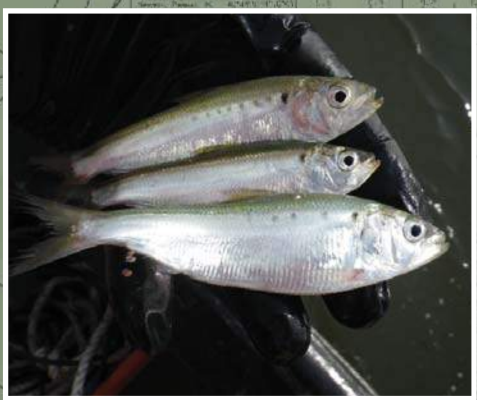
US Army Corps of Engineers®
New York District

NEW YORK AND NEW JERSEY HARBOR DEEPENING PROJECT

2013 Migratory Finfish Report



FINAL REPORT

October 2014

NEW YORK/NEW JERSEY HARBOR DEEPENING PROJECT

2013

MIGRATORY FINFISH REPORT

Final Report

October 2014

Prepared for:

U.S. Army Corps of Engineers – New York District

Jacob K. Javits Federal Building
26 Federal Plaza
New York, New York 10278

TABLE OF CONTENTS

1.0 INTRODUCTION 1
1.1 Background 1
1.2 Study Objectives 3
1.3 Target Species Life History 4
1.3.1 Alewife 4
1.3.2 Blueback herring 5
1.3.3 American shad 6
1.3.4 Atlantic menhaden 7
1.3.5 Striped bass 8
1.4 Overview of 2006 Migratory Finfish Survey 9
1.5 Overview of 2011 Migratory Finfish Survey 11
1.6 Overview of 2012 Migratory Finfish Survey 12
1.7 Report Organization – 2013 Migratory Finfish Survey 14
2.0 METHODS 15
2.1 Study Areas and Sampling Locations 15
2.1.1 Arthur Kill and Kill Van Kull (AK/KVK) 15
2.1.2 Newark Bay (NB) 16
2.1.3 Upper Bay (UB) 16
2.1.4 Lower Bay (LB) 16
2.2 Water Quality 17
2.3 Finfish Sampling 17
2.4 Data Analysis 19
2.4.1 Catch per Unit Effort 19
2.4.2 Statistical Methods 19
3.0 RESULTS 22
3.1 Water Quality 22
3.2 Finfish Descriptive Findings 22
3.2.1 Alewife 24
3.2.2 American shad 26
3.2.3 Atlantic menhaden 27
3.2.4 Blueback herring 28
3.2.5 Striped bass 32
3.3 Timing of Migration 32
4.0 DISCUSSION 34
4.1 Spatial and Temporal Patterns 34
4.2 Dredging and Migratory Finfish 38
5.0 SUMMARY 41
6.0 LITERATURE CITED 43

APPENDICES

A Water Quality Data by Date and Station Collected During the 2013 Migratory Finfish Survey. A-1

B Mid-water Trawl Catch per Unit Effort by Date and Station Collected During the 2013 Migratory Finfish Survey B-1

C Output from Statistical Analyses for the 2013 Migratory Finfish Sampling Program C-1

D Near-Bottom Mid-water Trawl Collection Results……………………………..D-1

LIST OF TABLES

1-1 Observed seasonal patterns of target species collected during the 2006, 2011 and 2012 Migratory Finfish Sampling Programs.

2-1 Description of mid-water stations sampled during the 2006 and 2011-2013 Migratory Finfish Sampling Programs.

2-2 Water quality parameters and meter specifications for water quality measurements taken during the 2006 and 2011-2013 Migratory Finfish Sampling Programs.

2-3 Specifications of the 18-ft mid-water trawl used to collect finfish during the 2006 and 2011-2013 Migratory Finfish Sampling Programs.

3-1 Number of valid samples collected per sample week and season during the 2013 Migratory Finfish Sampling Program.

3-2 Checklist of finfish species (common and scientific names) collected in mid-water trawl samples during the 2006 and 2011-2013 Migratory Finfish Sampling Programs.

3-3 Total number of finfish collected by species each month in mid-water trawl samples during the 2013 Migratory Finfish Sampling Program.

3-4 Average mid-water trawl CPUE (± 1 standard error) by species for all channel and non-channel stations in the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB), and Lower Bay (LB) during the 2013 Migratory Finfish Sampling Program.

3-5 Summary of significant differences among target species Cumulative Frequency Distributions during spring for the 2013 Migratory Finfish Sampling Program.

3-6 Summary of significant differences among target species Cumulative Frequency Distributions during fall for the 2013 Migratory Finfish Sampling Program.

4-1 Relevant studies with migratory finfish collections conducted in the Hudson-Raritan Estuary.

4-2 Summary of harborwide Water Quality/Total Suspended Solids (WQ/TSS) monitoring surveys conducted by USACE-New York District, 2001-2013.

LIST OF FIGURES

2-1 2006 and 2011-2013 Migratory Finfish Sampling Program mid-water trawl locations.

3-1a Average weekly water quality data by region during the 2013 Migratory Finfish Sampling Program.

3-1b Mid-water temperatures (average, maximum, minimum) by week for each region during the 2013 Migratory Finfish Sampling Program.

3-2 Average daily water and air temperatures during 2013 from NOAA water quality buoys at three locations in NY/NJ Harbor.

3-3 Average weekly alewife mid-water trawl CPUE at channel and non-channel stations, and average weekly mid-water temperature in the Arthur Kill/Kill Van Kull, Newark Bay, Upper Bay, and Lower Bay during the 2013 Migratory Finfish Sampling Program.

3-4a Total station CPUE (fish/10 min. tow) of alewife during spring for the 2013 Migratory Finfish Sampling Program.

3-4b Total station CPUE (fish/10 min. tow) of alewife during fall for the 2013 Migratory Finfish Sampling Program.

3-5 Length frequency distribution of alewife in total length (TL) 10 mm intervals by season and study area, 2013 Migratory Finfish Sampling Program.

3-6 Average weekly American shad mid-water trawl CPUE at channel and non-channel stations, and average weekly mid-water temperature for the Arthur Kill/Kill Van Kull, Newark Bay, Upper Bay, and Lower Bay during the 2013 Migratory Finfish Sampling Program.

3-7a Total station CPUE (fish/10 min tow) of American shad during spring for the 2013 Migratory Finfish Sampling Program.

3-7b Total station CPUE (fish/10 min tow) of American shad during fall for the 2013 Migratory Finfish Sampling Program.

3-8 Length frequency distribution of American shad in total length 10 mm intervals by season and study area, 2013 Migratory Finfish Sampling Program.

3-9 Average weekly Atlantic menhaden mid-water trawl CPUE at channel and non-channel stations, and average weekly mid-water temperature in the Arthur Kill/Kill Van Kull, Newark Bay, Upper Bay, and Lower Bay during the 2013 Migratory Finfish Sampling Program.

3-10a Total station CPUE (fish/10 min tow) of Atlantic menhaden during spring for the 2013 Migratory Finfish Sampling Program.

LIST OF FIGURES

3-10b Total station CPUE (fish/10 min tow) of Atlantic menhaden during fall for the 2013 Migratory Finfish Sampling Program.

3-11 Length frequency distribution of Atlantic menhaden in total length (TL) 10 mm intervals by season and study area, 2013 Migratory Finfish Sampling Program.

3-12 Average weekly blueback herring mid-water trawl CPUE at channel and non-channel stations, and average weekly mid-water temperature for the Arthur Kill/Kill Van Kull, Newark Bay, Upper Bay, and Lower Bay during the 2013 Migratory Finfish Sampling Program.

3-13a Total station CPUE (fish/10 min tow) of blueback herring during spring for the 2013 Migratory Finfish Sampling Program.

3-13b Total station CPUE (fish/10 min tow) of blueback herring during fall for the 2013 Migratory Finfish Sampling Program.

3-14 Length frequency distribution of blueback herring in total length (TL) 10 mm intervals by season and study area, 2013 Migratory Finfish Sampling Program.

3-15 Cumulative occurrence of target species for spring and fall sampling, 2013 Migratory Finfish Survey.

1.0 INTRODUCTION

1.1 BACKGROUND

The 2013 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 the timing and location 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 aspects of their use of the Harbor during migrations, such as seasonal timing and migratory pathways, have not previously been well studied. This program will provide data on target migratory species that can be evaluated in relation to management of dredging operations.

By traversing 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 (i.e. blueback herring, *Alosa aestivalis*, and alewife, *Alosa pseudoharengus*) and in some cases American shad (*Alosa sapidissima*) (NJDEP 2005). Almost a dozen species utilize the NY/NJ Harbor during some part of their annual migration (Waldman 2006). Additional species include the Atlantic sturgeon (*Acipenser oxyrinchus*), shortnose sturgeon (*Acipenser brevirostrum*), striped bass (*Morone saxatilis*), hickory shad (*Alosa mediocris*), rainbow smelt (*Osmerus mordax*), American eel (*Anguilla rostrata*), and Atlantic tomcod (*Microgadus tomcod*).

Finfish migrations in the NY/NJ Harbor are dominated by anadromous (marine species that spawn in freshwater) species that occur bi-annually in the Harbor during spring and fall. To characterize these migratory movements through the Harbor, five target species were selected. Four species, as identified by National Marine Fisheries Service (NMFS) and state agencies as migratory species of particular concern, were selected for the MFS program: American shad, blueback herring, alewife, and striped bass. Atlantic menhaden (*Brevoortia tyrannus*), while not an anadromous species, is a seasonal migrant and was added as a fifth target species due to its important role as a forage species (ASMFC 2012). All the target species have commercial and recreational value, and striped bass is a large predator in the Harbor that represents a higher trophic level than the other target species.

Recent evidence suggests that blueback herring and alewife (collectively referred to as river herring) stocks have declined in abundance since the 1970’s and there are currently restrictions in place to prevent excessive commercial harvest (ASMFC 2012). According to the most recent river herring stock assessment, populations have experienced a 93% decrease in commercial landings compared to the 1970’s. From 1999-2010, numbers of spawning river herring declined in ten out of seventeen rivers studied. Although some independent studies have recently shown increasing trends, overall, biological data suggest that river herring are experiencing a decline in mean length, mean length-at-age, and percent repeat spawners (ASMFC 2012). These characteristics are typical of declining populations undergoing increasing mortality (ASMFC 2012). At the beginning of 2013, both river herring species were candidates for federal listing. On August 12, 2013, however, based on the best scientific and commercial data available, NMFS determined that listing alewife and blueback herring as endangered or threatened under the Endangered Species Act was not warranted at this time.

Migratory fish are potentially vulnerable to habitat disturbance along migration corridors because their migratory behavior concentrates them in 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 NY/NJ Harbor to access upstream spawning areas and the annual juvenile production must pass through the NY/NJ Harbor as they emigrate to the marine environment. Timing and duration of passage within the NY/NJ Harbor are influenced by the given species’ biology, environmental cues including temperature and river discharge, as well as the specific migratory pathway (e.g., spawning run travelled). Spawning runs to the Hudson River and its tributaries as well as the Hackensack and Passaic Rivers and the East River are of particular importance because access to these waterbodies requires passage through navigation channels and other areas within the NY/NJ Harbor complex.

In the NY/NJ HDP, seasonal dredging restrictions for finfish have been instituted primarily to protect essential fish habitat, specifically spawning and nursery habitat for winter flounder (USACE-NYD 2010, Wilber *et al.* 2013). However, regional concerns have become increasingly focused on migratory finfish stocks. Developing an understanding of where migratory pathways occur and the timing of peak seasonal use (temporal and spatial patterns) can improve effective management of dredging activities within the NY/NJ Harbor while protecting these resources. For example, knowledge of species-specific depth preferences during migration, rate of passage, and whether their abundances are concentrated in shoals or channels will influence their potential exposure to dredging activities.

The 2013 MFS supplements an initial study performed during 2006 and follow-up studies in 2011 and 2012. The 2006 MFS included spring and fall sampling using mid-water and bottom trawls within the NY/NJ Harbor. The 2011 and 2012 MFS consisted of spring, summer and fall sampling using only mid-water trawls within the Harbor. Data from the 2006 MFS indicated that, with the exception of striped bass, the target species were collected in greater abundances using the mid-water trawl gear type and exhibited distinct seasonal patterns in abundance. Therefore, preliminary findings from the 2006 MFS formed a basis for the sampling protocol used in the follow-up MFS programs of 2011 through 2013, in terms of timing and spatial coverage of stations.

1.2 STUDY OBJECTIVES

The objectives of the 2013 MFS Program were to:

1. Identify the major migratory pathways of the five target migratory species (four anadromous species and Atlantic menhaden) 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 the NY/NJ Harbor. Seasonal movements include both the upstream and downstream migrations of spawning adults and older juveniles and the downstream movement of young-of-year (YOY) juveniles.

This report focuses on the findings of the 2013 MFS Program and references the results of the 2006, 2011, and 2012 MFS Programs.

1.3 TARGET SPECIES LIFE HISTORY

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, an anadromous species, inhabits waters from the Gulf of Saint Lawrence to South Carolina, occurring primarily between the Gulf of Maine and the Chesapeake Bay. Adult alewives enter the NY/NJ Harbor between late-February and mid-March moving upstream to spawn in freshwater tributaries in relatively shallow water with slow currents (Schmidt *et al.* 1988, Everly and Boreman 1999). Alewives typically spawn three to four weeks before blueback herring (Loesch 1987 in ASMFC 2009), when water temperatures rise to approximately 10°C. In 2010, alewives entered tributary spawning streams of the Hudson River during early April when water temperatures were just above 10.6 °C (Kahnle and Hattala 2010). Post-spawning adults quickly return downstream (Collette and Klein-MacPhee 2002 in ASMFC 2009). There are at least 18 Hudson River tributaries with recently documented alewife spawning runs, including larger runs in Canterbury Brook, Middlehope Brook, Wappingers Creek, Black Creek, and Roundout Creek in the lower Hudson River and Coxsackie Creek, Vloman Kill, Moordener Kill, and Poesten Kill in the upper Hudson River (Schmidt and Lake 2000).

Alewife larvae and juveniles remain in their freshwater nurseries until late May or June before moving downstream as YOY into the lower estuary where they remain until moving into the ocean in November (Stone *et al.* 1994, Everly and Boreman 1999). 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).

Generally, female alewives are larger and heavier, and grow slightly faster than males of the same age (ASMFC 2012). Size and age at sexual maturity vary depending on the latitudinal location of their natal rivers. River herrings with a minimum total length of 170 millimeters (mm) in the Hudson River watershed are characterized as spawning adults (ASMFC 2012). The River Herring Stock Assessment reported that Hudson River alewives and blueback herring of both sexes have experienced significant decreases in mean length over time and currently range from 240-280 mm total length for spawning adults (ASMFC 2012). Mean total length of river herring sampled during 2004-2010 from the Hudson River were on average about 25-45 mm smaller than those species and sexes sampled prior to 1986 (ASMFC 2012). Age at maturity is often calculated based on the spawning marks left on the fish's scale, which are scar-like rings extending around the scale (like an annuli) that are formed during the spawning migration into fresh water where little or no food is eaten by adult fish (ASMFC 2012). In the Hudson River, alewives that previously spawned ranged in age from four to ten years during 1999-2001, while females ranged in age from five to ten years (ASMFC 2012).

1.3.2 Blueback 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).

Adult blueback herring enter the Hudson-Raritan Estuary in early March prior to their migration to spawning areas from May to July (Stone *et al.* 1994). Adult blueback herring swim at mid-water 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 that of alewife (Loesch 1987) and they prefer deep freshwater habitats with swift currents over hard gravel or sand substrates (Loesch and Lund 1977, Everly and Boreman 1999). After spawning, blueback herring move into the lower estuary and coastal ocean waters, although 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 the 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).

Blueback herring are typically smaller than alewife, but follow the same general pattern of sex-specific growth where females are larger, heavier, and grow slightly faster than males of the same age (ASMFC 2012). As stated above, the River Herring Stock Assessment reported significant decreases in mean length over time for the Hudson River, with adult river herring currently ranging from 240-280 mm total length (ASMFC 2012). In the Hudson River, blueback herring that previously spawned ranged in age from three to nine years based on available data (1989-1990, 1999-2001), while females that had previously spawned ranged in age from three to ten years (ASMFC 2012).

1.3.3 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 waters from Connecticut to North Carolina (Gusey 1981). Adult American shad spend most of their life at sea as a schooling fish with immature and adult fish traveling together. American shad adults are primarily found in the Hudson-Raritan estuary during their spawning runs, beginning as early as March and lasting as late as June. Post-spawning movements keep the adults in the estuary until September before they migrate back to marine waters (Talbot 1954, Able and Fahay 2010, ASMFC 2012). Stone *et al.* (1994) suggested that American shad could be found in the Harbor year-round.

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 yolk-sac and post-yolk-sac larvae are planktonic and are passively transported to lower reaches of the estuary where metamorphosis to the juvenile stage occurs. Juveniles remain in the lower estuary until the late fall or early winter before migrating to the sea (Everly and Boreman 1999). In the estuary, juvenile American shad are present in peak abundances from June to December (Stone *et al.* 1994). The YOY shad emigration occurs as a gradual seaward movement over several months, and is strongly dependent on age and size (Limburg 1996). They typically reach a length of approximately 75-100 mm (3-4 in) by the end of summer when they are leaving the Hudson River (Limburg 1996). When they reach sexual maturity at four to six 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 a long-term Hudson River survey conducted from 1980 to 2008 (Hattala and Kahnle 2009).

1.3.4 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. Adults are rare or absent from the estuary during December to March (Stone *et al.* 1994, Able and Fahay 2010). Adults can frequently move 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).

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 produce pelagic eggs. 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). Atlantic menhanden juveniles collected from the Narragansett Bay ranged from 25-38 mm total length, while sexually mature males ranged in size from 180-280 mm total length by age one and sexually mature females ranged in size from 195 to over 300 mm total length by age two and three (Gray 1984).

1.3.5 Striped bass

Striped bass 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 *et al.* 1990). Due to extensive polychlorinated biphenyls (PCB) contamination in the upper areas of the river, resulting in high concentrations 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 migrate seasonally between southern New Jersey 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 New York and New Jersey in March before entering estuaries (Able and Fahay 2010). Striped bass are demersal and may be present in the Hudson-Raritan Estuary all year with adults primarily occurring from early March through early September (spawning in fresh waters from late April to June followed by post-spawning movements). Striped bass move upstream and spawn in the Hudson River above the salt front (Secor and Houde 1995) during April and May (Waldman *et al.* 1990).

Spawning occurs in early spring at or near the water 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 larval 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 shoals (Cantelmo and Wahtola 1992).

1.4 OVERVIEW OF 2006 MIGRATORY FINFISH SURVEY

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 could potentially be exposed to dredging operations during navigation channel deepening and maintenance. 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 species were collected during the mid-water trawl surveys and 53 species were collected during the bottom trawl surveys. The five 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 juvenile alewives occurred in the NY/NJ Harbor primarily during early spring (peak catches in April) and were generally absent from the area during the summer and early fall. During the late fall (November), catches were comprised of YOY juveniles entering the NY/NJ Harbor from freshwater nursery areas as well as juveniles returning to the estuary from coastal waters. Alewives were collected in both bottom (n=11) and mid-water (n=35) trawls and were not collected in the majority of samples. Alewives were collected at sample depths ranging from 9 to 28 feet for mid-water trawls, with 82% (n=896) collected from 20 to 28 feet. Few alewives were collected from bottom trawls (n=39), at sample depths ranging from 39 to 60 feet.

Mid-water and bottom trawl collections indicated that American shad were present in NY/NJ Harbor during late fall (primarily November). American shad were not collected in mid-water trawls during June, August, September, and October, and were not collected in bottom trawls during June, August, and September (note: one June sample event and no July sample events). 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 present in NY/NJ Harbor during 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 present in NY/NJ Harbor during early spring (primarily April) and were generally absent from the area during June through October. They were present in lower numbers during the late fall (November), with a combination of YOY and returning juveniles occurring in the catches. There were no notable significant differences in catch per unit effort (CPUE) among study areas in 2006.

Bottom and mid-water trawl collections indicated that striped bass were present in NY/NJ Harbor during the late fall (November) and almost exclusively were using near bottom habitat. Striped bass CPUE was highest in Newark Bay, followed by the Arthur Kill/Kill Van Kull. Few were collected in the Lower Bay and none were collected in the Upper Bay.

1.5 OVERVIEW OF 2011 MIGRATORY FINFISH SURVEY

To build upon results of the 2006 survey, the 2011 MFS survey was designed to collect additional data on temporal and spatial distributions of the migratory target species such that their potential exposure to deepening and maintenance dredging operations could be better assessed. One week of exploratory mid-water trawls was conducted during the first week of April followed by full surveys at all selected stations during the remaining weeks of April, May, and the first week of June 2011. An additional two summer surveys were completed during the weeks of 11 July and 15 August. The fall migratory sampling began the week of 12 September and continued to the first week of December 2011. Twenty fixed station locations were sampled with mid-water trawls during 2011 (Figure 2-1, Table 2-1). 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).

A total of 69,705 finfish (40 species) were collected. All five target species were collected by the mid-water trawl. Blueback herring, alewife, and American shad ranked second, third, and fifth most abundant, respectively, in the total catch for the 2011 MFS program. The single most abundant species collected was bay anchovy (*Anchoa mitchilli*) and gizzard shad (*Dorosoma cepedianum*) ranked fourth. During April through December, months with the highest abundance coincided with months of 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).

Results of the 2011 MFS Program are consistent with the findings of the 2006 MFS survey. The migratory target species, particularly American shad and river herring, displayed distinct seasonal occurrences in the NY/NJ Harbor. Juveniles were found in the inner NY/NJ Harbor areas (not the Lower Bay) in the spring and all NY/NJ Harbor areas during fall.

Mid-water trawl collections indicated that alewives were present in NY/NJ Harbor during the spring (primarily April and May) and fall (October and November) and were generally absent from the area during the summer months. YOY juveniles entered the NY/NJ Harbor from freshwater nursery areas and juveniles returned from coastal waters largely via channels in 2011.

As observed in 2006, American shad were present in the NY/NJ Harbor during fall (October-November) and generally were absent throughout the rest of the sampling period. Highest CPUEs occurred in the non-channel locations of the Upper Bay during the 2011 sampling.

During 2011, Atlantic menhaden were not collected in great numbers throughout the survey. Highest abundances were observed during the fall months (October-December), but no CPUE exceeded 1.8 fish/10-minute tow. There were also no discernible patterns between station types among study areas.

Blueback herring were collected in high abundances during fall months, especially in the Upper Bay (September through December), but also were present throughout the NY/NJ Harbor during spring months. Summer months yielded very few catches. In the Upper and Lower Bays, collections were primarily made at non-channel stations.

Like Atlantic menhaden, striped bass were collected in relatively low numbers throughout the 2011 sampling effort, primarily in the Arthur Kill/Newark Bay portion of the harbor. CPUE peaked at 2.0 fish/10-minute tow in May in the Arthur Kill/Kill Van Kull region. This species was completely absent from the Lower Bay. All collections were made in channel stations.

1.6 OVERVIEW OF 2012 MIGRATORY FINFISH SURVEY

During the 2012 MFS, twenty fixed stations consistent with locations sampled in previous years were sampled with the mid-water trawl (Figure 2-1, Table 2-1). Of these stations, 17 were located in channel areas and 3 were in non-channel areas.

A total of 119,951 finfish (34 species) were collected. All five target species were collected by the mid-water trawl. Blueback herring, alewife, and American shad ranked second, fifth, and tenth most abundant, respectively, in the total catch for the 2012 MFS program. As in 2006 and 2011, the single most abundant species collected was bay anchovy. During April through December, months with the highest abundance coincided with months of highest species richness, which were October (n=31,234 finfish; 13 species), November (n=29,082 finfish; 13 species), and August (n=29,344 finfish; 12 species).

Results of the 2012 MFS Program are consistent with the findings of the 2006 and 2011 MFS surveys. The target species, particularly alewife and blueback herring, are characterized by distinct patterns of seasonal occurrence in the NY/NJ Harbor. Juveniles were present in the inner Harbor area (i.e., not the Lower Bay) in the spring, and are distributed throughout the NY/NJ Harbor during fall. An especially large out-migration of juvenile blueback herring (along with lesser numbers of other clupeids) was documented in fall 2012; this may have been influenced by the occurrence of Hurricane Sandy, which produced a large storm surge in the Harbor on October 29, 2012.

As in previous years, mid-water trawl collections indicated that alewives were present in NY/NJ Harbor during the spring (primarily April and May) and fall (October and November) and were generally absent from the area during the summer months. YOY juveniles entered the NY/NJ Harbor from freshwater nursery areas and juveniles returned from coastal waters largely via channels in 2012.

As observed in 2006 and 2011, American shad were present in the NY/NJ Harbor primarily during fall (October-November). Similar to 2011, highest CPUEs occurred in the non-channel locations of the Upper Bay during the 2012 sampling.

During 2012, Atlantic menhaden were collected in higher numbers than the previous year. Highest abundances were observed during the spring and fall months in Newark Bay and during fall in the Arthur Kill/Kill Van Kull areas, with peak CPUE's ranging from 9.5-15.0 fish/10-minute tow. Similar fish collections were recorded during the spring and fall in the Upper Bay as well during the 2012 MFS.

Similar to 2011, blueback herring were collected in high abundances during fall months especially in the Upper Bay (September through December), while spring numbers indicated the species was present, but not in high numbers. Summer months yielded very low catches. In the Upper and Lower Bays, collections were primarily made at non-channel stations.

Striped bass were collected in very low numbers throughout the 2012 sampling effort. Only three individuals were collected during the entire 2012 sampling effort. It is likely that mid-water trawls are not optimal gear for collection of striped bass due to their highly motile nature and strong affinity for submerged structures. In 2006, striped bass were primarily collected during bottom trawl sampling, not using mid-water trawls. Therefore, the 2012 results are not unexpected.

1.7 REPORT ORGANIZATION – 2013 MIGRATORY FINFISH SURVEY

For the purposes of this report, the finfish collected were classified into one of three groups: target migratory 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 highlight species that were identified by resource agencies as important and to consider the relative contribution of each species to the NY/NJ Harbor's finfish community. Data analyses and treatment in the discussion focus upon the 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. Section 3 presents the results of the mid-water trawl sampling program. Section 4 discusses finfish use of the NY/NJ Harbor in terms of seasonal distribution/movements and habitat use throughout the Harbor. Migratory finfish survey results are qualitatively discussed within the context of USACE-NYD's ongoing efforts to better understand potential impacts associated with exposure to total suspended solids (TSS) and underwater noise on fish behavior and migration within NY/NJ Harbor. Section 5 provides a concise summary of the overall results of the MFS Program.

2.0 METHODS

2.1 STUDY AREAS AND SAMPLING LOCATIONS

During the 2013 MFS, 20 fixed stations consistent with locations sampled in previous years were sampled with the mid-water trawl (Figure 2-1, Table 2-1). Fewer stations were sampled in 2011-2013 than 2006, so that each station could be sampled more frequently (i.e., weekly during the peak spring and fall migration periods). Of these stations, 17 were located in channel areas and 3 were in non-channel areas. This distribution of sampling effort reflects the difficulty of sampling shallow water areas using a mid-water trawl, and a focus on sampling in the navigation channels where dredging occurs.

The NY/NJ Harbor was divided into four study areas representing distinct subsections of the harbor complex in order to detect differential usage by migratory species: the Arthur Kill/Kill Van Kull, Newark Bay, Upper New York Bay, and Lower New York Bay. These are interconnected areas of varying hydrodynamics and physical properties (such as substrate). Sampling stations were distributed within each study area as described in the following sub-sections.

2.1.1 Arthur Kill and Kill Van Kull (AK/KVK)

The AK/KVK study area is confluent with the Upper Bay via the Kill Van Kull (a narrow, tidal strait) and with the Raritan Bay via the Arthur Kill (another narrow, tidal strait). This study area has a dynamic hydrology due to the variation in tidal velocity, amount of freshwater flow, and complex bathymetry connecting bays (i.e., Upper, Newark, and Raritan bays). Little shallow water habitat exists in this study area. Six channel stations were sampled in this area using the mid-water trawl; four (MAK-1 to 4) were in the Arthur Kill and 2 (MKK-1 and 2) were in the Kill Van Kull. These were the same stations sampled during 2006, 2011 and 2012. 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 issues related to towing a mid-water trawl in a high vessel traffic area.

2.1.2 Newark Bay (NB)

The Hackensack and Passaic River basins form the watershed of Newark Bay. The Newark Bay study area consists of broader expanses of open water than the Arthur Kill/Kill Van Kull, though it is not as large a body of water as the Upper or Lower Bay. Newark Bay contains extensive deep water navigation channels, and its shorelines and shallow water habitats have been greatly modified by bulkheads, riprap, and historic fill. Four stations were sampled in Newark Bay using the mid-water trawl; all four (MNB-1, 2, 5, and 6) were in navigation channels. Stations were established at the mouths of the Passaic and Hackensack Rivers. Two non-channel stations (MNB-3 & 4) sampled in 2006 were not sampled during these follow-up surveys due to the decreased number of stations included in these programs.

2.1.3 Upper Bay (UB)

The Upper Bay study area is centrally located within NY/NJ Harbor, connecting the three other study areas to the Hudson River. The Upper Bay begins at the mouth of the Hudson River and empties into the Lower Bay. It 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 extensive deep, open water channels and relatively few remaining areas of shallow water habitat due to historic shoreline modifications and development of port facilities. Six stations were sampled in the Upper Bay using the mid-water trawl; five (MUB-1 through 3, 8 and 9) were in channels and one (MUB-11) was a non-channel station. Two non-channel stations (MNB-6 and 7) and three channel stations (MNB-4, 5, and 10) sampled in 2006 were not sampled during these follow-up surveys due to the decreased number of stations included in these programs.

2.1.4 Lower Bay (LB)

The Lower Bay study area contains expanses of both deep and shallow open water. Water quality is influenced by the Atlantic Ocean more so than the other three study areas. Four stations were sampled in the Lower Bay using the mid-water trawl; two (MLB-3 and 5) were channel areas and two (MLB-4 and 6) were non-channel areas. Two non-channel stations (MLB-1 and 2) sampled in 2006 were not sampled in 2011-2013. One channel station (MLB-5) and one non-channel station (MLB-6) were added to the 2011-2013 surveys to sample nearshore areas where the Lower Bay constricts through the Narrows and into 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. This sample depth varied based on station depth and location.

Water quality data collected during the 2013 MFS Program were supplemented by data derived from National Oceanic and Atmospheric Administration (NOAA) water quality buoys. While NOAA data are collected at the surface (http://www.ndbc.noaa.gov/measdes.shtml), these data were demonstrated to be characteristic of mid-water temperatures and provide a sound dataset to supplement the MFS Program. Hourly air and water temperature data from three NOAA buoys in NY/NJ Harbor were downloaded for the 2013 calendar year: Bergen Point West Reach (GNN4) in the Kill Van Kull, Sandy Hook (SDHN4) in the Lower Bay, and the Battery (BATN6) in the Upper Bay (Figure 3-2). Data were averaged daily.

MFS Program water quality data for 2013 are provided in Appendix A.

2.3 FINFISH SAMPLING

The U.S. Army Corps of Engineers' M/V (motor vessel) *Hudson* was the primary sampling vessel used for the mid-water trawl surveys. Surveys were scheduled during daylight hours (between one hour after sunrise and one hour before sunset). Mid-water trawls were conducted using an 18-foot (5.5 m) 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 at the beginning of each tow. At seven station locations, 15 deeper "near-bottom" trawls were towed in an effort to collect target species that may congregate below the mid-depth level. Results from this sampling are presented in Appendix D.

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 20 stations. The spring migratory sampling began during the last week of March, and continued weekly through April, bi-weekly in May, and once during first week of June 2013. Two summer surveys during the weeks of 8 July and 12 August followed. The fall migratory sampling began the week of 9 September and continued weekly to the first week of December 2013 (Table 3-1). Surveys were conducted on consecutive days, weather conditions permitting, until all stations 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 channel and shoal areas. GPS coordinates were recorded to the nearest one hundredth of a minute (e.g., 40° 35.56') at the start and end of each trawl transect. All pertinent sample information was recorded on a Field Data Sheet.

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

Finfish collection data are provided in Appendix B.

2.4 DATA ANALYSIS

2.4.1 Catch per Unit Effort

CPUE, defined for the purpose of this study as the number of fish collected per ten minutes of trawling, was determined for each 2013 mid-water trawl sample and was standardized to ten minutes using the following formula:

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

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 NY/NJ Harbor. Spring is represented by the months March through June (corresponding to week-of-year 12 through 23), summer by July (week 28) and August (week 33), and fall by September through December (week of year 37 through 49).

2.4.2 Statistical Methods

The 2013 survey data were analyzed using univariate statistical procedures to assess target species catch rates in terms of: 1) difference across regions and 2) timing of occurrence across species. Each test is described in greater detail below. All statistical analyses were conducted using NCSS 2007 software (Hintze 2007).

2.4.2.1 ANOVA for Difference in Catch Rates across Regions

Consistent with the 2012 survey data, catch rates in 2013 for species other than alewife and blueback herring were too low to support statistical analysis of catch rates across regions. As such, the catch rates for juveniles and adults of these river herring were evaluated during the spring and fall, respectively. The null hypothesis (H_o) tested was: catch rates were not different across the study areas within each season. For example, for juvenile alewives, the null hypothesis tested assumed that median CPUEs of alewife during spring were not different among study areas. The results of this evaluation were used to identify which study areas, if any, support relatively higher numbers of these target species during either spring or fall.

Due to the highly variable catch rates, including a preponderance of low and "0" values, the data did not meet the assumptions of conventional univariate Analysis of Variance (ANOVA). Specifically, non-normality and heterogeneity of variance, even after application of a logarithmic (log y+1) transformation, were evident in the data. Accordingly, the non-parametric Kruskal-Wallis one-way ANOVA was selected to test for differences in catch rates among survey areas ($p \leq 0.05$). Dunn's multiple comparison test (MCT) was then used to indicate differences between specific locations where required.

The Kruskal-Wallis test is a powerful non-parametric substitution for the one-way ANOVA that may be employed when the assumption of normality is not met by the data (Hintze 2007) and was used to test for differences in blueback herring and alewife CPUE among survey areas during spring and fall (see raw data in Appendix C). Because the test is based on ranks of data rather than absolute values, the transformed (log (CPUE+1)) and untransformed data produce the same ANOVA results.

Where a significant result was obtained, Dunn's MCT (with Bonferroni adjustment) was used to determine which survey areas had significantly different median CPUEs. Median CPUEs were deemed significantly different if Dunn's z-value was greater than 2.6383. The results of the Dunn's MCT were reported by indicating the study area mean ranks sorted in ascending order.

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.

2.4.2.2 CFD Analysis for Difference in Period of Occurrence

Cumulative frequency distributions (CFDs) derived from empirical catch 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 (Hintze 2007). Cumulative frequency distribution graphs were developed to evaluate temporal catch patterns and predict the probability of when (by week 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 timings of all target species are equal. The alternative hypothesis is that the timings for at least two of the target species are different. The log-rank 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 18 March through 3 June) and for fall (weeks of 9 September through 2 December). The raw data used for these analyses are presented in Appendices C-4 and C-5.

3.0 RESULTS

3.1 WATER QUALITY

During the 2013 study period, average weekly mid-water temperatures ranged from 4.2 (18 March, Lower Bay) to 22.8°C (8 July, Newark Bay) (Figure 3-1a). Overall for each week, average temperatures were consistent among the Harbor areas. Sample weeks with the greatest temperature range occurred during the week of 8 July for the Upper Bay and Lower Bays, 7 October for Arthur Kill/Kill Van Kull, and 3 June for Newark Bay (Figure 3-1b).

Average weekly salinity at mid-water ranged from 15.1 (3 June, Newark Bay) to 28.4 ppt (23 September, Lower Bay) during the 2013 study period (Figure 3-1a). The lowest mean salinities were in Newark Bay followed by the Arthur Kill/Kill Van Kull, then the Upper Bay; mean salinities were approximately 2.7 ppt higher within the Lower Bay than the Upper Bay.

Dissolved oxygen concentrations fluctuated with temperature and were somewhat linked to salinity (Figure 3-1a). Dissolved oxygen concentrations were generally highest during weeks in March, April, and December, and were lowest during weeks in August and September among the four areas. During the 2013 study period, average weekly mid-water dissolved oxygen concentration ranged from 4.8 (8 July, Newark Bay) to 13.9 mg/L (8 April, Lower Bay).

Water and air temperature data from the NOAA research buoys were graphically depicted for 2013 to supplement the water quality data collected during the MFS program (Figure 3-2). During 2013, average daily water temperatures began to rise during early March. Average daily water temperatures did not fall much below 4ºC (when blueback herring begin to stage in estuaries [Loesch and Lund 1977, Able and Fahay 2010]) for the three water quality buoys even during the traditionally coldest months of January and February.

3.2 FINFISH DESCRIPTIVE FINDINGS

A total of 440 mid-water trawls were conducted during the 2013 MFS, comprised of 374 samples from channel stations and 66 samples from non-channel stations (Table 3-1). A total of 33,239 finfish (21 species) were collected (Table 3-3). The most abundant species collected were bay anchovy, blueback herring, and Atlantic herring (*Clupea harengus*), which were ranked first, second, and third by number collected, respectively (Table 3-2). High abundances and species richness occurred in the months of October (n=9,805 finfish; 11 species), September (n=9,224 finfish; 8 species), August (n=6,489 finfish; 7 species) and July (n=3,006 finfish; 4 species) (Table 3-3).

Of the five target species, all except striped bass were collected by the mid-water trawls (Table 3-2). Of the four target species that were collected, three species ranked within the top ten. Blueback herring, alewife, and American shad ranked second, fourth, and tenth most abundant, respectively, in the total catch for the 2013 MFS program (Table 3-2). Target species represented 12.3% (n=4,089) of the total finfish catch (Table 3-3).

Several EFH species were also collected during the 2013 MFS program, including Atlantic herring (n=1,409), bluefish (*Pomatomus saltatrix*) (n=86), and butterfish (*Peprilus triacanthus*) (n=75) (Table 3-3). Overall, average CPUE of non-target EFH species peaked at a total of 4.47 fish/10-minute tow in Newark Bay and averaged 3.50 fish/10-minute tow for all non-target EFH species across all Harbor areas.

CPUE of non-target, non-EFH species ("other 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). Total CPUE of other species was highest in the Lower Bay (125.51 fish/10-minute tow), followed by Newark Bay (57.84 fish/10-minute tow) (Table 3-4). Average CPUE of bay anchovy was highest in the Lower Bay (125.18 fish/10-minute tow) and lowest in the Upper Bay (39.64 fish/10-minute tow; Table 3-4). Excluding bay anchovy, CPUE by region for other species was low and characterized by a substantial number of zero catches, which resulted in high standard errors (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.

3.2.1 Alewife

3.2.1.1 Seasonal and Temperature-related Patterns

Alewives were collected in the NY/NJ Harbor during the weeks of 15 April through 20 May in the spring, during the week of 19 August in the summer, and during the weeks of 9 September, 7 October, and 18 November in the fall (Figure 3-3). CPUEs reached 19.8, 0.2, and 3.3 fish/10-minute tow during the spring, summer, and fall respectively. The highest average weekly CPUE of alewives (19.8 fish/10-minute tow) was collected at Upper Bay channel stations during the week of 14 April.

3.2.1.2 Channel – Non-channel Station Patterns

Alewife CPUE decreased from 19.8 to 1.2 to 6.2 fish/10-minute tow in channel stations in the Upper Bay during the weeks of 15 April, 22 April, and 6 May, respectively. This corresponds with an increase from 0.5 to 3.0 to 6.0 fish/10-minute tow in non-channel stations in the Lower Bay during the same weeks. During the week of 6 May, CPUE reached 12.0 fish/10-minute tow in Newark Bay. All other catches in the study areas were in channel stations.

3.2.1.3 Harbor Study Area Patterns

Average CPUE was highest in the Upper Bay (1.1 fish/10-minute tow) and lowest in the Arthur Kill/Kull Van Kull (0.04 fish/10-minute tow) (Table 3-4). In the spring, Upper Bay collections comprised approximately 64% of the total alewife catch, followed by 24% from the two Newark Bay channel stations near the mouths of the Hackensack and Passaic Rivers (MNB-5 and MNB-6) (Figure 3-4a). Approximately 9% of alewives collected in the spring came from two stations in the Lower Bay, while fish were only collected in the Arthur Kill/Kill Van Kull during the week of 6 May (Figure 3-3, 3-4a).

Alewife CPUE did not differ among study areas in the spring ($p = 0.32$) (the complete results are presented in Appendix C-2). The mean ranks for the study areas were as follows (the line connecting all locations indicates no significant difference in mean rank):

AK/KVK=85.63	NB=91.58	UB=92.51	LB=93.71

Fewer alewives were caught during the fall, with fish collected only at the two Newark Bay channel stations near the mouths of the Hackensack and Passaic Rivers (MNB-5 [5%] and MNB-6 [60%]), and at one Upper Bay channel station (36%) (Figure 3-4b).

Similar to the spring, alewife CPUE did not differ among study areas for fall samples ($p = 0.22$) (the complete results are presented in Appendix C-2). The mean ranks for the study areas were as follows (the line connecting all locations indicates no significant difference in mean rank):

AK/KVK=108.50 LB=108.50 UB=111.83 NB=113.50

3.2.1.4 Length Frequency Distributions

Figure 3-5 depicts the length frequency distributions for alewives by season and harbor area. More alewives were collected in the spring (March–early June) than the fall (September–early December). Spring alewife collections from Newark Bay averaged 106 mm total length, and ranged from 96-134 mm (n=50); Arthur Kill/Kill Van Kull alewives averaged 121 mm total length, and ranged from 117-128 mm (n=5); Upper Bay alewives averaged 109 mm total length, and ranged from 80-307 mm (n=136); Lower Bay alewives averaged 133 mm total length, and ranged from 110-220 (n=20).

During each of two summer months (one July and one August survey), one (121 mm) alewife was collected in the Upper Bay.

During the fall, Newark Bay alewives averaged 137 mm total length, and ranged from 128-143 mm (n=14); Upper Bay alewives averaged 120 mm total length, and ranged from 98-149 mm (n=8).

Of all alewives collected during both spring and fall 2013, 97% (n=233) were in length intervals representative of juveniles or immature fish (< 170 mm), and six fish were representative of adults (≥ 170 mm; per Hattala *et al.* 2012 in ASMFC 2012). During the spring, three adult alewives were collected from the Upper Bay at MUB-8 and one at MUB-9 on 17 April, and two adult alewives were collected from the Lower Bay (MLB-4) in mid- to late-April. No alewives over 170 mm were collected during the fall.

3.2.2 American shad

3.2.2.1 Seasonal and Temperature-Related Patterns

American shad were collected in the NY/NJ Harbor from the weeks of 22 April through 20 May during the spring and from the week of 21 October to the week of 2 December during the fall (Figure 3-6). No American shad were caught during the summer sampling period. Average weekly CPUE of American shad peaked at Upper Bay non-channel stations during the week of 4 November (2.0 fish/10-minute tow). During November, American shad were collected during four consecutive weeks in the Upper Bay, and these catches occurred after mid-water temperatures in the Upper Bay dropped below approximately 14 °C (Figure 3-6).

3.2.2.2 Channel – Non-channel Station Patterns

Average weekly American shad CPUEs were low across all channel stations in the Harbor, peaking at 0.6 fish/10-minute tow in the Upper Bay during the week of 6 May and the week of 18 November (Figure 3-6). In comparison, the peak CPUE occurred in the Upper Bay at non-channel stations, with 2.0 fish/10-minute tow during the week of 4 November and 1.0 fish/10-minute tow during the week of 11 November (Figure 3-6).

3.2.2.3 Harbor Study Area Patterns

Average CPUE for American shad during the entire sampling period was low across all areas, with the Upper Bay having the highest overall CPUE (0.10 fish/10-minute tow, Table 3-4). No American shad were collected in the Arthur Kill/Kill Van Kull. In the spring (March-June), total American shad collections were low in Newark Bay, the Upper Bay, and the Lower Bay (total CPUE at each station between zero and two fish/10-minute) (Figure 3-7a). During the fall months (September-December), American shad were only collected at three stations in the Upper Bay, at total CPUE of six or fewer fish/10-minute tow (Figure 3-7b). Due to low catch rates, ANOVA and MCT analyses were not run for American shad.

3.2.2.4 Length Frequency Distributions

In the spring, America shad total lengths ranged from a minimum of 106 mm (Newark Bay) to a maximum of 161 mm (Upper Bay; Figure 3-8). The mean total lengths (mm) were 130 (n=2), 148 (n=3), and 149 (n=2) from Newark Bay, Upper Bay, and Lower Bay, respectively.

In the fall, American shad were only collected in the Upper Bay, with 80% of American shad in the 90 to 149 mm size class (Figure 3-8). The mean total length was 136 mm, with a range from 112-161 (n=10). None of the American shad collected were sexually mature adults, which are expected to measure 450 mm or more in total length (Hattala and Kahnle 2009).

3.2.3 Atlantic menhaden

3.2.3.1 Seasonal and Temperature-Related Patterns

Atlantic menhaden were collected in the NY/NJ Harbor during the spring from 15 April to 6 May and during the fall in the weeks of 9 September, 14 October, and 11 November (Figure 3-9). No Atlantic menhaden were collected in the Upper Bay or Lower Bay during the fall or during the summer in any region. During the spring, the majority of Atlantic menhaden collections occurred in late April and early May, with a maximum CPUE of 1.0 fish/10-minute tow in the Lower Bay during the week of 15 April and in the Upper Bay during the week of 22 April (Figure 3-9). Collections of Atlantic menhaden in the Arthur Kill/Kill Van Kull and Newark Bay reached a maximum of 0.3 fish/10-minute tow across all seasons. During the fall, Atlantic menhaden CPUE peaked at 0.3 fish/10-minute tow in Newark Bay during the week of 14 October. Generally, Atlantic menhaden were collected when Harbor water temperatures were below 13 ^{o}C.

3.2.3.2 Channel – Non-channel Station Patterns

Collections at non-channel stations in the Lower Bay totaled 1.0 fish/10-minute tow during the week of 15 April. This collection of Atlantic menhaden in non-channel areas coincided with collection of 0.2, 0.3, and 0.2 fish/10-minute tow at channel stations in the Arthur Kill/Kill Van Kull, Newark Bay, and Upper Bay, respectively, and preceded a collection of 1.0 fish/10-minute tow at channel stations in the Upper Bay during the week of 22 April (Figure 3-9).

3.2.3.3 Harbor Study Area Patterns

Overall, average CPUEs for Atlantic menhaden across the entire sampling program were highest in the Upper Bay region (0.05 CPUE); all other regions had an average of 0.02 CPUE (Table 3-4). During the spring, Atlantic menhaden were collected at three channel stations in the Upper Bay, and one station each in the Lower Bay, Newark Bay, and Arthur Kill/Kill Van Kull. All station total CPUEs during the spring were less than 5 fish/10-minute tow (Figure 3-10a). During the fall, one Atlantic menhaden was caught at one station each in the Arthur Kill/Kill Van Kull, Newark Bay, and Lower Bay, and were none caught in the Upper Bay (Table 3-3, Figure 3-10b). No menhaden were caught at any station during the summer (two sample events during July-August). Due to low catch rates, ANOVA and MCT analyses were not run for Atlantic menhaden.

3.2.3.4 Length Frequency Distributions

During the spring, Atlantic menhaden total lengths averaged 345 mm in the Upper Bay (n=7) and 335 mm in the Lower Bay (n=2). Arthur Kill/Kill Van Kull and Newark Bay collections during the spring were limited to one Atlantic menhaden each at 326 and 114 mm TL, respectively (Figure 3-11). Two separate length groups were observed during the spring: year-1 fish, represented by a length of 114 mm TL (n=1), and spawning adults, represented by lengths of 315 to 370 mm TL (n=10). The year-1 fish was caught in Newark Bay, and the spawning adults were caught in all regions except Newark Bay.

Similar to the spring, fall collections of Atlantic menhaden fell into two length groups. The two groups were represented by lengths of 107 to 117 mm TL (n=2) from Arthur Kill/Kill Van Kull and 383 mm TL (n=1) from Newark Bay (Figure 3-11). No fish with total length between 117 mm and 383 mm TL were collected during the fall.

3.2.4 Blueback herring

3.2.4.1 Seasonal and Temperature-related Patterns

Blueback herring were the most abundant target species caught in the 2013 Migratory Finfish Survey, with a total of 3,824 individuals collected (Table 3-3). Blueback herring were collected in the Harbor during all weeks sampled except the weeks of 3 June, 8 July, and 21 October (Figure 3-12). Few blueback herring were collected during late May through early September with average regional weekly CPUE less than or equal to 2.2 fish/10-minute tow.

Blueback herring were collected in the spring from late March to early April, in all NY/NJ Harbor areas. Average weekly spring mid-water trawl collections of blueback herring peaked at Newark Bay stations during the week of 15 April (229.5 fish/10-minute tow; Figure 3-12). The peak average weekly CPUE occurred in Arthur Kill/Kill Van Kull during the week of 22 April (17.8 fish/10-minute tow), and during the week of 15 April in the Upper Bay (26.0 fish/10-minute tow in channel stations and 17.0 fish/10-minute tow in non-channel stations) and the Lower Bay (7.0 fish/10-minute tow) (Figure 3-12).

During summer sampling, three blueback herring were collected in Newark Bay during the week of 19 August with a CPUE of 0.8 fish/10-minute tow.

Blueback herring were collected in every NY/NJ Harbor area during the fall, although only 0.5 and 0.2 fish/10-minute tow were collected in the Lower Bay and Arthur Kill/Kill Van Kull, respectively. The highest average CPUE for blueback herring (277.8 fish/10-minute tow) occurred during the week of 28 October in Newark Bay; this was also the highest weekly average of any target species. Other high weekly average CPUEs were also documented in Newark Bay during this period: 67.5 during 14 October, and 30.0 during 18 November. Average weekly CPUE in the Upper Bay reached 11.0 fish/10-minute tow during the week of 18 November.

The weeks with relatively abundant collections of blueback herring in the spring occurred when average mid-water temperatures were also approximately 10° C or greater. The large catches of blueback herring during September and October in Newark Bay were preceded by a drop in average mid-water temperatures from approximately 17 °C to 14 °C during the week of 28 October.

3.2.4.2 Channel – Non-channel Station Patterns

Blueback herring were primarily collected from non-channel stations during the spring, peaking at 17.0 fish/10-minute tow in the Upper Bay and 7.0 fish/10-minute tow in the Lower Bay during the week of 15 April. Blueback herring were collected at non-channel stations during September to October in the Upper Bay (1.0 fish/10-minute tow) and during the week of 30 September in the Lower Bay (0.5 fish/10-minute tow) (Figure 3-12).

3.2.4.3 Harbor Study Area Patterns

Across the entire sampling program average blueback herring CPUE was highest in Newark Bay (37.48 fish/10-minute tow) and lowest in the Lower Bay (0.33 fish/10-minute tow, Table 3-4).

During the spring, blueback herring were collected at 17 of 20 stations across all study areas. They were most abundant in Newark Bay, with total CPUEs between 100 and 1,000 fish per 10-minute tow at three stations. Blueback herring were also relatively abundant during the spring in the Arthur Kill/Kill Van Kull, where most were collected at one station (MAK-4); and the Upper Bay, where they were collected at all stations. They did not utilize the Lower Bay to as great an extent (Figure 3-13a).

Median CPUE did not differ among study areas for the spring samples (p = 0.65) (the complete results are presented in Appendix C-3). The mean ranks for the study areas were as follows (the line connecting all locations indicates no significant difference in mean rank):

AK/KVK=86.28 LB=89.25 UB=92.03 NB=95.79

During the fall, blueback herring collections were most concentrated at two stations in northern Newark Bay (MNB-5 and MNB-6), accounting for 42.6% of the total for this species during the 2013 sampling program (Figure 3-12). The highest catch rate for a target species in a single tow in 2013 (1,111 fish/10-minute tow), was recorded at one Newark Bay station (MNB-6) in the fall on 30 October (Appendix B). Outside of these two Newark Bay stations, blueback herring were relatively scarce, with one station in the Upper Bay having a total CPUE of between 10 and 100 fish, while total catches at all other stations ranged from a total of 0 to 10 fish/10-minute tow (Figure 3-13b).

Consistent with these observations, median blueback herring CPUE did differ among study areas for the fall samples ($p < 0.01$) (the complete results are presented in Appendix C-3), with the Newark Bay median CPUE being significantly higher than other regions (Arthur Kill/Kill Van Kull (z = 3.98), Lower Bay (z = 3.99) and Upper Bay (z = 3.01)) while the other regions were not significantly different from each other. The results of the Dunn's MCT are summarized below by indicating the study area mean ranks, with a line connecting those study areas that were not significantly different:

LB=101.31	AK/KVK=103.87	UB=110.24	NB=130.02

3.2.4.4 Length Frequency Distributions

During spring, regardless of Harbor area, almost all of the blueback herring caught (96.7%; n=802) occurred in the 60 to 170 mm size range (Figure 3-14). For this period, 27 blueback herring were 170 mm total length or greater, which represent spawning adults (Hattala *et al.* in ASMFC 2012). Of the spawning adults, 63.0% (n=17) were collected in the Lower Bay, 25.9% (n=7) and the remainder (n=3) were collected in Newark Bay. The mean total length of blueback herring collected during spring was 98 mm (n=232) for the Arthur Kill/Kill Van Kull, 96 mm (n=397) for Newark Bay, 98 mm (n=172) for the Upper Bay, and 188 mm (n=28) for the Lower Bay.

During the summer, blueback herring were only collected in Newark Bay with a mean total length of 72 mm (n=3) (Figure 3-14).

During fall, the length frequency distribution consisted entirely of juvenile or immature fish (n=522). The mean total length of blueback herring collected in the fall was 57 mm (n=14) for the Arthur Kill/Kill Van Kull, 83 mm (n=435) for Newark Bay, 104 mm (n=72) for the Upper Bay, and one fish with a total length of 56 mm for the Lower Bay. Compared to the spring, fish collected during the fall were smaller and had less overall variation in sizes across all areas, with the size of all blueback herring ranging between 48 mm and 153 mm total TL (Figure 3-14).

3.2.5 Striped bass

No striped bass were collected during the 2013 MFS Program (Table 3-3).

3.3 TIMING OF MIGRATION

Cumulative frequency distribution (CFD) graphs were developed to investigate spring and fall temporal occurrence patterns for the target species. CFDs were plotted for target species for spring (weeks of 18 March through 3 June) and fall (weeks of 9 September through 2 December) (Figure 3-15). Striped bass were absent from all 2013 MFS collections and therefore not included in the CFD analysis. The results of the CFDs are presented in Appendix C-6 and C-7.

The log-rank test indicated significant differences in 2013 among target species occurrence during the spring ($p < 0.01$). The spring CFD for American shad was significantly different from all other species. The spring CFD for alewives was also significantly different from the spring CFD for blueback herring. No other combinations of species were found to have significantly different CFDs from each other (Table 3-5). American shad occurred latest in the spring, while the three remaining species (i.e., alewife, blueback herring, and Atlantic menhaden) generally overlapped in occurrence with the exception of blueback herring, which were abundant throughout the NY/NJ Harbor at a much earlier date in comparison to the other species.

As depicted in Figure 3-15, the CFD indicates that by the week of 1 April, approximately 13% of the blueback herring and no other target species would have passed through the study area. By the week of 22 April, approximately 72% of blueback herring, and 53% of alewives would have passed through the study area, but by the week of 6 May, nearly all of both species would have passed through (99% of blueback herring and 97% of alewives). American shad were collected starting from the week of 22 April, and the CFD indicates that only approximately 14% would have passed through the study area by the week of 29 April. However, by the next week, (6 May), approximately 86% of American shad would have passed through the area. Atlantic menhaden were collected from the week of 15 April to 4 June. The results of the CFD indicate that approximately 45% would have passed through the study area by the week of 15 April, and by 22 April, 91% would have passed through the study area.

The log-rank test also indicated significant differences in 2013 among target species with occurrence during the fall ($p < 0.01$). Significant differences in CFDs were identified between blueback herring and alewife, blueback herring and American shad, and alewife and American shad (Table 3-6). The remaining CFDs were not significantly different. Alewife tended to occur early in the fall sampling period, blueback herring in the middle, and American shad later in the season which resulted in the significant differences in the CFDs.

As depicted in Figure 3-15, the CFD indicates that approximately 59% of alewife would have passed through the study area by the week of 9 September, and approximately 91% by 7 October. However, only approximately 7% of blueback herring, and no American shad, would have passed through the area by this week. By the week of 4 November, when 40% of American shad would have passed through the survey area, approximately 89% of blueback herring would have already passed through. Although 33% of Atlantic menhaden would have passed through the survey area by the first week of fall sampling (beginning 9 September), only 67% would have passed through by the week of 25 November. By this time approximately 90% of alewives and American shad and 99% of blueback herring would have already passed through.

4.0 DISCUSSION

The MFS provides region-specific life history information for key migratory species that occur in the NY/NJ Harbor. The program's five target species (alewife, American shad, Atlantic menhaden, blueback herring, and striped bass) may use the Harbor in a variety of ways: as a pre-spawning staging area, as a corridor to access spawning habitat in the Hudson River or other tributaries, and as foraging grounds and overwintering habitat for juveniles. As indicated earlier, information gained from this study can be used to better assess potential interactions between dredging operations and migratory species as they move through the harbor complex.

This study was conducted in concert with USACE-NYD's ongoing efforts to monitor the extent and duration of suspended sediment plumes generated during dredging operations, and followed USACE Engineering Research and Development Center's (ERDC) underwater acoustic surveys of backhoe and cutterhead dredge operations and ambient noise conditions in the Anchorage Channel and Kill Van Kull Channel, respectively (Reine *et al.* 2012, Reine *et al.* 2013). These studies were designed to fill knowledge gaps and provide a better understanding of potential impacts to fish migration from dredging operations within NY/NJ Harbor.

4.1 SPATIAL AND TEMPORAL PATTERNS

Spatial and temporal distribution patterns observed for the five target species are summarized in Table 1-1, and a summary of other migratory finfish surveys completed in the Hudson Raritan Estuary is provided in Table 4-1. In the Estuary, most fisheries surveys targeting migratory species have been conducted within the Hudson River and its tributaries, and relatively few within the NY/NJ Harbor, or the Arthur Kill, Kill Van Kull and tributaries along New Jersey's coast (Table 4-1).

Alewife and blueback herring co-occur throughout much of their range; however, their individual life histories often result in different spatial and temporal distribution patterns (Monroe 2000). Blueback herring were the most abundant of the five target species investigated during the 2013 MFS. In spring 2013, blueback herring were collected in all Harbor areas, occurring at 17 of the 20 stations sampled (Figure 3-13a). Blueback herring were especially abundant in catches in Newark Bay, and occurred in relatively high abundance throughout the Upper Bay, and in the Arthur Kill. Blueback herring were collected in relatively low abundance at Lower Bay stations. However, differences in blueback herring abundance among the four study areas were not statistically significant during spring 2013. During 2006 and 2011 MFS surveys, it was noted that blueback herring abundance was especially high in spring up to three weeks prior to peak alewife abundance, most notably in the Upper Bay (USACE-NYD 2012). These observed abundance patterns during the previous survey years were deemed indicative of "staging" in the estuary, prior to initiation of migration upriver to spawn. Loesch and Lund (1977) described blueback herring collections in the lower Connecticut River several weeks prior to initiation of spawning. However, this spring staging pattern was not clearly observed during the 2012 MFS, possibly due to unseasonably warm winter temperatures, which have been reported to deter fish from pre-migration staging because it is energetically costly for the fish to linger in the estuary (NMFS 2012). During spring 2013, the dense congregation, or "staging" of blueback herring during mid-April in the Upper Bay as well as in the Arthur Kill/Kill Van Kull and Newark Bay was clearly observed in association with water temperatures of 15 °C or less. During fall, blueback herring were abundant throughout the Harbor, especially within Newark Bay, and they continued to be abundant throughout November. Significant differences in blueback herring abundance were noted between Newark Bay and the other three study areas during spring 2013; however, no significant differences in blueback herring abundance were observed among the Upper Bay, Lower Bay or Arthur Kill/Kill Van Kull study areas.

In spring 2013, blueback herring were common, yet alewives were relatively rare throughout the Harbor. Alewives were consistently collected in the Upper Bay and Newark Bay from mid-April through mid-May but were uncommon or absent at Arthur Kill/Kill Van Kull and Lower Bay stations at this time. The onset of alewife spawning runs typically precedes blueback herring runs by three to four weeks and is cued by water temperatures ranging from 5 to 10 ^{o}C (Monroe 2000). Water temperatures in the NY/NJ Harbor averaged approximately 5 ^{o}C throughout mid to late March 2013 and increased to approximately 10 ^{o}C by mid-April. Consistent with observations made in previous MFS sampling years, it is likely that alewife were beginning their migration out of NY/NJ Harbor to upstream waters by the start of the 2013 MFS. No significant differences in alewife abundance among harbor regions were observed during spring 2013.

During fall, alewives were uncommon in collections, appearing only at three stations: two in Newark Bay near the confluence of the Hackensack and Passaic Rivers, and a single channel station within the Upper Bay. No significant differences in alewife abundance were observed among any of the four Harbor areas during fall 2013.

Most alewife and blueback herring collected during spring 2013 MFS collections were juveniles and sub-adults. In general, greater numbers of both alewife and blueback herring were collected in spring. However, the highest CPUE for blueback herring throughout the entire 2013 MFS was recorded in Newark Bay during the last week of October. Loesch (1987) reported that blueback herring and alewife from the Connecticut River reached spawning size at approximately 260-300 mm. In contrast, spawning in Hudson River alewife and blueback herring populations has been reported among much smaller individuals (approximately 170 mm or greater; Hattala *et al.* 2012), and recent observed trends have shown a decrease in mean length and mean length-at-age. During the spring 2013 MFS survey, 27 blueback herring and six alewives greater than 170 mm (i.e., "spawning adults") were collected, often with many 90-120 mm juveniles of both species. During the fall, no spawning-sized blueback herring or alewives were collected. Stone *et al.* (1994) indicated that alewife and juvenile blueback herring may be present throughout the year in the Hudson-Raritan Estuary, in varying abundance depending on life stage and season.

Many factors cue juvenile river herring out-migration, including increased flow, decreasing water temperatures, lunar phases, and decreased food availability in tributaries (Monroe 2000, Yako *et al.* 2002). Juvenile blueback herring tend to remain in their natal spawning rivers a month longer than alewives and migrate downstream within a narrow timeframe as compared to alewives, which emigrate throughout the summer in successive cohorts (Monroe 2000). In the Connecticut River, juvenile blueback herring out-migration has been documented to end in late October and early November when water temperatures reach 10 ºC (O'Leary and Kynard 1986). 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 (Marcy 1969, Walton 1983). During the 2013 MFS, the greatest abundance of blueback herring was observed in the Newark Bay during the week of 28 October, coincident with a marked decline in water temperatures Harbor-wide. As suggested in previous year's MFS reports, this phenomenon may indicate that at least some juvenile blueback herring remain in the Harbor during winter, rather than out-migrating to the ocean.

Atlantic menhaden were much less abundant during the 2013 MFS program (n = 14) in comparison to the 2006 (n = 1,254, USACE-NYD 2007), and 2012 (n = 266, USACE-NYD 2013b) surveys, and about half as abundant as in the 2011 survey (n = 29, USACE-NYD 2013a). During spring of 2013, a total of 11 menhaden were collected among the four Harbor study areas, with the majority (seven individuals) from the Upper Bay. During fall, only three menhaden were collected (two from the Arthur Kill/Kill Van Kull and one from Newark Bay). The 11 menhaden collected during spring 2013 represented two distinct age classes (Year-1 and spawning adults) based on length frequency analysis and published size/age class intervals (Reintjes 1982, Rogers and Van Den Avyle 1989). Year-1 fish (80-140 mm TL) represented 9% of the spring total. Spawning adults, 5-7 years of age (290 – 370 mm TL), represented 91% of all menhaden collected in the spring. No YOY Atlantic menhaden were collected during spring 2013 among the four Harbor study areas. Atlantic menhaden collected during the fall migration also fell into either Year-1 or spawning adult age/size classes, again with an absence of YOY among the four Harbor study areas.

American shad were uncommon during spring collections, occurring in low densities (total of seven individuals) in Newark Bay, the Upper Bay and the Lower Bay. No shad were collected at Arthur Kill/Kill Van Kull stations in spring 2013. During fall surveys, shad were only collected at Upper Bay sampling stations (total of 10 individuals), in association with blueback herring juveniles (i.e., favoring the Upper and Lower Bays, peak fall abundance during November). Co-occurrence of shad and river herring has been documented in other northeastern estuaries (Monroe 2000).

Although collected in low numbers during previous MFS years (2006, 2011, 2012) striped bass were entirely absent from 2013 MFS collections. However, striped bass have been documented as abundant during the USACE-NYD's annual Aquatic Biological Survey (ABS) Program, in which bottom trawls were used to collect fish throughout the Harbor (including many stations in common with the MFS program) from December/January through May/June during 1998 through 2010. Striped bass were collected throughout the year during the multi-year ABS surveys, with highest CPUE generally occurring during summer and fall in the Upper Bay, Newark Bay and Arthur Kill. This comparison among the two surveys suggests that the location within the water column targeted by the two gear types (MFS mid-water vs. ABS bottom trawl) is a critical determinant of effectiveness in collecting striped bass.

While considered a highly motile, pelagic species, striped bass are strongly attracted to submerged structures, especially as juveniles (Cantelmo and Wahtola 1992, Able and Duffy-Anderson 2006). Both juveniles and adults are known to be adaptable, opportunistic predators, often feeding on benthic or demersal prey such as blue crabs or other crustaceans (Booth and Gary 1993, Steimle *et al.* 2000). Adult and juvenile striped bass were collected in mid-water trawl samples during the 1982-1983 NJDEP Fishery Resources Inventory, at Weehawken and Jersey City, New Jersey, primarily during winter, fall, and early spring sampling events (NJDEP 1984). However, striped bass were considerably more abundant, and widely distributed (seasonally and spatially) among bottom trawl and trap net samples during the NJDEP survey. During December 1995, and again in December 1997, a survey of fish overwintering patterns in the lower Hudson River was conducted by Hartman and Nagy (2006). These investigators used gill nets and mid-water trawls to verify a fisheries hydroacoustics sampling program for the lower Hudson River. Striped bass was among the most common species collected in mid-water trawl samples (up to 25% of total catch per sample) at stations ranging from the Battery north to Haverstraw Bay.

4.2 DREDGING AND MIGRATORY FINFISH

Migratory finfish populations are potentially vulnerable to anthropogenic disturbances such as dredging (ASMFC 2009). Research has suggested that primary and secondary impacts from dredging can include channelization of spawning and nursery habitat, dredged material placement that interferes with migration or isolates spawning habitat, release of contaminants, and high TSS levels, which may inhibit feeding and respiration, especially among larval and juvenile fish (ASMFC 2009). State and Federal resource agencies (e.g., NYSDEC, NJDEP, NMFS) have used seasonal dredging windows to protect fish during the critical migration periods, (Reine *et al.* 1998, Evans *et al.* 2011). These restrictions are based on concerns that various anadromous species, including striped bass, American shad, river herring, and sturgeon may be prevented from migrating or may avoid entry to natal spawning streams due to TSS plumes (Reine *et al.* 1998). Underwater noise produced during dredging operations has been hypothesized to disrupt fish migration by blocking or delaying movement through navigable waterways, interrupting or impairing communication, and disrupting foraging behavior. However, field studies have not conclusively demonstrated TSS or sound-associated interference of fish migration by navigation dredging operations (Reine *et al.* 1998).

The potential for dredging impacts on migratory species depends on site-specific conditions and interactions among the dredge plant, *in situ* sediment characteristics, local hydrodynamics, and distribution of fish in space and time (Wilber and Clarke 2001). Larval and juvenile fish, in particular, may be sensitive to dredging-induced turbidity, as their gills may become clogged or abraded by floating particulates. Feeding ability of some larval and juvenile fishes is decreased under high TSS conditions due to a reduction in available light (Snyder 1976, Auld and Schubel 1978). Juvenile and adult migratory fish are sufficiently mobile to easily avoid long exposures to localized plumes, unless they are actually attracted to the plume, are confined to an area with restricted circulation, or if dredging occurs near the estuarine salt front where certain species may stage prior to upstream movement (Wilber and Clarke 2001).

Recent TSS surveys conducted by USACE-NYD (2011) demonstrate that dredging in areas with high fractions of fine sediment, and/or strong tidal currents do create sediment plumes that extend down-current from the dredge. However, regardless of sediment type and current regime, TSS concentrations decreased exponentially with distance and the lateral size of sediment plumes from dredging was limited and remained confined to the channel basins. Plumes invariably became bottom features within relatively short distances from the dredge, which would also tend to minimize exposures to mid-water migrants.

Similar to TSS, the effect of underwater sound on fish is a function of magnitude and duration of exposure, and can potentially affect fish behavior by disturbing feeding, predator avoidance, and social interactions, or can have more lasting physical effects (Popper 2003, Popper and Hasting 2009). The majority of dredging operations associated with the HDP involves the use of mechanical bucket dredges. However, cutterhead dredges are also used for fracturing hard substrates and hopper dredgers have been used to dredge the Ambrose Channel. Sounds generated during dredging activities include scraping/grinding sounds; hydraulic pump noise; sounds emanating from the barge's hull (particularly during early stages of filling), and sounds associated with the periodic movement of the dredge using cables, spuds, and tugboats (Reine *et al.* 2013). The magnitude and extent of the various underwater sounds produced are influenced by substrate type, channel morphology, site-specific hydrodynamic conditions, equipment maintenance status, and skill of the dredge operator.

During 2011, USACE-ERDC conducted a field assessment at the confluence of the Kill Van Kull and the Upper Bay to characterize underwater sounds associated with dredging in rock and gravel substrate (Reine *et al.* 2013). The findings of this study indicated that ambient noise in the Upper Bay approached or exceeded preliminary NMFS sound threshold criteria for a continuous noise source. Non-continuous, repetitive sounds occurred during dredging, but lasted for only a few seconds per event. Dredge engine/generator noise was the only continuous sound that exceeded the 120 dB threshold for continuous noise. In general, sounds produced by the cutterhead and backhoe dredges were no more prominent, and actually less intense within most frequencies ranges, than those produced by deep-draft commercial vessels transiting the study area, and other sound sources such as ferry traffic. As in the case of suspended sediment plumes, no conclusive evidence exists of attraction, avoidance, or neutral behavioral responses to dredge sounds by target species in NY/NJ Harbor.

5.0 SUMMARY

The results of the 2013 MFS Program are generally consistent with the findings of the 2006, 2011, and 2012 MFS surveys, as well as previous studies that demonstrate that migratory finfish use NY/NJ Harbor during spring and fall migration periods. The target species, particularly alewife and blueback herring, are characterized by distinct patterns of seasonal occurrence in the Harbor. Juveniles were present in the inner Harbor area (i.e., not the Lower Bay) in the spring and are distributed throughout the Harbor during the fall. Striped bass, notably juveniles, are known to aggregate in the upper Harbor during winter, but were not captured by the single fishing gear (mid-water trawl) used in the 2013 survey.

The findings of the 2013 MFS Program and recent USACE-NYD TSS surveys indicate that most target migratory finfish species would have limited exposure to suspended sediment plumes resulting from dredging operations. The possible exception is striped bass, which generally exhibit a greater preference for demersal habitats and submerged structures in comparison to the clupeid species surveyed, and would have a greater likelihood of occurring within the vicinity of sediment plumes. However, the limited spatial extent and short duration of sediment plumes as well as the high degree of motility and known spatial and temporal distribution patterns of the target migratory species suggests that exposures under most scenarios would be minimal. Detailed information on the dredging scenario, such as type of dredge, sediment type, and water current regime, may be viewed in tandem with knowledge of the temporal and spatial occurrences of a given target species, as well as what is known of that species' migratory behavior, to formulate future project-specific impact assessments.

Likewise, adverse effects on migratory fish associated with dredging-related underwater sounds should be treated on a project-specific basis, taking into consideration all relevant knowledge. In many cases the potential impacts would be expected to be minimal, as a result of limited exposure time during migration and the relatively high ambient noise levels present throughout the NY/NJ Harbor area. Seasonal dredging restrictions for finfish have been instituted in the Harbor to protect essential fish habitat, specifically winter flounder spawning and nursery habitat. However, regional concerns have increased with regard to impacts on migratory fish stocks. Results of the New York District's monitoring program contribute to a better understanding of migratory pathways and peak seasonal use (temporal and spatial patterns). These efforts, in conjunction with other USACE-NYD TSS studies and underwater sound studies can inform management decisions regarding how to conduct dredging activities within NY/NJ Harbor while protecting regional fisheries resources.

6.0 LITERATURE CITED

Able, K.W. and J.T. Duffy-Anderson. 2006. Impacts of piers on juvenile fishes in the lower Hudson River. In: J.S. Levinton and J.R. Waldman, (Eds.) The Hudson River Estuary. Cambridge University Press, New York. 428-440 pp.

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

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

Atlantic States Marine Fisheries Commission (ASMFC). 2012. River Herring Benchmark Stock Assessment; Volumes I and II. Stock Assessment Report No. 12-02

Auld, A.H. and J.R. Schubel. 1978. Effects of suspended sediment on fish eggs and larvae: a Laboratory assessment. Estuarine and Coastal Marine Science 6:153-164.

Booth, K.J, and M.L. Gary 1993. Striped bass feeding behavior and the potential effect on the blue crab population in the Chesapeake Bay. Fisheries Technical Memorandum Series Number Two, Maryland Department of Natural Resources, Annapolis, MD.

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.

Collette, 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.

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.

EA Engineering, Science, and Technology. 1998. Brooklyn Navy Yard Cogeneration Facility, 1997. Ichthyoplankton Entrainment Monitoring Study. Prepared for the Brooklyn Navy Yard Cogeneration Facility, L.P./Palmark.

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.

Gray, C.L. 1984. Atlantic menhaden (*Brevoortia tyrannus*) Species Profile. Narragansett Bay Estuary Project. NBP-92-84. 38 pp.

Gusey, W.F. 1981. The Fish and Wildlife Resources of the South Atlantic Coast. Houston. Shell Oil Company.

Hartman, K.J. and B.W. Nagy. 2006. Winter distribution and abundance of Hudson River fishes using hydroacoustics. In: J. Waldman, K. Limburg, and D. Strayer, (eds.) Hudson River Fishes and Their Environment. American Fisheries Society Symposium 51:151-173.

Hattala, K.A., and A.W. Kahnle. 2009. Status of American Shad in the Hudson River, New York. Updated August.. 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.

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 Program. Revised January 2010.

Limburg, K.E. 1996. Growth and migration of 0-year American shad (*Alosa sapidissima*) in the Hudson River estuary: otolith microstructural analysis. Canadian Journal of Fisheries and Aquatic Sciences 53: 220–238.

