STATE OF CONNECTICUT
DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION

Robert Klee
Commissioner

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

A STUDY OF MARINE RECREATIONAL FISHERIES IN CONNECTICUT

Federal Aid in Sport Fish Restoration
F16AF00268 (F-54-R-36)
Annual Performance Report
March 1, 2016 – February 28, 2017

Cover Photo: Fisheries Biologist (retired) Penny Howell holding an Atlantic cod caught during the April 2016 Long Island Sound Trawl Survey aboard the *R/V John Dempsey*.

After more than 38 years of service to the State, Penelope (Penny) Howell retired on March 1, 2017. Penny had a long and distinguished career with CT DEEP Fisheries Division's Marine Fisheries Program (formerly known as the Marine Fisheries Division).

Penny began her career with Marine Fisheries collecting biological data on scup (porgy) aboard commercial trawling vessels in Long Island Sound. She often recalled her experiences working alongside commercial fishermen as the first woman hired in the Division. She was an integral part of a study examining the effects of trawling on lobster and was a contributing author to the legislative report required by Special Act 83-29 of the CT General Assembly.

Another notable undertaking Penny took on early in her career was to help design and implement the Long Island Sound (LIS) Trawl Survey in 1984, the Marine Fisheries Program's largest and second-longest running project. The LIS Trawl Survey monitors the abundance of over 100 marine finfish species and provides invaluable data for species stock assessments and studies that focus on the effect of environmental changes on species composition.

Penny always felt strongly that the nearshore resources below the high tide line were of importance and in need of monitoring. To address that need, she developed a number of surveys to collect data on this essential habitat and the species that occupy it. This included the ongoing Estuarine Seine Survey (created in 1988) to document winter flounder spawning sites, among other things.

In the mid-90's, Penny was tasked with evaluating the white perch populations in the CT River. She developed a tagging study to document the species' population levels and movement in the river. The information collected helped develop the recreational and commercial harvest restrictions for white perch in CT.

With few resources, Penny established a horseshoe crab spawning survey along the Connecticut coast, enlisting the help of numerous volunteers, both from the public and scientific communities. These data were ultimately used to determine the commercial harvest quota for this species set in 2000, as well as to help determine areas that should be closed to commercial harvest in an effort to protect the food source of endangered migrating shore birds.

Penny has an unparalleled ability to talk about science and marine fisheries assessment on a level that all could understand. She developed a number of games for students of all ages, which broke down the most complex of population estimation methods and made learning fun. Penny was a familiar face, representing the Department on numerous Atlantic States Marine Fisheries Commission (ASMFC) committees, presenting at many professional conferences and giving talks to public interest groups. Outreach and education efforts were a priority for Penny as she was always eager to engage the public and others to raise awareness of environmental and conservation issues.

Similarly, Penny's writing contributions spanned from describing intricate modeling methods for marine species stock assessment reports to publishing a number of articles in reputable, peer-reviewed journals such as the *Journal of Shellfish Research*, *Transactions of American Fisheries Society*, and *Marine and Coastal Fisheries*. For six years, Penny was also a contributing author and editor for the marine fisheries articles featured in *Connecticut Wildlife* magazine, highlighting Connecticut's marine species and the programs that monitor them.

For the last seven years of her career, Penny dedicated most of her time to the American lobster resource, serving as the State's representative on ASMFCs American Lobster Technical Committee. She stepped into management of the species just after the catastrophic die-off in Long Island Sound, helping to document the decline of the resource and the continued recruitment failure of the species in the Sound. Her first task was to manage a one million dollar study to determine the cause of the large-scale mortalities of lobster, working with geneticists, pathologists, and a number of environmental researchers along the coast. One of the most notable findings from this work was documentation of the thermal stress point for lobster (68^{o}F). Having learned the biological threshold for the species, Penny worked to find ways to monitor the bottom temperatures in Long Island Sound, documenting the ongoing stressful conditions for lobster which have hampered the species' rebound. She also took the lead on evaluating the effects of changing environmental conditions on other notable species in the Sound, including winter flounder.

Penny established numerous professional relationships within CT DEEP, ASMFC, other State resource agencies, and the environmental community. As a highly respected scientist, Penny was always willing to help someone design a study, improve the way data were collected, or select the appropriate statistical test to analyze results.

Penny was a tremendous asset to the Department.
Although we will surely miss her,
we sincerely wish her well in her retirement.

*Penny at home;
photo courtesy of the
Howell-Heller family*

State of Connecticut
Department of Energy and Environmental Protection
79 Elm Street
Hartford, CT 06106-5127
www.ct.gov/deep

Federal Aid in Sport Fish Restoration
F16AF00268 (F-54-R-36)
Annual Performance Report

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

Period Covered: March 1, 2016 - February 28, 2017

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Date: Aug 21, 2017

JOB 1: MARINE ANGLER SURVEY

MARINE ANGLER SURVEY

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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 are difficult to obtain through traditional access point intercept surveys such as MRIP, and is particularly important for 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 Connecticut waters (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 and returning from selected private boat sites, previously identified are areas of 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 along the coast. Each card issued bears a unique identification number and all cards handed out to anglers were accounted for using the unique card ID number. As an incentive to maximize participation, anglers entering their Conservation ID/Fishing License Number are eligible to win a raffle prize at the end of the year. Boat-based anglers were also interviewed when their fishing trips were completed to aid in data collection.

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

RESULTS AND DISCUSIION

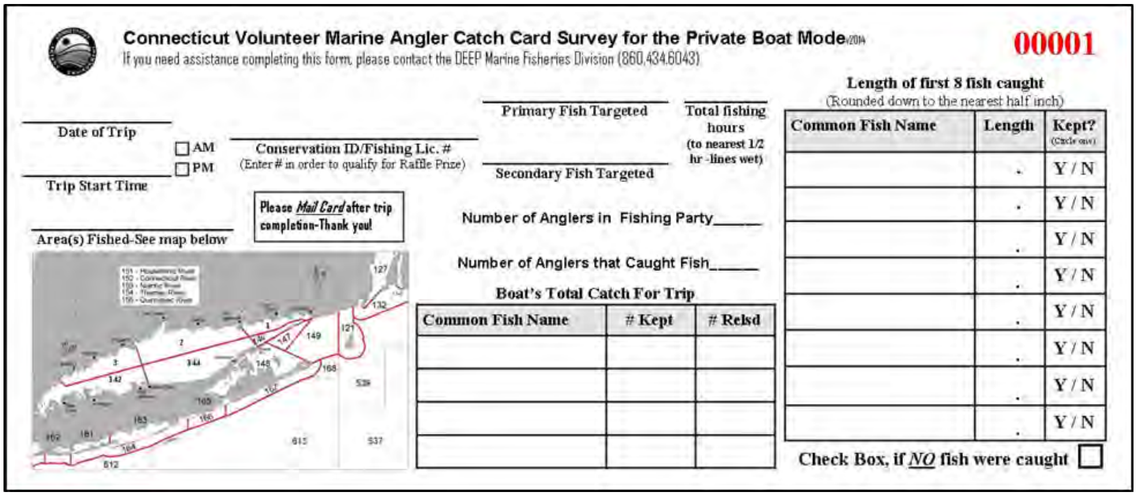
CT DEEP staff completed 338 interviews and distributed 257 catch cards to boat based anglers (60 at eight launch sites along CT's coastline) in Connecticut. Four launch sites in the east and west were chosen along with a group of Fairfield County boat anglers (FCBA). A total of 172 catch cards were distributed to Fairfield county boat anglers, 34 distributed (provided) at western boat launches, 26 distributed at eastern launches and another 25 to eastern boat anglers. Sixty-five cards were returned from western anglers (FCBA & western launches) and 27 cards were returned from anglers in the east in 2016. A total of 92 cards were returned (36%) with 291 anglers reporting their fishing trip activities in 2016. Of the 291 anglers, 227 (78%) caught at least one fish. There was a total of 575 (40%) fish kept and 857 (60%) fish released, including 13 finfish species or species groups.

The catch data from eastern and western sites are examined separately to address concerns regarding differences in angler catches in the eastern versus western Long Island Sound which were not clear when coast-wide catches were grouped (Table 1.1). Catch and disposition of striped bass and summer flounder were similar between regions. Black sea bass and tautog were more prevalent in the east; scup and bluefish were more common in the west (Table 1.3).

Volunteer anglers measured a total of 1,432 fish in 2016 (Table 1.2). Targeted species (black sea bass, bluefish, scup, striped bass, summer flounder, and tautog) accounted for 80% of the measured catch in 2016.

MODIFICATIONS
None.

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


Connecticut Volunteer Marine Angler Catch Card Survey for the Private Boat Mode v2014

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

00001

Date of Trip ☐ AM ☐ PM

Trip Start Time

Conservation ID/Fishing Lic. #
(Enter # in order to qualify for Raffle Prize)

Please *Mail Card* after trip completion-Thank you!

Area(s) Fished-See map below

Primary Fish Targeted

Secondary Fish Targeted

Total fishing hours (to nearest 1/2 hr -lines wet)

Number of Anglers in Fishing Party______

Number of Anglers that Caught Fish______

Boat's Total Catch For Trip

Common Fish Name	# Kept	# Relsd

Length of first 8 fish caught
(Rounded down to the nearest half inch)

Common Fish Name	Length	Kept? (Circle one)
	.	Y / N
	.	Y / N
	.	Y / N
	.	Y / N
	.	Y / N
	.	Y / N
	.	Y / N
	.	Y / N

Check Box, if *NO* fish were caught ☐

Figure 1.2. Connecticut Volunteer Marine Angler.

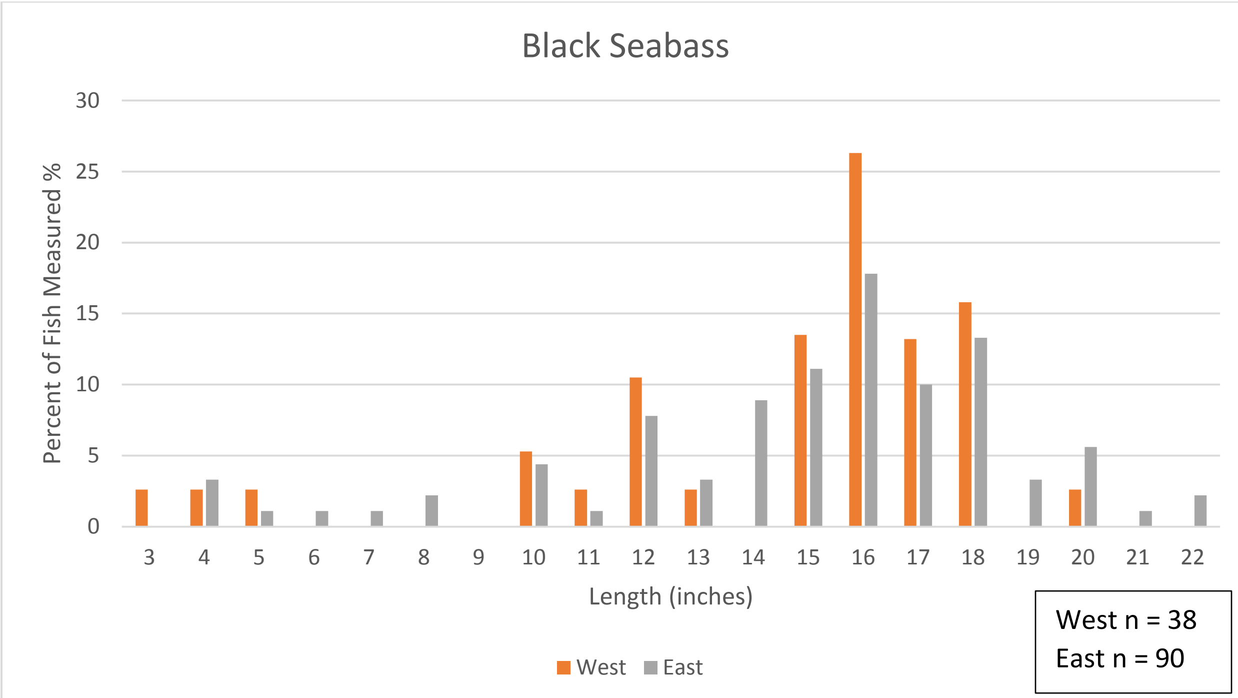
Table 1.1. 2016 reported angler catch by species and disposition.
Species listed in bold type are targeted in this program

Species	Kept	%	Released	%	Total
Black Sea Bass	**77**	**60.2**	**51**	**39.8**	**128**
Bluefish	**61**	**35.3**	**112**	**64.7**	**173**
Catfish	0	0	1	100	1
Dogfish	0	0	17	100	17
False Albacore	8	28.6	20	71.4	26
Menhaden	13	100	0	0	15
Scup	**175**	**55.4**	**141**	**44.6**	**316**
Sea Robin	0	0	31	100	31
Skate	0	0	4	100	4
Striped Bass	**48**	**15.9**	**254**	**84.1**	**302**
Summer Flounder	**90**	**42.9**	**120**	**57.1**	**210**
Tautog	**97**	**49.2**	**100**	**50.8**	**197**
Winter Flounder	6	50	6	50	12
Total	**575**	**40.2**	**857**	**59.8**	**1432**

Table 1.2. Total number of fish measured by species.
Species listed in bold type are targeted in this program

Species	Number Measured	Percent of Total
Black Sea Bass	**128**	**8.90%**
Bluefish	**173**	12%
Catfish	1	0.00%
Dogfish	17	1.20%
False Albacore	26	1.80%
Menhaden	15	1.00%
Scup	**316**	**22.10%**
Sea Robin	31	2.20%
Skate	4	0.20%
Striped Bass	**302**	**21.10%**
Summer Flounder	**210**	**14.70%**
Tautog	**197**	**13.80%**
Winter Flounder	12	0.80%
Total	**1432**	

Figure 1.3. Length frequency of black sea bass and tautog measured by volunteer anglers in western versus eastern Long Island Sound. *Frequencies include kept and released fish.*



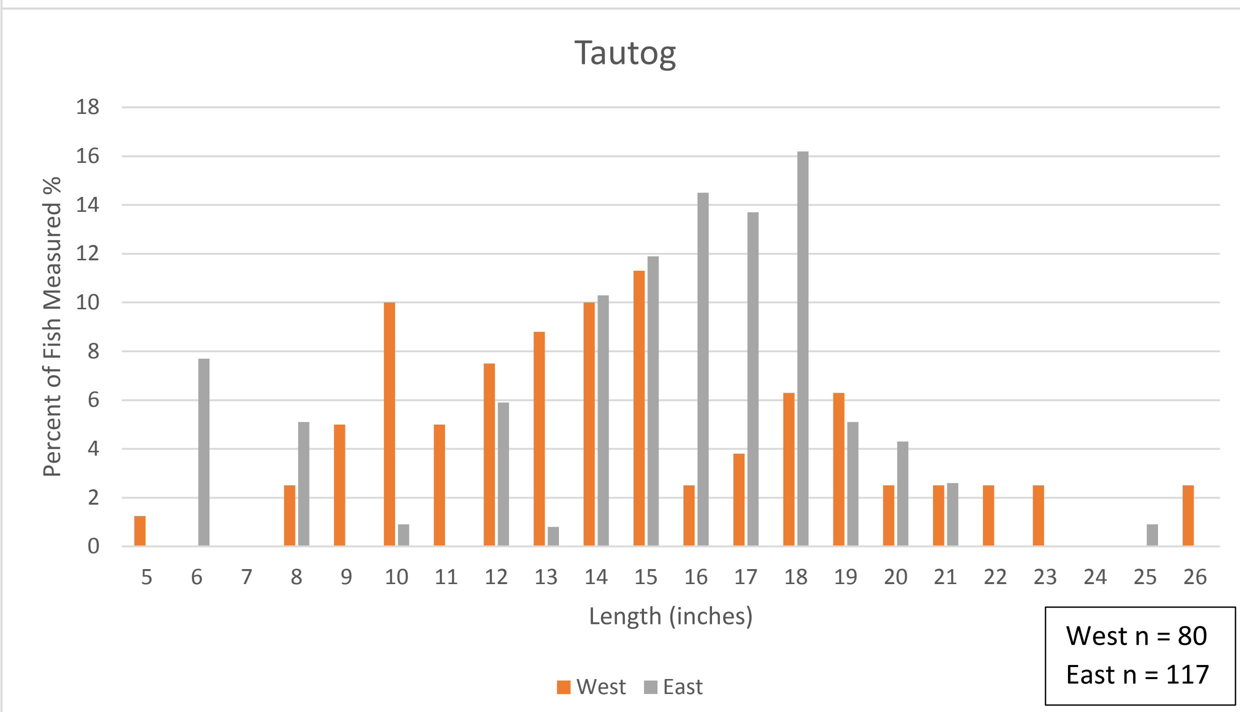
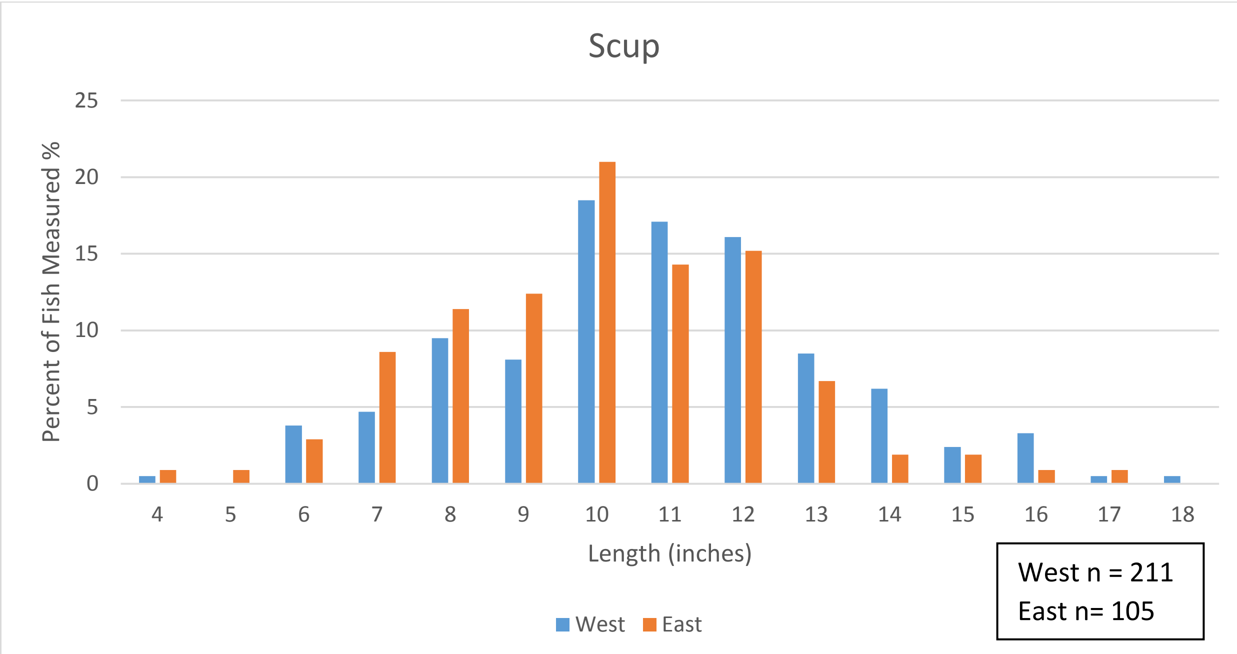


Figure 1.4. Length frequency of scup and summer flounder measured by volunteer anglers in western and eastern Long Island Sound. *Frequencies include kept and released fish.*



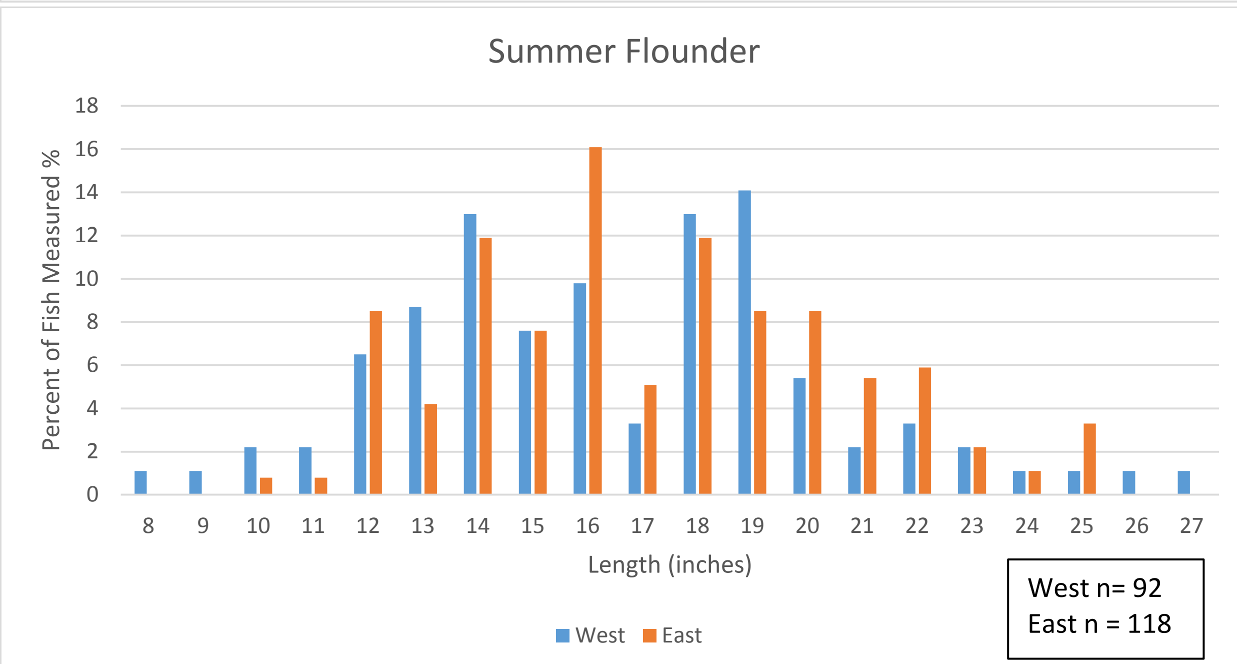
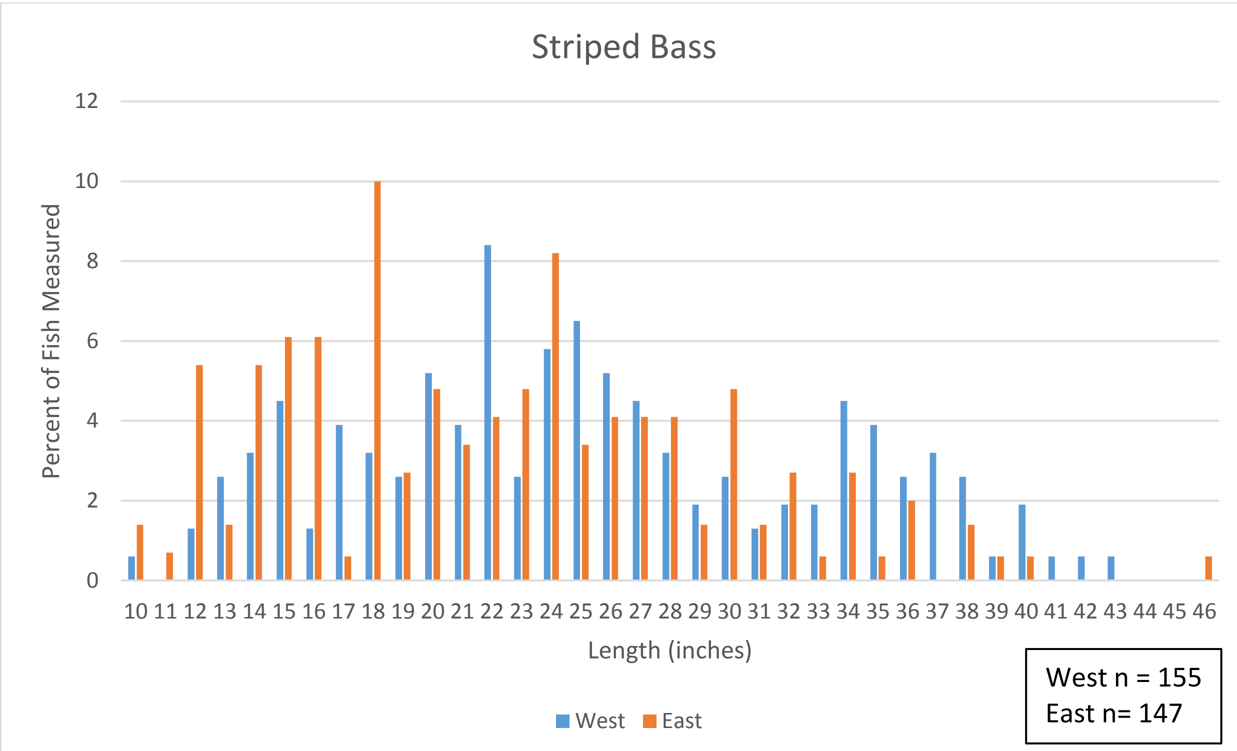


Figure 1.5. Length frequency of striped bass and bluefish measured by volunteer anglers in western versus eastern Long Island Sound. *Frequencies include kept and released fish.*



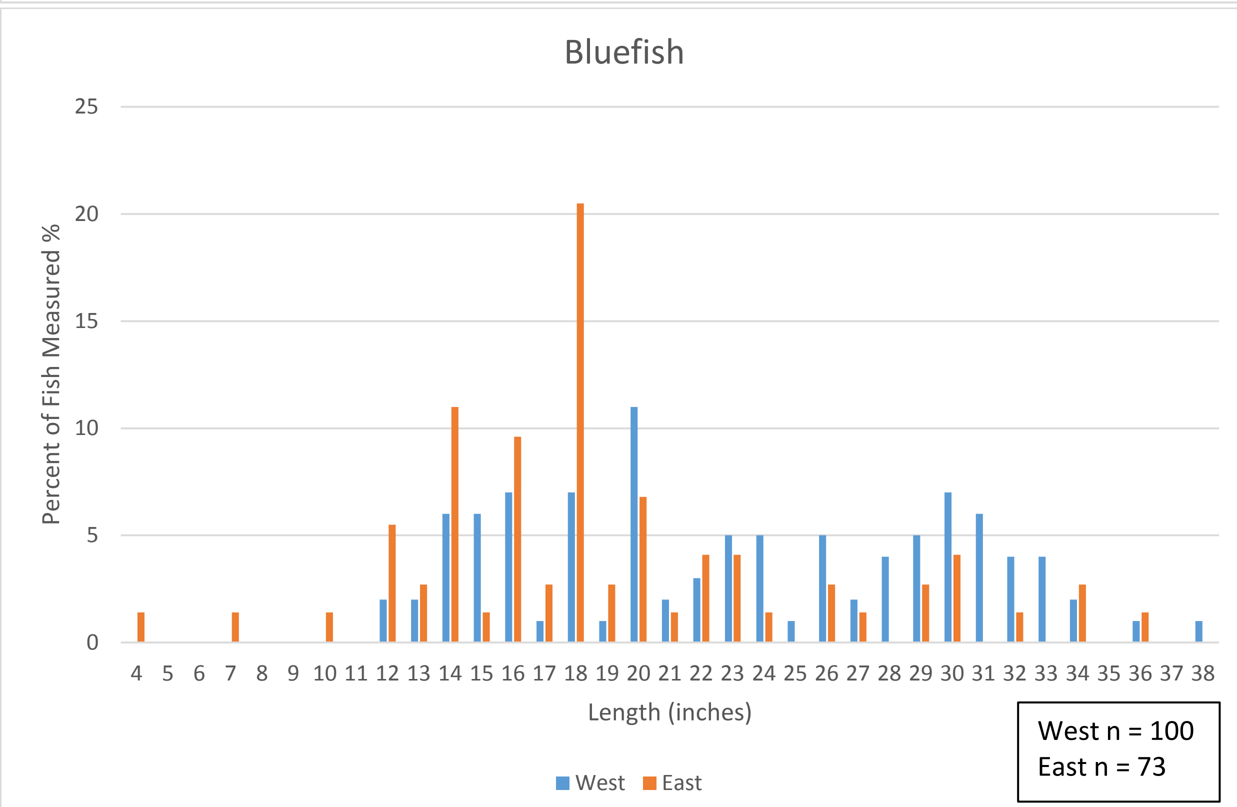
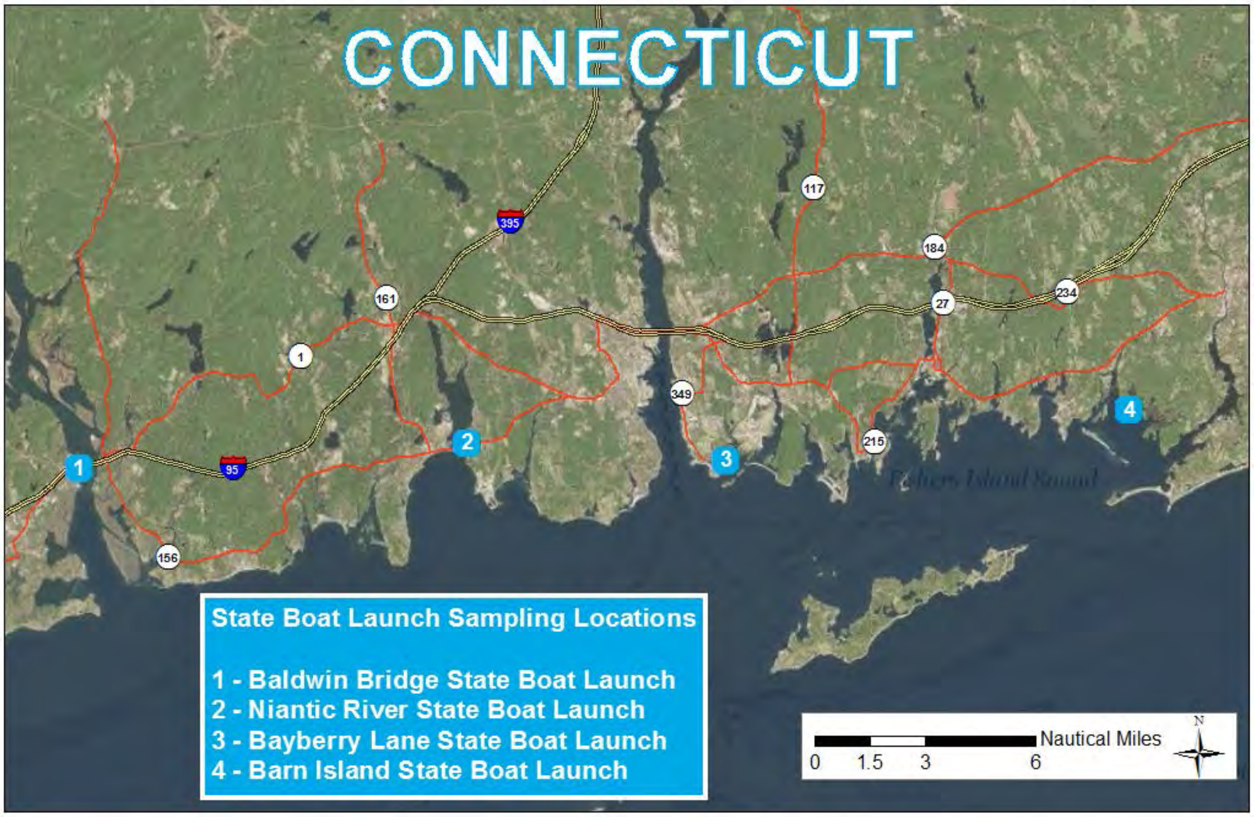


Table 1.3. Reported angler catch by region, species and disposition in 2016. ***Species listed in bold type are targeted in this boat based catch card program.***

Eastern Catch						
Species	Kept	%	Released	%	Total	% Statewide Catch
Black Sea Bass	**52**	**58**	**38**	**42**	**90**	**70.3**
Bluefish	**9**	**12**	**64**	**88**	**73**	**42.2**
Catfish	0	0	1	100	1	100
Dogfish	0	0	0	0	0	0
False Albacore	8	31	18	69	26	100
Menhaden	13	100	0	0	13	86.7
Scup	**43**	**41**	**62**	**59**	**105**	**33.2**
Sea Robin	0	0	6	100	6	19.4
Skate	0	0	4	100	4	100
Striped Bass	**16**	**11**	**131**	**89**	**147**	**48.7**
Summer Flounder	**49**	**42**	**69**	**59**	**118**	**56.2**
Tautog	**66**	**56**	**51**	**44**	**117**	**59.4**
Winter Flounder	**6**	**60**	**4**	**40**	**10**	**83.3**
Total	291	34.4	556	65.6	710	49.6

Western Catch						
Species	Kept	%	Released	%	Total	% Statewide Catch
Black Sea Bass	**25**	**66**	**13**	**34**	**38**	**29.7**
Bluefish	**52**	**52**	**48**	**48**	**100**	**57.8**
Catfish	0	0	0	0	0	0
Dogfish	0	0	17	100	17	100
False Albacore	0	0	0	0	0	0
Menhaden	2	100	0	0	2	13.3
Scup	**132**	**63**	**79**	**37**	**211**	**66.8**
Sea Robin	0	0	25	100	25	80.6
Skate	0	0	0	0	0	0
Striped Bass	**32**	**21**	**123**	**79**	**155**	**51.3**
Summer Flounder	**41**	**45**	**51**	**55**	**92**	**43.8**
Tautog	**31**	**39**	**49**	**61**	**80**	**40.6**
Winter Flounder	**0**	**0**	**2**	**100**	**2**	**16.7**
Total	315	44	407	56	722	50.4

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



JOB 2: VOLUNTEER ANGLER SURVEY

VOLUNTEER ANGLER SURVEY

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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) began in 1979 with the primary purpose of supplementing 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 and in 1997, length data for other marine finfish were added.

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 in a logbook (Appendix 2.1). The logbook contains fields in which to record 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 are 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, 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. The 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 agency web site (www.ct.gov/deep/fishing) has helped increase volunteer participation. The guide is distributed to all anglers who purchase a Connecticut fishing license and is also circulated by bait and tackle shops and other entities.

RESULTS AND DISCUSSION

In 2016, a total of 32 anglers participated in the program, recording 827 trips for an average of 26 trips each. Fewer VAS anglers 28% (9) entered their own data through the eLogbook application on the ACCSP website (www.accsp.org) in 2016 than 2015 (22 anglers), which was the second year of the eLogbook program. Most of the anglers that entered their own data expressed favorable comments toward the SAFIS eLogbook.

The private boat mode comprised the most trips (54%) recorded, followed by shore based trips (44%), see Job 3 for description of regular and enhanced shore sites. Of the total, 79% of the recorded trips were successful in catching fish. VAS anglers recorded catching 27 species including near shore species to open ocean pelagic species. This included seven principal recreational species currently under fisheries management plans which comprised 81% of the total catch. With the exception of several bait species and a few pelagic species, the release rate for nearly all species was 71% or greater.

VAS participants measured over 94% of their total catch (12,010 fish) and 97% of the seven principal species they caught (9,752 total). These data show a wide range in the release rate of the principal species. For example, 71% of scup caught were released while 83% of summer flounder caught were released. For bluefish, which has no minimum legal size, the release rate was 79%. See Figure 3.1 through Figure– 3.7 for length frequency information on the 2016 VAS harvest and catch & release data.

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 for 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 Program, P.O. Box 719, Old Lyme CT 06371.

MODIFICATIONS

None.

ACKNOWLEDGEMENTS

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

Table 2.1. Distribution of fishing trips by VAS anglers.

MODE	TRIPS	PERCENT
Private Boat	449	54.3%
Shore (Regular)	273	33.0%
Shore (Enhanced)	89	10.8%
Charter	4	0.5%
Party	12	1.4%
All Modes	827	

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

	Harvested		Released		Total
Species	Number	%	Number	%	Number
American Eel	8	89%	1	11%	9
American Shad	3	100%	0		3
Atlantic Cod	5	17%	24	83%	29
Atlantic Herring	15	100%	0		15
Atlantic Menhaden	535	87%	80	13%	615
Black Sea Bass	476	21%	1775	79%	2251
Blue Shark	0		2	100%	2
Bluefin Tuna	1	100%	0		1
Bluefish	234	21%	875	79%	1109
Chub Mackerel	23	100%	0		23
Cunner	0		12	100%	12
Dogfish	0		146	100%	146
Gray Triggerfish	1	100%	0		1
Hickory Shad	72	46%	84	54%	156
Little Tunny	1	6%	16	94%	17
Mako Shark	3	75%	1	25%	4
Scup	792	29%	1916	71%	2708
Sea Robin	7	1%	1068	99%	1075
Skate	3	3%	103	97%	106
Skipjack Tuna	6	38%	10	62%	16
Spot	0		1	100%	1
Striped Bass	71	3%	1990	97%	2061
Summer Flounder	228	17%	1134	83%	1362
Tautog	58	26%	166	74%	224
Weakfish	4	15%	22	85%	26
Winter Flounder	1	3%	36	97%	37
Yellowfin Tuna	1	100%	0		1
Total	**2468**	**21.6%**	**8964**	**78.4%**	**12010**

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

Species	Harvest		Release		Total
	Number	%	Number	%	Number
Black Sea Bass	476	21.1%	1,775	78.9%	2,251
Bluefish	234	21.1%	875	78.9%	1,109
Scup	792	29.2%	1,916	70.8%	2,708
Striped Bass	71	3.4%	1,990	96.6%	2,061
Summer Flounder	228	16.7%	1134	83.3%	1,362
Tautog	58	25.9%	166	74.1%	224
Winter Flounder	1	2.7%	36	97.3%	37
Total	**1,860**	**19.1%**	**7,892**	**80.9%**	**9,752**

Figure 3.1. Length frequency of Summer Flounder caught by disposition.

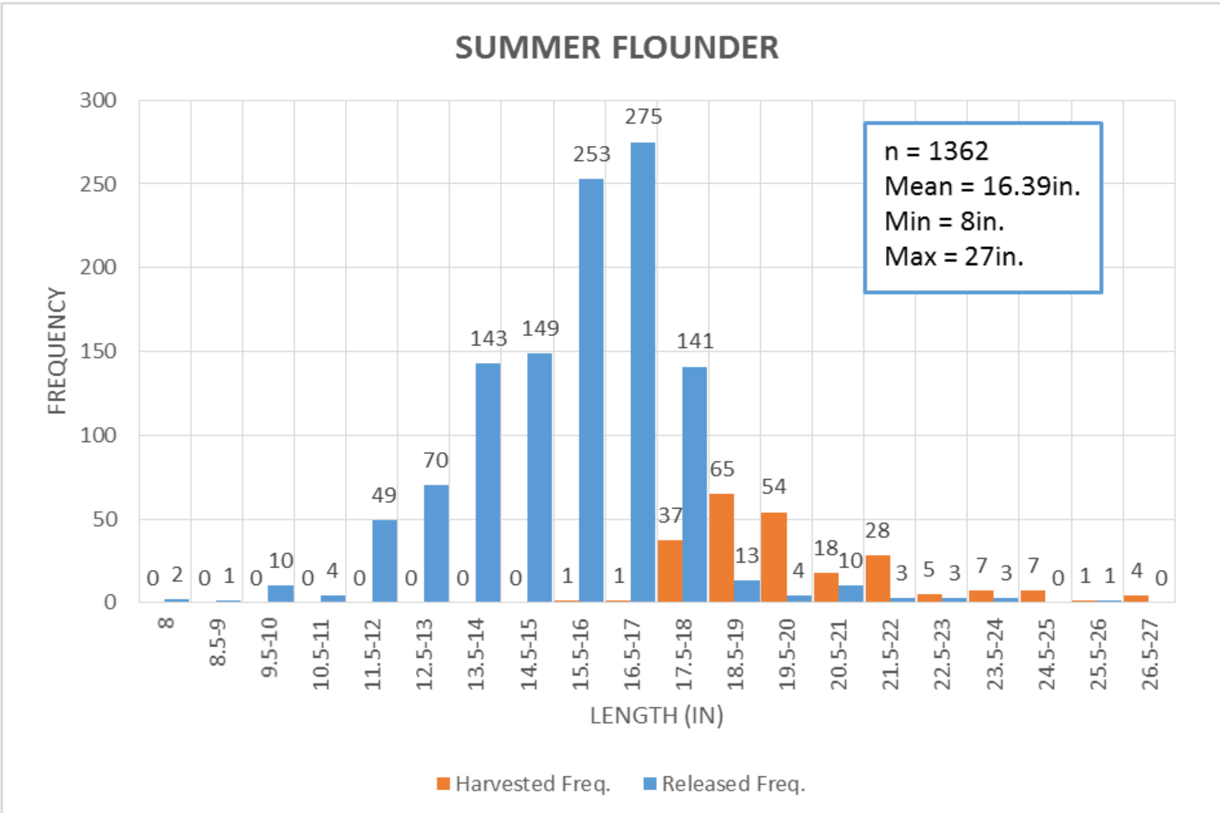


Figure 3.2. Length frequency of Striped Bass caught by disposition.

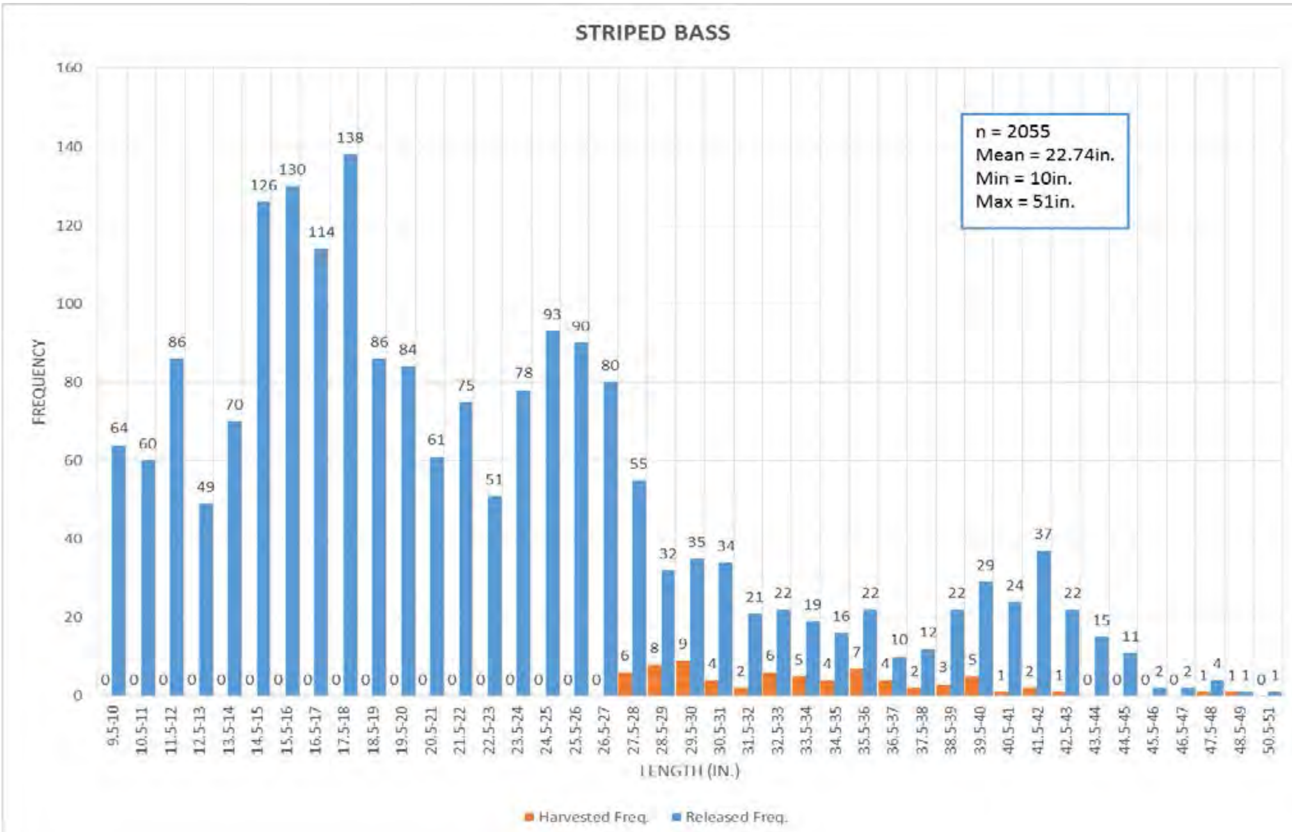


Figure 3.3 Length Frequency of Bluefish Caught by disposition.

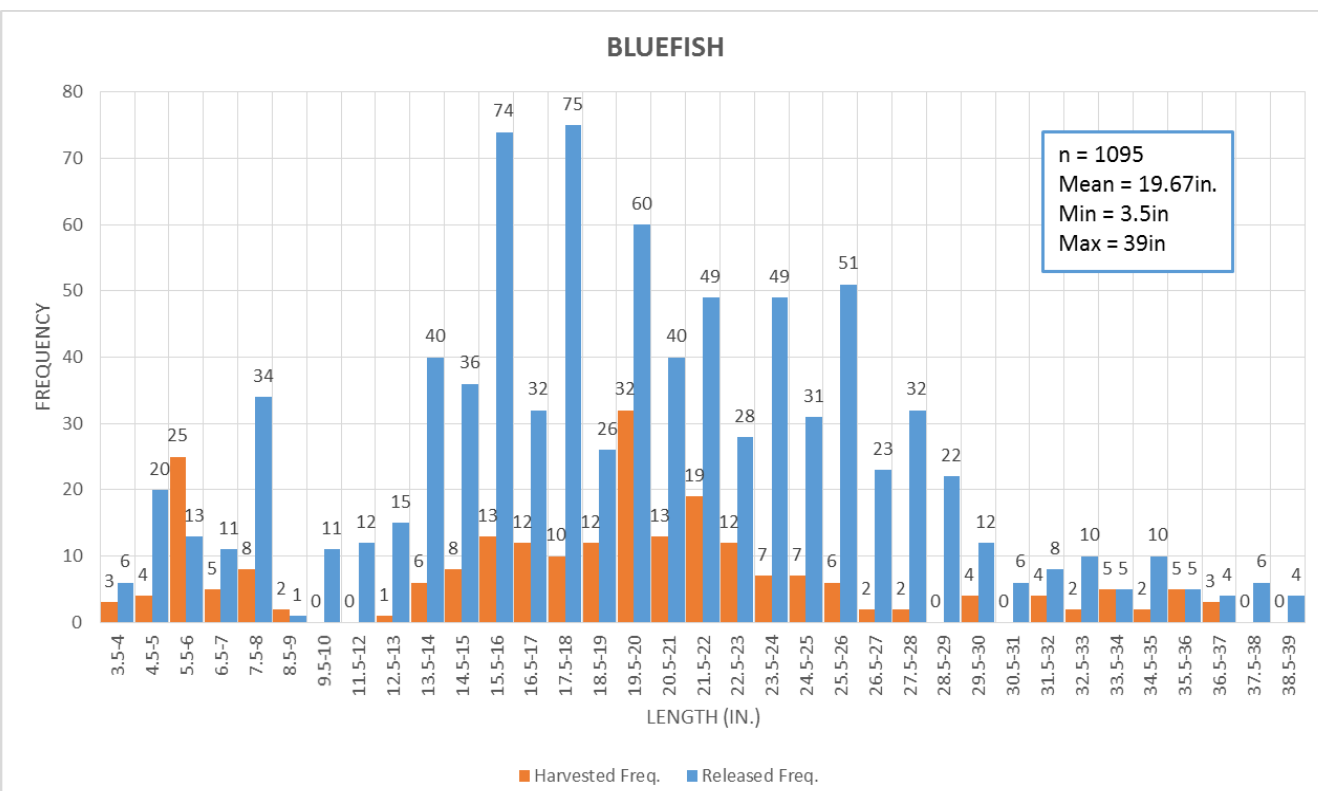


Figure 3.4 Length Frequency of Black Sea Bass caught by disposition.

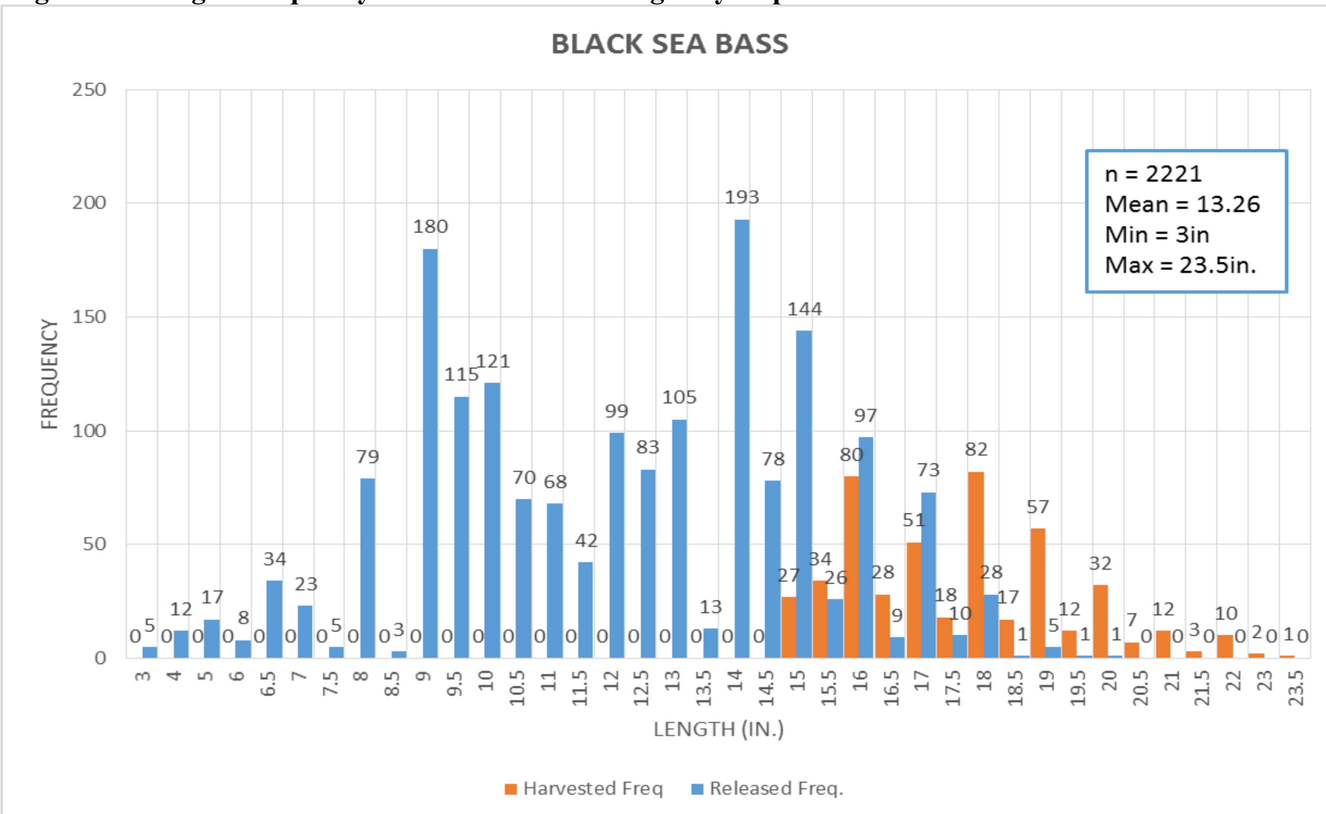


Figure 3.5 Length Frequency of Scup caught by disposition.

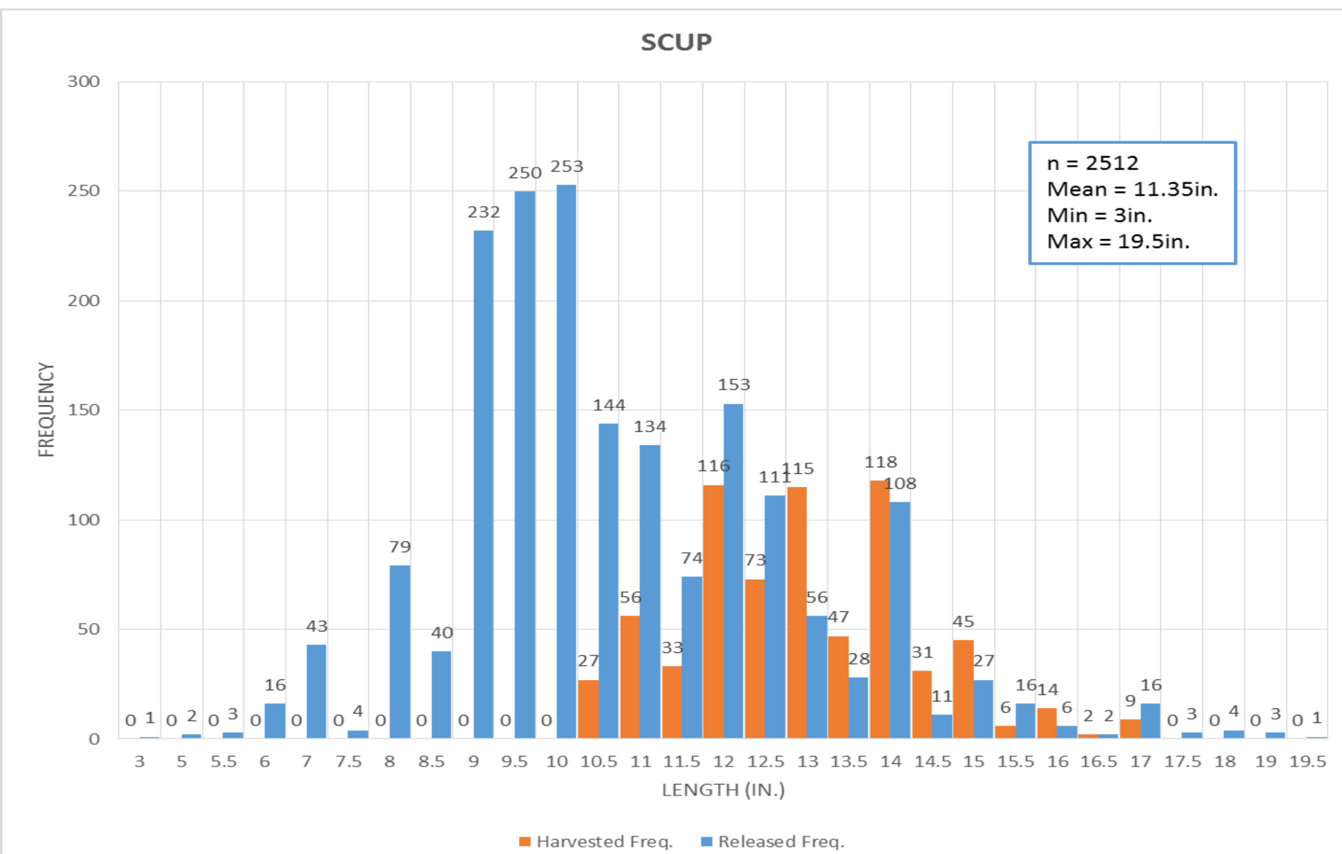


Figure 3.6 Length Frequency of Tautog caught by disposition.

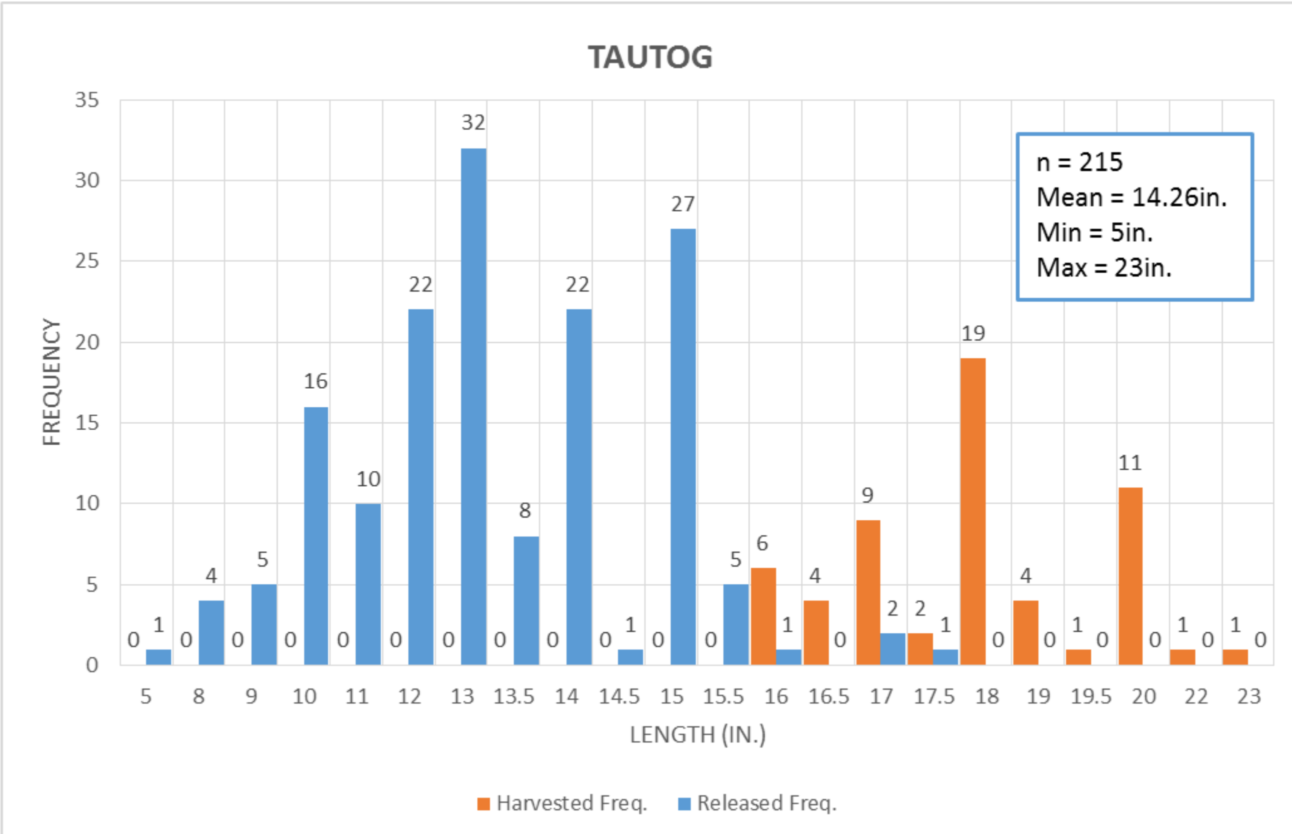
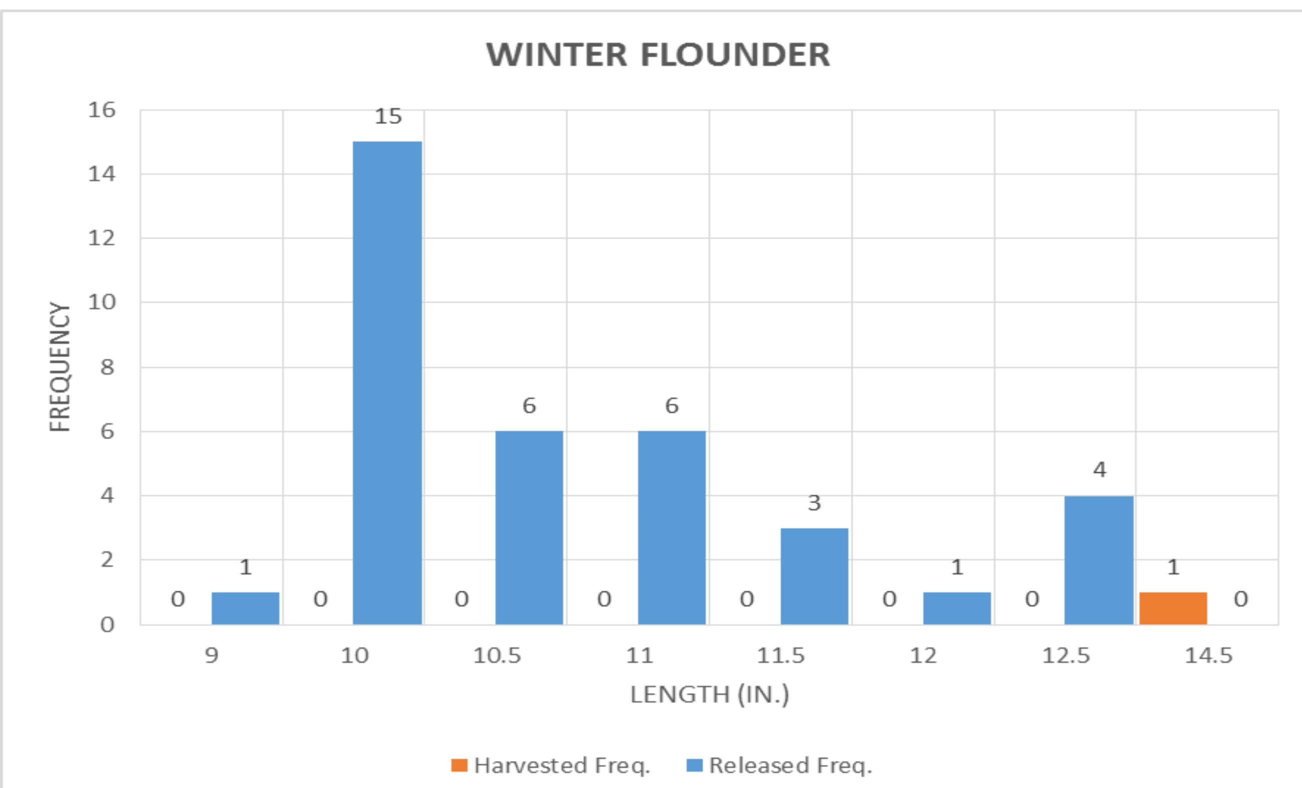


Figure 3.7 Length Frequency of Winter Flounder by disposition.



APPENDIX 2.1. Connecticut Volunteer Angler Logbook

TAPE

CONNECTICUT MARINE VOLUNTEER ANGLER SURVEY

Rev.4/2017 – 12 Trip

Angler Code | | | | | | |

This space for office use only.

Logged ______

Entered ______

Checked ______

TAPE

Send Me ☐ *More Logbooks*

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 make critical important 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
David R Molnar david.molnar@ct.gov or at 860 447-4334

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.

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 through 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

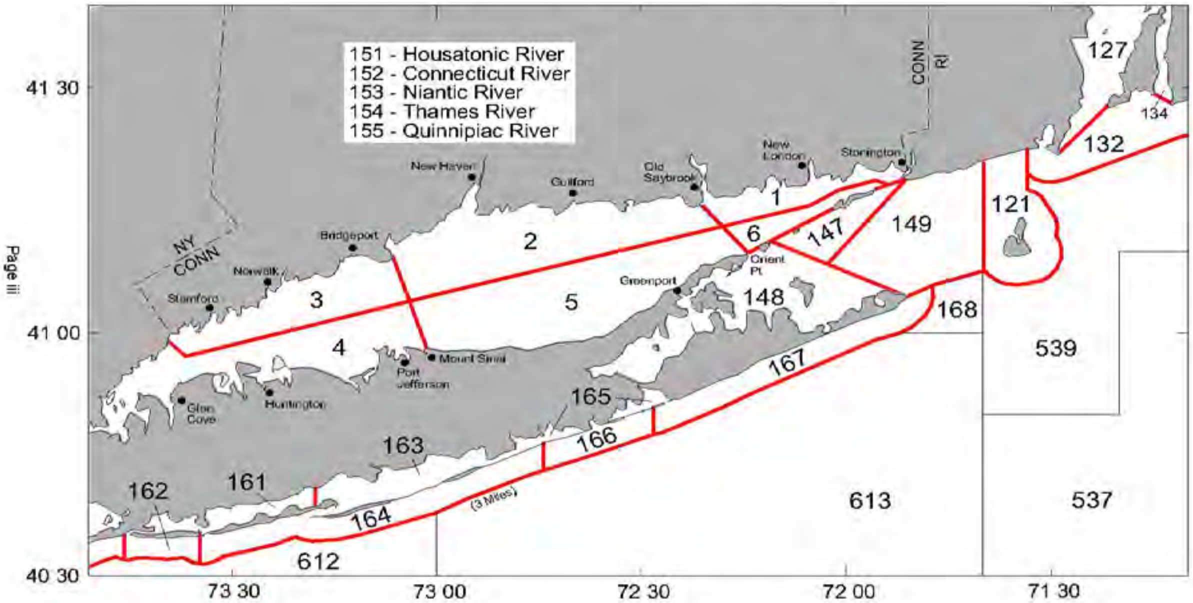
ALB - Albacore tuna
BET - Big eye tuna
BFT - Bluefin tuna
BON - Bonito
LTNY - Little tunny
SKJ - Skipjack
YFT - Yellowfin tuna
DOL - Dolphin fish / mahi-mahi
WAH - Wahoo

Sharks and Skates

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

Page iii

Long Island Sound and Vicinity Fishing Area Chart



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
		.	
		.	
		.	
		.	
		.	
		.	
		.	
		.	
		.	
		.	
		.	
		.	
		.	
		.	

Comments/Observations:____________________________

JOB 3: ENHANCED OPPORTUNITY SHORE FISHING PROGRAM

JOB 3: ENHANCED OPPORTUNITY SHORE FISHING PROGRAM

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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. To meet this need, the agency designated shore based fishing sites (see Appendix 8.1) which allowed for less restrictive fishing regulations. Anglers fishing from designated enhanced opportunity shore fishing sites in 2016 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 the 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. In order to ensure that these less restrictive regulations meet the required conservation of the fishery management plan, The Atlantic States Marine Fisheries Commission (ASMFC) Summer Flounder, Scup and Black Sea Bass Management Board requested that DEEP monitor of the enhanced shore fishing sites to provide additional catch information.

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 the 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 for sampling were established comprising a total of 39 of the 46 Enhanced Shore Fishing 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 with a waterproof daily catch card, pencil, measuring tape, and verbal instructions 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 that were distributed to shore anglers were categorized by identification number, date, and enhanced shore fishing site code. From May through December 2016 there were a total of 76 assignments (Table 3.1) attributed to500 sites sampled (Table 3.2) in four zones. The largest number of intercepts and interviews occurred in June (Table 3.3).

A total of 874 catch cards were distributed to anglers at enhanced shore fishing sites and 308 (35%) were returned. The reported catch included 18 species/taxonomic groups totaling 1,014 fish (Table 3.4) similar to the total for partial trip interviews as described in methods. The majority of the fish (71%) were released due to regulatory discard or undesirable catch. The total harvest reported was 297 fish comprised of 11 species.

Length Information

Each individual angler reported the common name(s) of the first seven fish captured, regardless of species and size. A total of 515 fish measurements by anglers and 409 fish measurements by agents were received, comprising 20 species (Table 3.5). Scup, sea robin, bluefish and striped bass were the most frequently harvested species measured by anglers (Figure 3.1), and comprised 69% of the total measured catch.

Enhanced shore fishing

Although sample sizes are small, data gathered from this program indicate that having a minimum length of 9 inches at the Enhanced Sites improved the success rate for shore based scup anglers by 45% compared to anglers complying with the previously higher legal minimum length of 10 inches required at other shore locations. This increase is a near doubling of the 21% recorded in 2014, which was the first year of the program. Shore-based summer flounder anglers improved their success rate by 66% compared to anglers complying with legal minimum length requirements, similar to the 29% increase recorded in 2014. The success rates for each species were calculated using the length frequencies of kept fish from the returned catch cards. Specifically, the proportion of scup harvested between 9 and 10 inches and the proportion of summer flounder harvested between 16 and 18 inches.

MODIFICATIONS

No modifications are expected.

Table 3.1: Assignments by month and zone.

Month	Zone1	Zone2	Zone3	Zone4	Total
May	4	4	4	1	**13**
June	4	4	5	2	**15**
July	3	2	1	3	**9**
August	2	3	2	2	**9**
September	2	3	2	1	**8**
October	5	4	3	3	**15**
November	2	2	1	1	**6**
December	0	0	0	1	**1**
Total	**22**	**22**	**18**	**14**	**76**

Table 3.2: Sites visited by month and zone.

MONTH	Zone1	zone2	zone3	zone4	total
MAY	24	32	24	6	**86**
JUNE	24	32	30	12	**98**
JULY	18	16	6	18	**58**
AUG	12	24	12	12	**60**
SEPT	12	24	12	6	**54**
OCT	30	32	18	18	**98**
NOV	12	16	6	6	**40**
DEC	0	0	0	6	**6**
TOTAL	**132**	**176**	**108**	**84**	**500**

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

Month	Intercepts (parties)	Anglers Interviewed
MAY	78	118
JUN	151	219
JUL	90	129
AUG	120	168
SEP	65	82
OCT	88	122
NOV	27	38
DEC	1	1
Total	**620**	**877**

Table 3.4: Catch disposition from Enhanced Shore Fishing Sites.

	RETURNED CREEL CARDS			PARTIAL INTERVIEW		
SPECIES	**RELEASE**	**KEPT**	**TOTAL**	**RELEASE**	**KEPT**	**TOTAL**
ATLANTIC MENHADEN	0	26	26	7	55	62
BLACK SEA BASS	32	3	35	33	0	33
BLUEFISH	67	61	128	38	60	98
CATFISHES	1	8	9	1	8	9
CLEARNOSE SKATE				1	0	1
CUNNER				1	0	1
DOGFISH UNC	2	0	2	2	0	2
HICKORY SHAD	75	16	91	17	12	29
NORTHERN KINGFISH	1	0	1	0	1	1
SCUP	205	157	362	112	236	348
SEA ROBINS UNC	148	6	154	151	13	164
SKATES UNC	2	0	2	1	0	1
SPOTTED HAKE	1	0	1			
STRIPED BASS	102	4	106	26	3	29
STRIPED SEA ROBIN	8	1	9	14	3	17
SUMMER FLOUNDER	44	9	53	57	7	64
TAUTOG	23	6	29	37	3	40
WEAKFISH	4	0	4	1	0	1
WINTER FLOUNDER	1	0	1			
NORTHERN PUFFER	1	0	1	3	0	3
COMBINED TOTAL	**717**	**297**	**1014**	**502**	**401**	**903**
PERCENT OF TOTAL	**71%**	**29%**		**55%**	**45%**	

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

SPECIES	MEASURED BY ANGLER	MEASURED BY AGENT	TOTAL LENGTHS
ATLANTIC MENHADEN	14	31	45
BLACK SEA BASS	18	6	24
BLUEFISH	74	59	133
CATFISHES	9	8	17
CUNNER		1	1
CLEARNOSE SKATE		1	1
DOGFISH	2		2
HICKORY SHAD	28	8	36
NORTHERN KINGFISH	1	1	2
SCUP	129	229	358
SEA ROBIN UNC	94	18	112
SKATE UNC	2		2
SPOTTED HAKE	1		1
STRIPED BASS	58	8	66
STRIPED SEA ROBIN	9	17	26
SUMMER FLOUNDER	45	16	61
TAUTOG	26	5	31
WEAKFISH	4	1	5
WINTER FLOUNDER	1		1
NORTHERN PUFFER	0		0
COMBINED TOTAL	**515**	**409**	**924**

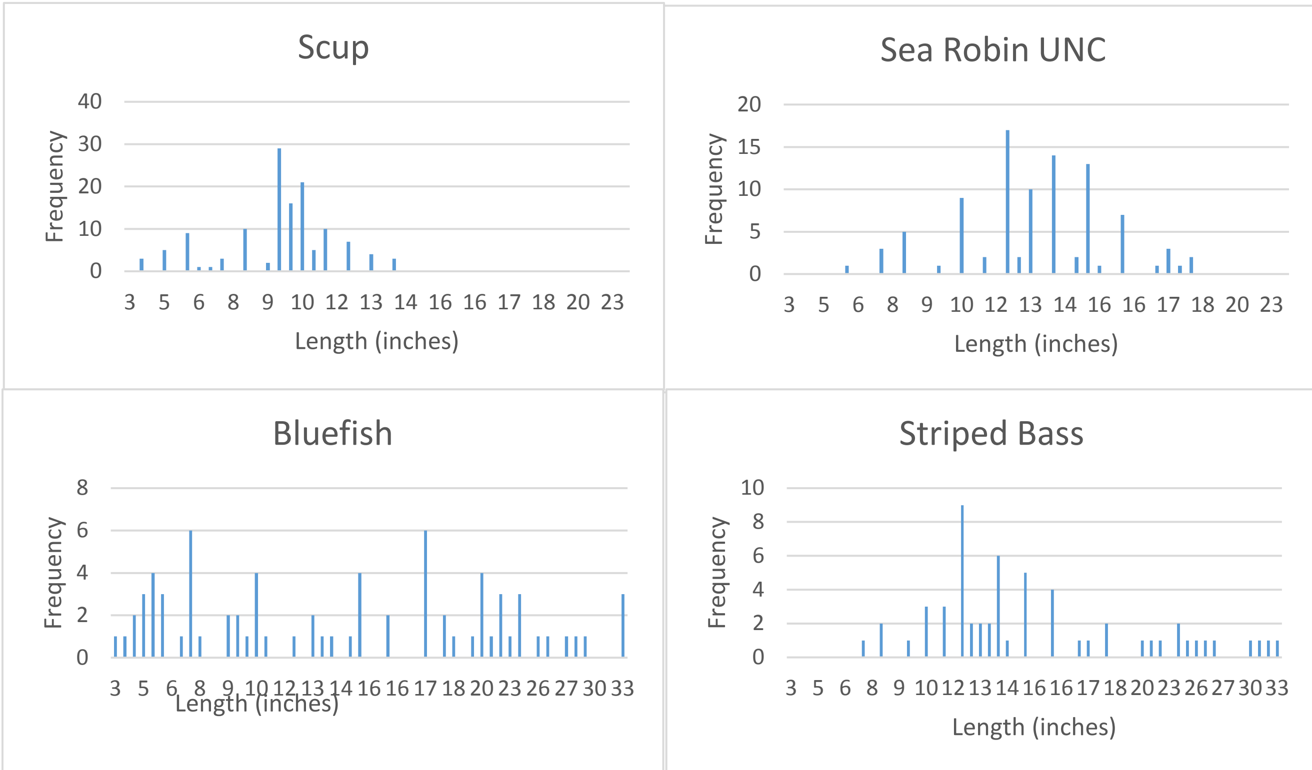
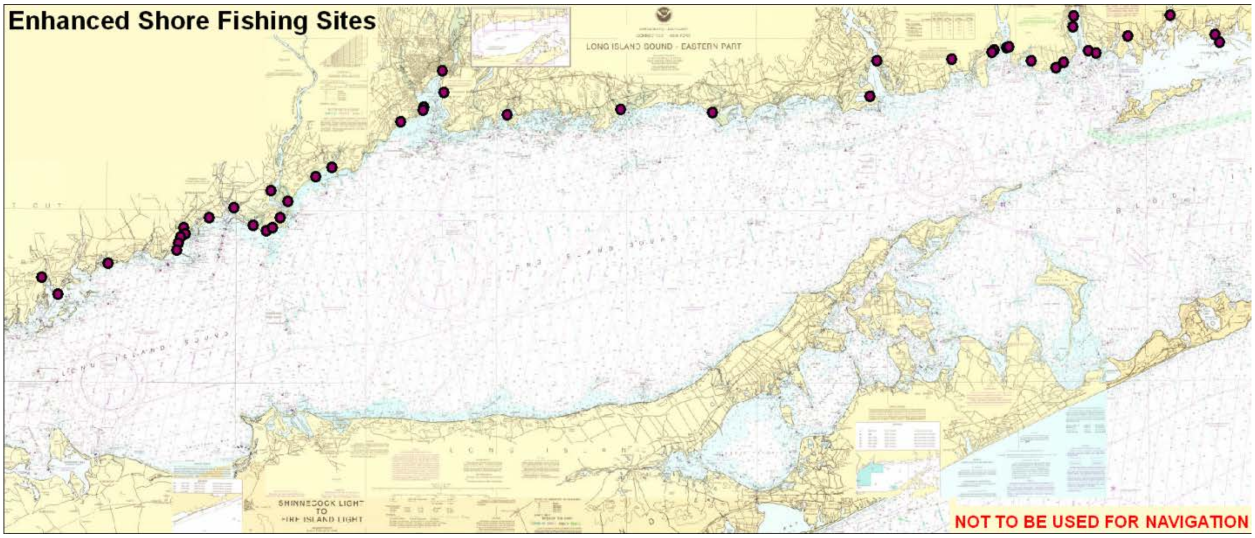
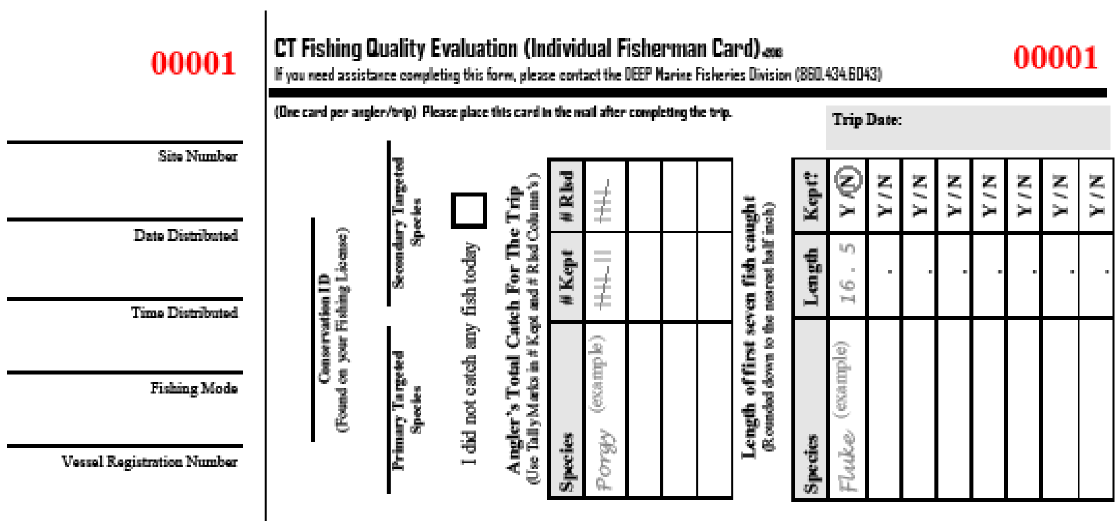


Figure 3.1: Length frequencies of popular marine fish measured at Enhanced Shore Fishing Sites. Total length is rounded down to the nearest half-inch.

