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New York District

NEW YORK AND NEW JERSEY HARBOR DEEPENING PROJECT

2011
Migratory Finfish Report

FINAL REPORT

January 2013

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1.0 INTRODUCTION

1.1 BACKGROUND

The 2011 Migratory Finfish Survey (MFS) was conducted as part of the New York and New Jersey Harbor Deepening Project (HDP). The HDP is a United States Army Corps of Engineers – New York District (USACE-NYD) and Port Authority of New York and New Jersey (PANYNJ) sponsored project to deepen navigation channels to 50 feet to accommodate larger commercial vessels. The purpose of the study is to investigate timing and spatial distribution of seasonal movements of migratory fish in the New York/New Jersey Harbor (NY/NJ Harbor). The general life histories of these species are well known, but their migratory behaviors while passing through the Harbor have not been well studied. This program will provide data on target migratory species that can be evaluated in relation to dredging operations.

Through the NY/NJ Harbor and the Hudson-Raritan Estuary, migratory finfish species gain access to upstream freshwater spawning/nursery habitat, the largest being the Hudson River and its tributaries. Other important spawning rivers include the Bronx River (via the East River) in New York, and the Hackensack and Passaic Rivers, the Raritan River, and Shrewsbury/Navesink Rivers in New Jersey, particularly for river herring and in some cases American shad (NJDEP 2005). Almost a dozen species utilize the NY/NJ Harbor during some part of their annual migration (Waldman 2006).

Finfish migrations in the NY/NJ Harbor are dominated by anadromous (marine species that spawn in freshwater) species and occur bi-annually during spring and fall. To characterize these movements, five target species, as identified by National Marine Fisheries Service and state agencies as species of particular concern, were selected for the MFS program: American shad, blueback herring, alewife, striped bass, and Atlantic menhaden. These target species are of concern due to their anadromous migratory behavior (except Atlantic menhaden), importance as forage (American shad, blueback herring, alewife, Atlantic menhaden) for other species , commercial and recreational value (American shad, Atlantic menhaden, striped bass), as well as their role as a major predator in the Harbor (striped bass). River herring (blueback herring and alewife) stocks are stable or declining in abundance and have restrictions to protect against excessive commercial harvest (Waldman 2006).

Migratory fish may be potentially vulnerable to habitat disturbance because their migratory behavior concentrates them through relatively small areas over short periods of time. For example, adult spawning stocks of American shad, blueback herring, alewife and striped bass that use the Hudson River pass through the Harbor to access upstream spawning areas and the annual juvenile production will pass through the Harbor as they emigrate to the marine environment. The timing and duration within the Harbor is a function of the species biology, environmental cues like temperature, as well as the migratory pathway, or spawning run, travelled. Spawning runs to the Hudson River and its tributaries as well as the Hackensack and Passaic Rivers are of particular importance because access to these waterbodies requires passage through navigation channels and busy Harbor ports.

In NY/NJ Harbor, seasonal dredging restrictions for finfish have been instituted primarily to protect essential fish habitat, specifically winter flounder spawning and nursery habitat. However, regional concerns have become increasingly focused on migratory finfish stocks. Developing an understanding of where migratory pathways occur and peak seasonal use (temporal and spatial patterns) can improve the ability to effectively manage dredging activities within the NY/NJ Harbor while protecting the resource. For example, the depth of migratory fish runs or whether they utilize shoals or channels would influence their potential exposure to dredging activities.

The 2011 MFS supplements an initial study performed during 2006. The 2006 MFS included spring and fall sampling using mid-water and bottom trawls within the NY/NJ Harbor. Being pelagic species (except striped bass), the target species were collected in greater abundance using the mid-water trawl gear type and exhibited seasonal patterns in abundance. Preliminary findings from the 2006 MFS formed the basis of the 2011 MFS program sampling methodology, in terms of timing and spatial coverage of stations.

1.1 OVERVIEW OF 2006 MIGRATORY FINFISH SURVEY FINDINGS

As described above, the 2006 MFS was initiated 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 (USACE-NYD 2011). 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 Survey (ABS; USACE 2007). During the 2006 MFS, 16 bottom trawl and 26 mid-water trawl locations were sampled. Of the 26 mid-water trawl stations, 18 were located in navigation channels and 8 were in non-channel areas. Of the 16 bottom trawl stations, 12 were located in navigation channels and 4 were in non-channel areas.

A total of 55,290 finfish (58 species) were collected. Twenty-seven (27) species were collected during the mid-water trawl surveys and 53 species were collected during the bottom trawl surveys. The five (5) target species were collected by both survey methods. Spatial and temporal patterns observed for the five target species are summarized in Table 1-1 (adapted from Table 4-5 of USACE-NYD 2011) and in the following paragraphs.

Mid-water and bottom trawl collections indicated that alewife were more likely to use the NY/NJ Harbor during early spring (primarily April); they appeared to be generally absent from the area during the summer and early fall, returning during the late fall (November). When present, trawl collections suggested a preference for mid-water (they may also occur near bottom) in channel over non-channel stations. 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.

Mid-water and bottom trawl collections indicated that American shad were more likely to use the NY/NJ Harbor during late fall (primarily November) and appeared to be generally out of the area from June through October. No patterns were observed between station types and among study areas in mid-water trawls.

Mid-water and bottom trawl collections indicated that Atlantic menhaden were more likely to use the NY/NJ Harbor during the late summer (August) to late fall (November). 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; they were less common in the Lower Bay followed by the Upper Bay.

Mid-water and bottom trawl collections indicated that blueback herring were more likely to use the NY/NJ Harbor during early spring (primarily April); they appeared to be generally out of the area from June through October and returned in lower numbers during the late fall (November). There were no significant differences among study areas in mid-water or bottom trawl collections.

Bottom trawl collections indicated that striped bass were more likely to use the NY/NJ Harbor during the late fall (November) and were almost exclusively using near bottom habitat. 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.

1.2 STUDY OBJECTIVES

During the 2006 survey, the MFS Program was viewed as an extension of the NYD's multi-year Aquatic Biological Sampling (ABS) Program that focused on benthic finfish in NY/NJ Harbor. The 2011 MFS was developed as an independent sampling program with study objectives distinct from the ABS Program and intended to focus on migratory species that may encounter dredging operations.

Therefore, the objectives of the 2011 MFS Program were to:

1. Identify the major migratory pathways of the five target migratory species within NY/NJ Harbor. Spatial distribution factors include depth and harbor area for both adults and juveniles.
2. Characterize temporal migratory patterns of target species within NY/NJ Harbor. Seasonal movements include both the upstream and downstream migration of

spawning adults and the downstream movement of juveniles. Although not the focus of this program, sampling also collected juveniles and sub-adults (yearlings and older) that move into the Harbor during spring.

3. Based on the patterns of Harbor use by target species, provide a qualitative evaluation of potential disturbances of dredging operations (noise, TSS) on migration.

This report focuses on the findings of the 2011 MFS Program, with the 2006 MFS Program as an additional information source.

1.3 TARGET SPECIES LIFE HISTORY

Similar to the 2006 MFS, target migratory species of the 2011 MFS were American shad, alewife, Atlantic menhaden, blueback herring, and striped bass. The following sub-sections briefly summarize key life history characteristics and timing of migratory movements for each target species.

1.3.1 Alewife

The alewife (*Alosa pseudoharengus*), an anadromous species, inhabits waters from the Gulf of Saint Lawrence to South Carolina, with their primary distribution between the Gulf of Maine and the Chesapeake Bay. Adult alewife enter the NY/NJ Harbor between late-February and mid-March, to spawn in freshwater tributaries in relatively shallow water with a slow current (Everly and Boreman 1999, Schmidt et al. 1988). Alewife usually spawn three to four weeks before blueback herring (Loesch 1987 in ASMFC 2009), when water temps are approximately 10°C. In 2010, the first spawning alewives entered tributary streams of the Hudson River during early April when water temperatures were above just above 10.6 °C (Kahnle and Hattala 2010). Post-spawning adults quickly return downstream (Colette and Klein-MacPhee 2002 in ASMFC 2009). There are 16 Hudson River tributaries with documented alewife spawning runs, including Canterbury Brook, Moodna Creek, Fishkill Creek, Quassaick Creek, and Hathaways Glen Brook in the lower Hudson River and Coxsackie Creek, Moordener Kill, and Poesten Kill in the upper Hudson River (Schmidt and Lake 1999).

Alewife larvae and juveniles remain in their freshwater nurseries until late May or June before moving downstream as young of year (YOY) into the lower estuary until November and eventually into the ocean (Everly and Boreman 1999, Stone et al. 1994). It is generally accepted that juveniles join the adult population at sea within the first year of their lives and follow a north-south seasonal migration along the Atlantic coast, similar to that of American shad (Neves 1981).

The growth rate of alewife and the age at which they reach sexual maturity is variable by region (Monroe 2000). Alewife and blueback herring ("river herrings") in the NY/NJ Harbor with a total length of less than 170 mm are characterized as "immature" (Hattala et al. in ASFMC 2012). Monroe (2000) reports that sexual maturity is reached later in populations which spawn further to the north, for example at around 3 years for alewife spawning in Massachusetts tributaries. An average length of 26.4 cm is reported at age 4 in alewife from the Connecticut River, and alewife in the Chesapeake Bay are reported to reach 11.5 to 12.5 cm by age 1 (Monroe 2000).

1.3.2 American shad

American shad is an anadromous species occurring along the Atlantic coast from the St. Lawrence River in Canada, to the St. Johns River in Florida, with high concentrations in the waters from Connecticut to North Carolina (Gusey 1981). The adult American shad spend most of their life at sea as a schooling fish with immature and adult fish traveling together. American shad adults may be present all year in the Hudson-Raritan estuary with adults primarily occurring in coastal ocean waters in March and April, and entering the estuary from April through early September (spawning in fresh waters as early as March or as late as June followed by post-spawning movements to the lower estuary; ASMFC 2007, Talbot 1954, Stone et al. 1994, Able and Fahay 2010).

Spawning occurs in tidal freshwater areas of the Hudson River estuary between dusk and midnight at water temperatures between 12 and 21°C (Waldman 2006). Eggs are demersal and non-adhesive. Both feeding and yolk-sac larvae are planktonic and are passively transported to lower reaches of the estuary where they remain as juveniles until the late fall or early winter before migrating to the sea (Everly and Boreman 1999). In the estuary, juvenile American shad have the highest abundance from June to December (Stone et al. 1994). The YOY shad emigration occurs as a gradual seaward movement over several months (ASA 2010). They typically reach a length of 3-4 inches by the end of summer they are when they are leaving the Hudson River (ASA 2010). When they reach sexual maturity at 4 to 6 years old, they return to their natal rivers to spawn. Mean total length of American shad spawning stock in the Hudson River ranged from 450-520 mm for males and 520-590 mm for females during the study period of 1980-2008 (Hattala and Kahnle 2009).

1.3.3 Atlantic menhaden

Atlantic menhaden, locally referred to as “bunker”, is a seasonally abundant clupeid that occurs in large schools in coastal bays and estuaries. Atlantic menhaden migrate seasonally along the Atlantic coast from Maine to central Florida, moving north through the Mid-Atlantic Bight during spring and south during fall to overwinter in waters south of Cape Hatteras, North Carolina (Able and Fahay 2010). Adults are present in coastal ocean waters of NY/NJ primarily in March and enter estuaries in April where they are generally abundant from May through November, and adults are absent or rare from the estuary during December to March (Able and Fahay 2010, Stone et al. 1994). Adults can undergo frequent movements in and out of bays and inlets depending on tides, season, and weather, which may be regulated by local availability of food (Monroe 2000 and references therein). Some Atlantic menhaden have been reported to overwinter in estuaries in the southern portion of their range (Chesapeake Bay to Florida) (Reintjes 1969).

Atlantic menhaden primarily spawn in continental shelf waters along the U.S. Atlantic coast, although some spawning activity is reported to occur in the lower reaches of estuaries and coastal bays (Dovel 1971). Multiple spawning events occur annually, during the spring and again in the fall to early winter (McHugh et al. 1959).

Atlantic menhaden eggs are pelagic, and after hatching, some larvae move into estuaries from October through June. Large schools of juvenile Atlantic menhaden use tributaries and estuaries as nurseries during the summer before migrating offshore in the fall to deeper or warmer waters (Monroe 2000).

1.3.4 Blueback herring

Blueback herring (*Alosa aestivalis*) is an anadromous clupeid closely related to the alewife, and together these species are commonly referred to as river herring. Blueback herring inhabit coastal and estuarine waters from Nova Scotia to Florida, with concentrations in the Middle and South Atlantic Bight. In general, blueback herring have a more southern distribution than alewife (Mullen et al. 1986). Similar to alewife, blueback herring are present in coastal ocean waters prior to entering estuaries on their annual spawning runs during the spring (Schmidt et al. 1988). Prior to the spawning run, adult blueback herring stage in estuaries at the mouth of natal rivers in March and early April when water temperatures are approximately 4-9°C (Loesch and Lund 1977, Able and Fahay 2010).

Specifically, in the Hudson-Raritan estuary, adult blueback herring enter the estuary in early March, prior to their migration to spawning areas from May to July (Stone et al. 1994). Adult blueback herring swim at midwater depths and have been documented to feed during their freshwater migration (Monroe 2000). The blueback herring spawning period usually begins about a month later than alewife (Loesch 1987) and they prefer deep freshwater habitats with swift currents over hard gravel or sand substrates (Everly and Boreman 1999, Loesch and Lund 1977). After spawning, blueback herring move to the lower estuary and coastal ocean waters; a few adults may remain in the estuary through winter (Stone et al. 1994).

Juvenile blueback herring begin migrating downstream to the estuary at the end of summer, approximately a month after American shad and alewife (Marcy 1976, Monroe 2000 and references therein). By the end of November juveniles have typically returned to the ocean, though some evidence of juvenile overwintering in estuaries has been reported in New Jersey and lower Connecticut River (Monroe 2000 and references therein). Aside from a few juveniles overwintering within estuaries during their first year, researchers assume that most juveniles join the adult population at sea within the first year of their lives, and follow a north-south seasonal migration along the Atlantic coast, where changes in temperature likely drive oceanic migration (Neves 1981).

The growth rate of blueback herring and the age at which they reach sexual maturity is variable by region (Monroe 2000). Alewife and blueback herrings ("river herrings") in the NY/NJ area with a total length of less than 170 mm are characterized as "immature" (Hattala et al. in ASFMC 2012). First spawning of blueback herring is reported at age 3-6, and average length for age 3 blueback caught in the Connecticut River was 259 mm (Monroe 2000).

1.3.5 Striped bass

Striped bass (*Morone saxatilis*) is one of the most important sport and commercial fish species in the eastern United States. Along the Atlantic coast, three systems – the Hudson River, Chesapeake Bay, and Albemarle – Pamlico Sound serve as the primary spawning grounds for this anadromous species. The Hudson-Raritan Estuary is recognized as an important spawning and nursery habitat for striped bass, contributing up to 10% of the entire western Atlantic coastal stock (McLaren et al. 1981; Waldman 1990). Because of high levels of polychlorinated biphenyls (PCB) contamination in the upper areas of the river and in fish tissue, commercial fishing for striped bass in the Hudson River has been closed since 1976.

Hudson River striped bass exhibit considerable variation in migration patterns. Many remain in estuarine waters throughout the year, while others migrate along the coast, mixing with other Atlantic coast populations (Secor et al. 2001). In coastal situations, the larger juveniles and adult striped bass have seasonal migrations between southern NJ and Maine, moving southerly during the fall and northerly during the late winter and early spring (Waldman et al. 1990), before moving up the Hudson River to spawn.

Adult striped bass are present in coastal ocean waters of NY/NJ primarily in March before entering estuaries (Able and Fahay 2010). Striped bass are demersal species that 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). Striped bass move upstream and spawn above the salt front (Secor and Houde 1995), during April and May in the Hudson River (Waldman et al. 1990).

Spawning occurs in early spring at or near the surface in fresh or slightly brackish waters usually concentrated between river mile 33 to 55 (miles measured upstream from the Battery), from early May through June (Boreman and Klauda 1988). Eggs and larvae remain in the Hudson River, upstream of the NY/NJ Harbor, until the end of the post yolk-sac stage toward the end of the summer, when juveniles migrate from upstream areas to higher salinity waters closer to the Harbor (EA 1998).

YOY striped bass may remain in the NY/NJ Harbor and Hudson River areas through their first year (Able and Fahay 2010), with high catches usually occurring during summer and fall. In the Hudson-Raritan estuary, juvenile striped bass are common all year with higher abundance from late April to November (Stone et al. 1994). Juvenile striped bass are abundant in inter-pier areas of NY/NJ Harbor, but they can also be found in high concentrations in open water. They prefer deep to moderately deep basins over shallow basins (Cantelmo and Wahtola 1992).

1.4 REPORT ORGANIZATION

For this report, the finfish collected were classified into one of three groups: target species, Essential Fish Habitat (EFH) managed species, and other finfish species that were collected during the sampling program. 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. Specific focus from data analysis through discussion was given to the five target migratory finfish species.

Section 2 describes the study design, sampling areas and stations, and provides a summary of the equipment and data analysis methods used and Section 3 presents the results of the mid-water 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. Migratory finfish survey results are discussed within the context of USACE-NYD's ongoing efforts to better understand potential total suspended solids and noise impacts on fish behavior and migration within NY/NJ Harbor. These efforts include monitoring the extent and duration of re-suspended sediment plumes generated during harbor deepening dredging operations, as well as conducting underwater acoustic surveys of operating dredges and ambient conditions. Section 5 provides a brief summary of the MFS Program.

2.0 METHODS

2.1 STUDY AREAS AND SAMPLING LOCATIONS

During the 2006 MFS, stations were sampled with both mid-water and bottom trawls to determine the effectiveness at capturing the migratory target species. A recommendation from that program was to sample target migratory finfish species using the mid-water trawl because of the high target species catch rates using this gear, with the exception of striped bass. As identified in the 2006 MFS, striped bass almost exclusively use near bottom habitat (USACE 2007) and catch rates using a mid-water trawl most likely underestimate abundance. [1]In 2006, a total of 26 fixed stations (18 channel and 8 non-channel stations) were sampled across the harbor bi-monthly during spring and fall. The 2006 MFS sampling design served as the basis for the 2011 MFS program.

During the 2011 MFS, twenty (20) fixed mid-water trawl stations with similar locations as 2006 (Figure 2-1, Table 2-1) were sampled. Fewer stations were sampled in 2011 so that each station could be sampled more frequently (i.e., weekly during the peak spring and fall migration periods). Of these stations, seventeen (17) were located in channel areas and three (3) were in non-channel areas. This distribution of sampling effort reflects

[1] Even though mid water trawl may underestimate catch, striped bass are still included as a target species as they are an important species within NY/NJ Harbor.

limitations on sampling shallow water areas using mid-water trawling, and a focus on sampling in the navigation channels where dredging occurs.

The NY/NJ Harbor was divided into four study areas based on discrete system geography, usage by migratory species, 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, but varying hydrodynamics and physical properties (such as substrate). Sampling stations were distributed within each study area as described in the following:

Arthur Kill and Kill Van Kull (AK/KVK)

The AK/KVK study area joins the Upper Bay via the Kill Van Kull (a narrow tidal straight) with the Raritan Bay via the Arthur Kill (another narrow tidal straight), and mixes waters with Newark Bay. This study area has a dynamic hydrology due to the variation in tidal velocity, amount of freshwater flow, and bathymetry among the three connecting bays (i.e., Upper, Newark, and Raritan bays). Little shallow water habitat exists in this study area. 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. These were the same stations sampled during the 2006 MFS. Due to the limited extent of shallow water habitat within this study area, deep water channel stations were selected due to water depth and safety towing a mid-water trawl.

Newark Bay (NB)

The Hackensack and Passaic River basins form the watershed of Newark Bay. The Newark Bay study area is relatively more open than the AK/KVK, contains deep water navigation channels, and its shorelines and shallow water habitat has been greatly modified by bulkheads, riprap, and historic fill. Four (4) stations were sampled in Newark Bay using the mid-water trawl; all four (MNB-1, 2, 5, & 6) were in navigation channels. Stations were established at the mouths of the Passaic and Hackensack rivers. Two (2) non-channel stations (MNB-3 & 4) sampled in 2006 were not sampled in 2011 due to the decreased number of total stations included in the 2011 program.

Upper New York Bay (UB)

The Upper Bay study area is centrally located within the NY/NJ Harbor, connecting the three other study areas. The Upper Bay begins at the mouth of the Hudson River and empties into ends at the Lower Bay, is connected to the Newark Bay and Arthur Kill via the Kill Van Kull to the west, and exchanges water with the East River and Long Island Sound. Similar to Newark Bay, this study area contains deep, open water channels and few areas of shallow water habitat due to historic shoreline modifications. Six (6) stations were sampled in the Upper Bay using the mid-water trawl; five (MUB-1 through 3, 8 & 9) were in channels and one (MUB-11) was a non-channel station. Two (2) non-channel stations (MNB-6 & 7) and three channel stations (MNB-4, 5, & 10) sampled in 2006 were not sampled in 2011 due to the decreased number of total stations included in the 2011 program.

Lower New York Bay (LB)

The Lower Bay study area contains an expanse of both deep and shallow open water, and water chemistries are influenced by the Atlantic Ocean more so than the other three study areas. Four (4) stations were sampled in the Lower Bay using the mid-water trawl; two (2) (MLB-3 & 5) were channel areas and two (2) (MLB-4 & 6) were non-channel areas. Two non-channel stations (MLB-1 & 2) sampled in 2006 were not sampled in 2011. One channel station (MLB-5) and one non-channel station (MLB- 6) were only sampled in 2011. The locations of MLB-5 and MLB-6 were selected to sample nearshore areas as the Lower Bay constricts towards the Narrows of the Upper Bay.

2.2 WATER QUALITY

Dissolved oxygen, temperature, conductivity, and salinity were measured after each trawl using a calibrated YSI Pro2030 multi parameter handheld meter with other available meters (YSI Model 85 Handheld Oxygen, Conductivity, Salinity and Temperature System) as back-up meters. Temperature was measured to the nearest +/- 0.3 °C; dissolved oxygen (+/- 0.3 mg/L); conductivity (+/- 1 μS [micro Siemens]/cm); and salinity (+/- 0.1 ppt [parts per thousand]) and recorded on the Field Data Sheet (Table 2-2). Water quality parameters recorded with mid-water trawls were taken at the sample depth.

Water quality data collected during the 2011 MFS Program were supplemented by National Oceanic and Atmospheric Administration (NOAA) water quality buoys. Hourly air and water temperature data from three buoys in NY/NJ Harbor were downloaded for the 2011 calendar year: Bergen Point West Reach (GNN4) in the Kill Van Kull, Sandy Hook (SDHN4) in the Lower Bay, and the Battery (BATN6) in Upper Bay (Figure 2-1). Data were averaged daily.

MFS Program water quality data for 2011 are provided in Appendix A.

2.3 FINFISH SAMPLING

The U.S. Army Corps of Engineers' *Hudson* was the primary sampling vessel used for the mid-water trawl survey. Surveys were scheduled during daylight hours (from one hour after sunrise and one hour before sunset). Mid-water trawls were conducted using an 18-foot (5.5 m) mid-water balloon trawl (Table 2-3), rigged for mid-water trawling. For transects less than 38 feet deep, a minimum cable length of 200 feet of tow cable was deployed to ensure the mid-water trawl extended beyond the *Hudson*'s wheel wash. The float cable length required to fish at mid depths down to 20 feet was determined using a chart of sample depth, float cable lengths, and tow speeds. For transects greater than 38 feet deep, the tow cable length was determined from a chart of wire angle (target angle of approximately 80°) and sample depth to provide the amount of wire from the trawl doors to the water surface and ensuring the mid-water trawl was being towed below the *Hudson*'s wheel wash. For mid-water trawls based on wire angle and length to determine sample depth, the wire angle was measured using a mechanical inclinometer to measure the wire angle at the beginning of each tow. Mid-water trawls were towed into the prevailing current at a speed of approximately 6.6 ft/sec (200 cm/sec). Tow velocities were monitored using a General Oceanics electronic flowmeter and deck readout to ensure consistency of tow speed throughout the sampling program. Tidal current differences between the surface and mid-water, as indicated by wire angles deviating from approximately 80°, required slight adjustments in the *Hudson*'s speed through the surface water to maintain a target angle of approximately 80° (range between 78 and 82°).

Mid-water sampling was conducted weekly at twenty (20) stations, except during one exploratory survey the week of April 4, 2011 when six stations were sampled. The spring migratory sampling began with one week of exploratory mid-water trawls the first week of April and continued with full surveys sampling all selected stations during the remaining weeks of April, May, and the first week of June 2011, two summer surveys the week of 11 July and 15 August followed. The fall migratory sampling began the week of 12 September and continued to the first week of December 2011 (Table 2-4). Surveys were conducted on consecutive days, weather conditions permitting, until all locations were sampled.

Mid-water 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') at the start and end of each transect sampled. All pertinent sample information was recorded on a Field Data Sheet (Figure 2-3).

Following each trawl sample, fish collected were identified, enumerated, and total length was measured to the nearest millimeter, and all fish were returned to the water. The total length of up to 100 specimens of each target species (Atlantic menhaden, American shad, blueback herring, alewife and striped bass) was recorded. For all non-target species, total length on up to 25 specimens of each species was recorded on randomly selected individuals. 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.

Survey data and observations were recorded on Field Data Sheets.

Finfish collection data are provided as Appendix B.

2.4 DATA ANALYSIS

2.4.1 Descriptive Statistics

Catch per unit effort (CPUE), defined as the number of fish collected per 10 minutes of trawling, was determined for each 2011 mid-water trawl sample and was standardized to 10 minutes using the following formula:

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

Where:
N equals the number of fish collected during the trawl and
T equals the actual tow time expressed in minutes.

Average weekly CPUE was calculated by grouping sample events based on a 7-day weekly period, and averaging CPUEs within that period. Monthly averages were calculated by averaging samples collected within a calendar month, independent of the weekly grouping.

Spring and fall migratory seasons were grouped based on target species abundance in the Harbor. Spring is represented by the months April through June (corresponds to week of year 15 through 23), summer as July and August (week of year 29-34), and Fall as September through December (week of year 38-50).

The GIS figures provide total CPUE for each target species for spring and fall 2011. CPUE were summed by season due to the large number of zero catches observed for many of the target species.

2.4.2 Statistical methods

2.4.2.1 Analysis of Variance

A two-way repeated measure Analysis of Variance (ANOVA) was attempted to test the differences in catch rates for five target species by location and week of year. A two-way repeated measure ANOVA is a powerful test to measure interactions between and within subjects. The one-way ANOVA is used to detect differences between two or more group means. Data were not sufficient to conduct the two way repeated measures or the one-way ANOVA for American shad, Atlantic menhaden, and striped bass. These species were collected so infrequently that there are insufficient data points to draw meaningful conclusions regarding time and location of occurrence. While catches of alewife and blueback herring were sufficient to run comparative statistics, data did not meet the assumptions of normality, equal variance, or both for the raw (i.e., CPUE) and transformed data (i.e., log (CPUE+1)). See Appendix C-1 for additional detail on the two-way repeated measure ANOVA.

2.4.2.2 Kruskal-Wallis One-Way ANOVA

Because the data were not normally distributed, the Kruskal-Wallis one-way ANOVA was used to test for significant differences among median CPUEs by study area for each target species/season combination. The Kruskal-Wallis test is a particularly powerful nonparametric substitution for the one-way ANOVA that may be employed when the assumption of normality is not met by the data (Hintze 2007). The null hypothesis is that the group medians are equal (e.g., median CPUEs of alewife during spring are equal for all study areas), while the alternative hypothesis is that at least one group median is different (e.g., median CPUEs of alewife during spring among study areas are not all equal). The test does need a sample size of at least five and also has the following assumptions (Connover 1971):

1) All samples are random samples from their respective populations,
2) In addition to independence within each sample, there is mutual independence among the various samples,

3) All random variables are continuous,
4) The measurement scale is at least ordinal, and
5) Either the k population distribution functions (i.e., for each group, in this case study area) that originated the samples under comparison are identical, or else some populations tend to yield larger values than other populations do.

A sixth assumption is often added to the above list by requiring that the population distributions from the samples under comparison are drawn be not only continuous but of the same shape. Thus, the population distributions must have the same variability, skewness, etc. (Neter et al. 1985).

The Kruskal-Wallis one-way ANOVA was run in NCSS 2007. The Kruskal-Wallis uses the following Chi-Square (H) (which is not corrected for ties):

$$H=12/N(N+1)* \sum_{i=1}^{k}(R_i^2/n_i)-3(N+1)$$

Where N is the total sample size, n_i is the sample size of the i^{th} group, k is the number of groups, R_i is the sum of the rank of the ranks of the i^{th} group. H can be corrected for ties by dividing H by the following correction factor, where t is the count for a particular tie (Hintze 2007):

$$H_c=H/1- \sum t(t^2-1)/N(N^2-1)$$

The Kruskal-Wallis one-way ANOVA was run for the spring and fall samples of alewife and blueback herring. As stated in Section 2.4.1, spring is represented by the months April through June (corresponds to week of year 15 through 23 and fall as September through December (week of year 38 through 50).

2.4.2.3 Dunn's Test

Once a significant result was obtained from the Kruskal-Wallis one-way ANOVA, Dunn's multiple comparison test was used to determine which study area comparisons had significantly different median CPUEs. Dunn's test is a distribution-free multiple comparison procedure; as such there is no assumption that the data are normal. The test adjusts the error rate (α_f) on a comparison wise basis. Where $\alpha_f=1-(1-\alpha)^c$ and c is the number of comparisons. The formula uses average ranks as follows:

$$|\bar{R}_i-\bar{R}_j|/\sqrt{(N[N+1]/12*(1/n_i+1/n_j)} \geq Z\alpha$$

Where $\alpha= \alpha_f/(k(k-1))$ and k is the number of treatments (also known as the Bonferroni correction) (Hintze 2007).

If there are ties, the following formula is used:

$$|\bar{R}_i-\bar{R}_j|/\sqrt{\{[N(N^2-1)-(\sum t^3-\sum t)]*(1/n_i+1/n_j)\}/(12(N-1)} \geq Z\alpha$$

Where N is the total sample size and t is the number of values in the combined sample that are tied at a given rank (Hintze 2007). The z-value is adjusted for multiple comparisons (as described above); this is called the Bonferroni Test.

The Kruskal-Wallis one-way ANOVA was attempted to test the differences among study areas for the blueback and alewife spring and fall samples (see raw data in Appendix C, Table C.1-1). The raw data for the blueback herring spring and fall samples met the assumption of equal variances. However, the raw and transformed data for alewife spring and fall samples had significantly different group variances as indicated by the results of the modified Levene test for equal variances. Thus, the samples probably did not meet the Kruskal-Wallis assumption of originating from distributions with the same shape and variability. Therefore, the Kruskal-Wallis results might be inaccurate. However, the Kruskal-Wallis results for alewife are being presented, because some authors consider that the Kruskal–Wallis test “may also be applied when the k population variances are somewhat heterogeneous” (i.e., variances are different among the groups) (Zar 1999). The NCSS 2007 results of the assumption testing for the Kruskal-Wallis one way ANOVA for are presented in Appendices C, Tables C.1-2, C.1-3, C.1-4, C.1-5, C.1-6, and C.1-7.

2.4.2.4 Cumulative Frequency Distribution

Cumulative frequency distributions (CFDs) derived from empirical data, i.e., empirical distribution functions, can be used to compare standardized responses among variables (Hintze 2007). Empirical distribution functions were run using the Nondetect Analysis in NCSS 2007. Cumulative frequency distribution graphs were developed using empirical distribution functions to investigate temporal patterns and predict the probability of when (by date of year) a given percentage of fish could be expected to occur within a study area. This probability can be used to examine differences among the target species in the timing of the adult spawning migration and downstream juvenile migration. The null hypothesis of the distribution functions is that the distribution functions (timing) of all target species are equal. The alternative hypothesis is that at one distribution functions (timing) for at least two of the target species are different. The logrank chi-square test with the Bonferroni adjusted probability level was used to test the hypothesis. CFDs were developed for all target species for spring (weeks of 11 April through 30 May) and for fall (weeks of 26 September through 5 December). The raw data used for these analyses are presented in Appendices C-4 and C-5.

3.0 RESULTS

Water quality and migratory finfish data and results are provided for all four NY/NJ Harbor study areas (Arthur Kill/Kill Van Kull, Newark Bay, Upper Bay, and Lower Bay). The data was also sorted and analyzed by station type (non-channel and channel) and season. Species composition and patterns in relative abundance are described in the following sections.

3.1 WATER QUALITY

During the 2011 study period, average weekly mid-water temperatures ranged from 7.0 (4 April, Arthur Kill/Kill Van Kull) to 24.5°C (11 July, Newark Bay). Overall for each week, average temperatures were consistent among the Harbor areas.

Average weekly salinity at mid-water ranged from 7.8 (25 April, Newark Bay) to 26.5 ppt (31 October, Lower Bay) during the 2011 study period. Salinity fluctuated throughout the sampling period. For example, Newark Bay reached salinities of approximately 10 ppt or less during four weeks of the sample period (weeks of 18-25 April; 23 May; 12 September; 24 October), mostly due to the frequency and intensity of storm events during 2011. Mean salinity ranges differed between areas. The lowest mean salinities were in Newark Bay followed by the Arthur Kill/Kill Van Kull, then the Upper Bay; mean salinities were approximately 4 ppt higher within the Lower Bay than Upper Bay.

Dissolved oxygen concentrations fluctuated 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 highest during weeks in April and December, and were lowest during weeks in August among the four areas. During the 2011 study period, average weekly mid-water dissolved oxygen concentration ranged from 4.2 (15 August, Newark Bay and Arthur Kill/Kill Van Kull) to 10.8 mg/L (11 April, Lower Bay).

The New York/New Jersey area was hit by a series of tropical storms in late August and early September 2011, which influenced water quality. Tropical Storms Irene, Katia, and Lee brought extreme levels of rainfall over this period, the effect of which is visible in salinity measurements from all four study areas during September. All four study areas show a marked drop in mean salinity the week of 12 September 2011, and the lowest mean salinities recorded for all areas except Newark Bay were during this week, reflecting the large amounts of freshwater runoff entering these water bodies during this time.

Water and air temperature data from the NOAA research buoys were graphically depicted 2011 and 2006 to supplement the water quality data collected during the MFS program (Figure 3-2a and 3-2b). During 2011, average daily water temperatures began increasing in early February and first reached temperatures of 4ºC (when blueback herring begin to stage in estuaries [Loesch and Lund 1977, Able and Fahay 2010]) on 18 February (Sandy Hook) and 6 March (Battery and Bergen Point). During 2006, average daily water temperatures began to rise during early March. However, unlike 2011, the 2006 average daily water temperatures did not fall much below 4ºC for the three water quality buoys even during the traditionally coldest months of January and February.

3.2 FINFISH DESCRIPTIVE FINDINGS

A total of 426 mid-water trawls were conducted during the 2011 MFS, 363 samples from channel stations and 63 samples from non-channel stations (Table 3-1), and a total of 69,705 finfish (40 species) were collected (Table 3-2, Table 3-3). The five target species were collected by the mid-water trawl, with blueback herring, alewife, and American shad ranked second, third, and fifth most abundant, respectively, for the 2011 MFS program. The most abundant species collected was bay anchovy and gizzard shad ranked fourth. During April through December, months with the highest abundance were also the months with the highest species richness, which were May (n=10,083 finfish; 24 species), September (n=10,012 finfish; 19 species), and October (n=31,271 finfish; 24 species; Table 3-3).

Target species represented 16% of the total finfish catch (n=11,176; Table 3-3). Several EFH species were also collected during the 2011 MFS program, the most abundant being silver hake (n=180), butterfish (n=135), and Atlantic herring (n=116).

CPUE of non-target species was greater for each study area than for target species and EFH species combined due to high catch rates of bay anchovy (Table 3-4). Average CPUE of bay anchovy ranged from 64 fish/10 min in Newark Bay to 292 fish/10 min in Lower Bay (Table 3-4). Excluding bay anchovy, CPUE by region for the non-target species was low and characterized by a substantial number of zero catches, which resulted in high standard errors (Table 3-4). Overall, average CPUE of non-target EFH species was less than 2 fish/10 min across all Harbor areas, while average CPUE of non-target Other species was highest in the Lower Bay (292 fish/10 min), followed by Arthur Kill/Kill Van Kull (129 fish/10 min) (Table 3-4).

The following sub-sections describe the relative abundance and distribution of the five target species: alewife, American shad, Atlantic menhaden, blueback herring, and striped bass. In addition to these migratory species, four (4) American eel larvae (leptocephalus life stage) were collected from the Upper Bay (MUB-1, MUB-9) on 18 May 2011, and although American eel was not a target species they are an important migratory species in the Harbor (Table 3-3). Atlantic tomcod is an anadromous species that was also collected in May, with a total of 14 individuals collected at four stations across the Kill Van Kull, Newark Bay, and Upper Bay. In October, one river herring was collected that could not be identified to species, and was therefore not included in the target species analyses described in the following sections (Table 3-3). These non-target migratory species were all collected from channel stations (Table 3-4).

3.2.1 Alewife

Seasonal and Temperature-related Patterns

Based on the weekly CPUE data, alewife were present in the Harbor from the weeks of 11 April through 23 May during the spring, and from the week of 12 September through the week of 5 December representing the fall (Figure 3-3). Some alewife were collected during July and August, but with CPUE less than 1.0 fish/10 min.

The highest average weekly CPUE of alewife were collected from the Upper Bay channel stations during the week of 9 May 2011 (118.0 fish/10 min), which followed the second highest week of 25 April 2011 (104.6 fish/10 min) in the same study area. Alewife were also common in channel station collections in Newark Bay during the week of 2 May with average CPUE of 59.8 fish/10 min and September through December with a peak of 94.3 fish/10 min during the week of 3 October 2011.

The sharp decrease in alewife CPUE in the spring after the week of 23 May 2011 coincides with or comes just after a sharp increase in average mid-water temperature across all Harbor areas (Figure 3-2). This timing is especially apparent in the Arthur Kill/Kill Van Kull and Newark Bay, where average mid-water temperatures rose from 12.7 °C to 19.4 °C in the three weeks from 9 May to 30 May; during this same three week period Alewife weekly average CPUE dropped from 21 and 14 fish/10 min in Newark Bay and Arthur Kill/Kill Van Kull, respectively, to below 1 fish/10 min for both areas. Similarly in the fall, the re-appearance of larger numbers of alewife coincides roughly with average mid-water temperatures reaching or falling below approximately 20 °C.

Channel – Non-channel Station Patterns

Alewife were collected primarily from channel stations, regardless of season or Harbor area. Average weekly CPUE of alewife at non-channel stations were very low for most of the sampling period, peaking at 18.0 fish/10 min the week of 12 September at Upper Bay sampling locations (Figure 3-3).

Harbor Study Area Patterns

Overall, average CPUE across the entire sampling period was highest in Newark Bay (17.6 fish/10 min) and lowest in Lower Bay (0.3 fish/10 min) (Table 3-4). In the spring, Upper Bay collections comprised over 70% of the total alewife catch. During the spring, alewife appeared to be predominantly travelling through the Upper Bay channel stations towards the Hudson River and from the Upper Bay into the Newark Bay (Figure 3-4a). Few alewife were collected at Arthur Kill stations, indicating this was not a primary route for accessing spawning grounds. The results of the Kruskal-Wallis one-way ANOVA detected differences in median CPUE among study areas for the alewife spring samples ($p < 0.001$) (the complete results are presented in Appendix C-2). The Dunn's multiple comparison test (with Bonferroni adjustment) was used to detect the differences. The critical value for the Bonferroni comparison was ">2.63831". The only comparison that was significantly different was the Upper Bay and Lower Bay (Z=4.4530). The results of the Dunn's multiple comparison test are summarized below by indicating the study area mean ranks[2] sorted in ascending order, with a line connecting those study areas that were not significantly different:

LB=56.61 AK/KVK=78.42 NB=81.97 UB=97.53

[2] The study area mean ranks are the study areas sum of ranks used in the Kruskal-Wallis and Dunn's tests divided by the study area counts. The study area mean ranks roughly represent the study area median CPUEs.

During the fall, Newark Bay comprised 52% of the total catch of alewife. Stations located at the mouths of the Hackensack and Passaic Rivers yielded equally high CPUE and the other Newark Bay station also had high CPUE during fall (Figure 3-4b). Contrary to spring, alewife was more abundant in the Arthur Kill than other harbor areas, with most stations yielding over 100 CPUE during the fall. Few alewife appeared to utilize Upper Bay, and almost none were collected at the Lower Bay stations during fall (Figure 3-4b). The results of the Kruskal-Wallis one-way ANOVA did detect differences in median CPUE among study areas for the alewife fall samples ($p < 0.001$) (the complete results are presented in Appendix C-2). The Dunn's multiple comparison test (with Bonferroni adjustment) was used to detect the differences. The critical value for the Bonferroni comparison was ">2.63831". The only comparison that was not significantly different was the Newark Bay and the Arthur Kill/Kill Van Kull (Z=1.4341). The mean ranks for the study areas were as follows:

LB=53.93 UB=99.95 <u>AK/KVK=132.67 NB=149.65</u>

As stated in Section 2.4.2.2, the data for the spring and fall samples of alewives did not meet the assumption of equal variance for the Kruskal-Wallis one-way ANOVA; as such, the results could be inaccurate. However, some authors consider that although the Kruskal–Wallis test assumes that the sampled populations have the same dispersions and shapes, it can still be used when this is not the case because it is typically little affected by some departure from those assumptions (Zar 1999).

Length Frequency Distributions

Figure 3-5 depicts the length frequency distributions for alewife by season and Harbor area. In the spring (April-June), alewife collected from the Arthur Kill/Kill Van Kull, Newark Bay, and Upper Bay had similar length frequency distributions. The largest percentage of fish measured in each of these three areas fell into the 90 mm length interval. Mean total length for alewife caught in these the areas were also very similar, at 108 mm for both the Arthur Kill/Kill Van Kull and Upper Bay and 105 mm for Newark Bay. Alewife collected from the Lower Bay during the spring were on average slightly larger (Mean TL=117 mm), and narrower in distribution of lengths, with 75% falling in the 110 mm length interval. Spring alewife lengths ranged from 80 mm to 271 mm, both of which were collected from Upper Bay stations.

During summer months (two sample events from July-August), one alewife (TL=140 mm) was collected in Newark Bay.

Length distribution of alewife caught during fall (September-December) was similar across all four survey areas. The largest percentage of fish caught in each area occurred within the 90 mm length interval, which was the same during spring 2011 for Arthur Kill/KVK, Newark Bay, and Upper Bay. However, alewife collected during the fall had a wider range of lengths than during spring, ranging from 28 mm (Newark Bay) to 200 mm (Kill Van Kull).

The majority of alewife caught in both spring and fall were sizes representative of juveniles or immature fish, while relatively few (11 in spring and 35 in fall) had lengths greater than 170 mm, which might indicate sexually mature adults (per Hattala et al. in ASFMC 2012). The 11 fish greater than 170 mm collected during spring were all collected from Upper Bay stations, between the end of April and mid-May. During the fall, alewife over 170 mm were collected from each study area from late September through the last sample week in December.

3.2.2 American shad

Seasonal and Temperature-Related Patterns

Based on the weekly CPUE data, American shad were present in the Harbor from the weeks of 11 April through 16 May during the spring, and from the week of 12 September the week of 5 December representing the fall (Figure 3-6). Average weekly CPUE of American shad peaked at Upper Bay non-channel stations from the week of 17 October (21.0 fish/10 min) to 7 November 2011 (38.0 fish/10 min). These large catches occurred after mid-water temperatures in the Upper Bay began to drop steeply below approximately 18-20 °C. Average CPUE at Lower Bay non-channel stations peaked at 8.0 fish/10 min during the week of 12 September, but was dominated by zero catches.

Very few American shad were collected both at channel and non-channel stations in Arthur Kill/Kill Van Kull and Newark Bay (Figure 3-6).

Channel – Non-channel Station Patterns

American shad CPUE was low throughout channel stations in the Harbor peaking at 5.6 fish/10 min during the week of 31 October 2011 in Upper Bay, with all other average weekly CPUE at 2.6 fish/10 min or less. In comparison, non-channel station CPUE peaked in Upper Bay at 30 fish/10 min the week of 7 November and peaked in Lower Bay at 8 fish/10 min the week of 12 September.

Harbor Study Area Patterns

Overall, average CPUE for American shad across the entire sampling period was the highest in Upper Bay (1.2 fish/10 min) and all other regions were low (approximately 0.3 fish/10 min) (Table 3-4). In the spring (April-June), total American shad collections were low. No American shad were collected during the spring at seven stations across Newark Bay, Lower Bay, and the Arthur Kill (Figure 3-7a). During the fall months (September-December), American shad were predominantly collected at Upper Bay stations relative to other Harbor areas, and favored the eastern half of Upper Bay (i.e., Bay Ridge Flats, Ambrose Channel). Modest collections of American shad occurred in Lower Bay non-channel station MLB-6 and Arthur Kill channel station MAK-2. Across the Harbor, American shad were abundant in fall collections compared to spring (Figure 3-7b). Due to low catch rates, Kruskal-Wallis one-way ANOVA to detect differences among study areas was not run for American shad.

Length Frequency Distributions

In the spring, America shad lengths ranged from minimum of 108 mm (Upper Bay) to a maximum of 241 mm (Kill Van Kull; Figure 3-8). The mean total lengths from the Arthur Kill/Kill Van Kull, Newark Bay and Upper Bay were similar, at 157, 164, and 154 mm, respectively. A single American shad collected during spring in Lower Bay had a total length of 238 mm.

No American shad were caught during the summer (two sample events during July-August).

In the fall, the distribution of lengths was fairly similar for all areas, with the majority of American shad ranging from 83 and 172 mm in total length (Figure 3-8). The exception to this was one fish measuring 245 mm, caught in mid-November at the mouth of the Passaic River in Newark Bay. Similar to spring Arthur Kill/KVK, Newark Bay and Upper Bay length distribution during fall were alike, averaging at approximately 117 mm. The mean total length for shad caught during fall months in the Lower Bay was slightly smaller at 101 mm, and were dominated by the 90 mm length interval.

It is unlikely that any American shad collected were sexually mature adults, which at a minimum would be expected to measure 450 mm or more in total length (per Hattala and Kahnle 2009).

3.2.3 Atlantic menhaden

Seasonal and Temperature-Related Patterns

Atlantic menhaden were collected in very small numbers throughout the Harbor, with a total of 29 individuals collected during the 2011 MFS Program (Table 3-3). Based on the weekly CPUE data, Atlantic menhaden were present in low abundance in the Harbor generally from the weeks of 15 May through 5 December, with no clear seasonal pattern (Figure 3-9).

Channel – Non-channel Station Patterns

Atlantic menhaden were collected at channel and non-channel stations. Collections peaked in Newark Bay channel stations during the week of 3 October with an average CPUE of 1.8 fish/10 min. Non-channel collections peaked in Upper Bay during the week of 14 November with an average CPUE of 1.0 fish/10 min. There were no other collections higher than a CPUE of 0.8 fish/10 min in either channel or non-channel locations throughout the Harbor for the rest of the sampling period (Figure 3-9).

Harbor Study Area Patterns

For spring and fall, weekly Atlantic menhaden CPUE was compared among stations. Overall, average CPUE for Atlantic menhaden across the entire sampling program was very low, the highest being Newark Bay (0.2 fish/10 min CPUE). For all other regions, CPUE was less than 0.1 fish/10 min (Table 3-4). No Atlantic menhaden were collected at 15 of the 20 stations sampled during the spring (Figure 3-10a). Only stations in the Upper Bay and Newark Bay yielded non-zero CPUEs. Each Harbor area had a few stations with non-zero collections during fall. However, at the majority of stations (11 of the 20) sampled during the fall, no Atlantic menhaden were collected (Figure 3-10b). Due to low catch rates, Kruskal-Wallis one-way ANOVA to detect differences among study areas was not run for Atlantic menhaden.

Length Frequency Distributions

During the spring, Atlantic menhaden were collected from Newark Bay and Upper Bay, and had a similar length distribution averaging 343 and 344 mm TL, respectively (Figure 3-11). One menhaden was caught during the summer (two sample events during July-August), in Newark Bay, at 338 mm. In the fall, Atlantic menhaden fell into two length groups, one spanning the 60 mm and 160 mm length intervals, and a larger group between the 290 and 340 mm length intervals (Figure 3-11).

3.2.4 Blueback herring

Seasonal and Temperature-related Patterns

Blueback herring were the most abundant target species caught in the 2011 Migratory Finfish Survey, with a total of 6,578 collected (Table 3-3). Based on the weekly CPUE data, blueback herring were present in the Harbor from the weeks of 4 April through 9 May representing the spring migration period, and from the week of 12 September through the week of 5 December representing the fall migration (Figure 3-12). Some blueback herring were collected during late May, July and August, but with average weekly CPUE at or less than 2.0 fish/10 min.

Average weekly mid-water trawl collections of blueback herring peaked at Upper Bay non-channel stations during the week of 14 November (average CPUE = 1,034.0 fish/10 min; Figure 3-12). Lower Bay non-channel stations yielded high numbers during spring and fall sampling, peaking at an average CPUE of 201.5 fish/10 min during the week of 12 September and 193 fish/10 min during the week of 14 November. Channel station CPUE peaked in the Arthur Kill/Kill Van Kull during the week of 11 April (113.0 fish/10 min). Lower Bay channel station CPUE peaked the week of 31 October (97.5 fish/10 min) and Newark Bay peaked 29 September (70.8 fish/10 min). Upper Bay channel station CPUE peaked during the first week of sampling, 4 April (108.0 fish/10 min).

The large catches of blueback herring during the week of 14 November in the Upper and Lower Bays were preceded by a sharp drop, and then a stabilization, in average mid-water temperatures in those areas. Temperatures dropped from approximately 20 °C to approximately 12° C over the course of the month of October, 2011, and then remained near 12° C through the first week of December, 2011. The larger catches of blueback herring in the spring occurred when average mid-water temperatures were also approximately 12° C or less.

Channel – Non-channel Station Patterns

In the Upper and Lower Bays where both channel and non-channel station types were sampled, blueback herring were collected primarily from non-channel stations and in relatively high CPUE during both spring and fall. Blueback herring were collected in low numbers at channel stations during late spring and summer months from the week of 2 May through September in all regions and through the week of 17 October for Upper and Lower Bay (Figure 3-12).

Harbor Study Area Patterns

During both the spring and fall migration periods, blueback herring were most abundant in Upper and Lower Bays. Average CPUE across the whole harbor during the sampling program was 15.3 fish/10 min. Average CPUE was highest in Upper and Lower Bay (20.7 and 20.4 fish/10 min, respectively) and lowest in Newark Bay (9.0 fish/10 min) (Table 3-4).

Total CPUE during spring show blueback herring using the Arthur Kill/Kill Van Kull, Newark Bay, and Upper Bay during these months (Figure 3-13a). The Kruskal-Wallis one-way ANOVA detected differences in median CPUE among study areas for the blueback herring spring samples ($p < 0.05$) (the complete results are presented in Appendix C-3). The Dunn's multiple comparison test (with Bonferroni adjustment) was used to detect the differences. The critical value for the Bonferroni comparison was ">2.63831". The only comparison that was significantly different was the Upper Bay and Lower Bay (Z=2.8813). The mean ranks for the study areas were as follows:

LB=62.17	AK/KVK=80.26	NB=85.14	UB=89.86

Blueback herring were collected in high densities at channel and non-channel stations throughout Upper Bay during spring months.

During the fall, Upper Bay and Lower Bay yielded high CPUE of blueback herring (78% of the total blueback herring catch) relative to Arthur Kill/Kill Van Kull and Newark Bay. During the fall, Upper Bay CPUE was larger at non-channel station MUB-11 (>1,000 total fish/10 min) and in general at stations in the eastern portion of the bay (Figure 3-13b). However, the Kruskal-Wallis one-way ANOVA did not detect any statistically significant difference in median CPUE among study areas for the blueback herring fall samples (probability level = 0.933) (see Appendix C-3). High CPUE collections of blueback herring also occurred at both channel and non-channel Lower Bay stations during the fall months.

Length Frequency Distributions

In the spring, the bulk (99%) of the blueback herring caught from all areas fell between the 70 and 160 mm length intervals (Figure 3-14). Thirty blueback herring were measured at lengths of 170 mm to 285 mm. Of these 30 fish, the majority (21) were caught in the Upper Bay, while four each were caught in the Arthur Kill/KVK and Lower Bay, and one was caught in Newark Bay. Twenty-four of these fish were caught in April, the remaining six were caught in May. The 30 fish with lengths of 170 mm or greater may represent spawning adults (per Hattala et al. in ASFMC 2012), while the lengths of the remaining fish indicate that they are likely juveniles. The mean total lengths for blueback herring taken in the spring were 97 mm for the Arthur Kill/KVK, 94 mm for Newark Bay, 102 mm for the Upper Bay, and 118 for the Lower Bay.

During the summer months (July-August), blueback herring (n=6) were collected from Newark Bay and had an average total length of 85 mm (Figure 3-14).

In the fall, the distribution of lengths followed a similar pattern as in the spring, but without fish greater than 160 mm (Figure 3-14), in other words, consisting of all juvenile or immature fish. The overall distribution was slightly “tighter”, and the lengths somewhat smaller for all areas in the fall, with all blueback taken falling between 51 mm and 138 mm. Mean total lengths for blueback herring caught in the fall were very similar across all areas, at 72 mm for both the Arthur Kill/KVK and Newark Bay, 74 mm for the Upper Bay, and 73 mm for the Lower Bay.

3.2.5 Striped bass

Seasonal Patterns

A total of 34 striped bass were collected during the 2011 MFS Program, primarily in May (76%) (Table 3-3). Based on the weekly CPUE data, striped bass were present in the Harbor from the weeks of 25 April through 23 May during the spring (Figure 3-15). Minimal catches occurred during the weeks of 12 September, 24 October, and 14 November, and these dates may loosely correspond to the fall migratory movement of striped bass (Figure 3-15).

Average weekly CPUE peaked the week of 16 May, when striped bass were collected in the Arthur Kill/Kill Van Kull and Newark Bay at CPUEs of 2.0 and 1.0 fish/10 min (Figure 3-15).

Channel – Non-channel Station Patterns

Minimal catch occurred at channel stations, but no striped bass were collected at non-channel stations during the 2011 Program (Figure 3-15).

Harbor Study Area Patterns

No striped bass were collected in the Lower Bay during 2011. All other Harbor areas yielded low catch rates of striped bass. During spring, striped bass were collected at Newark Bay stations MNB-5 and MNB-6 (the mouths of the Hackensack and Passaic Rivers, respectively) on 16 May (Figures 3-15, 3-16a). Low catches of striped bass were observed at several stations in the Arthur Kill, Kill Van Kull, and Upper Bay. Channel station MAK-4 in the Arthur Kill yielded the highest total CPUE during spring (total CPUE = 11 fish/10 min; Figure 3-16a). No striped bass were collected at 10 of the 20 stations sampled during 2011.

Fall collections yielded fewer fish than spring. Minimal catch was observed at station MKK-1, MUB-8, and MUB-9, which occur on the western portion of the Upper Bay. No striped bass were collected during the fall at 17 of the 20 stations sampled (Figure 3-16b).

Due to low catch rates due to their demersal nature, Kruskal-Wallis one-way ANOVA to detect differences among study areas was not run for striped bass.

Length Frequency Distributions

All but one of the striped bass caught during the spring was grouped between the 70 mm and 170 mm length intervals (Figure 3-17). One (1) striped bass collected from the Upper Bay was 740 mm TL. The distribution for striped bass during the fall followed a similar pattern as in the spring, albeit with far fewer fish caught. One (1) striped bass caught from the Arthur Kill/KVK measured 65 mm TL. Four (4) striped bass caught from the Upper Bay ranged from 50 and 100 mm in length, with one measured at 651 mm.

3.3 TIMING OF MIGRATION

Cumulative frequency distribution (CFD) graphs were developed to investigate spring and fall temporal patterns for the target species. CFDs were plotted for each target species for spring (weeks of 11 April through 16 May) and fall (weeks of 26 September through 5 December) (Figure 3-18). The results of the CFDs are presented in Appendix C-6 and C-7.

The logrank test indicates that there were significant differences in 2011 among target species occurrence during the spring (prob < 0.0001). The results of the logrank test indicate that the CFDs for all target species are significantly different. The CFD is presented in Figure 3-18. The CFD indicates that by 18 April approximately 1% of the alewife and 37% of the blueback herring would have passed through the study area. By the week of 23 May, approximately 100% of alewife and blueback herring would have passed through the study area (Figure 3-18). Because the CPUE for American shad, Atlantic menhaden and striped bass was so low, they are being discussed separately. American shad were caught from the week of 11 April through the week of 16 May. The CFD indicates that by 18 April 17% would have passed through the study area and by 16 May 78% would have passed through the study area. The CPUE for Atlantic menhaden in the spring samples totaled 7. Atlantic menhaden were only caught the weeks of 23 May and 30 May. The results of the CFD indicate that 43% would have passed through the study area by the week of 23 May. Striped bass were caught from the 25 April through the 23 May. The CFD indicates that 10% would have passed through the study area by the week of 2 May and 97% would have passed through the study area by 23 May.

The logrank test indicates there were also significant differences in 2011 among target species with occurrence during the fall (prob=0.0001). The significant differences were between the timing of alewife and American shad and alewife and blueback herring. By week of 5 December, approximately 89% of alewife would have passed through the study area, 94% of the American shad, 94% of the Atlantic menhaden, 91% of the blueback herring, and by week of 14 November, 67% of the striped bass passed through the study area (Figure 3-18).

4.0 DISCUSSION

The Migratory Finfish Sampling Program provides regionally specific life history information for key migratory species that occur in the NY/NJ Harbor. The program's target species, alewife, American shad, Atlantic menhaden, blueback herring, and striped bass are valuable species, both economically and ecologically, and are species of importance to local and regional resource managers. Furthermore, these species represent a larger group of migratory finfish that may use the Harbor in a variety of ways: as pre-spawning staging area, as a corridor to access spawning habitat, as foraging grounds for juveniles moving through, and as overwintering habitat for young juveniles. As indicated earlier, information garnered from this study can be evaluated to begin to understand potential interactions between dredging operations and migratory species as they move through the Harbor.

This study taken in conjunction with USACE-NYD's ongoing efforts to monitor the extent and duration of re-suspended sediment plumes generated during harbor deepening dredging operations as well as recent underwater acoustic surveys of operating backhoe and cutterhead dredges and ambient noise conditions (Reine et al. 2013, Reine et al. 2012) highlight existing efforts underway to better understand potential impacts due to dredging operations on fish migration within NY/NJ Harbor.

4.1 SPATIAL AND TEMPORAL PATTERNS

Weekly sampling during the spring and fall migratory periods was critical to advancing the program during 2011. Apparent spatial and temporal patterns observed for the five target species are summarized in Table 4-1, and a summary of other finfish surveys completed in the Harbor are summarized in Table 4-2.

Alewife and blueback herring co-occur throughout much of their range; however, their life histories result in different spatial and temporal patterns (Monroe 2000). During the 2006 and 2011 MFS Programs, alewife predominantly used channel stations in Upper Bay, Arthur Kill/Kill Van Kull, and Newark Bay (very low or no catch in Lower Bay). The GIS station mapping performed in 2011 showed alewife tending to use Upper Bay and Newark Bay during the spring and Newark Bay and Arthur Kill during the fall. The results of the Kruskal-Wallis one-way ANOVA and Dunn's tests suggest a gradation in spring alewife abundance between the study areas with higher median CPUE's (Upper Bay and Newark Bay) and with the lowest median CPUE (Lower Bay), with only statistically significant differences between the the Upper Bay and Lower Bays. During fall, the results of the Kruskal-Wallis one-way ANOVA and Dunn's tests suggest a difference in abundance between the Newark Bay and Arthur Kill/Kill Van Kull study areas that had the highest median CPUEs and the Upper Bay and Lower Bay that had intermediate and lowest median CPUEs, respectively.

In contrast, blueback herring occurred in all Harbor areas during spring (except for the Lower Bay during 2006). During fall, blueback herring exhibited a propensity for Lower Bay and non-channel Upper Bay stations. The results of the Kruskal-Wallis one-way ANOVA detected statistically significant differences among the blueback herring spring samples that the Dunn's test showed to be significantly different only between the Upper Bay and Lower Bay areas. The Kruskal-Wallis one-way ANOVA did not detect statistically significant differences among median CPUEs for the blueback herring fall samples.

Temporally, both alewife and blueback herring exhibited discrete spring and fall seasonal residences in the NY/NJ Harbor. During spring 2011, relatively high blueback herring catch rates occurred up to three weeks prior to peak catches of alewife, most notably in the Upper Bay. High early collections of blueback herring may be due to staging in the estuary. Loesch and Lund (1977) collected blueback herring in the lower Connecticut River during mid-April with water temperatures as low as 4.7ºC, but spawning runs did not commence until mid-May. By mid-May 2011, both catches of alewife and blueback herring in the Harbor had declined. However, because alewife and blueback herring spring catches were dominated by juveniles and sub-adults, making inferences of the timing of spawning runs and migratory pathways taken by adults is difficult. Spawning-sized adults from the Connecticut River were approximately 260-300 mm for both alewife and blueback herring (Loesch 1987), but spawning sized adults in the Hudson

River have been reported much smaller, at lengths of 170 mm or greater (per Hattala et al. in ASFMC 2012). Most river herring collected during spring as part of the MFS Program have been less than 150 mm total length. Interestingly, the 30 blueback herring and the 11 alewife greater than 170 mm (i.e., "spawning adults") collected during spring 2011 were collected in samples with many other 90-100 mm juveniles or immature fish (i.e., the modal size group). Stone et al. (1994) indicated that alewife and juvenile blueback herring may be present all year in the Hudson-Raritan estuary, with abundances dependent upon the life stage and season, indicating the patterns observed during 2006 and 2011 may not be uncommon.

Many factors cue juvenile river herring migration to the ocean, including increased flow, decreasing water temperatures, lunar phases, and decreased food availability in tributaries (Yako et al. 2002, Monroe 2000 and references therein). Juvenile blueback herring tend to remain in their natal spawning rivers a month longer than alewife and migrate downstream within a narrow timeframe as compared to alewife that emigrate throughout summer in successive cohorts (Monroe 2000 and references therein). During fall 2011, juvenile blueback herring were collected in high abundance during early September and approximately two weeks earlier than most alewife. Given the tropical storms during late August and early September, the emigration to saline waters most likely did not follow traditional cues and timing. Harbor tributaries were flooded and extremely turbid (Figure 4-1, a NASA satellite image taken on September 1, 2011), making residency and foraging in the tributaries difficult, and Harbor salinities were lower than normal, making the transition from freshwater less stressful for the YOY.