Loesch, J. G. 1987. Overview of life history aspects of anadromous alewife and blueback herring in freshwater habitats. pp. 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*. Transactions of the American Fisheries Society 106:583-589.

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 Society 98 (4): 622-630.

Marcy, B. C., Jr. 1976. Fishes of the lower Connecticut River and the effects of the Connecticut Yankee plant. pp. 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.

McHugh, J.L., R.T. Oglesby, and A.L. Pacheco. 1959. Length, weight, and age composition of the menhaden catch in Virginia waters. Limnology and Oceanography 4: 145-162.

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, T.A. 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).

National Marine Fisheries Service (NMFS). 2012. River Herring Climate Change Workshop Report: River Herring: Alewife (*Alosa pseudoharengus*) and Blueback Herring (*Alosa aestivalis*), convened on July 18-19, 2012. Report prepared December 27, 2012.

Neves, R. J. 1981. Offshore distribution of alewife and blueback herring along the Atlantic coast. U.S. National Marine Fisheries Service Fishery Bulletin 79: 473-485.

New Jersey Department of Environmental Protection and Energy (NJDEP). 1984. Inventory of the fishery resources of the Hudson River from Bayonne to Piermont. New Jersey Department of Environmental Protection and Energy, Bureau of Marine Fisheries. Final Report.

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

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 Research and Development Center, Vicksburg, MS. 14pp.

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.

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 (ERDC TN-DOER-E36) U.S. Army Engineer Research and Development Center, Vicksburg, MS. www.wes.army.mil/el/dots/doer.

Reintjes, J.W. 1982. Atlantic menhaden, *Brevoortia tyrannus*. In M.D. Grosslein and T.R. Azarovitz (eds.). Fish Distribution. Mesa New York Bight Atlas, Monographs. 15, 182pp.

Rogers, S. G., and M. J. Van Den Avyle. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic) - Atlantic menhaden. U.S. Fish and Wildlife Service Biological Report 82(11.108). U.S. Army Corps of Engineers TR EL-82-4. 23 pp.

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 ed. 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. 2000. Alewives in the Hudson River Tributaries, Two Years of Sampling. Final Report to the Hudson River Foundation. Prepared by Hudsonia Limited. April 3, 2000.

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

Secor DH, Rooker JR, Zlokovitz E, Zdanowicz V. 2001. Identification of riverine, estuarine, and coastal contingents of Hudson River striped bass based upon otolith elemental fingerprints. Marine Ecological Progress Series 211: 245-253.

Snyder, G.R. 1976. Effects of dredging on aquatic organisms with special application to areas adjacent to the northeastern Pacific Ocean. Marine Fisheries Review 38:34-38.

Steimle, F.W., R.A. Pikanowski, D.G. McMillan, C.A. Zetlin, and S.J. Wilk. 2000. Demersal Fish and American Lobster Diets in the Lower Hudson-Raritan Estuary. NOAA Technical Memorandum NMFS-NE-161.

Stone, S.L., T.A. Lowery, J.D. Field, S.H. Jury, D.M. Nelson, M.E. Monaco, C.D. Williams, and 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 – New York District (USACE-NYD). 2010. Application of Winter Flounder Early Life History Data to Seasonal Dredging Constraints and Essential Fish Habitat Designations. November 2010.

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.

United States Army Corps of Engineers (USACE) – New York District (NYD). 2013a. 2011 Migratory Finfish Report for the Harbor Deepening Project. January 2013.

United States Army Corps of Engineers (USACE) – New York District (NYD). 2013b. 2012 Migratory Finfish Report for the Harbor Deepening Project. November 2013.

Waldman, J.R., 2006. The Diadromous Fish Fauna of the Hudson River: Life Histories, Conservation Concerns and 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.

Wilber, D. H., Clarke, D. G., Gallo, J., Alcoba, C. J., Dilorenzo, A. M., and S. E. Zappala. 2013. Identification of winter flounder (*Pseudopleuronectes americanus*) estuarine spawning habitat and factors influencing egg and larval distributions. Estuaries and Coasts. 36:1304-1318.

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.

Table 1-1. Observed seasonal patterns of target species collected during the 2006, 2011, and 2012 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)	Pattern for use of 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 pattern 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)	Abundance indicated use of 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	Pattern for use of 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 2-1. Description of mid-water stations sampled during the 2006 and 2011-2013 Migratory Finfish Sampling Program

Harbor Area	Station Name	Station Type	Station Location	MLLW Depth (ft)	Valid Samples Collected			
					2006	2011	2012	2013
Arthur Kill/ Kill Van Kull	MAK-1	Channel	In channel off Elizabethport	40	12	22	22	22
	MAK-2	Channel	In channel at mouth of Piles Creek	33	12	21	22	22
	MAK-3	Channel	In channel at mouth of Rahway River	35	12	21	22	22
	MAK-4	Channel	In channel, just S of Fresh Kills/Cedar Point	35	12	21	22	22
	MKK-1	Channel	In channel off Constable Hook	49	12	22	22	22
	MKK-2	Channel	In channel off tip of Bayonne	47	12	21	22	22
Newark Bay	MNB-1	Channel	Mouth of S. Elizabeth Channel	41	12	22	22	22
	MNB-2	Channel	Just S of Elizabeth Channel	43	12	21	22	22
	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	22	22
	MNB-6	Channel	In channel; mouth of Passaic River	30	11	21	22	22
Upper Bay	MUB-1	Channel	Middle of The Narrows, just N of Verrazano	62	12	21	22	22
	MUB-2	Channel	In Anchorage Channel, just S of 24 buoy	47	12	22	22	22
	MUB-3	Channel	Bay Ridge Channel, just SE of marker 7	37	12	22	22	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	22	22

Table 2-1 (continued). Description of mid-water and stations sampled during the 2006 and 2011-2013 Migratory Finfish Sampling Program

Harbor Area	Station Name	Station Type	Station Location	MLLW Depth (ft)	Valid Samples Collected			
					2006	2011	2012	2013
Upper Bay	MUB-9	Channel	Edge of Anchorage Channel; just E of Ellis Is.	51	12	21	22	22
	MUB-10	Channel	Edge of Anchorage Channel; E of Liberty Is.	51	12	---	---	---
	MUB-11	Non-Channel	Bay Ridge Flats	12	---	21	22	22
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	22	22
	MLB-4	Non-Channel	On flats SW of West Bank	15	12	21	22	22
	MLB-5	Channel	Ambrose Channel S of marker 22	42	---	21	22	22
	MLB-6	Non-Channel	SE of Coney Island	24	---	21	22	22

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 2006 and 2011-2013 Migratory Finfish Sampling Programs.

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 2011-2013 Migratory Finfish Sampling Programs.

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	Determined using the target sample depth and expected wire angle to get tow cable length from the chart in Table 4 of the SOP. If floats are used the tow cable length is set at 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	16 - 18-inch round air filled or foam floats, attached to door with cable of varying length depending on fishing depth.
Float line length	As per table specifications in the SOP.

Table 3-1. Number of valid mid-water trawl samples collected per sample week and season during the 2013 Migratory Finfish Sampling Program.

Season Grouping	Sample Week	Number of Valid Samples Collected
Spring	March 18, 2013	20
	March 25, 2013	20
	April 1, 2013	20
	April 8, 2013	20
	April 15, 2013	20
	April 22, 2013	20
	May 6, 2013	20
	May 20, 2013	20
	June 3, 2013	20
Summer	July 8, 2013	20
	August 19, 2013	20
Fall	September 9, 2013	20
	September 23, 2013	20
	September 30, 2013	20
	October 7, 2013	20
	October 14, 2013	20
	October 21, 2013	20
	October 28, 2013	20
	November 4, 2013	20
	November 11, 2013	20
	November 18, 2013	20
	December 2, 2013	20

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 2011-2013 Migratory Finfish Sampling Programs.

Group	Common Name	Scientific Name	2006	2011	2012	2013
Target Species	Alewife	*Alosa pseudoharengus*	4	3	5	4
	American shad	*Alosa sapidissima*	8	5	10	10
	Atlantic menhaden	*Brevoortia tyrannus*	3	X	6	X
	Blueback herring	*Alosa aestivalis*	2	2	2	2
	Striped bass	*Morone saxatilis*	X	X	X	
Essential Fish Habitat Species	Atlantic cod	*Gadus morhua*				X
	Atlantic herring	*Clupea harengus harengus*	5	9	3	3
	Black sea bass	*Centropristis striata*		X		X
	Bluefish	*Pomatomus saltatrix*	10	X	X	6
	Butterfish	*Peprilus triacanthus*	6	7	8	7
	Pollock	*Pollachius virens*		X		
	Red hake	*Urophycis chuss*		X		
	Scup	*Stenotomus chrysops*		X		
	Silver hake	*Merluccius bilinearis*		6	X	
	Spanish mackerel	*Scomberomorus maculatus*	X			
	Windowpane	*Scophthalmus aquosus*		X		
	Winter flounder	*Pseudopleuronectes americanus*	X		X	
Other Species	American eel	*Anguilla rostrata*		X		
	American sandlance	*Ammodytes americanus*	X		X	X
	Atlantic croaker	*Micropogonias undulatus*		X	X	
	Atlantic cutlassfish	*Trichiurus lepturus*	X			
	Atlantic moonfish	*Selene setapinnis*	X	X	X	X
	Atlantic silverside	*Menidia menidia*	X	X	X	8
	Atlantic thread herring	*Opisthonema oglinum*		X	7	
	Atlantic tomcod	*Microgadus tomcod*		X	X	
	Banded killifish	*Fundulus diaphanus*		X		
	Bay anchovy	*Anchoa mitchilli*	1	1	1	1
	Blue crab	*Callinectes sapidus*	7	10	X	9
	Blue runner	*Caranx crysos*			X	
	Boxfishes	*Ostraciidae*	X			

Table 3-2 (continued). Checklist of finfish species (common and scientific names) collected in mid-water trawl samples during the 2006 and 2011-2013 Migratory Finfish Sampling Programs.

Group	Common Name	Scientific Name	2006	2011	2012	2013
Other Species	Conger eel	*Conger oceanicus*		X	X	
	Feather blenny	*Hypsoblennius hentz*			X	
	Fourbeard rockling	*Enchelyopus cimbrius*	X			
	Gizzard shad	*Dorosoma cepedianum*		4		
	Grubby	*Myoxocephalus aenaeus*	X			
	Hickory shad	*Alosa mediocris*	X			
	Inland silverside	*Menidia beryllina*			X	
	Lined seahorse	*Hippocampus erectus*	X	X	X	X
	Lookdown	*Selene vomer*	X			
	Naked goby	*Gobiosoma bosci*		X		
	Northern pipefish	*Syngnathus fuscus*	X	X	X	X
	Northern puffer	*Sphoeroides maculatus*			X	
	Northern searobin	*Prionotus carolinus*		X		X
	Northern stargazer	*Astroscopus guttatus*	X		X	
	Oyster toadfish	*Opsanus tau*		X		
	Pinfish	*Lagodon rhomboides*		X		
	River herrings	*Alosa spp.*		X		
	Silver perch	*Bairdiella chrysoura*		X		
	Skilletfish	*Gobiesox strumosus*			X	
	Smallmouth flounder	*Etropus microstomus*		X		
	Spotfin butterflyfish	*Chaetodon ocellatus*				X
	Spotted hake	*Urophycis regia*	X	X	X	X
	Striped anchovy	*Anchoa hepsetus*	9	8	4	5
	Striped cusk-eel	*Ophidion marginatum*		X		
	Striped searobin	*Prionotus evolans*	X	X	X	
	Threespine stickleback	*Gasterosteus aculeatus*			X	
	Weakfish	*Cynoscion regalis*		X	X	
	White mullet	*Mugil curema*			9	
	White perch	*Morone americana*		X	X	X

(X = Present in Catch; Ranked 1-10 with 1 being the most common species)

Table 3-3. Total number of finfish collected by species each month in mid-water trawl samples during the 2013 Migratory Finfish Sampling Program.

Group	Common Name	March	April	May	June	July	August	September	October	November	December	Total
Target Species	Alewife		112	99			1	13	7	2		**234**
	American shad		1	6					2	7	1	**17**
	Atlantic menhaden		10	1				1	1	1		**14**
	Blueback herring	249	1,275	599			3	50	1,457	180	11	**3,824**
	Striped bass											**0**
	Sub-total	*249*	*1,398*	*705*	*0*	*0*	*4*	*64*	*1,467*	*190*	*12*	***4,089***
Essential Fish Habiat Species	Atlantic cod		2									**2**
	Atlantic herring	28	1,010	369	2							**1,409**
	Black sea bass									1		**1**
	Bluefish				40	14	8	12	8	4		**86**
	Butterfish			19	1	2	7	8	37	1		**75**
	Sub-total	*28*	*1,012*	*388*	*43*	*16*	*15*	*20*	*45*	*6*	*0*	***1,573***
Other Species	American sandlance									1	16	**17**
	Atlantic moonfish						1		2	1		**4**
	Atlantic silverside									1	49	**50**
	Bay anchovy	5	13	238	193	2,986	6,456	9,052	8,274	115	37	**27,369**
	Blue crab				2	4	13	9	6	2		**36**
	Lined seahorse		1	1						1		**3**
	Northern pipefish	3	1									**4**

Table 3-3 (continued.) Total number of finfish collected by species each month in mid-water trawl samples during the 2013 Migratory Finfish Sampling Program.

Group	Common Name	March	April	May	June	July	August	September	October	November	December	Total
Other Species	Northern searobin			1								**1**
	Spotfin butterflyfish								1			**1**
	Spotted hake			1								**1**
	Striped anchovy							79	10			**89**
	White perch		2									**2**
	Sub-total	*8*	*17*	*241*	*195*	*2,990*	*6,470*	*9,140*	*8,293*	*121*	*102*	***27,577***
Total Number		**285**	**2,427**	**1,334**	**238**	**3,006**	**6,489**	**9,224**	**9,805**	**317**	**114**	**33,239**
Number of Species		**4**	**10**	**10**	**5**	**4**	**7**	**8**	**11**	**13**	**5**	**21**

Table 3-4. Average mid-water trawl CPUE (± 1 standard error) by species for all channel and non-channel stations in the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB) and Lower Bay (LB) during the 2013 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	0.04	0.04	0.73	0.41	1.32	0.82	0.02	0.02	0.53
	Non-Channel							0.43	0.30	0.22
Alewife	Combined	0.04	0.04	0.73	0.41	1.10	0.68	0.23	0.15	0.52
	Channel			0.02	0.02	0.09	0.04	0.02	0.02	0.03
	Non-Channel					0.14	0.10	0.02	0.02	0.08
American Shad	Combined			0.02	0.02	0.10	0.04	0.02	0.02	0.04
	Channel	0.02	0.01	0.02	0.02	0.06	0.05			0.03
	Non-Channel							0.05	0.05	0.02
Atlantic Menhaden	Combined	0.02	0.01	0.02	0.02	0.05	0.04	0.02	0.02	0.03
	Channel	1.92	1.02	37.48	17.28	2.05	0.86	0.05	0.05	10.37
	Non-Channel					0.86	0.77	0.61	0.26	0.74
Blueback herring	Combined	1.92	1.02	37.48	17.28	1.85	0.73	0.33	0.14	10.39
	Channel									
	Non-Channel									
Striped bass	Combined									
Sum of Target Species Combined CPUE		**1.98**		**38.25**		**3.10**		**0.60**		**10.98**

Table 3-4 (continued). Average mid-water trawl CPUE (± 1 standard error) by species for all navigation channel and non-channel stations in the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB) and Lower Bay (LB) during the 2013 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	
Essential Fish Habitat Species										
Atlantic cod	Channel									
	Non-Channel					0.09	0.09			0.05
	Combined					0.02	0.02			0.00
Atlantic herring	Channel	3.16	1.81	4.47	2.88	4.13	2.45	0.14	0.10	2.97
	Non-Channel					2.09	1.08	2.11	2.09	2.10
	Combined	3.16	1.81	4.47	2.88	3.79	2.05	1.13	1.05	3.13
Black sea bass	Channel									
	Non-Channel					0.05	0.05			0.02
	Combined					0.01	0.01			0.00
Bluefish	Channel	0.29	0.18	0.23	0.10	0.12	0.06			0.16
	Non-Channel					0.05	0.05	0.32	0.16	0.18
	Combined	0.29	0.18	0.23	0.10	0.11	0.05	0.16	0.08	0.20
Butterfish	Channel	0.05	0.02	0.02	0.02	0.36	0.15	0.30	0.13	0.18
	Non-Channel					0.32	0.27	0.16	0.07	0.24
	Combined	0.05	0.02	0.02	0.02	0.36	0.13	0.23	0.07	0.16
Sum of EFH Species Combined CPUE		**3.49**		**4.72**		**4.27**		**1.51**		**3.50**

Table 3-4 (continued). Average mid-water trawl CPUE (± 1 standard error) by species for all navigation channel and non-channel stations in the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB) and Lower Bay (LB) during the 2013 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	
Other Species										
	Channel					0.01	0.01	0.36	0.36	0.09
	Non-Channel									
American sandlance	Combined					0.01	0.01	0.18	0.18	0.05
	Channel	0.01	0.01			0.01	0.01	0.02	0.02	0.01
	Non-Channel					0.05	0.05			0.02
Atlantic moonfish	Combined	0.01	0.01			0.02	0.01	0.01	0.01	0.01
	Channel	0.20	0.16	0.26	0.25	0.01	0.01			0.12
	Non-Channel									
Atlantic silverside	Combined	0.20	0.16	0.26	0.25	0.01	0.01			0.12
	Channel	46.13	17.72	57.20	22.56	16.55	6.49	1.18	0.88	30.27
	Non-Channel					155.05	91.33	249.18	127.61	202.11
Bay anchovy	Combined	46.13	17.72	57.20	22.56	39.64	16.50	125.18	64.82	67.04
	Channel	0.10	0.04	0.17	0.06	0.01	0.01	0.02	0.02	0.08
	Non-Channel					0.14	0.07	0.07	0.05	0.10
Blue crab	Combined	0.10	0.04	0.17	0.06	0.03	0.01	0.05	0.03	0.09
	Channel	0.01	0.01	0.01	0.01					0.00
	Non-Channel							0.02	0.02	0.01
Lined seahorse	Combined	0.01	0.01	0.01	0.01			0.01	0.01	0.01
	Channel	0.01	0.01			0.02	0.01			0.01
	Non-Channel					0.05	0.05			0.02
Northern pipefish	Combined	0.01	0.01			0.02	0.01			0.01

Table 3-4 (continued). Average mid-water trawl CPUE (± 1 standard error) by species for all navigation channel and non-channel stations in the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB) and Lower Bay (LB) during the 2013 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**	
Other Species										
Northern searobin	Channel	0.01	0.01							0.00
	Non-Channel									
	Combined	0.01	0.01							0.00
Spotfin butterflyfish	Channel					0.01	0.01			0.00
	Non-Channel									
	Combined					0.01	0.01			0.00
Spotted hake	Channel	0.01	0.01							0.00
	Non-Channel									
	Combined	0.01	0.01							0.00
Striped anchovy	Channel	0.20	0.15	0.17	0.12	0.25	0.18			0.15
	Non-Channel					0.64	0.48	0.16	0.12	0.40
	Combined	0.20	0.15	0.17	0.12	0.31	0.17	0.08	0.06	0.19
White perch	Channel			0.02	0.02					0.01
	Non-Channel									
	Combined			0.02	0.02					0.01
Sum of Other Species Combined CPUE		**46.66**		**57.84**		**40.04**		**125.51**		**67.51**
Sum of All Species Combined CPUE		***52.13***		***100.81***		***47.41***		***127.63***		***81.99***

(Shaded cells represent station types that were not sampled)

Table 3-5. Summary of significant differences among target species Cumulative Frequency Distributions during spring for the 2013 Migratory Finfish Sampling Program.

	Alewife	**American Shad**	**Atlantic Menhaden**	**Blueback Herring**
Alewife	--	Significantly Different	NS	Significantly Different
American Shad		--	Significantly Different	Significantly Different
Atlantic Menhaden			--	NS
Blueback Herring				--

NS = Not significant

Table 3-6. Summary of significant differences among target species Cumulative Frequency Distributions during fall for the 2013 Migratory Finfish Sampling Program.

	Alewife	**American Shad**	**Atlantic Menhaden**	**Blueback Herring**
Alewife	--	Significantly Different	NS	Significantly Different
American Shad		--	NS	Significantly Different
Atlantic Menhaden			--	NS
Blueback Herring				--

NS = Not significant

Table 4-1. Relevant studies with migratory finfish collections conducted in the Hudson-Raritan Estuary.

Survey	Author	Year	Gear	Target Species	Sampling Period	Summary
Westway Fish Sampling	Lawler, Metusky, and Skelly Engineers	1980	Bottom trawling, mid-water trawling	All	1979-1980	Sampling in the vicinity of the proposed Westway site took place from 1979-1980 along the west side of Manhattan. Bottom and mid-water trawls targeted all species that occurred between the piers. YOY striped bass were collected during this sampling and were shown to be using the interpier areas.
A Study of Marine Recreational Fisheries in Connecticut: Long Island Sound Trawl Survey	CTDEEP	1984-2011	14-m Otter Trawl	All	Spring and Fall	Connecticut DEP Marine Fisheries Division has conducted the Long Island Sound Trawl Survey for 28 years. This study enumerates and identifies all species collected. Biomass, age specific, and length frequency indices are calculated for all species including the five migratory finfish species that are the focus of this study.
Inventory of the fishery resources of the Hudson River from Bayonne to Piermont	New Jersey Department of Environmental Protection	1984	Bottom trawling, mid-water trawling, trap nets, gill nets	All	Fall 1982 - Fall 1983	The fisheries of the lower Hudson River (Bayonne to Piermont) were sampled once per season beginning in the fall of 1982 and continuing through the fall of 1983. Sampling gear included bottom and midwater trawls, trap nets, and gill nets. Sampling took place at representative locations. The most commonly occurring and abundant fish species collected were alewife, American eel, American shad, Atlantic tomcod, bay anchovy, blueback herring, hogchoker, striped bass, white perch and winter flounder.
Riverwalk Existing Hydrological, Water Quality, and Biological Conditions Report	Lawler, Metusky, and Skelly Engineers	1985	Bottom trawling	All	October 1983 - April 1984	Bottom trawling was conducted bi-weekly in inter-pier areas along the east side of Manhattan from October 1983 through April 1984. Striped bass were among the most abundant species collected during this study.
Hunter's Point Aquatic Sampling Program	Lawler, Metusky, and Skelly Engineers	1986	Bottom trawl, ichthyoplankton trawl, trap nets, gill nets, beach seine	All	March 1985-February 1986	Bottom trawl and ichthyoplankton samples were collected at 8 locations along the East River. At 4 of these locations, trap nets, gill nets, and beach seines were deployed as well. Sampling yielded 45 different species, with striped bass, American shad, alewife, and blueback herring being among the most abundant species.

Table 4-1 (continued). Relevant studies with migratory finfish collections conducted in the Hudson-Raritan Estuary.

Survey	Author	Year	Gear	Target Species	Sampling Period	Summary
Jamaica Bay Fisheries Survey	National Parks Service	1991	Otter trawl, gill net and beach seine	All	1988-1989	A total of 81 species were collected using otter trawls, gill nets, and beach seines at locations around Jamaica Bay from 1988-1989. Species collected during otter trawls were made up primarily of winter flounder, but also included blueback herring, alewife, American shad, Atlantic menhaden, and striped bass.
Newark Bay Sampling Program	Lawler, Metusky, and Skelly Engineers	1996	Bottom trawl	All	April 1995 - March 1996	Bottom trawl sampling was conducted at six Newark Bay locations at monthly intervals between April 1995 and March 1996 with the purpose of characterizing the species composition and relative abundances of the fish community in shoal areas of the Bay. Twenty-seven species of fish were collected yielded large catches of bay anchovy, striped bass and winter flounder.
New York New Jersey Harbor Deepening Project: Aquatic Biological Survey	USACE-NYD	1998-2010	30ft otter trawl	Focus is winter flounder, migratory fish species recorded as well	December-June	Bottom trawl surveys targeted winter flounder. All species that were caught were identified and enumerated. Alewife, bluebacks, and striped bass were most abundant from January-April. Atlantic menhaden and American Shad were not collected in high abundance during this time period.
River Herring Spawning Stock Survey	NYSDEC	1999-2001	gill nets, cast nets, scap and dip nets, and jigging	Alewife, blueback herring	Spring-Fall	Recent concerns of fishers indicate that changes "appear" to be occurring in the herring stocks. To document current status, NYS Department of Environmental Conservation biologists developed this program with funding through the Hudson River Estuary Program.
Gill Net & Otter Trawl Sampling Norton Basin, Little Bay, Grass Hassock Channel, and The Raunt	Barry Vitor & Associates submitted to PANYNJ	2002	Gill net and Otter Trawl	All species	August	Gill net and otter trawl sampling took place in August of 2002 in various regions of Jamaica Bay. Results indicated that Atlantic Menhaden were caught in the highest abundance during gill net sampling at most stations. During otter trawl sampling, very few numbers of migratory fish were caught

Table 4-1 (continued). Relevant studies with migratory finfish collections conducted in the Hudson-Raritan Estuary.

Survey	Author	Year	Gear	Target Species	Sampling Period	Summary
Marine Biological Studies of the Marine Transfer Stations Operated by the NYCDOS	NYCDOS	2003	trawling, gill nets	All	January 2003-January 2004	Trawling and gill net sampling took place from January 2003 through January of 2004 at eight Marine Transfer Stations around the New York Harbor Estuary. All species were targeted. Of the five migratory species that are the focus of the Migratory Finfish Survey, striped bass was most abundant with over 400 fish collected. The other four species were not collected in great abundance. Conclusions from the study indicated that the general fisheries population, both adult and larval, were healthy from both a species abundance and numerical point of view.
A study of the Striped Bass in the Marine District of New York State	NYSDEC	2005	Beach Seine	Primarily striped bass, all other species that were collected were recorded as well	May-Oct	Beach seining at various bays and inlets along western long island yielded collection numbers for all migratory fish species except American shad. Results indicate that peak abundance for striped bass YOY is occurring from June through October. Alewife and blueback were sparsely caught during this sampling period, while Atlantic Menhaden YOY were caught in huge numbers from June through October 2005
Nearshore fish communities of the mid-Hudson River Estuary, 1984-2005	NYSDEC	2005	Beach Seine	Focus is striped bass, other migratory fish species recorded as well	July-November	Beach seine sampling took place in the Tappan Zee Haverstraw Bay Area of the Hudson at 25 sites that were sampled every two weeks from July through November, 2005. Striped bass YOY peak abundance was July-September with low older fish abundance during this time. Blueback herring were most abundant during October and November. Alewife peaked early during sampling during July, with very few caught after August. Menhaden peaked during August then again in October. American shad abundance was relatively low throughout sampling peaking in late July.

Table 4-1 (continued). Relevant studies with migratory finfish collections conducted in the Hudson-Raritan Estuary.

Survey	Author	Year	Gear	Target Species	Sampling Period	Summary
Winter Distribution and Abundance of Hudson River Fishes Using Hydroacoustics	K.J. Hartman and B.W. Nagy	2006	Mid-water trawls, gill nets	All	December 1995, December 1997	Hartman and Nagy reported on sampling that was conducted in December 1995 and 1997 in the Hudson River from the Battery to Poughkeepsie. A total of 13 species was collected in midwater trawls in 1995 including striped bass, white perch, bay anchovy, alewife, blueback herring, and Atlantic croaker. The fish that mostly made up the Lower Hudson collections (Yonkers and the Battery) were striped bass and white perch.
Tappan Zee Bridge FEIS: Appendix F, Attachment 1 - Aquatic Sampling Program	AECOM	2011	Gill nets	All species	April 2007-May 2008	Sampling was conducted every other month from April 2007-May 2008. Alewives mostly occurred May 2008 sampling. American shad and blueback herring were caught in low numbers in April and May. Striped bass were present throughout the entirety of the sampling with peak abundance occurring in April. Older year classes of striped bass were caught in April and May while sub-adults and YOY fish were caught later in the year. Atlantic menhaden were caught in high numbers throughout the warmer months when the salinity was at its peak in August.
Evaluation of Fish Species Assemblages at the Proposed 91st Street Converted MTS and South Bronx and Bush Terminal Mitigation Sites	NYCDOS	2012	Mid-water trawls, bottom trawls, trap nets, ichthyoplankton sled tows	All	December 2011-January 2012	A total of 243 finfish from 13 species and 17 blue crabs (Callinectes sapidus) were collected during the December 2011 and January 2012 sampling program conducted at the East 91st Street MTS site. Blueback herring were the most abundant species collected during this survey. Striped bass, alewife, American shad, and Atlantic menhaden were also collected during this survey.

Table 4-1 (continued). Relevant studies with migratory finfish collections conducted in the Hudson-Raritan Estuary.

Survey	Author	Year	Gear	Target Species	Sampling Period	Summary
River Herring Benchmark Stock Assessment	Atlantic State Marine Fisheries Commission	2012	seining, trawling, gill nets	alewife, blueback herring	2001-2011	Of the 52 in-river stocks of alewife and blueback herring for which data were available, 22 were depleted, 1 stock was increasing, and the status of 28 stocks could not be determined because the time-series of available data was too short. In most recent years, 2 were increasing, 4 were decreasing, and 9 were stable with 38 rivers not having enough data to assess recent trends. The coastwide meta-complex of river herring stocks on the US Atlantic coast is depleted to near historic lows. A depleted status indicates that there was evidence for declines in abundance due to a number of factors, but the relative importance of these factors in reducing river herring stocks could not be determined.

Seasonal distribution/occurrence varies yearly within the NY/NJ Harbor area. Two studies summarized available information:

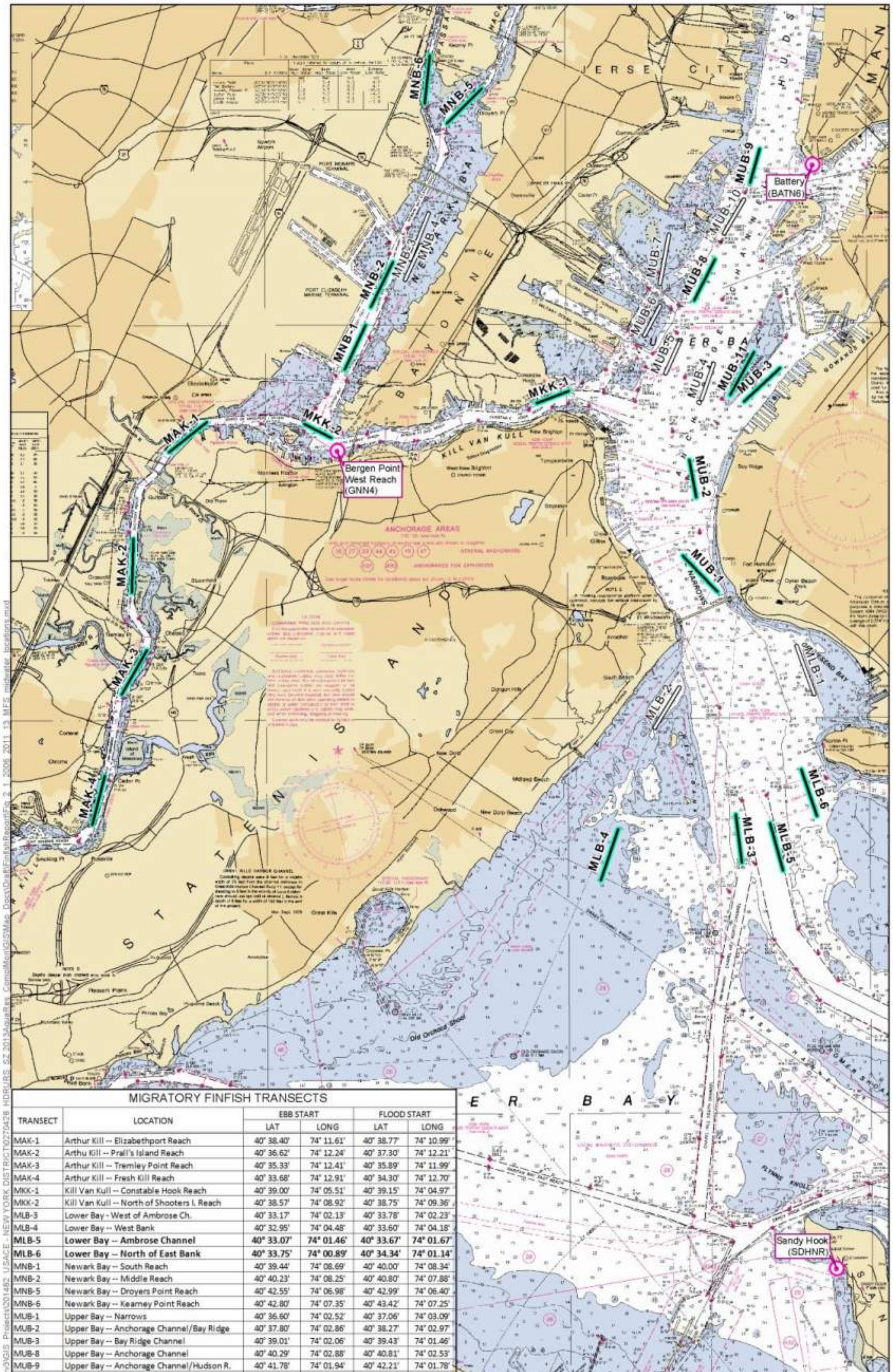
[a] = Woodhead 1991; ° = USACE-NYD 2004b

Table 4-2. Summary of harborwide Water Quality/Total Suspended Solids (WQ/TSS) monitoring surveys conducted by USACE-New York District, 2001-2013.

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

Table 4-2 (continued). Summary of harborwide Water Quality/Total Suspended Solids (WQ/TSS) monitoring surveys conducted by USACE-New York District, 2001-2013.

Survey	Type of Survey(s) (Type of Data Collected)	Area(s) Surveyed	Dates
S-E-1 B	Far Field Dredge (Mobile ADCP, OBS Arrays, TSS/Turbidity Water Samples	Newark Bay (Port Elizabeth Channel)	April 2009
S-KVK-1	Far Field Cutterhead Dredge (Mobile ADCP, OBS Arrays, TSS/Turbidity Water Samples	Kill Van Kull	June 2009
S-AN-2	Far Field Dredge (Mobile ADCP, TSS/Turbidity)	Upper New York Bay (Anchorage Channel)	January 2011
S-KVK-2	Far Field Cutterhead Dredge (Mobile ADCP, OBS Arrays, TSS/Turbidity Water Samples	Kill Van Kull	March 2011
S-NB-2 #1 & #2	Far Field Dredge (Mobile ADCP, OBS Arrays, TSS/Turbidity Water Samples	Newark Bay (South Elizabeth Channel)	July & October 2011
S-AK-2	Far Field Dredge (Mobile ADCP, TSS/Turbidity Water Samples)	Arthur Kill	March 2012
S-AK-3	Far Field Dredge (Mobile ADCP, TSS/Turbidity Water Samples)	Arthur Kill	November 2013



MIGRATORY FINFISH TRANSECTS

TRANSECT	LOCATION	EBB START		FLOOD START	
		LAT	LONG	LAT	LONG
MAK-1	Arthur Kill -- Elizabethport Reach	40° 38.40'	74° 11.61'	40° 38.77'	74° 10.99'
MAK-2	Arthu Kill -- Prall's Island Reach	40° 36.62'	74° 12.24'	40° 37.30'	74° 12.21'
MAK-3	Arthur Kill -- Tremley Point Reach	40° 35.33'	74° 12.41'	40° 35.89'	74° 11.99'
MAK-4	Arthur Kill -- Fresh Kill Reach	40° 33.68'	74° 12.91'	40° 34.30'	74° 12.70'
MKK-1	Kill Van Kull -- Constable Hook Reach	40° 39.00'	74° 05.51'	40° 39.15'	74° 04.97'
MKK-2	Kill Van Kull -- North of Shooters I. Reach	40° 38.57'	74° 08.92'	40° 38.75'	74° 09.36'
MLB-3	Lower Bay - West of Ambrose Ch.	40° 33.17'	74° 02.13'	40° 33.78'	74° 02.23'
MLB-4	Lower Bay -- West Bank	40° 32.95'	74° 04.48'	40° 33.60'	74° 04.18'
MLB-5	**Lower Bay -- Ambrose Channel**	**40° 33.07'**	**74° 01.46'**	**40° 33.67'**	**74° 01.67'**
MLB-6	**Lower Bay -- North of East Bank**	**40° 33.75'**	**74° 00.89'**	**40° 34.34'**	**74° 01.14'**
MNB-1	Newark Bay -- South Reach	40° 39.44'	74° 08.69'	40° 40.00'	74° 08.34'
MNB-2	Newark Bay -- Middle Reach	40° 40.23'	74° 08.25'	40° 40.80'	74° 07.88'
MNB-5	Newark Bay -- Droyers Point Reach	40° 42.55'	74° 06.98'	40° 42.99'	74° 06.40'
MNB-6	Newark Bay -- Kearney Point Reach	40° 42.80'	74° 07.35'	40° 43.42'	74° 07.25'
MUB-1	Upper Bay -- Narrows	40° 36.60'	74° 02.52'	40° 37.06'	74° 03.09'
MUB-2	Upper Bay -- Anchorage Channel/Bay Ridge	40° 37.80'	74° 02.86'	40° 38.27'	74° 02.97'
MUB-3	Upper Bay -- Bay Ridge Channel	40° 39.01'	74° 02.06'	40° 39.43'	74° 01.46'
MUB-8	Upper Bay -- Anchorage Channel	40° 40.29'	74° 02.88'	40° 40.81'	74° 02.53'
MUB-9	Upper Bay -- Anchorage Channel/Hudson R.	40° 41.78'	74° 01.94'	40° 42.21'	74° 01.78'
MUB-11	**Upper Bay -- Bay Ridge Flats**	**40° 39.09'**	**74° 02.29'**	**40° 39.64'**	**74° 01.89'**

Transects in **bold** were added for the 2011 survey.

Figure 2-1
2006 and 2011-2013 Migratory Finfish Sampling Program mid-water trawl locations.

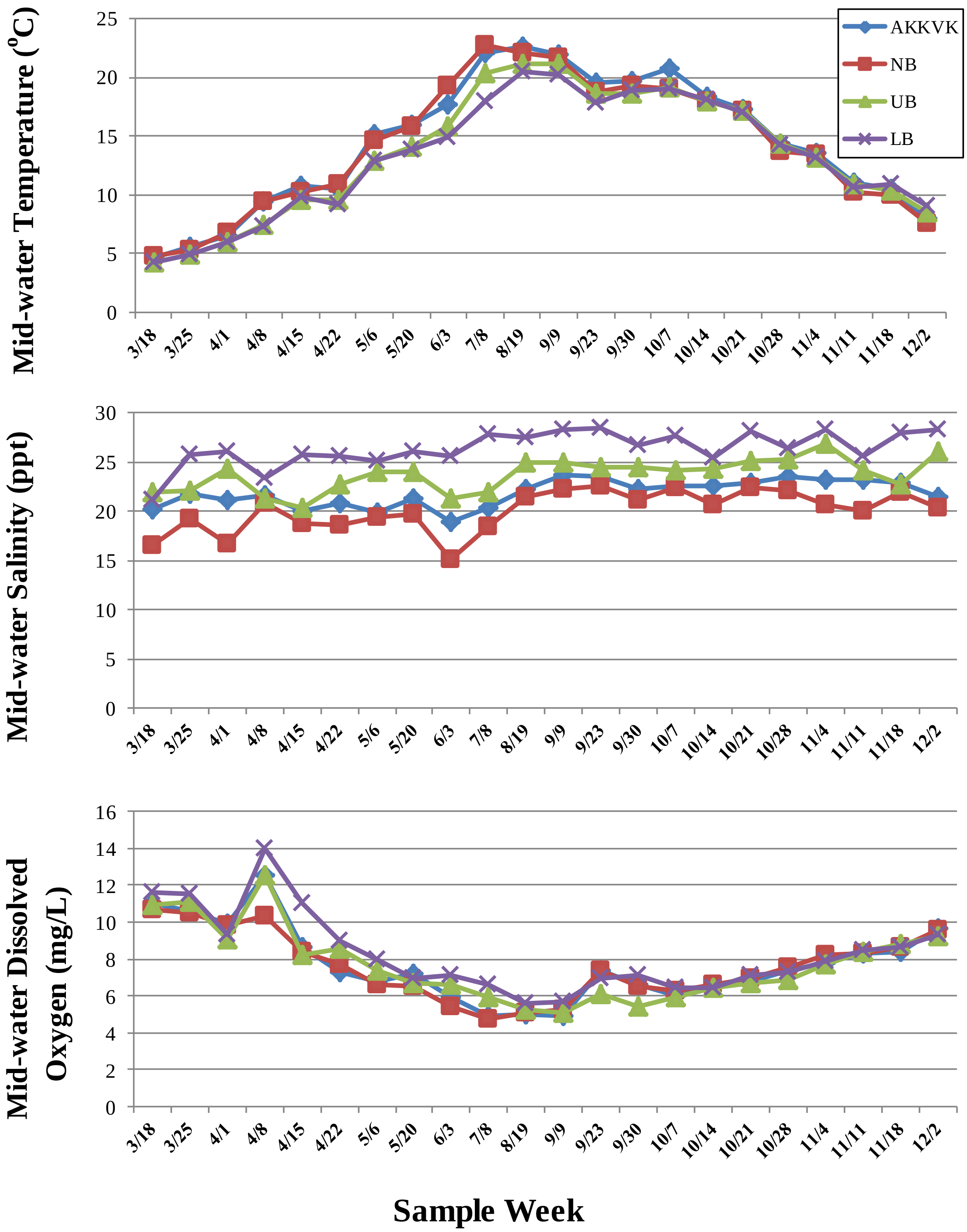


Figure 3-1a Average weekly water quality data by region during the 2013 Migratory Finfish Sampling Program.
Notes: Sample week is indicated by Monday of week.

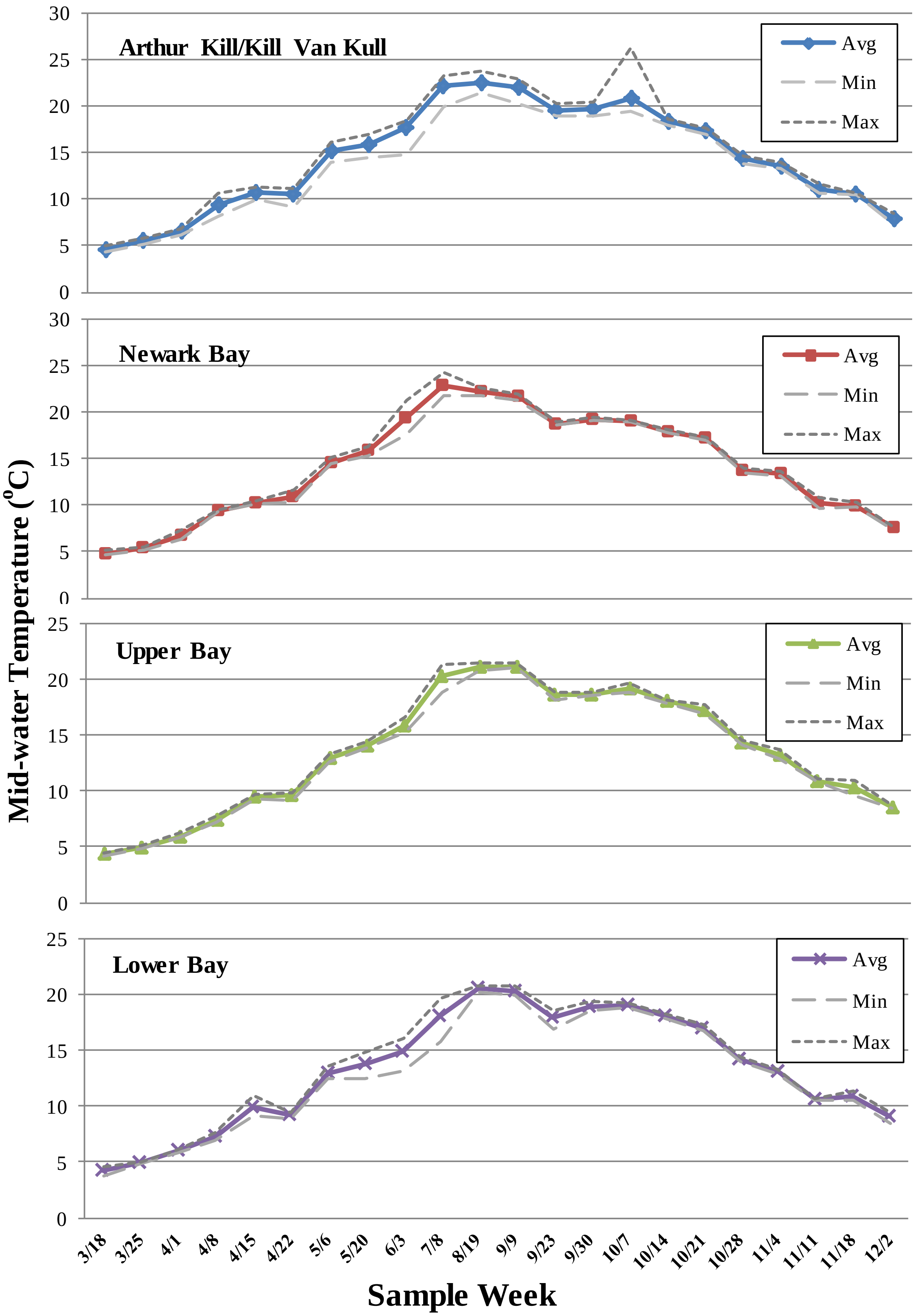


Figure 3-1b Mid-water temperatures (average, maximum, minimum) by week for each region during the 2013 Migratory Finfish Sampling Program.

Notes: Sample week is indicated by Monday of week.

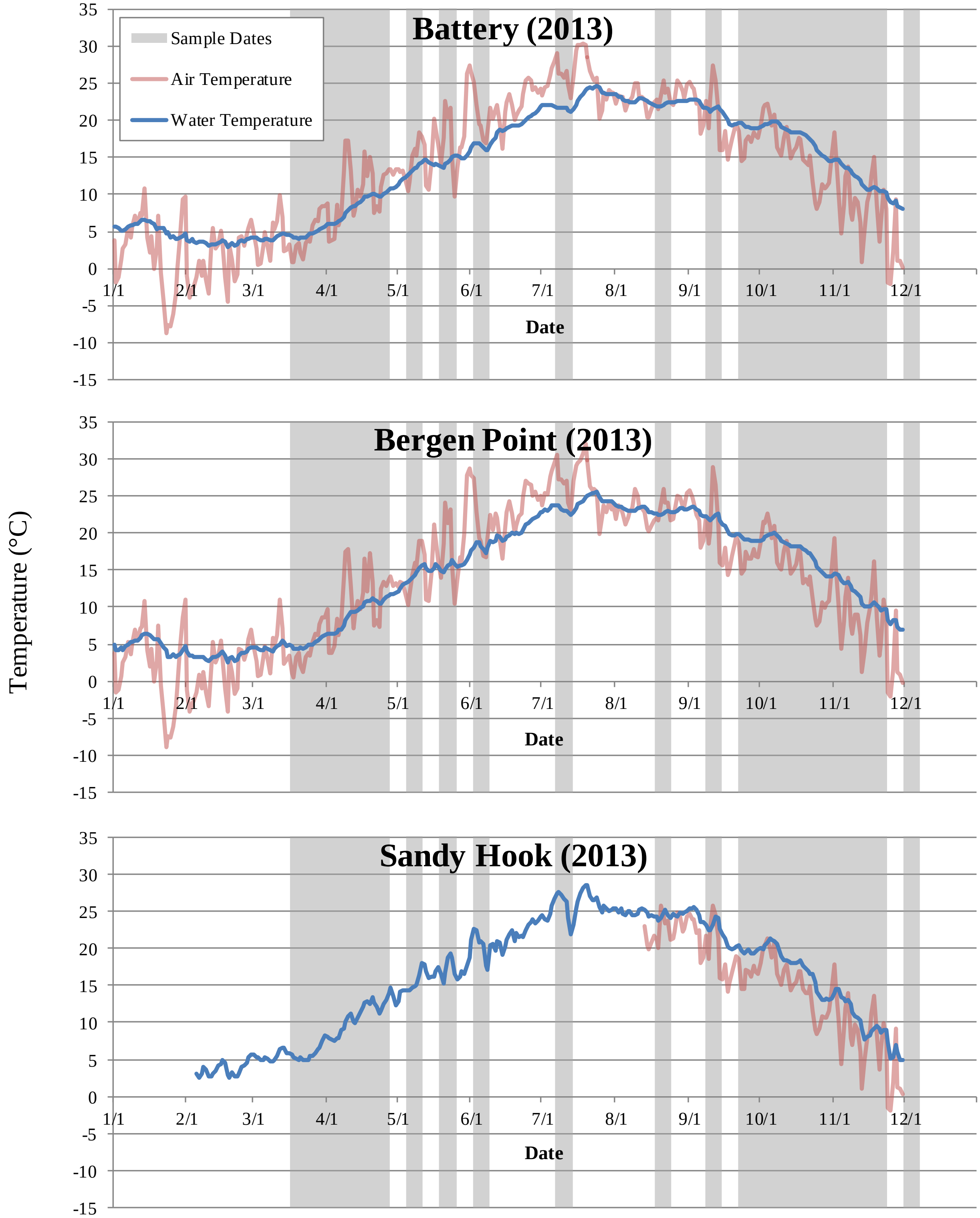


Figure 3-2. Average daily water and air temperatures during 2013 from NOAA water quality buoys at three locations in NY/NJ Harbor. (Note: Solid shading represents sampling weeks; Sandy Hook buoys has missing data due to damage from Hurricane Sandy in October 2012; NOAA buoy data accessed 1/2/2014 at http://nbdc.noaa.gov//)

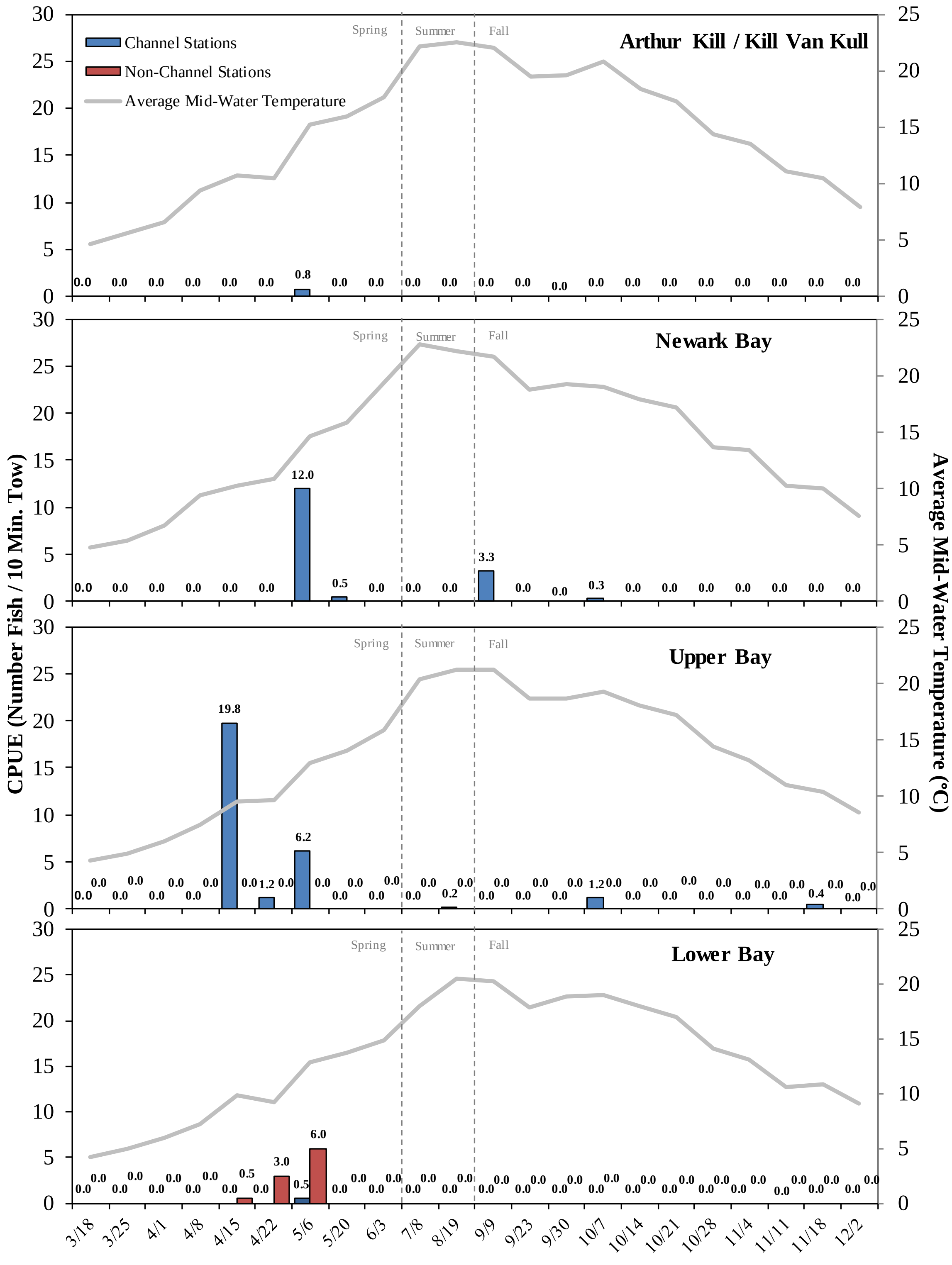


Figure 3-3 Average weekly alewife mid-water trawl CPUE at channel and non-channel stations, and average weekly mid-water temperature in the Arthur Kill/Kill Van Kull, Newark Bay, Upper Bay, and Lower Bay during the 2013 Migratory Finfish Sampling Program

Note: Dates listed indicate the Monday of each sampling week.
Non-channel stations were not sampled in Arthur Kill/Kill Van Kull Sampling Areas
Sampling seasons are shown as described in Section 2.3

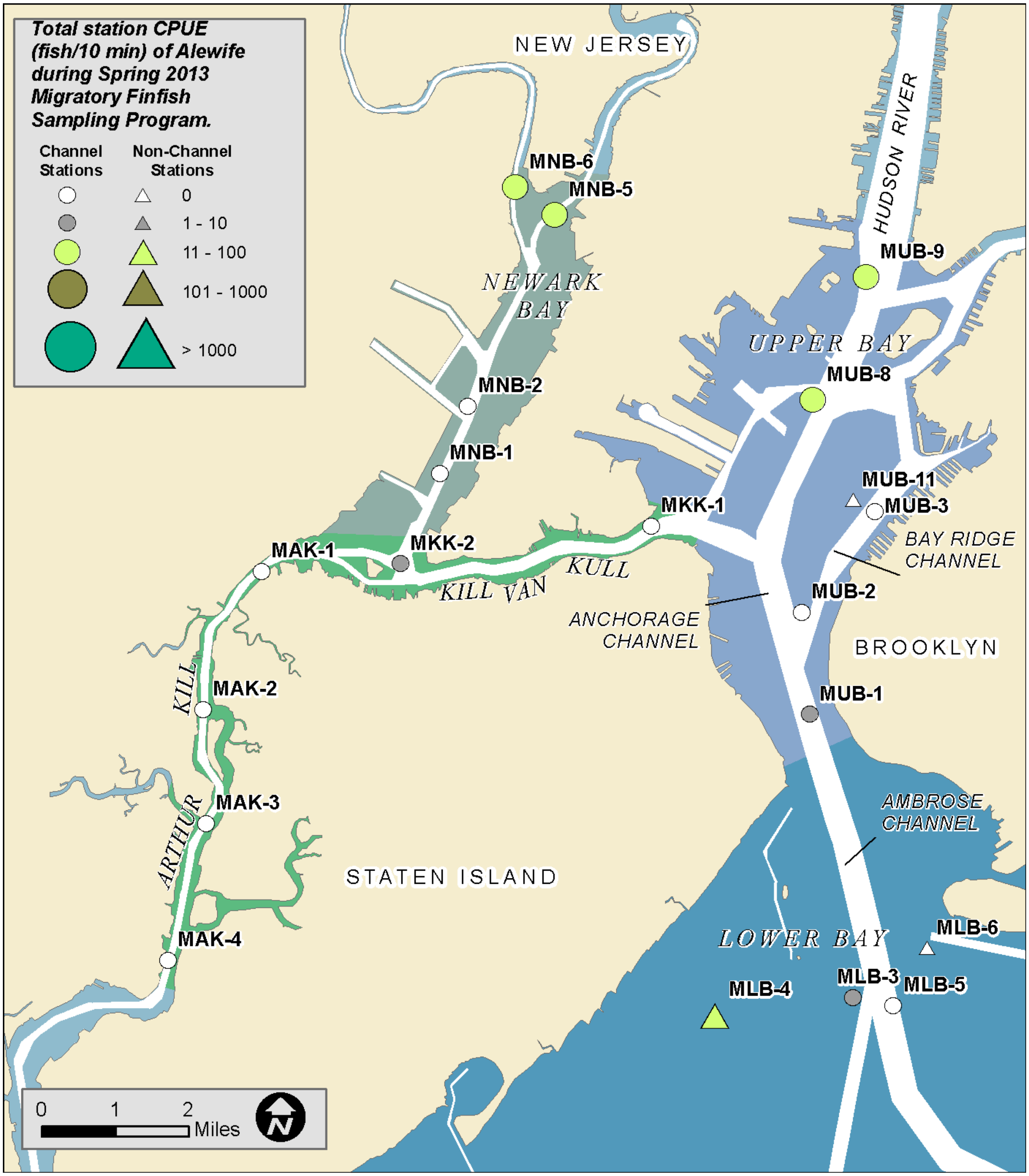


Figure 3-4a. Total station CPUE (fish/10 min. tow) of alewife during spring for the 2013 Migratory Finfish Sampling Program.

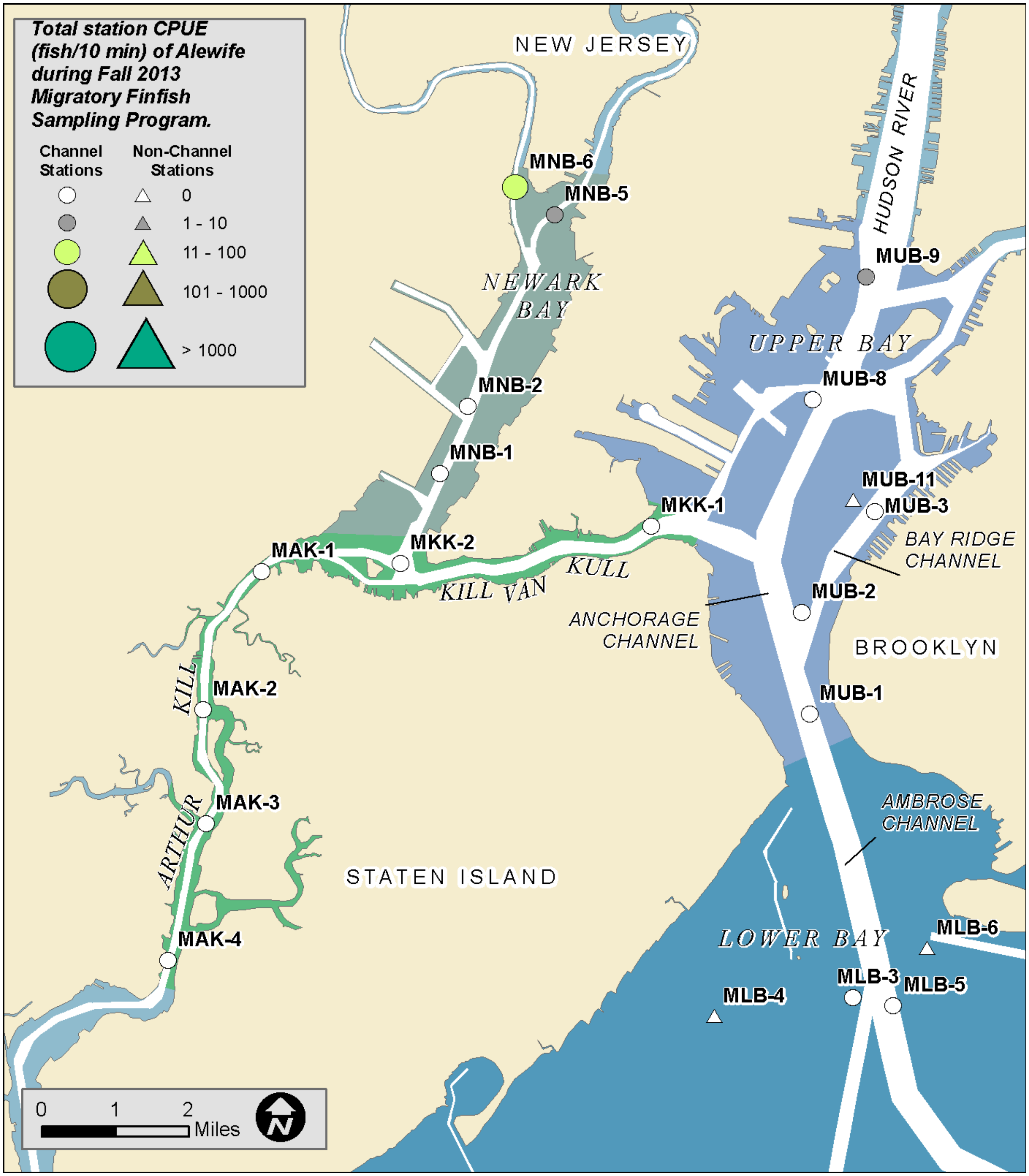


Figure 3-4b. Total station CPUE (fish/10 min. tow) of alewife during fall for the 2013 Migratory Finfish Sampling Program.

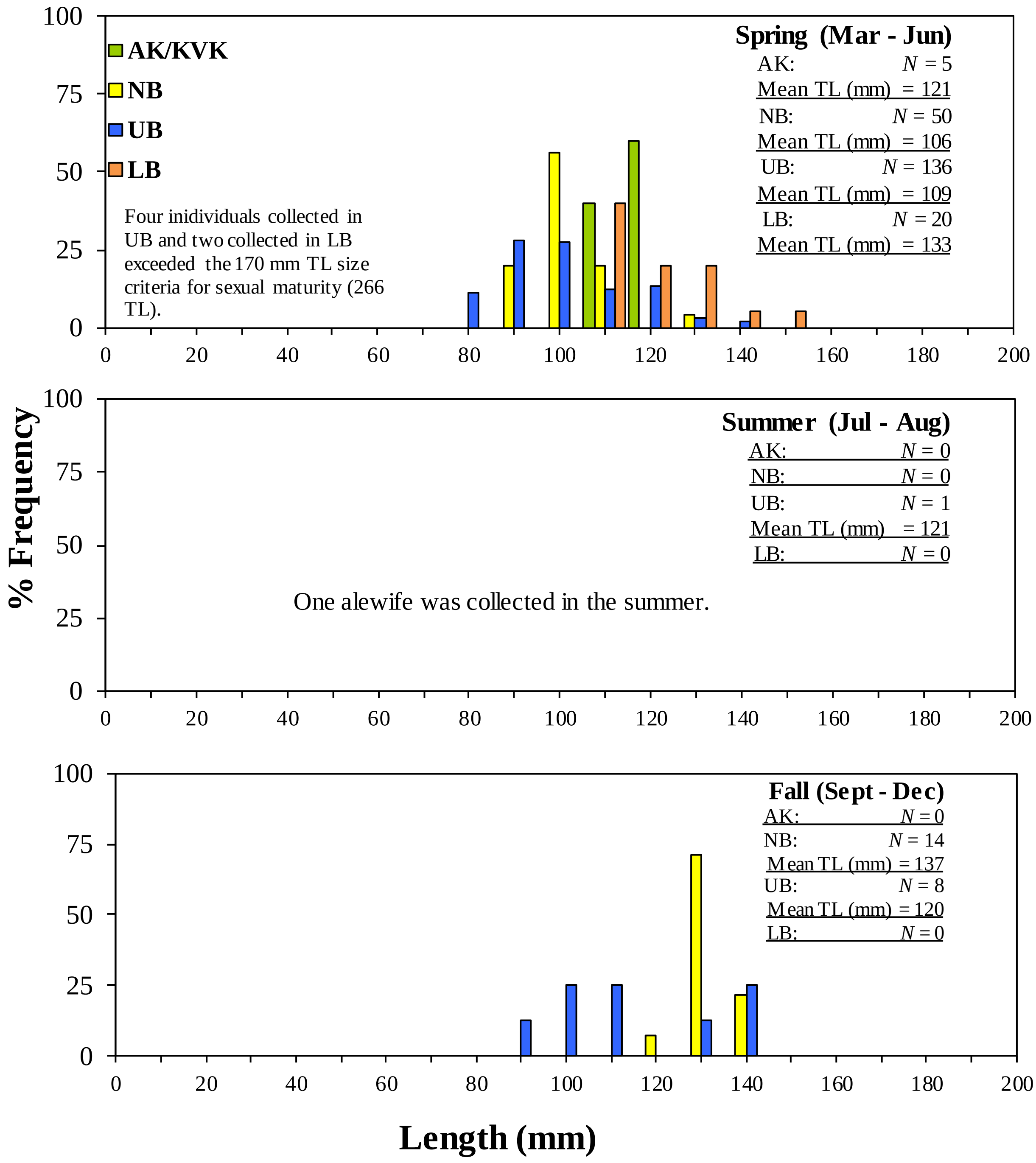


Figure 3-5 Length frequency distribution of alewife in total length (TL) 10 mm intervals, by season and study area, 2013 Migratory Finfish Sampling Program

AK/KVK = Arthur Kill/Kill Van Kull, NB = Newark Bay, UB = Upper Bay, and LB = Lower Bay

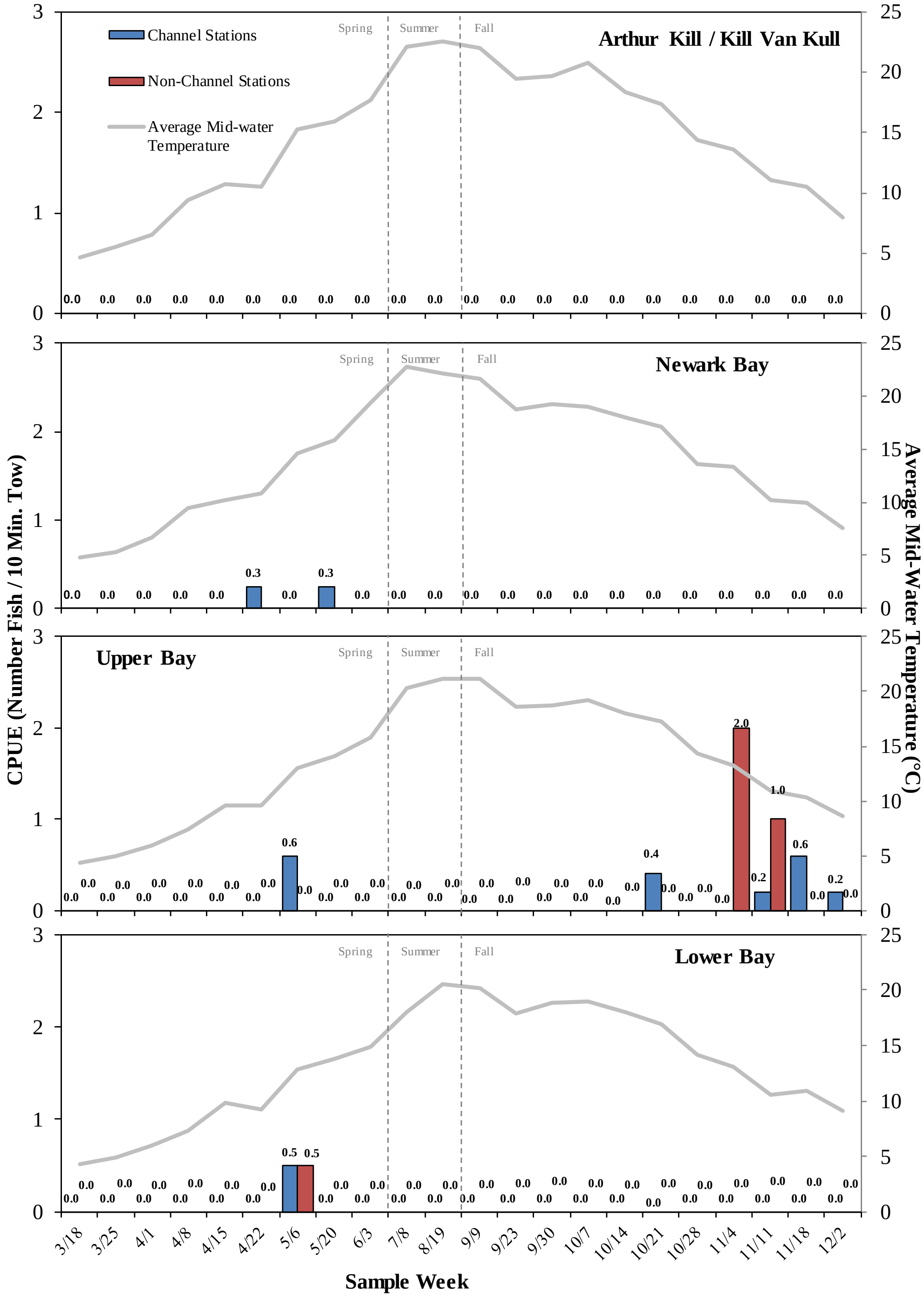


Figure 3-6 Average weekly American shad mid-water trawl CPUE at channel and non-channel stations, and average weekly mid-water temperature in the Arthur Kill/Kill Van Kull, Newark Bay, Upper Bay, and Lower Bay during the 2013 Migratory Finfish Sampling Program.

Note: Dates listed indicate the Monday of each sampling week.

Non-channel stations were not sampled in Arthur Kill/Kill Van Kull Sampling Areas

Sampling seasons are shown as described in Section 2.3

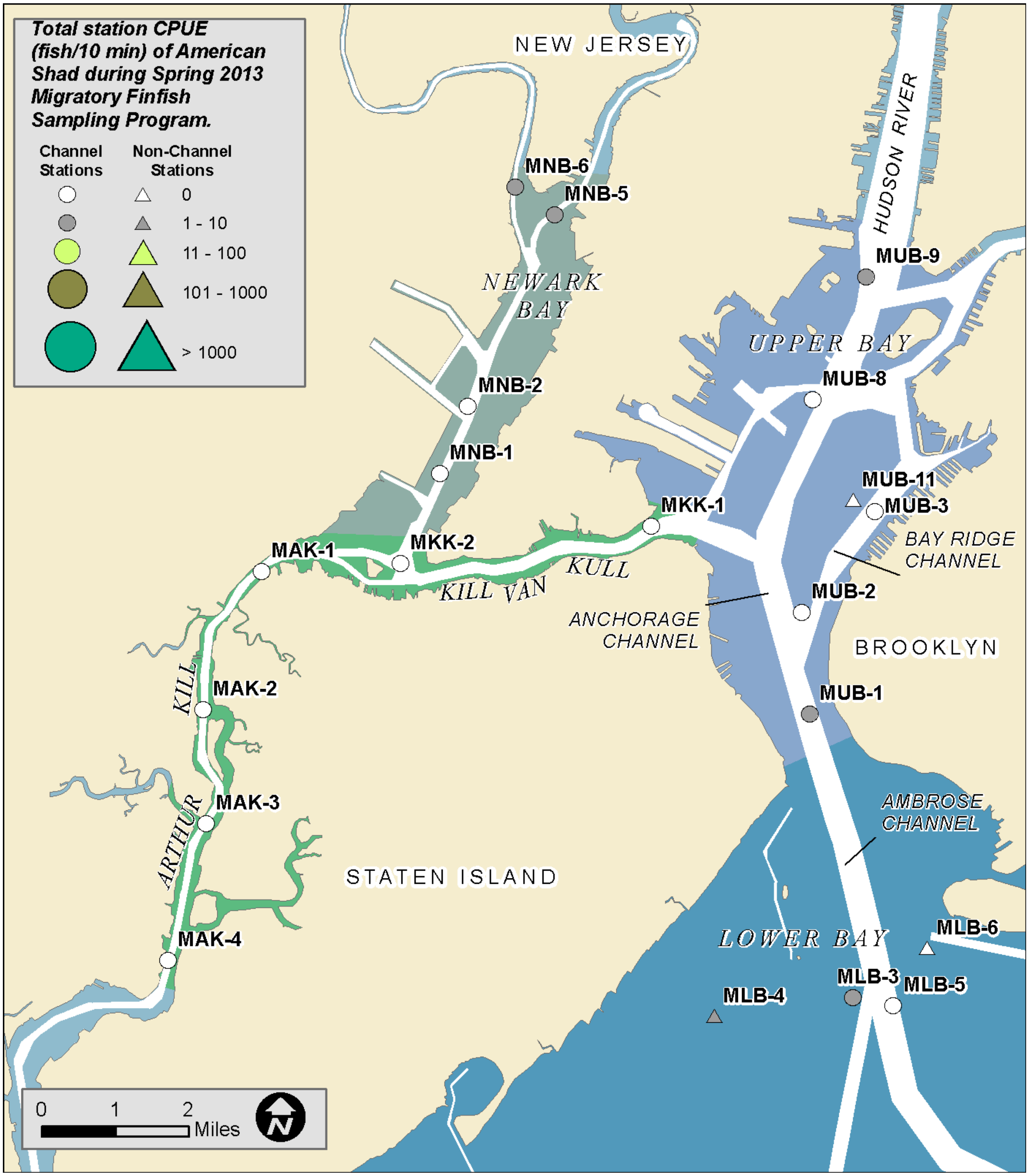


Figure 3-7a. Total station CPUE (fish/10 min. tow) of American shad during spring for the 2013 Migratory Finfish Sampling Program.