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)

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

00001

(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 Columns)

Species	# Kept	# Rlsd
Porgy (example)	HHH II	HHH

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

Appendix 3.3: List of Enhanced Shore Fishing Sites

SITE	CITY
FAIRFIELD COUNTY	
Pleasure Beach Family Fishing Pier	Bridgeport
Saint Mary's by the Sea	Bridgeport
Seaside Park	Bridgeport
Ash Creek Open Space	Fairfield
Jennings Beach	Fairfield
Penfield Beach	Fairfield
Penfield Reef	Fairfield
Calf Pasture Beach	Norwalk
Maritime Aquarium Park	Norwalk
Bond's Dock	Stratford
Long Beach	Stratford
Point-No-Point	Stratford
Russian Beach	Stratford
Short Beach Park	Stratford
Sherwood Island State Park	Westport
MIDDLESEX COUNTY	
South Cove Causeway	Old Saybrook
Saybrook Point	Old Saybrook
NEW HAVEN COUNTY	
Branford Point	Branford
Chaffinch Island Park	Guilford
Hammonasset Beach State Park	Madison
Connecticut Audubon Coastal Center	Milford
Gulf Beach	Milford
Silver Sands State Park	Milford
Tomlinson Bridge Fishing Pier	New Haven
Fort Nathan Hale Park	New Haven
Criscuolo Park	New Haven
Bradley Point Park	West Haven
Sandy Point	West Haven
Sandy Point Bird Sanctuary	West Haven
NEW LONDON COUNTY	
Cini Memorial Park	East Lyme
Hole-in-the-Wall Beach	East Lyme
McCook Park	East Lyme
Rocky Neck State Park	East Lyme
Bluff Point State Park and Reserve	Groton
Eastern Point Beach	Groton
UCONN-Avery Point	Groton
City Pier and Waterfront Park	New London
Fort Trumbull State Park	New London
DEEP Marine Headquarters-Ferry Landing Park	Old Lyme
Mystic River Park	Stonington
Stonington Point	Stonington
Stonington Town Dock Fishing Pier	Stonington
Harkness Memorial State Park	Waterford
Mago Point Park	Waterford
Waterford Beach Park	Waterford

JOB 5: MARINE FINFISH SURVEY

Long Island Sound Trawl Survey

LONG ISLAND SOUND TRAWL SURVEY

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JOB 5: LONG ISLAND SOUND TRAWL SURVEY (LISTS)

CRUISE RESULTS FROM THE 2016 SPRING AND FALL SURVEYS

STUDY PERIOD AND AREA

The Connecticut DEEP Marine Fisheries Program completed the thirty-third year of the Long Island Sound Trawl Survey in 2016. The Long Island Sound Trawl Survey (LISTS) 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 (LIS) is surveyed in the spring, from April through June, and during the fall, from September through October. This report includes results from the 2016 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

1) Provide 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) Provide length-frequency distributions of bluefish, scup, summer flounder, winter flounder, tautog, striped bass, weakfish, black sea bass, and other ecologically important species.
3) Provide annual total counts and biomass for all finfish species taken and annual total biomass for all common macro-invertebrate species taken.
4) Provide species list for LIS based on LISTS sampling, noting the presence of additional species from other sampling conducted by the Marine Fisheries Programs.
5) Provide fishery independent survey data to cooperative state researchers or agencies, such as the National Marine Fisheries Service (NMFS), Atlantic States Marine Fisheries Commission (ASMFC), New England and Mid-Atlantic Fishery Management Councils (NEFMC and MAFMC, respectively), 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 (LIS). A stratified-random design based on bottom type and depth interval was chosen and 40 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, at various times during the time-series, age structures were collected from bluefish, menhaden, tautog, scup, winter flounder, weakfish or summer flounder. 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 fishery resources.

METHODS

Sampling Design

LISTS is conducted from longitude 72° 03' (New London, Connecticut) to longitude 73° 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 mesh 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, Gottschall et al. 2000). Discrete stratum areas smaller than a sample site are not sampled.

Sampling Procedures

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

The survey's otter trawl was 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 was placed onto a sorting table and sorted by species. Finfish, lobsters and squid were 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 were 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 were recorded to the centimeter as either total length or fork length (e.g. measurements from 100 mm to 109 mm were recorded as 10 cm) and entered in the database as 105 mm (Table 5.3). Lobsters were measured to 0.1 mm carapace length. Squid were measured using the mantle length (cm), horseshoe crab measurements were taken using prosomal width (cm) and whelk (knobbed and channeled) shell widths were measured in millimeters.

The number of individuals measured from each tow varied by species, the size of the catch and range of lengths (Table 5.3). If a species was subsampled, the length frequency of the catch was determined by multiplying the proportion of measured individuals in each centimeter interval by the total number of individuals caught. Some species were sorted and subsampled by length group so that, for example, all large individuals were measured and a subsample of small (often young-of-year) specimens was measured. All individuals not measured in a length group were counted. The length frequency of each group was estimated as described above, i.e. the proportion of individuals in each centimeter interval of the subsample was expanded to determine the total number of individuals caught in the length group. The estimated length frequencies of each size group were then appended to complete the length frequency for that species. This procedure was often used with catches of bluefish, scup, and weakfish, which were 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 were 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). However, bluefish catches are hard to predict so the number of age samples varied greatly; sometimes more than the target number was collected solely from LISTS samples but other times LISTS samples needed to be augmented with samples from the recreational fishery to meet the target number. Sufficient numbers of bluefish age samples from LIS would also make it possible to develop an LIS-specific age key, so bluefish age samples were sometimes still collected even after the target number was reached. Subsamples of scup, stratified by length group, were measured to the nearest mm (fork length) and scales from each individual were taken for ageing.

Scup scales were removed posterior to the pectoral fin and ventral to the lateral line. The scales were pressed onto plastic laminate with an Ann Arbor roller press to obtain an impression of the scale, which was then viewed with a microfiche reader at 21x. Scales were also taken from all summer flounder greater than 59 cm. At least 15 scales were removed from the caudal peduncle area. These scales were pressed and aged to supplement the NMFS age key and were also included in the formulation of LISTS summer flounder catch-at-age matrix (see below). Subsamples of winter flounder, stratified by length group and area (as listed in bottom of Table 5.3), were iced and taken to the lab where they were measured to the millimeter (total length), weighed (gm) and sexed. Their maturity stage was determined (NMFS 1989), and otoliths were collected for age determination later. Amendment 2 of the ASMFC Atlantic menhaden Fishery Management Plan introduced a requirement of 10 fish for age samples per 300 metric tons landed in the commercial bait fishery to support improved stock assessments. Connecticut has such a small menhaden commercial fishery that one 10-fish sample would suffice. The same size/age component of the menhaden population taken in the commercial fishery was available to LISTS so menhaden scales were collected during LISTS sampling; 216 menhaden age samples were taken in 2016. LISTS age samples of menhaden provide one of the few fishery independent sources of age data for adult menhaden in northern waters and are therefore valuable for stock assessments. Menhaden fork length (mm), and sex were recorded and scales were taken about mid-body (lateral line) and below the insertion of the dorsal fin. The ASMFC Tautog Fishery Management Plan (FMP) requires CT DEEP to collect a minimum of 200 age structures per. Due to the low numbers of tautog caught in LISTS in recent years (less than 250 fish), age structures were collected from most tautog taken in LISTS. Tautog were iced and taken to the lab, where their total length (mm), sex, and total weight (gm) were recorded and age structures were collected. LISTS has used opercula to age tautog since 1984 (Cooper 1967). The ASMFC Tautog Technical Committee requested that states collect paired age structures for comparison studies; therefore, LISTS began collecting tautog otoliths in addition to opercula in 2012. Results from an ASMFC Tautog Ageing Workshop in May 2012 indicated there was no clear benefit to switching from opercula to otoliths for Connecticut, so otoliths were collected (minimum of 50 paired structures per ASMFC) and archived for potential use in the future. Subsequent to the 2012 workshop, a study conducted by Massachusetts Division of Marine Fisheries (Elzey and Trull 2016) showed tautog pelvic fin spine sections may be a better structure (easier to read and non-lethal to collect). In 2016, LISTS started to collect pelvic fin spines for tautog, archiving them for future ageing work.

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 Greater Atlantic Regional Fisheries Office (GARFO) Protected Species Division. Sampling procedures have been modified in recent years to minimize the likelihood of injury to Atlantic sturgeon (a Federally listed 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 27 m, 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). Twelve (12) Atlantic sturgeon were captured on eight (8) of the 196 tows completed in 2016. No other protected species were encountered. 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) was calculated for the common finfish and invertebrate species. To calculate the geometric mean, the numbers and weight per tow were logged ($\log_e$) to normalize the highly skewed catch frequencies typical of trawl surveys:

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

Means were 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 - 2016 for 38 finfish species, lobster, and long-finned squid (1986 - 2016). 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 in the time-series (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 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 had been converted to age, the proportion at age was 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 by using observed modes in the LISTS length frequencies 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 330 bluefish, nine (9) from the spring period and 321 from the fall period. Of the samples taken in the spring, one was obtained from a demonstration tow not conducted as part of the LIS Trawl Survey. The majority of the fall samples were obtained from LISTS (213 fish), but a significant number were also collected from headboat (108 racks). In 2012 a coast wide biological sampling program was initiated through ASMFC Addendum 1 of the bluefish management plan. Since there are only five 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 calculating a geometric mean catch per tow for each group (Table 5.22) was continued through 2016. Comparison of the mean lengths-at-age reported for young-of-year and age 1 bluefish in the New York Bight (Chiarella and Conover 1990) and LIS (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 1 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**. Scales from 832 scup were collected in 2016; 447 from the spring cruise and 385 from the fall cruise. An index-at-age matrix was developed for 1984-2016 using spring

(May-June only) and fall (September-October) LISTS data (Table 5.23). April data was omitted since very few scup are taken during the month. A total of 14,471 scup aged between 1984 and 2016 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. Indices-at-age were computed for both spring and fall each year. 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 2016 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. As in 2015, LISTS staff decided to also collect representative scale samples from smaller fluke in 2016 in the effort to eventually create an LIS-specific age-key. 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 2016, 282 summer flounder were aged: 166 from the spring (10 > 59cm) and 116 from the fall (6 > 59cm). 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).

- **Tautog**. An index-at-age matrix was developed for 1984-2015 using all survey months (Gottschall and Pacileo 2007) (Table 5.27). During 2016, age structures were collected from 276 tautog caught on LISTS: 231 collected in the spring and 45 collected in the fall. Ageing for 2006-2012 has been completed and preliminary ageing for 2013-2015 has been done. The index-at-age matrix will be updated for 2016 fish once the structures have been aged.

- **Weakfish**. Age 0 and age 1+ indices were calculated for both spring (1984 – 2016) and fall surveys (1984 – 2009, 2011 - 2016) (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 1984-2016 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. As 2016 age samples (n=525) have not been aged, a pooled key of the previous two years was used.

  Each flounder aged as described above was also assessed for maturity stage by sex following Burnett (1989). 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 15^0C (60^0F), tend to spawn at the lower end of their temperature tolerance range, and are more abundant north of Long Island Sound than south of New York. Species in the warm temperate group prefer warmer temperatures (11-22^0C or 50-77^0F), 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 or 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 scup, bluefish, and weakfish (Figure 5.16). 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 2016 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 14, 2016, and continued until April 27 for a total of nine (9) days underway and 26 tows completed. May sampling started on May 19 and continued until June 6 with twelve (12) sampling days underway and 40 sites completed. June sampling began on June 16 and ended on June 30, taking eleven (11) days underway to complete the 40 sites. The Fall Survey commenced on September 8 and needed twelve (12) days underway to complete 40 tows. The 40 sites for October were also completed in thirteen (13) days (from Oct 11 – Nov 1). Thus, a total of 196 LISTS tows were completed in 57 days underway during the spring and fall 2016 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 sample, 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 of tow time 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 2016 survey is summarized in Table 5.10.

Cooperative Sample and Data Collection

LISTS staff participate 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 2016, while Table 5.12 shows sample requests 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, Fisheries Division staff often have sample or data requests for media or other public outreach events (see Job 11 of this report).

Number of Species Identified

LISTS observed 55 finfish species in 2016 (Table 5.13). This included two new species for the survey: sand tiger shark (*Carcharias ta*urus) and bluntnose stingray (*Dasyatis say*). A female sand tiger shark (153.5 cm TL, 21.8 kg) was caught in October in the eastern sound, a few miles north of Mattituck, NY. The bluntnose stingray (51.5 cm TL, 0.6 kg) was also captured in October, about 3 miles south of Guilford, CT. From 1984 to 2016, LISTS has identified 111 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 39 types of invertebrates were collected in 2016 (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 (1984-2016) of the finfish species collected each year and their respective rank by numbers. Annual total biomass of invertebrates is also included in this appendix (1992-2016), ranked by weight (kg). A total of 277,166 finfish weighing 28,495 kg were sampled in 2016 (Table 5.15). In the spring of 2016, a total of 173,041 finfish weighing 18,025 kg were sampled and a total of 104,124 finfish weighing 10,469 kg were sampled in fall of 2016 (Table 5.16). A total of 1,126 kg of invertebrates were taken in 2016 (Table 5.15). The total biomass of invertebrate catch taken in the spring of 2016 was 458 kg while a total of 668 kg of invertebrates were taken in fall (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 - 2016	Table 5.30;
American shad	spring and fall	1989 - 2016	Table 5.31;
American lobster	spring and fall (M&F)	1984 - 2016	Table 5.32-Table 5.35;
Atlantic herring	spring and fall	1989 - 2016	Table 5.36;
Atlantic menhaden	spring and fall	1996 – 2016	Table 5.37;
black sea bass	spring and fall	1987 – 2016	Table 5.38, Table5.39

blueback herring	spring and fall	1989 - 2016	Table 5.40;
bluefish	spring and fall	1984 - 2016	Table 5.41, Table 5.42;
butterfish	spring and fall	1986 - 1990, 1992 - 2016	Table 5.43;
clearnose skate	spring and fall	1993 - 2016	Table 5.44, Table 5.45;
fourspot flounder	spring and fall	1989 - 1990, 1996 - 2016	Table 5.46;
hickory shad	spring and fall	1991 - 2016	Table 5.47;
horseshoe crab	spring and fall (M&F)	1998 - 2016	Table 5.48, Table 5.49;
long-finned squid	spring and fall	1986 - 1990, 1992 - 2016	Table 5.50, Table 5.51;
scup	spring and fall	1984 - 2016	Table 5.52, Table 5.53;
striped bass	spring and fall	1984 - 2016	Table 5.54, Table 5.55;
summer flounder	spring and fall	1984 - 2016	Table 5.56, Table 5.57;
tautog	spring and fall	1984 - 2016	Table 5.58, Table 5.59;
weakfish	spring and fall	1984 - 2016	Table 5.60, Table 5.61;
windowpane flounder	spring and fall	1989, 1990, 1994 - 2016	Table 5.62, Table 5.63;
winter flounder	April-May and fall	1984 - 2016	Table 5.64, Table 5.65;
winter skate	spring and fall	1995 - 2016	Table 5.66.

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 1984-2016 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). Bluefish and weakfish recruitment indices were calculated using modal analyses of the length frequencies. For each of the 38 finfish species, plots including catch per tow in numbers and biomass in kilograms are illustrated in Figures 5.8 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; 1992-2016), American lobster (1984-2016), horseshoe crab (1992-2016), and long-finned squid (1986-2016).

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. Summer flounder, scup and weakfish indices-at-age are calculated and presented separately for each season. Modal distributions were used to calculate recruitment indices for bluefish and weakfish. 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).

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 1984-2016 as an indicator of annual biological diversity or species richness. Trends in these indicators were tested for statistical significance by regression analysis. Results (Figure 5.18) show that the average number of warm temperate species captured/tow in spring and fall cruises has increased ($F=32.2$ and 86.7 respectively, $p<0.0001$); while the average number of cold temperate species has decreased, especially in spring ($F=52.5$, $p<0.0001$) but also in fall cruises ($F=20.2$, $p<0.0001$).

MODIFICATIONS

An analysis of the 30+ year time series of LISTS catch at age data for winter flounder will be conducted during the next project segment to determine how project resources will be allocated with respect to winter flounder ageing. Although winter flounder otoliths were collected in 2016 using the standard procedures outlined in the Methods, ageing of the structures was not completed for this project year due to work force limitations. Given expected further attrition in staffing levels, Project staff have begun looking at whether or not to continue the labor-intensive process of collecting, processing and ageing 400-900 winter flounder otoliths each year given the other demands upon Project resources. One alternative course of action may be to reduce the number of winter flounder ageing samples collected and/or processed. Another option may be to use a LISTS time-series pooled age key to assign ages to winter flounder lengths. Additional options may be to obtain age keys from neighboring states or use a regional key as is done for other species (such as summer flounder). Since winter flounder abundance in Long Island Sound has been decreasing for some time now (more than a decade), there is no longer a substantial recreational (or commercial) fishery for it; therefore, Project resources may need to be allocated differently in the future.

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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 2016.
In addition to the species listed below, other rarely occurring species (totaling less than 30 fish/year each) were measured. During 2016, twenty-seven 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
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.
	otoliths or pelvic fin rays	collected from minimum 50 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**	**2016**
April	-	-	35	40	40	40	40	45*	-	40	40	40	40	40	40	40	40	40	40	40	40	40	-	40	40	40	40	12	40	40	40	40	36
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	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	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	41**	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	40
November	29	40	40	40	40	40	40	-	-	-	-	-	-	-	-	-	-	-	-	40	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**200**	**246**	**316**	**320**	**320**	**320**	**297**	**205**	**160**	**240**	**240**	**200**	**200**	**200**	**200**	**200**	**201**	**200**	**200**	**200**	**199**	**200**	**120**	**200**	**160**	**200**	**78**	**172**	**200**	**200**	**199**	**200**	**196**

Table 5.5. Station information for LISTS April 2016.

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)
SP2016001	4/14/2016	1434	S	1	15:04	30	41.2327	-72.3929	7.8	23.3	7.1	26.3	2.9	1.4406	0.0073
SP2016002	4/15/2016	1436	T	4	7:34	12	41.2332	-72.2950	7.1	26.8	6.7	28.4	2.9	0.5790	0.0029
SP2016003	4/15/2016	1437	T	4	8:44	30	41.2286	-72.2910	7.2	24.7	6.7	28.4	3.4	1.6751	0.0085
SP2016004	4/15/2016	1738	T	2	10:32	30	41.2877	-72.1508	7.3	28.0	7.1	28.3	2.6	1.3058	0.0066
SP2016005	4/15/2016	1133	S	4	12:54	28	41.2018	-72.3411	7.5	26.4	6.8	27.8	0.9	0.3976	0.0020
SP2016006	4/18/2016	528	S	3	8:39	30	41.0971	-72.5421	7.4	27.1	7.5	27.1	2.8	1.4024	0.0071
SP2016007	4/18/2016	427	T	3	10:57	30	41.0882	-72.6027	7.6	27.1	7.5	27.1	2.3	1.1515	0.0058
SP2016008	4/18/2016	424	M	4	13:13	30	41.0788	-72.7585	9.9	26.9	6.9	27.1	2.5	1.2412	0.0063
SP2016009	4/18/2016	1024	T	3	15:00	30	41.1748	-72.7729	9.7	26.7	7.6	27.0	3.3	1.6596	0.0084
SP2016010	4/19/2016	1328	T	2	8:17	30	41.2385	-72.5753	7.7	26.5	7.6	26.9	3.8	1.8865	0.0095
SP2016011	4/19/2016	1127	T	3	9:28	30	41.1808	-72.6602	7.6	26.8	7.3	27.1	2.4	1.1986	0.0061
SP2016012	4/19/2016	1428	T	1	11:02	30	41.2367	-72.6375	7.9	26.6	7.7	26.7	3.3	1.6488	0.0083
SP2016013	4/19/2016	1427	T	1	12:03	30	41.2543	-72.5817	8.3	25.8	7.9	26.7	2.6	1.2844	0.0065
SP2016014	4/19/2016	1323	M	2	13:52	30	41.2303	-72.7968	9.4	26.7	8.9	26.8	2.5	1.2628	0.0064
SP2016015	4/20/2016	917	T	2	7:53	28	41.1552	-73.0633	9.2	26.4	7.8	26.7	2.6	1.1989	0.0061
SP2016016	4/20/2016	714	T	1	9:07	30	41.1323	-73.1349	8.9	26.2	8.8	26.3	3.3	1.6570	0.0084
SP2016017	4/20/2016	1118	M	1	10:39	30	41.1692	-73.0281	9.3	26.3	8.6	26.5	0.9	0.4483	0.0023
SP2016018	4/20/2016	1319	M	1	11:52	30	41.2032	-73.0439	10.0	26.2	8.5	26.6	3.2	1.6186	0.0082
SP2016019	4/20/2016	1121	M	2	13:01	30	41.1816	-72.9421	9.5	26.5	8.5	26.9	3.3	1.6410	0.0083
SP2016020	4/20/2016	624	T	4	14:34	30	41.1107	-72.7983	9.1	27.0	7.1	27.1	3.2	1.6193	0.0082
SP2016021	4/20/2016	1124	T	2	16:06	30	41.1910	-72.7920	9.4	26.7	7.8	27.0	2.3	1.1380	0.0058
SP2016022	4/21/2016	830	S	4	8:23	30	41.1638	-72.4998	7.7	27.2	7.5	27.4	3.6	1.8153	0.0092
SP2016023	4/21/2016	129	S	2	9:53	30	41.0290	-72.5623	9.2	26.9	9.0	27.0	3.4	1.7158	0.0087
SP2016024	4/21/2016	5824	S	1	11:36	30	40.9818	-72.6561	9.5	26.7	8.9	26.8	3.0	1.5174	0.0077
SP2016025	4/21/2016	5921	M	3	12:57	30	40.9955	-72.8123	9.4	26.6	7.3	27.1	2.8	1.3824	0.0070
SP2016026	4/21/2016	5918	M	3	14:16	30	40.9988	-72.9686	10.0	26.7	8.0	26.8	2.4	1.1817	0.0060
SP2016027	4/22/2016	720	M	3	8:10	30	41.0995	-72.9698	10.2	26.7	7.6	26.9	2.6	1.2815	0.0065
SP2016028	4/22/2016	220	M	4	10:02	30	41.0362	-72.9736	10.2	26.4	7.2	27.1	2.5	1.2638	0.0064
SP2016029	4/22/2016	120	M	4	11:15	30	41.0295	-72.9052	9.6	26.8	7.2	27.1	2.8	1.4228	0.0072
SP2016030	4/25/2016	515	M	2	8:25	30	41.0933	-73.1301	9.9	25.9	8.6	26.6	3.3	1.6683	0.0084
SP2016031	4/25/2016	210	T	2	10:07	30	41.0492	-73.3183	10.6	26.1	8.0	26.6	3.5	1.7540	0.0089
SP2016032	4/25/2016	5709	S	2	11:33	22	40.9483	-73.4058	12.6	26.1	10.8	26.3	3.4	1.2540	0.0063
SP2016033	4/25/2016	10	T	4	13:23	30	41.0023	-73.3703	11.1	26.2	7.8	26.6	2.8	1.4218	0.0072
SP2016034	4/27/2016	5714	T	3	9:00	30	40.9658	-73.1743	9.2	26.4	8.6	26.6	3.1	1.5473	0.0078
SP2016035	4/27/2016	5811	M	3	10:20	30	40.9810	-73.2953	10.3	26.3	8.3	26.6	3.3	1.6421	0.0083
SP2016036	4/27/2016	11	M	4	11:49	30	41.0062	-73.3496	10.4	26.3	8.4	26.5	2.3	1.1483	0.0058

Table 5.6. Station information for LISTS May 2016.

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)
SP2016037	5/19/2016	1533	S	1	13:11	30	41.2518	-72.3738	11.6	26.4	11.2	27.0	3.8	1.8957	0.0096
SP2016038	5/19/2016	1738	T	2	16:50	30	41.2850	-72.1971	11.4	28.5	10.9	28.8	2.8	1.4004	0.0071
SP2016039	5/20/2016	1433	S	2	9:41	30	41.2477	-72.3548	11.1	27.2	10.9	28.1	3.5	1.7282	0.0087
SP2016040	5/20/2016	1432	S	2	11:11	30	41.2335	-72.3990	11.5	26.9	10.9	28.1	2.6	1.3225	0.0067
SP2016041	5/20/2016	1336	T	4	13:08	30	41.2221	-72.2483	11.7	27.4	10.3	29.3	1.8	0.9072	0.0046
SP2016042	5/23/2016	931	S	4	8:14	30	41.1593	-72.4490	11.7	27.5	11.2	27.9	3.6	1.8098	0.0091
SP2016043	5/23/2016	330	S	1	12:13	30	41.0508	-72.5176	13.4	26.5	13.0	26.6	3.1	1.5502	0.0078
SP2016044	5/23/2016	428	S	3	14:23	30	41.0721	-72.6331	13.2	26.5	11.7	27.0	3.3	1.6517	0.0083
SP2016045	5/24/2016	629	S	4	8:40	30	41.1128	-72.5015	13.7	26.6	11.8	27.4	3.4	1.7047	0.0086
SP2016046	5/24/2016	531	T	3	10:25	30	41.0836	-72.5106	13.9	26.6	12.0	27.2	2.3	1.1547	0.0058
SP2016047	5/24/2016	227	T	3	13:00	30	41.0390	-72.6445	13.8	26.4	11.9	26.8	2.9	1.4413	0.0073
SP2016048	5/24/2016	328	T	3	14:44	30	41.0533	-72.6321	14.4	26.5	12.1	27.0	3.3	1.6680	0.0084
SP2016049	5/25/2016	926	T	4	9:38	30	41.1633	-72.6324	13.7	26.4	11.5	27.1	3.5	1.7728	0.0090
SP2016050	5/25/2016	625	T	4	11:27	30	41.1010	-72.7506	14.1	26.4	11.2	26.9	2.6	1.3213	0.0067
SP2016051	5/25/2016	825	T	4	13:24	30	41.1363	-72.7670	14.4	26.5	11.4	27.1	3.0	1.5116	0.0076
SP2016052	5/26/2016	528	S	3	8:39	30	41.0985	-72.5466	14.4	26.2	12.2	27.1	3.0	1.4808	0.0075
SP2016053	5/26/2016	24	M	3	11:21	30	41.0053	-72.7490	15.0	26.3	11.6	26.9	3.6	1.8240	0.0092
SP2016054	5/26/2016	122	M	4	12:50	30	41.0278	-72.8178	15.3	26.4	10.9	27.1	3.2	1.6189	0.0082
SP2016055	5/26/2016	621	M	3	14:28	30	41.0992	-72.9063	14.8	26.5	11.5	27.1	0.4	0.2167	0.0011
SP2016056	5/27/2016	1118	M	1	7:54	30	41.1805	-73.0516	15.9	26.3	12.5	26.4	3.4	1.7145	0.0087
SP2016057	5/27/2016	1320	M	1	9:32	30	41.2318	-72.9563	15.1	26.2	13.6	26.5	3.5	1.7426	0.0088
SP2016058	5/27/2016	1220	T	1	10:32	30	41.2105	-72.9543	14.8	26.4	11.7	26.5	3.2	1.5821	0.0080
SP2016059	5/27/2016	922	M	3	11:51	30	41.1661	-72.8488	16.1	26.7	12.0	27.1	3.0	1.5160	0.0077
SP2016060	5/31/2016	1427	T	1	13:28	30	41.2481	-72.6068	14.7	27.4	14.0	27.6	3.5	1.7320	0.0088
SP2016061	5/31/2016	1223	M	2	15:04	22	41.2122	-72.7952	19.6	26.7	12.9	27.0	3.5	1.2833	0.0065
SP2016062	6/1/2016	513	M	2	8:54	30	41.0975	-73.2138	15.2	25.6	12.5	26.5	3.2	1.6205	0.0082
SP2016063	6/1/2016	511	M	2	11:35	22	41.1005	-73.2708	18.4	25.5	12.1	26.4	3.2	1.1817	0.0060
SP2016064	6/1/2016	311	T	2	13:06	12	41.0560	-73.3053	19.2	25.5	11.7	26.4	3.3	0.6500	0.0033
SP2016065	6/1/2016	110	T	3	14:03	23	41.0250	-73.3568	14.7	26.1	12.4	26.6	3.3	1.2486	0.0063
SP2016066	6/2/2016	313	M	3	8:55	30	41.0598	-73.2067	16.0	26.3	11.7	26.7	3.5	1.7502	0.0088
SP2016067	6/2/2016	11	M	4	10:40	30	41.0173	-73.2955	16.9	26.2	11.2	26.9	3.0	1.5070	0.0076
SP2016068	6/2/2016	5613	T	2	13:11	30	40.9492	-73.1930	15.3	26.2	12.1	26.5	3.1	1.5351	0.0078
SP2016069	6/2/2016	5614	T	2	15:00	30	40.9408	-73.1833	14.9	26.3	12.6	26.4	3.4	1.7087	0.0086
SP2016070	6/3/2016	114	M	4	9:21	30	41.0120	-73.2116	16.4	26.3	11.3	26.9	3.0	1.4981	0.0076
SP2016071	6/3/2016	14	M	4	11:28	30	40.9988	-73.1832	15.8	26.4	11.3	14.7	3.3	1.6715	0.0084
SP2016072	6/3/2016	18	M	3	13:49	30	41.0105	-73.0165	15.3	26.5	11.6	27.1	2.8	1.4016	0.0071
SP2016073	6/3/2016	119	M	4	15:28	30	41.0185	-73.0172	15.7	26.5	12.3	26.9	2.7	1.3618	0.0069
SP2016074	6/6/2016	818	T	2	8:43	30	41.1497	-73.0055	18.0	26.7	13.1	26.9	3.6	1.7844	0.0090
SP2016075	6/6/2016	715	T	1	10:26	21	41.1197	-73.1800	17.7	25.8	15.2	26.5	3.0	1.0512	0.0053
SP2016076	6/6/2016	517	T	3	12:03	30	41.0963	-73.0783	18.2	26.8	17.1	26.9	3.2	1.5974	0.0081

Table 5.7. Station information for LISTS June 2016.

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)
SP2016077	6/16/2016	1738	T	2	8:12	30	41.2877	-72.1608	15.3	29.5	14.5	30.0	3.3	1.6284	0.0082
SP2016078	6/16/2016	1737	T	1	10:11	30	41.2906	-72.1963	15.6	29.4	15.4	29.6	3.2	1.5794	0.0080
SP2016079	6/16/2016	1235	T	4	12:59	30	41.2137	-72.2678	16.5	27.9	14.5	29.9	2.1	1.0739	0.0054
SP2016080	6/16/2016	831	S	4	15:32	30	41.1432	-72.4443	16.9	27.8	15.2	28.9	3.0	1.5240	0.0077
SP2016081	6/17/2016	929	S	3	8:23	30	41.1640	-72.5288	15.6	28.6	15.5	28.6	3.2	1.6152	0.0082
SP2016082	6/17/2016	1028	T	4	10:20	30	41.1668	-72.6212	17.5	27.1	16.0	28.2	3.1	1.5731	0.0079
SP2016083	6/17/2016	1428	T	1	13:30	30	41.2378	-72.6285	17.0	27.8	16.6	28.1	3.9	1.9341	0.0098
SP2016084	6/20/2016	630	S	4	8:17	30	41.1080	-72.4935	18.8	26.9	16.3	28.3	3.3	1.6376	0.0083
SP2016085	6/20/2016	430	T	3	10:33	30	41.0755	-72.5192	19.0	26.9	16.5	28.1	2.5	1.2558	0.0063
SP2016086	6/20/2016	128	T	2	13:16	30	41.0230	-72.6196	19.5	26.8	16.6	27.7	3.5	1.7706	0.0089
SP2016087	6/21/2016	530	S	3	8:29	30	41.0953	-72.5067	19.7	26.7	16.5	28.2	3.3	1.6358	0.0083
SP2016088	6/21/2016	326	T	3	10:07	30	41.0652	-72.6686	19.5	26.7	17.7	16.4	3.5	1.7550	0.0089
SP2016089	6/21/2016	125	T	4	11:44	30	41.0190	-72.6924	19.6	26.7	15.5	27.2	3.2	1.6147	0.0082
SP2016090	6/21/2016	325	T	3	13:11	30	41.0548	-72.7592	19.9	26.6	16.1	27.7	3.3	1.6465	0.0083
SP2016091	6/21/2016	1128	T	3	15:01	30	41.1825	-72.6378	20.7	27.2	16.8	28.2	3.7	1.8634	0.0094
SP2016092	6/22/2016	1025	T	3	8:47	30	41.1763	-72.7090	20.5	26.9	16.4	28.1	3.6	1.8192	0.0092
SP2016093	6/22/2016	222	M	4	11:25	30	41.0433	-72.8353	19.4	26.9	15.7	27.8	3.3	1.6584	0.0084
SP2016094	6/22/2016	21	M	3	13:22	30	41.0008	-72.9221	19.7	26.7	15.6	27.3	3.3	1.6465	0.0083
SP2016095	6/23/2016	511	M	2	9:06	30	41.1006	-73.2648	19.3	26.1	15.5	26.3	3.4	1.6931	0.0086
SP2016096	6/23/2016	7	M	3	11:04	30	41.0172	-73.4578	18.5	26.2	15.6	26.4	3.5	1.7325	0.0088
SP2016097	6/23/2016	5709	S	2	13:01	30	40.9550	-73.4059	18.6	26.1	16.6	26.2	2.8	1.4166	0.0072
SP2016098	6/23/2016	10	T	4	15:01	30	41.0006	-73.3721	19.3	26.3	15.1	26.5	3.1	1.5577	0.0079
SP2016099	6/24/2016	1118	M	1	7:51	30	41.1918	-73.0138	19.5	26.6	18.6	26.6	3.3	1.6332	0.0083
SP2016100	6/24/2016	818	T	2	10:00	30	41.1556	-72.9944	19.5	26.4	15.6	26.6	3.4	1.7088	0.0086
SP2016101	6/24/2016	1120	T	2	12:19	30	41.1860	-72.9768	20.4	26.5	16.3	26.8	2.8	1.3961	0.0071
SP2016102	6/27/2016	5613	T	2	9:25	30	40.9496	-73.1923	19.3	26.3	16.1	26.6	2.9	1.4750	0.0075
SP2016103	6/27/2016	5513	S	2	11:09	30	40.9290	-73.2463	19.1	26.4	17.2	26.4	3.3	1.6328	0.0083
SP2016104	6/27/2016	314	M	3	13:16	30	41.0518	-73.2040	21.7	26.3	16.0	26.9	2.9	1.4538	0.0073
SP2016105	6/28/2016	719	M	3	8:24	30	41.1245	-72.9780	21.4	26.9	16.6	27.7	2.8	1.4208	0.0072
SP2016106	6/28/2016	319	M	4	10:16	30	41.0480	-73.0167	19.9	26.7	16.2	27.8	3.2	1.6245	0.0082
SP2016107	6/28/2016	120	M	4	11:51	30	41.0210	-72.9570	19.8	26.7	15.7	27.7	3.2	1.6120	0.0081
SP2016108	6/28/2016	422	M	4	13:30	24	41.0718	-72.8940	20.7	26.8	16.0	27.6	2.7	1.0996	0.0056
SP2016109	6/28/2016	622	M	4	14:44	30	41.0973	-72.8651	21.0	26.8	16.3	27.6	2.6	1.3059	0.0066
SP2016110	6/29/2016	1119	M	2	7:59	30	41.1885	-73.0056	20.7	27.1	17.3	27.2	3.5	1.7284	0.0087
SP2016111	6/29/2016	1425	M	1	10:19	30	41.2435	-72.7260	20.8	27.6	20.1	27.6	3.3	1.6492	0.0083
SP2016112	6/29/2016	1423	T	1	11:49	30	41.2390	-72.8115	21.5	27.4	20.4	27.5	3.1	1.5442	0.0078
SP2016113	6/29/2016	1022	M	2	13:36	30	41.1810	-72.8368	22.2	27.1	17.3	27.7	3.3	1.6658	0.0084
SP2016114	6/30/2016	5923	M	3	9:51	30	40.9916	-72.7900	21.0	26.6	16.1	27.3	3.4	1.7221	0.0087
SP2016115	6/30/2016	5823	S	1	11:40	30	40.9830	-72.8199	20.9	26.6	20.8	26.6	3.5	1.7397	0.0088
SP2016116	6/30/2016	5824	S	1	12:46	30	40.9793	-72.7361	21.2	26.7	20.8	26.7	3.3	1.6510	0.0083

Table 5.8. Station information for LISTS September 2016.
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)
FA2016001	9/8/2016	1837	T	1	11:23	30	41.2863	-72.1968	22.1	30.6	21.4	30.5	3.0	1.4987	0.0076
FA2016002	9/8/2016	1738	T	2	13:10	30	41.2843	-72.1851	23.2	30.5	21.6	30.4	2.6	1.3178	0.0067
FA2016003	9/8/2016	1434	S	1	15:23	30	41.2443	-72.3285	21.6	30.3	21.5	30.3	2.7	1.3708	0.0069
FA2016004	9/9/2016	931	S	4	8:30	30	41.1630	-72.4456	22.3	29.5	22.0	29.7	1.9	0.9495	0.0048
FA2016005	9/9/2016	428	S	3	10:36	30	41.0823	-72.5838	23.8	28.9	23.1	29.1	2.8	1.3786	0.0070
FA2016006	9/9/2016	128	T	2	12:20	30	41.0302	-72.5800	24.4	29.0	23.0	29.1	3.1	1.5297	0.0077
FA2016007	9/12/2016	327	T	3	9:27	30	41.0593	-72.6381	23.6	28.7	23.6	28.7	2.5	1.2485	0.0063
FA2016008	9/12/2016	324	M	4	11:13	30	41.0620	-72.7560	23.8	28.7	23.0	29.2	2.5	1.2567	0.0064
FA2016009	9/12/2016	5922	M	3	13:12	30	40.9953	-72.8423	24.0	28.4	23.5	28.5	2.8	1.4003	0.0071
FA2016010	9/12/2016	5824	S	1	10:28	30	40.9818	-72.7936	24.4	28.5	23.6	28.5	2.7	1.3489	0.0068
FA2016011	9/14/2016	830	S	4	11:21	30	41.1466	-72.4925	22.4	29.6	21.9	29.9	1.8	0.9221	0.0047
FA2016012	9/15/2016	1534	T	1	8:13	30	41.2607	-72.3553	21.5	29.1	21.5	30.3	2.2	1.1023	0.0056
FA2016013	9/15/2016	1029	S	3	10:58	30	41.1713	-73.5371	22.1	29.7	22.0	29.7	2.3	1.1387	0.0058
FA2016014	9/15/2016	426	T	3	12:52	30	41.0778	-72.6415	23.4	28.8	23.2	28.9	2.3	1.1655	0.0059
FA2016015	9/15/2016	725	T	4	14:55	30	41.1240	-72.7131	23.7	28.8	23.0	29.1	2.5	1.2411	0.0063
FA2016016	9/20/2016	1028	T	4	8:57	30	41.1748	-72.5806	22.9	28.8	22.7	29.2	3.4	1.6893	0.0085
FA2016017	9/20/2016	925	T	4	11:03	30	41.1643	-72.7261	23.2	28.6	22.8	29.1	2.6	1.2955	0.0065
FA2016018	9/20/2016	623	M	4	13:32	30	41.1110	-72.7998	23.6	28.8	22.9	29.0	3.3	1.6345	0.0083
FA2016019	9/21/2016	1228	T	3	8:57	30	41.2132	-72.5473	22.6	29.2	22.4	29.3	2.8	1.4016	0.0071
FA2016020	9/21/2016	1126	T	3	11:12	30	41.1977	-72.6682	23.0	29.0	22.8	29.1	3.7	1.8723	0.0095
FA2016021	9/21/2016	819	T	2	13:44	26	41.1373	-73.0113	23.6	28.5	23.1	28.6	2.6	1.1236	0.0057
FA2016022	9/22/2016	522	M	4	9:17	30	41.1027	-72.8338	23.0	28.6	22.9	29.0	2.8	1.4134	0.0071
FA2016023	9/22/2016	320	M	4	11:08	30	41.0595	-72.9291	23.6	28.7	23.0	28.9	2.9	1.4317	0.0072
FA2016024	9/22/2016	417	T	3	12:50	30	41.0868	-73.0186	23.8	28.6	23.1	28.8	3.7	1.8412	0.0093
FA2016025	9/22/2016	917	T	2	14:51	30	41.1490	-73.0947	23.7	28.4	23.2	28.3	2.9	1.4414	0.0073
FA2016026	9/23/2016	615	M	2	8:35	30	41.1046	-73.1443	23.1	28.3	23.1	28.3	2.5	1.2639	0.0064
FA2016027	9/23/2016	214	M	3	10:23	30	41.0490	-73.1628	23.4	28.5	23.1	28.7	2.9	1.4388	0.0073
FA2016028	9/23/2016	111	M	3	12:11	23	41.0413	-73.2576	23.6	28.4	23.2	28.6	3.0	1.1310	0.0057
FA2016029	9/23/2016	313	M	3	13:47	30	41.0468	-73.2617	23.7	28.4	23.2	28.6	2.6	1.3230	0.0067
FA2016030	9/26/2016	612	M	1	9:21	30	41.1077	-73.2646	21.8	28.4	21.4	28.3	3.1	1.5263	0.0077
FA2016031	9/26/2016	511	M	2	11:02	30	41.1035	-73.2565	22.0	28.4	21.5	28.4	2.8	1.4200	0.0072
FA2016032	9/26/2016	7	M	3	13:02	30	41.0193	-73.4486	22.9	28.3	22.7	28.4	2.8	1.3828	0.0070
FA2016033	9/26/2016	5709	S	2	15:17	30	40.9486	-73.4091	22.6	28.1	22.5	28.2	2.8	1.4088	0.0071
FA2016034	9/27/2016	5713	T	2	10:02	30	40.9647	-73.2026	22.6	28.4	22.5	28.4	2.9	1.4390	0.0073
FA2016035	9/27/2016	5513	S	2	11:32	30	40.9301	-73.2458	22.2	28.2	22.1	28.2	3.1	1.5281	0.0077
FA2016036	9/27/2016	5914	M	4	13:32	30	40.9935	-73.1988	22.9	28.4	22.8	28.6	3.3	1.6327	0.0082
FA2016037	9/27/2016	15	T	4	16:01	20	41.0043	-73.1253	23.1	28.5	22.8	28.7	3.1	1.0292	0.0052
FA2016038	9/28/2016	1118	M	1	7:53	30	41.1772	-73.0582	21.5	28.5	21.5	28.4	2.5	1.2322	0.0062
FA2016039	9/28/2016	1223	M	2	10:16	30	41.2013	-72.8428	21.9	28.7	21.9	28.7	2.7	1.3382	0.0068
FA2016040	9/28/2016	1428	T	1	12:31	30	41.2358	-72.6346	21.6	29.2	21.6	29.2	3.5	1.7351	0.0088

Table 5.9. Station information for LISTS October 2016.

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)
FA2016041	10/11/2016	1840	T	1	16:31	23	41.3220	-72.0840	17.8	29.1	18.0	30.8	3.2	1.2083	0.0061
FA2016042	10/12/2016	830	S	4	8:12	30	41.1473	-72.4851	19.1	29.8	19.2	29.8	3.1	1.5600	0.0079
FA2016043	10/12/2016	428	S	3	9:50	30	41.0825	-72.5726	19.4	29.3	19.4	29.3	2.4	1.1977	0.0061
FA2016044	10/12/2016	423	M	4	11:54	30	41.0853	-72.7825	20.0	29.0	19.7	29.1	2.6	1.2842	0.0065
FA2016045	10/12/2016	323	M	4	13:29	30	41.0610	-72.8468	20.1	28.9	19.8	29.1	3.2	1.6015	0.0081
FA2016046	10/13/2016	629	S	4	8:50	30	41.1147	-72.4951	19.2	29.6	19.2	29.6	2.8	1.4106	0.0071
FA2016047	10/13/2016	5824	S	1	11:28	30	40.9743	-72.7493	19.3	29.0	19.1	29.0	2.8	1.3935	0.0070
FA2016048	10/13/2016	5924	M	3	12:45	30	40.9882	-72.7943	19.2	28.9	19.3	29.1	3.6	1.7887	0.0090
FA2016049	10/13/2016	327	T	3	15:14	30	41.0635	-72.6203	19.7	29.2	19.2	29.3	2.7	1.3283	0.0067
FA2016050	10/14/2016	1434	S	1	7:45	30	41.2325	-72.3900	18.5	30.4	18.5	30.3	1.9	0.9690	0.0049
FA2016051	10/14/2016	1428	T	1	10:03	30	41.2491	-72.5706	18.4	29.4	18.5	29.3	2.8	1.4227	0.0072
FA2016052	10/14/2016	1425	M	1	11:37	26	41.2382	-72.7280	18.4	29.0	18.3	28.9	2.6	1.1254	0.0057
FA2016053	10/14/2016	1225	T	2	13:52	30	41.1946	-72.7780	19.1	28.9	19.0	28.9	3.8	1.9182	0.0097
FA2016054	10/17/2016	1128	T	3	8:56	30	41.1965	-72.5750	18.6	29.2	18.7	29.3	3.9	1.9467	0.0098
FA2016055	10/17/2016	624	T	4	11:33	30	41.1193	-72.7515	19.3	29.1	19.1	29.2	3.3	1.6439	0.0083
FA2016056	10/17/2016	825	T	4	13:41	30	41.1353	-72.7654	19.3	29.0	19.1	29.1	3.5	1.7280	0.0087
FA2016057	10/17/2016	1228	T	3	15:47	30	41.2018	-72.5991	18.6	29.1	18.5	29.3	3.9	1.9564	0.0099
FA2016058	10/18/2016	1127	T	3	8:39	30	41.1920	-72.6003	18.6	29.1	18.8	29.3	3.7	1.8570	0.0094
FA2016059	10/18/2016	725	T	4	11:27	30	41.1300	-72.6976	19.2	29.1	19.1	29.3	3.6	1.8030	0.0091
FA2016060	10/18/2016	627	S	3	13:46	30	41.0978	-72.6908	19.4	29.3	19.0	29.3	2.9	1.4352	0.0073
FA2016061	10/19/2016	926	T	4	9:56	30	41.1642	-72.6263	19.0	29.3	19.1	29.4	3.7	1.8661	0.0094
FA2016062	10/19/2016	21	M	3	12:22	30	41.0111	-72.8688	19.4	29.0	19.1	29.1	3.3	1.6425	0.0083
FA2016063	10/19/2016	217	M	4	14:34	30	41.0476	-73.0030	19.8	28.9	19.2	29.1	2.7	1.3738	0.0069
FA2016064	10/20/2016	1118	M	1	8:16	26	41.1983	-72.9981	18.4	28.5	18.3	28.5	3.0	1.2874	0.0065
FA2016065	10/20/2016	1018	T	2	9:50	30	41.1723	-72.9898	18.5	28.6	18.5	28.6	3.2	1.5819	0.0080
FA2016066	10/21/2016	110	T	3	9:40	30	41.0293	-73.3226	19.3	28.7	19.2	28.8	2.9	1.4568	0.0074
FA2016067	10/21/2016	5709	S	2	12:46	30	40.9515	-73.4103	18.9	28.2	18.8	28.4	3.3	1.6314	0.0082
FA2016068	10/24/2016	721	M	3	8:43	30	41.1223	-72.9353	17.6	28.8	17.8	28.8	3.2	1.5816	0.0080
FA2016069	10/24/2016	1121	M	2	10:43	21	41.1830	-72.9371	17.5	28.6	17.4	28.6	3.0	1.0444	0.0053
FA2016070	10/24/2016	919	T	2	12:26	30	41.1593	-72.9351	18.0	28.8	18.0	28.8	2.3	1.1694	0.0059
FA2016071	10/24/2016	1221	T	2	14:13	30	41.2200	-72.8671	16.9	28.5	16.9	28.5	2.7	1.3628	0.0069
FA2016072	10/24/2016	1220	T	1	15:39	30	41.2197	-72.9026	17.0	28.6	16.9	28.6	2.9	1.4518	0.0073
FA2016073	10/26/2016	12	M	4	9:40	30	41.0158	-73.2382	16.5	28.5	17.8	29.0	3.1	1.5375	0.0078
FA2016074	10/26/2016	5513	S	2	13:50	30	40.9290	-73.2441	16.3	28.4	16.1	28.4	2.9	1.4718	0.0074
FA2016075	10/26/2016	5613	T	2	15:12	30	40.9381	-73.2428	16.4	28.3	16.4	28.4	3.1	1.5523	0.0078
FA2016076	10/27/2016	315	M	3	8:52	30	41.0652	-73.1288	16.9	29.0	16.8	28.9	3.4	1.6816	0.0085
FA2016077	10/27/2016	5914	M	4	10:40	30	41.0021	-73.1695	16.9	28.9	17.2	29.0	3.0	1.5004	0.0076
FA2016078	10/27/2016	214	M	3	12:28	30	41.0511	-73.1645	16.9	29.0	17.1	29.0	2.8	1.3804	0.0070
FA2016079	11/1/2016	817	M	2	8:15	30	41.1400	-73.0438	15.0	28.8	15.1	28.7	3.7	1.8326	0.0093
FA2016080	11/1/2016	513	M	2	10:18	30	41.0890	-73.2545	15.9	28.9	15.9	28.9	2.5	1.2445	0.0063

Table 5.10. Samples with non-standard tow durations and reasons for incomplete tows, spring and fall 2016.
Standard LISTS tows begin with SP (spring) or FA (fall).

Sample	Date	Site	Bottom Type	Depth Interval	Time	Duration	Reason	Comments
APRIL								
SP2016002	4/15/2016	1436	T	4	7:34	12	ran out of room	obstructions up ahead
SP2016005	4/15/2016	1133	S	4	12:54	28	hang	trawl dug into side of sand dune during boost
SP2016015	4/20/2016	917	T	2	7:53	28	hang	lots of mud on door but no other sign of hang & no damage to net
SP2016032	4/25/2016	5709	S	2	11:33	22	pots	line of pots hooked on door; two tears in net
MAY								
SP2016061	5/31/2016	1223	M	2	15:04	22	speed drop	pot warp on door
SP2016063	6/1/2016	511	M	2	11:35	22	ran out of room	known wreck up ahead
SP2016064	6/1/2016	311	T	2	13:06	12	speed drop	pot on door; pot in wing
SP2016065	6/1/2016	110	T	3	14:03	23	speed drop	nothing on cables or in net
SP2016075	6/6/2016	715	T	1	10:26	21	speed drop	one ghost pot in net
JUNE								
SP2016108	6/28/2015	422	M	4	13:30	24	speed drop	nothing on cables or in net
SEPT								
FA2016021	9/21/2016	819	T	2	13:44	26	speed drop	nothing on cables or in net
FA2016028	9/23/2016	111	M	3	12:11	23	speed drop	string of old pot gear on starboard wing
FA2016037	9/27/2016	15	T	4	16:01	20	ran out of room	known pot hangs up ahead
OCT								
FA2016041	10/11/2016	1840	T	1	16:31	23	hang	strayed too far from tow path; tore up net
FA2016052	10/14/2016	1425	M	1	11:37	26	hang	large tear in port wing; had to switch nets
FA2016064	10/20/2016	1118	M	1	8:16	26	ran out of room	pots all around us
FA2016069	10/24/2016	1121	M	2	10:43	21	speed drop	string of pot gear on port wing; substantial damage to net

Table 5.11. Data requests by month.

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.

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 2016.
Fifty-five finfish species were observed in 2016. (Bold type indicates new species). Since 1984, one hundred-eleven 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	menhaden, Atlantic	Brevoortia tyrannus
anchovy, striped	Anchoa hepsetus	moonfish	Selene setapinnis
black sea bass	Centropristis striata	pinfish	Lagodon rhomboides
blue runner	Caranx crysos	pollock	Pollachius virens
bluefish	Pomatomus saltatrix	puffer, northern	Sphoeroides maculatus
butterfish	Peprilus triacanthus	**ray, bluntnose stingray**	**Dasyatis say**
cod, Atlantic	Gadus morhua	ray, roughtail stingray	Dasyatis centroura
cunner	Tautogolabrus adspersus	rockling, fourbeard	Enchelyopus cimbrius
cusk-eel, striped	Ophidion marginatum	scad, rough	Trachurus lathami
dogfish, smooth	Mustelus canis	scup	Stenotomus chrysops
dogfish, spiny	Squalus acanthias	sea raven	Hemitripterus americanus
flounder, fourspot	Paralichthys oblongus	searobin, northern	Prionotus carolinus
flounder, smallmouth	Etropus microstomus	searobin, striped	Prionotus evolans
flounder, summer	Paralichthys dentatus	sennet, northern	Sphyraena borealis
flounder, windowpane	Scophthalmus aquosus	shad, American	Alosa sapidissima
flounder, winter	Pseudopleuronectes american	shad, hickory	Alosa mediocris
goosefish	Lophius americanus	**shark, sand tiger**	**Carcharias**
haddock	Melanogrammus aeglefinus	silverside, Atlantic	Menidia menidia
hake, red	Urophycis chuss	skate, clearnose	Raja eglanteria
hake, silver	Merluccius bilinearis	skate, little	Leucoraja erinacea
hake, spotted	Urophycis regia	skate, winter	Leucoraja ocellata
herring, Atlantic	Clupea harengus	spot	Leiostomus xanthurus
herring, alewife	Alosa pseudoharengus	striped bass	Morone saxatilis
herring, blueback	Alosa aestivalis	sturgeon, Atlantic	Acipenser oxyrinchus
hogchoker	Trinectes maculatus	tautog	Tautoga onitis
jack, crevalle	Caranx hippos	toadfish, oyster	Opsanus tau
kingfish, northern	Menticirrhus saxatilis	weakfish	Cynoscion regalis
lizardfish, inshore	Synodus foetens		

Names taken from: Common and scientific names of fishes from the United States, Canada and Mexico, Sixth Edition (Nelson et al. 2004).

Table 5.14. List of invertebrates observed in 2016.
In 2016, thirty-nine 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.	lobster, American	Homarus americanus
anemones	anemomes spp.	mussel, blue	Mytilus edulis
arks	Noetia-Anadara spp.	northern moon snail	Lunatia heros
bryozoan, bushy	Phylum Bryozoa	oyster, common	Crassostrea virginica
clam, common razer	Ensis directus	polychaetes	Class polychfeta
clam, hard clams	Artica-Mercinaria-Pitar sp.	sea urchin, purple	Arbacia punctulata
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, Japanese shore	Hemigrapsus sanguineus	slipper shell, common	Crepidula fornicata
crab, blue	Callinectes sapidus	sponge spp.	sponge spp.
crab, flat claw hermit	Pagurus pollicaris	sponge, boring	Cliona celate
crab, horseshoe	Limulus polyphemus	sponge, red bearded	Microciona prolifera
crab, lady	Ovalipes ocellatus	squid, bobtail	Sepioid spp.
crab, rock	Cancer irroratus	squid, longfin inshore	Loligo pealeii
crab, spider	Libinia emarginata	starfish spp.	Asteriid spp.
hydroid spp.	hydroid spp.	tunicates, misc	misc. class ascidiacea
jelly, comb	Phylum Ctenophora	whelk, channeled	Busycotypus canaliculatus
jelly, water	Rhacostoma atlanticum	whelk, knobbed	Busycon carica
jellyfish, lion's mane	Cyanea capillata		

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 2016.
Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Young-of-year anchovies and Gadids are neither separated by species nor quantified; young-of-year Atlantic herring and American sand lance are not quantified. Number of tows (sample size) = 196.

species	count	%	weight	%
scup	175,632	63.4	16,006.2	56.2
butterfish	65,596	23.7	2,036.1	7.1
striped searobin	5,886	2.1	1,964.4	6.9
weakfish	4,689	1.7	297.6	1.0
northern searobin	3,178	1.1	452.1	1.6
alewife	2,811	1.0	132.0	0.5
bluefish	2,793	1.0	1,118.7	3.9
spotted hake	2,456	0.9	113.8	0.4
windowpane flounder	1,593	0.6	154.7	0.5
smooth dogfish	1,338	0.5	2,785.6	9.8
bay anchovy	1,239	0.4	8.7	0.0
black sea bass	1,181	0.4	823.4	2.9
winter flounder	1,108	0.4	261.0	0.9
fourspot flounder	1,056	0.4	175.3	0.6
American shad	944	0.3	46.2	0.2
silver hake	891	0.3	32.9	0.1
Atlantic menhaden	876	0.3	69.4	0.2
red hake	668	0.2	50.3	0.2
summer flounder	462	0.2	386.4	1.4
blueback herring	448	0.2	12.2	0.0
little skate	377	0.1	193.1	0.7
hogchoker	354	0.1	41.8	0.1
Atlantic herring	340	0.1	37.1	0.1
tautog	306	0.1	288.5	1.0
moonfish	265	0.1	5.2	0.0
striped bass	167	0.1	261.9	0.9
smallmouth flounder	148	0.1	4.2	0.0
clearnose skate	134	0.0	228.7	0.8
goosefish	70	0.0	23.3	0.1
northern kingfish	31	0.0	4.8	0.0
hickory shad	18	0.0	4.2	0.0
winter skate	17	0.0	31.6	0.1
blue runner	15	0.0	1.5	0.0
Atlantic sturgeon	12	0.0	318.3	1.1
spot	12	0.0	1.7	0.0
spiny dogfish	9	0.0	43.6	0.2
striped anchovy	8	0.0	0.5	0.0
northern puffer	5	0.0	0.9	0.0
cunner	4	0.0	0.5	0.0
inshore lizardfish	4	0.0	0.3	0.0
oyster toadfish	4	0.0	1.7	0.0
Atlantic silverside	3	0.0	0.3	0.0
fourbeard rockling	3	0.0	0.3	0.0
striped cusk-eel	3	0.0	0.1	0.0
northern sennet	2	0.0	0.2	0.0
bluntnose stingray	1	0.0	0.6	0.0
Atlantic cod	1	0.0	4.9	0.0
crevalle jack	1	0.0	0.1	0.0
haddock	1	0.0	0.1	0.0
pinfish	1	0.0	0.1	0.0
pollock	1	0.0	0.1	0.0
roughtail stingray	1	0.0	45.4	0.2
rough scad	1	0.0	0.1	0.0
sea raven	1	0.0	0.2	0.0
sand tiger shark	1	0.0	21.8	0.1
Total	**277,166**		**28,495**	

species	count	%	weight	%
Finfish not ranked				
anchovy spp, (yoy)				
Atlantic herring, (yoy)				
American sand lance (yoy)				
gadid spp, (yoy)				
Invertebrates				
longfin inshore squid	12,424	94.1	464.4	41.1
horseshoe crab	164	1.2	315.5	28.0
spider crab	nc		140.6	12.5
lion's mane jellyfish	221	1.7	72.1	6.4
American lobster	74	0.6	25.2	2.2
common slipper shell	nc		19.2	1.7
bushy bryozoan	nc		11.2	1.0
mantis shrimp	206	1.6	9.5	0.8
knobbed whelk	23	0.2	8.8	0.8
flat claw hermit crab	nc		8.7	0.8
boring sponge	nc		7.4	0.7
rock crab	nc		6.8	0.6
channeled whelk	29	0.2	6.0	0.5
hydroid spp.	nc		5.9	0.5
blue crab	20	0.1	5.0	0.4
hard clams	22	0.2	3.2	0.3
mud crabs	nc		2.5	0.2
mixed sponge species	nc		1.9	0.2
sand shrimp	nc		1.8	0.2
lady crab	nc		1.7	0.2
Tubularia, spp.	nc		1.5	0.1
northern moon snail	nc		1.3	0.1
arks	3	0.0	1.3	0.1
starfish spp.	1	0.0	0.9	0.1
blue mussel	1	0.0	0.8	0.1
common oyster	5	0.0	0.6	0.1
surf clam	1	0.0	0.5	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
anemones	nc		0.1	0.0
bobtail squid	1	0.0	0.1	0.0
red bearded sponge	nc		0.1	0.0
common razor clam	1	0.0	0.1	0.0
Japanese shore crab	1	0.0	0.1	0.0
polychaetes	1	0.0	0.1	0.0
tunicates, misc	nc		0.1	0.0
purple sea urchin	nc		0.1	0.0
water jelly	1	0.0	0.1	0.0
Total	**13,200**		**1,125.8**	

Note: nc= not counted

Table 5.16. Total counts and weight (kg) of finfish taken in the spring and fall sampling periods, 2016.
Species are listed in order of descending count. Young-of-year bay anchovy, striped anchovy, Atlantic herring, American sand lance and Gadids are not included. Number of tows (sample sizes): Spring = 116 and Fall = 80.

Spring				
species	**count**	**%**	**weight**	**%**
scup	131,247	75.8	10,798.3	59.9
butterfish	18,543	10.7	881.5	4.9
striped searobin	4,996	2.9	1,643.0	9.1
northern searobin	2,903	1.7	433.3	2.4
alewife	2,796	1.6	130.9	0.7
spotted hake	2,358	1.4	100.5	0.6
windowpane flounder	1,149	0.7	111.2	0.6
winter flounder	1,010	0.6	239.2	1.3
fourspot flounder	1,008	0.6	169.5	0.9
black sea bass	973	0.6	736.1	4.1
silver hake	889	0.5	32.6	0.2
American shad	698	0.4	29.8	0.2
red hake	667	0.4	50.2	0.3
smooth dogfish	616	0.4	1,434.6	8.0
Atlantic menhaden	558	0.3	44.4	0.2
bay anchovy	496	0.3	3.7	0.0
Atlantic herring	340	0.2	37.1	0.2
weakfish	261	0.2	56.2	0.3
tautog	256	0.1	252.9	1.4
little skate	248	0.1	129.6	0.7
summer flounder	238	0.1	192.3	1.1
hogchoker	210	0.1	25.2	0.1
blueback herring	187	0.1	3.2	0.0
striped bass	129	0.1	166.6	0.9
goosefish	70	0.0	23.3	0.1
clearnose skate	64	0.0	107.4	0.6
smallmouth flounder	47	0.0	1.5	0.0
hickory shad	16	0.0	3.7	0.0
winter skate	15	0.0	28.8	0.2
northern kingfish	10	0.0	1.8	0.0
spiny dogfish	9	0.0	43.6	0.2
bluefish	8	0.0	10.6	0.1
cunner	4	0.0	0.5	0.0
Atlantic silverside	3	0.0	0.3	0.0
Atlantic sturgeon	3	0.0	49.1	0.3
fourbeard rockling	3	0.0	0.3	0.0
striped cusk-eel	3	0.0	0.1	0.0
oyster toadfish	3	0.0	1.4	0.0
northern puffer	2	0.0	0.4	0.0
Atlantic cod	1	0.0	4.9	0.0
pinfish	1	0.0	0.1	0.0
pollock	1	0.0	0.1	0.0
roughtail stingray	1	0.0	45.4	0.3
sea raven	1	0.0	0.2	0.0
Total	**173,041**		**18,025.4**	

Fall				
species	**count**	**%**	**weight**	**%**
butterfish	47,053	45.2	1,154.6	11.0
scup	44,385	42.6	5,207.9	49.7
weakfish	4,428	4.3	241.4	2.3
bluefish	2,785	2.7	1,108.1	10.6
striped searobin	889	0.9	321.4	3.1
bay anchovy	743	0.7	5.0	0.0
smooth dogfish	722	0.7	1,351.0	12.9
windowpane flounder	445	0.4	43.5	0.4
Atlantic menhaden	318	0.3	25.0	0.2
northern searobin	274	0.3	18.8	0.2
moonfish	265	0.3	5.2	0.0
blueback herring	261	0.3	9.0	0.1
American shad	246	0.2	16.4	0.2
summer flounder	224	0.2	194.1	1.9
black sea bass	208	0.2	87.3	0.8
hogchoker	144	0.1	16.6	0.2
little skate	129	0.1	63.5	0.6
smallmouth flounder	101	0.1	2.7	0.0
spotted hake	99	0.1	13.3	0.1
winter flounder	97	0.1	21.8	0.2
clearnose skate	70	0.1	121.3	1.2
tautog	50	0.0	35.6	0.3
fourspot flounder	48	0.0	5.8	0.1
striped bass	38	0.0	95.3	0.9
northern kingfish	21	0.0	3.0	0.0
alewife	15	0.0	1.1	0.0
blue runner	15	0.0	1.5	0.0
spot	12	0.0	1.7	0.0
Atlantic sturgeon	9	0.0	269.2	2.6
striped anchovy	8	0.0	0.5	0.0
inshore lizardfish	4	0.0	0.3	0.0
northern puffer	3	0.0	0.5	0.0
hickory shad	2	0.0	0.5	0.0
northern sennet	2	0.0	0.2	0.0
silver hake	2	0.0	0.3	0.0
winter skate	2	0.0	2.8	0.0
bluntnose stingray	1	0.0	0.6	0.0
crevalle jack	1	0.0	0.1	0.0
haddock	1	0.0	0.1	0.0
red hake	1	0.0	0.1	0.0
rough scad	1	0.0	0.1	0.0
sand tiger shark	1	0.0	21.8	0.2
oyster toadfish	1	0.0	0.3	0.0
Total	**104,124**		**10,469.3**	

Table 5.17. Total catch of invertebrates taken in the spring and fall sampling periods, 2016.
Species are ranked by total weight (kg). Number of tows (sample sizes): Spring = 116 and Fall = 80.

Spring				
species	**count**	**%**	**weight**	**%**
longfin inshore squid	2,021	87	143.4	31.2
spider crab	nc		126.2	27.5
horseshoe crab	55	2.4	105.4	22.9
American lobster	72	3.1	24.5	5.3
rock crab	nc		6.7	1.5
common slipper shell	nc		5.9	1.3
knobbed whelk	13	0.5	5.7	1.2
boring sponge	nc		5	1.1
mantis shrimp	92	3.9	4.8	1
bushy bryozoan	nc		4.7	1
flat claw hermit crab	nc		3.9	0.8
blue crab	13	0.5	3.1	0.7
channeled whelk	16	0.7	3.1	0.7
hydroid spp.	nc		2.4	0.5
mud crabs	nc		2	0.4
sand shrimp	nc		1.8	0.4
Tubularia, spp.	nc		1.5	0.3
lion's mane jellyfish	30	1.3	1.3	0.3
mixed sponge species	nc		1.1	0.2
northern moon snail	nc		1.1	0.2
starfish spp.	1	0	0.9	0.2
arks	1	0	0.6	0.1
common oyster	5	0.2	0.6	0.1
hard clams	1	0	0.5	0.1
blue mussel	1	0	0.4	0.1
surf clam	nc		0.3	0.1
comb jelly spp	nc		0.2	0
ghost shrimp	1	0	0.2	0
lady crab	nc		0.2	0
bobtail squid	1	0	0.1	0
red bearded sponge	nc		0.1	0
star coral	nc		0.1	0
Japanese shore crab	1	0	0.1	0
polychaetes	1	0	0.1	0
tunicates, misc	nc		0.1	0
purple sea urchin	nc		0.1	0
Total	**2,325**		**458.2**	

Note: nc= not counted

Fall				
species	**count**	**%**	**weight**	**%**
longfin inshore squid	10,404	95.7	321.0	48.0
horseshoe crab	110	1.0	210.1	31.4
lion's mane jellyfish	190	1.8	70.8	10.6
spider crab	nc		14.4	2.2
common slipper shell	nc		13.3	2.0
bushy bryozoan	nc		6.5	1.0
flat claw hermit crab	nc		4.8	0.7
mantis shrimp	114	1.0	4.7	0.7
hydroid spp.	nc		3.5	0.5
knobbed whelk	10	0.1	3.1	0.5
channeled whelk	13	0.1	2.9	0.4
hard clams	21	0.2	2.7	0.4
boring sponge	nc		2.4	0.4
blue crab	7	0.1	1.9	0.3
lady crab	nc		1.5	0.2
mixed sponge species	nc		0.8	0.1
arks	2	0.0	0.7	0.1
American lobster	2	0.0	0.7	0.1
mud crabs	nc		0.5	0.1
blue mussel	nc		0.4	0.1
northern moon snail	nc		0.2	0.0
surf clam	1	0.0	0.2	0.0
anemones	nc		0.1	0.0
star coral	nc		0.1	0.0
common razor clam	1	0.0	0.1	0.0
rock crab	nc		0.1	0.0
water jelly	1	0.0	0.1	0.0
Total	**10,876**		**667.6**	

Table 5.18. Spring indices of abundance for selected species, 1984-2016.

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																	84-15
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**	**2016**	**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	1.71	1.03
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	1.78	0.34
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	0.05	
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	14.13	
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	0.02	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	1.80	
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	0.04	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	1.82	4.48
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	1.36	
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	3.41	29.17
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	3.40	50.01
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	1.05	3.74
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	1.71	4.36
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	4.92	
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	0.69	1.94
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	0.28	
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	0.49	
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	0.05	
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	0.33	4.85
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	1.04	
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	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	0.00	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	0.02	0.49
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	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	0.00	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	131.15	11.80
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	0.01	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	1.82	1.93
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	5.91	
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	0.85	
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	0.08	
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	0.28	
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	0.43	7.72
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	0.07	0.17
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	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	5.97	4.68
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	0.48	0.50
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	0.02	
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	0.59	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	0.55	

Table 5.19. Fall indices of abundance for selected species, 1984-2016.

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																	84-15
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**	**2016**	**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	0.11	
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	1.37	
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	11.25	22.17
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	172.44	166.93
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	0.00	
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	5.24	1.74
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	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	0.24	
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	1.92	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	1.10	
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	0.28	
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	0.01	
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	0.02	
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	0.74	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	0.00	
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	0.21	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	0.89	0.30
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	0.16	0.06
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	0.02	5.37
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	0.80	0.72
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	0.77	1.41
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	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	0.00	
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	0.01	0.12
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	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	307.01	182.10
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	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	1.24	
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	3.51	3.64
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	0.85	0.90
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	0.02	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	0.43	0.19
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	0.48	
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	0.02	
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	0.07	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	94.57	118.50
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	0.14	
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	0.06	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	0.23	
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	6.33	19.91

Table 5.20. Finfish and invertebrate biomass indices for the spring sampling period, 1992-2016.
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**	**2016**
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	0.37
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	1.48
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	0.05
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	2.03
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	0.00
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	3.21
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	0.09
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	0.61
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	1.05
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	0.56
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	0.82
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	0.24
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	0.20
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	0.53
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	0.16
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	0.02
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	0.14
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	0.01
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	0.23
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
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	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	0.00
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	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	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	20.25
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	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	0.50
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	3.13
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	0.15
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	0.03
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	0.39
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	0.30
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	0.10
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	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	0.50
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	0.07
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	0.53
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	0.23
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	0.02
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	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	0.29
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	0.00
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	0.05
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	0.72
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	0.01
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	0.15
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	0.00
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	0.01
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	0.00
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	0.04
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	0.80
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	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	0.06

Table 5.21. Finfish and invertebrate biomass indices for the fall sampling period, 1992-2016.
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**	**2016**
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	0.01
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	0.59
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	2.97
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	6.58
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	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	8.30
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	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	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	1.69
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	0.26
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	0.11
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	0.00
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	0.00
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	0.14
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	0.00
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	0.05
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	0.17
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	0.03
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	0.17
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	0.06
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
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	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	0.00
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	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	22.28
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
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	0.18
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	1.72
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	0.14
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	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	0.65
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	0.32
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	0.02
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	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	0.20
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	0.27
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	0.19
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	1.07
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	0.02
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	0.06
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	0.75
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	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	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	0.13
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	0.43
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	0.01
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	0.00
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	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	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	0.05
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	3.17
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	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	0.06

Table 5.22. Bluefish indices of abundance, 1984-2016.
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	16.54	2.22	0.88	1.47
2015	7.47	1.04	0.42	0.93
2016	8.83	1.20	1.25	1.65
84-15 mean	**15.41**	**2.12**	**3.01**	**4.85**

Table 5.23. Scup indices-at-age, 1984-2016.

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	5.546	3.985	5.037	1.747	0.570	0.595	0.266	0.121	0.093
2016	972.305	318.511	0	653.794	191.206	68.931	15.618	29.868	5.192	3.221	2.646	1.294	0.535
84-15 Mean	**38.359**	**25.939**	**0**	**12.419**	**10.748**	**9.355**	**3.059**	**1.442**	**0.751**	**0.384**	**0.131**	**0.042**	**0.026**
		34.805											

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
2016	307.010	97.769	55.695	153.546	54.808	18.187	9.458	10.490	2.765	1.150	0.700	0.195	0.017
84-14 Mean	**182.100**	**15.355**	**134.626**	**32.119**	**8.115**	**3.851**	**2.188**	**0.673**	**0.314**	**0.136**	**0.051**	**0.018**	**0.008**
		17.930	**132.160**										

(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, 37 fish in 2015 and 29 fish in 2016. The oldest scup aged were two 15-year-old fish taken in 2015.

Table 5.24. Age frequency of striped bass taken in spring, 1984-2016.
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**	**2016**
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
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	71
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	5
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	19
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	23
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	2
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	3
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	0
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	2
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	1
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	0
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	1
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**	**129**

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, 1984-2016.
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
2016	0.48	0.0074	0.2642	0.0186	0.0707	0.0856	0.0074	0.0112	.	0.0074	0.0037	.	0.0037
84-15 mean		**0.0042**	**0.1221**	**0.1168**	**0.0848**	**0.0764**	**0.0542**	**0.0268**	**0.0112**	**0.0046**	**0.0023**	**0.0010**	**0.0001**

Table 5.26. Summer flounder indices-at-age, 1984-2016.

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 2015-2016, 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	**0-12**	**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	3.0018	0	0.9679	0.7073	0.4854	0.4332	0.2981	0.0466	0.0369	0.0126	0.0072	0.0022	0.0022	0.0022
2015	1.6341	0	0.7770	0.3569	0.2050	0.1232	0.0904	0.0487	0.0176	0.0093	0.0017	0.0018	0.0020	0.0005
2016	1.3568	0	0.1449	0.4154	0.3449	0.1985	0.0952	0.0771	0.0503	0.0216	0.0055	0.0006	0.0028	0
84-15 Mean	**1.5154**	**0**	**0.5858**	**0.4139**	**0.2513**	**0.1387**	**0.0706**	**0.0296**	**0.0141**	**0.0067**	**0.0024**	**0.0014**	**0.0008**	**0.0001**

							Fall							
Year	**0-12**	**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	0.0000	-	-	-	-	-	-	-	-	-	-	-	-	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
2016	1.9198	0.0361	0.2401	0.6223	0.5563	0.2687	0.1223	0.0319	0.0421	0	0	0	0	0
84-15 Mean	**1.9992**	**0.1303**	**0.7907**	**0.6707**	**0.2952**	**0.1153**	**0.0397**	**0.0127**	**0.0057**	**0.0017**	**0.0006**	**0.0007**	**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, 1984-2016.
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
2016	5.87	0.73	0.81	0.59	0.85	0.43
84-15 mean	**19.69**	**1.43**	**0.30**	**0.35**	**0.17**	**0.23**

Table 5.29. Winter flounder indices-at-age, 1984-2016.

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). Indices-at-age for 2016 are based on a 2014/2015 pooled key.

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	0.64	0.89	0.84	0.29	0.64	0.65	0.22	0.27	0.11	0.02	0	0.005	0.01	0
2016	3.98	1.32	0.63	0.93	0.73	1.00	0.79	0.40	0.08	0.02	0.02	0.00	0	0	0	0
84-15 Mean	60.23	9.44	5.61	7.72	27.84	15.24	6.24	2.13	0.68	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	0.01	0	0
2016	1.08	0.69	NA	0.03	0.07	0.29	0.36	0.23	0.06	0.02	0.02	0.00	0	0	0	0
84-15 Mean	10.78	4.29	NA	0.27	2.81	3.41	2.44	1.12	0.42	0.17	0.08	0.03	0.01	0.00	0.00	0.00

Note years with non-standard # of tows: 1984: April = 0 tows, May = 13 tows, and 19 tows in June used to increase sample size; 1985: April = 0 tows, May = 41 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; 2016: April = 36 tows .

TABLES 5.30 - 5.66
LENGTH FREQUENCIES
LISTS

Table 5.30. Alewife length frequencies, spring and fall, 1 cm intervals, 1989–2016.
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**	**2016**
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	0
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	1
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
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	27
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	81
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	230
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	303
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	181
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	351
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	407
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	375
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	353
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	263
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	89
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	32
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	51
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	21
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	7
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	4
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	3
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	4
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	3
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	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	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	1
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	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	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**	**2,796**

													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**	**2016**
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	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	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	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	0
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	0
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	0
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	0
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	0
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	3
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	8
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	4
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	0
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	0
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	0
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	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	0
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	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	0
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	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	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	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	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**	**15**

Table 5.31. American shad length frequencies, spring and fall, 2.0 cm intervals (midpoint given), 1989-2016.

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**	**2016**
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	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	1	16
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	38	89
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	27	203
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	13	127
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	5	150
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	2	87
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	1	16
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	19	3
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	5	4
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	0	1
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	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	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	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	0	0
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	0	0
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	0	0
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	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	1	1
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	0	0
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	0	0
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	1	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	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**	**113**	**698**

													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**	**2016**	**20116**
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	0	0
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	0	2
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	5
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	18	4
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	7	9
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	2	80
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	26	134
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	62	11
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	27	0
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	6	0
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	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	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
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
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	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	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
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	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	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
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	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	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	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**	**161**	**245**

Table 5.32. American lobster length frequencies-spring, female, 1 mm intervals, 1984–2016.
Lobsters were measured from each tow.

Female Length	Spring 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)	2016 (116)
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	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	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	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	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	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	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	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	0
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	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	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	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	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	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	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	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	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	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	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	1
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	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	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	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	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	0
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	0
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	0
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	0
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	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	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	0
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	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	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	0
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	0
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	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	0
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	0
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	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	2
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	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	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	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	1
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	1
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	2
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	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	1
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	0
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	1
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	0
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	1
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	0
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	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	4
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	2
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	2
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	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	0
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	0
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	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	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	3
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	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	1
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	1
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	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	2
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	1
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	1
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	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	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	2
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	2
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	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	1
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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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**	**36**
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, 1984–2016.

Lobsters were measured from each tow.

Female	Fall																																
	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	2016
Length	(70)	(80)	(80)	(80)	(80)	(80)	(80)	(80)	(80)	(120)	(120)	(80)	(80)	(80)	(80)	(80)	(80)	(80)	(80)	(40)	(80)	(80)	(40)	(80)	(40)	(80)	(0)	(80)	(80)	(80)	(79)	(80)	(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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	0
42	7	0	5	0	4	2	3	36	52	21	43	7	24	49	9	17	2	3	0	1	2	0	1	0	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	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	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	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	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	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	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	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	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	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	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	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	0
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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	0
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	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	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	0
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	0
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	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	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	0
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	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	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	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	0
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	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	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	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	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	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	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	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	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	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	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	0
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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	0
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, 1984–2016.
Lobsters were measured from each tow.

