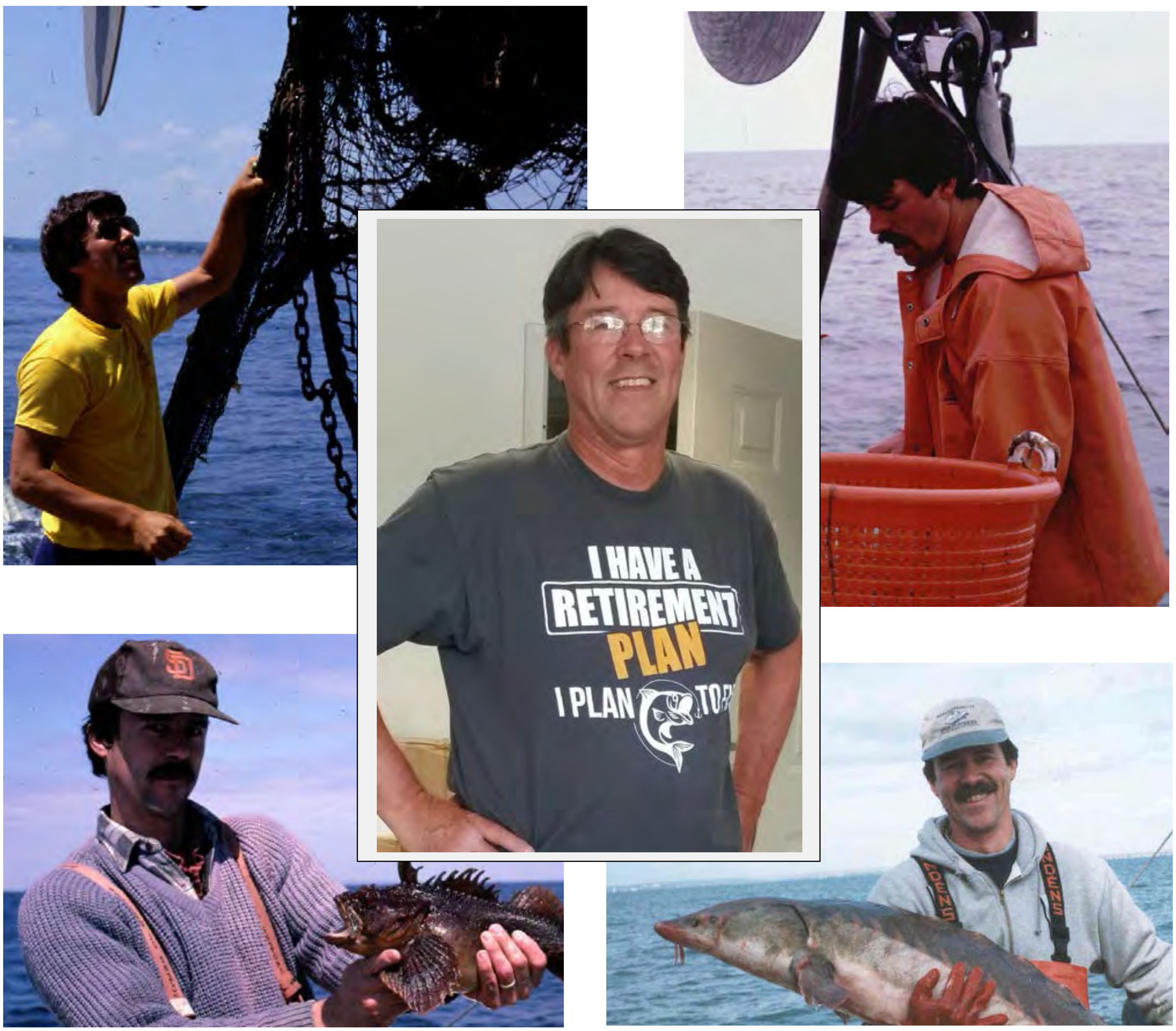
STATE OF CONNECTICUT
DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION

Robert Klee
Commissioner

Bureau of Natural Resources
Marine Fisheries Division
www.ct.gov/deep/fishing

A STUDY OF MARINE RECREATIONAL FISHERIES IN CONNECTICUT



Federal Aid in Sport Fish Restoration
F15AF00222 (F-54-R-35)
Annual Performance Report
March 1, 2015 – February 29, 2016

Cover Photos: ***David (Dave) Simpson during his time spent on the water with the Long Island Sound Trawl Survey over the past 36+ years and how he plans to spend his upcoming retirement (FISHING!)***

David G. Simpson, of the Marine Fisheries Division, is featured on the cover of this year's report to honor his significant contributions to the project and to fishery management in Connecticut. After a 36+ year career as a marine fisheries biologist with the department, Dave set his retirement for September 1, 2016. Dave began working for the "Marine Region" as a seasonal resource assistant for $4.18 per hour back in 1980 when the office was located on the grounds of Harkness State Park in Waterford. Having been a mate and captain of the Blackhawk party fishing boat in the late 1970's, Dave was the obvious choice to captain the research vessel James P. Galligan II in the inaugural year (1984) of the "F54" Long Island Sound Trawl Survey. Dave subsequently became PI for the trawl survey and eventually became supervising fisheries biologist overseeing the survey PI as well as others. Dave was also instrumental in the design, construction and delivery of the John Dempsey, the division's present research vessel.

As his career developed, Dave served on many interstate committees including the Summer Flounder, Scup and Black Sea Bass Technical Committee, the ASFMC Management and Science Committee, NEAMAP Management Board and a five-year or so stretch as Connecticut's designee to the New England Fishery Management Council. Dave became director of the Marine Fisheries Division in 2008 and set about making his mark on the Division and fishing in Connecticut. Not afraid to depart from convention, Dave applied creativity and innovation in parleying Connecticut's unutilized commercial striped bass quota into the Bonus Striped Bass Fishing Program, which was initially conceived to provide enhanced recreational striped bass fishing opportunity for urban, youth and shore anglers. He similarly instituted the Enhanced Opportunity Shore Fishing Program, giving shore-bound anglers greater chance for fishing success through a reduced size limit for scup and summer flounder at certain designated shore fishing sites.

Dave's steady and unflappable manner and his ability to make well-reasoned decisions and find practical solutions to problems have truly been an asset to the trawl survey and to the Marine Fisheries Division. We sincerely wish him well in his retirement, and hope that he leaves at least a few fish in the Sound for continued success of the LIS Trawl Survey.

State of Connecticut
Department of Energy and Environmental Protection
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www.ct.gov/deep

Federal Aid in Sport Fish Restoration
F15AF00222 (F-54-R-35)
Annual Performance Report

Project Title: ***A Study of Marine Recreational Fisheries in Connecticut***

Period Covered: March 1, 2015 - February 29, 2016

Job Title	***Prepared by*:**
Job 1: Marine Angler Survey	David Molnar
Job 2. Volunteer Angler Survey	David Molnar
Job 3. Enhanced Shore Fishing	Gregory Wojcik
Job 4. Tackle Shop Co-Op Survey	Inactive
Job 5. Long Island Sound Trawl Survey	Kurt Gottschall Deborah Pacileo
Job 6. Studies in Conservation Engineering	Kurt Gottschall Deborah Pacileo
Job 7. Alosine Survey	Inactive
Job 8. Estuarine Seine Survey	David Molnar Penelope Howell
Job 9. Volunteer Estuarine Fisheries Database	Penelope Howell
Job 10. Cooperative Interagency Resource Monitoring	Matthew Lyman Katie O’Brien-Clayton
Job 11. Public Outreach	David Molnar
Job 12. Marine Fisheries GIS	Deborah Pacileo Jacqueline Roberts

***Approved by*:**
David G. Simpson, Director
Marine Fisheries Division

Date: August 15, 2016

EXECUTIVE SUMMARY

Project: A Study of Marine Recreational Fisheries in Connecticut
Federal Aid Project: F54R-35 (Federal Aid in Sport Fish Restoration)
Annual Progress Report: March 1, 2015 – February 29, 2016

Purpose of the Project

The Long Island Sound (LIS) drainage basin encompasses more than 16,000 square miles and a population of 8.4 million people. Coastal communities account for 87% of the population, with an average density of 3,961 persons/sq mi compared to 558 per square mile basin-wide and 64 per sq mi nationally, and so constitutes one of the most densely populated areas in the nation.

This concentrated population has placed a significant burden on the Sound. Nevertheless, Long Island Sound and its tributaries in Connecticut support a wide diversity of marine life including many recreationally valuable species. Recreational fisheries for bluefish, winter flounder, scup, tautog, striped bass, summer flounder, and other species attract approximately 140,000 licensed anglers making on average 1.5 million fishing trips to the Connecticut coastline each year. The total value of the recreational fishery in both New York and Connecticut waters of LIS currently exceeds $100 million annually, while the commercial fishery contributes an additional $80 million each year.

Regionally, the recreational and commercial fisheries for these species have historically been intensive and in several cases overfishing led to depleted stock conditions and lost fishing opportunity during the 1980's and 1990's. Striped bass and summer flounder were reduced to record low levels in the mid to late 1980's whereas scup, winter flounder and tautog abundance reached minimum levels in the mid-1990's. Alarmed by the decline in these resources, fishery managers imposed new restrictions on harvest. Striped bass harvests were cut drastically, initially by the "producer states" of Maryland, then Virginia, and later by the coastal states under the Atlantic Striped Bass Conservation Act of 1984 resulting in the first fishery management plan among Atlantic coastal states with compulsory compliance provisions. Following striped bass, Amendment 2 to the Summer Flounder Fishery Management Plan (FMP) adopted quota based management restricting both recreational and commercial harvest coast-wide beginning in 1993. Scup, tautog and winter flounder FMPS's followed suit with very restrictive harvest limits. Aggressive fishery management has resulted in dramatic stock recovery for striped bass, summer flounder and scup, while helping to mitigate declining trends in tautog abundance. Winter flounder remain seriously depleted as a result of a combination of factors, likely including overfishing, unfavorably mild winter temperatures and increased predation.

The stock assessments for these species are revised and updated routinely to support continued management. These assessments require up-to-date basic population monitoring of age structure, growth and age at maturity. They also require detailed catch and effort statistics, estimates of fishery discarding and discard mortality rates as well as fishery independent measures of abundance, exploitation and size composition. In addition, as stocks of principal inshore predators are restored, questions have arisen concerning the status of the forage base and its ability to support growing predator populations. Finally, evaluating water quality management efforts to increase average summer dissolved oxygen levels in the western Sound through nitrogen reduction programs require oxygen monitoring and direct periodic evaluation of finfish responses.

This project is designed to address all of these issues by monitoring trends in abundance of all common marine finfish, including age and growth of selected sportfish, and by estimating harvest rates and size composition for a variety of important recreational species. Jobs 1-8 are designed to provide the components of stock assessments described above based on the resources and the recreational and commercial fisheries occurring in Long Island Sound. Catch and size composition of the fishery (Jobs 1-4) and fishery independent measures of abundance and size composition (Jobs 5-8) are vital to understanding how regional fishery management plans are likely to affect local stocks and the fishery they support. Each of these jobs also provides the basis for developing state specific strategies for compliance with fishery management plans where such latitude is permitted.

Evaluating the effects of non-fishing human activities on the health and abundance of valued recreational species is critically needed as part of a comprehensive management strategy being implemented for these resources by Long Island Sound Study member agencies (CTDEEP, NYDEC, NYCDEP, USEPA) and the Marine Fisheries Division. As a consequence of Connecticut's urbanized shoreline, LIS waters are subject to multiple impacts from human activities. Continued expansion of these activities has led to conflicts between different users and clashes between human activities and the sustained productivity of this ecosystem. In addition to human alterations, the LIS estuary experiences physical challenges to its productivity due to storms, sea-level rise and other climate effects. Job 10 provides trends in area, duration and intensity of hypoxia, the most significant water quality problem facing the Sound today.

Since its formation in the early 1970s, the Department has placed a high priority on environmental literacy for all of the state's citizens. Job 11 provides for public outreach to communicate with anglers and other interested citizens concerning the benefits of this project in particular and of the Federal Aid in Sportfish Restoration program in general. Several citizens' groups have formed in response to educational programs and/or to address local environmental issues. These groups have spent thousands of volunteer hours gathering species-specific fisheries abundance data and accompanying water quality information. This piecemeal approach has met local short-term goals but does not lend itself to meeting larger goals. Collectively these data could form a robust context for evaluating region-wide environmental impacts due to human activities, harvest removals, and long-term physical habitat change. Job 9 provides a mechanism for collating these data in a comprehensive manner. Additionally, the Job provides a means for a second critical component of cross-program standardization, or quality assurance, which would be required to join the different datasets. This project addresses these shortcomings by establishing a flexible data framework where historical datasets can be collated, standardized, and accessed.

In recent years, there has been an increased need for staff to use geospatial technology to map and analyze marine environmental or fisheries related information. Project staff have also experienced an increasing number of requests to provide geospatial data to others (intra-agency, inter-agency, private organizations, academic institutions, and concerned members of the public). Job 12 is designed to support this need for geospatial datasets, data layers, analyses and products.

Job 1: Marine Angler Survey

Goal: To enhance the fisheries management process by providing supplemental catch, effort and size composition data for several important recreational finfish species through a voluntary catch card survey program targeting private boat anglers from specific eastern and western Connecticut boat launches.

Key Findings:

- DEEP staff completed 788 interviews and distributed 947 catch cards to boat based anglers at launch sites equally distributed in eastern and western portions of the state (441 interviews, 478 cards east of CT River; 347 interviews, 469 cards west of New Haven).
- A total of 168 cards were returned (18%) with 510 anglers reporting their fishing trip activities. Of the 510 anglers, 395 (77%) caught at least one fish. A total of 1,229 (43%) fish were kept and 1,655 (57%) fish were released, including 19 finfish species or species groups.
- There were a total of 2,876 fish reported caught. 1,244 (43%) were harvested and 1,655 (57%) were released at sea.
- A total of 1,376 fish reported caught at the eastern locations. 607 (44%) were harvested and 769 (56%) were released at sea.
- Another 1,508 fish reported caught at the western locations. 622 (41%) were harvested and 886 (59%) were released at sea.
- There were 19 different species of fish reported caught. The most commonly caught species were scup, summer flounder, tautog, black sea bass and striped bass which make up 82% of the total catch.
- Anglers measured a total of 2,876 fish. The top three species measured scup (609 lengths), summer flounder (575 lengths), tautog (438 lengths) and black sea bass (412 lengths).

Conclusions:

- Coastwide fishery management plans are resulting in increases in several fish populations and good catches of many primary recreational species throughout long island sound.

Recommendations:

- Continue to obtain catch and harvest information and angler participation rates in order to monitor the status of the recreational fishery. Sampling levels will be curtailed in 2016 due to the Division’s increased involvement in the Marine Recreational Information Program (MRIP).

Job 2: Volunteer Angler Survey

Goal: To enhance the fisheries management process by providing supplemental catch, effort and size composition data for several important recreational finfish species through a voluntary logbook program.

Key Findings:

- A total of 33 anglers participated in the survey and made 762 trips in 2015. Volunteers made 460 trips with a private boat and 28 from a party/charter boat. Additionally, 220 fishing trips were recorded from shore sites under regular regulations and 54 from enhanced shore sites (see Job 3).

- Volunteer anglers caught a total of 8,216 finfish. A total of 2,121 were harvested (26%) and 6,095 were released (74%).

- There were 20 different species of fish reported caught. The most commonly caught species (in rank order) were scup, summer flounder, black sea bass, both species of searobin, bluefish, striped bass, menhaden, and tautog, which make up 88% of the total catch.

- Anglers measured a total of 7,795 fish. Seven principal recreational species measured were scup (1,768 lengths), summer flounder (1,682 lengths), black sea bass (1,547 lengths), striped bass (593 lengths), bluefish (618 lengths), tautog (373 lengths) and winter flounder (6 lengths).

- Collecting length measurements on released fish provides valuable data not available through the Marine Recreational Information Program except for the party boat mode.

Conclusions:

- Volunteer anglers provide a tremendous amount of data on the size and catch composition of popular recreational species in Connecticut, supplying several stock assessments with scarce length information on released fish.

Recommendations:

- Maintain the Volunteer Angler Survey as an effective means of characterizing angler behavior, especially in collecting length data on released fish that are not available from the Marine Recreational Information Program.

Job 3: Enhanced Shore Fishing

Goal: To maintain and improve the shore fishing experience, opportunity and quality of access to public trust marine fisheries resources in Connecticut, especially in urban areas, while maintaining marine fish conservation objectives.

Key Findings:

- Creel survey agents spent a total of 1,054 hours at 31 enhanced shore fishing sites between Stonington and Norwalk CT from May through December 2015. A total of 219 assignments included 1,462 sites sampled in five zones.

- Creel agents observed 2,075 angler hours of fishing. The top three sites with the most observed fishing were CT DEEP Marine Headquarters (Old Lyme) which averaged 6.0 anglers per hour, South Benson (Fairfield) with 3.8 anglers per hour and the South Cove Causeway (Old Saybrook) averaging 3.1 anglers per hour.

- A total of 1,958 anglers were interviewed and 1,736 catch cards were distributed. Of these, 682 (39%) cards were returned. Catch data was collected from both the field interview and the returned catch cards.

- 1,434 fish were reported caught in the catch cards, of which 780 fish (54%) were released and 654 fish (46%) were reported kept.

- There were a total of 1,151fish measured by both anglers and creel survey anglers. The top three species measured include scup (402 lengths), bluefish (241lengths) and sea robins (236 lengths).

- Providing a 1” lower minimum length for scup has allowed anglers to take home 40% more fish from these sites (124 of 229 fish harvested were between 9 and almost 10 inches). Also, having a 2” lower minimum length for summer flounder has provided anglers with 22% more fish at keeper length (17 of 21 fish harvested were between 16 and almost 18 inches).

Conclusions:

- Providing anglers with a lower minimum length for both summer flounder and scup has enhanced opportunity along the Connecticut shore and allowed anglers to keep more fish for consumption.

Recommendations:

- Continue creel sampling across Enhanced Shore Fishing sites to monitor shore fishing activity and the effects of different minimum sizes for both scup and summer flounder at these sites. Sampling levels will be curtailed in 2016 due to the Division’s increased involvement in the Marine Recreational Information Program (MRIP).

Job 4: Tackle Shop Coop Survey INACTIVE

Job 5: Marine Finfish Survey - Long Island Sound Trawl Survey (LISTS)

Goal: To provide long term monitoring of abundance, biomass and size composition of marine fishery resources along with environmental parameters, in order to evaluate the effects of fishing and environmental conditions on the distribution and abundance of living resources in Long Island Sound.

Key Findings:

- The full complement of 120 spring and 80 fall trawl survey samples was completed in 2015.

- The total fish species count (66) is above the 32- year average of 57.6 species per year (1984-

2014), ranking 3rd overall. In addition, the 2015 survey documented 43 invertebrate species, egg deposition of four species (e.g. squid, whelk), seven plants and one reptile (see bullet on endangered species interactions).

- The total fish count was 163,221 weighing 15,625.2 kg. Only a subset of invertebrates are counted (lobsters, blue crab, squid, horseshoe crab, mantis shrimp…) while all invertebrate species are quantified by a total weight for each species in each tow. The total invertebrate count (of those enumerated) was 29,150 while the total weight of all invertebrates collected in 2015 was 1,958.6 kg. These values are within the range observed historically.

- Scup abundance (geometric mean count per tow (geomn) = 422.2) was the highest since 2007 and the fifth highest abundance recorded since 1984. Black sea bass abundance (1.94) in 2015 was the second highest recorded, exceeded only by the 2014 index of 2.73 (geomn). Sea bass abundance since 2012 has exceeded levels seen at any time between 1984 and 2011. Smooth dogfish (smooth hound) abundance, like black sea bass has increased dramatically since 2012 reaching record abundance in 2015 (geomn=7.3). Other species at record abundance include northern kingfish, Atlantic menhaden, Striped sea robin (2015 rank= 2nd after 2012).

- Record low abundances of windowpane flounder and winter flounder, little skate and American lobster were recorded in 2015, continuing long term declining trends in these species.

- Endangered Species Interactions: Two species, one Atlantic sturgeon and one Kemp's ridley sea turtle (Length 310mm, Width 310mm), were captured on two of the 200 tows completed in 2015. This is the first Kemp's ridley encounter for the survey. Both captures were reported to NMFS within 24 hours as required under the conditions of our authorization to conduct sampling activities.

Conclusions:

- The abundance of some recreationally important species in Long Island Sound remains moderate to high including scup, striped bass, summer flounder and black sea bass. However, some recreational species like winter flounder and tautog have gone through a protracted period of declining abundance and this is cause for concern. Additionally, several species not typically targeted by recreational fishermen have undergone changes in abundance in trawl survey catches which are consistent with broad scale increasing temperature trends in the northwest Atlantic.

Recommendation:

- Continue this broad scale living marine resource monitoring of Long Island Sound begun in 1984.

Job 6: Studies in Conservation Engineering

Goal: The original goal, "to develop a better understanding of fishing gear performance, including differences in gear technology and associated change of size and species selectivity," has been modified to "evaluate new technology for potential inclusion in the Long Island Sound Trawl Survey."

Key Findings:

- The main impetus for evaluating the performance of different fishing gear as stated in the original goal was prolonged difficulty in acquiring the same style doors that the Long Island Sound Trawl Survey (LISTS) had been using since 1984. Ultimately, a new vendor for the old style doors was found, therefore, the decision was made to not make any significant changes to the door and net configuration at this time. This eliminates the need to evaluate any potential change in fishing efficiency and avoids any risk of affecting the consistency of LISTS's valuable long time-series.

- Instead of investigating different nets or doors, efforts focused on evaluating new components for an onboard electronic data acquisition system for fisheries research to modernize LISTS data collection and data entry.

- Bluetooth and wireless technologies have continued to improve over the years to the point where it may now feasible to have an electronic data acquisition system for a relatively small vessel like the R/V John Dempsey where there is insufficient space for permanently hardwired electronic or computerized equipment on deck and where the deck layout has to be completely changed ten times a year to accommodate a different survey.

- Several components for an electronic data acquisition system for the Long Island Sound Trawl Survey have been evaluated and selected for purchase: electronic measuring boards, tablets, weighing scales and printers.

Conclusions:

- With continued development of Bluetooth and wireless technologies (improved performance and reduced cost), it now seems feasible to incorporate components of an electronic data acquisition system into the Long Island Sound Trawl Survey (LISTS).

Recommendations:

- Continue to evaluate new technologies as needed and, after successful vetting, incorporate into existing surveys as time and funding permits. Continue investigation and development of software to integrate new hardware components with a new database for LISTS.

Job 7: Alosine Survey INACTIVE

Job 8: Estuarine Seine Survey

Goal: To monitor the abundance and size composition of near-shore young-of-year and forage fish resources, with physical habitat parameters, in order to evaluate the effects of fishing and environmental conditions on the distribution and abundance of marine resources in Long Island Sound.

Key Findings:

- A total of 48 seine hauls were taken in September 2015 at eight sites, yielding a total catch of 11,132 fish of 27 species and 16,966 invertebrates of 11 species.

- The 2015 annual index of recruitment for young-of-year winter flounder (0.6 fish/haul) ranked fourth lowest out of 28 annual indices.

- Mean catch of all finfish (330fish/haul) was the highest in the 28 year time series and more than double the time series median of 135 fish/haul. Geometric means were calculated for 22 species commonly captured in the survey since it began in 1988.

- An index of forage abundance was generated using the catch of four of the most common forage species caught: Atlantic silversides, striped killifish, mummichog, and sheepshead minnow. The index for 2015 (171 forage fish/haul) was the second highest of the 28-year series, and well above the time series median of 102fish/haul.

- YOY scup, black seabass, tautog, and bluefish indices reflect record high abundance in 2015.

- A total of 396 seine hauls were taken monthly, June – September, 2013-2015 at six of the eight seine sites that were unchanged physically since similar samples (N=415) were taken in 1988-1990 in the same months. YOY winter flounder abundance was highest in June and declined over the summer during both time periods. Although abundance in June was similar for both time periods, attrition from July-September in 2013-2015 was more than five times greater compared to the same months in 1988-1990.

- Over the 28-year time series, the mean number of cold temperate species captured per haul was less than three with a negative trend while the mean number of warm temperate species increased significantly from about three to more than seven.

Conclusions:

- Juvenile abundance of many recreationally important species in Long Island Sound continues to increase, as does the diversity of forage and other finfish and invertebrates. This trend demonstrates the important role the Sound plays as a nursery and feeding ground. However, some recreational species, especially winter flounder, have gone through a protracted period of declining abundance and this is cause for concern.

Recommendations:

- Continue this inshore monitoring survey of marine fishery resources of coastal Long Island Sound which began in 1988. An extended time series is a necessary context for assessment of successful reproduction and recruitment.

Job 9: Volunteer Estuarine Fisheries Database

Goal: Identify estuarine nearshore waters critical to the production and growth of recreationally important finfish for the purpose of protecting and enhancing these populations in shallow water habitats and promote citizens' greater understanding and appreciation of local marine resources through participation in local volunteer survey projects.

Key Findings:

- Marine Fisheries staff continued working with three citizen's group gathering fisheries and water quality data. Data from the Maritime Aquarium Marine Life Study cruises off Norwalk and the US Coast guard Academy Thames River Survey were added to Harbor Watch (Norwalk), Cedar Island Marina Research Program (Clinton) and Project Oceanology (CT River).

- Data from these programs provide further evidence of rising water temperature and coincident shifts in species composition and abundance.

- Harbor Watch beam trawl sampling captured 5-15 finfish species annually for years with comparable effort in June through October, modestly increasing in 2015 when 499 fish were caught of 17 species. In 2015, winter flounder were captured in 18 of the 19 grids sampled and their number/tow were the highest recorded since 2005. Flounder were most abundant in the lower harbor, a distribution that differed from the early 1990s when the species was most abundant in the upper harbor

Conclusions:

- Volunteer effort by citizen groups provides valuable complementary information on Connecticut estuarine resources, including in areas not directly sampled by DEEP.

Recommendations:

- Maintain working relationships with these groups and encourage their continued volunteer efforts monitoring environmental health in nearshore waters.

Job 10: Cooperative Interagency Resource Monitoring.

Goal: To monitor the physical, chemical and biological indicators of environmental conditions in Long Island Sound.

Key Findings:

- Eight cruises were completed from May 28 September16, 2015 between 28 May and 16 Over the season, five stations were documented as hypoxic and of the 252 site visits completed, hypoxic conditions were found four surveys**.**

- Summer hypoxia (DO<3.0 mg/l) in 2015 was very limited, impacting the second smallest area since the survey began in 1991.

- Severe hypoxia (DO<1.0 mg/l) was not detected at all in 2015. Moderately severe hypoxia (DO 1.0 < 2.0 mg/l) was limited to the New York waters of far western Long Island Sound from approximately Oak Neck LI (south of Greenwich CT/ Rye NY border) to Execution Rocks.

- Early season (May) bottom water temperatures were well below average following an unusually cold winter, but rose quickly to above average by early July, remaining above average through the hypoxia monitoring season in early September.

Conclusions:

- Hypoxia impacts on living marine resources were minimal in 2015 given dissolved oxygen concentrations remained above 3.5 mg/l through the entire Sound east of Greenwich CT.

Recommendations:

- Maintain the Long Island Sound Water Quality / Hypoxia Monitoring Program.

Job 11: Public Outreach

Goal: To increase awareness among anglers and the general public of fisheries information provided by this project and how this information contributes to state and federal efforts to enhance, restore and protect marine habitat and recreational fish populations.

Key Findings:

- A total of 17,296 outdoor and environmental writers, marine anglers and boaters, marina operators, fishing tackle retailers, Fisheries Advisory Council (FAC) members, students, and members of the general public attended outreach events. The importance of research and monitoring to good fisheries management was incorporated into the programs.

- These same audiences also learned that good water quality and proper pollution prevention (non-fishing impacts) are essential to good fisheries habitat management.

- Total attendance at five engagements with sportsmen clubs and other recreational environmental clubs was 233. The audience was encouraged to become actively involved in the fishery management process by attending public hearings and FAC meetings. Notices of public hearings were sent to hundreds of tackle shops and various media outlets including the DEEP website (www.ct.gov/deep/fishing).

- Total attendance at one career day event with a Connecticut college was 52. The students were encouraged to become actively involved in fisheries biology and management.

- The message that the majority of marine finfish research and monitoring are funded through Federal excise taxes on fishing and motorboat fuels was emphasized at major department outreach events.

Conclusions:

- Large numbers of anglers and members of the general public are provided information about Marine Fisheries programs through participation in outdoor fishing & hunting shows, Science and Career Days, public speaking engagements and displays at the Marine Fisheries Office.

Recommendations:

- Continue outreach efforts.

Job 12: Marine Fisheries GIS.

Goal: To maintain a geographic information system (GIS) of Project data to support map applications and geospatial analyses needed to assist with planning and executing Marine Fisheries Division surveys that support sport fish restoration goals.

Key Accomplishments:

- GIS Staff created map summaries of tautog (blackfish) catch and release tag data from volunteer anglers. The maps were useful in illustrating that the majority of tautog recaptured had been tagged in the same general area where they were released.

- Spatial depictions of the magnitude of tautog harvest by MRIP sample site, symbolized by fishing distance from shore, and maps showing the distribution of recreation tautog harvest were used to propose a new management area for tautog to include both CT and NY waters of LIS.

- A series of maps were created to illustrate the movement of the mean center annual recreational catch and harvest of black sea bass along the northeastern coast of the United States. These maps show that the mean centers of catch rates are shifting northward from New Jersey toward the southern coast of Long Island Sound, possibly indicating a range expansion for this species.

- Data from the Estuarine Seine Survey were used to generate maps of forage fish indices for 5-year intervals, 1988-2012. The highest indices of abundance were typically in the east, although more recent time periods show moderate abundances in the west as well.

- Spatial analyses of data generated by a temperature model developed by CT DEEP, Stevens Institute and NOAA/NMFS show the amount and distribution of habitat in LIS suitable for warm temperate Mid-Atlantic fish species will likely increase (both in area and amount of time) in the future..

Conclusions:

- The implementation of a job focused on developing GIS at Marine Fisheries Division allowed staff to benefit from spatial depiction and analyses for a variety of Agency and Project related goals.

- Providing maps to users such as: recreational angler groups, Federal agencies, and regional planning committees, has been an effective way of providing Connecticut’s sport fish restoration information to the public.

Recommendations:

- Continue to assist Marine Fisheries Division projects that support sport fish restoration goals through the use of GIS data and software.

JOB 1: MARINE ANGLER SURVEY

MARINE ANGLER SURVEY

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

JOB 1: MARINE ANGLER SURVEY

GOAL

To collect marine recreational angler fishing information in the boat mode through a voluntary catch card survey program.

OBJECTIVES

Provide estimates of:

1) Length-frequency distribution of harvested black sea bass, bluefish, scup, winter flounder, summer flounder, tautog, striped bass, and weakfish.
2) Length-frequency distribution of discarded black sea bass, bluefish, scup, winter flounder, summer flounder, tautog, striped bass, and weakfish.
3) Targeted catch/effort of black sea bass, bluefish, scup, winter flounder, summer flounder, tautog and striped bass.
4) Percent of targeted trips by species.

INTRODUCTION

CT DEEP has collected marine recreational fisheries information along the Connecticut coastline since 1979 under several state and federal programs. In 2013-2015, NMFS assumed full angler survey responsibility for the federal Marine Recreational Information Program (MRIP) while DEEP continued to manage the site registry. Beginning in 2014, the Marine Angler Survey shifted focus to collection of length frequency of both harvested and released fish to supplement the MRIP survey. Length frequency data that includes released fish is difficult to obtain through traditional access point intercept surveys such as MRIP and is particularly important to effective stock assessments. In addition, this program is designed to better characterize the private boat mode which lands a substantial proportion of fish caught in the Connecticut (85% in 2012).

METHODS

Marine recreational fishing information was collected through a voluntary catch card program. Post-marked daily catch cards (Figure 1.1) were distributed to anglers departing from selected private boat sites with high activity to maximize catch card distribution. Boat-based anglers at these selected fishing sites were recruited by DEEP staff to voluntarily report their fishing trip effort information and collect length measurements on fish caught, including both kept and released fish (discards). Each participating boat angler or angler group was given a waterproof daily catch card, pencil, and measuring tape in addition to verbal instructions. Anglers were encouraged to mail the post-marked catch cards upon trip completion or leave them in designated drop-off-boxes installed at key fishing sites. Each card issued had a unique identification number printed on it and all cards given out to anglers was accounted for through the card ID number. As an incentive to maximize participation, anglers entering their Conservation ID/Fishing License Number would be eligible for wining a raffle prize at year’s end.

Anglers were requested to provide the following information:

- Date of Trip (mm/dd)/Trip Start Time (check box AM/PM)
- Conservation ID/Fishing License Number
- Primary Fish Targeted
- Secondary Fish Targeted
- Total Hours Fishing (lines wet)
- Areas Fished (see map)
- Number of Anglers that Caught Fish
- Number of Anglers in Fishing Party
- Boat's Total Catch for Trip
    - Total Number of Fish Caught and Disposition (Kept/Released)
- If No Fish Caught -Check Box
- Length of First 8 Fish Caught
    - Common Fish Name, Length, Disposition (Kept/Released)

Anglers were instructed to measure each fish to the nearest ½ inch (rounded down) and record disposition by circling either Y (yes) or N (no) in the Kept column. Fishing boat vessel registration was also requested. All data were entered and stored in an electronic database.

RESULTS AND DISCUSSION

DEEP staff completed 788 interviews and distributed 947 catch cards to boat based anglers at launch sites equally distributed in eastern and western portions of the state (441 interviews, 478 cards east of CT River; 347 interviews, 469 cards west of New Haven). A total of 168 cards were returned (18%) with 510 anglers reporting their fishing trip activities. Of the 510 anglers, 395 (77%) caught at least one fish. A total of 1,229 (43%) fish were kept and 1,655 (57%) fish were released (Table 1.1) including 19 finfish species or species groups. In addition, a catch of 17 blue crab was reported (of which 15 were kept), along with a few green crabs and spider crabs which were released. The catch data from eastern and western sites were examined separately to address concerns that there was a difference in angler catches in the eastern versus western Long Island Sound that was not clear when coast-wide catches were grouped (Table 1.2). Catch and disposition of most species were similar between regions with the exception of summer flounder that were more prevalent in the east and striped bass that were more prevalent in the west, with a higher percentage released.

Volunteer anglers measured a total of 2,876 fish in 2015, or nearly twice the number measured in 2014. The targeted species (black sea bass, bluefish, scup, striped bass, tautog, summer and winter flounder) accounted for 95% of the measured catch (Table 1.3). Length frequencies of tautog captured in the eastern versus western Sound were similar while the most common size of black seabass measured in the east was an inch smaller than the most commonly caught seabass in the west (Figure 1.2).

MODIFICATIONS

None.

Table 1.1: Reported angler catch by species and disposition.
Species listed in bold type are targeted in this program.

Species	Kept	%	Released	%	Total
Atlantic Bonito	1	33.3	2	66.7	3
Atlantic Stingray	0	0	1	100.0	1
Atlantic Sturgeon	0	0	1	100.0	1
Black Sea Bass	**241**	**58.9**	**171**	**41.1**	**412**
Bluefish	**135**	**39.1**	**210**	**60.9**	**345**
Cunner	0	0	3	100.0	3
Dogfish	4	15.4	22	84.6	26
False Albacore	5	71.4	2	28.6	7
Mahi Mahi	4	100.0	0	0.0	4
Menhaden	33	94.3	2	5.7	35
Scup	**390**	**64.0**	**219**	**36.0**	**609**
Sea Robins spp	1	1.9	53	98.2	54
Skates	1	10.0	9	90.0	10
Striped Bass	**76**	**21.5**	**281**	**78.7**	**357**
Summer Flounder	**183**	**31.8**	**392**	**68.2**	**575**
Tautog	**152**	**34.7**	**286**	**65.3**	**438**
Triggerfish, grey	0	0.0	1	100.0	1
Winter Flounder	2	100.0	0	0.0	2
Yellowfin Tuna	1	100.0	0	0.0	1
Total	**1229**	**42.6**	**1655**	**57.4**	**2884**

	Eastern Catch					%Statewide	Western Catch					%Statewide
Species	**Kept**	**%**	**Released**	**%**	**Total**	**Catch**	**Kept**	**%**	**Released**	**%**	**Total**	**Catch**
Atlantic Bonito	1	33.3	2	66.7	3	100.0						
Atlantic Stingray	0	0	1	100.0	1	100.0						
Atlantic Sturgeon	0	0	1	100.0	1	100.0						
Black Sea Bass	**130**	**62.5**	**78**	**37.5**	**208**	**50.5**	**111**	**54.4**	**93**	**45.6**	**204**	**49.5**
Bluefish	**77**	**44.8**	**95**	**55.2**	**172**	**49.9**	**58**	**33.5**	**115**	**66.5**	**173**	**50.1**
Cunner	0	0.0	3	100.0	3	100.0						
Dogfish	4	25.0	12	75.0	16	61.5	0	0	10	100.0	10	38.5
False Albacore	0	0.0	1	100.0	1	14.3	5	83.3	1	16.7	6	85.7
Mahi Mahi	4	100.0	0	0	4	100.0	0	0.0	0	0.0	0	0.0
Menhaden	26	96.3	1	3.7	27	77.1	7	87.5	1	12.5	8	22.9
Scup	**134**	**62.0**	**82**	**38.0**	**216**	**35.5**	**256**	**65.1**	**137**	**34.9**	**393**	**64.5**
Sea Robins spp	1	2.8	35	97.2	36	66.7	0	0	18	100.0	18	33.3
Skates spp	1	10.0	9	90.0	10	100.0	0	0	0	0	0	0
Striped Bass	**43**	**33.1**	**87**	**66.9**	**130**	**36.7**	**33**	**14.5**	**194**	**85.5**	**227**	**63.6**
Summer Flounder	**109**	**30.5**	**248**	**69.5**	**357**	**62.1**	**74**	**33.9**	**144**	**66.1**	**218**	**37.9**
Tautog	**74**	**39.6**	**113**	**60.4**	**187**	**42.7**	**78**	**31.1**	**173**	**68.9**	**251**	**57.3**
Triggerfish, grey	0	0	1	100.0	1	100.0						
Winter Flounder	2	100.0	0	2.0	2	100.0						
Yellowfin Tuna	1	100.0	0	1.0	1	100.0						
Total	**607**	**44.11**	**769**	**55.89**	**1376**	**48.1**	**622**	**41.2**	**886**	**58.8**	**1508**	**51.9**

Table 2.2: Reported angler catch by region, species and disposition. ***Species listed in bold type are targeted in this program.***

Table 1.3: Total number of fish measured by species.

Species	Number Measured	Percent of Total
Atlantic Bonito	3	0.1%
Atlantic Stingray	1	0.0%
Atlantic Sturgeon	1	0.0%
Black Sea Bass	409	14.2%
Bluefish	343	11.9%
Cunner	3	0.1%
Dogfish	26	0.9%
False Albacore	7	0.2%
Mahi-Mahi	4	0.1%
Menhaden	35	1.2%
Scup	608	21.1%
Searobins spp	54	1.9%
Skates spp	10	0.3%
Striped Bass	357	12.4%
Summer Flounder	573	19.9%
Tautog	438	15.2%
Triggerfish, grey	1	0.0%
Winter Flounder	2	0.1%
Yellowfin Tuna	1	0.0%
Total	**2,876**	

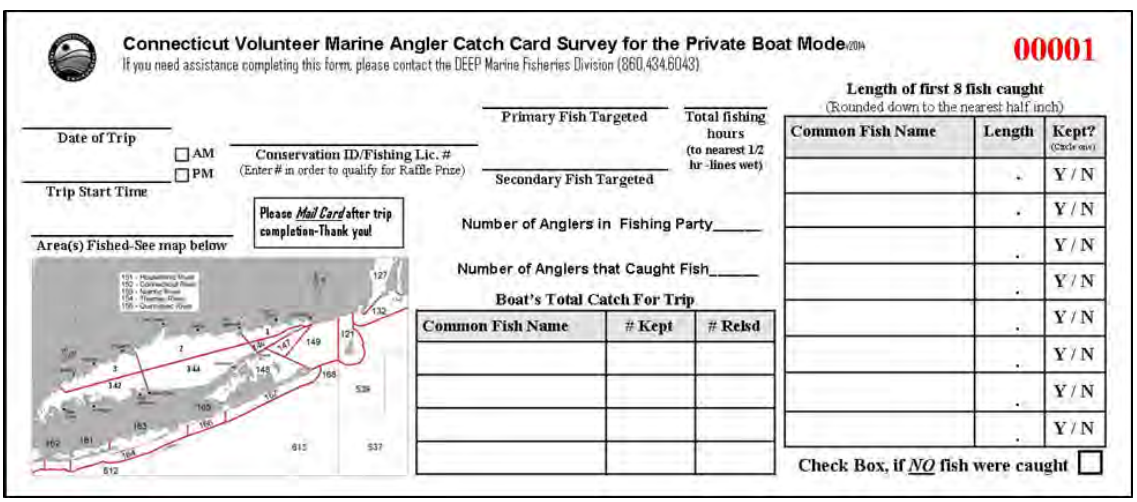


Figure 1.1: Connecticut Volunteer Marine Angler Catch Card for the Private Boat Mode

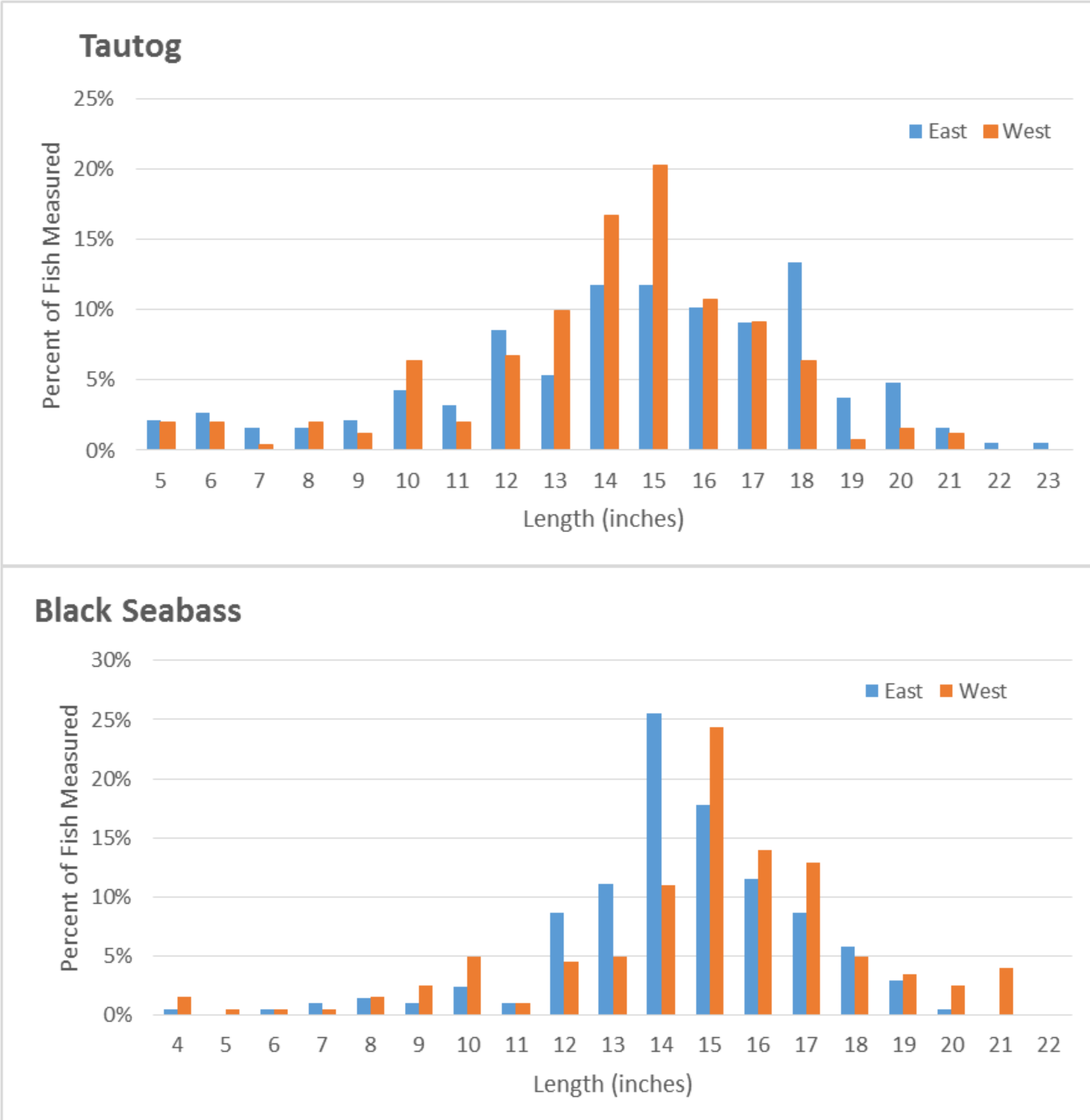
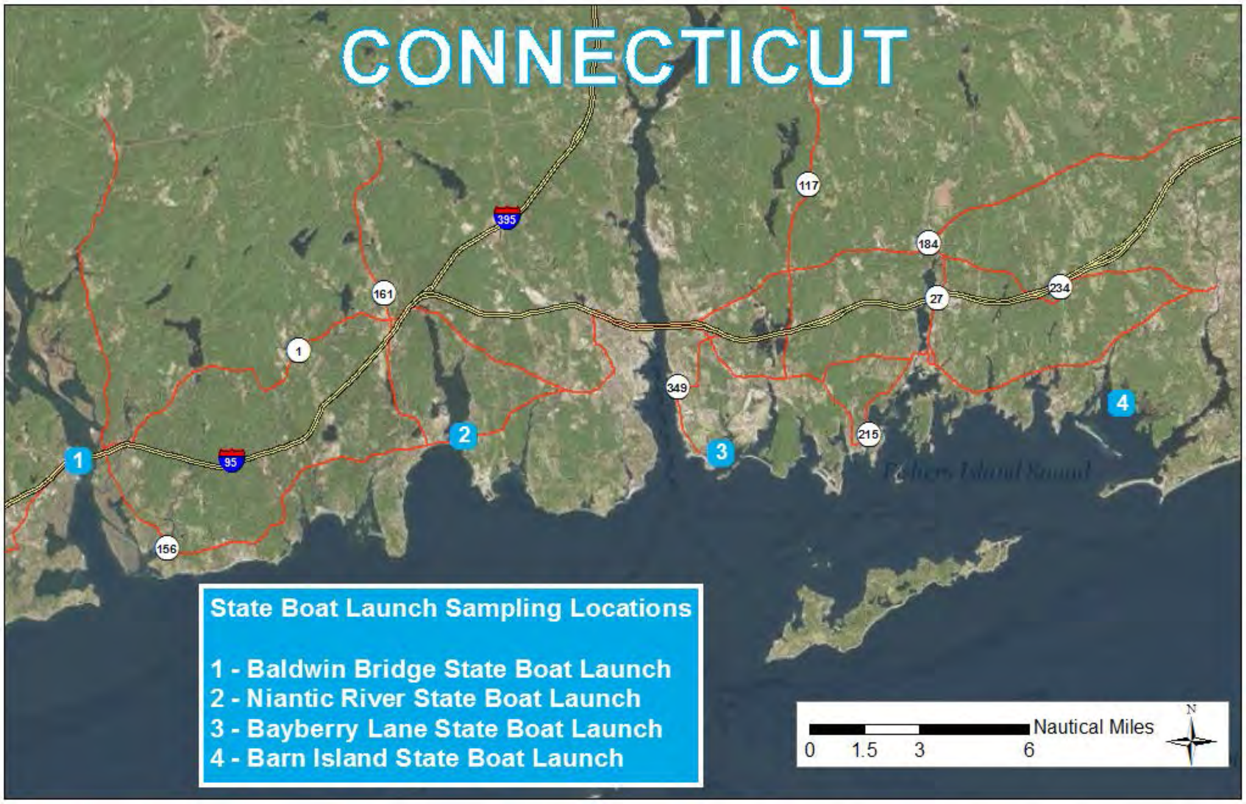


Figure 1.2: Length frequency of tautog and black seabass measured by volunteer anglers in eastern versus western Long Island Sound. *Frequencies include kept and released fish.*

Appendix 1.1: Recreational Boat Angler Sampling Locations in the East and West.



JOB 2: VOLUNTEER ANGLER SURVEY

VOLUNTEER ANGLER SURVEY

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

JOB 2: VOLUNTEER ANGLER SURVEY

GOAL

To enhance the fisheries management process by providing supplemental catch, effort and size composition data for several important recreational finfish species through a voluntary logbook program.

OBJECTIVES

Provide estimates of:

1) *Size composition for both kept and released bluefish, striped bass and other common species.*
2) *Catch frequency by trip for both kept and discarded fish.*

INTRODUCTION

The Connecticut Volunteer Angler Survey (VAS) program has been in existence since 1979. Its primary purpose is to supplement the National Marine Fisheries Service, Marine Recreational Fishery Statistics Survey/Marine Recreational Information Program by providing additional length measurement data. The Survey emphasizes measurements of fish that are released which are under reported in the federal surveys. The survey's initial objective was to collect marine recreational fishing information concerning finfish species with special emphasis on striped bass. In 1994, the collection of bluefish length measurements was added to the survey to fully document that fishery. In 1997, length data for other marine finfish were added to the Survey.

METHODS

The VAS is designed to collect trip and catch information from marine recreational (hook and line) anglers who volunteer to record their fishing activities by logbook. The logbook format consists of recording fishing effort, target species, fishing mode (boat and shore), area fished (subdivisions of Long Island Sound and adjacent waters), catch information concerning finfish kept (harvested) and released, and length measurements. Instructions for volunteers are provided on the inside cover of the postage paid logbook. Each participating angler is assigned a unique numeric code for confidentiality purposes. After the logbook data are entered into the Survey database, logbooks were returned to each volunteer for their personal records. Furthermore, to improve communications with recreational anglers and to encourage more public participation, volunteers are notified of upcoming public hearings including proposed and final changes in recreational fishing regulations.

In 2013 the VAS program was incorporated into the Atlantic Coastal Cooperative Statistics Program (ACCSP) Standard Atlantic Fisheries Information System (SAFIS) eLogbook application. Under the ACCSP eLogbook application, the VAS database was upgraded from the previous outdated software. The VAS logbook format was slightly modified so that the information collected would be compatible with ACCSP minimum data element standards (Appendix 2.1). Initially one of the primary purposes of incorporating the VAS database into ACCSP SAFIS was to enable anglers to enter their own fishing information and compile their own statistics using eLogbook. However, a data entry problem occurred concerning the ‘fishing area’ field. Because of the unique geographic location of Connecticut’s shoreline, marine anglers often fish over multiple areas crossing interstate and federal boundaries during a single trip. Unfortunately, eLogbook software did not allow entry of data from fishing areas outside of Connecticut’s marine waters. Therefore, as in previous years, paper logbooks were distributed to Survey volunteers and Marine Fisheries staff completed VAS data entry. The problem was resolved in 2014, but only a portion of the volunteers entered their own data in 2014 and 2015, with the remainder submitting paper logbooks.

Since the Survey began in 1997, the number of participants has ranged from 18 anglers participating in 1979 to 115 anglers in 1997. Advertising the VAS program through the annually published Connecticut Angler’s Guide and on the state web site (www.ct.gov/deep/fishing) has helped increase volunteer participation. The guide is distributed to anglers purchasing Connecticut fishing licenses in addition to being circulated by bait and tackle shops and other entities.

RESULTS AND DISCUSSION

In 2015 a total of 33 anglers participated in the program, making 762 trips for an average of 23 trips each (Table 2.1). Two-thirds (22) VAS angler’s entered their own data through the eLogbook application on the ACCSP website (www.accsp.org) in 2015, an increase from 12 anglers who did so in 2014 which was the first year of the eLogbook program. Most of the anglers that entered their own data expressed favorable comments toward the program.

The private boat mode comprised the most trips (60%) recorded, followed by shore based trips (36%, see Job 3 for description of regular and enhanced shore sites). Of the total, 76% of the fishing trips caught fish. VAS anglers recorded their catch of 20 species from near shore species to open ocean pelagic species (Table 2.2), including seven principal recreational species currently under a fisheries management plans comprising 79% of their total catch. With the exception of Atlantic menhaden and hickory shad, the release rate for all species was 50% or greater.

VAS participants measured over 90% of their total catch of 8,216 fish, and 100% of the seven principal species they caught (N=6,502, Table 2.3). These data show a wide range in the release rate of the principal species, for example 67% of scup caught by private boat anglers were released while 99% of summer flounder caught by regular shore based anglers were released. For bluefish with no minimum legal size, the release rate varied from 81% for private boat anglers to 32% for all shore based anglers (Figure 3.1).

CONCLUSIONS

VAS anglers provide valuable recreational fisheries catch data at a relatively low cost. In addition, the length data on released fish provided by this program is difficult or unattainable through conventional access point angler intercept surveys and is essential to effective assessment of the recreational fishery coastwide and in Connecticut. Any anglers interested in participating in the program can contact David Molnar at 860-434-6043, or e-mail address: david.molnar@ct.gov or writing to State of Connecticut, DEEP, Marine Fisheries Office, P.O. Box 719, Old Lyme CT 06371.

MODIFICATIONS

None.

ACKNOWLEDGEMENTS

We very grateful to all anglers who have participated in the survey. Without their cooperation and assistance, the VAS program would be not possible.

Table 2.1:

MODE	TRIPS	PERCENT
Private Boat	460	60%
Shore (Regular)	220	29%
Shore (Enhanced)	54	7%
Charter Boat	10	1%
Party Boat	18	2%
ALL Modes	762	

Table 2.2: Total angler catch by species and disposition. Seven principal recreational species are shown in bold type.

	Harvest		Release		Total
Species	Number	%	Number	%	Number
Atlantic Bonito	1	100%	0		1
Atlantic Cod	1	100%	0		1
Atlantic Herring	0		32	100%	32
Atlantic Menhaden	511	89%	61	11%	572
Black Sea Bass	**485**	**33%**	**997**	**67%**	**1482**
Blue Shark	0		10	100%	10
Bluefin Tuna	1	33%	2	67%	3
Bluefish	**175**	**28%**	**458**	**72%**	**633**
Cunner	0		2	100%	2
Dogfish	1	1%	113	99%	114
Hickory Shad	23	61%	15	39%	38
Little Tunny	0		3	100%	3
Mako Shark	2	40%	3	60%	5
Scup	**582**	**33%**	**1200**	**67%**	**1782**
Sea Robins	21	3%	791	98%	811
Skates	4	3%	118	97%	122
Striped Bass	**57**	**10%**	**526**	**90%**	**584**
Summer Flounder	**206**	**13%**	**1435**	**87%**	**1641**
Tautog	**48**	**13%**	**326**	**87%**	**374**
Winter Flounder	**3**	**50%**	**3**	**50%**	**6**
TOTAL	**2121**	**26%**	**6095**	**74%**	**8216**

Table 2.3: Measured catch and disposition of seven principal recreational species.

Species	Harvest Number	Harvest %	Release Number	Release %	Total Number
Black sea bass	502	32.4%	1,045	67.6%	1,547
Bluefish	218	35.3%	400	64.7%	618
Scup	586	33.1%	1,182	66.9%	1,768
Striped bass	61	10.3%	532	89.7%	593
Summer flounder	212	12.6%	1470	87.4%	1682
Tautog	47	12.6%	326	87.4%	373
Winter flounder	3	50.0%	3	50.0%	6
Total	**1,629**	**24.7%**	**4,958**	**75.3%**	**6,587**

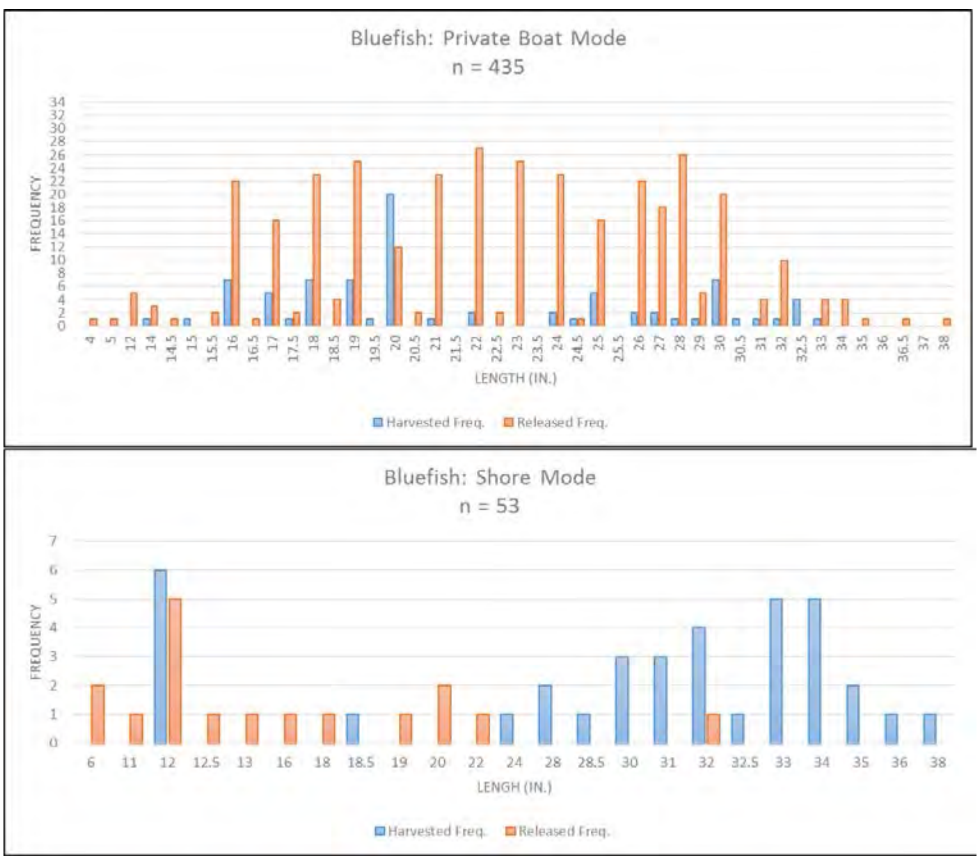


Figure 3.1 Length frequency if bluefish caught by private boat and shore anglers by disposition.

APPENDIX 2.1: Connecticut Volunteer Angler Logbook

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST-CLASS MAIL PERMIT NO. 75 OLD LYME CT

POSTAGE WILL BE PAID BY ADDRESSEE

CT DEEP MARINE FISHERIES DIVISION
PO BOX 719
OLD LYME CT 06371-9973

TAPE

CONNECTICUT VOLUNTEER ANGLER SURVEY

Rev. 2/2013 – 12 Trip

Angler Code

CONNECTICUT DEEP MARINE FISHERIES DIVISION VOLUNTEER ANGLER SURVEY

This space for office use only.

Logged ______

Entered ______

Checked ______

TAPE

Send Me ☐ *More Logbooks*

CONNECTICUT ENERGY ENVIRONMENT

Connecticut Department of
Energy & Environmental Protection
Bureau of Natural Resources
Marine Fisheries Division

TAPE

VOLUNTEER ANGLER SURVEY INSTRUCTIONS

Listed below are instructions for filling out the logbook. Upon logbook completion, tape the prepaid postage logbook shut and drop it off in the mail. All information is kept confidential. Once the information is entered into the database, and error checked, the logbooks will be returned for your own records. If you are interested in online reporting please contact us.

The information provided by this report will help us in making fishery management decisions. Please help us by completing this report as accurately as possible.

If you have any questions or comments regarding the survey, please contact Rod MacLeod (rod.macleod@ct.gov) or Greg Wojcik (gregory.wojcik@ct.gov) at 860.434.6043.

Trip Header Record

The top of each page is for recording **each trip's header information**. In this section, make a new entry for each trip made. If you fill a logbook page before the trip is over, continue onto the next page. Use as many pages and books as necessary to record your fishing activity. If you have a multi-day trip, make only one entry for that trip.

Date Enter the date that your fishing trip occurred on.

Start Time Enter the time on a 24 hour clock (military time) that you started your fishing trip.

Mode Indicate the fishing mode by putting a check mark in the appropriate box. The Shore (Enhanced Site) option refers to the designated shore fishing sites along the Connecticut coast that allow for the harvest of smaller select species. See the anglers guide for more information.

Trip Effort Record

Enter the approprate fishing effort information for the fishing area.

Fishing Area Enter the code for the area in which you made your catch. Refer to the Fishing Area Chart on page iii for the appropriate area code. If you fish in the race along the border between area 6 and 147, please use area code 6.

Total Anglers Enter the total number of anglers that are in the fishing party.

Lucky Anglers Enter the number of anglers that caught fish in the fishing party.

Hours Fished Enter the actual fishing time or 'lines wet' to the nearest half hour. Do not include travel time.

Targeted Species Enter the 1st (Primary) targeted species and 2nd (secondary) targeted species.

VOLUNTEER ANGLER SUVEY INSTRUCTIONS (CONTINUED)

Trip Catch Record

Under each trip effort record are the associated catch records. Enter a catch row for each species, disposition (Kept/Released) and length. If you caught more fish then rows provide, continue onto the next effort or page as necessary. If you do not catch or harvest any fish, complete the trip header and effort information (Date to Targeted Species 2).

Species Enter the species code from the Species Code List below. If the species is not listed, write in the species name.

K / R Indicate if the fish were kept or released by writhing K (Kept) or R (Released). If you kept and released the same species indicate this by adding an additional row. If you kept and released the same species, complete two rows.

Length (in) Enter the length in inches of the fish. **ROUND DOWN TO THE NEAREST HALF INCH**. In previous years, the Volunteer Angler Survey requested rounding to the nearest half inch but rounding down helps produce more accurate data.

Quantity Enter the number of fish of that specific species, disposition (K/R), and length. If any of these fields change, create a new row. If additional rows are needed, continue onto the next page.

Species Code List

Groundfish

COD - Cod
HADD - Haddock
POLL - Pollock

Flounders

FLUK - Summer flounder / fluke
FLBB - Winter flounder / blackback

Other Finfish

BLU - Bluefish
BSB - Black sea bass
CUN - Cunner
EEL - Eel, American
MEN - Menhaden / bunker
WPRC - Perch, white
SCUP - Scup / porgy
SROB - Sea robins
HSHD - Hickory shad
STB - Striped bass

Other Finfish continued

TAUG - Tautog / blackfish
TRIG - Triggerfish
WEAK - Weakfish / squeteague / gray sea trout

Tuna / Large Pelagics

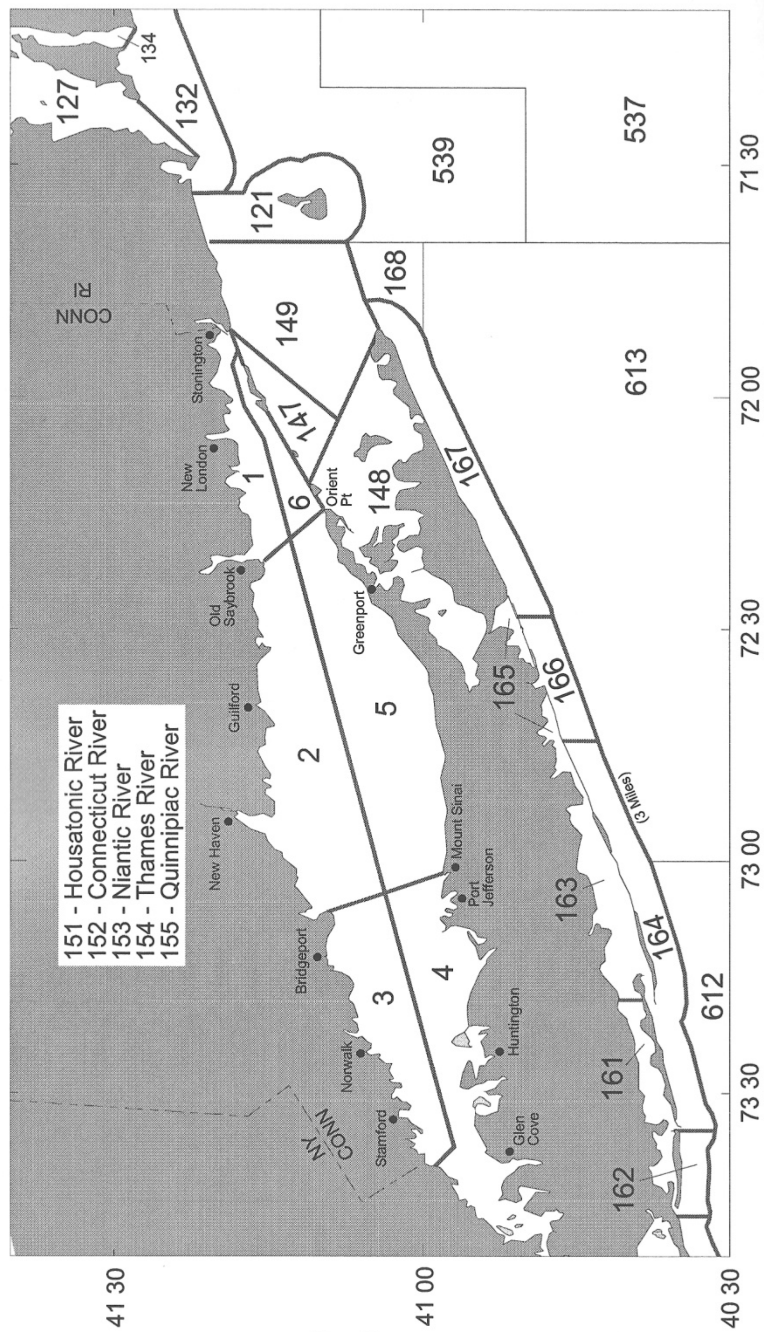
ALB - Albacore tuna
BET - Big eye tuna
BFT - Bluefin tuna
BON - Bonito
LTNY - Little tunny
SKJ - Skipjack
YFT - Yellowfin tuna
DOL - Dolphin fish / mahi-mahi
WAH - Wahoo

Sharks and Skates

DGSP - Dogfish, spiny
DGSM - Dogfish, smooth
SKAT - Skate
SHBL - Shark, blue

If you caught a species that does not appear in this list, write in the species name or contact the Marine Fisheries Division for the proper species code.

Long Island Sound and Vicinity Fishing Area Chart



Page iii

Date: __ / __ / ____ **Start Time:** __ : __

Mode: Private Boat ☐ Charter Boat ☐ Party Boat ☐ Shore ☐ Shore (Enhanced Site) ☐

Area	Total Anglers	Lucky Anglers	Hours Fished	Targeted Species 1	Targeted Species 2

Species	K/R	Length (in)	Quantity
		.	
		.	
		.	
		.	
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Comments/Observations:______________________________

JOB 3: ENHANCED OPPORTUNITY SHORE FISHING PROGRAM

JOB 3: ENHANCED OPPORTUNITY SHORE FISHING PROGRAM

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

JOB 3: ENHANCED OPPORTUNITY SHORE FISHING PROGRAM

GOAL

To maintain and improve the fishing experience, opportunity and quality of access to public trust marine fisheries resources in Connecticut especially in urban areas, while maintaining marine fish conservation objectives.

OBJECTIVES

1. *Preserve the quality of shore fishing opportunity for species whose management is heavily minimum size dependent, while also meeting fishery management plan conservation objectives.*
2. *Collect data from the designated enhanced shore fishing sites necessary to gauge the biological and social impact of enhanced opportunity and whether fishery management plan harvest targets are still being met.*
3. *Create an "adopt-a-shore-site" relationship with tackle shops that are located near specific sites to help maintain and manage locations.*
4. *Establish contacts with local officials of town owned sites especially within urban areas to increase awareness and appreciation of quality shore based recreational fishing opportunity in their community.*
5. *Increase public awareness of the sites to encourage activity by increasing communication with tackle shops and anglers.*

INTRODUCTION

DEEP Marine Fisheries has identified the need to enhance fishing opportunity for shore based anglers. Additionally, the Atlantic States Marine Fisheries Commission (ASMFC) Summer Flounder, Scup and Black Sea Bass Management Board requested that DEEP increase monitoring of the enhanced shore fishing sites to provide additional catch information for stock assessments. To meet both these needs, the agency designated shore based fishing sites (see Appendix 8.1) that allowed for less restrictive fishing regulations. Anglers fishing from designated enhanced opportunity shore fishing sites in 2015 were allowed to harvest scup at 9 inches minimum length (vs. 10.5 inches in other private fishing modes and 11 inches for party/charter modes) and summer flounder at 16 inches (vs 18 inches for other modes). The smaller minimum sizes were adopted out of concern that shore anglers were taking a disproportional share of conservation burden associated with the increased minimum sizes adopted in response to the harvest limits established under the joint ASMFC/MAFMC fishery management plans for these species.

A voluntary daily angler catch card program was developed to collect fishing trip and catch information, including length measurements of harvested and released (discarded) fish, from recreational anglers at enhanced shore fishing sites. Collecting length measurement data, especially on discarded fish, is extremely difficult to obtain through traditional access point angler intercept surveys (e.g. MRIP). In past years, such length data has been successfully collected utilizing volunteer anglers to report their fishing trip information through a logbook survey (VAS, Job 2) and this program was used as a template for the more extensive catch card program (see Appendix 3.2).

METHODS

Five assignment zones were established comprising a total of 39 sites from Stonington to Norwalk (Figure 3.1). For each assignment, the zone, time of day (am or pm), starting site and direction of travel was randomly selected using the SAS ‘ranuni’ function. Upon arriving at a site, the creel agent would record:

- Date and time of creel agent arrival
- Weekend or weekday
- Site name
- Initial count of angler(s)
- Arrival and departure time of additional anglers
- Date and time of creel agent departure

Each angler was asked to participate in an angler survey to provide fishing effort and catch information. If they agreed, the creel agent would perform a partial trip interview. The following questions were asked:

- What time did you start fishing?
- Have you been interviewed by this program already this year?
- What species are you fishing for?
- How Many times do you go saltwater fishing per year?
- Of those, what percent are from shore?
- Are there any comments you would like to make about shore fishing in CT (Pro’s or Con’s).
- Have you caught any fish yet on this trip? If yes, how many fish of each species did you catch?

All fish caught while the creel agent is on site, are measured and recorded. To capture the remaining catch and effort information, each participating angler was provided a waterproof daily catch card, pencil, measuring tape, and verbal instructions were given by DEEP staff. Anglers were asked to fill out the following (data fields):

- Conservation identification number (fishing license number)
- Primary target species
- Secondary target species
- Total hours spent fishing
- Date (mm/dd/yy)/start time (check box AM/PM)
- Total number of fish kept and released by species
- Length measurements for the first seven fish caught.

Anglers were encouraged to mail in the post-marked catch card, or deposit it into designated drop-off-boxes installed at fishing sites, upon trip completion. Also, questions concerning the survey could be answered by contacting the DEEP Marine Headquarters office.

RESULTS AND DISCUSSION

Catch cards distributed to shore anglers were categorized by identification number, date, and enhanced shore fishing site code. From May-December 2015 there were a total of 219 assignments (Table 3.1) totaling 1,462 sites sampled (Table 3.2) in five zones. The largest number of intercepts and interviews occurred in August (Table 3.3).

A total of 1,736 cards were distributed to anglers at enhanced shore fishing sites and 682 (39%) were returned. The reported catch included 26 species/taxonomic groups totaling 1,434 fish (Table 3.4) similar to the total for partial interviews. Half of the fish (54%) were released due to regulatory discard or undesirable catch. The total harvest reported was 654 fish comprised of 11 species.

Length Information

Each individual angler reported common name(s) of the first seven fish captured regardless of species and size. A total of 1,151 fish measurements were received, comprised of 18 species (Table 3.5). Bluefish, scup, striped bass and summer flounder were the most frequently harvested and measured by anglers (Figure 3.1), and comprised 67% of the total measured catch.

Enhanced shore fishing

Although sample sizes are small, data gathered from this program indicates that the reduced minimum length requirements at the Enhanced Sites improved success rate for shore scup anglers by 40% compared to anglers complying with legal minimum length requirements. This increase is a near doubling of the 21% recorded in 2014, the first year of the program. Shore-based summer flounder anglers improved their success rate by 22% compared to anglers complying with legal minimum length requirements, similar to the 29% increase recorded in 2014.

MODIFICATIONS

No modifications are expected.

Table 3.1: Assignments by month and zone.

MONTH	ZONE1	ZONE2	ZONE3	ZONE4	ZONE5	TOTAL
MAY	3	3	4	3	2	**15**
JUNE	7	7	5	7	7	**33**
JULY	9	7	6	10	7	**39**
AUGUST	9	6	8	8	9	**40**
SEPTEMBER	7	6	6	7	6	**32**
OCTOBER	8	8	6	7	8	**37**
NOVEMBER	5	5	4	4	5	**23**
DECEMBER	3	4	2	2	1	**12**
TOTAL	**48**	**42**	**39**	**46**	**44**	**219**

Table 3.2: Sites visited by month and zone.

MONTH	ZONE1	ZONE2	ZONE3	ZONE4	ZONE5	TOTAL
MAY	18	24	24	18	10	**94**
JUNE	42	52	30	42	35	**201**
JULY	54	56	35	60	35	**240**
AUG	56	47	48	45	45	**241**
SEPT	50	56	34	38	35	**213**
OCT	47	64	36	42	40	**229**
NOV	36	48	24	24	25	**157**
DEC	18	40	12	11	6	**87**
TOTAL	**321**	**387**	**243**	**280**	**231**	**1462**

Table 3.3: Fishing parties intercepted and total anglers interviewed by month.

Month	Intercepts (parties)	Anglers Interviewed
MAY	99	166
JUN	213	361
JUL	262	423
AUG	320	494
SEP	190	273
OCT	115	173
NOV	42	60
DEC	6	8
Total	**1247**	**1958**

Table 3.4: Catch disposition from Enhanced Shore Fishing Sites.

	RETURNED CREEL CARD			PARTIAL INTERVIEW		
SPECIES	RELEASE	KEPT	TOTAL	RELEASE	KEPT	TOTAL
ALBACORE TUNA	3		3			
AMERICAN EEL	3	1	4	2	4	6
ATLANTIC MENHADEN	1	74	75	12	160	172
ATLANTIC NEEDLEFISH	1		1			
ATLANTIC SEA HERRING		6	6		7	7
BLACK SEA BASS	2		2			
BLUEFISH	183	165	348	146	162	308
BUTTERFISH	1		1			
CATFISHES	2		2	1	1	2
CUNNER				2		2
DOGFISH UNC	2		2	2		2
HICKORY SHAD	4	4	8	2	5	7
LITTLE TUNNY				2		2
NORTHERN KINGFISH		1	1		1	1
NORTHERN PUFFER	2		2	2		2
SMOOTH DOGFISH	1		1			
SCUP	203	321	524	126	330	456
SEA ROBINS UNC	244	64	308	275	67	342
SKATES UNC	3		3	9		9
STRIPED BASS	39	2	41	59	6	65
SUMMER FLOUNDER	63	14	77	80	17	97
TAUTOG	18	2	20	21	1	22
TOMCOD	1		1			
WEAKFISH	3		3	2		2
WHITE PERCH	1		1			
WINTER FLOUNDER				1		1
COMBINED TOTAL	**780**	**654**	**1434**	**744**	**761**	**1505**
PERCENT OF TOTAL	**54%**	**46%**				

Table 3.5: Length measurements of finfish captured at Enhanced Shore Fishing Sites.

SPECIES	MEASURED BY ANGLER	MEASURED BY AGENT	TOTAL LENGTHS
AMERICAN EEL	2	4	6
ATLANTIC MENHADEN	35	51	86
ATLANTIC SEA HERRING		6	6
BLUEFISH	121	120	241
CATFISHES	1	1	2
CUNNER	2		2
DOGFISH UNC	1	1	2
HICKORY SHAD	5	2	7
NORTHERN KINGFISH		1	1
NORTHERN PUFFER	2		2
SCUP	99	303	402
SEA ROBINS UNC	114	122	236
SKATES UNC	3	2	5
STRIPED BASS	23	12	35
SUMMER FLOUNDER	62	33	95
TAUTOG	14	6	20
WEAKFISH	2		2
WINTER FLOUNDER		1	1
COMBINED TOTAL	**486**	**665**	**1,151**

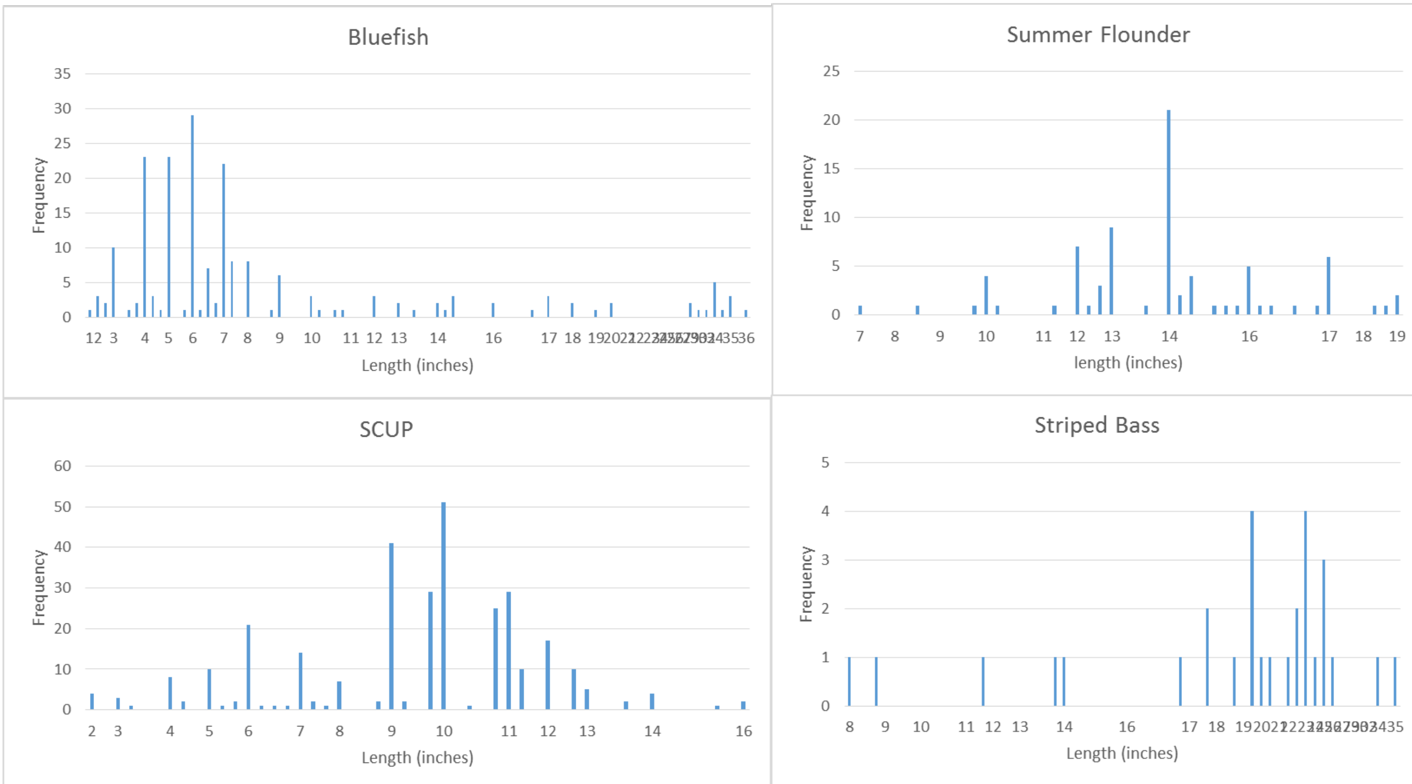
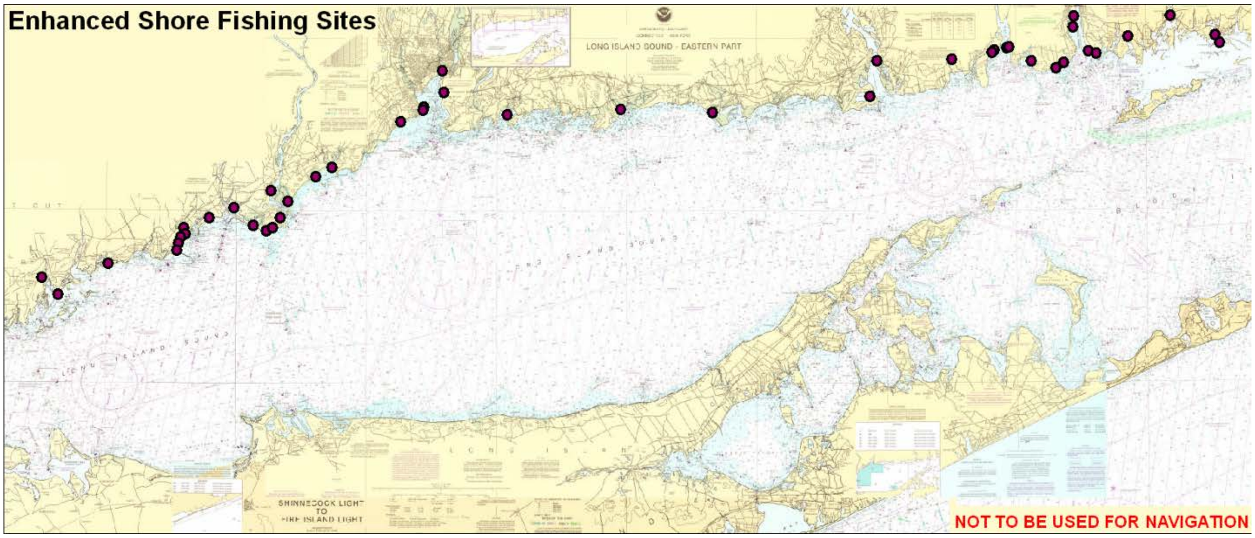
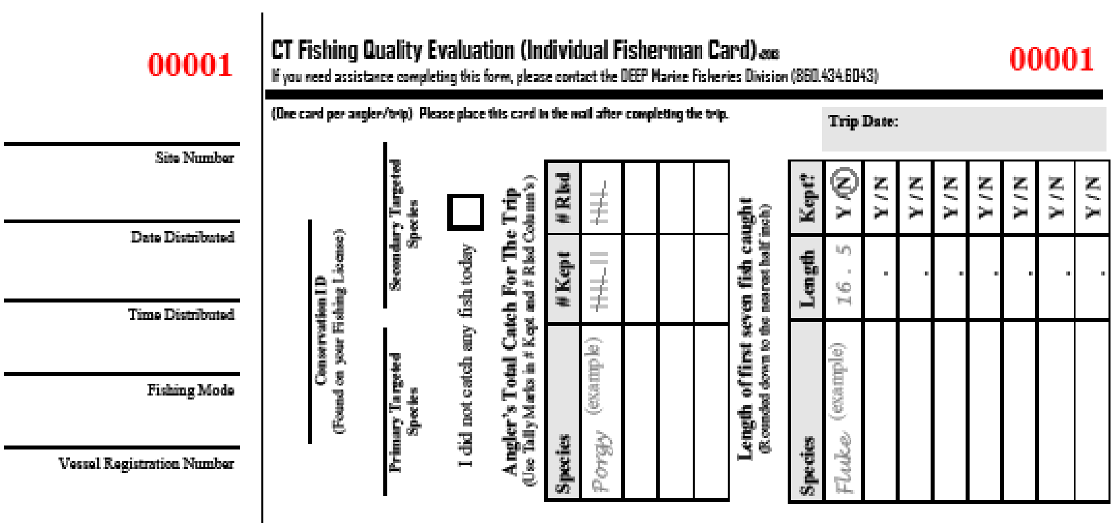


Figure 3.1: Length frequencies of popular marine fish measured at Enhanced Shore Fishing Sites. Total length is rounded down to the nearest half inch.

Appendix 3.1: Map of Enhanced Shore Fishing Sites



Appendix 3.2: Enhanced Shore Fishing Site Catch Card


00001

Site Number

Date Distributed

Time Distributed

Fishing Mode

Vessel Registration Number

CT Fishing Quality Evaluation (Individual Fisherman Card)

00001

If you need assistance completing this form, please contact the DEEP Marine Fisheries Division (860.434.6043)

(One card per angler/trip) Please place this card in the mail after completing the trip.

Trip Date:

Conservation ID (Found on your Fishing License)

Primary Targeted Species

Secondary Targeted Species

I did not catch any fish today

Angler's Total Catch For The Trip (Use Tally Marks in # Kept and # Rlsd Column's)

Species	# Kept	# Rlsd
Porgy (example)	~~IIII~~ II	~~IIII~~

Length of first seven fish caught (Rounded down to the nearest half inch)

Species	Length	Kept?
Fluke (example)	16 . 5	Y / N
	.	Y / N
	.	Y / N
	.	Y / N
	.	Y / N
	.	Y / N
	.	Y / N
	.	Y / N

JOB 5: MARINE FINFISH SURVEY

Long Island Sound Trawl Survey

LONG ISLAND SOUND TRAWL SURVEY

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

JOB 5: LONG ISLAND SOUND TRAWL SURVEY (LISTS)

CRUISE RESULTS FROM THE 2015 SPRING AND FALL SURVEYS

STUDY PERIOD AND AREA

The Connecticut DEEP Marine Fisheries Division completed the thirty-second year of the Long Island Sound Trawl Survey in 2015. The Long Island Sound Trawl Survey encompasses an area from New London to Greenwich, Connecticut and includes waters from 5 to 46 meters in depth in both Connecticut and New York state waters. Typically, Long Island Sound is surveyed in the spring, from April through June, and during the fall, from September through October. This report includes results from the 2015 spring and fall sampling periods and provides time series information since the commencement of the survey in 1984.

GOAL

To provide long term monitoring of abundance, biomass and size composition of marine fishery resources along with environmental parameters, in order to evaluate the effects of fishing and environmental conditions on the distribution and abundance of living resources in Long Island Sound.

OBJECTIVES

Provide:

1) Annual indices of counts and biomass per standard tow for 40 common species and age-specific indices of abundance for winter flounder, tautog, scup, summer flounder, bluefish (Age 0, 1+) and weakfish (Age 0, 1+).
2) Length-frequency distributions of bluefish, scup, summer flounder, winter flounder, tautog, striped bass, weakfish, black sea bass, and other ecologically important species.
3) Annual total counts and biomass for all finfish species taken and annual total biomass for all common macro-invertebrate species taken.
4) Species list for Long Island Sound based on LIS Trawl Survey sampling, noting the presence of additional species from other sampling conducted by the Marine Fisheries Division.
5) Fishery independent survey data to cooperative state researchers or agencies, such as the National Marine Fisheries Service, Atlantic States Marine Fisheries Commission, New England and Mid-Atlantic Councils, and researchers associated with state or local universities

INTRODUCTION

The Long Island Sound Trawl Survey (LISTS) was initiated in 1984 to provide fishery independent monitoring of important recreational species in Long Island Sound. A stratified-random design based on bottom type and depth interval was chosen and forty sites were sampled monthly from April through November to establish seasonal patterns of abundance and distribution. Seven finfish species were initially of primary interest: bluefish, scup, striped bass, summer flounder, tautog, weakfish, and winter flounder. Length data for these species were collected from every tow; scup, tautog, and winter flounder were sampled for aging. Lobster were also enumerated and measured from every tow. All fish species were identified and counted.

Since 1984, several changes have been incorporated into the Survey. In 1991, the sampling schedule was changed to a spring/fall format, although sampling is still conducted on a monthly basis (April - June, September, and October). Beginning in 1992, species were weighed in aggregate with an onboard scale to provide indices of biomass. Furthermore, more species have been sampled for lengths, such as windowpane and fourspot flounders, and important forage species such as butterfish, long-finned squid, and several herring species. By 2003, the list of species measured expanded to 20 finfish species and two invertebrate species (lobster and long-finned squid), plus rarely occurring species. Beginning in 2014, lengths were collected from all finfish species on each tow. In addition, age structures were collected from bluefish, menhaden, tautog, scup, winter flounder, weakfish and large summer flounder (>59 cm). All of these changes serve to improve the quality and quantity of information made available to fishery managers for local and regional assessment of stock condition, and to provide a more complete annual inventory of LIS (Long Island Sound) fishery resources.

METHODS

Sampling Design

LISTS is conducted from longitude 72º 03' (New London, Connecticut) to longitude 73º 39' (Greenwich, Connecticut). The sampling area includes Connecticut and New York waters from 5 to 46 m in depth and is conducted over mud, sand and transitional (mud/sand) sediment types. Sampling is divided into spring (April-June) and fall (Sept-Oct) periods, with 40 sites sampled monthly for a total of 200 sites annually. The sampling gear employed is a 14 m otter trawl with a 51 mm codend (Table 5.1). To reduce the bias associated with day-night changes in catchability of some species, sampling is conducted during daylight hours only (Sissenwine and Bowman 1978).

LISTS employs a stratified-random sampling design. The sampling area is divided into 1.85 x 3.7 km (1 x 2 nautical miles) sites (Figure 5.1), with each site assigned to one of 12 strata defined by depth interval (0 - 9.0 m, 9.1 - 18.2 m, 18.3 - 27.3 m or, 27.4+ m) and bottom type (mud, sand, or transitional as defined by Reid et al. 1979). For each monthly sampling cruise, sites are selected randomly from within each stratum. The number of sites sampled in each stratum was determined by dividing the total stratum area by 68 km^2 (20 square nautical miles), with a minimum of two sites sampled per stratum (Table 5.2). Discrete stratum areas smaller than a sample site are not sampled.

Sampling Procedures

Prior to each tow, temperature (ºC) and salinity (ppt) are measured at 1 m below the surface and 0.5 m above the bottom using a YSI model 30 S-C-T meter. Water is collected at depth with a five-liter Niskin bottle, and temperature and salinity are measured within the bottle immediately upon retrieval.

The survey's otter trawl is towed from the 15.2 m aluminum R/V John Dempsey for 30 minutes at approximately 3.5 knots, depending on the tide. At completion of the tow, the catch is placed onto a sorting table and sorted by species. Finfish, lobsters and squid are counted and weighed in aggregate (to the nearest 0.1 kg) by species with a precision marine-grade scale (30 kg, +/- 10 gm capacity). Catches weighing less than 0.1 kg are recorded as 0.1 kg. During the initial two years of the survey (1984 & 1985), lobsters were the only invertebrates recorded. Squid abundance has been recorded since 1986. Since 1992, additional invertebrate species have been weighed in aggregate, and some have been counted. The complete time series of species counted and weighed in the survey is documented in Appendix 5.4.

For finfish species, lengths are recorded to the centimeter as either total length or fork length (e.g. measurements from 100 mm to 109 mm are recorded as 10 cm) and entered in the database as 105 mm (Table 5.3). Lobsters are measured to 0.1 mm carapace length. Squid are measured using the mantle length (cm), horseshoe crab measurements are taken using prosomal width (cm) and whelk (knobbed and channeled) shell widths are measured in millimeters.

The number of individuals measured from each tow varies by species, the size of the catch and range of lengths (Table 5.3). If a species is subsampled, the length frequency of the catch is determined by multiplying the proportion of measured individuals in each centimeter interval by the total number of individuals caught. Some species are sorted and subsampled by length group so that, for example, all large individuals are measured and a subsample of small (often young-of-year) specimens is measured. All individuals not measured in a length group are counted. The length frequency of each group is estimated as described above, i.e. the proportion of individuals in each centimeter interval of the subsample is expanded to determine the total number of individuals caught in the length group. The estimated length frequencies of each size group are then appended to complete the length frequency for that species. This procedure is often used with catches of bluefish, scup, and weakfish, which are usually dominated by young-of-year or discrete age/length classes.

Bluefish, menhaden, scup, summer flounder, tautog, weakfish (ageing was discontinued in 2013) and winter flounder are sampled for age determination (Table 5.3). The target number of age samples (otolith) for bluefish were 50 from the spring period (defined by ASMFC Bluefish Technical Committee as Jan-July) and 50 from the fall period (August-December). Subsamples of scup, stratified by length group, are measured to the nearest mm (fork length) and scales from each individual are taken for ageing. Scup scales are removed posterior to the pectoral fin and ventral to the lateral line. The scales are pressed onto plastic laminate with an Ann Arbor roller press to obtain an impression of the scale, which is then viewed with a microfiche reader at 21x. Scales are also taken from all summer flounder greater than 59 cm. At least 15 scales are removed from the caudal peduncle area. These scales are pressed and aged to supplement the National Marine Fisheries Service age key and are also included in the formulation of LISTS summer flounder catch-at-age matrix (see below).

Menhaden scales are collected from roughly 50 fish each year as required by Amendment 2 of the ASMFC Atlantic menhaden management plan. Amendment 2 introduced a requirement for biological sampling of the commercial bait harvest to support improved stock assessments. However since Connecticut has such a small menhaden commercial fishery, sampling it would be difficult. The same size/age component of the menhaden population taken in the commercial fishery is available to LISTS so collections are taken as part of each survey cruise. Menhaden fork length (mm), and sex are recorded and scales are taken about mid-body (lateral line) and below the insertion of the dorsal fin. Most tautog taken in LISTS are aged due to the low numbers caught in recent years (under 250 fish). Tautog are iced and taken to the lab, where their total length (mm), sex, and total weight (gm) are recorded and their age is determined from opercular bones (Cooper 1967). At the request of the ASMFC Tautog Technical Committee, LISTS began collecting tautog otoliths in addition to opercles in 2012. Results from a recent ASMFC Tautog Ageing Workshop (May 2012) indicated there was no clear benefit to switching from opercles to otoliths for CT, so tautog otoliths will be collected (minimum of 50 per/ASMFC) and archived for potential use in the future. Subsamples of winter flounder, stratified by length group and area (as listed in bottom of Table 5.3), are iced and taken to the lab where they are measured to the millimeter (total length), weighed (gm) and sexed. Their maturity stage is determined (NMFS 1989), and they are aged with whole and/or sectioned otoliths (Simpson et al. 1988). Weakfish scales were obtained and processed as described above for scup, and, prior to 2013, otoliths were sectioned and read using procedures described in Simpson et al. 1988. However, since the compliance criteria for a number of other species managed through ASMFC Fishery Management Plans have increased to include ageing over the years, coincidence with stagnant (or declining) levels of funding and staff, age structures for weakfish will no longer be collected because it is not required.

In reports prior to 2001, three species were not included in annual and seasonal totals: American sand lance, bay anchovy, and striped anchovy. These species, with the possible exception of striped anchovy, can be very abundant in Long Island Sound, but are not retained well in the otter trawl. Additionally, many of these fish are young-of-year and often drop out of the net as it is retrieved and wound on the net reel. For this reason they were not included in the list of species to be counted when LISTS was started in 1984. However, to document the occurrence of these species in LISTS catches, American sand lance was added in 1994, striped anchovy was added in 1996, and bay anchovy was added in 1998. Since 2001, adults of these three species have been included in the annual and seasonal totals and the young-of-year are listed if present in the year’s catch but are not quantified (Table 5.15, Appendix 5.4). Young-of-year for these three species are included in the database but are cataloged with a separate species identifier and quantities are considered estimates (Appendix 5.2).

Interactions with endangered species during the course of sampling are regulated by the by NOAA Fisheries GARFO Protectected Species Division. Sampling procedures have been modified in recent years to minimize the likelihood of injury to Atlantic sturgeon (an endangered species since 2012). When sampling in a season and area where the chance of catching a sturgeon is high (based on historic LISTS catch) and water depth is greater than 27m, gear retrieval speed is reduced to decrease the stress induced by rapid changes in pressure. When an endangered species is detected in the net, it is removed as quickly and carefully as possible. Subsequent handling and processing of endangered species adhere to the Reasonable and Prudent Measures, as well as, the Terms and Conditions spelled out in the ESA Section 7 Biological

Opinion's Incidental Take Statement issued by NOAA for CT in January 2013 (http://www.greateratlantic.fisheries.noaa.gov/protected/section7/bo/actbiops/usfws_state_fisheries_surveys_2013.pdf). Additionally, handling and processing of sturgeon follow protocols described in A Protocol for Use of Shortnose, Atlantic, Gulf, and Green Sturgeons (Kahn and Mohead. 2010. U.S. Dep. Commerce, NOAA Tech Memo, NMFS-OPR-45, 62p., http://www.nmfs.noaa.gov/pr/pdfs/species/kahn_mohead_2010.pdf). One Atlantic sturgeon and one Kemp's ridley sea turtle were captured on two of the 200 tows completed in 2015. All interactions with endangered species are detailed in Appendix 5.5.

Data Analysis

Indices of Abundance: Annual Mean Count and Weight per Tow

To evaluate the relative abundance of common species, an annual spring (April - June) and fall (September - October) geometric mean number per tow and weight per tow (biomass, kg) is calculated for the common finfish and invertebrate species. To calculate the geometric mean, the numbers and weight per tow are logged ($\log_e$) to normalize the highly skewed catch frequencies typical of trawl surveys:

$$\text{Transformed variable} = \ln(\text{variable}+1).$$

Means are computed on the log scale and then retransformed to the geometric mean:

$$\text{geometric mean} = \exp(\text{mean})-1.$$

The geometric mean count per tow was calculated from 1984 - 2015 for 38 finfish species, lobster, and long-finned squid (1986 - 2015). The geometric mean weight per tow was calculated using weight data collected since 1992 for the same species, plus an additional 13 invertebrates.

For the seven finfish species that were measured on every tow (bluefish, scup, striped bass, summer flounder, tautog, weakfish, and winter flounder) biomass indices were calculated for the years 1984 - 1991 by using length/weight equations to convert length frequencies to weight per tow. Bluefish, scup, weakfish and winter flounder lengths were converted using equations from Wilk et al. 1978; striped bass conversions were accomplished using an equation from Young et al. 1994; summer flounder and tautog conversions were accomplished using equations developed from LISTS data from 1984 -1987 and 1984 -1996 respectively.

Indices of Abundance: Indices-at-Age and Age Group

Annual age specific indices (indices-at-age matrices) were calculated for scup, striped bass, summer flounder, winter flounder and tautog. The age data used to calculate the indices came from three sources: striped bass ages were derived using the von Bertalanffy (1938) equation; summer flounder age-length keys were obtained from the National Marine Fisheries Service (NMFS) Northeast Fisheries Science Center spring and fall trawl surveys combined with LISTS ages (>59 cm); scup, winter flounder and tautog age-length keys (in 1 cm intervals) were obtained directly from LISTS. Since fish growth can fluctuate annually as a function of population size or other environmental factors, a year and season specific age-length key was used wherever possible. Once lengths have been converted to age, the proportion at age is multiplied by the abundance index of the appropriate season to produce an index of abundance at age.

Recruitment (young-of-year) and age 1+ (all fish age one and older) indices were calculated for bluefish and weakfish. Observed modes in the length frequencies were used to separate the two groups.

The specific methods used to calculate indices-at-age for each species were as follows:

- **Bluefish**. Age samples (otoliths) were taken from 157 bluefish, 18 from the spring period and 136 from the fall period. Of the 18 samples taken in the spring, only three (3) were obtained from LISTS; the bulk of the samples came from recreational anglers. All of the fall samples were obtained from LISTS (136 fish). No samples were obtained through donations from a fishing tournaments in 2015. In 2012 a coast wide biological sampling program was initiated through ASMFC addendum 1 of the bluefish management plan. Since there is only four years of data from the northeast, there are still limited results available at this time. Therefore, the method of using modes observed in the fall length frequencies to separate bluefish into age 0 and age 1+ groups, and calculate a geometric mean catch per tow for each group (Table 5.22) was continued through 2015. Comparison of the mean length-at-ages reported for young-of-year and age 1 bluefish in the New York Bight (Chiarella and Conover 1990) and Long Island Sound (Richards 1976) with LISTS length frequencies suggests that bluefish can easily be identified as either age 0 (snapper bluefish) or adults (age 1+). Richards (1976) and Chiarella and Conover (1990) determined that most bluefish less than 30 cm are age 0. A discontinuity in the LISTS fall length frequencies occurs most years between 26 cm and 39 cm (Table 5.42). Therefore 30 cm was determined to be a suitable length for partitioning age 0 and age one fish. With the addition the biological sampling programs along the coast, a regional northeast key is being compiled through ASMFC..

  Prior to 2012, there was limited bluefish ageing in the northeast. Although North Carolina state biologists have aged bluefish for some time, their age keys were not used to age Long Island Sound bluefish because North Carolina mean lengths-at-age are not consistent with modes observed in Long Island Sound bluefish length frequencies. This difference suggests that growth may vary by region, or that early and late spawned bluefish may be differentially distributed along the coast (Kendall and Walford 1979).

- **Scup**. An index-at-age matrix was developed for 1984-2015 using spring (May-June only) and fall (September-October) LISTS data (Table 5.23). April data was omitted since very few scup are taken at this time. A total of 13,674 scup aged between 1984 and 2015 were used to make year and season specific age-length keys (1 cm intervals). In the relatively few instances when the season/year specific key failed at a given 1 cm length interval, a three-year pooled key was used to determine the age. Three-year pooled keys were calculated using the years preceding and following the “run” year. For the terminal year, only two years were used for the pooled key. The final index-at-age was computed for both spring and fall indices-at-age. Since very few scup older than age 9 are taken (less than 4% in any given year), an age 10+ group is calculated by summing indices for ages 10 and up. To represent the full adult portion of the population an age 2+ index is calculated by summing the indices for ages 2 through 10+.

- **Striped bass**. To approximate the ages of striped bass taken in the spring survey (Table 5.24), the average of the Chesapeake Bay and Hudson River striped bass von Bertalanffy parameters (L_{max} = 49.9 in, K = 0.13, t_o = 0.16, Vic Crecco, pers. comm.) were used in the rearranged von Bertalanffy equation:

$$t = (1/K) * (-\log_e ((L_{max} - L_t) / L_{max})) + t_o$$

Since this equation estimates age t as a fraction of a year, the estimates were rounded to the nearest year (e.g. age 3 = ages 2.5 to 3.4). A spring catch-at-age matrix was developed for 1984 through 2014 by apportioning the spring index by the percentage of fish at each age (Table 5.25).

- **Summer flounder**. The year and season specific age-length keys (1 cm intervals) used to age LISTS catches were provided by NMFS from their spring and fall trawl surveys. These keys were supplemented with fish caught and aged by LISTS (typically 60 cm and over). LISTS also provides the age data from these fish (< 60cm) to NMFS. In 2015, LISTS staff decided to collect representative scale samples from smaller fluke, as well, in the effort to create an LIS-specific age-key eventually. Until there are sufficient age samples to create the LIS-specific age-key, an age-key will be constructed using both LISTS and NMFS age data. In 2015; 151 summer flounder, were aged; 27 from the spring (5 > 60cm) and 124 from the fall (one > 60cm). Since 2001, whenever the season/year specific key failed at a given 1 cm length interval a pooled year key using only adjacent years was used (Gottschall and Pacileo 2002). Since it is thought that growth rates for summer flounder have changed over time, a pooled key using only adjacent years would more accurately represent fish that could not be aged by the season/year specific key. Using this methodology, the catch-at-age matrix (Table 5.26) will remain unchanged for all but the terminal year, which will be updated as the following years' data becomes available.

- **Tautog**. An index-at-age matrix was developed for 1984-2015 using all survey months (Gottschall and Pacileo 2007) (Table 5.27). During 2015, 304 tautog were captured and opercles were collected from all; 276 collected in the spring and 23 were collected in the fall. Ageing for 2006-2012 has been completed. Preliminary ageing for 2013-2015 samples has been done.

- **Weakfish**. Age 0 and age 1+ indices were calculated for both spring (1984 – 2013) and fall surveys (1984 – 2009, 2013) (Table 5.28). Since few weakfish are taken in April, the spring geometric mean was calculated using only May and June. All weakfish taken in spring are assumed to be age 1+. Similar to bluefish, the fall age 0 and 1+ indices were calculated by using length frequencies to separate the catch. Since a break in the fall length frequencies generally occurs between 24 and 32 cm each year (Table 5.57), weakfish less than 30 cm are considered to be age 0 while those greater than or equal to 30 cm are ages 1+. Ageing for weakfish was discontinued in 2013.

- ♦ **Winter flounder**. An index-at-age matrix was developed for 1984-2015 using April and May LISTS data (Table 5.29). June data were not used since length frequency data suggest that many adult winter flounder have left the Sound by this time (an exception was made for 1984, the first year of LISTS, because very few samples were taken in the spring months). A total of 23,697 winter flounder aged between 1984 and 2015 were used to make year and region (east of Stratford Shoal, west of Stratford Shoal) specific age-length keys in 1 cm intervals. Similar to scup and summer flounder, three year pooled keys using only the adjacent years (two years for the terminal year runs) were used to assign ages if year specific keys were not available.

  Each flounder aged as described above was also assessed for maturity stage (following Burnett 1989) by sex. CT DEEP staging of winter flounder was verified in a cooperative study with NMFS in 2009-2010 (Gottschall and Pacileo 2011). The percentage of male and female fish in each centimeter length group that was sexually mature (ripe, resting, or spent) was calculated in order to determine the length group at which 50% was mature each year.

Species Richness by Group

The Long Island Sound Trawl Survey monitors species richness using groups of species classified as either cold temperate or warm temperate. For the purposes of tracking species richness, American sand lance, bay anchovy, and striped anchovy were omitted (see *Sampling Procedures* section). All other finfish species captured in LISTS were divided into groups based on their temperature preferences and seasonal spawning habits as documented in the literature (Collette and Klein-MacPhee 2002, Murdy et al. 1997). Species in the cold temperate group prefer water temperatures below 15^{0}C (60^{0}F), tend to spawn at the lower end of their temperature tolerance range, and are more abundance north of Long Island Sound than south of New York. Species in the warm temperate group prefer warmer temperatures (11-22^{0}C or 50-77^{0}F), tend to spawn in the upper range of their temperature tolerance, and are more abundant south of the Sound than north of Cape Cod (Appendix 5.6). Species that are not tolerant of cold temperatures, are abundant only south of Chesapeake Bay but stray into northern waters mostly as juveniles, and spawn only in the mid-Atlantic Bight and south were placed into a separate group (subtropical) and were not included in the analysis because they are typically only present in the fall LISTS.

Open Water Forage Abundance

A Long Island Sound open water forage index of abundance was compiled to measure the available food base which supports resident and migratory species within the Sound. This index is formulated as a biomass index that is assembled from 11 of the forage species that are most common in LISTS catches along with three other species that are considered forage at an early life stage (young-of-year, YOY). The species used to generate the index are; Atlantic herring, long-finned squid, butterfish, alewife, blueback herring, American shad, hickory shad, menhaden, whiting, spotted hake, and red hake along with young-of-year stage of scup, bluefish, and weakfish. The geometric mean biomass is calculated using the aggregate of these 14 species on a per tow basis and calculated using the same methodology as described above for individual species biomass indices.

RESULTS AND DISCUSSION

Overview of LISTS 2015 Spring and Fall Surveys

Each month of the survey, sampling aboard the R/V John Dempsey generally began in the east end of Long Island Sound and progressed westward. The April survey commenced on April 7, 2015, and continued until April 21 for a total of seven (7) days underway and 40 tows completed. May sampling started on May 11 and continued until May 26 with nine (9) sampling days underway and 40 sites completed. June sampling began on June 10 and ended on June 25, taking ten (10) days underway to complete the 40 sites. The Fall Survey commenced on September 10 and needed ten (10) days underway to complete 40 tows. The 40 sites for October were also completed in ten (10) days. Thus, a total of 200 LISTS tows were completed in 46 days underway during the spring and fall 2015 surveys (Table 5.4); not including transit days or weather days.

Maps showing the sites selected versus the sites sampled during each month of sampling are provided in Figure 5.2 (April), Figure 5.3 (May), Figure 5.4 (June), Figure 5.5 (September) and Figure 5.6 (October). Within each figure the red bordered sites are the sites selected for the month and the solid blue dots indicate the actual sites sampled. If a site had to be relocated during sampling, an explanation of why it was moved is provided under the figure. Additional site/station information is provided in Table 5.5 (April), Table 5.6 (May), Table 5.7 (June), Table 5.8 (September) and Table 5.9 (October). These tables provide date of saple, time, tow duration, latitude/longitude, surface and bottom temperature and salinity, average tow speed, distance towed and approximate area swept for each tow.

Sometimes, a full 30-minute tow cannot be completed. Typical reasons for short tows include lack of room because of observed pot gear set in the immediate area, a drop in speed due to entanglement with some object on the bottom (frequently derelict pot gear), or a complete stop in forward motion (submerged wreck or rock pile). Survey crew will often attempt to finish an interrupted tow by clearing the net (if needed) and resetting beyond the obstruction or observed gear. If this is not possible, a site may have to be moved to another site nearby with the same stratum (bottom type and depth). If the site was moved, the data from the initial site will not be used. Typically, a minimum of 15-20 minutes is required for a LISTS tow to be recorded. However, there are occasions when a tow with less than 15 minutes will be accepted, usually because there is no alternate site in the designated strata in the vicinity. Short tow information for each month in the 2014 survey is summarized in Table 5.10.

Cooperative Sample and Data Collection

Throughout the time series, LISTS staff have been participating in cooperative efforts for sample collections, data requests, and special projects using survey personnel, equipment, and other resources. Most of these cooperative efforts are with state researchers or agencies, the National Marine Fisheries Service, Atlantic States Marine Fisheries Commission, New England and Mid-Atlantic Councils, and researchers or graduate students associated with state or local universities. Table 5.11 illustrates many of the organizations that requested data in 2015, while Table 5.12 shows sample request received and fulfilled. In recent years, many requests for samples have come from high schools, aquariums, or other educational organizations needing finfish and invertebrates for teaching purposes. Additionally, our own staff often have sample or data requests for media or other public outreach events (see Job 11 of this report).

Number of Species Identified

Sixty-six finfish species were observed in the 2015 Long Island Sound Trawl Survey (Table 5.13). This includes three new species for the survey; red cornet fish (*Fistularia petimba*), Atlantic threadfin (*Opisthonema oglinum*) and mahogany snapper (*Lutjanus mahogoni*). From 1984 to 2015, LIS Trawl Survey has identified one hundred nine (109) finfish species (Appendix 5.1), averaging 58 species per year with a range of 43 to 70 species (Figure 5.7). In addition, a total of 43 types of invertebrates were collected in 2015 (Table 5.14). Most invertebrates are identified to species. However, in some cases, invertebrates were identified to genus or a higher level taxon.

Total Catch

Appendix 5.4 presents a time series (1984-2015) of the finfish species collected each year and their respective rank by numbers. Annual total biomass of invertebrates is also included in this appendix (1992-2015), ranked by weight (kg). A total of 163,223 finfish weighing 15,625 kg were sampled in 2015 (Table 5.15). A total of 32,937 finfish weighing 7,002 kg were sampled in spring of 2015 (Table 5.16). A total of 130,289 finfish weighing 8,623 kg were sampled in fall of 2015 (Table 5.16). A total of 1,959 kg of invertebrates were taken in 2015 (Table 5.15). The total biomass of invertebrate catch taken in the spring of 2015 was 503 kg (Table 5.17). A total of 1,456 kg of invertebrates were taken in fall of 2015 (Table 5.17).

Length Frequencies

Length frequency tables are provided primarily to give the reader an understanding of the size range of various species taken in LISTS. Lengths are converted to age frequencies for analysis of principal species such as scup, bluefish, striped bass, summer flounder, tautog, winter flounder, and weakfish. Changes such as an expansion in the size (age) range for some important recreational species are apparent in recent years including more large scup (Table 5.52-5.53), striped bass (Table 5.54-5.55), and summer flounder (Table 5.56-5.57).

Length frequencies were prepared for 22 species:

alewife	spring and fall	1989 - 2015	Table 5.30;
American shad	spring and fall	1989 - 2015	Table 5.31;
American lobster	spring and fall (M&F)	1984 - 2015	Table 5.32-Table 5.35;
Atlantic herring	spring and fall	1989 - 2015	Table 5.36;
Atlantic menhaden	spring and fall	1996 – 2015	Table 5.37;
black sea bass	spring and fall	1987 – 2015	Table 5.38, Table5.39
blueback herring	spring and fall	1989 - 2015	Table 5.40;
bluefish	spring and fall	1984 - 2015	Table 5.41, Table 5.42;
butterfish	spring and fall	1986 - 1990, 1992 - 2015	Table 5.43;
clearnose skate	spring and fall	1993 - 2015	Table 5.44, Table 5.45;
fourspot flounder	spring and fall	1989 - 1990, 1996 - 2015	Table 5.46;

hickory shad	spring and fall	1991 - 2015	Table 5.47;
horseshoe crab	spring and fall (M&F)	1998 - 2015	Table 5.48, Table 5.49;
long-finned squid	spring and fall	1986 - 1990, 1992 - 2015	Table 5.50, Table 5.51;
scup	spring and fall	1984 - 2015	Table 5.52, Table 5.53;
striped bass	spring and fall	1984 - 2015	Table 5.54, Table 5.55;
summer flounder	spring and fall	1984 - 2015	Table 5.56, Table 5.57;
tautog	spring	1984 - 2015	Table 5.58;
weakfish	spring and fall	1984 - 2015	Table 5.59, Table 5.60;
windowpane flounder	spring and fall	1989, 1990, 1994 - 2015	Table 5.61, Table 5.62;
winter flounder	April-May and fall	1984 - 2015	Table 5.63, Table 5.64;
winter skate	spring and fall	1995 - 2015	Table 5.65.

For the years where length data are available, length frequencies were prepared for the seasons or months for which the preferred indices of abundance and catch-at-age matrices are calculated; for some species length frequencies are provided for both seasons.

Seasonal Indices of Abundance

The geometric mean count per tow was calculated from 1984-2015 for 38 finfish species plus lobster and long-finned squid (squid since 1986). All spring (April-June) and fall (September-October) data are used to compute the abundance indices presented in Tables 5.18 (spring) and 5.19 (fall), with the preferred seasonal index (for counts) denoted by an asterisk. Geometric mean biomass-per-tow indices have been calculated for 38 finfish and 15 invertebrate species (or species groups) since 1992, for both spring and fall (Table 5.20 and 5.21, respectively). Age specific indices of abundance were calculated for selected important recreational species, including scup, striped bass, summer flounder, and winter flounder (see below). For two other species, bluefish and weakfish recruitment indices were calculated using modal analysis of the length frequencies. For each of the thirty-eight finfish species, plots including catch per tow in numbers and biomass in kilograms are illustrated in Figures 2.8 through 5.13. These figures also include plots of each of the age specific indices and recruitment indices mentioned above. Figure 5.14 provides plots of abundance (biomass) indices for crabs (lady, rock, spider; 1992-2015), American lobster (1984-2015), horseshoe crab (1992-2015), and long-finned squid (1986-2015).

Indices of Abundance: Important Recreational Species

Spring and fall abundance indices are presented in Tables 5.18-5.19. Indices of abundance at age were also calculated for seven important recreational species: bluefish (Table 5.22), scup (Table 5.23), striped bass (Table 5.24 age frequency, Table 5.25 indices at age), summer flounder (Table 5.26), tautog (Table 5.27), weakfish (Table 5.28) and winter flounder (Table 5.29). Bluefish and striped bass indices-at-age are based on the fall and spring surveys, respectively, whereas winter flounder indices-at-age are based on only the April and May cruises of the spring survey. In 2015, LISTS collected otoliths from 429 winter flounder, 425 of which were used in the development of age keys and the final catch-at-age matrix. Both scup and weakfish indices-at-age are calculated and presented separately for each season. Scales from 771 scup were collected and aged in 2014, 764 of which were used in the keys and calculations of the age matrix. Weakfish and bluefish use modal distributions for calculating their respective recruitment index. Although age structures for bluefish are now being collected, it may take a few years before there is enough age data to construct a robust age key (see methods).

Winter Flounder Habitat Use

The distribution and demographics of LISTS winter flounder catches were examined for changes related to habitat quality in 2003-2013 compared to 1992-2002 (see Howell et al. 2016). Analysis of variance of individual condition indices (log-log length-weight regression residuals) by sex for post-spawn (resting) mature and immature fish identified consistent and significant differences among six survey strata. Highest condition indices were found in fish captured in shallow (<18 m) mud, sand, and transitional bottom sediment and deep (>18 m) mud areas, collectively classified as high quality habitat. Geospatial analyses of catch distribution showed the proportion of the population occupying high quality habitat remained unchanged at 59% over the time series 1992-2013 even as abundance declined by over 80%. As abundance decreased, condition decreased in mature females, increased in immature fish of both sexes, and was mixed in mature males. Additionally, the proportion mature at length shifted significantly upward for both sexes, back-calculated length-at-age 2 and 3 of mature flounder increased, and estimated winter growth declined for age 3 mature and immature females. The details of these analyses suggest increased competition for prey among mature fish and increased predation pressure on smaller fish. This population may be responding to an increase in the abundance of competing mid-Atlantic species brought about by increasing water temperature coastwide and in LIS. These second order effects may have chronically hindered reproduction and therefore stock rebuilding, especially in areas of low quality habitat.

Winter Flounder Average Size at Maturity

Average size at maturity for winter flounder captured in April and May cruises has increased since maturation data recording began in 1990. The number mature by cm-interval and sex was calculated for the subset of fish examined in the laboratory each year, and a five-year average computed to maximize sample size. The resulting maturation curves (Figure 5.18) skew right for both sexes from 1990-94 to 2010-2013. The 50%-midpoint for females has increased from 24-26cm in the 1990s to 27cm after 2000. The 50%-midpoint for males has increased from 16-19cm in the 1990s to 20-22cm after 2000. These results indicate not only a larger average size at maturation but also a greater synchronization of the maturation process over a smaller size range.

Species Richness by Group

The number of cold temperate and warm temperate species captured in each tow was averaged by seasonal cruise (April-June and September-October) for each year from 1984-2015 as an indicator of annual biological diversity or species richness. Trends in these indicators were tested for statistical significance by regression analysis. Results (Figure 5.19) show that the average number of warm temperate species captured/tow in spring and fall cruises has increased ($F=26.2$ and 82.8 respectively, $p<0.0001$); while the average number of cold temperate species has decreased, especially in spring ($F=43.9$, $p<0.0001$) but also in fall cruises ($F=14.9$, $p=0.0006$).

MODIFICATIONS

No modifications.

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TABLES 5.1 - 5.29
LISTS

Table 5.1. Specifications for the Wilcox 14 m high-rise trawl net and associated gear.

Component	Description
Headrope	9.1 m long, 13 mm combination wire rope
Footrope	14.0 m long, 13 mm combination wire rope
Sweep	Combination type, 9.5 mm chain in belly, 7.9 mm chain in wing
Floats	7 floats, plastic, 203 mm diameter
Wings	102 mm mesh, #21 twisted nylon
Belly	102 mm mesh, #21 twisted nylon
Tail Piece	76 mm mesh, #21 twisted nylon
Codend	51 mm mesh, #54 braided nylon
Ground Wires	18.2 m long, 6x7 wire, 9.5 mm diameter
Bridle Wires:	top legs 27.4 m long, 6x7 wire, 6.4 mm diameter
Bottom Legs	27.4 m long, 6x7 wire, 11.1 mm, rubber disc type, 40 mm diameter
Doors	Steel "V" type, 1.2 m long x 0.8 m high, 91 kg
Tow Warp	6x7 wire, 9.5 mm diameter

Table 5.2. The number of sites scheduled for sampling each month within the 12 depth-bottom type strata.

	Depth Interval (m)				
Bottom type	**0 - 9.0**	**9.1 - 18.2**	**18.3 - 27.3**	**27.4+**	**Totals**
Mud	2	3	5	5	15
Sand	2	2	2	2	8
Transitional	3	5	5	4	17
Totals	**7**	**10**	**12**	**11**	**40**

Table 5.3. Length and age data collected in 2015.

In addition to the species listed below, other rarely occurring species (totaling less than 30 fish/year each) were measured. During 2014, thirty-one other species were measured during LISTS sampling as either rarely occurring species or for other research related projects

Species measured	Measurement	# tows/day	# fish measured
Alewife	FL (cm)	All	min of 15 / tow
American lobster	CL (0.1 mm)	All	min of 50 / tow
American shad	FL (cm)	All	min of 15 / tow
Atlantic herring	FL (cm)	All	min of 15 YOY and min of 30 adults / tow
Atlantic menhaden	FL (cm)	All	min of 15 / tow
Atlantic sturgeon	FL (cm)	All	All
Blueback herring	FL (cm)	All	min of 15 / tow
Bluefish	FL (cm)	All	min of 30 YOY / tow, all adults
black sea bass	TL (cm)	All	All
butterfish	FL cm)	All	min of 15 YOY and 15 adults / tow
cunner	TL (cm)	All	All
dogfish, smooth	FL (cm)	All	All
dogfish, spiny	FL (cm)	All	All
fourspot flounder	TL (cm)	All	min of 30/tow
hake, red	TL (cm)	All	min of 30/tow
hake, silver (whiting)	TL (cm)	All	min of 30/tow
hake, spotted	TL (cm)	All	min of 30/tow
hickory shad	FL (cm)	All	All
horseshoe crab	PW (cm)	All	All
northern searobin	FL (cm)	All	min of 30/tow
moonfish	FL (cm)	All	min of 10/tow
smallmouth flounder	TL (cm)	All	min of 10/tow
striped bass	FL (cm)	All	All
striped searobin	FL (cm)	All	min of 30/tow
scup	FL (cm)	All	min of 15 YOY and 30 / mode for age 1+
long-finned squid	ML (cm)	All	min of 30 / tow
summer flounder	FL (cm)	All	All
tautog	TL (cm)	All	All
weakfish	FL (cm)	All	min of 15 YOY / tow, all adults
whelk , channeled	PW (mm)	All	All
whelk , knobbed	PW (mm)	All	All
windowpane flounder	TL (cm)	All	min of 50 / tow
winter flounder	TL (cm)	All	min of 100 / tow
winter skate	TL (cm)	All	All

Species aged	Structure	Subsample
bluefish	scales / otoliths	Collected each season. For each season, minimum of 50 scale and otolith samples collected from full length distribution. Spring collection may use other means of sampling to obtain the required minimum.
Menhaden	scales	Collected each season. For each season, minimum of 50 scale samples collected from full length distribution.
scup	scales	Collected every month. For each month scales are taken from the following: 3 fish/cm <20 cm; 5/cm from 20-29 cm; and all fish > 30 cm.
summer flounder	scales	all fish > = 60 cm
tautog	opercular bones	Collected from a minimum of 200 fish/year.
weakfish	scales / otoliths	Ageing/collections discontinued in October 2014
winter flounder	otoliths	Collected during April and May from two areas in the Sound: eastern-central and western. For each month and area, subsamples are taken as follows: in the eastern-central area 7 fish / cm < 30 cm, 14 / cm from 30-36 cm, all fish > 36 cm. In the western area 5 fish / cm < 30 cm, 10/cm from 30-36 cm, all fish > than 36 cm.

Notes: min = minimum; YOY = young-of-year; FL = fork length; TL = total length; CL = carapace length; ML = mantle length; PW = prosomal width.

Table 5.4. Number of Long Island Sound Trawl Survey (LISTS) samples taken by year and cruise.

In 1984, thirty-five sites per monthly cruise from April through November were scheduled for sampling. Starting in 1985, forty sites per cruise were scheduled. In 1991, the Trawl Survey was modified to a spring (April - June) and fall (September - October) format--July, August and November sampling was suspended. In 1993 and 1994, an additional cruise of 40 sites was added to the fall period. The additional fall cruise was suspended in 1995. One hundred twenty tows were conducted in 2006 due to delays in rebuilding the main engine on the R/V John Dempsey (spring) and mechanical failure/overhaul of the hydraulic power take-off (fall). Delays in overhauling the transmission in the fall of 2008 resulted in missing September sampling. The June cruise and all of fall sampling in 2010 were canceled for an engine replacement in the R/V John Dempsey. Due to delays in engine replacement, begun in 2010 but not completed until late April 2011, April sampling in 2011 was abbreviated.

																	Year															
Cruise	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
April	-	-	35	40	40	40	40	40	-	40	40	40	40	40	40	40	40	40	40	40	40	40	-	40	40	40	40	12	40	40	40	40
May	13	41	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	38	40	40	40	40	40
June	19	5	41	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	39	40	40	40	40	40	-	40	40	40	40	40
July	35	40	40	40	40	40	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
August	34	40	40	40	40	40	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
September	35	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	-	40	-	40	40	40	40	40
Sept/Oct	-	-	-	-	-	-	-	-	-	40	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
October	35	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	-	40	40	-	40	40	40	-	40	40	40	39	40
November	29	40	40	40	40	40	40	-	-	-	-	-	-	-	-	-	-	-	-	40	-	-	-	-	-	-	-	-	-	-	-	-
Total	**200**	**246**	**316**	**320**	**320**	**320**	**297**	**200**	**160**	**240**	**240**	**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**	**199**	**200**	**120**	**200**	**160**	**200**	**78**	**172**	**200**	**200**	**199**	**200**

Table 5.5. Station information for LISTS April 2015.

Standard LISTS tows in the spring begin with SP and fall begins with FA. Latitude (N) and Longitude (W) are displayed in decimal degrees. Surface and bottom temperature and salinity are labeled as S_ and B_, respectively. Area swept is estimated by assuming the effective sweep is 2/3rds of the footrope length.

Sample Number	Date	Site Number	Bottom Type	Depth Interval	Time Start	Duration (min)	Latitude	Longitude	S_Temp (sfc, C)	S_Salinity (sfc, ppt)	B_Temp (btm, C)	B_Salinity (btm, ppt)	Ave Speed (knots)	Distance (nm)	Area Swept (sq.nm)
SP2015001	4/7/2015	730	S	4	8:31	26	41.1313	-72.4648	2.7	27.3	2.7	27.8	3.2	1.3985	0.0071
SP2015002	4/7/2015	628	S	3	9:31	30	41.1155	-72.5615	2.9	26.8	2.7	27.7	3.6	1.8027	0.0091
SP2015003	4/7/2015	527	T	3	10:21	30	41.1015	-72.6123	3.1	26.7	2.7	27.3	3.8	1.8850	0.0095
SP2015004	4/7/2015	224	M	4	11:48	30	41.0410	-72.7971	3.0	27.0	2.4	27.7	2.5	1.2601	0.0064
SP2015005	4/7/2015	828	S	3	13:39	24	41.1386	-72.6123	2.9	27.6	2.7	27.7	2.7	1.0815	0.0055
SP2015006	4/7/2015	1027	T	4	14:43	30	41.1798	-72.6425	3.7	27.0	3.0	27.7	2.8	1.4009	0.0071
SP2015007	4/7/2015	1028	T	4	15:48	30	41.1648	-72.6305	3.4	27.0	2.7	27.6	3.7	1.8743	0.0095
SP2015008	4/13/2015	1333	S	1	7:06	30	41.2365	-72.3473	4.4	25.6	3.8	28.3	2.3	1.1488	0.0058
SP2015009	4/13/2015	1837	T	1	8:50	30	41.2957	-72.1978	4.5	28.7	4.4	29.0	3.3	1.6750	0.0085
SP2015010	4/13/2015	1737	T	1	9:53	25	41.3140	-72.1818	5.9	27.6	5.3	28.7	3.1	1.2936	0.0065
SP2015011	4/13/2015	931	S	4	12:28	30	41.1591	-72.4474	4.2	27.5	3.5	28.1	2.7	1.3697	0.0069
SP2015012	4/13/2015	229	T	2	14:03	30	41.0427	-72.5690	4.7	27.3	4.1	27.3	3.3	1.6632	0.0084
SP2015013	4/13/2015	28	T	2	15:07	30	41.0180	-72.5854	4.6	27.1	4.3	27.2	3.4	1.6978	0.0086
SP2015014	4/13/2015	5825	S	1	16:30	30	41.0008	-72.7130	4.6	27.1	4.5	27.1	3.2	1.5785	0.0080
SP2015015	4/14/2015	619	M	3	8:13	30	41.1027	-73.0185	4.5	24.3	3.4	27.4	3.1	1.5461	0.0078
SP2015016	4/14/2015	322	M	4	9:41	30	41.0528	-72.8865	5.4	26.5	2.7	27.8	3.0	1.4824	0.0075
SP2015017	4/14/2015	5923	M	3	11:52	30	40.9963	-72.7350	5.4	26.5	4.0	27.0	2.7	1.3344	0.0067
SP2015018	4/14/2015	5919	M	3	13:54	30	40.9981	-72.9888	4.6	26.5	3.4	26.9	3.1	1.5435	0.0078
SP2015019	4/14/2015	417	T	3	15:21	30	41.0736	-73.0778	4.7	25.8	2.9	27.2	2.9	1.4353	0.0073
SP2015020	4/15/2015	918	T	2	7:44	30	41.1658	-73.0101	5.8	27.0	4.4	27.3	3.3	1.6334	0.0083
SP2015021	4/15/2015	614	M	2	9:13	30	41.1138	-73.1794	3.9	25.9	3.0	26.7	3.0	1.4752	0.0075
SP2015022	4/15/2015	511	M	2	10:18	30	41.1012	-73.2610	4.8	25.2	2.8	26.8	3.0	1.4902	0.0075
SP2015023	4/15/2015	7	M	3	12:21	30	41.0160	-73.4550	4.7	26.3	3.4	26.6	2.7	1.3586	0.0069
SP2015024	4/15/2015	10	T	4	13:48	30	41.0010	-73.3712	5.0	26.2	3.0	26.9	3.0	1.5158	0.0077
SP2015025	4/15/2015	312	M	3	14:56	30	41.0532	-73.2927	6.6	24.9	3.5	26.6	2.8	1.4192	0.0072
SP2015026	4/15/2015	513	M	2	15:58	30	41.0878	-73.2565	5.7	25.1	3.1	26.7	2.9	1.4617	0.0074
SP2015027	4/16/2015	517	T	3	8:06	30	41.1043	-73.0305	5.0	26.6	3.1	27.3	3.6	1.8147	0.0092
SP2015028	4/16/2015	14	M	4	9:33	30	41.0190	-73.1708	4.8	26.2	2.7	27.4	3.1	1.5486	0.0078
SP2015029	4/16/2015	5513	S	2	10:54	30	40.9251	-73.2503	6.4	25.9	4.8	26.4	3.3	1.6331	0.0083
SP2015030	4/16/2015	17	M	4	12:41	30	41.0071	-73.0742	4.6	26.3	2.8	27.5	3.4	1.7101	0.0086
SP2015031	4/16/2015	118	M	4	14:17	24	41.0280	-73.0156	6.0	26.2	4.4	26.9	2.9	1.1565	0.0058
SP2015032	4/17/2015	824	T	4	8:55	30	41.1285	-72.8060	5.8	27.0	3.3	27.5	2.3	1.1596	0.0059
SP2015033	4/17/2015	924	T	3	9:51	30	41.1361	-72.7668	5.6	27.0	3.4	27.4	3.0	1.4951	0.0076
SP2015034	4/17/2015	923	T	3	10:50	30	41.1565	-72.7853	4.7	27.0	3.9	27.3	2.9	1.4466	0.0073
SP2015035	4/17/2015	1020	T	2	12:07	30	41.1801	-72.9146	5.7	27.0	4.9	27.2	2.5	1.2366	0.0062
SP2015036	4/17/2015	1320	M	1	13:21	30	41.2348	-72.9568	7.5	26.4	6.4	26.9	2.9	1.4365	0.0073
SP2015037	4/21/2015	1425	M	1	9:34	30	41.2378	-72.7305	6.5	25.7	6.3	26.1	3.3	1.6409	0.0083
SP2015038	4/21/2015	1327	T	2	10:47	30	41.2271	-72.6671	6.1	25.3	5.2	26.1	2.1	1.0577	0.0053
SP2015039	4/21/2015	1427	T	1	11:40	30	41.2397	-72.6468	6.0	24.8	5.3	25.7	2.7	1.3578	0.0069
SP2015040	4/21/2015	1432	S	2	13:19	30	41.2288	-72.4465	5.3	26.8	5.2	27.5	3.2	1.6201	0.0082

Table 5.6. Station information for LISTS May 2015.

Standard LISTS tows in the spring begin with SP and fall begins with FA. Latitude (N) and Longitude (W) are displayed in decimal degrees. Surface and bottom temperature and salinity are labeled as S_ and B_, respectively. Area swept is estimated by assuming the effective sweep is 2/3rds of the footrope length.

Sample Number	Date	Site Number	Bottom Type	Depth Interval	Time Start	Duration (min)	Latitude	Longitude	S_Temp (sfc, C)	S_Salinity (sfc, ppt)	B_Temp (btm, C)	B_Salinity (btm, ppt)	Ave Speed (knots)	Distance (nm)	Area Swept (sq.nm)
SP2015041	5/11/2015	1436	T	4	7:26	30	41.2333	-72.2870	8.7	27.7	7.8	29.3	4.0	2.0039	0.0101
SP2015042	5/11/2015	1437	T	4	8:39	30	41.2447	-72.2122	9.1	27.5	7.6	29.6	1.8	0.9167	0.0046
SP2015043	5/11/2015	1336	T	4	10:13	30	41.2223	-72.2455	9.2	27.3	7.6	29.4	1.8	0.8865	0.0045
SP2015044	5/11/2015	931	S	4	12:13	30	41.1591	-72.4451	9.1	27.2	8.1	27.9	3.0	1.4828	0.0075
SP2015045	5/11/2015	729	S	3	13:49	30	41.1188	-72.5323	10.3	27.0	9.2	27.5	3.3	1.6616	0.0084
SP2015046	5/11/2015	628	S	3	15:06	30	41.1136	-72.5698	10.8	27.1	8.8	27.5	2.2	1.1234	0.0057
SP2015047	5/12/2015	830	S	4	8:36	30	41.1482	-72.4860	10.2	27.2	8.3	28.3	1.9	0.9647	0.0049
SP2015048	5/12/2015	227	T	3	10:36	30	41.0468	-72.6018	12.4	26.4	9.3	27.2	2.6	1.2812	0.0065
SP2015049	5/12/2015	5823	S	1	12:41	30	40.9810	-72.8228	11.8	26.3	11.6	26.4	3.3	1.6378	0.0083
SP2015050	5/12/2015	5825	S	1	13:53	30	40.9752	-72.7710	12.8	26.4	11.7	26.4	3.1	1.5529	0.0078
SP2015051	5/12/2015	229	T	2	15:33	30	41.0345	-72.6101	13.8	26.3	9.7	26.6	2.3	1.1541	0.0058
SP2015052	5/14/2015	827	T	3	9:35	30	41.1405	-72.6190	9.5	27.4	9.1	27.6	2.5	1.2331	0.0062
SP2015053	5/14/2015	5925	T	1	11:24	30	41.0030	-72.7067	13.1	26.4	12.0	26.4	2.8	1.3751	0.0069
SP2015054	5/14/2015	426	T	3	12:54	30	41.0680	-72.6988	12.5	26.5	9.3	26.8	3.5	1.7542	0.0089
SP2015055	5/15/2015	1432	S	2	7:26	30	41.2343	-72.4020	9.4	27.3	9.2	28.4	3.4	1.6896	0.0085
SP2015056	5/15/2015	1025	T	3	9:24	30	41.1778	-72.7015	10.1	27.2	9.5	27.4	3.2	1.5853	0.0080
SP2015057	5/15/2015	422	M	4	11:01	30	41.0803	-72.8453	12.2	26.6	8.2	26.7	2.6	1.3107	0.0066
SP2015058	5/18/2015	5713	T	2	9:23	30	40.9658	-73.1996	11.5	26.2	8.7	26.6	3.6	1.7939	0.0091
SP2015059	5/18/2015	5613	T	2	10:57	30	40.9478	-73.1875	14.3	25.9	9.0	26.4	3.2	1.6175	0.0082
SP2015060	5/18/2015	5813	M	3	12:24	30	40.9675	-73.2729	11.7	26.2	9.2	26.3	2.7	1.3410	0.0068
SP2015061	5/19/2015	1118	M	1	7:59	30	41.1790	-73.0588	12.7	26.6	12.5	26.5	2.7	1.3666	0.0069
SP2015062	5/19/2015	719	M	3	9:45	30	41.1248	-72.9746	12.0	26.4	8.5	26.7	3.8	1.8769	0.0095
SP2015063	5/19/2015	620	M	3	11:03	23	41.1046	-72.9755	16.4	27.2	8.2	26.7	2.5	0.9522	0.0048
SP2015064	5/19/2015	118	M	4	12:29	30	41.0323	-72.9940	12.3	26.3	7.6	26.7	3.1	1.5531	0.0078
SP2015065	5/19/2015	15	T	4	13:59	30	41.0085	-73.1223	11.7	26.3	7.8	26.7	2.6	1.2842	0.0065
SP2015066	5/19/2015	12	M	4	16:03	30	41.0192	-73.2220	12.6	26.1	8.1	26.6	2.6	1.2870	0.0065
SP2015067	5/20/2015	715	T	1	8:15	30	41.1281	-73.1255	12.4	25.8	12.3	25.8	3.5	1.7407	0.0088
SP2015068	5/20/2015	212	M	3	9:43	30	41.0448	-73.2400	12.8	26.2	8.8	26.6	3.3	1.6554	0.0084
SP2015069	5/20/2015	311	T	2	11:01	30	41.0452	-73.3568	11.8	26.2	10.8	26.3	2.4	1.1968	0.0060
SP2015070	5/20/2015	412	M	2	13:34	30	41.0633	-73.3260	12.1	26.2	9.7	26.4	3.0	1.4974	0.0076
SP2015071	5/20/2015	514	M	2	15:00	30	41.0850	-73.2166	12.3	26.0	9.3	26.6	3.4	1.6780	0.0085
SP2015072	5/21/2015	14	M	4	9:05	30	41.0216	-73.1636	11.6	26.3	8.3	26.6	3.0	1.5233	0.0077
SP2015073	5/21/2015	5709	S	2	11:08	27	40.9456	-73.4080	13.6	25.9	11.7	26.1	3.1	1.4157	0.0072
SP2015074	5/21/2015	110	T	3	14:26	30	41.0213	-73.3716	12.2	26.2	9.4	26.3	3.1	1.5731	0.0079
SP2015075	5/21/2015	11	M	4	15:45	30	41.0023	-73.3700	12.2	26.2	8.4	26.6	3.2	1.5872	0.0080
SP2015076	5/26/2015	917	T	2	8:14	30	41.1535	-73.0804	11.7	26.4	.	.	3.4	1.7084	0.0086
SP2015077	5/26/2015	1319	M	1	9:29	30	41.2085	-72.9898	12.9	26.6	.	.	3.4	1.6831	0.0085
SP2015078	5/26/2015	1220	T	1	10:42	30	41.2088	-72.9550	13.7	26.6	.	.	3.2	1.6185	0.0082
SP2015079	5/26/2015	922	M	3	12:21	30	41.1191	-72.8325	13.2	26.6	.	.	3.1	1.5677	0.0079
SP2015080	5/26/2015	1123	M	2	14:00	30	41.1805	-72.8498	13.3	26.8	.	.	3.0	1.4963	0.0076

Table 5.7. Station information for LISTS June 2015.

Standard LISTS tows in the spring begin with SP and fall begins with FA. Latitude (N) and Longitude (W) are displayed in decimal degrees. Surface and bottom temperature and salinity are labeled as S_ and B_, respectively. Area swept is estimated by assuming the effective sweep is 2/3rds of the footrope length.

