Assessment of Recreationally Important Finfish Stocks in Rhode Island Waters

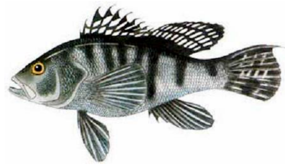
2014 Annual Performance Reports F-61-R-21

Jobs 1-14

Note: Jobs 5 and 7 have been completed

PERIOD: January 1, 2014 – December 31, 2014

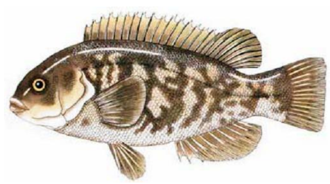
Rhode Island Division of Fish and Wildlife




ASSESSMENT OF RECREATIONALLY IMPORTANT FINFISH STOCKS IN RHODE ISLAND WATERS

COASTAL FISHERY RESOURCE ASSESSMENT
TRAWL SURVEY
2014

PERFORMANCE REPORT
F-61-R SEGMENT 21
JOBS 1 AND 2



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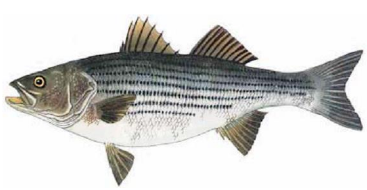
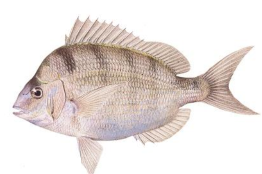
Division of Fish and Wildlife
Marine Fisheries

March 2015

Annual Performance Report

STATE: Rhode Island PROJECT NUMBER: F-61-R
SEGMENT NUMBER: 21

PROJECT TITLE: Assessment of Recreationally Important Finfish Stocks in Rhode Island Waters

JOB NUMBER: 1
TITLE: Narragansett Bay Monthly Fishery Resource Assessment

JOB OBJECTIVE: To collect, summarize and analyze bottom trawl data for biological and fisheries management purposes.

PERIOD COVERED: January 1, 2014 ï December 31, 2014.

PROJECT SUMMARY: Job 1, summary accomplished:
A: 144, twenty minute bottom trawl were successfully completed.
B: Data on weight, length, sex and numbers were gathered on 64 species. Hydrographic data were gathered as well. Additionally, anecdotal notations were made on other plant and animal species. Although not previously discussed, these notations are in keeping with past practice.

TARGET DATE: December 2014

SCHEDULE OF PROGRESS: On schedule.

SIGNIFICANT DEVIATIONS: None

.
JOB NUMBER: 2
TITLE: Seasonal Fishery Resource Assessment of Narragansett Bay, Rhode Island Sound and Block Island Sound

JOB OBJECTIVE: To collect, summarize and analyze bottom trawl data for biological and fisheries management purposes.

PERIOD COVERED: Spring(April ï May)/ Fall (September ï October) 2014

PROJECT SUMMARY: Job 2, summary accomplished:
A: 44, twenty minute tows were successfully completed during the Spring 2014 survey (26 NB. ï 6 RIS ï 12 BIS).
B: 44, twenty minute tow were successfully completed during the Fall 2014 survey (26 NB. ï 6 RIS ï 12 BIS)

TARGET DATE: DECEMBER 2014.

SCHEDULE OF PROGRESS: On schedule.

SIGNIFICANT DEVIATIONS: None

JOBS 1 & 2

RECOMMENDATIONS: Continuation of both the Monthly and Seasonal Trawl surveys into 2015, Data provided by these surveys is used extensively in the Atlantic States Marine Fisheries Commission Fishery Management process and Fishery Management Plans.

RESULTS AND DISCUSSION: 144 tows were completed during 2014 Job 1 (Monthly survey). 64 species accounted for a combined weight of 5,248.8 kgs. and 282,495 length measurements being added to the existing Narragansett Bay monthly trawl data set
By contrast, 88 tows were completed during 2014 Job 2 (Seasonal survey) 67 species accounted for a combined weight of 4,888.4 kgs. and 345,362 length measurements added to the existing seasonal data set.

With the completion of the 2014 surveys, combined survey(s) Jobs (1&2) data now reflects the completion of 5,970 tows with data collected on 132 species.

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Coastal Fishery Resource Assessment ï Trawl Survey

Introduction:

The Rhode Island Division of Fish and Wildlife - Marine Fisheries Section, began monitoring finfish populations in Narragansett Bay in 1968, continuing through 1977. These data provided monthly identification of finfish and crustacean assemblages. As management strategies changed and focus turned to the near inshore waters, outside of Narragansett Bay, a comprehensive fishery resource assessment program was instituted in 1979. (Lynch T. R. Coastal Fishery Resource Assessment, 2007)

Since the inception of the Rhode Island Seasonal Trawl Survey (April 1979) and the Narragansett Bay Monthly Trawl Survey (January 1990), 5,970 tows have been conducted within Rhode Island territorial waters with data collected on 132 species. This performance report reflects the efforts of the 2014 survey year as it relates to the past 35 years. (Lynch T. R. Coastal Fishery Resource Assessment, 2007)

Methods:

The methodology used in the allocation of sampling stations employs both random and fixed station allocation. Fixed station allocation began in 1988 in Rhode Island Sound and Block Island Sound. This was based on the frequency of replicate stations selected by depth stratum since 1979. With the addition of the Narragansett Bay monthly portion of the survey in 1990, an allocation system of fixed and randomly selected stations has been employed depending on the segment (Monthly vs. Seasonal) of the annual surveys.

Sampling stations were established by dividing Narragansett Bay into a grid of cells. The seasonal trawl survey is conducted in the spring and fall of each year. Usually 44 stations are sampled each season; however this number has ranged from 26 to 72 over the survey time series due to mechanical and weather conditions. The stations sampled in Narragansett Bay are a combination of fixed and random sites. 13 fixed during the monthly portion and 26, (14 of which are randomly selected) during the seasonal portion. The random sites are randomly selected from a predefined grid. All stations sampled in Rhode Island and Block Island Sounds are fixed.

Depth Stratum Identification

Area	**Stratum**	**Area nm2**	**Depth Range (m)**
Narragansett Bay	1	15.50	<=6.09
	2	51.00	>=6.09
Rhode Island Sound	3	0.25	<=9.14
	4	2.25	9.14 ï 18.28
	5	13.5	18.28 ï 27.43
	6	9.75	>=27.43
Block Island Sound	7	3.50	<=9.14
	8	10.50	9.14 ï 18.28
	9	11.50	18.28 ï 27.43
	10	12.25	27.43 ï 36.57
	11	4.00	>=36.57

At each station, an otter trawl equipped with a ¼ mesh inch liner is towed for twenty minutes. The Coastal Trawl survey net is 210 x 4.5ò, 2 seam (40ô / 55ô), the mesh size is 4.5ò and the sweep is 5/16ò chain, hung 12ò spacing, 13 links per space. Figure 1 depicts the RI Coastal Trawl survey net plan.

The research vessel used in the Coastal Trawl Survey is the R/V John H. Chafee. Built in 2002, the Research Vessel is a 50ô Wesmac hull, powered by a 3406 Caterpillar engine generating 700 hp.

Data on wind direction and speed, sea condition, air temperature and cloud cover as well as surface and bottom water temperatures, are recorded at each station. Catch is sorted by species. Length (cm/mm) is recorded for all finfish, skates, squid, scallops, Whelk lobster, blue crabs and horseshoe crabs. Similarly, weights (gm/kg) and number are recorded as well. Anecdotal information is also recorded for incidental plant and animal species.

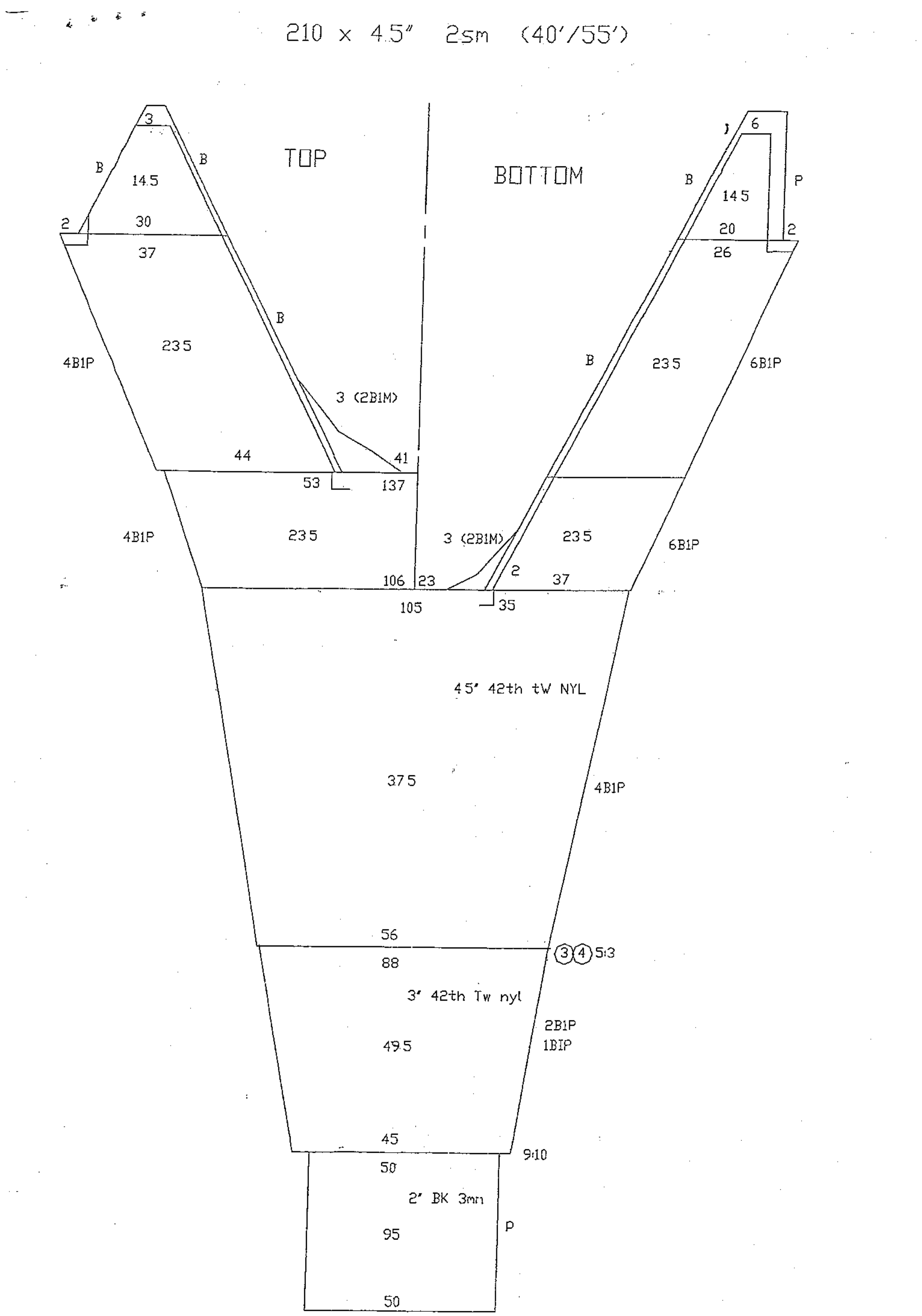
Survey changes- Beginning January 2012 the Rhode Island Coastal Trawl Survey began using an updated set of trawl doors. Throughout 2012, a comparative gear calibration study was completed to determine if a significant change to the survey catch data is exists. The analysis of this calibration study was completed in 2013.

RIDEM R/V John H. Chafee

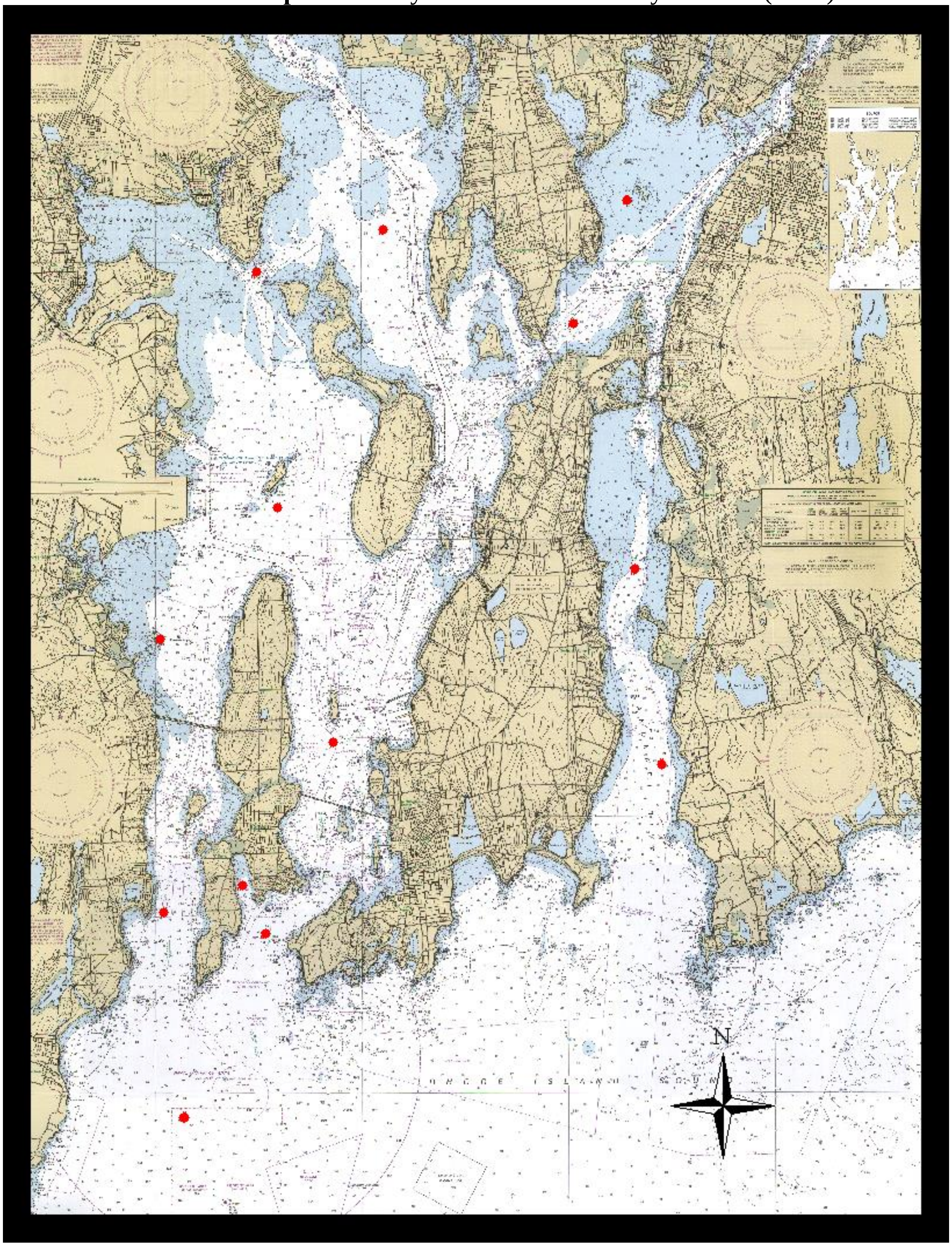
Acknowledgements:

Special thanks are again extended to Captain Richard Mello and Assistant Captain, Patrick Brown, and the entire seasonal staff and volunteers. The support given over the years has been greatly appreciated.

Figure 1


210 x 4.5" 2sm (40'/55')
TOP
BOTTOM
3
B
B
14.5
2
30
37
B
235
4B1P
3 (2B1M)
44
41
53
137
6
P
B
14.5
20
2
26
B
235
6B1P
4B1P
235
3 (2B1M)
235
6B1P
2
106
23
37
105
35
45' 42th tW NYL
375
4B1P
56
88
3 4 5:3
3' 42th Tw nyl
2B1P
1B1P
49.5
45
9:10
50
2' BK 3mm
95
P
50

Map 1 Monthly Coastal Trawl Survey Stations (fixed)



Results: Job 1. Monthly Coastal Trawl Survey; 12 fixed stations in Narragansett Bay and 1 in Rhode Island Sound.

A total of 64 species were observed and recorded during the 2014 Narragansett Bay Monthly Trawl Survey totaling 282,495 individuals or 1961.7 fish per tow. In weight, the catch accounted for 5,248.8 kg. or 64.6 kg. per tow. (Figures 2 and 3) The top ten species by number and catch are represented in figures 4 and 5. The catch between demersal and pelagic species is represented in figures 6 and 7.

Figure 2 (Total Catch in Number)

Fish Name	Scientific Name	Total Number
Scup	STENOTOMUS CHRYSOPS	105634
Butterfish	PEPRILUS TRIACANTHUS	54064
Bay Anchovy	ANCHOA MITCHILLI	42137
Longfin Squid	LOLIGO PEALEI	30894
Atlantic Menhaden	BREVOORTIA TYRANNUS	11433
Atlantic Herring	CLUPEA HARENGUS	11189
Atlantic Moonfish	SELENE SETAPINNIS	9774
Alewife	ALOSA PSEUDOHARENGUS	6394
Atlantic Silverside	MENIDIA MENIDIA	5774
Weakfish	CYNOSCION REGALIS	1932
Silver Hake	MERLUCCIUS BILINEARIS	686
Little Skate	LEUCORAJA ERINACEA	443
Black Sea Bass	CENTROPRISTIS STRIATA	358
Bluefish	POMATOMUS SALTATRIX	333
Northern Searobin	PRIONOTUS CAROLINUS	155
Winter Flounder	PLEURONECTES AMERICANUS	144
Summer Flounder	PARALICHTHYS DENTATUS	108
American Lobster	HOMARUS AMERICANUS	106
Striped Searobin	PRIONOTUS EVOLANS	105
Tautog	TAUTOGA ONITIS	83
American Shad	ALOSA SAPIDISSIMA	81
Spotted Hake	UROPHYCIS REGIA	74
Blueback Herring	ALOSA AESTIVALIS	73
Northern Kingfish	MENTICIRRHUS SAXATILIS	60
Atlantic Cod	GADUS MORHUA	55
Smooth Dogfish	MUSTELUS CANIS	47
Rough Scad	TRACHURUS LATHAMI	47
Fourspot Flounder	PARALICHTHYS OBLONGUS	43
Channeled Whelk	BUSYCOTYPUS CANALICULATUS	36
Red Hake	UROPHYCIS CHUSS	32
Windowpane Flounder	SCOPHTHALMUS AQUOSUS	27
Smallmouth Flounder	ETROPUS MICROSTOMUS	19
Knobbed Whelk	BUSYCON CARICA	19
Blue Crab	CALLINECTES SAPIDUS	18
Horseshoe Crab	LIMULUS POLYPHEMUS	13
Winter Skate	LEUCORAJA OCELLATA	12
Inshore Lizardfish	SYNODUS FOETENS	12
Cunner	TAUTOGOLABRUS ADSPERSUS	10

White Hake	UROPHYCIS TENUIS	6
Crevalle Jack	CARANX HIPPOS	6
Mantis Shrimp	SQUILLA EMPUSA	6
Clearnose Skate	RAJA EGLANTERIA	4
Rainbow Smelt	OSMERUS MORDAX	4
Haddock	MELANOGRAMMUS AEGLEFINUS	4
Bigeye	PRIACANTHUS ARENATUS	4
Longhorn Sculpin	OCTODECEMSPINOS	4
Shortfin Squid	ILLEX ILLECEBROSUS	4
Atlantic Mackerel	SCOMBER SCOMBRUS	3
Striped Bass	MORONE SAXATILIS	3
Grubby	MYOXOCEPHALUS AENAEUS	3
Northern Puffer	SPHOEROIDES MACULATUS	3
Hickory Shad	ALOSA MEDIOCRIS	2
Hogchoker	TRINECTES MACULATUS	2
Spot	LEIOSTOMUS XANTHURUS	2
Dwarf Goatfish	UPENEUS PARVUS	2
Sea Lamprey	PETROMYZON MARINUS	1
Bullnose Ray	MYLIOBATIS FREMINVILLEI	1
Conger Eel	CONGER OCEANICUS	1
Pollock	POLLACHIUS VIRENS	1
Cusk	BROSME BROSME	1
American Sand Lance	AMMODYTES AMERICANUS	1
Planehead Filefish	MONACANTHUS HISPIDUS	1
Round Scad	DECAPTERUS PUNCTATUS	1
Atlantic Tomcod	MICROGADUS TOMCOD	1

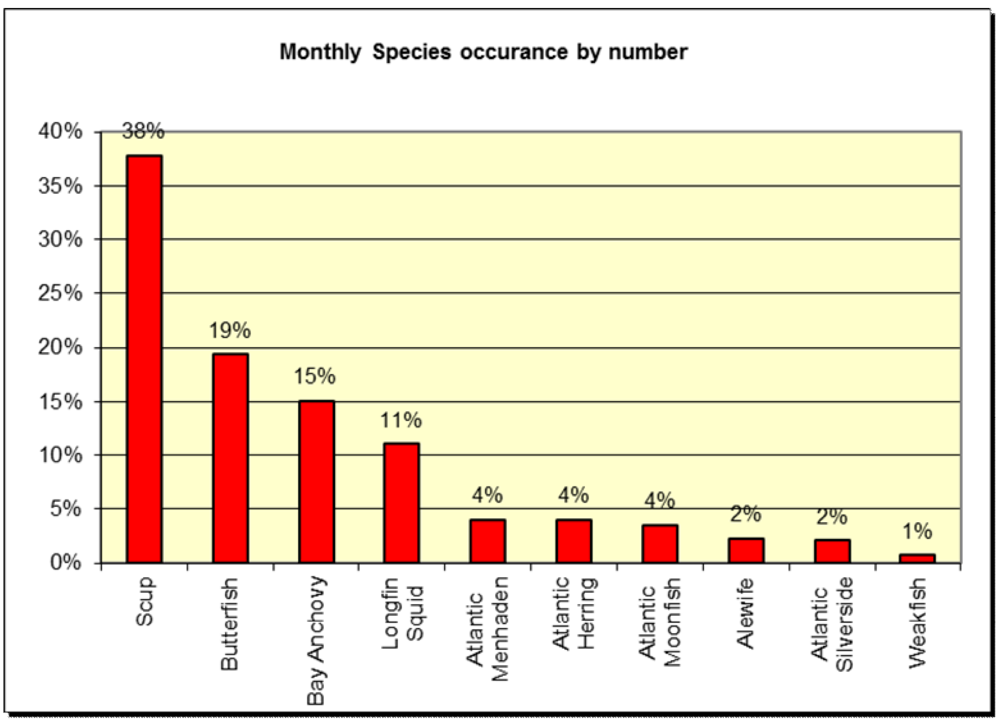
Figure 3 (Total Catch in Kilograms)

Fish Name	Scientific Name	Total Kg
Scup	STENOTOMUS CHRYSOPS	2588.725
Butterfish	PEPRILUS TRIACANTHUS	1075.507
Longfin Squid	LOLIGO PEALEI	499.911
Atlantic Herring	CLUPEA HARENGUS	317.804
Little Skate	LEUCORAJA ERINACEA	261.745
Black Sea Bass	CENTROPRISTIS STRIATA	161.895
Alewife	ALOSA PSEUDOHARENGUS	153.553
Tautog	TAUTOGA ONITIS	110.965
Bay Anchovy	ANCHOA MITCHILLI	107.9885
Summer Flounder	PARALICHTHYS DENTATUS	95.8
Smooth Dogfish	MUSTELUS CANIS	45.44
Weakfish	CYNOSCION REGALIS	40.57
Atlantic Moonfish	SELENE SETAPINNIS	40.223
Striped Searobin	PRIONOTUS EVOLANS	39.43
Atlantic Menhaden	BREVOORTIA TYRANNUS	38.8675
American Lobster	HOMARUS AMERICANUS	37.87
Winter Flounder	PLEURONECTES AMERICANUS	35

Horseshoe Crab	LIMULUS POLYPHEMUS	25.93
Bluefish	POMATOMUS SALTATRIX	25.195
Northern Searobin	PRIONOTUS CAROLINUS	23.805
Atlantic Silverside	MENIDIA MENIDIA	20.293
Silver Hake	MERLUCCIUS BILINEARIS	14.757
Winter Skate	LEUCORAJA OCELLATA	14.175
Clearnose Skate	RAJA EGLANTERIA	9.44
Striped Bass	MORONE SAXATILIS	8.6
Fourspot Flounder	PARALICHTHYS OBLONGUS	8.235
Windowpane Flounder	SCOPHTHALMUS AQUOSUS	6.5585
Channeled Whelk	BUSYCOTYPUS CANALICULATUS	6.145
Northern Kingfish	MENTICIRRHUS SAXATILIS	4.84
Spotted Hake	UROPHYCIS REGIA	4.075
Knobbed Whelk	BUSYCON CARICA	3.89
Blue Crab	CALLINECTES SAPIDUS	3.81
Red Hake	UROPHYCIS CHUSS	2.48
Longhorn Sculpin	OCTODECEMSPINOS	2.06
American Shad	ALOSA SAPIDISSIMA	1.122
Rough Scad	TRACHURUS LATHAMI	0.88
Bullnose Ray	MYLIOBATIS FREMINVILLEI	0.66
Hickory Shad	ALOSA MEDIOCRIS	0.64
Cunner	TAUTOGOLABRUS ADSPERSUS	0.603
Inshore Lizardfish	SYNODUS FOETENS	0.51
Haddock	MELANOGRAMMUS AEGLEFINUS	0.47
Atlantic Mackerel	SCOMBER SCOMBRUS	0.41
Smallmouth Flounder	ETROPUS MICROSTOMUS	0.375
Blueback Herring	ALOSA AESTIVALIS	0.371
Crevalle Jack	CARANX HIPPOS	0.34
Mantis Shrimp	SQUILLA EMPUSA	0.133
Hogchoker	TRINECTES MACULATUS	0.125
Spot	LEIOSTOMUS XANTHURUS	0.12
Atlantic Tomcod	MICROGADUS TOMCOD	0.09
Bigeye	PRIACANTHUS ARENATUS	0.07
Dwarf Goatfish	UPENEUS PARVUS	0.06
Northern Puffer	SPHOEROIDES MACULATUS	0.06
Shortfin Squid	ILLEX ILLECEBROSUS	0.035
Planehead Filefish	MONACANTHUS HISPIDUS	0.03
Conger Eel	CONGER OCEANICUS	0.025
Rainbow Smelt	OSMERUS MORDAX	0.025
Grubby	MYOXOCEPHALUS AENAEUS	0.025
White Hake	UROPHYCIS TENUIS	0.02
Atlantic Cod	GADUS MORHUA	0.01425
Sea Lamprey	PETROMYZON MARINUS	0.01
Cusk	BROSME BROSME	0.01
American Sand Lance	AMMODYTES AMERICANUS	0.005
Round Scad	DECAPTERUS PUNCTATUS	0.005
Pollock	POLLACHIUS VIRENS	0.00025

Figure 4 Monthly Survey Top Ten Species Catch in Number

Fish Name	Scientific Name	%
Scup	STENOTOMUS CHRYSOPS	38%
Butterfish	PEPRILUS TRIACANTHUS	19%
Bay Anchovy	ANCHOA MITCHILLI	15%
Longfin Squid	LOLIGO PEALEI	11%
Atlantic Menhaden	BREVOORTIA TYRANNUS	4%
Atlantic Herring	CLUPEA HARENGUS	4%
Atlantic Moonfish	SELENE SETAPINNIS	4%
Alewife	ALOSA PSEUDOHARENGUS	2%
Atlantic Silverside	MENIDIA MENIDIA	2%
Weakfish	CYNOSCION REGALIS	1%



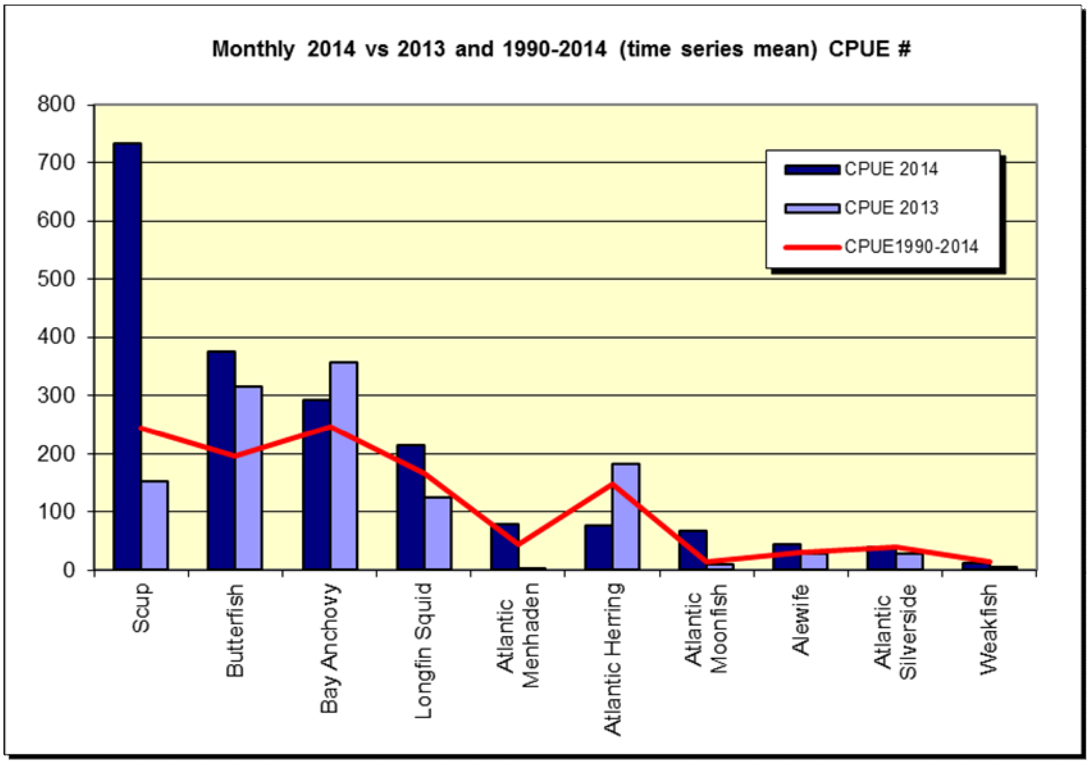
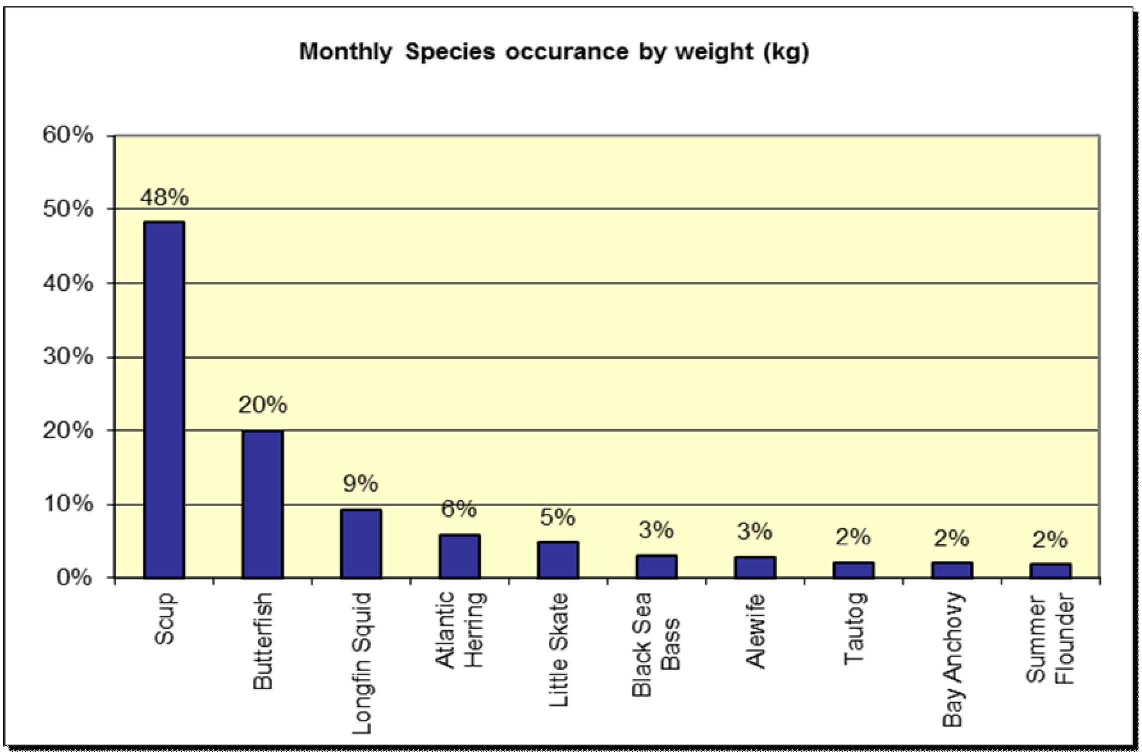
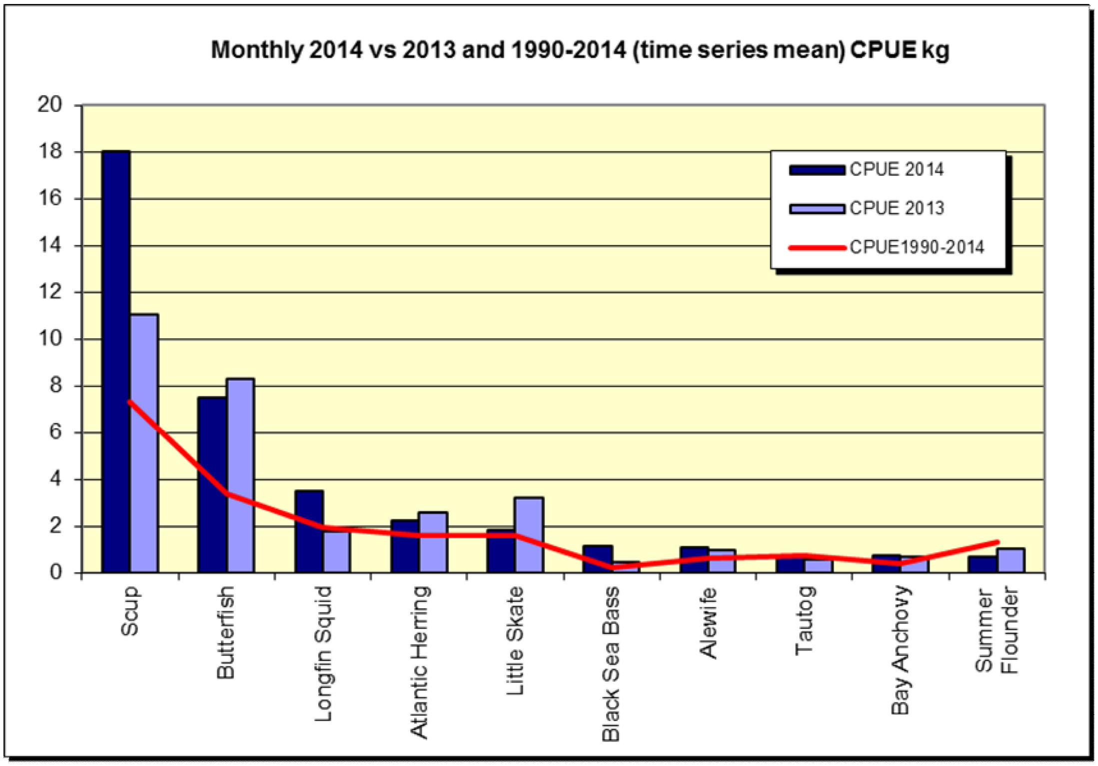

Monthly 2014 vs 2013 and 1990-2014 (time series mean) CPUE #
800
700
600
500
400
300
200
100
0
CPUE 2014
CPUE 2013
CPUE1990-2014
Scup
Butterfish
Bay Anchovy
Longfin Squid
Atlantic Menhaden
Atlantic Herring
Atlantic Moonfish
Alewife
Atlantic Silverside
Weakfish

Figure 5 Top Ten Species Catch in Kilograms

Fish Name	Scientific Name	%
Scup	STENOTOMUS CHRYSOPS	48%
Butterfish	PEPRILUS TRIACANTHUS	20%
Longfin Squid	LOLIGO PEALEI	9%
Atlantic Herring	CLUPEA HARENGUS	6%
Little Skate	LEUCORAJA ERINACEA	5%
Black Sea Bass	CENTROPRISTIS STRIATA	3%
Alewife	ALOSA PSEUDOHARENGUS	3%
Tautog	TAUTOGA ONITIS	2%
Bay Anchovy	ANCHOA MITCHILLI	2%
Summer Flounder	PARALICHTHYS DENTATUS	2%

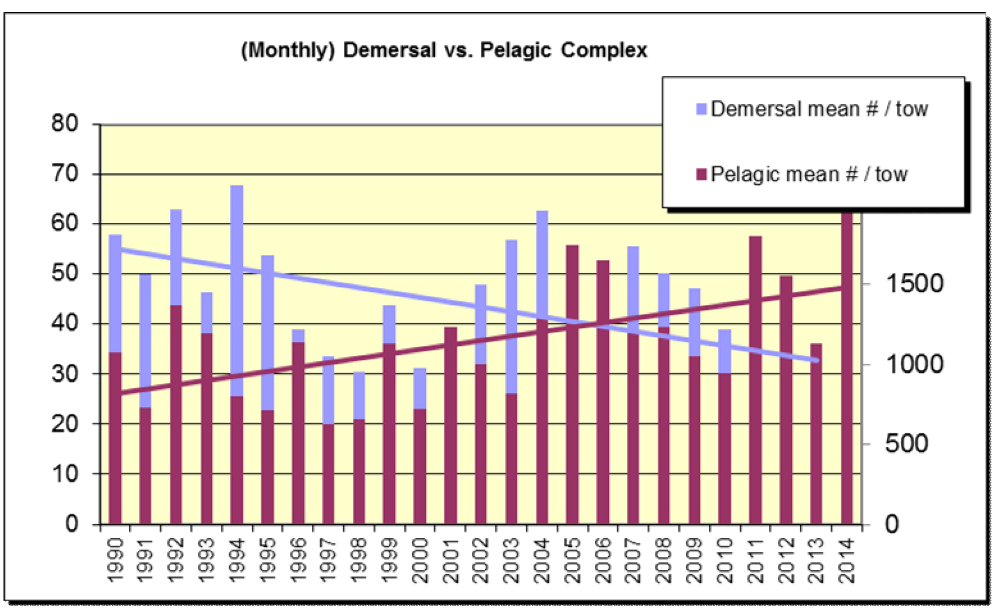


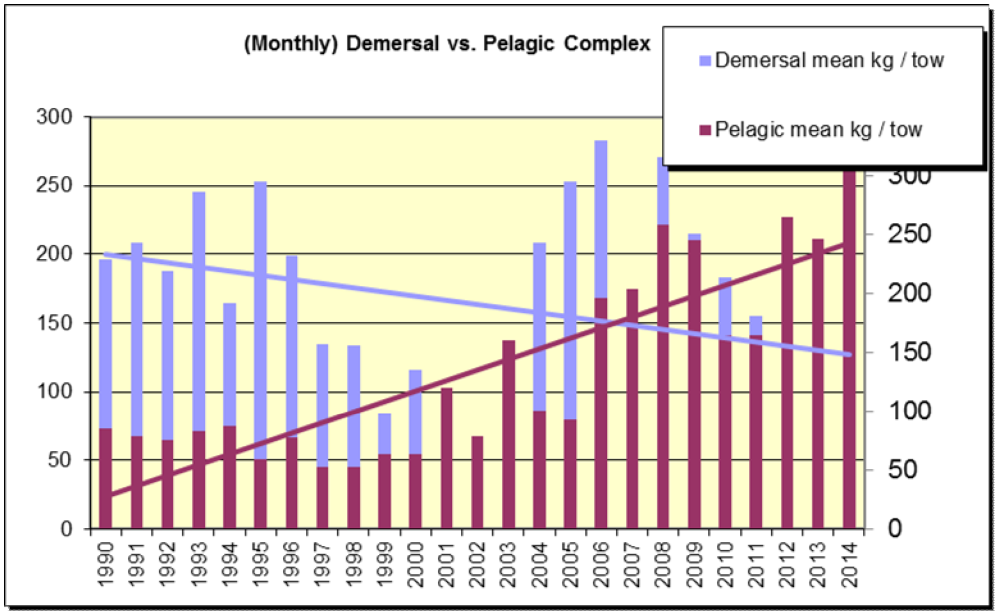

Monthly 2014 vs 2013 and 1990-2014 (time series mean) CPUE kg
20
18
16
14
12
10
8
6
4
2
0
CPUE 2014
CPUE 2013
CPUE1990-2014
Scup
Butterfish
Longfin Squid
Atlantic Herring
Little Skate
Black Sea Bass
Alewife
Tautog
Bay Anchovy
Summer Flounder

Demersal vs. Pelagic Species Complex

Demersal Species	**Pelagic/Multi-Habitat Species**
Cunner	Alewife
Four Spot Flounder	Atlantic Herring
Goosefish	Atlantic Moonfish
Hog Choker	Bay Anchovy
Lobster	Black Sea Bass
Longhorn Sculpin	Blueback Herring
Northern Searobin	Bluefish
Ocean Pout	Butterfish
Red Hake	Longfin Squid
Sea Raven	Menhaden
Silver Hake	Rainbow Smelt
Skates	Scup
Smooth Dogfish	Shad
Spiny Dogfish	Silverside
Spotted Hake	Striped Bass
Striped Searobin	Weakfish
Summer Flounder	
Tautog	
Windowpane Flounder	
Winter Flounder	

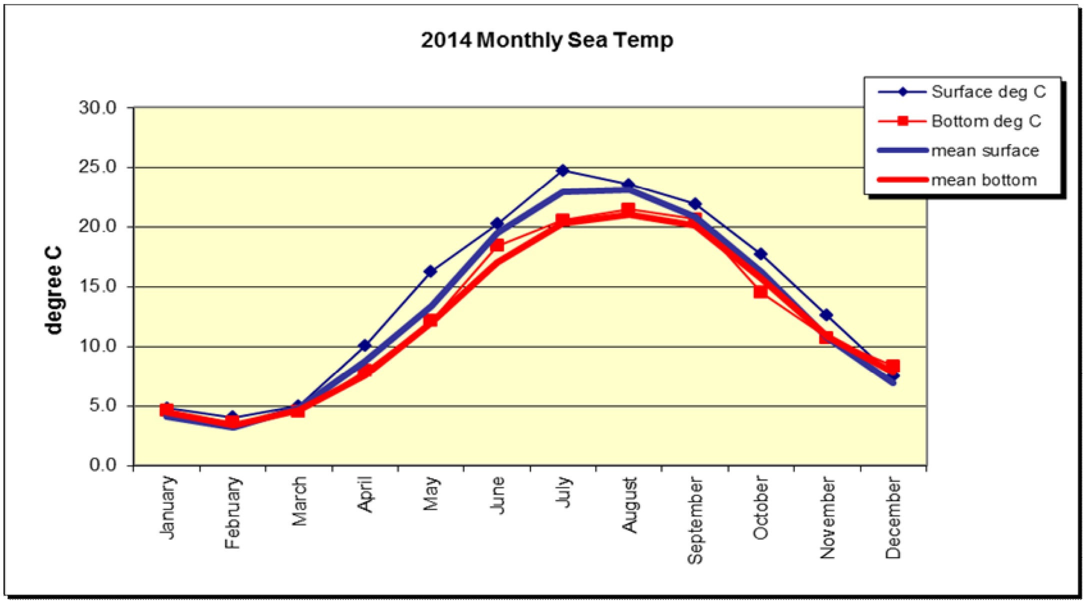
Figure 6 and 7

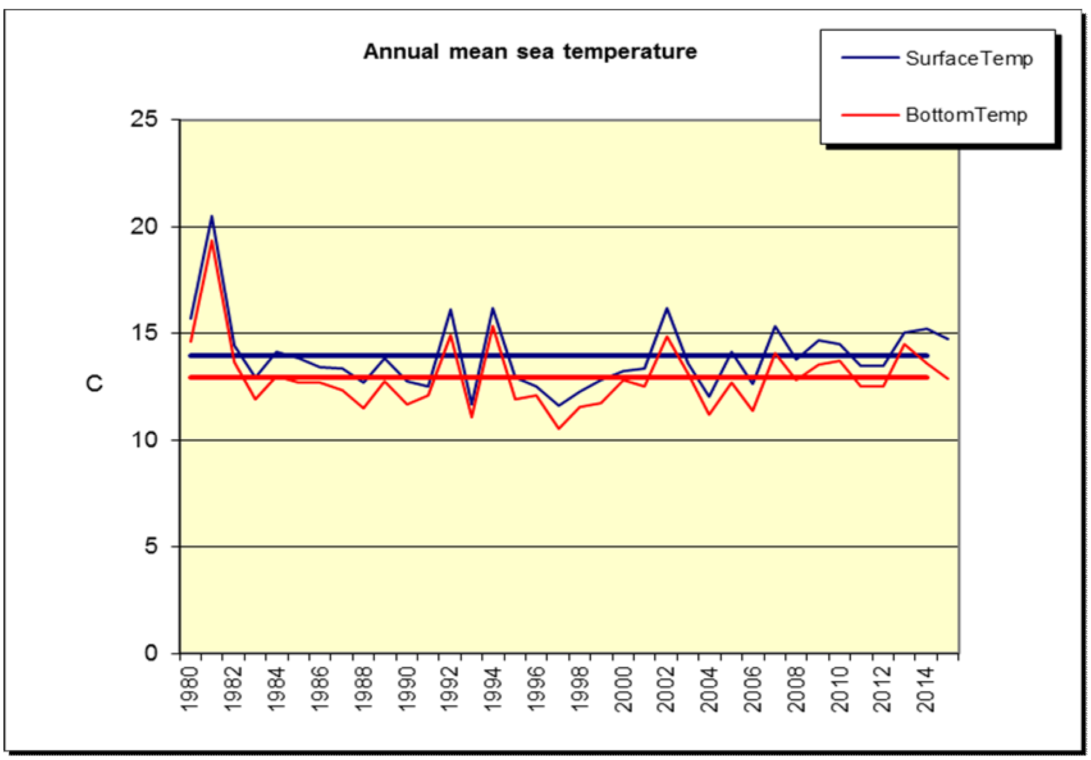



(Monthly) Demersal vs. Pelagic Complex
Demersal mean kg / tow
Pelagic mean kg / tow
300
250
200
150
100
50
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014

Survey Temperature Profile   (Annual mean surface and bottom temperature)

Surface and bottom temperatures are collected at every station. The bottom temperature is collected by Niskin bottle at the average or maximum depth for each station.





Results: Job 2. The Seasonal Coastal Trawl Survey is defined by 12 fixed stations in Narragansett Bay, 14 random stations in Narragansett Bay, 6 fixed stations in Rhode Island Sound, 12 fixed stations in Block Island Sound.
67 species were observed and recorded during the 2014 Rhode Island Seasonal Trawl Survey, totaling 345362 individuals or 3924.5 fish per tow. In weight, the catch accounted for 4888.4 kg. or 55.5 kg. per tow. (Figures 8 and 9) The top ten species by number and catch are represented in figures 10 and 11. The change between demersal and pelagic species is represented in figures 12 and 13.

Figure 8 (Total Catch in Number)

Fish Name	Scientific Name	Total Number
Scup	STENOTOMUS CHRYSOPS	194236
Butterfish	PEPRILUS TRIACANTHUS	58766
Longfin Squid	LOLIGO PEALEI	35587
Bay Anchovy	ANCHOA MITCHILLI	21396
Atlantic Menhaden	BREVOORTIA TYRANNUS	14747
Atlantic Moonfish	SELENE SETAPINNIS	11292
Bluefish	POMATOMUS SALTATRIX	3089
Weakfish	CYNOSCION REGALIS	2256
Alewife	ALOSA PSEUDOHARENGUS	1419
Little Skate	LEUCORAJA ERINACEA	728
Atlantic Cod	GADUS MORHUA	387
Winter Flounder	PLEURONECTES AMERICANUS	212
Black Sea Bass	CENTROPRISTIS STRIATA	175
Summer Flounder	PARALICHTHYS DENTATUS	117
Winter Skate	LEUCORAJA OCELLATA	115
Atlantic Silverside	MENIDIA MENIDIA	99
Atlantic Herring	CLUPEA HARENGUS	89
Northern Kingfish	MENTICIRRHUS SAXATILIS	81
Longhorn Sculpin	MYOXOCEPHALUS OCTODECEMSPINOS	81
Smooth Dogfish	MUSTELUS CANIS	51
Windowpane Flounder	SCOPHTHALMUS AQUOSUS	31
American Shad	ALOSA SAPIDISSIMA	29
Ocean Pout	MACROZOARCES AMERICANUS	29
Northern Searobin	PRIONOTUS CAROLINUS	28
Sea Scallop	PLACOPECTEN MAGELLANICUS	24
Blueback Herring	ALOSA AESTIVALIS	23
Inshore Lizardfish	SYNODUS FOETENS	22
Spotted Hake	UROPHYCIS REGIA	19
Striped Searobin	PRIONOTUS EVOLANS	19
American Lobster	HOMARUS AMERICANUS	19
Tautog	TAUTOGA ONITIS	18
Northern Puffer	SPHOEROIDES MACULATUS	18
Round Scad	DECAPTERUS PUNCTATUS	18
Horseshoe Crab	LIMULUS POLYPHEMUS	18
Red Hake	UROPHYCIS CHUSS	14

Fourspot Flounder	PARALICHTHYS OBLONGUS	10
Smallmouth Flounder	ETROPUS MICROSTOMUS	10
Rough Scad	TRACHURUS LATHAMI	9
Crevalle Jack	CARANX HIPPOS	9
Blue Crab	CALLINECTES SAPIDUS	9
Silver Hake	MERLUCCIUS BILINEARIS	6
Channeled Whelk	BUSYCOTYPUS CANALICULATUS	6
Yellowtail Flounder	PLEURONECTES FERRUGINEUS	5
Knobbed Whelk	BUSYCON CARICA	5
Clearnose Skate	RAJA EGLANTERIA	4
Bigeye	PRIACANTHUS ARENATUS	4
Atlantic Mackerel	SCOMBER SCOMBRUS	3
Grubby	MYOXOCEPHALUS AENAEUS	3
Dwarf Goatfish	UPENEUS PARVUS	3
Mantis Shrimp	SQUILLA EMPUSA	3
Haddock	MELANOGRAMMUS AEGLEFINUS	2
Pollock	POLLACHIUS VIRENS	2
Northern Pipefish	SYNGNATHUS FUSCUS	2
Striped Bass	MORONE SAXATILIS	2
Cunner	TAUTOGOLABRUS ADSPERSUS	2
Sea Lamprey	PETROMYZON MARINUS	1
Barndoor Skate	DIPTURIS LAEVIS	1
Hickory Shad	ALOSA MEDIOCRIS	1
Conger Eel	CONGER OCEANICUS	1
Cusk	BROSME BROSME	1
Witch Flounder	GLYPTOCEPHALUS CYNOGLOSSUS	1
Hogchoker	TRINECTES MACULATUS	1
Atlantic Bonito	SARDA SARDA	1
American Sand Lance	AMMODYTES AMERICANUS	1
Goosefish	LOPHIUS AMERICANUS	1
Planehead Filefish	MONACANTHUS HISPIDUS	1
Atlantic Sturgeon	ACIPENSER OXYRHYNCHUS	0

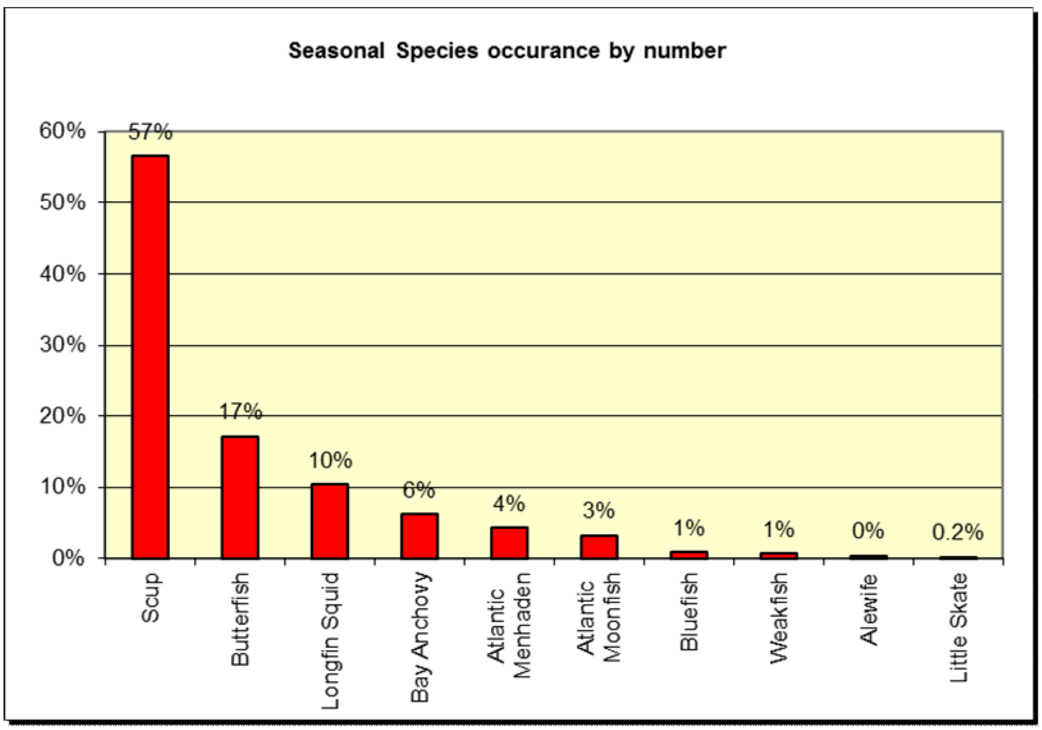
Figure 9 (Total Catch in Kilograms)