Male	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)	2016 (116)
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	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	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	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	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	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	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	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	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	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	0
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	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	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	1
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	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	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	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	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	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	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	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	0
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	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	0
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	0
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	1
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	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	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	0
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	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	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	0
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	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	0
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	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	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	0
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	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	1
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	0
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	1
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	1
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	0
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	0
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	1
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	0
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	1
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	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	1
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	3
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	1
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	1
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	1
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	1
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	2
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	0
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	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	2
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	1
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	1
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	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	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	1
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	0
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	1
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	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	1
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	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	0
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	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	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	2
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	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	2
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	1
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	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	0
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	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	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	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	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	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	1	0	0	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	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	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	1
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	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	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	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**	**36**
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, 1984–2016.

Lobsters were measured from each tow.

Male 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)	2016 (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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	1
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	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	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	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	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	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	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	0
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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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**	**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, 1989-2016.

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**	**2016**
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	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	0
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	18
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	5
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	3
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	3
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	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	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	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	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	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	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	0
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	0
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	4
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	41
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	63
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	36
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	10
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	3
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	10
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	30
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	47
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	47
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	10
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	9
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	0
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	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	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	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	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	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**	**339**

													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**	**2016**
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	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	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	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	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	0
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	0
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	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	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	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	0
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	0
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	0
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	0
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	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	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	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	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	0
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	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	2	0
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**	**0**

Table 5.37. Atlantic menhaden length frequency, spring and fall, 1 cm intervals, 1996-2016.
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**	**2016**
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60
9	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	125
10	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	7	0	0	0	115
11	0	0	0	1	0	0	13	0	0	0	0	0	0	0	0	0	3	0	0	0	72
12	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	15	0	0	0	39
13	0	0	0	0	0	0	6	0	0	0	2	0	0	0	0	0	8	0	0	0	8
14	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	5	0	0	0	3
15	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	8	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	1
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
18	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	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
20	0	0	0	0	1	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	1	0	0	0	0	0	0	1	0	0	0	0
22	0	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
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	1	0	0	1	1
26	0	0	0	0	0	0	1	0	0	0	0	4	0	0	0	0	2	3	6	0	3
27	0	0	0	0	0	0	1	0	0	0	0	6	2	3	1	4	14	25	46	24	10
28	0	1	0	0	1	0	1	0	0	0	0	5	4	9	5	10	33	32	81	53	23
29	0	1	0	0	1	0	0	1	3	0	1	5	2	2	1	18	53	59	79	75	34
30	0	1	0	0	0	0	1	1	0	0	0	4	1	5	0	10	28	27	34	54	13
31	0	3	0	0	0	0	0	0	1	0	2	4	1	0	0	1	12	13	19	20	3
32	0	0	0	0	1	0	3	0	0	0	0	0	0	0	0	0	1	0	1	2	1
33	0	0	0	0	2	0	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	0
35	0	0	0	0	0	0	0	0	1	0	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	0
37	0	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	0
Total	**0**	**6**	**0**	**1**	**9**	**0**	**47**	**2**	**5**	**1**	**5**	**33**	**10**	**19**	**7**	**43**	**195**	**162**	**267**	**229**	**543**

											Fall										
length	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
4	0	0	0	0	0	0	0	1	0	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	0
6	0	0	0	0	0	0	0	17	1	0	0	24	0	0	-	0	1	1	0	1	0
7	1	0	0	20	12	0	2	32	26	0	1	39	2	0	-	0	0	0	0	34	1
8	0	1	18	51	73	0	6	22	178	11	0	32	2	2	-	0	0	0	0	58	1
9	0	11	53	152	128	0	8	9	135	22	0	12	6	0	-	0	0	0	0	73	0
10	1	5	120	471	125	1	9	1	143	19	0	34	3	3	-	0	1	0	2	70	0
11	0	6	49	337	51	25	14	1	47	13	2	51	2	4	-	0	0	0	1	30	2
12	0	11	44	25	35	30	10	1	18	9	8	24	1	5	-	6	0	4	5	22	11
13	0	0	20	2	15	16	14	4	1	1	1	49	0	4	-	7	1	5	0	5	42
14	0	2	0	0	6	7	20	2	0	3	2	7	0	3	-	9	0	4	0	2	112
15	0	0	0	0	2	4	24	0	0	1	0	1	1	5	-	6	1	1	0	0	90
16	0	0	0	0	2	0	8	0	0	2	1	1	4	4	-	3	0	1	0	0	19
17	0	0	0	0	3	0	12	0	0	0	0	0	3	0	-	0	1	0	0	0	2
18	0	0	0	0	0	0	17	0	0	0	0	0	0	1	-	0	2	0	0	0	0
19	0	0	0	0	0	0	16	0	0	0	0	0	0	1	-	0	2	0	0	0	0
20	0	0	0	1	0	0	2	0	0	0	0	0	0	0	-	0	2	0	0	0	0
21	0	0	0	1	0	0	1	0	0	1	0	0	0	0	-	0	1	0	0	0	0
22	0	0	0	0	0	0	1	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	1	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	3	1
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	1	7	5	1
26	0	0	0	0	0	0	1	0	0	0	0	3	0	0	-	0	7	2	2	14	2
27	2	0	0	0	0	0	1	0	0	1	0	21	9	4	-	4	27	6	68	131	11
28	3	1	0	3	0	0	2	0	3	4	0	35	2	7	-	18	68	13	164	249	17
29	23	17	0	6	1	0	18	5	10	21	2	31	1	1	-	48	66	12	132	233	4
30	30	25	0	28	3	0	29	8	44	54	2	18	0	5	-	30	35	14	63	100	1
31	11	17	1	42	7	1	39	8	65	43	2	7	0	2	-	4	11	5	2	18	0
32	2	6	1	27	12	0	27	3	51	21	1	2	0	0	-	2	0	1	9	2	0
33	0	1	0	19	4	2	25	2	10	5	0	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	0
35	0	0	0	0	1	0	5	0	1	1	0	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**	**70**	**455**	**1,051**	**317**

Table 5.38. Black sea bass length frequencies, spring, 1 cm intervals, 1986-2016.
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	2016
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	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	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	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	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	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	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	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	2
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	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	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	1
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	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	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	1
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	0
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	2
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	0
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	2
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	2
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	5
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	6
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	4
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	5
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	2
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	2
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	8
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	8
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	12
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	27
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	50
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	57
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	89
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	110
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	102
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	72
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	77
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	69
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	67
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	53
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	36
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	36
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	25
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	10
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	15
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	10
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	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	0
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	1
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	1
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	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	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	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	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**	**971**

Table 5.39. Black sea bass length frequencies, fall, 1 cm intervals, 1986-2016.
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**	**2016**
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	0
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	1
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	2
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	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	0
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	0
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	1
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	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	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	3
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	3
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	22
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	19
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	15
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	19
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	5
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	11
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	5
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	2
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	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	1
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	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	1
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	1
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	5
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	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	6
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	3
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	2
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	0
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	1
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	4
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	3
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	3
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	2
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	6
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	7
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	7
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	10
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	7
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	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	5
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	0
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	3
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	5
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	2
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	6
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	2
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	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	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	0
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	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	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	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	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	0
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**	**207**

Table 5.40. Blueback herring length frequencies, spring and fall, 1 cm intervals, 1989-2016.

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**	**2016**
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	0
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	3
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	13
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	45
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	52
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	40
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	23
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	5
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	1
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	1
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	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	1
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	2
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	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	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	0
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	1
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	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	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	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	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	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**	**187**

														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**	**2016**
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	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	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	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	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	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	0
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	0
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	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	17
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	151
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	92
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	1
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	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	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	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	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	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	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	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	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	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**	**261**

Table 5.41. Bluefish length frequencies, spring, 1 cm intervals, 1984-2016.
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	2016
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	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	0
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	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	1
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	0
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	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	1
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	1
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	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	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	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	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	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	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	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	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	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	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	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	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	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	1
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	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	1
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	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	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	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	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	0
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	1
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	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	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	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	1
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	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	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	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	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	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	1
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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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**	**8**

Table 5.42. Bluefish length frequencies, fall, 1 cm intervals, 1984-2016.
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	2016
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	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	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	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	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	1
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	16
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	93
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	268
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	334
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	182
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	121
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	111
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	106
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	116
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	198
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	229
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	172
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	159
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	103
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	76
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	24
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	26
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	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	1
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	1
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	2
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	3
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	3
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	4
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	3
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	10
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	3
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	10
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	19
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	23
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	42
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	27
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	14
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	2
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	0
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	2
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	2
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	5
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	1
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	3
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	8
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	11
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	12
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	19
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	29
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	32
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	17
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	11
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	6
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	9
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	7
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	9
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	6
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	17
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	17
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	14
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	10
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	6
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	2
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	2
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	2
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	0
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	3
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	1
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	0
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	6
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	1
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	3
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	4
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	4
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	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	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	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	1
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**	**2,785**

Table 5.43. Butterfish length frequencies, 1 cm intervals, spring and fall, 1986-1990, 1992–2016.

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**	**2016**
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	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	2
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	16
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	9
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	2
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	2
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	26
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	539
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	2916
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	6194
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	3693
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	1807
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	1288
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	1064
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	645
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	261
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	45
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	5
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	1
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	0
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	0
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	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	1	0	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	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	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**	**18,515**

	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**	**2016**
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
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	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
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	98
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	151
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	2,448
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	8,977
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	13,489
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	11,727
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	4,517
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	1,032
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	88
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	317
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	928
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	1,963
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	1,069
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	167
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	75
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	3
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	0
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	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	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	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	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	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**	**47,054**

Table 5.44. Clearnose skate length frequencies, spring, 1 cm intervals, 1993-2016.

	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	2016
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	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	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	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	1
50	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	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	0
52	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	2
53	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	1	4	2	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	1
56	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	1	2	0	1
57	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	1	0	1	0
58	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	1	0	2
59	0	0	0	0	0	0	0	0	0	4	1	0	0	1	2	0	0	0	1	0	0	1	0	3
60	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	0	0	8	0	1	0	2
61	0	0	1	0	0	0	1	0	0	2	0	0	0	0	1	0	0	0	0	7	0	2	2	5
62	0	0	0	0	0	0	2	0	0	1	0	0	0	2	0	2	2	0	0	5	1	1	2	4
63	0	0	0	0	0	0	0	0	0	2	1	0	0	1	0	1	0	0	1	3	1	1	1	3
64	0	0	0	0	0	0	0	1	0	3	0	1	0	0	1	0	1	0	1	9	0	3	2	3
65	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2	2	1	0	1	4	0	2	1	2
66	0	0	0	0	0	0	0	0	0	1	2	0	0	0	3	0	1	0	4	4	2	3	1	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	4
68	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	2	1	0	1	6	2	3	2	4
69	0	0	0	0	0	0	0	0	1	4	0	1	1	0	4	0	2	0	0	7	2	4	2	5
70	0	0	0	0	0	0	0	0	0	4	0	0	0	0	4	0	4	0	3	5	3	4	1	3
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	4	0	1	1	5
72	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	1	0	0	3	1	2	1	2
73	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	5	0	0	1	4
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	1	1	1	0
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	1	2
76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	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	0
78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	2	0
79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
80	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	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	1
82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	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	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	0
86	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	0	0	0	0	0	0	0	1	0	0	1	0	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	1
89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	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	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	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	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**	**64**

Table 5.45. Clearnose skate length frequencies, fall, 1 cm intervals, 1993-2016.

	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**	**2016**
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	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	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	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	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	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	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	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	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
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	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	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	1
53	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	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	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	1
56	0	0	0	0	0	0	0	0	0	0	2	0	2	0	2	0	0	0	0	3	2	0	5	2
57	0	0	0	0	0	0	0	0	0	1	0	0	4	0	0	0	1	0	1	4	1	0	4	0
58	0	0	0	0	0	1	0	2	2	3	0	0	4	1	1	0	0	0	1	5	3	0	3	0
59	2	0	0	0	0	1	0	1	3	0	0	0	1	2	0	0	0	0	3	1	4	2	8	0
60	0	0	0	0	0	0	0	1	2	0	0	0	7	3	1	0	1	0	1	4	2	1	4	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	1
62	0	0	0	0	1	0	1	0	4	0	1	0	7	1	2	1	2	0	0	8	7	2	3	5
63	0	0	0	0	0	2	3	1	0	2	0	0	2	2	1	2	1	0	3	9	12	0	2	1
64	0	0	0	0	0	0	3	1	5	5	2	0	3	0	3	0	1	0	2	9	16	2	8	6
65	0	0	0	0	0	3	1	2	1	1	2	1	7	1	6	1	6	0	1	14	12	3	2	1
66	0	0	1	0	1	4	0	0	5	2	9	3	4	0	5	3	3	0	5	12	12	3	8	2
67	0	0	0	1	0	1	2	1	3	2	5	4	6	2	3	2	4	0	1	17	17	4	2	6
68	0	0	0	0	0	1	1	0	3	0	4	0	5	1	8	3	2	0	5	11	17	4	5	6
69	0	0	0	0	0	0	0	3	3	0	3	1	11	2	6	0	1	0	3	11	19	8	3	6
70	0	0	0	0	0	0	0	0	5	0	2	1	6	2	2	1	3	0	1	12	18	7	6	3
71	0	0	0	0	0	0	0	0	4	0	5	1	2	1	5	2	1	0	1	9	10	3	5	3
72	0	0	0	0	0	0	0	1	1	0	3	1	6	0	3	2	5	0	2	5	6	2	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	5
74	0	0	0	0	0	0	0	0	1	1	4	0	1	0	5	0	2	0	4	5	2	2	1	2
75	0	0	0	0	0	1	0	1	1	2	0	0	2	0	4	1	2	0	1	4	4	1	2	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	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	1
78	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	3	1	3	0	1
79	0	0	0	0	0	0	1	0	0	0	1	2	1	0	4	1	0	0	0	3	0	2	0	1
80	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	2	0	0	1	1	1	1	0
81	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	2	1	0	0	1	0	0	2	0
82	0	0	0	0	0	1	0	0	1	0	0	0	1	0	1	0	1	0	0	0	1	0	1	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	1
84	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	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	1	1	0	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	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	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	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	1
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	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	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	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	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	0
95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	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	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	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	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	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**	**69**

Table 5.46. Fourspot flounder length frequencies, spring and fall, 2 cm intervals (midpoint given), 1989, 1990, 1996-2016.
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**	**2016**
13	2	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0	1	0	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	0
17	21	8	1	3	8	12	1	2	17	2	13	0	0	6	0	0	6	2	5	1	1	0	3
19	19	19	8	16	14	61	22	5	89	8	8	0	6	7	7	4	2	1	24	2	6	3	12
21	17	42	31	60	13	28	26	4	99	6	4	1	18	11	9	10	3	10	42	11	5	1	51
23	11	341	198	161	16	32	239	42	33	8	4	14	24	9	17	6	5	45	56	20	9	1	79
25	56	528	279	353	105	72	422	181	84	124	26	71	29	44	39	37	33	157	258	185	64	19	211
27	103	225	208	456	209	97	256	300	199	228	82	75	33	105	81	91	55	150	441	209	172	52	235
29	120	139	193	392	233	81	201	245	191	187	129	64	44	170	108	127	55	107	461	189	179	87	185
31	89	60	117	192	137	66	139	153	175	163	178	68	61	121	94	90	69	93	303	139	107	77	111
33	51	27	54	76	60	60	81	45	89	88	113	52	36	52	70	51	36	49	92	100	78	41	69
35	8	33	15	22	16	25	39	11	26	47	35	31	13	43	34	31	24	27	31	27	29	26	39
37	2	12	6	3	4	7	12	8	7	12	5	11	4	9	11	7	9	9	4	16	8	6	10
39	0	4	3	0	2	1	1	2	3	6	2	3	1	7	2	0	4	5	0	0	0	3	2
41	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	1	0	0	0	0	1	0	0
43	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	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	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**	**1,007**

										Fall													
length	**1989**	**1990**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
5	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	1	-	0	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	0
9	5	0	0	23	19	0	2	2	0	4	1	0	2	1	1	7	-	4	0	0	3	1	0
11	9	4	2	46	27	5	4	17	5	2	12	4	5	0	7	16	-	17	3	1	11	3	0
13	10	15	5	68	22	24	6	25	3	3	9	9	13	2	8	59	-	28	4	11	26	20	3
15	6	17	35	55	21	42	5	15	9	0	13	17	4	5	11	45	-	22	13	10	47	23	9
17	0	0	42	16	3	16	1	0	3	0	1	26	3	2	16	20	-	4	12	2	49	11	8
19	0	0	22	0	0	4	1	0	1	0	0	2	0	0	7	6	-	0	0	4	5	1	2
21	0	0	0	2	2	3	2	0	2	0	1	0	0	1	0	0	-	0	0	1	0	0	0
23	1	2	9	2	5	0	17	1	5	0	0	0	1	1	0	1	-	0	0	0	1	0	3
25	0	3	42	7	16	5	58	3	7	3	4	1	0	6	1	2	-	2	3	0	1	0	1
27	0	7	41	10	22	4	77	5	13	7	6	5	0	7	1	6	-	1	9	2	4	1	4
29	0	3	24	5	22	5	54	10	18	11	13	5	0	20	6	8	-	1	11	2	4	4	9
31	0	1	20	3	6	3	25	1	18	4	30	6	0	12	5	6	-	1	6	2	8	2	6
33	0	0	6	1	1	1	7	1	13	7	19	2	1	3	1	11	-	3	6	0	0	5	1
35	0	0	4	0	1	0	5	0	6	5	6	7	0	4	4	1	-	2	2	2	1	0	2
37	0	0	0	0	0	0	2	1	3	0	2	0	0	0	0	1	-	1	0	0	0	0	1
39	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	-	0	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**	**49**

Table 5.47. Hickory shad length frequencies, spring and fall, 1 cm intervals, 1991-2016.

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**	**2016**
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	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	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	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	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	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	2
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	1
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	3
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	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	1
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	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	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	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	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	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	4
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	2
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	0
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	0
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	1
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	0
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	0
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	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	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	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	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	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
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	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
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
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	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**	**16**

											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**	**2016**
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	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	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	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	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	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	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	1
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	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	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	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	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	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	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	0
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	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	0
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	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	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	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	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
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	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	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**	**2**

Table 5.48. Horseshoe crab length frequencies by sex, spring, 1 cm intervals, 1998-2016.
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**	**2016**
F	**13**		1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
F	**14**		1	3	0	1	2	0	1	0	0	0	0	0	0	0	0	0	1	0
F	**15**		0	0	0	1	1	0	0	0	0	1	0	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	0
F	**17**		1	0	2	2	1	4	1	0	1	1	0	0	0	1	0	0	1	0
F	**18**		2	1	0	3	2	4	0	0	2	1	1	0	0	0	2	3	1	0
F	**19**		4	1	2	2	5	5	0	0	3	4	1	0	0	2	0	5	1	2
F	**20**		5	2	0	7	1	2	3	0	3	2	0	0	1	2	0	4	0	0
F	**21**		8	2	1	8	6	2	1	0	3	8	1	0	3	5	4	5	3	4
F	**22**		8	6	4	13	10	7	2	0	10	4	6	0	3	3	2	3	3	2
F	**23**		14	15	18	19	22	17	3	2	9	14	4	3	4	9	7	14	7	4
F	**24**		15	7	15	32	29	25	5	4	15	11	12	6	3	15	19	13	3	5
F	**25**		15	10	23	25	22	20	8	5	11	16	10	9	9	14	19	11	11	14
F	**26**		23	13	28	26	22	23	3	2	16	12	10	4	16	14	17	26	9	4
F	**27**		15	9	18	18	18	18	8	4	10	9	9	5	18	11	8	22	10	6
F	**28**		8	6	9	6	7	4	2	2	5	4	10	3	8	10	13	9	3	2
F	**29**		3	0	3	4	4	4	0	3	5	1	3	4	1	3	2	3	1	0
F	**30**		1	0	3	2	0	0	3	2	0	2	1	1	4	0	1	1	1	0
F	**31**		0	0	0	0	4	0	0	0	0	1	1	0	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	0
M	**14**		0	0	0	0	0	0	0	0	1	0	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	0
M	**16**		0	0	0	2	5	2	0	1	2	0	0	2	0	0	0	0	0	0
M	**17**		5	2	4	7	9	9	0	0	3	2	3	0	1	5	0	1	1	1
M	**18**		11	8	12	19	24	21	2	0	17	10	3	2	5	7	6	9	4	3
M	**19**		22	13	32	42	25	33	3	0	19	12	10	7	7	8	16	17	7	5
M	**20**		15	16	30	20	33	31	7	0	21	10	11	7	15	13	10	13	12	2
M	**21**		18	5	13	14	16	10	1	0	6	12	5	3	3	9	6	6	7	1
M	**22**		4	5	7	6	7	6	2	0	4	2	1	1	4	5	3	1	0	0
M	**23**		1	0	3	1	4	2	1	0	0	1	1	0	0	0	2	1	0	0
M	**24**		2	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
M	**25**		0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	3	1	0
M	**26**		0	0	0	1	0	0	0	0	0	0	1	0	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	0
M	**28**		0	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	0
M	**30**		0	0	0	1	0	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	0
Total		**51**	**204**	**125**	**228**	**285**	**285**	**251**	**60**	**25**	**166**	**141**	**104**	**57**	**105**	**138**	**138**	**173**	**88**	**55**

No sex recorded in the spring of 1998

Table 5.49. Horseshoe crab length frequencies by sex, fall, 1 cm intervals, 1998-2016.
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**	**2016**
F	**13**	0	0	2	0	0	0	3	0	1	0	0	0	-	0	0	0	0	0	2
F	**14**	0	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	0
F	**16**	0	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	0
F	**18**	0	2	0	1	0	1	1	1	0	0	0	0	-	0	0	0	0	1	1
F	**19**	3	2	2	2	0	1	0	0	1	0	1	1	-	0	0	0	2	1	0
F	**20**	5	1	1	4	4	2	3	0	2	0	0	2	-	0	0	0	0	1	1
F	**21**	3	2	2	3	1	4	6	3	1	1	1	0	-	0	0	0	1	2	1
F	**22**	3	8	13	13	10	3	9	4	1	2	6	6	-	6	0	2	2	0	1
F	**23**	8	15	15	12	8	8	13	10	7	7	6	14	-	6	2	3	4	6	9
F	**24**	7	19	30	27	21	9	24	10	6	17	14	22	-	18	10	12	8	10	14
F	**25**	17	12	20	31	33	13	19	6	12	26	17	17	-	19	9	11	11	7	17
F	**26**	19	23	33	31	18	9	29	12	10	22	15	24	-	25	16	27	10	9	12
F	**27**	14	7	21	22	18	7	22	8	3	17	11	28	-	16	5	15	10	3	9
F	**28**	2	4	10	8	13	6	15	5	4	8	11	22	-	11	3	10	6	5	6
F	**29**	2	3	2	5	2	3	8	2	0	4	1	5	-	2	4	2	3	1	2
F	**30**	0	1	1	2	0	2	1	2	0	2	0	2	-	0	1	2	0	0	1
F	**31**	0	1	0	0	1	0	0	2	0	0	0	1	-	0	0	0	1	0	1
F	**32**	0	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	0
F	**34**	0	0	0	0	0	1	0	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	0
M	**12**	0	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	0
M	**14**	0	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	0
M	**16**	0	0	2	1	5	3	0	0	0	1	1	0	-	1	0	0	0	0	0
M	**17**	6	5	7	6	3	5	11	0	1	3	1	2	-	3	0	1	1	1	1
M	**18**	12	14	28	18	14	15	21	3	9	3	9	18	-	13	4	2	5	1	7
M	**19**	10	20	39	27	31	11	39	13	4	12	21	14	-	9	4	6	13	3	5
M	**20**	20	23	35	32	22	8	30	12	9	19	23	31	-	10	1	17	4	9	7
M	**21**	6	11	18	15	9	4	15	4	2	10	6	13	-	7	1	7	6	4	8
M	**22**	5	3	8	4	6	0	10	2	5	6	2	5	-	6	0	5	0	1	3
M	**23**	0	0	3	2	6	1	1	0	2	3	1	3	-	0	1	2	0	0	1
M	**24**	0	0	1	3	0	0	1	0	1	2	0	2	-	0	0	0	0	0	0
M	**25**	0	0	2	0	0	0	0	0	0	0	0	1	-	0	0	1	0	0	0
M	**26**	2	0	0	3	0	0	0	0	1	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	0
M	**28**	0	0	0	0	0	0	0	1	0	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	0
Total		**145**	**177**	**295**	**274**	**229**	**117**	**281**	**101**	**83**	**165**	**148**	**234**	**-**	**152**	**61**	**125**	**87**	**66**	**109**

Table 5.50. Long-finned squid length frequencies, spring, 1 cm intervals, 1986-1990, 1992-2016.

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**	**2016**
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	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
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	29
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	70
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	63
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	52
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	48
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	39
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	70
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	144
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	229
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	313
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	251
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	160
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	90
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	90
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	88
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	70
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	67
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	26
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	42
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	32
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	16
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	14
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	8
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	4
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	0
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	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	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	1
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	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	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	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	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	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	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	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	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	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**	**2,020**

Table 5.51. Long-finned squid length frequencies, fall, 1 cm intervals, 1986-1990, 1992-2016.

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**	**2016**
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	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	60
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	95
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	91
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	322
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	1,066
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	1,475
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	1,566
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	1,633
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	1,327
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	1,015
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	611
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	545
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	240
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	132
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	88
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	42
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	64
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	14
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	7
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	9
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	0
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	0
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	0
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	0
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	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	0	1	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	0	1	0
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	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	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	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**	**10,402**

Table 5.52. Scup spring length frequencies, 1 cm intervals, 1984-2016.
Lengths were recorded from every tow.

length	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Spring 2000
5	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	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
8	0	0	0	6	3	84	0	12	0	0	0	11	0	0	10	24	61
9	4	30	50	33	46	1,049	11	80	9	0	11	408	152	10	163	128	976
10	8	138	377	46	160	2,523	270	514	49	3	48	1,202	537	145	1,381	355	5,293
11	10	362	724	38	144	2,075	493	1,365	67	4	92	1,437	1,055	311	1,617	313	10,571
12	5	194	427	9	31	312	280	576	57	3	67	809	826	151	712	131	8,815
13	2	51	122	4	9	87	56	122	18	4	23	108	397	36	359	51	4,041
14	0	7	64	2	0	72	22	0	11	5	2	20	29	25	154	16	1,043
15	2	4	4	11	4	137	40	3	3	77	7	3	3	11	66	1	201
16	9	47	26	65	19	121	202	8	4	217	48	6	61	49	24	13	48
17	37	91	91	119	40	105	310	63	49	339	142	11	264	123	57	75	229
18	22	204	208	174	34	95	231	182	135	286	194	28	545	216	89	161	1,034
19	28	130	182	100	16	50	121	347	258	159	203	30	390	136	66	172	1,451
20	11	71	131	33	25	33	30	256	136	35	99	22	153	81	21	130	1,106
21	3	15	36	15	44	13	26	223	65	27	95	19	34	62	11	78	513
22	7	7	6	4	49	7	18	292	11	17	56	17	10	96	8	29	173
23	6	22	103	3	33	12	12	225	10	25	44	19	1	86	17	25	240
24	4	38	124	5	14	9	6	103	21	14	23	24	8	46	18	26	282
25	3	28	77	2	4	5	7	33	15	8	10	15	2	20	12	13	199
26	0	11	73	2	3	3	3	15	10	1	8	5	1	5	10	10	154
27	2	3	35	3	1	4	1	5	4	4	6	8	2	3	7	7	50
28	0	12	4	5	4	3	3	1	6	2	2	0	1	3	3	2	13
29	1	14	6	3	2	0	0	2	2	0	0	0	1	0	1	6	19
30	0	11	3	1	0	1	0	2	1	1	1	1	1	3	0	0	8
31	0	1	0	1	2	0	0	1	0	0	1	0	1	4	0	1	6
32	0	2	1	0	1	1	1	0	1	0	0	1	0	0	0	3	3
33	0	2	1	0	0	0	0	0	0	0	1	0	0	0	0	0	4
34	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	3
35	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	1
36	1	0	1	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
38	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	1	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	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	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
44	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
46	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
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**

length	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
5	0	0	0	0	0	1	0	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
7	1	0	0	0	0	1	0	13	0	0	0	0	0	0	0	72
8	0	16	0	0	4	56	4	145	3	0	0	35	0	15	32	2,674
9	98	400	0	0	77	322	145	606	148	0	19	435	60	77	435	15,025
10	405	2,303	4	1	169	1,151	926	1,700	1,966	14	115	3,169	338	455	2,585	27,025
11	645	3,389	19	1	136	1,259	1,033	2,055	3,476	22	203	3,888	460	1,007	3,918	23,949
12	586	1,706	33	1	62	1,263	486	950	3,418	7	178	2,589	300	1,402	2,111	12,415
13	265	722	25	2	19	888	78	586	1,141	1	77	1,241	93	623	785	6,004
14	104	498	7	1	8	626	76	357	561	3	16	262	74	123	86	2,758
15	220	247	7	42	56	251	298	426	593	40	19	62	98	108	60	556
16	1,349	1,035	121	327	129	722	1,177	1,971	1,430	222	100	52	504	226	229	3,003
17	4,517	2,943	415	485	129	1,670	1,607	3,916	2,151	614	215	206	1,343	669	784	9,775
18	8,611	4,097	733	403	140	2,254	1,444	3,722	1,953	780	312	642	2,764	755	1,319	10,201
19	6,452	3,619	720	261	114	1,607	918	1,978	1,078	527	270	1,123	3,058	520	1,196	5,162
20	1,840	3,679	390	381	29	934	390	1,315	798	424	257	909	1,402	718	593	1,389
21	518	6,253	427	584	42	559	266	2,149	1,320	599	655	377	271	1,539	371	618
22	292	8,129	660	1,077	111	416	458	2,835	1,941	723	1,260	200	296	2,305	510	1,214
23	755	5,618	931	982	174	427	603	2,340	1,522	641	1,387	313	665	1,674	699	1,311
24	833	2,385	977	745	161	361	558	1,351	1,149	580	1,123	568	738	711	802	1,012
25	278	1,292	1,025	844	216	234	272	854	909	573	930	816	591	326	896	1,010
26	132	1,266	741	1,215	332	262	128	642	793	523	658	1,000	312	379	847	1,220
27	93	491	363	1,200	353	283	91	382	504	350	651	931	461	338	426	1,367
28	88	282	201	730	379	427	109	230	267	243	637	721	689	316	243	1,206
29	36	147	81	331	332	622	115	198	234	153	468	565	753	346	155	741
30	8	71	33	116	171	618	156	64	90	41	321	467	627	299	158	435
31	3	35	23	37	101	441	167	54	42	34	235	307	496	227	118	324
32	2	10	11	28	41	317	126	68	32	15	123	174	310	174	148	262
33	2	11	4	11	16	266	65	57	57	14	78	105	152	100	102	166
34	1	4	2	8	1	30	37	47	16	4	44	63	106	61	63	127
35	0	3	0	1	2	17	18	26	10	4	32	31	36	20	31	109
36	0	2	1	1	1	4	9	11	11	2	28	17	23	8	34	48
37	0	0	1	1	0	2	3	4	8	1	15	6	8	1	8	41
38	0	1	0	1	1	0	1	0	0	0	5	4	10	3	10	28
39	0	0	0	0	0	0	0	0	1	0	3	2	3	0	3	3
40	0	0	0	0	0	1	0	0	0	0	1	3	0	1	3	0
41	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0
42	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	1	0	0	0	0	0	0	0
44	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
46	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	1	0	0	0	0	0	0
Total	**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**	**131,250**

Table 5.53. Scup fall length frequencies, 1 cm intervals, 1984-2016.
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**	**2016**
2	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
3	0	8	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	13	4	9	0	0	-	4	0	0	0	0	2
4	1	61	0	0	17	1	3	14	196	0	6	0	0	18	4	1	1	28	117	19	143	363	11	74	0	34	-	21	29	4	11	21	4
5	16	90	313	213	103	128	57	120	483	28	312	1	13	70	224	21	168	317	603	214	1,302	850	129	381	0	234	-	131	119	7	204	799	55
6	295	249	626	1,193	625	612	340	1,805	1,516	554	931	41	185	338	1,246	1,041	991	1,891	2,132	573	4,723	4,122	389	1,303	4	1,106	-	705	567	116	1,033	3,154	370
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	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	1,759
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	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	3,354
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	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	1,747
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	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	697
11	8	1,064	19	12	81	95	601	1,191	78	814	432	606	525	499	728	20,073	1,806	888	2,020	3	1,896	1,973	126	2,547	1,733	75	-	632	2,695	375	1,526	2,094	1,073
12	0	9	4	22	17	124	28	88	40	12	46	103	31	191	94	6,931	467	312	488	6	344	734	256	1,316	84	10	-	112	726	118	362	532	3,881
13	14	59	41	144	53	670	51	2	304	13	4	46	39	44	56	1,190	428	229	197	87	77	680	606	1,645	27	81	-	42	154	70	205	281	6,261
14	30	265	322	288	274	1,449	13	46	860	70	22	403	161	130	180	198	2,744	309	276	249	159	1,158	1,101	3,269	193	598	-	248	482	288	230	1,335	5,499
15	86	339	603	277	649	1,102	171	305	1,393	176	68	1,283	459	517	504	459	6,889	690	854	325	268	784	1,210	4,216	367	1,890	-	883	1,483	454	537	2,361	3,665
16	91	473	452	149	313	487	373	910	942	251	117	1,478	491	588	738	742	10,695	762	1,403	201	130	555	801	3,003	493	2,445	-	1,425	2,233	331	589	2,667	1,753
17	46	299	361	61	111	213	362	683	465	168	103	869	299	289	446	1,583	7,208	593	1,642	92	75	359	338	1,468	330	1,777	-	1,138	2,015	203	416	1,813	575
18	27	170	188	29	81	87	415	242	110	70	87	262	111	101	193	1,548	3,508	225	1,370	43	37	261	179	555	110	830	-	613	1,332	83	271	735	799
19	8	44	55	20	85	42	309	39	28	56	57	47	51	21	72	1,196	771	294	733	175	78	234	113	676	88	320	-	293	455	176	143	218	1,942
20	21	15	36	52	93	43	266	13	145	95	34	18	75	32	33	436	396	769	621	586	189	308	147	1,121	185	343	-	110	199	505	190	241	3,058
21	47	8	44	87	87	34	424	56	254	111	41	9	70	34	33	289	337	967	797	693	339	194	158	1,179	228	336	-	186	212	640	151	397	1,819
22	59	38	116	88	96	34	333	64	265	88	56	4	58	39	27	460	216	655	1,214	500	447	147	128	655	238	226	-	288	388	478	201	479	802
23	75	77	133	61	18	14	101	86	181	44	38	4	23	17	16	329	189	328	1,185	315	544	88	134	365	150	190	-	408	319	164	335	337	667
24	93	64	84	33	17	9	34	98	27	16	33	3	7	10	7	173	124	195	1,071	506	744	104	90	189	94	170	-	649	184	179	358	248	722
25	46	49	38	27	4	6	21	47	23	12	17	1	1	12	5	66	49	96	769	726	1,072	146	59	181	123	170	-	822	112	238	277	313	576
26	38	53	13	28	10	3	10	19	17	10	11	0	0	4	2	13	35	55	271	720	878	173	42	170	147	167	-	643	106	162	190	516	672
27	38	64	9	36	7	1	2	13	22	10	7	0	2	1	2	19	42	27	184	558	790	212	23	91	99	128	-	502	122	129	100	400	798
28	31	18	12	11	3	1	3	6	13	7	6	0	2	1	1	4	20	11	67	261	731	214	15	78	85	107	-	383	116	108	100	232	615
29	9	21	4	7	0	0	1	1	6	4	2	0	0	0	3	2	13	14	32	101	433	174	23	32	59	86	-	341	59	135	57	145	564
30	8	16	2	1	0	0	0	0	0	3	0	0	0	0	0	0	3	4	22	75	122	101	36	27	51	35	-	196	63	116	88	95	299
31	7	7	1	1	0	0	1	2	1	0	0	0	1	0	0	1	2	3	14	23	45	46	26	43	22	28	-	111	26	47	64	98	157
32	2	1	0	0	0	0	3	0	0	0	1	0	0	0	0	1	0	0	1	14	25	18	20	37	20	21	-	76	17	36	49	76	94
33	1	2	0	3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	5	10	3	6	27	14	13	-	31	11	24	22	67	58
34	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	5	2	10	11	13	-	16	1	9	7	18	40
35	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	1	1	0	1	1	6	7	-	10	0	7	4	12	9
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	4	0	0	1	4	2	-	7	1	2	3	5	2
37	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	-	2	0	1	0	5	0
38	0	0	0	0	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
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	0	0	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	0	0	-	0	0	0	1	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**	**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**	**44,388**

Table 5.54. Striped bass spring length frequencies, 2 cm intervals (midpoint given), 1984–2016.

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**	**2016**
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	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	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	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	1
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	1
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	3
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	10
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	15
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	9
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	21
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	9
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	3
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	1
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	3
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	1
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	0
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	0
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	3
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	3
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	1
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	6
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	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	8
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	6
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	3
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	6
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	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	1
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	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	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	1
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	0
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	1
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	1
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	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	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	0
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	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	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	3
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	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	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	0
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	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**	**1**
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**	**128**

Table 5.55. Striped bass fall length frequencies, 2 cm intervals (midpoint given), 1984–2016.
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**	**2016**
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	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	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	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	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	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	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	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	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	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	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	0
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	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	0
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	0
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	0
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	0
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	1
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	3
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	4
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	5
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	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	4
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	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	2
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	2
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	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	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	0
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	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	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	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	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	0
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	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	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	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	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	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	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	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	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	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	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	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	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	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	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**	**36**

Table 5.56. Summer flounder length frequencies, spring, 2 cm intervals (midpoint given), 1984–2016.

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**	**2016**
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	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	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	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	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	1
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	0
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	0
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	3
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	7
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	14
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	25
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	20
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	23
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	25
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	17
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	17
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	14
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	13
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	14
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	9
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	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	3
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	5
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	3
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	5
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	1
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	4
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	1
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	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	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	1
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	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	1
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	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	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**	**236**

Table 5.57. Summer flounder length frequencies, fall, 2 cm intervals (midpoint given), 1984–2016.
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**	**2016**
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	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	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	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	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	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	1
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	5
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	2
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	3
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	1
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	1
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	8
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	21
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	23
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	24
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	23
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	32
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	21
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	16
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	17
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	5
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	6
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	5
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	3
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	1
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	2
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	2
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	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	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	1
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	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	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	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**	**224**

Table 5.58. Tautog length frequencies, spring, 1 cm intervals, 1984-2016.
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	2016
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	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	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	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	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	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	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	2
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	6
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	5
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	3
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	1
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	5
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	9
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	3
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	6
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	9
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	1
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	3
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	2
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	8
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	8
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	4
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	5
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	5
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	9
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	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	7
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	7
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	16
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	13
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	8
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	9
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	12
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	11
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	16
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	10
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	8
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	8
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	6
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	3
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	0
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	3
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	7
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	3
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	0
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	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	0
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	2
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	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	0
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	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	0
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	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	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	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	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	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	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	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	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	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	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**	**254**

Table 5.59. Tautog length frequencies, fall, 1 cm intervals, 1984-2016.

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	2016
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	0
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	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	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	0
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	1
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	0
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	0
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	2
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	1
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	1
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	0
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	3
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	1
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	1
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	0
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	2
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	1
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	4
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	0
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	3
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	4
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	2
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	5
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	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	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	4
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	4
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	1
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	2
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	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	1
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	2
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	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	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	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	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	0
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	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	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	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	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	1
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	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	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	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	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	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	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	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	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	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	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	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	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	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	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**	**46**

Table 5.60. Weakfish length frequencies, spring, 2 cm intervals (midpoint given), 1984-2016.
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**	**2016**
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	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	11
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	93
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	73
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	15
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	4
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	5
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	4
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	10
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	9
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	13
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	15
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	5
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	1
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	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	1
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	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	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	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	0
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	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	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	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	1
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	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	1
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	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	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	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	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	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	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	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	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**	**261**

Table 5.61. Weakfish length frequencies, fall, 2 cm intervals (midpoint given), 1984-2016.

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**	**2016**
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	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	0
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	16
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	190
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	457
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	802
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	1785
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	607
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	215
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	124
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	1
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	1
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	7
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	22
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	47
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	44
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	45
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	22
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	9
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	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	5
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	6
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	4
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	5
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	3
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	5
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	1
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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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**	**4,429**

Table 5.62. Windowpane flounder length frequencies, spring, 1 cm intervals, 1989, 1990, 1994-2016.

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**	**2016**
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	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	1
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	8
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	26
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	47
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	133
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	168
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	105
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	77
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	35
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	17
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	9
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	2
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	4
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	4
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	7
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	16
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	16
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	30
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	49
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	79
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	83
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	87
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	68
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	36
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	14
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	10
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	5
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	2
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	2
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	4
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	1
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	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	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	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	1
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	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	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	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**	**1,146**

Table 5.63. Windowpane flounder length frequencies, fall, 1 cm intervals, 1989, 1990, 1994-2016.

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**	**2016**
6	1	0	1	0	0	0	0	0	3	1	0	0	3	0	0	0	0	1	-	0	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	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	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	0
10	18	11	78	10	165	50	2	4	3	9	1	20	22	67	1	14	5	17	-	9	6	7	9	1	0
11	15	9	60	22	227	75	31	11	7	14	0	13	27	111	5	18	3	24	-	19	1	7	13	1	2
12	16	12	50	15	270	107	33	6	9	9	1	6	16	155	2	26	15	29	-	31	5	6	7	0	1
13	23	6	30	10	285	173	47	3	11	9	6	0	14	145	8	44	43	19	-	19	10	10	14	0	5
14	33	14	11	13	306	154	48	5	23	6	0	4	8	109	3	36	58	27	-	36	14	10	14	4	9
15	58	23	23	9	250	110	39	6	18	3	5	8	3	62	2	37	38	25	-	43	18	11	10	12	15
16	140	38	15	16	181	60	34	3	11	3	5	9	3	33	0	30	28	31	-	41	19	13	24	8	24
17	188	44	35	26	112	78	33	11	30	7	14	4	9	12	7	21	20	35	-	72	37	13	19	11	66
18	91	53	47	48	101	119	54	11	15	12	8	11	2	8	19	19	16	47	-	70	19	19	28	16	63
19	46	46	49	47	145	179	95	44	29	6	10	7	11	20	32	26	10	45	-	52	44	31	12	19	86
20	49	28	39	48	131	213	96	67	30	13	9	6	18	30	39	39	31	24	-	41	50	29	18	18	62
21	21	11	23	24	125	165	69	38	52	18	9	11	35	50	25	36	40	28	-	35	87	23	27	21	20
22	14	14	16	19	65	123	37	18	28	22	21	2	25	48	25	42	25	26	-	51	58	28	34	23	8
23	3	10	20	6	67	63	32	12	37	30	39	6	10	14	12	32	27	20	-	47	79	30	43	29	13
24	9	4	7	9	25	49	13	11	33	19	39	11	15	13	9	19	32	23	-	40	45	15	55	24	9
25	4	3	6	3	22	28	9	6	18	19	25	14	8	10	10	6	9	9	-	16	24	29	50	28	14
26	2	0	8	3	19	29	9	4	16	9	10	18	4	3	4	8	16	6	-	18	22	17	29	25	15
27	6	2	3	1	11	17	8	3	5	11	12	17	4	5	3	4	5	4	-	7	14	16	21	24	21
28	2	1	4	1	3	12	1	1	4	5	6	9	2	3	3	3	2	7	-	9	1	13	7	5	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	5
30	2	1	2	1	0	5	0	0	1	2	2	2	0	1	1	0	0	0	-	3	1	2	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	0
32	1	0	0	1	0	0	0	0	0	0	0	2	0	1	0	0	0	1	-	0	1	0	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	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**	**445**

Table 5.64. Winter flounder length frequencies, April-May, 1 cm intervals, 1984-2016.
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**	**2016**
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	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	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	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	1
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	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	7
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	22
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	28
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	51
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	48
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	39
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	29
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	21
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	20
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	28
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	16
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
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	22
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	15
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	27
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	25
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	25
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	20
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	34
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	38
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	34
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	17
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
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	43
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	43
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	53
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	27
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	20
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	7
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	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	8
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	9
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	1
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	1
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	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	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	0
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	1
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	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	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	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	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	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	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**	**850**

Table 5.65. Winter flounder length frequencies, fall, 1 cm intervals, 1984-2016.
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**	**2016**
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	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	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	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	1
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	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	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	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	0
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	0
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	6
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	11
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	5
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	1
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	5
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	7
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	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	4
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	6
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	1
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	6
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	3
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	1
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	5
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	4
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	2
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	5
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	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	0
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	2
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	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	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	2
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	5
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	3
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	0
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	0
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	0
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	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	0
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	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	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	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**	**97**

Table 5.66. Winter skate length frequencies, spring and fall, 2 cm intervals (midpoint given), 1995-2016.

											Spring											
length	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
27	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	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
31	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	1	0	0	0	1	0	0	0	0	1	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	1	0	0
37	0	0	0	0	0	0	1	0	0	3	0	0	1	1	1	1	1	7	7	2	0	0
39	0	0	0	0	0	0	0	1	2	2	0	0	1	0	1	0	1	5	3	3	2	1
41	0	0	0	0	0	0	0	1	1	2	0	0	1	1	1	2	0	4	3	5	1	0
43	0	0	0	0	0	3	0	1	2	4	1	0	0	1	2	1	0	0	9	3	0	0
45	0	0	0	0	1	3	0	0	0	6	0	0	2	1	1	2	0	7	5	4	0	0
47	0	0	0	0	0	2	0	0	0	4	3	0	3	0	0	0	1	1	3	5	0	1
49	0	0	0	0	0	2	0	0	1	2	1	1	1	2	2	0	0	3	2	7	1	0
51	0	1	0	1	0	0	0	1	1	0	1	0	0	0	1	0	0	3	3	2	1	2
53	0	0	0	0	1	3	1	0	1	0	0	1	1	0	1	0	0	1	3	6	2	1
55	0	0	2	3	1	1	0	0	1	1	1	4	3	0	1	0	0	2	5	5	4	1
57	1	2	4	3	2	0	0	0	6	0	0	1	2	1	3	0	2	2	4	2	3	1
59	5	4	1	5	3	2	0	1	1	2	0	1	0	0	2	1	0	2	2	3	2	2
61	1	5	2	1	0	0	3	1	1	1	3	1	1	3	2	0	1	2	4	1	1	1
63	2	2	2	4	1	0	0	1	2	3	2	2	0	1	1	0	2	1	3	1	1	0
65	4	2	4	7	0	0	0	0	0	0	1	1	1	2	0	0	2	3	2	0	0	1
67	1	1	2	2	1	1	0	1	1	1	3	3	0	1	1	1	2	3	2	2	0	0
69	2	0	1	4	2	0	0	1	4	1	0	1	2	3	2	0	3	1	2	4	0	1
71	1	3	2	3	1	2	2	1	2	2	0	1	2	3	0	0	0	4	1	1	2	0
73	0	3	0	0	0	1	2	4	0	2	1	4	3	1	1	1	3	5	2	3	0	3
75	4	4	1	5	3	1	2	1	3	1	0	1	4	3	3	4	3	5	0	0	1	0
77	0	2	3	6	7	2	1	1	1	1	0	0	2	4	0	1	2	0	1	3	1	0
79	1	2	1	4	1	1	2	3	1	1	1	0	4	3	2	1	4	2	0	0	1	0
81	0	4	0	3	2	1	1	2	3	3	0	1	1	1	1	0	2	3	0	1	0	0
83	0	3	0	2	0	0	1	0	1	1	0	0	1	0	3	1	1	4	0	2	1	0
85	0	2	1	1	0	3	1	2	1	0	0	0	0	0	0	0	0	3	1	0	1	0
87	0	0	0	0	0	0	1	1	1	0	0	0	0	1	0	0	0	1	0	1	0	0
89	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	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	0
93	0	0	1	0	0	0	0	1	0	1	0	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	0
Total	**22**	**40**	**27**	**55**	**26**	**29**	**18**	**26**	**37**	**45**	**18**	**23**	**37**	**35**	**32**	**16**	**30**	**77**	**72**	**67**	**25**	**15**

											Fall											
length	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	-	0	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	0
41	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	-	0	1	0	0	0	0
43	0	0	2	0	0	0	0	2	0	0	0	0	0	1	0	-	2	1	1	0	1	0
45	2	0	1	0	0	0	0	1	0	0	0	0	0	0	0	-	0	4	3	2	1	0
47	0	0	0	0	1	0	0	0	0	1	1	0	0	1	0	-	0	1	0	1	0	0
49	1	5	1	0	0	0	0	0	0	0	1	0	0	0	0	-	0	1	4	1	0	0
51	0	0	1	0	2	0	2	0	0	0	0	0	0	1	0	-	0	2	1	0	0	0
53	2	0	2	1	0	0	1	1	0	0	1	0	0	0	0	-	0	2	0	1	0	0
55	1	2	1	0	1	0	4	0	0	0	0	0	0	1	0	-	0	0	1	2	0	1
57	2	6	2	0	0	0	0	3	0	0	2	0	0	1	1	-	3	0	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	1
61	0	5	0	0	0	0	3	0	0	0	0	0	1	0	0	-	0	0	1	1	1	0
63	1	4	1	0	0	0	1	0	0	0	2	0	0	0	0	-	0	0	1	1	0	0
65	2	3	0	1	1	0	0	1	0	3	0	0	0	1	1	-	1	0	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	0
69	0	2	1	1	0	0	0	1	0	0	0	0	1	1	1	-	0	1	3	0	0	0
71	0	0	0	0	0	0	0	1	0	2	0	0	2	1	1	-	0	0	1	2	0	0
73	0	2	1	1	1	0	0	2	0	1	1	0	0	0	0	-	1	1	0	1	0	0
75	1	3	1	0	1	0	1	1	0	1	1	0	1	1	1	-	0	1	0	0	0	0
77	0	1	0	0	0	0	1	2	0	1	0	0	0	2	0	-	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	0
81	0	0	0	1	0	0	1	1	0	0	1	0	1	1	1	-	0	1	0	0	0	0
83	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	-	0	1	0	0	0	0
85	0	0	0	0	0	0	0	1	0	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	0
Total	**15**	**37**	**19**	**7**	**7**	**1**	**20**	**19**	**0**	**9**	**13**	**0**	**7**	**16**	**11**	**-**	**7**	**20**	**17**	**14**	**5**	**2**

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 - 5.18
LISTS

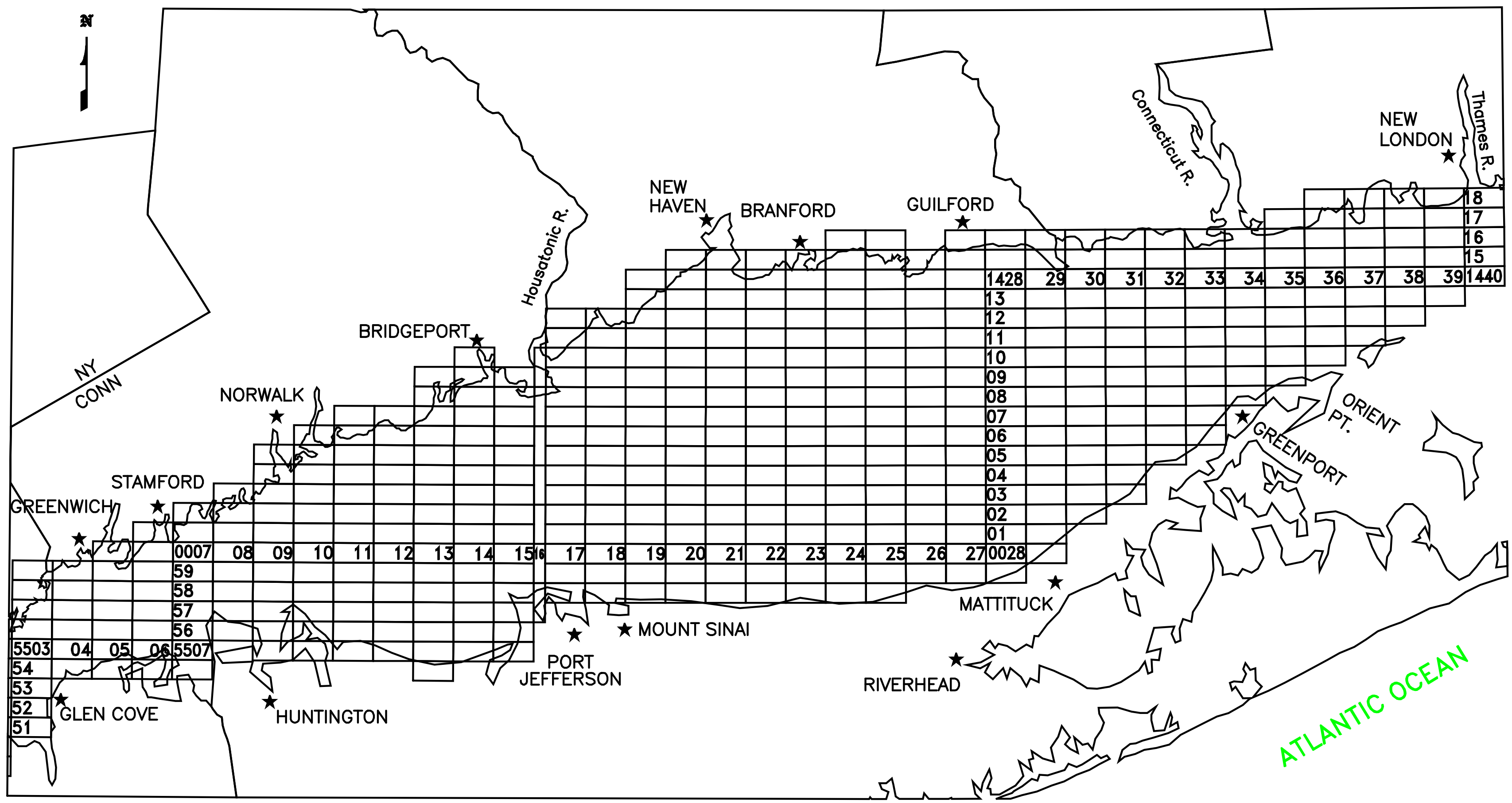
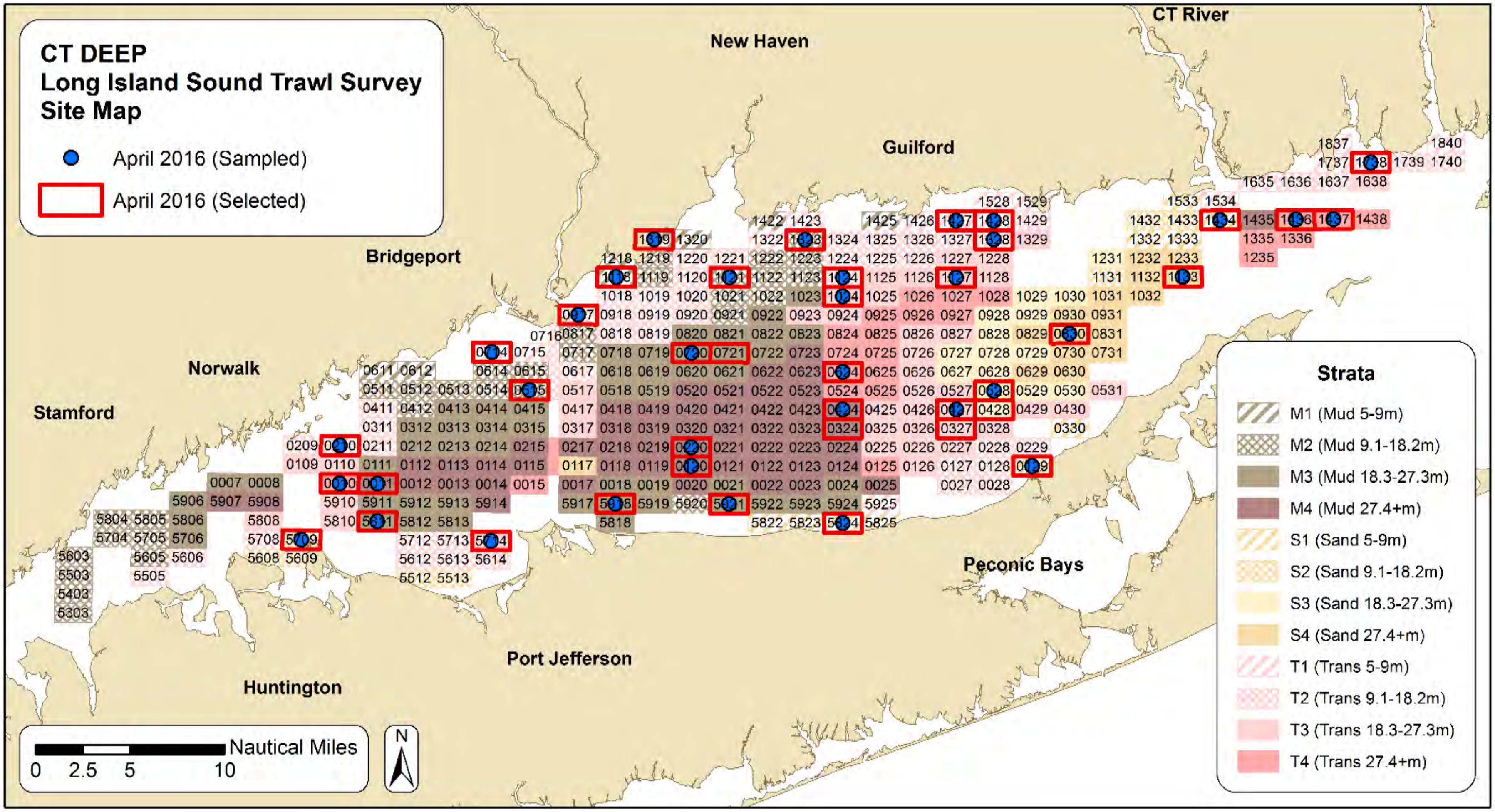


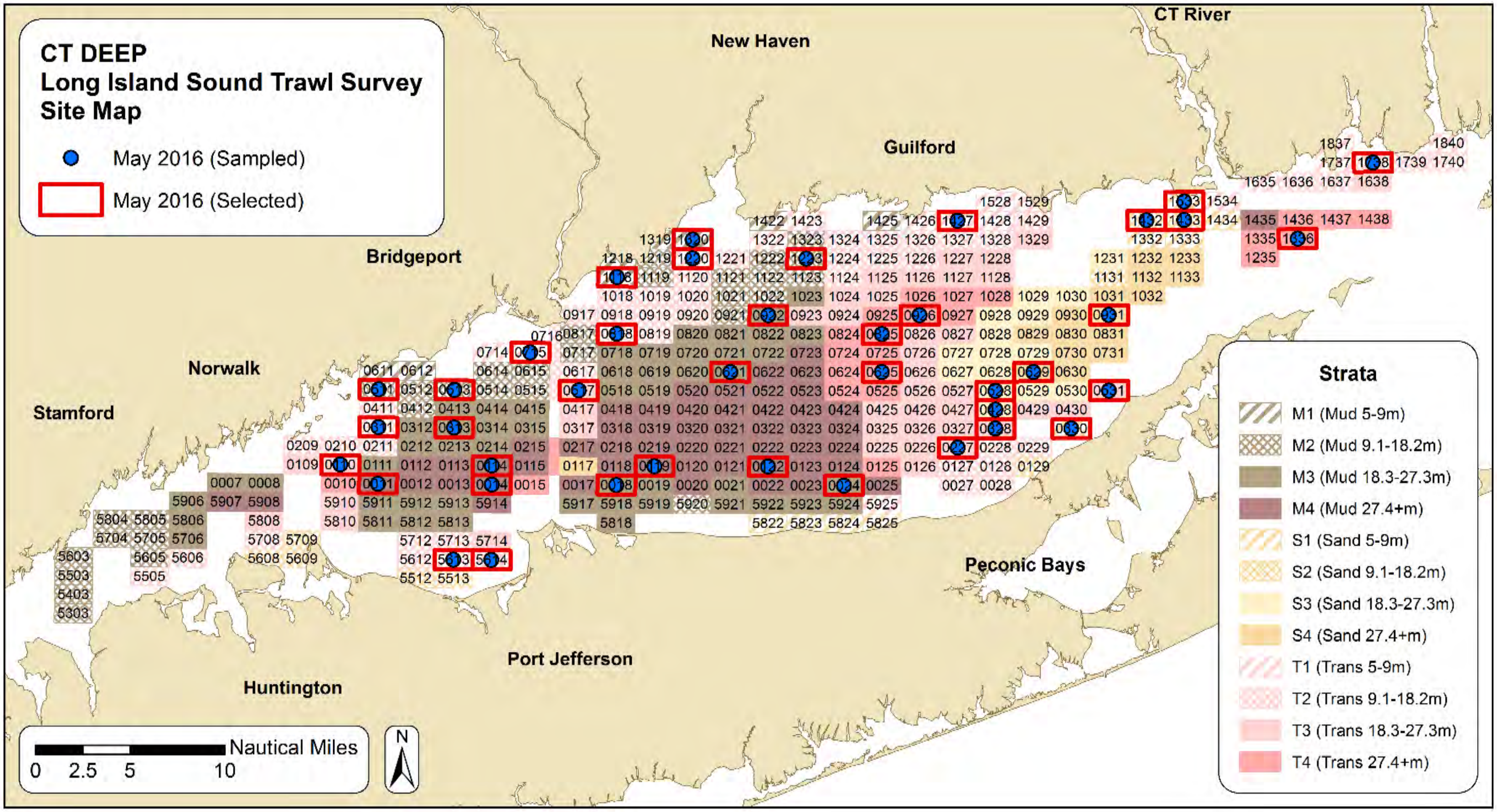
Figure 5.1. Trawl Survey site grid. *Each sampling site is 1x2 nmi (nautical miles). A four-digit number identifies the site: the first two digits are the row numbers (corresponding to minutes of latitude) and the last two digits are the column numbers (corresponding to two nautical miles in length on 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 2016 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.*



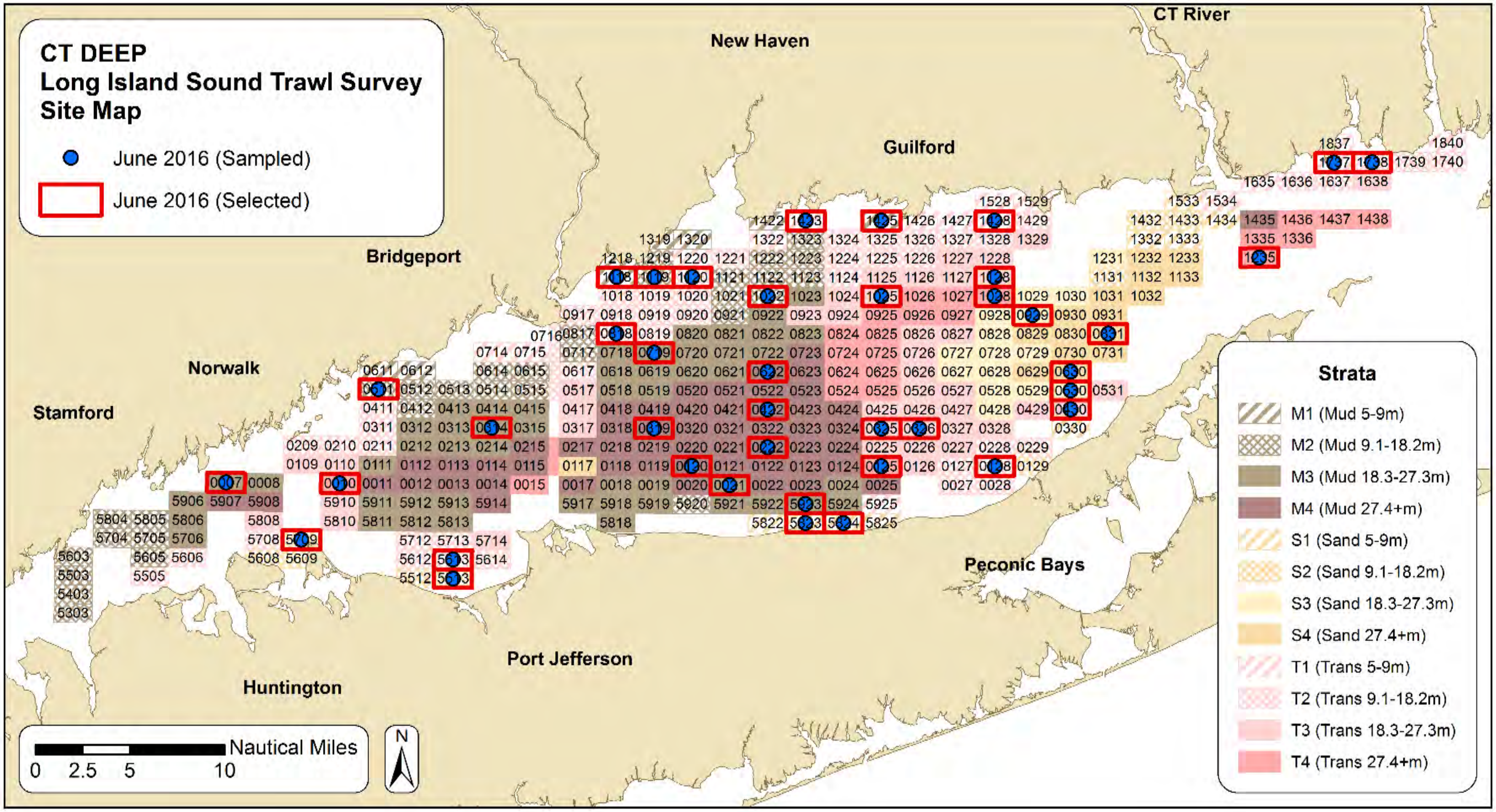
Month	Sample	Site Sampled	Sampled Strata	Site Selected	Selected Strata	Reason Not Sampled
April				0324	M4	logistical issues and time constraints
April				0327	T3	logistical issues and time constraints
April				0428	S3	logistical issues and time constraints
April				0721	M3	logistical issues and time constraints

Figure 5.3. May 2016 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.*



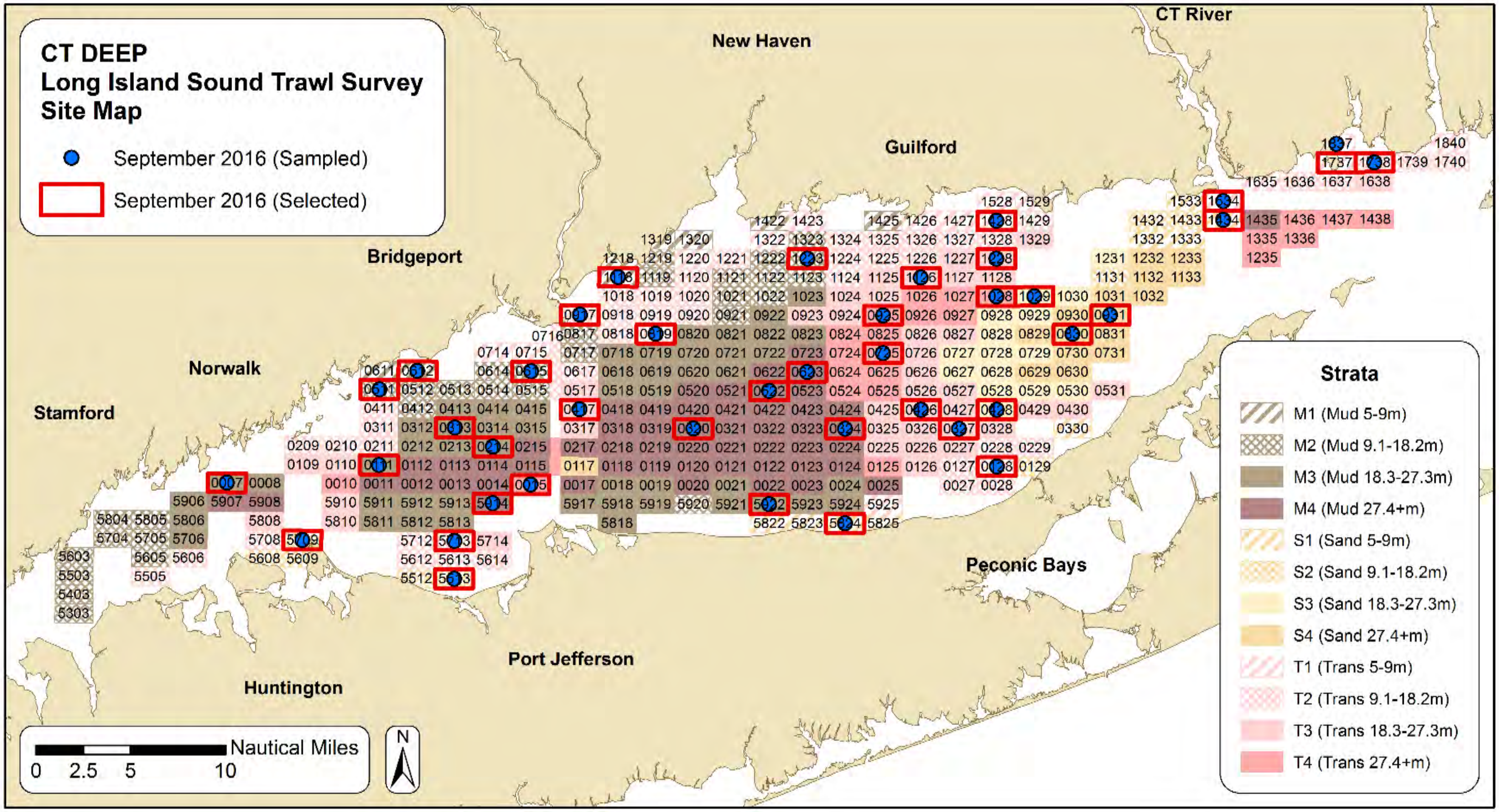
Month	Sample	Site Sampled	Sampled Strata	Site Selected	Selected Strata	Reason Moved
May						No sites were moved during this cruise

Figure 5.4. June 2016 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.*



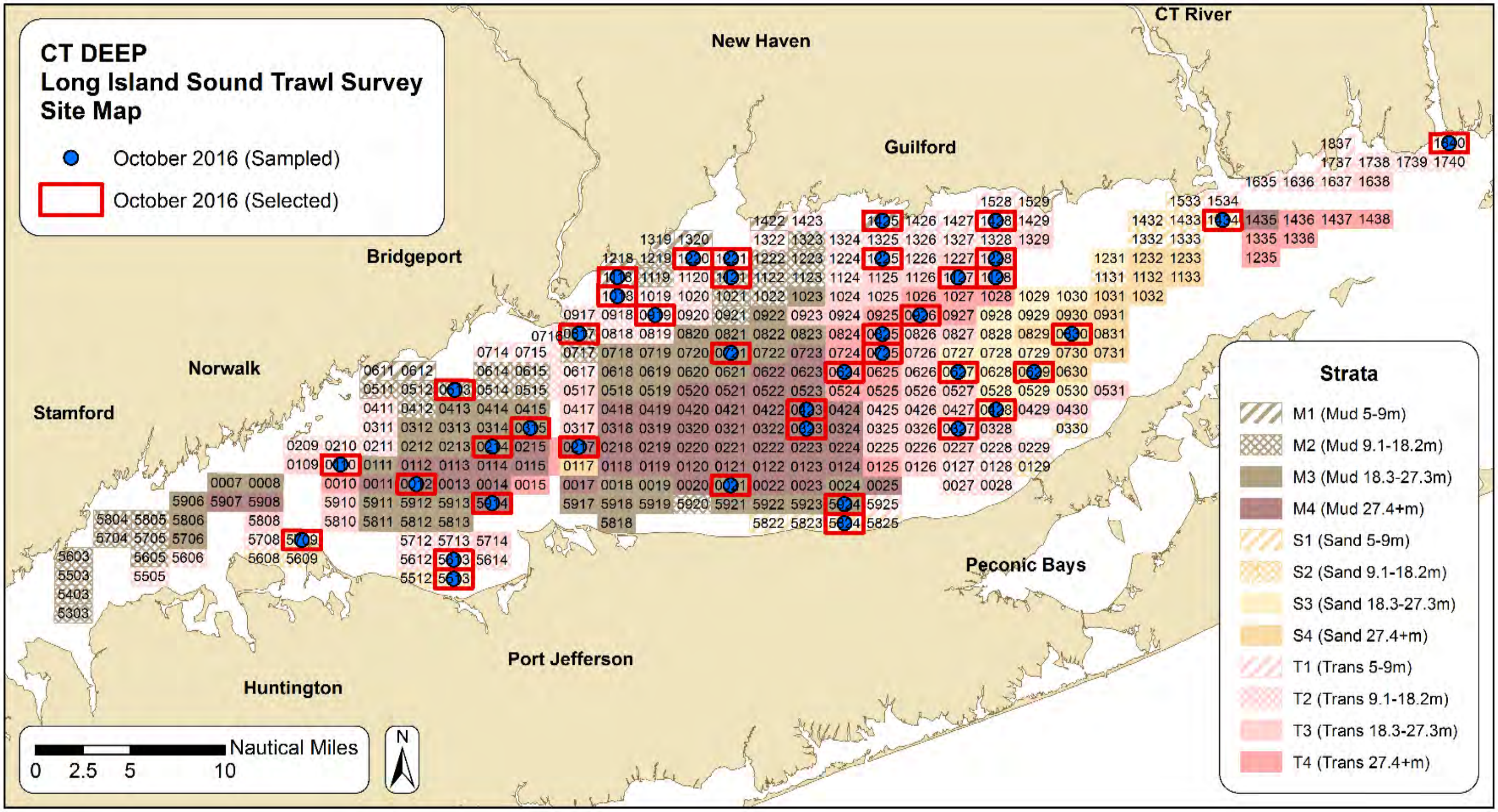
Month	Sample	Site Sampled	Sampled Strata	Site Selected	Selected Strata	Reason Moved
June						No sites were moved during this cruise

Figure 5.5. September 2016 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	FA2016001	1837	T1	1737	T1	obstruction along planned towpath

Figure 5.6. October 2016 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						No sites were moved during this cruise

Figure 5.7. Number of finfish species observed annually, 1984-2016. *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 57.8 for the time-series. See Table 5.4 for details on number of tows completed each year.*

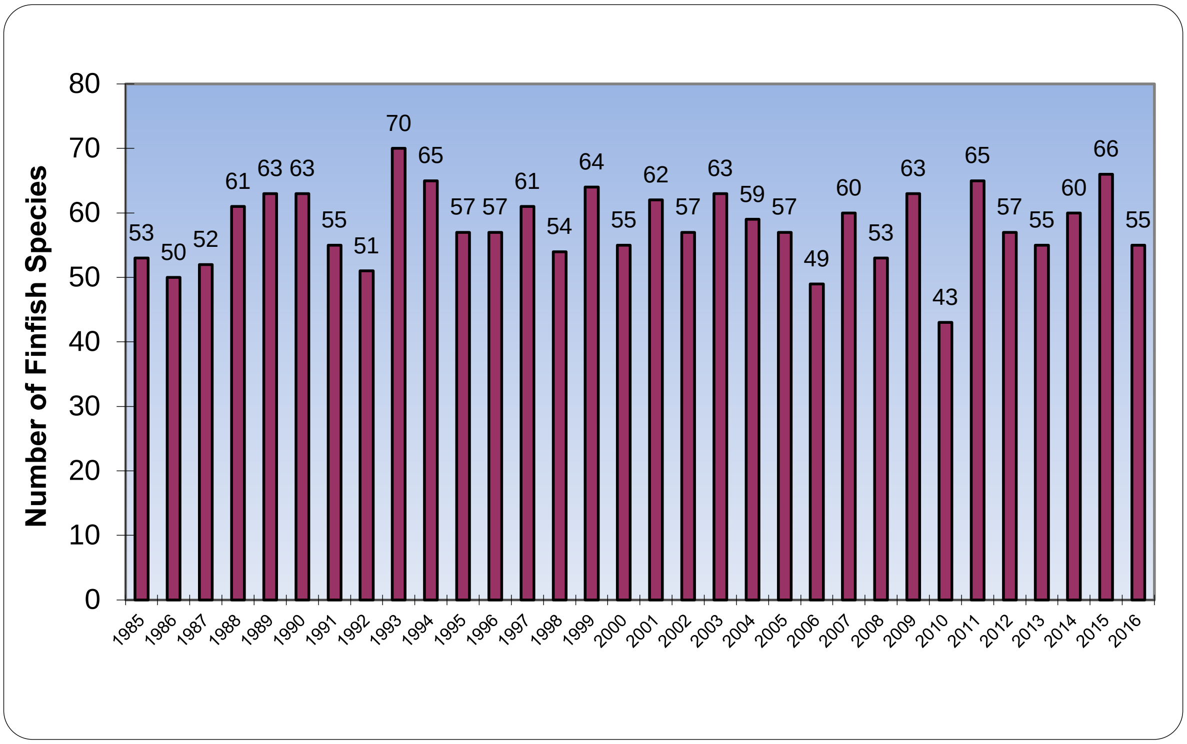
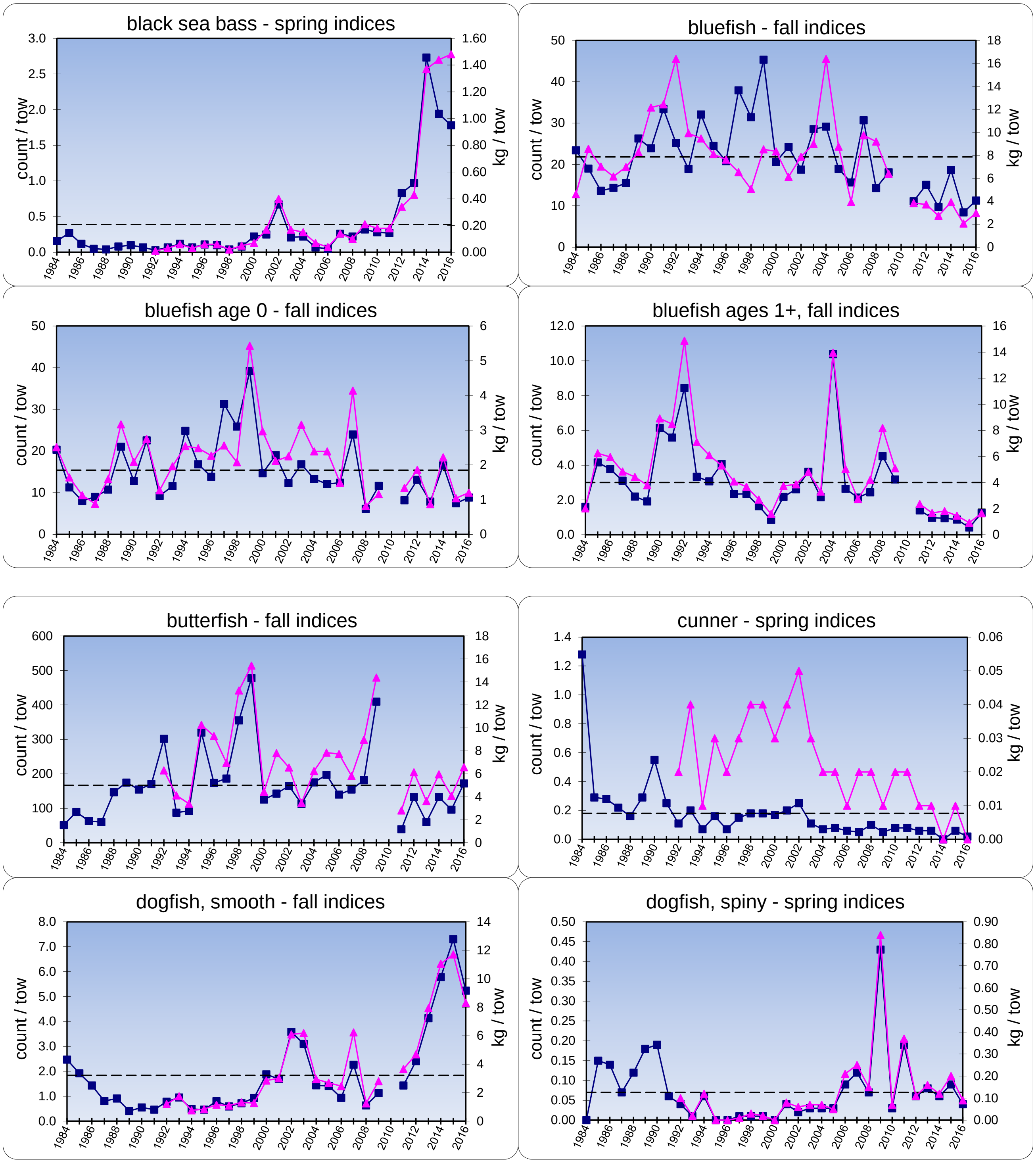


Figure 5.8. Plots of abundance indices for: black sea bass, bluefish (total, age 0, and ages 1+), butterfish, cunner, and dogfish (smooth and spiny).