Sample Number	Date	Site Number	Bottom Type	Depth Interval	Time Start	Duration (min)	Latitude	Longitude	S_Temp (sfc, C)	S_Salinity (sfc, ppt)	B_Temp (btm, C)	B_Salinity (btm, ppt)	Ave Speed (knots)	Distance (nm)	Area Swept (sq.nm)
SP2015081	6/10/2015	1534	T	1	7:35	30	41.2586	-72.3523	13.0	27.6	13.0	28.3	3.6	1.8188	0.0092
SP2015082	6/10/2015	1737	T	1	11:02	30	41.2898	-72.1945	13.5	29.2	13.0	29.4	3.1	1.5285	0.0077
SP2015083	6/10/2015	1436	T	4	12:34	30	41.2468	-72.2256	14.5	25.8	12.5	29.6	3.4	1.7154	0.0087
SP2015084	6/11/2015	931	S	4	8:03	30	41.1615	-72.4395	14.0	27.9	12.9	28.8	2.1	1.0346	0.0052
SP2015085	6/11/2015	330	S	1	9:54	30	41.0637	-72.4946	15.2	27.1	15.3	27.1	2.1	1.0323	0.0052
SP2015086	6/11/2015	129	S	2	12:17	30	41.0205	-72.6155	16.1	26.7	14.5	26.7	0.4	0.2137	0.0011
SP2015087	6/11/2015	729	S	3	14:30	30	41.1100	-72.5891	17.5	27.0	14.3	27.7	.	.	.
SP2015088	6/12/2015	531	T	3	8:32	30	41.0918	-72.4727	14.9	27.5	15.0	27.5	2.5	1.2320	0.0062
SP2015089	6/12/2015	325	T	3	11:15	30	41.0562	-72.7563	19.0	26.8	12.7	27.3	3.5	1.7494	0.0088
SP2015090	6/12/2015	427	T	3	12:49	30	41.0771	-72.6563	18.7	26.8	13.8	27.0	2.8	1.3885	0.0070
SP2015091	6/12/2015	627	S	3	14:53	30	41.1010	-72.6816	19.7	26.9	13.6	27.3	2.6	1.3169	0.0067
SP2015092	6/15/2015	830	S	4	7:54	30	41.1500	-72.4919	15.6	27.6	14.4	28.2	4.0	1.9947	0.0101
SP2015093	6/15/2015	5823	S	1	11:35	30	40.9810	-72.8203	17.3	26.4	15.7	26.6	3.5	1.7350	0.0088
SP2015094	6/16/2015	926	T	4	8:20	30	41.1633	-72.6301	16.8	26.8	14.9	27.8	3.8	1.8887	0.0095
SP2015095	6/16/2015	725	T	4	10:44	30	41.1252	-72.7110	16.4	26.7	14.4	27.5	3.1	1.5663	0.0079
SP2015096	6/16/2015	423	M	4	12:27	30	41.0841	-72.7809	17.4	26.5	12.9	27.3	3.0	1.4818	0.0075
SP2015097	6/16/2015	5920	M	2	14:01	30	40.9960	-72.8966	17.0	26.5	13.0	27.4	2.7	1.3583	0.0069
SP2015098	6/17/2015	817	M	2	8:00	30	41.1292	-73.0938	17.8	26.6	15.5	27.7	2.6	1.2825	0.0065
SP2015099	6/17/2015	620	M	3	9:28	30	41.1058	-72.9753	16.9	26.7	13.4	28.2	2.5	1.2318	0.0062
SP2015100	6/17/2015	422	M	4	11:04	30	41.0700	-72.9001	17.4	27.1	13.1	28.2	2.6	1.2981	0.0066
SP2015101	6/17/2015	219	M	4	12:58	30	41.0525	-72.9276	17.4	27.1	13.1	28.2	2.8	1.4099	0.0071
SP2015102	6/17/2015	5914	M	4	14:51	30	41.0055	-73.1472	16.3	27.1	12.6	28.1	2.5	1.2397	0.0063
SP2015103	6/18/2015	617	T	2	8:07	30	41.1158	-73.0428	17.8	27.5	13.5	28.1	3.5	1.7419	0.0088
SP2015104	6/18/2015	313	M	3	10:13	30	41.0602	-73.2151	17.6	27.2	13.7	27.8	3.6	1.8167	0.0092
SP2015105	6/18/2015	210	T	2	11:43	30	41.0490	-73.3213	17.6	26.8	13.1	27.7	3.5	1.7670	0.0089
SP2015106	6/18/2015	5804	M	2	13:46	18	40.9820	-73.5616	18.4	26.8	13.9	27.3	3.2	0.9549	0.0048
SP2015107	6/18/2015	5911	M	3	17:03	30	40.9898	-73.3322	17.0	27.1	13.0	27.9	3.1	1.5284	0.0077
SP2015108	6/22/2015	315	M	3	8:36	30	41.0631	-73.1270	18.7	26.3	14.6	27.2	3.0	1.5131	0.0076
SP2015109	6/22/2015	110	T	3	10:19	29	41.0308	-73.3213	18.7	26.2	15.3	26.8	3.1	1.4773	0.0075
SP2015110	6/22/2015	10	T	4	12:04	30	41.0006	-73.3733	19.5	26.2	14.1	27.1	2.8	1.3814	0.0070
SP2015111	6/22/2015	5612	T	2	13:44	25	40.9453	-73.3010	20.8	26.1	16.8	26.5	3.0	1.2308	0.0062
SP2015112	6/24/2015	5513	S	2	9:41	30	40.9257	-73.2505	19.7	26.3	18.9	26.3	3.3	1.6686	0.0084
SP2015113	6/24/2015	5714	T	3	11:11	30	40.9542	-73.2233	20.7	26.2	15.5	26.7	3.3	1.6294	0.0082
SP2015114	6/24/2015	14	M	4	12:37	30	41.0062	-73.2333	20.5	26.4	14.0	27.3	3.0	1.4786	0.0075
SP2015115	6/24/2015	920	T	2	15:19	30	41.1535	-72.9851	20.3	26.9	15.4	27.4	2.9	1.4714	0.0074
SP2015116	6/25/2015	1118	M	1	7:44	30	41.1803	-73.0560	18.9	27.0	16.5	27.1	3.5	1.7568	0.0089
SP2015117	6/25/2015	922	M	3	10:37	30	41.1207	-72.8176	20.2	26.8	15.5	27.4	2.9	1.4735	0.0074
SP2015118	6/25/2015	1425	M	1	12:18	30	41.2376	-72.7280	18.1	27.3	17.3	27.4	3.3	1.6383	0.0083
SP2015119	6/25/2015	1427	T	1	13:39	23	41.2373	-72.6530	17.4	27.3	16.5	27.5	2.8	1.0746	0.0054
SP2015120	6/25/2015	1429	T	2	14:52	30	41.2255	-72.6265	18.6	27.4	16.1	27.9	2.8	1.3758	0.0070

Table 5.8. Station information for LISTS September 2015.

Standard LISTS tows in the spring begin with SP and fall begins with FA. Latitude (N) and Longitude (W) are displayed in decimal degrees. Surface and bottom temperature and salinity are labeled as S_ and B_, respectively. Area swept is estimated by assuming the effective sweep is 2/3rds of the footrope length.

Sample Number	Date	Site Number	Bottom Type	Depth Interval	Time Start	Duration (min)	Latitude	Longitude	S_Temp (sfc, C)	S_Salinity (sfc, ppt)	B_Temp (btm, C)	B_Salinity (btm, ppt)	Ave Speed (knots)	Distance (nm)	Area Swept (sq.nm)
FA2015001	9/10/2015	1533	S	1	7:30	30	41.2560	-72.3815	23.3	27.5	23.1	28.9	2.6	1.3099	0.0066
FA2015002	9/10/2015	1737	T	1	9:27	30	41.2903	-72.1980	23.0	30.1	22.8	30.2	3.4	1.6944	0.0086
FA2015003	9/10/2015	1437	T	4	10:57	30	41.2460	-72.1985	22.2	29.9	20.9	30.5	2.4	1.2182	0.0062
FA2015004	9/10/2015	1436	T	4	12:32	30	41.2493	-72.2234	23.5	29.2	21.7	30.2	2.0	0.9807	0.0050
FA2015005	9/10/2015	931	S	4	14:56	30	41.1615	-72.4423	24.4	28.2	22.7	29.5	2.2	1.0760	0.0054
FA2015006	9/11/2015	1333	S	1	7:31	30	41.2305	-72.4056	22.4	29.4	22.3	29.3	2.0	1.0144	0.0051
FA2015007	9/11/2015	1529	T	1	9:32	30	41.2508	-72.5671	23.0	28.9	22.9	29.0	3.5	1.7667	0.0089
FA2015008	9/11/2015	1425	M	1	13:36	30	41.2376	-72.7256	24.2	28.3	24.0	28.3	2.9	1.4516	0.0073
FA2015009	9/11/2015	1423	T	1	15:25	30	41.2386	-72.8096	24.6	28.1	24.3	28.1	3.1	1.5483	0.0078
FA2015010	9/15/2015	1022	M	2	8:20	30	41.1705	-72.8867	23.1	28.1	23.3	28.1	2.9	1.4618	0.0074
FA2015011	9/15/2015	1225	T	2	10:32	30	41.1913	-72.7820	23.4	28.2	23.4	28.2	2.8	1.3844	0.0070
FA2015012	9/15/2015	830	S	4	14:59	30	41.1348	-72.5507	22.9	29.2	22.5	29.4	1.8	0.8781	0.0044
FA2015013	9/17/2015	430	T	3	8:41	30	41.0863	-72.4915	23.0	28.3	22.9	29.0	3.4	1.7143	0.0087
FA2015014	9/17/2015	328	T	3	10:31	30	41.0603	-72.5843	23.4	28.2	23.1	28.6	3.8	1.9010	0.0096
FA2015015	9/17/2015	327	T	3	12:12	30	41.0615	-72.6308	23.7	28.3	23.2	28.6	3.6	1.8164	0.0092
FA2015016	9/17/2015	326	T	3	13:43	30	41.0658	-72.6685	24.2	28.4	23.2	28.5	3.3	1.6675	0.0084
FA2015017	9/17/2015	24	M	3	15:13	30	40.9977	-72.7855	24.3	27.8	23.2	27.7	3.4	1.7039	0.0086
FA2015018	9/18/2015	229	T	2	8:51	30	41.0455	-72.5569	23.1	28.0	23.1	28.2	3.3	1.6378	0.0083
FA2015019	9/18/2015	129	S	2	10:41	30	41.0287	-72.5668	23.4	27.9	23.3	27.9	3.7	1.8283	0.0092
FA2015020	9/18/2015	227	T	3	12:33	30	41.0335	-72.6635	24.0	28.0	23.4	28.0	2.6	1.2759	0.0064
FA2015021	9/18/2015	528	S	3	14:10	30	41.0897	-72.5920	23.7	28.8	23.0	28.9	2.5	1.2405	0.0063
FA2015022	9/23/2015	728	S	3	8:25	30	41.1235	-72.5692	21.7	29.3	21.6	29.3	2.3	1.1321	0.0057
FA2015023	9/23/2015	825	T	4	9:50	30	41.1468	-72.7111	22.4	28.2	22.5	28.6	2.6	1.2774	0.0065
FA2015024	9/23/2015	522	M	4	11:27	30	41.1021	-72.8351	22.7	28.1	22.8	28.7	2.9	1.4510	0.0073
FA2015025	9/23/2015	120	M	4	13:06	30	41.0285	-72.9070	22.8	28.1	22.9	28.7	2.9	1.4489	0.0073
FA2015026	9/23/2015	420	M	4	15:07	30	41.0790	-72.9684	23.1	28.1	22.4	28.1	2.7	1.3655	0.0069
FA2015027	9/24/2015	413	M	3	8:47	20	41.0732	-73.2106	22.4	28.0	22.4	28.0	2.9	0.9690	0.0049
FA2015028	9/24/2015	5709	S	2	10:44	30	40.9453	-73.4086	22.1	27.5	22.4	27.7	2.9	1.4314	0.0072
FA2015029	9/24/2015	5911	M	3	12:49	30	40.9900	-73.3317	22.5	27.7	22.1	27.7	3.1	1.5528	0.0078
FA2015030	9/24/2015	115	M	4	14:32	30	41.0185	-73.1776	23.0	27.9	22.5	28.0	2.6	1.3019	0.0066
FA2015031	9/24/2015	817	M	2	16:18	30	41.1258	-73.1055	22.1	27.4	21.9	27.5	2.7	1.3348	0.0067
FA2015032	9/25/2015	212	M	3	9:10	30	41.0433	-73.2425	22.4	28.0	22.4	28.0	3.2	1.6044	0.0081
FA2015033	9/25/2015	5614	T	2	11:28	30	40.9348	-73.2223	22.3	27.8	22.3	27.8	3.1	1.5444	0.0078
FA2015034	9/28/2015	818	T	2	7:52	30	41.1501	-73.0088	21.5	27.9	21.6	27.8	3.9	1.9726	0.0100
FA2015035	9/28/2015	313	M	3	9:41	30	41.0505	-73.2555	22.0	27.7	22.0	27.7	2.5	1.2715	0.0064
FA2015036	9/28/2015	13	M	4	11:26	30	41.0027	-73.2578	22.1	27.5	22.0	27.6	3.1	1.5501	0.0078
FA2015037	9/28/2015	1120	T	2	13:51	30	41.1865	-72.9768	22.0	27.8	21.5	27.8	3.7	1.8450	0.0093
FA2015038	9/29/2015	1320	M	1	8:00	30	41.2058	-72.9823	21.2	28.0	21.2	28.1	3.0	1.4797	0.0075
FA2015039	9/29/2015	921	M	2	9:52	30	41.1642	-72.9294	22.0	28.2	21.8	28.3	2.5	1.2571	0.0064
FA2015040	9/29/2015	624	T	4	11:38	30	41.1093	-72.7952	22.7	28.4	22.1	28.8	2.6	1.2762	0.0064

Table 5.9. Station information for LISTS October 2015.

Standard LISTS tows in the spring begin with SP and fall begins with FA. Latitude (N) and Longitude (W) are displayed in decimal degrees. Surface and bottom temperature and salinity are labeled as S_ and B_, respectively. Area swept is estimated by assuming the effective sweep is 2/3rds of the footrope length

Sample Number	Date	Site Number	Bottom Type	Depth Interval	Time Start	Duration (min)	Latitude	Longitude	S_Temp (sfc, C)	S_Salinity (sfc, ppt)	B_Temp (btm, C)	B_Salinity (btm, ppt)	Ave Speed (knots)	Distance (nm)	Area Swept (sq.nm)
FA2015041	10/14/2015	1533	S	1	8:17	30	41.2546	-72.3836	18.2	28.0	18.4	29.1	2.3	1.1317	0.0057
FA2015042	10/15/2015	1434	S	1	7:03	30	41.2413	-72.3365	17.7	25.7	18.0	28.5	3.2	1.6232	0.0082
FA2015043	10/15/2015	1737	T	1	9:10	30	41.2887	-72.1983	17.8	.	17.7	.	3.0	1.5225	0.0077
FA2015044	10/15/2015	1738	T	2	10:36	30	41.2856	-72.2000	18.2	30.2	18.0	30.2	2.7	1.3397	0.0068
FA2015045	10/15/2015	730	S	4	13:09	30	41.1318	-72.4683	18.6	29.1	18.5	29.1	3.0	1.5074	0.0076
FA2015046	10/15/2015	1228	T	3	14:50	30	41.2023	-72.6035	18.3	28.5	18.2	28.5	3.8	1.8758	0.0095
FA2015047	10/19/2015	1432	S	2	7:15	30	41.2338	-72.3990	16.6	29.0	16.5	29.3	2.4	1.2184	0.0062
FA2015048	10/19/2015	1126	T	3	9:19	30	41.1980	-72.6658	17.0	28.2	16.8	28.1	2.8	1.4171	0.0072
FA2015049	10/19/2015	824	T	4	11:02	30	41.1290	-72.7996	17.9	28.3	17.7	28.4	2.8	1.3771	0.0070
FA2015050	10/19/2015	925	T	4	12:36	30	41.1247	-72.7081	17.7	28.4	17.7	28.5	2.9	1.4505	0.0073
FA2015051	10/19/2015	1026	T	4	14:20	30	41.1650	-72.7150	17.6	28.3	17.5	28.4	2.6	1.2845	0.0065
FA2015052	10/21/2015	931	S	4	7:56	30	41.1612	-72.4430	17.1	29.1	17.0	29.6	2.0	0.9833	0.0050
FA2015053	10/21/2015	530	S	3	9:31	30	41.0955	-72.5080	17.3	28.8	17.2	28.9	2.2	1.0755	0.0054
FA2015054	10/21/2015	529	S	3	10:54	30	41.0995	-72.5386	17.2	28.6	17.3	28.8	2.6	1.3144	0.0066
FA2015055	10/21/2015	426	T	3	12:18	30	41.0763	-73.6406	17.7	28.4	17.3	28.6	3.2	1.5957	0.0081
FA2015056	10/21/2015	325	T	3	14:43	30	41.0608	-72.7155	18.3	28.4	17.5	28.5	3.6	1.8092	0.0091
FA2015057	10/22/2015	314	M	3	8:51	30	41.0612	-73.1534	17.3	28.1	17.6	28.3	2.6	1.3068	0.0066
FA2015058	10/22/2015	15	T	4	10:32	30	41.0073	-73.1243	17.2	28.1	17.7	28.4	2.5	1.2265	0.0062
FA2015059	10/22/2015	5513	S	2	12:26	30	40.9276	-73.2501	16.6	27.6	16.4	27.6	3.2	1.6158	0.0082
FA2015060	10/22/2015	5614	T	2	14:37	30	40.9337	-73.2238	16.8	27.6	16.3	27.7	3.2	1.6242	0.0082
FA2015061	10/23/2015	511	M	2	8:51	30	41.1020	-73.2578	16.4	27.9	16.4	27.9	3.1	1.5582	0.0079
FA2015062	10/23/2015	7	M	3	10:38	30	41.0150	-73.4538	17.2	28.0	17.2	27.9	2.7	1.3278	0.0067
FA2015063	10/23/2015	611	M	1	12:30	30	41.1010	-73.3203	15.8	27.8	15.7	27.7	3.3	1.6626	0.0084
FA2015064	10/23/2015	513	M	2	13:49	30	41.0882	-73.2578	17.4	28.2	17.2	28.2	3.2	1.6141	0.0082
FA2015065	10/26/2015	415	M	3	8:40	30	41.0723	-73.1425	16.4	28.3	16.4	28.1	3.6	1.7914	0.0091
FA2015066	10/26/2015	110	T	3	10:28	30	41.0232	-73.3660	16.5	28.3	16.8	28.2	2.6	1.3161	0.0067
FA2015067	10/26/2015	311	T	2	13:06	30	41.0473	-73.3518	16.0	28.0	15.5	27.9	3.7	1.8699	0.0094
FA2015068	10/26/2015	213	M	3	14:45	30	41.0396	-73.2621	17.2	28.2	16.9	28.2	3.5	1.7719	0.0090
FA2015069	10/27/2015	818	T	2	7:54	30	41.1526	-72.9993	16.1	28.2	16.0	28.2	3.7	1.8488	0.0093
FA2015070	10/27/2015	5918	M	3	9:48	30	40.9950	-72.9838	16.4	28.3	16.4	28.2	3.4	1.7012	0.0086
FA2015071	10/27/2015	121	M	4	11:36	30	41.0146	-72.9328	16.5	28.3	16.7	28.3	2.9	1.4503	0.0073
FA2015072	10/27/2015	521	M	4	13:19	30	41.0843	-72.9164	16.7	28.3	16.6	28.3	3.5	1.7682	0.0089
FA2015073	11/3/2015	1119	M	2	7:59	30	41.1978	-72.9513	14.6	27.9	14.7	27.8	2.6	1.3182	0.0067
FA2015074	11/3/2015	622	M	4	9:51	30	41.1013	-72.8428	15.8	28.4	15.7	28.3	3.0	1.4856	0.0075
FA2015075	11/3/2015	320	M	4	11:19	30	41.0583	-72.9278	16.0	28.1	15.9	28.2	3.3	1.6294	0.0082
FA2015076	11/3/2015	418	M	4	12:48	30	41.0941	-72.9820	16.5	28.2	16.2	28.2	3.3	1.6424	0.0083
FA2015077	11/4/2015	1319	M	1	7:58	30	41.2123	-72.9944	14.5	27.7	14.5	27.7	3.6	1.7781	0.0090
FA2015078	11/4/2015	1427	T	1	12:54	30	41.2350	-72.6633	15.3	28.1	15.0	28.2	3.0	1.5038	0.0076
FA2015079	11/4/2015	1428	T	1	14:33	30	41.2357	-72.6422	15.1	28.0	14.8	28.2	2.7	1.3386	0.0068
FA2015080	11/4/2015	1429	T	2	16:04	30	41.2265	-72.6299	15.1	28.3	15.1	28.3	2.7	1.3607	0.0069

Table 5.10. Samples with non-standard tow durations and reasons for incomplete tows, spring and fall 2015.
Standard LISTS tows begin with SP (spring) or FA (fall).

Sample	Date	Site	Bottom Type	Depth Interval	Time	Duration	Reason	Comments
APRIL								
SP2015001	4/7/2015	730	S	4	8:31	26	speed drop	nothing on cables or in net
SP2015005	4/7/2015	828	S	3	13:39	24	speed drop	nothing on cables or in net
SP2015010	4/13/2015	1737	T	1	9:53	25	ran out of room	depth ahead was too shallow for stratum
SP2015031	4/16/2015	118	M	4	14:17	24	pots	string of ghost pots in stbd wing; pots stuck in mud; lots of weight; had to cut; no damage to net
MAY								
SP2015063	5/19/2015	620	M	3	11:03	23	hang	couple of broken tree branches in net & through meshes; no damage to net
SP2015073	5/21/2015	5709	S	2	11:08	27	hang	large tree through both wings; net badly torn; had to switch to different net for next tow
JUNE								
SP2015106	6/18/2015	5804	M	2	13:46	18	hang	came to abrupt stop; couple pieces of coral-encrusted wood in net when finally got it on deck; minor damage to net
SP2015109	6/22/2015	110	T	3	10:19	29	pots	active gear wrapped around net; untangled & let it go
SP2015111	6/22/2015	5612	T	2	13:44	25	pots	hauled back early because saw buoys ahead of us but got lines on both doors anyway because sets were North-South; flipped lines off doors; no pots in net
SP2015119	6/25/2015	1427	T	1	13:39	23	speed drop	nothing on cables or in net
SEPT								
FA2015027	9/24/2015	413	M	3	8:47	20	pots	one string hanging and one pot in net
OCT	no short tows							

Table 5.11. Data requests by month, 2015.

MONTH	REQUEST	ORGANIZATION OR PURPOSE
January		
	LISTS BSB data	ASMFC TC
	LISTS species richness data	media
February		
	LISTS HOR data	CT DEEP
	LISTS HOR data for Compliance Report	ASMFC TC
	LISTS abundance indices	Dominion
March		
	LISTS STB data	NY DEC
	LISTS WFL data	ASMFC TC
	LISTS BLF data	ASMFC TC
	LISTS ATH data for Compliance Report	ASMFC TC
	LISTS PGY data	ASMFC TC
April		
	LISTS BLF data for Compliance Report	ASMFC TC
	LISTS MEN data for Compliance Report	ASMFC TC
May		
	LISTS lobster lengths for Stock Assessment	ASMFC TC
	LISTS SFL data	ASMFC TC
	LISTS data for ALW, BBH	UC Santa Cruz
	LISTS indices of abundance various species	Normandeau Assoc.
	MEN data	Dominion
June		
	LISTS species indicators for LISS	EPA
	LISTS MKR data	ASMFC TC
	LISTS STB data for Compliance Report	ASMFC TC
	LISTS WFL age matrix	ASMFC TC
July		
	LISTS whelk data	NY DEC
	LISTS BKF data for Compliance Report	ASMFC TC
	LISTS data for ATS	ASMFC TC
August		
	LISTS invertebrate data	Norwalk Aquarium
	LISTS SPD data for Compliance Report	ASMFC TC
	LISTS LOB data for Compliance Report	ASMFC TC
	LISTS WKF data for Compliance Report	ASMFC TC
	WFL data	ASMFC TC
September		
	LISTS ATS data for Compliance Report	ASMFC TC
	LISTS BSB data for Compliance Report	ASMFC TC
	LISTS SFL data for Compliance Report	ASMFC TC
	LISTS PGY data for Compliance Report	ASMFC TC
	LISTS species indicators for LISS	EPA
October		
	MEN data	CT DEEP
November		
	LISTS WFL data for Compliance Report	ASMFC TC
	LISTS BADD index	EPA LISS
	LISTS LOB data	CT DEEP
December		
	LISTS indices of abundance various species	CT DEEP

Table 5.12. Sample requests by month, 2015.

MONTH	REQUEST	ORGANIZATION OR PURPOSE
May		
	squid & various finfish specimens for dissection class	Putnam High School
	hermit crabs	UConn
	variety of hardy fish & invertebrates for "Stormwater Classroom"	East Lyme School System
	variety of fish for x-ray of head structures for ageing manual	ASMFC
	tautog tissue samples for DNA study	VIMS
	channeled and knobbed whelk (conch)	NY DEC
June		
	channeled and knobbed whelk (conch)	NY DEC
	tautog tissue samples for DNA study	VIMS
	hermit crabs	UConn
September		
	channeled and knobbed whelk (conch)	NY DEC
October		
	squid & various finfish specimens for dissection class	Putnam High School
	channeled and knobbed whelk (conch)	NY DEC
	stripers for PCB study	NY DEC
November		
	channeled and knobbed whelk (conch)	NY DEC

Table 5.13. List of finfish species observed in 2015.

Sixty-six finfish species were observed in 2015. (Bold type indicates new species). Since 1984, one hundred-nine species of finfish have been identified in LISTS (see Appendix 5.1 for the full list of species).

Common Name	Scientific Name	Common Name	Scientific Name
anchovy, bay	Anchoa mitchilli	hogchoker	Trinectes maculatus
anchovy, striped	Anchoa hepsetus	jack, crevalle	Caranx hippos
bigeye	Priacanthus arenatus	kingfish, northern	Menticirrhus saxatilis
bigeye, short	Pristigenys alta	lamprey, sea	Petromyzon marinus
black sea bass	Centropristis striata	mackerel, Atlantic	Scomber scombrus
blue runner	Caranx crysos	menhaden, Atlantic	Brevoortia tyrannus
bluefish	Pomatomus saltatrix	moonfish	Selene setapinnis
butterfish	Peprilus triacanthus	ocean pout	Macrozoarces americanus
cod, Atlantic	Gadus morhua	pipefish, northern	Syngnathus fuscus
cornetfish, red	**Fistularia petimba**	puffer, northern	Sphoeroides maculatus
croaker, Atlantic	Micropogonias undulatus	ray, roughtail stingray	Dasyatis centroura
cunner	Tautogolabrus adspersus	rockling, fourbeard	Enchelyopus cimbrius
dogfish, smooth	Mustelus canis	sand lance, American	Ammodytes americanus
dogfish, spiny	Squalus acanthias	scad, bigeye	Selar crumenophthalmus
eel, conger	Conger oceanicus	scad, rough	Trachurus lathami
filefish, planehead	Monacanthus hispidus	scad, round	Decapterus punctatus
flounder, fourspot	Paralichthys oblongus	sculpin, longhorn	Myoxocephalus octodecemspin
flounder, smallmouth	Etropus microstomus	scup	Stenotomus chrysops
flounder, summer	Paralichthys dentatus	searobin, northern	Prionotus carolinus
flounder, windowpane	Scophthalmus aquosus	searobin, striped	Prionotus evolans
flounder, winter	Pseudopleuronectes american	shad, American	Alosa sapidissima
flounder, yellowtail	Pleuronectes ferrugineus	shad, hickory	Alosa mediocris
glasseye snapper	Priacanthus cruentatus	silverside, Atlantic	Menidia menidia
goosefish	Lophius americanus	skate, clearnose	Raja eglanteria
gunnel, rock	Pholis gunnellus	skate, little	Leucoraja erinacea
hake, red	Urophycis chuss	skate, winter	Leucoraja ocellata
hake, silver	Merluccius bilinearis	**snapper, mahogany**	**Lutjanus mahogoni**
hake, spotted	Urophycis regia	spot	Leiostomus xanthurus
herring, Atlantic	Clupea harengus	striped bass	Morone saxatilis
herring, Atlantic thread	**Opisthonema oglinum**	sturgeon, Atlantic	Acipenser oxyrinchus
herring, alewife	Alosa pseudoharengus	tautog	Tautoga onitis
herring, blueback	Alosa aestivalis	toadfish, oyster	Opsanus tau
herring, round	Etrumeus teres	weakfish	Cynoscion regalis

Names taken from: Common and Scientific Names of Fishes from the United States, Canada and Mexico, American Fisheries Society, Sixth ed., 2004.

Table 5.14. List of invertebrates observed in 2015.

In 2015, forty-three invertebrate" species" were identified. In most cases, invertebrates are identified to species; however, species that are very similar are identified to genus, and in difficult cases, to a higher taxon.

Common Name	Scientific Name	Common Name	Scientific Name
Tubularia hydroids	Tubularia, spp.	oyster, common	Crassostrea virginica
anemones	anemomes spp.	polychaetes	Class polychfeta
arks	Noetia-Anadara spp.	sand dollar	Echinarachnius parma
bryozoan, bushy	Phylum Bryozoa	sea grape	Molgula spp.
bryozoan, rubbery	Alcyonidium verrilli	sea urchin, purple	Arbacia punctulata
clam, common razer	Ensis directus	shrimp, brown	Penaeus aztecus
clam, hard clams	Artica-Mercinaria-Pitar sp.	shrimp, coastal mud	Upogebia affinis
clam, surf	Spisula solidissima	shrimp, ghost	Gilvossius setimanus
coral, star	Astrangia poculata	shrimp, mantis	Squilla empusa
crab, mud	Family Xanthidae	shrimp, sand	Crangon septemspinosa
crab, blue	Callinectes sapidus	slipper shell, common	Crepidula fornicata
crab, flat claw hermit	Pagurus pollicaris	sponge spp.	sponge spp.
crab, horseshoe	Limulus polyphemus	sponge, boring	Cliona celate
crab, lady	Ovalipes ocellatus	sponge, deadman's fingers	Haliclona spp.
crab, rock	Cancer irroratus	sponge, red bearded	Microciona prolifera
crab, spider	Libinia emarginata	squid, longfin inshore	Loligo pealeii
hydroid spp.	hydroid spp.	starfish spp.	Asteriid spp.
jelly, comb	Phylum Ctenophora	tunicates, misc	misc. class ascidiacea
jellyfish, lion's mane	Cyanea capillata	whelk, channeled	Busycotypus canaliculatus
lobster, American	Homarus americanus	whelk, knobbed	Busycon carica
mussel, blue	Mytilus edulis	worms, fan	Myxicola infundibulum
northern moon snail	Lunatia heros		

Names taken from: A Field Guide to the Atlantic Seashore, Peterson Field Guide Series, 1978 (Gosner, 1978).

Table 5.15. Total number and weight (kg) of finfish and invertebrates caught in 2015.
Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Young-of-year bay and striped anchovy are neither separated by species or quantified; young-of-year Atlantic herring and American sand lance are not quantified. Number of tows (sample size)=200.

species	count	%	weight	%
scup	80,534	49.3	6,045.5	38.7
butterfish	53,265	32.6	1,011.2	6.5
weakfish	10,077	6.2	530.4	3.4
striped searobin	2,728	1.7	1,058.2	6.8
bluefish	2,650	1.6	324.4	2.1
smooth dogfish	1,438	0.9	2,804.1	17.9
winter flounder	1,340	0.8	319.7	2.0
Atlantic menhaden	1,279	0.8	361.2	2.3
windowpane flounder	1,150	0.7	191.1	1.2
black sea bass	1,109	0.7	678.0	4.3
moonfish	891	0.5	14.6	0.1
summer flounder	808	0.5	449.3	2.9
northern searobin	805	0.5	133.2	0.9
Atlantic herring	630	0.4	71.8	0.5
alewife	485	0.3	30.5	0.2
red hake	480	0.3	44.5	0.3
bay anchovy	399	0.2	3.1	0.0
little skate	387	0.2	192.0	1.2
fourspot flounder	386	0.2	76.3	0.5
tautog	308	0.2	339.7	2.2
spotted hake	302	0.2	40.1	0.3
American shad	275	0.2	24.7	0.2
hogchoker	255	0.2	31.2	0.2
blueback herring	249	0.2	7.1	0.0
striped bass	187	0.1	405.2	2.6
rough scad	144	0.1	7.1	0.0
clearnose skate	131	0.1	225.0	1.4
silver hake	100	0.1	6.5	0.0
northern kingfish	97	0.1	7.1	0.0
smallmouth flounder	73	0.0	3.6	0.0
blue runner	68	0.0	6.7	0.0
winter skate	30	0.0	51.8	0.3
fourbeard rockling	20	0.0	2.0	0.0
spiny dogfish	19	0.0	80.8	0.5
red cornetfish	14	0.0	0.6	0.0
spot	14	0.0	1.7	0.0
cunner	13	0.0	1.8	0.0
hickory shad	12	0.0	5.5	0.0
northern puffer	11	0.0	0.8	0.0
Atlantic croaker	6	0.0	1.5	0.0
Atlantic silverside	5	0.0	0.4	0.0
Atlantic cod	5	0.0	4.7	0.0
crevalle jack	4	0.0	0.4	0.0
Atlantic mackerel	4	0.0	0.4	0.0
American sand lance	4	0.0	0.1	0.0
bigeye scad	3	0.0	0.3	0.0
planehead filefish	2	0.0	0.2	0.0
glasseye snapper	2	0.0	0.1	0.0
goosefish	2	0.0	0.1	0.0
ocean pout	2	0.0	0.5	0.0
northern pipefish	2	0.0	0.2	0.0
longhorn sculpin	2	0.0	0.7	0.0
striped anchovy	2	0.0	0.1	0.0
oyster toadfish	2	0.0	0.9	0.0
yellowtail flounder	2	0.0	0.7	0.0
Atlantic sturgeon	1	0.0	15.8	0.1
bigeye	1	0.0	0.1	0.0
conger eel	1	0.0	0.3	0.0
mahogany snapper	1	0.0	0.1	0.0
round herring	1	0.0	0.1	0.0
round scad	1	0.0	0.1	0.0
rock gunnel	1	0.0	0.1	0.0
roughtail stingray	1	0.0	7.8	0.0
short bigeye	1	0.0	0.1	0.0
sea lamprey	1	0.0	1.2	0.0
Atlantic thread herring	1	0.0	0.1	0.0
Total	**163,223**		**15,625**	

Finfish not ranked

anchovy spp, (yoy)
Atlantic herring, (yoy)
American sand lance (yoy)
gadid spp, (yoy)

Invertebrates

species	count	%	weight	%
longfin inshore squid	28,266	97.0	1366.2	69.6
horseshoe crab	159	0.5	288.3	14.7
spider crab	nc		133.3	6.8
common slipper shell	nc		29.8	1.5
American lobster	92	0.3	24.0	1.2
knobbed whelk	37	0.1	15.7	0.8
bushy bryozoan	nc		10.1	0.5
mantis shrimp	187	0.6	9.8	0.5
flat claw hermit crab	nc		8.1	0.4
sea grape	1	0.0	7.8	0.4
boring sponge	nc		7.6	0.4
lion's mane jellyfish	347	1.2	6.5	0.3
mixed sponge species	nc		6.3	0.3
channeled whelk	26	0.1	5.8	0.3
blue crab	22	0.1	4.7	0.2
blue mussel	nc		4.2	0.2
northern moon snail	1	0.0	4.0	0.2
hydroid spp.	nc		3.9	0.2
rock crab	nc		3.8	0.2
sand shrimp	nc		3.7	0.2
mud crabs	nc		2.9	0.1
starfish spp.	nc		2.5	0.1
lady crab	nc		2.4	0.1
arks	nc		1.5	0.1
common oyster	nc		0.8	0.0
rubbery bryzoan	nc		0.7	0.0
Tubularia, spp.	nc		0.5	0.0
coastal mud shrimp	2	0.0	0.4	0.0
surf clam	2	0.0	0.4	0.0
red bearded sponge	nc		0.3	0.0
deadman's fingers sponge	nc		0.3	0.0
fan worm tubes	nc		0.3	0.0
hard clams	1	0.0	0.3	0.0
polychaetes	nc		0.3	0.0
brown shrimp	2	0.0	0.2	0.0
comb jelly spp	nc		0.2	0.0
star coral	nc		0.2	0.0
ghost shrimp	1	0.0	0.2	0.0
purple sea urchin	2	0.0	0.2	0.0
anemones	nc		0.1	0.0
sand dollar	1	0.0	0.1	0.0
common razor clam	1	0.0	0.1	0.0
tunicates, misc	nc		0.1	0.0
Total	**29,150**		**1,958.6**	

Note: nc= not counted

Table 5.16. Total counts and weight (kg) of finfish taken in the spring and fall sampling periods, 2015.
Species are listed in order of descending count.. Young-of-year bay anchovy, striped anchovy, Atlantic herring and American sand lance are not included. Number of tows (sample sizes): Spring = 120 and Fall=80.

Spring				
species	**count**	**%**	**weight**	**%**
scup	19,763	60.0	3,013.0	43.0
butterfish	4,788	14.5	293.8	4.2
winter flounder	1,171	3.6	282.6	4.0
striped searobin	1,046	3.2	486.4	6.9
black sea bass	1,006	3.1	604.5	8.6
windowpane flounder	864	2.6	148.4	2.1
northern searobin	676	2.1	124.2	1.8
Atlantic herring	611	1.9	70.5	1.0
summer flounder	542	1.6	245.1	3.5
fourspot flounder	316	1.0	70.9	1.0
smooth dogfish	299	0.9	729.1	10.4
tautog	285	0.9	330.0	4.7
little skate	260	0.8	123.8	1.8
Atlantic menhaden	229	0.7	97.2	1.4
alewife	185	0.6	17.8	0.3
blueback herring	155	0.5	3.2	0.0
spotted hake	133	0.4	6.5	0.1
American shad	114	0.3	9.4	0.1
red hake	96	0.3	3.9	0.1
silver hake	74	0.2	3.8	0.1
hogchoker	64	0.2	7.9	0.1
striped bass	59	0.2	111.9	1.6
clearnose skate	35	0.1	68.4	1.0
winter skate	25	0.1	45.3	0.6
bay anchovy	22	0.1	0.6	0.0
smallmouth flounder	22	0.1	1.1	0.0
fourbeard rockling	19	0.1	1.9	0.0
spiny dogfish	19	0.1	80.8	1.2
cunner	11	0.0	1.5	0.0
hickory shad	9	0.0	4.2	0.1
Atlantic silverside	5	0.0	0.4	0.0
Atlantic cod	5	0.0	4.7	0.1
weakfish	5	0.0	2.3	0.0
American sand lance	4	0.0	0.1	0.0
bluefish	3	0.0	2.2	0.0
Atlantic croaker	3	0.0	0.4	0.0
goosefish	2	0.0	0.1	0.0
ocean pout	2	0.0	0.5	0.0
northern pipefish	2	0.0	0.2	0.0
longhorn sculpin	2	0.0	0.7	0.0
yellowtail flounder	2	0.0	0.7	0.0
northern kingfish	1	0.0	0.1	0.0
rock gunnel	1	0.0	0.1	0.0
sea lamprey	1	0.0	1.2	0.0
oyster toadfish	1	0.0	0.4	0.0
Total	**32,937**		**7,001.8**	

Fall				
species	**count**	**%**	**weight**	**%**
scup	60,771	46.6	3,032.5	35.2
butterfish	48,477	37.2	717.4	8.3
weakfish	10,072	7.7	528.1	6.1
bluefish	2,647	2.0	322.2	3.7
striped searobin	1,683	1.3	571.8	6.6
smooth dogfish	1,139	0.9	2,075.0	24.1
Atlantic menhaden	1,050	0.8	264.0	3.1
moonfish	891	0.7	14.6	0.2
red hake	384	0.3	40.6	0.5
bay anchovy	377	0.3	2.5	0.0
alewife	300	0.2	12.7	0.1
windowpane flounder	286	0.2	42.7	0.5
summer flounder	266	0.2	204.2	2.4
hogchoker	191	0.1	23.3	0.3
spotted hake	169	0.1	33.6	0.4
winter flounder	169	0.1	37.1	0.4
American shad	161	0.1	15.3	0.2
rough scad	144	0.1	7.1	0.1
northern searobin	129	0.1	9.0	0.1
striped bass	128	0.1	293.3	3.4
little skate	127	0.1	68.2	0.8
black sea bass	104	0.1	73.5	0.9
clearnose skate	96	0.1	156.6	1.8
northern kingfish	96	0.1	7.0	0.1
blueback herring	94	0.1	3.9	0.0
fourspot flounder	71	0.1	5.4	0.1
blue runner	68	0.1	6.7	0.1
smallmouth flounder	51	0.0	2.5	0.0
silver hake	26	0.0	2.7	0.0
tautog	23	0.0	9.7	0.1
Atlantic herring	19	0.0	1.3	0.0
red cornetfish	14	0.0	0.6	0.0
spot	14	0.0	1.7	0.0
northern puffer	11	0.0	0.8	0.0
winter skate	5	0.0	6.5	0.1
crevalle jack	4	0.0	0.4	0.0
Atlantic mackerel	4	0.0	0.4	0.0
bigeye scad	3	0.0	0.3	0.0
Atlantic croaker	3	0.0	1.1	0.0
hickory shad	3	0.0	1.3	0.0
cunner	2	0.0	0.3	0.0
planehead filefish	2	0.0	0.2	0.0
glasseye snapper	2	0.0	0.1	0.0
striped anchovy	2	0.0	0.1	0.0
Atlantic sturgeon	1	0.0	15.8	0.2
bigeye	1	0.0	0.1	0.0
conger eel	1	0.0	0.3	0.0
mahogany snapper	1	0.0	0.1	0.0
fourbeard rockling	1	0.0	0.1	0.0
round herring	1	0.0	0.1	0.0
round scad	1	0.0	0.1	0.0
roughtail stingray	1	0.0	7.8	0.1
short bigeye	1	0.0	0.1	0.0
oyster toadfish	1	0.0	0.5	0.0
Atlantic thread herring	1	0.0	0.1	0.0
Total	**130,289**		**8,623.4**	

Table 5.17. Total catch of invertebrates taken in the spring and fall sampling periods, 2015.
Species are ranked by total weight (kg). Number of tows (sample sizes): Spring = 120 and Fall=80.

	Spring			
species	**count**	**%**	**weight**	**%**
horseshoe crab	93	4.1	164.0	32.5
spider crab	nc		127.2	25.2
longfin inshore squid	1,649	73.4	99.7	19.7
American lobster	81	3.6	20.1	4.0
common slipper shell	nc		18.8	3.7
bushy bryozoan	nc		8.9	1.8
sea grape	1	0.1	7.8	1.5
boring sponge	nc		7.6	1.5
lion's mane jellyfish	347	15.5	6.5	1.3
flat claw hermit crab	nc		4.3	0.9
sand shrimp	nc		3.7	0.7
northern moon snail	1	0.0	3.7	0.7
rock crab	nc		3.6	0.7
hydroid spp.	nc		3.5	0.7
blue mussel	nc		3.0	0.6
mantis shrimp	46	2.1	2.9	0.6
channeled whelk	11	0.5	2.9	0.6
knobbed whelk	5	0.2	2.6	0.5
mud crabs	nc		2.4	0.5
starfish spp.	nc		2.2	0.4
arks	nc		1.2	0.2
lady crab	nc		1.0	0.2
common oyster	nc		0.8	0.2
rubbery bryzoan	nc		0.6	0.1
blue crab	3	0.1	0.5	0.1
Tubularia, spp.	nc		0.5	0.1
coastal mud shrimp	1	0.0	0.3	0.1
deadman's fingers sponge	nc		0.3	0.1
polychaetes	nc		0.3	0.1
surf clam	2	0.1	0.3	0.1
red bearded sponge	nc		0.2	0.0
comb jelly spp	nc		0.2	0.0
star coral	nc		0.2	0.0
ghost shrimp	1	0.0	0.2	0.0
hard clams	1	0.0	0.2	0.0
sand dollar	1	0.0	0.1	0.0
common razor clam	1	0.0	0.1	0.0
tunicates, misc	nc		0.1	0.0
purple sea urchin	2	0.1	0.1	0.0
Total	**2,246**		**502.6**	

Note: nc= not counted

	Fall			
species	**count**	**%**	**weight**	**%**
longfin inshore squid	26,617	98.9	1,266.5	86.9
horseshoe crab	66	0.2	124.3	8.5
knobbed whelk	32	0.1	13.1	0.9
common slipper shell	nc		11.0	0.8
mantis shrimp	141	0.5	6.9	0.5
mixed sponge species	nc		6.3	0.4
spider crab	nc		6.1	0.4
blue crab	19	0.1	4.2	0.3
American lobster	11	0.0	3.9	0.3
flat claw hermit crab	nc		3.8	0.3
channeled whelk	15	0.1	2.9	0.2
lady crab	nc		1.4	0.1
bushy bryozoan	nc		1.2	0.1
blue mussel	nc		1.2	0.1
mud crabs	nc		0.5	0.0
hydroid spp.	nc		0.4	0.0
arks	nc		0.3	0.0
fan worm tubes	nc		0.3	0.0
northern moon snail	nc		0.3	0.0
starfish spp.	nc		0.3	0.0
brown shrimp	2	0.0	0.2	0.0
rock crab	nc		0.2	0.0
anemones	nc		0.1	0.0
red bearded sponge	nc		0.1	0.0
coastal mud shrimp	1	0.0	0.1	0.0
hard clams	nc		0.1	0.0
rubbery bryzoan	nc		0.1	0.0
surf clam	nc		0.1	0.0
purple sea urchin	nc		0.1	0.0
Total	**26,904**		**1,456.0**	

Table 5.18. Spring indices of abundance for selected species, 1984-2015.

The geometric mean count per tow was calculated for 38 finfish and 2 invertebrates using April-June data. An asterisk next to the species name and time series mean, indicates that the spring index is a better estimate than the fall index (Simpson et al. 1991). Two asterisks indicate that both the spring and the fall indices provide good estimates.

	Spring																																84-14
Species	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Mean**
alewife *	0.43	0.10	0.66	1.00	0.47	0.72	0.54	0.39	0.39	0.84	1.83	0.96	2.18	1.44	1.11	1.89	1.53	0.75	0.95	1.14	1.86	1.30	0.78	1.62	1.32	1.04	1.29	0.94	0.77	1.06	0.88	0.77	1.04
black sea bass *	0.16	0.27	0.12	0.05	0.04	0.08	0.10	0.07	0.03	0.07	0.12	0.07	0.11	0.10	0.04	0.08	0.22	0.25	0.67	0.21	0.22	0.07	0.05	0.26	0.22	0.32	0.28	0.27	0.83	0.97	2.73	1.94	0.29
bluefish	0.00	0.02	0.19	0.07	0.11	0.07	0.09	0.52	0.31	0.05	0.07	0.03	0.07	0.18	0.12	0.24	0.08	0.07	0.30	0.16	0.11	0.11	0.22	0.16	0.08	0.24	0.01	0.17	0.07	0.11	0.03	0.02	
butterfish	8.92	0.62	2.38	0.25	0.46	0.80	1.60	2.17	2.60	0.48	1.71	1.06	3.22	6.16	6.51	1.90	3.35	2.94	7.09	3.17	2.10	2.27	18.67	3.48	4.64	9.44	1.99	15.64	13.44	3.38	2.87	3.26	
cunner *	1.28	0.29	0.28	0.22	0.16	0.29	0.55	0.25	0.11	0.20	0.07	0.16	0.07	0.15	0.18	0.18	0.17	0.20	0.25	0.11	0.07	0.08	0.06	0.05	0.10	0.05	0.08	0.08	0.06	0.06	0.00	0.06	0.19
dogfish, smooth	0.39	0.46	0.45	0.21	0.49	0.48	0.34	0.46	0.56	0.26	0.60	0.33	0.44	0.24	0.47	0.54	0.53	0.55	1.19	0.63	0.53	0.44	1.33	0.64	0.87	1.05	0.09	1.51	0.82	0.80	0.78	0.87	
dogfish, spiny *	0.00	0.15	0.14	0.07	0.12	0.18	0.19	0.06	0.04	0.01	0.06	0.00	0.00	0.01	0.01	0.01	0.00	0.04	0.02	0.03	0.03	0.03	0.09	0.12	0.07	0.43	0.03	0.19	0.06	0.08	0.06	0.09	0.08
flounder, fourspot *	18.18	10.55	3.15	2.38	4.62	4.14	6.53	8.46	9.33	2.37	2.59	5.00	4.82	7.54	4.34	3.53	4.57	3.83	4.82	2.78	2.56	1.14	1.86	3.37	2.94	1.71	1.52	4.09	5.45	2.26	1.90	0.87	4.59
flounder, summer	0.63	0.44	0.95	1.06	0.50	0.10	0.35	0.64	0.55	0.51	0.86	0.28	0.96	1.00	1.30	1.44	1.79	1.75	3.19	3.42	1.84	0.80	0.61	2.51	1.61	1.93	2.69	3.85	3.06	3.24	3.00	1.64	
flounder, windowpane *	172.27	119.82	67.82	40.33	66.02	101.71	39.74	30.87	13.17	24.71	23.54	10.69	37.47	30.43	24.27	14.19	8.11	9.04	5.44	4.90	5.96	2.29	2.98	15.65	10.11	7.08	11.40	9.39	9.85	5.96	5.02	3.26	30.01
flounder, winter *	111.96	66.81	61.50	67.92	100.96	135.23	170.12	118.95	54.31	53.34	74.35	48.11	93.05	57.41	59.36	32.80	33.67	46.40	25.49	21.22	16.45	17.47	7.50	20.58	22.34	18.98	20.88	16.68	12.02	6.35	4.10	3.93	51.49
hake, red *	15.04	3.02	4.67	3.84	3.64	13.12	4.75	4.35	4.83	6.00	0.89	4.12	1.49	1.41	6.28	7.21	4.01	2.64	5.11	1.18	1.37	1.06	1.30	3.85	3.37	1.48	3.27	0.60	3.35	1.35	0.70	0.26	3.85
hake, silver *	7.53	1.83	1.19	2.48	2.25	4.86	5.53	3.87	2.67	1.56	1.73	4.88	1.15	4.32	4.64	12.57	2.28	7.64	5.92	0.76	2.63	0.57	4.75	0.98	19.08	2.30	5.24	2.10	19.45	1.47	1.08	0.25	4.49
hake, spotted	0.00	0.00	0.02	0.01	0.22	0.01	0.02	0.22	0.08	0.07	0.02	0.21	0.31	0.25	0.26	1.11	2.68	1.52	2.05	1.18	0.65	0.37	1.47	1.04	3.15	0.65	1.89	1.84	1.60	2.15	1.03	0.43	
herring, Atlantic *	0.00	0.58	1.12	2.77	2.16	2.27	5.73	4.91	2.73	7.24	2.95	4.23	1.70	2.53	1.06	0.99	1.21	0.85	0.41	0.49	0.53	1.33	0.31	1.66	0.77	1.82	2.56	1.57	0.73	2.64	1.44	0.69	1.98
herring, blueback	5.42	0.30	0.34	0.14	0.03	0.05	0.08	0.11	0.20	0.08	0.55	0.29	0.28	0.25	0.15	0.02	0.37	0.19	0.15	0.27	0.46	0.33	0.13	0.29	0.21	0.43	0.37	0.14	0.13	0.26	0.15	0.42	
hogchoker	0.63	0.45	0.14	0.15	0.18	0.21	0.17	0.14	0.24	0.08	0.11	0.03	0.10	0.05	0.03	0.06	0.11	0.10	0.15	0.15	0.19	0.11	0.08	0.17	0.13	0.11	0.15	0.24	0.29	0.32	0.40	0.21	
kingfish, northern	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.01	0.00	0.01	
lobster, American**	7.09	3.10	2.76	3.30	2.24	3.76	5.33	7.74	7.88	6.72	4.10	8.36	6.77	7.67	18.52	12.49	11.01	7.56	6.31	3.89	2.50	2.43	1.94	3.22	2.72	1.40	1.30	0.79	0.97	0.44	0.45	0.31	4.99
menhaden, Atlantic	0.09	0.11	0.18	0.39	0.17	0.14	0.10	0.03	0.14	0.07	0.05	0.11	0.02	0.02	0.00	0.01	0.03	0.00	0.13	0.01	0.02	0.01	0.04	0.13	0.05	0.07	0.05	0.11	0.63	0.37	0.62	0.66	
moonfish	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
ocean pout *	0.21	0.04	0.06	0.06	0.07	0.12	0.14	0.14	0.14	0.23	0.10	0.09	0.11	0.08	0.06	0.06	0.08	0.03	0.06	0.06	0.06	0.02	0.04	0.05	0.04	0.08	0.04	0.10	0.05	0.00	0.00	0.01	0.08
rockling, fourbeard*	2.87	0.37	0.43	0.56	0.61	0.88	0.82	0.58	0.80	0.59	0.27	0.58	0.33	0.60	0.47	0.66	0.55	0.57	0.37	0.36	0.48	0.35	0.09	0.35	0.26	0.18	0.17	0.19	0.16	0.02	0.02	0.08	0.50
scad, rough	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.00	0.00	0.00	
sculpin, longhorn *	0.20	0.33	0.18	0.15	0.15	0.24	0.65	0.39	0.12	0.06	0.04	0.03	0.04	0.02	0.01	0.01	0.06	0.02	0.02	0.01	0.03	0.00	0.00	0.02	0.01	0.01	0.01	0.04	0.01	0.01	0.00	0.01	0.09
scup	2.80	5.65	3.40	1.17	1.11	2.77	2.25	3.09	1.75	1.32	1.88	5.24	3.25	3.23	4.25	2.22	28.46	7.20	50.42	4.84	8.12	3.48	59.05	10.00	19.87	21.92	6.88	22.34	50.24	14.23	14.96	10.13	11.85
sea raven*	0.36	0.37	0.29	0.37	0.17	0.11	0.19	0.09	0.03	0.01	0.01	0.01	0.01	0.01	0.10	0.04	0.08	0.04	0.06	0.01	0.04	0.02	0.00	0.03	0.00	0.02	0.05	0.02	0.02	0.00	0.01	0.00	0.08
searobin, northern *	6.48	14.38	0.82	0.71	1.13	0.85	0.62	1.36	1.18	1.26	1.21	1.07	1.26	1.73	0.72	1.03	2.66	1.55	2.67	1.16	0.80	0.32	1.19	0.82	1.32	1.73	1.52	1.16	5.05	1.90	1.68	0.57	1.98
searobin, striped	1.30	1.78	1.33	0.60	0.57	0.66	0.71	1.55	1.52	0.46	0.93	1.28	0.82	0.71	1.48	1.82	3.69	2.36	3.83	1.85	1.40	0.31	0.89	0.95	1.07	2.14	0.77	2.96	5.01	2.80	2.50	1.92	
shad, American	0.10	1.36	0.57	0.92	0.44	0.90	0.34	0.54	0.75	0.29	0.68	0.49	0.48	1.08	0.86	0.80	0.38	0.08	0.61	0.20	0.34	0.28	0.25	0.44	0.57	0.57	0.53	0.49	0.46	0.43	0.41	0.48	
shad, hickory	0.52	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.02	0.01	0.02	0.01	0.07	0.05	0.09	0.12	0.09	0.04	0.15	0.09	0.10	0.25	0.27	0.12	0.02	0.03	0.02	0.01	0.07	0.03	0.11	0.04	
skate, clearnose	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.03	0.02	0.03	0.10	0.04	0.03	0.01	0.07	0.09	0.06	0.08	0.01	0.08	0.39	0.12	0.15	0.15	
skate, little *	5.71	7.22	7.19	5.34	15.51	21.24	11.50	25.19	12.41	12.03	16.96	6.58	18.78	11.23	11.65	7.56	6.21	8.03	7.63	7.03	6.54	1.65	1.40	2.82	1.56	1.03	1.02	1.15	2.15	1.11	1.08	0.61	7.95
skate, winter*	0.00	0.12	0.15	0.07	0.37	0.34	0.22	0.23	0.18	0.23	0.14	0.12	0.24	0.16	0.24	0.17	0.16	0.10	0.13	0.16	0.21	0.09	0.13	0.15	0.12	0.15	0.10	0.14	0.32	0.28	0.26	0.09	0.18
spot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.00	0.00	
squid, long-finned**	nc	nc	3.24	2.56	9.37	4.98	7.87	7.18	6.44	4.23	3.82	6.21	3.24	5.14	3.33	3.49	2.70	2.73	3.22	2.50	9.43	4.76	11.55	2.14	3.45	6.57	3.20	4.10	3.34	1.47	4.09	3.93	4.70
striped bass *	0.02	0.00	0.00	0.05	0.04	0.06	0.16	0.15	0.22	0.27	0.30	0.59	0.63	0.85	0.97	1.10	0.84	0.61	1.30	0.87	0.56	1.17	0.61	1.02	0.57	0.60	0.40	0.48	0.43	0.67	0.41	0.20	0.51
sturgeon, Atlantic	0.06	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.03	0.02	0.03	0.01	0.01	0.01	0.05	0.04	0.02	0.01	0.05	0.00	0.00	0.02	0.05	0.02	0.01	0.01	0.01	0.02	0.02	0.02	0.00	0.00	
tautog *	2.75	1.47	1.50	0.71	0.65	1.09	1.00	0.92	0.82	0.42	0.44	0.15	0.49	0.40	0.42	0.40	0.57	0.70	0.91	0.52	0.54	0.57	0.64	0.48	0.50	0.40	0.25	0.38	0.44	0.43	0.51	0.47	0.69
weakfish	0.02	0.00	0.07	0.01	0.04	0.03	0.05	0.18	0.12	0.06	0.03	0.11	0.12	0.27	0.24	0.28	0.11	0.17	0.12	0.02	0.10	0.17	0.14	0.07	0.03	0.05	0.01	0.08	0.50	0.32	0.11	0.02	

Table 5.19. Fall indices of abundance for selected species, 1984-2015.

The geometric mean count per tow was calculated for 38 finfish and 2 invertebrates using September-October data. An asterisk next to the species name and a time series mean, indicates that the fall index provides a better estimate than the spring index (Simpson et al. 1991). Two asterisks indicate that both the spring and the fall indices provide good estimates. There was no fall sampling in 2010.

	Fall																																84-14
Species	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Mean**
alewife	0.42	0.01	0.05	0.04	0.19	0.16	0.11	0.07	0.19	0.40	0.66	0.16	0.24	1.23	0.11	0.42	0.25	0.55	0.22	0.58	0.26	0.43	0.05	0.95	0.42	0.18	-	0.43	0.07	0.40	0.18	0.64	
black sea bass	0.03	0.11	0.01	0.03	0.05	0.01	0.06	0.14	0.01	0.04	0.06	0.01	0.05	0.03	0.07	0.23	0.18	0.43	1.01	0.15	0.35	0.17	0.24	0.36	0.93	0.26	-	0.29	1.49	0.99	1.35	0.65	
bluefish *	23.41	19.01	13.66	14.32	15.49	26.25	23.88	33.43	25.22	18.92	32.06	24.46	20.80	37.90	31.41	45.31	20.57	24.24	18.75	28.53	29.13	18.89	15.66	30.66	14.28	18.11	-	11.10	15.06	9.71	18.61	8.42	22.63
butterfish *	51.93	89.72	63.41	60.09	146.67	174.87	154.65	170.59	301.72	87.73	93.05	320.06	173.74	186.62	355.49	477.91	125.97	142.89	165.07	112.86	175.37	197.24	140.23	154.53	181.71	409.75	-	39.62	132.47	60.24	132.54	96.23	169.29
cunner	0.09	0.05	0.05	0.06	0.05	0.06	0.05	0.08	0.09	0.05	0.05	0.03	0.01	0.05	0.08	0.06	0.07	0.04	0.03	0.06	0.04	0.05	0.02	0.01	0.05	0.05	-	0.01	0.03	0.01	0.02	0.01	
dogfish, smooth *	2.47	1.92	1.43	0.81	0.91	0.41	0.55	0.46	0.78	0.95	0.49	0.46	0.80	0.59	0.72	0.93	1.88	1.69	3.58	3.10	1.44	1.41	0.94	2.27	0.63	1.13	-	1.43	2.41	4.13	5.78	7.30	1.55
dogfish, spiny	0.04	0.00	0.00	0.03	0.01	0.00	0.12	0.00	0.02	0.05	0.10	0.00	0.01	0.04	0.07	0.03	0.04	0.16	0.05	0.00	0.18	0.22	0.00	0.00	0.11	0.08	-	0.01	0.01	0.00	0.00	0.00	
flounder, fourspot	1.18	1.03	0.50	0.37	1.73	0.80	1.47	0.74	1.44	1.55	1.33	0.44	2.05	3.29	1.63	1.19	1.15	1.17	1.09	0.96	1.14	1.11	0.65	0.73	1.30	1.82	-	1.35	0.81	0.42	0.86	0.41	
flounder, summer *	0.99	1.19	1.73	1.40	1.42	0.14	0.87	1.26	1.02	1.11	0.55	0.54	2.19	2.50	1.72	2.68	1.91	4.42	6.12	3.39	1.95	2.41	1.35	1.89	3.09	3.12	-	2.56	3.74	3.07	1.71	2.03	2.07
flounder, windowpane	22.11	11.56	7.32	6.85	12.10	8.68	7.19	4.71	6.79	9.48	3.89	2.43	28.13	13.36	4.64	2.53	2.81	1.81	1.86	3.39	2.27	6.14	1.54	3.65	7.95	5.59	-	5.32	3.38	3.13	2.42	1.67	
flounder, winter	7.31	2.75	3.86	5.42	10.07	11.03	15.42	6.10	6.41	9.32	6.13	3.77	12.29	7.75	6.69	8.66	7.08	3.07	1.74	1.25	2.19	2.15	0.94	0.82	2.26	1.55	-	1.27	1.37	0.33	0.44	0.81	
hake, red	0.74	0.33	1.00	0.37	0.75	1.14	0.44	0.33	0.39	1.81	0.59	0.20	1.62	0.89	0.53	0.29	1.20	0.41	0.15	0.73	0.76	0.45	0.33	0.54	0.41	0.90	-	0.60	0.21	0.39	0.66	1.14	
hake, silver	0.55	0.23	1.65	0.01	0.30	0.60	0.96	0.32	0.48	0.20	3.34	0.22	0.06	0.80	0.07	0.16	0.09	0.07	0.07	0.18	0.18	0.09	0.64	0.04	0.28	0.18	-	0.41	0.40	0.12	0.11	0.16	
hake, spotted *	0.28	0.17	0.21	0.14	0.10	0.05	0.11	0.03	0.39	1.48	0.50	0.16	1.68	0.12	0.41	0.61	1.18	0.35	0.86	1.95	0.14	0.32	0.56	0.39	0.69	1.11	-	2.62	1.15	1.93	1.49	0.91	0.71
herring, Atlantic	0.00	0.00	0.01	0.02	0.40	0.08	0.04	0.03	1.47	0.14	0.14	0.00	0.19	0.06	0.25	0.00	0.02	0.00	0.00	0.38	0.02	0.02	0.03	0.02	0.02	0.06	-	0.04	0.00	0.03	0.03	0.10	
herring, blueback *	0.38	0.16	0.07	0.13	0.53	0.34	0.10	0.04	0.08	0.11	0.93	0.27	0.05	0.75	0.16	0.06	0.06	0.20	0.06	0.10	0.09	0.06	0.15	0.24	0.05	0.09	-	0.08	0.01	0.00	0.04	0.17	0.18
hogchoker *	0.90	0.56	0.21	0.17	0.30	0.17	0.22	0.38	0.15	0.18	0.05	0.07	0.18	0.05	0.05	0.19	0.10	0.15	0.21	0.26	0.15	0.13	0.11	0.20	0.12	0.09	-	0.59	0.94	0.65	0.67	1.06	0.27
kingfish, northern *	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.02	0.06	0.03	0.19	0.04	0.04	0.12	0.05	0.01	0.02	0.01	0.00	0.04	0.03	0.00	0.04	0.05	0.05	-	0.21	0.24	0.09	0.23	0.38	0.05
lobster, American **	7.41	3.33	4.75	5.95	3.54	3.75	7.29	9.90	9.52	11.50	10.13	8.05	10.07	19.60	10.47	11.18	6.83	4.28	2.68	3.03	3.68	2.10	1.48	1.21	2.07	1.82	-	0.38	0.29	0.16	0.09	0.08	5.55
menhaden, Atlantic *	0.23	0.15	0.79	0.14	0.13	0.45	0.66	0.59	2.00	0.40	1.02	0.56	0.43	0.57	0.73	1.08	0.97	0.32	0.76	0.95	1.63	0.94	0.23	0.80	0.47	0.28	-	0.74	0.94	0.39	0.61	2.49	0.67
moonfish *	0.05	0.33	0.11	0.04	0.41	0.10	0.04	0.17	0.22	0.04	0.34	0.25	1.99	0.91	2.08	1.15	2.11	0.82	1.36	0.69	0.74	1.55	1.51	1.66	5.08	10.03	-	1.50	0.79	2.62	3.92	1.06	1.42
ocean pout	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	
rockling, fourbeard	0.08	0.01	0.04	0.05	0.21	0.15	0.07	0.04	0.06	0.03	0.06	0.01	0.11	0.07	0.03	0.04	0.12	0.03	0.01	0.04	0.04	0.01	0.00	0.02	0.06	0.04	-	0.03	0.01	0.00	0.00	0.01	
scad, rough *	0.13	0.08	0.03	0.27	0.42	0.08	0.08	0.01	0.00	0.21	0.03	0.00	0.18	0.05	0.00	0.00	0.00	0.07	0.07	0.14	0.09	0.19	0.15	0.08	0.00	0.38	-	0.32	0.12	0.14	0.04	0.37	0.11
sculpin, longhorn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	
scup *	10.72	30.97	25.76	18.54	39.70	65.09	69.48	311.57	83.73	77.06	92.52	59.14	61.46	41.28	103.27	537.68	521.10	177.64	348.70	152.23	291.46	424.06	116.75	475.29	303.26	139.38	-	198.23	223.52	40.68	182.58	422.23	174.10
sea raven	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	
searobin, northern	0.20	0.22	0.31	0.03	0.38	0.18	0.43	0.43	0.15	0.25	0.80	0.12	0.27	0.14	0.93	0.62	0.47	1.15	1.25	0.51	1.03	0.68	0.21	1.05	1.11	0.88	-	1.19	2.07	1.56	2.70	0.84	
searobin, striped *	2.75	3.44	1.64	0.90	3.44	3.83	2.39	1.97	2.75	4.44	2.00	0.74	4.03	2.62	3.68	4.48	5.68	3.34	4.85	6.44	4.67	3.26	0.81	2.25	3.66	3.54	-	4.10	7.06	5.29	5.83	6.93	3.53
shad, American *	3.13	0.19	0.27	0.29	2.66	3.10	0.65	0.72	0.54	1.11	1.84	1.90	0.27	0.91	1.22	1.73	0.55	0.41	0.76	0.75	0.95	0.54	0.12	0.38	0.41	0.46	-	0.42	0.44	0.31	0.20	0.71	0.91
shad, hickory *	0.02	0.01	0.03	0.01	0.00	0.00	0.01	0.00	0.05	0.04	0.10	0.04	0.09	0.10	0.05	0.12	0.09	0.03	0.04	0.09	0.13	0.25	0.24	0.08	0.03	0.06	-	0.05	0.19	0.16	0.04	0.02	0.07
skate, clearnose *	0.00	0.00	0.02	0.02	0.00	0.00	0.02	0.02	0.05	0.04	0.01	0.02	0.01	0.03	0.12	0.10	0.10	0.34	0.18	0.33	0.10	0.48	0.23	0.44	0.38	0.24	-	0.27	0.73	0.68	0.34	0.47	0.18
skate, little	4.41	3.62	4.01	2.72	8.13	4.31	7.50	5.24	5.52	10.00	6.41	3.37	11.55	6.90	7.73	5.23	5.25	5.07	5.39	2.99	3.12	3.90	1.03	1.09	1.28	0.99	-	0.84	1.14	0.63	0.82	0.55	
skate, winter	0.00	0.01	0.00	0.00	0.03	0.03	0.05	0.02	0.07	0.09	0.12	0.07	0.17	0.08	0.05	0.06	0.01	0.13	0.13	0.00	0.07	0.10	0.00	0.06	0.21	0.10	-	0.05	0.17	0.12	0.09	0.04	
spot *	0.00	0.18	0.20	0.02	0.09	0.00	0.04	0.02	0.00	0.38	0.18	0.03	0.99	0.08	0.00	0.28	0.63	0.08	0.35	0.00	0.07	0.00	0.19	0.00	2.67	0.01	-	0.04	1.60	1.70	0.16	0.10	0.33
squid, long-finned **	nc	nc	27.40	28.60	159.16	85.60	69.12	62.97	172.95	272.11	127.96	155.28	180.99	68.57	202.29	132.50	109.87	60.18	35.48	269.32	94.47	81.12	70.58	179.39	114.99	187.15	-	85.68	62.53	32.59	112.67	195.00	115.77
striped bass	0.01	0.00	0.01	0.01	0.03	0.00	0.00	0.05	0.05	0.09	0.06	0.08	0.13	0.40	0.18	0.23	0.27	0.23	0.37	0.12	0.77	0.25	0.47	0.38	0.44	0.30	-	0.24	0.17	0.26	0.17	0.26	
sturgeon, Atlantic *	0.03	0.01	0.03	0.03	0.00	0.02	0.02	0.01	0.08	0.08	0.06	0.02	0.01	0.02	0.02	0.07	0.03	0.08	0.05	0.10	0.04	0.03	0.10	0.05	0.06	0.10	-	0.02	0.02	0.01	0.05	0.01	0.04
tautog	0.72	0.32	0.22	0.50	0.25	0.17	0.16	0.23	0.20	0.15	0.14	0.11	0.07	0.11	0.23	0.36	0.23	0.20	0.26	0.37	0.16	0.19	0.20	0.13	0.23	0.08	-	0.07	0.14	0.15	0.18	0.15	
weakfish *	1.55	6.35	13.57	0.73	3.54	8.69	5.71	12.11	3.22	4.18	11.21	5.64	15.49	12.93	5.28	31.36	63.42	40.51	41.45	49.46	59.07	26.00	1.50	63.96	9.11	6.65	-	12.27	22.27	7.50	41.56	31.05	19.54

Table 5.20. Finfish and invertebrate biomass indices for the spring sampling period, 1992-2015.
The geometric mean weight (kg) per tow was calculated for 38 finfish and 15 invertebrate species for the spring (April-June) sampling period.

	Spring																							
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
alewife	0.06	0.17	0.32	0.15	0.50	0.25	0.20	0.37	0.34	0.15	0.25	0.19	0.25	0.22	0.21	0.31	0.22	0.24	0.16	0.17	0.17	0.20	0.18	0.12
black sea bass	0.01	0.03	0.06	0.03	0.06	0.06	0.02	0.05	0.07	0.17	0.40	0.17	0.15	0.07	0.04	0.14	0.10	0.21	0.18	0.18	0.34	0.43	1.37	1.44
bluefish	0.45	0.08	0.13	0.04	0.10	0.23	0.17	0.35	0.09	0.08	0.36	0.20	0.12	0.14	0.23	0.21	0.11	0.30	0.03	0.24	0.11	0.18	0.03	0.01
butterfish	0.43	0.10	0.31	0.19	0.73	1.27	1.06	0.52	0.69	0.79	1.48	0.64	0.41	0.55	2.30	0.66	1.06	1.37	0.49	2.69	1.87	0.66	0.61	0.66
cunner	0.02	0.04	0.01	0.03	0.02	0.03	0.04	0.04	0.03	0.04	0.05	0.03	0.02	0.02	0.01	0.02	0.02	0.01	0.02	0.02	0.01	0.01	0.00	0.01
dogfish, smooth	1.04	0.44	1.14	0.63	0.83	0.42	0.90	1.05	0.85	0.82	2.31	1.10	0.87	0.77	2.83	1.14	1.88	2.07	0.18	2.90	1.68	1.32	1.27	1.41
dogfish, spiny	0.10	0.02	0.12	0.00	0.00	0.01	0.03	0.02	0.00	0.08	0.06	0.07	0.07	0.05	0.21	0.25	0.15	0.84	0.07	0.37	0.11	0.16	0.12	0.20
flounder, fourspot	2.19	0.75	0.75	1.48	1.37	2.08	1.28	0.96	1.31	1.28	1.35	1.01	1.03	0.44	0.60	1.05	0.93	0.64	0.62	1.23	1.60	0.75	0.65	0.34
flounder, summer	0.35	0.27	0.48	0.16	0.53	0.60	1.15	1.09	1.35	1.21	2.38	2.45	1.69	0.67	0.61	1.72	1.44	1.40	1.28	2.73	2.22	2.16	2.09	1.07
flounder, windowpane	1.96	2.53	2.96	1.60	4.76	4.16	3.21	2.38	1.69	1.97	1.31	1.21	1.32	0.54	0.63	2.51	2.04	1.29	2.20	1.86	1.74	1.32	1.26	0.78
flounder, winter	8.72	7.54	9.44	6.51	14.61	10.63	9.65	6.67	7.46	9.77	6.31	6.64	3.87	2.94	1.65	4.99	3.84	2.94	4.26	3.60	2.72	2.26	1.46	1.01
hake, red	0.78	0.85	0.14	0.66	0.21	0.33	0.94	1.05	0.59	0.45	0.96	0.13	0.20	0.22	0.25	0.67	0.61	0.23	0.47	0.09	0.65	0.24	0.11	0.03
hake, silver	0.20	0.14	0.40	0.36	0.12	0.39	0.48	0.56	0.19	0.54	0.52	0.06	0.16	0.05	0.33	0.10	1.02	0.27	0.33	0.26	0.87	0.15	0.07	0.03
hake, spotted	0.01	0.01	0.00	0.02	0.03	0.09	0.03	0.13	0.27	0.17	0.20	0.13	0.18	0.05	0.14	0.11	0.31	0.07	0.14	0.21	0.22	0.20	0.15	0.05
herring, Atlantic	1.06	2.03	1.09	1.77	0.55	0.88	0.25	0.22	0.42	0.26	0.14	0.19	0.12	0.32	0.09	0.55	0.19	0.37	0.65	0.30	0.17	0.60	0.32	0.18
herring, blueback	0.05	0.02	0.06	0.03	0.04	0.04	0.02	0.00	0.04	0.02	0.01	0.02	0.04	0.04	0.02	0.04	0.02	0.06	0.04	0.02	0.01	0.03	0.02	0.03
hogchoker	0.04	0.02	0.02	0.01	0.02	0.01	0.01	0.01	0.03	0.04	0.04	0.04	0.04	0.03	0.02	0.05	0.03	0.02	0.04	0.06	0.07	0.09	0.10	0.05
kingfish, northern	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
menhaden, Atlantic	0.07	0.03	0.03	0.04	0.01	0.01	0.00	0.00	0.02	0.00	0.03	0.01	0.01	0.00	0.02	0.07	0.03	0.04	0.03	0.07	0.29	0.22	0.37	0.39
moonfish	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ocean pout	0.07	0.09	0.04	0.04	0.04	0.03	0.02	0.02	0.03	0.01	0.03	0.02	0.03	0.00	0.01	0.02	0.01	0.03	0.01	0.03	0.01	0.00	0.00	0.00
rockling, fourbeard	0.13	0.10	0.05	0.10	0.05	0.11	0.08	0.13	0.09	0.12	0.06	0.06	0.08	0.05	0.02	0.05	0.05	0.03	0.03	0.03	0.03	0.00	0.00	0.01
scad, rough	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
sculpin, longhorn	0.06	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.03	0.01	0.01	0.01	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
scup	0.48	0.49	0.58	0.65	0.73	0.75	0.75	0.56	4.56	2.85	13.16	2.28	3.93	1.65	10.41	3.35	5.88	6.40	3.14	9.55	9.99	6.47	5.61	3.53
sea raven	0.03	0.00	0.00	0.00	0.01	0.00	0.05	0.03	0.05	0.02	0.03	0.01	0.01	0.00	0.00	0.02	0.00	0.01	0.02	0.01	0.01	0.00	0.01	0.00
searobin, northern	0.26	0.35	0.28	0.27	0.28	0.33	0.17	0.22	0.70	0.51	0.51	0.40	0.29	0.08	0.35	0.26	0.23	0.44	0.52	0.30	0.81	0.34	0.39	0.22
searobin, striped	0.86	0.30	0.51	0.77	0.46	0.40	0.87	1.14	1.99	1.40	2.21	1.21	0.97	0.22	0.49	0.56	0.65	1.34	0.47	1.81	2.25	1.54	1.53	1.21
shad, American	0.29	0.09	0.21	0.10	0.11	0.23	0.13	0.20	0.05	0.01	0.11	0.03	0.04	0.05	0.05	0.07	0.08	0.07	0.07	0.07	0.10	0.06	0.07	0.06
shad, hickory	0.01	0.01	0.01	0.01	0.03	0.02	0.05	0.06	0.05	0.03	0.09	0.05	0.04	0.10	0.11	0.05	0.00	0.01	0.00	0.00	0.02	0.01	0.05	0.02
skate, clearnose	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.03	0.04	0.06	0.13	0.07	0.04	0.02	0.08	0.12	0.08	0.11	0.02	0.11	0.54	0.17	0.21	0.23
skate, little	5.89	5.99	8.87	3.38	9.35	6.00	6.27	4.25	3.43	4.47	4.56	4.35	4.01	1.05	0.91	1.82	0.97	0.71	0.66	0.79	1.34	0.74	0.71	0.41
skate, winter	0.37	0.52	0.28	0.21	0.46	0.29	0.46	0.27	0.25	0.21	0.25	0.24	0.28	0.12	0.22	0.23	0.19	0.23	0.15	0.25	0.46	0.25	0.33	0.12
spot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00
striped bass	0.31	0.43	0.45	0.49	0.77	1.13	1.15	1.86	1.13	0.93	2.10	1.38	0.87	1.52	1.27	1.37	0.86	0.93	0.66	0.96	0.58	0.98	0.54	0.29
sturgeon, Atlantic	0.05	0.05	0.08	0.03	0.02	0.04	0.13	0.08	0.05	0.03	0.16	0.00	0.00	0.05	0.15	0.06	0.02	0.02	0.02	0.08	0.10	0.06	0.00	0.00
tautog	1.00	0.51	0.51	0.19	0.63	0.42	0.49	0.51	0.59	0.78	1.09	0.61	0.62	0.65	0.84	0.61	0.60	0.51	0.30	0.44	0.38	0.40	0.51	0.42
weakfish	0.11	0.03	0.01	0.05	0.06	0.15	0.20	0.31	0.12	0.11	0.12	0.03	0.04	0.09	0.12	0.08	0.02	0.04	0.01	0.04	0.39	0.22	0.08	0.01
Invertebrates																								
crab, blue	0.03	0.02	0.00	0.02	0.00	0.02	0.02	0.03	0.04	0.01	0.04	0.01	0.01	0.00	0.01	0.04	0.02	0.00	0.02	0.03	0.04	0.03	0.00	0.00
crab, flat claw hermit	0.15	0.08	0.18	0.02	0.09	0.04	0.10	0.10	0.07	0.12	0.14	0.32	0.17	0.05	0.04	0.11	0.09	0.12	0.08	0.09	0.05	0.07	0.07	0.03
crab, horseshoe	0.35	0.45	0.60	0.13	0.61	0.33	0.55	0.80	0.74	0.94	0.76	1.33	0.96	0.39	0.25	0.86	0.62	0.65	0.52	0.81	0.55	0.70	0.45	0.38
crab, lady	0.25	0.23	0.16	0.18	0.50	0.50	0.39	0.16	0.13	0.04	0.07	0.01	0.01	0.01	0.04	0.02	0.02	0.01	0.06	0.11	0.06	0.01	0.01	0.01
crab, rock	1.17	0.61	0.64	0.14	0.45	0.32	1.04	0.55	0.25	0.35	0.31	0.36	0.14	0.05	0.16	0.16	0.20	0.18	0.13	0.25	0.16	0.06	0.03	0.02
crab, spider	0.98	1.08	1.22	0.32	0.96	0.52	0.69	0.39	0.35	1.02	1.30	1.85	1.42	0.36	0.27	0.55	0.57	0.46	0.70	0.78	0.74	0.62	0.55	0.42
jellyfish, lion's mane	0.01	0.11	0.01	0.15	0.10	0.08	0.19	0.06	0.06	0.03	0.02	0.23	0.14	0.38	0.11	0.00	0.10	0.03	0.08	0.08	0.01	0.16	0.14	0.05
lobster, American	2.80	2.32	1.53	3.24	2.72	3.02	6.56	4.95	3.90	3.04	2.55	1.48	1.03	1.00	0.84	1.24	1.18	0.62	0.55	0.30	0.33	0.17	0.15	0.12
mussel, blue	0.31	0.01	0.07	0.03	0.03	0.01	0.05	0.03	0.04	0.01	0.17	0.08	0.11	0.09	0.04	0.04	0.02	0.00	0.02	0.02	0.04	0.06	0.08	0.02
northern moon shell	0.05	0.04	0.12	0.03	0.02	0.02	0.04	0.05	0.05	0.08	0.10	0.10	0.06	0.02	0.00	0.03	0.03	0.04	0.04	0.04	0.01	0.02	0.03	0.02
oyster, common	0.04	0.00	0.06	0.00	0.00	0.01	0.02	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.03	0.01	0.00	0.02	0.00	0.01
shrimp, mantis	0.06	0.13	0.05	0.05	0.04	0.03	0.03	0.07	0.18	0.08	0.04	0.03	0.03	0.01	0.02	0.05	0.04	0.04	0.01	0.07	0.05	0.05	0.03	0.02
squid, long-finned	1.01	0.91	0.67	0.89	0.55	0.99	0.41	0.62	0.51	0.41	0.42	0.42	1.69	1.08	1.41	0.33	0.40	0.92	0.77	0.61	0.43	0.20	0.76	0.55
starfish sp.	0.22	0.13	0.06	0.02	0.03	0.03	0.05	0.04	0.06	0.28	0.24	0.29	0.12	0.06	0.03	0.09	0.13	0.11	0.12	0.09	0.02	0.01	0.01	0.01
whelks	0.16	0.04	0.07	0.01	0.07	0.03	0.06	0.08	0.09	0.13	0.12	0.31	0.15	0.05	0.05	0.12	0.11	0.08	0.05	0.13	0.06	0.10	0.05	0.03

Table 5.21. Finfish and invertebrate biomass indices for the fall sampling period, 1992-2015.
The geometric mean weight (kg) per tow was calculated for 38 finfish and 15 invertebrate species for the fall (Sept-Oct) sampling period. There was no fall sampling in 2010.

	Fall																							
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
alewife	0.03	0.08	0.10	0.02	0.04	0.22	0.02	0.07	0.02	0.09	0.03	0.09	0.04	0.05	0.01	0.14	0.04	0.02	-	0.06	0.01	0.03	0.03	0.10
black sea bass	0.01	0.01	0.01	0.00	0.01	0.01	0.05	0.07	0.07	0.23	0.31	0.08	0.08	0.08	0.07	0.14	0.23	0.07	-	0.15	0.33	0.46	0.82	0.49
bluefish	16.39	9.91	9.45	8.09	7.62	6.53	5.06	8.51	8.34	6.11	7.87	8.99	16.39	8.75	3.92	9.74	9.19	6.40	-	3.84	3.72	2.73	3.91	2.06
butterfish	6.31	4.12	3.40	10.26	9.30	6.97	13.27	15.43	4.45	7.80	6.56	3.47	6.24	7.85	7.73	5.82	8.97	14.39	-	2.81	6.14	3.62	5.97	4.08
cunner	0.02	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.00	0.00	0.00	0.01	-	0.00	0.01	0.00	0.00	0.00
dogfish, smooth	1.20	1.75	0.76	0.85	1.16	1.09	1.32	1.27	2.85	3.02	6.09	6.18	2.95	2.70	2.46	6.23	1.25	2.80	-	3.66	4.69	7.93	11.05	11.70
dogfish, spiny	0.03	0.08	0.18	0.00	0.01	0.05	0.10	0.05	0.06	0.24	0.07	0.00	0.27	0.34	0.00	0.00	0.18	0.18	-	0.01	0.01	0.00	0.00	0.00
flounder, fourspot	0.14	0.16	0.14	0.08	0.48	0.24	0.19	0.14	0.35	0.17	0.25	0.30	0.29	0.19	0.06	0.19	0.16	0.21	-	0.11	0.14	0.05	0.10	0.06
flounder, summer	0.87	0.85	0.47	0.43	1.61	1.84	1.77	2.27	1.77	3.19	4.41	3.27	1.74	1.93	1.36	1.65	1.97	2.41	-	1.82	2.74	2.18	1.41	1.54
flounder, windowpane	0.51	0.73	0.42	0.32	2.11	1.30	0.61	0.38	0.45	0.30	0.38	0.43	0.26	0.57	0.29	0.42	0.98	0.64	-	0.68	0.61	0.57	0.47	0.37
flounder, winter	0.84	0.99	0.78	0.45	1.56	1.04	0.87	1.37	1.28	0.62	0.55	0.34	0.32	0.41	0.16	0.22	0.49	0.26	-	0.28	0.40	0.11	0.17	0.22
hake, red	0.11	0.34	0.19	0.04	0.48	0.18	0.10	0.06	0.32	0.07	0.02	0.19	0.14	0.10	0.06	0.12	0.09	0.13	-	0.14	0.04	0.08	0.14	0.28
hake, silver	0.04	0.02	0.28	0.02	0.01	0.06	0.01	0.03	0.01	0.01	0.01	0.02	0.02	0.01	0.08	0.01	0.03	0.02	-	0.04	0.05	0.02	0.01	0.03
hake, spotted	0.09	0.30	0.15	0.04	0.37	0.03	0.08	0.17	0.34	0.09	0.19	0.41	0.03	0.08	0.17	0.10	0.16	0.23	-	0.53	0.27	0.38	0.36	0.28
herring, Atlantic	0.07	0.01	0.01	0.00	0.02	0.01	0.02	0.00	0.00	0.00	0.00	0.03	0.00	0.01	0.00	0.00	0.00	0.01	-	0.00	0.00	0.00	0.00	0.01
herring, blueback	0.01	0.01	0.12	0.03	0.01	0.09	0.02	0.01	0.01	0.05	0.01	0.01	0.01	0.01	0.01	0.03	0.00	0.01	-	0.01	0.00	0.00	0.01	0.03
hogchoker	0.02	0.03	0.01	0.01	0.04	0.01	0.01	0.04	0.02	0.03	0.05	0.04	0.03	0.03	0.02	0.04	0.02	0.02	-	0.11	0.17	0.11	0.10	0.23
kingfish, northern	0.00	0.01	0.00	0.03	0.01	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.00	-	0.04	0.04	0.02	0.03	0.07
menhaden, Atlantic	0.36	0.22	0.36	0.25	0.25	0.24	0.09	0.39	0.22	0.05	0.35	0.25	0.49	0.43	0.06	0.29	0.12	0.10	-	0.39	0.47	0.18	0.31	0.99
moonfish	0.02	0.00	0.03	0.03	0.12	0.05	0.13	0.09	0.13	0.04	0.08	0.03	0.04	0.07	0.07	0.11	0.27	0.21	-	0.07	0.04	0.11	0.20	0.12
ocean pout	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00
rockling, fourbeard	0.01	0.00	0.01	0.00	0.02	0.01	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01	-	0.00	0.00	0.00	0.00	0.00
scad, rough	0.00	0.03	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.00	0.03	-	0.05	0.01	0.01	0.01	0.06
sculpin, longhorn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00
scup	4.96	3.72	3.33	4.63	3.68	2.49	4.50	22.72	30.76	11.28	23.69	28.95	16.31	13.79	10.49	24.42	16.53	13.73	-	20.28	13.54	6.47	10.71	20.95
sea raven	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00
searobin, northern	0.02	0.05	0.06	0.02	0.04	0.02	0.08	0.06	0.08	0.13	0.18	0.11	0.11	0.09	0.05	0.08	0.09	0.08	-	0.11	0.22	0.23	0.24	0.10
searobin, striped	0.82	0.54	0.32	0.34	0.81	0.60	1.04	1.37	1.59	1.27	2.12	2.43	0.96	0.82	0.38	0.37	0.94	0.61	-	1.12	2.81	2.66	2.26	2.84
shad, American	0.14	0.35	0.39	0.43	0.06	0.16	0.26	0.42	0.14	0.07	0.16	0.17	0.15	0.10	0.02	0.05	0.08	0.11	-	0.09	0.08	0.06	0.03	0.12
shad, hickory	0.03	0.02	0.04	0.02	0.05	0.05	0.02	0.07	0.05	0.02	0.02	0.05	0.07	0.14	0.11	0.03	0.01	0.02	-	0.01	0.09	0.08	0.02	0.01
skate, clearnose	0.06	0.05	0.01	0.04	0.01	0.05	0.17	0.15	0.15	0.53	0.30	0.46	0.17	0.71	0.30	0.69	0.64	0.40	-	0.41	1.01	0.93	0.54	0.66
skate, little	2.47	4.61	3.47	1.78	5.66	3.81	4.06	2.85	2.92	2.88	3.00	1.96	2.02	2.32	0.67	0.65	0.82	0.64	-	0.58	0.66	0.44	0.58	0.38
skate, winter	0.11	0.15	0.21	0.09	0.25	0.10	0.09	0.08	0.01	0.21	0.21	0.00	0.11	0.16	0.00	0.12	0.31	0.18	-	0.07	0.20	0.15	0.12	0.05
spot	0.00	0.07	0.03	0.00	0.14	0.01	0.00	0.06	0.13	0.01	0.08	0.00	0.01	0.00	0.03	0.00	0.34	0.00	-	0.01	0.41	0.47	0.02	0.02
striped bass	0.09	0.16	0.11	0.15	0.21	0.68	0.38	0.39	0.51	0.48	0.70	0.26	1.25	0.48	0.88	0.64	0.79	0.61	-	0.43	0.26	0.44	0.26	0.38
sturgeon, Atlantic	0.21	0.19	0.13	0.10	0.02	0.06	0.04	0.21	0.08	0.23	0.18	0.27	0.09	0.12	0.23	0.13	0.21	0.29	-	0.10	0.10	0.03	0.11	0.04
tautog	0.22	0.22	0.15	0.09	0.07	0.14	0.27	0.31	0.30	0.20	0.27	0.43	0.21	0.23	0.23	0.16	0.20	0.07	-	0.05	0.08	0.11	0.12	0.08
weakfish	0.47	0.56	1.26	1.27	1.88	1.70	0.94	3.39	3.17	2.41	2.86	1.72	2.85	2.52	0.42	3.51	1.17	0.66	-	1.37	1.88	0.99	2.13	3.12
Invertebrates																								
crab, blue	0.15	0.17	0.05	0.04	0.04	0.11	0.10	0.17	0.11	0.05	0.10	0.06	0.02	0.00	0.01	0.07	0.02	0.04	-	0.09	0.07	0.05	0.02	0.04
crab, flat claw hermit	0.17	0.40	0.15	0.11	0.26	0.16	0.35	0.16	0.17	0.33	0.30	0.13	0.18	0.16	0.05	0.12	0.24	0.16	-	0.12	0.13	0.12	0.05	0.04
crab, horseshoe	1.01	1.16	0.55	0.32	1.27	1.32	0.93	1.09	1.31	1.39	1.76	1.67	1.93	0.93	1.00	1.40	1.92	1.21	-	1.25	0.65	1.21	0.87	0.58
crab, lady	1.52	1.58	1.52	1.56	3.54	1.84	0.82	0.48	0.60	0.17	0.14	0.10	0.08	0.14	0.07	0.07	0.25	0.18	-	0.30	0.20	0.07	0.06	0.02
crab, rock	0.58	0.55	0.18	0.09	0.45	0.32	0.37	0.22	0.19	0.13	0.12	0.04	0.08	0.02	0.10	0.04	0.28	0.09	-	0.09	0.05	0.03	0.01	0.00
crab, spider	0.53	1.89	0.46	0.25	0.71	0.42	0.25	0.24	0.21	0.30	0.27	0.47	0.32	0.13	0.10	0.15	0.25	0.29	-	0.21	0.18	0.21	0.10	0.07
jellyfish, lion's mane	0.02	0.01	0.03	0.17	0.18	0.50	0.17	0.03	0.22	0.17	0.10	0.01	0.13	0.12	0.46	0.45	0.02	0.58	-	0.01	0.03	0.59	0.07	0.00
lobster, American	3.17	4.11	3.58	3.03	3.48	7.22	4.24	4.16	2.65	1.91	1.10	1.28	1.46	0.84	0.61	0.51	0.80	0.77	-	0.12	0.10	0.06	0.04	0.04
mussel, blue	0.07	0.06	0.12	0.02	0.00	0.01	0.09	0.00	0.04	0.12	0.11	0.02	0.10	0.10	0.02	0.07	0.04	0.03	-	0.03	0.02	0.16	0.06	0.01
northern moon shell	0.03	0.02	0.03	0.01	0.01	0.00	0.02	0.01	0.00	0.04	0.10	0.00	0.00	0.01	0.00	0.00	0.03	0.01	-	0.00	0.00	0.01	0.00	0.00
oyster, common	0.01	0.02	0.00	0.00	0.00	0.01	0.00	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.01	-	0.00	0.01	0.00	0.00	0.00
shrimp, mantis	0.05	0.08	0.02	0.02	0.13	0.06	0.02	0.09	0.18	0.05	0.06	0.02	0.04	0.03	0.04	0.06	0.08	0.06	-	0.22	0.20	0.14	0.11	0.08
squid, long-finned	5.00	7.92	4.71	4.68	5.53	2.20	6.40	6.06	4.05	2.39	1.81	5.88	3.38	3.47	2.15	6.51	4.29	4.25	-	2.52	2.28	1.25	4.01	10.03
starfish sp.	0.11	0.08	0.07	0.00	0.01	0.02	0.05	0.02	0.12	0.22	0.09	0.01	0.10	0.11	0.02	0.05	0.09	0.06	-	0.03	0.00	0.01	0.01	0.00
whelks	0.28	0.28	0.06	0.08	0.22	0.10	0.27	0.23	0.38	0.52	0.38	0.24	0.24	0.20	0.08	0.20	0.30	0.20	-	0.21	0.15	0.17	0.09	0.15

Table 5.22. Bluefish indices of abundance, 1984-2015.

Using September and October length data, the geometric mean catch per tow was calculated for two age groups of bluefish: age-0 and all fish age 1 and older. Age-0 was defined as bluefish less than 30 cm fork length.

	Fall			
Year	age 0 count / tow	age 0 kg / tow	ages 1+ count / tow	ages 1+ kg / tow
1984	20.34	2.51	1.61	2.03
1985	11.27	1.64	4.16	6.25
1986	8.05	1.13	3.77	5.96
1987	9.01	0.88	3.11	4.85
1988	10.73	1.59	2.20	4.43
1989	21.07	3.17	1.92	3.80
1990	12.82	2.09	6.14	8.92
1991	22.57	2.75	5.59	8.49
1992	9.23	1.27	8.44	14.88
1993	11.61	1.96	3.34	7.11
1994	24.85	2.54	3.07	6.09
1995	16.85	2.48	4.07	5.32
1996	13.85	2.27	2.34	4.09
1997	31.26	2.56	2.35	3.68
1998	25.89	2.08	1.65	2.70
1999	39.19	5.43	0.86	1.61
2000	14.67	2.97	2.18	3.75
2001	19.04	2.11	2.62	3.87
2002	12.35	2.25	3.63	4.81
2003	16.85	3.16	2.16	3.31
2004	13.30	2.39	10.38	13.96
2005	12.10	2.39	2.65	5.04
2006	12.43	1.49	2.14	2.74
2007	23.98	4.14	2.44	4.22
2008	6.14	0.82	4.52	8.18
2009	11.65	1.16	3.18	5.09
2010	-	-	-	-
2011	8.21	1.34	1.40	2.36
2012	13.11	1.86	0.97	1.67
2013	7.86	0.87	0.96	1.82
2014	16.53	2.22	0.88	1.47
2015	7.47	1.04	0.42	0.93
84-14 mean	**15.87**	**2.18**	**3.24**	**5.21**

Table 5.23. Scup indices-at-age, 1984-2015.

Spring (May and June) and fall (September and October) catch and age data were used to determine the geometric mean indices-at-age[1]. The spring and fall age keys were used to expand length frequencies to age frequencies and then the spring and fall overall indices were proportioned by the percentage of fish in each age. The 0-10+ index represents the overall index (sum of ages 0-10+), and the adult 2+ index is provided as the sum of ages 2-10+ index. Fish older than age 9 were included in the age 10+ index[2].

Spring (May-June)

Year	0-10+	2+	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10+
1984	2.797	2.308	0	0.489	1.311	0.577	0.307	0.074	0.004	0.002	0	0	0.034
1985	5.648	2.707	0	2.941	2.002	0.327	0.244	0.047	0.025	0.050	0	0.004	0.008
1986	7.230	2.785	0	4.444	1.651	0.988	0.137	0.003	0.003	0.003	0	0	0.003
1987	2.186	1.758	0	0.428	1.646	0.071	0.034	0.007	0	0	0	0	0
1988	2.061	0.893	0	1.168	0.309	0.502	0.054	0.026	0	0	0	0	0.003
1989	6.249	0.615	0	5.634	0.563	0.034	0.016	0.000	0.001	0.001	0	0	0
1990	4.867	2.345	0	2.521	2.098	0.206	0.037	0.005	0	0	0	0	0
1991	7.046	2.795	0	4.251	1.436	1.258	0.086	0.012	0.002	0	0	0	0
1992	1.749	1.360	0	0.389	1.212	0.093	0.052	0.002	0	0.002	0	0	0
1993	2.530	2.492	0	0.038	2.286	0.189	0.006	0.006	0.002	0.002	0	0	0
1994	3.892	3.093	0	0.799	2.038	0.931	0.100	0.015	0.003	0.007	0	0	0
1995	13.587	0.645	0	12.943	0.387	0.199	0.052	0.003	0.003	0	0	0	0
1996	7.766	2.562	0	5.204	2.477	0.074	0.004	0.006	0.002	0	0	0	0
1997	7.558	4.394	0	3.164	2.610	1.679	0.063	0.009	0.023	0.005	0.005	0	0
1998	10.826	0.761	0	10.065	0.578	0.115	0.063	0.005	0	0	0	0	0
1999	4.732	2.021	0	2.711	1.755	0.162	0.074	0.030	0	0	0	0	0
2000	146.224	21.711	0	124.513	17.184	4.237	0.195	0.064	0.030	0	0	0	0
2001	22.486	20.837	0	1.649	18.988	1.575	0.252	0.018	0.003	0.001	0	0	0
2002	257.914	208.764	0	49.150	66.611	123.248	17.437	1.294	0.099	0.035	0.040	0	0
2003	13.116	12.980	0	0.136	4.047	3.284	4.964	0.608	0.069	0.005	0.005	0	0
2004	26.915	26.902	0	0.014	3.965	8.956	4.904	8.207	0.764	0.079	0.018	0.009	0
2005	8.483	7.325	0	1.157	1.278	1.055	1.511	1.269	1.944	0.223	0.045	0	0
2006	59.052	40.570	0	18.482	23.719	5.629	2.072	2.557	3.160	2.897	0.529	0.007	0
2007	32.802	25.288	0	7.514	15.865	5.845	1.489	0.548	0.536	0.541	0.385	0.073	0.007
2008	92.100	75.143	0	16.957	40.620	27.815	4.936	0.911	0.158	0.303	0.236	0.148	0.016
2009	104.454	72.840	0	31.614	28.228	28.413	12.491	2.498	0.613	0.215	0.134	0.250	0
2010	68.138	67.717	0	0.421	24.265	21.998	14.002	6.019	1.187	0.118	0.058	0.041	0.029
2011	36.112	33.985	0	2.127	3.285	11.378	9.812	4.116	3.391	1.421	0.248	0.071	0.263
2012	114.410	65.371	0	49.039	25.925	11.982	9.231	9.567	4.671	2.755	0.871	0.144	0.226
2013	57.922	53.309	0	4.613	29.415	8.721	3.150	4.982	4.451	1.545	0.758	0.169	0.117
2014	60.483	45.822	0	14.661	10.635	23.833	5.069	1.504	2.323	1.486	0.608	0.319	0.045
2015	36.141	17.961	0	18.180	5.520	4.016	5.033	1.755	0.563	0.592	0.273	0.117	0.092
84-14 Mean	**38.430**	**26.197**	**0**	**12.233**	**10.916**	**9.528**	**2.995**	**1.433**	**0.757**	**0.377**	**0.127**	**0.040**	**0.024**

Fall (Sept-Oct)

Year	0-10+	2+	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10+
1984	10.721	1.692	7.986	1.043	0.783	0.519	0.280	0.092	0.018	0	0	0	0
1985	30.972	1.277	24.914	4.781	0.425	0.587	0.190	0.044	0.030	0.002	0	0	0
1986	25.761	2.519	12.863	10.379	2.277	0.219	0.013	0.005	0.005	0	0	0	0
1987	18.544	2.063	12.468	4.013	1.405	0.579	0.058	0.009	0.009	0.004	0	0	0
1988	39.699	2.092	31.687	5.920	1.818	0.242	0.032	0	0	0	0	0	0
1989	65.087	1.596	40.920	22.571	1.501	0.083	0.012	0	0	0	0	0	0
1990	69.477	7.396	54.350	7.731	6.946	0.398	0.034	0.005	0.008	0	0	0.005	0
1991	311.570	2.953	291.568	17.050	1.759	1.040	0.147	0.008	0	0	0	0	0
1992	83.731	6.244	50.971	26.516	5.540	0.398	0.287	0.013	0.007	0	0	0	0
1993	77.057	1.165	74.061	1.831	1.019	0.121	0.012	0.010	0	0	0.003	0	0
1994	92.523	0.657	90.778	1.088	0.457	0.185	0.012	0.003	0	0	0	0	0
1995	59.136	0.150	32.465	26.521	0.144	0.006	0	0	0	0	0	0	0
1996	61.459	1.400	51.497	8.562	1.365	0.029	0	0.005	0	0	0	0	0
1997	41.276	0.809	31.791	8.677	0.630	0.172	0.008	0	0	0	0	0	0
1998	103.272	0.628	90.404	12.240	0.537	0.069	0.022	0	0	0	0	0	0
1999	537.683	8.574	498.180	30.930	8.349	0.195	0.019	0.011	0	0	0	0	0
2000	521.103	9.265	250.391	261.446	8.323	0.794	0.140	0.008	0	0	0	0	0
2001	177.641	20.239	140.506	16.897	18.421	1.607	0.186	0.025	0	0	0	0	0
2002	348.703	41.179	259.902	47.623	23.321	16.812	0.665	0.325	0.048	0	0.007	0	0
2003	152.227	83.963	52.910	15.354	32.065	22.394	26.440	2.493	0.539	0.016	0.016	0	0
2004	291.458	36.277	251.052	4.129	8.338	15.082	5.978	6.245	0.534	0.072	0.008	0.021	0
2005	424.063	18.183	373.318	32.562	8.144	2.437	4.015	1.505	1.689	0.332	0.060	0	0
2006	116.755	13.575	52.164	51.016	9.525	2.341	0.257	0.351	0.377	0.681	0.044	0	0
2007	475.295	37.346	319.893	118.056	29.335	5.929	0.896	0.226	0.302	0.313	0.313	0.033	0
2008	303.256	24.478	243.679	35.099	11.921	7.044	3.556	1.055	0.502	0.137	0.124	0.140	0
2009	139.380	31.506	67.486	40.388	20.786	6.934	2.615	0.735	0.214	0.131	0.068	0.022	0
2010	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	198.226	40.786	119.032	38.409	8.157	14.894	9.669	3.922	3.225	0.586	0.167	0.025	0.140
2012	223.522	15.983	153.235	54.305	9.963	2.846	2.063	0.567	0.137	0.323	0.076	0.007	0
2013	40.683	16.235	17.744	6.704	9.187	4.069	0.807	1.058	0.746	0.237	0.090	0.031	0.011
2014	182.583	14.003	144.702	23.878	4.325	6.505	1.188	0.426	0.808	0.476	0.193	0.051	0.032
2015	422.228	31.773	330.498	59.957	14.802	4.859	8.230	1.723	0.551	0.917	0.410	0.209	0.072
84-14 Mean	**174.095**	**14.808**	**128.097**	**31.191**	**7.892**	**3.818**	**1.987**	**0.638**	**0.307**	**0.110**	**0.039**	**0.011**	**0.006**

(1) *In 1984, 1985, 2003, 2004, 2006, 2008, 2010, 2011, and 2014 less than the number of scheduled tows were conducted in some months (Table 5.4).*

(2) *Fish in the age 10+ group include: 6 fish taken 1984-1988, 8 fish taken 2002-2010, 81 taken in 2011, 28 taken in 2012, 26 taken in 2013, 15 taken in 2014, and 37 taken in 2015. The oldest scup aged were two 15-year-old fish taken in 2015.*

Table 5.24. Age frequency of striped bass taken in spring, 1984-2015.
Ages were derived from trawl survey length data using the average of Hudson River and Chesapeake Bay von Bertalanffy parameters.

	Year																															
Age	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
1	0	0	0	0	0	0	0	0	0	2	0	0	3	0	0	0	1	0	2	1	1	0	0	2	11	5	0	1	11	0	0	0
2	0	0	0	2	1	5	28	11	4	3	6	98	12	36	119	41	113	47	150	30	15	220	3	46	20	84	3	2	46	49	4	2
3	0	0	0	0	1	3	8	7	8	7	10	26	97	116	122	87	20	41	76	38	38	54	25	109	15	54	7	2	13	33	94	13
4	0	0	0	2	4	1	2	3	13	16	20	8	37	40	68	42	22	15	48	23	18	59	15	44	48	130	17	29	13	21	73	23
5	0	0	0	2	0	1	1	5	5	14	18	7	14	17	28	95	22	28	45	39	21	33	22	44	41	64	24	50	19	12	20	17
6	0	0	0	2	1	1	3	0	1	8	8	6	7	14	20	46	32	36	52	41	22	28	11	28	11	34	11	44	12	16	6	1
7	0	0	0	0	0	0	0	2	0	7	1	1	8	9	3	17	12	13	25	23	14	16	10	9	7	10	6	29	5	10	1	1
8	0	0	0	0	0	0	0	1	2	1	1	3	2	4	1	4	4	2	12	5	3	9	4	3	3	1	2	7	3	15	5	1
9	0	0	0	0	0	0	0	2	1	1	1	0	3	2	1	0	1	2	3	7	2	1	3	1	1	0	0	1	2	1	1	0
10	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	1	2	0	1	0	0	0	3	3	2	0	0	0	0	2	1	0
11	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	1	1	0	0	0	0	0	1	1	0	1
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Total	**0**	**0**	**0**	**8**	**7**	**11**	**43**	**32**	**34**	**59**	**65**	**150**	**184**	**238**	**362**	**334**	**229**	**184**	**414**	**207**	**135**	**421**	**97**	**289**	**159**	**382**	**70**	**166**	**125**	**160**	**205**	**59**

Note: *number of fish taken but not measured = one in 1984, one in 1988, two in 1990.*

Table 5.25. Striped bass indices-at-age, 1984-2015.
Spring length data was converted to ages using the average of Hudson River and Chesapeake Bay von Bertalanffy parameters (Vic Crecco, pers comm). Indices-at-age were then determined by apportioning the spring indices (from Table 5.18) by the percentage of fish in each age.

		Spring											
Year	**Index**	**Age 1**	**Age 2**	**Age 3**	**Age 4**	**Age 5**	**Age 6**	**Age 7**	**Age 8**	**Age 9**	**Age 10**	**Age 11**	**Age 12**
1984	0.02	0	0	0	0	0	0	0	0	0	0	0	0
1985	0.00	0	0	0	0	0	0	0	0	0	0	0	0
1986	0.00	0	0	0	0	0	0	0	0	0	0	0	0
1987	0.05	0	0.0125	0	0.0125	0.0125	0.0125	0	0	0	0	0	0
1988	0.04	0	0.0057	0.0057	0.0229	0	0.0057	0	0	0	0	0	0
1989	0.06	0	0.0273	0.0164	0.0055	0.0055	0.0055	0	0	0	0	0	0
1990	0.16	0	0.1042	0.0298	0.0074	0.0037	0.0112	0	0	0	0.0037	0	0
1991	0.15	0	0.0516	0.0328	0.0141	0.0234	0	0.0094	0.0047	0.0094	0.0047	0	0
1992	0.22	0	0.0259	0.0518	0.0841	0.0324	0.0065	0	0.0129	0.0065	0	0	0
1993	0.27	0.0093	0.0140	0.0326	0.0745	0.0652	0.0372	0.0326	0.0047	0.0047	0	0	0
1994	0.30	0	0.0277	0.0462	0.0923	0.0831	0.0369	0.0046	0.0046	0.0046	0	0	0
1995	0.59	0	0.3855	0.1023	0.0315	0.0275	0.0236	0.0039	0.0118	0	0.0039	0	0
1996	0.63	0.0103	0.0411	0.3321	0.1267	0.0479	0.0240	0.0274	0.0068	0.0103	0	0.0034	0
1997	0.85	0	0.1286	0.4143	0.1429	0.0607	0.0500	0.0321	0.0143	0.0071	0	0	0
1998	0.97	0	0.3189	0.3269	0.1822	0.0750	0.0536	0.0080	0.0027	0.0027	0	0	0
1999	1.10	0	0.1346	0.2857	0.1379	0.3119	0.1510	0.0558	0.0131	0	0.0033	0.0033	0
2000	0.84	0.0037	0.4163	0.0737	0.0811	0.0811	0.1179	0.0442	0.0147	0.0037	0.0074	0	0
2001	0.61	0	0.1558	0.1359	0.0497	0.0928	0.1193	0.0431	0.0066	0.0066	0	0	0
2002	1.30	0.0063	0.4722	0.2392	0.1511	0.1416	0.1637	0.0787	0.0378	0.0094	0.0031	0	0
2003	0.87	0.0042	0.1267	0.1605	0.0971	0.1647	0.1732	0.0971	0.0211	0.0296	0	0	0
2004	0.56	0.0042	0.0627	0.1588	0.0752	0.0878	0.0919	0.0585	0.0125	0.0084	0	0.0042	0
2005	1.17	0	0.6100	0.1497	0.1636	0.0915	0.0776	0.0444	0.0250	0.0028	0	0.0028	0
2006	0.61	0	0.0189	0.1572	0.0943	0.1384	0.0692	0.0629	0.0252	0.0189	0.0189	0.0063	0
2007	1.02	0.0071	0.1629	0.3860	0.1558	0.1558	0.0992	0.0319	0.0106	0.0035	0.0106	0	0
2008	0.57	0.0394	0.0717	0.0538	0.1721	0.1470	0.0394	0.0251	0.0108	0.0036	0.0072	0	0
2009	0.60	0.0078	0.1316	0.0846	0.2037	0.1003	0.0533	0.0157	0.0016	0	0	0	0
2010	0.40	0	0.0169	0.0394	0.0958	0.1352	0.0620	0.0338	0.0113	0	0	0	0
2011	0.48	0.0029	0.0058	0.0058	0.0839	0.1446	0.1272	0.0839	0.0202	0.0029	0	0	0.0029
2012	0.43	0.0381	0.1595	0.0451	0.0451	0.0659	0.0416	0.0173	0.0104	0.0069	0	0.0035	0
2013	0.67	0	0.2052	0.1382	0.0879	0.0503	0.0670	0.0419	0.0628	0.0042	0.0084	0.0042	0
2014	0.41	0	0.0080	0.1880	0.1460	0.0400	0.0120	0.0020	0.0100	0.0020	0.0020	0.0000	0
2015	0.20	0	0.0068	0.0441	0.0780	0.0576	0.0034	0.0034	0.0034	0.0000	0.0000	0.0034	0
84-14 mean		**0.0043**	**0.1259**	**0.1191**	**0.0851**	**0.0770**	**0.0559**	**0.0276**	**0.0115**	**0.0048**	**0.0024**	**0.0009**	**0.0001**

Table 5.26. Summer flounder indices-at-age, 1984-2015.

Year and season specific age keys obtained from the NMFS spring and fall surveys were used to convert LISTS length frequencies to ages. Starting in 2000 LISTS ageing data (60 cm and over) were added to the age key to supplement the older age groups. In 2015, LISTS age data for smaller fish were also incorporated into the age key. Indices-at-age were determined for each season by apportioning the spring and fall overall indices (from Table 5.18 and Table 5.19) by the percentage of fish in each age.

							Spring							
Year	**0-11**	**Age 0**	**Age 1**	**Age 2**	**Age 3**	**Age 4**	**Age 5**	**Age 6**	**Age 7**	**Age 8**	**Age 9**	**Age 10**	**Age 11**	**Age 12**
1984	0.6291	0	0.3236	0.2610	0.0445	0	0	0	0	0	0	0	0	0
1985	0.4410	0	0.0166	0.3168	0.0489	0.0587	0	0	0	0	0	0	0	0
1986	0.9510	0	0.7700	0.0892	0.0742	0.0126	0.0050	0	0	0	0	0	0	0
1987	1.0572	0	0.9515	0.0793	0.0202	0.0036	0.0026	0	0	0	0	0	0	0
1988	0.4986	0	0.2317	0.2232	0.0352	0.0085	0	0	0	0	0	0	0	0
1989	0.1016	0	0.0111	0.0550	0.0191	0.0164	0	0	0	0	0	0	0	0
1990	0.3475	0	0.3053	0.0201	0.0156	0.0065	0	0	0	0	0	0	0	0
1991	0.6391	0	0.3892	0.2059	0.0205	0.0235	0	0	0	0	0	0	0	0
1992	0.5546	0	0.3182	0.1906	0.0229	0	0.0229	0	0	0	0	0	0	0
1993	0.5074	0	0.3216	0.1504	0.0101	0.0152	0.0101	0	0	0	0	0	0	0
1994	0.8601	0	0.4959	0.3136	0.0324	0	0	0	0.0182	0	0	0	0	0
1995	0.2796	0	0.2023	0.0608	0.0110	0	0	0	0.0055	0	0	0	0	0
1996	0.9609	0	0.6216	0.2370	0.0868	0	0.0052	0	0.0103	0	0	0	0	0
1997	0.9991	0	0.4481	0.4461	0.0740	0.0121	0.0134	0.0054	0	0	0	0	0	0
1998	1.3067	0	0.0734	0.5952	0.4693	0.1167	0.0324	0.0197	0	0	0	0	0	0
1999	1.4401	0	0.3263	0.5563	0.3521	0.1110	0.0696	0.0248	0	0	0	0	0	0
2000	1.7898	0	0.3805	0.7853	0.4240	0.0538	0.1316	0.0092	0	0.0054	0	0	0	0
2001	1.7468	0	0.8408	0.3395	0.3653	0.1073	0.0488	0.0333	0.0067	0.0051	0	0	0	0
2002	3.1851	0	1.0571	1.2637	0.4646	0.2233	0.0930	0.0362	0.0236	0.0145	0.0091	0	0	0
2003	3.4211	0	1.6080	1.0159	0.3949	0.2316	0.0851	0.0462	0.0327	0.0025	0.0042	0	0	0
2004	1.8381	0	0.2592	0.8180	0.4100	0.1878	0.0338	0.0817	0.0302	0.0145	0.0029	0	0	0
2005	0.8038	0	0.2523	0.2641	0.1495	0.0334	0.0364	0.0393	0.0196	0.0046	0.0046	0	0	0
2006	0.6129	0	0.0383	0.3597	0.0676	0.0654	0.0337	0.0263	0.0168	0.0051	0	0	0	0
2007	2.5073	0	1.1569	0.2053	0.5595	0.3163	0.1150	0.0888	0.0428	0.0152	0.0065	0.0010	0	0
2008	1.6145	0	0.6008	0.2912	0.2374	0.2633	0.1165	0.0622	0.0236	0.0033	0.0054	0.0054	0.0054	0
2009	1.9295	0	0.7772	0.3770	0.2905	0.1804	0.1949	0.0700	0.0258	0.0101	0.0036	0	0	0
2010	2.6878	0	1.8671	0.2805	0.2113	0.1439	0.0944	0.0416	0.0244	0.0142	0.0052	0.0052	0	0
2011	3.8479	0	1.0024	1.0839	0.8014	0.3820	0.3159	0.1098	0.0628	0.0580	0.0171	0.0146	0	0
2012	3.0620	0	0.4684	0.6283	0.9746	0.6346	0.2044	0.0754	0.0333	0.0224	0.0050	0.0113	0.0043	0
2013	3.2359	0	0.8843	0.6681	0.6637	0.6734	0.2047	0.0818	0.0201	0.0184	0.0041	0.0044	0.0129	0
2014	2.9996	0	0.9709	0.7062	0.4847	0.4325	0.2977	0.0465	0.0369	0.0126	0.0072	0.0022	0.0022	0.0022
2015	1.6335	0	0.7873	0.3486	0.2024	0.1235	0.0906	0.0487	0.0176	0.0093	0.0017	0.0018	0.002	0.0005
84-14 Mean	**1.5115**	**0.0000**	**0.5797**	**0.4157**	**0.2528**	**0.1392**	**0.0699**	**0.0290**	**0.0140**	**0.0066**	**0.0024**	**0.0014**	**0.0008**	**0.0001**

							Fall							
Year	**0-11**	**Age 0**	**Age 1**	**Age 2**	**Age 3**	**Age 4**	**Age 5**	**Age 6**	**Age 7**	**Age 8**	**Age 9**	**Age 10**	**Age 11**	**Age 12**
1984	0.9888	0	0.5648	0.3269	0.0713	0.0140	0.0042	0.0042	0.0034	0	0	0	0	0
1985	1.1931	0.2453	0.3605	0.4984	0.0804	0	0.0085	0	0	0	0	0	0	0
1986	1.7157	0.1738	1.1902	0.2681	0.0817	0.0019	0	0	0	0	0	0	0	0
1987	1.3963	0.0749	1.0573	0.2309	0.0305	0.0027	0	0	0	0	0	0	0	0
1988	1.4159	0.0150	0.8739	0.4782	0.0366	0.0122	0	0	0	0	0	0	0	0
1989	0.1363	0	0.0227	0.1051	0.0085	0	0	0	0	0	0	0	0	0
1990	0.8678	0.0321	0.6720	0.1214	0.0339	0.0042	0.0042	0	0	0	0	0	0	0
1991	1.2557	0.0363	0.8141	0.3457	0.0432	0.0082	0.0041	0.0041	0	0	0	0	0	0
1992	1.0178	0.0131	0.5685	0.3578	0.0561	0.0134	0.0089	0	0	0	0	0	0	0
1993	1.1113	0.0842	0.8371	0.1490	0.0362	0.0029	0	0.0019	0	0	0	0	0	0
1994	0.5517	0.1325	0.3008	0.0957	0.0138	0.0089	0	0	0	0	0	0	0	0
1995	0.5408	0.0424	0.3812	0.1043	0.0090	0.0039	0	0	0	0	0	0	0	0
1996	2.1914	0.0840	1.0394	1.0276	0.0375	0.0029	0	0	0	0	0	0	0	0
1997	2.4980	0.0693	0.8494	1.2261	0.3016	0.0321	0.0099	0.0084	0.0012	0	0	0	0	0
1998	1.7153	0	0.3251	1.0456	0.2867	0.0392	0.0187	0	0	0	0	0	0	0
1999	2.6787	0.0482	0.8000	1.4412	0.2963	0.0823	0.0084	0.0023	0	0	0	0	0	0
2000	1.9134	0.1151	0.5117	0.8244	0.2971	0.1122	0.0433	0.0067	0	0.0029	0	0	0	0
2001	4.4181	0.0208	2.6891	1.1372	0.4342	0.1095	0.0153	0.0078	0	0.0042	0	0	0	0
2002	6.1211	0.4415	3.0870	1.9304	0.4769	0.1216	0.0429	0.0168	0.0040	0	0	0	0	0
2003	3.3879	0	1.4584	1.3192	0.4069	0.0873	0.0908	0.0164	0.0089	0	0	0	0	0
2004	1.9537	0.2545	0.3848	0.7551	0.4398	0.0804	0.0241	0.0150	0	0	0	0	0	0
2005	2.4099	0.0671	1.0930	0.7441	0.3554	0.0866	0.0316	0.0123	0.0166	0.0032	0	0	0	0
2006	1.3148	0.0976	0.2170	0.5915	0.2299	0.0957	0.0435	0.0214	0.0182	0	0	0	0	0
2007	1.8880	0.1295	0.5669	0.3869	0.4676	0.2012	0.0778	0.0408	0.0087	0.0043	0	0	0.0043	0
2008	3.0853	0.7816	0.4848	0.9581	0.4458	0.3256	0.0804	0.0090	0	0	0	0	0	0
2009	3.1169	0.4054	0.6606	0.8883	0.6241	0.3182	0.1330	0.0437	0.0244	0.0070	0.0122	0.0000	0.0000	0
2010	-	-	-	-	-	-	-	-	-	-	-	-	-	0
2011	2.5578	0.1173	0.6933	0.9333	0.5641	0.1232	0.0543	0.0275	0.0130	0.0130	0.0061	0.0052	0.0075	0
2012	3.7358	0.1633	0.4592	0.8283	1.4239	0.5848	0.1836	0.0631	0.0296	0	0	0	0	0
2013	3.0664	0.2181	0.5709	0.6080	0.8049	0.6328	0.1789	0.0291	0.0139	0.0016	0	0.0082	0	0
2014	1.7086	0.1231	0.4034	0.3945	0.3620	0.2825	0.0823	0.0294	0.0205	0.0078	0	0.0031	0	0
2015	2.0218	0.0547	0.5740	0.6717	0.3957	0.1830	0.0821	0.0347	0.0135	0.0086	0	0.0038	0	0
84-14 Mean	**2.0651**	**0.1329**	**0.7979**	**0.6707**	**0.2919**	**0.1130**	**0.0383**	**0.0120**	**0.0054**	**0.0015**	**0.0006**	**0.0006**	**0.0004**	**0.0000**

note: 1984-1999 indices-at-age were run using a GT 60cm group in the age key.

Table 5.27. Tautog indices-at-age, 1984-2015.

Year and season specific age keys obtained from the LISTS spring and fall surveys were used to convert LISTS length frequencies to ages. Indices-at-age were then determined for each season by apportioning the spring and fall overall indices (from Table 5.18 and Table 5.19) by the percentage of fish in each age, and then summing the spring and fall indices-at-age. The age 1-20+ index is the sum of indices ages 1 – 20+. The age 20+ category includes 36 fish ranging from 20 to 30 years of age.

						Age					
Year	**1 - 20+**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1984	3.4691	0.0109	0.0816	0.1898	0.3030	0.4587	0.4955	0.2903	0.2852	0.3101	0.3529
1985	1.7967	0	0.0199	0.0962	0.1902	0.1651	0.1281	0.1836	0.3005	0.2020	0.0902
1986	1.7199	0.0012	0.0275	0.0961	0.0483	0.1029	0.2012	0.2409	0.2452	0.2863	0.1017
1987	1.2128	0.0237	0.0801	0.0594	0.0602	0.0999	0.1345	0.1910	0.1348	0.0957	0.0522
1988	0.9007	0.0031	0.0323	0.0474	0.0720	0.0445	0.0401	0.0755	0.1008	0.1641	0.0790
1989	1.2589	0	0.0433	0.0684	0.1365	0.0889	0.1154	0.1495	0.1600	0.1046	0.0817
1990	1.1615	0.0102	0.0829	0.1569	0.1117	0.1142	0.0498	0.0500	0.1245	0.0874	0.0623
1991	1.1466	0.0053	0.0251	0.0575	0.1184	0.1241	0.1486	0.0931	0.1253	0.1071	0.1067
1992	1.0254	0.0196	0.0489	0.0708	0.0414	0.0490	0.1231	0.1323	0.0849	0.0632	0.0636
1993	0.5695	0.0033	0.0212	0.0519	0.0302	0.0163	0.0606	0.0595	0.0423	0.0489	0.0522
1994	0.5837	0.0087	0.0368	0.0327	0.0678	0.0557	0.0551	0.0555	0.0799	0.0516	0.0312
1995	0.2530	0.0033	0.0093	0.0090	0.0295	0.0608	0.0267	0.0212	0.0346	0.0150	0.0219
1996	0.5628	0.0073	0.0518	0.0305	0.0086	0.0762	0.0452	0.0654	0.0712	0.0667	0.0609
1997	0.5079	0	0.0390	0.0675	0.0568	0.0574	0.0639	0.0491	0.0556	0.0486	0.0101
1998	0.6442	0	0.0425	0.0281	0.0701	0.0821	0.0876	0.0875	0.0848	0.0465	0.0575
1999	0.7614	0.0498	0.0792	0.0583	0.0666	0.1015	0.1379	0.0748	0.0843	0.0431	0.0203
2000	0.8004	0.0009	0.0468	0.0578	0.0832	0.0737	0.1403	0.1376	0.0897	0.0392	0.0467
2001	0.8946	0.0062	0.0305	0.0862	0.0830	0.1294	0.1197	0.1193	0.1058	0.0715	0.0454
2002	1.1665	0.0098	0.0237	0.0599	0.1009	0.1749	0.1972	0.1895	0.2091	0.0739	0.0419
2003	0.8977	0.0027	0.0132	0.0080	0.0598	0.1485	0.2385	0.1596	0.0893	0.0778	0.0185
2004	0.6936	0.0071	0.0209	0.0152	0.0360	0.0710	0.1930	0.1096	0.0494	0.0812	0.0441
2005	0.7596	0.0100	0.0367	0.0618	0.0261	0.0922	0.1437	0.1576	0.1064	0.0303	0.0268
2006	0.8405	0	0.0334	0.0345	0.1039	0.1274	0.1140	0.1196	0.1521	0.0620	0.0479
2007	0.6135	0.0034	0.0125	0.0170	0.0462	0.0478	0.0608	0.0918	0.0935	0.0966	0.0533
2008	0.7268	0.0061	0.0272	0.0439	0.0620	0.0848	0.1164	0.0708	0.0649	0.0831	0.0640
2009	0.4822	0.0145	0.0364	0.0070	0.0026	0.0394	0.0681	0.1013	0.0658	0.0319	0.0324
2010	0.2472	0	0.0053	0.0455	0.0093	0.0053	0.0315	0.0503	0.0294	0.0096	0.0093
2011	0.4456	0.0180	0.0401	0.0532	0.0303	0.0301	0.0612	0.0630	0.0415	0.0267	0.0167
2012	0.5809	0.0270	0.1148	0.0919	0.0808	0.0635	0.0389	0.0384	0.0499	0.0489	0.0115
2013	0.5781	0.0075	0.0653	0.0561	0.1211	0.0857	0.0912	0.0532	0.0386	0.0215	0.0214
2014	0.6958	0	0.0281	0.1540	0.0854	0.1112	0.1286	0.0754	0.0522	0.0243	0.0185
2015	0.6160	0.0422	0.0494	0.0710	0.0722	0.0758	0.0981	0.0900	0.0584	0.0266	0.0149
84-14 Mean	**0.9031**	**0.0084**	**0.0405**	**0.0617**	**0.0755**	**0.0962**	**0.1179**	**0.1083**	**0.1049**	**0.0813**	**0.0562**

						Age					
Year		**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20+**
1984		0.1259	0.2281	0.0933	0.0507	0.0448	0.0322	0.0468	0.0156	0.0006	0.0531
1985		0.1595	0.0982	0.0226	0.0994	0	0.0249	0.0039	0.0124	0	0
1986		0.1423	0.0863	0.0374	0.0522	0.0232	0.0071	0.0114	0.0003	0.0023	0.0061
1987		0.0606	0.0543	0.0479	0.0313	0.0246	0.0267	0.0105	0.0004	0.0048	0.0202
1988		0.0469	0.0395	0.0295	0.0225	0.0493	0.0086	0.0063	0.0055	0.0052	0.0286
1989		0.0569	0.0932	0.0430	0.0404	0.0348	0.0172	0.0067	0.0048	0	0.0136
1990		0.0979	0.0375	0.0568	0.0397	0.0221	0.0250	0.0089	0.0169	0.0035	0.0033
1991		0.0609	0.0258	0.0399	0.0361	0.0216	0.0007	0.0159	0.0117	0.0080	0.0148
1992		0.0599	0.0512	0.0440	0.0581	0.0236	0.0208	0.0167	0.0298	0.0167	0.0078
1993		0.0368	0.0351	0.0351	0.0129	0.0157	0.0152	0.0129	0.0097	0.0097	0
1994		0.0234	0.0238	0.0071	0.0118	0.0118	0.0096	0.0024	0.0047	0.0070	0.0071
1995		0.0036	0.0036	0.0073	0	0	0	0.0036	0	0	0.0036
1996		0.0230	0.0127	0.0103	0.0048	0.0099	0.0090	0.0086	0.0004	0.0001	0.0002
1997		0.0072	0.0119	0.0144	0.0048	0.0121	0.0071	0	0.0024	0	0
1998		0.0192	0.0164	0.0055	0.0055	0	0.0027	0.0055	0	0	0.0027
1999		0.0191	0.0090	0.0087	0.0029	0	0	0.0030	0.0029	0	0
2000		0.0213	0.0130	0.0123	0.0101	0.0084	0.0104	0.0023	0	0.0027	0.0040
2001		0.0407	0.0161	0.0152	0.0004	0.0053	0.0105	0.0036	0.0001	0.0026	0.0031
2002		0.0257	0.0185	0.0107	0.0070	0.0147	0.0039	0	0	0	0.0052
2003		0.0274	0.0088	0.0059	0.0184	0.0029	0.0124	0	0.0029	0	0.0031
2004		0.0204	0.0221	0.0119	0.0003	0.0028	0.0031	0.0026	0.0002	0	0.0027
2005		0.0347	0.0257	0.0039	0.0037	0	0	0	0	0	0
2006		0.0183	0.0200	0.0037	0	0.0037	0	0	0	0	0
2007		0.0294	0.0156	0.0194	0.0108	0.0019	0.0116	0	0.0019	0	0
2008		0.0322	0.0225	0.0228	0.0163	0.0098	0	0	0	0	0
2009		0.0343	0.0064	0.0091	0.0217	0.0070	0.0032	0.0011	0	0	0
2010		0.0192	0.0139	0.0048	0.0046	0.0046	0	0	0	0.0046	0
2011		0.0167	0.0161	0.0080	0.0080	0.0040	0	0.0040	0.0080	0	0
2012		0	0.0077	0.0038	0	0.0038	0	0	0	0	0
2013		0.0066	0	0	0.0033	0.0033	0.0033	0	0	0	0
2014		0.0148	0	0	0.0033	0	0	0	0	0	0
2015		0.0060	0.0016	0.0033	0.0049	0	0	0.0016	0	0	0
84-14 Mean		**0.0414**	**0.0333**	**0.0205**	**0.0187**	**0.0118**	**0.0086**	**0.0057**	**0.0042**	**0.0022**	**0.0058**

Table 5.28. Weakfish age 0 and age 1+ indices of abundance, 1984-2015.
Using spring (May, June) and fall (September, October) length data, the geometric mean catch per tow was calculated for three groups of weakfish: fall age-0, spring - all fish age 1 and older (1+), and fall - all fish age 1 and older (1+). Weakfish less than 30 cm fork length in the fall were defined as age-0.

	Fall		Fall		Spring	
Year	**age 0 count / tow**	**age 0 kg / tow**	**ages 1+ count / tow**	**age 1+ kg / tow**	**ages 1+ count / tow**	**ages 1+ kg / tow**
1984	1.00	0.14	0.53	0.84	0.02	0.15
1985	6.19	0.74	0.24	0.46	0.00	0.10
1986	13.16	0.91	0.24	0.51	0.10	0.33
1987	0.63	0.13	0.11	0.16	0.02	0.11
1988	3.49	0.30	0.06	0.13	0.05	0.17
1989	8.69	0.94	0.02	0.10	0.04	0.16
1990	5.56	0.56	0.08	0.13	0.07	0.13
1991	11.95	1.44	0.31	0.41	0.28	0.26
1992	3.05	0.31	0.18	0.24	0.12	0.22
1993	4.08	0.46	0.12	0.18	0.10	0.15
1994	11.19	1.23	0.06	0.13	0.04	0.12
1995	5.22	0.84	0.70	0.64	0.18	0.16
1996	15.23	1.49	0.56	0.52	0.19	0.19
1997	12.38	1.03	0.89	0.81	0.42	0.34
1998	5.02	0.76	0.28	0.36	0.37	0.41
1999	30.93	3.21	0.39	0.51	0.45	0.59
2000	63.31	3.34	0.30	0.32	0.18	0.28
2001	40.09	2.20	0.52	0.54	0.27	0.26
2002	41.35	2.85	0.16	0.26	0.16	0.26
2003	49.41	1.77	0.07	0.17	0.04	0.14
2004	58.98	2.99	0.21	0.25	0.15	0.16
2005	25.86	2.50	0.12	0.18	0.27	0.23
2006	1.05	0.20	0.29	0.30	0.14	0.22
2007	63.93	3.86	0.06	0.14	0.11	0.22
2008	9.03	1.17	0.08	0.14	0.05	0.12
2009	6.48	0.57	0.30	0.22	0.08	0.16
2010	-	-	-	-	0.02	0.12
2011	11.64	0.87	0.68	0.55	0.10	0.15
2012	21.96	1.47	0.73	0.69	0.62	0.56
2013	7.01	0.59	0.52	0.52	0.52	0.44
2014	41.53	2.27	0.08	0.12	0.17	0.23
2015	30.91	3.11	0.46	0.35	0.03	0.11
84-14 mean	**19.31**	**1.37**	**0.30**	**0.35**	**0.17**	**0.23**

Table 5.29. Winter flounder indices-at-age, 1984-2015.

The Long Island Sound Trawl Survey April and May catch and age data was used to calculate the geometric mean indices-at-age. An April-May age key was used to convert lengths to ages, and an overall April-May index (the ages 1-13 index in the table) was apportioned by the percentage of fish at age. The 4+ index is the sum of indices ages 4-13 and represents the abundance of winter flounder that are recruited to the fishery. The age-0 indices were obtained from the Estuarine Seine Survey (Job 8).

Catch-at-age: numbers								April-May								
Year	**1 - 13**	**4+**	**Age 0**	**Age 1**	**Age 2**	**Age 3**	**Age 4**	**Age 5**	**Age 6**	**Age 7**	**Age 8**	**Age 9**	**Age 10**	**Age 11**	**Age 12**	**Age 13**
1984	111.96	27.91	-	8.21	44.01	31.83	20.96	4.23	1.23	0.67	0.74	0.04	0.01	0.03	0	0
1985	83.58	18.13	-	4.11	28.46	32.88	14.17	2.33	0.82	0.45	0.19	0.11	0.04	0.02	0	0
1986	63.65	15.43	-	6.69	26.00	15.53	12.26	2.05	0.50	0.24	0.24	0.10	0.01	0.03	0	0
1987	79.92	13.35	-	7.32	44.69	14.56	5.05	6.55	1.28	0.11	0.24	0.13	0	0	0	0
1988	137.59	12.13	15.40	14.49	71.87	39.10	8.59	1.83	1.46	0.16	0.04	0.02	0.02	0	0	0
1989	148.19	14.97	1.66	13.56	78.43	41.23	10.85	2.84	0.98	0.14	0.09	0.06	0.01	0	0	0
1990	223.09	15.29	2.80	11.31	131.52	64.97	8.97	4.09	1.96	0.19	0.05	0	0.02	0	0	0
1991	150.20	14.31	5.23	8.52	66.99	60.39	9.31	4.05	0.80	0.14	0	0	0	0.01	0	0
1992	61.39	10.49	11.90	6.80	31.32	12.78	8.97	1.10	0.36	0.05	0	0	0	0	0	0
1993	63.60	9.16	5.68	19.11	19.87	15.46	4.81	3.24	0.80	0.15	0.11	0.04	0.01	0	0	0
1994	84.44	4.87	14.23	9.57	64.14	5.86	3.01	1.14	0.49	0.17	0.05	0.01	0.01	0	0	0
1995	50.12	2.31	10.10	14.35	23.69	9.77	1.36	0.63	0.20	0.08	0.02	0.02	0.00	0	0	0
1996	110.62	15.92	19.22	11.46	59.07	24.17	14.41	0.97	0.28	0.14	0.06	0.04	0.01	0	0	0
1997	71.31	13.84	7.47	12.53	25.53	19.41	9.45	3.76	0.51	0.07	0.03	0.01	0.01	0.01	0	0
1998	72.91	17.06	9.16	11.22	32.40	12.23	12.67	3.15	0.99	0.14	0.02	0.07	0	0	0	0
1999	41.35	11.10	8.70	6.56	12.42	11.27	6.09	3.20	1.14	0.61	0.04	0.01	0.02	0	0	0
2000	45.41	13.25	4.33	7.11	16.66	8.40	7.70	3.42	1.53	0.31	0.26	0.01	0.01	0	0.01	0
2001	54.50	15.61	1.34	8.45	19.60	10.85	8.06	5.46	1.28	0.68	0.05	0.08	0	0	0	0
2002	43.71	7.99	3.06	6.27	19.90	9.56	4.43	1.95	1.02	0.35	0.11	0.03	0.10	0	0	0
2003	27.84	8.83	8.07	2.47	7.83	8.71	4.79	1.95	0.77	0.82	0.29	0.07	0.14	0	0	0
2004	20.46	6.81	10.96	6.32	3.88	3.45	3.88	1.92	0.64	0.21	0.11	0.03	0.01	0	0	0.01
2005	16.10	2.03	5.63	7.06	6.18	0.84	0.81	0.67	0.21	0.16	0.10	0.05	0.01	0.01	0	0
2006	5.59	0.74	0.93	1.14	2.60	1.10	0.19	0.14	0.17	0.09	0.01	0.09	0.03	0.02	0	0
2007	28.68	4.16	4.73	2.98	10.83	10.70	3.10	0.61	0.15	0.11	0.12	0.04	0.01	0.01	0.01	0
2008	24.11	4.97	1.97	11.46	3.49	4.18	4.12	0.65	0.12	0.04	0.03	0.01	0	0	0.01	0
2009	22.65	2.86	0.77	7.56	11.21	1.02	1.31	1.21	0.22	0.06	0.04	0	0.01	0	0.01	0
2010	20.88	1.84	0.96	6.64	8.45	3.94	0.71	0.57	0.44	0.11	0.01	0	0	0	0	0
2011	27.95	5.55	1.12	6.54	9.34	6.53	3.66	1.15	0.30	0.39	0.04	0	0	0	0	0
2012	15.80	2.83	0.29	4.84	5.61	2.51	1.97	0.62	0.09	0.06	0.05	0.03	0	0	0	0
2013	10.08	4.03	0.27	0.61	3.50	1.94	1.96	1.33	0.48	0.10	0.08	0.05	0.02	0	0	0
2014	5.90	2.34	0.47	0.84	0.64	2.08	1.36	0.62	0.26	0.06	0.03	0.01	0	0	0	0
2015	3.94	1.92		0.89	0.84	0.29	0.64	0.65	0.22	0.27	0.11	0.02	0	0.005	0.01	0
84-14 Mean	62.05	9.68	5.79	7.94	28.71	15.72	6.42	2.18	0.69	0.23	0.10	0.04	0.02	0.00	0.00	0.00

Catch-at-age: biomass (kg)								April-May								
Year	**1-13**	**4+**	**Age 0**	**Age 1**	**Age 2**	**Age 3**	**Age 4**	**Age 5**	**Age 6**	**Age 7**	**Age 8**	**Age 9**	**Age 10**	**Age 11**	**Age 12**	**Age 13**
1984	15.68	7.81	NA	0.31	3.06	4.50	5.18	1.51	0.49	0.30	0.28	0.03	0.01	0.01	0	0
1985	13.91	5.96	NA	0.15	2.54	5.26	3.97	0.97	0.46	0.33	0.11	0.08	0.03	0.02	0	0
1986	10.33	5.39	NA	0.24	2.16	2.55	3.68	0.88	0.32	0.21	0.16	0.09	0.01	0.03	0	0
1987	11.76	4.94	NA	0.30	4.03	2.50	1.39	2.59	0.64	0.08	0.14	0.09	0	0	0	0
1988	18.28	4.51	NA	0.54	6.06	7.17	2.64	0.93	0.74	0.12	0.03	0.02	0.03	0	0	0
1989	22.62	5.64	NA	0.43	7.99	8.56	3.62	1.32	0.47	0.10	0.07	0.05	0.01	0	0	0
1990	29.01	7.09	NA	0.33	10.37	11.21	3.79	2.19	0.89	0.14	0.04	0	0.04	0	0	0
1991	24.59	5.54	NA	0.32	6.82	11.92	3.53	1.47	0.43	0.10	0	0	0	0.01	0	0
1992	12.29	4.79	NA	0.27	3.82	3.41	3.81	0.71	0.25	0.02	0	0	0	0	0	0
1993	10.26	4.43	NA	0.54	1.93	3.36	1.96	1.73	0.51	0.11	0.08	0.04	0.01	0	0	0
1994	12.20	2.95	NA	0.34	7.13	1.79	1.51	0.77	0.43	0.16	0.06	0.01	0.01	0	0	0
1995	7.72	1.39	NA	0.51	2.70	3.12	0.71	0.39	0.18	0.08	0.02	0.01	0.01	0	0	0
1996	20.41	7.36	NA	0.41	6.11	6.53	6.32	0.61	0.22	0.12	0.06	0.03	0.01	0	0	0
1997	15.53	6.96	NA	0.48	2.61	5.48	4.26	2.23	0.36	0.07	0.03	0.01	0.01	0.01	0	0
1998	14.66	7.28	NA	0.36	3.59	3.43	4.88	1.64	0.60	0.09	0.02	0.05	0	0	0	0
1999	10.29	5.32	NA	0.23	1.41	3.33	2.60	1.59	0.69	0.39	0.02	0.00	0.03	0	0	0
2000	12.63	7.22	NA	0.32	2.31	2.78	3.68	2.05	0.96	0.29	0.21	0.01	0.01	0	0.01	0
2001	14.02	7.94	NA	0.27	2.33	3.48	3.39	3.05	0.87	0.51	0.05	0.07	0	0	0	0
2002	10.83	4.41	NA	0.31	3.05	3.06	2.13	1.12	0.70	0.28	0.09	0.02	0.07	0	0	0
2003	8.87	5.03	NA	0.09	0.96	2.79	2.35	1.21	0.50	0.59	0.23	0.06	0.08	0	0	0
2004	6.11	4.19	NA	0.19	0.53	1.20	2.13	1.24	0.50	0.18	0.10	0.02	0.01	0	0	0.01
2005	3.37	1.75	NA	0.28	0.96	0.38	0.57	0.61	0.22	0.17	0.09	0.06	0.02	0.01	0	0
2006	1.82	0.71	NA	0.06	0.48	0.58	0.16	0.13	0.17	0.08	0.02	0.09	0.05	0.02	0	0
2007	7.02	2.34	NA	0.12	1.18	3.38	1.55	0.37	0.14	0.10	0.11	0.03	0.01	0.01	0.01	0
2008	5.08	3.00	NA	0.39	0.39	1.30	2.31	0.47	0.11	0.05	0.04	0.01	0	0	0.01	0
2009	3.96	1.89	NA	0.28	1.48	0.32	0.68	0.88	0.20	0.05	0.04	0	0.01	0	0.02	0
2010	4.26	1.38	NA	0.24	1.16	1.49	0.40	0.45	0.42	0.10	0.01	0	0	0	0	0
2011	6.72	3.19	NA	0.23	1.34	1.96	1.81	0.78	0.22	0.35	0.04	0	0	0	0	0
2012	3.88	1.85	NA	0.20	0.93	0.90	1.13	0.47	0.09	0.06	0.06	0	0	0	0	0
2013	3.42	2.45	NA	0.02	0.37	0.57	0.98	0.86	0.39	0.07	0.08	0.06	0	0	0	0
2014	2.33	1.48	NA	0.03	0.09	0.73	0.74	0.44	0.21	0.06	0.03	0.01	0	0	0	0
2015	1.19	0.99	NA	0.02	0.09	0.08	0.27	0.33	0.13	0.16	0.07	0.01	0	0.006	0.004	0
84-14 Mean	11.09	4.39	NA	0.28	2.90	3.52	2.51	1.15	0.43	0.17	0.08	0.03	0.02	0.00	0.00	0.00

Note: 1984: April = 0 tows, May = 13 tows, and 19 tows in June used to increase sample size; 1985: April = 0 tows, May = 41 tows; 1986-1991, 1993-1995, 1997-2004, 2009, and 2012-2015: April = 40 tows, May = 40 tows; 1992 and 2006: April = 0 tows, May = 40; 1996: April = 17 tows, May = 63 tows; 2005: April = 35 tows, May = 45 tows; 2007: April = 35 tows, May = 45 tows; 2008: April = 36, and May = 44 tows; 2010: May = 38 tows, 2011: April = 12 tows.