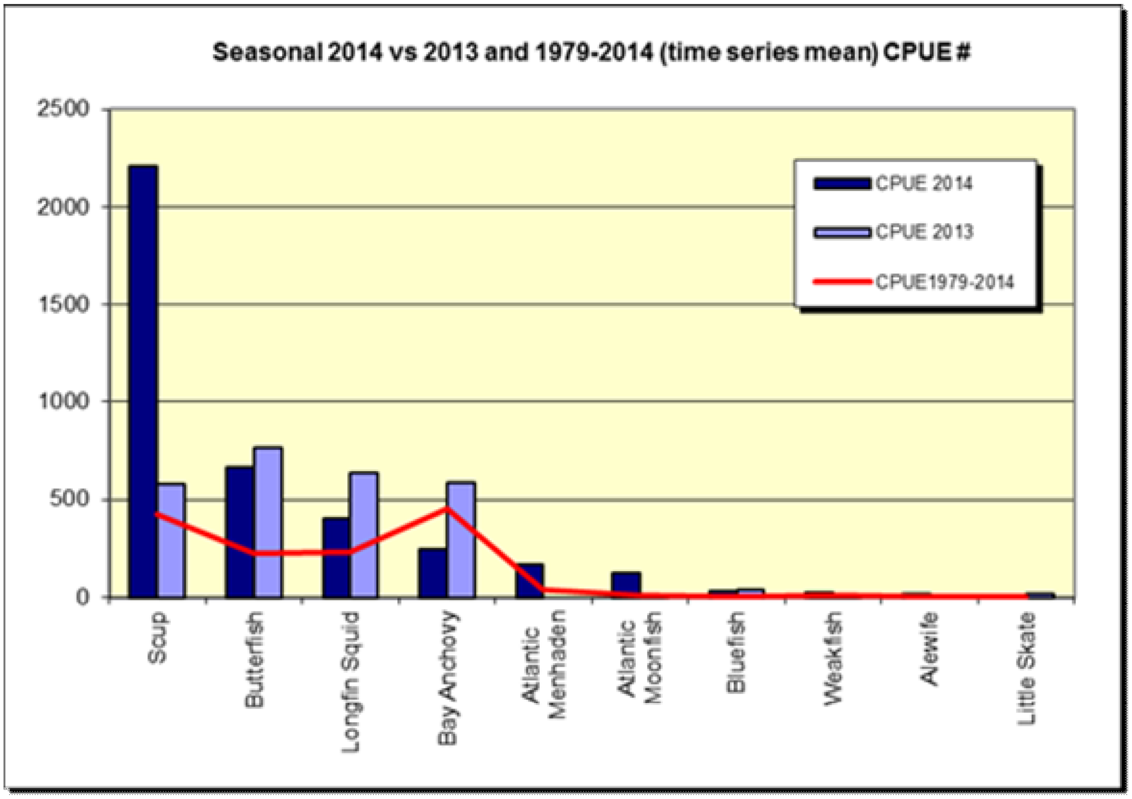
Fish Name	Scientific Name	Total Kg
Scup	STENOTOMUS CHRYSOPS	1758.41
Butterfish	PEPRILUS TRIACANTHUS	1040.435
Longfin Squid	LOLIGO PEALEI	796.961
Little Skate	LEUCORAJA ERINACEA	402.655
Winter Skate	LEUCORAJA OCELLATA	105.62
Bluefish	POMATOMUS SALTATRIX	101.205
Summer Flounder	PARALICHTHYS DENTATUS	96.32
Winter Flounder	PLEURONECTES AMERICANUS	82.505
Black Sea Bass	CENTROPRISTIS STRIATA	76.4
Smooth Dogfish	MUSTELUS CANIS	48.795
Atlantic Menhaden	BREVOORTIA TYRANNUS	44.681
Weakfish	CYNOSCION REGALIS	44.465
Atlantic Moonfish	SELENE SETAPINNIS	42.2605
Alewife	ALOSA PSEUDOHARENGUS	33.825
Horseshoe Crab	LIMULUS POLYPHEMUS	33.59
Longhorn Sculpin	MYOXOCEPHALUS OCTODECEMSPINOS	32.245
Bay Anchovy	ANCHOA MITCHILLI	31.724
Ocean Pout	MACROZOARCES AMERICANUS	29.34
Tautog	TAUTOGA ONITIS	16.745
Clearnose Skate	RAJA EGLANTERIA	8.595
Windowpane Flounder	SCOPHTHALMUS AQUOSUS	8.3385
Striped Searobin	PRIONOTUS EVOLANS	8.32
American Lobster	HOMARUS AMERICANUS	7.81
Northern Kingfish	MENTICIRRHUS SAXATILIS	5.875
Northern Searobin	PRIONOTUS CAROLINUS	3.72
Fourspot Flounder	PARALICHTHYS OBLONGUS	2.21
Atlantic Bonito	SARDA SARDA	2.2
Atlantic Herring	CLUPEA HARENGUS	2.178
Spotted Hake	UROPHYCIS REGIA	2.033
Striped Bass	MORONE SAXATILIS	1.875
Conger Eel	CONGER OCEANICUS	1.68
Yellowtail Flounder	PLEURONECTES FERRUGINEUS	1.68
Blue Crab	CALLINECTES SAPIDUS	1.58
Knobbed Whelk	BUSYCON CARICA	1.445
Red Hake	UROPHYCIS CHUSS	1.38
Sea Scallop	PLACOPECTEN MAGELLANICUS	1.345
Channeled Whelk	BUSYCOTYPUS CANALICULATUS	1.105
Inshore Lizardfish	SYNODUS FOETENS	0.84
American Shad	ALOSA SAPIDISSIMA	0.805
Northern Puffer	SPHOEROIDES MACULATUS	0.695
Goosefish	LOPHIUS AMERICANUS	0.62
Atlantic Silverside	MENIDIA MENIDIA	0.485
Hickory Shad	ALOSA MEDIOCRIS	0.43
Crevalle Jack	CARANX HIPPOS	0.415

Rough Scad	TRACHURUS LATHAMI	0.335
Barndoor Skate	DIPTURIS LAEVIS	0.325
Round Scad	DECAPTERUS PUNCTATUS	0.29
Witch Flounder	GLYPTOCEPHALUS CYNOGLOSSUS	0.255
Mantis Shrimp	SQUILLA EMPUSA	0.185
Atlantic Mackerel	SCOMBER SCOMBRUS	0.17
Smallmouth Flounder	ETROPUS MICROSTOMUS	0.152
Haddock	MELANOGRAMMUS AEGLEFINUS	0.14
Atlantic Cod	GADUS MORHUA	0.12775
Blueback Herring	ALOSA AESTIVALIS	0.126
Cunner	TAUTOGOLABRUS ADSPERSUS	0.085
Dwarf Goatfish	UPENEUS PARVUS	0.08
Hogchoker	TRINECTES MACULATUS	0.08
Bigeye	PRIACANTHUS ARENATUS	0.07
Silver Hake	MERLUCCIUS BILINEARIS	0.06
Planehead Filefish	MONACANTHUS HISPIDUS	0.055
Sea Lamprey	PETROMYZON MARINUS	0.025
Grubby	MYOXOCEPHALUS AENAEUS	0.025
Northern Pipefish	SYNGNATHUS FUSCUS	0.02
Cusk	BROSME BROSME	0.01
Pollock	POLLACHIUS VIRENS	0.0005
American Sand Lance	AMMODYTES AMERICANUS	0.00025
Atlantic Sturgeon	ACIPENSER OXYRHYNCHUS	0

Figure 10 Top Ten Species Catch in Number

Fish Name	Scientific Name	%
Scup	STENOTOMUS CHRYSOPS	57%
Butterfish	PEPRILUS TRIACANTHUS	17%
Longfin Squid	LOLIGO PEALEI	10%
Bay Anchovy	ANCHOA MITCHILLI	6%
Atlantic Menhaden	BREVOORTIA TYRANNUS	4%
Atlantic Moonfish	SELENE SETAPINNIS	3%
Bluefish	POMATOMUS SALTATRIX	1%
Weakfish	CYNOSCION REGALIS	1%
Alewife	ALOSA PSEUDOHARENGUS	0%
Little Skate	LEUCORAJA ERINACEA	0.2%

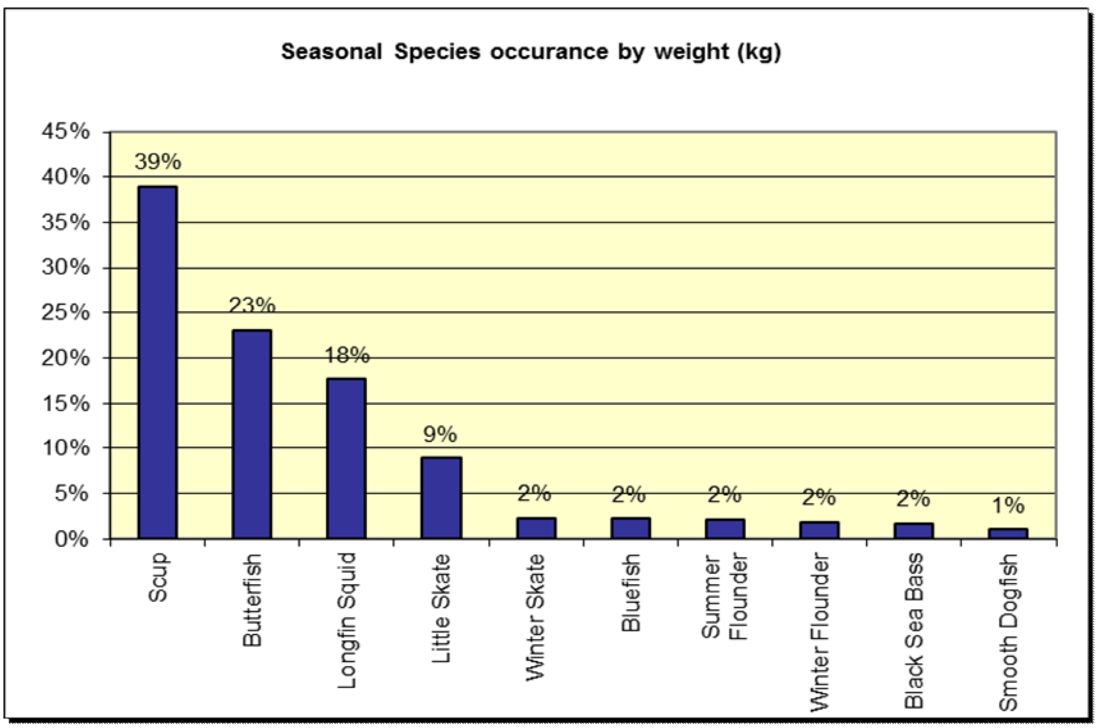


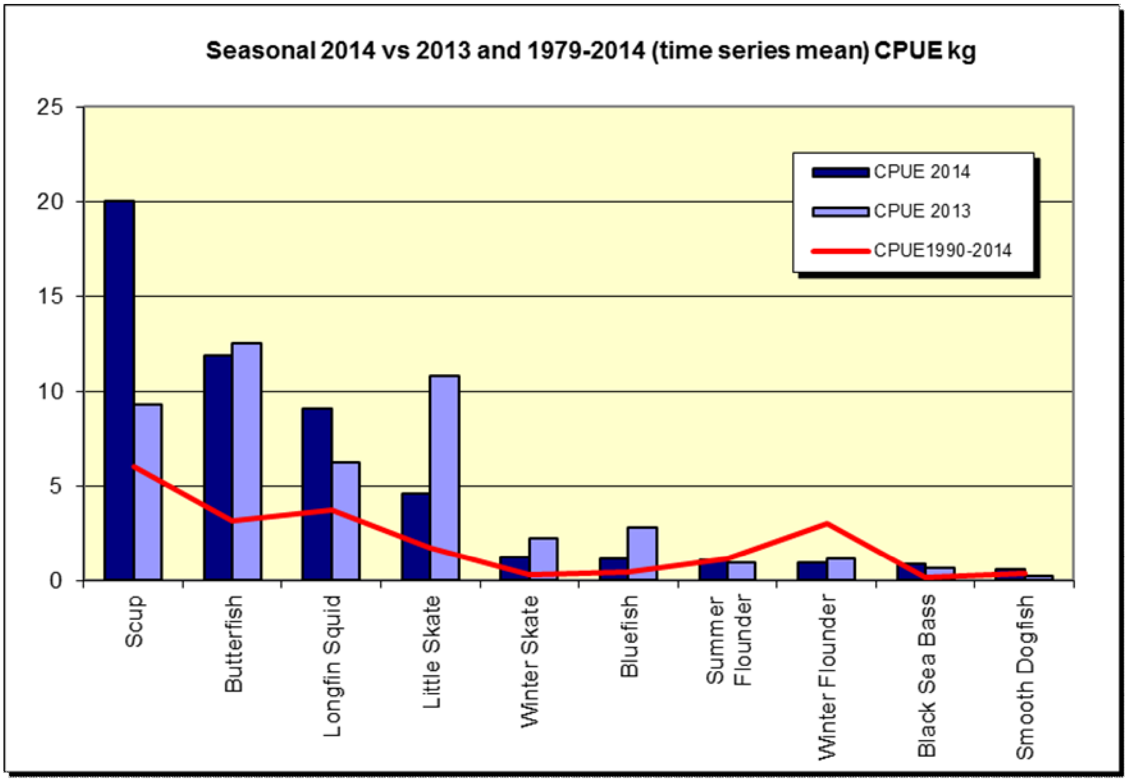


Seasonal 2014 vs 2013 and 1979-2014 (time series mean) CPUE #
2500
2000
1500
1000
500
0
CPUE 2014
CPUE 2013
CPUE1979-2014
Scup
Butterfish
Longfin Squid
Bay Anchovy
Atlantic Menhaden
Atlantic Moonfish
Bluefish
Weakfish
Alewife
Little Skate

Figure 11 Top Ten Species Catch in Kilograms

Fish Name	Scientific Name	%
Scup	STENOTOMUS CHRYSOPS	39%
Butterfish	PEPRILUS TRIACANTHUS	23%
Longfin Squid	LOLIGO PEALEI	18%
Little Skate	LEUCORAJA ERINACEA	9%
Winter Skate	LEUCORAJA OCELLATA	2%
Bluefish	POMATOMUS SALTATRIX	2%
Summer Flounder	PARALICHTHYS DENTATUS	2%
Winter Flounder	PLEURONECTES	2%
Black Sea Bass	CENTROPRISTIS STRIATA	2%
Smooth Dogfish	MUSTELUS CANIS	1%

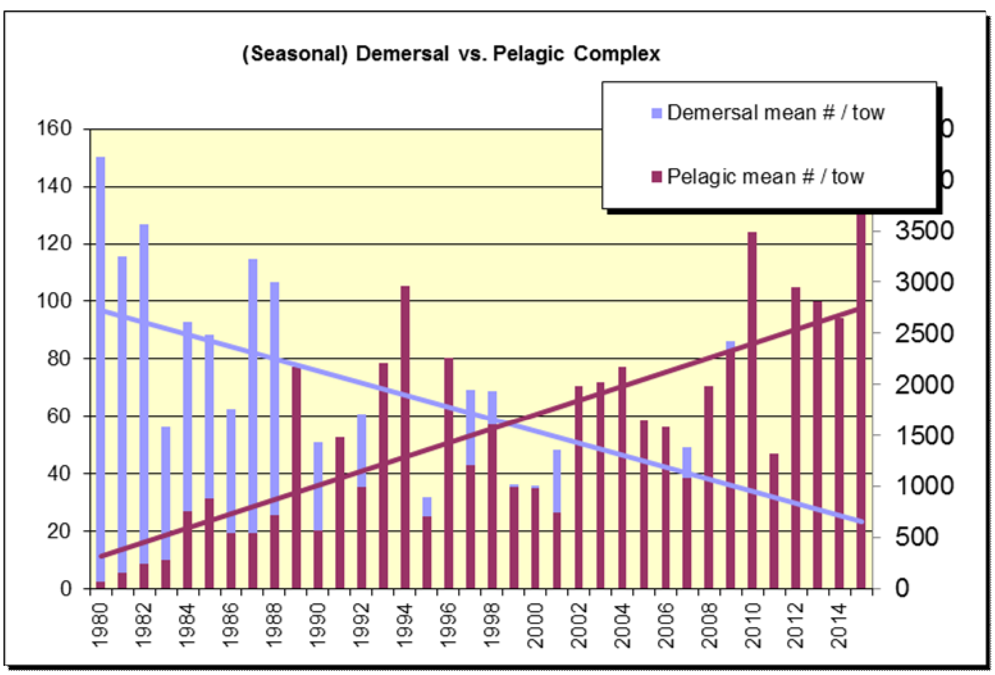


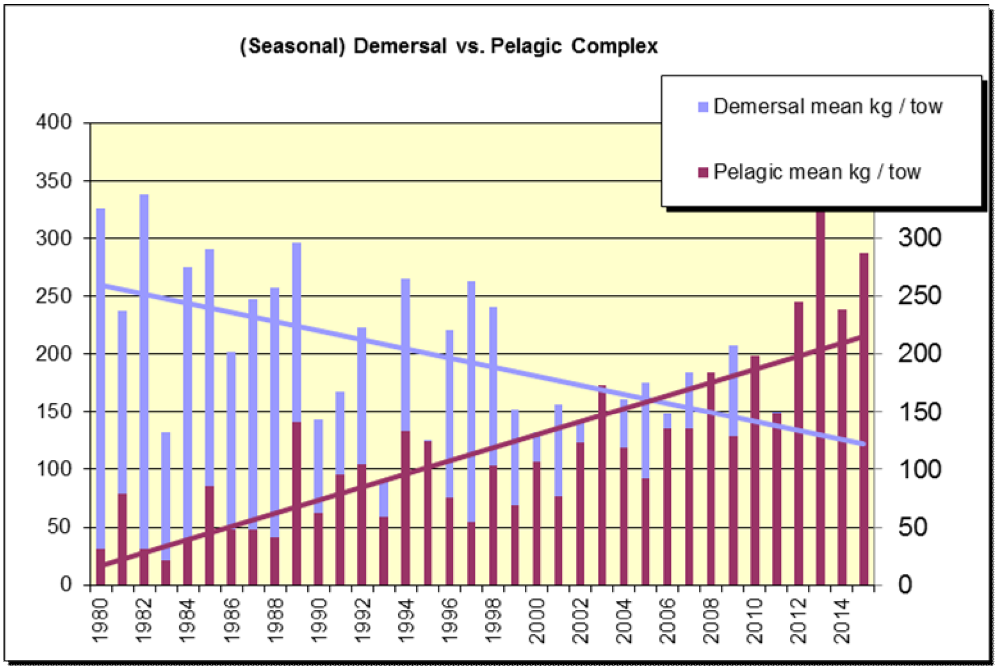

Seasonal 2014 vs 2013 and 1979-2014 (time series mean) CPUE kg
25
20
15
10
5
0
CPUE 2014
CPUE 2013
CPUE1990-2014
Scup
Butterfish
Longfin Squid
Little Skate
Winter Skate
Bluefish
Summer Flounder
Winter Flounder
Black Sea Bass
Smooth Dogfish

Demersal vs. Pelagic Species Complex

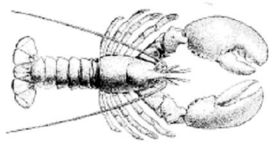
Demersal Species	**Pelagic/Multi-Habitat Species**
Cunner	Alewife
Four Spot Flounder	Atlantic Herring
Goosefish	Atlantic Moonfish
Hog Choker	Bay Anchovy
Lobster	Black Sea Bass
Longhorn Sculpin	Blueback Herring
Northern Searobin	Bluefish
Ocean Pout	Butterfish
Red Hake	Longfin Squid
Sea Raven	Menhaden
Silver Hake	Rainbow Smelt
Skates	Scup
Smooth Dogfish	Shad
Spiny Dogfish	Silverside
Spotted Hake	Striped Bass
Striped Searobin	Weakfish
Summer Flounder	
Tautog	
Windowpane Flounder	
Winter Flounder	

Figure 12 and 13



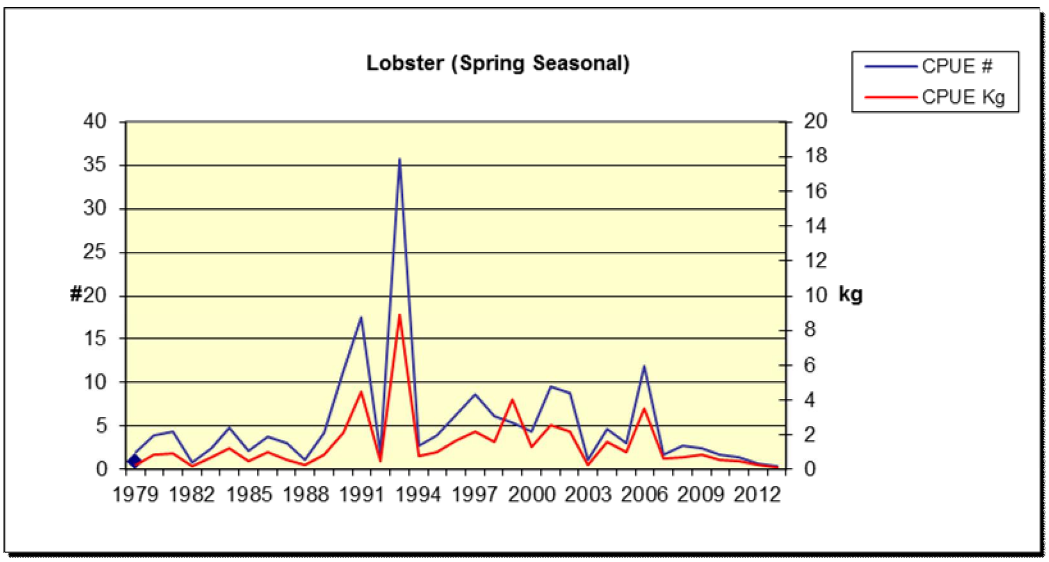

(Seasonal) Demersal vs. Pelagic Complex
Demersal mean kg / tow
Pelagic mean kg / tow
400
350
300
250
200
150
100
50
0
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

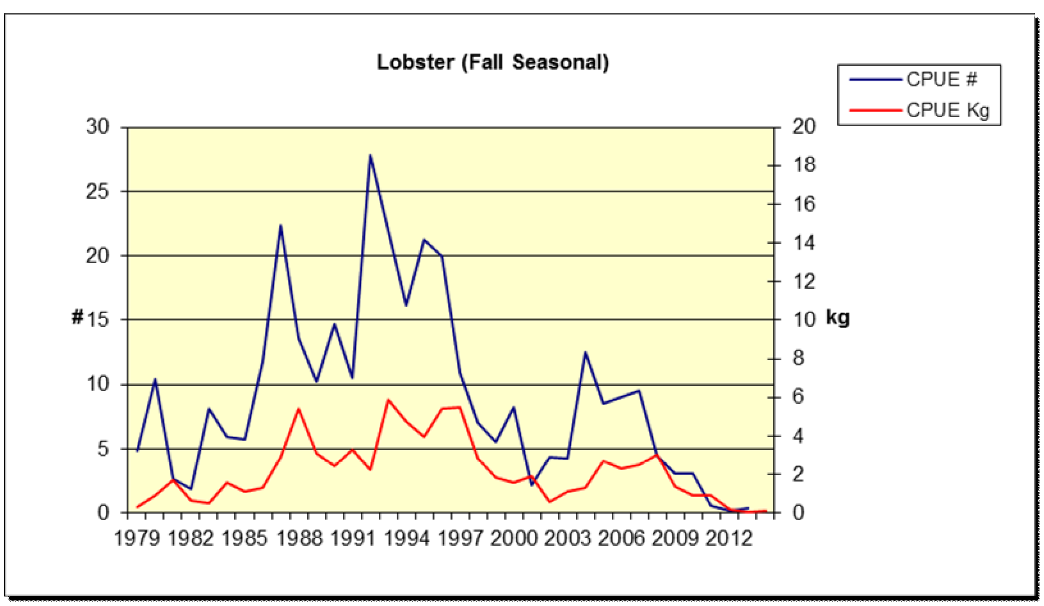
The following species represented are of high importance and are currently managed under fishery management plans through the Atlantic States Marine Fisheries Commission, New England Fishery Management Council, or the National Marine Fisheries Service. The seasonal portion of the Rhode Island Coastal Trawl Survey is an accurate indicator of relative abundance based on the biology and life history of a particular species. Values presented are expressed in either relative number or kilograms per tow. All data collected from both the Seasonal and Monthly Coastal Trawl Surveys are available upon request.



American Lobster ***Homarus americanus***

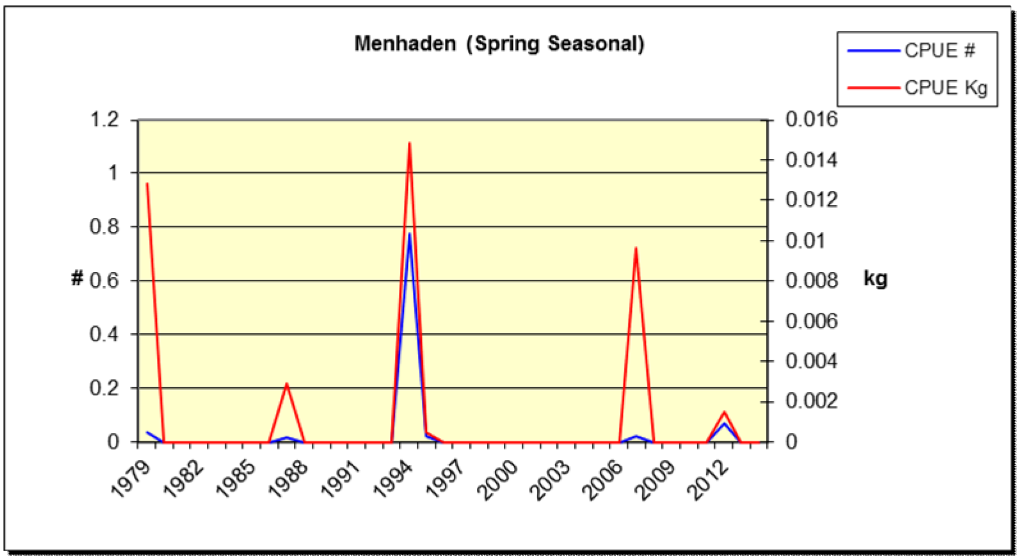
Stock Status: Southern New England Stock: overfished. Depleted Poor condition.
Management: ASMFC Amendment III, Addendum XXII

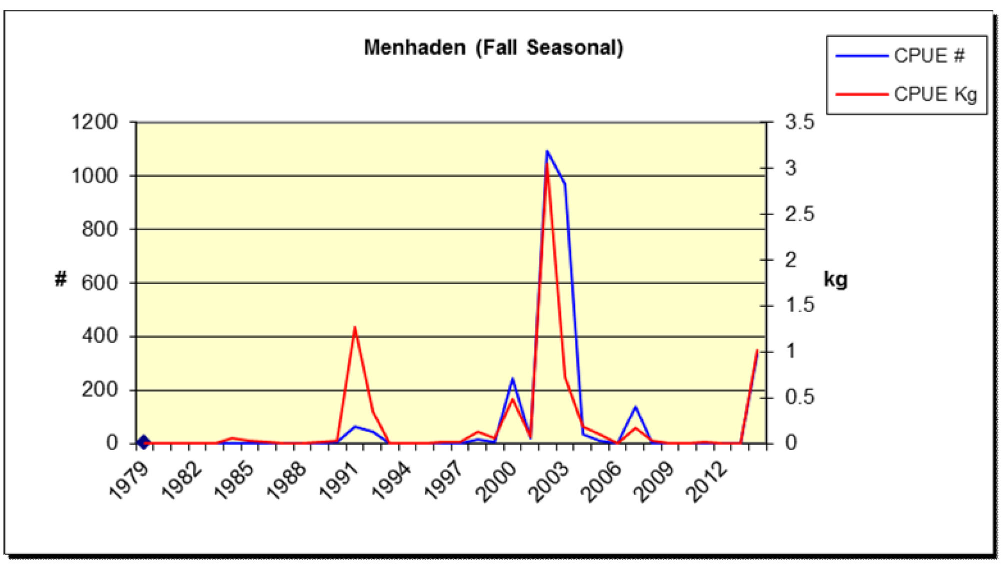




Atlantic Menhaden ***Brevoortia tyrannus***

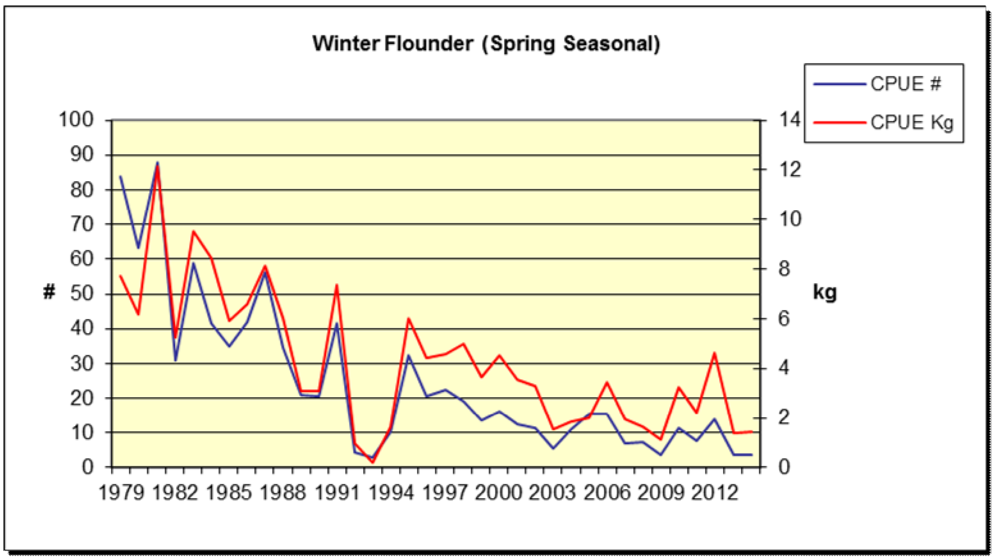
Stock Status: Not Overfished and overfishing is not occurring.
Management: ASMFC Amendment II

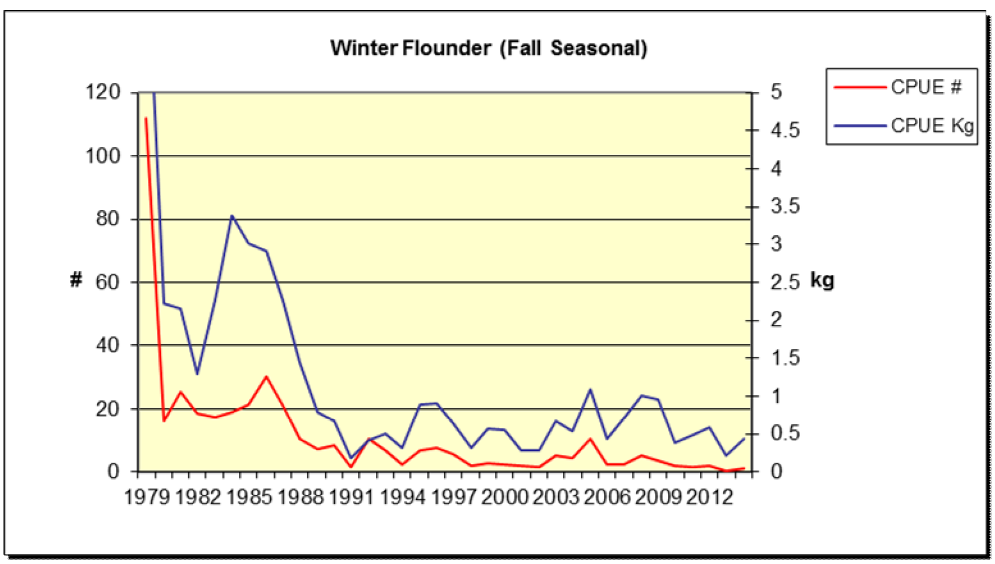




Winter Flounder ***Pleuronectes americanus***

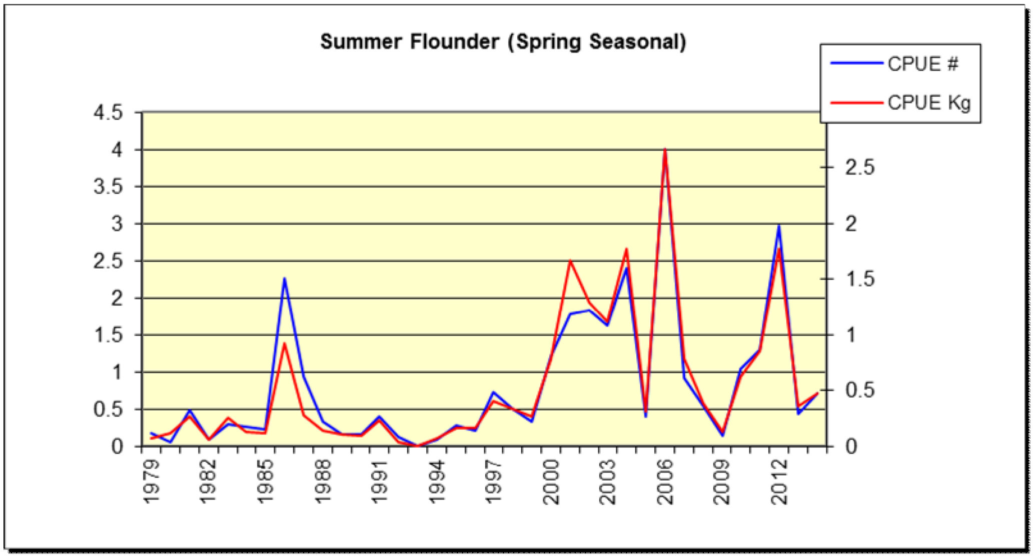
Stock Status: Overfished but overfishing is not occurring.
Management: ASMFC Amendment I, Addendum III

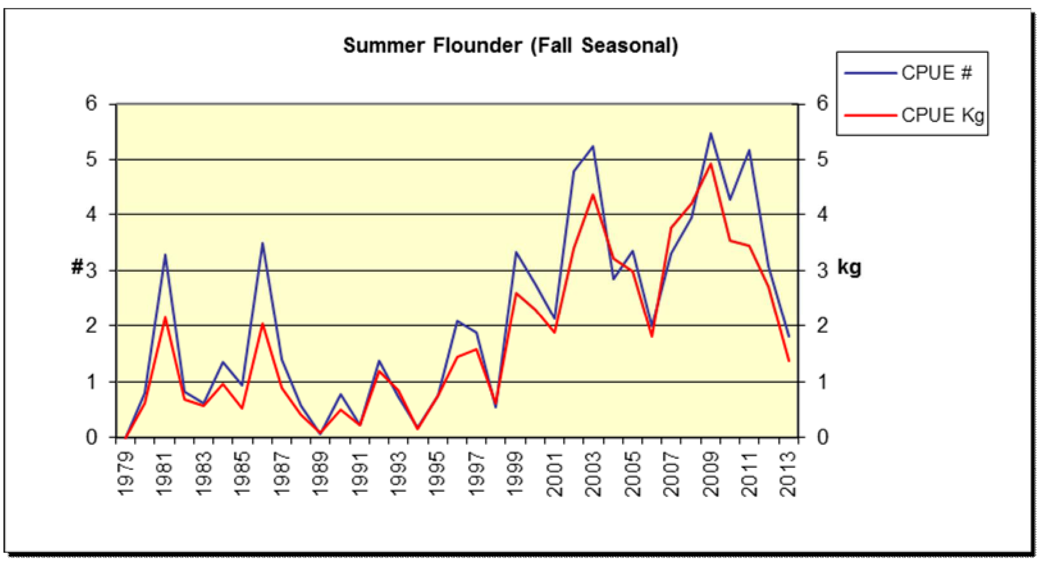


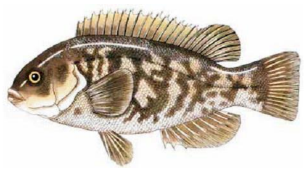


Summer Flounder ***Paralichthys dentatus***

Stock Status: Not overfished and overfishing is not occurring.
Management: ASMFC Amendment XV Addendum XXV

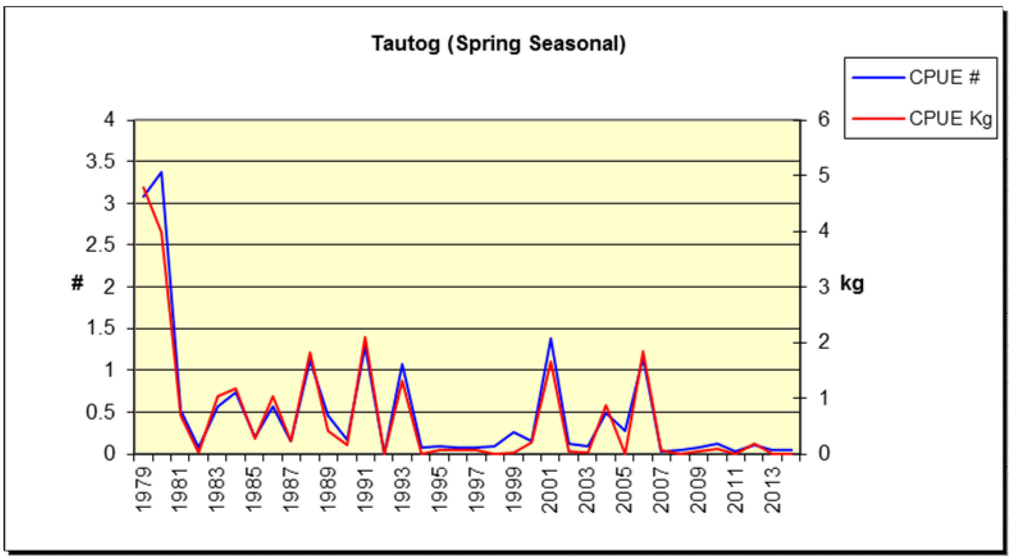


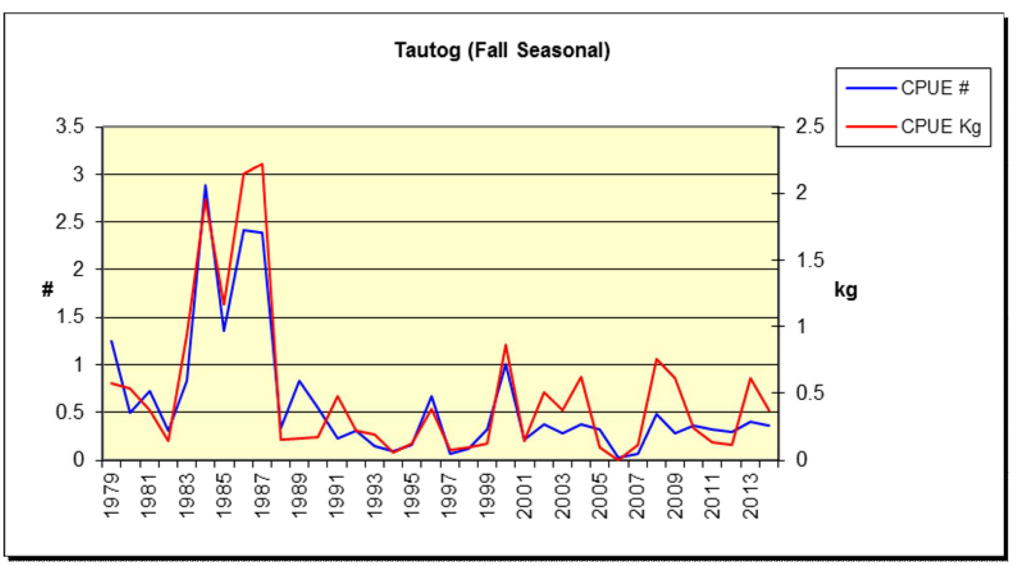


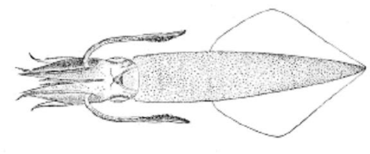


Tautog *Tautoga onitis*

Stock Status: Overfished and Overfishing is occurring based on Regional (Rhode Island and Massachusetts) Stock Assessment
Management: ASMFC Amendment I, Addendum V

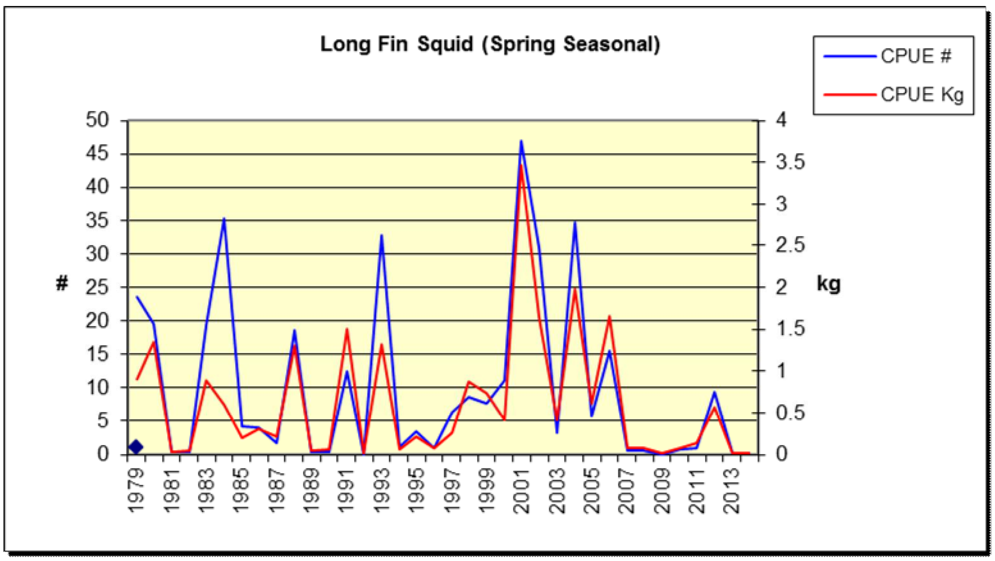


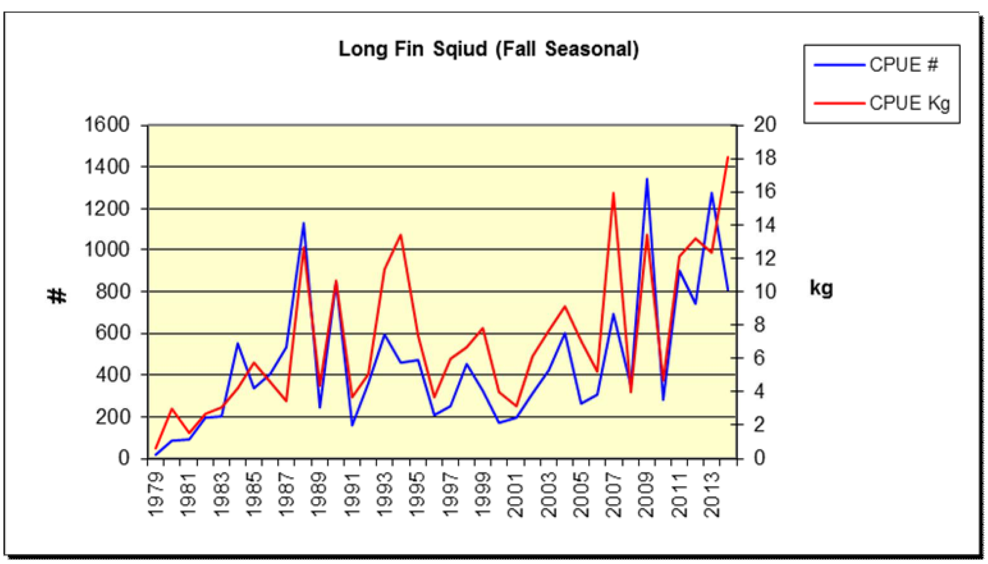




Longfin Squid ***Loligo pealei***

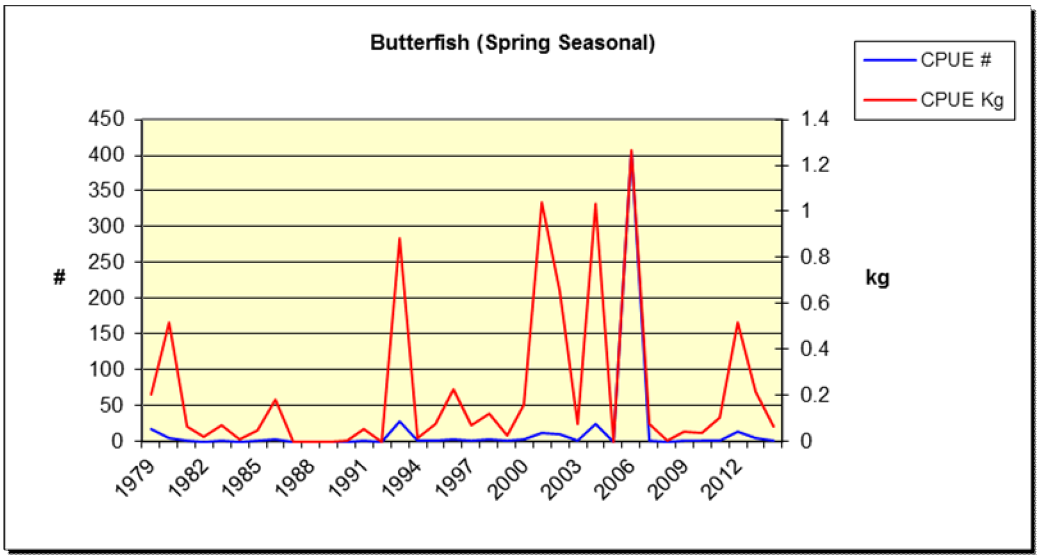
Stock Status: Overfishing undetermined not overfished
Management: NMFS, MAFMC, Atlantic Mackerel, Squid Butterfish FMP

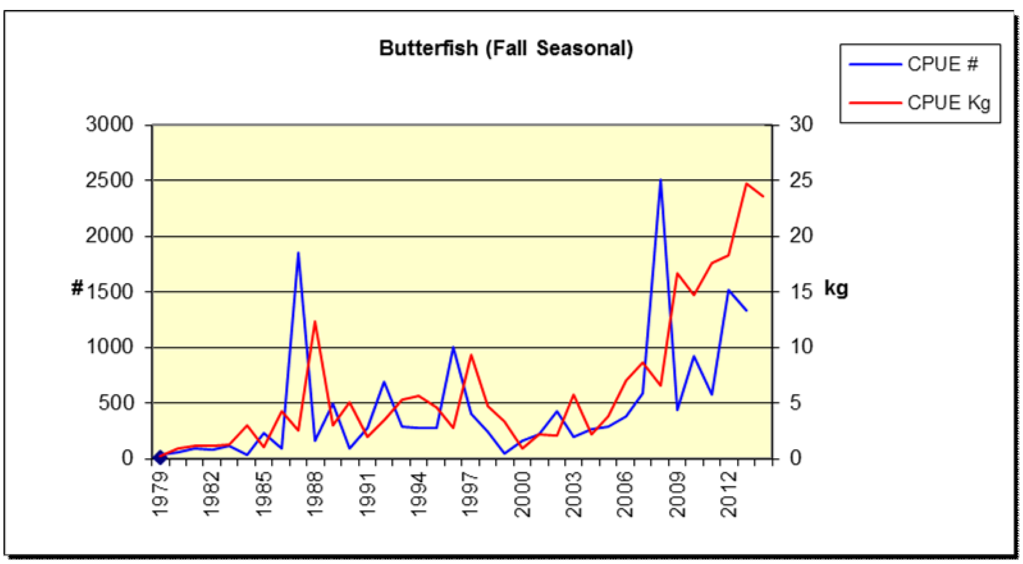




Butterfish ***Peprlilus triacanthus***

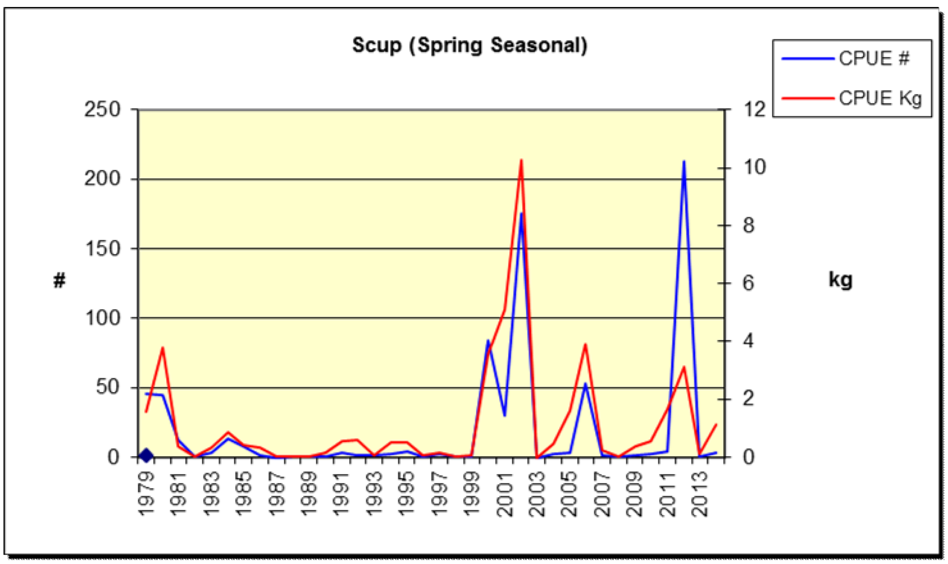
Stock Status: Variable / Uncertain
Management: Mid Atlantic Fishery Management Council, Atlantic Mackerel, Squid Butterfish FMP, ACL

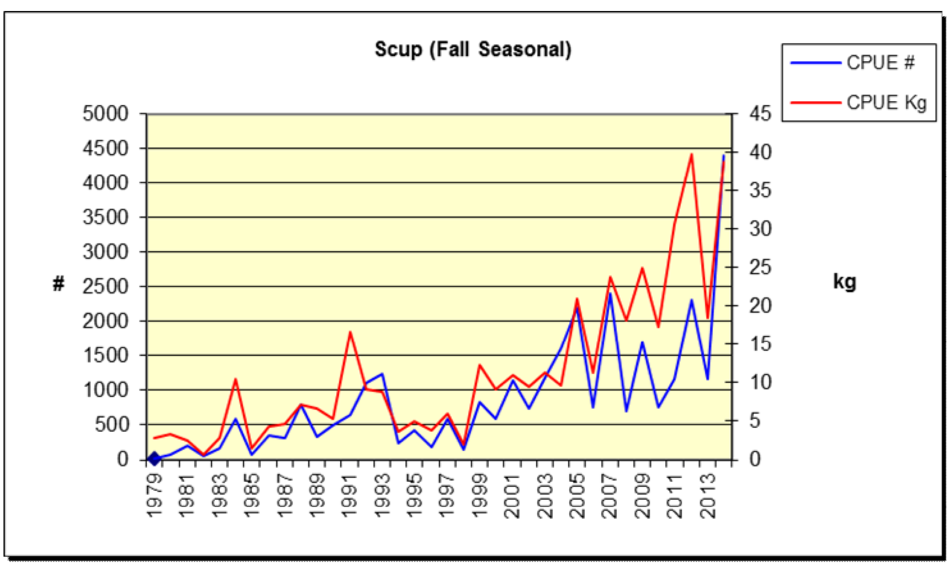


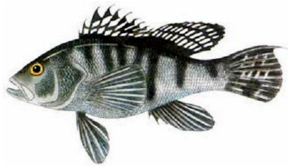


Scup ***Stenotomus chrysops***

Stock Status: Rebuilt, not overfished and overfishing is not occurring
Management: ASMFC Amendment XIIV, Addendum XXII, Summer Flounder, Scup Black Sea Bass FMP

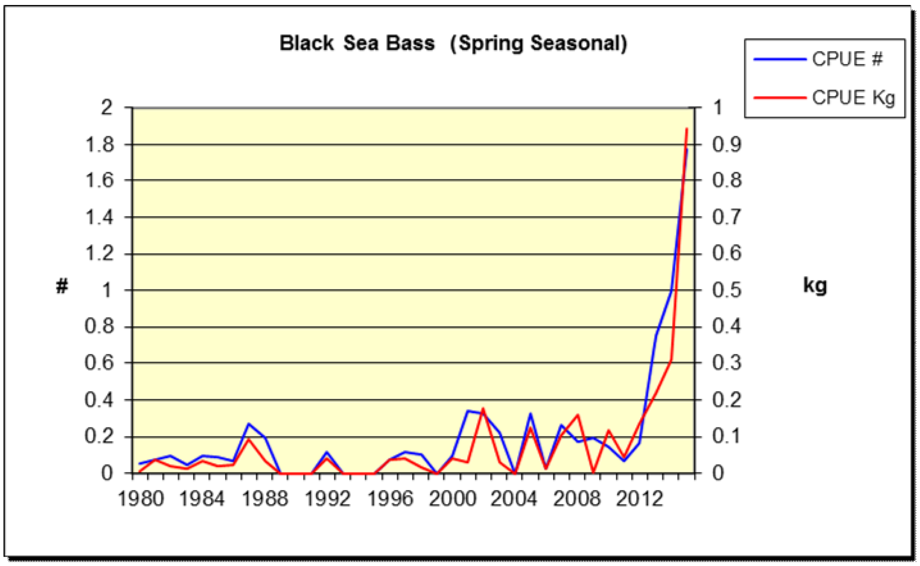


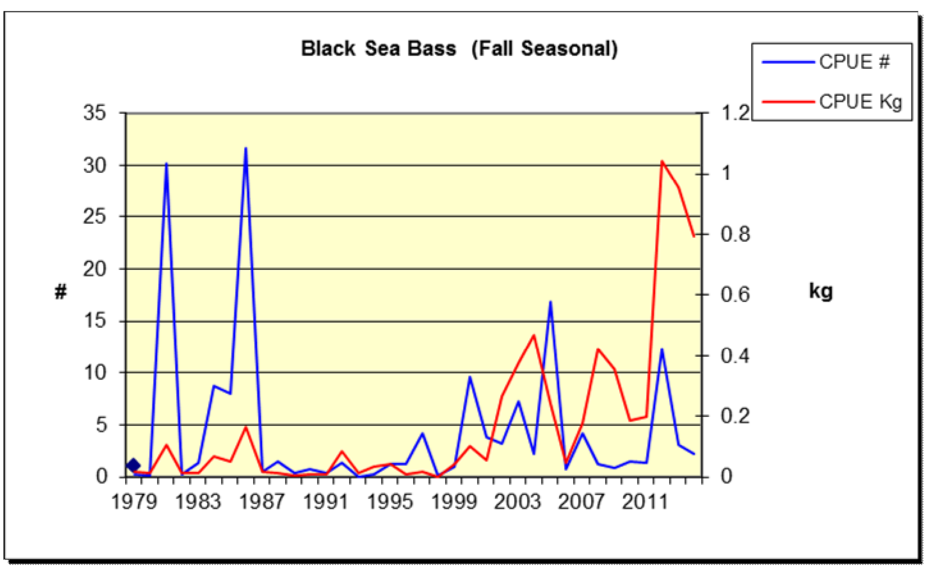




Black Sea Bass ***Centropristis striata***

Stock Status: Rebuilt, not overfished but overfishing is occurring
Management: ASMFC Amendment XIIV, Addendum XXIII





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Lynch, Timothy R. 2007. Assessment of Recreationally Important Finfish Stocks in Rhode Island Waters, Coastal Fishery Resource Assessment, Performance Report.

Assessment of Recreationally Important Finfish
Stocks in Rhode Island Coastal Ponds

Young of the Year Survey of Selected Rhode Island Coastal Ponds and Embayments

by
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Principal Biologist (Marine Fisheries)
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Federal Aid in Sportfish Restoration
F-61-R

Performance Report ï Job#3 March 2015

Performance Report

State: Rhode Island

Project Number: F-61-R
Segment Number: 21

Project Title: Assessment of Recreationally Important Finfish Stocks in Rhode Island Waters.

Period Covered: January 1, 2014 – December 31, 2014

Job Number & Title: Job 3 – Young of the Year Survey of Selected Rhode Island Coastal Ponds and Embayments”

Job Objectives: To collect, analyze, and summarize beach seine survey data from Rhode Island’s coastal ponds and estuaries, for the purpose of forecasting recruitment in relation to the spawning stock biomass of winter flounder and other recreationally important species.

Summary: In 2014, Investigators caught 56 species of finfish representing 34 families. This number is similar to the 48 species from 33 families that were collected during 2013. Additionally, the numbers of individuals caught in 2014 increased from the 2013 survey; 61086 collected in 2014 and 16366 collected in 2013. This increase in number of animals caught is reflective of the high frequency of Atlantic menhaden, and Atlantic Silversides caught throughout the sampling season, notably one large menhaden catch in September.

Target Date: 2015

Status of Project: On Schedule

Significant Deviations: There were no significant deviations in 2014.

Recommendations: Continue into the next segment with the project as currently designed; continue at each of the 24 sample stations. The new stations added 2011 in Green Hill Pond, Potter’s Pond, and the lower Pawcatuck River should remain part of the survey moving forward. These stations provide additional information on population compositions in these ponds which previously were not being sampled.

Remarks:

During 2014, Investigators sampled twenty four traditional stations in four coastal ponds, Winnapaug Pond, Quonochontaug Pond, Charlestown Pond, Point Judith Pond, Green Hill Pond, Potter’s Pond, Little Narragansett Bay and Narrow River. The stations added during 2011 are displayed in figures 1-3. For purposes of this report, the index value time series for young of the year (YOY) winter flounder will not include the data taken from the new stations. For consistency, the time series species indices will only include the stations traditionally used in the past. The potential bias the new stations could introduce to the time series is unknown. This potential bias will be examined further when these samples have been sampled for a few more years. For the calculation of the annual catch per unit effort statistics for all species including winter flounder data from all stations will be used.