Juvenile blueback herring emigration to the ocean has been documented to end in late October and early November in the Connecticut River when water temperatures had reached 10ºC (O'Leary and Kynard 1986). In NY/NJ Harbor during the 2011 MFS, the largest collection of blueback herring occurred in Upper and Lower Bays during the week of 14 November which followed a drop in NY/NJ Harbor water temperatures. Following this sample week, blueback herring were also collected in high rates in December 2011, despite water temperatures of approximately 10ºC. In the Chesapeake

Bay and Connecticut River, alewife and blueback herring were documented in inshore waters at the mouth of their natal river for one to two years (Walton 1981, Marcy 1969). These late-season catches in NY/NJ Harbor may have been due to steadied water temperatures or may be an indication that juvenile blueback herring remain in the Harbor for a period of time.

American shad occurred in low densities during the spring and were more common during the fall, both in 2006 and 2011. No spawning sized American shad were collected (approximately 300-500 mm TL; Monroe 2000 and references therein). Juvenile shad collected during fall 2011 followed similar spatial and temporal patterns as blueback herring juveniles, i.e., favoring Lower Bay and non-channel Upper Bay stations. Co-occurrence of shad and river herring has been documented and well studied in many other (Monroe 2000 and references therein).

For the remaining target species, Atlantic menhaden, and striped bass, low catch rates make it difficult to infer spatial and seasonal patterns using the MFS Program data. General MFS Program patterns are noted on Table 4-1. These species were also collected as part of the USACE's annual ABS Program, in which the NY/NJ Harbor was sampled from December/January through May/June. These species were collected in high densities using a bottom trawl at many of the same locations sampled as part of the MFS Program. During the ABS Program, Atlantic menhaden occurred predominantly in Upper and Lower Bay channel stations (different locations than MFS Program) during summer and fall. Striped bass were collected in the Harbor throughout the year, with highest CPUE during summer and fall in the Upper Bay, Newark Bay and Arthur Kill (different locations than MFS Program).

4.2 DREDGING AND MIGRATORY FINFISH

Migratory finfish populations are vulnerable to anthropogenic disturbances, such as dredging (ASMFC 2009). The primary and secondary impacts from dredging relate to channelization at spawning and nursery locations, improper dredged material placement that inhibits upstream access or smothers important spawning substrate, release of contaminants, and high TSS levels (ASMFC 2009). State resource managers in Maryland, Pennsylvania, Massachusetts, New York and New Jersey and Federal resource agencies such as NMFS (Reine et al. 1998, Evans et al. 2011) have used seasonal dredging windows to protect fish migration, specifically adult and juvenile fishes. These restrictions are based on concerns that various anadromous species may be blocked from migratory pathways or avoid entry to natal spawning streams due to TSS plumes (Reine et al. 1998). Anadromous fishes such as striped bass, American shad, alewife, sturgeon (e.g., shortnose, gulf, pallid), and a number of salmonids (e.g., chinook, coho) were the most frequently listed species of concern (Reine et al. 1998). Many of these species were not targeted as part of the MFS Program. However, field studies have not conclusively demonstrated migratory blockage by navigation dredging operations (Reine et al. 1998).

Within NY/NJ Harbor, resource agencies historically have viewed noise and TSS as potential impacts to adult and juvenile life stages of migratory species (migratory species' spawning and early life stage nursery habitat are not known to occur in the Harbor). Dredging-induced sounds have been hypothesized to affect fish migration by blocking or delaying migration through navigable waterways, interrupting or impairing communication, or disrupting foraging behavior. To address these potential effects, the following discussion evaluates TSS and noise associated with dredging operations on migratory species using the NY/NJ Harbor, based on the findings from the Migratory Finfish Survey Program, total suspended sediment (TSS) surveys conducted in the NY/NJ Harbor, a dredging noise characterization study conducted in the NY/NJ Harbor, and other literature.

Total Suspended Solids

The potential for impacts of dredging on migratory species depends on site-specific conditions and the interaction of dredge plant, in situ sediment characteristics, local hydrodynamics, and distributions of organisms in space and time that affect duration of suspended sediment exposure (Wilber and Clarke 2001). When encountered, motile organisms like fish typically are exposed to localized plumes for short durations, unless the organism follows the plume, is confined to an area with restricted circulation, or if dredging occurs near the salt front where fish meander from fresh to salt water while they osmoregulate (Wilber and Clarke 2001).

As part of USACE-NYD's on going Harborwide Water Quality/Total Suspended Solids (WQ/TSS) Monitoring Program, a number of WQ/TSS were surveys conducted in the greater New York Harbor (Table 4-3). These surveys were designed to monitor the extent of plumes of re-suspended sediment generated by ship traffic and harbor deepening dredging operations. The size, extent, and duration of the sediment plume were highly dependent upon site-specific sediment type and current characteristics. In general, the TSS surveys demonstrate that in areas with finer sediment grain size, and/or stronger currents, the plume of suspended sediment is transported further downcurrent from the source of re-suspension. For example, in Upper Bay (Contract Area S-AN-2 with sand/silt substrate), suspended sediment concentrations were typically 200 mg/L or less within 500 meters of the dredge platform and dissipated to background conditions within 1,000 meters of the dredge (USACE 2011). In comparison, in Newark Bay (Contract Area S-NB-1 with silt/clay), the core of the plumes measured previously in Newark Bay typically ranged between 80 and 200 mg/L within the first 75 meters down current from the source, although a consistent pattern was observed of relatively rapid decay and settlement within the water column in which TSS concentrations 150 meters downcurrent from the source generally did not exceed 100 mg/L (USACE 2008). However, regardless of sediment type and current condition, the lateral size of sediment plumes from dredging was limited, and remain confined to the channel basins.

To provide context to these concentrations, Sherk et al. (1975) reported responses of estuarine species to ranging TSS concentrations and documented the physiological and lethal effects to these species. Adult striped bass (juveniles were not tested) and juvenile menhaden (adults were not tested) were classified as “Sensitive Species”, defined by 24-hour exposures of between 1,000 and 9900 mg/L were lethal to 10% of the population (Sherk et al. 1975). To evaluate sub-lethal effects, striped bass were exposed to TSS of 600 mg/L for 11 days and 1,500 mg/L for 14 days. The low concentration (600 mg/L) of suspended solids had little effect on striped bass, even over the prolonged exposure (Sherk et al. 1975). Neither Atlantic menhanden or river herring or other Alosins were tested by Sherk et al. (1975). For comparison to striped bass, species that were Highly Sensitive (i.e., young-of-year white perch), evoked a significant physiological response after being exposed to 650 mg/L of suspended solids for 5 days, which was very similar to fish exposed to prolonged levels of low dissolved oxygen. These suspended solid concentrations are greater than concentrations observed by USACE WQ/TSS surveys conducted in the Upper and Newark Bays. In addition, based on mobile nature of fish and observations of the USACE WQ/TSS surveys, TSS plumes associated with dredging operations rapidly decay so the five-day exposure period is not realistic exposure period for juvenile and adult migratory species collected in NY.NJ Harbor

Noise

The audible range of most fish is within the frequency range of 50 to 1,000 Hz and with the best sensitivity at 100 to 400 Hz (Reine et al. 2013). Members of the clupeiform genus *Alosa*, which include the migratory river herring (alewife, blueback herring) and American shad, have extraordinarily high frequency hearing capabilities (Mann et al. 2001). Similar to TSS, the effect of noise on fish is a function of magnitude and duration of exposure. Noise can affect fish behavior by disturbing feeding, predator avoidance, and social interactions, or have more lasting physical effects (Popper 2003, Popper and Hasting 2009). Existing NMFS Marine Mammal Protection Act guidance identifies sound pressure level (SPL) thresholds of 180 dB re 1 µPa for potential injury at 1 meter (Level A Criterion), 160 dB re 1µPA at 1 meter (Level B Criterion) for behavioral disturbance/harassment from an impulsive noise source (e.g., seismic survey), and 120 dB re 1 µPA at 1 meter for behavioral disturbance/harassment from a continuous noise source (e.g., dredging) (referenced in Reine et al. 2013). These SPLs are often used as thresholds for injury and disturbance for others species as well.

Within the NY/NJ Harbor, the majority of dredging associated with the HDP is conducted using mechanical bucket dredges. However, cutterhead dredges used in the fracturing phase are used in site specific cases and hopper dredgers have been used to dredge Ambrose Channel. The processes which comprise sound sources associated with mechanical backhoe (excavator) dredging activities fall within several categories that range in duration from seconds to minutes: physical removal including scraping/grinding sounds, sounds from the hydraulic pumps as the articulating arm moves, sounds emanating from the barge's hull (particularly during early stages of filling), and periodic movement of the dredge using cables, spuds, and tugboats (Reine et al. 2013). The various underwater sounds produced are influenced by factors such as substrate type, geomorphology of the waterway, site-specific hydrodynamic conditions, equipment maintenance status, and skill of the dredge operator.

During 2011, the USACE Engineering Research and Development Center (ERDC) completed a study in the NY/NJ Harbor, in the Upper Bay near the mouth of the Kill Van Kull to characterize underwater sounds of dredging rock and gravel (Reine et al. 2013). Excavations in rock and gravel were considered to represent worst-case scenario for mechanical dredging-related noises. To assess the risks associated with backhoe dredging operations, sounds were characterized with respect to sound pressure levels (SPL) generated by this dredge type. These SPLs did not exceed 160 dB re 1µPa at 55 meters (the closest listening station occupied in the study). Ambient sound ranged from 97 to 131 dB re 1µ Pa, and averaged 117.1 dB re 1µ Pa. For additional details, see Reine et al. (2013).

The engine/generator was the only continuous sound that exceeded the 120 dB threshold for continuous noise. However, at a distance of 135m, the engine/generator peaked at 12.5 dB (50-1,000Hz) and 9.5 dB (100-400 Hz) above the threshold limit. These decreased as distance from the dredge plant increased, to approximately at or below the threshold level at a distance of 330m (Reine et al. 2013). Reine et al. (2013) noted that ambient noise in the Upper Bay during the survey approached or exceeded the NMFS sound thresholds for a continuous noise source (ambient SPL averaged 117.1 dB re 1µPa, with a maximum SPL of 131.2 dB re 1µPa; Reine et al. 2013).

Other non-continuous, repetitive sounds occurred during dredging, but lasted only seconds per event. These never exceeded the threshold of 160 dB for behavioral disturbance. The most intense recorded sounds were associated with bottom grabs (peak = 148.1 dB re 1µPa, 50-1,000 Hz) and walking spud maneuvers (peak = 147.4 dB re 1µPa, 50- 1,000 Hz) at 60 m and 75 m respectively from the source, respectively.

Based on these findings and the ambient conditions of 117.1 dB re 1µ Pa, potential impacts of fish would be limited to behavioral responses to sound stimuli associated with dredging processes (Reine et al. 2013). These behavioral responses would be expected to occur in narrow corridors that are dominated by deep water habitats (e.g., Arthur Kill/Kill Van Kull) where it would be more difficult for the fish to avoid the noise and disturbance.

5.0 SUMMARY

The analysis of the 2011 MFS Program data presented is consistent with the findings of the 2006 MFS survey as well as previous studies in that migratory finfish use the NY/NJ Harbor during Spring and Fall migration periods (Stone et al. 1994, Waldman 2006, Able and Fahay 2010). The migratory target species, particularly American shad and river herring, displayed seasonal occurrence in the Harbor. Juveniles were found in the inner Harbor areas (not Lower Bay) in the spring and all Harbor areas during fall.

Few studies have evaluated the biological response of adult estuarine finfish to TSS levels and duration of exposure comparable to navigation dredging operations (Wilber and Clarke 2001). However, based on the findings of the 2011 MFS Program and the ongoing USACE-NYD TSS surveys, it appears that the target migratory finfish species would have limited exposure to resuspended sediment plumes resulting from dredging operations. Sediment plumes have been found to be more concentrated within the bottom half of the water, while for the most part, target species were collected at higher rates within the middle of the water column. Additionally, the sediment plumes dissipate within several hundred meters of the dredge plant and remain confined to the navigation channel, indicating that migratory species may be exposed to temporarily elevated TSS levels in the channels, while species using the shallow flats within the Harbor would not be affected. Given the extent and short duration of these sediment plumes and the locations within the water column and Harbor where the target migratory species most occurred, these species would be expected to experience minimal negative effects from TSS during dredging operations.

In addition, given the brief exposure of migratory fish to noise associated with dredging operations within the NY/NJ Harbor while accessing spawning or overwintering grounds and the high ambient noise levels in the Harbor, these effects are most likely minimal.

In NY/NJ Harbor, seasonal dredging restrictions for finfish have been instituted primarily to protect essential fish habitat, specifically winter flounder spawning and nursery habitat. However, regional concerns have become increasingly focused on migratory finfish stocks. Developing an understanding of where migratory pathways occur and peak seasonal use (temporal and spatial patterns) in conjunction with USACE-NYD TSS studies and noise studies can improve the ability to effectively manage dredging activities within the NY/NJ Harbor while protecting the resource.

6.0 LITERATURE CITED

Able, K.W. and M.P. Fahay. 2010. Ecology of Estuarine Fishes: Temperate Waters of the Western North Atlantic. Johns Hopkins University Press. 566p.

Atlantic States Marine Fisheries Commission (ASFMC). 2007. American Shad Stock Assessment Report for Peer Review. Stock Assessment Report No. 07-01 (Supplement).

Atlantic States Marine Fisheries Commission (ASFMC). 2009. Amendment 2 to the Interstate Fishery Management Plan for Shad and River Herring (River Herring Management).

Boreman, J. and R.J. Klauda. 1988. Distributions of early life stages of striped bass in the Hudson River Estuary, 1974 – 1979. *American Fisheries Society Monograph* 4:53-58.

Cantelmo, F.R. and C.H. Wahtola, Jr. 1992. Aquatic habitat impacts of pile-supported and other structures in the lower Hudson River. pp. 59-75. In W. Wise, D.J. Suszkowski, and J.R. Waldman (eds.). Proceedings: Conference on the impacts of New York Harbor development on aquatic resources. Hudson River Foundation, New York, NY.

Colette, B.B. and G.Klein-MacPhee, eds. 2002. Bigelow and Schroeder's Fishes of the Gulf of Maine. 3rd Edition Smithsonian Institution Press, Washington, DC. in ASMFC 2009. Volume 53.

Connover, W.J. 1971. Practical Nonparametric Statistics. John Wiley & Sons Inc., New York, 462 pp.

Dovel, W.L. 1971. Fish eggs and larvae of the upper Chesapeake Bay. University of Maryland Natural Resources Institute Contribution No. 460, Special Science Report No. 4.

Evans, N.T., K.H. Ford, B.C. Chase, J.J. Sheppard. 2011. Recommended Time of Year Restrictions (TOYs) for Coastal Alteration Projects to Protect Marine Fisheries Resources in Massachusetts. Massachusetts Division of Marine Fisheries Technical Report TR-47. April 2011. 69 pp.

Everly, A.W. and J. Boreman. 1999. Habitat Use and Requirements of Important Fish Species Inhabiting the Hudson River Estuary: Availability of Information. NOAA Technical Memorandum NMFS-NE-121.

Hattala, K.A., and A.W. Kahnle. Status of American Shad in the Hudson River, New York. Updated August 2009. Hudson River Fisheries Unit, Bureau of Marine Resources, New York Department of Environmental Conservation.

Hattala, K. A., Kahnle, A. W., and Adams, R. D. 2012. Status of New York River Herring Stocks. In Stock Assessment Report No. 12-02 of the Atlantic States Marine Fisheries Commission River Herring Benchmark Stock Assessment Volume II. Accepted for Management Use May 2012.

Hill, M. O., 1973. Reciprocal averaging: an eigenvector method of ordination. Journal of Ecology. 61: 237-249.

Hintze, Jerry L. 2007. NCSS 2007 Manual. Published by NCSS. Kaysville, Utah.

Kahnle, A., and K. Hattala. 2010. Hudson River American shad: an ecosystem-based plan for recovery. Prepared for New York State Department of Environmental Conservation and Hudson River Estuary. Revised January 2010.

Loesch, J. G. 1987. Overview of life history aspects of anadromous alewife and blueback herring in freshwater habitats. Pages 89-103 in M. J. Dadswell, R. J. Klauda, C. M. Moffitt, and R. L. Saunders, editors. Common strategies of anadromous and catadromous fishes. American Fisheries Society Symposium 1, Bethesda, Maryland.

Loesch, J.G. and W.A. Lund. 1977. A contribution to the life history of the blueback herring, *Alosa aestivalis*. Trans Am. Fish Soc. 106:583-589.

Mann, D. A., Higgs, D. M., Tavolga, W. N., Souza, M. J. & Popper, A. N. (2001). Ultrasound detection by clupeiform fishes. Journal of the Acoustical Society of America 109, 3048–3054.

Marcy, B. C., Jr. 1969. Age determination from scales of *Alosa pseudoharengus* (Wilson) and *Alosa aestivalis* (Mitchill) in Connecticut waters. Transactions of the American Fisheries.

Marcy, B. C., Jr. 1976. Fishes of the lower Connecticut River and the effects of the Connecticut Yankee plant. Pages 61-114 in D. Merriman, and L. M. Thorper, editors. The Connecticut River ecological study: The impact of a nuclear power plant. American Fisheries Society Monograph No. 1, Bethesda, Maryland.

McLaren, J.B., J.C. Cooper, T.B. Hoff and V. Lander. 1981. Movements of Hudson River striped bass. *Transactions of the American Fisheries Society* 110:158-167.

Monroe, TA. 2000. An Overview of the Biology, Ecology, and Fisheries of the Clupeoid Fishes Occurring in the Gulf of Maine. Northeast Fisheries Science Center Reference Document 00-02. March 2000.

Mullen, D.M., C.W. Fay and J.R. Moring. 1986. Alewife/Blueback Herring – Species Profiles: life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic).U.S. Fish and Wildlife Service Biological Report 82(11.56).

New Jersey Department of Environmental Protection (NJDEP). 2005. Locations of anadromous American Shad and river herring during their spawning period in New Jersey's freshwaters including known migratory impediments and fish ladders. Prepared by NJDEP on March 2005.

Netter, J., W. Wasserman and M.H. Kutner. 1985. Applied Linear Statistical Models. Second Edition. Irwin, Illinois, 1127 pp.

Neves, R. J. 1981. Offshore distribution of alewife and blueback herring along the Atlantic coast. U.S. Natl. Mar. Fish. Serv. Fish. Bull. 79: 473-485.

O'Leary, J. A., and B. Kynard. 1986. Behavior, length, and sex ratio of seaward-migrating juvenile American shad and blueback herring in the Connecticut River. Transactions of the American Fisheries Society 115: 529-536.

Popper, A.N. 2003. Effects of anthropogenic sound on fishes. Fisheries 28: 24–31.

Popper, A.N. and M.C. Hastings. 2009. The effects of anthropogenic sources of sound on fishes (A review paper). Journal of Fish Biology 75: 455–489.

Reine, K.J., D.D. Dickerson and D.G. Clarke. 1998. Environmental windows associated with dredging operations. DOER Technical Notes Collection (TN DOER-E2). U.S. Army Engineer Res. and Devel. Center, Vicksburg, MS. 14pp.

Reine, K. J., Clarke, D. G., and C. Dickerson. 2013. Characterization of Underwater Sounds Produced by a Backhoe Dredge Excavating Rock and Gravel, *DOER Technical Notes Collection* U.S. Army Engineer Research and Development Center, Vicksburg, MS. *www.wes.army.mil/el/dots/doer*

Reine, K. J., Clarke, D. G., and C. Dickerson. 2012. Characterization of Underwater Sounds Produced by a Hydraulic Cutterhead Dredge Fracturing Limestone Rock, *DOER Technical Notes Collection* (ERDC TN-DOER-E34), U. S. Army Engineer Research and Development Center, Vicksburg, MS. www.wes.army.mil/el/dots/doer.

Schmidt,R.E., R.J. Klauda, and J.M. Bartels. 1988. Distribution and movements of the early life stages of three species of Alosa in the Hudson River, with comments on Mechanisms to reduce interspecific competition. In C.L. Smith eds. Fisheries Research in the Hudson River, The Hudson River Environmental Society. State University of New York Press, Albany, NY. 407 pp.

Schmidt, R.E. and T.R. Lake. 1999. Alewives in the Hudson River Tributaries. Final Report to the Hudson River Foundation. Prepared by Hudsonia Limited. March 15, 1999.

Secor, D.H. and E.D. Houde. 1995. Temperature effects on the timing of striped bass egg production, larval viability, and recruitement potential in the Patuxent River (Chesapeake Bay). Estuaries 18(3):527-544.

Sherk, J.A., J.M. O'Connor, and D.A. Neumann. 1975. Effects of suspended and deposited sediments on estuarine environments." Estuarine Research 2. L. E. Cronin, ed., Academic Press, New York, 541-558.

Stone, S.L., T.A. Lowery, J.D. Field, S.H. Jury, D.M. Nelson, M.E. Monaco, C.D. Williams, L. Andreasen. 1994. Distribution and abundance of fishes and invertebrates in mid-Atlantic estuaries. ELMR Report Number 12. NOAA/NOS Strategic Environmental Assessments Division, Silver Springs, MD.

Talbot, G.B. 1954. Factors Associated with Fluctuations in Abundance of Hudson River Shad. Fishery Bulletin of the Fish and Wildlife Service (USFWS), Volume 56, Fishery Bulletin 101.

United States Army Corps of Engineers (USACE) – New York District (NYD). 2007. 2006 Aquatic Biological Survey for the Harbor Deepening Project.

United States Army Corps of Engineers (USACE) – New York District (NYD). 2008. Far Field Surveys of Suspended Sediment Plumes Associated With Harbor Deepening Dredging In Newark Bay. September 2008.

United States Army Corps of Engineers (USACE) – New York District (NYD). 2011. Far Field Surveys of Suspended Sediment Plumes Associated With Harbor Deepening Dredging In Upper Bay. August 2011.

Waldman, J.R., 2006. The Diadromous Fish Fauna of the Hudson River: Life Histories, Conservation Concerns & Research Avenues. pp. 171-188 in: J.S. Levinton and J.R. Waldman, (Eds.) The Hudson River Estuary. Cambridge University Press, New York.

Waldman, J.R., D.J. Dunning, Q.E. Ross, and M.T. Mattson. 1990. Range dynamics of Hudson River striped bass along the Atlantic coast. *Transactions of the American Fisheries Society* 119:910-919.

Walton, C.1. 1983. Growth parameters for typical anadromous and dwarf stocks of alewives, *Alosa pseudoharengus* (Pisces, Clupeidae). Environmental Biology of Fishes 9:277-287.

Wilber, D.H., and Clarke, D.G. 2001. Biological effects of suspended sediments: A review of suspended sediment impacts on fish and shellfish with relation to dredging activities in estuaries. North American Journal of Fisheries Management 21(4), 855-875.

Yako, L.A., M.E. Mather, and F. Juanes. 2002. Mechanisms for migration of anadromous herring: An ecological basis for effective conservation. Ecological Applications, 12(2): 521–534.

Zar, J.H. 1999. Biostatistical Analysis. Fourth Edition. Prentice Hall Inc., New Jersey, 663 pp

Table 2-1. Description of mid-water stations sampled during the 2006 and 2011 Migratory Finfish Sampling Program.

Harbor Area	Station Name	Station Type	Station Location	MLLW Depth (ft)	Valid Samples Collected	
					2006	2011
Arthur Kill/ Kill Van Kull	MAK-1	Channel	In channel off Elizabethport	40	12	22
	MAK-2	Channel	In channel at mouth of Piles Creek	33	12	21
	MAK-3	Channel	In channel at mouth of Rahway River	35	12	21
	MAK-4	Channel	In channel, just S of Fresh Kills/Cedar Point	35	12	21
	MKK-1	Channel	In channel off Constable Hook	49	12	22
	MKK-2	Channel	In channel off tip of Bayonne	47	12	21
Newark Bay	MNB-1	Channel	Mouth of S. Elizabeth Channel	41	12	22
	MNB-2	Channel	Just S of Elizabeth Channel	43	12	21
	MNB-3	Non-Channel	On flats opposite Elizabeth & Port Newark channels	9	12	---
	MNB-4	Non-Channel	Off channel just S of NJTPK Ext. bridge	7	12	---
	MNB-5	Channel	In channel; mouth of Hackensack River	30	12	21
	MNB-6	Channel	On flats at mouth of Passaic River	30	12	21
Upper Bay	MUB-1	Channel	Middle of The Narrows, just N of Verrazano	62	12	21
	MUB-2	Channel	In Anchorage Channel, just S of 24 buoy	47	12	22
	MUB-3	Channel	Bay Ridge Channel, just SE of marker 7	37	12	22
	MUB-4	Channel	In Anchorage channel, just W Bay Ridge Flats	38	12	---
	MUB-5	Channel	E of Jersey Flats; N of channel to MOT	52	12	---
	MUB-6	Non-Channel	Jersey Flats	10	12	---
	MUB-7	Non-Channel	Shallows off Caven Point	6	12	---
	MUB-8	Channel	Edge of Anchorage Channel; SE of Liberty Is.	54	12	22
	MUB-9	Channel	Edge of Anchorage Channel; just E of Ellis Is.	51	12	21

Table 2-1. Description of mid-water stations sampled during the 2006 and 2011 Migratory Finfish Sampling Program.

Harbor Area	Station Name	Station Type	Station Location	MLLW Depth (ft)	Valid Samples Collected	
					2006	2011
	MUB10	Channel	Edge of Anchorage Channel; E of Liberty Is.	51	12	---
	MUB11	Non-Channel	Bay Ridge Flats	12	--	21
Lower Bay	MLB-1	Non-Channel	Gravesend Bay	25	12	---
	MLB-2	Non-Channel	N of West Bank/Hoffman Is.	27	12	---
	MLB-3	Channel	Outside Ambrose Channel; E of Swinburne Is.	31	12	21
	MLB-4	Non-Channel	On flats SW of West Bank	15	12	21
	MLB-5	Channel	Ambrose Channel S of marker 22	42	--	21
	MLB-6	Non-Channel	SE of Coney Island	24	--	21

Notes:
-- : Not sampled

Source:
National Oceanic & Atmospheric Administration navigation charts 12333, 12327, NOAA Soundings (2006), and NOAA Soundings (undated)

Table 2-2. Water quality parameters and meter specifications for water quality measurements taken during the 2011 Migratory Finfish Sampling Program.

Water Quality Parameter	Parameter Units and Accuracy
Temperature	+/- 0.3°C
Dissolved oxygen	+/- 0.3 mg/L
Conductivity	+/- 1 µS/cm
Salinity	+/- 0.1 ppt

Table 2-3. Specifications of the 18-ft mid-water trawl used to collect finfish during the 2006 and 2011 Migratory Finfish Sampling Program.

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/cable 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

Table 3-1. Number of valid mid-water trawl tows collected by sample week during the 2011 Migratory Finfish Sampling Program.

Sample Week	Number of Valid Samples Collected
April 4, 2011	6*
April 11, 2011	20
April 18, 2011	20
April 25, 2011	20
May 2, 2011	20
May 9, 2011	20
May 16, 2011	20
May 23, 2011	20
May 30, 2011	20
July 11, 2011	20
August 15, 2011	20
September 12, 2011	20
September 26, 2011	20
October 3, 2011	20
October 10, 2011	20
October 17, 2011	20
October 24, 2011	20
October 31, 2011	20
November 7, 2011	20
November 14, 2011	20
November 21, 2011	20
December 5, 2011	20

**Exploratory Survey: MAK-1, MKK-1, MNB-1, MUB-2, MUB-3, MUB-8*
Note - Dates listed indicate the Monday of each Sample Week.

Table 3-2. Checklist of finfish species (common and scientific names) collected in mid-water trawl samples during the 2006 and 2011 Migratory Finfish Sampling Program.

Group	Common Name	Scientific Name	2006	2011
Target Species	Alewife	*Alosa pseudoharengus*	4	3
	American shad	*Alosa sapidissima*	8	5
	Atlantic menhaden	*Brevoortia tyrannus*	3	X
	Blueback herring	*Alosa aestivalis*	2	2
	Striped bass	*Morone saxatilis*	X	X
Essential Fish Habitat Species	Atlantic herring	*Clupea harengus harengus*	5	9
	Black sea bass	*Centropristis striata*		X
	Bluefish	*Pomatomus saltatrix*	10	X
	Butterfish	*Peprilus triacanthus*	6	7
	Pollock	*Pollachius virens*		X
	Red hake	*Urophycis chuss*		X
	Scup	*Stenotomus chrysops*		X
	Silver hake	*Merluccius bilinearis*		6
	Spanish mackerel	*Scomberomorus maculatus*	X	
	Windowpane	*Scophthalmus aquosus*		X
	Winter flounder	*Pseudopleuronectes americanus*	X	
Other Species	American eel	*Anguilla rostrata*		X
	American sandlance	*Ammodytes americanus*	X	
	Atlantic croaker	*Micropogonias undulatus*		X
	Atlantic cutlassfish	*Trichiurus lepturus*	X	
	Atlantic moonfish	*Selene setapinnis*	X	X
	Atlantic silverside	*Menidia menidia*	X	X
	Atlantic thread herring	*Opisthonema oglinum*		X
	Atlantic tomcod	*Microgadus tomcod*		X
	Banded killifish	*Fundulus diaphanus*		X
	Bay anchovy	*Anchoa mitchilli*	1	1
	Blue crab	*Callinectes sapidus*	7	10
	Boxfishes	*Ostraciidae*	X	
	Conger eel	*Conger oceanicus*		X
	Fourbeard rockling	*Enchelyopus cimbrius*	X	
	Gizzard shad	*Dorosoma cepedianum*		4
	Grubby	*Myoxocephalus aenaeus*	X	
	Hickory shad	*Alosa mediocris*	X	
	Lined seahorse	*Hippocampus erectus*	X	X
	Lookdown	*Selene vomer*	X	
	Naked goby	*Gobiosoma bosci*		X
	Northern pipefish	*Syngnathus fuscus*	X	X

Table 3-2. Checklist of finfish species (common and scientific names) collected in mid-water trawl samples during the 2006 and 2011 Migratory Finfish Sampling Program.

Group	Common Name	Scientific Name	2006	2011
	Northern searobin	*Prionotus carolinus*		X
	Northern stargazer	*Astroscopus guttatus*	X	
	Oyster toadfish	*Opsanus tau*		X
	Pinfish	*Lagodon rhomboides*		X
	River herrings	*Alosa spp.*		X
	Silver perch	*Bairdiella chrysoura*		X
	Smallmouth flounder	*Etropus microstomus*		X
	Spotted hake	*Urophycis regia*	X	X
	Striped anchovy	*Anchoa hepsetus*	9	8
	Striped cusk-eel	*Ophidion marginatum*		X
	Striped searobin	*Prionotus evolans*	X	X
	Weakfish	*Cynoscion regalis*		X
	White perch	*Morone americana*		X

Table 3-3. Total number of finfish collected by species each month in mid-water trawl samples during the 2011 Migratory Finfish Sampling Programs.

Group	Common Name	April	May	June	July	August	September	October	November	December	Total
Target Species	Alewife	704	1,423		1		242	1,092	578	236	4,276
	American shad	12	11				29	96	99	12	259
	Atlantic menhaden		7		1		5	9	6	1	29
	Blueback herring	2,240	414	2	6		462	1,253	1,888	313	6,578
	Striped bass	3	26				2	2	1		34
	Sub-total	*2,959*	*1,881*	*2*	*8*	*0*	*740*	*2,452*	*2,572*	*562*	*11,176*
Essential Fish Habiat Species	Atlantic herring	4	100	5				1	4	2	116
	Black sea bass							1			1
	Bluefish		16		5	2	18	31			72
	Butterfish		35		35	2	19	37	3	4	135
	Pollock		1								1
	Red hake		2								2
	Scup		1								1
	Silver hake		25					8	141	6	180
	Windowpane	1	4								5
	Sub-total	*5*	*184*	*5*	*40*	*4*	*37*	*78*	*148*	*12*	*513*
Other Species	American eel		4								4
	Atlantic croaker						1	10		4	15
	Atlantic moonfish						13	36	8	1	58
	Atlantic silverside	3					1		2		6
	Atlantic thread herring		1								1
	Atlantic tomcod		14								14
	Banded killifish		46								46
	Bay anchovy	12	7,876	815	4,247	3,311	9,138	28,399	2,013	1,372	57,183
	Blue crab				5	26	21	32	8		92

Table 3-3. Total number of finfish collected by species each month in mid-water trawl samples during the 2011 Migratory Finfish Sampling Programs.

Group	Common Name	April	May	June	July	August	September	October	November	December	Total
	Conger eel	1									1
	Gizzard shad						1	170	79	17	267
	Lined seahorse	7	10				2				19
	Naked goby							2			2
	Northern pipefish		3								3
	Northern searobin						1				1
	Oyster toadfish						1	3	1		5
	Pinfish						2	1			3
	River herrings							1			1
	Silver perch							7	2		9
	Smallmouth flounder	9	1								10
	Spotted hake	21	31								52
	Striped anchovy					48	38	39			125
	Striped cusk-eel	1									1
	Striped searobin							1			1
	Weakfish		2				16	38	1		57
	White perch		30					2	8		40
	Sub-total	*54*	*8,018*	*815*	*4,252*	*3,385*	*9,235*	*28,741*	*2,122*	*1,394*	*58,016*
Total Number		**3,018**	**10,083**	**822**	**4,300**	**3,389**	**10,012**	**31,271**	**4,842**	**1,968**	**69,705**
Number of Species		**13**	**24**	**3**	**7**	**5**	**19**	**24**	**17**	**11**	**40**

Table 3-4. Monthly average mid-water trawl CPUE (± 1 standard error) by species for all channel stations in the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB), and Lower Bay (LB) during the 2011 Migratory Finfish Sampling Program.

Common Name	Station Type	Region								Average CPUE
		AK/KVK		Newark Bay		Upper Bay		Lower Bay		
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	
Target Species										
	Channel	7.031	1.2037	17.576	3.8918	16.704	4.549			13.770
	Non-Channel					2.571	1.029	0.571	0.297	1.571
Alewife	Combined	7.031	1.2037	17.576	3.8918	14.403	3.837	0.286	0.151	9.824
	Channel	0.375	0.0928	0.329	0.0792	0.713	0.197	0.071	0.053	0.372
	Non-Channel					3.905	2.031	0.500	0.384	2.202
American Shad	Combined	0.375	0.0928	0.329	0.0792	1.233	0.378	0.286	0.194	0.556
	Channel	0.039	0.0172	0.165	0.08	0.065	0.030			0.090
	Non-Channel					0.048	0.048	0.048	0.033	0.048
Atlantic Manhaden	Combined	0.039	0.0172	0.165	0.08	0.062	0.026	0.024	0.017	0.072
	Channel	11.156	3.6216	9.012	3.6912	9.167	3.609	6.214	4.718	8.887
	Non-Channel					79.857	49.752	34.667	14.058	57.262
Blueback herring	Combined	11.156	3.6216	9.012	3.6912	20.674	8.798	20.440	7.533	15.321
	Channel	0.180	0.0963	0.047	0.0371	0.065	0.027			0.097
	Non-Channel									
Striped bass	Combined	0.180	0.0963	0.047	0.0371	0.054	0.023			0.094
Sum of Combined Target Species CPUE		18.781		27.129		36.426		21.036		25.867
Essential Fish Habitat Species										
	Channel	0.297	0.0876	0.188	0.0758	0.259	0.081			0.248
	Non-Channel					0.810	0.491	0.405	0.257	0.607
Atlantic herring	Combined	0.297	0.0876	0.188	0.0758	0.349	0.105	0.202	0.130	0.259
Black sea bass	Channel					0.009	0.009			0.009

Table 3-4. Monthly average mid-water trawl CPUE (± 1 standard error) by species for all channel stations in the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB), and Lower Bay (LB) during the 2011 Migratory Finfish Sampling Program.

Common Name	Station Type	Region								Average CPUE
		AK/KVK		Newark Bay		Upper Bay		Lower Bay		
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	
	Non-Channel									
	Combined					0.008	0.008			0.008
Bluefish	Channel	0.125	0.0457	0.388	0.1606	0.185	0.097			0.233
	Non-Channel					0.048	0.048	0.048	0.033	0.048
	Combined	0.125	0.0457	0.388	0.1606	0.163	0.081	0.024	0.017	0.175
Butterfish	Channel	0.102	0.033	0.259	0.0949	0.593	0.202	0.310	0.242	0.316
	Non-Channel					0.190	0.112	0.452	0.205	0.321
	Combined	0.102	0.033	0.259	0.0949	0.527	0.170	0.381	0.158	0.317
Pollock	Channel			0.012	0.0118					0.012
	Non-Channel									
	Combined			0.012	0.0118					0.012
Red hake	Channel					0.019	0.019			0.019
	Non-Channel									
	Combined					0.016	0.016			0.016
Scup	Channel					0.009	0.009			0.009
	Non-Channel									
	Combined					0.008	0.008			0.008
Silver hake	Channel	1.203	0.7135	0.118	0.0513	0.130	0.066	0.024	0.024	0.369
	Non-Channel					0.048	0.048			0.048
	Combined	1.203	0.7135	0.118	0.0513	0.116	0.056	0.012	0.012	0.362
Windowpane	Channel	0.016	0.011	0.012	0.0118	0.009	0.009			0.012
	Non-Channel							0.024	0.024	0.024
	Combined	0.016	0.011	0.012	0.0118	0.008	0.008	0.012	0.012	0.012

Table 3-4. Monthly average mid-water trawl CPUE (± 1 standard error) by species for all channel stations in the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB), and Lower Bay (LB) during the 2011 Migratory Finfish Sampling Program.

Common Name	Station Type	Region								Average CPUE
		AK/KVK		Newark Bay		Upper Bay		Lower Bay		
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	
Sum of Combined EFH Species CPUE		1.742		0.976		1.194		0.631		1.168
Other Species										
American eel	Channel					0.037	0.029			0.037
	Non-Channel									
	Combined					0.031	0.024			0.031
Atlantic croaker	Channel			0.059	0.0349	0.093	0.075			0.076
	Non-Channel									
	Combined			0.059	0.0349	0.078	0.063			0.068
Atlantic moonfish	Channel	0.133	0.0513	0.141	0.0823	0.213	0.078	0.024	0.024	0.128
	Non-Channel					0.143	0.104	0.048	0.033	0.095
	Combined	0.133	0.0513	0.141	0.0823	0.202	0.067	0.036	0.020	0.128
Atlantic silverside	Channel	0.008	0.0078	0.035	0.0201			0.024	0.024	0.022
	Non-Channel					0.048	0.048			0.048
	Combined	0.008	0.0078	0.035	0.0201	0.008	0.008	0.012	0.012	0.016
Atlantic thread herring	Channel									
	Non-Channel							0.024	0.024	0.024
	Combined							0.012	0.012	0.012
Atlantic tomcod	Channel	0.094	0.067	0.012	0.0118	0.009	0.009			0.038
	Non-Channel									
	Combined	0.094	0.067	0.012	0.0118	0.008	0.008			0.038
Banded killifish	Channel					0.074	0.074			0.074
	Non-Channel									
	Combined					0.062	0.062			0.062

Table 3-4. Monthly average mid-water trawl CPUE (± 1 standard error) by species for all channel stations in the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB), and Lower Bay (LB) during the 2011 Migratory Finfish Sampling Program.

Common Name	Station Type	Region								Average CPUE
		AK/KVK		Newark Bay		Upper Bay		Lower Bay		
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	
Bay anchovy	Channel	126.727	50.127	64.424	12.742	65.991	13.594	4.857	2.665	65.499
	Non-Channel					183.524	59.723	578.595	256.501	381.060
	Combined	126.727	50.127	64.424	12.742	85.124	15.322	291.726	131.314	142.000
Blue crab	Channel	0.328	0.0867	0.271	0.0827	0.185	0.060	0.024	0.024	0.202
	Non-Channel					0.190	0.190	0.048	0.033	0.119
	Combined	0.328	0.0867	0.271	0.0827	0.186	0.059	0.036	0.020	0.205
Conger eel	Channel					0.009	0.009			0.009
	Non-Channel									
	Combined					0.008	0.008			0.008
Gizzard shad	Channel	0.453	0.2063	2.459	1.7722					1.456
	Non-Channel									
	Combined	0.453	0.2063	2.459	1.7722					1.456
Lined seahorse	Channel	0.008	0.0078	0.012	0.0118	0.083	0.030	0.095	0.046	0.050
	Non-Channel					0.095	0.066	0.048	0.033	0.071
	Combined	0.008	0.0078	0.012	0.0118	0.085	0.027	0.071	0.028	0.044
Naked goby	Channel			0.012	0.0118	0.009	0.009			0.011
	Non-Channel									
	Combined			0.012	0.0118	0.008	0.008			0.010
Northern pipefish	Channel	0.008	0.0078	0.024	0.0165					0.016
	Non-Channel									
	Combined	0.008	0.0078	0.024	0.0165					0.016
Northern searobin	Channel					0.009	0.009			0.009
	Non-Channel									
	Combined					0.008	0.008			0.008

Table 3-4. Monthly average mid-water trawl CPUE (± 1 standard error) by species for all channel stations in the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB), and Lower Bay (LB) during the 2011 Migratory Finfish Sampling Program.

Common Name	Station Type	Region								Average CPUE
		AK/KVK		Newark Bay		Upper Bay		Lower Bay		
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	
Oyster toadfish	Channel	0.008	0.0078			0.037	0.023			0.022
	Non-Channel									
	Combined	0.008	0.0078			0.031	0.019			0.019
Pinfish	Channel					0.028	0.021			0.028
	Non-Channel									
	Combined					0.023	0.017			0.023
River herrings	Channel					0.009	0.009			0.009
	Non-Channel									
	Combined					0.008	0.008			0.008
Silver perch	Channel	0.016	0.0156	0.059	0.0588	0.019	0.019			0.031
	Non-Channel									
	Combined	0.016	0.0156	0.059	0.0588	0.016	0.016			0.030
Smallmouth flounder	Channel	0.008	0.0078			0.083	0.075			0.046
	Non-Channel									
	Combined	0.008	0.0078			0.070	0.062			0.039
Spotted hake	Channel	0.078	0.0527	0.071	0.0599	0.315	0.220	0.024	0.024	0.122
	Non-Channel							0.024	0.024	0.024
	Combined	0.078	0.0527	0.071	0.0599	0.264	0.184	0.024	0.017	0.109
Striped anchovy	Channel	0.695	0.3079	0.118	0.0635	0.083	0.059	0.071	0.071	0.242
	Non-Channel					0.333	0.287	0.167	0.083	0.250
	Combined	0.695	0.3079	0.118	0.0635	0.124	0.068	0.119	0.055	0.264
Striped cusk-eel	Channel					0.009	0.009			0.009
	Non-Channel									
	Combined					0.008	0.008			0.008

Table 3-4. Monthly average mid-water trawl CPUE (± 1 standard error) by species for all channel stations in the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB), and Lower Bay (LB) during the 2011 Migratory Finfish Sampling Program.

Common Name	Station Type	Region								Average CPUE
		AK/KVK		Newark Bay		Upper Bay		Lower Bay		
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	
Striped searobin	Channel					0.009	0.009			0.009
	Non-Channel									
	Combined					0.008	0.008			0.008
Weakfish	Channel	0.039	0.0205	0.118	0.0844	0.389	0.171			0.182
	Non-Channel									
	Combined	0.039	0.0205	0.118	0.0844	0.326	0.144			0.161
White perch	Channel	0.008	0.0078	0.447	0.1783	0.009	0.009			0.155
	Non-Channel									
	Combined	0.008	0.0078	0.447	0.1783	0.008	0.008			0.154
Sum of Combined Other Species CPUE		128.609		68.259		86.690		292.036		144.923

Table 4-1. Observed preferences of target species collected during the 2006 and 2011 Migratory Finfish Sampling Programs.

Species	Season/Month of Concern	NY/NJ Harbor Areas of Concern	Habitat Usage (channel/non-channel)	Comments and additional seasonal information (based on other studies)
Alewife	April, May and September through November	Upper Bay and Arthur Kill/Kill Van Kull, and Newark Bay (not Lower 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	October, 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)	Upper Bay and Arthur Kill/Kill Van Kull, and Newark Bay (not Lower Bay)	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 September through November	Upper Bay and Lower Bay	Common in non-channel habitats (MUB-11 significantly higher CPUE during fall); also present in 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 (uncommon in mid-water)	Primarily Newark Bay, Arthur Kill/Kill Van Kull	Possible preference for channel habitat.	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.°)

Seasonal distribution/occurrence varies yearly within the NY/NJ Harbor area. Two studies summarized available information:
[a] = Woodhead 1991
° = USACE-NYD 2004b

Table 4-2. Other relevant aquatic biological studies conducted in the Hudson-Raritan Estuary.

Region	Year	Authors	Title	Summary
NY/NJ Harbor (All Regions)	2004-2011	USACE-NYD	Annual Aquatic Biological Survey Reports	Ongoing yearly surveys conducted as part of the New York/New Jersey Harbor deepening project. Objective is to collect data on finfish, shellfish, macroinvertebrates and water quality, with a focus on fish community structure, distribution and seasonal patterns of habitat use in NY/NJ harbor. Sampling methods include epibenthic sled-mounted plankton nets, bottom trawls, sediment collections, water quality data.
	2003	USACE-NYD	2002-2003 Biological Sampling Program	
	2002	USACE-NYD	2001-2002 Aquatic Biological Sampling Program	
	2001	USACE-NYD	2000-2001 Supplemental Sampling Program	
	1999	USACE-NYD	1998-1999 New York and New Jersey Harbor Navigation Study	
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.

Table 4-2. Other relevant aquatic biological studies conducted in the Hudson-Raritan Estuary.

Region	Year	Authors	Title	Summary
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.
Upper Bay	2011	Henningson, Durham, and Richardson, P.C. (HDR)	World Financial Center Cooling Water Intake Structure 2010 Impingement Mortality and Entrainment Characterization Study	61 impingement sampling events collecting fish washed from travelling screens and 40 entrainment sampling events collecting ichthyoplankton from in front of travelling screens, conducted from January 2010 to April 2011, at World Financial Center in Lower Manhattan.
	2009	Henningson, Durham, and Richardson, P.C. (HDR)	One New York Plaza 2008 to 2009 Impingement Mortality and Entrainment Characterization Study	42 impingement sampling events collecting fish washed from travelling screens and 32 entrainment sampling evemts collecting ichthyoplankton from in front of travelling screens, at 1 New York Plaza building in Lower Manhattan, from June 2008 to July 2009.
	2003	Lawler, Matusky & Skelly Engineers, LLP. (LMS)	NYPA Charles Poletti Power Project Studies to Determine the Effects of Entrainment and Impingement	Impingement sampling events collecting fish washed from travelling screens and entrainment sampling collecting ichthyoplankton from in front of travelling screens, at Poletti power plant in Astoria, Queens.
	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.

Table 4-2. Other relevant aquatic biological studies conducted in the Hudson-Raritan Estuary.

Region	Year	Authors	Title	Summary
Upper Bay	1991 (and other years)	Lawler, Matusky & Skelly Engineers, LLP. (LMS)	1990 Year Class Report for the Hudson River Estuary Monitoring Program for Consolidated Edison Company of New York. Project No. 115-158	
	1989	EEA Inc.	East River Landing Aquatic Environmental Study. Final Report.	Benthic survey of interpier and underpier areas of the lower East River conducted in 1987 and 1988.
	1981	Hazen and Sawyer Engineers	Newtown Creek Water Pollution Control Plant Final Report Monitoring Program	Zooplankton study conducted for Newtown Creek WPC, May – October 1980.
	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	2010	USACE-NYD	Ambrose Obstruction Biological Sampling	Benthic grab sampling, lobster, crab, and fish traps, and bottom trawl surveys conducted in September 2009 at the entrance to Ambrose Channel to assess biological community utilizing an underwater obstruction and surrounding area.
	2007	HDR/LMS	Pre- & Post-Installation Fisheries Survey for the Neptune Regional Transmission System, LLC Submarine Cable Route	Bottom trawl survey conducted at six stations along the lower Raritan River in April, May and June 2006 and 2007 to obtain information on species composition, relative abundance, and general conditions of demersal fish and blue crab in the area of the proposed cable route before and after installation.

Table 4-2. Other relevant aquatic biological studies conducted in the Hudson-Raritan Estuary.

Region	Year	Authors	Title	Summary
Lower Bay	2004	USACE-ERDC /Northern Ecological Associates Inc.	Monitoring of Fish and Fish-feeding habits on the Shoreline of Raritan and Sandy Hook Bays, New Jersey: Interim Report	Beach seine sampling on beaches at Port Monmouth, Keansburg and Union Beach, NJ conducted in 2002-2003 to assess impacts of beach nourishment on biological communities.
	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.
	1984	McCormick, J.M., Multer, H.G., Stainken, D.M.	A Review of Raritan Bay Research	Literature review of biological and other environmental studies conducted in Raritan Bay over past ~100 years.
	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.

Table 4-2. Other relevant aquatic biological studies conducted in the Hudson-Raritan Estuary.

Region	Year	Authors	Title	Summary
Lower Bay	1976	Wilk, S.J., and Silverman, M.J.	Summer Benthic Fish Fauna of Sandy Hook Bay, New Jersey	Otter trawls conducted from July to October 1970 to determine summer species composition, relative abundance, and distribution of benthic fishes in Sandy Hook Bay. Thirty-eight species and 25 families of fishes were captured.

Table 4-3. Summary of Harborwide Water Quality/Total Suspended Solids (WQ/TSS) Monitoring Surveys Conducted by USACE-New York District, 2001-2011.

Survey	**Type of Survey(s) (Type of Data Collected)**	**Area(s) Surveyed**	**Dates**
Pilot Study	Ambient, Far Field Dredge, Ship Wake, Storm Event(TSS/Turbidity)	Newark Bay, Arthur Kill, Upper NY Bay	March 2001-February 2002
Arthur Kill 2/3	Far Field Dredge (Mobile ADCP, OBS Arrays, TSS/Turbidity)	Arthur Kill N. of Shooters Island	June 2006
Newark Bay Ship Wake	Ship Wake (Mobile ADCP)	Newark Bay (Port Elizabeth)	July 2006
Near Field Pilot Study	Near Field Dredge (Bucket Mounted OBS, Platform Mounted OBS and ADCP	Newark Bay	January 2008
S-NB-1 #1	Far Field Dredge (Mobile ADCP, TSS/Turbidity)	Newark Bay	February 2008
S-NB-1 #2	Far Field Dredge (Mobile ADCP, OBS Arrays, TSS/Turbidity)	Newark Bay	November 2008
South Elizabeth Hydrodynamic	Hydrodynamic (Mobile ADCP)	Newark Bay (South Elizabeth Channel)	November 2008
Port Jersey Habitat Enhancement Project	TSS/Turbidity	Upper New York Bay (Port Jersey)	December 2008
S-E-1 A	Far Field Dredge (Mobile ADCP, OBS Arrays, TSS/Turbidity)	Newark Bay (Port Elizabeth Channel)	March 2009
S-E-1 B	Far Field Dredge (Mobile ADCP, OBS Arrays, TSS/Turbidity Water Samples	Newark Bay (Port Elizabeth Channel)	April 2009
S-AN-2	Far Field Dredge (Mobile ADCP, TSS/Turbidity)	Upper New York Bay (Anchorage Channel)	January 2011

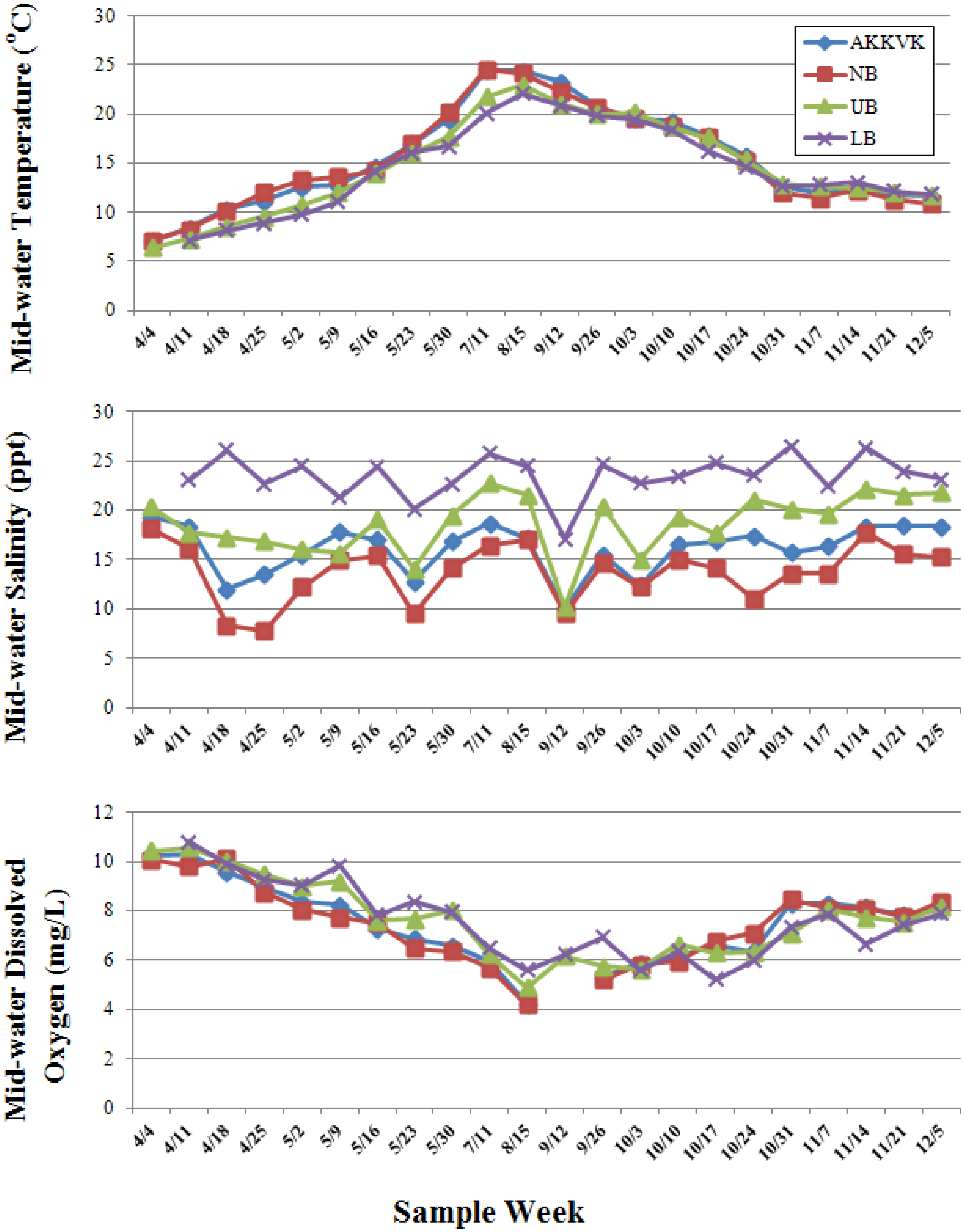


Figure 3-1. Average mid-water temperatures, dissolved oxygen, and salinities in the four study areas during each sampling period, 2011 Migratory Finfish Sampling Program.