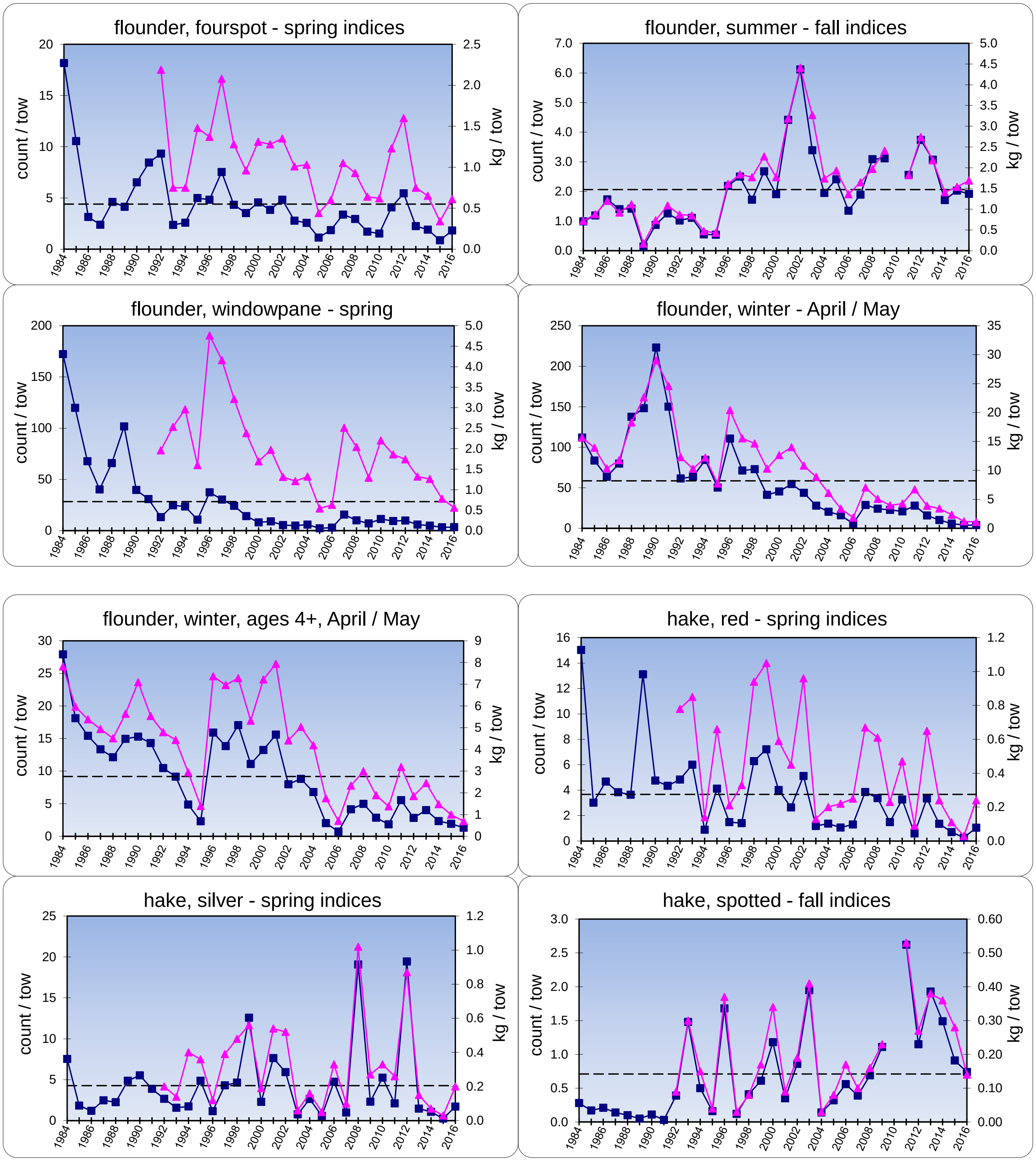
Legend:

■ = 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).



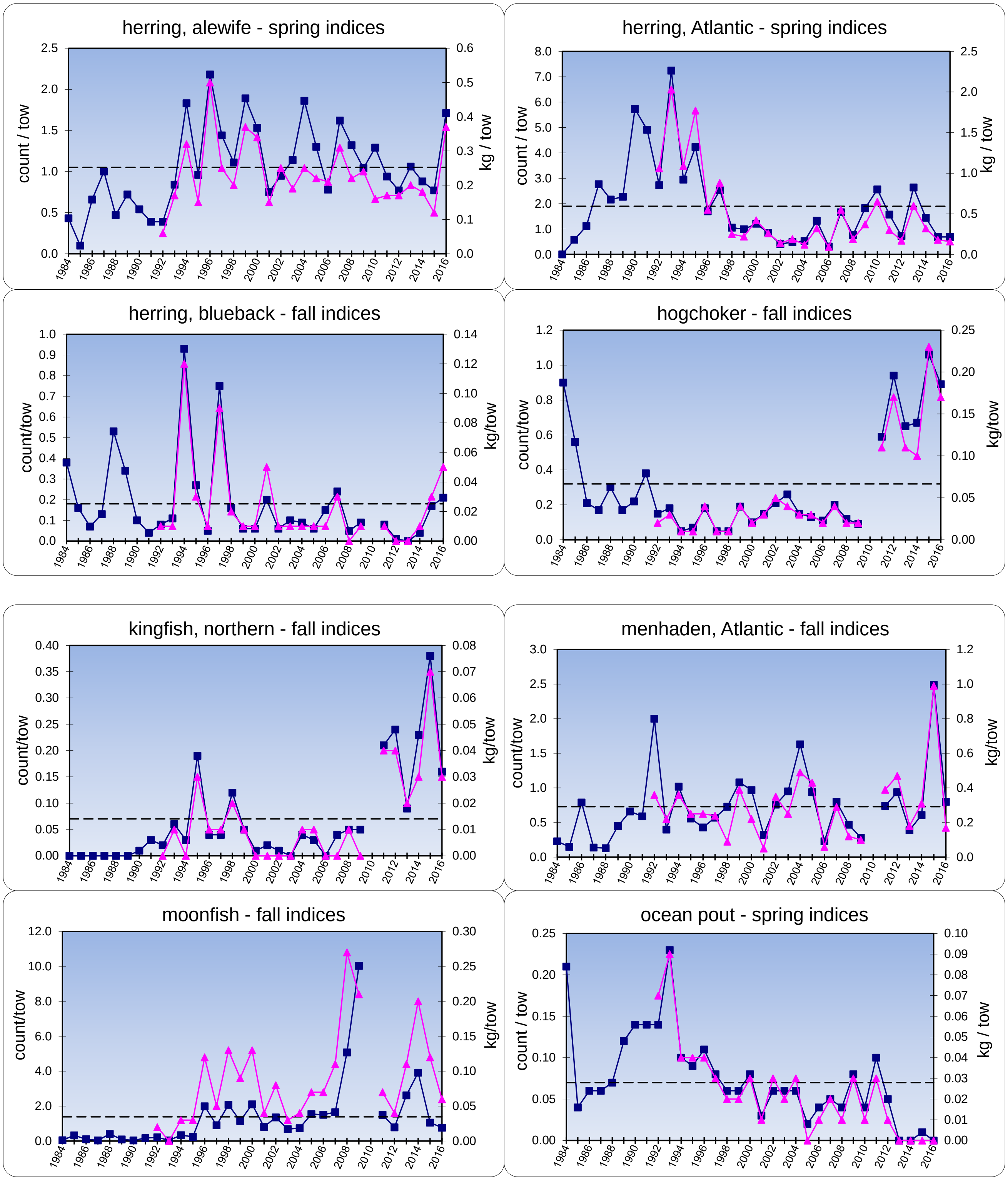
Legend:

■ = 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.



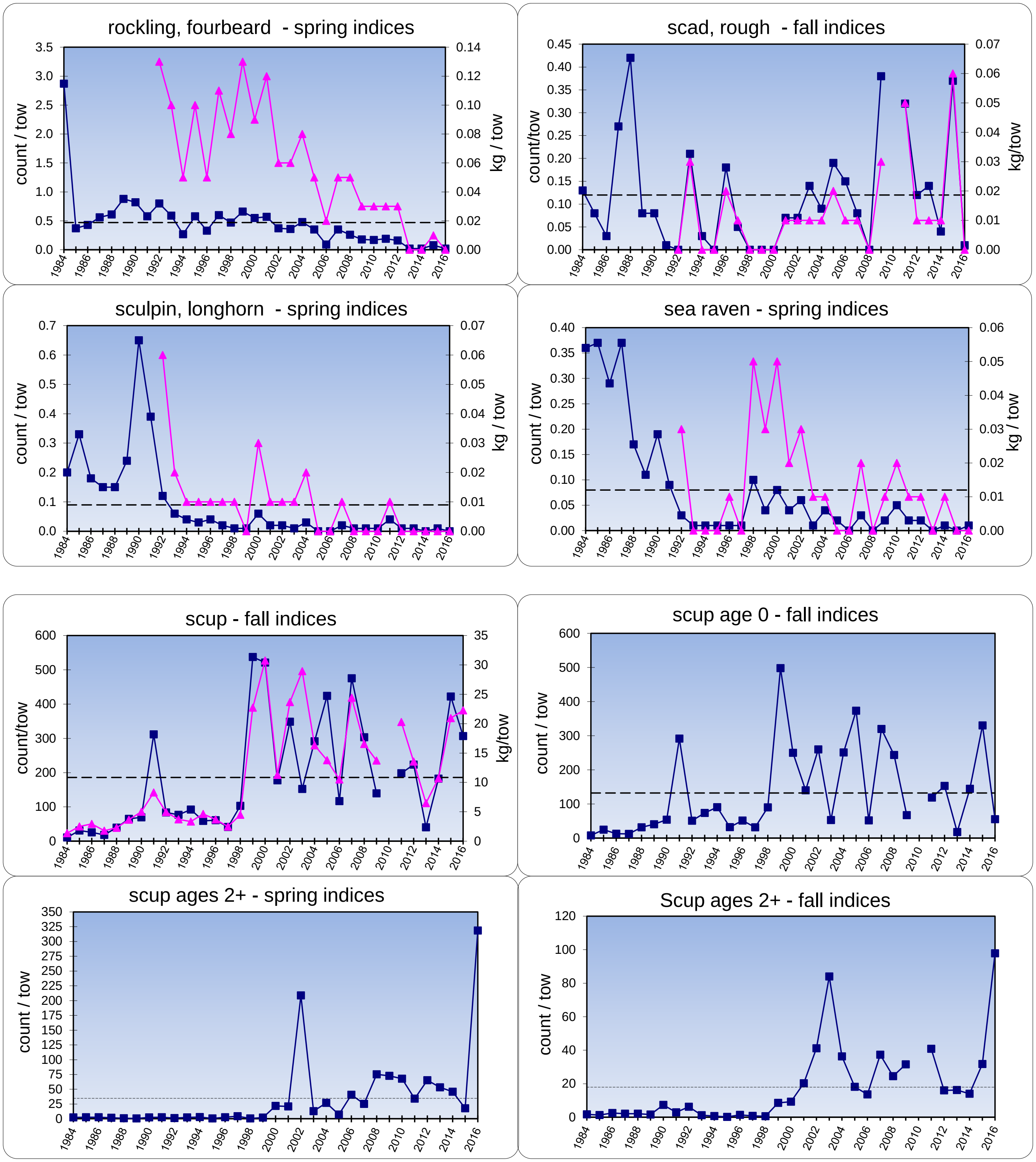
Legend:

■ = 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+).



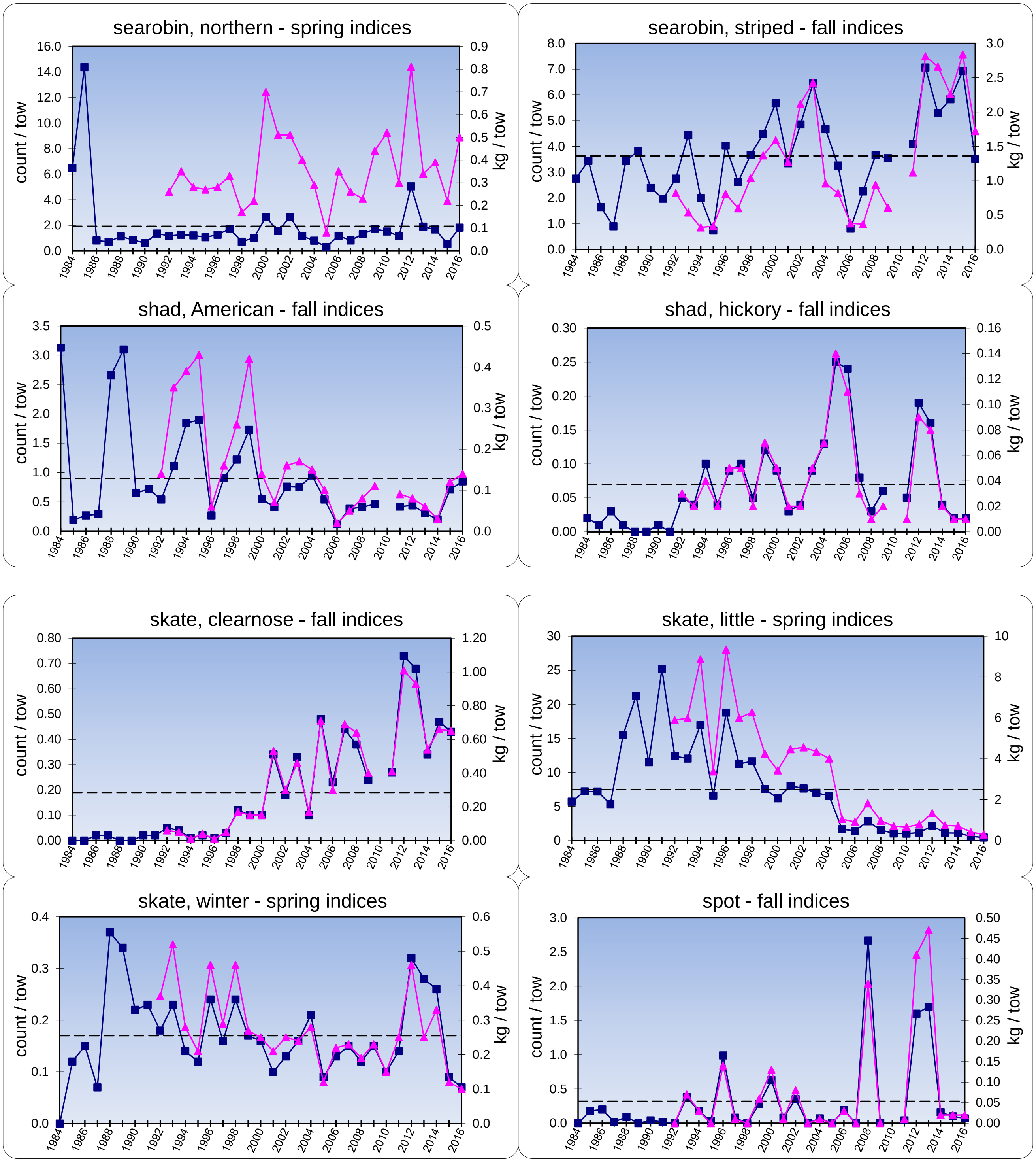
Legend:

■ = 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.



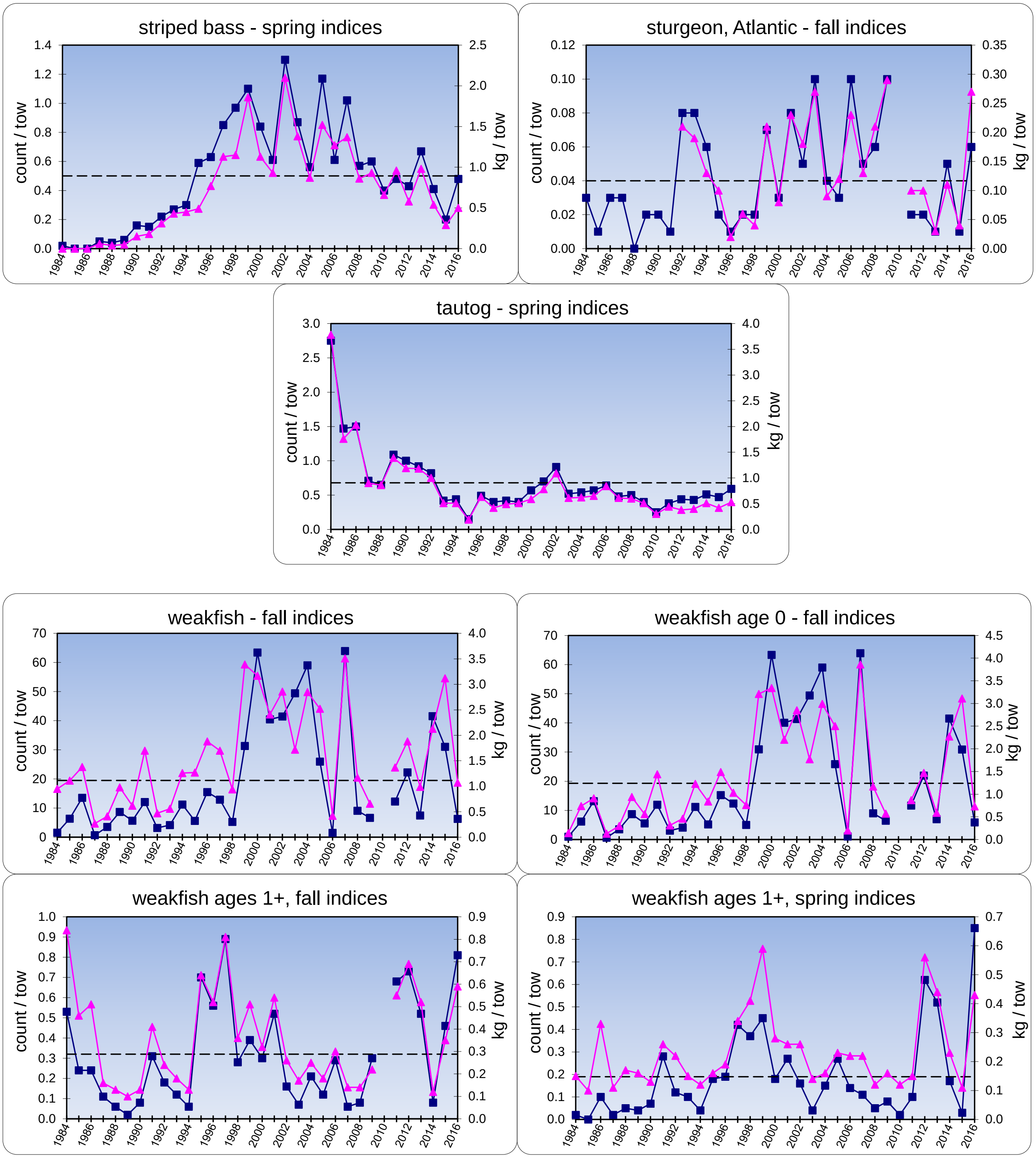
Legend:

■ = 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+).



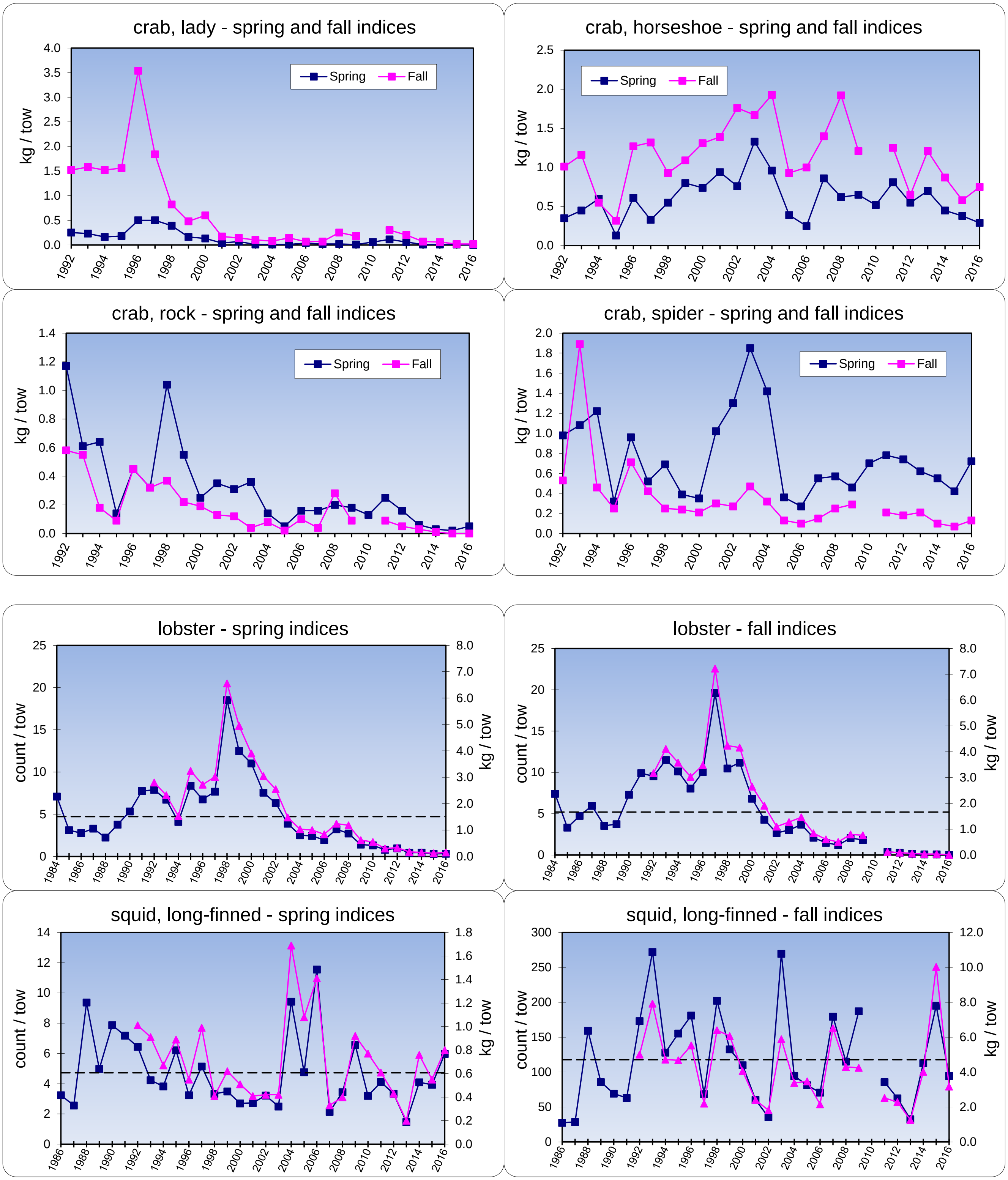
Legend:

■ = 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, 1984-2016. This index measures the diversity of species supported within the Sound's various habitats.

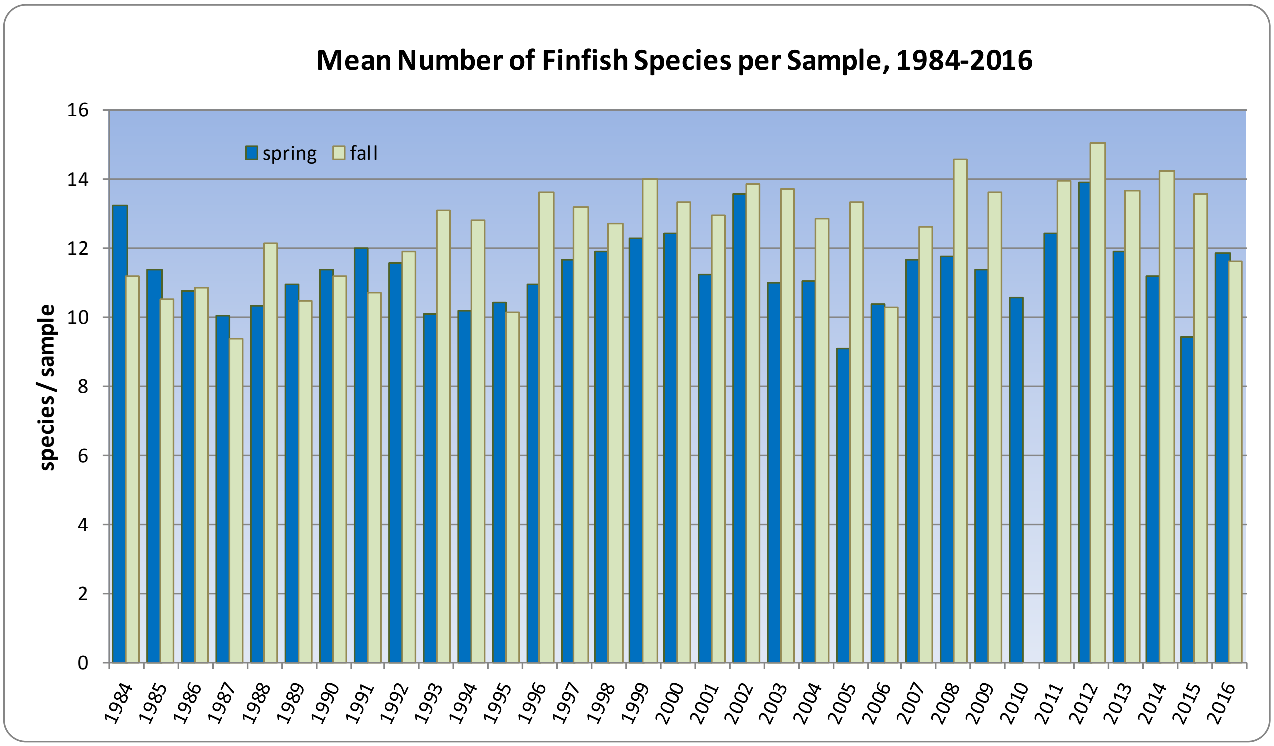


Figure 5.16. Open water forage abundance, 1992-2016. The geometric mean is calculated as the aggregate sample biomass per tow of 14 of the most common forage species sampled in the survey. This index measures the available food base which supports both resident and migratory species. The average since 1992 is 14.56 kg/tow (red line).

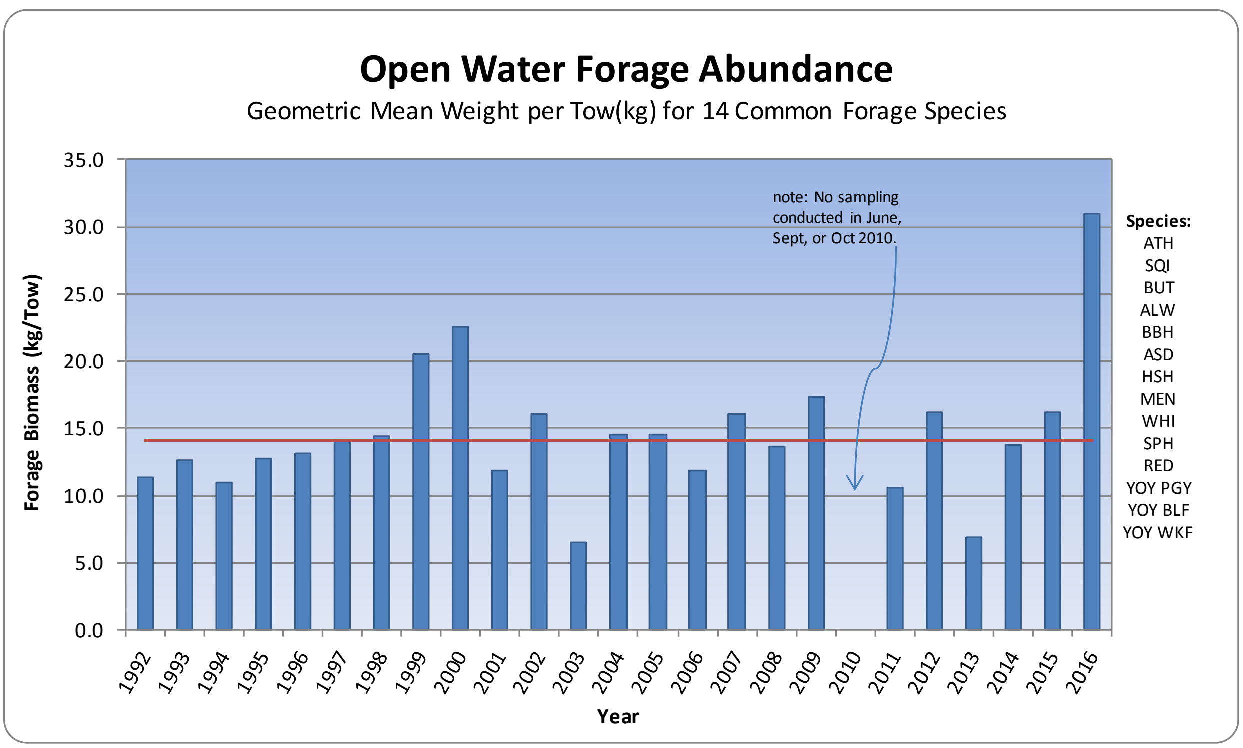
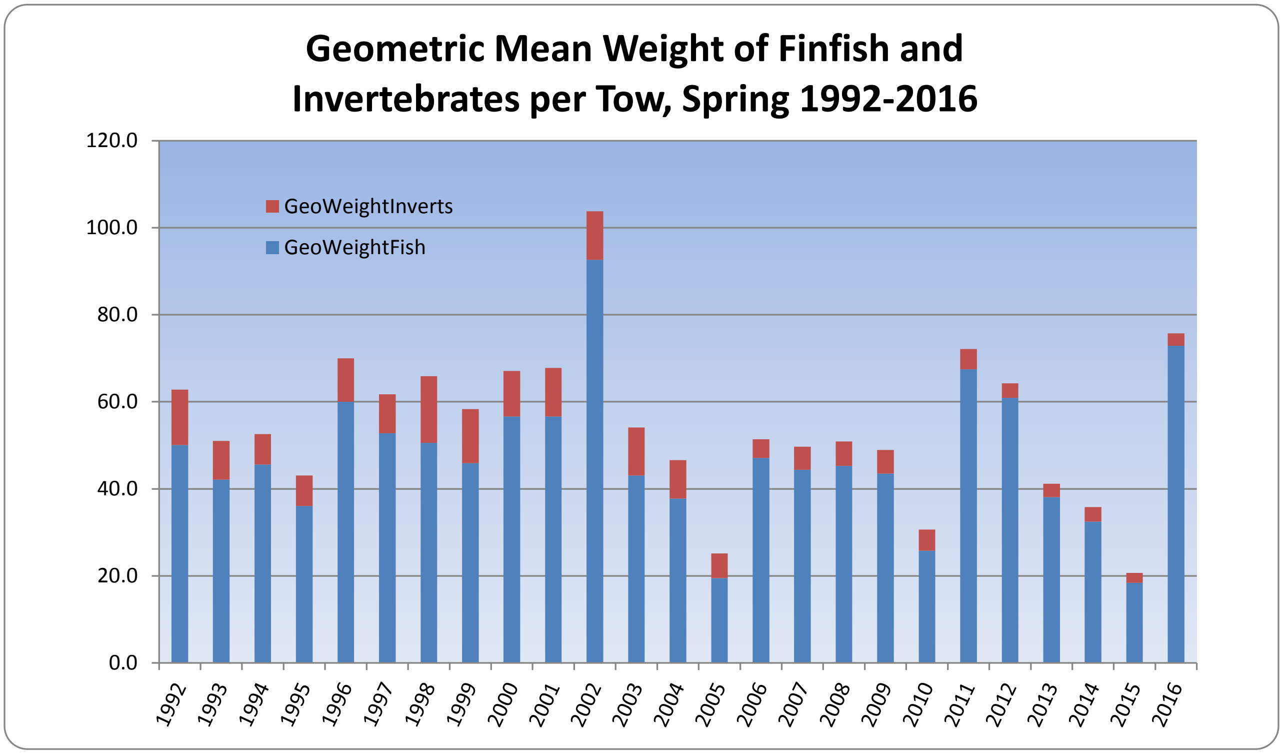


Figure 5.17. Geometric mean biomass of finfish and invertebrates per sample, spring and fall, 1992-2016. This index measures the diversity of species supported within the Sound's various habitats.



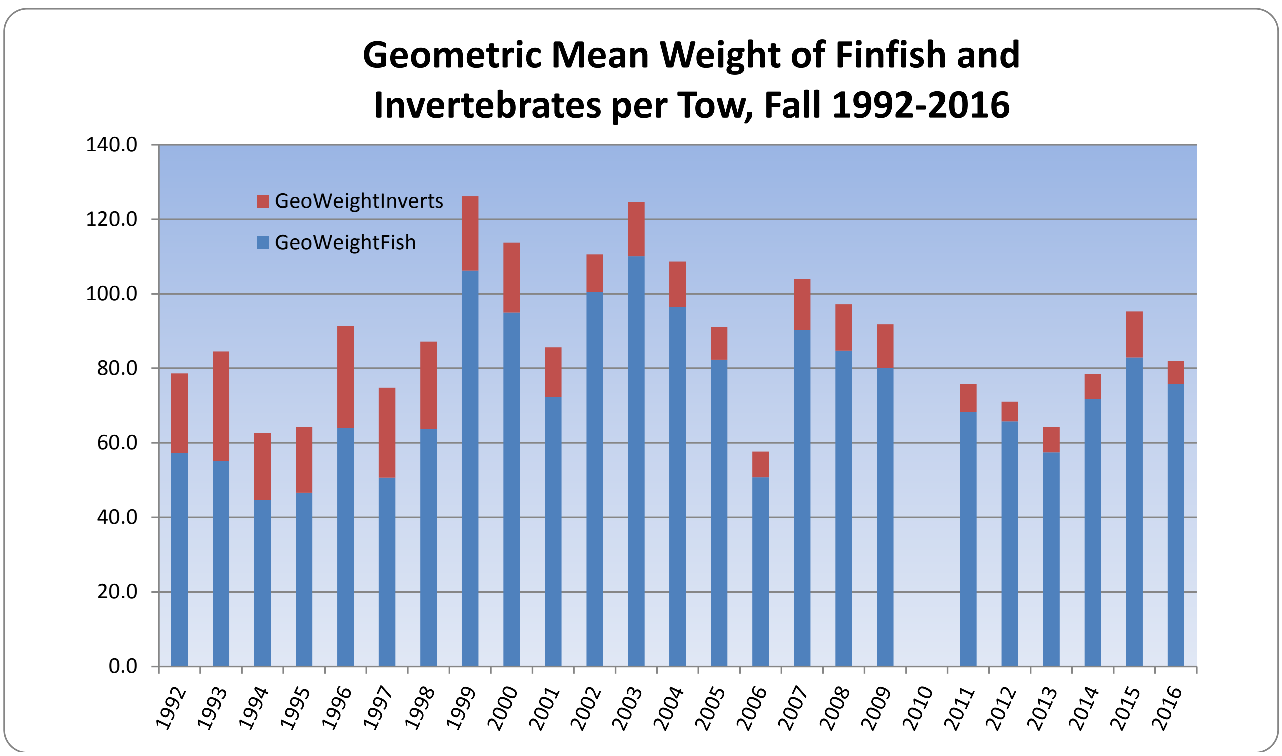
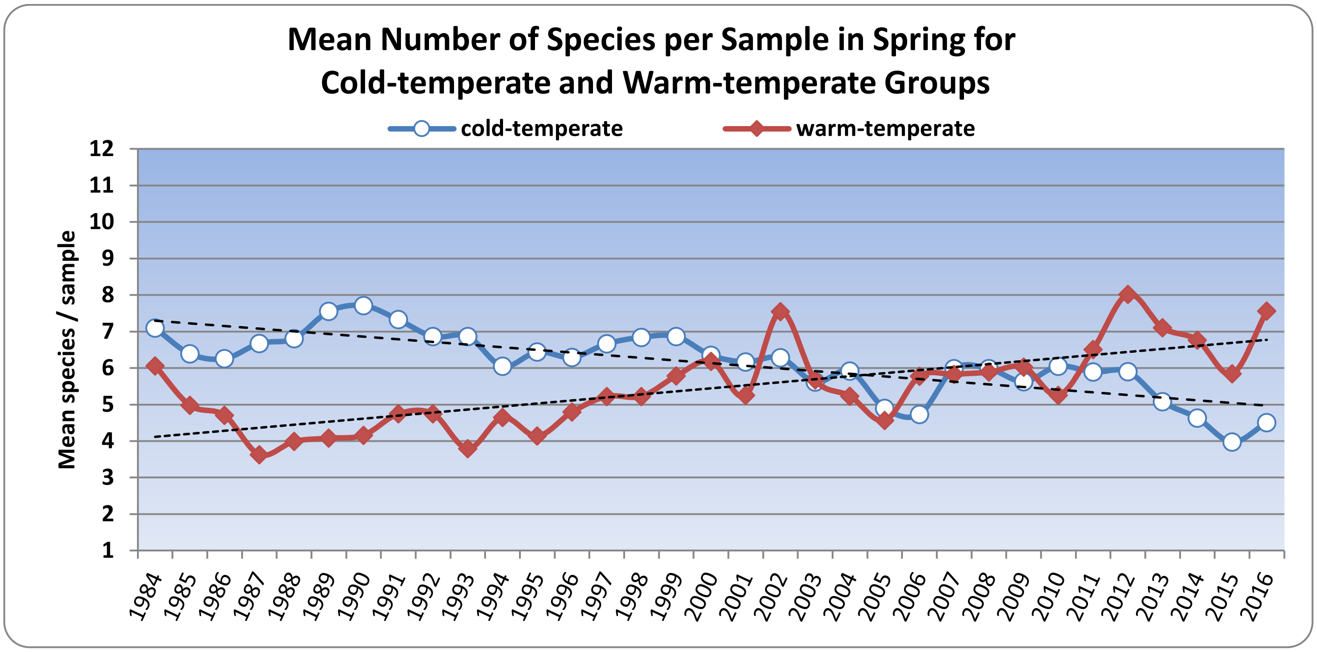
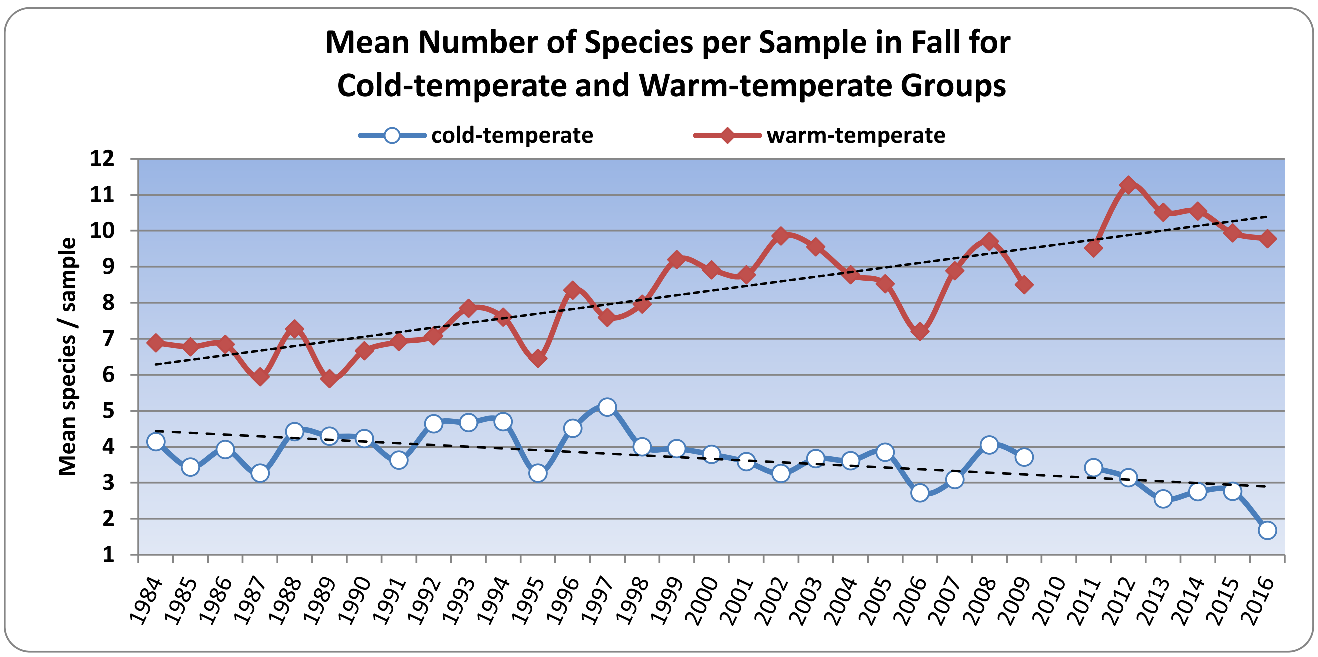


Figure 5.18. Trends in the number of cold temperate versus warm temperate species per sample captured in spring and fall LIS Trawl Surveys. See Appendix 2.5 for list of species included in analysis.





APPENDICES
LISTS

Appendix 5.1. List of finfish species identified by A *Study of Marine Recreational Fisheries in Connecticut* (F54R) and other CT DEEP Marine Fisheries programs. LISTS has collected one hundred-eleven (111) finfish species from 1984-2016.
This appendix contains a list of 154 species identified (Bold type indicates new species) from all sampling programs conducted since 1984. Species are listed alphabetically by common name (Nelson et al. 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
MC (F54R)	Marine Creel Surveys	1985 to present	Marine Angler Surveys
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 dolomieu*	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	*Centropristis 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 punctatus*	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 undulates*	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 acanthias*	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	*Stephanolepis hispidus*	LISTS; EPA
filefish, scrawled	*Aluterus scriptus*	IS
flounder, American plaice	*Hippoglossoides platessoides*	LISTS

Appendix 5.1 cont.

Common Name	Scientific Name	Survey
flounder, fourspot	*Paralichthys oblongus*	LISTS;NRRWS; IS; SS; MISC;EPA
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	*Limanda ferruginea*	LISTS; IS
glasseye snapper	*Heteropriacanthus cruentatus*	LISTS
goatfish, dwarf	*Upeneus parvus*	LISTS
goatfish, red	*Mullus auratus*	LISTS
goby, code	*Gobiosoma robustum*	IS
goby, naked	*Gobiosoma bosc*	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	*Cyprinodon variegatus*	ESS;ISS
moonfish	*Selene setapinnis*	LISTS;NRRWS; SS; MISC;EPA
mullet, striped	*Mugil cephalus*	ISS
mullet, white	*Mugil curema*	LISTS;ESS;ISS
mummichog	*Fundulus heteroclitus*	ESS; IS
needlefish, Atlantic	*Strongylura marina*	ESS;ISS
ocean pout	*Zoarces 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; ESS
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

Appendix 5.1 cont.

Common Name	Scientific Name	Survey
pumpkinseed	*Lepomis gibbosus*	ESS;ISS; NCA; TN;CTR
radiated shanny	*Ulvaria subbifurcata*	SNFH
ray, Atlantic stingray	*Dasyatis sabina*	MC
ray, bluntmose stingray	***Dasyatis say***	LISTS
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
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
shark, sand tiger shark	***Carcharias taurus***	LISTS
shark, sandbar (brown) shark	*Carcharhinus plumbeus*	LISTS
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
skilletfish	*Gobiesox strumosus*	ESS
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 commersonii*	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, horseshoe crab and squid taken in the LISTS, 1984-2016.

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), Atlantic herring (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	2016	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	160	200	78	172	200	200	199	200	196	6,983
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	1,239	36,121
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	8	303
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	2,536	89,730
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	0	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	0	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	1,181	6,243
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	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	15	183
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	2,793	191,803
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	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	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	65,596	2,175,496
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	1	262
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	2	118
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	0	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	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	164	5,909
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	0	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	4	2,024
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	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	3	14
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	1,338	18,576
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	9	2,269
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	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	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	0	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	0	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	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	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	0	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	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	1,056	66,122
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	148	2,002
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	462	18,647
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	1,593	263,382
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	1,108	434,234
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	0	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	0	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	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	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	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	70	155
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	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	0	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	1	51
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	668	62,233
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	891	62,758
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	2,456	14,892
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	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	2,811	25,225
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	340	94,209
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	817	42,460
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	0	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	448	8,232
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	0	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	354	3,957
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	1	55
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	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	31	399
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	0	12

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	2016	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	160	200	78	172	200	200	199	200	196	**6,983**
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	4	**132**
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	74	**181,033**
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	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	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	0	**755**
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	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	876	**14,353**
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	265	**16,658**
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	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	0	**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	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	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	1	**3**
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	0	**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	1	**57**
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	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	5	**230**
ray, bluntnose stingray	0	0	0	0	0	0	0	0	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**
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	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	1	**10**
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	3	**5,408**
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	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	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	0	**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	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	0	**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	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	**1,232**
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	0	**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	0	**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	175,632	**1,447,057**
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	1	**551**
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	0	**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	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	3,178	**37,876**
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	5,886	**57,677**
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	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	2	**34**
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	944	**25,121**
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	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	18	**936**
shark, sand tiger	0	0	0	0	0	0	0	0	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**
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	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	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	3	**123**
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	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	134	**1,575**
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	377	**117,672**
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	17	**1,676**
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	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	0	**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	12	**3,976**
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	12,424	**588,680**
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	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	167	**6,755**
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	12	**474**
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	306	**10,868**
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	4	**84**
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	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	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	4,689	**206,872**

Appendix 5.2 cont.

Total count of finfish, lobster, horseshoe crab and squid taken in the LISTS, 1984-2016.

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
2016	196	293,181
	6,943	6,426,207

Appendix 5.3. Annual total weight (kg) of finfish, lobster, horseshoe crab and squid taken in LISTS, 1992-2016.

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	2016	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	196	4,764
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	8.7	**173.1**
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	0.5	**9.2**
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	3.1	**32.7**
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	0.0	**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	0.0	**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	823.4	**3,063.1**
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	0.0	**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	1.5	**16.2**
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	1,118.7	**27,490.2**
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	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	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	2,036.1	**44,580.9**
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	4.9	**31.1**
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	0.2	**5.7**
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	0.0	**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	**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	315.5	**13,147.3**
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	0.0	**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	0.5	**90.0**
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	0.0	**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	0.1	**1.1**
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	2,785.6	**37,736.3**
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	43.6	**2,436.1**
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	**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	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	0.0	**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	0.0	**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	0.0	**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	0.0	**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	0.0	**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	0.0	**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	175.3	**6,627.0**
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	4.2	**84.3**
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	386.4	**11,693.6**
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	154.7	**11,331.8**
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	261.0	**31,266.6**
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	0.0	**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	0.0	**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	0.0	**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	0.0	**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	23.3	**40.9**
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	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	0.0	**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	0.1	**3.5**
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	50.3	**2,737.5**
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	32.9	**1,461.8**
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	113.8	**1,101.8**
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	0.0	**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	37.1	**7,179.5**
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	1.3	**28.9**
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	**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	132.0	**1,525.8**
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	12.2	**182.4**
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	0.0	**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	41.8	**293.7**
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	0.1	**4.6**
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	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	4.8	**40.7**
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	0.0	**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	0.3	**12.4**
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	25.2	**29,256.6**
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	0.0	**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	0.0	**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	0.0	**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	2016	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	196	4,764
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	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	69.4	**2,240.4**
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	5.2	**196.7**
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	0.0	**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	0.0	**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	0.0	**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	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	0.1	**0.3**
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	0.0	**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	0.1	**2.1**
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	0.0	**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	0.9	**14.1**
ray, bluntnose stingray	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	**0.6**
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	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	45.4	**159.2**
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	0.3	**226.3**
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	0.0	**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	0.0	**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	0.0	**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	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	0.0	**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	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	0.1	**33.5**
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	0.0	**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	0.0	**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	16,006.0	**121,302.4**
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	0.2	**56.0**
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	0.0	**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	0.0	**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	452.1	**3,717.9**
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	1,964.4	**14,916.1**
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	0.0	**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	0.2	**2.9**
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	46.2	**1,109.7**
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	0.0	**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	4.2	**276.0**
shark, sand tiger	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.8	**21.8**
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	0.0	**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	0.3	**4.6**
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	0.0	**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	228.7	**2,890.1**
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	193.1	**31,063.8**
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	31.6	**2,856.2**
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	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	0.0	**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	1.7	**394.9**
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	464.4	**16,011.1**
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	0.0	**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	261.9	**12,383.2**
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	318.3	**6,213.1**
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	288.5	**8,106.2**
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	1.7	**28.0**
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	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	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	297.6	**7,966.8**
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**	**29,304.2**	**466,195.4**

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

species	count	%	weight	%
Invertebrates				
American lobster	2865	100	.	.
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**		-	

species	count	%	weight	%
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	.	.

species	count	%	weight	%
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	%
Invertebrates				
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**		-	
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**		-	

species	count	%	weight	%
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**		-	

species	count	%	weight	%
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	%
scup	45,790	29.9	.	.
butterfish	40,537	26.4	.	.
winter flounder	26,623	17.4	.	.
windowpane flounder	8,482	5.5	.	.
little skate	6,479	4.2	.	.
bluefish	5,845	3.8	.	.
weakfish	4,320	2.8	.	.
Atlantic herring	4,003	2.6	.	.
fourspot flounder	3,553	2.3	.	.
red hake	2,085	1.4	.	.
silver hake	1,537	1.0	.	.
striped searobin	865	0.6	.	.
northern searobin	609	0.4	.	.
tautog	501	0.3	.	.
American shad	361	0.2	.	.
Atlantic menhaden	348	0.2	.	.
summer flounder	263	0.2	.	.
smooth dogfish	193	0.1	.	.
fourbeard rockling	163	0.1	.	.
longhorn sculpin	139	0.1	.	.
hogchoker	104	0.1	.	.
alewife	103	0.1	.	.
cunner	75	0	.	.
spotted hake	73	0	.	.
winter skate	50	0	.	.
ocean pout	42	0	.	.
black sea bass	39	0	.	.
blueback herring	38	0	.	.
striped bass	38	0	.	.

species	count	%	weight	%
moonfish	24	0	.	.
smallmouth flounder	20	0	.	.
sea raven	19	0	.	.
spiny dogfish	14	0	.	.
yellow jack	11	0	.	.
goosefish	8	0	.	.
northern puffer	5	0	.	.
northern kingfish	4	0	.	.
Atlantic tomcod	4	0	.	.
Atlantic sturgeon	3	0	.	.
clearnose skate	2	0	.	.
Atlantic mackerel	2	0	.	.
mackerel scad	2	0	.	.
rainbow smelt	2	0	.	.
Spanish mackerel	2	0	.	.
spot	2	0	.	.
bigeye scad	1	0	.	.
planehead filefish	1	0	.	.
hickory shad	1	0	.	.
red goatfish	1	0	.	.
rough scad	1	0	.	.
sea lamprey	1	0	.	.
oyster toadfish	1	0	.	.
Total	**153,389**		-	
Invertebrates				
American lobster	8,524	40.9	.	.
long-finned squid	12,322	59.1	.	.
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
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**	

species	count	%	weight	%
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

species	count	%	weight	%
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				
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
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**	

species	count	%	weight	%
Invertebrates				
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

species	count	%	weight	%
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				
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
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

species	count	%	weight	%
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				
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**	

Invertebrates

species	count	%	weight	%
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
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

species	count	%	weight	%
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
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

species	count	%	weight	%
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	%	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	**Finfish not ranked**				
winter flounder	1,699	1.8	271.2	2.6	anchovy spp, yoy				
bay anchovy	1,492	1.6	8.3	0.1	Atlantic herring, yoy				
silver hake	1,267	1.4	37.7	0.4	American sand lance (yoy)				
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	**Invertebrates**				
alewife	573	0.6	49.5	0.5	long-finned squid	7,802	83.4	326	32.5
fourspot flounder	466	0.5	88.1	0.8	horseshoe crab	109	1.2	205.8	20.5
striped searobin	366	0.4	113.5	1.1	American lobster	748	8	197.9	19.7
moonfish	361	0.4	3.5	0	boring sponge	nc	nc	51.3	5.1
smooth dogfish	332	0.4	1,176.6	11.2	spider crab	nc	nc	50.6	5
spotted hake	321	0.3	24.3	0.2	lion's mane jellyfish	558	6	45.4	4.5
weakfish	241	0.3	52.2	0.5	rock crab	nc	nc	40.4	4
summer flounder	203	0.2	180.5	1.7	bushy bryozoan	nc	nc	17.8	1.8
tautog	186	0.2	301.4	2.9	blue mussel	nc	nc	7.6	0.8
striped bass	144	0.2	418.7	4	channeled whelk	41	0.4	7.6	0.8
hickory shad	75	0.1	19.1	0.2	lady crab	nc	nc	7.5	0.7
American shad	68	0.1	6.1	0.1	deadman's fingers sponge	nc	nc	6.8	0.7
Atlantic herring	66	0.1	10.3	0.1	hydroid spp.	nc	nc	5.9	0.6
blueback herring	63	0.1	2.5	0	flat claw hermit crab	nc	nc	5.7	0.6
clearnose skate	36	0	52.4	0.5	starfish spp.	nc	nc	4.8	0.5
Atlantic menhaden	28	0	5.5	0.1	rubbery bryzoan	nc	nc	4	0.4
winter skate	23	0	60	0.6	common slipper shell	nc	nc	3.9	0.4
hogchoker	22	0	3.2	0	mantis shrimp	70	0.7	3.4	0.3
Atlantic sturgeon	21	0	368.7	3.5	mud crabs	nc	nc	2.1	0.2
black sea bass	19	0	9.3	0.1	blue crab	11	0.1	1.8	0.2
fourbeard rockling	14	0	1.5	0	knobbed whelk	5	0.1	1.2	0.1
rough scad	14	0	0.5	0	sand shrimp	nc	nc	0.6	0.1
spot	14	0	1.2	0	mixed sponge species	nc	nc	0.6	0.1
spiny dogfish	11	0	47	0.4	moon jelly	2	0	0.5	0
cunner	8	0	1.3	0	sea grape	nc	nc	0.5	0
smallmouth flounder	7	0	0.6	0	arks	nc	nc	0.4	0
ocean pout	5	0	0.9	0	purple sea urchin	2	0	0.4	0
glasseye snapper	4	0	0.1	0	star coral	nc	nc	0.3	0
inshore lizardfish	4	0	0.4	0	hard clams	1	0	0.3	0
northern pipefish	3	0	0.2	0	northern red shrimp	1	0	0.3	0
rock gunnel	2	0	0.1	0	red bearded sponge	nc	nc	0.2	0
yellow jack	2	0	0.1	0	fan worm tubes	nc	nc	0.2	0
Atlantic bonito	1	0	3.2	0	northern moon snail	nc	nc	0.2	0
planehead filefish	1	0	0.1	0	surf clam	1	0	0.2	0
goosefish	1	0	1.2	0	brown shrimp	1	0	0.1	0
pollock	1	0	0.1	0	ghost shrimp	nc	nc	0.1	0
oyster toadfish	1	0	1.2	0	Japanese shore crab	nc	nc	0.1	0
yellowtail flounder	1	0	0.4	0	northern cyclocardia	nc	nc	0.1	0
Total	**92,042**		**10,500.2**		**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
Total	**177,841**		**17,540.3**	

species	count	%	weight	%
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)				
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)

species	count	%	weight	%
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)

Invertebrates

species	count	%	weight	%
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
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

species	count	%	weight	%
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 gadids, 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 bryzoan	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

Appendix 5.4. cont. 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 gadids, 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 5.4. cont. . 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 gadids, 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 bryozoan	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

Appendix 5.4. cont. . Total number and weight (kg) of finfish and invertebrates caught in 2016.
Finfish species are in order of descending count. Invertebrate species are in order of descending weight (nc = not counted). Young-of-year gadids, 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)=196.

species	count	%	weight	%
scup	175,632	63.4	16,006.2	56.2
butterfish	65,596	23.7	2,036.1	7.1
striped searobin	5,886	2.1	1,964.4	6.9
weakfish	4,689	1.7	297.6	1.0
northern searobin	3,178	1.1	452.1	1.6
alewife	2,811	1.0	132.0	0.5
bluefish	2,793	1.0	1,118.7	3.9
spotted hake	2,456	0.9	113.8	0.4
windowpane flounder	1,593	0.6	154.7	0.5
smooth dogfish	1,338	0.5	2,785.6	9.8
bay anchovy	1,239	0.4	8.7	0.0
black sea bass	1,181	0.4	823.4	2.9
winter flounder	1,108	0.4	261.0	0.9
fourspot flounder	1,056	0.4	175.3	0.6
American shad	944	0.3	46.2	0.2
silver hake	891	0.3	32.9	0.1
Atlantic menhaden	876	0.3	69.4	0.2
red hake	668	0.2	50.3	0.2
summer flounder	462	0.2	386.4	1.4
blueback herring	448	0.2	12.2	0.0
little skate	377	0.1	193.1	0.7
hogchoker	354	0.1	41.8	0.1
Atlantic herring	340	0.1	37.1	0.1
tautog	306	0.1	288.5	1.0
moonfish	265	0.1	5.2	0.0
striped bass	167	0.1	261.9	0.9
smallmouth flounder	148	0.1	4.2	0.0
clearnose skate	134	0.0	228.7	0.8
goosefish	70	0.0	23.3	0.1
northern kingfish	31	0.0	4.8	0.0
hickory shad	18	0.0	4.2	0.0
winter skate	17	0.0	31.6	0.1
blue runner	15	0.0	1.5	0.0
Atlantic sturgeon	12	0.0	318.3	1.1
spot	12	0.0	1.7	0.0
spiny dogfish	9	0.0	43.6	0.2
striped anchovy	8	0.0	0.5	0.0
northern puffer	5	0.0	0.9	0.0
cunner	4	0.0	0.5	0.0
inshore lizardfish	4	0.0	0.3	0.0
oyster toadfish	4	0.0	1.7	0.0
Atlantic silverside	3	0.0	0.3	0.0
fourbeard rockling	3	0.0	0.3	0.0
striped cusk-eel	3	0.0	0.1	0.0
northern sennet	2	0.0	0.2	0.0
bluntnose stingray	1	0.0	0.6	0.0
Atlantic cod	1	0.0	4.9	0.0
crevalle jack	1	0.0	0.1	0.0
haddock	1	0.0	0.1	0.0
pinfish	1	0.0	0.1	0.0
pollock	1	0.0	0.1	0.0
roughtail stingray	1	0.0	45.4	0.2
rough scad	1	0.0	0.1	0.0
sea raven	1	0.0	0.2	0.0
sand tiger shark	1	0.0	21.8	0.1
Total	**277,166**		**28,495**	

species	count	%	weight	%
Finfish not ranked				
anchovy spp, (yoy)				
Atlantic herring, (yoy)				
American sand lance (yoy)				
gadid spp, (yoy)				
Invertebrates				
longfin inshore squid	12,424	94.1	464.4	41.1
horseshoe crab	164	1.2	315.5	28.0
spider crab	nc		140.6	12.5
lion's mane jellyfish	221	1.7	72.1	6.4
American lobster	74	0.6	25.2	2.2
common slipper shell	nc		19.2	1.7
bushy bryozoan	nc		11.2	1.0
mantis shrimp	206	1.6	9.5	0.8
knobbed whelk	23	0.2	8.8	0.8
flat claw hermit crab	nc		8.7	0.8
boring sponge	nc		7.4	0.7
rock crab	nc		6.8	0.6
channeled whelk	29	0.2	6.0	0.5
hydroid spp.	nc		5.9	0.5
blue crab	20	0.1	5.0	0.4
hard clams	22	0.2	3.2	0.3
mud crabs	nc		2.5	0.2
mixed sponge species	nc		1.9	0.2
sand shrimp	nc		1.8	0.2
lady crab	nc		1.7	0.2
Tubularia, spp.	nc		1.5	0.1
northern moon snail	nc		1.3	0.1
arks	3	0.0	1.3	0.1
starfish spp.	1	0.0	0.9	0.1
blue mussel	1	0.0	0.8	0.1
common oyster	5	0.0	0.6	0.1
surf clam	1	0.0	0.5	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
anemones	nc		0.1	0.0
bobtail squid	1	0.0	0.1	0.0
red bearded sponge	nc		0.1	0.0
common razor clam	1	0.0	0.1	0.0
Japanese shore crab	1	0.0	0.1	0.0
polychaetes	1	0.0	0.1	0.0
tunicates, misc	nc		0.1	0.0
purple sea urchin	nc		0.1	0.0
water jelly	1	0.0	0.1	0.0
Total	**13,200**		**1,125.8**	

Note: nc= not counted

Appendix 5.5: Endangered Species Interactions: Twelve (12) Atlantic sturgeon were captured on eight (8) of the 196 tows completed in 2016; a higher encounter rate (4.1%) than average for the LISTS time series of tows (2.3%). The Atlantic sturgeon captures occurred over all survey bottom types (sand, mud and transition), and in all but the shallowest (<9m) depth interval. All individuals were released alive and uninjured, and were reported to NMFS within 24 hours. Details for each individual are provided below:

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	Photo	Release time	Release lat (N)	Release lon (W)
SP2016039	5/20/2016	14-33	9:40	30	ATS	1,180	1,060	10.08			ADDED	YES	YES	10:30	41.1432	72.2457
SP2016044	5/23/2016	04-28	14:23	30	ATS	1,652	1,480	29.10			ADDED	YES	YES	15:27	41.0815	72.3236
SP2016079	6/16/2016	12-35	12:59	30	ATS	1,217	1,095	9.85			ADDED	YES	YES	13:59	41.1211	72.1803
FA2016009	9/12/2016	59-22	13:11	30	ATS	1,168	1,053	9.40			ADDED	YES	YES	14:30	40.5917	72.5313
FA2016009	9/12/2016	59-22	13:11	30	ATS	1,443	1,225	17.70			ADDED	YES	YES	14:10	40.5917	72.5313
FA2016009	9/12/2016	59-22	13:11	30	ATS	1,454	1,265	15.90			ADDED	YES	YES	14:20	40.5917	72.5313
FA2016019	9/21/2016	12-28	8:56	30	ATS	1,736	1,518	26.80			ADDED	YES	YES	9:57	41.1225	72.3561
FA2016019	9/21/2016	12-28	8:56	30	ATS	2,055	1,832	46.00			ADDED	YES	YES	10:08	41.1221	72.3566
FA2016019	9/21/2016	12-28	8:56	30	ATS	2,058	1,860	48.00	RECAP		RECAP	NO	YES	10:14	41.1218	72.3571
FA20166048	10/13/2016	59-24	12:45	30	ATS	2,128	1,930	53.40			ADDED	YES	YES	13:42	41.0110	72.4295
FA2016056	10/17/2016	08-25	13:40	30	ATS	1,400	1,225	14.28			ADDED	YES	YES	14:38	41.0960	72.4115
FA2016059	10/18/2016	07-25	11:27	30	ATS	1,825	1,634	37.60			ADDED	YES	YES	12:20	41.0697	72.4604

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 bosc*
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

JOB 6: STUDIES IN CONSERVATION ENGINEERING

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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 door 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 are 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

Work during this segment focused on Objectives 3 and 4, however future segments may focus on other Objectives.

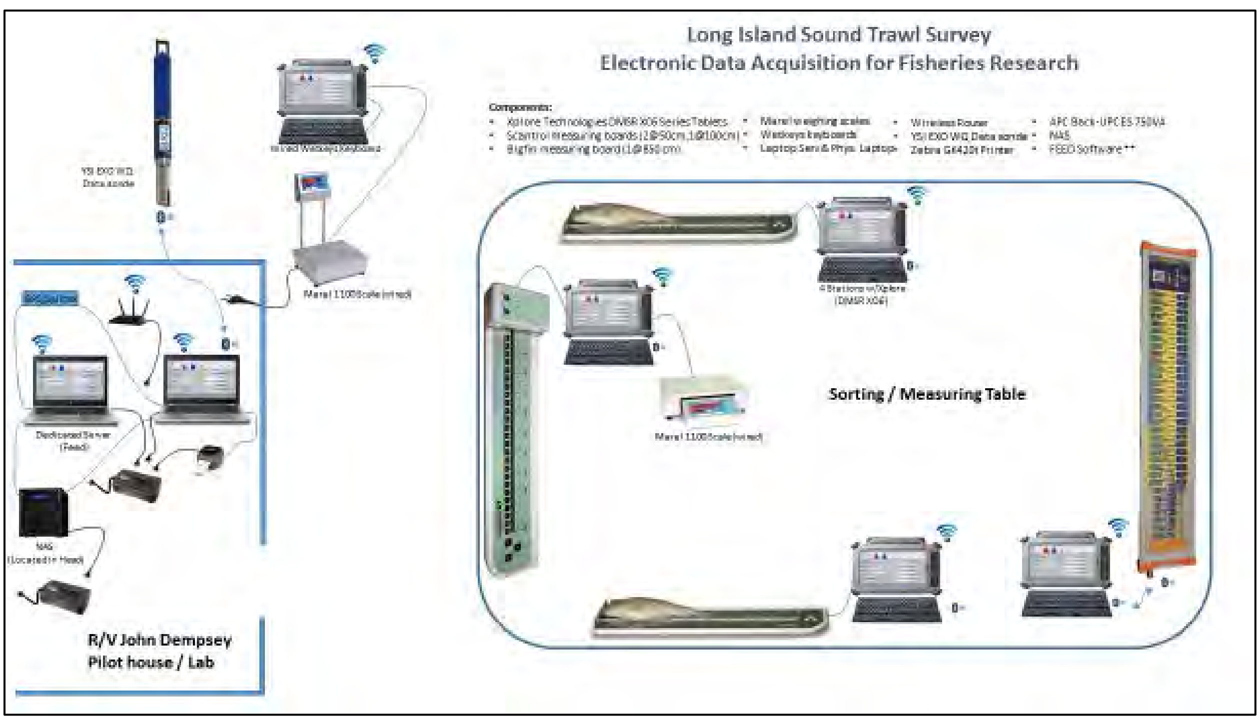
Long Island Sound Trawl Survey (LISTS) staff are attempting to upgrade the data collection processes that have been in place since the inception of the survey 33 years ago. Although paper and pencil for recording data on research vessels has worked well for LISTS for decades, a number of similar fish 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 LISTS. Project staff canvassed staff from other surveys and investigated the components that would be required to configure 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 these improvements result in better quality data being available more quickly for fisheries management decisions.

METHODS

Two main aspects of LISTS make 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 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 need to be wireless and/or Bluetooth capable as much as possible.



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

RESULTS

After evaluating numerous options for the components of an electronic data acquisition system for fisheries research under the previous segment, efforts during this project segment focused on procuring components for the new LISTS system. Principle components purchased during this segment include: Xplore Technologies Tablets, Bigfin measuring boards, Marel weighing scales, waterproof keyboards, YSI EXO water quality Data Sonde, Zebra GK420t label printers, and license for FEED software.

There is still a significant amount of work to be done before there is a functioning system. Components that still need to be acquired include laptop for server, wireless router for networking, NAS for backup of data and UPS for uninterrupted power supply. Custom mounting brackets for tablets, keyboards and electronic measuring boards need to designed and fabricated, as well.

A customized software application is being designed to coordinate all of the electronic components and incorporate standardized LISTS protocols for data collected from each sample, data storage and quality assurance. Information on current LISTS protocols for sampling, sub-sampling, recording data at sea, data entry, and database management (including data dictionary and error checking procedures) have been shared with the contractor who is developing a custom FEED application for LISTS.

MODIFICATIONS

None: 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. However, in the next segment of the Project, we expect to conduct beta testing of the components of an electronic data acquisition system purchased for the LISTS. We also expect to continue development of the FEED software being customized for the LISTS.

JOB 7: ALOSINE SURVEY

JOB 7: AMERICAN SHAD MONITORING AND INSHORE SEINE SURVEYS

GOAL

To monitor relative abundance and distribution of American shad and other fish in Connecticut's nearshore waters.

OBJECTIVES

Provide:

1) Information on the adult American shad spawning population: commercial catch, age structure, sex ratio and size.
2) Annual indices of relative abundance for juvenile shad, blueback herring and common nearshore marine species.

STUDY PERIOD AND AREA

This report contains information on adult American shad monitoring and seine studies on juvenile American shad (*Alosa sapidissima*), blueback herring (*Alosa aestivalis*), menhaden (*Brevoortia tyrannus*) and common nearshore marine species. Areas of the Connecticut River sampled range from Holyoke, MA to Essex, CT. The Thames River seine survey begins just south of Norwich Harbor and ends in Uncasville, CT. Time series data collected under a previous funding source are also included.

This project was funded by USFWS through a State Wildlife Grant (F14AF01185; T-14-R-1) awarded from September 1, 2014 date through December 31, 2016 and was reinstated on F54 on January 1, 2017. For the sake of consistency and formatting, the activities and accomplishments for monitoring during that period have been included here in their entirety.

STATE OF CONNECTICUT
Department of Energy and Environmental Protection
Bureau of Natural Resources
Fisheries Division

State Wildlife Grant
F14AF01185 (T-14-R-1)

Project Title:	*Survey of Alosines and Other Important Forage Species in the Connecticut and Thames Rivers*
Period Covered:	September 1, 2014 – December 31, 2016
Prepared by:	Jacqueline Roberts
Date:	June 1, 2017
Approved by:	Peter Aarrestad, Director Fisheries Division Mark Alexander, Assistant Director Fisheries Division

ALOSINE SURVEY

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GOAL

To continue to provide long-term monitoring of alosine abundance and population structure in Connecticut. To document occurrence of forage fish in Connecticut's nearshore waters.

Project Objectives

- Characterize the adult American shad (*Alosa sapidissima*) spawning population in the Connecticut River: sex ratio, size structure, age structure, and spawning history.
- Calculate annual indices of relative juvenile abundance for American shad and blueback herring (*A. aestivalis*), and document occurrence of other estuarine and marine species.

Study Period and Area

This report contains information on monitoring of adult and juvenile American shad, juvenile blueback herring, and other estuarine and marine fishes during the study period of September 1, 2014-August 30, 2016. Areas of the Connecticut River sampled ranged from Holyoke, MA to Essex, CT. Areas of the Thames River sampled ranged from Norwich, CT to Uncasville, CT. This report includes data collected under previous funding sources.

Introduction and Background

The American shad (hereafter just referred to as "shad"), the largest member of the herring family, is an anadromous fish that undertakes spring spawning migrations into a number of Atlantic coastal rivers including the Connecticut River. Annual shad spawning migrations in the Connecticut River have supported both recreational and commercial fisheries in Connecticut, as well as recreational fisheries in upriver states, for generations. Shad have been an important food fish in the Connecticut River since colonial days and once supported one of the most economically valuable fisheries in Connecticut. Because of its historical importance to Connecticut, the American shad was designated the State Fish in 2003. The Connecticut River remains one of the most productive shad rivers in New England.

The State of Connecticut Department of Energy and Environmental Protection Fisheries Division (CT DEEP) has conducted surveys on shad since 1974. The Connecticut River shad population is one of the most well studied on the Atlantic coast, and has been the subject of a long-running CT DEEP research study that has compiled one of the only available continuous long-term time series of shad abundance and demography data. CT DEEP provides data on Connecticut River shad to a variety of groups including the US Fish and Wildlife Service, NOAA National Marine Fisheries Service (NMFS), the Atlantic States Marine Fisheries Commission (ASMFC), and various academic and research institutions. For decades, Connecticut's shad studies were funded by NMFS through the Anadromous Fish Conservation Act of 1965. This source of funding was eliminated in 2009 and has not since been reinstated. Due to declines in annual budgets and staffing levels, some CT DEEP shad monitoring activities have been discontinued or now only occur on an opportunistic basis. The annual shad monitoring that CT DEEP currently maintains for the Connecticut River includes assessments of harvest in the commercial fishery, adult abundance, and adult population characteristics such as sex ratio, size and age structure, and spawning history (i.e. frequency of repeat-spawning). Monitoring of abundance and population structure is accomplished in cooperation with the Massachusetts Division of Fish and Wildlife (MA DFW), which monitors fish passage at the Holyoke Dam (first mainstem dam on the river) in Holyoke, MA (Slater 2016). In addition, CT DEEP conducts an annual summer-fall seine survey targeting juvenile shad that documents year class strength and thus predicts potential recruitment of adult shad to the Connecticut River run in future years.

Blueback herring, another anadromous herring native to the Atlantic coast, have experienced substantial population declines range-wide. Prior to 1986, approximately 500,000 adult blueback herring were passed annually at the Holyoke Dam fish lift, but annual passage declined steadily after 1995 and has remained below 1,000 since 2003. The decline of blueback herring in the Connecticut River along with a decline of closely-related alewife (*A. pseudoharengus*) in some Connecticut coastal streams led to the 2002 declaration of a moratorium on “river herring” (collective term for blueback herring and alewife) harvest in Connecticut. River herring were subsequently listed as Species of Special Concern by NMFS to bring awareness to data deficiencies and associated uncertainties around population status. In 2005, Connecticut’s Endangered Species Scientific Taxonomic Advisory Committee for Fish listed blueback herring as a State Species of Special Concern.

CT DEEP has monitored juvenile blueback herring abundance in the Connecticut River since 1978 as part of the previously-discussed annual seine survey. Despite declines in adult abundance at the Holyoke lift, the annual blueback herring juvenile index has continued to indicate reproductive success in the river stretch south of Holyoke in most years. The CT DEEP seine survey is the only source of continuous long-term data on juvenile blueback herring in the Connecticut River.

Juvenile alosine (a term referring to fish of the genus *Alosa*) sampling was expanded to the Thames River system after 1996 to monitor the impacts of a newly installed fish lift at the Greenville Dam. CT DEEP initiated the Thames River seine survey to estimate juvenile production of shad and blueback herring. Sites were chosen based on previous work conducted by CT DEEP in that river system. Since 1996, the survey has collected few juvenile alosines, but has documented catches of forage fish, many of which are listed as species of greatest conservation need (GCN) in Connecticut’s 2015 Wildlife Action Plan (CT DEEP 2015). This survey therefore addresses several high priority actions outlined in the Connecticut Wildlife Action Plan including: continuation of long term monitoring, compiling baseline information on GCN species, monitoring population fluctuations, and assessing distribution and abundance by life stage. In particular, this survey has provided information on several GCN species, including:

- GCN Most Important: alewife, Atlantic tomcod, blueback herring, tautog and winter flounder
- GCN Very Important: American shad, cunner, fourspine stickleback.
- GCN Important: Atlantic menhaden, Atlantic silverside, bay anchovy, golden shiner, hogchoker, largemouth bass, northern pipefish, white sucker and yellow perch.

METHODS

Adult American Shad

The adult shad population was characterized by information collected annually at the Holyoke Fish lift. Daily fish lift numbers, daily sex ratio, and number of days of lift operation were reported by MASS DFW. The annual sex ratio was calculated by weighting the daily sex ratios by the number of fish lifted daily. MASS DFW staff also collected scale samples from a daily subsample of adult shad and provided these samples to CT DEEP. Scales were used to characterize age structure and spawning history. All shad sampled for scales were measured to fork length (mm), and approximately 25 scales were removed from above the lateral line anterior to the dorsal fin of each fish. Sex determination was accomplished by external inspection for sex-specific characters and expression of gametes. Some shad were sacrificed to verify sex determination.

Scale samples were stratified by sex and 1-cm length group, and a representative number of samples was chosen from each stratum for analysis. CT DEEP staff processed scale samples by first immersing them in a soap solution and then cleaning them with an ultrasonic cleaner. Three to five representative scales were selected from each sample and then pressed onto acetate using an Ann Arbor roller press. Age determinations were made as the consensus of two or more readers viewing projected images (43x) and counting annuli and spawning scars (indicative of previous spawning events) according to the criteria of Cating (1953). Ages and repeat spawning frequencies were extrapolated to the annual lift count by direct proportion.

Connecticut River Seine Survey

Collections of juvenile shad and juvenile blueback herring were made weekly from mid-July through mid-October at seven fixed locations ranging from Holyoke MA to Essex CT. Seine haul locations and techniques were identical to those used by CT DEEP in the Connecticut River seine survey since 1978. The sampling sites for this survey were chosen based on location, physical conditions and accessibility (Marcy 2004, Crecco et. al. 1981, Savoy and Shake 1993). One seine haul per station was made during daylight hours with a 15.2 m nylon bag seine (0.5 cm delta mesh) and 30.5 m lead ropes. The seine was fished with the aid of a boat to deploy it upstream and offshore. Using the lead ropes, the seine was towed in a downstream arc to the shore and beached. Species in the family Clupeidae (shad, blueback herring, alewife, and Atlantic menhaden *Brevoortia tyrannus*) were returned to the laboratory for measurement and identification. All fish species other than those from the family Clupeidae were identified, quantified, and released. To facilitate returning large catches of fish quickly to the water and thus minimizing mortality, some fish were identified only to the family or genus level (e.g. sunfish, catfish, killifish). Large catches of common species were estimated with a visual count to minimize handling and processing time. In the laboratory, juvenile clupeids were identified to species by the criteria of Lippson and Moran (1974) and counted. For each sample, up to 40 randomly selected clupeids of each species were measured to total length (mm).