Materials and Methods:

As in previous years, investigators attempted to perform all seining on an incoming tide. To collect animals, investigators used a seine 130 ft. long (39.62m), 5.5 ft deep (1.67m) with ¼ò mesh (6.4mm). The seine had a bag at its midpoint, a weighted footrope and floats on the head rope. Figure 4 describes the area covered by the seine net. The beach seine was set in a semi-circle, away from the shoreline and back again using an outboard powered 16' Lund aluminum boat. The net was then hauled toward the beach by hand and the bag was emptied into a large water-filled tote. All animals collected were identified to species, measured, enumerated, and sub-samples were taken when appropriate. Water quality parameters temperature, salinity and dissolved oxygen, were measured at each station. Figure 1 shows the location of the subject coastal ponds and the Narrow River, while figures 2 - 3 indicate the location of the sampling stations within each pond.

Results and Discussion:

Winter Flounder (*Pseudopleuronectes americanus*)

Juvenile winter flounder were collected at 24 out of 24 stations over the course of the season. Winter flounder ranked third in overall species abundance (n=1506) in 2014, with the highest mean abundance, fish/seine haul, occurring in June (Table 1). This is a departure from the usual expected pattern of highest index values occurring in July. Several of the ponds had their highest values in June including the Pawcatuck River, Charlestown, and Green Hill ponds. Quonochontaug pond had its greatest mean abundance in July. Narrow River, Point Judith, and Winnipaug ponds had their greatest mean abundance in August. Only three winter flounder were caught in Potterǿs pond in 2014. The greatest numbers of winter flounder in one haul were captured in June in Green Hill pond station GH1 where 218 individuals were captured.

During 2014, 1506 winter flounder were collected, up from the 1096 collected in 2013. The juvenile winter flounder abundance index (YOY WFL index) for the survey measured using the mean fish/seine haul increased from 8.54 fish/seine haul in 2013 to 11.11 fish/seine haul in 2014. The 2014 index value rebounded from the lowest recorded since the surveys inception observed in 2013. For the purposes of consistency, the YOY WFL index is only calculated using fish < 12 cm from the long term stations of the survey. Data collected from the new stations is not included in the index so as not to bias the results. A standardization methodology will be required to integrate this data into the overall YOY WFL index. Table 2 and figure 5b display the mean catch per seine haul (CPUE) of winter flounder for each month by pond during the 2013 survey. Figure 5a displays the abundance indices over the duration of the coastal pond survey. Figure 15 displays the annual abundance index for all stations combined.

Narrow River and Quonochontaug Pond trended upward in 2014. Quonochontaug remains at a lower than average index value. While Winnipaug, Charlestown and Point Judith ponds trended downward. In fact, Winnipaug, and Charlestown ponds like 2013 experienced their lowest index values since the inception of the survey which is notable as they are usually among the more heavily populated YOY winter flounder water bodies. The index values by pond remained high in august but then were reduced in September and October. This is an improvement from 2012 and 2013 where after July YOY winter flounder numbers in each of the ponds drastically declined and never returned for the rest of the sampling season (figure 5b). These results indicate that 2014 recruitment from the coastal ponds although slightly improved from 2013 will not be strong.

Two other RIDFW surveys target juvenile and adult winter flounder, the Narragansett Bay Spring Seasonal Trawl Survey and the Narragansett Bay Juvenile Survey. A comparison of the Coastal Pond Survey to these other projects reveals that despite some slight differences, they display similar trends (Figure 16). The downward YOY trend in 2014 is mirrored in the Narragansett Bay Seine Survey. The continued low abundance in YOY WFL numbers was also observed in Narragansett Bay (McNamee Pers Comm). The spring Trawl Survey WFL index fell back to a low value, likely a result of regulations which changed ending the prohibition on possession of winter flounder in federal waters of Southern New England. Federal possession limits were either unlimited or set to 5000 lbs per trip depending on the permit category of the vessel. It is believed that these high limits encourage a directed fishery for winter flounder in the spring. Possession limits remain 50 pounds in State waters. The Narragansett Bay Seine Survey collects the most YOY WFL in June (McNamee Pers Comm). It should be noted that the Narragansett Bay Survey does not begin sampling until June and may miss those juvenile finfish which occur in May in the shallow coves etc. The 2010 Narragansett Bay Survey experienced one of the its lowest abundance index value since its inception (cpue = 1.56), in 2011 the index value rebounded (cpue = 7.27) approaching a more average value for the time series but then went back down in 2012 (cpue= 5.27) ,2013 (cpue= 3.31), and 2014 (cpue= 2.54) the second lowest value recorded in the time series. The Spring Trawl Survey collects the greatest number of winter flounder in April and May and is considered the best indicator for estimating local abundance especially for post spawn adults (Olszewski Pers Comm). The spring trawl index more than doubled from a low point of 3.67 WFL per tow in 2009 to 11.56 WFL per tow in 2010 then decreased to 7.53 WFL per tow in 2011 but rebounded again in 2012 to 13.86 WFL per tow. In 2013, the spring index returned to the low point 3.68 WFL per tow and remains low in 2014 with **xx** WFL per tow.

The time series of the survey shows that the ponds exhibit fluctuations of WFL abundance over time. One exception is Point Judith pond which has experienced a significant decline since 2000 and bottomed out at 0.89 fish/seine haul during 2010. Between 2011 and 2014 , the overall YOY WFL index in Point Judith pond increased to 6.33 WFL per haul in 2013 but decreased in 2014 to 3.44 WFL per haul. This increasing trend in abundance might reflect the recent no possession rule in the pond as well as the former coast wide closure. Again as in 2013, it is important to note that the YOY WFL population in Point Judith Pond crashed in August and did not recover. Point Judith Pond is the only coastal pond where both a juvenile survey and an adult winter flounder survey occur annually. When relative abundance and number of WFL per seine haul of juvenile winter flounder are compared to the relative abundance and number of WFL per fyke net haul of the Adult Winter Flounder Tagging Survey, (Figure 17), a decline in relative abundance of winter flounder is observed in both surveys. The index value observed on the adult spawner survey was the lowest ever recorded at 0.8 WFL per net haul. The decline in adult spawner abundance and related decline in juvenile abundance does not support a fishery in the pond due to the lack of surplus production (Gibson, 2010). Given that winter flounder population shows an affinity for discrete spawning locations and the young of year tend to remain near the spawning location, the fish in this pond are in danger of depletion (Buckley et. al. 2008). A regulation was enacted 4/8/11 to close Point Judith Pond to both recreational and commercial fishing for winter flounder (RIMF Regulations Part 7 sec 8). Data from this survey and the Adult winter flounder spawning survey was the evidence used for justification of this regulation.

In 2014, juvenile winter flounder ranged in size from 1 to 25 cm, representing age groups 0-2+. One adult flounder (age 2+) was caught during the 2014 survey. The size range of animals collected is similar to those caught from 2004 through 2013 where the flounder ranged from 1 to 19 cm, 2 to 18 cm, 2 to 17 cm, 1 to 22, 1 to 19 cm, 2 to 19, 2 to 18, 2 to 35, 2 to 36, 2 to 15 respectively. Length frequency distributions indicate that the majority of individuals collected during sampling season were group 0 fish, less than 12 cm total length (Figure 6). During 2014, 99.53% of all winter flounder caught were <12 cm in length. The size ranges of these fish agree with ranges for young-of-the-year winter flounder in the literature (Able & Fahay 1998; Berry 1959; Berry et al. 1965). Mean monthly lengths for winter flounder are presented in Table 3. Length frequency distributions for coastal ponds by month are shown in Figures 7 -14. The WFL frequency histograms for each pond over time in years past have displayed two peaks in average size for YOY WFL suggesting two cohorts or a protracted spawning event. This result was not clearly observed in the Coastal Pond Survey during 2014. Instead a more traditional one peaked histogram describes the size range of YOY WFL caught in the survey this year (figures 7 and 9).

Winter Flounder YOY were caught in each of the new ponds and stations being sampled (Table 1). Green Hill pond displayed a pattern of abundance with the highest numbers of YOY WFL caught in May and June decreasing to no fish found in July in 2014. In 2014 Potter pond which usually displays the same pattern, low abundances were observed. The WFL caught during May in Green Hill (Figure 8) are larger on average than WFL YOY caught in the other ponds (3-4 cm verses 2 cm respectively) suggesting either an earlier spawning event or a higher growth rate. The water temperature in Green Hill was approximately 3 degrees Celsius higher than the average pond temperature for July and August (Table 13) and Potter's Pond station 1 had slightly higher average temperatures and is located in an area with low tidal flushing. The abundance time series indicates that the YOY WFL in these two ponds are either experiencing mortality or are being displaced due to increasing water temperatures and/or decreasing dissolved oxygen. The Lower Pawcatuck River is a more open system than the other ponds sampled in the survey. Instead of an inlet breaching a barrier beach there is only a mostly sub tidal sandbar separating the water body from the ocean. With the exception of July the water temperatures are cooler than the average pond temperatures (Table 13). YOY WFL were caught at all three stations in the Lower Pawcatuck River with station 1 catching the most consistent numbers (Table 1). The new station in Point Judith Pond added 2010, still consistently catches higher numbers of YOY WFL than the other stations in the pond which is not surprising considering it was chosen due to its proximity to a known WFL spawning location.

<u>Bluefish *(Pomatomus saltatrix)*</u>

Fifty three bluefish were collected in June, July, August, and September and occurred in each of the coastal ponds sampled in 2014. This is a decrease from the 144 fish caught in 2013 and similar to than the 55 individuals captured during 2012. The abundance index for 2014 was 0.37 fish/seine lower than the 2013 value of 1.00 fish/seine and similar to the value of 0.38 fish/seine haul observed in 2012. Table 4 contains the abundance indices for the survey by month and pond. Bluefish ranged in size from 5 cm to 22 cm. No adult bluefish were caught in 2014. Figure 18 displays the annual abundance index of bluefish for all stations combined.

<u>Tautog (*Tautoga onitis*)</u>

One hundred and thirty six tautog were collected between May and October in each of the ponds except Green Hill and Potter's ponds in 2014. This is higher than the 2013 catch of 101 individuals. The total survey 2014 abundance index was 0.94 fish/seine haul up slightly from the 2013 abundance index of 0.70 fish/seine haul. Table 5 contains the abundance indices for the survey by month and pond. The highest abundances in 2014 occurred in Charlestown Pond. Tautog caught in 2014 ranged in size from 4 cm to 16 cm. Figure 19 displays the annual abundance index of tautog for all stations combined.

Black Sea Bass (*Centropristis striata*)

A total of 175 juvenile black sea bass were collected from August to October from each of the ponds except Potter◊s Pond in 2013. This is less than the 219 fish that were caught in 2013 and lower than the 403 fish collected in 2012. The highest abundances were found in Charlestown Pond. The total survey 2014 abundance index was 1.22 fish/seine haul down from the 2013 abundance index of 1.52 fish/seine haul and below the 2012 value of 2.80 fish/ seine haul. The population in the ponds continues trending upwards, the high BSB index value of 2014 represents another high value consistent with observations for other recent years. Black sea bass abundance throughout state waters was high again during 2014 (McNamee, pers comm.). Table 5 contains the abundance indices for the survey by month and pond. Black sea bass caught in 2012 ranged in size from 2 cm to 8 cm. Figure 20 displays the annual abundance index of black sea bass for all stations combined.

Scup *(Stenotomus chrysops)*

Thirty scup were collected during the 2014 in July, August, September, and October in each of the ponds except green hill and Potter◊s. This is lower than the 52 scup caught in 2013. By way of contrast 106 were caught in 2012. The total survey abundance index was 0.21 fish per haul. Table 7 contains the abundance indices for the survey by month and pond. Scup caught in 2014 ranged in size from 3 cm to 11 cm. Figure 21 displays the annual abundance index of scup for all stations combined.

Clupeids:

In 2014 five species of clupeids were caught in the coastal pond survey, Atlantic menhaden (*Brevoortia tyrannus*), Hickory shad (*Alosa mediocius*), Blueback herring (*Alosa aestivalis*), Atlantic herring (*Alosa harengus*) and Alewife (*Alosa pseudoharengus*). Two hundred twenty nine Alewife were captured in 2014. The total survey abundance was 1.59 fish / seine haul. A continuation of an upward trend. Thirty five thousand eighty one Atlantic menhaden were caught during 2014. The total survey abundance was 243.62 fish /seine haul. There were several schools of YOY menhaden captured in 2014 notable one school was estimated to have 34,000 plus fish. One hickory shad was caught in Potter◊s pond in September. It was a 32 cm beauty certainly not a mediocre fish. 4 Atlantic herring were captured in 2014 and 20 Blueback herring were caught in 2014. Table 8 contains the abundance indices for culpeids by month pooled across all 5 ponds. Figures 22a and 22b display the annual abundance index of clupeids for all stations combined. Menhaden are plotted on a separate axis for scale issues.

Baitfish Species:

Atlantic Silversides *(Menidia sp.)*

Silversides had the second highest abundance of all species with 19356 caught during the 2014 survey, up compared to the 11638 silversides collected in 2013. Silversides were collected in each of the ponds throughout the time period of the survey (May ï October). The highest abundances were observed in Charlestown and Point Judith ponds. The total survey abundance index was 134.42 fish / seine haul. Table 9 contains the abundance indices for the survey by month and pond. Atlantic silversides caught in 2014 ranged in size from 2 cm to 13 cm.

<u>Striped Killifish *(Fundulus majalis)*</u>
Striped killifish ranked fifth in species abundance with 901 fish caught during 2014. This is similar to the 907 fish caught during 2013. They occurred in each of the ponds and were caught each month during the survey. Point Judith Pond had the highest abundance of striped killifish. The total survey abundance index was 6.26 fish / seine haul, the lowest recorded since the inception of the survey. Table 10 contains the abundance indices for the survey by month and pond. Striped killifish caught in 2014 ranged in size from 3 cm to 11 cm.

<u>Common Mummichog *(Fundulus heteroclitus)*</u>
The mummichog was fourth in overall abundance in 2014 with 1038 individuals collected. This value is an increase from 301 mummichogs collected in 2013. Mummichogs occurred in each of the ponds and were caught each month during the survey. Narrow River had the highest abundances of Mummichogs. The total 2014 survey abundance index was 7.91 fish / seine haul. It should be noted this value rebounded from the lowest on record in 2013 of 2.09 fish/ seine haul. Table 11 contains the abundance indices for the survey by month and pond. Mummichogs caught in 2014 ranged in size from 3 cm to 9 cm.

<u>Sheepshead Minnow *(Cyprinodon variegatus)*</u>
The Sheepshead minnow ranked twentieth in overall abundance with 56 individuals collected. This is an increase from the 45 fish caught in 2013. Sheepshead minnow occurred in each of the ponds and were caught each month during the survey. Narrow River had the highest abundances of Sheepshead minnows. The total survey abundance index was 0.39 fish / seine haul, the lowest recorded since the inception of the survey. Table 12 contains the abundance indices for the survey by month and pond. Sheepshead minnow caught in 2013 ranged in size from 2 cm to 8 cm.

Figure 23 displays the annual abundance index of the baitfish species for all stations combined.

<u>Physical and Chemical Data:</u>
Physical and Chemical data for the 2014 Coastal Pond Survey is summarized in tables 13 ï 15. Water temperature in 2014 averaged 21.0 ºC, with a range of 13.7ºC in May to 28.9 ºC in August. Salinity ranged from 18.0 ppt to 29.7 ppt, and averaged 24.7 ppt. Dissolved oxygen was not recorded during 2014 due to no YSI meter. The YSI meter used to collect water quality data gradually lost functionality in 2013, a replacement could not be ordered for 2014 due to state purchasing rules. Temperature was taken with a standard scientific thermometer. Salinity was taken with a hand held refractometer. A new unit has been acquired for 2015.

<u>New Station Preliminary Data</u>
This year was the fourth year of sampling the three additional ponds. On a whole the samples were consistent with 2013. A brief description of each pond follows.

<u>Green Hill Pond</u>: Green Hill Pond is a small coastal pond located east of Charlestown Pond. It does not open directly to the ocean, instead its only inlet is via Charlestown Pond and is thus not well flushed. Green Hill pond has water quality issues including high summer

temperatures, high nutrient load, and a permanent shellfish closure. GH ï 1 is in the northeastern quadrant of the pond on a small island. The bottom substrate is mud with shell hash. GH ï 2 is in the southeastern quadrant of the pond on a sand bar. The bottom substrate is muddy fine sand. WFL YOY have been caught in relatively high abundance in May suggesting spawning activity within the pond. The WFL YOY decreased in abundance at the stations in July and August when the water was warm and were not caught frequently after it had cooled in the fall. Other species frequently present in the pond are the baitfish species, naked goby, and blue crabs.

<u>Potter Pond:</u> Potter Pond is a small coastal pond located west of Point Judith Pond. Similarly to Green Hill Pond, it does not open directly to the ocean; instead its only inlet is via Point Judith Pond. The local geography is such that the tide flushes the pond more than in Green Hill. The inlet to Potter Pond is closer to the inlet to Point Judith Pond and its inlet is shorter. PP ï 1 is in the southwestern quadrant of the pond in a shallow cove. The bottom substrate is mud. PP ï 2 is in the northwestern quadrant of the pond adjacent to a deep (~25ô) glacial kettle hole. The bottom substrate is fine sand with some cobble. WFL YOY have been caught at both stations but only PP ï 1 with high frequency. Similarly to the Green Hill during both stations WFL YOY are highest in May and decreased in abundance as the season progressed. The water temperature in Potterõs Pond does not get as warm as Green Hill Pond but still may be a factor at station PP ï 1. The geography of this station does not facilitate flushing and water quality may explain the lack of WFL YOY in mid-summer. Interestingly all three years had small catches of 1 year old flounder at station PP-1 during the late summer and early fall. Water temperatures are higher than the pond proper and dissolved oxygen was lower in that section of the pond. The rest of the pond does not have the same water quality issues. Other species frequently caught in the pond include the baitfish species, American eel, oyster toad fish, naked goby, tautog, and blue crabs.

<u>Lower Pawcatuck River</u>: The lower Pawcatuck River or Little Narragansett Bay is the mouth of a coastal estuary formed by the Pawcatuck River. It is different form the other stations on the survey in that it does not have a traditional barrier beach pierced by an inlet; instead it is relatively open to Block Island Sound. PR ï 1 is a small protected beach in a small cove surrounded by large boulders. The bottom substrate is fine sand. This station had the most consistent catch of WFL YOY which were present during all months of the survey. PR ï 2 is located on a sand bar island in the middle of Little Narragansett Bay on the protected side. This sand bar is all that is left of a larger barrier beach which existed prior to the 1938 hurricane. The bottom substrate is coarse sand. This station caught WFL YOY but at lower frequencies that PR ï 1, the highest catch number was observed in October. PR ï 3 was originally located in the southern part of Little Narragansett Bay on the protected side of Napatree Beach. After it was initially sampled in May 2011, the station was relocated because it was extremely shallow and a high wave energy area. PR ï 3 is currently located in the northern section of Little Narragansett Bay at the mouth of the river near G. Willie Cove. The station is on a *Spartina spp*. covered bank at the head of G. Willie Cove. The bottom substrate is cobble. This station was selected to best characterize the species assemblage in the Lower Pawcatuck River as the majority of the shoreline consists of marsh grass covered banks. The station has been sampled in all 6 months since 2012. WFL YOY are not present in high frequencies at the station which is not unexpected due to the bottom substrate. Other species frequently caught in the river include the baitfish species, alewife, tomcod, menhaden, and bluefish.

Point Judith Pond: The new station PJ ï 4 is located in the eastern section of the pond on Ram Island. The bottom substrate is silty sand with some large cobble. The station was selected because of its proximity to three fyke net stations sampled during the Adult Winter Flounder Spawner Survey. The station was added to better classify the species in the pond and to better document the decline of WFL YOY in the pond. The station had higher catch frequencies of WFL YOY than the other stations in the pond combined but still is low in comparison to the other ponds.

The first four years of sampling the new stations successfully collected target species, notably WFL YOY. It is recommended that these stations be sampled into the future so as to continue to provide species assemblage information from these coastal ponds. The additional catch frequencies and distributions of WFL YOY will provide a better understanding of the population, notably in areas where the fish only occur in the spring / early summer. Further analysis will be required to integrate data from these new stations into the traditional abundance indices. Until then the data will be presented separately for the time series indices but not for the annual information.

Summary

In 2014, Investigators caught 56 species of finfish representing 34 families. This number is similar to the 48 species from 33 families that were collected during 2013.   Additionally, the numbers of individuals landed in 2014 increased from the 2013 survey; 61086 collected in 2013 and 16369 collected in 2013.   This increase in number of animals caught is reflective of the fact that high numbers of Atlantic menhaden and Atlantic silverside were caught this year. Appendix 1 displays the frequency of all species caught by station during the 2014 Coastal Pond Survey. Additional data is available by request.

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Table 1: 2014 Coastal Pond Survey Winter Flounder Frequency by station and month

Station	May	Jun	Jul	Aug	Sep	Oct	Totals	Mean	STD
CP1	0	7	11	3	2	0	**23**	**3.83**	**4.36**
CP2	2	11	2	0	0	0	**15**	**2.50**	**4.28**
CP3	0	9	0	3	2	1	**15**	**2.50**	**3.39**
CP4	0	1	4	3	1	2	**11**	**1.83**	**1.47**
GH1	122	218	0	0	0	0	**340**	**56.67**	**92.89**
GH2	21	2	0	0	0	0	**23**	**3.83**	**8.45**
NR1	7	9	2	1	1	1	**21**	**3.50**	**3.56**
NR2	0	39	53	178	16	23	**309**	**51.50**	**64.63**
NR3	0	56	119	156	4	18	**353**	**58.83**	**65.12**
PJ1	0	1	2	14	0	1	**18**	**3.00**	**5.44**
PJ2	3	8	1	14	0	1	**27**	**4.50**	**5.47**
PJ3	0	4	10	1	1	1	**17**	**2.83**	**3.76**
PJ4	0	7	4	28	0	0	**39**	**6.50**	**10.91**
PP1	0	0	1	0	0	1	**2**	**0.33**	**0.52**
PP2	0	1	0	0	0	0	**1**	**0.17**	**0.41**
PR1	1	18	3	2	0	1	**25**	**4.17**	**6.85**
PR2	0	2	3	0	3	0	**8**	**1.33**	**1.51**
PR3	0	0	0	0	1	0	**1**	**0.17**	**0.41**
QP1	0	19	6	1	1	0	**27**	**4.50**	**7.45**
QP2	0	3	47	5	8	2	**65**	**10.83**	**17.93**
QP3	0	9	8	20	5	1	**43**	**7.17**	**7.25**
WP1	0	3	1	5	4	11	**24**	**4.00**	**3.90**
WP2	0	13	16	48	0	8	**85**	**14.17**	**17.83**
WP3	0	7	3	0	1	3	**14**	**2.33**	**2.66**
Totals	**156**	**447**	**296**	**482**	**50**	**75**			
Mean	**6.50**	**18.63**	**12.33**	**20.08**	**2.08**	**3.13**			
STD	**25.00**	**44.39**	**26.52**	**46.77**	**3.59**	**6.00**			

Table 2: 2014 Coastal Pond Survey winter flounder abundance indices (fish/seine haul) by pond and month

Pond	May	Jun	Jul	Aug	Sep	Oct
Charlestown Pond	0.5	7.0	4.3	2.3	1.3	0.8
Green Hill Pond	71.5	110.0	0.0	0.0	0.0	0.0
Narrow River	2.3	34.7	58.0	111.7	7.0	14.0
Point Judith Pond	0.8	5.0	4.3	14.3	0.3	0.8
Potter's Pond	0.0	0.5	0.5	0.0	0.0	0.5
Pawcatuck River	0.3	6.7	2.0	0.7	1.3	0.3
Quonochontaug Pond	0.0	10.3	20.3	8.7	4.7	1.0
Winnipaug Pond	0.0	7.7	6.7	17.7	1.7	7.3
Total	**6.5**	**18.6**	**12.3**	**20.1**	**2.1**	**3.1**

Table 3: 2014 Coastal Pond Survey average lengths of juvenile winter flounder by pond and month.

Pond	May	Jun	Jul	Aug	Sep	Oct
Charlestown Pond	3.9	5.9	7.1	6.7	7.9	8.7
Green Hill Pond	3.7	5.3				
Narrow River	2.5	22.7	4.3	4.1	4.8	5.7
Point Judith Pond	12.5	4.9	5.9	6.2	8.1	15.9
Potter's Pond		18.0	4.9			13.3
Pawcatuck River	8.3	3.5	5.0	6.8	7.8	6.4
Quonochontaug Pond		4.4	5.3	6.2	6.5	7.2
Winnipaug Pond		3.3	5.2	5.1	6.4	6.7

Table 4: 2014 Coastal Pond Survey bluefish abundance indices (fish/seine haul) by pond and month

Pond	May	Jun	Jul	Aug	Sep	Oct
Charlestown Pond	0	0.31	1.03	1.44	2.04	1.13
Green Hill Pond	0	1.50	0	2.00	0.50	0
Narrow River	0	0.61	1.47	4.76	4.60	0.33
Point Judith Pond	0	2.15	3.05	2.83	2.67	1.25
Potter's Pond	0	1.00	1.00	0.75	0.67	0
Pawcatuck River	0	0.67	2.25	17.22	0.67	0
Quonochontaug Pond	0	1.33	2.64	10.05	13.44	0.33
Winnipaug Pond	0	0	1.56	1.33	6.19	3.83
Total pond index	**0**	**7.57**	**12.99**	**40.38**	**30.77**	**6.88**

Table 5: 2014 Coastal Pond Survey tautog abundance indices (fish/seine haul) by pond and month

Pond	May	Jun	Jul	Aug	Sep	Oct
Charlestown Pond	2.08	1.41	1.19	8.39	6.68	1.59
Green Hill Pond	0	0	0	0	0	0
Narrow River	0.33	0.33	0.40	0.63	1.19	1.08
Point Judith Pond	0.56	0.69	2.83	1.53	1.71	0.65
Potter's Pond	0	0	0	0.50	0	0.50
Pawcatuck River	0	2.22	2.67	1.92	1.11	0.33
Quonochontaug Pond	0.67	0.56	1.29	3.33	4.19	1.33
Winnipaug Pond	0.50	0.33	1.00	1.28	1.85	1.07
Total pond index	**4.15**	**5.55**	**9.37**	**17.58**	**16.73**	**6.55**

Table 6: 2014 Coastal Pond Survey black sea bass abundance indices (fish/seine haul) by pond and month

Pond	May	Jun	Jul	Aug	Sep	Oct
Charlestown Pond	0.38	0	3.50	4.80	7.28	3.57
Green Hill Pond	0	0.50	0	0	0	0
Narrow River	0	0	0.33	3.38	3.03	1.79
Point Judith Pond	0.50	0.25	0.75	1.54	2.94	0.42
Potter's Pond	0	0	0	0	0	0
Pawcatuck River	0	0.33	0	1.67	1.78	0
Quonochontaug Pond	0	0	0	4.62	3.25	2.50
Winnipaug Pond	0	0	0	0.57	2.86	2.00
Total pond index	**0.88**	**1.08**	**4.58**	**16.57**	**21.14**	**10.28**

Table 7: 2014 Coastal Pond Survey Scup abundance indices (fish/seine haul) by pond and month

Pond	May	Jun	Jul	Aug	Sep	Oct
Charlestown Pond	0	0	1.69	1.59	1.75	0.50
Green Hill Pond	0	0	0	0	0	0
Narrow River	0	5.67	0.67	0.95	0	0.33
Point Judith Pond	0	0.25	1.06	0.58	0.42	0.25
Potter's Pond	0	0	0	0	0	0
Pawcatuck River	0	0	1.67	2.83	1.78	0
Quonochontaug Pond	0	0.33	2.83	2.38	0.50	0.33
Winnipaug Pond	0	0	0.50	3.73	0.33	0
Total pond index	**0**	**6.25**	**8.42**	**12.08**	**4.78**	**1.42**

Table 8: 2014 Coastal Pond Survey Clupeid abundance indices (fish/seine haul) by month

Species	May	Jun	Jul	Aug	Sep	Oct
Alewife	0	0.71	8.42	0.08	0.33	0
Atlantic Menhaden	0	0	1.67	0.58	1459.17	0.29
Atlantic Herring	0	0.17	0	0	0	0
Blueback Herring	0	0	0.71	0.13	0	0
Hickory Shad	0	0	0	0	0.04	0

Table 9: 2014 Coastal Pond Survey Atlantic Silverside abundance indices (fish/seine haul) by pond and month

Pond	May	Jun	Jul	Aug	Sep	Oct
Charlestown Pond	35.90	37.71	214.79	177.83	90.71	79.96
Green Hill Pond	18.13	11.63	51.63	1004.88	55.80	147.10
Narrow River	34.20	4.50	14.33	164.44	88.78	38.72
Point Judith Pond	46.81	65.33	73.92	148.21	122.71	20.38
Potter's Pond	22.13	24.88	8.10	32.10	30.90	82.10
Pawcatuck River	27.67	7.25	35.50	168.08	85.92	27.08
Quonochontaug Pond	55.93	82.11	52.94	86.22	38.50	32.89
Winnipaug Pond	42.40	7.33	30.22	99.89	84.00	22.22
Total pond index	**283.16**	**240.74**	**481.43**	**1881.66**	**597.31**	**450.45**

Table 10: 2014 Coastal Pond Survey Striped Killifish abundance indices (fish/seine haul) by pond and month

Pond	May	Jun	Jul	Aug	Sep	Oct
Charlestown Pond	8.71	19.89	26.16	50.48	38.38	62.17
Green Hill Pond	17.75	5.00	9.67	2.75	4.50	4.83
Narrow River	1.61	4.75	13.62	10.51	22.98	41.03
Point Judith Pond	8.77	13.40	35.53	56.28	89.64	87.94
Potter's Pond	2.00	3.00	2.83	5.50	7.63	3.17
Pawcatuck River	22.50	0	0.67	57.56	6.17	23.33
Quonochontaug Pond	1.24	3.43	9.04	30.19	46.36	61.48
Winnipaug Pond	2.37	7.97	22.89	57.67	56.22	101.50
Total pond index	**64.95**	**57.45**	**120.40**	**270.93**	**271.87**	**385.46**

Table 11: 2014 Coastal Pond Survey Mumichog abundance indices (fish/seine haul) by pond and month

Pond	May	Jun	Jul	Aug	Sep	Oct
Charlestown Pond	30.03	57.91	40.35	73.19	31.86	23.99
Green Hill Pond	7.67	27.75	25.88	7.75	40.00	4.88
Narrow River	45.42	105.48	91.40	60.44	28.68	15.86
Point Judith Pond	16.13	39.21	86.49	46.07	30.13	15.18
Potter's Pond	45.83	40.88	31.10	15.90	15.25	4.10
Pawcatuck River	0.50	6.67	5.11	5.67	17.33	0.67
Quonochontaug Pond	4.60	20.86	19.96	22.44	9.72	4.58
Winnipaug Pond	10.38	10.65	32.82	71.35	26.84	13.85
Total pond index	**160.56**	**309.40**	**333.10**	**302.82**	**199.81**	**83.10**

Table 12: 2014 Coastal Pond Survey Sheepshead Minnow abundance indices (fish/seine haul) by pond and month

Pond	May	Jun	Jul	Aug	Sep	Oct
Charlestown Pond	3.46	3.59	12.00	13.86	16.42	27.85
Green Hill Pond	0.50	0	0	0	7.00	14.50
Narrow River	1.60	2.31	3.83	6.71	12.02	75.08
Point Judith Pond	0.30	0.50	1.36	3.11	17.79	6.50
Potter's Pond	1.00	0	10.00	1.00	1.33	26.75
Pawcatuck River	0	0	0	0	0.33	2.00
Quonochontaug Pond	0.33	0.50	1.50	2.42	33.73	48.75
Winnipaug Pond	0.33	0.67	3.72	19.71	18.60	65.48
Total pond index	**7.53**	**7.56**	**32.42**	**46.81**	**107.22**	**266.91**

Table 13: 2014 Coastal Pond Survey average water temperature (degrees Celcius) by pond and month Note: Temperatures were taken with a thermometer as YSI was not functional.

Station	May	June	July	August	September	October
Charlestown Pond	16.88	21.38	21.88	25.75	20.18	17.73
Green Hill Pond	19.50	25.50	24.60	28.90	23.75	15.50
Narrow River	16.33	18.67	20.50	25.73	22.73	17.43
Point Judith Pond	16.75	19.88	22.50	25.39	22.48	18.75
Potter's Pond	19.75	22.00	24.25	26.30	22.45	18.80
Pawcatuck River	17.33	22.17	24.33	23.23	19.77	14.03
Quonochontaug Pond	16.00	21.00	25.33	25.53	20.93	19.07
Winnipaug Pond	13.67	19.50	22.50	25.53	20.37	17.63
Average	17.03	21.26	23.24	25.80	21.58	17.37

Table 14: 2014 Coastal Pond Survey average salinity (ppt) by pond and month
Note: Salinty measurements were taken using a refractometer as YSI was not functional.

Station	May	June	July	August	September	October
Charlestown Pond	27.00	26.50	25.00	27.50	27.50	27.50
Green Hill Pond	18.00	18.00	19.50	20.50	20.50	19.50
Narrow River	20.67	20.67	24.00	22.67	24.67	24.00
Point Judith Pond	26.00	27.25	28.00	28.25	27.25	27.25
Potter's Pond	21.00	18.00	21.50	25.50	22.50	22.50
Pawcatuck River	23.00	24.00	26.33	24.33	24.00	23.00
Quonochontaug Pond	28.00	28.67	29.67	27.67	29.00	27.33
Winnipaug Pond	27.67	27.67	25.00	26.33	27.33	26.00
Average	23.92	23.84	24.88	25.34	25.34	24.64

Table 15: 2014 Coastal Pond Survey average dissolved oxygen (mg/l) by pond and month
Note: No dissolved oxygen measurements were taken in 2014 as YSI was not functional.

Station	**May**	**June**	**July**	**August**	**September**	**October**
Charlestown Pond						
Green Hill Pond						
Narrow River						
Point Judith Pond						
Potter's Pond						
Pawcatuck River						
Quonochontaug Pond						
Winnipaug Pond						
Average						

Figure 1: Location of coastal ponds sampled by the Coastal Pond Juvenile Finfish Survey in Southern Rhode Island.

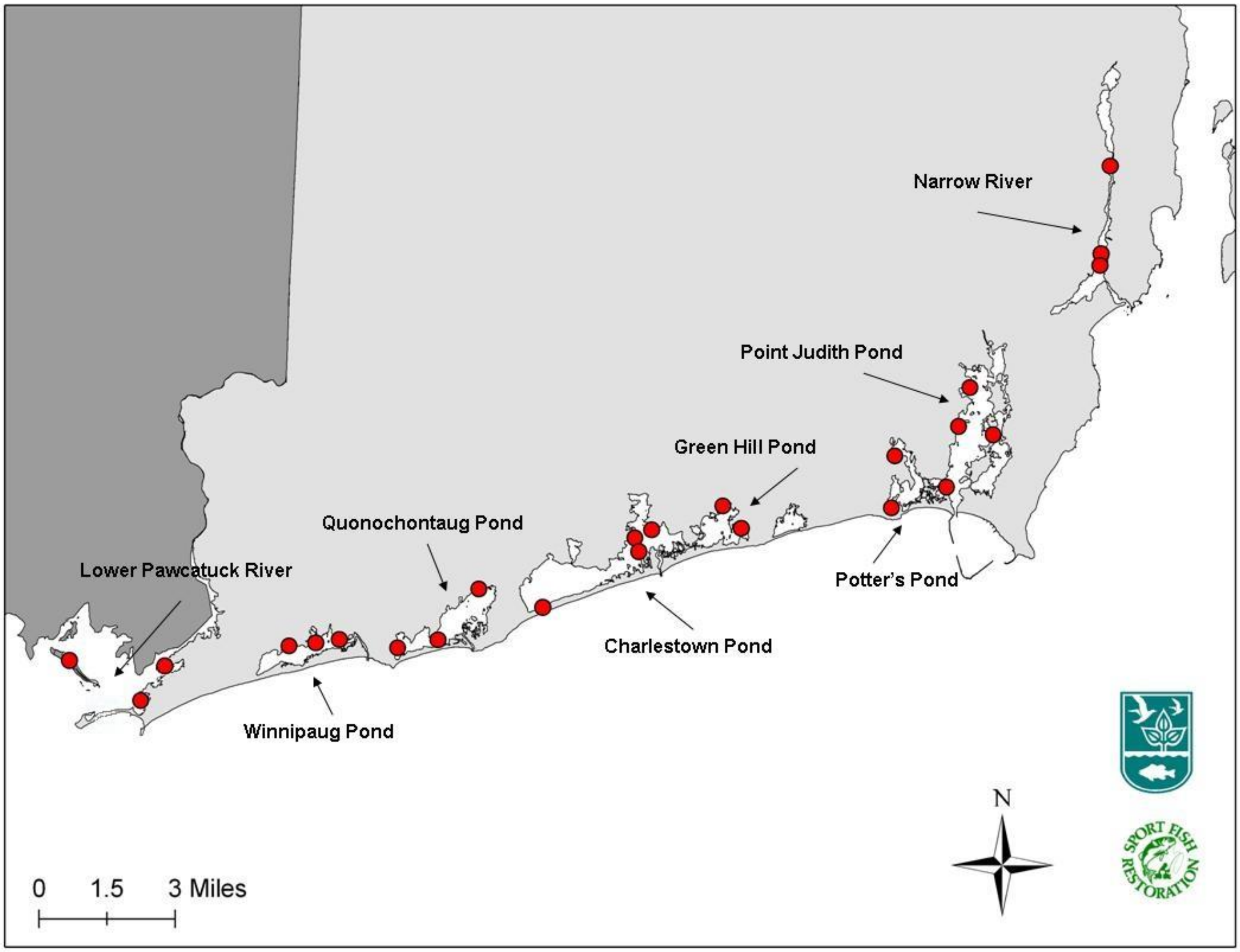


Figure 2: Coastal Pond Juvenile Finfish Survey station locations (western ponds).

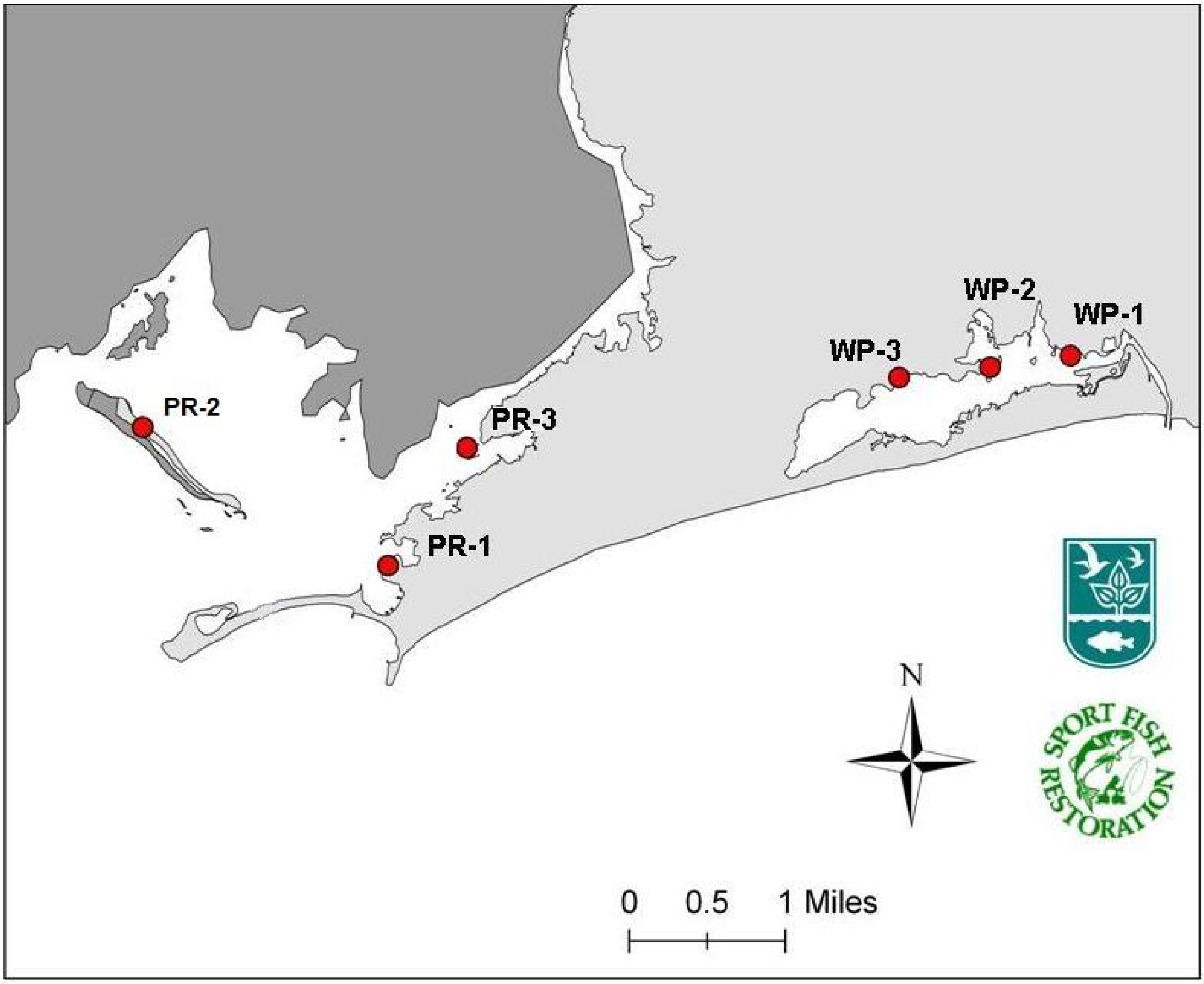


Figure 2 (cont): Coastal Pond Juvenile Finfish Survey station locations (western ponds).

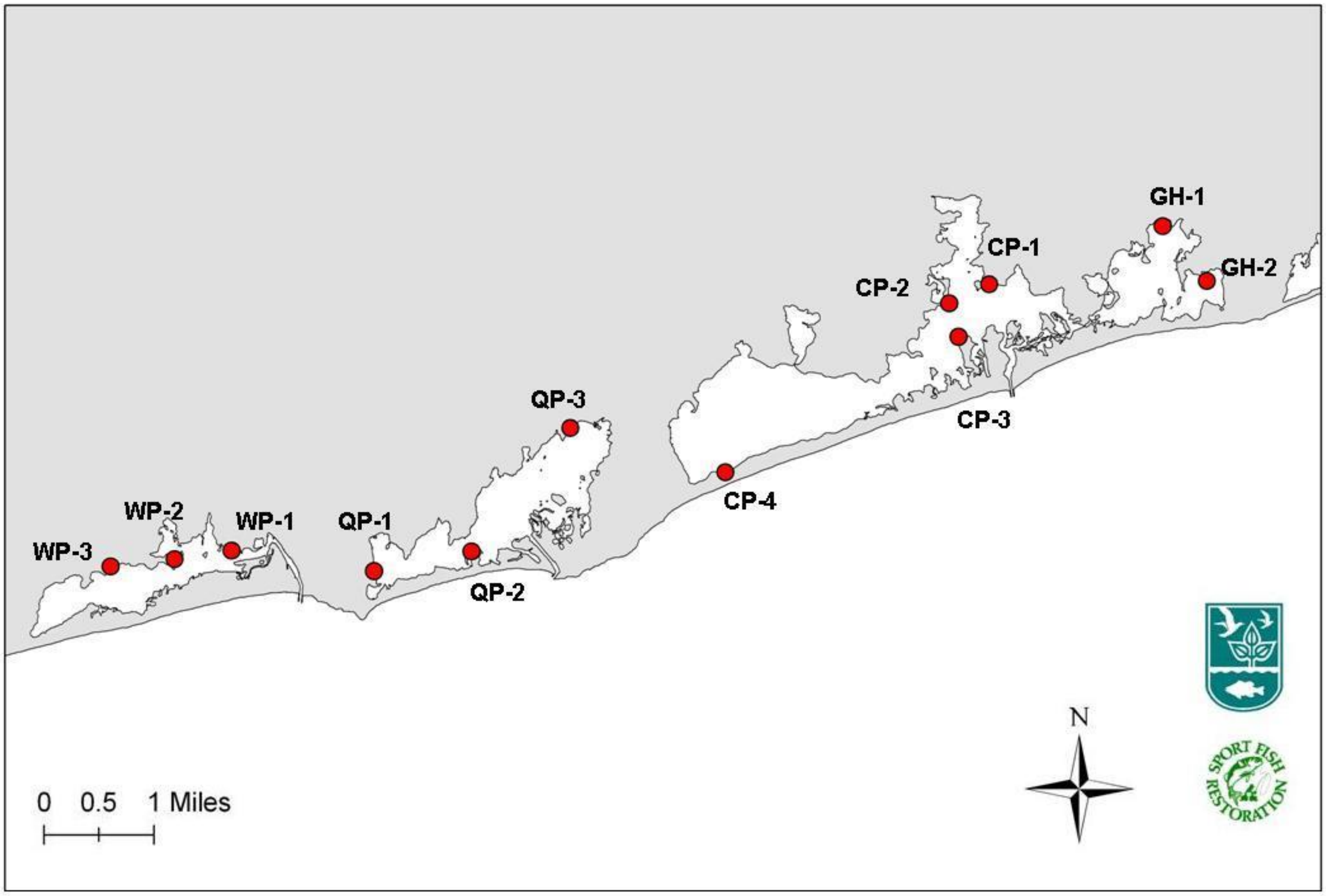


Figure 3: Coastal Pond Juvenile Finfish Survey station locations (eastern ponds).

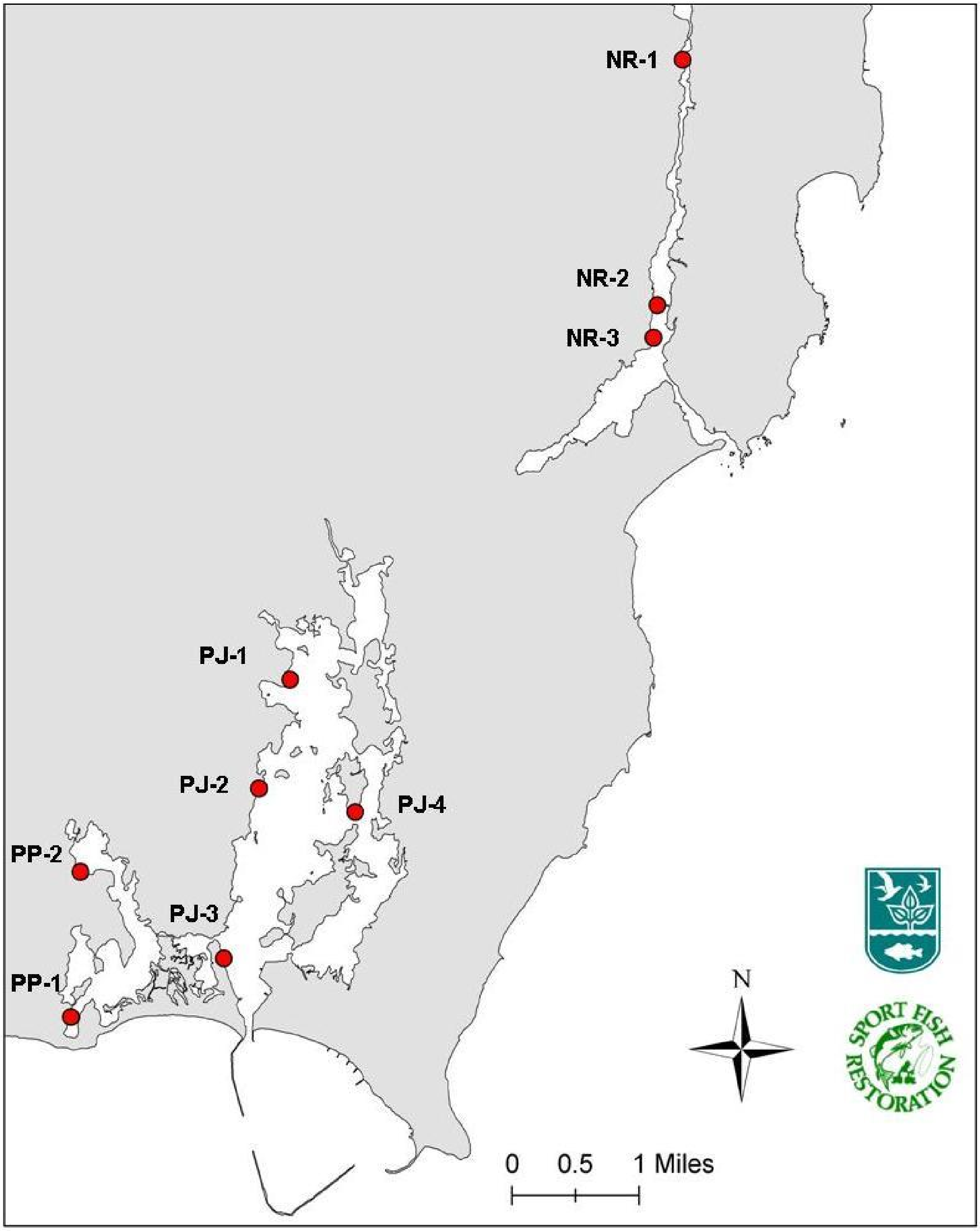


Figure 4
Coastal Pond Juvenile Finfish Survey

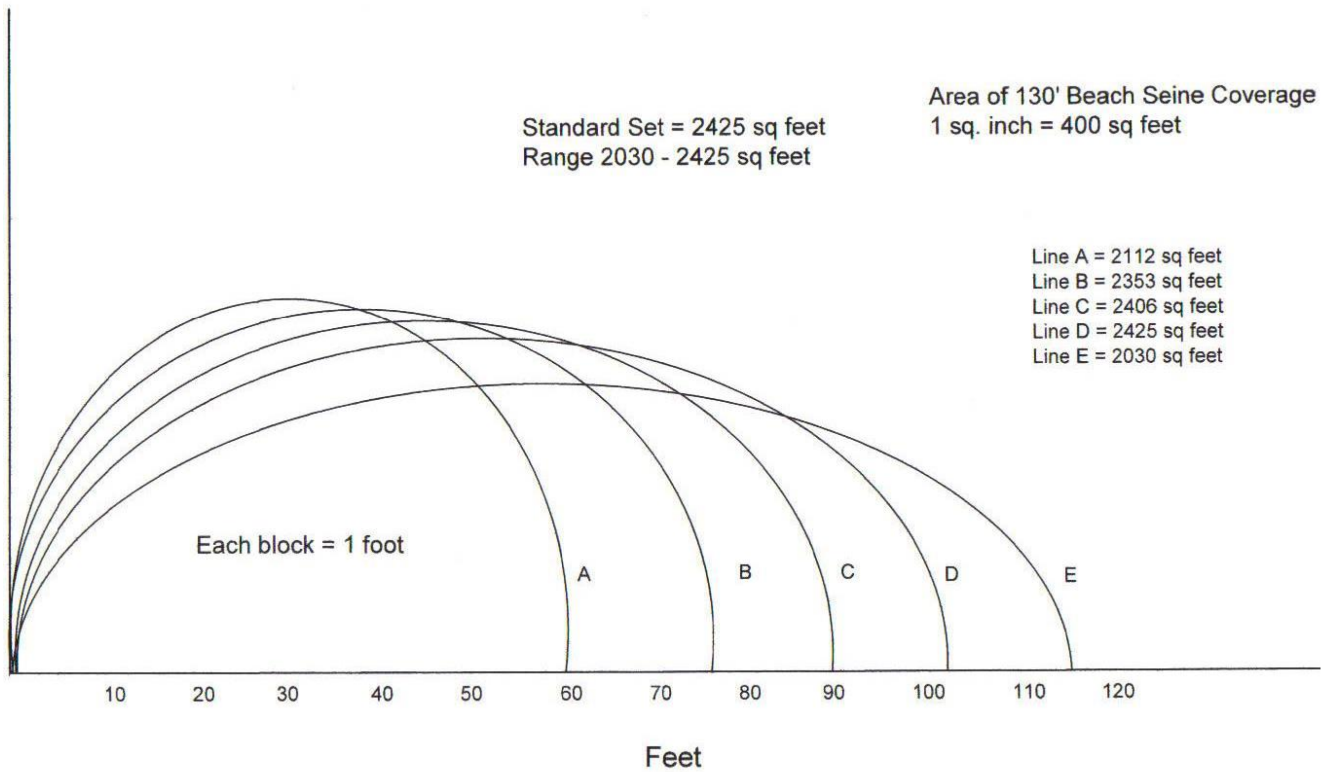


Figure 5a: Time series of abundance indices (fish/seine haul) for winter flounder YOY from each Coastal Pond in the survey.

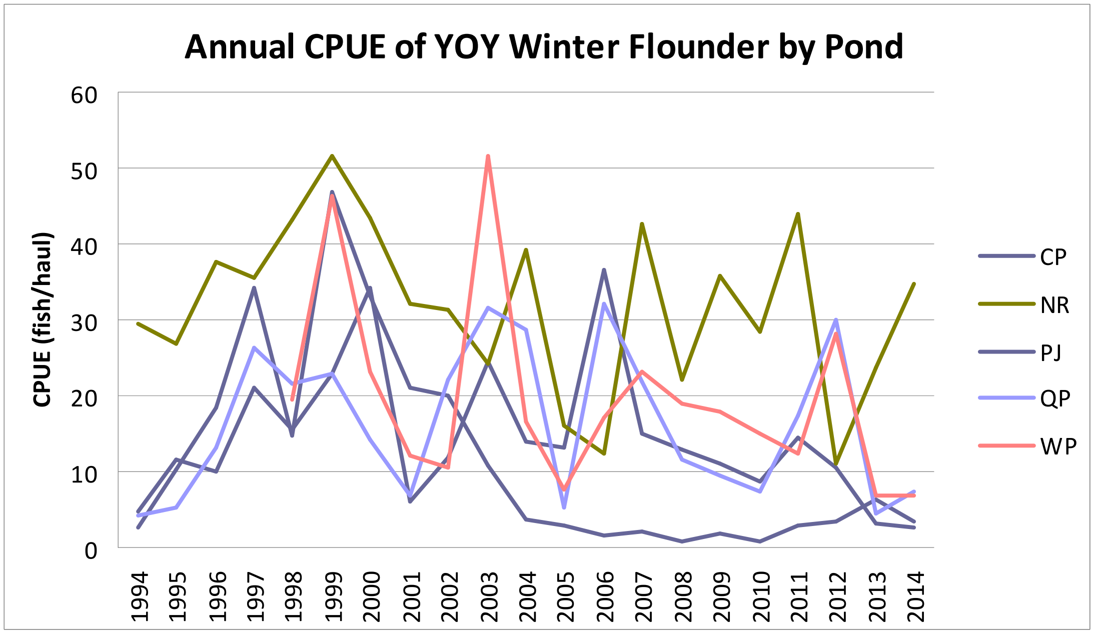


Figure 5b: 2014 time series of abundance indices (fish/seine haul) by month for winter flounder YOY for each Coastal Pond in the survey.