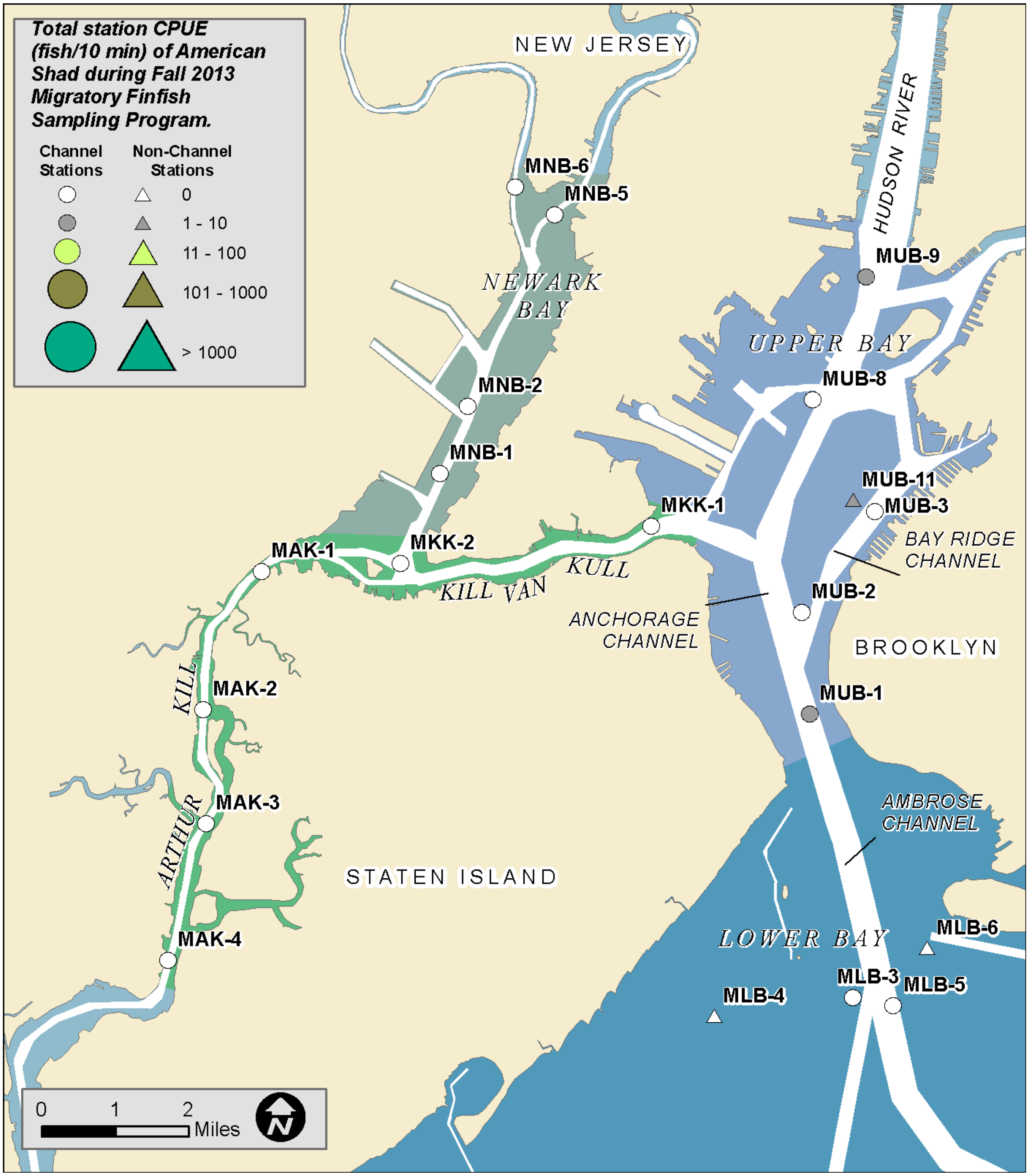


Figure 3-7b. Total station CPUE (fish/10 min. tow) of American shad during fall for the 2013 Migratory Finfish Sampling Program.

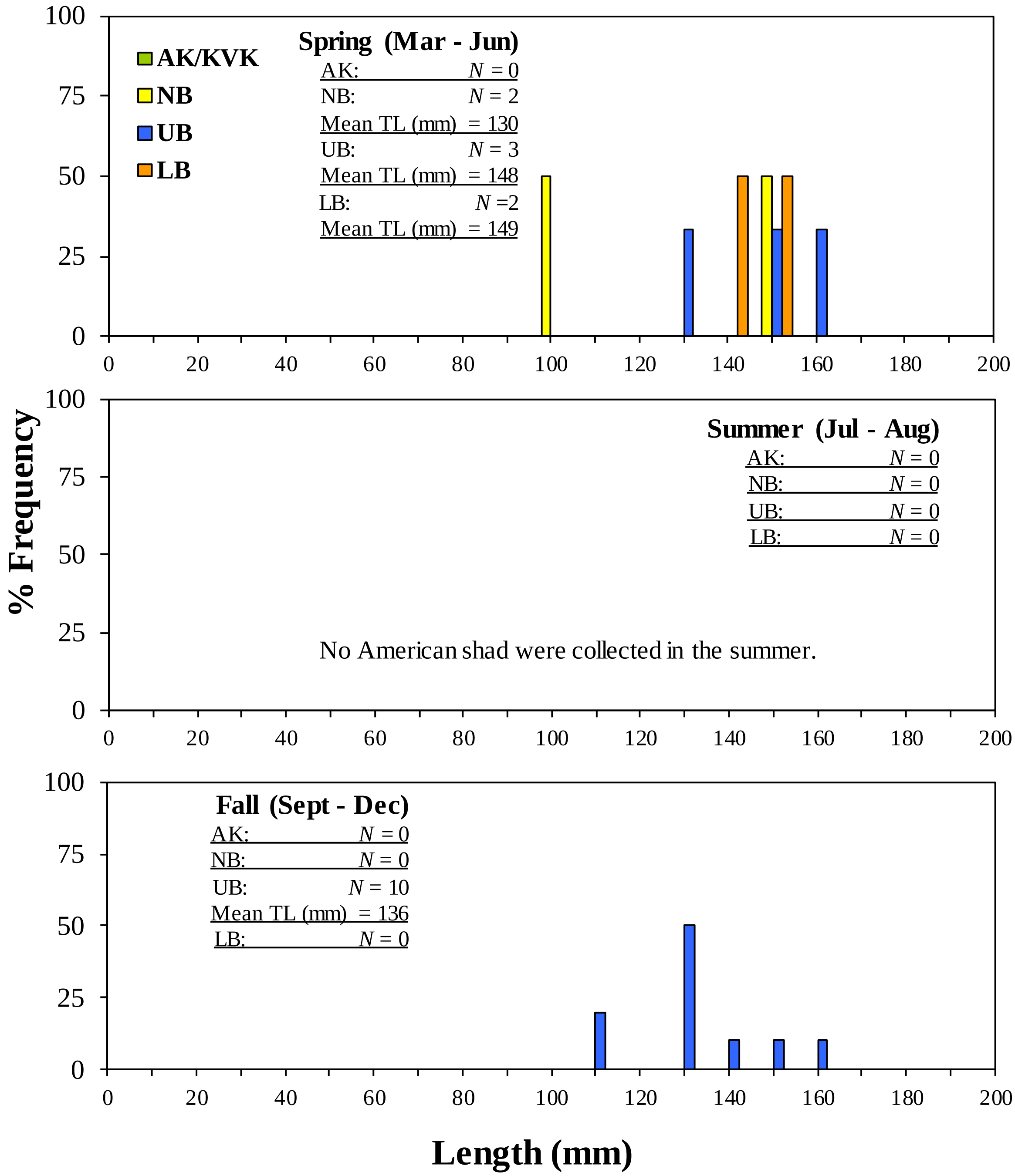


Figure 3-8 Length frequency distribution of American shad in total length (TL) 10 mm intervals, by season and study area, 2013 Migratory Finfish Sampling Program

AK/KVK = Arthur Kill/Kill Van Kull, NB = Newark Bay, UB = Upper Bay, and LB = Lower Bay

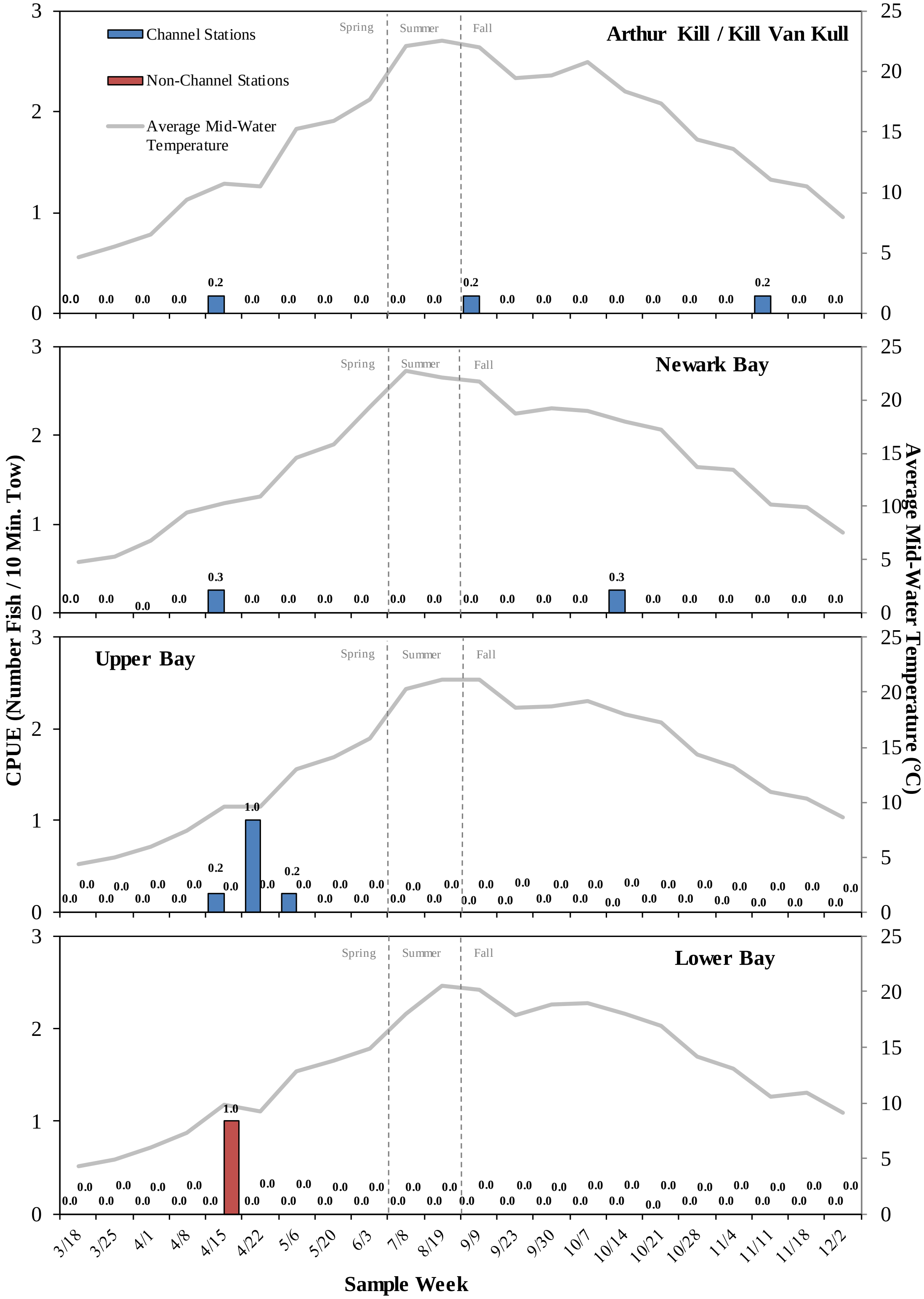


Figure 3-9 Average weekly Atlantic menhaden mid-water trawl CPUE at channel and non-channel stations, and average weekly mid-water temperature in the Arthur Kill/Kill Van Kull, Newark Bay, Upper Bay, and Lower Bay during the 2013 Migratory Finfish Sampling Program.

Note: Dates listed indicate the Monday of each sampling week.
Non-channel stations were not sampled in Arthur Kill/Kill Van Kull Sampling Areas
Sampling seasons are shown as described in Section 2.3

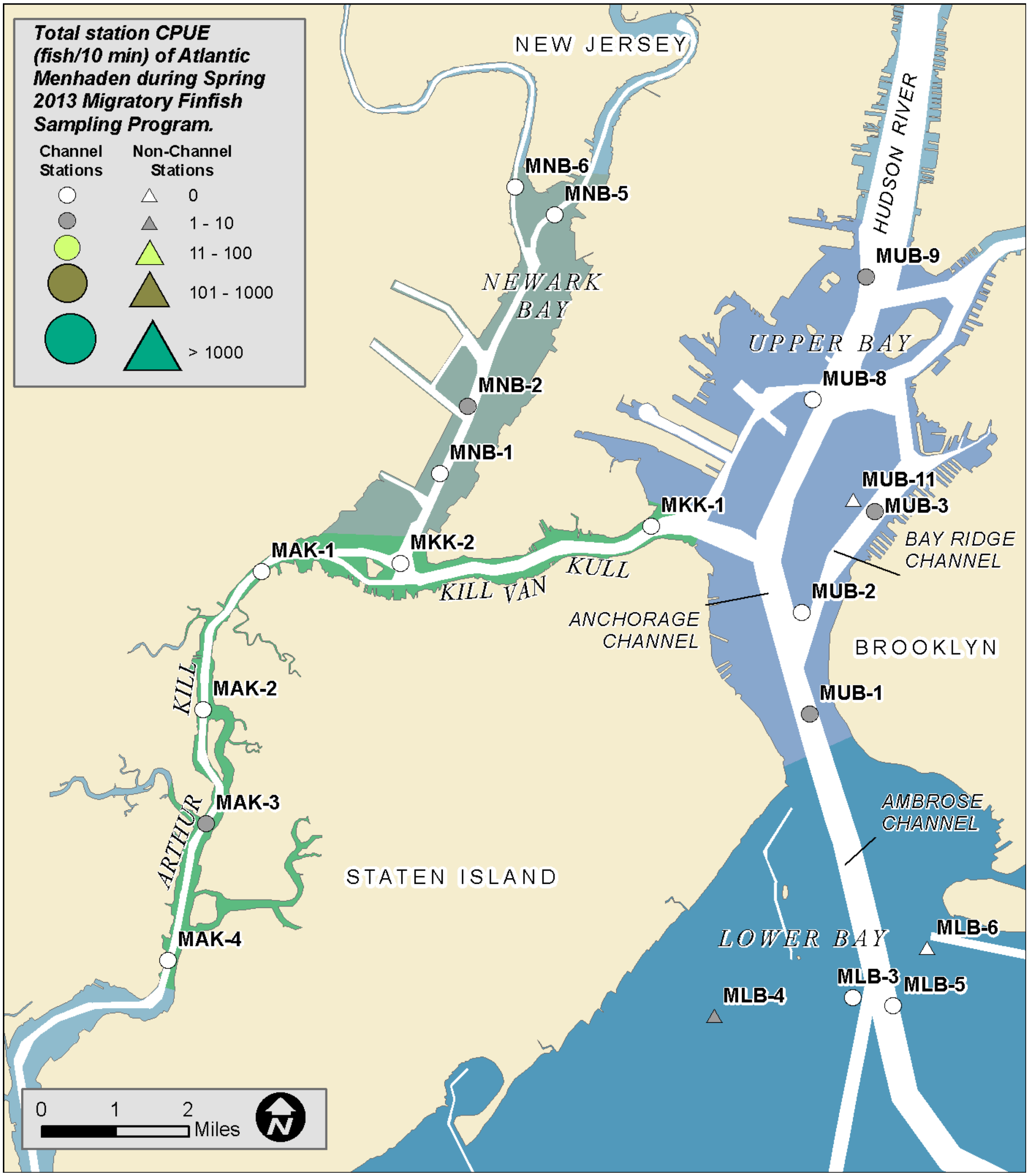


Figure 3-10a. Total station CPUE (fish/10 min. tow) of Atlantic menhaden during spring for the 2013 Migratory Finfish Sampling Program.

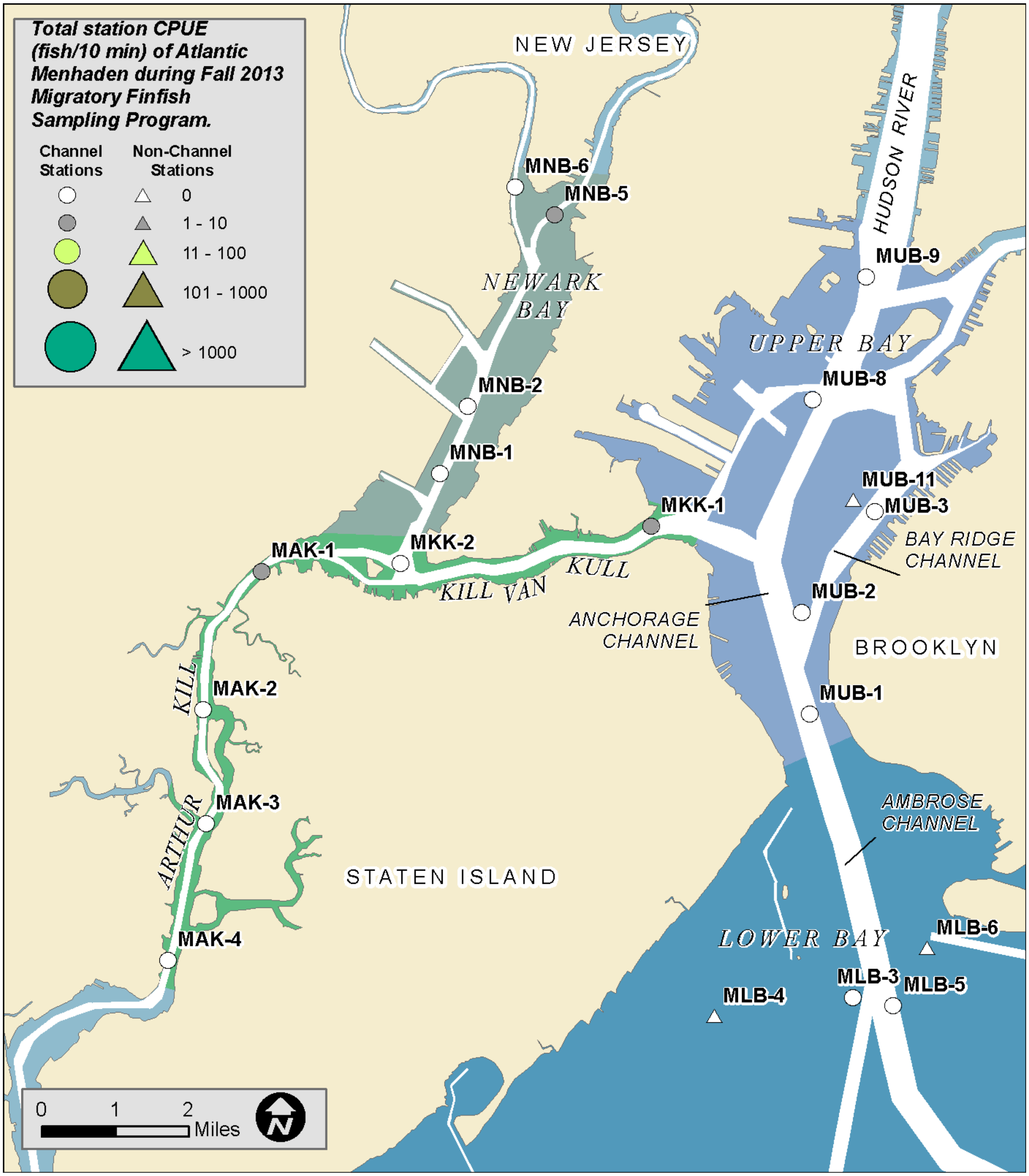


Figure 3-10b. Total station CPUE (fish/10 min. tow) of Atlantic menhaden during fall for the 2013 Migratory Finfish Sampling Program.

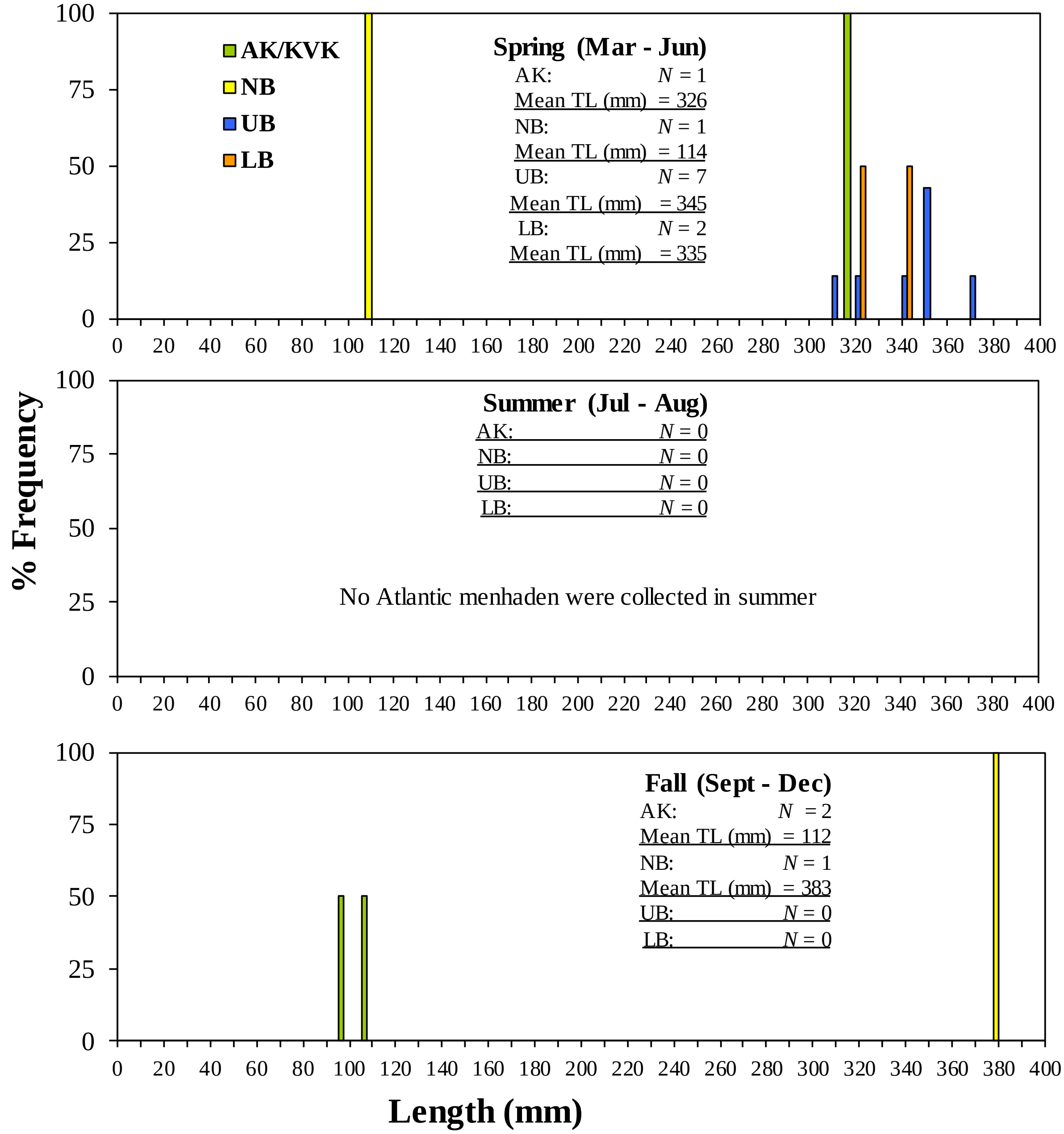


Figure 3-11 Length frequency distribution of Atlantic menhaden in total length (TL) 10 mm intervals, by season and study area, 2013 Migratory Finfish Sampling Program

AK/KVK = Arthur Kill/Kill Van Kull, NB = Newark Bay, UB = Upper Bay, and LB = Lower Bay

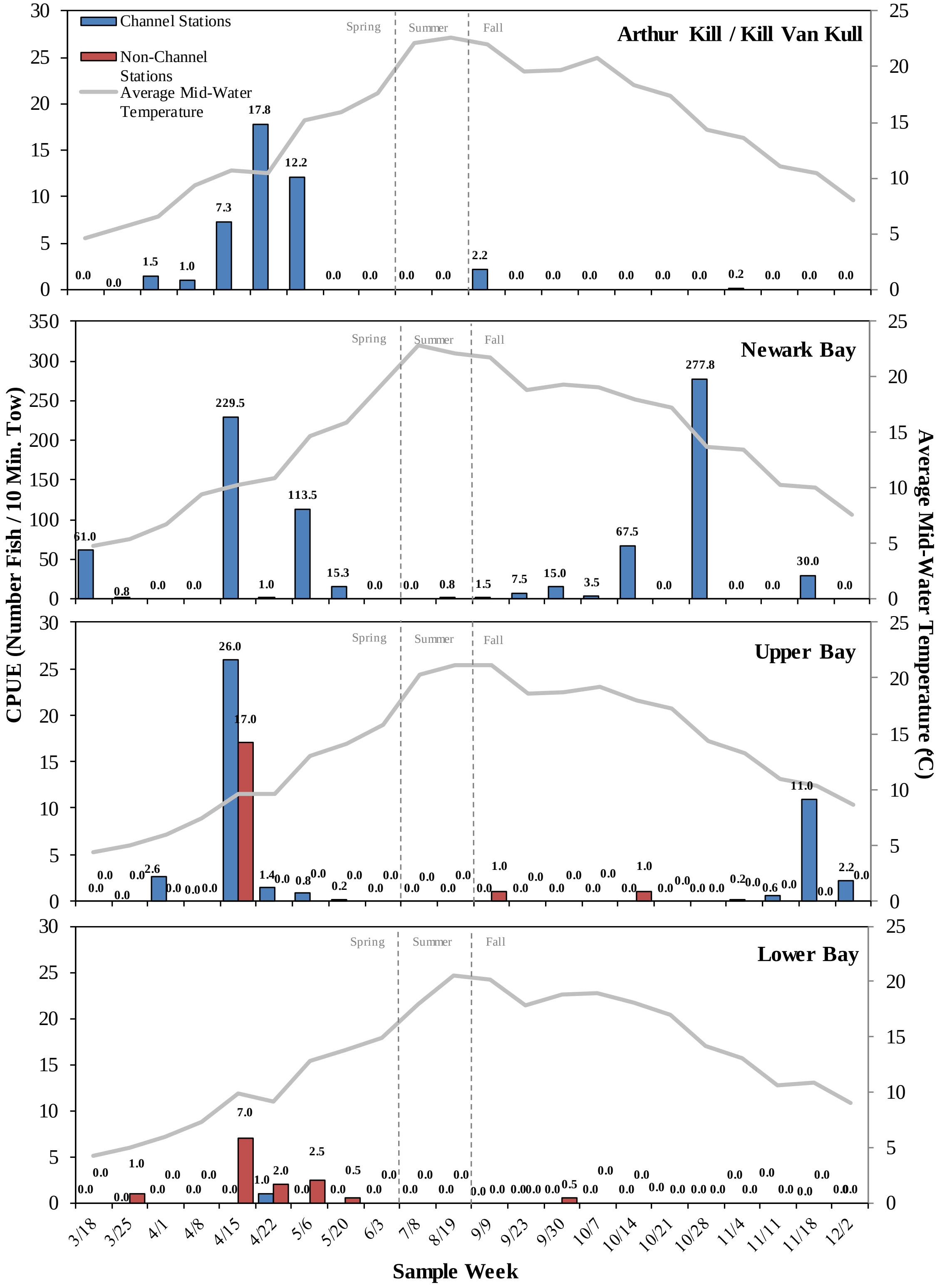


Figure 3-12 Average weekly blueback herring mid-water trawl CPUE at channel and non-channel stations, and average weekly mid-water temperature in the Arthur Kill/Kill Van Kull, Newark Bay, Upper Bay, and Lower Bay during the 2013 Migratory Finfish Sampling Program.

Note: Dates listed indicate the Monday of each sampling week.

Non-channel stations were not sampled in Arthur Kill/Kill Van Kull Sampling Areas.

CPUE y-axis scale differs for Newark Bay figure.

Sampling seasons are shown as described in Section 2.3

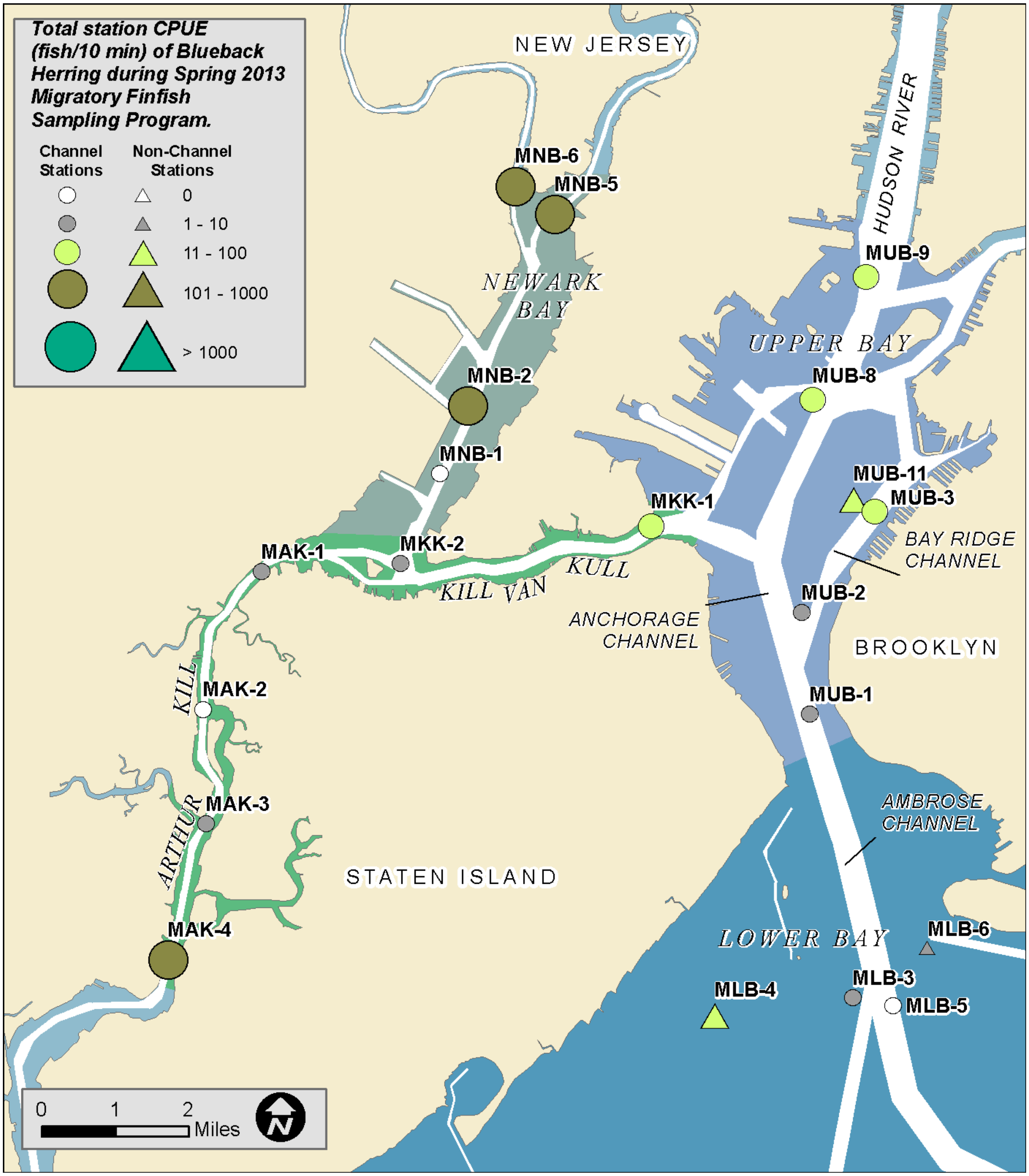


Figure 3-13a. Total station CPUE (fish/10 min. tow) of blueback herring during spring for the 2013 Migratory Finfish Sampling Program.

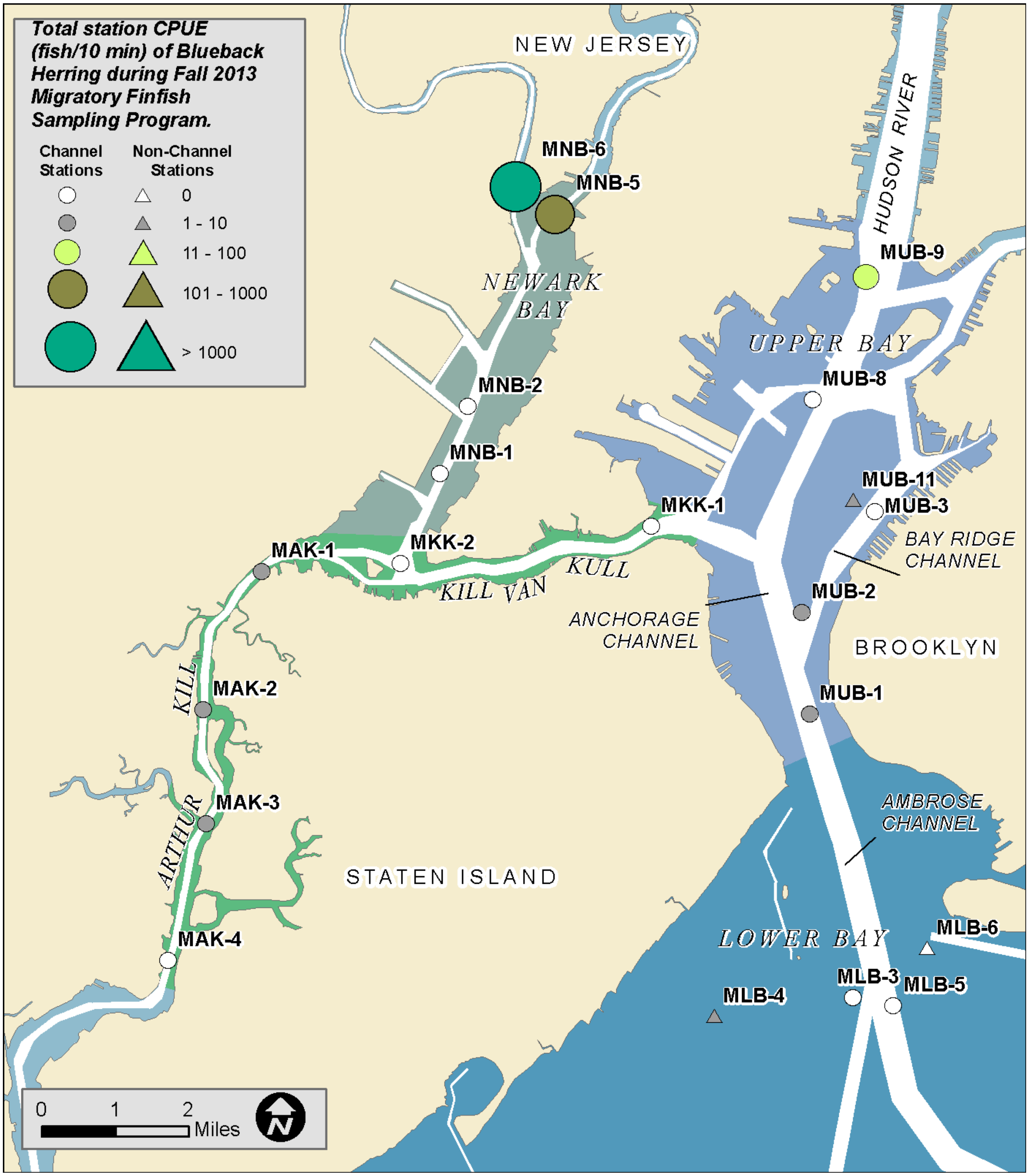


Figure 3-13b. Total station CPUE (fish/10 min. tow) of blueback herring during fall for the 2013 Migratory Finfish Sampling Program.

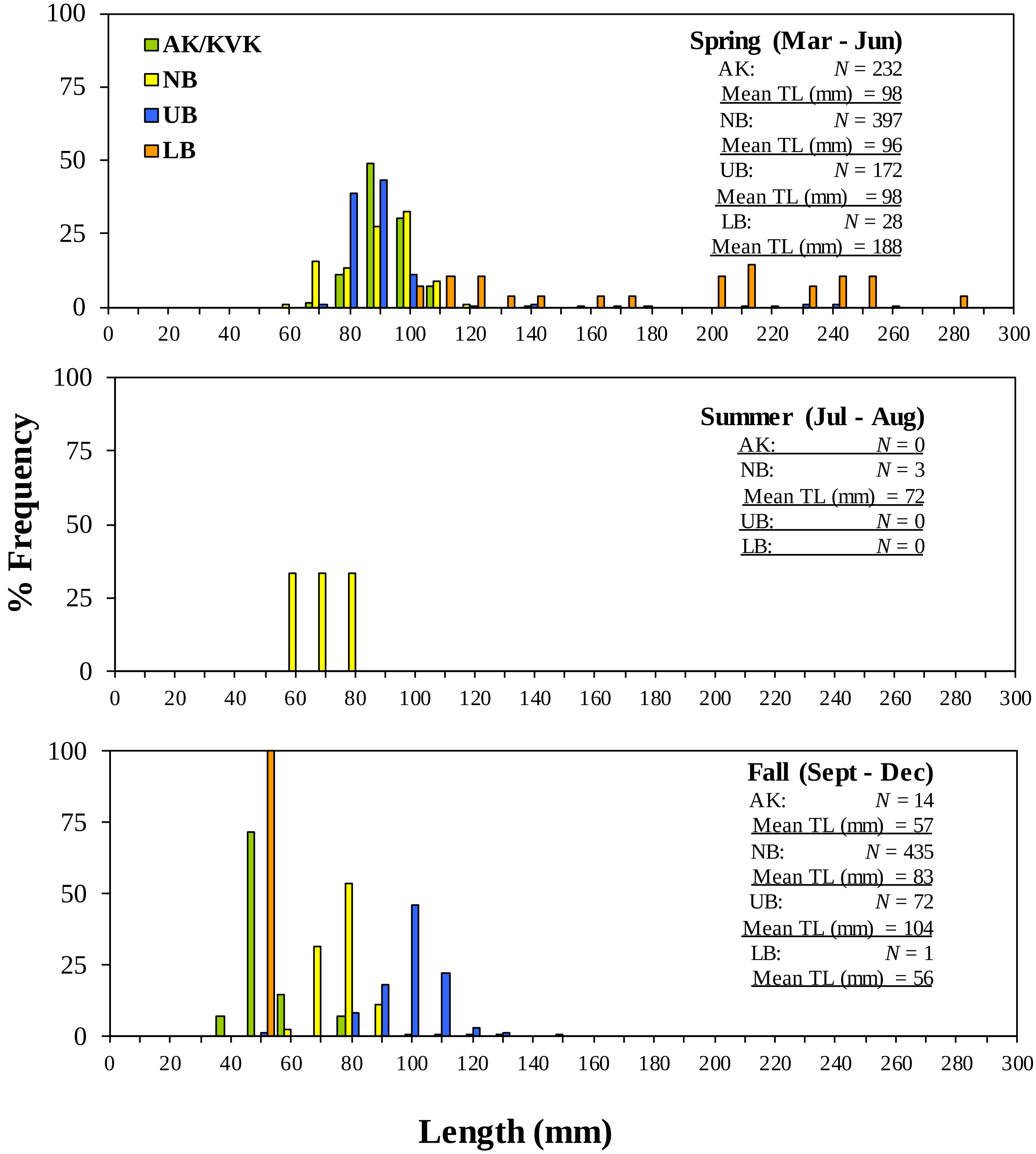


Figure 3-14 Length frequency distribution of blueback herring in total length (TL), 10 mm intervals, by season and study area, 2013 Migratory Finfish Sampling Program

AK/KVK = Arthur Kill/Kill Van Kull, NB = Newark Bay, UB = Upper Bay, and LB = Lower Bay

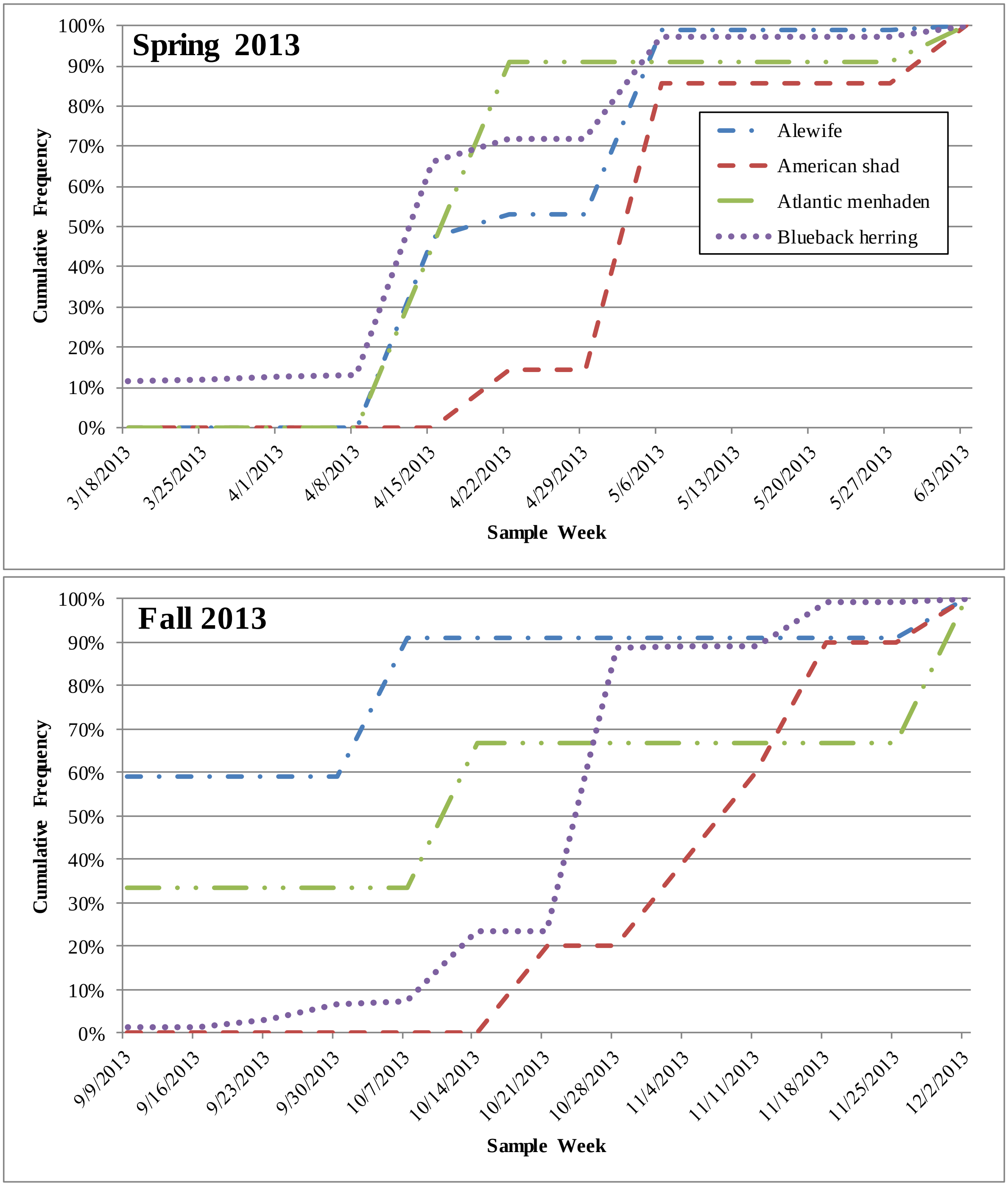


Figure 3-15 **Cumulative occurrence of target species during the spring and fall sampling, 2013 Migratory Finfish Sampling Program**

Note: Sampling Week is indicated by Monday of week. Striped bass were not included due to no catch.

Appendix A

Water Quality Data by Date and Station Collected During the 2013 Migratory Finfish Survey

Date	Station	Temp (°C)	DO (mg/L)	SpCond @ 25°C (µS/cm)	Salinity (ppt)	Depth (ft)
3/20/2013	MAK-1	4.6	10.7	35209	21.7	23
3/20/2013	MAK-2	4.7	10.7	34890	21.6	21
3/20/2013	MAK-3	4.7	11	33456	20.6	21
3/20/2013	MAK-4	5	11.7	27173	17.2	21
3/20/2013	MKK-1	4.4	11.3	32076	19.6	29
3/20/2013	MKK-2	4.5	10.5	33087	20.1	29
3/20/2013	MNB-1	4.6	10.8	28969	17.7	28
3/20/2013	MNB-2	4.6	10.9	28808	17.5	29
3/20/2013	MNB-5	4.8	10.2	26742	16.8	18
3/20/2013	MNB-6	5.2	10.7	23542	14.1	10
3/21/2013	MLB-3	4.2	11.6	23589	21.6	16
3/21/2013	MLB-4	3.8	12.8	34083	20.8	9
3/21/2013	MLB-5	4.5	11.4	35869	15.8	29
3/21/2013	MLB-6	4.5	10.7	41495	26.5	12
3/21/2013	MUB-1	4.5	11.4	33898	20.3	35
3/21/2013	MUB-11	4.2	11	28281	20	10
3/21/2013	MUB-2	4.2	11.1	25989	20.6	25
3/21/2013	MUB-3	4.4	10.7	40589	25.4	19
3/21/2013	MUB-8	4.3	10.8	37631	23.5	29
3/21/2013	MUB-9	4.3	10.7	35621	21.7	31
3/27/2013	MLB-3	4.9	11.4	41489	28	17
3/27/2013	MLB-4	4.9	11.7	39789	23	9
3/27/2013	MLB-5	4.9	11.6	42449	28.5	29
3/27/2013	MLB-6	5	11.4	38807	23.5	14
3/27/2013	MUB-1	4.9	11.9	23994	15.9	35
3/27/2013	MUB-11	4.8	11	38410	24	10
3/27/2013	MUB-2	4.9	11	41989	24.9	28
3/27/2013	MUB-3	5.1	10.8	40102	24.4	21
3/27/2013	MUB-8	4.9	11	33082	19.5	30
3/27/2013	MUB-9	4.9	11	28350	23.6	32
3/28/2013	MAK-1	5.8	10.4	33814	20.9	27
3/28/2013	MAK-2	5.8	10.3	34000	21	23
3/28/2013	MAK-3	5.8	10.3	34231	21.2	23
3/28/2013	MAK-4	5.7	10.5	35079	21.8	23
3/28/2013	MKK-1	5.1	11.1	38719	24.2	30
3/28/2013	MKK-2	5.2	10.7	33754	21.1	28
3/28/2013	MNB-1	5.2	10.6	34030	21	30
3/28/2013	MNB-2	5.2	10.5	31304	19.3	29
3/28/2013	MNB-5	5.4	10.5	30702	18.8	17
3/28/2013	MNB-6	5.5	10.3	29348	17.9	12
4/3/2013	MAK-1	6.5	9.8	33800	20.9	25

Date	Station	Temp (°C)	DO (mg/L)	SpCond @ 25°C (µS/cm)	Salinity (ppt)	Depth (ft)
4/3/2013	MAK-2	6.7	9.6	33940	21	21
4/3/2013	MAK-3	6.7	9.7	34120	21.2	21
4/3/2013	MAK-4	6.9	9.7	33760	21	21
4/3/2013	MKK-1	6.2	10.4	35440	22	27
4/3/2013	MKK-2	6.3	10.5	33430	20.7	28
4/3/2013	MNB-1	6.3	10.1	33010	20.5	28
4/3/2013	MNB-2	6.5	9.7	33100	20.5	28
4/3/2013	MNB-5	6.9	9.8	23190	13.9	16
4/3/2013	MNB-6	7.3	9.8	18500	11.6	9.5
4/4/2013	MLB-3	6.1	8.7	40990	25.9	16
4/4/2013	MLB-4	6	10.8	40040	25.2	10
4/4/2013	MLB-5	6	8.5	44440	28.3	29
4/4/2013	MLB-6	5.8	9.2	38860	24.8	12
4/4/2013	MUB-1	5.9	9	40160	25.2	34
4/4/2013	MUB-11	5.8	9.2	38670	24.2	10
4/4/2013	MUB-2	5.8	8.9	38600	24.1	24
4/4/2013	MUB-3	5.9	9.2	36190	22.5	19
4/4/2013	MUB-8	6.3	9.1	38900	24.2	28
4/4/2013	MUB-9	5.9	9.1	40870	25.8	31
4/9/2013	MKK-1	8.1	14.1	39889	21.7	27
4/9/2013	MLB-3	7.2	13.5	44717	28.7	18
4/9/2013	MLB-4	7.4	14.5	22655	13.6	9
4/9/2013	MLB-5	6.9	13.4	41089	27.1	30
4/9/2013	MLB-6	7.6	14.4	33367	24.1	13
4/9/2013	MUB-1	7.4	13.4	37689	23	37
4/9/2013	MUB-11	7.3	11.8	27754	23.7	11
4/9/2013	MUB-2	7.8	13.8	32037	19.9	25
4/9/2013	MUB-3	7.4	12.7	27997	18.9	20
4/9/2013	MUB-8	7.2	12.2	26899	19.8	29
4/9/2013	MUB-9	7.3	11.5	36286	22.6	29
4/10/2013	MAK-1	9.1	13.3	36417	21.9	30
4/10/2013	MAK-2	10.1	11.2	33920	21.2	22
4/10/2013	MAK-3	10.6	11.7	33770	20.6	23
4/10/2013	MAK-4	10.2	12.1	34340	22.1	22
4/10/2013	MKK-2	8.2	13	31528	21.9	30
4/10/2013	MNB-1	9.4	10.1	33860	21.4	28
4/10/2013	MNB-2	9.3	10.5	35050	21.6	28
4/10/2013	MNB-5	9.5	10.6	32050	20.1	17
4/10/2013	MNB-6	9.4	10.2	31580	20.1	10
4/16/2013	MAK-1	10.4	8.6	31300	19.2	26
4/16/2013	MAK-2	11.1	8.6	31160	19.4	22

Date	Station	Temp (°C)	DO (mg/L)	SpCond @ 25°C (µS/cm)	Salinity (ppt)	Depth (ft)
4/16/2013	MAK-3	11.2	8.4	33220	20.5	22
4/16/2013	MAK-4	11.3	8.8	34410	21.2	22
4/16/2013	MKK-1	10.3	9.3	31220	19.4	29
4/16/2013	MKK-2	10	8.1	32280	20.2	30
4/16/2013	MNB-1	10.2	9	30640	19	29
4/16/2013	MNB-2	10.2	8.6	31040	19.3	30
4/16/2013	MNB-5	10.2	8.3	31050	19.3	16
4/16/2013	MNB-6	10.5	7.7	28450	17.5	9.5
4/17/2013	MLB-3	9.5	10.3	40640	26.2	16
4/17/2013	MLB-4	10.9	13.1	36460	23.1	9
4/17/2013	MLB-5	9.1	10.2	43400	28.1	30
4/17/2013	MLB-6	9.8	10.6	39860	25.3	16
4/17/2013	MUB-1	9.4	7.9	37620	24	33
4/17/2013	MUB-11	9.6	8.1	30830	19.3	9
4/17/2013	MUB-2	9.7	8	27660	16.8	24
4/17/2013	MUB-3	9.5	8.1	37180	23.3	19
4/17/2013	MUB-8	9.7	9.2	27730	18.5	27
4/17/2013	MUB-9	9.3	8	28030	19.9	31
4/23/2013	MAK-1	10.4	8	30940	19.2	23
4/23/2013	MAK-2	11	7.4	32190	20.3	21
4/23/2013	MAK-3	11.1	7	34390	21.5	20
4/23/2013	MAK-4	11	7.2	34530	21.7	20
4/23/2013	MKK-1	9.2	8	36000	23.2	30
4/23/2013	MKK-2	10.3	6	31310	19.4	31
4/23/2013	MNB-1	10.4	8	31530	19.6	30
4/23/2013	MNB-2	10.3	7.8	32790	20	30
4/23/2013	MNB-5	11.2	7.4	28660	17.6	19
4/23/2013	MNB-6	11.6	7.5	28810	17.1	11
4/24/2013	MLB-3	9.4	9.4	36450	22.5	16
4/24/2013	MLB-4	9.4	8.6	37080	23.4	10
4/24/2013	MLB-5	8.9	8.9	45780	29.4	30
4/24/2013	MLB-6	9.1	8.9	41920	26.8	16
4/24/2013	MUB-1	9.1	8.4	42220	27.2	37
4/24/2013	MUB-11	9.7	8.6	34190	21.4	10
4/24/2013	MUB-2	9.4	8.5	38160	23.3	26
4/24/2013	MUB-3	9.7	8.8	33520	21	20
4/24/2013	MUB-8	9.8	8.5	33670	21	28
4/24/2013	MUB-9	9.8	8.3	36200	22.8	31
5/7/2013	MKK-1	13.9	6.8	33030	20.6	27
5/7/2013	MLB-3	13	7.7	39300	25	17
5/7/2013	MLB-4	13.5	8.7	37980	24.1	8

Date	Station	Temp (°C)	DO (mg/L)	SpCond @ 25°C (µS/cm)	Salinity (ppt)	Depth (ft)
5/7/2013	MLB-5	12.5	7.7	42670	27	28
5/7/2013	MLB-6	12.5	7.7	43050	24	15
5/7/2013	MUB-1	12.6	7.3	43160	27.8	37
5/7/2013	MUB-11	13.2	7	36130	23	9
5/7/2013	MUB-2	12.8	7.4	39740	24.8	27
5/7/2013	MUB-3	13.3	7	35560	22.5	19
5/7/2013	MUB-8	12.8	7.7	38360	24.4	29
5/7/2013	MUB-9	13.1	7.6	34150	21.4	31
5/8/2013	MAK-1	15.3	6.8	31290	19.5	21
5/8/2013	MAK-2	15.6	6.5	31310	19.5	20
5/8/2013	MAK-3	15.9	6.4	31130	19.4	21
5/8/2013	MAK-4	16.2	6.9	30990	19.4	20
5/8/2013	MKK-2	14.4	7.3	32470	20.3	30
5/8/2013	MNB-1	14.4	6.9	32360	20.1	30
5/8/2013	MNB-2	14.4	6.7	32260	20.2	28
5/8/2013	MNB-5	14.6	6.7	30760	19.2	17
5/8/2013	MNB-6	15.1	6.1	29380	17.8	10
5/21/2013	MLB-3	13.5	6.7	40640	25.7	17
5/21/2013	MLB-4	14.8	7.7	39220	25.1	9
5/21/2013	MLB-5	12.4	6.9	44990	29.2	29
5/21/2013	MLB-6	14.4	6.6	37800	24.5	14
5/21/2013	MUB-1	14.1	6.6	37120	23.6	35
5/21/2013	MUB-11	14	6.7	37890	24	10
5/21/2013	MUB-2	14.4	6.4	36510	23.4	25
5/21/2013	MUB-3	13.9	6.7	38410	24.1	19
5/21/2013	MUB-8	14.2	7	38670	24.7	27
5/21/2013	MUB-9	13.8	7	38510	24.4	32
5/22/2013	MAK-1	16.1	7.7	33450	21.1	23
5/22/2013	MAK-2	16.3	7.2	33630	20.5	20
5/22/2013	MAK-3	16.3	6.9	33790	21.3	20
5/22/2013	MAK-4	16.9	8.1	32940	20.6	20
5/22/2013	MKK-1	14.5	7.2	36340	23.1	30
5/22/2013	MKK-2	15.4	6.2	33900	21.3	30
5/22/2013	MNB-1	15.3	6.6	32390	21.1	29
5/22/2013	MNB-2	15.6	6.9	32740	20.6	27
5/22/2013	MNB-5	16.1	6.4	30910	18.7	17
5/22/2013	MNB-6	16.3	6.1	28290	18.1	10
6/4/2013	MAK-1	18.2	6	28460	17.6	25
6/4/2013	MAK-2	17.8	5.9	29420	18.4	20
6/4/2013	MAK-3	18.4	5.6	29280	18.1	21
6/4/2013	MAK-4	18.5	5.6	29440	18.5	20

Date	Station	Temp (°C)	DO (mg/L)	SpCond @ 25°C (µS/cm)	Salinity (ppt)	Depth (ft)
6/4/2013	MKK-1	14.8	6.7	36640	23.3	29
6/4/2013	MKK-2	18.2	5.8	28660	17.7	29
6/4/2013	MNB-1	17.7	6.1	29720	18.5	28
6/4/2013	MNB-2	17.8	5.9	29500	18.5	28
6/4/2013	MNB-5	21.3	4.7	20290	12.1	17
6/4/2013	MNB-6	20.6	5	17000	11.1	9
6/5/2013	MLB-3	15.4	7.5	38220	24.3	17
6/5/2013	MLB-4	16.1	6.6	37680	24	9
6/5/2013	MLB-5	13.2	7.1	43660	27.5	29
6/5/2013	MLB-6	14.7	7.2	39480	26.2	13
6/5/2013	MUB-1	16.6	7.3	31340	19.6	33
6/5/2013	MUB-11	15.9	6.4	33650	21.3	9
6/5/2013	MUB-2	15.6	6.6	35780	22.3	24
6/5/2013	MUB-3	15.7	6.7	35110	22.1	19
6/5/2013	MUB-8	15.9	6.4	32690	20.4	27
6/5/2013	MUB-9	15.2	6.5	36000	22.4	30
7/9/2013	MKK-1	19.9	5.5	36470	23	28
7/9/2013	MLB-3	18.8	7.6	42120	26.7	18
7/9/2013	MLB-4	19.6	6.5	38800	24.9	9
7/9/2013	MLB-5	15.8	6.3	46240	30.5	30
7/9/2013	MLB-6	17.8	6.2	44810	29.1	15
7/9/2013	MUB-1	18.9	6.1	40700	26.2	35
7/9/2013	MUB-11	21	5.6	30870	19	10
7/9/2013	MUB-2	21.3	6.9	34020	21.2	28
7/9/2013	MUB-3	19.2	5.3	37470	24.4	21
7/9/2013	MUB-8	20.2	6	35020	21.9	30
7/9/2013	MUB-9	21.2	5.6	30250	18.8	30
7/10/2013	MAK-1	21.9	5.1	31050	19.2	25
7/10/2013	MAK-2	22.8	4.9	31140	19.5	22
7/10/2013	MAK-3	23.2	4.4	31800	20	22
7/10/2013	MAK-4	22.7	4.2	33600	21.1	22
7/10/2013	MKK-2	22.3	5.3	30420	19	29
7/10/2013	MNB-1	21.8	5	32050	20	29
7/10/2013	MNB-2	22	5.1	31720	19.8	29
7/10/2013	MNB-5	23.2	4.7	28800	17.8	20
7/10/2013	MNB-6	24.2	4.3	25820	16	21
8/19/2013	MLB-3	20.5	5.7	42280	27.2	16
8/19/2013	MLB-4	20.7	5.6	41840	26.9	10
8/19/2013	MLB-5	20.2	5.8	43740	28.3	29
8/19/2013	MLB-6	20.6	5.3	42910	27.7	16
8/19/2013	MUB-1	21.1	5.4	39820	25.5	33

Date	Station	Temp (°C)	DO (mg/L)	SpCond @ 25°C (µS/cm)	Salinity (ppt)	Depth (ft)
8/19/2013	MUB-11	21.2	5	38680	24.7	9
8/19/2013	MUB-2	21.5	5.2	37820	24	25
8/19/2013	MUB-3	21.2	4.9	38890	24.9	20
8/19/2013	MUB-8	20.8	5.7	40840	26.2	30
8/19/2013	MUB-9	21.2	5.4	38000	24	30
8/20/2013	MAK-1	22.3	5.1	34990	22.1	23
8/20/2013	MAK-2	23	5.1	33770	21.8	20
8/20/2013	MAK-3	23.4	4.9	33580	21.1	21
8/20/2013	MAK-4	23.7	4.7	33220	20.9	22
8/20/2013	MKK-1	21.4	5.1	38260	24.3	30
8/20/2013	MKK-2	21.6	5.2	37110	23.5	30
8/20/2013	MNB-1	21.8	5.2	35850	22.7	30
8/20/2013	MNB-2	21.8	5.18	34580	21.8	29
8/20/2013	MNB-5	22.3	5.1	33620	21.1	16
8/20/2013	MNB-6	22.6	4.8	31920	19.9	10
9/10/2013	MAK-1	22.2	5	36280	23	30
9/10/2013	MAK-2	22.2	5	36280	23	22
9/10/2013	MAK-3	22.8	4.5	35620	22.5	23
9/10/2013	MAK-4	23	4.7	35580	22.7	22
9/10/2013	MKK-1	20.3	5.2	41820	27.2	29
9/10/2013	MKK-2	21.4	5.2	36980	23.5	28
9/10/2013	MNB-1	21.3	5.3	37780	24	30
9/10/2013	MNB-2	21.6	5.4	36440	23.1	30
9/10/2013	MNB-5	22	5	32910	20.4	18
9/10/2013	MNB-6	21.8	5.3	34540	21.7	11
9/11/2013	MLB-3	19.9	5.7	44350	28.7	19
9/11/2013	MLB-4	20.7	5.7	41860	27	10
9/11/2013	MLB-5	19.9	5.6	44440	28.8	30
9/11/2013	MLB-6	20.4	5.8	44420	28.9	16
9/11/2013	MUB-1	21.1	5.3	42720	27.3	35
9/11/2013	MUB-11	21	5	39550	25.3	9
9/11/2013	MUB-2	21	5.1	39610	25.4	26
9/11/2013	MUB-3	21.1	5.1	39530	25.2	20
9/11/2013	MUB-8	21.4	5.1	36940	23.3	26
9/11/2013	MUB-9	21.5	4.9	36680	23.2	30
9/24/2013	MAK-1	19.2	7.2	37350	23.5	30
9/24/2013	MAK-2	20	7.1	35930	22.7	22
9/24/2013	MAK-3	20.3	7.2	36010	22.7	22
9/24/2013	MAK-4	19.7	7.2	37370	23.7	22
9/24/2013	MKK-1	19	7.2	38820	24.7	30
9/24/2013	MKK-2	18.9	8.1	37580	23.9	30

Date	Station	Temp (°C)	DO (mg/L)	SpCond @ 25°C (µS/cm)	Salinity (ppt)	Depth (ft)
9/24/2013	MNB-1	18.8	7.5	37320	23.8	30
9/24/2013	MNB-2	18.7	7.6	36640	23.2	31
9/24/2013	MNB-5	18.7	7.2	29360	21	17
9/24/2013	MNB-6	18.9	7.3	31290	22.4	10
9/25/2013	MLB-3	18.5	7.6	43220	27.9	18
9/25/2013	MLB-4	18.4	7.3	40450	26	10
9/25/2013	MLB-5	16.8	6.1	46500	30.5	30
9/25/2013	MLB-6	17.8	6.9	45030	29.2	17
9/25/2013	MUB-1	18.2	6.4	42440	27.1	35
9/25/2013	MUB-11	18.8	5.7	38220	24.3	10
9/25/2013	MUB-2	18.7	6.2	37040	24	26
9/25/2013	MUB-3	18.5	6.2	40100	25.2	20
9/25/2013	MUB-8	18.8	6	38180	24.3	29
9/25/2013	MUB-9	18.9	6	34990	22.3	32
10/1/2013	MLB-3	18.9	6.8	41600	26.7	17
10/1/2013	MLB-4	19.3	8.2	39960	25.6	9
10/1/2013	MLB-5	18.5	7.1	43900	28.4	28
10/1/2013	MLB-6	18.7	6.5	40280	25.9	12
10/1/2013	MUB-1	18.6	5.2	39000	24.9	32
10/1/2013	MUB-11	18.6	5.9	38530	24.5	10
10/1/2013	MUB-2	18.6	5.4	38110	24.2	24
10/1/2013	MUB-3	18.8	5	38240	24.3	20
10/1/2013	MUB-8	18.8	6.5	37610	24	28
10/1/2013	MUB-9	18.6	4.6	37990	24.6	32
10/2/2013	MAK-1	19.4	7	34990	22.1	28
10/2/2013	MAK-2	20.1	6.6	34550	21.9	20
10/2/2013	MAK-3	20	6.4	34680	21.9	21
10/2/2013	MAK-4	20.4	6.2	34340	21.6	20
10/2/2013	MKK-1	18.9	6.8	36600	23.3	30
10/2/2013	MKK-2	19	6.9	35430	22.4	30
10/2/2013	MNB-1	19.1	6.8	35240	22.2	30
10/2/2013	MNB-2	19.1	6.8	34960	22	28
10/2/2013	MNB-5	19.4	6.3	31930	20	18
10/2/2013	MNB-6	19.5	6.2	31940	20	10
10/8/2013	MKK-1	20	5.5	36050	22.8	29
10/8/2013	MLB-3	18.8	5.9	43830	28.3	18
10/8/2013	MLB-4	19.2	6.3	40530	26	10
10/8/2013	MLB-5	18.9	6.9	43950	28.5	30
10/8/2013	MLB-6	19	6.7	43320	28	16
10/8/2013	MUB-1	18.9	6.3	41570	26.6	35
10/8/2013	MUB-11	19	5.8	38080	23.9	10

Date	Station	Temp (°C)	DO (mg/L)	SpCond @ 25°C (µS/cm)	Salinity (ppt)	Depth (ft)
10/8/2013	MUB-2	19.1	5.9	40350	26	30
10/8/2013	MUB-3	19.3	5.9	37880	24.1	21
10/8/2013	MUB-8	19.3	5.7	36800	23.7	28
10/8/2013	MUB-9	19.7	5.8	32330	20.2	30
10/9/2013	MAK-1	19.5	6	35140	22.2	15
10/9/2013	MAK-2	26.2	7.1	34660	22.1	22
10/9/2013	MAK-3	20.1	5.9	35150	22.1	23
10/9/2013	MAK-4	19.7	5.8	36230	23.6	23
10/9/2013	MKK-2	19.4	6	35790	22.6	30
10/9/2013	MNB-1	19.1	6.3	31890	22.8	29
10/9/2013	MNB-2	19	6.5	31670	22.9	27
10/9/2013	MNB-5	19	6.2	36410	21.9	17
10/9/2013	MNB-6	19	6.1	35150	21.8	10
10/15/2013	MLB-3	18	6.3	38830	24.8	17
10/15/2013	MLB-4	18.3	6.6	40000	25.2	9
10/15/2013	MLB-5	17.9	6.6	41580	26.7	28
10/15/2013	MLB-6	18	6.4	38780	24.7	14
10/15/2013	MUB-1	18	6.5	40090	25.6	36
10/15/2013	MUB-11	18	6.3	38000	24.2	9
10/15/2013	MUB-2	17.9	6.5	38260	24.4	24
10/15/2013	MUB-3	18.1	6.2	37280	23.6	19
10/15/2013	MUB-8	18.1	6.6	38760	24.7	31
10/15/2013	MUB-9	18.1	6.5	37210	23.6	30
10/16/2013	MAK-1	18.4	6.5	34680	21.9	28
10/16/2013	MAK-2	18.5	6.3	34940	22.1	20
10/16/2013	MAK-3	18.6	6.3	35150	22.2	21
10/16/2013	MAK-4	18.5	6.3	35610	22.6	19
10/16/2013	MKK-1	18.1	6.7	38320	24.4	30
10/16/2013	MKK-2	18	6.8	35190	22.1	30
10/16/2013	MNB-1	18.1	6.8	35210	22.2	30
10/16/2013	MNB-2	18	6.9	34540	21.7	30
10/16/2013	MNB-5	17.9	6.5	32070	20	18
10/16/2013	MNB-6	17.8	6.4	30310	18.8	11
10/21/2013	MKK-1	17.6	6.6	36480	23	28
10/21/2013	MLB-3	17	7.2	44380	28.7	18
10/21/2013	MLB-4	17.3	7.1	41300	26.5	9
10/21/2013	MLB-5	16.9	7.3	44380	28.6	30
10/21/2013	MLB-6	16.7	7	44120	28.5	16
10/21/2013	MUB-1	17	7.1	42240	27.1	35
10/21/2013	MUB-11	17.1	6.5	37060	23.5	11
10/21/2013	MUB-2	16.9	7	41920	26.8	28

Date	Station	Temp (°C)	DO (mg/L)	SpCond @ 25°C (µS/cm)	Salinity (ppt)	Depth (ft)
10/21/2013	MUB-3	17.1	6.8	40170	25.6	22
10/21/2013	MUB-8	17.5	6.5	38380	24.4	30
10/21/2013	MUB-9	17.7	6.4	37300	23.3	32
10/22/2013	MAK-1	16.9	7.1	36200	22.8	30
10/22/2013	MAK-2	17.3	6.9	35870	22.7	23
10/22/2013	MAK-3	17.4	6.6	35640	22.4	23
10/22/2013	MAK-4	17.6	6.5	35190	22.2	23
10/22/2013	MKK-2	17.2	7	37460	23.8	30
10/22/2013	MNB-1	17.2	7	36470	23.1	29
10/22/2013	MNB-2	17.3	7.1	35660	22.6	30
10/22/2013	MNB-5	17.2	6.9	34880	22	20
10/22/2013	MNB-6	17	6.9	34720	21.9	12
10/29/2013	MKK-1	14.7	6.8	37500	23.9	30
10/29/2013	MLB-3	14.4	7	41400	26.5	17
10/29/2013	MLB-4	13.9	8.2	39920	25	9
10/29/2013	MLB-5	14.1	7	44030	28.2	29
10/29/2013	MLB-6	14.3	7	40620	26	14
10/29/2013	MUB-1	14.3	7	39300	24.8	32
10/29/2013	MUB-11	14.3	6.8	39460	25.1	9
10/29/2013	MUB-2	14.1	7.1	40200	25.7	26
10/29/2013	MUB-3	14.4	6.8	39420	25	20
10/29/2013	MUB-8	14.5	7	40490	25.4	27
10/29/2013	MUB-9	14.5	6.7	40020	25.5	30
10/30/2013	MAK-1	13.8	7.9	36800	23.3	28
10/30/2013	MAK-2	14.3	7.3	36920	23.3	21
10/30/2013	MAK-3	14.5	7.2	36840	23.2	24
10/30/2013	MAK-4	14.7	7.1	37220	23.6	19
10/30/2013	MKK-2	14.2	7.7	36720	23.4	29
10/30/2013	MNB-1	13.9	7.7	37120	23.5	29
10/30/2013	MNB-2	13.8	7.7	37000	23.3	28
10/30/2013	MNB-5	13.5	7.4	34370	21.5	18
10/30/2013	MNB-6	13.4	7.4	32540	20	11
11/5/2013	MKK-1	13.3	7.7	37060	23.4	28
11/5/2013	MLB-3	13.2	7.9	43060	27.7	18
11/5/2013	MLB-4	13.2	7.9	41280	26.3	9
11/5/2013	MLB-5	13.3	7.9	45560	29.5	30
11/5/2013	MLB-6	12.8	7.7	45760	29.7	15
11/5/2013	MUB-1	12.9	7.9	44020	28.3	36
11/5/2013	MUB-11	13.2	7.6	42090	27.1	11
11/5/2013	MUB-2	13	7.8	43460	27.9	28
11/5/2013	MUB-3	13.2	7.6	42220	27.3	22

Date	Station	Temp (°C)	DO (mg/L)	SpCond @ 25°C (µS/cm)	Salinity (ppt)	Depth (ft)
11/5/2013	MUB-8	13.2	7.7	40400	25.9	29
11/5/2013	MUB-9	13.7	7.5	38400	24.4	32
11/6/2013	MAK-1	13.9	7.7	35990	22.8	15
11/6/2013	MAK-2	13.8	7.8	35950	22.7	22
11/6/2013	MAK-3	13.7	7.6	36610	23.2	22
11/6/2013	MAK-4	13.3	8.1	35530	23.8	22
11/6/2013	MKK-2	13.5	8	36990	23.4	30
11/6/2013	MNB-1	13.6	7.9	36990	23.5	30
11/6/2013	MNB-2	13.6	8.3	37150	23.6	29
11/6/2013	MNB-5	13.2	8.6	35900	13.1	16
11/6/2013	MNB-6	13.2	8	35280	22.3	10
11/12/2013	MAK-1	10.7	8.5	37720	23.5	28
11/12/2013	MAK-2	11	8.3	37120	23.3	20
11/12/2013	MAK-3	11	8.1	37270	23.2	20
11/12/2013	MAK-4	11.1	8.1	36620	23.6	20
11/12/2013	MKK-1	11.7	8.4	36320	22.9	29
11/12/2013	MKK-2	11	8.2	36310	23.1	29
11/12/2013	MNB-1	10.8	8.3	36310	22.8	54
11/12/2013	MNB-2	10.3	8.7	35700	22.3	26
11/12/2013	MNB-5	9.7	8.1	30650	18.8	16
11/12/2013	MNB-6	10	8.2	26150	15.9	10
11/13/2013	MLB-3	10.6	8.5	40210	25.2	17
11/13/2013	MLB-4	10.5	8.5	41720	26.6	8
11/13/2013	MLB-5	10.7	8.4	41270	25.8	29
11/13/2013	MLB-6	10.6	8.5	39300	24.9	15
11/13/2013	MUB-1	11	8.4	37100	23.3	35
11/13/2013	MUB-11	10.9	8.3	38040	24	8
11/13/2013	MUB-2	10.8	8.4	40140	25.2	25
11/13/2013	MUB-3	10.9	8.3	37580	23.5	19
11/13/2013	MUB-8	11.1	8.4	39620	24.8	29
11/13/2013	MUB-9	10.8	8.4	38640	24	30
11/19/2013	MAK-1	10.4	8.4	36920	23	30
11/19/2013	MAK-2	10.6	8.2	36120	22.6	23
11/19/2013	MAK-3	10.5	8.3	35620	22.3	23
11/19/2013	MAK-4	10.4	8.3	36940	22.5	22
11/19/2013	MKK-2	10.4	8.4	36620	22.9	31
11/19/2013	MNB-1	10.3	8.6	36230	22.8	28
11/19/2013	MNB-2	9.9	9.1	35240	22	28
11/19/2013	MNB-5	9.8	8.6	33340	20.8	18
11/19/2013	MNB-6	9.9	8.4	35060	21.8	11
11/20/2013	MUB-11	9.6	9	35070	21.9	10

Date	Station	Temp (°C)	DO (mg/L)	SpCond @ 25°C (µS/cm)	Salinity (ppt)	Depth (ft)
11/20/2013	MUB-8	10	8.9	36640	22.9	30
11/20/2013	MUB-9	10.5	8.5	33260	20.9	30
11/22/2013	MKK-1	10.7	8.6	37730	24	30
11/22/2013	MLB-3	11.1	8.5	45170	29.1	18
11/22/2013	MLB-4	10.5	8.7	39430	25.1	10
11/22/2013	MLB-5	11.3	8.5	45580	29.4	30
11/22/2013	MLB-6	10.7	8.7	44310	28.5	16
11/22/2013	MUB-1	10.6	8.7	39510	25.1	33
11/22/2013	MUB-2	10.5	9.1	37000	23.3	27
11/22/2013	MUB-3	11	8.6	35840	22.6	19
12/3/2013	MAK-1	8.1	10	33000	20.5	28
12/3/2013	MAK-2	8.2	9.4	32320	20.1	21
12/3/2013	MAK-3	7.8	9.4	32550	20.2	21
12/3/2013	MAK-4	7.4	9.6	32980	20.6	21
12/3/2013	MKK-1	8.5	9.6	40140	25.3	32
12/3/2013	MKK-2	7.8	9.8	34610	21.6	32
12/3/2013	MNB-1	7.7	9.7	34500	21.4	31
12/3/2013	MNB-2	7.5	9.6	32860	20.3	31
12/3/2013	MNB-5	7.5	9.5	32350	20.1	19
12/3/2013	MNB-6	7.4	9.5	31840	19.6	12
12/4/2013	MLB-3	9.1	9.2	44250	28.1	18
12/4/2013	MLB-4	8.5	9.3	40200	25.5	9
12/4/2013	MLB-5	9.4	9.3	46290	29.8	30
12/4/2013	MLB-6	9.3	9.4	46120	29.8	16
12/4/2013	MUB-1	8.7	9.3	43800	28	37
12/4/2013	MUB-11	8.5	9.1	41230	26	12
12/4/2013	MUB-2	8.6	9.3	41850	26.4	29
12/4/2013	MUB-3	8.6	9.2	42200	26.9	22
12/4/2013	MUB-8	8.4	9.4	40670	25.8	31
12/4/2013	MUB-9	8.6	9.3	37530	23.6	33