The juvenile abundance index (*JI*) for shad and blueback herring in each year was calculated as a geometric mean catch per seine tow (Gottschall and Pacileo 2016):

$$JI = e^{((\sum_a \ln(n_a+1))/T)-1}$$

where: n_a = number of shad or herring collected in seine tow a, and T = total number of seine tows conducted in that year among all sites and sample dates. The geometric mean is the preferred method when reporting to ASMFC because it normalizes clustered data.

Thames River Seine Survey

Up to seven fixed stations were sampled twice monthly during the same time frame as the Connecticut River seine survey. Gear and methods used in the Thames River survey were identical to those used in the Connecticut River survey.

RESULTS

Adult Shad Monitoring at Holyoke

All results collected during the funding timeframe of September 1, 2014 through August 31, 2016 are presented below. To compare the 2014-2016 juvenile abundance indices to all values of the time series, data collected prior to the start of the funding period are also presented.

In 2014, The Holyoke fish lift was open for fish passage during the time period of April 24 through July 15 (lift was closed for a total of 12 days during this period due to high water events or other operational factors). A total of 513 American shad was sampled for scales over 29 different days. The number of shad passed at Holyoke in 2014 was 370,506, which was above the long-term (1975-2016) mean of 306,046 and ranked as the 13th highest value in the time series.

In 2015, upstream fish passage operations at Holyoke were conducted from April 27 through June 21. Lift operations were discontinued earlier than usual in the season to allow for construction of new downstream passage facilities. The number of shad passed at Holyoke in 2015 (412,656) was the seventh highest since 1975 and was the second highest since peak passage in 1992 (Figure 1). American shad scales (n=816) were collected on 40 different days throughout the season.

In 2016, upstream fish passage operations at Holyoke were conducted April 1 through July 15. The number of shad passed at Holyoke in 2016 (385,930) was the ninth highest since 1975 and the fourth highest since peak passage in 1992 (Figure 1). American shad scales (n=829) were collected on 53 different days. Annual American Shad passage was above the long-term (1975–2016) mean.

Adult Shad Age Structure

In 2014, 496 (187 female, 309 male) scale samples were examined for age and incidence of repeat spawning. The sex ratio at Holyoke was 66% male and 34% female. Length of American shad collected at the Holyoke lift ranged from 32.0 to 49.0 cm FL for males and 37.0 to 53.5 cm FL for females (Figure 2). Average size among males and females was 40.6 cm FL and 46.4 cm FL, respectively. Analysis of age structure indicated that adult male shad were from the 2007-2011 year classes. Fifty-seven percent of males were four years old; thirty-four and five percent of males were five and three years old, respectively. Six-year old males comprised 2.5 percent of the sample. Seven-year old males were rare, comprising only 0.3 percent of the sample (Table 1). The majority of female shad sampled (59.9%) were age five from the 2009 year class. Twenty-one and thirteen percent of females were six and four years old, respectively. As observed for males, seven-year old females were rare (just over 5% of the sample; see Table 1). The overall incidence of repeat spawning among both sexes was 3.2%. The repeat spawning frequency was 2.9% among males and 3.7% among females (Table 1).

In 2015, scale samples from 229 females and 222 males were examined. The 2015 sex ratio at Holyoke was 57% male and 43% female. Length of American shad collected at the Holyoke lift ranged from 30.0 to 47.4 cm FL for males and 34.0 to 51.2 cm FL for females. Average size among males and females was 41.2 cm FL and 45.6 cm FL, respectively. Adult male shad in 2015 were from the 2008-2012 year classes. Twenty-one percent of males were four years old. Sixty-two and two percent of males were five and three years old, respectively. Six-year old males comprised nine percent of the sample (Table 2). The majority of female shad in 2015 (65%) were age five from the 2010 year class. Twenty-one percent of females were six years old. Thirteen percent of females were four years old; seven-year old females were rare (1% of the sample). The overall incidence of repeat spawning among both sexes in 2015 was 2.0%. The repeat spawning frequency was 1.8% and 2.2% among males and females, respectively. (Table 2).

In 2016, scale samples from 294 females and 369 males were processed. Some of these processed samples (received late in the 2016 season) have not yet been aged. The sex ratio at Holyoke was 55% male and 45% female. Length of American shad collected at the Holyoke lift ranged from 32.5 to 48.5 cm FL for males and 36.5 to 51.0 cm FL for females. Average size among males and females was 40.0 cm FL and 45.6 cm FL, respectively. Based on scale samples that have been analyzed to-date, adult male shad in 2016 were from the 2009-2013 year classes. Twenty-eight percent of males were four years old. Fifty-one and ten percent of males were five and three years old, respectively. Ten percent of males were six years old; seven-year old males were rare (<1%; see Table 3). The majority of female shad in 2016 (47%) were age five from the 2011 year class. Thirty-eight percent of females were six years old. Twelve and three percent of females were four and seven years old, respectively. The overall incidence of repeat spawning among both sexes in 2016 was 8.4%. The repeat spawning frequency was 5.8% for males and 11.3% for females (Table 3). The 2016 repeat spawning frequencies were the highest among the three years in the project period.

Connecticut River Seine Survey

American Shad and Blueback Herring Juvenile Abundance Indices

The 2014 seine survey in the Connecticut River was conducted from July 16 through October 15. A total of 3,358 juvenile American shad was collected (Table 4). The highest catch in a single sample in 2014 was 604 shad collected at the Wilson site (RKM 89) in early September, representing 49% of the total Wilson catch for the season and 18% of the overall catch among sites (Table 4). The stations that accounted for the largest proportions of the season's catch were Holyoke (43%) and Wilson (36%; see Figure 3). A total of 4,903 blueback herring was collected in 2014 (Table 7).

The juvenile abundance index for shad in 2014 was more than double the 2013 index and ranks as the ninth largest in the time series (Table 10). The 2014 shad index was slightly more than double the blueback herring index.

The 2015 seine survey in the Connecticut River was conducted from July 15 through October 14. A total of 3,448 juvenile American shad was collected (Table 5), which was similar to 2014. The highest catch in a single sample in 2015 was 354 shad collected at the Wilson site (RKM 89) in early September, representing 35% of the Wilson catch for the season and 29% of the overall catch among sites (Table 5). The sites that accounted for the largest proportions of the season's catch were Holyoke (20%) and Wilson (29%; see Figure 4). A total of 11,044 blueback herring was collected in 2015 (Table 8), which indicated a moderately large year class (ranked 17th in the time series). The shad abundance index in 2015 (8.53) was comparable to the 2014 index (8.09), and ranks as the eighth largest value in the time series (Table 10, Figure 2).

The 2016 Connecticut River seine survey began on July 13 and continued through October 12. A total of 26,615 juvenile American shad was collected, which was the highest total catch in the entire time series (Table 6). The highest single sample catch in 2016 was 3,744 shad at the Holyoke site in late August. Northern stations accounted for 92% of the total shad catch (Figure 5). A total of 2,793 blueback herring was collected in 2016 (Table 9). The shad index in 2016 was the highest value in the time series, almost double the 2015 value. The 2016 blueback herring index was the lowest in the time series (Table 10).

Connecticut River shad produced strong year classes in all three years of the project period, including the highest value in the 42-year time series. Blueback herring produced a weak 2014 year class, a moderate 2015 year class, and a very weak 2016 year class (lowest index value ever recorded). Overall, during the three years of the project period, shad were predominately caught at northern sites while blueback herring were mostly caught at southern sites.

Species Frequencies of Occurrence

In the 90 hauls completed in 2014, over 37,000 fish were collected, representing 30 species or taxonomic groups. The most abundant species collected were Atlantic menhaden, shiners, blueback herring and American shad. Shiners, juvenile shad, yellow perch, sunfish and blueback herring had the five highest frequencies of occurrence (Table 11).

The 2015 total annual catch was over 87,000 fish and was also comprised of 30 species or taxonomic groups. The large increase in total catch can be attributed to young-of-the-year Atlantic menhaden catch (54,621), which was 63% of the total catch and nearly three times higher than the 2014 Atlantic menhaden catch. Blueback herring, shiners and American shad were also in the top five catches (Table 11).

The 2016 total catch was over 64,000 fish. The total catch of Atlantic menhaden (7,359) was the lowest among the three years of the project period. In 2016, American shad and shiners had the highest frequency of occurrence among the project period (Table 11).

Thames River Seine Survey

The Thames River was sampled on a bi-weekly basis during each of the three project years. The total number of sites sampled annually varied (2014: 27 sites; 2015: 41; 2016: 49). The number of species or taxonomic groups collected in the Thames were comparable among years and ranged from 23 to 28 (Table 12). Atlantic menhaden, Atlantic silverside, killifish, and bluefish were in the top five occurrences for all three sampling years (Table 12). Atlantic silverside had the highest frequency of occurrence in all three years of the project period. Winter flounder**,** tautog, and scup were collected in each year. Longhorn sculpin were collected for the first time in this survey in 2014.

Annual Atlantic menhaden catches have varied widely during the 19 years of the Thames survey, from a low in 2013 of just 31 fish, to over a million fish collected in 2000. The 2014 menhaden index (22.78), was the third highest in the overall time series. The 2015 index (14.45) ranked fifth in the overall times series. The 2016 index (5.02) ranked tenth in the time series and was well below the time series mean of 14.9.

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Table 1. Fishery independent spawning history and age distribution of adult American shad collected at the Connecticut River Holyoke Fishlift, 2014.

2014 American Shad Age Structure							
Age	**3**	**4**	**5**	**6**	**7**	**Total**	**% Rpt Spawn**
%Bucks	5.50%	57.61%	33.98%	2.59%	0.32%		2.91%
Shad (n)	13,453	140,864	83,094	6,331	791	244,534	
		4	**5**	**6**	**7**		**% Rpt Spawn**
%Roes		13.90%	59.90%	20.90%	5.40%		3.74%
Shad (n)		10,902	117,585	48,280	1,557	178,324	
	3	**4**	**5**	**6**	**7**		**% Rpt Spawn**
% Combined	3.43%	41.13%	43.75%	9.48%	2.22%		3.23%
Shad (n)	12,699	152,386	162,096	35,108	8,217	370,506	

Table 2. Fishery independent spawning history and age distribution of adult American shad collected at the Connecticut River Holyoke Fishlift, 2015.

2015 American Shad Age Structure							
Age	**3**	**4**	**5**	**6**	**7**	**Total**	**% Rpt Spawn**
%Bucks	2.30%	20.70%	62.20%	14.40%	0.50%		1.80%
Shad (n)	5,278	48,555	145,666	33,778	1,056	234,332	
		4	**5**	**6**	**7**		**% Rpt Spawn**
%Roes		6.10%	65.90%	27.10%	0.90%		2.20%
Shad (n)		10,902	117,585	48,280	1,557	178,324	
	3	**4**	**5**	**6**	**7**		**% Rpt Spawn**
% Combined	1.10%	13.30%	63.90%	20.80%	0.70%		2.00%
Shad (n)	5,278	59,457	263,251	82,057	2,613	412,656	

Table 3.Fishery independent spawning history and age distribution of adult American shad collected at the Connecticut River Holyoke Fishlift, 2016.

2016 American Shad Age Structure							
Age	**3**	**4**	**5**	**6**	**7**	**Total**	**% Rpt Spawn**
%Bucks	10.00%	27.50%	50.80%	10.80%	0.80%		5.80%
Shad (n)	21,051	59,644	107,008	22,805	1,754	212,262	
		4	**5**	**6**	**7**		**% Rpt Spawn**
%Roes		11.30%	47.20%	37.70%	2.80%		11.30%
Shad (n)		21,299	81,919	65,535	4,915	173,669	
	3	**4**	**5**	**6**	**7**		**% Rpt Spawn**
% Combined	5.80%	19.90%	49.10%	23.50%	1.80%		8.40%
Shad (n)	20,402	79,906	188,715	90,107	6,801	385,930	

Table 4. Catch and effort of juvenile American shad from the 2014 CT River seine survey. **Catches in grey were collected under separate funding source.*

Date	HOLYOKE	ENFIELD	WILSON	GLASTONBURY	SALMON RIVER	DEEP RIVER	ESSEX	Catch	Effort
*7/16/2014	3	25	3	0	20	4	27	82	7
*7/23/2014	0	11	46	2	2	42	6	109	7
*7/30/2014	214	19	6	4	6	6	0	255	7
*8/6/2014	0	20	143	10	6	3	40	222	7
*8/13/2014	472	0	94	32	16	72	17	703	7
*8/20/2014	1	0	162	6	8	22	41	240	7
*8/27/2014	76	19	47	12	3	10	0	167	7
9/3/2014	39	1	74	0	7	20	0	141	7
9/10/2014	104	0	604	5	16	4	19	752	7
9/17/2014	17	0	18		11	6	0	52	6
9/24/2014	360	0	0		43	17	0	420	6
10/1/2014	144		17		9	12	0	182	5
10/8/2014	0		9		8	0	0	17	5
10/15/2014	0		0		8	0	8	16	5
Total	1430	95	1223	71	163	218	158	3358	90

Table 5. Catch and effort of juvenile American shad from the 2015 CT River seine survey.

.Date	HOLYOKE	ENFIELD	WILSON	GLASTONBURY	SALMON RIVER	DEEP RIVER	ESSEX	Catch	Effort
7/15/2015	6	0	16	10	95	46	6	179	7
7/22/2015	138	2	16	2	51	30	172	411	7
7/29/2015	0	47	0	11	164	146	37	405	7
8/5/2015	235	0	49	1	55	185	23	548	7
8/13/2015	44	0	160	4	13	104	4	329	7
8/19/2015	18	0	24	2	120	23	0	187	7
8/27/2015	227	0	26	4	23	12	2	294	7
9/27/2015	0	0	115	20	17	0	5	157	7
9/10/2015	19	0	354	22	2	16	3	416	7
9/16/2015	1	0	233	20	1	0	0	255	7
9/22/2015	1	0	1	109	0	11	3	125	7
10/1/2015					0	10	0	10	3
10/7/2015	0	0	6	10	25	8	64	113	7
10/14/2015	0	0	0	0	8	0	11	19	4
Total	689	49	1000	215	574	591	330	3448	91

Table 6. Catch and effort of juvenile American shad from the 2016 CT River seine survey. **Catches in grey were collected under separate funding source.*

Date	HOLYOKE	ENFIELD	WILSON	GLASTONBURY	SALMON RIVER	DEEP RIVER	ESSEX	Catch	Effort
7/13/2016	293	5	1596	0	52	12	0	1958	7
7/20/2016	1189	12	286	0	18	3	0	1508	7
7/27/2016	1071	0	651	0	359	7	0	2088	7
8/3/2016	2571	0	283	0	600	1	5	3460	7
8/10/2016	1415	29	572	5	18			2039	5
8/17/2016	221	0	631	0	474	0	0	1326	7
8/24/2016	3744	0	490	0	5	2	0	4241	7
*9/1/2016	2984	17	689	0	48	29	0	3767	7
*9/7/2016	711	193	927	0	70	0	0	1901	7
*9/14/2016	190	68	154	0	71	0	0	483	7
*9/21/2016	515	62	790	0	109	0	1	1477	7
*9/28/2016	104	37	233	0	5	30	0	409	7
*10/5/2016	387	28	460	0	2	3	0	880	7
*10/12/2016	0	0	50	0	5	18	5	78	7
Total	15395	451	7812	5	1836	105	11	25615	96

Table 7. Catch and effort of juvenile blueback herring from the 2014 CT River seine survey. *Catches in grey were collected under a previous funding source.

Date	HOLYOKE	ENFIELD	WILSON	GLASTONBURY	SALMON RIVER	DEEP RIVER	ESSEX	Catch	Effort
*7/16/2014	0	0	1	0	5	16	20	42	7
*7/23/2014	0	1	0	0	3	42	56	102	7
*7/30/2014	0	0	0	1	6	0	0	7	7
*8/6/2014	0	0	1	1	273	77	178	530	7
*8/13/2014	0	0	0	37	574	0	0	611	7
*8/20/2014	0	0	0	23	188	411	20	642	7
*8/27/2014	0	0	0	3	44	0	5	52	7
9/3/2014	0	0	0	0	490	439	0	929	7
9/10/2014	0	0	0	7	162	18	0	187	7
9/17/2014	0	0	0		460	452	0	912	6
9/24/2014	0	0	0		33	556	0	589	6
10/1/2014	0		0		48	116	0	164	5
10/8/2014	0		1		0	8	80	89	5
10/15/2014	0		0		3	4	40	47	5
Total	0	1	3	72	2289	2139	399	4903	90

Table 8. Catch and effort of juvenile blueback herring from the 2015 CT River seine survey.

Date	HOLYOKE	ENFIELD	WILSON	GLASTONBURY	SALMON RIVER	DEEP RIVER	ESSEX	Catch	Effort
7/15/2015	0	0	0	0	0	27	813	840	7
7/22/2015	0	0	0	2	24	1874	31	1931	7
7/29/2015	0	0	0	0	18	126	130	274	7
8/5/2015	0	0	0	1	144	572	2	719	7
8/13/2015	1	0	0	45	295	682	0	1023	7
8/19/2015	2	0	18	299	1180	792	0	2291	7
8/27/2015	0	0	41	0	311	443	4	799	7
9/2/2015	0	0	4	23	502	0	2	531	7
9/10/2015	2	0	55	3	250	272	4	586	7
9/16/2015	0	0	373	54	280	0	0	707	7
9/22/2015	0	0	3	36	384	62	1	486	7
10/1/2015					192	113	8	313	3
10/7/2015	0	0	1	1	183	220	32	437	7
10/14/2015			0		12	0	95	107	4
Total	5	0	495	464	3775	5183	1122	11044	91

Table 9. Catch and effort of juvenile blueback herring from the 2016 CT River seine survey.
*Catches in grey were collected under a previous funding source.

Date	HOLYOKE	ENFIELD	WILSON	GLASTONBURY	SALMON RIVER	DEEP RIVER	ESSEX	Catch	Effort
7/13/2016	0	0	12	0	13	76	0	101	7
7/20/2016	0	1	0	0	36	38	0	75	7
7/27/2016	0	0	0	0	283	131	1	415	7
8/3/2016	0	0	6	0	64	2	2	74	7
8/10/2016	0	0	1	2	28			31	5
8/17/2016	0	0	3	0	0	0	0	3	7
8/24/2016	0	0	5	0	0	15	0	20	7
*9/1/2016	0	0	10	0	0	80	0	90	7
*9/7/2016	0	0	3	0	2	0	0	5	7
*9/14/2016	0	0	1	1	1403	0	0	1405	7
*9/21/2016	0	0	3	0	277	0	0	280	7
*9/28/2016	0	0	1	0	9	140	0	150	7
*10/5/2016	0	0	0	0	0	1	0	1	7
*10/12/2016	0	0	0	0	4	4	135	143	7
Total	0	1	45	3	2119	487	138	2793	96

Table 10. Time series of geometric mean relative abundance index (CPUE) of juvenile American shad and blueback herring, 1978-2016. Values in grey were collected under a previous funding source.

Year	Juv Shad	Juv BBH
1978	5.89	
1979	7.84	24.8
1980	9.21	26.75
1981	6.05	11.49
1982	1.81	6.09
1983	4.99	16.47
1984	3.37	11.57
1985	7.14	18.23
1986	6.29	13.61
1987	9.89	21.58
1988	5.68	17.04
1989	4.85	7.52
1990	10.39	14.41
1991	3.92	11.36
1992	7.21	9.87
1993	9.49	14.43
1994	12.22	13.92
1995	1.34	5.03
1996	6.5	5.91
1997	6.75	9.66
1998	3.65	4.39
1999	5.47	5.57
2000	4.42	4.17
2001	2.73	3.83
2002	5.55	3.95
2003	6.88	5.88
2004	5.62	2.36
2005	10.08	4.1
2006	1.82	3.5
2007	8.15	6.61
2008	5.06	2.2
2009	3.4	1.77
2010	10.23	12.82
2011	3.08	2.93
2012	3.03	2.22
2013	3.16	6.89
2014	8.09	3.69
2015	8.53	8.63
2016	16.7	1.55

Table 11. List of fish species or family and percent frequency of occurrence of fish collected in Connecticut River seine survey, 2014-2016. **includes more than one species.*

Species	2014	2015	2016
alewife	6.67	8.79	7.29
American eel	12.22	6.59	65.00
American shad	75.56	74.73	65.63
Atlantic silverside	4.44	7.69	11.46
bay anchovy	5.56	3.30	
black crappie	16.67	15.38	21.88
blue crab	5.56	4.40	12.50
blueback herring	45.56	59.34	36.46
bluefish	8.89	8.79	6.25
carp	3.33	8.79	18.75
catfish*	24.44	14.29	23.96
fallfish	4.44	6.59	4.17
golden shiner	8.89	18.68	14.58
hickory shad	2.22		1.04
hogchoker	10.00	15.38	19.79
killifish & mummichog*	35.56	37.36	50.00
largemouth bass	23.33	8.79	26.04
Atlantic menhaden	26.67	42.86	22.92
northern pike	13.33	12.09	10.42
chain pickerel		1.10	1.04
pipefish			3.13
rock bass	10.00	7.69	16.67
smallmouth bass	28.89	20.88	15.63
spottail shiner*	75.56	69.23	72.92
stickleback*	4.44	3.30	2.08
striped bass	3.33		2.08
sunfish*	46.67	34.07	46.88
tessellated darter	36.67	29.67	30.21
white perch	4.44	1.10	2.08
white sucker	37.78	21.98	34.38
winter flounder			1.04
yellow perch	55.56	50.55	34.38

Table 12. List of fish species or group and percent frequency of occurrence of fish collected in Thames River seine survey, 2014-2016. **includes more than one species.*

Species	2014	2015	2016
alewife	3.70	9.76	2.04
American eel		2.44	4.08
American shad		2.44	
Atlantic needlefish	3.70		
Atlantic silverside	92.59	92.68	95.92
bay anchovy	3.70	12.20	4.08
blueback herring	7.41	2.44	4.08
bluefish	44.44	78.05	53.06
blue runner		2.44	
butterfish	3.70		4.08
crevalle jack	3.70	7.32	
Atlantic croaker			4.08
cunner			2.04
grubby	3.70		2.04
hogchoker	11.11	9.76	8.16
killifish & mummichog*	40.74	73.17	67.35
longhorn sculpin	3.70		
lizardfish		24.39	2.04
Atlantic menhaden	51.85	53.66	44.90
naked goby	11.11	9.76	10.20
northern kingfish	3.70	21.95	10.20
northern puffer		2.44	
pipefish		26.83	26.53
scup	3.70	31.71	20.41
sheepshead minnow		2.44	2.04
spottaill shiner	11.11	2.44	6.12
stickleback*	11.11	12.20	2.04
striped bass	3.70		14.29
summer flounder	22.22	2.44	
sunfish*	3.70		2.04
tautog	18.52	17.07	20.41
tomcod		2.44	
weakfish		7.32	
white perch		7.32	
white sucker		4.88	
winter flounder	14.81	26.83	12.24

Table 13. Number collected, number of seine hauls and geometric mean catch per haul (G Mn) of Thames River juvenile Atlantic menhaden, 1998-2016. Values in grey were collected under a separate funding source.

Year	Menhaden	Seine Hauls	G Mn
1998	429,209	151	12.63
1999	594,724	144	20.61
2000	1,020,000	112	50.25
2001	5,458	119	2.13
2002	840,458	55	117.46
2003	248,984	80	12.78
2004	30,274	56	3.91
2005	3,118	30	1.19
2006	129,719	64	6.08
2007	100,082	56	6.39
2008	195	63	0.37
2009	39,909	62	2.11
2010	212	64	0.18
2011	418	56	0.58
2012	8,662	40	3.49
2013	31	76	0.14
2014	27,332	27	22.78
2015	120,664	41	14.45
2016	41,273	49	5.02

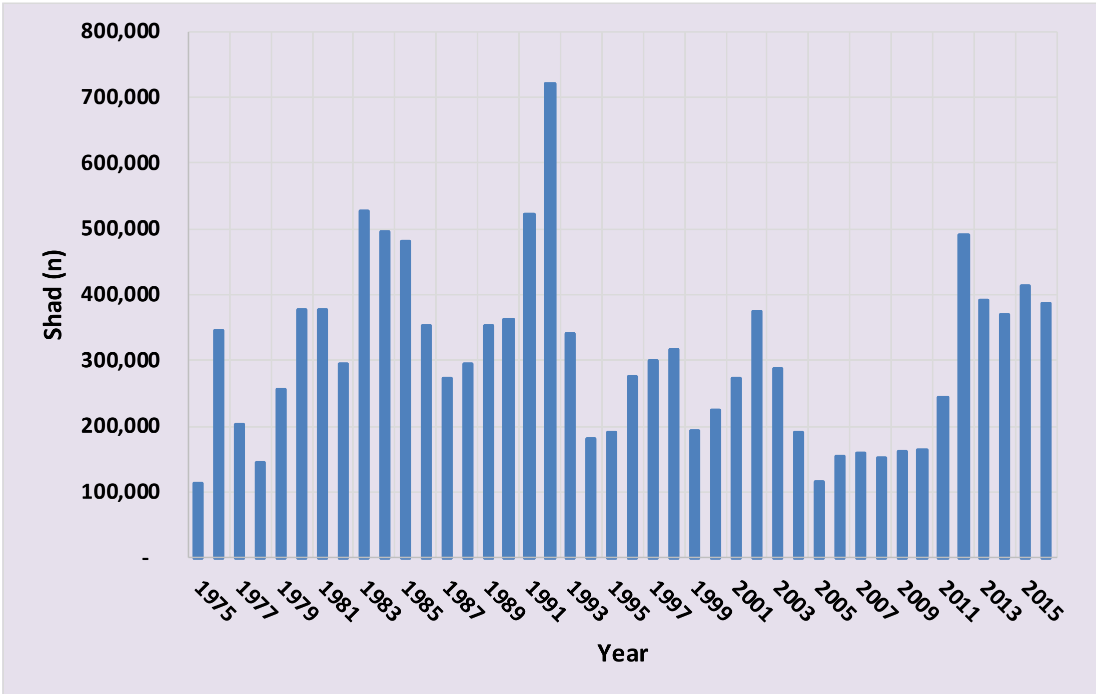

Figure 1. Number of adult American shad lifted at the Connecticut River Holyoke Dam (RKM 140), 1975-2016.

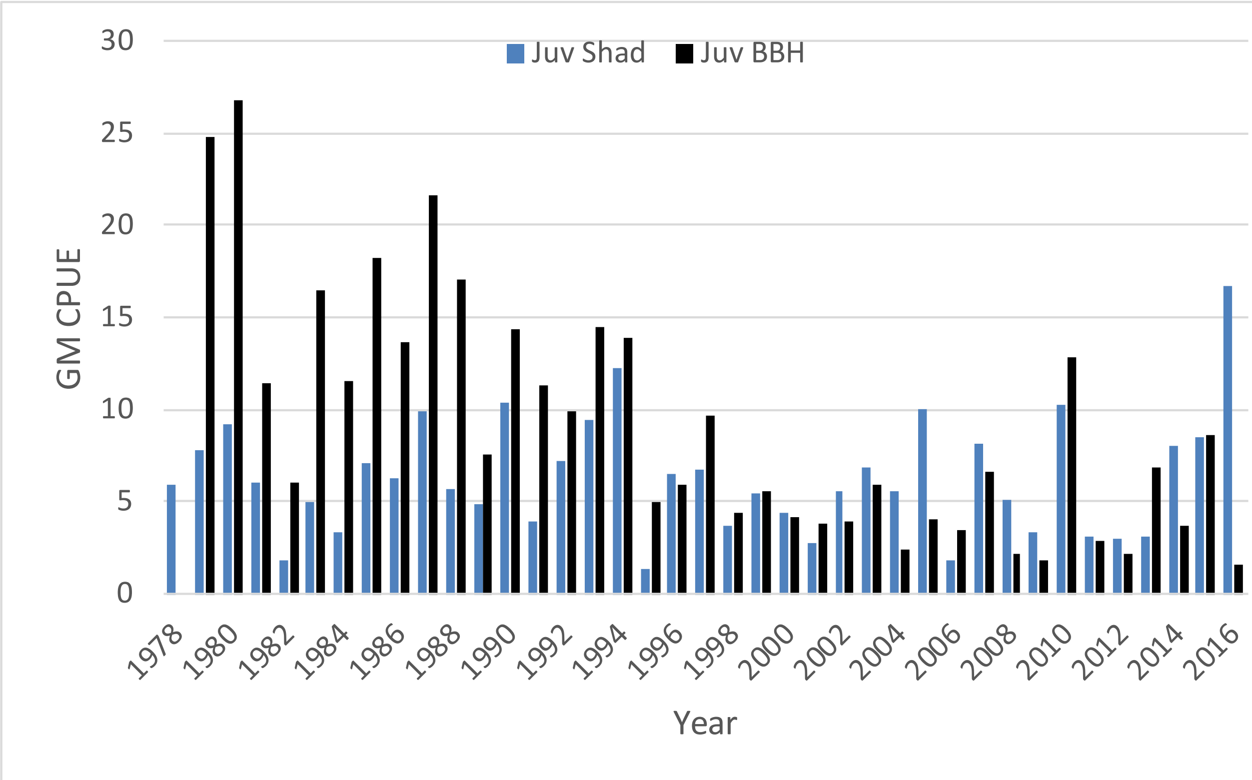

Figure 2 Annual Geometric mean CPUE of Connecticut River juvenile American shad and blueback herring, 1978-2016.

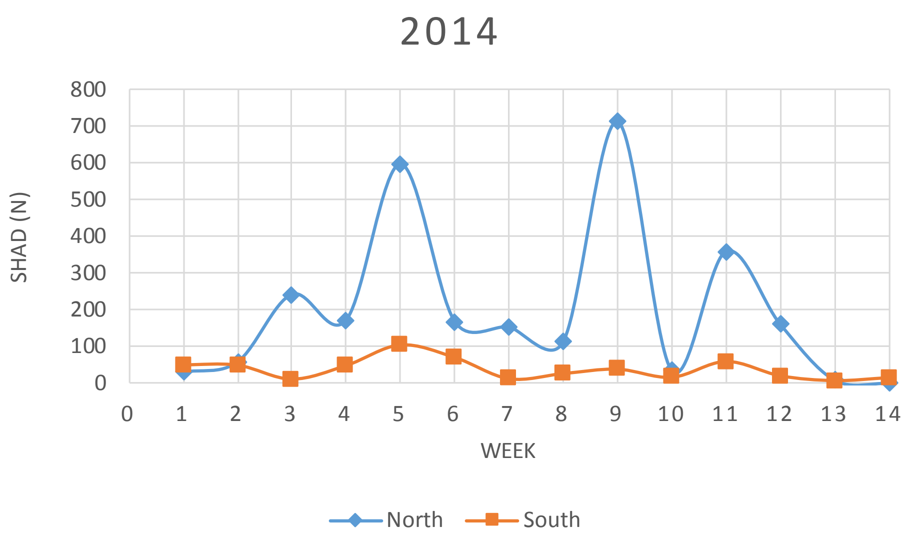

Figure 3. Weekly catches of Connecticut River juvenile shad, 2014. Catches are grouped by location: North=Holyoke, Enfield, Wilson, Glastonbury. South=Salmon River, Deep River, Essex.

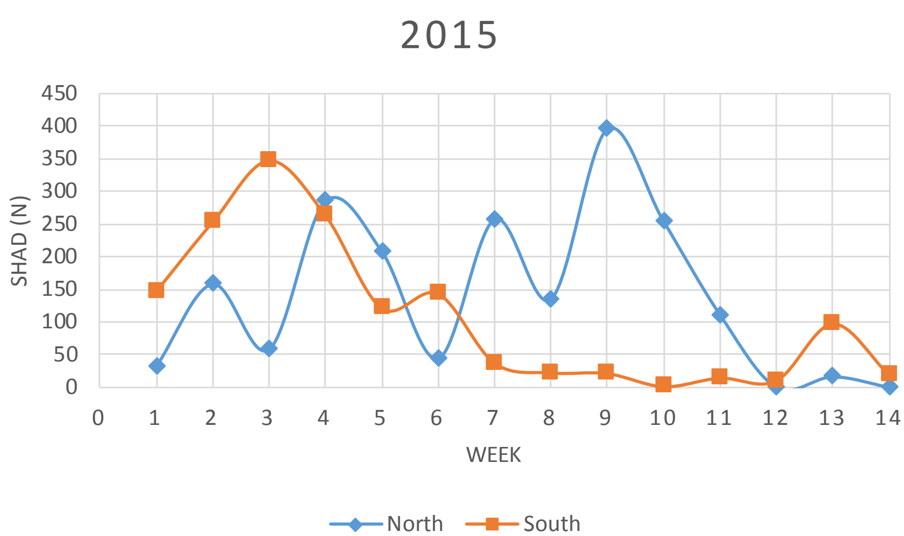

Figure 4. Weekly catches of Connecticut River juvenile shad, 2015. Catches are grouped by location: North=Holyoke, Enfield, Wilson, Glastonbury. South=Salmon River, Deep River, Essex.

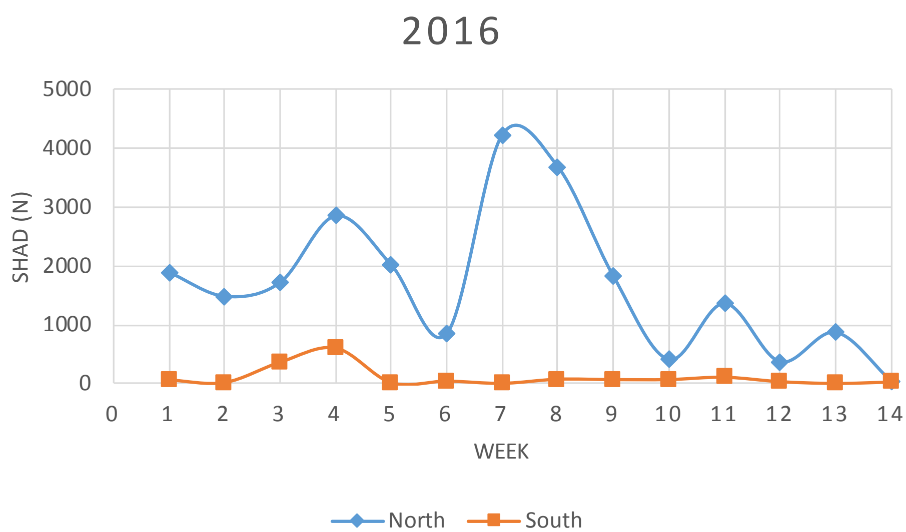

Figure 5. Weekly catches of Connecticut River juvenile shad, 2016. Catches are grouped by location: North=Holyoke, Enfield, Wilson, Glastonbury. South=Salmon River, Deep River, Essex.

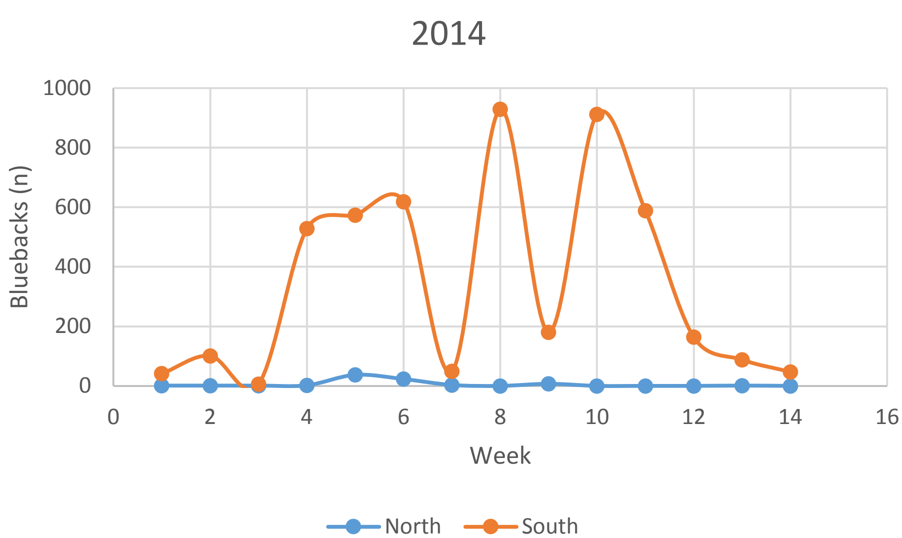

Figure 6. Weekly catches of Connecticut River juvenile blueback herring, 2014. Catches are grouped by location: North=Holyoke, Enfield, Wilson, Glastonbury. South=Salmon River, Deep River, Essex.

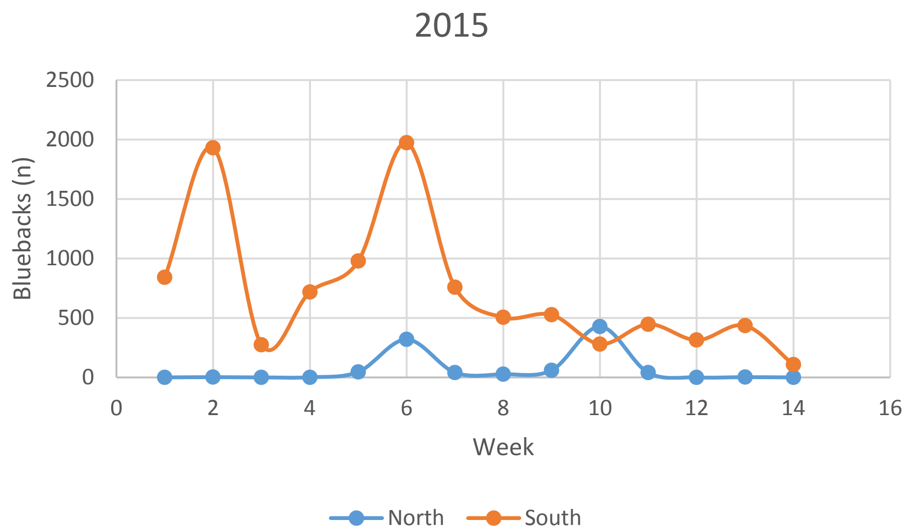

Figure 7. Weekly catches of Connecticut River juvenile blueback herring, 2015. Catches are grouped by location: North=Holyoke, Enfield, Wilson, Glastonbury. South=Salmon River, Deep River, Essex.

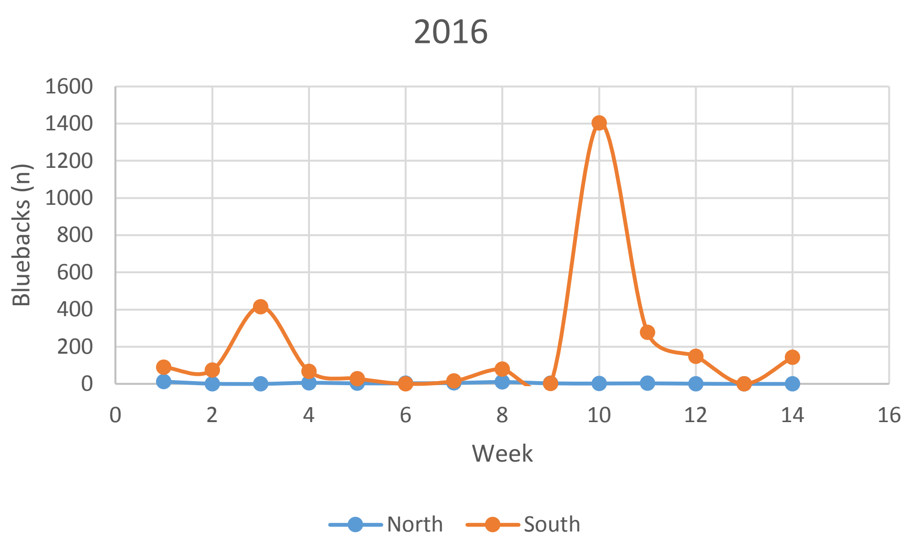

Figure 8. Weekly catches of Connecticut River juvenile blueback herring, 2016. Catches are grouped by location: North=Holyoke, Enfield, Wilson, Glastonbury. South=Salmon River, Deep River, Essex.

JOB 8: ESTUARINE SEINE SURVEY

JOB 8: ESTUARINE SEINE SURVEY

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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. All sites have been sampled since 1988 except Milford which was added in 1990.

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 2016 at eight sites, yielding a total catch of 13,466 fish of 28 species and 16,072 invertebrates of 17 species. Geometric mean catch of all finfish (159 fish/haul) was above the 29-year time series median of 139 fish/haul (Figure 8.2). Although total catch has varied considerably year to year, the increasing trend is significant (df=28, r^2=0.11, p=0.048). 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 showed a marked increase above the 28 year time series average in 2015, with 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 remained absent in 2015 after low abundance was observed in 2011 and 2014, and no presence recorded in 2009-10 and 2012-13 (Table 8.1).

Relative Abundance of Juvenile Winter Flounder and Tautog

The 2016 index of YOY winter flounder (0.6 fish/haul) is similar to the 2015 index and continued a modest increase from the record low abundance observed in 2013 (Table 8.3, Figure 8.3). The time series has a significant negative trend (r^2=0.36, p<0.001, df= 28), 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) and Greenwich. Three of the eight sites had no catch (Table 8.3) and the frequency of occurrence of this species has decreased over the time series (Figure 8.3) indicating that juvenile production has contracted in several areas of the Sound. Mean length of YOY winter flounder captured at all sites in 2016 was 59.9mm and shows no trend over the 29-year time series, ranging from 47.3 to 71.1mm.

The 2016 index of YOY tautog (1.1 fish/haul) was near to near the series average of 1.0 tautog /haul, a decline from 2015,the highest abundance in the time series (Table 8.1, Figure 8.4). Overall, the time series has a significant increasing trend (r^2=0.25, p=0.004, df=28). Relatively abundant year classes have been produced in 1998-1999, 2002-2004, 2007-2008, 2012 and 2014-2015. 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, Figures 8.5 and 8.6). Scup occurred in 1999 but the highest relative abundance has been in the last five years of the time series. In 2015 the species was present in record numbers and the 2016 index (1.3 fish/haul) remains above the time series mean (0.8 fish/haul).

YOY black sea bass first appeared in Survey catches in 1991 and every year since 1998, reaching their record highest recorded abundance in 2015 (2.8 fish/haul). The 2016 index (1.9 fish/haul) is the third highest in the time series, behind 2014 and 2015.

YOY bluefish show a pattern similar to black seabass, first appearing in the catch in 1991 and remaining consistent since 1998. Their abundance increased dramatically in 2014 and 2015, returning to average abundance for the time series (0.26 fish/haul) in 2016 (Table 8.4)

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 8.7). The 2016 index (99 fish/haul) was near the mean (98 fish/haul) for the time series, decreasing from the 2015 index which was the second highest.

Although numerically driven by the abundance of silverside, all four forage fish species increased in abundance and occurrence in 2015 and were at or above their time series mean in 2016. Over the 29 year time series, the forage index has shown considerable variability, common for short-lived forage species, with no significant trend ((r^2 0.06, p=0.12, Figure 8.7).

Relative Abundance of Invertebrate Species

A total of 16,068 invertebrates comprised of 16 species were captured in 2016 (Table 8.6, Appendix 8.2), similar to 2015. Six crab species were present in the seine hauls, along with three shrimp species, one gastropod and one bivalve. Mud snail, sand shrimp, shore shrimp, green crab, and hermit crab were the most abundant and were observed more than 50% (Table 8.3).

Blue crabs were captured in the Groton, Waterford, Clinton and Milford sites at relatively low abundance in 2016 (n=6 crabs) down from a time series high in 2009 (n=333 crabs). A single Asian shore crab was observed in the Old Lyme site in 2016. The shore shrimp returned to moderate abundance in 2016, after increasing substantially in 2014-2015, 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 observed in 2016.

Finfish Species Richness

Over the 29-year time series, the mean number of cold temperate species captured per seine haul (Figure 8.8, Table 8.7) shows a negative trend (r^2=0.20, p=0.01). In contrast, the mean number of warm temperate species captured per haul has increased significantly (r^2=0.61, p<0.001), from about three to more than seven over the time series.

MODIFICATIONS

None.

Table 8.1: Geometric mean catch of finfish species commonly captured in seine samples, 1988-2016. *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 captured in seine samples, 1988-2016. *See Appendix 8.1 for complete taxonomic names.*

Species	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
alewife	0	0	0	0	0	0	0	0	0	0	0	0	0.0
American sand lance	0	0	0	0	0	0	0.1	0	0	0	0	0	0.0
American shad	0	0	0	0	0	0	0	0	0	0	0	0.1	0.0
Atlantic menhaden	0.4	0.2	0.4	0.6	0.1	0.3	0	0.1	0.03	0.08	1.2	9.9	0.4
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	73.0
Atlantic tomcod	0	0	0	0	0	0	0	0.1	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	5.8
blueback herring	0	0	0	0	0	0	0	0	0.01	0.01	0	0.1	0.0
bluefish	0.2	0.1	0.2	0	0	0.3	0	0.2	0.4	0.2	0.8	3.4	0.3
cunner	0.5	0.3	0.1	0.5	0.1	0.2	0.1	0	0.4	0.02	0.5	0. 1	0.0
fourspine stickleback	0	0	0	0	0	0	0	0	0	0	0.15	0	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	0.0
inshore lizardfish	0	0	1.9	0.2	0.3	0.2	0.1	0.2	0.2	0.13	1.6	0.4	0.0
mummichog	2.3	1.5	2.5	7.3	2.9	3.8	1.7	3.1	1.6	0.9	5	5.3	2.2
naked goby	0	0	0.1	0	0	0	0	0	0.06	0.05	0.08	0.04	0.0
northern kingfish	0.3	0.1	0	0	0.2	0.3	0.5	0.2	0.5	0.7	1.1	1	0.1
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	0.5
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	0.2
rainbow smelt	0.2	0	0	0	0	0	0	0	0	0	0	0	0.0
scup	0.2	0.9	0.1	1	0.1	1.9	0.1	0.2	2.1	0.12	2.6	9.5	1.3
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	0.5
smallmouth flounder	0	0	0	0	0.1	0.2	0.1	0.9	0.4	0.5	0.1	0.2	0.1
striped bass	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	10.2
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	0.0
summer flounder	0	0	0.2	0.1	0.1	0	0.1	0	0.08	0.1	0.04	0.1	0.0
tautog	1.4	0.7	0.4	2.4	1	0.4	0.4	0.3	1.3	0.6	3.5	4.8	1.1
weakfish	0	0	0	0	0	0	0	0	0	0	0.03	0	0.0
windowpane flounder	0.2	0.2	0	0	0.2	0	0	0.1	0	0	0.03	0	0.0
winter flounder 1+	0.1	0.2	0.1	0.1	0.1	0	0	0	0.02	0	0.04	0.03	0.0
winter flounder YOY	11	5.6	0.9	4.7	2	0.8	1	1.1	0.3	0.3	0.5	0.6	0.6

Table 8.2: Frequency of occurrence of finfish species commonly captured in seine samples, 1988-2016. *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 *continued*: Frequency of occurrence of finfish species commonly captured in seine samples, 1988-2016. *See Appendix 8.1 for complete taxonomic names.*

Species	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
alewife	0	0	0	0	0	0	0	0	0	0	0	0	0
American sand lance	0	0	0	0	0	0	0.04	0	0	0	0	0	0
American shad	0	0	0	0	0	0	0	0	0	0	0	0.04	0
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	0.10
Atlantic silverside	1	1	1	1	1	1	1	1	0.98	1	1	1	1.00
Atlantic tomcod	0.02	0.02	0	0	0.02	0	0	0.06	0	0	0	0	0
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	0.9	0.88
blueback herring	0	0	0	0.02	0	0	0.02	0	0.02	0	0	0.02	0
bluefish	0.15	0.04	0.08	0	0.02	0.15	0.02	0.1	0.21	0.08	0.23	0.77	0.21
cunner	0.29	0.21	0.13	0.25	0.1	0.17	0.08	0.04	0.23	0.02	0.31	0.1	0
fourspine stickleback	0.02	0	0.02	0	0	0.02	0	0.04	0	0	0.15	0	0.04
grubby	0.5	0.46	0.27	0.15	0.19	0.27	0.21	0.42	0.23	0.2	0.19	0.15	0.02
inshore lizardfish	0.06	0	0.6	0.13	0.19	0.15	0.13	0.1	0.15	0.13	0.6	0.25	0
mummichog	0.35	0.27	0.48	0.65	0.48	0.5	0.4	0.42	0.35	0.27	0.54	0.65	0.40
naked goby	0.04	0	0.08	0	0.02	0	0	0.02	0.08	0.06	0.08	0.02	0.02
northern kingfish	0.17	0.1	0.02	0.02	0.19	0.17	0.23	0.13	0.29	0.35	0.4	0.38	0.10
northern pipefish	0.48	0.25	0.29	0.42	0.23	0.52	0.4	0.44	0.6	0.6	0.69	0.75	0.31
northern puffer	0.4	0.31	0.29	0.44	0.23	0.23	0.21	0.31	0.42	0.38	0.48	0.31	0.21
rainbow smelt	0.08	0	0	0	0	0	0	0	0	0	0	0	0
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	0.38
sheepshead minnow	0.15	0.15	0.06	0.4	0.27	0.13	0.1	0.13	0.25	0.07	0.17	0.13	0.13
smallmouth flounder	0	0	0.02	0	0.13	0.15	0.06	0.4	0.17	0.29	0.06	0.15	0.13
striped bass	0	0	0	0	0.02	0	0	0	0	0	0	0	0
striped killifish	0.73	0.96	0.65	0.88	0.94	0.75	0.9	0.98	0.65	0.58	0.88	0.88	0.79
striped searobin	0.38	0.13	0.13	0.27	0.19	0.4	0.17	0.06	0.08	0.15	0.49	0.29	0.02
summer flounder	0	0	0.19	0.06	0.15	0.02	0.04	0	0.08	0.12	0.06	0.13	0.02
tautog	0.54	0.42	0.17	0.54	0.42	0.35	0.31	0.23	0.6	0.33	0.63	0.83	0.67
weakfish	0	0	0	0	0	0	0	0	0	0	0.02	0	0
windowpane flounder	0.21	0.15	0.06	0.04	0.1	0	0.04	0.02	0	0	0.04	0	0
winter flounder 1+	0.17	0.21	0.15	0.08	0.15	0.04	0.04	0.04	0.04	0	0.06	0.04	0.02
winter flounder YOY	0.98	0.94	0.46	0.92	0.71	0.52	0.6	0.63	0.27	0.23	0.33	0.46	0.35

Table 8.3: Mean catch of young-of-year winter flounder at eight sites sampled by seine, 1988-2016.
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
2016	0.12	0	1.49	0.20	0	0	1.14	6.03	0.63

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

Table 8.4: Total catch of finfish species commonly captured in seine samples, 1988-2016. *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	2016	Total
alewife							1								28	1													0	30
American sand lance					1		10																13						0	24
American shad		18	1								151																	42	0	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	150	20,201
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	6459	156,644
Atlantic tomcod						3					1						1	3			1			8					0	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	500	8,366
blueback herring		26																		9			3		1	1		11	0	51
bluefish			3	194	10		5	2			3	24	1		13	5	23	8	30		7	53	1	26	54	17	194	289	45	1,007
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	0	870
fourspine stickleback	33	76		183	11	21	1		3		24	3	1	7			9		2			8		2			13		2	399
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	1,085
inshore lizardfish	5		2			4	6			46	6	16	15	103	2		3		169	18	26	22	10	16	23	11	135	38	0	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	519	17,985
naked goby			1	4				1			1	1		4	2	2	2		13		2			2	4	4	6	5	1	55
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	10	744
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	48	3,750
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	18	1,919
rainbow smelt						5	2										34												0	41
scup												1		58	172	131	50	154	6	170	14	413	21	30	375	18	485	1573	198	3,869
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	742	6,262
smallmouth flounder	1			1		8	14	7	2	5		40	3	12					1		14	21	5	114	63	49	15	13	7	395
striped bass												1				6					1								0	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	1482	36,649
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	1,086
summer flounder						2	6		1		1								16	8	8	1	6		6	7	3	11	1	77
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	75	3,175
weakfish																15											4		0	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		0	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	1	458
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	74	15,366

Table 8.5: Total catch of finfish species infrequently captured in seine samples, 1988-2016. *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	2016	Total
American eel	1	3					1				5														1		2	15		28
Anchovy, spp (YOY)																					15								3051	3066
Atlantic needlefish																					2								1	3
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					1	22
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	2	32
pumpkinseed				2													3													5
rainwater killifish									3	4			2		6	35	53	19	3										4	129
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			15	219
white perch																		3			11			6						20
yellow jack																							1							1

Table 8.6: Total catch of invertebrate species taken in seine samples, 2004-2016. *See Appendix 8.2 for complete taxonomic names.*

Species		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016		Total
bluecrab		1	2	84	31	4	333	35	23	27	18	17	18	6		599
boreal squid					1											1
brown shrimp				11										3		14
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	2,878		8329
green crab		234	266	341	147	644	176	308	228	175	253	273	213	256		3514
horseshoe crab														1		1
Japanese shore crab		1		1	1				6	1			1	1		12
Jonah crab							2									2
lady crab		298	119	66	195	92	42	19	24	18	13	41	102	12		1041
mantis shrimp										1						1
mole crab		1	5													6
moon jelly								319						461		780
mud crabs		60	55	74	30	85	67	308	80	80	1100	43	142	9		2133
mud snail		948	2,071	4,478	3,569	3,810	3,128	2,699	2,683	3072	5,787	6,938	11,132	11,687		62002
northern comb jelly							346	36			3,620	1,200		185		5387
northern moon snail														4		4
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	33		10941
scallop (bay)												3	3	1		7
shore shrimp		990	404	1,149	707	1,390	535	619	762	402	511	1011	4795	478		13753
spider crab		4	5	6	1	3	1	7	33	13	20	14	45	53		205
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.**

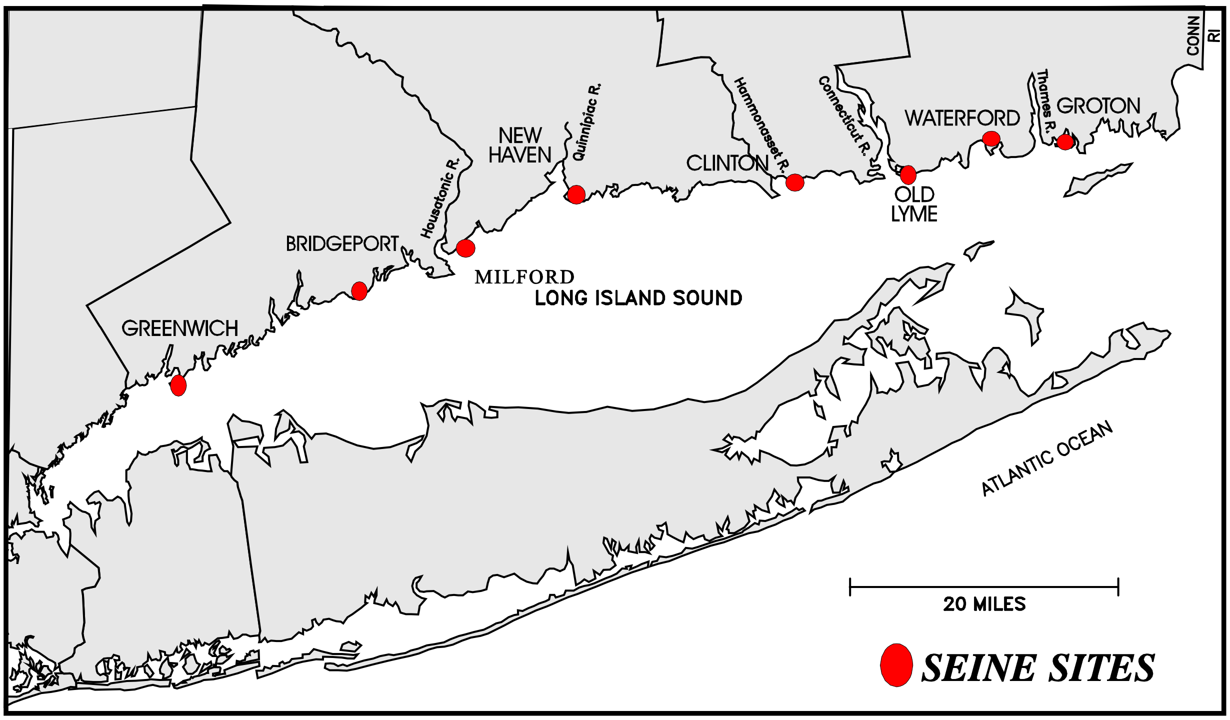
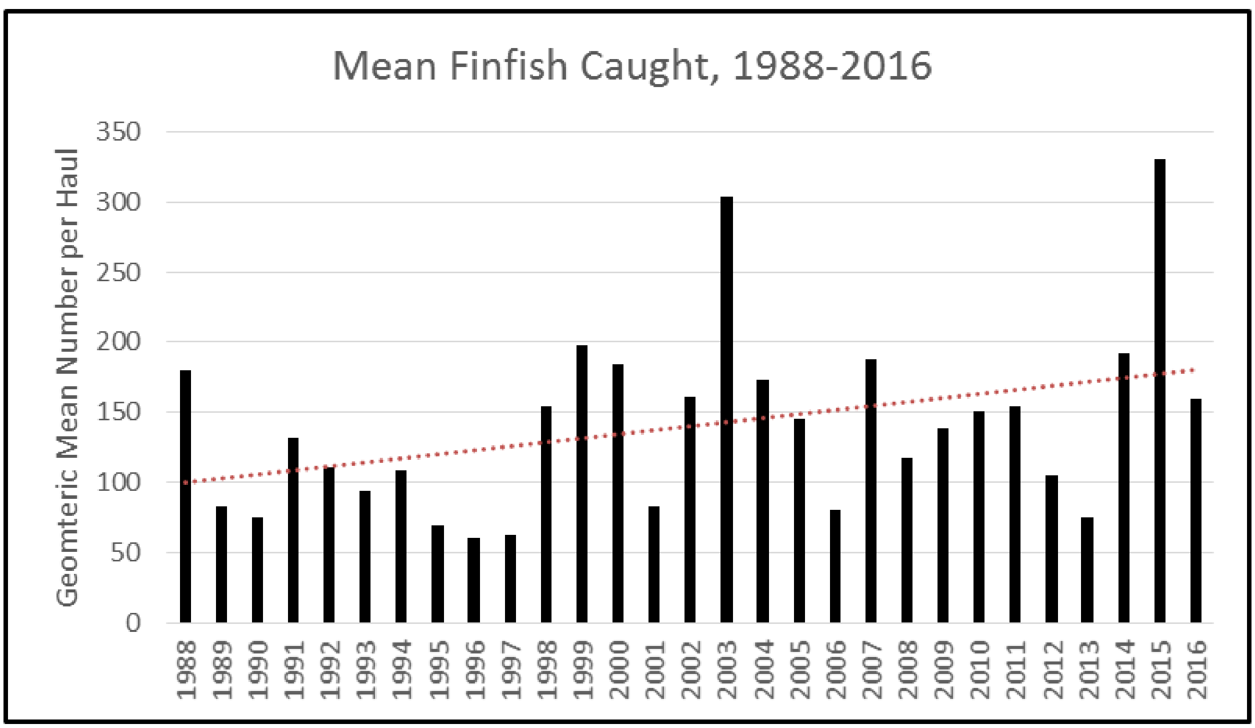


Figure 8.2: Mean catch of all finfish captured in seine samples, 1988-2016. *Geometric mean catch (numbers) per haul includes samples at all sites. Note that sampling at the Milford site began in 1990.*



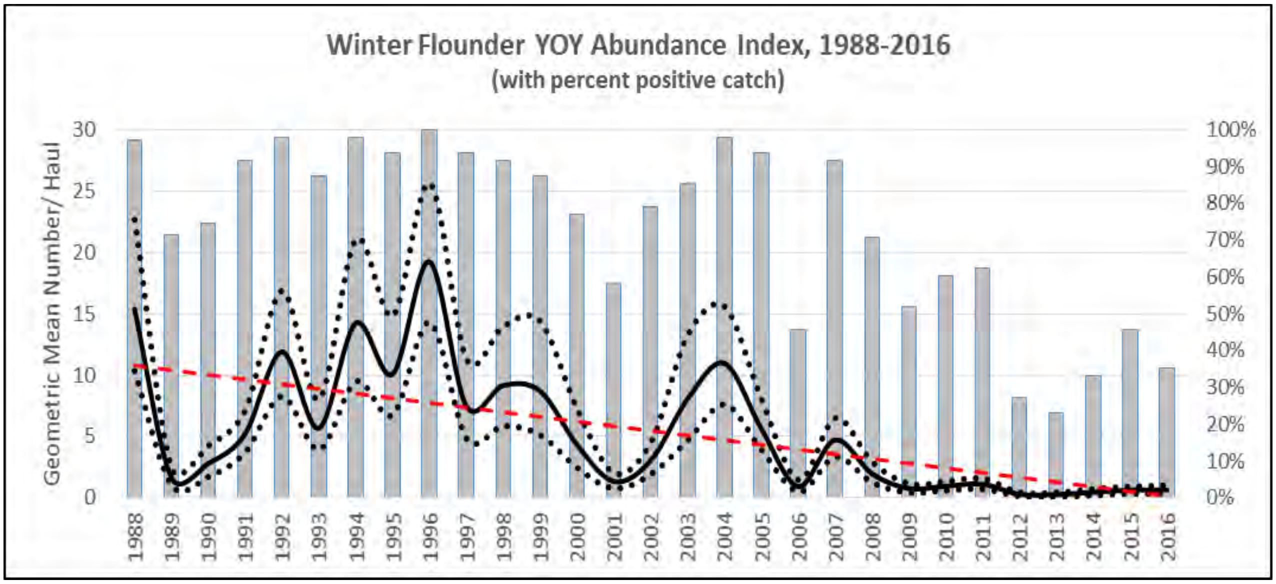


Figure 8.3: Mean catch and occurrence of young-of-year winter flounder, 1988-2016. *Confidence intervals (95%) are shown (dotted lines). The negative trend (dashed line) is significant (r^2 =036, p<0.001, df =28). Percent of hauls catching winter flounder (shaded bars) has also decreased.*

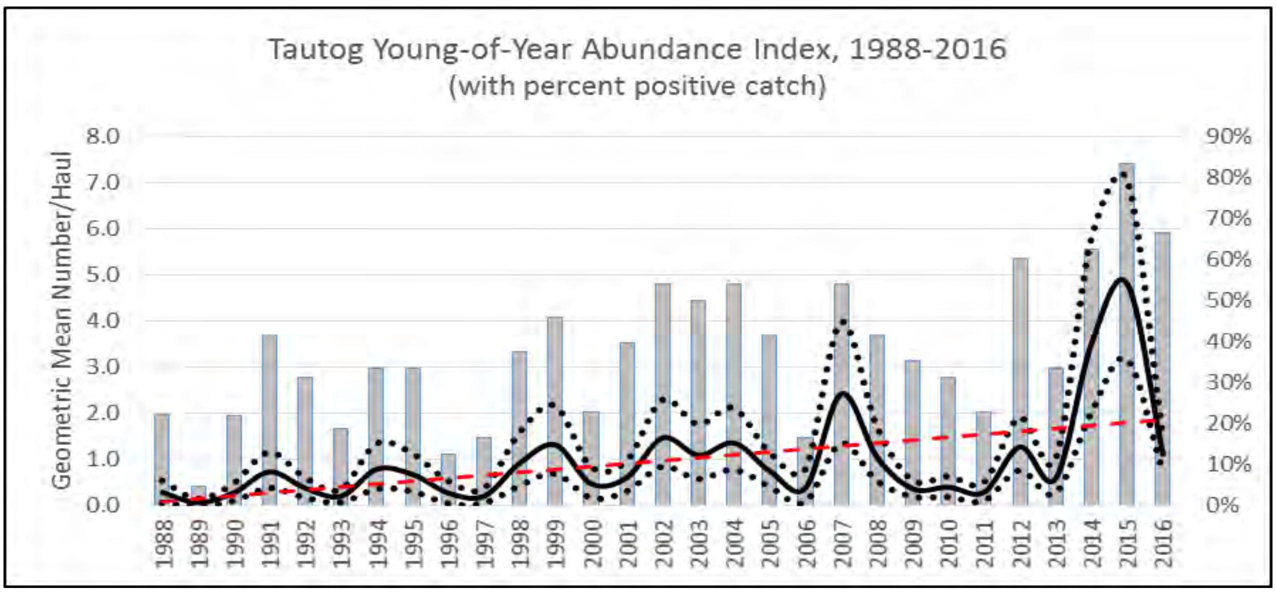


Figure 8.4: Mean catch and occurrence of young-of-year tautog, 1988-2016. *Confidence intervals (95%) are shown (dotted lines). The positive trend (dashed line) is significant (r^2 =0.25, p=0.003, df= 28). Percent of hauls catching tautog (shaded bars) has also increased.*

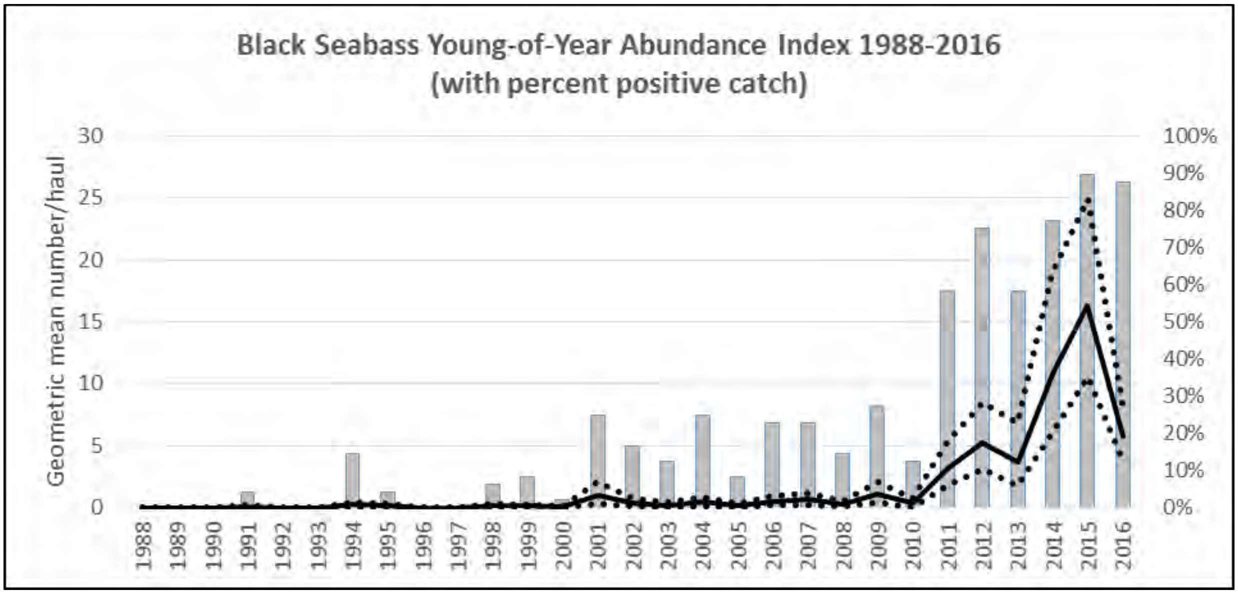


Figure 8.5: Mean catch of black seabass young-of-year, 1988-2016. Annual percent of hauls catching one or more black seabass are also shown.

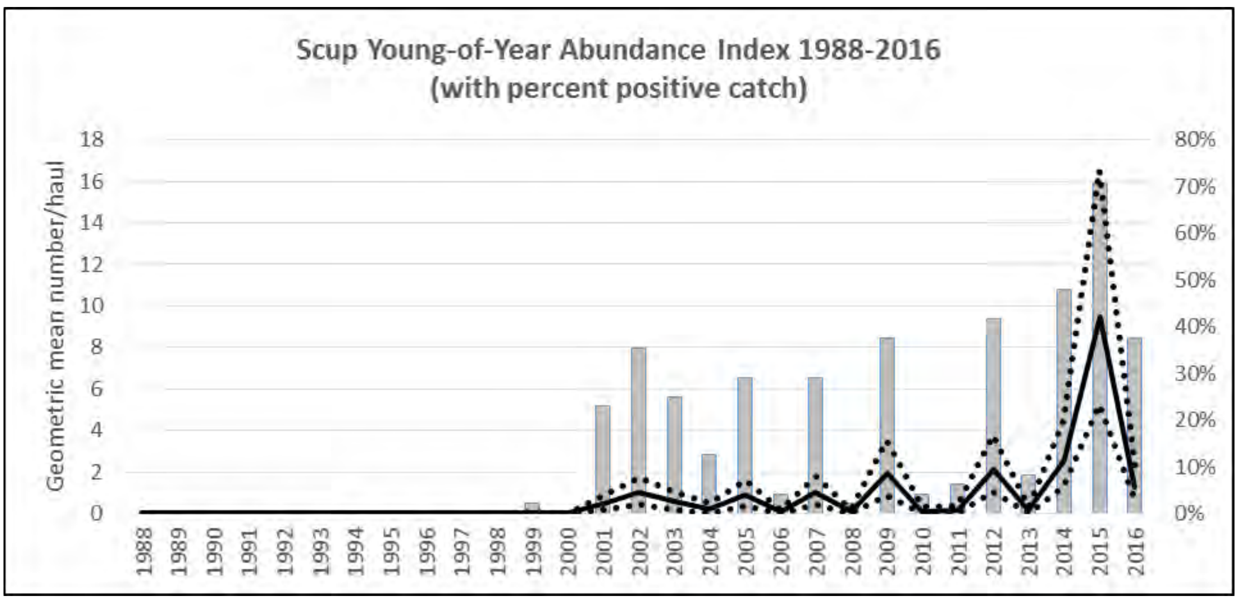
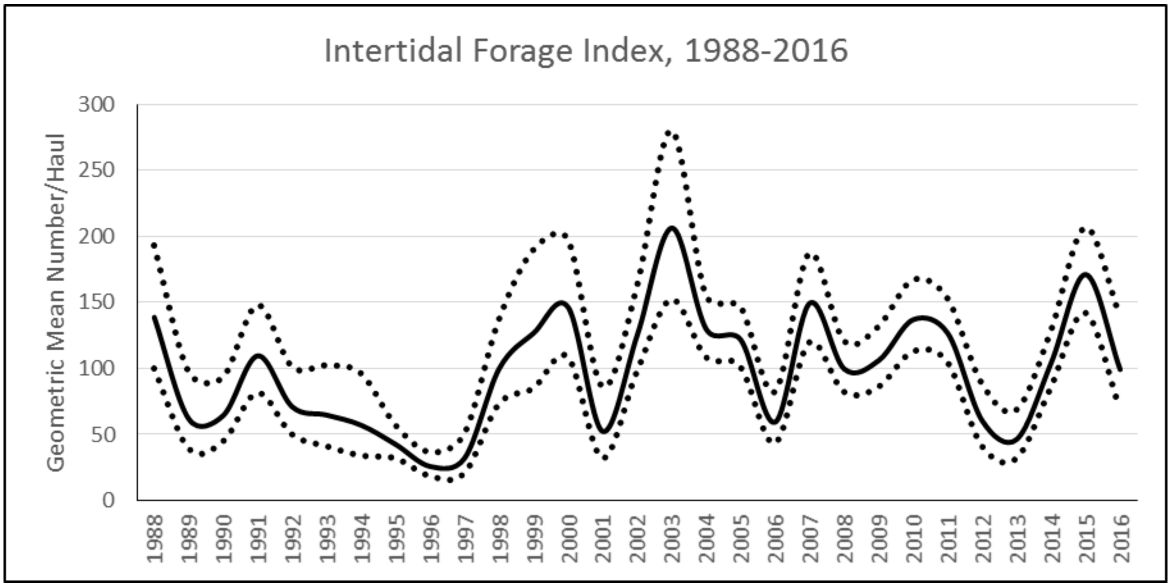


Figure 8.6: Mean catch of scup young-of-year, 1988-2016. Annual percent of hauls catching one or more scup are also shown.



	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	2016
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	99

Figure 8.7: Mean catch of forage fish, 1988-2016. *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.*

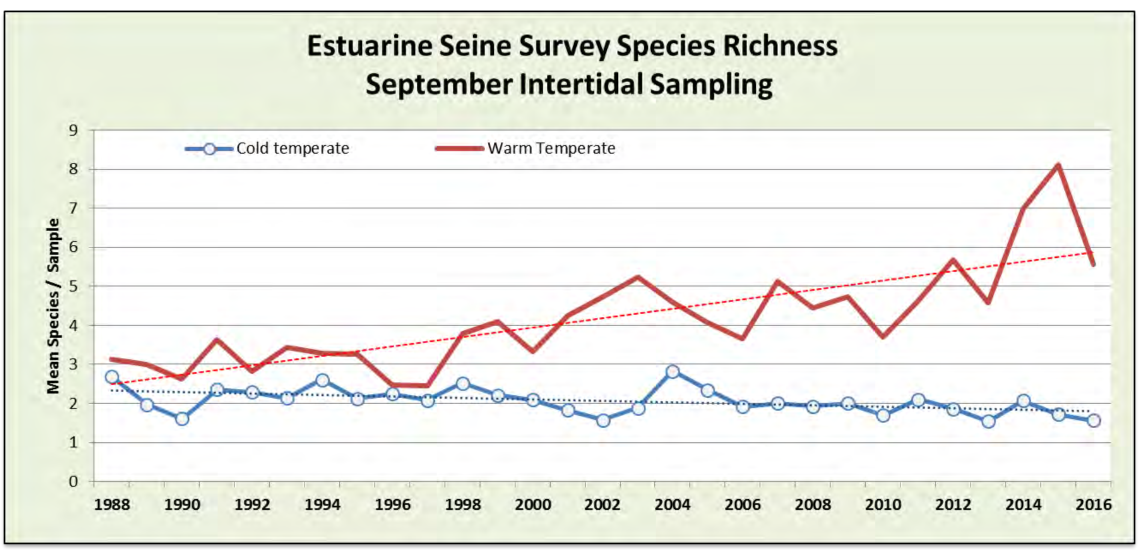


Figure 8.8: Trend in species richness for cold and warm temperate species at eight seine sites, 1988-2016. *See Table 8.7 for species listings by group.*

Appendix 8.1: Finfish species captured in the Estuarine Seine Survey, 1988-2016.

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 captured in the Estuarine Seine Survey, 1988-2016.

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

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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 location-specific size, growth and movement data for recreationally important species to inform immediate and long-term local, regional, and interstate assessments and management plans.
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. 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, movement data for tautog (*Tautoga onitis*) within Long Island Sound were obtained from a cooperative volunteer tagging study. Release and return data (location, date, name of tagger and person reporting return) are archived at the CT DEEP Marine Fisheries Office in annual Excel spreadsheets and GIS shape files.

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 Fisheries Division staff, and continued in 2015-16 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.

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, 2015). 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.

Tautog Tagging Study

The Recreational Fishing Alliance (RFA) and the University of Connecticut initiated a cooperative tautog tagging study with the assistance of CT DEEP Fisheries Division staff to learn more about the migratory range, timing, and habits of this species. American Littoral Society tags were used to take advantage of the broadly established tag recognition this program has, the simplicity in tag method being designed for use by fishermen, and the cost effectiveness of ALS tag report management. Tagging operations are designed to begin as soon as practicable in the spring and early summer to take advantage of spawning aggregations both for efficiency and to allow tagged fish to randomly mingle into the greater population prior to post-spawn dispersal during feeding excursions. Beginning in spring 2015, tautog were tagged with American Littoral Society (ALS) yellow "spaghetti" fish tags. All ALS tags are labeled with a unique six digit tag number and the message "RETURN LITTORAL SOC. HIGHLANDS, NJ 07732."

RESULTS

Harbor Watch Norwalk Harbor Survey

From 1990-1994, the Harbor Watch program documented an abundance and high diversity of benthic fish (Table 9.1). 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. Beam trawl sampling captured 5-15 finfish species annually for years with comparable effort in June through October (Table 9.1). Average catch abundance in 2016 (0.9 fish/tow) was the third lowest, following the modest increase reported in 2015. The total number of species captured in 2016 (12) was among the highest. In 2016, winter flounder were only captured in 9 out of 19 grids sampled, considerably lower than 2015 when the species was captured in 18 of the 19 grids sampled and their number/tow were the highest recorded since 2005. As opposed to 2015 when flounder were most abundant in the lower harbor (Box L, Figure 9.1, Crosby et al. 2015), highest catch in 2016 was distributed between mid-harbor sites (Boxes C, D, E) and the lower harbor (Boxes P and T). Distributions in 2015 and 2016 differed from the early 1990s when the species were most abundant in the upper harbor.

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 9.3). Warming was greatest in the upper river (Stations 1 and 1a), and all stations combined show a positive slope of approximately 1.1^0C (2.0^0F) over the time period.

Coast Guard Academy Thames River Survey

The Academy marine science class surveys of the Thames River are documented beginning in 1974 (Table 9.2). Annual surveys varied from 4-18 otter trawl tows. Finfish were captured in all samples (i.e., 100% positive tows). Mean catch in trawl samples varied from 2.9-12.0 fish/tow without trend 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.

Tautog Tagging Study

Eighteen volunteer anglers tagged and released 353 tautog in 2015 (Figure 9.4), and 144 tautog in 2016 (figure 9.5). Of fish tagged in 2015 by these volunteers and through the American Littoral Society fish tagging program, 28 were recaptured. These recaptured fish were at-large between 1 and 141 days, with an average time at-large of 60 days. Most fish were recaptured on the same grounds they were first tagged. However, two recaptured fish did show notable movement, one that moved from the Housatonic area to Clinton. Importantly, another fish at-large just 13 days after being tagged in late October was recaptured in New York waters near Race Rock (Fishers Island), demonstrating some degree of shared resource between New York and Connecticut state waters. An additional fish tagged in 2015 was recaptured the following spring in the same location as it was tagged (Kelsey Point, Clinton) after 189 days at large.

Forty-eight of the 144 tautog tagged in 2016 were tagged and released by personnel at the Millstone Environmental Laboratory off Two Tree Island in eastern Long Island Sound. Five of these fish were recaptured in 2016 at the same location after being at large for 8-34 days (mean = 23 days). Two additional tautog, tagged by recreational anglers in 2016 near Southwest reef off Westbrook, were recaptured in the vicinity within a month of initial tagging. While there were some notable distances traveled by individual fish, the large majority of recaptured tautog have been taken in the same general area where they were released.

MODIFICATIONS

The Tautog Tagging Study will continue in 2017. Data collection from other volunteer groups will be discontinued due to limitations on Fisheries staff time.