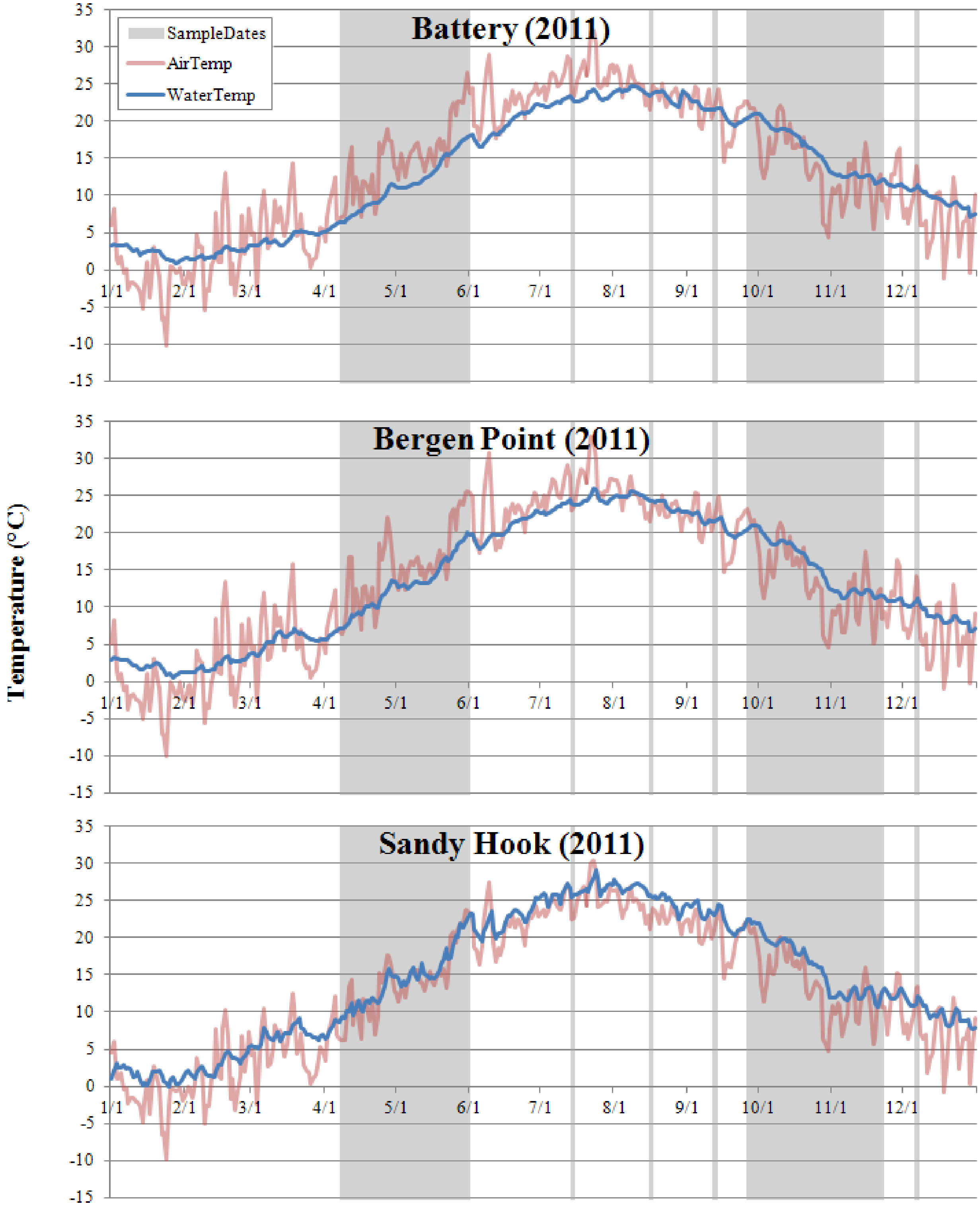


Figure 3-2a. Average daily water and air temperatures during 2011 from NOAA water quality buoys at three locations in NY/NJ Harbor. (Note: Solid shaded sample dates represent weekly sampling)

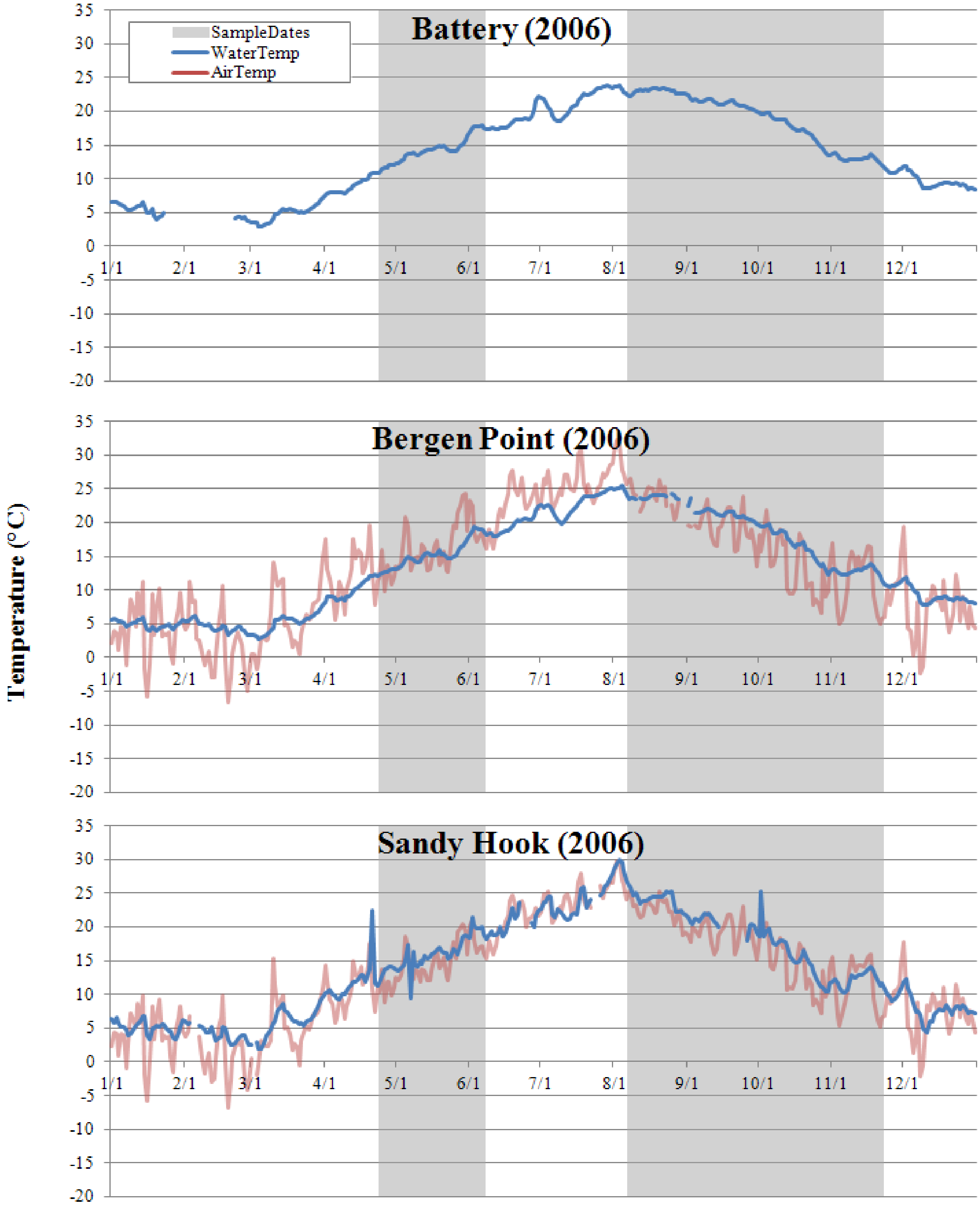


Figure 3-2b. Average daily water and air temperatures during 2006 from NOAA water quality buoys at three locations in NY/NJ Harbor. (Note: Solid shaded sample dates represent weekly sampling)

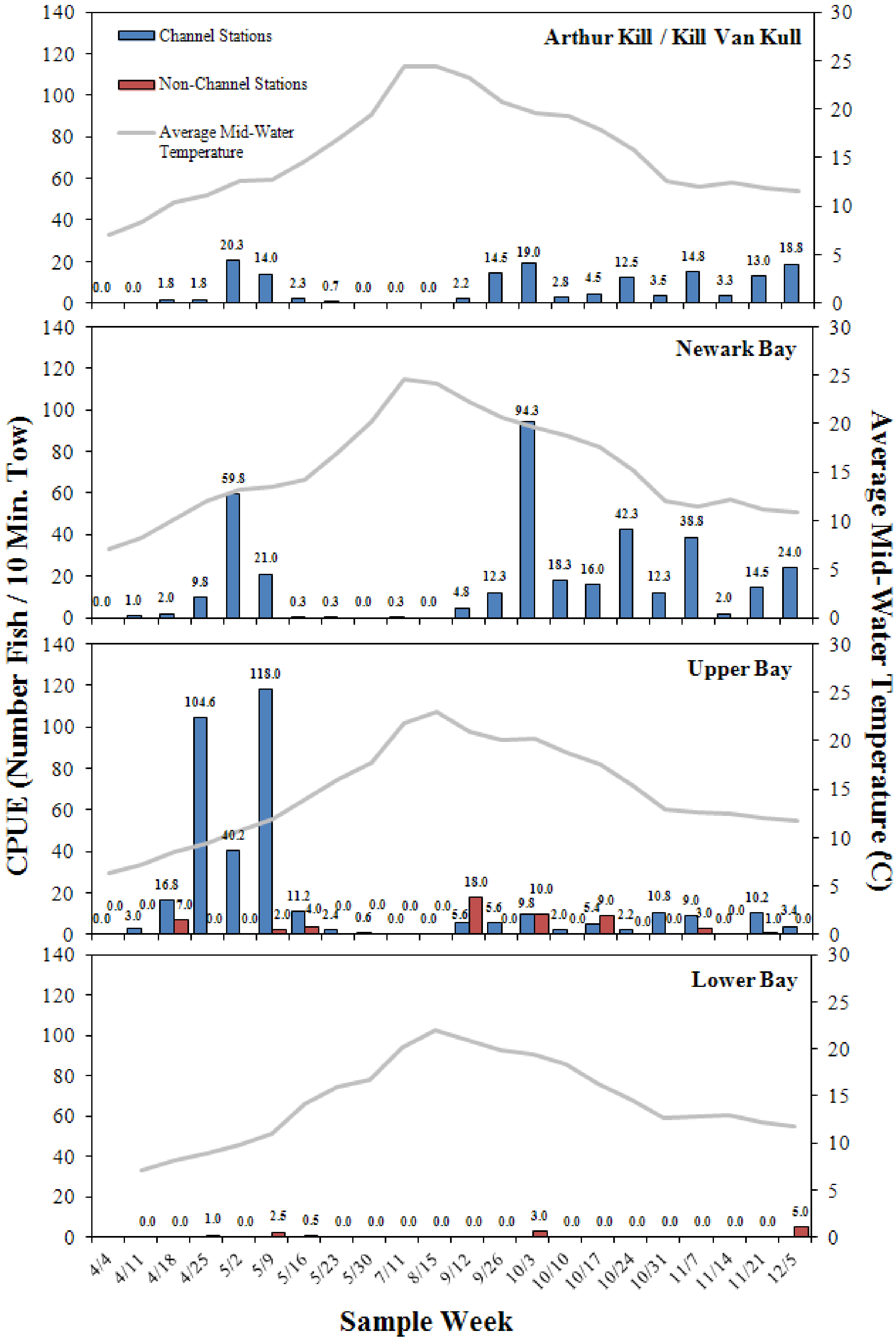


Figure 3-3. Alewife average weekly CPUE (fish/10 min) and average weekly mid-water temperature for the Arthur Kill/Kill Van Kull, Newark Bay, Upper Bay, and Lower Bay, 2011 Migratory Finfish Sampling Program. (Note: Dates listed indicate the Monday of each sampling week; Non-channel stations were not sampled in Arthur Kill/Kill Van Kull)

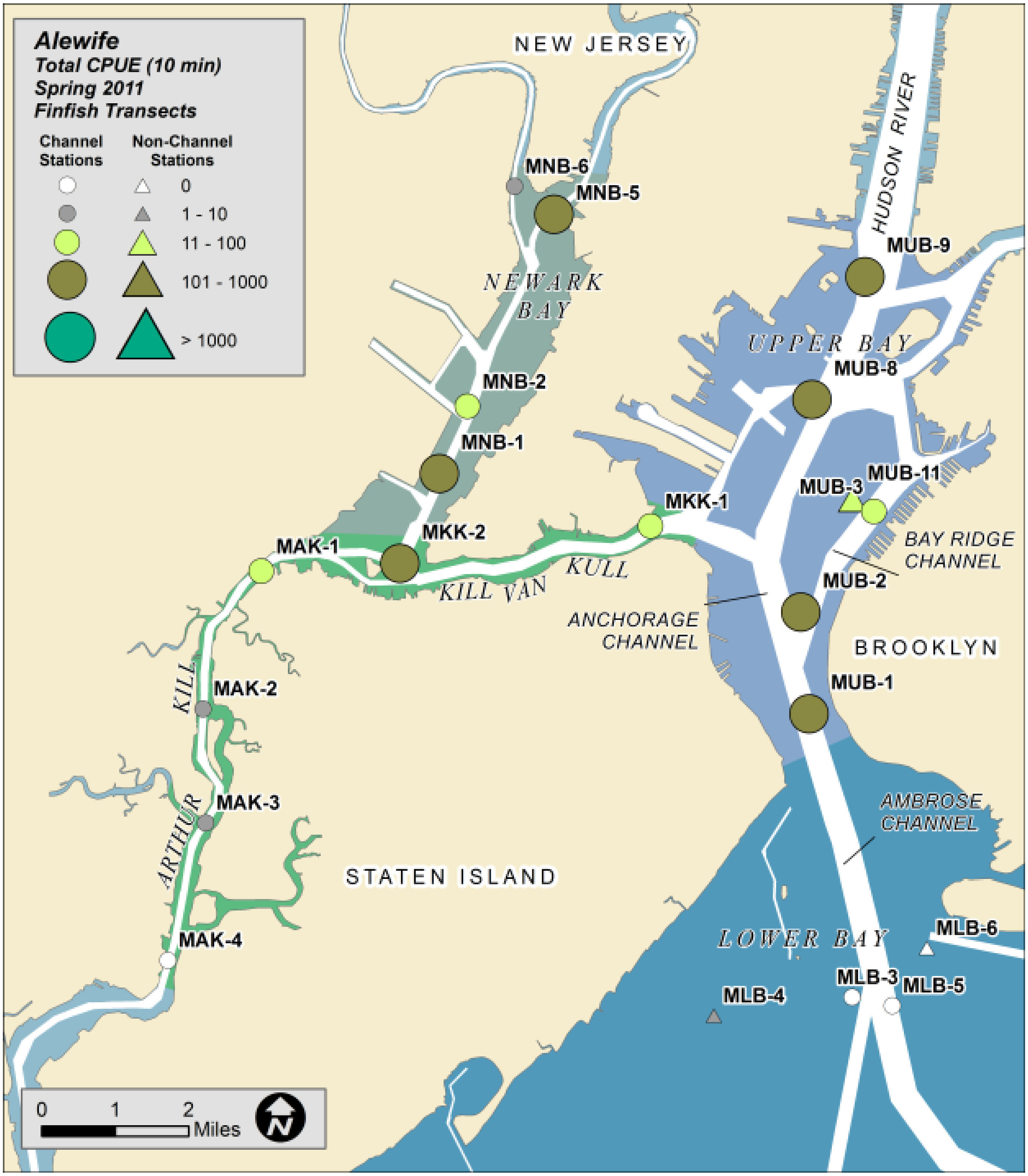


Figure 3-4a. Total station CPUE (fish/10 min) of alewife during spring, 2011 Migratory Finfish Sampling Program.

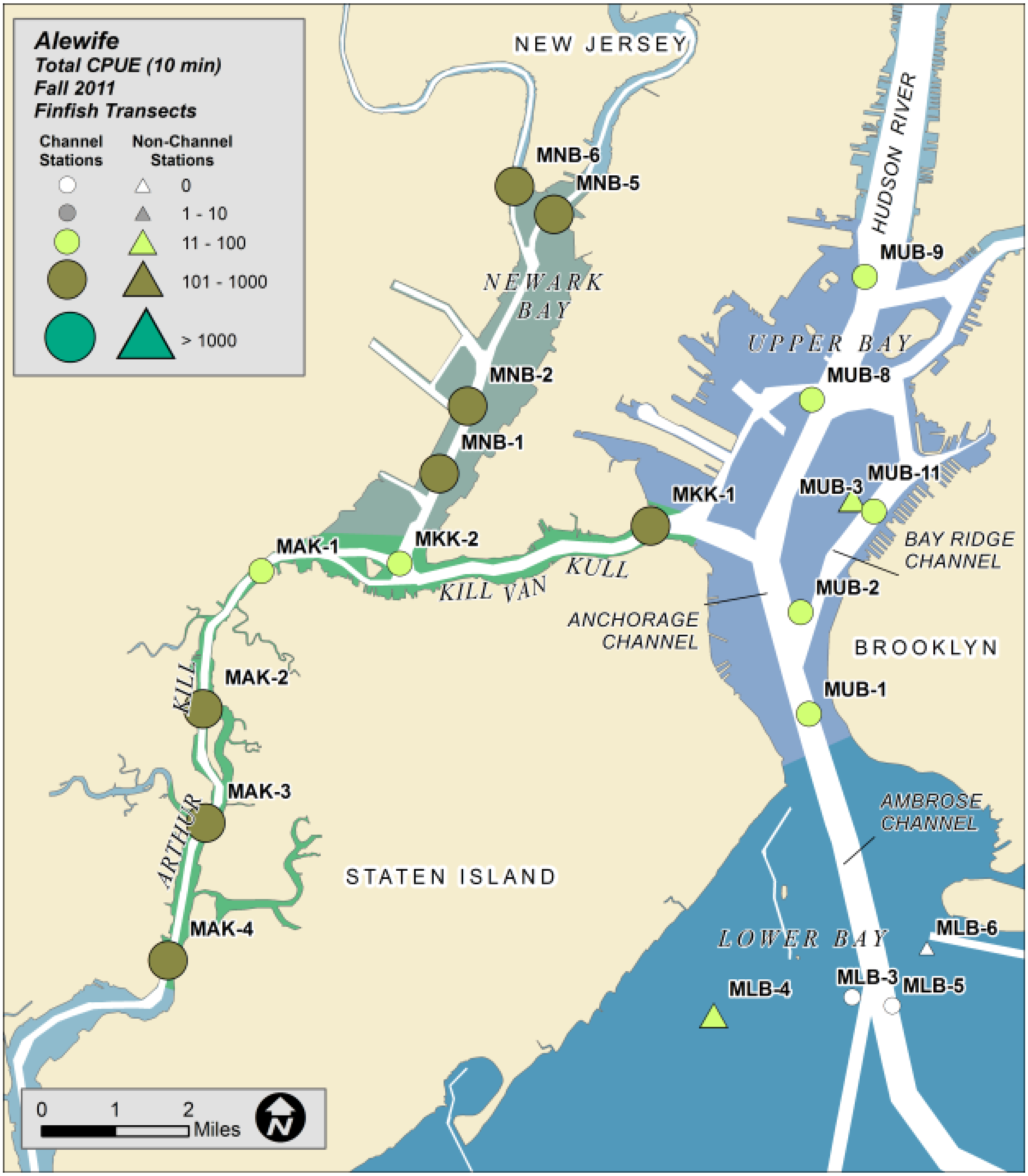


Figure 3-4b. Total station CPUE (fish/10 min) of alewife during fall, 2011 Migratory Finfish Sampling Program.

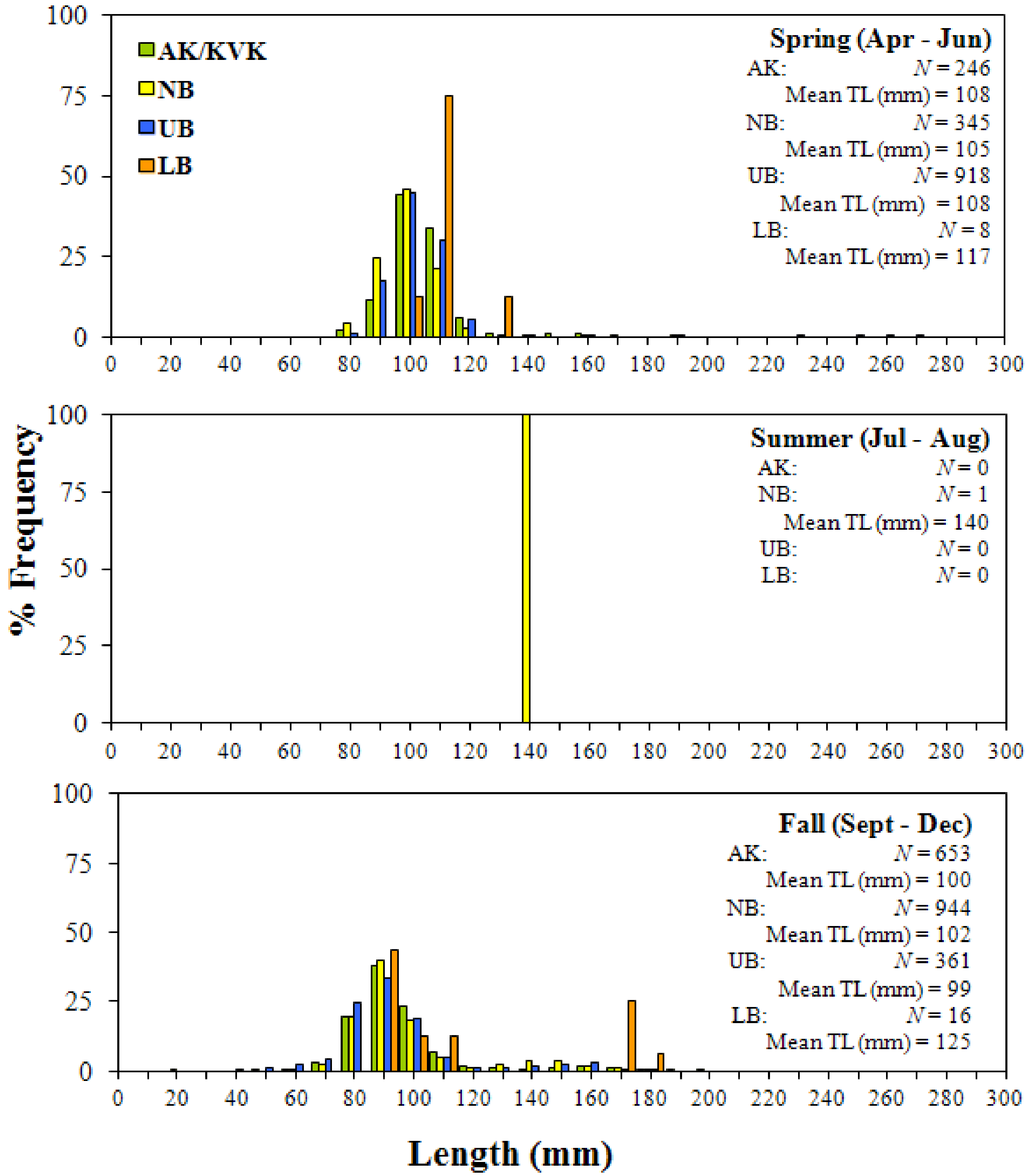


Figure 3-5. Length frequency distribution (10 mm intervals) by season and all study areas for alewife collected during mid-water trawls during the 2011 Migratory Finfish Sampling Program.

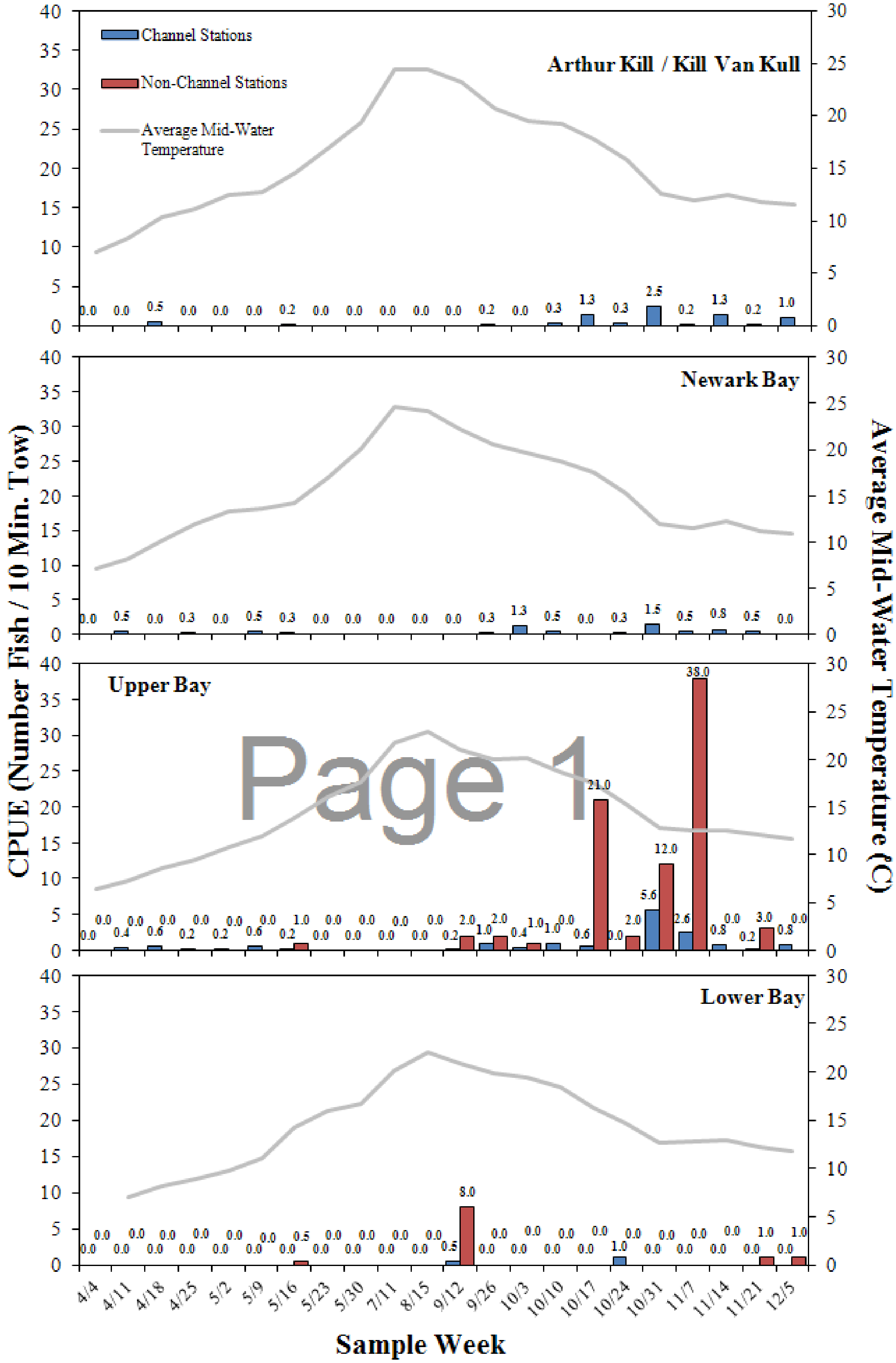


Figure 3-6. American shad average weekly CPUE (fish/10 min) and average weekly mid-water temperature for the Arthur Kill/Kill Van Kull, Newark Bay, Upper Bay, and Lower Bay, 2011 Migratory Finfish Sampling Program. (Note: Dates listed indicate the Monday of each sampling week; Non-channel stations were not sampled in Arthur Kill/Kill Van Kull).

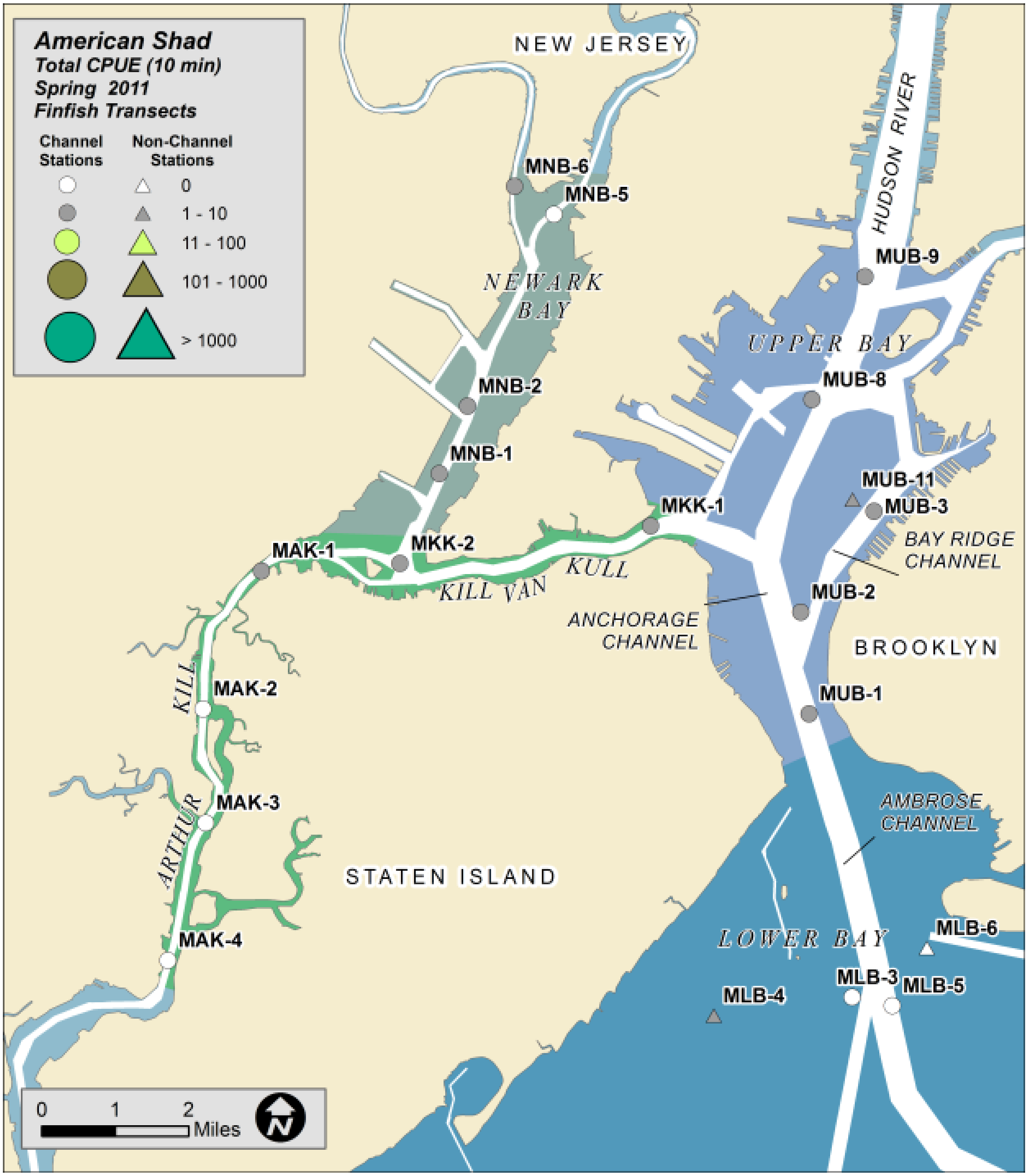


Figure 3-7a. Total station CPUE (fish/10 min) of American shad during spring, 2011 Migratory Finfish Sampling Program.

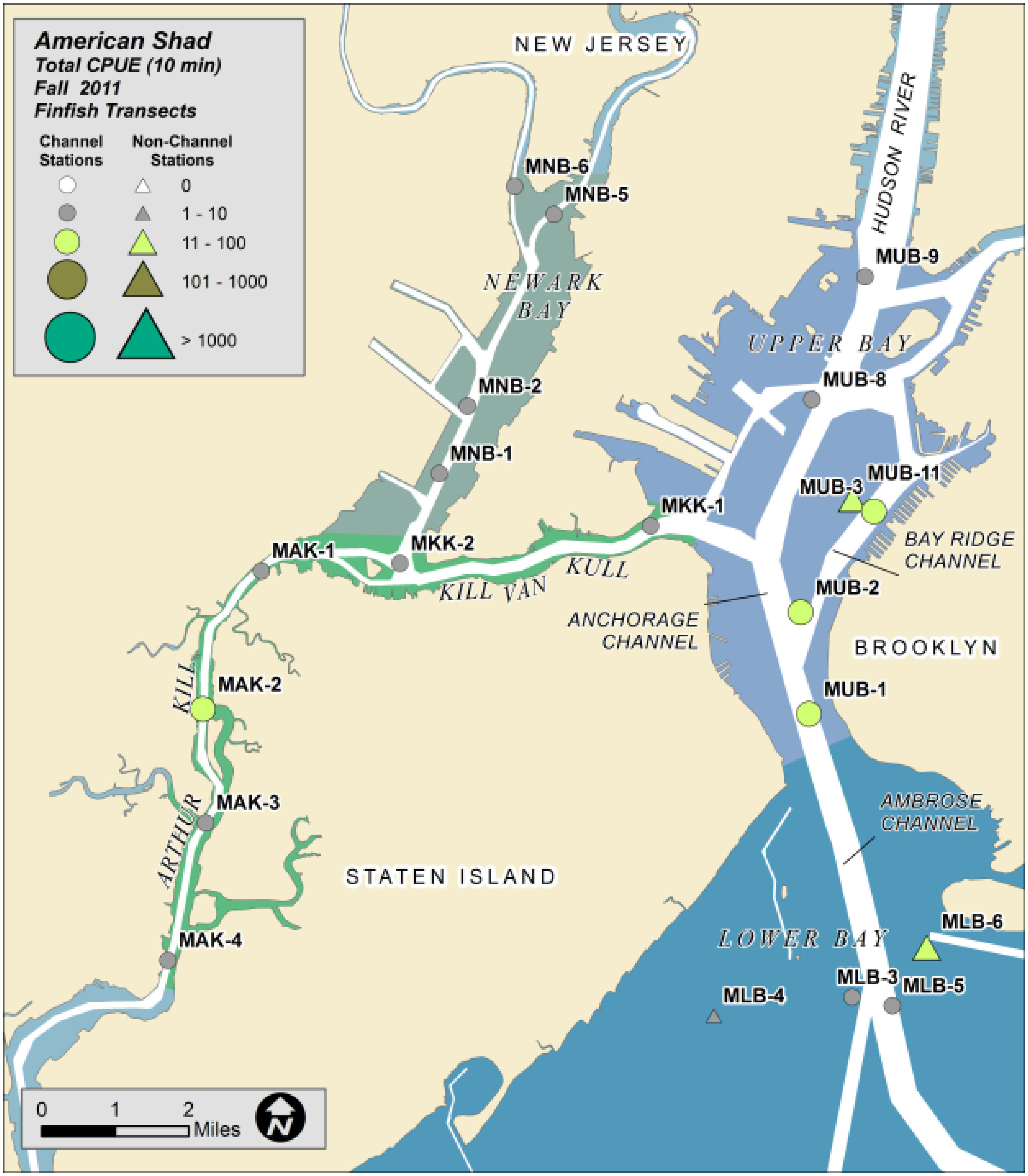


Figure 3-7b. Average station CPUE (fish/10 min) of American shad during fall, 2011 Migratory Finfish Sampling Program.

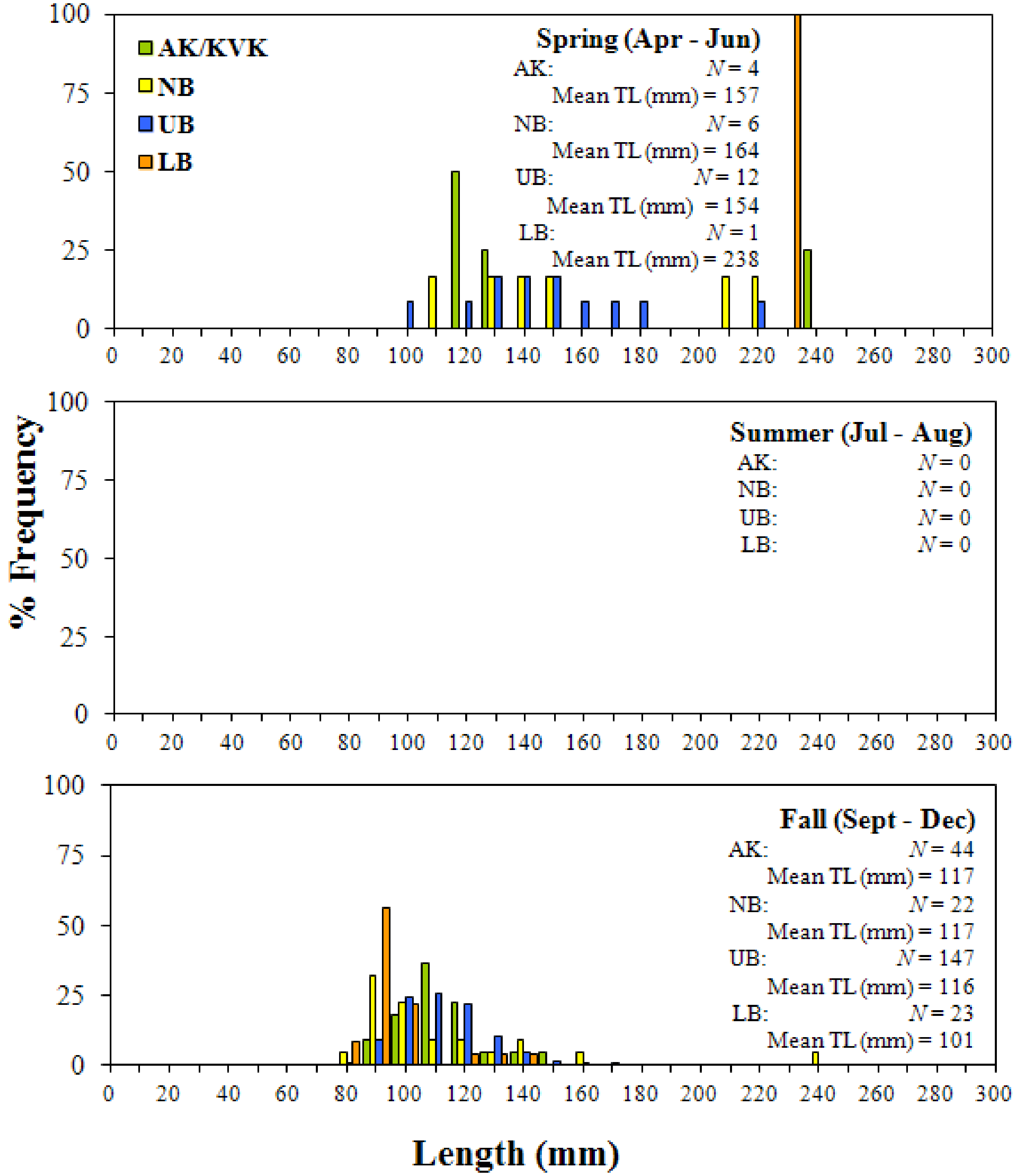


Figure 3-8. Length frequency distribution (10 mm intervals) by season and all study areas for American shad collected during mid-water trawls during the 2011 Migratory Finfish Sampling Program.

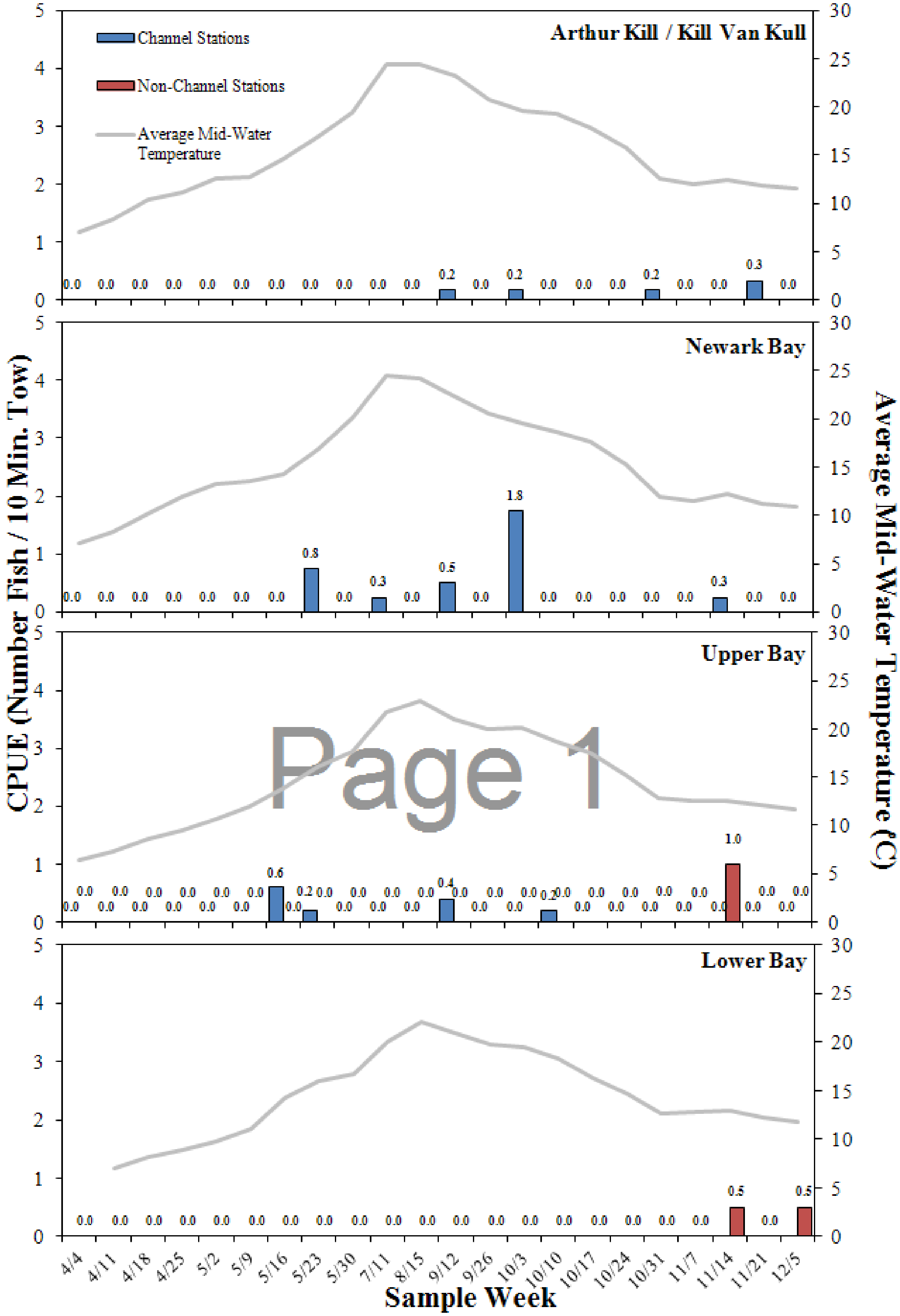


Figure 3-9. Atlantic menhaden average weekly CPUE (fish/10 min) and average weekly mid-water temperature for the Arthur Kill/Kill Van Kull, Newark Bay, Upper Bay, and Lower Bay, 2011 Migratory Finfish Sampling Program. (Note: Dates listed indicate the Monday of each sampling week; Non-channel stations were not sampled in Arthur Kill/Kill Van Kull)

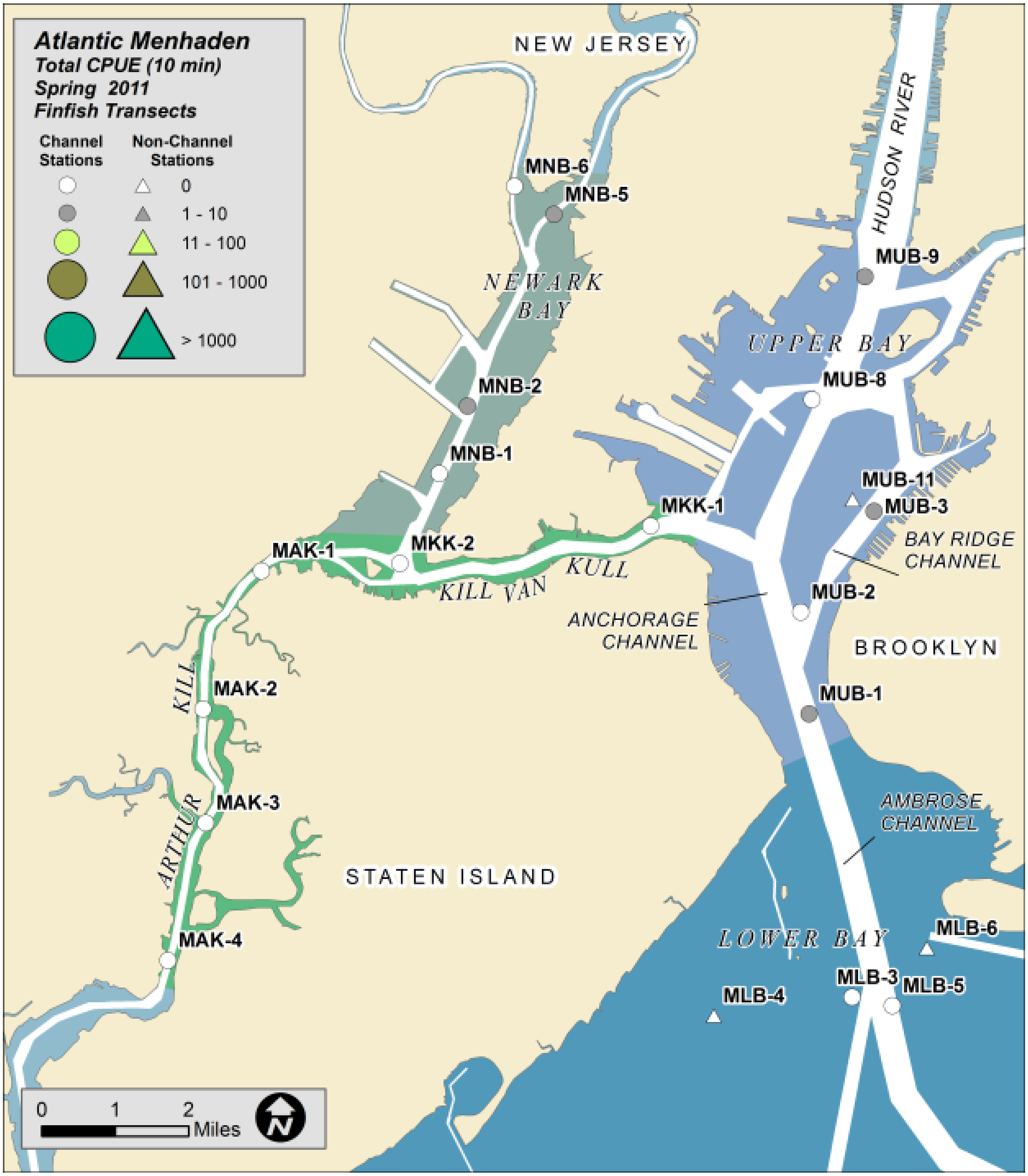


Figure 3-10a. Average station CPUE (fish/10 min) of Atlantic menhaden during spring, 2011 Migratory Finfish Sampling Program.

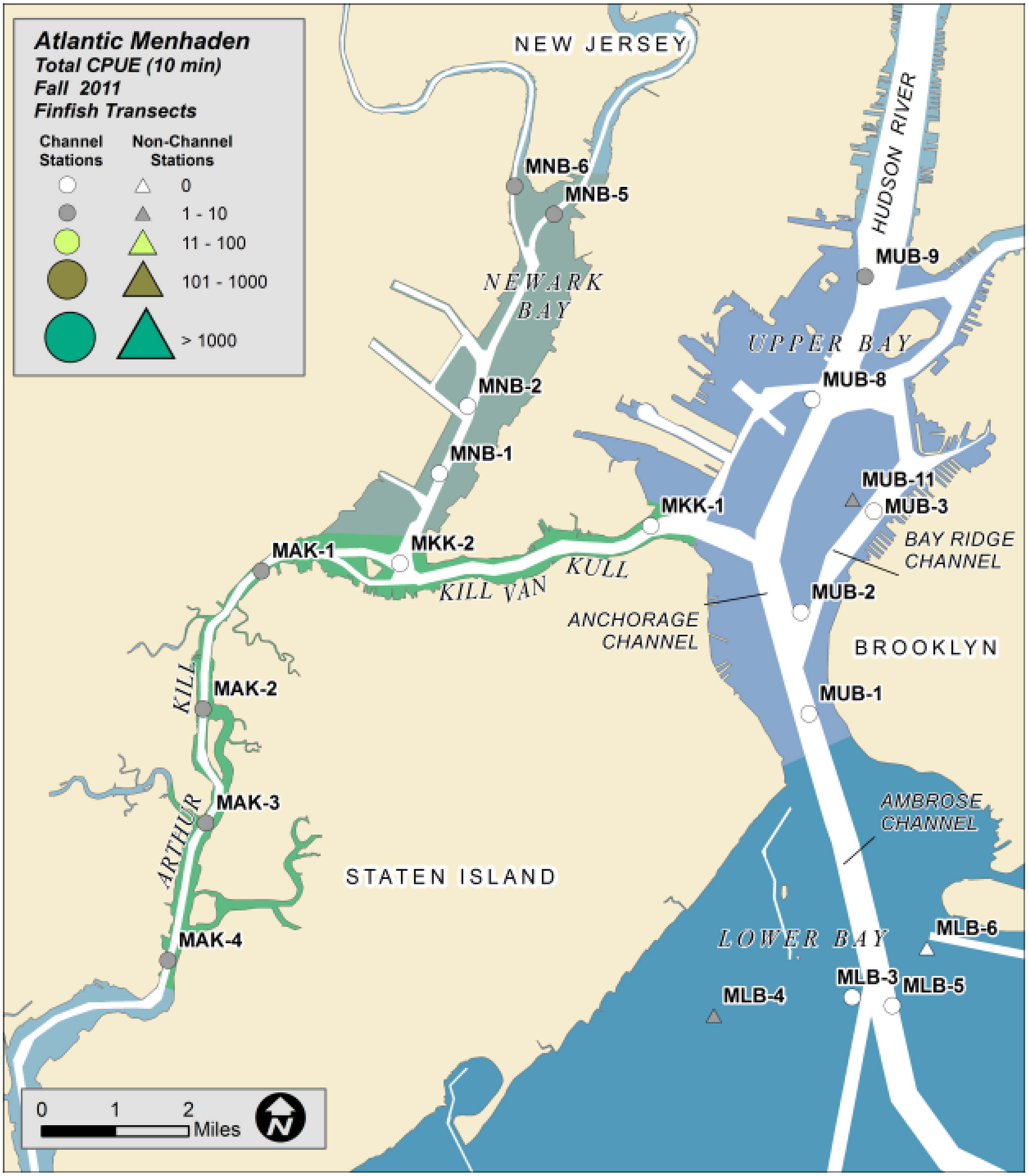


Figure 3-10b. Total station CPUE (fish/10 min) of Atlantic menhaden during fall, 2011 Migratory Finfish Sampling Program.

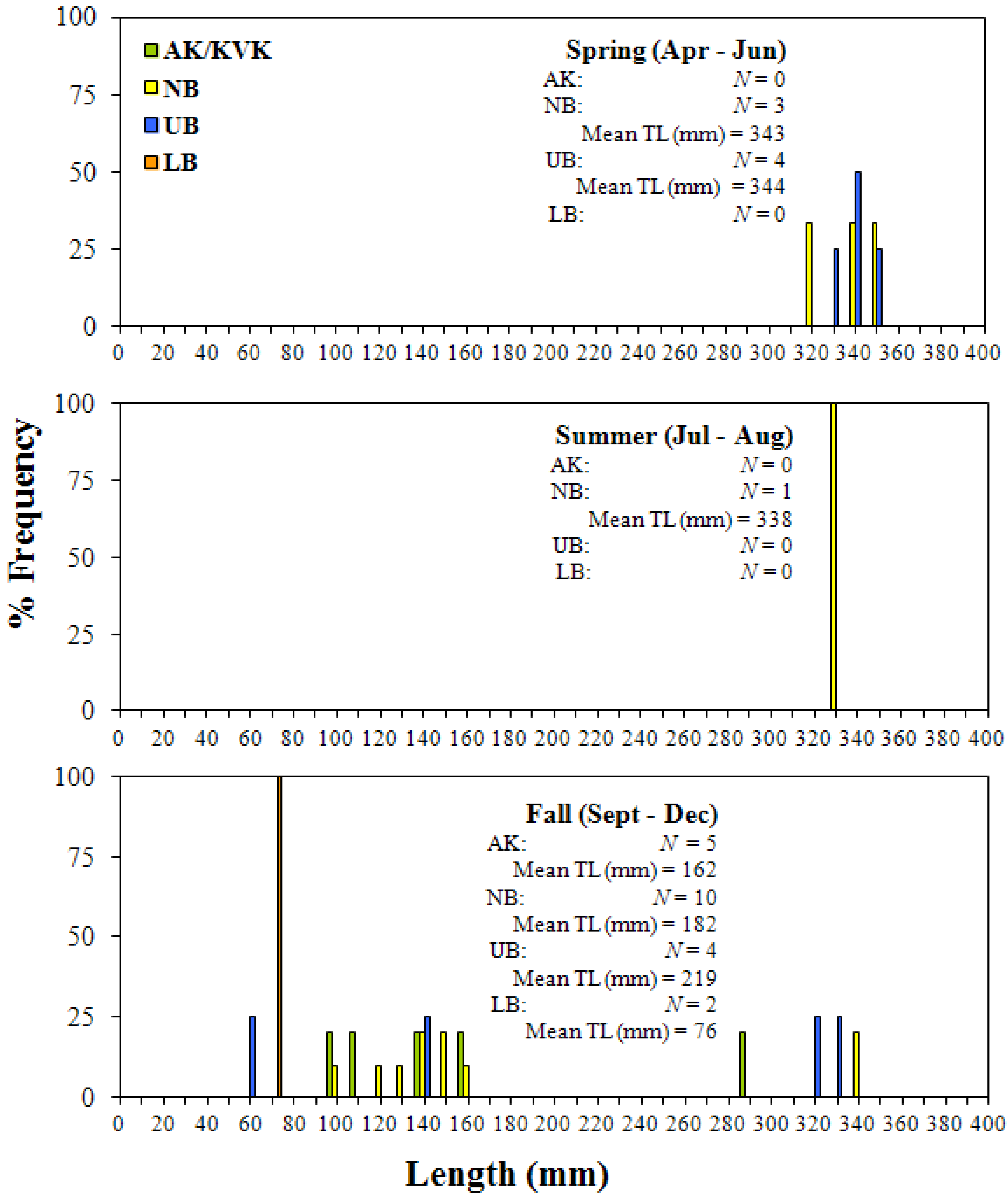


Figure 3-11. Length frequency distribution (10 mm intervals) by season and all study areas for Atlantic menhaden collected during mid-water trawls during the 2011 Migratory Finfish Sampling Program.

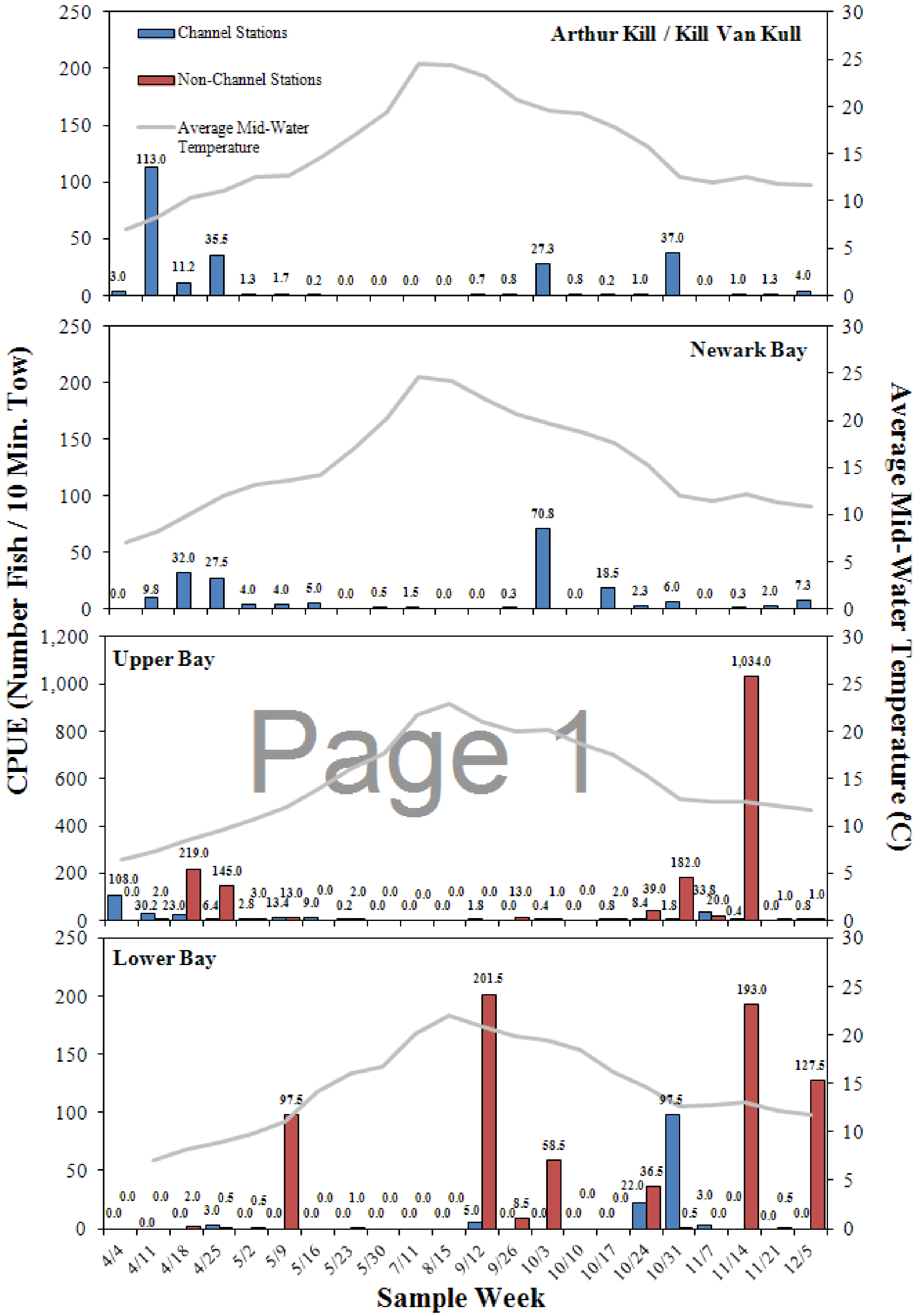


Figure 3-12. Blueback herring average weekly CPUE (fish/10 min) and average weekly mid-water temperature for the Arthur Kill/Kill Van Kull, Newark Bay, Upper Bay, and Lower Bay, 2011 Migratory Finfish Sampling Program. (Note: Dates listed indicate the Monday of each sampling week; Scale change for Upper Bay; Non-channel stations were not sampled in Arthur Kill/Kill Van Kull)

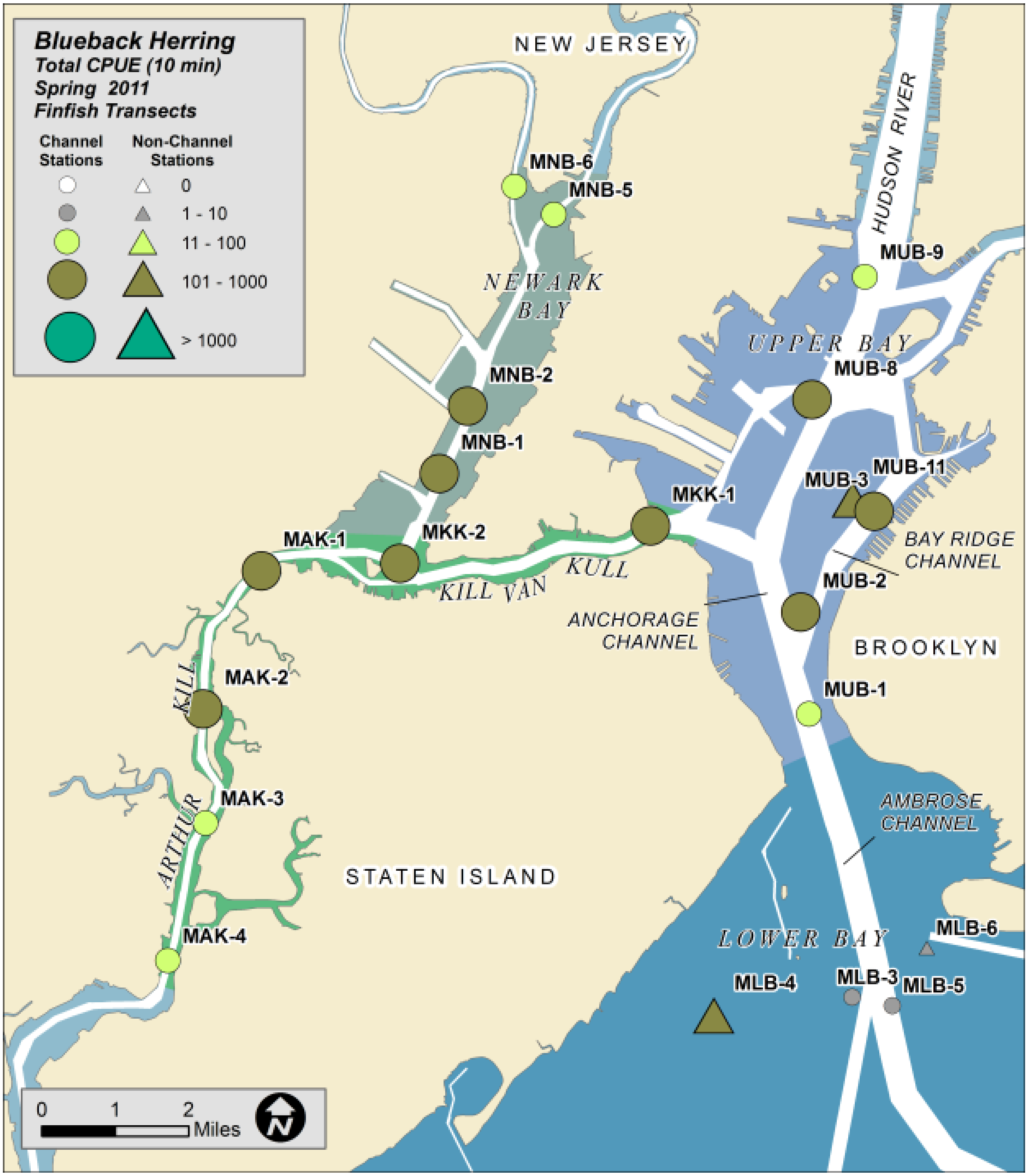


Figure 3-13a. Total station CPUE (fish/10 min) of blueback herring during spring, 2011 Migratory Finfish Sampling Program.

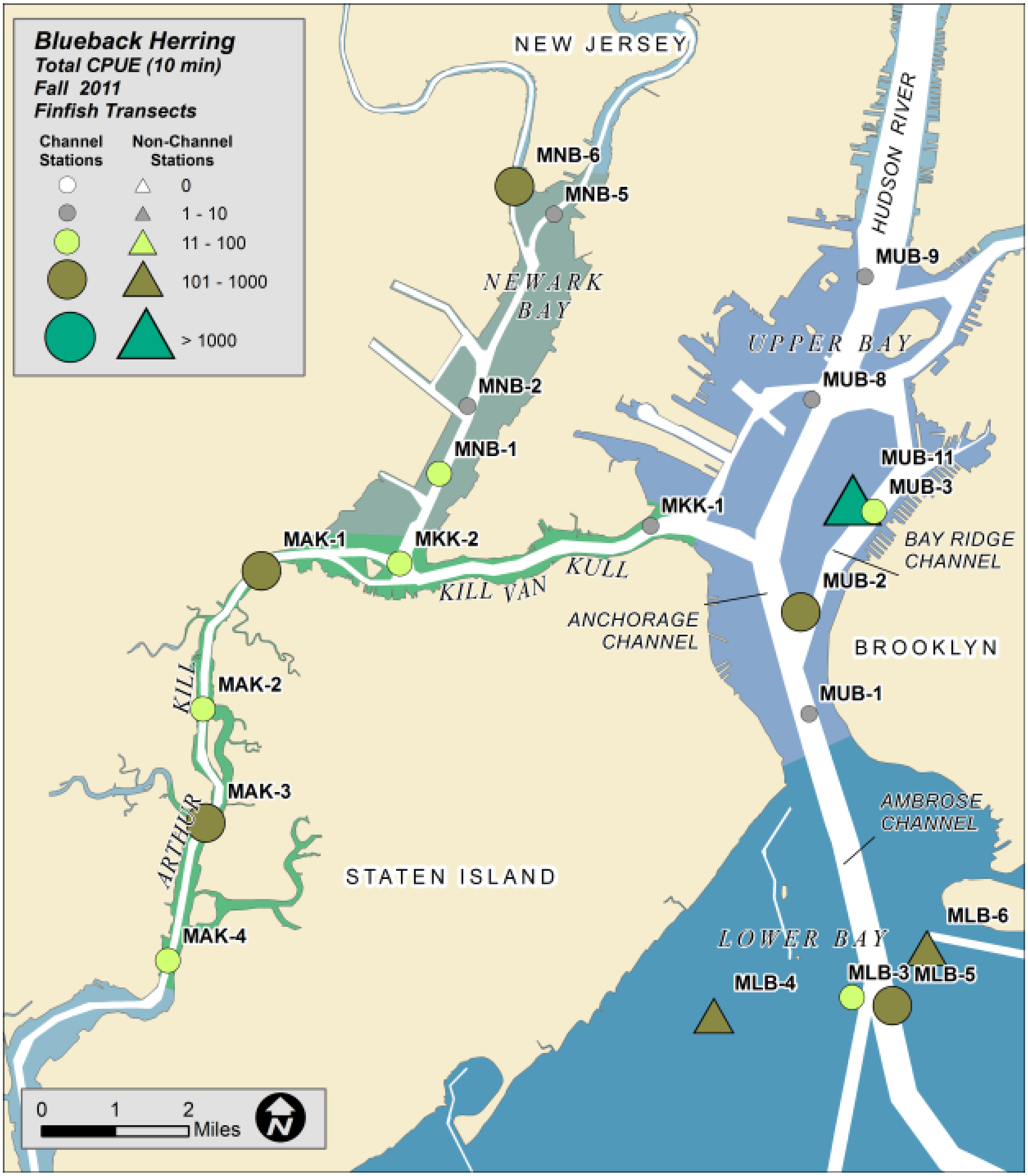


Figure 3-13b. Total station CPUE (fish/10 min) of blueback herring during fall, 2011 Migratory Finfish Sampling Program.

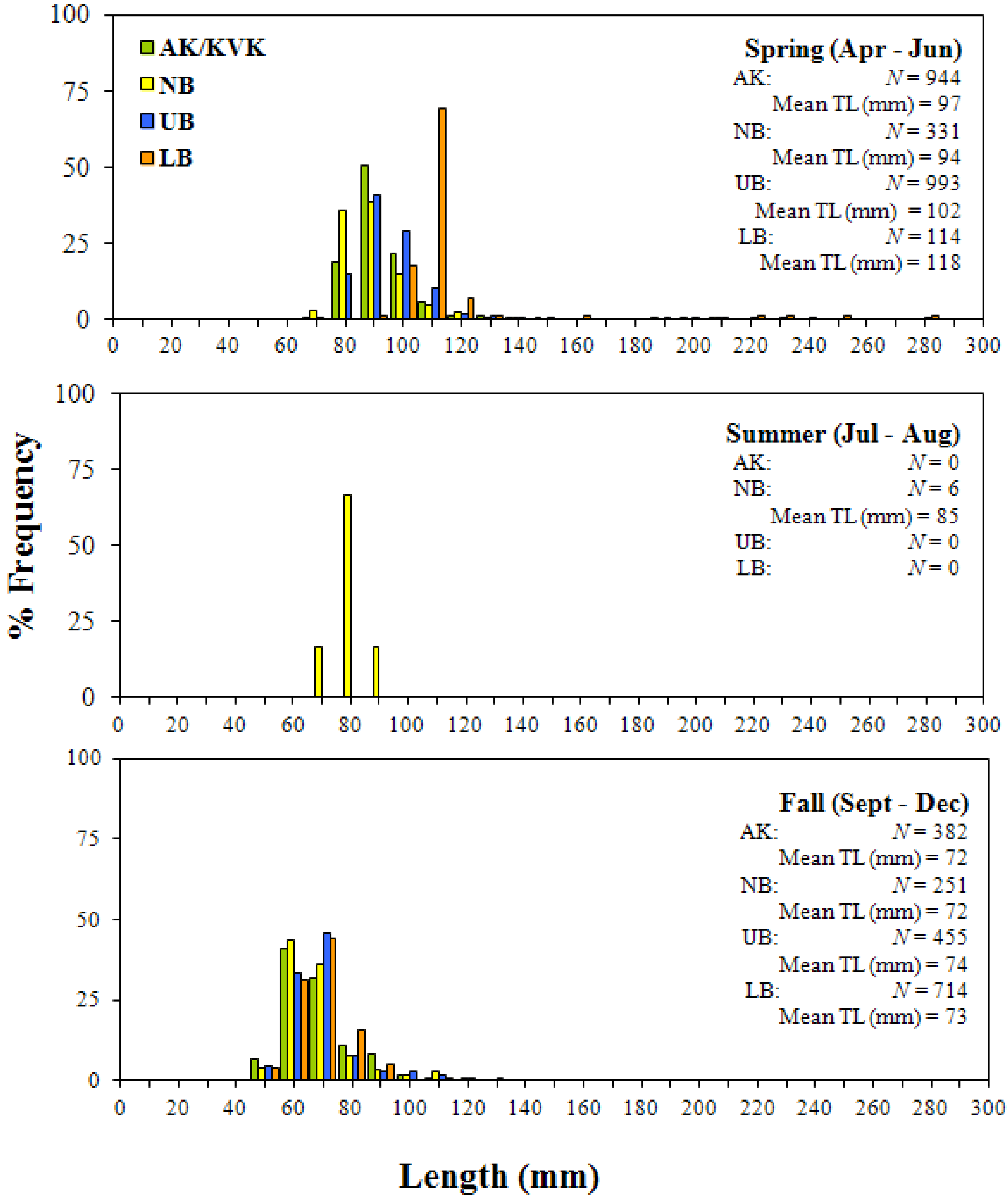


Figure 3-14. Length frequency distribution (10 mm intervals) by season and all study areas for blueback herring collected during mid-water trawls during the 2011 Migratory Finfish Sampling Program.