TABLES 5.30 - 5.66
LENGTH FREQUENCIES
LISTS

Table 5.30. Alewife length frequencies, spring and fall, 1 cm intervals, 1989–2015.

From 1989 - 1990, lengths were recorded from the first three tows of each day; since 1991, lengths have been recorded from every tow.

													Spring														
length	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
6	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
7	0	0	0	0	2	0	0	0	0	0	0	4	0	0	1	0	1	0	0	4	0	2	1	0	0	0	3
8	0	0	0	0	18	3	3	0	0	0	2	9	16	0	3	1	2	0	0	4	1	10	0	1	3	2	12
9	0	0	2	0	15	9	6	1	6	0	6	21	32	1	18	6	16	0	0	4	6	10	0	3	7	5	11
10	0	0	0	1	11	19	18	2	22	7	6	28	23	5	32	55	32	0	8	5	11	23	5	6	16	7	16
11	0	0	5	4	10	44	11	2	64	11	20	52	14	6	27	87	26	29	13	32	10	9	22	8	11	16	13
12	6	0	4	7	6	83	17	8	127	12	32	43	5	29	25	100	55	44	34	131	17	6	54	27	19	15	7
13	1	0	4	4	47	122	48	16	63	44	42	99	4	70	11	83	61	15	38	193	24	12	48	98	18	24	6
14	0	0	9	7	77	172	35	26	69	61	56	234	7	139	28	63	37	9	37	178	51	6	50	187	14	33	6
15	3	0	8	5	68	140	54	32	56	51	120	334	6	157	25	33	50	49	85	86	101	8	59	123	12	48	7
16	2	0	8	5	84	159	38	86	44	50	144	320	4	86	26	31	74	25	128	46	106	7	37	56	5	53	5
17	5	4	4	16	63	108	32	203	28	34	330	85	5	82	21	33	73	78	161	47	142	5	7	27	10	16	5
18	4	4	9	8	59	81	7	254	32	22	136	15	4	15	19	18	71	93	182	25	196	2	11	17	21	30	5
19	6	7	7	2	37	33	7	180	9	11	99	20	3	6	26	42	59	86	122	49	215	7	11	24	22	24	9
20	3	1	7	2	27	24	10	161	17	17	82	22	9	17	13	30	26	76	105	38	137	7	9	19	10	50	3
21	1	0	3	1	13	17	14	107	34	22	72	27	12	28	22	50	21	40	71	21	53	18	9	18	28	58	9
22	4	2	8	2	10	26	12	103	48	18	47	41	18	46	25	48	18	18	41	14	29	22	10	24	34	25	20
23	5	1	8	6	3	12	12	76	44	16	47	90	36	63	40	36	7	5	28	16	13	12	16	27	39	8	17
24	7	0	3	2	1	12	7	34	28	14	21	58	45	49	42	13	6	1	10	7	14	4	7	18	15	18	12
25	3	2	1	0	3	5	2	9	9	2	11	11	23	12	29	11	3	1	3	0	11	2	4	11	4	12	10
26	1	0	1	2	1	5	1	3	1	2	2	1	5	7	17	5	2	0	2	0	1	0	2	3	3	4	7
27	2	0	1	0	0	1	0	0	0	0	0	1	2	1	2	2	1	0	0	0	0	0	0	1	0	1	1
28	1	0	0	0	1	1	0	0	0	1	0	0	0	1	0	2	1	0	0	1	0	0	2	0	0	0	0
29	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**56**	**21**	**93**	**74**	**556**	**1,076**	**334**	**1,304**	**701**	**395**	**1,275**	**1,515**	**274**	**820**	**452**	**749**	**642**	**569**	**1,068**	**901**	**1,138**	**172**	**364**	**698**	**291**	**449**	**185**

													Fall														
length	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
6	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	-	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	1	0	0	1	0	-	0	0	0	0	0
9	0	0	0	0	3	1	0	0	1	0	0	1	6	1	1	0	1	0	3	2	0	-	1	0	0	1	3
10	0	0	0	0	5	1	4	1	1	0	1	4	23	0	7	1	7	0	8	2	1	-	1	0	0	2	9
11	0	0	0	0	27	30	5	5	6	1	3	5	59	0	33	6	14	0	22	1	2	-	9	0	8	0	23
12	0	0	0	1	120	82	9	25	12	9	6	9	86	4	64	7	8	0	44	0	2	-	22	2	14	7	32
13	0	0	3	0	88	84	14	21	21	7	9	17	72	0	4	12	17	0	87	5	10	-	14	3	16	27	88
14	0	0	2	4	16	36	11	30	31	0	11	10	23	3	3	16	15	0	134	14	10	-	22	0	34	48	26
15	0	0	1	8	21	31	0	9	53	0	5	8	24	3	5	28	15	2	118	4	8	-	28	2	6	12	53
16	3	0	3	10	53	14	4	1	110	1	25	2	36	17	20	30	12	4	31	0	1	-	14	1	2	4	37
17	2	0	0	12	25	33	1	2	194	4	34	0	27	8	19	12	3	0	8	3	1	-	19	2	2	0	11
18	3	0	0	9	13	24	1	1	62	3	11	1	5	0	0	1	5	0	6	0	1	-	17	0	0	2	14
19	0	0	0	2	1	11	0	0	0	1	4	1	0	1	0	0	0	0	7	1	0	-	1	0	1	0	3
20	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	-	0	0	0	0	0
21	0	0	0	0	3	1	1	0	0	1	2	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	1
22	0	1	0	0	2	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
23	0	0	0	0	0	1	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	-	0	0	0	1	1
24	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
25	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
27	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
Total	**8**	**1**	**9**	**46**	**377**	**354**	**50**	**95**	**492**	**27**	**117**	**58**	**364**	**38**	**156**	**113**	**98**	**6**	**468**	**33**	**37**	**0**	**148**	**10**	**83**	**104**	**301**

Table 5.31. American shad length frequencies, spring and fall, 2.0 cm intervals (midpoint given), 1989-2015.

From 1989 - 1990, lengths were recorded from the first three tows of each day; since 1991, lengths have been recorded from every tow.

														Spring													
length	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
7	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	
9	0	0	0	0	8	2	17	0	6	9	5	5	2	13	6	1	6	0	0	0	1	0	0	0	11	7	
11	0	0	1	3	7	2	16	5	24	27	20	46	1	101	12	8	11	0	5	26	12	12	5	3	48	41	
13	4	0	10	8	4	4	11	9	59	85	31	29	2	87	11	14	10	0	20	78	36	21	28	34	38	32	
15	49	1	82	17	6	22	22	191	177	108	65	21	2	41	0	45	25	38	54	180	66	77	100	106	20	9	
17	29	8	49	23	10	72	68	154	319	97	52	32	4	49	3	6	4	14	44	51	40	47	25	45	11	3	
19	5	5	4	33	6	374	40	47	62	32	20	13	0	17	0	2	0	5	8	11	15	5	3	5	2	1	
21	1	3	10	25	6	158	6	9	2	1	35	1	0	4	4	2	6	0	3	3	3	2	1	0	1	1	
23	0	3	31	20	5	18	2	16	5	8	50	4	0	7	7	4	7	0	4	3	4	0	0	10	8	16	
25	0	2	10	7	1	6	0	15	1	7	14	2	3	4	0	0	3	0	7	0	0	1	0	22	1	2	
27	0	1	1	0	0	2	0	5	0	1	1	1	0	0	0	0	2	0	4	0	0	0	0	4	0	2	
29	0	0	0	0	0	1	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	
31	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	
33	0	0	0	0	0	0	0	1	3	0	3	3	0	1	0	0	1	0	2	0	0	0	0	0	0	0	
35	0	1	1	1	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0	0	0	0	1	
37	0	0	0	2	0	1	0	0	4	0	1	0	0	1	0	0	1	1	0	0	0	0	0	0	0	1	
39	1	0	0	3	2	2	1	0	2	0	4	0	0	2	0	0	0	1	1	0	0	0	0	0	0	1	
41	1	0	1	5	2	3	2	0	3	0	3	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
43	0	0	1	4	2	1	0	0	1	1	6	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	
45	1	0	1	7	2	3	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
47	0	0	0	2	0	1	2	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	2	1	
49	0	0	0	2	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	
51	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total	**91**	**24**	**202**	**163**	**61**	**675**	**189**	**452**	**669**	**378**	**313**	**157**	**14**	**337**	**43**	**83**	**79**	**60**	**152**	**353**	**178**	**165**	**162**	**231**	**142**	**120**	**0**

														Fall													
length	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
7	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	-	0	0	0	1	
9	0	0	7	1	2	6	7	0	6	1	5	0	1	1	4	5	4	0	2	4	0	-	4	4	0	9	
11	0	1	4	5	23	26	16	1	20	14	27	0	4	1	14	6	3	0	19	4	27	-	4	4	0	2	
13	0	0	7	21	54	208	24	7	28	13	44	0	1	0	22	4	5	0	26	3	22	-	2	2	1	2	
15	0	0	4	2	33	245	14	2	5	4	6	0	0	0	0	2	0	0	13	0	36	-	2	0	2	5	
17	0	0	22	7	10	20	2	0	12	64	13	2	5	11	15	77	3	1	2	0	3	-	6	2	8	0	
19	32	34	93	41	53	57	84	0	67	290	130	16	47	199	121	155	23	6	5	6	42	-	35	5	31	9	
21	129	143	22	102	466	229	335	15	99	123	251	104	34	44	80	21	46	0	8	28	88	-	42	52	32	9	
23	30	27	0	30	394	197	83	19	12	0	179	39	3	0	6	0	14	1	8	7	25	-	14	21	5	1	
25	0	0	0	1	24	50	3	4	0	0	17	0	1	0	0	1	0	0	0	0	0	-	0	0	0	2	
27	0	0	0	3	2	7	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	
37	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	
41	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	
49	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	
51	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	
Total	**192**	**205**	**159**	**214**	**1,061**	**1,047**	**568**	**48**	**251**	**509**	**674**	**161**	**96**	**256**	**262**	**273**	**98**	**8**	**83**	**52**	**243**	**-**	**109**	**90**	**79**	**40**	**0**

Table 5.32. American lobster length frequencies-spring, female, 1 mm intervals, 1984–2015.

Lobsters were measured from each tow.

Female	Spring																														
Length	1984 (32)	1985 (46)	1986 (116)	1987 (120)	1988 (120)	1989 (120)	1990 (120)	1991 (120)	1992 (80)	1993 (120)	1994 (120)	1995 (120)	1996 (120)	1997 (120)	1998 (120)	1999 (120)	2000 (120)	2001 (120)	2002 (120)	2003 (120)	2004 (119)	2005 (120)	2006 (80)	2007 (120)	2008 (120)	2009 (120)	2010 (78)	2011 (92)	2012 (120)	2013 (120)	2014 (120)	2015 (120)
16	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
17	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	2	0	2	0	4	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	1	0	0	3	1	0	2	4	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	4	0	1	3	1	1	2	6	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	2	1	8	0	2	0	1	0	0	0	0	2	0	0	1	0	0	0	0	1
25	1	0	0	0	0	0	1	0	0	1	0	1	1	0	3	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
26	0	0	0	0	0	0	0	3	5	0	0	0	6	9	3	9	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	1	0	0	1	0	5	7	12	4	6	9	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
28	0	2	0	0	1	0	0	3	0	1	1	0	5	8	6	10	11	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0
29	0	0	1	2	0	0	0	4	0	2	0	0	13	14	7	8	13	3	2	1	1	0	0	0	0	0	0	2	1	0	0	0
30	0	0	0	1	1	0	11	6	0	5	3	0	13	12	95	2	19	2	0	1	0	0	0	1	0	0	0	1	5	0	0	0
31	0	0	0	0	1	1	6	3	6	1	1	4	8	22	19	16	20	1	4	1	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	1	0	0	13	7	2	20	0	2	15	13	18	21	23	2	2	1	1	0	0	0	0	0	1	0	0	1	1	0
33	0	1	0	2	2	6	8	0	5	1	6	21	14	13	35	18	8	3	0	2	1	1	0	5	1	0	0	2	0	0	0	0
34	0	3	0	1	0	0	5	8	15	4	0	18	7	22	64	8	37	4	8	2	3	0	0	4	0	0	1	0	0	4	0	0
35	4	4	3	2	0	0	9	1	4	6	4	22	15	22	59	22	48	3	5	2	1	2	0	4	0	1	0	0	1	0	1	0
36	5	3	2	11	0	0	9	8	6	14	0	8	14	21	41	26	48	3	5	2	0	0	0	0	0	0	0	0	4	3	2	0
37	0	4	1	2	0	0	10	9	6	7	11	27	21	42	58	29	36	2	3	4	0	2	0	3	3	0	0	1	4	0	0	0
38	2	0	0	7	2	4	6	11	13	17	1	49	10	31	72	42	35	7	10	2	3	0	1	5	0	0	1	1	2	0	0	0
39	1	3	0	3	5	1	0	8	12	9	4	22	16	39	73	34	53	7	3	2	3	2	0	10	3	1	2	4	1	1	3	0
40	1	4	2	10	4	4	7	6	17	28	8	41	18	30	98	23	68	8	10	6	5	2	3	11	1	0	3	1	1	0	3	1
41	2	3	1	18	2	3	22	9	10	23	8	18	18	17	71	36	58	11	8	4	2	2	2	13	1	3	2	0	1	1	1	1
42	1	6	3	8	1	3	17	22	9	41	11	46	18	33	143	54	65	11	18	5	6	0	0	5	2	0	1	1	1	2	2	1
43	1	1	1	22	0	11	19	16	11	13	11	53	27	44	59	50	84	9	6	8	6	4	1	7	1	2	1	0	3	0	1	1
44	1	1	2	16	6	2	13	12	14	25	9	61	22	32	43	38	117	19	15	15	4	5	4	9	3	3	0	1	4	0	0	1
45	0	2	1	9	1	12	11	12	5	24	8	38	22	36	135	35	138	9	14	3	3	2	2	9	0	0	1	0	1	1	2	0
46	4	3	1	12	3	8	4	18	26	30	2	34	22	42	88	64	102	15	22	4	0	1	4	3	3	1	1	2	3	1	1	1
47	2	1	4	31	2	14	4	21	8	40	8	59	35	53	70	77	91	18	20	25	7	2	5	11	3	1	0	1	5	0	4	0
48	2	2	2	15	6	20	22	17	28	35	12	54	31	56	104	59	72	11	17	9	7	6	2	7	3	5	3	2	1	1	5	0
49	4	4	4	10	4	7	13	28	19	67	15	37	32	55	198	90	89	8	15	15	5	1	3	7	2	2	0	5	6	3	3	1
50	6	1	6	7	4	7	16	18	5	40	21	51	43	67	139	63	104	13	21	13	6	2	0	10	6	1	0	3	2	1	3	1
51	4	5	6	8	3	15	33	24	22	59	16	58	48	88	133	95	109	31	17	13	5	2	4	16	6	3	1	0	3	0	5	0
52	9	8	3	15	3	14	29	45	32	35	33	58	57	73	165	89	125	40	25	11	6	4	3	13	3	3	1	0	4	3	4	2
53	10	4	4	20	5	19	14	38	31	54	24	53	47	82	167	89	83	32	26	9	6	6	5	14	3	3	0	0	2	0	2	1
54	2	4	6	15	2	22	38	35	18	38	29	44	45	87	140	84	152	30	41	15	6	7	2	9	3	3	1	1	3	0	1	0
55	9	2	8	14	3	9	26	19	26	47	17	59	64	82	191	91	132	34	38	21	8	9	11	20	6	7	2	2	4	0	4	0
56	6	9	11	12	14	15	31	47	16	60	17	64	56	98	152	99	85	44	24	14	10	14	2	20	7	0	3	0	4	0	4	0
57	10	3	6	10	11	23	24	57	61	79	24	46	60	95	159	156	102	44	28	11	7	10	7	17	12	6	1	2	0	3	3	0
58	1	8	7	15	6	25	38	35	27	53	17	56	62	111	144	118	118	38	35	11	12	12	7	15	9	5	5	1	3	2	2	0
59	10	18	7	14	7	29	13	51	28	52	37	70	66	97	144	147	105	45	32	12	12	11	9	15	4	3	5	0	12	2	2	0
60	6	12	11	19	9	25	34	45	43	57	30	91	76	97	114	102	97	60	48	15	16	10	3	24	6	4	1	3	2	1	2	0
61	5	14	11	8	12	15	33	49	31	56	44	62	62	92	181	160	79	46	40	21	6	20	13	28	7	3	2	2	3	1	0	0
62	12	9	5	11	4	12	57	33	34	75	46	61	67	94	118	116	75	59	46	13	11	14	9	22	10	7	2	2	4	0	0	0
63	4	9	10	27	9	27	56	41	25	60	44	60	70	96	133	136	66	43	41	28	14	13	6	23	11	5	4	1	5	0	3	0
64	10	16	9	16	8	13	38	33	41	75	24	64	91	86	176	148	110	75	46	23	11	16	8	25	10	6	1	1	0	1	2	2
65	9	7	9	29	15	25	46	45	26	68	28	72	78	110	169	160	84	63	48	10	16	19	12	16	13	10	0	0	0	0	0	0
66	11	15	18	25	10	21	43	59	48	86	26	84	87	116	147	121	99	55	39	15	19	9	3	21	23	8	1	0	4	0	2	1
67	6	20	22	21	14	31	33	51	41	52	28	67	62	98	148	171	90	72	42	16	23	23	9	17	8	4	4	1	7	0	3	0
68	21	10	12	43	11	14	41	65	37	45	29	76	73	94	142	158	107	49	48	19	20	13	14	21	15	7	4	2	1	1	2	4
69	10	8	18	33	16	16	36	78	56	58	30	71	57	107	148	188	76	79	52	28	16	13	1	13	19	10	2	2	1	0	1	0
70	15	5	14	30	13	29	51	59	37	67	27	79	74	119	157	177	86	67	57	25	21	12	6	23	20	6	6	0	1	0	0	1
71	10	11	12	21	12	13	29	48	49	67	44	92	88	125	117	166	91	74	45	24	15	18	10	23	14	6	3	4	2	2	2	0
72	11	6	20	18	8	24	40	50	48	61	30	77	91	107	157	177	98	75	80	20	13	22	10	30	15	8	0	1	2	4	2	1
73	13	9	18	13	14	20	47	39	54	54	37	97	69	107	171	164	99	59	61	30	17	17	8	23	18	8	6	1	3	1	3	1
74	10	6	17	20	8	24	24	43	52	45	39	60	74	130	153	215	104	66	70	25	11	12	9	17	13	6	5	0	2	0	2	1
75	15	12	17	28	7	20	67	87	56	54	25	83	68	103	181	196	124	80	47	27	16	19	9	17	14	7	5	0	0	4	0	2
76	14	9	20	14	8	25	67	71	41	38	24	78	69	114	229	185	102	59	45	15	9	16	11	13	25	5	9	0	4	0	1	0
77	9	5	15	19	15	32	41	77	69	44	20	102	65	95	160	195	109	52	39	23	16	13	17	16	11	6	3	2	1	0	1	0
78	24	9	15	14	13	49	60	57	63	64	22	90	61	110	177	176	93	48	55	18	7	9	15	16	16	10	4	4	1	1	2	0
79	23	6	24	21	10	55	42	64	35	52	30	77	92	117	179	203	98	51	52	11	10	9	13	14	12	14	3	2	3	2	0	1
80	22	1	18	10	11	35	34	45	31	71	41	71	79	92	180	200	91	63	41	16	15	9	11	15	8	7	9	3	4	1	0	2
81	10	2	7	15	13	19	69	56	49	48	34	72	86	148	170	140	85	62	33	11	15	9	9	12	16	2	8	2	0	1	1	0
82	9	0	3	9	5	15	28	41	36	35	21	71	57	110	108	106	47	40	21	14	8	6	5	14	10	4	5	0	1	0	0	1
83	9	5	5	8	3	7	25	22	16	7	7	15	31	28	65	59	41	25	17	4	4	7	3	9	14	9	2	1	1	0	0	1
84	3	1	7	9	4	11	15	12	7	8	4	11	19	20	7	33	14	18	18	4	4	5	3	5	7	7	2	0	3	3	0	0
85	5	2	5	7	6	3	11	5	7	8	8	17	20	28	22	9	15	9	7	1	5	1	0	5	6	2	1	2	0	1	0	0
86	9	3	6	3	6	8	14	14	3	3	2	11	23	24	23	10	12	8	11	2	0	3	0	2	7	1	4	0	0	0	1	0
87	10	0	3	4	8	13	17	9	7	13	15	16	11	13	12	9	8	7	4	4	1	3	3	0	1	2	1	0	2	0	0	0
88	2	3	8	3	9	9	6	11	3	11	2	7	13	18	17	5	1	9	1	0	1	0	0	2	5	3	2	0	0	0	0	0
89	3	6	5	8	5	8	12	10	12	5	2	16	12	16	13	11	8	9	5	1	1	1	0	3	0	1	0	0	0	0	0	0
90	15	2	4	3	8	4	5	8	11	3	3	9	15	10	11	10	7	10	4	1	4	2	0	1	4	0	0	0	0	0	0	0
91	5	1	1	6	2	5	11	8	1	3	0	5	7	11	6	3	2	4	0	0	0	2	1	0	0	0	2	0	1	0	0	0
92	4	2	0	2	3	2	7	1	0	3	3	3	5	7	7	2	1	2	7	0	1	0	0	0	1	3	0	0	0	0	0	0
93	0	1	2	1	2	1	2	1	0	0	1	0	6	3	0	2	5	0	1	0	0	0	1	0	1	0	3	0	0	0	1	0
94	0	2	1	1	3	1	1	2	0	1	5	1	1	1	4	1	0	1	0	1	0	0	0	1	2	0	0	0	0	0	0	0
95	0	0	1	2	2	3	8	4	0	0	0	0	0	0	6	0	0	1	1	0	0	0	0	1	0	1	0	0	0	0	0	0
96	0	1	0	0	0	2	0	1	0	1	2	0	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
97	1	1	1	0	3	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
98	2	2	0	1	0	1	1	0	1	0	0	0	1	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
99	3	0	2	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
102	2	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
103	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
104	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
106	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
109	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
110	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
111	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**451**	**335**	**469**	**838**	**405**	**914**	**1,621**	**1,946**	**1,560**	**2,336**	**1,131**	**3,052**	**2,837**	**4,220**	**6,921**	**5,731**	**4,595**	**2,011**	**1,646**	**709**	**483**	**458**	**296**	**737**	**449**	**238**	**144**	**69**	**139**	**56**	**90**	**30**
legal size	81.0					81.8		82.6															83.3	84.1			85.7					

Table 5.33. American lobster length frequencies–fall, female, 1 mm intervals, 1984–2015.

Lobsters were measured from each tow.

Female Length	Fall 1984 (70)	1985 (80)	1986 (80)	1987 (80)	1988 (80)	1989 (80)	1990 (80)	1991 (80)	1992 (80)	1993 (120)	1994 (120)	1995 (80)	1996 (80)	1997 (80)	1998 (80)	1999 (80)	2000 (80)	2001 (80)	2002 (80)	2003 (40)	2004 (80)	2005 (80)	2006 (40)	2007 (80)	2008 (40)	2009 (80)	2010 (0)	2011 (80)	2012 (80)	2013 (80)	2014 (79)	2015 (80)
16	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
22	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	-	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	-	0	0	0	0	0
24	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
25	0	0	0	0	0	1	0	0	0	0	0	1	2	0	0	0	0	1	0	0	1	0	0	0	0	0	-	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	1	4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
27	0	0	0	0	0	1	0	0	0	3	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	-	0	0	0	0	0
28	0	0	0	0	0	0	1	0	4	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
29	0	0	0	0	0	1	1	0	0	3	3	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	-	0	2	0	0	0
30	0	0	0	0	1	0	4	0	2	5	3	0	5	7	2	0	0	0	0	0	0	0	0	0	0	1	-	0	0	0	0	0
31	0	0	1	0	0	0	3	0	7	11	8	1	5	4	0	0	1	1	0	0	1	0	0	0	0	0	-	0	0	0	0	0
32	1	0	0	0	0	0	3	1	15	4	13	1	4	5	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
33	0	0	0	2	1	1	3	12	9	2	2	0	0	1	1	5	0	0	0	0	0	0	0	0	1	0	-	1	0	0	0	0
34	1	0	0	0	2	1	0	6	16	3	17	2	6	8	1	8	0	0	0	0	1	0	0	0	0	0	-	1	0	0	0	0
35	0	0	6	1	0	2	3	0	23	5	16	3	8	6	0	2	1	0	0	0	1	0	0	0	0	0	-	1	0	0	0	0
36	4	0	1	1	1	3	1	1	31	7	26	0	8	14	0	5	0	0	0	0	0	0	0	0	1	0	-	0	0	3	0	0
37	4	0	2	0	3	2	10	22	19	2	19	5	5	7	1	8	1	0	1	0	1	1	0	0	0	0	-	0	0	0	0	0
38	3	2	2	3	3	2	8	1	24	9	23	1	18	17	2	13	1	2	0	0	0	1	0	0	0	0	-	0	0	1	0	0
39	6	0	10	1	1	0	9	15	32	6	22	0	7	22	2	4	1	2	1	0	0	0	2	0	0	1	-	0	0	0	0	0
40	0	0	3	1	12	14	14	20	35	16	24	12	23	15	3	8	1	1	0	0	0	0	0	0	0	0	-	0	0	0	0	0
41	3	0	0	5	2	6	19	21	32	22	52	8	39	15	7	13	2	0	0	1	2	1	0	0	0	0	-	1	0	0	0	0
42	7	0	5	0	4	2	3	36	52	21	43	7	24	49	9	17	2	3	0	0	2	0	1	0	0	0	-	0	0	0	0	0
43	5	0	2	4	4	2	16	23	30	39	52	16	20	25	5	15	3	0	1	1	1	4	0	0	0	0	-	0	1	0	0	0
44	29	7	1	8	1	6	11	32	32	29	63	14	46	47	9	17	5	0	2	1	2	1	0	0	0	2	-	1	1	1	0	0
45	18	0	7	3	2	0	12	25	50	17	57	22	38	32	7	27	4	2	2	1	0	1	1	0	0	1	-	0	1	0	0	0
46	10	0	1	11	6	6	26	34	42	43	63	20	33	50	12	18	9	3	2	1	5	2	2	1	0	0	-	1	0	0	0	0
47	21	7	3	12	2	12	18	52	47	44	41	27	32	42	5	16	2	1	0	1	2	0	0	0	0	1	-	1	0	0	0	0
48	10	5	4	14	8	18	19	35	58	52	69	28	33	58	14	15	7	2	6	0	2	2	1	0	1	0	-	0	0	0	0	0
49	29	6	7	14	15	11	15	27	77	58	47	47	19	71	11	27	10	2	4	2	4	1	1	0	0	1	-	0	0	1	0	0
50	27	9	6	21	12	4	31	41	52	38	69	54	28	61	13	31	10	6	2	2	2	4	3	2	3	0	-	0	0	0	0	0
51	35	8	2	12	3	11	10	44	73	72	94	45	41	49	15	30	13	6	3	1	2	2	0	0	1	0	-	0	1	0	0	0
52	26	11	3	15	3	11	21	40	66	54	59	51	42	120	18	34	13	3	6	3	5	2	1	0	0	0	-	1	0	0	0	0
53	33	8	3	22	10	7	22	55	82	94	55	43	43	106	29	18	16	9	3	1	6	10	2	3	1	3	-	0	0	1	0	0
54	16	8	18	11	12	14	20	41	61	83	76	38	58	82	17	45	28	8	1	3	2	2	3	1	2	3	-	1	1	0	0	1
55	23	10	27	21	2	6	22	59	58	59	54	39	45	102	48	32	18	9	1	3	7	8	1	1	3	1	-	3	2	0	0	0
56	45	10	11	36	10	24	22	29	82	87	74	45	41	90	23	32	33	12	1	3	6	0	3	2	1	6	-	3	2	0	0	0
57	16	15	16	18	7	7	15	52	71	71	78	50	44	121	24	39	22	13	5	2	13	5	2	1	10	6	-	2	0	0	0	0
58	23	16	11	19	13	17	36	55	63	119	79	69	47	114	29	31	23	14	6	5	5	8	1	2	2	5	-	1	0	1	0	0
59	21	11	13	26	13	23	30	79	66	110	84	48	46	110	35	36	28	18	5	6	10	4	4	0	2	5	-	0	2	1	0	0
60	30	18	20	18	7	17	16	74	53	115	70	53	51	140	29	35	34	8	6	9	7	6	1	4	5	2	-	1	2	0	0	0
61	10	4	17	24	12	14	37	46	52	91	79	51	56	119	34	37	27	9	5	2	12	7	2	1	2	6	-	1	1	0	0	0
62	27	16	23	21	14	32	41	64	53	107	117	44	53	133	39	44	32	19	3	5	10	3	5	1	2	8	-	1	1	1	0	0
63	31	14	13	22	8	20	22	53	66	130	93	58	41	126	51	45	29	19	6	6	16	12	4	4	4	5	-	0	1	0	0	0
64	25	10	15	29	23	31	26	71	38	100	86	79	38	139	34	44	29	21	9	12	19	5	4	4	4	7	-	0	0	0	0	0
65	17	9	39	24	15	28	26	77	44	93	89	49	43	146	49	42	37	18	9	6	15	9	1	2	3	9	-	0	0	0	0	0
66	24	26	25	23	15	16	42	70	56	90	87	82	53	126	51	43	26	19	5	5	10	7	1	4	1	6	-	0	0	1	0	0
67	17	24	33	11	19	16	29	38	43	78	106	51	38	117	26	53	31	17	8	11	14	6	2	3	3	8	-	0	1	0	0	0
68	15	8	27	18	22	30	36	41	42	94	77	48	55	124	54	44	37	19	7	6	4	8	1	6	4	4	-	0	0	0	2	0
69	13	18	15	27	26	32	21	34	61	104	85	38	50	136	54	47	30	22	4	8	16	12	5	1	4	3	-	1	0	0	0	0
70	63	18	42	27	34	23	20	36	51	122	63	60	55	128	47	35	34	23	17	4	13	5	0	4	3	3	-	0	0	0	0	2
71	26	21	28	34	33	40	30	50	50	94	87	62	87	127	50	40	20	20	3	6	14	2	0	2	3	6	-	2	0	0	0	0
72	27	16	27	32	13	12	39	58	31	81	85	38	49	150	41	53	32	25	11	12	10	3	2	3	6	4	-	0	0	0	0	0
73	21	29	42	24	18	15	58	46	33	74	69	60	40	106	41	47	36	24	9	6	10	5	2	6	4	5	-	1	0	1	0	2
74	31	17	23	29	14	21	36	30	39	85	73	44	38	111	37	49	39	19	12	7	16	9	3	2	3	1	-	1	0	1	0	1
75	39	14	25	24	14	12	21	31	25	66	84	31	58	122	67	50	29	28	7	7	16	5	3	7	3	1	-	1	0	1	0	0
76	31	14	22	36	14	13	35	27	35	112	50	38	57	113	47	43	26	21	10	8	15	5	3	4	2	3	-	0	0	0	0	0
77	17	16	10	26	13	14	17	37	40	74	72	36	23	64	41	31	22	18	2	1	18	5	3	4	0	1	-	0	0	0	1	1
78	27	17	24	27	27	21	22	24	19	57	53	19	34	96	43	38	20	33	6	15	5	8	2	2	0	2	-	0	0	0	0	0
79	26	19	16	37	31	13	29	33	26	72	42	28	28	91	34	28	32	21	2	9	12	6	3	5	3	5	-	0	0	0	1	0
80	33	11	15	20	23	12	6	14	23	65	26	25	44	91	25	32	26	19	14	2	16	4	2	5	1	4	-	0	1	0	0	0
81	13	7	13	14	5	10	12	18	24	36	38	36	41	61	25	28	20	20	2	4	3	4	0	0	2	5	-	3	0	0	0	1
82	9	2	19	6	6	2	10	14	10	39	26	25	21	52	23	23	14	7	2	5	3	8	3	2	0	5	-	0	0	1	0	0
83	10	5	8	12	6	12	8	3	11	17	11	12	31	20	10	6	13	7	4	1	2	9	1	5	0	4	-	0	0	0	0	0
84	5	6	2	7	1	1	4	10	8	17	22	10	7	17	5	4	7	6	0	0	2	1	0	0	1	3	-	0	0	1	0	0
85	9	1	8	6	9	3	6	17	7	8	20	5	5	13	5	2	5	3	1	0	2	1	0	1	2	1	-	0	0	0	0	0
86	11	2	9	10	0	1	10	12	4	10	14	1	6	12	5	2	6	1	0	0	2	1	0	0	0	1	-	0	0	0	0	0
87	11	6	9	8	23	4	18	12	5	16	20	1	8	11	3	5	5	3	0	1	1	2	1	0	1	1	-	1	0	0	0	0
88	9	3	9	9	3	1	3	9	9	13	8	1	20	10	7	5	2	1	0	0	0	1	0	0	0	0	-	0	0	2	0	0
89	3	4	6	2	7	3	5	1	8	8	12	5	13	14	1	3	3	3	0	0	0	4	0	0	1	0	-	0	0	0	0	0
90	8	1	3	6	0	1	6	1	5	1	15	9	5	10	1	2	1	2	1	0	0	1	0	0	0	1	-	0	0	0	0	0
91	3	1	2	5	0	1	1	0	3	0	5	0	9	3	2	1	1	0	0	0	0	0	0	0	0	1	-	0	0	0	0	0
92	8	0	0	2	1	1	4	1	7	1	6	1	3	1	3	0	0	0	0	0	0	0	0	0	0	2	-	0	0	0	0	1
93	2	2	0	3	2	0	0	1	2	1	8	0	1	4	2	1	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
94	0	2	0	1	0	0	0	2	1	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	-	0	0	0	0	0
95	1	0	0	1	6	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
96	3	0	0	1	1	0	1	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
97	15	1	0	1	1	0	1	0	1	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
98	2	1	0	1	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
99	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
100	0	1	0	1	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
101	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
102	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
103	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
104	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
105	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
107	1	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
111	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
113	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
117	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
Total	**1,089**	**523**	**759**	**907**	**622**	**688**	**1,133**	**1,917**	**2,301**	**3,264**	**3,198**	**1,795**	**1,979**	**4,196**	**1,329**	**1,511**	**957**	**596**	**223**	**195**	**365**	**225**	**84**	**94**	**96**	**150**	**-**	**31**	**20**	**18**	**4**	**9**
legal size:	81.0					81.8		82.6														83.3	84.1				85.7					

Table 5.34. American lobster length frequencies–spring, male, 1 mm intervals, 1984–2015.

Lobsters were measured from each tow.

Male	**Spring**																															
	1984	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Length	(32)	(46)	(116)	(120)	(120)	(120)	(120)	(120)	(80)	(120)	(120)	(120)	(120)	(120)	(120)	(120)	(120)	(120)	(120)	(120)	(119)	(120)	(80)	(120)	(120)	(120)	(78)	(92)	(120)	(120)	(120)	(120)
16	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	3	0	0	0	0	1	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	2	0	2	0	1	0	6	0	1	3	0	0	3	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	1	1	0	4	6	4	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	4	0	0	4	3	2	2	2	1	0	0	2	0	0	0	0	0	0	2	1	0	0	0
27	0	0	0	0	0	9	0	0	1	9	2	0	2	1	2	1	1	2	0	1	0	0	0	0	1	0	0	0	0	0	0	1
28	0	0	0	0	0	0	0	0	1	3	1	0	2	1	5	2	12	2	2	0	0	0	0	1	1	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	9	0	0	2	3	5	0	9	3	1	0	0	0	0	0	0	0	0	3	0	0	1	0
30	0	0	0	1	0	1	5	0	5	1	0	3	10	5	2	4	15	3	1	2	1	0	0	0	0	0	0	0	0	2	0	0
31	0	1	0	1	1	0	0	8	4	3	2	0	8	13	14	7	18	3	4	0	0	1	1	1	0	0	0	0	1	0	1	0
32	0	0	0	0	3	6	0	6	6	8	1	8	9	12	11	16	17	2	2	5	0	0	0	2	0	0	1	1	3	2	0	0
33	0	2	1	2	0	0	1	9	0	6	4	15	6	9	4	15	16	3	9	3	0	1	0	1	1	0	0	1	0	0	0	0
34	0	0	3	2	0	1	1	5	1	6	0	27	19	16	52	12	25	2	4	1	0	0	0	5	0	0	1	0	0	0	1	0
35	2	0	2	0	0	0	4	5	9	5	1	20	12	22	26	23	33	2	5	2	4	0	1	2	1	0	0	1	2	0	1	0
36	2	4	0	1	1	7	14	4	5	7	3	17	13	24	34	19	26	6	1	3	1	2	0	6	0	0	1	3	3	0	1	0
37	1	1	2	5	0	3	2	23	9	12	4	15	20	32	58	35	32	5	3	2	4	2	0	7	1	0	0	1		0	0	0
38	0	1	1	5	2	7	14	9	1	26	3	18	18	21	93	12	28	3	8	4	2	1	2	7	0	0	2	1	4	0	3	1
39	0	0	0	10	0	6	12	5	7	15	4	31	15	20	33	20	35	11	9	4	3	2	3	8	0	1	0	0	1	0	0	0
40	0	2	0	7	2	8	3	5	12	17	7	25	21	41	32	20	52	8	10	2	0	1	2	4	2	0	1	3	3	2	1	2
41	0	2	2	9	1	0	11	8	7	4	10	28	19	41	75	46	55	3	13	7	3	0	1	6	3	0	2	2	2	0	0	2
42	4	2	0	3	1	9	13	10	13	42	7	39	18	46	125	36	63	14	9	10	3	5	0	16	3	2	0	3	4	1	2	0
43	1	2	1	16	0	9	14	9	12	23	5	52	26	24	70	51	32	5	9	10	5	2	2	8	1	1	1	0	2	1	1	0
44	3	0	1	15	1	3	10	11	6	42	9	17	21	50	170	44	110	10	15	9	1	0	4	12	2	1	3	3	2	0	3	1
45	1	5	4	22	3	7	7	20	13	45	6	39	28	46	76	50	65	17	16	20	5	3	2	9	3	1	2	2	4	3	1	3
46	0	2	2	24	2	24	7	12	25	37	9	32	22	66	155	71	74	19	18	18	4	3	2	11	0	4	1	3	2	0	6	0
47	0	1	2	31	7	3	2	17	47	32	9	54	32	66	146	87	65	17	9	4	4	4	1	16	0	2	2	1	0	0	1	0
48	6	6	5	9	1	8	20	17	7	23	6	45	32	78	93	60	57	22	29	6	3	6	5	8	4	2	2	0	2	1	5	1
49	9	3	4	24	4	22	20	45	21	40	19	46	18	82	120	87	69	16	18	8	15	3	4	16	3	3	1	0	3	0	1	0
50	7	3	1	19	4	23	10	21	25	30	21	29	35	61	66	83	110	34	22	16	7	6	4	9	4	2	0	2	2	0	3	2
51	3	4	4	12	2	20	26	42	16	75	16	62	45	57	158	90	65	24	31	19	8	8	9	10	3	5	0	0	1	0	2	0
52	9	5	2	12	2	15	23	21	25	37	31	49	52	75	81	80	100	27	27	14	10	6	2	12	3	2	2	0	7	0	3	0
53	5	9	7	17	4	10	12	33	16	41	26	60	50	56	138	69	66	25	20	11	5	7	5	19	6	4	1	0	2	1	1	1
54	10	3	16	14	7	14	30	45	36	43	29	74	49	74	210	79	110	33	38	26	15	6	5	21	5	4	1	4	4	2	0	1
55	5	3	6	18	7	23	16	42	27	50	27	46	51	82	101	101	114	38	23	18	2	9	6	12	5	3	2	1	3	4	4	0
56	3	12	11	17	10	6	34	38	37	44	14	70	54	83	130	82	95	37	29	19	13	11	9	7	7	6	6	2	4	0	3	1
57	1	7	10	26	11	17	36	30	12	51	27	54	60	68	145	93	95	43	35	22	7	6	5	21	4	3	3	3	1	1	2	2
58	12	7	5	10	4	19	44	71	31	47	35	41	83	96	111	111	99	43	46	11	12	8	5	13	8	1	2	1	2	2	0	0
59	3	13	7	12	14	25	29	57	27	88	34	71	56	67	63	144	89	43	43	13	6	11	10	24	9	7	4	2	3	0	1	1
60	1	9	14	29	8	23	49	50	37	42	34	94	84	156	121	105	105	56	35	24	8	9	6	16	9	6	1	0	4	2	3	1
61	9	14	16	12	10	22	39	56	46	62	34	77	59	102	176	123	83	51	36	28	14	10	14	11	11	6	3	3	5	2	3	0
62	11	10	13	15	6	30	44	78	36	65	54	57	58	127	152	117	84	69	44	20	11	12	7	12	16	12	2	0	5	0	2	2
63	18	15	16	28	8	24	52	65	54	44	36	59	60	101	167	132	73	54	44	24	16	13	13	19	19	5	6	2	5	3	4	2
64	8	16	12	26	8	21	45	72	43	63	27	73	90	95	153	133	98	69	46	26	10	14	8	22	16	4	8	3	5	1	0	0
65	13	8	11	20	15	20	47	55	36	73	33	77	73	97	165	111	96	75	50	30	21	17	8	16	16	8	2	1	5	1	1	5
66	5	10	11	26	16	32	49	71	31	71	23	39	73	107	223	129	64	56	39	23	31	15	6	22	23	2	6	2	0	1	0	2
67	1	5	11	26	11	32	29	57	44	39	21	69	60	118	182	149	66	77	53	24	16	14	6	33	19	1	3	1	10	1	0	0
68	5	10	13	12	7	21	33	80	48	26	34	67	64	100	147	116	81	82	32	36	22	23	11	20	19	10	5	0	0	1	2	2
69	8	9	10	19	24	25	39	71	46	43	32	57	79	101	156	140	77	73	51	25	11	20	8	16	11	4	3	4	3	2	3	2
70	8	11	14	23	7	34	38	50	51	27	24	60	77	99	158	152	85	73	44	27	21	16	9	15	21	11	5	2	5	1	2	0
71	9	5	13	22	13	29	55	66	23	48	42	85	58	91	112	152	62	71	56	20	29	20	7	4	18	5	11	3	1	0	0	1
72	6	17	13	14	17	33	40	93	42	37	41	59	85	111	145	105	72	62	42	23	13	11	8	25	15	7	4	3	5	2	0	2
73	14	5	10	21	11	28	37	94	42	34	27	93	64	82	122	109	61	63	46	15	22	16	6	13	14	3	6	1	2	3	1	0
74	6	9	27	21	11	45	40	74	36	32	33	67	71	92	146	123	74	85	40	35	15	10	2	15	8	9	5	3	4	2	1	1
75	6	3	13	15	10	35	29	63	40	48	21	84	62	73	81	120	52	72	39	21	16	14	6	19	11	5	2	3	3	0	2	0
76	12	3	20	16	18	18	33	79	23	32	23	47	48	67	143	122	49	69	50	25	9	11	4	13	8	3	4	2	5	0	0	3
77	9	7	10	14	7	22	30	69	31	24	12	50	54	66	115	97	57	63	35	24	18	17	2	8	14	10	6	2	6	0	1	0
78	18	3	18	9	11	33	46	37	29	38	20	55	35	46	113	90	37	56	55	14	9	8	4	9	13	8	0	2	3	0	0	1
79	7	9	15	21	15	22	31	77	19	41	30	36	43	64	129	83	43	57	31	14	13	9	7	13	7	12	6	4	0	4	0	0
80	5	6	9	22	5	23	34	49	22	19	32	52	37	57	77	63	47	67	39	19	8	10	6	15	9	4	7	0	1	1	0	2
81	8	0	9	11	1	34	21	53	34	31	19	43	27	70	118	67	44	45	41	11	6	8	5	11	9	10	3	1	1	2	0	0
82	2	3	2	10	4	9	18	39	25	13	13	51	27	62	97	83	23	36	31	10	7	2	1	16	8	2	2	0	1	2	1	1
83	9	0	5	9	7	18	12	33	24	6	7	15	15	47	33	41	37	25	21	4	8	4	7	2	8	6	0	3	0	1	1	0
84	5	1	8	12	2	5	10	33	9	7	3	26	8	34	28	29	24	23	21	8	7	3	3	8	10	2	2	2	2	2	0	1
85	3	2	6	8	4	6	9	28	6	3	0	14	4	49	18	20	26	23	18	2	8	3	5	5	1	2	1	1	0	0	0	1
86	1	3	5	1	6	26	8	28	7	4	2	15	13	12	19	17	30	23	15	1	8	1	1	7	6	1	2	1	0	2	0	0
87	3	0	1	13	8	9	4	31	0	0	6	3	6	30	37	23	11	15	8	3	3	1	2	1	7	4	0	2	0	1	0	0
88	0	0	5	4	1	14	2	21	2	0	4	14	4	32	15	27	12	10	13	2	2	1	1	1	4	1	1	0	0	3	0	1
89	5	0	2	2	3	2	6	21	5	0	2	11	3	33	28	23	13	10	8	2	1	3	2	0	4	4	2	0	0	0	0	0
90	0	0	0	1	5	6	5	24	2	1	0	7	7	30	25	24	16	11	9	3	0	0	1	3	3	4	0	1	0	0	1	0
91	4	0	1	7	4	7	5	26	6	1	0	7	2	25	11	20	11	14	8	3	1	4	0	0	3	2	1	1	0	0	1	0
92	2	0	2	4	2	3	1	24	1	3	0	8	11	23	15	9	8	10	10	1	0	1	1	0	1	0	0	1	1	1	0	0
93	0	0	3	6	1	10	0	5	0	1	0	8	2	6	27	4	13	9	4	0	1	1	0	5	0	0	0	0	1	0	0	1
94	0	2	1	3	0	1	0	9	1	0	0	9	2	7	16	17	11	9	4	3	2	0	1	0	3	0	0	1	0	0	0	0
95	1	0	0	5	0	0	0	1	0	1	2	7	1	4	5	8	7	0	1	2	1	0	0	0	1	1	0	0	1	0	0	0
96	0	0	1	1	0	0	2	8	1	1	0	6	0	1	8	4	5	2	3	0	1	0	0	0	0	0	0	0	0	0	0	0
97	3	3	1	2	1	9	2	2	4	0	0	3	0	6	3	4	1	2	0	1	0	0	0	0	2	1	0	0	0	0	0	0
98	0	0	0	3	0	0	1	1	0	0	1	0	0	2	0	0	1	0	2	1	0	1	1	0	0	0	0	0	0	0	0	0
99	2	0	0	1	0	1	0	2	0	0	0	1	1	1	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
100	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
101	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
104	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
107	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**317**	**295**	**436**	**854**	**375**	**1,031**	**1,362**	**2,429**	**1,371**	**1,906**	**1,064**	**2,690**	**2,389**	**3,875**	**6,112**	**4,554**	**3,624**	**2,198**	**1,633**	**843**	**541**	**439**	**266**	**690**	**451**	**231**	**149**	**99**	**154**	**64**	**77**	**51**
legal size	81.0					81.8		82.6															83.3	84.1			85.7					

Table 5.35. American lobster length frequencies–fall, male, 1 mm intervals, 1984–2015.
Lobsters were measured from each tow.

Male	Fall																															
Length	1984 (70)	1985 (80)	1986 (80)	1987 (80)	1988 (80)	1989 (80)	1990 (80)	1991 (80)	1992 (80)	1993 (120)	1994 (120)	1995 (80)	1996 (80)	1997 (80)	1998 (80)	1999 (80)	2000 (80)	2001 (80)	2002 (80)	2003 (40)	2004 (80)	2005 (80)	2006 (40)	2007 (80)	2008 (40)	2009 (80)	2010 (0)	2011 (80)	2012 (80)	2013 (80)	2014 (79)	2015 (80)
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
25	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
26	0	0	2	0	0	0	0	0	1	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
27	0	0	0	0	0	2	0	0	1	9	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	-	0	0	0	0	0
28	1	2	0	0	0	0	3	0	0	3	4	0	1	1	0	1	0	0	0	0	0	1	0	0	0	0	-	1	0	0	0	0
29	0	0	0	0	0	1	3	0	0	6	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
30	0	0	0	0	0	0	3	0	3	0	4	0	3	2	0	0	0	0	0	0	0	1	0	0	0	0	-	0	0	0	0	0
31	0	0	2	0	1	0	2	0	4	2	3	0	6	2	2	0	0	0	0	0	0	1	0	1	0	0	-	0	0	0	0	0
32	4	0	0	4	0	0	0	5	13	2	3	0	4	5	2	2	0	0	0	0	1	0	0	0	0	0	-	0	0	0	0	0
33	1	0	0	2	0	1	0	3	4	0	9	1	11	3	1	5	3	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
34	1	0	0	2	1	0	2	1	13	4	11	0	4	1	1	1	1	0	0	0	0	0	0	0	1	1	-	0	0	0	0	0
35	3	0	0	1	0	0	3	7	13	15	12	1	8	3	0	4	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
36	3	0	0	1	0	1	5	8	25	8	21	1	7	14	2	1	0	0	0	1	1	0	0	0	0	0	-	0	0	0	0	0
37	3	0	6	0	1	1	7	4	38	4	21	1	11	7	0	2	0	0	0	0	0	1	0	0	0	0	-	0	0	0	0	0
38	2	2	2	3	2	0	0	6	40	6	34	1	17	14	3	5	0	0	0	0	1	4	3	0	0	0	-	0	0	0	0	0
39	0	0	2	1	2	1	5	8	34	5	25	4	16	28	7	17	3	0	1	0	0	1	0	0	1	0	-	0	0	0	0	0
40	3	0	6	2	1	5	10	8	35	21	35	6	15	14	5	7	1	0	2	0	0	0	0	0	0	1	-	0	1	0	0	0
41	6	1	1	3	4	1	12	13	43	14	54	5	11	24	1	6	1	0	1	0	0	1	2	0	1	0	-	0	0	0	0	0
42	4	6	2	0	11	3	12	13	43	34	55	5	29	25	9	8	5	0	1	1	2	1	0	0	1	0	-	1	1	0	0	0
43	1	0	3	3	2	1	7	7	49	17	56	12	23	41	5	21	2	2	0	0	0	1	1	1	1	0	-	0	0	0	0	0
44	4	1	1	5	11	1	6	13	35	13	63	26	16	40	5	19	3	2	1	1	3	0	0	0	0	2	-	2	0	0	0	0
45	7	3	3	3	8	10	11	42	44	34	43	20	44	53	9	18	5	3	2	1	2	2	2	0	0	1	-	1	0	0	0	0
46	2	2	1	7	4	14	10	31	44	19	58	33	18	35	7	16	5	2	3	0	0	2	0	0	2	1	-	2	0	0	0	0
47	13	4	3	10	10	5	16	14	66	60	26	26	33	41	13	20	7	2	2	1	2	3	0	1	1	0	-	0	0	0	0	0
48	15	3	5	7	14	4	16	10	67	49	72	19	49	72	8	20	9	9	1	0	3	2	0	0	0	0	-	0	2	0	0	0
49	4	2	10	8	2	12	18	45	48	100	56	33	30	48	10	37	9	1	0	1	6	3	2	0	1	2	-	0	0	0	0	0
50	13	5	8	21	9	11	16	37	63	56	55	53	28	56	15	44	9	3	2	0	5	4	3	1	0	0	-	1	2	0	0	0
51	51	6	5	17	10	11	24	46	74	30	88	27	22	88	21	37	18	6	3	3	3	0	1	0	0	1	-	0	1	0	0	0
52	15	5	11	17	3	16	31	43	65	78	82	56	30	80	36	42	9	4	2	0	3	4	1	1	1	3	-	0	0	0	1	0
53	13	9	3	30	5	15	22	57	55	83	83	61	37	103	29	29	15	8	3	1	7	1	0	1	0	1	-	1	0	0	0	0
54	24	12	19	26	21	17	25	76	47	59	97	59	30	116	23	43	21	7	2	3	8	5	2	1	3	3	-	1	1	0	0	0
55	23	4	17	23	13	26	25	47	83	84	70	80	32	96	26	46	38	9	2	2	12	3	3	1	0	7	-	1	1	0	0	0
56	18	12	25	18	13	13	13	37	65	104	90	52	43	89	39	39	21	10	3	4	10	3	3	0	2	6	-	0	0	0	0	0
57	9	0	10	30	26	18	36	43	64	101	79	92	27	111	44	42	27	10	5	4	8	8	1	7	2	4	-	0	0	0	0	0
58	29	15	24	23	13	30	34	51	68	68	107	58	48	80	42	57	21	10	8	5	6	7	3	1	1	5	-	1	0	0	0	0
59	47	8	26	31	16	14	23	43	86	109	78	76	40	143	33	54	29	24	10	8	10	13	6	5	1	6	-	0	2	0	0	0
60	16	6	11	26	7	26	39	56	77	103	109	69	30	134	56	61	37	9	9	7	13	7	2	2	0	1	-	0	0	0	0	0
61	23	5	10	25	30	12	24	57	68	138	120	78	59	128	53	64	44	15	8	5	17	8	5	4	1	3	-	0	0	0	0	0
62	50	17	26	23	10	13	36	37	57	125	92	80	42	145	57	49	28	19	10	7	10	6	3	1	4	7	-	0	2	0	0	0
63	14	18	37	20	15	19	28	63	68	144	107	74	41	149	60	63	39	29	15	7	4	9	5	4	1	10	-	2	0	0	0	0
64	28	17	22	24	35	19	25	86	74	87	106	73	77	138	57	68	42	35	9	8	19	12	2	2	2	8	-	0	3	0	0	0
65	36	10	39	31	20	16	39	87	49	107	83	75	73	161	75	48	37	34	17	10	14	14	3	4	6	11	-	1	1	0	0	0
66	22	13	21	41	31	27	22	60	59	81	87	93	40	130	63	61	41	24	12	7	21	6	4	2	6	11	-	3	1	1	1	0
67	14	16	39	28	21	24	30	78	82	108	119	63	46	136	51	38	43	38	13	7	17	12	2	7	7	14	-	1	3	0	1	0
68	16	18	30	31	17	19	42	71	69	107	79	55	34	113	67	61	57	33	21	7	15	12	5	5	4	16	-	0	4	1	0	0
69	46	13	22	32	31	30	24	51	81	131	101	75	28	121	52	54	41	21	20	11	23	10	2	5	5	8	-	0	2	0	0	0
70	32	11	28	31	14	24	26	63	56	117	112	79	36	122	60	78	42	22	12	8	30	7	1	4	3	6	-	3	0	0	1	0
71	8	14	25	23	21	25	24	58	63	115	83	52	63	126	69	75	48	47	21	13	20	6	6	0	4	12	-	1	0	0	0	0
72	23	20	31	36	29	19	33	89	61	86	76	65	66	86	77	64	47	52	13	9	19	10	6	9	2	8	-	0	1	2	0	0
73	40	18	42	29	13	42	40	53	44	85	83	51	44	98	54	70	47	32	6	5	20	9	0	3	4	9	-	1	0	0	0	1
74	36	18	22	25	22	19	39	28	69	130	108	56	42	99	64	65	37	39	21	14	10	4	1	8	6	12	-	1	0	0	0	0
75	9	8	23	18	16	28	33	38	53	101	97	58	35	99	62	63	39	33	14	6	23	12	0	3	1	11	-	1	1	0	0	0
76	21	15	24	25	12	36	20	37	33	75	66	37	32	88	55	66	33	28	14	5	16	4	5	7	0	6	-	1	1	0	1	0
77	13	6	23	19	33	18	32	28	53	79	52	55	37	94	55	60	31	33	17	3	7	9	5	6	2	7	-	0	0	0	0	0
78	28	12	9	32	13	29	24	36	46	70	55	59	33	76	46	54	28	38	11	5	8	3	1	5	4	2	-	2	1	0	1	0
79	5	13	11	33	8	19	19	56	48	61	66	43	47	81	52	59	35	35	17	6	9	4	2	5	4	6	-	2	2	0	0	0
80	15	18	13	20	22	15	38	40	49	102	53	39	29	78	44	51	34	26	7	5	5	7	3	4	0	3	-	0	0	0	0	0
81	23	11	18	10	8	17	16	45	39	47	66	46	32	83	37	52	25	18	14	2	12	5	0	4	0	2	-	0	0	1	0	1
82	7	7	20	10	6	6	21	19	21	46	26	41	15	57	34	29	23	21	10	3	8	5	3	5	4	5	-	0	0	0	0	0
83	6	6	12	5	6	11	14	23	29	26	25	23	10	23	20	20	12	4	3	1	3	2	1	0	4	2	-	0	0	0	0	0
84	4	2	13	5	8	10	6	10	23	12	15	31	8	19	6	15	7	6	1	2	3	2	0	4	1	1	-	0	0	0	0	0
85	7	2	15	8	10	3	14	15	39	11	13	17	5	12	4	10	8	3	1	1	3	2	0	0	0	3	-	0	0	0	0	0
86	7	5	11	5	5	3	8	2	10	10	30	26	14	20	7	10	3	3	0	0	2	0	0	0	2	0	-	0	1	0	0	0
87	5	0	15	5	7	6	17	2	16	8	13	15	4	16	6	17	3	1	0	0	0	3	0	1	0	1	-	0	0	0	1	0
88	3	1	12	7	2	0	26	2	16	9	25	13	8	14	6	7	7	3	0	0	3	0	0	0	0		-	0	0	0	0	0
89	7	5	9	5	9	7	7	4	19	9	20	17	10	15	8	12	5	0	0	0	0	0	0	0	0	2	-	0	0	0	0	0
90	18	3	13	3	5	7	8	8	10	3	22	10	5	14	3	4	6	0	1	0	4	0	0	0	0	0	-	0	0	1	0	0
91	4	2	14	5	2	11	5	7	12	17	15	6	3	15	4	7	3	0	0	0	1	0	0	1	0	2	-	0	0	0	0	0
92	7	0	8	4	14	1	3	2	10	3	19	6	3	10	4	5	1	0	0	0	0	0	0	0	0	2	-	0	0	0	0	0
93	1	0	0	1	6	0	6	5	7	3	12	12	0	8	3	3	1	0	0	0	1	0	0	0	2	0	-	0	0	0	0	0
94	1	1	2	1	0	1	4	2	3	2	12	2	1	6	0	2	1	0	0	0	1	0	0	0	0	0	-	0	0	0	0	0
95	0	1	5	1	0	0	0	1	3	2	9	1	0	4	5	1	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
96	0	0	3	1	0	14	0	0	1	4	1	2	0	4	4	1	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
97	13	0	4	3	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	-	0	0	0	0	0
98	1	1	0	0	0	0	0	0	0	1	0	0	0	0	2	0	1	0	0	0	1	0	0	0	0	0	-	0	0	0	0	0
99	0	1	4	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
100	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
101	0	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
102	0	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
103	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
104	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
105	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
106	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	-	0	0	0	0	0
107	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
Total	**930**	**436**	**888**	**945**	**712**	**814**	**1,198**	**2,043**	**2,853**	**3,563**	**3,673**	**2,406**	**1,750**	**4,165**	**1,783**	**2,107**	**1,202**	**814**	**375**	**200**	**454**	**266**	**101**	**126**	**100**	**235**	**-**	**31**	**34**	**6**	**8**	**2**
legal size:	81.0					81.8		82.6														83.3	84.1			85.7						

Table 5.36. Atlantic herring length frequencies, spring and fall, 1 cm intervals, 1989-2015.

From 1989 - 2013, Atlantic herring lengths were recorded from the first three tows of each day; since 2014, lengths have been recorded from every tow.

	Spring																										
length	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
3	0	0	0	5	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
4	0	0	0	0	4	0	0	0	0	18	504	61	0	0	1	2	0	0	0	1	213	2	12	0	29	3	2
5	0	2	0	11	3	1	0	0	1	149	1,547	104	0	0	8	30	76	3	20	36	3,416	28	35	15	429	29	51
6	1	3	3	16	1	0	1	3	0	92	237	1	3	0	9	10	140	2	2	13	449	12	59	2	227	0	7
7	0	1	4	15	2	0	2	15	69	84	18	7	11	1	0	8	118	1	0	12	44	1	103	2	38	2	1
8	0	0	7	0	1	0	0	5	165	28	5	1	6	1	0	9	73	11	0	23	48	1	132	0	10	1	0
9	0	0	3	0	1	0	1	1	27	11	4	0	8	0	0	3	8	10	0	16	59	0	43	1	1	2	0
10	0	0	0	0	3	1	0	0	0	2	0	0	1	0	0	0	0	0	0	2	6	0	3	1	0	5	0
11	0	0	0	0	3	1	0	1	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	46	0
12	0	0	0	0	38	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	492	0
13	0	8	0	0	215	8	0	0	5	0	0	0	0	0	0	1	3	0	0	0	0	5	1	1	0	483	0
14	0	1	0	0	203	11	0	1	29	0	0	0	1	0	0	9	7	0	0	0	1	29	26	6	23	200	0
15	2	0	8	0	122	9	6	0	59	5	0	0	2	0	0	49	14	0	9	1	9	39	55	16	112	48	1
16	3	1	38	0	174	17	7	3	12	8	0	3	0	0	0	65	20	0	14	0	91	49	19	12	121	6	4
17	2	31	33	0	100	42	8	2	4	5	0	6	2	0	0	140	63	0	27	2	149	25	3	3	119	18	2
18	2	4	29	2	28	32	12	0	10	2	0	0	1	0	3	275	98	0	166	6	28	31	7	0	49	95	8
19	0	16	19	29	21	39	12	6	21	0	1	0	11	2	1	117	57	0	467	1	203	86	14	20	32	85	39
20	0	161	67	15	41	43	78	10	40	5	1	6	65	3	2	67	67	0	228	7	521	222	14	107	50	52	47
21	0	333	72	24	35	29	283	26	14	4	2	11	85	17	0	12	19	0	99	11	279	106	8	196	148	16	60
22	0	424	70	111	96	14	399	15	19	11	10	38	77	32	0	16	11	3	105	9	162	71	24	91	847	4	58
23	0	201	160	61	387	111	245	20	7	4	15	36	14	87	4	0	15	4	106	13	144	97	59	23	824	60	29
24	0	195	297	311	436	224	290	22	18	1	19	47	33	71	17	0	25	3	150	27	71	105	173	21	268	71	90
25	0	315	337	751	645	485	416	46	117	2	9	99	31	18	36	3	21	5	122	38	87	108	214	16	104	30	90
26	1	447	360	503	921	560	1,028	85	202	31	10	70	46	30	63	3	78	3	125	39	108	110	210	18	96	50	72
27	0	347	514	382	807	947	723	93	236	33	35	80	24	27	65	14	106	9	122	38	69	95	147	11	30	30	34
28	0	338	513	391	825	604	706	64	234	44	37	104	34	19	72	9	87	6	116	36	85	62	65	4	5	4	16
29	2	247	319	492	550	387	337	37	82	21	25	69	29	52	52	1	40	3	47	15	44	26	48	4	1	0	1
30	0	156	383	142	287	204	231	29	31	1	11	24	8	3	27	3	19	1	6	6	27	7	2	0	0	0	0
31	2	127	139	77	129	29	14	4	15	2	0	0	4	0	8	1	0	0	0	2	6	0	2	0	0	0	0
32	0	50	22	1	33	6	14	1	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	11	13	2	0	2	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	8	1	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**15**	**3,427**	**3,411**	**3,341**	**6,119**	**3,808**	**4,814**	**489**	**1,421**	**566**	**2,491**	**767**	**497**	**363**	**368**	**847**	**1,165**	**64**	**1,931**	**355**	**6,319**	**1,317**	**1,479**	**570**	**3,563**	**1,834**	**612**

	Fall																										
length	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
7	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
8	0	0	0	99	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	-	0	0	0	0	0
9	0	0	0	328	16	4	0	0	2	3	0	0	0	0	1	0	0	0	0	0	4	-	1	0	1	0	0
10	0	0	0	176	3	6	0	14	6	59	0	0	0	0	12	1	0	0	0	0	2	-	0	0	1	0	0
11	0	3	0	34	5	9	0	11	3	49	0	1	0	0	47	0	0	2	0	0	1	-	0	0	1	0	2
12	0	0	0	3	9	11	0	1	0	0	0	0	0	0	20	1	0	0	1	0	0	-	0	0	0	0	1
13	0	0	0	0	13	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	-	0	0	0	0	0
14	0	0	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
15	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
16	0	0	0	1	7	2	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	-	0	0	0	1	3
17	0	0	1	0	7	5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	-	1	0	0	2	2
18	0	0	6	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	-	1	0	0	0	6
19	0	0	5	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	-	0	0	0	0	1
20	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
21	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
22	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	1	0	0	0	0
23	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	-	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	-	0	0	0	0	1
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	-	0	0	0	0	1
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	2
Total	**0**	**3**	**12**	**642**	**110**	**40**	**0**	**27**	**12**	**112**	**0**	**2**	**0**	**0**	**80**	**3**	**3**	**2**	**2**	**1**	**9**	**-**	**4**	**0**	**3**	**3**	**19**

Table 5.37. Atlantic menhaden length frequency, spring and fall, 1 cm intervals, 1996-2015.
Menhaden are scheduled to be measured from every tow. However, the following numbers of menhaden were not measured: 5 juveniles and 4 adults in 1996, and 7 adults in 1997.

										Spring										
length	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	7	0	0	0
11	0	0	0	1	0	0	13	0	0	0	0	0	0	0	0	0	3	0	0	0
12	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	15	0	0	0
13	0	0	0	0	0	0	6	0	0	0	2	0	0	0	0	0	8	0	0	0
14	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	5	0	0	0
15	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	8	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
20	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
25	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	1	0	0	1
26	0	0	0	0	0	0	1	0	0	0	0	4	0	0	0	0	2	3	6	0
27	0	0	0	0	0	0	1	0	0	0	0	6	2	3	1	4	14	25	46	24
28	0	1	0	0	1	0	1	0	0	0	0	5	4	9	5	10	33	32	81	53
29	0	1	0	0	1	0	0	1	3	0	1	5	2	2	1	18	53	59	79	75
30	0	1	0	0	0	0	1	1	0	0	0	4	1	5	0	10	28	27	34	54
31	0	3	0	0	0	0	0	0	1	0	2	4	1	0	0	1	12	13	19	20
32	0	0	0	0	1	0	3	0	0	0	0	0	0	0	0	0	1	0	1	2
33	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Total	**0**	**6**	**0**	**1**	**9**	**0**	**47**	**2**	**5**	**1**	**5**	**33**	**10**	**19**	**7**	**43**	**195**	**162**	**267**	**229**

										Fall										
length	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
4	0	0	0	0	0	0	0	1	0	0	0	0	0	0	-	0	0	0	0	0
5	0	0	0	0	0	0	0	2	0	0	0	1	0	0	-	0	0	0	0	1
6	0	0	0	0	0	0	0	17	1	0	0	24	0	0	-	0	1	1	0	1
7	1	0	0	20	12	0	2	32	26	0	1	39	2	0	-	0	0	0	0	34
8	0	1	18	51	73	0	6	22	178	11	0	32	2	2	-	0	0	0	0	58
9	0	11	53	152	128	0	8	9	135	22	0	12	6	0	-	0	0	0	0	73
10	1	5	120	471	125	1	9	1	143	19	0	34	3	3	-	0	1	0	2	70
11	0	6	49	337	51	25	14	1	47	13	2	51	2	4	-	0	0	0	1	30
12	0	11	44	25	35	30	10	1	18	9	8	24	1	5	-	6	0	4	5	22
13	0	0	20	2	15	16	14	4	1	1	1	49	0	4	-	7	1	5	0	5
14	0	2	0	0	6	7	20	2	0	3	2	7	0	3	-	9	0	4	0	2
15	0	0	0	0	2	4	24	0	0	1	0	1	1	5	-	6	1	1	0	0
16	0	0	0	0	2	0	8	0	0	2	1	1	4	4	-	3	0	1	0	0
17	0	0	0	0	3	0	12	0	0	0	0	0	3	0	-	0	1	0	0	0
18	0	0	0	0	0	0	17	0	0	0	0	0	0	1	-	0	2	0	0	0
19	0	0	0	0	0	0	16	0	0	0	0	0	0	1	-	0	2	0	0	0
20	0	0	0	1	0	0	2	0	0	0	0	0	0	0	-	0	2	0	0	0
21	0	0	0	1	0	0	1	0	0	1	0	0	0	0	-	0	1	0	0	0
22	0	0	0	0	0	0	1	0	0	0	0	0	0	0	-	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
24	0	0	0	1	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	3
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	1	7	5
26	0	0	0	0	0	0	1	0	0	0	0	3	0	0	-	0	7	2	2	14
27	2	0	0	0	0	0	1	0	0	1	0	21	9	4	-	4	27	6	68	131
28	3	1	0	3	0	0	2	0	3	4	0	35	2	7	-	18	68	13	164	249
29	23	17	0	6	1	0	18	5	10	21	2	31	1	1	-	48	66	12	132	233
30	30	25	0	28	3	0	29	8	44	54	2	18	0	5	-	30	35	14	63	100
31	11	17	1	42	7	1	39	8	65	43	2	7	0	2	-	4	11	5	2	18
32	2	6	1	27	12	0	27	3	51	21	1	2	0	0	-	2	0	1	9	2
33	0	1	0	19	4	2	25	2	10	5	0	0	0	0	-	0	0	0	0	0
34	0	0	0	1	4	0	9	1	7	2	1	0	0	0	-	0	0	0	0	0
35	0	0	0	0	1	0	5	0	1	1	0	0	0	0	-	0	0	0	0	0
Total	**73**	**103**	**306**	**1,187**	**484**	**86**	**320**	**119**	**740**	**234**	**23**	**392**	**36**	**51**	**-**	**137**	**226**		**455**	**1,051**

Table 5.38. Black sea bass length frequencies, spring, 1 cm intervals, 1987-2015.
Since 1987, black sea bass have been measured from every tow.

	Spring																													
length	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	1	0	1	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	8	0	0	0	0	1	1	2	0	0	3	0	2	0
9	0	0	0	0	0	2	0	0	0	0	0	0	0	1	2	0	9	0	0	0	0	1	1	1	0	0	9	2	2	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	5	0	0	0	0	7	7	2	0	0	8	2	9	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	5	0	0	0	0	1	2	1	0	0	11	0	10	0
12	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2	0	5	0	0	0	0	1	2	2	0	1	14	0	2	1
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	9	0	0	0	0	2	1	1	0	1	12	1	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3	0	0	0	1	0	0	0	0	0	2	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	2	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	4	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	1	0	1	1	0	0	6	1	0
19	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	14	1	1
20	0	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	24	9	0
21	0	0	0	1	0	0	0	0	1	0	1	0	0	1	1	0	1	1	1	0	0	1	1	0	0	0	1	33	9	2
22	0	2	0	1	0	0	0	1	1	0	1	0	0	0	1	2	0	1	0	0	1	4	2	2	1	2	2	34	6	0
23	0	1	0	0	2	0	0	1	1	0	3	0	1	0	1	0	1	2	1	0	0	4	3	3	1	2	4	22	10	8
24	0	3	0	0	0	0	1	1	3	3	2	1	2	1	8	1	5	4	0	0	0	0	0	3	1	2	1	12	19	1
25	2	0	0	2	0	0	1	2	2	1	0	2	1	0	0	0	2	0	1	0	0	4	1	2	0	2	1	11	39	4
26	0	0	1	0	1	0	1	0	1	3	0	1	1	0	1	5	2	0	1	0	0	1	2	1	1	0	3	3	67	6
27	0	0	0	0	0	0	0	0	1	1	0	1	1	2	2	4	1	0	1	0	0	1	0	0	2	0	6	2	93	7
28	1	0	0	0	4	0	0	1	0	0	0	0	0	0	3	0	2	0	1	0	1	1	0	2	0	0	3	2	125	5
29	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	2	0	6	0	0	1	1	2	4	0	3	0	152	17
30	0	0	0	1	2	0	0	1	2	0	0	1	0	1	1	3	1	0	4	0	0	0	0	2	4	1	2	0	139	41
31	0	0	0	0	1	0	0	0	0	0	0	1	1	1	0	3	10	0	7	0	0	0	3	2	2	2	3	1	96	51
32	0	0	2	0	1	0	0	2	1	0	1	4	0	1	1	3	15	1	5	0	0	4	5	2	3	3	6	6	91	94
33	0	0	1	0	1	0	0	0	2	0	2	1	0	0	1	11	12	1	3	0	0	1	2	2	0	1	7	5	43	91
34	2	0	0	1	1	0	0	0	1	0	1	1	1	1	3	6	11	1	2	0	0	3	3	4	6	1	10	9	49	106
35	0	0	0	0	0	0	0	1	0	0	1	3	0	0	1	7	11	2	1	1	0	5	0	4	1	3	6	4	19	129
36	1	0	1	0	1	0	0	1	1	2	1	0	0	1	0	3	13	0	3	4	0	5	0	7	0	2	7	8	14	107
37	0	0	0	0	1	0	0	0	0	0	1	1	0	2	0	5	6	2	0	1	0	1	1	3	2	5	3	10	11	81
38	1	0	1	0	0	1	0	0	0	0	0	0	0	1	3	2	11	3	0	1	0	1	0	4	2	4	8	4	9	62
39	1	0	0	0	0	2	0	0	2	0	1	0	0	0	0	3	13	1	0	1	0	0	1	7	0	5	12	6	3	56
40	0	0	0	1	0	1	0	0	0	0	3	0	0	0	1	2	15	2	1	0	0	2	0	4	0	3	4	9	6	38
41	0	0	0	0	0	3	0	0	0	0	0	0	0	1	0	3	11	4	4	4	0	1	1	5	2	2	11	8	8	37
42	0	1	0	1	0	0	0	0	1	1	0	0	0	1	1	1	11	3	0	4	1	0	0	7	1	2	1	2	3	21
43	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	5	3	2	2	0	1	1	3	0	2	6	1	0	9
44	2	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	5	2	1	1	1	0	0	0	0	1	2	3	1	10
45	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	7	0	1	0	0	1	1	0	1	0	3	2	1	4
46	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	6	2	1	0	0	0	1	0	0	1	2	2	2	2
47	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	5	0	2	0	0	1	0	2	0	0	2	1	3	1
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	1	0	1	4
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	0	0	1	0	0	0	0	0	1	3	0	4
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	2
51	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	1	1	2
52	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
54	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
57	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**12**	**8**	**8**	**12**	**19**	**16**	**3**	**12**	**22**	**11**	**20**	**18**	**8**	**16**	**47**	**67**	**239**	**46**	**49**	**19**	**7**	**58**	**43**	**84**	**36**	**48**	**186**	**263**	**1058**	**1004**

Table 5.39. Black sea bass length frequencies, fall, 1 cm intervals, 1987-2015.
Since 1987, black sea bass have been measured from every tow.

																Fall														
length	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	1
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	2	0	0	1	-	0	1	3	3	0
5	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	2	0	3	1	0	0	0	1	-	4	0	2	0	0
6	0	0	0	0	1	0	0	3	0	0	0	0	0	0	0	3	1	0	7	0	0	1	1	0	-	4	1	3	5	1
7	0	0	0	0	0	4	0	3	1	0	1	0	0	3	0	6	4	0	23	2	0	3	2	0	-	2	1	3	2	1
8	0	2	0	1	0	4	0	1	2	0	1	0	0	0	1	5	8	0	15	2	0	4	0	2	-	1	2	1	2	1
9	0	0	0	0	1	3	0	0	4	0	0	0	1	0	0	3	6	0	10	2	0	1	2	0	-	1	2	0	4	0
10	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	1	3	0	5	2	0	2	0	0	-	0	2	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	5	0	2	2	0	1	0	0	-	0	5	0	0	0
12	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	-	0	3	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	-	0	4	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	2	0	-	0	14	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	-	0	21	0	0	0
16	0	0	0	0	0	2	0	0	0	0	0	0	0	2	1	0	1	0	0	0	0	1	5	0	-	0	37	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	0	7	0	0	0	1	4	8	2	-	0	20	3	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	16	1	0	0	1	1	14	6	-	0	20	3	0	0
19	0	0	0	0	0	0	0	0	0	0	0	2	0	3	1	0	23	0	0	0	2	2	10	4	-	0	23	1	0	0
20	0	0	0	0	0	3	0	0	0	0	2	0	1	6	3	0	19	0	0	0	1	4	10	6	-	0	14	1	0	0
21	0	0	0	0	0	1	0	0	0	1	0	1	0	4	1	0	17	0	0	1	3	4	9	4	-	0	9	1	2	0
22	0	0	0	0	0	1	0	0	1	0	0	0	0	1	1	0	5	0	0	0	0	1	4	3	-	0	3	8	1	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	4	0	1	0	0	2	0	0	-	0	6	11	2	0
24	0	0	2	0	0	0	0	0	0	0	1	0	0	3	0	0	2	0	0	0	0	0	0	0	-	0	0	12	1	0
25	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2	-	0	0	14	1	0
26	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	-	1	0	18	2	0
27	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0	2	-	1	1	15	3	3
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	4	2	0	-	1	2	13	10	2
29	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	3	0	1	1	2	0	1	0	0	-	2	1	8	13	2
30	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	5	0	0	0	0	1	0	-	5	1	8	10	1
31	0	0	0	0	1	0	2	0	0	0	0	0	0	0	1	0	1	1	0	0	0	2	1	0	-	4	1	4	21	4
32	0	0	2	0	0	0	0	0	0	0	0	1	0	2	3	2	0	0	0	0	0	2	0	0	-	1	0	4	14	5
33	0	0	0	0	2	0	0	0	0	0	0	0	0	0	3	2	0	0	0	2	0	0	0	0	-	1	1	4	23	3
34	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	2	2	0	0	1	0	1	1	0	-	1	1	0	21	9
35	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	3	2	1	1	0	0	0	1	1	-	2	1	1	27	11
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	2	0	0	-	0	1	2	20	8
37	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	9	2	0	0	0	0	1	1	0	-	3	1	3	12	6
38	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	7	3	0	0	1	0	1	0	1	-	1	1	6	11	5
39	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	2	0	1	-	2	2	1	7	8
40	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	2	0	1	0	0	0	1	0	-	1	3	7	8	13
41	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	3	0	0	1	0	2	0	0	-	3	2	2	4	4
42	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	2	0	0	0	0	-	3	4	3	2	5
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	0	0	0	0	1	0	0	-	0	3	5	3	4
44	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	3	1	0	0	0	0	0	0	0	-	1	3	2	0	2
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	-	0	0	3	1	1
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	-	0	1	1	0	1
47	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	-	0	1	0	1	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	-	0	2	2	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	1	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0	0	-	0	0	1	2	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	1	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	1	1	1	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	1
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	-	0	1	1	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	1
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	1
Total	**0**	**3**	**9**	**1**	**8**	**22**	**2**	**8**	**12**	**1**	**6**	**4**	**10**	**33**	**22**	**66**	**155**	**11**	**75**	**23**	**12**	**53**	**77**	**38**	**0**	**45**	**224**	**185**	**239**	**104**

Table 5.40. Blueback herring length frequencies, spring and fall, 1 cm intervals, 1989-2015.

From 1989 - 1990, lengths were recorded from the first three tows of each day; since 1991, lengths have been recorded from every tow.

	Spring																										
length	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
6	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6
7	0	0	2	0	2	7	2	0	0	2	0	4	1	0	3	2	1	0	0	1	0	4	0	0	5	1	17
8	0	0	3	0	2	76	20	4	0	5	0	10	7	12	7	9	8	1	0	8	0	1	0	0	9	8	30
9	0	0	2	0	3	114	11	5	21	15	0	14	5	9	23	23	14	8	1	11	7	4	3	3	9	3	24
10	0	0	5	10	7	74	9	19	45	45	0	18	2	9	26	47	6	23	9	14	19	19	5	18	5	1	32
11	0	0	3	4	9	41	9	10	258	48	0	28	1	6	11	39	10	2	3	12	25	38	9	12	8	2	29
12	3	0	5	0	2	9	5	3	4	16	0	18	2	3	4	20	12	0	5	2	27	8	3	5	1	2	10
13	0	0	0	4	0	13	5	2	0	2	0	12	1	1	1	12	3	1	3	4	17	10	6	1	1	0	3
14	0	0	0	15	0	5	3	1	1	1	0	3	0	0	0	0	7	0	1	1	5	4	2	0	0	0	0
15	0	0	1	27	1	3	4	7	0	0	1	2	0	4	0	0	8	1	2	2	9	1	0	0	0	0	0
16	0	0	0	65	0	8	3	7	0	3	5	1	1	1	4	4	13	2	23	1	30	4	2	2	7	0	0
17	0	0	1	11	3	9	1	10	4	0	5	3	10	7	4	4	11	2	37	7	64	2	12	2	5	6	0
18	0	1	0	2	0	3	0	4	2	0	0	5	15	2	3	3	1	2	7	3	49	1	3	2	3	11	1
19	0	0	0	0	1	2	4	3	2	0	0	0	3	0	0	3	2	1	3	2	17	2	1	0	1	4	0
20	0	0	0	4	0	1	1	0	0	0	0	2	1	1	0	0	5	2	0	1	2	0	1	0	1	3	0
21	2	1	2	0	0	1	1	3	0	0	0	1	3	0	0	3	2	3	2	0	1	1	0	0	7	2	1
22	1	0	0	1	0	3	0	4	0	1	0	3	0	0	1	0	1	0	1	1	0	1	0	0	5	2	0
23	0	0	3	2	0	3	2	3	1	0	0	5	0	1	0	1	0	0	1	1	0	1	0	0	0	0	0
24	0	1	2	0	0	0	0	2	0	0	0	3	0	0	0	0	0	0	2	0	0	1	0	0	1	0	0
25	0	0	0	1	0	1	1	1	0	0	0	1	0	0	2	0	0	1	1	0	0	0	0	0	0	0	0
26	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**6**	**3**	**29**	**147**	**30**	**373**	**83**	**90**	**338**	**140**	**11**	**136**	**52**	**56**	**89**	**173**	**104**	**49**	**101**	**71**	**272**	**102**	**47**	**45**	**68**	**47**	**153**

	Fall																										
length	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
5	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
6	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
7	0	0	0	0	0	0	5	0	2	0	0	0	0	0	0	1	0	0	0	0	0	-	0	0	0	0	0
8	0	0	0	0	0	0	33	0	2	0	0	0	0	0	0	0	0	0	1	0	0	-	0	0	0	0	0
9	0	0	0	0	0	0	21	3	2	2	1	0	0	0	0	0	0	0	1	0	2	-	0	0	0	0	0
10	0	0	0	0	0	1	3	0	8	1	0	1	0	0	0	0	0	0	0	0	0	-	0	0	0	0	1
11	0	0	0	0	3	13	4	0	3	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	1
12	0	0	3	9	8	227	14	0	12	1	1	0	7	0	0	2	0	0	0	0	0	-	0	0	0	1	0
13	38	1	4	11	24	225	48	0	117	18	0	0	36	2	0	15	2	2	0	0	0	-	0	1	0	1	0
14	77	0	1	6	18	247	40	1	111	28	1	0	117	7	0	17	3	8	1	1	3	-	4	0	0	2	26
15	24	0	0	1	20	94	3	3	34	16	0	3	52	3	4	6	2	4	14	2	5	-	9	0	0	3	60
16	0	0	0	0	2	14	0	0	0	5	2	1	10	0	4	0	0	0	31	0	2	-	9	0	0	1	6
17	0	0	0	0	0	2	0	0	0	1	1	2	2	0	1	0	0	0	7	0	1	-	3	0	0	2	0
18	1	0	0	0	0	1	0	0	0	0	0	1	3	0	0	0	0	0	0	0	5	-	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
20	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	-	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	-	0	0	0	0	0
22	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
24	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
25	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
Total	**140**	**2**	**9**	**27**	**76**	**827**	**172**	**7**	**292**	**72**	**8**	**8**	**227**	**12**	**9**	**42**	**8**	**14**	**55**	**3**	**18**	**0**	**25**	**1**	**0**	**10**	**94**

Table 5.41. Bluefish length frequencies, spring, 1 cm intervals, 1984-2015.
Bluefish lengths were recorded from every tow.

																Spring																
length	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1
25	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	3	0	1	0	0	0	0	1	0
26	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	4	0	1	0	0	0	1	8	1	3	0	0	0	0	1	0
27	0	0	0	0	0	0	1	1	1	0	0	0	0	2	2	0	2	0	0	0	2	0	1	2	0	2	0	1	0	0	0	1
28	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	4	0	0	7	0	0	0	0	0	0
29	0	0	2	0	0	0	1	2	0	0	0	1	1	1	0	1	4	0	1	0	0	0	1	0	0	3	0	0	0	0	0	0
30	0	0	0	0	0	0	0	7	0	0	0	0	0	1	0	0	1	0	0	1	0	1	2	1	0	0	0	0	1	0	0	0
31	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	1	0	0
32	0	0	1	0	0	0	0	11	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0
33	0	0	0	0	0	0	0	6	0	0	0	0	0	2	0	1	0	0	1	0	0	0	2	1	0	2	0	0	2	0	0	0
34	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0
35	0	0	0	1	0	0	0	9	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	1	0	0	0	1	2	0	1	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	0
37	0	0	0	0	0	0	0	10	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
38	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	0	1	0	1	1	0	0	0
39	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
40	0	0	1	0	0	0	1	5	0	0	0	0	0	0	0	0	0	1	1	1	0	2	0	0	0	0	0	0	0	0	0	0
41	0	0	1	0	0	0	1	6	0	0	0	1	0	0	0	4	0	3	5	4	0	5	0	0	0	0	0	0	0	0	0	0
42	0	0	1	1	1	0	0	14	1	0	0	0	0	2	2	2	0	3	5	4	1	1	0	1	3	0	0	1	1	1	0	0
43	0	0	1	0	0	0	0	12	0	0	0	0	1	1	0	1	1	6	8	3	0	1	0	0	4	0	0	3	1	2	0	0
44	0	0	1	0	0	0	0	10	3	0	0	0	1	0	2	2	0	1	3	1	0	1	1	2	7	0	0	0	0	0	0	0
45	0	0	0	0	0	0	1	7	1	0	0	1	1	0	1	0	0	4	3	2	0	0	1	1	3	0	0	4	0	2	0	0
46	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	2	2	2	0	1	0	2	1	2	0	0	3	0	0	0	0
47	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	1	0	0	0	4	0	0	0	0	1	0	1	0	0
48	0	0	1	1	0	0	0	3	3	1	0	0	0	0	1	1	1	1	0	0	0	1	2	0	1	0	0	0	0	0	0	0
49	0	0	2	1	3	0	0	1	2	2	0	0	0	0	0	5	0	1	3	1	1	0	1	0	0	1	0	0	0	0	0	0
50	0	0	2	1	1	1	0	1	8	0	0	0	2	4	2	3	1	0	5	1	1	0	3	1	1	0	0	1	0	1	0	0
51	0	0	0	0	4	1	1	6	4	2	0	0	1	6	1	3	0	1	4	3	5	1	0	0	0	1	0	1	0	0	0	1
52	0	0	2	2	3	1	0	5	3	1	1	0	2	3	0	6	2	0	3	3	1	1	4	1	0	3	0	2	1	2	0	0
53	0	0	2	1	3	0	0	1	4	0	1	0	0	3	2	0	0	2	3	0	2	1	2	1	0	4	0	1	1	2	0	0
54	0	0	3	0	4	0	0	2	0	0	1	0	0	1	0	2	0	1	4	1	1	2	0	0	0	0	0	2	0	1	0	0
55	0	0	1	1	7	0	1	2	0	1	0	0	3	1	1	1	1	0	2	0	0	0	0	3	1	4	0	1	0	1	0	0
56	0	0	2	2	3	0	0	0	0	1	0	1	0	1	3	1	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0
57	0	0	1	0	5	0	0	2	1	1	0	0	0	0	0	1	0	1	0	1	0	1	2	0	1	1	0	0	0	0	0	0
58	0	1	0	0	3	1	1	0	0	1	0	0	0	0	0	1	1	0	0	1	0	1	0	1	0	0	0	0	1	0	0	0
59	0	0	0	0	3	0	0	0	0	0	1	0	0	1	0	2	0	0	0	3	1	1	1	1	0	0	0	1	0	1	0	0
60	0	0	0	0	1	1	0	0	1	0	1	0	0	2	0	1	0	0	0	1	0	0	0	1	1	3	1	1	0	0	1	0
61	0	0	3	0	1	1	0	0	1	1	3	0	0	1	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
62	0	0	0	0	1	0	0	1	0	0	3	0	0	0	1	0	0	0	0	1	0	1	0	1	1	1	0	0	0	0	0	0
63	0	0	1	0	0	0	0	0	1	1	1	0	0	0	2	2	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
64	0	0	1	1	0	1	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	1	1	0	2	0	0	0	0
65	0	0	0	0	0	2	0	1	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0
66	0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	1	1	0	1	0	1	0	0	0
67	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	4	0	0	1	1	0	0
68	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0
70	0	0	1	0	0	0	1	2	1	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
72	0	0	1	0	0	1	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	0	0	3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**0**	**1**	**35**	**13**	**43**	**13**	**17**	**147**	**42**	**13**	**12**	**6**	**15**	**38**	**23**	**51**	**26**	**29**	**56**	**36**	**18**	**25**	**39**	**39**	**29**	**52**	**2**	**28**	**19**	**20**	**6**	**3**

Table 5.42. Bluefish length frequencies, fall, 1 cm intervals, 1984-2015.

Bluefish lengths were recorded from every tow.

																Fall																
length	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
6	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	1	0	0	0	0	0	2	33	0	1	0	0	3	12	2	0	1	1	0	0	0	2	0	0	0	0	0	0	0	0	0
8	1	5	0	2	0	0	0	14	96	1	11	1	0	13	85	40	0	15	1	0	3	1	3	1	0	1	0	0	0	0	4	0
9	1	6	0	3	3	0	3	38	228	4	71	0	0	135	344	252	2	25	8	8	15	76	8	30	0	28	0	0	1	0	2	2
10	0	4	7	16	39	3	21	115	184	27	183	6	4	941	647	720	14	89	56	33	342	308	76	86	2	93	0	4	0	2	42	13
11	38	13	13	79	76	76	53	200	290	56	1266	156	3	2006	1127	484	50	213	96	70	730	421	239	41	19	317	0	2	10	12	167	110
12	350	52	20	108	270	249	57	280	269	171	2842	397	10	2905	2008	338	42	136	149	77	748	451	349	157	120	442	0	15	36	22	363	170
13	958	96	45	322	332	494	49	260	123	432	2880	428	54	1258	1558	316	168	122	250	33	420	499	64	379	301	324	0	40	90	71	495	229
14	1483	556	138	500	183	596	99	202	96	283	2023	154	93	518	834	337	284	122	216	12	299	273	131	231	483	136	0	132	157	250	576	373
15	1076	1232	376	482	151	903	409	241	401	149	1763	61	510	351	433	300	126	336	126	32	129	117	110	134	225	120	0	196	501	486	305	484
16	1028	1284	533	399	307	1187	540	405	566	146	1033	145	1399	469	160	503	155	679	70	200	113	231	172	328	45	475	0	476	871	363	181	439
17	770	783	399	147	472	1155	643	681	495	552	829	497	1924	536	127	361	216	568	36	460	161	389	229	821	22	630	0	603	761	204	404	217
18	246	351	258	92	458	1380	729	589	498	1177	512	902	1227	407	97	190	476	363	33	697	241	668	181	1664	49	350	0	491	523	126	638	155
19	180	204	128	26	322	1057	493	574	340	1268	529	995	618	363	114	244	724	307	116	790	315	859	106	1733	40	116	0	278	272	53	466	138
20	182	64	125	6	360	499	280	383	208	854	482	602	329	188	117	446	1270	228	247	681	348	751	79	1379	49	63	0	168	185	37	330	46
21	64	32	44	13	172	404	227	245	56	320	321	333	158	144	82	467	976	164	370	330	328	437	29	772	20	20	0	72	127	14	156	50
22	38	12	48	7	171	149	102	270	25	119	336	148	17	98	115	490	491	90	407	97	293	268	43	518	7	7	0	34	75	9	115	51
23	30	9	38	2	22	49	48	128	3	95	133	54	15	56	100	606	350	71	316	7	257	161	21	335	1	4	0	18	36	6	43	68
24	19	15	9	3	12	11	49	119	1	33	184	7	3	16	181	515	230	49	236	2	214	119	22	151	2	1	0	18	30	1	25	27
25	0	9	6	2	6	7	14	92	0	33	81	7	4	9	189	517	107	27	120	0	126	59	6	69	0	1	0	3	18	0	17	18
26	0	5	0	0	1	0	5	27	0	8	54	1	0	3	108	311	9	14	29	0	42	25	6	16	1	0	0	1	5	0	9	6
27	2	0	0	0	0	5	4	5	0	2	8	2	0	0	59	165	0	4	21	0	11	7	8	2	0	0	0	0	2	0	0	1
28	0	0	0	0	0	0	0	1	0	0	1	0	0	0	4	44	0	5	1	0	8	0	2	1	0	0	0	1	2	0	0	0
29	0	2	0	0	0	0	0	0	0	0	0	0	0	0	4	10	0	0	0	0	2	0	0	3	2	0	0	1	1	0	1	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	1	0	0	1	0	1	0	0	0	0	1	1
31	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	4	0	2	0	0	0	0	0	2	0	1	0
33	0	0	0	2	0	0	4	0	0	0	0	2	0	0	1	0	0	0	2	0	10	0	2	1	0	1	0	0	2	0	4	0
34	0	0	0	1	0	0	8	0	1	0	0	5	0	0	1	0	0	0	7	0	39	0	3	0	0	0	0	1	3	0	5	0
35	0	0	0	3	1	0	9	0	2	0	0	17	0	1	0	0	0	0	6	1	41	0	1	3	0	1	0	0	1	0	4	0
36	1	2	0	3	1	1	11	1	2	0	6	31	0	1	1	0	0	3	12	2	58	0	12	0	2	9	0	2	2	1	3	0
37	3	6	1	13	1	0	29	0	19	0	4	61	0	1	1	1	2	12	15	4	129	0	15	5	3	26	0	3	3	0	17	0
38	11	16	5	18	1	1	70	6	44	0	7	81	2	18	8	2	13	21	24	7	197	0	32	11	17	59	0	5	11	2	12	1
39	14	50	30	38	5	9	75	12	74	4	23	111	0	34	20	5	18	31	44	13	231	0	18	34	25	52	0	13	7	1	7	1
40	40	72	57	48	12	22	127	38	85	7	57	80	11	60	31	3	46	55	82	9	159	8	17	43	24	55	0	13	11	1	2	2
41	24	61	62	36	12	50	118	92	84	12	58	45	7	49	15	12	83	35	70	6	53	7	8	35	11	29	0	10	9	2	0	5
42	18	39	81	25	16	51	101	110	55	16	75	25	12	37	15	5	50	18	57	6	22	22	9	37	6	25	0	19	4	3	2	4
43	14	24	20	16	15	50	55	118	22	26	50	12	10	15	13	6	23	13	29	7	11	21	2	31	7	10	0	16	6	1	4	3
44	5	8	12	13	22	24	20	82	17	36	20	7	10	12	12	0	11	6	8	3	7	31	0	24	5	8	0	8	3	2	2	1
45	1	6	8	8	10	10	5	55	18	44	12	3	13	8	18	1	5	9	2	3	8	26	2	16	5	2	0	6	4	4	0	1
46	8	3	27	5	9	13	8	35	21	38	3	6	18	2	16	2	2	11	2	8	12	21	0	12	6	0	0	7	3	2	0	1
47	5	8	36	4	16	6	17	34	51	37	4	13	43	4	13	5	7	4	6	6	16	17	1	13	5	3	0	1	4	5	0	1
48	3	28	24	5	11	10	5	44	72	35	1	8	45	16	15	5	5	8	8	10	21	14	3	15	9	3	0	4	1	9	3	0
49	18	27	28	6	8	11	12	44	107	46	8	12	29	11	18	4	9	17	6	9	26	20	3	16	11	7	0	10	2	22	0	0
50	13	27	25	9	11	9	17	43	112	26	5	12	26	6	10	0	15	17	6	9	33	31	3	12	15	10	0	3	3	13	0	1
51	12	31	18	5	5	10	19	30	98	24	8	9	12	10	14	7	17	9	7	9	26	26	1	14	14	11	0	9	4	6	1	2
52	16	27	14	2	9	18	10	11	101	22	17	18	10	4	5	4	26	8	13	4	10	13	7	11	14	5	0	5	5	6	0	0
53	15	17	7	12	9	14	6	10	61	4	25	7	7	6	3	6	14	4	6	3	12	9	5	11	14	4	0	1	3	7	0	0
54	11	16	7	16	2	12	1	5	54	10	36	5	8	4	6	3	8	3	5	0	13	4	5	10	8	2	0	3	2	2	2	2
55	9	9	2	9	6	9	4	0	36	1	20	1	2	1	3	1	8	2	7	6	18	4	2	1	4	2	0	2	3	5	0	1
56	8	7	2	15	1	9	1	0	28	12	17	3	5	1	1	3	1	3	3	7	14	3	2	1	3	2	0	1	3	5	0	0
57	5	2	2	15	0	3	0	3	26	21	15	0	5	7	1	7	2	1	9	1	34	11	5	4	0	6	0	0	0	3	0	1
58	2	2	7	6	6	5	3	5	16	33	4	0	4	8	3	3	6	3	2	1	25	5	3	3	4	3	0	1	0	3	2	1
59	2	3	8	5	6	2	0	1	13	35	7	1	4	2	3	9	0	5	7	3	14	10	2	10	1	5	0	2	3	0	8	1
60	5	8	3	6	4	1	2	5	4	67	9	4	4	4	3	2	6	5	2	3	11	5	3	22	4	7	0	1	0	3	5	0
61	1	12	2	3	4	3	3	1	6	41	11	0	4	6	2	1	5	5	1	2	7	7	3	10	7	7	0	2	1	6	1	0
62	2	3	3	3	5	2	2	3	7	34	8	4	2	1	5	2	1	3	2	1	11	13	0	18	4	5	0	0	1	3	1	0
63	0	10	8	2	10	2	7	3	4	20	12	1	0	4	5	1	5	0	4	2	10	14	2	6	6	3	0	3	4	4	2	0
64	0	6	10	3	4	1	7	1	4	27	12	3	1	0	3	2	8	0	1	1	12	4	1	13	0	1	0	0	0	3	4	0
65	0	6	1	3	8	1	6	0	8	3	27	3	0	2	4	1	3	2	4	0	10	10	2	10	5	7	0	0	0	3	0	1
66	0	5	7	2	7	2	9	0	1	8	28	3	1	1	4	0	4	1	5	0	6	6	1	8	5	6	0	0	0	1	4	0
67	0	6	4	1	7	2	3	1	2	8	21	2	2	3	1	3	3	4	1	1	3	5	0	5	9	12	0	2	2	4	2	2
68	1	6	5	5	13	6	4	4	0	1	30	3	0	0	1	3	3	2	3	1	5	7	0	5	6	11	0	2	2	1	4	4
69	0	1	3	5	4	4	8	5	4	1	5	1	2	1	1	3	0	3	4	0	7	3	0	6	4	11	0	1	1	2	0	3
70	0	1	9	3	4	13	5	4	6	0	10	2	0	0	1	4	3	0	5	2	5	1	0	0	8	11	0	2	0	3	3	0
71	1	0	4	1	3	6	10	1	5	1	7	3	3	1	0	3	5	1	2	0	1	0	0	1	3	15	0	4	0	3	1	3
72	1	1	2	3	4	3	9	3	6	5	4	2	0	2	1	0	1	1	3	1	4	1	0	3	2	11	0	6	1	4	1	1
73	0	1	1	5	3	4	7	2	9	6	3	2	1	3	0	0	1	1	1	0	2	2	0	2	1	9	0	2	4	1	1	2
74	0	0	2	1	0	3	5	3	10	2	3	3	5	2	2	1	1	0	1	0	1	2	0	1	1	4	0	3	1	2	0	4
75	2	1	3	2	9	2	8	5	7	6	2	1	2	1	2	4	0	1	0	1	0	2	0	0	0	8	0	2	2	1	1	1
76	0	2	1	1	2	3	7	6	3	3	5	2	3	2	0	1	0	0	2	0	2	1	0	0	1	2	0	2	0	1	2	2
77	0	1	0	0	1	1	3	0	3	1	3	1	5	4	1	0	0	0	1	0	1	0	0	0	0	2	0	1	2	3	0	0
78	0	2	2	1	0	2	1	1	2	3	2	1	0	1	0	1	0	1	0	0	0	0	0	1	0	1	0	2	0	0	1	0
79	0	0	0	0	1	1	0	1	2	3	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0
80	0	1	0	0	0	0	2	0	1	0	3	0	2	0	0	1	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0
81	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
82	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
83	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**6,738**	**5,300**	**2,740**	**2,598**	**3,645**	**8,636**	**4,671**	**5,699**	**5,225**	**6,459**	**16,232**	**5,514**	**6,688**	**10,776**	**8,789**	**7,788**	**6,112**	**3,957**	**3,395**	**3,681**	**6,489**	**6,506**	**2,064**	**9,336**	**1,667**	**3,604**	**0**	**2,735**	**3,829**	**1,809**	**4,452**	**2,650**

Table 5.43. Butterfish length frequencies, 1 cm intervals, spring and fall, 1986-1990, 1992–2015.

Prior to 2014, length frequencies of butterfish were taken from the first three tows of each day; since 2014, lengths have been recorded from every tow.

															Spring														
length	**1986**	**1987**	**1988**	**1989**	**1990**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	2	0	1	2	4	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	2	0	0	0	0	3	0	9	0	15	0	1	1	8	1	5	0	3	3	3	3	0
5	0	0	0	0	0	2	0	6	0	2	0	0	4	0	51	1	29	1	0	1	5	3	53	0	9	2	39	20	7
6	0	0	0	0	0	0	0	35	0	21	3	0	0	0	207	0	7	20	0	2	0	1	276	1	35	6	109	35	65
7	0	0	0	2	0	0	0	57	1	7	0	3	0	0	202	0	3	95	1	0	0	3	233	0	50	0	218	26	62
8	0	0	0	2	0	0	0	18	0	0	0	0	0	1	107	0	0	101	2	4	0	0	228	0	34	3	76	14	35
9	0	0	0	0	0	0	0	0	4	0	57	5	4	0	15	0	4	47	0	61	12	1	197	198	7	279	4	40	1
10	4	0	0	40	0	2	0	4	7	0	165	183	10	0	5	4	10	146	10	201	73	53	225	530	2	768	13	231	50
11	29	0	0	269	5	16	3	28	20	19	618	622	16	84	51	44	130	427	27	540	292	74	461	291	28	1,523	95	718	463
12	39	0	3	208	7	32	17	45	80	190	1,005	656	55	961	272	202	616	433	216	1,632	794	409	1,426	47	217	1,489	427	608	1063
13	26	0	6	34	16	88	25	75	62	485	1,598	466	152	1,265	317	656	546	201	442	3,108	531	976	1,196	110	1,347	1,214	639	326	668
14	61	0	7	2	28	111	10	76	30	327	1,296	190	145	317	145	990	129	71	425	1,690	130	739	439	237	1,819	735	531	188	552
15	66	0	27	3	26	50	9	117	24	255	1,033	173	122	122	236	851	137	64	234	493	234	646	237	376	1,443	396	200	107	443
16	57	0	20	10	26	49	25	156	44	275	951	267	148	31	381	669	155	126	124	173	190	654	201	301	1,228	330	149	278	387
17	25	0	14	7	38	41	23	92	25	178	654	175	137	47	332	490	64	107	81	104	146	396	154	61	982	237	149	313	311
18	20	0	0	0	18	38	10	44	14	83	307	88	106	28	284	335	36	50	71	72	85	405	113	41	599	83	129	252	359
19	7	0	0	4	16	27	4	9	3	48	110	70	24	23	128	249	26	21	59	84	22	179	49	5	286	35	13	150	265
20	0	0	1	2	7	10	0	4	1	13	72	29	27	21	53	142	16	9	12	27	18	56	9	13	67	40	14	37	39
21	4	0	0	1	5	1	0	0	0	2	22	3	8	7	7	26	4	1	4	1	0	1	7	0	33	0	0	7	10
22	4	0	0	0	7	0	1	0	0	0	0	5	3	0	1	4	4	1	0	0	0	0	0	0	0	0	0	0	6
23	0	0	0	0	1	2	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Total	**342**	**0**	**78**	**584**	**200**	**469**	**127**	**768**	**315**	**1,905**	**7,906**	**2,935**	**965**	**2,907**	**2,804**	**4,666**	**1,933**	**1,921**	**1,710**	**8,196**	**2,544**	**4,598**	**5,509**	**2,211**	**8,191**	**7,143**	**2,808**	**3,353**	**4,788**

															Fall														
length	**1986**	**1987**	**1988**	**1989**	**1990**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
3	0	0	0	0	0	0	0	0	3	0	0	0	2	0	0	0	0	2	0	0	0	0	0	-	24	0	0	0	0
4	0	2	87	0	0	0	20	1	8	2	2	1	3	0	16	15	0	7	0	1	15	0	6	-	0	10	8	0	0
5	0	3	1,141	23	3	475	436	16	268	180	33	20	13	72	69	53	52	29	260	2	152	29	324	-	78	64	71	80	108
6	0	10	5,778	144	62	2,429	3,144	197	426	601	461	317	250	334	409	616	685	710	658	34	1,270	230	1,997	-	345	280	662	802	981
7	12	146	5,728	678	173	13,780	4,344	1,701	5,055	1,540	1,614	920	3,755	2,709	1,405	1,842	4,972	9,342	2,991	162	1,951	771	9,132	-	1,075	1,559	2,164	3,546	12,643
8	117	1,093	4,844	1,425	471	22,246	5,983	7,653	11,919	3,292	5,449	4,070	24,915	8,904	3,196	7,453	5,630	18,524	14,062	1,060	4,508	4,744	18,840	-	3,621	5,148	2,395	14,503	23,067
9	277	2,236	5,489	3,196	2,515	22,133	7,781	17,663	12,110	5,856	11,122	14,691	53,739	16,392	4,444	14,401	3,067	13,237	18,276	4,647	5,086	8,864	16,054	-	5,715	7,742	2,127	20,159	6,886
10	1,143	2,017	1,068	4,927	5,886	6,614	4,001	8,178	3,765	6,674	10,645	29,516	31,244	13,110	6,002	14,408	832	13,284	16,897	9,830	7,584	6,576	5,377	-	3,197	7,792	1,662	14,199	613
11	919	1,204	477	1,661	2,781	634	871	2,414	832	5,493	6,050	23,892	8,496	3,528	2,997	5,682	294	4,193	8,203	5,929	6,404	4,103	1,678	-	648	3,451	798	5,337	666
12	623	1,041	51	216	827	65	360	1,951	346	2,344	2,849	7,162	2,009	915	2,004	430	639	982	2,391	3,266	2,614	1,812	5,041	-	2,451	1,426	382	1,474	959
13	409	2,477	204	45	212	94	2,400	2,610	131	976	818	675	1,156	306	1,714	264	570	218	1,265	1,173	1,122	457	9,925	-	2,295	647	867	781	836
14	259	1,946	172	144	52	50	1,721	1,238	273	2,072	289	498	481	93	2,307	247	231	350	212	281	278	4	6,842	-	729	429	2,684	1,657	384
15	95	1,334	196	139	234	101	797	679	597	2,104	197	272	212	30	2,026	190	95	420	188	184	405	131	2,211	-	240	670	2,051	1,342	627
16	106	387	197	210	415	177	390	41	951	1,196	238	388	92	151	1,521	85	156	320	203	688	420	368	1,167	-	103	1,296	1,224	836	366
17	184	124	228	117	133	130	124	144	853	392	335	574	158	392	391	152	66	208	137	398	228	539	836	-	120	1,318	990	502	176
18	48	59	115	102	83	347	54	110	429	59	407	168	80	198	310	266	8	89	177	77	145	243	117	-	84	749	821	550	74
19	30	10	19	27	91	16	19	2	68	34	211	263	62	106	199	206	0	29	44	39	110	11	63	-	24	105	175	188	62
20	4	8	2	26	8	8	3	0	0	11	20	14	7	4	155	94	13	16	11	3	1	68	15	-	1	66	30	62	16
21	18	2	0	0	0	1	8	1	0	0	10	62	6	1	31	15	1	1	4	0	0	1	0	-	1	0	0	3	10
22	0	0	0	2	0	0	8	0	0	0	0	0	0	0	0	14	1	1	1	0	0	0	0	-	0	0	0	0	4
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	-	0	0	0	0	0
25	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	-	0	0	0	0	0
Total	**4,244**	**14,108**	**25,796**	**13,082**	**13,946**	**69,300**	**32,464**	**44,599**	**38,034**	**32,826**	**40,750**	**83,503**	**126,680**	**47,245**	**29,196**	**46,433**	**17,312**	**61,962**	**65,980**	**27,775**	**32,293**	**28,951**	**79,627**	**-**	**20,751**	**32,752**	**19,111**	**66,021**	**48,478**

Table 5.44. Clearnose skate length frequencies, spring, 1 cm intervals, 1993-2015.

	Spring																						
length	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
47	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
50	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
52	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1
54	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	1	4	2
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	1	2	0
57	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	1	0	1
58	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	1	0
59	0	0	0	0	0	0	0	0	0	4	1	0	0	1	2	0	0	0	1	0	0	1	0
60	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	0	0	8	0	1	0
61	0	0	1	0	0	0	1	0	0	2	0	0	0	0	1	0	0	0	0	7	0	2	2
62	0	0	0	0	0	0	2	0	0	1	0	0	0	2	0	2	2	0	0	5	1	1	2
63	0	0	0	0	0	0	0	0	0	2	1	0	0	1	0	1	0	0	1	3	1	1	1
64	0	0	0	0	0	0	0	1	0	3	0	1	0	0	1	0	1	0	1	9	0	3	2
65	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2	2	1	0	1	4	0	2	1
66	0	0	0	0	0	0	0	0	0	1	2	0	0	0	3	0	1	0	4	4	2	3	1
67	0	0	0	0	0	0	0	0	1	2	0	0	0	1	1	1	2	0	1	9	4	1	1
68	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	2	1	0	1	6	2	3	2
69	0	0	0	0	0	0	0	0	1	4	0	1	1	0	4	0	2	0	0	7	2	4	2
70	0	0	0	0	0	0	0	0	0	4	0	0	0	0	4	0	4	0	3	5	3	4	1
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	4	0	1	1
72	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	1	0	0	3	1	2	1
73	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	5	0	0	1
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	1	1	1
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	1
76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	2
79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
80	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1
81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	2
82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
83	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
84	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
87	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**1**	**0**	**0**	**0**	**5**	**3**	**6**	**31**	**8**	**5**	**2**	**9**	**22**	**12**	**21**	**1**	**13**	**95**	**24**	**42**	**35**

Table 5.45. Clearnose skate length frequencies, fall, 1 cm intervals, 1993-2015.

											Fall												
length	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**0**	**0**
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	**0**	**0**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**0**	**0**
43	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
47	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0
51	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
52	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0
54	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	1	3	2	0	3
55	0	0	0	0	0	0	0	0	1	0	0	0	3	2	1	1	0	0	0	1	2	0	3
56	0	0	0	0	0	0	0	0	0	0	2	0	2	0	2	0	0	0	0	3	2	0	5
57	0	0	0	0	0	0	0	0	0	1	0	0	4	0	0	0	1	0	1	4	1	0	4
58	0	0	0	0	0	1	0	2	2	3	0	0	4	1	1	0	0	0	1	5	3	0	3
59	2	0	0	0	0	1	0	1	3	0	0	0	1	2	0	0	0	0	3	1	4	2	8
60	0	0	0	0	0	0	0	1	2	0	0	0	7	3	1	0	1	0	1	4	2	1	4
61	0	0	0	0	0	0	1	0	4	1	2	1	7	3	1	0	1	0	3	9	4	0	6
62	0	0	0	0	1	0	1	0	4	0	1	0	7	1	2	1	2	0	0	8	7	2	3
63	0	0	0	0	0	2	3	1	0	2	0	0	2	2	1	2	1	0	3	9	12	0	2
64	0	0	0	0	0	0	3	1	5	5	2	0	3	0	3	0	1	0	2	9	16	2	8
65	0	0	0	0	0	3	1	2	1	1	2	1	7	1	6	1	6	0	1	14	12	3	2
66	0	0	1	0	1	4	0	0	5	2	9	3	4	0	5	3	3	0	5	12	12	3	8
67	0	0	0	1	0	1	2	1	3	2	5	4	6	2	3	2	4	0	1	17	17	4	2
68	0	0	0	0	0	1	1	0	3	0	4	0	5	1	8	3	2	0	5	11	17	4	5
69	0	0	0	0	0	0	0	3	3	0	3	1	11	2	6	0	1	0	3	11	19	8	3
70	0	0	0	0	0	0	0	0	5	0	2	1	6	2	2	1	3	0	1	12	18	7	6
71	0	0	0	0	0	0	0	0	4	0	5	1	2	1	5	2	1	0	1	9	10	3	5
72	0	0	0	0	0	0	0	1	1	0	3	1	6	0	3	2	5	0	2	5	6	2	2
73	0	0	0	0	0	0	0	0	3	3	1	0	1	1	3	1	2	0	0	3	10	3	3
74	0	0	0	0	0	0	0	0	1	1	4	0	1	0	5	0	2	0	4	5	2	2	1
75	0	0	0	0	0	1	0	1	1	2	0	0	2	0	4	1	2	0	1	4	4	1	2
76	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	1	1	0	1	2	0	2	1
77	0	0	2	0	0	0	0	0	1	4	0	0	0	0	3	1	0	0	0	4	1	1	0
78	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	3	1	3	0
79	0	0	0	0	0	0	1	0	0	0	1	2	1	0	4	1	0	0	0	3	0	2	0
80	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	2	0	0	1	1	1	1
81	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	2	1	0	0	1	0	0	2
82	0	0	0	0	0	1	0	0	1	0	0	0	1	0	1	0	1	0	0	0	1	0	1
83	0	0	0	0	0	0	1	0	0	0	0	1	1	0	1	0	0	0	0	1	0	0	2
84	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
85	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	1	1	0	0
86	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	2	0	0	1	0
87	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0
88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
89	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	2	0
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
93	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
98	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
99	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Total	**2**	**0**	**3**	**1**	**4**	**20**	**17**	**15**	**59**	**29**	**47**	**17**	**100**	**27**	**75**	**25**	**46**	**0**	**44**	**185**	**193**	**62**	**96**

Table 5.46. Fourspot flounder length frequencies, spring and fall, 2 cm intervals (midpoint given), 1989, 1990, 1996-2015.

Prior to 2014, Fourspot flounder lengths were recorded from the first three tows of each day; since 2014, lengths have been recorded from every tow.

	Spring																					
length	**1989**	**1990**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
13	2	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0	1	0	0	0
15	5	2	0	0	5	5	0	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0
17	21	8	1	3	8	12	1	2	17	2	13	0	0	6	0	0	6	2	5	1	1	0
19	19	19	8	16	14	61	22	5	89	8	8	0	6	7	7	4	2	1	24	2	6	3
21	17	42	31	60	13	28	26	4	99	6	4	1	18	11	9	10	3	10	42	11	5	1
23	11	341	198	161	16	32	239	42	33	8	4	14	24	9	17	6	5	45	56	20	9	1
25	56	528	279	353	105	72	422	181	84	124	26	71	29	44	39	37	33	157	258	185	64	19
27	103	225	208	456	209	97	256	300	199	228	82	75	33	105	81	91	55	150	441	209	172	52
29	120	139	193	392	233	81	201	245	191	187	129	64	44	170	108	127	55	107	461	189	179	87
31	89	60	117	192	137	66	139	153	175	163	178	68	61	121	94	90	69	93	303	139	107	77
33	51	27	54	76	60	60	81	45	89	88	113	52	36	52	70	51	36	49	92	100	78	41
35	8	33	15	22	16	25	39	11	26	47	35	31	13	43	34	31	24	27	31	27	29	26
37	2	12	6	3	4	7	12	8	7	12	5	11	4	9	11	7	9	9	4	16	8	6
39	0	4	3	0	2	1	1	2	3	6	2	3	1	7	2	0	4	5	0	0	0	3
41	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	1	0	0	0	0	1	0
43	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Total	**504**	**1,440**	**1,113**	**1,734**	**822**	**548**	**1,439**	**999**	**1,015**	**879**	**602**	**394**	**271**	**585**	**472**	**455**	**302**	**655**	**1,719**	**899**	**659**	**316**

	Fall																					
length	**1989**	**1990**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
5	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	1	-	0	0	0	0	0
7	0	1	0	1	4	0	0	1	0	0	1	0	2	0	0	1	-	1	0	1	1	0
9	5	0	0	23	19	0	2	2	0	4	1	0	2	1	1	7	-	4	0	0	3	1
11	9	4	2	46	27	5	4	17	5	2	12	4	5	0	7	16	-	17	3	1	11	3
13	10	15	5	68	22	24	6	25	3	3	9	9	13	2	8	59	-	28	4	11	26	20
15	6	17	35	55	21	42	5	15	9	0	13	17	4	5	11	45	-	22	13	10	47	23
17	0	0	42	16	3	16	1	0	3	0	1	26	3	2	16	20	-	4	12	2	49	11
19	0	0	22	0	0	4	1	0	1	0	0	2	0	0	7	6	-	0	0	4	5	1
21	0	0	0	2	2	3	2	0	2	0	1	0	0	1	0	0	-	0	0	1	0	0
23	1	2	9	2	5	0	17	1	5	0	0	0	1	1	0	1	-	0	0	0	1	0
25	0	3	42	7	16	5	58	3	7	3	4	1	0	6	1	2	-	2	3	0	1	0
27	0	7	41	10	22	4	77	5	13	7	6	5	0	7	1	6	-	1	9	2	4	1
29	0	3	24	5	22	5	54	10	18	11	13	5	0	20	6	8	-	1	11	2	4	4
31	0	1	20	3	6	3	25	1	18	4	30	6	0	12	5	6	-	1	6	2	8	2
33	0	0	6	1	1	1	7	1	13	7	19	2	1	3	1	11	-	3	6	0	0	5
35	0	0	4	0	1	0	5	0	6	5	6	7	0	4	4	1	-	2	2	2	1	0
37	0	0	0	0	0	0	2	1	3	0	2	0	0	0	0	1	-	1	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	-	0	0	0	0	0
Total	**31**	**53**	**252**	**239**	**171**	**112**	**266**	**83**	**106**	**46**	**118**	**85**	**33**	**64**	**68**	**192**	**-**	**87**	**69**	**38**	**161**	**71**

Table 5.47. Hickory shad length frequencies, spring and fall, 1 cm intervals, 1991-2015.

Hickory shad were measured from every tow, with the exception of one fish in each of fall 1996, fall 1997, and fall 1998.

											Spring														
length	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	3	0	0	0	0	0	1	0	0	0
18	0	0	0	1	0	1	0	0	2	0	0	0	0	0	1	7	1	2	1	0	0	0	0	0	0
19	0	0	0	1	0	0	1	0	0	0	0	0	0	3	5	6	0	1	1	0	0	0	0	0	0
20	0	0	0	0	0	2	0	2	0	0	0	0	0	2	4	2	0	0	0	0	1	2	0	0	0
21	0	0	0	0	0	1	0	0	0	0	0	0	0	2	3	1	1	0	0	1	0	1	0	1	0
22	0	0	0	0	0	0	0	0	1	0	2	0	0	1	1	0	0	0	0	0	0	0	0	0	0
23	0	0	1	0	0	0	0	0	1	0	0	0	1	2	0	2	1	0	0	0	0	0	0	0	0
24	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1	1	1	0	0	0	0	0	1	0	0
25	0	0	0	0	0	0	0	2	0	0	0	0	0	1	1	6	5	0	0	0	0	0	1	1	0
26	0	0	0	0	0	0	0	1	0	0	0	2	0	0	6	5	2	0	0	0	0	2	0	3	0
27	0	0	0	0	0	0	1	0	1	0	0	1	0	0	18	3	5	0	1	0	0	3	0	2	0
28	0	0	0	1	0	1	1	1	2	2	0	4	1	0	14	3	3	0	1	1	0	1	3	4	1
29	0	0	0	0	0	0	2	4	1	7	0	5	0	2	5	2	1	0	1	0	0	1	0	1	1
30	0	0	1	1	1	0	1	5	1	5	0	5	3	1	6	5	2	0	0	0	0	1	0	4	0
31	0	0	0	0	1	1	1	2	1	4	0	2	0	0	1	0	2	0	1	0	0	0	0	1	0
32	0	2	0	0	0	3	0	6	6	2	1	2	1	1	0	5	1	0	0	0	0	0	0	1	1
33	0	0	0	0	0	2	1	2	3	1	0	3	2	0	0	0	1	0	0	0	0	0	0	0	1
34	0	0	0	0	0	0	1	3	1	2	2	1	3	1	2	1	1	0	0	0	0	0	0	1	2
35	0	0	1	0	0	1	0	2	2	2	0	4	2	2	2	0	0	0	0	0	0	0	0	0	1
36	0	0	0	0	0	0	0	2	1	1	0	4	1	0	1	0	0	0	0	0	0	0	0	0	2
37	0	0	0	0	0	0	0	1	0	0	1	2	0	0	0	0	0	0	0	0	0	1	0	1	0
38	0	0	0	0	0	0	0	1	0	0	1	2	2	1	1	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**1**	**2**	**3**	**4**	**2**	**12**	**9**	**34**	**24**	**26**	**10**	**40**	**16**	**20**	**75**	**53**	**27**	**3**	**6**	**2**	**1**	**14**	**5**	**20**	**9**

											Fall														
length	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
19	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
22	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	-	0	0	0	0	0
23	0	0	0	3	0	0	0	0	1	0	0	0	0	0	0	2	0	0	0	-	2	1	0	0	0
24	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	-	2	1	0	0	0
25	0	0	0	6	0	1	1	0	2	0	0	0	0	0	2	1	2	0	0	-	0	2	0	0	0
26	0	1	2	8	0	3	1	0	5	0	0	0	0	4	3	0	0	0	0	-	3	1	0	0	0
27	0	0	0	3	0	2	0	0	5	2	0	1	0	3	0	1	0	0	0	-	0	0	0	0	0
28	0	1	0	1	0	3	0	0	2	0	0	1	0	1	1	1	0	0	2	-	0	1	3	0	0
29	0	0	0	2	0	0	0	0	0	2	0	0	0	1	2	3	0	0	0	-	0	4	7	0	1
30	0	1	0	1	1	0	1	0	0	0	0	0	0	0	8	7	2	0	3	-	0	3	7	2	0
31	0	0	1	0	1	0	2	1	2	0	0	0	1	0	15	1	2	0	2	-	0	7	5	1	0
32	0	1	0	0	1	2	2	1	7	3	1	0	2	0	12	1	1	0	0	-	0	3	1	0	1
33	0	2	1	2	0	1	3	2	2	2	3	1	2	1	5	0	1	2	0	-	0	1	1	1	0
34	0	2	0	0	1	4	2	0	3	4	0	1	1	0	5	1	0	0	0	-	0	4	1	1	1
35	0	0	2	0	0	0	0	0	0	2	0	0	0	2	1	1	0	0	0	-	0	0	1	0	0
36	0	1	0	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	0	-	0	1	1	1	0
37	0	1	1	0	0	0	1	0	2	1	0	0	0	1	2	0	0	0	0	-	0	0	0	0	0
38	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	1	0	0	0	-	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	1	0	0	-	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	-	0	0	0	0	0
Total	**0**	**10**	**7**	**27**	**4**	**16**	**15**	**5**	**32**	**16**	**4**	**5**	**6**	**18**	**60**	**22**	**10**	**2**	**7**	**0**	**7**	**29**	**27**	**6**	**3**

Table 5.48. Horseshoe crab length frequencies by sex, spring, 1 cm intervals, 1998-2015.
Horseshoe crabs were measured (prosomal width) from every tow.

		Spring																	
Sex	**length**	**1998***	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
F	**13**		1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
F	**14**		1	3	0	1	2	0	1	0	0	0	0	0	0	0	0	0	1
F	**15**		0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0
F	**16**		1	0	0	3	2	1	1	0	0	1	0	0	0	1	0	2	0
F	**17**		1	0	2	2	1	4	1	0	1	1	0	0	0	1	0	0	1
F	**18**		2	1	0	3	2	4	0	0	2	1	1	0	0	0	2	3	1
F	**19**		4	1	2	2	5	5	0	0	3	4	1	0	0	2	0	5	1
F	**20**		5	2	0	7	1	2	3	0	3	2	0	0	1	2	0	4	0
F	**21**		8	2	1	8	6	2	1	0	3	8	1	0	3	5	4	5	3
F	**22**		8	6	4	13	10	7	2	0	10	4	6	0	3	3	2	3	3
F	**23**		14	15	18	19	22	17	3	2	9	14	4	3	4	9	7	14	7
F	**24**		15	7	15	32	29	25	5	4	15	11	12	6	3	15	19	13	3
F	**25**		15	10	23	25	22	20	8	5	11	16	10	9	9	14	19	11	11
F	**26**		23	13	28	26	22	23	3	2	16	12	10	4	16	14	17	26	9
F	**27**		15	9	18	18	18	18	8	4	10	9	9	5	18	11	8	22	10
F	**28**		8	6	9	6	7	4	2	2	5	4	10	3	8	10	13	9	3
F	**29**		3	0	3	4	4	4	0	3	5	1	3	4	1	3	2	3	1
F	**30**		1	0	3	2	0	0	3	2	0	2	1	1	4	0	1	1	1
F	**31**		0	0	0	0	4	0	0	0	0	1	1	0	0	0	0	0	0
F	**32**		0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0
M	**14**		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
M	**15**		0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
M	**16**		0	0	0	2	5	2	0	1	2	0	0	2	0	0	0	0	0
M	**17**		5	2	4	7	9	9	0	0	3	2	3	0	1	5	0	1	1
M	**18**		11	8	12	19	24	21	2	0	17	10	3	2	5	7	6	9	4
M	**19**		22	13	32	42	25	33	3	0	19	12	10	7	7	8	16	17	7
M	**20**		15	16	30	20	33	31	7	0	21	10	11	7	15	13	10	13	12
M	**21**		18	5	13	14	16	10	1	0	6	12	5	3	3	9	6	6	7
M	**22**		4	5	7	6	7	6	2	0	4	2	1	1	4	5	3	1	0
M	**23**		1	0	3	1	4	2	1	0	0	1	1	0	0	0	2	1	0
M	**24**		2	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
M	**25**		0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	3	1
M	**26**		0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0
M	**27**		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M	**28**		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M	**29**		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
M	**30**		0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
U	**22**		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		**51**	**204**	**125**	**228**	**285**	**285**	**251**	**60**	**25**	**166**	**141**	**104**	**57**	**105**	**138**	**138**	**173**	**88**

No sex recorded in the spring of 1998

Table 5.49. Horseshoe crab length frequencies by sex, fall, 1 cm intervals, 1998-2015.
Horseshoe crabs were measured (prosomal width) from every tow.

		Fall																	
Sex	**length**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
F	**13**	0	0	2	0	0	0	3	0	1	0	0	0	-	0	0	0	0	0
F	**14**	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
F	**15**	0	0	0	0	2	0	0	0	0	0	0	0	-	0	0	0	0	0
F	**16**	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
F	**17**	1	1	0	0	2	1	0	1	1	0	1	0	-	0	0	0	0	1
F	**18**	0	2	0	1	0	1	1	1	0	0	0	0	-	0	0	0	0	1
F	**19**	3	2	2	2	0	1	0	0	1	0	1	1	-	0	0	0	2	1
F	**20**	5	1	1	4	4	2	3	0	2	0	0	2	-	0	0	0	0	1
F	**21**	3	2	2	3	1	4	6	3	1	1	1	0	-	0	0	0	1	2
F	**22**	3	8	13	13	10	3	9	4	1	2	6	6	-	6	0	2	2	0
F	**23**	8	15	15	12	8	8	13	10	7	7	6	14	-	6	2	3	4	6
F	**24**	7	19	30	27	21	9	24	10	6	17	14	22	-	18	10	12	8	10
F	**25**	17	12	20	31	33	13	19	6	12	26	17	17	-	19	9	11	11	7
F	**26**	19	23	33	31	18	9	29	12	10	22	15	24	-	25	16	27	10	9
F	**27**	14	7	21	22	18	7	22	8	3	17	11	28	-	16	5	15	10	3
F	**28**	2	4	10	8	13	6	15	5	4	8	11	22	-	11	3	10	6	5
F	**29**	2	3	2	5	2	3	8	2	0	4	1	5	-	2	4	2	3	1
F	**30**	0	1	1	2	0	2	1	2	0	2	0	2	-	0	1	2	0	0
F	**31**	0	1	0	0	1	0	0	2	0	0	0	1	-	0	0	0	1	0
F	**32**	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
F	**33**	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
F	**34**	0	0	0	0	0	1	0	0	0	0	0	0	-	0	0	0	0	0
M	**11**	0	0	0	1	0	0	0	0	0	0	0	0	-	0	0	0	0	0
M	**12**	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
M	**13**	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
M	**14**	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
M	**15**	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
M	**16**	0	0	2	1	5	3	0	0	0	1	1	0	-	1	0	0	0	0
M	**17**	6	5	7	6	3	5	11	0	1	3	1	2	-	3	0	1	1	1
M	**18**	12	14	28	18	14	15	21	3	9	3	9	18	-	13	4	2	5	1
M	**19**	10	20	39	27	31	11	39	13	4	12	21	14	-	9	4	6	13	3
M	**20**	20	23	35	32	22	8	30	12	9	19	23	31	-	10	1	17	4	9
M	**21**	6	11	18	15	9	4	15	4	2	10	6	13	-	7	1	7	6	4
M	**22**	5	3	8	4	6	0	10	2	5	6	2	5	-	6	0	5	0	1
M	**23**	0	0	3	2	6	1	1	0	2	3	1	3	-	0	1	2	0	0
M	**24**	0	0	1	3	0	0	1	0	1	2	0	2	-	0	0	0	0	0
M	**25**	0	0	2	0	0	0	0	0	0	0	0	1	-	0	0	1	0	0
M	**26**	2	0	0	3	0	0	0	0	1	0	0	1	-	0	0	0	0	0
M	**27**	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
M	**28**	0	0	0	0	0	0	0	1	0	0	0	0	-	0	0	0	0	0
M	**29**	0	0	0	1	0	0	0	0	0	0	0	0	-	0	0	0	0	0
Total		**145**	**177**	**295**	**274**	**229**	**117**	**281**	**101**	**83**	**165**	**148**	**234**	**-**	**152**	**61**	**125**	**87**	**66**

Table 5.50. Long-finned squid length frequencies, spring, 1 cm intervals, 1986-1990, 1992-2015.

From 1986 – 1990, and 1992-2013, Length frequencies of squid taken from the first three tows of each day; since 2014, lengths have been recorded from every tow.

														Spring															
length	**1986**	**1987**	**1988**	**1989**	**1990**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	14	0	0	0	0	1	0	0
3	0	0	0	0	0	0	0	0	1	5	1	18	4	11	0	6	0	6	0	1	2	111	17	1	0	5	4	5	2
4	0	0	3	0	0	3	9	31	48	23	11	103	10	32	5	44	11	51	1	12	8	220	66	1	6	28	17	35	36
5	0	1	35	0	1	7	64	137	87	39	35	323	32	36	12	48	16	70	11	18	36	220	128	5	17	45	46	63	111
6	0	6	53	0	0	8	99	117	175	23	46	444	20	31	15	36	6	88	20	13	35	148	141	2	45	64	31	62	117
7	2	2	60	0	0	17	96	108	178	33	45	324	18	20	24	27	9	65	4	9	21	66	74	9	42	40	22	41	58
8	3	10	30	0	3	20	49	63	141	34	42	290	18	13	26	36	12	51	7	8	19	55	30	7	15	31	22	38	52
9	2	2	40	2	0	20	42	83	170	40	45	159	43	24	41	18	26	24	6	12	30	54	63	4	23	59	31	44	45
10	2	9	53	1	9	17	47	71	248	55	51	135	47	18	52	41	24	59	10	30	50	106	67	40	38	130	57	32	83
11	1	23	76	4	4	28	60	141	367	75	69	67	82	39	74	49	33	84	28	61	53	173	163	72	39	155	75	40	125
12	19	103	152	6	11	70	133	125	367	78	98	33	88	92	90	75	53	198	51	123	60	220	317	132	77	108	78	70	213
13	24	232	202	12	24	58	163	133	258	95	125	50	106	111	87	72	88	321	146	163	64	112	367	171	75	60	34	99	155
14	22	243	294	36	43	91	163	108	146	81	180	18	99	96	52	86	74	448	208	119	58	105	209	167	65	44	26	136	166
15	22	368	300	48	83	87	210	79	132	77	213	13	94	101	39	62	63	414	234	137	37	75	177	133	65	37	16	146	95
16	14	343	271	111	146	67	289	80	80	43	166	5	71	76	34	47	41	475	227	138	36	76	114	78	50	63	16	195	70
17	7	479	252	81	142	53	218	67	98	42	174	14	39	59	31	46	42	352	180	102	13	61	126	73	41	24	4	113	86
18	36	208	223	92	145	59	195	28	66	44	105	10	41	58	16	22	27	200	134	77	21	48	99	50	41	16	18	71	54
19	23	361	222	95	128	30	150	24	53	24	83	5	20	32	26	12	11	144	64	40	19	20	54	60	28	21	9	65	45
20	24	328	143	62	90	52	80	18	65	19	78	9	22	35	22	14	15	124	81	57	11	25	42	21	44	19	8	77	45
21	27	214	102	30	67	45	90	13	30	15	39	1	16	24	16	18	14	136	53	33	5	34	21	35	21	36	4	46	36
22	13	238	100	42	53	46	43	16	17	12	51	8	12	19	17	6	12	115	53	26	9	14	22	28	16	24	3	61	26
23	13	160	46	40	54	22	28	7	9	4	55	3	9	18	3	9	13	49	36	32	3	7	9	14	21	13	7	53	10
24	13	174	33	35	48	11	23	7	5	9	61	0	16	11	10	6	14	64	41	21	6	10	16	14	23	3	4	28	5
25	6	195	65	28	63	9	21	9	12	0	33	3	10	14	9	2	7	40	23	22	4	3	9	9	6	6	1	30	1
26	6	242	37	58	32	21	37	5	26	2	36	4	3	12	9	6	5	28	28	8	4	5	12	7	2	2	0	29	1
27	7	197	41	27	53	13	10	4	14	2	7	1	4	6	0	1	2	17	9	9	1	2	5	0	7	4	0	12	0
28	2	133	19	32	51	11	27	3	0	1	10	0	2	1	4	2	0	15	9	6	1	1	4	1	0	5	0	14	1
29	2	86	10	8	30	15	7	2	7	3	1	3	5	0	2	3	2	5	3	4	1	1	2	0	0	2	0	9	0
30	5	121	24	12	31	3	1	2	9	1	14	1	0	0	1	8	2	11	0	6	1	0	3	0	3	2	0	6	0
31	3	78	14	11	5	4	8	1	3	0	0	0	1	1	1	0	0	3	2	2	1	0	1	0	0	0	0	1	0
32	0	61	7	6	9	1	7	0	0	1	0	0	0	0	1	3	0	1	1	0	0	0	1	0	2	0	0	2	0
33	0	25	7	7	6	9	0	1	5	0	5	0	1	1	0	1	0	0	0	1	0	0	2	0	0	0	0	0	0
34	0	0	0	0	9	2	2	1	8	0	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0
35	1	38	0	0	2	0	0	1	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	38	4	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	2	0	0	5	2	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**301**	**4,719**	**2,918**	**896**	**1,347**	**900**	**2,371**	**1,485**	**2,825**	**880**	**1,883**	**2,044**	**933**	**993**	**721**	**809**	**622**	**3,658**	**1,670**	**1,290**	**609**	**1,986**	**2,361**	**1,134**	**812**	**1,047**	**534**	**1,625**	**1,638**

Table 5.51. Long-finned squid length frequencies, fall, 1 cm intervals, 1986-1990, 1992-2015.

From 1986 – 1990, and 1992-2013, Length frequencies of squid taken from the first three tows of each day; since 2014, lengths have been recorded from every tow.