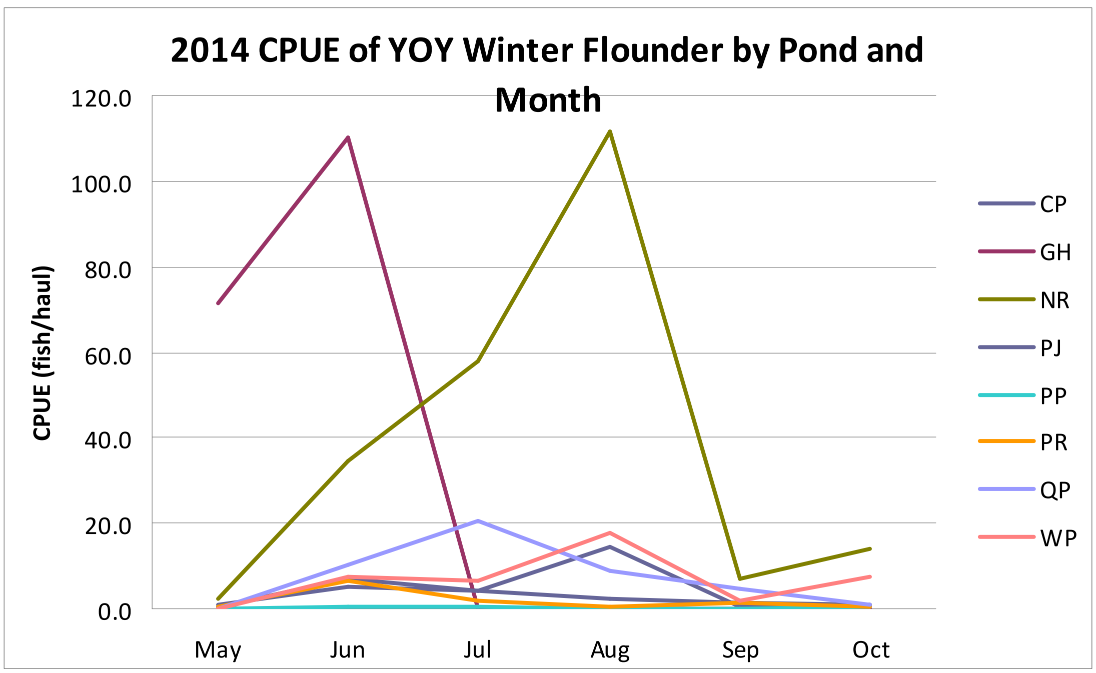


Figure 6: Length frequency of all winter flounder caught in Coastal Pond Survey during 2014.

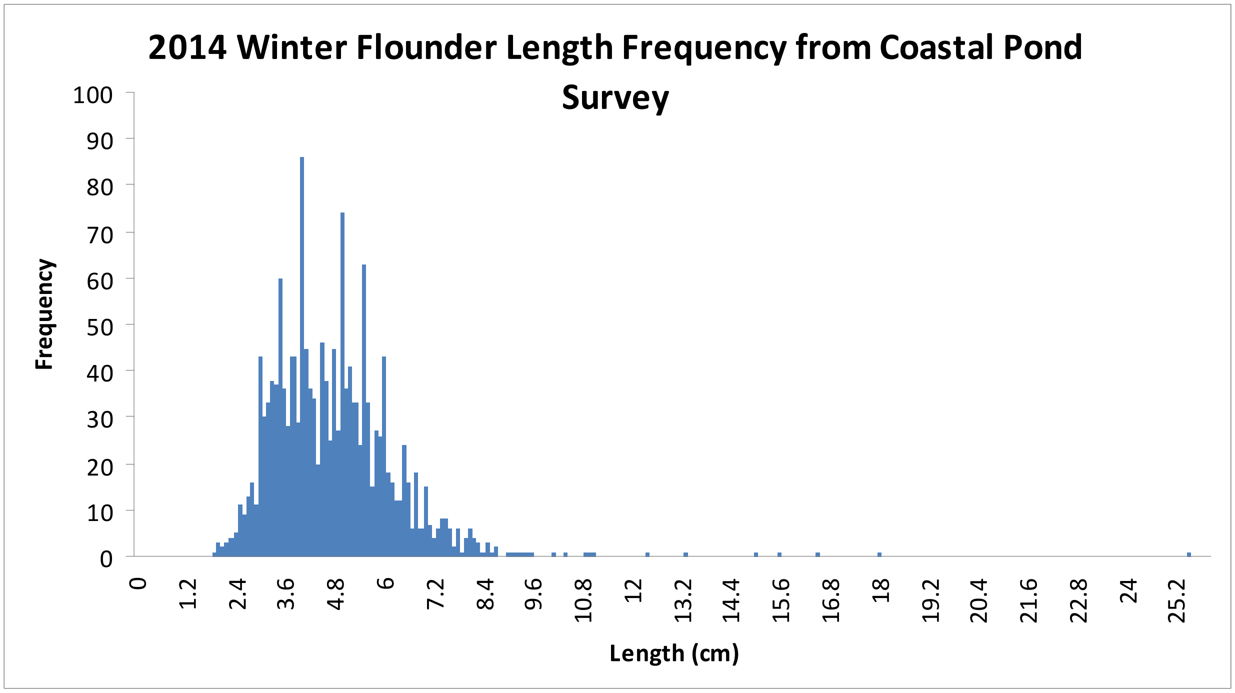


Figure 7: Monthly length frequency of winter flounder from Charlestown Pond, 2014.

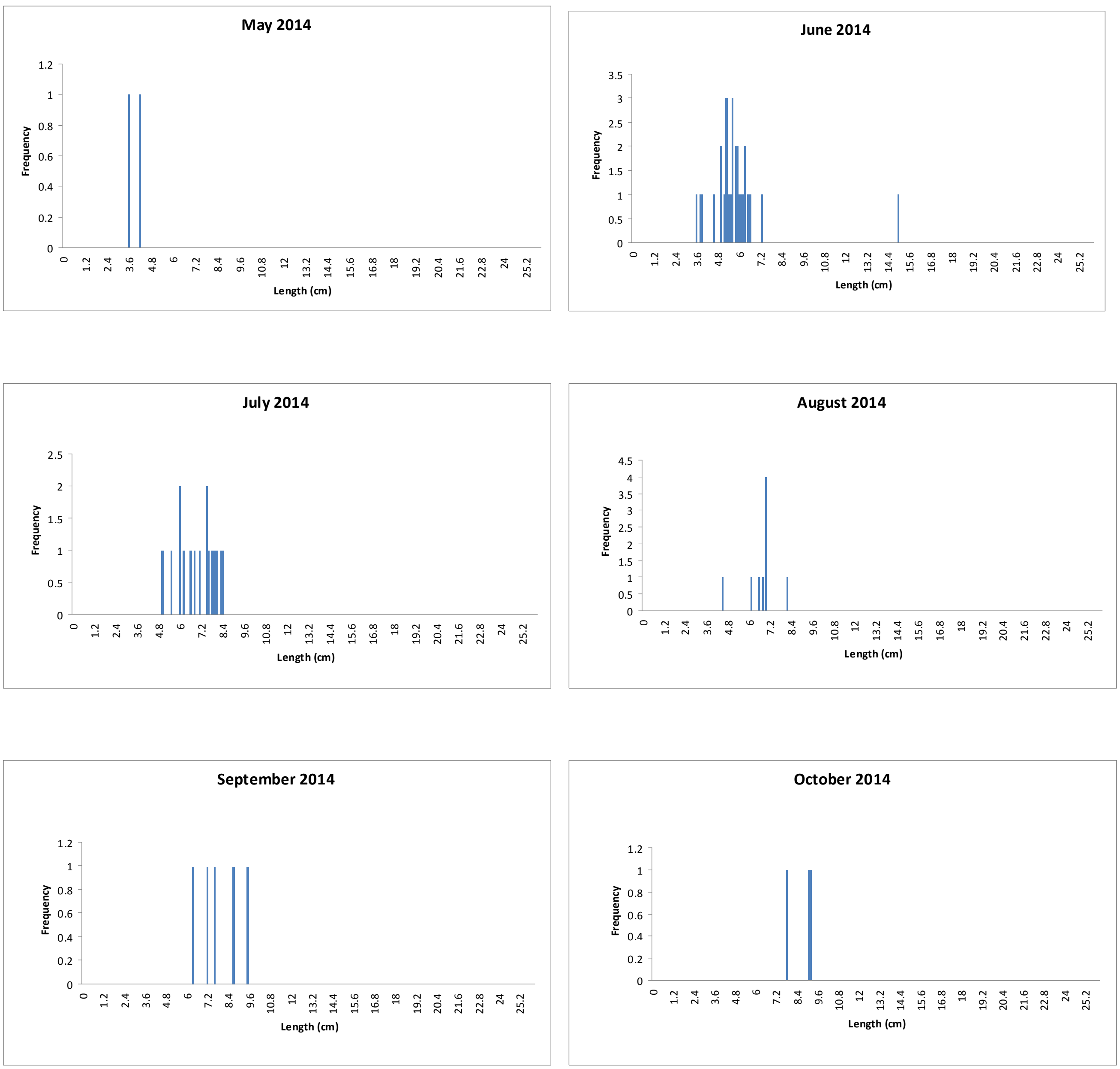
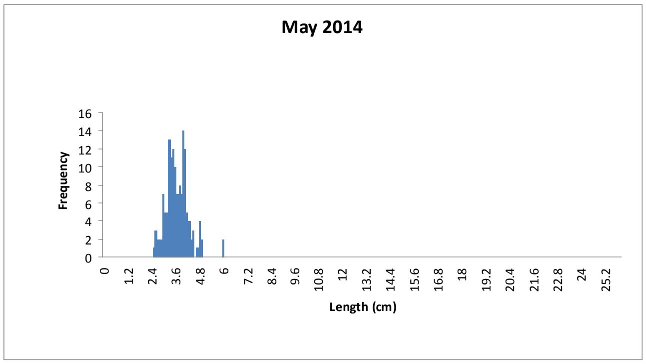
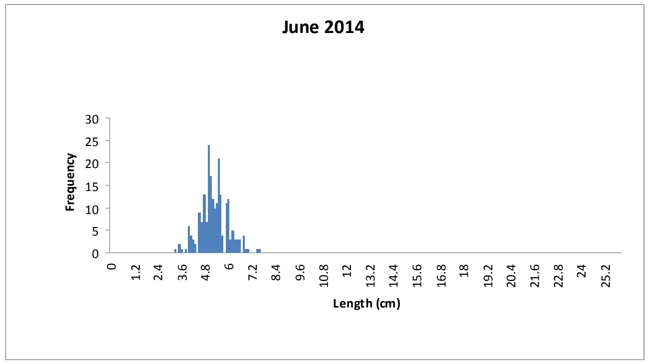
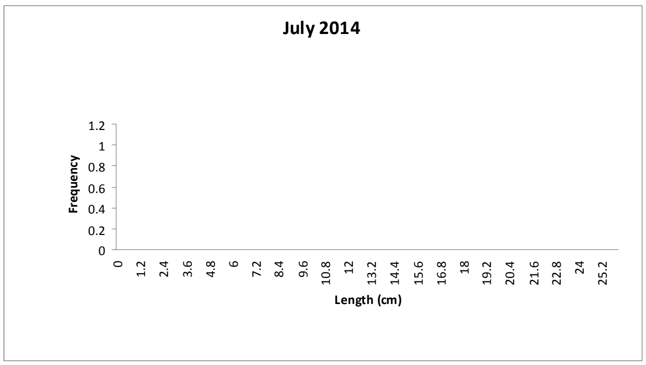
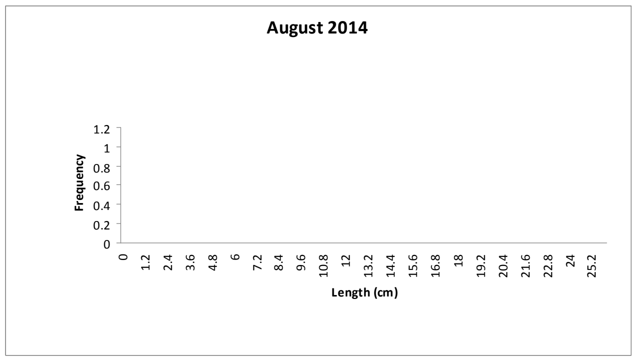


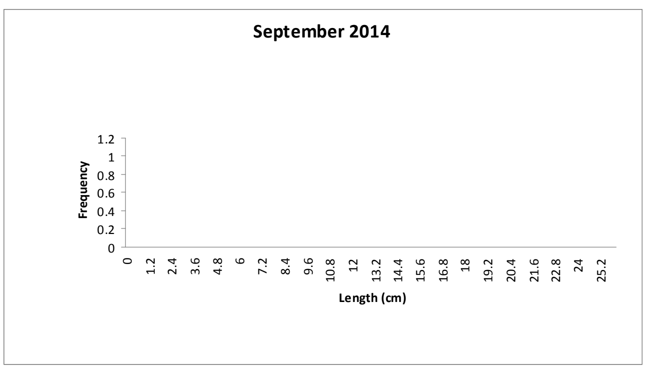
Figure 8: Monthly length frequency of winter flounder from Green Hill Pond, 2014.











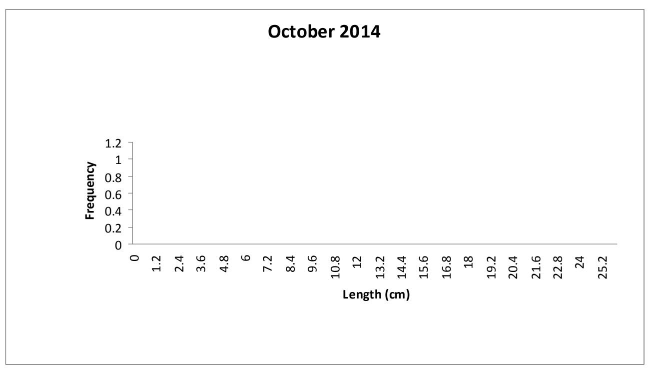
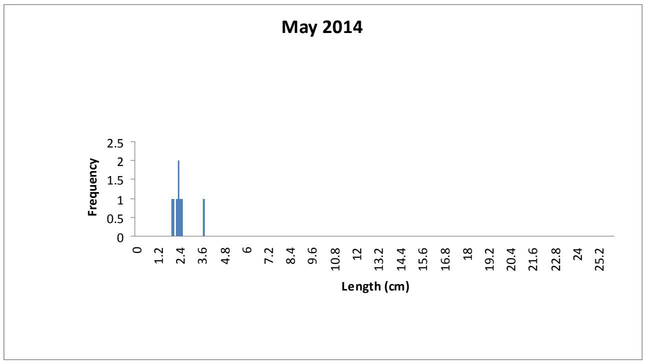
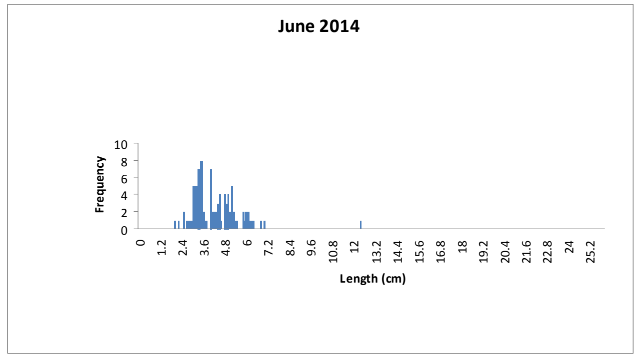
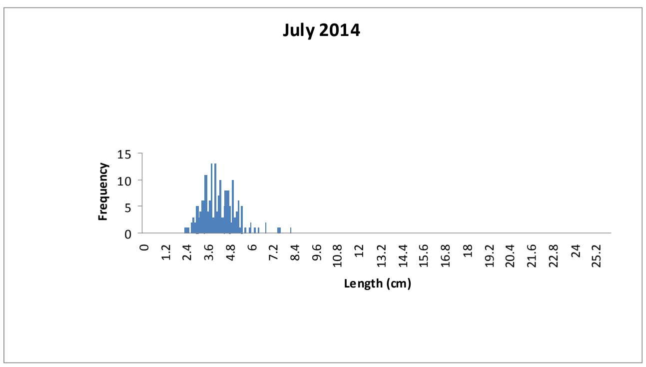
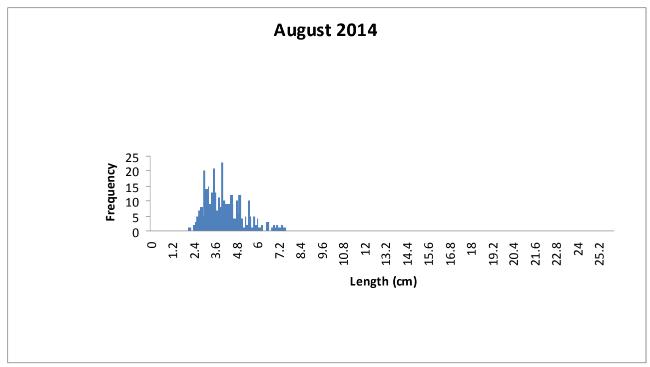


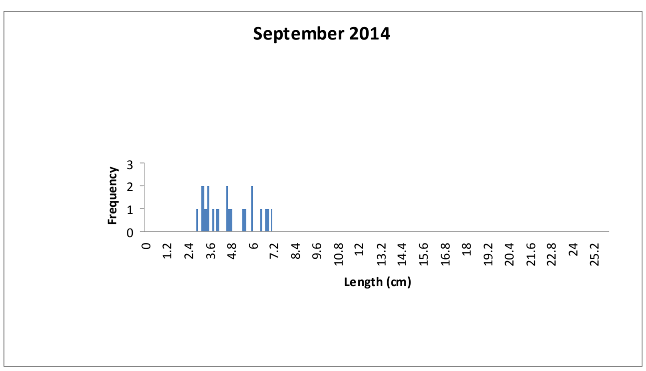
Figure 9: Monthly length frequency of winter flounder from Narrow River, 2014.











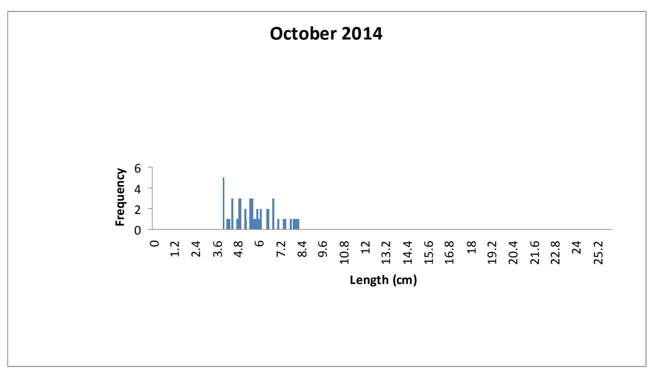
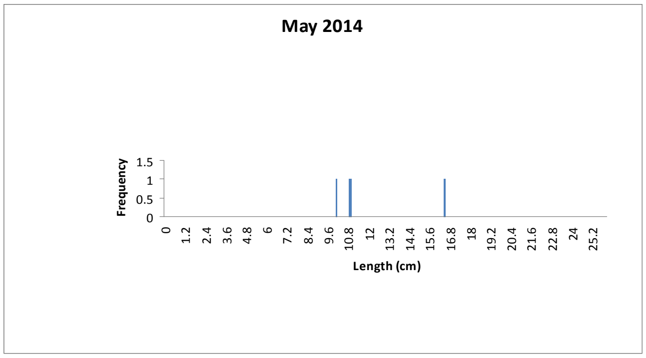
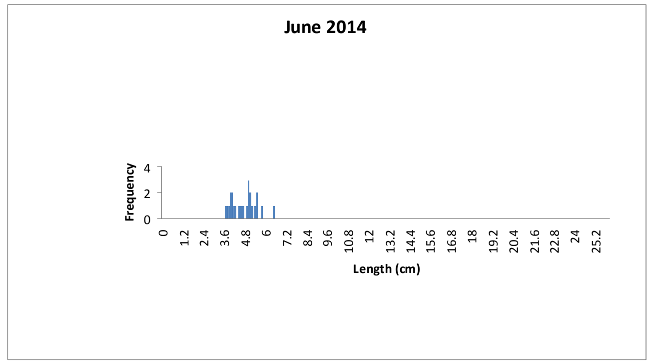
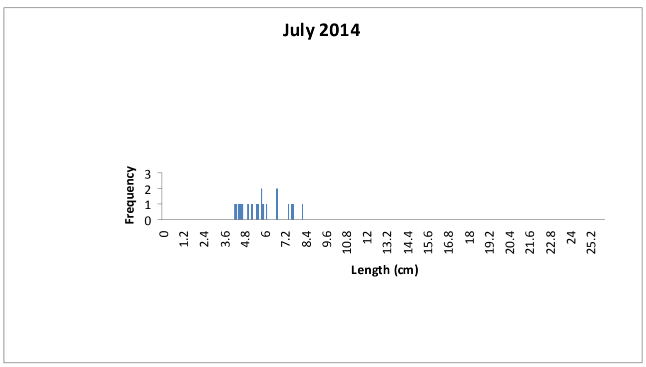
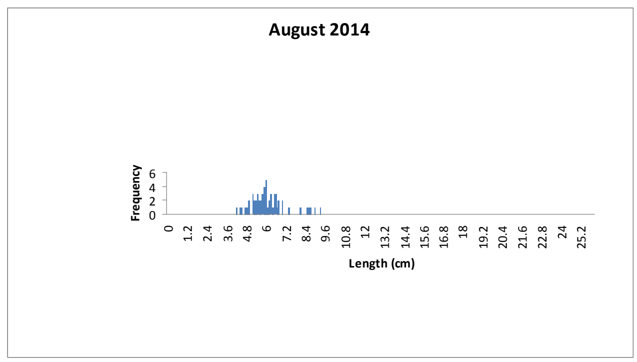


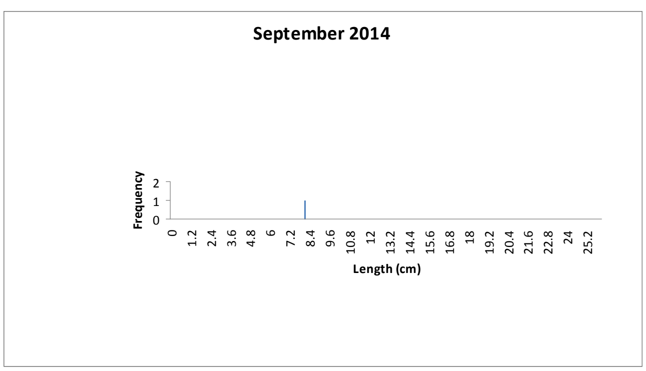
Figure 10: Monthly length frequency of winter flounder from Point Judith Pond, 2013.











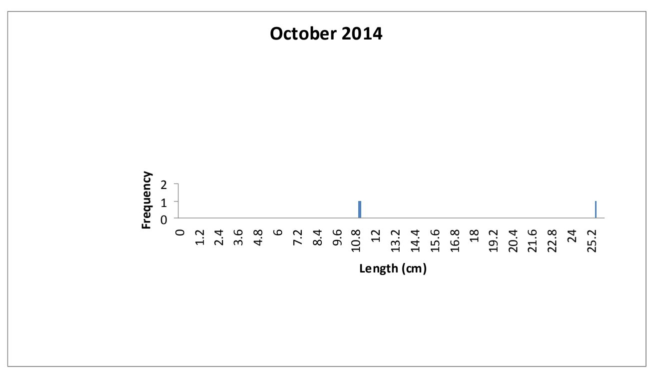


Figure 11: Monthly length frequency of winter flounder from Potter Pond, 2014.

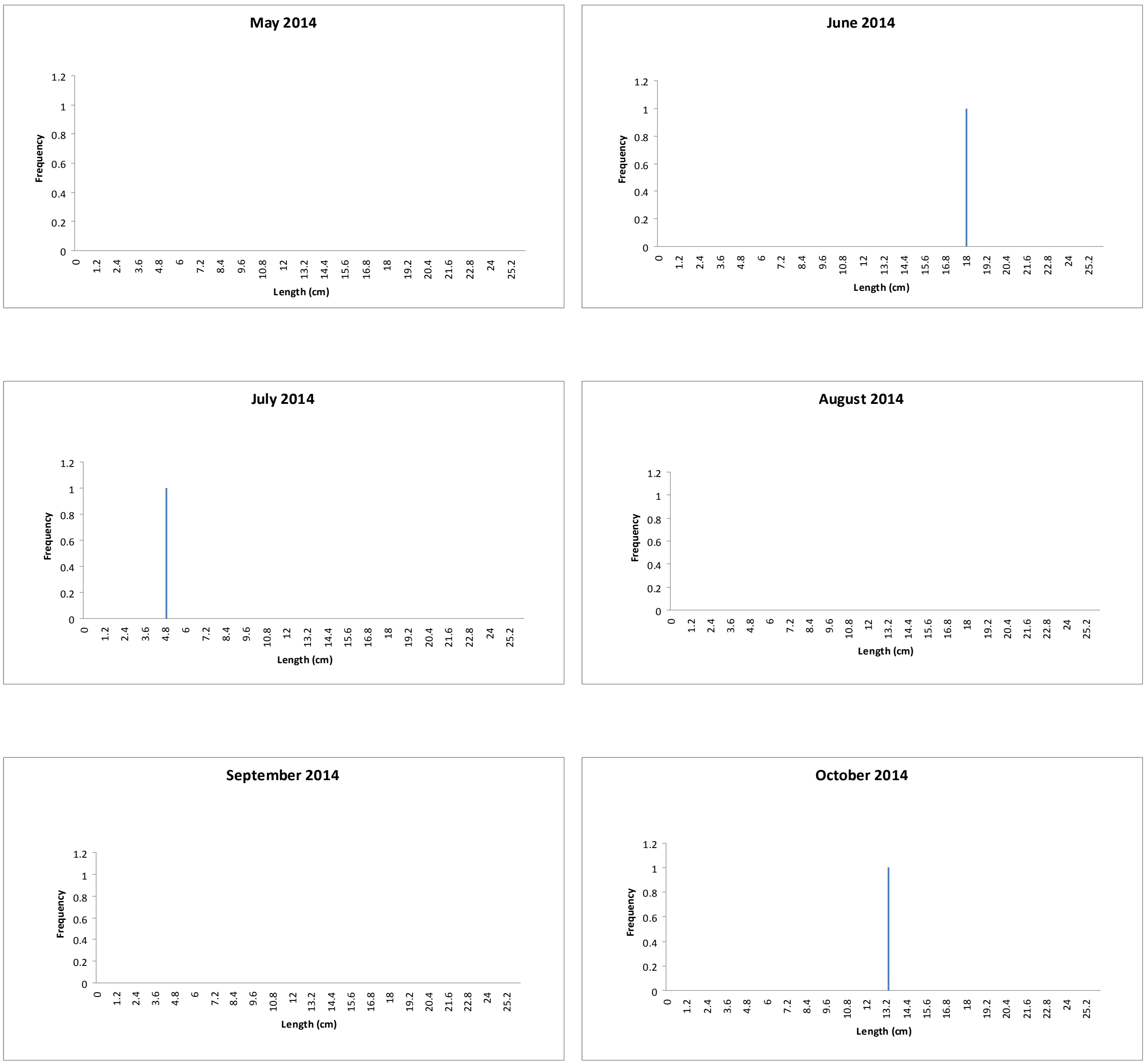


Figure 12: Monthly length frequency of winter flounder from Pawcatuck River, 2014.

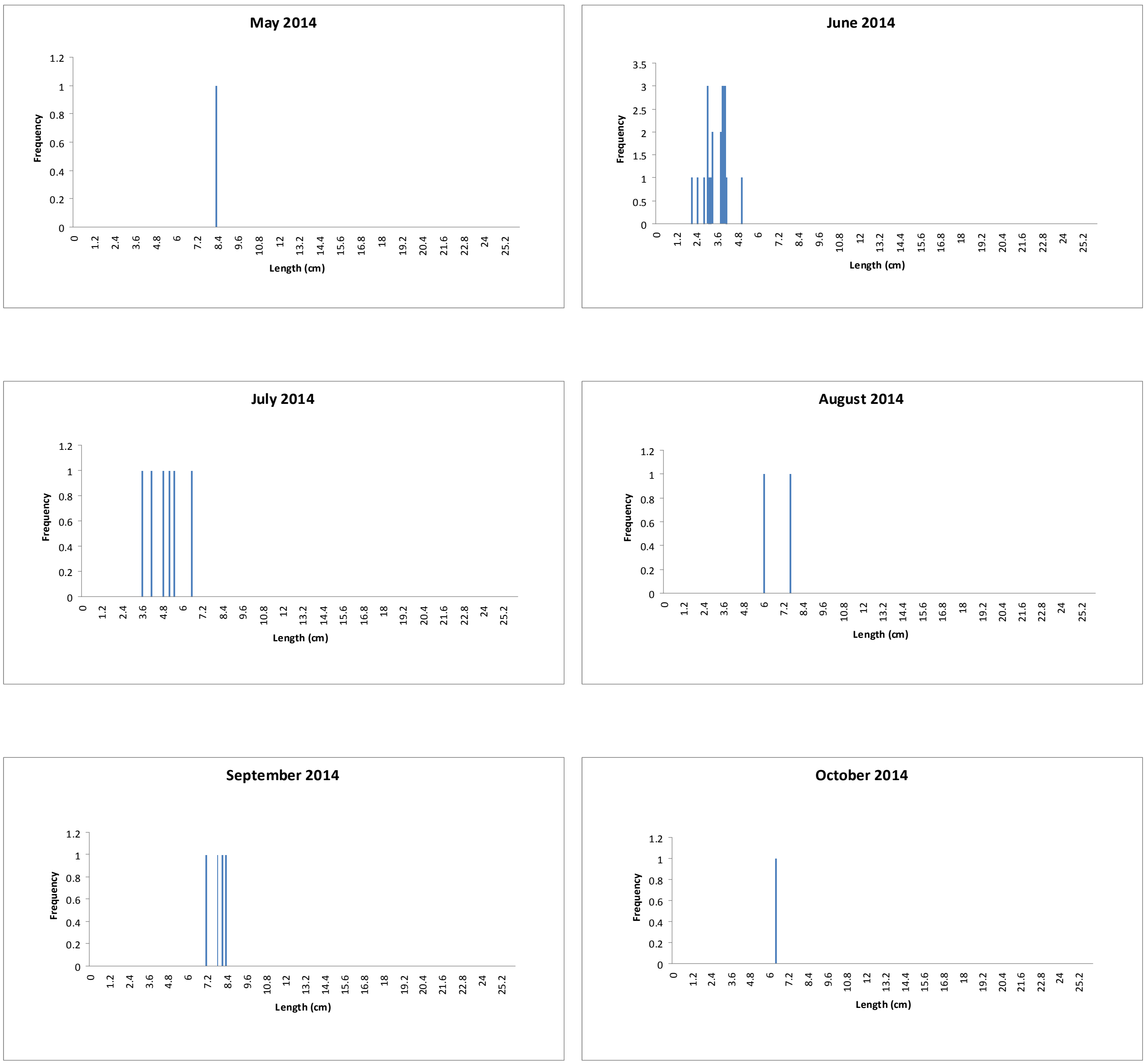


Figure 13: Monthly length frequency of winter flounder from Quonochontaug Pond, 2014.

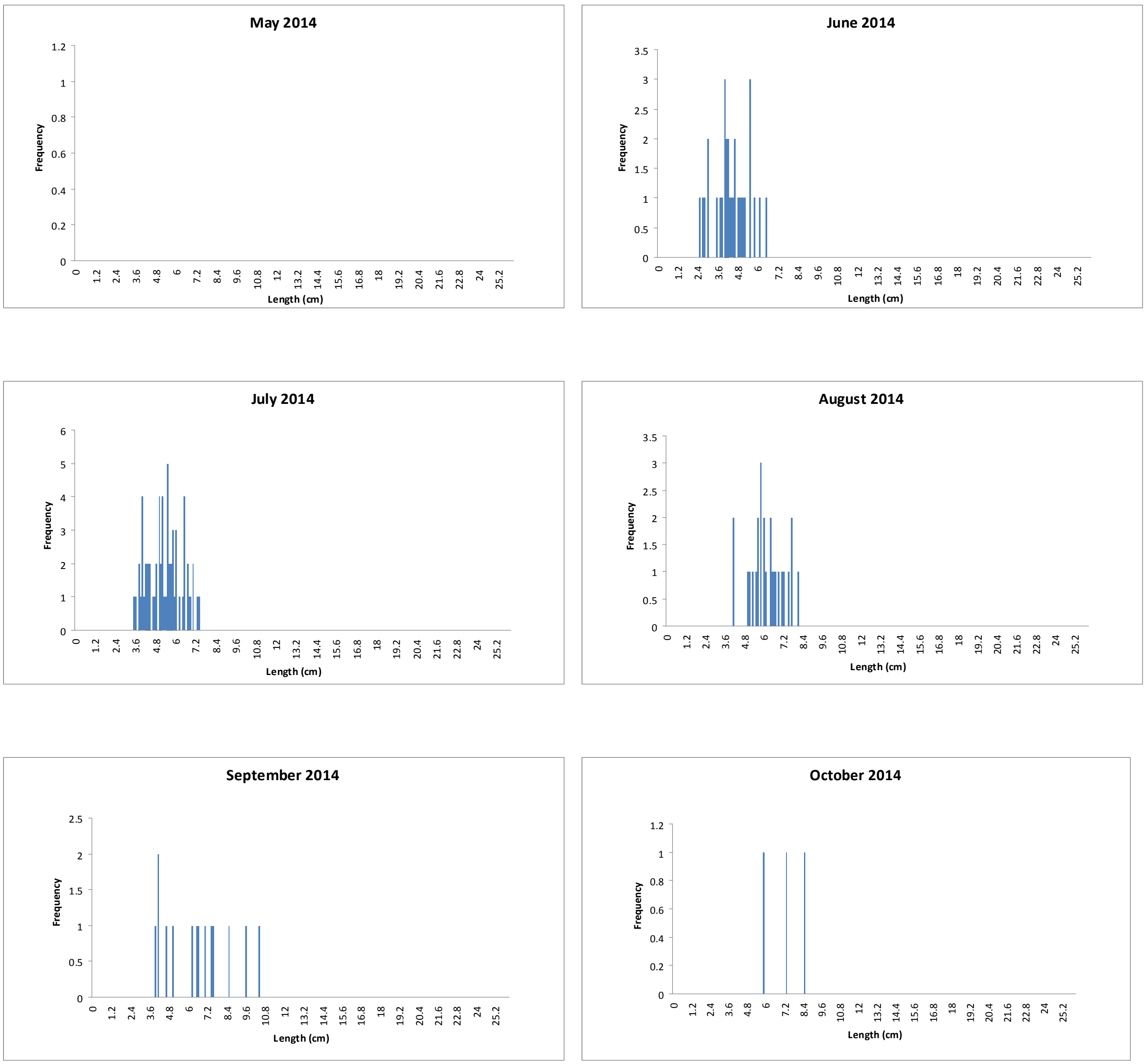


Figure 14: Monthly length frequency of winter flounder from Winnipaug Pond, 2014.

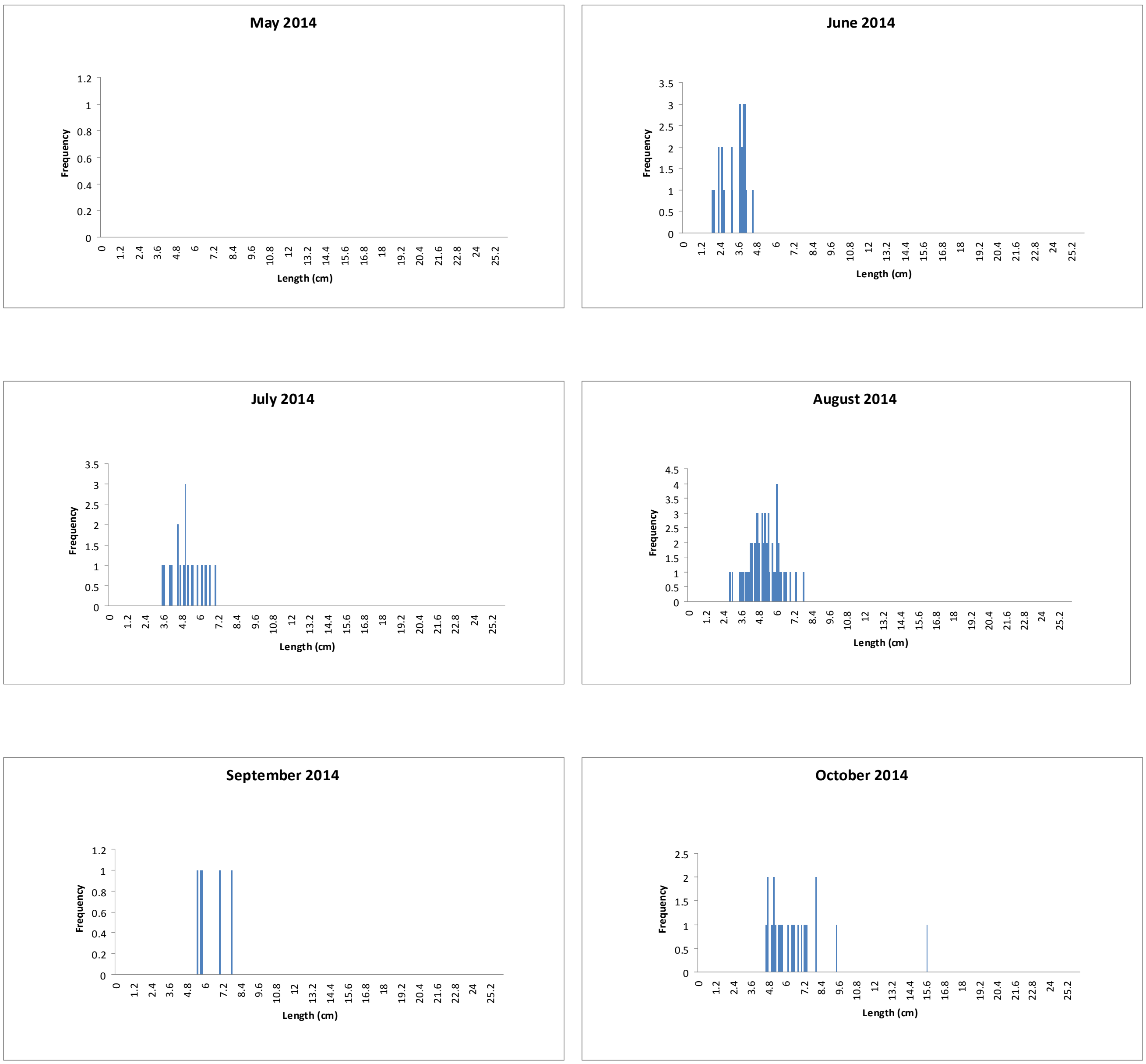


Figure 15: Time series of annual abundance indices for winter flounder YOY from the coastal pond survey.

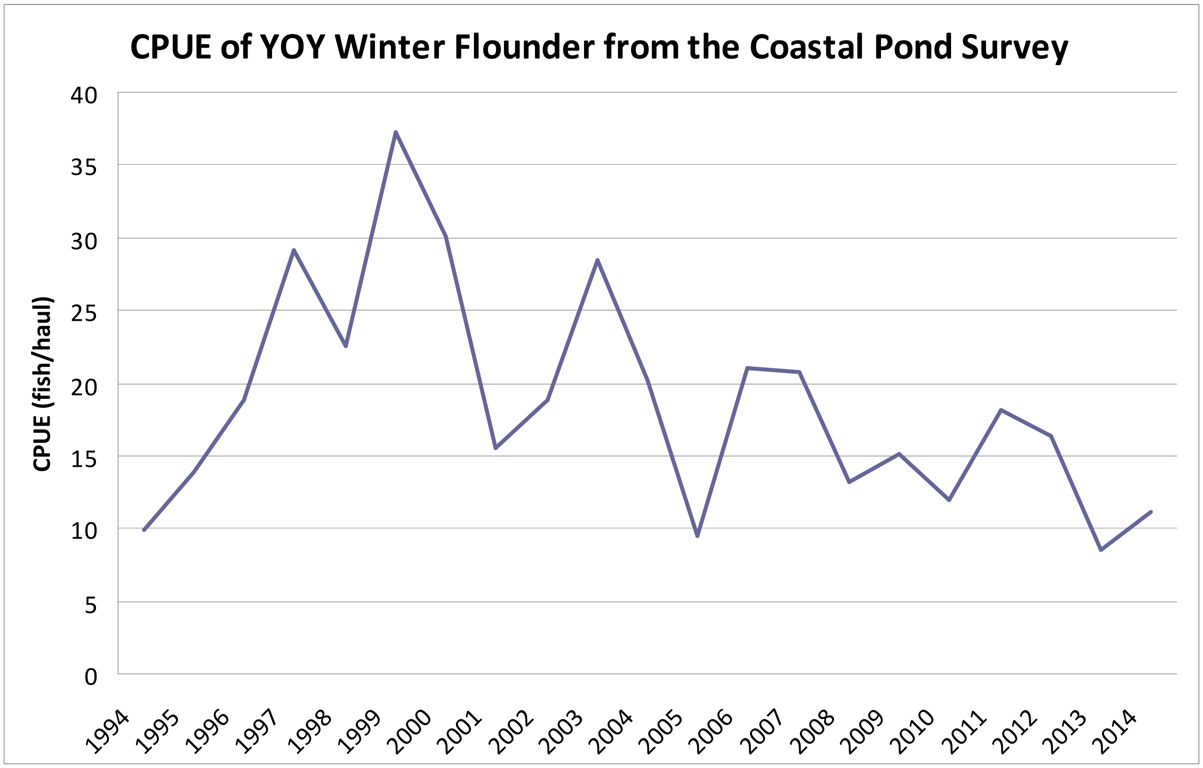


Figure 16: Abundance indices (fish/haul) from the Coastal Pond Survey, Narragansett Bay Seine Survey, and RIDFW Trawl Survey for winter flounder.

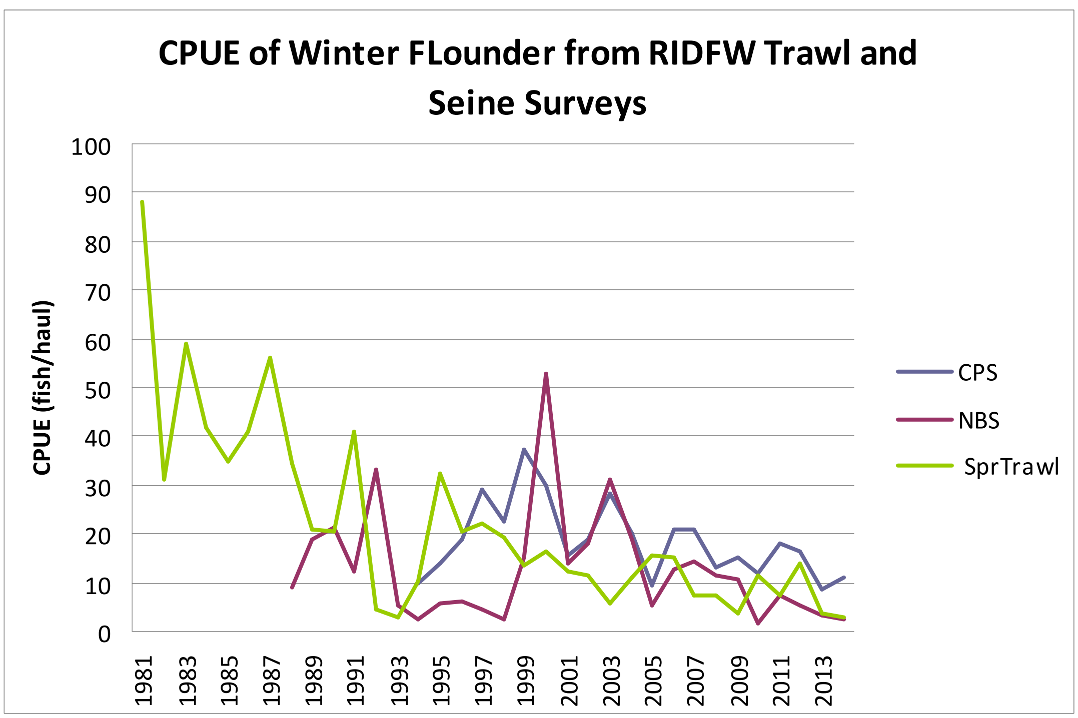


Figure 17: Abundance indices (fish/haul) from the Coastal Pond Survey and the Adult Winter Flounder Tagging Survey for winter flounder.

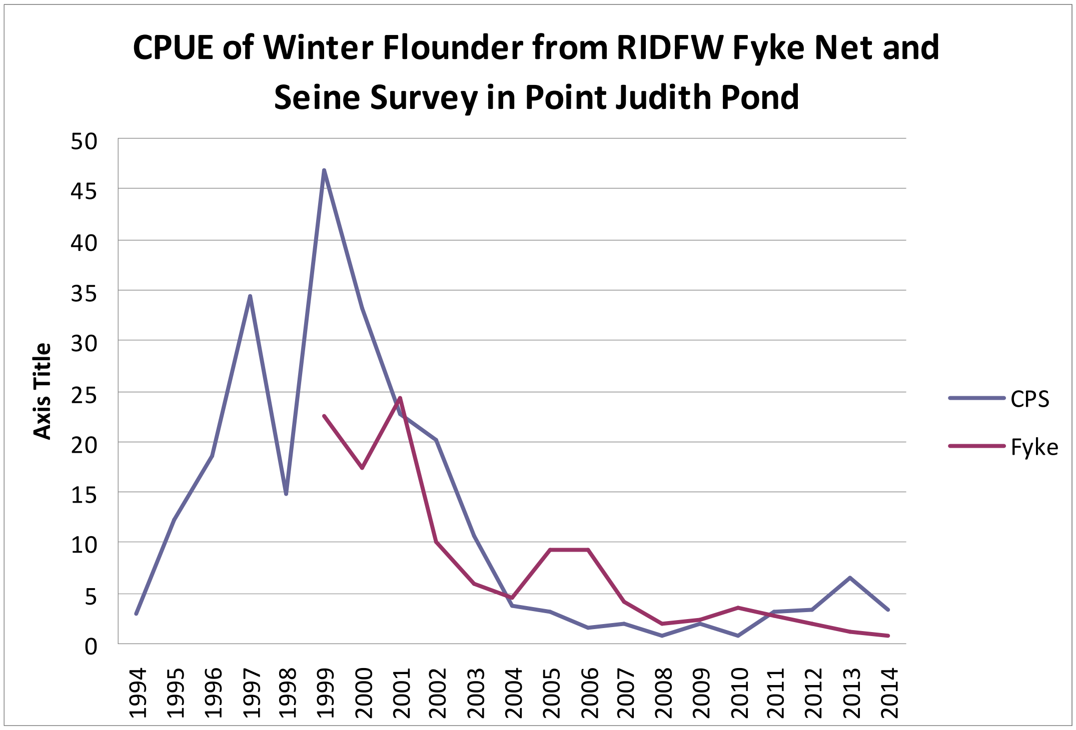


Figure 18. Time series of annual abundance indices for bluefish from the coastal pond survey.

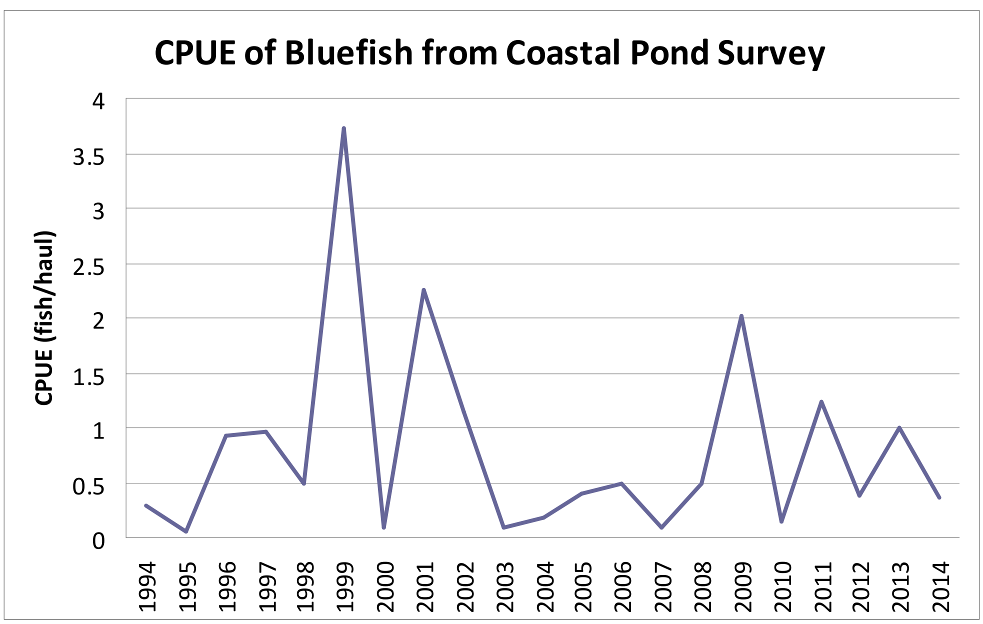


Figure 19. Time series of annual abundance indices for Tautog from the coastal pond survey.

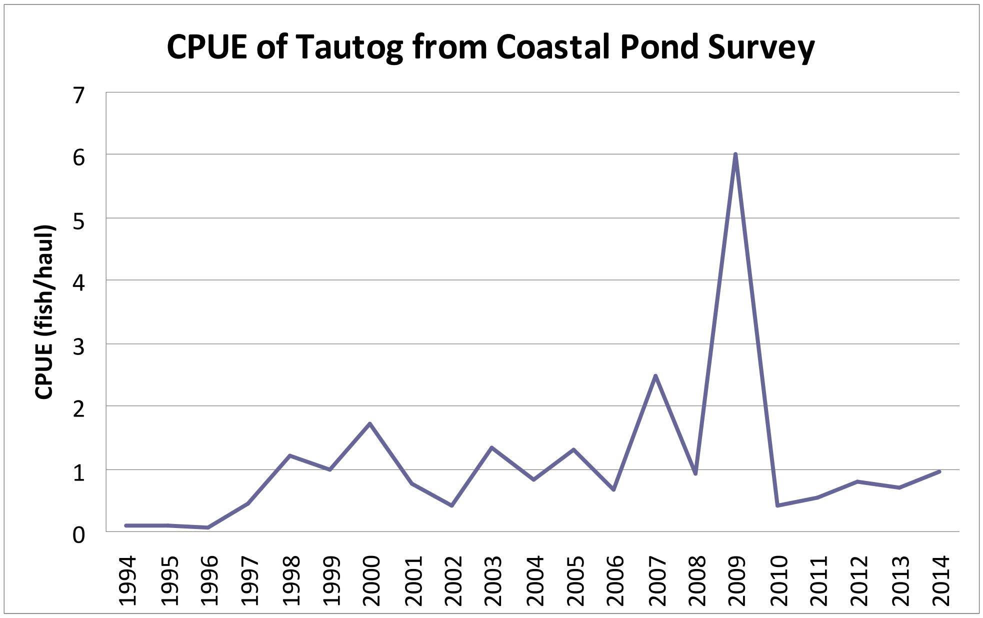


Figure 20. Time series of annual abundance indices for Black Sea Bass from the coastal pond survey.

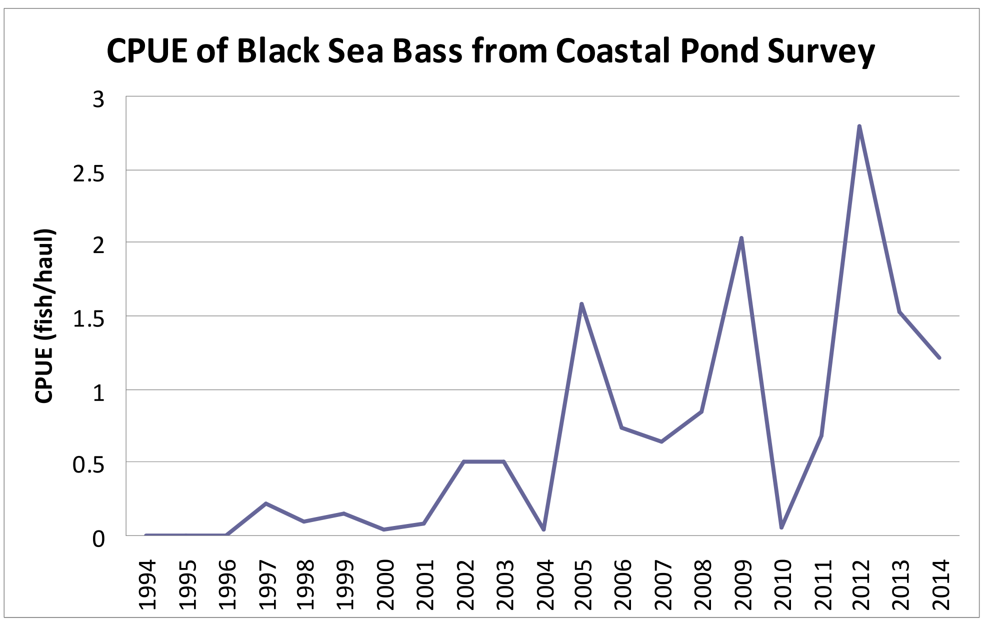


Figure 21. Time series of annual abundance indices for Scup from the coastal pond survey.

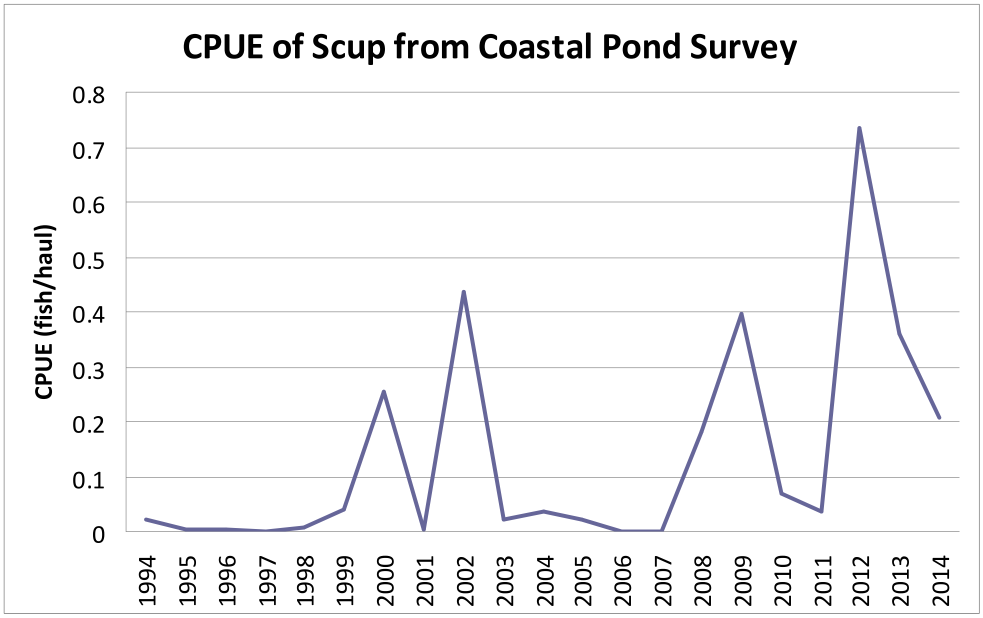


Figure 22. Time series of annual abundance indices for Clupeids from the coastal pond survey (menhaden on right y- axis)

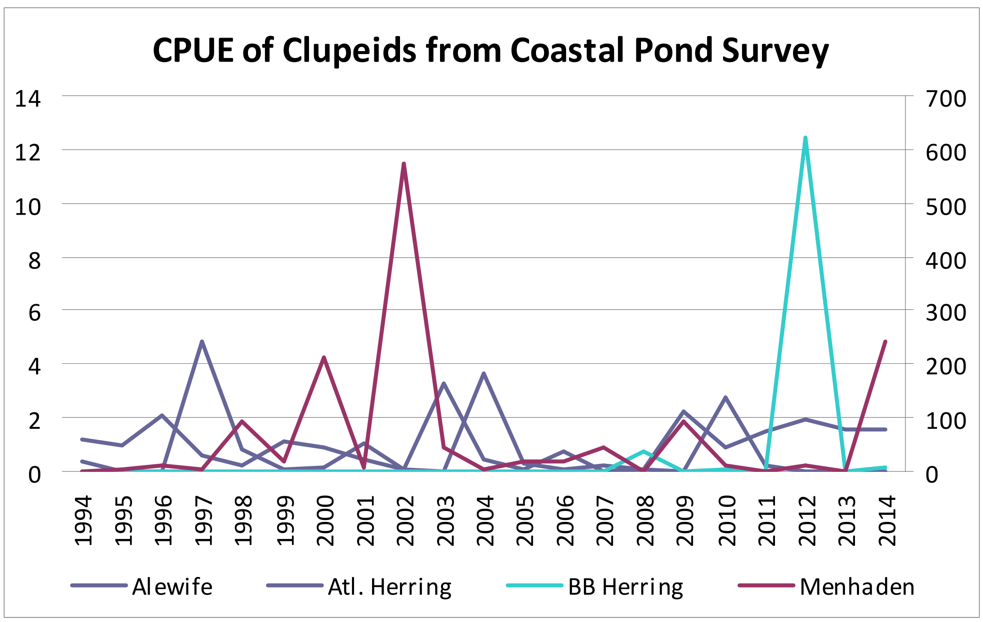
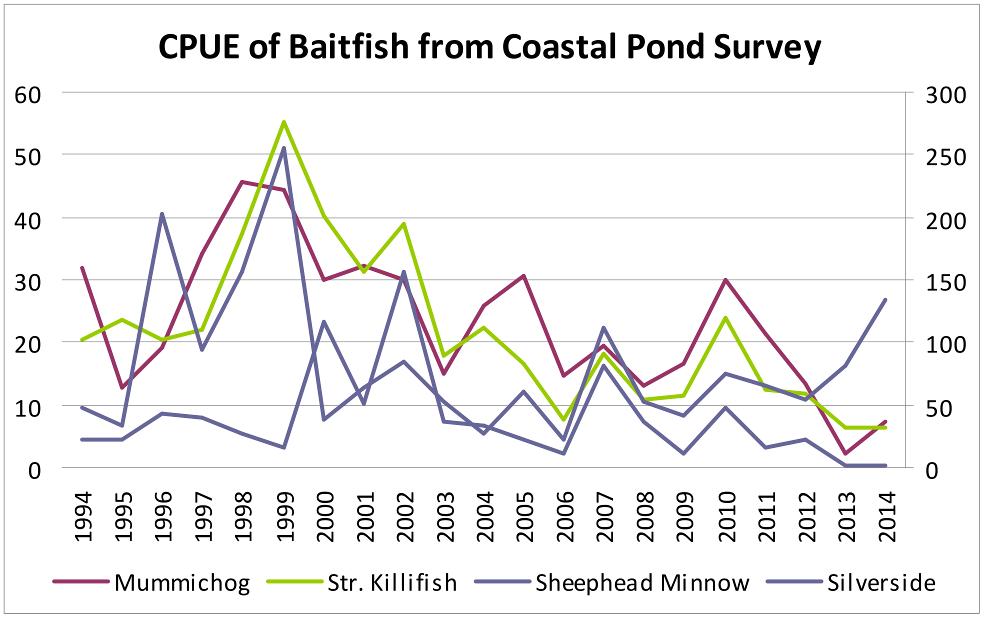


Figure 23. Time series of annual abundance indices for Baitfish from the coastal pond survey (silversides on right y- axis).