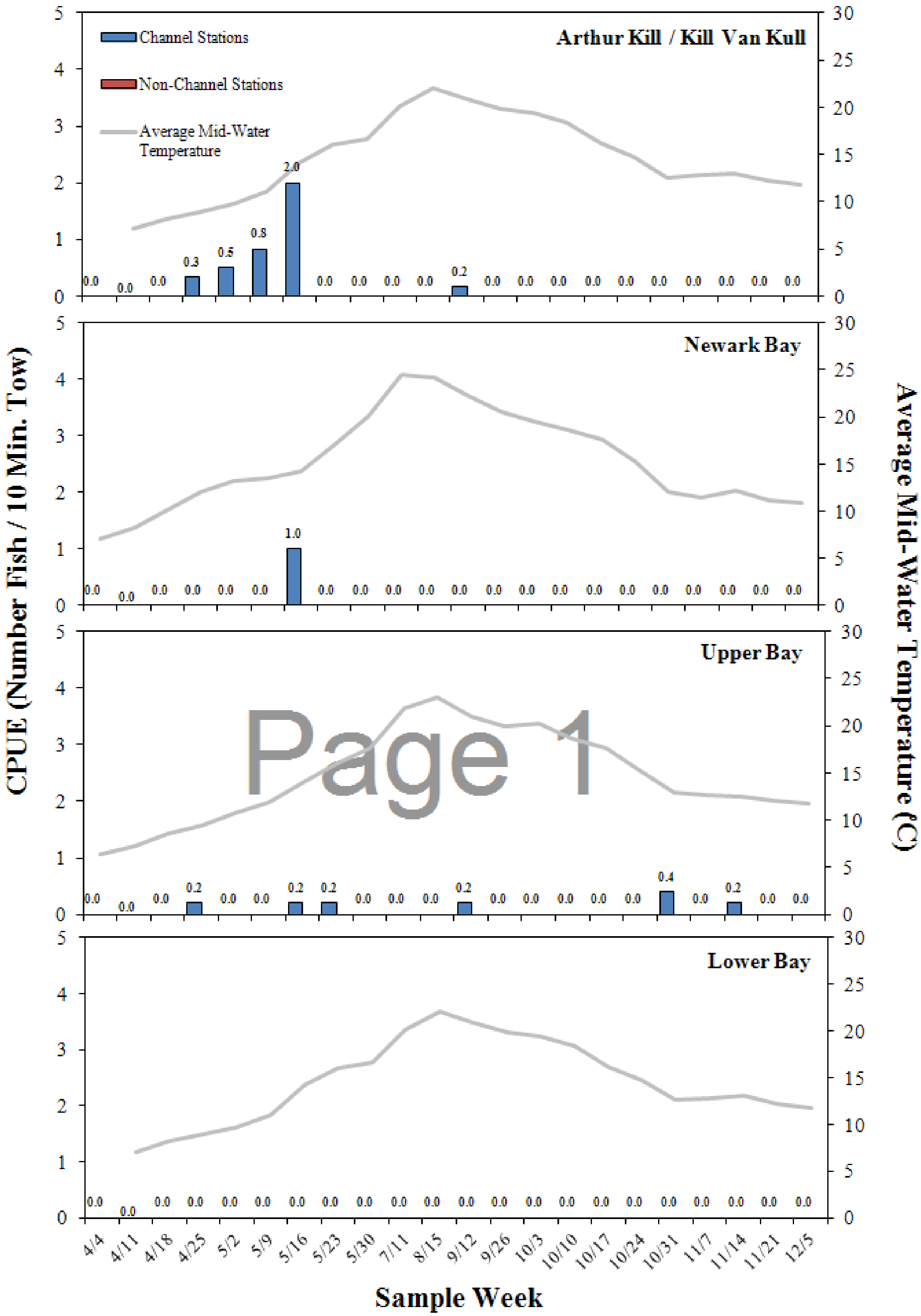


Figure 3-15. Striped bass average weekly CPUE (fish/10 min) and average weekly mid-water temperature for the Arthur Kill/Kill Van Kull, Newark Bay, Upper Bay, and Lower Bay, 2011 Migratory Finfish Sampling Program. (Note: Dates listed indicate the Monday of each sampling week; Non-channel stations were not sampled in Arthur Kill/Kill Van Kull)

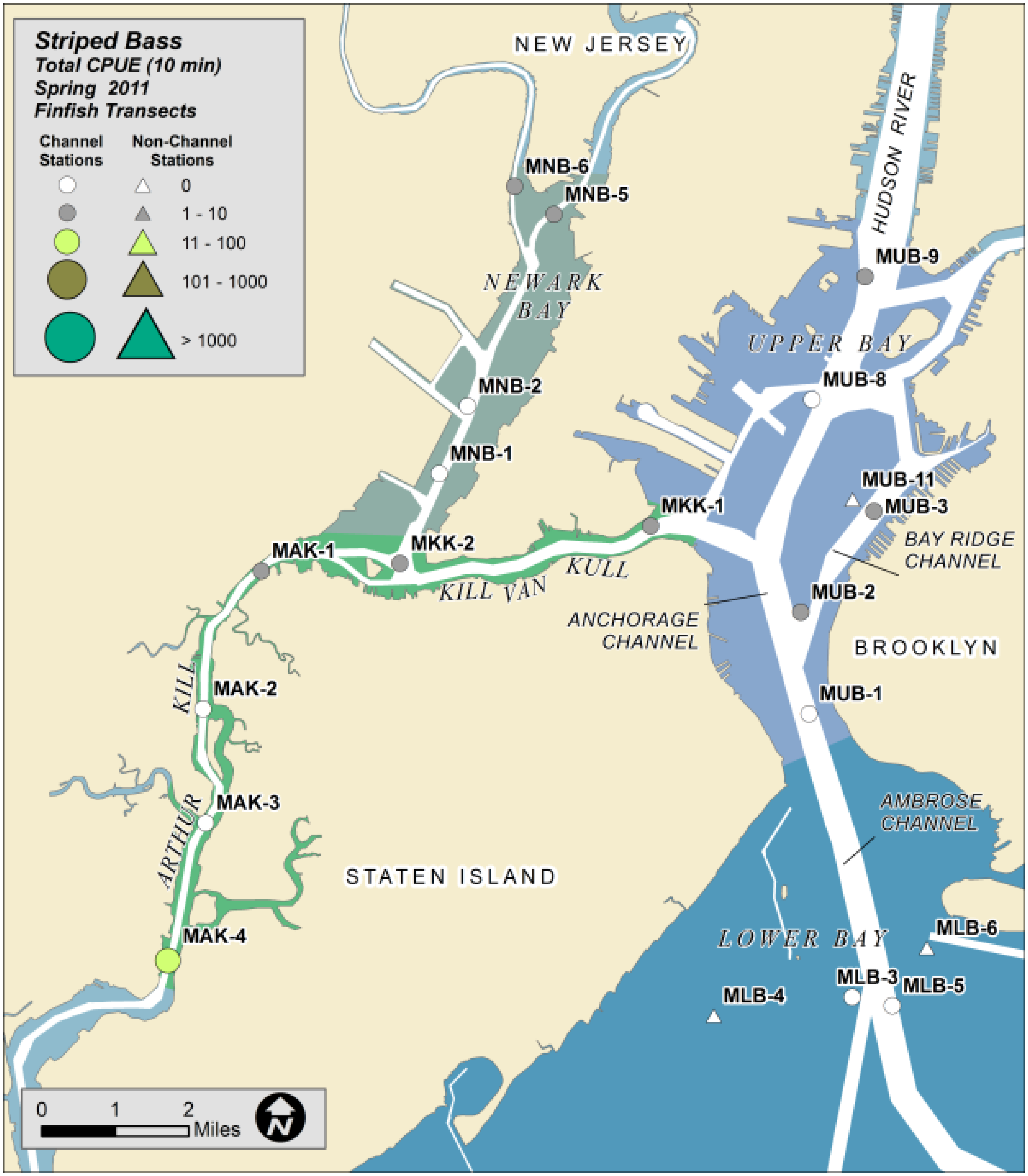


Figure 3-16a. Total station CPUE (fish/10 min) of striped bass during spring, 2011 Migratory Finfish Sampling Program.

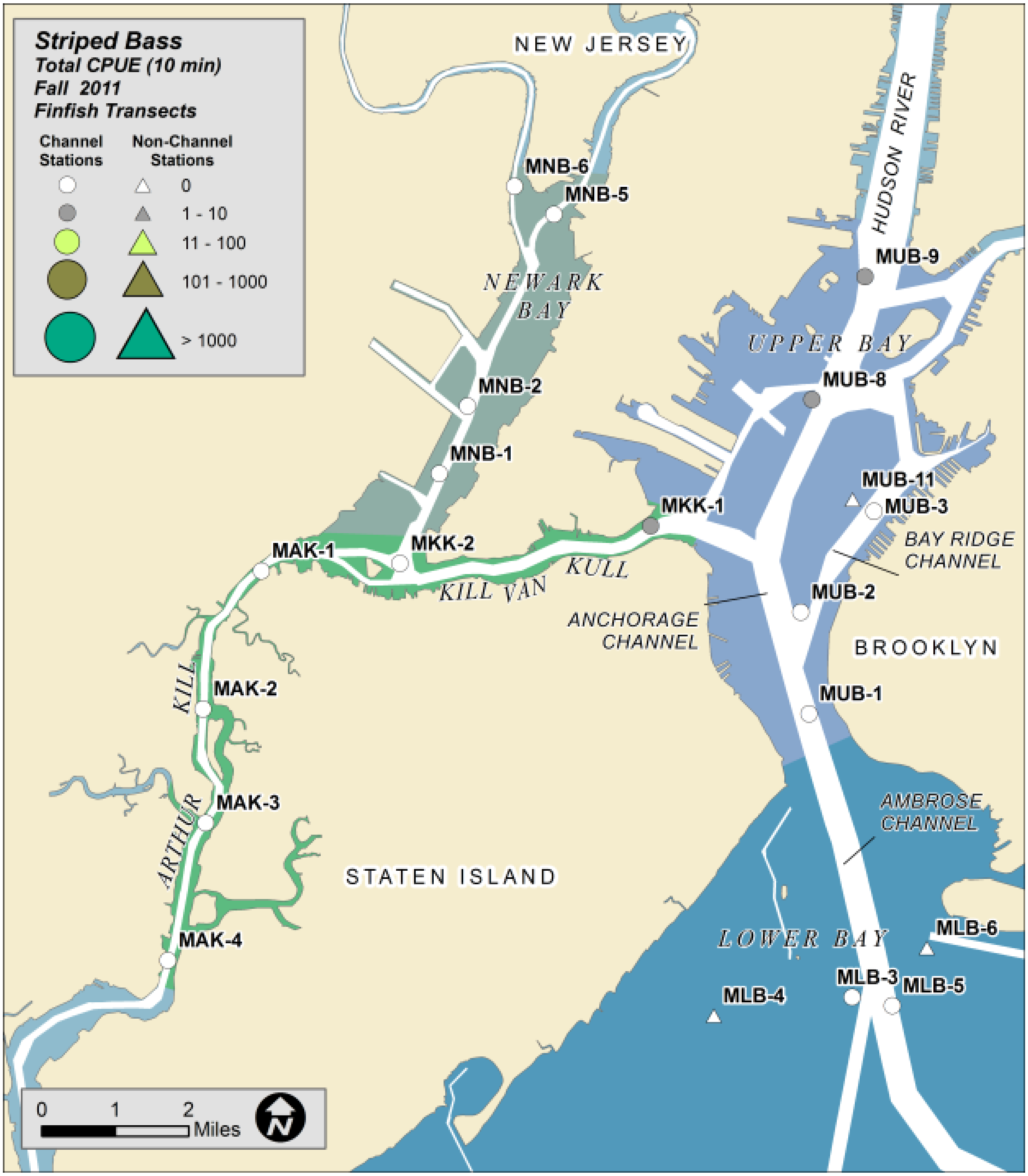


Figure 3-16b. Total station CPUE (fish/10 min) of striped bass during fall, 2011 Migratory Finfish Sampling Program.

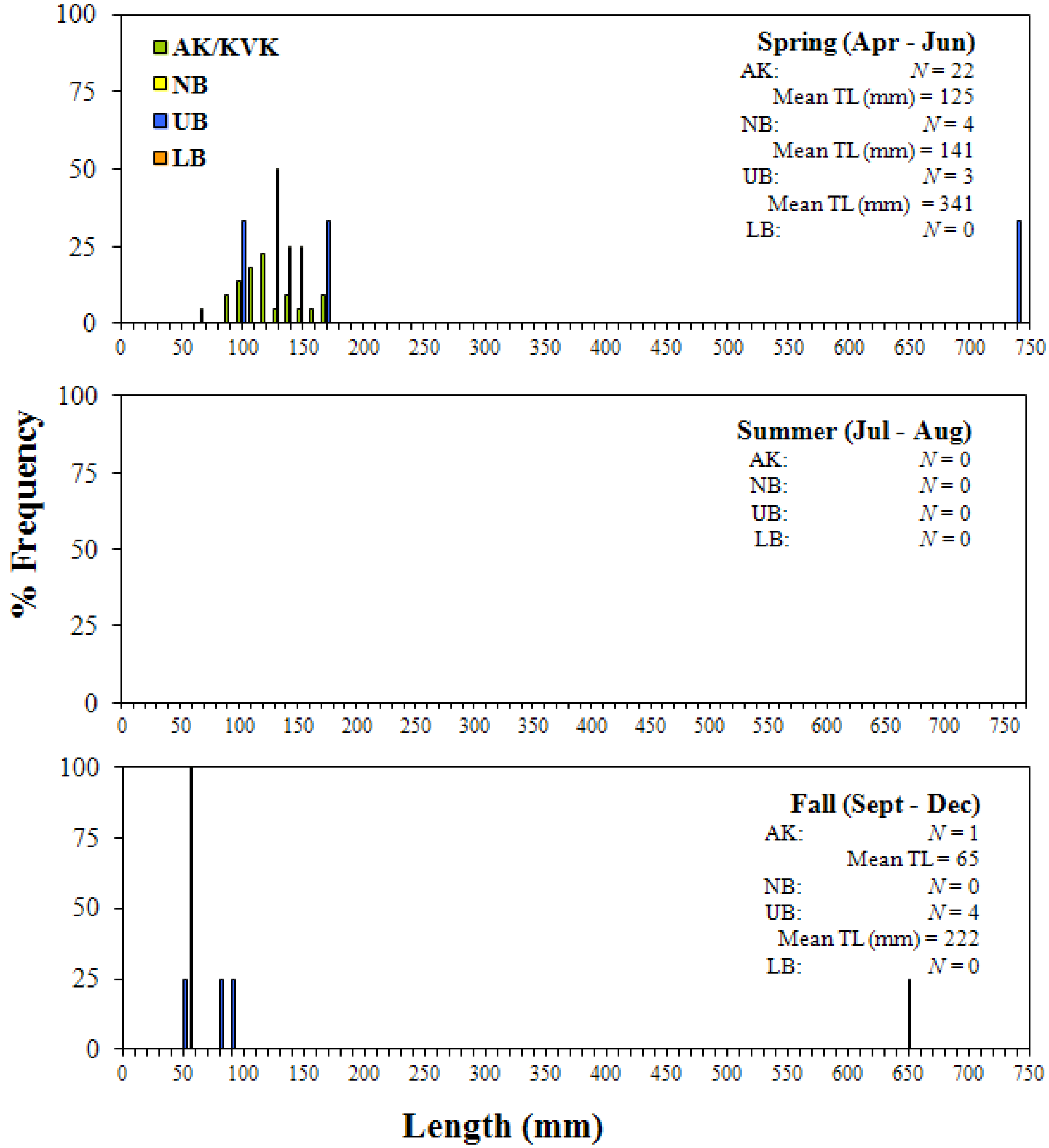
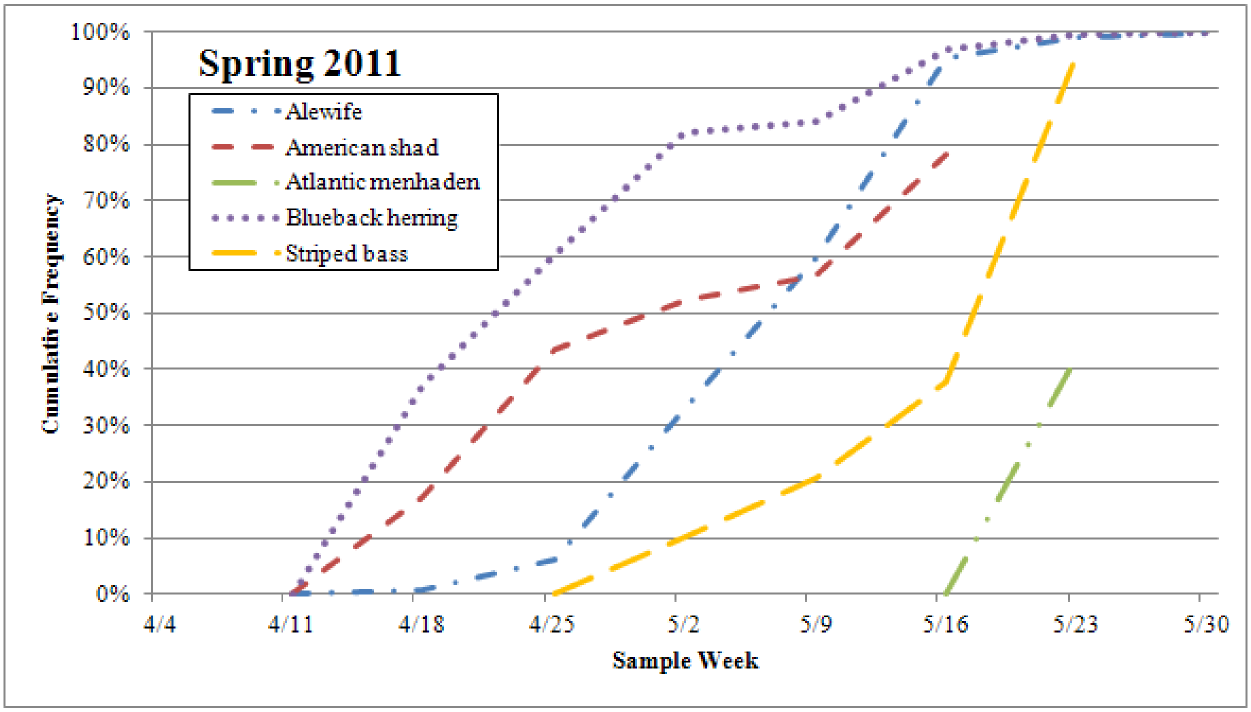


Figure 3-17. Length frequency distribution (10 mm intervals) by season and all study areas for striped bass collected during mid-water trawls during the 2011 Migratory Finfish Sampling Program.



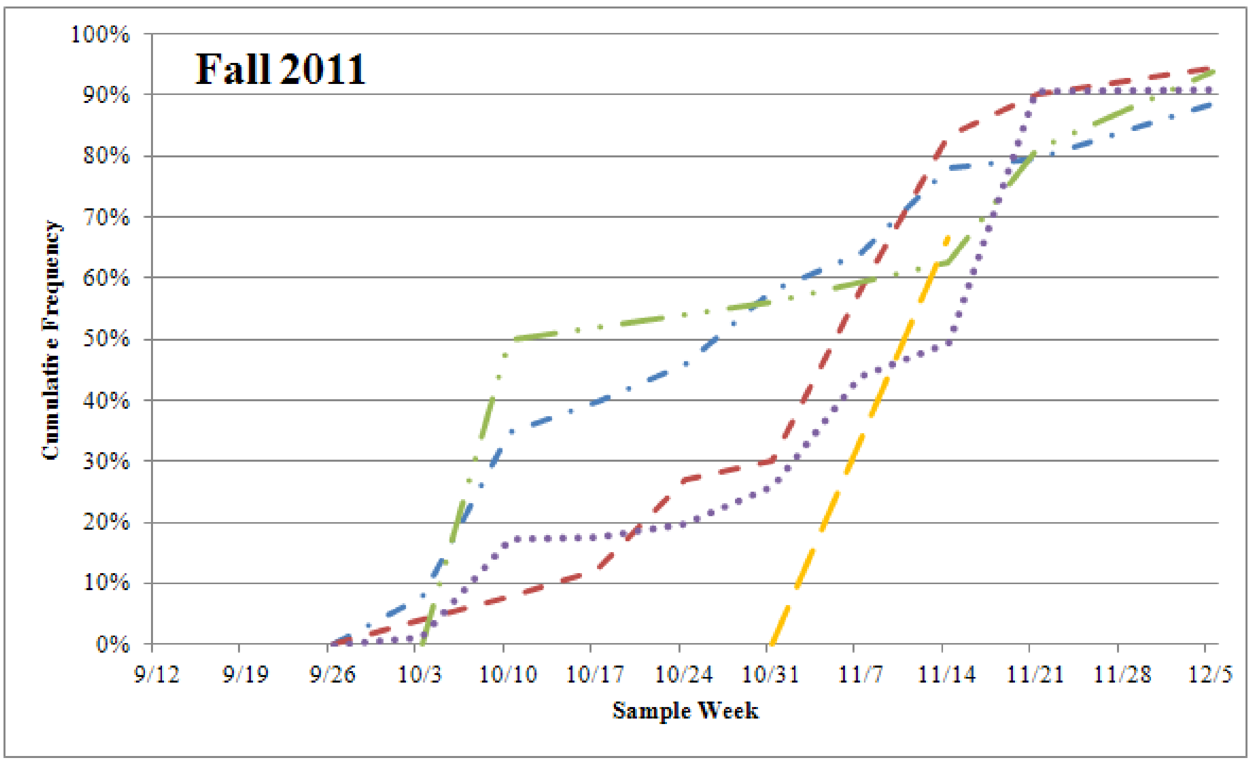


Figure 3-18. Cumulative frequency of target species for spring and fall sampling periods, 2011 Migratory Finfish Survey. (Note: Dates listed indicate the Monday of each sample week.)

Figure 4-1. Aerial image of NY/NJ Harbor following Hurricane/Tropical Storm Irene, taken 1 September 2011 (Courtesy NASA).

Appendix A

Mid-water Trawl Catch per Unit Effort by Date and Station Collected During the 2011 Migratory Finfish Survey

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
4/8/2011	MAK-1	Atlantic herring	1	1
4/8/2011	MAK-1	Blueback herring	6	6
4/8/2011	MUB-8	Blueback herring	324	324
4/11/2011	MAK-1	Blueback herring	168	168
4/11/2011	MAK-2	Blueback herring	319	319
4/11/2011	MAK-4	Blueback herring	1	1
4/11/2011	MKK-2	Blueback herring	190	190
4/11/2011	MNB-1	Alewife	2	2
4/11/2011	MNB-1	American shad	2	2
4/11/2011	MNB-1	Atlantic silverside	1	1
4/11/2011	MNB-1	Blueback herring	38	38
4/11/2011	MNB-2	Alewife	2	2
4/11/2011	MNB-2	Blueback herring	1	1
4/11/2011	MNB-5	Atlantic silverside	1	1
4/12/2011	MLB-5	Spotted hake	1	1
4/12/2011	MUB-1	American shad	1	1
4/12/2011	MUB-1	Blueback herring	39	39
4/12/2011	MUB-11	Blueback herring	2	2
4/12/2011	MUB-2	Alewife	15	15
4/12/2011	MUB-2	American shad	1	1
4/12/2011	MUB-2	Atlantic herring	1	1
4/12/2011	MUB-2	Blueback herring	112	112
4/12/2011	MUB-2	Lined seahorse	1	1
4/12/2011	MUB-8	Spotted hake	1	1
4/18/2011	MLB-4	Blueback herring	3	3
4/18/2011	MLB-6	Blueback herring	1	1
4/18/2011	MUB-11	Alewife	7	7
4/18/2011	MUB-11	Atlantic herring	1	1
4/18/2011	MUB-11	Atlantic silverside	1	1
4/18/2011	MUB-11	Blueback herring	219	219
4/18/2011	MUB-11	Lined seahorse	1	1
4/18/2011	MUB-2	Alewife	73	73
4/18/2011	MUB-2	American shad	2	2
4/18/2011	MUB-2	Blueback herring	17	17
4/18/2011	MUB-3	American shad	1	1
4/18/2011	MUB-3	Atlantic herring	1	1
4/18/2011	MUB-3	Blueback herring	82	82
4/18/2011	MUB-3	Lined seahorse	1	1
4/18/2011	MUB-8	Alewife	2	2
4/18/2011	MUB-8	Blueback herring	1	1
4/18/2011	MUB-8	Smallmouth flounder	8	8

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
4/18/2011	MUB-8	Spotted hake	9	9
4/18/2011	MUB-8	Striped cusk-eel	1	1
4/18/2011	MUB-9	Alewife	9	9
4/18/2011	MUB-9	Blueback herring	15	15
4/18/2011	MUB-9	Conger eel	1	1
4/19/2011	MAK-1	American shad	1	1
4/19/2011	MAK-1	Blueback herring	1	1
4/19/2011	MAK-2	Blueback herring	25	25
4/19/2011	MKK-1	Alewife	8	8
4/19/2011	MKK-1	American shad	1	1
4/19/2011	MKK-1	Blueback herring	25	25
4/19/2011	MKK-2	Alewife	3	3
4/19/2011	MKK-2	American shad	1	1
4/19/2011	MKK-2	Blueback herring	16	16
4/19/2011	MNB-2	Blueback herring	102	102
4/19/2011	MNB-5	Alewife	7	7
4/19/2011	MNB-5	Blueback herring	24	24
4/19/2011	MNB-6	Alewife	1	1
4/19/2011	MNB-6	Blueback herring	2	2
4/25/2011	MLB-3	Blueback herring	1	1
4/25/2011	MLB-3	Lined seahorse	1	1
4/25/2011	MLB-4	Alewife	2	2
4/25/2011	MLB-4	Bay anchovy	1	1
4/25/2011	MLB-4	Spotted hake	1	1
4/25/2011	MLB-4	Windowpane	1	1
4/25/2011	MLB-5	Blueback herring	5	5
4/25/2011	MLB-6	Blueback herring	1	1
4/25/2011	MUB-1	Alewife	262	262
4/25/2011	MUB-1	Blueback herring	1	1
4/25/2011	MUB-1	Lined seahorse	1	1
4/25/2011	MUB-11	Blueback herring	145	145
4/25/2011	MUB-2	Alewife	53	53
4/25/2011	MUB-2	American shad	1	1
4/25/2011	MUB-3	Alewife	3	3
4/25/2011	MUB-3	Bay anchovy	3	3
4/25/2011	MUB-3	Blueback herring	3	3
4/25/2011	MUB-8	Alewife	27	27
4/25/2011	MUB-8	Bay anchovy	5	5
4/25/2011	MUB-8	Blueback herring	26	26
4/25/2011	MUB-8	Lined seahorse	2	2
4/26/2011	MAK-1	Alewife	6	6

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
4/26/2011	MAK-1	Smallmouth flounder	1	1
4/26/2011	MAK-1	Spotted hake	6	6
4/26/2011	MAK-1	Striped bass	1	1
4/26/2011	MAK-2	Blueback herring	1	1
4/26/2011	MAK-3	Blueback herring	33	33
4/26/2011	MAK-4	Blueback herring	39	39
4/26/2011	MKK-1	Alewife	3	3
4/26/2011	MKK-1	Blueback herring	138	138
4/26/2011	MKK-2	Alewife	2	2
4/26/2011	MKK-2	Bay anchovy	1	1
4/26/2011	MKK-2	Blueback herring	2	2
4/26/2011	MKK-2	Spotted hake	3	3
4/26/2011	MKK-2	Striped bass	1	1
4/26/2011	MNB-1	Alewife	38	38
4/26/2011	MNB-1	American shad	1	1
4/26/2011	MNB-1	Bay anchovy	1	1
4/26/2011	MNB-1	Blueback herring	75	75
4/26/2011	MNB-2	Alewife	1	1
4/26/2011	MNB-2	Blueback herring	27	27
4/26/2011	MNB-6	Blueback herring	8	8
4/27/2011	MUB-9	Alewife	178	178
4/27/2011	MUB-9	Bay anchovy	1	1
4/27/2011	MUB-9	Blueback herring	2	2
4/27/2011	MUB-9	Striped bass	1	1
5/2/2011	MLB-4	Blueback herring	1	1
5/2/2011	MUB-1	Blueback herring	1	1
5/2/2011	MUB-11	Bay anchovy	1	1
5/2/2011	MUB-11	Blueback herring	3	3
5/2/2011	MUB-11	Lined seahorse	1	1
5/2/2011	MUB-2	Alewife	17	17
5/2/2011	MUB-2	Bay anchovy	25	25
5/2/2011	MUB-2	Blueback herring	2	2
5/2/2011	MUB-3	Alewife	20	20
5/2/2011	MUB-3	Blueback herring	9	9
5/2/2011	MUB-8	Alewife	164	164
5/2/2011	MUB-8	American shad	1	1
5/2/2011	MUB-8	Bay anchovy	5	5
5/2/2011	MUB-8	Blueback herring	2	2
5/2/2011	MUB-8	Silver hake	1	1
5/2/2011	MUB-9	Lined seahorse	1	1
5/2/2011	MUB-9	Red hake	2	2

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
5/2/2011	MUB-9	Smallmouth flounder	1	1
5/2/2011	MUB-9	Spotted hake	22	22
5/2/2011	MUB-9	Windowpane	1	1
5/3/2011	MAK-1	Alewife	6	6
5/3/2011	MAK-1	Atlantic herring	4	4
5/3/2011	MAK-1	Blueback herring	3	3
5/3/2011	MAK-1	Striped bass	1	1
5/3/2011	MAK-2	Bay anchovy	1	1
5/3/2011	MAK-2	Blueback herring	1	1
5/3/2011	MAK-3	Atlantic herring	1	1
5/3/2011	MAK-4	Atlantic herring	3	3
5/3/2011	MKK-1	Alewife	65	65
5/3/2011	MKK-1	Blueback herring	1	1
5/3/2011	MKK-1	Striped bass	2	2
5/3/2011	MKK-2	Alewife	51	51
5/3/2011	MKK-2	Bay anchovy	8	8
5/3/2011	MKK-2	Blueback herring	3	3
5/3/2011	MNB-1	Alewife	37	37
5/3/2011	MNB-1	Bay anchovy	3	3
5/3/2011	MNB-1	White perch	1	1
5/3/2011	MNB-2	Alewife	71	71
5/3/2011	MNB-2	Bay anchovy	1	1
5/3/2011	MNB-5	Alewife	131	131
5/3/2011	MNB-5	Bay anchovy	3	3
5/3/2011	MNB-5	Blueback herring	6	6
5/3/2011	MNB-5	White perch	3	3
5/3/2011	MNB-6	Blueback herring	10	10
5/3/2011	MNB-6	Lined seahorse	1	1
5/9/2011	MLB-3	Bay anchovy	12	12
5/9/2011	MLB-3	Lined seahorse	1	1
5/9/2011	MLB-4	Alewife	5	5
5/9/2011	MLB-4	Atlantic herring	2	2
5/9/2011	MLB-4	Bay anchovy	54	54
5/9/2011	MLB-4	Blueback herring	195	195
5/9/2011	MLB-4	Butterfish	1	1
5/9/2011	MLB-5	Bay anchovy	95	95
5/9/2011	MLB-5	Lined seahorse	1	1
5/9/2011	MLB-6	Bay anchovy	11	11
5/9/2011	MUB-1	Alewife	233	233
5/9/2011	MUB-1	American shad	1	1
5/9/2011	MUB-1	Atlantic herring	1	1

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
5/9/2011	MUB-1	Bay anchovy	455	455
5/9/2011	MUB-1	Blueback herring	38	38
5/9/2011	MUB-11	Alewife	2	2
5/9/2011	MUB-11	Atlantic herring	1	1
5/9/2011	MUB-11	Bay anchovy	122	122
5/9/2011	MUB-11	Blueback herring	13	13
5/9/2011	MUB-2	Alewife	17	17
5/9/2011	MUB-2	Atlantic herring	1	1
5/9/2011	MUB-2	Bay anchovy	188	188
5/9/2011	MUB-2	Lined seahorse	1	1
5/9/2011	MUB-3	Alewife	1	1
5/9/2011	MUB-3	Bay anchovy	3	3
5/9/2011	MUB-3	Blueback herring	6	6
5/9/2011	MUB-8	Alewife	98	98
5/9/2011	MUB-8	Atlantic herring	1	1
5/9/2011	MUB-8	Bay anchovy	26	26
5/9/2011	MUB-8	Blueback herring	12	12
5/9/2011	MUB-9	Alewife	241	241
5/9/2011	MUB-9	American shad	2	2
5/9/2011	MUB-9	Bay anchovy	45	45
5/9/2011	MUB-9	Blueback herring	11	11
5/10/2011	MAK-1	Alewife	39	39
5/10/2011	MAK-1	Atlantic herring	5	5
5/10/2011	MAK-1	Striped bass	5	5
5/10/2011	MAK-2	Bay anchovy	109	109
5/10/2011	MAK-2	Blueback herring	5	5
5/10/2011	MAK-3	Bay anchovy	1	1
5/10/2011	MAK-3	Blueback herring	2	2
5/10/2011	MKK-1	Alewife	1	1
5/10/2011	MKK-1	Bay anchovy	2	2
5/10/2011	MKK-2	Alewife	44	44
5/10/2011	MKK-2	Blueback herring	3	3
5/10/2011	MKK-2	Butterfish	1	1
5/10/2011	MNB-1	Alewife	69	69
5/10/2011	MNB-1	Atlantic herring	3	3
5/10/2011	MNB-1	Bay anchovy	3	3
5/10/2011	MNB-1	Blueback herring	13	13
5/10/2011	MNB-1	Northern pipefish	1	1
5/10/2011	MNB-1	Silver hake	3	3
5/10/2011	MNB-2	American shad	2	2
5/10/2011	MNB-2	Atlantic herring	1	1

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
5/10/2011	MNB-2	Bay anchovy	3	3
5/10/2011	MNB-2	Blueback herring	1	1
5/10/2011	MNB-2	Silver hake	1	1
5/10/2011	MNB-5	Alewife	15	15
5/10/2011	MNB-5	Bay anchovy	5	5
5/10/2011	MNB-5	Blueback herring	1	1
5/10/2011	MNB-5	Silver hake	1	1
5/10/2011	MNB-5	Spotted hake	5	5
5/10/2011	MNB-5	White perch	7	7
5/10/2011	MNB-5	Windowpane	1	1
5/10/2011	MNB-6	Blueback herring	1	1
5/17/2011	MAK-1	Alewife	2	2
5/17/2011	MAK-1	Atlantic herring	1	1
5/17/2011	MAK-1	Bay anchovy	7	7
5/17/2011	MAK-1	Silver hake	1	1
5/17/2011	MAK-1	Striped bass	1	1
5/17/2011	MAK-2	Alewife	2	2
5/17/2011	MAK-2	Blueback herring	1	1
5/17/2011	MAK-3	Alewife	2	2
5/17/2011	MAK-3	Atlantic herring	1	1
5/17/2011	MAK-3	Bay anchovy	1	1
5/17/2011	MAK-3	Windowpane	1	1
5/17/2011	MAK-4	Bay anchovy	417	417
5/17/2011	MAK-4	Bluefish	5	5
5/17/2011	MAK-4	Striped bass	11	11
5/17/2011	MKK-2	Atlantic herring	5	5
5/17/2011	MKK-2	Atlantic tomcod	5	5
5/17/2011	MKK-2	Bay anchovy	39	39
5/17/2011	MKK-2	Silver hake	2	2
5/17/2011	MKK-2	Spotted hake	1	1
5/17/2011	MKK-2	Windowpane	1	1
5/17/2011	MNB-1	Atlantic herring	1	1
5/17/2011	MNB-1	Bay anchovy	3	3
5/17/2011	MNB-1	Northern pipefish	1	1
5/17/2011	MNB-2	Atlantic herring	5	5
5/17/2011	MNB-2	Bay anchovy	71	71
5/17/2011	MNB-2	Spotted hake	1	1
5/17/2011	MNB-2	White perch	1	1
5/17/2011	MNB-5	Atlantic herring	1	1
5/17/2011	MNB-5	Bay anchovy	6	6
5/17/2011	MNB-5	Striped bass	3	3

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
5/17/2011	MNB-5	Weakfish	1	1
5/17/2011	MNB-5	White perch	1	1
5/17/2011	MNB-6	Alewife	1	1
5/17/2011	MNB-6	American shad	1	1
5/17/2011	MNB-6	Atlantic herring	1	1
5/17/2011	MNB-6	Bay anchovy	1	1
5/17/2011	MNB-6	Blueback herring	20	20
5/17/2011	MNB-6	Striped bass	1	1
5/17/2011	MNB-6	White perch	12	12
5/17/2011	MUB-8	Alewife	7	7
5/17/2011	MUB-8	American shad	1	1
5/17/2011	MUB-8	Atlantic herring	2	2
5/17/2011	MUB-8	Bay anchovy	22	22
5/17/2011	MUB-8	Bluefish	9	9
5/18/2011	MKK-1	Alewife	8	8
5/18/2011	MKK-1	American shad	1	1
5/18/2011	MKK-1	Atlantic herring	6	6
5/18/2011	MKK-1	Atlantic tomcod	7	7
5/18/2011	MKK-1	Bay anchovy	85	85
5/18/2011	MKK-1	Butterfish	2	2
5/18/2011	MKK-1	Northern pipefish	1	1
5/18/2011	MKK-1	Silver hake	10	10
5/18/2011	MLB-3	Butterfish	10	10
5/18/2011	MLB-4	Alewife	1	1
5/18/2011	MLB-4	American shad	1	1
5/18/2011	MLB-4	Atlantic herring	9	9
5/18/2011	MLB-4	Bay anchovy	62	62
5/18/2011	MLB-4	Bluefish	1	1
5/18/2011	MLB-4	Butterfish	5	5
5/18/2011	MLB-5	Bay anchovy	5	5
5/18/2011	MLB-5	Silver hake	1	1
5/18/2011	MLB-6	Lined seahorse	1	1
5/18/2011	MUB-1	American eel	3	3
5/18/2011	MUB-1	Atlantic herring	3	3
5/18/2011	MUB-1	Atlantic menhaden	2	2
5/18/2011	MUB-1	Bay anchovy	129	129
5/18/2011	MUB-1	Butterfish	4	4
5/18/2011	MUB-11	Alewife	4	4
5/18/2011	MUB-11	American shad	1	1
5/18/2011	MUB-11	Atlantic herring	3	3
5/18/2011	MUB-11	Bay anchovy	73	73

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
5/18/2011	MUB-2	Atlantic herring	4	4
5/18/2011	MUB-2	Bay anchovy	49	49
5/18/2011	MUB-2	Lined seahorse	1	1
5/18/2011	MUB-2	Striped bass	1	1
5/18/2011	MUB-3	Alewife	46	46
5/18/2011	MUB-3	Atlantic herring	2	2
5/18/2011	MUB-3	Atlantic menhaden	1	1
5/18/2011	MUB-3	Bay anchovy	120	120
5/18/2011	MUB-3	Blueback herring	45	45
5/18/2011	MUB-9	Alewife	3	3
5/18/2011	MUB-9	American eel	1	1
5/18/2011	MUB-9	Atlantic herring	4	4
5/18/2011	MUB-9	Bay anchovy	30	30
5/18/2011	MUB-9	Butterfish	4	4
5/25/2011	MAK-1	Alewife	1	1
5/25/2011	MAK-1	Atlantic herring	3	3
5/25/2011	MAK-1	Bay anchovy	114	114
5/25/2011	MAK-1	Butterfish	1	1
5/25/2011	MAK-2	Bay anchovy	6	6
5/25/2011	MAK-3	Alewife	2	2
5/25/2011	MAK-3	Bay anchovy	1	1
5/25/2011	MKK-1	Atlantic herring	1	1
5/25/2011	MKK-1	Bay anchovy	11	11
5/25/2011	MKK-1	Butterfish	2	2
5/25/2011	MKK-2	Alewife	1	1
5/25/2011	MKK-2	Atlantic herring	1	1
5/25/2011	MKK-2	Bay anchovy	6	6
5/25/2011	MKK-2	White perch	1	1
5/25/2011	MNB-1	Bay anchovy	4	4
5/25/2011	MNB-1	White perch	2	2
5/25/2011	MNB-2	Atlantic herring	1	1
5/25/2011	MNB-2	Atlantic menhaden	1	1
5/25/2011	MNB-2	Atlantic tomcod	1	1
5/25/2011	MNB-2	Bay anchovy	3	3
5/25/2011	MNB-2	Pollock	1	1
5/25/2011	MNB-5	Atlantic herring	1	1
5/25/2011	MNB-5	Atlantic menhaden	2	2
5/25/2011	MNB-5	Bay anchovy	11	11
5/25/2011	MNB-5	White perch	2	2
5/25/2011	MNB-6	Alewife	1	1
5/26/2011	MLB-3	Butterfish	2	2

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
5/26/2011	MLB-3	Lined seahorse	1	1
5/26/2011	MLB-4	Atlantic thread herring	1	1
5/26/2011	MLB-4	Bay anchovy	2	2
5/26/2011	MLB-4	Blueback herring	2	2
5/26/2011	MLB-6	Butterfish	1	1
5/26/2011	MUB-11	Bay anchovy	6	6
5/26/2011	MUB-11	Blueback herring	2	2
5/26/2011	MUB-2	Atlantic herring	1	1
5/26/2011	MUB-2	Bay anchovy	5	5
5/26/2011	MUB-2	Blueback herring	1	1
5/26/2011	MUB-2	Lined seahorse	1	1
5/26/2011	MUB-3	Alewife	10	10
5/26/2011	MUB-3	Bay anchovy	8	8
5/26/2011	MUB-3	Striped bass	1	1
5/26/2011	MUB-8	Atlantic tomcod	1	1
5/26/2011	MUB-8	Bay anchovy	14	14
5/26/2011	MUB-8	Scup	1	1
5/26/2011	MUB-8	Silver hake	5	5
5/26/2011	MUB-8	Spotted hake	2	2
5/26/2011	MUB-9	Alewife	2	2
5/26/2011	MUB-9	Atlantic menhaden	1	1
5/26/2011	MUB-9	Bay anchovy	91	91
5/26/2011	MUB-9	Butterfish	1	1
5/31/2011	MLB-4	Atlantic herring	6	6
5/31/2011	MLB-4	Bay anchovy	4337	4337
5/31/2011	MLB-4	Butterfish	1	1
5/31/2011	MUB-11	Atlantic herring	10	10
5/31/2011	MUB-11	Bay anchovy	347	347
5/31/2011	MUB-3	Alewife	3	3
5/31/2011	MUB-3	Bay anchovy	11	11
5/31/2011	MUB-3	Bluefish	1	1
5/31/2011	MUB-8	Banded killifish	46	8
5/31/2011	MUB-9	Atlantic herring	5	5
5/31/2011	MUB-9	Bay anchovy	598	598
5/31/2011	MUB-9	Weakfish	1	1
6/1/2011	MAK-1	Atlantic herring	2	2
6/1/2011	MAK-1	Bay anchovy	213	213
6/1/2011	MAK-3	Bay anchovy	226	226
6/1/2011	MAK-4	Bay anchovy	1	1
6/1/2011	MKK-1	Atlantic herring	1	1
6/1/2011	MKK-1	Bay anchovy	21	21

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
6/1/2011	MKK-2	Atlantic herring	2	2
6/1/2011	MKK-2	Bay anchovy	31	31
6/1/2011	MNB-1	Bay anchovy	2	2
6/1/2011	MNB-2	Bay anchovy	40	40
6/1/2011	MNB-5	Bay anchovy	49	49
6/1/2011	MNB-5	Blueback herring	2	2
6/1/2011	MNB-6	Bay anchovy	232	232
7/14/2011	MAK-2	Bay anchovy	103	103
7/14/2011	MAK-2	Bluefish	1	1
7/14/2011	MAK-3	Bay anchovy	194	194
7/14/2011	MAK-4	Bay anchovy	585	585
7/14/2011	MKK-2	Bay anchovy	462	462
7/14/2011	MKK-2	Blue crab	1	1
7/14/2011	MKK-2	Bluefish	1	1
7/14/2011	MKK-2	Butterfish	2	2
7/14/2011	MNB-1	Alewife	1	1
7/14/2011	MNB-1	Bay anchovy	455	455
7/14/2011	MNB-1	Blue crab	1	1
7/14/2011	MNB-1	Butterfish	4	4
7/14/2011	MNB-2	Bay anchovy	269	269
7/14/2011	MNB-2	Bluefish	1	1
7/14/2011	MNB-2	Butterfish	1	1
7/14/2011	MNB-5	Bay anchovy	432	432
7/14/2011	MNB-5	Blue crab	2	2
7/14/2011	MNB-5	Blueback herring	1	1
7/14/2011	MNB-5	Butterfish	6	6
7/14/2011	MNB-6	Atlantic menhaden	1	1
7/14/2011	MNB-6	Bay anchovy	164	164
7/14/2011	MNB-6	Blue crab	1	1
7/14/2011	MNB-6	Blueback herring	5	5
7/14/2011	MNB-6	Butterfish	1	1
7/15/2011	MKK-1	Bay anchovy	8	8
7/15/2011	MKK-1	Bluefish	1	1
7/15/2011	MKK-1	Butterfish	1	1
7/15/2011	MLB-4	Bay anchovy	1574	1574
7/15/2011	MUB-2	Butterfish	19	19
7/15/2011	MUB-9	Bay anchovy	1	1
7/15/2011	MUB-9	Bluefish	1	1
7/15/2011	MUB-9	Butterfish	1	1
8/16/2011	MAK-1	Bay anchovy	124	124
8/16/2011	MAK-1	Blue crab	3	3

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
8/16/2011	MAK-2	Blue crab	2	2
8/16/2011	MAK-3	Bay anchovy	1332	1332
8/16/2011	MAK-3	Blue crab	9	9
8/16/2011	MAK-3	Bluefish	1	1
8/16/2011	MAK-3	Striped anchovy	33	33
8/16/2011	MAK-4	Bay anchovy	1074	1074
8/16/2011	MAK-4	Blue crab	1	1
8/16/2011	MKK-2	Blue crab	1	1
8/16/2011	MKK-2	Striped anchovy	4	4
8/16/2011	MNB-1	Bay anchovy	493	493
8/16/2011	MNB-1	Bluefish	1	1
8/16/2011	MNB-1	Striped anchovy	5	5
8/16/2011	MNB-2	Bay anchovy	159	159
8/16/2011	MNB-2	Blue crab	1	1
8/16/2011	MNB-5	Bay anchovy	109	109
8/16/2011	MNB-6	Bay anchovy	1	1
8/16/2011	MNB-6	Blue crab	3	3
8/16/2011	MNB-6	Butterfish	2	2
8/16/2011	MNB-6	Striped anchovy	1	1
8/17/2011	MKK-1	Blue crab	1	1
8/17/2011	MKK-1	Striped anchovy	4	4
8/17/2011	MLB-4	Striped anchovy	1	1
8/17/2011	MLB-6	Blue crab	1	1
8/17/2011	MUB-11	Bay anchovy	1	1
8/17/2011	MUB-3	Bay anchovy	18	18
8/17/2011	MUB-8	Blue crab	2	2
8/17/2011	MUB-9	Blue crab	2	2
9/12/2011	MLB-3	Blue crab	1	1
9/12/2011	MLB-3	Striped anchovy	3	3
9/12/2011	MLB-4	Bay anchovy	3147	3147
9/12/2011	MLB-4	Blueback herring	63	63
9/12/2011	MLB-4	Bluefish	1	1
9/12/2011	MLB-4	Striped anchovy	3	3
9/12/2011	MLB-5	American shad	1	1
9/12/2011	MLB-5	Blueback herring	10	10
9/12/2011	MLB-6	American shad	16	16
9/12/2011	MLB-6	Blueback herring	340	340
9/12/2011	MLB-6	Lined seahorse	1	1
9/12/2011	MUB-1	Alewife	9	9
9/12/2011	MUB-1	Bay anchovy	145	145
9/12/2011	MUB-1	Blueback herring	1	1

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
9/12/2011	MUB-1	Bluefish	1	1
9/12/2011	MUB-1	Butterfish	2	2
9/12/2011	MUB-1	Northern searobin	1	1
9/12/2011	MUB-1	Pinfish	2	2
9/12/2011	MUB-1	Weakfish	5	5
9/12/2011	MUB-11	Alewife	18	18
9/12/2011	MUB-11	American shad	2	2
9/12/2011	MUB-11	Bay anchovy	269	269
9/12/2011	MUB-11	Bluefish	1	1
9/12/2011	MUB-11	Butterfish	2	2
9/12/2011	MUB-2	Alewife	4	4
9/12/2011	MUB-2	Atlantic moonfish	2	2
9/12/2011	MUB-2	Bay anchovy	97	97
9/12/2011	MUB-2	Blueback herring	1	1
9/12/2011	MUB-2	Butterfish	3	3
9/12/2011	MUB-3	American shad	1	1
9/12/2011	MUB-3	Bay anchovy	388	388
9/12/2011	MUB-3	Blue crab	3	3
9/12/2011	MUB-3	Blueback herring	6	6
9/12/2011	MUB-3	Butterfish	2	2
9/13/2011	MAK-1	Alewife	1	1
9/13/2011	MAK-1	Atlantic menhaden	1	1
9/13/2011	MAK-1	Bay anchovy	61	61
9/13/2011	MAK-1	Blue crab	1	1
9/13/2011	MAK-1	Blueback herring	1	1
9/13/2011	MAK-2	Alewife	2	2
9/13/2011	MAK-2	Bay anchovy	99	99
9/13/2011	MAK-3	Alewife	7	7
9/13/2011	MAK-3	Bay anchovy	306	306
9/13/2011	MAK-4	Alewife	1	1
9/13/2011	MAK-4	Bay anchovy	14	14
9/13/2011	MAK-4	Blue crab	1	1
9/13/2011	MAK-4	Striped anchovy	1	1
9/13/2011	MKK-1	Bay anchovy	126	126
9/13/2011	MKK-1	Blueback herring	2	2
9/13/2011	MKK-1	Butterfish	1	1
9/13/2011	MKK-1	Lined seahorse	1	1
9/13/2011	MKK-1	Oyster toadfish	1	1
9/13/2011	MKK-1	Striped bass	1	1
9/13/2011	MKK-1	Weakfish	1	1
9/13/2011	MKK-2	Alewife	2	2

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
9/13/2011	MKK-2	Bay anchovy	163	163
9/13/2011	MKK-2	Blue crab	3	3
9/13/2011	MKK-2	Blueback herring	1	1
9/13/2011	MKK-2	Bluefish	1	1
9/13/2011	MKK-2	Gizzard shad	1	1
9/13/2011	MKK-2	Weakfish	1	1
9/13/2011	MNB-1	Alewife	5	5
9/13/2011	MNB-1	Bay anchovy	85	85
9/13/2011	MNB-1	Butterfish	1	1
9/13/2011	MNB-2	Alewife	3	3
9/13/2011	MNB-2	Bay anchovy	84	84
9/13/2011	MNB-2	Blue crab	2	2
9/13/2011	MNB-2	Butterfish	1	1
9/13/2011	MNB-2	Weakfish	1	1
9/13/2011	MNB-5	Alewife	11	11
9/13/2011	MNB-5	Atlantic silverside	1	1
9/13/2011	MNB-5	Bay anchovy	11	11
9/13/2011	MNB-5	Blue crab	1	1
9/13/2011	MNB-5	Bluefish	2	2
9/13/2011	MNB-6	Atlantic menhaden	2	2
9/13/2011	MNB-6	Bay anchovy	18	18
9/13/2011	MUB-8	Alewife	6	6
9/13/2011	MUB-8	Bay anchovy	166	166
9/13/2011	MUB-8	Butterfish	1	1
9/13/2011	MUB-9	Alewife	9	9
9/13/2011	MUB-9	Atlantic croaker	1	1
9/13/2011	MUB-9	Atlantic menhaden	2	2
9/13/2011	MUB-9	Atlantic moonfish	3	3
9/13/2011	MUB-9	Bay anchovy	425	425
9/13/2011	MUB-9	Blueback herring	1	1
9/13/2011	MUB-9	Striped bass	1	1
9/13/2011	MUB-9	Weakfish	8	8
9/26/2011	MAK-1	Blue crab	1	1
9/26/2011	MAK-2	Atlantic moonfish	3	3
9/26/2011	MAK-2	Bay anchovy	24	24
9/26/2011	MAK-2	Striped anchovy	2	2
9/26/2011	MAK-3	Bay anchovy	61	61
9/26/2011	MAK-3	Blue crab	1	1
9/26/2011	MAK-3	Blueback herring	1	1
9/26/2011	MAK-3	Striped anchovy	4	4
9/26/2011	MAK-4	Alewife	6	6

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
9/26/2011	MAK-4	American shad	1	1
9/26/2011	MAK-4	Bay anchovy	1131	1131
9/26/2011	MAK-4	Blue crab	2	2
9/26/2011	MAK-4	Blueback herring	4	4
9/26/2011	MAK-4	Striped anchovy	7	7
9/26/2011	MKK-1	Alewife	81	81
9/26/2011	MKK-1	Bay anchovy	53	53
9/26/2011	MKK-1	Blue crab	1	1
9/26/2011	MKK-1	Striped anchovy	2	2
9/26/2011	MKK-2	Atlantic moonfish	1	1
9/26/2011	MKK-2	Bay anchovy	7	7
9/26/2011	MKK-2	Bluefish	1	1
9/26/2011	MKK-2	Butterfish	1	1
9/26/2011	MUB-11	American shad	2	2
9/26/2011	MUB-11	Bay anchovy	424	424
9/26/2011	MUB-11	Blueback herring	13	13
9/26/2011	MUB-11	Striped anchovy	6	6
9/26/2011	MUB-2	American shad	1	1
9/26/2011	MUB-3	American shad	1	1
9/26/2011	MUB-3	Blue crab	1	1
9/26/2011	MUB-8	Bluefish	1	1
9/26/2011	MUB-9	Alewife	23	23
9/26/2011	MUB-9	American shad	2	2
9/26/2011	MUB-9	Bay anchovy	288	288
9/26/2011	MUB-9	Bluefish	5	5
9/26/2011	MUB-9	Butterfish	3	3
9/26/2011	MUB-9	Striped anchovy	2	2
9/27/2011	MNB-1	Alewife	2	2
9/27/2011	MNB-1	Bay anchovy	45	45
9/27/2011	MNB-1	Blue crab	1	1
9/27/2011	MNB-1	Bluefish	4	4
9/27/2011	MNB-2	Alewife	1	1
9/27/2011	MNB-2	Atlantic moonfish	4	4
9/27/2011	MNB-2	Bay anchovy	56	56
9/27/2011	MNB-2	Blue crab	1	1
9/27/2011	MNB-5	Alewife	14	14
9/27/2011	MNB-5	Bay anchovy	300	300
9/27/2011	MNB-5	Blue crab	1	1
9/27/2011	MNB-5	Bluefish	1	1
9/27/2011	MNB-6	Alewife	32	32
9/27/2011	MNB-6	American shad	1	1

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
9/27/2011	MNB-6	Blueback herring	1	1
9/27/2011	MNB-6	Striped anchovy	1	1
9/28/2011	MLB-4	Bay anchovy	963	963
9/28/2011	MLB-4	Blueback herring	17	17
9/28/2011	MLB-4	Striped anchovy	1	1
9/28/2011	MLB-6	Bay anchovy	1	1
9/28/2011	MUB-1	Alewife	5	5
9/28/2011	MUB-1	American shad	1	1
9/28/2011	MUB-1	Bay anchovy	181	181
9/28/2011	MUB-1	Butterfish	2	2
9/28/2011	MUB-1	Striped anchovy	6	6
10/3/2011	MKK-1	Alewife	3	3
10/3/2011	MKK-1	Bay anchovy	44	44
10/3/2011	MLB-3	Butterfish	1	1
10/3/2011	MLB-4	Alewife	6	6
10/3/2011	MLB-4	Bay anchovy	3968	3968
10/3/2011	MLB-4	Blueback herring	117	117
10/3/2011	MLB-4	Butterfish	6	6
10/3/2011	MLB-6	Bay anchovy	1	1
10/3/2011	MLB-6	Striped anchovy	1	1
10/3/2011	MUB-1	Alewife	16	16
10/3/2011	MUB-1	Bay anchovy	205	205
10/3/2011	MUB-11	Alewife	10	10
10/3/2011	MUB-11	American shad	1	1
10/3/2011	MUB-11	Atlantic moonfish	2	2
10/3/2011	MUB-11	Bay anchovy	765	765
10/3/2011	MUB-11	Blue crab	4	4
10/3/2011	MUB-11	Blueback herring	1	1
10/3/2011	MUB-11	Butterfish	1	1
10/3/2011	MUB-2	Alewife	14	14
10/3/2011	MUB-2	American shad	2	2
10/3/2011	MUB-2	Atlantic moonfish	5	5
10/3/2011	MUB-2	Bay anchovy	162	162
10/3/2011	MUB-2	Bluefish	1	1
10/3/2011	MUB-2	Butterfish	4	4
10/3/2011	MUB-2	Weakfish	3	3
10/3/2011	MUB-3	Alewife	4	4
10/3/2011	MUB-3	Atlantic moonfish	3	3
10/3/2011	MUB-3	Bay anchovy	317	317
10/3/2011	MUB-3	Blue crab	3	3
10/3/2011	MUB-3	Butterfish	1	1

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
10/3/2011	MUB-3	River herrings	1	1
10/3/2011	MUB-8	Alewife	11	11
10/3/2011	MUB-8	Bay anchovy	246	246
10/3/2011	MUB-8	Blueback herring	1	1
10/3/2011	MUB-8	Pinfish	1	1
10/3/2011	MUB-9	Alewife	4	4
10/3/2011	MUB-9	Atlantic croaker	1	1
10/3/2011	MUB-9	Atlantic moonfish	1	1
10/3/2011	MUB-9	Bay anchovy	989	989
10/3/2011	MUB-9	Blue crab	3	3
10/3/2011	MUB-9	Blueback herring	1	1
10/3/2011	MUB-9	Bluefish	1	1
10/3/2011	MUB-9	Butterfish	3	3
10/3/2011	MUB-9	Weakfish	13	13
10/4/2011	MAK-1	Alewife	10	10
10/4/2011	MAK-1	Blueback herring	119	119
10/4/2011	MAK-2	Alewife	31	31
10/4/2011	MAK-2	Atlantic menhaden	1	1
10/4/2011	MAK-2	Bay anchovy	45	45
10/4/2011	MAK-2	Blue crab	1	1
10/4/2011	MAK-2	Blueback herring	2	2
10/4/2011	MAK-2	Bluefish	1	1
10/4/2011	MAK-2	Striped anchovy	4	4
10/4/2011	MAK-3	Alewife	20	20
10/4/2011	MAK-3	Bay anchovy	76	76
10/4/2011	MAK-3	Striped anchovy	5	5
10/4/2011	MAK-4	Alewife	36	36
10/4/2011	MAK-4	Bay anchovy	6073	6073
10/4/2011	MAK-4	Blueback herring	34	34
10/4/2011	MAK-4	Striped anchovy	19	19
10/4/2011	MKK-2	Alewife	14	14
10/4/2011	MKK-2	Bay anchovy	48	48
10/4/2011	MKK-2	Blueback herring	9	9
10/4/2011	MNB-1	Alewife	8	8
10/4/2011	MNB-1	Bay anchovy	102	102
10/4/2011	MNB-1	Blue crab	1	1
10/4/2011	MNB-1	Blueback herring	2	2
10/4/2011	MNB-1	Bluefish	1	1
10/4/2011	MNB-2	Alewife	42	42
10/4/2011	MNB-2	American shad	4	4
10/4/2011	MNB-2	Bay anchovy	39	39

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
10/4/2011	MNB-2	Blueback herring	1	1
10/4/2011	MNB-2	Bluefish	2	2
10/4/2011	MNB-2	Striped anchovy	1	1
10/4/2011	MNB-5	Alewife	140	140
10/4/2011	MNB-5	Atlantic menhaden	1	1
10/4/2011	MNB-5	Atlantic moonfish	3	3
10/4/2011	MNB-5	Bay anchovy	49	49
10/4/2011	MNB-5	Blue crab	1	1
10/4/2011	MNB-5	Bluefish	2	2
10/4/2011	MNB-5	Striped anchovy	1	1
10/4/2011	MNB-5	Weakfish	1	1
10/4/2011	MNB-6	Alewife	187	187
10/4/2011	MNB-6	American shad	1	1
10/4/2011	MNB-6	Atlantic menhaden	6	6
10/4/2011	MNB-6	Bay anchovy	296	296
10/4/2011	MNB-6	Blueback herring	280	280
10/4/2011	MNB-6	Bluefish	4	4
10/4/2011	MNB-6	Striped anchovy	1	1
10/11/2011	MLB-4	Bay anchovy	870	870
10/11/2011	MLB-4	Striped anchovy	1	1
10/11/2011	MUB-1	Butterfish	1	1
10/11/2011	MUB-11	Bay anchovy	115	115
10/11/2011	MUB-2	Blue crab	1	1
10/11/2011	MUB-3	Bay anchovy	2	2
10/11/2011	MUB-8	American shad	2	2
10/11/2011	MUB-8	Butterfish	1	1
10/11/2011	MUB-9	Alewife	10	10
10/11/2011	MUB-9	American shad	3	3
10/11/2011	MUB-9	Atlantic menhaden	1	1
10/11/2011	MUB-9	Bay anchovy	91	91
10/11/2011	MUB-9	Butterfish	6	6
10/12/2011	MAK-1	Bay anchovy	56	56
10/12/2011	MAK-1	Blue crab	1	1
10/12/2011	MAK-1	Blueback herring	2	2
10/12/2011	MAK-2	American shad	1	1
10/12/2011	MAK-2	Bay anchovy	3	3
10/12/2011	MAK-2	Striped anchovy	1	1
10/12/2011	MAK-3	Alewife	5	5
10/12/2011	MAK-3	Bay anchovy	48	48
10/12/2011	MKK-1	Bay anchovy	10	10
10/12/2011	MKK-1	Blue crab	1	1