LITERATURE CITED

Crosby, S., P. Fraboni, N. Cantatore, J. Cooper, and R. Harris, 2015. Harbor Watch water quality reports for the Norwalk River Watershed, 35 pages.
Harris, R., P. Fraboni, N. Cantatore, J. Cooper, and, 2014. Harbor Watch Norwalk Harbor juvenile benthic marine fish report, 9 pages.
Mrakovcich, K., personal communication, 2015. Methods for Coast Guard Academy sampling of the Thames River.

Table 9.1: Beam trawl total finfish catch in the Norwalk Harbor, June-October, 1990-2016. 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
2016	68	0.9	1.3	0.6	54%	12

Table 9.2 Otter trawl total finfish catch in the lower Thames River, August-October 1974-2016. 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
2016	12	5.2	6.4	4.0	17

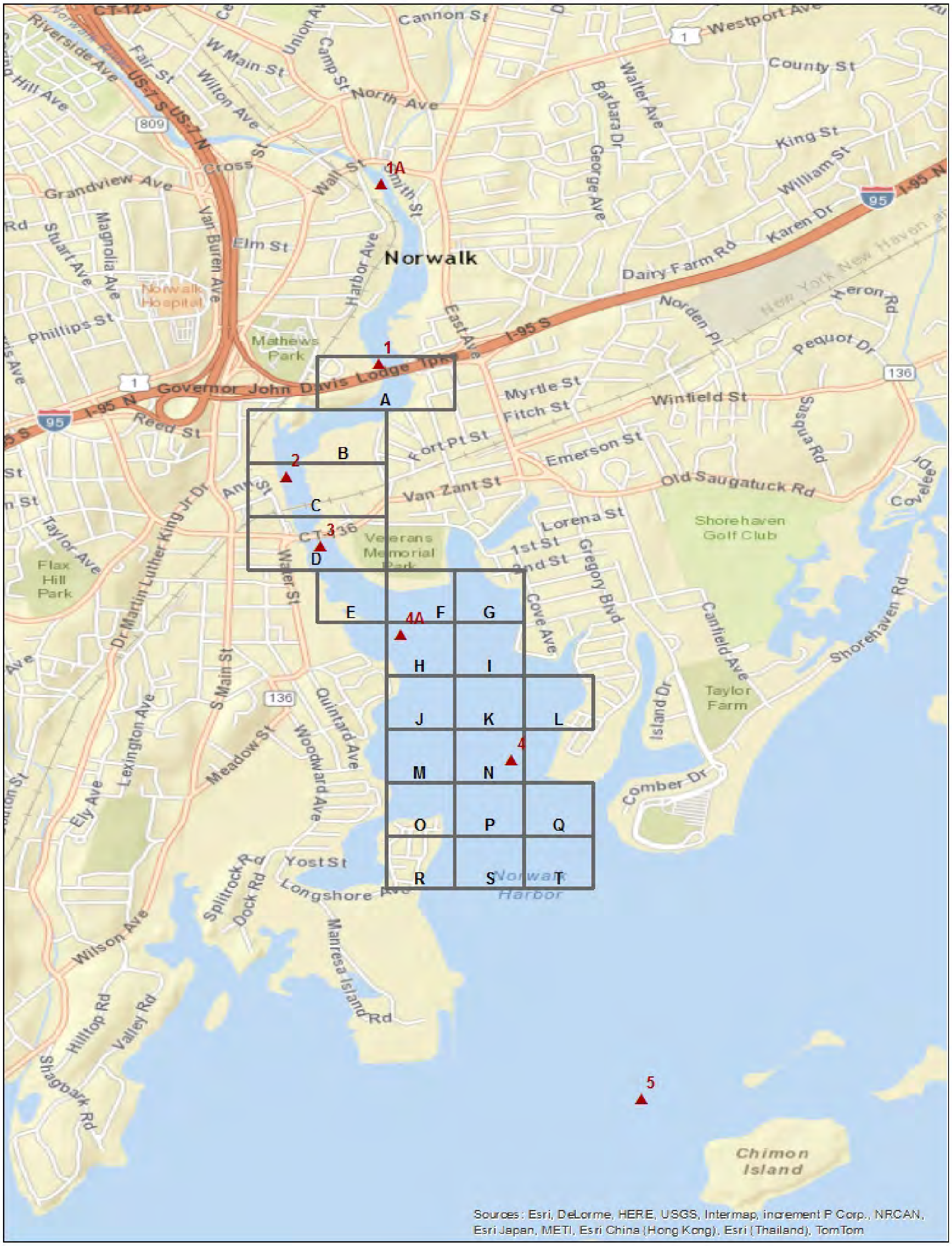


Figure 9.1. Harbor Watch sampling locations in the Norwalk River. Beam trawl sampling was completed within the lettered grids while water quality sampling stations are shown by the numbered triangles (Figure provided by Harbor Watch).

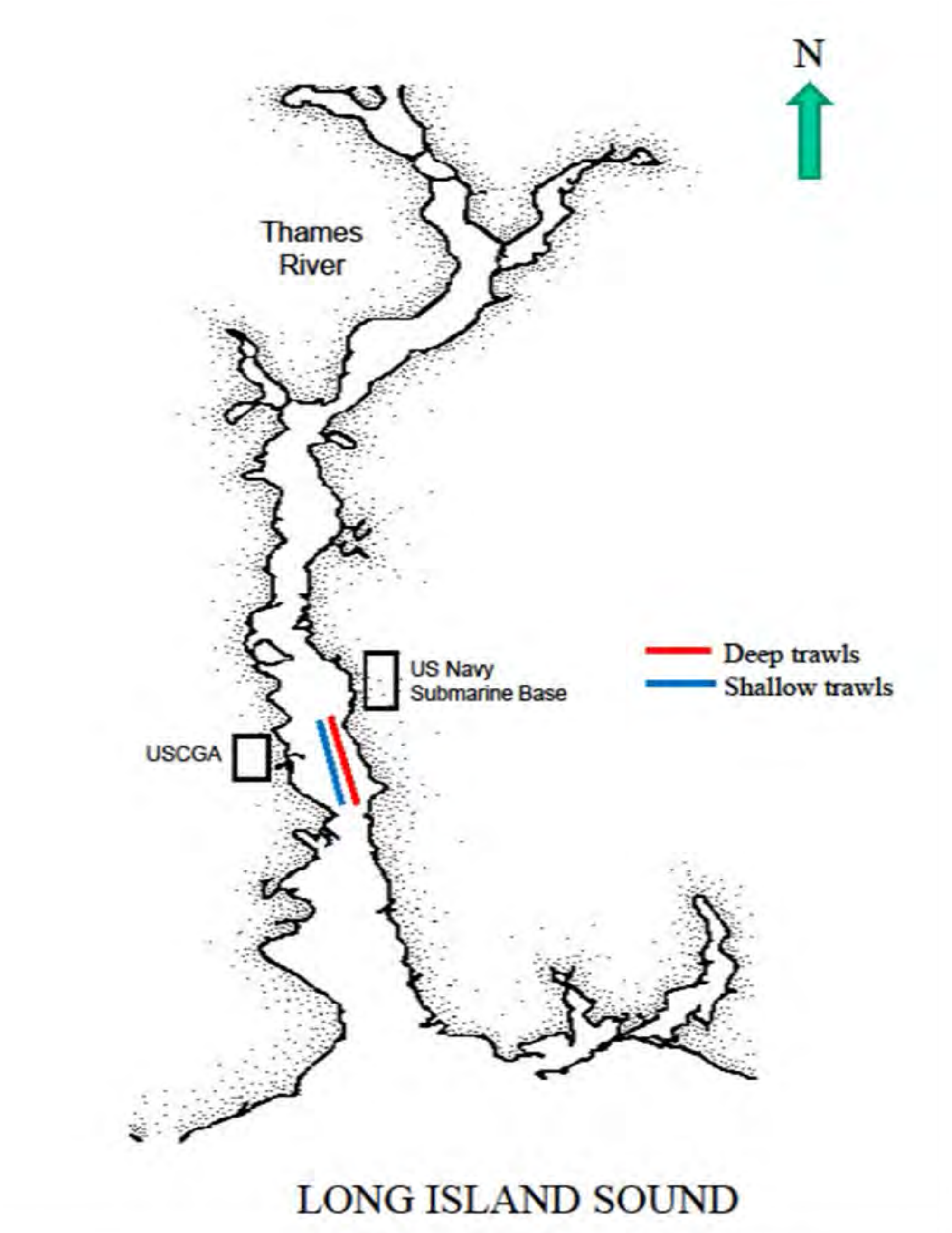


Figure 9.2. US Coast Guard Academy (USCGA) sampling locations in the Thames River. (Figure provided by USCGA).

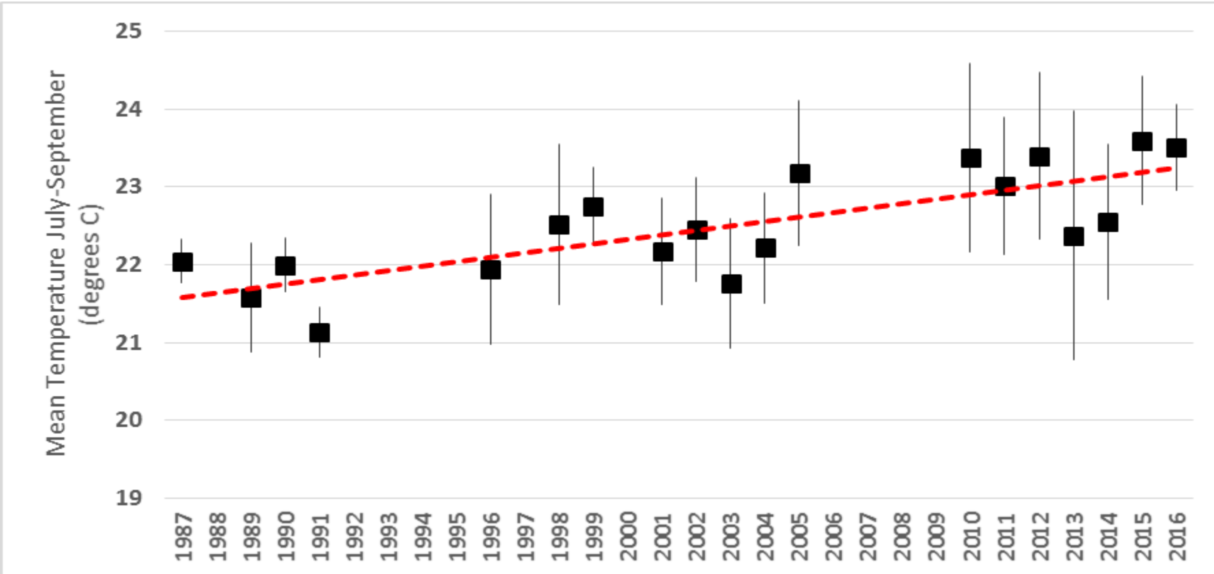


Figure 9.3. Mean water column temperature at eight stations in the Norwalk River, 1987-2016.

Error bars show two standard deviations of the data above and below the mean. The regression line shows the average increase in temperature over the time series and is statistically significant ($r^2 = 0.57$, $p<0.001$, df=18). See Figure 9.1 for station locations in the river.

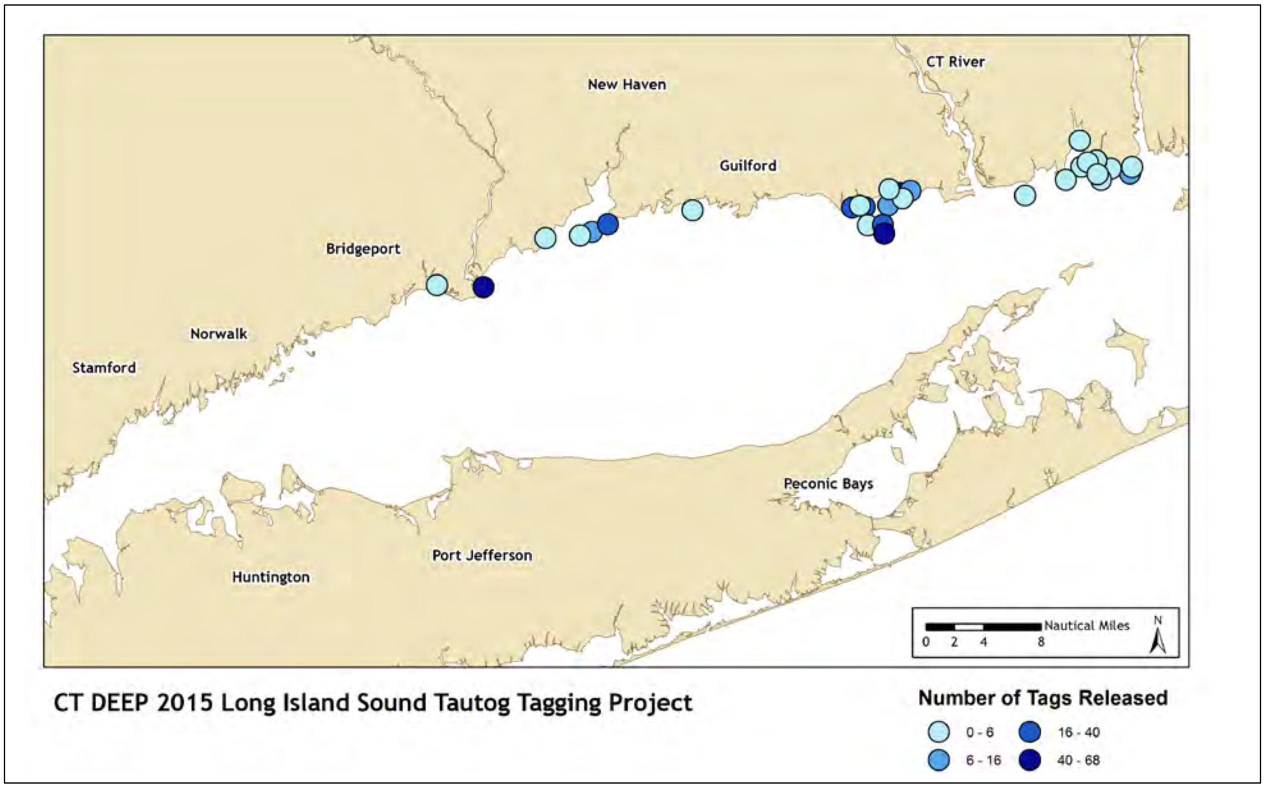


Figure 9.4. Release locations of tagged tautog, 2015.

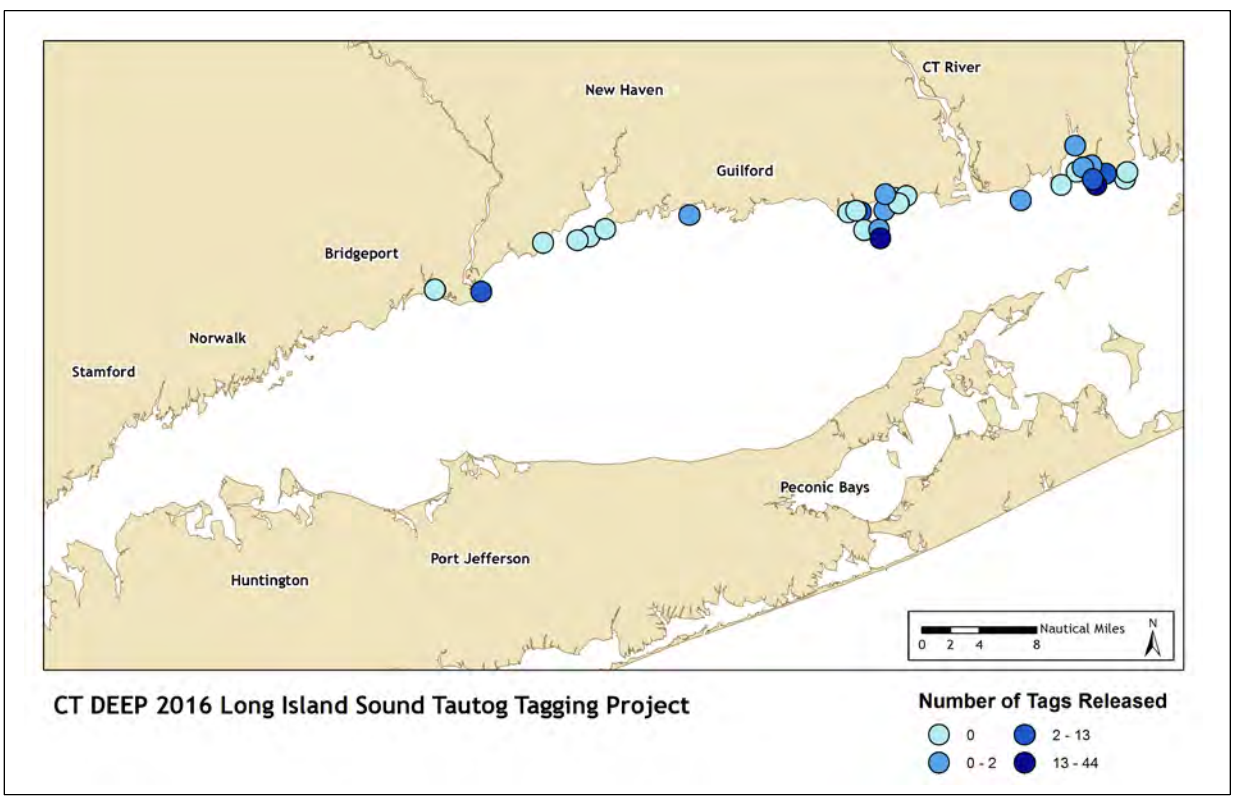


Figure 9.5. Release locations of tagged tautog, 2016.

JOB 10: COOPERATIVE INTERAGENCY RESOURCE MONITORING

2016 Long Island Sound Hypoxia Season Review

Connecticut Department of Energy & Environmental Protection

79 Elm Street, Hartford, CT 06106

Robert J. Klee, Commissioner

Interstate Environmental Commission

2800 Victory Boulevard, Building 6S Room 106

College of Staten Island—CUNY Campus

Staten Island, NY 10314

Introduction

Designated as an estuary of national significance by Congress in 1987, Long Island Sound is home to a diverse network of flora and fauna and over 4 million people. It is an estuary of recreational, commercial, and socioeconomic value. The Sound is bordered by the states of Connecticut and New York and has a watershed area extending through Maine and Quebec that encompasses over 16,000 square miles and 9 million people. Over time, the Sound has been subject to the effects of increased nutrient loading as a result of urbanization and changes in land use (Latimer *et al.*, 2014). Seasonal weather patterns, particularly during the summer months, exacerbate the effects of nutrient loading, causing hypoxic conditions in the Sound, most prominently in the Western Basin. This, in turn, negatively impacts the water quality of this estuary, the ecosystem services and resources it provides, and the habitat that is home to its many species. In response to the critical need to document summer hypoxic conditions in Long Island Sound and its embayments as defined in the Long Island Sound Study's Comprehensive Conservation and Management Plan, the Connecticut Department of Energy and Environmental Protection (CT DEEP) and the Interstate Environmental Commission (IEC), have monitored dissolved oxygen, as well as key water quality parameters relevant to hypoxia, in Long Island Sound since 1991.

This report presents a summary of *in situ* data collected by CT DEEP and IEC during the 2016 hypoxia season. The hypoxia season is defined as June-September. Data from the Long Island Sound Integrated Coastal Observing System (LISICOS) are presented with permission for informational purposes. Sampling and analyses were conducted under EPA-approved Quality Assurance Project Plans.

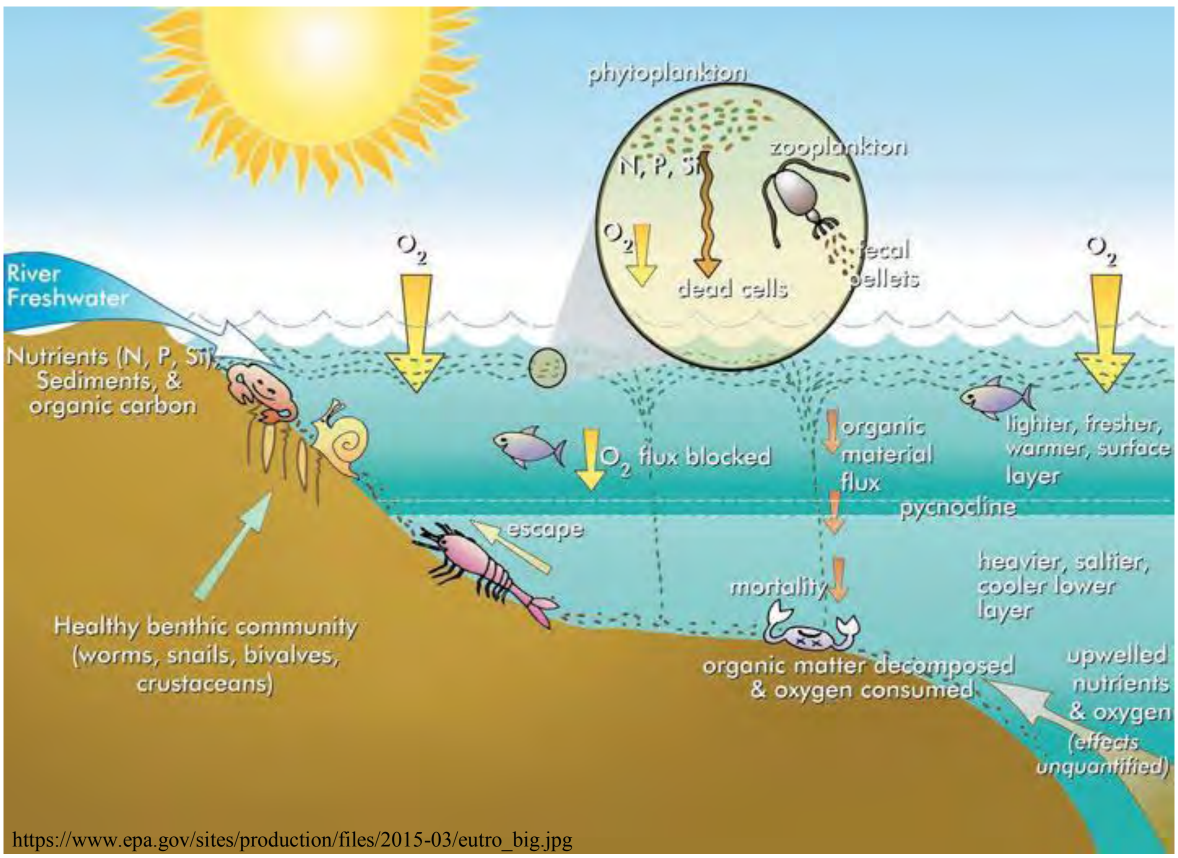
The CT DEEP and IEC Long Island Sound (LIS) Water Quality Monitoring Programs are synoptic in nature and are intended to characterize water quality conditions at one moment in time over a broad area (the entire Sound). Both programs support long term monitoring databases designed to detect changes in hypoxia due to changing conditions *(e.g.*, management actions, climate change, productivity). Both programs also provide data (*e.g.* nutrient, BOD, TSS, chlorophyll a) not currently available from fixed station buoy applications. In addition, CTDEEP provides limited biological data (plankton communities).

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 threshold of 3.0 milligrams per liter (mg/L) for extended periods of time (*e.g*., days). These episodic conditions are not captured by CT DEEP or IEC surveys.

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.

What is Hypoxia?

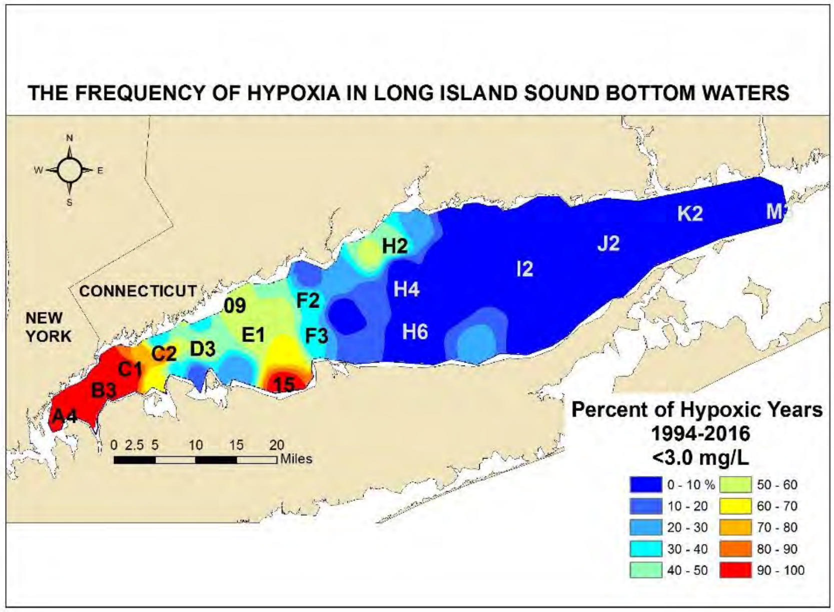
The term "hypoxia" means low dissolved oxygen ("DO") concentrations in the water. Marine organisms need oxygen to live, and low concentrations, depending on the duration and the size of the area affected, can have serious consequences for a marine ecosystem. As defined by the Long Island Sound Study, hypoxia exists when DO drops below a concentration of 3 mg/L, although research suggests that there may be adverse effects to organisms even above this level, depending upon the length of exposure (EPA, 2000 and Simpson *et al.,* 1995). The Connecticut Department of Energy & Environmental Protection, the New York State Department of Environmental Conservation and the Interstate Environmental Commission have 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, excess nitrogen tends to exasperate hypoxia beyond that which may be caused by natural conditions.



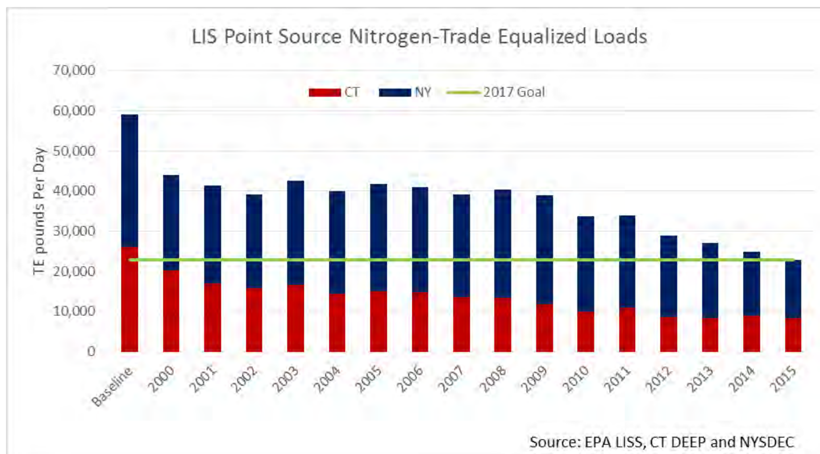
https://www.epa.gov/sites/production/files/2015-03/eutro_big.jpg

How Does Low Oxygen Impact the Sound?

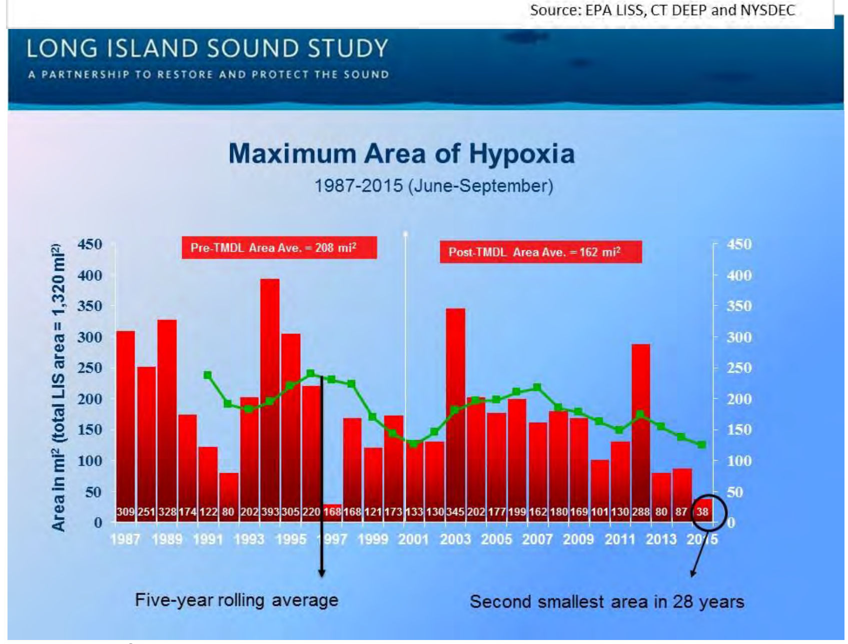
Each summer low oxygen levels render hundreds of square miles of bottom water unhealthy for aquatic life. Dissolved oxygen levels follow seasonal patterns with a decrease in bottom water DO over the course of the summer. Hypoxic conditions during the summer are mainly confined to the Narrows and Western Basin of Long Island Sound (map right). 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.



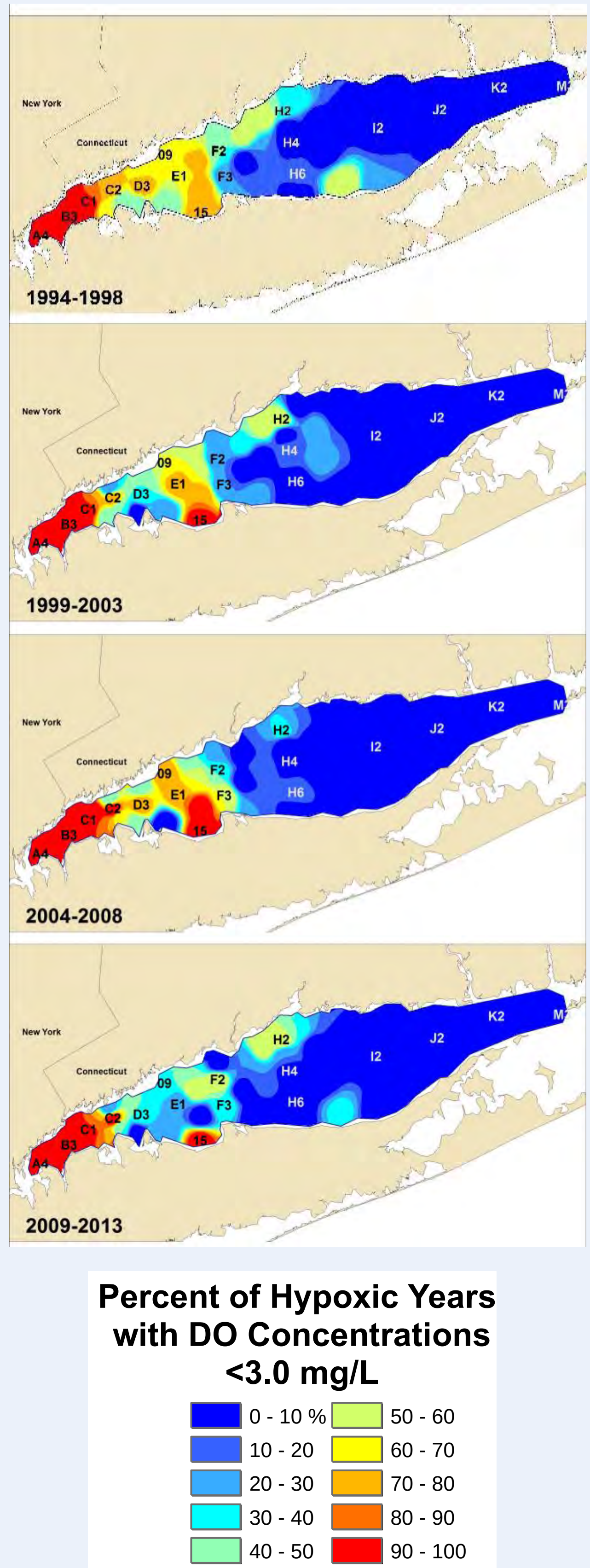
EPA, NY and CT implemented the *Total Maximum Daily Load to Achieve Water Quality Standards for Dissolved Oxygen in Long Island Sound (2000 TMDL)* which has resulted in significant progress in reducing open water Sound hypoxic conditions. Across Connecticut and New York, 106 wastewater treatment plants have been upgraded and 40 million fewer pounds of nitrogen have entered the Sound (51.5% reduction).



EPA estimates a 40% reduction in the five year rolling average area of hypoxia across the Sound, compared to pre-TMDL levels (EPA 2015).



The maps in the sidebar display the percentage of years when dissolved oxygen concentrations at each station were below 3.0 mg/L in the bottom waters of Long Island Sound in five year intervals. The maps show the area of hypoxia reducing in the Western Sound (Stations 09, E1, D3), but continuing to persist in the Narrows (Stations A4, B3, C1). The maps are based on CT DEEP monitoring data only. Updates to hypoxia maps combining IEC and CT DEEP data have not been completed for years prior to 2016.



Habitat Impairment Associated With Hypoxia

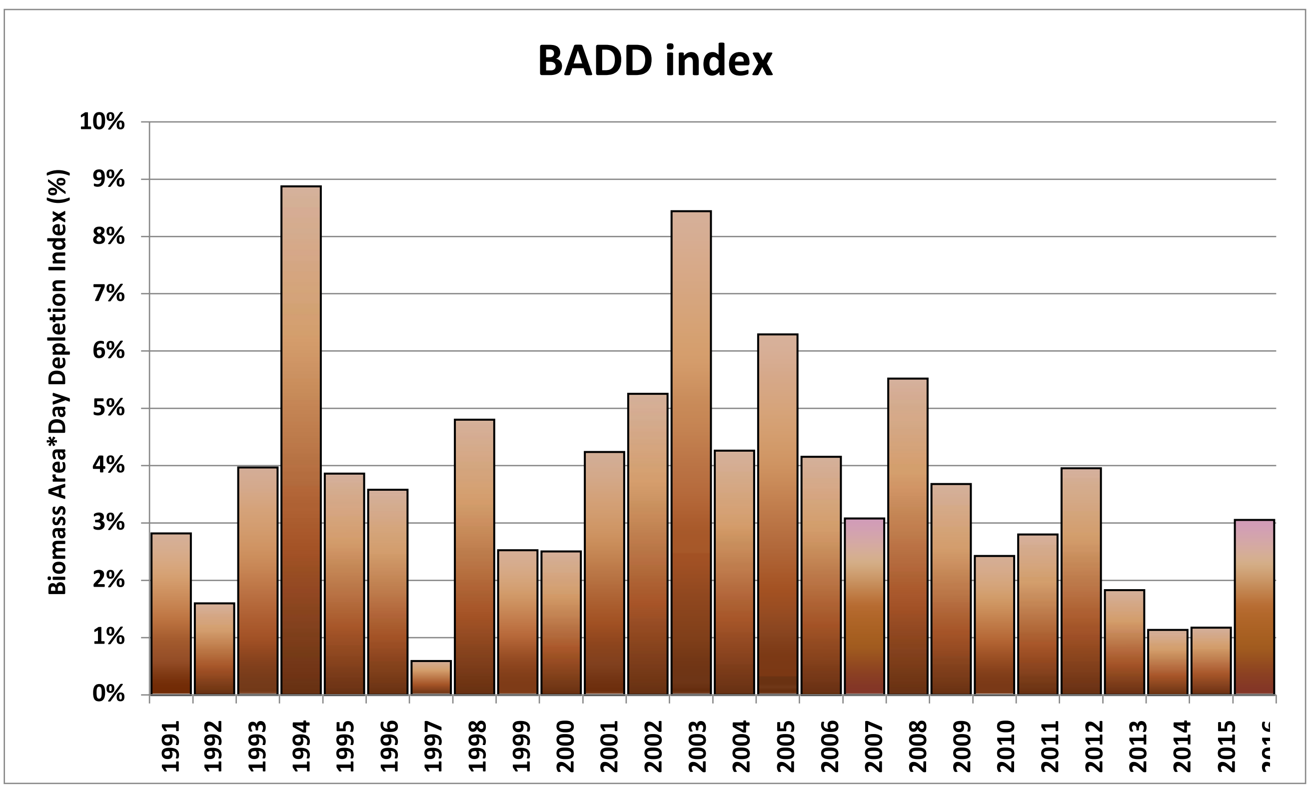
The following description of the "Biomass Area-Day Depletion (BADD) index of habitat impairment was excerpted from an article written by CT DEEP Marine Fisheries Biologist Penny Howell for the July/August 2014 edition of CT Wildlife Magazine.

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 (Simpson *et al,* 1995, 1996).

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 (Simpson *et al,* 1995,1996). *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* (Simpson *et al,* 1995, 1996).

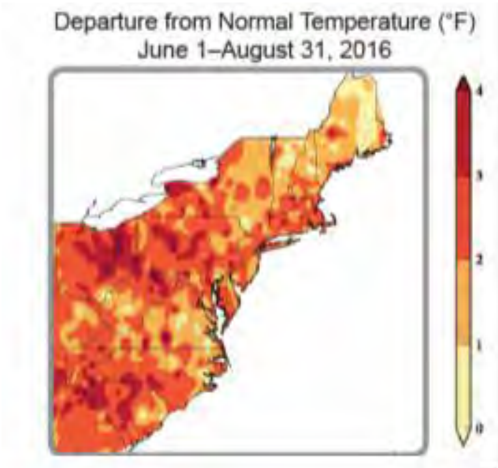
For each survey the total area of the Sound encompassing each 1-mg interval of DO is calculated and the depletion percentage applied. These area depletions are summed over the number of days they persist during the designated hypoxia season. The summed area-day depletion is then expressed as a percentage 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.

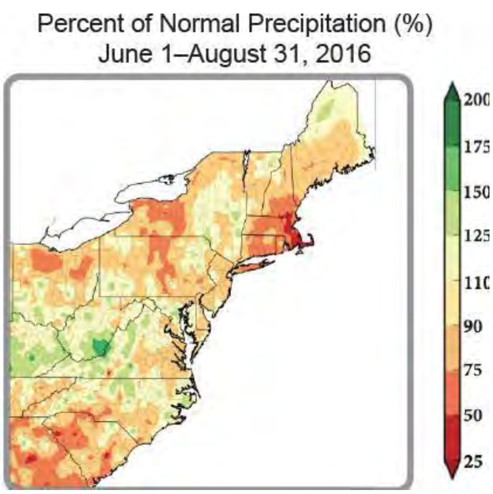
In an average year, hypoxic waters cover ~440 km^2 (169 miles^2) for 55 days and result in a BADD impairment index of 2.5%. In the worst year (1994), hypoxia spread over 1,000 km^2 (395 miles^2) for the entire season, resulting in a BADD index of almost 9%. In 2016, the BADD index was 3.05% up from 0.77% in 2015.

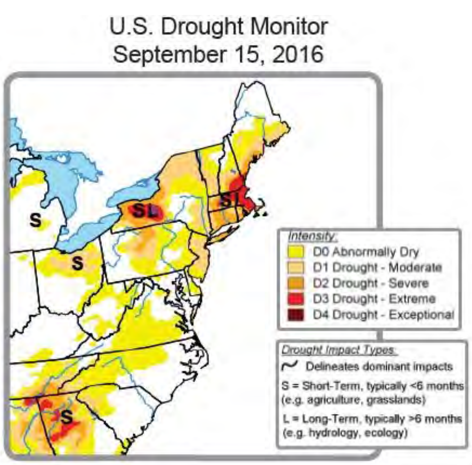


2016 Summer Weather Conditions

The Northeast Regional Climate Center (NRCC) at Cornell University is tasked with disseminating climate data and information for 12 states. The NRCC included the graphics at the left in their Eastern Region Quarterly Climate Impacts and Outlook Summary September 2016 (NRRC 2016a).







The summer of 2016 was warm and dry, with this summer being recorded as the second warmest on record for the Eastern region. Across the region, June was 0.8ºF above normal, July was 2.2 ºF above normal, August was 3.6ºF above normal, and September was 4.2ºF above normal. The warmth continued into November where the region as a whole was 2.0ºF above normal. The average August 2016 air temperatures at climate sites around Long Island Sound ranged from 78.4ºF in Bridgeport, CT (5.1ºF above normal) to 81.6 ºF at LaGuardia Airport in Queens, NY (5.3ºF above normal) to 77.3ºF at Islip, NY on Long Island (4.5ºF above normal).

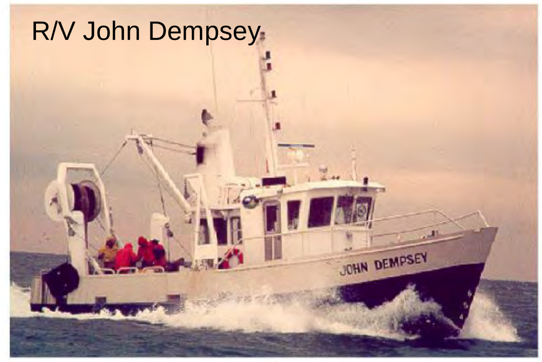
Precipitation was below normal across the Eastern Region for the summer of 2016. At the beginning of June, NRRC noted that only about 1% of the Northeast was in a drought with the region receiving 89% of its normal precipitation. By September 37% of the Northeast was in a moderate, severe, or extreme drought. The lack of precipitation continued into November. Across Long Island Sound, precipitation totals varied widely from site to site and month to month. At Bridgeport, CT, June was very dry with only 35% of normal precipitation but July was wet with 139% of normal rainfall; during August and September rainfall was also below normal with 8-% and 78% or normal precipitation recorded. At LaGuardia Airport in Queens, NY, June was also dry with 57% of the normal precipitation falling, July was wet (111% of normal), but August was drier than in Bridgeport with only 27% of normal rainfall amounts recorded. September saw a slight improvement with 68% of normal precipitation reaching the ground at the Airport. On Long Island at Islip, NY June precipitation amounts were 26% of normal, July was 94% of normal, August was 23% of normal, and September was 85% of normal.

A Northeast Drought and Climate Outlook Forum was held in Boston in October to discuss the drought situation across the region (NRRC 2016b).

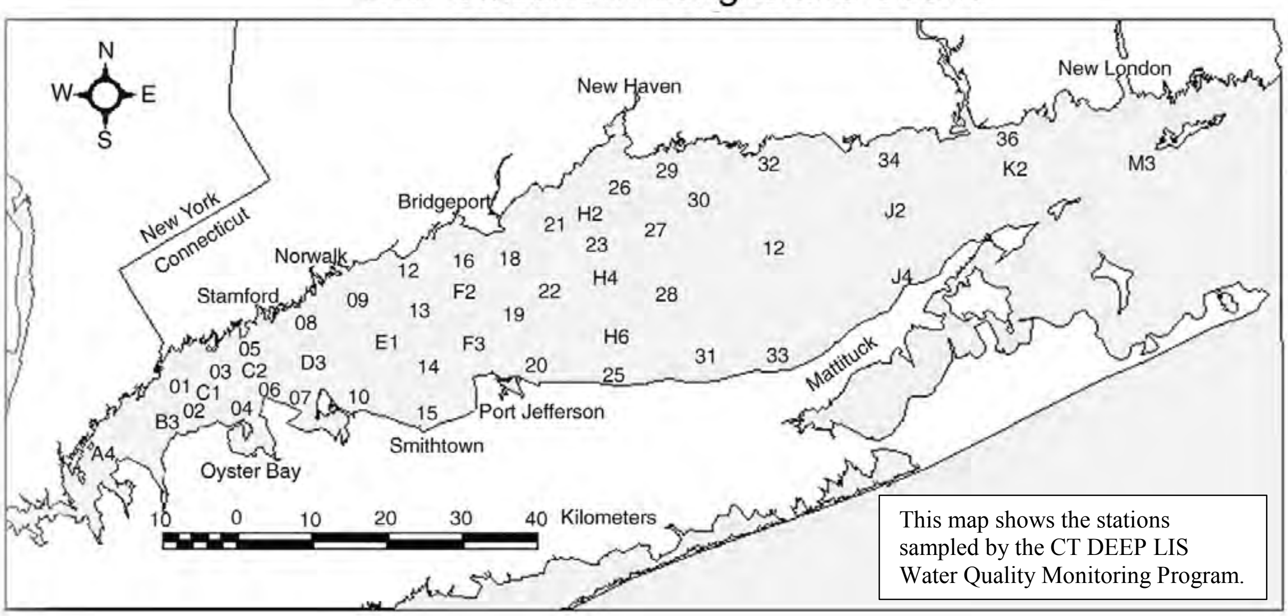
This climate information is useful as physical processes influence the timing and duration of hypoxia.

CT DEEP 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*. 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.



DEP stations in Long Island Sound



This map shows the stations sampled by the CT DEEP LIS Water Quality Monitoring Program.

CT DEEP Methods

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.

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 specified depth (surface= 2 meters below the surface; and bottom = 5 meters above the bottom). Samples are filtered aboard the mini laboratory and preserved for later analyses at the University of Connecticut's Center for Environmental Science and Engineering in Storrs, Connecticut.

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.

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.

All samples are collected and analyzed under EPA-approved Quality Assurance Project Plans.

IEC Program Overview

The Interstate Environmental Commission (IEC) is a tri-state water and air pollution control agency located in Staten Island, NY on the College of Staten Island campus. Established in 1936, the IEC serves the states of New York, New Jersey, and Connecticut. The IEC's area of jurisdiction runs west from New Haven, CT, and Port Jefferson, NY, on Long Island Sound. As of 2012, IEC has been in a temporary host relationship with the New England Interstate Water Pollution Control Commission (NEIWPCC).

IEC has conducted monitoring in the far Western Long Island Sound and the Upper East River since 1991. IEC's monitoring program was designed to align with CT DEEP's program. The overall goal of IEC's seasonal monitoring program is to effectively measure key water quality indicators identified by the Long Island Sound Study (LISS), such as hypoxia and nutrient pollution, which are important for managing priority areas of concern.

IEC's monitoring program is conducted between June and September as dissolved oxygen concentrations in Long Island Sound typically reach their lowest levels during the summer. This allows for better characterization of hypoxia and identification of critical areas in the Sound. Between June and September, IEC collects *in situ* data from 22 stations in the Western portion of the Sound on a weekly basis. *In situ* parameters include water temperature, dissolved oxygen, salinity, pH, and water clarity (secchi disk depth). In addition, IEC collects biweekly samples for chlorophyll a, Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), and a suite of nutrient parameters. More information about IEC and its monitoring program can be found below or on the IEC website: (http://www.iec-nynjct.org).

IEC monitoring data incorporated in this report for hypoxia maps uses data from 13 of 22 stations. The nine stations not included are representative of embayments. IEC data represented in this report that is not dissolved oxygen data was derived from IEC's six axial stations, which was combined with CT DEEP's seven axial stations. IEC's six axial stations include the following: A1, A2M, A3, A4, A5, B3. CT DEEP's seven axial stations include the following: A4, B3, D3, F3, H4, I2, and M3. Additional IEC data can be derived from IEC's weekly season summaries.

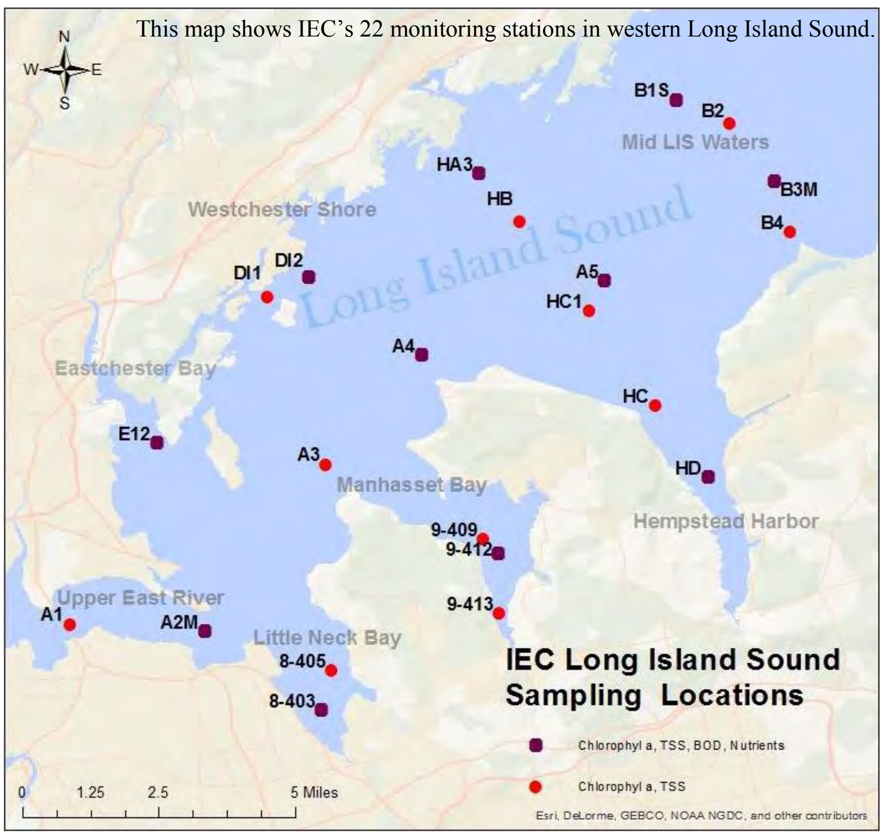
IEC staff preparing water quality sonde for deployment.

IEC staff recording *in situ* data.

IEC Methods

Dissolved oxygen, temperature, salinity, and pH data are collected using a YSI EXO 1 Multiparameter Sonde at bottom, mid, and surface depths at all 22 stations on a weekly basis from June through September. For stations with a depth of less than 10 meters, only surface and bottom measurements are collected. In addition, data collection includes percent cloud cover, sea state, water clarity as measured by Secchi disk depth as well as weather and precipitation data.

Surface grab samples (within one meter of the surface) are collected on a biweekly basis June through September for chlorophyll a and Total Suspended Solids (TSS) at all 22 stations and a suite of nutrient parameters and Biochemical Oxygen Demand (BOD) at 11 of the 22 stations. The map below highlights where sample collection takes place and for which parameters. Samples collected for chlorophyll a and TSS are collected directly into a clean, dry, 1000-mL polypropylene sample bottle and are stored in the dark. BOD and nutrient samples are collected using a clean, dry, 2000-mL polypropylene sample bottle. All samples are kept at ≤4°C during collection and transport to the IEC laboratory. The IEC laboratory is a nationally certified environmental testing laboratory with National Environmental Laboratory Accreditation Program (NELAP) accreditation.



This map shows IEC's 22 monitoring stations in western Long Island Sound.

The 11 stations for BOD and nutrient sampling, which was added to the program in 2014, were chosen based on feedback and input from the Long Island Sound Study Water Quality Monitoring Workgroup. The specific nutrient parameters that are analyzed include Ammonia, Nitrate+Nitrite, Particulate Nitrogen, Orthophosphate/DIP, Total Dissolved Phosphorus, Particulate Phosphorus, Dissolved Organic Carbon, Particulate Carbon, Dissolved Silica, and Biogenic Silica.

Chlorophyll a, TSS, BOD and all nutrient parameters (with the exception of Dissolved Organic Carbon and Particulate Carbon) are analyzed in-house at the IEC laboratory. Samples for Dissolved Organic Carbon and Particulate Carbon analysis are subcontracted to the University of Maryland's Center for Environmental Science, Chesapeake Biological Laboratory, Nutrient Analytical Services Laboratory in Solomons, MD. Further information on sampling and analytical methods can be found in the EPA-approved QAPP *Ambient Water Quality Monitoring in Far Western Long Island Sound, version 3.0.*

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 Environmental Monitoring for Public Access and Community Tracking (EMPACT) grant program and is now provided, in part, 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 where they are stored in a database and uploaded to the LISICOS website: http://lisicos.uconn.edu/index.php.

The system is maintained by the University of Connecticut.

2016 Important Facts

CT DEEP conducted eight cruises during the summer of 2016 between 10 June and 13 September. Over the course of the season, fifteen (15) different stations were documented as hypoxic and of the 275 site visits completed in 2016, hypoxic conditions were found during three surveys.

IEC conducted twelve cruises during the summer of 2016 between 28 June and 13 September. Hypoxic conditions were found during nine surveys (embayment stations included). 18 different stations were documented as hypoxic.

Cruise	Start Date	End Date	Number of stations	Number of hypoxic	Hypoxic Area (mi^2)
WQJUN16	6/8/16	6/14/16	1	0	0
HYJUN16	6/20/16	6/20/16	2	0	0
IEC Run	6/28/16	6/28/16	2	0	0
WQJUL16	7/5/16	7/7/16	4	0	0
IEC Run	7/5/16	7/5/16	2	0	0
IEC Run	7/12/16	7/12/16	2	2	NC
HYJUL16	7/18/16	7/19/16	4	1	19.0
IEC Run	7/19/16	7/19/16	2	11	NC
IEC Run	7/26/16	7/26/16	2	12	NC
WQAUG1	8/1/16	8/4/16	4	0	0
IEC Run	8/3/16	8/3/16	2	2	NC
IEC Run	8/9/16	8/9/16	2	2	NC
IEC Run	**8/16/16**	**8/16/16**	**2**	**15**	NC
HYAUG1	**8/16/16**	**8/18/16**	**4**	**15**	**197.5**
IEC Run	8/23/16	8/23/16	2	8	NC
WQSEP16	8/29/16	8/31/16	4	5	53.7
IEC Run	8/30/16	8/30/16	2	7	NC
IEC Run	9/9/16	9/9/16	2	0	NC
HYSEP16	9/12/16	9/13/16	3	0	NC
IEC Run	9/13/16	9/13/16	2	0	NC

NC= Not calculated
Bold= highest area of hypoxia

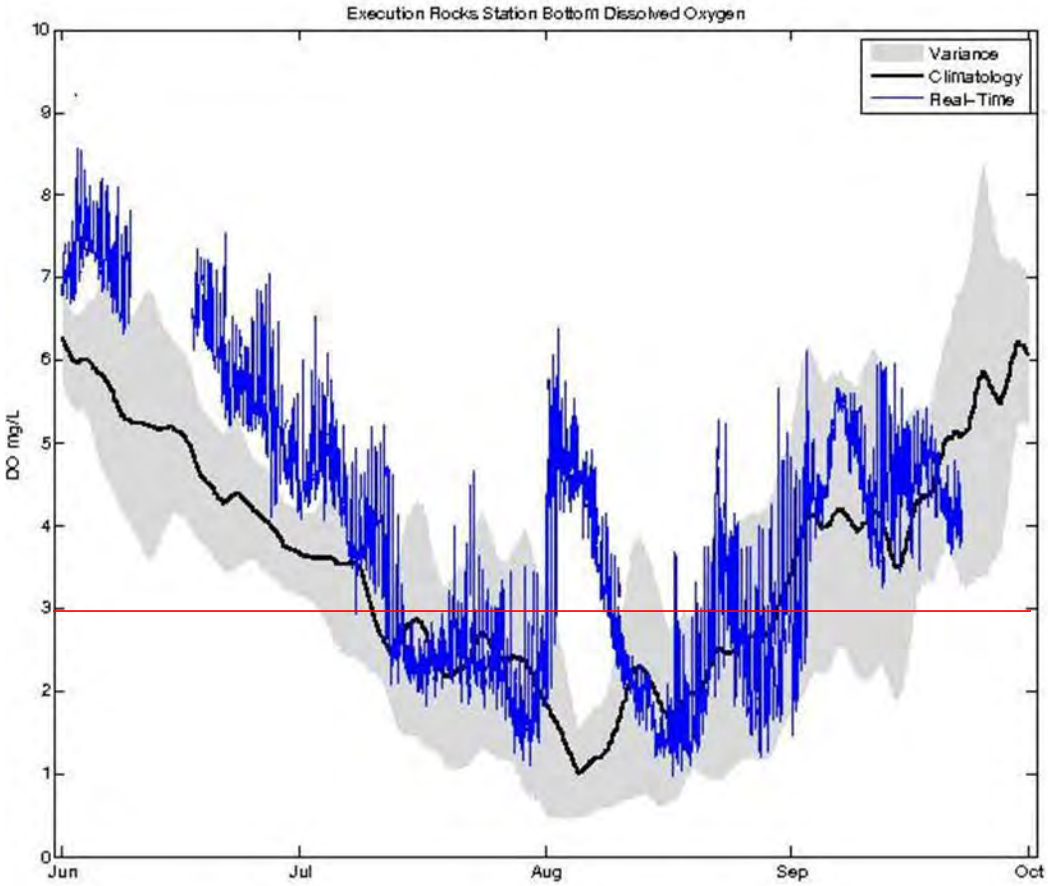
2016 Duration Estimates

Start dates and end dates for the hypoxic events are estimated by plotting CT DEEP and IEC data from stations A4 and B3 in an Excel spreadsheet and then using a line with markers chart to interpolate when the DO concentration drops below/rises above 3.0 mg/L. The 2016 hypoxic event was estimated to have begun on July 8th. There was a clear period in the beginning of August when DO concentrations rose above 3.0 mg/L and remained above this threshold for 8 days. This is also evident in data collected by the LISICOS Execution Rocks Buoy (next page). DO concentrations decreased below the hypoxia threshold again on 8 August and remained there for another 28 days, until the fourth of September when concentrations climbed above the 3.0 mg/L threshold. Compared to the previous 24-year average duration of 55 days, 2016 was near average, with the event lasting 51 days.

	Event #1	**Event #2**	**Total**
Estimated Start Date	**7/8/2016**	**8/8/2016**	
Estimated End Date	**7/30/2016**	**9/4/2016**	
Duration (days)	**23**	**28**	**51**
Maximum Area (mi_2)			**197.5**

Duration Based on Buoy Data Obtained from the LISICOS Network on 29 September 2016

The figure below is from the LISICOS website and depicts the 2016 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

Estimated Dates Event #1	7/8/16-7/31/16
Estimated Dates Event #2	8/8/16-9/5/16
Duration below 3.0 mg/L (cumulative days)	37.3
Duration below 2.0 mg/L (cumulative days)	12.9
Duration below 1.0 mg/L (cumulative days)	0.01
Minimum DO value (mg/L)	0.98 (17 August)
Days with no data	

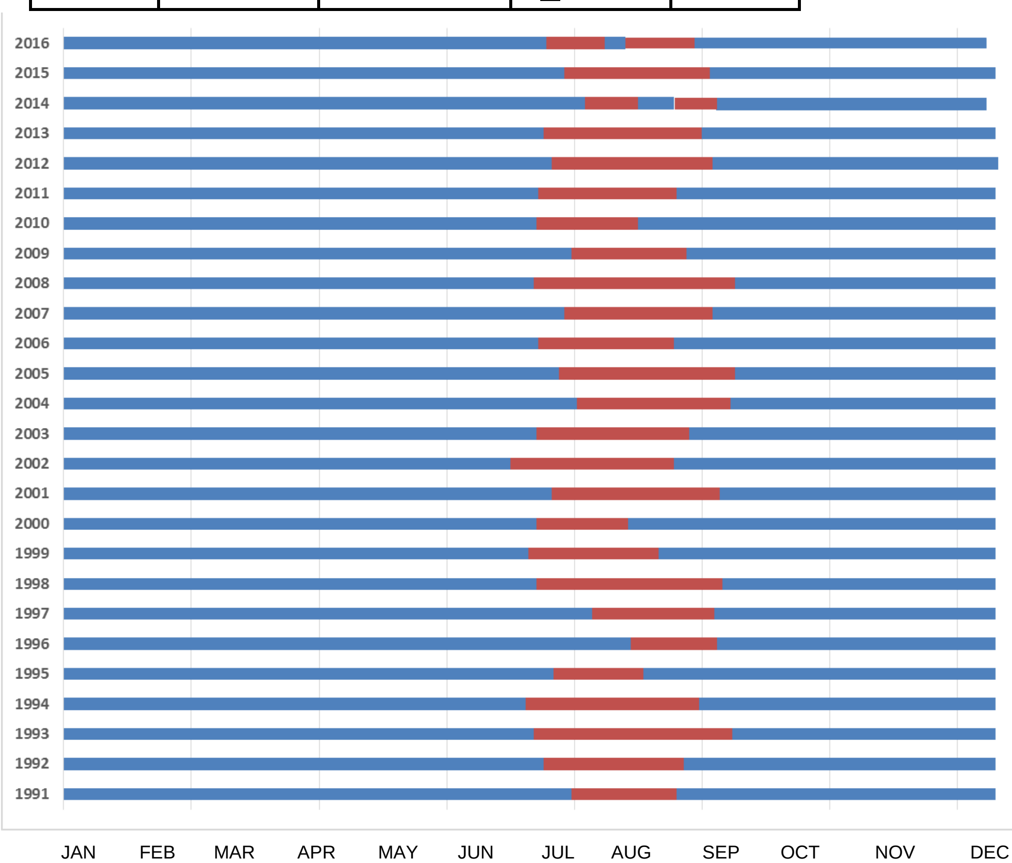
Data obtained from the LISICOS Execution Rocks Buoy Bottom Dissolved Oxygen Prediction Tool webpage (http://lisicos.uconn.edu/do_fcst.php?site=exrx). Duration is calculated by LISICOS by summing the time (in days) of the number of samples where DO was below the specified value (T. Fake, pers comm. 18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

Timing and Duration of Hypoxia, DEEP Data 1991 - 2016

Year	Estimated Start Date	Estimated End Date	Maximum Area (mi^2)	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 16	305	35
1996	Aug 10	Sept 12	220	34
1997	July 27	Sept 12	30	48
1998	July 5	Sept 16	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
2016*	July 8	Sept 3	197.5	51
Average	July 12	Sept 4	170.6	55
Deviation	±10 days	±12 days	± 87.8 mi^2	± 13 days

The table to the left and the graph below display the onset, duration, and end of the hypoxic events from 1991 through 2016. 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 and 2016 there were clear periods where the DO concentration rose above the 3.0 mg/L threshold in the early/middle part of August before dipping again during late August and early September.



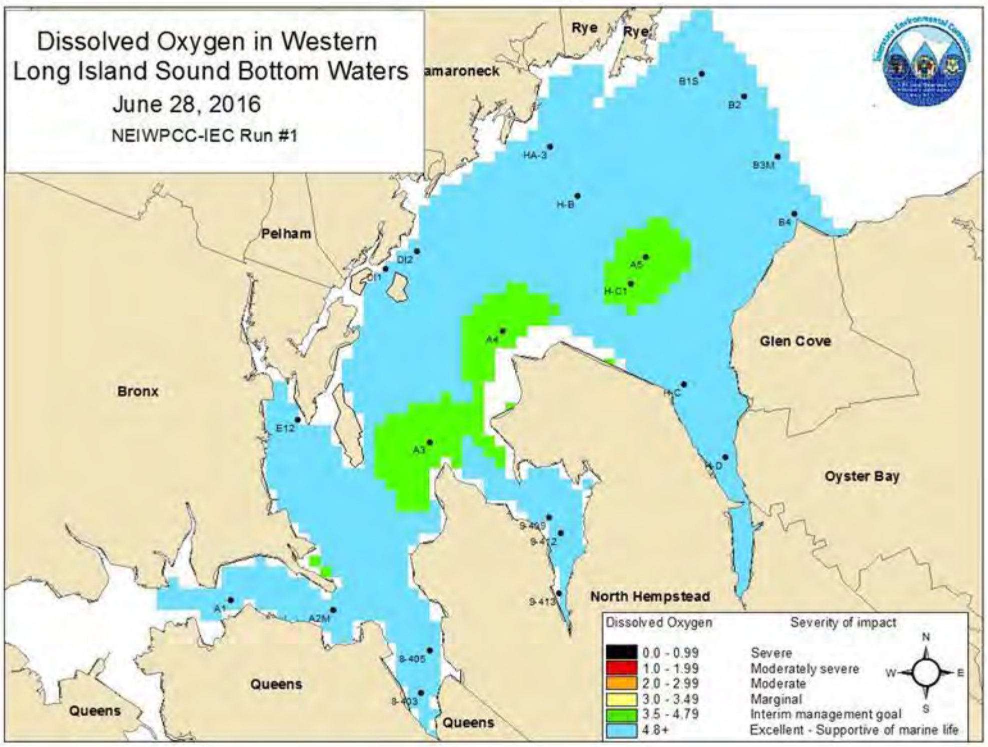
Hypoxia Maps

The following maps depict the development of hypoxia based on CT DEEP and IEC data through the 2016 season. Data for all surveys are available upon request.

Beginning with this year's *Season Summary Report*, readers will notice maps have been created for all IEC surveys and DEEP surveys. Additionally, maps were created that combine DEEP and IEC data into a single map. The following 13 IEC stations were incorporated in the combined maps: A1, A2M, A3, A4, A5, B1S, B2, B3M, B4, H-A3, H-B, H-C, H-C1. As IEC and DEEP share two stations (A4 and B3), the data from these stations were averaged together to create the new combined maps. IEC stations in embayments (*i.e.,* DI1, DI2, 9-409, 9-412, 9-413, E-12, 8-405, 8-403, and H-D) were not included in the combined maps.

While areal estimates were calculated using these combined hypoxia maps and are presented in this report, they are to be considered for informational purposes only. It is inappropriate to utilize the combined areal estimates as the official hypoxic area for 2016 as they are not comparable to the previous 24 years estimates. DEEP is just beginning the process of updating all the areal estimates from 1991 to the present utilizing historical datasets from IEC. Once completed the datasets would again be comparable.

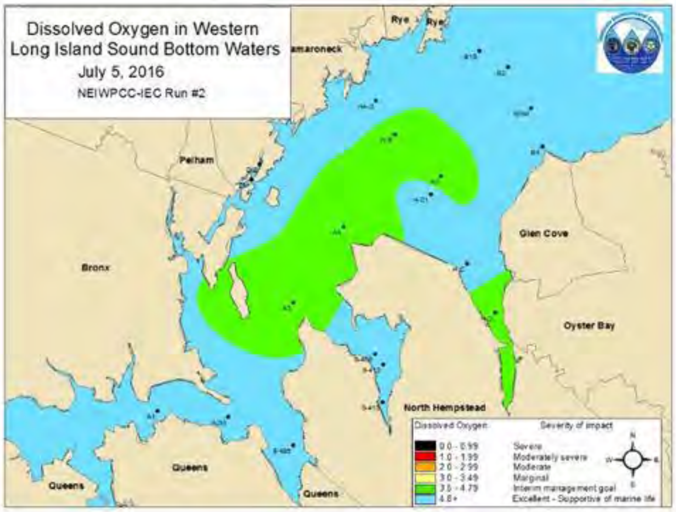
IEC Run #1

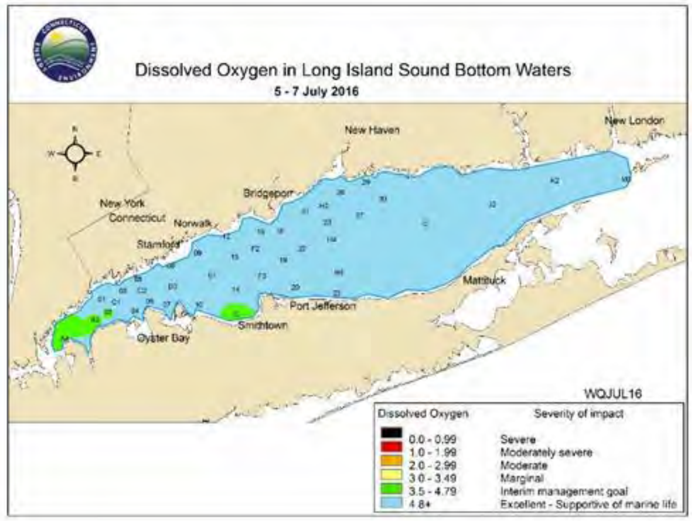


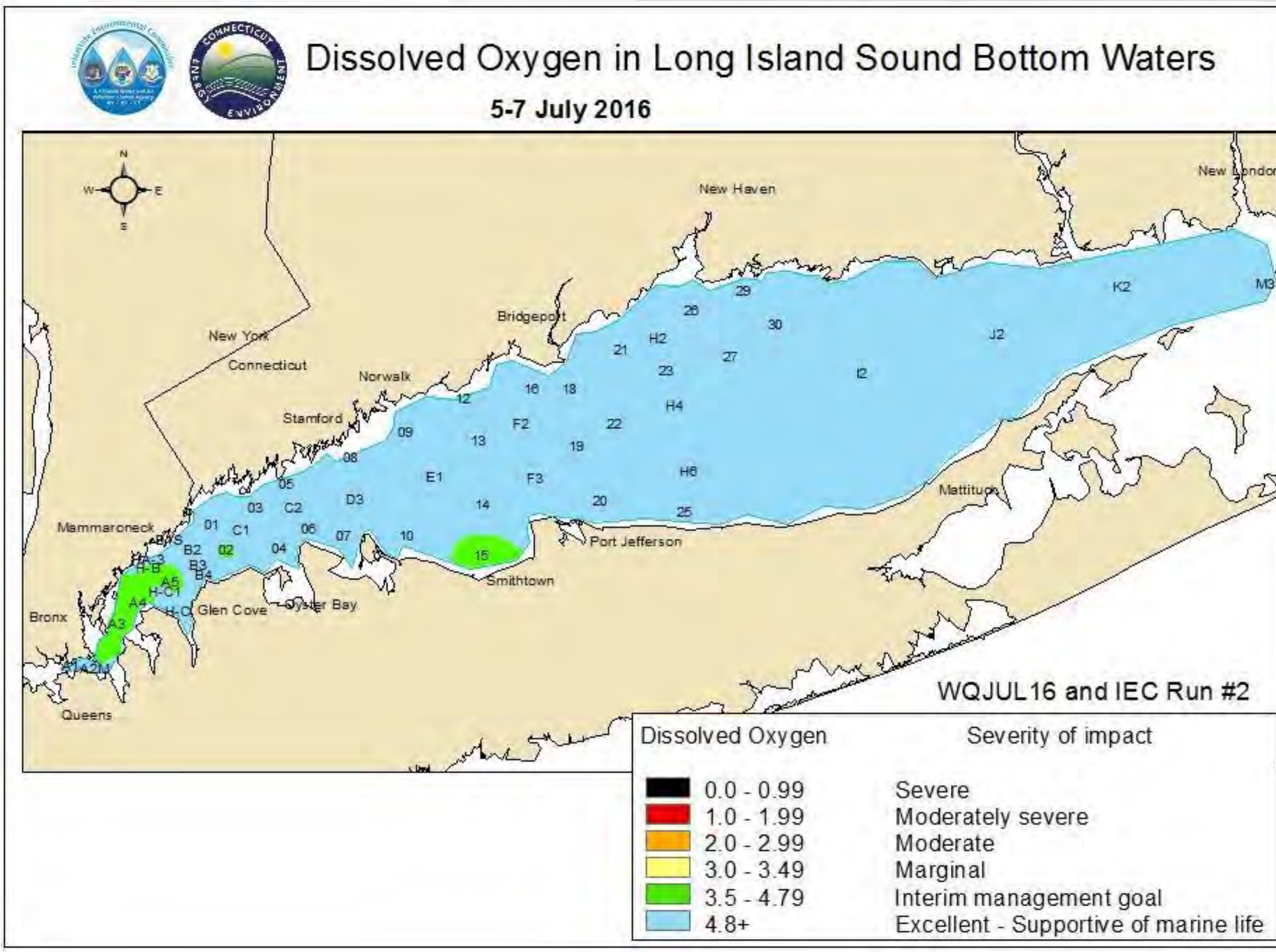
During the WQJUN16 and HYJUN16 surveys all CT DEEP stations had DO concentrations above 4.8 mg/L; therefore, no maps were produced. During IEC's first sampling run on 28 June, four stations had concentrations below 4.8 mg/L, which are represented above.

DEEP WQJUL16 and IEC Run #2

During the WQJUL16 and Run #2 surveys dissolved oxygen concentrations in the bottom waters of LIS were less than 4.8 mg/L at four CT DEEP stations- A4, B3, 02, and 15 and five IEC stations- A3, A4, H-B, A5, and H-D.

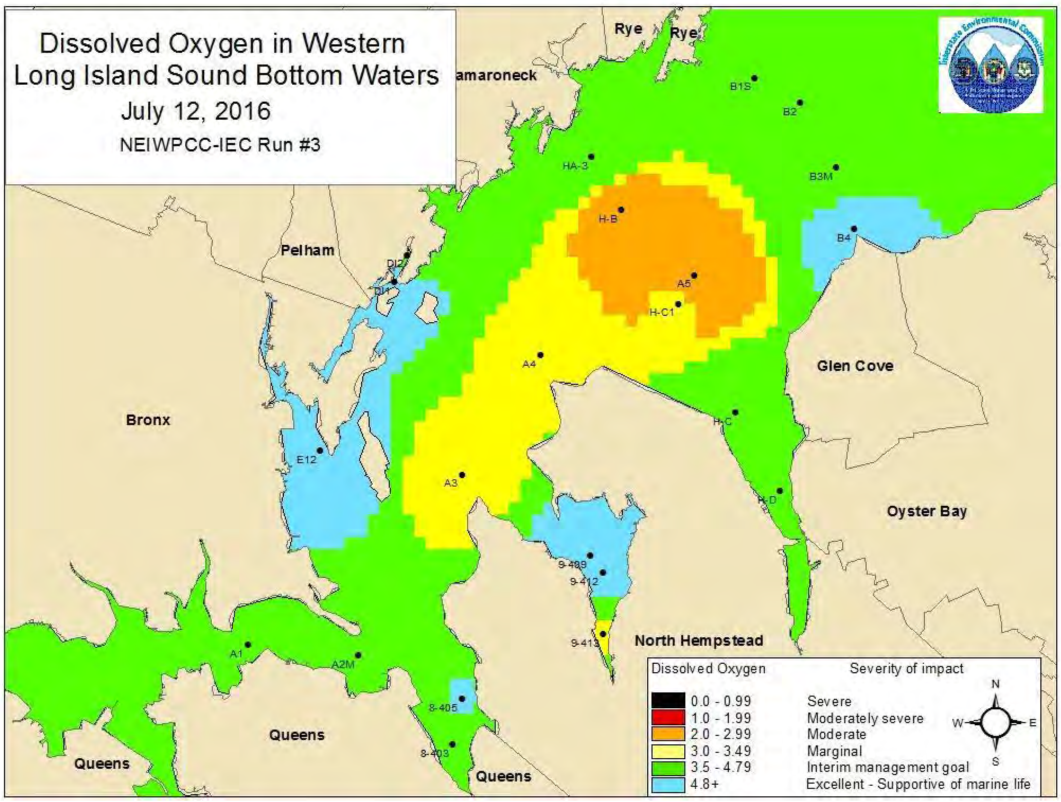






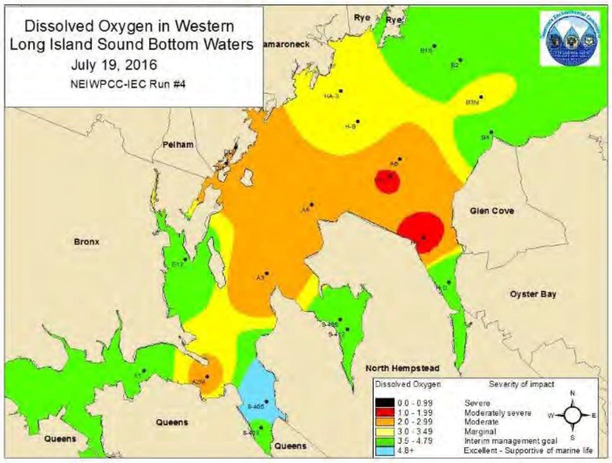
IEC Run #3

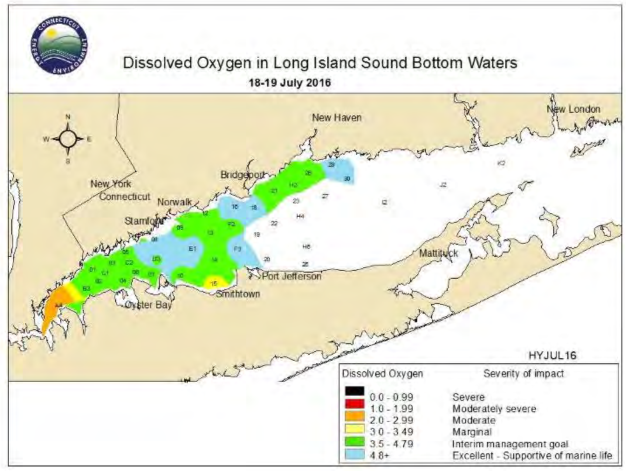
During IEC Run #3 on 12 July, two stations in the far Western Sound exhibited DO concentrations below 3.0 mg/L; four stations were below 3.5 mg/L; and nine stations were below 4.8 mg/L.