Appendix 1a: Catch frequency of all species by station for 2014 Coastal Pond Survey original ponds.

Species	CP1	CP2	CP3	CP4	NR1	NR2	NR3	PJ1	PJ2	PJ3	PJ4	QP1	QP2	QP3	WP1	WP2	WP3
ALEWIFE (ALOSA PSEUDOHARENGUS)	2		39		38	1	111		17		4	3		1			
ANCHOVY BAY (ANCHOA MITCHILLI)		4	1	1				9						4	4	1	
BLUE CRAB (CALINECTES SAPIDIUS)	6	5		16	48	1		2			5	3	2			1	7
BLUE CRAB FEMALE (CALINECTES SAPIDIUS)	2			1	11	1	2		1	1	5						2
BLUE CRAB MALE (CALINECTES SAPIDIUS)		3		6	13	1	2	2			12						
BLUEFISH (POMATOMUS SALTATRIX)		4	7	1	3	3		1			7	19	1				
CORNETFISH BLUESPOTTED (FISTULARIA TABACARIA)									1								
CUNNER (TAUTOGOLABRUS ADSPERSUS)		9	4									1	1				
EEL AMERICAN (ANGUILLA ROSTRATA)		1															
FLOUNDER SMALLMOUTH (ETROPUS MICROSTOMUS)			1			2			4	1	29			2			2
FLOUNDER SUMMER (PARALICHTHYS DENTATUS)	1				3	1					2	1	1	1		4	3
FLOUNDER WINTER (PSEUDOPLEURONECTES AMERICANUS)	23	15	15	11	21	309	353	18	27	17	39	27	65	43	24	85	14
GOBY NAKED (GOBIOSOMA BOSC)	1			1	1			4			4	5	3	2			
GRUBBY (MYOXOCEPHALUS AENAEUS)	3		8			11	14		3			4	5	1	1	3	3
HERRING ATLANTIC (CLUPEA HARENGUS)								1		2							
HERRING BLUEBACK (ALOSA AESTIVALIS)					1				1					1			
HOGCHOKER (TRINECTES MACULATUS)					8												
HORSESHOE CRAB (LIMULUS POLYPHEMUS)		2	2			2	2					2		1			1
JACK CREVALLE (CARANX HIPPOS)		1			7			1	1	1							2
KILLIFISH STRIPED (FUNDULUS MAJALIS)	4	1	11	19	2	7	1			136	15	10	46	15	187	9	
LIZARDFISH INSHORE (SYNODUS FOETENS)	5					4		3	10	1	5	2	3	8	1	7	
MENHADEN ATLANTIC (BREVOORTIA TYRANNUS)	5	2			3	7			7	1		34974	5			46	2
MINNOW SHEEPSHEAD (CYPRINODON VARIEGATUS)	39		1	1	2	5									3	1	
MOJARRA SPOTFIN (EUCINOSTOMUS ARGENTEUS)			1													1	1
MULLET WHITE (MUGIL CUREMA)	4				1	2							4	10			
MUMMICHOG (FUNDULUS HETEROCLITUS)	232	16	37	3	3	44	13	11	1		10		4		436	4	15
NEEDLEFISH ATLANTIC (STRONGYLURA MARINA)		37	12	2									3				
PERCH WHITE (MORONE AMERICANA)					153	22	9										
PERMIT (TRACHINOTUS FALCATUS)					2												1
PIPEFISH NORTHERN (SYNGNATHUS FUSCUS)	3	5	4	2	2	1		8	5		2	3	7	1		2	7
POLLOCK (POLLACHIUS VIRENS)			12				2		1				1				
PUFFER NORTHERN (SPHOEROIDES MACULATUS)		2			1			1			2	1	2	9		1	1
RAINWATER KILLIFISH (LUCANIA PARVA)	38	52	31	10		1		1	1			1					5
SCAD ROUND (DECAPTERUS PUNCTATUS)			2														
SCAMP (MYCTEROPERCA PHENAX)			1														
SCUP (STENOTOMUS CHRYSOPS)		2									1	3					
SEA BASS BLACK (CENTROPRISTIS STRIATA)	41	8	69			2	2	1	1		2		33			13	2
SEAHORSE LINED (HIPPOCAMPUS ERECTUS)													5				
SEAROBIN NORTHERN (PRIONOTUS CAROLINUS)					3												
SEAROBIN STRIPED (PRIONOTUS EVOLANS)	2		1		7		2	3			1		6	3		13	1
SENNET NORTHERN (SPHYRAENA BOREALIS)		5	1														
SILVERSIDE ATLANTIC (MENIDIA MENIDIA)	866	1254	2288	516	42	1178	180	180	80	1006	233	207	333	512	165	554	207
SNAKEFISH (TRACHINOCEPHALUS MYOPS)														1			
SPOT (LEIOSTOMUS XANTHURUS)							1										
STICKLEBACK FOURSPINE (APELTES QUADRACUS)	14	156	288	7	3	47	12	1									7
STICKLEBACK THREESPINE (GASTEROSTEUS ACULEATUS)	2	1	1		1	13	1								4	1	
TAUTOG (TAUTOGA ONITIS)	2	16	54			1		4	2		7	1	17		1		1
TOADFISH OYSTER (OPSANUS TAU)												1					
TOMCOD ATLANTIC (MICROGADUS TOMCOD)		2						1									
WATER HAUL (NO FISH BUT GOOD TOW)										0					0		
WINDOWPANE (SCOPHTHALMUS AQUOSUS)							1		1			1					

Appendix 1b: Catch frequency of all species by station for 2014 Coastal Pond Survey (new ponds).

Species	GH1	GH2	PP1	PP2	PR1	PR2	PR3
ALEWIFE (ALOSA PSEUDOHARENGUS)							13
ANCHOVY BAY (ANCHOA MITCHILLI)			1				
BLUE CRAB (CALINECTES SAPIDIUS)	8		29	3			
BLUE CRAB FEMALE (CALINECTES SAPIDIUS)	1		10	2	4	1	
BLUE CRAB MALE (CALINECTES SAPIDIUS)	2	1	23	3	9	4	3
BLUEFISH (POMATOMUS SALTATRIX)		1	3	2			1
CUNNER (TAUTOGOLABRUS ADSPERSUS)					2	1	
EEL AMERICAN (ANGUILLA ROSTRATA)		2		2			
FLOUNDER SMALLMOUTH (ETROPUS MICROSTOMUS)					1		
FLOUNDER SUMMER (PARALICHTHYS DENTATUS)	9				1		
FLOUNDER WINTER (PSEUDOPLEURONECTES AMERICANUS)	340	23	2	1	25	8	1
GOBY NAKED (GOBIOSOMA BOSC)	8	1	37	1	1		
GRUBBY (MYOXOCEPHALUS AENAEUS)				2	10	1	1
GUNNEL ROCK (PHOLIS GUNNELLUS)				1	1		
HERRING ATLANTIC (CLUPEA HARENGUS)				1			
HERRING BLUEBACK (ALOSA AESTIVALIS)						11	6
HORSESHOE CRAB (LIMULUS POLYPHEMUS)		1					
JACK CREVALLE (CARANX HIPPOS)	1						
KILLIFISH STRIPED (FUNDULUS MAJALIS)		1	3	3	18	411	2
KINGFISH NORTHERN (MENTICIRRHUS SAXATILIS)						1	
LIZARDFISH INSHORE (SYNODUS FOETENS)					13		
MENHADEN ATLANTIC (BREVOORTIA TYRANNUS)						21	8
MINNOW SHEEPSHEAD (CYPRINODON VARIEGATUS)	2	2		1	1		
MULLET WHITE (MUGIL CUREMA)			3				
MUMMICHOG (FUNDULUS HETEROCLITUS)	22	45	13	115			14
NEEDLEFISH ATLANTIC (STRONGYLURA MARINA)	1	3	1				1
PERCH WHITE (MORONE AMERICANA)			2	5			
PIPEFISH NORTHERN (SYNGNATHUS FUSCUS)	2	1	11	6	3	3	1
PUFFER NORTHERN (SPHOEROIDES MACULATUS)					1		
RAINWATER KILLIFISH (LUCANIA PARVA)	1	4	2	12			2
SAND LANCE AMERICAN (AMMODYTES AMERICANUS)						500	
SCUP (STENOTOMUS CHRYSOPS)					7	5	12
SEA BASS BLACK (CENTROPRISTIS STRIATA)					1		
SEAROBIN STRIPED (PRIONOTUS EVOLANS)			2		3	1	
SHAD HICKORY (ALOSA MEDIOCRIS)				1			
SILVERSIDE ATLANTIC (MENIDIA MENIDIA)	7233	472	828	207	109	413	293
STICKLEBACK FOURSPINE (APELTES QUADRACUS)	5	78	9	11	2	8	40
STICKLEBACK NINESPINE (PUNGITIUS PUNGITIUS)				2			
TAUTOG (TAUTOGA ONITIS)			1	1	4	1	23
TOADFISH OYSTER (OPSANUS TAU)	1	2	1	3			
TOMCOD ATLANTIC (MICROGADUS TOMCOD)				1		3	11
WINDOWPANE (SCOPHTHALMUS AQUOSUS)					1		

ASSESSMENT OF RECREATIONALLY IMPORTANT FINFISH STOCKS IN RHODE ISLAND WATERS

NARRAGANSETT BAY JUVENILE FINFISH SURVEY

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2014

PERFORMANCE REPORT

STATE: Rhode Island

PROJECT NUMBER: F-61-R
SEGMENT NUMBER: 21

PROJECT TITLE: Assessment of Recreationally Important Finfish Stocks in Rhode Island Waters.

PERIOD COVERED: 1 January 2014 - 31 December 2014

JOB NUMBER AND TITLE: IV - Juvenile Marine Finfish Survey

JOB OBJECTIVE: To monitor the relative abundance and distribution of the juvenile life history stage of winter flounder (*Pseudopleuronectes americanus*), tautog (*Tautoga onitis*), bluefish (*Pomatomus saltatrix*), scup (*Stenotomus crysops*), weakfish (*Cynocion regalis*), black sea bass (*Centropristis striata*), alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), Atlantic menhaden (*Brevoortia tyrannus*), Atlantic herring (*Clupea harengus),* striped bass (*Morone saxatilis*), and other selected species of commercial and recreational importance in Narragansett Bay. To use these data to evaluate short and long term annual changes in juvenile population dynamics, to provide data for stock assessments, and for the development of Fishery Management Plans. To collect fish community data that is used to continue to identify, characterize, and map essential juvenile finfish habitat in Narragansett Bay.

SUMMARY: Eighteen fixed stations (Figure 1) around Narragansett Bay were sampled once a month from June through October 2014 with the standard 61 x 3.05 m beach seine. Adults and juveniles of approximately sixty-three species were collected during the 2014 survey. For comparison seventy-four species were collected in 2008, the highest number of species and families collected since the survey began. For the entire survey time series (1988 ï 2014), all individuals of the target species: winter flounder, tautog, bluefish, weakfish, black sea bass, scup, river herring, sea herring, and menhaden were enumerated and measured. With few exceptions (noted) all individuals of these species that were collected in the survey were juveniles. Adult and juveniles of other species collected were not differentiated for data analysis or descriptive purposes prior to 2009. Presence and relative abundance (few, many, abundant) of three forage species: Atlantic silversides (*Menidia menidia*), common mummichog (*Fundulus heteroclitus*) and striped killifish (*Fundulus majalis*) had been noted until 2009. Since 2009 all finfish species caught were enumerated and measured. Invertebrate species were noted and enumerated using the relative abundance scale as noted above. Data on weather, water temperature, salinity, and dissolved oxygen were recorded at each station.

TARGET DATE: December 2014

SIGNIFICANT DEVIATIONS: There were no significant deviations to methodology in 2014.

RECOMMENDATIONS: Continue standard seine survey at all eighteen stations. Continue to provide comments and recommendations to other resource management and regulatory agencies regarding potential anthropogenic impacts to fisheries resources and habitat. Continue to analyze and provide data for use in fisheries stock assessments. A reassessment and characterization of the habitat at each station should be undertaken to see if any major changes have occurred since the original evaluation. A power analysis of the data specifically for the target species should be undertaken to quantify the adequacy of the sampling protocol.

REMARKS: Abundance trends derived from adult data collected from the RIDFW seasonal trawl survey since 1979 indicate a declining abundance of demersal species and an increasing abundance for pelagic species in Rhode Island waters. It should be noted that the trawl survey samples both adult and juvenile fish and invertebrates. This trend has also been observed in other estuaries along the Atlantic coast. Reasons for these shifts are attributed to a number of factors but may not be limited to these factors. These include the effects of climate change, warming coastal waters, water quality, habitat degradation and loss, overexploitation of some species leading to niche replacement by other species, and trophic level changes and shifts associated with all of these factors. Anthropogenic affects and the synergy between factors have no doubt led to changes in fish communities along the coast (Kennish, 1992).

A non parametric Mann-Kendall test for trend significance can be used to show annual abundance trends for species collected during this juvenile survey. Two iterations of this test were run on a sample of different species. The first was to analyze the entire dataset and then a second iteration of this non parametric trend analysis was done using a shortened time period of 10 years. While no species have any significant long term trend in abundance, striped bass, and river herring showed significant trends of decreasing abundance during the past 10 years. The other species such as juvenile bluefish, winter flounder, and tautog show no abundance trend for either the full dataset or the past ten years (Table 1a, b). The data in Table 1a all indicate trends or lack thereof for the entire survey data series going back to 1988.

Reductions and annual fluctuations in abundance of many species may be attributed to a number of factors outlined above. Any one or more of these factors and/or the synergy between them may be responsible for inhibiting populations of some species from returning to historic or in some cases sustainable levels. Continued monitoring of juvenile fish populations is necessary to document the abundance and distribution of important species as well as the interactions between species. Further, this data can be analyzed to evaluate the effectiveness of management actions, an example being a spawning closure enacted for tautog in 2006 and then lengthened in 2010. This spawning closure was in part supported by the data derived from this survey. Trends in abundance and shifts in fish community composition can also be evaluated with these data.

While the primary purpose for conducting this survey is to provide data for making informed fisheries management decisions, these data are also used when evaluating the adverse impacts of dredging and water dependent development projects.

METHODS, RESULTS & DISCUSSION: A 61m x 3.05m beach seine, deployed from a 23ô boat, was used to sample the juvenile life stage of selected fish species in Narragansett Bay. Monthly seine collections were completed at the eighteen standard survey stations (Figure 1) from June through October 2014.

Number of individuals and lengths were recorded for all finfish species. While both juveniles and adults were represented in the collections for many species, individuals collected for the target species were predominately young-of-the-year juveniles (YOY). Species and number of individuals (both juveniles and adults) of invertebrate species collected were also recorded with the use of a relative index of abundance (abundant, many, few). Tables 3 - 7 show the species occurrence and number caught at each station for June through October. Table 8 is a summary table for all stations and species collected during the 2014 survey. Tables 9-13 provide the number of fish/seine haul for each station along with the station mean, monthly mean, and annual abundance index for each target species. Figures 2 ï 10 show the annual abundance index trends for a number of important species for both the original and standardized indices. It should be noted when interpreting these data, that the survey began in 1986 with fifteen stations. The data represented in the graphs begins in 1988 as the period of time when the survey began using consistent methodology with the 15 stations. Station 16 (Dyer Is.) was added in June 1990, station 17 (Warren R.) was added in July of 1993, and station 18 (Wickford) was added in July of 1995. The addition of the stations is standardized in the analysis, see appendix A.

Table 15 provides bottom temperature, salinity, and dissolved oxygen data for each station by month.

<u>Winter flounder</u>

Juvenile winter flounder (*Pseudopleuronectes americanus*) were present in forty-four percent of the seine hauls for 2014. This is a small increase from 2013 when they were present in forty-three percent of the hauls. A total of 229 fish were collected in 2014 (all fish but one would be considered young-of-the-year (YOY) according to Table 2 winter flounder maximum size by month). This was a decrease from the 298 individuals collected during the 2013 survey. They were present at all but two stations (no presence at stations 10 and 16), and were collected in all months (Table 9).

The 2014 juvenile winter flounder standardized abundance index was 2.57 ± 1.00 S.E. fish/seine haul; this is lower than the 2013 index of 4.51 ± 1.19 S.E. fish/seine haul. Figure 2 shows the standardized annual abundance indices since 1988. The Mann-Kendall test showed no significant abundance trend for this species for the full dataset, or in the last 10 years (Table 1a, b).

June had the highest mean monthly abundance of 7.00 ± 2.38 S.E. fish/seine haul. Spectacle Island (Sta. 13) and Chepiwonoxet Pt (Sta. 3) had the highest mean station abundance of 13.8 ± 6.84 and 6.80 ± 4.91 S.E. respectively. Overall upper and mid bay stations continue to have higher abundances than lower bay stations. This is expected since the primary spawning area for this species is believed to be in the Providence River followed by a secondary spawning area in Greenwich Bay where Station 3 is located. Wickford (Sta. 18), located in the lower bay, also has high numbers of juveniles. This station is located just outside Wickford Harbor, an area believed to be an important winter flounder spawning area.

Winter flounder length frequency data from the 2014 survey indicate that all but one of the winter flounder collected were young-of-the-year (YOY). The maximum lengths by month for YOY winter flounder used for this report are supported by growth rates in Rhode Island waters as reported in the literature (Delong et al, 2001; Meng et al, 2000; Meng et al, 2001; Meng et al, 2008). See Table 2 for maximum YOY lengths by month.

Figure 2 shows the 2012 abundance index continues to be lower than most years since 2000, the survey high. The Division of Fish and Wildlifeôs trawl survey data (sampling both adults and juveniles) saw a flat trend in abundance from 2013 to 2014 during the spring seasonal survey, while the fall trawl survey saw a small increase from 2013 to 2014. Over the course of the Narragansett Bay Juvenile Finfish Seine Survey the abundance index rose between 1995 and 2000, but then decreased with variability to 2014. The Mann-Kendall trend analysis shows no trend in the abundance of juvenile winter flounder in Narragansett Bay over the entire time series, and the declining trend indicated for the shortened 10 year time series in the terminal year of 2012 has dissipated in 2014, now showing no trend as we move away from the peak years of the early 2000ôs. The dramatic abundance fluctuations over the past ten years shown in Figure 2 and the declining trend over the last decade continue to be a concern to resource managers.

Tautog

During the 2014 survey 319 juvenile tautog (*Tautoga onitis*) were collected. This is an increase from the 2013 survey when 294 juveniles were collected. The 2014 standardized abundance was one of the lower values in the survey time series, and was flat relative to the previous year. The 2014 abundance index was 3.63 ± 1.49 S.E. fish/seine haul, a decrease from the 2013 index of 6.39 ± 1.90 S.E. (Figure 3). As indicated in the introduction, based on this survey data, it can be concluded that the spawning closure enacted in 2006 and then extended in 2010 does not appear to be having a significant impact on the number of juveniles produced during the spring to this point. However, it may take some time for a slow growing species such as tautog to recoup its spawning stock biomass to levels that will have significant impacts; therefore we will continue to monitor this species closely in the coming years.

Juvenile tautog were collected in fifty-three percent of the seine hauls in 2014 (Table 10). This is an increase from 2013 when they were present in forty-six percent of the seine hauls. In 2014 August had the highest mean monthly abundance of 7.94 ± 3.15 fish per seine haul, which corresponds to the majority of the survey time series data which indicates August as being the month with the highest abundance. Hog Island (Sta. 9) had the highest mean station abundance of 13.00 ± 10.06 S.E. followed by Patience Island (Sta. 5) with a mean station abundance of 7.60 ± 5.63 S.E. fish/seine haul. The Mann-Kendall test showed no long-term or short term abundance trend for juvenile tautog (Table 1a, b). It should be noted that this survey data was used as a young of the year index for the benchmark stock assessment for tautog by the Atlantic States Marine Fisheries Commission.

Our Narragansett Bay spring trawl survey had a flat abundance trend for tautog from 2013 to 2014, while the fall trawl survey saw a slight decrease. There would be a lag in time between when juveniles are caught in the seine survey and when the cohort shows up in the trawl survey, but the trends are worth monitoring.

Bluefish

During the 2014 survey 1,246 juvenile bluefish (*Pomatomus saltatrix*) were collected. This is significantly higher than the 897 juveniles collected in 2013. Juveniles were present in thirty-four percent of the seine hauls and were collected at seventeen of the eighteen stations (Table

11). They were present in all months with the exceptions of June and October. It should be noted that since this survey began only one hundred thirty-eight juvenile bluefish have been collected in October, in six different years (1990, 1997, 1999, 2005, 2011, and 2012), and only when water temperatures were 16 ï 21° C.

The abundance index for 2014 was 14.59 ± 6.92 S.E. fish/seine haul. This is higher than the 2013 abundance index of 4.63 ± 1.75 S.E fish/seine haul (Figure 4). The Mann-Kendall test showed no long-term or 10 year abundance trend for this species (Table 1a, b).

July had the highest mean monthly abundance of 47.06 ± 15.23 S.E. fish/seine haul (Table 11). July and August are typically the months of highest juvenile abundance for this species. The only exception to this was in 2005 when September had the highest mean monthly abundance. This was probably due to the higher than normal water temperatures during September 2005.

In 2014, Conimicut Pt (Sta. 2) had the highest mean station abundance of 51.00 ± 46.14 S.E. fish/seine haul (Table 11). This was due to a single high catch of bluefish at this station in July.

Length frequency data for 2014 indicates that all juveniles collected were young-of-the-year individuals.

The spatial distribution and abundance of juvenile bluefish in Narragansett Bay is highly variable and is dependent on a number of factors: natural mortality, fishing mortality, size of offshore spawning stocks, spawning success, number of cohorts, success of juvenile immigration into the estuaries, and the availability of appropriate size prey species like Atlantic silversides (*Menidia menidia*) when juveniles enter the bay. The annual abundance indices since 1988 show dramatic fluctuations supporting a synergy of these factors affecting recruitment of this species to Narragansett Bay (Figure 4).

Striped Bass

During the 2014 survey 7 striped bass (*Morone saxatalis*) were collected. This is lower than the 16 fish collected in 2013. Striped bass were present in seven percent of the seine hauls and were collected at three of the eighteen stations (Table 14). They were present in June and August.

The abundance index for 2014 was 0.08 ± 0.06 S.E. fish/seine haul. This is lower than in 2013, which had an abundance index of 0.10 ± 0.06 S.E fish/seine haul (Figure 8). The Mann-Kendall test showed no abundance trend for this species for the entire dataset, but indicated a decreasing trend for the truncated 10 year dataset (Table 1a, b).

August had the highest mean monthly abundance of 0.22 ± 0.17 S.E. fish/seine haul (Table 14). September and October are usually the months with the highest abundance for the entire time series.

In 2013, Dyer Island (Sta. 16) had the highest mean station abundances of 1.00 ± 0.63 S.E. (Table 14). The station with the highest abundance each year is variable, though it does tend to be the lower bay stations in general for the entire time series.

Length frequency data for 2013 indicates that a mix of juveniles and adults were collected. This is normal for the seine survey. The spatial distribution and abundance of striped bass in Narragansett Bay is highly variable and is most likely highly dependent on the availability of appropriate size prey species like Atlantic silversides (*Menidia menidia*) and juvenile menhaden (*Brevoortia tyrannus*) when fish enter the bay. The annual abundance indices since 1988 show fluctuations in abundance from year to year (Figure 8), but generally appears to have had an increasing trend during the late 90s to early 2000s, but now appears to be on a downward trajectory since 2008. The standardized index, which accounts for some of these factors, follows a similar trend year to year as the straight catch per unit effort (CPUE) index.

Clupeidae

Four species of clupeids are routinely collected during the survey. Alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*), collectively referred to as river herring, and Atlantic menhaden (*Brevoortia tyrannus*) are most common. Atlantic herring (*Clupea harengus*) have also been collected during the surveys time series but in very small numbers.

River Herring

Due to the large numbers of anadromous herring collected, and the difficulty of separating juvenile alewives from juvenile blueback herring without sacrificing them, both species are combined under the single category of river herring. Data collected from this survey and the Divisionôs Anadromous Fish Restoration Project show alewives to be the predominate river herring species collected, although both species are present and have been stocked as part of the Divisionôs restoration efforts.

River herring were present in eighteen percent of the seine hauls and were collected at eleven of the eighteen stations during 2014. River herring were present in July, August, and September in 2014. A total of 440 juveniles were collected in 2014, a decrease from the number collected in 2013 (973 fish).

The highest mean monthly abundance for 2014 occurred during July and was 21.29 ± 9.87 S.E. fish/seine haul. Spectacle Cove and Warren River (Sta. 13 and 17) had the highest mean station abundance of 25.40 ± 25.40 S.E. and 25.40 ± 24.90, respectively (Table 13). Single large catches of these species are due to their schooling behavior and is the reason for the high standard error associated with the indices.

The standardized abundance index for 2014 was 5.15 ± 2.59 S.E. fish/seine haul (Figure 5). The annual abundance indices since 1988 show dramatic fluctuations as is a common occurrence with schooling clupeid species. The standardized index seems to indicate a decrease in abundance in recent years, which is corroborated by the 10 year Mann-Kendall test (Table 1b), however the Mann-Kendall test showed no long-term abundance trend for river herring (Table 1a).

Figure 6 shows the estimated spawning stock size of river herring as monitored by our Anadromous Fish Restoration Program at two fishways in Rhode Island. There may be some correlation between increasing numbers of returning adult fish (Figure 6) and the abundance index generated by this survey (Figure 5) as the recent small increases in juvenile abundance in the data corresponds to an increase in returning adults, and vise versa. Due to an extended period of low abundance of river herring in Rhode Island, the taking of either species of river herring is currently prohibited in all state waters.

Menhaden

One-hundred and ninety-five Atlantic menhaden (*Brevoortia tyrannus*) were collected during the 2014 survey, a large increase from 2013. They were present in thirteen percent of the seine hauls and were collected at ten of the eighteen stations (Table 12). By comparison eight thousand two hundred and fifty three juveniles were collected in 2007, which was much higher than in the past four years.

The highest mean monthly abundance for 2014 occurred during August and was 7.22 ± 4.88 S.E. fish/seine haul. Chepiwonoxet Pt (Sta. 3) had the highest mean station abundance of 13.80 ± 13.55 S.E. (Table 13). Single large catches of these species are due to their schooling behavior and is the reason for the high standard error associated with the indices.

The standardized abundance index for 2014 was 2.17 ± 1.60 S.E. fish/seine haul. This is lower than recent years but higher than in 2013 (Figure 7). The standardized index indicates an increased abundance during the 2000s. In the most recent years a decreasing abundance is evident. Our Narragansett Bay spring trawl survey had a decrease in the abundance of menhaden in 2014, while the fall trawl survey showed a strong increase. The trawl survey catches juveniles as well as some age one fish. The Mann-Kendall test showed no long-term or short-term abundance trend for this species (Table 1a, b).

Similar to river herring, juvenile menhaden were also observed in very large schools around Narragansett Bay and as discussed earlier, this behavior often results in single large catches resulting in a high abundance index and large standard error. This schooling behavior also contributes to the variability of their spatial and temporal abundance from year to year. Because of these characteristics it is difficult to develop an abundance index that will accurately reflect the number of juveniles actually observed in the field rather than the number represented in the samples. The standardization techniques used for analysis this year are an effort to take in to account this variability and high percentage of zero catches through the use of a delta lognormal model.

Weakfish

One weakfish, *Cynocion regalis,* was collected during the 2014 survey. Station 3 in Greenwich Bay and Station 4 at the mouth of the Potowomut River, immediately south of Greenwich Bay, are the stations where this species is collected most frequently, and station 3 is where the individual was collected in 2014.

The abundance trend over the past several years indicate the juvenile population of this species in Narragansett Bay fluctuates dramatically, a trend also reflected in our trawl survey. The abundance index for 2014 was 0.01 ± 0.01 S.E fish/seine haul. This was higher than the 2013 index of 0 (Figure 9). Possible reasons for this high variability in abundance, other than fishing pressure, may be environmental and anthropogenic factors that affect spawning and nursery habitat. Survival rate at each life history stage may also be influenced by these factors. The literature indicates this species spawns in calm coves within the estuary and juveniles move up the estuary to nursery areas of lower salinity. These are the same areas of the bay where anthropogenic impacts are high, often resulting in hypoxic and/or anoxic events that may increase mortality of the early life history stages of this species.

With the limited and sporadic juvenile data generated by this survey a juvenile population trend analysis is difficult. A nominal index was developed, but due to the sparse nature of the data, the index generated should be viewed with caution.

Black Sea Bass

Twenty-six juvenile black sea bass (*Centropristis striata*) were collected in 2014 compared to three hundred and eight collected during the 2012 survey, the last time a high recruitment event occurred in Narragansett Bay. The number of black sea bass has been highly variable from year to year during the time series of this survey, but the 2012 number stands out as unique. Black sea bass were caught in seven percent of the seine hauls in 2014.

The highest mean monthly abundance for 2014 occurred during August and was 0.56 ± 0.33 S.E. fish/seine haul. Rose Island (Sta. 10) had the highest mean station abundance of 2.40 ± 1.50 S.E. (Table 13).

The abundance index for 2014 was 0.29 ± 0.21 S.E. fish/seine haul. This was higher than the 2013 index of 0.07 ± 0.07 S.E (Figure 10). Our Narragansett Bay spring survey had a large increase in the abundance of black sea bass in 2014, while the fall index dropped down from the high values in 2012 and 2013. This recruitment signal in recent years was seen not only in RI waters, but all along the Atlantic coast. The Mann-Kendall test showed no long-term abundance trend for this species for both the long term and 10 year time period (Table 1a, b).

Both the trawl survey and the coastal pond survey seem to be better indicators for local abundances of black sea bass. The Narragansett Bay seine survey does not catch them in any consistent manner leading one to believe that they may be using deeper water and or the coastal ponds as their preferred nursery areas. There are no indications that there are any problems with the local abundance of black sea bass, information that is also corroborated by the coastwide stock assessment for black sea bass, which indicates no overfishing and a rebuilt stock.

Other important species

Juveniles of other commercial or recreationally important species were also collected during the 2014 survey. These juveniles included scup (*Stenotomus chrysops*), Northern kingfish (*Menticirrhus saxatilis*), and windowpane flounder (*Scophthalmus aquosus*).

Four-hundred and fifty-six juvenile scup were collected in 2014 during July, August, and September. One-hundred and fifty-eight Northern kingfish were collected in 2014 with the majority collected in August. No windowpane flounder were collected in 2014. Nine summer flounder were collected in 2014 in July, August, and October. Seven smallmouth flounder were caught in 2014. Relative to the sixty-eight smallmouth flounder that were caught in 2011, and the thirty-three that were caught in 2010, this is a decrease in abundance for 2014. This species will have to be monitored in future years to see if, due to changing habitat conditions or possible vacant niches, it is increasing its residency in the Bay. See Tables 3-8 for additional survey data on these species.

Physical & Chemical Data

Previous to 2010 a YSI 85 was used to collect water temperature, salinity and dissolved oxygen data from the bottom water at all stations on each sampling date. This meter was upgraded in 2010 to a YSI Professional Plus Multiparameter instrument 6050000. The instrument collects the same suite of information as the YSI 85, but is an improved meter with better functionality. The water quality data collected are shown in Table 15. An important note is that the YSI failed towards the end of 2014. Data from water quality data buoys in close proximity to station locations was used to fill in temperature and salinity data once the meter failed, and is represented in the table. A new YSI has been purchased for the 2015 field season.

Water temperatures during the 2014 survey ranged from a low of 14.4°C at Spectacle Cove (Sta. 13) in October to a high of 26.7°C at Chepiwonoxet Pt (Sta. 3) in August.

Salinities ranged from 20.0 *ppt* at Gaspee Pt. (Sta. 1) in August to 30.9 *ppt* at Potter Cove (Sta. 8) in August.

Due to the failure of the YSI meter in 2014, station specific dissolved oxygen readings were not accomplished. This data will be improved by borrowing data from water quality data buoys in close proximity, and a new YSI meter was purchased for the field season in 2015.

SUMMARY: In summary, data from the 2014 Juvenile Finfish Survey continue to show that a number of commercial and recreationally important species utilize Narragansett Bay as an important nursery area. Using the Mann Kendall test, winter flounder, tautog, river herring, menhaden, striped bass, and bluefish showed no long-term abundance trends. Striped bass and river herring showed a decreasing abundance trend when analyzed over the past 10 years. For some species abundance trends from this survey agree with those from our coastal pond survey and/or trawl survey, in some instances they do not. This outcome is probably influenced by the species specific use of habitat and looking at appropriate data lags between the juvenile life stages and the adult stages. Hopefully, juvenile survey abundance indices will be reflected later in the abundance of adults in the trawl survey, but this is not always the case.

Sixty-three species, both vertebrates and invertebrates, were collected in 2014. This is higher than, but fairly close to the survey mean for the past twenty-five years of sixty species. An initial audit of the earlier time series and information contained on the field logs was undertaken to determine if some of the species diversity was missing from the earlier time series. Some issues were resolved from this analysis, however there are still some unresolved issues contained in the historical field logs. These final issues will be addressed over the coming year.

During 2014 seven tropical and subtropical species were collected during the survey. While tropical and subtropical species are collected during this survey every year, the number of species and individuals is dependent upon the course of the Gulf Stream, the number of streamers and warm core rings it generates, and the proximity of these features to southern New

England.

The survival and recruitment of juvenile finfish to the Rhode Island fishery is controlled by many factors: over-fishing of adult stocks, spawning and nursery habitat degradation and loss, water quality changes, and ecosystem changes that effect fish community structure. Any one of these factors, or a combination of them, may adversely impact juvenile survival and/or recruitment in any given year.

An ongoing effort to increase populations of important species must embrace a comprehensive approach that takes into account the above factors, their synergy and the changing fish community in the Bay. A continued effort to identify and protect essential fish habitat (EFH) and improve water quality is essential to this effort. The Division through our permit review program does represent the interests of fish and habitat preservation and protection. As well, properly informed management decisions are tantamount to preserving spawning stock biomass in order to create and maintain sustainable populations. This surveyọs dataset is used to inform the statistical catch at age models for both a regional tautog assessment as well as the coastwide menhaden assessment. In addition to the direct usage of the data in fisheries models, the other information collected by the survey helps to identify ancillary information such as abundances of forage species and habitat parameters, all important information for making good informed management decisions. These activities will all continue to be an important component of this project.

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FIGURES

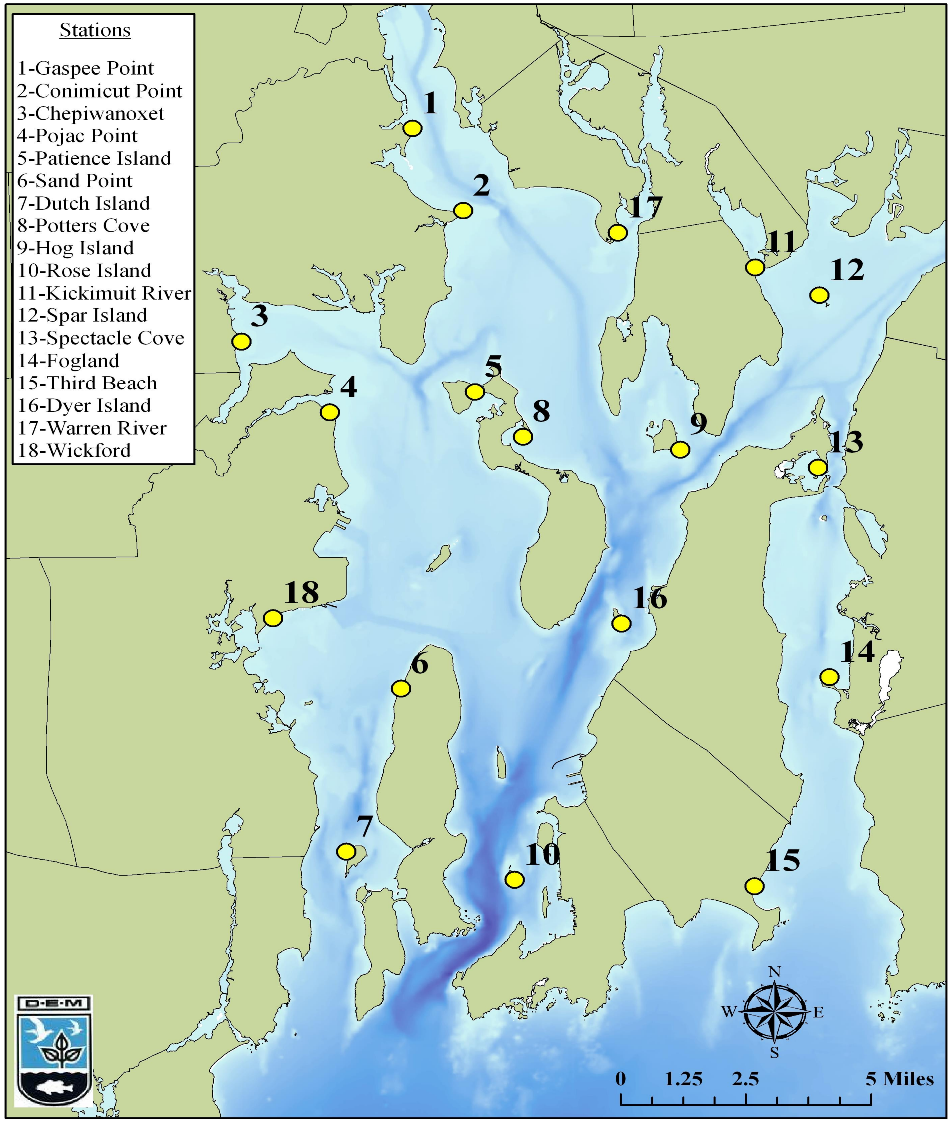


Figure 1. Survey station location map.

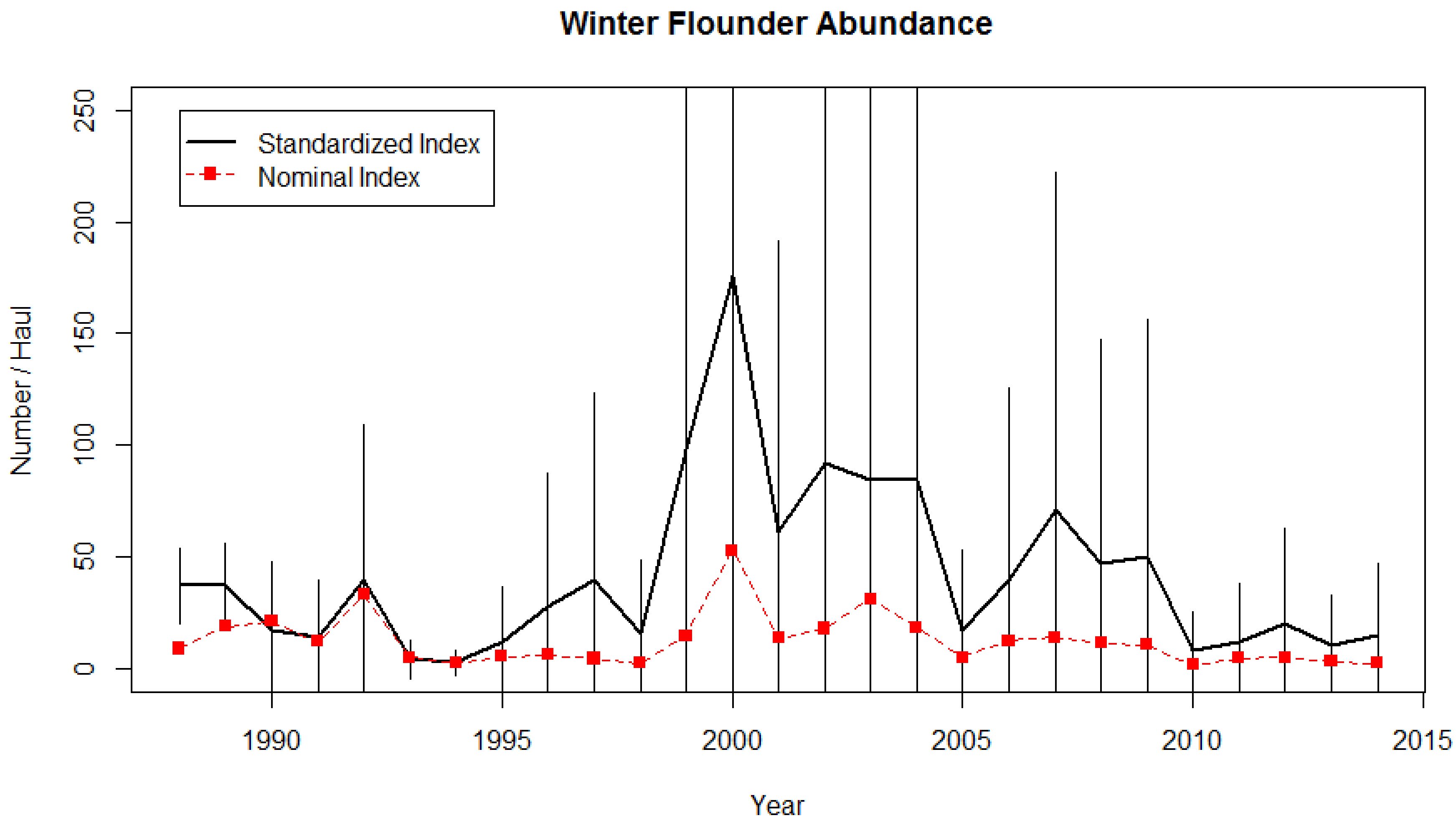


Figure 2. Juvenile winter flounder standardized abundance index 1988 ï 2014 (see appendix A for standardization methodology).

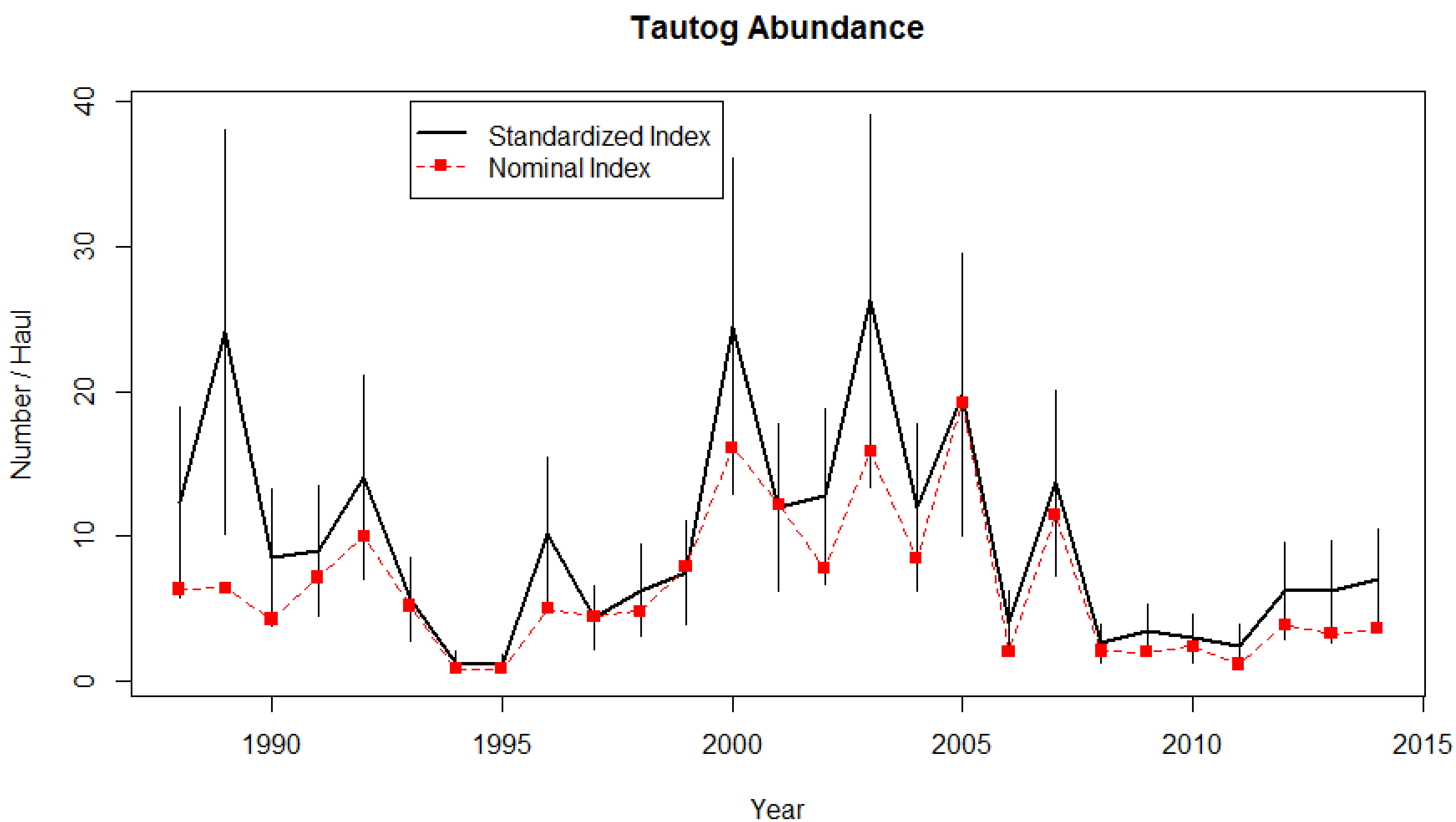


Figure 3. Juvenile tautog standardized annual abundance index 1988 ï 2014 (see appendix A for standardization methodology).

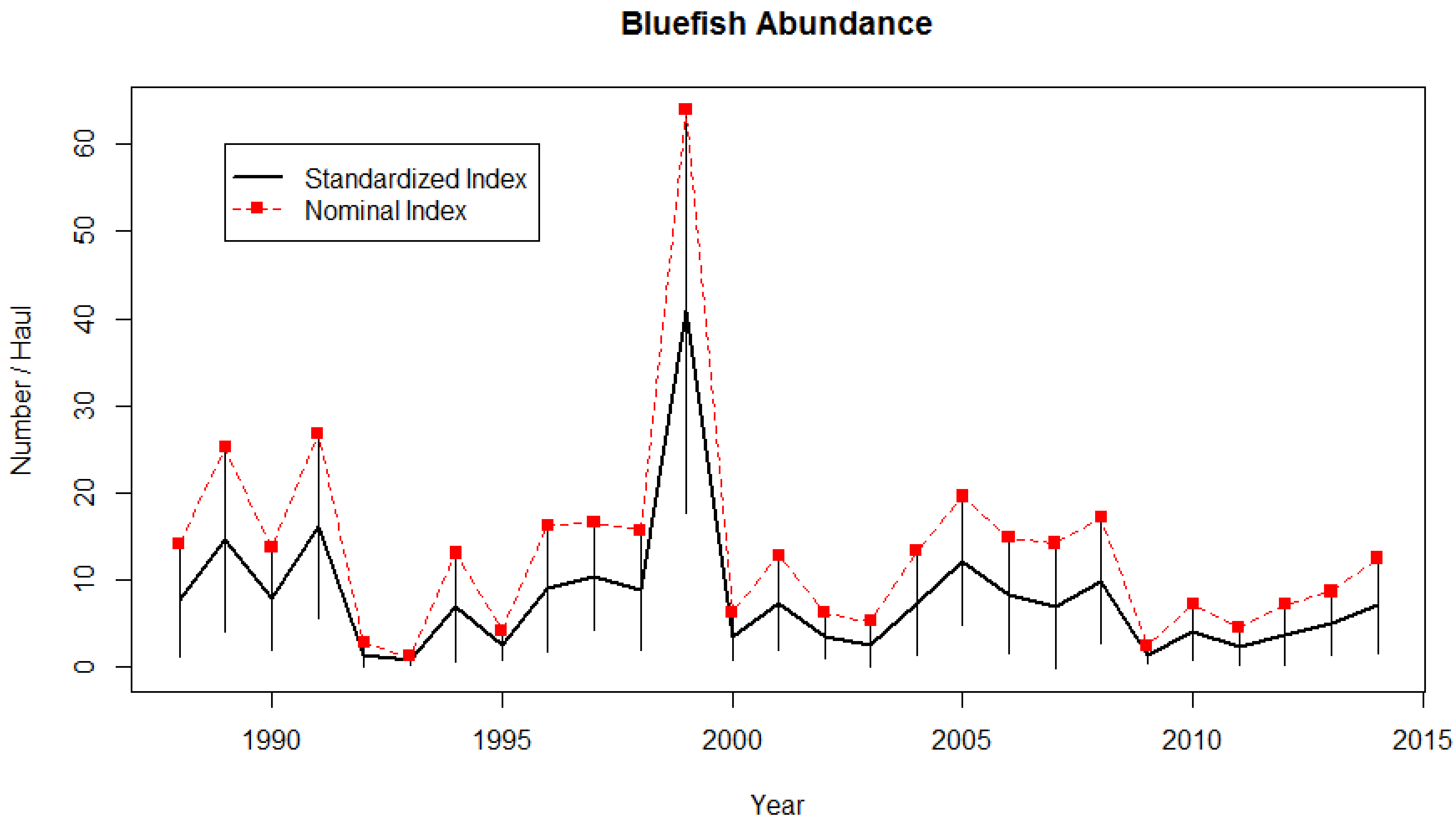


Figure 4. Juvenile bluefish standardized annual abundance index 1988 ï 2014 (see appendix A for standardization methodology).