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
10/12/2011	MKK-1	Blueback herring	1	1
10/12/2011	MKK-1	Bluefish	1	1
10/12/2011	MKK-2	Alewife	12	12
10/12/2011	MKK-2	American shad	1	1
10/12/2011	MKK-2	Bay anchovy	20	20
10/12/2011	MKK-2	Blueback herring	2	2
10/12/2011	MNB-1	American shad	1	1
10/12/2011	MNB-2	Alewife	7	7
10/12/2011	MNB-2	Bay anchovy	2	2
10/12/2011	MNB-2	Bluefish	1	1
10/12/2011	MNB-5	Alewife	66	66
10/12/2011	MNB-5	Bay anchovy	63	63
10/12/2011	MNB-6	American shad	1	1
10/12/2011	MNB-6	Bluefish	12	12
10/17/2011	MAK-1	Alewife	6	6
10/17/2011	MAK-1	Bay anchovy	93	93
10/17/2011	MAK-1	Blue crab	1	1
10/17/2011	MAK-1	Striped anchovy	1	1
10/17/2011	MAK-2	American shad	2	2
10/17/2011	MAK-3	Alewife	7	7
10/17/2011	MAK-3	American shad	6	6
10/17/2011	MAK-3	Atlantic herring	1	1
10/17/2011	MAK-3	Bay anchovy	109	109
10/17/2011	MAK-3	Bluefish	1	1
10/17/2011	MAK-3	Striped anchovy	2	2
10/17/2011	MAK-4	Bay anchovy	2	2
10/17/2011	MAK-4	Blueback herring	1	1
10/17/2011	MKK-1	Alewife	1	1
10/17/2011	MKK-1	Bay anchovy	7	7
10/17/2011	MKK-2	Alewife	13	13
10/17/2011	MKK-2	Atlantic moonfish	1	1
10/17/2011	MKK-2	Bay anchovy	21	21
10/17/2011	MNB-1	Alewife	1	1
10/17/2011	MNB-1	Bay anchovy	31	31
10/17/2011	MNB-1	Butterfish	1	1
10/17/2011	MNB-2	Alewife	6	6
10/17/2011	MNB-2	Bay anchovy	37	37
10/17/2011	MNB-2	Butterfish	1	1
10/17/2011	MNB-5	Alewife	31	31
10/17/2011	MNB-5	Bay anchovy	132	132
10/17/2011	MNB-5	Blueback herring	2	2

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
10/17/2011	MNB-6	Alewife	26	26
10/17/2011	MNB-6	Blueback herring	72	72
10/18/2011	MLB-4	Butterfish	1	1
10/18/2011	MUB-1	Atlantic moonfish	1	1
10/18/2011	MUB-11	Alewife	9	9
10/18/2011	MUB-11	American shad	21	21
10/18/2011	MUB-11	Bay anchovy	460	460
10/18/2011	MUB-11	Blueback herring	2	2
10/18/2011	MUB-11	Butterfish	1	1
10/18/2011	MUB-11	Striped anchovy	1	1
10/18/2011	MUB-2	Alewife	21	21
10/18/2011	MUB-2	Striped anchovy	1	1
10/18/2011	MUB-3	American shad	3	3
10/18/2011	MUB-3	Bay anchovy	1	1
10/18/2011	MUB-3	Blueback herring	4	4
10/18/2011	MUB-8	Bay anchovy	21	21
10/18/2011	MUB-8	Weakfish	1	1
10/18/2011	MUB-9	Alewife	6	6
10/18/2011	MUB-9	Atlantic moonfish	4	4
10/18/2011	MUB-9	Bay anchovy	233	233
10/18/2011	MUB-9	Butterfish	3	3
10/18/2011	MUB-9	Weakfish	9	9
10/24/2011	MLB-3	American shad	2	2
10/24/2011	MLB-3	Bay anchovy	39	39
10/24/2011	MLB-3	Blueback herring	42	42
10/24/2011	MLB-4	Bay anchovy	8870	8870
10/24/2011	MLB-4	Blueback herring	72	72
10/24/2011	MLB-5	Bay anchovy	50	50
10/24/2011	MLB-5	Blueback herring	2	2
10/24/2011	MLB-6	Bay anchovy	186	186
10/24/2011	MLB-6	Blueback herring	1	1
10/24/2011	MUB-1	Alewife	11	11
10/24/2011	MUB-1	Atlantic moonfish	3	3
10/24/2011	MUB-1	Bay anchovy	133	133
10/24/2011	MUB-1	Blue crab	2	2
10/24/2011	MUB-1	Butterfish	3	3
10/24/2011	MUB-11	American shad	2	2
10/24/2011	MUB-11	Bay anchovy	985	985
10/24/2011	MUB-11	Blueback herring	39	39
10/24/2011	MUB-3	Bay anchovy	1	1
10/24/2011	MUB-3	Blueback herring	42	42

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
10/24/2011	MUB-9	Bay anchovy	2	2
10/25/2011	MAK-1	Alewife	10	10
10/25/2011	MAK-1	Atlantic moonfish	1	1
10/25/2011	MAK-1	Bay anchovy	41	41
10/25/2011	MAK-1	Blue crab	1	1
10/25/2011	MAK-1	Butterfish	1	1
10/25/2011	MAK-2	Alewife	32	32
10/25/2011	MAK-2	American shad	1	1
10/25/2011	MAK-2	Bay anchovy	29	29
10/25/2011	MAK-3	Alewife	8	8
10/25/2011	MAK-3	Bay anchovy	719	719
10/25/2011	MAK-3	Blue crab	2	2
10/25/2011	MAK-3	Bluefish	1	1
10/25/2011	MAK-4	Alewife	5	5
10/25/2011	MAK-4	American shad	1	1
10/25/2011	MAK-4	Bay anchovy	51	51
10/25/2011	MAK-4	Blue crab	1	1
10/25/2011	MAK-4	Blueback herring	6	6
10/25/2011	MAK-4	Bluefish	1	1
10/25/2011	MKK-1	Alewife	11	11
10/25/2011	MKK-1	Atlantic moonfish	1	1
10/25/2011	MKK-1	Bay anchovy	85	85
10/25/2011	MKK-1	Silver hake	1	1
10/25/2011	MKK-1	Weakfish	2	2
10/25/2011	MKK-2	Alewife	9	9
10/25/2011	MKK-2	Atlantic moonfish	5	5
10/25/2011	MKK-2	Bay anchovy	128	128
10/25/2011	MNB-1	Alewife	20	20
10/25/2011	MNB-1	Atlantic moonfish	5	5
10/25/2011	MNB-1	Bay anchovy	271	271
10/25/2011	MNB-1	Blue crab	2	2
10/25/2011	MNB-1	Butterfish	2	2
10/25/2011	MNB-1	Gizzard shad	1	1
10/25/2011	MNB-1	Silver hake	1	1
10/25/2011	MNB-2	Alewife	2	2
10/25/2011	MNB-2	Bay anchovy	34	34
10/25/2011	MNB-2	Blueback herring	1	1
10/25/2011	MNB-2	Bluefish	2	2
10/25/2011	MNB-2	Gizzard shad	20	20
10/25/2011	MNB-2	Silver hake	2	2
10/25/2011	MNB-2	Silver perch	5	5

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
10/25/2011	MNB-2	Weakfish	7	7
10/25/2011	MNB-2	White perch	1	1
10/25/2011	MNB-5	Atlantic croaker	1	1
10/25/2011	MNB-5	Bay anchovy	273	273
10/25/2011	MNB-5	Blue crab	5	5
10/25/2011	MNB-5	Naked goby	1	1
10/25/2011	MNB-6	Alewife	147	147
10/25/2011	MNB-6	American shad	1	1
10/25/2011	MNB-6	Bay anchovy	37	37
10/25/2011	MNB-6	Blueback herring	8	8
10/25/2011	MNB-6	Gizzard shad	149	149
10/31/2011	MLB-4	Bay anchovy	47	47
10/31/2011	MLB-4	Blueback herring	1	1
10/31/2011	MLB-5	Blueback herring	195	195
10/31/2011	MUB-1	American shad	15	15
10/31/2011	MUB-11	American shad	12	12
10/31/2011	MUB-11	Atlantic moonfish	1	1
10/31/2011	MUB-11	Bay anchovy	156	156
10/31/2011	MUB-11	Blueback herring	182	182
10/31/2011	MUB-2	Alewife	44	44
10/31/2011	MUB-2	American shad	7	7
10/31/2011	MUB-2	Bay anchovy	82	82
10/31/2011	MUB-2	Blueback herring	4	4
10/31/2011	MUB-3	Alewife	1	1
10/31/2011	MUB-3	American shad	6	6
10/31/2011	MUB-3	Bay anchovy	32	32
10/31/2011	MUB-3	Blueback herring	5	5
10/31/2011	MUB-8	Alewife	6	6
10/31/2011	MUB-8	Bay anchovy	163	163
10/31/2011	MUB-8	Black sea bass	1	1
10/31/2011	MUB-8	Blue crab	2	2
10/31/2011	MUB-8	Naked goby	1	1
10/31/2011	MUB-8	Oyster toadfish	1	1
10/31/2011	MUB-8	Silver hake	4	4
10/31/2011	MUB-9	Alewife	3	3
10/31/2011	MUB-9	Atlantic croaker	8	8
10/31/2011	MUB-9	Bay anchovy	133	133
10/31/2011	MUB-9	Oyster toadfish	2	2
10/31/2011	MUB-9	Silver perch	2	2
10/31/2011	MUB-9	Striped bass	2	2
10/31/2011	MUB-9	Striped searobin	1	1

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
10/31/2011	MUB-9	Weakfish	2	2
10/31/2011	MUB-9	White perch	1	1
11/1/2011	MAK-1	Alewife	5	5
11/1/2011	MAK-1	American shad	4	4
11/1/2011	MAK-1	Atlantic menhaden	1	1
11/1/2011	MAK-1	Atlantic moonfish	2	2
11/1/2011	MAK-1	Atlantic silverside	1	1
11/1/2011	MAK-1	Bay anchovy	10	10
11/1/2011	MAK-1	Blueback herring	7	7
11/1/2011	MAK-2	Alewife	4	4
11/1/2011	MAK-2	American shad	6	6
11/1/2011	MAK-2	Atlantic moonfish	1	1
11/1/2011	MAK-2	Bay anchovy	12	12
11/1/2011	MAK-2	Blueback herring	80	80
11/1/2011	MAK-3	American shad	1	1
11/1/2011	MAK-3	Bay anchovy	3	3
11/1/2011	MAK-3	Blueback herring	132	132
11/1/2011	MAK-4	Alewife	2	2
11/1/2011	MAK-4	American shad	4	4
11/1/2011	MAK-4	Bay anchovy	3	3
11/1/2011	MAK-4	Blueback herring	2	2
11/1/2011	MKK-1	Alewife	5	5
11/1/2011	MKK-1	Atlantic moonfish	1	1
11/1/2011	MKK-1	Bay anchovy	58	58
11/1/2011	MKK-1	Blue crab	2	2
11/1/2011	MKK-1	Gizzard shad	1	1
11/1/2011	MKK-2	Alewife	5	5
11/1/2011	MKK-2	Bay anchovy	81	81
11/1/2011	MKK-2	Blueback herring	1	1
11/1/2011	MKK-2	Butterfish	1	1
11/1/2011	MKK-2	Gizzard shad	3	3
11/1/2011	MNB-1	Alewife	18	18
11/1/2011	MNB-1	American shad	3	3
11/1/2011	MNB-1	Bay anchovy	19	19
11/1/2011	MNB-1	Blueback herring	17	17
11/1/2011	MNB-2	Alewife	5	5
11/1/2011	MNB-2	American shad	1	1
11/1/2011	MNB-2	Bay anchovy	41	41
11/1/2011	MNB-2	Blueback herring	3	3
11/1/2011	MNB-2	Butterfish	2	2
11/1/2011	MNB-5	Alewife	11	11

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
11/1/2011	MNB-5	American shad	1	1
11/1/2011	MNB-5	Bay anchovy	29	29
11/1/2011	MNB-5	Blueback herring	1	1
11/1/2011	MNB-5	Gizzard shad	2	2
11/1/2011	MNB-5	White perch	1	1
11/1/2011	MNB-6	Alewife	15	15
11/1/2011	MNB-6	American shad	1	1
11/1/2011	MNB-6	Bay anchovy	52	52
11/1/2011	MNB-6	Blueback herring	3	3
11/7/2011	MAK-1	Alewife	11	11
11/7/2011	MAK-1	Bay anchovy	21	21
11/7/2011	MAK-1	Gizzard shad	5	5
11/7/2011	MAK-2	Alewife	16	16
11/7/2011	MAK-2	American shad	1	1
11/7/2011	MAK-2	Bay anchovy	50	50
11/7/2011	MAK-3	Alewife	10	10
11/7/2011	MAK-3	Bay anchovy	83	83
11/7/2011	MAK-4	Bay anchovy	11	11
11/7/2011	MKK-1	Alewife	38	38
11/7/2011	MKK-1	Bay anchovy	29	29
11/7/2011	MKK-1	Silver hake	74	74
11/7/2011	MKK-1	Silver perch	2	2
11/7/2011	MKK-2	Alewife	14	14
11/7/2011	MKK-2	Atlantic moonfish	1	1
11/7/2011	MKK-2	Bay anchovy	295	295
11/7/2011	MNB-1	Alewife	48	48
11/7/2011	MNB-1	Bay anchovy	3	3
11/7/2011	MNB-1	Gizzard shad	2	2
11/7/2011	MNB-2	Alewife	32	32
11/7/2011	MNB-2	Bay anchovy	8	8
11/7/2011	MNB-5	Alewife	74	74
11/7/2011	MNB-5	American shad	2	2
11/7/2011	MNB-5	Bay anchovy	6	6
11/7/2011	MNB-5	Gizzard shad	1	1
11/7/2011	MNB-6	Alewife	1	1
11/7/2011	MNB-6	Bay anchovy	6	6
11/8/2011	MLB-3	Bay anchovy	1	1
11/8/2011	MLB-3	Blueback herring	6	6
11/8/2011	MLB-4	Bay anchovy	103	103
11/8/2011	MLB-6	Bay anchovy	1	1
11/8/2011	MUB-1	Bay anchovy	2	2

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
11/8/2011	MUB-1	Blue crab	1	1
11/8/2011	MUB-1	Blueback herring	2	2
11/8/2011	MUB-11	Alewife	3	3
11/8/2011	MUB-11	American shad	38	38
11/8/2011	MUB-11	Bay anchovy	73	73
11/8/2011	MUB-11	Blueback herring	20	20
11/8/2011	MUB-11	Silver hake	1	1
11/8/2011	MUB-2	American shad	2	2
11/8/2011	MUB-2	Bay anchovy	11	11
11/8/2011	MUB-2	Blueback herring	164	164
11/8/2011	MUB-3	Alewife	26	26
11/8/2011	MUB-3	American shad	11	11
11/8/2011	MUB-3	Bay anchovy	42	42
11/8/2011	MUB-3	Blueback herring	3	3
11/8/2011	MUB-9	Alewife	19	19
11/8/2011	MUB-9	Bay anchovy	134	134
11/14/2011	MKK-1	Alewife	3	3
11/14/2011	MKK-1	American shad	4	4
11/14/2011	MKK-1	Bay anchovy	77	77
11/14/2011	MKK-1	Blueback herring	1	1
11/14/2011	MKK-1	Gizzard shad	2	2
11/14/2011	MKK-1	Silver hake	8	8
11/14/2011	MLB-3	Atlantic silverside	1	1
11/14/2011	MLB-4	Atlantic menhaden	1	1
11/14/2011	MLB-4	Bay anchovy	58	58
11/14/2011	MLB-4	Blue crab	1	1
11/14/2011	MLB-4	Blueback herring	386	386
11/14/2011	MLB-6	Atlantic moonfish	1	1
11/14/2011	MUB-11	Atlantic menhaden	1	1
11/14/2011	MUB-11	Blueback herring	1034	1034
11/14/2011	MUB-3	Blueback herring	2	2
11/14/2011	MUB-8	American shad	2	2
11/14/2011	MUB-8	Bay anchovy	2	2
11/14/2011	MUB-8	Striped bass	1	1
11/14/2011	MUB-9	American shad	2	2
11/14/2011	MUB-9	Bay anchovy	23	23
11/14/2011	MUB-9	Oyster toadfish	1	1
11/15/2011	MAK-1	Alewife	3	3
11/15/2011	MAK-1	American shad	1	1
11/15/2011	MAK-1	Bay anchovy	3	3
11/15/2011	MAK-1	Blueback herring	1	1

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
11/15/2011	MAK-2	Alewife	1	1
11/15/2011	MAK-2	American shad	3	3
11/15/2011	MAK-2	Bay anchovy	114	114
11/15/2011	MAK-2	Blueback herring	1	1
11/15/2011	MAK-3	Alewife	6	6
11/15/2011	MAK-3	Bay anchovy	60	60
11/15/2011	MAK-3	Blueback herring	3	3
11/15/2011	MAK-4	Alewife	1	1
11/15/2011	MAK-4	Bay anchovy	1	1
11/15/2011	MKK-2	Alewife	6	6
11/15/2011	MKK-2	Bay anchovy	22	22
11/15/2011	MKK-2	Silver hake	53	53
11/15/2011	MKK-2	Weakfish	1	1
11/15/2011	MNB-1	American shad	1	1
11/15/2011	MNB-1	Bay anchovy	1	1
11/15/2011	MNB-1	Blueback herring	1	1
11/15/2011	MNB-2	Alewife	1	1
11/15/2011	MNB-2	Bay anchovy	19	19
11/15/2011	MNB-5	Alewife	1	1
11/15/2011	MNB-5	Bay anchovy	58	58
11/15/2011	MNB-6	Alewife	6	6
11/15/2011	MNB-6	American shad	2	2
11/15/2011	MNB-6	Atlantic menhaden	1	1
11/15/2011	MNB-6	Bay anchovy	42	42
11/15/2011	MNB-6	Gizzard shad	1	1
11/21/2011	MKK-1	Alewife	1	1
11/21/2011	MKK-1	Bay anchovy	1	1
11/21/2011	MLB-3	Atlantic moonfish	1	1
11/21/2011	MLB-3	Bay anchovy	1	1
11/21/2011	MLB-4	American shad	2	2
11/21/2011	MLB-6	Blueback herring	1	1
11/21/2011	MUB-1	Alewife	2	2
11/21/2011	MUB-1	American shad	1	1
11/21/2011	MUB-1	Atlantic moonfish	1	1
11/21/2011	MUB-1	Bay anchovy	1	1
11/21/2011	MUB-11	Alewife	1	1
11/21/2011	MUB-11	American shad	3	3
11/21/2011	MUB-11	Atlantic herring	2	2
11/21/2011	MUB-11	Bay anchovy	6	6
11/21/2011	MUB-11	Blueback herring	1	1
11/21/2011	MUB-2	Bay anchovy	1	1

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
11/21/2011	MUB-3	Atlantic herring	2	2
11/21/2011	MUB-3	Bay anchovy	3	3
11/21/2011	MUB-8	Alewife	49	49
11/21/2011	MUB-8	Bay anchovy	5	5
11/21/2011	MUB-8	Silver hake	3	3
11/21/2011	MUB-9	Bay anchovy	37	37
11/22/2011	MAK-1	Bay anchovy	19	19
11/22/2011	MAK-1	Blue crab	1	1
11/22/2011	MAK-2	Alewife	15	15
11/22/2011	MAK-2	Bay anchovy	47	47
11/22/2011	MAK-2	Blue crab	2	2
11/22/2011	MAK-2	Blueback herring	2	2
11/22/2011	MAK-2	Gizzard shad	4	4
11/22/2011	MAK-3	Alewife	29	29
11/22/2011	MAK-3	American shad	1	1
11/22/2011	MAK-3	Atlantic menhaden	1	1
11/22/2011	MAK-3	Bay anchovy	65	65
11/22/2011	MAK-3	Blueback herring	2	2
11/22/2011	MAK-3	Gizzard shad	9	9
11/22/2011	MAK-4	Alewife	29	29
11/22/2011	MAK-4	Atlantic menhaden	1	1
11/22/2011	MAK-4	Bay anchovy	56	56
11/22/2011	MAK-4	Blue crab	1	1
11/22/2011	MAK-4	Blueback herring	2	2
11/22/2011	MAK-4	Gizzard shad	23	23
11/22/2011	MKK-2	Alewife	4	4
11/22/2011	MKK-2	Bay anchovy	25	25
11/22/2011	MKK-2	Blueback herring	2	2
11/22/2011	MNB-1	Alewife	14	14
11/22/2011	MNB-1	American shad	1	1
11/22/2011	MNB-1	Bay anchovy	11	11
11/22/2011	MNB-1	Blueback herring	2	2
11/22/2011	MNB-1	Gizzard shad	9	9
11/22/2011	MNB-2	Alewife	1	1
11/22/2011	MNB-2	Bay anchovy	22	22
11/22/2011	MNB-2	Gizzard shad	1	1
11/22/2011	MNB-2	Silver hake	2	2
11/22/2011	MNB-5	Alewife	3	3
11/22/2011	MNB-5	Bay anchovy	4	4
11/22/2011	MNB-5	Gizzard shad	1	1
11/22/2011	MNB-5	White perch	2	2

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
11/22/2011	MNB-6	Alewife	40	40
11/22/2011	MNB-6	American shad	1	1
11/22/2011	MNB-6	Bay anchovy	42	42
11/22/2011	MNB-6	Blueback herring	6	6
11/22/2011	MNB-6	Gizzard shad	15	15
11/22/2011	MNB-6	White perch	5	5
12/6/2011	MKK-1	Alewife	45	45
12/6/2011	MKK-1	Bay anchovy	6	6
12/6/2011	MKK-1	Silver hake	1	1
12/6/2011	MLB-4	Alewife	10	10
12/6/2011	MLB-4	American shad	2	2
12/6/2011	MLB-4	Atlantic menhaden	1	1
12/6/2011	MLB-4	Bay anchovy	35	35
12/6/2011	MLB-4	Blueback herring	255	255
12/6/2011	MLB-4	Butterfish	4	4
12/6/2011	MLB-5	Bay anchovy	1	1
12/6/2011	MLB-6	Atlantic moonfish	1	1
12/6/2011	MLB-6	Bay anchovy	10	10
12/6/2011	MUB-1	Alewife	5	5
12/6/2011	MUB-1	American shad	1	1
12/6/2011	MUB-1	Bay anchovy	24	24
12/6/2011	MUB-11	Bay anchovy	51	51
12/6/2011	MUB-11	Blueback herring	1	1
12/6/2011	MUB-2	Bay anchovy	6	6
12/6/2011	MUB-3	Bay anchovy	218	218
12/6/2011	MUB-8	Alewife	4	4
12/6/2011	MUB-8	American shad	3	3
12/6/2011	MUB-8	Bay anchovy	199	199
12/6/2011	MUB-8	Blueback herring	4	4
12/6/2011	MUB-9	Alewife	8	8
12/6/2011	MUB-9	Bay anchovy	64	64
12/6/2011	MUB-9	Silver hake	1	1
12/7/2011	MAK-1	Alewife	1	1
12/7/2011	MAK-1	Bay anchovy	10	10
12/7/2011	MAK-1	Gizzard shad	1	1
12/7/2011	MAK-2	Alewife	8	8
12/7/2011	MAK-2	American shad	2	2
12/7/2011	MAK-2	Bay anchovy	36	36
12/7/2011	MAK-2	Blueback herring	4	4
12/7/2011	MAK-2	Gizzard shad	1	1
12/7/2011	MAK-3	Alewife	20	20

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
12/7/2011	MAK-3	American shad	2	2
12/7/2011	MAK-3	Bay anchovy	28	28
12/7/2011	MAK-3	Gizzard shad	1	1
12/7/2011	MAK-3	Silver hake	1	1
12/7/2011	MAK-4	Alewife	34	34
12/7/2011	MAK-4	American shad	2	2
12/7/2011	MAK-4	Bay anchovy	57	57
12/7/2011	MAK-4	Blueback herring	20	20
12/7/2011	MAK-4	Gizzard shad	7	7
12/7/2011	MAK-4	Silver hake	1	1
12/7/2011	MKK-2	Alewife	5	5
12/7/2011	MKK-2	Bay anchovy	2	2
12/7/2011	MKK-2	Silver hake	2	2
12/7/2011	MNB-1	Alewife	6	6
12/7/2011	MNB-1	Bay anchovy	30	30
12/7/2011	MNB-1	Gizzard shad	3	3
12/7/2011	MNB-2	Alewife	6	6
12/7/2011	MNB-2	Atlantic croaker	2	2
12/7/2011	MNB-2	Atlantic herring	2	2
12/7/2011	MNB-2	Bay anchovy	29	29
12/7/2011	MNB-2	Blueback herring	1	1
12/7/2011	MNB-2	Gizzard shad	1	1
12/7/2011	MNB-5	Alewife	84	84
12/7/2011	MNB-5	Atlantic croaker	2	2
12/7/2011	MNB-5	Bay anchovy	44	44
12/7/2011	MNB-5	Blueback herring	4	4
12/7/2011	MNB-5	Gizzard shad	3	3
12/7/2011	MNB-6	Bay anchovy	522	522
12/7/2011	MNB-6	Blueback herring	24	24

Appendix B

Water Quality Data by Date and Station Collected During the 2011 Migratory Finfish Survey

Date	Station	Temp (°C)	DO (mg/L)	SpCond @ 25°C (µS/cm)	Salinity (ppt)	Depth (ft)
4/8/2011	MAK-1	7.6	10.1	29700	18.3	25
4/8/2011	MKK-1	6.4	10.3	33170	20.4	27
4/8/2011	MNB-1	7.1	10.1	29480	18.1	30
4/8/2011	MUB-2	6.4	10.8	32820	21.5	26
4/8/2011	MUB-3	6.4	10.2	31690	19.5	20
4/8/2011	MUB-8	6.3	10.3	32520	20.1	25
4/11/2011	MAK-1	7.9	10.3	29940	18.1	25
4/11/2011	MAK-2	8.4	9.9	29920	18.5	22
4/11/2011	MAK-3	8.8	10.1	29600	17.8	22
4/11/2011	MAK-4	9.2	10.3	27990	17.8	22
4/11/2011	MKK-2	7.6	10.6	29920	18.2	25
4/11/2011	MNB-1	7.8	9.8	29530	18.2	26
4/11/2011	MNB-2	7.6	9.9	30680	18.9	27
4/11/2011	MNB-5	9.1	9.6	22040	13	17
4/11/2011	MNB-6	8.5	9.9	22960	14.3	10
4/12/2011	MKK-1	8.3	10.6	31660	19.6	25
4/12/2011	MLB-3	7.1	10.6	36740	22.9	15
4/12/2011	MLB-4	7.2	10.8	37430	23.4	7
4/12/2011	MLB-5	6.6	10.8	41310	25.4	25
4/12/2011	MLB-6	7.4	11	33210	20.6	12
4/12/2011	MUB-1	7.1	10.5	32910	20.3	30
4/12/2011	MUB-11	7.6	10.5	26880	16.2	8
4/12/2011	MUB-2	7.2	10.6	29990	18.4	24
4/12/2011	MUB-3	7.2	10.7	35620	22.3	20
4/12/2011	MUB-8	7.2	10.5	26760	16.3	25
4/12/2011	MUB-9	7.3	10.6	21110	13	30
4/18/2011	MLB-3	8	9.9	42350	27	16
4/18/2011	MLB-4	8.3	10	36410	24.4	10
4/18/2011	MLB-5	8.1	9.8	42560	27.1	30
4/18/2011	MLB-6	8.2	9.9	41100	25.9	13
4/18/2011	MUB-1	8.3	9.9	35250	22.1	32
4/18/2011	MUB-11	8.6	9.8	28660	17.6	8
4/18/2011	MUB-2	8.6	10.2	26930	16.6	24
4/18/2011	MUB-3	8.8	10	26300	16	20
4/18/2011	MUB-8	8.5	10.3	28300	12.8	25
4/18/2011	MUB-9	8.4	10	32500	18.4	25
4/19/2011	MAK-1	10.8	9.6	17100	10.2	25
4/19/2011	MAK-2	10.5	9.5	20080	12	23
4/19/2011	MAK-3	10.4	9.5	21310	12.7	23
4/19/2011	MAK-4	10.2	9.2	24520	14.9	22
4/19/2011	MKK-1	9.8	9.8	21900	12	28

Date	Station	Temp (°C)	DO (mg/L)	SpCond @ 25°C (µS/cm)	Salinity (ppt)	Depth (ft)
4/19/2011	MKK-2	10.3	9.8	17700	10.3	29
4/19/2011	MNB-1	9.8	10	18960	11.3	28
4/19/2011	MNB-2	10	9.6	19310	11.5	28
4/19/2011	MNB-5	10.2	9.5	16000	9.6	20
4/19/2011	MNB-6	10.6	11.4	16880	0.9	15
4/25/2011	MLB-3	8.6	9.1	35580	22.3	20
4/25/2011	MLB-4	9.4	9.5	31000	19.2	8
4/25/2011	MLB-5	8.4	9.2	38600	24.3	27
4/25/2011	MLB-6	9.2	9.2	39290	24.9	17
4/25/2011	MUB-1	9.5	9.7	31550	19.6	30
4/25/2011	MUB-11	9	9.2	31000	19.6	8
4/25/2011	MUB-2	9.3	9.5	25000	15.1	25
4/25/2011	MUB-3	9.2	9.6	33900	18.6	20
4/25/2011	MUB-8	9.5	9.3	23160	14	30
4/26/2011	MAK-1	10.2	9	26900	16.4	25
4/26/2011	MAK-2	11.5	9	19750	11.8	20
4/26/2011	MAK-3	11.7	8.7	26300	12.3	21
4/26/2011	MAK-4	11.9	8.5	21220	12.6	21
4/26/2011	MKK-1	10.5	9.2	22500	13.8	25
4/26/2011	MKK-2	10.8	9.4	23680	14.4	24
4/26/2011	MNB-1	10.5	8.9	20900	12.6	27
4/26/2011	MNB-2	11.3	8.7	15800	9.4	27
4/26/2011	MNB-5	12.6	7.9	12000	7.2	17
4/26/2011	MNB-6	13.6	9.5	30220	1.9	11
4/27/2011	MUB-9	10.3	9.5	24000	14.4	30
5/2/2011	MLB-3	9.5	9.2	40850	26.1	20
5/2/2011	MLB-4	10.2	8.7	32500	20.3	10
5/2/2011	MLB-5	9.5	9.2	42500	27.1	30
5/2/2011	MLB-6	10.3	9.4	37830	23.9	14
5/2/2011	MUB-1	11.3	9.4	23220	14.2	30
5/2/2011	MUB-11	11.1	9.2	22400	13.8	7
5/2/2011	MUB-2	10.5	9	26700	16.6	25
5/2/2011	MUB-3	10.9	9	24670	15	20
5/2/2011	MUB-8	10.4	8.8	27640	17	26
5/2/2011	MUB-9	10.1	8.7	31900	19.6	30
5/3/2011	MAK-1	12.7	8.5	22800	13.8	25
5/3/2011	MAK-2	13.2	8.1	22900	13.9	20
5/3/2011	MAK-3	12.9	8.2	24800	15.1	22
5/3/2011	MAK-4	12.6	7.8	27250	16.7	22
5/3/2011	MKK-1	12	8.7	25440	15.3	29
5/3/2011	MKK-2	11.7	8.9	24770	18.2	28

Date	Station	Temp (°C)	DO (mg/L)	SpCond @ 25°C (µS/cm)	Salinity (ppt)	Depth (ft)
5/3/2011	MNB-1	12.3	8.3	24270	14.8	28
5/3/2011	MNB-2	12.7	8.3	22250	13.4	29
5/3/2011	MNB-5	13.5	8	19680	11.7	17
5/3/2011	MNB-6	14.5	7.6	15500	9.1	10
5/9/2011	MLB-3	10.7	9.5	31890	20	19
5/9/2011	MLB-4	12.5	10.7	30640	19	9
5/9/2011	MLB-5	10.6	9.7	38870	21.1	27
5/9/2011	MLB-6	10.3	9.4	37690	25.2	15
5/9/2011	MUB-1	11.5	9.4	30870	18.7	34
5/9/2011	MUB-11	12.7	9.1	21450	13.3	9
5/9/2011	MUB-2	12.2	9.2	23420	14.4	28
5/9/2011	MUB-3	12.3	9.1	23640	14	20
5/9/2011	MUB-8	11.4	9.1	27530	17	29
5/9/2011	MUB-9	11.6	9.2	24090	16.5	29
5/10/2011	MAK-1	12.9	8.3	26570	16.3	25
5/10/2011	MAK-2	13.4	8.2	26360	16.3	22
5/10/2011	MAK-3	13.6	8	26340	16.2	22
5/10/2011	MAK-4	14.2	7.8	26890	15.7	22
5/10/2011	MKK-1	9.9	8.7	38860	25.6	30
5/10/2011	MKK-2	12.3	8.4	27280	16.9	26
5/10/2011	MNB-1	13	8.1	26460	16.3	27
5/10/2011	MNB-2	12.5	8.1	26450	17.9	28
5/10/2011	MNB-5	14.8	7	20110	11.9	15
5/10/2011	MNB-6	14	7.7	22690	13.7	10
5/17/2011	MAK-1	14.6	7.5	26490	16.3	20
5/17/2011	MAK-2	15.3	6.9	26210	16.1	21
5/17/2011	MAK-3	15.2	7.1	26670	16.4	22
5/17/2011	MAK-4	15.1	6.9	27240	16.7	20
5/17/2011	MKK-2	13.7	7.8	28890	17.9	30
5/17/2011	MNB-1	13.9	7.8	27480	16.9	35
5/17/2011	MNB-2	13.8	7.8	28220	17.4	39
5/17/2011	MNB-5	14.3	7.6	25390	15.5	16
5/17/2011	MNB-6	15	6.8	21680	11.9	16
5/17/2011	MUB-8	13.3	7.9	30120	18.7	29
5/18/2011	MKK-1	13.8	7.5	29750	18.6	28
5/18/2011	MLB-3	14.2	7.9	40190	25.6	20
5/18/2011	MLB-4	13.9	7.9	33400	20.9	10
5/18/2011	MLB-5	14.3	7.8	40550	26	30
5/18/2011	MLB-6	14.3	7.7	39750	25.2	17
5/18/2011	MUB-1	13.9	7.7	34050	21.4	30
5/18/2011	MUB-11	14	7.5	30380	19	9

Date	Station	Temp (°C)	DO (mg/L)	SpCond @ 25°C (µS/cm)	Salinity (ppt)	Depth (ft)
5/18/2011	MUB-2	14	7.6	29250	18.2	28
5/18/2011	MUB-3	14.3	7.6	29170	18	20
5/18/2011	MUB-9	13.9	7.3	30730	19.1	30
5/25/2011	MAK-1	16.4	6.9	24860	15.2	25
5/25/2011	MAK-2	17.5	6.8	19500	11.6	22
5/25/2011	MAK-3	17.4	6.7	19570	11.8	22
5/25/2011	MAK-4	17.4	6.5	19890	12	24
5/25/2011	MKK-1	15.9	7.3	24260	14.7	30
5/25/2011	MKK-2	17	7	19810	11.6	27
5/25/2011	MNB-1	16.5	6.7	19450	11.7	26
5/25/2011	MNB-2	16.2	6.5	21720	13	27
5/25/2011	MNB-5	17.8	5.9	13130	7.6	16
5/25/2011	MNB-6	17.3	6.9	10000	5.8	12
5/26/2011	MLB-3	15.4	7.9	33850	21.3	16
5/26/2011	MLB-4	17.3	9.1	26180	16.1	8
5/26/2011	MLB-5	14.7	7.9	40000	25.1	30
5/26/2011	MLB-6	16.7	8.6	28990	18	11
5/26/2011	MUB-1	16.2	7.9	19730	11.8	35
5/26/2011	MUB-11	16.3	7.7	25740	15.9	9
5/26/2011	MUB-2	16	7.6	25570	15.5	24
5/26/2011	MUB-3	15.4	7.4	31720	19.8	20
5/26/2011	MUB-8	15.7	7.4	24600	15.1	29
5/26/2011	MUB-9	16.4	7.9	11360	6.4	30
5/31/2011	MLB-3	17	8	32950	20.8	15
5/31/2011	MLB-4	16.7	7.4	33790	21.5	9
5/31/2011	MLB-5	16.2	8.3	38660	24.9	26
5/31/2011	MLB-6	16.8	8.1	37150	23.6	15
5/31/2011	MUB-1	18	9	31660	19.8	32
5/31/2011	MUB-11	16.9	7.4	32250	28.4	9
5/31/2011	MUB-2	17.9	8	26630	16.4	23
5/31/2011	MUB-3	17.3	7.8	31650	19.8	20
5/31/2011	MUB-8	17.6	7.9	28160	17.6	28
5/31/2011	MUB-9	18.2	7.9	23640	14.7	29
6/1/2011	MAK-1	19.3	6.7	26440	16.2	25
6/1/2011	MAK-2	20	6.3	25770	15.8	21
6/1/2011	MAK-3	19.7	5.8	27180	16.7	21
6/1/2011	MAK-4	19.7	5.7	27630	17.1	21
6/1/2011	MKK-1	17	7.6	32760	20.6	30
6/1/2011	MKK-2	20.9	7.3	24320	14.7	29
6/1/2011	MNB-1	19.4	7.1	25940	15.9	27
6/1/2011	MNB-2	19.2	7	26440	16.2	27

Date	Station	Temp (°C)	DO (mg/L)	SpCond @ 25°C (µS/cm)	Salinity (ppt)	Depth (ft)
6/1/2011	MNB-5	20.8	5.8	21260	12.8	16
6/1/2011	MNB-6	21.2	5.5	19800	11.8	12
7/14/2011	MAK-1	24.1	6.2	29710	18.4	20
7/14/2011	MAK-2	25	5.9	29370	18.1	20
7/14/2011	MAK-3	25.5	5.6	29260	18.1	20
7/14/2011	MAK-4	25.3	5.6	29820	18.4	20
7/14/2011	MKK-2	24	6.5	29720	18.4	27
7/14/2011	MNB-1	23.9	6.1	30250	18.7	27
7/14/2011	MNB-2	24.3	5.9	28320	17.5	26
7/14/2011	MNB-5	24.7	5.6	26500	16.2	17
7/14/2011	MNB-6	25.3	5.2	22050	13.4	11
7/15/2011	MKK-1	22.7	5.9	32910	20.6	27
7/15/2011	MLB-3	19.2	6.5	41650	26.8	21
7/15/2011	MLB-4	20.9	6.5	38770	24.7	9
7/15/2011	MLB-5	19.7	6.5	40880	26.2	30
7/15/2011	MLB-6	20.6	6.5	39830	25.5	15
7/15/2011	MUB-1	21.3	7.2	38100	24.2	37
7/15/2011	MUB-11	21.9	5.9	35420	22.3	10
7/15/2011	MUB-2	21.6	6.4	36630	23.2	25
7/15/2011	MUB-3	22	5.9	35320	22.3	20
7/15/2011	MUB-8	22.3	5.9	34370	21.6	25
7/15/2011	MUB-9	21.6	6	36260	22.9	30
8/16/2011	MAK-1	24.5	4.8	26750	16.2	25
8/16/2011	MAK-2	24.5	4.4	26710	16.5	21
8/16/2011	MAK-3	24.7	4.1	24720	15	23
8/16/2011	MAK-4	25.1	2.7	29460	18.3	23
8/16/2011	MKK-2	24	4.7	29230	18.1	30
8/16/2011	MNB-1	23.9	4.5	28100	17.3	29
8/16/2011	MNB-2	24	4.3	30460	18.9	29
8/16/2011	MNB-5	24.2	4.2	28210	17.3	17
8/16/2011	MNB-6	24.6	3.8	24190	14.4	12
8/17/2011	MKK-1	23.6	4.6	30820	19.1	28
8/17/2011	MLB-3	22.1	5.7	38450	24.5	20
8/17/2011	MLB-4	22.6	5.4	36230	22.9	10
8/17/2011	MLB-5	21.3	5.9	40360	25.8	30
8/17/2011	MLB-6	22.1	5.4	39010	24.9	16
8/17/2011	MUB-1	22.6	5	36090	22.8	32
8/17/2011	MUB-11	23	5.1	34660	21.8	19
8/17/2011	MUB-2	23.4	4.5	32100	20	27
8/17/2011	MUB-3	22.7	4.9	35220	22.2	20
8/17/2011	MUB-8	22.9	5	34160	21.5	27

Date	Station	Temp (°C)	DO (mg/L)	SpCond @ 25°C (µS/cm)	Salinity (ppt)	Depth (ft)
8/17/2011	MUB-9	23.1	4.8	33570	21	30
9/12/2011	MLB-3	20.8	6.3	25450	17	20
9/12/2011	MLB-4	20.9	5.6	25920	15.9	11
9/12/2011	MLB-5	20.8	6.7	37200	23.6	30
9/12/2011	MLB-6	21	6.3	19780	11.8	16
9/12/2011	MUB-1	21.6	6.3	14430	8.3	30
9/12/2011	MUB-11	21.3	6	18750	11.2	9
9/12/2011	MUB-2	21.1	6.4	18380	11.1	25
9/12/2011	MUB-3	21.2	6	16920	10	20
9/13/2011	MAK-1	23.7	*	11350	6.5	22
9/13/2011	MAK-2	23.4	*	16380	9.7	21
9/13/2011	MAK-3	24.1	*	12560	7.2	21
9/13/2011	MAK-4	24.3	*	13820	8	21
9/13/2011	MKK-1	21.6	*	29140	18	30
9/13/2011	MKK-2	22.4	*	18150	10.7	30
9/13/2011	MNB-1	22.2	*	20090	12	30
9/13/2011	MNB-2	22.1	*	16510	9.7	30
9/13/2011	MNB-5	22.4	*	12150	6.9	16
9/13/2011	MNB-6	22.4	*	3314	*	10
9/13/2011	MUB-8	19.8	*	24220	*	30
9/13/2011	MUB-9	21	*	21270	*	30
9/26/2011	MAK-1	20.6	5.4	24650	15	20
9/26/2011	MAK-2	20.8	5.4	24890	15.2	20
9/26/2011	MAK-3	21.2	5.2	24520	14.9	20
9/26/2011	MAK-4	21	4.8	25310	15.4	20
9/26/2011	MKK-1	20.3	5.6	28450	17.6	25
9/26/2011	MKK-2	20.5	5.4	24340	14.8	25
9/26/2011	MUB-11	20.1	5.7	30880	19.2	10
9/26/2011	MUB-2	19.9	5.8	33600	21.1	25
9/26/2011	MUB-3	20	5.4	31170	19.6	20
9/26/2011	MUB-8	19.9	5.8	33720	21.2	25
9/26/2011	MUB-9	20.1	5.6	29600	18.6	25
9/27/2011	MNB-1	20.5	5.3	26420	16.2	28
9/27/2011	MNB-2	20.5	5.3	25450	15.6	28
9/27/2011	MNB-5	20.6	5.2	23770	14.3	16
9/27/2011	MNB-6	20.8	5	26030	12.5	10
9/28/2011	MLB-3	19.8	7.7	37600	24.3	20
9/28/2011	MLB-4	20.3	6.3	36700	21.8	10
9/28/2011	MLB-5	19.4	6.5	40500	25.9	27
9/28/2011	MLB-6	19.7	7.2	41400	26.6	16
9/28/2011	MUB-1	20	6.3	36200	22.9	30

Date	Station	Temp (°C)	DO (mg/L)	SpCond @ 25°C (µS/cm)	Salinity (ppt)	Depth (ft)
10/3/2011	MKK-1	19.7	6.2	19104	11.4	29
10/3/2011	MLB-3	19.5	5.7	36724	23.3	21
10/3/2011	MLB-4	19.6	5.9	29479	18.3	10
10/3/2011	MLB-5	19.2	4.9	41144	26.4	30
10/3/2011	MLB-6	19.4	5.9	36493	23.1	17
10/3/2011	MUB-1	19.9	5.6	31412	19.6	33
10/3/2011	MUB-11	20	6	18676	11.1	10
10/3/2011	MUB-2	19.9	6	23001	13.9	29
10/3/2011	MUB-3	20.2	5.5	25676	15.8	20
10/3/2011	MUB-8	20.4	5.3	25171	15.3	28
10/3/2011	MUB-9	20.6	5.3	23529	14.3	30
10/4/2011	MAK-1	19.5	5.8	20625	12.4	21
10/4/2011	MAK-2	19.5	5.6	21445	12.9	21
10/4/2011	MAK-3	19.5	5.8	20774	12.5	21
10/4/2011	MAK-4	19.6	5.8	20828	12.5	22
10/4/2011	MKK-2	19.4	6	21166	12.7	28
10/4/2011	MNB-1	19.5	6.1	21673	13.1	30
10/4/2011	MNB-2	19.5	5.7	21620	13	22
10/4/2011	MNB-5	19.8	5.6	20545	12.3	18
10/4/2011	MNB-6	19.5	5.9	17694	10.6	14
10/11/2011	MLB-3	18.3	6.2	37300	24.1	16
10/11/2011	MLB-4	18.5	6.4	32600	20.6	10
10/11/2011	MLB-5	18.2	6.4	39950	25.6	30
10/11/2011	MLB-6	18.5	6.5	36460	23.1	16
10/11/2011	MUB-1	19	7.2	29312	18.1	30
10/11/2011	MUB-11	18.7	6.7	29500	18.4	10
10/11/2011	MUB-2	18.6	6.7	32970	20.7	25
10/11/2011	MUB-3	18.6	6.2	32350	20.6	20
10/11/2011	MUB-8	18.5	7	32700	20.4	26
10/11/2011	MUB-9	18.8	6	28550	17.7	26
10/12/2011	MAK-1	19.4	6	25950	15.9	26
10/12/2011	MAK-2	19.6	5.9	25800	15.8	26
10/12/2011	MAK-3	19.3	6.4	27560	17	26
10/12/2011	MAK-4	19.1	6.7	27650	17.1	26
10/12/2011	MKK-1	18.8	6.1	27600	17.2	27
10/12/2011	MKK-2	19.2	6	36460	16.2	30
10/12/2011	MNB-1	18.7	6.1	27550	17	27
10/12/2011	MNB-2	18.6	6.2	25470	15.6	27
10/12/2011	MNB-5	18.7	5.8	24620	15.1	16
10/12/2011	MNB-6	18.8	5.7	21120	12.5	10
10/17/2011	MAK-1	17.5	6.9	24519	14.9	25

Date	Station	Temp (°C)	DO (mg/L)	SpCond @ 25°C (µS/cm)	Salinity (ppt)	Depth (ft)
10/17/2011	MAK-2	17.8	6.7	26128	16	22
10/17/2011	MAK-3	18	6.6	26231	16.1	22
10/17/2011	MAK-4	17.8	6.5	27004	16.6	22
10/17/2011	MKK-1	17.9	5.9	33628	21.1	29
10/17/2011	MKK-2	17.7	6.8	26450	16.2	28
10/17/2011	MNB-1	17.7	6.5	26486	16.3	27
10/17/2011	MNB-2	17.6	6.8	26124	16	29
10/17/2011	MNB-5	17.3	7.3	17297	10.5	17
10/17/2011	MNB-6	17.7	6.5	22634	13.7	12
10/18/2011	MLB-3	16.2	5.5	39458	25.2	20
10/18/2011	MLB-4	17.3	6.1	33903	21.3	10
10/18/2011	MLB-5	15	4.2	43077	28	30
10/18/2011	MLB-6	16.4	5.1	39200	24.9	16
10/18/2011	MUB-1	16.9	5.9	36102	22.9	30
10/18/2011	MUB-11	17.5	7.1	21658	13.1	8
10/18/2011	MUB-2	17.5	6.4	28042	17.1	26
10/18/2011	MUB-3	17.7	6.1	29515	18.4	20
10/18/2011	MUB-8	17.8	6.1	29063	18	25
10/18/2011	MUB-9	17.9	6.2	26700	16.4	30
10/24/2011	MLB-3	14.7	5.9	37602	23.9	16
10/24/2011	MLB-4	14.8	6	36260	23	8
10/24/2011	MLB-5	14.2	5.9	39668	25.3	29
10/24/2011	MLB-6	14.9	6.1	35340	22.1	12
10/24/2011	MUB-1	15.6	6.1	32456	20.3	32
10/24/2011	MUB-11	15.5	6.8	31195	19.4	9
10/24/2011	MUB-2	15.5	6.7	31709	19.7	24
10/24/2011	MUB-3	15.5	6.4	32804	20.5	20
10/24/2011	MUB-8	14.9	6.1	35977	22.9	30
10/24/2011	MUB-9	14.9	5.8	37201	23.6	30
10/25/2011	MAK-1	15.8	6.4	26823	16.5	25
10/25/2011	MAK-2	15.9	6.5	26707	16.4	20
10/25/2011	MAK-3	16	6.4	26233	16.1	20
10/25/2011	MAK-4	16.2	6.3	26817	16.5	20
10/25/2011	MKK-1	15.1	6.2	33213	21.2	30
10/25/2011	MKK-2	15.6	6.4	29071	18	30
10/25/2011	MNB-1	15.7	6.5	26790	16.4	27
10/25/2011	MNB-2	15.6	6.9	24585	14.9	26
10/25/2011	MNB-5	15.3	6.6	17414	10.3	16
10/25/2011	MNB-6	14.6	8.4	5273	2.7	10
10/31/2011	MLB-3	12.7	7.4	41980	26.8	20
10/31/2011	MLB-4	12.5	7.4	36650	23.2	10

Date	Station	Temp (°C)	DO (mg/L)	SpCond @ 25°C (µS/cm)	Salinity (ppt)	Depth (ft)
10/31/2011	MLB-5	12.9	7.2	44600	28.8	30
10/31/2011	MLB-6	12.3	7.4	42430	27.2	17
10/31/2011	MUB-1	12.7	7.2	36400	23	30
10/31/2011	MUB-11	12.7	7	30820	19.1	9
10/31/2011	MUB-2	12.6	7.3	35190	22	27
10/31/2011	MUB-3	12.8	7.1	32860	20.7	20
10/31/2011	MUB-8	13.5	6.9	30600	19	27
10/31/2011	MUB-9	12.9	7.1	27830	16.9	30
11/1/2011	MAK-1	12.6	8.1	24219	14.7	25
11/1/2011	MAK-2	12.8	8	24460	14.9	23
11/1/2011	MAK-3	12.5	7.7	24813	15.1	23
11/1/2011	MAK-4	12.3	8.8	27554	17.1	23
11/1/2011	MKK-1	12.6	8.5	25885	15.8	28
11/1/2011	MKK-2	12.7	8.7	27363	16.8	28
11/1/2011	MNB-1	12	8.3	23481	14.2	28
11/1/2011	MNB-2	12.3	7.9	24464	14.9	23
11/1/2011	MNB-5	12	8.8	21624	13.1	16
11/1/2011	MNB-6	11.7	8.8	20342	12.2	9
11/7/2011	MAK-1	11.7	8.5	24200	14.7	24
11/7/2011	MAK-2	11.9	8.4	26100	16	20
11/7/2011	MAK-3	12	8.2	26370	16.2	20
11/7/2011	MAK-4	12	8.3	25300	15.5	37
11/7/2011	MKK-1	12.5	8.1	31950	20	29
11/7/2011	MKK-2	11.7	8.4	25980	15.8	28
11/7/2011	MNB-1	12.1	8	28250	17.6	28
11/7/2011	MNB-2	12	7.8	27230	16.7	25
11/7/2011	MNB-5	10.9	8.2	18720	11.1	16
11/7/2011	MNB-6	10.8	8.5	16130	9.1	10
11/8/2011	MLB-3	12.7	7.8	35900	22.6	15
11/8/2011	MLB-4	12.6	8	32200	20.1	10
11/8/2011	MLB-5	13.1	7.7	39900	25.5	28
11/8/2011	MLB-6	12.7	7.9	35300	21.4	12
11/8/2011	MUB-1	12.4	8.1	31300	19.5	35
11/8/2011	MUB-11	12.8	7.9	30300	18.8	10
11/8/2011	MUB-2	12.4	8.3	31000	19.2	24
11/8/2011	MUB-3	12.8	7.9	30400	18.9	20
11/8/2011	MUB-8	12.5	8	33300	21	28
11/8/2011	MUB-9	12.6	8	33200	20.6	25
11/14/2011	MKK-1	12.4	7.9	32823	20.6	28
11/14/2011	MLB-3	12.9	6.9	41174	26.3	20
11/14/2011	MLB-4	12.5	7.7	35712	22.5	10

Date	Station	Temp (°C)	DO (mg/L)	SpCond @ 25°C (µS/cm)	Salinity (ppt)	Depth (ft)
11/14/2011	MLB-5	13.7	5.6	44801	28.9	30
11/14/2011	MLB-6	12.9	6.4	42833	27.7	17
11/14/2011	MUB-1	12.6	7.5	37863	24	30
11/14/2011	MUB-11	12.2	8.1	32752	20.5	10
11/14/2011	MUB-2	12.6	7.4	38438	24.4	30
11/14/2011	MUB-3	12.6	7.5	32830	24	20
11/14/2011	MUB-8	12.4	7.8	34147	21.4	28
11/14/2011	MUB-9	12.5	8	30532	19	30
11/15/2011	MAK-1	12.3	8.4	28261	17.4	25
11/15/2011	MAK-2	12.5	8.3	28636	17.7	22
11/15/2011	MAK-3	12.6	8.1	18199	17.4	22
11/15/2011	MAK-4	12.5	8.1	28734	17.7	22
11/15/2011	MKK-2	12.5	8	31148	19.3	30
11/15/2011	MNB-1	12.4	8	30713	19.1	29
11/15/2011	MNB-2	12.3	8	30695	19.1	28
11/15/2011	MNB-5	12.1	8.1	28119	17.1	19
11/15/2011	MNB-6	12	8.3	25658	15.7	12
11/21/2011	MKK-1	12	7.9	31467	19.7	29
11/21/2011	MLB-3	12.3	7.4	36940	23.6	15
11/21/2011	MLB-4	11.7	7.9	37147	23.5	8
11/21/2011	MLB-5	12.6	7	39822	25.7	27
11/21/2011	MLB-6	12.1	7.5	36200	22.8	12
11/21/2011	MUB-1	12.1	7.6	34510	21.7	30
11/21/2011	MUB-11	12.1	7.5	34506	21.2	8
11/21/2011	MUB-2	12	7.6	32815	20.5	27
11/21/2011	MUB-3	12.1	7.5	33810	21.2	20
11/21/2011	MUB-8	12.1	7.7	34409	21.6	27
11/21/2011	MUB-9	12.2	7.4	36448	23	30
11/22/2011	MAK-1	11.6	7.9	29005	17.9	23
11/22/2011	MAK-2	12	7.7	28987	17.9	20
11/22/2011	MAK-3	11.9	7.7	29724	18.4	20
11/22/2011	MAK-4	11.8	7.7	30510	18.9	20
11/22/2011	MKK-2	11.4	8	28692	17.7	28
11/22/2011	MNB-1	11.6	7.7	29722	18.4	28
11/22/2011	MNB-2	11.7	7.5	30113	18.7	28
11/22/2011	MNB-5	10.7	7.7	21178	12.7	16
11/22/2011	MNB-6	10.9	8.1	20095	12.6	10
12/6/2011	MKK-1	11.9	7.5	37116	23.5	28
12/6/2011	MLB-3	11.9	7.8	36784	23.3	16
12/6/2011	MLB-4	11.5	8	34265	21.4	9
12/6/2011	MLB-5	12.1	7.7	39688	25.3	28

Date	Station	Temp (°C)	DO (mg/L)	SpCond @ 25°C (µS/cm)	Salinity (ppt)	Depth (ft)
12/6/2011	MLB-6	11.7	8.1	35812	22.6	12
12/6/2011	MUB-1	11.6	8.2	34086	21.2	36
12/6/2011	MUB-11	11.5	8.4	32677	20.4	8
12/6/2011	MUB-2	11.7	8.2	35482	22.4	23
12/6/2011	MUB-3	11.4	8.6	31227	19.5	20
12/6/2011	MUB-8	11.9	7.6	36149	22.8	26
12/6/2011	MUB-9	12.1	8	38347	24.3	31
12/7/2011	MAK-1	11.3	8.5	26526	16.2	22
12/7/2011	MAK-2	11.5	7.9	29373	18.1	20
12/7/2011	MAK-3	11.6	8.2	27315	16.8	20
12/7/2011	MAK-4	11.7	8.1	27197	16.7	20
12/7/2011	MKK-2	11.6	8	30470	18.9	30
12/7/2011	MNB-1	11.3	8	29375	18.2	30
12/7/2011	MNB-2	11.2	8.2	28140	17.4	28
12/7/2011	MNB-5	10.7	8.4	23146	13.9	17
12/7/2011	MNB-6	10.2	8.8	19464	11.4	10

Notes:

*DO readings and some Salinity readings from 9/13/2011 invalid.

Appendix C
Detail on Statistical Analyses

Appendix C-1
Analysis of Variance Detail

A two-way repeated measure Analysis of Variance (ANOVA) was attempted to test the differences in catch rates for five target species by location and week of year. A two-way repeated measure ANOVA is a powerful test to measure interactions between and within subjects. However, the assumptions are restrictive. These include:

1) continuous response variables;
2) residuals are normally distributed with mean equal to zero and constant variance;
3) subjects are independent;
4) within-subject co-variances are equal for all between-subject groups;
5) within subject covariances are circular (Hintze 2007).

The one-way ANOVA is used to detect differences between two or more group means. The assumptions for the one-way ANOVA include:

1) data are continuous;
2) each group is normally distributed about the mean;
3) variances of the populations are equal;
4) groups are independent;
5) each group is a simple random sample from the population (Hintze 2007).

Data were not sufficient to conduct the two way repeated measures or the one-way ANOVA for American shad, Atlantic menhaden, and striped bass. These species were collected so infrequently that there are insufficient data points to draw meaningful conclusions regarding time and location of occurrence.

While catches of alewife and blueback herring were sufficient to run comparative statistics, data did not meet the assumptions of normality, equal variance, or both for the raw and log (CPUE+1) transformed data. Data were split into spring and fall samples and within each dataset, data were limited to consecutive weeks of occurrence. The data used for the alewife and blueback herring spring and fall samples are presented in Table C.1-1. The assumptions were tested using the NCSS 2007 one-way ANOVA analysis. The results of assumption testing for the raw and transformed data for spring and fall samples of alewife are presented in Tables C.1-2, C.1-3, C.1-4, and C.1-5. These results indicate that the data are not normally distributed, do not have equal variances, or both. As such neither a repeated measures two-way ANOVA or a one-way ANOVA could be completed. The results for the assumption testing for raw data for the spring and fall samples of blueback herring are presented in Appendices C.1-5 and C.1-6. The results indicate the data are not normally distributed, but do have equal variances.