Appendix B

Mid-water Trawl Catch per Unit Effort by Date and Station Collected During the 2013 Migratory Finfish Survey

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
3/20/2013	MAK-2	Bay anchovy	1	1
3/20/2013	MNB-5	Bay anchovy	1	1
3/20/2013	MNB-5	Blueback herring	244	244
3/27/2013	MLB-4	Blueback herring	2	2
3/27/2013	MUB-1	Northern pipefish	1	1
3/27/2013	MUB-11	Northern pipefish	1	1
3/27/2013	MUB-3	Atlantic herring	2	2
3/27/2013	MUB-8	Atlantic herring	3	3
3/27/2013	MUB-9	Atlantic herring	8	8
3/28/2013	MAK-1	Bay anchovy	2	2
3/28/2013	MAK-1	Northern pipefish	1	1
3/28/2013	MKK-1	Atlantic herring	5	5
3/28/2013	MKK-2	Atlantic herring	3	3
3/28/2013	MNB-1	Atlantic herring	4	4
3/28/2013	MNB-2	Atlantic herring	3	3
3/28/2013	MNB-5	Bay anchovy	1	1
3/28/2013	MNB-5	Blueback herring	2	2
3/28/2013	MNB-6	Blueback herring	1	1
4/3/2013	MKK-1	Atlantic herring	2	2
4/3/2013	MKK-2	Atlantic herring	4	4
4/3/2013	MKK-2	Blueback herring	9	9
4/3/2013	MNB-1	Atlantic herring	2	2
4/3/2013	MNB-1	White perch	1	1
4/3/2013	MNB-2	Atlantic herring	2	2
4/3/2013	MNB-2	Lined seahorse	1	1
4/3/2013	MNB-5	Atlantic herring	4	4
4/3/2013	MNB-5	Bay anchovy	2	2
4/3/2013	MNB-6	Atlantic herring	1	1
4/4/2013	MUB-1	Atlantic herring	3	3
4/4/2013	MUB-1	Blueback herring	1	1
4/4/2013	MUB-11	Atlantic herring	1	1
4/4/2013	MUB-2	Atlantic herring	11	11
4/4/2013	MUB-2	Blueback herring	1	1
4/4/2013	MUB-3	Atlantic herring	4	4
4/4/2013	MUB-8	Atlantic herring	2	2
4/4/2013	MUB-8	Blueback herring	11	11
4/4/2013	MUB-9	Atlantic herring	3	3
4/9/2013	MKK-1	Blueback herring	5	5
4/9/2013	MUB-2	Atlantic herring	5	5
4/9/2013	MUB-3	Atlantic herring	9	9
4/9/2013	MUB-8	Atlantic herring	18	18

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
4/9/2013	MUB-9	Atlantic herring	10	10
4/9/2013	MUB-9	Northern pipefish	1	1
4/10/2013	MAK-1	Atlantic herring	4	4
4/10/2013	MAK-1	Blueback herring	1	1
4/10/2013	MNB-1	Atlantic herring	25	25
4/10/2013	MNB-5	Atlantic herring	5	5
4/10/2013	MNB-6	Atlantic herring	12	12
4/16/2013	MAK-1	Atlantic herring	1	1
4/16/2013	MAK-3	Atlantic herring	10	10
4/16/2013	MAK-3	Atlantic menhaden	1	1
4/16/2013	MAK-3	Blueback herring	5	5
4/16/2013	MAK-4	Atlantic herring	2	2
4/16/2013	MAK-4	Blueback herring	3	3
4/16/2013	MKK-1	Atlantic herring	10	10
4/16/2013	MKK-1	Blueback herring	36	36
4/16/2013	MKK-2	Atlantic herring	165	165
4/16/2013	MNB-1	Atlantic herring	20	20
4/16/2013	MNB-2	Atlantic herring	6	6
4/16/2013	MNB-2	Atlantic menhaden	1	1
4/16/2013	MNB-2	Blueback herring	918	918
4/16/2013	MNB-5	Atlantic herring	5	5
4/16/2013	MNB-6	Atlantic herring	4	4
4/17/2013	MLB-4	Alewife	1	1
4/17/2013	MLB-4	Atlantic menhaden	2	2
4/17/2013	MLB-4	Blueback herring	8	8
4/17/2013	MLB-6	Blueback herring	6	6
4/17/2013	MUB-1	Atlantic herring	8	8
4/17/2013	MUB-1	Atlantic menhaden	1	1
4/17/2013	MUB-11	Atlantic cod	2	2
4/17/2013	MUB-11	Atlantic herring	14	14
4/17/2013	MUB-11	Blueback herring	17	17
4/17/2013	MUB-2	Atlantic herring	25	25
4/17/2013	MUB-2	Bay anchovy	2	2
4/17/2013	MUB-3	Atlantic herring	17	17
4/17/2013	MUB-3	Bay anchovy	1	1
4/17/2013	MUB-3	Blueback herring	58	58
4/17/2013	MUB-8	Alewife	85	85
4/17/2013	MUB-8	Blueback herring	45	45
4/17/2013	MUB-9	Alewife	14	14
4/17/2013	MUB-9	Blueback herring	27	27
4/23/2013	MAK-3	Atlantic herring	12	12

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
4/23/2013	MAK-4	Atlantic herring	3	3
4/23/2013	MAK-4	Bay anchovy	1	1
4/23/2013	MAK-4	Blueback herring	107	107
4/23/2013	MKK-1	Atlantic herring	15	15
4/23/2013	MKK-1	Bay anchovy	2	2
4/23/2013	MNB-1	Atlantic herring	16	16
4/23/2013	MNB-2	Blueback herring	1	1
4/23/2013	MNB-5	American shad	1	1
4/23/2013	MNB-5	Atlantic herring	252	252
4/23/2013	MNB-5	Blueback herring	3	3
4/23/2013	MNB-5	White perch	1	1
4/23/2013	MNB-6	Atlantic herring	12	12
4/24/2013	MLB-3	Blueback herring	2	2
4/24/2013	MLB-4	Alewife	6	6
4/24/2013	MLB-4	Bay anchovy	1	1
4/24/2013	MLB-4	Blueback herring	4	4
4/24/2013	MLB-5	Atlantic herring	2	2
4/24/2013	MLB-6	Bay anchovy	1	1
4/24/2013	MUB-1	Atlantic herring	2	2
4/24/2013	MUB-1	Bay anchovy	2	2
4/24/2013	MUB-11	Atlantic herring	7	7
4/24/2013	MUB-11	Bay anchovy	1	1
4/24/2013	MUB-8	Atlantic herring	9	9
4/24/2013	MUB-8	Blueback herring	3	3
4/24/2013	MUB-9	Alewife	6	6
4/24/2013	MUB-9	Atlantic herring	266	266
4/24/2013	MUB-9	Atlantic menhaden	5	5
4/24/2013	MUB-9	Blueback herring	4	4
5/7/2013	MLB-3	Alewife	1	1
5/7/2013	MLB-3	American shad	1	1
5/7/2013	MLB-3	Atlantic herring	4	4
5/7/2013	MLB-3	Bay anchovy	13	13
5/7/2013	MLB-4	Alewife	12	12
5/7/2013	MLB-4	American shad	1	1
5/7/2013	MLB-4	Atlantic herring	92	92
5/7/2013	MLB-4	Bay anchovy	4	4
5/7/2013	MLB-4	Blueback herring	5	5
5/7/2013	MUB-1	Alewife	4	4
5/7/2013	MUB-1	American shad	2	2
5/7/2013	MUB-1	Blueback herring	2	2
5/7/2013	MUB-11	Atlantic herring	5	5

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
5/7/2013	MUB-11	Bay anchovy	52	52
5/7/2013	MUB-2	Atlantic herring	3	3
5/7/2013	MUB-3	Atlantic herring	6	6
5/7/2013	MUB-3	Atlantic menhaden	1	1
5/7/2013	MUB-3	Bay anchovy	15	15
5/7/2013	MUB-8	Atlantic herring	9	9
5/7/2013	MUB-9	Alewife	27	27
5/7/2013	MUB-9	American shad	1	1
5/7/2013	MUB-9	Atlantic herring	31	31
5/7/2013	MUB-9	Bay anchovy	22	22
5/7/2013	MUB-9	Blueback herring	2	2
5/7/2013	MUB-9	Butterfish	2	2
5/8/2013	MAK-3	Atlantic herring	173	173
5/8/2013	MAK-4	Blueback herring	73	73
5/8/2013	MKK-2	Alewife	5	5
5/8/2013	MKK-2	Atlantic herring	5	5
5/8/2013	MKK-2	Bay anchovy	3	3
5/8/2013	MNB-1	Atlantic herring	5	5
5/8/2013	MNB-2	Atlantic herring	8	8
5/8/2013	MNB-5	Alewife	24	24
5/8/2013	MNB-5	Bay anchovy	1	1
5/8/2013	MNB-5	Blueback herring	29	29
5/8/2013	MNB-6	Alewife	24	24
5/8/2013	MNB-6	Atlantic herring	4	4
5/8/2013	MNB-6	Bay anchovy	1	1
5/8/2013	MNB-6	Blueback herring	425	425
5/21/2013	MLB-4	Atlantic herring	1	1
5/21/2013	MLB-4	Bay anchovy	27	27
5/21/2013	MLB-4	Blueback herring	1	1
5/21/2013	MLB-4	Butterfish	2	2
5/21/2013	MLB-4	Lined seahorse	1	1
5/21/2013	MLB-5	Bay anchovy	37	37
5/21/2013	MLB-5	Butterfish	1	1
5/21/2013	MUB-1	Blueback herring	1	1
5/21/2013	MUB-1	Butterfish	1	1
5/21/2013	MUB-11	Atlantic herring	19	19
5/21/2013	MUB-11	Bay anchovy	25	25
5/21/2013	MUB-11	Butterfish	1	1
5/21/2013	MUB-3	Butterfish	1	1
5/21/2013	MUB-8	Butterfish	2	2
5/21/2013	MUB-9	Butterfish	7	7

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
5/22/2013	MAK-1	Butterfish	1	1
5/22/2013	MAK-1	Spotted hake	1	1
5/22/2013	MKK-2	Atlantic herring	1	1
5/22/2013	MKK-2	Butterfish	1	1
5/22/2013	MKK-2	Northern searobin	1	1
5/22/2013	MNB-1	Atlantic herring	1	1
5/22/2013	MNB-5	Alewife	2	2
5/22/2013	MNB-5	Atlantic herring	2	2
5/22/2013	MNB-5	Bay anchovy	16	16
5/22/2013	MNB-6	American shad	1	1
5/22/2013	MNB-6	Bay anchovy	22	22
5/22/2013	MNB-6	Blueback herring	61	61
6/4/2013	MAK-4	Atlantic herring	1	1
6/4/2013	MAK-4	Bay anchovy	2	2
6/4/2013	MAK-4	Blue crab	1	1
6/4/2013	MKK-1	Atlantic herring	1	1
6/4/2013	MKK-1	Bluefish	22	22
6/4/2013	MKK-2	Bluefish	8	8
6/4/2013	MNB-1	Bay anchovy	13	13
6/4/2013	MNB-1	Blue crab	1	1
6/4/2013	MNB-1	Butterfish	1	1
6/4/2013	MNB-2	Bay anchovy	6	6
6/4/2013	MNB-5	Bay anchovy	102	102
6/4/2013	MNB-6	Bay anchovy	69	69
6/5/2013	MLB-4	Bay anchovy	1	1
6/5/2013	MLB-4	Bluefish	1	1
6/5/2013	MLB-6	Bluefish	5	5
6/5/2013	MUB-1	Bluefish	1	1
6/5/2013	MUB-8	Bluefish	3	3
7/9/2013	MKK-1	Bay anchovy	2	2
7/9/2013	MKK-1	Blue crab	1	1
7/9/2013	MLB-4	Bay anchovy	840	840
7/9/2013	MLB-4	Bluefish	1	1
7/9/2013	MLB-4	Butterfish	1	1
7/9/2013	MUB-11	Bay anchovy	1	1
7/9/2013	MUB-11	Blue crab	1	1
7/9/2013	MUB-3	Bay anchovy	27	27
7/9/2013	MUB-8	Bay anchovy	116	116
7/9/2013	MUB-9	Bay anchovy	552	552
7/9/2013	MUB-9	Bluefish	3	3
7/9/2013	MUB-9	Butterfish	1	1

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
7/10/2013	MAK-1	Bay anchovy	5	5
7/10/2013	MAK-1	Blue crab	1	1
7/10/2013	MAK-1	Bluefish	1	1
7/10/2013	MAK-3	Bay anchovy	485	485
7/10/2013	MAK-3	Bluefish	2	2
7/10/2013	MAK-4	Bay anchovy	238	238
7/10/2013	MAK-4	Bluefish	2	2
7/10/2013	MNB-1	Bay anchovy	133	133
7/10/2013	MNB-2	Bay anchovy	201	201
7/10/2013	MNB-2	Bluefish	2	2
7/10/2013	MNB-5	Bay anchovy	254	254
7/10/2013	MNB-6	Bay anchovy	132	132
7/10/2013	MNB-6	Blue crab	1	1
7/10/2013	MNB-6	Bluefish	3	3
8/19/2013	MLB-3	Blue crab	1	1
8/19/2013	MLB-4	Bay anchovy	4994	4994
8/19/2013	MLB-4	Blue crab	2	2
8/19/2013	MLB-4	Bluefish	3	3
8/19/2013	MLB-4	Butterfish	2	2
8/19/2013	MUB-1	Alewife	1	1
8/19/2013	MUB-1	Bay anchovy	16	16
8/19/2013	MUB-1	Bluefish	1	1
8/19/2013	MUB-1	Butterfish	5	5
8/19/2013	MUB-9	Bay anchovy	5	5
8/20/2013	MAK-1	Bay anchovy	8	10
8/20/2013	MAK-2	Bay anchovy	283	283
8/20/2013	MAK-2	Blue crab	1	1
8/20/2013	MAK-3	Atlantic moonfish	1	1
8/20/2013	MAK-3	Bay anchovy	129	129
8/20/2013	MAK-3	Blue crab	5	5
8/20/2013	MAK-3	Bluefish	1	1
8/20/2013	MAK-4	Bay anchovy	234	234
8/20/2013	MAK-4	Blue crab	2	2
8/20/2013	MKK-2	Bay anchovy	20	20
8/20/2013	MNB-1	Bay anchovy	51	51
8/20/2013	MNB-1	Blue crab	1	1
8/20/2013	MNB-2	Bay anchovy	41	41
8/20/2013	MNB-5	Bay anchovy	62	62
8/20/2013	MNB-5	Blue crab	1	1
8/20/2013	MNB-5	Bluefish	1	1
8/20/2013	MNB-6	Bay anchovy	613	613

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
8/20/2013	MNB-6	Blueback herring	3	3
8/20/2013	MNB-6	Bluefish	2	2
9/10/2013	MAK-1	Atlantic menhaden	1	1
9/10/2013	MAK-1	Bay anchovy	130	130
9/10/2013	MAK-1	Striped anchovy	3	3
9/10/2013	MAK-2	Bay anchovy	1613	1613
9/10/2013	MAK-2	Blue crab	1	1
9/10/2013	MAK-2	Blueback herring	8	8
9/10/2013	MAK-2	Striped anchovy	1	1
9/10/2013	MAK-3	Bay anchovy	1335	1335
9/10/2013	MAK-3	Blueback herring	5	5
9/10/2013	MAK-3	Striped anchovy	2	2
9/10/2013	MAK-4	Bay anchovy	866	866
9/10/2013	MAK-4	Striped anchovy	20	20
9/10/2013	MKK-2	Bay anchovy	98	98
9/10/2013	MKK-2	Blue crab	1	1
9/10/2013	MNB-1	Bay anchovy	14	14
9/10/2013	MNB-1	Blue crab	2	2
9/10/2013	MNB-1	Striped anchovy	1	1
9/10/2013	MNB-5	Bay anchovy	74	74
9/10/2013	MNB-5	Blue crab	3	3
9/10/2013	MNB-5	Bluefish	1	1
9/10/2013	MNB-6	Alewife	13	13
9/10/2013	MNB-6	Bay anchovy	815	815
9/10/2013	MNB-6	Blueback herring	6	6
9/10/2013	MNB-6	Bluefish	8	8
9/10/2013	MNB-6	Striped anchovy	10	10
9/11/2013	MLB-4	Bay anchovy	67	67
9/11/2013	MLB-5	Butterfish	2	2
9/11/2013	MLB-6	Butterfish	1	1
9/11/2013	MUB-11	Bay anchovy	1069	1069
9/11/2013	MUB-11	Blueback herring	1	1
9/11/2013	MUB-11	Bluefish	1	1
9/11/2013	MUB-11	Striped anchovy	4	4
9/11/2013	MUB-3	Striped anchovy	3	3
9/11/2013	MUB-8	Bay anchovy	293	293
9/11/2013	MUB-8	Striped anchovy	1	1
9/11/2013	MUB-9	Bay anchovy	144	144
9/11/2013	MUB-9	Blue crab	1	1
9/11/2013	MUB-9	Striped anchovy	2	2
9/24/2013	MKK-2	Bay anchovy	276	276

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
9/24/2013	MNB-5	Bay anchovy	123	123
9/24/2013	MNB-5	Blueback herring	11	11
9/24/2013	MNB-5	Striped anchovy	2	2
9/24/2013	MNB-6	Bay anchovy	1676	1676
9/24/2013	MNB-6	Blueback herring	19	19
9/24/2013	MNB-6	Bluefish	2	2
9/25/2013	MLB-3	Butterfish	2	2
9/25/2013	MLB-4	Bay anchovy	13	13
9/25/2013	MLB-5	Butterfish	1	1
9/25/2013	MUB-11	Bay anchovy	354	354
9/25/2013	MUB-11	Blue crab	1	1
9/25/2013	MUB-11	Striped anchovy	10	10
9/25/2013	MUB-2	Butterfish	1	1
9/25/2013	MUB-8	Striped anchovy	1	1
9/25/2013	MUB-9	Bay anchovy	92	92
9/25/2013	MUB-9	Butterfish	1	1
9/25/2013	MUB-9	Striped anchovy	19	19
10/1/2013	MLB-3	Butterfish	3	3
10/1/2013	MLB-4	Bay anchovy	660	660
10/1/2013	MLB-4	Blueback herring	1	1
10/1/2013	MLB-4	Striped anchovy	2	2
10/1/2013	MLB-5	Butterfish	4	4
10/1/2013	MUB-1	Butterfish	14	14
10/1/2013	MUB-11	Bay anchovy	7	7
10/1/2013	MUB-11	Butterfish	6	6
10/1/2013	MUB-8	Butterfish	1	1
10/1/2013	MUB-9	Butterfish	1	1
10/2/2013	MKK-1	Butterfish	2	2
10/2/2013	MNB-1	Butterfish	1	1
10/2/2013	MNB-5	Bay anchovy	330	330
10/2/2013	MNB-5	Blue crab	1	1
10/2/2013	MNB-5	Blueback herring	57	57
10/2/2013	MNB-5	Striped anchovy	1	1
10/2/2013	MNB-6	Blueback herring	3	3
10/8/2013	MKK-1	Bay anchovy	80	80
10/8/2013	MKK-1	Bluefish	1	1
10/8/2013	MLB-4	Bay anchovy	2141	2141
10/8/2013	MLB-4	Striped anchovy	5	5
10/8/2013	MLB-6	Blue crab	1	1
10/8/2013	MLB-6	Butterfish	1	1
10/8/2013	MUB-1	Bay anchovy	5	5

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
10/8/2013	MUB-11	Bay anchovy	131	131
10/8/2013	MUB-2	Bay anchovy	37	37
10/8/2013	MUB-2	Striped anchovy	1	1
10/8/2013	MUB-3	Bay anchovy	67	67
10/8/2013	MUB-9	Alewife	6	6
10/8/2013	MUB-9	Bay anchovy	295	295
10/8/2013	MUB-9	Bluefish	5	5
10/8/2013	MUB-9	Butterfish	1	1
10/9/2013	MAK-2	Bay anchovy	56	56
10/9/2013	MKK-2	Bay anchovy	143	143
10/9/2013	MNB-5	Alewife	1	1
10/9/2013	MNB-5	Bay anchovy	36	36
10/9/2013	MNB-5	Blue crab	1	1
10/9/2013	MNB-5	Blueback herring	2	2
10/9/2013	MNB-6	Bay anchovy	201	201
10/9/2013	MNB-6	Blueback herring	12	12
10/9/2013	MNB-6	Bluefish	1	1
10/9/2013	MNB-6	Striped anchovy	1	1
10/15/2013	MLB-4	Bay anchovy	1623	1623
10/15/2013	MUB-1	Bay anchovy	4	4
10/15/2013	MUB-11	Bay anchovy	1759	1759
10/15/2013	MUB-11	Blueback herring	1	1
10/15/2013	MUB-2	Bay anchovy	3	3
10/15/2013	MUB-2	Butterfish	1	1
10/15/2013	MUB-8	Spotfin butterflyfish	1	1
10/16/2013	MAK-1	Bay anchovy	1	1
10/16/2013	MKK-1	Bay anchovy	20	20
10/16/2013	MNB-2	Bay anchovy	2	2
10/16/2013	MNB-5	Atlantic menhaden	1	1
10/16/2013	MNB-5	Bay anchovy	27	27
10/16/2013	MNB-5	Blue crab	3	3
10/16/2013	MNB-5	Blueback herring	5	5
10/16/2013	MNB-6	Blueback herring	265	265
10/21/2013	MKK-1	Bay anchovy	13	13
10/21/2013	MKK-1	Bluefish	1	1
10/21/2013	MLB-3	Atlantic moonfish	1	1
10/21/2013	MLB-4	Bay anchovy	483	483
10/21/2013	MUB-1	Bay anchovy	1	1
10/21/2013	MUB-1	Butterfish	1	1
10/21/2013	MUB-9	American shad	2	2
10/21/2013	MUB-9	Bay anchovy	77	77

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
10/22/2013	MAK-2	Butterfish	1	1
10/22/2013	MKK-2	Bay anchovy	6	6
10/29/2013	MLB-4	Bay anchovy	66	66
10/29/2013	MUB-8	Atlantic moonfish	1	1
10/30/2013	MNB-6	Blueback herring	1111	1111
11/5/2013	MKK-1	Bay anchovy	1	1
11/5/2013	MKK-1	Butterfish	1	1
11/5/2013	MLB-4	Bay anchovy	19	19
11/5/2013	MLB-4	Bluefish	4	4
11/5/2013	MUB-11	American shad	2	2
11/5/2013	MUB-11	Bay anchovy	7	7
11/5/2013	MUB-8	Bay anchovy	1	1
11/5/2013	MUB-9	Bay anchovy	3	3
11/5/2013	MUB-9	Blueback herring	1	1
11/6/2013	MAK-1	Blueback herring	1	1
11/6/2013	MAK-3	Bay anchovy	1	1
11/6/2013	MAK-4	Bay anchovy	1	1
11/6/2013	MNB-1	Bay anchovy	1	1
11/6/2013	MNB-2	Bay anchovy	6	6
11/6/2013	MNB-5	Blue crab	1	1
11/6/2013	MNB-6	Bay anchovy	2	2
11/12/2013	MAK-2	Bay anchovy	1	1
11/12/2013	MKK-1	Atlantic menhaden	1	1
11/12/2013	MKK-1	Bay anchovy	16	16
11/12/2013	MKK-1	Lined seahorse	1	1
11/12/2013	MKK-2	Bay anchovy	3	3
11/12/2013	MNB-2	Bay anchovy	2	2
11/12/2013	MNB-5	Bay anchovy	2	2
11/13/2013	MLB-3	Bay anchovy	1	1
11/13/2013	MLB-4	Bay anchovy	2	2
11/13/2013	MUB-1	American shad	1	1
11/13/2013	MUB-1	Bay anchovy	3	3
11/13/2013	MUB-1	Blueback herring	2	2
11/13/2013	MUB-11	American shad	1	1
11/13/2013	MUB-11	Atlantic moonfish	1	1
11/13/2013	MUB-11	Bay anchovy	4	4
11/13/2013	MUB-11	Black sea bass	1	1
11/13/2013	MUB-11	Blue crab	1	1
11/13/2013	MUB-2	Bay anchovy	18	18
11/13/2013	MUB-2	Blueback herring	1	1
11/13/2013	MUB-3	Bay anchovy	18	18

Date	Station	Common Name	Number Caught	CPUE (#/10 min. tow)
11/19/2013	MKK-2	Atlantic silverside	1	1
11/19/2013	MNB-5	Bay anchovy	2	2
11/19/2013	MNB-5	Blueback herring	112	112
11/19/2013	MNB-6	Blueback herring	8	8
11/20/2013	MUB-11	Bay anchovy	1	1
11/20/2013	MUB-8	American sandlance	1	1
11/20/2013	MUB-9	Alewife	2	2
11/20/2013	MUB-9	American shad	3	3
11/20/2013	MUB-9	Blueback herring	55	55
12/3/2013	MAK-1	Bay anchovy	2	2
12/3/2013	MAK-2	Bay anchovy	4	4
12/3/2013	MAK-3	Bay anchovy	1	1
12/3/2013	MAK-4	Atlantic silverside	21	21
12/3/2013	MAK-4	Bay anchovy	3	3
12/3/2013	MKK-2	Atlantic silverside	4	4
12/3/2013	MKK-2	Bay anchovy	2	2
12/3/2013	MNB-1	Atlantic silverside	22	22
12/3/2013	MNB-6	Atlantic silverside	1	1
12/4/2013	MLB-4	Bay anchovy	22	22
12/4/2013	MLB-5	American sandlance	16	16
12/4/2013	MLB-5	Bay anchovy	1	1
12/4/2013	MUB-8	Atlantic silverside	1	1
12/4/2013	MUB-9	American shad	1	1
12/4/2013	MUB-9	Bay anchovy	2	2
12/4/2013	MUB-9	Blueback herring	11	11

Appendix C

Output from Statistical Analyses for the 2013 Migratory Finfish Sampling Program

Appendix C-1
Analysis of Variance Detail

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
12	3/20/2013	Spring	MKK-1	AKKVK	Alewife	0	0	Alewife Spring
12	3/20/2013	Spring	MKK-1	AKKVK	American shad	0	0	American shad Spring
12	3/20/2013	Spring	MKK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
12	3/20/2013	Spring	MKK-1	AKKVK	Blueback herring	0	0	Blueback herring Spring
12	3/20/2013	Spring	MKK-1	AKKVK	Striped bass	0	0	Striped bass Spring
12	3/20/2013	Spring	MKK-2	AKKVK	Alewife	0	0	Alewife Spring
12	3/20/2013	Spring	MKK-2	AKKVK	American shad	0	0	American shad Spring
12	3/20/2013	Spring	MKK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
12	3/20/2013	Spring	MKK-2	AKKVK	Blueback herring	0	0	Blueback herring Spring
12	3/20/2013	Spring	MKK-2	AKKVK	Striped bass	0	0	Striped bass Spring
12	3/20/2013	Spring	MNB-5	NB	Alewife	0	0	Alewife Spring
12	3/20/2013	Spring	MNB-5	NB	American shad	0	0	American shad Spring
12	3/20/2013	Spring	MNB-5	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
12	3/20/2013	Spring	MNB-5	NB	Blueback herring	244	2.389166	Blueback herring Spring
12	3/20/2013	Spring	MNB-5	NB	Striped bass	0	0	Striped bass Spring
12	3/20/2013	Spring	MNB-6	NB	Alewife	0	0	Alewife Spring
12	3/20/2013	Spring	MNB-6	NB	American shad	0	0	American shad Spring
12	3/20/2013	Spring	MNB-6	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
12	3/20/2013	Spring	MNB-6	NB	Blueback herring	0	0	Blueback herring Spring
12	3/20/2013	Spring	MNB-6	NB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
12	3/20/2013	Spring	MNB-2	NB	Alewife	0	0	Alewife Spring
12	3/20/2013	Spring	MNB-2	NB	American shad	0	0	American shad Spring
12	3/20/2013	Spring	MNB-2	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
12	3/20/2013	Spring	MNB-2	NB	Blueback herring	0	0	Blueback herring Spring
12	3/20/2013	Spring	MNB-2	NB	Striped bass	0	0	Striped bass Spring
12	3/20/2013	Spring	MNB-1	NB	Alewife	0	0	Alewife Spring
12	3/20/2013	Spring	MNB-1	NB	American shad	0	0	American shad Spring
12	3/20/2013	Spring	MNB-1	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
12	3/20/2013	Spring	MNB-1	NB	Blueback herring	0	0	Blueback herring Spring
12	3/20/2013	Spring	MNB-1	NB	Striped bass	0	0	Striped bass Spring
12	3/20/2013	Spring	MAK-1	AKKVK	Alewife	0	0	Alewife Spring
12	3/20/2013	Spring	MAK-1	AKKVK	American shad	0	0	American shad Spring
12	3/20/2013	Spring	MAK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
12	3/20/2013	Spring	MAK-1	AKKVK	Blueback herring	0	0	Blueback herring Spring
12	3/20/2013	Spring	MAK-1	AKKVK	Striped bass	0	0	Striped bass Spring
12	3/20/2013	Spring	MAK-2	AKKVK	Alewife	0	0	Alewife Spring
12	3/20/2013	Spring	MAK-2	AKKVK	American shad	0	0	American shad Spring
12	3/20/2013	Spring	MAK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
12	3/20/2013	Spring	MAK-2	AKKVK	Blueback herring	0	0	Blueback herring Spring
12	3/20/2013	Spring	MAK-2	AKKVK	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
12	3/20/2013	Spring	MAK-3	AKKVK	Alewife	0	0	Alewife Spring
12	3/20/2013	Spring	MAK-3	AKKVK	American shad	0	0	American shad Spring
12	3/20/2013	Spring	MAK-3	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
12	3/20/2013	Spring	MAK-3	AKKVK	Blueback herring	0	0	Blueback herring Spring
12	3/20/2013	Spring	MAK-3	AKKVK	Striped bass	0	0	Striped bass Spring
12	3/20/2013	Spring	MAK-4	AKKVK	Alewife	0	0	Alewife Spring
12	3/20/2013	Spring	MAK-4	AKKVK	American shad	0	0	American shad Spring
12	3/20/2013	Spring	MAK-4	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
12	3/20/2013	Spring	MAK-4	AKKVK	Blueback herring	0	0	Blueback herring Spring
12	3/20/2013	Spring	MAK-4	AKKVK	Striped bass	0	0	Striped bass Spring
12	3/21/2013	Spring	MLB-4	LB	Alewife	0	0	Alewife Spring
12	3/21/2013	Spring	MLB-4	LB	American shad	0	0	American shad Spring
12	3/21/2013	Spring	MLB-4	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
12	3/21/2013	Spring	MLB-4	LB	Blueback herring	0	0	Blueback herring Spring
12	3/21/2013	Spring	MLB-4	LB	Striped bass	0	0	Striped bass Spring
12	3/21/2013	Spring	MLB-3	LB	Alewife	0	0	Alewife Spring
12	3/21/2013	Spring	MLB-3	LB	American shad	0	0	American shad Spring
12	3/21/2013	Spring	MLB-3	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
12	3/21/2013	Spring	MLB-3	LB	Blueback herring	0	0	Blueback herring Spring
12	3/21/2013	Spring	MLB-3	LB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPU E+1)**	**Species/Se ason**
								Spring
12	3/21/2013	Spring	MLB-5	LB	Alewife	0	0	Alewife Spring
12	3/21/2013	Spring	MLB-5	LB	American shad	0	0	American shad Spring
12	3/21/2013	Spring	MLB-5	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
12	3/21/2013	Spring	MLB-5	LB	Blueback herring	0	0	Blueback herring Spring
12	3/21/2013	Spring	MLB-5	LB	Striped bass	0	0	Striped bass Spring
12	3/21/2013	Spring	MLB-6	LB	Alewife	0	0	Alewife Spring
12	3/21/2013	Spring	MLB-6	LB	American shad	0	0	American shad Spring
12	3/21/2013	Spring	MLB-6	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
12	3/21/2013	Spring	MLB-6	LB	Blueback herring	0	0	Blueback herring Spring
12	3/21/2013	Spring	MLB-6	LB	Striped bass	0	0	Striped bass Spring
12	3/21/2013	Spring	MUB-1	UB	Alewife	0	0	Alewife Spring
12	3/21/2013	Spring	MUB-1	UB	American shad	0	0	American shad Spring
12	3/21/2013	Spring	MUB-1	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
12	3/21/2013	Spring	MUB-1	UB	Blueback herring	0	0	Blueback herring Spring
12	3/21/2013	Spring	MUB-1	UB	Striped bass	0	0	Striped bass Spring
12	3/21/2013	Spring	MUB-2	UB	Alewife	0	0	Alewife Spring
12	3/21/2013	Spring	MUB-2	UB	American shad	0	0	American shad Spring
12	3/21/2013	Spring	MUB-2	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
12	3/21/2013	Spring	MUB-2	UB	Blueback herring	0	0	Blueback herring Spring
12	3/21/2013	Spring	MUB-2	UB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA

WOY	Date	Season	Station	Area Grouping for MFS Report	Common Name	CPUE - 10min	Log(CPUE+1)	Species/Season
								Spring
12	3/21/2013	Spring	MUB-11	UB	Alewife	0	0	Alewife Spring
12	3/21/2013	Spring	MUB-11	UB	American shad	0	0	American shad Spring
12	3/21/2013	Spring	MUB-11	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
12	3/21/2013	Spring	MUB-11	UB	Blueback herring	0	0	Blueback herring Spring
12	3/21/2013	Spring	MUB-11	UB	Striped bass	0	0	Striped bass Spring
12	3/21/2013	Spring	MUB-3	UB	Alewife	0	0	Alewife Spring
12	3/21/2013	Spring	MUB-3	UB	American shad	0	0	American shad Spring
12	3/21/2013	Spring	MUB-3	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
12	3/21/2013	Spring	MUB-3	UB	Blueback herring	0	0	Blueback herring Spring
12	3/21/2013	Spring	MUB-3	UB	Striped bass	0	0	Striped bass Spring
12	3/21/2013	Spring	MUB-8	UB	Alewife	0	0	Alewife Spring
12	3/21/2013	Spring	MUB-8	UB	American shad	0	0	American shad Spring
12	3/21/2013	Spring	MUB-8	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
12	3/21/2013	Spring	MUB-8	UB	Blueback herring	0	0	Blueback herring Spring
12	3/21/2013	Spring	MUB-8	UB	Striped bass	0	0	Striped bass Spring
12	3/21/2013	Spring	MUB-9	UB	Alewife	0	0	Alewife Spring
12	3/21/2013	Spring	MUB-9	UB	American shad	0	0	American shad Spring
12	3/21/2013	Spring	MUB-9	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
12	3/21/2013	Spring	MUB-9	UB	Blueback herring	0	0	Blueback herring Spring
12	3/21/2013	Spring	MUB-9	UB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
13	3/27/2013	Spring	MUB-9	UB	Alewife	0	0	Alewife Spring
13	3/27/2013	Spring	MUB-9	UB	American shad	0	0	American shad Spring
13	3/27/2013	Spring	MUB-9	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
13	3/27/2013	Spring	MUB-9	UB	Blueback herring	0	0	Blueback herring Spring
13	3/27/2013	Spring	MUB-9	UB	Striped bass	0	0	Striped bass Spring
13	3/27/2013	Spring	MUB-8	UB	Alewife	0	0	Alewife Spring
13	3/27/2013	Spring	MUB-8	UB	American shad	0	0	American shad Spring
13	3/27/2013	Spring	MUB-8	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
13	3/27/2013	Spring	MUB-8	UB	Blueback herring	0	0	Blueback herring Spring
13	3/27/2013	Spring	MUB-8	UB	Striped bass	0	0	Striped bass Spring
13	3/27/2013	Spring	MUB-11	UB	Alewife	0	0	Alewife Spring
13	3/27/2013	Spring	MUB-11	UB	American shad	0	0	American shad Spring
13	3/27/2013	Spring	MUB-11	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
13	3/27/2013	Spring	MUB-11	UB	Blueback herring	0	0	Blueback herring Spring
13	3/27/2013	Spring	MUB-11	UB	Striped bass	0	0	Striped bass Spring
13	3/27/2013	Spring	MUB-3	UB	Alewife	0	0	Alewife Spring
13	3/27/2013	Spring	MUB-3	UB	American shad	0	0	American shad Spring
13	3/27/2013	Spring	MUB-3	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
13	3/27/2013	Spring	MUB-3	UB	Blueback herring	0	0	Blueback herring Spring
13	3/27/2013	Spring	MUB-3	UB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
13	3/27/2013	Spring	MUB-2	UB	Alewife	0	0	Alewife Spring
13	3/27/2013	Spring	MUB-2	UB	American shad	0	0	American shad Spring
13	3/27/2013	Spring	MUB-2	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
13	3/27/2013	Spring	MUB-2	UB	Blueback herring	0	0	Blueback herring Spring
13	3/27/2013	Spring	MUB-2	UB	Striped bass	0	0	Striped bass Spring
13	3/27/2013	Spring	MLB-4	LB	Alewife	0	0	Alewife Spring
13	3/27/2013	Spring	MLB-4	LB	American shad	0	0	American shad Spring
13	3/27/2013	Spring	MLB-4	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
13	3/27/2013	Spring	MLB-4	LB	Blueback herring	2	0.477121	Blueback herring Spring
13	3/27/2013	Spring	MLB-4	LB	Striped bass	0	0	Striped bass Spring
13	3/27/2013	Spring	MLB-3	LB	Alewife	0	0	Alewife Spring
13	3/27/2013	Spring	MLB-3	LB	American shad	0	0	American shad Spring
13	3/27/2013	Spring	MLB-3	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
13	3/27/2013	Spring	MLB-3	LB	Blueback herring	0	0	Blueback herring Spring
13	3/27/2013	Spring	MLB-3	LB	Striped bass	0	0	Striped bass Spring
13	3/27/2013	Spring	MLB-5	LB	Alewife	0	0	Alewife Spring
13	3/27/2013	Spring	MLB-5	LB	American shad	0	0	American shad Spring
13	3/27/2013	Spring	MLB-5	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
13	3/27/2013	Spring	MLB-5	LB	Blueback herring	0	0	Blueback herring Spring
13	3/27/2013	Spring	MLB-5	LB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
13	3/27/2013	Spring	MLB-6	LB	Alewife	0	0	Alewife Spring
13	3/27/2013	Spring	MLB-6	LB	American shad	0	0	American shad Spring
13	3/27/2013	Spring	MLB-6	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
13	3/27/2013	Spring	MLB-6	LB	Blueback herring	0	0	Blueback herring Spring
13	3/27/2013	Spring	MLB-6	LB	Striped bass	0	0	Striped bass Spring
13	3/27/2013	Spring	MUB-1	UB	Alewife	0	0	Alewife Spring
13	3/27/2013	Spring	MUB-1	UB	American shad	0	0	American shad Spring
13	3/27/2013	Spring	MUB-1	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
13	3/27/2013	Spring	MUB-1	UB	Blueback herring	0	0	Blueback herring Spring
13	3/27/2013	Spring	MUB-1	UB	Striped bass	0	0	Striped bass Spring
13	3/28/2013	Spring	MKK-1	AKKVK	Alewife	0	0	Alewife Spring
13	3/28/2013	Spring	MKK-1	AKKVK	American shad	0	0	American shad Spring
13	3/28/2013	Spring	MKK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
13	3/28/2013	Spring	MKK-1	AKKVK	Blueback herring	0	0	Blueback herring Spring
13	3/28/2013	Spring	MKK-1	AKKVK	Striped bass	0	0	Striped bass Spring
13	3/28/2013	Spring	MAK-1	AKKVK	Alewife	0	0	Alewife Spring
13	3/28/2013	Spring	MAK-1	AKKVK	American shad	0	0	American shad Spring
13	3/28/2013	Spring	MAK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
13	3/28/2013	Spring	MAK-1	AKKVK	Blueback herring	0	0	Blueback herring Spring
13	3/28/2013	Spring	MAK-1	AKKVK	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
13	3/28/2013	Spring	MAK-2	AKKVK	Alewife	0	0	Alewife Spring
13	3/28/2013	Spring	MAK-2	AKKVK	American shad	0	0	American shad Spring
13	3/28/2013	Spring	MAK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
13	3/28/2013	Spring	MAK-2	AKKVK	Blueback herring	0	0	Blueback herring Spring
13	3/28/2013	Spring	MAK-2	AKKVK	Striped bass	0	0	Striped bass Spring
13	3/28/2013	Spring	MAK-3	AKKVK	Alewife	0	0	Alewife Spring
13	3/28/2013	Spring	MAK-3	AKKVK	American shad	0	0	American shad Spring
13	3/28/2013	Spring	MAK-3	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
13	3/28/2013	Spring	MAK-3	AKKVK	Blueback herring	0	0	Blueback herring Spring
13	3/28/2013	Spring	MAK-3	AKKVK	Striped bass	0	0	Striped bass Spring
13	3/28/2013	Spring	MAK-4	AKKVK	Alewife	0	0	Alewife Spring
13	3/28/2013	Spring	MAK-4	AKKVK	American shad	0	0	American shad Spring
13	3/28/2013	Spring	MAK-4	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
13	3/28/2013	Spring	MAK-4	AKKVK	Blueback herring	0	0	Blueback herring Spring
13	3/28/2013	Spring	MAK-4	AKKVK	Striped bass	0	0	Striped bass Spring
13	3/28/2013	Spring	MNB-1	NB	Alewife	0	0	Alewife Spring
13	3/28/2013	Spring	MNB-1	NB	American shad	0	0	American shad Spring
13	3/28/2013	Spring	MNB-1	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
13	3/28/2013	Spring	MNB-1	NB	Blueback herring	0	0	Blueback herring Spring
13	3/28/2013	Spring	MNB-1	NB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
13	3/28/2013	Spring	MNB-2	NB	Alewife	0	0	Alewife Spring
13	3/28/2013	Spring	MNB-2	NB	American shad	0	0	American shad Spring
13	3/28/2013	Spring	MNB-2	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
13	3/28/2013	Spring	MNB-2	NB	Blueback herring	0	0	Blueback herring Spring
13	3/28/2013	Spring	MNB-2	NB	Striped bass	0	0	Striped bass Spring
13	3/28/2013	Spring	MNB-5	NB	Alewife	0	0	Alewife Spring
13	3/28/2013	Spring	MNB-5	NB	American shad	0	0	American shad Spring
13	3/28/2013	Spring	MNB-5	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
13	3/28/2013	Spring	MNB-5	NB	Blueback herring	2	0.477121	Blueback herring Spring
13	3/28/2013	Spring	MNB-5	NB	Striped bass	0	0	Striped bass Spring
13	3/28/2013	Spring	MNB-6	NB	Alewife	0	0	Alewife Spring
13	3/28/2013	Spring	MNB-6	NB	American shad	0	0	American shad Spring
13	3/28/2013	Spring	MNB-6	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
13	3/28/2013	Spring	MNB-6	NB	Blueback herring	1	0.30103	Blueback herring Spring
13	3/28/2013	Spring	MNB-6	NB	Striped bass	0	0	Striped bass Spring
13	3/28/2013	Spring	MKK-2	AKKVK	Alewife	0	0	Alewife Spring
13	3/28/2013	Spring	MKK-2	AKKVK	American shad	0	0	American shad Spring
13	3/28/2013	Spring	MKK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
13	3/28/2013	Spring	MKK-2	AKKVK	Blueback herring	0	0	Blueback herring Spring
13	3/28/2013	Spring	MKK-2	AKKVK	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
14	4/3/2013	Spring	MKK-1	AKKVK	Alewife	0	0	Alewife Spring
14	4/3/2013	Spring	MKK-1	AKKVK	American shad	0	0	American shad Spring
14	4/3/2013	Spring	MKK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
14	4/3/2013	Spring	MKK-1	AKKVK	Blueback herring	0	0	Blueback herring Spring
14	4/3/2013	Spring	MKK-1	AKKVK	Striped bass	0	0	Striped bass Spring
14	4/3/2013	Spring	MKK-2	AKKVK	Alewife	0	0	Alewife Spring
14	4/3/2013	Spring	MKK-2	AKKVK	American shad	0	0	American shad Spring
14	4/3/2013	Spring	MKK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
14	4/3/2013	Spring	MKK-2	AKKVK	Blueback herring	9	1	Blueback herring Spring
14	4/3/2013	Spring	MKK-2	AKKVK	Striped bass	0	0	Striped bass Spring
14	4/3/2013	Spring	MNB-5	NB	Alewife	0	0	Alewife Spring
14	4/3/2013	Spring	MNB-5	NB	American shad	0	0	American shad Spring
14	4/3/2013	Spring	MNB-5	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
14	4/3/2013	Spring	MNB-5	NB	Blueback herring	0	0	Blueback herring Spring
14	4/3/2013	Spring	MNB-5	NB	Striped bass	0	0	Striped bass Spring
14	4/3/2013	Spring	MNB-6	NB	Alewife	0	0	Alewife Spring
14	4/3/2013	Spring	MNB-6	NB	American shad	0	0	American shad Spring
14	4/3/2013	Spring	MNB-6	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
14	4/3/2013	Spring	MNB-6	NB	Blueback herring	0	0	Blueback herring Spring
14	4/3/2013	Spring	MNB-6	NB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
14	4/3/2013	Spring	MNB-2	NB	Alewife	0	0	Alewife Spring
14	4/3/2013	Spring	MNB-2	NB	American shad	0	0	American shad Spring
14	4/3/2013	Spring	MNB-2	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
14	4/3/2013	Spring	MNB-2	NB	Blueback herring	0	0	Blueback herring Spring
14	4/3/2013	Spring	MNB-2	NB	Striped bass	0	0	Striped bass Spring
14	4/3/2013	Spring	MNB-1	NB	Alewife	0	0	Alewife Spring
14	4/3/2013	Spring	MNB-1	NB	American shad	0	0	American shad Spring
14	4/3/2013	Spring	MNB-1	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
14	4/3/2013	Spring	MNB-1	NB	Blueback herring	0	0	Blueback herring Spring
14	4/3/2013	Spring	MNB-1	NB	Striped bass	0	0	Striped bass Spring
14	4/3/2013	Spring	MAK-1	AKKVK	Alewife	0	0	Alewife Spring
14	4/3/2013	Spring	MAK-1	AKKVK	American shad	0	0	American shad Spring
14	4/3/2013	Spring	MAK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
14	4/3/2013	Spring	MAK-1	AKKVK	Blueback herring	0	0	Blueback herring Spring
14	4/3/2013	Spring	MAK-1	AKKVK	Striped bass	0	0	Striped bass Spring
14	4/3/2013	Spring	MAK-2	AKKVK	Alewife	0	0	Alewife Spring
14	4/3/2013	Spring	MAK-2	AKKVK	American shad	0	0	American shad Spring
14	4/3/2013	Spring	MAK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
14	4/3/2013	Spring	MAK-2	AKKVK	Blueback herring	0	0	Blueback herring Spring
14	4/3/2013	Spring	MAK-2	AKKVK	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
14	4/3/2013	Spring	MAK-3	AKKVK	Alewife	0	0	Alewife Spring
14	4/3/2013	Spring	MAK-3	AKKVK	American shad	0	0	American shad Spring
14	4/3/2013	Spring	MAK-3	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
14	4/3/2013	Spring	MAK-3	AKKVK	Blueback herring	0	0	Blueback herring Spring
14	4/3/2013	Spring	MAK-3	AKKVK	Striped bass	0	0	Striped bass Spring
14	4/3/2013	Spring	MAK-4	AKKVK	Alewife	0	0	Alewife Spring
14	4/3/2013	Spring	MAK-4	AKKVK	American shad	0	0	American shad Spring
14	4/3/2013	Spring	MAK-4	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
14	4/3/2013	Spring	MAK-4	AKKVK	Blueback herring	0	0	Blueback herring Spring
14	4/3/2013	Spring	MAK-4	AKKVK	Striped bass	0	0	Striped bass Spring
14	4/4/2013	Spring	MUB-8	UB	Alewife	0	0	Alewife Spring
14	4/4/2013	Spring	MUB-8	UB	American shad	0	0	American shad Spring
14	4/4/2013	Spring	MUB-8	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
14	4/4/2013	Spring	MUB-8	UB	Blueback herring	11	1.079181	Blueback herring Spring
14	4/4/2013	Spring	MUB-8	UB	Striped bass	0	0	Striped bass Spring
14	4/4/2013	Spring	MUB-9	UB	Alewife	0	0	Alewife Spring
14	4/4/2013	Spring	MUB-9	UB	American shad	0	0	American shad Spring
14	4/4/2013	Spring	MUB-9	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
14	4/4/2013	Spring	MUB-9	UB	Blueback herring	0	0	Blueback herring Spring
14	4/4/2013	Spring	MUB-9	UB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
14	4/4/2013	Spring	MUB-11	UB	Alewife	0	0	Alewife Spring
14	4/4/2013	Spring	MUB-11	UB	American shad	0	0	American shad Spring
14	4/4/2013	Spring	MUB-11	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
14	4/4/2013	Spring	MUB-11	UB	Blueback herring	0	0	Blueback herring Spring
14	4/4/2013	Spring	MUB-11	UB	Striped bass	0	0	Striped bass Spring
14	4/4/2013	Spring	MUB-3	UB	Alewife	0	0	Alewife Spring
14	4/4/2013	Spring	MUB-3	UB	American shad	0	0	American shad Spring
14	4/4/2013	Spring	MUB-3	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
14	4/4/2013	Spring	MUB-3	UB	Blueback herring	0	0	Blueback herring Spring
14	4/4/2013	Spring	MUB-3	UB	Striped bass	0	0	Striped bass Spring
14	4/4/2013	Spring	MUB-2	UB	Alewife	0	0	Alewife Spring
14	4/4/2013	Spring	MUB-2	UB	American shad	0	0	American shad Spring
14	4/4/2013	Spring	MUB-2	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
14	4/4/2013	Spring	MUB-2	UB	Blueback herring	1	0.30103	Blueback herring Spring
14	4/4/2013	Spring	MUB-2	UB	Striped bass	0	0	Striped bass Spring
14	4/4/2013	Spring	MLB-6	LB	Alewife	0	0	Alewife Spring
14	4/4/2013	Spring	MLB-6	LB	American shad	0	0	American shad Spring
14	4/4/2013	Spring	MLB-6	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
14	4/4/2013	Spring	MLB-6	LB	Blueback herring	0	0	Blueback herring Spring
14	4/4/2013	Spring	MLB-6	LB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
14	4/4/2013	Spring	MLB-5	LB	Alewife	0	0	Alewife Spring
14	4/4/2013	Spring	MLB-5	LB	American shad	0	0	American shad Spring
14	4/4/2013	Spring	MLB-5	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
14	4/4/2013	Spring	MLB-5	LB	Blueback herring	0	0	Blueback herring Spring
14	4/4/2013	Spring	MLB-5	LB	Striped bass	0	0	Striped bass Spring
14	4/4/2013	Spring	MLB-3	LB	Alewife	0	0	Alewife Spring
14	4/4/2013	Spring	MLB-3	LB	American shad	0	0	American shad Spring
14	4/4/2013	Spring	MLB-3	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
14	4/4/2013	Spring	MLB-3	LB	Blueback herring	0	0	Blueback herring Spring
14	4/4/2013	Spring	MLB-3	LB	Striped bass	0	0	Striped bass Spring
14	4/4/2013	Spring	MLB-4	LB	Alewife	0	0	Alewife Spring
14	4/4/2013	Spring	MLB-4	LB	American shad	0	0	American shad Spring
14	4/4/2013	Spring	MLB-4	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
14	4/4/2013	Spring	MLB-4	LB	Blueback herring	0	0	Blueback herring Spring
14	4/4/2013	Spring	MLB-4	LB	Striped bass	0	0	Striped bass Spring
14	4/4/2013	Spring	MUB-1	UB	Alewife	0	0	Alewife Spring
14	4/4/2013	Spring	MUB-1	UB	American shad	0	0	American shad Spring
14	4/4/2013	Spring	MUB-1	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
14	4/4/2013	Spring	MUB-1	UB	Blueback herring	1	0.30103	Blueback herring Spring
14	4/4/2013	Spring	MUB-1	UB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
15	4/9/2013	Spring	MUB-9	UB	Alewife	0	0	Alewife Spring
15	4/9/2013	Spring	MUB-9	UB	American shad	0	0	American shad Spring
15	4/9/2013	Spring	MUB-9	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
15	4/9/2013	Spring	MUB-9	UB	Blueback herring	0	0	Blueback herring Spring
15	4/9/2013	Spring	MUB-9	UB	Striped bass	0	0	Striped bass Spring
15	4/9/2013	Spring	MUB-8	UB	Alewife	0	0	Alewife Spring
15	4/9/2013	Spring	MUB-8	UB	American shad	0	0	American shad Spring
15	4/9/2013	Spring	MUB-8	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
15	4/9/2013	Spring	MUB-8	UB	Blueback herring	0	0	Blueback herring Spring
15	4/9/2013	Spring	MUB-8	UB	Striped bass	0	0	Striped bass Spring
15	4/9/2013	Spring	MUB-11	UB	Alewife	0	0	Alewife Spring
15	4/9/2013	Spring	MUB-11	UB	American shad	0	0	American shad Spring
15	4/9/2013	Spring	MUB-11	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
15	4/9/2013	Spring	MUB-11	UB	Blueback herring	0	0	Blueback herring Spring
15	4/9/2013	Spring	MUB-11	UB	Striped bass	0	0	Striped bass Spring
15	4/9/2013	Spring	MUB-3	UB	Alewife	0	0	Alewife Spring
15	4/9/2013	Spring	MUB-3	UB	American shad	0	0	American shad Spring
15	4/9/2013	Spring	MUB-3	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
15	4/9/2013	Spring	MUB-3	UB	Blueback herring	0	0	Blueback herring Spring
15	4/9/2013	Spring	MUB-3	UB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
15	4/9/2013	Spring	MLB-4	LB	Alewife	0	0	Alewife Spring
15	4/9/2013	Spring	MLB-4	LB	American shad	0	0	American shad Spring
15	4/9/2013	Spring	MLB-4	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
15	4/9/2013	Spring	MLB-4	LB	Blueback herring	0	0	Blueback herring Spring
15	4/9/2013	Spring	MLB-4	LB	Striped bass	0	0	Striped bass Spring
15	4/9/2013	Spring	MLB-3	LB	Alewife	0	0	Alewife Spring
15	4/9/2013	Spring	MLB-3	LB	American shad	0	0	American shad Spring
15	4/9/2013	Spring	MLB-3	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
15	4/9/2013	Spring	MLB-3	LB	Blueback herring	0	0	Blueback herring Spring
15	4/9/2013	Spring	MLB-3	LB	Striped bass	0	0	Striped bass Spring
15	4/9/2013	Spring	MLB-5	LB	Alewife	0	0	Alewife Spring
15	4/9/2013	Spring	MLB-5	LB	American shad	0	0	American shad Spring
15	4/9/2013	Spring	MLB-5	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
15	4/9/2013	Spring	MLB-5	LB	Blueback herring	0	0	Blueback herring Spring
15	4/9/2013	Spring	MLB-5	LB	Striped bass	0	0	Striped bass Spring
15	4/9/2013	Spring	MLB-6	LB	Alewife	0	0	Alewife Spring
15	4/9/2013	Spring	MLB-6	LB	American shad	0	0	American shad Spring
15	4/9/2013	Spring	MLB-6	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
15	4/9/2013	Spring	MLB-6	LB	Blueback herring	0	0	Blueback herring Spring
15	4/9/2013	Spring	MLB-6	LB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
15	4/9/2013	Spring	MUB-1	UB	Alewife	0	0	Alewife Spring
15	4/9/2013	Spring	MUB-1	UB	American shad	0	0	American shad Spring
15	4/9/2013	Spring	MUB-1	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
15	4/9/2013	Spring	MUB-1	UB	Blueback herring	0	0	Blueback herring Spring
15	4/9/2013	Spring	MUB-1	UB	Striped bass	0	0	Striped bass Spring
15	4/9/2013	Spring	MUB-2	UB	Alewife	0	0	Alewife Spring
15	4/9/2013	Spring	MUB-2	UB	American shad	0	0	American shad Spring
15	4/9/2013	Spring	MUB-2	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
15	4/9/2013	Spring	MUB-2	UB	Blueback herring	0	0	Blueback herring Spring
15	4/9/2013	Spring	MUB-2	UB	Striped bass	0	0	Striped bass Spring
15	4/9/2013	Spring	MKK-1	AKKVK	Alewife	0	0	Alewife Spring
15	4/9/2013	Spring	MKK-1	AKKVK	American shad	0	0	American shad Spring
15	4/9/2013	Spring	MKK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
15	4/9/2013	Spring	MKK-1	AKKVK	Blueback herring	5	0.778151	Blueback herring Spring
15	4/9/2013	Spring	MKK-1	AKKVK	Striped bass	0	0	Striped bass Spring
15	4/10/2013	Spring	MKK-2	AKKVK	Alewife	0	0	Alewife Spring
15	4/10/2013	Spring	MKK-2	AKKVK	American shad	0	0	American shad Spring
15	4/10/2013	Spring	MKK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
15	4/10/2013	Spring	MKK-2	AKKVK	Blueback herring	0	0	Blueback herring Spring
15	4/10/2013	Spring	MKK-2	AKKVK	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
15	4/10/2013	Spring	MAK-1	AKKVK	Alewife	0	0	Alewife Spring
15	4/10/2013	Spring	MAK-1	AKKVK	American shad	0	0	American shad Spring
15	4/10/2013	Spring	MAK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
15	4/10/2013	Spring	MAK-1	AKKVK	Blueback herring	1	0.30103	Blueback herring Spring
15	4/10/2013	Spring	MAK-1	AKKVK	Striped bass	0	0	Striped bass Spring
15	4/10/2013	Spring	MAK-2	AKKVK	Alewife	0	0	Alewife Spring
15	4/10/2013	Spring	MAK-2	AKKVK	American shad	0	0	American shad Spring
15	4/10/2013	Spring	MAK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
15	4/10/2013	Spring	MAK-2	AKKVK	Blueback herring	0	0	Blueback herring Spring
15	4/10/2013	Spring	MAK-2	AKKVK	Striped bass	0	0	Striped bass Spring
15	4/10/2013	Spring	MAK-3	AKKVK	Alewife	0	0	Alewife Spring
15	4/10/2013	Spring	MAK-3	AKKVK	American shad	0	0	American shad Spring
15	4/10/2013	Spring	MAK-3	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
15	4/10/2013	Spring	MAK-3	AKKVK	Blueback herring	0	0	Blueback herring Spring
15	4/10/2013	Spring	MAK-3	AKKVK	Striped bass	0	0	Striped bass Spring
15	4/10/2013	Spring	MAK-4	AKKVK	Alewife	0	0	Alewife Spring
15	4/10/2013	Spring	MAK-4	AKKVK	American shad	0	0	American shad Spring
15	4/10/2013	Spring	MAK-4	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
15	4/10/2013	Spring	MAK-4	AKKVK	Blueback herring	0	0	Blueback herring Spring
15	4/10/2013	Spring	MAK-4	AKKVK	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
15	4/10/2013	Spring	MNB-2	NB	Alewife	0	0	Alewife Spring
15	4/10/2013	Spring	MNB-2	NB	American shad	0	0	American shad Spring
15	4/10/2013	Spring	MNB-2	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
15	4/10/2013	Spring	MNB-2	NB	Blueback herring	0	0	Blueback herring Spring
15	4/10/2013	Spring	MNB-2	NB	Striped bass	0	0	Striped bass Spring
15	4/10/2013	Spring	MNB-5	NB	Alewife	0	0	Alewife Spring
15	4/10/2013	Spring	MNB-5	NB	American shad	0	0	American shad Spring
15	4/10/2013	Spring	MNB-5	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
15	4/10/2013	Spring	MNB-5	NB	Blueback herring	0	0	Blueback herring Spring
15	4/10/2013	Spring	MNB-5	NB	Striped bass	0	0	Striped bass Spring
15	4/10/2013	Spring	MNB-6	NB	Alewife	0	0	Alewife Spring
15	4/10/2013	Spring	MNB-6	NB	American shad	0	0	American shad Spring
15	4/10/2013	Spring	MNB-6	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
15	4/10/2013	Spring	MNB-6	NB	Blueback herring	0	0	Blueback herring Spring
15	4/10/2013	Spring	MNB-6	NB	Striped bass	0	0	Striped bass Spring
15	4/10/2013	Spring	MNB-1	NB	Alewife	0	0	Alewife Spring
15	4/10/2013	Spring	MNB-1	NB	American shad	0	0	American shad Spring
15	4/10/2013	Spring	MNB-1	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
15	4/10/2013	Spring	MNB-1	NB	Blueback herring	0	0	Blueback herring Spring
15	4/10/2013	Spring	MNB-1	NB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
16	4/16/2013	Spring	MKK-1	AKKVK	Alewife	0	0	Alewife Spring
16	4/16/2013	Spring	MKK-1	AKKVK	American shad	0	0	American shad Spring
16	4/16/2013	Spring	MKK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
16	4/16/2013	Spring	MKK-1	AKKVK	Blueback herring	36	1.568202	Blueback herring Spring
16	4/16/2013	Spring	MKK-1	AKKVK	Striped bass	0	0	Striped bass Spring
16	4/16/2013	Spring	MNB-1	NB	Alewife	0	0	Alewife Spring
16	4/16/2013	Spring	MNB-1	NB	American shad	0	0	American shad Spring
16	4/16/2013	Spring	MNB-1	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
16	4/16/2013	Spring	MNB-1	NB	Blueback herring	0	0	Blueback herring Spring
16	4/16/2013	Spring	MNB-1	NB	Striped bass	0	0	Striped bass Spring
16	4/16/2013	Spring	MNB-2	NB	Alewife	0	0	Alewife Spring
16	4/16/2013	Spring	MNB-2	NB	American shad	0	0	American shad Spring
16	4/16/2013	Spring	MNB-2	NB	Atlantic menhaden	1	0.30103	Atlantic menhaden Spring
16	4/16/2013	Spring	MNB-2	NB	Blueback herring	918	2.963316	Blueback herring Spring
16	4/16/2013	Spring	MNB-2	NB	Striped bass	0	0	Striped bass Spring
16	4/16/2013	Spring	MNB-6	NB	Alewife	0	0	Alewife Spring
16	4/16/2013	Spring	MNB-6	NB	American shad	0	0	American shad Spring
16	4/16/2013	Spring	MNB-6	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
16	4/16/2013	Spring	MNB-6	NB	Blueback herring	0	0	Blueback herring Spring
16	4/16/2013	Spring	MNB-6	NB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
16	4/16/2013	Spring	MNB-5	NB	Alewife	0	0	Alewife Spring
16	4/16/2013	Spring	MNB-5	NB	American shad	0	0	American shad Spring
16	4/16/2013	Spring	MNB-5	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
16	4/16/2013	Spring	MNB-5	NB	Blueback herring	0	0	Blueback herring Spring
16	4/16/2013	Spring	MNB-5	NB	Striped bass	0	0	Striped bass Spring
16	4/16/2013	Spring	MAK-1	AKKVK	Alewife	0	0	Alewife Spring
16	4/16/2013	Spring	MAK-1	AKKVK	American shad	0	0	American shad Spring
16	4/16/2013	Spring	MAK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
16	4/16/2013	Spring	MAK-1	AKKVK	Blueback herring	0	0	Blueback herring Spring
16	4/16/2013	Spring	MAK-1	AKKVK	Striped bass	0	0	Striped bass Spring
16	4/16/2013	Spring	MAK-2	AKKVK	Alewife	0	0	Alewife Spring
16	4/16/2013	Spring	MAK-2	AKKVK	American shad	0	0	American shad Spring
16	4/16/2013	Spring	MAK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
16	4/16/2013	Spring	MAK-2	AKKVK	Blueback herring	0	0	Blueback herring Spring
16	4/16/2013	Spring	MAK-2	AKKVK	Striped bass	0	0	Striped bass Spring
16	4/16/2013	Spring	MAK-3	AKKVK	Alewife	0	0	Alewife Spring
16	4/16/2013	Spring	MAK-3	AKKVK	American shad	0	0	American shad Spring
16	4/16/2013	Spring	MAK-3	AKKVK	Atlantic menhaden	1	0.30103	Atlantic menhaden Spring
16	4/16/2013	Spring	MAK-3	AKKVK	Blueback herring	5	0.778151	Blueback herring Spring
16	4/16/2013	Spring	MAK-3	AKKVK	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
16	4/16/2013	Spring	MAK-4	AKKVK	Alewife	0	0	Alewife Spring
16	4/16/2013	Spring	MAK-4	AKKVK	American shad	0	0	American shad Spring
16	4/16/2013	Spring	MAK-4	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
16	4/16/2013	Spring	MAK-4	AKKVK	Blueback herring	3	0.60206	Blueback herring Spring
16	4/16/2013	Spring	MAK-4	AKKVK	Striped bass	0	0	Striped bass Spring
16	4/16/2013	Spring	MKK-2	AKKVK	Alewife	0	0	Alewife Spring
16	4/16/2013	Spring	MKK-2	AKKVK	American shad	0	0	American shad Spring
16	4/16/2013	Spring	MKK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
16	4/16/2013	Spring	MKK-2	AKKVK	Blueback herring	0	0	Blueback herring Spring
16	4/16/2013	Spring	MKK-2	AKKVK	Striped bass	0	0	Striped bass Spring
16	4/17/2013	Spring	MUB-8	UB	Alewife	85	1.934498	Alewife Spring
16	4/17/2013	Spring	MUB-8	UB	American shad	0	0	American shad Spring
16	4/17/2013	Spring	MUB-8	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
16	4/17/2013	Spring	MUB-8	UB	Blueback herring	45	1.662758	Blueback herring Spring
16	4/17/2013	Spring	MUB-8	UB	Striped bass	0	0	Striped bass Spring
16	4/17/2013	Spring	MUB-9	UB	Alewife	14	1.176091	Alewife Spring
16	4/17/2013	Spring	MUB-9	UB	American shad	0	0	American shad Spring
16	4/17/2013	Spring	MUB-9	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
16	4/17/2013	Spring	MUB-9	UB	Blueback herring	27	1.447158	Blueback herring Spring
16	4/17/2013	Spring	MUB-9	UB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
16	4/17/2013	Spring	MUB-11	UB	Alewife	0	0	Alewife Spring
16	4/17/2013	Spring	MUB-11	UB	American shad	0	0	American shad Spring
16	4/17/2013	Spring	MUB-11	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
16	4/17/2013	Spring	MUB-11	UB	Blueback herring	17	1.255273	Blueback herring Spring
16	4/17/2013	Spring	MUB-11	UB	Striped bass	0	0	Striped bass Spring
16	4/17/2013	Spring	MUB-3	UB	Alewife	0	0	Alewife Spring
16	4/17/2013	Spring	MUB-3	UB	American shad	0	0	American shad Spring
16	4/17/2013	Spring	MUB-3	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
16	4/17/2013	Spring	MUB-3	UB	Blueback herring	58	1.770852	Blueback herring Spring
16	4/17/2013	Spring	MUB-3	UB	Striped bass	0	0	Striped bass Spring
16	4/17/2013	Spring	MUB-2	UB	Alewife	0	0	Alewife Spring
16	4/17/2013	Spring	MUB-2	UB	American shad	0	0	American shad Spring
16	4/17/2013	Spring	MUB-2	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
16	4/17/2013	Spring	MUB-2	UB	Blueback herring	0	0	Blueback herring Spring
16	4/17/2013	Spring	MUB-2	UB	Striped bass	0	0	Striped bass Spring
16	4/17/2013	Spring	MUB-1	UB	Alewife	0	0	Alewife Spring
16	4/17/2013	Spring	MUB-1	UB	American shad	0	0	American shad Spring
16	4/17/2013	Spring	MUB-1	UB	Atlantic menhaden	1	0.30103	Atlantic menhaden Spring
16	4/17/2013	Spring	MUB-1	UB	Blueback herring	0	0	Blueback herring Spring
16	4/17/2013	Spring	MUB-1	UB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
16	4/17/2013	Spring	MLB-6	LB	Alewife	0	0	Alewife Spring
16	4/17/2013	Spring	MLB-6	LB	American shad	0	0	American shad Spring
16	4/17/2013	Spring	MLB-6	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
16	4/17/2013	Spring	MLB-6	LB	Blueback herring	6	0.845098	Blueback herring Spring
16	4/17/2013	Spring	MLB-6	LB	Striped bass	0	0	Striped bass Spring
16	4/17/2013	Spring	MLB-5	LB	Alewife	0	0	Alewife Spring
16	4/17/2013	Spring	MLB-5	LB	American shad	0	0	American shad Spring
16	4/17/2013	Spring	MLB-5	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
16	4/17/2013	Spring	MLB-5	LB	Blueback herring	0	0	Blueback herring Spring
16	4/17/2013	Spring	MLB-5	LB	Striped bass	0	0	Striped bass Spring
16	4/17/2013	Spring	MLB-3	LB	Alewife	0	0	Alewife Spring
16	4/17/2013	Spring	MLB-3	LB	American shad	0	0	American shad Spring
16	4/17/2013	Spring	MLB-3	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
16	4/17/2013	Spring	MLB-3	LB	Blueback herring	0	0	Blueback herring Spring
16	4/17/2013	Spring	MLB-3	LB	Striped bass	0	0	Striped bass Spring
16	4/17/2013	Spring	MLB-4	LB	Alewife	1	0.30103	Alewife Spring
16	4/17/2013	Spring	MLB-4	LB	American shad	0	0	American shad Spring
16	4/17/2013	Spring	MLB-4	LB	Atlantic menhaden	2	0.477121	Atlantic menhaden Spring
16	4/17/2013	Spring	MLB-4	LB	Blueback herring	8	0.954243	Blueback herring Spring
16	4/17/2013	Spring	MLB-4	LB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
17	4/23/2013	Spring	MKK-1	AKKVK	Alewife	0	0	Alewife Spring
17	4/23/2013	Spring	MKK-1	AKKVK	American shad	0	0	American shad Spring
17	4/23/2013	Spring	MKK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
17	4/23/2013	Spring	MKK-1	AKKVK	Blueback herring	0	0	Blueback herring Spring
17	4/23/2013	Spring	MKK-1	AKKVK	Striped bass	0	0	Striped bass Spring
17	4/23/2013	Spring	MKK-2	AKKVK	Alewife	0	0	Alewife Spring
17	4/23/2013	Spring	MKK-2	AKKVK	American shad	0	0	American shad Spring
17	4/23/2013	Spring	MKK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
17	4/23/2013	Spring	MKK-2	AKKVK	Blueback herring	0	0	Blueback herring Spring
17	4/23/2013	Spring	MKK-2	AKKVK	Striped bass	0	0	Striped bass Spring
17	4/23/2013	Spring	MNB-1	NB	Alewife	0	0	Alewife Spring
17	4/23/2013	Spring	MNB-1	NB	American shad	0	0	American shad Spring
17	4/23/2013	Spring	MNB-1	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
17	4/23/2013	Spring	MNB-1	NB	Blueback herring	0	0	Blueback herring Spring
17	4/23/2013	Spring	MNB-1	NB	Striped bass	0	0	Striped bass Spring
17	4/23/2013	Spring	MNB-2	NB	Alewife	0	0	Alewife Spring
17	4/23/2013	Spring	MNB-2	NB	American shad	0	0	American shad Spring
17	4/23/2013	Spring	MNB-2	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
17	4/23/2013	Spring	MNB-2	NB	Blueback herring	1	0.30103	Blueback herring Spring
17	4/23/2013	Spring	MNB-2	NB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
17	4/23/2013	Spring	MNB-5	NB	Alewife	0	0	Alewife Spring
17	4/23/2013	Spring	MNB-5	NB	American shad	1	0.30103	American shad Spring
17	4/23/2013	Spring	MNB-5	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
17	4/23/2013	Spring	MNB-5	NB	Blueback herring	3	0.60206	Blueback herring Spring
17	4/23/2013	Spring	MNB-5	NB	Striped bass	0	0	Striped bass Spring
17	4/23/2013	Spring	MNB-6	NB	Alewife	0	0	Alewife Spring
17	4/23/2013	Spring	MNB-6	NB	American shad	0	0	American shad Spring
17	4/23/2013	Spring	MNB-6	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
17	4/23/2013	Spring	MNB-6	NB	Blueback herring	0	0	Blueback herring Spring
17	4/23/2013	Spring	MNB-6	NB	Striped bass	0	0	Striped bass Spring
17	4/23/2013	Spring	MAK-4	AKKVK	Alewife	0	0	Alewife Spring
17	4/23/2013	Spring	MAK-4	AKKVK	American shad	0	0	American shad Spring
17	4/23/2013	Spring	MAK-4	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
17	4/23/2013	Spring	MAK-4	AKKVK	Blueback herring	107	2.033424	Blueback herring Spring
17	4/23/2013	Spring	MAK-4	AKKVK	Striped bass	0	0	Striped bass Spring
17	4/23/2013	Spring	MAK-3	AKKVK	Alewife	0	0	Alewife Spring
17	4/23/2013	Spring	MAK-3	AKKVK	American shad	0	0	American shad Spring
17	4/23/2013	Spring	MAK-3	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
17	4/23/2013	Spring	MAK-3	AKKVK	Blueback herring	0	0	Blueback herring Spring
17	4/23/2013	Spring	MAK-3	AKKVK	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
17	4/23/2013	Spring	MAK-2	AKKVK	Alewife	0	0	Alewife Spring
17	4/23/2013	Spring	MAK-2	AKKVK	American shad	0	0	American shad Spring
17	4/23/2013	Spring	MAK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
17	4/23/2013	Spring	MAK-2	AKKVK	Blueback herring	0	0	Blueback herring Spring
17	4/23/2013	Spring	MAK-2	AKKVK	Striped bass	0	0	Striped bass Spring
17	4/23/2013	Spring	MAK-1	AKKVK	Alewife	0	0	Alewife Spring
17	4/23/2013	Spring	MAK-1	AKKVK	American shad	0	0	American shad Spring
17	4/23/2013	Spring	MAK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
17	4/23/2013	Spring	MAK-1	AKKVK	Blueback herring	0	0	Blueback herring Spring
17	4/23/2013	Spring	MAK-1	AKKVK	Striped bass	0	0	Striped bass Spring
17	4/24/2013	Spring	MUB-1	UB	Alewife	0	0	Alewife Spring
17	4/24/2013	Spring	MUB-1	UB	American shad	0	0	American shad Spring
17	4/24/2013	Spring	MUB-1	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
17	4/24/2013	Spring	MUB-1	UB	Blueback herring	0	0	Blueback herring Spring
17	4/24/2013	Spring	MUB-1	UB	Striped bass	0	0	Striped bass Spring
17	4/24/2013	Spring	MLB-6	LB	Alewife	0	0	Alewife Spring
17	4/24/2013	Spring	MLB-6	LB	American shad	0	0	American shad Spring
17	4/24/2013	Spring	MLB-6	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
17	4/24/2013	Spring	MLB-6	LB	Blueback herring	0	0	Blueback herring Spring
17	4/24/2013	Spring	MLB-6	LB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
17	4/24/2013	Spring	MLB-5	LB	Alewife	0	0	Alewife Spring
17	4/24/2013	Spring	MLB-5	LB	American shad	0	0	American shad Spring
17	4/24/2013	Spring	MLB-5	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
17	4/24/2013	Spring	MLB-5	LB	Blueback herring	0	0	Blueback herring Spring
17	4/24/2013	Spring	MLB-5	LB	Striped bass	0	0	Striped bass Spring
17	4/24/2013	Spring	MLB-3	LB	Alewife	0	0	Alewife Spring
17	4/24/2013	Spring	MLB-3	LB	American shad	0	0	American shad Spring
17	4/24/2013	Spring	MLB-3	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
17	4/24/2013	Spring	MLB-3	LB	Blueback herring	2	0.477121	Blueback herring Spring
17	4/24/2013	Spring	MLB-3	LB	Striped bass	0	0	Striped bass Spring
17	4/24/2013	Spring	MLB-4	LB	Alewife	6	0.845098	Alewife Spring
17	4/24/2013	Spring	MLB-4	LB	American shad	0	0	American shad Spring
17	4/24/2013	Spring	MLB-4	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
17	4/24/2013	Spring	MLB-4	LB	Blueback herring	4	0.69897	Blueback herring Spring
17	4/24/2013	Spring	MLB-4	LB	Striped bass	0	0	Striped bass Spring
17	4/24/2013	Spring	MUB-2	UB	Alewife	0	0	Alewife Spring
17	4/24/2013	Spring	MUB-2	UB	American shad	0	0	American shad Spring
17	4/24/2013	Spring	MUB-2	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
17	4/24/2013	Spring	MUB-2	UB	Blueback herring	0	0	Blueback herring Spring
17	4/24/2013	Spring	MUB-2	UB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
17	4/24/2013	Spring	MUB-3	UB	Alewife	0	0	Alewife Spring
17	4/24/2013	Spring	MUB-3	UB	American shad	0	0	American shad Spring
17	4/24/2013	Spring	MUB-3	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
17	4/24/2013	Spring	MUB-3	UB	Blueback herring	0	0	Blueback herring Spring
17	4/24/2013	Spring	MUB-3	UB	Striped bass	0	0	Striped bass Spring
17	4/24/2013	Spring	MUB-11	UB	Alewife	0	0	Alewife Spring
17	4/24/2013	Spring	MUB-11	UB	American shad	0	0	American shad Spring
17	4/24/2013	Spring	MUB-11	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
17	4/24/2013	Spring	MUB-11	UB	Blueback herring	0	0	Blueback herring Spring
17	4/24/2013	Spring	MUB-11	UB	Striped bass	0	0	Striped bass Spring
17	4/24/2013	Spring	MUB-8	UB	Alewife	0	0	Alewife Spring
17	4/24/2013	Spring	MUB-8	UB	American shad	0	0	American shad Spring
17	4/24/2013	Spring	MUB-8	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
17	4/24/2013	Spring	MUB-8	UB	Blueback herring	3	0.60206	Blueback herring Spring
17	4/24/2013	Spring	MUB-8	UB	Striped bass	0	0	Striped bass Spring
17	4/24/2013	Spring	MUB-9	UB	Alewife	6	0.845098	Alewife Spring
17	4/24/2013	Spring	MUB-9	UB	American shad	0	0	American shad Spring
17	4/24/2013	Spring	MUB-9	UB	Atlantic menhaden	5	0.778151	Atlantic menhaden Spring
17	4/24/2013	Spring	MUB-9	UB	Blueback herring	4	0.69897	Blueback herring Spring
17	4/24/2013	Spring	MUB-9	UB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA