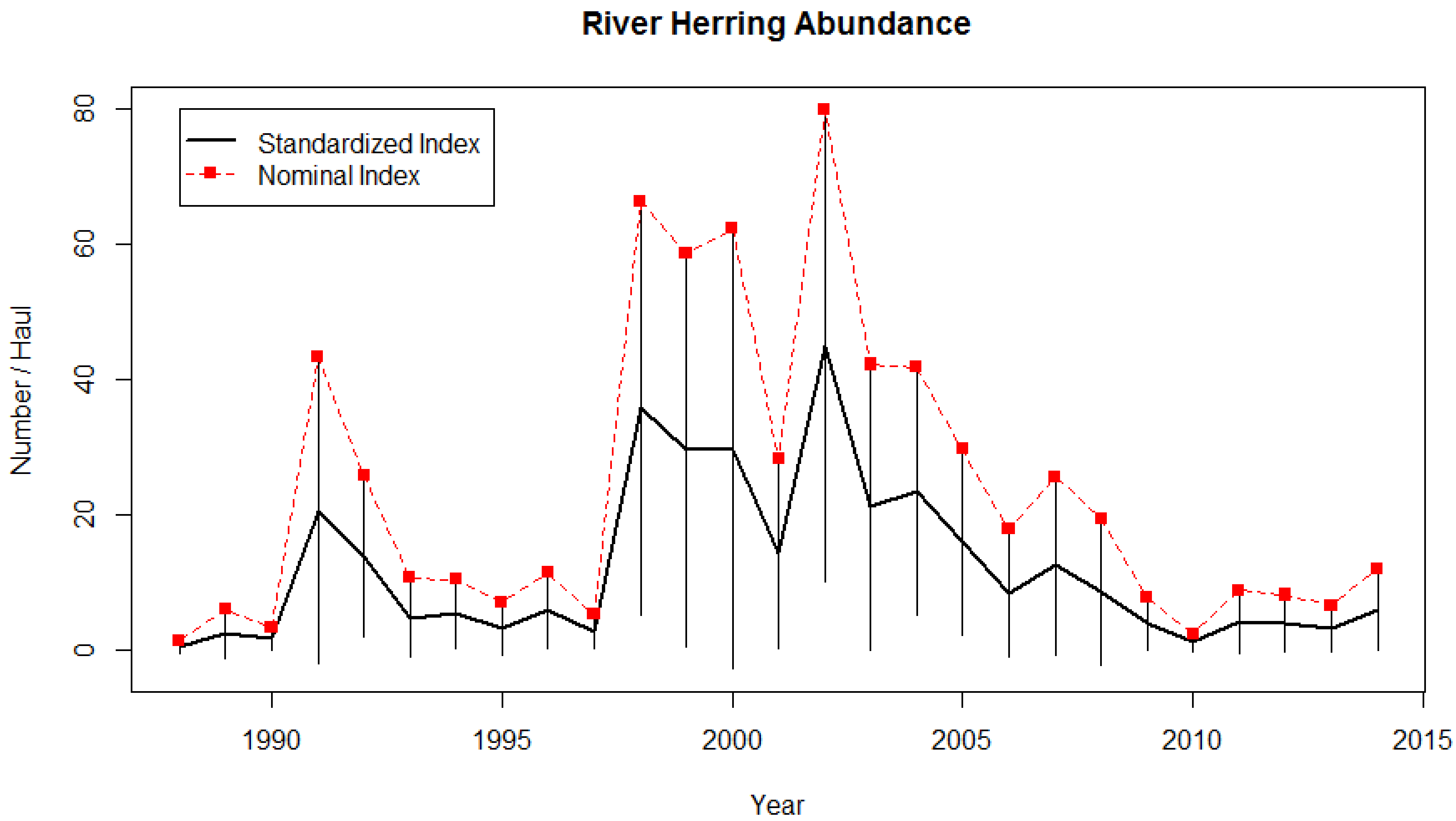
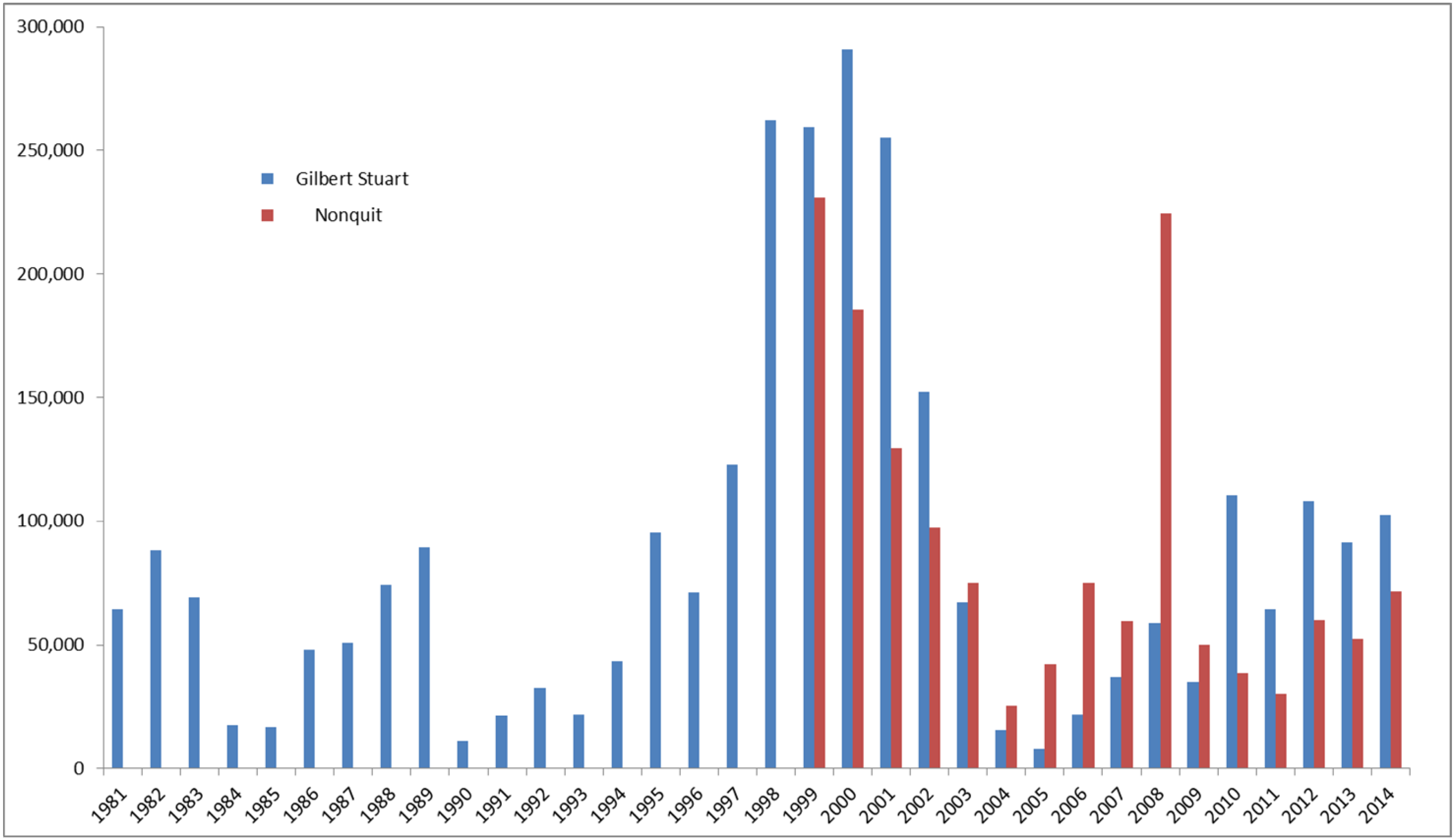


Figure 5. Juvenile river herring standardized annual abundance index 1988 ï 2014 (see appendix A for standardization methodology).



Courtesy - Phil Edwards, RIF&W Anadromous Fish Restoration Program

Figure 6. River herring spawning stock size from monitoring at two locations 1999 ï 2014.

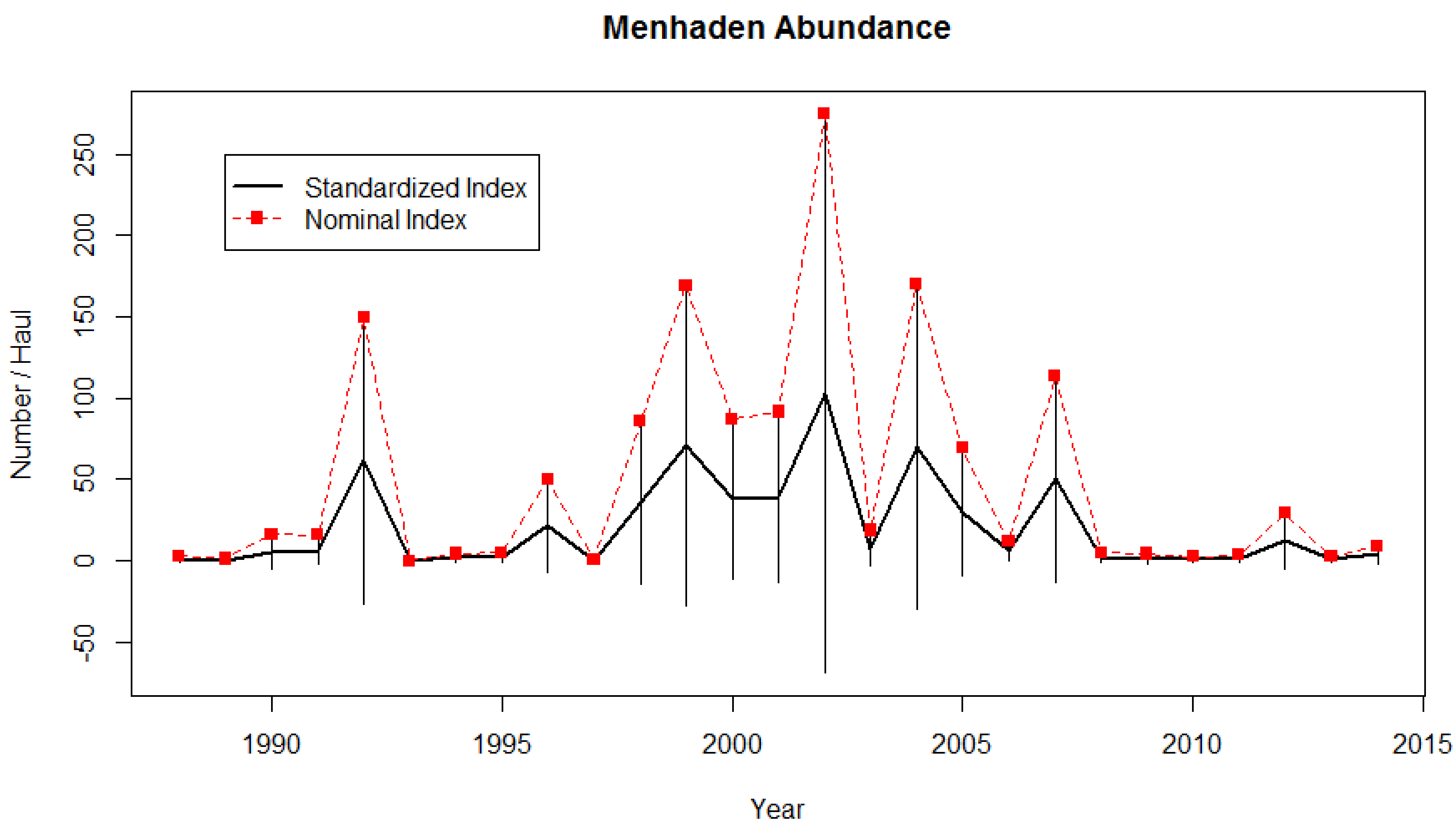


Figure 7. Juvenile menhaden standardized annual abundance index 1988 ï 2014 (see appendix A for standardization methodology).

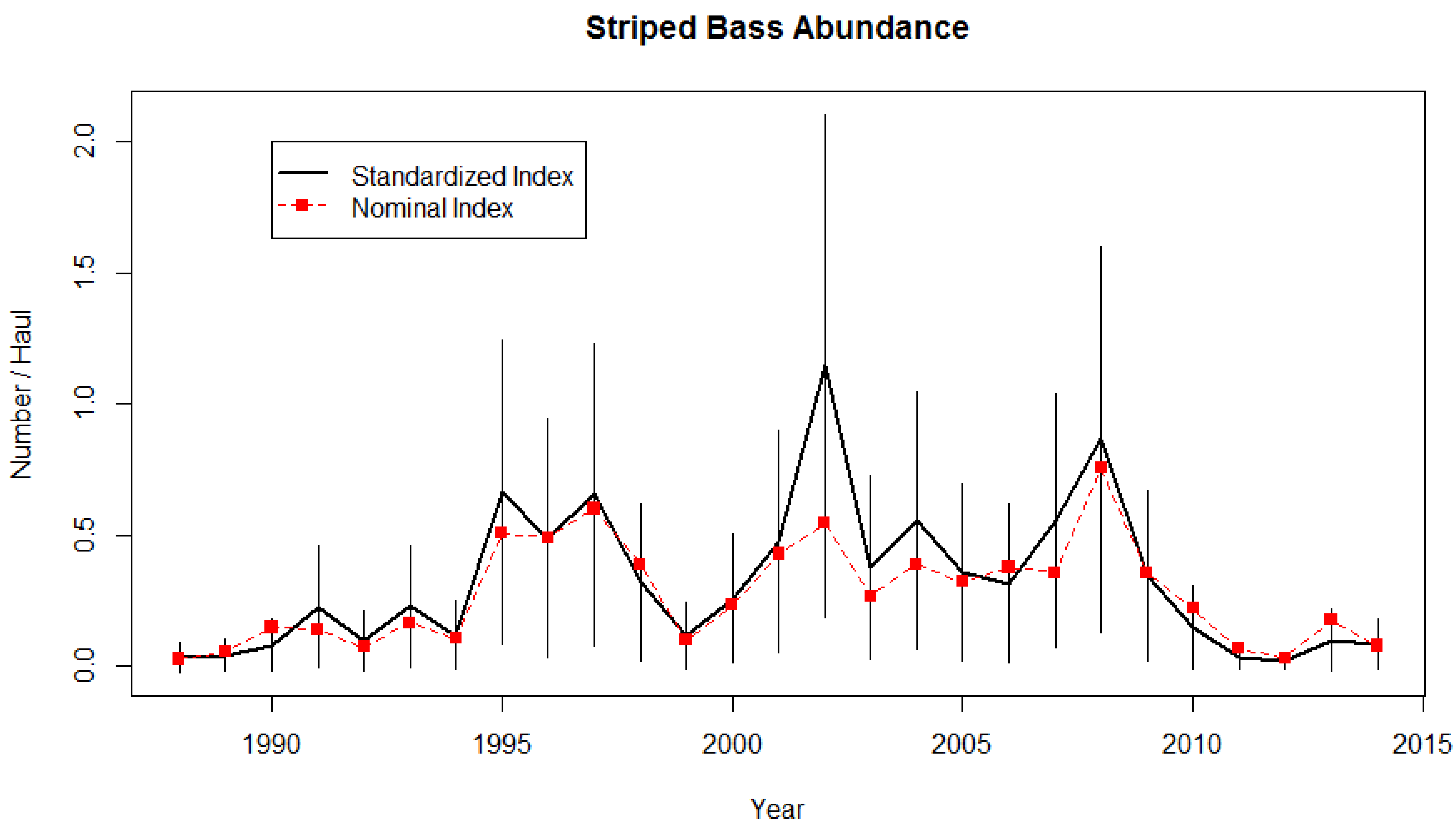


Figure 8. Striped bass standardized annual abundance index 1988 ï 2014 (see appendix A for standardization methodology).

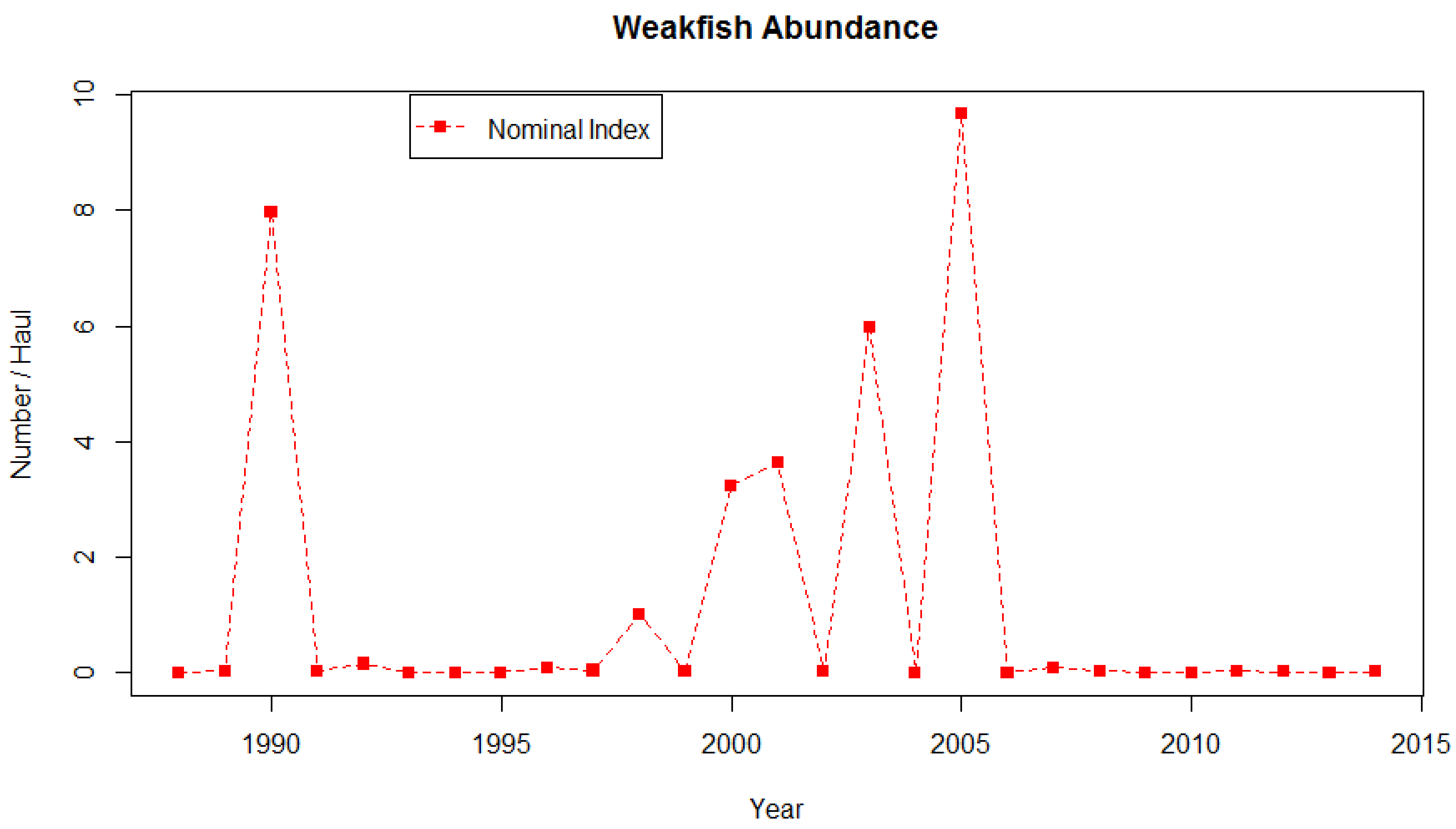


Figure 9. Weakfish annual abundance index 1988 ï 2014.

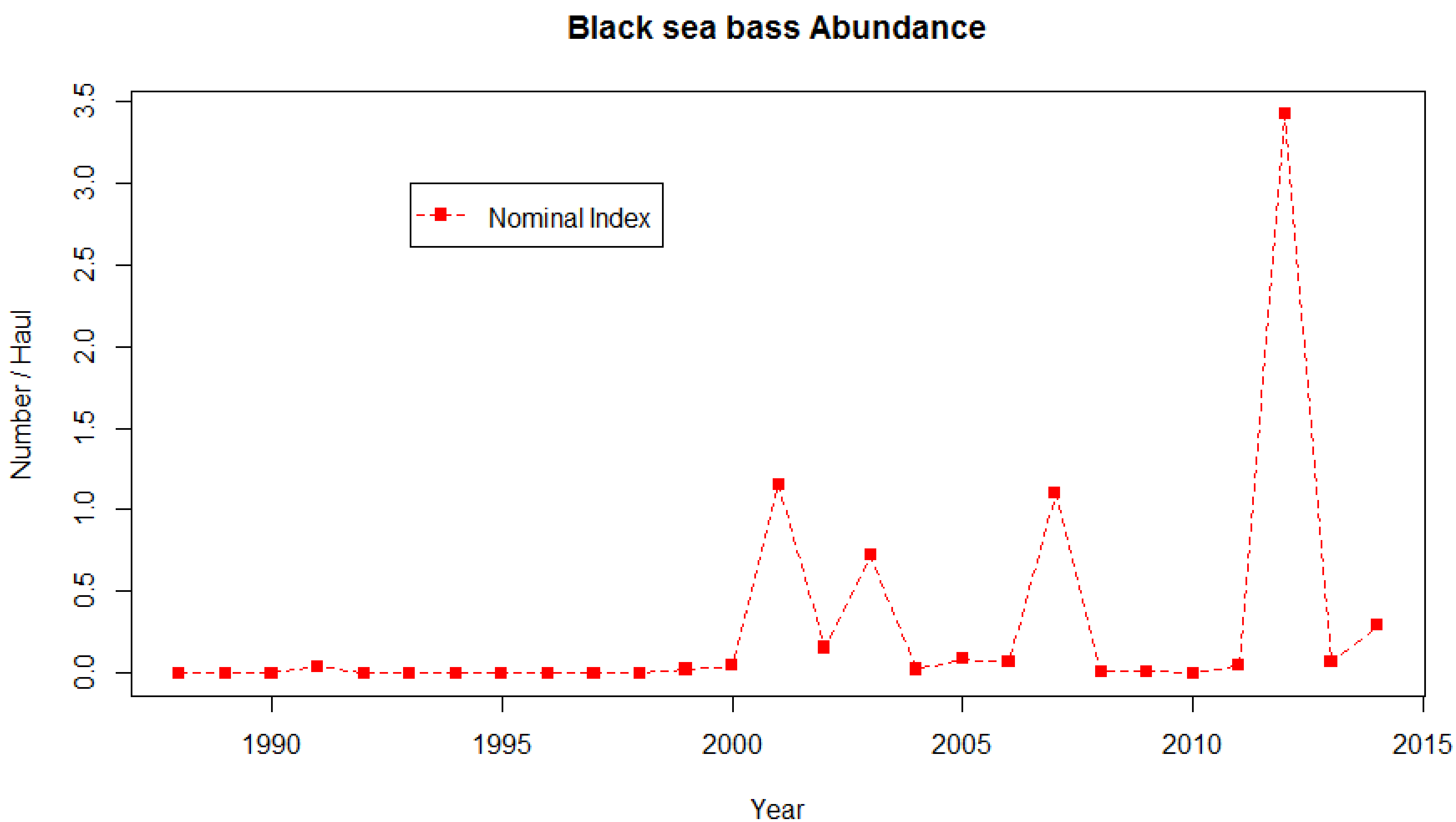


Figure 10. Black sea bass annual abundance index 1988 ï 2014.

TABLES

Table 1a. Mann-Kendall test for target species abundance trend analysis (Full dataset; 1988 - 2014).

Mann-Kendall test	Winter Flounder	Tautog	Bluefish	River Herring	Menhaden	Striped Bass
S	7	-55	-49	7	7	25
n Observations	27	27	27	27	27	27
Variance	2301	2301	2301	2301	2301	2301
Tau	0.0199	-0.157	-0.140	0.020	0.020	0.071
2-sided p value	0.900	0.260	0.317	0.900	0.900	0.617
α	0.05	0.05	0.05	0.05	0.05	0.05
Significant Trend	No	No	No	No	No	No

Table 1b. Mann-Kendall test for target species abundance trend analysis (2004-2014).

Mann-Kendall test	Winter Flounder	Tautog	Bluefish	River Herring	Menhaden	Striped Bass
S	-13	-5	-13	-21	-17	-25
n Observations	10	10	10	10	10	10
Variance	125	125	125	125	125	125
Tau	-0.289	-0.111	-0.289	-0.467	-0.378	-0.556
2-sided p value	0.283	0.721	0.283	0.074	0.152	0.032
α	0.05	0.05	0.05	0.05	0.05	0.05
Significant Trend	No	No	No	BorderlineŹ	No	YesŹ

Table 2. Young-of-the-Year (YOY) winter flounder - maximum total length for each month.*

Month	July	August	September	October
Max. YOY length (TL)	100 mm	107 mm	109 mm	115 mm

* data provided by L. Buckley, National Marine Fisheries Service, Narragansett Laboratory, Narragansett, R.I.

Table 3. Species presence by station for June 2014.

	Station																		
Scientific Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Grand Total
Anchoa mitchilli								1											1
Aurelia aurita			1																1
Calinectes sapidus	1		1														1		3
Carcinus maenus	1	1			1		1	1	1		1		1	1			1		10
Clupea harengus			1	1															2
Crangon septemspinosa	1	1	1	1	1				1		1				1		1	1	10
Crepidula fornicata		1						1	1				1	1		1			6
Ctenophora phylum		1	1	1		1			1			1	1	1	1			1	10
Emerita talpoida															1				1
Fundulus heteroclitus	1		1		1						1		1	1			1		7
Fundulus majalis	1								1		1		1						4
Geukensia demissa			1																1
Gobiosoma bosc		1		1															2
Hemigrapsus sanguineus														1					1
Isopoda order							1												1
Libinia emarginata	1	1	1	1	1		1	1	1		1						1		10
Limulus polyphemus				1	1				1									1	4
Littorina littorea						1			1		1			1					4
Menidia menidia	1	1	1	1	1	1		1					1	1			1	1	11
Menticirrhus saxatilis																	1		1
Mercenaria mercenaria						1													1
Microgadus tomcod												1	1	1			1		4
Morone saxatilis	1			1												1	1	1	5
Myoxocephalus aenaeus					1		1		1	1	1		1						6
Mytilus edulis	1															1			2
Nassarius obsoletus	1	1	1			1			1		1							1	7
Ovalipes ocellatus															1				1
Pagurus spp	1	1	1	1	1	1		1	1		1		1		1	1		1	13
Palaemonetes vulgaris		1	1	1	1		1	1	1		1	1	1						10
Panopeus spp	1		1								1		1			1			5
Paralichthys dentatus			1																1
Prionotus evolans															1				1
Pseudopleuronectes americanus	1	1	1	1	1	1			1		1	1	1		1		1	1	13
Scophthalmus aquosus															1				1
Sphoeroides maculatus					1														1
Syngnathus fuscus		1		1	1				1		1		1	1		1			8
Tautoga onitis		1			1	1	1		1	1		1	1				1		9
Tautogolabrus adspersus						1	1												2
Busycon carica												1							1
Nassarius trivittatus							1					1		1					3
Urophycis chuss					1														1
Urophycis regia																1			1
Grand Total	13	13	15	12	14	9	8	7	15	2	13	7	14	10	8	7	11	8	186

Table 4. Species presence by station for July 2014.

	Station																		
Scientific Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Grand Total
Alosa aestivalis &/or pseudoharengus	1	1			1	1	1		1				1	1		1	1		10
Apeltes quadracus			1	1															2
Calinectes sapidus	1		1																2
Carcinus maenus		1	1					1			1		1	1			1		7
Crangon septemspinosa	1		1		1	1		1									1		6
Crepidula fornicata						1								1					2
Ctenophora phylum	1			1		1	1	1	1	1	1	1	1		1	1	1		13
Cyprinodon variegatus																1			1
Emerita talpoida															1				1
Fundulus heteroclitus	1				1						1		1						4
Fundulus majalis	1	1	1			1		1	1						1		1		8
Geukensia demissa													1						1
Hemigrapsus sanguineus											1	1							2
Isopoda order															1				1
Libinia emarginata			1	1				1			1	1					1		6
Limulus polyphemus																	1		1
Littorina littorea				1									1	1					3
Lucania parva											1								1
Menidia menidia	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1		16
Menticirrhus saxatilis	1		1	1				1							1		1		6
Microgadus tomcod												1	1						2
Mugil curema								1											1
Myoxocephalus aenaeus						1						1	1				1		4
Mytilus edulis							1			1									2
Nassarius obsoletus	1	1	1	1	1				1			1	1						8
Ovalipes ocellatus			1												1				2
Pagurus spp	1	1	1		1			1		1	1	1	1	1		1	1		12
Palaemonetes vulgaris			1			1			1		1	1				1			6
Panopeus spp			1					1			1	1	1	1					6
Paralichthys dentatus								1									1		2
Pomatomus saltatrix	1	1	1	1	1	1	1	1	1		1	1	1		1		1		14
Prionotus evolans					1			1					1			1			4
Pseudopleuronectes americanus	1	1	1		1	1	1	1	1		1	1	1				1		12
Sphoeroides maculatus						1		1											2
Stenotomus chrysops					1												1		2
Strongylura marina				1															1
Syngnathus fuscus											1								1
Tautoga onitis		1	1	1		1	1	1	1		1	1	1	1			1		12
Tautogolabrus adspersus		1																	1
Trachurus lathami							1												1
Grand Total	12	10	16	10	10	12	8	16	9	3	14	13	16	8	8	7	16		188

Table 5. Species presence by station for August 2014.

	Station																		
Scientific Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Grand Total
Alosa aestivalis &/or pseudoharengus		1	1						1				1			1			5
Amphipoda order						1													1
Anguilla rostrata			1										1						2
Apeltes quadracus		1																	1
Aurelia aurita															1				1
Brevoortia tyrannus			1				1							1					3
Calinectes sapidus	1		1										1		1	1		1	6
Cancer irroratus																1			1
Carcinus maenus	1	1	1		1	1		1					1	1		1			9
Centropristus striata					1				1						1				3
Crangon septemspinosa										1									1
Crepidula fornicata												1							1
Ctenophora phylum				1	1	1	1	1		1	1	1		1		1	1	1	12
Cynoscion regalis			1																1
Cyprinodon variegatus											1					1			2
Etropus microstomus															1				1
Fundulus heteroclitus	1	1	1	1		1		1	1		1		1	1			1		11
Fundulus majalis	1	1	1	1	1	1	1	1	1		1		1	1	1	1	1	1	16
Gobiosoma bosc		1											1						2
Hemigrapsus sanguineus							1							1					2
Isopoda order															1				1
Libinia emarginata		1	1							1	1							1	5
Limulus polyphemus																	1		1
Littorina littorea							1						1	1					3
Menidia menidia	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18
Menticirrhus saxatilis	1	1	1	1	1	1									1	1	1	1	10
Microgadus tomcod									1										1
Morone saxatilis								1								1			2
Mya arenaria	1																		1
Myoxocephalus aenaeus	1					1			1		1		1	1		1			7
Nassarius obsoletus	1		1	1				1					1						5
Opsanus tau									1									1	2
Ovalipes ocellatus	1		1	1	1								1		1			1	7
Pagurus spp				1		1		1			1				1	1		1	7
Palaemonetes vulgaris		1	1		1	1					1	1	1	1	1	1	1		11
Panopeus spp		1	1	1	1			1			1	1	1	1		1			10
Paralichthys dentatus			1						1				1						3
Pomatomus saltatrix		1							1			1			1	1			5
Prionotus evolans	1		1	1											1			1	5
Pseudopleuronectes americanus	1		1	1		1		1	1				1	1				1	9
Sphoeroides maculatus				1	1	1		1	1		1				1				7
Stenotomus chrysops							1								1				2
Strongylura marina																	1		1
Syngnathus fuscus		1		1			1		1	1			1				1		7
Synodus foetens	1	1	1	1											1			1	6
Tautoga onitis		1			1	1	1	1	1		1	1	1	1	1	1		1	13
Tautogolabrus adspersus					1		1		1							1	1		5
Trachurus lathami		1																	1
Fistularia tabacaria										1									1
Trachinotus falcatus															1				1
Grand Total	13	16	19	14	12	13	10	12	15	6	12	7	18	13	18	17	10	13	238

Table 6. Species presence by station for September 2014.

	Station																	
Scientific Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Grand Total
Alosa aestivalis &/or pseudoharengus		1			1					1									3
Anchoa mitchilli									1										1
Brevoortia tyrannus											1						1	1	3
Calinectes sapidus	1			1													1	1	4
Carcinus maenus	1	1		1	1	1		1			1		1	1			1		10
Centropristus striata										1							1		2
Crangon septemspinosa		1																	1
Crepidula fornicata	1	1							1										3
Ctenophora phylum				1			1			1					1				4
Cyprinodon variegatus									1		1								2
Etropus microstomus															1				1
Fundulus heteroclitus	1	1		1				1	1		1		1	1	1		1		10
Fundulus majalis	1	1	1	1	1			1	1	1	1		1	1	1		1	1	14
Geukensia demissa			1																1
Libinia emarginata			1	1															2
Limulus polyphemus		1																	1
Littorina littorea						1	1						1	1					4
Menidia menidia	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	17
Menticirrhus saxatilis	1														1		1	1	4
Mugil curema														1				1	2
Mya arenaria	1																		1
Myoxocephalus aenaeus						1						1	1						3
Mytilus edulis										1									1
Nassarius obsoletus			1	1							1								3
Opsanus tau													1						1
Ovalipes ocellatus				1														1	2
Pagurus spp	1	1	1	1		1		1			1		1	1					9
Palaemonetes vulgaris		1	1	1			1	1			1		1	1	1				9
Panopeus spp		1	1								1		1						4
Pomatomus saltatrix	1	1	1		1	1	1		1	1	1		1		1			1	12
Prionotus evolans				1														1	2
Pseudopleuronectes americanus	1			1			1												3
Sphoeroides maculatus		1		1															2
Stenotomus chrysops			1				1										1		3
Strongylura marina																	1		1
Syngnathus fuscus			1																1
Synodus foetens	1		1									1	1					1	5
Tautoga onitis						1	1	1	1	1		1		1			1	1	9
Tautogolabrus adspersus																	1		1
Fistularia tabacaria					1														1
Busycon carica												1							1
Grand Total	12	13	12	14	6	7	8	7	8	8	11	5	12	9	8		12	11	163

Table 7. Species presence by station for October 2014.

	Station																		
Scientific Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Grand Total
Anchoa mitchilli						1													1
Aurelia aurita										1									1
Brevoortia tyrannus	1	1	1	1	1						1								6
Calinectes sapidus																		1	1
Cancer irroratus																1			1
Carcinus maenus	1	1	1	1		1		1	1	1	1		1			1			11
Centropristus striata					1					1									2
Crangon septemspinosa	1		1															1	3
Crepidula fornicata	1	1				1	1		1							1			6
Ctenophora phylum							1								1				2
Cyprinodon variegatus	1										1					1	1		4
Etropus microstomus															1				1
Fundulus heteroclitus	1	1	1	1		1					1						1		7
Fundulus majalis	1	1	1	1	1	1		1	1	1	1		1		1	1	1	1	15
Hemigrapsus sanguineus		1																	1
Isopoda order										1						1			2
Limulus polyphemus					1														1
Littorina littorea						1	1						1						3
Menidia menidia	1		1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	16
Myoxocephalus aenaeus									1		1					1			3
Mytilus edulis										1									1
Nassarius obsoletus				1					1				1				1		4
Opsanus tau											1								1
Ovalipes ocellatus		1	1	1															3
Pagurus spp	1		1	1			1	1		1	1					1			8
Palaemonetes vulgaris	1	1		1		1		1	1		1	1	1				1	1	11
Panopeus spp		1		1				1											3
Paralichthys dentatus			1																1
Pseudopleuronectes americanus			1	1					1		1								4
Syngnathus fuscus			1	1			1		1	1								1	6
Tautoga onitis	1	1		1			1	1	1	1	1			1		1	1	1	12
Tautogolabrus adspersus							1			1						1			3
Fistularia tabacaria						1										1			2
Urophycis regia																		1	1
Grand Total	11	10	11	13	5	9	8	7	10	11	12	1	6	2	4	12	7	8	147

Table 8. Summary of species occurrence by station in 2014.

	Station																		
Scientific Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Grand Total
Alosa aestivalis &/or pseudoharengus	1	1	1		1	1	1		1	1			1	1		1	1		12
Amphipoda order						1													1
Anchoa mitchilli						1		1	1										3
Anguilla rostrata			1										1						2
Apeltes quadracus		1	1	1															3
Aurelia aurita			1							1					1				3
Brevoortia tyrannus	1	1	1	1	1		1				1			1			1	1	10
Calinectes sapidus	1		1	1									1		1	1	1	1	8
Cancer irroratus																1			1
Carcinus maenus	1	1	1	1	1	1	1	1	1	1	1		1	1		1	1		15
Centropristus striata					1				1	1					1		1		5
Clupea harengus			1	1															2
Crangon septemspinosa	1	1	1	1	1	1		1	1	1	1				1		1	1	13
Crepidula fornicata	1	1				1	1	1	1			1	1	1		1			10
Ctenophora phylum	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18
Cynoscion regalis			1																1
Cyprinodon variegatus	1								1		1					1	1		5
Emerita talpoida															1				1
Etropus microstomus															1				1
Fundulus heteroclitus	1	1	1	1	1	1		1	1		1		1	1	1		1		13
Fundulus majalis	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	17
Geukensia demissa			1										1						2
Gobiosoma bosc		1		1									1						3
Hemigrapsus sanguineus		1					1				1	1		1					5
Isopoda order							1			1					1	1			4
Libinia emarginata	1	1	1	1	1		1	1	1	1	1	1					1	1	13
Limulus polyphemus		1		1	1				1								1	1	6
Littorina littorea				1		1	1		1		1		1	1					7
Lucania parva											1								1
Menidia menidia	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18
Menticirrhus saxatilis	1	1	1	1	1	1		1							1	1	1	1	11
Mercenaria mercenaria						1													1
Microgadus tomcod									1			1	1	1			1		5
Morone saxatilis	1			1				1								1	1	1	6
Mugil curema								1						1				1	3
Mya arenaria	1																		1
Myoxocephalus aenaeus	1				1	1	1		1	1	1	1	1	1		1	1		12
Mytilus edulis	1						1			1						1			4
Nassarius obsoletus	1	1	1	1	1	1		1	1		1	1	1				1	1	13
Opsanus tau									1		1		1					1	4
Ovalipes ocellatus	1	1	1	1	1								1		1			1	8
Pagurus spp	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18
Palaemonetes vulgaris	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	17
Panopeus spp	1	1	1	1	1			1			1	1	1	1		1			11
Paralichthys dentatus			1					1	1				1				1		5
Pomatomus saltatrix	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	17
Prionotus evolans	1		1	1	1			1					1		1	1		1	9
Pseudopleuronectes americanus	1	1	1	1	1	1	1	1	1		1	1	1	1	1		1	1	16
Scophthalmus aquosus															1				1
Sphoeroides maculatus		1		1	1	1		1	1		1				1				8
Stenotomus chrysops			1		1		1								1		1		5
Strongylura marina				1													1		2
Syngnathus fuscus		1	1	1	1		1		1	1	1		1	1		1	1	1	13
Synodus foetens	1	1	1	1								1	1		1			1	8
Tautoga onitis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18
Tautogolabrus adspersus		1			1	1	1		1	1						1	1		8
Trachurus lathami		1					1												2
Busycon carica												1							1
Fistularia tabacaria					1	1				1						1			4
Nassarius trivittatus							1					1		1					3
Trachinotus falcatus															1				1
Urophycis chuss					1														1
Urophycis regia																1		1	2
Grand Total	27	28	30	29	28	23	23	22	27	18	23	17	27	20	24	24	28	23	441

* The units are number of times present at each station (maximum would be 18 times present for a species at all stations for the year).

Table 9. Numbers of juvenile winter flounder per seine haul in 2014.

Station

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Mean	St Dev	SE
JUN	5	10	26	3	1	2	0	0	9	0	7	4	37	0	1	0	5	16	7.00	10.09	2.38
JUL	3	1	1	0	1	1	2	5	1	0	2	1	18	0	0	0	5		2.41	4.32	1.02
AUG	4	0	6	1	0	2	0	3	22	0	0	0	14	1	0	0	0	1	3.00	5.87	1.38
SEP	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0		0	0	0.18	0.39	0.09
OCT	0	0	1	1	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0.28	0.57	0.14
Mean	2.60	2.20	6.80	1.20	0.40	1.00	0.60	1.60	6.60	0.00	2.20	1.00	13.80	0.20	0.20	0.00	2.00	4.25			
St Dev	2.07	4.38	10.99	1.10	0.55	1.00	0.89	2.30	9.34	0.00	2.86	1.73	15.30	0.45	0.45	0.00	2.74	7.85			
SE	0.93	1.96	4.91	0.49	0.24	0.45	0.40	1.03	4.18	0.00	1.28	0.77	6.84	0.20	0.20	0.00	1.22	3.51		Total Fish	
Number	13	11	34	6	2	5	3	8	33	0	11	5	69	1	1	0	10	17		229	

Table 10. Numbers of juvenile tautog per seine haul in 2014.

Station

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Mean	St Dev	SE
JUN	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	1	0	0.56	2.12	0.50
JUL	0	1	1	1	0	1	7	6	3	0	6	11	39	1	0	0	4		4.76	9.38	2.21
AUG	0	14	0	0	29	6	9	2	53	0	2	6	11	1	3	5	0	2	7.94	13.35	3.15
SEP	0	0	0	0	0	5	8	1	2	3	0	2	0	4	0		17	2	2.59	4.35	1.02
OCT	3	7	0	6	0	0	5	2	7	3	1	0	0	1	0	4	1	1	2.28	2.52	0.59
Mean	0.60	4.40	0.20	1.40	7.60	2.40	5.80	2.20	13.00	1.20	1.80	3.80	10.00	1.40	0.60	2.25	4.60	1.25			
St Dev	1.34	6.11	0.45	2.61	12.58	2.88	3.56	2.28	22.51	1.64	2.49	4.71	16.90	1.52	1.34	2.63	7.09	0.96			
SE	0.60	2.73	0.20	1.17	5.63	1.29	1.59	1.02	10.06	0.73	1.11	2.11	7.56	0.68	0.60	1.18	3.17	0.43		Total Fish	
Number	3	22	1	7	38	12	29	11	65	6	9	19	50	7	3	9	23	5		319	

Table 11. Numbers of juvenile bluefish per seine haul in 2014.

Station

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Mean	St Dev	SE
JUN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00
JUL	60	235	35	100	56	2	1	64	5	0	32	157	3	0	36	0	14		47.06	64.63	15.23
AUG	0	19	0	0	0	0	0	0	47	0	0	32	0	0	1	2	0	0	5.61	13.36	3.15
SEP	2	1	25	0	286	1	3	0	1	1	8	0	3	0	13		0	1	20.29	68.77	16.21
OCT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00
Mean	12.40	51.00	12.00	20.00	68.40	0.60	0.80	12.80	10.60	0.20	8.00	37.80	1.20	0.00	10.00	0.50	2.80	0.25			
St Dev	26.62	103.18	16.81	44.72	124.04	0.89	1.30	28.62	20.45	0.45	13.86	68.06	1.64	0.00	15.54	1.00	6.26	0.50			
SE	11.91	46.14	7.52	20.00	55.47	0.40	0.58	12.80	9.15	0.20	6.20	30.44	0.73	0.00	6.95	0.45	2.80	0.22		Total Fish	
Number	62	255	60	100	342	3	4	64	53	1	40	189	6	0	50	2	14	1		1246	

Table 12. Numbers of juvenile menhaden per seine haul in 2014.

Station

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Mean	St Dev	SE
JUN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00
JUL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0.00	0.00	0.00
AUG	0	0	68	0	0	0	2	0	0	0	0	0	0	60	0	0	0	0	7.22	20.71	4.88
SEP	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0		1	1	0.18	0.39	0.09
OCT	2	1	1	2	55	0	0	0	0	0	1	0	0	0	0	0	0	0	3.44	12.89	3.04
Mean	0.40	0.20	13.80	0.40	11.00	0.00	0.40	0.00	0.00	0.00	0.40	0.00	0.00	12.00	0.00	0.00	0.20	0.25			
St Dev	0.89	0.45	30.30	0.89	24.60	0.00	0.89	0.00	0.00	0.00	0.55	0.00	0.00	26.83	0.00	0.00	0.45	0.50			
SE	0.40	0.20	13.55	0.40	11.00	0.00	0.40	0.00	0.00	0.00	0.24	0.00	0.00	12.00	0.00	0.00	0.20	0.22		Total Fish	
Number	2	1	69	2	55	0	2	0	0	0	2	0	0	60	0	0	1	1		195	

Table 13. Numbers of juvenile river herring per seine haul in 2014.

	Station																				
Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Mean	St Dev	SE
JUN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00
JUL	0	34	0	0	19	1	1	0	4	0	0	0	125	1	0	50	127		21.29	41.89	9.87
AUG	0	14	5	0	0	0	0	0	16	0	0	0	2	0	0	4	0	0	2.28	4.87	1.15
SEP	0	1	0	0	2	0	0	0	0	34	0	0	0	0	0		0	0	2.18	8.22	1.94
OCT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00
Mean	0.00	9.80	1.00	0.00	4.20	0.20	0.20	0.00	4.00	6.80	0.00	0.00	25.40	0.20	0.00	13.50	25.40	0.00			
St Dev	0.00	14.77	2.24	0.00	8.32	0.45	0.45	0.00	6.93	15.21	0.00	0.00	55.68	0.45	0.00	24.41	56.80	0.00			
SE	0.00	6.61	1.00	0.00	3.72	0.20	0.20	0.00	3.10	6.80	0.00	0.00	24.90	0.20	0.00	10.91	25.40	0.00		Total Fish	
Number	0	49	5	0	21	1	1	0	20	34	0	0	127	1	0	54	127	0		440	

Table 14. Numbers of striped bass per seine haul in 2014.

	Station																				
Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Mean	St Dev	SE
JUN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0.17	0.51	0.12
JUL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0.00	0.00	0.00
AUG	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	3	0	0	0.22	0.73	0.17
SEP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0.00	0.00	0.00
OCT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00
Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.40	0.00			
St Dev	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.41	0.89	0.00			
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.63	0.40	0.00		Total Fish	
Number	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	4	2	0		7	

Table 15. Temperature and salinity (dissolved oxygen not available in 2014) by station and month ï 2014 (NA indicates a day where batteries failed on YSI).

		Month					
Station		JUN	JUL	AUG	SEP	OCT	Grand Total
1	Average of Salinity	23.4	26.5	20	25.3	28.3	24.7
	Average of Temp (C)	22.4	24.2	23.8	20.8	17	21.64
2	Average of Salinity	22.5	29.7	25	26.5	29	26.54
	Average of Temp (C)	20.8	23.6	23.4	21.1	17	21.18
3	Average of Salinity	26.4	29.5	26.9	29.5	28.3	28.12
	Average of Temp (C)	20.8	24.7	26.7	19.4	14.9	21.3
4	Average of Salinity	27.1	29.5	27.1	29.9	28.3	28.38
	Average of Temp (C)	20	24.7	24.6	22	14.9	21.24
5	Average of Salinity	26.8	29.2	27.7	28.2	29	28.18
	Average of Temp (C)	20.6	22.7	23.1	22.4	18	21.36
6	Average of Salinity	27.9	30.6	28.2	28.6	30	29.06
	Average of Temp (C)	19.3	22.4	23	21.2	18	20.78
7	Average of Salinity	28.4	30.6	28.5	29.1	30	29.32
	Average of Temp (C)	18.2	21.9	21.8	20.5	18	20.08
8	Average of Salinity	26.2	30.2	30.9	28	30.8	29.38333333
	Average of Temp (C)	20.2	23.1	22.4	21	17.6	21.23333333
9	Average of Salinity	27.4	30.5	30.9	28.7	30.8	29.66
	Average of Temp (C)	18.8	22.7	22.4	21.4	18	20.66
10	Average of Salinity	28.9	30.6	30.8	29.4	29.8	29.9
	Average of Temp (C)	16.2	21.9	22.2	22	17	19.86
11	Average of Salinity	25.9	27.9	26.1	29.8	27.1	27.36
	Average of Temp (C)	21.8	23.9	23	21	14.9	20.92
12	Average of Salinity	24.8	29.3	26.1	30.9	28.1	27.84
	Average of Temp (C)	21.4	23.8	23.1	20.4	14.4	20.62
13	Average of Salinity	27.6	29.3	27.6	30.9	28.1	28.7
	Average of Temp (C)	22.5	23.8	24.9	21	14.4	21.32
14	Average of Salinity	27.9	30.8	28.3	30.9	28.1	29.2
	Average of Temp (C)	22.8	23	23.2	20	14.4	20.68
15	Average of Salinity	28.5	30.8	27.7	30.9	28.1	29.2
	Average of Temp (C)	20.6	23	23.5	20	14.4	20.3
16	Average of Salinity	27.5	30.5	30.9		29.8	29.675
	Average of Temp (C)	20.6	22.7	22.4		17	20.675
17	Average of Salinity	26.5	30.5	30.2	28	30.8	29.2
	Average of Temp (C)	19.9	22.7	22.4	22.6	17	20.92
18	Average of Salinity	27.6		27.8	28.8	28.5	28.175
	Average of Temp (C)	20.1		23.6	20.7	15	19.85
Total Average of Salinity		26.73888889	29.78888889	27.81666667	29.02352941	29.05	28.47752809
Total Average of Temp (C)		20.38888889	23.21666667	23.30555556	21.02941176	16.21666667	20.82921348

APPENDIX A

Standardized Index Development – Delta Lognormal

Menhaden, Bluefish, River Herring

The standardized indices for 2 of the main target species of the survey considered five factors as possible influences on the indices of abundance, which are summarized below:

Factor	**Levels**	**Value**
Year	25	1988-2014
Month	5	June - October
Temperature (°C)	Continuous	
Salinity (ppt)	Continuous	
Station	18	18 fixed stations throughout bay

The delta lognormal model approach (Lo et al., 1992) was used to develop standardized indices of abundance for the seine survey data. This method combines separate generalized linear model (GLM) analyses of the proportion of successful hauls (i.e. hauls that caught winter flounder) and the catch rates on successful hauls to construct a single standardized CPUE index. Parameterization of each model was accomplished using a GLM procedure in the R statistical software package (dglm function see: http://www.sefsc.noaa.gov/sedar/download/SEDAR17-RD16%20User%20Guide%20Delta-GLM%20function%20for%20R%20languageenvironment%20(Ver.%201.7.2,%2007-06-2006).pdf?id=DOCUMENT).

For each GLM procedure of proportion positive trips, a binomial error distribution was assumed, and the logit link was selected. The response variable was proportion successful trips. During the analysis of catch rates on successful trips, a model assuming lognormal error distribution was examined.

The final models for the analysis of catch rates on successful trips, in all cases were:

Ln(catch) = Year + Month + Station + Temperature + Salinity

The final models for the analysis of the proportion of successful hauls, in all cases including menhaden, were:

Success = Year + Month + Station + Temperature + Salinity

Standardized Index Development – Negative Binomial Generalized Linear Model

Winter Flounder, Tautog, Striped Bass

The standardized indices for 3 of the main target species of the survey considered up to six factors as possible influences on the indices of abundance, which are summarized below:

Species	**Factor**	**Levels**	**Value**
Winter Flounder	Year	25	1988-2014
	Station Periods	4	Stations were added to the survey on 3 separate occasions (station 16 added June 1990, station 17 added July 1993, station 18 added July 1995)
	Temperature (°C)	Continuous	
	Salinity (ppt)	Continuous	
	Station	18	18 fixed stations throughout bay
Tautog	Year	25	1988-2012
	Station Periods	4	Stations were added to the survey on 3 separate occasions (station 16 added June 1990, station 17 added July 1993, station 18 added July 1995)
	Station	18	18 fixed stations throughout bay
Striped Bass	Year	25	1988-2012
	Station Periods	4	Stations were added to the survey on 3 separate occasions (station 16 added June 1990, station 17 added July 1993, station 18 added July 1995)
	Temperature (°C)	Continuous	
	Salinity (ppt)	Continuous	
	Station	18	18 fixed stations throughout bay
	Month	5	June - October

The negative binomial generalized linear model approach was used to develop standardized indices of abundance for the seine survey data. This method produces a generalized linear model (GLM) for the catch rates on all hauls to construct a single standardized CPUE index. Parameterization of each model was accomplished using a GLM procedure in the R statistical software package, the code of which was modified from Nelson and Coreia of the Northeast Fishery Science Center (personal communication).

During the analysis of catch rates on hauls, a model assuming a negative binomial error distribution was examined. The linking function selected was ñlogò, and the response variable was abundance (count) for each individual haul where one of the three species was caught.

A stepwise approach was used to quantify the relative importance of the factors. First a GLM model was fit on year. These results reflect the distribution of the nominal data. Next, each potential factor was added to the null model sequentially and the resulting reduction in deviance per degree of freedom was examined. The factor that caused the greatest reduction in deviance per degree of freedom was added to the base model if the factor was significant based upon a Chi-Square test ($p<0.05$). This model then became the base model, and the process was repeated, adding factors individually until no factor met the criteria for incorporation into the final model.

The final models for the analysis of catch rates were:

Winter Flounder: Abundance = Year + Temperature + + Station + Station Periods
Tautog: Abundance = Year + Temperature + Station + Salinity
Striped Bass: Abundance = Year + Station

Assessment of Recreationally Important Finfish
Stocks in Rhode Island Coastal Waters

<u>2014 Annual Performance Report for Job VI, Part A:</u>

Assessment, Protection, and Enhancement of Fish Habitat to Sustain Coastal and Marine Ecosystems and Healthy Stocks of Recreationally Important Finfish:

Assessing, Monitoring, and Minimizing Impacts to Marine Habitat

by
Eric Schneider
& Chris Deacutis
Principal Marine Fisheries Biologist
& Sup. Environmental Scientist

Rhode Island Department of Environmental Management
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Federal Aid in Sportfish Restoration
F-61-R

2014 Performance Report for Job VI, Part A March 31, 2015

PERFORMANCE REPORT

STATE: Rhode Island

PROJECT NUMBER: F-61-R
SEGMENT NUMBER: 21

PROJECT TITLE: Assessing, Monitoring, and Minimizing Impacts to Marine Habitat

PERIOD COVERED: January 1, 2014 - December 31, 2014

JOB NUMBER AND TITLE: VI, Part A: Assessment, Protection, and Enhancement of Fish Habitat to Sustain Coastal and Marine Ecosystems and Healthy Stocks of Recreationally Important Finfish

STAFF: Eric Schneider (Principal Marine Fisheries Biologist) and Chris Deacutis, PhD (Supervising Environmental Scientist)

JOB OBJECTIVE: The goal of this project is to assess, protect, and restore important marine habitat to support healthy marine ecosystems and stocks of recreationally important finfish. We will obtain this goal by addressing the following objectives:

(1) Identify, assess, and monitor sensitive and important marine habitat in Rhode Island (RI) waters in concert with developing a RI Marine Habitat Management and Restoration Plan.
(2) Provide a comprehensive review of permit applications for projects that occur in Rhode Island waters and may directly or indirectly impact coastal and marine resources and their habitat, including economic development projects, such as energy, infrastructure, dredging, and dredge spoil disposal projects, as well as aquaculture and habitat restoration projects.
(3) In the event of a significant environmental incident: coordinate hazard mitigation, assessment of natural resource damages, and resulting habitat restoration.

SUMMARY: This report summarizes all work conducted for this project between January 1 and December 31, 2014. During this period we focused on aspects related to the three aforementioned objectives.

To address Objective 1 we summarized all available data that could be used to identify, assess and quantify fish habitat in Narragansett Bay. In addition to addressing this objective, this review also supported a need identified by the Atlantic Coast Fish Habitat Partnership who is funding a project to identify potential restoration areas for winter flounder based on current habitat data and fishery independent data, including the RI DEM Narragansett Bay Trawl Survey The project is on-going the summary of all data sources is still in draft format. We expect to have the data summary completed by mid-2015.

We have been also been meeting with a group of scientists at the US EPA Atlantic Ecology division (AED) Laboratory (Narragansett, RI) who are attempting to apply the ñBiological Condition Gradientò technique to various National Estuary Programs (including Narragansett Bay) for assessment of present water quality conditions in relation to past conditions, with a goal towards identifying achievable improvements in water quality through management decisions. This process uses various historical and recent data sets , including historical benthic community data sets, qualitative metadata from historical documents (e.g., state fishery commission reports), and Sediment Profile Imaging (SPI) techniques to assess marine habitat conditions in relation to water quality gradients (e.g., eutrophication and/or toxics impact levels).

Although the goals are oriented towards water quality measures, we believe there are significant aspects that can be used for our present project to assess recreational fish habitats in RI marine waters and develop restoration plans. This data pertaining to each of these projects directly addresses a need to ñreview and summarize previously collected habitat-related data to identify the current knowledge base and data gapsò. Once this review is finalized we can begin to develop the 5-year plan to address this objective, with a goal of having a completed Marine Habitat Management and Restoration Plan by 2020.

To address Objective 2 Division of Fish and Wildlife (DFW) staff reviewed 85 projects and applications as part of its Environmental Review program during the 2014 calendar year (91). Verbal comment was provided on all general permit reviews through the monthly general permit meeting at the RI CRMC with the US Army Corps. Most residential dock permits were new requests and were located in the coastal ponds, but most did not encroach on known eelgrass beds. Projects having significant concern are detailed below in the Results section.

To address Objective 3 The RI DFW responded to one moderate-sized Fish Kill and provided a report to the Director, the Division of Water Resources, and the RIDEM Emergency Response section (see below and App. VI A1).

TARGET DATE: December 2014

DEVIATIONS: There were no significant deviations from the timeline proposed in the current grant, except that we did not complete the development of a 5-year plan to address the goal of having a Marine Habitat Management and Restoration Plan by 2020. Once our review of previously collected habitat-related data is complete we will begin to develop the 5-year plan. We expect this delay will not impact the overall goal of having the plan completed by 2020.

RECOMMENDATIONS: We recommend continuing to collaborate with Dr. Emily Shumchenia on work that is presently funded by USEPA under Biological Condition Gradient efforts with local Natôl Estuary Programs, including the Narragansett Bay Estuary Program. We see an opportunity to steer some of her work towards habitat mapping and assessments that will be extremely useful in the pursuing development of the RI Marine Habitat Management and Restoration Plan.

INTRODUCTION

Healthy and resilient coastal and marine ecosystems depend on the careful stewardship of both the living marine resources and the habitats upon which they depend. The importance of fish habitat to the sustainability of healthy fisheries was formally recognized with the advent of the Essential Fish Habitat (EFH) component of the Sustainable Fisheries Act (1996). Site specific baseline information detailing the condition of the habitat (water column environment, submerged aquatic vegetation (SAV), and the benthic structural habitat and epifauna) is required for several important fishery management tasks, including identifying areas of important habitat that should be protected, documenting the spatial distribution and condition of habitat in case of an environmental disaster, assessing changes over time due to impacts from climate change or other anthropogenic factors, as well as minimizing impacts from development activities.

In Rhode Island (RI) most of the habitat-related survey work is conducted via collaborative projects that are often coordinated by non-regulatory partners and do not have consistent funding sources. Although the information collected by these projects is usually beneficial to managers, there is not an overarching plan or vision regarding how RI's marine habitat should be assessed, monitored, and managed. Thus, there is a clear need for a Marine Habitat Management and Restoration Plan that provides guidance for current (on-going) projects and establishes priorities for future work. This type of plan would also be a vital resource when establishing goals and objectives of cooperative projects and when seeking funds via a competitive grant process.

APPROACH

The anticipated approach for each objective is described separately below.