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping**	**Common Name**	**CPUE_ 10min**	**Log(CPUE+1)**	**Species-Season**
16	11-Apr-11	Spring	MNB-1	NB	Alewife	2	0.477121255	AlewifeSpring
16	11-Apr-11	Spring	MNB-1	NB	Blueback herring	38	1.591064607	Blueback herringSpring
16	11-Apr-11	Spring	MNB-5	NB	Alewife	0	0	AlewifeSpring
16	11-Apr-11	Spring	MNB-5	NB	Blueback herring	0	0	Blueback herringSpring
16	11-Apr-11	Spring	MNB-6	NB	Alewife	0	0	AlewifeSpring
16	11-Apr-11	Spring	MNB-6	NB	Blueback herring	0	0	Blueback herringSpring
16	11-Apr-11	Spring	MNB-2	NB	Alewife	2	0.477121255	AlewifeSpring
16	11-Apr-11	Spring	MNB-2	NB	Blueback herring	1	0.301029996	Blueback herringSpring
16	11-Apr-11	Spring	MAK-1	AKKVK	Alewife	0	0	AlewifeSpring
16	11-Apr-11	Spring	MAK-1	AKKVK	Blueback herring	168	2.227886705	Blueback herringSpring
16	11-Apr-11	Spring	MAK-2	AKKVK	Alewife	0	0	AlewifeSpring
16	11-Apr-11	Spring	MAK-2	AKKVK	Blueback herring	319	2.505149978	Blueback herringSpring
16	11-Apr-11	Spring	MAK-3	AKKVK	Alewife	0	0	AlewifeSpring
16	11-Apr-11	Spring	MAK-3	AKKVK	Blueback herring	0	0	Blueback herringSpring
16	11-Apr-11	Spring	MAK-4	AKKVK	Alewife	0	0	AlewifeSpring
16	11-Apr-11	Spring	MAK-4	AKKVK	Blueback herring	1	0.301029996	Blueback herringSpring
16	11-Apr-11	Spring	MKK-2	AKKVK	Alewife	0	0	AlewifeSpring
16	11-Apr-11	Spring	MKK-2	AKKVK	Blueback herring	190	2.281033367	Blueback herringSpring
16	12-Apr-11	Spring	MKK-1	AKKVK	Alewife	0	0	AlewifeSpring
16	12-Apr-11	Spring	MKK-1	AKKVK	Blueback herring	0	0	Blueback herringSpring
16	12-Apr-11	Spring	MLB-4	LB	Alewife	0	0	AlewifeSpring
16	12-Apr-11	Spring	MLB-4	LB	Blueback herring	0	0	Blueback herringSpring
16	12-Apr-11	Spring	MLB-3	LB	Alewife	0	0	AlewifeSpring
16	12-Apr-11	Spring	MLB-3	LB	Blueback herring	0	0	Blueback herringSpring
16	12-Apr-11	Spring	MLB-5	LB	Alewife	0	0	AlewifeSpring

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping**	**Common Name**	**CPUE_ 10min**	**Log(CPUE+1)**	**Species-Season**
16	12-Apr-11	Spring	MLB-5	LB	Blueback herring	0	0	Blueback herringSpring
16	12-Apr-11	Spring	MLB-6	LB	Alewife	0	0	AlewifeSpring
16	12-Apr-11	Spring	MLB-6	LB	Blueback herring	0	0	Blueback herringSpring
16	12-Apr-11	Spring	MUB-1	UB	Alewife	0	0	AlewifeSpring
16	12-Apr-11	Spring	MUB-1	UB	Blueback herring	39	1.602059991	Blueback herringSpring
16	12-Apr-11	Spring	MUB-2	UB	Alewife	15	1.204119983	AlewifeSpring
16	12-Apr-11	Spring	MUB-2	UB	Blueback herring	112	2.053078443	Blueback herringSpring
16	12-Apr-11	Spring	MUB-3	UB	Alewife	0	0	AlewifeSpring
16	12-Apr-11	Spring	MUB-3	UB	Blueback herring	0	0	Blueback herringSpring
16	12-Apr-11	Spring	MUB-11	UB	Alewife	0	0	AlewifeSpring
16	12-Apr-11	Spring	MUB-11	UB	Blueback herring	2	0.477121255	Blueback herringSpring
16	12-Apr-11	Spring	MUB-9	UB	Alewife	0	0	AlewifeSpring
16	12-Apr-11	Spring	MUB-9	UB	Blueback herring	0	0	Blueback herringSpring
16	12-Apr-11	Spring	MUB-8	UB	Alewife	0	0	AlewifeSpring
16	12-Apr-11	Spring	MUB-8	UB	Blueback herring	0	0	Blueback herringSpring
17	18-Apr-11	Spring	MLB-4	LB	Alewife	0	0	AlewifeSpring
17	18-Apr-11	Spring	MLB-4	LB	Blueback herring	3	0.602059991	Blueback herringSpring
17	18-Apr-11	Spring	MLB-3	LB	Alewife	0	0	AlewifeSpring
17	18-Apr-11	Spring	MLB-3	LB	Blueback herring	0	0	Blueback herringSpring
17	18-Apr-11	Spring	MLB-5	LB	Alewife	0	0	AlewifeSpring
17	18-Apr-11	Spring	MLB-5	LB	Blueback herring	0	0	Blueback herringSpring
17	18-Apr-11	Spring	MLB-6	LB	Alewife	0	0	AlewifeSpring
17	18-Apr-11	Spring	MLB-6	LB	Blueback herring	1	0.301029996	Blueback herringSpring
17	18-Apr-11	Spring	MUB-1	UB	Alewife	0	0	AlewifeSpring
17	18-Apr-11	Spring	MUB-1	UB	Blueback herring	0	0	Blueback herringSpring
17	18-Apr-11	Spring	MUB-2	UB	Alewife	73	1.86923172	AlewifeSpring

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping**	**Common Name**	**CPUE_ 10min**	**Log(CPUE+1)**	**Species-Season**
17	18-Apr-11	Spring	MUB-2	UB	Blueback herring	17	1.255272505	Blueback herringSpring
17	18-Apr-11	Spring	MUB-3	UB	Alewife	0	0	AlewifeSpring
17	18-Apr-11	Spring	MUB-3	UB	Blueback herring	82	1.919078092	Blueback herringSpring
17	18-Apr-11	Spring	MUB-11	UB	Alewife	7	0.903089987	AlewifeSpring
17	18-Apr-11	Spring	MUB-11	UB	Blueback herring	219	2.342422681	Blueback herringSpring
17	18-Apr-11	Spring	MUB-9	UB	Alewife	9	1	AlewifeSpring
17	18-Apr-11	Spring	MUB-9	UB	Blueback herring	15	1.204119983	Blueback herringSpring
17	18-Apr-11	Spring	MUB-8	UB	Alewife	2	0.477121255	AlewifeSpring
17	18-Apr-11	Spring	MUB-8	UB	Blueback herring	1	0.301029996	Blueback herringSpring
17	19-Apr-11	Spring	MAK-1	AKKVK	Alewife	0	0	AlewifeSpring
17	19-Apr-11	Spring	MAK-1	AKKVK	Blueback herring	1	0.301029996	Blueback herringSpring
17	19-Apr-11	Spring	MAK-2	AKKVK	Alewife	0	0	AlewifeSpring
17	19-Apr-11	Spring	MAK-2	AKKVK	Blueback herring	25	1.414973348	Blueback herringSpring
17	19-Apr-11	Spring	MAK-3	AKKVK	Alewife	0	0	AlewifeSpring
17	19-Apr-11	Spring	MAK-3	AKKVK	Blueback herring	0	0	Blueback herringSpring
17	19-Apr-11	Spring	MAK-4	AKKVK	Alewife	0	0	AlewifeSpring
17	19-Apr-11	Spring	MAK-4	AKKVK	Blueback herring	0	0	Blueback herringSpring
17	19-Apr-11	Spring	MNB-1	NB	Alewife	0	0	AlewifeSpring
17	19-Apr-11	Spring	MNB-1	NB	Blueback herring	0	0	Blueback herringSpring
17	19-Apr-11	Spring	MNB-2	NB	Alewife	0	0	AlewifeSpring
17	19-Apr-11	Spring	MNB-2	NB	Blueback herring	102	2.012837225	Blueback herringSpring
17	19-Apr-11	Spring	MNB-5	NB	Alewife	7	0.903089987	AlewifeSpring
17	19-Apr-11	Spring	MNB-5	NB	Blueback herring	24	1.397940009	Blueback herringSpring
17	19-Apr-11	Spring	MNB-6	NB	Alewife	1	0.301029996	AlewifeSpring
17	19-Apr-11	Spring	MNB-6	NB	Blueback herring	2	0.477121255	Blueback herringSpring
17	19-Apr-11	Spring	MKK-2	AKKVK	Alewife	3	0.602059991	AlewifeSpring

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping**	**Common Name**	**CPUE_ 10min**	**Log(CPUE+1)**	**Species-Season**
17	19-Apr-11	Spring	MKK-2	AKKVK	Blueback herring	16	1.230448921	Blueback herringSpring
17	19-Apr-11	Spring	MKK-1	AKKVK	Alewife	8	0.954242509	AlewifeSpring
17	19-Apr-11	Spring	MKK-1	AKKVK	Blueback herring	25	1.414973348	Blueback herringSpring
18	25-Apr-11	Spring	MUB-11	UB	Alewife	0	0	AlewifeSpring
18	25-Apr-11	Spring	MUB-11	UB	Blueback herring	145	2.164352856	Blueback herringSpring
18	25-Apr-11	Spring	MUB-3	UB	Alewife	3	0.602059991	AlewifeSpring
18	25-Apr-11	Spring	MUB-3	UB	Blueback herring	3	0.602059991	Blueback herringSpring
18	25-Apr-11	Spring	MUB-2	UB	Alewife	53	1.73239376	AlewifeSpring
18	25-Apr-11	Spring	MUB-2	UB	Blueback herring	0	0	Blueback herringSpring
18	25-Apr-11	Spring	MLB-4	LB	Alewife	2	0.477121255	AlewifeSpring
18	25-Apr-11	Spring	MLB-4	LB	Blueback herring	0	0	Blueback herringSpring
18	25-Apr-11	Spring	MLB-3	LB	Alewife	0	0	AlewifeSpring
18	25-Apr-11	Spring	MLB-3	LB	Blueback herring	1	0.301029996	Blueback herringSpring
18	25-Apr-11	Spring	MLB-5	LB	Alewife	0	0	AlewifeSpring
18	25-Apr-11	Spring	MLB-5	LB	Blueback herring	5	0.77815125	Blueback herringSpring
18	25-Apr-11	Spring	MLB-6	LB	Alewife	0	0	AlewifeSpring
18	25-Apr-11	Spring	MLB-6	LB	Blueback herring	1	0.301029996	Blueback herringSpring
18	25-Apr-11	Spring	MUB-1	UB	Alewife	262	2.419955748	AlewifeSpring
18	25-Apr-11	Spring	MUB-1	UB	Blueback herring	1	0.301029996	Blueback herringSpring
18	25-Apr-11	Spring	MUB-8	UB	Alewife	27	1.447158031	AlewifeSpring
18	25-Apr-11	Spring	MUB-8	UB	Blueback herring	26	1.431363764	Blueback herringSpring
18	26-Apr-11	Spring	MKK-1	AKKVK	Alewife	3	0.602059991	AlewifeSpring
18	26-Apr-11	Spring	MKK-1	AKKVK	Blueback herring	138	2.1430148	Blueback herringSpring
18	26-Apr-11	Spring	MNB-2	NB	Alewife	1	0.301029996	AlewifeSpring
18	26-Apr-11	Spring	MNB-2	NB	Blueback herring	27	1.447158031	Blueback herringSpring
18	26-Apr-11	Spring	MNB-1	NB	Alewife	38	1.591064607	AlewifeSpring

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping	Common Name	CPUE_ 10min	Log(CPUE+1)	Species-Season
18	26-Apr-11	Spring	MNB-1	NB	Blueback herring	75	1.880813592	Blueback herringSpring
18	26-Apr-11	Spring	MNB-6	NB	Alewife	0	0	AlewifeSpring
18	26-Apr-11	Spring	MNB-6	NB	Blueback herring	8	0.954242509	Blueback herringSpring
18	26-Apr-11	Spring	MNB-5	NB	Alewife	0	0	AlewifeSpring
18	26-Apr-11	Spring	MNB-5	NB	Blueback herring	0	0	Blueback herringSpring
18	26-Apr-11	Spring	MAK-2	AKKVK	Alewife	0	0	AlewifeSpring
18	26-Apr-11	Spring	MAK-2	AKKVK	Blueback herring	1	0.301029996	Blueback herringSpring
18	26-Apr-11	Spring	MAK-3	AKKVK	Alewife	0	0	AlewifeSpring
18	26-Apr-11	Spring	MAK-3	AKKVK	Blueback herring	33	1.531478917	Blueback herringSpring
18	26-Apr-11	Spring	MAK-4	AKKVK	Alewife	0	0	AlewifeSpring
18	26-Apr-11	Spring	MAK-4	AKKVK	Blueback herring	39	1.602059991	Blueback herringSpring
18	26-Apr-11	Spring	MAK-1	AKKVK	Alewife	6	0.84509804	AlewifeSpring
18	26-Apr-11	Spring	MAK-1	AKKVK	Blueback herring	0	0	Blueback herringSpring
18	26-Apr-11	Spring	MKK-2	AKKVK	Alewife	2	0.477121255	AlewifeSpring
18	26-Apr-11	Spring	MKK-2	AKKVK	Blueback herring	2	0.477121255	Blueback herringSpring
18	27-Apr-11	Spring	MUB-9	UB	Alewife	178	2.252853031	AlewifeSpring
18	27-Apr-11	Spring	MUB-9	UB	Blueback herring	2	0.477121255	Blueback herringSpring
19	02-May-11	Spring	MLB-6	LB	Alewife	0	0	AlewifeSpring
19	02-May-11	Spring	MLB-6	LB	Blueback herring	0	0	Blueback herringSpring
19	02-May-11	Spring	MLB-5	LB	Alewife	0	0	AlewifeSpring
19	02-May-11	Spring	MLB-5	LB	Blueback herring	0	0	Blueback herringSpring
19	02-May-11	Spring	MLB-3	LB	Alewife	0	0	AlewifeSpring
19	02-May-11	Spring	MLB-3	LB	Blueback herring	0	0	Blueback herringSpring
19	02-May-11	Spring	MLB-4	LB	Alewife	0	0	AlewifeSpring
19	02-May-11	Spring	MLB-4	LB	Blueback herring	1	0.301029996	Blueback herringSpring
19	02-May-11	Spring	MUB-1	UB	Alewife	0	0	AlewifeSpring

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping	Common Name	CPUE_ 10min	Log(CPUE+1)	Species-Season
19	02-May-11	Spring	MUB-1	UB	Blueback herring	1	0.301029996	Blueback herringSpring
19	02-May-11	Spring	MUB-2	UB	Alewife	17	1.255272505	AlewifeSpring
19	02-May-11	Spring	MUB-2	UB	Blueback herring	2	0.477121255	Blueback herringSpring
19	02-May-11	Spring	MUB-11	UB	Alewife	0	0	AlewifeSpring
19	02-May-11	Spring	MUB-11	UB	Blueback herring	3	0.602059991	Blueback herringSpring
19	02-May-11	Spring	MUB-3	UB	Alewife	20	1.322219295	AlewifeSpring
19	02-May-11	Spring	MUB-3	UB	Blueback herring	9	1	Blueback herringSpring
19	02-May-11	Spring	MUB-8	UB	Alewife	164	2.217483944	AlewifeSpring
19	02-May-11	Spring	MUB-8	UB	Blueback herring	2	0.477121255	Blueback herringSpring
19	02-May-11	Spring	MUB-9	UB	Alewife	0	0	AlewifeSpring
19	02-May-11	Spring	MUB-9	UB	Blueback herring	0	0	Blueback herringSpring
19	03-May-11	Spring	MKK-2	AKKVK	Alewife	51	1.716003344	AlewifeSpring
19	03-May-11	Spring	MKK-2	AKKVK	Blueback herring	3	0.602059991	Blueback herringSpring
19	03-May-11	Spring	MAK-1	AKKVK	Alewife	6	0.84509804	AlewifeSpring
19	03-May-11	Spring	MAK-1	AKKVK	Blueback herring	3	0.602059991	Blueback herringSpring
19	03-May-11	Spring	MAK-2	AKKVK	Alewife	0	0	AlewifeSpring
19	03-May-11	Spring	MAK-2	AKKVK	Blueback herring	1	0.301029996	Blueback herringSpring
19	03-May-11	Spring	MAK-3	AKKVK	Alewife	0	0	AlewifeSpring
19	03-May-11	Spring	MAK-3	AKKVK	Blueback herring	0	0	Blueback herringSpring
19	03-May-11	Spring	MAK-4	AKKVK	Alewife	0	0	AlewifeSpring
19	03-May-11	Spring	MAK-4	AKKVK	Blueback herring	0	0	Blueback herringSpring
19	03-May-11	Spring	MNB-1	NB	Alewife	37	1.579783597	AlewifeSpring
19	03-May-11	Spring	MNB-1	NB	Blueback herring	0	0	Blueback herringSpring
19	03-May-11	Spring	MNB-2	NB	Alewife	71	1.857332496	AlewifeSpring
19	03-May-11	Spring	MNB-2	NB	Blueback herring	0	0	Blueback herringSpring
19	03-May-11	Spring	MNB-5	NB	Alewife	131	2.120573931	AlewifeSpring

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping	Common Name	CPUE_ 10min	Log(CPUE+1)	Species-Season
19	03-May-11	Spring	MNB-5	NB	Blueback herring	6	0.84509804	Blueback herringSpring
19	03-May-11	Spring	MNB-6	NB	Alewife	0	0	AlewifeSpring
19	03-May-11	Spring	MNB-6	NB	Blueback herring	10	1.041392685	Blueback herringSpring
19	03-May-11	Spring	MKK-1	AKKVK	Alewife	65	1.819543936	AlewifeSpring
19	03-May-11	Spring	MKK-1	AKKVK	Blueback herring	1	0.301029996	Blueback herringSpring
20	09-May-11	Spring	MLB-4	LB	Alewife	5	0.77815125	AlewifeSpring
20	09-May-11	Spring	MLB-4	LB	Blueback herring	195	2.292256071	Blueback herringSpring
20	09-May-11	Spring	MLB-3	LB	Alewife	0	0	AlewifeSpring
20	09-May-11	Spring	MLB-3	LB	Blueback herring	0	0	Blueback herringSpring
20	09-May-11	Spring	MLB-5	LB	Alewife	0	0	AlewifeSpring
20	09-May-11	Spring	MLB-5	LB	Blueback herring	0	0	Blueback herringSpring
20	09-May-11	Spring	MLB-6	LB	Alewife	0	0	AlewifeSpring
20	09-May-11	Spring	MLB-6	LB	Blueback herring	0	0	Blueback herringSpring
20	09-May-11	Spring	MUB-1	UB	Alewife	233	2.369215857	AlewifeSpring
20	09-May-11	Spring	MUB-1	UB	Blueback herring	38	1.591064607	Blueback herringSpring
20	09-May-11	Spring	MUB-2	UB	Alewife	17	1.255272505	AlewifeSpring
20	09-May-11	Spring	MUB-2	UB	Blueback herring	0	0	Blueback herringSpring
20	09-May-11	Spring	MUB-3	UB	Alewife	1	0.301029996	AlewifeSpring
20	09-May-11	Spring	MUB-3	UB	Blueback herring	6	0.84509804	Blueback herringSpring
20	09-May-11	Spring	MUB-11	UB	Alewife	2	0.477121255	AlewifeSpring
20	09-May-11	Spring	MUB-11	UB	Blueback herring	13	1.146128036	Blueback herringSpring
20	09-May-11	Spring	MUB-9	UB	Alewife	241	2.383815366	AlewifeSpring
20	09-May-11	Spring	MUB-9	UB	Blueback herring	11	1.079181246	Blueback herringSpring
20	09-May-11	Spring	MUB-8	UB	Alewife	98	1.995635195	AlewifeSpring
20	09-May-11	Spring	MUB-8	UB	Blueback herring	12	1.113943352	Blueback herringSpring
20	10-May-11	Spring	MNB-1	NB	Alewife	69	1.84509804	AlewifeSpring

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping	Common Name	CPUE_ 10min	Log(CPUE+1)	Species-Season
20	10-May-11	Spring	MNB-1	NB	Blueback herring	13	1.146128036	Blueback herringSpring
20	10-May-11	Spring	MNB-2	NB	Alewife	0	0	AlewifeSpring
20	10-May-11	Spring	MNB-2	NB	Blueback herring	1	0.301029996	Blueback herringSpring
20	10-May-11	Spring	MNB-5	NB	Alewife	15	1.204119983	AlewifeSpring
20	10-May-11	Spring	MNB-5	NB	Blueback herring	1	0.301029996	Blueback herringSpring
20	10-May-11	Spring	MNB-6	NB	Alewife	0	0	AlewifeSpring
20	10-May-11	Spring	MNB-6	NB	Blueback herring	1	0.301029996	Blueback herringSpring
20	10-May-11	Spring	MAK-1	AKKVK	Alewife	39	1.602059991	AlewifeSpring
20	10-May-11	Spring	MAK-1	AKKVK	Blueback herring	0	0	Blueback herringSpring
20	10-May-11	Spring	MAK-2	AKKVK	Alewife	0	0	AlewifeSpring
20	10-May-11	Spring	MAK-2	AKKVK	Blueback herring	5	0.77815125	Blueback herringSpring
20	10-May-11	Spring	MAK-3	AKKVK	Alewife	0	0	AlewifeSpring
20	10-May-11	Spring	MAK-3	AKKVK	Blueback herring	2	0.477121255	Blueback herringSpring
20	10-May-11	Spring	MAK-4	AKKVK	Alewife	0	0	AlewifeSpring
20	10-May-11	Spring	MAK-4	AKKVK	Blueback herring	0	0	Blueback herringSpring
20	10-May-11	Spring	MKK-2	AKKVK	Alewife	44	1.653212514	AlewifeSpring
20	10-May-11	Spring	MKK-2	AKKVK	Blueback herring	3	0.602059991	Blueback herringSpring
20	10-May-11	Spring	MKK-1	AKKVK	Alewife	1	0.301029996	AlewifeSpring
20	10-May-11	Spring	MKK-1	AKKVK	Blueback herring	0	0	Blueback herringSpring
21	17-May-11	Spring	MKK-2	AKKVK	Alewife	0	0	AlewifeSpring
21	17-May-11	Spring	MKK-2	AKKVK	Blueback herring	0	0	Blueback herringSpring
21	17-May-11	Spring	MNB-1	NB	Alewife	0	0	AlewifeSpring
21	17-May-11	Spring	MNB-1	NB	Blueback herring	0	0	Blueback herringSpring
21	17-May-11	Spring	MNB-2	NB	Alewife	0	0	AlewifeSpring
21	17-May-11	Spring	MNB-2	NB	Blueback herring	0	0	Blueback herringSpring
21	17-May-11	Spring	MNB-5	NB	Alewife	0	0	AlewifeSpring

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping**	**Common Name**	**CPUE_ 10min**	**Log(CPUE+1)**	**Species-Season**
21	17-May-11	Spring	MNB-5	NB	Blueback herring	0	0	Blueback herringSpring
21	17-May-11	Spring	MNB-6	NB	Alewife	1	0.301029996	AlewifeSpring
21	17-May-11	Spring	MNB-6	NB	Blueback herring	20	1.322219295	Blueback herringSpring
21	17-May-11	Spring	MAK-4	AKKVK	Alewife	0	0	AlewifeSpring
21	17-May-11	Spring	MAK-4	AKKVK	Blueback herring	0	0	Blueback herringSpring
21	17-May-11	Spring	MAK-3	AKKVK	Alewife	2	0.477121255	AlewifeSpring
21	17-May-11	Spring	MAK-3	AKKVK	Blueback herring	0	0	Blueback herringSpring
21	17-May-11	Spring	MAK-2	AKKVK	Alewife	2	0.477121255	AlewifeSpring
21	17-May-11	Spring	MAK-2	AKKVK	Blueback herring	1	0.301029996	Blueback herringSpring
21	17-May-11	Spring	MAK-1	AKKVK	Alewife	2	0.477121255	AlewifeSpring
21	17-May-11	Spring	MAK-1	AKKVK	Blueback herring	0	0	Blueback herringSpring
21	17-May-11	Spring	MUB-8	UB	Alewife	7	0.903089987	AlewifeSpring
21	17-May-11	Spring	MUB-8	UB	Blueback herring	0	0	Blueback herringSpring
21	18-May-11	Spring	MUB-1	UB	Alewife	0	0	AlewifeSpring
21	18-May-11	Spring	MUB-1	UB	Blueback herring	0	0	Blueback herringSpring
21	18-May-11	Spring	MLB-6	LB	Alewife	0	0	AlewifeSpring
21	18-May-11	Spring	MLB-6	LB	Blueback herring	0	0	Blueback herringSpring
21	18-May-11	Spring	MLB-5	LB	Alewife	0	0	AlewifeSpring
21	18-May-11	Spring	MLB-5	LB	Blueback herring	0	0	Blueback herringSpring
21	18-May-11	Spring	MLB-3	LB	Alewife	0	0	AlewifeSpring
21	18-May-11	Spring	MLB-3	LB	Blueback herring	0	0	Blueback herringSpring
21	18-May-11	Spring	MLB-4	LB	Alewife	1	0.301029996	AlewifeSpring
21	18-May-11	Spring	MLB-4	LB	Blueback herring	0	0	Blueback herringSpring
21	18-May-11	Spring	MKK-1	AKKVK	Alewife	8	0.954242509	AlewifeSpring
21	18-May-11	Spring	MKK-1	AKKVK	Blueback herring	0	0	Blueback herringSpring
21	18-May-11	Spring	MUB-2	UB	Alewife	0	0	AlewifeSpring

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping**	**Common Name**	**CPUE_ 10min**	**Log(CPUE+1)**	**Species-Season**
21	18-May-11	Spring	MUB-2	UB	Blueback herring	0	0	Blueback herringSpring
21	18-May-11	Spring	MUB-3	UB	Alewife	46	1.672097858	AlewifeSpring
21	18-May-11	Spring	MUB-3	UB	Blueback herring	45	1.662757832	Blueback herringSpring
21	18-May-11	Spring	MUB-11	UB	Alewife	4	0.698970004	AlewifeSpring
21	18-May-11	Spring	MUB-11	UB	Blueback herring	0	0	Blueback herringSpring
21	18-May-11	Spring	MUB-9	UB	Alewife	3	0.602059991	AlewifeSpring
21	18-May-11	Spring	MUB-9	UB	Blueback herring	0	0	Blueback herringSpring
22	25-May-11	Spring	MNB-1	NB	Alewife	0	0	AlewifeSpring
22	25-May-11	Spring	MNB-1	NB	Blueback herring	0	0	Blueback herringSpring
22	25-May-11	Spring	MNB-2	NB	Alewife	0	0	AlewifeSpring
22	25-May-11	Spring	MNB-2	NB	Blueback herring	0	0	Blueback herringSpring
22	25-May-11	Spring	MNB-5	NB	Alewife	0	0	AlewifeSpring
22	25-May-11	Spring	MNB-5	NB	Blueback herring	0	0	Blueback herringSpring
22	25-May-11	Spring	MNB-6	NB	Alewife	1	0.301029996	AlewifeSpring
22	25-May-11	Spring	MNB-6	NB	Blueback herring	0	0	Blueback herringSpring
22	25-May-11	Spring	MKK-2	AKKVK	Alewife	1	0.301029996	AlewifeSpring
22	25-May-11	Spring	MKK-2	AKKVK	Blueback herring	0	0	Blueback herringSpring
22	25-May-11	Spring	MAK-3	AKKVK	Alewife	2	0.477121255	AlewifeSpring
22	25-May-11	Spring	MAK-3	AKKVK	Blueback herring	0	0	Blueback herringSpring
22	25-May-11	Spring	MAK-4	AKKVK	Alewife	0	0	AlewifeSpring
22	25-May-11	Spring	MAK-4	AKKVK	Blueback herring	0	0	Blueback herringSpring
22	25-May-11	Spring	MAK-2	AKKVK	Alewife	0	0	AlewifeSpring
22	25-May-11	Spring	MAK-2	AKKVK	Blueback herring	0	0	Blueback herringSpring
22	25-May-11	Spring	MAK-1	AKKVK	Alewife	1	0.301029996	AlewifeSpring
22	25-May-11	Spring	MAK-1	AKKVK	Blueback herring	0	0	Blueback herringSpring
22	25-May-11	Spring	MKK-1	AKKVK	Alewife	0	0	AlewifeSpring

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping	Common Name	CPUE_ 10min	Log(CPUE+1)	Species-Season
22	25-May-11	Spring	MKK-1	AKKVK	Blueback herring	0	0	Blueback herringSpring
22	26-May-11	Spring	MLB-6	LB	Alewife	0	0	AlewifeSpring
22	26-May-11	Spring	MLB-6	LB	Blueback herring	0	0	Blueback herringSpring
22	26-May-11	Spring	MLB-5	LB	Alewife	0	0	AlewifeSpring
22	26-May-11	Spring	MLB-5	LB	Blueback herring	0	0	Blueback herringSpring
22	26-May-11	Spring	MLB-3	LB	Alewife	0	0	AlewifeSpring
22	26-May-11	Spring	MLB-3	LB	Blueback herring	0	0	Blueback herringSpring
22	26-May-11	Spring	MLB-4	LB	Alewife	0	0	AlewifeSpring
22	26-May-11	Spring	MLB-4	LB	Blueback herring	2	0.477121255	Blueback herringSpring
22	26-May-11	Spring	MUB-1	UB	Alewife	0	0	AlewifeSpring
22	26-May-11	Spring	MUB-1	UB	Blueback herring	0	0	Blueback herringSpring
22	26-May-11	Spring	MUB-2	UB	Alewife	0	0	AlewifeSpring
22	26-May-11	Spring	MUB-2	UB	Blueback herring	1	0.301029996	Blueback herringSpring
22	26-May-11	Spring	MUB-3	UB	Alewife	10	1.041392685	AlewifeSpring
22	26-May-11	Spring	MUB-3	UB	Blueback herring	0	0	Blueback herringSpring
22	26-May-11	Spring	MUB-11	UB	Alewife	0	0	AlewifeSpring
22	26-May-11	Spring	MUB-11	UB	Blueback herring	2	0.477121255	Blueback herringSpring
22	26-May-11	Spring	MUB-8	UB	Alewife	0	0	AlewifeSpring
22	26-May-11	Spring	MUB-8	UB	Blueback herring	0	0	Blueback herringSpring
22	26-May-11	Spring	MUB-9	UB	Alewife	2	0.477121255	AlewifeSpring
22	26-May-11	Spring	MUB-9	UB	Blueback herring	0	0	Blueback herringSpring
23	31-May-11	Spring	MUB-9	UB	Alewife	0	0	AlewifeSpring
23	31-May-11	Spring	MUB-9	UB	Blueback herring	0	0	Blueback herringSpring
23	31-May-11	Spring	MUB-8	UB	Alewife	0	0	AlewifeSpring
23	31-May-11	Spring	MUB-8	UB	Blueback herring	0	0	Blueback herringSpring
23	31-May-11	Spring	MUB-1	UB	Alewife	0	0	AlewifeSpring

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping**	**Common Name**	**CPUE_ 10min**	**Log(CPUE+1)**	**Species-Season**
23	31-May-11	Spring	MUB-1	UB	Blueback herring	0	0	Blueback herringSpring
23	31-May-11	Spring	MLB-5	LB	Alewife	0	0	AlewifeSpring
23	31-May-11	Spring	MLB-5	LB	Blueback herring	0	0	Blueback herringSpring
23	31-May-11	Spring	MLB-6	LB	Alewife	0	0	AlewifeSpring
23	31-May-11	Spring	MLB-6	LB	Blueback herring	0	0	Blueback herringSpring
23	31-May-11	Spring	MLB-3	LB	Alewife	0	0	AlewifeSpring
23	31-May-11	Spring	MLB-3	LB	Blueback herring	0	0	Blueback herringSpring
23	31-May-11	Spring	MLB-4	LB	Alewife	0	0	AlewifeSpring
23	31-May-11	Spring	MLB-4	LB	Blueback herring	0	0	Blueback herringSpring
23	31-May-11	Spring	MUB-2	UB	Alewife	0	0	AlewifeSpring
23	31-May-11	Spring	MUB-2	UB	Blueback herring	0	0	Blueback herringSpring
23	31-May-11	Spring	MUB-3	UB	Alewife	3	0.602059991	AlewifeSpring
23	31-May-11	Spring	MUB-3	UB	Blueback herring	0	0	Blueback herringSpring
23	31-May-11	Spring	MUB-11	UB	Alewife	0	0	AlewifeSpring
23	31-May-11	Spring	MUB-11	UB	Blueback herring	0	0	Blueback herringSpring
23	01-Jun-11	Spring	MKK-1	AKKVK	Alewife	0	0	AlewifeSpring
23	01-Jun-11	Spring	MKK-1	AKKVK	Blueback herring	0	0	Blueback herringSpring
23	01-Jun-11	Spring	MAK-1	AKKVK	Alewife	0	0	AlewifeSpring
23	01-Jun-11	Spring	MAK-1	AKKVK	Blueback herring	0	0	Blueback herringSpring
23	01-Jun-11	Spring	MAK-2	AKKVK	Alewife	0	0	AlewifeSpring
23	01-Jun-11	Spring	MAK-2	AKKVK	Blueback herring	0	0	Blueback herringSpring
23	01-Jun-11	Spring	MAK-3	AKKVK	Alewife	0	0	AlewifeSpring
23	01-Jun-11	Spring	MAK-3	AKKVK	Blueback herring	0	0	Blueback herringSpring
23	01-Jun-11	Spring	MAK-4	AKKVK	Alewife	0	0	AlewifeSpring
23	01-Jun-11	Spring	MAK-4	AKKVK	Blueback herring	0	0	Blueback herringSpring
23	01-Jun-11	Spring	MNB-2	NB	Alewife	0	0	AlewifeSpring

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping	Common Name	CPUE_ 10min	Log(CPUE+1)	Species-Season
23	01-Jun-11	Spring	MNB-2	NB	Blueback herring	0	0	Blueback herringSpring
23	01-Jun-11	Spring	MNB-1	NB	Alewife	0	0	AlewifeSpring
23	01-Jun-11	Spring	MNB-1	NB	Blueback herring	0	0	Blueback herringSpring
23	01-Jun-11	Spring	MNB-5	NB	Alewife	0	0	AlewifeSpring
23	01-Jun-11	Spring	MNB-5	NB	Blueback herring	2	0.477121255	Blueback herringSpring
23	01-Jun-11	Spring	MNB-6	NB	Alewife	0	0	AlewifeSpring
23	01-Jun-11	Spring	MNB-6	NB	Blueback herring	0	0	Blueback herringSpring
23	01-Jun-11	Spring	MKK-2	AKKVK	Alewife	0	0	AlewifeSpring
23	01-Jun-11	Spring	MKK-2	AKKVK	Blueback herring	0	0	Blueback herringSpring
29	14-Jul-11	Summer	MAK-4	AKKVK	Blueback herring	0	0	Blueback herringSummer
29	14-Jul-11	Summer	MAK-3	AKKVK	Blueback herring	0	0	Blueback herringSummer
29	14-Jul-11	Summer	MAK-2	AKKVK	Blueback herring	0	0	Blueback herringSummer
29	14-Jul-11	Summer	MAK-1	AKKVK	Blueback herring	0	0	Blueback herringSummer
29	14-Jul-11	Summer	MNB-5	NB	Blueback herring	1	0.301029996	Blueback herringSummer
29	14-Jul-11	Summer	MNB-6	NB	Blueback herring	5	0.77815125	Blueback herringSummer
29	14-Jul-11	Summer	MNB-2	NB	Blueback herring	0	0	Blueback herringSummer
29	14-Jul-11	Summer	MNB-1	NB	Blueback herring	0	0	Blueback herringSummer
29	14-Jul-11	Summer	MKK-2	AKKVK	Blueback herring	0	0	Blueback herringSummer

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping	Common Name	CPUE_ 10min	Log(CPUE+1)	Species-Season
29	15-Jul-11	Summer	MLB-3	LB	Blueback herring	0	0	Blueback herringSummer
29	15-Jul-11	Summer	MLB-5	LB	Blueback herring	0	0	Blueback herringSummer
29	15-Jul-11	Summer	MLB-6	LB	Blueback herring	0	0	Blueback herringSummer
29	15-Jul-11	Summer	MLB-4	LB	Blueback herring	0	0	Blueback herringSummer
29	15-Jul-11	Summer	MUB-1	UB	Blueback herring	0	0	Blueback herringSummer
29	15-Jul-11	Summer	MUB-2	UB	Blueback herring	0	0	Blueback herringSummer
29	15-Jul-11	Summer	MKK-1	AKKVK	Blueback herring	0	0	Blueback herringSummer
29	15-Jul-11	Summer	MUB-11	UB	Blueback herring	0	0	Blueback herringSummer
29	15-Jul-11	Summer	MUB-3	UB	Blueback herring	0	0	Blueback herringSummer
29	15-Jul-11	Summer	MUB-9	UB	Blueback herring	0	0	Blueback herringSummer
29	15-Jul-11	Summer	MUB-8	UB	Blueback herring	0	0	Blueback herringSummer
34	16-Aug-11	Summer	MAK-1	AKKVK	Blueback herring	0	0	Blueback herringSummer
34	16-Aug-11	Summer	MAK-2	AKKVK	Blueback herring	0	0	Blueback herringSummer
34	16-Aug-11	Summer	MAK-3	AKKVK	Blueback herring	0	0	Blueback herringSummer
34	16-Aug-11	Summer	MAK-4	AKKVK	Blueback herring	0	0	Blueback herringSummer
34	16-Aug-11	Summer	MKK-2	AKKVK	Blueback herring	0	0	Blueback herringSummer
34	16-Aug-11	Summer	MNB-1	NB	Blueback herring	0	0	Blueback herringSummer
34	16-Aug-11	Summer	MNB-2	NB	Blueback herring	0	0	Blueback herringSummer
34	16-Aug-11	Summer	MNB-5	NB	Blueback herring	0	0	Blueback herringSummer
34	16-Aug-11	Summer	MNB-6	NB	Blueback herring	0	0	Blueback herringSummer
34	17-Aug-11	Summer	MKK-1	AKKVK	Blueback herring	0	0	Blueback herringSummer
34	17-Aug-11	Summer	MUB-2	UB	Blueback herring	0	0	Blueback herringSummer

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping	Common Name	CPUE_ 10min	Log(CPUE+1)	Species-Season
34	17-Aug-11	Summer	MUB-1	UB	Blueback herring	0	0	Blueback herringSummer
34	17-Aug-11	Summer	MLB-6	LB	Blueback herring	0	0	Blueback herringSummer
34	17-Aug-11	Summer	MLB-5	LB	Blueback herring	0	0	Blueback herringSummer
34	17-Aug-11	Summer	MLB-3	LB	Blueback herring	0	0	Blueback herringSummer
34	17-Aug-11	Summer	MLB-4	LB	Blueback herring	0	0	Blueback herringSummer
34	17-Aug-11	Summer	MUB-3	UB	Blueback herring	0	0	Blueback herringSummer
34	17-Aug-11	Summer	MUB-11	UB	Blueback herring	0	0	Blueback herringSummer
34	17-Aug-11	Summer	MUB-9	UB	Blueback herring	0	0	Blueback herringSummer
34	17-Aug-11	Summer	MUB-8	UB	Blueback herring	0	0	Blueback herringSummer
38	12-Sep-11	Fall	MLB-4	LB	Alewife	0	0	AlewifeFall
38	12-Sep-11	Fall	MLB-3	LB	Alewife	0	0	AlewifeFall
38	12-Sep-11	Fall	MLB-6	LB	Alewife	0	0	AlewifeFall
38	12-Sep-11	Fall	MLB-5	LB	Alewife	0	0	AlewifeFall
38	12-Sep-11	Fall	MUB-3	UB	Alewife	0	0	AlewifeFall
38	12-Sep-11	Fall	MUB-11	UB	Alewife	18	1.278753601	AlewifeFall
38	12-Sep-11	Fall	MUB-2	UB	Alewife	4	0.698970004	AlewifeFall
38	12-Sep-11	Fall	MUB-1	UB	Alewife	9	1	AlewifeFall
38	13-Sep-11	Fall	MUB-9	UB	Alewife	9	1	AlewifeFall
38	13-Sep-11	Fall	MUB-8	UB	Alewife	6	0.84509804	AlewifeFall
38	13-Sep-11	Fall	MKK-1	AKKVK	Alewife	0	0	AlewifeFall
38	13-Sep-11	Fall	MKK-2	AKKVK	Alewife	2	0.477121255	AlewifeFall
38	13-Sep-11	Fall	MNB-1	NB	Alewife	5	0.77815125	AlewifeFall
38	13-Sep-11	Fall	MNB-2	NB	Alewife	3	0.602059991	AlewifeFall
38	13-Sep-11	Fall	MNB-5	NB	Alewife	11	1.079181246	AlewifeFall
38	13-Sep-11	Fall	MNB-6	NB	Alewife	0	0	AlewifeFall
38	13-Sep-11	Fall	MAK-4	AKKVK	Alewife	1	0.301029996	AlewifeFall
38	13-Sep-11	Fall	MAK-3	AKKVK	Alewife	7	0.903089987	AlewifeFall
38	13-Sep-11	Fall	MAK-2	AKKVK	Alewife	2	0.477121255	AlewifeFall
38	13-Sep-11	Fall	MAK-1	AKKVK	Alewife	1	0.301029996	AlewifeFall
40	26-Sep-11	Fall	MUB-9	UB	Alewife	23	1.380211242	AlewifeFall
40	26-Sep-11	Fall	MUB-8	UB	Alewife	0	0	AlewifeFall
40	26-Sep-11	Fall	MUB-11	UB	Alewife	0	0	AlewifeFall
40	26-Sep-11	Fall	MUB-3	UB	Alewife	0	0	AlewifeFall

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping	Common Name	CPUE_ 10min	Log(CPUE+1)	Species-Season
40	26-Sep-11	Fall	MUB-2	UB	Alewife	0	0	AlewifeFall
40	26-Sep-11	Fall	MAK-4	AKKVK	Alewife	6	0.84509804	AlewifeFall
40	26-Sep-11	Fall	MAK-3	AKKVK	Alewife	0	0	AlewifeFall
40	26-Sep-11	Fall	MAK-2	AKKVK	Alewife	0	0	AlewifeFall
40	26-Sep-11	Fall	MAK-1	AKKVK	Alewife	0	0	AlewifeFall
40	26-Sep-11	Fall	MKK-2	AKKVK	Alewife	0	0	AlewifeFall
40	26-Sep-11	Fall	MKK-1	AKKVK	Alewife	81	1.913813852	AlewifeFall
40	27-Sep-11	Fall	MNB-1	NB	Alewife	2	0.477121255	AlewifeFall
40	27-Sep-11	Fall	MNB-2	NB	Alewife	1	0.301029996	AlewifeFall
40	27-Sep-11	Fall	MNB-5	NB	Alewife	14	1.176091259	AlewifeFall
40	27-Sep-11	Fall	MNB-6	NB	Alewife	32	1.51851394	AlewifeFall
40	28-Sep-11	Fall	MUB-1	UB	Alewife	5	0.77815125	AlewifeFall
40	28-Sep-11	Fall	MLB-6	LB	Alewife	0	0	AlewifeFall
40	28-Sep-11	Fall	MLB-5	LB	Alewife	0	0	AlewifeFall
40	28-Sep-11	Fall	MLB-3	LB	Alewife	0	0	AlewifeFall
40	28-Sep-11	Fall	MLB-4	LB	Alewife	0	0	AlewifeFall
41	03-Oct-11	Fall	MUB-8	UB	Alewife	11	1.079181246	AlewifeFall
41	03-Oct-11	Fall	MUB-9	UB	Alewife	4	0.698970004	AlewifeFall
41	03-Oct-11	Fall	MKK-1	AKKVK	Alewife	3	0.602059991	AlewifeFall
41	03-Oct-11	Fall	MUB-11	UB	Alewife	10	1.041392685	AlewifeFall
41	03-Oct-11	Fall	MUB-3	UB	Alewife	4	0.698970004	AlewifeFall
41	03-Oct-11	Fall	MUB-2	UB	Alewife	14	1.176091259	AlewifeFall
41	03-Oct-11	Fall	MUB-1	UB	Alewife	16	1.230448921	AlewifeFall
41	03-Oct-11	Fall	MLB-6	LB	Alewife	0	0	AlewifeFall
41	03-Oct-11	Fall	MLB-5	LB	Alewife	0	0	AlewifeFall
41	03-Oct-11	Fall	MLB-3	LB	Alewife	0	0	AlewifeFall
41	03-Oct-11	Fall	MLB-4	LB	Alewife	6	0.84509804	AlewifeFall
41	04-Oct-11	Fall	MAK-4	AKKVK	Alewife	36	1.568201724	AlewifeFall
41	04-Oct-11	Fall	MAK-3	AKKVK	Alewife	20	1.322219295	AlewifeFall
41	04-Oct-11	Fall	MAK-2	AKKVK	Alewife	31	1.505149978	AlewifeFall
41	04-Oct-11	Fall	MAK-1	AKKVK	Alewife	10	1.041392685	AlewifeFall
41	04-Oct-11	Fall	MKK-2	AKKVK	Alewife	14	1.176091259	AlewifeFall
41	04-Oct-11	Fall	MNB-5	NB	Alewife	140	2.149219113	AlewifeFall
41	04-Oct-11	Fall	MNB-6	NB	Alewife	187	2.274157849	AlewifeFall
41	04-Oct-11	Fall	MNB-2	NB	Alewife	42	1.633468456	AlewifeFall
41	04-Oct-11	Fall	MNB-1	NB	Alewife	8	0.954242509	AlewifeFall
42	11-Oct-11	Fall	MUB-9	UB	Alewife	10	1.041392685	AlewifeFall
42	11-Oct-11	Fall	MUB-8	UB	Alewife	0	0	AlewifeFall

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping	Common Name	CPUE_ 10min	Log(CPUE+1)	Species-Season
42	11-Oct-11	Fall	MUB-11	UB	Alewife	0	0	AlewifeFall
42	11-Oct-11	Fall	MUB-3	UB	Alewife	0	0	AlewifeFall
42	11-Oct-11	Fall	MUB-2	UB	Alewife	0	0	AlewifeFall
42	11-Oct-11	Fall	MLB-6	LB	Alewife	0	0	AlewifeFall
42	11-Oct-11	Fall	MLB-5	LB	Alewife	0	0	AlewifeFall
42	11-Oct-11	Fall	MLB-3	LB	Alewife	0	0	AlewifeFall
42	11-Oct-11	Fall	MLB-4	LB	Alewife	0	0	AlewifeFall
42	11-Oct-11	Fall	MUB-1	UB	Alewife	0	0	AlewifeFall
42	12-Oct-11	Fall	MAK-1	AKKVK	Alewife	0	0	AlewifeFall
42	12-Oct-11	Fall	MAK-2	AKKVK	Alewife	0	0	AlewifeFall
42	12-Oct-11	Fall	MAK-3	AKKVK	Alewife	5	0.77815125	AlewifeFall
42	12-Oct-11	Fall	MAK-4	AKKVK	Alewife	0	0	AlewifeFall
42	12-Oct-11	Fall	MKK-2	AKKVK	Alewife	12	1.113943352	AlewifeFall
42	12-Oct-11	Fall	MNB-1	NB	Alewife	0	0	AlewifeFall
42	12-Oct-11	Fall	MNB-2	NB	Alewife	7	0.903089987	AlewifeFall
42	12-Oct-11	Fall	MNB-5	NB	Alewife	66	1.826074803	AlewifeFall
42	12-Oct-11	Fall	MNB-6	NB	Alewife	0	0	AlewifeFall
42	12-Oct-11	Fall	MKK-1	AKKVK	Alewife	0	0	AlewifeFall
43	17-Oct-11	Fall	MKK-2	AKKVK	Alewife	13	1.146128036	AlewifeFall
43	17-Oct-11	Fall	MAK-1	AKKVK	Alewife	6	0.84509804	AlewifeFall
43	17-Oct-11	Fall	MAK-2	AKKVK	Alewife	0	0	AlewifeFall
43	17-Oct-11	Fall	MAK-3	AKKVK	Alewife	7	0.903089987	AlewifeFall
43	17-Oct-11	Fall	MAK-4	AKKVK	Alewife	0	0	AlewifeFall
43	17-Oct-11	Fall	MNB-1	NB	Alewife	1	0.301029996	AlewifeFall
43	17-Oct-11	Fall	MNB-2	NB	Alewife	6	0.84509804	AlewifeFall
43	17-Oct-11	Fall	MNB-5	NB	Alewife	31	1.505149978	AlewifeFall
43	17-Oct-11	Fall	MNB-6	NB	Alewife	26	1.431363764	AlewifeFall
43	17-Oct-11	Fall	MKK-1	AKKVK	Alewife	1	0.301029996	AlewifeFall
43	18-Oct-11	Fall	MUB-8	UB	Alewife	0	0	AlewifeFall
43	18-Oct-11	Fall	MUB-9	UB	Alewife	6	0.84509804	AlewifeFall
43	18-Oct-11	Fall	MUB-11	UB	Alewife	9	1	AlewifeFall
43	18-Oct-11	Fall	MUB-3	UB	Alewife	0	0	AlewifeFall
43	18-Oct-11	Fall	MUB-2	UB	Alewife	21	1.342422681	AlewifeFall
43	18-Oct-11	Fall	MLB-6	LB	Alewife	0	0	AlewifeFall
43	18-Oct-11	Fall	MLB-5	LB	Alewife	0	0	AlewifeFall
43	18-Oct-11	Fall	MLB-3	LB	Alewife	0	0	AlewifeFall
43	18-Oct-11	Fall	MLB-4	LB	Alewife	0	0	AlewifeFall
43	18-Oct-11	Fall	MUB-1	UB	Alewife	0	0	AlewifeFall

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping	Common Name	CPUE_ 10min	Log(CPUE+1)	Species-Season
44	24-Oct-11	Fall	MUB-9	UB	Alewife	0	0	AlewifeFall
44	24-Oct-11	Fall	MUB-8	UB	Alewife	0	0	AlewifeFall
44	24-Oct-11	Fall	MUB-11	UB	Alewife	0	0	AlewifeFall
44	24-Oct-11	Fall	MUB-3	UB	Alewife	0	0	AlewifeFall
44	24-Oct-11	Fall	MUB-2	UB	Alewife	0	0	AlewifeFall
44	24-Oct-11	Fall	MLB-6	LB	Alewife	0	0	AlewifeFall
44	24-Oct-11	Fall	MLB-5	LB	Alewife	0	0	AlewifeFall
44	24-Oct-11	Fall	MLB-3	LB	Alewife	0	0	AlewifeFall
44	24-Oct-11	Fall	MLB-4	LB	Alewife	0	0	AlewifeFall
44	24-Oct-11	Fall	MUB-1	UB	Alewife	11	1.079181246	AlewifeFall
44	25-Oct-11	Fall	MKK-1	AKKVK	Alewife	11	1.079181246	AlewifeFall
44	25-Oct-11	Fall	MKK-2	AKKVK	Alewife	9	1	AlewifeFall
44	25-Oct-11	Fall	MAK-1	AKKVK	Alewife	10	1.041392685	AlewifeFall
44	25-Oct-11	Fall	MAK-4	AKKVK	Alewife	5	0.77815125	AlewifeFall
44	25-Oct-11	Fall	MAK-3	AKKVK	Alewife	8	0.954242509	AlewifeFall
44	25-Oct-11	Fall	MAK-2	AKKVK	Alewife	32	1.51851394	AlewifeFall
44	25-Oct-11	Fall	MNB-1	NB	Alewife	20	1.322219295	AlewifeFall
44	25-Oct-11	Fall	MNB-2	NB	Alewife	2	0.477121255	AlewifeFall
44	25-Oct-11	Fall	MNB-5	NB	Alewife	0	0	AlewifeFall
44	25-Oct-11	Fall	MNB-6	NB	Alewife	147	2.170261715	AlewifeFall
45	31-Oct-11	Fall	MUB-8	UB	Alewife	6	0.84509804	AlewifeFall
45	31-Oct-11	Fall	MUB-9	UB	Alewife	3	0.602059991	AlewifeFall
45	31-Oct-11	Fall	MUB-11	UB	Alewife	0	0	AlewifeFall
45	31-Oct-11	Fall	MUB-3	UB	Alewife	1	0.301029996	AlewifeFall
45	31-Oct-11	Fall	MUB-2	UB	Alewife	44	1.653212514	AlewifeFall
45	31-Oct-11	Fall	MUB-1	UB	Alewife	0	0	AlewifeFall
45	31-Oct-11	Fall	MLB-6	LB	Alewife	0	0	AlewifeFall
45	31-Oct-11	Fall	MLB-5	LB	Alewife	0	0	AlewifeFall
45	31-Oct-11	Fall	MLB-3	LB	Alewife	0	0	AlewifeFall
45	31-Oct-11	Fall	MLB-4	LB	Alewife	0	0	AlewifeFall
45	01-Nov-11	Fall	MKK-1	AKKVK	Alewife	5	0.77815125	AlewifeFall
45	01-Nov-11	Fall	MNB-5	NB	Alewife	11	1.079181246	AlewifeFall
45	01-Nov-11	Fall	MNB-6	NB	Alewife	15	1.204119983	AlewifeFall
45	01-Nov-11	Fall	MNB-2	NB	Alewife	5	0.77815125	AlewifeFall
45	01-Nov-11	Fall	MNB-1	NB	Alewife	18	1.278753601	AlewifeFall
45	01-Nov-11	Fall	MAK-1	AKKVK	Alewife	5	0.77815125	AlewifeFall
45	01-Nov-11	Fall	MAK-2	AKKVK	Alewife	4	0.698970004	AlewifeFall
45	01-Nov-11	Fall	MAK-3	AKKVK	Alewife	0	0	AlewifeFall

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping	Common Name	CPUE_ 10min	Log(CPUE+1)	Species-Season
45	01-Nov-11	Fall	MAK-4	AKKVK	Alewife	2	0.477121255	AlewifeFall
45	01-Nov-11	Fall	MKK-2	AKKVK	Alewife	5	0.77815125	AlewifeFall
46	07-Nov-11	Fall	MKK-1	AKKVK	Alewife	38	1.591064607	AlewifeFall
46	07-Nov-11	Fall	MKK-2	AKKVK	Alewife	14	1.176091259	AlewifeFall
46	07-Nov-11	Fall	MNB-1	NB	Alewife	48	1.69019608	AlewifeFall
46	07-Nov-11	Fall	MNB-2	NB	Alewife	32	1.51851394	AlewifeFall
46	07-Nov-11	Fall	MNB-5	NB	Alewife	74	1.875061263	AlewifeFall
46	07-Nov-11	Fall	MNB-6	NB	Alewife	1	0.301029996	AlewifeFall
46	07-Nov-11	Fall	MAK-4	AKKVK	Alewife	0	0	AlewifeFall
46	07-Nov-11	Fall	MAK-3	AKKVK	Alewife	10	1.041392685	AlewifeFall
46	07-Nov-11	Fall	MAK-2	AKKVK	Alewife	16	1.230448921	AlewifeFall
46	07-Nov-11	Fall	MAK-1	AKKVK	Alewife	11	1.079181246	AlewifeFall
46	08-Nov-11	Fall	MUB-9	UB	Alewife	19	1.301029996	AlewifeFall
46	08-Nov-11	Fall	MUB-8	UB	Alewife	0	0	AlewifeFall
46	08-Nov-11	Fall	MLB-4	LB	Alewife	0	0	AlewifeFall
46	08-Nov-11	Fall	MLB-3	LB	Alewife	0	0	AlewifeFall
46	08-Nov-11	Fall	MLB-5	LB	Alewife	0	0	AlewifeFall
46	08-Nov-11	Fall	MLB-6	LB	Alewife	0	0	AlewifeFall
46	08-Nov-11	Fall	MUB-1	UB	Alewife	0	0	AlewifeFall
46	08-Nov-11	Fall	MUB-2	UB	Alewife	0	0	AlewifeFall
46	08-Nov-11	Fall	MUB-3	UB	Alewife	26	1.431363764	AlewifeFall
46	08-Nov-11	Fall	MUB-11	UB	Alewife	3	0.602059991	AlewifeFall
47	14-Nov-11	Fall	MUB-9	UB	Alewife	0	0	AlewifeFall
47	14-Nov-11	Fall	MUB-8	UB	Alewife	0	0	AlewifeFall
47	14-Nov-11	Fall	MUB-11	UB	Alewife	0	0	AlewifeFall
47	14-Nov-11	Fall	MUB-3	UB	Alewife	0	0	AlewifeFall
47	14-Nov-11	Fall	MUB-2	UB	Alewife	0	0	AlewifeFall
47	14-Nov-11	Fall	MLB-6	LB	Alewife	0	0	AlewifeFall
47	14-Nov-11	Fall	MLB-5	LB	Alewife	0	0	AlewifeFall
47	14-Nov-11	Fall	MLB-3	LB	Alewife	0	0	AlewifeFall
47	14-Nov-11	Fall	MLB-4	LB	Alewife	0	0	AlewifeFall
47	14-Nov-11	Fall	MUB-1	UB	Alewife	0	0	AlewifeFall
47	14-Nov-11	Fall	MKK-1	AKKVK	Alewife	3	0.602059991	AlewifeFall
47	15-Nov-11	Fall	MAK-1	AKKVK	Alewife	3	0.602059991	AlewifeFall
47	15-Nov-11	Fall	MAK-2	AKKVK	Alewife	1	0.301029996	AlewifeFall
47	15-Nov-11	Fall	MAK-3	AKKVK	Alewife	6	0.84509804	AlewifeFall
47	15-Nov-11	Fall	MAK-4	AKKVK	Alewife	1	0.301029996	AlewifeFall
47	15-Nov-11	Fall	MKK-2	AKKVK	Alewife	6	0.84509804	AlewifeFall

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping**	**Common Name**	**CPUE_ 10min**	**Log(CPUE+1)**	**Species-Season**
47	15-Nov-11	Fall	MNB-1	NB	Alewife	0	0	AlewifeFall
47	15-Nov-11	Fall	MNB-2	NB	Alewife	1	0.301029996	AlewifeFall
47	15-Nov-11	Fall	MNB-5	NB	Alewife	1	0.301029996	AlewifeFall
47	15-Nov-11	Fall	MNB-6	NB	Alewife	6	0.84509804	AlewifeFall
48	21-Nov-11	Fall	MUB-8	UB	Alewife	49	1.698970004	AlewifeFall
48	21-Nov-11	Fall	MUB-9	UB	Alewife	0	0	AlewifeFall
48	21-Nov-11	Fall	MUB-11	UB	Alewife	1	0.301029996	AlewifeFall
48	21-Nov-11	Fall	MUB-3	UB	Alewife	0	0	AlewifeFall
48	21-Nov-11	Fall	MLB-6	LB	Alewife	0	0	AlewifeFall
48	21-Nov-11	Fall	MLB-3	LB	Alewife	0	0	AlewifeFall
48	21-Nov-11	Fall	MLB-5	LB	Alewife	0	0	AlewifeFall
48	21-Nov-11	Fall	MLB-4	LB	Alewife	0	0	AlewifeFall
48	21-Nov-11	Fall	MUB-1	UB	Alewife	2	0.477121255	AlewifeFall
48	21-Nov-11	Fall	MUB-2	UB	Alewife	0	0	AlewifeFall
48	21-Nov-11	Fall	MKK-1	AKKVK	Alewife	1	0.301029996	AlewifeFall
48	22-Nov-11	Fall	MAK-4	AKKVK	Alewife	29	1.477121255	AlewifeFall
48	22-Nov-11	Fall	MAK-3	AKKVK	Alewife	29	1.477121255	AlewifeFall
48	22-Nov-11	Fall	MAK-2	AKKVK	Alewife	15	1.204119983	AlewifeFall
48	22-Nov-11	Fall	MAK-1	AKKVK	Alewife	0	0	AlewifeFall
48	22-Nov-11	Fall	MKK-2	AKKVK	Alewife	4	0.698970004	AlewifeFall
48	22-Nov-11	Fall	MNB-1	NB	Alewife	14	1.176091259	AlewifeFall
48	22-Nov-11	Fall	MNB-2	NB	Alewife	1	0.301029996	AlewifeFall
48	22-Nov-11	Fall	MNB-5	NB	Alewife	3	0.602059991	AlewifeFall
48	22-Nov-11	Fall	MNB-6	NB	Alewife	40	1.612783857	AlewifeFall
50	06-Dec-11	Fall	MUB-8	UB	Alewife	4	0.698970004	AlewifeFall
50	06-Dec-11	Fall	MUB-9	UB	Alewife	8	0.954242509	AlewifeFall
50	06-Dec-11	Fall	MUB-11	UB	Alewife	0	0	AlewifeFall
50	06-Dec-11	Fall	MUB-3	UB	Alewife	0	0	AlewifeFall
50	06-Dec-11	Fall	MUB-2	UB	Alewife	0	0	AlewifeFall
50	06-Dec-11	Fall	MLB-6	LB	Alewife	0	0	AlewifeFall
50	06-Dec-11	Fall	MLB-5	LB	Alewife	0	0	AlewifeFall
50	06-Dec-11	Fall	MLB-3	LB	Alewife	0	0	AlewifeFall
50	06-Dec-11	Fall	MLB-4	LB	Alewife	10	1.041392685	AlewifeFall
50	06-Dec-11	Fall	MUB-1	UB	Alewife	5	0.77815125	AlewifeFall
50	06-Dec-11	Fall	MKK-1	AKKVK	Alewife	45	1.662757832	AlewifeFall
50	07-Dec-11	Fall	MKK-2	AKKVK	Alewife	5	0.77815125	AlewifeFall
50	07-Dec-11	Fall	MNB-1	NB	Alewife	6	0.84509804	AlewifeFall
50	07-Dec-11	Fall	MNB-2	NB	Alewife	6	0.84509804	AlewifeFall

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping**	**Common Name**	**CPUE_ 10min**	**Log(CPUE+1)**	**Species-Season**
50	07-Dec-11	Fall	MNB-5	NB	Alewife	84	1.929418926	AlewifeFall
50	07-Dec-11	Fall	MNB-6	NB	Alewife	0	0	AlewifeFall
50	07-Dec-11	Fall	MAK-1	AKKVK	Alewife	1	0.301029996	AlewifeFall
50	07-Dec-11	Fall	MAK-2	AKKVK	Alewife	8	0.954242509	AlewifeFall
50	07-Dec-11	Fall	MAK-4	AKKVK	Alewife	34	1.544068044	AlewifeFall
50	07-Dec-11	Fall	MAK-3	AKKVK	Alewife	20	1.322219295	AlewifeFall

Acronyms:
AKKVK – Arthur Kill/Kill Van Kull Study Area
CPUE – Catch per unit effort
LB – Lower Bay
MAK – Mid-water Trawl in AK
MKK – Mid-water Trawl in KVK
MLB – Mid-water Trawl in LB
MNB – Mid-water Trawl in NB
MUB – Mid-water Trawl in UB
NB – Newark Bay
UB – Upper Bay
WOY – week of year

Table C-1.2. Assumption Testing for Spring Alewife Samples, Raw CPUE Data

Page/Date/Time	1 6/5/2012 3:22:16 PM
Database	C:\DOCUMENTS AND SETTINGS\VW ... SS 2007\DATA\MFS\05222012.S0
Filter	Spp_Season="AlewifeSpring"
Response	CPUE_10min

Tests of Assumptions Section

Assumption	Test Value	Prob Level	Decision (0.05)
Skewness Normality of Residuals	10.1911	0.000000	Reject
Kurtosis Normality of Residuals	7.2085	0.000000	Reject
Omnibus Normality of Residuals	155.8205	0.000000	Reject
Modified-Levene Equal-Variance Test	5.0775	0.002213	Reject

Box Plot Section

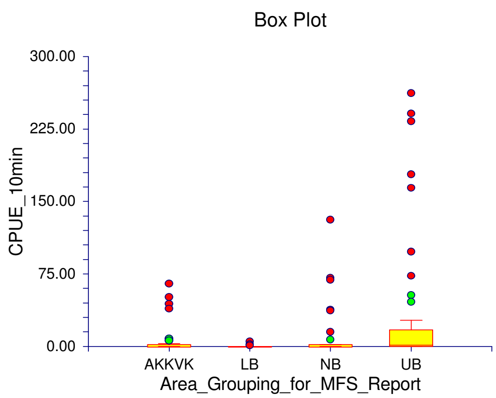


Table C.1-3. Assumption Testing for Spring Alewife Samples, Log(CPUE+1) Transformed Data

Page/Date/Time	1 6/7/2012 8:41:37 PM
Database	C:\DOCUMENTS AND SETTINGS\VW ... SS 2007\DATA\MFS\05222012.S0
Filter	Spp_Season="AlewifeSpring"
Response	LOG_CPUE_1_

Tests of Assumptions Section

Assumption	Test Value	Prob Level	Decision (0.05)
Skewness Normality of Residuals	5.5669	0.000000	Reject
Kurtosis Normality of Residuals	2.2225	0.026251	Reject
Omnibus Normality of Residuals	35.9300	0.000000	Reject
Modified-Levene Equal-Variance Test	10.0367	0.000004	Reject

Box Plot Section

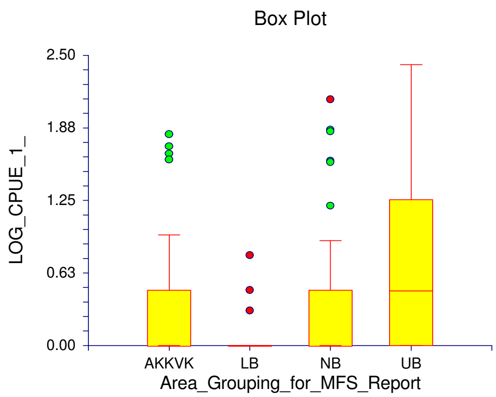


Table C.1-3. **Assumption Testing for Fall Alewife Samples, Raw Data**

Page/Date/Time	1 6/5/2012 3:17:33 PM
Database	C:\DOCUMENTS AND SETTINGS\VW ... SS 2007\DATA\MFS\05222012.S0
Filter	Spp_Season="AlewifeFall"
Response	CPUE_10min

Tests of Assumptions Section

Assumption	Test Value	Prob Level	Decision (0.05)
Skewness Normality of Residuals	12.2489	0.000000	Reject
Kurtosis Normality of Residuals	8.8187	0.000000	Reject
Omnibus Normality of Residuals	227.8060	0.000000	Reject
Modified-Levene Equal-Variance Test	11.0134	0.000001	Reject

Box Plot Section

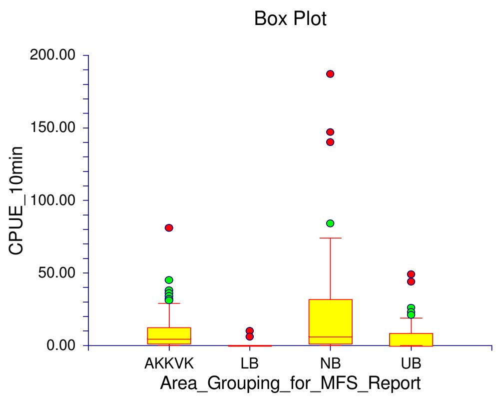


Table C.1-4. Assumption Testing for Spring Alewife Samples, Log(CPUE+1) Transformed Data

Page/Date/Time	1 6/7/2012 8:39:54 PM
Database	C:\DOCUMENTS AND SETTINGS\VW ... SS 2007\DATA\MFS\05222012.S0
Filter	Spp_Season="AlewifeFall"
Response	LOG_CPUE_1_

Tests of Assumptions Section

Assumption	Test Value	Prob Level	Decision (0.05)
Skewness Normality of Residuals	2.3019	0.021343	Reject
Kurtosis Normality of Residuals	-1.5482	0.121584	Accept
Omnibus Normality of Residuals	7.6953	0.021329	Reject
Modified-Levene Equal-Variance Test	15.4135	0.000000	Reject

Box Plot Section

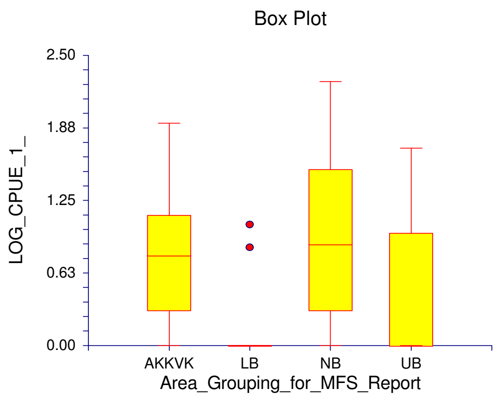


Table C-1.5. Assumption Testing for Spring Blueback Herring Samples, Raw CPUE Data

Page/Date/Time	1 6/5/2012 3:29:44 PM
Database	C:\DOCUMENTS AND SETTINGS\VW ... SS 2007\DATA\MFS\05222012.S0
Filter	Spp_Season="Blueback herringSpring"
Response	CPUE_10min

Tests of Assumptions Section

Assumption	Test Value	Prob Level	Decision (0.05)
Skewness Normality of Residuals	10.6611	0.000000	Reject
Kurtosis Normality of Residuals	7.4919	0.000000	Reject
Omnibus Normality of Residuals	169.7871	0.000000	Reject
Modified-Levene Equal-Variance Test	0.7712	0.511767	Accept

Box Plot Section

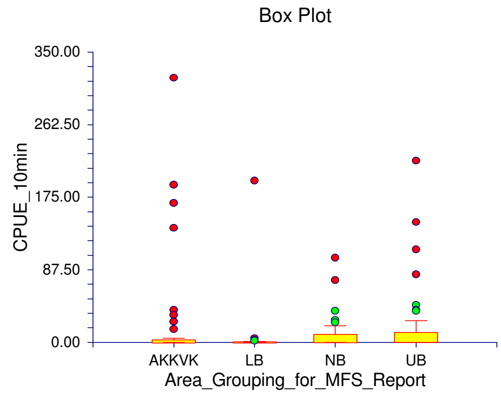


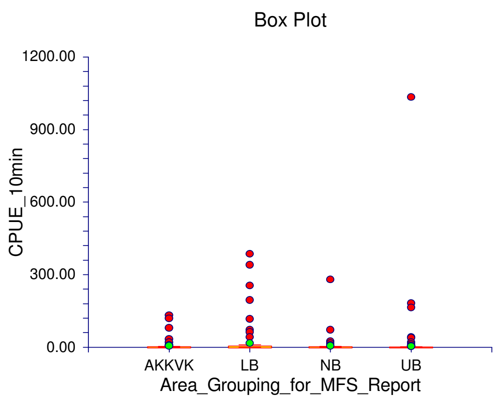
Table C-1.6. Assumption Testing for Fall Blueback Herring Samples, Raw CPUE Data

Page/Date/Time	1 6/5/2012 3:28:46 PM
Database	C:\DOCUMENTS AND SETTINGS\VW ... SS 2007\DATA\MFS\05222012.S0
Filter	Spp_Season="Blueback herringFall"
Response	CPUE_10min

Tests of Assumptions Section

Assumption	Test Value	Prob Level	Decision (0.05)
Skewness Normality of Residuals	16.1910	0.000000	Reject
Kurtosis Normality of Residuals	10.7056	0.000000	Reject
Omnibus Normality of Residuals	376.7584	0.000000	Reject
Modified-Levene Equal-Variance Test	1.1485	0.330470	Accept

Box Plot Section



Appendix C-2
Results of the Kruskall-Wallis One-Way ANOVA for the Spring and Fall Alewife Samples

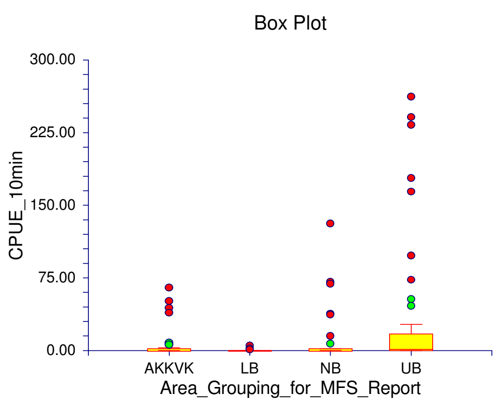
Alewife Spring Analysis of Variance Report

Page/Date/Time	1 6/5/2012 3:22:16 PM
Database	C:\DOCUMENTS AND SETTINGS\VW ... SS 2007\DATA\MFS\05222012.S0
Filter	Spp_Season="AlewifeSpring"
Response	CPUE_10min

Tests of Assumptions Section

Assumption	Test Value	Prob Level	Decision (0.05)
Skewness Normality of Residuals	10.1911	0.000000	Reject
Kurtosis Normality of Residuals	7.2085	0.000000	Reject
Omnibus Normality of Residuals	155.8205	0.000000	Reject
Modified-Levene Equal-Variance Test	5.0775	0.002213	Reject

Box Plot Section



Expected Mean Squares Section

Source Term	DF	Term Fixed?	Denominator Term	Expected Mean Square
A: Area_Grouping_for_MFS_Report		3	Yes	S(A) S+sA
S(A)	156	No		S(A)

Note: Expected Mean Squares are for the balanced cell-frequency case.