														Fall														
length	**1986**	**1987**	**1988**	**1989**	**1990**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
1	0	13	0	12	0	0	0	0	0	0	0	0	0	0	0	4	0	0	3	12	0	0	14	-	0	0	11	0	2
2	0	31	0	1	0	49	0	9	25	24	6	20	29	2	0	11	0	1	10	74	9	33	90	-	12	10	67	6	30
3	0	126	59	112	74	266	914	80	156	57	125	115	104	53	36	80	90	170	91	107	20	87	343	-	80	101	51	25	85
4	0	320	212	468	278	1,507	2,336	477	460	598	491	642	362	384	230	261	886	693	763	249	420	294	939	-	618	469	127	517	208
5	0	892	826	743	830	2,906	3,502	1,332	1,223	1,371	1,091	1,888	1,214	1,215	663	695	2,225	1,757	1,539	587	1,367	417	2,332	-	1,417	705	273	1,443	634
6	3	1,019	1,165	677	836	5,015	4,358	1,803	1,896	1,869	1,278	2,737	1,782	1,842	923	1,067	3,185	2,705	2,337	913	2,780	604	2,894	-	1,405	731	426	1,814	1,818
7	13	817	722	446	469	5,210	4,331	2,152	2,254	2,751	1,169	3,412	2,390	2,204	996	1,193	2,566	2,759	2,552	917	3,822	780	2,746	-	1,315	698	550	1,560	2,753
8	135	654	333	283	220	3,110	3,811	2,225	2,080	2,224	935	2,939	1,808	1,797	839	929	1,885	1,787	2,006	611	3,549	908	1,791	-	840	638	570	1,394	3,618
9	16	692	146	108	129	1,594	2,913	2,486	2,124	1,853	570	1,993	1,829	1,081	616	488	1,785	907	1,283	385	2,119	777	1,131	-	670	584	418	1,366	3,465
10	13	503	65	58	42	894	1,772	2,055	1,540	1,264	446	1,216	1,332	695	528	354	861	626	970	204	1,974	480	808	-	637	399	306	1,198	3,348
11	0	310	62	70	39	737	1,178	1,607	905	698	291	675	780	556	264	214	215	392	541	183	1,379	332	326	-	343	359	178	862	3,227
12	0	165	21	38	24	284	737	843	387	579	153	368	423	380	154	145	58	144	307	85	728	193	222	-	211	232	123	574	2,233
13	0	82	24	34	17	242	408	415	159	297	126	328	277	247	132	87	2	96	194	31	447	103	108	-	139	148	62	315	1,698
14	0	77	9	17	6	40	278	329	110	160	44	199	235	204	68	53	1	103	64	26	253	47	41	-	40	97	53	253	1,340
15	0	31	11	17	3	18	185	181	77	83	31	103	133	128	66	13	2	48	44	9	150	18	27	-	86	64	14	213	767
16	0	4	11	13	2	0	53	99	33	46	15	90	111	73	32	10	0	43	30	8	159	7	14	-	18	35	2	106	489
17	0	14	0	10	4	0	73	75	15	16	13	23	120	101	8	6	0	1	24	17	103	5	2	-	7	8	6	50	266
18	0	1	23	6	1	0	20	31	2	6	10	16	82	34	3	0	0	8	2	11	74	0	1	-	25	12	4	53	282
19	0	1	0	0	0	0	3	12	0	1	0	1	34	9	2	4	0	1	1	11	2	0	0	-	0	7	0	37	93
20	0	13	0	5	1	0	2	7	0	0	1	1	22	3	2	1	0	4	2	1	3	0	0	-	0	1	0	21	156
21	0	15	0	4	0	0	0	3	0	0	0	0	22	9	1	0	0	0	0	0	1	0	0	-	0	5	2	6	42
22	0	2	0	3	1	0	0	11	0	6	0	1	17	0	0	0	0	0	1	0	0	0	0	-	0	2	1	0	4
23	0	0	0	3	0	0	2	1	0	0	0	0	4	0	0	0	0	0	1	0	0	0	0	-	1	0	0	0	28
24	0	1	0	3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	5	0	0	-	0	0	0	0	1
25	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	-	0	0	0	0	4
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	1
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	1
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	1
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	1	0	0	0
Total	**180**	**5,783**	**3,689**	**3,136**	**2,976**	**21,872**	**26,877**	**16,233**	**13,446**	**13,903**	**6,795**	**16,767**	**13,111**	**11,018**	**5,563**	**5,615**	**13,761**	**12,245**	**12,765**	**4,441**	**19,364**	**5,085**	**13,829**	**-**	**7,864**	**5,306**	**3,244**	**11,813**	**26,594**

Table 5.52. Scup spring length frequencies, 1 cm intervals, 1984-2015.
Lengths were recorded from every tow.

	Spring																															
length	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	13	0	0	0	0	0	0	0
8	0	0	0	6	3	84	0	12	0	0	0	11	0	0	10	24	61	0	16	0	0	4	56	4	145	3	0	0	35	0	15	32
9	4	30	50	33	46	1,049	11	80	9	0	11	408	152	10	163	128	976	98	400	0	0	77	322	145	606	148	0	19	435	60	77	435
10	8	138	377	46	160	2,523	270	514	49	3	48	1,202	537	145	1,381	355	5,293	405	2,303	4	1	169	1,151	926	1,700	1,966	14	115	3,169	338	455	2,585
11	10	362	724	38	144	2,075	493	1,365	67	4	92	1,437	1,055	311	1,617	313	10,571	645	3,389	19	1	136	1,259	1,033	2,055	3,476	22	203	3,888	460	1,007	3,918
12	5	194	427	9	31	312	280	576	57	3	67	809	826	151	712	131	8,815	586	1,706	33	1	62	1,263	486	950	3,418	7	178	2,589	300	1,402	2,111
13	2	51	122	4	9	87	56	122	18	4	23	108	397	36	359	51	4,041	265	722	25	2	19	888	78	586	1,141	1	77	1,241	93	623	785
14	0	7	64	2	0	72	22	0	11	5	2	20	29	25	154	16	1,043	104	498	7	1	8	626	76	357	561	3	16	262	74	123	86
15	2	4	4	11	4	137	40	3	3	77	7	3	3	11	66	1	201	220	247	7	42	56	251	298	426	593	40	19	62	98	108	60
16	9	47	26	65	19	121	202	8	4	217	48	6	61	49	24	13	48	1,349	1,035	121	327	129	722	1,177	1,971	1,430	222	100	52	504	226	229
17	37	91	91	119	40	105	310	63	49	339	142	11	264	123	57	75	229	4,517	2,943	415	485	129	1,670	1,607	3,916	2,151	614	215	206	1,343	669	784
18	22	204	208	174	34	95	231	182	135	286	194	28	545	216	89	161	1,034	8,611	4,097	733	403	140	2,254	1,444	3,722	1,953	780	312	642	2,764	755	1,319
19	28	130	182	100	16	50	121	347	258	159	203	30	390	136	66	172	1,451	6,452	3,619	720	261	114	1,607	918	1,978	1,078	527	270	1,123	3,058	520	1,196
20	11	71	131	33	25	33	30	256	136	35	99	22	153	81	21	130	1,106	1,840	3,679	390	381	29	934	390	1,315	798	424	257	909	1,402	718	593
21	3	15	36	15	44	13	26	223	65	27	95	19	34	62	11	78	513	518	6,253	427	584	42	559	266	2,149	1,320	599	655	377	271	1,539	371
22	7	7	6	4	49	7	18	292	11	17	56	17	10	96	8	29	173	292	8,129	660	1,077	111	416	458	2,835	1,941	723	1,260	200	296	2,305	510
23	6	22	103	3	33	12	12	225	10	25	44	19	1	86	17	25	240	755	5,618	931	982	174	427	603	2,340	1,522	641	1,387	313	665	1,674	699
24	4	38	124	5	14	9	6	103	21	14	23	24	8	46	18	26	282	833	2,385	977	745	161	361	558	1,351	1,149	580	1,123	568	738	711	802
25	3	28	77	2	4	5	7	33	15	8	10	15	2	20	12	13	199	278	1,292	1,025	844	216	234	272	854	909	573	930	816	591	326	896
26	0	11	73	2	3	3	3	15	10	1	8	5	1	5	10	10	154	132	1,266	741	1,215	332	262	128	642	793	523	658	1,000	312	379	847
27	2	3	35	3	1	4	1	5	4	4	6	8	2	3	7	7	50	93	491	363	1,200	353	283	91	382	504	350	651	931	461	338	426
28	0	12	4	5	4	3	3	1	6	2	2	0	1	3	3	2	13	88	282	201	730	379	427	109	230	267	243	637	721	689	316	243
29	1	14	6	3	2	0	0	2	2	0	0	0	1	0	1	6	19	36	147	81	331	332	622	115	198	234	153	468	565	753	346	155
30	0	11	3	1	0	1	0	2	1	1	1	1	1	3	0	0	8	8	71	33	116	171	618	156	64	90	41	321	467	627	299	158
31	0	1	0	1	2	0	0	1	0	0	1	0	1	4	0	1	6	3	35	23	37	101	441	167	54	42	34	235	307	496	227	118
32	0	2	1	0	1	1	1	0	1	0	0	1	0	0	0	3	3	2	10	11	28	41	317	126	68	32	15	123	174	310	174	148
33	0	2	1	0	0	0	0	0	0	0	1	0	0	0	0	0	4	2	11	4	11	16	266	65	57	57	14	78	105	152	100	102
34	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	3	1	4	2	8	1	30	37	47	16	4	44	63	106	61	63
35	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	1	0	3	0	1	2	17	18	26	10	4	32	31	36	20	31
36	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	1	4	9	11	11	2	28	17	23	8	34
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2	3	4	8	1	15	6	8	1	8
38	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	5	4	10	3	10
39	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3	2	3	0	3
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	3	0	1	3
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Total	**166**	**1,497**	**2,877**	**684**	**689**	**6,801**	**2,143**	**4,430**	**942**	**1,232**	**1,183**	**4,204**	**4,474**	**1,624**	**4,806**	**1,771**	**36,537**	**28,134**	**50,654**	**7,955**	**9,817**	**3,506**	**18,292**	**11,764**	**31,052**	**27,623**	**7,155**	**10,435**	**21,283**	**17,042**	**15,528**	**19,760**

Table 5.53. Scup fall length frequencies, 1 cm intervals, 1984-2015.
Lengths were recorded from every tow.

	Fall															
length	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	8	0	0	0	7	0	0	0	0	0	0	0	0	0	0
4	1	61	0	0	17	1	3	14	196	0	6	0	0	18	4	1
5	16	90	313	213	103	128	57	120	483	28	312	1	13	70	224	21
6	295	249	626	1,193	625	612	340	1,805	1,516	554	931	41	185	338	1,246	1,041
7	627	588	753	491	1,782	1,367	640	4,923	1,554	4,383	5,217	219	788	1,020	2,354	4,570
8	345	1,827	507	499	2,264	1,765	2,152	11,168	2,595	9,063	11,585	602	2,048	1,318	4,330	9,886
9	719	2,637	210	434	2,050	1,500	3,806	13,883	936	9,169	13,327	1,867	3,502	1,479	4,515	18,224
10	262	2,025	84	77	656	798	2,728	5,539	250	5,754	4,712	1,916	2,667	1,184	3,126	29,863
11	8	1,064	19	12	81	95	601	1,191	78	814	432	606	525	499	728	20,073
12	0	9	4	22	17	124	28	88	40	12	46	103	31	191	94	6,931
13	14	59	41	144	53	670	51	2	304	13	4	46	39	44	56	1,190
14	30	265	322	288	274	1,449	13	46	860	70	22	403	161	130	180	198
15	86	339	603	277	649	1,102	171	305	1,393	176	68	1,283	459	517	504	459
16	91	473	452	149	313	487	373	910	942	251	117	1,478	491	588	738	742
17	46	299	361	61	111	213	362	683	465	168	103	869	299	289	446	1,583
18	27	170	188	29	81	87	415	242	110	70	87	262	111	101	193	1,548
19	8	44	55	20	85	42	309	39	28	56	57	47	51	21	72	1,196
20	21	15	36	52	93	43	266	13	145	95	34	18	75	32	33	436
21	47	8	44	87	87	34	424	56	254	111	41	9	70	34	33	289
22	59	38	116	88	96	34	333	64	265	88	56	4	58	39	27	460
23	75	77	133	61	18	14	101	86	181	44	38	4	23	17	16	329
24	93	64	84	33	17	9	34	98	27	16	33	3	7	10	7	173
25	46	49	38	27	4	6	21	47	23	12	17	1	1	12	5	66
26	38	53	13	28	10	3	10	19	17	10	11	0	0	4	2	13
27	38	64	9	36	7	1	2	13	22	10	7	0	2	1	2	19
28	31	18	12	11	3	1	3	6	13	7	6	0	2	1	1	4
29	9	21	4	7	0	0	1	1	6	4	2	0	0	0	3	2
30	8	16	2	1	0	0	0	0	0	3	0	0	0	0	0	0
31	7	7	1	1	0	0	1	2	1	0	0	0	1	0	0	1
32	2	1	0	0	0	0	3	0	0	0	1	0	0	0	0	1
33	1	2	0	3	0	0	0	0	0	1	0	0	0	0	0	0
34	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**3,050**	**10,641**	**5,030**	**4,344**	**9,496**	**10,592**	**13,249**	**41,363**	**12,705**	**30,983**	**37,272**	**9,782**	**11,609**	**7,957**	**18,939**	**99,319**

length	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
2	0	0	0	0	0	0	0	1	0	0	-	0	0	0	0	0
3	0	0	1	0	2	13	4	9	0	0	-	4	0	0	0	0
4	1	28	117	19	143	363	11	74	0	34	-	21	29	4	11	21
5	168	317	603	214	1,302	850	129	381	0	234	-	131	119	7	204	799
6	991	1,891	2,132	573	4,723	4,122	389	1,303	4	1,106	-	705	567	116	1,033	3,154
7	4,228	5,003	5,571	1,589	8,721	9,683	942	4,516	871	2,923	-	1,769	1,849	180	4,259	8,512
8	7,464	7,327	9,315	701	10,637	11,328	1,442	10,576	3,092	3,078	-	3,977	4,036	563	7,657	15,560
9	9,302	5,369	10,102	205	10,751	8,808	1,517	13,782	6,383	1,316	-	4,882	5,961	1275	6,878	11,241
10	6,831	2,837	6,754	33	5,987	5,295	459	10,376	7,196	610	-	2,365	5,770	701	3,654	5,762
11	1,806	888	2,020	3	1,896	1,973	126	2,547	1,733	75	-	632	2,695	375	1,526	2,094
12	467	312	488	6	344	734	256	1,316	84	10	-	112	726	118	362	532
13	428	229	197	87	77	680	606	1,645	27	81	-	42	154	70	205	281
14	2,744	309	276	249	159	1,158	1,101	3,269	193	598	-	248	482	288	230	1,335
15	6,889	690	854	325	268	784	1,210	4,216	367	1,890	-	883	1,483	454	537	2,361
16	10,695	762	1,403	201	130	555	801	3,003	493	2,445	-	1,425	2,233	331	589	2,667
17	7,208	593	1,642	92	75	359	338	1,468	330	1,777	-	1,138	2,015	203	416	1,813
18	3,508	225	1,370	43	37	261	179	555	110	830	-	613	1,332	83	271	735
19	771	294	733	175	78	234	113	676	88	320	-	293	455	176	143	218
20	396	769	621	586	189	308	147	1,121	185	343	-	110	199	505	190	241
21	337	967	797	693	339	194	158	1,179	228	336	-	186	212	640	151	397
22	216	655	1,214	500	447	147	128	655	238	226	-	288	388	478	201	479
23	189	328	1,185	315	544	88	134	365	150	190	-	408	319	164	335	337
24	124	195	1,071	506	744	104	90	189	94	170	-	649	184	179	358	248
25	49	96	769	726	1,072	146	59	181	123	170	-	822	112	238	277	313
26	35	55	271	720	878	173	42	170	147	167	-	643	106	162	190	516
27	42	27	184	558	790	212	23	91	99	128	-	502	122	129	100	400
28	20	11	67	261	731	214	15	78	85	107	-	383	116	108	100	232
29	13	14	32	101	433	174	23	32	59	86	-	341	59	135	57	145
30	3	4	22	75	122	101	36	27	51	35	-	196	63	116	88	95
31	2	3	14	23	45	46	26	43	22	28	-	111	26	47	64	98
32	0	0	1	14	25	18	20	37	20	21	-	76	17	36	49	76
33	0	0	2	5	10	3	6	27	14	13	-	31	11	24	22	67
34	0	0	0	3	2	5	2	10	11	13	-	16	1	9	7	18
35	0	0	0	1	1	0	1	1	6	7	-	10	0	7	4	12
36	0	0	1	0	4	0	0	1	4	2	-	7	1	2	3	5
37	0	0	0	0	0	0	0	1	0	2	-	2	0	1	0	5
38	0	0	0	0	0	0	0	0	0	0	-	0	0	1	0	3
39	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	-	0	0	0	1	0
Total	**64,927**	**30,198**	**49,829**	**9,602**	**51,706**	**49,133**	**10,533**	**63,921**	**22,507**	**19,371**	-	**24,021**	**31,842**	**7,925**	**30,172**	**60,772**

Table 5.54. Striped bass spring length frequencies, 2 cm intervals (midpoint given), 1984–2015.

All striped bass taken in the Survey were measured, with the exception of one fish taken in 1984, one in 1988, and two in 1990.

														Spring																		
length	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
11	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	8	0	0	0	1	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	3	0	0	0
19	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	5	0	0	5	0	0	0
21	0	0	0	0	0	2	3	0	0	0	0	4	1	0	2	1	3	0	8	0	0	1	0	0	0	21	0	0	5	3	0	0
23	0	0	0	0	0	1	1	0	1	0	0	9	0	0	11	1	8	1	22	0	0	23	0	7	1	24	1	0	10	11	0	1
25	0	0	0	1	0	1	4	2	0	0	0	18	0	2	28	1	18	7	32	4	2	57	0	9	4	24	1	2	8	9	1	0
27	0	0	0	0	0	0	5	1	2	0	2	28	2	5	30	2	24	15	38	4	1	67	1	12	4	7	1	0	8	11	0	0
29	0	0	0	0	1	0	9	2	0	1	1	24	4	12	21	14	28	16	27	11	4	50	1	10	6	5	0	0	8	7	2	0
31	0	0	0	0	0	1	6	2	1	2	2	12	4	14	20	10	29	5	17	7	5	19	1	4	4	1	0	0	5	4	1	1
33	0	0	0	1	0	0	0	6	1	0	3	7	8	5	20	24	7	6	12	10	10	6	2	5	4	6	0	0	2	7	1	0
35	0	0	0	0	1	0	3	2	1	1	0	8	20	2	19	16	3	4	7	7	13	7	6	6	1	2	1	1	2	7	5	2
37	0	0	0	0	0	0	3	1	0	0	1	8	26	25	25	15	2	11	12	11	11	4	5	16	2	5	2	1	3	10	12	2
39	0	0	0	0	0	1	0	0	0	0	3	3	19	42	23	13	2	14	14	7	4	7	6	35	2	10	3	0	3	9	33	0
41	0	0	0	0	0	2	2	1	3	1	3	4	17	30	25	19	6	7	20	3	2	20	2	26	2	19	1	0	1	2	31	5
43	0	0	0	0	0	0	0	1	3	5	1	0	7	16	17	11	3	2	17	5	1	13	4	25	6	14	0	0	4	2	12	4
45	0	0	0	1	0	0	0	0	5	2	2	3	12	6	19	9	4	1	17	2	3	12	2	11	7	21	0	0	5	4	12	1
47	0	0	0	0	2	0	0	0	0	3	6	0	7	10	15	10	5	6	9	3	2	17	0	7	10	30	2	6	1	4	22	6
49	0	0	0	0	2	0	2	1	2	3	4	1	5	13	14	6	4	3	8	5	6	17	1	12	9	28	7	4	1	6	19	6
51	0	0	0	0	0	1	0	1	4	3	4	2	7	7	12	6	4	3	9	7	1	4	6	5	10	32	2	8	5	3	13	4
53	0	0	0	1	0	0	0	1	2	5	4	2	7	4	8	11	5	2	5	6	6	9	6	8	12	19	5	11	1	4	6	6
55	0	0	0	0	0	0	1	1	1	4	2	2	5	3	13	13	7	3	8	9	3	7	6	4	12	9	7	11	5	3	10	7
57	0	0	0	0	0	0	0	2	2	2	8	1	2	3	6	21	4	5	9	9	6	13	3	15	12	13	8	13	6	0	2	1
59	0	0	0	2	0	1	0	0	0	4	2	2	2	7	7	22	4	5	10	11	4	5	5	5	8	17	6	5	6	6	3	5
61	0	0	0	0	0	0	0	2	1	2	5	2	3	3	2	26	4	10	17	7	6	6	4	12	5	17	3	13	1	2	4	4
63	0	0	0	1	1	0	0	0	1	5	1	0	2	3	2	21	8	13	6	9	7	7	4	15	5	15	2	12	1	3	2	1
65	0	0	0	0	0	0	0	0	0	1	4	0	3	5	10	15	10	4	13	9	4	8	6	4	1	12	4	8	2	6	2	0
67	0	0	0	0	0	1	0	0	1	1	0	1	3	4	6	10	9	6	19	14	6	4	3	8	4	8	1	15	4	3	1	0
69	0	0	0	0	0	0	2	0	0	3	3	3	1	3	1	10	3	13	15	10	5	7	2	5	3	3	2	9	4	4	2	0
71	0	0	0	1	0	0	1	0	0	0	1	2	1	3	1	10	5	6	6	5	3	9	1	4	5	7	2	12	3	3	1	0
73	0	0	0	0	0	0	0	2	0	3	0	0	7	6	2	5	8	5	12	10	2	6	3	3	3	3	2	7	1	4	0	1
75	0	0	0	0	0	0	0	0	0	3	1	0	0	0	0	6	1	2	4	10	5	5	1	3	0	3	4	8	3	2	1	0
77	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	3	5	2	0	6	1	5	2	1	1	0	9	0	2	0	0
79	0	0	0	0	0	0	0	1	1	0	0	3	2	3	0	1	2	1	7	1	1	4	2	0	1	1	1	5	1	7	5	0
81	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	2	2	0	4	0	2	4	1	2	2	0	1	1	2	5	0	0
83	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	1	4	0	1	1	1	0	0	0	1	0	3	0	1
85	0	0	0	0	0	0	0	2	0	0	0	0	2	1	0	0	0	1	3	2	0	1	0	0	0	0	0	1	1	0	1	0
87	0	0	0	0	0	0	0	0	1	1	1	0	1	1	1	0	0	1	0	4	2	0	2	1	1	0	0	0	0	0	0	0
89	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	3	0	0	0	0	0	1	1	0	0
91	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	1	0	0	0	1	0	1	0	0	0	0	2	0	0
93	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3	1	0	0	0	0	0	1	0
95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	1	1	0	1
97	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	**0**	**0**
Total	**0**	**0**	**0**	**8**	**7**	**11**	**43**	**32**	**34**	**59**	**65**	**151**	**184**	**239**	**361**	**335**	**229**	**184**	**413**	**208**	**135**	**422**	**97**	**287**	**160**	**382**	**69**	**165**	**125**	**160**	**205**	**59**

Table 5.55. Striped bass fall length frequencies, 2 cm intervals (midpoint given), 1984–2015.
All striped bass taken in the Survey were measured on each tow.

	Fall																															
length	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	1	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	1	1	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	7	2	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	13	1	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	9	1	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	4	2	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	-	3	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	1	4	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	4	0	0	0	0	0	-	1	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	7	0	2	0	0	0	-	0	0	0	0	3
43	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2	1	0	1	0	19	0	0	0	1	0	-	0	4	0	0	0
45	0	0	1	0	0	0	0	0	0	0	0	0	4	3	2	2	0	0	1	0	18	1	1	2	0	0	-	0	1	3	0	1
47	0	0	0	0	0	0	0	0	0	0	0	0	4	3	0	11	0	0	1	1	18	1	1	10	0	2	-	0	5	6	5	6
49	0	0	0	0	0	0	0	0	0	1	0	0	9	9	2	9	1	0	0	0	14	2	4	22	1	1	-	0	6	5	3	5
51	0	0	0	0	0	0	0	0	0	4	2	0	8	4	1	9	0	0	3	0	29	2	5	18	2	4	-	2	2	2	4	16
53	1	0	0	0	0	0	0	0	0	2	2	1	5	14	7	5	5	0	3	0	27	7	7	16	7	7	-	2	2	4	7	18
55	0	0	0	0	0	0	0	0	1	0	1	0	2	10	5	5	2	0	4	1	26	1	2	10	4	10	-	3	3	2	6	26
57	0	0	0	1	1	0	0	1	1	5	0	2	3	11	5	5	5	2	7	1	11	6	3	6	3	8	-	0	0	3	8	15
59	0	0	0	0	0	0	0	0	1	0	0	0	0	7	3	0	8	0	2	0	13	6	3	5	3	8	-	0	6	1	4	14
61	0	0	0	0	3	0	0	1	0	1	0	2	2	3	1	2	4	2	2	0	12	1	6	4	3	4	-	2	1	2	4	10
63	0	0	0	0	2	0	0	1	1	1	1	0	0	3	2	3	6	7	3	1	9	5	2	5	1	6	-	3	0	5	2	1
65	0	0	0	0	1	0	0	0	2	1	1	0	0	2	0	4	6	5	3	0	7	2	2	7	1	6	-	6	0	2	1	4
67	0	0	0	0	1	0	0	1	0	1	2	2	1	1	0	1	6	1	6	0	8	4	3	4	0	5	-	3	0	0	0	5
69	0	0	0	0	1	0	0	0	0	1	1	0	2	2	0	0	4	3	4	0	6	0	3	6	2	6	-	2	0	2	1	1
71	0	0	0	0	1	0	0	0	1	0	0	1	1	1	2	0	3	3	5	0	3	3	0	0	0	1	-	1	2	0	1	1
73	0	0	0	0	0	0	0	0	0	2	1	4	0	2	3	1	2	2	0	1	3	0	0	0	4	1	-	5	1	1	0	0
75	0	0	0	0	0	0	0	1	0	0	1	2	1	1	0	1	3	2	1	1	1	2	0	1	0	0	-	1	1	0	1	1
77	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	1	4	0	4	0	1	0	0	2	3	0	-	5	1	0	1	0
79	0	0	0	0	0	0	0	0	0	2	1	0	0	1	1	0	1	1	2	1	1	0	1	0	3	1	-	0	0	0	0	0
81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
83	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	-	0	0	2	0	0
85	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	2	1	0	1	0	3	-	1	0	0	0	1
87	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	1	0	0	-	0	0	0	0	0
89	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	-	1	0	0	1	0
91	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	-	0	0	0	0	0
93	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	-	0	0	0	0	0
95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	2	-	0	0	0	0	0
97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	5	-	0	0	0	0	0
99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	-	0	0	0	0	0
101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	-	0	0	0	0	0
103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	-	0	0	0	0	0
105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	-	0	0	0	0	0
107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	-	0	0	0	0	0
111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	-	0	0	0	0	0
Total	**1**	**0**	**1**	**1**	**10**	**0**	**0**	**6**	**8**	**22**	**16**	**15**	**48**	**80**	**37**	**62**	**64**	**28**	**56**	**8**	**243**	**47**	**47**	**131**	**39**	**83**	**-**	**77**	**46**	**40**	**49**	**128**

Table 5.56. Summer flounder length frequencies, spring, 2 cm intervals (midpoint given), 1984–2015.

All summer flounder taken in the Survey were measured, with the exception of one fish in 1990.

	Spring																															
length	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
13	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	15	0	0	1	0	0	0	1	0
17	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	28	1	1	7	0	0	1	0	0
19	0	0	0	36	0	0	1	0	0	0	0	1	1	0	0	0	2	0	0	2	1	0	0	37	1	3	10	0	0	0	1	5
21	0	0	11	39	0	0	0	0	0	0	3	2	2	1	0	0	2	1	1	3	0	0	0	46	5	16	21	1	0	15	5	19
23	0	0	10	31	1	0	1	3	2	0	9	1	2	2	0	0	0	6	1	13	1	2	1	37	3	21	38	4	2	21	15	35
25	1	0	22	33	2	0	2	6	1	9	20	1	2	10	1	2	6	5	2	27	3	3	0	21	7	43	86	21	4	41	29	67
27	8	0	43	25	20	0	7	12	6	22	32	3	11	10	2	14	7	26	13	79	8	14	0	11	13	55	94	50	22	58	61	87
29	7	0	39	6	18	0	15	17	14	15	10	9	45	22	5	32	21	60	50	135	25	10	2	19	34	53	78	90	56	56	92	56
31	9	1	17	3	18	0	19	23	12	12	19	12	44	27	4	42	23	53	89	104	14	19	5	19	28	24	37	92	51	33	74	49
33	0	7	13	5	12	1	12	9	8	7	22	2	14	25	7	22	28	16	57	54	18	15	21	6	25	26	10	70	44	36	65	25
35	2	8	4	2	13	3	1	5	6	7	16	2	12	11	11	22	22	10	41	49	13	12	17	9	14	20	7	81	58	35	50	21
37	1	3	4	5	8	2	1	6	2	6	20	1	10	20	28	26	34	20	57	75	34	8	14	12	10	28	16	69	60	64	48	30
39	3	3	3	4	5	1	2	5	2	7	7	0	12	16	38	18	36	12	61	71	51	9	10	22	14	36	20	55	66	62	33	27
41	1	3	7	1	8	2	1	6	5	4	6	3	5	10	35	14	33	19	51	77	49	13	5	26	17	35	12	38	34	68	33	22
43	0	1	3	0	2	2	0	0	2	4	6	7	6	6	22	16	22	24	28	58	48	10	5	30	13	28	13	25	43	46	29	20
45	0	0	1	1	3	0	0	8	4	0	4	0	5	4	15	11	29	16	21	33	18	5	4	26	6	30	7	19	23	39	23	17
47	0	0	3	3	3	1	1	4	2	1	3	0	1	6	9	10	18	14	20	43	28	12	3	25	14	14	16	26	24	28	16	12
49	1	0	1	1	1	2	0	2	1	0	2	1	3	2	12	17	7	10	14	32	26	6	3	35	9	13	10	20	23	20	17	10
51	0	0	5	0	1	0	0	1	1	0	1	0	1	3	15	9	8	12	19	19	13	8	7	26	15	16	9	15	15	18	16	8
53	0	0	1	0	1	0	2	1	0	1	1	2	3	5	5	9	5	8	10	21	16	6	4	10	15	8	2	18	8	13	18	8
55	0	2	1	0	1	1	0	0	1	2	1	0	3	2	6	8	8	8	14	10	13	5	2	11	18	14	2	15	8	12	17	4
57	0	0	0	0	0	1	1	0	0	0	2	0	0	1	5	4	5	8	12	9	3	2	1	13	14	16	2	14	3	6	14	7
59	0	0	0	0	1	1	0	0	0	2	0	0	2	3	3	8	8	2	6	12	8	4	1	5	5	17	3	7	8	9	3	7
61	0	2	0	0	0	0	0	0	0	1	2	1	1	0	1	3	4	4	6	5	5	3	0	2	4	7	3	7	1	3	4	0
63	0	0	0	0	0	0	0	0	0	1	0	0	0	1	2	0	2	1	7	10	9	0	4	6	5	8	2	8	6	3	3	1
65	0	1	0	0	0	0	0	1	1	0	1	0	0	0	1	1	2	4	2	8	2	1	0	7	3	4	6	4	5	5	1	2
67	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	2	3	5	4	0	1	1	1	1	1	6	0	1	1	1
69	0	0	0	1	0	1	0	0	0	0	0	0	1	1	1	1	0	0	0	4	2	0	0	3	0	1	1	0	1	0	2	1
71	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	1	2	0	3	4	0	0	0	0	0	0	1	3	3	0
73	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	1	0	1	2	2	0	1	0
75	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	1	2	0	1	1	0	0	0	0
77	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Total	**33**	**32**	**189**	**203**	**118**	**18**	**67**	**109**	**72**	**101**	**188**	**51**	**186**	**188**	**230**	**289**	**334**	**342**	**588**	**962**	**416**	**172**	**110**	**512**	**297**	**538**	**516**	**758**	**569**	**696**	**675**	**541**

Table 5.57. Summer flounder length frequencies, fall, 2 cm intervals (midpoint given), 1984–2015.
All summer flounder taken in the Survey were measured, with the exception of two fish in 1985.

	Fall																															
length	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	-	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	-	0	0	0	0	0
15	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	3	2	0	1	-	0	0	0	0	0
17	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	2	0	0	0	0	2	-	0	0	0	0	0
19	0	3	3	0	0	0	0	0	0	2	0	0	1	0	0	0	1	0	0	0	0	0	2	1	1	5	-	0	0	0	0	0
21	0	7	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	2	0	0	1	4	8	-	0	0	2	0	0
23	0	4	3	0	0	0	0	0	1	2	0	1	3	0	0	0	0	1	7	0	3	2	0	0	11	6	-	0	2	6	4	0
25	0	6	0	0	0	0	0	2	0	4	0	0	2	0	0	1	1	0	5	0	5	0	0	3	5	7	-	3	1	5	3	0
27	0	6	3	1	0	0	1	1	0	1	0	0	0	0	0	3	11	1	17	0	5	2	0	4	17	14	-	4	3	4	1	1
29	0	2	2	7	0	0	0	1	0	1	1	0	1	0	0	1	2	1	19	0	10	1	0	6	8	6	-	5	5	13	5	5
31	0	3	6	9	3	0	0	1	1	0	1	0	4	3	0	4	2	14	13	0	5	5	0	18	5	5	-	11	7	26	7	8
33	10	0	10	30	10	0	3	3	3	8	8	8	12	17	1	16	3	28	14	3	6	33	5	14	3	8	-	29	34	45	10	27
35	22	4	33	35	20	0	10	11	14	29	7	13	33	37	11	18	8	104	70	15	3	55	2	19	1	34	-	35	42	33	12	24
37	21	17	44	28	41	0	14	21	19	31	10	6	33	44	10	39	23	109	106	29	6	37	6	15	8	34	-	38	58	37	27	40
39	20	10	35	21	37	0	11	28	15	29	25	6	38	72	17	50	33	81	158	28	18	32	9	9	29	40	-	54	73	25	29	40
41	16	11	26	16	36	1	18	30	12	37	10	16	49	54	21	52	31	61	119	16	21	57	10	20	36	34	-	41	55	46	23	43
43	11	24	26	5	21	1	18	13	13	16	4	9	23	27	34	43	31	28	61	22	25	30	16	17	27	29	-	27	37	27	13	21
45	3	16	9	3	18	1	15	13	9	6	5	2	15	10	32	22	13	16	77	21	32	25	13	14	9	20	-	17	23	33	14	15
47	2	11	6	6	8	3	3	5	6	11	7	2	13	11	36	8	8	15	35	18	29	15	4	8	5	27	-	6	15	16	8	15
49	3	12	1	2	3	3	3	3	8	3	7	1	8	7	15	4	18	23	24	10	26	15	8	13	5	20	-	9	11	19	4	6
51	3	1	4	1	1	2	0	8	4	6	0	3	8	4	9	7	11	20	14	8	9	7	1	15	2	7	-	2	15	11	4	7
53	1	1	2	2	1	4	1	7	4	3	1	0	3	5	7	12	7	8	5	5	7	8	4	16	1	10	-	1	11	8	6	3
55	1	2	1	2	1	0	2	4	2	1	0	2	0	3	4	3	5	9	1	2	4	3	2	7	0	8	-	4	14	8	3	6
57	2	0	1	2	1	0	1	0	1	2	1	1	1	2	2	2	2	5	10	2	4	1	2	3	1	2	-	1	0	4	3	2
59	0	0	1	0	1	0	1	0	0	1	3	0	0	2	1	6	3	4	7	4	3	1	0	8	0	4	-	1	2	3	3	4
61	0	0	0	1	0	0	1	0	0	1	0	0	0	1	2	1	2	0	1	2	0	1	0	2	0	4	-	4	1	2	2	0
63	1	1	0	0	1	0	0	1	1	0	0	0	0	0	2	0	2	1	2	2	1	0	1	1	0	3	-	1	0	1	0	0
65	0	0	0	0	0	1	0	1	0	0	0	0	0	0	2	0	1	1	1	1	0	1	1	1	0	0	-	0	0	2	0	1
67	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	1	0	1	-	1	0	1	0	0
69	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	-	0	0	0	2	0
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	1	-	0	0	0	1	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	-	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	-	0	0	0	0	0
Total	**117**	**141**	**225**	**171**	**203**	**16**	**102**	**153**	**114**	**194**	**93**	**70**	**248**	**299**	**206**	**293**	**220**	**531**	**770**	**189**	**228**	**331**	**95**	**219**	**178**	**343**	**-**	**294**	**409**	**377**	**184**	**268**

Table 5.58. Tautog length frequencies, spring, 1 cm intervals, 1984-2015.
All tautog taken in the Survey were measured.

	Spring																															
length	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0
12	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	1	1	1	0	0	2	2	0	1	0	0	0	0	0	0	0	1
13	0	0	0	1	1	0	4	1	0	1	0	0	2	1	0	0	0	2	0	0	0	3	0	0	0	1	0	1	4	2	1	1
14	0	0	0	1	0	4	3	0	2	3	2	0	0	1	0	0	4	2	1	0	1	1	0	0	1	1	2	0	2	0	1	0
15	0	0	2	2	1	4	7	1	1	0	2	0	1	2	0	0	2	2	0	0	0	0	0	1	0	2	0	2	0	0	1	0
16	0	0	0	3	1	3	6	1	0	0	2	0	3	3	0	0	0	1	1	0	1	1	0	1	2	1	0	0	2	2	0	1
17	2	1	2	3	2	3	8	3	3	1	2	0	0	2	0	0	5	2	2	1	0	2	3	0	0	0	0	0	4	1	3	3
18	2	2	0	3	4	3	14	7	4	4	1	1	0	4	1	0	4	2	2	0	0	0	0	0	1	1	1	1	3	2	1	0
19	2	0	2	3	4	11	11	6	2	1	1	0	2	1	0	3	0	6	2	2	0	0	0	2	1	0	0	0	2	0	0	1
20	5	2	2	0	3	7	15	7	2	1	2	1	0	2	1	0	1	3	1	1	0	2	0	0	2	0	0	1	3	9	6	2
21	3	1	5	2	5	7	12	4	1	5	2	0	0	5	0	3	3	2	4	0	2	1	0	0	0	0	2	3	3	2	5	3
22	2	5	0	1	7	11	13	11	2	2	1	1	0	5	2	0	2	6	0	1	0	3	3	1	1	0	1	2	3	4	1	6
23	7	0	6	4	4	12	15	9	2	2	5	1	0	2	2	1	4	7	5	0	1	2	2	2	2	0	0	3	6	1	1	8
24	5	1	3	1	4	8	8	3	0	3	5	1	1	0	2	1	1	6	6	2	2	2	2	5	1	0	3	1	1	5	6	1
25	6	8	2	4	4	7	7	5	4	1	2	1	1	7	1	2	4	5	6	2	1	2	2	1	2	1	1	2	3	4	4	6
26	6	4	7	0	2	4	15	6	0	3	1	0	0	2	2	1	2	7	3	0	3	1	2	1	2	0	0	1	8	3	8	2
27	5	3	8	3	2	9	5	6	1	1	3	1	1	3	6	2	6	1	8	3	1	0	0	3	1	0	0	5	0	2	3	7
28	3	8	5	2	3	11	12	6	3	3	9	1	0	2	0	1	4	4	5	1	1	4	1	2	2	0	1	1	1	7	5	1
29	7	7	3	3	4	7	4	2	3	3	7	1	2	3	2	1	3	0	4	3	4	3	1	4	6	0	0	0	4	4	2	6
30	6	4	9	3	2	15	10	6	1	3	1	1	1	4	2	1	2	3	12	3	6	1	5	2	1	0	0	1	1	4	5	6
31	9	3	6	2	8	5	12	1	1	3	4	0	1	5	1	0	1	6	9	3	4	2	4	1	1	2	1	2	4	3	4	11
32	8	3	6	6	4	6	6	5	2	0	2	1	3	7	9	3	2	3	13	10	9	4	3	5	2	2	2	1	6	3	2	8
33	5	4	7	8	4	6	7	7	3	1	4	0	2	4	0	6	6	6	18	8	3	4	4	3	2	4	0	0	3	2	5	13
34	5	7	12	4	5	11	6	6	2	0	2	0	2	9	3	3	6	5	13	5	1	1	5	3	4	3	1	2	1	6	6	12
35	10	4	6	3	10	5	9	10	7	0	3	0	4	4	3	3	3	5	15	4	6	1	4	6	4	1	0	3	2	2	6	13
36	7	1	17	13	13	11	7	7	2	2	4	1	1	4	4	2	11	14	17	7	7	5	7	3	3	5	2	1	2	3	5	10
37	8	8	22	13	12	8	6	11	2	1	5	1	4	4	1	7	9	6	23	12	14	8	5	4	6	4	2	2	0	5	11	16
38	9	10	17	11	14	5	14	18	10	3	4	1	2	1	3	5	11	7	22	8	10	4	5	2	4	6	3	2	9	5	12	19
39	8	5	18	7	6	14	7	7	3	2	8	2	9	5	5	5	8	10	25	7	15	9	9	3	17	6	6	3	2	9	6	14
40	8	8	38	8	14	22	10	17	8	2	7	2	4	2	7	4	10	11	27	10	9	8	9	9	2	5	1	5	4	5	1	8
41	11	6	27	12	12	16	9	10	6	2	5	2	9	3	9	3	18	16	28	5	12	10	7	7	6	16	1	5	2	5	8	21
42	11	14	22	10	19	21	12	17	6	3	7	1	6	7	7	10	16	12	24	15	9	6	3	13	6	12	1	4	3	6	8	13
43	13	9	28	9	18	24	6	8	10	7	5	1	5	8	6	9	11	17	24	9	12	5	8	14	3	9	2	4	4	5	5	12
44	15	6	31	12	20	27	17	13	11	1	9	1	1	7	8	5	17	12	37	3	19	5	6	15	8	11	2	4	1	3	4	14
45	20	21	23	12	15	25	32	18	10	10	6	1	6	5	9	12	11	11	33	13	10	5	9	10	7	5	2	3	2	6	2	10
46	15	9	22	10	17	31	20	18	10	1	8	1	2	6	3	5	8	10	28	11	8	7	7	15	10	8	0	3	4	1	4	7
47	16	9	37	11	23	22	14	23	15	7	10	3	6	5	7	7	9	10	18	7	1	7	10	17	4	3	4	2	2	2	4	10
48	15	13	25	8	21	31	21	18	7	5	1	1	3	7	6	8	5	7	20	3	6	10	7	13	0	4	1	2	1	3	1	2
49	17	11	12	9	19	29	17	20	7	6	12	0	2	3	4	3	5	8	9	4	3	5	11	14	3	7	1	4	5	0	3	2
50	13	5	10	5	16	27	12	16	9	6	7	1	2	2	7	7	3	10	8	7	5	4	4	17	7	10	2	5	2	2	1	5
51	9	12	21	5	19	12	26	13	11	3	6	2	6	1	7	2	4	7	10	1	6	4	5	10	3	2	1	2	2	0	5	2
52	10	8	5	7	14	10	20	10	8	6	7	0	2	3	7	3	5	4	8	3	2	1	8	5	5	2	2	3	1	1	2	2
53	8	4	11	3	11	17	17	6	8	2	2	1	4	4	2	0	1	5	8	1	0	1	2	5	3	5	0	2	2	1	0	1
54	3	3	6	6	12	8	14	11	6	6	3	1	7	4	5	2	2	1	5	1	5	2	3	6	5	4	2	2	0	0	1	0
55	9	0	5	5	11	13	10	5	7	2	3	2	1	3	2	2	6	4	5	1	0	0	4	8	3	2	1	0	1	0	0	0
56	2	0	7	8	7	9	11	8	3	3	1	3	1	1	3	1	0	2	1	3	1	0	0	3	3	2	0	1	0	0	0	1
57	2	0	11	2	1	5	5	5	7	1	1	0	3	2	1	3	7	0	3	1	0	1	0	1	2	1	0	0	0	2	0	0
58	3	2	0	3	3	6	2	4	4	1	2	0	1	1	0	2	2	1	2	1	0	0	0	2	0	0	0	1	0	0	0	2
59	4	1	3	2	3	5	6	3	3	3	2	0	0	0	0	0	0	2	3	0	1	0	0	2	3	0	0	0	0	1	0	0
60	2	0	1	0	2	2	1	2	1	1	1	0	0	1	0	0	0	1	0	0	1	0	0	2	1	0	1	0	0	0	0	0
61	1	2	0	2	3	2	1	1	2	1	0	0	0	1	1	0	0	0	1	0	1	0	0	1	1	0	0	1	0	0	0	0
62	0	0	1	3	0	1	2	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0
64	0	0	0	0	0	3	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Total	**337**	**234**	**514**	**258**	**411**	**566**	**528**	**407**	**226**	**129**	**189**	**40**	**113**	**168**	**151**	**139**	**245**	**277**	**521**	**183**	**207**	**149**	**170**	**247**	**153**	**150**	**52**	**93**	**115**	**133**	**160**	**283**

Table 5.59. Tautog length frequencies, fall, 1 cm intervals, 1984-2015.
All tautog taken in the Survey were measured.

																Fall																
length	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
12	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	2	0	0	0	0	0	0
13	1	0	0	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	2	1	2	0	0	2	1	0	0	0	0	0	0	0	1	0	0	0	1	0	1	4
15	1	0	0	2	0	0	0	0	3	0	0	0	0	0	0	2	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
16	1	0	0	0	0	0	2	0	0	0	0	0	0	0	2	1	0	0	1	0	0	0	0	1	1	0	0	1	2	0	1	1
17	1	0	0	1	1	0	0	0	0	1	0	0	0	0	0	3	0	1	1	0	0	0	0	0	0	0	0	0	1	2	2	1
18	2	0	0	2	1	0	2	1	0	0	3	0	0	0	1	4	0	1	0	1	1	1	0	0	0	2	0	2	1	3	0	1
19	2	0	0	2	0	0	0	0	0	1	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0
20	3	0	0	0	0	0	0	0	0	0	1	0	0	0	1	4	1	0	1	0	0	0	0	0	1	0	0	1	0	1	0	2
21	2	2	0	5	0	0	0	1	2	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1
22	3	0	2	1	2	0	1	0	0	0	1	0	1	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	1	0	3	1
23	2	0	2	1	1	0	0	0	0	0	0	0	5	0	2	5	0	1	1	0	0	0	0	0	0	1	0	0	1	0	0	0
24	5	0	0	0	2	1	2	0	3	0	1	0	5	2	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	3	3
25	4	0	2	2	0	0	0	0	0	2	0	0	0	2	0	1	0	0	0	0	1	0	0	0	1	0	0	2	2	0	3	2
26	0	3	0	3	3	2	0	0	0	0	0	0	0	2	1	3	2	0	1	0	0	0	1	0	0	0	0	0	1	0	1	0
27	3	0	0	1	0	0	0	0	1	0	2	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	1	3	3	0	0
28	1	1	3	0	0	0	2	0	2	1	0	0	0	1	2	4	0	4	1	0	0	1	0	0	0	0	0	0	0	0	0	2
29	5	1	3	0	1	0	1	2	2	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	1	1
30	5	0	0	1	0	1	0	0	0	0	0	1	0	0	0	1	0	1	1	1	0	0	2	1	2	0	0	0	2	0	3	1
31	3	1	0	1	1	2	0	0	1	0	0	5	0	0	1	1	2	3	0	0	0	0	1	1	0	0	0	0	2	2	2	0
32	3	1	0	0	0	0	0	1	1	0	1	1	0	1	0	0	0	1	2	1	0	0	0	0	1	0	0	0	0	1	2	0
33	5	4	3	2	2	0	1	0	0	0	0	0	0	0	2	3	0	0	1	1	0	0	0	0	1	1	0	1	0	3	2	0
34	3	3	2	2	0	1	1	3	2	0	2	2	0	0	2	1	0	1	0	2	1	0	0	0	1	0	0	0	0	2	3	0
35	3	3	2	0	0	1	2	0	0	0	0	1	2	1	2	1	2	6	0	1	1	1	1	0	1	1	0	0	0	1	0	0
36	4	1	0	1	0	0	0	6	4	0	0	1	0	1	0	2	2	3	1	0	1	0	0	3	0	0	0	0	0	2	0	0
37	7	3	0	1	0	2	0	1	0	0	0	0	2	0	1	5	2	0	3	1	0	3	0	0	2	0	0	0	0	1	3	0
38	3	7	1	1	1	0	0	2	2	2	1	0	0	0	1	5	1	0	4	3	2	3	2	0	0	0	0	0	0	4	0	0
39	5	4	2	3	0	1	0	5	2	2	1	1	1	0	0	5	1	1	1	2	0	2	2	0	0	0	0	0	0	1	2	0
40	8	4	3	0	0	2	1	5	1	0	2	1	0	2	0	5	4	1	1	3	0	3	0	2	1	0	0	0	0	0	0	0
41	7	6	2	7	1	0	1	4	0	1	1	1	0	0	0	2	3	2	4	3	3	0	2	1	1	2	0	0	2	0	1	0
42	3	4	1	7	3	3	0	2	1	1	2	1	0	0	1	3	1	4	3	0	1	0	0	1	0	0	0	0	0	1	0	1
43	3	10	4	3	2	2	1	7	0	1	0	1	1	1	2	2	1	1	1	2	4	0	0	3	0	1	0	0	0	0	0	0
44	3	3	1	2	1	4	1	6	1	5	0	1	0	1	1	2	1	0	2	0	1	1	0	0	2	0	0	0	0	1	0	0
45	3	2	2	5	1	4	1	3	0	0	1	0	0	0	1	2	1	3	2	3	1	2	0	1	2	0	0	0	0	0	0	0
46	5	3	2	5	1	1	0	7	1	0	2	0	0	0	2	2	1	0	4	0	1	2	0	1	0	0	0	0	0	0	1	0
47	4	5	3	3	2	0	1	2	1	4	2	1	1	1	4	0	2	0	1	0	2	3	0	1	0	0	0	0	0	0	0	1
48	3	4	0	7	2	1	1	6	0	1	1	0	0	3	2	0	1	1	3	1	0	0	1	1	0	0	0	0	0	0	0	0
49	4	1	0	4	0	0	0	0	0	5	1	0	0	1	2	0	3	1	0	0	1	0	0	1	1	0	0	0	0	1	0	0
50	3	2	2	4	5	0	0	7	1	0	1	0	0	0	2	1	3	1	0	1	0	0	0	0	0	0	0	2	0	0	1	0
51	0	0	2	4	2	1	1	7	1	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	3	0	0	0	0	0	0	0
52	3	1	1	5	1	0	0	1	1	2	2	0	0	0	2	0	0	0	0	1	2	0	1	3	1	1	0	0	0	0	0	0
53	1	0	4	1	0	1	0	1	0	1	3	0	0	0	0	1	1	1	0	0	0	0	0	2	1	0	0	0	0	0	0	0
54	0	3	0	1	0	0	0	2	1	3	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
55	3	0	1	2	1	0	3	0	0	3	0	0	0	0	0	1	2	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
56	1	1	1	3	1	1	0	2	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
57	1	0	0	5	0	1	0	6	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
58	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0
59	0	1	1	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Total	**132**	**84**	**52**	**106**	**40**	**32**	**25**	**91**	**36**	**36**	**36**	**21**	**23**	**21**	**41**	**79**	**39**	**41**	**43**	**29**	**24**	**27**	**15**	**28**	**24**	**12**	**0**	**11**	**22**	**30**	**36**	**23**

Table 5.60. Weakfish length frequencies, spring, 2 cm intervals (midpoint given), 1984-2015.
Weakfish were measured from every tow.

	Spring																															
length	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
5	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	1	3	0	1
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	0	1	3	0	3	10	4	0	3
23	0	0	0	0	0	0	0	0	1	0	0	3	0	0	1	0	0	1	2	1	9	3	6	1	0	1	0	2	5	8	1	0
25	0	0	0	0	1	0	1	0	0	0	2	3	1	0	1	2	3	4	1	2	9	10	3	0	2	0	0	0	0	6	0	0
27	0	0	0	0	0	0	2	4	0	0	3	5	3	5	4	1	2	13	3	0	3	27	4	4	0	0	0	2	4	10	5	0
29	0	0	0	0	0	0	2	4	1	3	3	7	12	12	16	5	1	20	0	0	2	22	2	4	1	1	0	0	5	12	1	0
31	0	0	0	0	1	0	1	6	3	3	3	7	15	21	21	8	5	9	1	0	2	20	1	0	0	0	0	0	11	8	4	0
33	0	0	0	0	0	0	0	12	0	3	2	1	5	19	10	10	1	5	0	0	0	11	0	3	0	0	0	0	17	1	0	0
35	0	0	0	0	0	1	1	13	0	0	0	0	4	11	4	3	1	2	1	0	0	0	0	1	0	0	0	1	28	2	1	0
37	0	0	0	1	0	0	2	5	0	0	0	1	2	2	3	1	0	0	1	0	0	1	0	2	1	0	0	2	31	3	1	0
39	0	0	0	0	1	0	0	4	0	0	0	0	1	1	0	2	0	0	2	0	0	0	0	1	0	0	0	3	26	6	2	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	4	7	3	0	2	1	0	0	0	1	6	0	0	0	1	15	3	0	0
43	0	0	0	1	0	0	0	1	1	0	0	0	0	2	3	6	0	0	1	0	0	0	0	1	0	0	0	0	8	1	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	4	1	0	0	0	0	0	0	0	0	0	0	0	3	1	4	0
47	0	0	0	0	0	0	0	1	1	0	0	0	0	1	2	2	1	0	1	0	0	0	0	2	0	0	1	0	2	2	1	0
49	0	0	1	0	0	0	0	0	0	0	0	1	0	1	5	3	1	0	1	0	0	0	4	1	0	0	0	0	1	4	0	0
51	0	0	0	0	0	1	0	1	2	0	0	0	0	0	6	3	2	0	1	0	0	0	2	0	0	0	0	0	1	3	0	0
53	0	0	0	0	0	0	0	0	3	0	0	0	0	0	2	3	0	0	0	0	0	0	0	0	1	0	0	0	7	3	0	0
55	0	0	0	0	0	0	0	0	4	0	0	0	0	1	1	3	1	0	2	0	0	0	0	0	0	0	0	0	6	4	0	1
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	9	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
59	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	5	0	0	0	0	0	0	0	1	0	0	0	0	1	1	1	0
61	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	4	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	2	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0
65	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	3	0	0	1	0	0	0	0	0	0	0	0	0	0
71	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
73	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	2	1	4	0	0	0	0	0	0	0	0	0	0	0	1	0
75	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0
77	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0
79	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0
81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
83	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**1**	**0**	**9**	**2**	**6**	**5**	**9**	**51**	**18**	**11**	**13**	**28**	**43**	**81**	**92**	**85**	**29**	**59**	**28**	**5**	**28**	**96**	**26**	**31**	**6**	**10**	**1**	**16**	**187**	**86**	**24**	**5**

Table 5.61. Weakfish length frequencies, fall, 2 cm intervals (midpoint given), 1984-2015.

Weakfish were measured from every tow, with the exceptions of 968 juveniles in 1988 and 863 juveniles in 1989 that were not measured.

																Fall																
length	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
5	0	0	0	0	2	1	0	0	0	1	0	2	0	3	0	0	24	13	0	6	0	0	1	0	0	0	-	0	6	0	0	1
7	0	3	51	0	13	46	2	0	48	22	16	34	34	92	0	0	1,065	89	2	357	30	8	3	101	9	9	-	9	81	23	24	10
9	15	70	448	15	37	247	39	11	218	76	127	74	110	431	27	53	5,951	1,054	253	1,026	1,263	11	6	904	18	117	-	83	519	127	671	177
11	24	168	1,625	84	63	566	130	423	233	222	413	33	366	749	110	976	7,488	3,672	1,009	1,186	4,329	197	26	2,578	70	528	-	302	1,475	276	1418	305
13	69	187	2,191	98	60	1,152	207	522	289	340	1,586	137	713	598	589	1,748	3,650	4,135	2,455	1,108	5,940	1,246	41	4,876	492	938	-	455	1,246	379	2,358	1,071
15	54	474	894	22	31	1,699	519	831	292	550	2,561	566	1,529	214	788	2,802	1,641	2,124	3,740	1,153	3,909	2,538	37	4,570	931	692	-	620	1,606	485	3602	2305
17	17	1,196	107	3	17	750	629	949	120	503	2,538	957	2,084	356	1,160	2,889	1,821	764	1,875	590	1,168	2,739	36	2,084	594	212	-	665	1,017	239	1,586	3,109
19	5	379	50	2	3	162	312	741	35	235	665	748	1,165	651	497	2,007	1,169	366	851	132	471	1,798	27	991	253	43	-	225	332	125	396	1780
21	2	92	4	4	0	1	57	347	22	63	146	141	187	417	104	1,147	565	250	345	29	235	413	9	645	129	2	-	82	140	78	273	793
23	1	14	10	1	0	1	6	267	9	6	71	11	8	106	50	357	100	84	94	0	74	89	1	352	15	1	-	8	50	24	101	374
25	1	13	1	0	0	1	0	65	2	0	0	3	0	5	0	234	22	5	13	0	31	26	0	173	6	0	-	1	8	2	14	53
27	0	14	0	0	0	0	0	0	2	0	0	0	0	0	0	38	0	2	13	0	0	1	0	70	0	1	-	0	1	0	3	1
29	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	4	0	0	11	0	0	0	0	1	0	0	-	9	0	1	0	0
31	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	1	0	0	1	0	0	3	0	0	7	-	10	6	5	1	14
33	0	0	0	0	0	0	0	0	2	0	0	3	3	0	1	0	3	0	0	1	2	0	2	0	0	12	-	16	7	3	1	20
35	2	1	0	0	0	0	0	1	1	1	0	6	12	8	3	1	12	0	1	0	4	0	4	0	0	14	-	21	18	22	0	16
37	5	0	2	1	0	0	1	0	2	0	0	13	19	18	10	0	9	3	1	0	1	2	6	0	0	9	-	9	18	11	1	15
39	3	0	2	0	0	0	1	2	8	2	2	16	21	31	10	3	13	7	3	1	4	4	1	2	2	6	-	8	7	24	2	16
41	4	2	4	1	0	0	2	1	1	3	5	23	41	37	13	5	9	18	3	0	6	6	2	3	1	1	-	2	7	13	3	6
43	5	1	4	4	0	0	0	9	0	8	4	38	18	43	11	14	6	24	3	0	1	6	4	3	1	0	-	1	5	12	0	2
45	7	4	0	3	1	0	1	9	0	8	1	27	11	28	10	15	1	22	1	0	6	2	1	1	1	0	-	4	12	6	1	1
47	3	6	0	5	1	0	0	20	0	3	2	9	6	15	8	8	0	34	1	1	3	3	1	0	1	0	-	6	6	4	0	0
49	0	1	1	0	0	0	1	22	0	1	4	5	1	10	2	9	1	8	0	0	0	3	0	1	0	1	-	10	10	4	0	0
51	4	1	1	1	0	0	0	26	1	0	0	4	3	2	1	5	0	5	4	0	0	0	1	0	0	0	-	11	8	3	0	0
53	1	0	0	0	1	0	0	19	2	2	0	0	0	2	1	0	0	2	0	0	0	0	0	0	0	1	-	6	7	2	0	1
55	0	1	1	0	0	0	1	4	1	0	0	0	0	4	2	3	0	2	1	0	0	0	2	0	0	0	-	2	4	1	0	0
57	1	2	0	0	2	0	0	0	3	0	0	0	0	2	2	4	2	0	1	0	0	0	1	0	0	0	-	2	1	1	0	0
59	1	1	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	3	0	0	0	0	0	0	0	-	0	2	5	0	0
61	0	1	0	0	0	0	0	1	3	0	0	0	0	0	0	0	2	0	3	0	0	0	1	0	0	0	-	0	0	2	0	0
63	0	0	0	0	0	0	0	0	3	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	-	0	0	1	0	0
65	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	5	0	0	0	0	0	0	0	1	0	-	0	0	0	0	0
67	0	2	1	0	0	0	1	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
69	1	1	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
71	4	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
73	7	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
75	10	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	-	0	0	0	0	0
77	5	5	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
79	2	2	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
81	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
83	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	-	0	0	0	0	0
85	1	0	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
87	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
91	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
Total	**259**	**2,650**	**5,415**	**246**	**234**	**4,628**	**1,911**	**4,270**	**1,299**	**2,047**	**8,141**	**2,850**	**6,332**	**3,823**	**3,404**	**12,331**	**23,561**	**12,683**	**10,686**	**5,592**	**17,478**	**9,092**	**216**	**17,355**	**2,524**	**2,594**	**-**	**2,567**	**6,599**	**1,878**	**10,455**	**10,070**

Table 5.62. Windowpane flounder length frequencies, spring, 1 cm intervals, 1989, 1990, 1994-2015.

Prior to 2014, lengths were recorded from the first three tows of each day; since 2014, lengths have been recorded from every tow.

												Spring												
length	**1989**	**1990**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
4	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0
5	4	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	2	0	0	2	3
6	0	0	0	0	0	2	0	2	5	1	1	10	2	0	0	1	0	4	4	9	0	0	10	2
7	0	0	0	0	1	4	2	4	17	2	7	22	3	0	0	7	3	8	9	9	5	0	7	0
8	0	2	4	1	3	5	4	3	27	7	6	23	6	0	0	31	5	17	10	20	19	10	41	2
9	0	40	16	3	2	9	5	2	11	10	21	20	11	0	0	18	6	10	13	24	16	4	31	1
10	25	66	67	12	34	15	7	8	17	13	12	11	19	7	2	4	11	23	8	10	10	16	24	3
11	69	96	169	86	79	37	19	20	5	29	8	3	24	12	1	4	11	8	7	11	10	20	8	3
12	89	74	305	148	162	76	60	40	3	23	10	7	25	16	7	8	17	4	20	2	0	16	10	3
13	337	53	362	259	288	136	131	37	10	29	5	9	58	25	12	22	13	6	72	9	3	8	15	9
14	430	66	232	189	381	309	200	45	11	26	8	13	100	22	34	28	44	17	93	7	7	10	18	4
15	414	124	152	180	487	362	211	96	24	43	15	13	101	23	42	60	51	37	107	15	32	19	15	11
16	305	180	126	89	310	606	177	123	27	55	12	15	72	37	36	107	119	62	117	19	64	16	21	25
17	174	212	209	70	331	754	130	165	23	73	9	15	65	22	48	129	137	97	166	23	81	17	26	36
18	78	178	372	99	339	588	165	160	32	94	24	23	56	4	45	132	116	90	104	58	133	20	37	32
19	65	132	357	139	548	440	260	194	26	78	19	26	45	16	20	110	101	75	124	58	155	30	37	46
20	174	144	289	143	604	366	362	386	75	89	15	31	60	13	24	130	76	51	76	47	135	40	71	27
21	216	116	217	85	567	429	461	357	136	95	22	45	32	22	24	186	122	50	88	66	97	62	75	26
22	299	143	139	82	401	438	311	301	166	232	45	50	42	29	27	246	155	63	172	75	97	121	102	49
23	319	108	163	57	409	368	229	217	138	290	110	92	39	42	28	181	216	92	198	107	117	140	170	57
24	270	103	147	54	280	323	227	217	125	245	141	123	66	36	41	158	132	84	199	122	128	166	229	95
25	177	87	183	54	236	231	188	206	121	208	133	111	109	47	31	162	118	82	155	134	121	142	228	96
26	189	103	184	70	235	191	178	136	106	126	114	76	100	52	52	186	103	67	161	120	118	138	175	108
27	138	79	138	56	187	222	162	161	91	88	69	88	86	49	37	104	100	60	148	103	102	86	145	89
28	148	38	70	44	117	145	138	97	56	83	62	68	71	29	38	100	111	45	103	69	100	55	111	50
29	78	26	68	24	97	98	67	53	47	59	41	37	48	24	24	65	52	30	146	42	70	41	56	42
30	99	35	42	27	66	75	58	42	37	39	42	35	51	20	14	33	46	24	51	24	45	27	27	21
31	50	20	25	12	31	23	34	39	12	25	19	22	32	13	8	14	22	11	67	25	33	12	21	13
32	8	15	13	4	25	12	13	26	16	21	17	9	16	5	2	23	19	6	21	7	7	6	11	4
33	16	3	2	9	5	8	6	3	8	15	7	2	10	1	3	2	5	1	33	14	13	8	5	3
34	0	5	5	0	4	1	1	1	2	5	4	4	9	3	0	4	5	2	20	11	11	4	9	0
35	0	4	5	1	3	0	3	4	5	10	2	4	5	0	0	3	3	3	11	1	4	2	5	3
36	0	4	2	2	1	1	0	0	1	2	0	5	0	2	0	0	1	0	0	0	1	0	1	0
37	0	0	0	1	0	0	3	1	1	2	2	1	1	0	0	0	0	0	8	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**4,171**	**2,256**	**4,064**	**2,001**	**6,234**	**6,274**	**3,812**	**3,147**	**1,381**	**2,118**	**1,002**	**1,015**	**1,365**	**571**	**600**	**2,258**	**1,920**	**1,129**	**2,511**	**1,244**	**1,734**	**1,236**	**1,744**	**863**

Table 5.63. Windowpane flounder length frequencies, fall, 1 cm intervals, 1989, 1990, 1994-2015.

Prior to 2014, lengths were recorded from the first three tows of each day; since 2014, lengths have been recorded from every tow.

	Fall																							
length	**1989**	**1990**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
6	1	0	1	0	0	0	0	0	3	1	0	0	3	0	0	0	0	1	-	0	0	0	0	0
7	5	0	5	0	6	0	1	0	0	0	0	2	0	0	0	0	0	4	-	1	0	0	0	0
8	8	3	18	5	24	15	1	0	6	9	0	5	11	14	5	4	0	15	-	4	2	2	1	0
9	25	2	28	6	70	17	2	2	2	2	0	21	15	49	2	6	2	15	-	2	3	1	4	3
10	18	11	78	10	165	50	2	4	3	9	1	20	22	67	1	14	5	17	-	9	6	7	9	1
11	15	9	60	22	227	75	31	11	7	14	0	13	27	111	5	18	3	24	-	19	1	7	13	1
12	16	12	50	15	270	107	33	6	9	9	1	6	16	155	2	26	15	29	-	31	5	6	7	0
13	23	6	30	10	285	173	47	3	11	9	6	0	14	145	8	44	43	19	-	19	10	10	14	0
14	33	14	11	13	306	154	48	5	23	6	0	4	8	109	3	36	58	27	-	36	14	10	14	4
15	58	23	23	9	250	110	39	6	18	3	5	8	3	62	2	37	38	25	-	43	18	11	10	12
16	140	38	15	16	181	60	34	3	11	3	5	9	3	33	0	30	28	31	-	41	19	13	24	8
17	188	44	35	26	112	78	33	11	30	7	14	4	9	12	7	21	20	35	-	72	37	13	19	11
18	91	53	47	48	101	119	54	11	15	12	8	11	2	8	19	19	16	47	-	70	19	19	28	16
19	46	46	49	47	145	179	95	44	29	6	10	7	11	20	32	26	10	45	-	52	44	31	12	19
20	49	28	39	48	131	213	96	67	30	13	9	6	18	30	39	39	31	24	-	41	50	29	18	18
21	21	11	23	24	125	165	69	38	52	18	9	11	35	50	25	36	40	28	-	35	87	23	27	21
22	14	14	16	19	65	123	37	18	28	22	21	2	25	48	25	42	25	26	-	51	58	28	34	23
23	3	10	20	6	67	63	32	12	37	30	39	6	10	14	12	32	27	20	-	47	79	30	43	29
24	9	4	7	9	25	49	13	11	33	19	39	11	15	13	9	19	32	23	-	40	45	15	55	24
25	4	3	6	3	22	28	9	6	18	19	25	14	8	10	10	6	9	9	-	16	24	29	50	28
26	2	0	8	3	19	29	9	4	16	9	10	18	4	3	4	8	16	6	-	18	22	17	29	25
27	6	2	3	1	11	17	8	3	5	11	12	17	4	5	3	4	5	4	-	7	14	16	21	24
28	2	1	4	1	3	12	1	1	4	5	6	9	2	3	3	3	2	7	-	9	1	13	7	5
29	2	2	0	1	2	17	0	1	6	3	1	4	2	3	1	3	2	1	-	2	0	2	4	9
30	2	1	2	1	0	5	0	0	1	2	2	2	0	1	1	0	0	0	-	3	1	2	2	2
31	0	0	0	0	0	0	0	0	0	1	0	3	1	2	0	0	2	1	-	0	0	1	1	3
32	1	0	0	1	0	0	0	0	0	0	0	2	0	1	0	0	0	1	-	0	1	0	0	0
33	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
Total	**782**	**337**	**578**	**344**	**2,613**	**1,858**	**694**	**267**	**397**	**242**	**223**	**215**	**268**	**968**	**218**	**473**	**429**	**484**	**-**	**668**	**560**	**335**	**446**	**286**

Table 5.64. Winter flounder length frequencies, April-May, 1 cm intervals, 1984-2015.
Winter flounder were measured from every tow.

																April-May																
length	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
5	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	7	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	36	4	2	3	0	0	1	0	2	0	0	1	3	0	0	0	0	0	0	0	0	0	0
8	0	0	5	8	3	1	10	3	1	72	26	28	4	2	5	7	2	5	0	1	5	5	0	1	6	2	1	1	0	0	1	0
9	1	7	6	52	16	17	38	29	7	208	41	97	21	15	41	18	3	20	4	2	22	32	0	2	19	13	7	6	7	0	6	4
10	3	9	35	49	29	70	139	54	18	433	137	307	61	75	128	50	23	55	5	11	36	73	5	10	85	42	35	21	22	3	12	6
11	26	28	188	114	135	312	375	121	75	698	442	618	246	260	283	135	84	161	34	28	129	164	6	37	238	147	117	67	72	12	20	28
12	35	127	455	239	359	628	1,117	228	136	921	835	877	461	528	492	252	145	256	88	57	174	278	55	73	367	229	179	113	139	20	46	37
13	149	284	617	483	869	954	2,563	342	170	713	1,006	772	582	497	554	252	169	239	148	50	188	337	48	91	322	220	174	110	162	12	33	42
14	196	219	733	820	1,378	1,260	3,243	729	180	528	1,149	854	788	517	488	225	185	223	132	54	132	209	39	80	233	169	152	107	128	16	20	42
15	255	308	808	1,060	1,882	1,424	3,847	1,127	254	526	1,487	792	956	484	481	204	177	162	148	50	81	163	19	80	142	119	146	68	101	25	24	27
16	177	467	771	1,033	1,819	1,579	3,627	1,169	323	485	1,680	766	992	553	574	214	210	159	174	66	53	128	16	163	136	155	109	53	67	39	12	10
17	182	473	763	1,028	1,953	1,651	3,544	1,568	373	501	1,540	698	1,099	599	713	290	254	245	160	76	41	122	40	180	74	147	112	53	60	52	17	19
18	153	574	730	1,006	1,507	1,724	3,145	1,648	398	580	1,467	692	1,149	666	658	313	248	251	206	86	65	108	52	203	85	237	138	73	65	99	13	30
19	117	794	780	855	1,596	1,532	3,054	1,690	397	542	1,217	632	1,032	574	622	283	327	313	317	142	72	117	41	242	94	214	130	73	58	99	11	26
20	169	607	665	666	1,136	1,462	2,434	1,676	344	624	896	515	1,012	529	685	296	311	362	364	174	59	148	65	246	51	232	160	101	110	108	12	22
21	108	591	600	592	1,045	1,358	1,904	1,493	277	626	742	469	821	429	592	320	314	308	353	127	79	125	54	194	59	166	109	122	122	77	8	18
22	104	486	534	552	963	1,407	1,481	1,332	302	549	556	367	795	444	524	218	289	306	353	87	53	69	45	156	56	129	108	118	133	66	24	15
23	63	479	521	442	897	1,160	1,416	1,099	212	426	359	346	676	402	486	290	266	233	337	84	48	71	28	135	67	100	72	84	141	41	21	13
24	81	346	427	377	748	971	1,092	1,113	278	418	310	311	701	401	544	260	218	205	395	79	47	51	22	128	55	48	89	109	82	34	28	14
25	74	318	341	374	520	1,015	1,018	939	202	349	296	318	692	377	529	344	228	244	311	97	46	49	28	137	60	44	92	105	69	35	40	13
26	90	187	375	333	541	982	846	858	242	383	219	231	719	461	527	304	223	249	285	129	61	36	13	144	62	42	58	95	58	35	35	10
27	62	232	240	281	420	736	639	788	181	320	216	318	568	496	505	360	251	259	259	150	84	36	23	168	81	39	67	102	82	50	58	7
28	43	129	244	230	366	648	586	598	181	197	173	260	549	416	518	418	252	311	187	170	92	25	29	168	84	35	75	72	52	51	66	14
29	29	86	189	220	253	502	525	511	160	221	122	244	460	401	466	389	285	326	248	200	103	32	17	200	73	28	77	81	70	78	66	22
30	42	70	178	154	266	339	305	397	133	178	103	180	540	365	448	362	279	299	215	206	96	35	20	186	86	28	52	72	58	47	71	22
31	24	71	124	151	120	247	307	241	96	200	117	130	367	313	323	321	300	286	201	166	112	33	27	136	93	32	55	58	56	59	81	38
32	20	85	77	113	169	163	171	157	98	142	91	76	375	260	277	249	227	228	171	167	95	38	28	133	87	42	45	65	47	61	60	48
33	7	69	86	61	111	73	218	108	60	139	72	63	267	193	195	228	262	172	155	138	122	45	20	87	90	36	34	79	63	75	69	50
34	7	45	56	85	69	47	113	107	38	159	65	42	190	166	140	191	220	189	109	116	94	48	20	74	99	43	37	51	51	80	59	69
35	12	19	42	47	54	68	70	65	35	112	52	30	119	136	136	159	195	189	107	115	88	31	20	50	80	45	28	50	42	76	48	58
36	4	11	39	53	33	65	44	30	26	79	49	33	84	89	79	103	150	143	94	73	91	34	18	53	61	44	28	26	37	66	42	38
37	4	8	15	20	25	20	24	25	26	36	25	12	50	68	32	90	120	133	60	53	93	27	15	24	36	20	25	27	27	61	41	31
38	0	15	17	19	15	18	48	7	4	10	21	16	28	37	37	35	80	77	59	79	46	25	4	17	18	17	16	23	18	43	32	19
39	0	4	18	11	22	3	18	13	0	17	15	14	12	18	13	18	54	70	24	44	56	25	6	9	6	9	14	16	18	27	28	9
40	0	0	18	8	9	8	12	9	3	3	16	7	13	10	5	20	16	35	32	38	34	11	3	2	7	5	19	16	7	29	22	12
41	0	0	1	2	6	7	3	1	0	5	6	3	1	6	3	14	20	26	11	17	18	7	5	9	5	4	9	7	2	21	15	1
42	0	1	3	0	8	3	8	5	0	2	6	3	6	2	2	4	7	10	9	7	9	9	1	9	2	2	4	6	2	6	4	5
43	0	0	2	3	3	0	1	1	0	2	1	0	2	1	0	3	11	3	4	13	1	3	0	3	3	2	1	2	3	7	2	3
44	0	1	4	0	2	1	1	1	1	0	0	1	3	0	1	3	4	1	1	3	7	2	0	1	1	0	0	1	1	6	4	2
45	0	1	0	1	1	0	8	1	0	0	0	0	0	0	0	1	2	0	3	4	2	2	1	2	2	0	2	2	1	1	1	0
46	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	3	2	0	2	1	0	0	0	1	0	0	2
47	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0
49	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Total	**2,237**	**7,152**	**10,707**	**11,543**	**19,350**	**22,455**	**37,996**	**20,283**	**5,231**	**11,449**	**15,565**	**11,124**	**16,445**	**10,790**	**12,106**	**7,246**	**6,413**	**6,755**	**5,763**	**3,160**	**2,640**	**2,758**	**833**	**3,636**	**3,127**	**2,887**	**2,576**	**2,235**	**2,234**	**1,617**	**1,152**	**826**

Table 5.65. Winter flounder length frequencies, fall, 1 cm intervals, 1984-2015.
Winter flounder were measured from every tow.

																Fall																
length	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
5	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	-	0	0	0	0	0
7	0	0	0	0	1	0	1	1	3	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
8	0	0	0	1	7	0	0	1	5	43	0	1	2	0	0	0	0	0	0	0	2	2	0	0	0	0	-	0	0	0	0	0
9	0	0	0	0	3	4	0	1	8	83	3	0	3	4	2	0	0	0	0	0	0	1	0	0	0	3	-	0	0	0	0	0
10	0	2	0	0	10	3	2	1	9	39	6	3	11	5	3	0	0	2	0	0	2	1	2	0	0	0	-	1	0	0	0	0
11	1	3	2	2	8	6	4	9	6	42	10	16	16	6	3	0	0	6	0	0	9	0	0	0	1	1	-	0	2	0	0	0
12	9	16	16	8	34	38	6	34	18	159	63	28	54	23	20	3	5	13	0	1	21	4	1	3	2	11	-	2	4	0	1	3
13	18	37	43	47	97	127	34	72	72	331	149	67	157	77	68	44	20	62	6	1	41	28	6	9	10	21	-	5	14	0	3	8
14	25	57	82	54	243	343	130	139	85	409	230	87	218	113	137	128	53	123	24	5	65	77	8	10	23	36	-	7	38	1	3	12
15	31	63	116	67	295	367	260	144	149	435	219	96	255	165	190	194	111	122	37	10	61	98	17	9	45	51	-	19	59	3	7	12
16	60	55	104	72	302	293	345	91	182	377	187	77	225	176	192	243	156	116	40	9	48	99	23	9	60	48	-	28	62	3	12	21
17	65	49	118	53	207	315	327	110	140	247	146	61	173	175	160	268	170	80	43	11	37	66	11	6	43	50	-	22	61	5	9	10
18	89	53	86	72	167	213	319	99	111	151	142	64	132	116	87	225	169	66	33	10	19	52	5	10	49	35	-	25	50	6	12	9
19	111	41	50	79	212	199	326	108	99	85	141	41	119	126	60	158	148	32	31	8	21	33	5	7	25	31	-	18	26	4	10	9
20	97	36	45	83	184	146	310	95	97	68	124	32	136	78	46	108	107	28	35	9	7	24	7	16	17	14	-	11	25	3	8	4
21	100	37	27	53	184	121	245	96	84	51	111	23	96	65	25	86	89	25	23	10	8	14	4	19	6	10	-	11	16	0	8	9
22	67	33	22	54	138	105	176	79	68	39	56	19	97	38	28	52	62	20	38	10	4	9	7	15	6	4	-	5	15	3	3	10
23	63	22	17	44	104	107	146	73	42	39	38	13	65	55	24	29	41	16	28	17	2	6	3	17	4	5	-	7	22	2	2	3
24	38	17	13	25	77	68	91	40	37	38	24	10	58	32	15	27	47	33	31	15	1	1	3	18	4	2	-	4	20	4	4	10
25	34	14	9	21	40	85	53	48	28	29	26	5	47	23	14	29	35	24	28	10	0	7	2	9	9	6	-	4	30	2	5	5
26	36	10	7	14	32	39	49	20	17	30	28	2	25	26	11	19	30	31	27	18	5	6	2	12	10	0	-	2	20	5	2	2
27	16	10	1	5	32	43	38	13	8	22	13	3	27	20	13	17	21	15	20	21	3	5	0	8	9	3	-	7	20	3	9	2
28	34	6	2	11	12	33	16	17	13	10	8	3	14	14	8	13	25	20	9	11	4	5	0	4	6	0	-	6	16	2	3	1
29	13	3	1	5	9	30	12	7	7	12	10	1	17	7	7	17	15	22	10	10	6	1	0	4	7	3	-	5	7	3	4	4
30	14	6	2	3	13	10	14	5	7	7	7	0	10	7	3	8	13	17	8	10	2	1	1	9	13	1	-	3	5	4	5	3
31	8	1	2	2	4	12	1	8	3	8	8	2	13	5	11	7	8	4	4	16	2	1	0	7	8	1	-	2	7	1	2	5
32	6	0	1	2	6	4	3	2	1	4	3	1	4	2	4	5	6	4	6	11	3	1	0	6	3	4	-	2	7	3	1	3
33	5	1	2	0	1	1	4	6	0	3	2	1	3	4	5	9	9	6	10	12	2	1	1	0	4	1	-	2	4	1	2	5
34	1	2	0	0	0	1	0	1	1	2	2	0	3	3	5	1	10	2	7	10	3	0	0	0	5	2	-	3	4	1	1	1
35	4	0	0	4	0	3	1	0	0	0	1	1	1	1	3	4	6	3	4	4	3	1	0	2	3	0	-	1	5	1	2	2
36	1	0	1	0	0	0	1	0	0	0	1	0	2	0	0	2	4	3	4	4	2	1	0	2	3	2	-	4	0	1	2	0
37	0	0	0	0	0	0	0	0	0	0	3	0	0	1	0	0	1	1	3	1	2	2	0	1	3	2	-	2	2	0	2	3
38	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	2	1	5	4	2	2	0	0	4	2	-	1	4	0	1	8
39	2	0	0	0	0	0	0	0	0	3	0	0	0	1	0	1	1	3	5	0	2	2	0	0	2	0	-	0	1	0	1	1
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	3	2	2	0	1	3	2	-	0	0	0	0	1
41	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	3	3	0	0	2	0	0	0	0	-	1	1	0	2	1
42	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	-	0	0	0	1	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	-	0	0	0	0	3
44	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	1	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	-	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	-	1	0	0	0	0
Total	**949**	**575**	**769**	**781**	**2,422**	**2,717**	**2,914**	**1,321**	**1,300**	**2,771**	**1,765**	**657**	**1,984**	**1,370**	**1,146**	**1,699**	**1,364**	**907**	**527**	**262**	**392**	**557**	**108**	**213**	**387**	**351**	**-**	**211**	**547**	**61**	**128**	**170**

Table 5.66. Winter skate length frequencies, spring and fall, 2 cm intervals (midpoint given), 1995-2015.

											Spring										
length	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
27	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	1	0
37	0	0	0	0	0	0	1	0	0	3	0	0	1	1	1	1	1	7	7	2	0
39	0	0	0	0	0	0	0	1	2	2	0	0	1	0	1	0	1	5	3	3	2
41	0	0	0	0	0	0	0	1	1	2	0	0	1	1	1	2	0	4	3	5	1
43	0	0	0	0	0	3	0	1	2	4	1	0	0	1	2	1	0	0	9	3	0
45	0	0	0	0	1	3	0	0	0	6	0	0	2	1	1	2	0	7	5	4	0
47	0	0	0	0	0	2	0	0	0	4	3	0	3	0	0	0	1	1	3	5	0
49	0	0	0	0	0	2	0	0	1	2	1	1	1	2	2	0	0	3	2	7	1
51	0	1	0	1	0	0	0	1	1	0	1	0	0	0	1	0	0	3	3	2	1
53	0	0	0	0	1	3	1	0	1	0	0	1	1	0	1	0	0	1	3	6	2
55	0	0	2	3	1	1	0	0	1	1	1	4	3	0	1	0	0	2	5	5	4
57	1	2	4	3	2	0	0	0	6	0	0	1	2	1	3	0	2	2	4	2	3
59	5	4	1	5	3	2	0	1	1	2	0	1	0	0	2	1	0	2	2	3	2
61	1	5	2	1	0	0	3	1	1	1	3	1	1	3	2	0	1	2	4	1	1
63	2	2	2	4	1	0	0	1	2	3	2	2	0	1	1	0	2	1	3	1	1
65	4	2	4	7	0	0	0	0	0	0	1	1	1	2	0	0	2	3	2	0	0
67	1	1	2	2	1	1	0	1	1	1	3	3	0	1	1	1	2	3	2	2	0
69	2	0	1	4	2	0	0	1	4	1	0	1	2	3	2	0	3	1	2	4	0
71	1	3	2	3	1	2	2	1	2	2	0	1	2	3	0	0	0	4	1	1	2
73	0	3	0	0	0	1	2	4	0	2	1	4	3	1	1	1	3	5	2	3	0
75	4	4	1	5	3	1	2	1	3	1	0	1	4	3	3	4	3	5	0	0	1
77	0	2	3	6	7	2	1	1	1	1	0	0	2	4	0	1	2	0	1	3	1
79	1	2	1	4	1	1	2	3	1	1	1	0	4	3	2	1	4	2	0	0	1
81	0	4	0	3	2	1	1	2	3	3	0	1	1	1	1	0	2	3	0	1	0
83	0	3	0	2	0	0	1	0	1	1	0	0	1	0	3	1	1	4	0	2	1
85	0	2	1	1	0	3	1	2	1	0	0	0	0	0	0	0	0	3	1	0	1
87	0	0	0	0	0	0	1	1	1	0	0	0	0	1	0	0	0	1	0	1	0
89	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
91	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
93	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
95	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Total	**22**	**40**	**27**	**55**	**26**	**29**	**18**	**26**	**37**	**45**	**18**	**23**	**37**	**35**	**32**	**16**	**30**	**77**	**72**	**67**	**25**

											Fall										
length	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	-	0	0	0	0	0
39	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	-	0	2	0	0	0
41	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	-	0	1	0	0	0
43	0	0	2	0	0	0	0	2	0	0	0	0	0	1	0	-	2	1	1	0	1
45	2	0	1	0	0	0	0	1	0	0	0	0	0	0	0	-	0	4	3	2	1
47	0	0	0	0	1	0	0	0	0	1	1	0	0	1	0	-	0	1	0	1	0
49	1	5	1	0	0	0	0	0	0	0	1	0	0	0	0	-	0	1	4	1	0
51	0	0	1	0	2	0	2	0	0	0	0	0	0	1	0	-	0	2	1	0	0
53	2	0	2	1	0	0	1	1	0	0	1	0	0	0	0	-	0	2	0	1	0
55	1	2	1	0	1	0	4	0	0	0	0	0	0	1	0	-	0	0	1	2	0
57	2	6	2	0	0	0	0	3	0	0	2	0	0	1	1	-	3	0	0	0	0
59	2	2	2	1	0	0	1	1	0	0	0	0	0	0	1	-	0	1	0	0	1
61	0	5	0	0	0	0	3	0	0	0	0	0	1	0	0	-	0	0	1	1	1
63	1	4	1	0	0	0	1	0	0	0	2	0	0	0	0	-	0	0	1	1	0
65	2	3	0	1	1	0	0	1	0	3	0	0	0	1	1	-	1	0	0	0	0
67	1	2	2	1	0	0	2	0	0	0	3	0	1	1	1	-	0	0	1	2	1
69	0	2	1	1	0	0	0	1	0	0	0	0	1	1	1	-	0	1	3	0	0
71	0	0	0	0	0	0	0	1	0	2	0	0	2	1	1	-	0	0	1	2	0
73	0	2	1	1	1	0	0	2	0	1	1	0	0	0	0	-	1	1	0	1	0
75	1	3	1	0	1	0	1	1	0	1	1	0	1	1	1	-	0	1	0	0	0
77	0	1	0	0	0	0	1	2	0	1	0	0	0	2	0	-	0	0	0	0	0
79	0	0	0	0	0	0	1	1	0	0	0	0	0	1	1	-	0	0	0	0	0
81	0	0	0	1	0	0	1	1	0	0	1	0	1	1	1	-	0	1	0	0	0
83	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	-	0	1	0	0	0
85	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	-	0	0	0	0	0
87	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	-	0	0	0	0	0
Total	**15**	**37**	**19**	**7**	**7**	**1**	**20**	**19**	**0**	**9**	**13**	**0**	**7**	**16**	**11**	**-**	**7**	**20**	**17**	**14**	**5**

Winter skate were scheduled to be measured from every tow. However, the following numbers of skate were not measured: 4 in 1995, 10 in 1996, and 2 in 1997.

FIGURES 5.1 - 5.19
LISTS

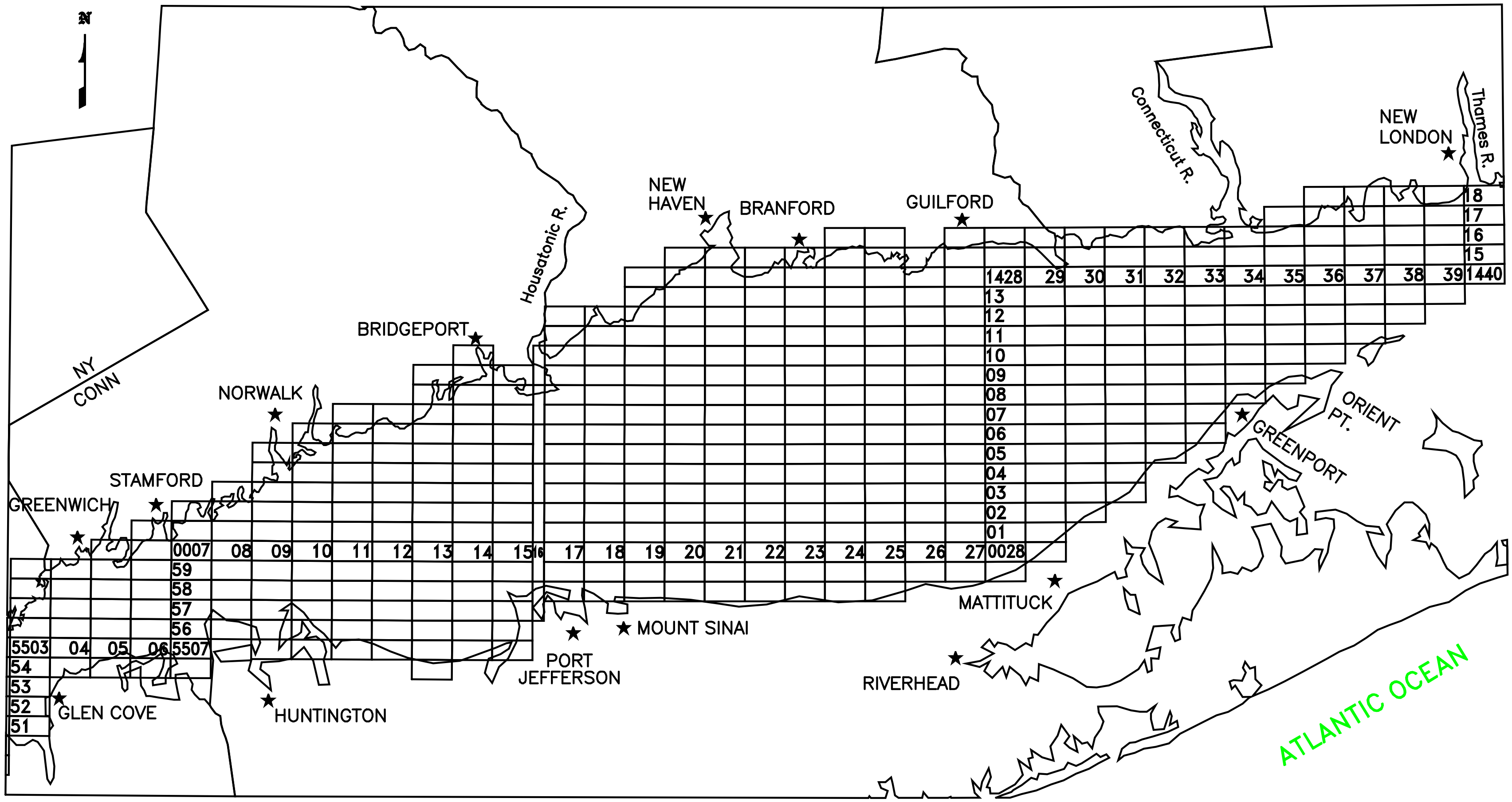
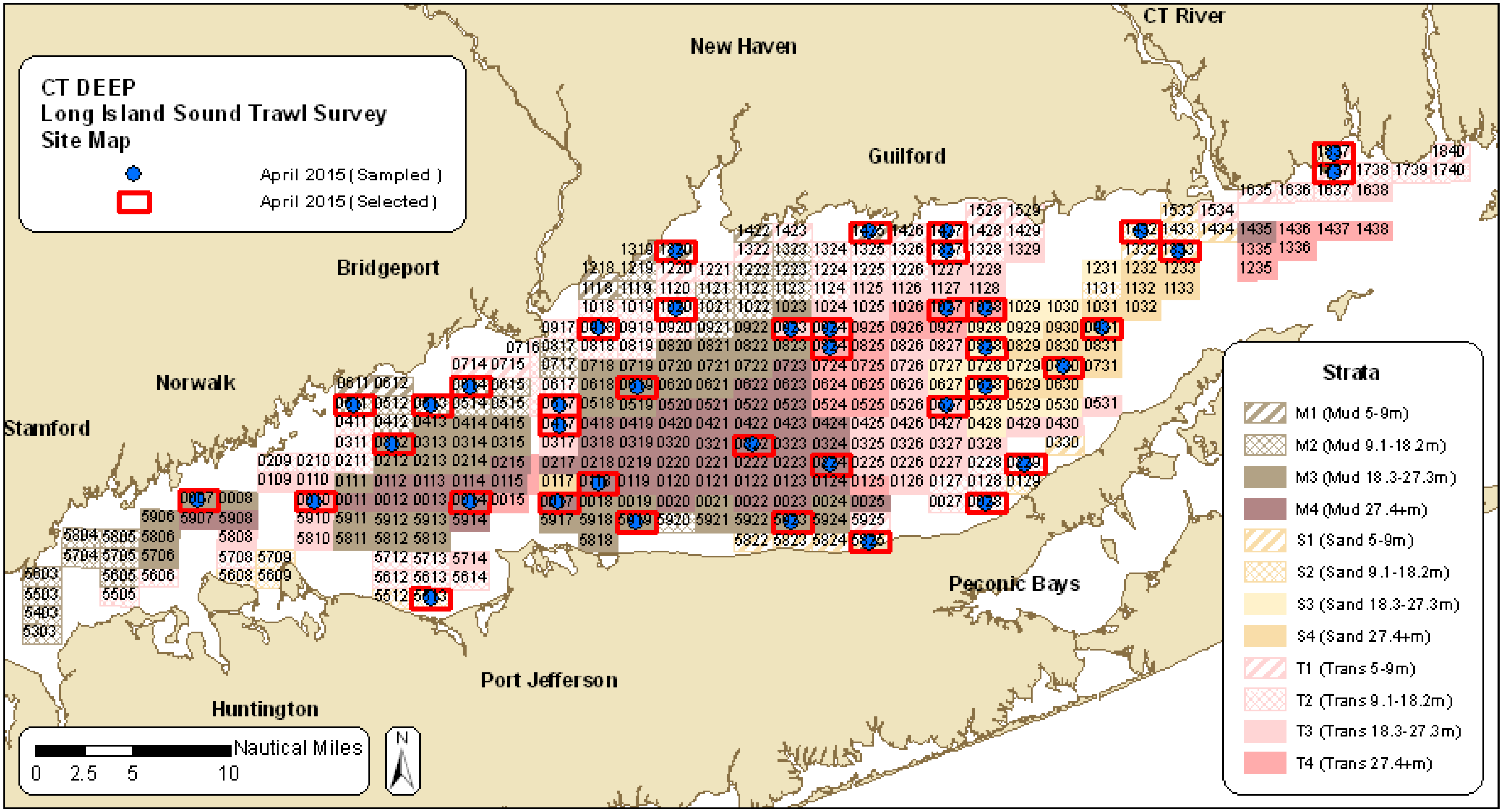


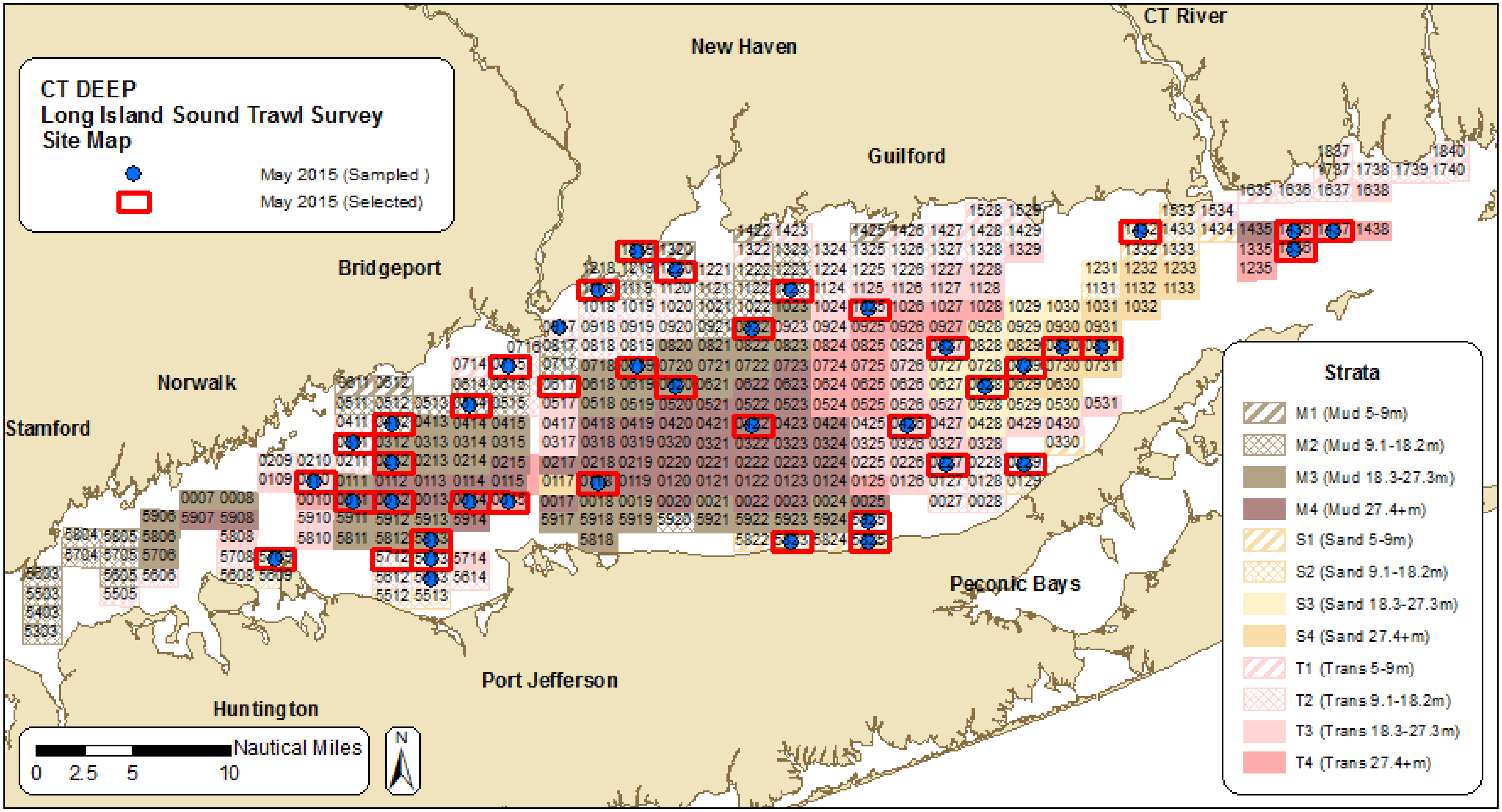
Figure 5.1. Trawl Survey site grid. *Each sampling site is 1x2 nmi (nautical miles). A four-digit number identifies the site: the first two digits are the row numbers (corresponding to minutes of latitude) and the last two digits are the column numbers (corresponding to two nautical miles in length on the longitudinal axis). Examples: site 1428 near Guilford and 0028 near Mattituck. (Note: The sites in column 16 are approximately 2x1 nmi. The grid was drawn on the Eastern and Western Long Island Sound 80,000:1 nautical charts, which overlap by the area in column 16.)*

Figure 5.2. April 2015 sites selected and sampled. *The red outlined rectangles are the sites selected for the cruise and the blue dots are the sites sampled. Samples collected from a different site than published in the "**Notice to Fishermen**" are noted in table below map.*



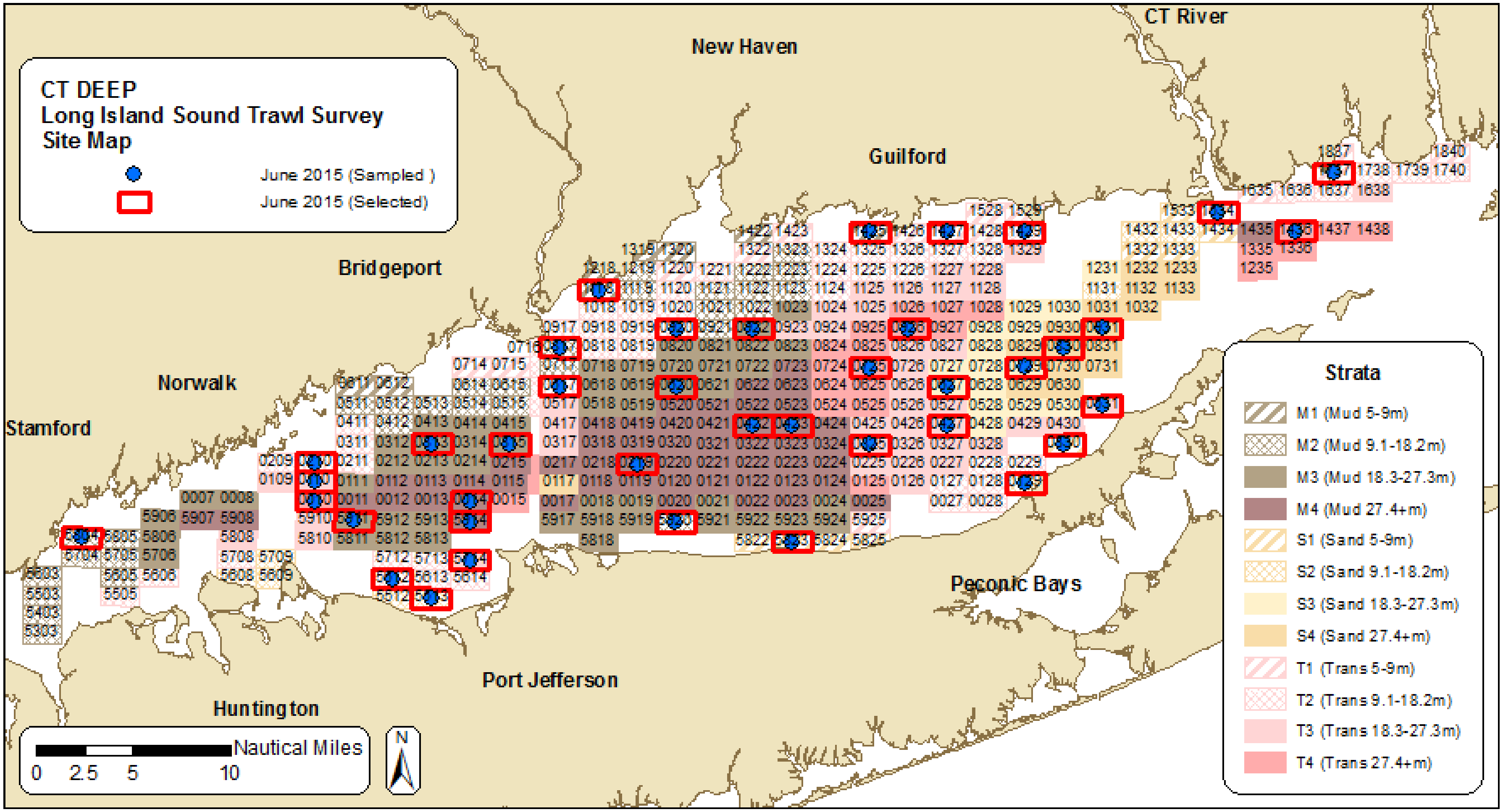
Month	Sample	Site Sampled	Sampled Strata	Site Selected	Selected Strata	Reason Moved
April	No sites were moved during this cruise					

Figure 5.3. May 2015 sites selected and sampled. *The red outlined rectangles are the sites selected for the cruise and the blue dots are the sites sampled. Samples collected from a different site than published in the "**Notice to Fishermen**" are noted in table below map.*



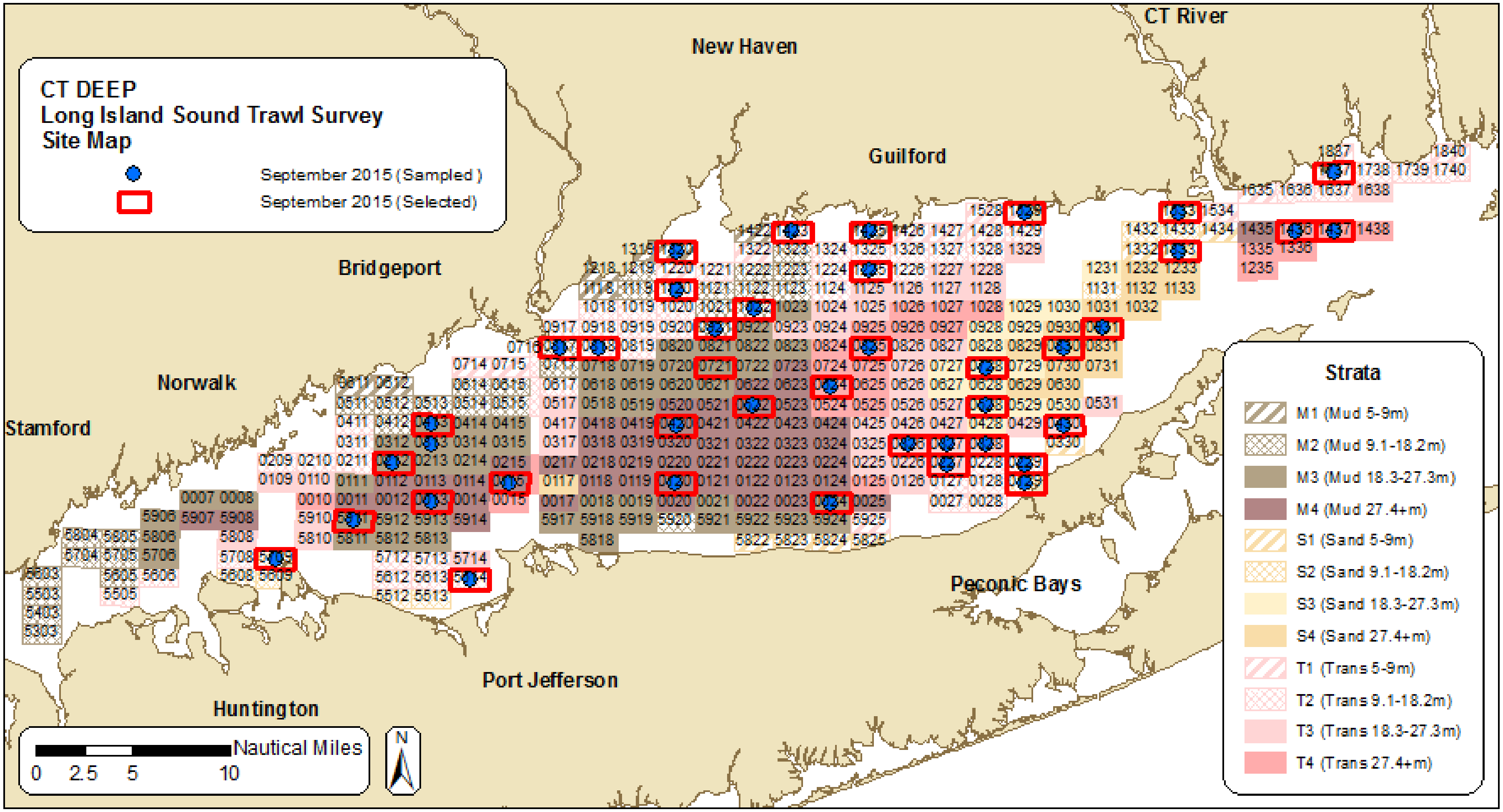
Month	Sample	Site Sampled	Sampled Strata	Site Selected	Selected Strata	Reason Moved
May	SP2015076	0917	T2	0617	T2	weather conditions on final day of sampling
May	SP2015059	5613	T2	5712	T2	weather conditions and conflict with ghost gear

Figure 5.4. June 2015 sites selected and sampled. *The red outlined rectangles are the sites selected for the cruise and the blue dots are the sites sampled. Samples collected from a different site than published in the "**Notice to Fishermen**" are noted in table below map.*



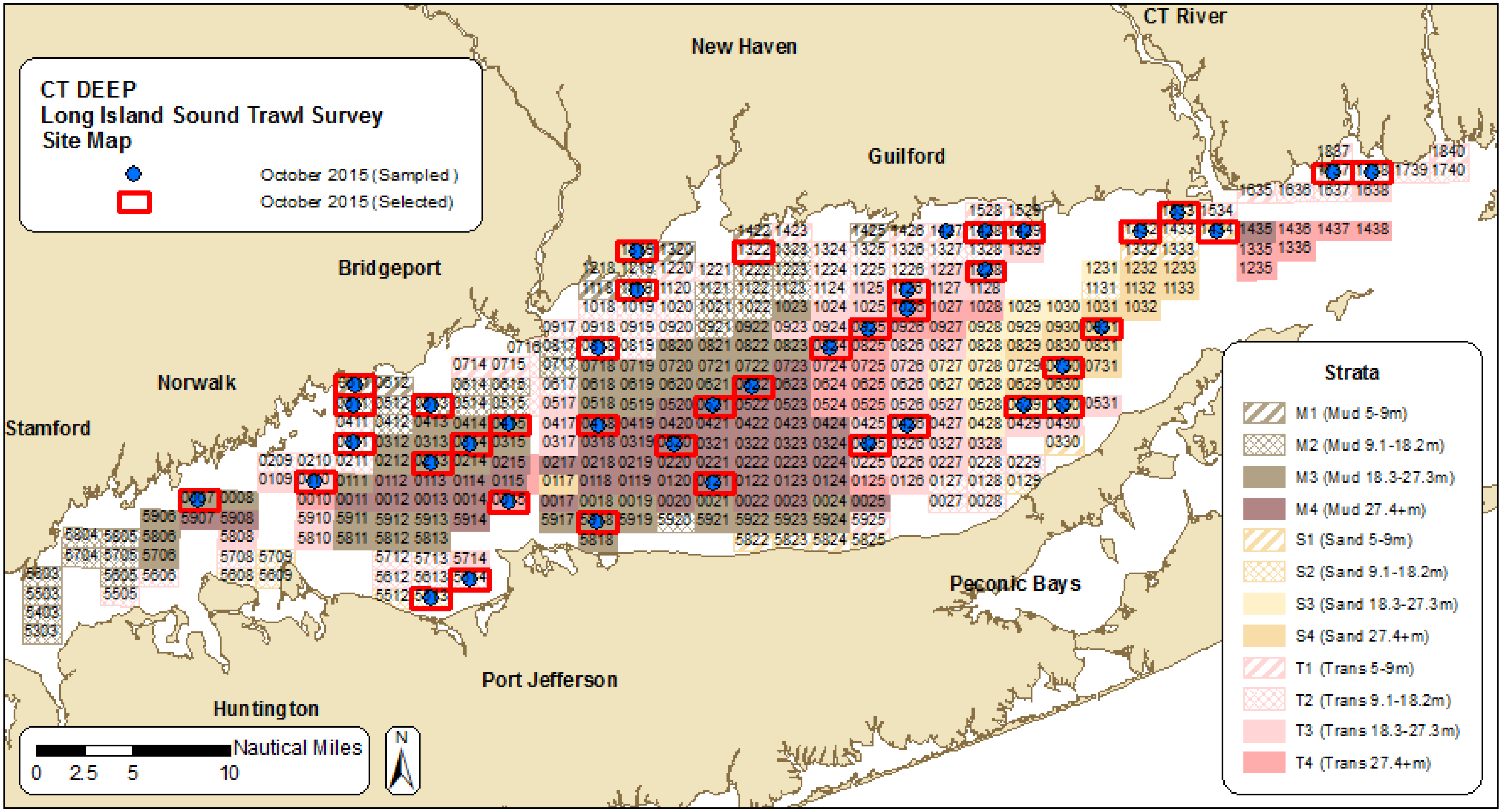
Month	Sample	Site Sampled	Sampled Strata	Site Selected	Selected Strata	Reason Moved
June	No sites were moved during this cruise					

Figure 5.5. September 2015 sites selected and sampled. *The red outlined rectangles are the sites selected for the cruise and the blue dots are the sites sampled. Samples collected from a different site than published in the "**Notice to Fishermen**" are noted in table below map.*



Month	Sample	Site Sampled	Sampled Strata	Site Selected	Selected Strata	Reason Moved
September	FA2015035	0313	M3	0721	M3	Towed by mistake so substituted for a site of same stratum

Figure 5.6. October 2015 sites selected and sampled. *The red outlined rectangles are the sites selected for the cruise and the blue dots are the sites sampled. Samples collected from a different site than published in the "**Notice to Fishermen**" are noted in table below map.*



Month	Sample	Site Sampled	Sampled Strata	Site Selected	Selected Strata	Reason Moved
October	FA2015078	1427	T1	1322	T1	site moved after two attempt were made to tow and gear was damaged

Figure 5.7. Number of finfish species observed annually, 1984-2015. *Note: there was no October sampling in 2006 and there was no June, September or October sampling in 2010. Average number of finfish species caught per year is 57.6 for the time-series. See Table 5.4 for details on number of tows completed each year.*

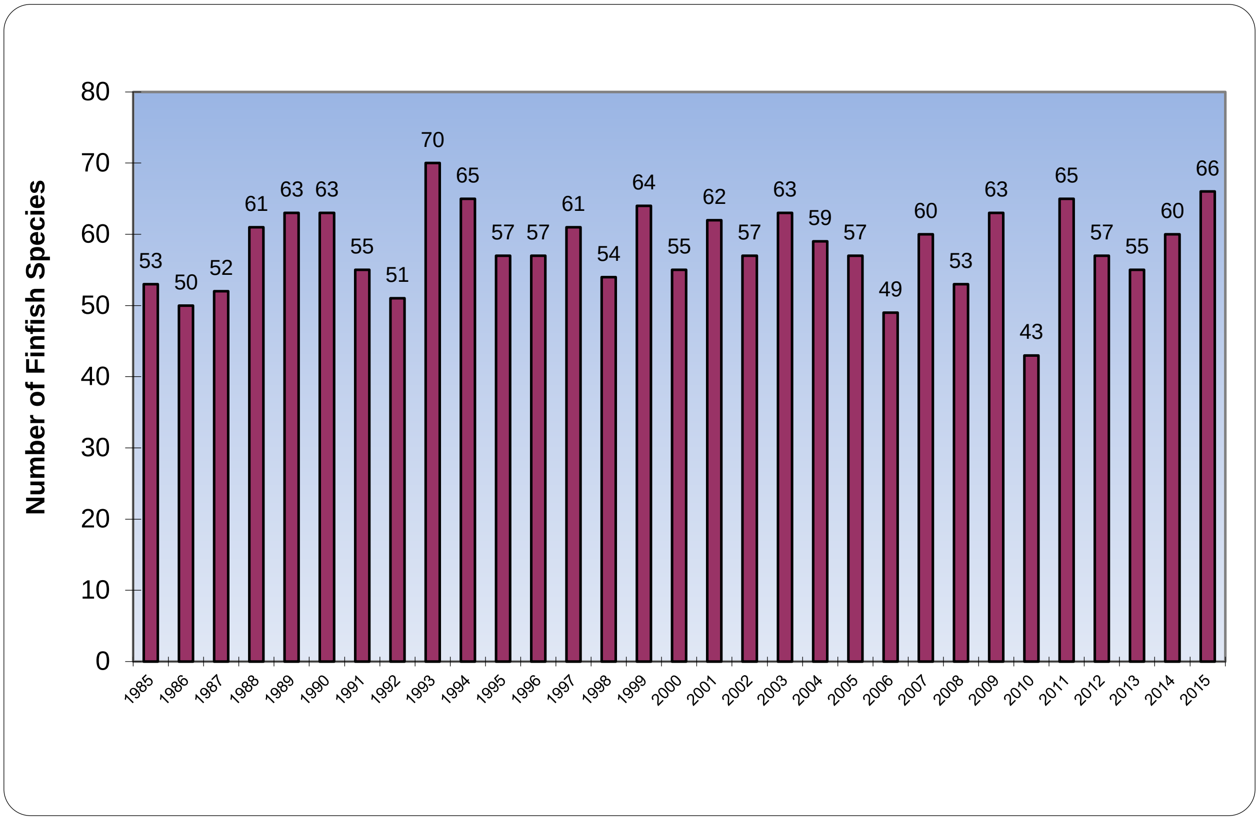
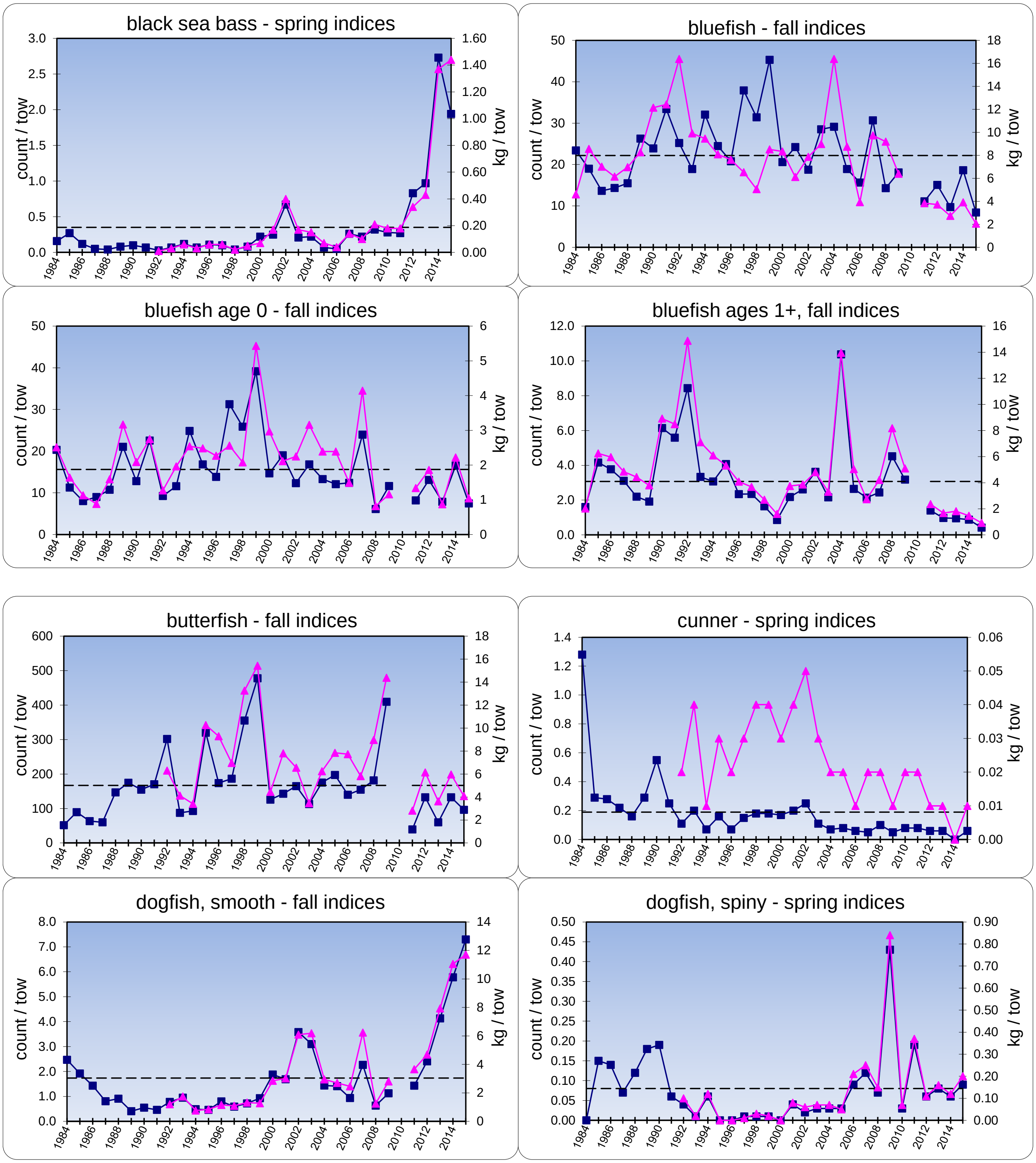
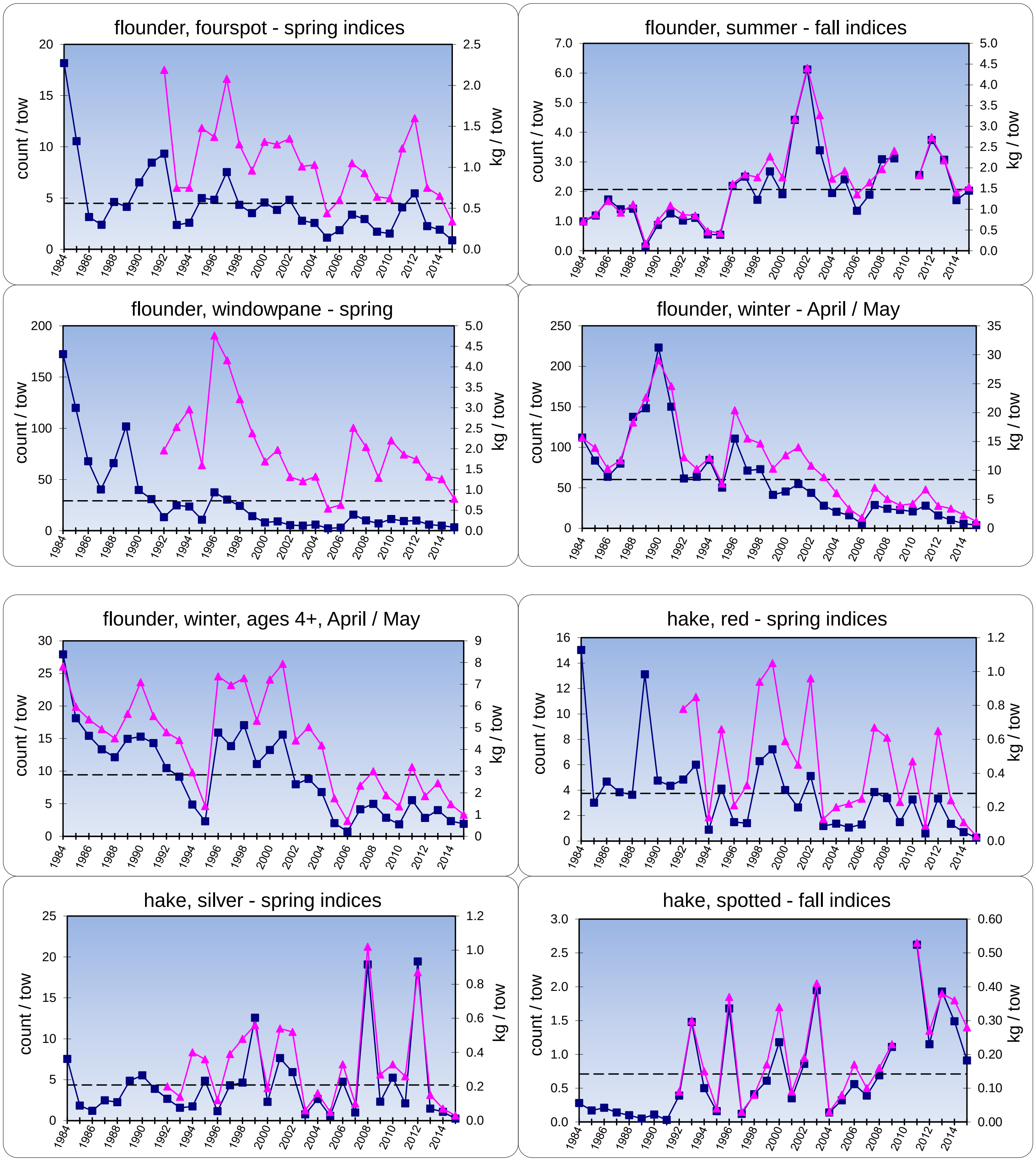


Figure 5.8. Plots of abundance indices for: black sea bass, bluefish (total, age 0, and ages 1+), butterfish, cunner, and dogfish (smooth and spiny).



Legend:
■ = count / tow
▲ = kg / tow
---- = mean count / tow

Figure 5.9. Plots of abundance indices for: flounders (fourspot, summer, windowpane, winter, and winter ages 4+) and hakes (red, silver, and spotted).



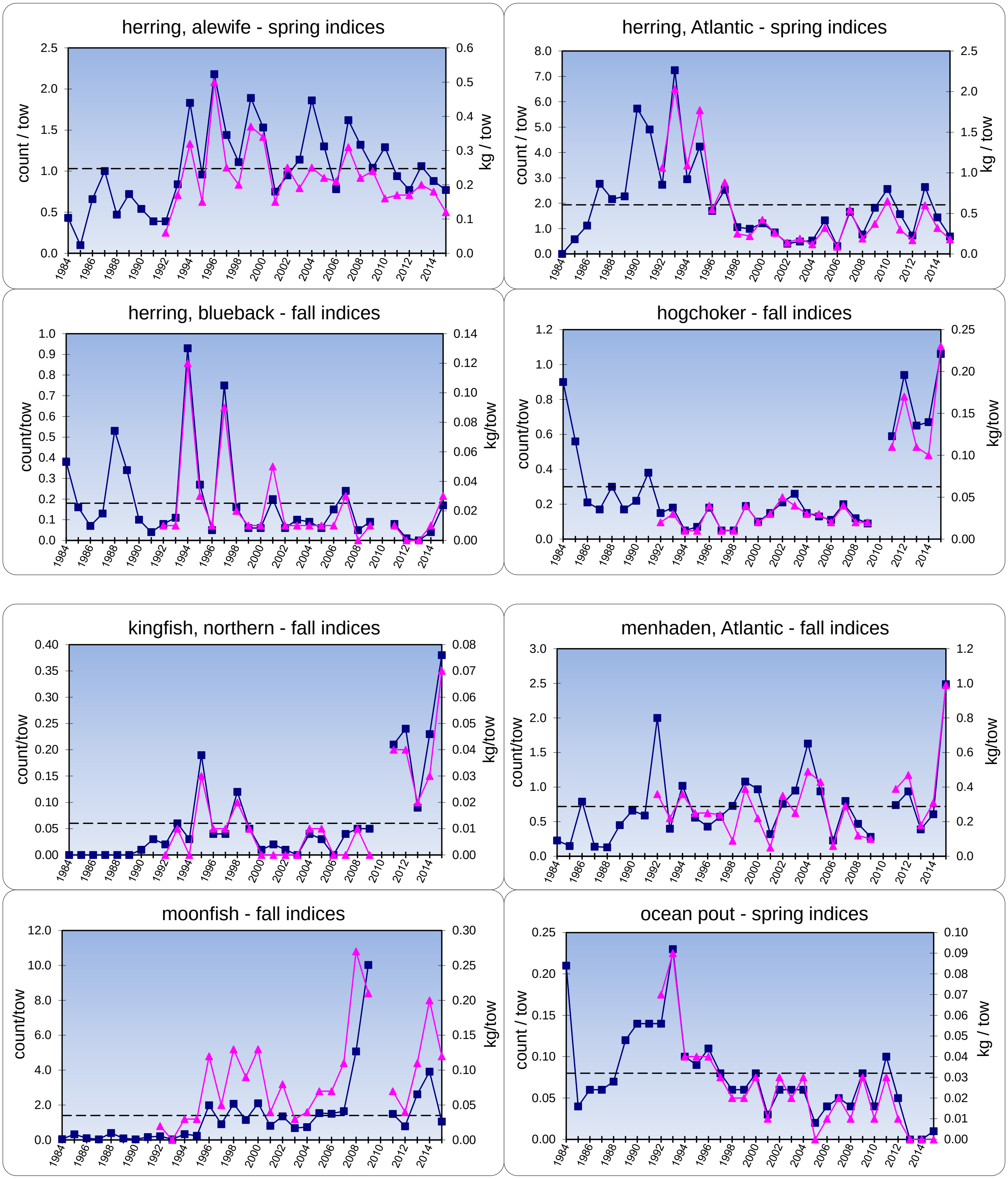
Legend:

■ = count / tow

▲ = kg / tow

---- = mean count / tow

Figure 5.10. Plots of abundance indices for: herrings (alewife, Atlantic, and blueback), hogchoker, Northern kingfish, Atlantic menhaden, moonfish, and ocean pout.



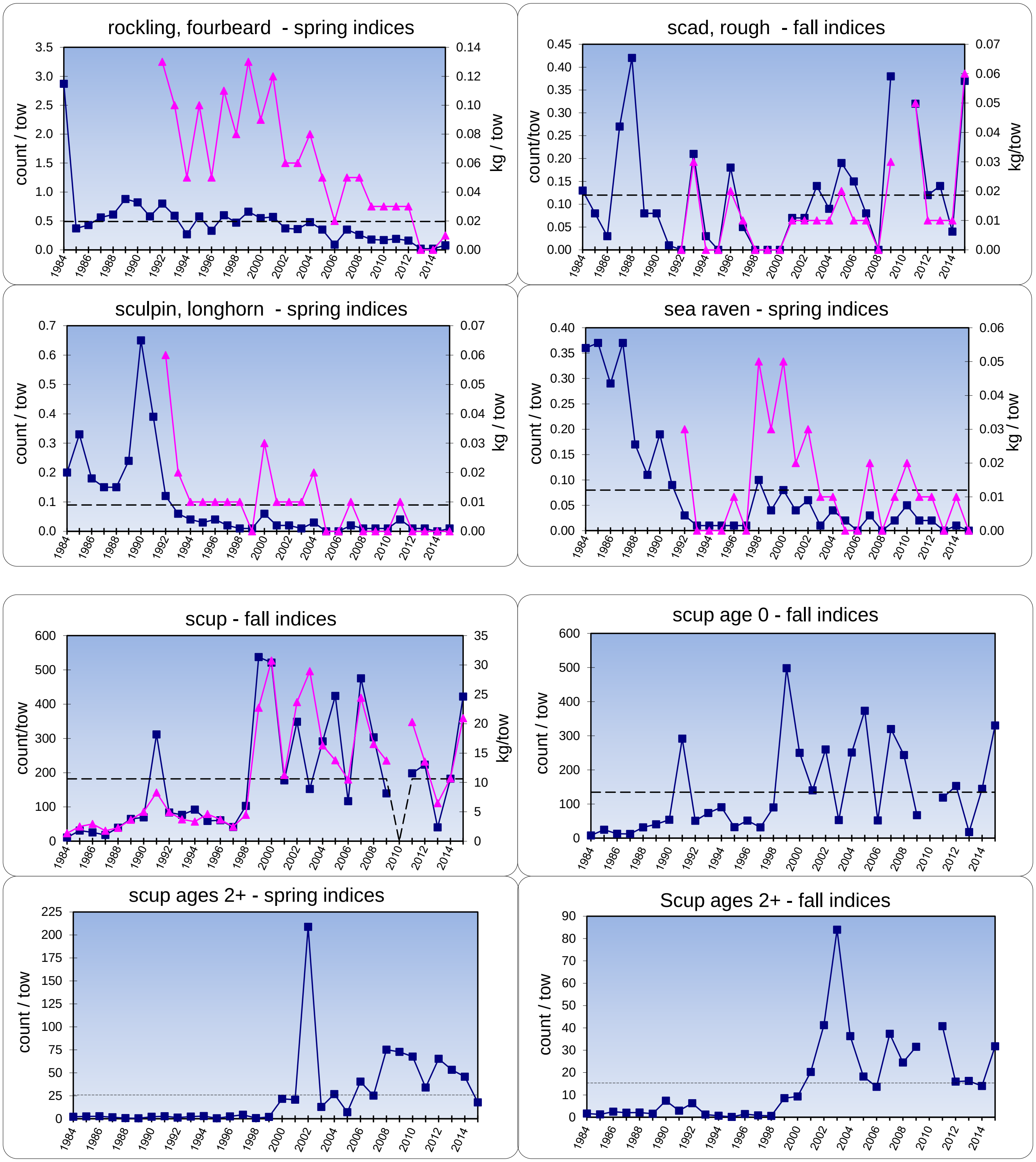
Legend:

■ = count / tow

▲ = kg / tow

---- = mean count / tow

Figure 5.11. Plots of abundance indices for: fourbeard rockling, rough scad, longhorn sculpin, sea raven, and scup (all ages, age 0, and ages 2+).



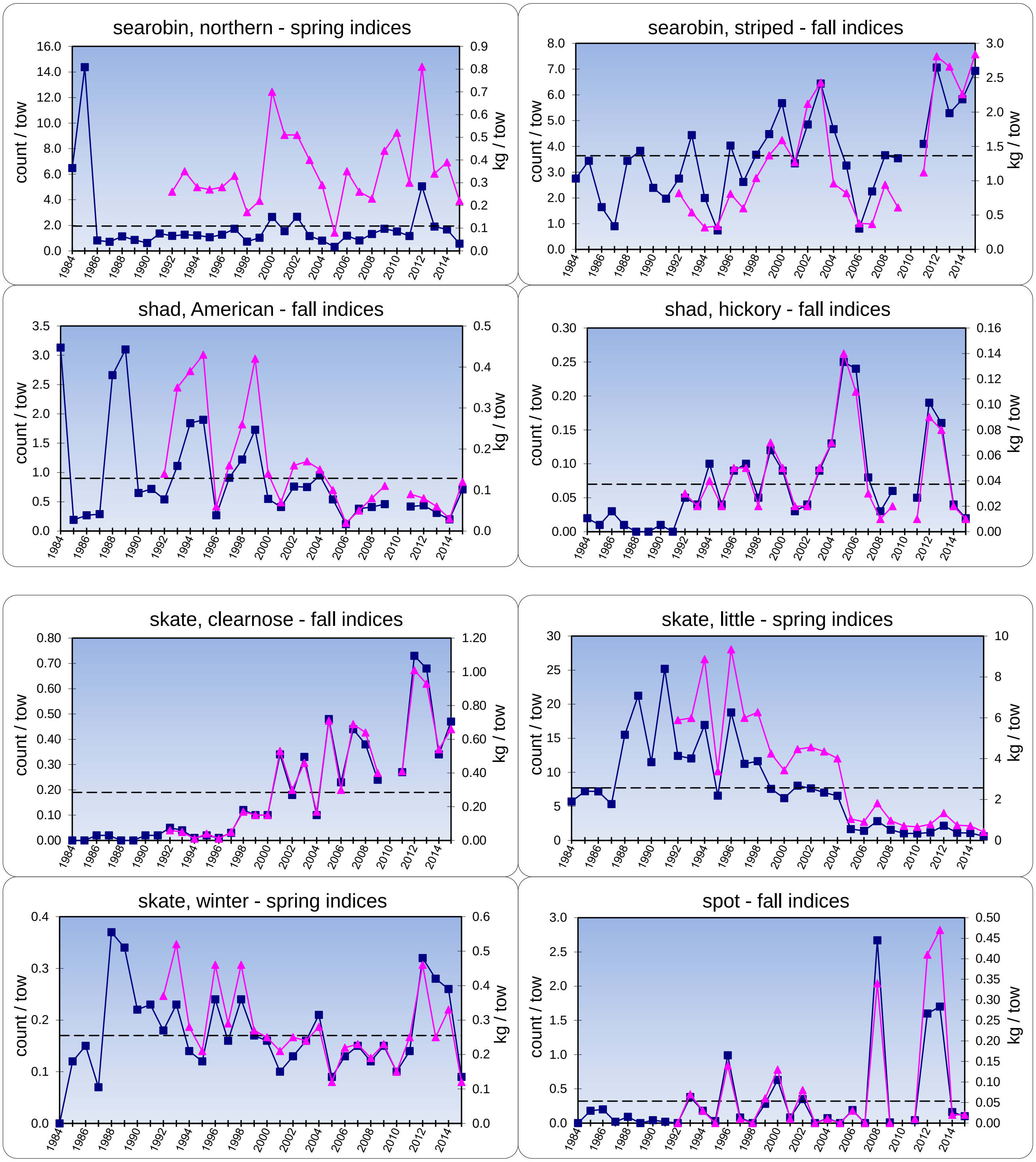
Legend:

■ = count / tow

▲ = kg / tow

---- = mean count / tow

Figure 5.12. Plots of abundance indices for: searobins (striped and northern), shad (American and hickory), skates (clearnose, little, and winter), and spot.



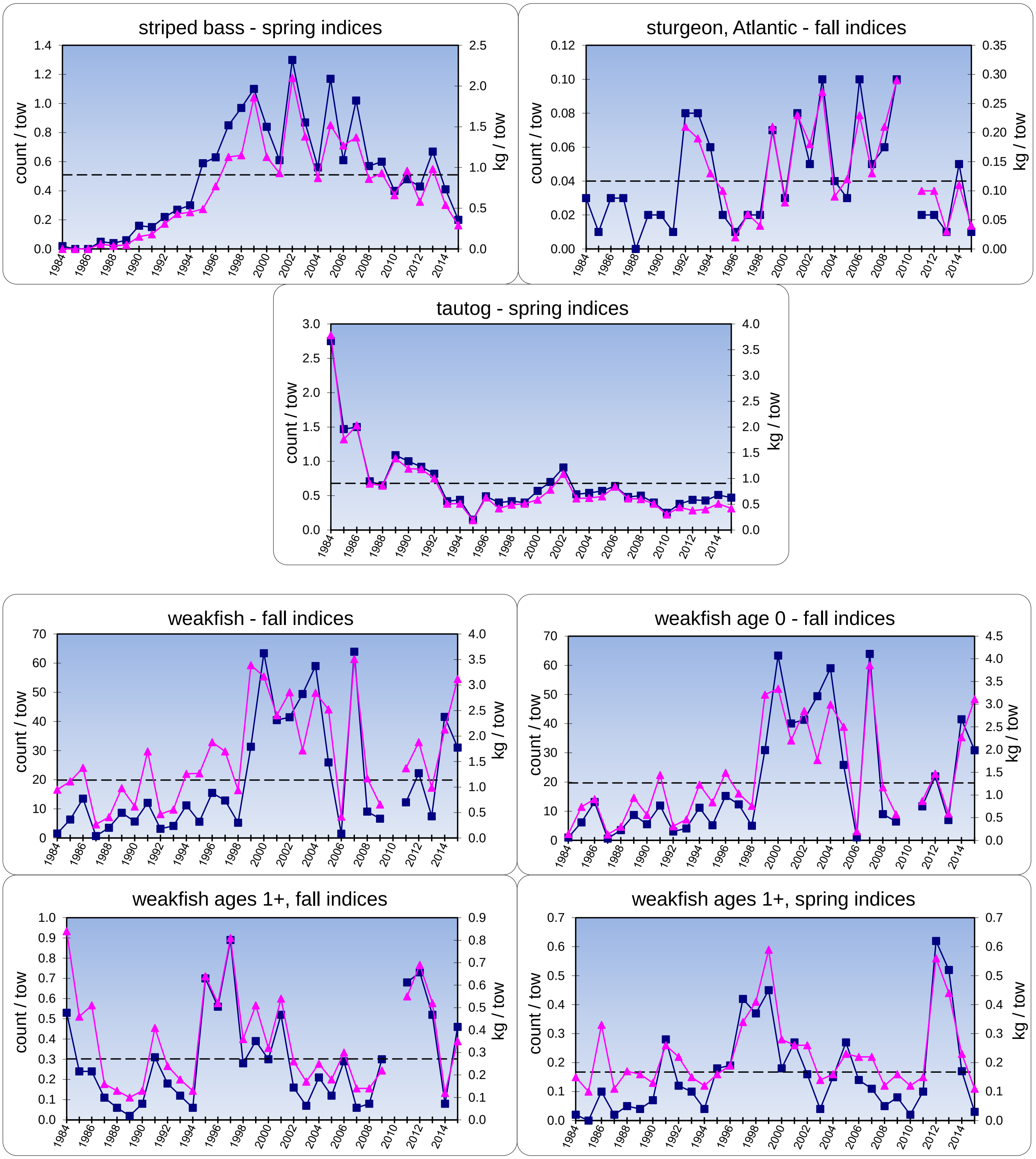
Legend:

■ = count / tow

▲ = kg / tow

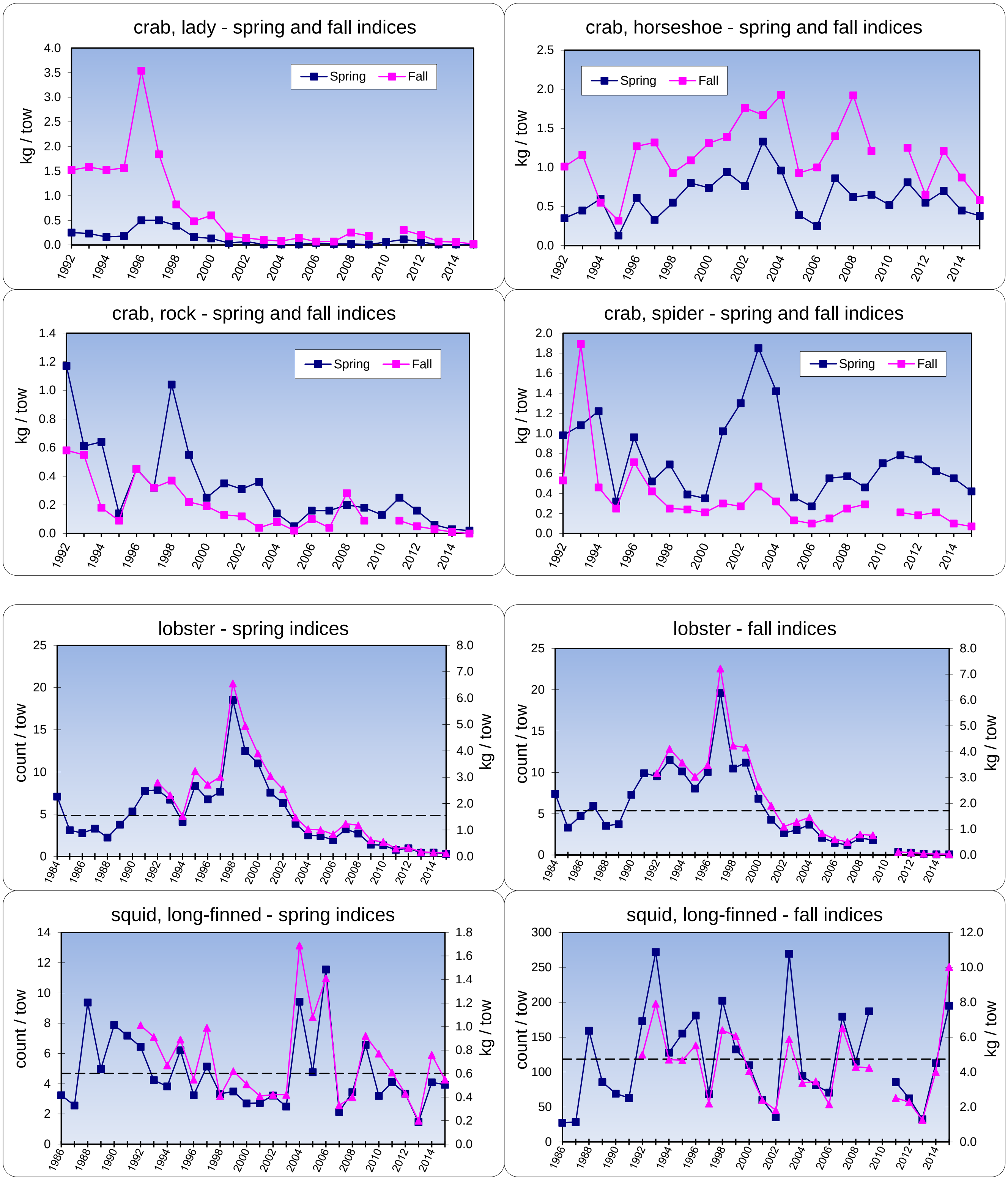
---- = mean count / tow

Figure 5.13 Plots of abundance indices for: striped bass, Atlantic sturgeon, tautog, and weakfish (all ages, age 0, and ages 1+).