Approach - Objective 1

During the first year of this project (2014) we proposed developing a 5-year plan to address this objective so that by the end of the 5 year period we have a completed Habitat Management and Restoration Plan that allows us to:

1. Identify, designate, and protect strategic or important habitat areas;
2. Establish research and monitoring needs and priorities;
3. Coordinate, complete, and maintain baseline habitat mapping (including seagrass, shell bottom, and other bottom types) using the most appropriate technology;
4. Selectively monitor of the status of those habitats;
5. Assess fish-habitat linkages and effects of human activities and climate change on those habitats.

More specifically, in order to develop a work plan for years 2-5 (2015-2018) we proposed (in year 1) to: review and summarize previously collected habitat-related data to identify the current knowledge base and data gaps; conduct a review of current scientific literature and begin to draft an approach to address current data gaps; participate in habitat survey work that provides detailed information to support site-specific assessments, including those for F-61 supported fishery independent surveys; and work with partners and other collaborators who are conducting habitat-related work in RI waters to discuss how best to collaborate on future projects.

Approach - Objective 2

To address Objective 2, the Division provided a comprehensive review of any project or activity, including economic development projects (e.g. energy and infrastructure), dredging and dredge spoil disposal projects, as well as other activities (e.g. recreational and commercial fishing, aquaculture, habitat restoration, etc.) that were proposed for Rhode Island waters and could pose potential direct or indirect impacts to coastal and marine resources and their habitat. Reviews included all available data and provided important information to permitting agencies to allow for more informed permitting decisions.

Depending on the size, scope, and location of the proposed project or activity the review process sometimes involved determining the living and non-living resources present at or near the project site and evaluating the potential direct and indirect adverse effects of the proposed project or activity on fishery resources and marine habitat. More specifically, this process often requires a site visit and a review of fishery resource data and marine habitat data, including EFH, that were collected at or near the project site or in similar habitat conditions. These data may include data collected by RI F&W finfish surveys funded by the USFWS Sport Fish Restoration Program (e.g. Narragansett Bay Monthly and Seasonal Fishery Resource Assessment, Winter Flounder Spawning Stock Biomass Survey, Young of the Year Survey of Selected RI Coastal Ponds and Embayments, and the Juvenile Marine Finfish Survey) and surveys related to finfish, shellfish, and ichthyoplankton conducted by RI F&W pursuant to other funding sources or other originations and institutions (e.g. MA DMF, NEMAP, NEFSC, URI GSO, etc.). Habitat data, including EFH data, may require leveraging data collected previously by RI F&W or other organizations and institutions.

In cases where site-specific habitat and marine resource data is limited, dated, or absent new data may be collected, analyzed, and summarized. When possible, this work takes advantage of collaborative efforts with other agencies. Collection of marine habitat and resource (finfish) data has required use of a vehicle, boat, research vessel, field equipment including but not limited to habitat surveying tools, such as submersible high-resolution digital cameras (video and still-shot), bottom samplers (benthic dredge/sled), water quality data sondes, meters, and associated equipment, and marine resource survey tools, including nets (bongo, seine), measuring boards, and foul weather gear. Data was assimilated and analyzed using statistical software, databases, imaging processing software, and GIS mapping and processing technologies where applicable.

Approach - Objective 3

The Division has the duty to provide available scientific information identifying important recreational fish habitat and pre-impact conditions in the event of a significant environmental incident classified as a Category 3 major environmental disaster incident (e.g., > 10,000 gal oil spill or wide coastal environmental impact likely). In addition, the Division provides a staff member with recreational fishery habitat expertise for coordination of Division responses related to assisting the Office of Emergency Response Incident Command in assessing any significant environmental impacts of a major oil spill or incident on recreational habitat and biota in Rhode Island marine waters. For moderate incidents such as fish kills, the staff will follow the ñBay Response Teamò (BART) protocols

Results

Results - Objective 1 (aspects of work plan development for a completed Marine Habitat Management and Restoration Plan by 2020)

RI DFW began documenting all available data that could be used to support assessment or identification of fish habitat and the quality of said habitat. The timeline of this review addressed a need identified by the Atlantic Coast Fish Habitat Partnership, who is funding a project to identify potential restoration areas for winter flounder based on current habitat data and fishery independent data, including the RI DEM Narragansett Bay Science and Trawl Survey (funded by this grant). The project is on-going the summary of all data sources is still in draft format. We expect to have the data summary completed by mid-2015.

This data summary directly addresses a need identified in the above approach to ñreview and summarize previously collected habitat-related data to identify the current knowledge base and data gapsò. Once this review is finalized we can begin to develop the 5-year plan to address this objective, with a goal of having a completed Marine Habitat Management and Restoration Plan by 2020. In pursuing the approach suggested above, we have also been working towards aspects to support Objective 1-2 (establishing research and monitoring needs and priorities); and Objective 1-3 (coordinate, complete, and maintain baseline habitat mapping, including seagrass, shell bottom, and other bottom types using the most appropriate technology).

Towards this end, we have been meeting almost monthly with a group of scientists at the Atlantic Ecology division (AED) Laboratory in Narragansett, RI who are attempting to apply the ñBiological Condition Gradientò technique to various National Estuary Programs (including Narragansett Bay) for assessment of present water quality conditions in relation to past conditions, with a goal towards identifying achievable improvements in water quality through management decisions. This process uses various historical and recent data sets , including historical benthic community data sets, qualitative metadata from historical documents (e.g., state fishery commission reports), and Sediment Profile Imaging (SPI) techniques to assess marine habitat conditions in relation to water quality gradients (e.g., eutrophication and/or toxics impact levels).

Although the goals are oriented towards water quality measures, we believe there are significant aspects that can be used for our present project to assess recreational fish habitats in RI marine waters and develop restoration plans. There are 2 SPI datasets covering large areas of the main passages of Narragansett Bay and calculating an Organism sediment Index (OSI) . One from 1988; and one from 2008. In addition, there is a comprehensive biotope characterization of Narragansett Bay bottom at 1 m resolution completed by Dr. John King and his graduate students that we hope to gain access to in 2015 by working with Dr. Emily Shumchenia, his former graduate student. We expect to work with Dr. Shumchenia in her role under USEPA funds to begin characterizing the bottom habitat in Narragansett Bay using the available coverage she has access to. Although there may be a need for minor funding to reach the resolution level we would need for the Habitat Restoration Plan (1 or 2 m), we are extremely confident that she will be able to provide significant geographic-specific benthic data for our mapping needs over wide expanses of Narragansett Bay.

Results - Objective 2 (comprehensive review of permit applications for projects that occur in Rhode Island waters and may directly or indirectly impact coastal and marine resources and their habitat)

Objective 2 Division of Fish and Wildlife (DFW) staff reviewed 85 projects and applications as part of its Environmental Review program during the 2014 calendar year (91). Verbal comment was provided on all general permit reviews through the monthly general permit meeting at the RI CRMC with the US Army Corps. Most residential dock permits were new requests and were located in the coastal ponds, but most did not encroach on known eelgrass beds. Projects having significant concern are detailed below in the Results section.

Results - Objective 3 (response to a significant environmental incident)

RI DFWstaff (Dr. Chris Deacutis & Dennis Erkan) responded to a moderate level fish kill of Menhaden (several hundred) in the (tidal) Seekonk River. We surveyed the area, took oxygen profiles, and documented the kill with fish counts and digital photography. A copy of the full report is provided in App VI A1.

Discussion

The DFWôs ability to protect marine resources and their habitat from adverse anthropogenic impact is largely dependent upon the quality and extent of the data available. Therefore, the DFW strives to use high quality, quantitative information to develop science-based recommendations for regulations and permits. There were several major permit issues dealt with in 2014, requiring substantial time and technical analysis by DEMF&W staff. The number of permits reviewed are listed in Table VI A1, while greater details are provided below for specific permits that included significant concerns we had that were responded to in the final permit :

- One dock which encroached on fringe marsh and eelgrass was required to use light transmitting materials for the dock materials, and take light measurements following construction to better determine for RI CRMC whether the light-transmitting material provides adequate light levels beneath the dock. The DEM F&W staff made recommendations and provided contacts to RICRMC technical staff concerning best protocols for light measurements in the field (Hobo use etc)

- The US FWS Narrow River Coastal Resiliency Project is an ongoing, complex project involving support of NRPA Water Quality; a monitoring program; installation of two BMPôs in high priority areas; enhanced flushing in upper Petasquamscutt Cove as well as other high priority refuge needs for the US FWS. This work is being funded by the Hurricane Sandy Coastal Resiliency Program under the Disaster Relief Appropriations Act 0f 2013. This project involves saltmarsh habitat enhancement and resiliency at the John H. Chafee NWR ï Narrow River. The project is targeting 68 acres of saltmarsh to restore surface drainage and treat adjacent marsh migration areas to enhance saltmarsh migration. The response of the system will be followed using robust monitoring protocols including nekton response.

Excavation of some tidal flats will be undertaken to enhance cool-water refugia for winter flounder; provide foraging habitat for striped bass; and enhance eel grass habitat. A side benefit will provide boat navigation away from saltmarsh shorelines, decreasing that erosion energy source. Beneficial use of the dredge materials by applying thin layer deposition techniques will be applied using the adjacent dredged sediments on specific areas of the saltmarsh in order to elevate zones showing severe erosion patterns due to SLR, providing some short-term resilience to sea level rise. RI DFW staff made a site visit and attended two informational interagency collaborator meetings on this project. The project received a Water Quality Certification (WQC) on 12/5/14 from RIDEM.

- The Manchester Street Power Station (MSS) is a gas-fired power plant located at the top of Narragansett Bay, along the Providence River behind the ACOE Hurricane Barrier. Like most power plants, this plant requires water to generate stream, and subsequently turn the turbines to create electricity, as well as to cool equipment at the plant. A significant volume of cooling water is withdrawn from and then discharged back to the Providence River, requiring a Rhode Island Pollutant Discharge Elimination System (RIPDES) permit from DEM. The DFW has been assisting the RIPDES program with a major technical review of materials related to a 316 a&b permit modification. Our word was to assess whether this intake and discharge results in adverse environmental impacts to marine resources and habitat.

In 2014, we provided the RIDEM Office of Water Resources (state Water Quality permitting division) with a substantial review of the 316a demonstration report as well as all station fish impingement and entrainment (I&E) data, and completed a graphic analyses of fish losses due to these I&E impacts. We were able to demonstrate a potentially substantial I&E impact of this plant to the local winter flounder population, *Pseudopleuronectes americanus*, as well as concerning levels of impact to tautog, *Tautoga onitis*, and the American eel, *Anguilla rostrata* (see Memo of 4/15/14 , App VI A) .

Briefly, the primary focus of the DFWôs concerns are related to impingement and entrainment impacts to all non-anadromous fish species. The following paragraphs have been copied verbatim from the ñSummary Key Findings and Conclusionsò section of the aforementioned memo.

> RIDFW has greatest concern over the impacts this facility is having on local fish populations through impingement and entrainment. Brayton Point (BP) in Mount Hope Bay is a much larger plant with pre-2011 (initiation of closed loop) flow four times larger than the MSS flow on both a monthly and annual mean basis. Despite this much larger flow by BP, the mean total fish impinged per year 1975-2010 by MSS is four times (4X) the much larger Brayton facility based on impingement data collected by MSS and BP. Even important non-schooling species (winter flounder) are captured approximately twice as often as the larger Brayton facility when it was at full once-through flow.

> We do not accept the comparison of adult equivalent losses from entrainment and impingement against the total state and regional southern NE landings because there is clear evidence of local populations of this species (and others like tautog) returning to specific areas of the Bay each year to reproduce, constituting a local population that is receiving the impact. We strongly recommend requiring Dominion, as part of this permit, to work with local fishery scientists to come up with a valid local subpopulation estimate for winter flounder and tautog in order to understand what percent of this local population is being impacted. We can then revisit this issue in several years once adequate quantitative data is available. Meanwhile, we recommend limiting the total volume and/or intake flow rate using all reasonable technologies available, including variable speed pumps and perhaps consider behavioral cues to allow fish to recognize they are entering the inescapable canal intake as they pass through the hurricane barrier, perhaps with painted extensions of the intakes that allow motion detection by fish. It should be noted that the variable speed pumps will not be helpful if this plant becomes a continuous baseload plant and thus, alternative means to decrease these very high rates of entrainment and impingement may need to be evaluated.
>
> Based on the hydrodynamic study by Dominion, we believe the intake volume is actually taking in a majority of the volume of water that exists just south of the hurricane barrier, making the plant a gauntlet for all macrolife that does not recognize it is being inexorably pulled into the intake canal.

We had several meetings with RIDEM Div. of Water Resources on our findings, and presented the fisheries concerns at a meeting on 11/10/14 between RIDEM and the Manchester Street-Dominion Power representatives (App. VI A3). Discussions are ongoing for the requirements of the final permit for the 316a permit modification request. We expect to continue our involvement in meetings with Dominion on this power plant permit into 2015.

- Pawtuxet Cove condo-marina project, which includes the dredging of the current marina and rebuilding the historic Edgewood Yacht Club that was lost to a fire. For this project, there was a desire to dredge the marina perimeter slightly deeper (8ô) than the outer perimeter depth (6ô). RI DFW spoke with RIDEM WQC and RI CRMC at PG meetings and requested that the dredge depth not be deeper than the outer perimeter edge depth in order to ensure adequate flushing in order to protect fish habitat from poor water quality and low dissolved oxygen. The RIDEM WQC indicated to the applicant that the max depth was an issue and the applicant complied and decreased the marina depth to the depth of the outer edge (6ô).

- Navy Pier Newport ï Dredge Pier 1&2. We attended a meeting at the Newport Navy Base (9/25/14) with RIDEM permit staff, Navy representatives, the US Army Corps, and the US EPA. The Navy is requesting a permit to dredge rock/fill and concrete as well as sediments between Piers 1 and 2 in Coddington Cove, Newport, RI. RI DFW provided verbal comment on the project. The applicant agreed to have the consultant utilize a turbidity curtain, and make continuous turbidity measurements both in the dredge zone and just outside of it. Dredging was ongoing for winter 2014-15.

- Deepwater Wind (Block Island Wind Farm)

After several years of review RI DEM issues the permits required to construct the Block Island (BI) Wind Farm. This 5 turbine offshore wind farm will be located within RI state waters. roughly three miles southeast of BI, with connection via submarine cable to BI and the mainland. The mainland landfall location is Scarborough Beach in Narragansett, RI. This would be the first offshore wind farm along the US Atlantic Coast

For several years the DFW has been active in review of offshore wind related issues. Between 2009 and 2010 the DFW participated in drafting and finalizing the RI CRMC Ocean Special Area Management Plan (Ocean SAMP), which is a federally recognized coastal management and regulatory tool. The goal of the Ocean SAMP is to provide a balanced approach to the development and protection of Rhode Island's ocean-based resources, using the best available science. The RI DFW has been involved throughout the permitting process, and in 2014, the DFW was heavily engaged in reviewing the application by Deepwater Wind for the BI Wind Farm and Transmission System. The 2014 review resulted in final permits being approved that included substantial monitoring requirements, including, requiring baseline survey work prior to, during, and post construction to determine possible effects of EMF on marine resources. The final RI DEM WQC and dredge permit were issued May 7, 2014. Some of the permit conditions also include Time Of Year (TOY) restrictions related to Jet Plowing a cable laying to protective winter flounder eggs and larva. Currently the DFW is waiting for a long-term monitoring and operations and maintenance plan for the transmission cables to be submitted for DEM review and approval. This plan shall include details regarding how a post-construction inspection will be performed and actions if the cable is not properly buried.

- A private shoreline owner desired to ñrestoreò a small fringe marsh blocking their view due to phragmites in Barrington, RI. Their original request was for a 500ô channel to reopen an intermittent breachway through the small barrier beach in front of the salt marsh and phragmites area. We requested that this type of private remediation/ñrestorationò for primary purposes other than restoration of natural marsh habitat be discouraged and/or denied by the CRMC. We recommend that restoration projects always be in collaboration with the RI DFW and the RI CRMC in order to eliminate projects using restoration as a justification for private shoreline alterations to intertidal and near-shore habitat. In this case, the RI CRMC recommended that the intermittent channel be opened only 35ô, and be allowed to naturally refill due to storms etc.

- We reviewed and verbally commented on other Hurricane Sandy restoration projects in RI ï These were multiple projects (including the above US FWS Narrow River Coastal Resiliency Project). It included repair of riprap at the USCG station, Pt Judith RI, repair of shoreline revetment at Camp Cronin, Narragansett, RI, and dredge of the navigation channel at Little Narragansett Bay in Westerly, RI. The latter project involved removal of 60,000 cubic yards sand and discharge to the lee side of Sandy Pt Island to increase plover habitat lost due to sea level rise.

Conclusion

The DFWôs ability to protect marine resources and their habitat from adverse anthropogenic impact is largely dependent upon the quality and extent of the data available. Therefore, the DFW strives to use high quality, quantitative information to develop science-based recommendations for regulations and permits. We will continue to improve data collection and the review process in order to protect the important recreational fishery resources of the state.

Literature Cited

ASMFC. 2007. The Importance of Habitat Created by Molluscan Shellfish to Managed Species along the Atlantic Coast of the United States. Prepared by L. D. Coen and R. E. Grizzle, Edited by J. Thomas and J. Nygard. ASMFC Habitat Management Series No. 8, http://www.asmfc.org/uploads/file/hms8ShellfishDocument.pdf

Sustainable Fisheries Act (16 USC 1801). 1996.. PUBLIC LAW 104ï 297 ð   OCT. 11, 1996 (http://www.nmfs.noaa.gov/sfa/sustainable_fishereries_act.pdf)

Table VI A1. General Permit Reviews performed in 2014 by RI DFW

	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Potential Impacts to SAV or Benthic Habitat												
SaltMarsh Restoration						1[a]				1[b]		2[a]
Eelgrass Restoration												1[b]
Coastal Restoration (other)		1[d]										
Maintenance Dredging		1[e]							1[f]	3[g]	2[g]	1[c]
New Dredging						1[h]	1[i]				1[j]	
New Marina		1[h]					1[i]				1[j]	
Marina Expansion or Reconfiguration												
Restoration of Tidal Flow to Coastal Pond			1[k]									
Residential Docks (new)	no mtg	4	3	3	3	5	4	no mtg	3	3	4	6
Residential Docks (modification)		1	0	0	2	0	1		0	1	1	1
Commercial Piers or Docks						1[l]						
Salt Marsh or Coastal Wetland Impacts												
Beach Nourishment or Coastal Feature Restoration		1[e]										
Waterfront Bulkhead/Riprap			1[m]		1[n]				1[n]	1[o]		
Waterfront Development											1[j]	
Aquaculture (potential shellfish or rec use conflicts)		1			3	1	1					1
Aquaculture expansion (potential shellfish or rec use conflicts)									1	1		1
Public Works or Utility			1[p]									
Fish Passage												
Potential Shellfish Impacts												
Channel Maintenance												
Boat Ramp (New or Repair)					1[q]							
Oyster Restoration												
Conflict with Recreational Use												
Impacts from Discharge												
- Total Number of Activities and Potential Impacts Identified		10	6	3	10	9	8		6	10	10	13
												85 tot

[a] Save The Bay -restoration- runnels or culverts for : Nayatt Pt area + Rocky Hill School + RICC

[b] Save the Bay restoration Jacobs Creek

[c] Narrow Rvr sandy restoration - dredge shoal deeper to decrease baot wake + open shoal for eelgrass (too shallow now)
use dredged materials for Thin Layer build-up for upper marsh - based on 2 (dates?) briefing meetings w/ US F&W + site visit

[d] Cooperative RI DEM F&W/The Nature Conservancy artificial reef project- no comment since applicant- respond to CRMC staff concerns (see special section on AR project)

[e] Little Narr Bay maintenance dredge for Sandy fill-in of channel (60,000 cy)- sand discharged to rebuild/increase shorearea on Sandy Pt Is. for plover habitat

[f] Navy Pier dredge mod

[g] Newport Harbor Marinas + Navy Pier Dredge Pier 1-2 Coddington Cove, Newport, RI

[h] Deepwater Wind - BI 5 turbine wind farm - dredge / fill trench for cable

[i] rebuild Edgewood YC - limit max depth to outer depth so no sill limiting flushing

[j] Pawtuxet Cove Condo + new 6 boat marina

[k] Barrington private home rqsts 500' channel through barrier bch- allowed 35' nat channel area w/ nat refill- to kill phrag

[l] Prudence Is. new ferry dock

[m] USCG Pt Judith riprap repair from Sandy

[n] Camp Cronin fishing area repair shoreline revetment -Sandy Damage

[o] Jamestown riprap repair

[p] RIDOT Sakonnet Rvr Bridge leave 5 piers for pedestrian walkway

[q] DEM State boat ramp at Galilee - required turbidity curtains-worked well

Appendices

Job VI – A

VI A1 **Fish Kill Report 2014**

VI A2 **Manchester Street Power (Dominion) 16a Review Memo from RIDEM F&W to RIDEM DWR April 15, 2014**

VI A3 **Presentation of Issues by RIDEM DWR + RIDEM F&W to Dominion Representatives Nov. 10, 2014**

FISH KILL INVESTIGATION REPORT FORM

Additional Comments: Largest kill area was between Bucklin Pt and state pier upper Seekonk but old kill- fish long surface scum line.

1 **Date:** 8/5/14	2 **Time of Arrival:** 2:15 PM **Total Time spent at site** : ~ 2 hrs	3. **Waterbody Location:** Seekonk River	4. **Person reporting:** Name: Chris Deacutis + Dennis Erkan Phone: 423-1939 Address: 3 Ft Wetherill Rd Jamestown, RI Affiliation: RIDEM F&W

5. **# of fish Killed**: _____ Incident Size: Minor <100 □ Moderate 100-1000 X Major >1000 □	6. **Dimensions of fish kill**: __________ by __________ From Red bridge to state pier in upper Seekonk River	7. **Fish Species Affected:** / **Fish Size** 1. __Atlantic Menhaden (adult) ______________ Same X□ Different □ Range ____ to ~12_ in. 2. ______________ Same □ Different □ Range ____ to ____ in. 3. ______________ Same □ Different □ Range ____ to ____ in. 4. ______________ Same □ Different □ Range ____ to ____ in 5. ______________ Same □ Different □ Range ____ to ____ in. 6. ______________ Same □ Different □ Range ____ to ____ in.
8. **Fish Species Not Affected** ___juv bluefish at surface ____________________ ____________________ ____________________ ____________________	Temp (F) ~ 80F Cloud Cover (%) clear Precipitation (%) 0 Wind Speed (mph) 5-10mph Wind direction - out of So	7a. **Other Species Affected:** 1, _____none seen ______________ Dead □ Dying □ Lethargic □ Live □ 2. ______________ Dead □ Dying □ Lethargic □ Live □ 3. ______________ Dead □ Dying □ Lethargic □ Live □

10. **Water Quality:** Temp (C): _23-25 C___ pH: ____________ DO: _7-9mg Surf; 2-0.5 mg/Lbttm__________ Conductivity: _________ Salinity: _5-24psu S ; 26-28 psu bttm__________ Chlorine: ____________	11. **Water Condition:** Turbid □ Sediment Loading □ Colored: __________ □ Odor: ___________ □ Tidal Stage: _hi tide______ SAV/ macroalgae ______ □	12. **Fish Condition:** Dying X□ Discoloration □ Increased respiration □ Emaciated □ Gills flared □ Odd fin position □ Eyes sunken in □ Spasms, convulsions □ Red/pink gills □ Swimming at surface □ Eyes bulging □ Erratic Swimming □ Gill clubbing □ Equilibrium loss □ Bloated □ Lethargy □ Excessive mucus □ Trying to get out of water □ Mouth agape □ Hemorrhaging □ Lesions □ Hypersensitivity □ Spine curved □ Other __all dead and decayed (days old) except 1 menhaden erratic swimming____________________ Run samples for:____________________

13. **Symptoms/Conditions**	**Possible Cause**	**Possible Source**	**Source present?**	
• Fish coming to surface gulping for air □ • Low dissolved oxygen X□	Oxygen depletion	Sewage Treatment Plan	Yes X□	No □
		Livestock Feedlot	Yes □	No □
		Irrigation/De-icing Runoff	Yes □	No □
		Decaying Plant Matter	Yes □	No □
		Dying Algal Bloom	Yes □	No □
• Fish coming to surface gulping for air □ • Adequate dissolved oxygen □	Early oxygen depletion with slow re-oxygenation	Ammonia Chemicals	Yes □	No □
		Livestock Feedlot	Yes □	No □
• Fish swimming erratically □ • Fish moving upstream to avoid something in water □	Chemical pollution	Heavy Metal Plant	Yes □	No □
		Chemical Waste Facility	Yes □	No □
		Sewage Treatment Plant	Yes □	No □
• Fish dying or dead after heavy rain □	Pesticide, herbicide washed out/runoff	Farms, Crop fields	Yes □	No □
		Aerial Crop Sprayer	Yes □	No □
		Man/mechanical Sprayer	Yes □	No □
• Fish coming to surface gulping for air □	Oxygen depletion	Dredging/ Marina activity	Yes □	No □
• Low pH □ Good clarity □ Orange Discoloration □	Acid	Coal/Strip Mining	Yes □	No □
• Fish dying below a dam or industrial plant □	Turbines or thermal shock	Heated water	Yes □	No □
• Kill restricted to one species or size class □	Spawning stress, disease	Pathogens, WQ poor	Yes X□	No □

14. **Documentation and Samples**:					15. **Prepared By**: Chris Deacutis
Photos taken	☐X				
Water samples	☐	Number: ______	Sent to: ______	Tested For: ______	
Fish Samples	☐	Number: ______	Sent to: ______	Tested For: ______	

Fish-Counting Record

Date: ____8-5-14____ **Time: Start** __**2:15PM**__ **Finish** _**4:15PM** **Name of investigator(s):** **Chris Deacutis + Dennis Erkan**__

Location/Waterbody Name: **Seekonk River**_________________ **Area Sampled:** (Entire) Length/Area ________________________

(Transects) # of Transects __**1 long transect**_____ **Transect #** _______ **Notes: ran up Seekonk w/ cts as go along. Dead fish strewn in very low #s along scum line in river center**____

SPECIES

Mi		Atl Menhaden					
1		~ 200-250					
2		Most dead between Bucklin & state pier #2 Pawtucket RI					
3							
4							
5							
6							

-

Fish Kill/Incident Notification

Date of Kill/Incident: 8-5-14 (ongoing + prev. kill several days earlier)

Date Reported: 8-4+5-14 Time Reported: email forwarded 9 Am + call from Tom Kutcher Save the Bay ~ 11AM

Name of Reporter: Tom Kutcher Save the Bay + employees of Waterman Grille

Address: Phone:

Organization Associated With: Save the Bay

Water(s) Involved: Seekonk River

Specific Location (bridge, highway/state road, landmark, park, etc.): Near Waterman Grill + above

Suspected Reason For Fish Kill/incident (natural / pollution): Low oxygen

Location of Source: N/A

Name of Alleged Polluter (if applicable): N/A

Address: Phone:

Species Involved: Atlantic Mernhaden

Fish Affected? X Yes ___ No

Approximate Number: 200-250 Still Dying? X Yes ___ No Some → ~ 1 %

Additional Comments: Most dead menhaden appear to have died several days prior. Snapshot on the Bay – NBC site shows very low DO since late Sun 8-3-14

Persons and Agencies Notified To Respond:

	NAME	DATE/TIME	PHONE	REPORT SENT TO
1.	Chris Deacutis DEMF&W	8/5/14	423-1939	___ Yes X No
2.	Dennis Erkan DEMF&W	8/5/14	423-1932	___ Yes X No

Division of Enforcement Notified at (401) 222-3070 X Yes ___ No

Report Prepared By: Chris Deacutis DEM F&W Further Action Needed? ___ Yes X No

Atl Menhaden adult –live but swimming erratically in circle –8-5-14
Seekonk River at blue boathouse

Dead decaying menhaden in scum slick 8-5-14 Seekonk River

Fish Kill DO data **Seekonk River**

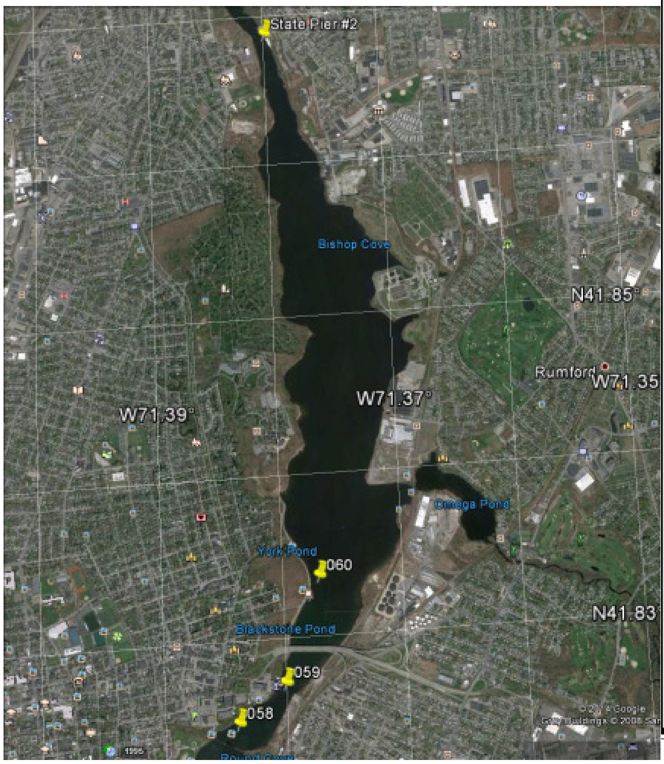
Date **8/5/2014** **Time** **2:30 PM to 3:30 PM**

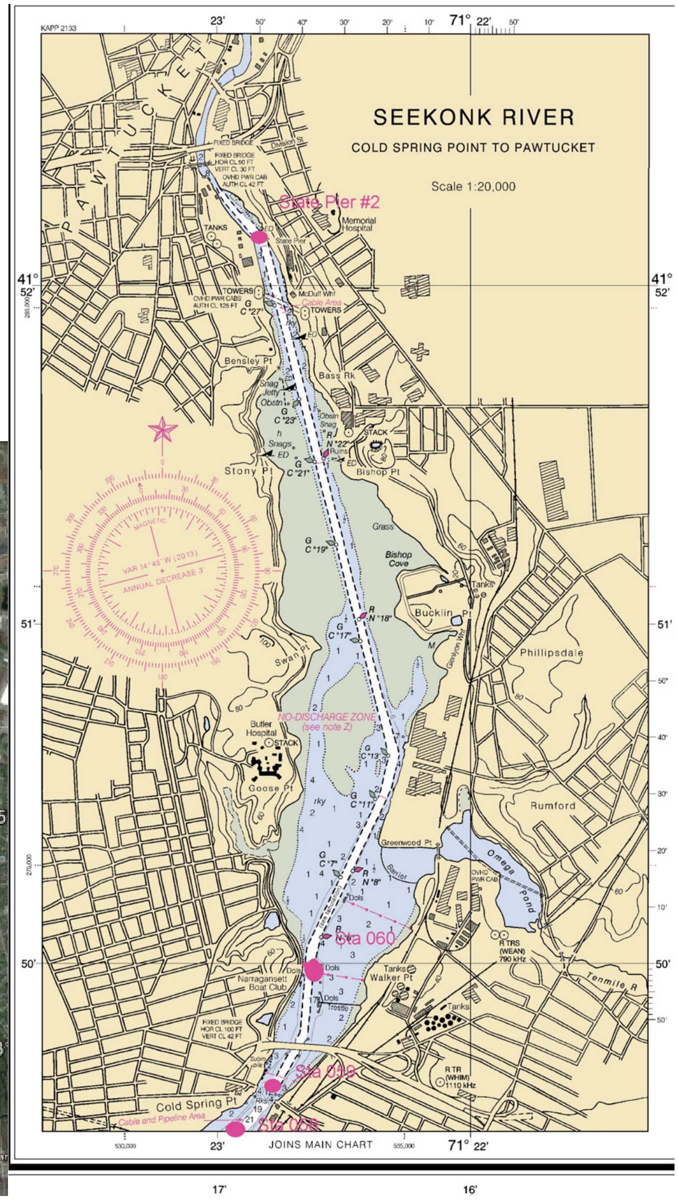
Station	**Depth (m)**	**Temp C**	**Sal psu**	**D.O.mg/L**	**Fish Ct**	**condition**	
58	0.2	24.98	24.9	6.98	12	dead	most dead sev days
	2.35	23.59	26.96	5.04			
59	0.2	24.5	24.4	7.22	35	dead	
	7	22.5	28.79	2.15			
60	0.2	24.8	24.5	7	1	swims erratic	
	5.5	22.59	28.57	1.92	15	dead	most dead sev days
state pier#2	0.2	25.86	5.36	9.75	121	dead	largest cts between 061-063
64	2.5	24.3	21.47	3.8	88	dead	
	2.9	23.95	22.98	2.5			
	3.5	23.19	25.64	0.6			
	4.9	22.88	26.26	0.5	272	total	

some more recent dead vs others

estimate more recent kill (last 2 days) ~ 200-250
but may be up to 300-350 due unseen dead onshore

size of kill : moderate (in the hundreds vs thousands)


State Pier #2
Bishop Cove
N41.85°
Rumford
W71.35
W71.37°
W71.39°
Omega Pond
York Pond
060
N41.83
Blackstone Pond
059
058


SEEKONK RIVER
COLD SPRING POINT TO PAWTUCKET
Scale 1:20,000
State Pier #2
Memorial Hospital
Bensley Pt
Bass Rk
Stony Pt
Bishop Pt
Bishop Cove
Bucklin Pt
Phillipsdale
Swan Pt
Butler Hospital
NO-DISCHARGE ZONE (see note Z)
Goose Pt
Rumford
Greenwood Pt
Omega Pond
Sta 060
Narragansett Boat Club
Walker Pt
Tenmile R
Sta 059
Cold Spring Pt
Sta 058
JOINS MAIN CHART
23'
71° 22'
41° 52'
51'
50'
17'
16'

Rhode Island
Department of Environmental Management

DIVISION OF FISH AND WILDLIFE
Marine Fisheries
3 Ft. Wetherill Road
Jamestown, RI 02835

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April 15, 2014

This memo provides comments on the §316(a) Demonstration Report for Dominion's Manchester Street Station (MSS), Providence, Rhode Island. It also includes comments and concerns related to the impacts of impingement & entrainment on the balanced indigenous population by this facility.

The below section responds to § 316(a) review issues related to thermal impacts including those to anadromous-catadromous species and thermal blockage potential. The section that follows discusses the serious concerns and reservations the Division of Fish and Wildlife (RIDFW) has related to § 316(b) impingement/entrainment impacts which we consider the greater threat to indigenous balanced fish populations from this facility.

Comments regarding §316(a): thermal impacts and potential anadromous fish passage blockage on the Providence and Woonasquatucket Rivers

Although maximum absolute temperatures of the effluent cooling waters are high (~29-31°C) and potentially approach lethal levels for more sensitive species, the limited area of impact suggests that few species would be forced to remain in these higher temperatures, and the temporal occurrence of these events is limited to hot summer months. There may be limited sublethal effects like avoidance behavior for some sensitive species due to warmer temperatures within the mixing area of the discharge behind the hurricane barrier in the Providence River, but this area is limited, and does not include critical habitat.

We agree in regards to assessment of coldwater shock mortality impacts that there is no evidence of present impacts based on the intermittent nature of the plant operation (merchant plant). However, we caution that if the plant were to become a baseload plant (continuous operation) in the future due to regional changes in electricity sources, this issue may become a problem, at least for species such as striped bass (Morone saxatilis) which are known to have overwintering populations at other facilities in the past (e.g., Brayton Point). Under those conditions, the plant may need to consider what options are available to limit access to the area near the discharge by overwintering larger fish such as striped bass in very cold periods.

In regards to potential blockage of anadromous fish passing the facility and attempting to return to native spawning habitat upstream, volunteers have counted approximately 9,200 river herring passing the Rising Sun fishway on the Woonasquatucket River in 2012. In the past, river herring have also been observed below the first dam on the Blackstone River at the head of the Seekonk (tidal) River, so these areas of the upper estuary are passageways for anadromous fish, including river herring (alewife and blueback herring) and have potential as anadromous passageway for shad. Fish traverse the Providence River to the Woonasquatucket River and there is evidence they also attempt to return to the Blackstone River via the Seekonk, but the dam structures at the end of the Blackstone River presently block their passage.

Despite large fluctuations in the number of adult fish counted at fish ladders annually (discussed in more detail below), fish make it past the facility and thus, there is no clear evidence of complete thermal blockage of fish trying to ascend the Woonasquatucket River. That said, thermal factors can pose significant impacts at levels less than complete blockage (run failure), such as by affecting fish behavior and the timing of staging and ascending, both of which are difficult to detect and quantify without intense monitoring. During 2010 and 2011 MSS conducted work to assess whether anadromous species were being (completely or partially) blocked by the thermal plume. However, as noted in the letter from RIDEM to Dominion dated April 5, 2011(Re: § 316(a) Thermal Variance Demonstration Process for Manchester Street Stations, RIPDES Permit # RI0000434), DEM cautioned that the sampling interval proposed for hydroacoustic surveys once every two weeks may not provide adequate data to quantitatively address the hypothesis that the plant does/does not block various anadromous fish species, and such surveys need to be conducted more frequently to fully address the issue. Similarly, we conveyed that lack of evidence does not eliminate possible impacts due to thermal factors; it simply suggests that no detectable impacts have been observed.

To date we have no data or information suggesting that fish are potentially being blocked, but some fish are being intercepted by the facility through impingement. We note that results from the 2010 and 2011 hydroacoustic surveys reflected the thermal discharge and associated level of plant operation (i.e. number of power generating days) during the survey. Thus, if power generation were to occur more consistently during this time (spring migration) potential impacts may need to be reevaluated.

There is an active, ongoing Blackstone River Fish Passage Project with a completed Environmental Assessment Report to restore fish passage in the last three dams. The US NRCS, US ACE, US F&W, RIDEM, the Blackstone River Watershed Council, and other groups are actively participating in this effort. Although RIDEM F&W is aware of a remnant run of river herring below the first obstruction (Main Street, Pawtucket RI), we do not presently have any quantitative information for the number of fish attempting to return to the Blackstone River. We have no data on the size of this remnant population, and have no data or evidence indicating any part of this population may be diverted from the Woonasquatucket / Providence River population.

At this time, RIDFW is not aware of any American shad (*Alosa sapidissima*) spawning in the Woonasquatucket River. However, the Woonasquatucket River is a candidate for future shad restoration (fry or adult transplants) and the newly built fishways are designed to pass American shad. RIDFW anadromous fish staff do not have any data on the seasonal migrations of shad in marine waters of this area. A small number of American shad (4 at Sabin Pt in April; 10 at Bullocks Reach in Oct 1996) were captured in the lower Providence River during a 1996

RIDFW gill net study of the Providence / Seekonk River (R.Satchwill, RIDFW, unpublished data), and small numbers of shad have been found impinged by MSS (Normandeau, 2012 & 2013). These data indicate that some shad are using the area. Because we have not observed shad reaching the Rising Sun fishway (i.e. no fish counted at fishway), we cannot determine if there is any thermal blockage for shad. Various factors are likely limiting shad runs at this time; however, the fishways on the Woonasquatucket River are designed to also accommodate shad and we must ensure habitat protection for potential future restored runs of shad. The 316(a) report should acknowledge that this species is also planned for restoration in the Woonasquatucket River (p V-26-V27), and future monitoring considerations should include this species.

Comments regarding §316(b): Entrainment / Impingement Impacts on the Balanced Indigenous Population at MSS.

Anadromous fish species

The sizes of the alewife and shad populations are unknown. We consider the mortality threat due to entrainment / impingement to be a greater negative impact from the MSS than thermal blockage issues. As noted in the hydrodynamic study, a significant part of the volume of water passing through the hurricane barrier is diverted through the facility. The Brayton Point (BP) pre-2011 flow is four times larger than the MSS flow on both a monthly and annual mean basis (Table 1). As shown in Fig 1. the total annual flows from Brayton overwhelm MSS; however, impingement rates at MSS are very high and total fish impinged numbers are comparable or higher than Brayton (see Total fish impinged for both facilities, Fig 2. and Tables 2 and 3). Thus, a significant part of the anadromous fish populations may be forced through this gauntlet. That said, RIDFW anadromous/freshwater staff has not observed any damaged or injured anadromous fish or American eels (catadromous species) as of this date at the fishways or in the Woonasquatucket River. However, we do not survey the areas between the Manchester Street facility outflow and the dam, so we have no information on any damaged fish that may not be capable of reaching the dam due to impingement damage.

Impingement mortality has the possibility of affecting migrating anadromous fish runs if components of the run are intercepted. We do not presently know the size of the run (total # of fish) that passes through the hurricane barrier (or MSS canal) to ascend the Woonasquatucket River. We only have estimates of alewife/blueback (river) herring individuals that actually reach the Rising Sun fishway. As noted above, if individuals (adults returning to spawn) are intercepted, there is a potential to affect population size. Therefore, the number captured on screens should be considered one mortality factor measurement negatively impacting the local anadromous population. The recorded small numbers of impinged shad, rainbow smelt and larger numbers of alewife as well as blueback herring indicate anadromous species attempt to pass the facility and are intercepted, but we have no observed shad numbers for the Rising Sun fishway on the Woonasquatucket. The Woonasquatucket presently does not have significant shad habitat available upstream, but we continue to target alewife / river herring for restoration purposes in that river system. We need more field data to gain an estimate of population sizes for these anadromous species passing the hurricane barrier in order to determine if the impingement

/ entrainment numbers are significant enough to impact returning anadromous species populations.

Appendix E of the Providence and Seekonk Rivers Finfish Study 2010-2011 (pg. 557-578, graphics through 636), describes the finfish sampling, the fishway sampling, and eel pot sampling data performed by Dominion's consultant in 2010 and 2011. These techniques seem adequate, with river herring counts taken at the fishway twice a week for determining the presence/absence (qualitative approach) of herring reaching the fishway during a given year. For juvenile river herring, trapnets at fishways can be an effective way to sample out-migrating juveniles as long as the trap net is not left unattended (in order to prevent fish kills). However, this has to be considered a qualitative method (P/A) if juveniles are passing over the spillway and not all passing through the fishway. For eel population sampling, eel pots as used by the consultant can be an effective method for sampling adult eels in fresh and marine waters and is fine for estimating eel densities. However, if the goal is to sample silver eels migrating out to sea, a better approach may be to set up fyke nets on nights in which it rains in late September and October. There are theories that out-migrating silver eels may not feed and could be difficult to catch in baited eel traps. Because these methods do not provide adequate data for population calculations, we still have no way to estimate the potential percent of the total migrating fish impinged by MSS in the Providence River passageway.

The Woonasquatucket River has just recently been restored with the completion of two dam removals (Paragon and Dyerville) and the construction of two new Denil fishways (Rising Sun and Atlantic Mills). In addition to the increase in available nursery and spawning habitat the RIDFW also recently began supplemental stocking of river herring broodstock. The volunteer direct counts of 7,200 and 9,200 in 2011 and 2012 are a great start for a river system just recently restored, and run size is anticipated to increase in the future. The 2010 run size reaching the fishway was estimated at 25,600. It should be noted that only the first fishway was opened and Paragon dam was still in place approximately 200 yards upstream. It is very possibly the herring were passing the first fishway, arriving at the second dam and "dropping back" over the first dam in an effort to continue moving upstream, therefore being counted numerous times at the first fishway, leading to a potential overcount that year. In 2011 and 2012 the first four obstructions were passable and herring were observed passing the second fishway.

Due to inadequate data on population sizes of the various anadromous species, RIDFW cannot determine what quantitative impacts the current level of impingement and entrainment will have on present or future in and out-migrating anadromous fish and American eel populations. The RIDFW anticipates the Woonasquatucket river herring runs will increase in future years due to habitat restoration and fish stocking activities, which is likely to increase the annual number of anadromous fish being impacted by impingement or entrainment at the facility.

After reviewing the fish kill summary of the incident on August 8, 2011 it appears resident fish exited through the fishway and became trapped in the trapnet. Mortality was probably caused by the force of the water. No anadromous fish were involved. This fish kill was likely caused by the duration of the trapnet set and not plant operations. As was outlined in the RIDFW scientific collector's permit, it is extremely important not to leave trapnets unattended or for long durations. Trapnets are a very effective way to sample out migrating juveniles, but great care and attention is needed to prevent fish kills.

Atlantic herring are shown to be in significant numbers in the estimated impingement record for a number of years. This herring species is not anadromous. There were significant numbers of Atlantic Herring in the Bay in 2011, but in most years, we would expect this species to be in low numbers and exist in the Bay mainly as juveniles since large numbers of adults would not normally be expected to occur that far up the Bay on a regular basis. It is extremely important that the consultant always verify the species ID for this species to make sure it is not being confounded with river herring sp. (alewives and bluebacks), which are anadromous.

Comments and concerns related to impingement and entrainment impacts to all non-anadromous fish species, especially representative important species from MSS facility

As noted in comments above, the MSS facility uses a much lower volume of once-through cooling water compared to the BP facility in Mount Hope Bay, prior to the latter facility switching to a closed loop cooling system in 2011. **On an annual flow basis, the BP facility is approximately 4 times greater than the total annual flow of the MSS facility based on 1975-2010 flows (Table 1)**. Although these facilities have significant differences in relation to total cooling water volume taken in, **the total fish impinged per year during several years at MSS actually exceeds the much larger Brayton facility (Fig. 2 and Table 2 and 3)**. Although a portion of the impingement counts can be attributed to the occurrence of menhaden, which show high-variability in counts due to their schooling behavior, **even after removing menhaden from (only) the MSS total count (Fig 3 and Table 3)**, **the MSS facility still "outfishes" the Brayton facility impingement count** (which includes menhaden impinged at the Brayton facility).

To further exemplify this difference, after standardizing impingement for flow (fish impinged per yr / total volume flow that yr), the **MSS facility exceeds the impingement rate of the larger Brayton facility by a mean of 4X, and in some years, by an order of magnitude, despite the radical difference in total flows (Fig. 4, Table 3).**

If we look at non-schooling important fish species, winter flounder (Pseudopleuronectes americanus) and tautog (Tautoga onitis), we still see discrepancies with the MSS facility still outfishing the Brayton facility, especially for winter flounder (Figs 6 through 9). More specifically, after correcting for differences in cooling water intake, the MSS facility is impinging approximately 2-times the number of winter flounder annually compared to the Brayton facility. This can only happen if 1) there are many more individual fish present in the Providence River relative to Mt. Hope Bay, and/or 2) the MSS facility is capturing a much larger percent of the total water habitat volume available to these fish in the area of the Providence River at a flow rate faster than they are able to escape. We suspect the reality is probably a mix of both possibilities, although the fish trawls done in the 2010-2011 study by Dominion . Part of the issue may be that the large volume intake is at the hurricane barrier, which may attract some fish species that prefer structure, and the facility then holds the water in the intake canal, where fish cannot escape back into the open environment. However, we are unable to estimate the impact of this impingement level on the local subpopulations of these recreationally and commercially important fish populations as explained below.

The 2012 & 2013 MSS Impingement & Entrainment Reports use impingement and entrainment (I/E) numbers to calculate adult equivalents of winter flounder and tautog, then compares these adult equivalents to the total RI state landings (commercial + recreational) for tautog from all RI waters, and for winter flounder, comparison of loss to the RI commercial and recreational landings out to 3 miles, as well as the entire southern NE/Mid-Atlantic winter flounder stock estimates to examine the potential impact these losses have on the populations. Neither of these population estimates is acceptable, because these landings values reflect total subpopulations of these species across wide geographic areas. It has been clearly substantiated that both these species show high site fidelity, often coming back to the exact same area of the Bay to reproduce yearly (Cooper, 1966; Howe et al. 1976; Phelan, 1992; Pierce and Howe, 1977; Saila, 1961). This leads to geographically distinct reproducing subpopulations. For winter flounder, at least 14 genetic subpopulations exist in Narragansett Bay (Buckley et al., 2008). The number of genetic subpopulations for tautog is not known, but this species is known to return repeatedly to the same area of the Bay to reproduce (Cooper, 1966) , indicating a strong likelihood of this species having a reproductive local subpopulation in the Providence River / Upper Bay.

The comparison of adult equivalents from impingement and entrainment numbers for these two species should be compared to local (Providence River/Upper Bay) subpopulation numbers rather than the entire regional population. Because these subpopulation numbers are unknown , we cannot determine the true impact of the I/E numbers on these two recreationally and commercially important marine species. The high numbers of I/E tautog and winter flounder individuals recorded at the MSS facility compared with the much larger Brayton facility suggests that these impacts have the potential to negatively impact these locally distinct genetic subpopulations in the Providence River / Upper Narragansett Bay. The Brayton Point I/E numbers were determined to have significant impacts on local winter flounder subpopulations in Mount Hope Bay, with potential high likelihood of impacts to the local tautog subpopulations as well.

Because we presently do not have estimates available for these reproducing subpopulations in the upper Bay, and therefore cannot determine the percent of these subpopulations intercepted by the facility, we strongly recommend that the facility be required in their permit conditions to develop estimates of these local reproducing genetically distinct subpopulation in collaboration with local fishery experts (e.g., Dr. Jeremy Collie or others) using catch-release tagging, including the potential use of telemetry tags, acoustic tags and receivers, and other suitable population techniques along with any genetic marker studies these experts feel may be needed to identify the Providence River / Upper Bay area subpopulations . For winter flounder, samples of winter flounder tissues from impinged individuals can be compared with the genetic results for the subpopulations from Buckley et al (2008) (samples were frozen if needed), and their genotype compared with the 14 subpopulations to indicate which subpopulations are being intercepted by the plant. Tagging studies concentrated in those areas of the Bay can then assist in estimating the actual size of the subpopulations in question.

In the meantime, all efforts should be made to require maximum minimization of the volume of flow entrained through the plant, with consideration of potential maximum flow limits during periods of high larval and juvenile entrainment and impingement for these two species (See App. A, Figs. 1 & 2). This plant is likely using a significant portion of the total volume of the Providence River in its cooling flow intake at the hurricane barrier area, and because this area is fairly constricted in the northernmost reaches of Narragansett Bay, it is likely acting like a siphon that intercepts a large portion of the water column, impacting inhabitants that cannot swim against the intake flow rates at the restricted intake gates in the hurricane barrier. This would suggest the percent of the local population impinged and entrained is quite high for these subpopulations.

RIDFW notes that there seems to be a clear pattern of MSS impinging more of the key species than BPS since 1996. If the same survival rates apply in adult equivalent analysis, MSS may be a larger drain on the local Narragansett Bay stocks than BPS during the time of its once-through cooling intake. Because the Manchester Street facility entrainment numbers are comparable for the flow differential, and the impingement numbers are actually *higher* than the Brayton facility numbers for a lower flow, we believe this provides strong evidence that a significant part of the local reproductive subpopulations of these two important species are being intercepted by the Manchester Street facility. Entrainment numbers also suggest a potential impact of this facility on larval winter flounder (Figs. 10). After return to full power operation in 1996, MSS winter flounder entrainment were about 50% of BPS. However, since 2006 they have been much closer. In fact, the equivalent adults lost at MSS have grown over time in comparison to local landings despite the fact this is a larger population than the subpopulation actually impacted (Fig. 11). Overall, MSS outfishes BP through entrainment at a ratio of 18:1 for winter flounder per billion gallons a year and 7:1 for tautog impinged per billion gallons per year (Fig. 12)

Summary Key Findings and Conclusions

§316(a) (thermal impacts)

The Division believes that lethal thermal impacts from heat stress are unlikely for the area of the Providence River where the thermal discharge occurs, although sublethal avoidance may occur. There is no evidence of cold shock mortality, and this will be unlikely when the plant is running as a merchant plant, turning off and on based on peak demand only. However, this issue may become a potential if the plant were to go to a continuous base load always-on plant with constant thermal output, especially in cold winters. Under those conditions, the plant may need to consider what options are available to limit access to the area near the discharge by larger fish such as striped bass in very cold periods.

In regards to potential for anadromous fish run blockage, the Division has no specific data indicating blockage is occurring, and some aspect of the migrating herring population is passing the facility and moving upstream to the fishway in the Woonasquatucket. However, we do not know the size of this or other anadromous populations attempting to pass the facility as they migrate upstream. Additionally, the fact that occasional shad are impinged at the intake suggests that other anadromous species not yet found at the fishway may be diverted through impingement or other processes in the area. We recommend that, as part of the permit language, DEM require Dominion to continue sampling of these populations during migration periods at an adequate frequency to maintain the time series that can be used to estimate population size and fully understand potential thermal impacts on anadromous species. Especially considering that these populations should increase from current and future fish passage restoration projects.

§316(b) (entrainment and impingement)
RIDFW has greatest concern over the impacts this facility is having on local fish populations through impingement and entrainment. Brayton Point (BP) in Mount Hope Bay is a much larger plant with pre-2011 (initiation of closed loop) flow four times larger than the MSS flow on both a monthly and annual mean basis. Despite this much larger flow by BP, the mean total fish impinged per year 1975-2010 by MSS is four times (4X) the much larger Brayton facility based on impingement data collected by MSS and BP. Even important non-schooling species (winter flounder) are captured approximately twice as often as the larger Brayton facility when it was at full once-through flow.

We do not accept the comparison of adult equivalent losses from entrainment and impingement against the total state and regional southern NE landings because there is clear evidence of local populations of this species (and others like tautog) returning to specific areas of the Bay each year to reproduce, constituting a local population that is receiving the impact. We strongly recommend requiring Dominion, as part of this permit, to work with local fishery scientists to come up with a valid local subpopulation estimate for winter flounder and tautog in order to understand what percent of this local population is being impacted. We can then revisit this issue in several years once adequate quantitative data is available. Meanwhile , we recommend limiting the total volume and/or intake flow rate using all reasonable technologies available, including variable speed pumps and perhaps consider behavioral cues to allow fish to recognize they are entering the inescapable canal intake as they pass through the hurricane barrier, perhaps with painted extensions of the intakes that allow motion detection by fish. It should be noted that the variable speed pumps will not be helpful if this plant becomes a continuous baseload plant and thus, alternative means to decrease these very high rates of entrainment and impingement may need to be evaluated.

Based on the hydrodynamic study by Dominion, we believe the intake volume is actually taking in a majority of the volume of water that exists just south of the hurricane barrier, making the plant a gauntlet for all macrolife that does not recognize it is being inexorably pulled into the intake canal.