Analysis of Variance Table

Source Term	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (Alpha=0.05)
A: Area_Grouping_for_MFS_Report			3	24092.63	8030.877	5.01
	0.002408*		0.910430			
S(A)	156	249966.6	1602.35			
Total (Adjusted)	159	274059.2				
Total	160					

* Term significant at alpha = 0.05

Analysis of Variance Report

Page/Date/Time	2 6/5/2012 3:22:16 PM
Database	C:\DOCUMENTS AND SETTINGS\VW ... SS 2007\DATA\MFS\05222012.S0
Filter	Spp_Season="AlewifeSpring"
Response	CPUE_10min

Kruskal-Wallis One-Way ANOVA on Ranks
Hypotheses
H0: All medians are equal.
Ha: At least two medians are different.

Test Results

Method	DF	Chi-Square (H)	Prob Level	Decision(0.05)
Not Corrected for Ties	3	15.12335	0.001714	Reject H0
Corrected for Ties	3	20.02204	0.000168	Reject H0
Number Sets of Ties	9			
Multiplicity Factor	1002108			

Group Detail

Group	Count	Sum of Ranks	Mean Rank	Z-Value	Median
AKKVK	48	3764.00	78.42	-0.3723	0
LB	32	1811.50	56.61	-3.2612	0
NB	32	2623.00	81.97	0.2005	0
UB	48	4681.50	97.53	3.0439	2

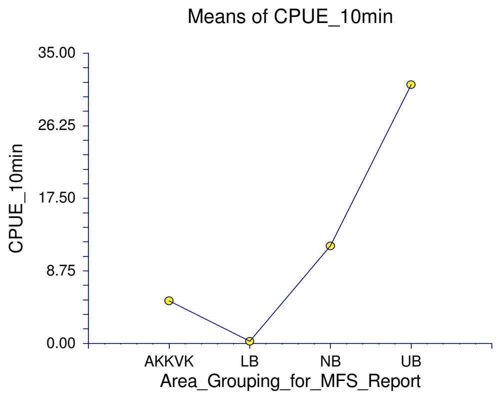
Means and Effects Section

Term	Count	Mean	Standard Error	Effect
All	160	13.29375		12.07813
A: Area_Grouping_for_MFS_Report				
AKKVK	48	5.125	5.77774	-6.953125
LB	32	0.25	7.076258	-11.82813
NB	32	11.75	7.076258	-0.328125
UB	48	31.1875	5.77774	19.10938

Analysis of Variance Report

Page/Date/Time	3 6/5/2012 3:22:16 PM
Database	C:\DOCUMENTS AND SETTINGS\VW ... SS 2007\DATA\MFS\05222012.S0
Filter	Spp_Season="AlewifeSpring"
Response	CPUE_10min

Plots of Means Section



Kruskal-Wallis Multiple-Comparison Z-Value Test (Dunn's Test)

CPUE_10min	AKKVK	LB	NB	UB
AKKVK	0.0000	2.3730	0.3865	2.3255
LB	2.3730	0.0000	2.5191	4.4530
NB	0.3865	2.5191	0.0000	1.6935
UB	2.3255	4.4530	1.6935	0.0000

Regular Test: Medians significantly different if z-value > 1.9600
Bonferroni Test: Medians significantly different if z-value > 2.6383

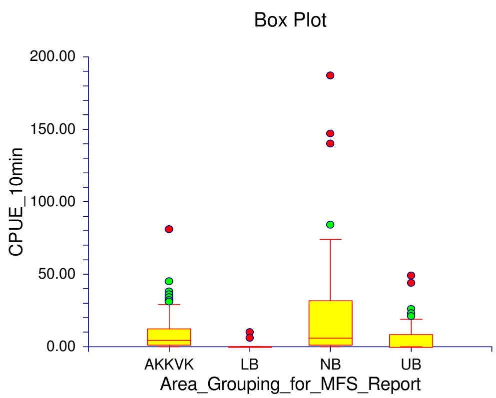
Alewife Fall Analysis of Variance Report

Page/Date/Time	1 6/5/2012 3:17:33 PM
Database	C:\DOCUMENTS AND SETTINGS\VW ... SS 2007\DATA\MFS\05222012.S0
Filter	Spp_Season="AlewifeFall"
Response	CPUE_10min

Tests of Assumptions Section

Assumption	Test Value	Prob Level	Decision (0.05)
Skewness Normality of Residuals	12.2489	0.000000	Reject
Kurtosis Normality of Residuals	8.8187	0.000000	Reject
Omnibus Normality of Residuals	227.8060	0.000000	Reject
Modified-Levene Equal-Variance Test	11.0134	0.000001	Reject

Box Plot Section



Expected Mean Squares Section

Source Term	DF	Term Fixed?	Denominator Term	Expected Mean Square
A: Area_Grouping_for_MFS_Report		3	Yes	S(A) S+sA
S(A)	216	No		S(A)

Note: Expected Mean Squares are for the balanced cell-frequency case.

Analysis of Variance Table

Source Term	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (Alpha=0.05)
A: Area_Grouping_for_MFS_Report			3	15845.2	5281.734	11.99
	0.000000*		0.999652			
S(A)	216	95130.51	440.419			
Total (Adjusted)	219	110975.7				
Total	220					

* Term significant at alpha = 0.05

Analysis of Variance Report

Page/Date/Time	2 6/5/2012 3:17:33 PM
Database	C:\DOCUMENTS AND SETTINGS\VW ... SS 2007\DATA\MFS\05222012.S0
Filter	Spp_Season="AlewifeFall"
Response	CPUE_10min

Kruskal-Wallis One-Way ANOVA on Ranks
Hypotheses
H0: All medians are equal.
Ha: At least two medians are different.

Test Results

Method	DF	Chi-Square (H)	Prob Level	Decision(0.05)
Not Corrected for Ties	3	61.21189	0.000000	Reject H0
Corrected for Ties	3	67.00212	0.000000	Reject H0

Number Sets of Ties	21
Multiplicity Factor	920166

Group Detail

Group	Count	Sum of Ranks	Mean Rank	Z-Value	Median
AKKVK	66	8756.00	132.67	3.3815	5
LB	44	2373.00	53.93	-6.5908	0
NB	44	6584.50	149.65	4.5611	6.5
UB	66	6596.50	99.95	-1.6098	0

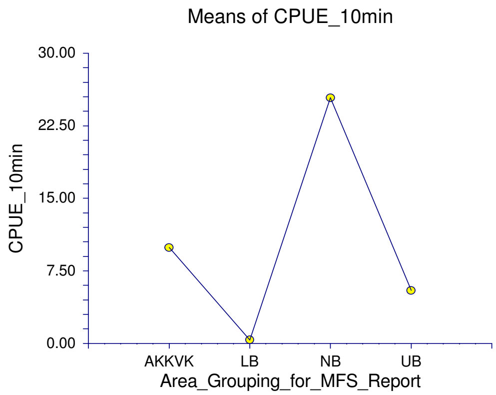
Means and Effects Section

Term	Count	Mean	Standard Error	Effect
All	220	9.763637		10.2822
A: Area_Grouping_for_MFS_Report				
AKKVK	66	9.909091	2.583218	-0.3731061
LB	44	0.3636364	3.163783	-9.918561
NB	44	25.38636	3.163783	15.10417
UB	66	5.469697	2.583218	-4.8125

Analysis of Variance Report

Page/Date/Time	3 6/5/2012 3:17:33 PM
Database	C:\DOCUMENTS AND SETTINGS\VW ... SS 2007\DATA\MFS\05222012.S0
Filter	Spp_Season="AlewifeFall"
Response	CPUE_10min

Plots of Means Section



Kruskal-Wallis Multiple-Comparison Z-Value Test (Dunn's Test)

CPUE_10min	AKKVK	LB	NB	UB
AKKVK	0.0000	6.6493	1.4341	3.0894
LB	6.6493	0.0000	7.3791	3.8861
NB	1.4341	7.3791	0.0000	4.1973
UB	3.0894	3.8861	4.1973	0.0000

Regular Test: Medians significantly different if z-value > 1.9600
Bonferroni Test: Medians significantly different if z-value > 2.6383

Appendix C-3
Results of the Kruskall-Wallis One-Way ANOVA for the Spring and Fall Blueback Herring Samples

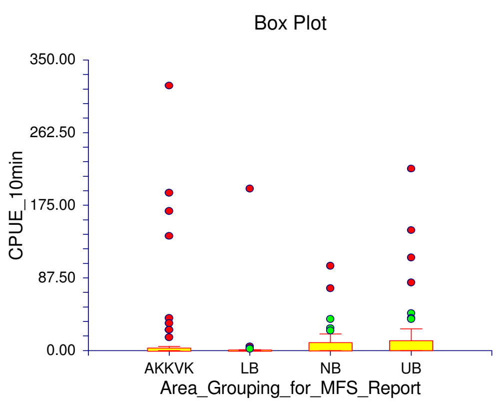
Blueback Herring Spring Analysis of Variance Report

Page/Date/Time	1 6/5/2012 3:29:44 PM
Database	C:\DOCUMENTS AND SETTINGS\VW ... SS 2007\DATA\MFS\05222012.S0
Filter	Spp_Season="Blueback herringSpring"
Response	CPUE_10min

Tests of Assumptions Section

Assumption	Test Value	Prob Level	Decision (0.05)
Skewness Normality of Residuals	10.6611	0.000000	Reject
Kurtosis Normality of Residuals	7.4919	0.000000	Reject
Omnibus Normality of Residuals	169.7871	0.000000	Reject
Modified-Levene Equal-Variance Test	0.7712	0.511767	Accept

Box Plot Section



Expected Mean Squares Section

Source Term	DF	Term Fixed?	Denominator Term	Expected Mean Square
A: Area_Grouping_for_MFS_Report		3	Yes	S(A) S+sA
S(A)	156	No		S(A)

Note: Expected Mean Squares are for the balanced cell-frequency case.

Analysis of Variance Table

Source Term	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (Alpha=0.05)
A: Area_Grouping_for_MFS_Report			3	4495.629	1498.543	0.77
	0.512524		0.212697			
S(A)	156	303654.2	1946.501			
Total (Adjusted)	159	308149.8				
Total	160					

* Term significant at alpha = 0.05

Analysis of Variance Report

Page/Date/Time	2 6/5/2012 3:29:44 PM
Database	C:\DOCUMENTS AND SETTINGS\VW ... SS 2007\DATA\MFS\05222012.S0
Filter	Spp_Season="Blueback herringSpring"
Response	CPUE_10min

Kruskal-Wallis One-Way ANOVA on Ranks
Hypotheses
H0: All medians are equal.
Ha: At least two medians are different.

Test Results

Method	DF	Chi-Square (H)	Prob Level	Decision(0.05)
Not Corrected for Ties	3	7.290705	0.063187	Accept H0
Corrected for Ties	3	8.824574	0.031717	Reject H0

Number Sets of Ties	10
Multiplicity Factor	711930

Group Detail

Group	Count	Sum of Ranks	Mean Rank	Z-Value	Median
AKKVK	48	3852.50	80.26	-0.0428	0
LB	32	1989.50	62.17	-2.5019	0
NB	32	2724.50	85.14	0.6335	0.5
UB	48	4313.50	89.86	1.6737	1

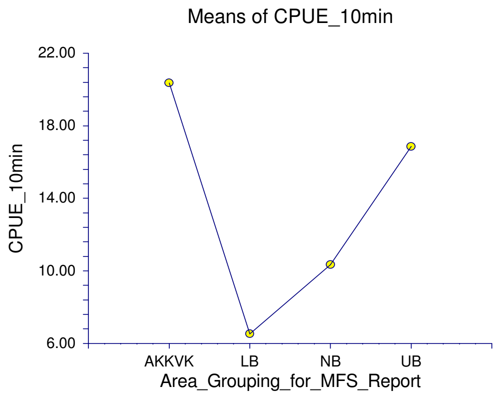
Means and Effects Section

Term	Count	Mean	Standard Error	Effect
All	160	14.5375		13.52083
A: Area_Grouping_for_MFS_Report				
AKKVK	48	20.35417	6.368053	6.833333
LB	32	6.53125	7.799241	-6.989583
NB	32	10.34375	7.799241	-3.177083
UB	48	16.85417	6.368053	3.333333

Analysis of Variance Report

Page/Date/Time	3 6/5/2012 3:29:44 PM
Database	C:\DOCUMENTS AND SETTINGS\VW ... SS 2007\DATA\MFS\05222012.S0
Filter	Spp_Season="Blueback herringSpring"
Response	CPUE_10min

Plots of Means Section



Kruskal-Wallis Multiple-Comparison Z-Value Test (Dunn's Test)

CPUE_10min	AKKVK	LB	NB	UB
AKKVK	0.0000	1.8821	0.5078	1.1172
LB	1.8821	0.0000	2.1816	2.8813
NB	0.5078	2.1816	0.0000	0.4915
UB	1.1172	2.8813	0.4915	0.0000

Regular Test: Medians significantly different if z-value > 1.9600
Bonferroni Test: Medians significantly different if z-value > 2.6383

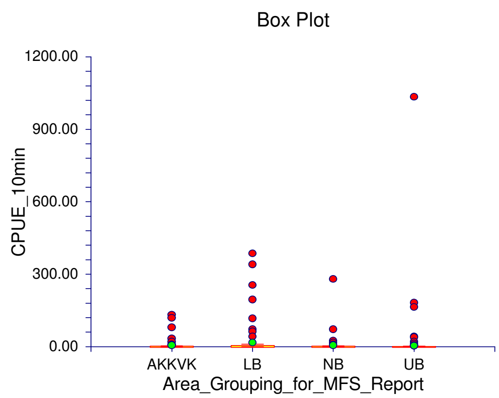
Blueback Herring Fall Analysis of Variance Report

Page/Date/Time	1 6/5/2012 3:28:46 PM
Database	C:\DOCUMENTS AND SETTINGS\VW ... SS 2007\DATA\MFS\05222012.S0
Filter	Spp_Season="Blueback herringFall"
Response	CPUE_10min

Tests of Assumptions Section

Assumption	Test Value	Prob Level	Decision (0.05)
Skewness Normality of Residuals	16.1910	0.000000	Reject
Kurtosis Normality of Residuals	10.7056	0.000000	Reject
Omnibus Normality of Residuals	376.7584	0.000000	Reject
Modified-Levene Equal-Variance Test	1.1485	0.330470	Accept

Box Plot Section



Expected Mean Squares Section

Source Term	DF	Term Fixed?	Denominator Term	Expected Mean Square
A: Area_Grouping_for_MFS_Report		3	Yes	S(A) S+sA
S(A)	216	No		S(A)

Note: Expected Mean Squares are for the balanced cell-frequency case.

Analysis of Variance Table

Source Term	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (Alpha=0.05)
A: Area_Grouping_for_MFS_Report			3	24815.48	8271.827	1.15
	0.330470		0.306869			
S(A)	216	1555726	7202.434			
Total (Adjusted)	219	1580541				
Total	220					

* Term significant at alpha = 0.05

Analysis of Variance Report

Page/Date/Time	2 6/5/2012 3:28:46 PM
Database	C:\DOCUMENTS AND SETTINGS\VW ... SS 2007\DATA\MFS\05222012.S0
Filter	Spp_Season="Blueback herringFall"
Response	CPUE_10min

Kruskal-Wallis One-Way ANOVA on Ranks
Hypotheses
H0: All medians are equal.
Ha: At least two medians are different.

Test Results

Method	DF	Chi-Square (H)	Prob Level	Decision(0.05)
Not Corrected for Ties	3	0.3364263	0.953038	Accept H0
Corrected for Ties	3	0.4357991	0.932752	Accept H0

Number Sets of Ties	10
Multiplicity Factor	2427954

Group Detail

Group	Count	Sum of Ranks	Mean Rank	Z-Value	Median
AKKVK	66	7496.00	113.58	0.4692	0
LB	44	4846.50	110.15	-0.0410	0
NB	44	4891.50	111.17	0.0781	0
UB	66	7076.00	107.21	-0.5016	0

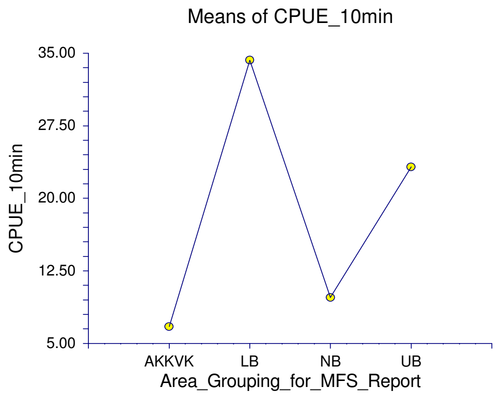
Means and Effects Section

Term	Count	Mean	Standard Error	Effect
All	220	17.8		18.50189
A: Area_Grouping_for_MFS_Report				
AKKVK	66	6.742424	10.44642	-11.75947
LB	44	34.27273	12.7942	15.77083
NB	44	9.75	12.7942	-8.751894
UB	66	23.24242	10.44642	4.74053

Analysis of Variance Report

Page/Date/Time	3 6/5/2012 3:28:46 PM
Database	C:\DOCUMENTS AND SETTINGS\VW ... SS 2007\DATA\MFS\05222012.S0
Filter	Spp_Season="Blueback herringFall"
Response	CPUE_10min

Plots of Means Section



Kruskal-Wallis Multiple-Comparison Z-Value Test (Dunn's Test)

CPUE_10min	AKKVK	LB	NB	UB
AKKVK	0.0000	0.3149	0.2210	0.6536
LB	0.3149	0.0000	0.0858	0.2697
NB	0.2210	0.0858	0.0000	0.3637
UB	0.6536	0.2697	0.3637	0.0000

Regular Test: Medians significantly different if z-value > 1.9600
Bonferroni Test: Medians significantly different if z-value > 2.6383

Appendix C-4
Data Used for the NonDetect Analysis to Derive the Cumulative Frequency Distribution for Spring Samples

Table C-4.1. Data Used for the NonDetect Analysis for Spring Samples						
Year	WOY	MONDAY	Area Grouping	Species Code	Common Name	SumOfCPUE_10min
2011	16	4/11/2011	AKKVK	2	Alewife	0
2011	16	4/11/2011	AKKVK	6	American shad	0
2011	16	4/11/2011	AKKVK	14	Atlantic menhaden	0
2011	16	4/11/2011	AKKVK	27	Blueback herring	678
2011	16	4/11/2011	AKKVK	156	Striped bass	0
2011	16	4/11/2011	LB	2	Alewife	0
2011	16	4/11/2011	LB	6	American shad	0
2011	16	4/11/2011	LB	14	Atlantic menhaden	0
2011	16	4/11/2011	LB	27	Blueback herring	0
2011	16	4/11/2011	LB	156	Striped bass	0
2011	16	4/11/2011	NB	2	Alewife	4
2011	16	4/11/2011	NB	6	American shad	2
2011	16	4/11/2011	NB	14	Atlantic menhaden	0
2011	16	4/11/2011	NB	27	Blueback herring	39
2011	16	4/11/2011	NB	156	Striped bass	0
2011	16	4/11/2011	UB	2	Alewife	15
2011	16	4/11/2011	UB	6	American shad	2
2011	16	4/11/2011	UB	14	Atlantic menhaden	0
2011	16	4/11/2011	UB	27	Blueback herring	153
2011	16	4/11/2011	UB	156	Striped bass	0
2011	17	4/18/2011	AKKVK	2	Alewife	11
2011	17	4/18/2011	AKKVK	6	American shad	3
2011	17	4/18/2011	AKKVK	14	Atlantic menhaden	0
2011	17	4/18/2011	AKKVK	27	Blueback herring	67
2011	17	4/18/2011	AKKVK	156	Striped bass	0
2011	17	4/18/2011	LB	2	Alewife	0
2011	17	4/18/2011	LB	6	American shad	0
2011	17	4/18/2011	LB	14	Atlantic menhaden	0
2011	17	4/18/2011	LB	27	Blueback herring	4
2011	17	4/18/2011	LB	156	Striped bass	0
2011	17	4/18/2011	NB	2	Alewife	8
2011	17	4/18/2011	NB	6	American shad	0
2011	17	4/18/2011	NB	14	Atlantic menhaden	0

Table C-4.1. Data Used for the NonDetect Analysis for Spring Samples						
Year	WOY	MONDAY	Area Grouping	Species Code	Common Name	SumOfCPUE_10min
2011	17	4/18/2011	NB	27	Blueback herring	128
2011	17	4/18/2011	NB	156	Striped bass	0
2011	17	4/18/2011	UB	2	Alewife	91
2011	17	4/18/2011	UB	6	American shad	3
2011	17	4/18/2011	UB	14	Atlantic menhaden	0
2011	17	4/18/2011	UB	27	Blueback herring	334
2011	17	4/18/2011	UB	156	Striped bass	0
2011	18	4/25/2011	AKKVK	2	Alewife	11
2011	18	4/25/2011	AKKVK	6	American shad	0
2011	18	4/25/2011	AKKVK	14	Atlantic menhaden	0
2011	18	4/25/2011	AKKVK	27	Blueback herring	213
2011	18	4/25/2011	AKKVK	156	Striped bass	2
2011	18	4/25/2011	LB	2	Alewife	2
2011	18	4/25/2011	LB	6	American shad	0
2011	18	4/25/2011	LB	14	Atlantic menhaden	0
2011	18	4/25/2011	LB	27	Blueback herring	7
2011	18	4/25/2011	LB	156	Striped bass	0
2011	18	4/25/2011	NB	2	Alewife	39
2011	18	4/25/2011	NB	6	American shad	1
2011	18	4/25/2011	NB	14	Atlantic menhaden	0
2011	18	4/25/2011	NB	27	Blueback herring	110
2011	18	4/25/2011	NB	156	Striped bass	0
2011	18	4/25/2011	UB	2	Alewife	523
2011	18	4/25/2011	UB	6	American shad	1
2011	18	4/25/2011	UB	14	Atlantic menhaden	0
2011	18	4/25/2011	UB	27	Blueback herring	177
2011	18	4/25/2011	UB	156	Striped bass	1
2011	19	5/2/2011	AKKVK	2	Alewife	122
2011	19	5/2/2011	AKKVK	6	American shad	0
2011	19	5/2/2011	AKKVK	14	Atlantic menhaden	0
2011	19	5/2/2011	AKKVK	27	Blueback herring	8
2011	19	5/2/2011	AKKVK	156	Striped bass	3
2011	19	5/2/2011	LB	2	Alewife	0
2011	19	5/2/2011	LB	6	American shad	0
2011	19	5/2/2011	LB	14	Atlantic	0

Table C-4.1. Data Used for the NonDetect Analysis for Spring Samples						
Year	WOY	MONDAY	Area Grouping	Species Code	Common Name	SumOfCPUE_10min
					menhaden	
2011	19	5/2/2011	LB	27	Blueback herring	1
2011	19	5/2/2011	LB	156	Striped bass	0
2011	19	5/2/2011	NB	2	Alewife	239
2011	19	5/2/2011	NB	6	American shad	0
2011	19	5/2/2011	NB	14	Atlantic menhaden	0
2011	19	5/2/2011	NB	27	Blueback herring	16
2011	19	5/2/2011	NB	156	Striped bass	0
2011	19	5/2/2011	UB	2	Alewife	201
2011	19	5/2/2011	UB	6	American shad	1
2011	19	5/2/2011	UB	14	Atlantic menhaden	0
2011	19	5/2/2011	UB	27	Blueback herring	17
2011	19	5/2/2011	UB	156	Striped bass	0
2011	20	5/9/2011	AKKVK	2	Alewife	84
2011	20	5/9/2011	AKKVK	6	American shad	0
2011	20	5/9/2011	AKKVK	14	Atlantic menhaden	0
2011	20	5/9/2011	AKKVK	27	Blueback herring	10
2011	20	5/9/2011	AKKVK	156	Striped bass	5
2011	20	5/9/2011	LB	2	Alewife	5
2011	20	5/9/2011	LB	6	American shad	0
2011	20	5/9/2011	LB	14	Atlantic menhaden	0
2011	20	5/9/2011	LB	27	Blueback herring	195
2011	20	5/9/2011	LB	156	Striped bass	0
2011	20	5/9/2011	NB	2	Alewife	84
2011	20	5/9/2011	NB	6	American shad	2
2011	20	5/9/2011	NB	14	Atlantic menhaden	0
2011	20	5/9/2011	NB	27	Blueback herring	16
2011	20	5/9/2011	NB	156	Striped bass	0
2011	20	5/9/2011	UB	2	Alewife	592
2011	20	5/9/2011	UB	6	American shad	3
2011	20	5/9/2011	UB	14	Atlantic menhaden	0
2011	20	5/9/2011	UB	27	Blueback herring	80
2011	20	5/9/2011	UB	156	Striped bass	0
2011	21	5/16/2011	AKKVK	2	Alewife	14
2011	21	5/16/2011	AKKVK	6	American shad	1

Table C-4.1. Data Used for the NonDetect Analysis for Spring Samples						
Year	WOY	MONDAY	Area Grouping	Species Code	Common Name	SumOfCPUE_10min
2011	21	5/16/2011	AKKVK	14	Atlantic menhaden	0
2011	21	5/16/2011	AKKVK	27	Blueback herring	1
2011	21	5/16/2011	AKKVK	156	Striped bass	12
2011	21	5/16/2011	LB	2	Alewife	1
2011	21	5/16/2011	LB	6	American shad	1
2011	21	5/16/2011	LB	14	Atlantic menhaden	0
2011	21	5/16/2011	LB	27	Blueback herring	0
2011	21	5/16/2011	LB	156	Striped bass	0
2011	21	5/16/2011	NB	2	Alewife	1
2011	21	5/16/2011	NB	6	American shad	1
2011	21	5/16/2011	NB	14	Atlantic menhaden	0
2011	21	5/16/2011	NB	27	Blueback herring	20
2011	21	5/16/2011	NB	156	Striped bass	4
2011	21	5/16/2011	UB	2	Alewife	60
2011	21	5/16/2011	UB	6	American shad	2
2011	21	5/16/2011	UB	14	Atlantic menhaden	3
2011	21	5/16/2011	UB	27	Blueback herring	45
2011	21	5/16/2011	UB	156	Striped bass	1
2011	22	5/23/2011	AKKVK	2	Alewife	4
2011	22	5/23/2011	AKKVK	6	American shad	0
2011	22	5/23/2011	AKKVK	14	Atlantic menhaden	0
2011	22	5/23/2011	AKKVK	27	Blueback herring	0
2011	22	5/23/2011	AKKVK	156	Striped bass	0
2011	22	5/23/2011	LB	2	Alewife	0
2011	22	5/23/2011	LB	6	American shad	0
2011	22	5/23/2011	LB	14	Atlantic menhaden	0
2011	22	5/23/2011	LB	27	Blueback herring	2
2011	22	5/23/2011	LB	156	Striped bass	0
2011	22	5/23/2011	NB	2	Alewife	1
2011	22	5/23/2011	NB	6	American shad	0
2011	22	5/23/2011	NB	14	Atlantic menhaden	3
2011	22	5/23/2011	NB	27	Blueback herring	0
2011	22	5/23/2011	NB	156	Striped bass	0
2011	22	5/23/2011	UB	2	Alewife	12

Table C-4.1. Data Used for the NonDetect Analysis for Spring Samples						
Year	WOY	MONDAY	Area Grouping	Species Code	Common Name	SumOfCPUE_10min
2011	22	5/23/2011	UB	6	American shad	0
2011	22	5/23/2011	UB	14	Atlantic menhaden	1
2011	22	5/23/2011	UB	27	Blueback herring	3
2011	22	5/23/2011	UB	156	Striped bass	1
2011	23	5/30/2011	AKKVK	2	Alewife	0
2011	23	5/30/2011	AKKVK	6	American shad	0
2011	23	5/30/2011	AKKVK	14	Atlantic menhaden	0
2011	23	5/30/2011	AKKVK	27	Blueback herring	0
2011	23	5/30/2011	AKKVK	156	Striped bass	0
2011	23	5/30/2011	LB	2	Alewife	0
2011	23	5/30/2011	LB	6	American shad	0
2011	23	5/30/2011	LB	14	Atlantic menhaden	0
2011	23	5/30/2011	LB	27	Blueback herring	0
2011	23	5/30/2011	LB	156	Striped bass	0
2011	23	5/30/2011	NB	2	Alewife	0
2011	23	5/30/2011	NB	6	American shad	0
2011	23	5/30/2011	NB	14	Atlantic menhaden	0
2011	23	5/30/2011	NB	27	Blueback herring	2
2011	23	5/30/2011	NB	156	Striped bass	0
2011	23	5/30/2011	UB	2	Alewife	3
2011	23	5/30/2011	UB	6	American shad	0
2011	23	5/30/2011	UB	14	Atlantic menhaden	0
2011	23	5/30/2011	UB	27	Blueback herring	0
2011	23	5/30/2011	UB	156	Striped bass	0

Appendix C-5
Data Used for the NonDetect Analysis to Derive the Cumulative Frequency Distribution for Fall Samples

Table C-5.1. Data Used for the NonDetect Analysis for Fall Samples						
Year	WOY	MONDAY	Area Grouping	Species Code	Common Name	SumOfCPUE_10min
2011	40	9/26/2011	AKKVK	2	Alewife	87
2011	40	9/26/2011	AKKVK	6	American shad	1
2011	40	9/26/2011	AKKVK	14	Atlantic menhaden	0
2011	40	9/26/2011	AKKVK	27	Blueback herring	5
2011	40	9/26/2011	AKKVK	156	Striped bass	0
2011	40	9/26/2011	LB	2	Alewife	0
2011	40	9/26/2011	LB	6	American shad	0
2011	40	9/26/2011	LB	14	Atlantic menhaden	0
2011	40	9/26/2011	LB	27	Blueback herring	17
2011	40	9/26/2011	LB	156	Striped bass	0
2011	40	9/26/2011	NB	2	Alewife	49
2011	40	9/26/2011	NB	6	American shad	1
2011	40	9/26/2011	NB	14	Atlantic menhaden	0
2011	40	9/26/2011	NB	27	Blueback herring	1
2011	40	9/26/2011	NB	156	Striped bass	0
2011	40	9/26/2011	UB	2	Alewife	28
2011	40	9/26/2011	UB	6	American shad	7
2011	40	9/26/2011	UB	14	Atlantic menhaden	0
2011	40	9/26/2011	UB	27	Blueback herring	13
2011	40	9/26/2011	UB	156	Striped bass	0
2011	41	10/3/2011	AKKVK	2	Alewife	114
2011	41	10/3/2011	AKKVK	6	American shad	0
2011	41	10/3/2011	AKKVK	14	Atlantic menhaden	1
2011	41	10/3/2011	AKKVK	27	Blueback herring	164
2011	41	10/3/2011	AKKVK	156	Striped bass	0
2011	41	10/3/2011	LB	2	Alewife	6
2011	41	10/3/2011	LB	6	American shad	0
2011	41	10/3/2011	LB	14	Atlantic menhaden	0
2011	41	10/3/2011	LB	27	Blueback herring	117
2011	41	10/3/2011	LB	156	Striped bass	0
2011	41	10/3/2011	NB	2	Alewife	377
2011	41	10/3/2011	NB	6	American shad	5
2011	41	10/3/2011	NB	14	Atlantic menhaden	7

Table C-5.1. Data Used for the NonDetect Analysis for Fall Samples						
Year	WOY	MONDAY	Area Grouping	Species Code	Common Name	SumOfCPUE_10min
2011	41	10/3/2011	NB	27	Blueback herring	283
2011	41	10/3/2011	NB	156	Striped bass	0
2011	41	10/3/2011	UB	2	Alewife	59
2011	41	10/3/2011	UB	6	American shad	3
2011	41	10/3/2011	UB	14	Atlantic menhaden	0
2011	41	10/3/2011	UB	27	Blueback herring	3
2011	41	10/3/2011	UB	156	Striped bass	0
2011	42	10/10/2011	AKKVK	2	Alewife	17
2011	42	10/10/2011	AKKVK	6	American shad	2
2011	42	10/10/2011	AKKVK	14	Atlantic menhaden	0
2011	42	10/10/2011	AKKVK	27	Blueback herring	5
2011	42	10/10/2011	AKKVK	156	Striped bass	0
2011	42	10/10/2011	LB	2	Alewife	0
2011	42	10/10/2011	LB	6	American shad	0
2011	42	10/10/2011	LB	14	Atlantic menhaden	0
2011	42	10/10/2011	LB	27	Blueback herring	0
2011	42	10/10/2011	LB	156	Striped bass	0
2011	42	10/10/2011	NB	2	Alewife	73
2011	42	10/10/2011	NB	6	American shad	2
2011	42	10/10/2011	NB	14	Atlantic menhaden	0
2011	42	10/10/2011	NB	27	Blueback herring	0
2011	42	10/10/2011	NB	156	Striped bass	0
2011	42	10/10/2011	UB	2	Alewife	10
2011	42	10/10/2011	UB	6	American shad	5
2011	42	10/10/2011	UB	14	Atlantic menhaden	1
2011	42	10/10/2011	UB	27	Blueback herring	0
2011	42	10/10/2011	UB	156	Striped bass	0
2011	43	10/17/2011	AKKVK	2	Alewife	27
2011	43	10/17/2011	AKKVK	6	American shad	8
2011	43	10/17/2011	AKKVK	14	Atlantic menhaden	0
2011	43	10/17/2011	AKKVK	27	Blueback herring	1
2011	43	10/17/2011	AKKVK	156	Striped bass	0
2011	43	10/17/2011	LB	2	Alewife	0
2011	43	10/17/2011	LB	6	American shad	0
2011	43	10/17/2011	LB	14	Atlantic	0

Table C-5.1. Data Used for the NonDetect Analysis for Fall Samples						
Year	WOY	MONDAY	Area Grouping	Species Code	Common Name	SumOfCPUE_10min
					menhaden	
2011	43	10/17/2011	LB	27	Blueback herring	0
2011	43	10/17/2011	LB	156	Striped bass	0
2011	43	10/17/2011	NB	2	Alewife	64
2011	43	10/17/2011	NB	6	American shad	0
2011	43	10/17/2011	NB	14	Atlantic menhaden	0
2011	43	10/17/2011	NB	27	Blueback herring	74
2011	43	10/17/2011	NB	156	Striped bass	0
2011	43	10/17/2011	UB	2	Alewife	36
2011	43	10/17/2011	UB	6	American shad	24
2011	43	10/17/2011	UB	14	Atlantic menhaden	0
2011	43	10/17/2011	UB	27	Blueback herring	6
2011	43	10/17/2011	UB	156	Striped bass	0
2011	44	10/24/2011	AKKVK	2	Alewife	75
2011	44	10/24/2011	AKKVK	6	American shad	2
2011	44	10/24/2011	AKKVK	14	Atlantic menhaden	0
2011	44	10/24/2011	AKKVK	27	Blueback herring	6
2011	44	10/24/2011	AKKVK	156	Striped bass	0
2011	44	10/24/2011	LB	2	Alewife	0
2011	44	10/24/2011	LB	6	American shad	2
2011	44	10/24/2011	LB	14	Atlantic menhaden	0
2011	44	10/24/2011	LB	27	Blueback herring	117
2011	44	10/24/2011	LB	156	Striped bass	0
2011	44	10/24/2011	NB	2	Alewife	169
2011	44	10/24/2011	NB	6	American shad	1
2011	44	10/24/2011	NB	14	Atlantic menhaden	0
2011	44	10/24/2011	NB	27	Blueback herring	9
2011	44	10/24/2011	NB	156	Striped bass	0
2011	44	10/24/2011	UB	2	Alewife	11
2011	44	10/24/2011	UB	6	American shad	2
2011	44	10/24/2011	UB	14	Atlantic menhaden	0
2011	44	10/24/2011	UB	27	Blueback herring	81
2011	44	10/24/2011	UB	156	Striped bass	0
2011	45	10/31/2011	AKKVK	2	Alewife	21
2011	45	10/31/2011	AKKVK	6	American shad	15

Table C-5.1. Data Used for the NonDetect Analysis for Fall Samples						
Year	WOY	MONDAY	Area Grouping	Species Code	Common Name	SumOfCPUE_10min
2011	45	10/31/2011	AKKVK	14	Atlantic menhaden	1
2011	45	10/31/2011	AKKVK	27	Blueback herring	222
2011	45	10/31/2011	AKKVK	156	Striped bass	0
2011	45	10/31/2011	LB	2	Alewife	0
2011	45	10/31/2011	LB	6	American shad	0
2011	45	10/31/2011	LB	14	Atlantic menhaden	0
2011	45	10/31/2011	LB	27	Blueback herring	196
2011	45	10/31/2011	LB	156	Striped bass	0
2011	45	10/31/2011	NB	2	Alewife	49
2011	45	10/31/2011	NB	6	American shad	6
2011	45	10/31/2011	NB	14	Atlantic menhaden	0
2011	45	10/31/2011	NB	27	Blueback herring	24
2011	45	10/31/2011	NB	156	Striped bass	0
2011	45	10/31/2011	UB	2	Alewife	54
2011	45	10/31/2011	UB	6	American shad	40
2011	45	10/31/2011	UB	14	Atlantic menhaden	0
2011	45	10/31/2011	UB	27	Blueback herring	191
2011	45	10/31/2011	UB	156	Striped bass	2
2011	46	11/7/2011	AKKVK	2	Alewife	89
2011	46	11/7/2011	AKKVK	6	American shad	1
2011	46	11/7/2011	AKKVK	14	Atlantic menhaden	0
2011	46	11/7/2011	AKKVK	27	Blueback herring	0
2011	46	11/7/2011	AKKVK	156	Striped bass	0
2011	46	11/7/2011	LB	2	Alewife	0
2011	46	11/7/2011	LB	6	American shad	0
2011	46	11/7/2011	LB	14	Atlantic menhaden	0
2011	46	11/7/2011	LB	27	Blueback herring	6
2011	46	11/7/2011	LB	156	Striped bass	0
2011	46	11/7/2011	NB	2	Alewife	155
2011	46	11/7/2011	NB	6	American shad	2
2011	46	11/7/2011	NB	14	Atlantic menhaden	0
2011	46	11/7/2011	NB	27	Blueback herring	0
2011	46	11/7/2011	NB	156	Striped bass	0
2011	46	11/7/2011	UB	2	Alewife	48

Table C-5.1. Data Used for the NonDetect Analysis for Fall Samples						
Year	WOY	MONDAY	Area Grouping	Species Code	Common Name	SumOfCPUE_10min
2011	46	11/7/2011	UB	6	American shad	51
2011	46	11/7/2011	UB	14	Atlantic menhaden	0
2011	46	11/7/2011	UB	27	Blueback herring	189
2011	46	11/7/2011	UB	156	Striped bass	0
2011	47	11/14/2011	AKKVK	2	Alewife	20
2011	47	11/14/2011	AKKVK	6	American shad	8
2011	47	11/14/2011	AKKVK	14	Atlantic menhaden	0
2011	47	11/14/2011	AKKVK	27	Blueback herring	6
2011	47	11/14/2011	AKKVK	156	Striped bass	0
2011	47	11/14/2011	LB	2	Alewife	0
2011	47	11/14/2011	LB	6	American shad	0
2011	47	11/14/2011	LB	14	Atlantic menhaden	1
2011	47	11/14/2011	LB	27	Blueback herring	386
2011	47	11/14/2011	LB	156	Striped bass	0
2011	47	11/14/2011	NB	2	Alewife	8
2011	47	11/14/2011	NB	6	American shad	3
2011	47	11/14/2011	NB	14	Atlantic menhaden	1
2011	47	11/14/2011	NB	27	Blueback herring	1
2011	47	11/14/2011	NB	156	Striped bass	0
2011	47	11/14/2011	UB	2	Alewife	0
2011	47	11/14/2011	UB	6	American shad	4
2011	47	11/14/2011	UB	14	Atlantic menhaden	1
2011	47	11/14/2011	UB	27	Blueback herring	1036
2011	47	11/14/2011	UB	156	Striped bass	1
2011	48	11/21/2011	AKKVK	2	Alewife	78
2011	48	11/21/2011	AKKVK	6	American shad	1
2011	48	11/21/2011	AKKVK	14	Atlantic menhaden	2
2011	48	11/21/2011	AKKVK	27	Blueback herring	8
2011	48	11/21/2011	AKKVK	156	Striped bass	0
2011	48	11/21/2011	LB	2	Alewife	0
2011	48	11/21/2011	LB	6	American shad	2
2011	48	11/21/2011	LB	14	Atlantic menhaden	0
2011	48	11/21/2011	LB	27	Blueback herring	1
2011	48	11/21/2011	LB	156	Striped bass	0

Table C-5.1. Data Used for the NonDetect Analysis for Fall Samples						
Year	WOY	MONDAY	Area Grouping	Species Code	Common Name	SumOfCPUE_10min
2011	48	11/21/2011	NB	2	Alewife	58
2011	48	11/21/2011	NB	6	American shad	2
2011	48	11/21/2011	NB	14	Atlantic menhaden	0
2011	48	11/21/2011	NB	27	Blueback herring	8
2011	48	11/21/2011	NB	156	Striped bass	0
2011	48	11/21/2011	UB	2	Alewife	52
2011	48	11/21/2011	UB	6	American shad	4
2011	48	11/21/2011	UB	14	Atlantic menhaden	0
2011	48	11/21/2011	UB	27	Blueback herring	1
2011	48	11/21/2011	UB	156	Striped bass	0
2011	50	12/5/2011	AKKVK	2	Alewife	113
2011	50	12/5/2011	AKKVK	6	American shad	6
2011	50	12/5/2011	AKKVK	14	Atlantic menhaden	0
2011	50	12/5/2011	AKKVK	27	Blueback herring	24
2011	50	12/5/2011	AKKVK	156	Striped bass	0
2011	50	12/5/2011	LB	2	Alewife	10
2011	50	12/5/2011	LB	6	American shad	2
2011	50	12/5/2011	LB	14	Atlantic menhaden	1
2011	50	12/5/2011	LB	27	Blueback herring	255
2011	50	12/5/2011	LB	156	Striped bass	0
2011	50	12/5/2011	NB	2	Alewife	96
2011	50	12/5/2011	NB	6	American shad	0
2011	50	12/5/2011	NB	14	Atlantic menhaden	0
2011	50	12/5/2011	NB	27	Blueback herring	29
2011	50	12/5/2011	NB	156	Striped bass	0
2011	50	12/5/2011	UB	2	Alewife	17
2011	50	12/5/2011	UB	6	American shad	4
2011	50	12/5/2011	UB	14	Atlantic menhaden	0
2011	50	12/5/2011	UB	27	Blueback herring	5
2011	50	12/5/2011	UB	156	Striped bass	0

Appendix C-6
Results of the Nondetect Analysis in NCSS 2007 to Derive the Cumulative Frequency Distribution for Spring Samples of Target Species

Nondetects Analysis Report

Page/Date/Time 1 3/5/2012 6:20:29 PM
Database C:\Documents and Settings\vw ... D\CFD data all spp spring.S0
Response Variable = WOY
Nondetects Variable = CENSOR. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).

Data Summary Section

Group	Type	Rows	Count	Minimum	Maximum
Alewife	Detected	24	2127	16	23
Alewife	Not Detected	0	0		
Alewife	Total	24	2127	16	23
American shad	Detected	13	23	16	21
American shad	Not Detected	0	0		
American shad	Total	13	23	16	21
Atlantic menhaden	Detected	3	7	21	22
Atlantic menhaden	Not Detected	0	0		
Atlantic menhaden	Total	3	7	21	22
Blueback herring	Detected	25	2326	16	23
Blueback herring	Not Detected	0	0		
Blueback herring	Total	25	2326	16	23
Striped bass	Detected	8	29	18	22
Striped bass	Not Detected	0	0		
Striped bass	Total	8	29	18	22

Data Summary Section: Response Quartiles

	Quartile	Estimate	Lower 95.0% C.L.	Upper 95.0% C.L.
Alewife	First (Q1)	18.000	18.000	18.000
Alewife	Median (Q2)	19.000	19.000	19.000
Alewife	Third (Q3)	20.000	20.000	20.000
American shad	First (Q1)	17.000	22.000	18.000
American shad	Median (Q2)	18.000	17.000	20.000
American shad	Third (Q3)	20.000	19.000	21.000
Atlantic menhaden	First (Q1)	21.000	21.000	22.000
Atlantic menhaden	Median (Q2)	22.000	21.000	22.000
Atlantic menhaden	Third (Q3)	22.000	21.000	22.000
Blueback herring	First (Q1)	16.000	23.000	16.000
Blueback herring	Median (Q2)	17.000	17.000	17.000
Blueback herring	Third (Q3)	18.000	18.000	18.000

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Confidence Limits Method = Linear (Greenwood).

Data Summary Section: Response Quartiles

	Quartile	Estimate	Lower 95.0% C.L.	Upper 95.0% C.L.
Striped bass	First (Q1)	20.000	19.000	21.000
Striped bass	Median (Q2)	21.000	20.000	21.000
Striped bass	Third (Q3)	21.000	21.000	21.000

Logrank Tests Section
Hypotheses
H0: Distribution Functions are Equal Among Groups
HA: At Least One Group Distribution Functions Differs

Test Name	Chi-Square	DF	Prob Level	Reject H0 (Alpha = 0.05)
Logrank	2100.265	4	0.0000	Yes
Gehan-Wilcoxon	1796.037	4	0.0000	Yes
Tarone-Ware	1961.797	4	0.0000	Yes
Peto-Peto	1677.303	4	0.0000	Yes
Mod. Peto-Peto	1677.206	4	0.0000	Yes

Multiple Pairwise Tests Section
Hypotheses
H0: Distribution Functions are Equal
HA: Distribution Functions Differ

Group Pair Tested: Alewife vs. American shad
Bonferroni

Test Name	Chi-Square	DF	Prob Level	Reject H0 (Alpha =0.05)	Adjusted Prob Level	Reject H0 (Alpha =0.05)
Logrank	13.735	1	0.0002	Yes	0.0021	Yes
Gehan-Wilcoxon	1.792	1	0.1807	No	1.0000	No
Tarone-Ware	5.542	1	0.0186	Yes	0.1856	No
Peto-Peto	0.116	1	0.7338	No	1.0000	No
Mod. Peto-Peto	0.116	1	0.7333	No	1.0000	No

Group Pair Tested: Alewife vs. Atlantic menhaden
Bonferroni

Test Name	Chi-Square	DF	Prob Level	Reject H0 (Alpha =0.05)	Adjusted Prob Level	Reject H0 (Alpha =0.05)
Logrank	249.353	1	0.0000	Yes	0.0000	Yes
Gehan-Wilcoxon	250.085	1	0.0000	Yes	0.0000	Yes
Tarone-Ware	249.720	1	0.0000	Yes	0.0000	Yes
Peto-Peto	251.980	1	0.0000	Yes	0.0000	Yes
Mod. Peto-Peto	251.980	1	0.0000	Yes	0.0000	Yes

Group Pair Tested: Alewife vs. Blueback herring

Test Name	Chi-Square	DF	Prob Level	Reject H0 (Alpha =0.05)	Bonferroni Adjusted Prob Level	Reject H0 (Alpha =0.05)
Logrank	1723.842	1	0.0000	Yes	0.0000	Yes
Gehan-Wilcoxon	1410.476	1	0.0000	Yes	0.0000	Yes
Tarone-Ware	1580.864	1	0.0000	Yes	0.0000	Yes
Peto-Peto	1266.393	1	0.0000	Yes	0.0000	Yes
Mod. Peto-Peto	1266.292	1	0.0000	Yes	0.0000	Yes

Group Pair Tested: Alewife vs. Striped bass

Test Name	Chi-Square	DF	Prob Level	Reject H0 (Alpha =0.05)	Bonferroni Adjusted Prob Level	Reject H0 (Alpha =0.05)
Logrank	56.133	1	0.0000	Yes	0.0000	Yes
Gehan-Wilcoxon	71.877	1	0.0000	Yes	0.0000	Yes
Tarone-Ware	65.214	1	0.0000	Yes	0.0000	Yes
Peto-Peto	112.525	1	0.0000	Yes	0.0000	Yes
Mod. Peto-Peto	112.531	1	0.0000	Yes	0.0000	Yes

Group Pair Tested: American shad vs. Atlantic menhaden

Test Name	Chi-Square	DF	Prob Level	Reject H0 (Alpha =0.05)	Bonferroni Adjusted Prob Level	Reject H0 (Alpha =0.05)
Logrank	21.519	1	0.0000	Yes	0.0000	Yes
Gehan-Wilcoxon	21.867	1	0.0000	Yes	0.0000	Yes
Tarone-Ware	21.720	1	0.0000	Yes	0.0000	Yes
Peto-Peto	21.985	1	0.0000	Yes	0.0000	Yes
Mod. Peto-Peto	21.982	1	0.0000	Yes	0.0000	Yes

Group Pair Tested: American shad vs. Blueback herring

Test Name	Chi-Square	DF	Prob Level	Reject H0 (Alpha =0.05)	Bonferroni Adjusted Prob Level	Reject H0 (Alpha =0.05)
Logrank	9.375	1	0.0022	Yes	0.0220	Yes
Gehan-Wilcoxon	11.118	1	0.0009	Yes	0.0085	Yes
Tarone-Ware	10.283	1	0.0013	Yes	0.0134	Yes
Peto-Peto	13.735	1	0.0002	Yes	0.0021	Yes
Mod. Peto-Peto	13.735	1	0.0002	Yes	0.0021	Yes

Group Pair Tested: American shad vs. Striped bass

Test Name	Chi-Square	DF	Prob Level	Reject H0 (Alpha =0.05)	Bonferroni Adjusted Prob Level	Reject H0 (Alpha =0.05)
Logrank	16.877	1	0.0000	Yes	0.0004	Yes
Gehan-Wilcoxon	13.035	1	0.0003	Yes	0.0031	Yes
Tarone-Ware	14.919	1	0.0001	Yes	0.0011	Yes
Peto-Peto	13.586	1	0.0002	Yes	0.0023	Yes
Mod. Peto-Peto	13.452	1	0.0002	Yes	0.0024	Yes

Group Pair Tested: Atlantic menhaden vs. Blueback herring

Bonferroni

Test Name	Chi-Square	DF	Prob Level	Reject H0 (Alpha =0.05)	Adjusted Prob Level	Reject H0 (Alpha =0.05)
Logrank	396.659	1	0.0000	Yes	0.0000	Yes
Gehan-Wilcoxon	397.549	1	0.0000	Yes	0.0000	Yes
Tarone-Ware	397.104	1	0.0000	Yes	0.0000	Yes
Peto-Peto	403.711	1	0.0000	Yes	0.0000	Yes
Mod. Peto-Peto	403.711	1	0.0000	Yes	0.0000	Yes

Group Pair Tested: Atlantic menhaden vs. Striped bass

Bonferroni

Test Name	Chi-Square	DF	Prob Level	Reject H0 (Alpha =0.05)	Adjusted Prob Level	Reject H0 (Alpha =0.05)
Logrank	12.548	1	0.0004	Yes	0.0040	Yes
Gehan-Wilcoxon	13.310	1	0.0003	Yes	0.0026	Yes
Tarone-Ware	12.945	1	0.0003	Yes	0.0032	Yes
Peto-Peto	14.983	1	0.0001	Yes	0.0011	Yes
Mod. Peto-Peto	14.983	1	0.0001	Yes	0.0011	Yes

Group Pair Tested: Blueback herring vs. Striped bass

Bonferroni

Test Name	Chi-Square	DF	Prob Level	Reject H0 (Alpha =0.05)	Adjusted Prob Level	Reject H0 (Alpha =0.05)
Logrank	213.547	1	0.0000	Yes	0.0000	Yes
Gehan-Wilcoxon	220.716	1	0.0000	Yes	0.0000	Yes
Tarone-Ware	217.421	1	0.0000	Yes	0.0000	Yes
Peto-Peto	242.660	1	0.0000	Yes	0.0000	Yes
Mod. Peto-Peto	242.662	1	0.0000	Yes	0.0000	Yes

Notes:
The most commonly used test is the Logrank test.

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Confidence Limits Method = Linear (Greenwood).

Logrank Test Detail Section

Group	Z-Value	Standard Error	Standardized Z-Value
Alewife	924.522	22.820	40.513
American shad	1.877	3.411	0.550
Atlantic menhaden	6.838	0.396	17.260
Blueback herring	-955.876	22.923	-41.700
Striped bass	22.639	2.213	10.229

Probability Level was 0.0000

Gehan-Wilcoxon Test Detail Section

Group	Z-Value	Standard Error	Standardized Z-Value
Alewife	3006664.000	82912.126	36.263
American shad	10329.000	11345.048	0.910
Atlantic menhaden	30743.000	1778.476	17.286
Blueback herring	-3143217.000	83093.952	-37.827
Striped bass	95481.000	8775.318	10.881

Probability Level was 0.0000

Tarone-Ware Test Detail Section

Group	Z-Value	Standard Error	Standardized Z-Value
Alewife	52315.103	1355.451	38.596
American shad	136.226	191.410	0.712
Atlantic menhaden	458.514	26.545	17.273
Blueback herring	-54376.081	1359.570	-39.995
Striped bass	1466.238	138.290	10.603

Probability Level was 0.0000

Peto-Peto Test Detail Section

Group	Z-Value	Standard Error	Standardized Z-Value
Alewife	484.835	14.274	33.967
American shad	2.665	1.935	1.378
Atlantic menhaden	6.683	0.384	17.425
Blueback herring	-513.536	14.299	-35.913
Striped bass	19.353	1.602	12.079

Probability Level was 0.0000

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Confidence Limits Method = Linear (Greenwood).

Mod. Peto-Peto Test Detail Section

Group	Z-Value	Standard Error	Standardized Z-Value
Alewife	484.689	14.270	33.965
American shad	2.665	1.934	1.378
Atlantic menhaden	6.682	0.383	17.425
Blueback herring	-513.383	14.296	-35.912
Striped bass	19.348	1.602	12.079

Probability Level was 0.0000

Specific Response Detail: Estimated Cumulative Proportion

CName	Response (R)	Cumulative Proportion P(R)	Standard Error of P(R)	Lower 95.0% C.L. for P(R)	Upper 95.0% C.L. for P(R)	Cum. Count
Alewife	3.000					0
American shad	3.000					0
Atlantic menhaden	3.000					0
Blueback herring	3.000					0
Striped bass	3.000					0
Alewife	6.000					0
American shad	6.000					0
Atlantic menhaden	6.000					0
Blueback herring	6.000					0
Striped bass	6.000					0
Alewife	9.000					0
American shad	9.000					0
Atlantic menhaden	9.000					0
Blueback herring	9.000					0
Striped bass	9.000					0
Alewife	12.000					0
American shad	12.000					0
Atlantic menhaden	12.000					0
Blueback herring	12.000					0
Striped bass	12.000					0
Alewife	15.000					0
American shad	15.000					0
Atlantic menhaden	15.000					0
Blueback herring	15.000					0
Striped bass	15.000					0

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Confidence Limits Method = Linear (Greenwood).