WOY	Date	Season	Station	Area Grouping for MFS Report	Common Name	CPUE - 10min	Log(CPUE+1)	Species/Season
								Spring
19	5/7/2013	Spring	MUB-9	UB	Alewife	27	1.447158	Alewife Spring
19	5/7/2013	Spring	MUB-9	UB	American shad	1	0.30103	American shad Spring
19	5/7/2013	Spring	MUB-9	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
19	5/7/2013	Spring	MUB-9	UB	Blueback herring	2	0.477121	Blueback herring Spring
19	5/7/2013	Spring	MUB-9	UB	Striped bass	0	0	Striped bass Spring
19	5/7/2013	Spring	MUB-8	UB	Alewife	0	0	Alewife Spring
19	5/7/2013	Spring	MUB-8	UB	American shad	0	0	American shad Spring
19	5/7/2013	Spring	MUB-8	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
19	5/7/2013	Spring	MUB-8	UB	Blueback herring	0	0	Blueback herring Spring
19	5/7/2013	Spring	MUB-8	UB	Striped bass	0	0	Striped bass Spring
19	5/7/2013	Spring	MUB-2	UB	Alewife	0	0	Alewife Spring
19	5/7/2013	Spring	MUB-2	UB	American shad	0	0	American shad Spring
19	5/7/2013	Spring	MUB-2	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
19	5/7/2013	Spring	MUB-2	UB	Blueback herring	0	0	Blueback herring Spring
19	5/7/2013	Spring	MUB-2	UB	Striped bass	0	0	Striped bass Spring
19	5/7/2013	Spring	MUB-1	UB	Alewife	4	0.69897	Alewife Spring
19	5/7/2013	Spring	MUB-1	UB	American shad	2	0.477121	American shad Spring
19	5/7/2013	Spring	MUB-1	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
19	5/7/2013	Spring	MUB-1	UB	Blueback herring	2	0.477121	Blueback herring Spring
19	5/7/2013	Spring	MUB-1	UB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
19	5/7/2013	Spring	MLB-6	LB	Alewife	0	0	Alewife Spring
19	5/7/2013	Spring	MLB-6	LB	American shad	0	0	American shad Spring
19	5/7/2013	Spring	MLB-6	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
19	5/7/2013	Spring	MLB-6	LB	Blueback herring	0	0	Blueback herring Spring
19	5/7/2013	Spring	MLB-6	LB	Striped bass	0	0	Striped bass Spring
19	5/7/2013	Spring	MLB-5	LB	Alewife	0	0	Alewife Spring
19	5/7/2013	Spring	MLB-5	LB	American shad	0	0	American shad Spring
19	5/7/2013	Spring	MLB-5	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
19	5/7/2013	Spring	MLB-5	LB	Blueback herring	0	0	Blueback herring Spring
19	5/7/2013	Spring	MLB-5	LB	Striped bass	0	0	Striped bass Spring
19	5/7/2013	Spring	MLB-3	LB	Alewife	1	0.30103	Alewife Spring
19	5/7/2013	Spring	MLB-3	LB	American shad	1	0.30103	American shad Spring
19	5/7/2013	Spring	MLB-3	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
19	5/7/2013	Spring	MLB-3	LB	Blueback herring	0	0	Blueback herring Spring
19	5/7/2013	Spring	MLB-3	LB	Striped bass	0	0	Striped bass Spring
19	5/7/2013	Spring	MLB-4	LB	Alewife	12	1.113943	Alewife Spring
19	5/7/2013	Spring	MLB-4	LB	American shad	1	0.30103	American shad Spring
19	5/7/2013	Spring	MLB-4	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
19	5/7/2013	Spring	MLB-4	LB	Blueback herring	5	0.778151	Blueback herring Spring
19	5/7/2013	Spring	MLB-4	LB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
19	5/7/2013	Spring	MUB-11	UB	Alewife	0	0	Alewife Spring
19	5/7/2013	Spring	MUB-11	UB	American shad	0	0	American shad Spring
19	5/7/2013	Spring	MUB-11	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
19	5/7/2013	Spring	MUB-11	UB	Blueback herring	0	0	Blueback herring Spring
19	5/7/2013	Spring	MUB-11	UB	Striped bass	0	0	Striped bass Spring
19	5/7/2013	Spring	MUB-3	UB	Alewife	0	0	Alewife Spring
19	5/7/2013	Spring	MUB-3	UB	American shad	0	0	American shad Spring
19	5/7/2013	Spring	MUB-3	UB	Atlantic menhaden	1	0.30103	Atlantic menhaden Spring
19	5/7/2013	Spring	MUB-3	UB	Blueback herring	0	0	Blueback herring Spring
19	5/7/2013	Spring	MUB-3	UB	Striped bass	0	0	Striped bass Spring
19	5/7/2013	Spring	MKK-1	AKKVK	Alewife	0	0	Alewife Spring
19	5/7/2013	Spring	MKK-1	AKKVK	American shad	0	0	American shad Spring
19	5/7/2013	Spring	MKK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
19	5/7/2013	Spring	MKK-1	AKKVK	Blueback herring	0	0	Blueback herring Spring
19	5/7/2013	Spring	MKK-1	AKKVK	Striped bass	0	0	Striped bass Spring
19	5/8/2013	Spring	MKK-2	AKKVK	Alewife	5	0.778151	Alewife Spring
19	5/8/2013	Spring	MKK-2	AKKVK	American shad	0	0	American shad Spring
19	5/8/2013	Spring	MKK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
19	5/8/2013	Spring	MKK-2	AKKVK	Blueback herring	0	0	Blueback herring Spring
19	5/8/2013	Spring	MKK-2	AKKVK	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
19	5/8/2013	Spring	MNB-1	NB	Alewife	0	0	Alewife Spring
19	5/8/2013	Spring	MNB-1	NB	American shad	0	0	American shad Spring
19	5/8/2013	Spring	MNB-1	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
19	5/8/2013	Spring	MNB-1	NB	Blueback herring	0	0	Blueback herring Spring
19	5/8/2013	Spring	MNB-1	NB	Striped bass	0	0	Striped bass Spring
19	5/8/2013	Spring	MNB-2	NB	Alewife	0	0	Alewife Spring
19	5/8/2013	Spring	MNB-2	NB	American shad	0	0	American shad Spring
19	5/8/2013	Spring	MNB-2	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
19	5/8/2013	Spring	MNB-2	NB	Blueback herring	0	0	Blueback herring Spring
19	5/8/2013	Spring	MNB-2	NB	Striped bass	0	0	Striped bass Spring
19	5/8/2013	Spring	MNB-5	NB	Alewife	24	1.39794	Alewife Spring
19	5/8/2013	Spring	MNB-5	NB	American shad	0	0	American shad Spring
19	5/8/2013	Spring	MNB-5	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
19	5/8/2013	Spring	MNB-5	NB	Blueback herring	29	1.477121	Blueback herring Spring
19	5/8/2013	Spring	MNB-5	NB	Striped bass	0	0	Striped bass Spring
19	5/8/2013	Spring	MNB-6	NB	Alewife	24	1.39794	Alewife Spring
19	5/8/2013	Spring	MNB-6	NB	American shad	0	0	American shad Spring
19	5/8/2013	Spring	MNB-6	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
19	5/8/2013	Spring	MNB-6	NB	Blueback herring	425	2.62941	Blueback herring Spring
19	5/8/2013	Spring	MNB-6	NB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
19	5/8/2013	Spring	MAK-4	AKKVK	Alewife	0	0	Alewife Spring
19	5/8/2013	Spring	MAK-4	AKKVK	American shad	0	0	American shad Spring
19	5/8/2013	Spring	MAK-4	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
19	5/8/2013	Spring	MAK-4	AKKVK	Blueback herring	73	1.869232	Blueback herring Spring
19	5/8/2013	Spring	MAK-4	AKKVK	Striped bass	0	0	Striped bass Spring
19	5/8/2013	Spring	MAK-3	AKKVK	Alewife	0	0	Alewife Spring
19	5/8/2013	Spring	MAK-3	AKKVK	American shad	0	0	American shad Spring
19	5/8/2013	Spring	MAK-3	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
19	5/8/2013	Spring	MAK-3	AKKVK	Blueback herring	0	0	Blueback herring Spring
19	5/8/2013	Spring	MAK-3	AKKVK	Striped bass	0	0	Striped bass Spring
19	5/8/2013	Spring	MAK-2	AKKVK	Alewife	0	0	Alewife Spring
19	5/8/2013	Spring	MAK-2	AKKVK	American shad	0	0	American shad Spring
19	5/8/2013	Spring	MAK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
19	5/8/2013	Spring	MAK-2	AKKVK	Blueback herring	0	0	Blueback herring Spring
19	5/8/2013	Spring	MAK-2	AKKVK	Striped bass	0	0	Striped bass Spring
19	5/8/2013	Spring	MAK-1	AKKVK	Alewife	0	0	Alewife Spring
19	5/8/2013	Spring	MAK-1	AKKVK	American shad	0	0	American shad Spring
19	5/8/2013	Spring	MAK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
19	5/8/2013	Spring	MAK-1	AKKVK	Blueback herring	0	0	Blueback herring Spring
19	5/8/2013	Spring	MAK-1	AKKVK	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
21	5/21/2013	Spring	MUB-8	UB	Alewife	0	0	Alewife Spring
21	5/21/2013	Spring	MUB-8	UB	American shad	0	0	American shad Spring
21	5/21/2013	Spring	MUB-8	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
21	5/21/2013	Spring	MUB-8	UB	Blueback herring	0	0	Blueback herring Spring
21	5/21/2013	Spring	MUB-8	UB	Striped bass	0	0	Striped bass Spring
21	5/21/2013	Spring	MUB-9	UB	Alewife	0	0	Alewife Spring
21	5/21/2013	Spring	MUB-9	UB	American shad	0	0	American shad Spring
21	5/21/2013	Spring	MUB-9	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
21	5/21/2013	Spring	MUB-9	UB	Blueback herring	0	0	Blueback herring Spring
21	5/21/2013	Spring	MUB-9	UB	Striped bass	0	0	Striped bass Spring
21	5/21/2013	Spring	MUB-11	UB	Alewife	0	0	Alewife Spring
21	5/21/2013	Spring	MUB-11	UB	American shad	0	0	American shad Spring
21	5/21/2013	Spring	MUB-11	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
21	5/21/2013	Spring	MUB-11	UB	Blueback herring	0	0	Blueback herring Spring
21	5/21/2013	Spring	MUB-11	UB	Striped bass	0	0	Striped bass Spring
21	5/21/2013	Spring	MUB-3	UB	Alewife	0	0	Alewife Spring
21	5/21/2013	Spring	MUB-3	UB	American shad	0	0	American shad Spring
21	5/21/2013	Spring	MUB-3	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
21	5/21/2013	Spring	MUB-3	UB	Blueback herring	0	0	Blueback herring Spring
21	5/21/2013	Spring	MUB-3	UB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
21	5/21/2013	Spring	MUB-1	UB	Alewife	0	0	Alewife Spring
21	5/21/2013	Spring	MUB-1	UB	American shad	0	0	American shad Spring
21	5/21/2013	Spring	MUB-1	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
21	5/21/2013	Spring	MUB-1	UB	Blueback herring	1	0.30103	Blueback herring Spring
21	5/21/2013	Spring	MUB-1	UB	Striped bass	0	0	Striped bass Spring
21	5/21/2013	Spring	MLB-4	LB	Alewife	0	0	Alewife Spring
21	5/21/2013	Spring	MLB-4	LB	American shad	0	0	American shad Spring
21	5/21/2013	Spring	MLB-4	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
21	5/21/2013	Spring	MLB-4	LB	Blueback herring	1	0.30103	Blueback herring Spring
21	5/21/2013	Spring	MLB-4	LB	Striped bass	0	0	Striped bass Spring
21	5/21/2013	Spring	MLB-3	LB	Alewife	0	0	Alewife Spring
21	5/21/2013	Spring	MLB-3	LB	American shad	0	0	American shad Spring
21	5/21/2013	Spring	MLB-3	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
21	5/21/2013	Spring	MLB-3	LB	Blueback herring	0	0	Blueback herring Spring
21	5/21/2013	Spring	MLB-3	LB	Striped bass	0	0	Striped bass Spring
21	5/21/2013	Spring	MLB-6	LB	Alewife	0	0	Alewife Spring
21	5/21/2013	Spring	MLB-6	LB	American shad	0	0	American shad Spring
21	5/21/2013	Spring	MLB-6	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
21	5/21/2013	Spring	MLB-6	LB	Blueback herring	0	0	Blueback herring Spring
21	5/21/2013	Spring	MLB-6	LB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping for MFS Report	Common Name	CPUE - 10min	Log(CPUE+1)	Species/Season
								Spring
21	5/21/2013	Spring	MLB-5	LB	Alewife	0	0	Alewife Spring
21	5/21/2013	Spring	MLB-5	LB	American shad	0	0	American shad Spring
21	5/21/2013	Spring	MLB-5	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
21	5/21/2013	Spring	MLB-5	LB	Blueback herring	0	0	Blueback herring Spring
21	5/21/2013	Spring	MLB-5	LB	Striped bass	0	0	Striped bass Spring
21	5/21/2013	Spring	MUB-2	UB	Alewife	0	0	Alewife Spring
21	5/21/2013	Spring	MUB-2	UB	American shad	0	0	American shad Spring
21	5/21/2013	Spring	MUB-2	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
21	5/21/2013	Spring	MUB-2	UB	Blueback herring	0	0	Blueback herring Spring
21	5/21/2013	Spring	MUB-2	UB	Striped bass	0	0	Striped bass Spring
21	5/22/2013	Spring	MKK-1	AKKVK	Alewife	0	0	Alewife Spring
21	5/22/2013	Spring	MKK-1	AKKVK	American shad	0	0	American shad Spring
21	5/22/2013	Spring	MKK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
21	5/22/2013	Spring	MKK-1	AKKVK	Blueback herring	0	0	Blueback herring Spring
21	5/22/2013	Spring	MKK-1	AKKVK	Striped bass	0	0	Striped bass Spring
21	5/22/2013	Spring	MKK-2	AKKVK	Alewife	0	0	Alewife Spring
21	5/22/2013	Spring	MKK-2	AKKVK	American shad	0	0	American shad Spring
21	5/22/2013	Spring	MKK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
21	5/22/2013	Spring	MKK-2	AKKVK	Blueback herring	0	0	Blueback herring Spring
21	5/22/2013	Spring	MKK-2	AKKVK	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
21	5/22/2013	Spring	MNB-1	NB	Alewife	0	0	Alewife Spring
21	5/22/2013	Spring	MNB-1	NB	American shad	0	0	American shad Spring
21	5/22/2013	Spring	MNB-1	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
21	5/22/2013	Spring	MNB-1	NB	Blueback herring	0	0	Blueback herring Spring
21	5/22/2013	Spring	MNB-1	NB	Striped bass	0	0	Striped bass Spring
21	5/22/2013	Spring	MNB-2	NB	Alewife	0	0	Alewife Spring
21	5/22/2013	Spring	MNB-2	NB	American shad	0	0	American shad Spring
21	5/22/2013	Spring	MNB-2	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
21	5/22/2013	Spring	MNB-2	NB	Blueback herring	0	0	Blueback herring Spring
21	5/22/2013	Spring	MNB-2	NB	Striped bass	0	0	Striped bass Spring
21	5/22/2013	Spring	MNB-5	NB	Alewife	2	0.477121	Alewife Spring
21	5/22/2013	Spring	MNB-5	NB	American shad	0	0	American shad Spring
21	5/22/2013	Spring	MNB-5	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
21	5/22/2013	Spring	MNB-5	NB	Blueback herring	0	0	Blueback herring Spring
21	5/22/2013	Spring	MNB-5	NB	Striped bass	0	0	Striped bass Spring
21	5/22/2013	Spring	MNB-6	NB	Alewife	0	0	Alewife Spring
21	5/22/2013	Spring	MNB-6	NB	American shad	1	0.30103	American shad Spring
21	5/22/2013	Spring	MNB-6	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
21	5/22/2013	Spring	MNB-6	NB	Blueback herring	61	1.792392	Blueback herring Spring
21	5/22/2013	Spring	MNB-6	NB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
21	5/22/2013	Spring	MAK-4	AKKVK	Alewife	0	0	Alewife Spring
21	5/22/2013	Spring	MAK-4	AKKVK	American shad	0	0	American shad Spring
21	5/22/2013	Spring	MAK-4	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
21	5/22/2013	Spring	MAK-4	AKKVK	Blueback herring	0	0	Blueback herring Spring
21	5/22/2013	Spring	MAK-4	AKKVK	Striped bass	0	0	Striped bass Spring
21	5/22/2013	Spring	MAK-3	AKKVK	Alewife	0	0	Alewife Spring
21	5/22/2013	Spring	MAK-3	AKKVK	American shad	0	0	American shad Spring
21	5/22/2013	Spring	MAK-3	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
21	5/22/2013	Spring	MAK-3	AKKVK	Blueback herring	0	0	Blueback herring Spring
21	5/22/2013	Spring	MAK-3	AKKVK	Striped bass	0	0	Striped bass Spring
21	5/22/2013	Spring	MAK-2	AKKVK	Alewife	0	0	Alewife Spring
21	5/22/2013	Spring	MAK-2	AKKVK	American shad	0	0	American shad Spring
21	5/22/2013	Spring	MAK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
21	5/22/2013	Spring	MAK-2	AKKVK	Blueback herring	0	0	Blueback herring Spring
21	5/22/2013	Spring	MAK-2	AKKVK	Striped bass	0	0	Striped bass Spring
21	5/22/2013	Spring	MAK-1	AKKVK	Alewife	0	0	Alewife Spring
21	5/22/2013	Spring	MAK-1	AKKVK	American shad	0	0	American shad Spring
21	5/22/2013	Spring	MAK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
21	5/22/2013	Spring	MAK-1	AKKVK	Blueback herring	0	0	Blueback herring Spring
21	5/22/2013	Spring	MAK-1	AKKVK	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA

WOY	Date	Season	Station	Area Grouping for MFS Report	Common Name	CPUE - 10min	Log(CPUE+1)	Species/Season
								Spring
23	6/4/2013	Spring	MKK-1	AKKVK	Alewife	0	0	Alewife Spring
23	6/4/2013	Spring	MKK-1	AKKVK	American shad	0	0	American shad Spring
23	6/4/2013	Spring	MKK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
23	6/4/2013	Spring	MKK-1	AKKVK	Blueback herring	0	0	Blueback herring Spring
23	6/4/2013	Spring	MKK-1	AKKVK	Striped bass	0	0	Striped bass Spring
23	6/4/2013	Spring	MKK-2	AKKVK	Alewife	0	0	Alewife Spring
23	6/4/2013	Spring	MKK-2	AKKVK	American shad	0	0	American shad Spring
23	6/4/2013	Spring	MKK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
23	6/4/2013	Spring	MKK-2	AKKVK	Blueback herring	0	0	Blueback herring Spring
23	6/4/2013	Spring	MKK-2	AKKVK	Striped bass	0	0	Striped bass Spring
23	6/4/2013	Spring	MAK-1	AKKVK	Alewife	0	0	Alewife Spring
23	6/4/2013	Spring	MAK-1	AKKVK	American shad	0	0	American shad Spring
23	6/4/2013	Spring	MAK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
23	6/4/2013	Spring	MAK-1	AKKVK	Blueback herring	0	0	Blueback herring Spring
23	6/4/2013	Spring	MAK-1	AKKVK	Striped bass	0	0	Striped bass Spring
23	6/4/2013	Spring	MAK-4	AKKVK	Alewife	0	0	Alewife Spring
23	6/4/2013	Spring	MAK-4	AKKVK	American shad	0	0	American shad Spring
23	6/4/2013	Spring	MAK-4	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
23	6/4/2013	Spring	MAK-4	AKKVK	Blueback herring	0	0	Blueback herring Spring
23	6/4/2013	Spring	MAK-4	AKKVK	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPU E+1)**	**Species/Se ason**
								Spring
23	6/4/2013	Spring	MAK-3	AKKVK	Alewife	0	0	Alewife Spring
23	6/4/2013	Spring	MAK-3	AKKVK	American shad	0	0	American shad Spring
23	6/4/2013	Spring	MAK-3	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
23	6/4/2013	Spring	MAK-3	AKKVK	Blueback herring	0	0	Blueback herring Spring
23	6/4/2013	Spring	MAK-3	AKKVK	Striped bass	0	0	Striped bass Spring
23	6/4/2013	Spring	MAK-2	AKKVK	Alewife	0	0	Alewife Spring
23	6/4/2013	Spring	MAK-2	AKKVK	American shad	0	0	American shad Spring
23	6/4/2013	Spring	MAK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Spring
23	6/4/2013	Spring	MAK-2	AKKVK	Blueback herring	0	0	Blueback herring Spring
23	6/4/2013	Spring	MAK-2	AKKVK	Striped bass	0	0	Striped bass Spring
23	6/4/2013	Spring	MNB-1	NB	Alewife	0	0	Alewife Spring
23	6/4/2013	Spring	MNB-1	NB	American shad	0	0	American shad Spring
23	6/4/2013	Spring	MNB-1	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
23	6/4/2013	Spring	MNB-1	NB	Blueback herring	0	0	Blueback herring Spring
23	6/4/2013	Spring	MNB-1	NB	Striped bass	0	0	Striped bass Spring
23	6/4/2013	Spring	MNB-2	NB	Alewife	0	0	Alewife Spring
23	6/4/2013	Spring	MNB-2	NB	American shad	0	0	American shad Spring
23	6/4/2013	Spring	MNB-2	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
23	6/4/2013	Spring	MNB-2	NB	Blueback herring	0	0	Blueback herring Spring
23	6/4/2013	Spring	MNB-2	NB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping for MFS Report	Common Name	CPUE - 10min	Log(CPUE+1)	Species/Season
								Spring
23	6/4/2013	Spring	MNB-6	NB	Alewife	0	0	Alewife Spring
23	6/4/2013	Spring	MNB-6	NB	American shad	0	0	American shad Spring
23	6/4/2013	Spring	MNB-6	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
23	6/4/2013	Spring	MNB-6	NB	Blueback herring	0	0	Blueback herring Spring
23	6/4/2013	Spring	MNB-6	NB	Striped bass	0	0	Striped bass Spring
23	6/4/2013	Spring	MNB-5	NB	Alewife	0	0	Alewife Spring
23	6/4/2013	Spring	MNB-5	NB	American shad	0	0	American shad Spring
23	6/4/2013	Spring	MNB-5	NB	Atlantic menhaden	0	0	Atlantic menhaden Spring
23	6/4/2013	Spring	MNB-5	NB	Blueback herring	0	0	Blueback herring Spring
23	6/4/2013	Spring	MNB-5	NB	Striped bass	0	0	Striped bass Spring
23	6/5/2013	Spring	MUB-8	UB	Alewife	0	0	Alewife Spring
23	6/5/2013	Spring	MUB-8	UB	American shad	0	0	American shad Spring
23	6/5/2013	Spring	MUB-8	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
23	6/5/2013	Spring	MUB-8	UB	Blueback herring	0	0	Blueback herring Spring
23	6/5/2013	Spring	MUB-8	UB	Striped bass	0	0	Striped bass Spring
23	6/5/2013	Spring	MUB-9	UB	Alewife	0	0	Alewife Spring
23	6/5/2013	Spring	MUB-9	UB	American shad	0	0	American shad Spring
23	6/5/2013	Spring	MUB-9	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
23	6/5/2013	Spring	MUB-9	UB	Blueback herring	0	0	Blueback herring Spring
23	6/5/2013	Spring	MUB-9	UB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
23	6/5/2013	Spring	MLB-4	LB	Alewife	0	0	Alewife Spring
23	6/5/2013	Spring	MLB-4	LB	American shad	0	0	American shad Spring
23	6/5/2013	Spring	MLB-4	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
23	6/5/2013	Spring	MLB-4	LB	Blueback herring	0	0	Blueback herring Spring
23	6/5/2013	Spring	MLB-4	LB	Striped bass	0	0	Striped bass Spring
23	6/5/2013	Spring	MLB-3	LB	Alewife	0	0	Alewife Spring
23	6/5/2013	Spring	MLB-3	LB	American shad	0	0	American shad Spring
23	6/5/2013	Spring	MLB-3	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
23	6/5/2013	Spring	MLB-3	LB	Blueback herring	0	0	Blueback herring Spring
23	6/5/2013	Spring	MLB-3	LB	Striped bass	0	0	Striped bass Spring
23	6/5/2013	Spring	MLB-5	LB	Alewife	0	0	Alewife Spring
23	6/5/2013	Spring	MLB-5	LB	American shad	0	0	American shad Spring
23	6/5/2013	Spring	MLB-5	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
23	6/5/2013	Spring	MLB-5	LB	Blueback herring	0	0	Blueback herring Spring
23	6/5/2013	Spring	MLB-5	LB	Striped bass	0	0	Striped bass Spring
23	6/5/2013	Spring	MLB-6	LB	Alewife	0	0	Alewife Spring
23	6/5/2013	Spring	MLB-6	LB	American shad	0	0	American shad Spring
23	6/5/2013	Spring	MLB-6	LB	Atlantic menhaden	0	0	Atlantic menhaden Spring
23	6/5/2013	Spring	MLB-6	LB	Blueback herring	0	0	Blueback herring Spring
23	6/5/2013	Spring	MLB-6	LB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
23	6/5/2013	Spring	MUB-1	UB	Alewife	0	0	Alewife Spring
23	6/5/2013	Spring	MUB-1	UB	American shad	0	0	American shad Spring
23	6/5/2013	Spring	MUB-1	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
23	6/5/2013	Spring	MUB-1	UB	Blueback herring	0	0	Blueback herring Spring
23	6/5/2013	Spring	MUB-1	UB	Striped bass	0	0	Striped bass Spring
23	6/5/2013	Spring	MUB-2	UB	Alewife	0	0	Alewife Spring
23	6/5/2013	Spring	MUB-2	UB	American shad	0	0	American shad Spring
23	6/5/2013	Spring	MUB-2	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
23	6/5/2013	Spring	MUB-2	UB	Blueback herring	0	0	Blueback herring Spring
23	6/5/2013	Spring	MUB-2	UB	Striped bass	0	0	Striped bass Spring
23	6/5/2013	Spring	MUB-3	UB	Alewife	0	0	Alewife Spring
23	6/5/2013	Spring	MUB-3	UB	American shad	0	0	American shad Spring
23	6/5/2013	Spring	MUB-3	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
23	6/5/2013	Spring	MUB-3	UB	Blueback herring	0	0	Blueback herring Spring
23	6/5/2013	Spring	MUB-3	UB	Striped bass	0	0	Striped bass Spring
23	6/5/2013	Spring	MUB-11	UB	Alewife	0	0	Alewife Spring
23	6/5/2013	Spring	MUB-11	UB	American shad	0	0	American shad Spring
23	6/5/2013	Spring	MUB-11	UB	Atlantic menhaden	0	0	Atlantic menhaden Spring
23	6/5/2013	Spring	MUB-11	UB	Blueback herring	0	0	Blueback herring Spring
23	6/5/2013	Spring	MUB-11	UB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Spring
28	7/9/2013	Summer	MUB-9	UB	Alewife	0	0	Alewife Summer
28	7/9/2013	Summer	MUB-9	UB	American shad	0	0	American shad Summer
28	7/9/2013	Summer	MUB-9	UB	Atlantic menhaden	0	0	Atlantic menhaden Summer
28	7/9/2013	Summer	MUB-9	UB	Blueback herring	0	0	Blueback herring Summer
28	7/9/2013	Summer	MUB-9	UB	Striped bass	0	0	Striped bass Summer
28	7/9/2013	Summer	MUB-8	UB	Alewife	0	0	Alewife Summer
28	7/9/2013	Summer	MUB-8	UB	American shad	0	0	American shad Summer
28	7/9/2013	Summer	MUB-8	UB	Atlantic menhaden	0	0	Atlantic menhaden Summer
28	7/9/2013	Summer	MUB-8	UB	Blueback herring	0	0	Blueback herring Summer
28	7/9/2013	Summer	MUB-8	UB	Striped bass	0	0	Striped bass Summer
28	7/9/2013	Summer	MUB-11	UB	Alewife	0	0	Alewife Summer
28	7/9/2013	Summer	MUB-11	UB	American shad	0	0	American shad Summer
28	7/9/2013	Summer	MUB-11	UB	Atlantic menhaden	0	0	Atlantic menhaden Summer
28	7/9/2013	Summer	MUB-11	UB	Blueback herring	0	0	Blueback herring Summer
28	7/9/2013	Summer	MUB-11	UB	Striped bass	0	0	Striped bass Summer
28	7/9/2013	Summer	MUB-3	UB	Alewife	0	0	Alewife Summer
28	7/9/2013	Summer	MUB-3	UB	American shad	0	0	American shad Summer
28	7/9/2013	Summer	MUB-3	UB	Atlantic menhaden	0	0	Atlantic menhaden Summer
28	7/9/2013	Summer	MUB-3	UB	Blueback herring	0	0	Blueback herring Summer
28	7/9/2013	Summer	MUB-3	UB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Summer
28	7/9/2013	Summer	MUB-2	UB	Alewife	0	0	Alewife Summer
28	7/9/2013	Summer	MUB-2	UB	American shad	0	0	American shad Summer
28	7/9/2013	Summer	MUB-2	UB	Atlantic menhaden	0	0	Atlantic menhaden Summer
28	7/9/2013	Summer	MUB-2	UB	Blueback herring	0	0	Blueback herring Summer
28	7/9/2013	Summer	MUB-2	UB	Striped bass	0	0	Striped bass Summer
28	7/9/2013	Summer	MLB-6	LB	Alewife	0	0	Alewife Summer
28	7/9/2013	Summer	MLB-6	LB	American shad	0	0	American shad Summer
28	7/9/2013	Summer	MLB-6	LB	Atlantic menhaden	0	0	Atlantic menhaden Summer
28	7/9/2013	Summer	MLB-6	LB	Blueback herring	0	0	Blueback herring Summer
28	7/9/2013	Summer	MLB-6	LB	Striped bass	0	0	Striped bass Summer
28	7/9/2013	Summer	MLB-5	LB	Alewife	0	0	Alewife Summer
28	7/9/2013	Summer	MLB-5	LB	American shad	0	0	American shad Summer
28	7/9/2013	Summer	MLB-5	LB	Atlantic menhaden	0	0	Atlantic menhaden Summer
28	7/9/2013	Summer	MLB-5	LB	Blueback herring	0	0	Blueback herring Summer
28	7/9/2013	Summer	MLB-5	LB	Striped bass	0	0	Striped bass Summer
28	7/9/2013	Summer	MLB-3	LB	Alewife	0	0	Alewife Summer
28	7/9/2013	Summer	MLB-3	LB	American shad	0	0	American shad Summer
28	7/9/2013	Summer	MLB-3	LB	Atlantic menhaden	0	0	Atlantic menhaden Summer
28	7/9/2013	Summer	MLB-3	LB	Blueback herring	0	0	Blueback herring Summer
28	7/9/2013	Summer	MLB-3	LB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Summer
28	7/9/2013	Summer	MLB-4	LB	Alewife	0	0	Alewife Summer
28	7/9/2013	Summer	MLB-4	LB	American shad	0	0	American shad Summer
28	7/9/2013	Summer	MLB-4	LB	Atlantic menhaden	0	0	Atlantic menhaden Summer
28	7/9/2013	Summer	MLB-4	LB	Blueback herring	0	0	Blueback herring Summer
28	7/9/2013	Summer	MLB-4	LB	Striped bass	0	0	Striped bass Summer
28	7/9/2013	Summer	MUB-1	UB	Alewife	0	0	Alewife Summer
28	7/9/2013	Summer	MUB-1	UB	American shad	0	0	American shad Summer
28	7/9/2013	Summer	MUB-1	UB	Atlantic menhaden	0	0	Atlantic menhaden Summer
28	7/9/2013	Summer	MUB-1	UB	Blueback herring	0	0	Blueback herring Summer
28	7/9/2013	Summer	MUB-1	UB	Striped bass	0	0	Striped bass Summer
28	7/9/2013	Summer	MKK-1	AKKVK	Alewife	0	0	Alewife Summer
28	7/9/2013	Summer	MKK-1	AKKVK	American shad	0	0	American shad Summer
28	7/9/2013	Summer	MKK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Summer
28	7/9/2013	Summer	MKK-1	AKKVK	Blueback herring	0	0	Blueback herring Summer
28	7/9/2013	Summer	MKK-1	AKKVK	Striped bass	0	0	Striped bass Summer
28	7/10/2013	Summer	MAK-1	AKKVK	Alewife	0	0	Alewife Summer
28	7/10/2013	Summer	MAK-1	AKKVK	American shad	0	0	American shad Summer
28	7/10/2013	Summer	MAK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Summer
28	7/10/2013	Summer	MAK-1	AKKVK	Blueback herring	0	0	Blueback herring Summer
28	7/10/2013	Summer	MAK-1	AKKVK	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Summer
28	7/10/2013	Summer	MAK-2	AKKVK	Alewife	0	0	Alewife Summer
28	7/10/2013	Summer	MAK-2	AKKVK	American shad	0	0	American shad Summer
28	7/10/2013	Summer	MAK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Summer
28	7/10/2013	Summer	MAK-2	AKKVK	Blueback herring	0	0	Blueback herring Summer
28	7/10/2013	Summer	MAK-2	AKKVK	Striped bass	0	0	Striped bass Summer
28	7/10/2013	Summer	MAK-3	AKKVK	Alewife	0	0	Alewife Summer
28	7/10/2013	Summer	MAK-3	AKKVK	American shad	0	0	American shad Summer
28	7/10/2013	Summer	MAK-3	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Summer
28	7/10/2013	Summer	MAK-3	AKKVK	Blueback herring	0	0	Blueback herring Summer
28	7/10/2013	Summer	MAK-3	AKKVK	Striped bass	0	0	Striped bass Summer
28	7/10/2013	Summer	MAK-4	AKKVK	Alewife	0	0	Alewife Summer
28	7/10/2013	Summer	MAK-4	AKKVK	American shad	0	0	American shad Summer
28	7/10/2013	Summer	MAK-4	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Summer
28	7/10/2013	Summer	MAK-4	AKKVK	Blueback herring	0	0	Blueback herring Summer
28	7/10/2013	Summer	MAK-4	AKKVK	Striped bass	0	0	Striped bass Summer
28	7/10/2013	Summer	MNB-5	NB	Alewife	0	0	Alewife Summer
28	7/10/2013	Summer	MNB-5	NB	American shad	0	0	American shad Summer
28	7/10/2013	Summer	MNB-5	NB	Atlantic menhaden	0	0	Atlantic menhaden Summer
28	7/10/2013	Summer	MNB-5	NB	Blueback herring	0	0	Blueback herring Summer
28	7/10/2013	Summer	MNB-5	NB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Summer
28	7/10/2013	Summer	MNB-6	NB	Alewife	0	0	Alewife Summer
28	7/10/2013	Summer	MNB-6	NB	American shad	0	0	American shad Summer
28	7/10/2013	Summer	MNB-6	NB	Atlantic menhaden	0	0	Atlantic menhaden Summer
28	7/10/2013	Summer	MNB-6	NB	Blueback herring	0	0	Blueback herring Summer
28	7/10/2013	Summer	MNB-6	NB	Striped bass	0	0	Striped bass Summer
28	7/10/2013	Summer	MNB-2	NB	Alewife	0	0	Alewife Summer
28	7/10/2013	Summer	MNB-2	NB	American shad	0	0	American shad Summer
28	7/10/2013	Summer	MNB-2	NB	Atlantic menhaden	0	0	Atlantic menhaden Summer
28	7/10/2013	Summer	MNB-2	NB	Blueback herring	0	0	Blueback herring Summer
28	7/10/2013	Summer	MNB-2	NB	Striped bass	0	0	Striped bass Summer
28	7/10/2013	Summer	MNB-1	NB	Alewife	0	0	Alewife Summer
28	7/10/2013	Summer	MNB-1	NB	American shad	0	0	American shad Summer
28	7/10/2013	Summer	MNB-1	NB	Atlantic menhaden	0	0	Atlantic menhaden Summer
28	7/10/2013	Summer	MNB-1	NB	Blueback herring	0	0	Blueback herring Summer
28	7/10/2013	Summer	MNB-1	NB	Striped bass	0	0	Striped bass Summer
28	7/10/2013	Summer	MKK-2	AKKVK	Alewife	0	0	Alewife Summer
28	7/10/2013	Summer	MKK-2	AKKVK	American shad	0	0	American shad Summer
28	7/10/2013	Summer	MKK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Summer
28	7/10/2013	Summer	MKK-2	AKKVK	Blueback herring	0	0	Blueback herring Summer
28	7/10/2013	Summer	MKK-2	AKKVK	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Summer
34	8/19/2013	Summer	MUB-9	UB	Alewife	0	0	Alewife Summer
34	8/19/2013	Summer	MUB-9	UB	American shad	0	0	American shad Summer
34	8/19/2013	Summer	MUB-9	UB	Atlantic menhaden	0	0	Atlantic menhaden Summer
34	8/19/2013	Summer	MUB-9	UB	Blueback herring	0	0	Blueback herring Summer
34	8/19/2013	Summer	MUB-9	UB	Striped bass	0	0	Striped bass Summer
34	8/19/2013	Summer	MUB-8	UB	Alewife	0	0	Alewife Summer
34	8/19/2013	Summer	MUB-8	UB	American shad	0	0	American shad Summer
34	8/19/2013	Summer	MUB-8	UB	Atlantic menhaden	0	0	Atlantic menhaden Summer
34	8/19/2013	Summer	MUB-8	UB	Blueback herring	0	0	Blueback herring Summer
34	8/19/2013	Summer	MUB-8	UB	Striped bass	0	0	Striped bass Summer
34	8/19/2013	Summer	MUB-11	UB	Alewife	0	0	Alewife Summer
34	8/19/2013	Summer	MUB-11	UB	American shad	0	0	American shad Summer
34	8/19/2013	Summer	MUB-11	UB	Atlantic menhaden	0	0	Atlantic menhaden Summer
34	8/19/2013	Summer	MUB-11	UB	Blueback herring	0	0	Blueback herring Summer
34	8/19/2013	Summer	MUB-11	UB	Striped bass	0	0	Striped bass Summer
34	8/19/2013	Summer	MUB-3	UB	Alewife	0	0	Alewife Summer
34	8/19/2013	Summer	MUB-3	UB	American shad	0	0	American shad Summer
34	8/19/2013	Summer	MUB-3	UB	Atlantic menhaden	0	0	Atlantic menhaden Summer
34	8/19/2013	Summer	MUB-3	UB	Blueback herring	0	0	Blueback herring Summer
34	8/19/2013	Summer	MUB-3	UB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Summer
34	8/19/2013	Summer	MUB-2	UB	Alewife	0	0	Alewife Summer
34	8/19/2013	Summer	MUB-2	UB	American shad	0	0	American shad Summer
34	8/19/2013	Summer	MUB-2	UB	Atlantic menhaden	0	0	Atlantic menhaden Summer
34	8/19/2013	Summer	MUB-2	UB	Blueback herring	0	0	Blueback herring Summer
34	8/19/2013	Summer	MUB-2	UB	Striped bass	0	0	Striped bass Summer
34	8/19/2013	Summer	MLB-6	LB	Alewife	0	0	Alewife Summer
34	8/19/2013	Summer	MLB-6	LB	American shad	0	0	American shad Summer
34	8/19/2013	Summer	MLB-6	LB	Atlantic menhaden	0	0	Atlantic menhaden Summer
34	8/19/2013	Summer	MLB-6	LB	Blueback herring	0	0	Blueback herring Summer
34	8/19/2013	Summer	MLB-6	LB	Striped bass	0	0	Striped bass Summer
34	8/19/2013	Summer	MLB-5	LB	Alewife	0	0	Alewife Summer
34	8/19/2013	Summer	MLB-5	LB	American shad	0	0	American shad Summer
34	8/19/2013	Summer	MLB-5	LB	Atlantic menhaden	0	0	Atlantic menhaden Summer
34	8/19/2013	Summer	MLB-5	LB	Blueback herring	0	0	Blueback herring Summer
34	8/19/2013	Summer	MLB-5	LB	Striped bass	0	0	Striped bass Summer
34	8/19/2013	Summer	MLB-3	LB	Alewife	0	0	Alewife Summer
34	8/19/2013	Summer	MLB-3	LB	American shad	0	0	American shad Summer
34	8/19/2013	Summer	MLB-3	LB	Atlantic menhaden	0	0	Atlantic menhaden Summer
34	8/19/2013	Summer	MLB-3	LB	Blueback herring	0	0	Blueback herring Summer
34	8/19/2013	Summer	MLB-3	LB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Summer
34	8/19/2013	Summer	MLB-4	LB	Alewife	0	0	Alewife Summer
34	8/19/2013	Summer	MLB-4	LB	American shad	0	0	American shad Summer
34	8/19/2013	Summer	MLB-4	LB	Atlantic menhaden	0	0	Atlantic menhaden Summer
34	8/19/2013	Summer	MLB-4	LB	Blueback herring	0	0	Blueback herring Summer
34	8/19/2013	Summer	MLB-4	LB	Striped bass	0	0	Striped bass Summer
34	8/19/2013	Summer	MUB-1	UB	Alewife	1	0.30103	Alewife Summer
34	8/19/2013	Summer	MUB-1	UB	American shad	0	0	American shad Summer
34	8/19/2013	Summer	MUB-1	UB	Atlantic menhaden	0	0	Atlantic menhaden Summer
34	8/19/2013	Summer	MUB-1	UB	Blueback herring	0	0	Blueback herring Summer
34	8/19/2013	Summer	MUB-1	UB	Striped bass	0	0	Striped bass Summer
34	8/20/2013	Summer	MKK-1	AKKVK	Alewife	0	0	Alewife Summer
34	8/20/2013	Summer	MKK-1	AKKVK	American shad	0	0	American shad Summer
34	8/20/2013	Summer	MKK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Summer
34	8/20/2013	Summer	MKK-1	AKKVK	Blueback herring	0	0	Blueback herring Summer
34	8/20/2013	Summer	MKK-1	AKKVK	Striped bass	0	0	Striped bass Summer
34	8/20/2013	Summer	MKK-2	AKKVK	Alewife	0	0	Alewife Summer
34	8/20/2013	Summer	MKK-2	AKKVK	American shad	0	0	American shad Summer
34	8/20/2013	Summer	MKK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Summer
34	8/20/2013	Summer	MKK-2	AKKVK	Blueback herring	0	0	Blueback herring Summer
34	8/20/2013	Summer	MKK-2	AKKVK	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPU E+1)**	**Species/Se ason**
								Summer
34	8/20/2013	Summer	MNB-1	NB	Alewife	0	0	Alewife Summer
34	8/20/2013	Summer	MNB-1	NB	American shad	0	0	American shad Summer
34	8/20/2013	Summer	MNB-1	NB	Atlantic menhaden	0	0	Atlantic menhaden Summer
34	8/20/2013	Summer	MNB-1	NB	Blueback herring	0	0	Blueback herring Summer
34	8/20/2013	Summer	MNB-1	NB	Striped bass	0	0	Striped bass Summer
34	8/20/2013	Summer	MNB-2	NB	Alewife	0	0	Alewife Summer
34	8/20/2013	Summer	MNB-2	NB	American shad	0	0	American shad Summer
34	8/20/2013	Summer	MNB-2	NB	Atlantic menhaden	0	0	Atlantic menhaden Summer
34	8/20/2013	Summer	MNB-2	NB	Blueback herring	0	0	Blueback herring Summer
34	8/20/2013	Summer	MNB-2	NB	Striped bass	0	0	Striped bass Summer
34	8/20/2013	Summer	MNB-5	NB	Alewife	0	0	Alewife Summer
34	8/20/2013	Summer	MNB-5	NB	American shad	0	0	American shad Summer
34	8/20/2013	Summer	MNB-5	NB	Atlantic menhaden	0	0	Atlantic menhaden Summer
34	8/20/2013	Summer	MNB-5	NB	Blueback herring	0	0	Blueback herring Summer
34	8/20/2013	Summer	MNB-5	NB	Striped bass	0	0	Striped bass Summer
34	8/20/2013	Summer	MNB-6	NB	Alewife	0	0	Alewife Summer
34	8/20/2013	Summer	MNB-6	NB	American shad	0	0	American shad Summer
34	8/20/2013	Summer	MNB-6	NB	Atlantic menhaden	0	0	Atlantic menhaden Summer
34	8/20/2013	Summer	MNB-6	NB	Blueback herring	3	0.60206	Blueback herring Summer
34	8/20/2013	Summer	MNB-6	NB	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Summer
34	8/20/2013	Summer	MAK-1	AKKVK	Alewife	0	0	Alewife Summer
34	8/20/2013	Summer	MAK-1	AKKVK	American shad	0	0	American shad Summer
34	8/20/2013	Summer	MAK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Summer
34	8/20/2013	Summer	MAK-1	AKKVK	Blueback herring	0	0	Blueback herring Summer
34	8/20/2013	Summer	MAK-1	AKKVK	Striped bass	0	0	Striped bass Summer
34	8/20/2013	Summer	MAK-4	AKKVK	Alewife	0	0	Alewife Summer
34	8/20/2013	Summer	MAK-4	AKKVK	American shad	0	0	American shad Summer
34	8/20/2013	Summer	MAK-4	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Summer
34	8/20/2013	Summer	MAK-4	AKKVK	Blueback herring	0	0	Blueback herring Summer
34	8/20/2013	Summer	MAK-4	AKKVK	Striped bass	0	0	Striped bass Summer
34	8/20/2013	Summer	MAK-3	AKKVK	Alewife	0	0	Alewife Summer
34	8/20/2013	Summer	MAK-3	AKKVK	American shad	0	0	American shad Summer
34	8/20/2013	Summer	MAK-3	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Summer
34	8/20/2013	Summer	MAK-3	AKKVK	Blueback herring	0	0	Blueback herring Summer
34	8/20/2013	Summer	MAK-3	AKKVK	Striped bass	0	0	Striped bass Summer
34	8/20/2013	Summer	MAK-2	AKKVK	Alewife	0	0	Alewife Summer
34	8/20/2013	Summer	MAK-2	AKKVK	American shad	0	0	American shad Summer
34	8/20/2013	Summer	MAK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Summer
34	8/20/2013	Summer	MAK-2	AKKVK	Blueback herring	0	0	Blueback herring Summer
34	8/20/2013	Summer	MAK-2	AKKVK	Striped bass	0	0	Striped bass

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
								Summer
37	9/10/2013	Fall	MKK-2	AKKVK	Alewife	0	0	Alewife Fall
37	9/10/2013	Fall	MKK-2	AKKVK	American shad	0	0	American shad Fall
37	9/10/2013	Fall	MKK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
37	9/10/2013	Fall	MKK-2	AKKVK	Blueback herring	0	0	Blueback herring Fall
37	9/10/2013	Fall	MKK-2	AKKVK	Striped bass	0	0	Striped bass Fall
37	9/10/2013	Fall	MNB-5	NB	Alewife	0	0	Alewife Fall
37	9/10/2013	Fall	MNB-5	NB	American shad	0	0	American shad Fall
37	9/10/2013	Fall	MNB-5	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
37	9/10/2013	Fall	MNB-5	NB	Blueback herring	0	0	Blueback herring Fall
37	9/10/2013	Fall	MNB-5	NB	Striped bass	0	0	Striped bass Fall
37	9/10/2013	Fall	MNB-6	NB	Alewife	13	1.146128	Alewife Fall
37	9/10/2013	Fall	MNB-6	NB	American shad	0	0	American shad Fall
37	9/10/2013	Fall	MNB-6	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
37	9/10/2013	Fall	MNB-6	NB	Blueback herring	6	0.845098	Blueback herring Fall
37	9/10/2013	Fall	MNB-6	NB	Striped bass	0	0	Striped bass Fall
37	9/10/2013	Fall	MNB-2	NB	Alewife	0	0	Alewife Fall
37	9/10/2013	Fall	MNB-2	NB	American shad	0	0	American shad Fall
37	9/10/2013	Fall	MNB-2	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
37	9/10/2013	Fall	MNB-2	NB	Blueback herring	0	0	Blueback herring Fall
37	9/10/2013	Fall	MNB-2	NB	Striped bass	0	0	Striped bass Fall
37	9/10/2013	Fall	MNB-1	NB	Alewife	0	0	Alewife Fall
37	9/10/2013	Fall	MNB-1	NB	American shad	0	0	American shad Fall
37	9/10/2013	Fall	MNB-1	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
37	9/10/2013	Fall	MNB-1	NB	Blueback herring	0	0	Blueback herring Fall
37	9/10/2013	Fall	MNB-1	NB	Striped bass	0	0	Striped bass Fall
37	9/10/2013	Fall	MAK-2	AKKVK	Alewife	0	0	Alewife Fall
37	9/10/2013	Fall	MAK-2	AKKVK	American shad	0	0	American shad Fall
37	9/10/2013	Fall	MAK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
37	9/10/2013	Fall	MAK-2	AKKVK	Blueback herring	8	0.954243	Blueback herring Fall
37	9/10/2013	Fall	MAK-2	AKKVK	Striped bass	0	0	Striped bass Fall
37	9/10/2013	Fall	MAK-3	AKKVK	Alewife	0	0	Alewife Fall
37	9/10/2013	Fall	MAK-3	AKKVK	American shad	0	0	American shad Fall
37	9/10/2013	Fall	MAK-3	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
37	9/10/2013	Fall	MAK-3	AKKVK	Blueback herring	5	0.778151	Blueback herring Fall
37	9/10/2013	Fall	MAK-3	AKKVK	Striped bass	0	0	Striped bass Fall
37	9/10/2013	Fall	MAK-4	AKKVK	Alewife	0	0	Alewife Fall
37	9/10/2013	Fall	MAK-4	AKKVK	American shad	0	0	American shad Fall
37	9/10/2013	Fall	MAK-4	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
37	9/10/2013	Fall	MAK-4	AKKVK	Blueback herring	0	0	Blueback herring Fall
37	9/10/2013	Fall	MAK-4	AKKVK	Striped bass	0	0	Striped bass Fall
37	9/10/2013	Fall	MAK-1	AKKVK	Alewife	0	0	Alewife Fall
37	9/10/2013	Fall	MAK-1	AKKVK	American shad	0	0	American shad Fall
37	9/10/2013	Fall	MAK-1	AKKVK	Atlantic menhaden	1	0.30103	Atlantic menhaden Fall
37	9/10/2013	Fall	MAK-1	AKKVK	Blueback herring	0	0	Blueback herring Fall
37	9/10/2013	Fall	MAK-1	AKKVK	Striped bass	0	0	Striped bass Fall
37	9/10/2013	Fall	MKK-1	AKKVK	Alewife	0	0	Alewife Fall
37	9/10/2013	Fall	MKK-1	AKKVK	American	0	0	American

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
					shad			shad Fall
37	9/10/2013	Fall	MKK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
37	9/10/2013	Fall	MKK-1	AKKVK	Blueback herring	0	0	Blueback herring Fall
37	9/10/2013	Fall	MKK-1	AKKVK	Striped bass	0	0	Striped bass Fall
37	9/11/2013	Fall	MUB-8	UB	Alewife	0	0	Alewife Fall
37	9/11/2013	Fall	MUB-8	UB	American shad	0	0	American shad Fall
37	9/11/2013	Fall	MUB-8	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
37	9/11/2013	Fall	MUB-8	UB	Blueback herring	0	0	Blueback herring Fall
37	9/11/2013	Fall	MUB-8	UB	Striped bass	0	0	Striped bass Fall
37	9/11/2013	Fall	MUB-9	UB	Alewife	0	0	Alewife Fall
37	9/11/2013	Fall	MUB-9	UB	American shad	0	0	American shad Fall
37	9/11/2013	Fall	MUB-9	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
37	9/11/2013	Fall	MUB-9	UB	Blueback herring	0	0	Blueback herring Fall
37	9/11/2013	Fall	MUB-9	UB	Striped bass	0	0	Striped bass Fall
37	9/11/2013	Fall	MUB-11	UB	Alewife	0	0	Alewife Fall
37	9/11/2013	Fall	MUB-11	UB	American shad	0	0	American shad Fall
37	9/11/2013	Fall	MUB-11	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
37	9/11/2013	Fall	MUB-11	UB	Blueback herring	1	0.30103	Blueback herring Fall
37	9/11/2013	Fall	MUB-11	UB	Striped bass	0	0	Striped bass Fall
37	9/11/2013	Fall	MUB-3	UB	Alewife	0	0	Alewife Fall
37	9/11/2013	Fall	MUB-3	UB	American shad	0	0	American shad Fall
37	9/11/2013	Fall	MUB-3	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
37	9/11/2013	Fall	MUB-3	UB	Blueback herring	0	0	Blueback herring Fall
37	9/11/2013	Fall	MUB-3	UB	Striped	0	0	Striped

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping for MFS Report	Common Name	CPUE - 10min	Log(CPUE+1)	Species/Season
					bass			bass Fall
37	9/11/2013	Fall	MUB-2	UB	Alewife	0	0	Alewife Fall
37	9/11/2013	Fall	MUB-2	UB	American shad	0	0	American shad Fall
37	9/11/2013	Fall	MUB-2	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
37	9/11/2013	Fall	MUB-2	UB	Blueback herring	0	0	Blueback herring Fall
37	9/11/2013	Fall	MUB-2	UB	Striped bass	0	0	Striped bass Fall
37	9/11/2013	Fall	MUB-1	UB	Alewife	0	0	Alewife Fall
37	9/11/2013	Fall	MUB-1	UB	American shad	0	0	American shad Fall
37	9/11/2013	Fall	MUB-1	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
37	9/11/2013	Fall	MUB-1	UB	Blueback herring	0	0	Blueback herring Fall
37	9/11/2013	Fall	MUB-1	UB	Striped bass	0	0	Striped bass Fall
37	9/11/2013	Fall	MLB-6	LB	Alewife	0	0	Alewife Fall
37	9/11/2013	Fall	MLB-6	LB	American shad	0	0	American shad Fall
37	9/11/2013	Fall	MLB-6	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
37	9/11/2013	Fall	MLB-6	LB	Blueback herring	0	0	Blueback herring Fall
37	9/11/2013	Fall	MLB-6	LB	Striped bass	0	0	Striped bass Fall
37	9/11/2013	Fall	MLB-5	LB	Alewife	0	0	Alewife Fall
37	9/11/2013	Fall	MLB-5	LB	American shad	0	0	American shad Fall
37	9/11/2013	Fall	MLB-5	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
37	9/11/2013	Fall	MLB-5	LB	Blueback herring	0	0	Blueback herring Fall
37	9/11/2013	Fall	MLB-5	LB	Striped bass	0	0	Striped bass Fall
37	9/11/2013	Fall	MLB-3	LB	Alewife	0	0	Alewife Fall
37	9/11/2013	Fall	MLB-3	LB	American shad	0	0	American shad Fall
37	9/11/2013	Fall	MLB-3	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
37	9/11/2013	Fall	MLB-3	LB	Blueback herring	0	0	Blueback herring Fall
37	9/11/2013	Fall	MLB-3	LB	Striped bass	0	0	Striped bass Fall
37	9/11/2013	Fall	MLB-4	LB	Alewife	0	0	Alewife Fall
37	9/11/2013	Fall	MLB-4	LB	American shad	0	0	American shad Fall
37	9/11/2013	Fall	MLB-4	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
37	9/11/2013	Fall	MLB-4	LB	Blueback herring	0	0	Blueback herring Fall
37	9/11/2013	Fall	MLB-4	LB	Striped bass	0	0	Striped bass Fall
39	9/24/2013	Fall	MKK-2	AKKVK	Alewife	0	0	Alewife Fall
39	9/24/2013	Fall	MKK-2	AKKVK	American shad	0	0	American shad Fall
39	9/24/2013	Fall	MKK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
39	9/24/2013	Fall	MKK-2	AKKVK	Blueback herring	0	0	Blueback herring Fall
39	9/24/2013	Fall	MKK-2	AKKVK	Striped bass	0	0	Striped bass Fall
39	9/24/2013	Fall	MNB-5	NB	Alewife	0	0	Alewife Fall
39	9/24/2013	Fall	MNB-5	NB	American shad	0	0	American shad Fall
39	9/24/2013	Fall	MNB-5	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
39	9/24/2013	Fall	MNB-5	NB	Blueback herring	11	1.079181	Blueback herring Fall
39	9/24/2013	Fall	MNB-5	NB	Striped bass	0	0	Striped bass Fall
39	9/24/2013	Fall	MNB-6	NB	Alewife	0	0	Alewife Fall
39	9/24/2013	Fall	MNB-6	NB	American shad	0	0	American shad Fall
39	9/24/2013	Fall	MNB-6	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
39	9/24/2013	Fall	MNB-6	NB	Blueback herring	19	1.30103	Blueback herring Fall
39	9/24/2013	Fall	MNB-6	NB	Striped bass	0	0	Striped bass Fall
39	9/24/2013	Fall	MNB-2	NB	Alewife	0	0	Alewife Fall
39	9/24/2013	Fall	MNB-2	NB	American	0	0	American

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
					shad			shad Fall
39	9/24/2013	Fall	MNB-2	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
39	9/24/2013	Fall	MNB-2	NB	Blueback herring	0	0	Blueback herring Fall
39	9/24/2013	Fall	MNB-2	NB	Striped bass	0	0	Striped bass Fall
39	9/24/2013	Fall	MNB-1	NB	Alewife	0	0	Alewife Fall
39	9/24/2013	Fall	MNB-1	NB	American shad	0	0	American shad Fall
39	9/24/2013	Fall	MNB-1	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
39	9/24/2013	Fall	MNB-1	NB	Blueback herring	0	0	Blueback herring Fall
39	9/24/2013	Fall	MNB-1	NB	Striped bass	0	0	Striped bass Fall
39	9/24/2013	Fall	MAK-1	AKKVK	Alewife	0	0	Alewife Fall
39	9/24/2013	Fall	MAK-1	AKKVK	American shad	0	0	American shad Fall
39	9/24/2013	Fall	MAK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
39	9/24/2013	Fall	MAK-1	AKKVK	Blueback herring	0	0	Blueback herring Fall
39	9/24/2013	Fall	MAK-1	AKKVK	Striped bass	0	0	Striped bass Fall
39	9/24/2013	Fall	MAK-2	AKKVK	Alewife	0	0	Alewife Fall
39	9/24/2013	Fall	MAK-2	AKKVK	American shad	0	0	American shad Fall
39	9/24/2013	Fall	MAK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
39	9/24/2013	Fall	MAK-2	AKKVK	Blueback herring	0	0	Blueback herring Fall
39	9/24/2013	Fall	MAK-2	AKKVK	Striped bass	0	0	Striped bass Fall
39	9/24/2013	Fall	MAK-3	AKKVK	Alewife	0	0	Alewife Fall
39	9/24/2013	Fall	MAK-3	AKKVK	American shad	0	0	American shad Fall
39	9/24/2013	Fall	MAK-3	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
39	9/24/2013	Fall	MAK-3	AKKVK	Blueback herring	0	0	Blueback herring Fall
39	9/24/2013	Fall	MAK-3	AKKVK	Striped	0	0	Striped

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
					bass			bass Fall
39	9/24/2013	Fall	MAK-4	AKKVK	Alewife	0	0	Alewife Fall
39	9/24/2013	Fall	MAK-4	AKKVK	American shad	0	0	American shad Fall
39	9/24/2013	Fall	MAK-4	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
39	9/24/2013	Fall	MAK-4	AKKVK	Blueback herring	0	0	Blueback herring Fall
39	9/24/2013	Fall	MAK-4	AKKVK	Striped bass	0	0	Striped bass Fall
39	9/24/2013	Fall	MKK-1	AKKVK	Alewife	0	0	Alewife Fall
39	9/24/2013	Fall	MKK-1	AKKVK	American shad	0	0	American shad Fall
39	9/24/2013	Fall	MKK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
39	9/24/2013	Fall	MKK-1	AKKVK	Blueback herring	0	0	Blueback herring Fall
39	9/24/2013	Fall	MKK-1	AKKVK	Striped bass	0	0	Striped bass Fall
39	9/25/2013	Fall	MUB-8	UB	Alewife	0	0	Alewife Fall
39	9/25/2013	Fall	MUB-8	UB	American shad	0	0	American shad Fall
39	9/25/2013	Fall	MUB-8	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
39	9/25/2013	Fall	MUB-8	UB	Blueback herring	0	0	Blueback herring Fall
39	9/25/2013	Fall	MUB-8	UB	Striped bass	0	0	Striped bass Fall
39	9/25/2013	Fall	MUB-9	UB	Alewife	0	0	Alewife Fall
39	9/25/2013	Fall	MUB-9	UB	American shad	0	0	American shad Fall
39	9/25/2013	Fall	MUB-9	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
39	9/25/2013	Fall	MUB-9	UB	Blueback herring	0	0	Blueback herring Fall
39	9/25/2013	Fall	MUB-9	UB	Striped bass	0	0	Striped bass Fall
39	9/25/2013	Fall	MUB-11	UB	Alewife	0	0	Alewife Fall
39	9/25/2013	Fall	MUB-11	UB	American shad	0	0	American shad Fall
39	9/25/2013	Fall	MUB-11	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
39	9/25/2013	Fall	MUB-11	UB	Blueback herring	0	0	Blueback herring Fall
39	9/25/2013	Fall	MUB-11	UB	Striped bass	0	0	Striped bass Fall
39	9/25/2013	Fall	MUB-3	UB	Alewife	0	0	Alewife Fall
39	9/25/2013	Fall	MUB-3	UB	American shad	0	0	American shad Fall
39	9/25/2013	Fall	MUB-3	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
39	9/25/2013	Fall	MUB-3	UB	Blueback herring	0	0	Blueback herring Fall
39	9/25/2013	Fall	MUB-3	UB	Striped bass	0	0	Striped bass Fall
39	9/25/2013	Fall	MUB-2	UB	Alewife	0	0	Alewife Fall
39	9/25/2013	Fall	MUB-2	UB	American shad	0	0	American shad Fall
39	9/25/2013	Fall	MUB-2	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
39	9/25/2013	Fall	MUB-2	UB	Blueback herring	0	0	Blueback herring Fall
39	9/25/2013	Fall	MUB-2	UB	Striped bass	0	0	Striped bass Fall
39	9/25/2013	Fall	MUB-1	UB	Alewife	0	0	Alewife Fall
39	9/25/2013	Fall	MUB-1	UB	American shad	0	0	American shad Fall
39	9/25/2013	Fall	MUB-1	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
39	9/25/2013	Fall	MUB-1	UB	Blueback herring	0	0	Blueback herring Fall
39	9/25/2013	Fall	MUB-1	UB	Striped bass	0	0	Striped bass Fall
39	9/25/2013	Fall	MLB-6	LB	Alewife	0	0	Alewife Fall
39	9/25/2013	Fall	MLB-6	LB	American shad	0	0	American shad Fall
39	9/25/2013	Fall	MLB-6	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
39	9/25/2013	Fall	MLB-6	LB	Blueback herring	0	0	Blueback herring Fall
39	9/25/2013	Fall	MLB-6	LB	Striped bass	0	0	Striped bass Fall
39	9/25/2013	Fall	MLB-5	LB	Alewife	0	0	Alewife Fall
39	9/25/2013	Fall	MLB-5	LB	American	0	0	American

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping for MFS Report	Common Name	CPUE - 10min	Log(CPUE+1)	Species/Season
					shad			shad Fall
39	9/25/2013	Fall	MLB-5	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
39	9/25/2013	Fall	MLB-5	LB	Blueback herring	0	0	Blueback herring Fall
39	9/25/2013	Fall	MLB-5	LB	Striped bass	0	0	Striped bass Fall
39	9/25/2013	Fall	MLB-3	LB	Alewife	0	0	Alewife Fall
39	9/25/2013	Fall	MLB-3	LB	American shad	0	0	American shad Fall
39	9/25/2013	Fall	MLB-3	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
39	9/25/2013	Fall	MLB-3	LB	Blueback herring	0	0	Blueback herring Fall
39	9/25/2013	Fall	MLB-3	LB	Striped bass	0	0	Striped bass Fall
39	9/25/2013	Fall	MLB-4	LB	Alewife	0	0	Alewife Fall
39	9/25/2013	Fall	MLB-4	LB	American shad	0	0	American shad Fall
39	9/25/2013	Fall	MLB-4	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
39	9/25/2013	Fall	MLB-4	LB	Blueback herring	0	0	Blueback herring Fall
39	9/25/2013	Fall	MLB-4	LB	Striped bass	0	0	Striped bass Fall
40	10/1/2013	Fall	MUB-8	UB	Alewife	0	0	Alewife Fall
40	10/1/2013	Fall	MUB-8	UB	American shad	0	0	American shad Fall
40	10/1/2013	Fall	MUB-8	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
40	10/1/2013	Fall	MUB-8	UB	Blueback herring	0	0	Blueback herring Fall
40	10/1/2013	Fall	MUB-8	UB	Striped bass	0	0	Striped bass Fall
40	10/1/2013	Fall	MUB-9	UB	Alewife	0	0	Alewife Fall
40	10/1/2013	Fall	MUB-9	UB	American shad	0	0	American shad Fall
40	10/1/2013	Fall	MUB-9	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
40	10/1/2013	Fall	MUB-9	UB	Blueback herring	0	0	Blueback herring Fall
40	10/1/2013	Fall	MUB-9	UB	Striped	0	0	Striped

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping for MFS Report	Common Name	CPUE - 10min	Log(CPUE+1)	Species/Season
					bass			bass Fall
40	10/1/2013	Fall	MUB-11	UB	Alewife	0	0	Alewife Fall
40	10/1/2013	Fall	MUB-11	UB	American shad	0	0	American shad Fall
40	10/1/2013	Fall	MUB-11	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
40	10/1/2013	Fall	MUB-11	UB	Blueback herring	0	0	Blueback herring Fall
40	10/1/2013	Fall	MUB-11	UB	Striped bass	0	0	Striped bass Fall
40	10/1/2013	Fall	MUB-3	UB	Alewife	0	0	Alewife Fall
40	10/1/2013	Fall	MUB-3	UB	American shad	0	0	American shad Fall
40	10/1/2013	Fall	MUB-3	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
40	10/1/2013	Fall	MUB-3	UB	Blueback herring	0	0	Blueback herring Fall
40	10/1/2013	Fall	MUB-3	UB	Striped bass	0	0	Striped bass Fall
40	10/1/2013	Fall	MUB-2	UB	Alewife	0	0	Alewife Fall
40	10/1/2013	Fall	MUB-2	UB	American shad	0	0	American shad Fall
40	10/1/2013	Fall	MUB-2	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
40	10/1/2013	Fall	MUB-2	UB	Blueback herring	0	0	Blueback herring Fall
40	10/1/2013	Fall	MUB-2	UB	Striped bass	0	0	Striped bass Fall
40	10/1/2013	Fall	MUB-1	UB	Alewife	0	0	Alewife Fall
40	10/1/2013	Fall	MUB-1	UB	American shad	0	0	American shad Fall
40	10/1/2013	Fall	MUB-1	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
40	10/1/2013	Fall	MUB-1	UB	Blueback herring	0	0	Blueback herring Fall
40	10/1/2013	Fall	MUB-1	UB	Striped bass	0	0	Striped bass Fall
40	10/1/2013	Fall	MLB-6	LB	Alewife	0	0	Alewife Fall
40	10/1/2013	Fall	MLB-6	LB	American shad	0	0	American shad Fall
40	10/1/2013	Fall	MLB-6	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping for MFS Report	Common Name	CPUE - 10min	Log(CPUE+1)	Species/Season
40	10/1/2013	Fall	MLB-6	LB	Blueback herring	0	0	Blueback herring Fall
40	10/1/2013	Fall	MLB-6	LB	Striped bass	0	0	Striped bass Fall
40	10/1/2013	Fall	MLB-5	LB	Alewife	0	0	Alewife Fall
40	10/1/2013	Fall	MLB-5	LB	American shad	0	0	American shad Fall
40	10/1/2013	Fall	MLB-5	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
40	10/1/2013	Fall	MLB-5	LB	Blueback herring	0	0	Blueback herring Fall
40	10/1/2013	Fall	MLB-5	LB	Striped bass	0	0	Striped bass Fall
40	10/1/2013	Fall	MLB-3	LB	Alewife	0	0	Alewife Fall
40	10/1/2013	Fall	MLB-3	LB	American shad	0	0	American shad Fall
40	10/1/2013	Fall	MLB-3	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
40	10/1/2013	Fall	MLB-3	LB	Blueback herring	0	0	Blueback herring Fall
40	10/1/2013	Fall	MLB-3	LB	Striped bass	0	0	Striped bass Fall
40	10/1/2013	Fall	MLB-4	LB	Alewife	0	0	Alewife Fall
40	10/1/2013	Fall	MLB-4	LB	American shad	0	0	American shad Fall
40	10/1/2013	Fall	MLB-4	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
40	10/1/2013	Fall	MLB-4	LB	Blueback herring	1	0.30103	Blueback herring Fall
40	10/1/2013	Fall	MLB-4	LB	Striped bass	0	0	Striped bass Fall
40	10/2/2013	Fall	MKK-1	AKKVK	Alewife	0	0	Alewife Fall
40	10/2/2013	Fall	MKK-1	AKKVK	American shad	0	0	American shad Fall
40	10/2/2013	Fall	MKK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
40	10/2/2013	Fall	MKK-1	AKKVK	Blueback herring	0	0	Blueback herring Fall
40	10/2/2013	Fall	MKK-1	AKKVK	Striped bass	0	0	Striped bass Fall
40	10/2/2013	Fall	MKK-2	AKKVK	Alewife	0	0	Alewife Fall
40	10/2/2013	Fall	MKK-2	AKKVK	American	0	0	American