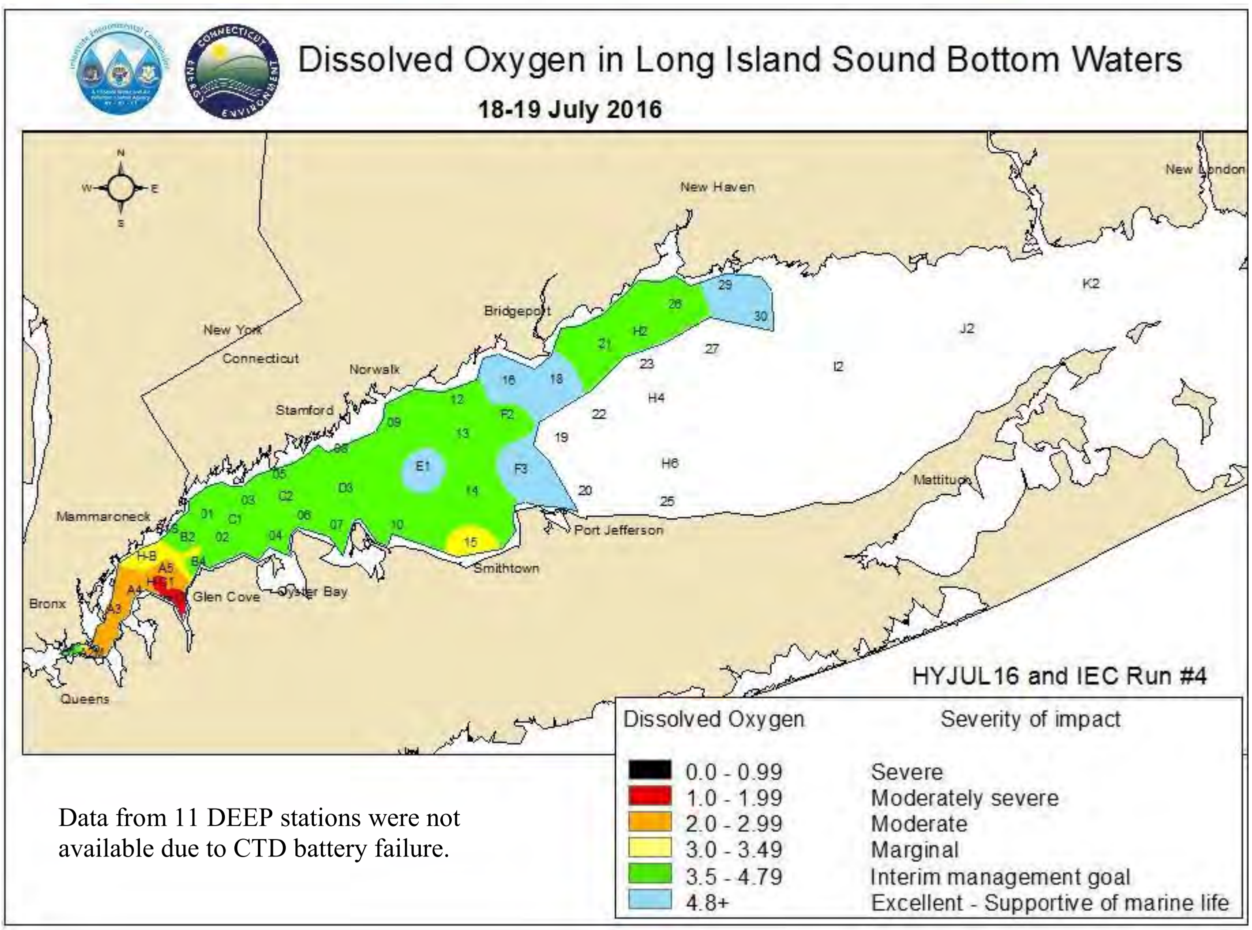


DEEP HYJUL16 and IEC Run #4

During IEC Run #4 on 19 July, only one station exhibited DO concentrations above 4.8 mg/L. Two stations (HC and HC-1) were below 2.0 mg/L, three stations were below 3.0 mg/L and three stations were below 3.5 mg/L. During the DEEP HYJUL16 survey, DO concentrations dropped below 4.8 mg/L at 19 stations with one station below 3.5 mg/L and one station below 3.0 mg/L. DEEP and IEC were coincidentally at Station A4 at the same time on 7/19. Measurements between the two agencies were comparable—DEEP logged a DO concentration of 2.44 mg/L at 34.4 meters (m) while IEC recorded 2.48 mg/L at 36.0 m.



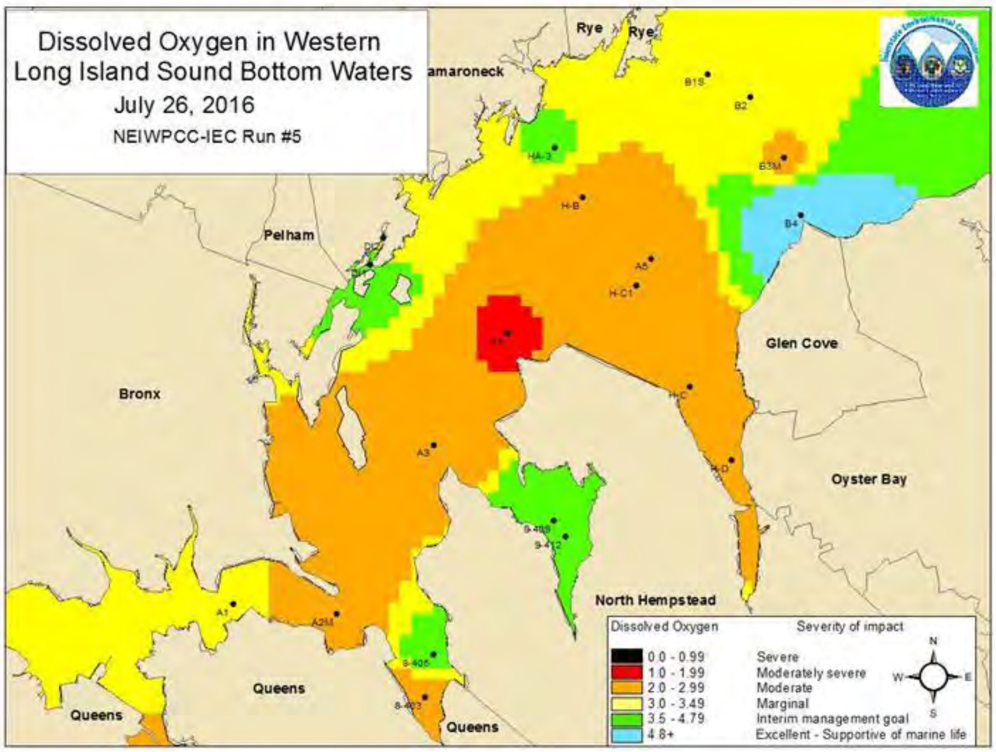




Data from 11 DEEP stations were not available due to CTD battery failure.

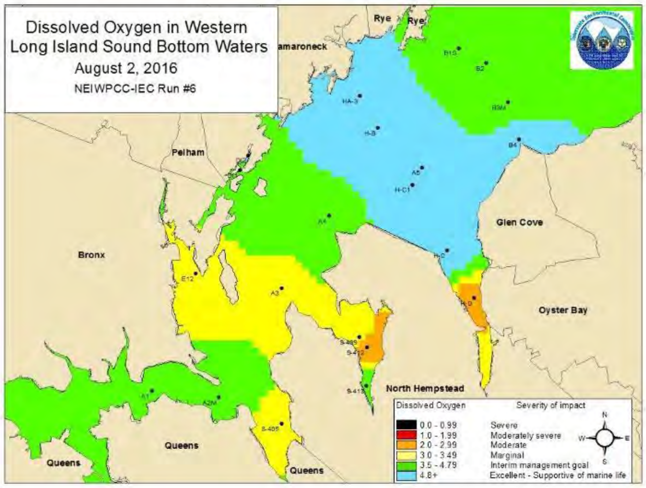
IEC Run #5

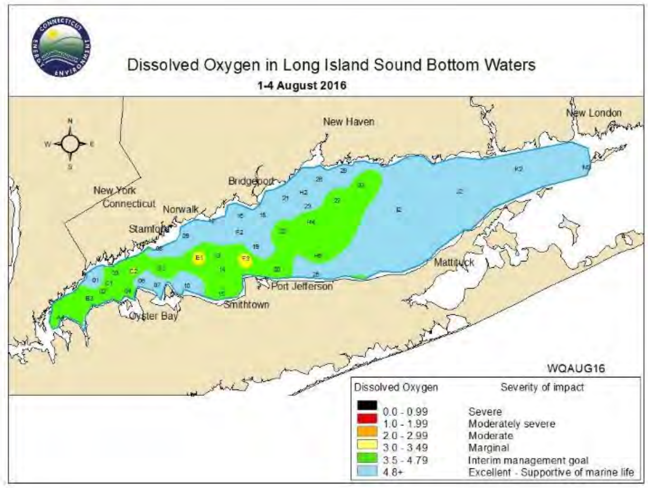
IEC Run #5 occurred on 26 July DO measurements at nineteen (19) stations were less than 4.8 mg/L. Of those, three were less than 3.5 mg/L; nine were less than 3.0 mg/L; and one station, A4, was less than 2.0 mg/L. At Station A4 the DO was 1.96 mg/L. Station B3 was at 2.95 mg/L.

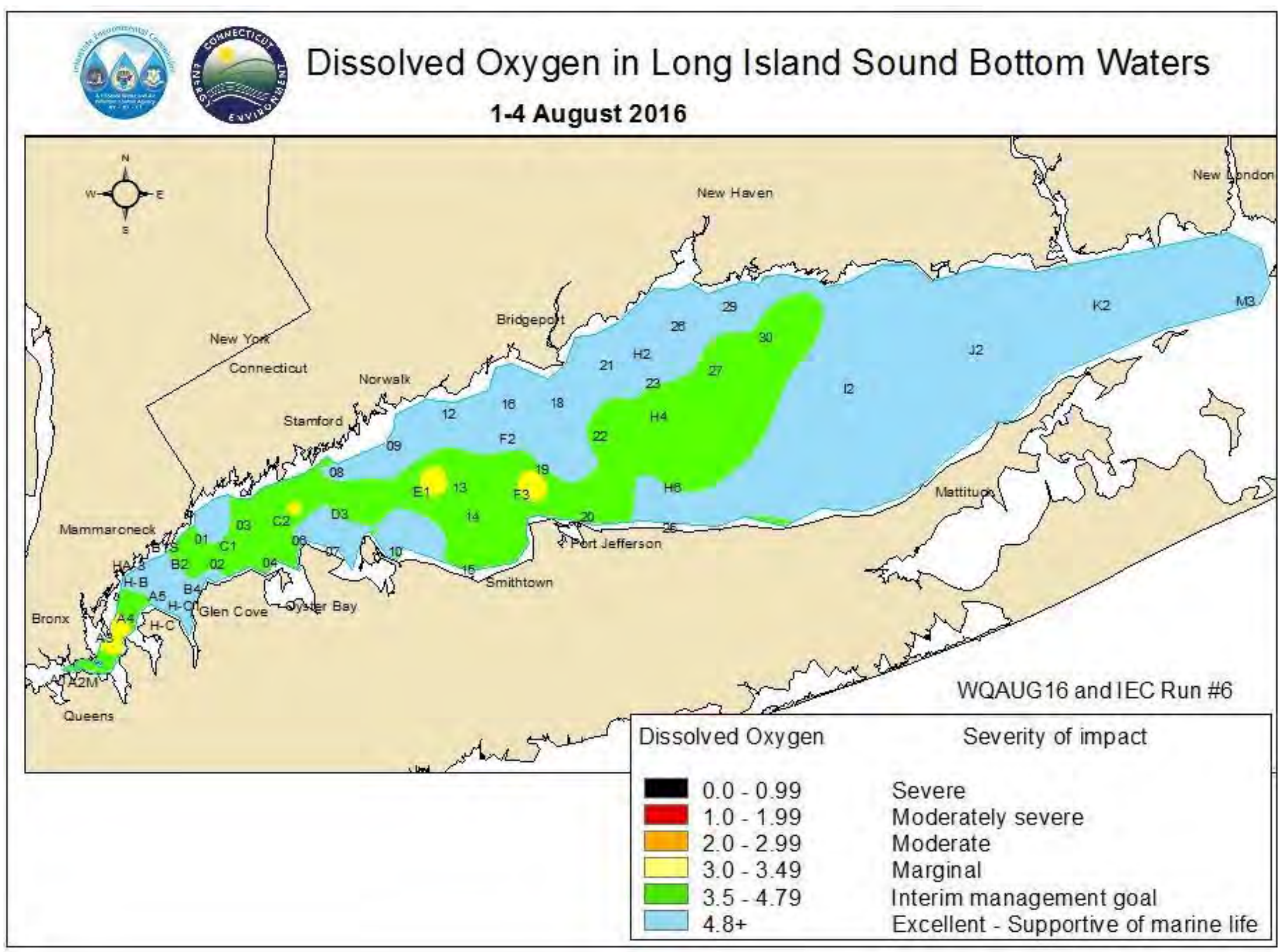


DEEP WQAUG16 and IEC Run #6

During the DEEP WQAUG16 survey, conditions improved with dissolved oxygen concentrations at all stations above 3.0 mg/L. DEEP stations C2, E1, and F3 lingered below 3.5 mg/L. During IEC Run #6 only two embayment stations were below 3.0 mg/L and four stations were less than 3.5 mg/L.

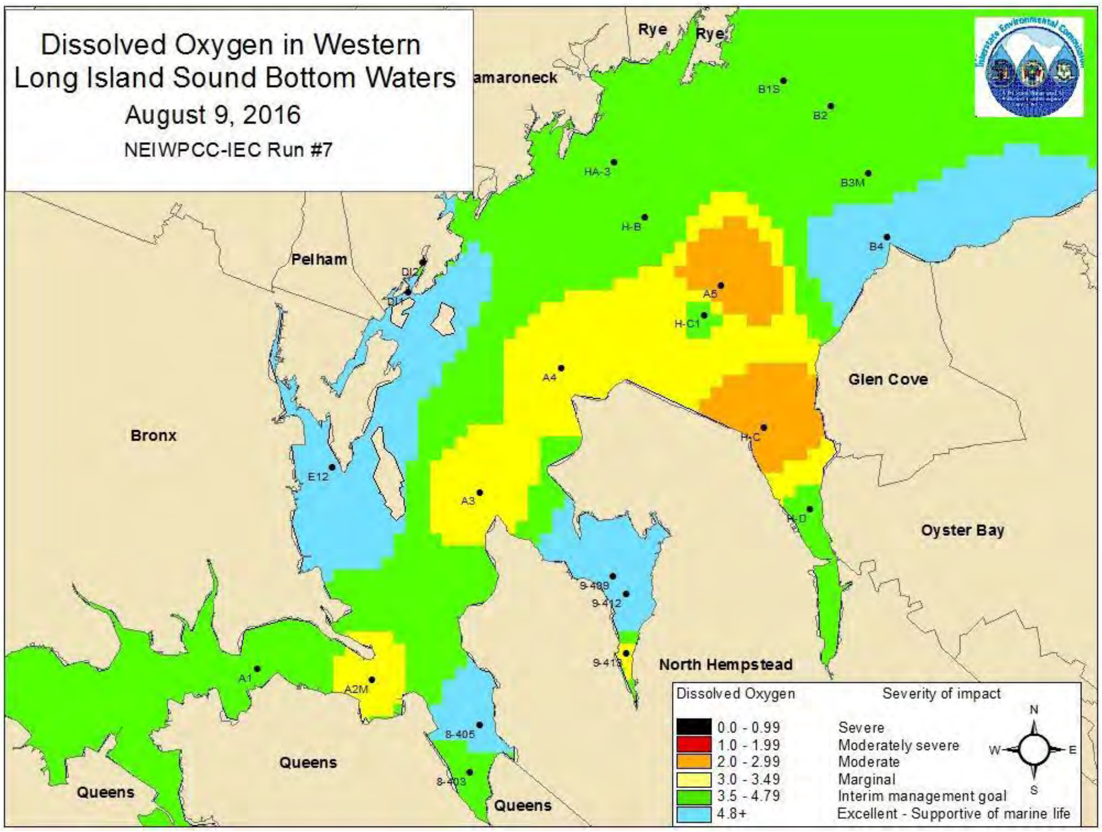






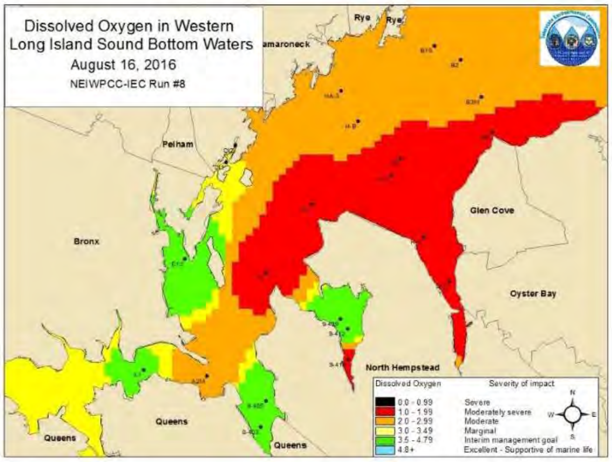
IEC Run #7

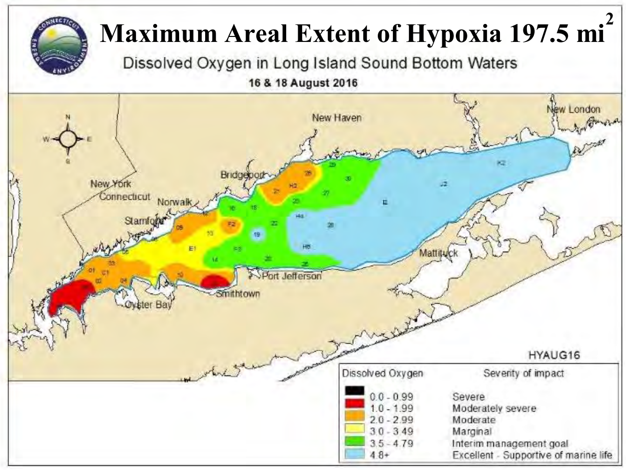
During IEC Run #7 on 9 August, DO concentrations at Stations A5 and H-C dropped below 3.0 mg/L. Four additional stations exhibited DO concentrations below 3.5 mg/L, including Station A4.

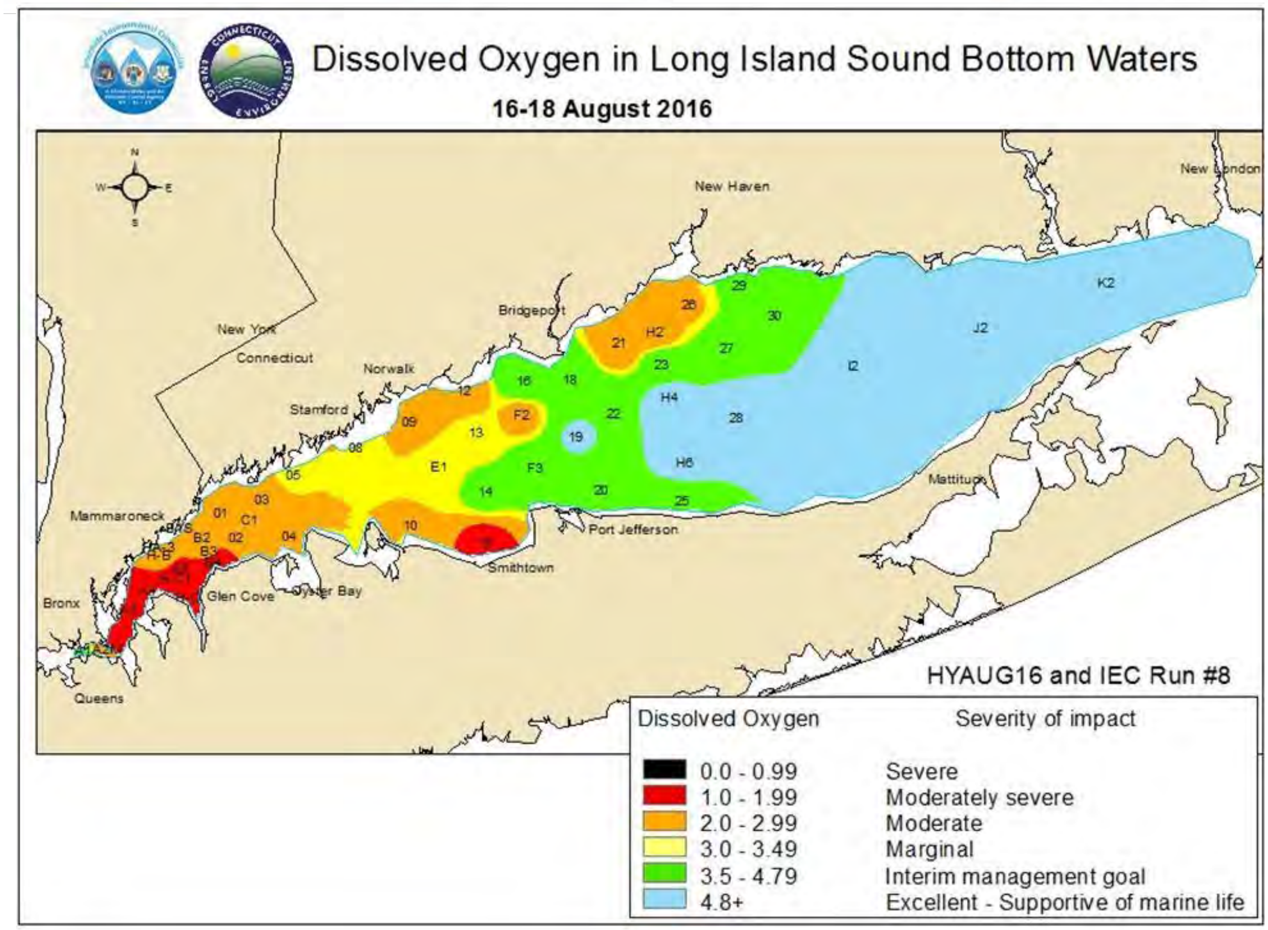


DEEP HYAUG16 and IEC Run #8

During the HYAUG16 survey, DEEP recorded three stations with DO concentrations less than 2.0 mg/L, and IEC documented eight stations below 2.0 mg/L. DEEP also logged 12 stations with concentrations less than 3.0 mg/L, and IEC measured DO's less than 3.0 mg/L at six stations. This would be the height of the hypoxic event. Based on the traditional DEEP map, 197.5 mi^2 of bottom waters were estimated to have DO concentrations below 3.0 mg/L.

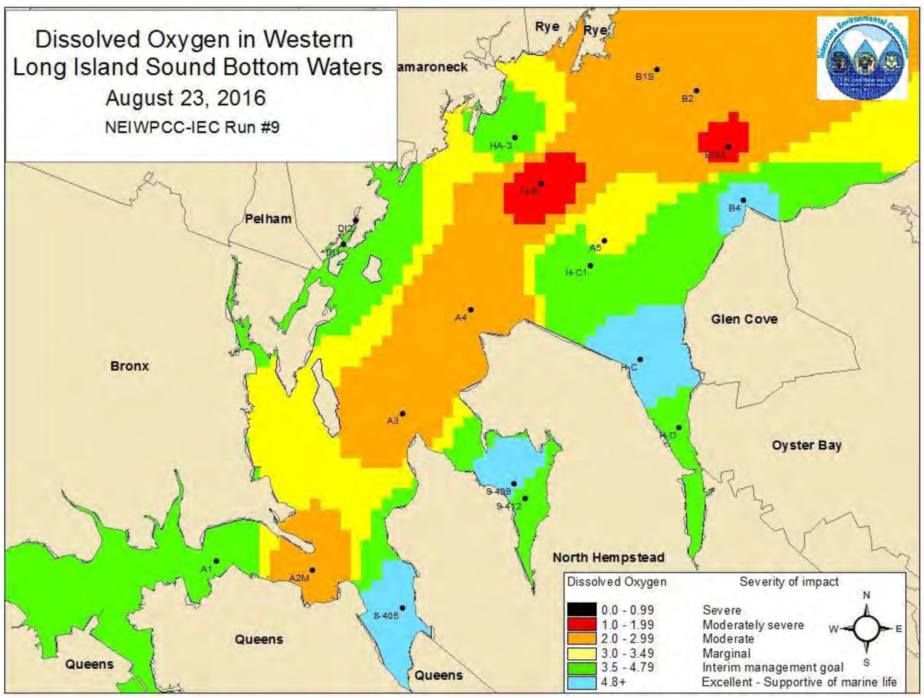






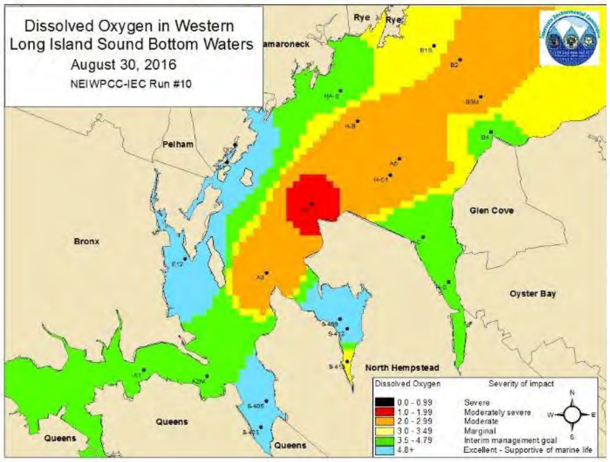
IEC Run #9

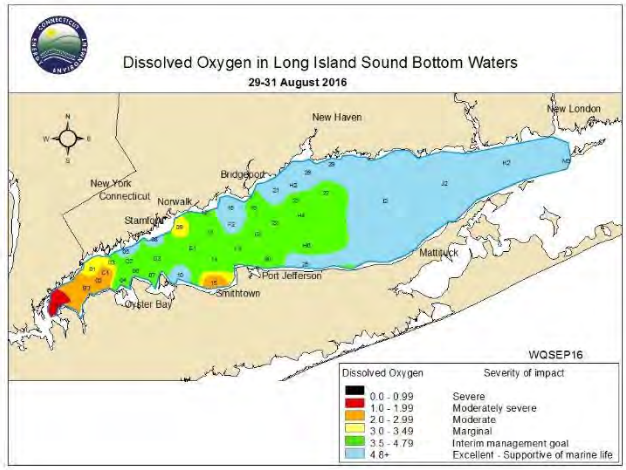
During IEC Run #9 on 23 August, conditions rebounded with only 2 stations exhibiting DO concentrations below 2.0 mg/L, compared to eight stations the week before. Five additional stations remained below 3.0 mg/L.

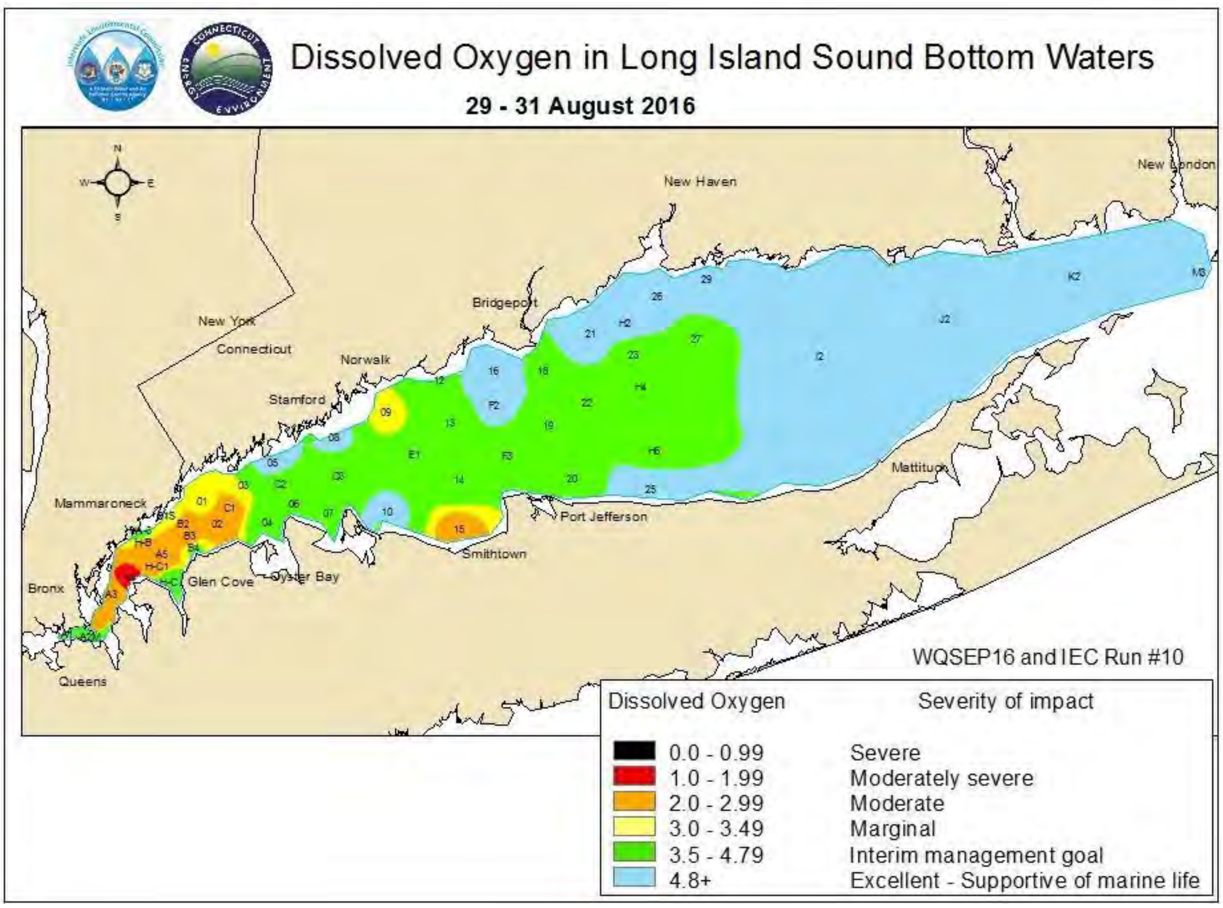


DEEP WQSEP16 and IEC Run #10

Hypoxic conditions were recorded in the Western Sound during the WQSEP16 survey and IEC Run #10. Concentrations at A4 were still below 2.0 mg/L. Four additional stations remained below 3.0 mg/L and two more were less than 3.5 mg/L during the DEEP survey. During the IEC survey six stations remained below 3.0 mg/L and two additional stations were less than 3.5 mg/L.

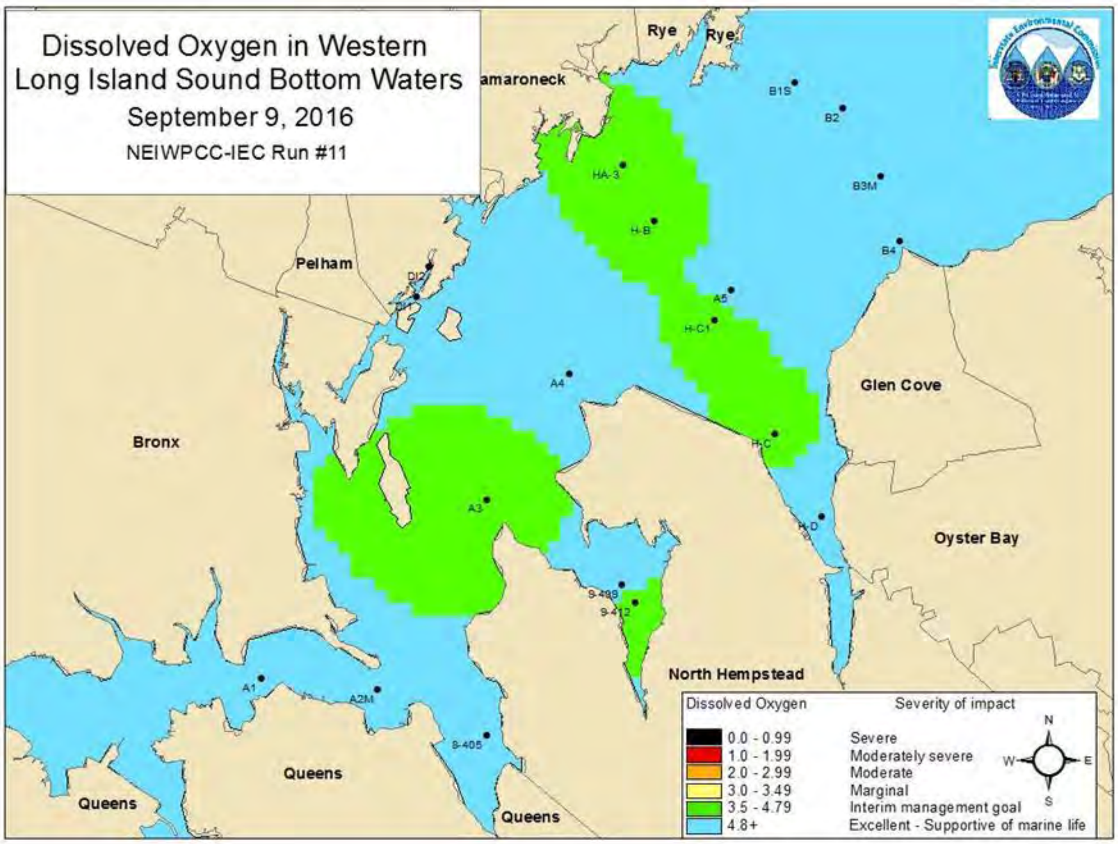






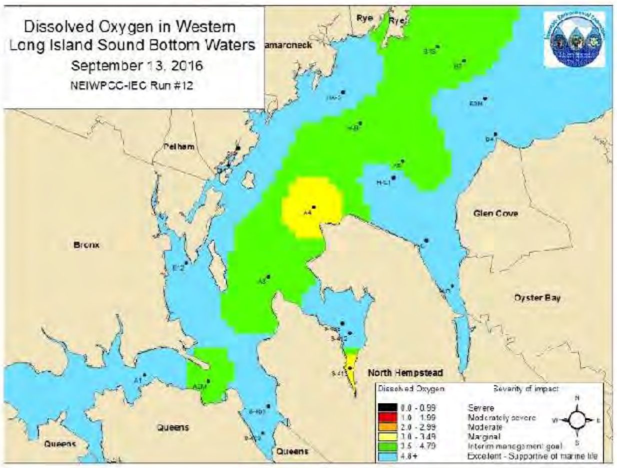
IEC Run #11

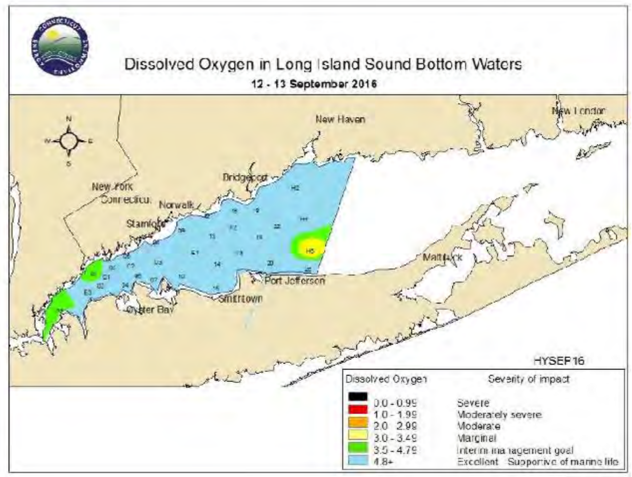
During IEC Run #11 on 9 September, the bottom waters of Western Long Island Sound showed marked improvement with only six stations below 4.8 mg/L.

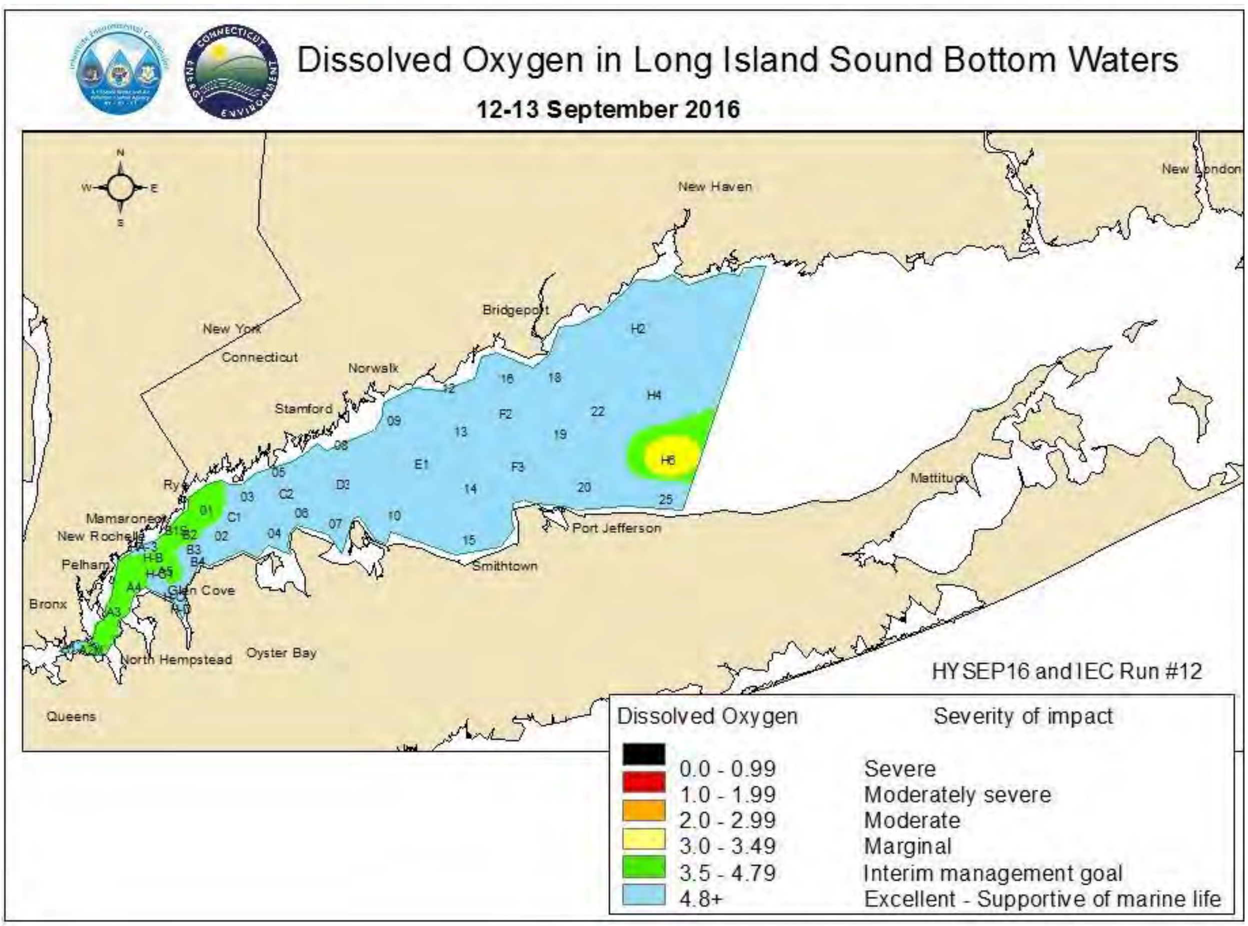


DEEP HYSEP16 and IEC Run #12

The remnants of Hurricane/Tropical Storm Hermine (August 28, 2016 – September 6, 2016) did not bring much precipitation to Long Island Sound, but sustained winds increased mixing and further alleviated hypoxic conditions. The LISICOS Execution Rocks buoy data showed concentrations climbing above 3.0 mg/L and staying above 3 mg/L beginning on or about 3 September. During the IEC Run #12, Station A4 was less than 3.5mg/L. During the DEEP HYSEP16 cruise, only one station, H6, was below 3.5 mg/L. Stations A4 and 01, which were sampled on 13 September, remained below 4.8 mg/L.







AREA ESTIMATES

The peak hypoxic event occurred during **IEC Run #8 and the HYAUG16** cruises between 16 and 18 August. Based on the *traditional CT DEEP stations only interpolation*, the **maximum area was 197.5 square miles**. Compared to the previous 24-year average, 2016 was slightly above average in area. The lowest dissolved oxygen concentration (1.37 mg/L) documented by CT DEEP during 2016 occurred on 8/16/16 at Station A4. The lowest dissolved oxygen concentration (1.42 mg/L) documented by IEC during 2016 occurred on 8/18/16, also at Station A4. The Execution Rock Buoy also recorded its' lowest reading during this time, 0.98 mg/L on 8/17.

The maximum areal estimate is still based on the traditional CT DEEP only data to maintain the continuity of the long-term data set and because the entire previous 24-year dataset has not been re-interpolated using both the CT DEEP and IEC stations.

The tables on the following two pages demonstrate the differences in the areal estimates between using CT DEEP data alone and CT DEEP data combined with IEC data. Differences in areal estimates are attributed to the increase in spatial coverage in the Western Sound. By increasing the spatial coverage, the map interpolation software used to create the maps places less emphasis (weighting) on stations A4 and B3. For example, if one looks at the areal estimates for the peak event, CT DEEP only data provides an estimate of 40.4 square miles of the bottom water with DO concentrations less than 2.0 mg/L. Adding in the IEC data reduces the estimate to 6.8 square miles. Looking at the maps on page 23 helps to further illustrate this. On the IEC only map (top left) one can see that there are 5 stations with concentrations in the 2-2.99 mg/L range. The CT DEEP only map (top right) uses data from stations A4 and B3, and interpolates that area in the 1-1.99 mg/L range.

			Area of hypoxia in Sq. mi	
Date	Survey Name	mg/L range	DEEP	IEC & DEEP
7/5-6/2016	WQJUL16 & IEC Survey #2	0 to 1	0	0
	WQJUL16 & IEC Survey #2	1 to 2	0	0
	WQJUL16 & IEC Survey #2	2 to 3	0	0
	WQJUL16 & IEC Survey #2	3 to 3.5	0	0
	WQJUL16 & IEC Survey #2	3.5 to 4.8	36.7	30.5
	WQJUL16 & IEC Survey #2	4.8 to 10	1018.3	1024.5
7/18-19/2016	HYJUL16 & IEC Survey #4	0 to 1	0	0
	HYJUL16 & IEC Survey #4	1 to 2	0	3.63
	HYJUL16 & IEC Survey #4	2 to 3	19	19.54
	HYJUL16 & IEC Survey #4	3 to 3.5	13.44	17.18
	HYJUL16 & IEC Survey #4	3.5 to 4.8	231.82	275.1
	HYJUL16 & IEC Survey #4	4.8 to 10*	790.74	739.55
8/1-4/2016	WQAUG16 & IEC Survey #6	0 to 1	0	0
	WQAUG16 & IEC Survey #6	1 to 2	0	0
	WQAUG16 & IEC Survey #6	2 to 3	0	0
	WQAUG16 & IEC Survey #6	3 to 3.5	9.92	14.75
	WQAUG16 & IEC Survey #6	3.5 to 4.8	333.79	318.03
	WQAUG16 & IEC Survey #6	4.8 to 10	711.29	722.22
8/16-18/2016	HYAUG16 & IEC Survey #8	0 to 1	0	0
	HYAUG16 & IEC Survey #8	1 to 2	40.42	6.8
	HYAUG16 & IEC Survey #8	2 to 3	157.03	167.49
	HYAUG16 & IEC Survey #8	3 to 3.5	100.81	101.97
	HYAUG16 & IEC Survey #8	3.5 to 4.8	236.1	237.14
	HYAUG16 & IEC Survey #8	4.8 to 10	520.64	541.6
8/29-31/2016	WQSEP16 & IEC Survey #10	0 to 1	0	0
	WQSEP16 & IEC Survey #10	1 to 2	11.04	2.86
	WQSEP16 & IEC Survey #10	2 to 3	42.63	45.02
	WQSEP16 & IEC Survey #10	3 to 3.5	31.7	37.8
	WQSEP16 & IEC Survey #10	3.5 to 4.8	366.41	373.36
	WQSEP16 & IEC Survey #10	4.8 to 10	603.22	596.49
9/12-13/2016	HYSEP16 & IEC Survey #12	0 to 1	0	0
	HYSEP16 & IEC Survey #12	1 to 2	0	0
	HYSEP16 & IEC Survey #12	2 to 3	0	0
	HYSEP16 & IEC Survey #12	3 to 3.5	11.85	12.05
	HYSEP16 & IEC Survey #12	3.5 to 4.8	44.09	52.86
	HYSEP16 & IEC Survey #12	4.8 to 10	999.06	990.09

*CTD battery failure resulted in no data for multiple stations. Area under estimated due to no data.

The following table is included to demonstrate the differences in the areal estimates between using DEEP data alone and DEEP data combined with IEC data.

Survey	Area <1.0 mg/L		Area <2.0 mg/L		Area <3.0 mg/L		Area <4.8 mg/L	
	DEEP	IEC & DEEP	DEEP	IEC & DEEP	DEEP	IEC & DEEP	DEEP	IEC & DEEP
WQJUN16	0	0	0	0	0	0	0	0
HYJUN16	0	0	0	0	0	0	0	0
WQJUL16 & IEC Survey #2	0	0	0	0	0	0	36.70	30.50
HYJUL16 & IEC Survey #4	0	0	0	3.63	19.00	23.17	264.25*	315.45*
WQAUG16 & IEC Survey #6	0	0	0	0	0	0	343.71	332.78
HYAUG16 & IEC Survey #8	0	0	40.42	6.80	197.50	174.29	534.37	513.40
WQSEP16 & IEC Survey #10	0	0	11.04	2.86	53.70	47.88	451.78	459.04
HYSEP16 & IEC Survey #12	0	0	0	0	0	0	55.95	64.90

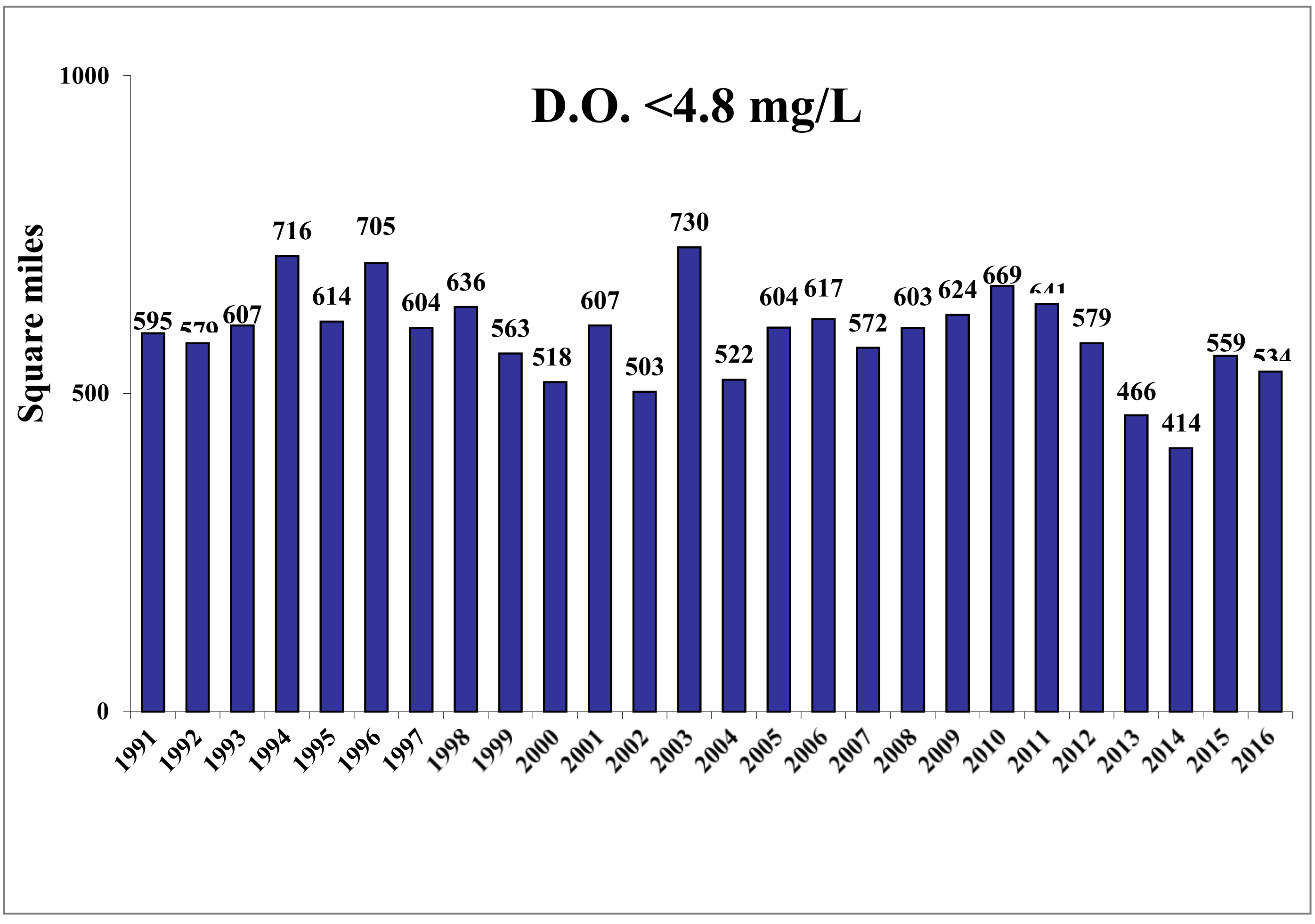

NOAA R/V Thomas Jefferson performing side scan sonar as seen from the stern of the R/V John Dempsey
Photo Courtesy of Matt Lyman, CT DEEP


View of Throg's Neck Bridge as seen during an IEC survey.

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

Aquatic organisms can be impacted by a combination of low dissolved oxygen concentrations, exposure, and extended duration of the low DO events. 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 based on biweekly sampling by CT DEEP. In 2016, the maximum area below 4.8 mg/L occurred during the HYAUG16 survey and was estimated at 534 square miles. From 1991-2016, the area affected by concentrations less than 4.8 mg/L averages 591.6 square miles and varies slightly from 414 to 730 square miles.

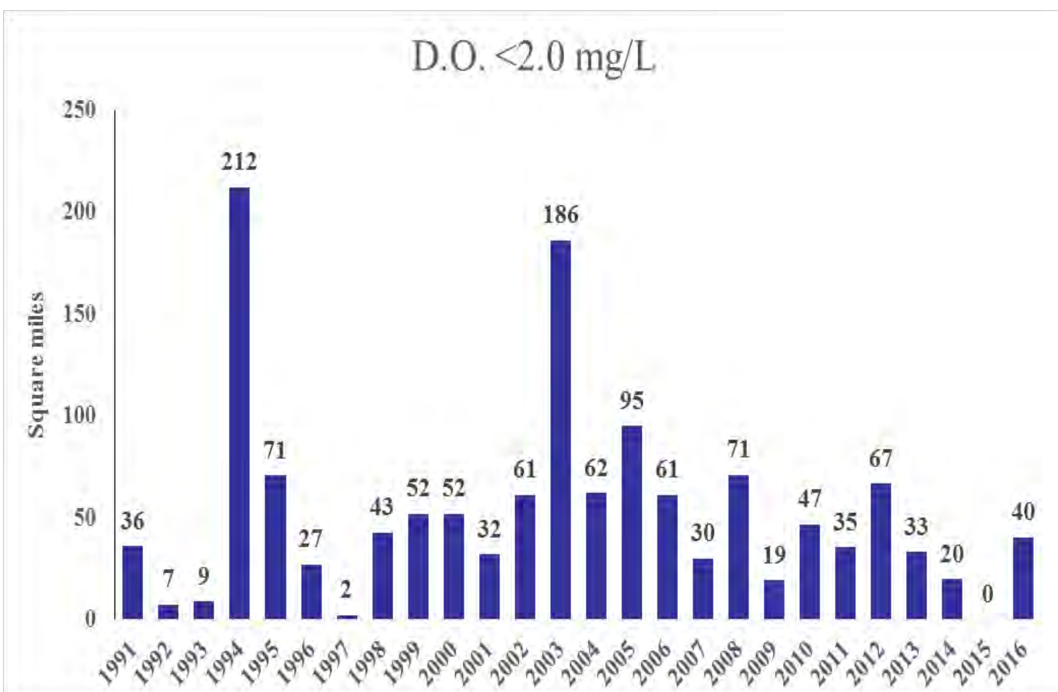


Severe Hypoxia

The Long Island Sound Study provides information on LIS hypoxia for inclusion in EPA's *Report on the Environment* (https://www.epa.gov/aboutepa/about-national-center-environmental-assessment-ncea) which reports on "the best available indicators of information on national conditions and trends in air, water, land, human health, and ecological systems…" The *Report on the Environment* 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.

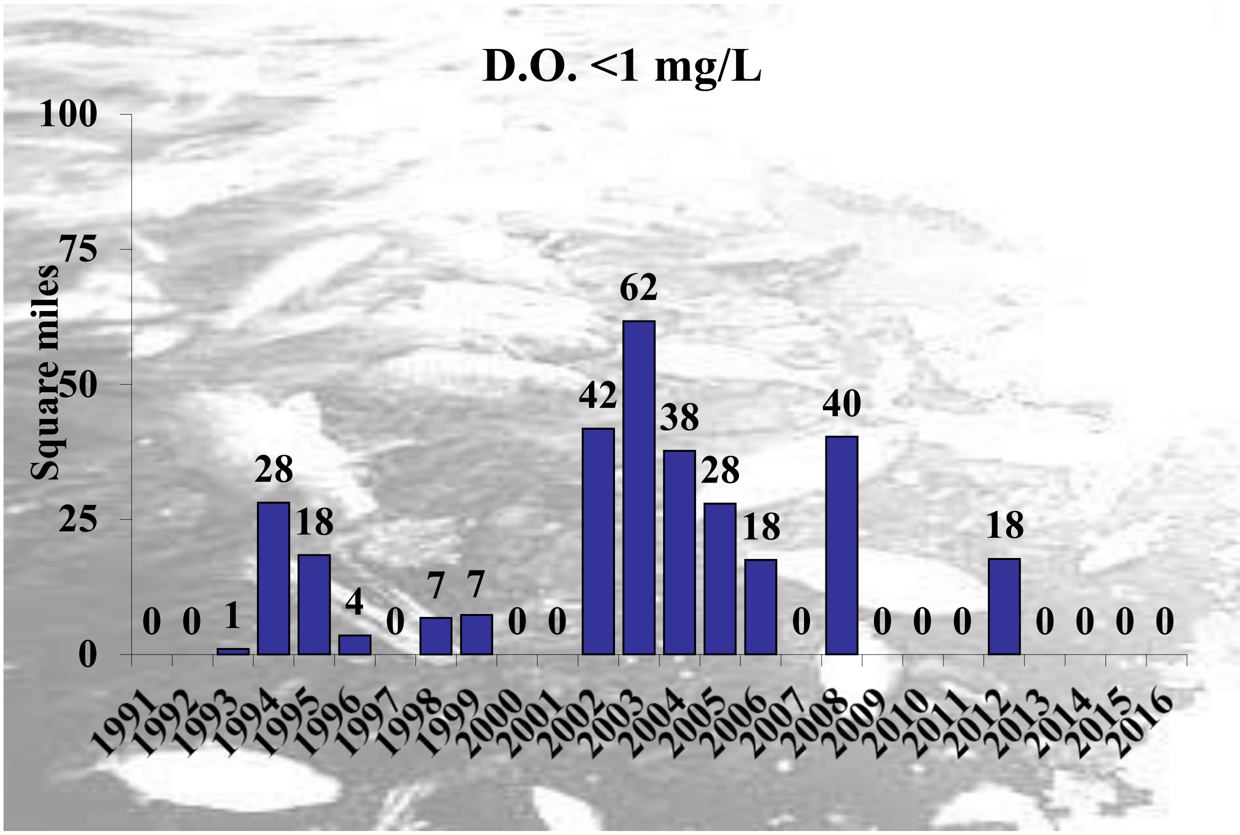
This chart illustrates the maximum area of bottom waters of Long Island Sound with DO concentrations less than 2.0 mg/L. Based on CT DEEP data, in 2016, bottom water dissolved oxygen concentrations were less than 2.0 mg/L over 40.4 square miles. This is an increase over the past three years, especially over last year when concentrations in the bottom waters never dropped below 2.0 mg/L (DEEP data). The average area with concentrations less than 2.0 mg/L, calculated from 1991-2016, is 52.7 mi^2. In 2016, based on CT DEEP estimates, there were 16 days with DO <2.0 mg/L. At the LISICOS Execution Rocks buoy, there were 12.90 cumulative days below 2.0 mg/L.

In comparison, the 30-year average size of the hypoxic zone in the northern Gulf of Mexico is roughly 5,312 mi^2 (larger than the State of Connecticut). 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. The 2016 Gulf of Mexico shelf-wide cruise was cancelled due to major engine problems with the R/V Nancy Foster. Continuously recording dissolved oxygen meters were deployed in the hypoxic zone in mid-June. Following data clean up and QA/QC, these data will be reported on the Gulf of Mexico Hypoxia website at http://www.gulfhypoxia.net/default.asp. The 2016 hypoxia forecast for the Gulf of Mexico released in June predicted the hypoxic zone would cover 6,824 mi^2 (Turner and Rabalais, 2016).



In LIS, 1994 and 2003 appear to be years when severe hypoxia (DO <2.0 mg/L) was especially prevalent. 1994 had cold winter bottom water temperatures and an unusually warm June which led to strong stratification. The highest average Delta T in July 1994 was 8.54°C. 2003 was the second hottest summer since 1895 and the 28th wettest which also led to the Sound being strongly stratified. Strong stratification (Delta T greater than 4°C) lasted for four months in 1994 (May-August) and only one month (July) in 2003.

Anoxia



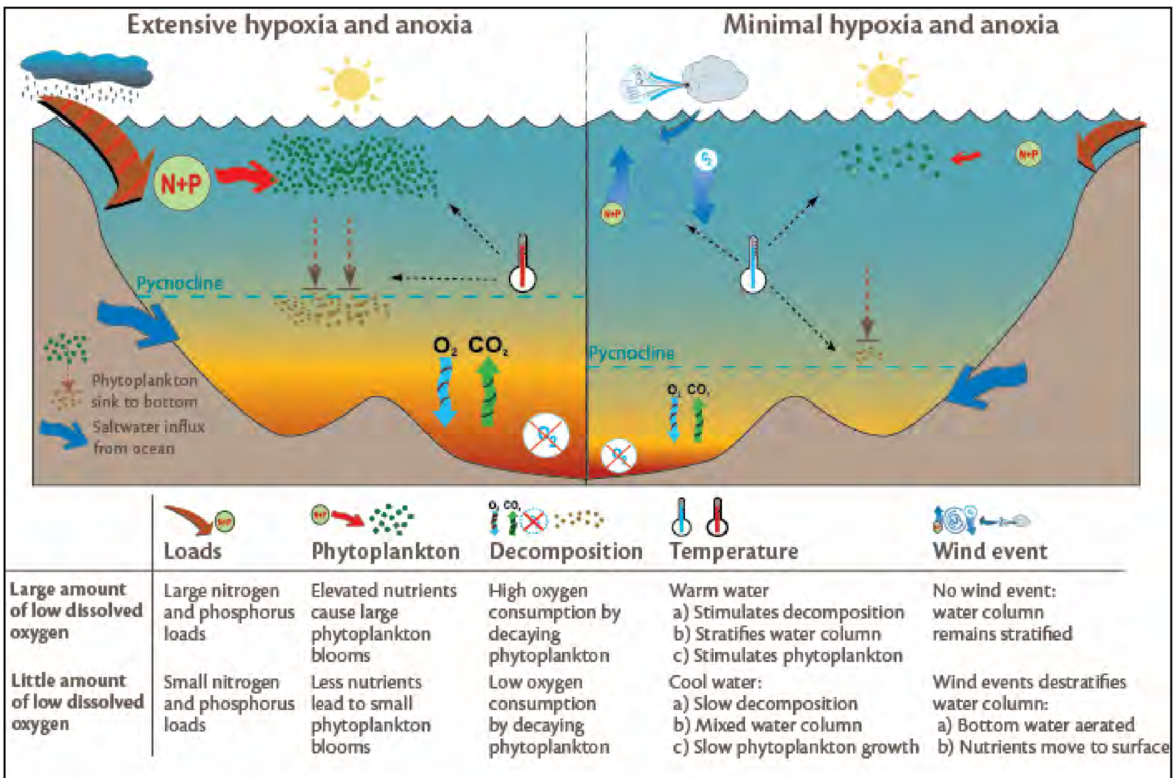
For management purposes, the Long Island Sound Study defines anoxia as DO concentrations less than 1 mg/L. This chart illustrates the maximum area of bottom waters in LIS with DO concentrations less than 1.0 mg/L based on biweekly sampling by CT DEEP.

In 13 of the past 26 years, there was no anoxia reported by CT DEEP. It is important to note that IEC and LISICOS have documented anoxic conditions during years when CTDEEP has not. In 2009 and 2010, IEC documented two stations that were anoxic. In 2011, the LISICOS Execution Rocks buoy (Station A4) captured a minimum DO of 0.61 mg/L.

Prior to 2002, the average area of bottom waters affected by anoxia was 5.9 mi^2. From 2002-2008 the average area affected was 32.4 mi^2. From 2009 to 2016, the average area affected was 2.2 mi^2. The overall average area affected from 1991-2016 is 12.4 mi^2. The greatest area with DO below 1 mg/L (62 square miles) was during the summer of 2003.

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. IEC's monitoring program records water temperature and salinity data weekly from June to September while CT DEEP's monitoring program records water temperatures and salinity year-round. Data collected during IEC's weekly summer surveys and CT DEEP's 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.



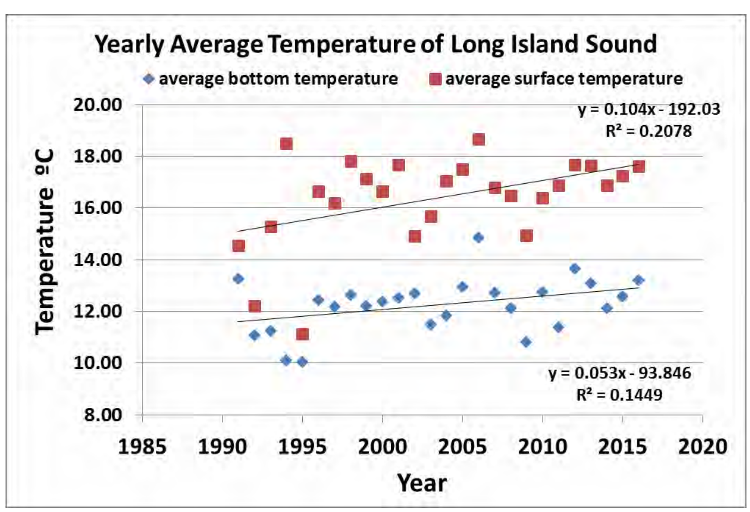
Conceptual diagram detailing the factors that determine the dissolved oxygen content of the tidal waters of Chesapeake Bay
Diagram courtesy of the Integration and Application Network (ian.umces.edu), University of Maryland Center for Environmental Science. Source: Ecocheck

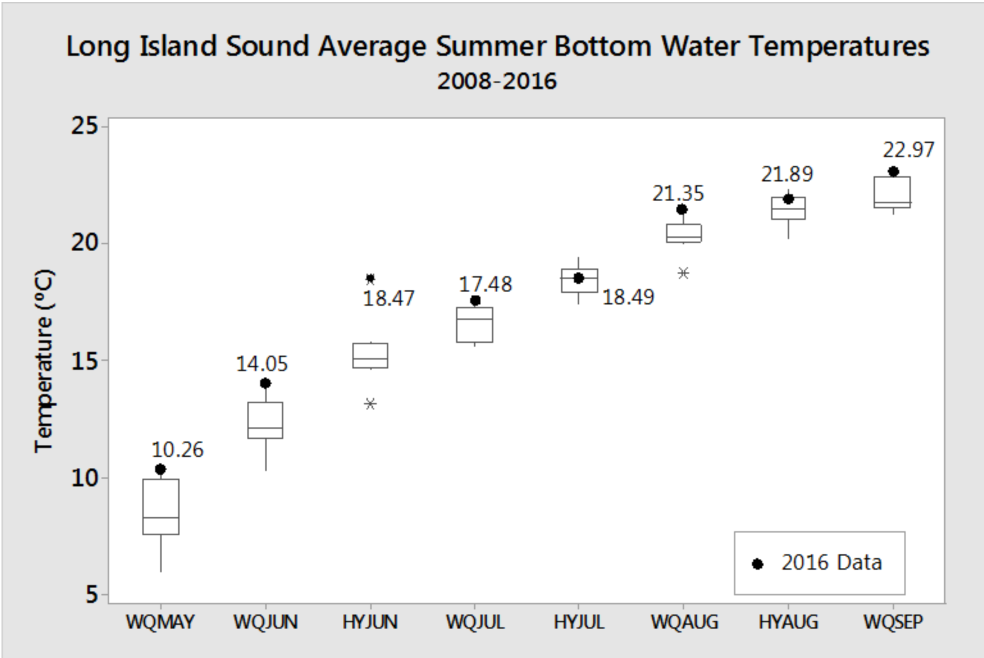
DEEP Water Temperature Data

2016 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. The Sound is coldest during February and March and warmest during August and September.

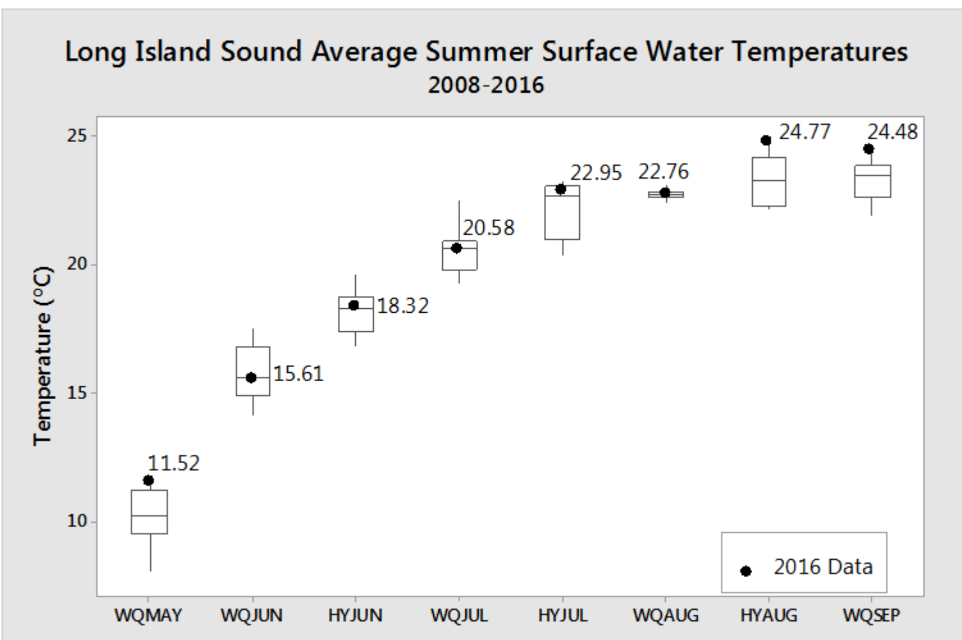
Cruise	2016 Max	1991-2016 Max	2016 Min	1991-2016 Min	2016 Average	1991-2016 Average
WQJAN	8.876	9.311	4.956	0.500	7.353	4.559
WQFEB	5.998	6.748	3.154	-1.325	4.253	2.154
CHFEB	2.611	4.464	1.526	-0.288	2.151	2.217
WQMAR	5.698	6.611	3.342	-1.189	3.878	2.267
CHMAR	6.279	6.575	4.905	-0.109	5.539	3.404
WQAPR	7.624	10.072	5.716	0.650	6.367	4.693
WQMAY	14.458	14.458	9.175	4.517	10.582	8.582
WQJUN	17.361	21.436	12.329	8.027	14.616	12.770
HYJUN	20.089	22.458	14.186	11.116	16.175	15.831
WQJUL	23.160	25.336	16.341	11.639	18.440	17.435
HYJUL	25.239	27.493	17.662	15.038	20.023	19.340
WQAUG	24.099	29.985	11.666	14.018	22.409	20.530
HYAUG	27.261	27.261	19.959	18.678	22.999	21.738
WQSEP	25.797	25.857	20.318	16.390	23.809	21.841
HYSEP	24.330	24.330	22.862	19.533	23.431	21.939
WQOCT		21.571		14.161		19.201
WQNOV		16.601		10.467		13.964
WQDEC		12.712		4.655		9.201

The yearly average surface and bottom temperature of the Sound show slight increases over the period 1991-2016





These box and whisker plots show the median water temperature, range, interquartile range, and outliers by cruise from 2008-2016 compared to the 2016 cruise. Water temperatures during the summer of 2016 mimicked air temperatures and were generally above the 2008-2016 medians.



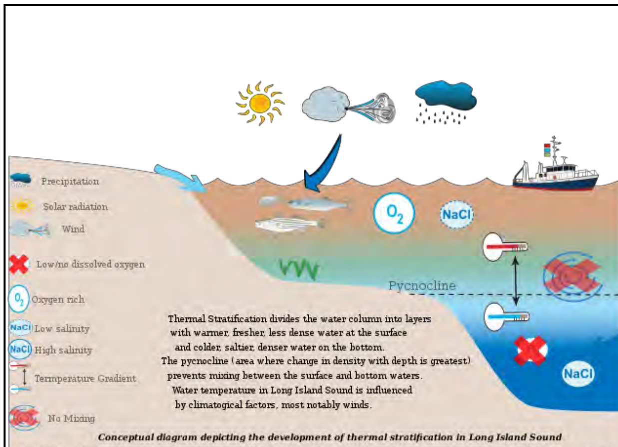
Historical IEC Water Temperature and Hypoxia Data

1991-2016 average summer (June-September) temperatures (ºC) for surface and bottom depths in Western Long Island Sound are summarized below in addition to percentage of hypoxic measurements.

Year	Mean Summer Temp. (ºC)		Mean ΔT (ºC)	Mean Summer DO (mg/L)		% Hypoxic Measurements (DO<3.0 mg/L)	
	Surface	Bottom		Surface	Bottom	Surface	Bottom
1991	22.2	21.5	0.65	6.47	4.21	0	24.2
1992	21.1	19.9	1.22	7.10	4.72	0	6.8
1993	21.8	20.3	1.49	6.88	4.19	0.93	24.1
1994	21.5	19.8	1.62	6.49	4.09	4.17	33.3
1995	22.3	20.8	1.46	6.85	5.24	0	3.5
1996	21.4	20.0	1.36	6.52	4.09	1.44	17.8
1997	21.5	19.8	1.63	6.97	5.15	1.55	19.3
1998	21.9	20.7	1.13	6.27	4.21	0	17.5
1999	22.6	21.2	1.32	6.40	3.91	0	25.4
2000	21.4	20.5	0.84	7.82	4.55	0	15.0
2001	22.0	20.8	1.12	6.59	3.19	3.83	47.0
2002	22.6	21.2	1.45	6.10	3.46	5.33	43.8
2003	21.1	19.2	1.85	6.81	3.50	2.89	37.8
2004	21.4	20.1	1.36	5.37	2.65	9.13	68.9
2005	22.9	20.9	2.00	7.36	3.50	3.31	44.1
2006	21.6	19.8	1.81	6.27	3.53	4.62	40.7
2007	21.2	19.7	1.51	7.10	4.10	2.23	19.1
2008	22.0	20.7	1.26	6.07	2.97	4.31	60.4
2009	22.0	20.3	1.70	8.28	4.25	1.59	27.5
2010	22.9	21.5	1.47	6.25	3.84	11.3	28.2
2011	22.3	21.0	1.33	5.95	4.05	1.14	21.5
2012	23.3	22.1	1.21	5.98	3.53	4.53	36.4
2013	22.4	21.0	1.37	6.58	4.10	0.40	24.7
2014	21.3	20.3	0.99	6.92	5.62	4.35	13.6
2015	22.8	21.5	1.20	5.71	4.27	2.25	17.4
2016	23.1	21.9	1.39	6.42	4.23	1.52	21.0

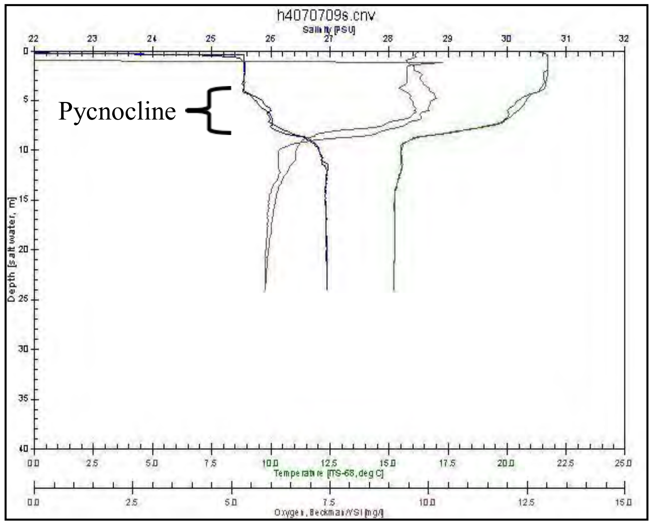
Delta T and Stratification

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. Stratification 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 depleted 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. The pycnocline generally 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 or 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.

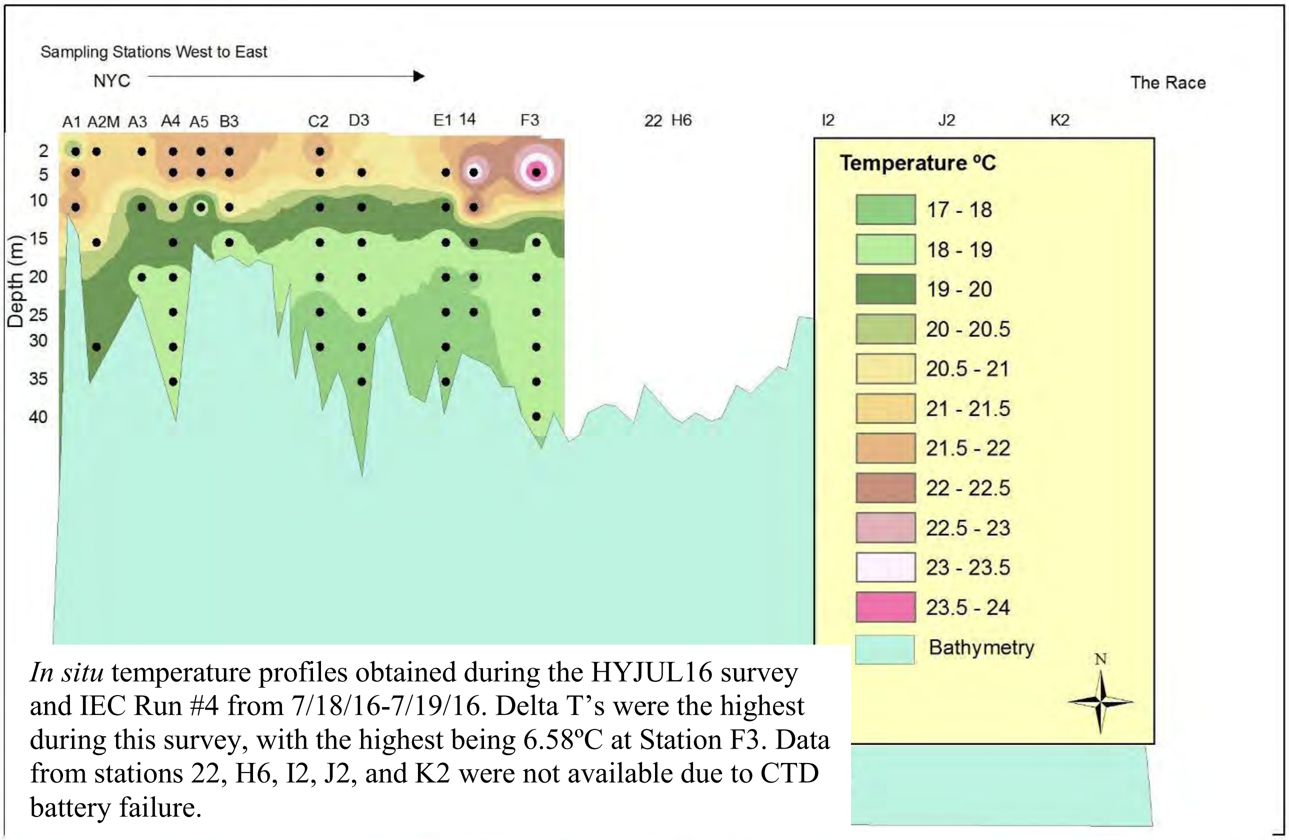


Conceptual diagram depicting the development of thermal stratification in Long Island Sound

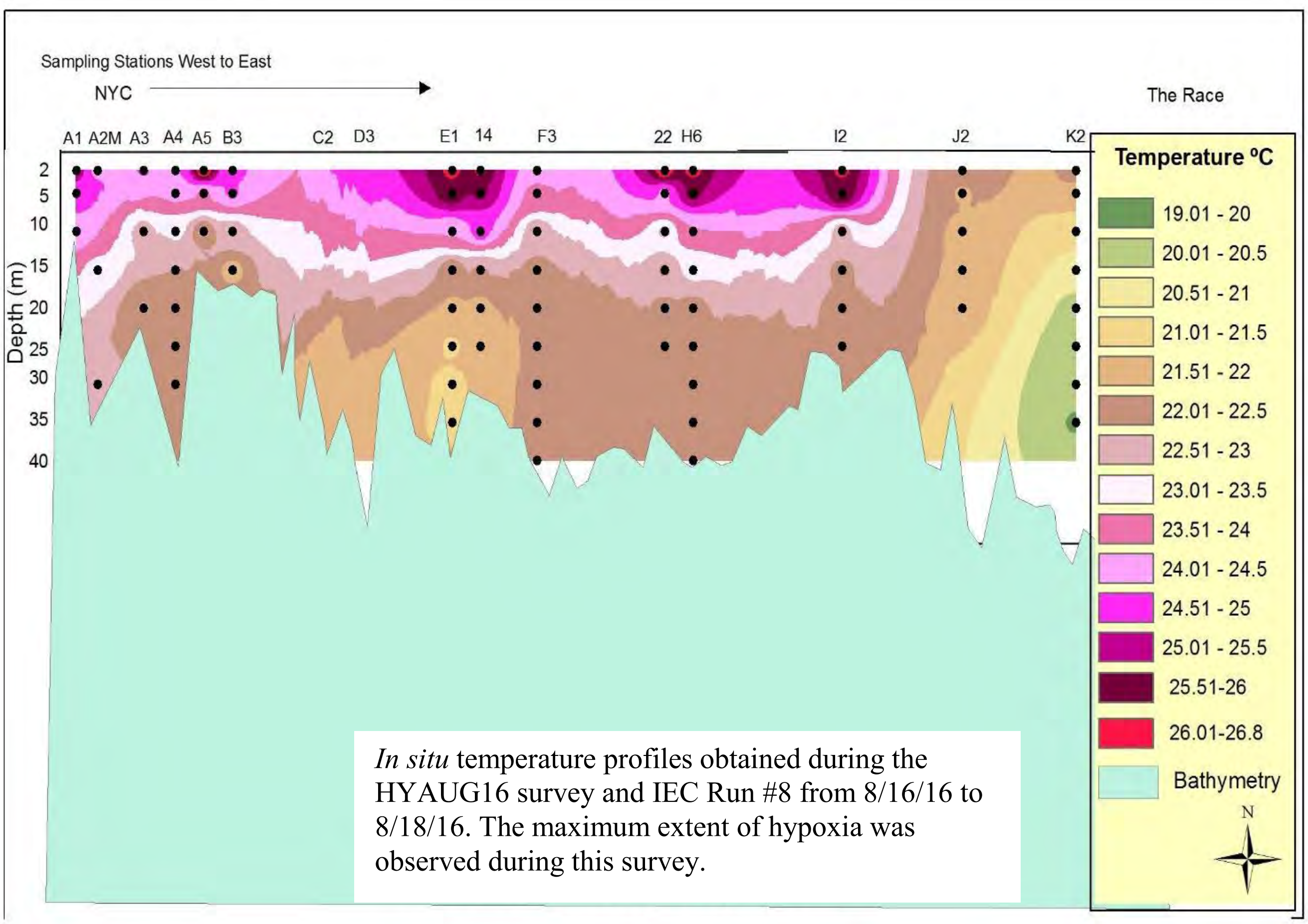
Symbols Courtesy of Integration and Application Network, University of Maryland Center for Environmental Science (ian.umces.edu/symbols



The temperature graphs on page 38 show computer interpolations along the west-east axis of LIS generated from profile data collected during two surveys by CT DEEP and IEC. During the mid-July IEC and DEEP surveys, surface water temperatures had warmed to an average of 22.5ºC while the bottom water remained cooler around an average of 18.7ºC. This set up the largest differences in temperatures between the surface and bottom waters with Delta T’s between 1.6 and 6.58ºC. The second graph shows how the water column was thermally stratified during the HYAUG16 survey when hypoxic conditions were at their worst. The temperature area maps on page 39 show how the Delta T’s varied over the course of the summer sampling season. Delta T’s increased from the WQAPR16 survey through the HYJUL16 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 1.1ºC over much of the Sound. Delta T’s continued to decrease during the HYSEP16 survey to around 0.3ºC, 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, bathymetry, 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.