Legend:
■ = count / tow
▲ = kg / tow
---- = mean count / tow

Figure 5.14. Plots of abundance and biomass indices for: crabs (lady, rock, and spider), horseshoe crab, American lobster, and long-finned squid.



Legend for bottom four graphs:

■ = count / tow

▲ = kg / tow

---- = mean count / tow

Figure 5.15. Mean number of finfish species per sample, spring and fall, 1984-2015. This index measures the diversity of species supported within the Sound's various habitats.

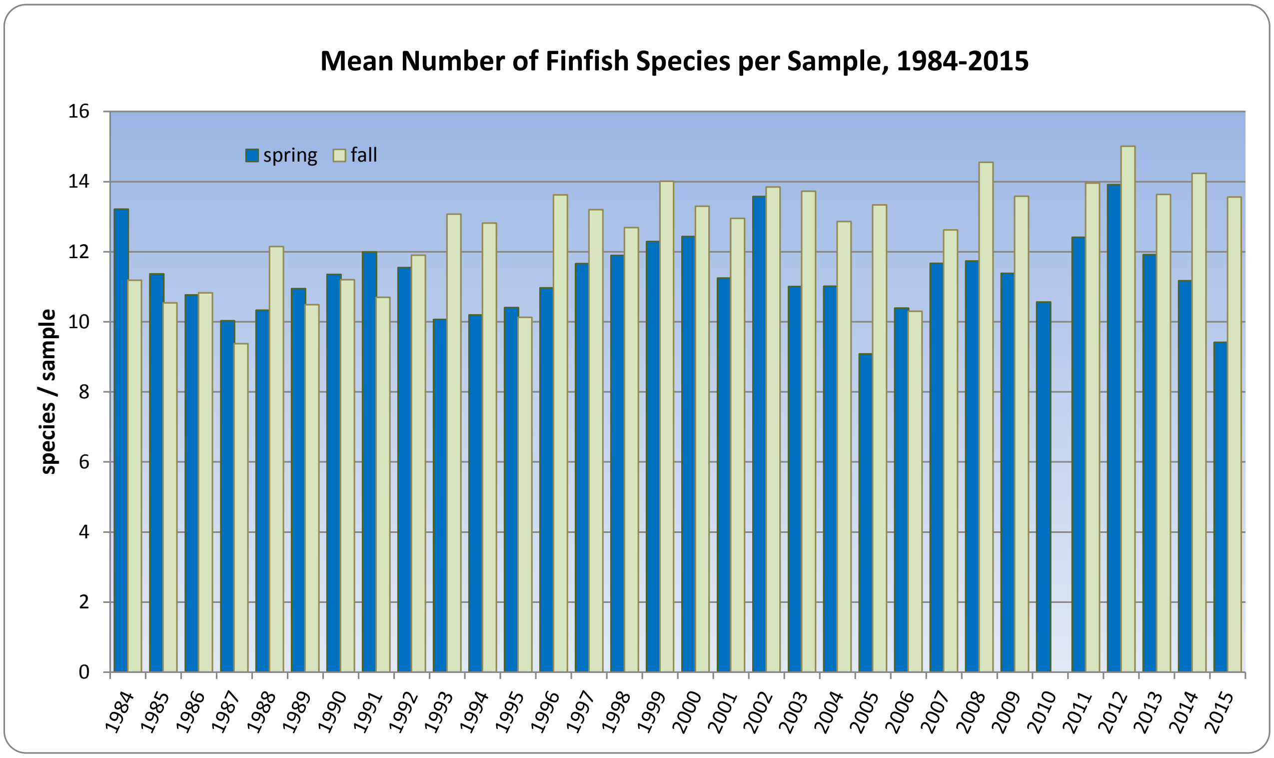


Figure 5.16. Open water forage abundance, 1992-2015. The geometric mean is calculated as the aggregate sample biomass per tow of 14 of the most common forage species sampled in the survey. This index measures the available food base which supports both resident and migratory species. The average since 1992 is 13.85 kg/tow (red line).

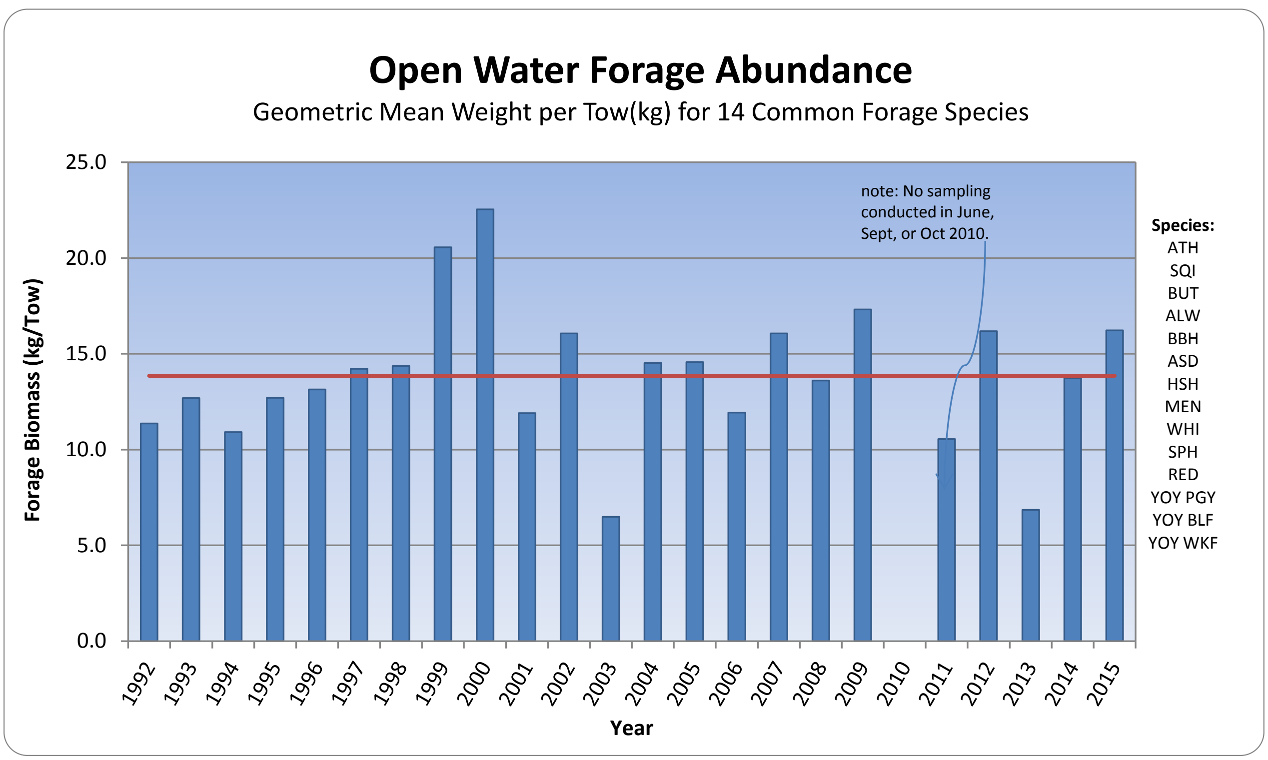
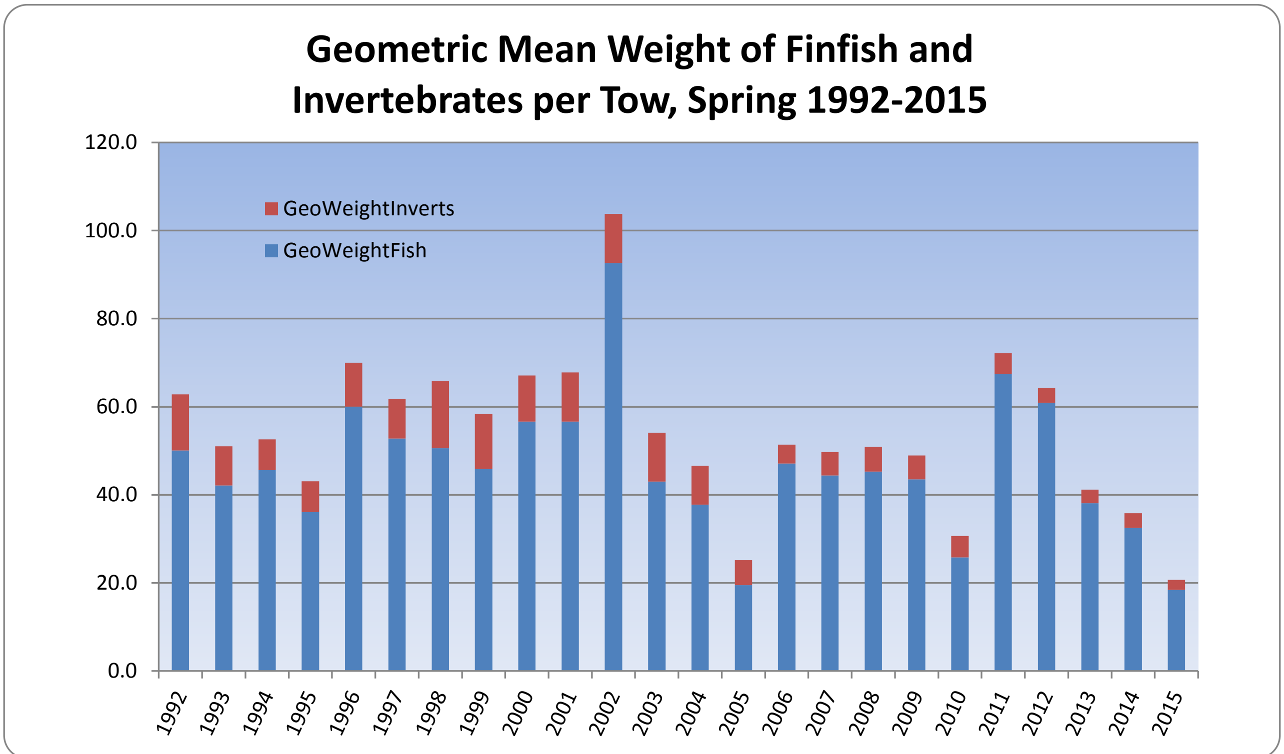


Figure 5.17. Geometric mean biomass of finfish and invertebrates per sample, spring and fall, 1992-2015. This index measures the diversity of species supported within the Sound's various habitats.



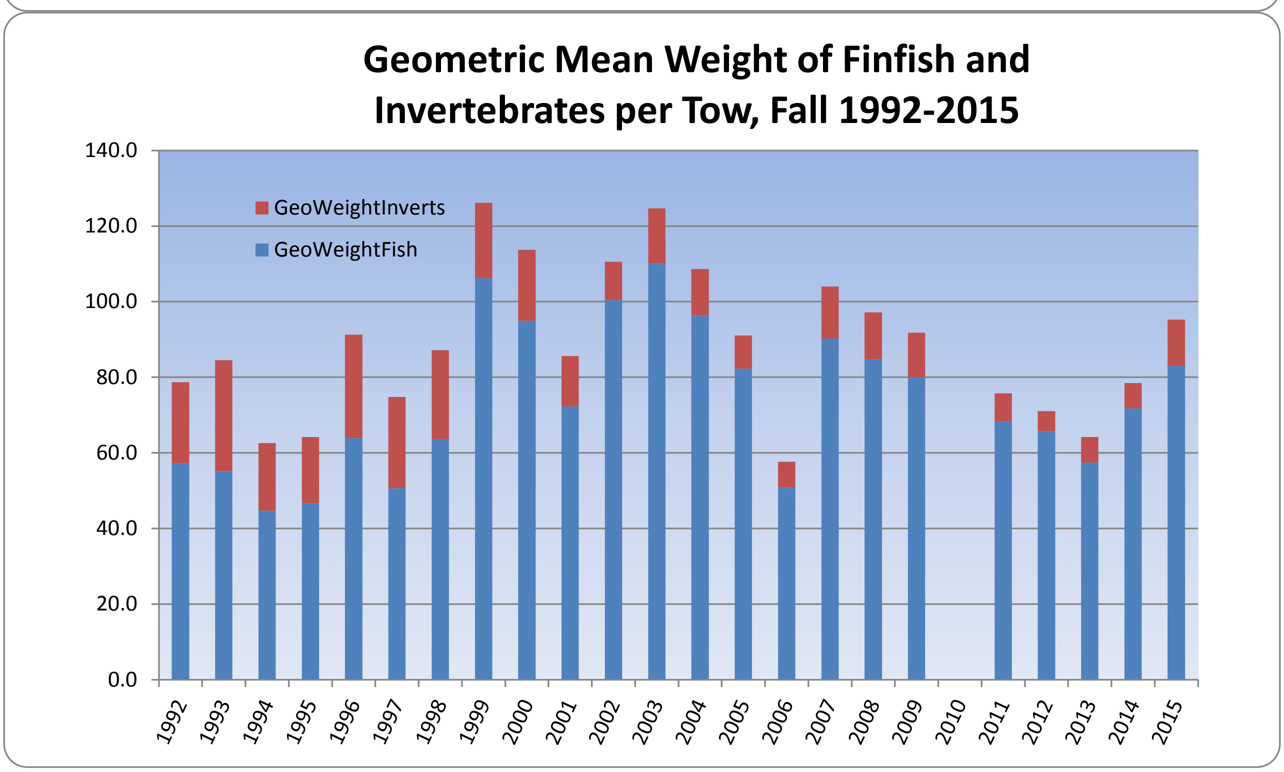
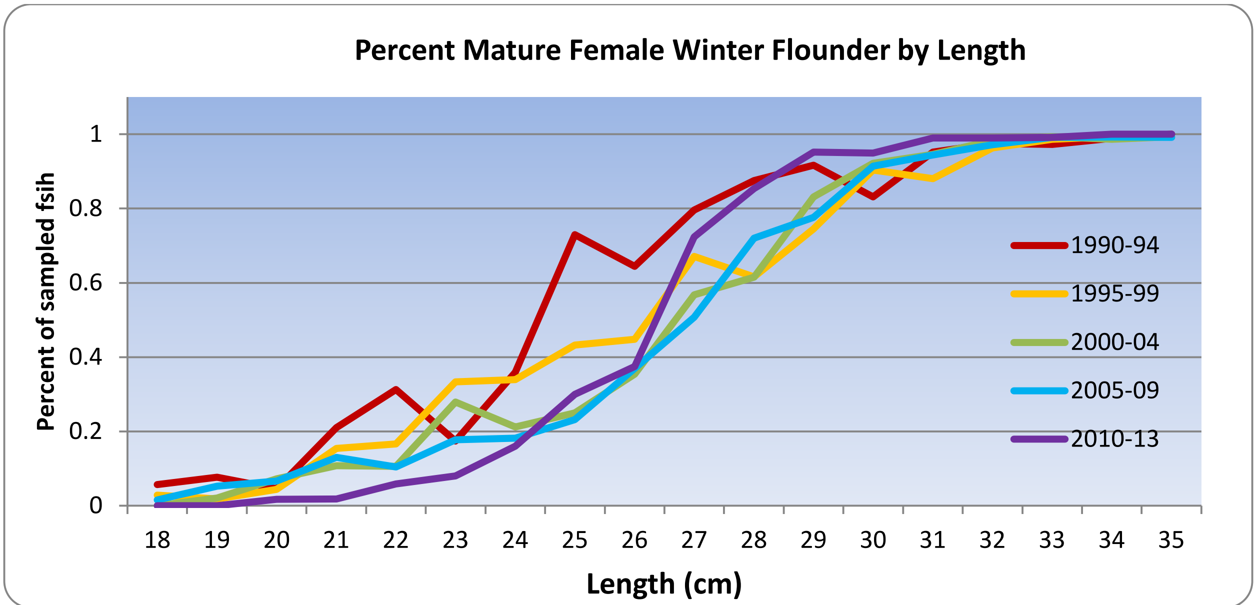


Figure 5.18: Percent of sampled winter flounder that were sexually mature by length group for female and male flounder captured in LISTS over five time periods, 1990-2013.



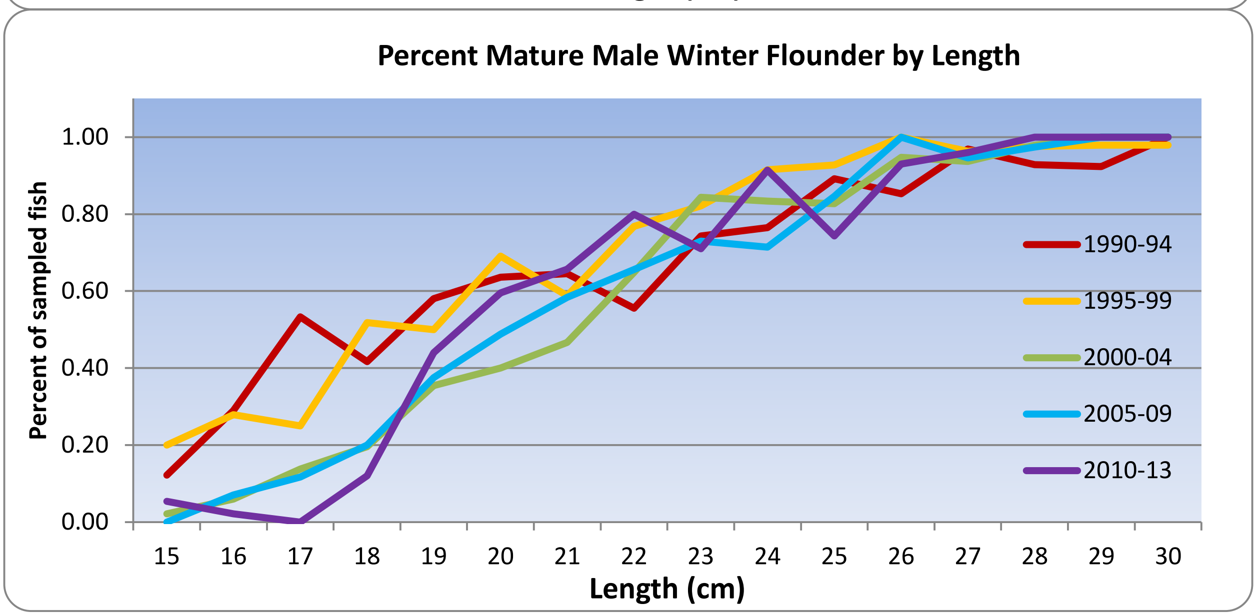
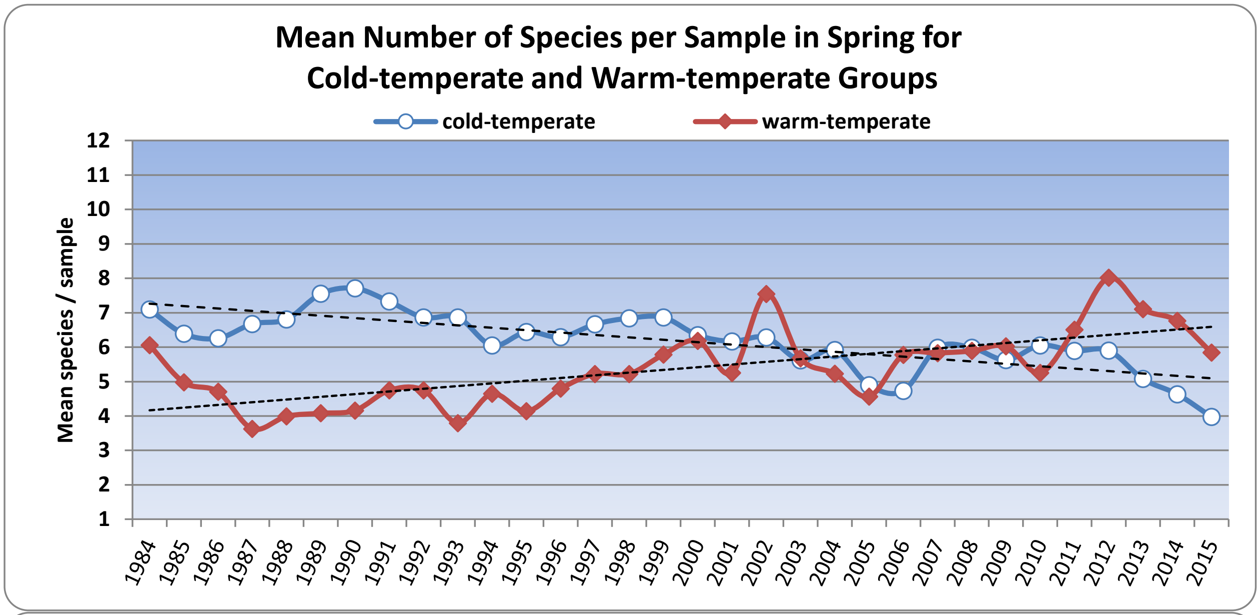
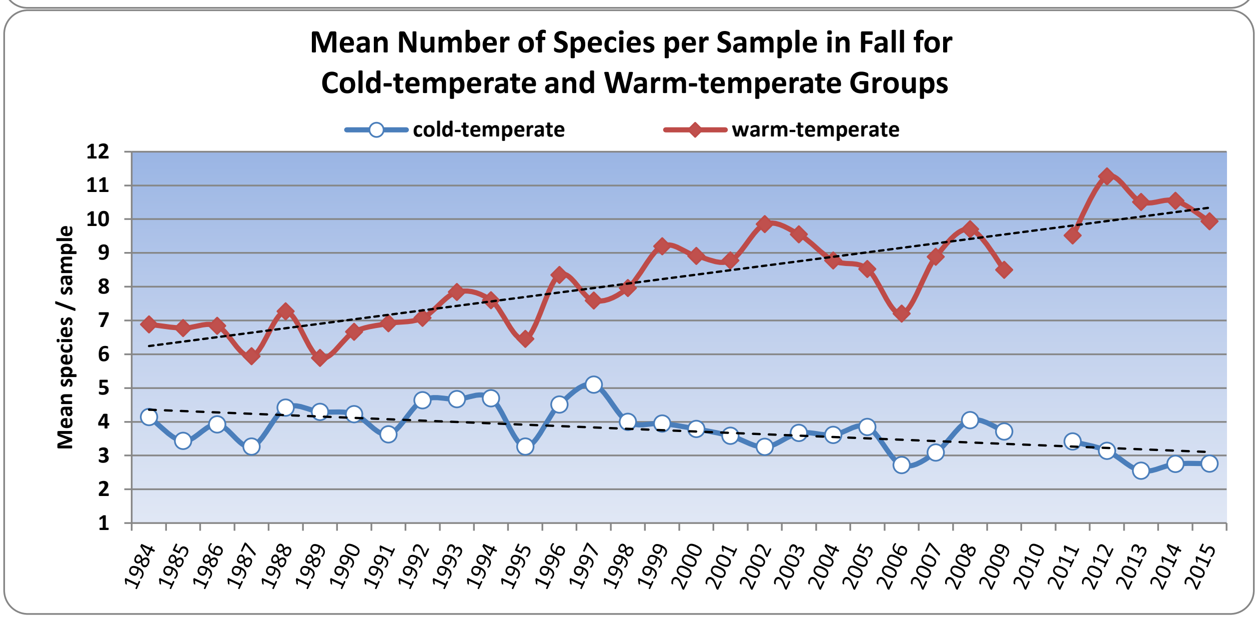


Figure 5.19. Trends in the number of cold temperate versus warm temperate species per sample captured in spring and fall LIS Trawl Surveys. See Appendix 2.5 for list of species included in analysis.





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APPENDICES
LISTS

Appendix 5.1. List of finfish species identified by A *Study of Marine Recreational Fisheries in Connecticut* (F54R) and other CT DEP Marine Fisheries Division programs. LISTS has collected one hundred-nine (109) finfish species from 1984-2015. *This appendix contains a list of 147 species identified (Bold type indicates new species) from all sampling programs conducted since 1984. Species are listed alphabetically by common name (AFS 2004). Sampling program abbreviations, survey time periods and gear type are as follows:*

Survey Abbreviation	Survey Description	Time Period	Gear Type
CTR	CT River Creel Survey	1997-1998	bus stop creel survey mainstem of CT River
EPA	cooperative sampling in western LIS with EPA	1986-1990	used LISTS net
ESS (F54R)	Estuarine Seine Survey	1988 to present	7.6m (25 ft) beach seine
IS (F54R)	Inshore Survey of Juvenile Winter Flounder	1990-1994	beam trawls (also a little data from 1995-1996)
ISS (F54R-starting 2008)	Inshore Seine Surveys in CT & TH rivers	1979 to present	15.2m (50 ft) bag seine set by boat
LISTS (F54R)	Long Island Sound Trawl Survey	1984 to present	14m (50 ft) trawls with 2" codend mesh
MISC	misc sampling conducted on R/V Dempsey	various	various
NCA	"inshore" EPA NCA C2K sampling	2000	skiff trawls
NRRWS	sampling in western end of LIS, the "Narrows"	2000-2007	14m (50 ft) trawls with 2" codend mesh
SNFH (F54R)	Study of Nearshore Finfish Habitat	1995-1996	plankton net
SS (F54R)	Summer Survey	1991-1993, 1996	14m (50 ft) trawls with codend liner in LIS
TN	Trap Net Survey	1997-1998	trap nets in rivers

Common Name	Scientific Name	Survey
anchovy, bay	*Anchoa mitchilli*	LISTS;NRRWS;ESS;ISS;IS; SS;NCA;MISC
anchovy, striped	*Anchoa hepsetus*	LISTS; ESS; IS; SS
banded rudderfish	*Seriola zonata*	LISTS; ESS
bass, largemouth	*Micropterus salmoides*	ISS; TN;CTR
bass, rock	*Ambloplites rupestris*	ISS; TN;CTR
bass, smallmouth	*Micropterus dolomieui*	ISS; TN;CTR
bass, striped	*Morone saxatilis*	LISTS;NRRWS;ESS;ISS; SS;NCA;MISC;EPA;TN;CTR
bigeye	*Priacanthus arenatus*	LISTS; IS
bigeye, short	*Pristigenys alta*	LISTS
black sea bass	*Centropristes striata*	LISTS;NRRWS;ESS; IS; SS;NCA;MISC;EPA
blenny, feather	*Hypsoblennius hentz*	LISTS
bluefish	*Pomatomus saltatrix*	LISTS;NRRWS;ESS;ISS; SS; MISC;EPA; CTR
bluegill	*Lepomis macrochirus*	TN;CTR
bonefish	*Albula vulpes*	ISS
bonito, Atlantic	*Sarda sarda*	LISTS; EPA
bullhead, brown	*Ameiurus nebulosus*	ISS; NCA; TN;CTR
burrfish, striped	*Chilomycterus schoepfi*	LISTS; ESS
burrfish, web	*Chilomycterus antillarum*	ESS
butterfish	*Peprilus triacanthus*	LISTS;NRRWS;ESS;ISS;IS; SS;NCA;MISC;EPA
carp	*Cyprinus carpio*	ISS; NCA; TN;CTR
catfish, channel	*Ictalurus puctatus*	ISS; NCA; TN;CTR
catfish, white	*Ameiurus catus*	NCA; TN;CTR
cod, Atlantic	*Gadus morhua*	LISTS; SS
cornetfish, bluespotted	*Fistularia tabacaria*	LISTS; ESS; IS
cornetfish, red	***Fistularia petimba***	LISTS; IS
crappie, black	*Pomoxis nigromaculatus*	ISS; NCA; TN;CTR
crappie, white	*Pomoxis annularis*	TN;CTR
croaker, Atlantic	*Micropogonias undulatus*	LISTS; IS
cunner	*Tautogolabrus adspersus*	LISTS;NRRWS;ESS;ISS;IS; SS; MISC;EPA
cusk-eel, fawn	*Lepophidium profundorum*	LISTS
cusk-eel, striped	*Ophidion marginatum*	LISTS; SS
darter, tessellated	*Etheostoma olmstedi*	ISS
dogfish, smooth	*Mustelus canis*	LISTS;NRRWS;ESS; IS; SS; MISC;EPA
dogfish, spiny	*Squalus acanthius*	LISTS;NRRWS; MISC
drum, black	*Pogonias cromis*	**LISTS**
eel, American	*Anguilla rostrata*	LISTS;NRRWS;ESS;ISS;IS;SNFH;SS;NCA; EPA;TN;CTR
eel, conger	*Conger oceanicus*	LISTS; IS; SS
fallfish	*Semotilus corporalis*	ISS
filefish, orange	*Aluterus schoepfi*	LISTS; IS; SS
filefish, planehead	*Monacanthus hispidus*	LISTS; EPA
filefish, scrawled	*Aluterus scriptus*	IS
flounder, American plaice	*Hippoglossoides platessoide*	LISTS
flounder, fourspot	*Paralichthys oblongus*	LISTS;NRRWS; IS; SS; MISC;EPA

Appendix 5.1 cont.

Common Name	Scientific Name	Survey
flounder, smallmouth	*Etropus microstomus*	LISTS;NRRWS;ESS; IS; SS;NCA;MISC
flounder, summer	*Paralichthys dentatus*	LISTS;NRRWS;ESS;ISS;IS; SS;NCA;MISC;EPA;TN;CTR
flounder, windowpane	*Scophthalmus aquosus*	LISTS;NRRWS;ESS;ISS;IS; SS;NCA;MISC;EPA;TN;CTR
flounder, winter	*Pseudopleuronectes americanus*	LISTS;NRRWS;ESS;ISS;IS;SNFH;SS;NCA;MISC;EPA;TN;CT
flounder, yellowtail	*Pleuronectes ferrugineus*	LISTS; IS
glasseye snapper	*Priacanthus cruentatus*	LISTS
goatfish, dwarf	*Upeneus parvus*	LISTS
goatfish, red	*Mullus auratus*	LISTS
goby, code	*Gobiosoma robustum*	IS
goby, naked	*Gobiosoma bosci*	LISTS; ESS;ISS;IS
goldfish	*Carassius auratus*	CTR
goosefish	*Lophius americanus*	LISTS; IS; SS; MISC
grubby	*Myoxocephalus aeneus*	LISTS; ESS;ISS;IS;SNFH;SS; EPA
gunnel, banded	*Pholis fasciata*	ESS; IS
gunnel, rock	*Pholis gunnellus*	LISTS; ESS;ISS;IS;SNFH;SS
gurnard, flying	*Dactylopterus volitans*	ESS
haddock	*Melanogrammus aeglefinus*	LISTS; SS
hake, red	*Urophycis chuss*	LISTS;NRRWS; IS; SS; MISC;EPA
hake, silver	*Merluccius bilinearis*	LISTS;NRRWS; SS; MISC;EPA
hake, spotted	*Urophycis regia*	LISTS;NRRWS; ESS; IS; SS; MISC;EPA
harvestfish	*Peprilus paru*	LISTS
herring, Atlantic	*Clupea harengus*	LISTS;NRRWS; IS;SNFH;SS; MISC;EPA
herring, Atlantic thread	***Opisthonema oglinum***	LISTS
herring, alewife	*Alosa pseudoharengus*	LISTS;NRRWS;ESS;ISS; SNFH;SS; MISC;EPA;TN;CTR
herring, blueback	*Alosa aestivalis*	LISTS;NRRWS;ESS;ISS;IS;SNFH;SS; EPA;TN;CTR
herring, round	*Etrumeus teres*	LISTS; EPA
hogchoker	*Trinectes maculatus*	LISTS;NRRWS;ESS;ISS;IS; SS; MISC;EPA;TN
jack, blue runner	*Caranx crysos*	LISTS; EPA
jack, crevalle	*Caranx hippos*	LISTS;NRRWS; ESS; ISS; EPA
jack, yellow	*Caranx bartholomaei*	LISTS;NRRWS; ESS; IS; MISC;EPA
killifish, rainwater	*Lucania parva*	ESS
killifish, striped	*Fundulus majalis*	ESS; IS
kingfish, northern	*Menticirrhus saxatilis*	LISTS;NRRWS;ESS;ISS;IS; SS; EPA
lamprey, sea	*Petromyzon marinus*	LISTS; IS; TN
lizardfish, inshore	*Synodus foetens*	LISTS;NRRWS;ESS;ISS;IS; SS; MISC
lookdown	*Selene vomer*	LISTS; ISS
lumpfish	*Cyclopterus lumpus*	LISTS; IS;SNFH
mackerel, Atlantic	*Scomber scombrus*	LISTS; ISS; SS; EPA
mackerel, Spanish	*Scomberomorus maculatus*	LISTS; SS; EPA
menhaden, Atlantic	*Brevoortia tyrannus*	LISTS;NRRWS;ESS;ISS;IS;SNFH;SS;NCA;MISC;EPA
minnow, sheepshead	*Cyrinodon variegatus*	ESS;ISS
moonfish	*Selene setapinnis*	LISTS;NRRWS; SS; MISC;EPA
mullet, white	*Mugil curema*	LISTS;ESS;ISS
mummichog	*Fundulus heteroclitus*	ESS; IS
needlefish, Atlantic	*Strongylura marina*	ESS;ISS
ocean pout	*Macrozoarces americanus*	LISTS;NRRWS; MISC;EPA
oyster toadfish	*Opsanus tau*	LISTS;NRRWS;ESS;ISS;IS;SNFH;SS; EPA
perch, white	*Morone americana*	LISTS;NRRWS;ESS;ISS;IS;SNFH; NCA; TN;CTR
perch, yellow	*Perca flavescens*	ISS; SNFH; TN;CTR
perch, silver	*Bairdiella chrysoura*	LISTS
pickerel, chain	*Esox niger*	ISS; TN
pike, northern	*Esox lucius*	ISS; TN;CTR
pinfish	*Lagodon rhomboides*	LISTS
pipefish, northern	*Syngnathus fuscus*	LISTS;NRRWS;ESS;ISS;IS;SNFH;SS;NCA; EPA
pollock	*Pollachius virens*	LISTS;NRRWS; SNFH;SS; EPA
pompano, African	*Alectis ciliaris*	LISTS; ISS
puffer, northern	*Sphoeroides maculatus*	LISTS;NRRWS;ESS;ISS;IS; SS
pumpkinseed	*Lepomis gibbosus*	ESS;ISS; NCA; TN;CTR
radiated shanny	*Ulvaria subbifurcata*	SNFH

Appendix 5.1 cont.

Common Name	Scientific Name	Survey
ray, bullnose	*Myliobatis freminvillei*	LISTS
ray, roughtail stingray	*Dasyatis centroura*	LISTS
rockling, fourbeard	*Enchelyopus cimbrius*	LISTS;NRRWS; IS;SNFH;SS; MISC;EPA
salmon, Atlantic	*Salmo salar*	LISTS; TN
sand lance, American	*Ammodytes americanus*	LISTS; ESS; IS;SNFH;SS
sandbar (brown) shark	*Carcharhinus plumbeus*	LISTS
scad, bigeye	*Selar crumenophthalmus*	LISTS; SS; MISC
scad, mackerel	*Decapterus macarellus*	LISTS; SS
scad, rough	*Trachurus lathami*	LISTS;NRRWS; SS; MISC;EPA
scad, round	*Decapterus punctatus*	LISTS;NRRWS
sculpin, longhorn	*Myoxocephalus octodecemspinosus*	LISTS;NRRWS; ISS; SNFH; MISC
scup	*Stenotomus chrysops*	LISTS;NRRWS;ESS;ISS;IS; SS;NCA;MISC;EPA
sea raven	*Hemitripterus americanus*	LISTS; SNFH; MISC;EPA
seahorse, lined	*Hippocampus erectus*	LISTS; ESS; IS
searobin, northern	*Prionotus carolinus*	LISTS;NRRWS;ESS; IS;SNFH;SS; MISC;EPA
searobin, striped	*Prionotus evolans*	LISTS;NRRWS;ESS;ISS;IS; SS;NCA;MISC;EPA
seasnail	*Liparis atlanticus*	LISTS; SNFH
sennet, northern	*Sphyraena borealis*	LISTS; ESS
shad, American	*Alosa sapidissima*	LISTS;NRRWS;ESS;ISS; SS; MISC;EPA;TN;CTR
shad, gizzard	*Dorosoma cepedianum*	LISTS;NRRWS; ISS; TN
shad, hickory	*Alosa mediocris*	LISTS;NRRWS; ISS; SS; MISC;EPA; CTR
sharksucker	*Echeneis naucrates*	LISTS
shiner, golden	*Notemigonus crysoleucas*	ISS; TN
shiner, spottail	*Notropis hudsonius*	ISS; NCA; TN;CTR
silverside, Atlantic	*Menidia menidia*	LISTS;NRRWS;ESS;ISS;IS;SNFH;SS; MISC;EPA
silverside, inland	*Menidia beryllina*	SNFH
skate, barndoor	*Dipturus laevis*	LISTS
skate, clearnose	*Raja eglanteria*	LISTS;NRRWS; IS
skate, little	*Leucoraja erinacea*	LISTS;NRRWS;ESS; IS; SS;NCA;MISC;EPA; CTR
skate, winter	*Leucoraja ocellata*	LISTS;NRRWS; SS; MISC
smelt, rainbow	*Osmerus mordax*	LISTS; ESS; IS;SNFH;SS; TN;CTR
snapper, grey	*Lutjanus griseus*	ESS; IS
snapper, mahogany	***Lutjanus mahogoni***	LISTS
spot	*Leiostomus xanthurus*	LISTS;NRRWS; ISS;IS; SS; MISC;EPA
stargazer, northern	Astroscopus guttatus	LISTS; ESS
stickleback, four-spine	*Apeltes quadracus*	ESS; IS
stickleback, nine-spine	*Pungitius pungitius*	ESS; IS
stickleback, three-spine	*Gasterosteus aculeatus*	ESS; IS; TN
sturgeon, Atlantic	*Acipenser oxyrinchus*	LISTS
sucker, white	*Catostomus commersoni*	ISS; NCA; TN;CTR
tautog	*Tautoga onitis*	LISTS;NRRWS;ESS;ISS;IS; SS;NCA;MISC;EPA
tomcod, Atlantic	*Microgadus tomcod*	LISTS;NRRWS;ESS;ISS;IS;SNFH;SS; EPA; CTR
triggerfish, gray	*Balistes capriscus*	LISTS
trout, brook	*Salvelinus fontinalis*	TN;CTR
trout, brown	*Salmo trutta*	CTR
walleye	*Sander vitreus*	TN
weakfish	*Cynoscion regalis*	LISTS;NRRWS;ESS;ISS;IS; SS;NCA;MISC;EPA

Appendix 5.2. Annual total count of finfish, lobster and squid taken in the LISTS, 1984-2015.

Counts include all tows- number of tows conducted shown in second row. Refer to Appendix 5.4 for details on number of tows conducted per month. Note: nc = not counted. Anchovy spp., (yoy) and sand lance, (yoy) are estimated.

Common name	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
(number of tows)	200	246	316	320	320	320	297	200	160	240	240	200	200	200	200	200	200	200	200	200	199	200	120	200	120	200	78	172	200	200	199	200	6,747
anchovy, bay	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	548	2,303	443	992	2,434	1,523	814	1,492	2,440	1,128	11,128	475	4,693	1,296	1,350	1,424	399	34,882
anchovy, striped	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	11	0	0	216	0	47	0	2	0	0	0	6	1	5	0	1	3	1	0	2	295
anchovy, spp (yoy-est)	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	2,667	15,700	935	1,515	3,410	13,110	3,254	2,179	1,267	8,537	1,135	0	2,382	93	2,004	9,786	19,220	87,194
bigeye	0	0	0	1	2	2	1	0	0	0	1	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	11
bigeye, short	1	2	0	0	1	2	0	0	0	1	1	0	3	2	0	0	0	1	5	0	0	0	0	0	0	0	0	0	0	0	0	1	20
black sea bass	34	53	44	24	22	21	39	39	5	20	34	12	27	22	18	50	69	134	394	64	124	42	19	116	122	121	37	91	410	449	1,295	1,109	5,061
blenny, feather	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4
blue runner	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	0	34	0	24	27	0	10	68	168
bluefish	9,927	8,946	5,712	3,517	3,857	12,568	8,195	5,845	5,269	6,469	16,245	5,524	6,705	10,815	8,814	7,843	6,135	3,986	3,450	3,766	6,504	6,532	2,100	9,378	1,699	3,657	2	2,765	3,851	1,829	4,457	2,650	189,010
bonito, Atlantic	0	2	0	1	1	1	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	9
burrfish, striped	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	2
butterfish	37,137	67,944	44,624	42,519	60,746	94,928	80,778	40,537	95,961	67,087	54,378	64,930	49,360	70,985	136,926	191,100	60,490	45,264	66,550	36,133	94,735	92,996	50,022	49,137	48,766	108,087	2,894	42,141	60,539	29,569	69,372	53,265	2,109,900
cod, Atlantic	0	0	0	0	0	0	1	0	0	0	0	2	0	1	0	0	1	0	0	58	33	10	0	0	0	15	21	109	0	0	5	5	261
Gadus spp. (yoy/larvae)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	0	0	0	34	8	17	0	0	5	16	116
cornetfish, red	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	14	17
cornte fish, blue spotted	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
crab, horseshoe	0	0	0	0	0	0	0	0	0	0	0	0	0	204	303	384	420	503	517	450	534	161	109	333	289	340	58	257	199	265	261	159	5,745
croaker, Atlantic	0	0	0	0	0	0	0	0	0	41	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	2	6	55
cunner	359	98	97	129	72	268	196	75	30	65	25	41	17	43	65	51	50	51	55	42	21	24	8	16	26	18	11	14	20	20	2	13	2,020
cusk-eel, fawn	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
cusk-eel, striped	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	2	0	0	6	0	11
dogfish, smooth	846	919	850	526	564	374	284	193	304	420	361	168	275	167	310	305	467	598	1,019	570	503	467	332	580	328	588	10	613	610	1,051	1,197	1,438	17,238
dogfish, spiny	89	252	173	76	434	99	417	14	6	14	58	0	1	7	18	10	4	48	17	85	38	41	11	32	35	148	3	58	16	21	15	19	2,260
drum, black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
eel, American	2	0	1	0	0	2	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	9
eel, american (yoy/larvae)	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0	0	0	1	0	0	0	0	0	0	0	3	4
eel, conger	0	0	0	0	0	0	0	0	1	3	0	2	1	0	0	2	0	2	0	3	0	0	0	0	0	0	0	3	1	1	0	1	20
eel, conger (yoy/larvae)	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	1	0	0	0	0	0	0	0	1	0	0	0	2
filefish, orange	0	1	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
filefish, planehead	4	20	1	0	25	13	23	1	0	10	1	0	3	0	0	3	0	1	0	1	0	0	1	0	1	1	0	0	0	0	4	2	115
flounder, American plaice	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	3
flounder, fourspot	2,691	2,759	2,126	2,112	4,653	2,924	4,698	3,553	2,774	1,447	1,674	2,584	2,815	4,122	1,908	1,393	2,590	2,167	1,859	1,877	1,406	688	466	1,094	902	1,036	402	1,400	2,597	1,144	820	386	65,066
flounder, smallmouth	2	0	2	15	39	13	4	20	12	30	17	19	41	58	97	96	61	98	139	49	50	44	7	48	89	96	31	67	258	128	152	73	1,854
flounder, summer	208	249	716	531	414	47	242	263	186	293	282	121	434	486	436	582	555	875	1,356	1,181	644	506	203	733	477	881	517	1,051	980	1,071	859	808	18,185
flounder, windowpane	26,200	18,936	22,514	15,588	26,919	31,082	14,738	8,482	2,980	8,526	6,678	3,815	14,116	10,324	6,483	4,643	2,488	3,065	1,991	2,177	2,275	1,982	1,077	4,051	3,511	2,496	2,850	2,831	3,536	2,096	2,191	1,150	261,789
flounder, winter	13,921	13,851	19,033	22,696	36,706	45,563	59,981	26,623	9,548	16,843	21,481	15,558	22,722	14,701	15,697	10,288	8,867	9,826	6,884	4,676	4,021	4,692	1,699	4,550	4,973	4,068	2,579	3,092	3,365	1,912	1,372	1,340	433,126
flounder, yellowtail	0	0	0	0	7	0	1	0	0	0	0	1	0	1	0	0	1	1	0	0	0	0	1	1	2	1	0	1	0	0	0	2	20
glasseye snapper	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	1	4	8	1	6	0	0	0	1	0	2	26
goatfish, dwarf	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
goatfish, red	1	0	0	0	0	0	2	1	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	21	1	0	29
goby, naked	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
goosefish	1	8	1	1	1	15	3	8	10	4	8	4	1	2	3	2	1	1	3	0	1	2	1	0	0	0	0	0	2	0	0	2	85
grubby	0	1	1	1	5	9	6	0	0	0	5	1	2	11	5	2	0	0	1	2	0	2	0	1	0	0	0	4	0	0	0	0	59
gunnel, rock	0	6	0	6	5	10	9	0	0	0	1	0	3	0	0	0	3	1	1	6	2	9	2	1	2	2	29	4	1	0	0	1	105
haddock	0	0	0	0	0	0	0	0	0	0	0	2	0	1	7	1	0	0	0	26	7	2	0	0	0	0	0	0	0	5	0	0	50
hake, red	3,696	1,161	3,061	2,258	3,808	7,365	3,300	2,085	1,606	4,183	546	1,977	872	748	3,015	2,973	2,393	1,382	2,103	873	829	585	625	2,788	1,723	897	990	278	1,720	849	398	480	61,565
hake, silver	1,525	724	1,464	1,848	3,427	3,551	4,243	1,537	544	508	2,136	1,941	489	1,973	1,870	5,126	679	3,945	2,013	496	1,417	165	1,267	290	6,587	947	1,747	948	7,519	519	323	100	61,867
hake, spotted	78	69	96	55	255	12	42	73	68	497	184	72	384	77	142	381	1,425	606	798	656	230	234	321	340	1,267	327	665	725	626	927	505	302	12,436
harvestfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3
herring, alewife	284	37	242	819	415	473	287	103	122	934	1,431	386	1,402	1,194	456	1,393	1,572	638	855	746	859	742	573	1,537	931	1,175	172	512	708	376	555	485	22,414
herring, Atlantic	112	510	2,536	2,549	2,721	2,560	25,029	4,003	4,565	6,271	3,850	9,135	972	3,455	893	2,511	770	497	365	459	851	1,168	66	1,932	356	6,330	1,318	1,482	571	3,566	1,838	630	93,869
herring, Atlantic (yoy-est)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,540	1,542	1,380	9,046	539	1,007	10,334	12	3,255	47	48	623	11,196	487	587	41,643
herring, Atlantic thread	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
herring, blueback	1,722	117	267	104	247	367	124	38	175	106	1,199	255	97	630	211	19	143	279	68	110	218	111	63	156	74	291	101	72	46	68	58	249	7,785
herring, round	22	15	0	1	0	0	0	0	2	6	2	0	0	0	31	0	0	5	0	0	0	0	0	0	0	0	0	0	2	0	0	1	87
hogchoker	293	282	140	87	113	118	259	104	61	73	37	17	45	15	12	39	40	85	100	92	83	61	22	78	38	39	34	147	340	250	246	255	3,604
jack, crevalle	0	1	0	1	4	0	0	0	0	6	8	1	0	3	0	8	0	0	1	2	2	2	0	2	0	1	0	4	2	0	2	4	54
jack, yellow	0	0	0	0	0	41	8	11	2	2	6	32	6	2	6	20	3	3	13	1	1	28	0	0	0	1	0	0	0	0	0	0	186
kingfish, northern	0	0	0	0	0	1	1	4	2	10	7	25	6	7	15	6	2	2	1	1	5	4	0	4	3	7	0	34	59	14	51	97	368
lamprey, sea	0	0	0	1	1	0	1	1	0	2	0	0	1	1	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	1	12
lizardfish, inshore	0	0	0	0	0	2	0	0	0	0	1	0	0	2	1	7	1	21	1	0	0	1	4	2	10	2	0	43	0	0	30	0	128
lobster, American	5,995	3,549	4,924	6,923	6,032	7,645	9,696	8,524	8,160	12,583	9,123	9,944	9,490	16,467	16,211	13,922	10,481	5,626	3,880	2,923	1,843	1,389	748	1,648	1,096	853	293	230	349	144	178	92	180,960
lookdown	0	0	0	0	0	0	2	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	7
lumpfish	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
mackerel, Atlantic	68	17	20	29	45	376	46	2	4	17	11	1	5	8	13	21	2	0	5	8	0	37	0	9	0	5	0	0	0	0	2	4	755

Appendix 5.2 cont.

Common name	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
(number of tows)	200	246	316	320	320	320	297	200	160	240	240	200	200	200	200	200	200	200	200	200	199	200	120	200	120	200	78	172	200	200	199	200	6,747
mackerel, Spanish	0	0	0	0	0	11	0	2	1	233	106	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	355
menhaden, Atlantic	161	304	718	600	335	623	407	348	1,115	298	411	318	88	116	306	1,187	492	86	366	799	746	235	28	426	47	69	7	181	426	234	723	1,279	13,477
moonfish	7	226	23	7	142	60	10	24	62	6	149	33	921	287	1,188	645	1,817	225	424	133	182	356	361	979	689	2,575	0	640	262	868	2,200	891	16,392
mullet, white	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2
ocean pout	26	3	14	14	30	58	39	42	18	66	42	30	26	15	13	17	18	6	13	14	18	3	5	12	9	22	6	27	14	0	0	2	621
perch, silver	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	3
perch, white	0	0	0	0	0	2	0	0	0	4	1	0	1	4	0	1	1	0	0	8	2	0	0	0	4	1	0	1	1	0	1	0	32
pinfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
pipefish, northern	1	0	1	0	3	0	0	0	5	21	2	2	0	1	0	2	4	4	2	6	2	4	3	2	0	2	4	4	1	2	1	2	81
pollock	5	0	3	8	6	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	18	2	5	0	1	0	0	56
pompano, African	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
puffer, northern	1	2	6	0	3	2	2	5	1	28	4	1	3	1	28	14	4	8	6	3	5	5	0	8	0	5	0	9	47	3	10	11	225
ray, bullnose ray	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
ray, roughtail stingray	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	1	0	0	0	1	0	0	1	1	0	0	1	9
rockling, fourbeard	376	89	184	312	563	686	393	163	150	242	93	169	109	199	133	233	185	251	106	113	173	106	14	87	81	47	35	43	43	3	4	20	5,405
rudderfish, banded	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2
salmon, Atlantic	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
sand lance, American	nc	nc	nc	nc	nc	nc	nc	nc	nc	3	25	95	0	2	4	178	4	4	3	19	70	6	0	30	7,495	1,227	13,061	9,535	2	7	12	4	31,786
sand lance, (yoy-est)	nc	nc	nc	nc	nc	nc	nc	nc	nc	0	1,000	5	0	0	100	1,075	0	430	0	0	0	0	5,444	2	3,750	7,932	0	15,600	0	0	0	0	35,338
scad, bigeye	0	0	0	0	15	63	1	1	0	0	3	0	2	1	1	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	111
scad, mackerel	0	0	0	0	0	0	1	2	6	0	4	1	3	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	21
scad, rough	34	32	19	89	180	81	41	1	0	100	13	0	35	65	0	0	0	10	10	12	14	62	14	13	0	59	0	150	19	28	5	144	1,231
scad, round	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	1	2	0	0	4	11	12	0	3	0	1	0	1	0	1	1	1	44
sculpin, longhorn	14	82	51	32	107	107	263	139	31	11	7	5	7	4	2	2	14	5	3	5	5	0	0	3	2	2	1	9	1	1	0	2	917
scup	8,806	18,054	16,449	9,761	12,566	37,642	21,193	45,790	13,646	32,218	38,456	13,985	16,087	9,582	23,742	101,095	101,464	58,325	100,481	26,926	61,521	52,642	28,829	75,681	53,560	46,991	7,157	34,457	53,119	24,961	45,705	80,534	1,271,425
sea raven	57	59	70	88	52	34	44	19	4	1	1	2	2	3	30	9	19	7	11	3	7	3	0	5	0	5	6	3	5	0	1	0	550
sea turtle, kemp's ridley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
seahorse, lined	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
searobin, northern	585	2,267	546	280	605	381	357	609	313	951	878	1,317	672	579	360	547	2,014	1,594	2,123	1,632	784	265	630	691	809	2,012	1,128	803	3,642	1,934	2,584	805	34,698
searobin, striped	1,434	2,295	2,035	1,482	2,086	2,211	2,353	865	857	1,491	1,298	682	1,008	819	1,321	1,690	3,129	2,061	2,394	2,235	1,308	757	366	755	612	1,507	141	1,630	2,973	2,724	2,544	2,728	51,791
seasnail	0	0	0	0	1	0	8	0	0	0	0	0	0	0	0	0	0	4	0	0	4	2	0	0	0	0	0	0	0	0	0	0	19
sennet, northern	1	0	0	0	0	1	0	0	0	2	0	0	0	0	0	6	0	1	2	0	0	8	0	2	0	5	0	1	3	0	0	0	32
shad, American	1,852	425	642	1,036	3,208	4,007	550	361	380	1,142	1,723	755	501	922	901	987	316	109	593	689	356	177	68	236	405	422	165	271	321	222	162	275	24,177
shad, gizzard	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	1	1	2	0	1	0	0	0	0	1	0	0	0	9
shad, hickory	71	4	7	6	4	40	2	1	12	10	31	6	29	25	40	56	42	14	45	41	39	136	75	37	5	13	2	8	42	33	30	12	918
shark, sandbar (brown)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
sharksucker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
silverside, Atlantic	0	0	0	0	0	0	0	0	1	54	3	39	0	2	0	1	2	1	0	1	0	0	0	1	2	3	1	0	0	3	1	5	120
skate, barndoor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
skate, clearnose	0	0	3	2	1	1	3	2	8	8	1	4	1	4	20	22	18	65	59	68	22	102	36	97	37	69	1	56	280	218	104	131	1,442
skate, little	2,751	4,614	4,303	3,847	9,471	9,349	11,902	6,479	3,495	6,051	6,714	2,372	6,203	4,068	4,305	3,686	3,340	4,311	4,242	4,071	3,044	1,317	593	1,277	682	709	281	674	1,406	583	770	387	117,295
skate, winter	1	20	34	17	114	120	85	50	31	62	51	41	88	48	62	41	31	38	45	82	53	31	23	44	51	44	16	37	97	91	82	30	1,659
smelt, rainbow	0	0	0	0	5	4	2	2	0	9	9	4	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	37
snapper, mahogany	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
spot	0	34	38	10	29	0	8	2	0	124	53	3	195	10	0	45	204	13	52	1	8	0	14	0	308	1	0	5	858	1,917	20	14	3,964
squid, long-finned	0	0	11,018	15,135	33,400	21,304	23,789	12,322	32,780	58,312	25,396	23,974	22,720	13,048	27,443	21,580	16,585	9,080	8,034	21,350	23,022	17,542	7,802	24,212	10,490	24,130	1,906	13,020	9,767	5,393	13,436	28,266	576,256
stargazer, northern	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	2
striped bass	10	13	12	30	31	59	117	38	42	81	81	165	232	319	400	397	293	214	469	383	378	469	144	422	199	466	71	243	170	200	255	187	6,588
sturgeon, Atlantic	11	3	6	6	7	13	9	3	30	60	60	6	3	5	17	39	7	18	18	29	8	9	21	18	7	18	1	5	7	4	13	1	462
tautog	734	773	796	624	629	791	693	501	265	164	224	61	136	190	194	217	287	319	565	225	232	179	186	280	179	163	53	106	135	161	194	308	10,563
toadfish, oyster	3	4	9	0	0	3	4	1	0	2	0	1	0	0	3	2	6	2	8	9	1	0	1	5	3	3	0	1	0	5	2	2	80
tomcod, Atlantic	2	1	0	8	2	3	3	4	8	5	2	4	2	1	0	1	0	0	0	0	2	0	0	0	0	1	0	2	0	0	0	0	51
triggerfish, gray	0	1	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
weakfish	366	2,740	7,751	327	1,341	5,914	2,246	4,320	1,317	2,060	8,156	2,881	6,375	3,904	3,495	12,416	23,595	12,739	10,713	8,183	17,505	9,191	241	17,386	2,531	2,604	1	2,583	6,785	1,964	10,477	10,077	202,183

Appendix 5.2 cont.

Total count of finfish, lobster, Horseshoe crab and squid taken in the LISTS, 1984-2015.

Year	Tows	Total Count
1984	200	122,527
1985	246	152,574
1986	316	153,383
1987	320	136,139
1988	320	216,479
1989	320	294,026
1990	297	277,183
1991	200	174,235
1992	160	186,975
1993	240	230,301
1994	240	204,795
1995	200	163,532
1996	200	165,756
1997	200	170,761
1998	200	258,082
1999	200	392,831
2000	200	271,608
2001	200	172,622
2002	200	229,284
2003	200	131,812
2004	199	250,439
2005	200	200,991
2006	120	109,330
2007	200	215,638
2008	120	164,948
2009	200	239,154
2010	78	39,340
2011	172	146,254
2012	200	170,798
2013	200	102,413
2014	199	177,250
2015	200	211,566
	6,747	6,133,026

Appendix 5.3. Annual total weight (kg) of finfish, lobster and squid taken in LISTS, 1992-2015.

Weights include all tows – number of tows shown in second row. Refer to Appendix 5.4 for details on number of tows conducted per month. Note: nw = not weighed.

Common name	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
(number of tows)	160	240	240	200	200	200	200	200	200	200	200	200	199	200	120	200	160	200	78	172	200	200	199	200	4,568
anchovy, bay	nw	nw	nw	nw	nw	nw	nw	5.6	12.2	3.6	6.6	13.3	10.3	5.8	8.3	14.5	7.7	35.3	2.8	10.5	8.6	6.8	9.4	3.1	**164.4**
anchovy, striped	nw	nw	nw	nw	0.2	0.0	0.0	6.1	0.0	1.2	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.4	0.0	0.1	0.2	0.1	0.0	0.1	**8.7**
Anchovy, spp (yoy-est)	nw	nw	nw	nw	nw	nw	nw	0.5	4.5	0.8	1.5	2.0	3.0	1.5	0.6	0.8	5.1	0.7	0.0	1.0	0.4	1.3	2.6	3.3	**29.6**
bigeye	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	**0.5**
bigeye, short	0.0	0.1	0.1	0.0	0.3	0.2	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	**1.1**
black sea bass	1.8	6.4	11.0	4.7	12.1	10.5	10.6	17.2	22.6	74.8	188.3	49.6	40.5	26.4	9.3	46.8	29.8	59.5	20.1	54.2	141.0	181.2	543.3	678.0	**2,239.7**
blenny, feather	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.2**
blue runner	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.0	2.3	0.0	1.7	2.7	0.0	0.9	6.7	**14.7**
bluefish	2,462.9	2,226.1	2,341.7	1,156.1	1,118.2	977.6	899.0	1,218.0	1,408.0	751.2	1,099.7	791.6	2,140.6	1,333.8	358.6	1,801.3	641.4	1,157.4	6.1	584.7	532.7	517.7	522.7	324.4	**26,371.5**
bonito, Atlantic	0.0	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**12.0**
burrfish, striped	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	**1.0**
butterfish	1,357.3	1,450.1	1,202.2	1,664.5	1,844.7	2,017.2	3,661.1	4,171.6	1,458.3	1,834.0	1,924.2	682.8	1,842.7	2,097.3	1,631.4	1,446.2	1,442.0	3,186.9	166.9	1,600.8	1,891.3	1,252.5	1,707.6	1,011.2	**42,544.8**
cod, Atlantic	0.0	0.0	0.0	0.1	0.0	0.3	0.0	0.0	0.1	0.0	0.0	2.8	4.7	0.9	0.0	0.0	0.0	1.0	2.1	9.2	0.0	0.0	0.3	4.7	**26.2**
Gadus spp. (yoy/larvae)	nw	nw	nw	nw	nw	nw	nw	nw	nw	nw	nw	nw	nw	1.5	0	0	0	1.8	0.3	0.4	0	0	0.4	1.1	**5.5**
cornetfish, red	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.6	**0.8**
corntefish, blue spotted	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	**0.1**
crab, horseshoe	514.1	807.9	463.1	116.8	717	472.4	489.4	634.1	689.4	870.7	862.9	751	873.4	304.2	205.8	596.4	496.8	645.8	112.2	505.2	385.8	531.8	497.3	288.3	**12,831.8**
croaker, Atlantic	0.0	2.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.1	0.2	1.5	**4.9**
cunner	3.7	6.2	2.1	4.4	2.6	4.1	8.1	5.9	5.3	5.9	7.2	6.7	3.7	4.1	1.3	3.0	3.6	1.8	1.3	1.9	2.8	1.8	0.2	1.8	**89.5**
cusk-eel, fawn	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.2**
cusk-eel, striped	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.0	0.0	0.6	0.0	**1.0**
dogfish, smooth	863.2	1,339.1	934.6	566.8	862.8	527.3	989.8	923.0	1,038.5	1,407.6	2,814.3	1,527.4	1,435.3	1,421.7	1,176.6	2,110.2	1,134.2	2,213.3	34.4	2,031.7	1,833.3	2,162.3	2,799.2	2,804.1	**34,950.7**
dogfish, spiny	30.7	58.4	199.6	0.0	2.1	13.7	44.5	51.1	9.9	128.6	48.0	239.5	104.7	102.0	47.0	122.3	127.7	545.7	16.2	203.5	62.8	91.5	62.2	80.8	**2,392.5**
drum, black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	**0.1**
eel, American	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**3.1**
eel, American (yoy)	nw	nw	nw	nw	nw	nw	nw	nw	nw	nw	nw	nw	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	**0.3**
eel, conger	0.1	0.2	0.0	1.2	0.1	0.0	0.0	0.5	0.0	0.3	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.3	1.2	0.0	0.3	**6.4**
eel, conger (yoy)	nw	nw	nw	nw	nw	nw	nw	nw	nw	nw	nw	nw	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	**0.2**
filefish, orange	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.2**
filefish, planehead	0.0	0.8	0.1	0.0	0.3	0.0	0.0	0.3	0.0	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.4	0.2	**2.6**
flounder, American plaice	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	**0.3**
flounder, fourspot	382.4	193.6	202.4	402.9	407.2	615.3	306.0	203.9	398.6	362.7	326.9	350.1	309.3	125.9	88.1	224.9	186.3	169.8	92.0	224.2	454.5	203.4	145.0	76.3	**6,451.7**
flounder, smallmouth	0.6	2.6	1.5	1.2	2.3	2.4	6.4	5.2	2.7	3.8	4.9	3.0	2.8	2.4	0.6	2.6	3.2	4.7	1.4	3.5	7.5	5.2	6.0	3.6	**80.1**
flounder, summer	142.1	193.1	173.0	79.6	266.4	326.0	431.3	459.8	471.3	628.1	989.3	845.7	627.2	406.1	180.5	590.9	398.0	694.4	229.6	713.0	718.5	726.6	567.4	449.3	**11,307.2**
flounder, windowpane	286.1	578.9	597.2	356.2	1,223.6	986.1	741.1	594.2	368.8	475.5	343.3	378.8	333.7	177.5	128.9	510.8	524.0	342.8	449.3	395.9	501.1	326.6	365.6	191.1	**11,177.1**
flounder, winter	1,344.8	1,898.0	2,060.9	1,614.7	3,335.0	2,439.4	2,450.3	2,011.7	1,921.4	1,993.6	1,584.1	1,421.9	839.9	566.1	271.2	951.3	751.9	524.0	450.5	613.8	604.9	576.8	459.7	319.7	**31,005.6**
flounder, yellowtail	0.0	0.0	0.0	0.1	0.0	0.3	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.4	1.0	0.4	0.2	0.0	0.3	0.0	0.0	0.0	0.7	**3.7**
glasseye snapper	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.7	0.1	0.6	0.0	0.0	0.0	0.1	0.0	0.1	**1.9**
goatfish, red	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.1	0.0	**0.9**
goby, naked	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.1**
goosefish	2.5	0.5	2.0	3.3	0.1	1.6	3.2	0.3	0.2	0.4	0.6	0.0	0.1	0.7	1.2	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.1	**17.6**
grubby	0.0	0.0	0.3	0.1	0.2	0.7	0.3	0.2	0.0	0.0	0.1	0.1	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	**2.4**
gunnel, rock	0.0	0.0	0.1	0.0	0.2	0.0	0.0	0.0	0.2	0.1	0.1	0.4	0.2	0.6	0.1	0.1	0.2	0.2	0.5	0.2	0.1	0.0	0.0	0.1	**3.4**
haddock	0.0	0.0	0.0	0.2	0.0	0.1	0.5	0.1	0.0	0.0	0.0	1.3	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	**3.4**
hake, red	127.7	254.4	63.9	145.6	95.5	80.5	217.5	226.5	162.6	109.7	206.6	73.4	51.6	56.0	37.4	200.4	141.3	59.5	64.3	25.1	148.6	61.1	33.5	44.5	**2,687.2**
hake, silver	22.0	21.9	127.6	61.6	20.0	70.8	88.3	99.6	28.8	152.2	89.6	13.9	27.3	7.1	37.7	14.6	208.5	50.0	35.4	40.3	171.0	23.6	10.6	6.5	**1,428.9**
hake, spotted	10.3	55.9	32.4	6.5	42.6	19.0	12.2	38.8	92.3	34.9	48.2	70.4	37.8	17.4	24.3	23.9	65.8	32.1	15.8	76.8	64.2	66.8	59.5	40.1	**988.0**
harvestfish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	**0.3**
herring, Atlantic	797.5	1,120.0	769.3	1,631.7	189.8	515.1	74.6	45.4	124.1	72.6	63.9	89.1	58.3	131.1	10.3	234.2	52.1	239.2	179.0	199.4	61.5	321.2	91.2	71.8	**7,142.4**
herring, Atlantic (yoy-est)	nw	nw	nw	nw	nw	nw	nw	nw	nw	1.5	1.9	2.8	2.4	1.2	0.2	4.2	0.4	1.9	0.3	0.5	1.2	7.3	0.5	1.3	**27.6**
herring, Atlantic thread	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	**0.1**
herring, alewife	9.2	54.5	83.2	24.6	134.6	81.3	35.1	107.6	96.0	41.7	70.2	55.3	56.1	47.6	49.5	101.3	51.1	96.0	14.3	29.8	47.0	34.1	43.2	30.5	**1,393.8**
herring, blueback	8.5	4.7	31.2	7.5	6.2	16.5	5.1	1.1	6.8	11.1	2.4	4.0	6.5	5.4	2.5	9.1	3.2	14.6	3.4	3.2	1.6	4.3	4.2	7.1	**170.2**
herring, round	0.2	0.3	0.2	0.0	0.0	0.0	0.6	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	**1.6**
hogchoker	5.6	7.3	3.9	1.7	5.4	1.8	1.9	5.0	5.9	10.5	13.3	8.6	9.5	8.7	3.2	11.4	5.6	4.5	4.4	16.8	30.7	27.2	27.8	31.2	**251.9**
jack, crevalle	0.0	0.5	0.5	0.1	0.0	0.6	0.0	0.7	0.0	0.0	0.1	0.2	0.2	0.2	0.0	0.1	0.0	0.1	0.0	0.4	0.2	0.0	0.2	0.4	**4.5**
jack, yellow	0.2	0.2	0.4	2.1	0.5	0.2	0.7	1.9	0.2	0.3	1.4	0.1	0.1	3.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	**11.4**
kingfish, northern	0.2	1.0	0.5	2.5	0.6	0.9	1.3	0.6	0.3	0.2	0.2	0.6	0.5	0.6	0.0	0.4	0.4	0.4	0.0	3.7	8.4	2.3	3.2	7.1	**35.9**
lamprey, sea	0.0	1.0	0.0	0.0	0.7	0.1	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.1	0.8	0.0	0.0	0.0	0.0	0.0	0.0	1.2	**5.2**
lizardfish, inshore	0.0	0.0	0.1	0.0	0.0	0.2	0.1	0.5	0.1	2.2	0.1	0.0	0.0	0.1	0.4	0.2	0.5	0.2	0.0	4.6	0.0	0.0	2.8	0.0	**12.1**
lobster, American	1,537.9	2,700.3	1,956.1	2,141.9	2,113.5	3,800.9	3,873.9	3,397.9	2,184.5	1,531.2	1,005.7	690.9	481.5	364.3	197.9	396.5	314.1	244.0	83.6	52.0	70.0	37.3	31.5	24.0	**29,231.4**
lookdown	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	**0.5**
lumpfish	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.2**
mackerel, Atlantic	1.0	1.3	0.9	0.1	0.5	1.7	1.1	3.1	0.8	0.0	2.5	1.9	0.0	5.7	0.0	0.8	0.0	0.4	0.0	0.0	0.0	0.0	0.2	0.4	**22.4**

Appendix 5.3 cont.

Common name	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
(number of tows)	160	240	240	200	200	200	200	200	200	200	200	200	199	200	120	200	160	200	78	172	200	200	199	200	4,568
mackerel, Spanish	1.5	5.3	6.4	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**15.5**
menhaden, Atlantic	60.6	103.9	87.8	41.9	40.5	38.5	9.2	90.9	31.8	4.7	96.3	344.9	110.7	77.9	5.5	63.9	10.4	18.0	2.7	69.8	144.6	87.5	267.8	361.2	**2,171.0**
moonfish	1.5	0.6	4.1	2.1	11.6	4.6	13.4	9.6	15.0	3.8	7.4	2.3	3.4	6.0	3.5	12.0	13.4	19.5	0.0	6.3	3.6	10.0	23.2	14.6	**191.5**
mullet, white	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	**0.2**
ocean pout	7.7	16.4	9.1	6.5	7.2	4.8	2.7	3.9	4.9	2.3	4.3	2.9	5.4	0.7	0.9	3.2	2.1	4.8	1.4	4.5	2.0	0.0	0.0	0.5	**98.2**
perch, silver	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.0	**0.3**
perch, white	0.0	0.3	0.3	0.0	0.1	0.9	0.0	0.4	0.2	0.0	0.0	1.4	0.5	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.2	0.0	0.2	0.0	**4.8**
pinfish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	**0.2**
pipefish, northern	0.4	0.6	0.2	0.1	0.0	0.1	0.0	0.1	0.2	0.3	0.2	0.4	0.2	0.3	0.2	0.2	0.0	0.2	0.3	0.3	0.1	0.2	0.1	0.2	**4.9**
pollock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.8	0.1	0.5	0.0	0.1	0.0	0.0	**2.0**
pompano, African	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.1**
puffer, northern	0.1	0.9	0.4	0.1	0.3	0.1	0.5	1.1	0.4	0.7	0.3	0.3	0.4	0.3	0.0	0.5	0.0	0.4	0.0	0.9	3.1	0.3	1.3	0.8	**13.2**
ray, bullnose ray	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.7	0.0	0.0	**5.7**
ray, roughtail stingray	0.0	0.0	0.0	0.0	0.0	50.6	3.4	0.0	0.0	2.5	24.4	0.0	4.1	0.0	0.0	0.0	3.0	0.0	0.0	13.0	5.0	0.0	0.0	7.8	**113.8**
rockling, fourbeard	12.8	15.7	8.5	14.7	8.6	17.3	11.6	28.8	14.7	21.5	9.7	9.2	13.0	6.8	1.5	7.6	7.1	3.9	2.9	4.0	3.5	0.2	0.4	2.0	**226.0**
rudderfish, banded	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	**0.4**
salmon, Atlantic	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.1**
sand lance, American	nw	0.3	0.6	0.4	0.0	0.1	0.3	0.3	0.3	0.3	0.1	0.2	0.2	0.2	0.0	0.3	7.2	2.0	5.2	7.5	0.2	0.1	0.2	0.1	**26.1**
sand lance, (yoy - est)	nw	0.0	0.8	0.1	0.0	0.0	0.1	0.4	0.0	0.6	0.0	0.0	0.0	0.0	2.9	0.1	0.2	2.3	0.0	3.8	0.0	0.0	0.0	0.0	**11.3**
scad, bigeye	0.0	0.0	0.3	0.0	0.1	0.1	0.1	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	**2.3**
scad, mackerel	0.2	0.0	0.4	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	**1.1**
scad, rough	0.0	4.4	0.2	0.0	1.5	2.0	0.0	0.0	0.0	0.7	0.7	0.5	0.7	1.9	0.5	0.7	0.0	2.8	0.0	6.8	1.1	1.3	0.5	7.1	**33.4**
scad, round	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.1	0.2	0.0	0.0	0.3	0.3	0.3	0.0	0.3	0.0	0.1	0.0	0.1	0.0	0.1	0.1	0.1	**2.5**
sculpin, longhorn	9.0	3.2	1.6	1.3	2.1	0.8	1.0	0.3	5.0	1.5	0.9	2.0	3.4	0.0	0.0	0.8	0.3	0.3	0.4	2.0	0.2	0.4	0.0	0.7	**37.2**
scup	837.7	867.9	878.1	770.5	739.4	530.5	740.5	3,641.3	6,679.0	5,828.4	13,814.0	5,221.9	6,801.1	3,080.7	4,636.1	5,333.5	6,509.9	6,332.1	1,971.6	6,759.5	6,170.2	5,945.6	5,161.4	6,045.5	**105,296.4**
sea raven	3.9	0.6	0.2	0.7	1.5	0.4	11.3	4.9	9.2	4.1	4.1	1.6	2.4	0.5	0.0	3.6	0.0	1.7	1.6	0.9	1.1	0.0	1.5	0.0	**55.8**
sea turtle, kemp's ridley	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	**3.8**
seahorse, lined	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.1**
searobin, northern	35.6	97.9	66.7	166.9	57.4	60.4	39.4	52.0	251.2	222.7	267.3	252.2	112.0	21.3	74.5	74.2	58.8	194.3	149.5	85.5	405.2	161.7	225.9	133.2	**3,265.8**
searobin, striped	305.1	260.0	208.6	277.5	278.7	230.5	509.7	497.0	1,036.1	861.0	1,065.0	805.1	465.4	183.7	113.5	217.0	263.0	471.8	66.4	558.7	1,086.4	1,112.5	1,020.8	1,058.2	**12,951.7**
seasnail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.7**
sennet, northern	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.1	0.2	0.0	0.0	0.7	0.0	0.2	0.0	0.4	0.0	0.1	0.3	0.0	0.0	0.0	**2.7**
shad, American	63.3	138.9	165.8	81.4	36.2	66.8	60.2	117.3	25.8	9.6	40.3	40.8	24.2	18.2	6.1	15.8	20.2	28.9	8.6	17.5	25.3	15.3	12.3	24.7	**1,063.5**
shad, gizzard	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	**0.9**
shad, hickory	4.9	4.4	7.6	2.5	10.2	9.1	15.9	19.4	17.1	6.7	19.6	20.1	14.2	43.1	19.1	10.4	1.1	3.6	0.4	1.5	14.1	10.8	10.5	5.5	**271.8**
sharksucker	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.3**
silverside, Atlantic	0.1	1.0	0.3	0.9	0.0	0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.2	0.3	0.1	0.0	0.0	0.3	0.1	0.4	**4.3**
skate, barndoor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.4**
skate, clearnose	10.3	11.3	1.8	11.0	1.7	7.4	36.8	39.4	37.9	132.4	107.3	130.8	48.2	187.1	52.4	193.3	78.1	148.5	4.5	109.8	491.7	387.0	207.7	225.0	**2,661.4**
skate, little	1,389.0	2,534.8	3,091.5	1,055.3	2,801.8	1,945.8	2,085.5	1,829.6	1,604.7	2,022.6	2,121.9	2,187.3	1,689.8	682.5	310.6	697.0	327.4	390.0	148.3	359.4	657.9	317.8	428.2	192.0	**30,870.7**
skate, winter	105.3	220.9	139.2	89.2	212.7	109.7	180.7	89.8	66.5	112.2	133.5	162.1	100.3	59.9	60.0	117.8	140.8	108.5	37.7	101.2	179.8	111.2	133.8	51.8	**2,824.6**
smelt, rainbow	0.0	0.6	0.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.7**
snapper, mahogany	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	**0.1**
spot	0.0	10.6	4.3	0.3	14.1	1.1	0.0	5.7	17.8	1.3	7.2	0.1	0.9	0.0	1.2	0.0	21.3	0.2	0.0	0.7	107.5	195.4	1.8	1.7	**393.2**
squid, long-finned	844.9	1,629.1	965.4	796.4	720.4	515.2	767.0	826.4	582.3	346.2	279.9	573.2	953.4	683.5	326.0	773.6	330.1	648.4	161.4	370.7	333.9	170.8	582.3	1,366.2	**15,546.7**
stargazer, northern	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	**0.2**
striped bass	89.4	210.3	198.6	185.3	373.5	509.9	484.2	815.4	602.6	472.5	855.2	770.3	811.8	675.1	418.7	888.0	456.3	897.4	173.2	721.9	278.0	421.0	407.5	405.2	**12,121.3**
sturgeon, Atlantic	244.8	633.6	848.6	145.5	19.9	37.8	189.7	498.6	79.0	270.6	275.3	550.2	117.6	152.7	368.7	336.4	111.3	286.6	5.6	181.9	154.2	98.0	272.4	15.8	**5,894.8**
tautog	508.3	320.0	373.9	95.1	225.9	271.8	347.1	326.6	463.5	491.2	921.1	346.0	353.7	269.2	301.4	551.4	309.4	285.4	83.1	151.7	128.9	160.8	192.5	339.7	**7,817.7**
toadfish, oyster	0.0	1.2	0.0	0.5	0.0	0.0	0.9	1.8	2.5	0.4	4.7	5.0	0.8	0.0	1.2	2.0	1.9	0.8	0.0	0.2	0.0	0.9	0.6	0.9	**26.3**
tomcod, Atlantic	1.3	0.8	0.3	0.8	0.3	0.1	0.0	0.7	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.0	0.0	0.0	0.0	**4.8**
triggerfish, gray	0.0	0.9	0.0	0.0	0.0	0.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**3.2**
weakfish	94.8	121.2	344.5	275.7	414.9	362.0	268.2	771.3	554.5	415.0	442.0	194.8	426.9	449.9	52.2	584.8	116.1	108.7	1.0	192.6	409.2	203.7	334.8	530.4	**7,669.2**
Total	**14,545.1**	**20,214.3**	**18,679.6**	**14,022.0**	**18,386.1**	**17,763.5**	**20,136.1**	**23,914.0**	**22,617.2**	**21,748.8**	**32,213.8**	**19,710.6**	**21,370.3**	**13,830.5**	**11,233.6**	**19,312.0**	**15,386.5**	**20,294.8**	**4,812.3**	**17,144.4**	**18,361.7**	**16,592.2**	**17,288.4**	**17,313.4**	**436,891.2**

Appendix 5.4. Total number and weight (kg) of finfish and invertebrates caught in LISTS in 1984.
Finfish species are in order of descending count. Number of tows (sample size)=102.

species	count	%	weight	%	species	count	%	weight	%
butterfish	18,700	31.0	.	.	Atlantic mackerel	48	0.1	.	.
windowpane flounder	13,746	22.8	.	.	spotted hake	46	0.1	.	.
winter flounder	6,847	11.4	.	.	sea raven	32	0.1	.	.
bluefish	6,738	11.2	.	.	ocean pout	25	0	.	.
scup	3,225	5.4	.	.	rough scad	22	0	.	.
fourspot flounder	1,868	3.1	.	.	longhorn sculpin	12	0	.	.
little skate	1,491	2.5	.	.	black sea bass	11	0	.	.
red hake	1,323	2.2	.	.	moonfish	7	0	.	.
American shad	982	1.6	.	.	Atlantic sturgeon	6	0	.	.
blueback herring	925	1.5	.	.	round herring	5	0	.	.
striped searobin	697	1.2	.	.	spiny dogfish	4	0	.	.
silver hake	575	1.0	.	.	American eel	2	0	.	.
smooth dogfish	534	0.9	.	.	striped bass	2	0	.	.
tautog	472	0.8	.	.	oyster toadfish	2	0	.	.
northern searobin	448	0.7	.	.	goosefish	1	0	.	.
fourbeard rockling	303	0.5	.	.	northern sennet	1	0	.	.
weakfish	260	0.4	.	.	northern puffer	1	0	.	.
hogchoker	252	0.4	.	.	red goatfish	1	0	.	.
cunner	220	0.4	.	.	**Total**	**60,230**			
summer flounder	150	0.2	.	.					
alewife	108	0.2	.	.	**Invertebrates**				
hickory shad	71	0.1	.	.	American lobster	2865	100	.	.
Atlantic menhaden	67	0.1	.	.	**Total**	**2,865**		-	

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in LISTS in 1985.
Finfish species are in order of descending count. Number of tows (sample size)=126.

species	count	%	weight	%
butterfish	34,512	41.4	.	.
scup	12,155	14.6	.	.
windowpane flounder	11,194	13.4	.	.
winter flounder	7,980	9.6	.	.
bluefish	5,302	6.4	.	.
weakfish	2,650	3.2	.	.
northern searobin	2,098	2.5	.	.
little skate	1,705	2.0	.	.
fourspot flounder	1,289	1.5	.	.
striped searobin	1,078	1.3	.	.
red hake	573	0.7	.	.
Atlantic herring	504	0.6	.	.
smooth dogfish	405	0.5	.	.
tautog	323	0.4	.	.
American shad	280	0.3	.	.
silver hake	250	0.3	.	.
summer flounder	175	0.2	.	.
hogchoker	163	0.2	.	.
moonfish	142	0.2	.	.
blueback herring	100	0.1	.	.
longhorn sculpin	80	0.1	.	.
cunner	51	0.1	.	.
sea raven	50	0.1	.	.
fourbeard rockling	44	0.1	.	.
Atlantic menhaden	38	0	.	.
black sea bass	35	0	.	.
spotted hake	27	0	.	.
spot	26	0	.	.
round herring	15	0	.	.
rough scad	14	0	.	.
Atlantic mackerel	13	0	.	.
spiny dogfish	13	0	.	.
winter skate	13	0	.	.
alewife	9	0	.	.
planehead filefish	7	0	.	.
rock gunnel	4	0	.	.
oyster toadfish	4	0	.	.
goosefish	3	0	.	.
ocean pout	3	0	.	.
Atlantic bonito	2	0	.	.
crevalle jack	1	0	.	.
grubby	1	0	.	.
gray triggerfish	1	0	.	.
hickory shad	1	0	.	.
orange filefish	1	0	.	.
northern puffer	1	0	.	.
Atlantic sturgeon	1	0	.	.
Atlantic tomcod	1	0	.	.
Total	**83,395**		-	

Invertebrates				
American lobster	1589	100	.	.
Total	**1,589**		-	

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in LISTS in 1986.
Finfish species are in order of descending count. Invertebrate species are in order of descending weight. Number of tows (sample size)=196.

species	count	%	weight	%
butterfish	25,192	28.0	.	.
windowpane flounder	18,848	20.9	.	.
winter flounder	15,341	17.0	.	.
scup	7,910	8.8	.	.
weakfish	5,427	6.0	.	.
little skate	3,210	3.6	.	.
bluefish	2,789	3.1	.	.
red hake	2,657	3.0	.	.
Atlantic herring	1,999	2.2	.	.
fourspot flounder	1,487	1.7	.	.
striped searobin	886	1.0	.	.
silver hake	723	0.8	.	.
tautog	566	0.6	.	.
smooth dogfish	430	0.5	.	.
summer flounder	414	0.5	.	.
northern searobin	396	0.4	.	.
American shad	344	0.4	.	.
Atlantic menhaden	318	0.4	.	.
blueback herring	256	0.3	.	.
alewife	216	0.2	.	.
fourbeard rockling	123	0.1	.	.
cunner	76	0.1	.	.
sea raven	70	0.1	.	.
hogchoker	60	0.1	.	.
longhorn sculpin	51	0.1	.	.
spiny dogfish	47	0.1	.	.
winter skate	32	0	.	.
spotted hake	30	0	.	.
black sea bass	28	0	.	.
spot	25	0	.	.
Atlantic mackerel	19	0	.	.
moonfish	14	0	.	.
ocean pout	14	0	.	.
oyster toadfish	9	0	.	.
hickory shad	6	0	.	.
rough scad	5	0	.	.
Atlantic sturgeon	4	0	.	.
clearnose skate	2	0	.	.
American eel	1	0	.	.
goosefish	1	0	.	.
grubby	1	0	.	.
northern pipefish	1	0	.	.
northern puffer	1	0	.	.
smallmouth flounder	1	0	.	.
striped bass	1	0	.	.
Total	**90,031**		-	

species	count	%	weight	%
<u>**Invertebrates**</u>				
American lobster	2,553	28.1	.	.
long-finned squid	6,537	71.9	.	.
Total	**9,090**		-	

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in LISTS in 1987. *Finfish species are in order of descending count. Invertebrate species are in order of descending weight. Number of tows (sample size)=200.*

species	count	%	weight	%
winter flounder	15,600	25.6	.	.
butterfish	14,674	24.1	.	.
windowpane flounder	11,031	18.1	.	.
scup	5,029	8.3	.	.
bluefish	2,611	4.3	.	.
little skate	2,140	3.5	.	.
red hake	1,729	2.8	.	.
Atlantic herring	1,628	2.7	.	.
fourspot flounder	1,298	2.1	.	.
silver hake	906	1.5	.	.
alewife	754	1.2	.	.
striped searobin	543	0.9	.	.
summer flounder	374	0.6	.	.
American shad	371	0.6	.	.
tautog	363	0.6	.	.
Atlantic menhaden	329	0.5	.	.
smooth dogfish	257	0.4	.	.
weakfish	248	0.4	.	.
fourbeard rockling	241	0.4	.	.
northern searobin	220	0.4	.	.
sea raven	86	0.1	.	.
blueback herring	79	0.1	.	.
cunner	79	0.1	.	.
hogchoker	61	0.1	.	.
rough scad	48	0.1	.	.
longhorn sculpin	32	0.1	.	.
spotted hake	22	0	.	.
spiny dogfish	19	0	.	.
ocean pout	14	0	.	.
black sea bass	13	0	.	.
winter skate	13	0	.	.
striped bass	10	0	.	.
Atlantic tomcod	8	0	.	.
smallmouth flounder	7	0	.	.
moonfish	6	0	.	.
rock gunnel	4	0	.	.
Atlantic sturgeon	4	0	.	.
spot	3	0	.	.
clearnose skate	2	0	.	.
hickory shad	2	0	.	.
Atlantic bonito	1	0	.	.
Atlantic mackerel	1	0	.	.
round herring	1	0	.	.
sea lamprey	1	0	.	.
Total	**60,862**		-	
Invertebrates				
American lobster	3,544	25.1	.	.
long-finned squid	10,552	74.9	.	.
Total	**14,096**		-	

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in LISTS in 1988. *Finfish species are in order of descending count. Invertebrate species are in order of descending weight. Number of tows (sample size)=200.*

species	count	%	weight	%
butterfish	45,983	36.7	.	.
winter flounder	25,695	20.5	.	.
windowpane flounder	19,497	15.6	.	.
scup	10,184	8.1	.	.
little skate	6,539	5.2	.	.
bluefish	3,688	2.9	.	.
fourspot flounder	2,478	2.0	.	.
red hake	1,933	1.5	.	.
weakfish	1,287	1.0	.	.
silver hake	1,210	1.0	.	.
striped searobin	1,194	1.0	.	.
Atlantic herring	1,193	1.0	.	.
American shad	1,187	0.9	.	.
northern searobin	474	0.4	.	.
tautog	455	0.4	.	.
smooth dogfish	385	0.3	.	.
summer flounder	320	0.3	.	.
fourbeard rockling	302	0.2	.	.
blueback herring	164	0.1	.	.
alewife	153	0.1	.	.
moonfish	137	0.1	.	.
rough scad	128	0.1	.	.
longhorn sculpin	103	0.1	.	.
winter skate	101	0.1	.	.
spotted hake	87	0.1	.	.
hogchoker	75	0.1	.	.
Atlantic menhaden	69	0.1	.	.
sea raven	50	0	.	.
cunner	48	0	.	.
spiny dogfish	39	0	.	.
smallmouth flounder	34	0	.	.
ocean pout	30	0	.	.
Atlantic mackerel	24	0	.	.
spot	18	0	.	.
black sea bass	17	0	.	.
striped bass	17	0	.	.
yellowtail flounder	6	0	.	.
grubby	5	0	.	.
rock gunnel	5	0	.	.
rainbow smelt	5	0	.	.
crevalle jack	4	0	.	.
bigeye scad	2	0	.	.
bigeye	2	0	.	.
planehead filefish	2	0	.	.
hickory shad	2	0	.	.
northern puffer	2	0	.	.
Atlantic sturgeon	2	0	.	.
Atlantic tomcod	2	0	.	.
Atlantic bonito	1	0	.	.
dwarf goatfish	1	0	.	.
goosefish	1	0	.	.
northern pipefish	1	0	.	.
short bigeye	1	0	.	.
striped cusk-eel	1	0	.	.
sea lamprey	1	0	.	.
Total	**125,344**		-	

species	count	%	weight	%
Invertebrates				
American lobster	2,114	8.5	.	.
long-finned squid	22,769	91.5	.	.
Total	**24,883**		-	

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in LISTS in 1989. *Finfish species are in order of descending count. Invertebrate species are in order of descending weight. Number of tows (sample size)=200.*

species	count	%	weight	%
butterfish	47,089	29.3	.	.
winter flounder	32,361	20.2	.	.
windowpane flounder	25,109	15.6	.	.
scup	17,391	10.8	.	.
bluefish	8,649	5.4	.	.
little skate	7,079	4.4	.	.
red hake	5,689	3.5	.	.
weakfish	5,496	3.4	.	.
American shad	1,977	1.2	.	.
fourspot flounder	1,877	1.2	.	.
striped searobin	1,763	1.1	.	.
silver hake	1,697	1.1	.	.
Atlantic herring	1,154	0.7	.	.
tautog	600	0.4	.	.
fourbeard rockling	397	0.2	.	.
blueback herring	307	0.2	.	.
northern searobin	297	0.2	.	.
Atlantic mackerel	237	0.1	.	.
Atlantic menhaden	230	0.1	.	.
smooth dogfish	202	0.1	.	.
alewife	190	0.1	.	.
longhorn sculpin	107	0.1	.	.
cunner	106	0.1	.	.
hogchoker	91	0.1	.	.
winter skate	91	0.1	.	.
spiny dogfish	66	0	.	.
ocean pout	58	0	.	.
bigeye scad	45	0	.	.
moonfish	42	0	.	.
summer flounder	35	0	.	.
sea raven	34	0	.	.
black sea bass	15	0	.	.
rough scad	11	0	.	.
striped bass	11	0	.	.
yellow jack	11	0	.	.
goosefish	9	0	.	.
smallmouth flounder	9	0	.	.
rock gunnel	8	0	.	.
grubby	7	0	.	.
spotted hake	7	0	.	.
rainbow smelt	4	0	.	.
planehead filefish	3	0	.	.
Atlantic sturgeon	3	0	.	.
Atlantic tomcod	3	0	.	.
bigeye	2	0	.	.
American eel	2	0	.	.
short bigeye	2	0	.	.
oyster toadfish	2	0	.	.
white perch	2	0	.	.
northern sennet	1	0	.	.
northern puffer	1	0	.	.
banded rudderfish	1	0	.	.
Spanish mackerel	1	0	.	.
Total	**160,581**		-	
Invertebrates				
American lobster	3,447	19.9	.	.
long-finned squid	13,883	80.1	.	.
Total	**17,330**		-	

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in LISTS in 1990.
Finfish species are in order of descending count. Invertebrate species are in order of descending weight. Number of tows (sample size)=200.

species	count	%	weight	%
winter flounder	47,184	31.1	.	.
butterfish	45,373	29.9	.	.
scup	15,393	10.2	.	.
windowpane flounder	9,825	6.5	.	.
Atlantic herring	8,779	5.8	.	.
little skate	6,456	4.3	.	.
bluefish	4,688	3.1	.	.
fourspot flounder	3,270	2.2	.	.
silver hake	2,334	1.5	.	.
red hake	2,237	1.5	.	.
weakfish	1,921	1.3	.	.
striped searobin	866	0.6	.	.
tautog	554	0.4	.	.
American shad	406	0.3	.	.
fourbeard rockling	299	0.2	.	.
longhorn sculpin	243	0.2	.	.
northern searobin	232	0.2	.	.
Atlantic menhaden	219	0.1	.	.
smooth dogfish	209	0.1	.	.
summer flounder	170	0.1	.	.
cunner	168	0.1	.	.
alewife	160	0.1	.	.
spiny dogfish	150	0.1	.	.
hogchoker	84	0.1	.	.
winter skate	61	0	.	.
blueback herring	46	0	.	.
striped bass	45	0	.	.
sea raven	42	0	.	.
ocean pout	39	0	.	.
black sea bass	27	0	.	.
spotted hake	21	0	.	.
Atlantic mackerel	10	0	.	.
rough scad	10	0	.	.
seasnail	8	0	.	.
planehead filefish	7	0	.	.
moonfish	7	0	.	.
rock gunnel	7	0	.	.
yellow jack	7	0	.	.
grubby	4	0	.	.
spot	4	0	.	.
Atlantic sturgeon	4	0	.	.
oyster toadfish	4	0	.	.
goosefish	3	0	.	.
smallmouth flounder	3	0	.	.
Atlantic tomcod	3	0	.	.
clearnose skate	2	0	.	.
lookdown	2	0	.	.
red goatfish	2	0	.	.
rainbow smelt	2	0	.	.
bigeye scad	1	0	.	.
bigeye	1	0	.	.
hickory shad	1	0	.	.
mackerel scad	1	0	.	.
northern kingfish	1	0	.	.
northern puffer	1	0	.	.
red cornetfish	1	0	.	.
sandbar shark	1	0	.	.
sea lamprey	1	0	.	.
yellowtail flounder	1	0	.	.
Total	**151,600**		-	
Invertebrates				
American lobster	5,369	27.0.	.	
long-finned squid	14,538	73.0.	.	
Total	**19,907**		-	

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in LISTS in 1991.
Finfish species are in order of descending count. Invertebrate species are in order of descending weight. Number of tows (sample size)=200.

species	count	%	weight	%	species	count	%	weight	%
scup	45,790	29.9	.	.	moonfish	24	0	.	.
butterfish	40,537	26.4	.	.	smallmouth flounder	20	0	.	.
winter flounder	26,623	17.4	.	.	sea raven	19	0	.	.
windowpane flounder	8,482	5.5	.	.	spiny dogfish	14	0	.	.
little skate	6,479	4.2	.	.	yellow jack	11	0	.	.
bluefish	5,845	3.8	.	.	goosefish	8	0	.	.
weakfish	4,320	2.8	.	.	northern puffer	5	0	.	.
Atlantic herring	4,003	2.6	.	.	northern kingfish	4	0	.	.
fourspot flounder	3,553	2.3	.	.	Atlantic tomcod	4	0	.	.
red hake	2,085	1.4	.	.	Atlantic sturgeon	3	0	.	.
silver hake	1,537	1.0	.	.	clearnose skate	2	0	.	.
striped searobin	865	0.6	.	.	Atlantic mackerel	2	0	.	.
northern searobin	609	0.4	.	.	mackerel scad	2	0	.	.
tautog	501	0.3	.	.	rainbow smelt	2	0	.	.
American shad	361	0.2	.	.	Spanish mackerel	2	0	.	.
Atlantic menhaden	348	0.2	.	.	spot	2	0	.	.
summer flounder	263	0.2	.	.	bigeye scad	1	0	.	.
smooth dogfish	193	0.1	.	.	planehead filefish	1	0	.	.
fourbeard rockling	163	0.1	.	.	hickory shad	1	0	.	.
longhorn sculpin	139	0.1	.	.	red goatfish	1	0	.	.
hogchoker	104	0.1	.	.	rough scad	1	0	.	.
alewife	103	0.1	.	.	sea lamprey	1	0	.	.
cunner	75	0	.	.	oyster toadfish	1	0	.	.
spotted hake	73	0	.	.	**Total**	**153,389**		-	
winter skate	50	0	.	.					
ocean pout	42	0	.	.	**Invertebrates**				
black sea bass	39	0	.	.	American lobster	8,524	40.9	.	.
blueback herring	38	0	.	.	long-finned squid	12,322	59.1	.	.
striped bass	38	0	.	.	**Total**	**20,846**		-	

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in LISTS in 1992. *Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Number of tows (sample size)=160.*

species	count	%	weight	%
butterfish	95,961	65.7	1,357.3	11.7
scup	13,646	9.3	837.7	7.2
winter flounder	9,548	6.5	1,344.8	11.5
bluefish	5,269	3.6	2,462.9	21.1
Atlantic herring	4,565	3.1	797.5	6.8
little skate	3,495	2.4	1,389.0	11.9
windowpane flounder	2,980	2.0	286.1	2.5
fourspot flounder	2,774	1.9	382.4	3.3
red hake	1,606	1.1	127.7	1.1
weakfish	1,317	0.9	94.8	0.8
Atlantic menhaden	1,115	0.8	60.6	0.5
striped searobin	857	0.6	305.1	2.6
silver hake	544	0.4	22.0	0.2
American shad	380	0.3	63.3	0.5
northern searobin	313	0.2	35.6	0.3
smooth dogfish	304	0.2	863.2	7.4
tautog	265	0.2	508.3	4.4
summer flounder	186	0.1	142.1	1.2
blueback herring	175	0.1	8.5	0.1
fourbeard rockling	150	0.1	12.8	0.1
alewife	122	0.1	9.2	0.1
spotted hake	68	0	10.3	0.1
moonfish	62	0	1.5	0
hogchoker	61	0	5.6	0
striped bass	42	0	89.4	0.8
longhorn sculpin	31	0	9.0	0.1
winter skate	31	0	105.3	0.9
cunner	30	0	3.7	0
Atlantic sturgeon	30	0	244.8	2.1
ocean pout	18	0	7.7	0.1
hickory shad	12	0	4.9	0
smallmouth flounder	12	0	0.6	0
goosefish	10	0	2.5	0
clearnose skate	8	0	10.3	0.1
Atlantic tomcod	8	0	1.3	0
mackerel scad	6	0	0.2	0
spiny dogfish	6	0	30.7	0.3

species	count	%	weight	%
black sea bass	5	0	1.8	0
northern pipefish	5	0	0.4	0
Atlantic mackerel	4	0	1.0	0
sea raven	4	0	3.9	0
northern kingfish	2	0	0.2	0
round herring	2	0	0.2	0
yellow jack	2	0	0.2	0
Atlantic silverside	1	0	0.1	0
conger eel	1	0	0.1	0
northern puffer	1	0	0.1	0
Spanish mackerel	1	0	1.5	0
Total	**146,035**		**11,648.2**	
Invertebrates				
American lobster	8,160	19.9	1,537.9	28.6
blue mussel	nc	nc	1,157.1	21.5
long-finned squid	32,780	80.1	844.9	15.7
horseshoe crab	nc	nc	514.1	9.6
lady crab	nc	nc	375.4	7.0
rock crab	nc	nc	239.1	4.5
boring sponge	nc	nc	225.5	4.2
spider crab	nc	nc	186.0	3.5
starfish spp.	nc	nc	148.6	2.8
whelks	nc	nc	57.5	1.1
flat claw hermit crab	nc	nc	34.7	0.6
bluecrab	nc	nc	18.1	0.3
mantis shrimp	nc	nc	10.3	0.2
northern moon snail	nc	nc	8.6	0.2
common oyster	nc	nc	7.3	0.1
lion's mane jellyfish	nc	nc	2.4	0
surf clam	nc	nc	1.7	0
hard clams	nc	nc	1.2	0
bushy bryozoan	nc	nc	1.0	0
purple sea urchin	nc	nc	0.4	0
mud crabs	nc	nc	0.3	0
star coral	nc	nc	0.1	0
Total	**40,940**		**5,372**	

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in LISTS in 1993. *Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Number of tows (sample size)=200.*

species	count	%	weight	%
butterfish	35,361	33.0	847.8	7.1
scup	18,785	17.6	581.4	4.8
winter flounder	16,090	15.0	1,855.7	15.4
windowpane flounder	7,953	7.4	547.6	4.6
Atlantic herring	6,269	5.9	1,119.8	9.3
little skate	5,186	4.8	2,172.3	18.1
bluefish	4,402	4.1	1,343.2	11.2
red hake	3,963	3.7	232.0	1.9
fourspot flounder	1,262	1.2	182.3	1.5
weakfish	1,142	1.1	60.3	0.5
striped searobin	1,079	1.0	165.4	1.4
northern searobin	935	0.9	96.8	0.8
American shad	791	0.7	101.1	0.8
alewife	788	0.7	48.2	0.4
silver hake	500	0.5	21.1	0.2
spotted hake	331	0.3	36.7	0.3
smooth dogfish	283	0.3	857.6	7.1
Atlantic menhaden	271	0.3	94.1	0.8
fourbeard rockling	241	0.2	15.6	0.1
summer flounder	224	0.2	137.9	1.1
tautog	157	0.1	308.2	2.6
Spanish mackerel	136	0.1	2.2	0
blueback herring	96	0.1	4.3	0
rough scad	92	0.1	3.8	0
striped bass	78	0.1	198.7	1.7
ocean pout	66	0.1	16.4	0.1
cunner	64	0.1	6.1	0.1
Atlantic sturgeon	60	0.1	633.6	5.3
winter skate	59	0.1	213.2	1.8
spot	57	0.1	4.5	0
hogchoker	56	0.1	5.2	0
Atlantic silverside	54	0.1	1.0	0
northern puffer	23	0	0.4	0
smallmouth flounder	23	0	2.1	0
Atlantic croaker	20	0	1.1	0
black sea bass	16	0	5.0	0
spiny dogfish	14	0	58.4	0.5
Atlantic mackerel	11	0	0.9	0
longhorn sculpin	11	0	3.2	0
planehead filefish	9	0	0.7	0
hickory shad	9	0	4.1	0
northern pipefish	9	0	0.4	0
rainbow smelt	9	0	0.6	0
crevalle jack	5	0	0.4	0
northern kingfish	5	0	0.6	0
Atlantic tomcod	5	0	0.8	0
clearnose skate	4	0	7.7	0.1
white perch	4	0	0.3	0
conger eel	3	0	0.2	0
goosefish	3	0	0.3	0
American sand lance	3	0	0.3	0
Atlantic bonito	2	0	6.4	0.1
lumpfish	2	0	0.2	0
moonfish	2	0	0.2	0
sea lamprey	2	0	1.0	0
Atlantic salmon	1	0	0.1	0
American eel	1	0	1.6	0
northern sennet	1	0	0.1	0
orange filefish	1	0	0.1	0
round herring	1	0	0.1	0
red cornetfish	1	0	0.1	0
red goatfish	1	0	0.1	0
short bigeye	1	0	0.1	0
sea raven	1	0	0.6	0
yellow jack	1	0	0.1	0
Total	**107,035**		**12,012.4**	

Invertebrates

species	count	%	weight	%
American lobster	10,306	20.6	2,173.5	34.4
long-finned squid	39,723	79.4	1,176.5	18.6
blue mussel	nc	nc	945.1	15.0
horseshoe crab	nc	nc	673.8	10.7
spider crab	nc	nc	511.2	8.1
lady crab	nc	nc	428.0	6.8
rock crab	nc	nc	155.9	2.5
flat claw hermit crab	nc	nc	45.7	0.7
starfish spp.	nc	nc	37.4	0.6
boring sponge	nc	nc	36.6	0.6
whelks	nc	nc	34.0	0.5
mantis shrimp	nc	nc	31.6	0.5
lion's mane jellyfish	nc	nc	27.6	0.4
bluecrab	nc	nc	20.0	0.3
northern moon snail	nc	nc	8.9	0.1
common oyster	nc	nc	2.0	0
surf clam	nc	nc	1.0	0
hard clams	nc	nc	0.9	0
purple sea urchin	nc	nc	0.7	0
arks	nc	nc	0.7	0
mud crabs	nc	nc	0.4	0
star coral	nc	nc	0.3	0
blood star	nc	nc	0.2	0
common slipper shell	nc	nc	0.2	0
sand shrimp	nc	nc	0.1	0
sand dollar	nc	nc	0.1	0
northern red shrimp	nc	nc	0.1	0
polychaetes	nc	nc	0.1	0
Total	**50,029**		**6,313**	

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in LISTS in 1994.
Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Number of tows (sample size)=200.

species	count	%	weight	%
butterfish	33,538	28.7	776.8	6.3
scup	25,451	21.8	660.8	5.4
winter flounder	20,615	17.6	1,992.2	16.2
bluefish	7,703	6.6	1,159.8	9.4
windowpane flounder	6,062	5.2	574.5	4.7
little skate	5,604	4.8	2,565.3	20.9
Atlantic herring	3,836	3.3	768.6	6.3
weakfish	3,320	2.8	160.0	1.3
silver hake	1,703	1.5	112.9	0.9
fourspot flounder	1,494	1.3	195.6	1.6
American shad	1,289	1.1	133.2	1.1
alewife	1,211	1.0	75.0	0.6
blueback herring	1,052	0.9	26.6	0.2
striped searobin	927	0.8	183.6	1.5
northern searobin	800	0.7	63.7	0.5
red hake	490	0.4	54.0	0.4
smooth dogfish	310	0.3	816.3	6.6
Atlantic menhaden	276	0.2	61.4	0.5
summer flounder	242	0.2	141.6	1.2
tautog	207	0.2	346.5	2.8
spotted hake	148	0.1	25.7	0.2
moonfish	93	0.1	2.6	0
fourbeard rockling	92	0.1	8.4	0.1
striped bass	81	0.1	198.6	1.6
Atlantic sturgeon	60	0.1	848.6	6.9
spiny dogfish	55	0	186.2	1.5
ocean pout	42	0	9.1	0.1
hogchoker	36	0	3.8	0
black sea bass	33	0	10.9	0.1
winter skate	33	0	101.5	0.8
American sand lance	25	0	0.6	0
Spanish mackerel	25	0	1.7	0
cunner	18	0	1.3	0
smallmouth flounder	15	0	1.3	0
hickory shad	14	0	3.7	0
rough scad	13	0	0.2	0
Atlantic mackerel	11	0	0.9	0
spot	11	0	1.1	0
rainbow smelt	9	0	0.6	0
crevalle jack	8	0	0.5	0
goosefish	8	0	2.0	0
northern kingfish	7	0	0.5	0

species	count	%	weight	%
longhorn sculpin	7	0	1.6	0
grubby	5	0	0.3	0
mackerel scad	4	0	0.4	0
Atlantic silverside	3	0	0.3	0
bigeye scad	2	0	0.2	0
lookdown	2	0	0.2	0
northern puffer	2	0	0.2	0
Atlantic tomcod	2	0	0.3	0
bigeye	1	0	0.1	0
clearnose skate	1	0	1.8	0
inshore lizardfish	1	0	0.1	0
northern pipefish	1	0	0.1	0
rock gunnel	1	0	0.1	0
sea raven	1	0	0.2	0
white perch	1	0	0.3	0
yellow jack	1	0	0.1	0
Total	**117,002**		**12,284.5**	

Invertebrates

species	count	%	weight	%
American lobster	7,057	31.6	1,533.9	38.6
long-finned squid	15,299	68.4	594.8	15.0
horseshoe crab	nc	nc	386.7	9.7
blue mussel	nc	nc	377.5	9.5
lady crab	nc	nc	338.5	8.5
spider crab	nc	nc	335.0	8.4
rock crab	nc	nc	136.8	3.4
starfish spp.	nc	nc	124.6	3.1
flat claw hermit crab	nc	nc	51.4	1.3
northern moon snail	nc	nc	34.6	0.9
common oyster	nc	nc	18.4	0.5
whelks	nc	nc	14.1	0.4
mantis shrimp	nc	nc	9.8	0.2
lion's mane jellyfish	nc	nc	4.2	0.1
bluecrab	nc	nc	3.7	0.1
arks	nc	nc	3.0	0.1
boring sponge	nc	nc	1.9	0
hard clams	nc	nc	1.3	0
bushy bryozoan	nc	nc	0.6	0
mud crabs	nc	nc	0.3	0
surf clam	nc	nc	0.3	0
purple sea urchin	nc	nc	0.1	0
Total	**22,356**		**3,972**	

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in LISTS in 1995.
Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Number of tows (sample size)=200.

species	count	%	weight	%
butterfish	64,930	50.1	1,664.5	15.2
winter flounder	15,558	12.0	1,614.7	14.7
scup	13,985	10.8	770.5	7.0
Atlantic herring	9,135	7.0	1,631.7	14.9
bluefish	5,524	4.3	1,156.1	10.5
windowpane flounder	3,815	2.9	356.2	3.2
weakfish	2,881	2.2	275.7	2.5
fourspot flounder	2,584	2.0	402.9	3.7
little skate	2,372	1.8	1,055.3	9.6
red hake	1,977	1.5	145.6	1.3
silver hake	1,941	1.5	61.6	0.6
northern searobin	1,317	1.0	166.9	1.5
American shad	755	0.6	81.4	0.7
striped searobin	682	0.5	277.5	2.5
alewife	386	0.3	24.6	0.2
Atlantic menhaden	318	0.2	41.9	0.4
blueback herring	255	0.2	7.5	0.1
fourbeard rockling	169	0.1	14.7	0.1
smooth dogfish	168	0.1	566.8	5.2
striped bass	165	0.1	185.3	1.7
summer flounder	121	0.1	79.6	0.7
American sand lance	95	0.1	0.4	0
spotted hake	72	0.1	6.5	0.1
tautog	61	0	95.1	0.9
cunner	41	0	4.4	0
winter skate	41	0	89.2	0.8
Atlantic silverside	39	0	0.9	0
moonfish	33	0	2.1	0
yellow jack	32	0	2.1	0
ocean pout	30	0	6.5	0.1
northern kingfish	25	0	2.5	0
smallmouth flounder	19	0	1.2	0
hogchoker	17	0	1.7	0
black sea bass	12	0	4.7	0
hickory shad	6	0	2.5	0
Atlantic sturgeon	6	0	145.5	1.3
longhorn sculpin	5	0	1.3	0
clearnose skate	4	0	11.0	0.1
goosefish	4	0	3.3	0
rainbow smelt	4	0	0.3	0
Atlantic tomcod	4	0	0.8	0
spot	3	0	0.3	0
Atlantic cod	2	0	0.1	0
conger eel	2	0	1.2	0
haddock	2	0	0.2	0
northern pipefish	2	0	0.1	0
sea raven	2	0	0.7	0
African pompano	1	0	0.1	0
crevalle jack	1	0	0.1	0
grubby	1	0	0.1	0
Atlantic mackerel	1	0	0.1	0
mackerel scad	1	0	0.1	0
northern puffer	1	0	0.1	0
oyster toadfish	1	0	0.5	0
yellowtail flounder	1	0	0.1	0
Total	**129,609**		**10,966.8**	

Invertebrates

species	count	%	weight	%
American lobster	9,944	29.3	2,141.9	55.1
long-finned squid	23,974	70.7	796.4	20.5
lady crab	nc	nc	535.0	13.8
horseshoe crab	nc	nc	116.8	3
spider crab	nc	nc	95.4	2.5
lion's mane jellyfish	nc	nc	78.3	2
rock crab	nc	nc	47.0	1.2
blue mussel	nc	nc	14.0	0.4
flat claw hermit crab	nc	nc	12.8	0.3
boring sponge	nc	nc	11.2	0.3
whelks	nc	nc	10.8	0.3
mantis shrimp	nc	nc	8.1	0.2
bluecrab	nc	nc	6.0	0.2
northern moon snail	nc	nc	5.8	0.1
starfish spp.	nc	nc	4.7	0.1
arks	nc	nc	1.4	0
hard clams	nc	nc	0.7	0
purple sea urchin	nc	nc	0.7	0
sand shrimp	nc	nc	0.4	0
ghost shrimp	nc	nc	0.3	0
mud crabs	nc	nc	0.2	0
common razor clam	nc	nc	0.1	0
shore shrimp	nc	nc	0.1	0
Total	**33,918**		**3,888**	

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in LISTS in 1996.
Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Number of tows (sample size)=200.

species	count	%	weight	%
butterfish	49,360	37.0	1,844.7	12.4
winter flounder	22,722	17.0	3,335.0	22.5
scup	16,087	12.0	739.4	5.0
windowpane flounder	14,116	10.6	1,223.6	8.2
bluefish	6,705	5.0	1,118.2	7.5
weakfish	6,375	4.8	414.9	2.8
little skate	6,203	4.6	2,801.8	18.9
fourspot flounder	2,815	2.1	407.2	2.7
alewife	1,402	1.0	134.6	0.9
striped searobin	1,008	0.8	278.7	1.9
Atlantic herring	972	0.7	189.8	1.3
moonfish	921	0.7	11.6	0.1
red hake	872	0.7	95.5	0.6
northern searobin	672	0.5	57.4	0.4
American shad	501	0.4	36.2	0.2
silver hake	489	0.4	20.0	0.1
summer flounder	434	0.3	266.4	1.8
spotted hake	384	0.3	42.6	0.3
smooth dogfish	275	0.2	862.8	5.8
striped bass	232	0.2	373.5	2.5
spot	195	0.1	14.1	0.1
tautog	136	0.1	225.9	1.5
fourbeard rockling	109	0.1	8.6	0.1
blueback herring	97	0.1	6.2	0
Atlantic menhaden	88	0.1	40.5	0.3
winter skate	88	0.1	212.7	1.4
hogchoker	45	0	5.4	0
smallmouth flounder	41	0	2.3	0
rough scad	35	0	1.5	0
hickory shad	29	0	10.2	0.1
black sea bass	27	0	12.1	0.1
ocean pout	26	0	7.2	0
cunner	17	0	2.6	0
striped anchovy	11	0	0.2	0
longhorn sculpin	7	0	2.1	0
northern kingfish	6	0	0.6	0
yellow jack	6	0	0.5	0
Atlantic mackerel	5	0	0.5	0
planehead filefish	3	0	0.3	0
mackerel scad	3	0	0.1	0

species	count	%	weight	%
northern puffer	3	0	0.3	0
rock gunnel	3	0	0.2	0
short bigeye	3	0	0.3	0
Atlantic sturgeon	3	0	19.9	0.1
bigeye scad	2	0	0.1	0
grubby	2	0	0.2	0
sea raven	2	0	1.5	0
Atlantic tomcod	2	0	0.3	0
clearnose skate	1	0	1.7	0
conger eel	1	0	0.1	0
gizzard shad	1	0	0.1	0
goosefish	1	0	0.1	0
sea lamprey	1	0	0.7	0
spiny dogfish	1	0	2.1	0
white perch	1	0	0.1	0
Total	**133,546**		**14,835.2**	
Invertebrates				
American lobster	9,490	29.5	2,113.5	39.1
lady crab	nc	nc	1,160.4	21.5
long-finned squid	22,720	70.5	720.4	13.3
horseshoe crab	nc	nc	717.0	13.3
spider crab	nc	nc	293.9	5.4
rock crab	nc	nc	162.7	3.0
lion's mane jellyfish	nc	nc	42.7	0.8
blue mussel	nc	nc	42.5	0.8
flat claw hermit crab	nc	nc	39.4	0.7
whelks	nc	nc	33.0	0.6
mantis shrimp	nc	nc	20.9	0.4
boring sponge	nc	nc	19.2	0.4
bushy bryozoan	nc	nc	15.2	0.3
starfish spp.	nc	nc	6.2	0.1
arks	nc	nc	4.3	0.1
northern moon snail	nc	nc	4.3	0.1
bluecrab	nc	nc	4.0	0.1
hard clams	nc	nc	3.2	0.1
surf clam	nc	nc	1.4	0
mud crabs	nc	nc	0.3	0
purple sea urchin	nc	nc	0.1	0
Total	**32,210**		**5,405**	

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in LISTS in 1997. *Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Number of tows (sample size)=200.*

species	count	%	weight	%
butterfish	70,985	50.3	2,017.2	15.5
winter flounder	14,701	10.4	2,439.4	18.8
bluefish	10,815	7.7	977.6	7.5
windowpane flounder	10,324	7.3	986.1	7.6
scup	9,582	6.8	530.5	4.1
fourspot flounder	4,122	2.9	615.3	4.7
little skate	4,068	2.9	1,945.8	15.0
weakfish	3,904	2.8	362.0	2.8
Atlantic herring	3,455	2.4	515.1	4.0
silver hake	1,973	1.4	70.8	0.5
alewife	1,194	0.8	81.3	0.6
American shad	922	0.7	66.8	0.5
striped searobin	819	0.6	230.5	1.8
red hake	748	0.5	80.5	0.6
blueback herring	630	0.4	16.5	0.1
northern searobin	579	0.4	60.4	0.5
summer flounder	486	0.3	326.0	2.5
striped bass	319	0.2	509.9	3.9
moonfish	287	0.2	4.6	0
fourbeard rockling	199	0.1	17.3	0.1
tautog	190	0.1	271.8	2.1
smooth dogfish	167	0.1	527.3	4.1
Atlantic menhaden	116	0.1	38.5	0.3
spotted hake	77	0.1	19.0	0.1
rough scad	65	0	2.0	0
smallmouth flounder	58	0	2.4	0
winter skate	48	0	109.7	0.8
cunner	43	0	4.1	0
hickory shad	25	0	9.1	0.1
black sea bass	22	0	10.5	0.1
hogchoker	15	0	1.8	0
ocean pout	15	0	4.8	0
grubby	11	0	0.7	0
spot	10	0	1.1	0
Atlantic mackerel	8	0	1.7	0
northern kingfish	7	0	0.9	0
spiny dogfish	7	0	13.7	0.1
Atlantic sturgeon	5	0	37.8	0.3
clearnose skate	4	0	7.4	0.1
longhorn sculpin	4	0	0.8	0
white perch	4	0	0.9	0
crevalle jack	3	0	0.6	0
sea raven	3	0	0.4	0
Atlantic silverside	2	0	0.1	0
goosefish	2	0	1.6	0
inshore lizardfish	2	0	0.2	0
round scad	2	0	0.2	0
American sand lance	2	0	0.1	0
short bigeye	2	0	0.2	0
yellow jack	2	0	0.2	0
bigeye scad	1	0	0.1	0
Atlantic cod	1	0	0.3	0
haddock	1	0	0.1	0
northern pipefish	1	0	0.1	0
northern puffer	1	0	0.1	0
roughtail stingray	1	0	50.6	0.4
sea lamprey	1	0	0.1	0
Atlantic tomcod	1	0	0.1	0
yellowtail flounder	1	0	0.3	0
Total	**141,040**		**12,974.6**	

Invertebrates	count	%	weight	%
American lobster	16,467	55.3	3,800.9	64.6
lady crab	nc	nc	592.5	10.1
long-finned squid	13,048	43.8	515.2	8.8
horseshoe crab	204	0.7	472.4	8.0
spider crab	nc	nc	188.3	3.2
rock crab	nc	nc	94.1	1.6
lion's mane jellyfish	nc	nc	88.0	1.5
bushy bryozoan	nc	nc	28.0	0.5
flat claw hermit crab	nc	nc	21.7	0.4
boring sponge	nc	nc	16.5	0.3
whelks	22	0.1	14.8	0.3
bluecrab	33	0.1	13.6	0.2
mantis shrimp	nc	nc	9.3	0.2
starfish spp.	nc	nc	7.3	0.1
hard clams	nc	nc	3.8	0.1
blue mussel	nc	nc	3.5	0.1
northern moon snail	nc	nc	3.3	0.1
northern comb jelly	nc	nc	2.0	0
arks	nc	nc	1.8	0
common oyster	nc	nc	1.8	0
surf clam	nc	nc	0.9	0
common slipper shell	nc	nc	0.7	0
mud crabs	nc	nc	0.6	0
sand shrimp	nc	nc	0.2	0
common razor clam	nc	nc	0.2	0
blood star	nc	nc	0.1	0
star coral	nc	nc	0.1	0
northern red shrimp	nc	nc	0.1	0
shore shrimp	nc	nc	0.1	0
purple sea urchin	nc	nc	0.1	0
Total	**29,774**		**5,882**	

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in LISTS in 1998. *Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Number of tows (sample size)=200.*

species	count	%	weight	%
butterfish	136,926	64.0	3,661.1	24.4
scup	23,742	11.1	740.5	4.9
winter flounder	15,697	7.3	2,450.3	16.3
bluefish	8,814	4.1	899.0	6.0
windowpane flounder	6,483	3.0	741.1	4.9
little skate	4,305	2.0	2,085.5	13.9
weakfish	3,495	1.6	268.2	1.8
red hake	3,015	1.4	217.5	1.4
fourspot flounder	1,908	0.9	306.0	2.0
silver hake	1,870	0.9	88.3	0.6
striped searobin	1,321	0.6	509.7	3.4
moonfish	1,188	0.6	13.4	0.1
American shad	901	0.4	60.2	0.4
Atlantic herring	893	0.4	74.6	0.5
alewife	456	0.2	35.1	0.2
summer flounder	436	0.2	431.3	2.9
striped bass	400	0.2	484.2	3.2
northern searobin	360	0.2	39.4	0.3
smooth dogfish	310	0.1	989.8	6.6
Atlantic menhaden	306	0.1	9.2	0.1
blueback herring	211	0.1	5.1	0
tautog	194	0.1	347.1	2.3
spotted hake	142	0.1	12.2	0.1
fourbeard rockling	133	0.1	11.6	0.1
smallmouth flounder	97	0	6.4	0
cunner	65	0	8.1	0.1
winter skate	62	0	180.7	1.2
hickory shad	40	0	15.9	0.1
round herring	31	0	0.6	0
sea raven	30	0	11.3	0.1
northern puffer	28	0	0.5	0
clearnose skate	20	0	36.8	0.2
black sea bass	18	0	10.6	0.1
spiny dogfish	18	0	44.5	0.3
Atlantic sturgeon	17	0	189.7	1.3
northern kingfish	15	0	1.3	0
Atlantic mackerel	13	0	1.1	0
ocean pout	13	0	2.7	0
hogchoker	12	0	1.9	0
haddock	7	0	0.5	0
yellow jack	6	0	0.7	0
grubby	5	0	0.3	0
round scad	4	0	0.3	0
American sand lance	4	0	0.3	0
goosefish	3	0	3.2	0
oyster toadfish	3	0	0.9	0
gray triggerfish	2	0	2.3	0
longhorn sculpin	2	0	1.0	0
bigeye scad	1	0	0.1	0
inshore lizardfish	1	0	0.1	0
mackerel scad	1	0	0.1	0
roughtail stingray	1	0	3.4	0
Total	**214,025**		**15,005.7**	

Invertebrates

species	count	%	weight	%
American lobster	16,211	36.7	3,873.9	60.2
long-finned squid	27,443	62.1	767.0	11.9
horseshoe crab	303	0.7	489.4	7.6
blue mussel	nc	nc	309.0	4.8
lady crab	nc	nc	291.2	4.5
rock crab	nc	nc	241.4	3.8
spider crab	nc	nc	157.2	2.4
lion's mane jellyfish	nc	nc	63.1	1.0
flat claw hermit crab	nc	nc	56.0	0.9
bushy bryozoan	nc	nc	55.6	0.9
boring sponge	nc	nc	24.9	0.4
knobbed whelk	51	0.1	22.5	0.3
starfish spp.	nc	nc	18.2	0.3
bluecrab	49	0.1	12.8	0.2
channeled whelk	40	0.1	10.1	0.2
whelks	52	0.1	9.8	0.2
northern moon snail	nc	nc	8.6	0.1
mantis shrimp	nc	nc	5.6	0.1
common oyster	nc	nc	5.4	0.1
hard clams	nc	nc	3.7	0.1
arks	nc	nc	2.0	0
red bearded sponge	nc	nc	1.4	0
surf clam	nc	nc	1.1	0
sea grape	nc	nc	0.8	0
mud crabs	nc	nc	0.7	0
boreal squid	18	0	0.7	0
purple sea urchin	nc	nc	0.6	0
common slipper shell	nc	nc	0.5	0
star coral	nc	nc	0.4	0
moon jelly	nc	nc	0.2	0
ghost shrimp	nc	nc	0.1	0
Total	**44,167**		**6,434**	

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in LISTS in 1999.
Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Number of tows (sample size)=200.

species	count	%	weight	%
butterfish	191,100	54.1	4,171.6	21.9
scup	101,095	28.6	3,641.3	19.1
weakfish	12,416	3.5	771.3	4.0
winter flounder	10,288	2.9	2,011.7	10.6
bluefish	7,843	2.2	1,218.0	6.4
silver hake	5,126	1.5	99.6	0.5
windowpane flounder	4,643	1.3	594.2	3.1
little skate	3,686	1.0	1,829.6	9.6
red hake	2,973	0.8	226.5	1.2
Atlantic herring	2,511	0.7	45.4	0.2
striped searobin	1,690	0.5	497.0	2.6
alewife	1,393	0.4	107.6	0.6
fourspot flounder	1,393	0.4	203.9	1.1
Atlantic menhaden	1,187	0.3	90.9	0.5
American shad	987	0.3	117.3	0.6
moonfish	645	0.2	9.6	0.1
summer flounder	582	0.2	459.8	2.4
bay anchovy	548	0.2	5.6	0
northern searobin	547	0.2	52.0	0.3
striped bass	397	0.1	815.4	4.3
spotted hake	381	0.1	38.8	0.2
smooth dogfish	305	0.1	923.0	4.8
fourbeard rockling	233	0.1	28.8	0.2
tautog	217	0.1	326.6	1.7
striped anchovy	216	0.1	6.1	0
American sand lance	178	0.1	0.3	0
smallmouth flounder	96	0	5.2	0
hickory shad	56	0	19.4	0.1
cunner	51	0	5.9	0
black sea bass	50	0	17.2	0.1
spot	45	0	5.7	0
winter skate	41	0	89.8	0.5
hogchoker	39	0	5.0	0
Atlantic sturgeon	39	0	498.6	2.6
clearnose skate	22	0	39.4	0.2
bigeye scad	21	0	1.4	0
Atlantic mackerel	21	0	3.1	0
yellow jack	20	0	1.9	0
blueback herring	19	0	1.1	0
ocean pout	17	0	3.9	0
northern puffer	14	0	1.1	0
spiny dogfish	10	0	51.1	0.3
sea raven	9	0	4.9	0
crevalle jack	8	0	0.7	0
inshore lizardfish	7	0	0.5	0
northern kingfish	6	0	0.6	0
northern sennet	6	0	0.5	0
planehead filefish	3	0	0.3	0
bigeye	2	0	0.2	0
conger eel	2	0	0.5	0
goosefish	2	0	0.3	0
grubby	2	0	0.2	0
northern pipefish	2	0	0.1	0
longhorn sculpin	2	0	0.3	0
oyster toadfish	2	0	1.8	0
Atlantic silverside	1	0	0.1	0
gizzard shad	1	0	0.1	0
haddock	1	0	0.1	0
round scad	1	0	0.1	0
striped cusk-eel	1	0	0.1	0
sharksucker	1	0	0.3	0
Spanish mackerel	1	0	0.2	0
Atlantic tomcod	1	0	0.7	0
white perch	1	0	0.4	0
Total	**353,203**		**19,054.7**	

species	count	%	weight	%
Invertebrates				
American lobster	13,922	38.1	3,397.9	61.6
long-finned squid	21,580	59.0	826.4	15.0
horseshoe crab	384	1.1	634.1	11.5
lady crab	nc	nc	159.7	2.9
rock crab	nc	nc	118.6	2.2
spider crab	nc	nc	95.4	1.7
bushy bryozoan	nc	nc	78.0	1.4
flat claw hermit crab	nc	nc	32.5	0.6
knobbed whelk	61	0.2	24.8	0.4
bluecrab	89	0.2	21.3	0.4
channeled whelk	81	0.2	21.1	0.4
mantis shrimp	376	1.0	19.3	0.4
boring sponge	nc	nc	19.3	0.4
lion's mane jellyfish	61	0.2	16.7	0.3
blue mussel	nc	nc	14.1	0.3
northern moon snail	nc	nc	9.1	0.2
starfish spp.	nc	nc	8.8	0.2
common oyster	nc	nc	4.7	0.1
arks	nc	nc	2.8	0.1
common slipper shell	nc	nc	1.8	0
mud crabs	nc	nc	1.7	0
hard clams	nc	nc	1.5	0
sand shrimp	nc	nc	1.0	0
purple sea urchin	nc	nc	1.0	0
northern red shrimp	nc	nc	0.9	0
surf clam	nc	nc	0.4	0
sea grape	nc	nc	0.2	0
star coral	nc	nc	0.1	0
common razor clam	nc	nc	0.1	0
moon jelly	nc	nc	0.1	0
nemerteans	nc	nc	0.1	0
Total	**36,554**		**5,514**	

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in LISTS in 2000.
Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Number of tows (sample size)=200.

species	count	%	weight	%
scup	101,464	44.4	6,679.0	34.9
butterfish	60,490	26.5	1,458.3	7.6
weakfish	23,595	10.3	554.5	2.9
winter flounder	8,867	3.9	1,921.4	10.0
bluefish	6,135	2.7	1,408.0	7.3
little skate	3,340	1.5	1,604.7	8.4
striped searobin	3,129	1.4	1,036.1	5.4
fourspot flounder	2,590	1.1	398.6	2.1
windowpane flounder	2,488	1.1	368.8	1.9
red hake	2,393	1.0	162.6	0.8
bay anchovy	2,303	1.0	12.2	0.1
northern searobin	2,014	0.9	251.2	1.3
moonfish	1,817	0.8	15.0	0.1
alewife	1,572	0.7	96.0	0.5
spotted hake	1,425	0.6	92.3	0.5
Atlantic herring	770	0.3	124.1	0.6
silver hake	679	0.3	28.8	0.2
summer flounder	555	0.2	471.3	2.5
Atlantic menhaden	492	0.2	31.8	0.2
smooth dogfish	467	0.2	1,038.5	5.4
American shad	316	0.1	25.8	0.1
striped bass	293	0.1	602.6	3.1
tautog	287	0.1	463.5	2.4
spot	204	0.1	17.8	0.1
fourbeard rockling	185	0.1	14.7	0.1
blueback herring	143	0.1	6.8	0
black sea bass	69	0	22.6	0.1
smallmouth flounder	61	0	2.7	0
cunner	50	0	5.3	0
hickory shad	42	0	17.1	0.1
hogchoker	40	0	5.9	0
winter skate	31	0	66.5	0.3
sea raven	19	0	9.2	0
clearnose skate	18	0	37.9	0.2
ocean pout	18	0	4.9	0
longhorn sculpin	14	0	5.0	0
Atlantic sturgeon	7	0	79.0	0.4
oyster toadfish	6	0	2.5	0
northern pipefish	4	0	0.2	0
northern puffer	4	0	0.4	0
American sand lance	4	0	0.3	0
spiny dogfish	4	0	9.9	0.1
rock gunnel	3	0	0.2	0
yellow jack	3	0	0.2	0
Atlantic silverside	2	0	0.1	0
Atlantic mackerel	2	0	0.8	0

species	count	%	weight	%
northern kingfish	2	0	0.3	0
round scad	2	0	0.2	0
bigeye	1	0	0.1	0
Atlantic cod	1	0	0.1	0
goosefish	1	0	0.2	0
inshore lizardfish	1	0	0.1	0
lined seahorse	1	0	0.1	0
white perch	1	0	0.2	0
yellowtail flounder	1	0	0.1	0
Total	**228,425**		**19,156.5**	
Invertebrates				
American lobster	10,481	36.0	2,184.5	49.9
horseshoe crab	420	1.4	689.4	15.8
long-finned squid	16,585	57.0	582.3	13.3
lady crab	nc	nc	308.4	7.1
spider crab	nc	nc	99.4	2.3
bushy bryozoan	nc	nc	95.2	2.2
rock crab	nc	nc	60.4	1.4
boring sponge	nc	nc	58.6	1.3
mantis shrimp	1,086	3.7	49.0	1.1
blue mussel	nc	nc	36.8	0.8
lion's mane jellyfish	223	0.8	36.4	0.8
channeled whelk	138	0.5	32.0	0.7
knobbed whelk	76	0.3	29.9	0.7
starfish spp.	nc	nc	29.0	0.7
flat claw hermit crab	nc	nc	26.0	0.6
bluecrab	104	0.4	19.3	0.4
northern moon snail	nc	nc	9.7	0.2
hydroid spp.	nc	nc	4.8	0.1
fan worm tubes	nc	nc	3.4	0.1
hard clams	nc	nc	3.3	0.1
arks	nc	nc	3.1	0.1
mud crabs	nc	nc	2.8	0.1
sand shrimp	nc	nc	2.7	0.1
common slipper shell	nc	nc	2.4	0.1
purple sea urchin	nc	nc	2.3	0.1
common oyster	nc	nc	1.4	0
sea grape	nc	nc	1.1	0
blood star	nc	nc	0.2	0
northern comb jelly	nc	nc	0.1	0
common razor clam	nc	nc	0.1	0
northern cyclocardia	nc	nc	0.1	0
northern red shrimp	nc	nc	0.1	0
surf clam	nc	nc	0.1	0
Total	**29,113**		**4,374**	

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in LISTS in 2001.
Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Young-of-year bay anchovy, striped anchovy, and American sand lance and Atlantic herring are not quantified. Number of tows (sample size)=200.

species	count	%	weight	%
scup	58,325	37.7	5,828.4	30.7
butterfish	45,264	29.3	1,834.0	9.7
weakfish	12,739	8.2	415.0	2.2
winter flounder	9,826	6.4	1,993.6	10.5
little skate	4,311	2.8	2,022.6	10.6
bluefish	3,986	2.6	751.2	4.0
silver hake	3,945	2.6	152.2	0.8
windowpane flounder	3,065	2.0	475.5	2.5
fourspot flounder	2,167	1.4	362.7	1.9
striped searobin	2,061	1.3	861.0	4.5
northern searobin	1,594	1.0	222.7	1.2
red hake	1,382	0.9	109.7	0.6
summer flounder	875	0.6	628.1	3.3
alewife	638	0.4	41.7	0.2
spotted hake	606	0.4	34.9	0.2
smooth dogfish	598	0.4	1,407.6	7.4
Atlantic herring	497	0.3	72.6	0.4
bay anchovy	443	0.3	3.6	0
tautog	319	0.2	491.2	2.6
blueback herring	279	0.2	11.1	0.1
fourbeard rockling	251	0.2	21.5	0.1
moonfish	225	0.1	3.8	0
striped bass	214	0.1	472.5	2.5
black sea bass	134	0.1	74.8	0.4
American shad	109	0.1	9.6	0.1
smallmouth flounder	98	0.1	3.8	0
Atlantic menhaden	86	0.1	4.7	0
hogchoker	85	0.1	10.5	0.1
clearnose skate	65	0	132.4	0.7
cunner	51	0	5.9	0
spiny dogfish	48	0	128.6	0.7
striped anchovy	47	0	1.2	0
winter skate	38	0	112.2	0.6
inshore lizardfish	21	0	2.2	0
Atlantic sturgeon	18	0	270.6	1.4
hickory shad	14	0	6.7	0
spot	13	0	1.3	0
rough scad	10	0	0.7	0
northern puffer	8	0	0.7	0
sea raven	7	0	4.1	0
ocean pout	6	0	2.3	0
round herring	5	0	0.1	0
longhorn sculpin	5	0	1.5	0
fawn cusk-eel	4	0	0.2	0
northern pipefish	4	0	0.3	0
American sand lance	4	0	0.3	0
seasnail	4	0	0.3	0
yellow jack	3	0	0.3	0
conger eel	2	0	0.3	0
northern kingfish	2	0	0.2	0
oyster toadfish	2	0	0.4	0
Atlantic silverside	1	0	0.1	0
American eel	1	0	0.6	0
planehead filefish	1	0	0.1	0
goosefish	1	0	0.4	0
naked goby	1	0	0.1	0
northern sennet	1	0	0.1	0
rock gunnel	1	0	0.1	0
red goatfish	1	0	0.1	0
roughtail stingray	1	0	2.5	0
short bigeye	1	0	0.1	0
yellowtail flounder	1	0	0.2	0
Total	**154,514**		**18,997.8**	

Finfish not ranked

American sand lance, yoy
anchovy spp, yoy
Atlantic herring, yoy

Invertebrates

species	count	%	weight	%
American lobster	5,626	35.1	1,531.2	39.2
horseshoe crab	503	3.1	870.7	22.3
long-finned squid	9,080	56.6	346.2	8.9
spider crab	nc	nc	302.5	7.7
bushy bryozoan	nc	nc	162.9	4.2
starfish spp.	nc	nc	154.7	4.0
rock crab	nc	nc	86.3	2.2
blue mussel	nc	nc	84.7	2.2
lady crab	nc	nc	79.0	2.0
flat claw hermit crab	nc	nc	57.6	1.5
knobbed whelk	118	0.7	53.3	1.4
channeled whelk	190	1.2	48.0	1.2
boring sponge	nc	nc	30.0	0.8
lion's mane jellyfish	182	1.1	25.9	0.7
northern moon snail	nc	nc	17.5	0.4
mantis shrimp	304	1.9	16.5	0.4
bluecrab	38	0.2	6.2	0.2
sea grape	nc	nc	6.1	0.2
common slipper shell	nc	nc	5.3	0.1
hydroid spp.	nc	nc	5.0	0.1
arks	nc	nc	4.0	0.1
mud crabs	nc	nc	3.6	0.1
hard clams	nc	nc	3.0	0.1
sand shrimp	nc	nc	2.8	0.1
common oyster	1	0	1.2	0
fan worm tubes	nc	nc	1.0	0
purple sea urchin	nc	nc	0.8	0
moon jelly	nc	nc	0.4	0
ghost shrimp	nc	nc	0.3	0
bobtail squid	1	0	0.1	0
common razor clam	nc	nc	0.1	0
northern red shrimp	nc	nc	0.1	0
surf clam	nc	nc	0.1	0
Total	**16,043**		**3,907**	