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
					shad			shad Fall
40	10/2/2013	Fall	MKK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
40	10/2/2013	Fall	MKK-2	AKKVK	Blueback herring	0	0	Blueback herring Fall
40	10/2/2013	Fall	MKK-2	AKKVK	Striped bass	0	0	Striped bass Fall
40	10/2/2013	Fall	MNB-1	NB	Alewife	0	0	Alewife Fall
40	10/2/2013	Fall	MNB-1	NB	American shad	0	0	American shad Fall
40	10/2/2013	Fall	MNB-1	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
40	10/2/2013	Fall	MNB-1	NB	Blueback herring	0	0	Blueback herring Fall
40	10/2/2013	Fall	MNB-1	NB	Striped bass	0	0	Striped bass Fall
40	10/2/2013	Fall	MNB-2	NB	Alewife	0	0	Alewife Fall
40	10/2/2013	Fall	MNB-2	NB	American shad	0	0	American shad Fall
40	10/2/2013	Fall	MNB-2	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
40	10/2/2013	Fall	MNB-2	NB	Blueback herring	0	0	Blueback herring Fall
40	10/2/2013	Fall	MNB-2	NB	Striped bass	0	0	Striped bass Fall
40	10/2/2013	Fall	MNB-6	NB	Alewife	0	0	Alewife Fall
40	10/2/2013	Fall	MNB-6	NB	American shad	0	0	American shad Fall
40	10/2/2013	Fall	MNB-6	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
40	10/2/2013	Fall	MNB-6	NB	Blueback herring	3	0.60206	Blueback herring Fall
40	10/2/2013	Fall	MNB-6	NB	Striped bass	0	0	Striped bass Fall
40	10/2/2013	Fall	MNB-5	NB	Alewife	0	0	Alewife Fall
40	10/2/2013	Fall	MNB-5	NB	American shad	0	0	American shad Fall
40	10/2/2013	Fall	MNB-5	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
40	10/2/2013	Fall	MNB-5	NB	Blueback herring	57	1.763428	Blueback herring Fall
40	10/2/2013	Fall	MNB-5	NB	Striped	0	0	Striped

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
					bass			bass Fall
40	10/2/2013	Fall	MAK-1	AKKVK	Alewife	0	0	Alewife Fall
40	10/2/2013	Fall	MAK-1	AKKVK	American shad	0	0	American shad Fall
40	10/2/2013	Fall	MAK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
40	10/2/2013	Fall	MAK-1	AKKVK	Blueback herring	0	0	Blueback herring Fall
40	10/2/2013	Fall	MAK-1	AKKVK	Striped bass	0	0	Striped bass Fall
40	10/2/2013	Fall	MAK-4	AKKVK	Alewife	0	0	Alewife Fall
40	10/2/2013	Fall	MAK-4	AKKVK	American shad	0	0	American shad Fall
40	10/2/2013	Fall	MAK-4	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
40	10/2/2013	Fall	MAK-4	AKKVK	Blueback herring	0	0	Blueback herring Fall
40	10/2/2013	Fall	MAK-4	AKKVK	Striped bass	0	0	Striped bass Fall
40	10/2/2013	Fall	MAK-3	AKKVK	Alewife	0	0	Alewife Fall
40	10/2/2013	Fall	MAK-3	AKKVK	American shad	0	0	American shad Fall
40	10/2/2013	Fall	MAK-3	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
40	10/2/2013	Fall	MAK-3	AKKVK	Blueback herring	0	0	Blueback herring Fall
40	10/2/2013	Fall	MAK-3	AKKVK	Striped bass	0	0	Striped bass Fall
40	10/2/2013	Fall	MAK-2	AKKVK	Alewife	0	0	Alewife Fall
40	10/2/2013	Fall	MAK-2	AKKVK	American shad	0	0	American shad Fall
40	10/2/2013	Fall	MAK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
40	10/2/2013	Fall	MAK-2	AKKVK	Blueback herring	0	0	Blueback herring Fall
40	10/2/2013	Fall	MAK-2	AKKVK	Striped bass	0	0	Striped bass Fall
41	10/8/2013	Fall	MUB-9	UB	Alewife	6	0.845098	Alewife Fall
41	10/8/2013	Fall	MUB-9	UB	American shad	0	0	American shad Fall
41	10/8/2013	Fall	MUB-9	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
41	10/8/2013	Fall	MUB-9	UB	Blueback herring	0	0	Blueback herring Fall
41	10/8/2013	Fall	MUB-9	UB	Striped bass	0	0	Striped bass Fall
41	10/8/2013	Fall	MUB-8	UB	Alewife	0	0	Alewife Fall
41	10/8/2013	Fall	MUB-8	UB	American shad	0	0	American shad Fall
41	10/8/2013	Fall	MUB-8	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
41	10/8/2013	Fall	MUB-8	UB	Blueback herring	0	0	Blueback herring Fall
41	10/8/2013	Fall	MUB-8	UB	Striped bass	0	0	Striped bass Fall
41	10/8/2013	Fall	MUB-11	UB	Alewife	0	0	Alewife Fall
41	10/8/2013	Fall	MUB-11	UB	American shad	0	0	American shad Fall
41	10/8/2013	Fall	MUB-11	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
41	10/8/2013	Fall	MUB-11	UB	Blueback herring	0	0	Blueback herring Fall
41	10/8/2013	Fall	MUB-11	UB	Striped bass	0	0	Striped bass Fall
41	10/8/2013	Fall	MUB-3	UB	Alewife	0	0	Alewife Fall
41	10/8/2013	Fall	MUB-3	UB	American shad	0	0	American shad Fall
41	10/8/2013	Fall	MUB-3	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
41	10/8/2013	Fall	MUB-3	UB	Blueback herring	0	0	Blueback herring Fall
41	10/8/2013	Fall	MUB-3	UB	Striped bass	0	0	Striped bass Fall
41	10/8/2013	Fall	MUB-2	UB	Alewife	0	0	Alewife Fall
41	10/8/2013	Fall	MUB-2	UB	American shad	0	0	American shad Fall
41	10/8/2013	Fall	MUB-2	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
41	10/8/2013	Fall	MUB-2	UB	Blueback herring	0	0	Blueback herring Fall
41	10/8/2013	Fall	MUB-2	UB	Striped bass	0	0	Striped bass Fall
41	10/8/2013	Fall	MUB-1	UB	Alewife	0	0	Alewife Fall
41	10/8/2013	Fall	MUB-1	UB	American	0	0	American

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
					shad			shad Fall
41	10/8/2013	Fall	MUB-1	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
41	10/8/2013	Fall	MUB-1	UB	Blueback herring	0	0	Blueback herring Fall
41	10/8/2013	Fall	MUB-1	UB	Striped bass	0	0	Striped bass Fall
41	10/8/2013	Fall	MLB-6	LB	Alewife	0	0	Alewife Fall
41	10/8/2013	Fall	MLB-6	LB	American shad	0	0	American shad Fall
41	10/8/2013	Fall	MLB-6	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
41	10/8/2013	Fall	MLB-6	LB	Blueback herring	0	0	Blueback herring Fall
41	10/8/2013	Fall	MLB-6	LB	Striped bass	0	0	Striped bass Fall
41	10/8/2013	Fall	MLB-5	LB	Alewife	0	0	Alewife Fall
41	10/8/2013	Fall	MLB-5	LB	American shad	0	0	American shad Fall
41	10/8/2013	Fall	MLB-5	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
41	10/8/2013	Fall	MLB-5	LB	Blueback herring	0	0	Blueback herring Fall
41	10/8/2013	Fall	MLB-5	LB	Striped bass	0	0	Striped bass Fall
41	10/8/2013	Fall	MLB-3	LB	Alewife	0	0	Alewife Fall
41	10/8/2013	Fall	MLB-3	LB	American shad	0	0	American shad Fall
41	10/8/2013	Fall	MLB-3	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
41	10/8/2013	Fall	MLB-3	LB	Blueback herring	0	0	Blueback herring Fall
41	10/8/2013	Fall	MLB-3	LB	Striped bass	0	0	Striped bass Fall
41	10/8/2013	Fall	MLB-4	LB	Alewife	0	0	Alewife Fall
41	10/8/2013	Fall	MLB-4	LB	American shad	0	0	American shad Fall
41	10/8/2013	Fall	MLB-4	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
41	10/8/2013	Fall	MLB-4	LB	Blueback herring	0	0	Blueback herring Fall
41	10/8/2013	Fall	MLB-4	LB	Striped	0	0	Striped

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping for MFS Report	Common Name	CPUE - 10min	Log(CPUE+1)	Species/Season
					bass			bass Fall
41	10/8/2013	Fall	MKK-1	AKKVK	Alewife	0	0	Alewife Fall
41	10/8/2013	Fall	MKK-1	AKKVK	American shad	0	0	American shad Fall
41	10/8/2013	Fall	MKK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
41	10/8/2013	Fall	MKK-1	AKKVK	Blueback herring	0	0	Blueback herring Fall
41	10/8/2013	Fall	MKK-1	AKKVK	Striped bass	0	0	Striped bass Fall
41	10/9/2013	Fall	MKK-2	AKKVK	Alewife	0	0	Alewife Fall
41	10/9/2013	Fall	MKK-2	AKKVK	American shad	0	0	American shad Fall
41	10/9/2013	Fall	MKK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
41	10/9/2013	Fall	MKK-2	AKKVK	Blueback herring	0	0	Blueback herring Fall
41	10/9/2013	Fall	MKK-2	AKKVK	Striped bass	0	0	Striped bass Fall
41	10/9/2013	Fall	MNB-5	NB	Alewife	1	0.30103	Alewife Fall
41	10/9/2013	Fall	MNB-5	NB	American shad	0	0	American shad Fall
41	10/9/2013	Fall	MNB-5	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
41	10/9/2013	Fall	MNB-5	NB	Blueback herring	2	0.477121	Blueback herring Fall
41	10/9/2013	Fall	MNB-5	NB	Striped bass	0	0	Striped bass Fall
41	10/9/2013	Fall	MNB-6	NB	Alewife	0	0	Alewife Fall
41	10/9/2013	Fall	MNB-6	NB	American shad	0	0	American shad Fall
41	10/9/2013	Fall	MNB-6	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
41	10/9/2013	Fall	MNB-6	NB	Blueback herring	12	1.113943	Blueback herring Fall
41	10/9/2013	Fall	MNB-6	NB	Striped bass	0	0	Striped bass Fall
41	10/9/2013	Fall	MNB-2	NB	Alewife	0	0	Alewife Fall
41	10/9/2013	Fall	MNB-2	NB	American shad	0	0	American shad Fall
41	10/9/2013	Fall	MNB-2	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
41	10/9/2013	Fall	MNB-2	NB	Blueback herring	0	0	Blueback herring Fall
41	10/9/2013	Fall	MNB-2	NB	Striped bass	0	0	Striped bass Fall
41	10/9/2013	Fall	MNB-1	NB	Alewife	0	0	Alewife Fall
41	10/9/2013	Fall	MNB-1	NB	American shad	0	0	American shad Fall
41	10/9/2013	Fall	MNB-1	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
41	10/9/2013	Fall	MNB-1	NB	Blueback herring	0	0	Blueback herring Fall
41	10/9/2013	Fall	MNB-1	NB	Striped bass	0	0	Striped bass Fall
41	10/9/2013	Fall	MAK-1	AKKVK	Alewife	0	0	Alewife Fall
41	10/9/2013	Fall	MAK-1	AKKVK	American shad	0	0	American shad Fall
41	10/9/2013	Fall	MAK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
41	10/9/2013	Fall	MAK-1	AKKVK	Blueback herring	0	0	Blueback herring Fall
41	10/9/2013	Fall	MAK-1	AKKVK	Striped bass	0	0	Striped bass Fall
41	10/9/2013	Fall	MAK-2	AKKVK	Alewife	0	0	Alewife Fall
41	10/9/2013	Fall	MAK-2	AKKVK	American shad	0	0	American shad Fall
41	10/9/2013	Fall	MAK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
41	10/9/2013	Fall	MAK-2	AKKVK	Blueback herring	0	0	Blueback herring Fall
41	10/9/2013	Fall	MAK-2	AKKVK	Striped bass	0	0	Striped bass Fall
41	10/9/2013	Fall	MAK-3	AKKVK	Alewife	0	0	Alewife Fall
41	10/9/2013	Fall	MAK-3	AKKVK	American shad	0	0	American shad Fall
41	10/9/2013	Fall	MAK-3	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
41	10/9/2013	Fall	MAK-3	AKKVK	Blueback herring	0	0	Blueback herring Fall
41	10/9/2013	Fall	MAK-3	AKKVK	Striped bass	0	0	Striped bass Fall
41	10/9/2013	Fall	MAK-4	AKKVK	Alewife	0	0	Alewife Fall
41	10/9/2013	Fall	MAK-4	AKKVK	American	0	0	American

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
					shad			shad Fall
41	10/9/2013	Fall	MAK-4	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
41	10/9/2013	Fall	MAK-4	AKKVK	Blueback herring	0	0	Blueback herring Fall
41	10/9/2013	Fall	MAK-4	AKKVK	Striped bass	0	0	Striped bass Fall
42	10/15/2013	Fall	MUB-8	UB	Alewife	0	0	Alewife Fall
42	10/15/2013	Fall	MUB-8	UB	American shad	0	0	American shad Fall
42	10/15/2013	Fall	MUB-8	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
42	10/15/2013	Fall	MUB-8	UB	Blueback herring	0	0	Blueback herring Fall
42	10/15/2013	Fall	MUB-8	UB	Striped bass	0	0	Striped bass Fall
42	10/15/2013	Fall	MUB-9	UB	Alewife	0	0	Alewife Fall
42	10/15/2013	Fall	MUB-9	UB	American shad	0	0	American shad Fall
42	10/15/2013	Fall	MUB-9	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
42	10/15/2013	Fall	MUB-9	UB	Blueback herring	0	0	Blueback herring Fall
42	10/15/2013	Fall	MUB-9	UB	Striped bass	0	0	Striped bass Fall
42	10/15/2013	Fall	MUB-11	UB	Alewife	0	0	Alewife Fall
42	10/15/2013	Fall	MUB-11	UB	American shad	0	0	American shad Fall
42	10/15/2013	Fall	MUB-11	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
42	10/15/2013	Fall	MUB-11	UB	Blueback herring	1	0.30103	Blueback herring Fall
42	10/15/2013	Fall	MUB-11	UB	Striped bass	0	0	Striped bass Fall
42	10/15/2013	Fall	MUB-3	UB	Alewife	0	0	Alewife Fall
42	10/15/2013	Fall	MUB-3	UB	American shad	0	0	American shad Fall
42	10/15/2013	Fall	MUB-3	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
42	10/15/2013	Fall	MUB-3	UB	Blueback herring	0	0	Blueback herring Fall
42	10/15/2013	Fall	MUB-3	UB	Striped	0	0	Striped

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
					bass			bass Fall
42	10/15/2013	Fall	MUB-2	UB	Alewife	0	0	Alewife Fall
42	10/15/2013	Fall	MUB-2	UB	American shad	0	0	American shad Fall
42	10/15/2013	Fall	MUB-2	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
42	10/15/2013	Fall	MUB-2	UB	Blueback herring	0	0	Blueback herring Fall
42	10/15/2013	Fall	MUB-2	UB	Striped bass	0	0	Striped bass Fall
42	10/15/2013	Fall	MUB-1	UB	Alewife	0	0	Alewife Fall
42	10/15/2013	Fall	MUB-1	UB	American shad	0	0	American shad Fall
42	10/15/2013	Fall	MUB-1	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
42	10/15/2013	Fall	MUB-1	UB	Blueback herring	0	0	Blueback herring Fall
42	10/15/2013	Fall	MUB-1	UB	Striped bass	0	0	Striped bass Fall
42	10/15/2013	Fall	MLB-6	LB	Alewife	0	0	Alewife Fall
42	10/15/2013	Fall	MLB-6	LB	American shad	0	0	American shad Fall
42	10/15/2013	Fall	MLB-6	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
42	10/15/2013	Fall	MLB-6	LB	Blueback herring	0	0	Blueback herring Fall
42	10/15/2013	Fall	MLB-6	LB	Striped bass	0	0	Striped bass Fall
42	10/15/2013	Fall	MLB-5	LB	Alewife	0	0	Alewife Fall
42	10/15/2013	Fall	MLB-5	LB	American shad	0	0	American shad Fall
42	10/15/2013	Fall	MLB-5	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
42	10/15/2013	Fall	MLB-5	LB	Blueback herring	0	0	Blueback herring Fall
42	10/15/2013	Fall	MLB-5	LB	Striped bass	0	0	Striped bass Fall
42	10/15/2013	Fall	MLB-3	LB	Alewife	0	0	Alewife Fall
42	10/15/2013	Fall	MLB-3	LB	American shad	0	0	American shad Fall
42	10/15/2013	Fall	MLB-3	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping for MFS Report	Common Name	CPUE - 10min	Log(CPUE+1)	Species/Season
42	10/15/2013	Fall	MLB-3	LB	Blueback herring	0	0	Blueback herring Fall
42	10/15/2013	Fall	MLB-3	LB	Striped bass	0	0	Striped bass Fall
42	10/15/2013	Fall	MLB-4	LB	Alewife	0	0	Alewife Fall
42	10/15/2013	Fall	MLB-4	LB	American shad	0	0	American shad Fall
42	10/15/2013	Fall	MLB-4	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
42	10/15/2013	Fall	MLB-4	LB	Blueback herring	0	0	Blueback herring Fall
42	10/15/2013	Fall	MLB-4	LB	Striped bass	0	0	Striped bass Fall
42	10/16/2013	Fall	MKK-1	AKKVK	Alewife	0	0	Alewife Fall
42	10/16/2013	Fall	MKK-1	AKKVK	American shad	0	0	American shad Fall
42	10/16/2013	Fall	MKK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
42	10/16/2013	Fall	MKK-1	AKKVK	Blueback herring	0	0	Blueback herring Fall
42	10/16/2013	Fall	MKK-1	AKKVK	Striped bass	0	0	Striped bass Fall
42	10/16/2013	Fall	MKK-2	AKKVK	Alewife	0	0	Alewife Fall
42	10/16/2013	Fall	MKK-2	AKKVK	American shad	0	0	American shad Fall
42	10/16/2013	Fall	MKK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
42	10/16/2013	Fall	MKK-2	AKKVK	Blueback herring	0	0	Blueback herring Fall
42	10/16/2013	Fall	MKK-2	AKKVK	Striped bass	0	0	Striped bass Fall
42	10/16/2013	Fall	MNB-1	NB	Alewife	0	0	Alewife Fall
42	10/16/2013	Fall	MNB-1	NB	American shad	0	0	American shad Fall
42	10/16/2013	Fall	MNB-1	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
42	10/16/2013	Fall	MNB-1	NB	Blueback herring	0	0	Blueback herring Fall
42	10/16/2013	Fall	MNB-1	NB	Striped bass	0	0	Striped bass Fall
42	10/16/2013	Fall	MNB-2	NB	Alewife	0	0	Alewife Fall
42	10/16/2013	Fall	MNB-2	NB	American	0	0	American

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping for MFS Report	Common Name	CPUE - 10min	Log(CPUE+1)	Species/Season
					shad			shad Fall
42	10/16/2013	Fall	MNB-2	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
42	10/16/2013	Fall	MNB-2	NB	Blueback herring	0	0	Blueback herring Fall
42	10/16/2013	Fall	MNB-2	NB	Striped bass	0	0	Striped bass Fall
42	10/16/2013	Fall	MNB-6	NB	Alewife	0	0	Alewife Fall
42	10/16/2013	Fall	MNB-6	NB	American shad	0	0	American shad Fall
42	10/16/2013	Fall	MNB-6	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
42	10/16/2013	Fall	MNB-6	NB	Blueback herring	265	2.424882	Blueback herring Fall
42	10/16/2013	Fall	MNB-6	NB	Striped bass	0	0	Striped bass Fall
42	10/16/2013	Fall	MNB-5	NB	Alewife	0	0	Alewife Fall
42	10/16/2013	Fall	MNB-5	NB	American shad	0	0	American shad Fall
42	10/16/2013	Fall	MNB-5	NB	Atlantic menhaden	1	0.30103	Atlantic menhaden Fall
42	10/16/2013	Fall	MNB-5	NB	Blueback herring	5	0.778151	Blueback herring Fall
42	10/16/2013	Fall	MNB-5	NB	Striped bass	0	0	Striped bass Fall
42	10/16/2013	Fall	MAK-1	AKKVK	Alewife	0	0	Alewife Fall
42	10/16/2013	Fall	MAK-1	AKKVK	American shad	0	0	American shad Fall
42	10/16/2013	Fall	MAK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
42	10/16/2013	Fall	MAK-1	AKKVK	Blueback herring	0	0	Blueback herring Fall
42	10/16/2013	Fall	MAK-1	AKKVK	Striped bass	0	0	Striped bass Fall
42	10/16/2013	Fall	MAK-4	AKKVK	Alewife	0	0	Alewife Fall
42	10/16/2013	Fall	MAK-4	AKKVK	American shad	0	0	American shad Fall
42	10/16/2013	Fall	MAK-4	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
42	10/16/2013	Fall	MAK-4	AKKVK	Blueback herring	0	0	Blueback herring Fall
42	10/16/2013	Fall	MAK-4	AKKVK	Striped	0	0	Striped

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
					bass			bass Fall
42	10/16/2013	Fall	MAK-3	AKKVK	Alewife	0	0	Alewife Fall
42	10/16/2013	Fall	MAK-3	AKKVK	American shad	0	0	American shad Fall
42	10/16/2013	Fall	MAK-3	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
42	10/16/2013	Fall	MAK-3	AKKVK	Blueback herring	0	0	Blueback herring Fall
42	10/16/2013	Fall	MAK-3	AKKVK	Striped bass	0	0	Striped bass Fall
42	10/16/2013	Fall	MAK-2	AKKVK	Alewife	0	0	Alewife Fall
42	10/16/2013	Fall	MAK-2	AKKVK	American shad	0	0	American shad Fall
42	10/16/2013	Fall	MAK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
42	10/16/2013	Fall	MAK-2	AKKVK	Blueback herring	0	0	Blueback herring Fall
42	10/16/2013	Fall	MAK-2	AKKVK	Striped bass	0	0	Striped bass Fall
43	10/21/2013	Fall	MUB-9	UB	Alewife	0	0	Alewife Fall
43	10/21/2013	Fall	MUB-9	UB	American shad	2	0.477121	American shad Fall
43	10/21/2013	Fall	MUB-9	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
43	10/21/2013	Fall	MUB-9	UB	Blueback herring	0	0	Blueback herring Fall
43	10/21/2013	Fall	MUB-9	UB	Striped bass	0	0	Striped bass Fall
43	10/21/2013	Fall	MUB-8	UB	Alewife	0	0	Alewife Fall
43	10/21/2013	Fall	MUB-8	UB	American shad	0	0	American shad Fall
43	10/21/2013	Fall	MUB-8	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
43	10/21/2013	Fall	MUB-8	UB	Blueback herring	0	0	Blueback herring Fall
43	10/21/2013	Fall	MUB-8	UB	Striped bass	0	0	Striped bass Fall
43	10/21/2013	Fall	MUB-11	UB	Alewife	0	0	Alewife Fall
43	10/21/2013	Fall	MUB-11	UB	American shad	0	0	American shad Fall
43	10/21/2013	Fall	MUB-11	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
43	10/21/2013	Fall	MUB-11	UB	Blueback herring	0	0	Blueback herring Fall
43	10/21/2013	Fall	MUB-11	UB	Striped bass	0	0	Striped bass Fall
43	10/21/2013	Fall	MUB-3	UB	Alewife	0	0	Alewife Fall
43	10/21/2013	Fall	MUB-3	UB	American shad	0	0	American shad Fall
43	10/21/2013	Fall	MUB-3	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
43	10/21/2013	Fall	MUB-3	UB	Blueback herring	0	0	Blueback herring Fall
43	10/21/2013	Fall	MUB-3	UB	Striped bass	0	0	Striped bass Fall
43	10/21/2013	Fall	MUB-2	UB	Alewife	0	0	Alewife Fall
43	10/21/2013	Fall	MUB-2	UB	American shad	0	0	American shad Fall
43	10/21/2013	Fall	MUB-2	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
43	10/21/2013	Fall	MUB-2	UB	Blueback herring	0	0	Blueback herring Fall
43	10/21/2013	Fall	MUB-2	UB	Striped bass	0	0	Striped bass Fall
43	10/21/2013	Fall	MUB-1	UB	Alewife	0	0	Alewife Fall
43	10/21/2013	Fall	MUB-1	UB	American shad	0	0	American shad Fall
43	10/21/2013	Fall	MUB-1	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
43	10/21/2013	Fall	MUB-1	UB	Blueback herring	0	0	Blueback herring Fall
43	10/21/2013	Fall	MUB-1	UB	Striped bass	0	0	Striped bass Fall
43	10/21/2013	Fall	MLB-6	LB	Alewife	0	0	Alewife Fall
43	10/21/2013	Fall	MLB-6	LB	American shad	0	0	American shad Fall
43	10/21/2013	Fall	MLB-6	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
43	10/21/2013	Fall	MLB-6	LB	Blueback herring	0	0	Blueback herring Fall
43	10/21/2013	Fall	MLB-6	LB	Striped bass	0	0	Striped bass Fall
43	10/21/2013	Fall	MLB-5	LB	Alewife	0	0	Alewife Fall
43	10/21/2013	Fall	MLB-5	LB	American	0	0	American

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
					shad			shad Fall
43	10/21/2013	Fall	MLB-5	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
43	10/21/2013	Fall	MLB-5	LB	Blueback herring	0	0	Blueback herring Fall
43	10/21/2013	Fall	MLB-5	LB	Striped bass	0	0	Striped bass Fall
43	10/21/2013	Fall	MLB-3	LB	Alewife	0	0	Alewife Fall
43	10/21/2013	Fall	MLB-3	LB	American shad	0	0	American shad Fall
43	10/21/2013	Fall	MLB-3	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
43	10/21/2013	Fall	MLB-3	LB	Blueback herring	0	0	Blueback herring Fall
43	10/21/2013	Fall	MLB-3	LB	Striped bass	0	0	Striped bass Fall
43	10/21/2013	Fall	MLB-4	LB	Alewife	0	0	Alewife Fall
43	10/21/2013	Fall	MLB-4	LB	American shad	0	0	American shad Fall
43	10/21/2013	Fall	MLB-4	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
43	10/21/2013	Fall	MLB-4	LB	Blueback herring	0	0	Blueback herring Fall
43	10/21/2013	Fall	MLB-4	LB	Striped bass	0	0	Striped bass Fall
43	10/21/2013	Fall	MKK-1	AKKVK	Alewife	0	0	Alewife Fall
43	10/21/2013	Fall	MKK-1	AKKVK	American shad	0	0	American shad Fall
43	10/21/2013	Fall	MKK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
43	10/21/2013	Fall	MKK-1	AKKVK	Blueback herring	0	0	Blueback herring Fall
43	10/21/2013	Fall	MKK-1	AKKVK	Striped bass	0	0	Striped bass Fall
43	10/22/2013	Fall	MKK-2	AKKVK	Alewife	0	0	Alewife Fall
43	10/22/2013	Fall	MKK-2	AKKVK	American shad	0	0	American shad Fall
43	10/22/2013	Fall	MKK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
43	10/22/2013	Fall	MKK-2	AKKVK	Blueback herring	0	0	Blueback herring Fall
43	10/22/2013	Fall	MKK-2	AKKVK	Striped	0	0	Striped

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping for MFS Report	Common Name	CPUE - 10min	Log(CPUE+1)	Species/Season
					bass			bass Fall
43	10/22/2013	Fall	MAK-1	AKKVK	Alewife	0	0	Alewife Fall
43	10/22/2013	Fall	MAK-1	AKKVK	American shad	0	0	American shad Fall
43	10/22/2013	Fall	MAK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
43	10/22/2013	Fall	MAK-1	AKKVK	Blueback herring	0	0	Blueback herring Fall
43	10/22/2013	Fall	MAK-1	AKKVK	Striped bass	0	0	Striped bass Fall
43	10/22/2013	Fall	MAK-2	AKKVK	Alewife	0	0	Alewife Fall
43	10/22/2013	Fall	MAK-2	AKKVK	American shad	0	0	American shad Fall
43	10/22/2013	Fall	MAK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
43	10/22/2013	Fall	MAK-2	AKKVK	Blueback herring	0	0	Blueback herring Fall
43	10/22/2013	Fall	MAK-2	AKKVK	Striped bass	0	0	Striped bass Fall
43	10/22/2013	Fall	MAK-3	AKKVK	Alewife	0	0	Alewife Fall
43	10/22/2013	Fall	MAK-3	AKKVK	American shad	0	0	American shad Fall
43	10/22/2013	Fall	MAK-3	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
43	10/22/2013	Fall	MAK-3	AKKVK	Blueback herring	0	0	Blueback herring Fall
43	10/22/2013	Fall	MAK-3	AKKVK	Striped bass	0	0	Striped bass Fall
43	10/22/2013	Fall	MAK-4	AKKVK	Alewife	0	0	Alewife Fall
43	10/22/2013	Fall	MAK-4	AKKVK	American shad	0	0	American shad Fall
43	10/22/2013	Fall	MAK-4	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
43	10/22/2013	Fall	MAK-4	AKKVK	Blueback herring	0	0	Blueback herring Fall
43	10/22/2013	Fall	MAK-4	AKKVK	Striped bass	0	0	Striped bass Fall
43	10/22/2013	Fall	MNB-5	NB	Alewife	0	0	Alewife Fall
43	10/22/2013	Fall	MNB-5	NB	American shad	0	0	American shad Fall
43	10/22/2013	Fall	MNB-5	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
43	10/22/2013	Fall	MNB-5	NB	Blueback herring	0	0	Blueback herring Fall
43	10/22/2013	Fall	MNB-5	NB	Striped bass	0	0	Striped bass Fall
43	10/22/2013	Fall	MNB-6	NB	Alewife	0	0	Alewife Fall
43	10/22/2013	Fall	MNB-6	NB	American shad	0	0	American shad Fall
43	10/22/2013	Fall	MNB-6	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
43	10/22/2013	Fall	MNB-6	NB	Blueback herring	0	0	Blueback herring Fall
43	10/22/2013	Fall	MNB-6	NB	Striped bass	0	0	Striped bass Fall
43	10/22/2013	Fall	MNB-2	NB	Alewife	0	0	Alewife Fall
43	10/22/2013	Fall	MNB-2	NB	American shad	0	0	American shad Fall
43	10/22/2013	Fall	MNB-2	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
43	10/22/2013	Fall	MNB-2	NB	Blueback herring	0	0	Blueback herring Fall
43	10/22/2013	Fall	MNB-2	NB	Striped bass	0	0	Striped bass Fall
43	10/22/2013	Fall	MNB-1	NB	Alewife	0	0	Alewife Fall
43	10/22/2013	Fall	MNB-1	NB	American shad	0	0	American shad Fall
43	10/22/2013	Fall	MNB-1	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
43	10/22/2013	Fall	MNB-1	NB	Blueback herring	0	0	Blueback herring Fall
43	10/22/2013	Fall	MNB-1	NB	Striped bass	0	0	Striped bass Fall
44	10/29/2013	Fall	MUB-8	UB	Alewife	0	0	Alewife Fall
44	10/29/2013	Fall	MUB-8	UB	American shad	0	0	American shad Fall
44	10/29/2013	Fall	MUB-8	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
44	10/29/2013	Fall	MUB-8	UB	Blueback herring	0	0	Blueback herring Fall
44	10/29/2013	Fall	MUB-8	UB	Striped bass	0	0	Striped bass Fall
44	10/29/2013	Fall	MUB-9	UB	Alewife	0	0	Alewife Fall
44	10/29/2013	Fall	MUB-9	UB	American	0	0	American

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
					shad			shad Fall
44	10/29/2013	Fall	MUB-9	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
44	10/29/2013	Fall	MUB-9	UB	Blueback herring	0	0	Blueback herring Fall
44	10/29/2013	Fall	MUB-9	UB	Striped bass	0	0	Striped bass Fall
44	10/29/2013	Fall	MUB-11	UB	Alewife	0	0	Alewife Fall
44	10/29/2013	Fall	MUB-11	UB	American shad	0	0	American shad Fall
44	10/29/2013	Fall	MUB-11	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
44	10/29/2013	Fall	MUB-11	UB	Blueback herring	0	0	Blueback herring Fall
44	10/29/2013	Fall	MUB-11	UB	Striped bass	0	0	Striped bass Fall
44	10/29/2013	Fall	MUB-3	UB	Alewife	0	0	Alewife Fall
44	10/29/2013	Fall	MUB-3	UB	American shad	0	0	American shad Fall
44	10/29/2013	Fall	MUB-3	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
44	10/29/2013	Fall	MUB-3	UB	Blueback herring	0	0	Blueback herring Fall
44	10/29/2013	Fall	MUB-3	UB	Striped bass	0	0	Striped bass Fall
44	10/29/2013	Fall	MUB-2	UB	Alewife	0	0	Alewife Fall
44	10/29/2013	Fall	MUB-2	UB	American shad	0	0	American shad Fall
44	10/29/2013	Fall	MUB-2	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
44	10/29/2013	Fall	MUB-2	UB	Blueback herring	0	0	Blueback herring Fall
44	10/29/2013	Fall	MUB-2	UB	Striped bass	0	0	Striped bass Fall
44	10/29/2013	Fall	MUB-1	UB	Alewife	0	0	Alewife Fall
44	10/29/2013	Fall	MUB-1	UB	American shad	0	0	American shad Fall
44	10/29/2013	Fall	MUB-1	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
44	10/29/2013	Fall	MUB-1	UB	Blueback herring	0	0	Blueback herring Fall
44	10/29/2013	Fall	MUB-1	UB	Striped	0	0	Striped

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping for MFS Report	Common Name	CPUE - 10min	Log(CPUE+1)	Species/Season
					bass			bass Fall
44	10/29/2013	Fall	MLB-6	LB	Alewife	0	0	Alewife Fall
44	10/29/2013	Fall	MLB-6	LB	American shad	0	0	American shad Fall
44	10/29/2013	Fall	MLB-6	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
44	10/29/2013	Fall	MLB-6	LB	Blueback herring	0	0	Blueback herring Fall
44	10/29/2013	Fall	MLB-6	LB	Striped bass	0	0	Striped bass Fall
44	10/29/2013	Fall	MLB-5	LB	Alewife	0	0	Alewife Fall
44	10/29/2013	Fall	MLB-5	LB	American shad	0	0	American shad Fall
44	10/29/2013	Fall	MLB-5	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
44	10/29/2013	Fall	MLB-5	LB	Blueback herring	0	0	Blueback herring Fall
44	10/29/2013	Fall	MLB-5	LB	Striped bass	0	0	Striped bass Fall
44	10/29/2013	Fall	MLB-3	LB	Alewife	0	0	Alewife Fall
44	10/29/2013	Fall	MLB-3	LB	American shad	0	0	American shad Fall
44	10/29/2013	Fall	MLB-3	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
44	10/29/2013	Fall	MLB-3	LB	Blueback herring	0	0	Blueback herring Fall
44	10/29/2013	Fall	MLB-3	LB	Striped bass	0	0	Striped bass Fall
44	10/29/2013	Fall	MLB-4	LB	Alewife	0	0	Alewife Fall
44	10/29/2013	Fall	MLB-4	LB	American shad	0	0	American shad Fall
44	10/29/2013	Fall	MLB-4	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
44	10/29/2013	Fall	MLB-4	LB	Blueback herring	0	0	Blueback herring Fall
44	10/29/2013	Fall	MLB-4	LB	Striped bass	0	0	Striped bass Fall
44	10/29/2013	Fall	MKK-1	AKKVK	Alewife	0	0	Alewife Fall
44	10/29/2013	Fall	MKK-1	AKKVK	American shad	0	0	American shad Fall
44	10/29/2013	Fall	MKK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
44	10/29/2013	Fall	MKK-1	AKKVK	Blueback herring	0	0	Blueback herring Fall
44	10/29/2013	Fall	MKK-1	AKKVK	Striped bass	0	0	Striped bass Fall
44	10/30/2013	Fall	MKK-2	AKKVK	Alewife	0	0	Alewife Fall
44	10/30/2013	Fall	MKK-2	AKKVK	American shad	0	0	American shad Fall
44	10/30/2013	Fall	MKK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
44	10/30/2013	Fall	MKK-2	AKKVK	Blueback herring	0	0	Blueback herring Fall
44	10/30/2013	Fall	MKK-2	AKKVK	Striped bass	0	0	Striped bass Fall
44	10/30/2013	Fall	MNB-1	NB	Alewife	0	0	Alewife Fall
44	10/30/2013	Fall	MNB-1	NB	American shad	0	0	American shad Fall
44	10/30/2013	Fall	MNB-1	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
44	10/30/2013	Fall	MNB-1	NB	Blueback herring	0	0	Blueback herring Fall
44	10/30/2013	Fall	MNB-1	NB	Striped bass	0	0	Striped bass Fall
44	10/30/2013	Fall	MNB-2	NB	Alewife	0	0	Alewife Fall
44	10/30/2013	Fall	MNB-2	NB	American shad	0	0	American shad Fall
44	10/30/2013	Fall	MNB-2	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
44	10/30/2013	Fall	MNB-2	NB	Blueback herring	0	0	Blueback herring Fall
44	10/30/2013	Fall	MNB-2	NB	Striped bass	0	0	Striped bass Fall
44	10/30/2013	Fall	MNB-5	NB	Alewife	0	0	Alewife Fall
44	10/30/2013	Fall	MNB-5	NB	American shad	0	0	American shad Fall
44	10/30/2013	Fall	MNB-5	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
44	10/30/2013	Fall	MNB-5	NB	Blueback herring	0	0	Blueback herring Fall
44	10/30/2013	Fall	MNB-5	NB	Striped bass	0	0	Striped bass Fall
44	10/30/2013	Fall	MNB-6	NB	Alewife	0	0	Alewife Fall
44	10/30/2013	Fall	MNB-6	NB	American	0	0	American

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
					shad			shad Fall
44	10/30/2013	Fall	MNB-6	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
44	10/30/2013	Fall	MNB-6	NB	Blueback herring	1111	3.046105	Blueback herring Fall
44	10/30/2013	Fall	MNB-6	NB	Striped bass	0	0	Striped bass Fall
44	10/30/2013	Fall	MAK-1	AKKVK	Alewife	0	0	Alewife Fall
44	10/30/2013	Fall	MAK-1	AKKVK	American shad	0	0	American shad Fall
44	10/30/2013	Fall	MAK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
44	10/30/2013	Fall	MAK-1	AKKVK	Blueback herring	0	0	Blueback herring Fall
44	10/30/2013	Fall	MAK-1	AKKVK	Striped bass	0	0	Striped bass Fall
44	10/30/2013	Fall	MAK-4	AKKVK	Alewife	0	0	Alewife Fall
44	10/30/2013	Fall	MAK-4	AKKVK	American shad	0	0	American shad Fall
44	10/30/2013	Fall	MAK-4	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
44	10/30/2013	Fall	MAK-4	AKKVK	Blueback herring	0	0	Blueback herring Fall
44	10/30/2013	Fall	MAK-4	AKKVK	Striped bass	0	0	Striped bass Fall
44	10/30/2013	Fall	MAK-3	AKKVK	Alewife	0	0	Alewife Fall
44	10/30/2013	Fall	MAK-3	AKKVK	American shad	0	0	American shad Fall
44	10/30/2013	Fall	MAK-3	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
44	10/30/2013	Fall	MAK-3	AKKVK	Blueback herring	0	0	Blueback herring Fall
44	10/30/2013	Fall	MAK-3	AKKVK	Striped bass	0	0	Striped bass Fall
44	10/30/2013	Fall	MAK-2	AKKVK	Alewife	0	0	Alewife Fall
44	10/30/2013	Fall	MAK-2	AKKVK	American shad	0	0	American shad Fall
44	10/30/2013	Fall	MAK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
44	10/30/2013	Fall	MAK-2	AKKVK	Blueback herring	0	0	Blueback herring Fall
44	10/30/2013	Fall	MAK-2	AKKVK	Striped	0	0	Striped

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
					bass			bass Fall
45	11/5/2013	Fall	MUB-9	UB	Alewife	0	0	Alewife Fall
45	11/5/2013	Fall	MUB-9	UB	American shad	0	0	American shad Fall
45	11/5/2013	Fall	MUB-9	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
45	11/5/2013	Fall	MUB-9	UB	Blueback herring	1	0.30103	Blueback herring Fall
45	11/5/2013	Fall	MUB-9	UB	Striped bass	0	0	Striped bass Fall
45	11/5/2013	Fall	MUB-8	UB	Alewife	0	0	Alewife Fall
45	11/5/2013	Fall	MUB-8	UB	American shad	0	0	American shad Fall
45	11/5/2013	Fall	MUB-8	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
45	11/5/2013	Fall	MUB-8	UB	Blueback herring	0	0	Blueback herring Fall
45	11/5/2013	Fall	MUB-8	UB	Striped bass	0	0	Striped bass Fall
45	11/5/2013	Fall	MUB-11	UB	Alewife	0	0	Alewife Fall
45	11/5/2013	Fall	MUB-11	UB	American shad	2	0.477121	American shad Fall
45	11/5/2013	Fall	MUB-11	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
45	11/5/2013	Fall	MUB-11	UB	Blueback herring	0	0	Blueback herring Fall
45	11/5/2013	Fall	MUB-11	UB	Striped bass	0	0	Striped bass Fall
45	11/5/2013	Fall	MUB-3	UB	Alewife	0	0	Alewife Fall
45	11/5/2013	Fall	MUB-3	UB	American shad	0	0	American shad Fall
45	11/5/2013	Fall	MUB-3	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
45	11/5/2013	Fall	MUB-3	UB	Blueback herring	0	0	Blueback herring Fall
45	11/5/2013	Fall	MUB-3	UB	Striped bass	0	0	Striped bass Fall
45	11/5/2013	Fall	MUB-2	UB	Alewife	0	0	Alewife Fall
45	11/5/2013	Fall	MUB-2	UB	American shad	0	0	American shad Fall
45	11/5/2013	Fall	MUB-2	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
45	11/5/2013	Fall	MUB-2	UB	Blueback herring	0	0	Blueback herring Fall
45	11/5/2013	Fall	MUB-2	UB	Striped bass	0	0	Striped bass Fall
45	11/5/2013	Fall	MUB-1	UB	Alewife	0	0	Alewife Fall
45	11/5/2013	Fall	MUB-1	UB	American shad	0	0	American shad Fall
45	11/5/2013	Fall	MUB-1	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
45	11/5/2013	Fall	MUB-1	UB	Blueback herring	0	0	Blueback herring Fall
45	11/5/2013	Fall	MUB-1	UB	Striped bass	0	0	Striped bass Fall
45	11/5/2013	Fall	MLB-6	LB	Alewife	0	0	Alewife Fall
45	11/5/2013	Fall	MLB-6	LB	American shad	0	0	American shad Fall
45	11/5/2013	Fall	MLB-6	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
45	11/5/2013	Fall	MLB-6	LB	Blueback herring	0	0	Blueback herring Fall
45	11/5/2013	Fall	MLB-6	LB	Striped bass	0	0	Striped bass Fall
45	11/5/2013	Fall	MLB-5	LB	Alewife	0	0	Alewife Fall
45	11/5/2013	Fall	MLB-5	LB	American shad	0	0	American shad Fall
45	11/5/2013	Fall	MLB-5	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
45	11/5/2013	Fall	MLB-5	LB	Blueback herring	0	0	Blueback herring Fall
45	11/5/2013	Fall	MLB-5	LB	Striped bass	0	0	Striped bass Fall
45	11/5/2013	Fall	MLB-3	LB	Alewife	0	0	Alewife Fall
45	11/5/2013	Fall	MLB-3	LB	American shad	0	0	American shad Fall
45	11/5/2013	Fall	MLB-3	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
45	11/5/2013	Fall	MLB-3	LB	Blueback herring	0	0	Blueback herring Fall
45	11/5/2013	Fall	MLB-3	LB	Striped bass	0	0	Striped bass Fall
45	11/5/2013	Fall	MLB-4	LB	Alewife	0	0	Alewife Fall
45	11/5/2013	Fall	MLB-4	LB	American	0	0	American

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
					shad			shad Fall
45	11/5/2013	Fall	MLB-4	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
45	11/5/2013	Fall	MLB-4	LB	Blueback herring	0	0	Blueback herring Fall
45	11/5/2013	Fall	MLB-4	LB	Striped bass	0	0	Striped bass Fall
45	11/5/2013	Fall	MKK-1	AKKVK	Alewife	0	0	Alewife Fall
45	11/5/2013	Fall	MKK-1	AKKVK	American shad	0	0	American shad Fall
45	11/5/2013	Fall	MKK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
45	11/5/2013	Fall	MKK-1	AKKVK	Blueback herring	0	0	Blueback herring Fall
45	11/5/2013	Fall	MKK-1	AKKVK	Striped bass	0	0	Striped bass Fall
45	11/6/2013	Fall	MAK-1	AKKVK	Alewife	0	0	Alewife Fall
45	11/6/2013	Fall	MAK-1	AKKVK	American shad	0	0	American shad Fall
45	11/6/2013	Fall	MAK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
45	11/6/2013	Fall	MAK-1	AKKVK	Blueback herring	1	0.30103	Blueback herring Fall
45	11/6/2013	Fall	MAK-1	AKKVK	Striped bass	0	0	Striped bass Fall
45	11/6/2013	Fall	MAK-2	AKKVK	Alewife	0	0	Alewife Fall
45	11/6/2013	Fall	MAK-2	AKKVK	American shad	0	0	American shad Fall
45	11/6/2013	Fall	MAK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
45	11/6/2013	Fall	MAK-2	AKKVK	Blueback herring	0	0	Blueback herring Fall
45	11/6/2013	Fall	MAK-2	AKKVK	Striped bass	0	0	Striped bass Fall
45	11/6/2013	Fall	MAK-3	AKKVK	Alewife	0	0	Alewife Fall
45	11/6/2013	Fall	MAK-3	AKKVK	American shad	0	0	American shad Fall
45	11/6/2013	Fall	MAK-3	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
45	11/6/2013	Fall	MAK-3	AKKVK	Blueback herring	0	0	Blueback herring Fall
45	11/6/2013	Fall	MAK-3	AKKVK	Striped	0	0	Striped

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
					bass			bass Fall
45	11/6/2013	Fall	MAK-4	AKKVK	Alewife	0	0	Alewife Fall
45	11/6/2013	Fall	MAK-4	AKKVK	American shad	0	0	American shad Fall
45	11/6/2013	Fall	MAK-4	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
45	11/6/2013	Fall	MAK-4	AKKVK	Blueback herring	0	0	Blueback herring Fall
45	11/6/2013	Fall	MAK-4	AKKVK	Striped bass	0	0	Striped bass Fall
45	11/6/2013	Fall	MKK-2	AKKVK	Alewife	0	0	Alewife Fall
45	11/6/2013	Fall	MKK-2	AKKVK	American shad	0	0	American shad Fall
45	11/6/2013	Fall	MKK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
45	11/6/2013	Fall	MKK-2	AKKVK	Blueback herring	0	0	Blueback herring Fall
45	11/6/2013	Fall	MKK-2	AKKVK	Striped bass	0	0	Striped bass Fall
45	11/6/2013	Fall	MNB-1	NB	Alewife	0	0	Alewife Fall
45	11/6/2013	Fall	MNB-1	NB	American shad	0	0	American shad Fall
45	11/6/2013	Fall	MNB-1	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
45	11/6/2013	Fall	MNB-1	NB	Blueback herring	0	0	Blueback herring Fall
45	11/6/2013	Fall	MNB-1	NB	Striped bass	0	0	Striped bass Fall
45	11/6/2013	Fall	MNB-2	NB	Alewife	0	0	Alewife Fall
45	11/6/2013	Fall	MNB-2	NB	American shad	0	0	American shad Fall
45	11/6/2013	Fall	MNB-2	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
45	11/6/2013	Fall	MNB-2	NB	Blueback herring	0	0	Blueback herring Fall
45	11/6/2013	Fall	MNB-2	NB	Striped bass	0	0	Striped bass Fall
45	11/6/2013	Fall	MNB-6	NB	Alewife	0	0	Alewife Fall
45	11/6/2013	Fall	MNB-6	NB	American shad	0	0	American shad Fall
45	11/6/2013	Fall	MNB-6	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
45	11/6/2013	Fall	MNB-6	NB	Blueback herring	0	0	Blueback herring Fall
45	11/6/2013	Fall	MNB-6	NB	Striped bass	0	0	Striped bass Fall
45	11/6/2013	Fall	MNB-5	NB	Alewife	0	0	Alewife Fall
45	11/6/2013	Fall	MNB-5	NB	American shad	0	0	American shad Fall
45	11/6/2013	Fall	MNB-5	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
45	11/6/2013	Fall	MNB-5	NB	Blueback herring	0	0	Blueback herring Fall
45	11/6/2013	Fall	MNB-5	NB	Striped bass	0	0	Striped bass Fall
46	11/12/2013	Fall	MKK-1	AKKVK	Alewife	0	0	Alewife Fall
46	11/12/2013	Fall	MKK-1	AKKVK	American shad	0	0	American shad Fall
46	11/12/2013	Fall	MKK-1	AKKVK	Atlantic menhaden	1	0.30103	Atlantic menhaden Fall
46	11/12/2013	Fall	MKK-1	AKKVK	Blueback herring	0	0	Blueback herring Fall
46	11/12/2013	Fall	MKK-1	AKKVK	Striped bass	0	0	Striped bass Fall
46	11/12/2013	Fall	MKK-2	AKKVK	Alewife	0	0	Alewife Fall
46	11/12/2013	Fall	MKK-2	AKKVK	American shad	0	0	American shad Fall
46	11/12/2013	Fall	MKK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
46	11/12/2013	Fall	MKK-2	AKKVK	Blueback herring	0	0	Blueback herring Fall
46	11/12/2013	Fall	MKK-2	AKKVK	Striped bass	0	0	Striped bass Fall
46	11/12/2013	Fall	MNB-1	NB	Alewife	0	0	Alewife Fall
46	11/12/2013	Fall	MNB-1	NB	American shad	0	0	American shad Fall
46	11/12/2013	Fall	MNB-1	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
46	11/12/2013	Fall	MNB-1	NB	Blueback herring	0	0	Blueback herring Fall
46	11/12/2013	Fall	MNB-1	NB	Striped bass	0	0	Striped bass Fall
46	11/12/2013	Fall	MNB-2	NB	Alewife	0	0	Alewife Fall
46	11/12/2013	Fall	MNB-2	NB	American	0	0	American

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
					shad			shad Fall
46	11/12/2013	Fall	MNB-2	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
46	11/12/2013	Fall	MNB-2	NB	Blueback herring	0	0	Blueback herring Fall
46	11/12/2013	Fall	MNB-2	NB	Striped bass	0	0	Striped bass Fall
46	11/12/2013	Fall	MNB-5	NB	Alewife	0	0	Alewife Fall
46	11/12/2013	Fall	MNB-5	NB	American shad	0	0	American shad Fall
46	11/12/2013	Fall	MNB-5	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
46	11/12/2013	Fall	MNB-5	NB	Blueback herring	0	0	Blueback herring Fall
46	11/12/2013	Fall	MNB-5	NB	Striped bass	0	0	Striped bass Fall
46	11/12/2013	Fall	MNB-6	NB	Alewife	0	0	Alewife Fall
46	11/12/2013	Fall	MNB-6	NB	American shad	0	0	American shad Fall
46	11/12/2013	Fall	MNB-6	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
46	11/12/2013	Fall	MNB-6	NB	Blueback herring	0	0	Blueback herring Fall
46	11/12/2013	Fall	MNB-6	NB	Striped bass	0	0	Striped bass Fall
46	11/12/2013	Fall	MAK-2	AKKVK	Alewife	0	0	Alewife Fall
46	11/12/2013	Fall	MAK-2	AKKVK	American shad	0	0	American shad Fall
46	11/12/2013	Fall	MAK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
46	11/12/2013	Fall	MAK-2	AKKVK	Blueback herring	0	0	Blueback herring Fall
46	11/12/2013	Fall	MAK-2	AKKVK	Striped bass	0	0	Striped bass Fall
46	11/12/2013	Fall	MAK-3	AKKVK	Alewife	0	0	Alewife Fall
46	11/12/2013	Fall	MAK-3	AKKVK	American shad	0	0	American shad Fall
46	11/12/2013	Fall	MAK-3	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
46	11/12/2013	Fall	MAK-3	AKKVK	Blueback herring	0	0	Blueback herring Fall
46	11/12/2013	Fall	MAK-3	AKKVK	Striped	0	0	Striped

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
					bass			bass Fall
46	11/12/2013	Fall	MAK-4	AKKVK	Alewife	0	0	Alewife Fall
46	11/12/2013	Fall	MAK-4	AKKVK	American shad	0	0	American shad Fall
46	11/12/2013	Fall	MAK-4	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
46	11/12/2013	Fall	MAK-4	AKKVK	Blueback herring	0	0	Blueback herring Fall
46	11/12/2013	Fall	MAK-4	AKKVK	Striped bass	0	0	Striped bass Fall
46	11/12/2013	Fall	MAK-1	AKKVK	Alewife	0	0	Alewife Fall
46	11/12/2013	Fall	MAK-1	AKKVK	American shad	0	0	American shad Fall
46	11/12/2013	Fall	MAK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
46	11/12/2013	Fall	MAK-1	AKKVK	Blueback herring	0	0	Blueback herring Fall
46	11/12/2013	Fall	MAK-1	AKKVK	Striped bass	0	0	Striped bass Fall
46	11/13/2013	Fall	MUB-8	UB	Alewife	0	0	Alewife Fall
46	11/13/2013	Fall	MUB-8	UB	American shad	0	0	American shad Fall
46	11/13/2013	Fall	MUB-8	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
46	11/13/2013	Fall	MUB-8	UB	Blueback herring	0	0	Blueback herring Fall
46	11/13/2013	Fall	MUB-8	UB	Striped bass	0	0	Striped bass Fall
46	11/13/2013	Fall	MUB-9	UB	Alewife	0	0	Alewife Fall
46	11/13/2013	Fall	MUB-9	UB	American shad	0	0	American shad Fall
46	11/13/2013	Fall	MUB-9	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
46	11/13/2013	Fall	MUB-9	UB	Blueback herring	0	0	Blueback herring Fall
46	11/13/2013	Fall	MUB-9	UB	Striped bass	0	0	Striped bass Fall
46	11/13/2013	Fall	MUB-11	UB	Alewife	0	0	Alewife Fall
46	11/13/2013	Fall	MUB-11	UB	American shad	1	0.30103	American shad Fall
46	11/13/2013	Fall	MUB-11	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
46	11/13/2013	Fall	MUB-11	UB	Blueback herring	0	0	Blueback herring Fall
46	11/13/2013	Fall	MUB-11	UB	Striped bass	0	0	Striped bass Fall
46	11/13/2013	Fall	MUB-3	UB	Alewife	0	0	Alewife Fall
46	11/13/2013	Fall	MUB-3	UB	American shad	0	0	American shad Fall
46	11/13/2013	Fall	MUB-3	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
46	11/13/2013	Fall	MUB-3	UB	Blueback herring	0	0	Blueback herring Fall
46	11/13/2013	Fall	MUB-3	UB	Striped bass	0	0	Striped bass Fall
46	11/13/2013	Fall	MUB-2	UB	Alewife	0	0	Alewife Fall
46	11/13/2013	Fall	MUB-2	UB	American shad	0	0	American shad Fall
46	11/13/2013	Fall	MUB-2	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
46	11/13/2013	Fall	MUB-2	UB	Blueback herring	1	0.30103	Blueback herring Fall
46	11/13/2013	Fall	MUB-2	UB	Striped bass	0	0	Striped bass Fall
46	11/13/2013	Fall	MLB-4	LB	Alewife	0	0	Alewife Fall
46	11/13/2013	Fall	MLB-4	LB	American shad	0	0	American shad Fall
46	11/13/2013	Fall	MLB-4	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
46	11/13/2013	Fall	MLB-4	LB	Blueback herring	0	0	Blueback herring Fall
46	11/13/2013	Fall	MLB-4	LB	Striped bass	0	0	Striped bass Fall
46	11/13/2013	Fall	MLB-3	LB	Alewife	0	0	Alewife Fall
46	11/13/2013	Fall	MLB-3	LB	American shad	0	0	American shad Fall
46	11/13/2013	Fall	MLB-3	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
46	11/13/2013	Fall	MLB-3	LB	Blueback herring	0	0	Blueback herring Fall
46	11/13/2013	Fall	MLB-3	LB	Striped bass	0	0	Striped bass Fall
46	11/13/2013	Fall	MLB-5	LB	Alewife	0	0	Alewife Fall
46	11/13/2013	Fall	MLB-5	LB	American	0	0	American

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping for MFS Report	Common Name	CPUE - 10min	Log(CPUE+1)	Species/Season
					shad			shad Fall
46	11/13/2013	Fall	MLB-5	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
46	11/13/2013	Fall	MLB-5	LB	Blueback herring	0	0	Blueback herring Fall
46	11/13/2013	Fall	MLB-5	LB	Striped bass	0	0	Striped bass Fall
46	11/13/2013	Fall	MLB-6	LB	Alewife	0	0	Alewife Fall
46	11/13/2013	Fall	MLB-6	LB	American shad	0	0	American shad Fall
46	11/13/2013	Fall	MLB-6	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
46	11/13/2013	Fall	MLB-6	LB	Blueback herring	0	0	Blueback herring Fall
46	11/13/2013	Fall	MLB-6	LB	Striped bass	0	0	Striped bass Fall
46	11/13/2013	Fall	MUB-1	UB	Alewife	0	0	Alewife Fall
46	11/13/2013	Fall	MUB-1	UB	American shad	1	0.30103	American shad Fall
46	11/13/2013	Fall	MUB-1	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
46	11/13/2013	Fall	MUB-1	UB	Blueback herring	2	0.477121	Blueback herring Fall
46	11/13/2013	Fall	MUB-1	UB	Striped bass	0	0	Striped bass Fall
47	11/19/2013	Fall	MKK-2	AKKVK	Alewife	0	0	Alewife Fall
47	11/19/2013	Fall	MKK-2	AKKVK	American shad	0	0	American shad Fall
47	11/19/2013	Fall	MKK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
47	11/19/2013	Fall	MKK-2	AKKVK	Blueback herring	0	0	Blueback herring Fall
47	11/19/2013	Fall	MKK-2	AKKVK	Striped bass	0	0	Striped bass Fall
47	11/19/2013	Fall	MAK-1	AKKVK	Alewife	0	0	Alewife Fall
47	11/19/2013	Fall	MAK-1	AKKVK	American shad	0	0	American shad Fall
47	11/19/2013	Fall	MAK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
47	11/19/2013	Fall	MAK-1	AKKVK	Blueback herring	0	0	Blueback herring Fall
47	11/19/2013	Fall	MAK-1	AKKVK	Striped	0	0	Striped

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping for MFS Report	Common Name	CPUE - 10min	Log(CPUE+1)	Species/Season
					bass			bass Fall
47	11/19/2013	Fall	MAK-2	AKKVK	Alewife	0	0	Alewife Fall
47	11/19/2013	Fall	MAK-2	AKKVK	American shad	0	0	American shad Fall
47	11/19/2013	Fall	MAK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
47	11/19/2013	Fall	MAK-2	AKKVK	Blueback herring	0	0	Blueback herring Fall
47	11/19/2013	Fall	MAK-2	AKKVK	Striped bass	0	0	Striped bass Fall
47	11/19/2013	Fall	MAK-3	AKKVK	Alewife	0	0	Alewife Fall
47	11/19/2013	Fall	MAK-3	AKKVK	American shad	0	0	American shad Fall
47	11/19/2013	Fall	MAK-3	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
47	11/19/2013	Fall	MAK-3	AKKVK	Blueback herring	0	0	Blueback herring Fall
47	11/19/2013	Fall	MAK-3	AKKVK	Striped bass	0	0	Striped bass Fall
47	11/19/2013	Fall	MAK-4	AKKVK	Alewife	0	0	Alewife Fall
47	11/19/2013	Fall	MAK-4	AKKVK	American shad	0	0	American shad Fall
47	11/19/2013	Fall	MAK-4	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
47	11/19/2013	Fall	MAK-4	AKKVK	Blueback herring	0	0	Blueback herring Fall
47	11/19/2013	Fall	MAK-4	AKKVK	Striped bass	0	0	Striped bass Fall
47	11/19/2013	Fall	MNB-5	NB	Alewife	0	0	Alewife Fall
47	11/19/2013	Fall	MNB-5	NB	American shad	0	0	American shad Fall
47	11/19/2013	Fall	MNB-5	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
47	11/19/2013	Fall	MNB-5	NB	Blueback herring	112	2.053078	Blueback herring Fall
47	11/19/2013	Fall	MNB-5	NB	Striped bass	0	0	Striped bass Fall
47	11/19/2013	Fall	MNB-6	NB	Alewife	0	0	Alewife Fall
47	11/19/2013	Fall	MNB-6	NB	American shad	0	0	American shad Fall
47	11/19/2013	Fall	MNB-6	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
47	11/19/2013	Fall	MNB-6	NB	Blueback herring	8	0.954243	Blueback herring Fall
47	11/19/2013	Fall	MNB-6	NB	Striped bass	0	0	Striped bass Fall
47	11/19/2013	Fall	MNB-2	NB	Alewife	0	0	Alewife Fall
47	11/19/2013	Fall	MNB-2	NB	American shad	0	0	American shad Fall
47	11/19/2013	Fall	MNB-2	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
47	11/19/2013	Fall	MNB-2	NB	Blueback herring	0	0	Blueback herring Fall
47	11/19/2013	Fall	MNB-2	NB	Striped bass	0	0	Striped bass Fall
47	11/19/2013	Fall	MNB-1	NB	Alewife	0	0	Alewife Fall
47	11/19/2013	Fall	MNB-1	NB	American shad	0	0	American shad Fall
47	11/19/2013	Fall	MNB-1	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
47	11/19/2013	Fall	MNB-1	NB	Blueback herring	0	0	Blueback herring Fall
47	11/19/2013	Fall	MNB-1	NB	Striped bass	0	0	Striped bass Fall
47	11/20/2013	Fall	MUB-9	UB	Alewife	2	0.477121	Alewife Fall
47	11/20/2013	Fall	MUB-9	UB	American shad	3	0.60206	American shad Fall
47	11/20/2013	Fall	MUB-9	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
47	11/20/2013	Fall	MUB-9	UB	Blueback herring	55	1.748188	Blueback herring Fall
47	11/20/2013	Fall	MUB-9	UB	Striped bass	0	0	Striped bass Fall
47	11/20/2013	Fall	MUB-8	UB	Alewife	0	0	Alewife Fall
47	11/20/2013	Fall	MUB-8	UB	American shad	0	0	American shad Fall
47	11/20/2013	Fall	MUB-8	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
47	11/20/2013	Fall	MUB-8	UB	Blueback herring	0	0	Blueback herring Fall
47	11/20/2013	Fall	MUB-8	UB	Striped bass	0	0	Striped bass Fall
47	11/20/2013	Fall	MUB-11	UB	Alewife	0	0	Alewife Fall
47	11/20/2013	Fall	MUB-11	UB	American	0	0	American

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
					shad			shad Fall
47	11/20/2013	Fall	MUB-11	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
47	11/20/2013	Fall	MUB-11	UB	Blueback herring	0	0	Blueback herring Fall
47	11/20/2013	Fall	MUB-11	UB	Striped bass	0	0	Striped bass Fall
47	11/22/2013	Fall	MUB-3	UB	Alewife	0	0	Alewife Fall
47	11/22/2013	Fall	MUB-3	UB	American shad	0	0	American shad Fall
47	11/22/2013	Fall	MUB-3	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
47	11/22/2013	Fall	MUB-3	UB	Blueback herring	0	0	Blueback herring Fall
47	11/22/2013	Fall	MUB-3	UB	Striped bass	0	0	Striped bass Fall
47	11/22/2013	Fall	MUB-2	UB	Alewife	0	0	Alewife Fall
47	11/22/2013	Fall	MUB-2	UB	American shad	0	0	American shad Fall
47	11/22/2013	Fall	MUB-2	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
47	11/22/2013	Fall	MUB-2	UB	Blueback herring	0	0	Blueback herring Fall
47	11/22/2013	Fall	MUB-2	UB	Striped bass	0	0	Striped bass Fall
47	11/22/2013	Fall	MUB-1	UB	Alewife	0	0	Alewife Fall
47	11/22/2013	Fall	MUB-1	UB	American shad	0	0	American shad Fall
47	11/22/2013	Fall	MUB-1	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
47	11/22/2013	Fall	MUB-1	UB	Blueback herring	0	0	Blueback herring Fall
47	11/22/2013	Fall	MUB-1	UB	Striped bass	0	0	Striped bass Fall
47	11/22/2013	Fall	MLB-6	LB	Alewife	0	0	Alewife Fall
47	11/22/2013	Fall	MLB-6	LB	American shad	0	0	American shad Fall
47	11/22/2013	Fall	MLB-6	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
47	11/22/2013	Fall	MLB-6	LB	Blueback herring	0	0	Blueback herring Fall
47	11/22/2013	Fall	MLB-6	LB	Striped	0	0	Striped

Table C.1-1. Raw Data Used for the ANOVA								
WOY	Date	Season	Station	Area Grouping for MFS Report	Common Name	CPUE - 10min	Log(CPUE+1)	Species/Season
					bass			bass Fall
47	11/22/2013	Fall	MLB-5	LB	Alewife	0	0	Alewife Fall
47	11/22/2013	Fall	MLB-5	LB	American shad	0	0	American shad Fall
47	11/22/2013	Fall	MLB-5	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
47	11/22/2013	Fall	MLB-5	LB	Blueback herring	0	0	Blueback herring Fall
47	11/22/2013	Fall	MLB-5	LB	Striped bass	0	0	Striped bass Fall
47	11/22/2013	Fall	MLB-3	LB	Alewife	0	0	Alewife Fall
47	11/22/2013	Fall	MLB-3	LB	American shad	0	0	American shad Fall
47	11/22/2013	Fall	MLB-3	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
47	11/22/2013	Fall	MLB-3	LB	Blueback herring	0	0	Blueback herring Fall
47	11/22/2013	Fall	MLB-3	LB	Striped bass	0	0	Striped bass Fall
47	11/22/2013	Fall	MLB-4	LB	Alewife	0	0	Alewife Fall
47	11/22/2013	Fall	MLB-4	LB	American shad	0	0	American shad Fall
47	11/22/2013	Fall	MLB-4	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
47	11/22/2013	Fall	MLB-4	LB	Blueback herring	0	0	Blueback herring Fall
47	11/22/2013	Fall	MLB-4	LB	Striped bass	0	0	Striped bass Fall
47	11/22/2013	Fall	MKK-1	AKKVK	Alewife	0	0	Alewife Fall
47	11/22/2013	Fall	MKK-1	AKKVK	American shad	0	0	American shad Fall
47	11/22/2013	Fall	MKK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
47	11/22/2013	Fall	MKK-1	AKKVK	Blueback herring	0	0	Blueback herring Fall
47	11/22/2013	Fall	MKK-1	AKKVK	Striped bass	0	0	Striped bass Fall
49	12/3/2013	Fall	MKK-1	AKKVK	Alewife	0	0	Alewife Fall
49	12/3/2013	Fall	MKK-1	AKKVK	American shad	0	0	American shad Fall
49	12/3/2013	Fall	MKK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
49	12/3/2013	Fall	MKK-1	AKKVK	Blueback herring	0	0	Blueback herring Fall
49	12/3/2013	Fall	MKK-1	AKKVK	Striped bass	0	0	Striped bass Fall
49	12/3/2013	Fall	MKK-2	AKKVK	Alewife	0	0	Alewife Fall
49	12/3/2013	Fall	MKK-2	AKKVK	American shad	0	0	American shad Fall
49	12/3/2013	Fall	MKK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
49	12/3/2013	Fall	MKK-2	AKKVK	Blueback herring	0	0	Blueback herring Fall
49	12/3/2013	Fall	MKK-2	AKKVK	Striped bass	0	0	Striped bass Fall
49	12/3/2013	Fall	MNB-1	NB	Alewife	0	0	Alewife Fall
49	12/3/2013	Fall	MNB-1	NB	American shad	0	0	American shad Fall
49	12/3/2013	Fall	MNB-1	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
49	12/3/2013	Fall	MNB-1	NB	Blueback herring	0	0	Blueback herring Fall
49	12/3/2013	Fall	MNB-1	NB	Striped bass	0	0	Striped bass Fall
49	12/3/2013	Fall	MNB-2	NB	Alewife	0	0	Alewife Fall
49	12/3/2013	Fall	MNB-2	NB	American shad	0	0	American shad Fall
49	12/3/2013	Fall	MNB-2	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
49	12/3/2013	Fall	MNB-2	NB	Blueback herring	0	0	Blueback herring Fall
49	12/3/2013	Fall	MNB-2	NB	Striped bass	0	0	Striped bass Fall
49	12/3/2013	Fall	MNB-5	NB	Alewife	0	0	Alewife Fall
49	12/3/2013	Fall	MNB-5	NB	American shad	0	0	American shad Fall
49	12/3/2013	Fall	MNB-5	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
49	12/3/2013	Fall	MNB-5	NB	Blueback herring	0	0	Blueback herring Fall
49	12/3/2013	Fall	MNB-5	NB	Striped bass	0	0	Striped bass Fall
49	12/3/2013	Fall	MNB-6	NB	Alewife	0	0	Alewife Fall
49	12/3/2013	Fall	MNB-6	NB	American	0	0	American

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
					shad			shad Fall
49	12/3/2013	Fall	MNB-6	NB	Atlantic menhaden	0	0	Atlantic menhaden Fall
49	12/3/2013	Fall	MNB-6	NB	Blueback herring	0	0	Blueback herring Fall
49	12/3/2013	Fall	MNB-6	NB	Striped bass	0	0	Striped bass Fall
49	12/3/2013	Fall	MAK-4	AKKVK	Alewife	0	0	Alewife Fall
49	12/3/2013	Fall	MAK-4	AKKVK	American shad	0	0	American shad Fall
49	12/3/2013	Fall	MAK-4	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
49	12/3/2013	Fall	MAK-4	AKKVK	Blueback herring	0	0	Blueback herring Fall
49	12/3/2013	Fall	MAK-4	AKKVK	Striped bass	0	0	Striped bass Fall
49	12/3/2013	Fall	MAK-3	AKKVK	Alewife	0	0	Alewife Fall
49	12/3/2013	Fall	MAK-3	AKKVK	American shad	0	0	American shad Fall
49	12/3/2013	Fall	MAK-3	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
49	12/3/2013	Fall	MAK-3	AKKVK	Blueback herring	0	0	Blueback herring Fall
49	12/3/2013	Fall	MAK-3	AKKVK	Striped bass	0	0	Striped bass Fall
49	12/3/2013	Fall	MAK-2	AKKVK	Alewife	0	0	Alewife Fall
49	12/3/2013	Fall	MAK-2	AKKVK	American shad	0	0	American shad Fall
49	12/3/2013	Fall	MAK-2	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
49	12/3/2013	Fall	MAK-2	AKKVK	Blueback herring	0	0	Blueback herring Fall
49	12/3/2013	Fall	MAK-2	AKKVK	Striped bass	0	0	Striped bass Fall
49	12/3/2013	Fall	MAK-1	AKKVK	Alewife	0	0	Alewife Fall
49	12/3/2013	Fall	MAK-1	AKKVK	American shad	0	0	American shad Fall
49	12/3/2013	Fall	MAK-1	AKKVK	Atlantic menhaden	0	0	Atlantic menhaden Fall
49	12/3/2013	Fall	MAK-1	AKKVK	Blueback herring	0	0	Blueback herring Fall
49	12/3/2013	Fall	MAK-1	AKKVK	Striped	0	0	Striped

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
					bass			bass Fall
49	12/4/2013	Fall	MUB-9	UB	Alewife	0	0	Alewife Fall
49	12/4/2013	Fall	MUB-9	UB	American shad	1	0.30103	American shad Fall
49	12/4/2013	Fall	MUB-9	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
49	12/4/2013	Fall	MUB-9	UB	Blueback herring	11	1.079181	Blueback herring Fall
49	12/4/2013	Fall	MUB-9	UB	Striped bass	0	0	Striped bass Fall
49	12/4/2013	Fall	MUB-8	UB	Alewife	0	0	Alewife Fall
49	12/4/2013	Fall	MUB-8	UB	American shad	0	0	American shad Fall
49	12/4/2013	Fall	MUB-8	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
49	12/4/2013	Fall	MUB-8	UB	Blueback herring	0	0	Blueback herring Fall
49	12/4/2013	Fall	MUB-8	UB	Striped bass	0	0	Striped bass Fall
49	12/4/2013	Fall	MUB-11	UB	Alewife	0	0	Alewife Fall
49	12/4/2013	Fall	MUB-11	UB	American shad	0	0	American shad Fall
49	12/4/2013	Fall	MUB-11	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
49	12/4/2013	Fall	MUB-11	UB	Blueback herring	0	0	Blueback herring Fall
49	12/4/2013	Fall	MUB-11	UB	Striped bass	0	0	Striped bass Fall
49	12/4/2013	Fall	MUB-3	UB	Alewife	0	0	Alewife Fall
49	12/4/2013	Fall	MUB-3	UB	American shad	0	0	American shad Fall
49	12/4/2013	Fall	MUB-3	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
49	12/4/2013	Fall	MUB-3	UB	Blueback herring	0	0	Blueback herring Fall
49	12/4/2013	Fall	MUB-3	UB	Striped bass	0	0	Striped bass Fall
49	12/4/2013	Fall	MUB-2	UB	Alewife	0	0	Alewife Fall
49	12/4/2013	Fall	MUB-2	UB	American shad	0	0	American shad Fall
49	12/4/2013	Fall	MUB-2	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
49	12/4/2013	Fall	MUB-2	UB	Blueback herring	0	0	Blueback herring Fall
49	12/4/2013	Fall	MUB-2	UB	Striped bass	0	0	Striped bass Fall
49	12/4/2013	Fall	MUB-1	UB	Alewife	0	0	Alewife Fall
49	12/4/2013	Fall	MUB-1	UB	American shad	0	0	American shad Fall
49	12/4/2013	Fall	MUB-1	UB	Atlantic menhaden	0	0	Atlantic menhaden Fall
49	12/4/2013	Fall	MUB-1	UB	Blueback herring	0	0	Blueback herring Fall
49	12/4/2013	Fall	MUB-1	UB	Striped bass	0	0	Striped bass Fall
49	12/4/2013	Fall	MLB-6	LB	Alewife	0	0	Alewife Fall
49	12/4/2013	Fall	MLB-6	LB	American shad	0	0	American shad Fall
49	12/4/2013	Fall	MLB-6	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
49	12/4/2013	Fall	MLB-6	LB	Blueback herring	0	0	Blueback herring Fall
49	12/4/2013	Fall	MLB-6	LB	Striped bass	0	0	Striped bass Fall
49	12/4/2013	Fall	MLB-5	LB	Alewife	0	0	Alewife Fall
49	12/4/2013	Fall	MLB-5	LB	American shad	0	0	American shad Fall
49	12/4/2013	Fall	MLB-5	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
49	12/4/2013	Fall	MLB-5	LB	Blueback herring	0	0	Blueback herring Fall
49	12/4/2013	Fall	MLB-5	LB	Striped bass	0	0	Striped bass Fall
49	12/4/2013	Fall	MLB-3	LB	Alewife	0	0	Alewife Fall
49	12/4/2013	Fall	MLB-3	LB	American shad	0	0	American shad Fall
49	12/4/2013	Fall	MLB-3	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
49	12/4/2013	Fall	MLB-3	LB	Blueback herring	0	0	Blueback herring Fall
49	12/4/2013	Fall	MLB-3	LB	Striped bass	0	0	Striped bass Fall
49	12/4/2013	Fall	MLB-4	LB	Alewife	0	0	Alewife Fall
49	12/4/2013	Fall	MLB-4	LB	American	0	0	American