Specific Response Detail: Estimated Cumulative Proportion

CName	Response (R)	Cumulative Proportion P(R)	Standard Error of P(R)	Lower 95.0% C.L. for P(R)	Upper 95.0% C.L. for P(R)	Cum. Count
Alewife	18.000	0.0606	0.0052	0.0505	0.0708	704
American shad	18.000	0.4348	0.1034	0.2322	0.6374	12
Atlantic menhaden	18.000					0
Blueback herring	18.000	0.6032	0.0101	0.5833	0.6231	1910
Striped bass	18.000	0.0000				3
Alewife	21.000	0.9549	0.0045	0.9460	0.9637	2107
American shad	21.000	0.7826	0.0860	0.6140	0.9512	23
Atlantic menhaden	21.000					3
Blueback herring	21.000	0.9686	0.0036	0.9615	0.9757	2319
Striped bass	21.000	0.3793	0.0901	0.2027	0.5559	28
Alewife	24.000	1.0000	0.0000	1.0000	1.0000	2127
American shad	24.000	1.0000	0.0000	1.0000	1.0000	23
Atlantic menhaden	24.000	1.0000	0.0000	1.0000	1.0000	7
Blueback herring	24.000	1.0000	0.0000	1.0000	1.0000	2326
Striped bass	24.000	1.0000	0.0000	1.0000	1.0000	29
Alewife	27.000	1.0000	0.0000	1.0000	1.0000	2127
American shad	27.000	1.0000	0.0000	1.0000	1.0000	23
Atlantic menhaden	27.000	1.0000	0.0000	1.0000	1.0000	7
Blueback herring	27.000	1.0000	0.0000	1.0000	1.0000	2326
Striped bass	27.000	1.0000	0.0000	1.0000	1.0000	29
Alewife	30.000	1.0000	0.0000	1.0000	1.0000	2127
American shad	30.000	1.0000	0.0000	1.0000	1.0000	23
Atlantic menhaden	30.000	1.0000	0.0000	1.0000	1.0000	7
Blueback herring	30.000	1.0000	0.0000	1.0000	1.0000	2326
Striped bass	30.000	1.0000	0.0000	1.0000	1.0000	29

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Confidence Limits Method = Linear (Greenwood).

Quantiles of Responses

CName	Proportion of Response	Estimated Quantile	Lower 95.0% C.L. Quantile	Upper 95.0% C.L. Quantile
Alewife	0.0000	16.000	21.000	16.000
American shad	0.0000	16.000	22.000	16.000
Atlantic menhaden	0.0000	21.000	21.000	21.000
Blueback herring	0.0000	16.000	23.000	16.000
Striped bass	0.0000	18.000	22.000	19.000
Alewife	0.0500	17.000	17.000	17.000
American shad	0.0500	16.000	22.000	17.000
Atlantic menhaden	0.0500	21.000	21.000	21.000
Blueback herring	0.0500	16.000	23.000	16.000
Striped bass	0.0500	18.000	22.000	19.000
Alewife	0.1000	18.000	18.000	18.000
American shad	0.1000	16.000	22.000	17.000
Atlantic menhaden	0.1000	21.000	21.000	22.000
Blueback herring	0.1000	16.000	23.000	16.000
Striped bass	0.1000	18.000	22.000	20.000
Alewife	0.1500	18.000	18.000	18.000
American shad	0.1500	16.000	22.000	17.000
Atlantic menhaden	0.1500	21.000	21.000	22.000
Blueback herring	0.1500	16.000	23.000	16.000
Striped bass	0.1500	19.000	22.000	20.000
Alewife	0.2000	18.000	18.000	18.000
American shad	0.2000	17.000	22.000	17.000
Atlantic menhaden	0.2000	21.000	21.000	22.000
Blueback herring	0.2000	16.000	23.000	16.000
Striped bass	0.2000	19.000	22.000	20.000
Alewife	0.2500	18.000	18.000	18.000
American shad	0.2500	17.000	22.000	18.000
Atlantic menhaden	0.2500	21.000	21.000	22.000
Blueback herring	0.2500	16.000	23.000	16.000
Striped bass	0.2500	20.000	19.000	21.000

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Confidence Limits Method = Linear (Greenwood).

Quantiles of Responses

CName	Proportion of Response	Estimated Quantile	Lower 95.0% C.L. Quantile	Upper 95.0% C.L. Quantile
Alewife	0.3000	18.000	18.000	18.000
American shad	0.3000	17.000	22.000	18.000
Atlantic menhaden	0.3000	21.000	21.000	22.000
Blueback herring	0.3000	16.000	23.000	16.000
Striped bass	0.3000	20.000	19.000	21.000
Alewife	0.3500	19.000	18.000	19.000
American shad	0.3500	17.000	17.000	19.000
Atlantic menhaden	0.3500	21.000	21.000	22.000
Blueback herring	0.3500	16.000	23.000	16.000
Striped bass	0.3500	20.000	19.000	21.000
Alewife	0.4000	19.000	19.000	19.000
American shad	0.4000	17.000	17.000	20.000
Atlantic menhaden	0.4000	21.000	21.000	22.000
Blueback herring	0.4000	17.000	17.000	17.000
Striped bass	0.4000	21.000	20.000	21.000
Alewife	0.4500	19.000	19.000	19.000
American shad	0.4500	18.000	17.000	20.000
Atlantic menhaden	0.4500	22.000	21.000	22.000
Blueback herring	0.4500	17.000	17.000	17.000
Striped bass	0.4500	21.000	20.000	21.000
Alewife	0.5000	19.000	19.000	19.000
American shad	0.5000	18.000	17.000	20.000
Atlantic menhaden	0.5000	22.000	21.000	22.000
Blueback herring	0.5000	17.000	17.000	17.000
Striped bass	0.5000	21.000	20.000	21.000
Alewife	0.5500	19.000	19.000	19.000
American shad	0.5500	19.000	17.000	20.000
Atlantic menhaden	0.5500	22.000	21.000	22.000
Blueback herring	0.5500	17.000	17.000	17.000
Striped bass	0.5500	21.000	20.000	21.000

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Confidence Limits Method = Linear (Greenwood).

Quantiles of Responses

CName	Proportion of Response	Estimated Quantile	Lower 95.0% C.L. Quantile	Upper 95.0% C.L. Quantile
Alewife	0.6000	20.000	19.000	20.000
American shad	0.6000	20.000	17.000	20.000
Atlantic menhaden	0.6000	22.000	21.000	22.000
Blueback herring	0.6000	17.000	17.000	18.000
Striped bass	0.6000	21.000	21.000	21.000
Alewife	0.6500	20.000	20.000	20.000
American shad	0.6500	20.000	18.000	21.000
Atlantic menhaden	0.6500	22.000	21.000	22.000
Blueback herring	0.6500	18.000	18.000	18.000
Striped bass	0.6500	21.000	21.000	21.000
Alewife	0.7000	20.000	20.000	20.000
American shad	0.7000	20.000	18.000	21.000
Atlantic menhaden	0.7000	22.000	21.000	22.000
Blueback herring	0.7000	18.000	18.000	18.000
Striped bass	0.7000	21.000	21.000	21.000
Alewife	0.7500	20.000	20.000	20.000
American shad	0.7500	20.000	19.000	21.000
Atlantic menhaden	0.7500	22.000	21.000	22.000
Blueback herring	0.7500	18.000	18.000	18.000
Striped bass	0.7500	21.000	21.000	21.000
Alewife	0.8000	20.000	20.000	20.000
American shad	0.8000	21.000	20.000	21.000
Atlantic menhaden	0.8000	22.000		22.000
Blueback herring	0.8000	18.000	18.000	18.000
Striped bass	0.8000	21.000	21.000	21.000
Alewife	0.8500	20.000	20.000	20.000
American shad	0.8500	21.000	20.000	21.000
Atlantic menhaden	0.8500	22.000		22.000
Blueback herring	0.8500	20.000	19.000	20.000
Striped bass	0.8500	21.000	21.000	21.000

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Confidence Limits Method = Linear (Greenwood).

Quantiles of Responses

CName	Proportion of Response	Estimated Quantile	Lower 95.0% C.L. Quantile	Upper 95.0% C.L. Quantile
Alewife	0.9000	20.000	20.000	20.000
American shad	0.9000	21.000	20.000	21.000
Atlantic menhaden	0.9000	22.000		22.000
Blueback herring	0.9000	20.000	20.000	20.000
Striped bass	0.9000	21.000	21.000	22.000
Alewife	0.9500	20.000	20.000	21.000
American shad	0.9500	21.000	20.000	21.000
Atlantic menhaden	0.9500	22.000		22.000
Blueback herring	0.9500	20.000	20.000	20.000
Striped bass	0.9500	21.000	21.000	22.000

Response Detail for CName = Alewife

Response (R)	Cumulative Proportion P(R)	Standard Error of P(R)	Lower 95.0% C.L. for P(R)	Upper 95.0% C.L. for P(R)	Cum. Count	Count
16.000	0.0000				19	19
17.000	0.0089	0.0020	0.0049	0.0129	129	110
18.000	0.0606	0.0052	0.0505	0.0708	704	575
19.000	0.3310	0.0102	0.3110	0.3510	1266	562
20.000	0.5952	0.0106	0.5743	0.6161	2031	765
21.000	0.9549	0.0045	0.9460	0.9637	2107	76
22.000	0.9906	0.0021	0.9865	0.9947	2124	17
23.000	0.9986	0.0008	0.9970	1.0000	2127	3

Response Detail for CName = American shad

Response (R)	Cumulative Proportion P(R)	Standard Error of P(R)	Lower 95.0% C.L. for P(R)	Upper 95.0% C.L. for P(R)	Cum. Count	Count
16.000	0.0000				4	4
17.000	0.1739	0.0790	0.0190	0.3288	10	6
18.000	0.4348	0.1034	0.2322	0.6374	12	2
19.000	0.5217	0.1042	0.3176	0.7259	13	1
20.000	0.5652	0.1034	0.3626	0.7678	18	5
21.000	0.7826	0.0860	0.6140	0.9512	23	5

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Response Variable = WOY
Nondetects Variable = CENSOR. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).

Response Detail for CName = Atlantic menhaden

Response (R)	Cumulative Proportion P(R)	Standard Error of P(R)	Lower 95.0% C.L. for P(R)	Upper 95.0% C.L. for P(R)	Cum. Count	Count
21.000	0.0000				3	3
22.000	0.4286	0.1870	0.0620	0.7952	7	4

Response Detail for CName = Blueback herring

Response (R)	Cumulative Proportion P(R)	Standard Error of P(R)	Lower 95.0% C.L. for P(R)	Upper 95.0% C.L. for P(R)	Cum. Count	Count
16.000	0.0000				870	870
17.000	0.3740	0.0100	0.3544	0.3937	1403	533
18.000	0.6032	0.0101	0.5833	0.6231	1910	507
19.000	0.8212	0.0079	0.8056	0.8367	1952	42
20.000	0.8392	0.0076	0.8243	0.8541	2253	301
21.000	0.9686	0.0036	0.9615	0.9757	2319	66
22.000	0.9970	0.0011	0.9948	0.9992	2324	5
23.000	0.9991	0.0006	0.9979	1.0000	2326	2

Response Detail for CName = Striped bass

Response (R)	Cumulative Proportion P(R)	Standard Error of P(R)	Lower 95.0% C.L. for P(R)	Upper 95.0% C.L. for P(R)	Cum. Count	Count
18.000	0.0000				3	3
19.000	0.1034	0.0566	0.0000	0.2143	6	3
20.000	0.2069	0.0752	0.0595	0.3543	11	5
21.000	0.3793	0.0901	0.2027	0.5559	28	17
22.000	0.9655	0.0339	0.8991	1.0000	29	1

Nondetects Analysis Report
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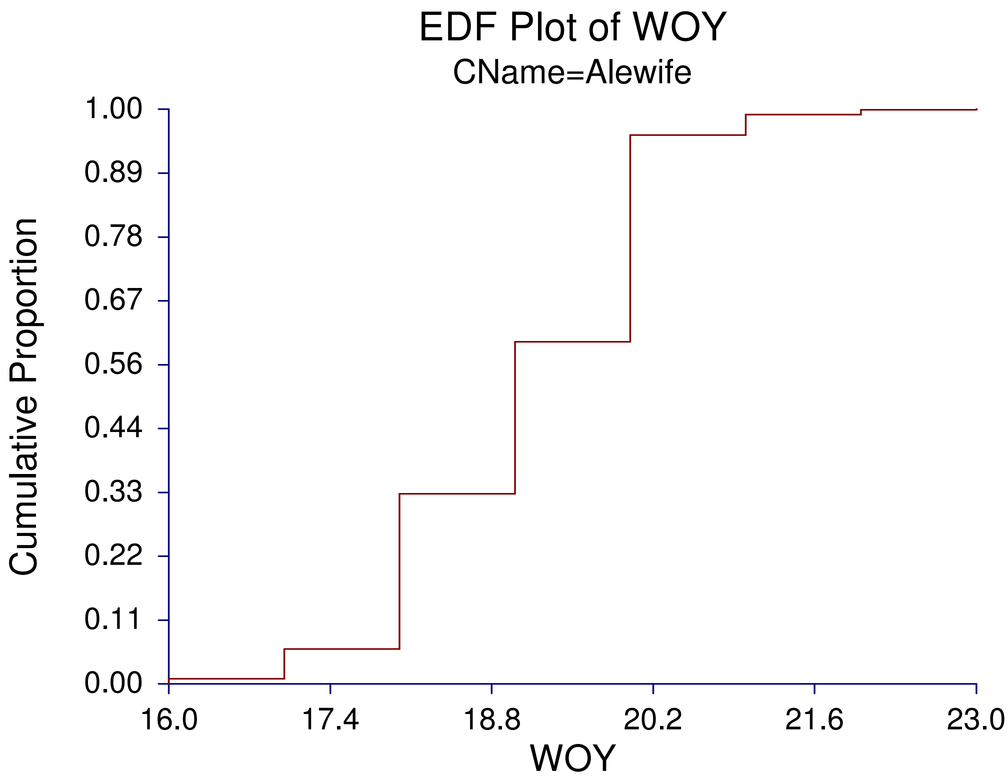
Nondetects Variable = CENSOR. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).

Plots Section



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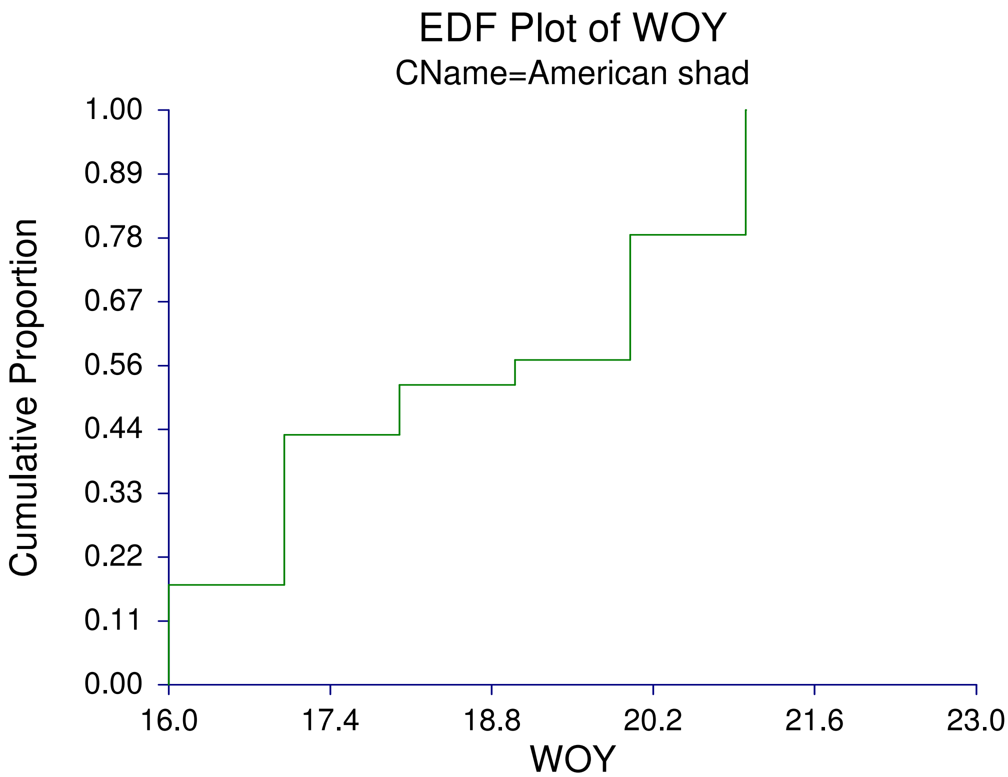
Confidence Limits Method = Linear (Greenwood).



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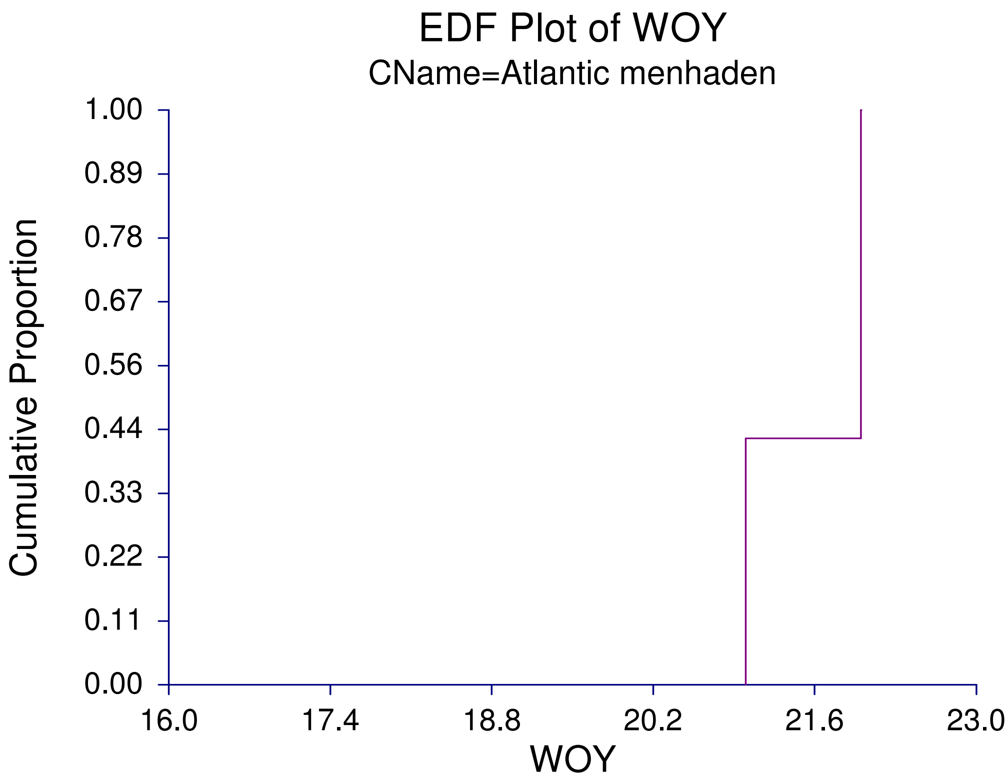

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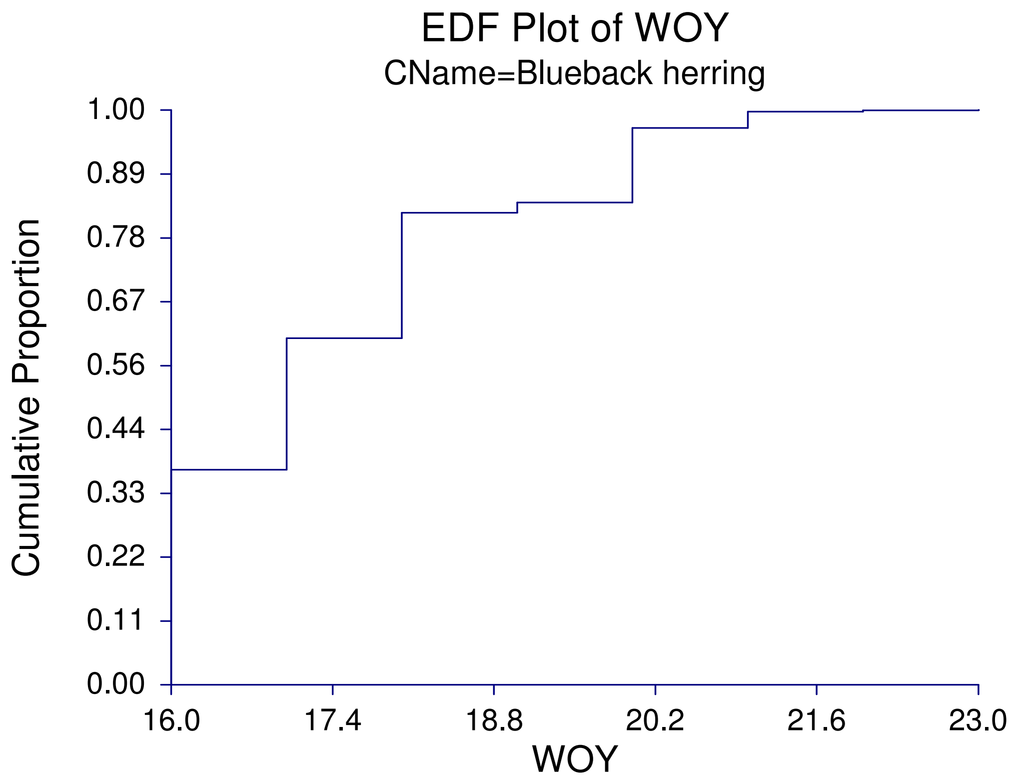
Nondetects Variable = CENSOR. Group Variable = CName

Confidence Limits Method = Linear (Greenwood).



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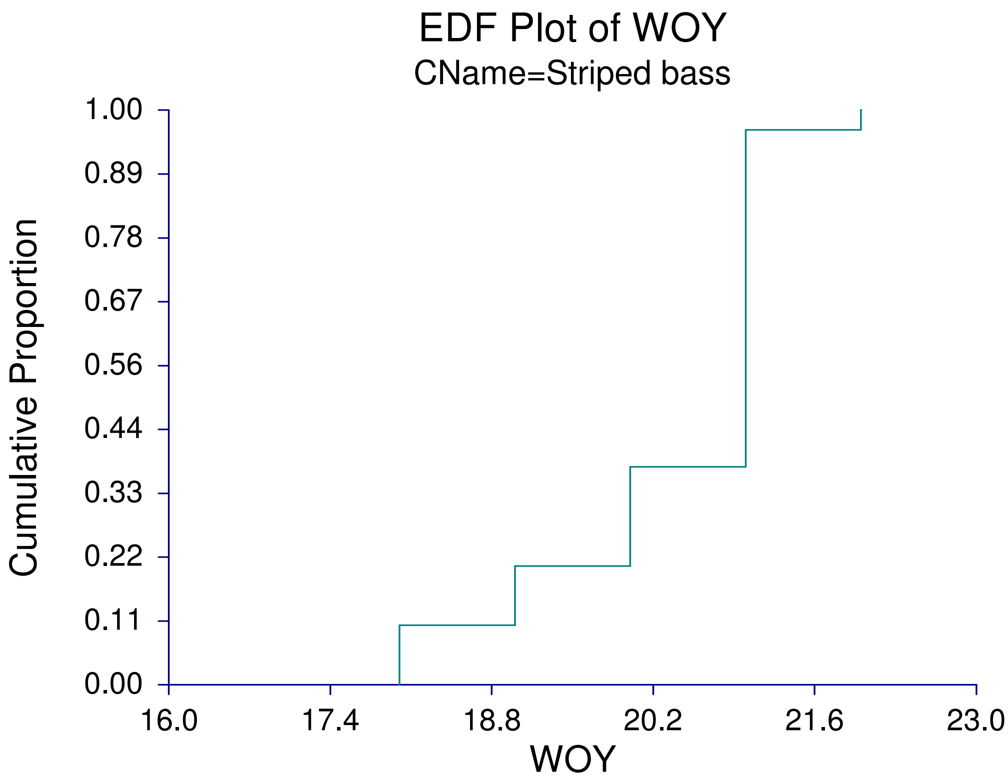
Confidence Limits Method = Linear (Greenwood).



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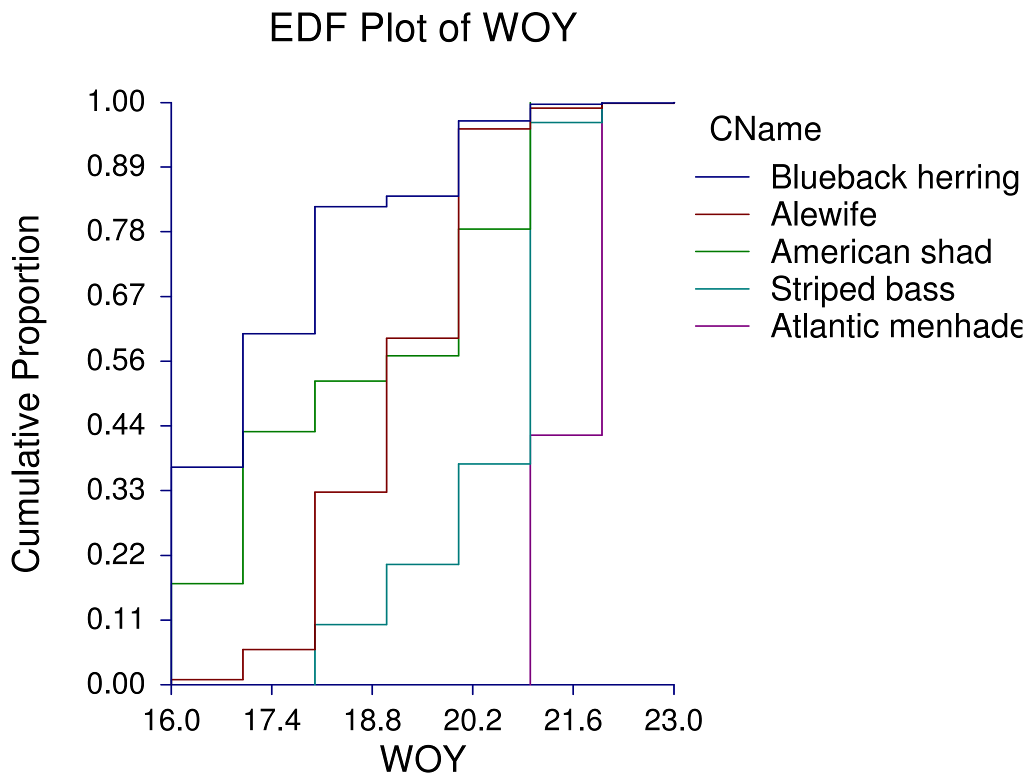
Confidence Limits Method = Linear (Greenwood).



Appendix C-7
Results of the Nondetect Analysis in NCSS 2007 to Derive the Cumulative Frequency Distribution for Fall Samples of Target Species

Nondetects Analysis Report
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Nondetects Variable = Censor. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).

Data Summary Section

Group	Type	Rows	Count	Minimum	Maximum
Alewife	Detected	31	2070	40	50
Alewife	Not Detected	0	0		
Alewife	Total	31	2070	40	50
American shad	Detected	30	216	40	50
American shad	Not Detected	0	0		
American shad	Total	30	216	40	50
Atlantic menhaden	Detected	9	16	41	50
Atlantic menhaden	Not Detected	0	0		
Atlantic menhaden	Total	9	16	41	50
Blueback herring	Detected	34	3490	40	50
Blueback herring	Not Detected	0	0		
Blueback herring	Total	34	3490	40	50
Striped bass	Detected	2	3	45	47
Striped bass	Not Detected	0	0		
Striped bass	Total	2	3	45	47

Data Summary Section: Response Quartiles

	Quartile	Estimate	Lower 95.0% C.L.	Upper 95.0% C.L.
Alewife	First (Q1)	41.000	41.000	41.000
Alewife	Median (Q2)	44.000	44.000	44.000
Alewife	Third (Q3)	46.000	46.000	46.000
American shad	First (Q1)	43.000	43.000	45.000
American shad	Median (Q2)	45.000	45.000	45.000
American shad	Third (Q3)	46.000	46.000	46.000
Atlantic menhaden	First (Q1)	41.000	47.000	41.000
Atlantic menhaden	Median (Q2)	42.000	47.000	47.000
Atlantic menhaden	Third (Q3)	47.000	42.000	48.000
Blueback herring	First (Q1)	44.000	44.000	45.000
Blueback herring	Median (Q2)	47.000	46.000	47.000
Blueback herring	Third (Q3)	47.000	47.000	47.000

Nondetects Analysis Report
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Database C:\DOCUMENTS AND SETTINGS\VW ... MFS\02232012 CFD\CFD FALL.S0
Response Variable = WOY
Nondetects Variable = Censor. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).

Data Summary Section: Response Quartiles

	Quartile	Estimate	Lower 95.0% C.L.	Upper 95.0% C.L.
Striped bass	First (Q1)	45.000	45.000	47.000
Striped bass	Median (Q2)	45.000	45.000	47.000
Striped bass	Third (Q3)	47.000	45.000	47.000

Logrank Tests Section
Hypotheses
H0: Distribution Functions are Equal Among Groups
HA: At Least One Group Distribution Functions Differs

Test Name	Chi-Square	DF	Prob Level	Reject H0 (Alpha = 0.05)
Logrank	336.345	4	0.0000	Yes
Gehan-Wilcoxon	325.940	4	0.0000	Yes
Tarone-Ware	345.576	4	0.0000	Yes
Peto-Peto	173.855	4	0.0000	Yes
Mod. Peto-Peto	173.851	4	0.0000	Yes

Multiple Pairwise Tests Section
Hypotheses
H0: Distribution Functions are Equal
HA: Distribution Functions Differ

Group Pair Tested: Alewife vs. American shad
Bonferroni

Test Name	Chi-Square	DF	Prob Level	Reject H0 (Alpha =0.05)	Adjusted Prob Level	Reject H0 (Alpha =0.05)
Logrank	48.399	1	0.0000	Yes	0.0000	Yes
Gehan-Wilcoxon	24.157	1	0.0000	Yes	0.0000	Yes
Tarone-Ware	35.605	1	0.0000	Yes	0.0000	Yes
Peto-Peto	25.040	1	0.0000	Yes	0.0000	Yes
Mod. Peto-Peto	25.025	1	0.0000	Yes	0.0000	Yes

Group Pair Tested: Alewife vs. Atlantic menhaden
Bonferroni

Test Name	Chi-Square	DF	Prob Level	Reject H0 (Alpha =0.05)	Adjusted Prob Level	Reject H0 (Alpha =0.05)
Logrank	0.050	1	0.8239	No	1.0000	No
Gehan-Wilcoxon	0.079	1	0.7787	No	1.0000	No
Tarone-Ware	0.073	1	0.7867	No	1.0000	No
Peto-Peto	0.082	1	0.7743	No	1.0000	No
Mod. Peto-Peto	0.082	1	0.7744	No	1.0000	No

Group Pair Tested: Alewife vs. Blueback herring
Bonferroni

Test Name	Chi-Square	DF	Prob Level	Reject H0 (Alpha =0.05)	Adjusted Prob Level	Reject H0 (Alpha =0.05)
Logrank	322.898	1	0.0000	Yes	0.0000	Yes
Gehan-Wilcoxon	313.620	1	0.0000	Yes	0.0000	Yes
Tarone-Ware	333.836	1	0.0000	Yes	0.0000	Yes
Peto-Peto	161.626	1	0.0000	Yes	0.0000	Yes
Mod. Peto-Peto	161.621	1	0.0000	Yes	0.0000	Yes

Group Pair Tested: Alewife vs. Striped bass
Bonferroni

Test Name	Chi-Square	DF	Prob Level	Reject H0 (Alpha =0.05)	Adjusted Prob Level	Reject H0 (Alpha =0.05)
Logrank	2.788	1	0.0950	No	0.9496	No
Gehan-Wilcoxon	1.292	1	0.2557	No	1.0000	No
Tarone-Ware	1.947	1	0.1629	No	1.0000	No
Peto-Peto	1.647	1	0.1994	No	1.0000	No
Mod. Peto-Peto	1.646	1	0.1995	No	1.0000	No

Group Pair Tested: American shad vs. Atlantic menhaden
Bonferroni

Test Name	Chi-Square	DF	Prob Level	Reject H0 (Alpha =0.05)	Adjusted Prob Level	Reject H0 (Alpha =0.05)
Logrank	4.086	1	0.0432	Yes	0.4324	No
Gehan-Wilcoxon	1.841	1	0.1748	No	1.0000	No
Tarone-Ware	3.409	1	0.0648	No	0.6483	No
Peto-Peto	0.361	1	0.5481	No	1.0000	No
Mod. Peto-Peto	0.352	1	0.5527	No	1.0000	No

Group Pair Tested: American shad vs. Blueback herring
Bonferroni

Test Name	Chi-Square	DF	Prob Level	Reject H0 (Alpha =0.05)	Adjusted Prob Level	Reject H0 (Alpha =0.05)
Logrank	1.422	1	0.2330	No	1.0000	No
Gehan-Wilcoxon	24.633	1	0.0000	Yes	0.0000	Yes
Tarone-Ware	11.458	1	0.0007	Yes	0.0071	Yes
Peto-Peto	7.375	1	0.0066	Yes	0.0662	No
Mod. Peto-Peto	7.383	1	0.0066	Yes	0.0658	No

Group Pair Tested: American shad vs. Striped bass
Bonferroni

Test Name	Chi-Square	DF	Prob Level	Reject H0 (Alpha =0.05)	Adjusted Prob Level	Reject H0 (Alpha =0.05)
Logrank	0.556	1	0.4559	No	1.0000	No
Gehan-Wilcoxon	0.275	1	0.6000	No	1.0000	No
Tarone-Ware	0.400	1	0.5272	No	1.0000	No
Peto-Peto	0.170	1	0.6802	No	1.0000	No
Mod. Peto-Peto	0.169	1	0.6810	No	1.0000	No

Group Pair Tested: Atlantic menhaden vs. Blueback herring

Test Name	Chi-Square	DF	Prob Level	Reject H0 (Alpha =0.05)	Bonferroni Adjusted Prob Level	Reject H0 (Alpha =0.05)
Logrank	4.945	1	0.0262	Yes	0.2617	No
Gehan-Wilcoxon	2.854	1	0.0911	No	0.9115	No
Tarone-Ware	4.068	1	0.0437	Yes	0.4371	No
Peto-Peto	1.406	1	0.2357	No	1.0000	No
Mod. Peto-Peto	1.405	1	0.2359	No	1.0000	No

Group Pair Tested: Atlantic menhaden vs. Striped bass

Test Name	Chi-Square	DF	Prob Level	Reject H0 (Alpha =0.05)	Bonferroni Adjusted Prob Level	Reject H0 (Alpha =0.05)
Logrank	1.296	1	0.2550	No	1.0000	No
Gehan-Wilcoxon	0.551	1	0.4578	No	1.0000	No
Tarone-Ware	0.876	1	0.3492	No	1.0000	No
Peto-Peto	0.383	1	0.5362	No	1.0000	No
Mod. Peto-Peto	0.354	1	0.5519	No	1.0000	No

Group Pair Tested: Blueback herring vs. Striped bass

Test Name	Chi-Square	DF	Prob Level	Reject H0 (Alpha =0.05)	Bonferroni Adjusted Prob Level	Reject H0 (Alpha =0.05)
Logrank	0.055	1	0.8138	No	1.0000	No
Gehan-Wilcoxon	0.041	1	0.8404	No	1.0000	No
Tarone-Ware	0.000	1	0.9968	No	1.0000	No
Peto-Peto	0.115	1	0.7342	No	1.0000	No
Mod. Peto-Peto	0.115	1	0.7341	No	1.0000	No

Notes:
The most commonly used test is the Logrank test.

Nondetects Analysis Report
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Nondetects Variable = Censor. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).

Logrank Test Detail Section

Group	Z-Value	Standard Error	Standardized Z-Value
Alewife	-533.851	29.452	-18.126
American shad	19.453	11.518	1.689
Atlantic menhaden	-4.963	3.502	-1.417
Blueback herring	518.512	29.783	17.410
Striped bass	0.849	1.289	0.659

Probability Level was 0.0000

Gehan-Wilcoxon Test Detail Section

Group	Z-Value	Standard Error	Standardized Z-Value
Alewife	-2102521.000	120242.879	-17.486
American shad	-61785.000	48748.680	-1.267
Atlantic menhaden	-15082.000	13366.809	-1.128
Blueback herring	2177863.000	122622.647	17.761
Striped bass	1525.000	5879.789	0.259

Probability Level was 0.0000

Tarone-Ware Test Detail Section

Group	Z-Value	Standard Error	Standardized Z-Value
Alewife	-33128.961	1817.607	-18.227
American shad	64.958	729.788	0.089
Atlantic menhaden	-274.066	206.802	-1.325
Blueback herring	33299.556	1847.378	18.025
Striped bass	38.512	85.895	0.448

Probability Level was 0.0000

Peto-Peto Test Detail Section

Group	Z-Value	Standard Error	Standardized Z-Value
Alewife	-214.124	16.739	-12.792
American shad	-4.530	6.783	-0.668
Atlantic menhaden	-2.038	1.859	-1.097
Blueback herring	220.603	17.064	12.928
Striped bass	0.089	0.813	0.110

Probability Level was 0.0000

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Confidence Limits Method = Linear (Greenwood).

Mod. Peto-Peto Test Detail Section

Group	Z-Value	Standard Error	Standardized Z-Value
Alewife	-214.071	16.735	-12.792
American shad	-4.534	6.782	-0.669
Atlantic menhaden	-2.038	1.858	-1.097
Blueback herring	220.554	17.060	12.928
Striped bass	0.089	0.813	0.109

Probability Level was 0.0000

Specific Response Detail: Estimated Cumulative Proportion

CName	Response (R)	Cumulative Proportion P(R)	Standard Error of P(R)	Lower 95.0% C.L. for P(R)	Upper 95.0% C.L. for P(R)	Cum. Count
Alewife	5.000					0
American shad	5.000					0
Atlantic menhaden	5.000					0
Blueback herring	5.000					0
Striped bass	5.000					0
Alewife	10.000					0
American shad	10.000					0
Atlantic menhaden	10.000					0
Blueback herring	10.000					0
Striped bass	10.000					0
Alewife	15.000					0
American shad	15.000					0
Atlantic menhaden	15.000					0
Blueback herring	15.000					0
Striped bass	15.000					0
Alewife	20.000					0
American shad	20.000					0
Atlantic menhaden	20.000					0
Blueback herring	20.000					0
Striped bass	20.000					0
Alewife	25.000					0
American shad	25.000					0
Atlantic menhaden	25.000					0
Blueback herring	25.000					0
Striped bass	25.000					0

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Confidence Limits Method = Linear (Greenwood).

Specific Response Detail: Estimated Cumulative Proportion

CName	Response (R)	Cumulative Proportion P(R)	Standard Error of P(R)	Lower 95.0% C.L. for P(R)	Upper 95.0% C.L. for P(R)	Cum. Count
Alewife	30.000					0
American shad	30.000					0
Atlantic menhaden	30.000					0
Blueback herring	30.000					0
Striped bass	30.000					0
Alewife	35.000					0
American shad	35.000					0
Atlantic menhaden	35.000					0
Blueback herring	35.000					0
Striped bass	35.000					0
Alewife	40.000	0.0000				164
American shad	40.000	0.0000				9
Atlantic menhaden	40.000					0
Blueback herring	40.000	0.0000				36
Striped bass	40.000					0
Alewife	45.000	0.5807	0.0108	0.5594	0.6019	1326
American shad	45.000	0.3009	0.0312	0.2398	0.3621	126
Atlantic menhaden	45.000	0.5625	0.1240	0.3194	0.8056	10
Blueback herring	45.000	0.2585	0.0074	0.2439	0.2730	1535
Striped bass	45.000					2
Alewife	50.000	0.8860	0.0070	0.8723	0.8997	2070
American shad	50.000	0.9444	0.0156	0.9139	0.9750	216
Atlantic menhaden	50.000	0.9375	0.0605	0.8189	1.0000	16
Blueback herring	50.000	0.9103	0.0048	0.9008	0.9198	3490
Striped bass	50.000	1.0000	0.0000	1.0000	1.0000	3

Nondetects Analysis Report
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Nondetects Variable = Censor. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).

Quantiles of Responses

CName	Proportion of Response	Estimated Quantile	Lower 95.0% C.L. Quantile	Upper 95.0% C.L. Quantile
Alewife	0.0500	40.000	50.000	40.000
American shad	0.0500	41.000	50.000	42.000
Atlantic menhaden	0.0500	41.000	47.000	41.000
Blueback herring	0.0500	41.000	41.000	41.000
Striped bass	0.0500	45.000	45.000	45.000
Alewife	0.1000	41.000	41.000	41.000
American shad	0.1000	42.000	41.000	43.000
Atlantic menhaden	0.1000	41.000	47.000	41.000
Blueback herring	0.1000	41.000	41.000	41.000
Striped bass	0.1000	45.000	45.000	45.000
Alewife	0.1500	41.000	41.000	41.000
American shad	0.1500	43.000	42.000	43.000
Atlantic menhaden	0.1500	41.000	47.000	41.000
Blueback herring	0.1500	41.000	41.000	41.000
Striped bass	0.1500	45.000	45.000	47.000
Alewife	0.2000	41.000	41.000	41.000
American shad	0.2000	43.000	43.000	43.000
Atlantic menhaden	0.2000	41.000	47.000	41.000
Blueback herring	0.2000	44.000	43.000	44.000
Striped bass	0.2000	45.000	45.000	47.000
Alewife	0.2500	41.000	41.000	41.000
American shad	0.2500	43.000	43.000	45.000
Atlantic menhaden	0.2500	41.000	47.000	41.000
Blueback herring	0.2500	44.000	44.000	45.000
Striped bass	0.2500	45.000	45.000	47.000
Alewife	0.3000	41.000	41.000	41.000
American shad	0.3000	44.000	43.000	45.000
Atlantic menhaden	0.3000	41.000	47.000	42.000
Blueback herring	0.3000	45.000	45.000	45.000
Striped bass	0.3000	45.000	45.000	47.000

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Response Variable = WOY
Nondetects Variable = Censor. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).

Quantiles of Responses

CName	Proportion of Response	Estimated Quantile	Lower 95.0% C.L. Quantile	Upper 95.0% C.L. Quantile
Alewife	0.3500	42.000	41.000	42.000
American shad	0.3500	45.000	44.000	45.000
Atlantic menhaden	0.3500	41.000	47.000	45.000
Blueback herring	0.3500	45.000	45.000	45.000
Striped bass	0.3500	45.000	45.000	47.000
Alewife	0.4000	43.000	42.000	43.000
American shad	0.4000	45.000	45.000	45.000
Atlantic menhaden	0.4000	41.000	47.000	47.000
Blueback herring	0.4000	45.000	45.000	45.000
Striped bass	0.4000	45.000	45.000	47.000
Alewife	0.4500	43.000	43.000	44.000
American shad	0.4500	45.000	45.000	45.000
Atlantic menhaden	0.4500	41.000	47.000	47.000
Blueback herring	0.4500	46.000	45.000	46.000
Striped bass	0.4500	45.000	45.000	47.000
Alewife	0.5000	44.000	44.000	44.000
American shad	0.5000	45.000	45.000	45.000
Atlantic menhaden	0.5000	42.000	47.000	47.000
Blueback herring	0.5000	47.000	46.000	47.000
Striped bass	0.5000	45.000	45.000	47.000
Alewife	0.5500	44.000	44.000	44.000
American shad	0.5500	45.000	45.000	46.000
Atlantic menhaden	0.5500	42.000	47.000	47.000
Blueback herring	0.5500	47.000	47.000	47.000
Striped bass	0.5500	45.000	45.000	47.000
Alewife	0.6000	45.000	44.000	45.000
American shad	0.6000	46.000	45.000	46.000
Atlantic menhaden	0.6000	45.000	47.000	47.000
Blueback herring	0.6000	47.000	47.000	47.000
Striped bass	0.6000	45.000	45.000	47.000

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Database C:\DOCUMENTS AND SETTINGS\VW ... MFS\02232012 CFD\CFD FALL.S0
Response Variable = WOY
Nondetects Variable = Censor. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).

Quantiles of Responses

CName	Proportion of Response	Estimated Quantile	Lower 95.0% C.L. Quantile	Upper 95.0% C.L. Quantile
Alewife	0.6500	46.000	45.000	46.000
American shad	0.6500	46.000	46.000	46.000
Atlantic menhaden	0.6500	47.000	47.000	48.000
Blueback herring	0.6500	47.000	47.000	47.000
Striped bass	0.6500	45.000	45.000	47.000
Alewife	0.7000	46.000	46.000	46.000
American shad	0.7000	46.000	46.000	46.000
Atlantic menhaden	0.7000	47.000	47.000	48.000
Blueback herring	0.7000	47.000	47.000	47.000
Striped bass	0.7000	47.000	45.000	47.000
Alewife	0.7500	46.000	46.000	46.000
American shad	0.7500	46.000	46.000	46.000
Atlantic menhaden	0.7500	47.000	42.000	48.000
Blueback herring	0.7500	47.000	47.000	47.000
Striped bass	0.7500	47.000	45.000	47.000
Alewife	0.8000	48.000	47.000	48.000
American shad	0.8000	46.000	46.000	47.000
Atlantic menhaden	0.8000	47.000	42.000	48.000
Blueback herring	0.8000	47.000	47.000	47.000
Striped bass	0.8000	47.000	45.000	47.000
Alewife	0.8500	48.000	48.000	48.000
American shad	0.8500	47.000	46.000	47.000
Atlantic menhaden	0.8500	48.000	45.000	50.000
Blueback herring	0.8500	47.000	47.000	47.000
Striped bass	0.8500	47.000	45.000	47.000
Alewife	0.9000	50.000		50.000
American shad	0.9000	47.000	47.000	48.000
Atlantic menhaden	0.9000	48.000	47.000	50.000
Blueback herring	0.9000	47.000	47.000	48.000
Striped bass	0.9000	47.000	45.000	47.000

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Response Variable = WOY
Nondetects Variable = Censor. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).

Quantiles of Responses

CName	Proportion of Response	Estimated Quantile	Lower 95.0% C.L. Quantile	Upper 95.0% C.L. Quantile
Alewife	0.9500	50.000		50.000
American shad	0.9500	50.000	48.000	50.000
Atlantic menhaden	0.9500	50.000	47.000	50.000
Blueback herring	0.9500	50.000		50.000
Striped bass	0.9500	47.000	45.000	47.000

Response Detail for CName = Alewife

Response (R)	Cumulative Proportion P(R)	Standard Error of P(R)	Lower 95.0% C.L. for P(R)	Upper 95.0% C.L. for P(R)	Cum. Count	Count
40.000	0.0000				164	164
41.000	0.0792	0.0059	0.0676	0.0909	720	556
42.000	0.3478	0.0105	0.3273	0.3683	820	100
43.000	0.3961	0.0107	0.3751	0.4172	947	127
44.000	0.4575	0.0109	0.4360	0.4789	1202	255
45.000	0.5807	0.0108	0.5594	0.6019	1326	124
46.000	0.6406	0.0105	0.6199	0.6613	1618	292
47.000	0.7816	0.0091	0.7638	0.7994	1646	28
48.000	0.7952	0.0089	0.7778	0.8126	1834	188
50.000	0.8860	0.0070	0.8723	0.8997	2070	236

Response Detail for CName = American shad

Response (R)	Cumulative Proportion P(R)	Standard Error of P(R)	Lower 95.0% C.L. for P(R)	Upper 95.0% C.L. for P(R)	Cum. Count	Count
40.000	0.0000				9	9
41.000	0.0417	0.0136	0.0150	0.0683	17	8
42.000	0.0787	0.0183	0.0428	0.1146	26	9
43.000	0.1204	0.0221	0.0770	0.1638	58	32
44.000	0.2685	0.0302	0.2094	0.3276	65	7
45.000	0.3009	0.0312	0.2398	0.3621	126	61
46.000	0.5833	0.0335	0.5176	0.6491	180	54
47.000	0.8333	0.0254	0.7836	0.8830	195	15
48.000	0.9028	0.0202	0.8633	0.9423	204	9
50.000	0.9444	0.0156	0.9139	0.9750	216	12

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Response Variable = WOY
Nondetects Variable = Censor. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).

Response Detail for CName = Atlantic menhaden

Response (R)	Cumulative Proportion P(R)	Standard Error of P(R)	Lower 95.0% C.L. for P(R)	Upper 95.0% C.L. for P(R)	Cum. Count	Count
41.000	0.0000				8	8
42.000	0.5000	0.1250	0.2550	0.7450	9	1
45.000	0.5625	0.1240	0.3194	0.8056	10	1
47.000	0.6250	0.1210	0.3878	0.8622	13	3
48.000	0.8125	0.0976	0.6213	1.0000	15	2
50.000	0.9375	0.0605	0.8189	1.0000	16	1

Response Detail for CName = Blueback herring

Response (R)	Cumulative Proportion P(R)	Standard Error of P(R)	Lower 95.0% C.L. for P(R)	Upper 95.0% C.L. for P(R)	Cum. Count	Count
40.000	0.0000				36	36
41.000	0.0103	0.0017	0.0070	0.0137	603	567
42.000	0.1728	0.0064	0.1602	0.1853	608	5
43.000	0.1742	0.0064	0.1616	0.1868	689	81
44.000	0.1974	0.0067	0.1842	0.2106	902	213
45.000	0.2585	0.0074	0.2439	0.2730	1535	633
46.000	0.4398	0.0084	0.4234	0.4563	1730	195
47.000	0.4957	0.0085	0.4791	0.5123	3159	1429
48.000	0.9052	0.0050	0.8954	0.9149	3177	18
50.000	0.9103	0.0048	0.9008	0.9198	3490	313

Response Detail for CName = Striped bass

Response (R)	Cumulative Proportion P(R)	Standard Error of P(R)	Lower 95.0% C.L. for P(R)	Upper 95.0% C.L. for P(R)	Cum. Count	Count
45.000	0.0000				2	2
47.000	0.6667	0.2722	0.1332	1.0000	3	1

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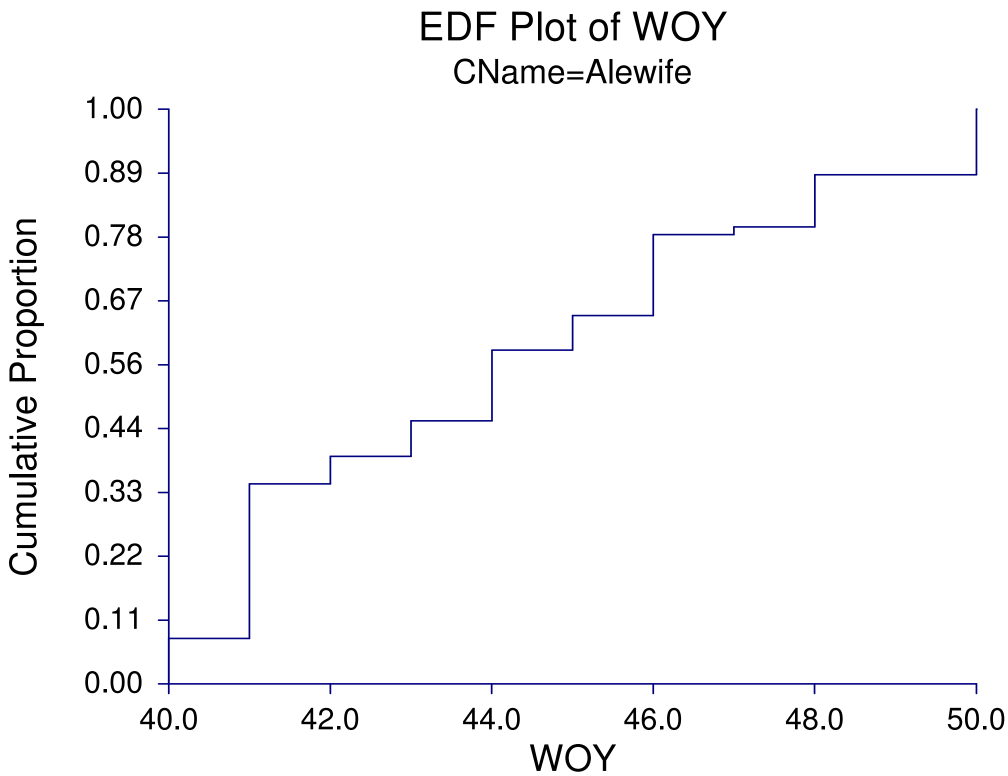
Nondetects Variable = Censor. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).

Plots Section



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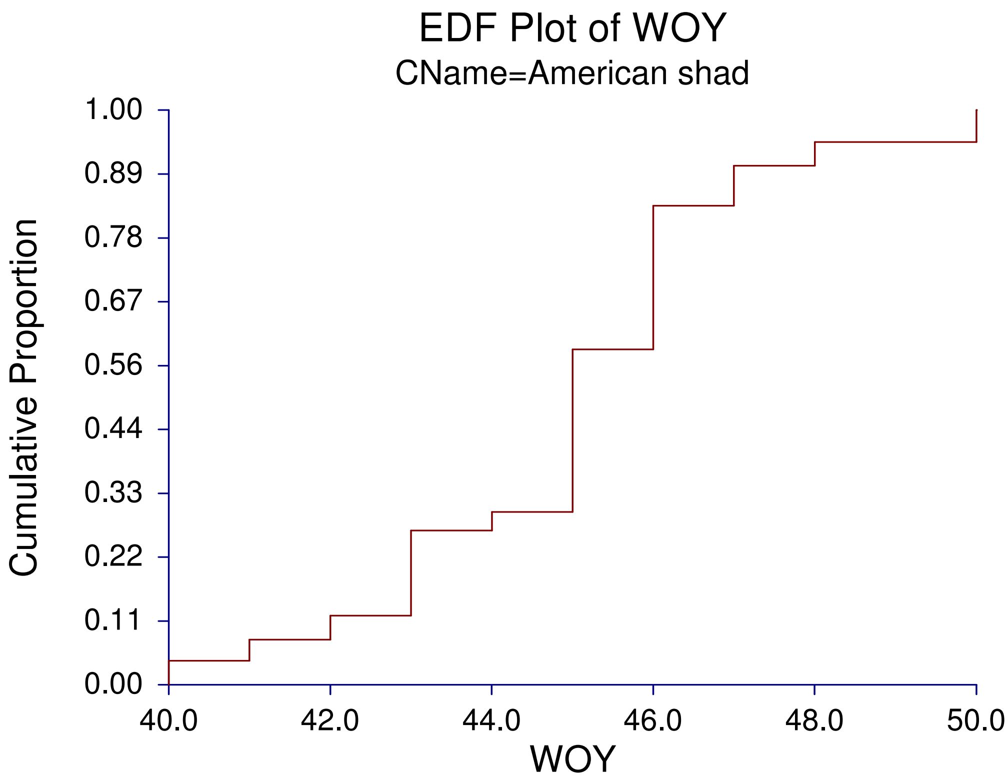

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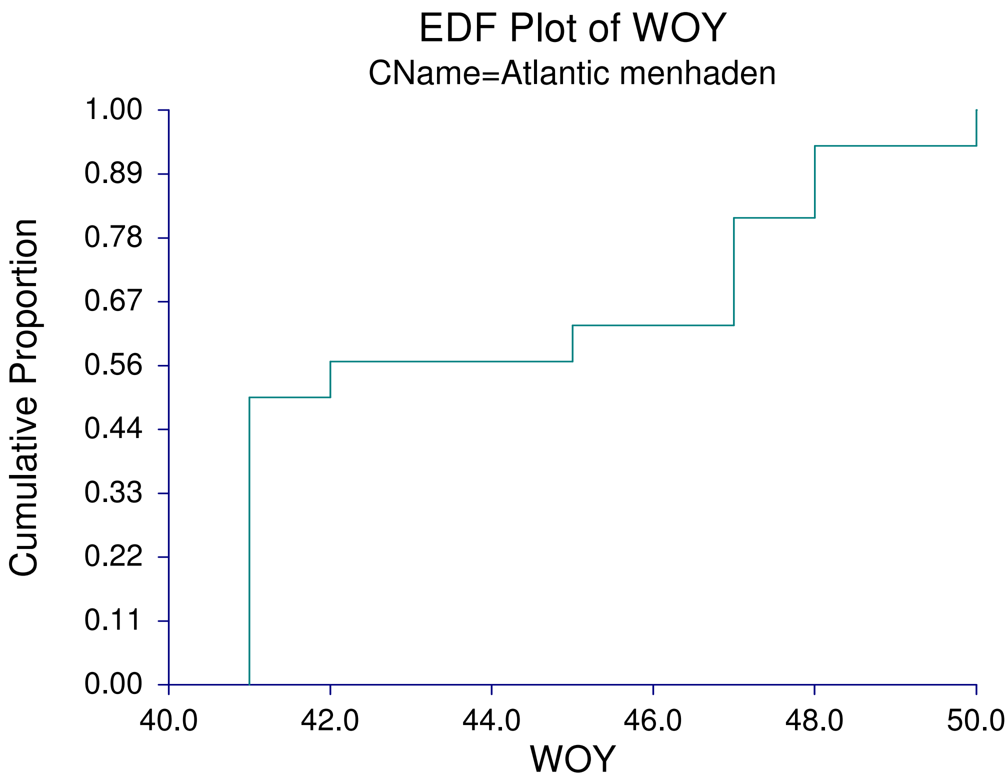

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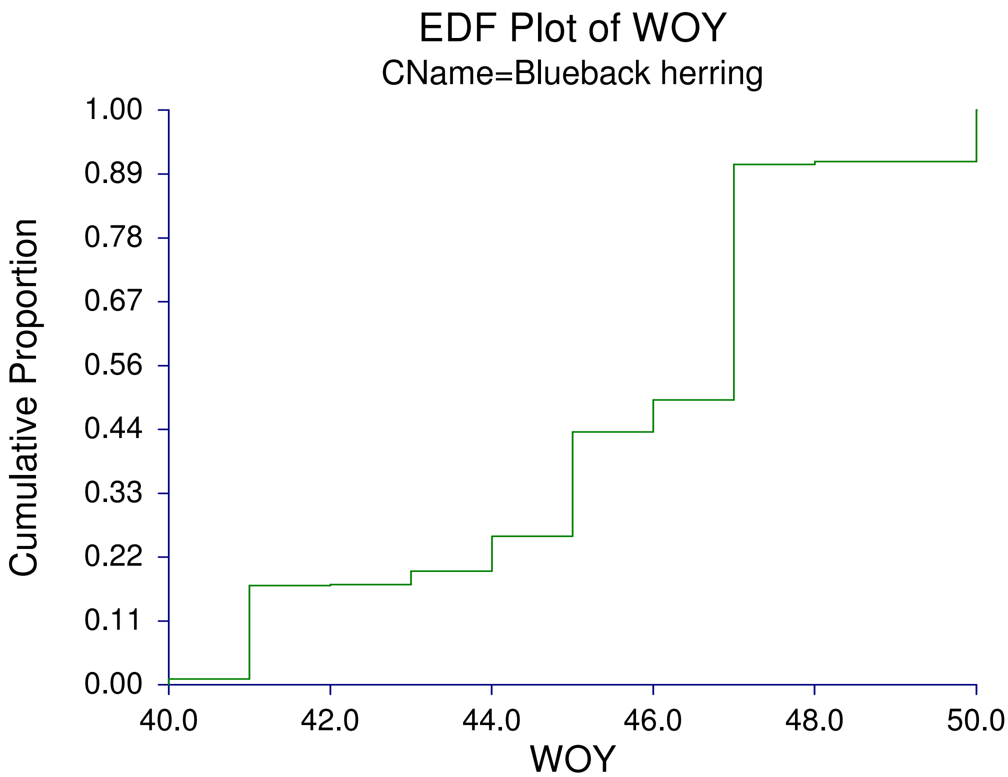
Confidence Limits Method = Linear (Greenwood).



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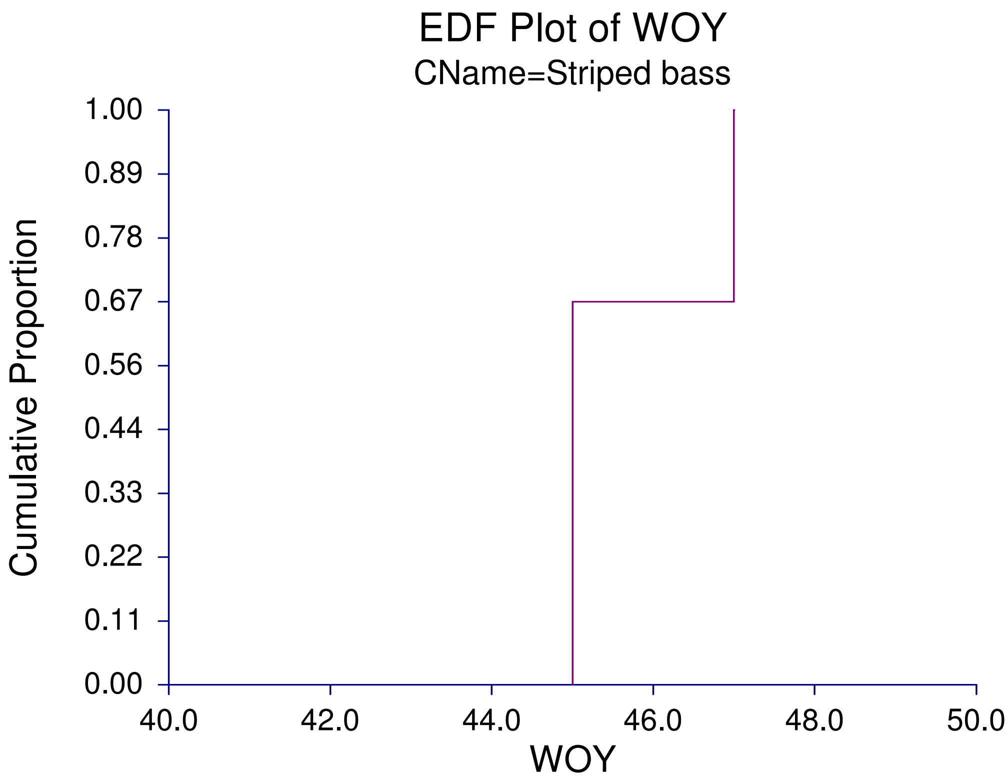
Confidence Limits Method = Linear (Greenwood).



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Response Variable = WOY
Nondetects Variable = Censor. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).