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in LISTS in 2002. *Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Young-of-year bay and striped anchovy are neither separated by species or quantified; young-of-year Atlantic herring are not quantified. Number of tows (sample size)=200.*

species	count	%	weight	%
scup	100,481	47.0	13,814.1	46.0
butterfish	66,550	31.1	1,924.2	6.4
weakfish	10,713	5.0	442.0	1.5
winter flounder	6,884	3.2	1,584.1	5.3
little skate	4,242	2.0	2,121.9	7.1
bluefish	3,450	1.6	1,099.7	3.7
striped searobin	2,394	1.1	1,065.0	3.5
northern searobin	2,123	1.0	267.3	0.9
red hake	2,103	1.0	206.6	0.7
silver hake	2,013	0.9	89.6	0.3
windowpane flounder	1,991	0.9	343.3	1.1
fourspot flounder	1,859	0.9	326.9	1.1
summer flounder	1,356	0.6	989.3	3.3
smooth dogfish	1,019	0.5	2,814.3	9.4
bay anchovy	992	0.5	6.6	0
alewife	855	0.4	70.2	0.2
spotted hake	798	0.4	48.2	0.2
American shad	593	0.3	40.3	0.1
tautog	565	0.3	921.1	3.1
striped bass	469	0.2	855.2	2.8
moonfish	424	0.2	7.4	0
black sea bass	394	0.2	188.3	0.6
Atlantic menhaden	366	0.2	96.3	0.3
Atlantic herring	365	0.2	63.9	0.2
smallmouth flounder	139	0.1	4.9	0
fourbeard rockling	106	0	9.7	0
hogchoker	100	0	13.3	0
blueback herring	68	0	2.4	0
clearnose skate	59	0	107.3	0.4
cunner	55	0	7.2	0
spot	52	0	7.2	0
hickory shad	45	0	19.6	0.1
winter skate	45	0	133.5	0.4
Atlantic sturgeon	18	0	275.3	0.9
spiny dogfish	17	0	48.0	0.2
ocean pout	13	0	4.3	0
yellow jack	13	0	1.4	0
sea raven	11	0	4.1	0
rough scad	10	0	0.7	0
oyster toadfish	8	0	4.7	0
northern puffer	6	0	0.3	0
Atlantic mackerel	5	0	2.5	0
short bigeye	5	0	0.2	0
goosefish	3	0	0.6	0
American sand lance	3	0	0.1	0
longhorn sculpin	3	0	0.9	0
northern sennet	2	0	0.2	0
northern pipefish	2	0	0.2	0
Atlantic bonito	1	0	2.4	0
crevalle jack	1	0	0.1	0
gizzard shad	1	0	0.1	0
grubby	1	0	0.1	0
inshore lizardfish	1	0	0.1	0
northern kingfish	1	0	0.2	0
rock gunnel	1	0	0.1	0
rainbow smelt	1	0	0.1	0
roughtail stingray	1	0	24.4	0.1
Total	**213,796**		**30,062.0**	

Finfish not ranked

anchovy spp, yoy
Atlantic herring, yoy

Invertebrates

species	count	%	weight	%
blue mussel	nc	nc	2,497.8	43.9
American lobster	3,880	29.7	1,005.7	17.7
horseshoe crab	517	4.0	862.9	15.2
spider crab	nc	nc	348.4	6.1
long-finned squid	8,034	61.5	279.9	4.9
lady crab	nc	nc	117.0	2.1
starfish spp.	nc	nc	91.8	1.6
bushy bryozoan	nc	nc	85.0	1.5
boring sponge	nc	nc	83.9	1.5
rock crab	nc	nc	74.6	1.3
flat claw hermit crab	36	0.3	55.8	1.0
channeled whelk	174	1.3	43.6	0.8
northern moon snail	nc	nc	40.3	0.7
knobbed whelk	40	0.3	19.1	0.3
bluecrab	84	0.6	16.1	0.3
lion's mane jellyfish	71	0.5	12.3	0.2
mantis shrimp	226	1.7	11.2	0.2
arks	nc	nc	7.8	0.1
common slipper shell	nc	nc	7.3	0.1
hydroid spp.	nc	nc	7.3	0.1
sea grape	nc	nc	5.3	0.1
hard clams	3	0	5.2	0.1
mud crabs	nc	nc	4.7	0.1
purple sea urchin	nc	nc	2.3	0
sand shrimp	nc	nc	1.6	0
rubbery bryzoan	nc	nc	1.0	0
surf clam	nc	nc	1.0	0
deadman's fingers sponge	nc	nc	0.5	0
blood star	nc	nc	0.4	0
common oyster	nc	nc	0.4	0
mixed sponge species	nc	nc	0.4	0
northern red shrimp	nc	nc	0.3	0
anemones	nc	nc	0.1	0
bobtail squid	1	0	0.1	0
ghost shrimp	nc	nc	0.1	0
ribbed mussel	nc	nc	0.1	0
sea cucumber	1	0	0.1	0
Total	**13,067**		**5,691**	

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in LISTS in 2003.
Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Young-of-year bay and striped anchovy are neither separated by species or quantified; young-of-year Atlantic herring are not quantified. Number of tows (sample size)=160.

species	count	%	weight	%
butterfish	25,483	34.4	524.6	3.7
scup	17,552	23.7	4,389.3	30.6
weakfish	5,596	7.6	131.9	0.9
winter flounder	4,245	5.7	1,276.5	8.9
bluefish	3,717	5.0	655.0	4.6
little skate	2,867	3.9	1,554.1	10.8
bay anchovy	2,254	3.0	12.5	0.1
windowpane flounder	1,858	2.5	333.9	2.3
fourspot flounder	1,658	2.2	327.7	2.3
striped searobin	1,529	2.1	687.0	4.8
northern searobin	1,468	2.0	240.7	1.7
summer flounder	1,151	1.6	825.0	5.8
red hake	681	0.9	31.1	0.2
alewife	608	0.8	49.4	0.3
smooth dogfish	552	0.7	1,508.8	10.5
spotted hake	527	0.7	41.6	0.3
Atlantic herring	448	0.6	87.8	0.6
American shad	305	0.4	23.5	0.2
silver hake	217	0.3	8.3	0.1
striped bass	215	0.3	542.1	3.8
tautog	210	0.3	325.4	2.3
Atlantic menhaden	121	0.2	16.1	0.1
fourbeard rockling	111	0.1	9.0	0.1
blueback herring	98	0.1	3.4	0
moonfish	97	0.1	1.3	0
hogchoker	89	0.1	8.3	0.1
black sea bass	57	0.1	45.7	0.3
Atlantic cod	57	0.1	2.7	0
clearnose skate	55	0.1	105.9	0.7
smallmouth flounder	38	0.1	2.4	0
winter skate	38	0.1	90.6	0.6
cunner	36	0	5.9	0
haddock	26	0	1.3	0
Atlantic sturgeon	23	0	391.9	2.7
hickory shad	22	0	10.3	0.1
American sand lance	19	0	0.2	0
ocean pout	14	0	2.9	0
rough scad	12	0	0.5	0
oyster toadfish	9	0	5.0	0
spiny dogfish	7	0	34.8	0.2
rock gunnel	6	0	0.4	0
round scad	4	0	0.3	0
glasseye snapper	3	0	0.1	0
conger eel	3	0	1.1	0
Atlantic mackerel	3	0	0.3	0
crevalle jack	2	0	0.2	0
northern pipefish	2	0	0.2	0
northern puffer	2	0	0.2	0
longhorn sculpin	2	0	0.9	0
sea raven	2	0	1.3	0
striped anchovy	2	0	0.1	0
Atlantic silverside	1	0	0.1	0

Species	count	%	weight	%
barndoor skate	1	0	0.4	0
Planehead filefish	1	0	0.1	0
rainbow smelt	1	0	0.1	0
sea lamprey	1	0	1.3	0
Spanish mackerel	1	0	2.1	0
Total	**74,107**		**14,323.6**	

Finfish not ranked

anchovy spp, yoy

Atlantic herring, yoy

Invertebrates	count	%	weight	%
Horseshoe crab	399	1.7	670.5	23.2
spider crab	nc	nc	640.6	22.2
American lobster	1,958	8.3	479.7	16.6
long-finned squid	19,231	81.9	421.3	14.6
boring sponge	nc	nc	107.5	3.7
rock crab	nc	nc	80.9	2.8
starfish spp.	nc	nc	73.7	2.6
flat claw hermit crab	nc	nc	61.3	2.1
channeled whelk	334	1.4	58.8	2.0
bushy bryozoan	nc	nc	54.3	1.9
lion's mane jellyfish	1,307	5.6	40.6	1.4
knobbed whelk	96	0.4	35.1	1.2
sea grape	nc	nc	31.1	1.1
northern moon snail	nc	nc	20.9	0.7
blue mussel	nc	nc	19.7	0.7
common slipper shell	nc	nc	16.8	0.6
lady crab	nc	nc	12.0	0.4
hydroid spp.	nc	nc	9.6	0.3
ribbed mussel	nc	nc	8.8	0.3
sand shrimp	nc	nc	6.8	0.2
arks	nc	nc	6.5	0.2
mud crabs	nc	nc	6.5	0.2
rubbery bryzoan	nc	nc	6.0	0.2
mantis shrimp	110	0.5	4.9	0.2
bluecrab	24	0.1	4.3	0.1
hard clams	nc	nc	3.9	0.1
star coral	nc	nc	1.9	0.1
coastal mud shrimp	4	0	0.7	0
purple sea urchin	nc	nc	0.6	0
blood star	nc	nc	0.4	0
northern red shrimp	2	0	0.4	0
Japanese shore crab	4	0	0.3	0
anemones	nc	nc	0.1	0
sand dollar	1	0	0.1	0
common razor clam	1	0	0.1	0
moon jelly	nc	nc	0.1	0
northern cyclocardia	nc	nc	0.1	0
mixed sponge species	nc	nc	0.1	0
Total	**23,471**		**2,887**	

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in LISTS in 2004.
Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Young-of-year bay and striped anchovy are neither separated by species or quantified; young-of-year Atlantic herring are not quantified. Number of tows (sample size)=199.

species	count	%	weight	%
butterfish	94,735	46.7	1,842.7	9.7
scup	61,521	30.3	6,801.1	35.7
weakfish	17,505	8.6	426.9	2.2
bluefish	6,504	3.2	2,140.6	11.2
winter flounder	4,021	2.0	839.9	4.4
little skate	3,044	1.5	1,689.8	8.9
windowpane flounder	2,275	1.1	333.7	1.8
bay anchovy	1,523	0.8	10.3	0.1
silver hake	1,417	0.7	27.3	0.1
fourspot flounder	1,406	0.7	309.3	1.6
striped searobin	1,308	0.6	465.4	2.4
alewife	859	0.4	56.1	0.3
Atlantic herring	851	0.4	58.3	0.3
red hake	829	0.4	51.6	0.3
northern searobin	784	0.4	112.0	0.6
Atlantic menhaden	746	0.4	110.7	0.6
summer flounder	644	0.3	627.2	3.3
smooth dogfish	503	0.2	1,435.3	7.5
striped bass	378	0.2	811.8	4.3
American shad	356	0.2	24.2	0.1
tautog	232	0.1	353.7	1.9
spotted hake	230	0.1	37.8	0.2
blueback herring	218	0.1	6.5	0
moonfish	182	0.1	3.4	0
fourbeard rockling	173	0.1	13.0	0.1
black sea bass	124	0.1	40.5	0.2
hogchoker	83	0	9.5	0
American sand lance	70	0	0.2	0
winter skate	53	0	100.3	0.5
smallmouth flounder	50	0	2.8	0
hickory shad	39	0	14.2	0.1
spiny dogfish	38	0	104.7	0.5
Atlantic cod	33	0	4.7	0
clearnose skate	22	0	48.2	0.3
cunner	21	0	3.7	0
ocean pout	18	0	5.4	0
rough scad	14	0	0.7	0
round scad	11	0	0.3	0
spot	8	0	0.9	0
Atlantic sturgeon	8	0	117.6	0.6
haddock	7	0	0.6	0
sea raven	7	0	2.4	0
northern kingfish	5	0	0.5	0
northern puffer	5	0	0.4	0
longhorn sculpin	5	0	3.4	0
seasnail	4	0	0.2	0
crevalle jack	2	0	0.2	0
northern pipefish	2	0	0.2	0
rock gunnel	2	0	0.2	0
Atlantic tomcod	2	0	0.2	0
white perch	2	0	0.5	0
American plaice	1	0	0.1	0
conger eel	1	0	0.1	0
gizzard shad	1	0	0.1	0
goosefish	1	0	0.1	0
pollock	1	0	0.1	0
roughtail stingray	1	0	4.1	0
oyster toadfish	1	0	0.8	0
yellow jack	1	0	0.1	0
Total	**202,887**		**19,056.6**	

Finfish not ranked

anchovy spp, yoy
Atlantic herring, yoy

Invertebrates

species	count	%	weight	%
long-finned squid	23,022	86.5	953.4	28.8
horseshoe crab	534	2.0	873.4	26.4
American lobster	1,843	6.9	481.5	14.5
spider crab	nc	nc	355.5	10.7
blue mussel	nc	nc	250.2	7.6
bushy bryozoan	nc	nc	50.9	1.5
flat claw hermit crab	nc	nc	42.4	1.3
channeled whelk	199	0.7	42.3	1.3
starfish spp.	nc	nc	41.7	1.3
boring sponge	nc	nc	41.7	1.3
rock crab	1	0.0	35.2	1.1
lion's mane jellyfish	803	3.0	34.0	1.0
common slipper shell	nc	nc	22.9	0.7
sea grape	nc	nc	16.4	0.5
lady crab	nc	nc	14.5	0.4
northern moon snail	nc	nc	11.5	0.3
knobbed whelk	21	0.1	7.7	0.2
mantis shrimp	159	0.6	7.0	0.2
arks	nc	nc	7.0	0.2
mud crabs	nc	nc	5.4	0.2
sand shrimp	nc	nc	4.7	0.1
bluecrab	13	0	2.8	0.1
hard clams	nc	nc	2.3	0.1
surf clam	5	0	1.0	0
purple sea urchin	nc	nc	0.8	0
mixed sponge species	nc	nc	0.6	0
hydroid spp.	nc	nc	0.6	0
deadman's fingers sponge	nc	nc	0.5	0
rubbery bryzoan	nc	nc	0.4	0
star coral	nc	nc	0.3	0
northern red shrimp	nc	nc	0.3	0
northern cyclocardia	nc	nc	0.2	0
blood star	nc	nc	0.1	0
coastal mud shrimp	1	0	0.1	0
sea cucumber	2	0	0.1	0
Total	**26,603**		**3,309.4**	

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in LISTS in 2005. *Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Young-of-year bay and striped anchovy are neither separated by species or quantified; young-of-year Atlantic herring are not quantified. Number of tows (sample size)=200.*

species	count	%	weight	%
butterfish	92,996	52.2	2,097.3	16.8
scup	52,642	29.6	3,080.7	24.7
weakfish	9,191	5.2	449.9	3.6
bluefish	6,532	3.7	1,333.8	10.7
winter flounder	4,692	2.6	566.1	4.5
windowpane flounder	1,982	1.1	177.5	1.4
little skate	1,317	0.7	682.5	5.5
Atlantic herring	1,168	0.7	131.1	1.1
bay anchovy	814	0.5	5.8	0
striped searobin	757	0.4	183.7	1.5
alewife	742	0.4	47.6	0.4
fourspot flounder	688	0.4	125.9	1
red hake	585	0.3	56.0	0.4
summer flounder	506	0.3	406.1	3.3
striped bass	469	0.3	675.1	5.4
smooth dogfish	467	0.3	1,421.7	11.4
moonfish	356	0.2	6.0	0
northern searobin	265	0.1	21.3	0.2
Atlantic menhaden	235	0.1	77.9	0.6
spotted hake	234	0.1	17.4	0.1
tautog	179	0.1	269.2	2.2
American shad	177	0.1	18.2	0.1
silver hake	165	0.1	7.1	0.1
hickory shad	136	0.1	43.1	0.3
blueback herring	111	0.1	5.4	0
fourbeard rockling	106	0.1	6.8	0.1
clearnose skate	102	0.1	187.1	1.5
rough scad	62	0	1.9	0
hogchoker	61	0	8.7	0.1
smallmouth flounder	44	0	2.4	0
black sea bass	42	0	26.4	0.2
spiny dogfish	41	0	102.0	0.8
Atlantic mackerel	37	0	5.7	0
winter skate	31	0	59.9	0.5
yellow jack	28	0	3.0	0
cunner	24	0	4.1	0
round scad	12	0	0.3	0
Atlantic cod	10	0	0.9	0
rock gunnel	9	0	0.6	0
Atlantic sturgeon	9	0	152.7	1.2
northern sennet	8	0	0.7	0
American sand lance	6	0	0.2	0
northern puffer	5	0	0.3	0
northern kingfish	4	0	0.6	0
northern pipefish	4	0	0.3	0
ocean pout	3	0	0.7	0
sea raven	3	0	0.5	0
crevalle jack	2	0	0.2	0
gizzard shad	2	0	0.2	0
goosefish	2	0	0.7	0
grubby	2	0	0.2	0
haddock	2	0	0.2	0
seasnail	2	0	0.2	0
glasseye snapper	1	0	0.1	0
inshore lizardfish	1	0	0.1	0
lookdown	1	0	0.1	0
pollock	1	0	0.1	0
Total	**178,073**		**12,474.3**	
Finfish not ranked				
anchovy spp, yoy				
Atlantic herring, yoy				
Invertebrates				
blue mussel	nc	nc	971.0	32.6
long-finned squid	17,542	83.2	683.5	22.9
American lobster	1,389	6.6	364.3	12.2
horseshoe crab	161	0.8	304.2	10.2
starfish spp.	nc	nc	198.4	6.7
lion's mane jellyfish	1,806	8.6	97.3	3.3
spider crab	nc	nc	92.0	3.1
bushy bryozoan	nc	nc	64.6	2.2
lady crab	nc	nc	48.8	1.6
boring sponge	nc	nc	26.1	0.9
flat claw hermit crab	nc	nc	23.1	0.8
channeled whelk	101	0.5	23.0	0.8
common slipper shell	nc	nc	12.2	0.4
rubbery bryzoan	nc	nc	11.0	0.4
knobbed whelk	23	0.1	9.7	0.3
rock crab	nc	nc	9.3	0.3
ribbed mussel	nc	nc	7.6	0.3
hard clams	nc	nc	7.2	0.2
northern moon snail	nc	nc	4.7	0.2
sea grape	nc	nc	4.5	0.2
mantis shrimp	64	0.3	3.8	0.1
arks	nc	nc	3.5	0.1
hydroid spp.	nc	nc	3.4	0.1
mud crabs	nc	nc	2.5	0.1
sand shrimp	nc	nc	2.1	0.1
deadman's fingers sponge	nc	nc	1.1	0
purple sea urchin	nc	nc	0.7	0
bluecrab	3	0	0.6	0
mixed sponge species	nc	nc	0.4	0
surf clam	nc	nc	0.4	0
star coral	nc	nc	0.3	0
sand dollar	1	0	0.2	0
northern red shrimp	nc	nc	0.2	0
boreal squid	1	0	0.1	0
Japanese shore crab	5	0	0.1	0
northern cyclocardia	nc	nc	0.1	0
common oyster	nc	nc	0.1	0
Total	**21,096**		**2,982.1**	

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in LISTS in 2006. *Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Young-of-year bay and striped anchovy are neither separated by species or quantified; young-of-year Atlantic herring and American sand lance are not quantified. Number of tows (sample size)=120.*

species	count	%	weight	%
butterfish	50,022	54.3	1,631.4	15.5
scup	28,829	31.3	4,636.1	44.2
bluefish	2,100	2.3	358.6	3.4
winter flounder	1,699	1.8	271.2	2.6
bay anchovy	1,492	1.6	8.3	0.1
silver hake	1,267	1.4	37.7	0.4
windowpane flounder	1,077	1.2	128.9	1.2
northern searobin	630	0.7	74.5	0.7
red hake	625	0.7	37.4	0.4
little skate	593	0.6	310.6	3
alewife	573	0.6	49.5	0.5
fourspot flounder	466	0.5	88.1	0.8
striped searobin	366	0.4	113.5	1.1
moonfish	361	0.4	3.5	0
smooth dogfish	332	0.4	1,176.6	11.2
spotted hake	321	0.3	24.3	0.2
weakfish	241	0.3	52.2	0.5
summer flounder	203	0.2	180.5	1.7
tautog	186	0.2	301.4	2.9
striped bass	144	0.2	418.7	4
hickory shad	75	0.1	19.1	0.2
American shad	68	0.1	6.1	0.1
Atlantic herring	66	0.1	10.3	0.1
blueback herring	63	0.1	2.5	0
clearnose skate	36	0	52.4	0.5
Atlantic menhaden	28	0	5.5	0.1
winter skate	23	0	60	0.6
hogchoker	22	0	3.2	0
Atlantic sturgeon	21	0	368.7	3.5
black sea bass	19	0	9.3	0.1
fourbeard rockling	14	0	1.5	0
rough scad	14	0	0.5	0
spot	14	0	1.2	0
spiny dogfish	11	0	47	0.4
cunner	8	0	1.3	0
smallmouth flounder	7	0	0.6	0
ocean pout	5	0	0.9	0
glasseye snapper	4	0	0.1	0
inshore lizardfish	4	0	0.4	0
northern pipefish	3	0	0.2	0
rock gunnel	2	0	0.1	0
yellow jack	2	0	0.1	0
Atlantic bonito	1	0	3.2	0
planehead filefish	1	0	0.1	0
goosefish	1	0	1.2	0
pollock	1	0	0.1	0
oyster toadfish	1	0	1.2	0
yellowtail flounder	1	0	0.4	0
Total	**92,042**		**10,500.2**	

species	count	%	weight	%
Finfish not ranked				
anchovy spp, yoy				
Atlantic herring, yoy				
American sand lance (yoy)				
Invertebrates				
long-finned squid	7,802	83.4	326	32.5
horseshoe crab	109	1.2	205.8	20.5
American lobster	748	8	197.9	19.7
boring sponge	nc	nc	51.3	5.1
spider crab	nc	nc	50.6	5
lion's mane jellyfish	558	6	45.4	4.5
rock crab	nc	nc	40.4	4
bushy bryozoan	nc	nc	17.8	1.8
blue mussel	nc	nc	7.6	0.8
channeled whelk	41	0.4	7.6	0.8
lady crab	nc	nc	7.5	0.7
deadman's fingers sponge	nc	nc	6.8	0.7
hydroid spp.	nc	nc	5.9	0.6
flat claw hermit crab	nc	nc	5.7	0.6
starfish spp.	nc	nc	4.8	0.5
rubbery bryzoan	nc	nc	4	0.4
common slipper shell	nc	nc	3.9	0.4
mantis shrimp	70	0.7	3.4	0.3
mud crabs	nc	nc	2.1	0.2
blue crab	11	0.1	1.8	0.2
knobbed whelk	5	0.1	1.2	0.1
sand shrimp	nc	nc	0.6	0.1
mixed sponge species	nc	nc	0.6	0.1
moon jelly	2	0	0.5	0
sea grape	nc	nc	0.5	0
arks	nc	nc	0.4	0
purple sea urchin	2	0	0.4	0
star coral	nc	nc	0.3	0
hard clams	1	0	0.3	0
northern red shrimp	1	0	0.3	0
red bearded sponge	nc	nc	0.2	0
fan worm tubes	nc	nc	0.2	0
northern moon snail	nc	nc	0.2	0
surf clam	1	0	0.2	0
brown shrimp	1	0	0.1	0
ghost shrimp	nc	nc	0.1	0
Japanese shore crab	nc	nc	0.1	0
northern cyclocardia	nc	nc	0.1	0
Total	**9,352**		**1,002.6**	

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in 2007.

Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Young-of-year bay and striped anchovy are neither separated by species or quantified; young-of-year Atlantic herring and American sand lance are not quantified. Number of tows (sample size)=200.

species	count	%	weight	%
scup	75,681	42.6	5,333.5	30.4
butterfish	49,137	27.6	1,446.2	8.2
weakfish	17,386	9.8	584.8	3.3
bluefish	9,378	5.3	1,801.3	10.3
winter flounder	4,550	2.6	951.3	5.4
windowpane flounder	4,051	2.3	510.8	2.9
red hake	2,788	1.6	200.4	1.1
bay anchovy	2,440	1.4	14.5	0.1
Atlantic herring	1,932	1.1	234.2	1.3
alewife	1,537	0.9	101.3	0.6
little skate	1,277	0.7	697.0	4.0
fourspot flounder	1,094	0.6	224.9	1.3
moonfish	979	0.6	12.0	0.1
striped searobin	755	0.4	217.0	1.2
summer flounder	733	0.4	590.9	3.4
northern searobin	691	0.4	74.2	0.4
smooth dogfish	580	0.3	2,110.2	12.0
Atlantic menhaden	426	0.2	63.9	0.4
striped bass	422	0.2	888.0	5.1
spotted hake	340	0.2	23.9	0.1
silver hake	290	0.2	14.6	0.1
tautog	280	0.2	551.4	3.1
American shad	236	0.1	15.8	0.1
blueback herring	156	0.1	9.1	0.1
black sea bass	116	0.1	46.8	0.3
clearnose skate	97	0.1	193.3	1.1
fourbeard rockling	87	0	7.6	0
hogchoker	78	0	11.4	0.1
smallmouth flounder	48	0	2.6	0
winter skate	44	0	117.8	0.7
hickory shad	37	0	10.4	0.1
spiny dogfish	32	0	122.3	0.7
American sand lance	30	0	0.3	0
Atlantic sturgeon	18	0	336.4	1.9
cunner	16	0	3.0	0
rough scad	13	0	0.7	0
ocean pout	12	0	3.2	0
Atlantic mackerel	9	0	0.8	0
glasseye snapper	8	0	0.7	0
northern puffer	8	0	0.5	0
striped anchovy	6	0	0.1	0
sea raven	5	0	3.6	0
oyster toadfish	5	0	2.0	0
yellow jack	5	0	0.4	0
northern kingfish	4	0	0.4	0
round scad	3	0	0.3	0
longhorn sculpin	3	0	0.8	0
American eel	2	0	0.9	0
inshore lizardfish	2	0	0.2	0
mackerel scad	2	0	0.1	0
northern sennet	2	0	0.2	0
northern pipefish	2	0	0.2	0
Atlantic silverside	1	0	0.1	0
gizzard shad	1	0	0.1	0
grubby	1	0	0.1	0
pollock	1	0	0.1	0
rock gunnel	1	0	0.1	0
striped burrfish	1	0	0.5	0
sea lamprey	1	0	0.1	0
yellowtail flounder	1	0	1.0	0
Finfish not ranked				
anchovy spp, yoy				
Atlantic herring, yoy				
American sand lance (yoy)				
Total	**177,841**		**17,540.3**	

species	count	%	weight	%
Invertebrates				
long-finned squid	24,212	88.2	773.6	30.8
horseshoe crab	333	1.2	596.4	23.7
American lobster	1,648	6.0	396.5	15.8
spider crab	nc	nc	165.5	6.6
lion's mane jellyfish	660	2.4	129.8	5.2
bushy bryozoan	nc	nc	107.4	4.3
mixed sponge species	nc	nc	84.5	3.4
rock crab	nc	nc	41.4	1.6
channeled whelk	196	0.7	33.4	1.3
flat claw hermit crab	nc	nc	27.5	1.1
blue mussel	nc	nc	20.4	0.8
starfish spp.	nc	nc	20.3	0.8
boring sponge	nc	nc	17.7	0.7
blue crab	68	0.2	13.0	0.5
mantis shrimp	264	1.0	12.1	0.5
deadman's fingers sponge	nc	nc	11.5	0.5
lady crab	nc	nc	11.5	0.5
knobbed whelk	23	0.1	11.1	0.4
common slipper shell	nc	nc	9.3	0.4
mud crabs	nc	nc	4.3	0.2
northern moon snail	nc	nc	4.3	0.2
sand shrimp	nc	nc	3.5	0.1
sea grape	nc	nc	3.5	0.1
arks	2	0	2.7	0.1
hydroid spp.	nc	nc	2.5	0.1
hard clams	1	0	2.2	0.1
rubbery bryzoan	nc	nc	1.4	0.1
common oyster	nc	nc	1.1	0
surf clam	10	0	1.0	0
anemones	16	0.1	0.6	0
purple sea urchin	2	0	0.6	0
red bearded sponge	nc	nc	0.5	0
star coral	nc	nc	0.4	0
water jelly	1	0	0.3	0
jonah crab	1	0	0.2	0
northern red shrimp	1	0	0.2	0
blood star	nc	nc	0.1	0
coastal mud shrimp	1	0	0.1	0
green sea urchin	1	0	0.1	0
Japanese shore crab	nc	nc	0.1	0
tunicates, misc	1	0	0.1	0
Total	**27,441**		**2,512.7**	

Note: nc= not counted

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in 2008.
Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Young-of-year bay and striped anchovy are neither separated by species or quantified; young-of-year Atlantic herring and American sand lance are not quantified. Number of tows (sample size)=120.

species	count	%	weight	%
scup	53,560	38	6,509.9	45.7
butterfish	48,766	34.6	1,442.0	10.1
American sand lance	7,495	5.3	7.2	0.1
silver hake	6,587	4.7	208.5	1.5
winter flounder	4,973	3.5	751.9	5.3
windowpane flounder	3,511	2.5	524.0	3.7
weakfish	2,531	1.8	116.1	0.8
red hake	1,723	1.2	141.3	1.0
bluefish	1,699	1.2	641.4	4.5
spotted hake	1,267	0.9	65.8	0.5
bay anchovy	1,128	0.8	7.7	0.1
alewife	931	0.7	51.1	0.4
fourspot flounder	902	0.6	186.3	1.3
northern searobin	809	0.6	58.8	0.4
moonfish	689	0.5	13.4	0.1
little skate	682	0.5	327.4	2.3
striped searobin	612	0.4	263.0	1.8
summer flounder	477	0.3	398.0	2.8
American shad	405	0.3	20.2	0.1
Atlantic herring	356	0.3	52.1	0.4
smooth dogfish	328	0.2	1,134.2	8.0
spot	308	0.2	21.3	0.1
striped bass	199	0.1	456.3	3.2
tautog	179	0.1	309.4	2.2
black sea bass	122	0.1	29.8	0.2
smallmouth flounder	89	0.1	3.2	0
fourbeard rockling	81	0.1	7.1	0
blueback herring	74	0.1	3.2	0
winter skate	51	0	140.8	1.0
Atlantic menhaden	47	0	10.4	0.1
hogchoker	38	0	5.6	0
clearnose skate	37	0	78.1	0.5
spiny dogfish	35	0	127.7	0.9
cunner	26	0	3.6	0
inshore lizardfish	10	0	0.5	0
ocean pout	9	0	2.1	0
Atlantic sturgeon	7	0	111.3	0.8
hickory shad	5	0	1.1	0
feather blenny	4	0	0.2	0
white perch	4	0	0.1	0
northern kingfish	3	0	0.4	0
oyster toadfish	3	0	1.9	0
Atlantic silverside	2	0	0.2	0
rock gunnel	2	0	0.2	0
longhorn sculpin	2	0	0.3	0
yellowtail flounder	2	0	0.4	0
Atlantic croaker	1	0	0.1	0
planehead filefish	1	0	0.1	0
glasseye snapper	1	0	0.1	0
pollock	1	0	0.1	0
roughtail stingray	1	0	3.0	0
sea lamprey	1	0	0.8	0
striped anchovy	1	0	0.1	0
Total	**140,777**		**14,239.8**	
Finfish not ranked				
anchovy spp, yoy				
Atlantic herring, yoy				
American sand lance (yoy)				
Invertebrates				
horseshoe crab	289	2.2	496.8	29.2
long-finned squid	10,490	80.5	330.1	19.4
American lobster	1,096	8.4	314.1	18.5
spider crab	nc	nc	145.8	8.6
rock crab	nc	nc	64.0	3.8
bushy bryozoan	nc	nc	54.2	3.2
lady crab	nc	nc	36.3	2.1
starfish spp.	nc	nc	32.1	1.9
boring sponge	nc	nc	30.1	1.8
channeled whelk	177	1.4	29.3	1.7
mixed sponge species	nc	nc	27.8	1.6
hydroid spp.	nc	nc	24.6	1.4
flat claw hermit crab	nc	nc	22.8	1.3
common slipper shell	nc	nc	15.7	0.9
lion's mane jellyfish	520	4	14.3	0.8
mantis shrimp	244	1.9	9.1	0.5
sea grape	nc	nc	6.6	0.4
arks	124	1	6.1	0.4
knobbed whelk	17	0.1	5.9	0.3
blue mussel	nc	nc	5.8	0.3
northern moon snail	1	0	5.6	0.3
sand shrimp	nc	nc	4.0	0.2
blue crab	16	0.1	3.8	0.2
mud crabs	nc	nc	3.5	0.2
rubbery bryzoan	nc	nc	3.1	0.2
common oyster	1	0	2.1	0.1
hard clams	8	0.1	1.4	0.1
purple sea urchin	15	0.1	0.9	0.1
northern red shrimp	21	0.2	0.7	0
deadman's fingers sponge	nc	nc	0.6	0
surf clam	9	0.1	0.6	0
red bearded sponge	nc	nc	0.4	0
Jonah crab	2	0	0.4	0
star coral	nc	nc	0.3	0
sea cucumber	2	0	0.3	0
tunicates, misc	nc	nc	0.3	0
anemones	nc	nc	0.2	0
coastal mud shrimp	1	0	0.1	0
green crab	1	0	0.1	0
moon jelly	1	0	0.1	0
northern cyclocardia	1	0	0.1	0
Total	**13,036**		**1,700.1**	

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in 2009.

Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Young-of-year bay and striped anchovy are neither separated by species or quantified; young-of-year Atlantic herring and American sand lance are not quantified. Number of tows (sample size)=200.

species	count	%	weight	%
butterfish	108,087	53.6	3,186.9	17
scup	46,991	23.3	6,332.1	33.8
bay anchovy	11,128	5.5	35.3	0.2
Atlantic herring	6,330	3.1	239.2	1.3
winter flounder	4,068	2	524.0	2.8
bluefish	3,657	1.8	1,157.4	6.2
weakfish	2,604	1.3	108.7	0.6
moonfish	2,575	1.3	19.5	0.1
windowpane flounder	2,496	1.2	342.8	1.8
northern searobin	2,012	1	194.3	1
striped searobin	1,507	0.7	471.8	2.5
American sand lance	1,227	0.6	2.0	0
alewife	1,175	0.6	96.0	0.5
fourspot flounder	1,036	0.5	169.8	0.9
silver hake	947	0.5	50.0	0.3
red hake	897	0.4	59.5	0.3
summer flounder	881	0.4	694.4	3.7
little skate	709	0.4	390.0	2.1
smooth dogfish	588	0.3	2,213.3	11.8
striped bass	466	0.2	897.4	4.8
American shad	422	0.2	28.9	0.2
spotted hake	327	0.2	32.1	0.2
blueback herring	291	0.1	14.6	0.1
tautog	163	0.1	285.4	1.5
spiny dogfish	148	0.1	545.7	2.9
black sea bass	121	0.1	59.5	0.3
smallmouth flounder	96	0	4.7	0
clearnose skate	69	0	148.5	0.8
Atlantic menhaden	69	0	18.0	0.1
rough scad	59	0	2.8	0
fourbeard rockling	47	0	3.9	0
winter skate	44	0	108.5	0.6
hogchoker	39	0	4.5	0
blue runner	34	0	2.3	0
ocean pout	22	0	4.8	0
Atlantic sturgeon	18	0	286.6	1.5
cunner	18	0	1.8	0
pollock	18	0	0.8	0
Atlantic cod	15	0	1.0	0
hickory shad	13	0	3.6	0
northern kingfish	7	0	0.4	0
glasseye snapper	6	0	0.6	0
Atlantic mackerel	5	0	0.4	0
northern sennet	5	0	0.4	0
northern puffer	5	0	0.4	0
sea raven	5	0	1.7	0
striped anchovy	5	0	0.4	0
Atlantic silverside	3	0	0.3	0
oyster toadfish	3	0	0.8	0
inshore lizardfish	2	0	0.2	0
northern pipefish	2	0	0.2	0
rock gunnel	2	0	0.2	0
longhorn sculpin	2	0	0.3	0
crevalle jack	1	0	0.1	0
planehead filefish	1	0	0.1	0
round scad	1	0	0.1	0
striped cusk-eel	1	0	0.1	0
spot	1	0	0.2	0
northern stargazer	1	0	0.1	0
Atlantic tomcod	1	0	0.1	0
white perch	1	0	0.1	0
yellow jack	1	0	0.1	0
yellowtail flounder	1	0	0.2	0
Total	**201,476**		**18,750**	

Finfish not ranked

anchovy spp, yoy
Atlantic herring, yoy
American sand lance (yoy)

Invertebrates

species	count	%	weight	%
long-finned squid	24,130	91.4	648.4	30.2
horseshoe crab	340	1.3	645.8	30
American lobster	853	3.2	244	11.3
spider crab	.	.	144.1	6.7
lion's mane jellyfish	641	2.4	89.3	4.2
lady crab	.	.	63.6	3
rock crab	.	.	42.4	2
common slipper shell	.	.	37	1.7
flat claw hermit crab	.	.	33.8	1.6
bushy bryozoan	.	.	33.3	1.5
starfish spp.	.	.	26.6	1.2
channeled whelk	127	0.5	26	1.2
hydroid spp.	.	.	25.7	1.2
knobbed whelk	39	0.1	11.6	0.5
mantis shrimp	215	0.8	10.7	0.5
Tubularia, spp.	.	.	9	0.4
northern moon snail	.	.	7.2	0.3
anemones	.	.	5.6	0.3
mixed sponge species	.	.	5.4	0.3
sea grape	.	.	5.0	0.2
boring sponge	.	.	4.2	0.2
blue crab	19	0.1	4.1	0.2
sand shrimp	.	.	3.8	0.2
deadman's fingers sponge	.	.	3.5	0.2
blue mussel	8	0	3.5	0.2
mud crabs	.	.	3.1	0.1
common oyster	1	0	3.1	0.1
arks	2	0	2.5	0.1
surf clam	18	0.1	1.7	0.1
hard clams	4	0	1.1	0.1
red bearded sponge	.	.	0.8	0
purple sea urchin	4	0	0.8	0
rubbery bryzoan	.	.	0.6	0
star coral	.	.	0.2	0
ghost shrimp	2	0	0.2	0
coastal mud shrimp	2	0	0.1	0
northern cyclocardia	1	0	0.1	0
northern red shrimp	1	0	0.1	0
sea cucumber	1	0	0.1	0
tunicates, misc	1	0	0.1	0
Total	**26,409**		**2,148.2**	

Note: nc= not counted

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in 2010.

Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Young-of-year bay and striped anchovy are neither separated by species or quantified; young-of-year Atlantic herring and American sand lance are not quantified. Number of tows (sample size)=78.

species	count	%	weight	%
American sand lance	13,061	35.3	5.2	0.1
scup	7,157	19.3	1,971.6	44.3
butterfish	2,894	7.8	166.9	3.7
windowpane flounder	2,850	7.7	449.3	10.1
winter flounder	2,579	7.0	450.5	10.1
silver hake	1,747	4.7	35.4	0.8
Atlantic herring	1,318	3.6	179.0	4
northern searobin	1,128	3	149.5	3.4
red hake	990	2.7	64.3	1.4
spotted hake	665	1.8	15.8	0.4
summer flounder	517	1.4	229.6	5.2
bay anchovy	475	1.3	2.8	0.1
fourspot flounder	402	1.1	92.0	2.1
little skate	281	0.8	148.3	3.3
alewife	172	0.5	14.3	0.3
American shad	165	0.4	8.6	0.2
striped searobin	141	0.4	66.4	1.5
blueback herring	101	0.3	3.4	0.1
striped bass	71	0.2	173.2	3.9
tautog	53	0.1	83.1	1.9
black sea bass	37	0.1	20.1	0.5
fourbeard rockling	35	0.1	2.9	0.1
hogchoker	34	0.1	4.4	0.1
smallmouth flounder	31	0.1	1.4	0
rock gunnel	29	0.1	0.5	0
Atlantic cod	21	0.1	2.1	0
winter skate	16	0	37.7	0.8
cunner	11	0	1.3	0
smooth dogfish	10	0	34.4	0.8
Atlantic menhaden	7	0	2.7	0.1
ocean pout	6	0	1.4	0
sea raven	6	0	1.6	0
northern pipefish	4	0	0.3	0
spiny dogfish	3	0	16.2	0.4
bluefish	2	0	6.1	0.1
hickory shad	2	0	0.4	0
pollock	2	0	0.1	0
American plaice	1	0	0.1	0
Atlantic silverside	1	0	0.1	0
Atlantic sturgeon	1	0	5.6	0.1
clearnose skate	1	0	4.5	0.1
longhorn sculpin	1	0	0.4	0
weakfish	1	0	1.0	0
Total	**37,029**		**4,455**	

Finfish not ranked

anchovy spp, yoy

Atlantic herring, yoy

American sand lance (yoy)

species	count	%	weight	%
Invertebrates				
long-finned squid	1,906	62.9	161.4	28.4
horseshoe crab	58	1.9	112.2	19.8
American lobster	293	9.7	83.6	14.7
spider crab .	.		81.6	14.4
bushy bryozoan .	.		23.1	4.1
rock crab .	.		16.7	2.9
starfish spp. .	.		15.1	2.7
common slipper shell .	.		11.2	2
lion's mane jellyfish	401	13.2	7.8	1.4
lady crab .	.		7.7	1.4
flat claw hermit crab .	.		6.8	1.2
hydroid spp. .	.		6.7	1.2
channeled whelk	33	1.1	4.5	0.8
northern moon snail .	.		4.1	0.7
blue mussel .	.		3.1	0.5
common oyster .	.		2.9	0.5
sea grape .	.		2.7	0.5
sand shrimp .	.		2.3	0.4
deadman's fingers sponge .	.		2.3	0.4
blue crab	10	0.3	2.0	0.4
arks .	.		1.6	0.3
mud crabs .	.		1.6	0.3
rubbery bryzoan .	.		1.2	0.2
mantis shrimp	19	0.6	1.1	0.2
Unknown Jellyfish	300	9.9	0.8	0.1
Tubularia, spp. .	.		0.5	0.1
anemones	5	0.1	0.4	0.1
surf clam	2	0.1	0.4	0.1
knobbed whelk	1	0	0.3	0.1
mixed sponge species .	.		0.3	0.1
northern comb jelly	1	0	0.2	0
purple sea urchin	4	0.1	0.2	0
boring sponge .	.		0.1	0
red bearded sponge .	.		0.1	0
coastal mud shrimp .	.		0.1	0
star coral .	.		0.1	0
hard clams .	.		0.1	0
sea cucumber .	.		0.1	0
Total	**3,033**		**567.0**	

Note: nc= not counted

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in 2011.
Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Young-of-year bay and striped anchovy are neither separated by species or quantified; young-of-year Atlantic herring and American sand lance are not quantified. Number of tows (sample size)=172.

species	count	%	weight	%
butterfish	42,141	36.7	1,600.8	9.9
scup	34,458	30.0	6,759.0	41.7
American sand lance	9,535	8.3	7.5	0.0
bay anchovy	4,693	4.1	10.5	0.1
winter flounder	3,092	2.7	613.8	3.8
windowpane flounder	2,831	2.5	395.9	2.4
bluefish	2,765	2.4	584.7	3.6
weakfish	2,583	2.3	192.6	1.2
striped searobin	1,630	1.4	558.7	3.4
Atlantic herring	1,482	1.3	199.4	1.2
fourspot flounder	1,400	1.2	224.2	1.4
summer flounder	1,051	0.9	713.0	4.4
silver hake	948	0.8	40.3	0.2
northern searobin	803	0.7	85.5	0.5
spotted hake	725	0.6	76.8	0.5
little skate	674	0.6	359.4	2.2
moonfish	640	0.6	6.3	0
smooth dogfish	613	0.5	2,031.7	12.5
alewife	512	0.4	29.8	0.2
red hake	278	0.2	25.1	0.2
American shad	271	0.2	17.5	0.1
striped bass	243	0.2	721.9	4.5
Atlantic menhaden	181	0.2	69.8	0.4
rough scad	150	0.1	6.8	0
hogchoker	147	0.1	16.8	0.1
Atlantic cod	109	0.1	9.2	0.1
tautog	106	0.1	151.7	0.9
black sea bass	91	0.1	54.2	0.3
blueback herring	72	0.1	3.2	0
smallmouth flounder	67	0.1	3.5	0
spiny dogfish	58	0.1	203.5	1.3
clearnose skate	56	0	109.8	0.7
inshore lizardfish	43	0	4.6	0
fourbeard rockling	43	0	4.0	0
winter skate	37	0	101.2	0.6
northern kingfish	34	0	3.7	0
ocean pout	27	0	4.5	0
blue runner	24	0	1.7	0
cunner	14	0	1.9	0
northern puffer	9	0	0.9	0
longhorn sculpin	9	0	2.0	0
hickory shad	8	0	1.5	0
Atlantic sturgeon	5	0	181.9	1.1
pollock	5	0	0.5	0
spot	5	0	0.7	0
crevalle jack	4	0	0.4	0
grubby	4	0	0.1	0
northern pipefish	4	0	0.3	0
rock gunnel	4	0	0.2	0
conger eel	3	0	1.1	0
sea raven	3	0	0.9	0
striped cusk-eel	2	0	0.2	0
Atlantic tomcod	2	0	0.2	0
American plaice	1	0	0.1	0
Atlantic croaker	1	0	0.2	0
northern sennet	1	0	0.1	0
round scad	1	0	0.1	0
roughtail stingray	1	0	13.0	0.1
striped burrfish	1	0	0.5	0
striped anchovy	1	0	0.1	0
silver perch	1	0	0.1	0
oyster toadfish	1	0	0.2	0
white perch	1	0	0.1	0
white mullet	1	0	0.1	0
yellowtail flounder	1	0	0.3	0
Total	**114,706**		**16,210.3**	

Finfish not ranked
anchovy spp, yoy
Atlantic herring, yoy
American sand lance (yoy)

species	count	%	weight	%
Invertebrates				
horseshoe crab	257	1.7	505.2	33.5
long-finned squid	13,020	86.4	370.7	24.6
spider crab	.	.	151.8	10.1
lady crab	.	.	132.4	8.8
American lobster	230	1.5	52.0	3.4
rock crab	.	.	45.5	3.0
hydroid spp.	.	.	30.5	2.0
mantis shrimp	971	6.4	29.6	2.0
bushy bryozoan	.	.	24.9	1.7
knobbed whelk	62	0.4	23.8	1.6
flat claw hermit crab	.	.	22.1	1.5
channeled whelk	99	0.7	19.0	1.3
starfish spp.	.	.	14.4	1.0
blue crab	69	0.5	12.4	0.8
lion's mane jellyfish	345	2.3	11.3	0.7
mixed sponge species	.	.	11.0	0.7
blue mussel	1	0	6.7	0.4
northern moon snail	.	.	5.6	0.4
boring sponge	.	.	5.5	0.4
hard clams	.	.	5.3	0.4
common slipper shell	.	.	5.2	0.3
sand shrimp	.	.	4.5	0.3
Tubularia, spp.	.	.	3.5	0.2
mud crabs	.	.	2.6	0.2
rubbery bryzoan	.	.	1.7	0.1
common oyster	1	0	1.6	0.1
sea grape	.	.	1.5	0.1
arks	.	.	1.4	0.1
surf clam	7	0	1.0	0.1
purple sea urchin	3	0	0.6	0
red bearded sponge	.	.	0.3	0
northern comb jelly	.	.	0.3	0
anemones	6	0	0.2	0
star coral	.	.	0.2	0
coastal mud shrimp	1	0	0.1	0
common razor clam	1	0	0.1	0
ghost shrimp	1	0	0.1	0
northern red shrimp	1	0	0.1	0
polychaetes	.	.	0.1	0
tunicates, misc	.	.	0.1	0
water jelly	1	0	0.1	0
Total	**15,076**		**1,505.0**	

Note: nc= not counted

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in 2012.
Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Young-of-year bay and striped anchovy are neither separated by species or quantified; young-of-year Atlantic herring and American sand lance are not quantified. Number of tows (sample size)=200.

species	count	%	weight	%
butterfish	60,539	37.9	1,891.3	10.8
scup	53,119	33.2	6,170.2	35.1
silver hake	7,519	4.7	171.0	1.0
weakfish	6,785	4.2	409.2	2.3
bluefish	3,851	2.4	532.7	3.0
northern searobin	3,642	2.3	405.2	2.3
windowpane flounder	3,536	2.2	501.1	2.9
winter flounder	3,365	2.1	604.9	3.4
striped searobin	2,973	1.9	1,086.4	6.2
fourspot flounder	2,597	1.6	454.5	2.6
red hake	1,720	1.1	148.6	0.8
little skate	1,406	0.9	657.9	3.7
bay anchovy	1,296	0.8	8.6	0.0
summer flounder	980	0.6	718.5	4.1
spot	858	0.5	107.5	0.6
alewife	708	0.4	47.0	0.3
spotted hake	626	0.4	64.2	0
smooth dogfish	610	0.4	1,833.3	10.4
Atlantic herring	571	0.4	61.5	0.4
Atlantic menhaden	426	0.3	144.6	0.8
black sea bass	410	0.3	141.0	0.8
hogchoker	340	0.2	30.7	0.2
American shad	321	0.2	25.3	0.1
clearnose skate	280	0.2	491.7	3
moonfish	262	0.2	3.6	0.0
smallmouth flounder	258	0.2	7.5	0.0
striped bass	170	0.1	278.0	1.6
tautog	135	0.1	128.9	0.7
winter skate	97	0.1	179.8	1
northern kingfish	59	0.0	8.4	0
northern puffer	47	0.0	3.1	0.0
blueback herring	46	0	1.6	0.0
fourbeard rockling	43	0	3.5	0
hickory shad	42	0	14.1	0
blue runner	27	0	2.7	0.0
cunner	20	0	2.8	0
rough scad	19	0	1.1	0
spiny dogfish	16	0	62.8	0
ocean pout	14	0	2.0	0
Atlantic sturgeon	7	0	154.2	1
sea raven	5	0	1.1	0
northern sennet	3	0	0.3	0
striped anchovy	3	0	0.2	0.0
crevalle jack	2	0	0.2	0
goosefish	2	0	0.8	0
pinfish	2	0	0.2	0
round herring	2	0	0.1	0
American sand lance	2	0	0.2	0
African pompano	1	0	0.1	0
conger eel	1	0	0.3	0
gizzard shad	1	0	0.1	0
northern pipefish	1	0	0.1	0
rock gunnel	1	0	0.1	0
roughtail stingray	1	0	5.0	0

species	count	%	weight	%
longhorn sculpin	1	0	0.2	0
white perch	1	0	0.2	0
white mullet	1	0	0.1	0
Total	**159,770**		**17,570.3**	
Finfish not ranked				
anchovy spp, yoy				
Atlantic herring, yoy				
American sand lance (yoy)				
Invertebrates				
horseshoe crab	199	1.7	385.8	30.6
long-finned squid	9,767	84.5	333.9	26.5
spider crab	.	.	162.4	12.9
American lobster	349	3.0	70.0	5.6
boring sponge	.	.	47.9	3.8
lady crab	.	.	45.3	3.6
rock crab	.	.	40.7	3.2
mantis shrimp	846	7.3	26.6	2.1
bushy bryozoan	.	.	20.4	1.6
flat claw hermit crab	.	.	18.3	1.5
blue crab	72	0.6	14.5	1.2
knobbed whelk	36	0.3	13.8	1.1
channeled whelk	76	0.7	13.7	1.1
blue mussel	1	0.0	9.4	0.7
common slipper shell	.	.	9.4	0.7
mixed sponge species	.	.	7.4	0.6
Tubularia, spp.	.	.	5.0	0.4
hydroid spp.	.	.	4.8	0.4
lion's mane jellyfish	50	0.4	4.4	0.3
mud crabs	.	.	3.9	0.3
starfish spp.	.	.	3.3	0.3
northern red shrimp	118	1.0	3.0	0.2
northern moon snail	.	.	1.8	0.1
sand shrimp	.	.	1.7	0.1
arks	.	.	1.4	0.1
hard clams	3	0	1.3	0.1
red bearded sponge	.	.	1.2	0.1
sea grape	.	.	1.1	0.1
deadman's fingers sponge	.	.	0.8	0.1
purple sea urchin	7	0	0.8	0
common oyster	.	.	0.8	0
surf clam	10	0.1	0.8	0
star coral	.	.	0.4	0
rubbery bryzoan	.	.	0.4	0
sea cucumber	3	0	0.4	0
tunicates, misc	16	0	0.4	0
water jelly	4	0	0.3	0
coastal mud shrimp	1	0	0.2	0
northern comb jelly	.	.	0.1	0
moon jelly	.	.	0.1	0
Total	**11,558**		**1,257.9**	

Note: nc= not counted

Appendix 5.4. cont. Total number and weight (kg) of finfish and invertebrates caught in 2013. Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Young-of-year bay and striped anchovy are neither separated by species or quantified; young-of-year Atlantic herring and American sand lance are not quantified. Number of tows (sample size)=200.

species	count	%	weight	%
butterfish	29,569	35.4	1,252.5	7.9
scup	24,961	29.9	5,945.6	37.5
Atlantic herring	3,566	4.3	321.2	2.0
striped searobin	2,724	3.3	1,112.5	7.0
windowpane flounder	2,096	2.5	326.6	2.1
weakfish	1,964	2.4	203.7	1.3
northern searobin	1,934	2.3	161.7	1.0
spot	1,917	2.3	195.4	1.2
winter flounder	1,912	2.3	576.8	3.6
bluefish	1,829	2.2	517.7	3.3
bay anchovy	1,350	1.6	6.8	0.0
fourspot flounder	1,144	1.4	203.4	1.3
summer flounder	1,071	1.3	726.6	4.6
smooth dogfish	1,051	1.3	2,162.3	13.6
spotted hake	927	1.1	66.8	0.4
moonfish	868	1.0	10.0	0.1
red hake	849	1.0	61.1	0.4
little skate	583	0.7	317.8	2.0
silver hake	519	0.6	23.6	0.1
black sea bass	449	0.5	181.2	1.1
alewife	376	0.5	34.1	0.2
hogchoker	250	0.3	27.2	0.2
Atlantic menhaden	234	0.3	87.5	0.6
American shad	222	0.3	15.3	0.1
clearnose skate	218	0.3	387.0	2.4
striped bass	200	0.2	421.0	2.7
tautog	161	0.2	160.8	1.0
smallmouth flounder	128	0.2	5.2	0.0
winter skate	91	0.1	111.2	0.7
blueback herring	68	0.1	4.3	0.0
hickory shad	33	0.0	10.8	0.1
rough scad	28	0.0	1.3	0.0
red goatfish	21	0.0	0.5	0.0
spiny dogfish	21	0.0	91.5	0.6
cunner	20	0.0	1.8	0.0
northern kingfish	14	0.0	2.3	0.0
American sand lance	7	0.0	0.1	0.0
haddock	5	0.0	0.4	0.0
oyster toadfish	5	0.0	0.9	0.0
Atlantic sturgeon	4	0.0	98.0	0.6
Atlantic silverside	3	0.0	0.3	0.0
northern puffer	3	0.0	0.3	0.0
fourbeard rockling	3	0.0	0.2	0.0
bullnose ray	2	0.0	5.7	0.0
harvestfish	2	0.0	0.2	0.0
northern pipefish	2	0.0	0.2	0.0
conger eel	1	0.0	1.2	0.0
Atlantic croaker	1	0.0	0.1	0.0
glasseye snapper	1	0.0	0.1	0.0
pollock	1	0.0	0.1	0.0
round scad	1	0.0	0.1	0.0
red cornetfish	1	0.0	0.1	0.0
longhorn sculpin	1	0.0	0.4	0.0
striped anchovy	1	0.0	0.1	0.0
northern stargazer	1	0.0	0.1	0.0
Total	**83,413**		**15,843.7**	

species	count	%	weight	%
Finfish not ranked				
anchovy spp, (yoy)				
Atlantic herring, (yoy)				
American sand lance (yoy)				
gadid spp, (yoy)				
Invertebrates				
blue mussel	3	0.0	622.1	31.9
horseshoe crab	265	3.4	531.8	27.3
long-finned squid	5,393	69.6	170.8	8.8
spider crab	nc		156.5	8.0
lion's mane jellyfish	1,067	13.8	150.0	7.7
common slipper shell	nc		61.0	3.1
American lobster	144	1.9	37.3	1.9
bushy bryozoan	nc		26.8	1.4
boring sponge	nc		26.1	1.3
mantis shrimp	646	8.3	21.6	1.1
flat claw hermit crab	nc		21.4	1.1
knobbed whelk	51	0.7	18.7	1.0
channeled whelk	95	1.2	18.6	1.0
hydroid spp.	nc		13.2	0.7
lady crab	nc		13.2	0.7
rock crab	nc		13.0	0.7
blue crab	52	0.7	10.4	0.5
Tubularia, spp.	nc		6.7	0.3
common oyster	nc		5.3	0.3
mud crabs	nc		3.5	0.2
sand shrimp	nc		2.9	0.1
northern moon snail	nc		2.9	0.1
surf clam	8	0.1	2.4	0.1
starfish spp.	1	0.0	2.1	0.1
sea grape	nc		2.1	0.1
arks	nc		1.9	0.1
hard clams	6	0.1	0.9	0.0
comb jelly spp	nc		0.8	0.0
red bearded sponge	nc		0.6	0.0
rubbery bryozoan	nc		0.5	0.0
purple sea urchin	10	0.1	0.5	0.0
coastal mud shrimp	4	0.1	0.3	0.0
deadman's fingers sponge	nc		0.3	0.0
mixed sponge species	nc		0.3	0.0
star coral	nc		0.2	0.0
sea cucumber	2	0.0	0.2	0.0
fan worm tubes	nc		0.1	0.0
ghost shrimp	1	0.0	0.1	0.0
Japanese shore crab	1	0.0	0.1	0.0
northern red shrimp	1	0.0	0.1	0.0
ribbed mussel	nc		0.1	0.0
Total	**7,750**		**1,947.4**	

Note: nc= not counted

Table 5.15. Total number and weight (kg) of finfish and invertebrates caught in 2014.
Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Young-of-year bay and striped anchovy are neither separated by species or quantified; young-of-year Atlantic herring and American sand lance are not quantified. Number of tows (sample size)=199.

species	count	%	weight	%
butterfish	69,372	45.3	1,707.6	10.6
scup	45,705	29.9	5,161.4	31.9
weakfish	10,477	6.8	334.8	2.1
bluefish	4,457	2.9	522.7	3.2
northern searobin	2,584	1.7	225.9	1.4
striped searobin	2,544	1.7	1,020.8	6.3
moonfish	2,200	1.4	23.2	0.1
windowpane flounder	2,191	1.4	365.6	2.3
Atlantic herring	1,838	1.2	91.2	0.6
bay anchovy	1,424	0.9	9.4	0.1
winter flounder	1,372	0.9	459.7	2.8
black sea bass	1,295	0.8	543.3	3.4
smooth dogfish	1,197	0.8	2,799.2	17.3
summer flounder	859	0.6	567.4	3.5
fourspot flounder	820	0.5	145.0	0.9
little skate	770	0.5	428.2	2.6
Atlantic menhaden	723	0.5	267.8	1.7
alewife	555	0.4	43.2	0.3
spotted hake	505	0.3	59.5	0.4
red hake	398	0.3	33.5	0.2
silver hake	323	0.2	10.6	0.1
striped bass	255	0.2	407.5	2.5
hogchoker	246	0.2	27.8	0.2
tautog	194	0.1	192.5	1.2
American shad	162	0.1	12.3	0.1
smallmouth flounder	152	0.1	6.0	0.0
clearnose skate	104	0.1	207.7	1.3
winter skate	82	0.1	133.8	0.8
blueback herring	58	0.0	4.2	0.0
northern kingfish	51	0.0	3.2	0.0
hickory shad	30	0.0	10.5	0.1
inshore lizardfish	30	0.0	2.8	0.0
spot	20	0.0	1.8	0.0
spiny dogfish	15	0.0	62.2	0.4
Atlantic sturgeon	13	0.0	272.4	1.7
American sand lance	12	0.0	0.2	0.0
blue runner	10	0.0	0.9	0.0
northern puffer	10	0.0	1.3	0.0
striped cusk-eel	6	0.0	0.6	0.0
Atlantic cod	5	0.0	0.3	0.0
rough scad	5	0.0	0.5	0.0
planehead filefish	4	0.0	0.4	0.0
fourbeard rockling	4	0.0	0.4	0.0
crevalle jack	2	0.0	0.2	0.0
Atlantic croaker	2	0.0	0.2	0.0
cunner	2	0.0	0.2	0.0
Atlantic mackerel	2	0.0	0.2	0.0
silver perch	2	0.0	0.2	0.0
oyster toadfish	2	0.0	0.6	0.0
Atlantic silverside	1	0.0	0.1	0.0
black drum	1	0.0	0.1	0.0
blue spotted cornetfish	1	0.0	0.1	0.0
lookdown	1	0.0	0.1	0.0
mackerel scad	1	0.0	0.1	0.0
northern pipefish	1	0.0	0.1	0.0
round scad	1	0.0	0.1	0.0
red goatfish	1	0.0	0.1	0.0
banded rudderfish	1	0.0	0.4	0.0
sea raven	1	0.0	1.5	0.0
white perch	1	0.0	0.2	0.0
Total	**153,100**		**16,173.8**	

species	count	%	weight	%
Finfish not ranked				
anchovy spp, (yoy)				
Atlantic herring, (yoy)				
American sand lance (yoy)				
gadid spp, (yoy)				
Invertebrates				
longfin inshore squid	13,436	86.3	582.3	37.9
horseshoe crab	261	1.7	497.3	32.4
spider crab	nc		145.6	9.5
blue mussel	nc		52.2	3.4
lion's mane jellyfish	1,262	8.1	48.2	3.1
American lobster	178	1.1	31.5	2.1
bushy bryozoan	nc		24.8	1.6
mixed sponge species	nc		20.6	1.3
common slipper shell	nc		18.8	1.2
mantis shrimp	332	2.1	14.4	0.9
flat claw hermit crab	nc		14.0	0.9
knobbed whelk	34	0.2	12.3	0.8
lady crab	nc		9.3	0.6
sea grape	nc		7.3	0.5
channeled whelk	29	0.2	5.9	0.4
hydroid spp.	nc		5.3	0.3
rock crab	nc		4.8	0.3
northern moon snail	nc		4.6	0.3
Tubularia, spp.	nc		4.6	0.3
boring sponge	nc		4.3	0.3
sand shrimp	nc		4.1	0.3
blue crab	18	0.1	3.0	0.2
arks	nc		2.7	0.2
mud crabs	nc		2.6	0.2
starfish spp.	2	0.0	1.6	0.1
ribbed mussel	nc		1.6	0.1
comb jelly spp	nc		1.4	0.1
star coral	nc		0.7	0.0
purple sea urchin	4	0.0	0.6	0.0
surf clam	4	0.0	0.5	0.0
coastal mud shrimp	1	0.0	0.3	0.0
rubbery bryzoan	nc		0.3	0.0
tunicates, misc	nc		0.3	0.0
anemones	5	0.0	0.2	0.0
brown shrimp	2	0.0	0.2	0.0
common razor clam	1	0.0	0.2	0.0
hard clams	nc		0.2	0.0
common oyster	nc		0.2	0.0
red bearded sponge	nc		0.1	0.0
deadman's fingers sponge	nc		0.1	0.0
ghost shrimp	1	0.0	0.1	0.0
water jelly	1	0.0	0.1	0.0
Total	**15,571**		**1,529.2**	

Note: nc= not counted

Appendix 5.5: Endangered Species Interactions: One (1) Atlantic sturgeon (ATS) and one (1) Kemp's ridley sea turtle (KST) were captured on two of the 200 tows completed in 2015. For Atlantic sturgeon, this yields a lower encounter rate (0.5%) than the average for the LISTS time series of tows (2.3%). This is the first Kemp's ridley encounter for the survey. The Atlantic sturgeon tow occurred over sand bottom type in the 5-9m depth interval, while the Kemp's ridley occurred over transition bottom type in the 5-9m depth interval. Both individuals were released alive and uninjured. Neither were scanned for a passive integrated transponder (PIT) due to a tag reader malfunction. Since the sturgeon could not be checked for a PIT, a genetic sample was not obtained. Both captures were reported to NMFS within 24 hours. Details for each species are provided below:

Photo	Sample	Date	Site	Tow Start	Duration (min)	Species	Total Length (mm)	Fork Length (mm)	Weight (kg)	Left Pec T-bar	Dorsal T-bar	PIT	Tissue Sample	Release time	Release lat (N)	Release lon (W)
	FA2015001	9/10/2015	1533	7:30	30	ATS	1,375	1,232	15.8	NONE	NONE	UNKNOWN	NO	9:14	41.2578	72.342

Photo	Sample	Date	Site	Tow Start	Duration (min)	Species	Curved Length (mm)	Curved Width (mm)	Weight (kg)			PIT		Release time	Release lat (N)	Release lon (W)
	FA2015009	9/11/2015	1423	15:25	30	KST	310	310	3.8			UNKNOWN		16:18	41.2248	72.8507

Appendix 5.6: Cold and warm temperate species captured in LISTS. Thirty-three (33) species are included in the cold temperate group, while thirty-four (34) species are included in the warm temperate group. Cold temperate species are defined as being more abundant north of Cape Cod, MA than south of New York, behaviorally adapted to cold temperatures including subfreezing but prefers ~3-15^{0}C, and spawns at lower end of temperature tolerance. Warm temperate species are defined as being more abundant south of New York than north of Cape Cod, MA, behaviorally avoids temperatures < 7-10^{0}C; prefers ~11-22^{0}C, and spawns at higher end of temperature tolerance.

Cold Temperate Group	
Common Name	Scientific Name
alewife	*Alosa pseudoharengus*
American plaice	*Hippoglossoides platessoides*
Atlantic herring	*Clupea harengus*
Atlantic cod	*Gadus morhua*
Atlantic mackerel	*Scomber scombrus*
Atlantic salmon	*Salmo salar*
Atlantic seasnail	*Liparis atlanticus*
Atlantic sturgeon	*Acipenser oxyrinchus*
Atlantic tomcod	*Microgadus tomcod*
barndoor skate	*Dipturus laevis*
cunner	*Tautogolabrus adspersus*
fawn cusk-eel	*Lepophidium profundorum*
fourspot flounder	*Hippoglossina oblonga*
grubby	*Myoxocephalus aeneus*
haddock	*Melanogrammus aeglefinus*
little skate	*Leucoraja erinacea*
longhorn sculpin	*Myoxocephalus octodecemspinosus*
lumpfish	*Cyclopterus lumpus*
monkfish (goosefish)	*Lophius americanus*
northern pipefish	*Syngnathus fuscus*
ocean pout	*Zoarces americanus*
pollock	*Pollachius virens*
rainbow smelt	*Osmerus mordax*
red hake	*Urophycis chuss*
rock gunnel	*Pholis gunnellus*
rockling	*Enchelyopus cimbrius*
searaven	*Hemitripterus americanus*
spiny dogfish	*Squalus acanthias*
whiting (silver hake)	*Merluccius bilinearis*
windowpane	*Scophthalmus aquosus*
winter flounder	*Pseudopleuronectes americanus*
winter skate	*Leucoraja ocellata*
yellowtail flounder	*Limanda ferruginea*

Warm Temperate Group	
Common Name	Scientific Name
American eel	*Anguilla rostrata*
American shad	*Alosa sapidissima*
Atlantic bonito	*Sarda sarda*
Atlantic croaker	*Micropogonias undulates*
Atlantic silversides	*Menidia menidia*
black seabass	*Centropristis striata*
blueback herring	*Alosa aestivalis*
bluefish	*Pomatomus saltatrix*
butterfish	*Peprilus triacanthus*
clearnose skate	*Raja eglanteria*
conger eel	*Conger oceanicus*
gizzard shad	*Dorosoma cepedianum*
hickory shad	*Alosa mediocris*
hogchoker	*Trinectes maculates*
lined seahorse	*Hippocampus erectus*
menhaden	*Brevoortia tyrannus*
naked goby	*Gobiosoma bosci*
northern kingfish	*Menticirrhus saxatilis*
northern puffer	*Sphoeroides maculates*
northern searobin	*Prionotus carolinus*
oyster toadfish	*Opsanus tau*
scup (porgy)	*Stenotomus chrysops*
sea lamprey	*Petromyzon marinus*
smallmouth flounder	*Etropus microstomus*
smooth dogfish	*Mustelus canis*
spot	*Leiostomus xanthurus*
spotted hake	*Urophycis regia*
striped bass	*Morone saxatilis*
striped cusk-eel	*Ophidion marginatum*
striped searobin	*Prionotus evolans*
summer flounder	*Paralichthys dentatus*
tautog (blackfish)	*Tautoga onitis*
white pearch	*Morone Americana*
weakfish	*Cynoscion regalis*

JOB 6: STUDIES IN CONSERVATION ENGINEERING

TABLE OF CONTENTS

JOB 6: STUDIES IN CONSERVATION ENGINEERING

GOAL

Evaluate new technologies and methodologies for potential inclusion in the Long Island Sound Trawl Survey or other Surveys of this Project.

OBJECTIVES

1) *Characterize catch composition and selectivity patterns using different gear combinations for Connecticut's marine fishery-independent monitoring surveys. Particular emphasis will be placed on evaluating modern trawl net design/materials and doors combinations for potential use on the Long Island Sound Trawl Survey.*

2) *Evaluate impacts of gear changes on associated thirty–year time series data which is used in numerous coastal stock assessments, management decisions, essential fish habitat analysis and climate change studies.*

3) *Assess electronic data acquisition systems for fisheries research for potential benefits of modernizing the Long Island Sound Trawl Survey or other Surveys of this Project.*

4) *Assess new software applications to integrate the components of an onboard electronic data acquisition system with a computerized database for data collection and QA/QC for the Long Island Sound Trawl Survey or other Surveys of this Project.*

INTRODUCTION

Based on new information received after last year's report was completed, the Goal was modified and new Objectives were added. Work during this segment focused on Objective 3, however future segments may focus on other Objectives.

Initially, work for this Job was intended to evaluate a new type of door for the Long Island Sound Trawl Survey (LISTS) because the doors currently in use were well-worn and needed to be replaced, yet Survey staff had been unsuccessful in locating a new, affordable, vendor for the old-style doors for the past few years. Ultimately, it was discovered that another survey on the Atlantic Coast was using the same doors as LISTS, and that the cost to get new ones from their vendor was reasonable. Subsequently, the decision was made to stay with the old-style doors rather than risk affecting the consistency of LISTS's valuable long time-series by changing to a new type of door. Since there would be no change in the door or net configuration fished for the Survey, there would also be no need to conduct the comparison tows as originally proposed for this Job. Instead, a different type of new technology would be evaluated: an electronic data acquisition system for fisheries research to modernize LISTS data collection and data entry.

Long Island Sound Trawl Survey (LISTS) staff are proposing to upgrade the data collection processes that have been in place since the inception of the survey 32 years ago. Although paper and pencil for recording data on research vessels has worked well for LISTS for decades, a number of similar fish surveys along the coast have been using electronic data acquisition hardware and software successfully for quite some time. Some surveys, notably the Northeast Federal bottom trawl surveys, have been mostly digital for over a decade now. Recent improvements in software and hardware are making a digital onboard system more realistic for the Long Island Sound Trawl Survey. Project staff are currently investigating the components that would be required to set-up a mostly wireless data collection system for the 50' R/V John Dempsey that would likely include an onboard computer network of electronic scales, measuring boards and mobile devices. Although electronic fisheries data acquisition systems can be expensive, they typically improve the accuracy and efficiency of fisheries independent surveys by streamlining sampling procedures and decreasing transcription errors at sea, as well as decreasing or eliminating data entry and key punch errors and QA/QC procedures in the office. All of which results in better quality data being available more quickly for fisheries management decisions.

An electronic measuring station on the NEAMAP trawl survey.

METHODS

Survey staff from other trawl surveys conducted along the Atlantic Coast were canvassed for information about their electronic data acquisition systems (MassDMF, NEAMAP, NMFS) and numerous vendors were contacted for detailed specifications of the available components. Repeatedly, two main aspects of the Long Island Sound Trawl Survey's needs made it difficult for LISTS to mimic the setup on the other Surveys. The first issue is the smaller vessel with much less deck space available to LISTS compared to other surveys. Other surveys have enough deck space to accommodate metal tables with windshields affixed to the deck while still having deck space to spill the codend and sort the catch. For LISTS, the sorting table becomes the measuring table once sorting is completed, so measuring workstations cannot be left set up on deck in between tows. Thus, any components for measuring stations need to be easily set up and taken down multiple times each day.

The second main issue for LISTS is that all of the Long Island Sound Trawl Survey gear has to be removed from the research vessel so gear for the Long Island Sound Ambient Water Quality Monitoring Program (Job 10) can be loaded. This means that, even if measuring stations could be affixed to the deck for the trawl survey, they would need to be removed for the water survey. This unloading/loading of gear occurs at least ten times each year and frequently there is only a few hours available to complete the transition.

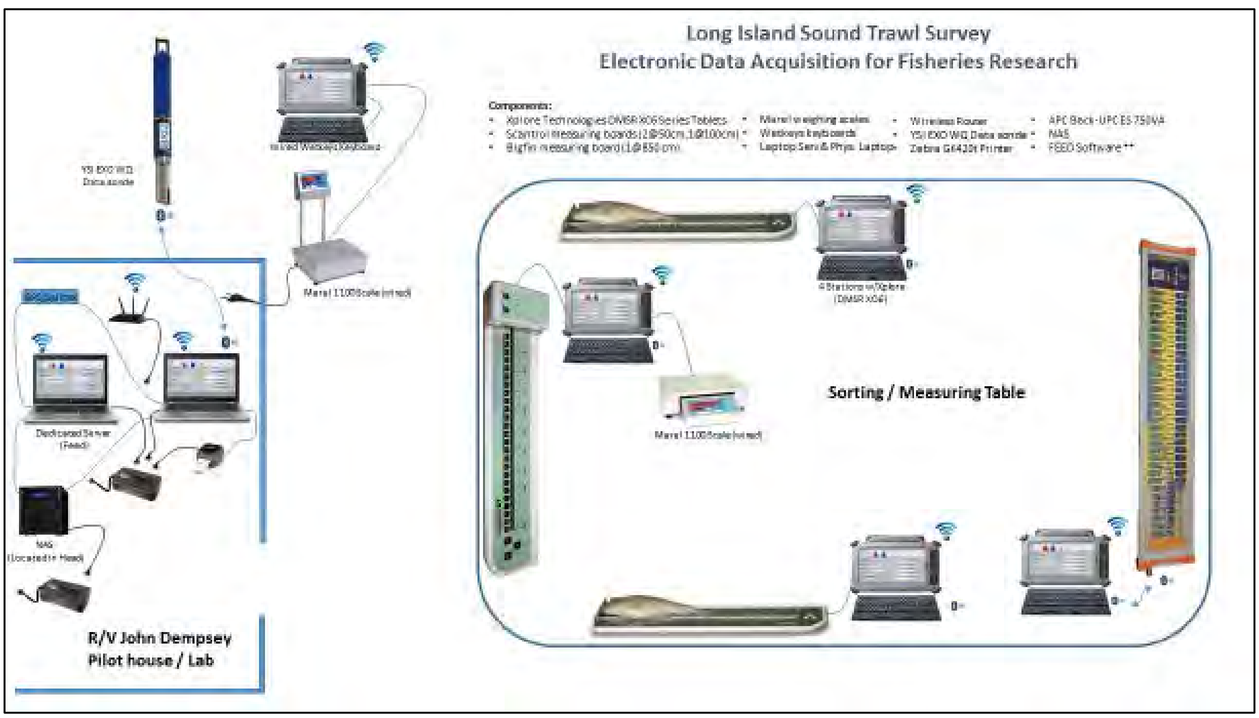
The other large-scale trawl surveys that were canvassed about their electronic data acquisition systems were primarily set up with hardwired components on semi-permanent workstations. LISTS' need to be able to easily and quickly set up and remove components for electronic measuring stations means components will need to be wireless and/or Bluetooth capable as much as possible.

RESULTS

After evaluating numerous options for the components of an electronic data acquisition system for fisheries research, the following specifications describe the components being considered for the LISTS' system:

- **Xplore Technologies DMSR XC6 Series Tablets** - http://www.xploretech.com/products/xc6-dmsr-rugged-sunlight-readable-windows-tablet -XC6-Dual Mode Sunlight Readable, Intel i5-VGA-Standard-Windows 7-64bit-256GB SSD (2 x 128GB)-4GB-`No WWAN-North America WiFi-Bluetooth\Camera-5 Day TAT-5yr Extended P.N. 01-35000-76F4E-00T05-000. Needs latest Office software; 10-cell (80.75 watt hour) long-lasting, Li-Ion Battery; 1 year limited warranty; Part Number: 11-01022, Dual Bay Battery Charger; one conditioning bay. Power cord not included, C13 Type power cord for NA sold separately. 1 year limited warranty. Part Number: 11-11013. Passive 3-D Float system dock and mounts for each location (provided by Xplore and Ram)
- **Scantrol measuring boards** (2@50cm,1@100cm) all wired USB powered through tablet FM-50USB, FM-100USB http://www.scantrol.com/wp-content/uploads/2013/01/FishMeter-brochure_interactive1.pdf
- **Bigfin measuring board** (1@850 cm) wireless and Bluetooth https://squareup.com/market/bigfinscientific
- **Marel weighing scales - M series 1100** https://marel.com/files/products/brochures/marine-scales-brochure_low.pdf?ind=fish converts and captures output directly into FEED software
- **I-key or Wetkeys keyboards (6) 100% waterproof** DU-5K-NI Nonincendive Keyboard with HulaPoint II - http://www.ikey.com/product/du-5k-ni/#sthash.UPFxbsgT.dpuf must have VESA Mounting holes for Ram bracket off of passive dock. SK-102-M

- **Laptop Serv & Phys. Laptop** – physical data from EXO2 and Helm feed (GPS NEMA 183) on one laptop (currently being used on Dempsey) FEED may be able to read all this data into database. Bluetooth to this laptop from EXO2 and convert NEMA using current serial to USB adaptor. Server Laptop will house FEED database. However if problems occur with network/server each laptop will have an independent separate FEED application that records data and then you would transfer by flash drive. With normal operation each tablets FEED application will write to the database on the Laptop server. This database server will only have that duty and, as with all the tablets, only ever be connected to the network. At some point we will work out downloads (say from the dock) to our network at marine HQ but for now we will use flash drives to backup each sampling day.
- **Wireless Router**
- **YSI EXO WQ Data sonde**
- **Zebra GK420t Printer** Zebra Advanced Printer G-Series GK420t - label printer - monochrome - direct thermal / thermal transfer. Mfg. Part: GK42-102510-000
- **APC Back-UPC ES 750VA** (2 total) APC Back-UPS ES 750VA UPS Mfg. Part: BE750G
- **NAS** for mirroring (backup) of hard drive
- **FEED Software**



Schematic of how the components of an electronic data acquisition system might be situated on the R/V John Dempsey.

Naturally, **t**he system configuration will need to be refined as components are gradually purchased and set up for use on the Survey in future segments of this Job. A customized software application will also need to be designed to integrate all of the new electronic components and incorporate standardized LISTS protocols for data collected from each sample, data storage and quality assurance.

MODIFICATIONS

Due to the nature of evaluating new technologies, it is not known ahead of time which ideas will be implemented. Therefore, the specific Objectives of this Job are likely to change over time. With that in mind, in the next segment of the Project, we expect to continue work to evaluate new hardware and software in the hopes of implementing an electronic data acquisition system on the LIS Trawl Survey. Future segments of the Project may be used to investigate other new technologies or methodologies that have potential benefits for the LIS Trawl Survey or other Surveys in this Project.

Job 7: ALOSINE SURVEY

INACTIVE

Job 7 was not active during the 2015-2016 grant period because the work was transferred to another source of funds. However, work on this job may be transferred back to this program funding before the end of the 2016-2017 grant period.

JOB 8: ESTUARINE SEINE SURVEY

JOB 8: ESTUARINE SEINE SURVEY

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Beach seining with 25' bag seine.

JOB 8: ESTUARINE SEINE SURVEY

GOAL

To monitor the abundance and size composition of near-shore young-of-year and forage fish resources, with physical habitat parameters, in order to evaluate the effects of fishing and environmental conditions on the distribution and abundance of marine resources in Long Island Sound.

OBJECTIVES

1) *Provide an annual index of recruitment for winter flounder (Age0, 1+), all finfsh species taken, and all crab species.*
2) *Provide an annual total count for all finfish taken.*
3) *Provide an index for shallow subtidal forage species abundance.*

METHODS

Eight sites (Figure 8.1) are sampled during September using an eight-meter (25 ft.) bag seine with 6.4mm (0.25 in.) bar mesh. Area swept is standardized to 4.6 m (15 ft.), width by means of a taut spreader rope and a 30m (98 ft.), measured distance, parallel to, or at a 45º angle to the shoreline, against the current or tide if present. At each site, six seine hauls are taken within two hours before and after low slack tide during daylight hours. Sites in Groton, Waterford, Old Lyme, Clinton, New Haven, Bridgeport and Greenwich have been sampled since 1988. The Milford site was added in 1990. In addition to September sampling, six of the original seven sites were sampled in June, July, and August 2013-2015 to compare with samples taken in these months in 1988-1990. Sampling methods were the same as described above.

Finfish, crabs, and other invertebrates taken in each sample are identified to species or lowest practical taxon (full listing given in Appendix 8.1, 8.2) and counted. One exception is inland silverside, which are not separated from Atlantic silverside because they are rare and difficult to identify. Qualitative counts were used for menhaden when abundant (n>1000) to minimize discard mortality. Winter flounder are measured to total length (mm), and classified as young-of-year (YOY) if less than 12 cm and age 1+ if 12cm or larger. The age of flounder near this size was verified in 1990-1992 by examination of the sagittal otolith. Physical data recorded at each seine location included water temperature and salinity at one-meter depth. The geometric (retransformed natural log) mean catch per standard haul is calculated for total finfish catch and individually for the 22 most abundant species, with separate indices for young-of-year (YOY) and winter flounder age 1 and older. Winter flounder YOY catch is also reported for each site. Confidence intervals (95%) for each geometric mean are retransformations of the corresponding log intervals. Frequency of occurrence is given as a percentage of all samples taken each year.

Diversity in the catch, or species richness, was computed for finfish species captured in the

Survey over the time series. Species were divided into three groups based on their temperature preferences and seasonal spawning habits as documented in the literature. Criteria used to assign species into a cold temperate group, warm temperate group, or subtropical group are listed in Job 5.

RESULTS

A total of 48 seine hauls were taken in 2015 at eight sites, yielding a total catch of 19,070 fish of 27 species and 16,966 invertebrates of 11 species. Geometric mean catch of all finfish (330 fish/haul) was the highest in the 28 year time series (Figure 8.2), and more than double the time series median of 135 fish/haul. Although total catch has varied considerably year to year, the increasing trend is significant (df=27, r^2=0.11, p=0.05). Dominant species contributing to this increase include young-of-year (YOY) black sea bass, tautog, scup (porgy), northern kingfish, striped searobin, and menhaden.

Geometric means were calculated for 22 species commonly captured since the survey began in 1988 (Table 8.1). The most frequently caught species was Atlantic silverside, which occurred in all samples, followed by black sea bass, striped killifish, tautog, snapper bluefish and northern pipefish (Table 8.2). This rank order has changed from previous years, with a notable decrease in winter flounder YOY (Figure 8.3) grubby, and windowpane flounder.

Scup, snapper bluefish, black sea bass and northern kingfish occurrence and abundance increased well above the 28 year time series average in 2015, increasing to record high abundance for the time series (Tables 8.1 and 8.2). Occurrence of striped searobin and inshore lizardfish also ranked high in the time series. Windowpane flounder was again absent in 2015 after re-occurring at low abundance in 2011 and 2014, but absent in 2009-10 and 2012-13 (Table 8.1).

Relative Abundance of Juvenile Winter Flounder and Tautog

The 2015 index of YOY winter flounder (0.6 fish/haul) continued a 4-year trend of modest increase, but still ranked fourth lowest out of the 28 annual indices (Table 8.3, Figure 8.3). The time series has a significant negative trend (r^2=0.34, p<0.001), and indicates that a relatively strong year class has not been produced since 1996 (Table 8.1, Figure 8.3). As in previous years, highest abundance was seen at eastern sites (Groton, Waterford, Old Lyme, Clinton) and Greenwich, with all but Old Lyme increasing from 2014 (Table 8.3). Abundance at the New Haven site continued to decline from previous high values, with the 2015 index at the same low value as the neighboring Milford site. No winter flounder were captured at the Bridgeport site in 2015, as was seen in 2012-13. Mean length of YOY winter flounder captured at all sites shows no trend over the 28-year time series, ranging from 47.3 to 71.1mm.

The 2015 index of YOY tautog (4.8 fish/haul) was the highest abundance in the time series (Table 8.1, Figure 8.4), significantly higher than the series average of 1.0 tautog /haul.

Overall, the time series has a significant increasing trend (r^2=0.27, p=0.003). Relatively abundant year classes have been produced in 1998-99, 2002-04, 2007-08, 2012 and 2014-15. The frequency of occurrence of this species has also increased over the time series (Figure 8.4) indicating that juvenile production and survival is improving in several areas of the Sound.

Presence of Other Important Recreational Finfish

YOY scup and black seabass are recent additions to the seine survey (Table 8.1, Figure 8.5). Scup occurred in 1999 but the highest relative abundance has been in the last ten years of the time series. In 2014 and 2015, the species was present in record numbers, reflecting excellent recruitment and survival. YOY black sea bass first appeared in 1991 and every year since 1997, reaching their record highest abundance in 2015. Juvenile striped bass first occurred in the survey in 1999 with one individual captured. In 2003, six more YOY striped bass were taken (Table 8.4). One large individual (369mm) was captured in 2008. YOY summer flounder also have occurred more recently in greater numbers (Table 8.4). Snapper bluefish occurred in 21 out of 28 years of the time series, reaching peak abundance in 1999 and 2014-15 (Table 8.4). Other species that were at their highest abundance in 2015 catches were northern searobin and American eel Table 8.5).

Relative Abundance of Forage Species

Seine survey catches are numerically dominated by forage species, defined here as short-lived, highly fecund species that spend the majority of their life cycle inshore where they are common food items for piscivorous fish. An index of forage fish abundance was generated using the catch of four of the most common forage species caught: Atlantic silverside, striped killifish, mummichog, and sheepshead minnow (Figure 8.6). The index for 2015 was the second highest in the 28 year time series. Although numerically driven by the abundance of silverside, three of the four forage fish species increased in abundance and occurrence in 2015; all but sheepshead minnow showed a large increase in abundance. Atlantic silverside abundance increased in 2015 to the highest value in the time series (115 fish/haul, Table 8.1). The mean catch of both *Fundulus* species (mummichog and striped killifish) increased significantly (r^2 0.11-0.28, p<0.05) over the 28 year time series. A decrease in these species' abundance in 2012-13 reversed a five-year trend of increasing abundance from 2007-2011. In 2014-15 striped killifish increased substantially in abundance and frequency of occurrence (14.5-17.1 fish/tow, 88% occurrence), abundance well above the series mean of 10.3 fish/haul. In 2015, mummichog abundance (5.3 fish/haul) was also well above the long-term average of 2.5 fish/haul. Over the 28 year time series, the forage index has shown a 5-7 year cyclical pattern, common for short-lived forage species, with no significant trend ((r^2 0.06, p=0.11, Figure 8.6).

Relative Abundance of Invertebrate Species

A total of 16,966 invertebrates of 11 species were captured in 2015 (Table 8.6, Appendix 8.2). Six crab species were present in the seine hauls, along with two shrimp species, one gastropod and bivalve. Mud snail, sand shrimp, shore shrimp, green crab, and hermit crab were the most abundant and at greater than 50% occurrence (Table 8.3).

Blue crabs were captured at the Clinton and Waterford sites only, and continued at relatively low abundance in 2015 (n=18 crabs) down from a time series high in 2009 (n=333 crabs). The Asian shore crab re-appeared in 2015, with only one captured at the Greenwich site. The shore shrimp increased substantially in abundance in 2014-15 from previous years, while sand shrimp decreased significantly (Table 8.3). Spider crab abundance has also increased nearly ten-fold since 2011 compared to earlier years, with the highest catch in 2015.

Finfish Species Richness

Over the 28-year time series, the mean number of cold temperate species captured per seine haul (Figure 8.7, Table 8.7) was less than three with a negative trend (r^2=0.15, p=0.025). In contrast, the mean number of warm temperate species increased significantly (r^2=0.59, p<0.001) from about three to more than seven over the time series.

Comparison of 2013-2015 Summer Sampling with 1988-1990

A total of 396 seine hauls were taken monthly, June – September, 2013-2015 at six of the eight seine sites (Groton, Waterford, Clinton, New Haven, Bridgeport, Greenwich, see Figure 8.1) that were unchanged physically since similar samples (N=415) were taken in 1988-1990 in the same months. Six hauls were taken at each site except for Greenwich where only three haul locations (Pelican Island) were comparable during both time periods.

Catch of all finfish species in June-September 2013-2015 resulted in a geometric mean of 22.6-227.4 fish/haul, which compared to 38.6.-159.1 in 1988-1990 (Figure 8.8). Lowest abundance was in June and peak abundance in August and September. This seasonal progression reflects resident and migrant species recruiting to the mesh size of the sampling gear and/or moving onto the nursery grounds. Standard errors for 2013-2015 monthly means (CV range of 13-28%) make the recent mean values statistically indistinguishable from 1988-1990 monthly means (CV range of 15-29%). However, a steady rise in species number, from 3.1 species/haul to 8.5 species/haul (Figure 8.8), was recorded by month in 2013-2015 that was not seen in 1988-1990 (range 4.1 to 5.2 species/haul).

In contrast to the seasonal increase in abundance seen in total finfish from June through September, winter flounder young-of-year (YOY) abundance was highest in June and declined over the summer during both time periods (Figure 8.9). Although abundance in June was similar for both time periods, attrition from July-September in 2013-2015 was more than five times greater (slope= -0. 66, r^2=0.99) compared to the same months in 1988-1990 (slope = -0.11, r^2=0.98). This increasing decline in abundance over the summer months reduced moderate June abundance to the extremely low abundance recorded in September 2013-2015.

The average size of YOY winter flounder captured in June 2013-2015 (mean=39.8mm, SE=5.9) was smaller than those captured in June 1988-1990 (mean=43.7mm, SE=5.7), a 9% decline but not statistically significant due to the large variance in the data. Average size of juveniles captured in September in the later years were also smaller on average than in the earlier period (57.2mm, SE=6.3 versus mean 60.6mm, SE=4.0, respectively) but again the two data sets are not statistically distinguishable.

Tautog YOY, captured principally in the Waterford, Clinton, and New Haven sites, showed the opposite pattern from winter flounder YOY. Numbers increased dramatically in August and September 2013-2015 (Figure 8.10), while 1988-1990 sampling resulted in low catches in all months.

Seasonal comparison of forage species (principally Atlantic silversides, with mummichog, striped killifish, and sheepshead minnow included) between the two time periods showed no significant difference in abundance (1988-1990: geometric mean=31.2, SE=1.14; 2013-2015: geometric mean=27.4, SE=1.15). A small change in the seasonal pattern of abundance was seen: 1988-1990 data followed a sigmoid seasonal pattern compared to a more linear monthly increase seen in 2013-2015 (Figure 8.11).

Although water temperature plays an important role in YOY growth and abundance, little change in mean water temperature at these shallow beach sites was recorded between the two time periods. In the later period, lower values occurred in June (mean1988-90=21.2^{0}C, SD=2.7; mean 2013-15 = 20.5^{0}C, SD=4.4) but similar values were recorded in September (mean 1988-90=21.6^{0}C, SD=2.1; mean 2013-15=21.8^{0}C, SD=3.6). Mean September temperature at these six sites shows no significant trend over the entire 28 year time series (Figure 8.12). Similarly, September salinity at these sites has varied widely and shows no significant trend over the time series (Figure 8.12).

MODIFICATIONS

Seasonal sampling June-August was planned for 2013-2015 only and will be discontinued in 2016.

Table 8.1: Geometric mean catch of finfish species commonly taken in seine samples, 1988-2015. *See Appendix 8.1 for complete taxonomic names.*

Species	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
alewife	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
American sand lance	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
American shad	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Atlantic menhaden	0.1	0.0	0.0	0.0	0.5	0.0	0.1	0.0	0.0	0.1	0.4	0.4	0.4	0.0	1.0	8.2
Atlantic silverside	68.2	31.6	45.0	88.5	51.2	42.7	37.7	27.0	17.7	23.1	74.3	102.5	99.7	36.1	80.1	113.6
Atlantic tomcod	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
black sea bass	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.1	0.0	0.0	0.1	0.1	0.0	1.0	0.4	0.2
blueback herring	0.0	0.1	0.0	0.5	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1
bluefish	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.9	0.0	0.1	0.0	0.2
cunner	0.2	0.3	0.0	0.1	0.2	0.0	0.3	0.2	0.3	0.0	0.3	0.5	0.3	0.2	0.3	0.2
fourspine stickleback	0.3	0.4	0.0	0.7	0.1	0.1	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.0
grubby	0.8	0.1	0.0	0.1	0.5	0.1	0.4	0.3	0.2	0.3	0.2	0.5	0.1	0.2	0.3	0.5
inshore lizardfish	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.4	0.1	0.2	0.2	1.2	0.0	0.0
mummichog	2.8	1.6	1.1	1.9	1.6	3.7	3.3	0.7	1.2	0.5	2.0	0.8	3.2	1.4	3.4	2.9
naked goby	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
northern kingfish	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.1	0.0	0.1	0.1	0.1	0.0	0.2	0.1	0.2
northern pipefish	0.7	0.3	0.4	1.0	0.9	0.9	1.1	0.5	1.0	0.4	2.1	1.0	1.0	1.4	0.5	0.3
northern puffer	0.1	0.3	0.1	0.4	0.1	0.4	0.2	0.5	0.2	0.1	0.1	0.2	0.6	0.2	0.7	0.7
rainbow smelt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
scup	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0	0.6
sheepshead minnow	0.8	1.0	0.1	0.6	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.4	0.2	0.6	0.7
smallmouth flounder	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.3	0.0	0.1	0.0	0.0
striped bass	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
striped killifish	11.9	7.9	5.9	4.2	3.1	4.9	5.1	3.9	2.0	1.5	7.2	4.5	8.6	7.5	14.5	14.9
striped searobin	0.2	0.2	0.1	0.2	0.1	0.9	0.1	0.0	0.1	0.4	1.9	0.6	0.1	0.4	0.3	0.7
summer flounder	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
tautog	0.3	0.1	0.3	0.7	0.4	0.2	0.8	0.7	0.3	0.2	0.9	1.3	0.5	0.6	1.5	1.1
weakfish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
windowpane flounder	0.6	0.1	0.2	0.2	0.3	0.3	0.1	0.2	0.7	0.4	0.1	0.1	0.1	0.0	0.0	0.1
winter flounder-age 1+	0.2	0.1	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.0
winter flounder YOY	15.4	1.7	2.9	5.2	11.9	5.7	14.2	10.1	19.2	7.5	9.2	8.7	4.3	1.3	3.1	8.1

Table 8.1 continued: Geometric mean catch of finfish species commonly taken in seine samples, 1988-2015. *See Appendix 8.1 for complete taxonomic names.*

Species	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
alewife	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
American sand lance	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
American shad	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Atlantic menhaden	0.4	0.2	0.4	0.6	0.1	0.3	0.0	0.1	0.03	0.08	1.2	9.9
Atlantic silverside	85.1	81.3	37.7	74.9	57.5	66.8	96.9	66.5	44.9	34.9	64.8	114.5
Atlantic tomcod	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
black sea bass	0.4	0.1	0.5	0.6	0.3	1.1	0.4	3.2	5.2	3.7	10.8	16.3
blueback herring	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.01	0.0	0.1
bluefish	0.2	0.1	0.2	0.0	0.0	0.3	0.0	0.2	0.4	0.2	0.8	3.4
cunner	0.5	0.3	0.1	0.5	0.1	0.2	0.1	0.0	0.4	0.02	0.5	0. 1
fourspine stickleback	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.15	0.0
grubby	1.3	0.8	0.3	0.3	0.2	0.5	0.3	0.7	0.2	0.2	0.2	0.2
inshore lizardfish	0.0	0.0	1.9	0.2	0.3	0.2	0.1	0.2	0.2	0.13	1.6	0.4
mummichog	2.3	1.5	2.5	7.3	2.9	3.8	1.7	3.1	1.6	0.9	5.0	5.3
naked goby	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.06	0.05	0.08	0.04
northern kingfish	0.3	0.1	0.0	0.0	0.2	0.3	0.5	0.2	0.5	0.7	1.1	1.0
northern pipefish	0.7	0.5	0.6	0.8	0.7	1.9	0.6	1.1	1.4	1.7	2.6	2.0
northern puffer	0.7	0.5	0.4	1.2	0.2	0.3	0.4	0.4	0.9	1.1	1.1	1.4
rainbow smelt	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
scup	0.2	0.9	0.1	1.0	0.1	1.9	0.1	0.2	2.1	0.12	2.6	9.5
sheepshead minnow	0.5	0.2	0.2	3.3	1.2	0.5	0.3	0.5	0.8	0.2	0.6	0.3
smallmouth flounder	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.9	0.4	0.5	0.1	0.2
striped bass	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
striped killifish	12.9	19.4	7.1	21.2	21.7	12.3	15.9	28.7	5.3	3.8	14.5	17.1
striped searobin	0.5	0.2	0.1	0.3	0.3	0.8	0.2	0.1	0.08	0.17	1.1	0.7
summer flounder	0.0	0.0	0.2	0.1	0.1	0.0	0.1	0.0	0.08	0.1	0.04	0.1
tautog	1.4	0.7	0.4	2.4	1.0	0.4	0.4	0.3	1.3	0.6	3.5	4.8
weakfish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.03	0.0
windowpane flounder	0.2	0.2	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.03	0.0
winter flounder-age 1+	0.1	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.02	0.0	0.04	0.03
winter flounder YOY	11.0	5.6	0.9	4.7	2.0	0.8	1.0	1.1	0.3	0.3	0.5	0.6

Table 8.2: Frequency of occurrence of finfish species commonly taken in seine samples, 1988-2015. *See Appendix 8.1 for complete taxonomic names.*

Species	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
alewife	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.02
American sand lance	0.00	0.00	0.00	0.00	0.02	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
American shad	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Atlantic menhaden	0.06	0.05	0.04	0.04	0.19	0.06	0.10	0.04	0.00	0.06	0.06	0.15	0.10	0.02	0.27	0.58
Atlantic silverside	0.97	0.93	0.96	1.00	1.00	0.96	1.00	0.96	0.94	0.92	0.98	0.94	1.00	0.92	1.00	0.96
Atlantic tomcod	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
black sea bass	0.00	0.00	0.00	0.04	0.00	0.00	0.15	0.04	0.00	0.00	0.06	0.08	0.02	0.25	0.17	0.13
blueback herring	0.00	0.05	0.04	0.13	0.04	0.00	0.06	0.02	0.00	0.00	0.02	0.08	0.02	0.00	0.04	0.06
bluefish	0.00	0.00	0.00	0.10	0.02	0.00	0.02	0.00	0.00	0.02	0.13	0.46	0.04	0.13	0.02	0.10
cunner	0.17	0.19	0.04	0.10	0.15	0.00	0.23	0.15	0.13	0.02	0.21	0.23	0.19	0.15	0.13	0.17
fourspine stickleback	0.17	0.19	0.00	0.23	0.15	0.04	0.02	0.00	0.04	0.00	0.13	0.04	0.02	0.06	0.00	0.00
grubby	0.33	0.07	0.04	0.10	0.31	0.06	0.33	0.25	0.19	0.29	0.17	0.27	0.10	0.17	0.21	0.29
inshore lizardfish	0.06	0.00	0.04	0.00	0.00	0.06	0.10	0.00	0.00	0.29	0.06	0.17	0.19	0.56	0.04	0.00
mummichog	0.47	0.48	0.35	0.40	0.38	0.50	0.42	0.35	0.42	0.15	0.42	0.29	0.44	0.42	0.54	0.44
naked goby	0.00	0.00	0.02	0.06	0.00	0.00	0.00	0.02	0.00	0.00	0.02	0.02	0.00	0.08	0.02	0.02
northern kingfish	0.00	0.00	0.00	0.06	0.08	0.10	0.04	0.15	0.04	0.13	0.10	0.08	0.04	0.13	0.04	0.15
northern pipefish	0.42	0.31	0.37	0.63	0.35	0.50	0.58	0.33	0.44	0.33	0.73	0.48	0.54	0.48	0.19	0.25
northern puffer	0.08	0.24	0.09	0.27	0.08	0.31	0.17	0.40	0.15	0.06	0.10	0.19	0.35	0.17	0.35	0.31
rainbow smelt	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
scup	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.23	0.35	0.25
sheepshead minnow	0.31	0.31	0.09	0.21	0.04	0.02	0.02	0.04	0.00	0.04	0.04	0.06	0.17	0.10	0.15	0.19
smallmouth flounder	0.03	0.00	0.00	0.02	0.00	0.13	0.10	0.06	0.04	0.04	0.00	0.21	0.06	0.13	0.00	0.00
striped bass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.06
striped killifish	0.78	0.67	0.65	0.73	0.58	0.65	0.58	0.69	0.54	0.40	0.75	0.67	0.63	0.71	0.85	0.81
striped searobin	0.11	0.12	0.11	0.10	0.08	0.48	0.10	0.02	0.10	0.35	0.60	0.38	0.10	0.29	0.25	0.40
summer flounder	0.00	0.00	0.00	0.00	0.00	0.04	0.10	0.00	0.02	0.00	0.02	0.00	0.00	0.00	0.00	0.00
tautog	0.22	0.05	0.22	0.42	0.31	0.19	0.33	0.33	0.13	0.17	0.38	0.46	0.23	0.40	0.54	0.50
weakfish	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13
windowpane flounder	0.31	0.10	0.13	0.23	0.23	0.19	0.17	0.19	0.35	0.23	0.13	0.13	0.06	0.00	0.02	0.10
winter flounder –age 1+	0.25	0.12	0.00	0.15	0.08	0.23	0.17	0.19	0.10	0.15	0.10	0.06	0.15	0.04	0.02	0.00
winter flounder YOY	0.97	0.71	0.74	0.92	0.98	0.88	0.98	0.94	1.00	0.94	0.92	0.88	0.77	0.58	0.79	0.85

Table 8.2 cont.: Frequency of occurrence of finfish species commonly taken in seine samples, 1988-2015. *See Appendix 8.1 for complete taxonomic names.*

Species	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
alewife	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
American sand lance	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00
American shad	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
Atlantic menhaden	0.08	0.06	0.13	0.17	0.02	0.15	0.02	0.02	0.04	0.04	0.23	0.54
Atlantic silverside	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00
Atlantic tomcod	0.02	0.02	0.00	0.00	0.02	0.00	0.00	0.06	0.00	0.00	0.00	0.00
black sea bass	0.25	0.08	0.23	0.23	0.15	0.27	0.13	0.58	0.75	0.58	0.77	0.90
blueback herring	0.00	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.02	0.00	0.00	0.02
bluefish	0.15	0.04	0.08	0.00	0.02	0.15	0.02	0.10	0.21	0.08	0.23	0.77
cunner	0.29	0.21	0.13	0.25	0.10	0.17	0.08	0.04	0.23	0.02	0.31	0.10
fourspine stickleback	0.02	0.00	0.02	0.00	0.00	0.02	0.00	0.04	0.00	0.00	0.15	0.00
grubby	0.50	0.46	0.27	0.15	0.19	0.27	0.21	0.42	0.23	0.20	0.19	0.15
inshore lizardfish	0.06	0.00	0.60	0.13	0.19	0.15	0.13	0.10	0.15	0.13	0.60	0.25
mummichog	0.35	0.27	0.48	0.65	0.48	0.50	0.40	0.42	0.35	0.27	0.54	0.65
naked goby	0.04	0.00	0.08	0.00	0.02	0.00	0.00	0.02	0.08	0.06	0.08	0.02
northern kingfish	0.17	0.10	0.02	0.02	0.19	0.17	0.23	0.13	0.29	0.35	0.40	0.38
northern pipefish	0.48	0.25	0.29	0.42	0.23	0.52	0.40	0.44	0.60	0.60	0.69	0.75
northern puffer	0.40	0.31	0.29	0.44	0.23	0.23	0.21	0.31	0.42	0.38	0.48	0.31
rainbow smelt	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
scup	0.13	0.29	0.04	0.29	0.02	0.38	0.04	0.06	0.42	0.08	0.48	0.71
sheepshead minnow	0.15	0.15	0.06	0.40	0.27	0.13	0.10	0.13	0.25	0.07	0.17	0.13
smallmouth flounder	0.00	0.00	0.02	0.00	0.13	0.15	0.06	0.40	0.17	0.29	0.06	0.15
striped bass	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
striped killifish	0.73	0.96	0.65	0.88	0.94	0.75	0.90	0.98	0.65	0.58	0.88	0.88
striped searobin	0.38	0.13	0.13	0.27	0.19	0.40	0.17	0.06	0.08	0.15	0.49	0.29
summer flounder	0.00	0.00	0.19	0.06	0.15	0.02	0.04	0.00	0.08	0.12	0.06	0.13
tautog	0.54	0.42	0.17	0.54	0.42	0.35	0.31	0.23	0.60	0.33	0.63	0.83
weakfish	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
windowpane flounder	0.21	0.15	0.06	0.04	0.10	0.00	0.04	0.02	0.00	0.00	0.04	0.00
winter flounder	0.17	0.21	0.15	0.08	0.15	0.04	0.04	0.04	0.04	0.00	0.06	0.04
winter flounder YOY	0.98	0.94	0.46	0.92	0.71	0.52	0.60	0.63	0.27	0.23	0.33	0.46

Table 8.3: Mean catch of young-of-year winter flounder at eight sites sampled by seine, 1988-2015.
BPT=Bridgeport, CLT=Clinton, GRT=Groton, GRW=Greenwich, MIL=Milford, OLM=Old Lyme, WTF=Waterford

Year	BPT	CLT	GRT	GRW	MIL	NHH	OLM	WTF	All Sites
1988	*18.72	2.73	11.39	9.63	-	38.66	58.19	29.57	15.4
1989	1.70	1.14	1.53	0.70	-	2.14	2.04	2.99	1.7
1990	3.97	0.19	2.21	0.51	1.62	5.69	16.83	2.64	2.9
1991	1.77	4.10	5.62	1.99	2.46	6.45	15.32	18.25	5.2
1992	3.34	5.53	6.25	9.42	4.29	40.15	47.99	32.52	11.9
1993	1.22	1.40	8.59	4.33	3.62	11.47	13.34	16.66	5.7
1994	4.46	8.11	38.36	4.26	4.62	35.34	61.65	21.03	14.2
1995	1.94	3.19	30.28	7.22	1.77	18.93	34.23	36.58	10.1
1996	7.67	11.81	15.67	*12.61	*6.58	*49.29	91.34	30.53	*19.2
1997	2.87	6.61	23.69	3.43	1.64	3.79	52.01	11.25	7.5
1998	1.24	4.03	17.63	8.12	0.91	22.37	57.19	21.89	9.2
1999	1.04	2.60	25.7	7.95	3.49	0.94	*137.07	36.12	8.7
2000	2.14	0.51	0.76	6.65	0.78	1.74	48.34	*41.56	4.3
2001	0.20	1.12	4.12	1.24	0.59	0	0.91	9.10	1.3
2002	0.91	2.66	3.06	5.08	0.26	1.08	15.55	8.98	3.1
2003	1.88	4.61	*45.78	5.88	0.89	1.70	51.13	32.30	8.1
2004	1.00	*18.36	33.84	11.27	3.36	33.06	11.13	13.04	11.0
2005	1.94	11.14	16.7	7.71	5.14	1.64	4.06	7.30	5.6
2006	0.12	1.38	5.53	0.12	0	0	3.30	1.29	0.9
2007	0.78	5.65	17.90	4.44	0.78	6.42	7.89	7.11	4.7
2008	0.51	2.45	10.84	0.51	0	1.57	2.62	5.94	2.0
2009	0.91	1.62	2.29	0.12	0.51	0.12	0.12	1.75	0.8
2010	0.41	1.11	1.71	1.33	0.12	0.41	1.88	1.57	1.0
2011	0.12	0.98	1.18	2.26	0.78	0.12	4.27	1.45	1.1
2012	0	0.26	0.70	0.76	0	0.12	0.26	0.44	0.3
2013	0	0	1.14	0.26	0	0	0.65	0.57	**0.28
2014	0.12	0.12	1.82	0.26	0.12	0.12	1.35	0.65	0.47
2015	0	0.59	1.96	0.70	0.12	0.12	0.51	2.40	0.64

*record high for a site/year.
**record low for time-series

Table 8.4: Total catch of finfish species commonly taken in seine samples, 1988-2015. *See Appendix 8.1 for complete taxonomic names.*

Species	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015		Total
alewife							1								28	1														30
American sand lance					1		10																13							24
American shad		18	1								151																	42		212
Atlantic menhaden	3	2	2	4	1,074	3	9	2		11	2,003	377	1,236	1	1,284	5,098	1,117	75	117	144	21	54	3	43	2	14	3404	3948		20,051
Atlantic silverside	4750	3316	5,356	6,383	5,468	5,263	6,311	2,352	1,942	3,249	6,345	10,120	8,738	4,417	5,730	13,278	5,122	5,089	3,267	5,087	3,245	4,156	7,063	4,657	4,142	3,958	3832	7549		150,185
Atlantic tomcod						3					1						1	3			1			8						17
black sea bass				10			41	43			27	14	2	687	63	27	110	15	82	109	33	304	86	489	783	1,197	1950	1794		7,866
blueback herring		26																		9			3		1	1		11		51
bluefish			3	194	10		5	2			3	24	1		13	5	23	8	30		7	53	1	26	54	17	194	289		962
cunner	15	27	2	5	19		42	24	63	1	23	142	26	15	110	15	54	35	18	58	8	28	15	2	42	1	73	7		870
fourspine stickleback	33	76		183	11	21	1		3		24	3	1	7			9		2			8		2			13			397
grubby	111	3	2	7	61	6	38	19	21	28	17	55	15	73	33	95	143	76	31	32	16	51	25	55	18	19	18	16		1,084
inshore lizardfish	5		2			4	6			46	6	16	15	103	2		3		169	18	26	22	10	16	23	11	135	38		676
mummichog	1,031	197	171	765	573	1,256	1,943	78	149	190	396	115	1,008	246	811	702	637	543	398	1,203	498	857	299	775	329	199	1098	999		17,466
naked goby			1	4				1			1	1		4	2	2	2		13		2			2	4	4	6	5		54
northern kingfish				3	4	23	2	9	3	10	7	6	5	17	5	21	38	11	1	1	23	42	76	30	54	81	149	113		734
northern pipefish	65	23	33	106	120	82	117	52	241	38	295	141	96	189	87	25	72	92	82	75	156	307	49	248	152	204	413	142		3,702
northern puffer	4	22	13	34	4	37	15	40	25	5	5	13	63	14	79	101	75	93	34	241	19	41	51	28	98	202	97	448		1,901
rainbow smelt						5	2										34													41
scup												1		58	172	131	50	154	6	170	14	413	21	30	375	18	485	1573		3,671
sheepshead minnow	174	815	5	345	4	1	2	30		14	19	12	267	59	402	276	205	28	104	1,439	304	203	82	219	238	59	154	60		5,520
smallmouth flounder	1			1		8	14	7	2	5		40	3	12					1		14	21	5	114	63	49	15	13		388
striped bass												1				6					1									8
striped killifish	1,511	1,383	748	659	465	773	1,923	520	269	289	1,066	539	1,797	1,494	1,698	3,410	1,548	1,470	1,063	1,994	1,874	1,508	1,300	1,964	720	493	1158	1531		35,167
striped searobin	22	12	5	94	5	71	5	1	9	40	178	51	7	33	33	62	38	19	6	32	36	82	14	4	7	14	121	84		1,085
summer flounder						2	6		1		1								16	8	8	1	6		6	7	3	11		76
tautog	23	5	23	72	32	16	104	88	42	19	135	174	67	59	153	140	145	64	93	321	131	25	33	27	123	73	467	446		3,100
weakfish																15											4			19
windowpane flounder	49	4	22	19	35	30	9	13	71	50	12	10	4		1	5	15	15	3	2	17		2	4			2			394
winter flounder 1+	12	6		7	6	14	13	12	21	282	9	4	7	2	3		9	11	7	6	13	2	2	2	2		3	2		457
winter flounder YOY	900	117	276	410	1,055	483	1,401	916	1,486	874	999	1,497	708	138	302	1,310	914	470	110	365	190	72	71	86	22	24	48	48		15,292

Table 8.5: Total catch of finfish species infrequently taken in seine samples, 1988-2015. *See Appendix 8.1 for complete taxonomic names*

Species	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015		Total
American eel	1	3					1				5														1		2	15		28
Anchovy, spp (YOY)																					15									15
Atlantic needlefish																					2									2
banded gunnel											2	3					4	2	3	1	3			1						19
banded rudderfish																							1							1
bay anchovy								4	69		27			1	11		1	12					1				520	24		670
blue spotted coronet fish												1															2			3
burrfish, striped				15	2		1			1	9	142	3	8	2	17								10		4				214
butterfish												1														21				22
crevalle jack	6							1															1							8
feather blenny																									36					36
flying gurnard																				1										1
gizzard shad																								4						4
grey snapper			1																											1
hogchoker							2															1								3
lined seahorse							4			1			2							2	7	2	1	2						21
little skate										1					1															2
northern searobin		2	1				1	1					3	40	24	5	4	13	2	10			1	9		6	35	105		262
northern sennet																			1											1
northern star gazer		5																												5
oyster toadfish	5			1						1	1			1		1	2	1	1	1	2	1				6	2	4		30
pumpkinseed				2													3													5
rainwater killifish									3	4			2		6	35	53	19	3											125
rock gunnel			1		1	1	1			3							1				1									9
smooth dogfish			1																											1
spot																											6			6
striped anchovy																						3								3
threespine stickleback														11																11
web burrfish																			1				1							2
white mullet	1	1	8		3										1				7	7	11		75	68		22				204
white perch																		3			11			6						20
yellow jack																							1							1

Table 8.6: Total catch of invertebrate species taken in seine samples, 1988-2015. *See Appendix 8.2 for complete taxonomic names.*

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015		Total
bluecrab	1	2	84	31	4	333	35	23	27	18	17	18		593
boreal squid				1										1
brown shrimp			11											11
channeled whelk							1				3			4
common slipper shell			13											13
flat claw hermit crab	761	532	703	153	244	539	558	441	283	367	562	308		5451
green crab	234	266	341	147	644	176	308	228	175	253	273	213		3258
Japanese shore crab	1		1	1				6	1			1		11
Jonah crab						2								2
lady crab	298	119	66	195	92	42	19	24	18	13	41	102		1029
mantis shrimp									1					1
mole crab	1	5												6
moon jelly							319							319
mud crabs	60	55	74	30	85	67	308	80	80	1100	43	142		2124
mud snail	948	2,071	4,478	3,569	3,810	3,128	2,699	2,683	3072	5,787	6938	11132		50315
northern comb jelly						346	36			3,620	1200			5202
oyster drill			38											38
rock crab	2						1							3
sand shrimp	278	373	1,027	525	2,625	762	902	1,507	246	1,794	662	207		10908
scallop (bay)											3	3		6
shore shrimp	990	404	1,149	707	1,390	535	619	762	402	511	1011	4795		13275
spider crab	4	5	6	1	3	1	7	33	13	20	14	45		152
squid (longfin)												6		6
starfish spp.							1							1

Table 8.7: Cold and warm temperate species captured in the Estuarine Seine Survey.

Cold Temperate Species

Common name	Scientific Name
alewife	*Alosa pseudoharengus*
American sand lance	*Ammodytes americanus*
Atlantic tomcod	*Microgadus tomcod*
cunner	*Tautogolabrus adspersus*
grubby	*Myoxocephalus aeneus*
little skate	*Leucoraja erinacea*
northern pipefish	*Syngnathus fuscus*
rock gunnel	*Pholis gunnellus*
rainbow smelt	*Osmerus mordax*
winter flounder	*Pseudopleuronectes americanus*
windowpane flounder	*Scophthalmus aquosus*

Warm Temperate Species

Common name	Scientific Name
American eel	*Anguilla rostrata*
American shad	*Alosa sapidissima*
Atlantic silversides	*Menidia menidia*
bay anchovy	*Anchoa mitchilli*
blueback herring	*Alosa aestivalis*
black seabass	*Centropristis striata*
bluefish	*Pomatomus saltatrix*
butterfish	*Peprilus triacanthus*
feather blenny	*Hypsoblennius hentz*
gizzard shad	*Dorosoma cepedianum*
hogchoker	*Trinectes maculates*
lined seahorse	*Hippocampus erectus*
menhaden	*Brevoortia tyrannus*
naked goby	*Gobiosoma bosci*
northern kingfish	*Menticirrhus saxatilis*
northern puffer	*Sphoeroides maculates*
northern searobin	*Prionotus carolinus*
northern stargazer	*Astroscopus guttatus*
oyster toadfish	*Opsanus tau*
pumkinseed	*Lepomis gibbosus*
scup	*Stenotomus chrysops*
silver perch	*Bairdiella chrysoura*
smooth dogfish	*Mustelus canis*
smallmouth flounder	*Etropus microstomus*
spotted hake	*Urophycis regia*
spot	*Leiostomus xanthurus*
striped searobin	*Prionotus evolans*
striped anchovy	*Anchoa hepsetus*
striped bass	*Morone saxatilis*
summer flounder	*Paralichthys dentatus*
tautog (blackfish)	*Tautoga onitis*
white perch	*Morone Americana*
weakfish	*Cynoscion regalis*

Figure 8.1: **Sampling locations of the Estuarine Seine Survey.**

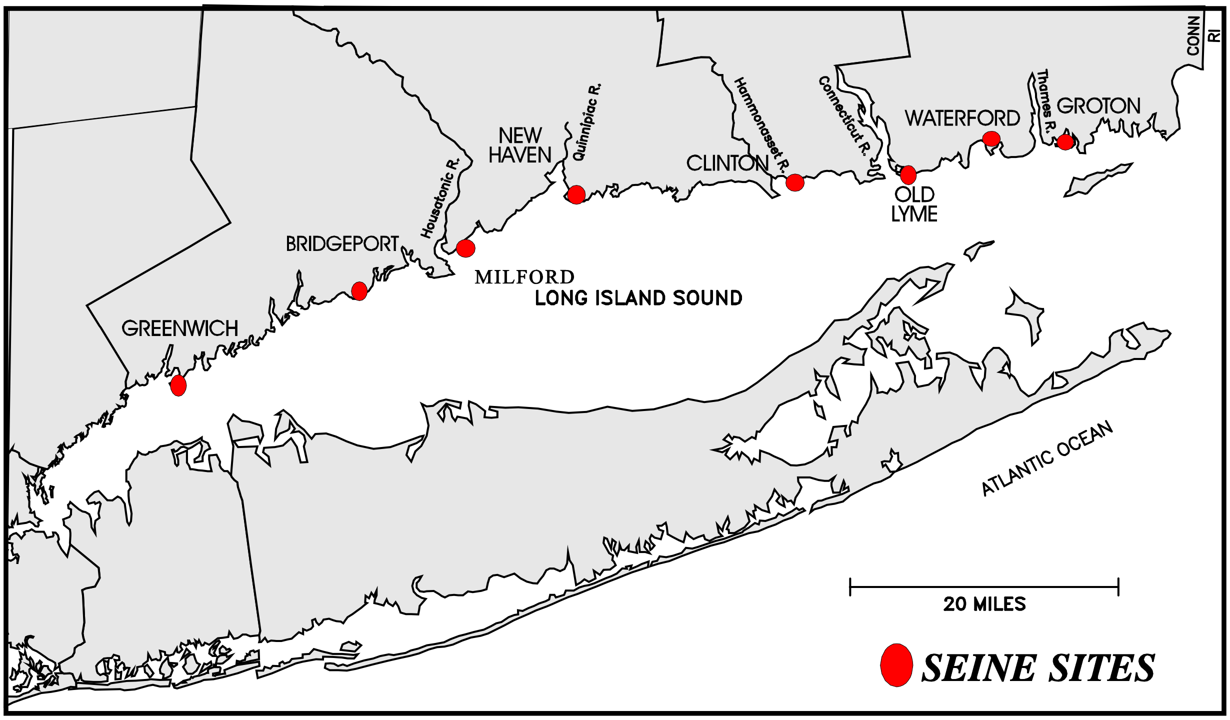


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Figure 8.2: Mean catch of all finfish taken in seine samples, 1988-2015. *Geometric mean catch (numbers) per haul includes samples at all sites. Note that sampling at the Milford site began in 1990.*

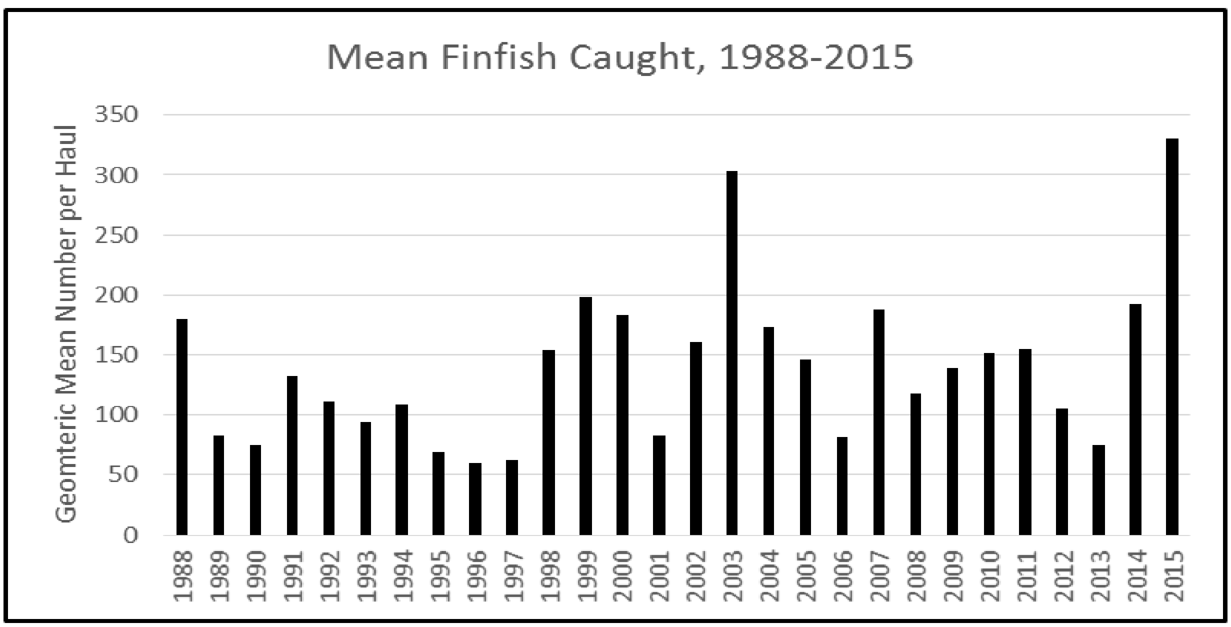

Figure 8.3: Mean catch of young-of-year winter flounder, 1988-2015. *Confidence intervals (95%) are shown (dotted lines). The negative trend (dashed line) is significant (r^2 =0.34, p<0.001).*

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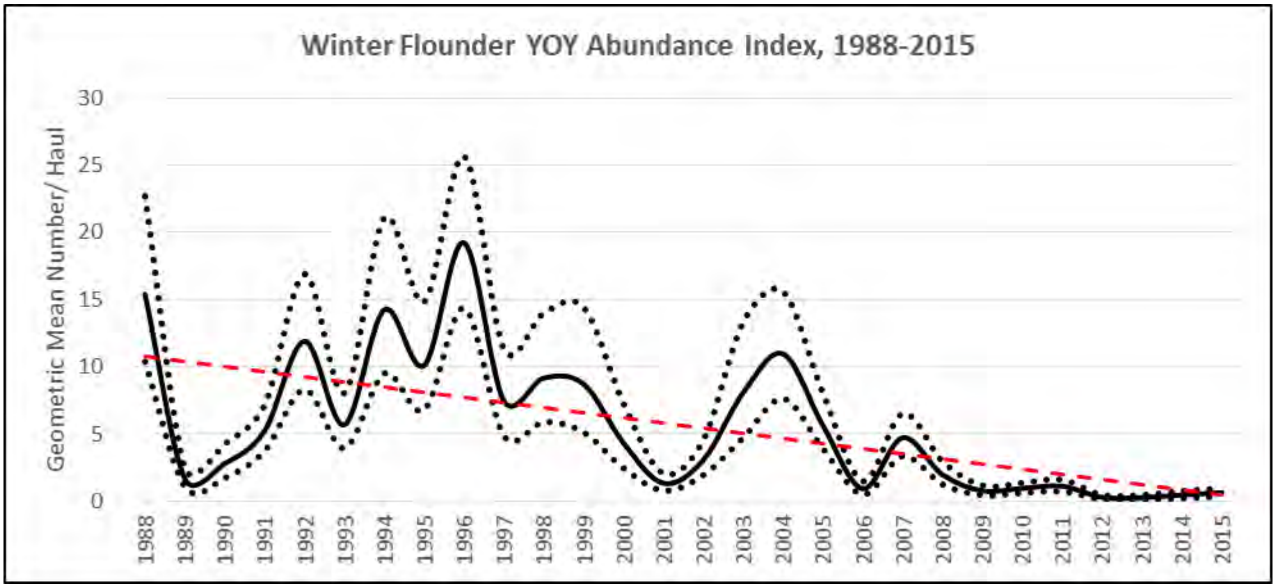
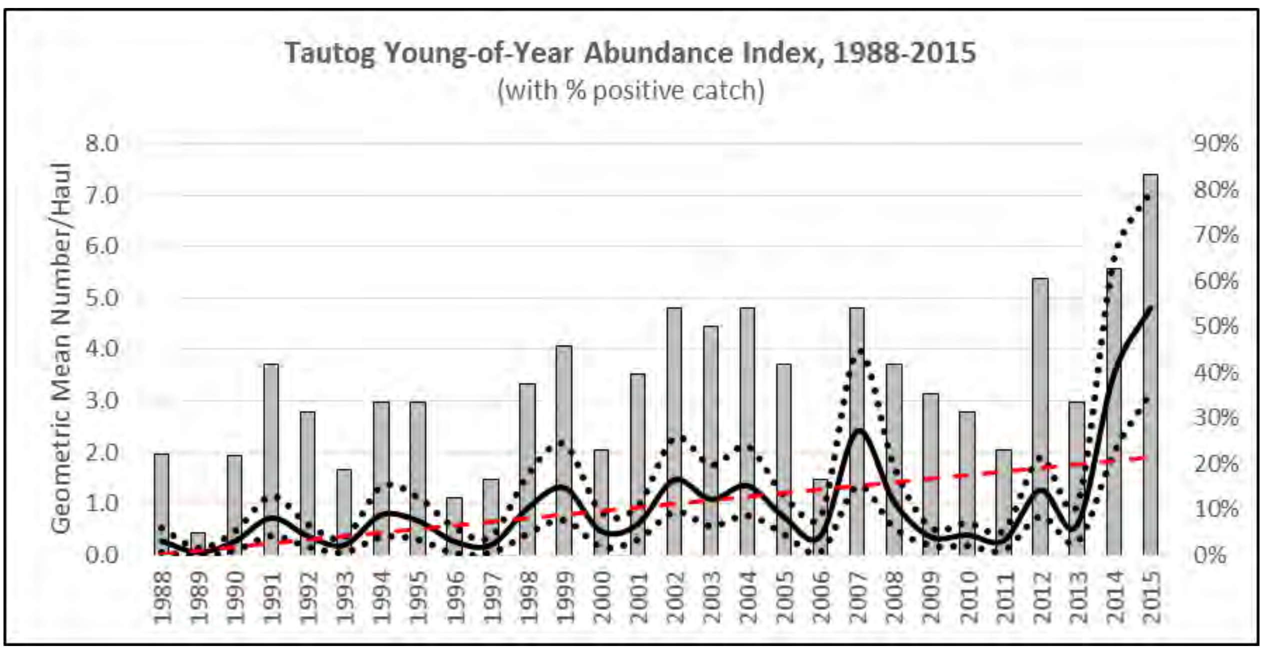


Figure 8.4: Mean catch and occurrence of young-of-year tautog, 1988-2015. *Confidence intervals (95%) are shown (dotted lines). The positive trend (dashed line) is significant (r^2 =0.27, p=0.003). Percent of hauls catching tautog (shaded bars) has also increased.*



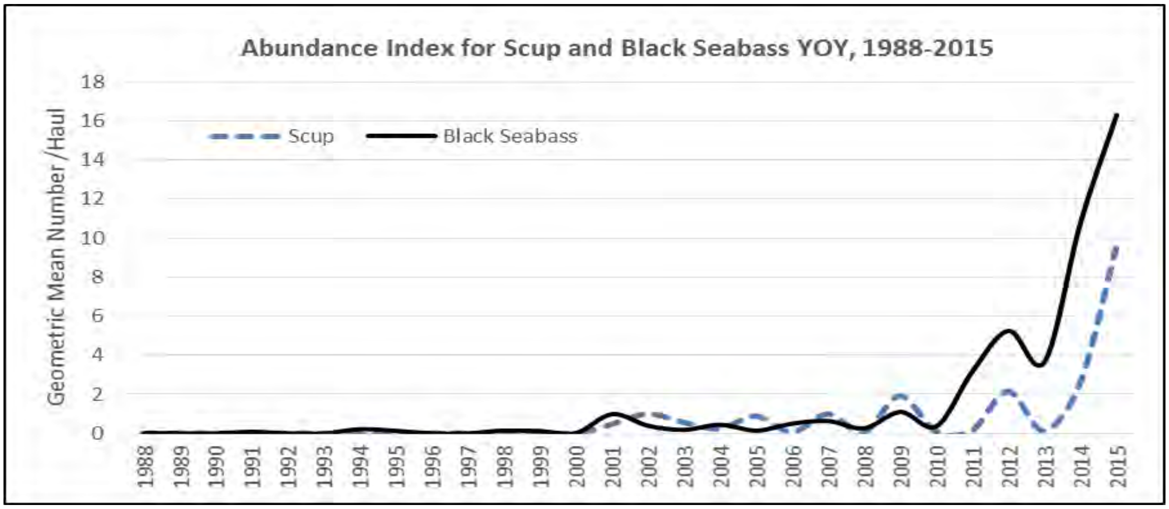
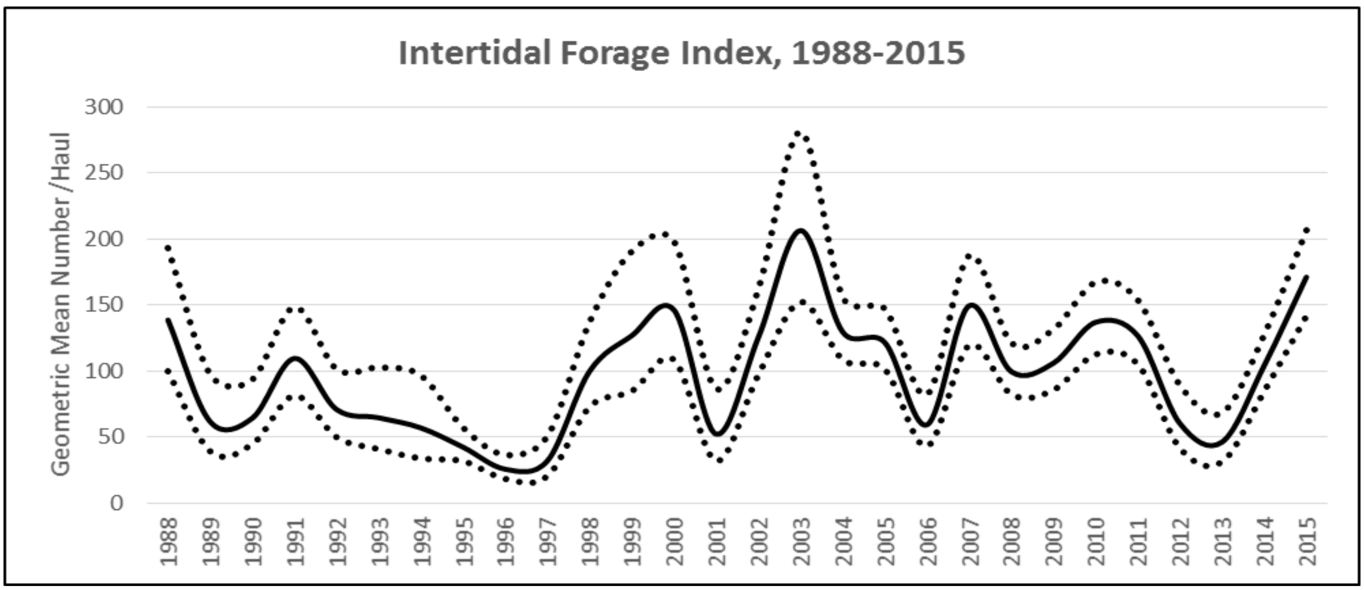


Figure 8.5: Mean catch of scup and black seabass young-of-year (YOY), 1988-2015.



	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mean:	139	62	64	110	71	65	57	42	26	32	100	127	146	52	125	206	130	122	59	149	100	106	137	127	60	46	104	171

Figure 8.6: Mean catch of forage fish, 1988-2015. *Forage species included in the index are Atlantic silversides, mummichog, sheepshead minnow, and striped killifish. Confidence intervals (95%) are shown (dotted lines) and annual geometric mean catch is shown in boxes below. See Appendix 8.1 for complete taxonomic names.*

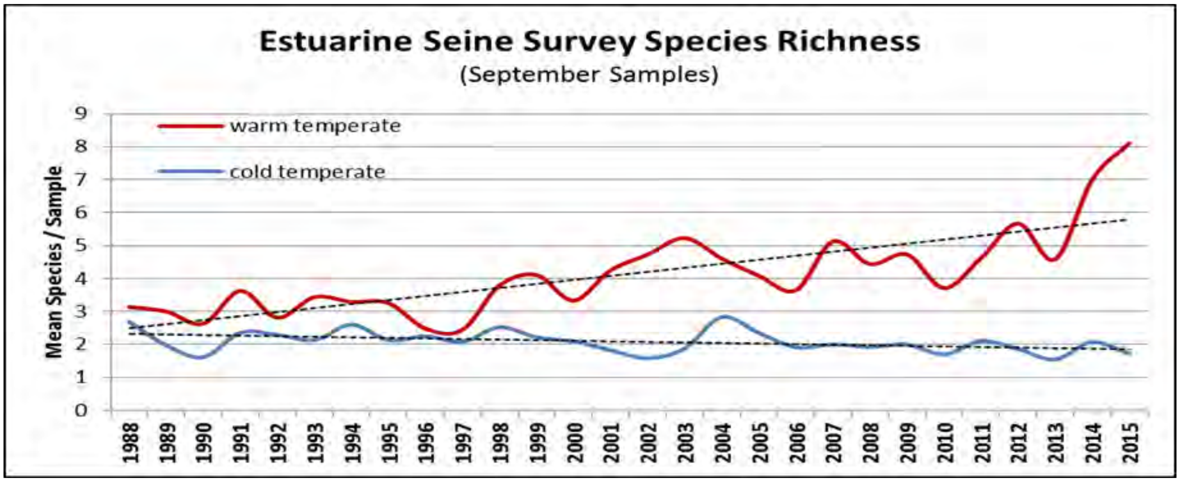


Figure 8.7: Trend in species richness for cold and warm temperate species at eight seine sites, 1988-2015. *See Table 8.7 for species listings by group.*

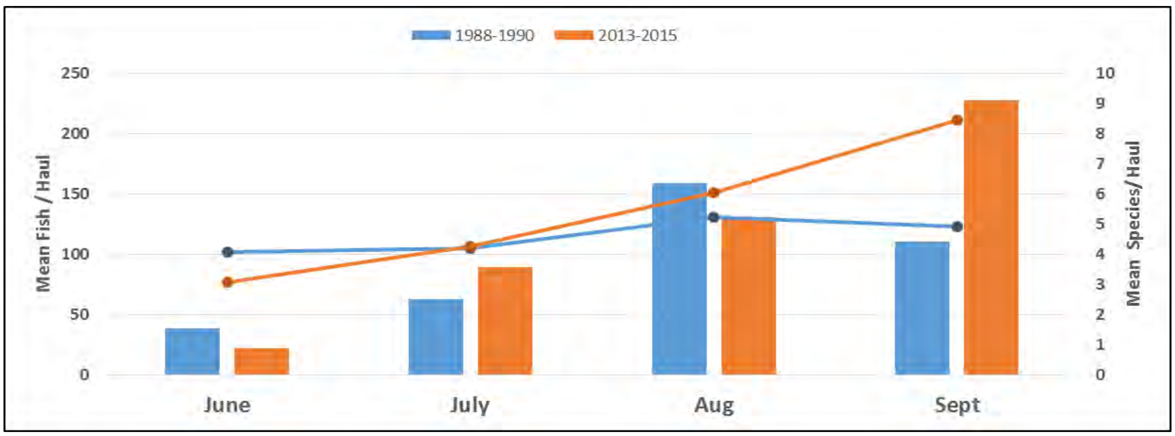


Figure 8.8: Seasonal abundance and diversity of finfish at six seine sites, 1988-1990 versus 2013-2015. *Total catch (geometric mean, bars) and species number (arithmetic mean, line) per haul are shown for finfish captured at six seine sites that remained consistent over the time periods.*

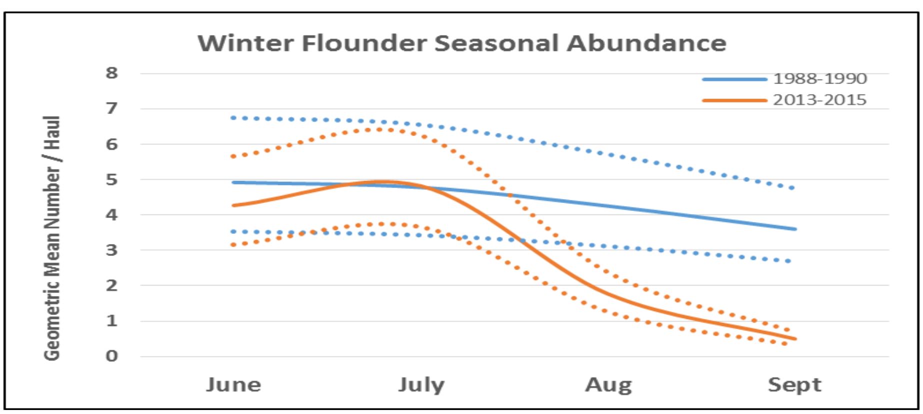


Figure 8.9: Seasonal change in winter flounder young of year abundance at six seine sites, 1988-1990 versus 2013-2015. *Confidence intervals (95%) are shown (dotted lines).*

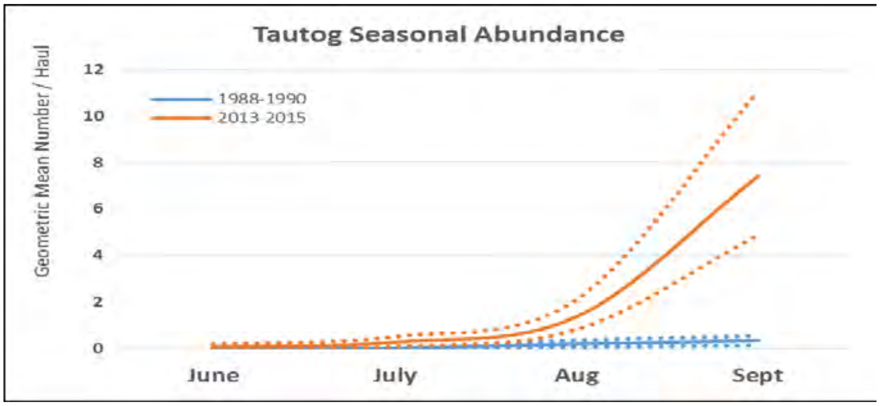


Figure 8.10: Seasonal change in tautog young of year abundance at six seine sites, 1988-1990 versus 2013-2015. *Confidence intervals (95%) are shown (dotted lines).*

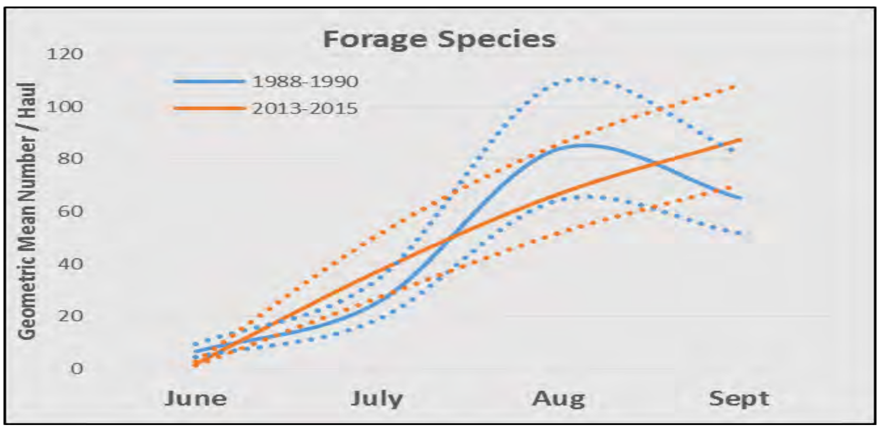


Figure 8.11: **Seasonal change in abundance of forage index species at six seine sites, 1988-1990 versus 2013-2015**. *Confidence intervals (95%) are shown (dotted lines).*

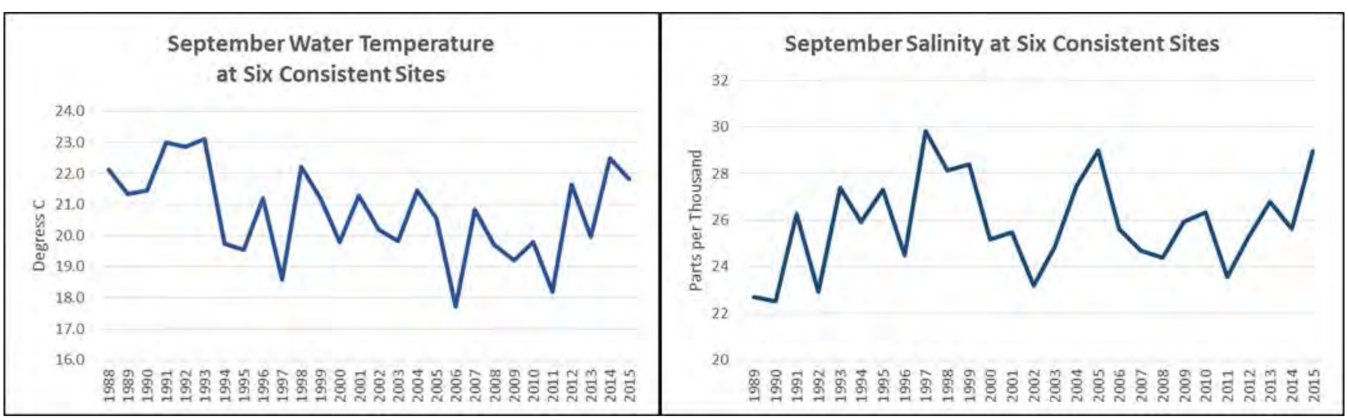


Figure 8.12: Mean water temperature and salinity at six consistent sites in September, 1988-2015.