Table C.1-1. Raw Data Used for the ANOVA								
WOY	**Date**	**Season**	**Station**	**Area Grouping for MFS Report**	**Common Name**	**CPUE - 10min**	**Log(CPUE+1)**	**Species/Season**
					shad			shad Fall
49	12/4/2013	Fall	MLB-4	LB	Atlantic menhaden	0	0	Atlantic menhaden Fall
49	12/4/2013	Fall	MLB-4	LB	Blueback herring	0	0	Blueback herring Fall
49	12/4/2013	Fall	MLB-4	LB	Striped bass	0	0	Striped bass Fall

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, Log(CPUE+1) Transformed Data**

Page/Date/Time	1 1/24/2014 3:35:12 PM
Database	C:\Users\jburnett\Desktop\2013 Stats\2013 MFR NCSS Database.S0
Filter	Species_Season = "Alewife Spring"
Response	Log_CPUE_1_

Tests of Assumptions Section

Assumption	Test Value	Prob Level	Decision (0.05)
Skewness Normality of Residuals	11.2710	0.000000	Reject
Kurtosis Normality of Residuals	7.7178	0.000000	Reject
Omnibus Normality of Residuals	186.6000	0.000000	Reject
Modified-Levene Equal-Variance Test	1.1735	0.321350	Accept

Box Plot Section

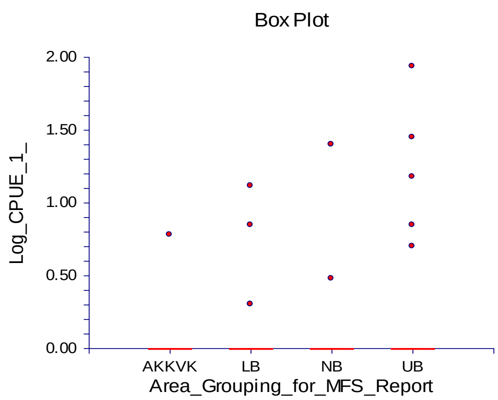


Table C.1-3. Assumption Testing for Fall Alewife Samples, Log(CPUE+1) Transformed Data

Page/Date/Time	1 1/24/2014 3:36:02 PM
Database	C:\Users\jburnett\Desktop\2013 Stats\2013 MFR NCSS Database.S0
Filter	Species_Season = "Alewife Fall"
Response	Log_CPUE_1_

Tests of Assumptions Section

Assumption	Test Value	Prob Level	Decision (0.05)
Skewness Normality of Residuals	16.2607	0.000000	Reject
Kurtosis Normality of Residuals	10.5678	0.000000	Reject
Omnibus Normality of Residuals	376.0893	0.000000	Reject
Modified-Levene Equal-Variance Test	1.2430	0.295029	Accept

Box Plot Section

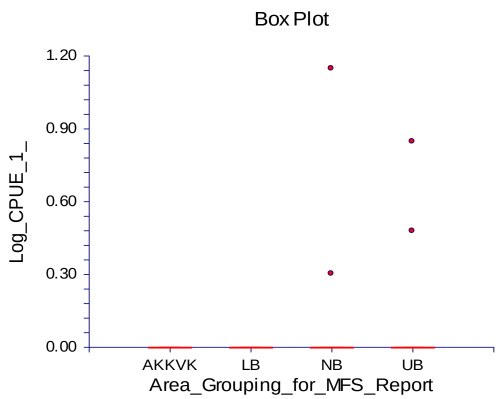


Table C.1-4. **Assumption Testing for Spring Blueback Herring Samples, Log(CPUE+1) Transformed Data**

Page/Date/Time	1 1/24/2014 5:28:26 PM
Database	C:\Users\jburnett\Desktop\2013 Stats\2013 MFR NCSS Database.S0
Filter	Species_Season = "Blueback herring Spring"
Response	Log_CPUE_1_

Tests of Assumptions Section

Assumption	Test Value	Prob Level	Decision (0.05)
Skewness Normality of Residuals	9.3548	0.000000	Reject
Kurtosis Normality of Residuals	6.2233	0.000000	Reject
Omnibus Normality of Residuals	126.2408	0.000000	Reject
Modified-Levene Equal-Variance Test	1.4606	0.226974	Accept

Box Plot Section

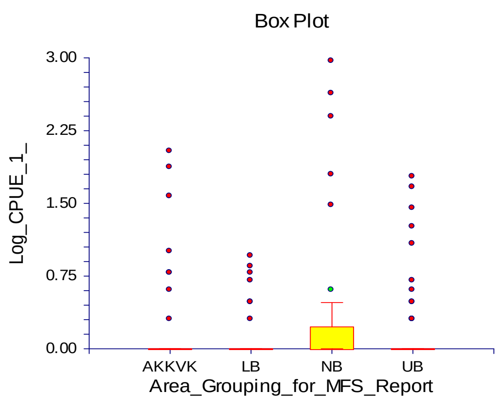


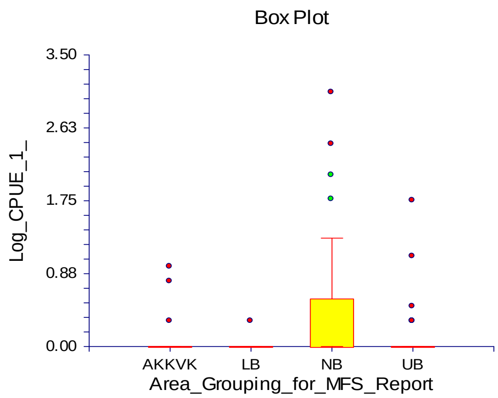
Table C.1-5. **Assumption Testing for Fall Blueback Herring Samples, Log(CPUE+1) Transformed Data**

Page/Date/Time	1 1/24/2014 5:27:26 PM
Database	C:\Users\jburnett\Desktop\2013 Stats\2013 MFR NCSS Database.S0
Filter	Species_Season = "Blueback herring Fall"
Response	Log_CPUE_1_

Tests of Assumptions Section

Assumption	Test Value	Prob Level	Decision (0.05)
Skewness Normality of Residuals	11.9698	0.000000	Reject
Kurtosis Normality of Residuals	8.5094	0.000000	Reject
Omnibus Normality of Residuals	215.6858	0.000000	Reject
Modified-Levene Equal-Variance Test	9.9203	0.000004	Reject

Box Plot Section



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

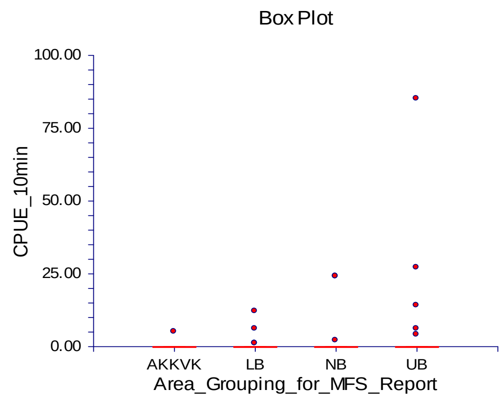
Alewife Spring Analysis of Variance Report

Page/Date/Time	1 1/24/2014 3:32:49 PM
Database	C:\Users\jburnett\Desktop\2013 Stats\2013 MFR NCSS Database.S0
Filter	Species_Season = "Alewife Spring"
Response	CPUE_10min

Tests of Assumptions Section

Assumption	Test Value	Prob Level	Decision (0.05)
Skewness Normality of Residuals	15.0868	0.000000	Reject
Kurtosis Normality of Residuals	10.0025	0.000000	Reject
Omnibus Normality of Residuals	327.6623	0.000000	Reject
Modified-Levene Equal-Variance Test	1.1308	0.338078	Accept

Box Plot Section



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	176.1982	58.73272	1.13	0.338078	0.301343
S(A)	176	9141.463	51.94013			
Total (Adjusted)	179	9317.661				
Total	180					

* Term significant at alpha = 0.05

Analysis of Variance Report

Page/Date/Time	2 1/24/2014 3:32:49 PM
Database	C:\Users\jburnett\Desktop\2013 Stats\2013 MFR NCSS Database.S0
Filter	Species_Season = "Alewife Spring"
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

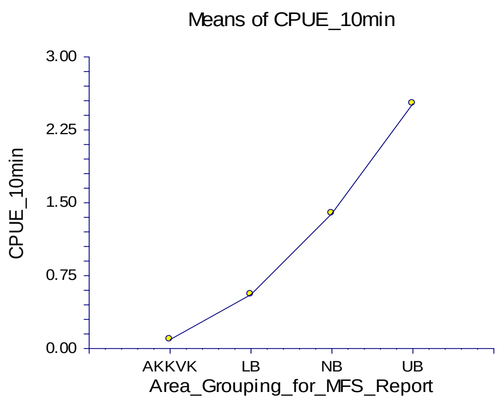
Method	DF	Chi-Square (H)	Prob Level	Decision(0.05)
Not Corrected for Ties	3	0.7041343	0.872231	Accept H0
Corrected for Ties	3	3.496265	0.321247	Accept H0

Number Sets of Ties	4
Multiplicity Factor	4657314

Group Detail

Group	Count	Sum of Ranks	Mean Rank	Z-Value	Median
AKKVK	54	4624.00	85.63	-0.8210	0
LB	36	3373.50	93.71	0.4130	0
NB	36	3297.00	91.58	0.1395	0
UB	54	4995.50	92.51	0.3387	0

Plots of Means Section



Analysis of Variance Report

Page/Date/Time 3 1/24/2014 3:32:49 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR NCSS Database.S0
Filter Species_Season = "Alewife Spring"
Response CPUE_10min

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

CPUE_10min	AKKVK	LB	NB	UB
AKKVK	0.0000	1.6057	1.1833	1.5287
LB	1.6057	0.0000	0.3856	0.2383
NB	1.1833	0.3856	0.0000	0.1840
UB	1.5287	0.2383	0.1840	0.0000

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

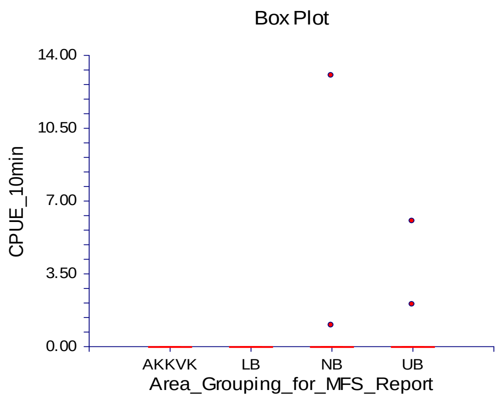
Alewife Fall Analysis of Variance Report

Page/Date/Time 1 1/24/2014 3:36:40 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR NCSS Database.S0
Filter Species_Season = "Alewife Fall"
Response CPUE_10min

Tests of Assumptions Section

Assumption	Test Value	Prob Level	Decision (0.05)
Skewness Normality of Residuals	17.5830	0.000000	Reject
Kurtosis Normality of Residuals	11.1152	0.000000	Reject
Omnibus Normality of Residuals	432.7108	0.000000	Reject
Modified-Levene Equal-Variance Test	1.1348	0.335913	Accept

Box Plot Section



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	3.224242	1.074747	1.13	0.335913	0.303473
S(A)	216	204.5758	0.94711			
Total (Adjusted)	219	207.8				
Total	220					

* Term significant at alpha = 0.05

Analysis of Variance Report

Page/Date/Time	2 1/24/2014 3:36:40 PM
Database	C:\Users\jburnett\Desktop\2013 Stats\2013 MFR NCSS Database.S0
Filter	Species_Season = "Alewife Fall"
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

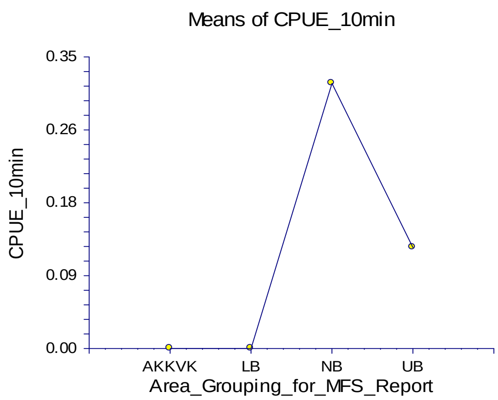
Method	DF	Chi-Square (H)	Prob Level	Decision(0.05)
Not Corrected for Ties	3	0.2352941	0.971700	Accept H0
Corrected for Ties	3	4.393056	0.222030	Accept H0

Number Sets of Ties	1
Multiplicity Factor	1.007748E+07

Group Detail

Group	Count	Sum of Ranks	Mean Rank	Z-Value	Median
AKKVK	66	7161.00	108.50	-0.3051	0
LB	44	4774.00	108.50	-0.2330	0
NB	44	4994.00	113.50	0.3495	0
UB	66	7381.00	111.83	0.2034	0

Plots of Means Section



Analysis of Variance Report

Page/Date/Time	3 1/24/2014 3:36:40 PM
Database	C:\Users\jburnett\Desktop\2013 Stats\2013 MFR NCSS Database.S0
Filter	Species_Season = "Alewife Fall"
Response	CPUE_10min

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

CPUE_10min	AKKVK	LB	NB	UB
AKKVK	0.0000	0.0000	1.7439	1.2999
LB	0.0000	0.0000	1.5920	1.1626
NB	1.7439	1.5920	0.0000	0.5813
UB	1.2999	1.1626	0.5813	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 Kruskal-Wallis One-Way ANOVA for the Spring and Fall Blueback Herring Samples

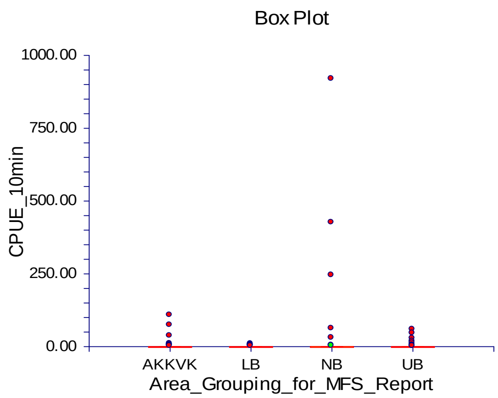
Blueback Herring Spring Analysis of Variance Report

Page/Date/Time	1 1/24/2014 5:29:03 PM
Database	C:\Users\jburnett\Desktop\2013 Stats\2013 MFR NCSS Database.S0
Filter	Species_Season = "Blueback herring Spring"
Response	CPUE_10min

Tests of Assumptions Section

Assumption	Test Value	Prob Level	Decision (0.05)
Skewness Normality of Residuals	15.0886	0.000000	Reject
Kurtosis Normality of Residuals	9.9968	0.000000	Reject
Omnibus Normality of Residuals	327.6003	0.000000	Reject
Modified-Levene Equal-Variance Test	3.1472	0.026468	Reject

Box Plot Section



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	55361.6	18453.87	3.15	0.026468*	0.723571
S(A)	176	1031990	5863.579			
Total (Adjusted)	179	1087351				
Total	180					

* Term significant at alpha = 0.05

Analysis of Variance Report

Page/Date/Time	2 1/24/2014 5:29:03 PM
Database	C:\Users\jburnett\Desktop\2013 Stats\2013 MFR NCSS Database.S0
Filter	Species_Season = "Blueback herring Spring"
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

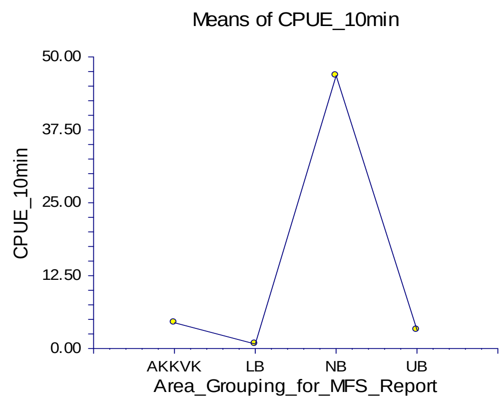
Method	DF	Chi-Square (H)	Prob Level	Decision(0.05)
Not Corrected for Ties	3	0.7930095	0.851138	Accept H0
Corrected for Ties	3	1.625281	0.653671	Accept H0

Number Sets of Ties	6
Multiplicity Factor	2986350

Group Detail

Group	Count	Sum of Ranks	Mean Rank	Z-Value	Median
AKKVK	54	4659.00	86.28	-0.7117	0
LB	36	3213.00	89.25	-0.1609	0
NB	36	3448.50	95.79	0.6813	0
UB	54	4969.50	92.03	0.2575	0

Plots of Means Section



Analysis of Variance Report

Page/Date/Time	3 1/24/2014 5:29:03 PM
Database	C:\Users\jburnett\Desktop\2013 Stats\2013 MFR NCSS Database.S0
Filter	Species_Season = "Blueback herring Spring"
Response	CPUE_10min

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

CPUE_10min	AKKVK	LB	NB	UB
AKKVK	0.0000	0.3795	1.2149	0.8209
LB	0.3795	0.0000	0.7625	0.3547
NB	1.2149	0.7625	0.0000	0.4806
UB	0.8209	0.3547	0.4806	0.0000

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

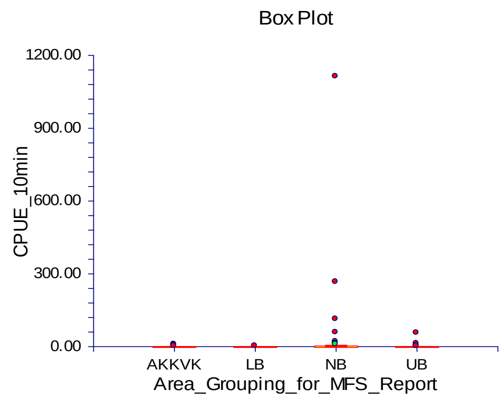
Blueback Herring Fall Analysis of Variance Report

Page/Date/Time	1 1/24/2014 5:26:00 PM
Database	C:\Users\jburnett\Desktop\2013 Stats\2013 MFR NCSS Database.S0
Filter	Species_Season = "Blueback herring Fall"
Response	CPUE_10min

Tests of Assumptions Section

Assumption	Test Value	Prob Level	Decision (0.05)
Skewness Normality of Residuals	18.3016	0.000000	Reject
Kurtosis Normality of Residuals	11.3649	0.000000	Reject
Omnibus Normality of Residuals	464.1101	0.000000	Reject
Modified-Levene Equal-Variance Test	2.6154	0.052058	Accept

Box Plot Section



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	45960.63	15320.21	2.62	0.052058	0.635867
S(A)	216	1265282	5857.787			
Total (Adjusted)	219	1311243				
Total	220					

* Term significant at alpha = 0.05

Analysis of Variance Report

Page/Date/Time	2 1/24/2014 5:26:00 PM
Database	C:\Users\jburnett\Desktop\2013 Stats\2013 MFR NCSS Database.S0
Filter	Species_Season = "Blueback herring Fall"
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

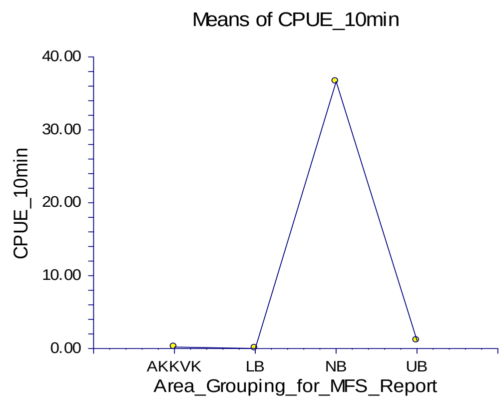
Method	DF	Chi-Square (H)	Prob Level	Decision(0.05)
Not Corrected for Ties	3	5.773707	0.123154	Accept H0
Corrected for Ties	3	20.47621	0.000135	Reject H0

Number Sets of Ties	6
Multiplicity Factor	7645410

Group Detail

Group	Count	Sum of Ranks	Mean Rank	Z-Value	Median
AKKVK	66	6855.50	103.87	-1.0112	0
LB	44	4457.50	101.31	-1.0711	0
NB	44	5721.00	130.02	2.2746	0
UB	66	7276.00	110.24	-0.0393	0

Plots of Means Section



Analysis of Variance Report

Page/Date/Time	3 1/24/2014 5:26:00 PM
Database	C:\Users\jburnett\Desktop\2013 Stats\2013 MFR NCSS Database.S0
Filter	Species_Season = "Blueback herring Fall"
Response	CPUE_10min

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

CPUE_10min	AKKVK	LB	NB	UB
AKKVK	0.0000	0.3898	3.9754	1.0828
LB	0.3898	0.0000	3.9849	1.3583
NB	3.9754	3.9849	0.0000	3.0069
UB	1.0828	1.3583	3.0069	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 Non-Detect Analysis to Derive the Cumulative Frequency Distribution for Spring Samples

Table C-4.1. Data Used for the Non-Detect Analysis for Spring Samples						
Year	Season	WOY	Area Grouping	Species Code	Common Name	CPUE - 10 Min
2013	Spring	12	AKKVK	2	Alewife	0
2013	Spring	12	AKKVK	6	American shad	0
2013	Spring	12	AKKVK	14	Atlantic menhaden	0
2013	Spring	12	AKKVK	27	Blueback herring	0
2013	Spring	12	AKKVK	156	Striped bass	0
2013	Spring	12	LB	2	Alewife	0
2013	Spring	12	LB	6	American shad	0
2013	Spring	12	LB	14	Atlantic menhaden	0
2013	Spring	12	LB	27	Blueback herring	0
2013	Spring	12	LB	156	Striped bass	0
2013	Spring	12	NB	2	Alewife	0
2013	Spring	12	NB	6	American shad	0
2013	Spring	12	NB	14	Atlantic menhaden	0
2013	Spring	12	NB	27	Blueback herring	244
2013	Spring	12	NB	156	Striped bass	0
2013	Spring	12	UB	2	Alewife	0
2013	Spring	12	UB	6	American shad	0
2013	Spring	12	UB	14	Atlantic menhaden	0
2013	Spring	12	UB	27	Blueback herring	0
2013	Spring	12	UB	156	Striped bass	0
2013	Spring	13	AKKVK	2	Alewife	0
2013	Spring	13	AKKVK	6	American shad	0
2013	Spring	13	AKKVK	14	Atlantic menhaden	0
2013	Spring	13	AKKVK	27	Blueback herring	0
2013	Spring	13	AKKVK	156	Striped bass	0
2013	Spring	13	LB	2	Alewife	0
2013	Spring	13	LB	6	American shad	0
2013	Spring	13	LB	14	Atlantic menhaden	0
2013	Spring	13	LB	27	Blueback herring	2
2013	Spring	13	LB	156	Striped bass	0
2013	Spring	13	NB	2	Alewife	0
2013	Spring	13	NB	6	American shad	0
2013	Spring	13	NB	14	Atlantic menhaden	0
2013	Spring	13	NB	27	Blueback herring	3
2013	Spring	13	NB	156	Striped bass	0
2013	Spring	13	UB	2	Alewife	0
2013	Spring	13	UB	6	American shad	0
2013	Spring	13	UB	14	Atlantic menhaden	0
2013	Spring	13	UB	27	Blueback herring	0
2013	Spring	13	UB	156	Striped bass	0
2013	Spring	14	AKKVK	2	Alewife	0
2013	Spring	14	AKKVK	6	American shad	0
2013	Spring	14	AKKVK	14	Atlantic menhaden	0
2013	Spring	14	AKKVK	27	Blueback herring	9
2013	Spring	14	AKKVK	156	Striped bass	0
2013	Spring	14	LB	2	Alewife	0
2013	Spring	14	LB	6	American shad	0
2013	Spring	14	LB	14	Atlantic menhaden	0
2013	Spring	14	LB	27	Blueback herring	0
2013	Spring	14	LB	156	Striped bass	0
2013	Spring	14	NB	2	Alewife	0
2013	Spring	14	NB	6	American shad	0
2013	Spring	14	NB	14	Atlantic menhaden	0
2013	Spring	14	NB	27	Blueback herring	0
2013	Spring	14	NB	156	Striped bass	0
2013	Spring	14	UB	2	Alewife	0

Table C-4.1. Data Used for the Non-Detect Analysis for Spring Samples						
Year	Season	WOY	Area Grouping	Species Code	Common Name	CPUE - 10 Min
2013	Spring	14	UB	6	American shad	0
2013	Spring	14	UB	14	Atlantic menhaden	0
2013	Spring	14	UB	27	Blueback herring	13
2013	Spring	14	UB	156	Striped bass	0
2013	Spring	15	AKKVK	2	Alewife	0
2013	Spring	15	AKKVK	6	American shad	0
2013	Spring	15	AKKVK	14	Atlantic menhaden	0
2013	Spring	15	AKKVK	27	Blueback herring	6
2013	Spring	15	AKKVK	156	Striped bass	0
2013	Spring	15	LB	2	Alewife	0
2013	Spring	15	LB	6	American shad	0
2013	Spring	15	LB	14	Atlantic menhaden	0
2013	Spring	15	LB	27	Blueback herring	0
2013	Spring	15	LB	156	Striped bass	0
2013	Spring	15	NB	2	Alewife	0
2013	Spring	15	NB	6	American shad	0
2013	Spring	15	NB	14	Atlantic menhaden	0
2013	Spring	15	NB	27	Blueback herring	0
2013	Spring	15	NB	156	Striped bass	0
2013	Spring	15	UB	2	Alewife	0
2013	Spring	15	UB	6	American shad	0
2013	Spring	15	UB	14	Atlantic menhaden	0
2013	Spring	15	UB	27	Blueback herring	0
2013	Spring	15	UB	156	Striped bass	0
2013	Spring	16	AKKVK	2	Alewife	0
2013	Spring	16	AKKVK	6	American shad	0
2013	Spring	16	AKKVK	14	Atlantic menhaden	1
2013	Spring	16	AKKVK	27	Blueback herring	44
2013	Spring	16	AKKVK	156	Striped bass	0
2013	Spring	16	LB	2	Alewife	1
2013	Spring	16	LB	6	American shad	0
2013	Spring	16	LB	14	Atlantic menhaden	2
2013	Spring	16	LB	27	Blueback herring	14
2013	Spring	16	LB	156	Striped bass	0
2013	Spring	16	NB	2	Alewife	0
2013	Spring	16	NB	6	American shad	0
2013	Spring	16	NB	14	Atlantic menhaden	1
2013	Spring	16	NB	27	Blueback herring	918
2013	Spring	16	NB	156	Striped bass	0
2013	Spring	16	UB	2	Alewife	99
2013	Spring	16	UB	6	American shad	0
2013	Spring	16	UB	14	Atlantic menhaden	1
2013	Spring	16	UB	27	Blueback herring	147
2013	Spring	16	UB	156	Striped bass	0
2013	Spring	17	AKKVK	2	Alewife	0
2013	Spring	17	AKKVK	6	American shad	0
2013	Spring	17	AKKVK	14	Atlantic menhaden	0
2013	Spring	17	AKKVK	27	Blueback herring	107
2013	Spring	17	AKKVK	156	Striped bass	0
2013	Spring	17	LB	2	Alewife	6
2013	Spring	17	LB	6	American shad	0
2013	Spring	17	LB	14	Atlantic menhaden	0
2013	Spring	17	LB	27	Blueback herring	6
2013	Spring	17	LB	156	Striped bass	0
2013	Spring	17	NB	2	Alewife	0
2013	Spring	17	NB	6	American shad	1
2013	Spring	17	NB	14	Atlantic menhaden	0

Table C-4.1. Data Used for the Non-Detect Analysis for Spring Samples						
Year	Season	WOY	Area Grouping	Species Code	Common Name	CPUE - 10 Min
2013	Spring	17	NB	27	Blueback herring	4
2013	Spring	17	NB	156	Striped bass	0
2013	Spring	17	UB	2	Alewife	6
2013	Spring	17	UB	6	American shad	0
2013	Spring	17	UB	14	Atlantic menhaden	5
2013	Spring	17	UB	27	Blueback herring	7
2013	Spring	17	UB	156	Striped bass	0
2013	Spring	19	AKKVK	2	Alewife	5
2013	Spring	19	AKKVK	6	American shad	0
2013	Spring	19	AKKVK	14	Atlantic menhaden	0
2013	Spring	19	AKKVK	27	Blueback herring	73
2013	Spring	19	AKKVK	156	Striped bass	0
2013	Spring	19	LB	2	Alewife	13
2013	Spring	19	LB	6	American shad	2
2013	Spring	19	LB	14	Atlantic menhaden	0
2013	Spring	19	LB	27	Blueback herring	5
2013	Spring	19	LB	156	Striped bass	0
2013	Spring	19	NB	2	Alewife	48
2013	Spring	19	NB	6	American shad	0
2013	Spring	19	NB	14	Atlantic menhaden	0
2013	Spring	19	NB	27	Blueback herring	454
2013	Spring	19	NB	156	Striped bass	0
2013	Spring	19	UB	2	Alewife	31
2013	Spring	19	UB	6	American shad	3
2013	Spring	19	UB	14	Atlantic menhaden	1
2013	Spring	19	UB	27	Blueback herring	4
2013	Spring	19	UB	156	Striped bass	0
2013	Spring	21	AKKVK	2	Alewife	0
2013	Spring	21	AKKVK	6	American shad	0
2013	Spring	21	AKKVK	14	Atlantic menhaden	0
2013	Spring	21	AKKVK	27	Blueback herring	0
2013	Spring	21	AKKVK	156	Striped bass	0
2013	Spring	21	LB	2	Alewife	0
2013	Spring	21	LB	6	American shad	0
2013	Spring	21	LB	14	Atlantic menhaden	0
2013	Spring	21	LB	27	Blueback herring	1
2013	Spring	21	LB	156	Striped bass	0
2013	Spring	21	NB	2	Alewife	2
2013	Spring	21	NB	6	American shad	1
2013	Spring	21	NB	14	Atlantic menhaden	0
2013	Spring	21	NB	27	Blueback herring	61
2013	Spring	21	NB	156	Striped bass	0
2013	Spring	21	UB	2	Alewife	0
2013	Spring	21	UB	6	American shad	0
2013	Spring	21	UB	14	Atlantic menhaden	0
2013	Spring	21	UB	27	Blueback herring	1
2013	Spring	21	UB	156	Striped bass	0
2013	Spring	23	AKKVK	2	Alewife	0
2013	Spring	23	AKKVK	6	American shad	0
2013	Spring	23	AKKVK	14	Atlantic menhaden	0
2013	Spring	23	AKKVK	27	Blueback herring	0
2013	Spring	23	AKKVK	156	Striped bass	0
2013	Spring	23	LB	2	Alewife	0
2013	Spring	23	LB	6	American shad	0
2013	Spring	23	LB	14	Atlantic menhaden	0
2013	Spring	23	LB	27	Blueback herring	0
2013	Spring	23	LB	156	Striped bass	0

Table C-4.1. Data Used for the Non-Detect Analysis for Spring Samples						
Year	Season	WOY	Area Grouping	Species Code	Common Name	CPUE - 10 Min
2013	Spring	23	NB	2	Alewife	0
2013	Spring	23	NB	6	American shad	0
2013	Spring	23	NB	14	Atlantic menhaden	0
2013	Spring	23	NB	27	Blueback herring	0
2013	Spring	23	NB	156	Striped bass	0
2013	Spring	23	UB	2	Alewife	0
2013	Spring	23	UB	6	American shad	0
2013	Spring	23	UB	14	Atlantic menhaden	0
2013	Spring	23	UB	27	Blueback herring	0
2013	Spring	23	UB	156	Striped bass	0

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

Table C-4.1. Data Used for the Non-Detect Analysis for Fall Samples						
Year	Season	WOY	Area Grouping for MFS Report	Species Code	Common Name	CPUE - 10 Min
2013	Fall	37	AKKVK	2	Alewife	0
2013	Fall	37	AKKVK	6	American shad	0
2013	Fall	37	AKKVK	14	Atlantic menhaden	1
2013	Fall	37	AKKVK	27	Blueback herring	13
2013	Fall	37	AKKVK	156	Striped bass	0
2013	Fall	37	LB	2	Alewife	0
2013	Fall	37	LB	6	American shad	0
2013	Fall	37	LB	14	Atlantic menhaden	0
2013	Fall	37	LB	27	Blueback herring	0
2013	Fall	37	LB	156	Striped bass	0
2013	Fall	37	NB	2	Alewife	13
2013	Fall	37	NB	6	American shad	0
2013	Fall	37	NB	14	Atlantic menhaden	0
2013	Fall	37	NB	27	Blueback herring	6
2013	Fall	37	NB	156	Striped bass	0
2013	Fall	37	UB	2	Alewife	0
2013	Fall	37	UB	6	American shad	0
2013	Fall	37	UB	14	Atlantic menhaden	0
2013	Fall	37	UB	27	Blueback herring	1
2013	Fall	37	UB	156	Striped bass	0
2013	Fall	39	AKKVK	2	Alewife	0
2013	Fall	39	AKKVK	6	American shad	0
2013	Fall	39	AKKVK	14	Atlantic menhaden	0
2013	Fall	39	AKKVK	27	Blueback herring	0
2013	Fall	39	AKKVK	156	Striped bass	0
2013	Fall	39	LB	2	Alewife	0
2013	Fall	39	LB	6	American shad	0
2013	Fall	39	LB	14	Atlantic menhaden	0
2013	Fall	39	LB	27	Blueback herring	0
2013	Fall	39	LB	156	Striped bass	0
2013	Fall	39	NB	2	Alewife	0
2013	Fall	39	NB	6	American shad	0
2013	Fall	39	NB	14	Atlantic menhaden	0
2013	Fall	39	NB	27	Blueback herring	30
2013	Fall	39	NB	156	Striped bass	0
2013	Fall	39	UB	2	Alewife	0
2013	Fall	39	UB	6	American shad	0
2013	Fall	39	UB	14	Atlantic menhaden	0
2013	Fall	39	UB	27	Blueback herring	0
2013	Fall	39	UB	156	Striped bass	0
2013	Fall	40	AKKVK	2	Alewife	0
2013	Fall	40	AKKVK	6	American shad	0
2013	Fall	40	AKKVK	14	Atlantic menhaden	0
2013	Fall	40	AKKVK	27	Blueback herring	0
2013	Fall	40	AKKVK	156	Striped bass	0
2013	Fall	40	LB	2	Alewife	0
2013	Fall	40	LB	6	American shad	0
2013	Fall	40	LB	14	Atlantic menhaden	0
2013	Fall	40	LB	27	Blueback herring	1
2013	Fall	40	LB	156	Striped bass	0
2013	Fall	40	NB	2	Alewife	0
2013	Fall	40	NB	6	American shad	0
2013	Fall	40	NB	14	Atlantic menhaden	0
2013	Fall	40	NB	27	Blueback herring	60
2013	Fall	40	NB	156	Striped bass	0
2013	Fall	40	UB	2	Alewife	0

Table C-4.1. Data Used for the Non-Detect Analysis for Fall Samples						
Year	Season	WOY	Area Grouping for MFS Report	Species Code	Common Name	CPUE - 10 Min
2013	Fall	40	UB	6	American shad	0
2013	Fall	40	UB	14	Atlantic menhaden	0
2013	Fall	40	UB	27	Blueback herring	0
2013	Fall	40	UB	156	Striped bass	0
2013	Fall	41	AKKVK	2	Alewife	0
2013	Fall	41	AKKVK	6	American shad	0
2013	Fall	41	AKKVK	14	Atlantic menhaden	0
2013	Fall	41	AKKVK	27	Blueback herring	0
2013	Fall	41	AKKVK	156	Striped bass	0
2013	Fall	41	LB	2	Alewife	0
2013	Fall	41	LB	6	American shad	0
2013	Fall	41	LB	14	Atlantic menhaden	0
2013	Fall	41	LB	27	Blueback herring	0
2013	Fall	41	LB	156	Striped bass	0
2013	Fall	41	NB	2	Alewife	1
2013	Fall	41	NB	6	American shad	0
2013	Fall	41	NB	14	Atlantic menhaden	0
2013	Fall	41	NB	27	Blueback herring	14
2013	Fall	41	NB	156	Striped bass	0
2013	Fall	41	UB	2	Alewife	6
2013	Fall	41	UB	6	American shad	0
2013	Fall	41	UB	14	Atlantic menhaden	0
2013	Fall	41	UB	27	Blueback herring	0
2013	Fall	41	UB	156	Striped bass	0
2013	Fall	42	AKKVK	2	Alewife	0
2013	Fall	42	AKKVK	6	American shad	0
2013	Fall	42	AKKVK	14	Atlantic menhaden	0
2013	Fall	42	AKKVK	27	Blueback herring	0
2013	Fall	42	AKKVK	156	Striped bass	0
2013	Fall	42	LB	2	Alewife	0
2013	Fall	42	LB	6	American shad	0
2013	Fall	42	LB	14	Atlantic menhaden	0
2013	Fall	42	LB	27	Blueback herring	0
2013	Fall	42	LB	156	Striped bass	0
2013	Fall	42	NB	2	Alewife	0
2013	Fall	42	NB	6	American shad	0
2013	Fall	42	NB	14	Atlantic menhaden	1
2013	Fall	42	NB	27	Blueback herring	270
2013	Fall	42	NB	156	Striped bass	0
2013	Fall	42	UB	2	Alewife	0
2013	Fall	42	UB	6	American shad	0
2013	Fall	42	UB	14	Atlantic menhaden	0
2013	Fall	42	UB	27	Blueback herring	1
2013	Fall	42	UB	156	Striped bass	0
2013	Fall	43	AKKVK	2	Alewife	0
2013	Fall	43	AKKVK	6	American shad	0
2013	Fall	43	AKKVK	14	Atlantic menhaden	0
2013	Fall	43	AKKVK	27	Blueback herring	0
2013	Fall	43	AKKVK	156	Striped bass	0
2013	Fall	43	LB	2	Alewife	0
2013	Fall	43	LB	6	American shad	0
2013	Fall	43	LB	14	Atlantic menhaden	0
2013	Fall	43	LB	27	Blueback herring	0
2013	Fall	43	LB	156	Striped bass	0
2013	Fall	43	NB	2	Alewife	0
2013	Fall	43	NB	6	American shad	0
2013	Fall	43	NB	14	Atlantic menhaden	0

Table C-4.1. Data Used for the Non-Detect Analysis for Fall Samples						
Year	Season	WOY	Area Grouping for MFS Report	Species Code	Common Name	CPUE - 10 Min
2013	Fall	43	NB	27	Blueback herring	0
2013	Fall	43	NB	156	Striped bass	0
2013	Fall	43	UB	2	Alewife	0
2013	Fall	43	UB	6	American shad	2
2013	Fall	43	UB	14	Atlantic menhaden	0
2013	Fall	43	UB	27	Blueback herring	0
2013	Fall	43	UB	156	Striped bass	0
2013	Fall	44	AKKVK	2	Alewife	0
2013	Fall	44	AKKVK	6	American shad	0
2013	Fall	44	AKKVK	14	Atlantic menhaden	0
2013	Fall	44	AKKVK	27	Blueback herring	0
2013	Fall	44	AKKVK	156	Striped bass	0
2013	Fall	44	LB	2	Alewife	0
2013	Fall	44	LB	6	American shad	0
2013	Fall	44	LB	14	Atlantic menhaden	0
2013	Fall	44	LB	27	Blueback herring	0
2013	Fall	44	LB	156	Striped bass	0
2013	Fall	44	NB	2	Alewife	0
2013	Fall	44	NB	6	American shad	0
2013	Fall	44	NB	14	Atlantic menhaden	0
2013	Fall	44	NB	27	Blueback herring	1111
2013	Fall	44	NB	156	Striped bass	0
2013	Fall	44	UB	2	Alewife	0
2013	Fall	44	UB	6	American shad	0
2013	Fall	44	UB	14	Atlantic menhaden	0
2013	Fall	44	UB	27	Blueback herring	0
2013	Fall	44	UB	156	Striped bass	0
2013	Fall	45	AKKVK	2	Alewife	0
2013	Fall	45	AKKVK	6	American shad	0
2013	Fall	45	AKKVK	14	Atlantic menhaden	0
2013	Fall	45	AKKVK	27	Blueback herring	1
2013	Fall	45	AKKVK	156	Striped bass	0
2013	Fall	45	LB	2	Alewife	0
2013	Fall	45	LB	6	American shad	0
2013	Fall	45	LB	14	Atlantic menhaden	0
2013	Fall	45	LB	27	Blueback herring	0
2013	Fall	45	LB	156	Striped bass	0
2013	Fall	45	NB	2	Alewife	0
2013	Fall	45	NB	6	American shad	0
2013	Fall	45	NB	14	Atlantic menhaden	0
2013	Fall	45	NB	27	Blueback herring	0
2013	Fall	45	NB	156	Striped bass	0
2013	Fall	45	UB	2	Alewife	0
2013	Fall	45	UB	6	American shad	2
2013	Fall	45	UB	14	Atlantic menhaden	0
2013	Fall	45	UB	27	Blueback herring	1
2013	Fall	45	UB	156	Striped bass	0
2013	Fall	46	AKKVK	2	Alewife	0
2013	Fall	46	AKKVK	6	American shad	0
2013	Fall	46	AKKVK	14	Atlantic menhaden	1
2013	Fall	46	AKKVK	27	Blueback herring	0
2013	Fall	46	AKKVK	156	Striped bass	0
2013	Fall	46	LB	2	Alewife	0
2013	Fall	46	LB	6	American shad	0
2013	Fall	46	LB	14	Atlantic menhaden	0
2013	Fall	46	LB	27	Blueback herring	0
2013	Fall	46	LB	156	Striped bass	0

Table C-4.1. Data Used for the Non-Detect Analysis for Fall Samples						
Year	Season	WOY	Area Grouping for MFS Report	Species Code	Common Name	CPUE - 10 Min
2013	Fall	46	NB	2	Alewife	0
2013	Fall	46	NB	6	American shad	0
2013	Fall	46	NB	14	Atlantic menhaden	0
2013	Fall	46	NB	27	Blueback herring	0
2013	Fall	46	NB	156	Striped bass	0
2013	Fall	46	UB	2	Alewife	0
2013	Fall	46	UB	6	American shad	2
2013	Fall	46	UB	14	Atlantic menhaden	0
2013	Fall	46	UB	27	Blueback herring	3
2013	Fall	46	UB	156	Striped bass	0
2013	Fall	47	AKKVK	2	Alewife	0
2013	Fall	47	AKKVK	6	American shad	0
2013	Fall	47	AKKVK	14	Atlantic menhaden	0
2013	Fall	47	AKKVK	27	Blueback herring	0
2013	Fall	47	AKKVK	156	Striped bass	0
2013	Fall	47	LB	2	Alewife	0
2013	Fall	47	LB	6	American shad	0
2013	Fall	47	LB	14	Atlantic menhaden	0
2013	Fall	47	LB	27	Blueback herring	0
2013	Fall	47	LB	156	Striped bass	0
2013	Fall	47	NB	2	Alewife	0
2013	Fall	47	NB	6	American shad	0
2013	Fall	47	NB	14	Atlantic menhaden	0
2013	Fall	47	NB	27	Blueback herring	120
2013	Fall	47	NB	156	Striped bass	0
2013	Fall	47	UB	2	Alewife	2
2013	Fall	47	UB	6	American shad	3
2013	Fall	47	UB	14	Atlantic menhaden	0
2013	Fall	47	UB	27	Blueback herring	55
2013	Fall	47	UB	156	Striped bass	0
2013	Fall	49	AKKVK	2	Alewife	0
2013	Fall	49	AKKVK	6	American shad	0
2013	Fall	49	AKKVK	14	Atlantic menhaden	0
2013	Fall	49	AKKVK	27	Blueback herring	0
2013	Fall	49	AKKVK	156	Striped bass	0
2013	Fall	49	LB	2	Alewife	0
2013	Fall	49	LB	6	American shad	0
2013	Fall	49	LB	14	Atlantic menhaden	0
2013	Fall	49	LB	27	Blueback herring	0
2013	Fall	49	LB	156	Striped bass	0
2013	Fall	49	NB	2	Alewife	0
2013	Fall	49	NB	6	American shad	0
2013	Fall	49	NB	14	Atlantic menhaden	0
2013	Fall	49	NB	27	Blueback herring	0
2013	Fall	49	NB	156	Striped bass	0
2013	Fall	49	UB	2	Alewife	0
2013	Fall	49	UB	6	American shad	1
2013	Fall	49	UB	14	Atlantic menhaden	0
2013	Fall	49	UB	27	Blueback herring	11
2013	Fall	49	UB	156	Striped bass	0

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

Nondetects Analysis Report

Page/Date/Time 1 1/24/2014 3:24:17 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Spring"
Response Variable = WOY
Nondetects Variable = Censor_1. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).

Data Summary Section

Group	Type	Rows	Count	Minimum	Maximum	
Alewife	Detected	9	211	16	21	
Alewife	Not Detected	0	0			
Alewife	Total	9	211	16	21	
American shad	Detected	4	7	17	21	
American shad	Not Detected	0	0			
American shad	Total	4	7	17	21	
Atlantic menhaden		Detected	6	11	16	19
Atlantic menhaden		Not Detected	0	0		
Atlantic menhaden		Total	6	11	16	19
Blueback herring	Detected	21	2123	12	21	
Blueback herring	Not Detected	0	0			
Blueback herring	Total	21	2123	12	21	

Data Summary Section: Response Quartiles

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

Nondetects Analysis Report

Page/Date/Time 2 1/24/2014 3:24:17 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Spring"
Response Variable = WOY
Nondetects Variable = Censor_1. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).

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	66.891	3	0.0000	Yes
Gehan-Wilcoxon	60.585	3	0.0000	Yes
Tarone-Ware	63.794	3	0.0000	Yes
Peto-Peto	44.935	3	0.0000	Yes
Mod. Peto-Peto	44.933	3	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	9.388	1	0.0022	Yes	0.0131	Yes
Gehan-Wilcoxon	7.887	1	0.0050	Yes	0.0299	Yes
Tarone-Ware	8.535	1	0.0035	Yes	0.0209	Yes
Peto-Peto	11.545	1	0.0007	Yes	0.0041	Yes
Mod. Peto-Peto	11.533	1	0.0007	Yes	0.0041	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	0.041	1	0.8403	No	1.0000	No
Gehan-Wilcoxon	1.320	1	0.2506	No	1.0000	No
Tarone-Ware	0.523	1	0.4698	No	1.0000	No
Peto-Peto	0.253	1	0.6150	No	1.0000	No
Mod. Peto-Peto	0.259	1	0.6107	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	47.905	1	0.0000	Yes	0.0000	Yes
Gehan-Wilcoxon	44.225	1	0.0000	Yes	0.0000	Yes

Tarone-Ware	46.279	1	0.0000	Yes	0.0000	Yes
Peto-Peto	27.405	1	0.0000	Yes	0.0000	Yes
Mod. Peto-Peto	27.404	1	0.0000	Yes	0.0000	Yes

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	10.918	1	0.0010	Yes	0.0057	Yes
Gehan-Wilcoxon	11.140	1	0.0008	Yes	0.0051	Yes
Tarone-Ware	11.099	1	0.0009	Yes	0.0052	Yes
Peto-Peto	10.535	1	0.0012	Yes	0.0070	Yes
Mod. Peto-Peto	10.517	1	0.0012	Yes	0.0071	Yes

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	18.378	1	0.0000	Yes	0.0001	Yes
Gehan-Wilcoxon	17.122	1	0.0000	Yes	0.0002	Yes
Tarone-Ware	17.715	1	0.0000	Yes	0.0002	Yes
Peto-Peto	17.903	1	0.0000	Yes	0.0001	Yes
Mod. Peto-Peto	17.902	1	0.0000	Yes	0.0001	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	2.218	1	0.1364	No	0.8184	No
Gehan-Wilcoxon	0.759	1	0.3838	No	1.0000	No
Tarone-Ware	1.384	1	0.2395	No	1.0000	No
Peto-Peto	0.862	1	0.3532	No	1.0000	No
Mod. Peto-Peto	0.861	1	0.3533	No	1.0000	No

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

Nondetects Analysis Report

Page/Date/Time 3 1/24/2014 3:24:17 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Spring"
Response Variable = WOY
Nondetects Variable = Censor_1. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).

Logrank Test Detail Section

Group	Z-Value	Standard Error	Standardized Z-Value
Alewife	55.407	8.109	6.833
American shad	5.040	1.214	4.150
Atlantic menhaden	2.675	2.009	1.331
Blueback herring	-63.122	8.386	-7.527

Probability Level was 0.0000

Gehan-Wilcoxon Test Detail Section

Group	Z-Value	Standard Error	Standardized Z-Value
Alewife	110529.000	16823.352	6.570
American shad	10991.000	2750.987	3.995
Atlantic menhaden	2731.000	4123.148	0.662
Blueback herring	-124251.000	17413.033	-7.136

Probability Level was 0.0000

Tarone-Ware Test Detail Section

Group	Z-Value	Standard Error	Standardized Z-Value
Alewife	2463.512	366.680	6.718
American shad	234.927	57.740	4.069
Atlantic menhaden	89.457	90.345	0.990
Blueback herring	-2787.897	379.387	-7.348

Probability Level was 0.0000

Peto-Peto Test Detail Section

Group	Z-Value	Standard Error	Standardized Z-Value
Alewife	26.883	5.224	5.147
American shad	3.693	0.896	4.120
Atlantic menhaden	1.004	1.302	0.771
Blueback herring	-31.581	5.416	-5.831

Probability Level was 0.0000

Nondetects Analysis Report

Page/Date/Time 4 1/24/2014 3:24:17 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Spring"
Response Variable = WOY
Nondetects Variable = Censor_1. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).

Mod. Peto-Peto Test Detail Section

Group	Z-Value	Standard Error	Standardized Z-Value
Alewife	26.871	5.221	5.147
American shad	3.691	0.896	4.120
Atlantic menhaden	1.003	1.302	0.771
Blueback herring	-31.565	5.414	-5.831

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
Alewife	6.000					0
American shad	6.000					0
Atlantic menhaden	6.000					0
Blueback herring	6.000					0
Alewife	9.000					0
American shad	9.000					0
Atlantic menhaden	9.000					0
Blueback herring	9.000					0
Alewife	12.000					0
American shad	12.000					0
Atlantic menhaden	12.000					0
Blueback herring	12.000	0.0000				244
Alewife	15.000					0
American shad	15.000					0
Atlantic menhaden	15.000					0
Blueback herring	15.000	0.1276	0.0072	0.1135	0.1418	277
Alewife	18.000	0.5308	0.0344	0.4635	0.5981	112
American shad	18.000	0.1429	0.1323	0.0000	0.4021	1
Atlantic menhaden	18.000	0.9091	0.0867	0.7392	1.0000	10
Blueback herring	18.000	0.7179	0.0098	0.6987	0.7370	1524

Nondetects Analysis Report

Page/Date/Time 5 1/24/2014 3:24:17 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Spring"
Response Variable = WOY
Nondetects Variable = Censor_1. Group Variable = CName
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	21.000	0.9905	0.0067	0.9774	1.0000	211
American shad	21.000	0.8571	0.1323	0.5979	1.0000	7
Atlantic menhaden	21.000	1.0000	0.0000	1.0000	1.0000	11
Blueback herring	21.000	0.9703	0.0037	0.9631	0.9775	2123
Alewife	24.000	1.0000	0.0000	1.0000	1.0000	211
American shad	24.000	1.0000	0.0000	1.0000	1.0000	7
Atlantic menhaden	24.000	1.0000	0.0000	1.0000	1.0000	11
Blueback herring	24.000	1.0000	0.0000	1.0000	1.0000	2123
Alewife	27.000	1.0000	0.0000	1.0000	1.0000	211
American shad	27.000	1.0000	0.0000	1.0000	1.0000	7
Atlantic menhaden	27.000	1.0000	0.0000	1.0000	1.0000	11
Blueback herring	27.000	1.0000	0.0000	1.0000	1.0000	2123
Alewife	30.000	1.0000	0.0000	1.0000	1.0000	211
American shad	30.000	1.0000	0.0000	1.0000	1.0000	7
Atlantic menhaden	30.000	1.0000	0.0000	1.0000	1.0000	11
Blueback herring	30.000	1.0000	0.0000	1.0000	1.0000	2123

Nondetects Analysis Report

Page/Date/Time 6 1/24/2014 3:24:17 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Spring"
Response Variable = WOY
Nondetects Variable = Censor_1. 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	16.000	21.000	16.000
American shad	0.0500	17.000	17.000	19.000
Atlantic menhaden	0.0500	16.000	21.000	16.000
Blueback herring	0.0500	12.000	19.000	12.000
Alewife	0.1000	16.000	21.000	16.000
American shad	0.1000	17.000	17.000	19.000
Atlantic menhaden	0.1000	16.000	21.000	16.000
Blueback herring	0.1000	12.000	19.000	12.000
Alewife	0.1500	16.000	21.000	16.000
American shad	0.1500	19.000	17.000	19.000
Atlantic menhaden	0.1500	16.000	21.000	16.000
Blueback herring	0.1500	16.000	16.000	16.000
Alewife	0.2000	16.000	21.000	16.000
American shad	0.2000	19.000	17.000	19.000
Atlantic menhaden	0.2000	16.000	21.000	17.000
Blueback herring	0.2000	16.000	16.000	16.000
Alewife	0.2500	16.000	21.000	16.000
American shad	0.2500	19.000	17.000	19.000
Atlantic menhaden	0.2500	16.000	21.000	17.000
Blueback herring	0.2500	16.000	16.000	16.000
Alewife	0.3000	16.000	21.000	16.000
American shad	0.3000	19.000	17.000	19.000
Atlantic menhaden	0.3000	16.000	21.000	17.000
Blueback herring	0.3000	16.000	16.000	16.000
Alewife	0.3500	16.000	21.000	16.000
American shad	0.3500	19.000	17.000	19.000
Atlantic menhaden	0.3500	16.000	21.000	17.000
Blueback herring	0.3500	16.000	16.000	16.000

Nondetects Analysis Report

Page/Date/Time 7 1/24/2014 3:24:17 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Spring"
Response Variable = WOY
Nondetects Variable = Censor_1. 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	0.4000	16.000	21.000	16.000
American shad	0.4000	19.000	17.000	19.000
Atlantic menhaden	0.4000	16.000	21.000	17.000
Blueback herring	0.4000	16.000	16.000	16.000
Alewife	0.4500	16.000	21.000	17.000
American shad	0.4500	19.000	19.000	19.000
Atlantic menhaden	0.4500	16.000	21.000	17.000
Blueback herring	0.4500	16.000	16.000	16.000
Alewife	0.5000	17.000	21.000	19.000
American shad	0.5000	19.000	19.000	19.000
Atlantic menhaden	0.5000	17.000	21.000	17.000
Blueback herring	0.5000	16.000	16.000	16.000
Alewife	0.5500	19.000	17.000	19.000
American shad	0.5500	19.000	19.000	19.000
Atlantic menhaden	0.5500	17.000	21.000	17.000
Blueback herring	0.5500	16.000	16.000	16.000
Alewife	0.6000	19.000	19.000	19.000
American shad	0.6000	19.000	19.000	21.000
Atlantic menhaden	0.6000	17.000	21.000	17.000
Blueback herring	0.6000	16.000	16.000	16.000
Alewife	0.6500	19.000	19.000	19.000
American shad	0.6500	19.000	19.000	21.000
Atlantic menhaden	0.6500	17.000	21.000	17.000
Blueback herring	0.6500	16.000	16.000	17.000
Alewife	0.7000	19.000	19.000	19.000
American shad	0.7000	19.000	19.000	21.000
Atlantic menhaden	0.7000	17.000	21.000	17.000
Blueback herring	0.7000	17.000	17.000	19.000

Nondetects Analysis Report

Page/Date/Time 8 1/24/2014 3:24:17 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Spring"
Response Variable = WOY
Nondetects Variable = Censor_1. 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	0.7500	19.000	19.000	19.000
American shad	0.7500	19.000	19.000	21.000
Atlantic menhaden	0.7500	17.000	17.000	19.000
Blueback herring	0.7500	19.000	19.000	19.000
Alewife	0.8000	19.000	19.000	19.000
American shad	0.8000	19.000	19.000	21.000
Atlantic menhaden	0.8000	17.000	17.000	19.000
Blueback herring	0.8000	19.000	19.000	19.000
Alewife	0.8500	19.000	19.000	19.000
American shad	0.8500	19.000	19.000	21.000
Atlantic menhaden	0.8500	17.000	17.000	19.000
Blueback herring	0.8500	19.000	19.000	19.000
Alewife	0.9000	19.000	19.000	19.000
American shad	0.9000	21.000	19.000	21.000
Atlantic menhaden	0.9000	17.000	17.000	19.000
Blueback herring	0.9000	19.000	19.000	19.000
Alewife	0.9500	19.000	19.000	19.000
American shad	0.9500	21.000	19.000	21.000
Atlantic menhaden	0.9500	19.000	17.000	19.000
Blueback herring	0.9500	19.000	19.000	19.000

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				100	100
17.000	0.4739	0.0344	0.4066	0.5413	112	12
19.000	0.5308	0.0344	0.4635	0.5981	209	97
21.000	0.9905	0.0067	0.9774	1.0000	211	2

Nondetects Analysis Report

Page/Date/Time 9 1/24/2014 3:24:17 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Spring"
Response Variable = WOY
Nondetects Variable = Censor_1. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).

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
17.000	0.0000				1	1
19.000	0.1429	0.1323	0.0000	0.4021	6	5
21.000	0.8571	0.1323	0.5979	1.0000	7	1

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
16.000	0.0000				5	5
17.000	0.4545	0.1501	0.1603	0.7488	10	5
19.000	0.9091	0.0867	0.7392	1.0000	11	1

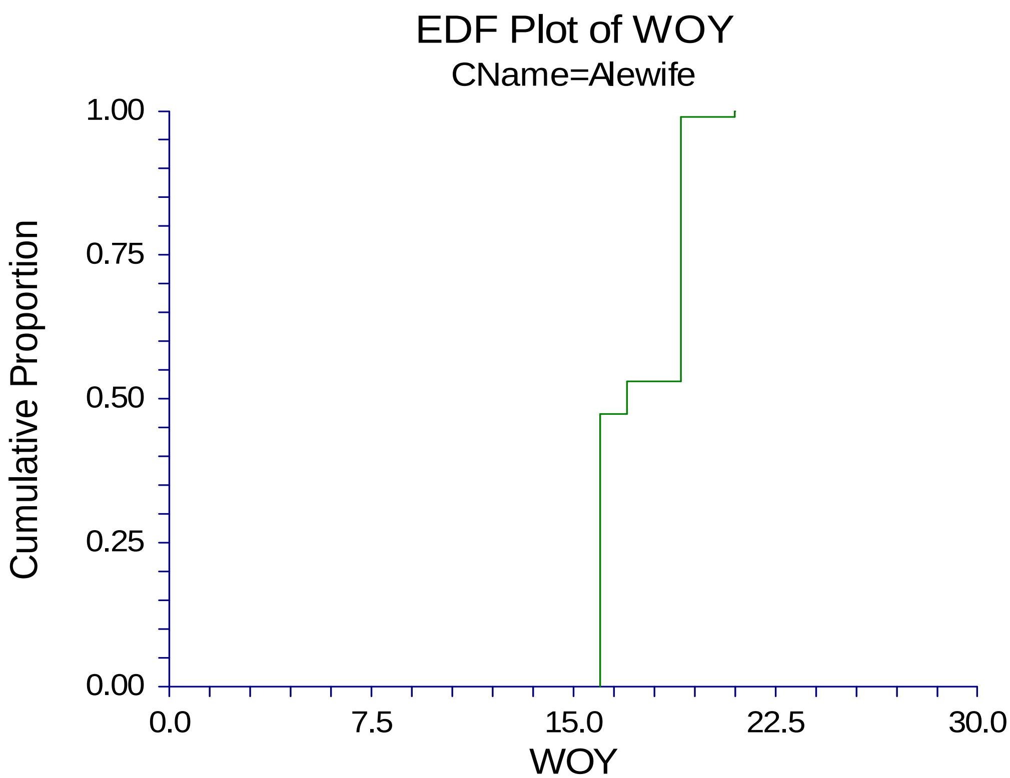
Response Detail for CName = Blueback herring

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
12.000	0.0000				244	244
13.000	0.1149	0.0069	0.1014	0.1285	249	5
14.000	0.1173	0.0070	0.1036	0.1310	271	22
15.000	0.1276	0.0072	0.1135	0.1418	277	6
16.000	0.1305	0.0073	0.1161	0.1448	1400	1123
17.000	0.6594	0.0103	0.6393	0.6796	1524	124
19.000	0.7179	0.0098	0.6987	0.7370	2060	536
21.000	0.9703	0.0037	0.9631	0.9775	2123	63

Nondetects Analysis Report

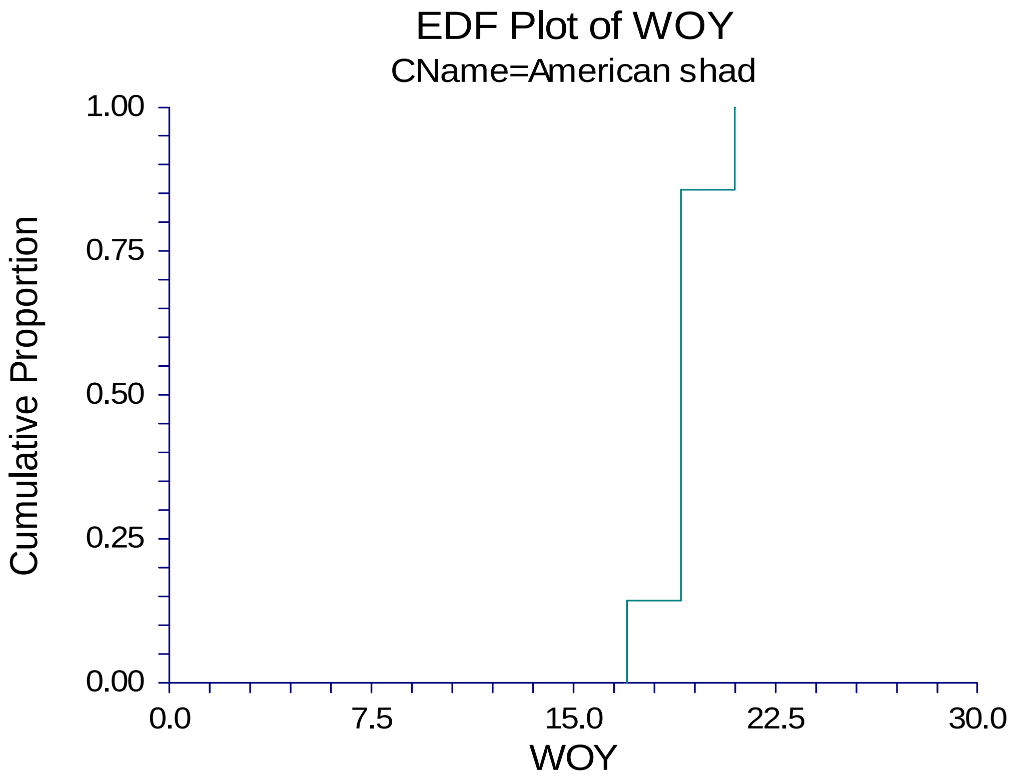
Page/Date/Time 10 1/24/2014 3:24:17 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Spring"
Response Variable = WOY
Nondetects Variable = Censor_1. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).

Plots Section



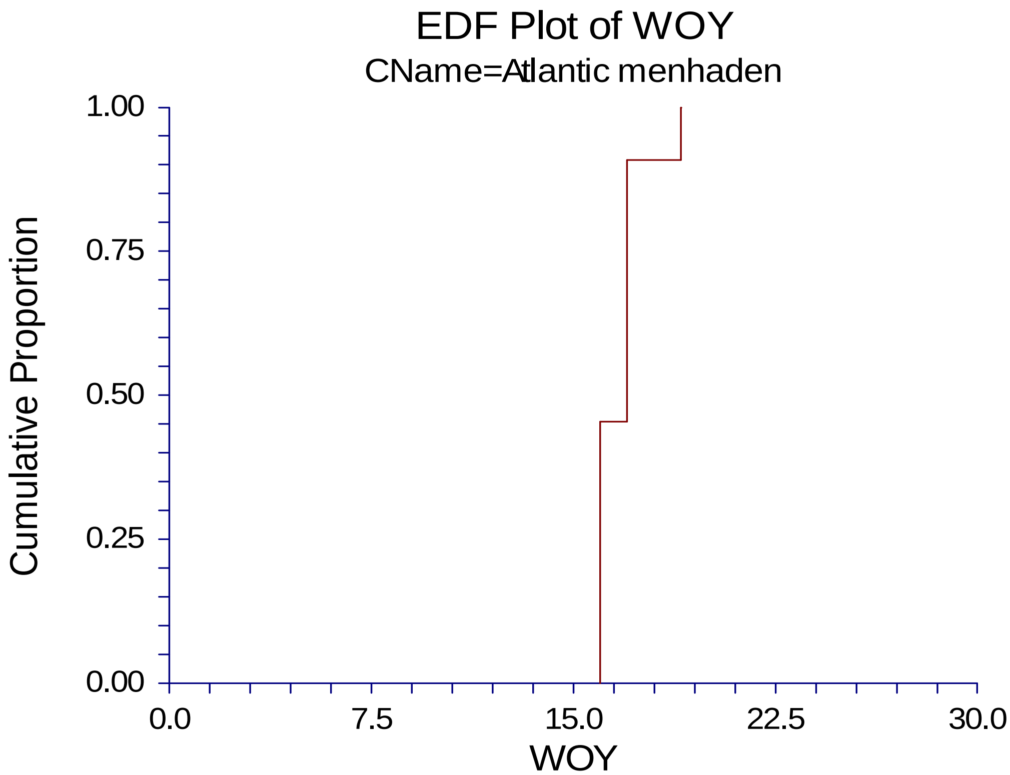
Nondetects Analysis Report

Page/Date/Time 11 1/24/2014 3:24:17 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Spring"
Response Variable = WOY
Nondetects Variable = Censor_1. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).



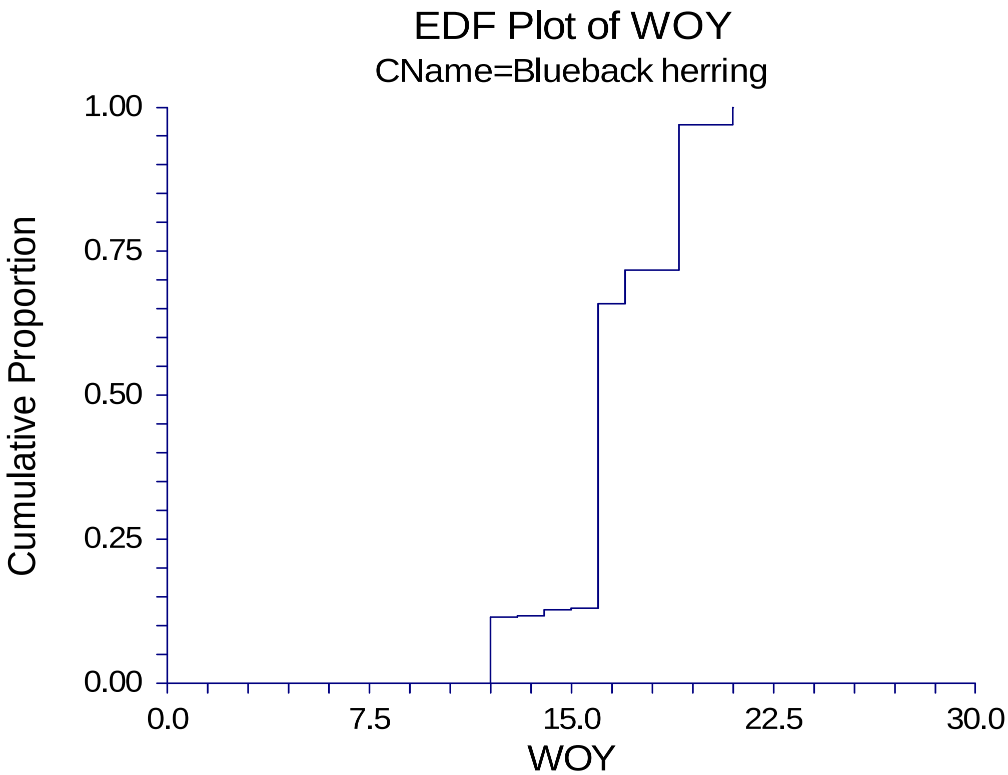
Nondetects Analysis Report

Page/Date/Time 12 1/24/2014 3:24:17 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Spring"
Response Variable = WOY
Nondetects Variable = Censor_1. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).



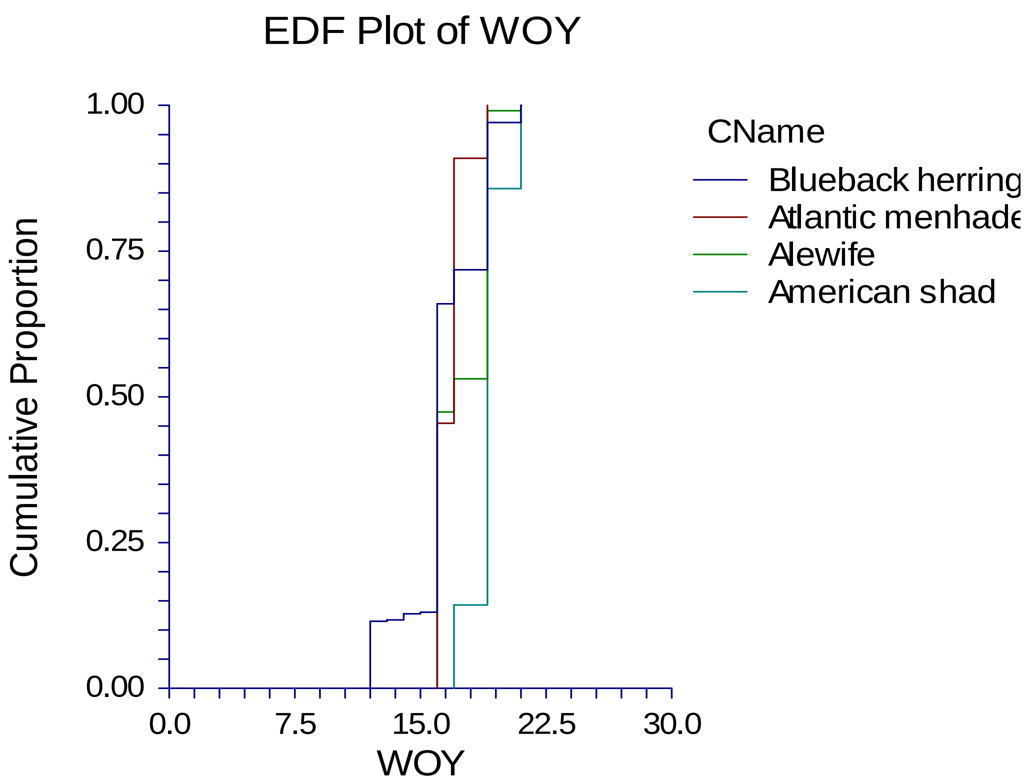
Nondetects Analysis Report

Page/Date/Time 13 1/24/2014 3:24:17 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Spring"
Response Variable = WOY
Nondetects Variable = Censor_1. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).



Nondetects Analysis Report

Page/Date/Time 14 1/24/2014 3:24:17 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Spring"
Response Variable = WOY
Nondetects Variable = Censor_1. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).



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

Nondetects Analysis Report

Page/Date/Time 1 1/24/2014 3:22:59 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Fall"
Response Variable = WOY
Nondetects Variable = Censor_1. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).

Data Summary Section

Group	Type	Rows	Count	Minimum	Maximum	
Alewife	Detected	4	22	37	47	
Alewife	Not Detected	0	0			
Alewife	Total	4	22	37	47	
American shad	Detected	5	10	43	49	
American shad	Not Detected	0	0			
American shad	Total	5	10	43	49	
Atlantic menhaden	Detected		3	3	37	46
Atlantic menhaden	Not Detected		0	0		
Atlantic menhaden	Total		3	3	37	46
Blueback herring	Detected	16	1698	37	49	
Blueback herring	Not Detected	0	0			
Blueback herring	Total	16	1698	37	49	

Data Summary Section: Response Quartiles

	Quartile	Estimate	Lower 95.0% C.L.	Upper 95.0% C.L.
Alewife	First (Q1)	37.000	49.000	37.000
Alewife	Median (Q2)	37.000	49.000	41.000
Alewife	Third (Q3)	41.000	49.000	41.000
American shad	First (Q1)	45.000	43.000	46.000
American shad	Median (Q2)	46.000	45.000	47.000
American shad	Third (Q3)	47.000	46.000	49.000
Atlantic menhaden	First (Q1)	37.000	49.000	46.000
Atlantic menhaden	Median (Q2)	42.000	49.000	46.000
Atlantic menhaden	Third (Q3)	46.000	49.000	46.000
Blueback herring	First (Q1)	44.000	42.000	44.000
Blueback herring	Median (Q2)	44.000	44.000	44.000
Blueback herring	Third (Q3)	44.000	44.000	44.000

Nondetects Analysis Report

Page/Date/Time 2 1/24/2014 3:22:59 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Fall"
Response Variable = WOY
Nondetects Variable = Censor_1. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).

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	117.224	3	0.0000	Yes
Gehan-Wilcoxon	77.857	3	0.0000	Yes
Tarone-Ware	100.775	3	0.0000	Yes
Peto-Peto	64.837	3	0.0000	Yes
Mod. Peto-Peto	64.804	3	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	28.155	1	0.0000	Yes	0.0000	Yes
Gehan-Wilcoxon	23.478	1	0.0000	Yes	0.0000	Yes
Tarone-Ware	25.773	1	0.0000	Yes	0.0000	Yes
Peto-Peto	24.704	1	0.0000	Yes	0.0000	Yes
Mod. Peto-Peto	24.539	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	2.341	1	0.1260	No	0.7562	No
Gehan-Wilcoxon	2.247	1	0.1339	No	0.8035	No
Tarone-Ware	2.301	1	0.1293	No	0.7757	No
Peto-Peto	3.207	1	0.0733	No	0.4399	No
Mod. Peto-Peto	3.196	1	0.0738	No	0.4429	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	73.528	1	0.0000	Yes	0.0000	Yes
Gehan-Wilcoxon	51.347	1	0.0000	Yes	0.0000	Yes

Tarone-Ware	69.006	1	0.0000	Yes	0.0000	Yes
Peto-Peto	12.787	1	0.0003	Yes	0.0021	Yes
Mod. Peto-Peto	12.770	1	0.0004	Yes	0.0021	Yes

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	3.837	1	0.0501	No	0.3008	No
Gehan-Wilcoxon	2.582	1	0.1081	No	0.6484	No
Tarone-Ware	3.158	1	0.0756	No	0.4533	No
Peto-Peto	2.521	1	0.1124	No	0.6741	No
Mod. Peto-Peto	2.399	1	0.1214	No	0.7286	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	41.696	1	0.0000	Yes	0.0000	Yes
Gehan-Wilcoxon	26.084	1	0.0000	Yes	0.0000	Yes
Tarone-Ware	31.021	1	0.0000	Yes	0.0000	Yes
Peto-Peto	52.297	1	0.0000	Yes	0.0000	Yes
Mod. Peto-Peto	52.279	1	0.0000	Yes	0.0000	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	3.423	1	0.0643	No	0.3859	No
Gehan-Wilcoxon	1.281	1	0.2577	No	1.0000	No
Tarone-Ware	1.941	1	0.1635	No	0.9812	No
Peto-Peto	0.117	1	0.7319	No	1.0000	No
Mod. Peto-Peto	0.118	1	0.7314	No	1.0000	No

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

Nondetects Analysis Report

Page/Date/Time 3 1/24/2014 3:22:59 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Fall"
Response Variable = WOY
Nondetects Variable = Censor_1. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).