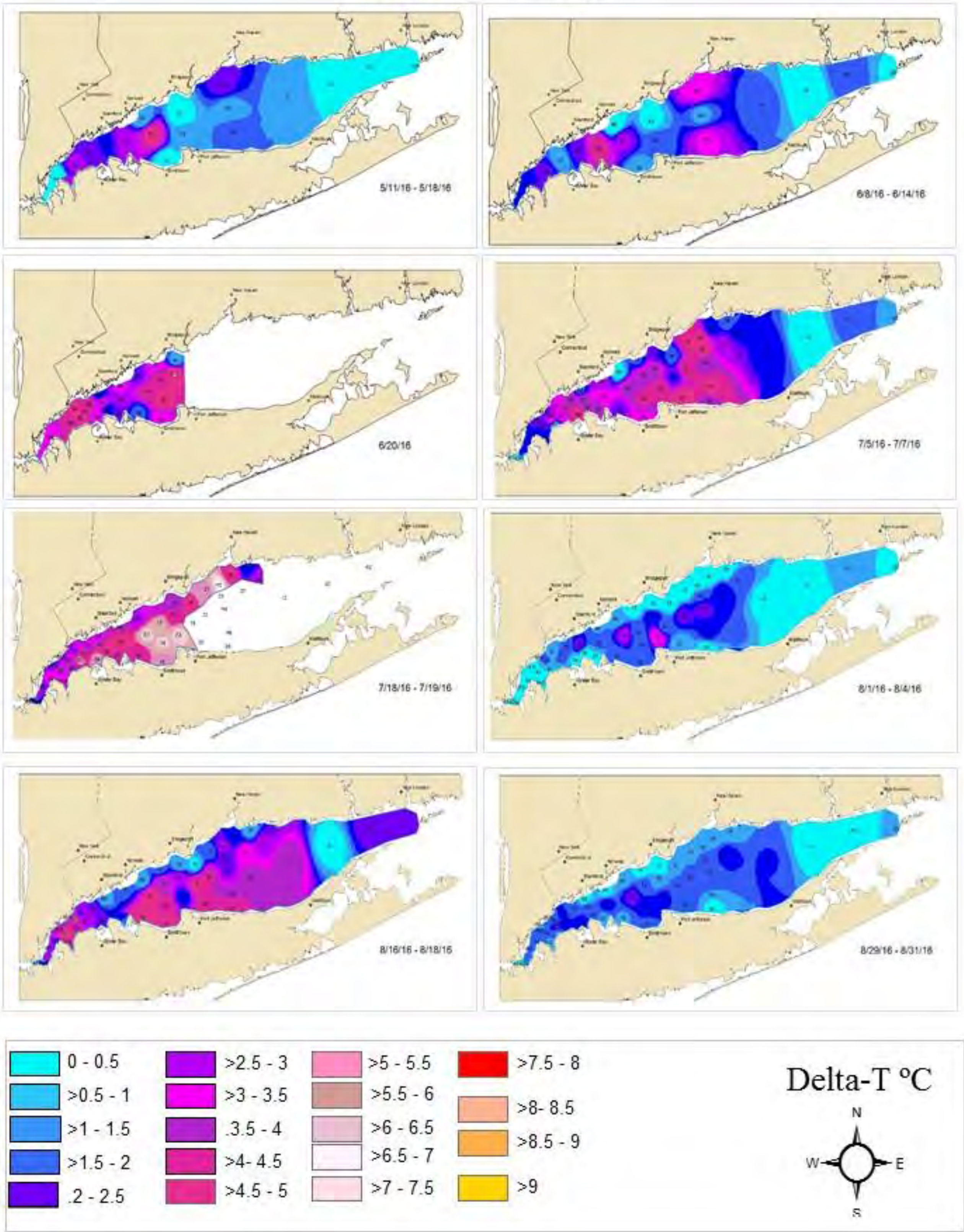


In situ temperature profiles obtained during the HYJUL16 survey and IEC Run #4 from 7/18/16-7/19/16. Delta T's were the highest during this survey, with the highest being 6.58ºC at Station F3. Data from stations 22, H6, I2, J2, and K2 were not available due to CTD battery failure.



In situ temperature profiles obtained during the HYAUG16 survey and IEC Run #8 from 8/16/16 to 8/18/16. The maximum extent of hypoxia was observed during this survey.

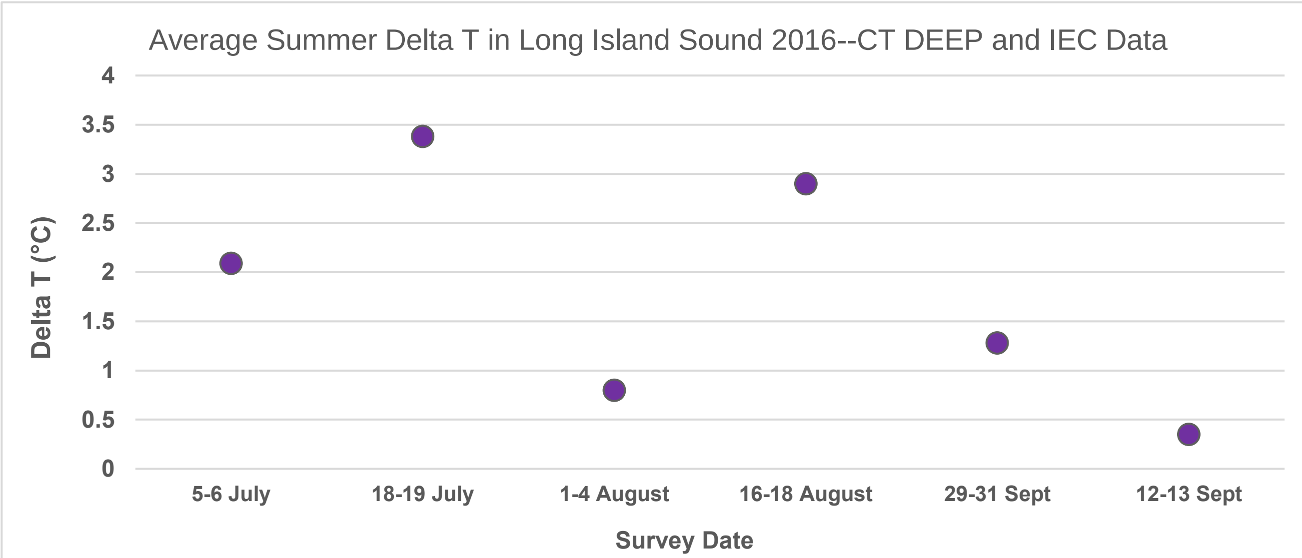
2016 Delta-T Maps

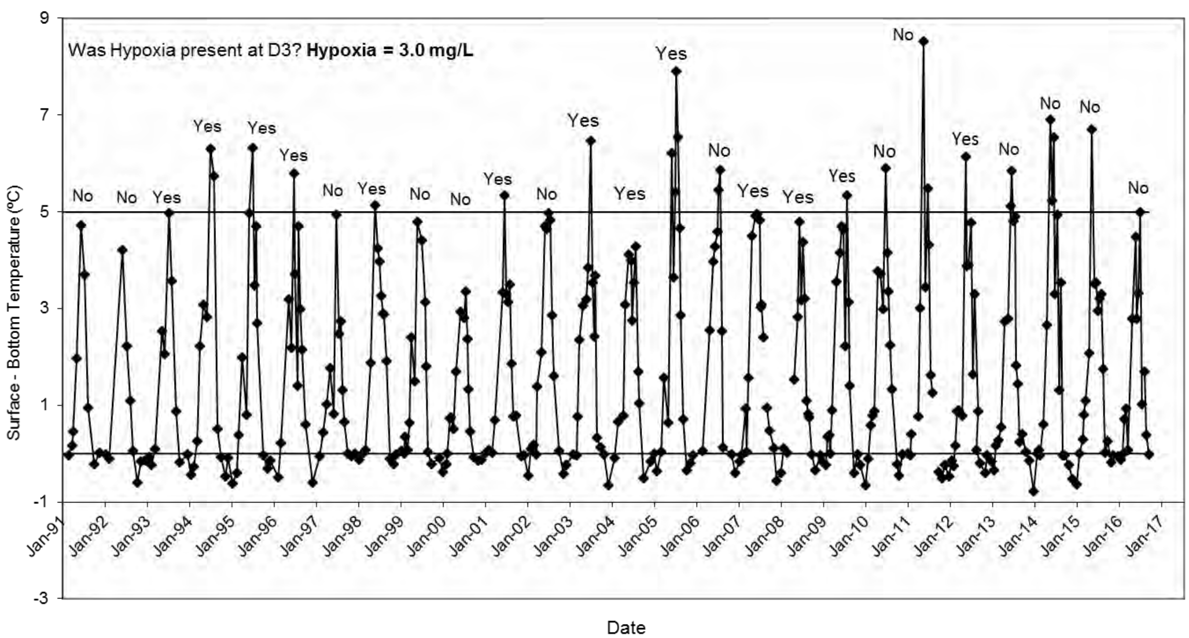


This table summarizes the minimum winter temperatures (January, February, and March), the maximum summer temperatures (June, July, August, and September), the maximum Delta T, and maximum hypoxic area at **Station D3**. Station D3 is located in the eastern-most and deepest portion of the Narrows (see 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 Delta T max, and 1994 had the largest area of hypoxia as indicated in bold.

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
2016	2.54	24.98	5.00	197.5

A compilation of CT DEEP and IEC water temperature data and Delta T calculations indicate that summer stratification in Long Island Sound was most prevalent during the middle of July and August. Stratification broke during the middle of September, as expected, in response to cooler air temperatures and storm-induced mixing.





Time series of ΔT (surface water temperature - bottom water temperature) at station D3, 1991 through 2016.

Station D3 is located in the eastern-most and the deepest portion of the Narrows. Station D3 does not experience hypoxia every year. This station is used as an example to show how stratification and the development of hypoxia in the Sound relate. Kaputa and Olsen (2000) found that there was a strong correlation between the maximum Delta T at D3 and the maximum area of hypoxia in the same year. Prior to 2004, when Station D3 became hypoxic the observed maximum Delta T was greater than 5ºC. Since 2004, this trend 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 2015, the maximum Delta T at D3 was 6.71ºC and the station was not hypoxic (lowest DO 3.5 mg/L). In 2016, the maximum Delta T at D3 was 5.00ºC and the station again was not hypoxic (lowest DO 3.84 mg/L).

DEEP Salinity Data

Salinity is a measure of the concentration of dissolved salts in seawater. During the summer months, Long Island Sound waters stratify and bottom waters become cool, dense, and more saline while surface waters are warmer, less dense, and have lower salinity.

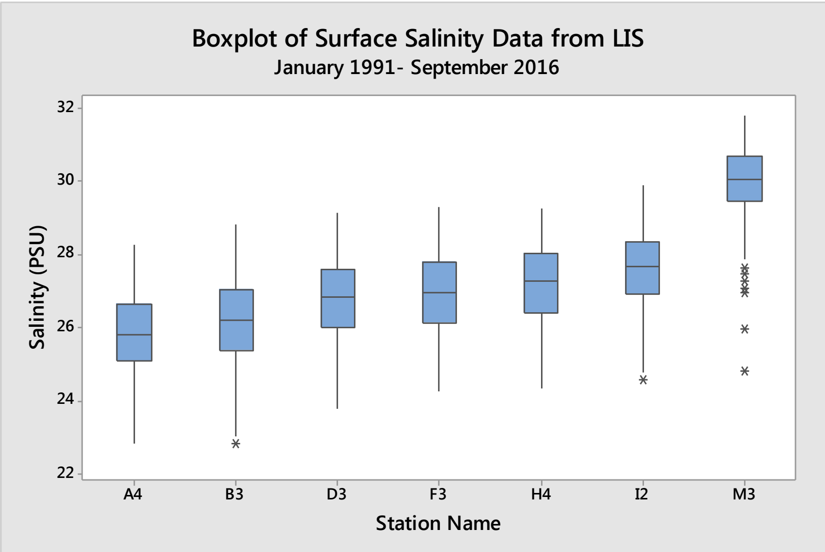
DEEP measures salinity in practical salinity units (PSU). Salinity levels across Long Island Sound vary from 23 PSU in the Western Sound at Station A4 to 33 PSU in the eastern Sound at Station M3. The Thames, Connecticut, and Housatonic rivers are the major sources of freshwater entering the Sound. Summary statistics for salinity data collected from seven stations across the Sound from 1991- 2016 are presented in the tables. Data collected this year are also presented separately.

		1991-2016 Bottom Water Statistics						
Station Name	Count	Minimum	Maximum	Mean	Median	SE Mean	Standard Deviation	Variance
A4	335	23.82	28.73	26.47	26.53	0.05	0.94	0.88
B3	382	24.26	28.93	26.72	26.76	0.05	0.93	0.87
D3	359	24.91	29.22	27.34	27.46	0.05	0.88	0.77
F3	333	25.15	29.43	27.70	27.79	0.05	0.86	0.74
H4	291	25.51	29.70	27.85	27.95	0.05	0.84	0.70
I2	310	25.76	29.99	28.14	28.23	0.05	0.83	0.70
M3	261	28.61	32.62	30.65	30.64	0.05	0.74	0.54

		2016 Bottom Water Statistics						
Station Name	Count	Minimum	Maximum	Mean	Median	SE Mean	Standard Deviation	Variance
A4	15	26.55	28.23	27.45	27.39	0.14	0.53	0.29
B3	14	26.76	28.53	27.67	27.57	0.16	0.61	0.37
D3	14	27.22	28.92	28.11	28.16	0.14	0.52	0.27
F3	12	27.53	29.24	28.48	28.55	0.17	0.60	0.35
H4	11	27.48	29.45	28.60	28.79	0.19	0.62	0.39
I2	9	27.66	29.66	28.62	28.83	0.24	0.73	0.54
M3	8	29.45	31.53	30.72	30.73	0.26	0.74	0.55

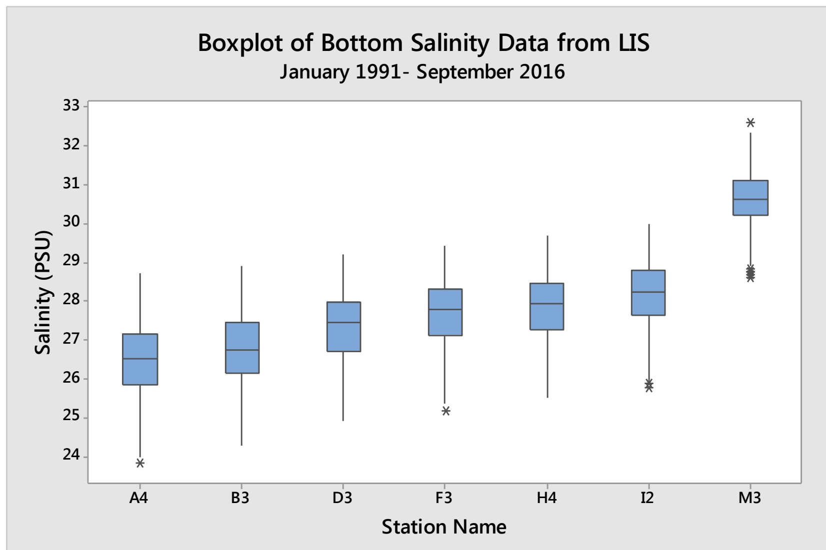
		1991-2016 Surface Statistics						
Station Name	Count	Minimum	Maximum	Mean	Median	SE Mean	Standard Deviation	Variance
A4	324	22.83	28.28	25.79	25.82	0.06	1.07	1.14
B3	365	22.80	28.84	26.17	26.19	0.06	1.08	1.17
D3	341	23.77	29.15	26.79	26.83	0.06	1.06	1.13
F3	312	24.25	29.31	26.93	26.98	0.06	1.09	1.18
H4	270	24.32	29.26	27.20	27.28	0.07	1.07	1.15
I2	278	24.56	29.91	27.59	27.68	0.06	1.03	1.06
M3	221	24.79	31.84	29.99	30.05	0.07	1.04	1.08

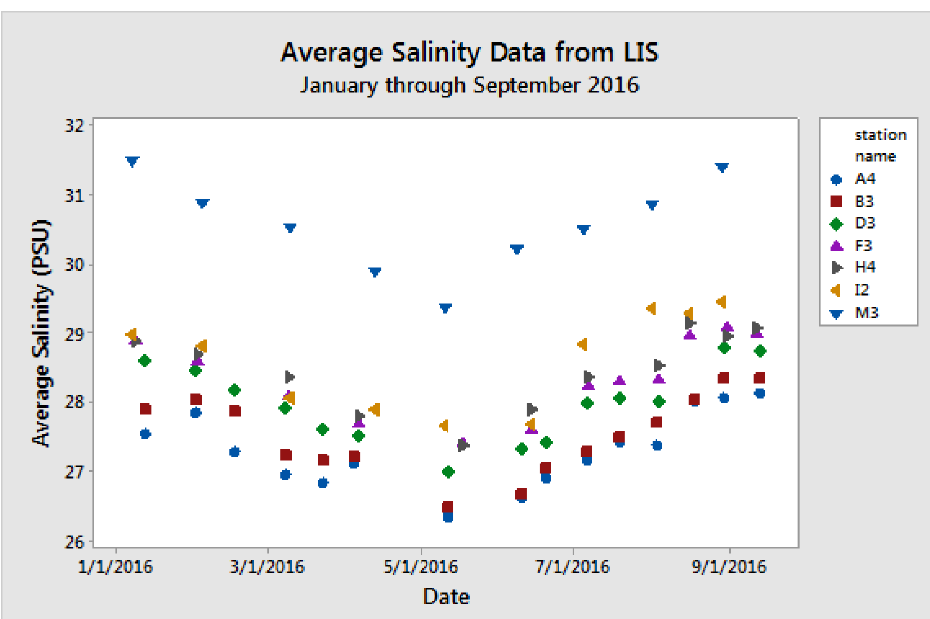
		2016 Surface Statistics						
Station Name	Count	Minimum	Maximum	Mean	Median	SE Mean	Standard Deviation	Variance
A4	14	25.90	27.96	26.96	26.90	0.16	0.61	0.37
B3	15	26.06	28.28	27.24	27.24	0.16	0.62	0.38
D3	13	26.79	28.67	27.79	27.70	0.18	0.65	0.42
F3	10	27.19	28.89	28.08	27.93	0.20	0.64	0.40
H4	11	27.19	29.09	28.21	28.22	0.19	0.62	0.38
I2	9	27.20	29.32	28.43	28.58	0.24	0.73	0.54
M3	8	28.97	31.13	30.00	30.00	0.27	0.77	0.59



This box plot, based upon data collected during CT DEEP surveys from January 1991 – September 2016, shows the median surface salinity, range, interquartile range, and outliers by station. Surface in this case refers to data collected two 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 2016, shows the median bottom salinity, range, interquartile range, and outliers by station. Bottom in this case refers to data collected five meters above the sediment/water interface. The bottom waters are generally saltier than the surface waters.





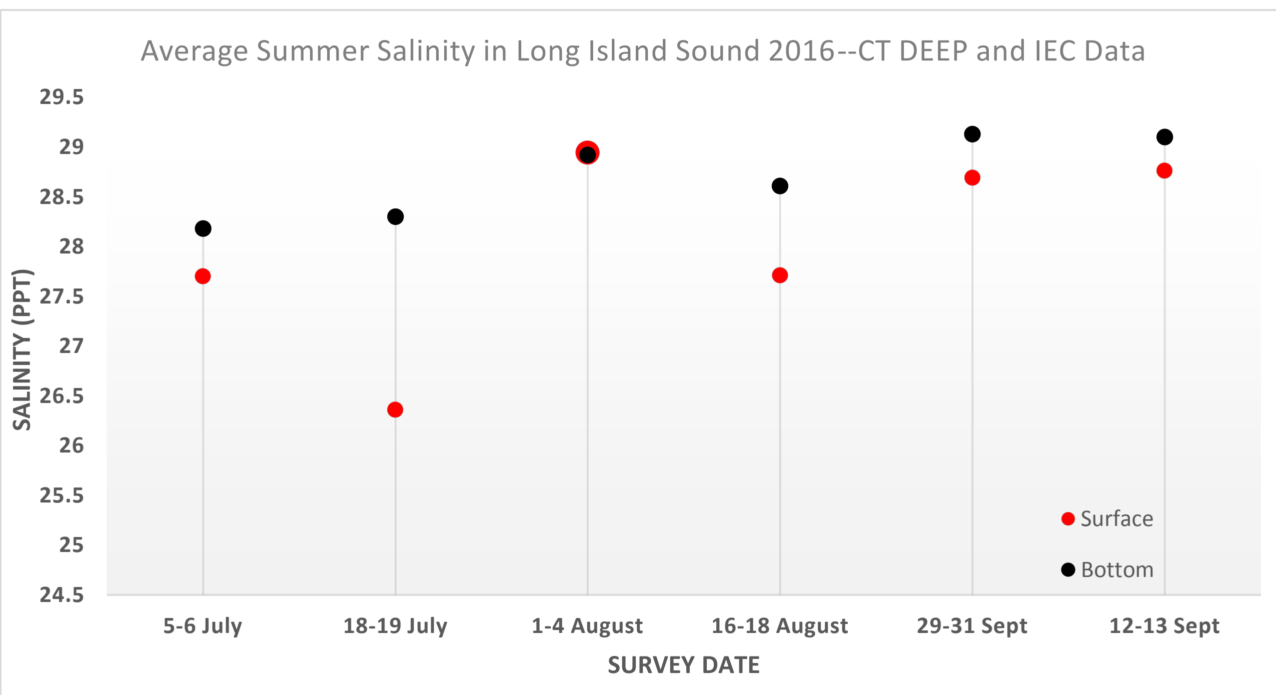
This plot illustrates the temporal variability of the mean salinity values by station from January-September 2016.

IEC 2016 Summer Salinity Data

Summer 2016 IEC Surface Salinity Statistics—Western Long Island Sound								
Station Name	**Count**	**Minimum**	**Maximum**	**Mean**	**Median**	**SE Mean**	**Standard Deviation**	**Variance**
A3	12	27.16	29.50	28.34	28.38	0.22	0.75	0.57
A2M	12	26.65	28.75	27.77	27.70	0.19	0.66	0.44
A1	12	26.32	28.56	27.56	27.80	0.21	0.72	0.52
B3M	12	27.52	30.23	28.79	28.79	0.25	0.85	0.72
A5	12	22.08	30.14	28.17	28.60	0.60	2.08	4.33
A4	12	22.03	29.90	27.96	28.27	0.58	2.02	4.07

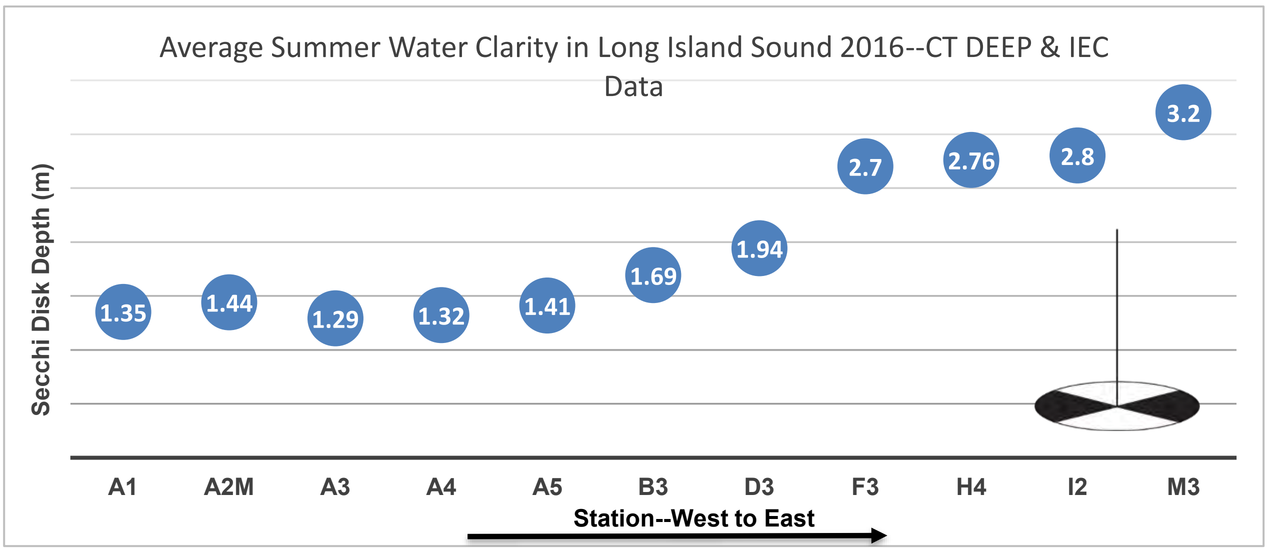
Summer 2016 IEC Bottom Salinity Statistics—Western Long Island Sound								
Station Name	**Count**	**Minimum**	**Maximum**	**Mean**	**Median**	**SE Mean**	**Standard Deviation**	**Variance**
A3	12	23.72	30.07	28.48	28.76	0.48	1.65	2.73
A2M	12	27.35	29.50	28.47	28.49	0.18	0.61	0.37
A1	12	25.66	29.41	27.79	27.97	0.27	0.95	0.91
B3M	12	28.11	30.29	29.28	29.21	0.20	0.70	0.49
A5	12	28.06	30.12	29.06	28.88	0.20	0.70	0.49
A4	12	28.06	30.05	29.00	28.81	0.19	0.65	0.43

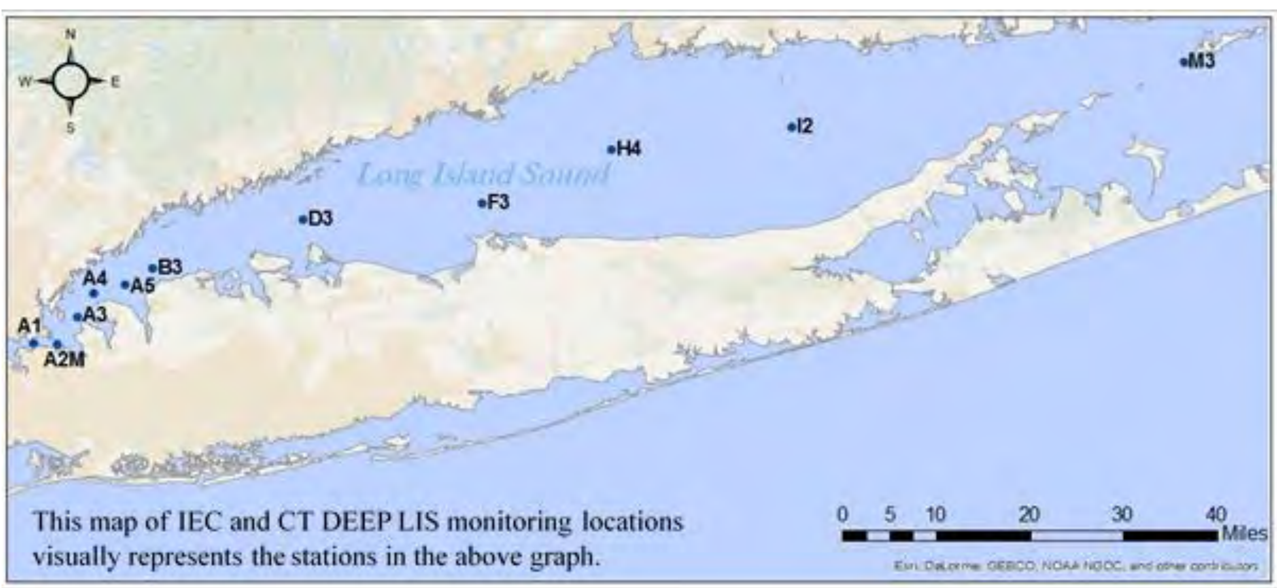
During the summer months, Long Island Sound waters stratify. Bottom waters become cool, dense, and more saline; surface waters are warmer, less dense, and have lower salinity. IEC salinity statistics for surface and bottom waters in the Western Sound are in the above tables. IEC measures salinity in parts per thousand (ppt). Salinity differences between surface and bottom waters are represented in the graph below.



Water Clarity

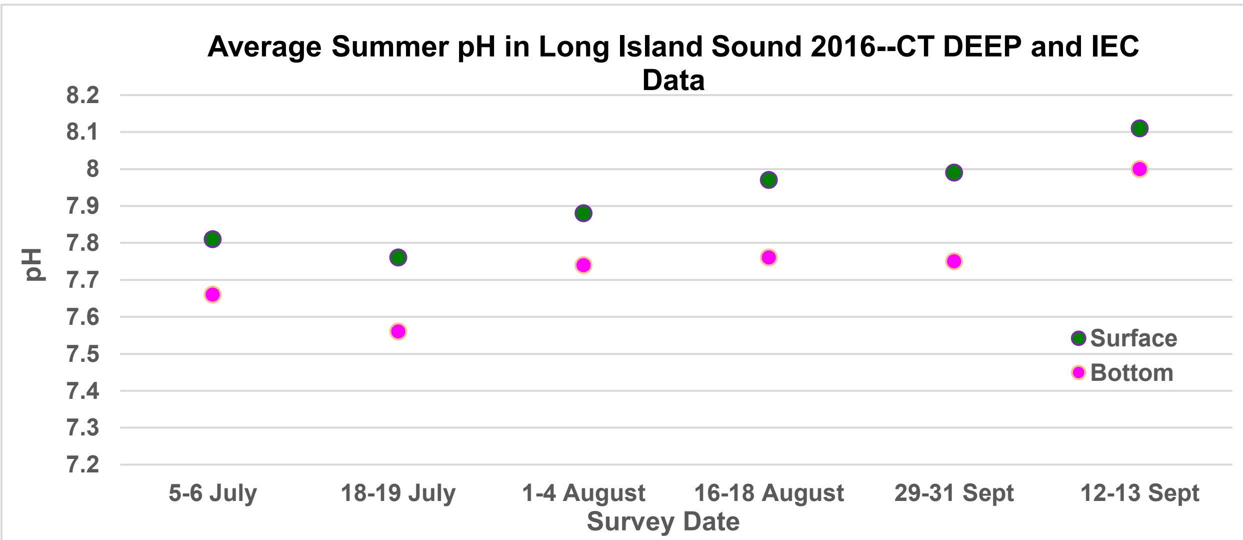
Water clarity is measured by lowering a Secchi disk into LIS until it disappears. It is then raised until it reappears. The depth where the disk vanishes and reappears is the Secchi disk depth. The depth to disappearance is related to the transparency of the water. Water clarity in Long Island Sound follows a west to east gradient, with clarity improving as you move eastward. The graph below highlights this gradient present in Long Island Sound. In 2016, the Western-most axial station (A1 near the Whitestone Bridge) had an average summer Secchi disk depth of 1.35 meters, whereas the eastern-most axial station (M3 near Fisher's Island) had an average summer Secchi disk depth of 3.2 meters. The eastern portion of Long Island Sound is a wide and deep channel with considerable influx from the Atlantic Ocean. This exchange of waters increases water clarity in the Eastern Sound. The Western Sound is more narrow and shallow compared to the Eastern Sound and its surrounding land is densely populated and developed. This results in less of an exchange of waters and also increases the concentrations of pollutants in the water that may affect water clarity.

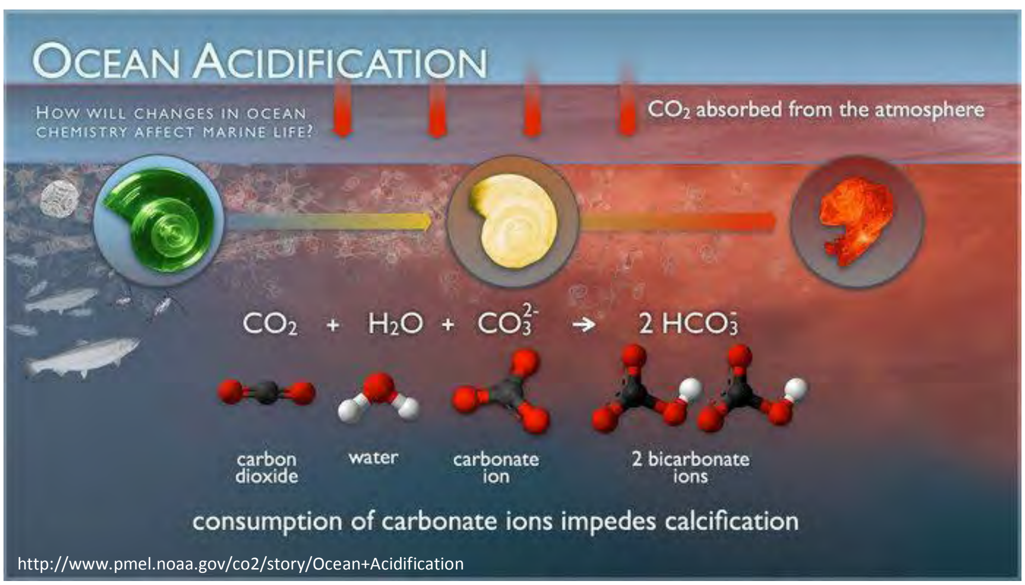




pH and Ocean Acidification

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. This process is depicted in the image below from NOAA. Carbonate ions are utilized by marine organisms in shell and skeletal formation. According to the NOAA Pacific Marine Environmental Laboratory Ocean Acidification, the pH of the ocean surface waters has already decreased from an average of 8.21 Standard Units (SU) to 8.10 SU since the beginning of the industrial revolution. The Intergovernmental Panel on Climate Change predicts a decrease of an additional 0.3 SU by 2100. Additional information specific to the Northeast region is available on the North East Coastal Acidification Network's website (http://www.necan.org/).

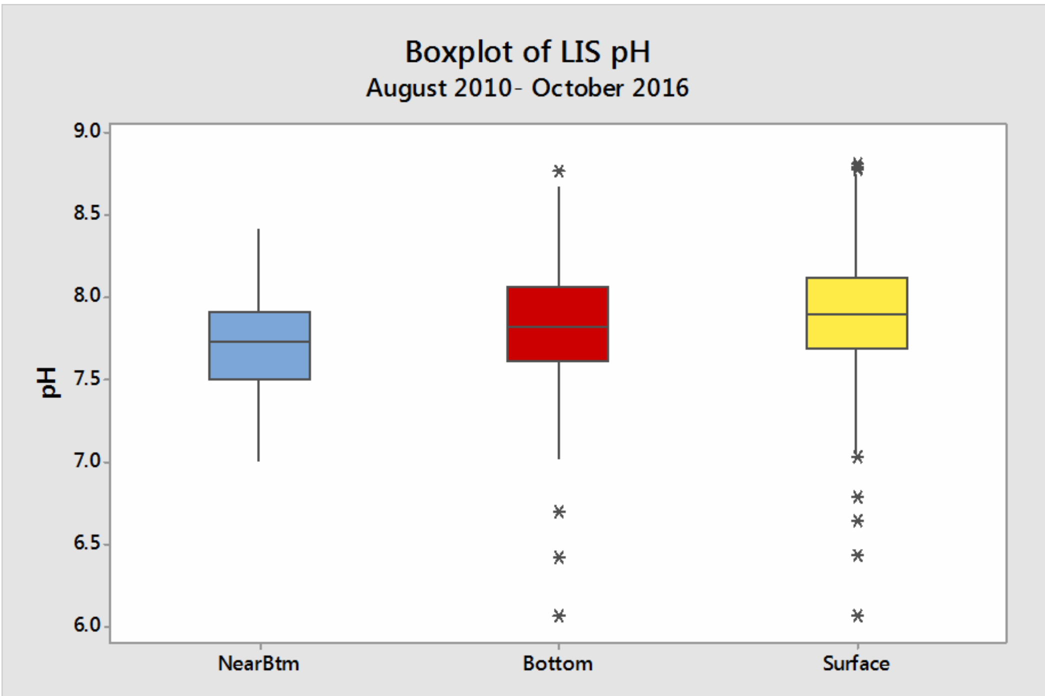




Data from the 2016 monitoring season, depicted in the graph above, show that the pH of bottom waters is lower than pH of surface waters. Surface and bottom waters followed a similar pattern in 2016 becoming increasingly less acidic at the end of the summer, when compared to the start of summer.

In August 2010, CT DEEP upgraded its SeaCat Profilers and began collecting and reporting pH data. Year round data collected through the WQOCT16 survey are summarized below.

	n	Maximum	Minimum	Mean	Median	SE Mean	StDev	Variance	Q1	Q3
Near Btm	1394	8.42	7.00	7.71	7.73	0.01	0.27	0.07	7.50	7.91
Bottom	1484	8.76	6.06	7.83	7.82	0.01	0.30	0.09	7.61	8.06
Surface	2224	8.81	6.07	7.90	7.90	0.01	0.28	0.08	7.69	8.12

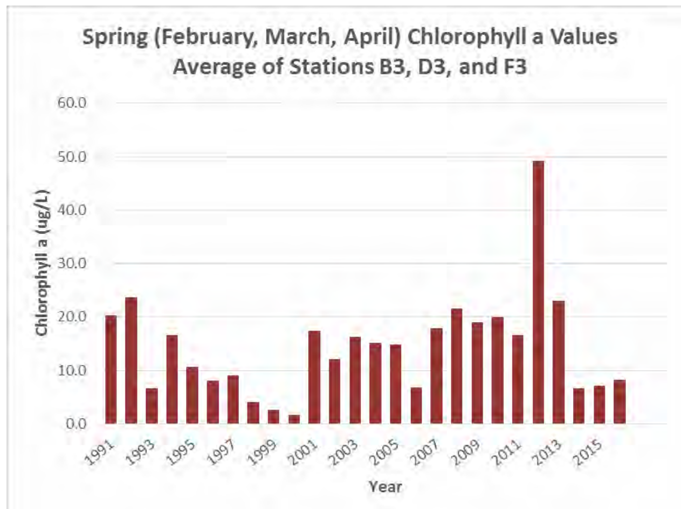


Chlorophyll a

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. Water temperature, nutrient concentrations, and light availability all factor into the amount of phytoplankton biomass found in the Sound.

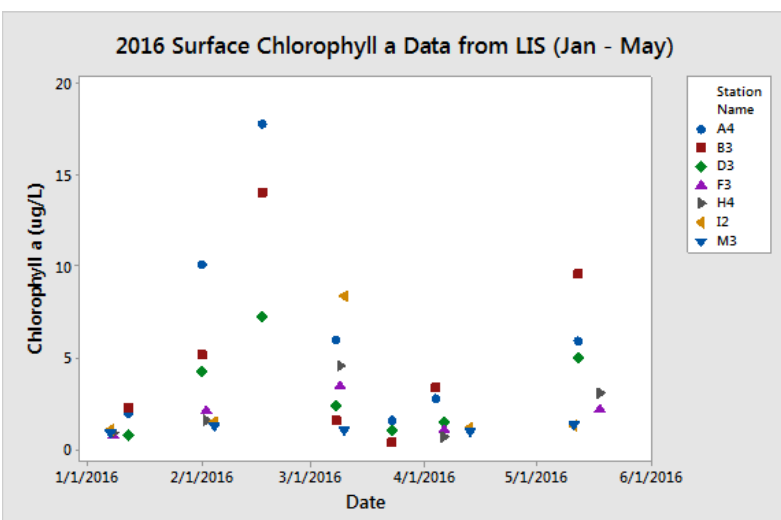
The concentration of chlorophyll a is used as a measure to estimate the quantity of phytoplankton biomass suspended in the surface waters. It is most commonly used because it is easy to measure and because photosynthetic production is directly proportional to the amount of chlorophyll present.

Chlorophyll a concentrations are measured year-round by CT DEEP using the CTD fluorometer for measurement as well as through the collection of grab samples using Niskin bottles. The grab samples are brought back into the onboard laboratory, filtered, and then sent to University of Connecticut for analysis.



IEC collects grab samples during the summer months and analyzes them for chlorophyll a content in their own in-house laboratory.

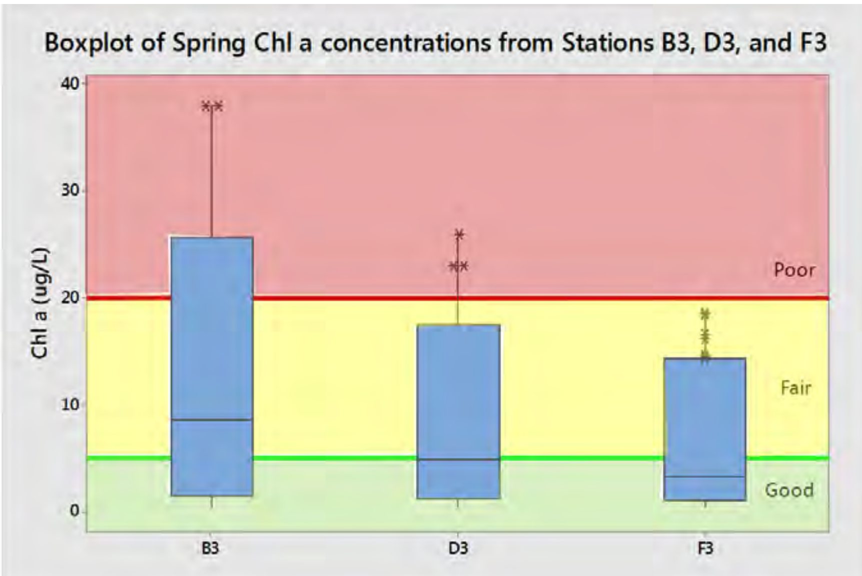
The spring phytoplankton bloom occurs in Long Island Sound between February and April. Historically high levels of chlorophyll a in the Western Sound during this time have been linked to summertime hypoxia conditions.



This plot illustrates the temporal variability of the surface chlorophyll a values (grab samples) by station from January- May 2016. The spring bloom was captured during the CHFEB16 (2/17) survey.

Microscopic images of phytoplankton.
Judy Li, NOAA, formerly of CT DEEP

The Integration and Application Network at the University of Maryland Center for Environmental Science released the first report card for Long Island Sound to the public in 2015. Chlorophyll a thresholds were set at 5 ug/L and 20 ug/L. The National Coastal Condition Report also uses these thresholds and ranks data in three categories: poor, fair, and good. Chlorophyll a concentrations less than 5 ug/L are good; concentrations between 5 and 20 ug/L are fair; and concentrations greater than 20 ug/L are poor.

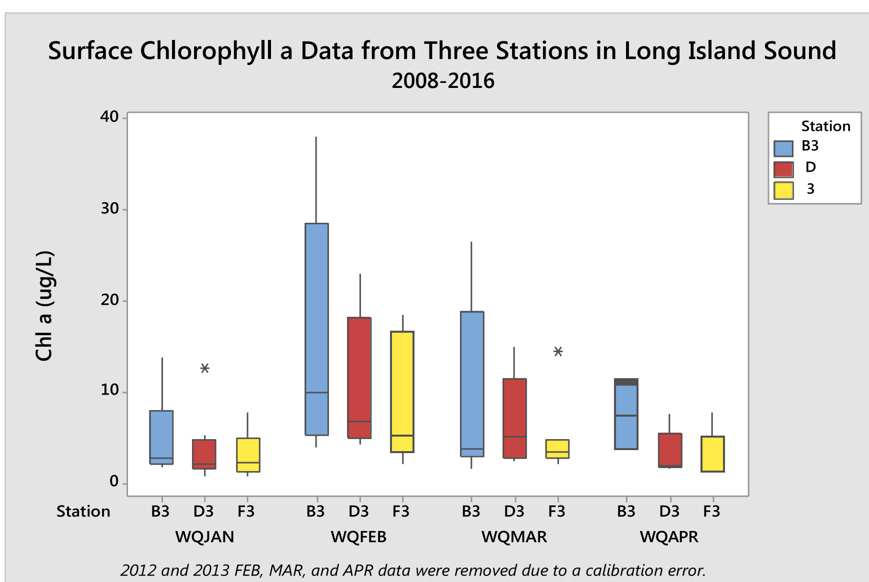


This boxplot examines spring (February-April) surface chlorophyll a data from three stations (B3, D3, and F3) in the Western/central portion of LIS from 1991 to 2016. Data from February, March, and April 2012 and 2013 are not included due to a lab calibration error.

At stations D3 and F3, 90% of the individual data are less than 20 ug/L and 75% of the data at B3 are less than 20 ug/L. This would place these stations in the fair category. The average concentration at each station is less than 20 ug/L but at or above 5 ug/L.

	n	Min	10th %	25th %	Median	75th %	90th %	Maximum	Mean	St Dev
B3	84	0.40	1.57	3.43	8.65	16.05	25.65	38.00	10.86	9.01
D3	83	0.50	1.24	2.37	4.90	10.00	17.47	26.00	6.97	6.28
F3	68	0.50	1.10	1.50	3.40	6.53	14.32	18.60	4.98	4.57

This boxplot examines recent data by survey.



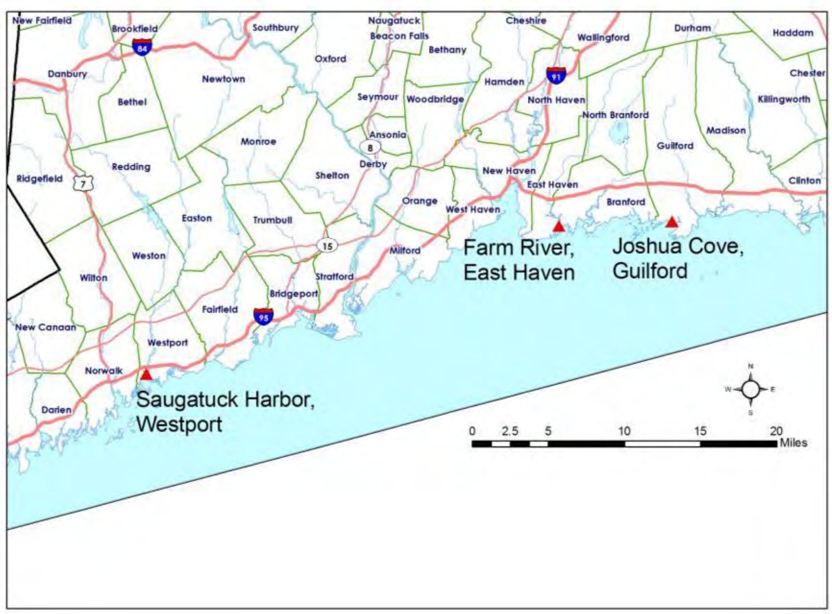
Embayment Pilot Project Sampling 2016

In 2016, CTDEEP began a pilot project to increase capacity for volunteer monitoring. The project is aimed at developing standard operating procedures for bacteria and water quality sampling in the near shore coastal waters of Connecticut.

Prior to engaging potential volunteer groups, CT DEEP conducted sampling in the Farm River in East Haven and Joshua Cove/Island Bay in Guilford. CT DEEP enlisted the Harbor Watch to sample a third embayment, Saugatuck Harbor in Westport.

Stations were sampled approximately monthly between July and September for bacteria, nutrients, and *in situ* parameters. Protocols were reviewed for macroalgae sampling and benthic macroinvertebrate sampling. One data loggers was deployed for a minimum of two weeks in both the Farm River and Joshua Cove to record continuous dissolved oxygen concentrations.

Additional data collection and SOP refinement will continue in 2017.



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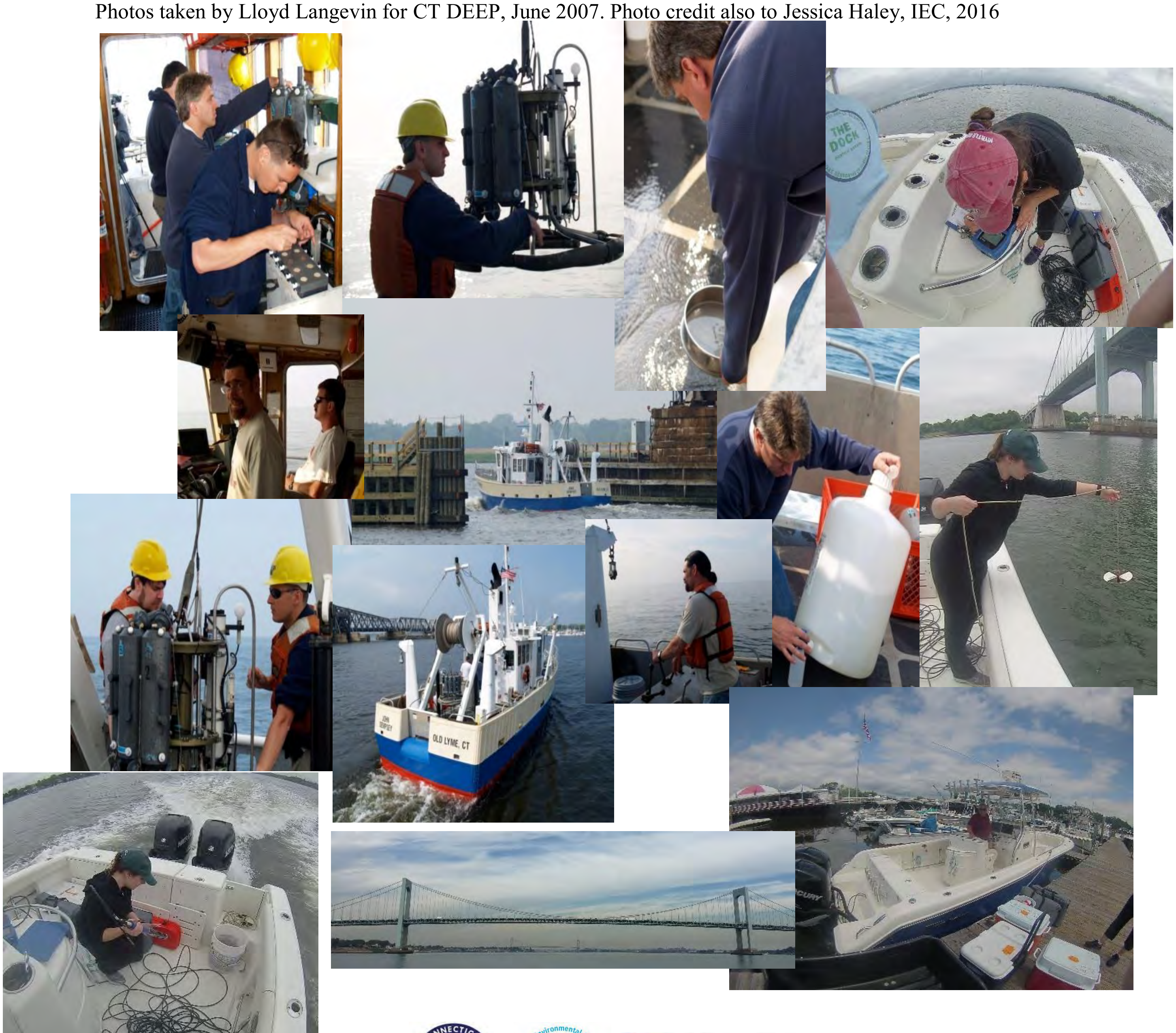
Photos taken by Lloyd Langevin for CT DEEP, June 2007. Photo credit also to Jessica Haley, IEC, 2016



Acknowledgements

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IEC's monitoring program was partially funded by an agreement (LI96144501) awarded by the Environmental Protection Agency to the New England Interstate Water Pollution Control Commission in partnership with the Interstate Environmental Commission. Although the information in this document has been funded wholly or in part by the United States Environmental Protection Agency under agreement LI96144501 to NEIWPCC, it has not undergone the Agency's publications review process and therefore, may not necessarily reflect the views of the Agency and no official endorsement should be inferred. The viewpoints expressed here do not necessarily represent those of the Interstate Environmental Commission, NEIWPCC, or EPA nor does mention of trade names, commercial products, or causes constitute endorsement or recommendation for use.

JOB 11: PUBLIC OUTREACH

JOB 11: PUBLIC OUTREACH

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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 5,095 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 236 (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 at Wolcott High School was 52 (Table 11.2). The students were encouraged to become actively involved in fisheries conservation, 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 2016 to February 2017 (segment 35).

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, Inland Fisheries Division, and Marine Fisheries Program display at one statewide fishing/boating show. The show was sponsored by CMTA, Channel 3, Channel 30 and Connecticut Outdoor Recreation Coalition and were held in February of 2017 at the Connecticut Convention Center. These shows attracted 4,533 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 Program Angler Surveys". F54R activities were highlighted at this show 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 CT DEEP Marine Fisheries Trophy Fish Award Program had a record year in angler participation. 208 marine angler's participated in this outreach program, catching 26 different species. Thirteen new state record holders, including four new species, were recognized. Marine anglers were presented with Trophy Fish Award Certificates of achievement and trophy fish lapel pin in either bronze, silver or gold color (depending on award type). Another three marine anglers were recognized as angler of the year. For a summary please see: 2016 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 CT DEEP 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 CMTA Boating Show, Trophy Fish Award Program and other activities the Fisheries Division held during 2016-17. '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).

Five articles describing Sport Fish Restoration projects were published in the Department's Wildlife Magazine. The first summarized Historic Fisheries in CT –Atlantic Sturgeon. A second highlighted CT Commercial Fishing Industry – Then and Now. Other articles describe Climate Change Here and Now in Long Island Sound, Small Menhaden and Large Whales in Long Island Sound and lastly, Scoring the Health of Long Island Sound. Some of these 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. 2016 CT DEEP Marine Trophy Fish Award Program Award being presented at the Northeast Fishing and Hunting Expo, Hartford CT.

Table 11.2. Summary of talks, tours, career days and workshops given by project staff highlighting F54R activities, March 2016 – February 2017 (segment 35).

DATE:	PRESENTATION TYPE:	ORGANIZATION	TITLE / TOPIC:	Target Audience	TOTAL #'S
3/14/2016	Talk	University of Connecticut	Habitat Restrictions ofr Fish and Lobster	College Students	44
3/21/2016	Talk	Conn College	Effects of Hypoxia on Fish in LIS	General Public	30
4/1/2016	Talk	Goodwin College	Climate Change	Outdoor Educators	50
4/14/2016	Career Day	Wolcott High School	Marine Careers	Students	52
4/21/2016	Talk	Fairfield County League of Sportsmen	Marine Fisheries Angler Survey	Marine Anglers	41
4/28/2016	Talk	Milford Striped Bass Club	Marine Fisheries Angler Survey	Marine Anglers	35
5/12/2016	Talk	Stratford Boat Owners Association	Marine Fisheries Angler Survey	Marine Anglers	30
5/13/2016	Talk	Sea Grant LIS Research Conference	Climate Change	General Public	50
8/10/2016	Talk	Old Lyme Land Trust	Climate Change	General Public	19
10/6/2016	Talk	Potapaug Audubon	Ecosystem Management	General Public	26
11/15/2016	Career Day	Cheshire High School	Marine Careers	Students	64
12/21/2016	Talk	Interclub Fairfield County Fishing Club	Marine Fisheries Angler Survey	Marine Anglers	66
1/19/2017	Web Ex	US EPA, NEIWPCC	Climate Change	Teachers	55
1/27/2017	Talk	Fairfield County Anglers Association	Marine Fisheries Management	Marine Anglers	64
2/09-12/2017	Outreach Display	CMTA Boating Show	Marine Angler Survey	General Public	4,533

JOB 12: MARINE FISHERIES GIS

JOB 12: MARINE FISHERIES GIS

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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 Program (MFP) surveys that support sport fish restoration goals, help people visualize the spatial extent of MFP 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 Program.

2) Provide maps and geospatial analyses of Marine Fisheries Program 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 fifth year of the Job (2016).

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

Saltwater Fishing Resource Maps:
Project staff used ArcGIS Online templates and widgets to create an online web application called the Saltwater Fishing Resource Map, to replace an older, outdated version on the DEEP website that was custom scripted and harder to maintain. This application was developed to help promote and protect recreational fishing opportunities in Long Island Sound. The online, interactive map

is available in two versions: a convenient format for smart phones (link to Saltwater Fishing Resource story map) that uses tabs to display different types of information on different tabs; and a version that can display all of the information at once, which is better suited for larger screens with desktop computer (link to Saltwater Fishing Resource all-in-one map) – although users can use either version from any device with access to the web. Anglers can find information that will help them plan a future fishing trip, including locations of bait and tackle shops, licensing agents, boat launches, and enhanced opportunity shore fishing sites (Job 3 in this report). Either version of the map can be accessed from the Agency website at www.ct.gov/deep/saltwaterfishing.

Figure 12.1. Saltwater Fishing Resource Maps online. Screen shot from CT DEEP web page (www.ct.gov/deep/saltwaterfishing) showing links to new versions of the Saltwater Fishing Resource Map

Popular Places to Fish app:

GIS staff also used ArcGIS Online to create another app to gather information about the 'Popular Places to Fish' layer included in the Saltwater Fishing Resource Map. This web app was shared with agency staff to gather comments on the Recreational Fishing Activity Areas layer (the predecessor to the Popular Places to Fish layer). By using this app, fisheries staff with minimal instructions were able to modify the spatial layer directly – without the assistance of staff trained in traditional desktop GIS software. The next step in the effort to produce a comprehensive spatial layer of popular fishing areas for Connecticut anglers is to create a similarly styled app that can be shared with anglers around the state who can then use the online app to submit feedback (such as indicating additional areas or species). Ultimately, the revised Popular Places to Fish layer will be incorporated into future versions of the online Saltwater Fishing Resource Maps.

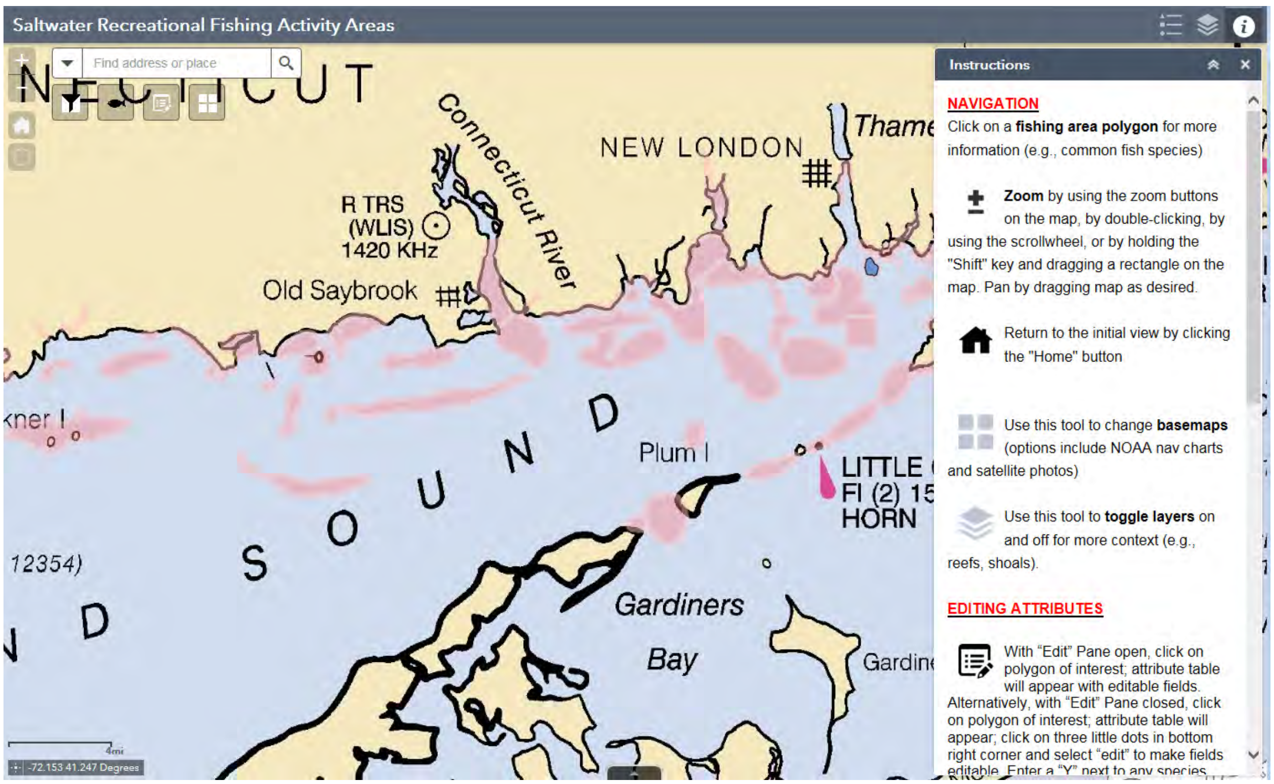

Figure 12.2. Popular Places to Fish app. A web application developed in ArcGIS Online for soliciting feedback and local knowledge from Fisheries Division staff.

Land Cover Change Analysis:
A land cover analysis project was created to show changes in the sites used for the Alosine Seine Survey (1984-2014, Job 7 in this report). Land cover classification data were downloaded from NOAA and the Connecticut CLEAR project. For years where classification data were not available, aerial images of the survey area were compared to classification data for previous years and then manually reclassified if there were significant changes. The comparisons were able to show the increase and decrease in several different land cover classifications, including developed land, forest, wetlands, agriculture, and water.

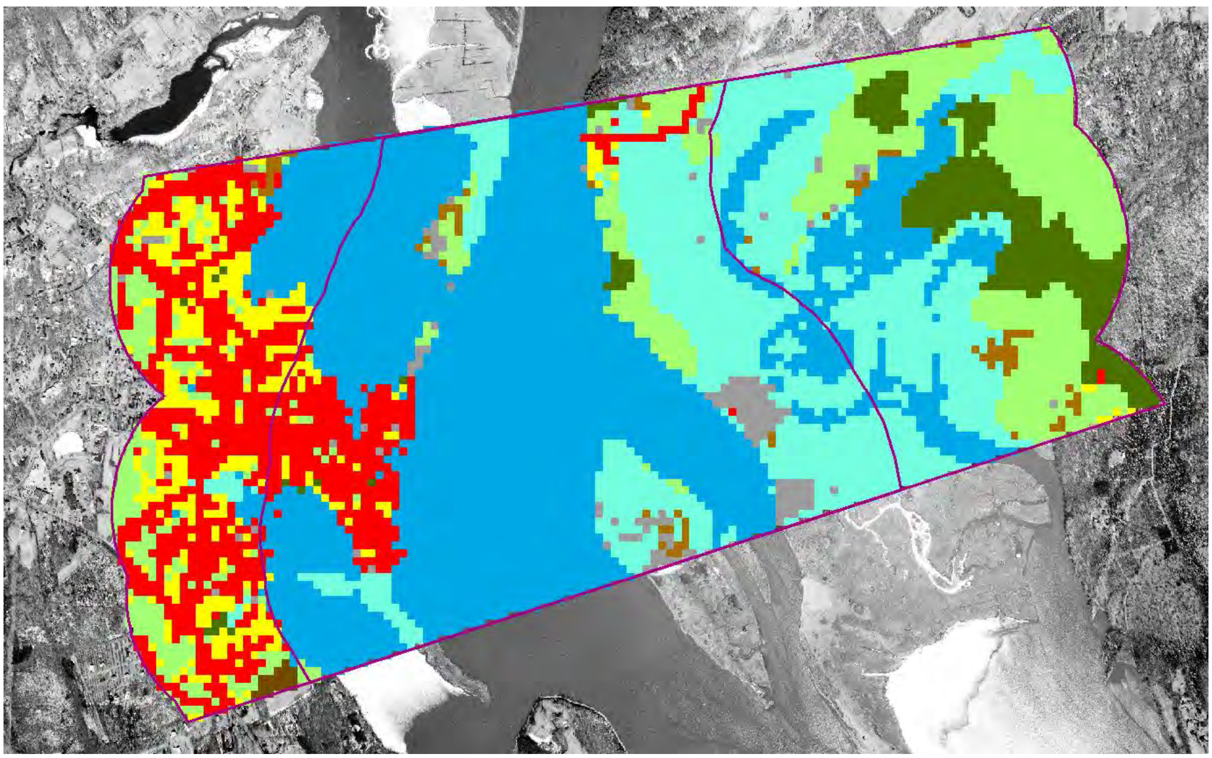

Figure 12.3. Land Cover Change Analysis. A land cover classification raster of the Essex Seine Survey Site with aerial imagery from 1965 underneath. The current land cover classification code was compared to the actual image of the ground to determine if change occurred, and whether the classification code needed to be changed.

NROC Northeast Ocean Data Portal:
Final versions of fish abundance and distribution data from the Long Island Sound Trawl Survey (LISTS) requested for the Northeast Regional Ocean Council's (NROC) and Northeast Regional Planning Body's (NRPB) Northeast Ocean Data Portal (NODP) were submitted and are now available for public viewing online (http://www.northeastoceandata.org/). Previously, the marine life data viewer included fish data from four other trawl surveys in the Northeast (various federal and state entities). Now that the data viewer also includes data gathered from LISTS, spatial data layers of fish abundace and distribution for LISTS can accessed from an online, interactive map viewer for the first time. Project staff submitted spatial data layers for 63 of the species catalogued by LISTS (Job 5 in this report). The viewer can display three metrics (log biomass, mean log biomass or variance of log biomass) for two time-periods (fall 1992-2014 or fall 2005-2014) for one species at a time for the survey selected. Project staff created a custom python script to generate over 370 layers of spatial data in the format requested by NROC/NRPB.

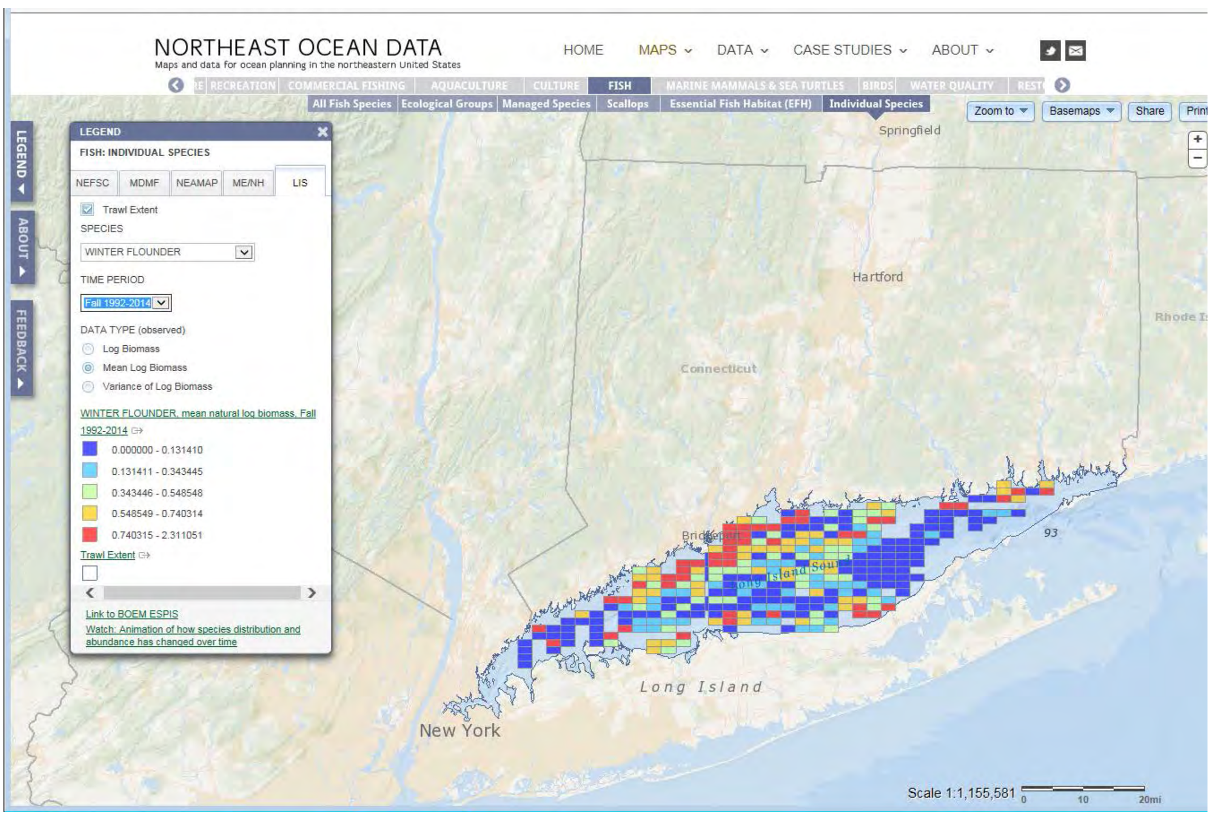

Figure 12.4. NODP map of winter flounder mean log biomass from LISTS, fall 1992-2014. The mean log biomass metric is site summary data. Note prevalence of relatively higher biomass along western Connecticut shoreline.

Since the NODP data viewer already contained spatial data from four other trawl surveys in the Northeast, spatial layers for LISTS had to conform as much as possible to the format of spatial layers from the other surveys. Thus, the metrics and time-periods for LISTS data are consistent with the metrics and time-periods for the other surveys in the data viewer. However, there are some differences in the list of species available for LISTS versus the other surveys in the viewer. Since Long Island Sound (LIS) is an estuary, the spatial data layers available for LISTS in the data viewer include some inshore species not found in the spatial data layers available for the other surveys. Conversely, some of the offshore species with spatial data layers in data viewer for the other trawl survey are not available for LISTS.

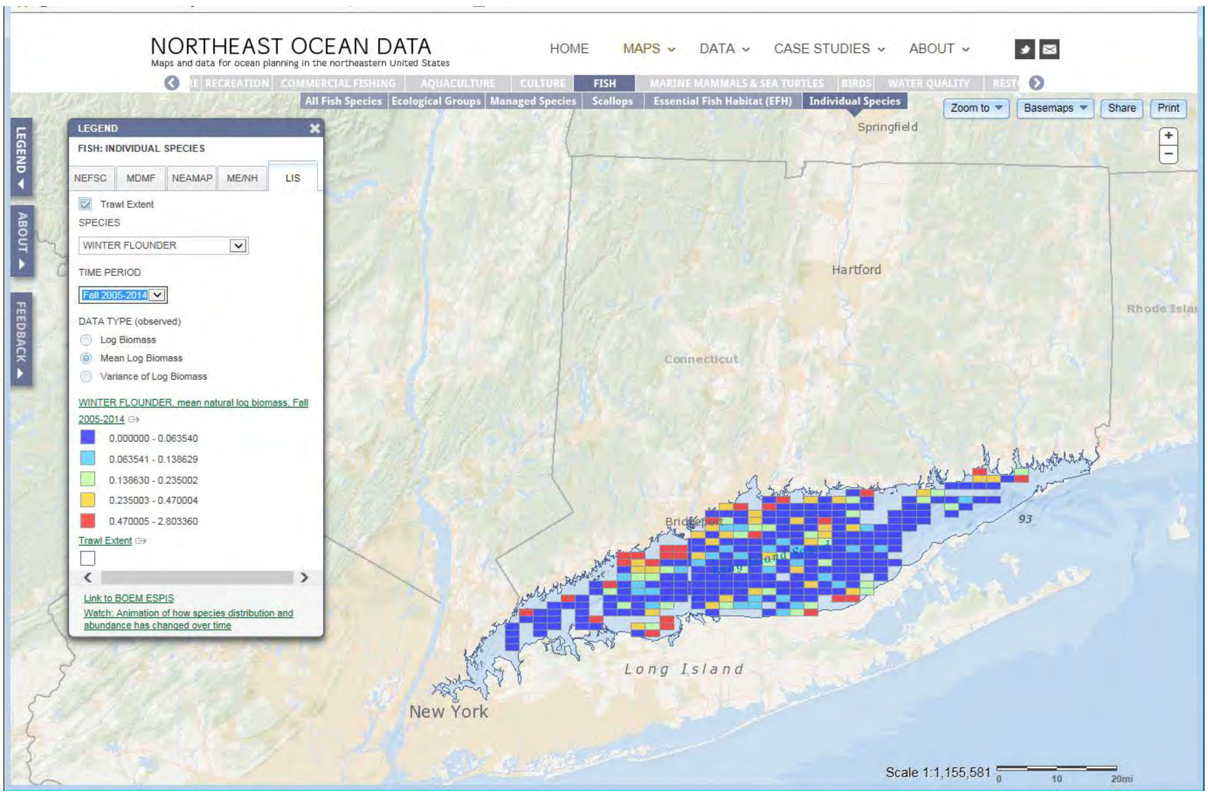

Figure 12.5. NODP map of winter flounder mean log biomass from LISTS, fall 2005-2014. Note the relatively smaller catches along western Connecticut shoreline as compared to previous screen shot for fall, 1992-2014.

The time-period options for each survey in the NODP data viewer include the entire time-series of biomass data for the survey and the most recent ten years of data. As examples of the spatial data layers from LISTS data now available in the online NODP marine life data viewer, Figures 12.4 and 12.5 display the mean log biomass (site summary data) for winter flounder from fall LISTS for the two time-periods (1992-2014 and 2005-2014, respectively). Figures 12.6 and 12.7 display the 2005-2014 log biomass (individual tow level data) for two other species popular with recreational anglers in LIS, black sea bass and summer flounder, respectively.

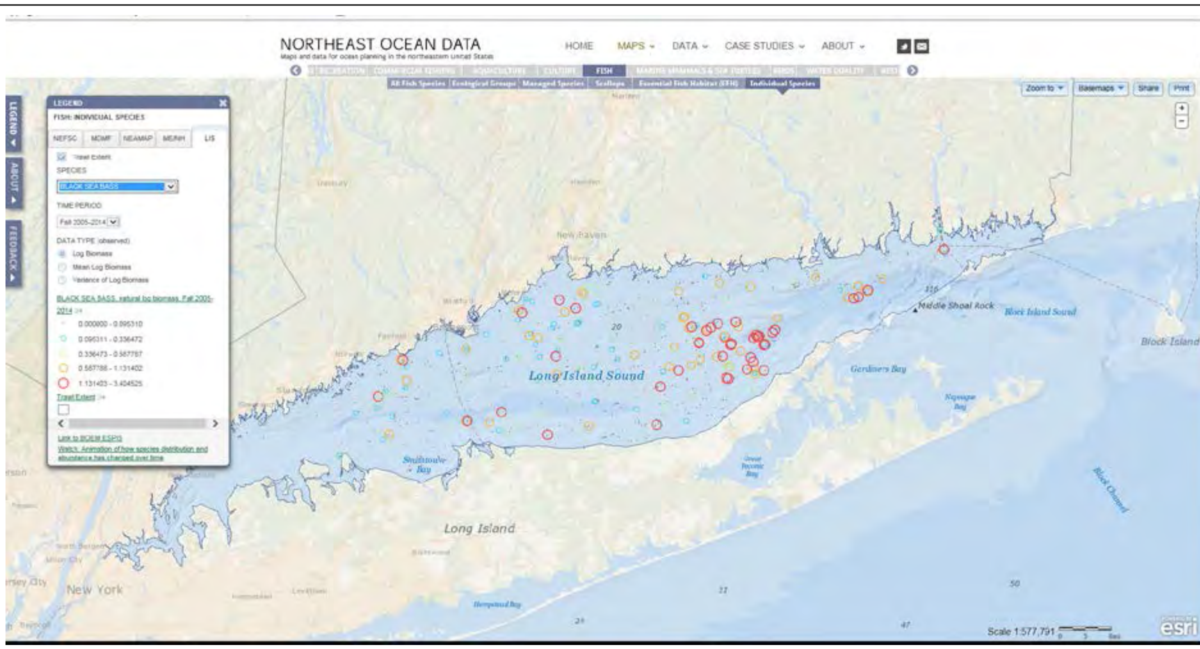

Figure 12.6. NODP map of black sea bass log biomass from LISTS, fall 2005-2014.

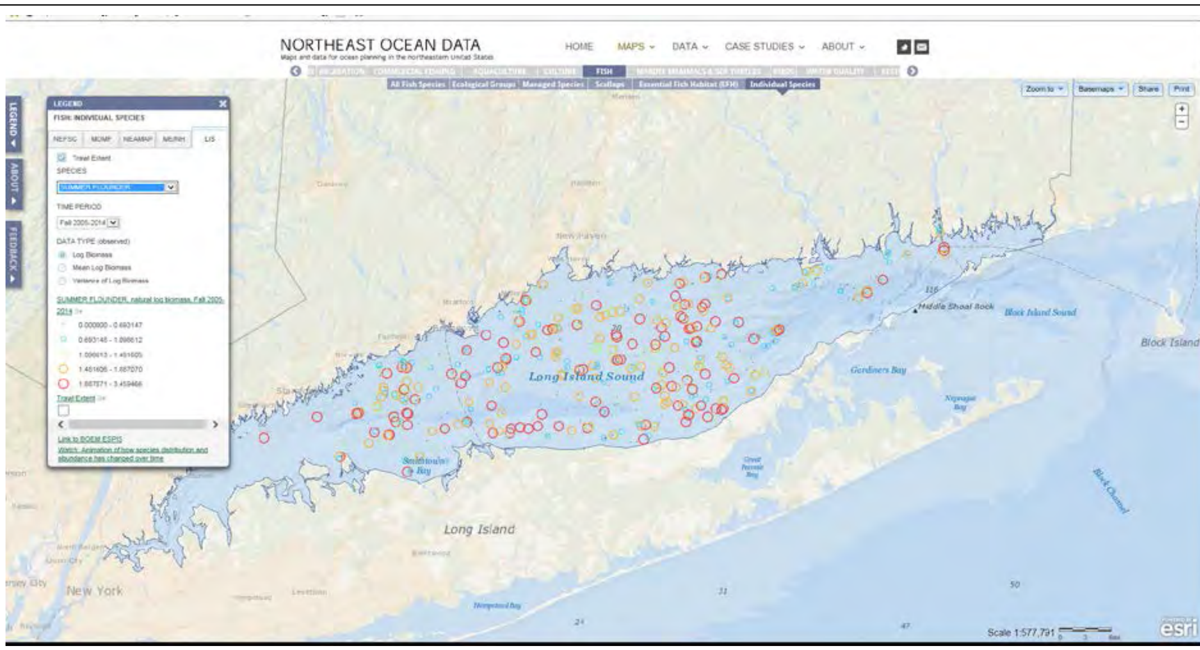

Figure 12.7. NODP map of summer flounder log biomass from LISTS, fall 2005-2014.

MODIFICATIONS

None.