Appendix 8.1: Finfish species taken in the Estuarine Seine Survey, 1988-2015.

COMMON NAME	SPECIES CODE	SCIENTIFIC NAME
Alewife	ALW	*Alosa pseudoharengus*
American eel	EEL	*Anguilla rostrata*
American shad	ASD	*Alosa sapidissima*
American sand lance	ASL	*Ammodytes americanus*
Atlantic needlefish	ANF	*Strongylura marina*
Atlantic silversides	ASS	*Menidia menidia*
Atlantic tomcod	TOM	*Microgadus tomcod*
Banded gunnel	BGN	*Pholis fasciata*
Banded rudderfish	RUD	*Seriola zonata*
Bay anchovy	ACH	*Anchoa mitchilli*
Black-spot stickleback	BSS	*Gasterosteus wheatlandi*
Black sea bass	BSB	*Centropristis striata*
Blueback herring	BBH	*Alosa aestivalis*
Bluefish	BLF	*Pomatomus saltatrix*
Blue spotted coronetfish	BSC	*Fistularia tabacaria*
Crevalle jack	CRJ	*Caranx hippos*
Cunner	CUN	*Tautogolabrus adspersus*
Feather Blenny	FBL	*Hypsoblennius hentzi*
Flying Gurnard	FGD	*Dactylopterus volitans*
Four-spine stickleback	FSS	*Apeltes quadracus*
Gizzard Shad	GIZ	*Dorosoma cepedianum*
Gray snapper	GRA	*Lutjanus griseus*
Grubby	GRB	*Myoxocephalus aeneus*
Hogchoker	HOG	*Trinectes maculatus*
Inshore lizardfish	LIZ	*Synodens foetens*
Little skate	LSK	*Raja erinacea*
Menhaden	MEN	*Brevoortia tyrannus*
Mummichog	MUM	*Fundulus heteroclitus*
Naked goby	NKG	*Gobiosoma bosci*
Nine-spine stickleback	NSS	*Pungitius pungitius*
Northern kingfish	NKF	*Menticirrhus saxatilis*
Northern pipefish	PIP	*Syngnathus fuscus*
Northern puffer	PUF	*Sphaeroides maculatus*
Northern searobin	NSR	*Prionotus carolinus*
Northern stargazer	STR	*Astroscopus guttatus*
Pumpkinseed	PUM	*Lepomis gibbosus*
Rainbow smelt	RSM	*Osmerus mordax*
Rainwater killifish	RWK	*Lucania parva*
Rock gunnel	RGN	*Pholis gunnellus*
Northern seahorse	SEH	*Hippocampus erectus*
Northern sennet	NOS	*Sphyraena borealis*
Scup	PGY	*Stenotomus chrysops*
Sheepshead minnow	SHM	*Cyprinodon variegates*
Shorthorn Sculpin	SHS	*Myoxocephalus scorpius*
Skilletfish	SKL	*Gobiesox strumosus*
Smallmouth flounder	SMF	*Etropus microstomus*
Smooth dogfish	SMD	*Mustelus canis*
Spotted hake	SPH	*Urophycis regius*
Striped anchovy	STA	*Anchoa hepsetus*
Striped bass	STB	*Morone saxatilis*
Striped burrfish	SBF	*Chilomycterus schoepfi*
Striped killifish	SKF	*Fundulus majalis*
Striped searobin	SSR	*Prionotus evolans*
Summer flounder	SFL	*Paralichthys dentatus*
Tautog	BKF	*Tautoga onitis*
Three-spine stickleback	TSS	*Gasterosteus aculeatus*

Appendix 8.1, continued:

Toadfish	**TDF**	*Ospsanus tau*
Weakfish	**WKF**	*Cynoscion regalis*
Web Burrfish	**WBF**	*Chilomycterus antillarum*
White mullet	**WML**	*Mugil curema*
Windowpane flounder	**WPF**	*Scopthalmus aquosus*
Winter flounder (YOY)	**WFO**	*Pseudopleuronectes americanus*
Winter flounder (AGE 1+)	**WFL**	*Pseudopleuronectes americanus*
Yellow jack	**YJK**	*Caranx bartholomaei*

Appendix 8.2: Invertebrate species taken in the Estuarine Seine Survey, 1988-2015.

COMMON NAME	SPECIES CODE	*SCIENTIFIC NAME*
Bay Scallop	**SCA**	*Argopecten irradians*
Blue crab	**BCR**	*Callinectes sapidus*
Brown Shrimp	**BNS**	*Panaeus aztecus*
Chaneled Whelk	**CHW**	*Busycotypus canaliculatus*
Northern Comb Jelly	**COM**	*Bolinopsis infundibulum*
Green crab	**GCR**	*Carcinus maenas*
Hermit crab	**HER**	*Pagurus spp.*
Horseshoe crab	**HSC**	*Limulus polyphemus*
Japanese crab	**JCR**	*Hemigrapsus sanguineus*
Lady crab	**LCR**	*Ovalipes ocellatus*
Mantis shrimp	**MAN**	*Squilla empusa*
Moon Jelly	**MOJ**	*Aurelia aurita*
Mud crab	**BMC**	*Panopeus spp.*
Mole crab	**MLR**	*Emerita talpoida*
Mud snail	**MSN**	*Nassarius obsoletus*
Rock crab	**RCR**	*Cancer irroratus*
Sand shrimp	**CRG**	*Crangon septemspinosa*
Sea Star	**STF**	*Asterias forbesi*
Shore shrimp	**PAL**	*Palaemonetes spp.*
Shortfin Squid	**ILL**	*Illex illecebrosus*

JOB 9: VOLUNTEER ESTUARINE FISHERIES DATABASE

JOB 9: VOLUNTEER ESTUARINE FISHERIES DATABASE

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

JOB 9: Volunteer Estuarine Fisheries Database

GOAL

Identify estuarine near-shore waters critical to the production and growth of recreationally important finfish for the purpose of protecting and enhancing these populations in shallow water habitats and promote citizens' greater understanding and appreciation of local marine resources through participation in local volunteer survey projects.

OBJECTIVES

1) Provide reliable indices of relative abundance for finfish and key water quality measurements by standardizing samples taken in Connecticut near-shore waters by local volunteers.
2) Document the occurrence of uncommon or rare species and their distribution by habitat type in order to determine their vulnerability to local extinction due to human activities and/or climate change.
3) Provide embayment-specific size and/or growth estimates for recreationally important species helpful to immediate and long-term local and regional assessments.
4) Develop and maintain a state-wide fisheries database of all volunteer survey programs in order to maximize their usefulness to all citizen groups, educational programs, municipalities, statewide regulatory programs and interstate management plans.

INTRODUCTION

Several citizens' groups formed in response to CT DEEP educational programs, as well as to address local environmental issues, have spent thousands of volunteer hours gathering fisheries abundance data and accompanying water quality information. This job was developed as a mechanism for establishing a flexible data framework where volunteer datasets can be collated, standardized, and accessed. This database should provide data useful for protecting the state's near-shore estuarine ecosystem which is particularly vulnerable to physical flux and alternation or degradation due to human activities.

METHODS

Data were obtained from citizen groups that have gathered fisheries abundance and water quality data for more than a decade. Based on interviews with the groups' leaders, these data were collated into the Volunteer Estuarine Fisheries Database and synthetic summaries were made for purposes of comparison. Data summarized in this report are in addition to earlier datasets provided by Harbor Watch, Cedar Island Marina Laboratory, and Project Oceanology which were presented in last year's report.

For each program, a matrix was generated in Excel or Access software documenting the date, location, and quantity of each species captured in their sampled area by gear type. The total number of each finfish species was computed as a percentage of the total finfish captured by year. Additionally, relative abundance of finfish grouped by thermal guild (Howell and Auster 2012) as well as total species number was computed for each study area as a generalized measure of embayment health.

Harbor Watch Norwalk Harbor Survey

Harbor Watch, a Program sponsored by Earth Place Nature Center in Westport CT, has run a beam trawl survey in the Norwalk River since 1990. The program was initiated under the guidance of Richard Harris, Program Director, and CT DEEP Marine Fisheries Division staff, and continued in 2015 under Program Director Sarah Crosby. The sampling program divides the saline portion of the river into 20 fishable grids which overlap previously established water quality sampling stations (Figure 9.1). Benthic finfish and invertebrates are captured using a one-meter beam trawl (0.63cm mesh net**)** towed for 5 minutes within one of the sample grids (Harris et al. 2014). Samples are made at least weekly at grids representing upper, middle, and lower reaches of the river. Sampling is accomplished with the help of students from Wilton High School.

Maritime Aquarium Outer Norwalk Channel Survey

Maritime Aquarium staff have run 'marine life study cruises' for the public since 1990. Sampling cruises are conducted at least once per week from April through October, with one tow taken on each cruise in Norwalk and Sheffield Harbors. Sampling is constrained by boat traffic, channel configuration, and submerged debris (Figure 9.2). Marine organisms are collected using an otter trawl deployed on the north side of the navigational channel near Tavern Island (approx. 41° 03.58' by 73° 25.049') and towed parallel to the channel in a westerly direction for approximately 20 minutes (Schneider and Schneirlein 2010). Catch data are recorded on standardized field sheets along with the location of sampling sites and weather conditions.

Coast Guard Academy Thames River Survey

The academic curriculum of the US Coast Guard Academy has included biological sampling of the Thames River since the 1970s. Samples are taken in the Thames River from the Gold Star Bridge upriver to the Naval Submarine Base (Figure 9.3). Shallow (5-10m depth) and channel (12-15m depth) tows are made one day per week from August to October with a 9.15m flat trawl net (# 15 twine, 5.10 cm stretch mesh, #21 twine codend with 1.27cm mesh and 0.95cm liner; Mrakovcich, personal communication). The same gear and manual deployment technique has been used over the years, however the vessel changed in 2013. Tow duration was 10 minutes in 1974-2006 and changed to the equivalent 0.5 km in 2007-2015. Seine samples were taken in front of the beach adjacent to Eagle Pier at the Coast Guard Academy during the month of September (Mrakovcich, personal communication). Hauls are made at low tide using a 15 m x 1.8 m seine net (0.6 cm square mesh with 1.8x1.8x1.8 m center bag).

RESULTS

Harbor Watch Norwalk Harbor Survey

From 1990-1994, the Harbor Watch program documented an abundance and high diversity of benthic fish (Figure 9.4). The largest concentrations of the target species, juvenile winter flounder, were captured from the I-95 Bridge south to the Maritime Center (grids A-D, Figure 9.1, Harris et al. 2014). From 1995-2005 comparable surveys were not performed due to necessary boat repairs and sampling outside Norwalk Harbor. Extensive dredging began in the upper harbor in 2005-2006. Limited sampling occurred in 2007 and resumed to a full program in 2008. The outer harbor was dredged in 2010, but did not hinder sampling in the harbor proper. Beam trawl sampling captured 5-15 finfish species annually for years with comparable effort in June through October (Table 9.1). The lowest diversity and catch rate were reported in 2010, with a modest increase reported in 2015 when 499 fish were caught of 17 species. In 2015, winter flounder were captured in 18 of the 19 grids sampled and their number/tow were the highest recorded since 2005. Flounder were most abundant in the lower harbor (Box L, Figure 9.1, Crosby et al. 2015), a distribution that differed from the early 1990s when they were most abundant in the upper harbor. Winter flounder juveniles were the most abundant species followed by northern searobin and black seabass. When species are grouped by thermal guild (Appendix 9.1) it appears that warm temperate species have become more common in recent years (Figure 9.5).

Bottom water temperatures taken weekly at six stations in the Norwalk River beginning in 1987 (Figure 9.1) show a clear warming trend for years with complete sampling during summer, July-September (Figure 9.6). Warming was greatest in the upper river (Stations 1 and 1a), and all stations combined show a positive slope of approximately 1.5^{0}C (2.7^{0}F) over the time period.

Maritime Aquarium OuterNorwalk Channel Survey
Aquarium staff have completed 98-181 otter trawl tows annually since 1993 with the exception of 1998 (Table 9.2, Figure 9.7). Mean catch declined from 19.7 fish/tow to less than 7 fish/tow through the 1990s and 2000s, but increased recently, exceeding 20 fish/tow in three of the last five years. Total species caught varied from 14-26 but show no trend over the time series. Several species of flounder, scup, and searobins have dominated the catch. As was seen in the Harbor Watch dataset above, when species are grouped by thermal guild (Appendix 9.2) it appears that warm temperate species have become more abundant in recent years: Collectively, warm temperate fish increased from 35% of the catch in 1993-1997 to 73% of the catch in 2006-2015 (Figure 9.8).

Coast Guard Academy Thames River Survey
The Academy marine science class surveys of the Thames River are documented beginning in 1974 (Table 9.3). Annual surveys varied from 4-18 otter trawl tows and 4-12 beach seine hauls. Finfish were captured in all samples by both gears (i.e., 100% positive tows). Mean catch in trawl samples varied from 2.9-12.0 fish/tow without trend (Figure 9.9) while total species captured ranged from 7-32 annually with a slight increase in recent years. Windowpane and winter flounder dominated the catch in the beginning of the time series, but were replaced by summer flounder, scup, and butterfish in later years. When species are grouped by thermal guild (Figure 9.10, Appendix 9.3), catch showed a substantial increase in the percentage of warm temperate species and declining percentage of cold temperate species. Trawl samples also caught subtropical species in greater frequency beginning in 2003. Bottom water temperatures, measured late August to early October, showed a modest increase only recently with no significant trend (Figure 9.11).

Mean catch in seine samples varied from 1.1-10.0 fish/haul without trend (Table 9.3, Figure 9.12). Total species captured ranged from 9-28 annually, also without trend. However, catch in the beginning of the time series was dominated by killifish, windowpane and winter flounder young-of-year while recent catches were principally menhaden and tautog young-of-year. Guild grouping of the species captured by beach seine also showed an increase in the percentage of the warm temperate group, most notably demersal and pelagic species, with a decline in the percentage of epibenthic species of both guilds (Figure 9.13, Appendix 9.4).

MODIFICATIONS
No modifications are expected.

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Harris, R., P. Fraboni, N. Cantatore, J. Cooper, and, 2014. Harbor Watch Norwalk Harbor juvenile benthic marine fish report, 9 pages.
Howell, P and P. Auster, 2012. Phase shift in an estuarine finfish community associated with warming temperatures. Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science, 4:1, 481-495.
Mrakovcich, K., personal communication, 2016. Methods for Coast Guard Academy sampling of the Thames River.
Schneider, J. and J. Schnierlein, 2010. Quality assurance project plan for R/V Oceanic marine life study cruise programs, winter creature cruise programs, and shoreline habitats programs. Maritime Aquarium at Norwalk, 138pp.

Table 9.1: Beam trawl total finfish catch in the Norwalk Harbor, June-October, 1990-2015. Geometric mean of all finfish species are shown with upper and lower 95% confidence intervals (U95, L95). The total number of tows taken (N), the percent of tows catching finfish (Positive Tows) and the total number of species caught each year are also listed.

	Norwalk Harbor Beam Trawl Survey				Positive	Total
Year	N	Mean	U95	L95	Tows	Species
1990	33	2.5	3.8	1.5	79%	5
1991	45	2.5	3.7	1.6	76%	11
1992	44	9.8	14.1	6.7	98%	14
1993	57	4.7	6.5	3.4	86%	9
2003	39	2.0	3.0	1.1	77%	14
2006	56	0.8	1.2	0.5	52%	7
2008	47	1.2	1.7	0.8	60%	15
2009	63	1.5	2.1	1.1	73%	9
2010	41	0.5	0.8	0.2	41%	5
2011	68	1.1	1.5	0.8	65%	10
2012	49	1.4	1.9	1.0	71%	14
2013	64	1.3	1.8	0.8	64%	12
2014	55	1.6	2.1	1.1	73%	12
2015	63	3.6	4.9	2.5	83%	14

Table 9.2 Otter trawl total finfish catch in the outer Norwalk channel, June-October, 1993-2015. Geometric mean of all finfish species are shown with upper and lower 95% confidence intervals (U95, L95). The total number of tows taken (N), the percent of tows catching finfish (Positive Tows) and the total number of species caught each year are also listed.

	Maritime Aquarium Trawl Survey				Positive	Total
Year	N	Mean	U95	L95	Tows	Species
1993	127	14.4	16.8	12.1	98%	26
1994	111	19.7	23.3	16.2	99%	21
1995	181	8.2	9.3	7.1	94%	17
1996	143	15.1	17.8	12.4	99%	20
1997	151	14.4	16.3	12.5	98%	15
1998	16					
1999	178	5.9	7	5	92%	17
2000	137	9.3	11.3	7.2	98%	22
2001	157	8.4	9.4	7.5	97%	17
2002	172	8.3	9.9	6.7	93%	19
2003	171	9.1	10.5	7.7	96%	17
2004	164	6.3	7.6	5.0	90%	14
2005	146	8.3	10.8	5.9	92%	19
2006	122	4.2	5.2	3.1	77%	18
2007	123	5.6	6.9	4.4	80%	21
2008	141	4.3	5.4	3.2	70%	25
2009	116	6.5	7.7	5.3	90%	17
2010	119	9.7	11.0	8.5	98%	19
2011	99	20.5	28.1	12.9	97%	21
2012	98	22.9	28.8	16.9	98%	20
2013	102	7.3	8.5	6.1	97%	19
2014	104	14.8	20.1	9.6	100%	22
2015	111	13.8	17.0	10.6	99%	23

Table 9.3: Otter trawl and seine net total finfish catch in the lower Thames River, August-October 1974-2015. Geometric mean of all finfish species are shown with upper and lower 95% confidence intervals (U95, L95). The total number of tows taken (N) and the total number of species caught each year are also listed.

	Thames River Trawl Survey				Total
Year	N	Mean	U95	L95	Species
1974	4	5.0	9.0	2.6	7
1975	6	3.4	6.2	1.7	15
1992	9	7.9	9.8	6.2	25
1993	15	7.4	9.7	5.6	18
1994	6	6.0	8.9	3.9	16
1995	9	5.5	10.0	2.8	14
1996	5	6.6	21.3	1.6	13
1997	6	7.5	14.0	3.8	16
1998	4	12.0	17.4	8.2	16
2003	10	6.2	10.4	3.6	27
2004	14	7.2	10.4	4.9	32
2005	8	8.4	13.2	5.2	20
2006	11	4.3	5.8	3.2	16
2007	17	5.1	6.9	3.6	18
2008	18	2.9	3.4	2.5	22
2009	13	5.6	8.1	3.8	17
2010	19	3.1	4.3	2.2	19
2011	12	3.4	4.2	2.8	16
2012	12	6.6	8.4	5.1	16
2013	4	2.7	4.9	1.3	14
2014	12	7.2	9.4	5.4	18
2015	10	5.4	8.8	3.2	19

	Thames River Seine Survey				Total
Year	N	Mean	U95	L95	Species
1974	2	6.9	10.7	4.3	9
1975	2	4.6	5.5	3.8	10
1992	6	6.1	9.2	4.0	16
1993	8	6.3	7.1	5.5	19
1994	9	10.0	13.9	7.1	14
1995	9	5.3	9.7	2.7	19
1996	9	7.8	13.3	4.4	15
1997	9	9.7	15.0	6.1	28
1998	5	8.5	12.7	5.6	15
2003	8	4.7	7.1	3.1	26
2004	9	6.0	8.2	4.3	21
2005	6	2.4	4.6	1.1	17
2006	11	1.1	1.9	0.5	14
2007	12	4.1	5.4	3.0	13
2008	5	4.8	5.3	4.4	12
2009	9	4.4	5.8	3.3	17
2010	6	9.4	12.0	7.4	14
2011	6	2.7	4.6	1.5	13
2012	9	2.5	3.5	1.7	15
2013	5	3.2	6.2	1.4	15
2014	3	9.3	20.8	3.9	15
2015	4	6.5	8.6	4.8	14

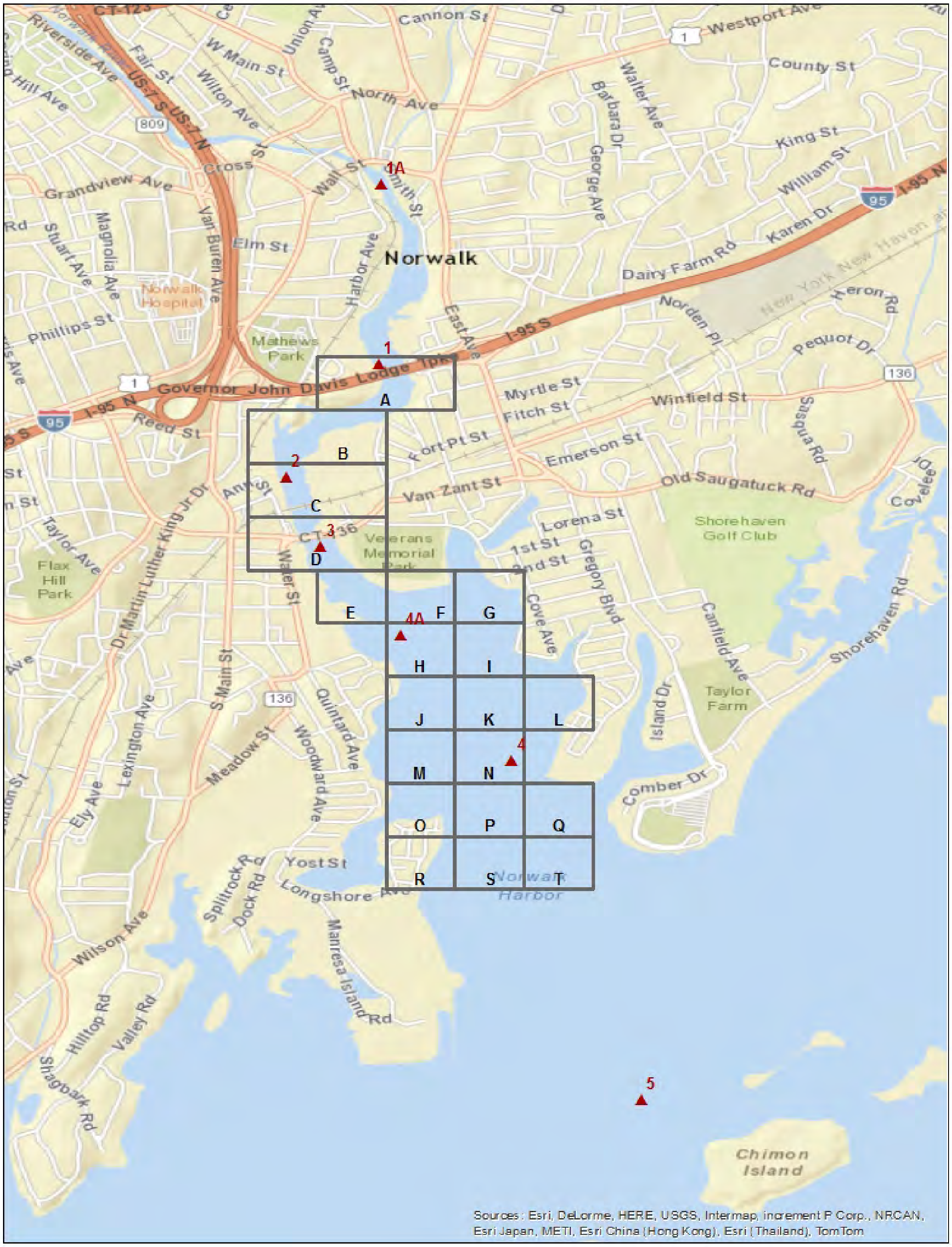


Figure 9.1: Harbor Watch sampling locations in the Norwalk River. Beam trawl sampling was completed within the lettered grids while water quality sampling stations are shown by the numbered triangles (Figure provided by Harbor Watch).

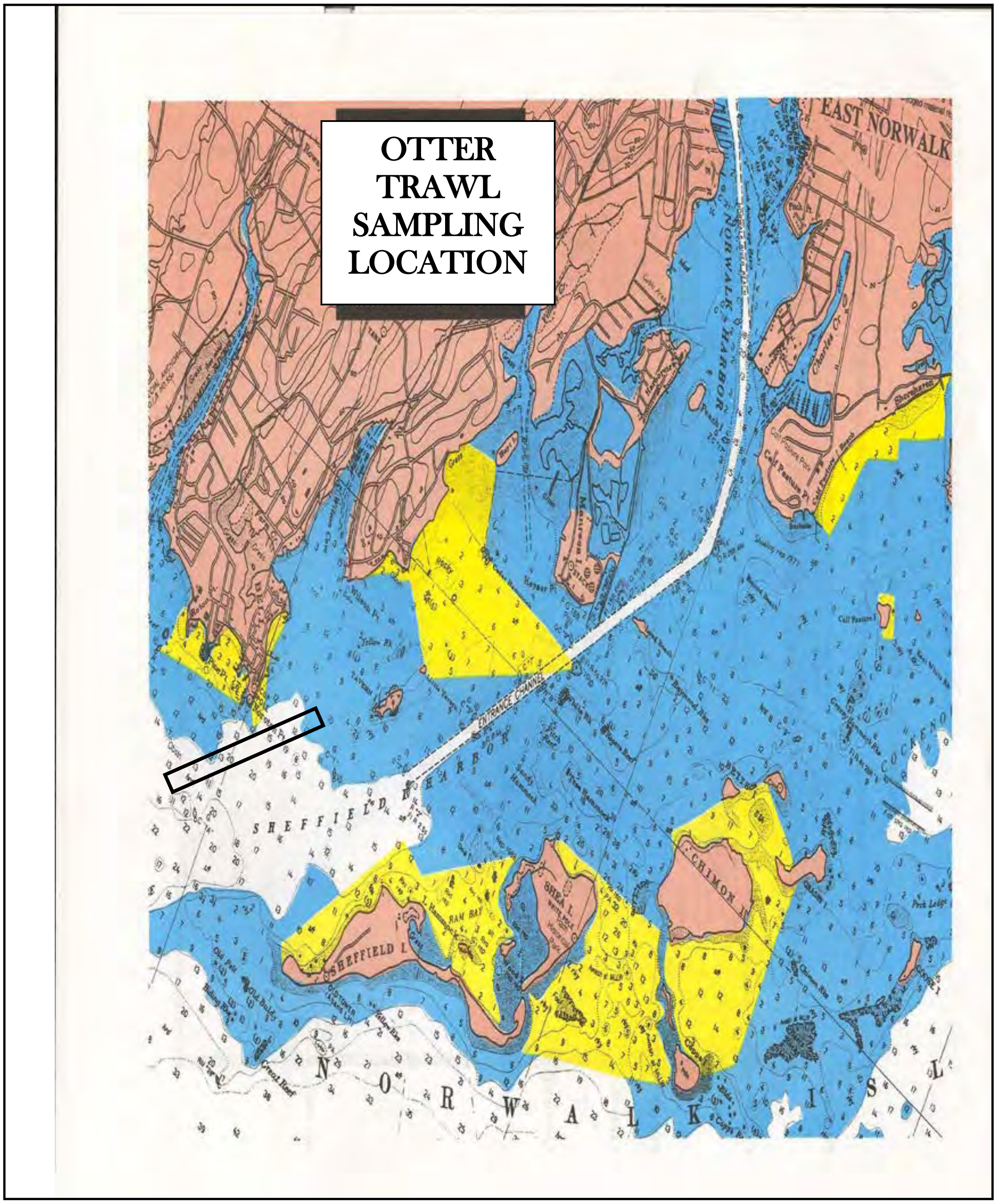


Figure 9.2: Maritime Aquarium Trawl Survey sampling location, Norwalk. Tow path falls within the black lines. (Figure provided by Maritime Aquarium).

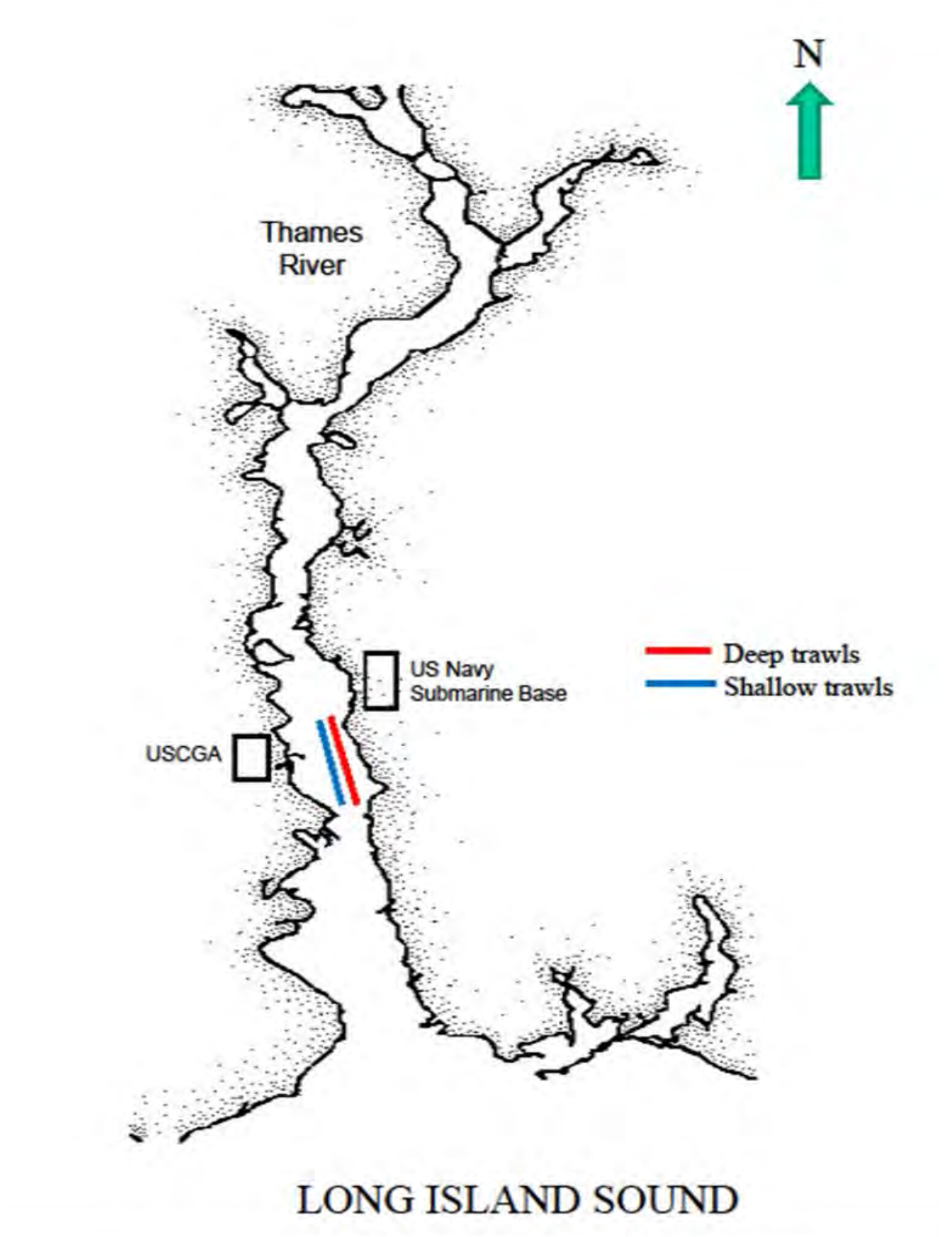


Figure 9.3: US Coast Guard Academy (USCGA) sampling locations in the Thames River. (Figure provided by USCGA).

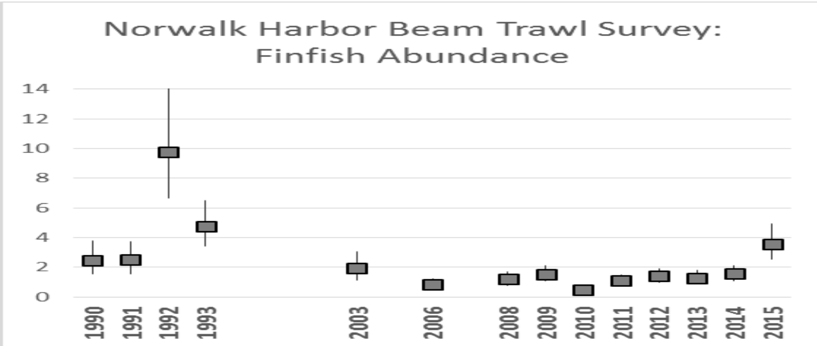


Figure 9.4: Finfish abundance trends in the beam trawl survey of Norwalk Harbor, 1990-2015. The geometric mean number per tow is shown with 95% confidence intervals (bars).

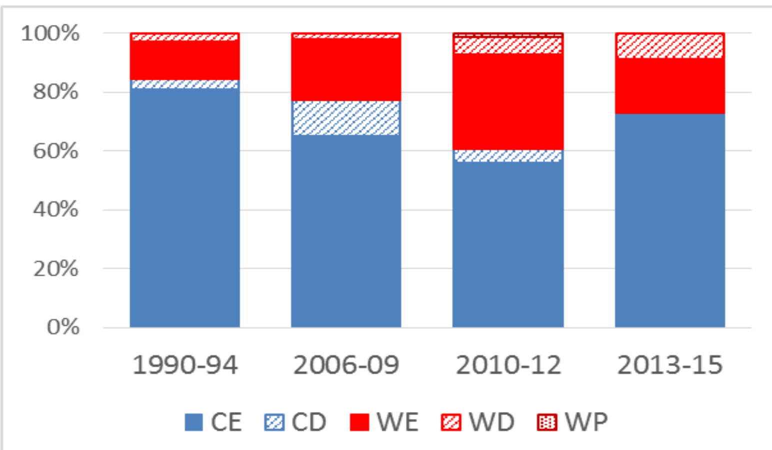


Figure 9.5: Percentage of finfish guilds captured in the Norwalk River beam trawl samples June-October, 1990-2015. Cold temperate epibenthic (CE) and demersal (CD) species are compared to warm temperate epibenthic (WE), demersal (WD) and pelagic (WP) species abundance in all samples for four time periods. Individual species occurrences are listed in Appendix 9.1

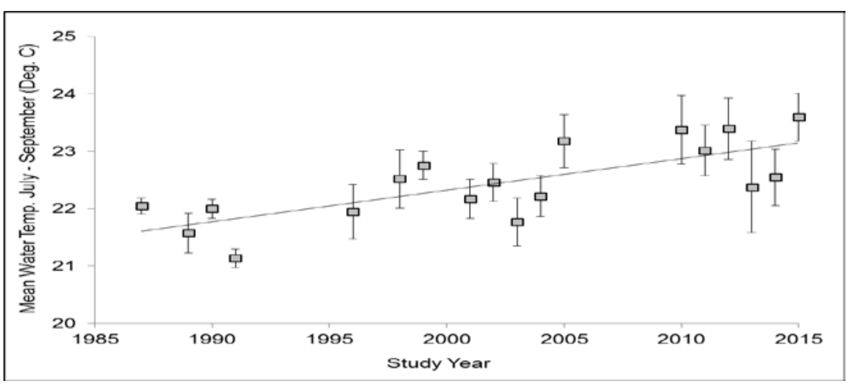


Figure 9.6: Mean bottom water temperature measured weekly July-September at six stations in the Norwalk River, 1987-2015. Standard deviation by station is indicated by the bars. The regression line shows the significant positive trend (R^2= 0.52, P=0.0004, slope =0.05 ^{0}C/year).

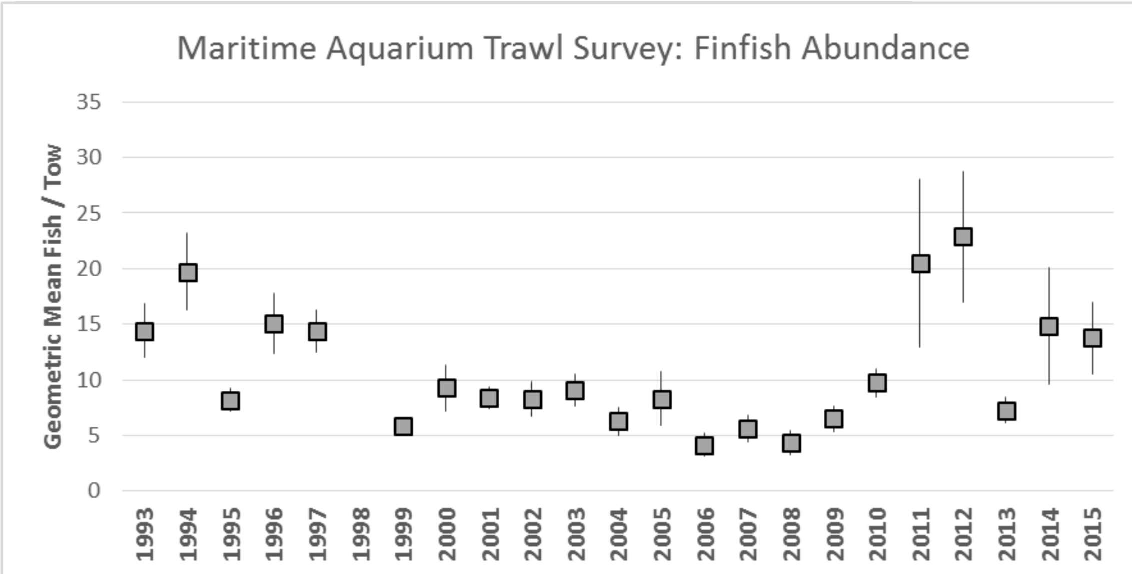


Figure 9.7: Finfish abundance trends in the otter trawl survey of outer Norwalk Harbor, 1993-2015. The geometric mean number per tow is shown with 95% confidence intervals (bars).

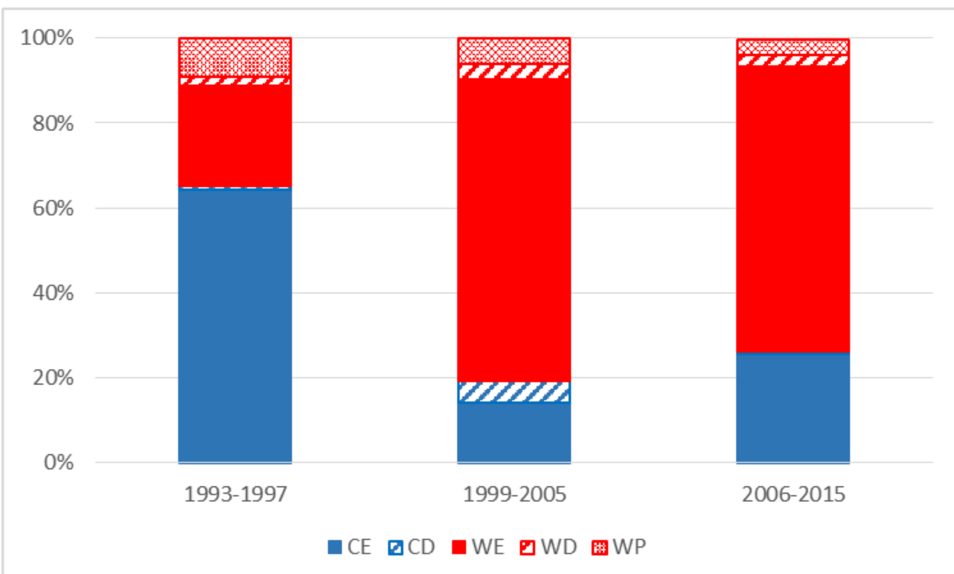


Figure 9.8: Percentage of finfish guilds captured in outer Norwalk Harbor trawl samples, June-October, 1993-2015. Cold temperate epibenthic (CE) and demersal (CD) species are compared to warm temperate epibenthic (WE), demersal (WD) and pelagic (WP) species abundance in all samples for three time perods. Individual species occurrences are listed in Appendix 9.2.

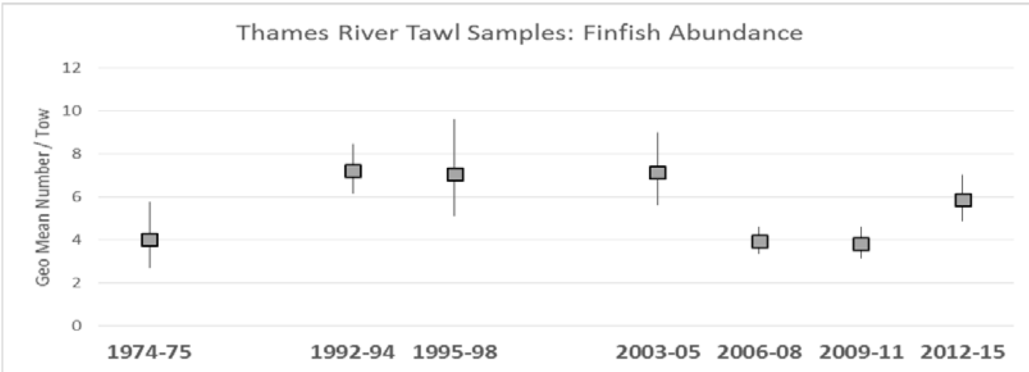


Figure 9.9: Finfish abundance trends in the otter trawl survey of the lower Thames River, 1974-2015. The geometric mean number per tow is shown with 95% confidence intervals (bars).

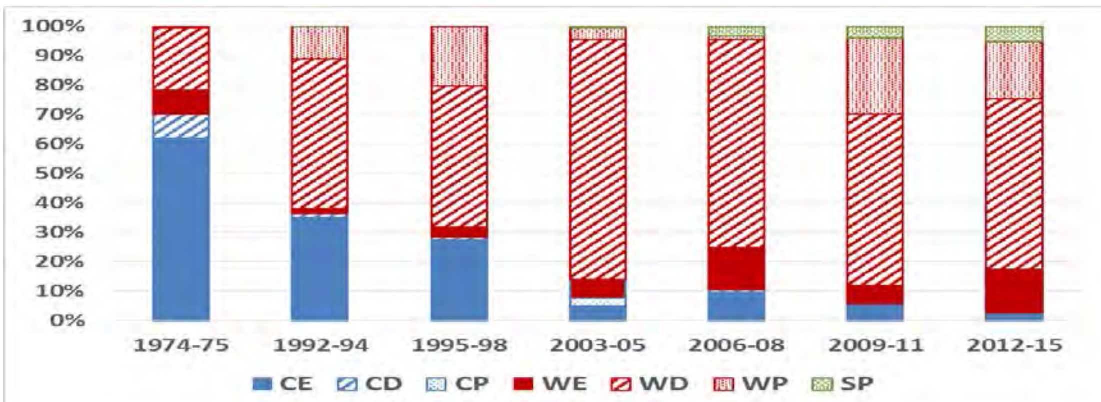


Figure 9.10: Percentage of finfish guilds captured in CGA Thames River trawl samples, August-October 1974-2015. Cold temperate epibenthic (CE) demersal (CD) and pelagic (CP) species are compared to warm temperate epibenthic (WE), demersal (WD), pelagic (WP) and subtropical pelagic (SP) species abundance in all samples for seven time periods. Individual species occurrences are listed in Appendix 9.3.

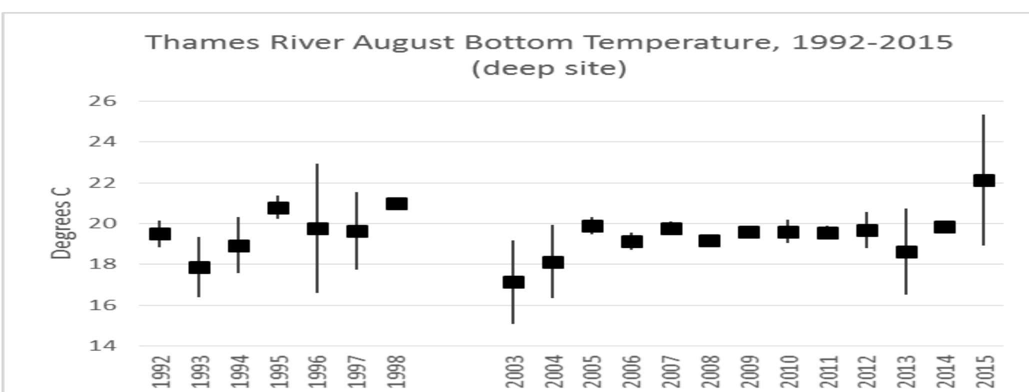


Figure 9.11: Mean bottom water temperature at the deep trawl site in the Thames River, August-October 1992-2015. Mean (degrees C) and 95% confidence intervals (bars) are shown.

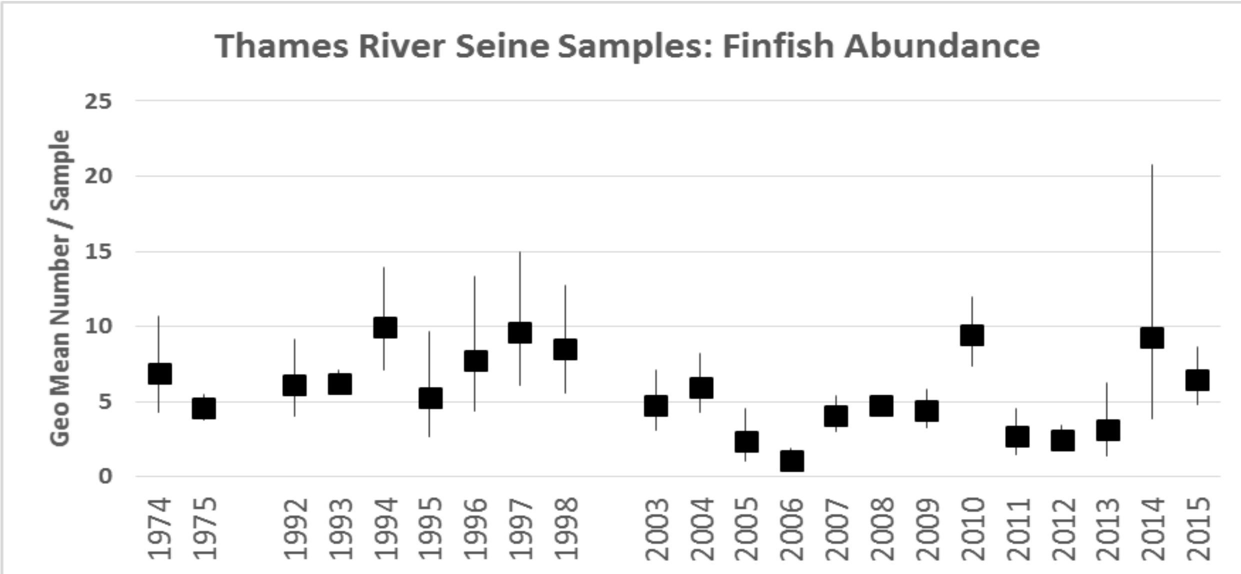


Figure 9.12: Finfish abundance trends in the seine survey of beach locations in the lower Thames River, 1974-2015. The geometric mean number per tow is shown with 95% confidence intervals (bars).

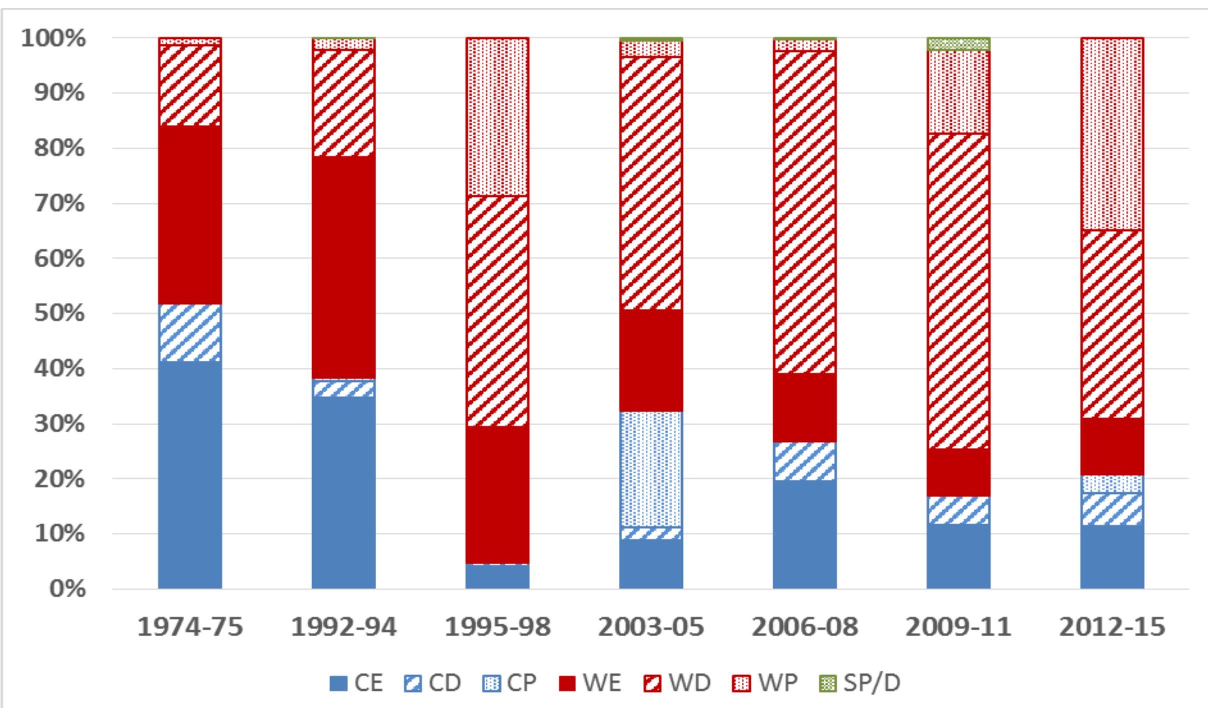


Figure 9.13: Percentage of finfish guilds captured in CGA Thames River seine samples for years with comparable effort August-October, 1974-2015. Cold temperate epibenthic (CE) demersal (CD) and pelagic (CP) species are compared to warm temperate epibenthic (WE), demersal (WD), pelagic (WP) and subtropical pelagic and demersal (SP/D) species abundance in all samples for seven time periods. Individual species occurrences are listed in Appendix 9.4.

Appendix 9.1: Finfish species occurrence in Norwalk River beam trawl samples, June-October, 1990-2015. Five thermal guilds were present: cold temperate-demersal (CD), cold-temperate-epibenthic (CE), warm temperate-demersal (WD), warm temperate-epibenthic (WE), and warm temperate-pelagic (WP).

Guild		Common Name	1990	1991	1992	1993	1994		2006	2008	2009	2010	2011	2012	2013	2014	2015
W	E	American Eel		1.4%	0.4%				1.1%								0.2%
W	D	Atlantic Silversides			0.2%		0.6%				0.5%		1.7%	1.0%	3.1%		1.2%
W	E	Banded Killifish								5.6%			3.4%				
W	P	Bay Anchovy												1.0%			
W	D	Black Sea Bass												4.2%			12.2%
W	P	Bluefish												1.0%			
C	D	Cunner	2.9%	2.7%	5.1%	1.4%	3.4%		8.7%	24.7%	0.9%		3.4%	10.4%	0.6%	0.8%	0.5%
C	E	Fourbeard Rockling			0.1%												
C	E	Fourspine Stickleback								2.2%							
C	E	Grubby		0.5%	1.1%				13.0%	6.7%	0.9%						
W	E	Hogchoker		0.5%												0.8%	
W	D	Inshore Lizardfish				0.2%							1.7%				
W	P	Menhaden (bunker)												2.1%			
C	E	Mummichog			1.5%		0.4%								0.6%		
W	E	Naked Goby			0.2%					2.2%	0.5%	3.2%		8.3%	5.0%	3.0%	0.7%
W	D	Northern Kingfish														0.8%	
C	E	Northern Searobin	10.8%	10.8%	10.7%	4.8%	3.2%			**5.6%**	**19.2%**		14.5%	19.8%	5.7%	18.8%	41.5%
W	E	Norhtern Pipefish	15.1%	11.7%	5.8%	15.9%	4.4%		13.0%	**14.6%**	**11.3%**	16.1%	23.9%	9.4%	5.0%	21.8%	1.2%
W	E	Northern Puffer			0.1%		0.2%							1.0%	1.3%	6.0%	0.5%
C	E	Oyster Toadfish				0.2%											
W	D	Rock gunnel								2.2%							
W	E	Scup (Porgy)									0.5%					2.3%	4.0%
W	E	Seahorse								2.2%							
W	D	Skilletfish													0.6%		
W	E	Spot								1.1%							
W	E	Striped Killifish		5.9%													
W	E	Striped Searobin							2.2%			25.8%					
W	E	Summer flounder		0.9%	0.2%	0.5%	0.2%		3.3%	3.4%	0.9%	3.2%	1.7%	1.0%	2.5%		0.9%
W	D	Smallmouth Flounder											0.9%	2.1%	0.6%	0.8%	0.2%
W	D	Tautog (Blackfish)	9.4%	3.6%	0.7%	0.2%				3.4%			3.4%	2.1%		6.0%	0.5%
C	D	Tomcod					0.8%			2.2%							
C	E	White Perch															
C	E	Windowpane Flounder		0.9%	0.4%	3.4%				2.2%					1.9%	2.3%	0.2%
C	E	Winter Flounder_YOY	61.9%	59.5%	73.3%	69.0%	85.6%		54.3%	**21.3%**	**65.3%**	48.4%	45.3%	36.5%	73.0%	36.8%	36.3%
C	E	Winter Flounder_Age1+		1.8%	0.1%	4.3%	1.1%		4.3%			3.2%					

Appendix 9.2: Finfish species occurrence in outer Norwalk Harbor Aquarium otter trawl samples, June-October, 1993-2015. Five thermal guilds were present: cold temperate-demersal (CD), cold-temperate-epibenthic (CE), warm temperate-demersal (WD), warm temperate-epibenthic (WE), and warm temperate-pelagic (WP).

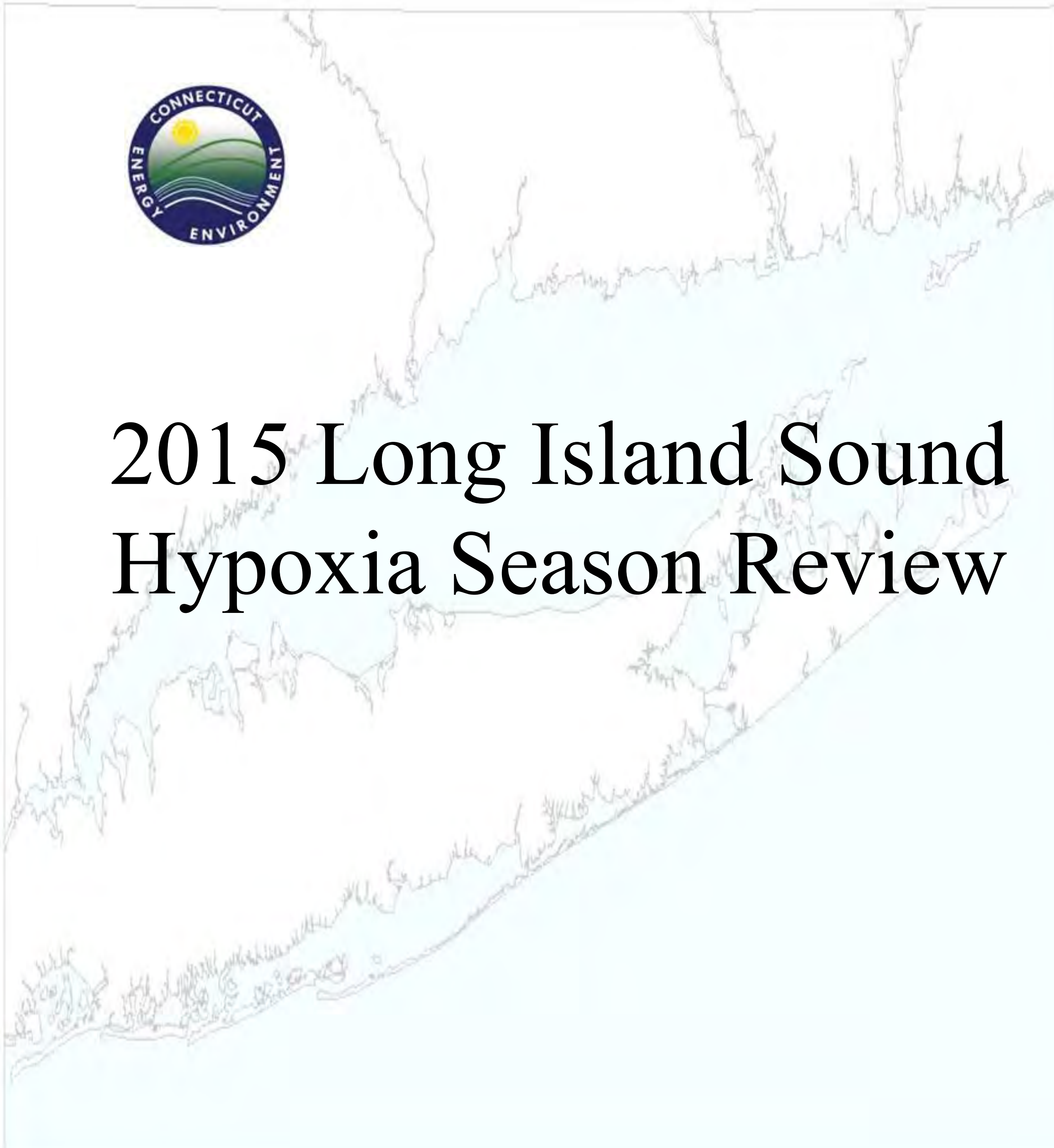
Guild		Common Name	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
C	P	Alewife														0.20%						0.04%			0.06%
W	E	American eel	0.05%			0.05%	0.00%								0.08%			0.16%							
W	P	Anchovy, bay															0.30%								
S	P	Atlantic Moonfish																2.80%	0.26%		0.16%				
W	D	Black Sea Bass				0.14%				0.08%								0.16%	0.40%			0.22%		0.32%	0.19%
W	P	Bluefish	1.96%	0.55%	0.40%	0.05%	0.09%		0.39%	0.08%	0.08%	1.05%	0.13%	0.97%	0.58%		0.74%				0.33%	1.74%	1.08%		0.13%
W	P	Butterfish	21.04%	11.90%	2.83%	1.53%	1.01%		3.20%	4.02%	4.39%	16.94%	3.02%	2.82%	2.97%	1.57%	0.30%	8.40%	2.52%	2.07%	1.70%	0.71%	0.54%	2.07%	0.25%
C	D	Cunner	0.74%	3.71%		0.09%	0.05%		0.10%		0.08%	0.07%	21.30%	13.81%	0.58%	1.38%	0.15%	1.15%	0.66%	0.43%	0.33%				0.19%
W	E	Flounder, Summer	1.06%	64.03%	7.21%	8.72%	24.35%		27.71%	17.01%	21.12%	14.97%	5.92%	7.00%	13.67%	9.06%	14.05%	17.46%	17.62%	18.38%	11.51%	8.75%	31.45%	9.59%	24.81%
C	E	Flounder, Windowpane	25.28%	11.65%	65.52%	70.95%	67.07%		17.83%	8.03%	15.82%	4.64%	5.21%	3.70%	3.71%	9.65%	9.17%	10.38%	9.27%	11.48%	7.35%	0.94%	3.76%	2.66%	7.78%
C	E	Flounder, Winter	36.57%		13.40%	8.45%	3.09%		5.81%	2.91%	4.24%	1.69%			6.84%	15.75%	5.92%	15.16%	26.75%	30.80%	14.75%	7.94%	9.41%	9.13%	24.62%
C	E	Flounder, Fourspot			0.07%	0.05%									0.16%			0.16%					0.13%		
W	E	Goby, naked								0.08%								0.16%							0.25%
C	D	Gunnel, banded															0.15%								
W	D	Gunnel, rock		0.04%	0.13%		0.09%		0.29%	0.08%	0.38%	0.21%			0.41%	0.59%	0.30%		0.13%	0.09%			0.54%	0.06%	0.19%
C	D	Hake, Silver								0.08%						0.39%				0.26%	0.11%				0.06%
W	E	Hake, Spotted	0.05%							0.08%		0.14%	0.13%							0.60%	0.33%	0.45%	4.30%	0.45%	0.06%
W	E	Hake, Southern																	0.26%					0.19%	
C	E	Hake, Red	0.05%																0.40%						
W	P	Herring, Blueback	0.85%	0.91%											0.08%										
W	E	Hogchocker		0.25%		0.05%					0.23%					0.20%		0.66%			0.11%	0.04%	0.54%	0.06%	0.06%
W	E	Killifish, Banded															0.44%								
W	D	Kingfish								0.31%															
W	E	Lined Seahorse																0.16%							
W	D	Lizardfish																						0.13%	
S	P	Lookdown																0.66%					0.13%	0.06%	0.06%
C	P	Mackerel	0.74%															0.16%							
S	P	Mackerel, Spanish	0.11%																						
W	P	Menhaden	0.26%			0.56%			0.10%	0.16%		0.07%	0.13%					1.48%		0.17%	1.43%	0.71%	0.27%		5.95%
W	E	Northern Pipefish	0.16%							0.08%								0.16%							
C	E	Oyster Toadfish	0.37%	0.36%	1.01%	0.70%	0.18%		0.58%	0.71%	0.83%	0.14%	0.26%	0.29%	0.41%	0.59%	0.59%	0.82%	1.46%	1.04%	0.33%	0.54%	0.81%	0.13%	
S	D	Permit															0.44%							0.13%	
W	D	Porgy / Scup	1.22%	1.31%	1.08%	0.23%			22.48%	54.25%	30.66%	47.43%	39.96%	57.30%	65.98%	55.91%	61.09%	29.82%	34.70%	26.14%	56.96%	70.15%	14.65%	54.92%	27.78%
C	E	Sculpin, Longhorn	0.05%	0.04%	0.13%	0.05%						0.14%				0.39%	0.15%		0.40%	0.52%	0.05%	0.13%	0.00%	0.06%	0.00%
C	E	Sculpin, Grubby	0.05%	0.15%																					
C	E	Sculpin, Shorthorn							0.48%		0.08%									0.17%	0.05%	0.00%	0.13%	0.13%	0.06%
C	E	Sea Robin, Northern	0.26%	0.19%	0.07%	0.28%	0.28%		3.39%	1.81%	3.33%	1.48%	1.99%	1.92%	0.41%	0.39%	0.57%	0.64%	0.65%	1.03%	0.56%	0.76%	8.06%	1.49%	0.95%
W	E	Sea Robin, Striped	1.22%	0.87%	0.33%	1.48%	1.38%		15.99%	8.35%	16.50%	7.10%	9.14%	8.98%	1.90%	2.56%	2.68%	2.99%	3.06%	4.83%	2.62%	2.99%	20.97%	14.51%	5.63%
W	D	Silverside	4.35%	0.36%										0.10%		0.20%	0.30%	3.13%		0.09%	0.44%			0.06%	0.06%
W	E	Skate, clearnosed		0.07%	1.55%	0.00%	0.37%		0.78%	0.31%	0.45%	0.21%	0.26%												
C	E	Skate, little	2.01%	2.58%	3.97%	5.99%	1.01%		0.19%				0.32%		0.08%										
C	D	Stickleback	0.05%																						
W	D	Smooth dogfish	0.05%	0.47%	1.95%	0.37%	0.46%		0.29%	0.24%	0.61%	2.18%	11.45%	0.88%	0.41%	0.20%	0.15%	0.33%	0.00%	0.43%	0.05%	0.45%	0.54%	2.72%	0.44%
C	P	Spiny dogfish	0.26%																						
W	D	Spot drum																				1.78%	1.88%		
W	P	Striped bass			0.13%	0.23%	0.32%					0.14%	0.51%	0.49%	0.08%		0.15%	0.16%	0.13%			0.13%			
W	D	Tautog (blackfish)	1.17%	0.15%	0.20%	0.05%	0.23%		0.39%	0.16%	0.30%	0.49%	0.06%	0.10%	0.58%	0.79%	0.74%	0.33%	1.32%	1.04%	0.66%	0.71%	0.81%	0.84%	0.25%
C	D	Tomcod		0.04%												0.20%									
W	D	Weakfish		0.36%						1.10%	0.91%	0.91%	0.19%	1.65%	1.07%		1.63%	2.47%		0.43%	0.16%	0.80%		0.26%	0.13%
C	D	White perch								0.08%															

Appendix 9.3: Finfish species occurrence in the Coast Guard Academy Thames River otter trawl samples, August-October, 1974-2015. Seven thermal guilds were present: cold temperate-demersal (CD), cold-temperate-epibenthic (CE), cold temperate-pelagic (CP), warm temperate-demersal (WD), warm temperate-epibenthic (WE), warm temperate-pelagic (WP), and subtropic pelagic (SP).

GUILD		YEAR	1974	1975	1992	1993	1994	1995	1996	1997	1998	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
C	P	Alewife											7.6%	0.1%										
W	P	Anchovy			0.9%	5.4%	1.1%	1.8%				0.5%	4.0%		0.8%	0.7%	0.4%	0.5%	41.8%	10.0%	46.8%	14.0%	7.8%	0.5%
W	P	Bass (Striped)								0.1%														
W	D	Blackfish (Tautog)	3.4%	4.1%	0.2%					0.1%		0.1%	0.1%	0.1%			0.2%		0.1%	0.2%				
S	P	Big Eye											0.1%			0.1%							0.05%	0.1%
W	E	Blowfish (N. Puffer)			0.1%	0.03%		0.1%																
W	P	Bluefish	0.3%	0.7%	0.2%	0.3%	2.5%		0.03%		1.9%	0.1%	0.03%					0.1%					0.1%	
W	P	Butterfish			0.1%		3.6%				0.4%	1.0%	0.2%	0.3%	0.8%		0.2%	22.2%	1.1%	2.2%	0.1%		1.1%	7.9%
C	D	Cunner	5.8%	9.0%	0.4%							0.7%	0.2%	0.2%	0.2%	0.2%	0.2%							0.1%
W	E	Cusk eel																	0.1%					
W	E	Eel (American)				0.1%						0.2%	0.1%											
C	E	Fourbeard Rockling			0.1%																			
C	E	Flounder (Fourspot)			0.4%		1.6%			0.1%	0.2%	0.1%	0.00%	0.1%		0.1%	0.4%	0.1%	0.2%	0.5%			0.05%	
W	E	Flounder (Gulf Stream)				0.03%				0.1%														
W	E	Flounder (Smallmouth)									0.3%		0.03%	0.04%		0.8%	4.1%	1.4%	0.4%	3.1%	1.5%	6.5%	0.9%	1.1%
W	E	Flounder (Summer)		0.4%	0.1%	0.4%	0.2%		0.03%	0.3%	0.1%	0.5%	0.8%	0.6%	3.0%	4.0%	19.5%	3.2%	2.4%	2.9%	1.1%	29.0%	4.4%	2.1%
C	E	Flounder (Windowpane)	14.4%	8.2%	2.4%	0.5%	16.3%	0.1%	1.4%	0.8%	0.4%	1.6%	0.7%	1.4%	2.1%	1.4%	6.1%	0.8%	1.2%	1.4%	0.2%	1.1%	0.6%	
C	E	Flounder (Winter)	74.6%	25.8%	24.9%	12.4%	44.5%	4.9%	0.4%	2.7%	1.1%	3.7%	1.7%	3.4%	4.7%	1.5%	11.7%	3.0%	5.8%	4.3%	1.3%	6.5%	0.0%	1.2%
W	E	Flounder (Hogchoker)		1.5%	0.1%		0.5%						0.03%	0.04%						0.2%	0.2%	2.2%	0.1%	0.3%
C	E	Flounder (Yellowtail)											0.1%											
W	E	Fundulus-killifish		13.1%	0.9%	0.9%		5.9%	0.1%	2.5%			14.7%	0.04%										
C	E	Fundulus-mummichog										0.1%	0.1%											
W	E	Goby																						0.1%
W	D	Gunnel						0.1%								0.1%			0.1%					
C	D	Hake (Silver)					2.0%								1.7%									
C	E	Hake (Red)													0.2%						0.1%			
W	E	Hake(Spotted)			0.3%				0.4%	0.1%		0.1%	0.1%	0.04%		0.3%	0.9%	0.3%	0.7%	0.7%	0.2%	3.2%	0.2%	0.1%
C	E	Hake (White)			0.1%		0.2%						0.1%	0.1%										
		Herring (unknown species)			0.2%																			0.1%
C	P	Herring (Atlantic)										0.1%	0.1%											
W	P	Herring (blue back)										0.1%	0.1%	0.8%										
W	P	Jack (Crevalle)									0.2%													
W	D	Kingfish		1.1%	0.2%	0.1%		0.9%			0.5%						0.2%		0.3%					
W	D	Lizardfish								0.3%					1.7%	0.1%	0.6%	0.5%	0.9%	0.0%	0.2%	4.3%	1.0%	0.2%
S	P	Lookdown			0.1%					0.4%														
W	P	Menhaden			19.3%			46.2%	71.6%		0.1%	0.1%	2.1%					0.1%						0.1%
S	P	Moonfish									0.7%	1.2%	0.4%	0.2%	8.4%	0.2%	1.9%	7.9%	2.0%	1.7%	0.8%	7.5%	8.9%	3.5%
W	D	Mullet								0.1%	0.1%		0.2%											
W	E	Pipefish		1.5%	0.1%	0.2%	1.2%	0.2%				0.1%	0.1%				0.4%							
C	E	Sculpin (Grubby)	0.3%	0.7%	0.1%					0.1%		0.2%					0.6%		0.1%					
C	E	Sculpin (Longhorn)												0.1%										
W	D	Scup (Porgy)		4.9%	3.2%	0.1%	3.3%	0.1%	0.03%	5.4%	30.0%	63.9%	52.7%	89.0%	74.7%	88.7%	27.7%	56.4%	40.5%	62.9%	39.0%	10.8%	62.1%	72.2%
W	D	Seabass (Black)										0.2%	0.2%	1.9%	0.8%	0.1%	1.1%	0.6%	1.1%	2.2%	1.8%	3.2%	0.9%	4.7%
W	E	Seahorse (lined)															0.2%							
C	E	Searobin (Northern)										0.1%			0.2%		0.2%							
W	E	Searobin (Striped)			0.2%	0.1%		0.1%	0.03%	0.8%	0.3%	0.2%	0.3%	1.2%	0.3%	1.8%	7.4%	1.0%	0.2%	1.4%	0.2%	3.2%	0.6%	0.5%
W	P	Shad											2.7%											
W	D	Sheepshead Minnow						0.1%																
W	D	Silversides (Atlantic)		1.5%	45.2%	78.2%	9.2%		25.6%	86.1%	62.8%	22.6%	6.6%			0.1%		0.1%						
C	E	Skate (little)				0.2%																		
C	P	Smelt									0.7%													
W	D	Smooth Dogfish																						0.1%
W	D	Spot		25.8%		0.4%	12.1%	39.6%	0.4%						0.2%		14.5%				2.3%	5.4%	0.05%	
C	D	Stickleback			0.2%	0.3%	0.8%	0.2%				0.2%												
C	E	Toadfish				0.3%	1.1%					0.4%	0.1%			0.2%				0.2%				
C	D	Tomcod		1.5%					0.03%			0.2%	0.1%											
W	D	Weakfish	1.0%						0.03%			2.1%	3.8%	0.5%	0.5%	0.1%	1.3%	1.8%	1.0%	6.0%	4.1%	3.2%	11.2%	4.9%

Appendix 9.4: Finfish species occurrence in the Coast Guard Academy Thames River seine samples, August-October, 1974-2015. Seven thermal guilds were present: cold temperate-epibenthic (CE), cold temperate-demersal (CD), cold temperate-pelagic (CP), warm temperate-epibenthic (WE), warm temperate-demersal (WD), warm temperate-pelagic (WP) and subtropic pelagic/demersal (WP/D).

GUILD		YEAR	1974	1975	1992	1993	1994	1995	1996	1997	1998	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
C	P	Alewife			0.8%		0.5%			0.04%		14.6%	47.5%	0.5%									13.5%	
W	P	Anchovy				3.5%	0.03%	2.5%		0.02%	0.6%		0.4%							4.5%	1.0%	12.4%		
W	P	Bass (Striped)								0.02%														
W	D	Blackfish (Tautog)	2.8%		0.5%	0.3%				0.1%	0.5%	0.7%		0.5%	7.4%	1.3%	5.3%	2.6%	1.9%		3.0%		1.2%	6.7%
W	E	Blowfish (N. Puffer)						0.2%		0.02%								0.2%						
W	P	Bluefish		2.8%			0.2%		1.4%	1.1%	1.1%			4.9%	0.9%			0.2%	18.9%		1.5%		0.2%	3.7%
W	P	Butterfish											0.8%											
C	D	Cunner	0.4%	7.5%								1.3%	0.1%	3.8%	12.0%	0.3%	1.1%	2.2%	0.1%	3.8%	4.9%	2.7%	0.1%	
W	E	Eel (American)			0.9%		0.3%	0.0%	0.1%	0.04%		0.5%		4.4%	5.6%	0.1%	8.1%	0.9%	0.2%	0.6%	2.0%	1.1%	0.2%	0.9%
C	E	Fourbeard Rockling				0.1%																		
C	E	Flounder (Fourspot)				0.1%				0.02%		0.2%	0.2%											
W	E	Flounder (Gulf Stream)								0.02%														
W	E	Flounder (Smallmouth)																						
W	E	Flounder (Summer)			1.3%	1.1%	2.8%	0.3%	0.3%	0.3%	0.1%	0.2%	1.1%									0.5%		
C	E	Flounder (Windowpane)		30.8%	0.2%	5.8%	0.0%	0.8%	0.0%	0.6%	0.1%	0.2%	3.1%											
C	E	Flounder (Winter)		49.5%	24.8%	70.8%	0.4%	4.9%	2.7%	4.2%	2.7%	2.4%	4.8%	9.8%	14.8%	0.7%	1.4%	3.3%	1.0%	0.6%	8.9%	1.6%		0.7%
C	E	Flounder (yellowtail)										0.3%	0.1%											
W	E	Fundulus diaphanus (banded killifish)												3.3%		0.3%	0.4%			17.3%				1.1%
W	E	Lucania parva (rainwater killifish)												0.5%										
W	E	Fundulus majalis (striped killifish)	55.8%		10.4%		9.2%	7.2%	0.6%	1.6%	0.1%	0.7%	1.4%	2.7%		0.3%	2.8%	0.9%			3.4%	15.1%		0.5%
C	E	Fundulus (mummichog)										1.8%		1.1%		0.1%	23.9%	1.7%	4.8%	20.5%	5.4%	2.7%	6.9%	4.4%
W	E	Goby	0.4%					0.1%							0.9%			0.2%	0.5%			4.3%		
C	D	Hake (Silver)										0.3%												
C	E	Hake (Red)										0.3%	0.2%											
W	E	Hake (Spotted)				0.4%	0.03%			0.02%			0.2%											
C	E	Hake (White)		0.9%		0.3%																		
		Herring (unknown species)									0.5%													
C	P	Herring (Atlantic)										0.3%												
W	P	Herring (blue back)										1.6%							1.1%				18.1%	
W	E	Hogchoker		3.7%			0.0%																	
W	P	Jack (Crevalle)																						
W	D	Kingfish				0.1%		0.04%	0.02%	0.04%	1.1%													
W	D	Lizardfish								0.1%			0.1%		6.5%									
S	P	Lookdown				0.3%																		
C	P	Mackerel (Atlantic)				0.1%																		
W	P	Mackerel (Spanish)				0.1%																		
W	P	Menhaden			1.4%			12.5%	70.5%	0.02%	24.6%	1.0%				0.1%	5.6%	15.2%	4.7%	0.6%	29.1%	1.6%	40.1%	31.7%
S	P	Moonfish											1.3%											
W	D	Mullet								0.04%		0.2%												
W	E	Northern Pipefish		0.9%	1.9%	0.3%	0.1%	0.7%	0.1%	0.3%	0.6%	0.2%		2.2%	12.0%	0.4%	2.1%	2.2%	0.7%	0.6%	1.5%	4.8%	1.0%	2.8%
S	D	Banded Rudderfish															0.7%	2.8%	0.2%	3.8%				
C	E	Sculpin (Grubby)				0.1%				0.0%		0.2%	0.1%	0.5%	8.3%	0.4%		0.6%		1.3%		4.8%	1.4%	
W	D	Scup (Porgy)		0.9%	3.5%	0.8%		0.0%		3.9%	11.5%	1.0%	36.0%		3.7%					0.6%	0.5%			0.2%
W	D	Seabass (Black)					0.0%				0.1%		0.3%					0.2%			8.9%	0.5%	0.2%	4.6%
C	E	Searobin (Northern)						0.0%		0.0%			0.1%											
W	E	Searobin (Striped)		0.9%	0.2%	1.1%		0.3%		0.3%	1.2%	0.2%	0.3%											
W	P	Shad			0.6%	0.1%						0.7%												
W	D	Sheepshead Minnow												0.5%										
W	D	Silversides (Atlantic)	24.5%	1.9%	42.9%	14.5%			23.7%	86.2%	55.2%	69.6%	0.3%	57.9%	15.7%	95.2%	44.0%	65.2%	64.8%	37.2%	27.6%	32.3%	16.4%	36.0%
W	D	Silversides (tidewater)												6.0%		0.1%								
C	E	Skate (little)							0.0%															
C	P	Smelt						0.0%																
W	D	Spot	1.6%				86.2%	68.2%	0.1%															
C	D	Stickleback	12.9%		8.8%			1.9%	0.1%	0.7%		0.8%			4.6%				0.2%	8.3%		14.5%	0.2%	
C	E	Oyster Toadfish	1.2%		1.3%			0.2%	0.2%	0.1%		0.7%		0.5%	3.7%	0.4%	4.6%	0.2%	1.0%		1.5%	1.1%	0.1%	6.7%
C	D	Tomcod	0.4%		0.6%		0.1%	0.0%	0.0%	0.0%		0.3%		0.5%	3.7%			1.5%			1.0%		0.1%	0.2%
W	D	Weakfish					0.2%			0.0%			1.7%											



2015 Long Island Sound Hypoxia Season Review

CONNECTICUT DEPARTMENT OF ENERGY & ENVIRONMENTAL PROTECTION
79 ELM STREET, HARTFORD, CT 06106
ROBERT J. KLEE, COMMISSIONER

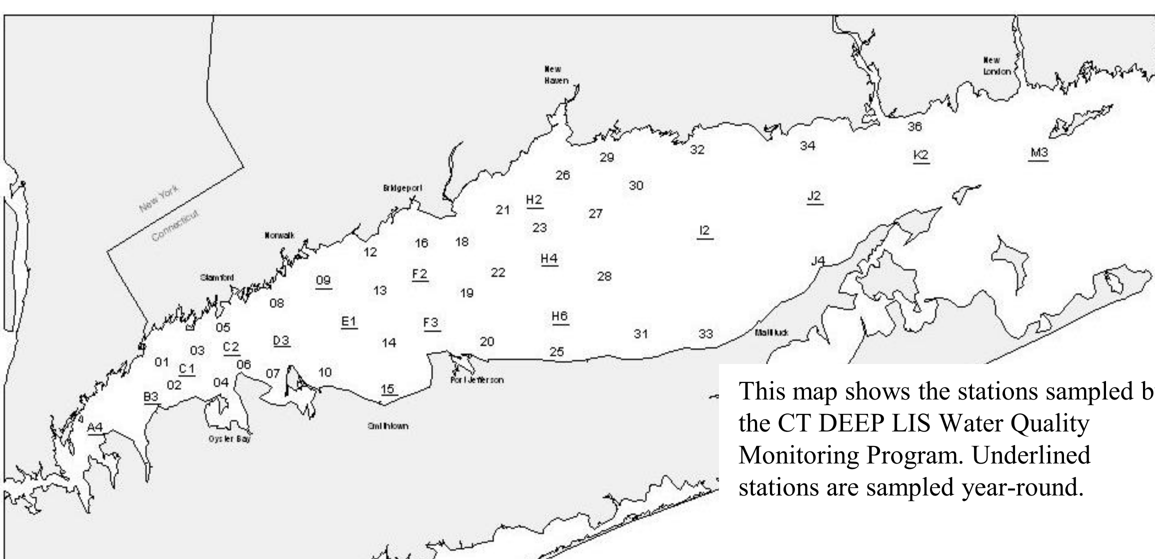
MONITORING LONG ISLAND SOUND 2015

Program Overview

Since 1991, the Connecticut Department of Energy & Environmental Protection (CT DEEP, formerly the Department of Environmental Protection, (CTDEP)) has conducted an intensive year-round water quality monitoring program on Long Island Sound (LIS). Water quality is monitored at up to forty-eight (48) sites by staff aboard the Department's Research Vessel *John Dempsey*.

R/V John Dempsey

Data from the surveys are used to quantify and identify annual trends and differences in water quality parameters relevant to hypoxia (low dissolved oxygen), especially nutrients, temperature, and chlorophyll. These data are also used to evaluate the effectiveness of the management program to reduce nitrogen concentrations. During the summer (June -September) CT DEEP conducts additional summer hypoxia surveys at bi-weekly intervals to better define the areal extent and duration of hypoxia.



This map shows the stations sampled by the CT DEEP LIS Water Quality Monitoring Program. Underlined stations are sampled year-round.

CT DEEP Methods

Dissolved oxygen, temperature, pH, and salinity data are collected *in situ* (on site in the water column) using an electronic instrument called a Conductivity Temperature Depth recorder (CTD) that takes measurements from the surface to the bottom of the water column. The CTD, a Sea-Bird model SBE-19 SeaCat Profiler equipped with auxiliary dissolved oxygen, photosynthetically-active radiation (PAR) and pH sensors, is attached to a Rosette Sampler and lowered through the water column at a rate of approximately 0.2 meters per second and measurements are recorded every 0.5 seconds. *In situ* data are reviewed in real-time.

Water samples are collected using Niskin water sampling bottles that are attached to the Rosette Sampler. The Rosette is lowered off the stern of the *Dempsey* and the bottles are triggered remotely to take a water sample at any depth. Parameters for which surface and bottom waters are tested include dissolved silica, particulate silica, particulate carbon, dissolved organic carbon, dissolved nitrogen, particulate nitrogen, ammonia, nitrate + nitrite, particulate phosphorus, total dissolved phosphorus, orthophosphate, chlorophyll *a*, and total suspended solids.

Samples are filtered aboard the mini laboratory and preserved for later analyses at the Center for Environmental Science and Engineering at the University of Connecticut. From October to May, *in situ* data and nutrient samples are collected once a month from 17 sites. Bi-weekly hypoxia surveys start in mid-June and end in September with up to 48 stations being sampled during each survey for *in situ* parameters.

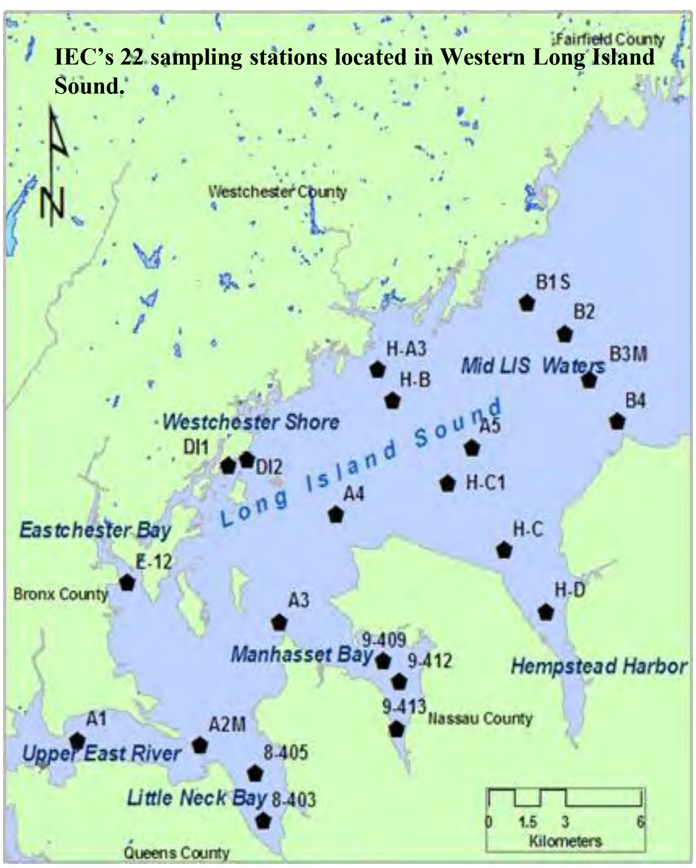
Since 2002, CT DEEP has collected zooplankton samples from six stations and phytoplankton from ten stations across Long Island Sound. The samples are sent to researchers at the University of Connecticut who identify species composition, abundance, community structure, and spatial and temporal distribution throughout the Sound.

IEC

The Interstate Environmental Commission (IEC) is a tri-state water and air pollution control agency. Established in 1936 the IEC serves the States of New York, New Jersey, and Connecticut (www.iec-nynjct.org). The IEC's area of jurisdiction runs west from New Haven, CT and Port Jefferson, NY on Long Island Sound.

IEC has conducted monitoring in the far western LIS and the Upper East River since 1991. IEC collects *in situ* data from 22 stations between June and September. *In situ* parameters include pH, temperature, salinity, water clarity (Secchi disk depth) and dissolved oxygen. More information about the program can be found on the IEC website under the Publications menu http://www.iec-nynjct.org/publications.htm.

Provisional IEC dissolved oxygen data collected during 2015 have been used to create hypoxia map interpolations in the far western Sound and appear on pages 13-22 adjacent to CTDEEP hypoxia maps. These maps are for illustrative purposes only.



IEC's 22 sampling stations located in Western Long Island Sound.

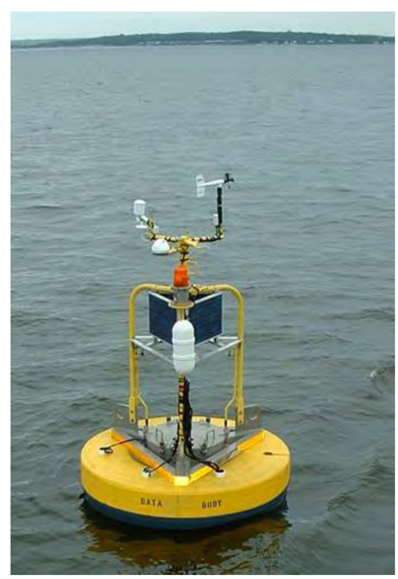
IEC Analyst utilizes a multi-parameter meter at station A2M during a summer monitoring survey

LISICOS

The Long Island Sound Integrated Coastal Observing System (LISICOS) was established in 2003 as a component of a regional/national ocean observing system. The system was conceptualized as part of a water quality monitoring program that combined the traditional ship-based point sampling surveys with continuous, real-time sampling stations. Funding for the program was first provided through the Environmental Protection Agency EMPACT grant program and is now provided by the National Oceanic and Atmospheric Administration.

The initial goal was to develop "a capability to observe and understand the LIS ecosystem and predict its response to natural and anthropogenic changes".

LISICOS monitors water quality parameters (e.g., salinity, temperature, dissolved oxygen, surface waves, photosynthetically available radiation, chlorophyll) and meteorological parameters (e.g., wind speed, direction, barometric pressure, wave height) at up to eight stations across the Sound. Sensors are attached to a moored buoy at various depths (surface, mid, bottom). Data are transmitted every 15 minutes in real-time via satellite (telemetered) where they are stored in a database and uploaded to the internet. The system is maintained by the University of Connecticut.

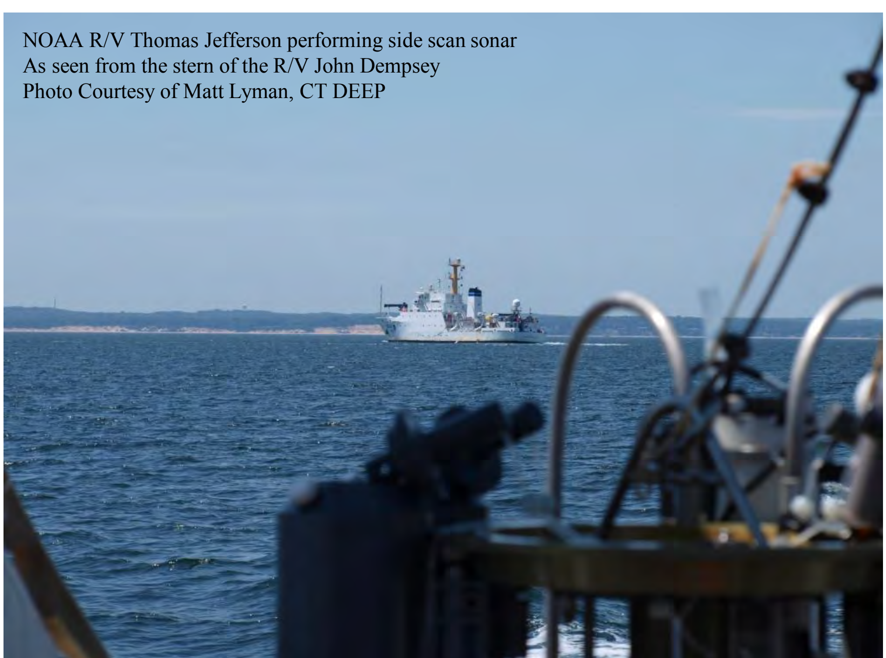


This report presents a summary of the 2015 *in situ* data collected by CT DEEP. Data from LISICOS and IEC are presented with permission for informational purposes.

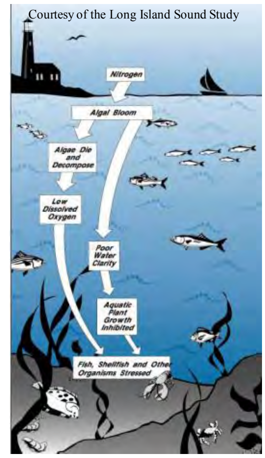
The CT DEEP and IEC LIS Water Quality Monitoring Programs are synoptic in nature and are intended to characterize water quality conditions at one moment in time over a broad area (the entire Sound). Water column profile data provided by the programs are useful for future determinations of volume of hypoxic waters. Both programs support long term monitoring databases designed to detect changes in hypoxia due to changing conditions (i.e. management actions, climate change, productivity). The CT DEEP program also provides nutrient and biological data not available from fixed station buoy applications.

The LISICOS water quality sensors are attached to fixed locations and provide a holistic view of the conditions over a more detailed span of time (i.e., data measured every 15 minutes from one station as opposed to every two weeks). The LISICOS continuously recording buoys have shown instances where vertical mixing within the water column raises the DO concentrations above the hypoxic thresholds for extended periods of time (e.g., days). These episodic conditions are not captured by CT DEEP or IEC surveys which occur bi-monthly during the hypoxic season.

As such CT DEEP and IEC data provide a snapshot of hypoxic conditions at one time while the LISICOS data provide a continuous measurement of hypoxia at specific buoy locations. Together these monitoring programs are better able to characterize the extent and duration of hypoxia across LIS. Both types of data contribute to a better understanding of hypoxia in LIS.

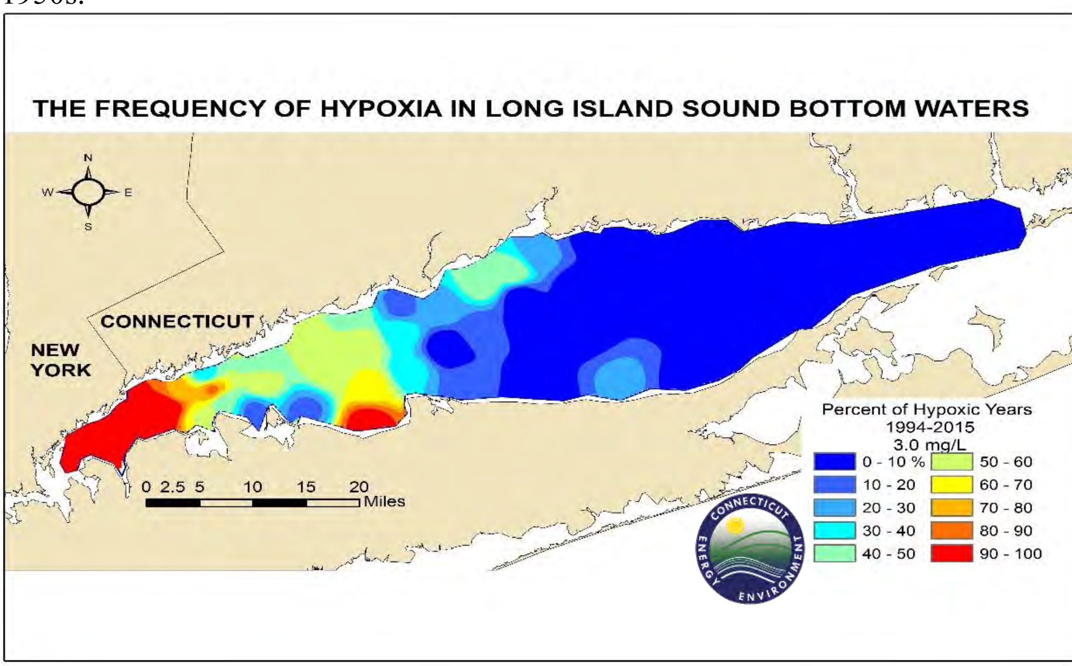


NOAA R/V Thomas Jefferson performing side scan sonar
As seen from the stern of the R/V John Dempsey
Photo Courtesy of Matt Lyman, CT DEEP



What is Hypoxia?

The term "hypoxia" means low dissolved oxygen ("DO") concentrations in the water. Marine organisms need oxygen to live, and low concentrations, depending on the duration and the size of the area affected, can have serious consequences for a marine ecosystem. As defined by the Long Island Sound Study, hypoxia exists when DO drops below a concentration of 3 milligrams per liter (mg/L), although ongoing national research suggests that there may be adverse affects to organisms even above this level, depending upon the length of exposure. In 2011, Connecticut adopted revised water quality criteria for dissolved oxygen. These criteria, designed to protect the state's waters from degradation, define hypoxia as DO concentrations below 3.0 mg/L. Low oxygen levels can occur naturally in estuaries during the summer, when calm weather conditions prevent the mixing of the water column that replenishes bottom water oxygen during the rest of the year. However, studies of the limited historical data base for the Sound suggest that summer oxygen depletion in Western Long Island Sound has grown worse since the 1950s.



How Does Low Oxygen Impact the Sound?

Each summer low oxygen levels render hundreds of square miles of bottom water unhealthy for aquatic life. DO levels follow seasonal patterns with a decrease in bottom water DO over the course of the summer. Hypoxic conditions during the summer are mainly confined to the Narrows and Western Basin of Long Island Sound. Those areas comprise the section of the Sound west of a line from Stratford, CT to Port Jefferson, NY. The maximum extent of the hypoxic condition typically occurs in early August.

Photo By Lloyd Langevin, June 2007

2015 Important Facts

CT DEEP conducted eight cruises during the summer of 2015 between 28 May and 16 September. Over the course of the season, five (5) different stations were documented as hypoxic and of the 252 site visits completed in 2015, hypoxic conditions were found four surveys. Compared to the previous 24-year average, 2015 was below average in area and near average in duration. In fact, 2015 had the second smallest area behind 1997 (see page 9).

Cruise	Start Date	End Date	Number of stations sampled	Number of hypoxic stations	Hypoxic Area (mi^2)
WQJUN15	5/28/15	6/5/15	17	0	0
HYJUN15	6/17/15	6/19/15	28	0	0
WQJUL15	7/6/15	7/8/15	40	0	0
HYJUL15	7/20/15	7/23/15	39	3	29.4
WQAUG15	8/3/15	8/6/15	39	3	34.8
HYAUG15	8/17/15	8/19/15	36	3	38.3
WQSEP15	8/31/15	9/2/15	31	2	21.7
HYSEP15	9/16/15	9/16/15	22	0	0

The peak event occurred during the HYAUG15 cruise between 17 and 19 August. The lowest dissolved oxygen concentration (2.12 mg/L) was documented during the HYJUL15 and HYAUG15 cruises at Station A4. The hypoxia area maps for 2015 appear on pages 12-21.

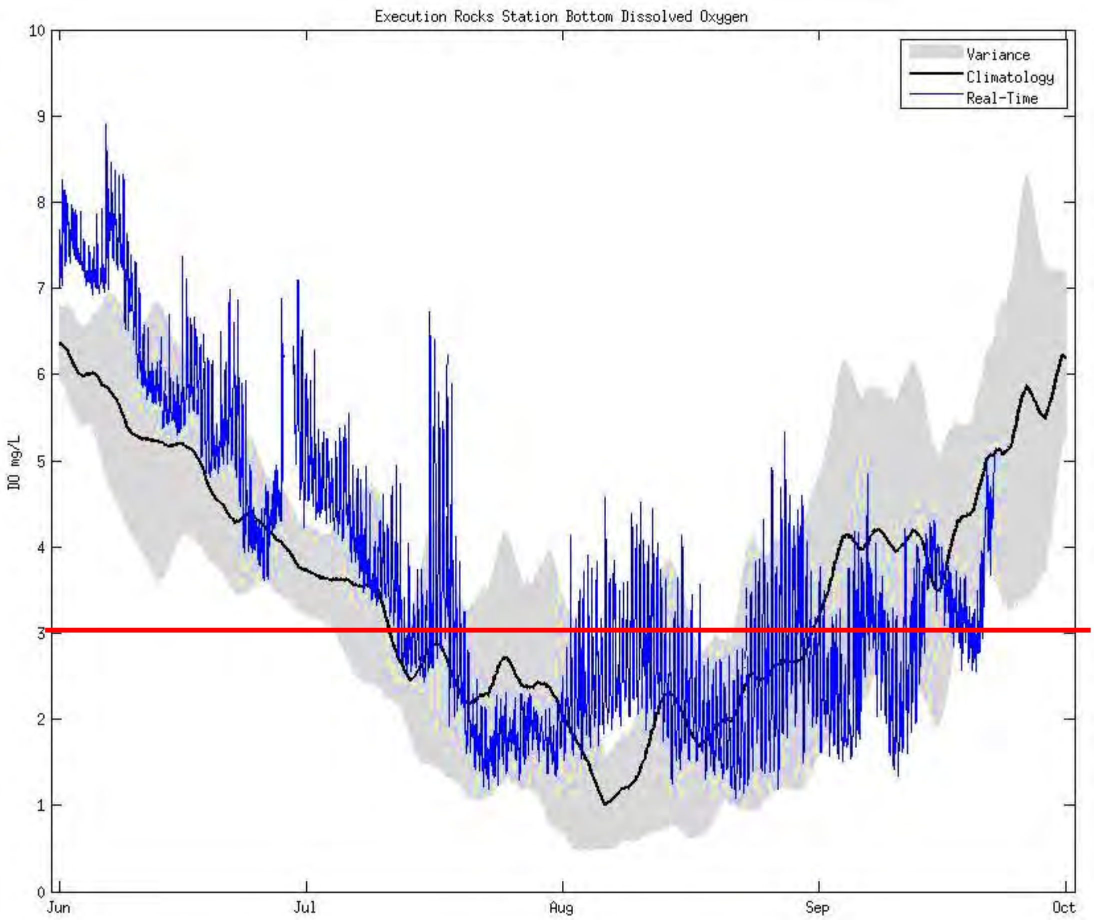
Based on CT DEEP and NEIWPCC-IEC data

Estimated Start Date	7/16/2015
Estimated End Date	9/10/2015
Duration (days)	57
Maximum Area (mi^2)	**38.3**

Start date and end date are estimated by plotting CT DEEP and NEIWPCC-IEC data from stations A4 and B3 in Excel using a line with markers chart and then interpolating when the DO concentration drops below/rises above 3.0 mg/L.

Duration Based on Buoy Data Obtained From the LISICOS Network on 28 September 2015

The figure below is from the LISICOS website and depicts the 2015 real-time bottom dissolved oxygen data (blue line); the average of the 10 year dataset (black line); and the variability observed over the historical station record (gray shading) from the Execution Rocks Buoy. The Western Sound Buoy was offline the entire summer after sustaining damage over the winter of 2014-2015.



Based on LISICOS Buoy Data Collected Between 1 June to 28 September

	Execution Rocks
Estimated Start Date	7/12/15
Estimated End Date	9/21/15
Duration below 3.0 mg/L (cumulative days)	50.07
Duration below 2.0 mg/L (cumulative days)	22.25
Duration below 1.0 mg/L (cumulative days)	0.00
Minimum DO value (mg/L)	1.09 (21 August)

Data obtained from the LISICOS Execution Rocks Buoy Bottom Dissolved Oxygen Prediction Tool webpage (http://lisicos.uconn.edu/do_fcst.php?site=exrx). Duration is calculated by LISICOS by summing the time (in days) of the number of samples where DO was below the specified value (T. Fake, pers comm. 18 October 2012). ***Data are provisional and subject to change.***

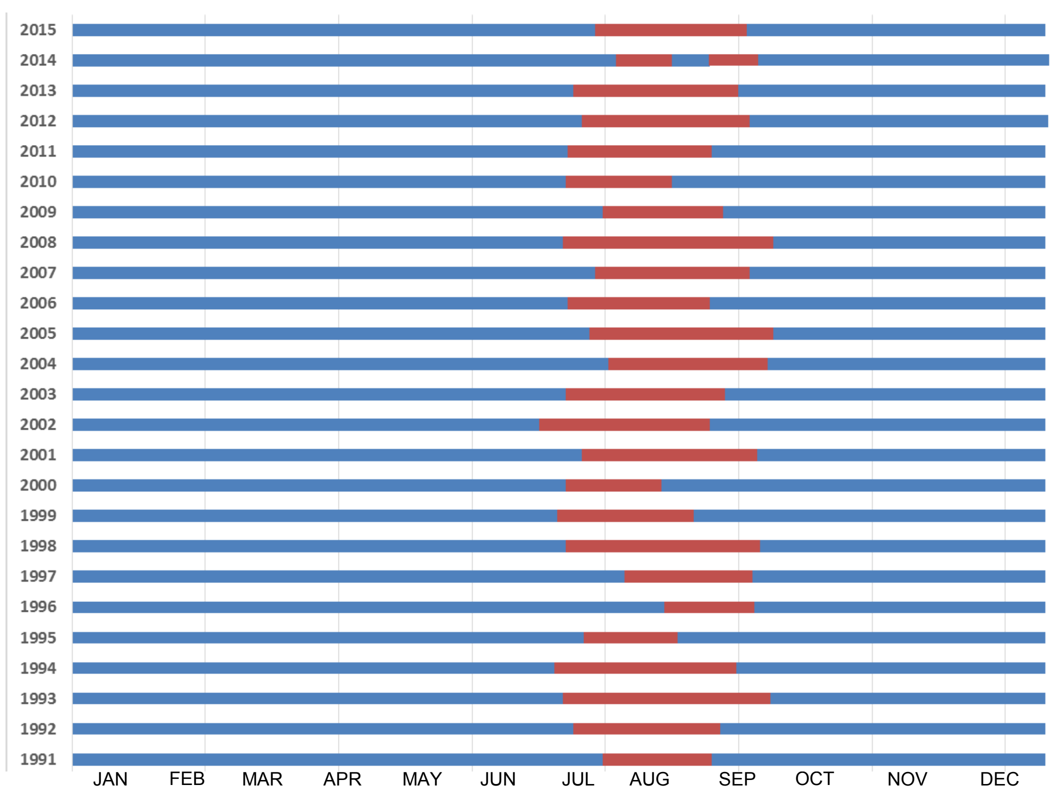
Timing and Duration of Hypoxia, 1991 - 2015

Year	Estimated Start Date	Estimated End Date	Maximum Area (mi²)	Duration (days)
1991	July 19	Aug 28	122	41
1992	July 7	Aug 30	80	55
1993	July 9	Sept 10	202	64
1994	July 1	Sept 6	393	68
1995	July 12	Aug 15	305	35
1996	Aug 10	Sept 12	220	34
1997	July 27	Sept 12	30	48
1998	July 5	Sept 15	168	73
1999	July 2	Aug 21	121	51
2000	July 2	Aug 6	173	35
2001	July 10	Sept 14	133	66
2002	June 25	Aug 28	130	65
2003	July 5	Sept 3	345	61
2004	July 20	Sept 12	202	55
2005	July 14	Sept 20	177	69
2006	July 6	Aug 27	199	53
2007	July 16	Sept 11	162	58
2008	July 3	Sept 19	180.1	79
2009	July 19	Sept 1	169.1	45
2010	July 5	August 13	101.1	40
2011	July 6	August 28	130.3	54
2012	July 10	Sept 10	288.5	63
2013	July 8	Sept 7	80.7	62
2014	July 24	Sept 9*	87.1	35
2015	July 16	Sept 10	38.3	57
Average	July 12	Sept 4	169	55
Deviation	±10 days	±12 days	± 87 mi²	± 13 days

The figure and table below display the onset, duration, and end of the hypoxia events from 1991 through 2015 based on the 3.0 mg/L standard.

Based on the LISS standard of 3.0 mg/L, the average date of onset was July 12 (± 10 days), the average end date was September 4 (± 12 days), and the average duration was 55 days (± 13 days). The earliest onset of hypoxia (red text) occurred on 25 June 2002 and the latest end date (green text) occurred on 20 September 2005. The maximum area of hypoxia was 393 square miles (blue text) and occurred in 1994. The longest hypoxic event occurred in 2008 (magenta text) and lasted 79 days.

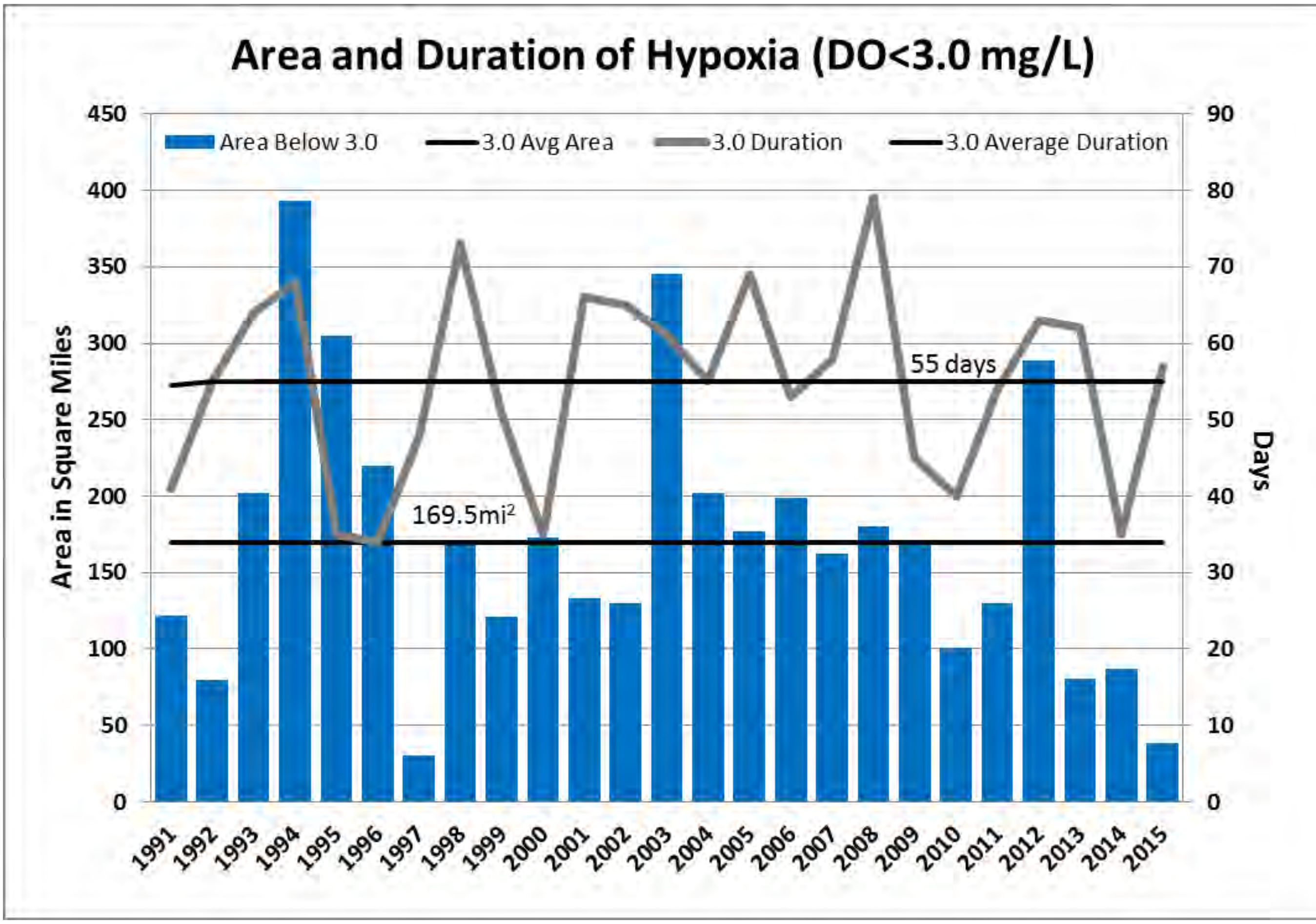
* In 2014 there was a clear period of 14 days where the DO concentration rose above the 3.0 mg/L threshold in the middle of August before dipping again during late August and early September.



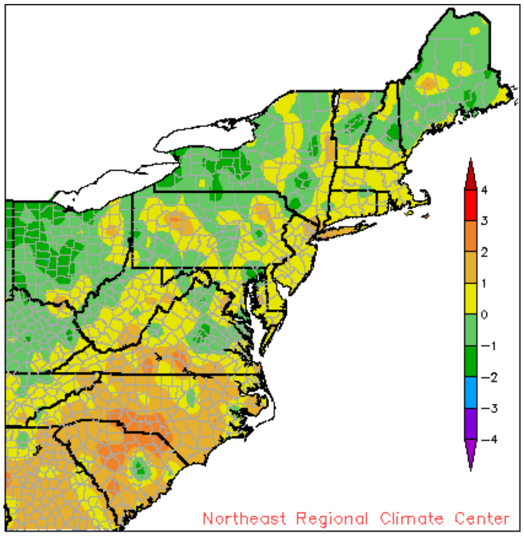
Timing and Duration of Hypoxia based on 3.0 mg/L

Yearly Comparison of Maximum Areal Extent and Duration of Hypoxia

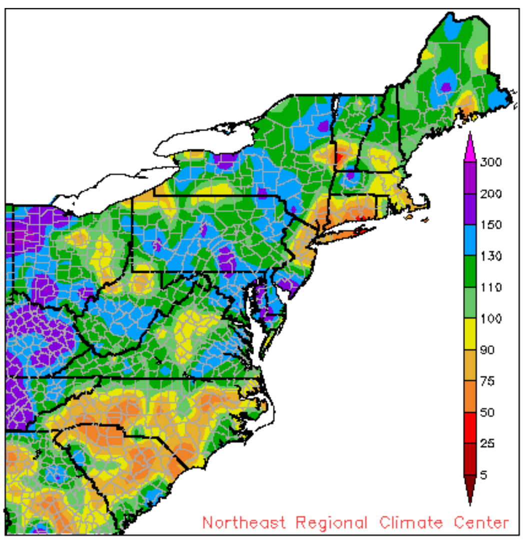
This graph utilizes the data presented on the previous page to illustrate the year-to-year differences in the maximum areal extent of hypoxic conditions. Based on the 3.0 mg/L DO standard the average areal extent was 169.5 mi^2 and the average duration was 55 days.



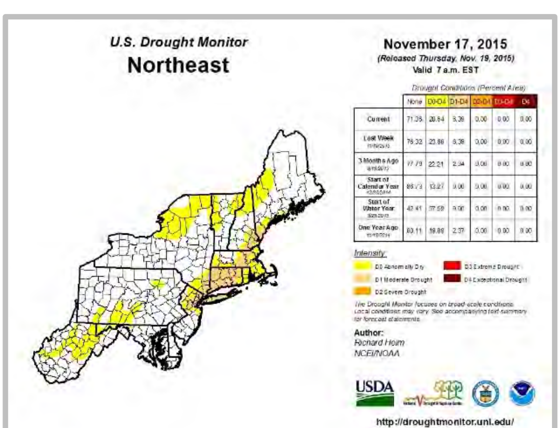
2015 Summer Weather Conditions



Departure from Normal Temperature (ºF)
June 1-August 31, 2015



Percent of Normal Precipitation (%)
June 1- Aug 31, 2015



The Northeast Regional Climate Center at Cornell is tasked with disseminating climate data and information for 12 states. The NRRC included the following graphics in their Eastern Region Quarterly Climate Impacts and Outlook Summary September 2015. http://www.nrcc.cornell.edu/services/reports/reports/2015-09.pdf

Average spring air temperatures were below normal for the area through March but warmer to above normal in May. June saw average temperatures across the region. July and August average temperatures across the region were above normal by 2-3 degrees. Record warmth was seen at Kennedy Airport during August. September temperatures continued above normal with Islip, NY marking the first part of the month as its warmest on record, 5 degrees above normal. Bridgeport, CT reported its second warmest September on record.

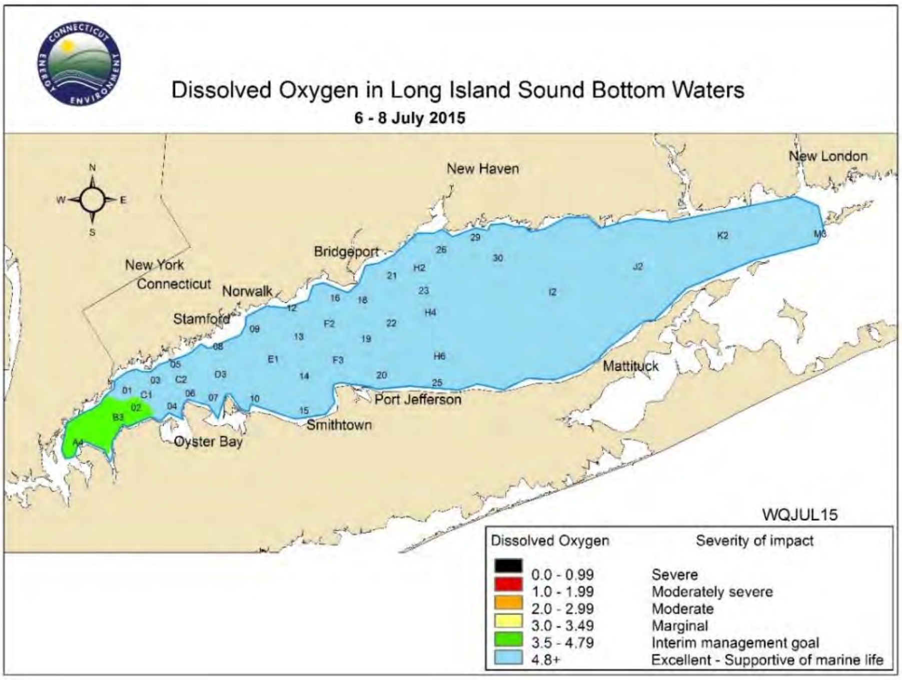
Spring precipitation was below normal for CT and Long Island, resulting in moderate drought conditions across the region. June was wetter than May, but abnormally dry conditions persisted into July and August On the last day of September, a slow moving cold front combined with remnants of a tropical system to bring 1-2 inches of rain to the region. Precipitation continued to be scarce through October and into November with the region classified as being abnormally dry or in a moderate drought by the US Drought Monitor http://www.nrcc.cornell.edu/page_drought.html.

This information is useful as physical processes influence the timing and duration of hypoxia.

Hypoxia Maps

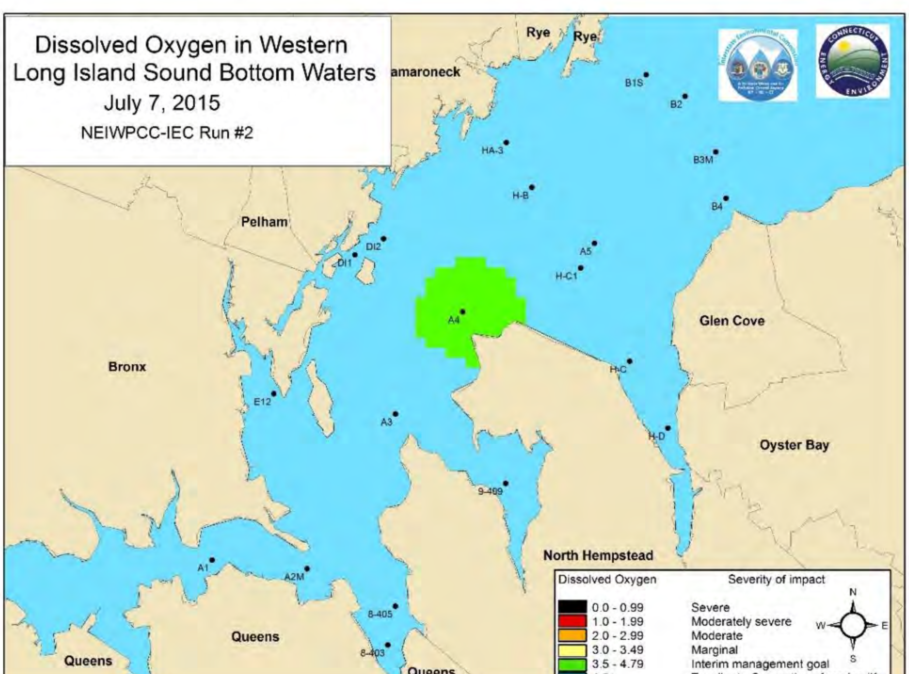
The following maps depict the development of hypoxia based on CT DEEP cruise data through the 2015 season. Data for all surveys are available upon request. NEIWPCC-IEC data were also mapped to provide additional details on hypoxic conditions in the far western Sound. IEC data are considered provisional. IEC data are not utilized to estimate the areal extent of hypoxia.

During the **WQJUN15** and **HYJUN15** survey all stations (CT DEEP and IEC) had DO concentrations **above 4.8 mg/L; therefore, no maps were produced**.



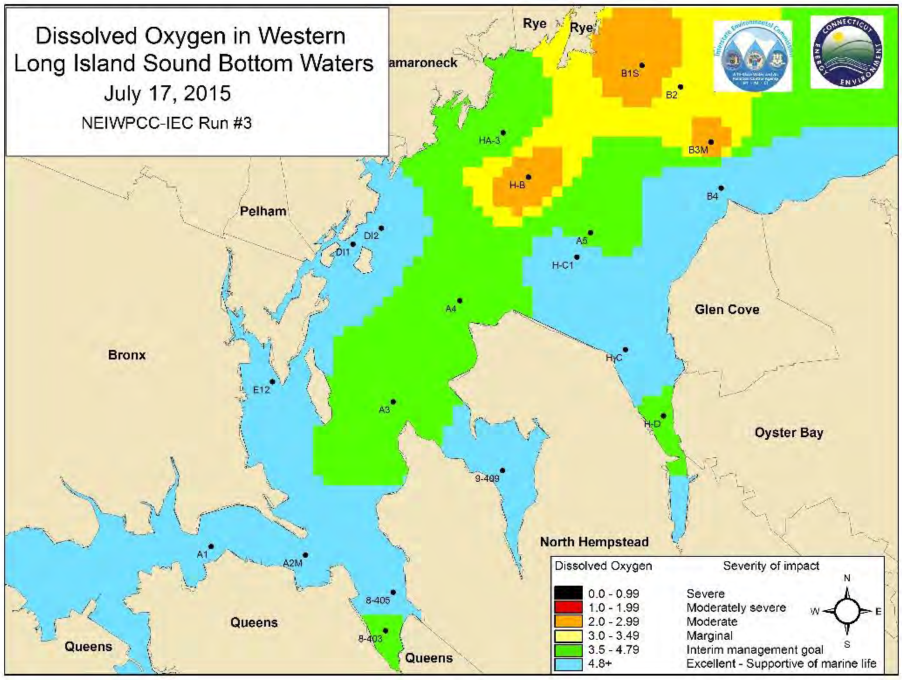
WQJUL15

During the WQJUL15 survey dissolved oxygen concentrations in the bottom waters of LIS were less than 4.8 mg/L at three CT DEEP stations in the far western Narrows- A4, B3, and 02. IEC only found DO concentrations below 4.8 mg/L at Station A4.

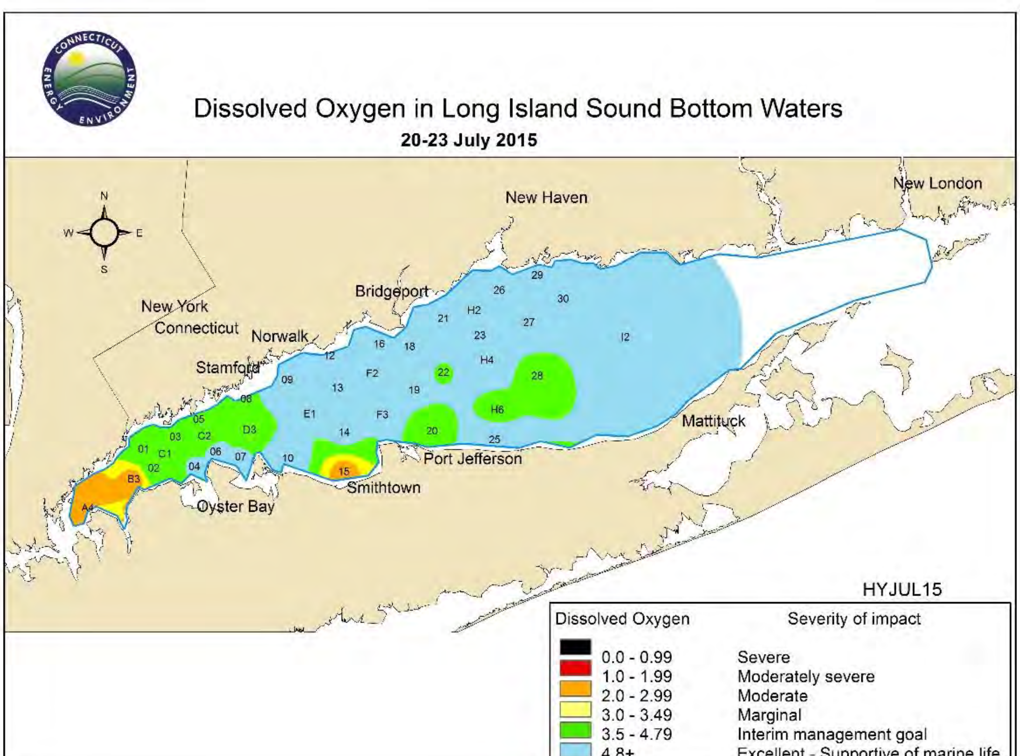


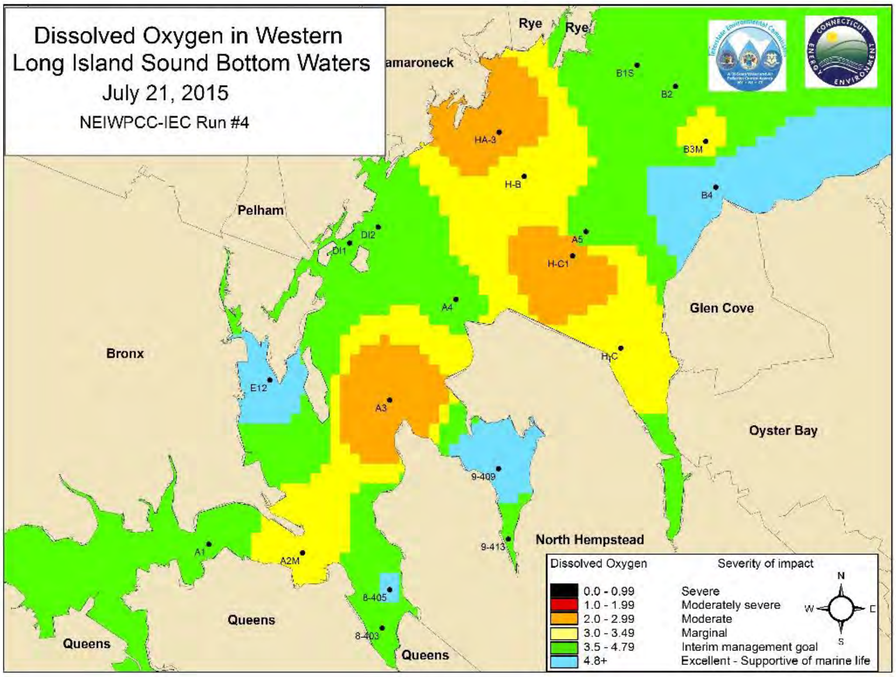
HYJUL15

During IEC Run #3, 11 out of 21 stations exhibited DO concentrations below 4.8 mg/L. Of those, Station B2 was at 3.0 mg/L and three stations were below 3.0 mg/L.



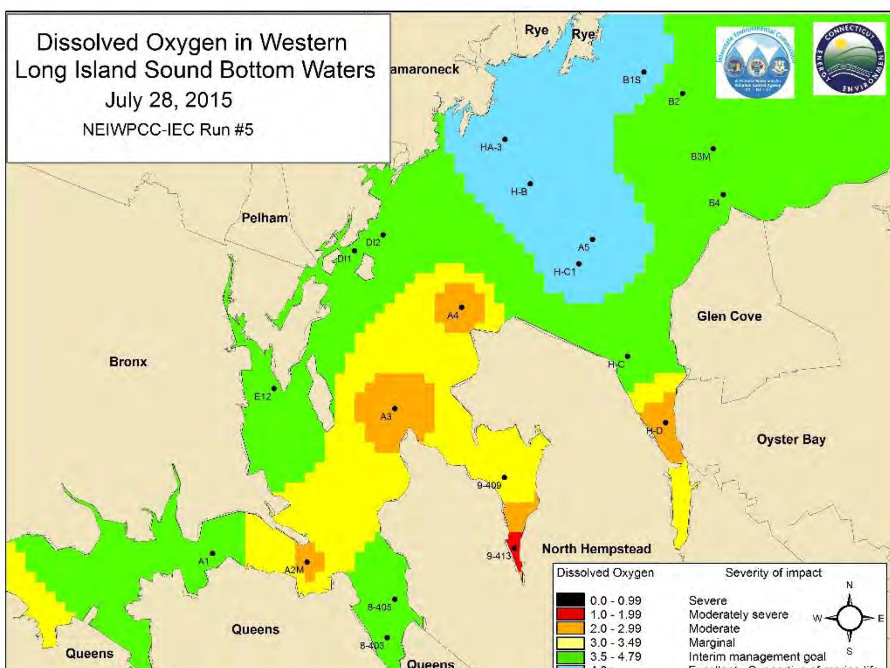
During the HYJUL15 survey, DO concentrations dropped below 4.8 mg/L at 12 stations with three stations below 3.0 mg/L.





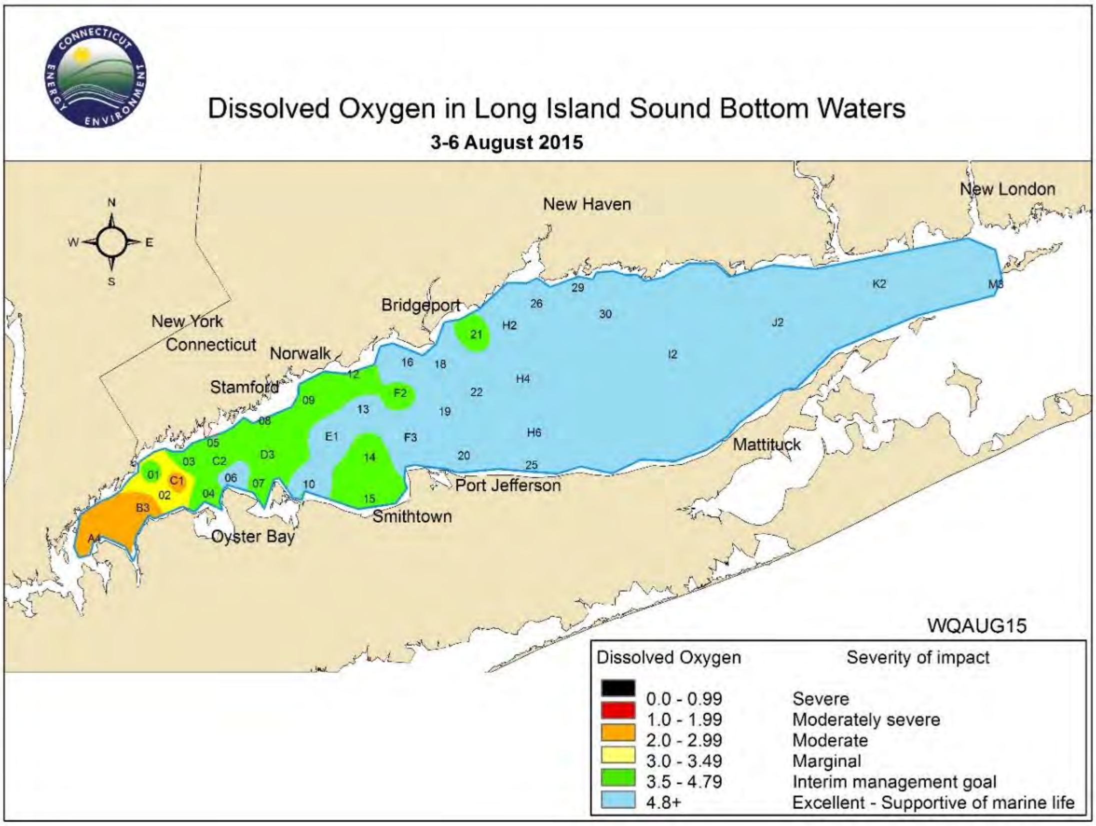
IEC Run #4 occurred two weeks prior to the CTDEEP WQAUG15 survey. At Station A4 the DO was 3.5 mg/L. Station B3 was at 3.3 mg/L. Stations A3, HA-3, and H-C1 dropped below 3.0 mg/L (2.5, 2.7, and 2.1 mg/L, respectively).

IEC Run #5 occurred on 7/28/15, a week prior to the CTDEEP WQAUG15 survey. Sixteen (16) stations were less than 4.8 mg/L. Of those, four were less than 3.5 mg/L and one station, 9-413, was less than 2.0 mg/L. At Station A4 the DO was 2.6 mg/L. Station B3 was at 3.5 mg/L.

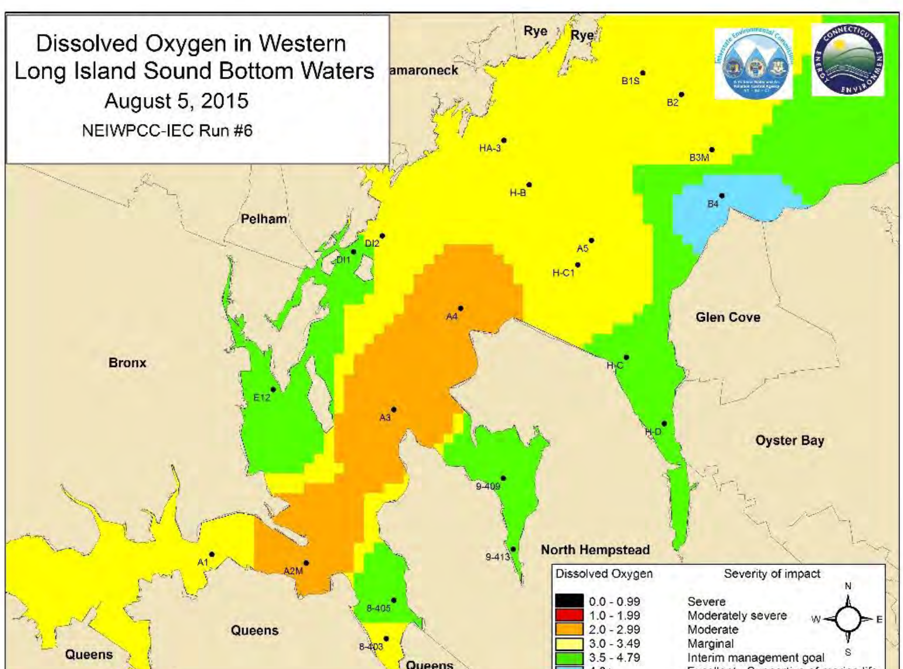


WQAUG15

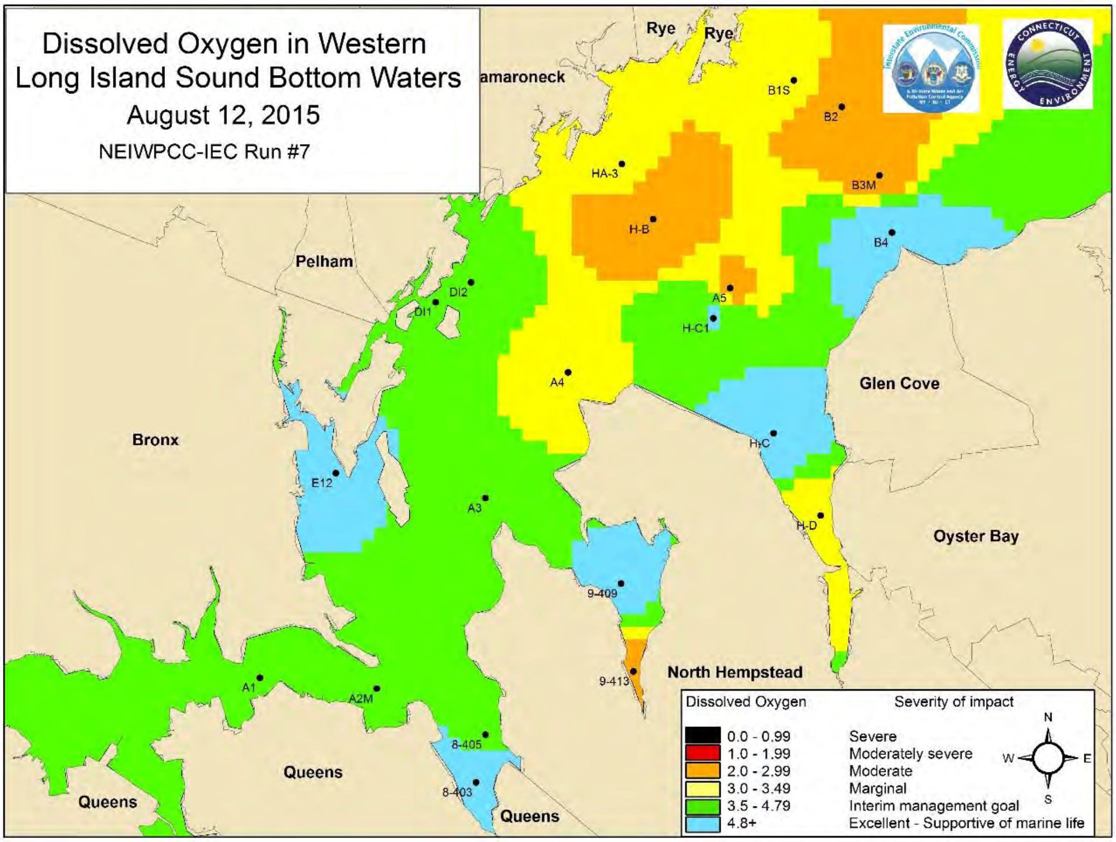
During the WQAUG15 survey, DO concentrations were below 3.0 mg/L at three stations. At Station B3 and A4, concentrations continued to be between 2.0 and 3.0 mg/L. DO concentrations at Station 02 were less than 3.5 mg/L



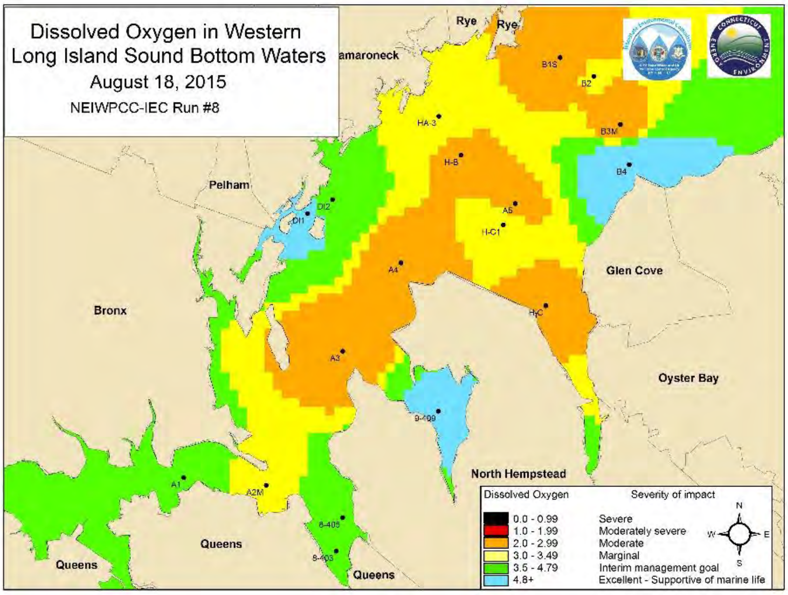
During IEC Run #6 only one station was above 4.8 mg/L. Eleven stations were less than 3.5 mg/L and three stations were less than 3.0 mg/L.



During IEC Run #7 conditions improved slightly with 11 stations exhibiting DO concentrations above 4.8 mg/L. Six stations were less than 4.8 mg/L, 4 stations were less than 3.5 mg/L and five stations were less than 3.0 mg/L.