Logrank Test Detail Section

Group	Z-Value	Standard Error	Standardized Z-Value
Alewife	-36.521	4.286	-8.521
American shad	7.495	1.161	6.455
Atlantic menhaden	-2.214	1.342	-1.650
Blueback herring	31.240	4.607	6.781

Probability Level was 0.0000

Gehan-Wilcoxon Test Detail Section

Group	Z-Value	Standard Error	Standardized Z-Value
Alewife	-29263.000	4107.590	-7.124
American shad	9870.000	1924.599	5.128
Atlantic menhaden	-1525.000	1397.845	-1.091
Blueback herring	20918.000	4729.103	4.423

Probability Level was 0.0000

Tarone-Ware Test Detail Section

Group	Z-Value	Standard Error	Standardized Z-Value
Alewife	-929.694	112.591	-8.257
American shad	263.700	47.193	5.588
Atlantic menhaden	-49.379	37.582	-1.314
Blueback herring	715.373	127.219	5.623

Probability Level was 0.0000

Peto-Peto Test Detail Section

Group	Z-Value	Standard Error	Standardized Z-Value
Alewife	-5.245	1.463	-3.584
American shad	6.392	0.884	7.232
Atlantic menhaden	0.153	0.533	0.287
Blueback herring	-1.300	1.782	-0.729

Probability Level was 0.0000

Nondetects Analysis Report

Page/Date/Time 4 1/24/2014 3:22:59 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Fall"
Response Variable = WOY
Nondetects Variable = Censor_1. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).

Mod. Peto-Peto Test Detail Section

Group	Z-Value	Standard Error	Standardized Z-Value
Alewife	-5.238	1.462	-3.582
American shad	6.388	0.883	7.231
Atlantic menhaden	0.153	0.532	0.287
Blueback herring	-1.302	1.781	-0.731

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
Alewife	10.000					0
American shad	10.000					0
Atlantic menhaden	10.000					0
Blueback herring	10.000					0
Alewife	15.000					0
American shad	15.000					0
Atlantic menhaden	15.000					0
Blueback herring	15.000					0
Alewife	20.000					0
American shad	20.000					0
Atlantic menhaden	20.000					0
Blueback herring	20.000					0
Alewife	25.000					0
American shad	25.000					0
Atlantic menhaden	25.000					0
Blueback herring	25.000					0
Alewife	30.000					0
American shad	30.000					0
Atlantic menhaden	30.000					0
Blueback herring	30.000					0

Nondetects Analysis Report

Page/Date/Time 5 1/24/2014 3:22:59 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Fall"
Response Variable = WOY
Nondetects Variable = Censor_1. Group Variable = CName
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	35.000					0
American shad	35.000					0
Atlantic menhaden	35.000					0
Blueback herring	35.000					0
Alewife	40.000	0.5909	0.1048	0.3855	0.7964	13
American shad	40.000					0
Atlantic menhaden	40.000	0.3333	0.2722	0.0000	0.8668	1
Blueback herring	40.000	0.0294	0.0041	0.0214	0.0375	111
Alewife	45.000	0.9091	0.0613	0.7890	1.0000	20
American shad	45.000	0.2000	0.1265	0.0000	0.4479	4
Atlantic menhaden	45.000	0.6667	0.2722	0.1332	1.0000	2
Blueback herring	45.000	0.8875	0.0077	0.8725	0.9025	1509
Alewife	50.000	1.0000	0.0000	1.0000	1.0000	22
American shad	50.000	1.0000	0.0000	1.0000	1.0000	10
Atlantic menhaden	50.000	1.0000	0.0000	1.0000	1.0000	3
Blueback herring	50.000	1.0000	0.0000	1.0000	1.0000	1698

Nondetects Analysis Report

Page/Date/Time 6 1/24/2014 3:22:59 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Fall"
Response Variable = WOY
Nondetects Variable = Censor_1. 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	37.000	49.000	37.000
American shad	0.0500	43.000	43.000	45.000
Atlantic menhaden	0.0500	37.000	49.000	42.000
Blueback herring	0.0500	40.000	40.000	40.000
Alewife	0.1000	37.000	49.000	37.000
American shad	0.1000	43.000	43.000	46.000
Atlantic menhaden	0.1000	37.000	49.000	42.000
Blueback herring	0.1000	42.000	42.000	42.000
Alewife	0.1500	37.000	49.000	37.000
American shad	0.1500	43.000	43.000	46.000
Atlantic menhaden	0.1500	37.000	49.000	46.000
Blueback herring	0.1500	42.000	42.000	42.000
Alewife	0.2000	37.000	49.000	37.000
American shad	0.2000	45.000	43.000	46.000
Atlantic menhaden	0.2000	37.000	49.000	46.000
Blueback herring	0.2000	42.000	42.000	42.000
Alewife	0.2500	37.000	49.000	37.000
American shad	0.2500	45.000	43.000	46.000
Atlantic menhaden	0.2500	37.000	49.000	46.000
Blueback herring	0.2500	44.000	42.000	44.000
Alewife	0.3000	37.000	49.000	37.000
American shad	0.3000	45.000	43.000	47.000
Atlantic menhaden	0.3000	37.000	49.000	46.000
Blueback herring	0.3000	44.000	44.000	44.000
Alewife	0.3500	37.000	49.000	37.000
American shad	0.3500	45.000	43.000	47.000
Atlantic menhaden	0.3500	42.000	49.000	46.000
Blueback herring	0.3500	44.000	44.000	44.000

Nondetects Analysis Report

Page/Date/Time 7 1/24/2014 3:22:59 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Fall"
Response Variable = WOY
Nondetects Variable = Censor_1. 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	0.4000	37.000	49.000	41.000
American shad	0.4000	46.000	43.000	47.000
Atlantic menhaden	0.4000	42.000	49.000	46.000
Blueback herring	0.4000	44.000	44.000	44.000
Alewife	0.4500	37.000	49.000	41.000
American shad	0.4500	46.000	45.000	47.000
Atlantic menhaden	0.4500	42.000	49.000	46.000
Blueback herring	0.4500	44.000	44.000	44.000
Alewife	0.5000	37.000	49.000	41.000
American shad	0.5000	46.000	45.000	47.000
Atlantic menhaden	0.5000	42.000	49.000	46.000
Blueback herring	0.5000	44.000	44.000	44.000
Alewife	0.5500	37.000	49.000	41.000
American shad	0.5500	46.000	45.000	47.000
Atlantic menhaden	0.5500	42.000	49.000	46.000
Blueback herring	0.5500	44.000	44.000	44.000
Alewife	0.6000	41.000	49.000	41.000
American shad	0.6000	47.000	45.000	47.000
Atlantic menhaden	0.6000	42.000	49.000	46.000
Blueback herring	0.6000	44.000	44.000	44.000
Alewife	0.6500	41.000	49.000	41.000
American shad	0.6500	47.000	45.000	47.000
Atlantic menhaden	0.6500	42.000	49.000	46.000
Blueback herring	0.6500	44.000	44.000	44.000
Alewife	0.7000	41.000	49.000	41.000
American shad	0.7000	47.000	45.000	47.000
Atlantic menhaden	0.7000	46.000	49.000	46.000
Blueback herring	0.7000	44.000	44.000	44.000

Nondetects Analysis Report

Page/Date/Time 8 1/24/2014 3:22:59 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Fall"
Response Variable = WOY
Nondetects Variable = Censor_1. 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	0.7500	41.000	49.000	41.000
American shad	0.7500	47.000	46.000	49.000
Atlantic menhaden	0.7500	46.000	49.000	46.000
Blueback herring	0.7500	44.000	44.000	44.000
Alewife	0.8000	41.000	41.000	47.000
American shad	0.8000	47.000	46.000	49.000
Atlantic menhaden	0.8000	46.000	49.000	46.000
Blueback herring	0.8000	44.000	44.000	44.000
Alewife	0.8500	41.000	41.000	47.000
American shad	0.8500	47.000	46.000	49.000
Atlantic menhaden	0.8500	46.000	49.000	46.000
Blueback herring	0.8500	44.000	44.000	44.000
Alewife	0.9000	41.000	41.000	47.000
American shad	0.9000	49.000	46.000	49.000
Atlantic menhaden	0.9000	46.000	42.000	46.000
Blueback herring	0.9000	47.000	44.000	47.000
Alewife	0.9500	47.000	41.000	47.000
American shad	0.9500	49.000	47.000	49.000
Atlantic menhaden	0.9500	46.000	42.000	46.000
Blueback herring	0.9500	47.000	47.000	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
37.000	0.0000				13	13
41.000	0.5909	0.1048	0.3855	0.7964	20	7
47.000	0.9091	0.0613	0.7890	1.0000	22	2

Nondetects Analysis Report

Page/Date/Time 9 1/24/2014 3:22:59 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Fall"
Response Variable = WOY
Nondetects Variable = Censor_1. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).

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
43.000	0.0000				2	2
45.000	0.2000	0.1265	0.0000	0.4479	4	2
46.000	0.4000	0.1549	0.0964	0.7036	6	2
47.000	0.6000	0.1549	0.2964	0.9036	9	3
49.000	0.9000	0.0949	0.7141	1.0000	10	1

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
37.000	0.0000				1	1
42.000	0.3333	0.2722	0.0000	0.8668	2	1
46.000	0.6667	0.2722	0.1332	1.0000	3	1

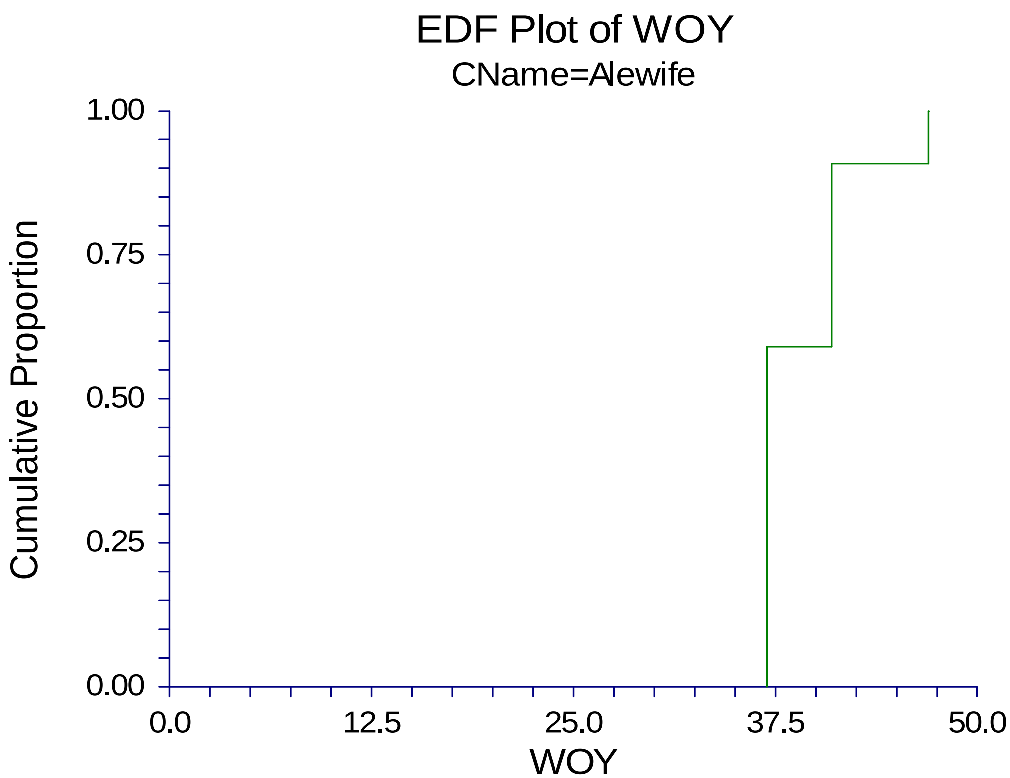
Response Detail for CName = Blueback herring

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
37.000	0.0000				20	20
39.000	0.0118	0.0026	0.0066	0.0169	50	30
40.000	0.0294	0.0041	0.0214	0.0375	111	61
41.000	0.0654	0.0060	0.0536	0.0771	125	14
42.000	0.0736	0.0063	0.0612	0.0860	396	271
44.000	0.2332	0.0103	0.2131	0.2533	1507	1111
45.000	0.8875	0.0077	0.8725	0.9025	1509	2
46.000	0.8887	0.0076	0.8737	0.9037	1512	3
47.000	0.8905	0.0076	0.8756	0.9053	1687	175
49.000	0.9935	0.0019	0.9897	0.9973	1698	11

Nondetects Analysis Report

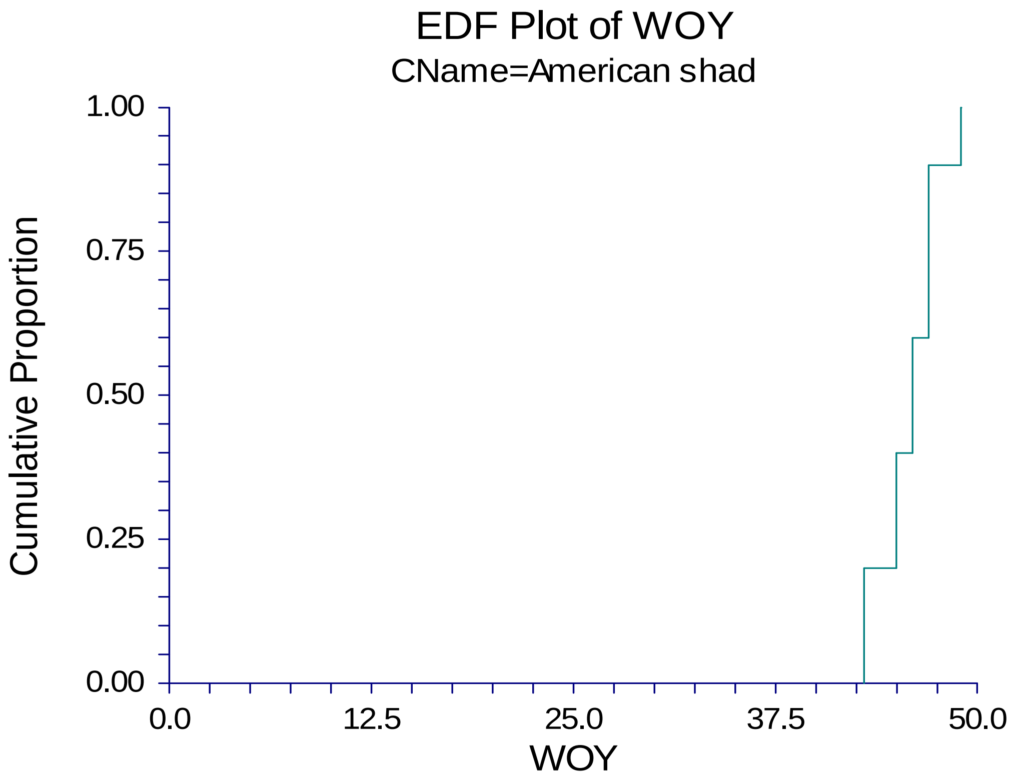
Page/Date/Time 10 1/24/2014 3:22:59 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Fall"
Response Variable = WOY
Nondetects Variable = Censor_1. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).

Plots Section



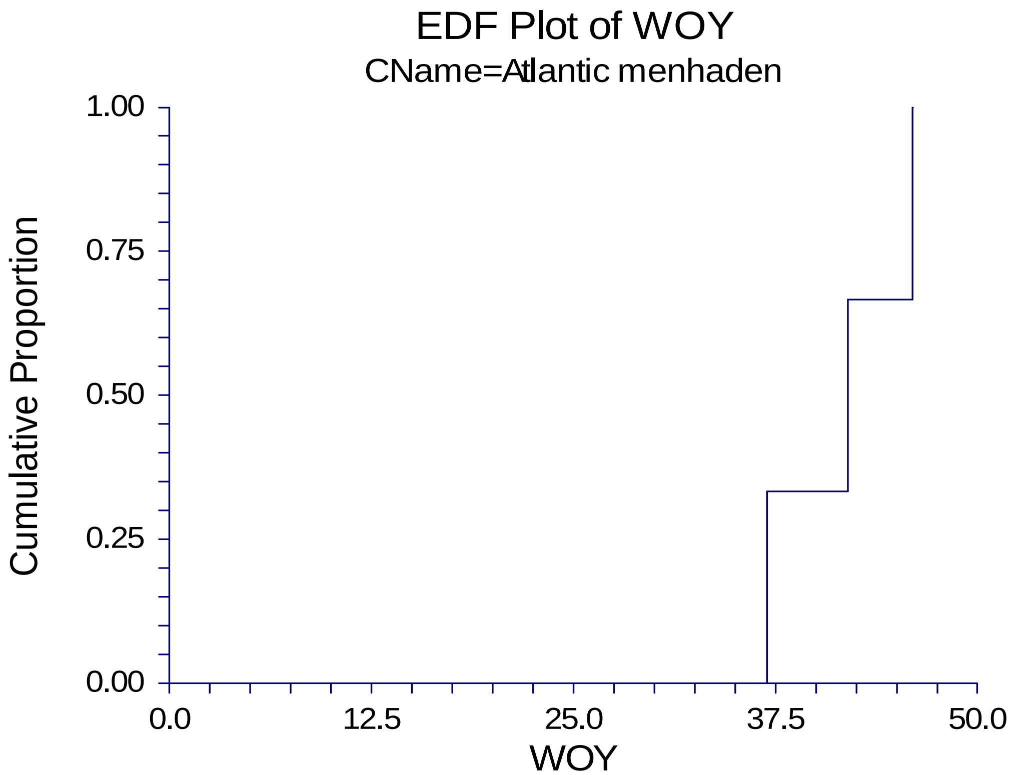
Nondetects Analysis Report

Page/Date/Time 11 1/24/2014 3:22:59 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Fall"
Response Variable = WOY
Nondetects Variable = Censor_1. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).



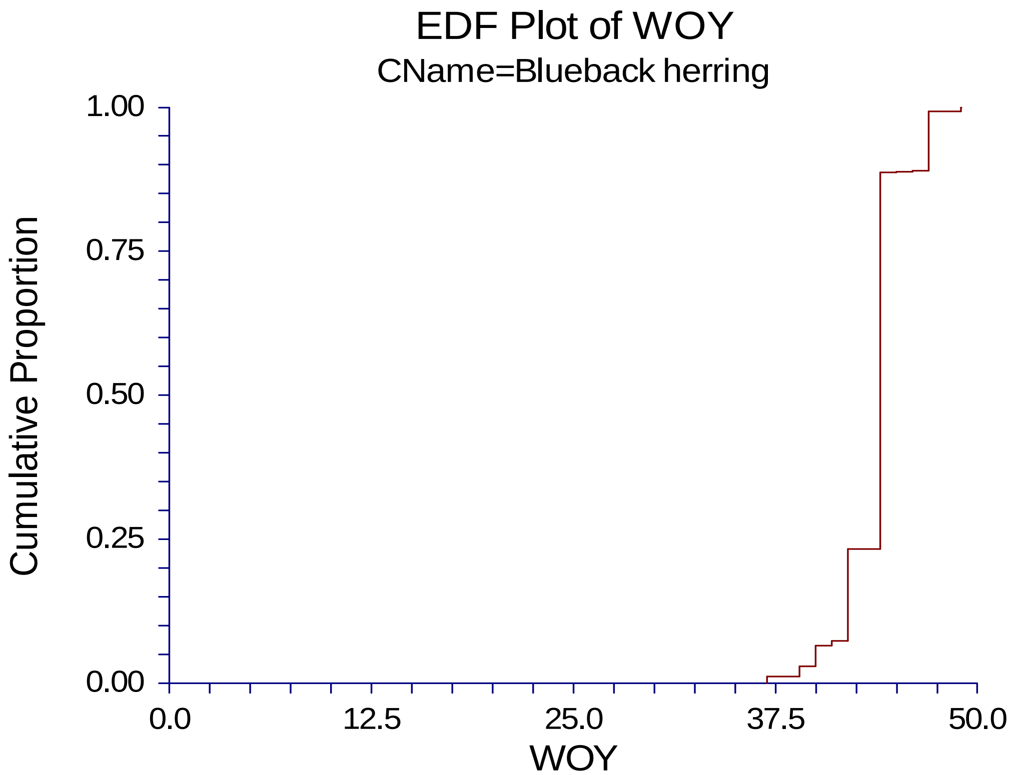
Nondetects Analysis Report

Page/Date/Time 12 1/24/2014 3:22:59 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Fall"
Response Variable = WOY
Nondetects Variable = Censor_1. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).



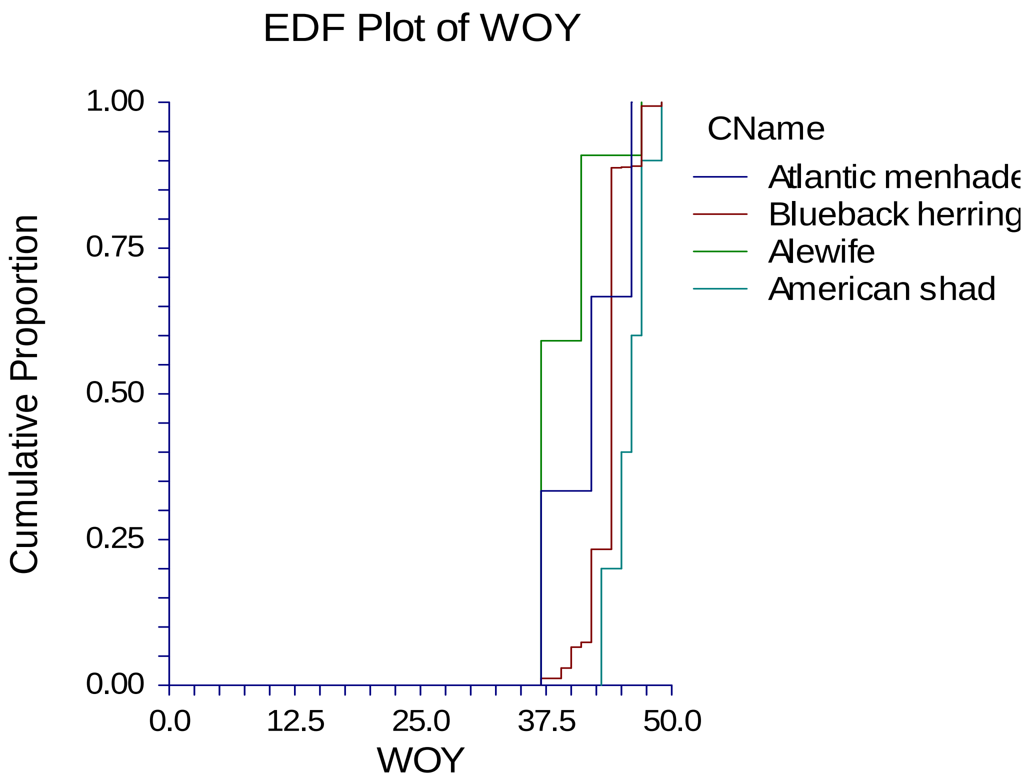
Nondetects Analysis Report

Page/Date/Time 13 1/24/2014 3:22:59 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Fall"
Response Variable = WOY
Nondetects Variable = Censor_1. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).



Nondetects Analysis Report

Page/Date/Time 14 1/24/2014 3:22:59 PM
Database C:\Users\jburnett\Desktop\2013 Stats\2013 MFR CFD Database_v2.S0
Filter Season = "Fall"
Response Variable = WOY
Nondetects Variable = Censor_1. Group Variable = CName
Confidence Limits Method = Linear (Greenwood).



Appendix D

Near-Bottom Mid-water Trawl Collection Results

Overview

In addition to the mid-water trawls that were conducted during 2013 Migratory Finfish sampling, 15 deeper "near bottom" trawls were conducted in an effort to collect target species that may be congregating below the mid-depth level. These near-bottom trawls were conducted based on target species life history and catch data from the 2011 and 2012 surveys, where it was speculated that the probability of capturing migratory spawning adults may be increased by sampling closer to the bottom. Near-bottom trawls were conducted when observations of potentially schooling target species were seen on the on-board "fish finder" during mid-water tows in which few or no target species were collected. If potential schools were observed below mid-water on the fish finder during a typical tow, a second ten-minute tow was immediately conducted at the same station, with the 18-foot balloon trawl set at approximately 70-90% of the total station depth.

As with mid-water trawls, following each near-bottom trawl, fish collected were identified, enumerated, and measured for total length to the nearest millimeter before being released into the water. The total lengths of up to 100 specimens of each target species (i.e., Atlantic menhaden, American shad, blueback herring, alewife and striped bass) were recorded. For all non-target species, total lengths of up to 25 specimens of each species were recorded for randomly selected individuals.

Results

Fifteen near-bottom trawls were conducted at seven different stations across three of the four harbor areas (Upper Bay, Lower Bay, and Newark Bay.) All near-bottom tows were conducted at channel stations. Ten near-bottom tows were conducted during the spring and five during the fall (Table D-1).

A total of 387 individuals of 12 species were collected across all near-bottom tows. Species collected in near-bottom tows which were not collected in mid-water tows include American eel (*Anguilla rostrata*), pollock (*Pollachius virens*), and striped searobin (*Prionotus evolans*). Of the total caught, 205 individuals represented four target species: alewife, American shad, Atlantic menhaden, and blueback herring. As with mid-water tows, no striped bass were collected in 2013. All target species collected in near-bottom tows were collected in the spring (Table D-2).

Figures D-1 through D-7 compare the Catch per Unit Effort (CPUE; number of fish/10-minute tow) for each pair of mid-water and near-bottom tows. For target and non-target species combined, catches were higher for mid-water tows in five of the pairs, higher near-bottom in five pairs, and the same in five pairs (including tows with no catch.)

More target species were collected in near-bottom than mid-water trawls in three of the 15 pairs of tows: MLB-3 on 24 April, MNB-1 on 23 April, and MUB-9 on 21 March. At MLB-3 on 24 April (Figure D-1), target species had a total CPUE of three (two Atlantic menhaden, and one blueback herring) in the near-bottom tow, compared to a CPUE of two (both blueback herring) in the corresponding mid-water tow. At MNB-1 on 23 April and MUB-9 on 21 March, no target species were collected mid-water, while alewife and American shad were collected near-bottom at MNB-1 (Figure D-2); and alewife, American shad, and a relatively large number of blueback herring (181 fish/10-minute tow) were collected near-bottom at MUB-9 (Figure D-7).

In four of the 15 pairs of tows more target species were collected mid-water than near-bottom; one in Newark Bay and three in Upper Bay. The largest difference occurred in the tow conducted at MNB-2 on 16 April, where blueback herring were collected with a CPUE of 918 fish/10-minute tow in the mid-water sample, while none were collected at near-bottom depth (Figure D-3).

In the remaining eight pairs of mid-water and near-bottom tows, no target species were collected at either depth.

Length frequency distributions of target species were similar between paired mid-water and near-bottom tows (Figures D-8 through D-11). Distributions for alewife and blueback herring show the same overall pattern at both depths, with juvenile/sub-adult fish of approximately 60 to 140 mm being most abundant and spawning adults (total length > 170 mm) collected. Two alewife of adult size were collected in near-bottom tows compared to one in mid-water tows. However, one adult blueback herring was collected near-bottom and six were collected mid-water. Overall, minimum, median, and maximum total length of target species were also similar between mid-water and near-bottom samples, the most notable difference being that a smaller size class of Atlantic menhaden was caught in mid-water tows (minimum 114 mm) versus near-bottom (minimum 342 mm) (Table D-3, Figure D-10).

Results from near-bottom tows suggest that four of the five target species collected in the 2013 sampling program (alewife, American shad, Atlantic menhaden, and blueback herring) do utilize near-bottom depths (approximately 70-90% of total water column depth). Comparisons of corresponding near-bottom and mid-water tows suggest these species may be present either depth at any given time, but over the entire sampling program there was no indication that one depth was preferred. Comparisons of length frequency distributions and total length measurements also provided no overall evidence that spawning adults prefer one depth over the other.

Table D-1. Valid Near-bottom Trawl Samples Collected During the 2013 Migratory Finfish Sampling Program

Region	**Station**	**Average Station Depth**	**Average Sample Depth**	**Number of Valid Samples**
Lower Bay	MLB-3-D	35	27.5	2
Newark Bay	MNB-1-D	59	50	1
	MNB-2-D	58.5	49.75	4
Upper Bay	MUB-1-D	73	61	1
	MUB-2-D	50	40	1
	MUB-3-D	40	27	2
	MUB-9-D	60.5	45.75	4
Total				**15**

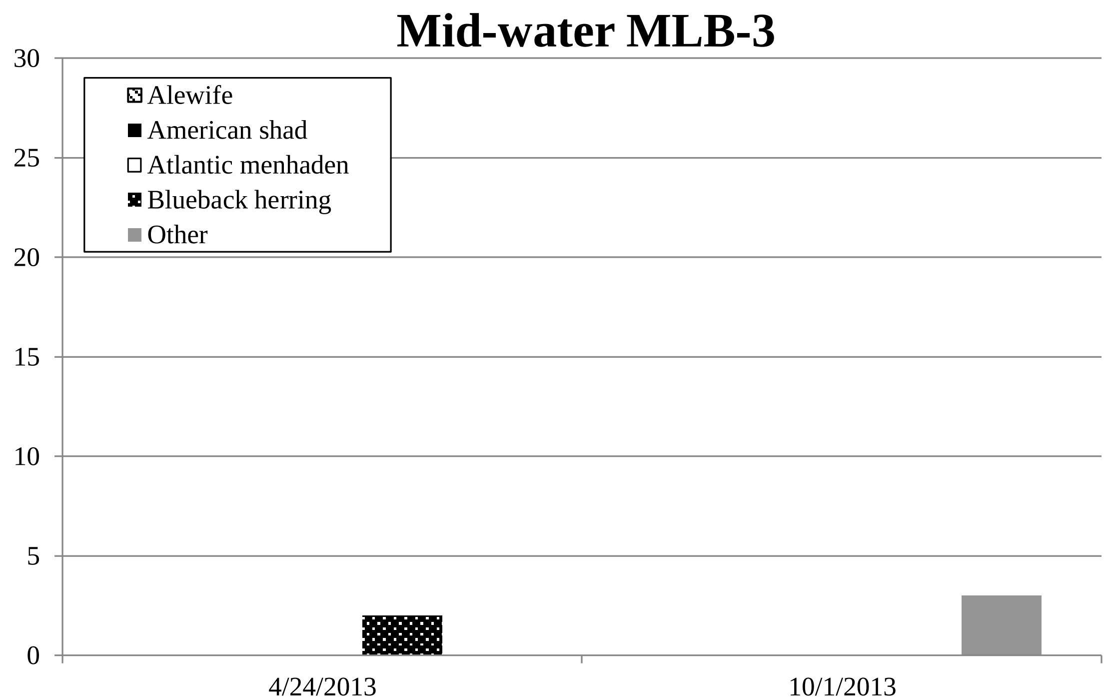
Table D-2. Total number of finfish collected by species each month in near-bottom trawl samples during the 2013 Migratory Finfish Sampling Program. Blank cells indicate no catch.

Group	Common Name	March	April	May	June	July	August	September	October	November	December	Total
Target Species	Alewife	7	11									18
	American shad	1										1
	Atlantic menhaden		2									2
	Blueback herring	181	3									184
	Sub-total	*189*	*16*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*205*
Essential Fish Habitat Species	Atlantic herring	3	9									12
	Butterfish			3				1	3			*7*
	Pollock		1									*1*
	Sub-total	*3*	*10*	*3*	*0*	*0*	*0*	*1*	*3*	*0*	*0*	*20*
Other Species	American eel		1									1
	Bay anchovy		1						10			11
	Northern pipefish		2									2
	Spotted hake	2	142									144
	Striped searobin		4									4
	Sub-total	*2*	*150*	*0*	*0*	*0*	*0*	*0*	*10*	*0*	*0*	*162*
Total Number		**194**	**176**	**3**	**0**	**0**	**0**	**1**	**13**	**0**	**0**	**387**
Number of Species		**5**	**10**	**1**	**0**	**0**	**0**	**1**	**2**	**0**	**0**	**12**

Table D-3. Minimum, median, and maximum Total Length, and number measured for target species collected in near-bottom tows during the 2013 Migratory Finfish Sampling Program.

Common Name	Sample Depth	Number Measured	Minimum of Total Length (mm)	Median of Total Length (mm)	Maximum of Total Length (mm)
Alewife	Mid-water	17	80	102	204
	Near-bottom	18	83	110	266
American shad	Mid-water	0	--	--	--
	Near-bottom	1	131	131	131
Atlantic menhaden	Mid-water	6	114	351	370
	Near-bottom	2	342	349	356
Blueback herring	Mid-water	55	64	95	281
	Near-bottom	103	76	90	254

-- Indicates No Catch



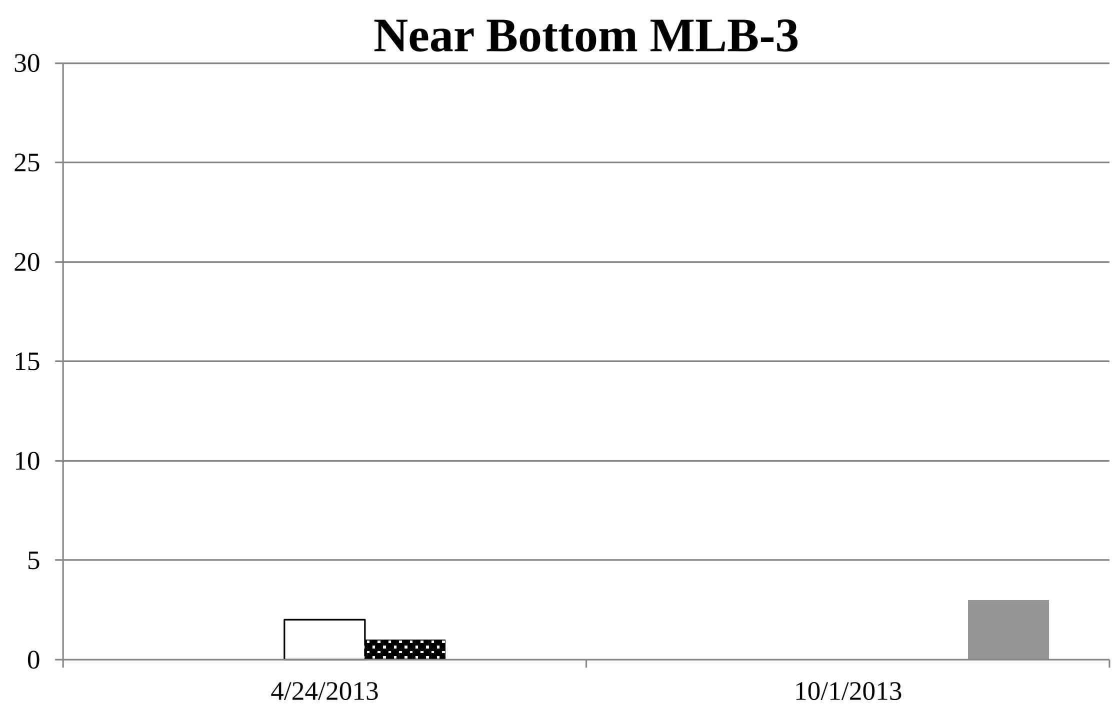
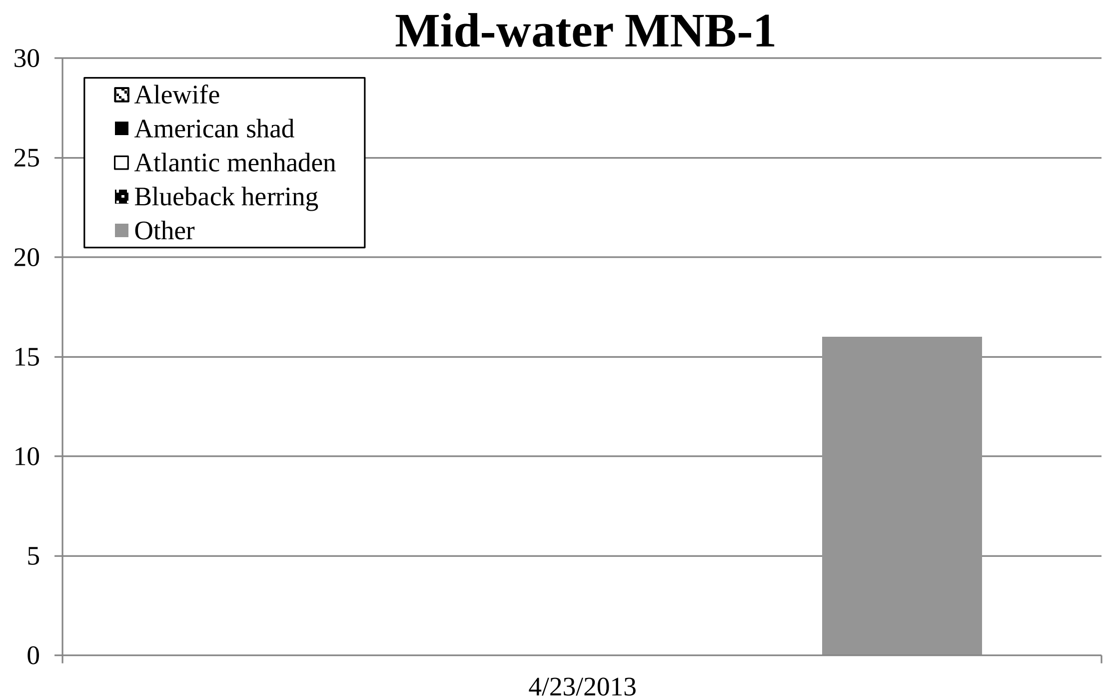


Figure D-1. CPUE (# Fish / 10-minute tow) for paired mid-water and near-bottom tows at MLB-3, 2013 Migratory Finfish Sampling Program.



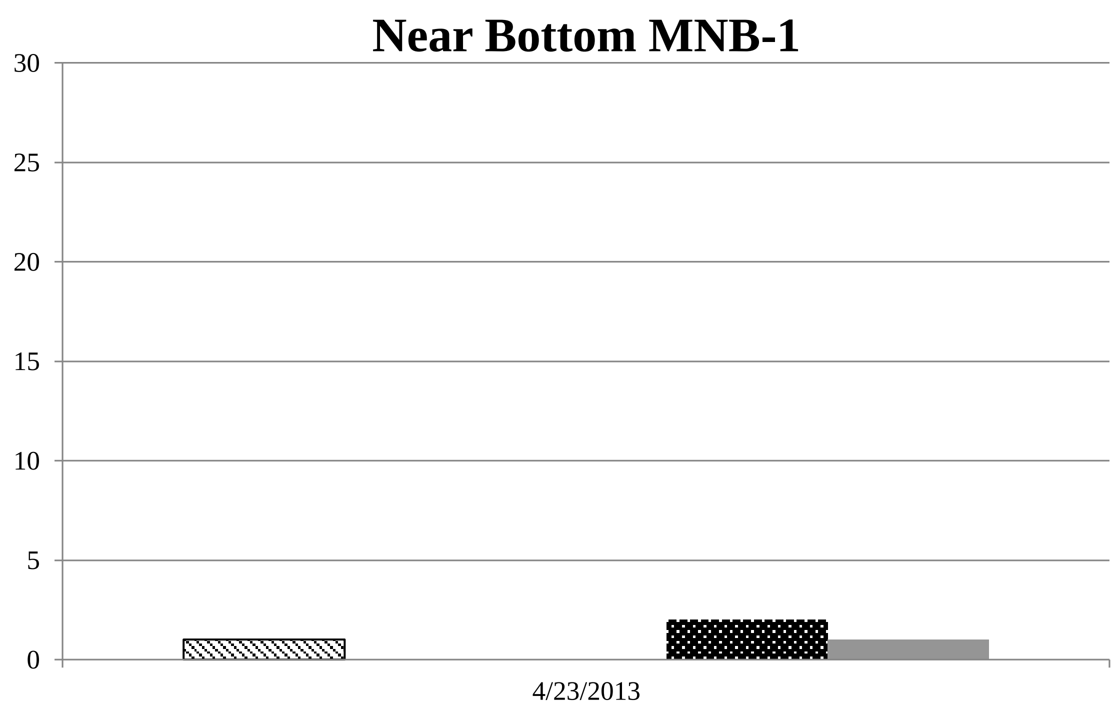
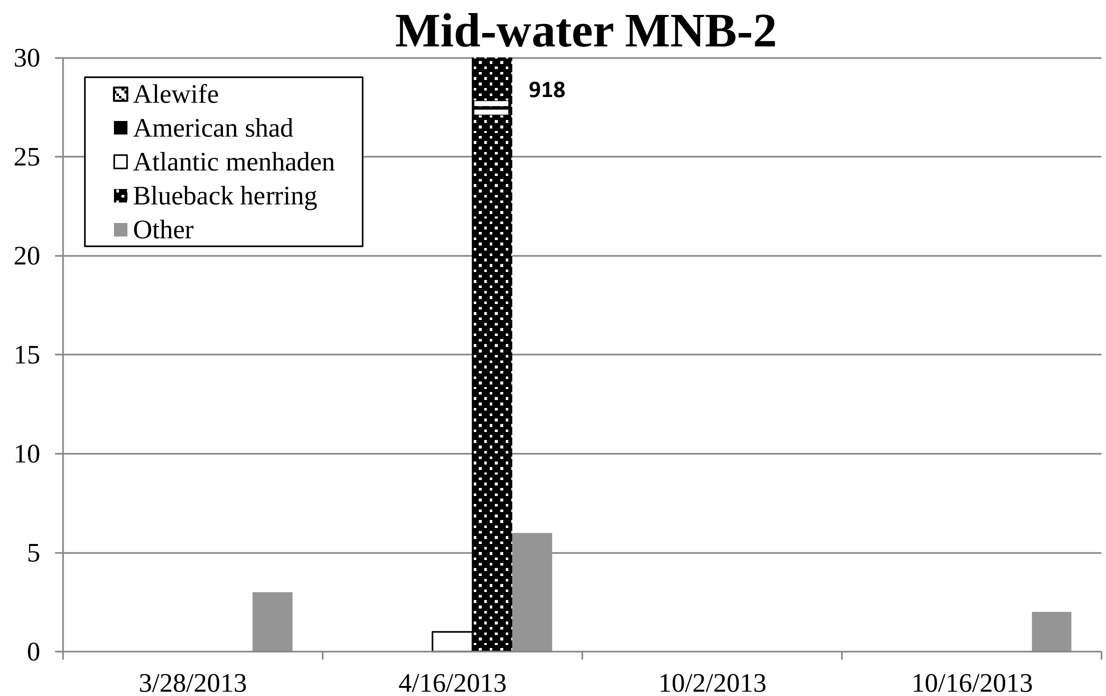


Figure D-2. CPUE (# Fish / 10-minute tow) for paired mid-water and near-bottom tows at MNB-1, 2013 Migratory Finfish Sampling Program.



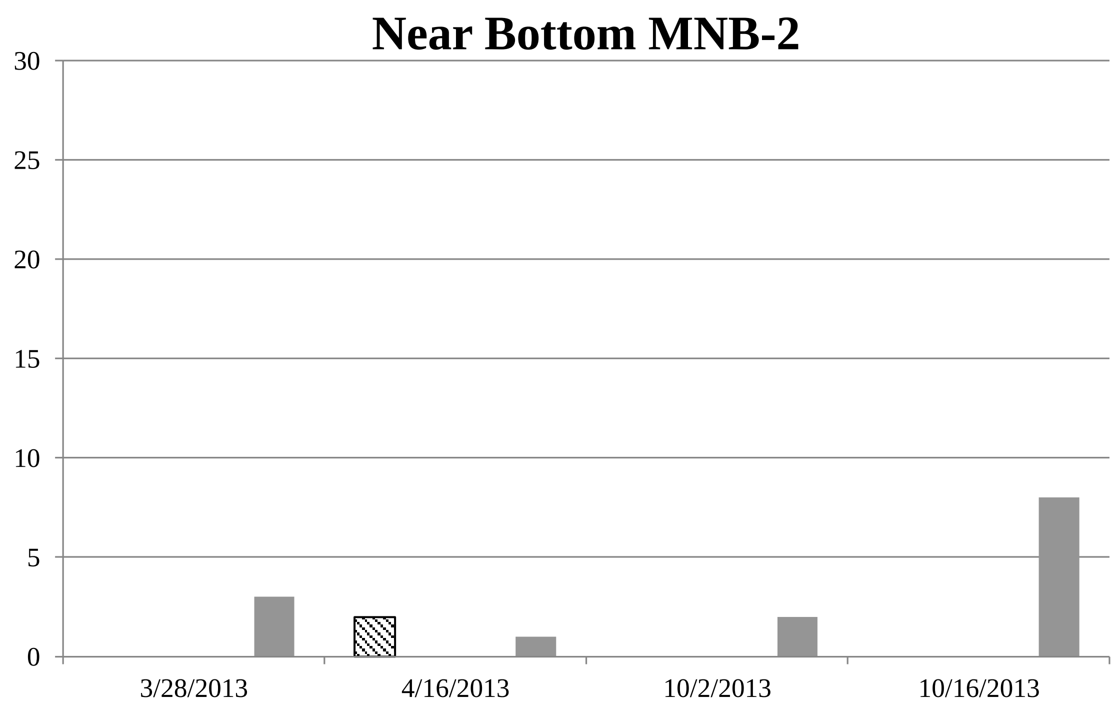
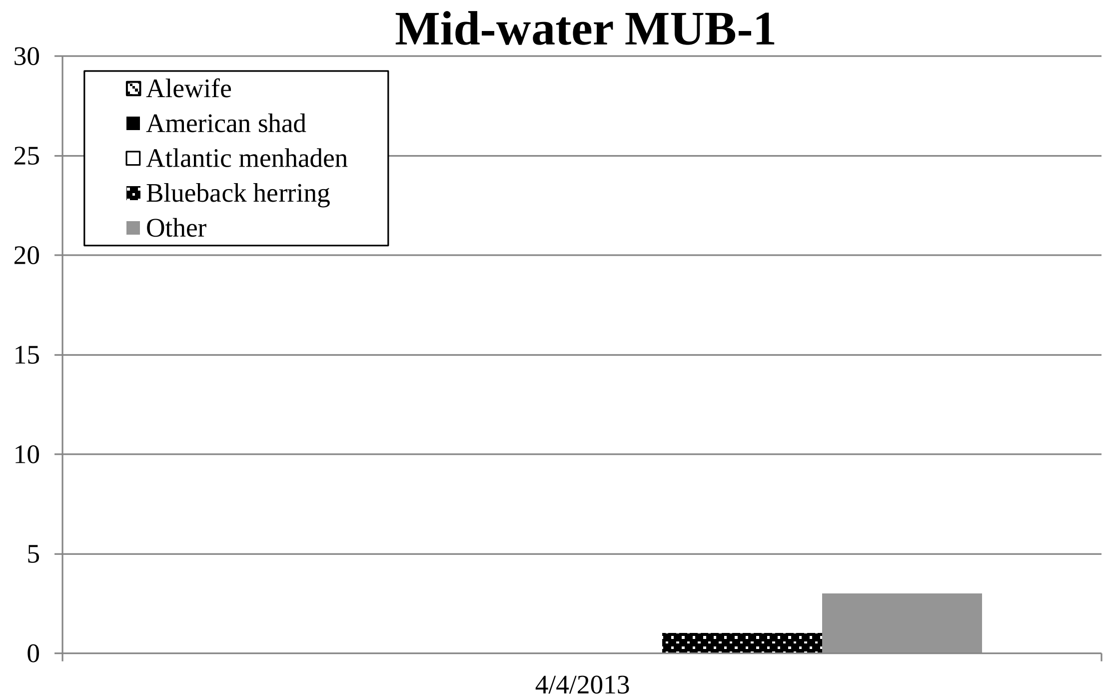


Figure D-3. CPUE (# Fish / 10-minute tow) for paired mid-water and near-bottom tows at MNB-2, 2013 Migratory Finfish Sampling Program.



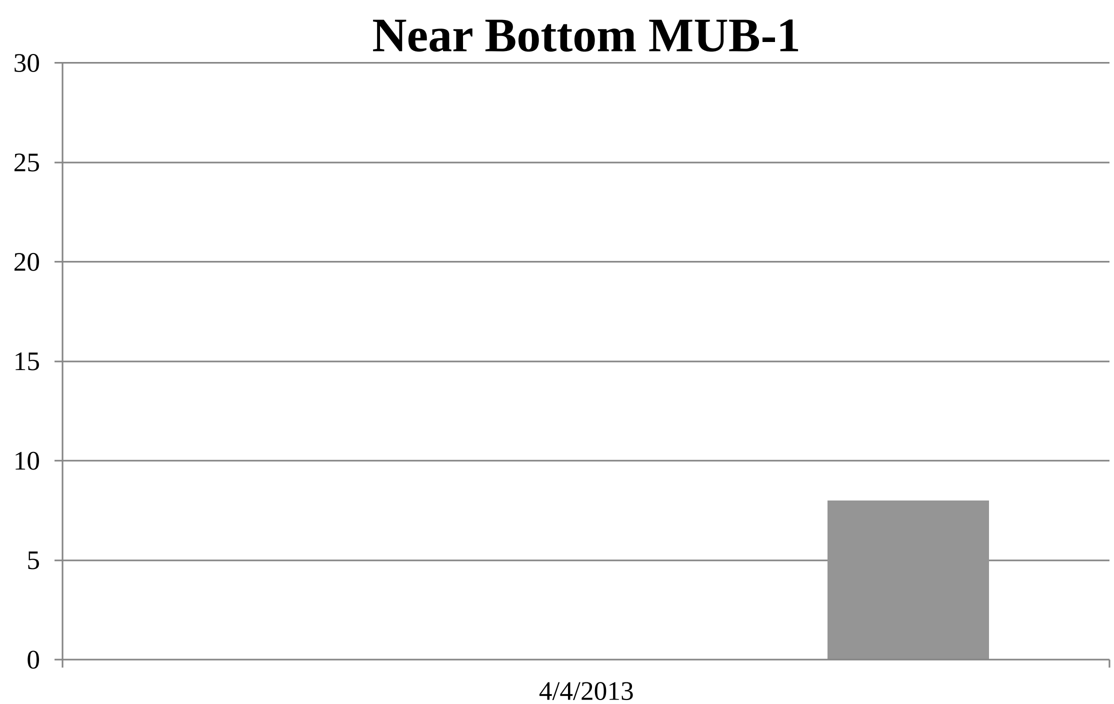
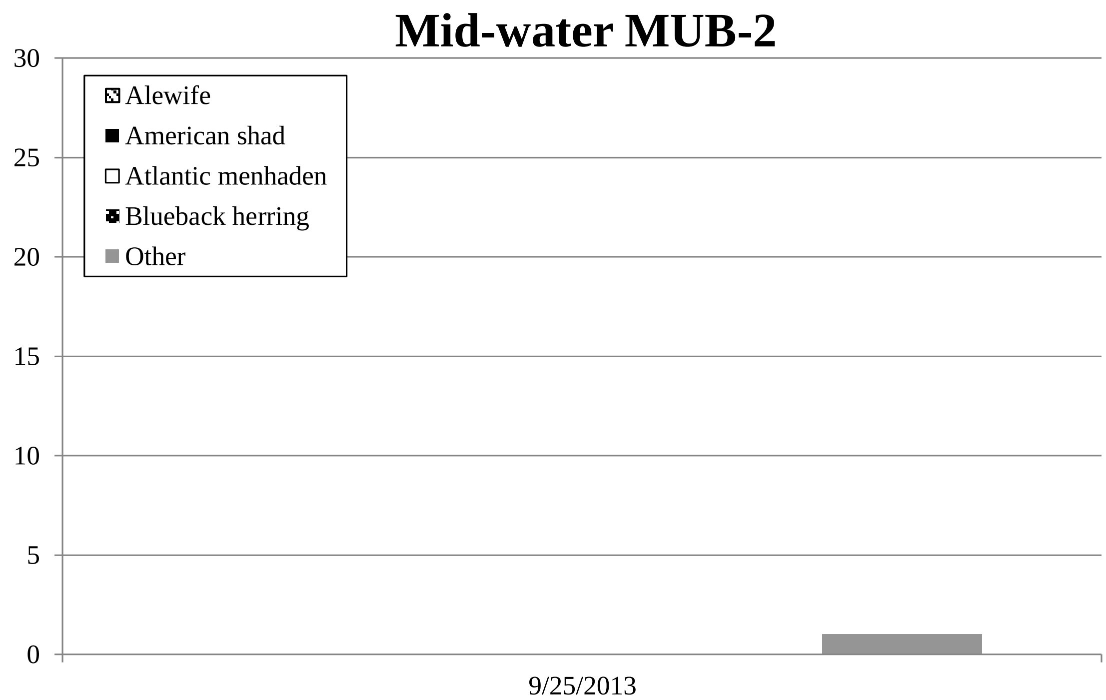


Figure D-4. CPUE (# Fish / 10-minute tow) for paired mid-water and near-bottom tows at MUB-1, 2013 Migratory Finfish Sampling Program.



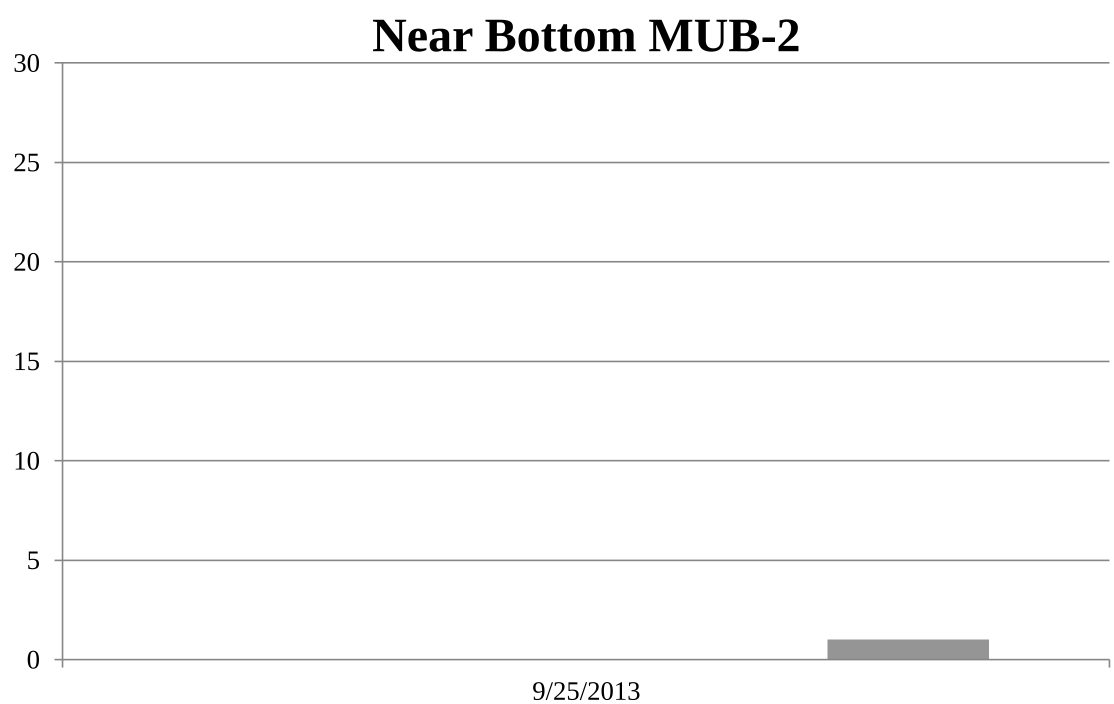


Figure D-5. CPUE (# Fish / 10-minute tow) for paired mid-water and near-bottom tows at MUB-2, 2013 Migratory Finfish Sampling Program.

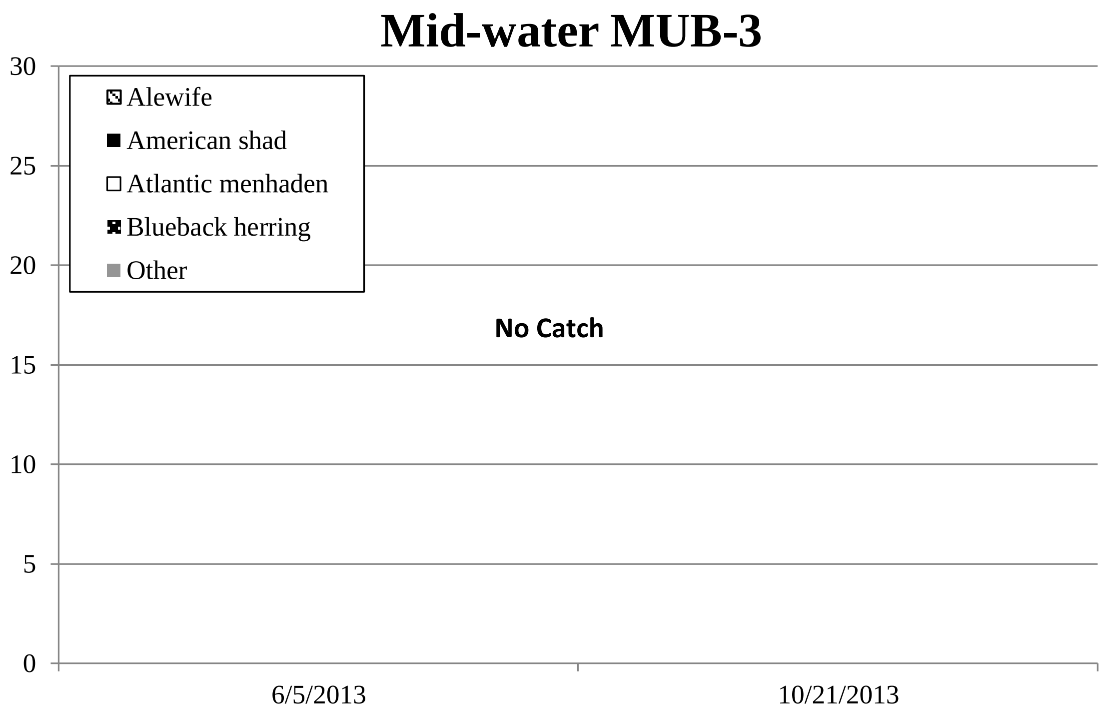
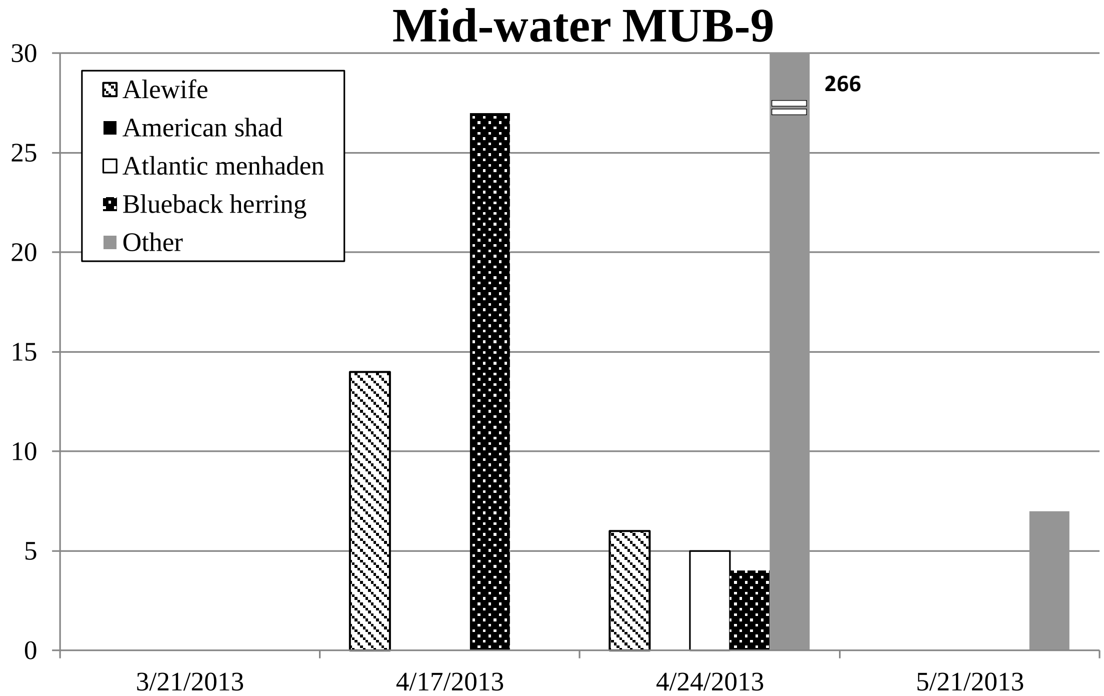


Figure D-6. CPUE (# Fish / 10-minute tow) for paired mid-water and near-bottom tows at MUB-3, 2013 Migratory Finfish Sampling Program.



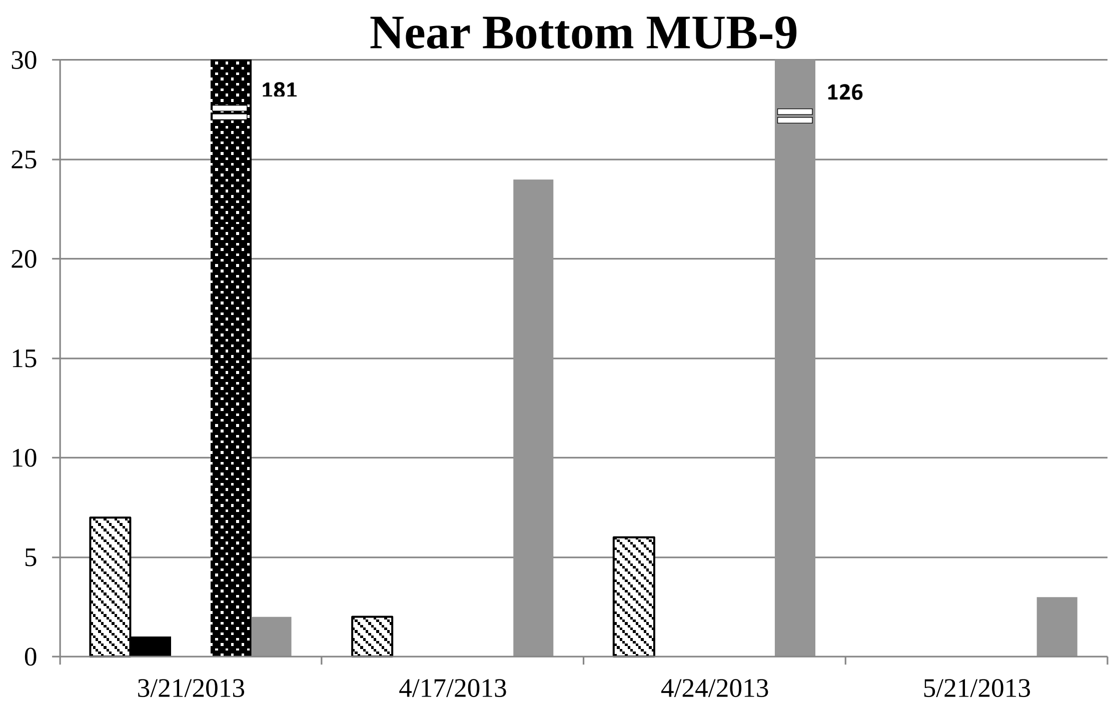


Figure D-7. CPUE (# Fish / 10-minute tow) for paired mid-water and near-bottom tows at MNB-9, 2013 Migratory Finfish Sampling Program.

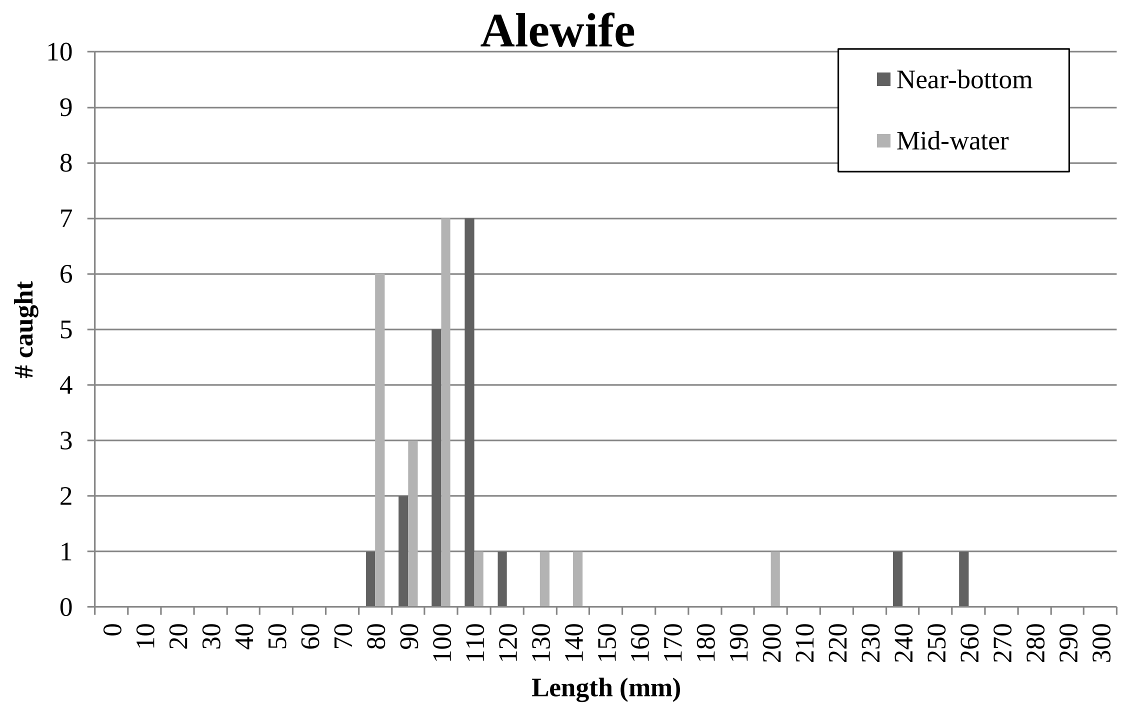


Figure D-8. Length frequency distributions for Alewife collected in paired Mid-water and Near-bottom tows, 2013 Migratory Finfish Sampling Program.

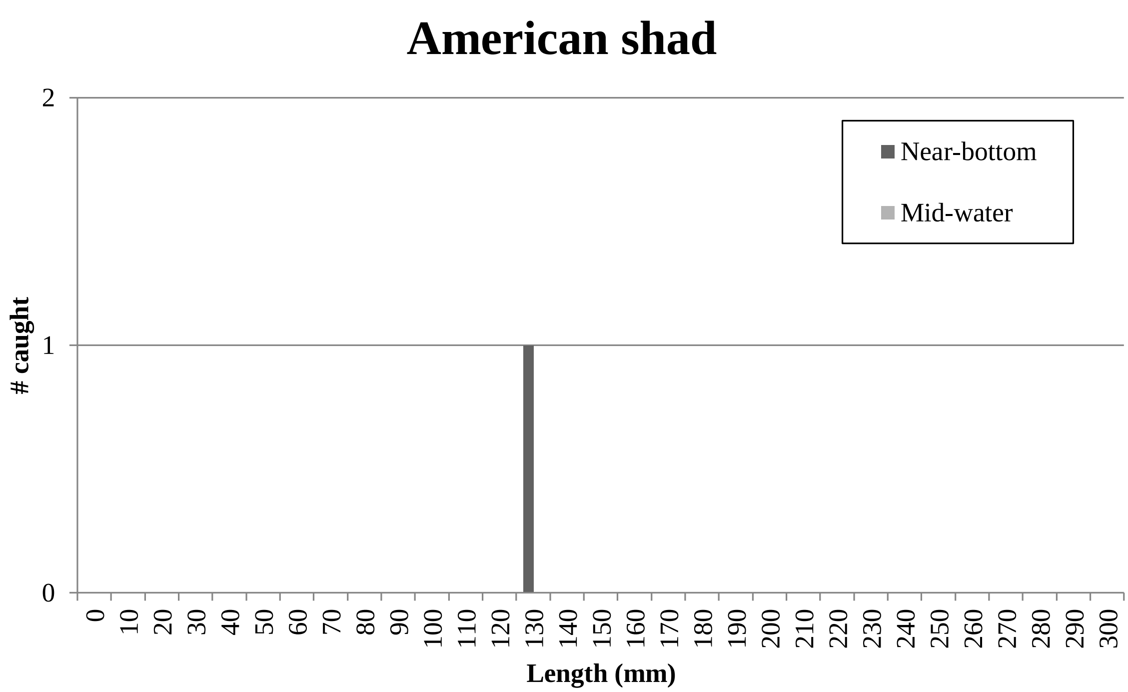


Figure D-9. Length frequency distributions for American shad collected in paired Mid-water and Near-bottom tows, 2013 Migratory Finfish Sampling Program.

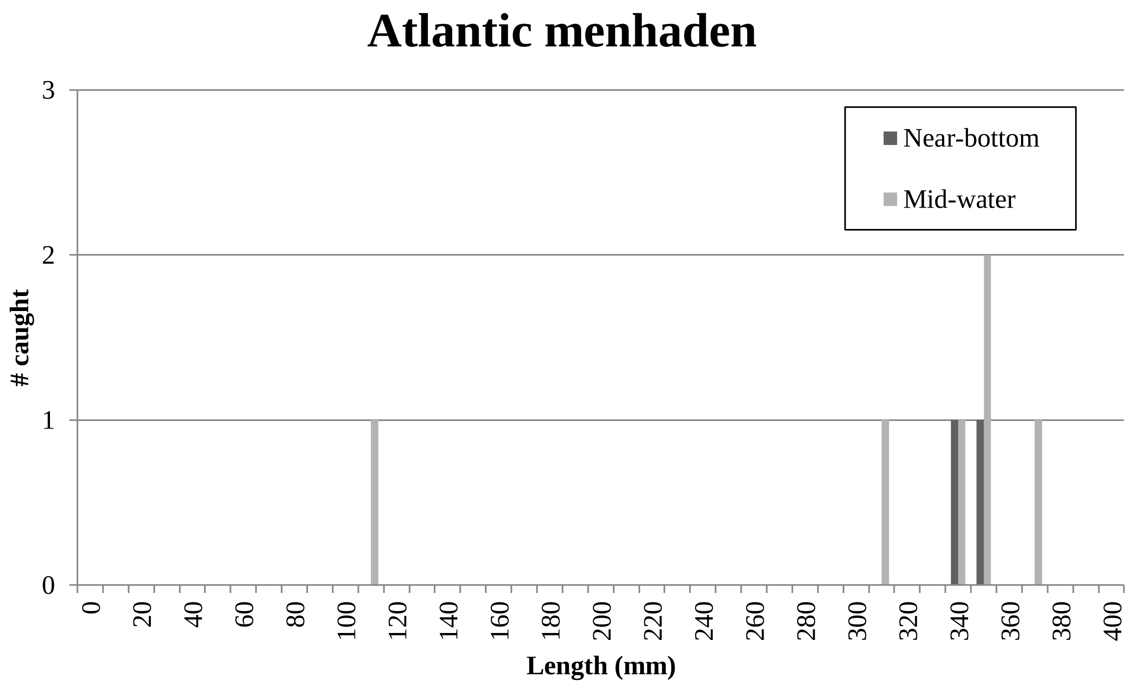


Figure D-10. Length frequency distributions for Atlantic menhaden collected in paired Mid-water and Near-bottom tows, 2013 Migratory Finfish Sampling Program.

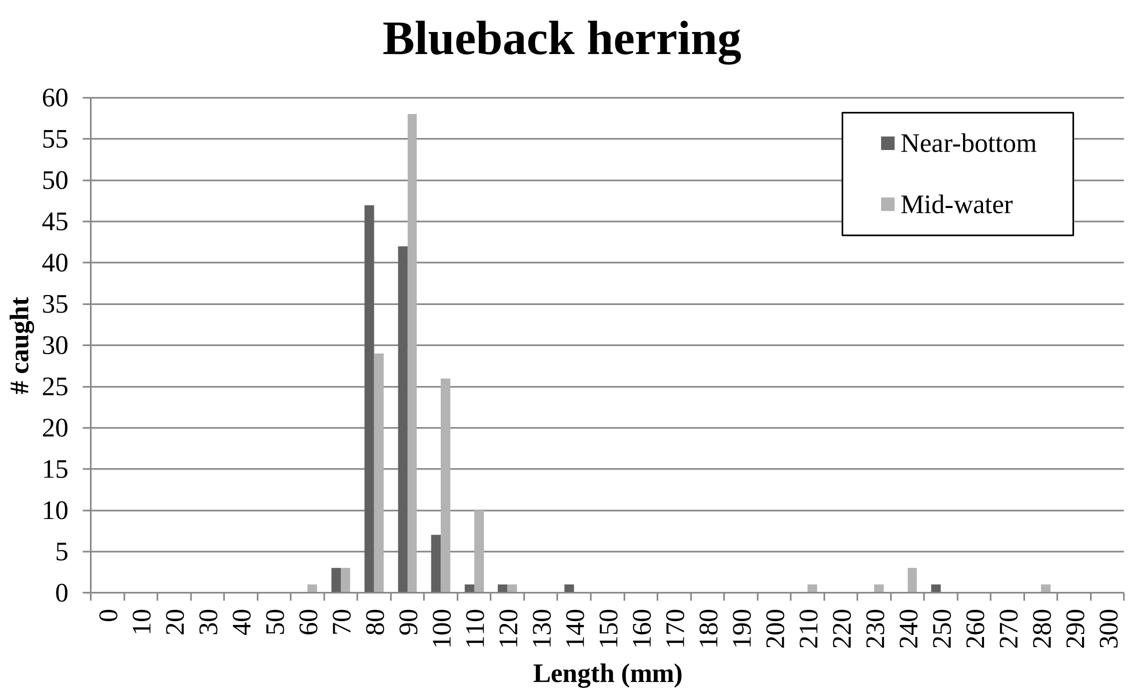


Figure D-11. Length frequency distributions for blueback herring collected in paired Mid-water and Near-bottom tows, 2013 Migratory Finfish Sampling Program.