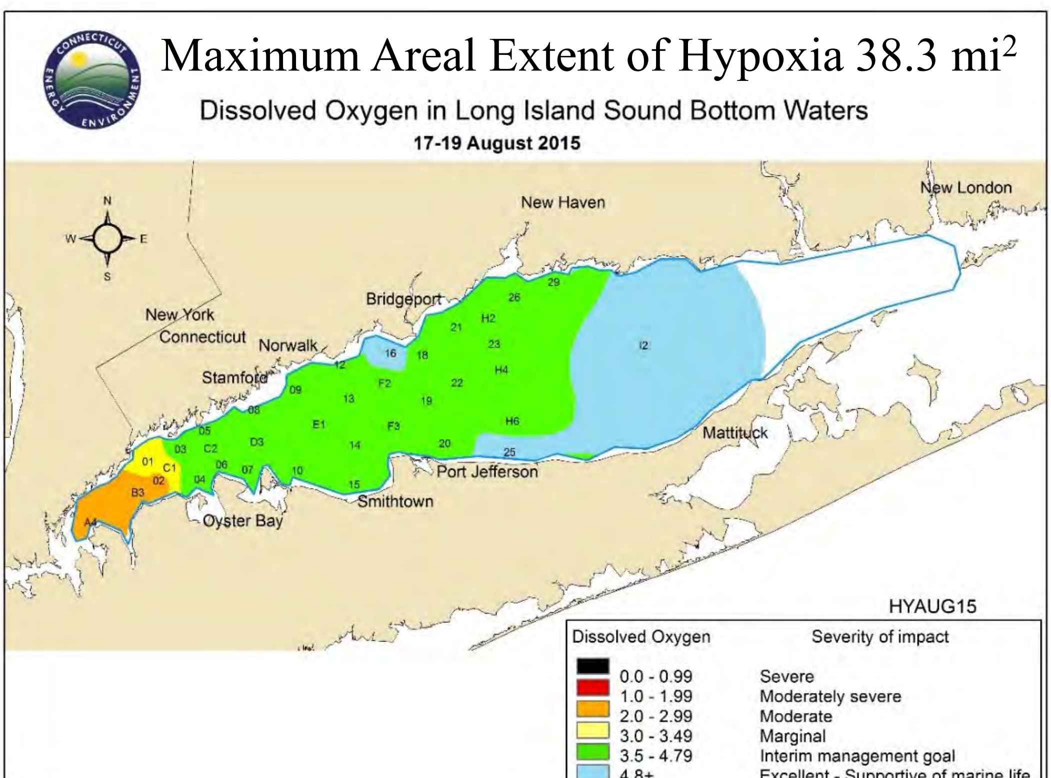


HYAUG15

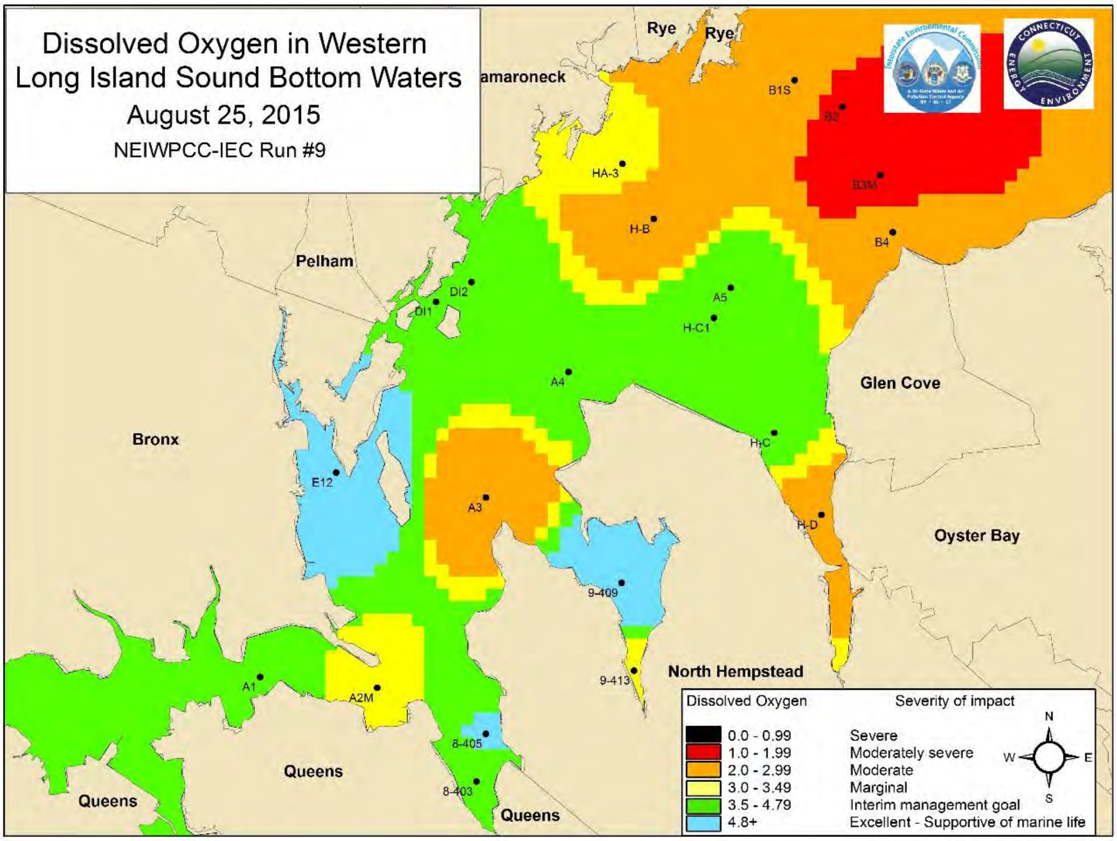


Concentrations degraded for IEC Run #8 with DO at 7 stations measuring less than 3.0 mg/L.

During the HYAUG15 survey DO concentrations across the Sound were less than 3.0 mg/L at 3 stations. Two stations had concentrations between 3.0 and 3.5 mg/L. 28 stations had concentrations between 3.5 mg/L and 4.8 mg/L. This would be the height of the hypoxic event. 2015 had the second lowest areal extent over the course of the 25-year sampling program, with only 1997 having a lower areal extent.

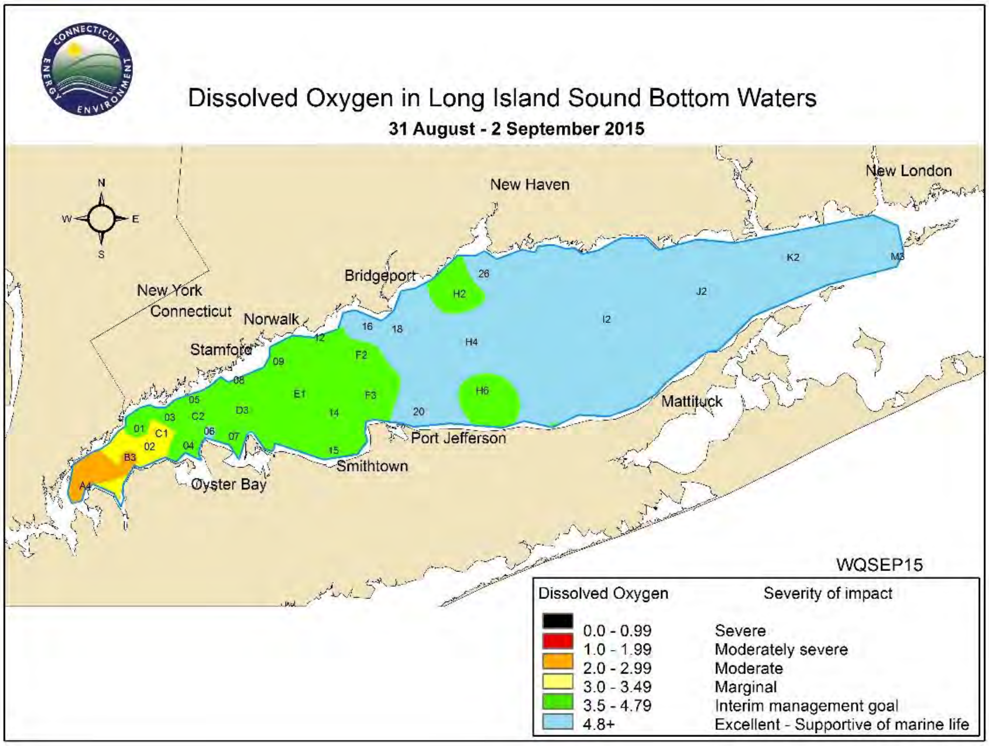


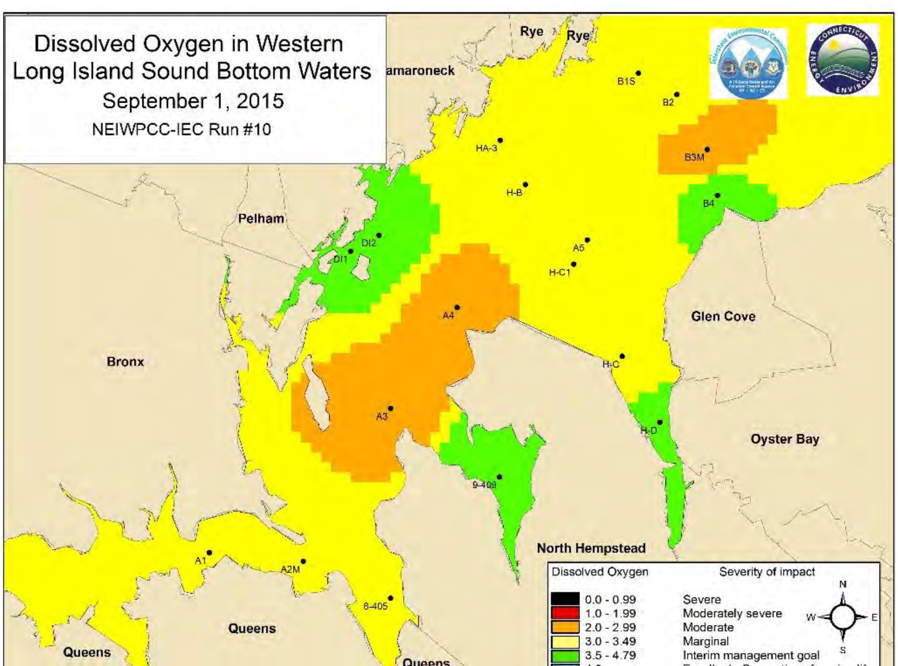
During IEC Run #9 conditions degraded with 2 stations exhibiting DO concentrations below 2.0 mg/L. Five stations were less than 3.0 mg/L, two stations were less than 3.5 mg/L, and eight stations were less than 4.8 mg/L.



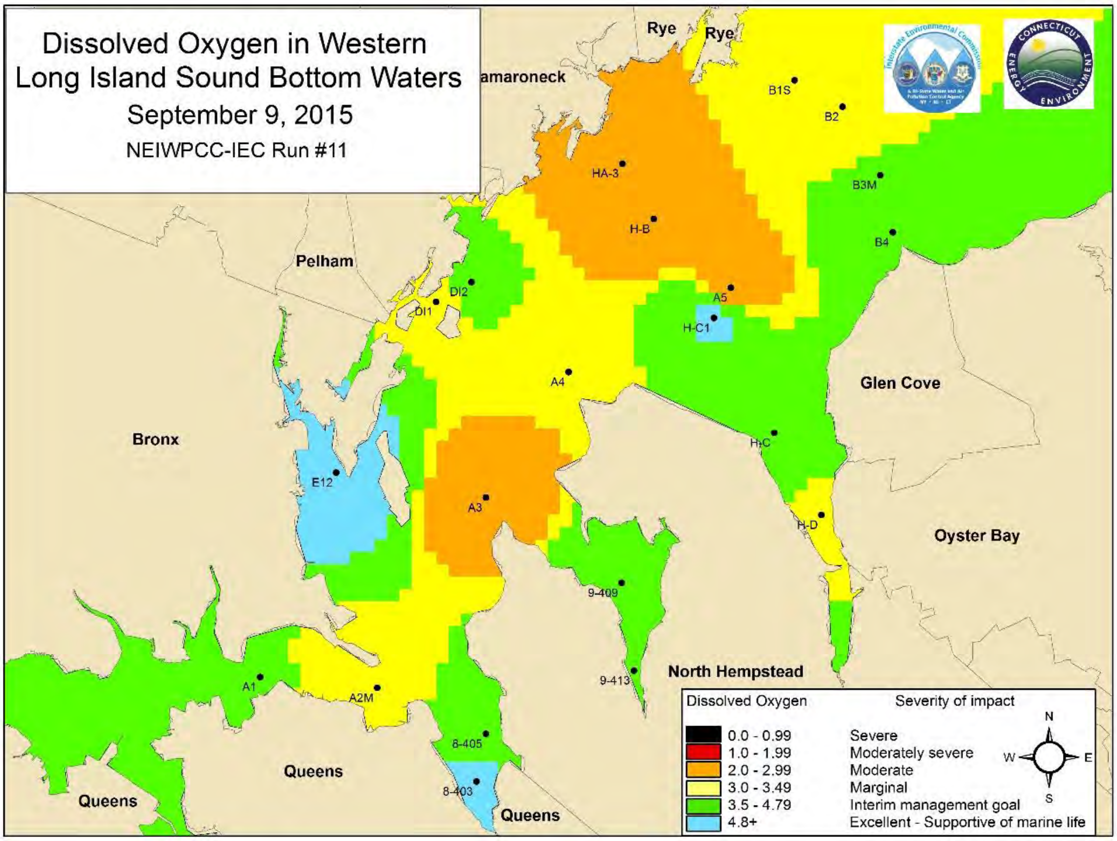
WQSEP15

The WQSEP15 survey and IEC Run #10 found conditions had improved slightly. Concentrations at A4 and B3 were 2.52 and 2.99 mg/L, respectively. Stations C1 and 01were below 3.5 mg/L and 18 stations were below 4.8 mg/L. IEC found similar conditions, with three stations exhibiting concentrations below 3.0 mg/L and nine stations below 3.5 mg/L.



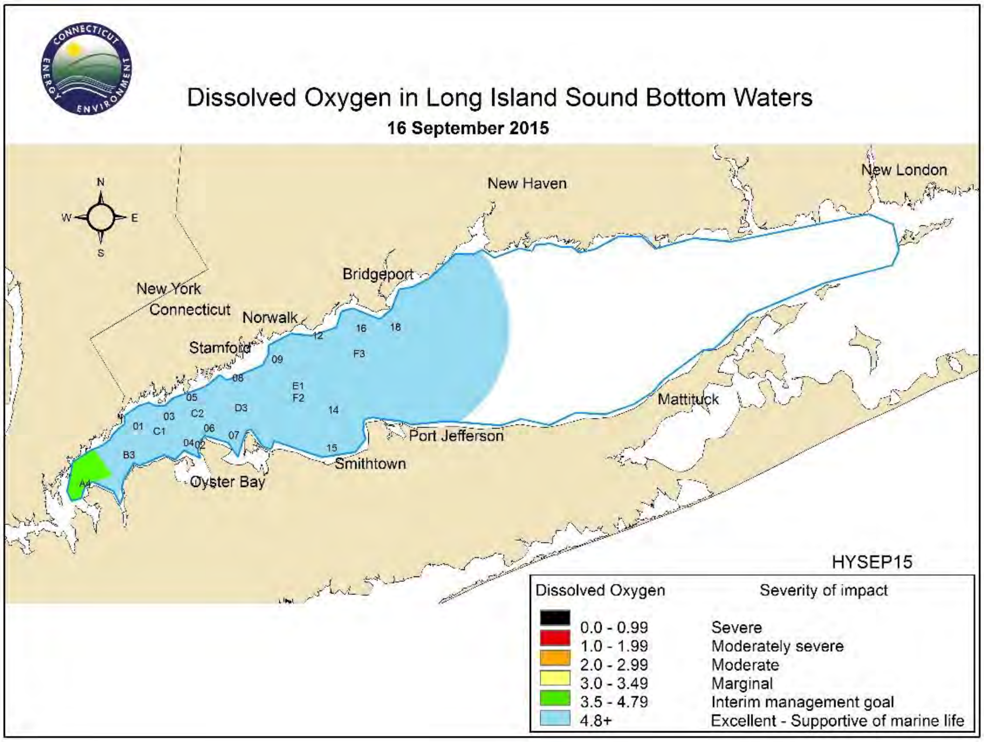


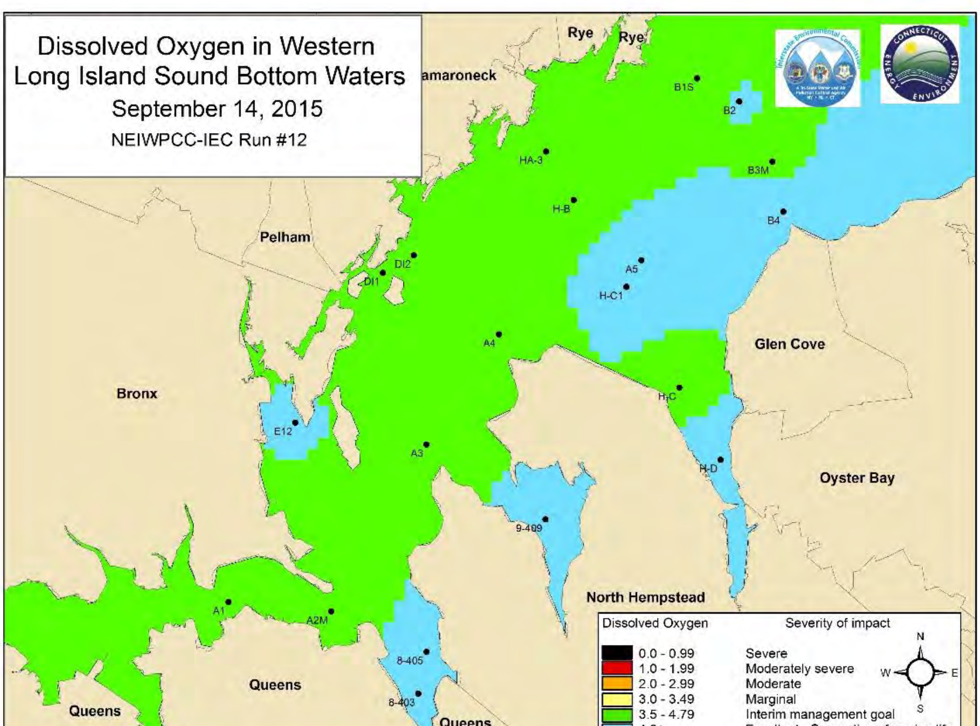
During IEC Run #11 conditions improved slightly. Four stations had DO concentrations less than 3.0 mg/L, six stations were less than 3.5 mg/L, and eight stations were less than 4.8 mg/L.



HYSEP15

Conditions rebounded for the HYSEP15 survey with only one CT DEEP station exhibiting DO concentrations below 4.8 mg/L (A4). IEC sampled two days prior to CT DEEP and found 11 stations with DO less than 4.8 mg/L. The LISICOS buoy data showed concentrations climbing above 3.0 mg/L and staying above 3 beginning on or about 14 September.

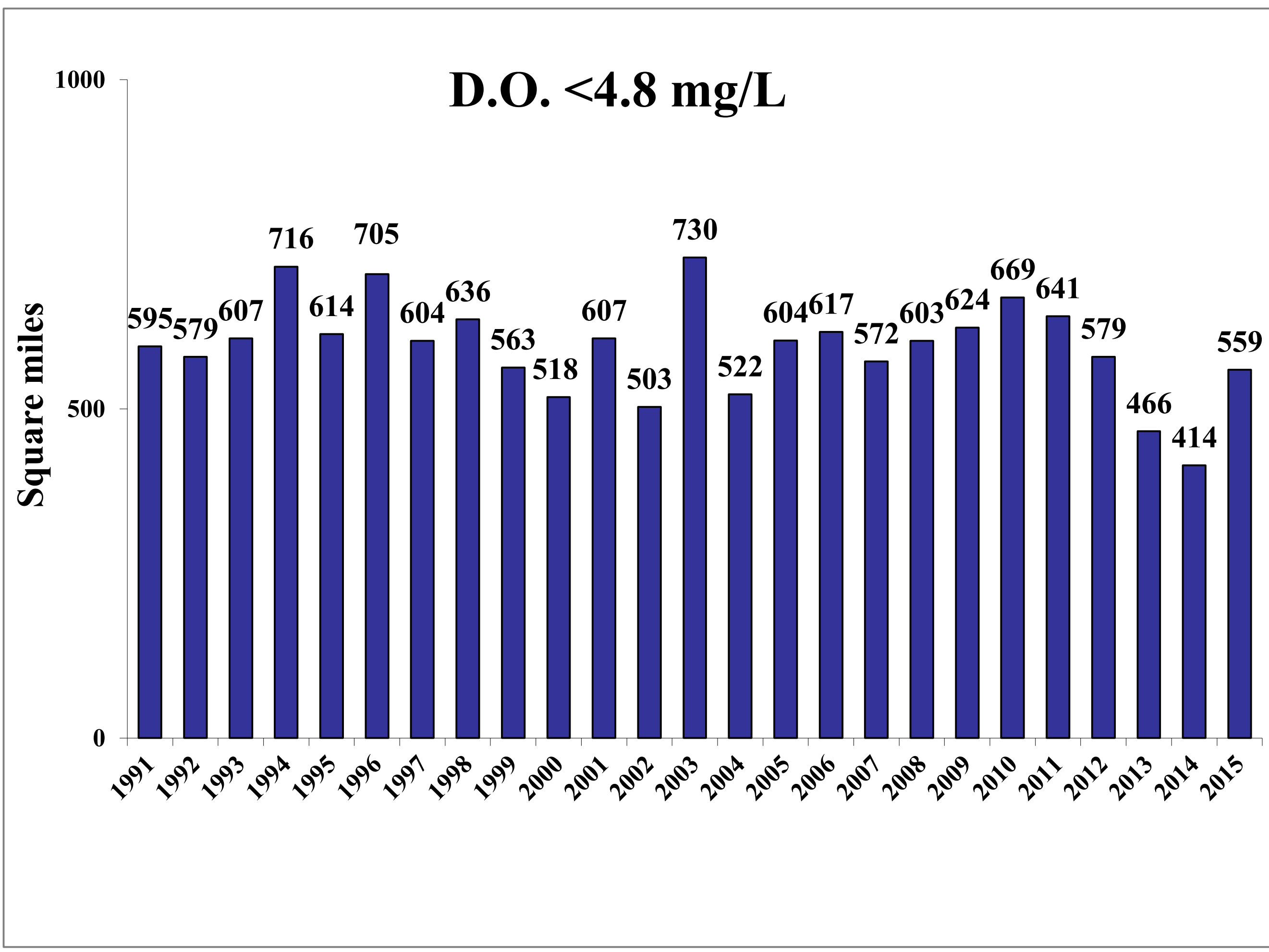




Area of Dissolved Oxygen Below the Chronic Criterion for Growth and Protection of Aquatic Life for LIS

Aquatic organisms are harmed based on a combination of minimum oxygen concentration and duration of the low DO excursion. CT DEEP established Dissolved Oxygen Chronic Exposure Criteria based on research and data collected by the EPA. A DO concentration of 4.8 mg/L meets the chronic criterion for growth and protection of aquatic life regardless of the duration.

This chart illustrates the maximum area of bottom waters within Long Island Sound with DO concentrations less than 4.8 mg/L. In 2015, the maximum area below 4.8 mg/L occurred during the HYAUG15 survey and was estimated at 559 square miles. From 1991-2015, the area affected by concentrations less than 4.8 mg/L averages 593.9 square miles and varies slightly from 414 to 730 square miles.

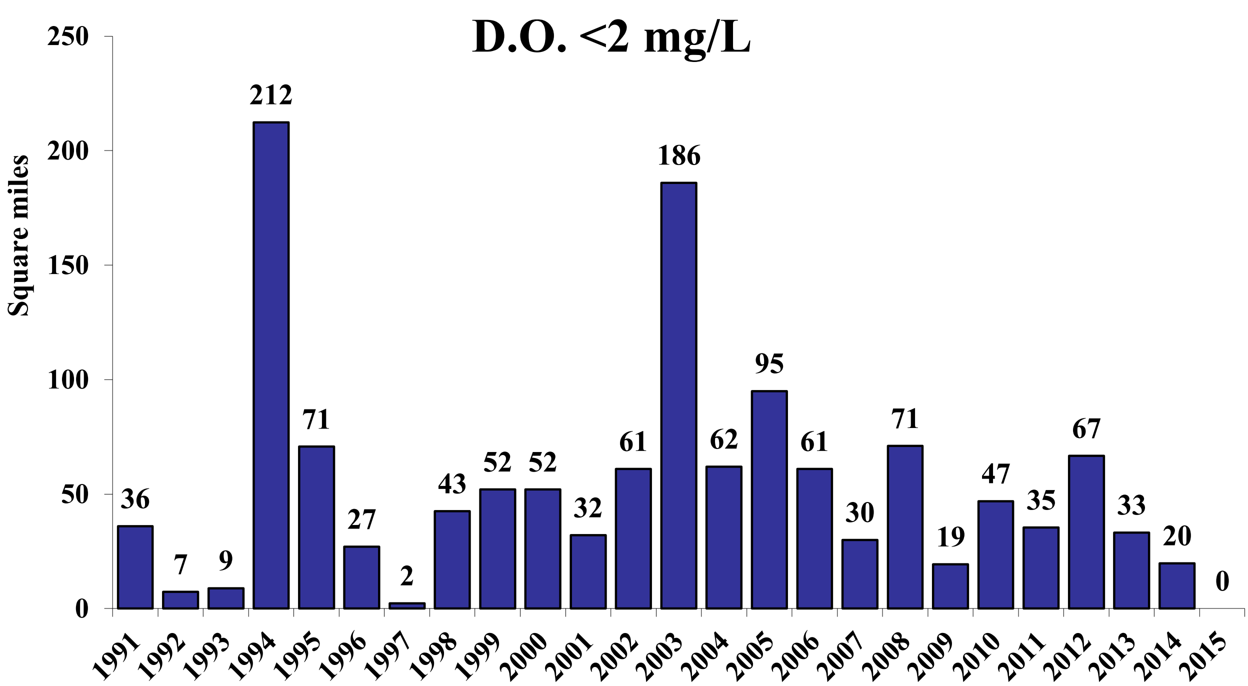


Severe Hypoxia

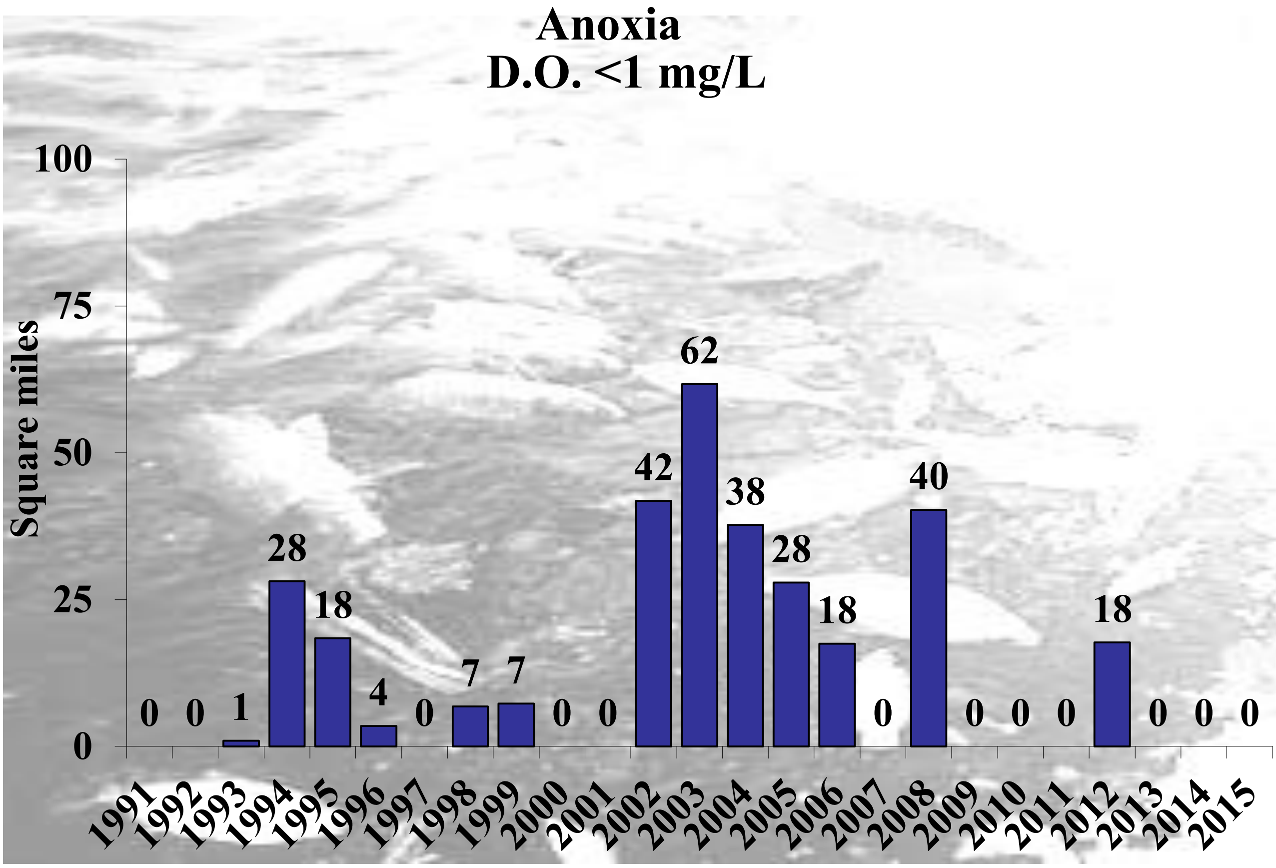
The Long Island Sound Study provides information on LIS Hypoxia for inclusion in EPA's *Report on the Environment* (http://www.epa.gov/ncea/roe/) which reports on "the best available indicators of information on national conditions and trends in air, water, land, human health, and ecological systems…". The ROE Report uses 2.0 mg/L as a benchmark to liken conditions in the Gulf of Mexico to LIS. In this report, the term severe hypoxia is used to describe DO < 2.0 mg/L and is discussed below.

This chart illustrates the maximum area of bottom waters of Long Island Sound with concentrations less than 2 mg/L. Based on CT DEEP data, in 2015, bottom water dissolved oxygen concentrations were all greater than 2.0 mg/L (i.e., area <2.0 mg/L= 0 mi^2). The average area with concentrations less than 2.0 mg/L, calculated from 1991-2015, is 53.2 mi^2. Based on the LISICOS Execution Rocks data there were 22.25 cumulative days below 2.0 mg/L.

For comparisons, the 30-year average size of the hypoxic zone in the northern Gulf of Mexico is roughly 5312 mi^2 (larger than the State of CT). The maximum area of the Gulf of Mexico hypoxic zone occurred in 2002 and was estimated at 8,841 mi^2 (22,898 km^2). The 2015 hypoxic zone covered 6474 mi^2 (16760 km^2) and was larger than 2014 (http://www.gulfhypoxia.net/Research/Shelfwide%20Cruises/2015/PressRelease2015.pdf).



In LIS, 1994 and 2003 appear to be especially bad years for concentrations less than 2 mg/L. 1994 had cold winter bottom water temperatures and an unusually warm June which led to the establishment of strong stratification. The highest average Delta T in July 1994 was 8.54 ºC. 2003 was the second hottest summer since 1895 and the 28th wettest which also led to the Sound being very strongly stratified. Strong stratification (Delta T greater than 4) lasted for four months in 1994 (May-August) and only one month (July) in 2003.



For management purposes the Long Island Sound Study defines anoxia as DO concentrations less than 1 mg/L. In 12 of the twenty-five years there was no anoxia reported by CT DEEP. The greatest area with DO below 1 mg/L observed in LIS, based on ~biweekly sampling by CT DEEP, was during the summer of 2003. Prior to 2002, the average area of bottom waters affected by anoxia was 5.92 mi^2. From 2002-2012 the average area affected was 22.24 mi^2. The overall average area affected from 1991-2015 is 12.4 mi^2. A consistent decline was observed from 2003-2007. During the summer of 2008 three stations (A4, B3, and 02) were observed to have gone anoxic. In 2009, 2010, and 2011 CT DEEP did not document any stations with DO < 1 mg/L. However, in 2009 and 2010 the Interstate Environmental Commission documented two stations that were anoxic. In 2011, no stations were documented to have gone anoxic by either the IEC or CT DEEP. However, the lowest concentration reported at the LISICOS Execution Rocks buoy (Station A4) for 2011 was 0.61 mg/L. In 2012, CT DEEP documented two stations that were anoxic (A4 and B3). IEC documented two anoxic stations (A3 (further west than A4, Hewlett Point and H-C in Hempstead Harbor). LISICOS also documented anoxic conditions (4.04 days and minimum DO of 0.52 mg/L). In 2013, 2014, and 2015 anoxic conditions were not documented by CT DEEP, IEC or LISICOS.

HABITAT IMPAIRMENT ASSOCIATED WITH HYPOXIA

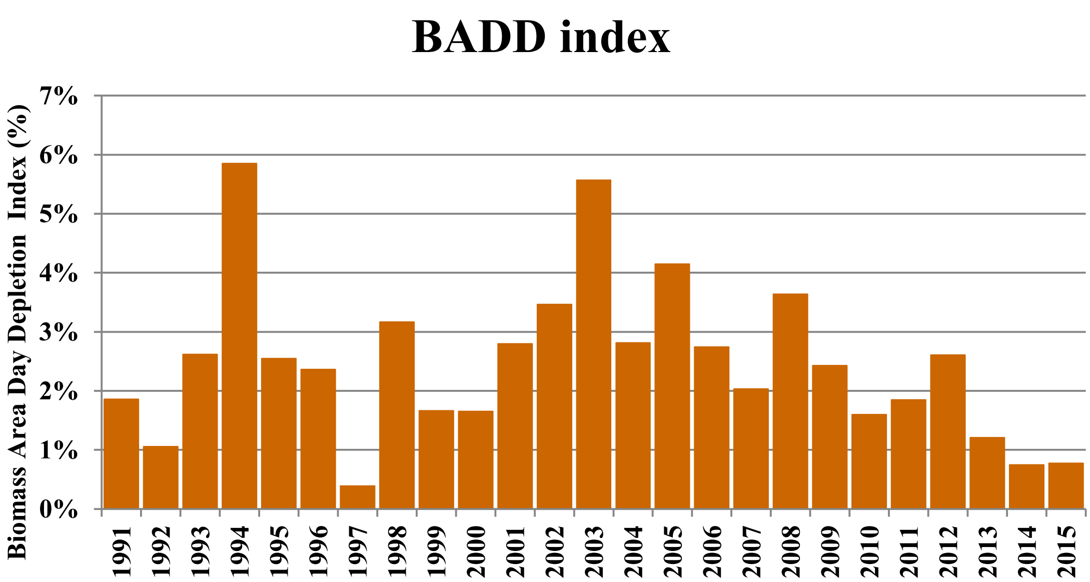
For Long Island Sound, DO levels below 3 mg/L are considered hypoxic, causing mobile animals to leave and sessile animals to die or be physically or behaviorally impaired. However, DO can become limiting below 4.8 mg/L for sensitive fish species, such as whiting and scup, while more tolerant species, such as butterfish, bluefish, lobster and Atlantic herring, are not affected until DO falls below 2 mg/L.

An index of habitat impairment, "Biomass Area-Day Depletion" (BADD) was developed by CT DEEP Marine Fisheries Division based on extensive sampling in the Sound from 1986-1993. Instead of individual species' responses to low oxygen, an aggregate response of 18 demersal (bottom-dwelling) finfish species was calculated as a general index of the impact on living resources to low oxygen conditions at or near the bottom of the Sound. The total weight, or biomass, of these demersal finfish species captured in samples taken at various levels of low DO was quantified and the percent reduction in biomass from that captured in fully oxygenated water was computed. These studies showed that the finfish biomass is reduced by 100% (total avoidance) in waters with DO less than 1.0 mg/L. In waters with 1.0-1.9 mg/L DO, biomass is reduced by 82%, while a 41% reduction occurs at 2.0-2.9 mg/L DO, and a 4% reduction occurs at 3.0-3.9 mg/L DO.

For each survey the total area of the Sound encompassing each 1-mg interval of DO is calculated and the depletion percentage applied. These area depletions are summed over the number of days they persist during the designated hypoxia season. The summed area-day depletion is then expressed as a percentage of the total available area (total sample area of 2,723 km^2) multiplied times the total season (94 days). A maximum BADD index of 100% would result from severe hypoxia occurring over the entire study area for the entire hypoxia season.

In an average year, hypoxic waters cover ~440 km^2 (169 miles^2) for 55 days and result in a BADD impairment index of 2.5%. In the worst year, hypoxia spread over 1,000 km^2 (395 miles^2) for the entire season, resulting in a BADD index of almost 6%. In 2015, the BADD index was 0.77%.

-Penny Howell, Fisheries Biologist, CT DEEP Marine Fisheries Division, CT Wildlife Article, July/August 2014

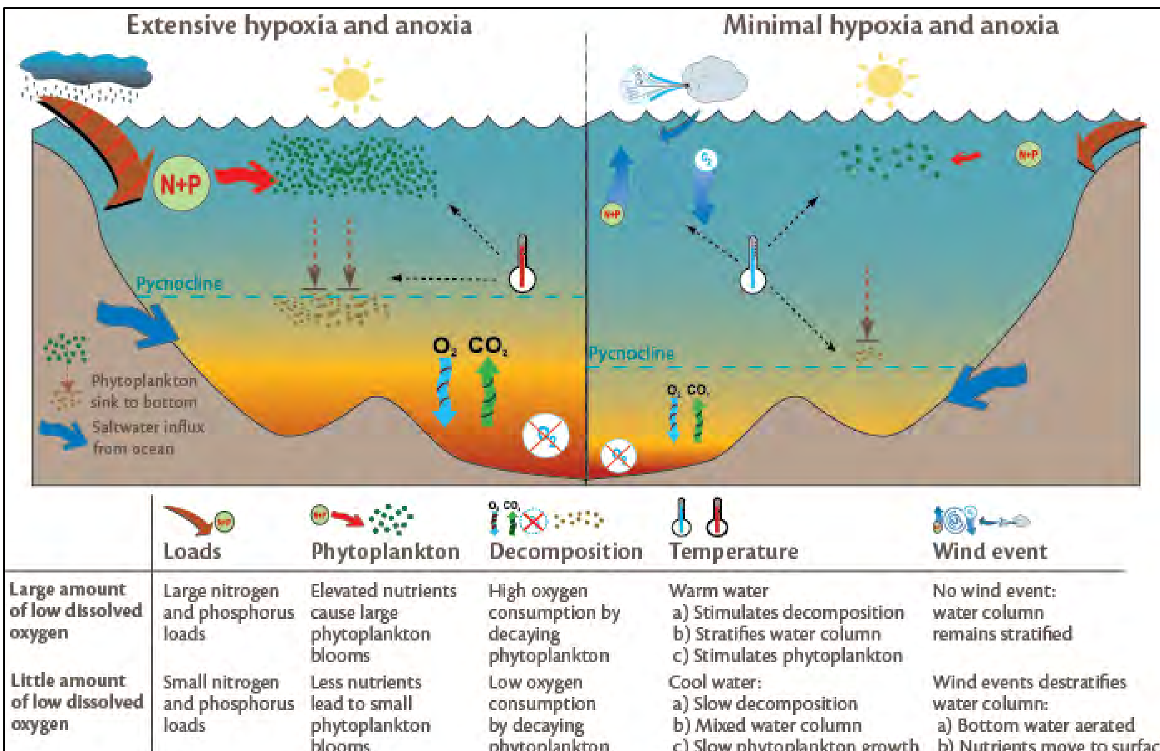


Simpson, David G., Kurt Gottschall, and Mark Johnson. 1995. Cooperative interagency resource assessment (Job 5). In : A study of marine recreational fisheries in Connecticut, CT DEP Marine Fisheries Office, PO Box 719, Old Lyme, CT 06371, p 87-135.

Simpson, David G., Kurt Gottschall, and Mark Johnson. 1996. Cooperative interagency resource assessment (Job 5). In : A study of marine recreational fisheries in Connecticut, CT DEP Marine Fisheries Office, PO Box 719, Old Lyme, CT 06371, p 99-122.

WATER TEMPERATURE AND HYPOXIA

In LIS, water temperature plays a major role in the ecology of the Sound especially in the timing and severity of the summer hypoxia event. CT DEEP's monitoring program records water temperatures and salinity year round, but data collected during the hypoxia monitoring cruises are used to help estimate the extent of favorable conditions for the onset, extent, and end of the hypoxic event. The conceptual diagram below, while developed for Chesapeake Bay, applies to Long Island Sound. In LIS, there are two key contributors to hypoxia: nutrient enrichment and stratification. (Stratification is discussed more on page 24.) Nutrients, especially nitrogen, flow into the Sound from numerous sources including point sources like wastewater treatment plants and nonpoint sources such as stormwater runoff. This enrichment leads to excessive growth of phytoplankton, particularly in the spring. Temperature can stimulate or impede phytoplankton growth. As the plankton die, they begin to decay and settle to the bottom. Bacterial decomposition breaks down the organic material from the algae, using up oxygen in the process.

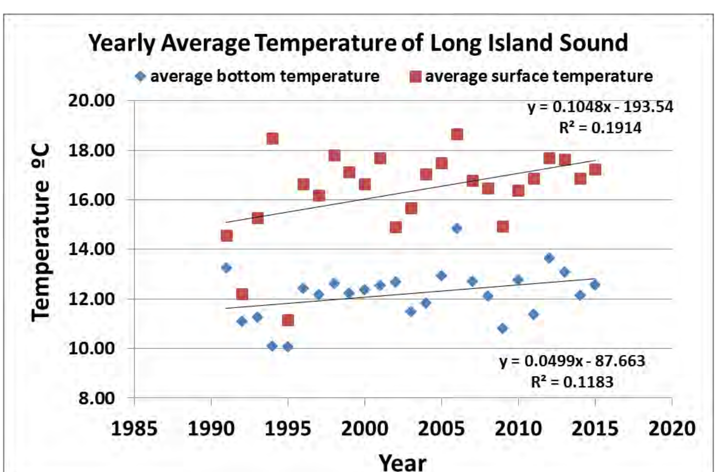


Conceptual diagram detailing the factors that determine the dissolved oxygen content of the tidal waters of Chesapeake Bay
Diagram courtesy of the Integration and Application Network (ian.umces.edu), University of Maryland Center for Environmental Science. Source: Ecocheck

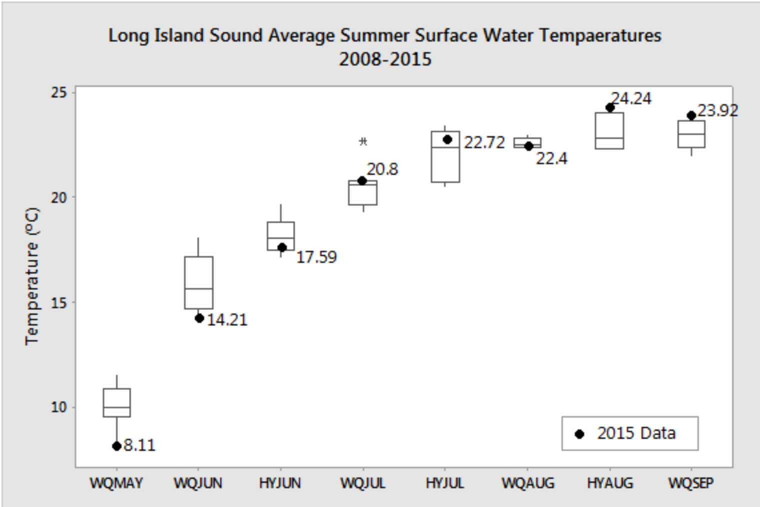
2015 Water Temperature Data

2015 maximum, minimum, and average water temperature (ºC) data are summarized below. Data are integrated across Long Island Sound (i.e., all stations and all depths) and are displayed by cruise. Data were obtained using the CT DEEP Sea Bird Sea Cat Conductivity, Temperature, Depth (CTD) profiler.

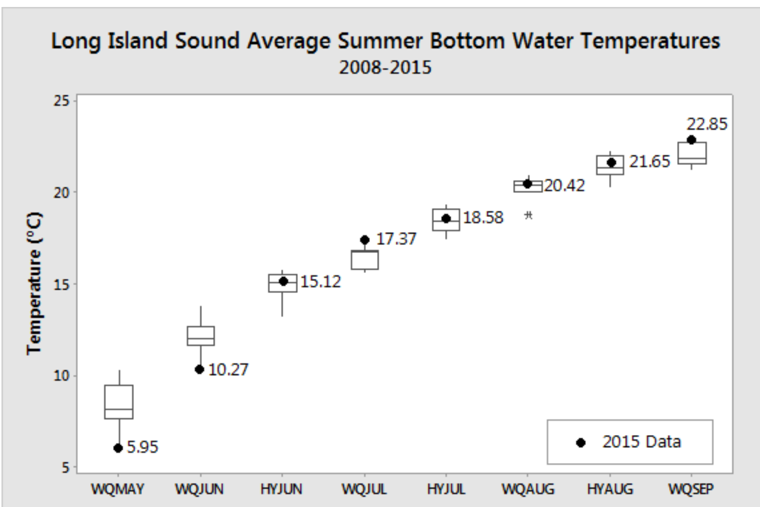
Cruise	2015 Max	1991-2015 Max	2015 Min	1991-2015 Min	2015 Average	1991-2015 Average
WQJAN	5.397	9.311	1.243	0.500	3.442	4.432
WQFEB	3.176	6.748	-0.462	-1.325	0.889	2.062
CHFEB	No Survey	4.464	No Survey	-0.288	No Survey	2.219
WQMAR	0.871	6.611	**-1.189**	**-1.189**	-0.602	2.198
CHMAR	No Survey	6.575	No Survey	0.113	No Survey	3.519
WQAPR	2.652	10.072	**0.650**	**0.650**	1.418	4.622
WQMAY	11.122	14.145	**4.517**	**4.517**	6.403	8.506
WQJUN	17.140	21.436	**8.027**	**8.027**	11.183	12.701
HYJUN	19.289	22.458	12.415	11.116	15.139	15.825
WQJUL	23.054	25.336	14.460	11.639	18.092	17.404
HYJUL	25.672	27.493	15.759	15.038	19.735	19.320
WQAUG	**29.985**	**29.985**	18.788	14.018	20.905	20.530
HYAUG	**26.492**	**26.492**	20.582	18.678	22.260	21.686
WQSEP	25.555	25.857	21.176	16.390	23.011	21.772
HYSEP	**23.835**	**23.835**	22.428	19.533	23.131	21.806
WQOCT	20.060	21.571	17.925	14.161	18.962	19.201
WQNOV		16.601		10.467		13.899
WQDEC		12.712		0.000		9.114



The Sound is coldest during February and March and warmest during August and September. The yearly average surface and bottom temperature of the Sound show slight increases over the period 1991-2015.

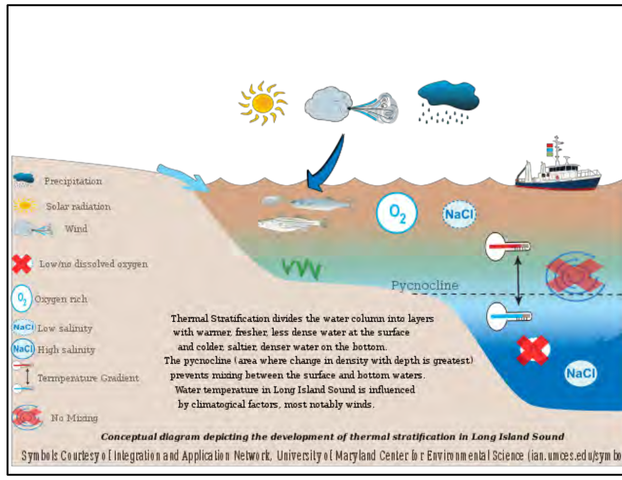


Water temperatures in 2015 mimicked air temperatures with May and June averages below the 2008-2015 mean and August and September being above.

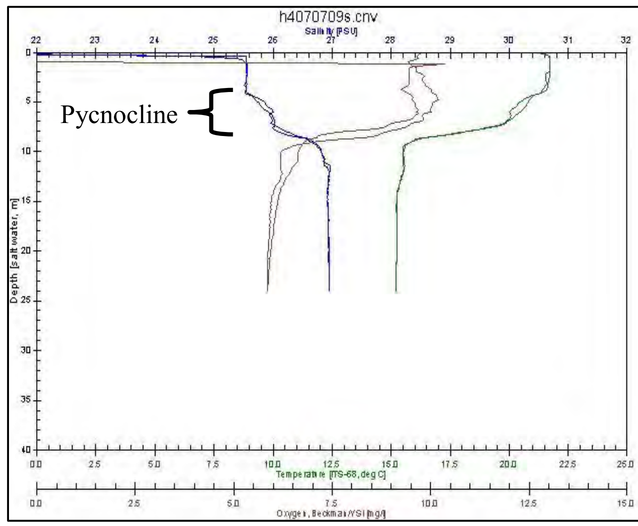


While box plots were not prepared using winter water temperature data, February, March and April were certainly cold; 2015 was the first time in at least nine years that the R/V John Dempsey was iced in at Milford Harbor.

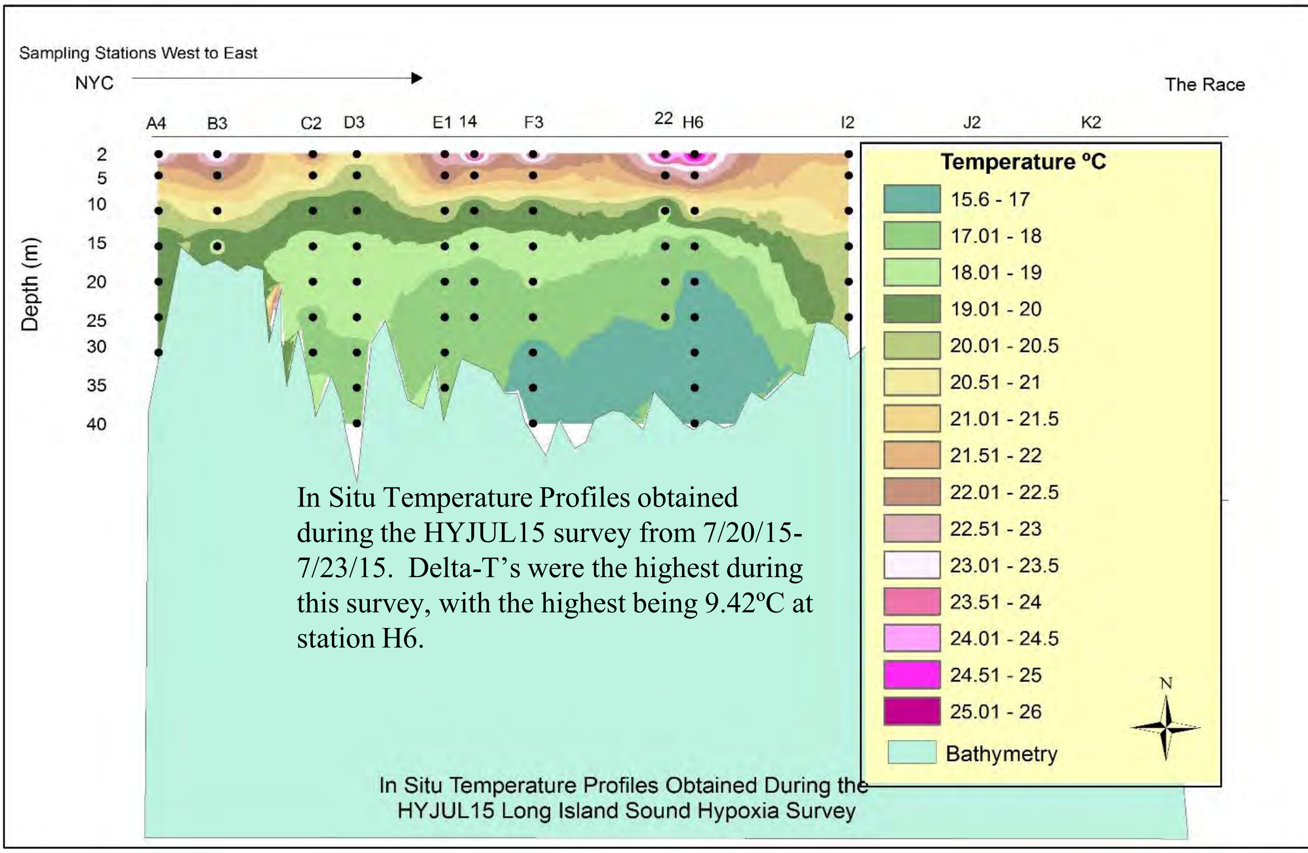
Delta T and Stratification



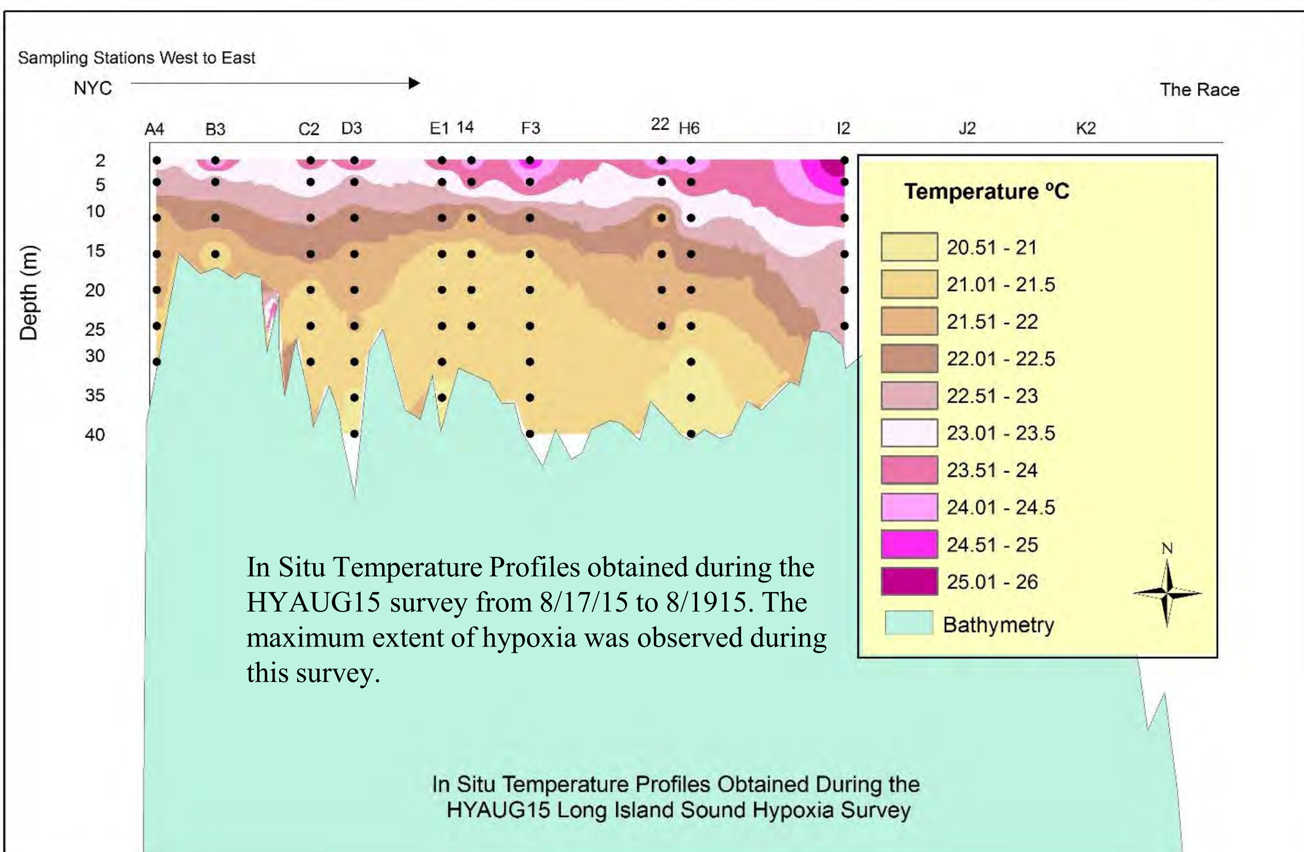
The temperature difference between the bottom waters and the surface waters is known as “Delta T". This Delta T, along with salinity differences, creates a density difference, or "density gradient" resulting in a separation or "stratification" of water layers that hinders the oxygenated surface waters from circulating downward and mixing with the oxygen starved bottom waters. The pycnocline, or zone where water density increases rapidly with depth due to the changes in temperatures and salinity, inhibits oxygenated surface waters from mixing with oxygen deplete bottom waters exacerbating the hypoxia. The pycnocline typically develops in LIS in late spring/early summer when rapid surface water warming exceeds the rate of warming in the bottom waters and persists into early fall when it is disrupted by strong winds associated with storms which lead to mixing or cooling air temperatures. With the dissolution of the pycnocline, hypoxic conditions are alleviated/eliminated. The smallest Delta Ts occur during the winter when the water column is well mixed. The largest Delta T’s occur during the early summer. The greater the delta T the greater is the potential for hypoxia to be more severe



The temperature graphs on page 30 show computer interpolations along the west-east axis of LIS generated from profile data collected during two CT DEEP surveys. During the HYJUL15 survey, surface water temperatures had warmed to an average of 22.72ºC while the bottom water remained cooler around an average of 18.57ºC. This set up the largest differences in temperatures between the surface and bottom waters with Delta-T’s between 0.97 and 9.42ºC. The second graph shows how the water column was thermally stratified during the HYAUG15 survey when hypoxic conditions were at their worst. The temperature area maps on page 31 show how the Delta T’s varied over the course of the summer sampling season. Delta T’s increased from the WQAPR15 survey through the HYJUL15 survey, setting up the stratification and leading to the maximum extent of hypoxia in late August. By the September survey Delta T’s decreased to around 1.5ºC over much of the Sound. Delta T’s continued to decrease during the HYSEP14 survey to around 0.1ºC, allowing the oxygenated surface waters to mix through to the bottom, leading to the end of the hypoxic event. The maps also show how the Delta T varies spatially. The western Sound typically has higher Delta T’s due to the limited flushing capacity, topology, and geology. In the east where cooler, oxygen rich, off- shore ocean water mixes with the Sound water, Delta T’s are much lower and hypoxia rarely occurs. This year the Central Sound had the highest Delta T’s.

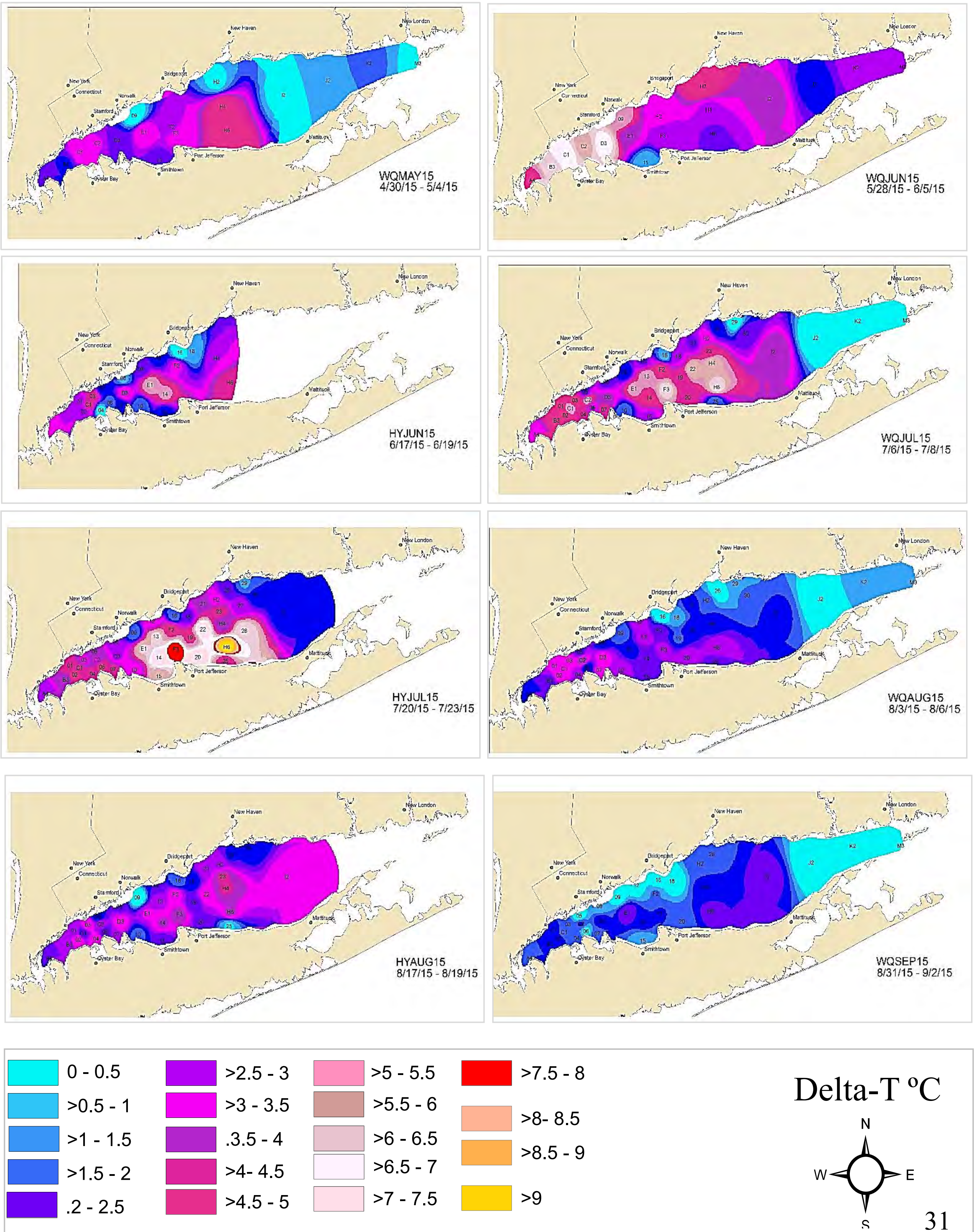


In Situ Temperature Profiles obtained during the HYJUL15 survey from 7/20/15-7/23/15. Delta-T's were the highest during this survey, with the highest being 9.42ºC at station H6.



In Situ Temperature Profiles obtained during the HYAUG15 survey from 8/17/15 to 8/1915. The maximum extent of hypoxia was observed during this survey.

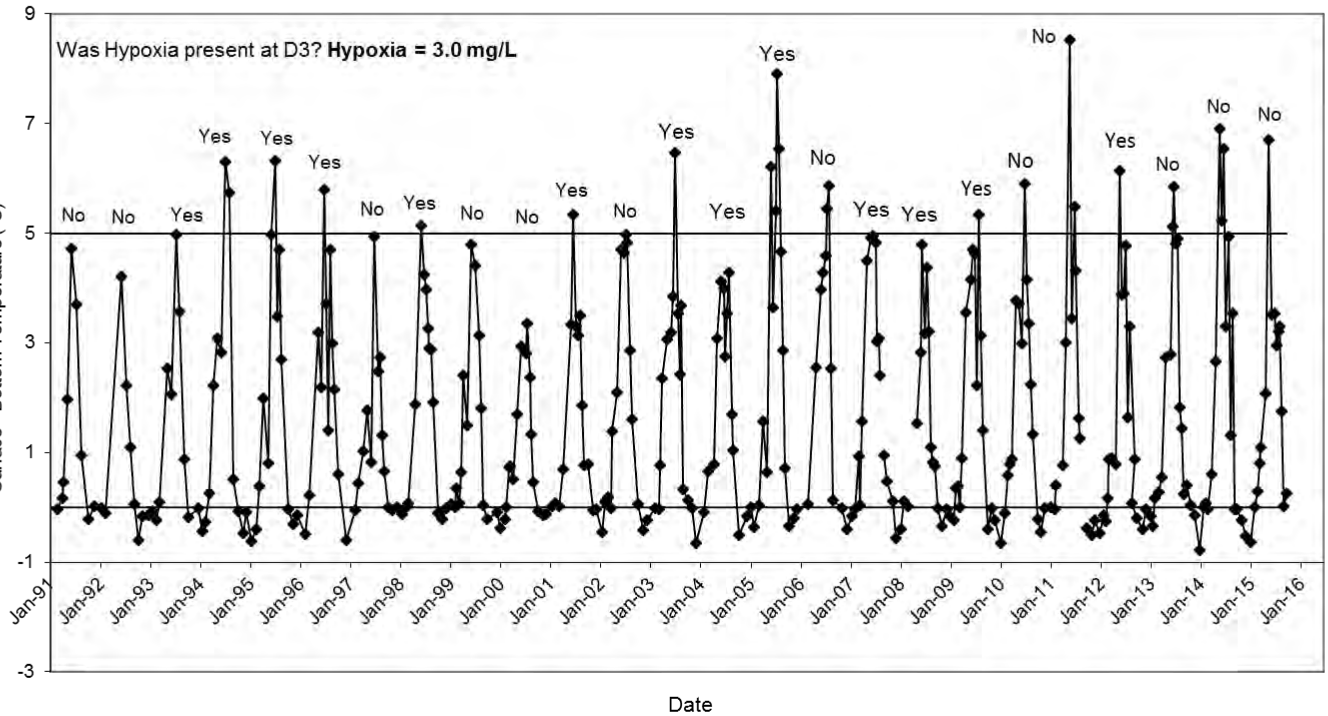
2015 Delta-T Maps



This table summarizes the minimum winter temperatures (January, February, and March), the maximum summer temperatures (June, July, August, and September), the maximum Delta T, and maximum hypoxic area at **Station D3**. Station D3 is located in the eastern-most and deepest portion of the Narrows (see map on page 1). The CT DEP 1991-1998 Data Review report (Kaputa and Olsen, 2000) found a positive correlation between the maximum Delta T observed at D3 and the maximum area of hypoxia in the same year. Delta T was not correlated to the duration of hypoxia. 2012 had the warmest minimum winter temperature, **2015 had the lowest winter temperature recorded**, 2014 had the highest summer temperature, 2011 had the highest ΔTmax, and 1994 had the largest area of hypoxia.

Year	Minimum Winter Temp (ºC)	Maximum Summer Temp (ºC)	Maximum ΔT (ºC)	Maximum Area of Hypoxia (mi^2) DO<3.0 mg/L
1991	2.69	22.23	4.75	122
1992	1.86	20.89	4.83	80
1993	1.06	22.68	5.33	202
1994	-0.68	24.08	6.33	**393**
1995	0.95	23.78	6.33	305
1996	-0.19	23.78	5.91	220
1997	1.87	21.81	4.96	30
1998	3.40	23.20	5.22	168
1999	2.67	23.41	5.51	121
2000	0.57	21.99	6.02	173
2001	1.67	23.20	5.38	133
2002	4.03	23.47	5.52	130
2003	-0.52	22.88	6.74	345
2004	-0.93	23.09	4.33	202
2005	0.53	25.10	8.19	177
2006	2.17	25.11	6.72	199
2007	0.83	23.03	5.12	162
2008	2.45	22.47	4.91	180.1
2009	0.72	24.31	5.90	169.1
2010	1.35	24.91	6.36	101.1
2011	0.66	22.32	**8.34**	130.3
2012	**4.09**	24.85	6.13	288.5
2013	2.00	24.23	5.85	80.7
2014	0.07	**25.86**	6.90	87.1
2015	**-1.1**	24.23	6.71	38.3

Kaputa, Nicholas P., and Christine B. Olsen. 2000. Long Island Sound summer hypoxia monitoring survey 1991-1998 data review. CTDEP Bureau of Water Management, Planning and Standards Division, 79 Elm Street, Hartford, CT 06106-5127, 45 p.



Time series of ΔT (surface water temperature - bottom water temperature) at station D3, 1991 through 2015.

Prior to 2004, when Station D3 became hypoxic the observed maximum delta-T was greater than 5ºC. Since 2004, this trend/pattern does not seem to hold. Over the period of record, 2011 had the highest observed Delta T at Station D3 (>8ºC) but the lowest dissolved oxygen concentration recorded in 2011 at D3 was 3.22 mg/L. In 2012, the Delta T was again over 5ºC and D3 was in fact hypoxic (lowest dissolved oxygen was 2.84 mg/L). In 2013, D3 was not hypoxic despite the Delta T again being over 5ºC (lowest concentration was 3.13 mg/L). In 2014, the maximum Delta T at D3 was 6.90ºC but D3 was not hypoxic (lowest DO 3.33 mg/L). In 2015, the maximum Delta T at D3 was 6.71ºC and the station was not hypoxic (lowest DO 3.5 mg/L).

Salinity

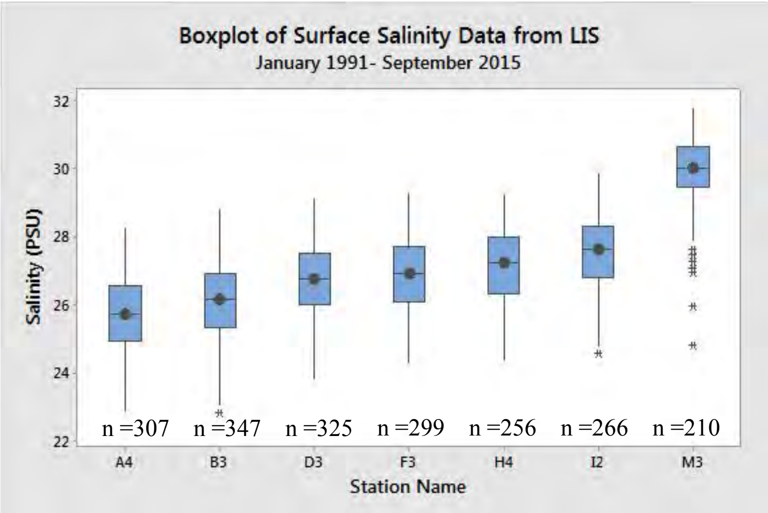
Salinity is a measure of the dissolved salts content of seawater. It is usually expressed in practical salinity units (PSU). Salinity levels across Long Island Sound vary from 23 PSU in the Western Sound at Station A4 to 33 PSU in the eastern Sound at Station M3. The Thames, Connecticut, and Housatonic rivers are the major sources of freshwater entering the Sound. Summary statistics for salinity data collected from seven stations across the Sound from 1991-2015 are presented in the tables below. Data collected this year are also presented separately.

		1991-2015 Bottom Water Statistics						
Station Name	Count	Minimum	Maximum	Mean	Median	SE Mean	Standard Deviation	Variance
A4	317	23.823	28.727	26.403	26.445	0.0515	0.916	0.839
B3	365	24.259	28.926	26.669	26.685	0.0479	0.916	0.839
D3	342	24.912	29.215	27.296	27.425	0.0471	0.871	0.759
F3	318	25.153	29.432	27.652	27.714	0.0474	0.846	0.716
H4	277	25.508	29.7	27.804	27.915	0.0494	0.823	0.677
I2	298	25.762	29.985	28.11	28.221	0.048	0.829	0.687
M3	250	28.608	32.622	30.635	30.616	0.0459	0.726	0.527

		2015 Bottom Water Statistics						
Station Name	Count	Minimum	Maximum	Mean	Median	SE Mean	Standard Deviation	Variance
A4	12	26.396	27.615	27.1	27.042	0.0998	0.346	0.12
B3	12	26.82	28.037	27.315	27.236	0.105	0.364	0.133
D3	12	27.208	28.592	27.863	27.764	0.132	0.458	0.21
F3	9	27.611	28.982	28.324	28.296	0.168	0.505	0.255
H4	12	27.611	29.348	28.271	28.163	0.134	0.463	0.215
I2	11	27.688	29.277	28.6	28.752	0.16	0.529	0.28
M3	9	30.567	31.869	31.143	30.952	0.149	0.447	0.2

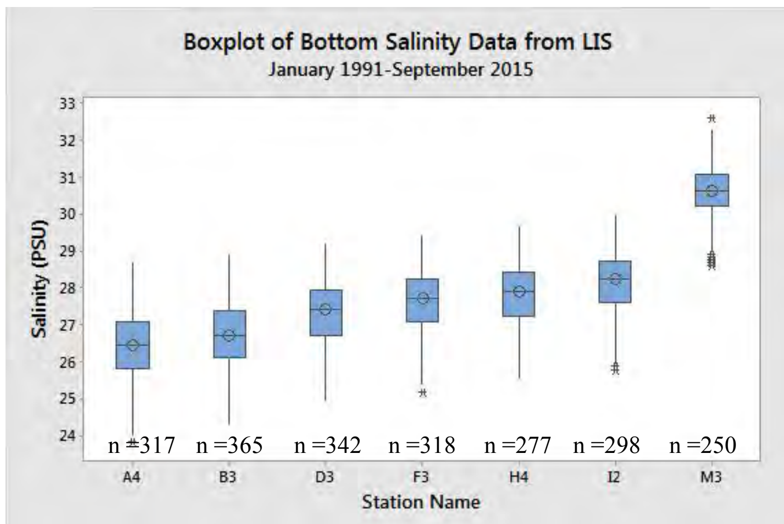
		1991-2015 Surface Statistics						
Station Name	Count	Minimum	Maximum	Mean	Median	SE Mean	Standard Deviation	Variance
A4	307	22.833	28.278	25.723	25.733	0.0595	1.042	1.086
B3	347	22.8	28.84	26.107	26.17	0.0572	1.065	1.134
D3	325	23.772	29.146	26.731	26.768	0.058	1.045	1.092
F3	299	24.246	29.307	26.875	26.911	0.0617	1.067	1.139
H4	256	24.315	29.262	27.136	27.224	0.066	1.055	1.114
I2	266	24.56	29.909	27.541	27.637	0.0623	1.017	1.034
M3	210	24.789	31.837	29.968	30.03	0.0717	1.039	1.08

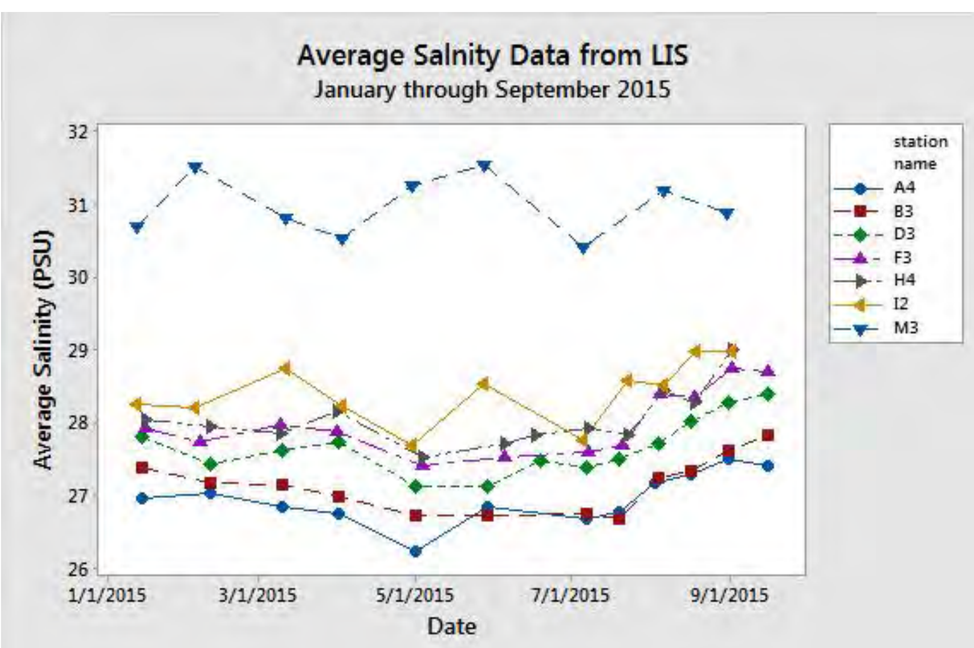
		2015 Surface Statistics						
Station Name	Count	Minimum	Maximum	Mean	Median	SE Mean	Standard Deviation	Variance
A4	12	25.642	27.247	26.506	26.542	0.155	0.536	0.288
B3	12	26.195	27.558	26.798	26.854	0.136	0.471	0.222
D3	13	26.482	28.235	27.317	27.251	0.129	0.466	0.217
F3	11	26.838	28.625	27.462	27.33	0.161	0.534	0.285
H4	11	27.201	28.355	27.627	27.5	0.114	0.378	0.143
I2	10	27.584	28.599	28.004	28.017	0.105	0.333	0.111
M3	9	29.639	31.177	30.4	30.442	0.166	0.499	0.249



This box plot, based upon data collected during CT DEEP surveys from January 1991 – September 2015, shows the median surface salinity, range, interquartile range, and outliers by station. Surface in this case refers to data collected two (2) meters below the air/water interface. Salinity increases from west to east across the Sound.

This box plot, based upon data collected during CT DEEP surveys from January 1991-September 2015 shows the median bottom salinity, range, interquartile range, and outliers by station. Bottom in this case refers to data collected five (5) meters above the sediment/water interface. The bottom waters are generally saltier than the surface waters.

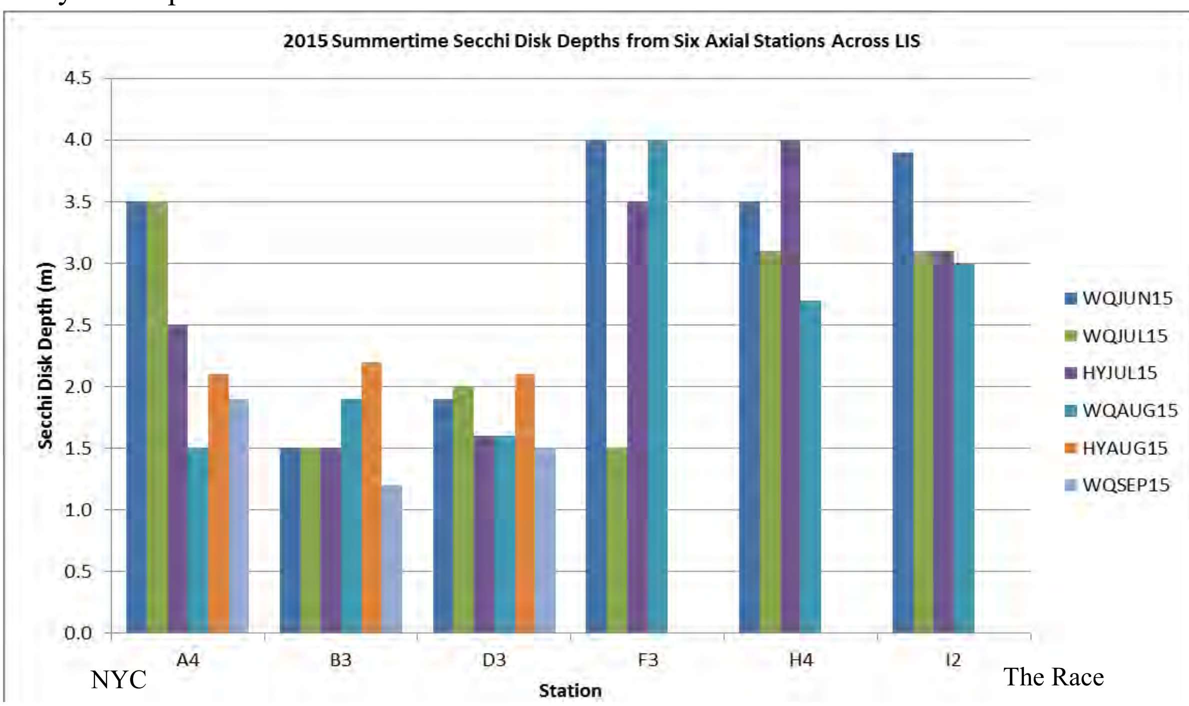




This plot illustrates the temporal variability of the mean salinity values by station from January-September 2015.

Water Clarity

Water clarity is measured by lowering a Secchi disk into LIS by a measured line until it disappears. It is then raised until it reappears. The depth where the disk vanishes and reappears is the Secchi disk depth. The depth to disappearance is related to the transparency of the water. Transparency may be reduced by both absorption and scattering of light. Water absorbs light, but absorption is greatly increased by the presence of organic acids that stain the water a brown "tea" color and by particles. Scattering is largely due to turbidity, which can be attributable to both inorganic silt or clay particles, or due to organic particles such as detritus or planktonic algae suspended in the water. CT DEEP began taking Secchi Disk measurements in June 2000. Since then, 3368 measurements have been entered into our database; of those 2,035 are from the 17 stations sampled annually. The 2000-2015 average Secchi depth is 2.4 m with a minimum depth of 0.4 m (WQSEP05, station A4) and a maximum depth of 6.2 m (WQNOV00 Station K2). Below is a graph depicting Secchi disk depths from six of the axial stations sampled by CT DEEP LISS Water Quality Monitoring Program between May and September 2015.



2014 data

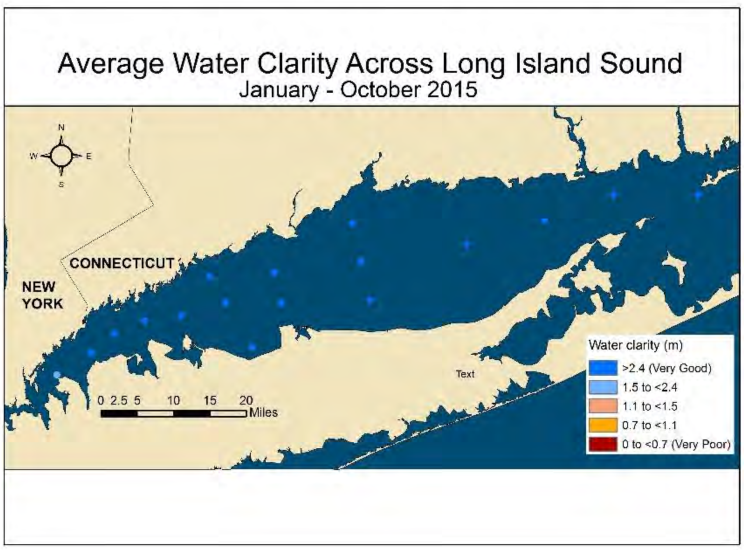
- Average Secchi Disk Depth: 2.83 m (n=294)
- Minimum Secchi Disk Depth: 1.0 m on multiple dates/stations
- Maximum Secchi Disk Depth: 5.1 m at Station 09 during the WQAPR14 cruise

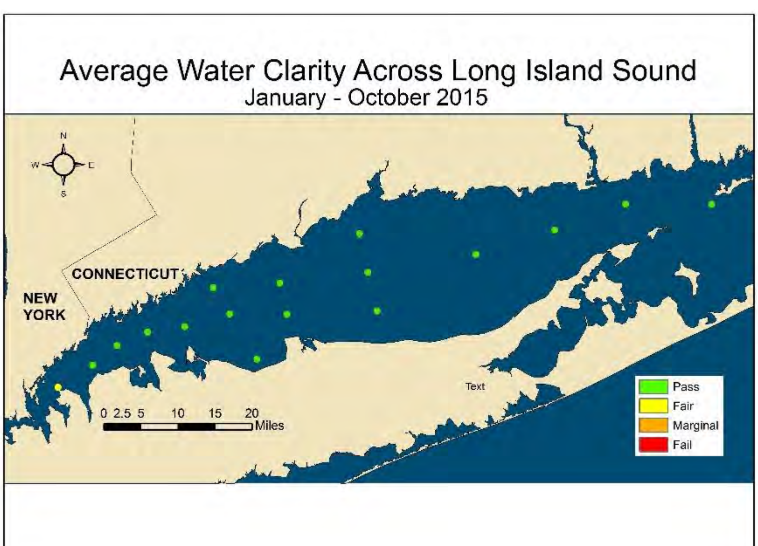
2015 data

- Average Secchi Disk Depth: 2.71 m (n=269)
- Minimum Secchi Disk Depth: 1.0 m at Station K2 during the WQJAN15 cruise
- Maximum Secchi Disk Depth: 5.0 m at Stations H4 during the WQSEP15 cruise

The Integration and Application Network at the University of Maryland Center for Environmental Science prepared a Report Card for Long Island Sound (based on 2013 data) that was released to the public in 2015 (http://ecoreportcard.org/report-cards/long-island-sound/). One of the indicators included in the Report Card is water clarity (Secchi disk depth).

The newly released Long Island Sound Comprehensive Conservation and Management Plan has identified improving water clarity as a goal to support healthy eelgrass communities. Water clarity is one of the major factors affecting eelgrass health and therefore extent. The CCMP states "For the purposes of this goal, "improved" is defined as an increase in the overall numeric criterion for water clarity in the Long Island Sound water quality report card by at least half letter grade (e.g., B to B+) between the initial 2015 report card evaluation and the evaluation conducted in 2035.





CT DEEP created maps similar to that found in the Report Card using the 2015 average Secchi depth data (January-October) from our 17 monthly water quality monitoring stations. Average Secchi depths across the Sound ranged from 1.95 m at Station A4 to 3.93 m at Station M3. Water clarity seems to have improved slightly from 2013 when the average Secchi depth at A4 was 1.71 m and at M3 was 3.24 m. However, recall that 2015 was abnormally dry. Therefore, the improved water clarity may simply be the result of decreased precipitation and fewer suspended solids entering the water column.

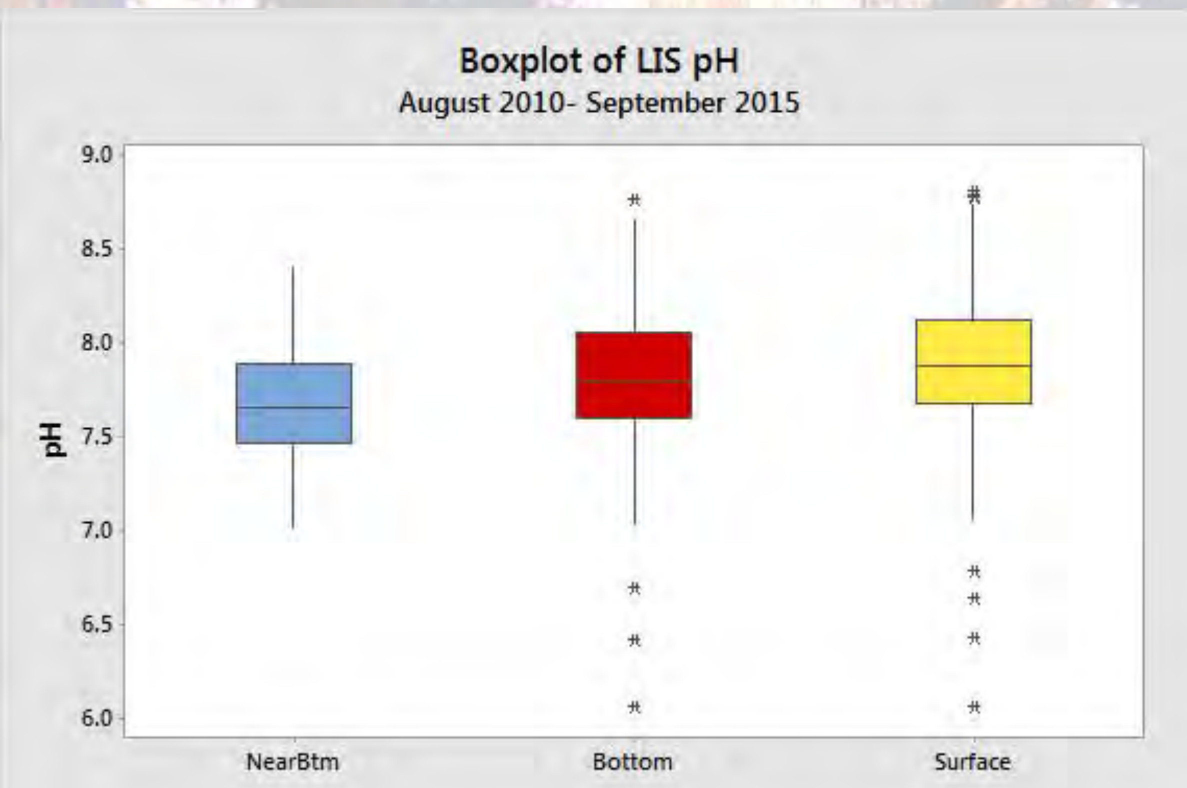
Criteria Threshold (m)	Overall Score Calculation
< 0.7	Fail (0%)
0.7-1.1	Marginal (33.3%)
1.1-2.4	Fair (66.7%)
> 2.4	Pass (100%)

pH and Ocean Acidification

Human activities have resulted in increases in atmospheric carbon dioxide (CO_2). The ocean absorbs CO_2, greatly reducing greenhouse gas levels in the atmosphere and minimizing the impact on climate. When CO_2 dissolves in seawater carbonic acid is formed. This acid formation reduces the pH of seawater and reduces the availability of carbonate ions. Carbonate ions are utilized by marine organisms in shell and skeletal formation. According to the NOAA Pacific Marine Environmental Laboratory Ocean Acidification Home Page, the pH of the ocean surface waters has already decreased from an average of 8.21 SU to 8.10 SU since the beginning of the industrial revolution and the Intergovernmental Panel on Climate Change predicts a decrease of an additional 0.3 SU by 2100. (See http://www.pmel.noaa.gov/co2/OA/background.html.)

With this issue in mind, CT DEEP upgraded its SeaCat Profilers and began collecting and reporting pH data in August 2010. Data collected through the HYSEP15 survey are summarized below.

	n	Maximum	Minimum	Mean	Median	SE Mean	StDev	Variance	Q1	Q3
Near Btm	1188	8.415	7.003	7.6754	7.6585	0.00792	0.2729	0.0745	7.461	7.885
Bottom	1242	8.762	6.061	7.8202	7.7985	0.00885	0.312	0.0974	7.593	8.0563
Surface	1896	8.806	6.066	7.896	7.877	0.00659	0.287	0.0824	7.68	8.12



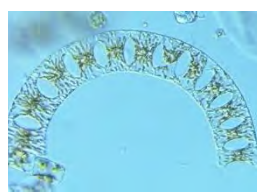
Chlorophyll a

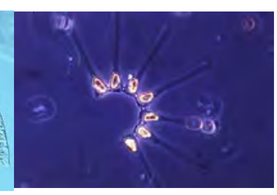
Chlorophyll is a pigment found in plants that gives them their green color. It allows plants to absorb light from the sun and convert it to chemical energy during photosynthesis. In photosynthesis carbon dioxide and water are combined to produce sugar giving off oxygen as a byproduct. Microscopic plants, called phytoplankton, form the basis of the food web in Long Island Sound. However, as in most cases in nature, too much phytoplankton may not be a good thing. Water temperature, nutrient concentrations, and light availability all factor into the amount of phytoplankton biomass found in the Sound.

The concentration of chlorophyll *a* is used as a measure to estimate the quantity of phytoplankton biomass suspended in the surface waters. It is most commonly used because it is easy to measure and because photosynthetic production is directly proportional to the amount of chlorophyll present.

Chlorophyll a concentrations are measured *in situ* using the CTD fluorometer as well as through the collection of grab samples using Niskin bottles. The grab samples are brought back into the onboard lab, filtered, and then sent to UConn for analysis.

The spring phytoplankton bloom occurs in Long Island Sound between February and April. Historically high levels of chlorophyll a in the western Sound during this time have been linked to summertime hypoxia conditions.





Unfortunately, April –October chlorophyll a data are not yet available from UConn. As a result, we are unable to evaluate the timing of the spring bloom or compare the chlorophyll concentrations to the thresholds put forth in the Long Island Sound Report Card.

National Coastal Condition Assessment Sampling 2015

© Richard Howard/ LISS

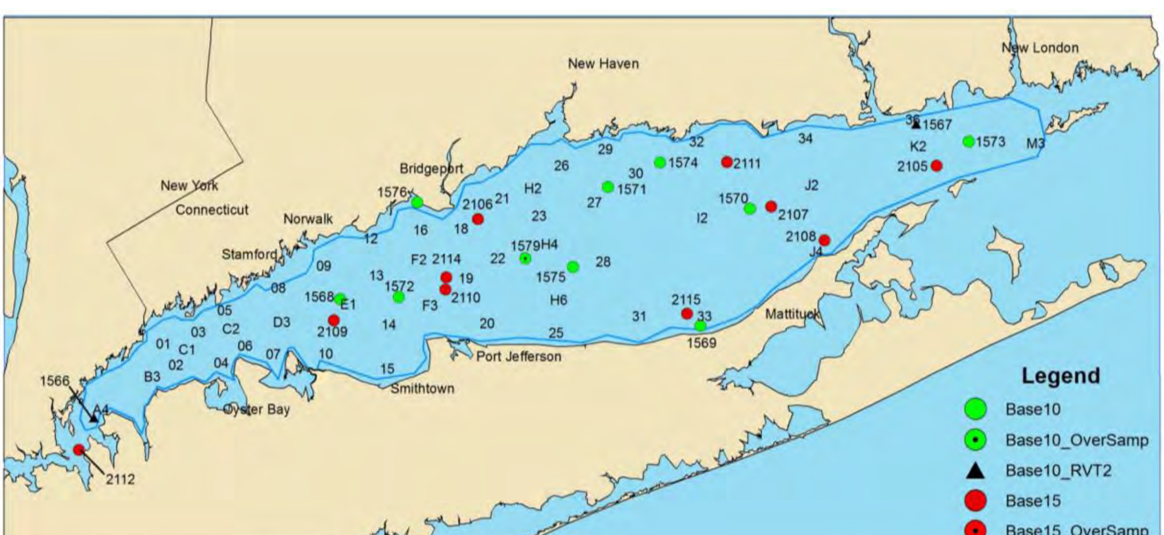
In 2015, CTDEEP participated in the NCCA, which is an EPA statistical survey on the condition of our Nation's marine water.

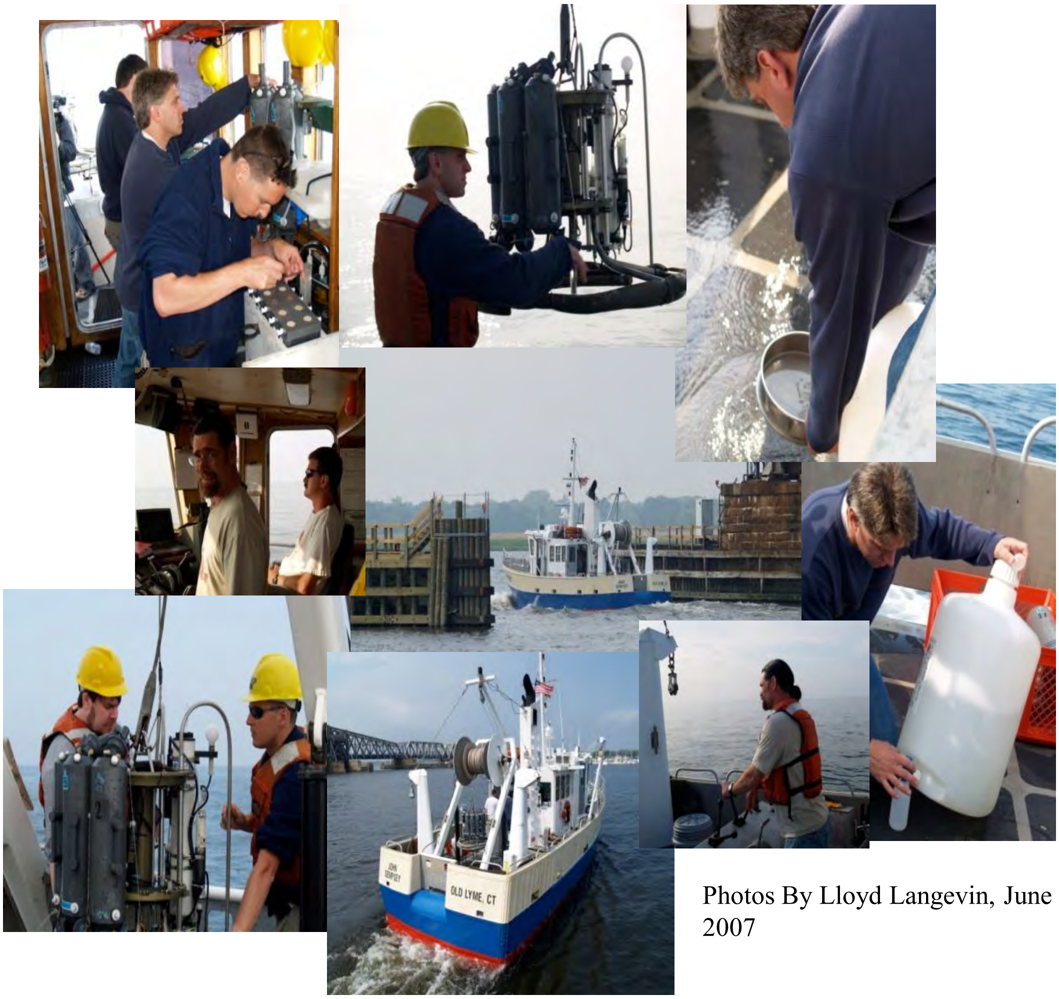
The survey aims to address two key questions:

- What percent of the Nation's coastal waters are in good, fair, and poor condition for key indicators of water quality, ecological health, and recreation?
- What is the relative importance of key stressors such as nutrients and contaminated sediments?

CTDEEP sampled 22 sites for water quality, sediment quality, benthic community condition, and fish tissue contaminants.

Additional information on the surveys can be found on EPA's website: http://www2.epa.gov/national-aquatic-resource-surveys/national-coastal-condition-assessment.





Photos By Lloyd Langevin, June 2007

Acknowledgements

Funding for the CT DEEP Long Island Sound Water Quality Monitoring Program is provided through a grant from the EPA through the Long Island Sound Study.

JOB 11: PUBLIC OUTREACH

JOB 11: PUBLIC OUTREACH

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

JOB 11 PUBLIC OUTREACH

GOAL

To increase awareness among anglers and the general public of the information products provided by this project and how this information contributes to state and federal efforts to enhance, restore and protect marine habitat and recreational fish populations.

OBJECTIVES

1) *Increase public awareness that research & monitoring are essential to good fisheries management and the majority of marine fisheries research & monitoring activities in Connecticut are funded through excise tax on fishing tackle and motorboat fuels*

SUMMARY

1. A total of 17,296 outdoor and environmental writers, marine anglers and boaters, marina operators, fishing tackle retailers, Fisheries Advisory Council (FAC) members, students, and members of the general public attended outreach events. The importance of research and monitoring to good fisheries management was incorporated into the programs (Table 11.2).

2. These same audiences also learned that good water quality and proper pollution prevention (non-fishing impacts) are essential to good fisheries habitat management.

3. Total attendance at five engagements with sportsmen clubs and other recreational environmental clubs was 233 (Table 11.2). The audience was encouraged to become actively involved in the fishery management process by attending public hearings and FAC meetings. Notices of public hearings were sent to hundreds of tackle shops and various media outlets including the DEEP website (www.ct.gov/deep/fishing).

4. Total attendance at one career day event with a Connecticut college was 52 (Table 11.2). The students were encouraged to become actively involved in fisheries biology and management.

5. The message that the majority of marine finfish research and monitoring are funded through Federal excise taxes on fishing and motorboat fuels was emphasized at major department outreach events (Table 11.2).

INTRODUCTION

Public outreach was formally incorporated into this project in 1997 (segment 17). An outreach plan was developed by project staff working closely with US Fish and Wildlife Service personnel. Six target audiences were identified in priority order (Table 11.1) in the outreach plan. This report summarizes F54R outreach activities conducted from March 2015 to February 2016 (segment 34).

Table 11.1:

Priority Audiences for Outreach Activities

1. Outdoor/environmental writers
2. Marine anglers
3. Marine boaters and Marina operators
4. Fishing tackle retailers
5. Fisheries Advisory Council (to CT DEEP)
6. General public

RESULTS AND DISCUSSION

Outdoor and Environmental Writers

DEEP press releases, project summaries, FAC quarterly reports and full annual reports were mailed and e-mailed out to several outdoor writers, members of the CT Outdoor Recreation Coalition (CORC) and Fisheries Advisory Council (FAC). Project staff were also interviewed concerning F54R activities in person, at public and regulatory hearings, and over the telephone by writers and reporters for the news media.

Marine Anglers and Marine Boaters

Project personnel organized and assisted in DEEP, Marine and Inland Fisheries Division displays at two statewide fishing/hunting and boating shows. The shows were sponsored by CMTA, Channel 3, Channel 30 and Connecticut Outdoor Recreation Coalition and were held in January and February of 2016 at the Connecticut Convention Center. These shows attracted 15,792 anglers, non-anglers, boaters, tackle retailers, legislators and general outdoor recreation enthusiasts. The theme for these show were "Enhanced Fishing Opportunities", Trophy Fish Close to Home" and "Marine Fisheries Division Angler Surveys". F54R activities were highlighted at these shows in displays entitled "Trophy Fish Award Program" and "Marine Angler Surveys, (a marine fisheries cooperative management program)". Audiences learned the importance of research and monitoring which are funded through excise taxes on fishing tackle and motorboat fuels. Colorful posters and pictures, brief project specific text and taxidermy reproductions helped draw attention to marine species monitored under F54R programs and solicit questions and discussion of those programs.

Several outreach displays were developed by project staff and mounted in the lobby and hallways at the Marine Fisheries Headquarters in Ferry Point State Park. These displays highlighted unique characteristics of Long Island Sound, public access, species identification, the trophy fish award program, marine angler surveys and gave a brief description of current F54R programs designed to protect the Sound's resources. These fisheries displays can easily be viewed by anglers, boaters and their families at this popular fishing and picnic area.

The Connecticut Department of Environmental Protection (DEEP) hosted the 'Eighth Annual Trophy Fish Award Ceremony' at the Northeast Fishing and Hunting Expo in the Connecticut Convention Center in Hartford on Saturday February 14, 2016. Nearly eighty (37 marine anglers) were recognized for their fishing achievements during 2015. Six new state record holders, including one new species (Dolphinfish), were honored. The Connecticut Department of Energy & Environmental Protection (DEEP) hosted the ceremony. Seventy-nine anglers were presented framed certificates and trophy fish award hats recognizing their achievement of having caught or landed the largest fish in one of several species categories during 2015. Another three marine anglers were recognized as angler of the year. For a summary please see: 2015 Marine Fisheries Trophy Fish Award Program Summary

Fishing Tackle Retailers

Fishing tackle retailers provide an important avenue for communication between the department and anglers. A complete list of fishing tackle retailers is maintained and updated yearly on the CTDEEP website. Timely DEEP press releases, species fact sheets, Connecticut angler guides and Marine Fisheries Brochure are mailed to tackle retailers to keep them informed. Correspondence between the marine fisheries office staff and retailers are ongoing.

Fisheries Advisory Council

The Fisheries Advisory Council, which represents a cross section of Connecticut residents with interests in fisheries issues, met quarterly to discuss statewide fisheries issues. For each quarterly meeting staff produce a report of recent project activities which is distributed to FAC members and posted on our web site. Marine FAC Quarterly Report. After each meeting most Council members report Council discussions back to the fishing and environmental groups they represent. Council members also discussed monitoring and funding issues at meetings with state legislators. Many Council members visited Marine Fisheries displays at the Northeast Fishing and Hunting Expo, CMTA Boating Show, Trophy Fish Award Program and other activities the Fisheries Division held during 2015-16. 'A Study of Marine Recreational Fisheries in Connecticut' was emailed to Fishery Advisory Council members to keep them informed.

General Public

Marine Headquarters is open daily Mon-Fri. attracting thousands to the public outreach displays at the office. Display topics included all F54R projects. Activities funded under other Federal Aid in Sport Fish Restoration projects were also highlighted; including Connecticut Pumpout Stations and Waste Reception Facilities (V-4), Motorboat Access Renovation and Development (F60D), Motorboat Access Area Operation and Maintenance (F70D), and Habitat Conservation and Enhancement (F61T).

Six articles describing Sport Fish Restoration projects were published in the Department's Wildlife Magazine. The first summarized mapping wildlife action plans in marine waters. A second highlighted Atlantic sturgeon in the CT River. Other articles described what is behind minimum size regulations, CT reef fish (tautog) gets special attention, CT DEEP survey captures migrating sea turtles and lastly, mapping changes in coastal fisheries abundance. These last two articles were based on data gathered in Job 2.

Sport Fish Restoration projects were also highlighted at public schools and universities throughout the year. Presentations titled "Marine Fisheries Management / Sportfish Restoration and Marine Resource Management" were provided to students. These outreach events highlighted the importance of coastal resources and all facets of marine resource protection. Approximately 52 students attended Marine Fisheries Division presentations.

Finally, project staff led numerous workshops and speaking engagements throughout the state, as well as informational tours and talks at the Marine Fisheries Office (Table 11.2). These talks and tours reached all target audiences, especially the business community, teachers and students. Audiences learned how to become active participants in the fisheries management process, through public informational hearings and FAC Meetings.

MODIFICATIONS

None.

Figure 11.1: 2015 CT DEEP Trophy Fish Award Program Marine Trophy Fish Awards being presented at the Northeast Fishing and Hunting Expo, Hartford CT, February 2016 (CT DEEP Marine Fisheries Division Trophy Fish Award Program).

Table 11.2: Summary of talks, tours, career days and workshops given by project staff highlighting F54R activities, March 2015 – February 2016 (segment 32).

DATE:	PRESENTATION TYPE:	ORGANIZATION	TITLE / TOPIC:	TARGET AUDIENCE	TOTAL
3/6/2015	Career Day	University of New Haven	Marine Fisheries Careers	College Students	52
3/17/2015	Talk	Guilford Library	Diversity in Long Island Sound	General Public	38
5/29/2014	Talk	Hole in the Wall Town Beach, Niantic	Marine Species in LIS	Students	210
6/6/2014	Fishing Derby	Fort Trumbull	Fishing	Students	205
6/18/2015	Talk	Fairfield County League of Sportsmen	Marine Fisheries Angler Survey	Marine Anglers	35
7/25/2015	Talk	Stratford Boat Owners Association	Marine Fisheries Angler Survey	Marine Anglers	29
9/26/2015	Marine Presentation	CT DEEP Hunting and Fishing Appreciation Day	Marine Fisheries Management	General Public and Anglers	690
10/6/2015	Talk	Essex Land Trust	Forage Fish in the CT River	General Public	14
11/6/2015	Talk	Mystic Aquarium Workshop Series	Teaching Climate Change	Teachers	12
12/1/2015	Talk	Stratford Boat Owners Association	Marine Fisheries Angler Survey	Marine Anglers	33
1/28-30/2016	Outreach Display	CMTA Boating Show	Enhanced Fishing Opportunities	General Public	7,433
2/12-14/2016	Outreach Display	Northeast Fish and Hunting Expo	Enhanced Fishing Opportunities	General Public	8,359
2/13/2016	Award Presentation	Northeast Fish and Hunting Expo	Trophy Fish Award Program Ceremony	Marine Anglers	167
2/29/2016	Talk	Fairfield County Anglers	Marine Fisheries Management	Marine Anglers	19
					17,296

JOB 12: MARINE FISHERIES GIS

TABLE OF CONTENTS

JOB 12: MARINE FISHERIES GIS

GOAL

To maintain a geographic information system (GIS) of Project data to support map applications and geospatial analyses, assist with planning and executing Connecticut DEEP Marine Fisheries Division (MFD) surveys that support sport fish restoration goals, help people visualize the spatial extent of MFD project sampling efforts, assist in evaluating the effects of fishing and environmental conditions on the distribution and abundance of living resources in Long Island Sound, evaluate effects of marine spatial planning projects on living marine resources and fisheries in Long Island Sound, and improve coordination with other agencies.

OBJECTIVES

1) Provide GIS-compatible, or GIS-ready, datasets and geo-referenced layers of data collected through other Jobs of this Project that are sanctioned by the Marine Fisheries Division.

2) Provide maps and geospatial analyses of Marine Fisheries Division data or other information relevant to managing living marine resources in Long Island Sound.

INTRODUCTION

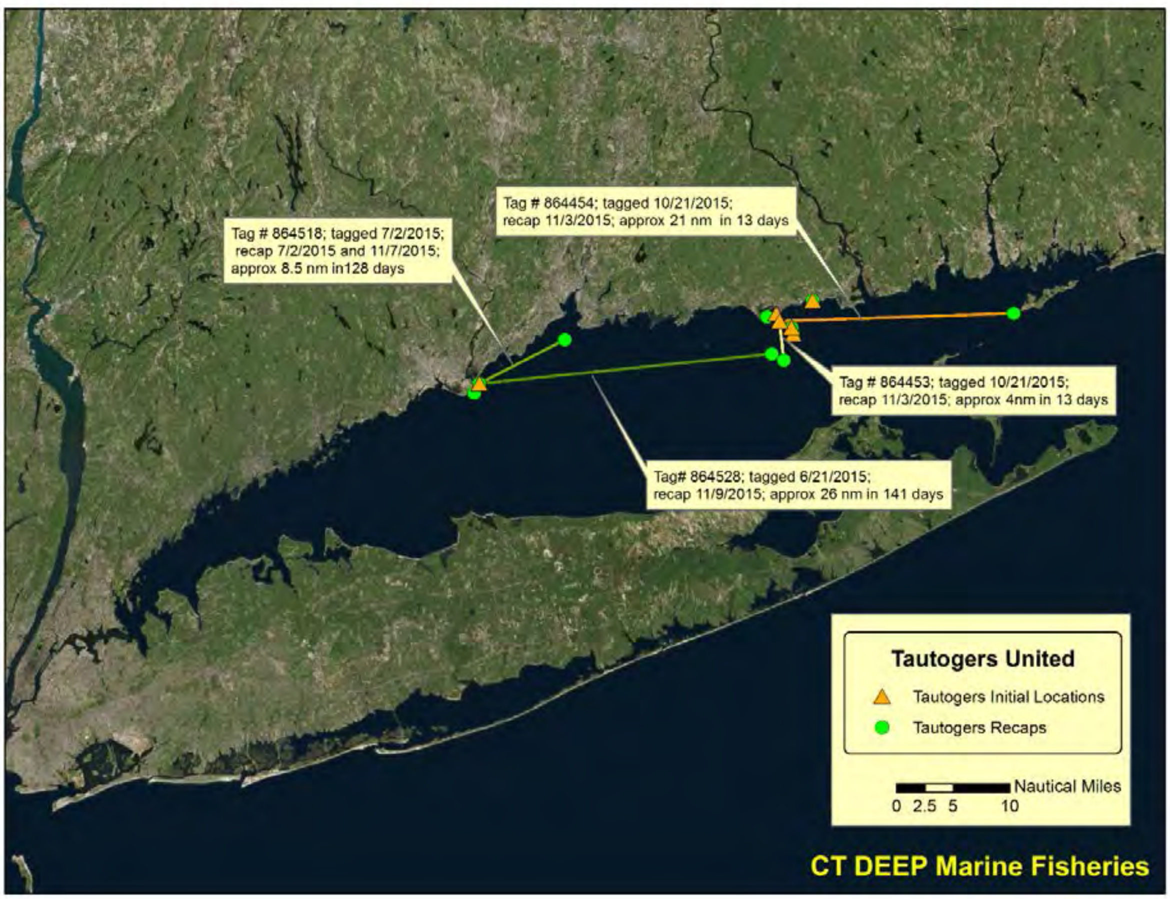
In recent years, there has been an increased need for staff to use geospatial technology to map and analyze marine environmental or fisheries related information. Project staff have also experienced an increasing number of requests to provide geospatial data to others (intra-agency, inter-agency, NGOs, academic institutions, etc) for use in, for example, fisheries stock assessments, habitat assessments, environmental sensitivity maps, and public outreach efforts. Therefore, in 2012, a new job was created within the project to support this need for geospatial datasets, data layers, analyses and products. This report includes results from the fourth year of the Job (2015).

METHODS

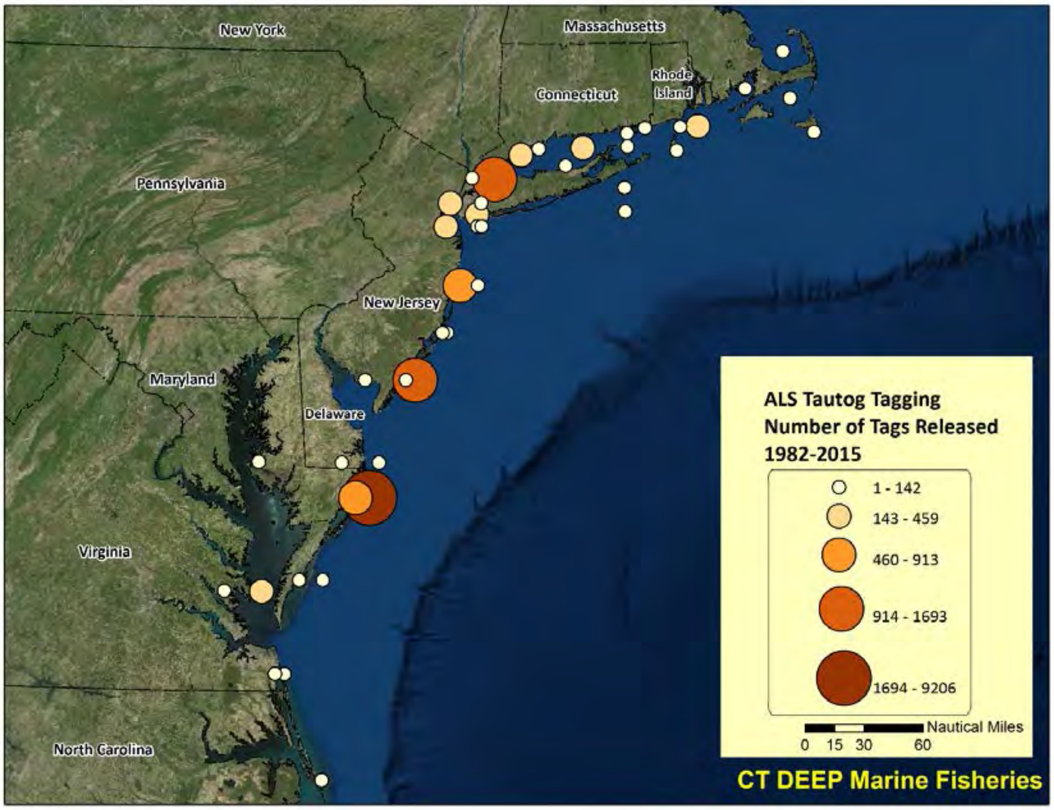
GIS work was accomplished using ESRI ArcMap software and extensions licensed by the Connecticut DEEP. Published layers comply with Department policy pertaining to GIS data. Custom scripts were developed using well established scripting utilities (*e.g.* Python, HTML, CSS, Javascript). Products designed for the Internet adhere to Agency requirements for Agency websites, pages and products. A number of the custom applications, scripts and tools created during earlier segments of the Job continue to be used as templates in subsequent years.

RESULTS

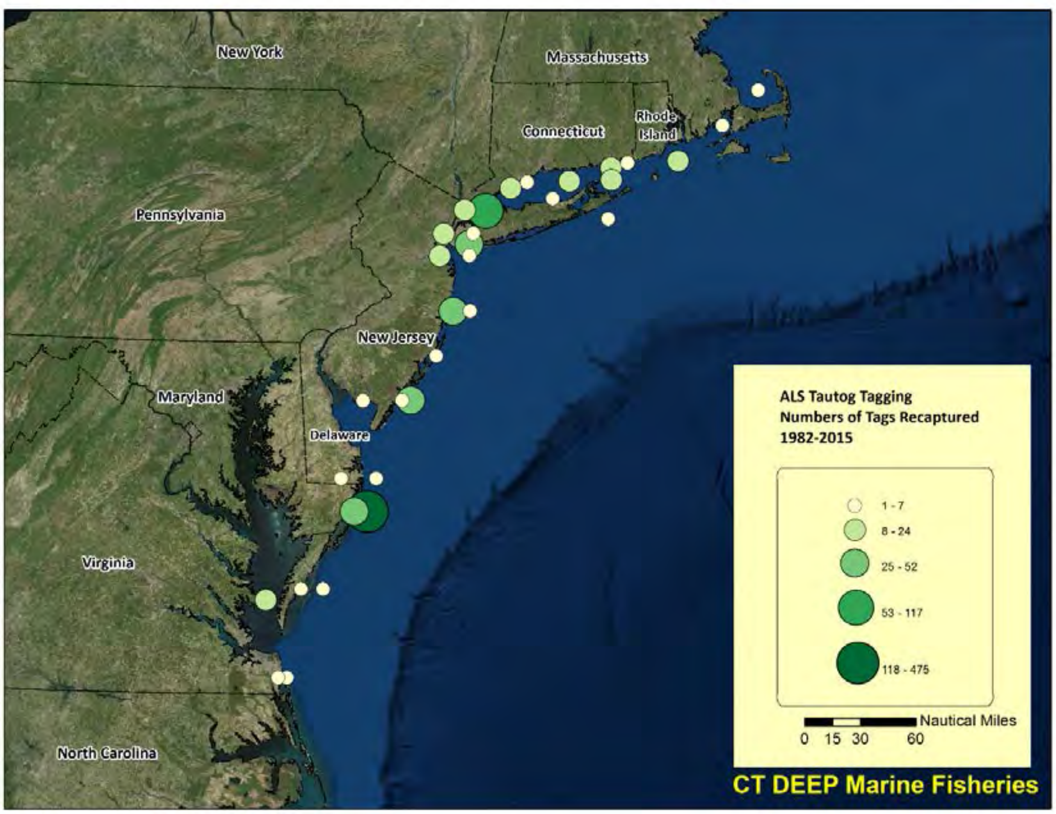
GIS staff created map summaries of tautog (blackfish) catch and release tag data from volunteer anglers. The maps were useful in illustrating that the majority of tautog recaptured had been tagged in the same general area where they were released. Maps of tautog tagged and recaptured along the Atlantic Coast from MA to NC were produced (see next page) based on data the anglers submitted to the American Littoral Society (ALS) tagging database. A local angling group, *Tautogers United*, is cooperating with project staff in an effort to get more detailed movement data for tautog in Long Island Sound (LIS) to assist with Interstate Management efforts. As part of this effort, not only are the anglers reporting their tagging information to ALS but they are also submitting it to CT DEEP Marine Fisheries Division. This allows project staff to preserve tag and recapture locations with greater precision than in the ALS coast wide tagging database. Based upon the finer resolution in the LIS locations provided by *Tautogers United* anglers, an additional map of tautog tagged (n=352) and recaptured (n=13) in LIS was produced to show finer- scale movements.



Tautog released along CT shore by angler group, *Tautogers United*, after being tagged with an ALS tag (orange triangles) and the recapture locations of the tagged fish (green circles). The majority of the recaptured fish did not move very far. The lines and comment boxes highlight the four *Tautogers United* tagged tautog with notable movements.

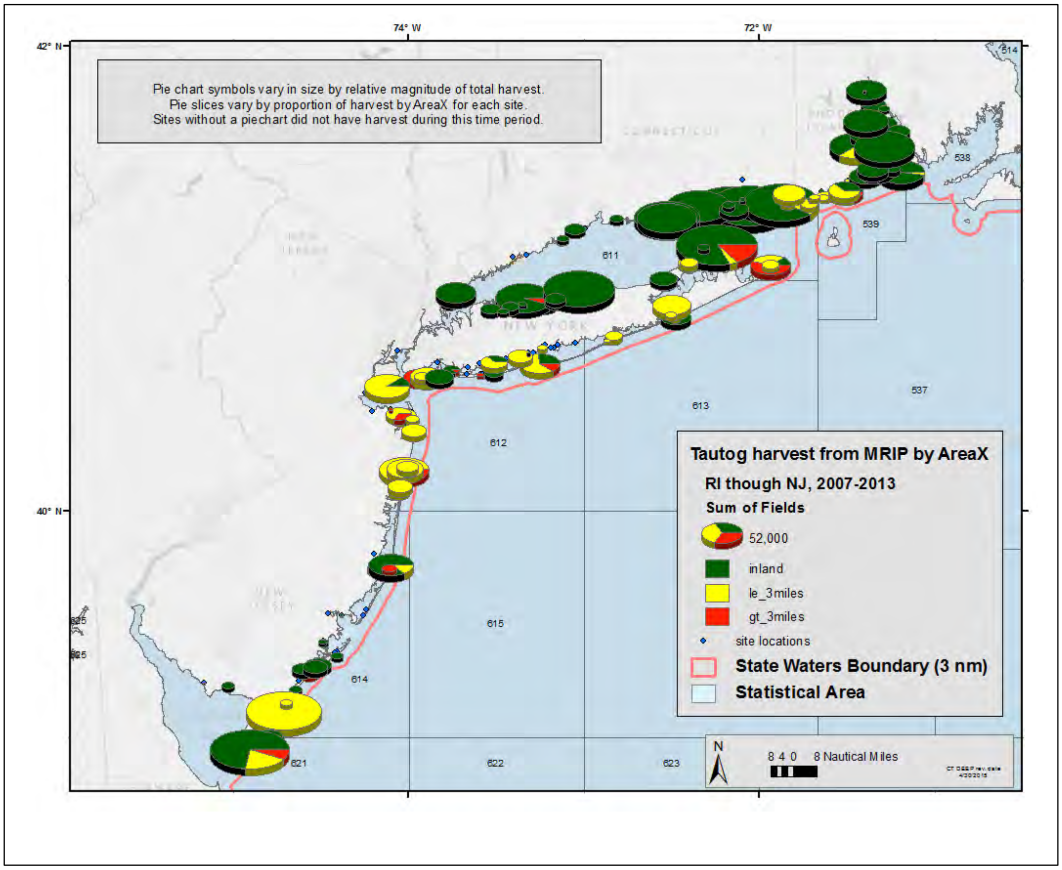


Number of Tautog tagged and released based on ALS Tagging Database, 1982-2015

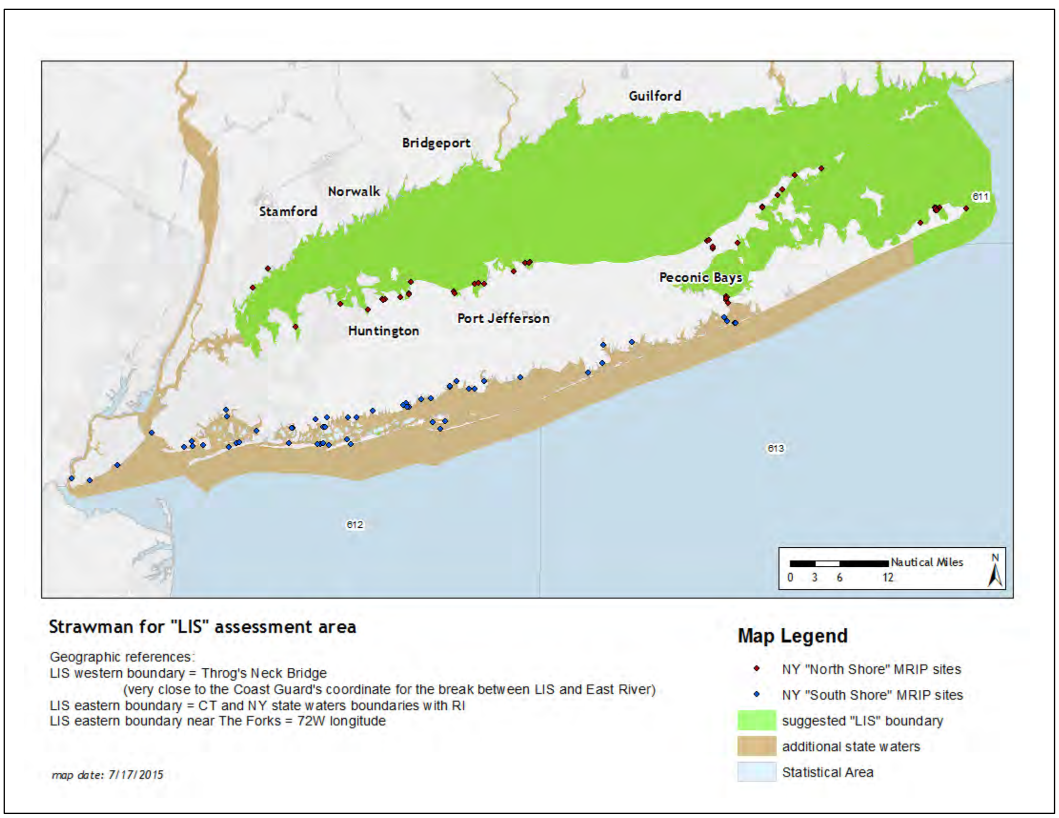


Number of tagged Tautog recaptured based on ALS Tagging Database, 1982-2015

Also as part of the effort to improve Interstate Management of tautog (blackfish), project staff conducted a spatial analysis of tautog recreational fishery data to assist stock assessment biologists determine appropriate regional boundaries for management areas along the coast.

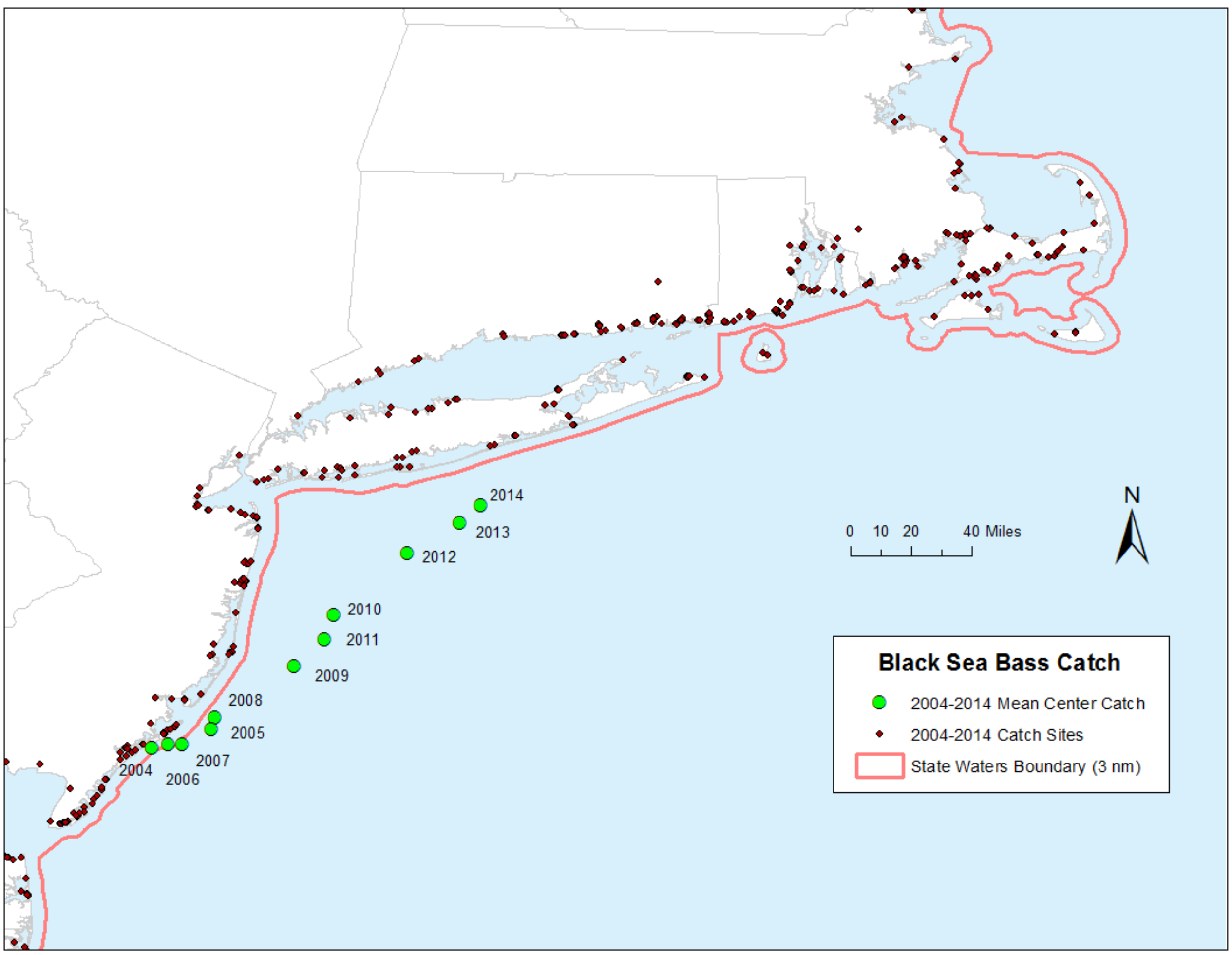


The most recent (2015) ASMFC benchmark stock assessment suggested that tautog in CT versus NY waters of Long Island Sound (LIS) be managed as two separate stock units. Biologists were concerned about this approach since the majority of tautog in LIS appear to stay in LIS and should be assessed as one stock.

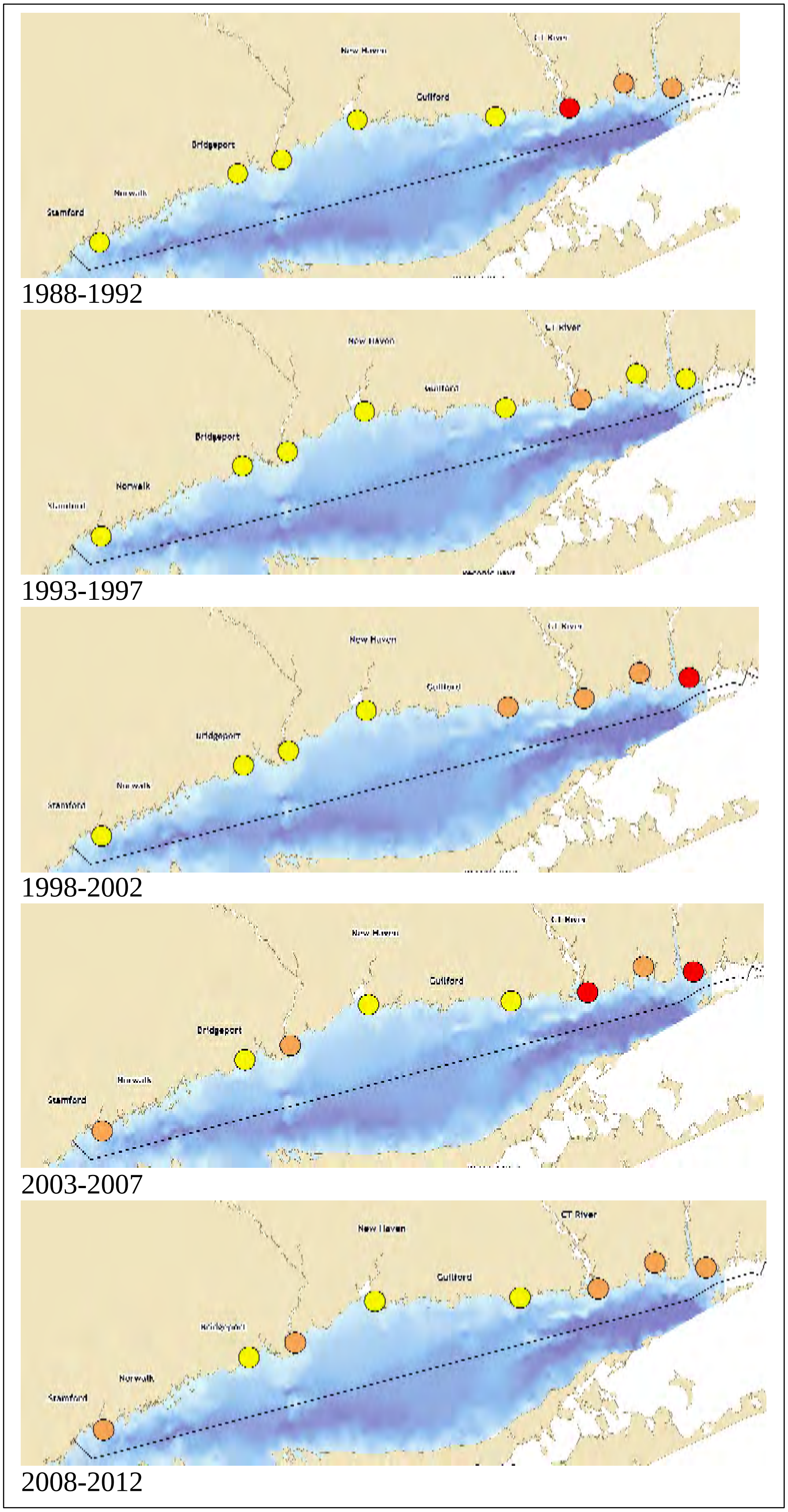


Based on data from the Marine Recreational Information Program (MRIP), magnitude of catch and harvest by distance from shore , as well as the location of sample sites (top right), were used to propose boundaries for a new Long Island Sound assessment area to include both CT and NY waters (bright green area in map, bottom right).

Marine Fisheries Division staff expanded the use of coast-wide angler catch data to map changes in the distribution of another recreationally important finfish using (GIS) ArcMap software. The status of the Black Sea Bass stock was in question as recreational catch data from the southern states showed the species declining in abundance while angler catch data from northern states were increasing. To make sense of this discrepancy, standardized recreational catch rates from all sites were averaged by their latitude and longitude for each year from 2004 to 2014 using spatial statistical tools in GIS. The DEEP biologists determined that the annual center of the coast-wide catch has moved northward each year from New Jersey toward the southern coast of Long Island Sound. On average the center of the catch distribution moved northward about 115 miles over ten years. This analysis quantified the shift, or possible expansion, in the range of Black Sea Bass along the coast which the biologists had previously only suspected had occurred. The coast-wide stock can now be more accurately assessed by mapping abundance and harvest geographically as well as through time.



This map illustrates the movement of the center of the annual recreational catch of Black Sea Bass along the northeastern coast of the United States, denoted by bright green circles. The northward change in latitude is most significant. Averaging latitude and longitude artificially places the symbols offshore even though all the data reflect near-shore catches (black dots).



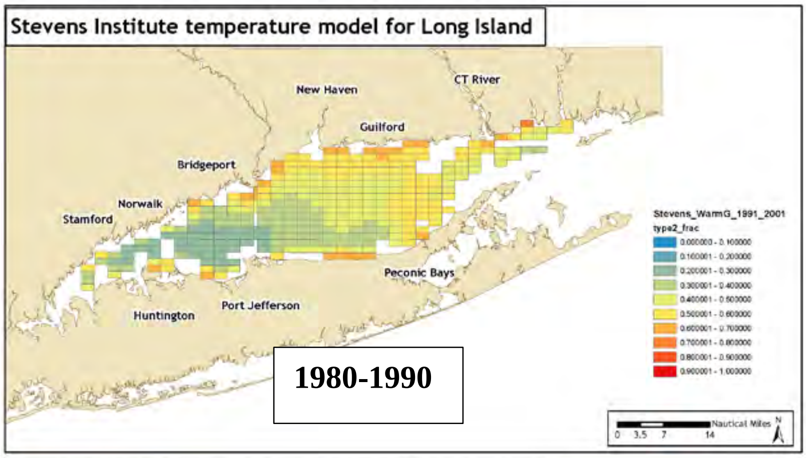
Data from the Estuarine Seine Survey (Job 8 in this report) were used to generate GIS map layers of forage fish indices by site for 5-year intervals. These layers were provided to NOAA's Center for Coastal Monitoring and Assessment for use in their Long Island Sound Environmental Sensitivity Index (ESI) mapping project.

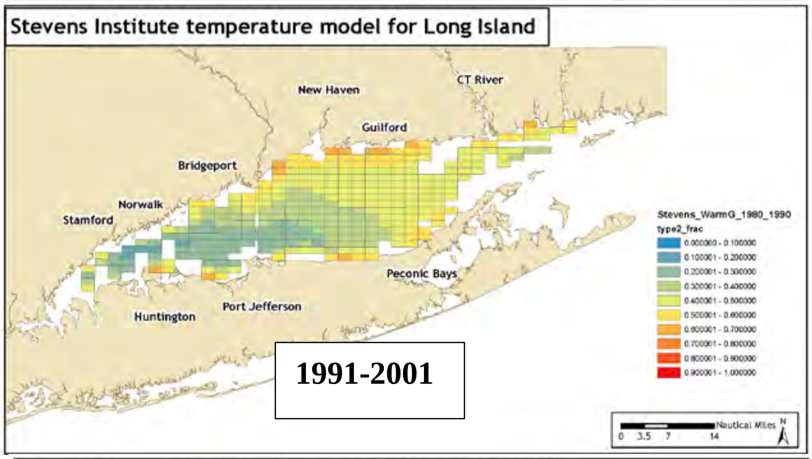
The Estuarine Seine Survey defines forage fish as short-lived, highly fecund species that spend the majority of their life cycles inshore where they are common food items for piscivorous fish. The index reflects relative abundance of the four most common forage species captured in this survey: Atlantic silversides, striped killifish, mummichog, and sheepshead minnow.

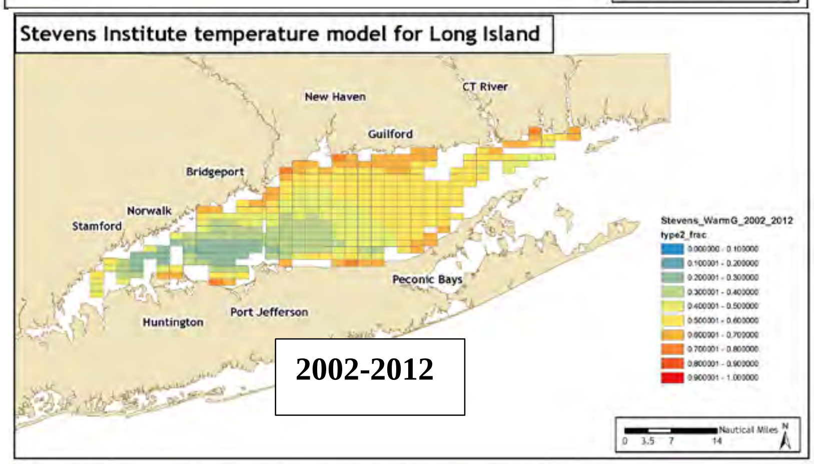
In these maps (left panel), red dots represent sites with high forage fish abundance while orange dots represent moderate abundance and yellow dots represent low abundance.

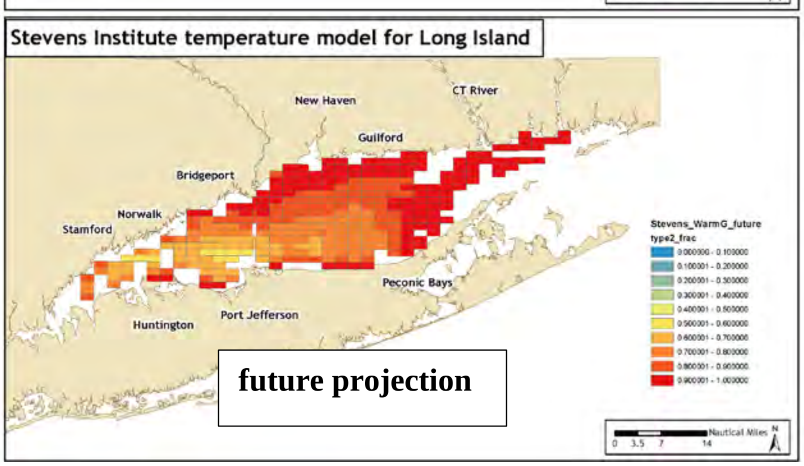
The highest abundances of forage fish are typically in the east, although the more recent time periods show moderate abundances in the west as well

NOAA's Long Island Sound ESI Atlas will be used by NOAA's Office of Response and Restoration in their assessment and response following major storms or natural disasters. The current ESI Atlas was last updated over a decade ago.









CT DEEP Marine Fisheries biologists, working with the Stevens Institute and NOAA NMFS, developed a model to simulate potential impacts of climate change on the Sound's ecosystem, including the effects on fish habitat in time and area (link: http://longislandsoundstudy.net/wp-content/uploads/2013/08/Georgas-et-al-R-CE-33-NYCT-CR-Final-Report.pdf).

Project staff then conducted a spatial analysis of data generated by the model to show in greater detail the spatial distribution of potential changes to finfish habitat.

Fish species not subject to commercial or sport harvest were grouped into warm and cold guilds based on the water temperatures each species preferred. Temperature preference was determined by guild abundance patterns in the LIS Trawl Survey, 1992-2013 (Job 5). Cold guild species prefer water temperatures from 7.1C-15.4C, whereas warm guild species prefer water temperatures from 11.8C-22.1C.

The map panel (left) shows the spatial distribution of habitat suited to warm guild species in four time periods: (1) 1980-1990, (2) 1991-2001, (3) 2002-2012, and (4) a future probability projection of a time when CO^2 will have doubled over current levels (a moderately conservative IPCC scenario).

The color ramps used in the maps go from blue to red and quantify the percentage of time the area is suitable for warm-guild species. Blue areas are suitable for warm-guild species 0-20% of the time, green areas are suitable 20-40% of the time, yellow areas are suitable 40-60% of the time, orange areas are suitable 60-80% of the time, and red areas are suitable 80-100% of the time.

For the past three decades (the top three maps, previous page), the area less suitable for warm-guild species (blue & green) has been gradually shrinking. Whereas, in the future (bottom map, previous page), the majority of the Sound will probably be highly suitable for warm-guild species more than 70% of the time (orange & red areas). This change in habitat distribution will allow many warm temperate Mid-Atlantic species to migrate into the Sound earlier and stay longer each year, increasing competition with currently abundant cold temperate New England species.

The citation for the climate model is: Georgas, Nickitas, Penelope Howell, Vincent Saba, Alan Blumberg, Philip Orton. 2016. *Analyzing history to project and manage the future: Simulating the effects of climate on Long Island Sound's physical environment and living marine resources*. Completion Report for New York Sea Grant project number: R/CE-33-NYCT. 50 pp

MODIFICATIONS

None.