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Year	MSS Tot Fish Impinge	ratio MSS: BP	MSS wfl	ratio MSS: BP	MSS ttog	ratio MSS: BP	BP tot fish	BPS wfl	BPS ttog
1975	60421	3.1	2381	0.5	34	0.1	19580	4483	341
1976	21450	0.7	1148	0.2	56	0.1	30635	4960	385
1977	66666	0.6	1503	0.1	56	0.0	120367	15544	2535
1978	35193	0.4	3017	0.1	145	0.1	79485	21987	2351
1979	55467	1.6	15101	3.8	6394	20.1	35768	3967	318
1980	No data	Missing data	No data	Missing data	No data	Missing data	28799	8203	643
1981	32457	2.1	3273	0.7	720	1.0	15728	5028	733
1982	122845	3.2	11207	5.9	1895	0.7	38936	1906	2894
1983	23137	1.3	4212	2.0	56	0.3	18185	2090	221
1984	6811	0.2	1572	0.3	95	0.2	27565	4585	584
1985	78911	2.5	25340	3.3	84	0.2	32189	7643	462
1986	43985	1.1	748	0.1	0	0.0	39616	6374	676
1987	28306	0.8	7106	1.0	316	0.2	34456	7043	1782
1988	42831	2.0	5516	2.1	1343	1.1	21868	2601	1226
1989	35635	1.1	2365	0.5	495	0.9	31698	4412	566
1990	31719	1.7	10823	7.7	152	2.6	19038	1403	58
1991	48173	1.2	2422	1.1	214	2.1	40208	2220	104
1992	167635	8.5	1660	1.8	20	0.0	19636	921	921
1993	7044	0.1	1935	0.5	92	0.3	82479	4263	367
1994	4566	0.1	912	0.4	258	0.4	63965	2499	691
1995	9661	0.2	4295	1.4	445	3.8	50265	3109	118
1996	139966	10.6	15360	8.9	465	5.9	13244	1720	79
1997	96849	3.5	13398	7.3	2075	2.1	27643	1842	982
1998	88014	17.0	5902	9.8	1295	3.6	5183	605	360
1999	9870753	94.1	9716	4.4	753	1.7	104858	2203	438
2000	165192	16.0	3948	6.7	337	0.9	10335	587	371
2001	928257	203.7	14622	16.2	1449	6.7	4556	904	216
2002	11904170	137.8	8850	8.7	1993	1.4	86393	1014	1465
2003	115619	1.2	11283	3.3	895	3.5	98009	3423	256
2004	123382	0.9	15997	3.0	891	1.6	132791	5318	555
2005	409247	17.0	29942	11.4	806	1.4	24028	2623	579
2006	97782	3.5	2088	0.5	663	2.3	28198	3931	283
2007	1074975	37.3	18992	12.3	703	1.3	28832	1543	529
2008	60070	1.6	8074	4.8	1897	3.2	38109	1689	589
2009	38613	2.8	3370	2.1	601	2.5	13996	1587	241
2010	25271	2.2	4731	2.5	357	0.8	11643	1885	428
2011	32455	na	2964	2.6	401	na		1151	
2012	819956	na	2405	6.6	349	na		364	
Median	60070	2.0	4295.0	1.7	445	0.9	29733.5	2550	495.5

Table 1. Mean Monthly Flows in Million Gallons per Day (MGD) from 1975-2010 at Brayton Point (BP) and Manchester St. Power (MSS) calculated based on tables from their I&E Reports for 2012 and ratio of flow BP:MSS (i.e.,size of BP flow compared with MSS).

Year	MSS Mo.Mean MGD	BP Mo.Mean MGD	Ratio Mo Flow Mean BP:MSS	MSS Tot Annual Flows In Bill. Galls.	BP Total Annual Flows InBill.Galls.	Ratio Annual Flow Mean BP: MSS
1975	226.07	No data	Missing data	82.52	248.22	3.0
1976	226.07	No data	Missing data	82.52	278.32	3.4
1977	226.07	739.00	3.3	82.52	269.74	3.3
1978	226.07	790.00	3.5	82.52	288.35	3.5
1979	226.07	636.00	2.8	82.52	232.14	2.8
1980	No data	705.00	Missing data	No data	257.33	Missing data
1981	226.07	640.00	2.8	82.52	233.60	2.8
1982	213.98	786.00	3.7	78.10	286.89	3.7
1983	232.05	688.00	3.0	84.70	251.12	3.0
1984	240.83	796.00	3.3	87.90	290.54	3.3
1985	257.11	904.00	3.5	93.84	329.96	3.5
1986	186.39	996.00	5.3	68.03	363.54	5.3
1987	249.76	1059.00	4.2	91.16	386.54	4.2
1988	311.05	1052.00	3.4	113.53	383.98	3.4
1989	162.23	1102.00	6.8	59.22	402.23	6.8
1990	253.32	1111.00	4.4	92.46	405.52	4.4
1991	166.67	1108.00	6.6	60.83	404.42	6.6
1992	110.89	1082.00	9.8	40.48	394.93	9.8
1993	109.68	1073.00	9.8	40.03	391.65	9.8
1994	122.80	1013.00	8.2	44.82	369.75	8.2
1995	225.45	1059.00	4.7	82.29	386.54	4.7
1996	275.57	1007.00	3.7	100.58	367.56	3.7
1997	276.02	929.00	3.4	100.75	339.09	3.4
1998	274.00	828.00	3.0	100.01	302.22	3.0
1999	261.79	897.00	3.4	95.55	327.41	3.4
2000	247.68	854.00	3.4	90.40	311.71	3.4
2001	233.84	890.00	3.8	85.35	324.85	3.8
2002	227.50	854.00	3.8	83.04	311.71	3.8
2003	231.19	828.00	3.6	84.38	302.22	3.6
2004	246.35	806.00	3.3	89.92	294.19	3.3
2005	241.99	870.00	3.6	88.33	317.55	3.6
2006	249.51	821.00	3.3	91.07	299.67	3.3
2007	256.17	877.00	3.4	93.50	320.11	3.4
2008	244.17	819.00	3.4	89.12	298.94	3.4
2009	240.34	762.00	3.2	87.72	278.13	3.2

Table. 2. Annual Fish Impinged and MSS:BP Ratio (impingement rate MSS compared to BP despite larger BP flow) for Total fish impinged; Winter Flounder (wfl) impinged; and Tautog(ttog) impinged ratios. Median is used because of extremely large variations in counts due to schooling fish species.

Ratio of Impingement MSS:BP			
Year	MSS fish/BG *NO*Menhdn	BP fish imp/BG Table 1-4*365 BP fish imp/BG	Ratio MSS: BP
1975	119	79	1.50
1976	106	110	0.96
1977	510	446	1.14
1978	198	276	0.72
1979	666	154	4.32
1980	0	112	no data MSS
1981	378	67	5.61
1982	1572	136	11.58
1983	248	72	3.42
1984	68	95	0.72
1985	640	98	6.56
1986	214	109	1.96
1987	294	89	3.30
1988	357	57	6.26
1989	433	79	5.50
1990	311	47	6.62
1991	153	99	1.54
1992	205	50	4.13
1993	170	211	0.81
1994	101	173	0.59
1995	116	130	0.89
1996	679	36	18.85
1997	906	82	11.12
1998	870	17	50.74
1999	647	320	2.02
2000	389	33	11.73
2001	516	14	36.79
2002	3151	277	11.37
2003	695	324	2.14
2004	739	451	1.64
2005	2435	76	32.18
2006	89	94	0.95
2007	427	90	4.74
2008	212	127	1.66
2009	311	50	6.19
2010	155	41	3.76
2011	306	0	miss data
2012	11	0	miss data
Mean	530.01	131	4.04

Table 3. Total Fish Impinged at MSS and BP per Billion Gallons and Ratio of Impingement rate per Billion Gallons MSS : BP (i.e., impingement rate per unit flow for MSS compared with BP despite larger flow of BP) [Note: Menhaden removed only from MSS total counts, not BP counts]

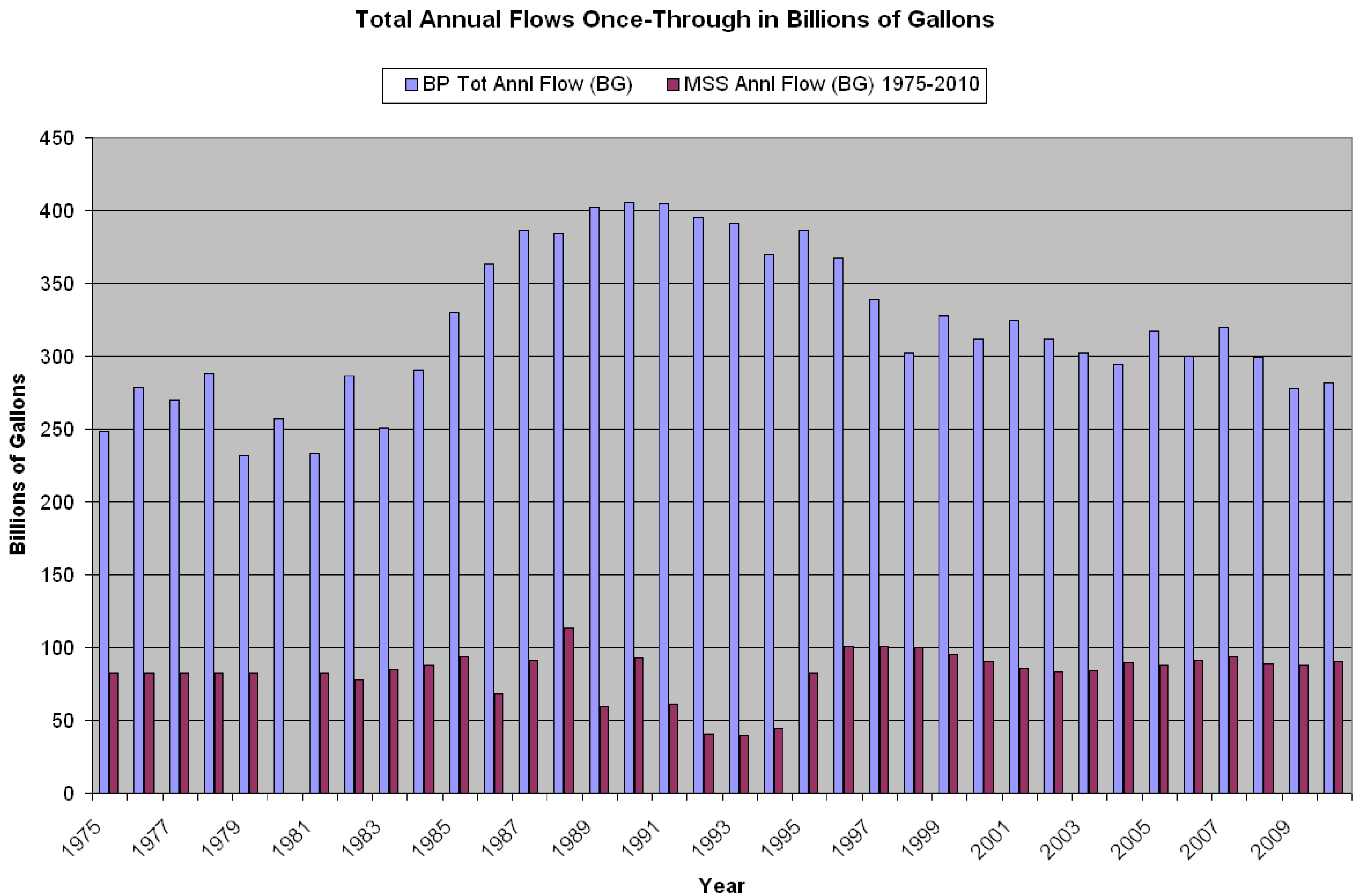


Fig. 1. Total annual flows Brayton Point and Manchester Street Facilities in billions of gallons.

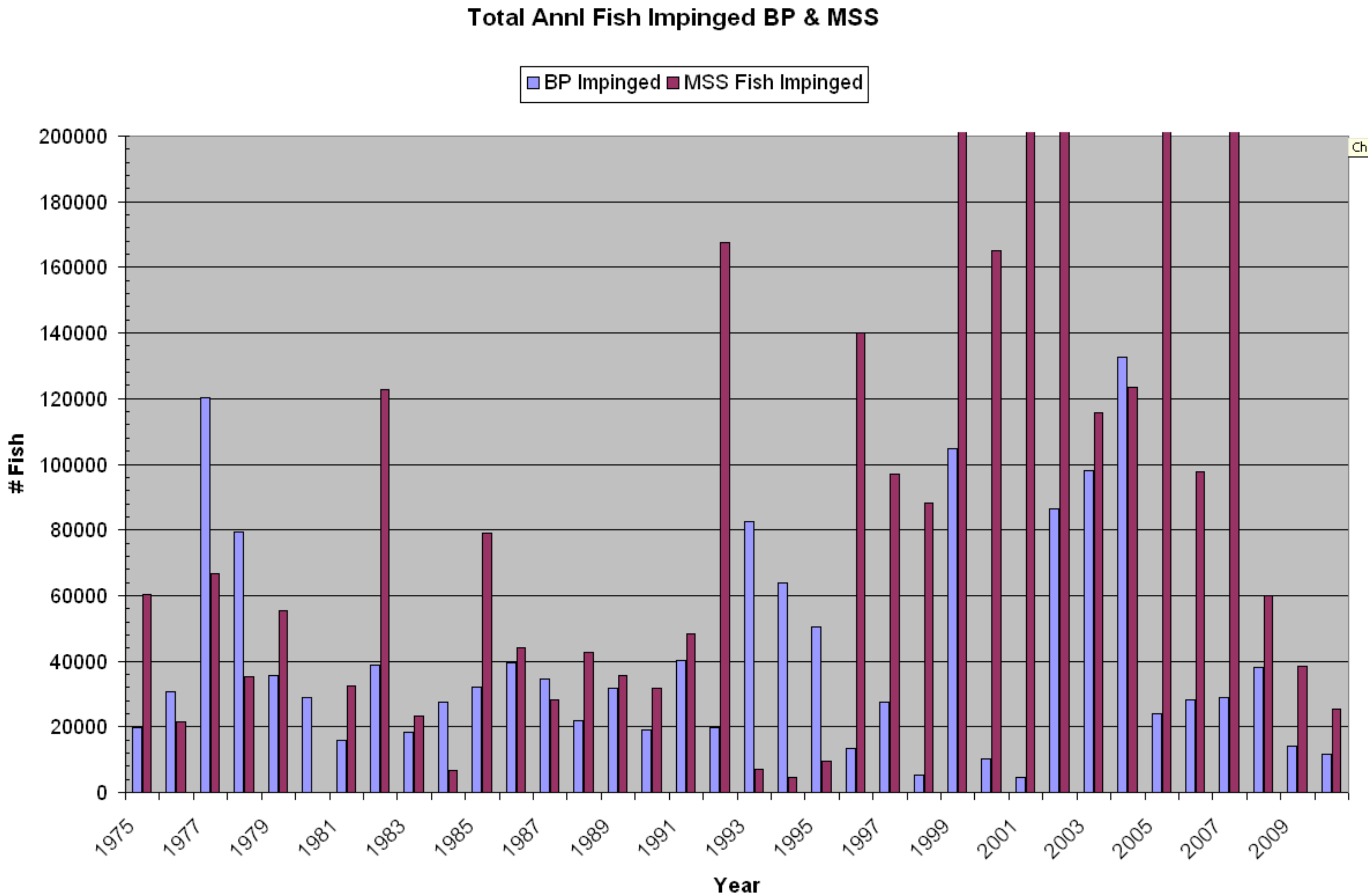


Fig. 2. Total estimated annual fish impinged for MSS and Brayton 1975-2010. From 1999 to 2007, Atlantic Menhaden were the cause of annual counts exceeding 200,000 total fish.

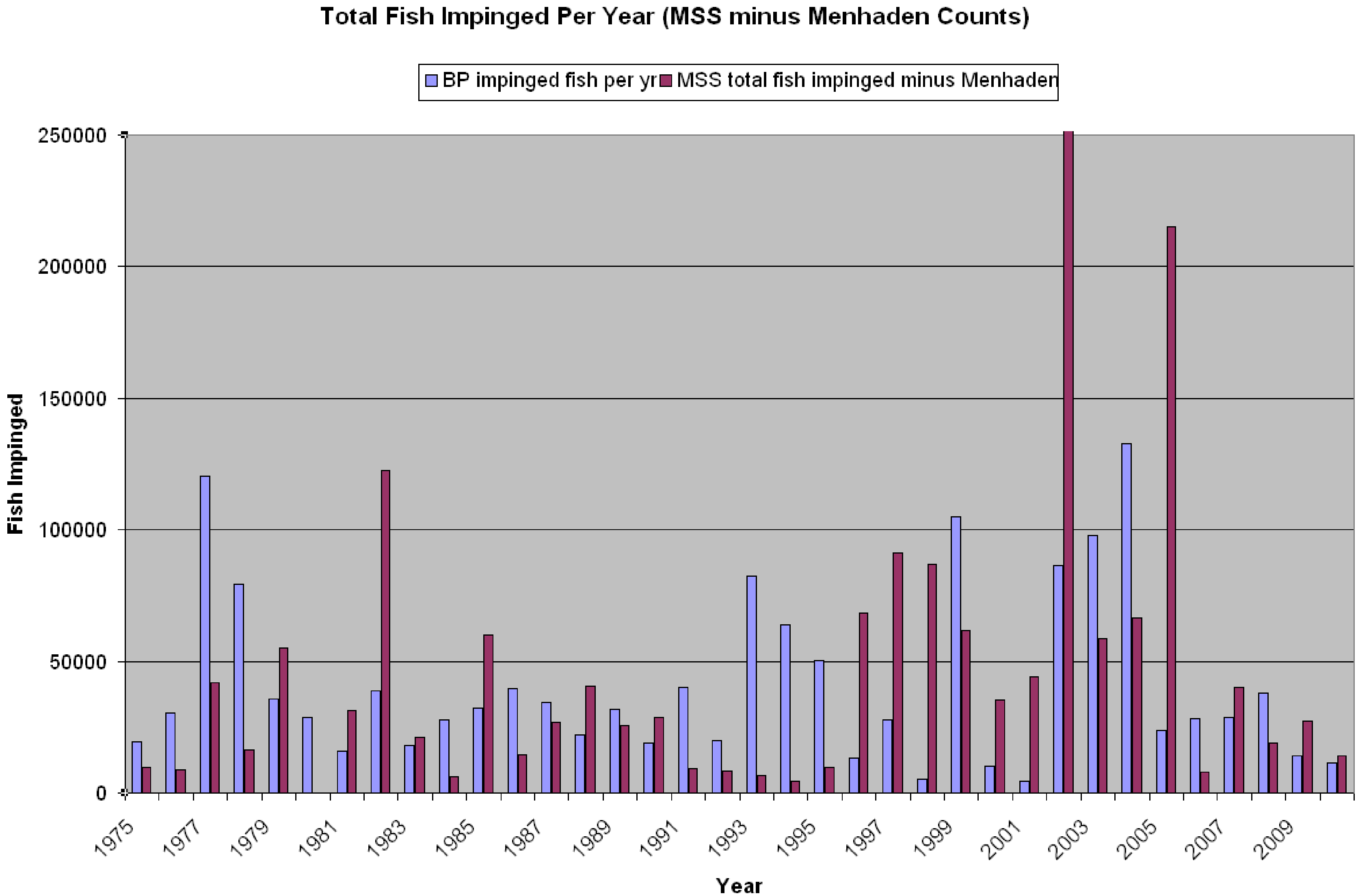


Fig. 3. Total estimated annual fish impinged for MSS and Brayton between 1975 and 2010 after removing Menhaden counts from MSS data tables.

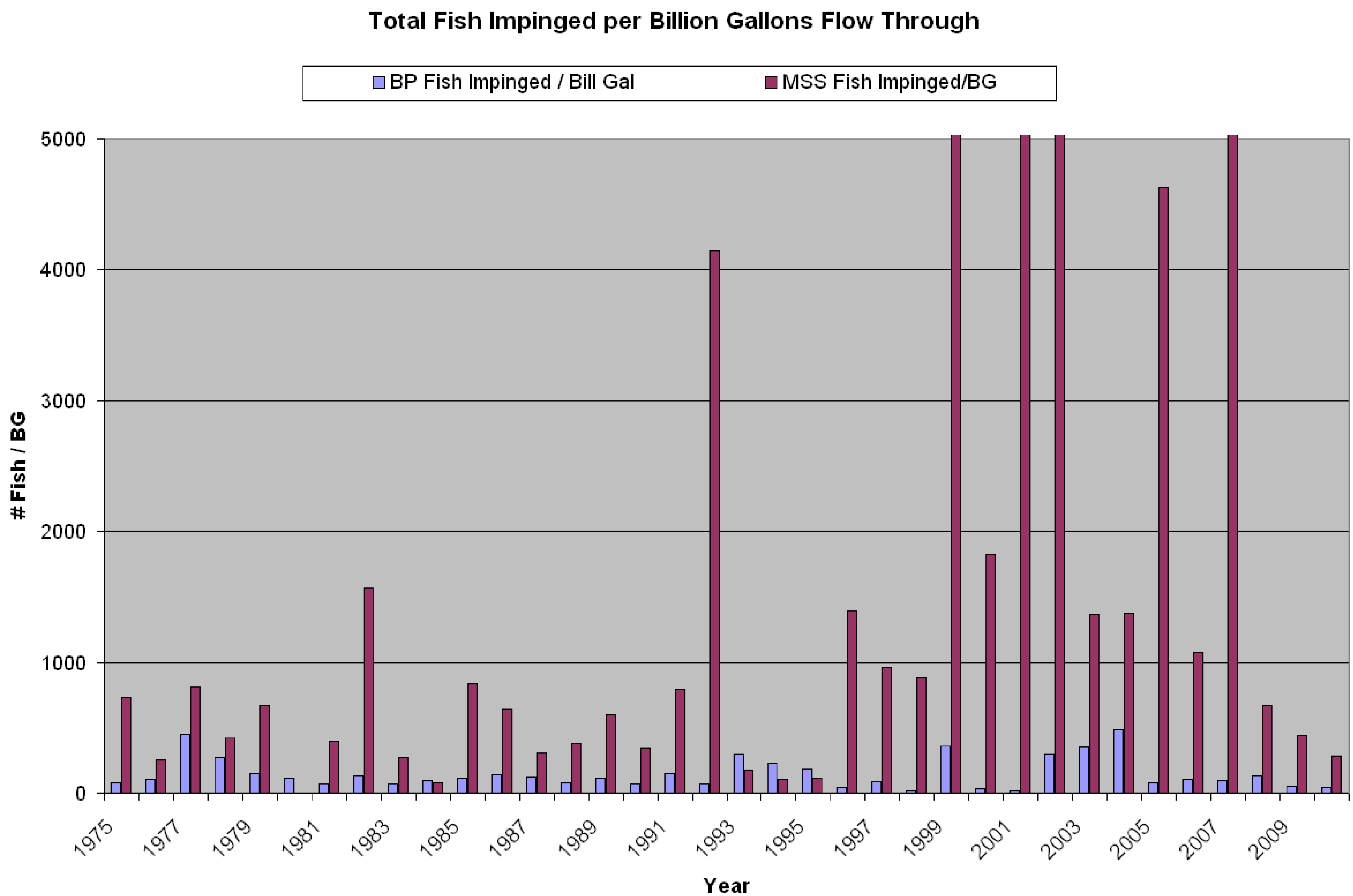


Fig. 4. Total fish impinged per year by Brayton and Manchester Street per Billion Gallons annual flow (includes Menhaden counts for MSS).

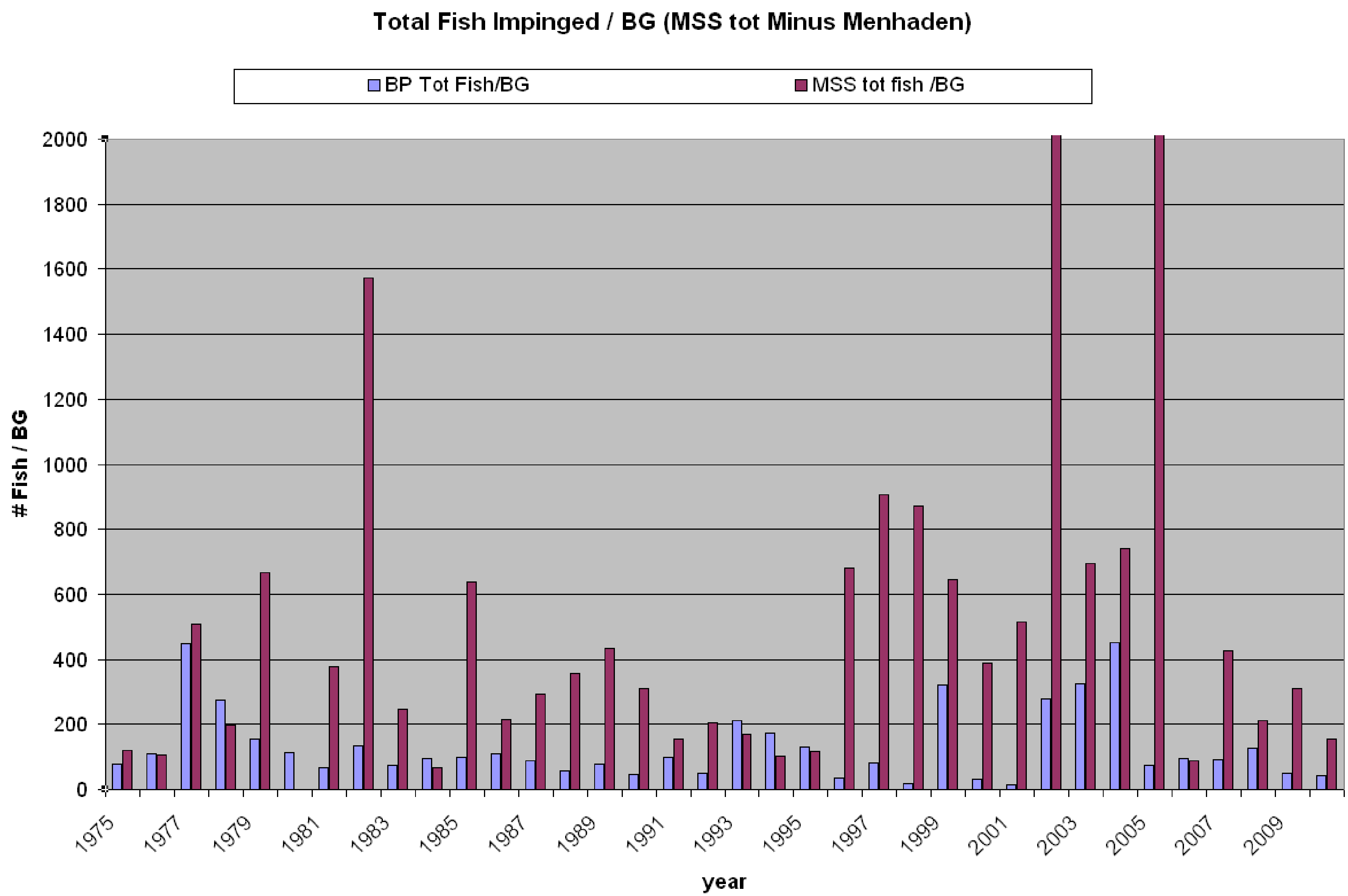


Fig. 5. Total fish impinged per year by Brayton Point (BP) and Manchester Street Power (MSS) per Billion Gallons annual flow with Menhaden counts for MSS removed.

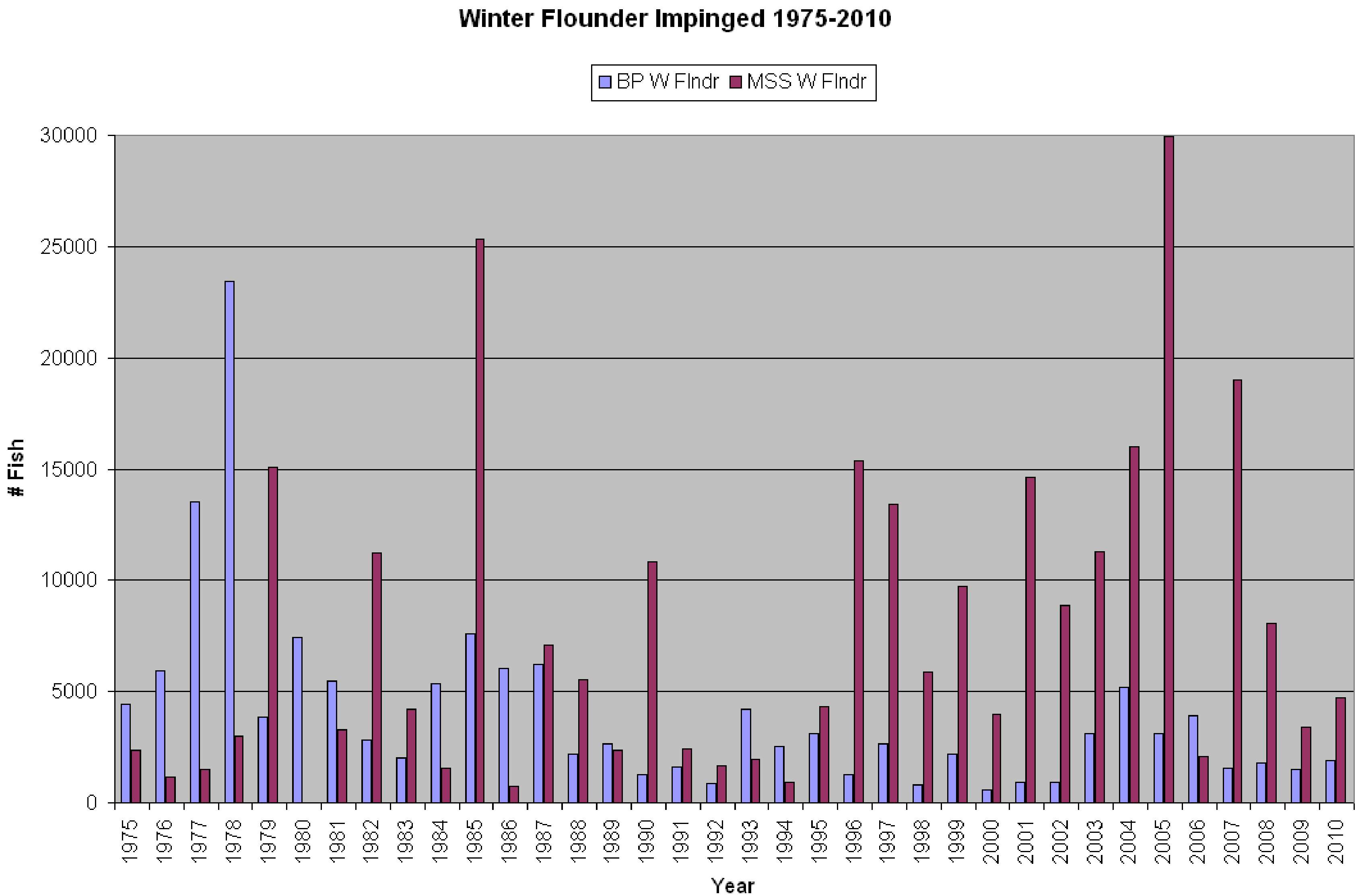


Fig. 6. Total winter flounder impinged per year 1975-2010 for Brayton Point (BP) and Manchester Street Power (MSS) facilities.

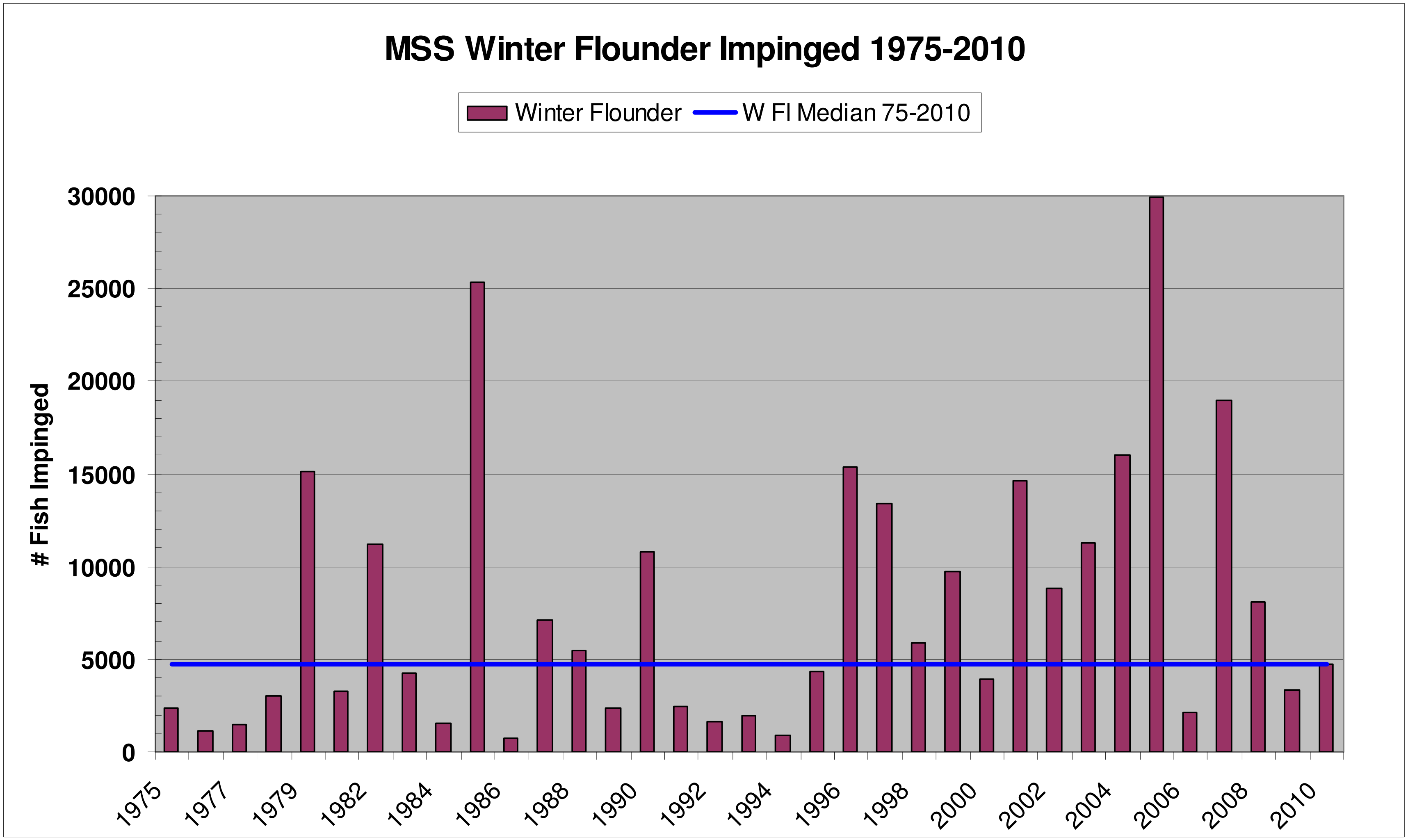


Fig. 7. Manchester Street Power (MSS) winter flounder impinged per year 1975-2010 and Median value 1975-2010

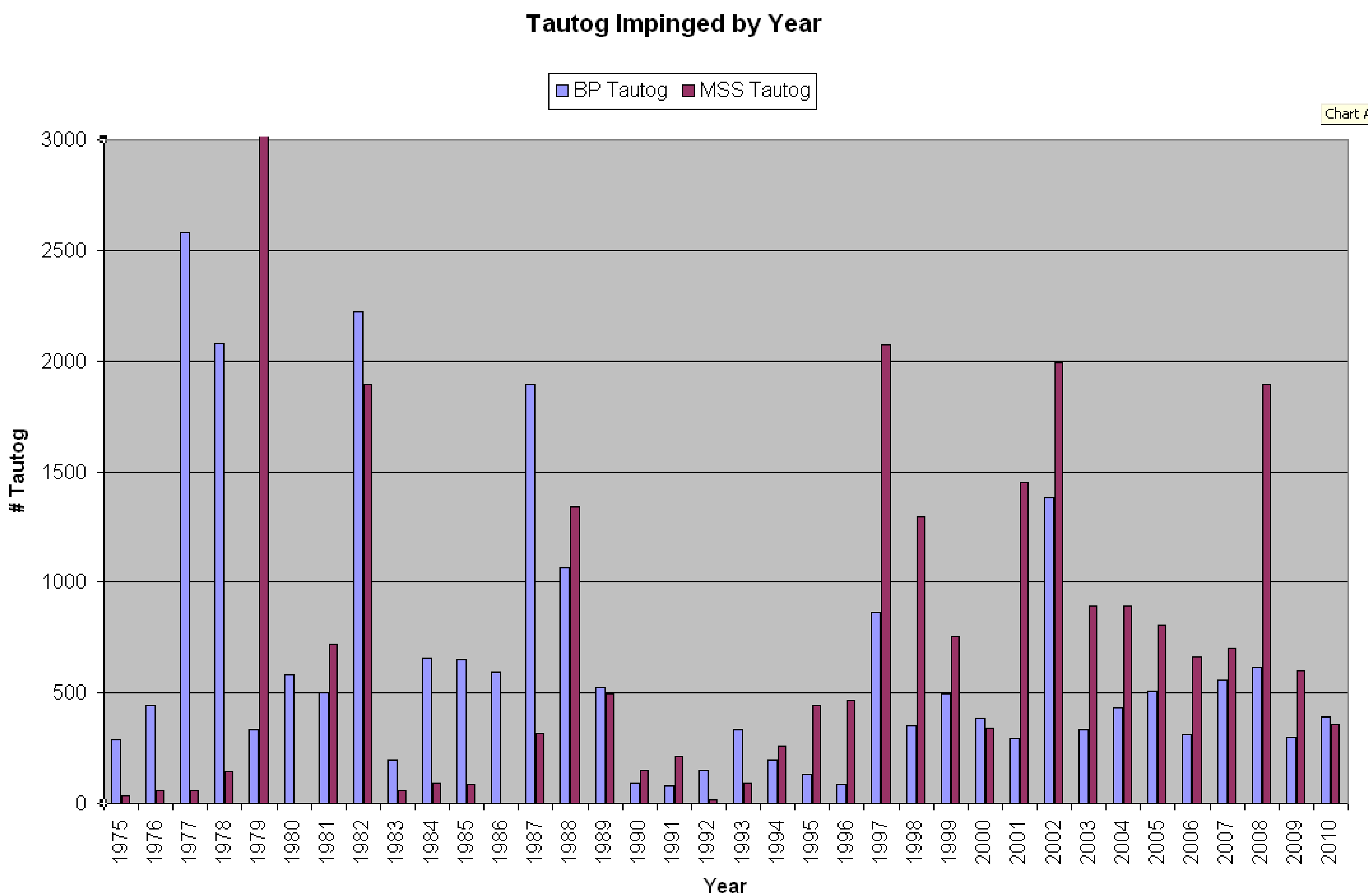


Fig. 8. Total tautog impinged per year 1975-2010 for Brayton Point (BP) and Manchester Street Power (MSS) facilities.(*1979 >6000 impinged by MSS).

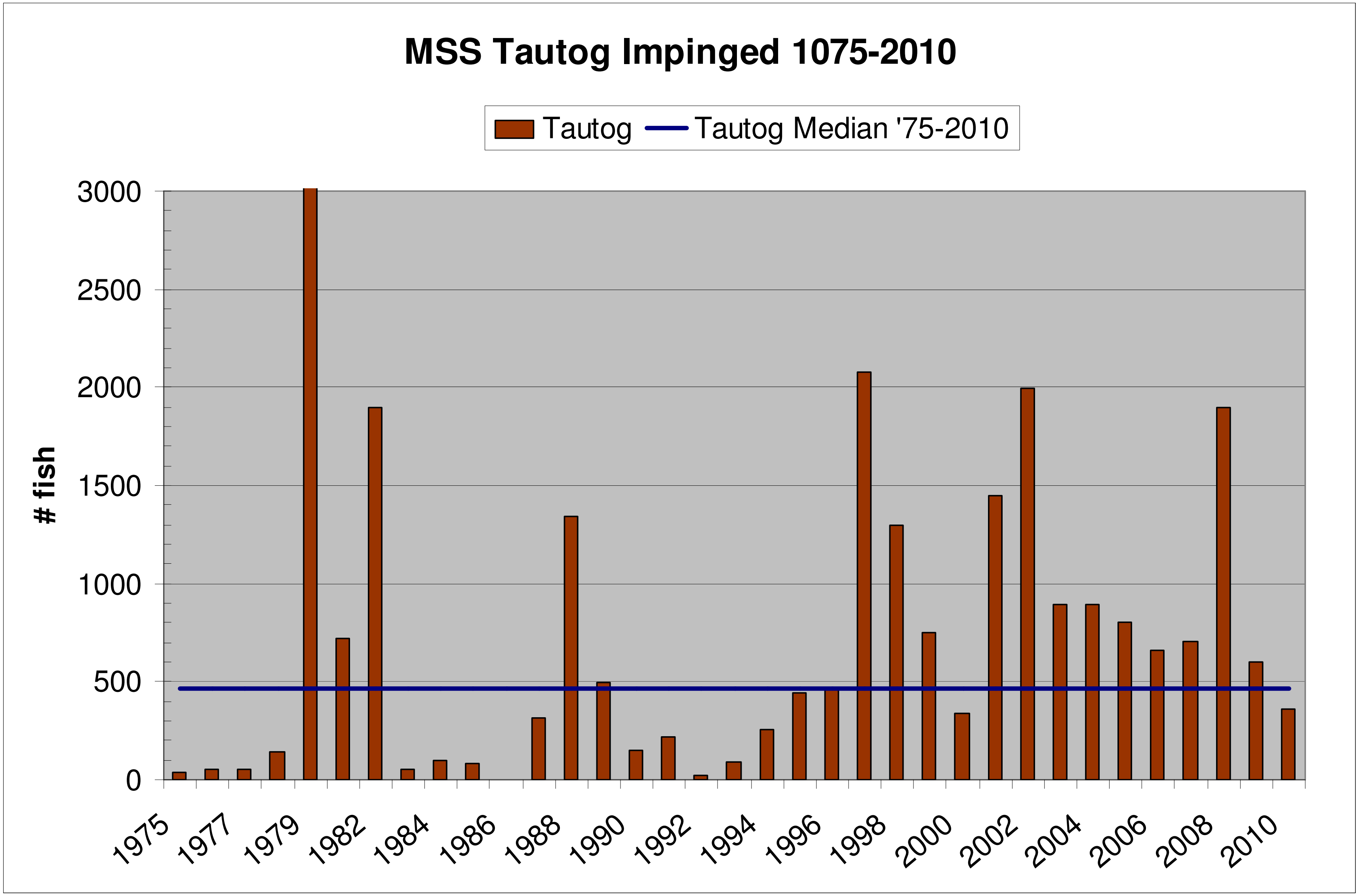


Fig. 9. Manchester Street Power (MSS) tautog impinged per year 1975-2010 and Median value 1975-2010

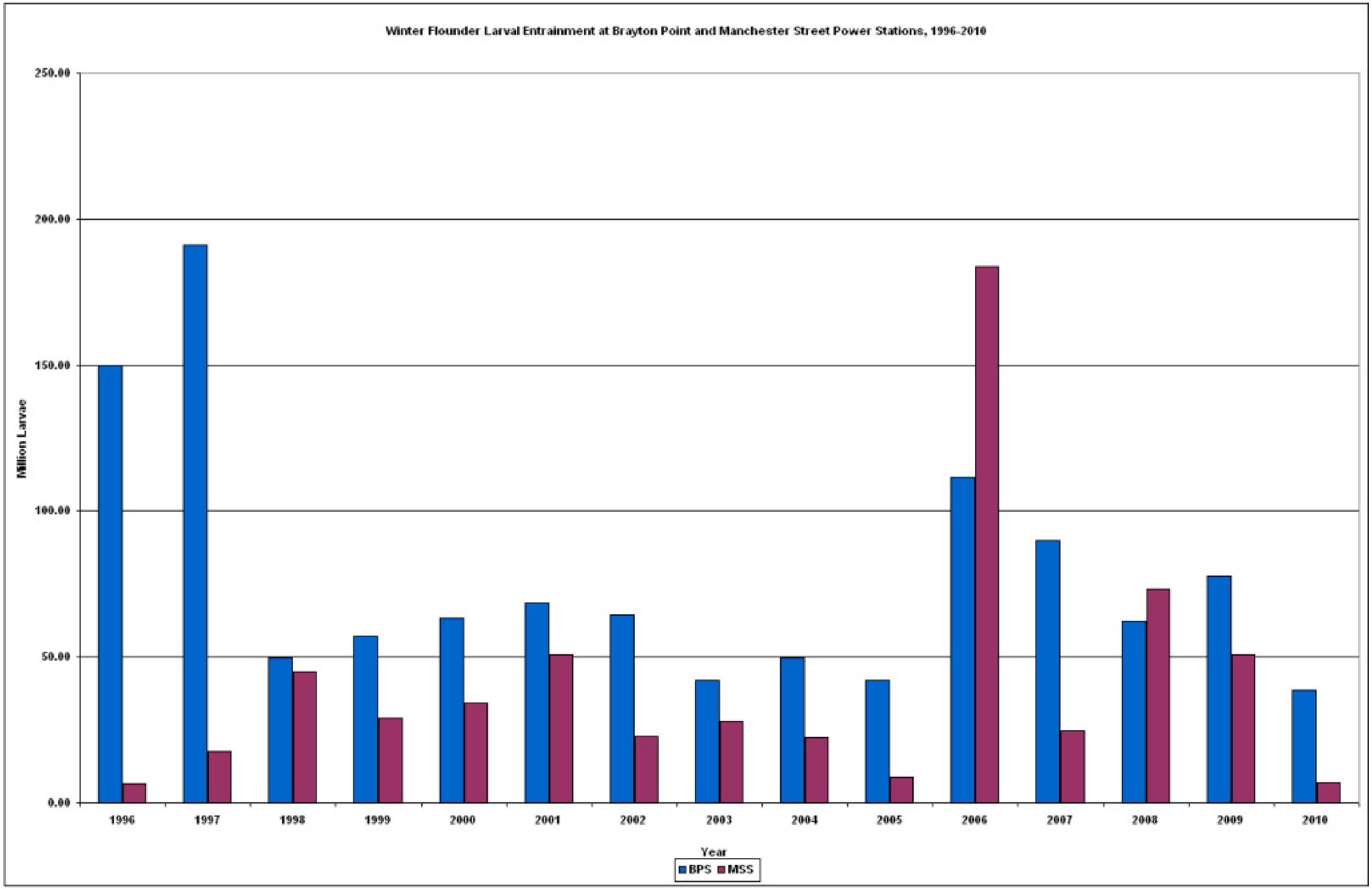


Fig. 10. Larval Winter flounder entrained by year 1996-2010 at Brayton Point (BP) (blue bars) and Manchester Street Power (MSS) (red bars). The 2011 and 2012 Flows for BP were reduced significantly due once-through cooling 2011= 0.5 BGD ; 2012 = 0.1 BGD ,

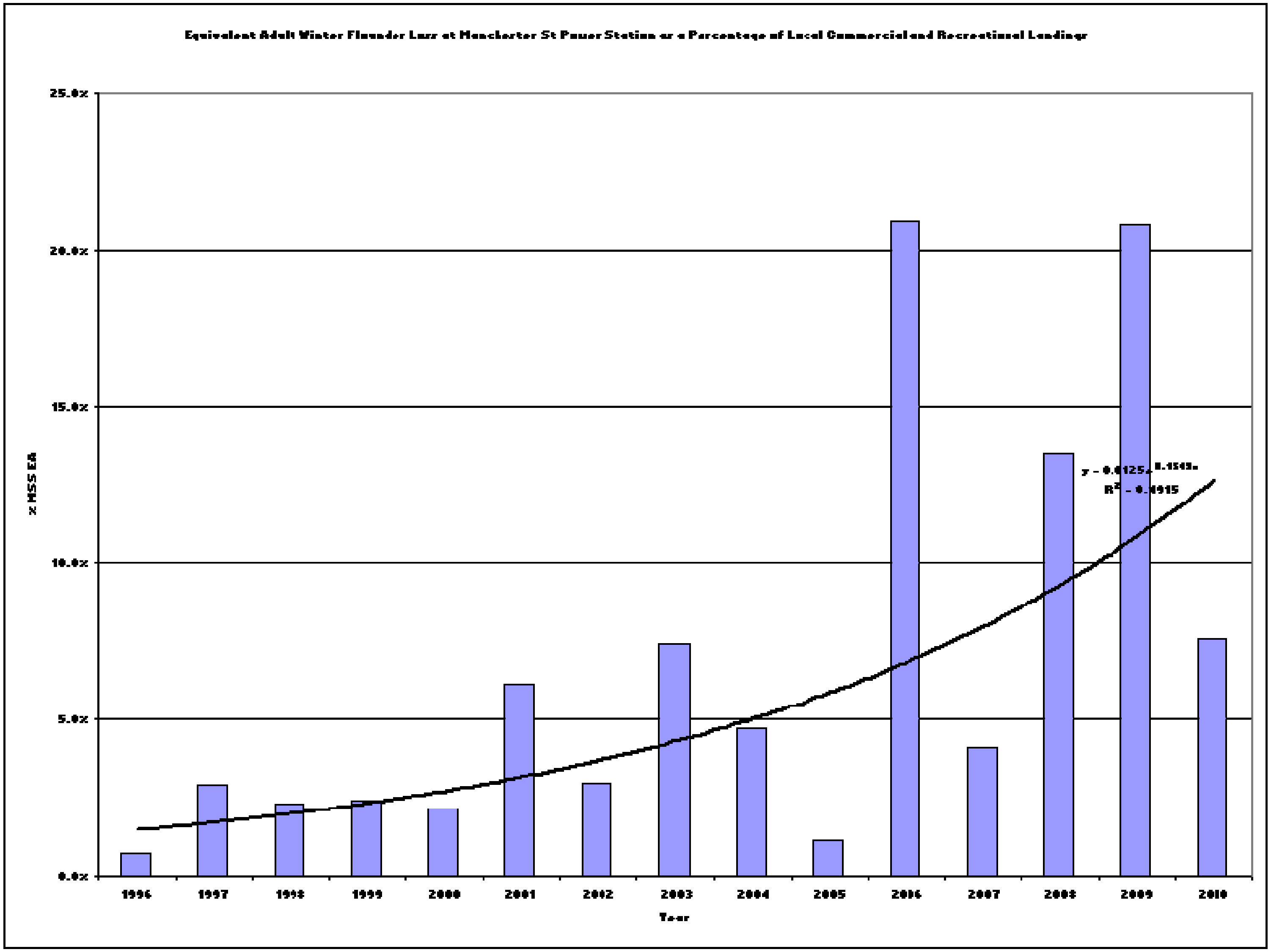


Fig. 11. Equivalent adult winter flounder at MSS as a percent of total RI landings showing a steady increase in catch rates.

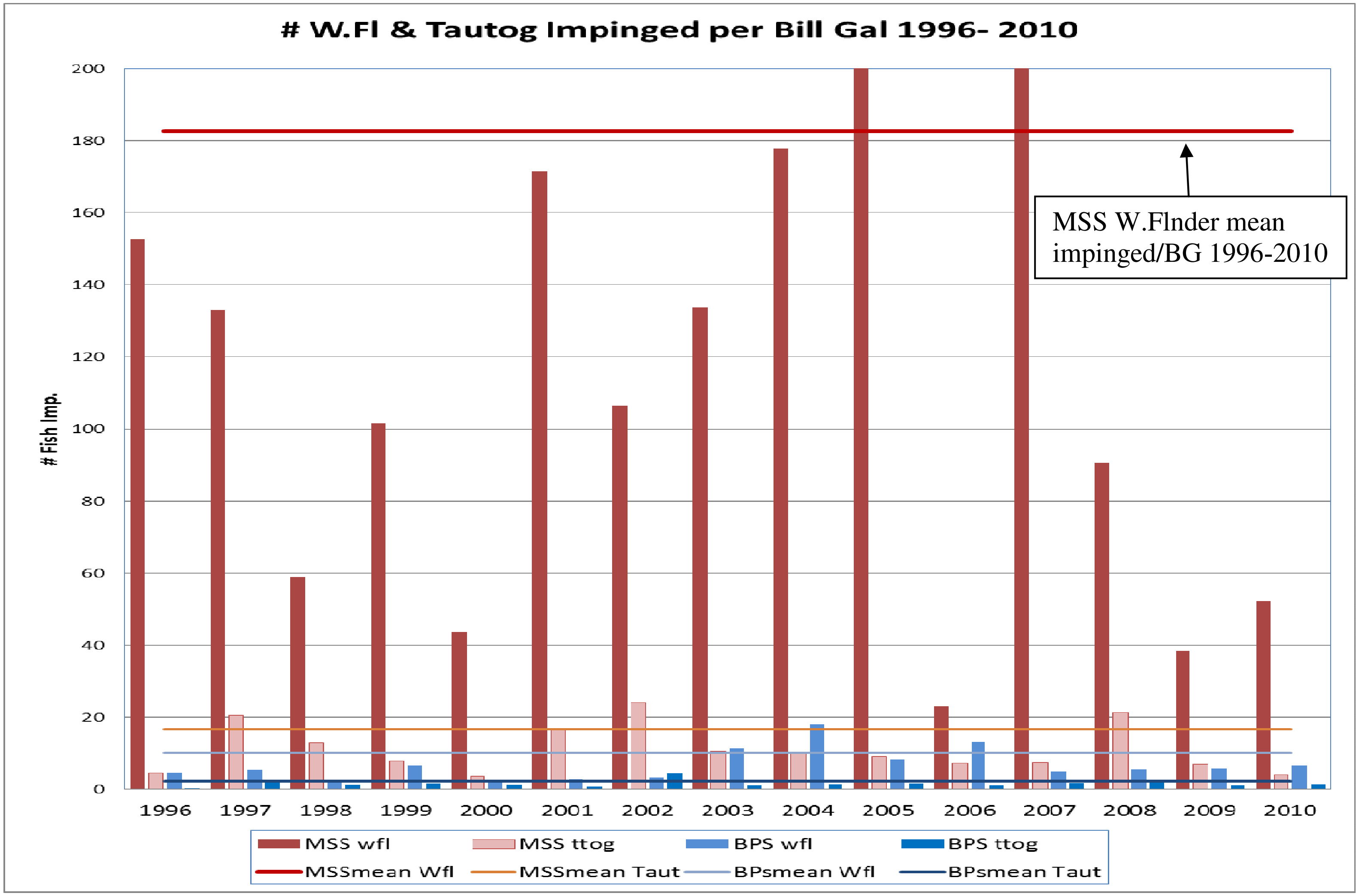


Fig. 12. 1996-2010 Winter Flounder and Tautog Impingement rates fish per bill. gal. annual flows MSS and Brayton Point.

Appendix A.
Seasonal Rates
of Average Monthly Impingement Rates
by species 1996 – 2013
based on MSS Estimated (actual flow) Impingement Tables.

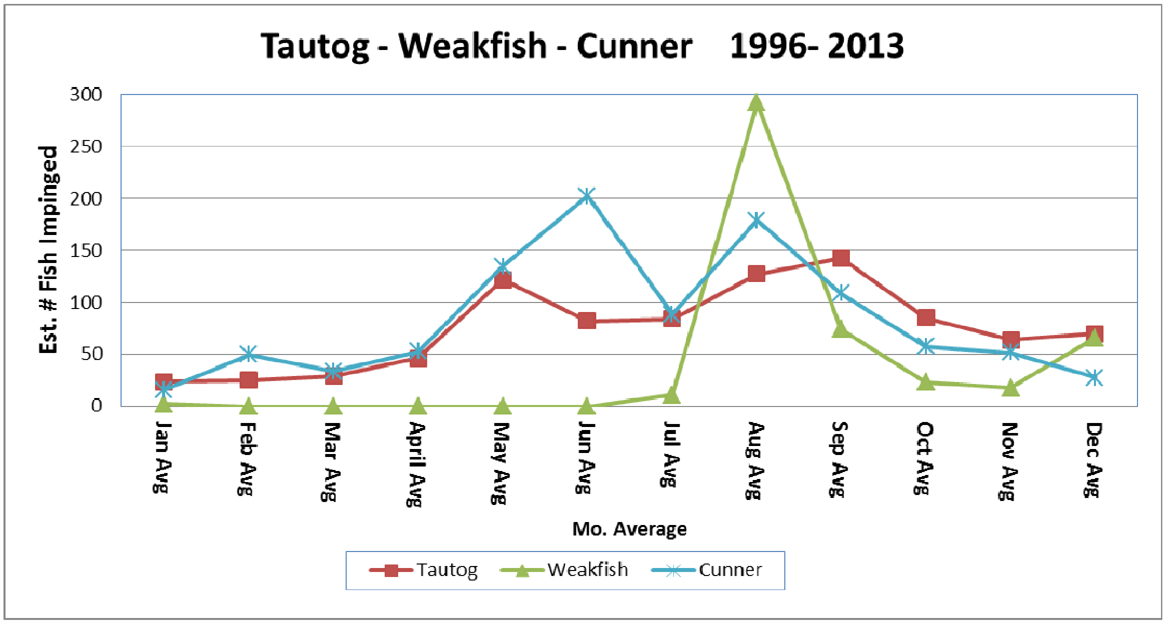


Fig.1. App.A. Average monthly impingement rate for Tautog, Weakfish, and Cunner based on 1996-2013 estimated impingement data from MSS.

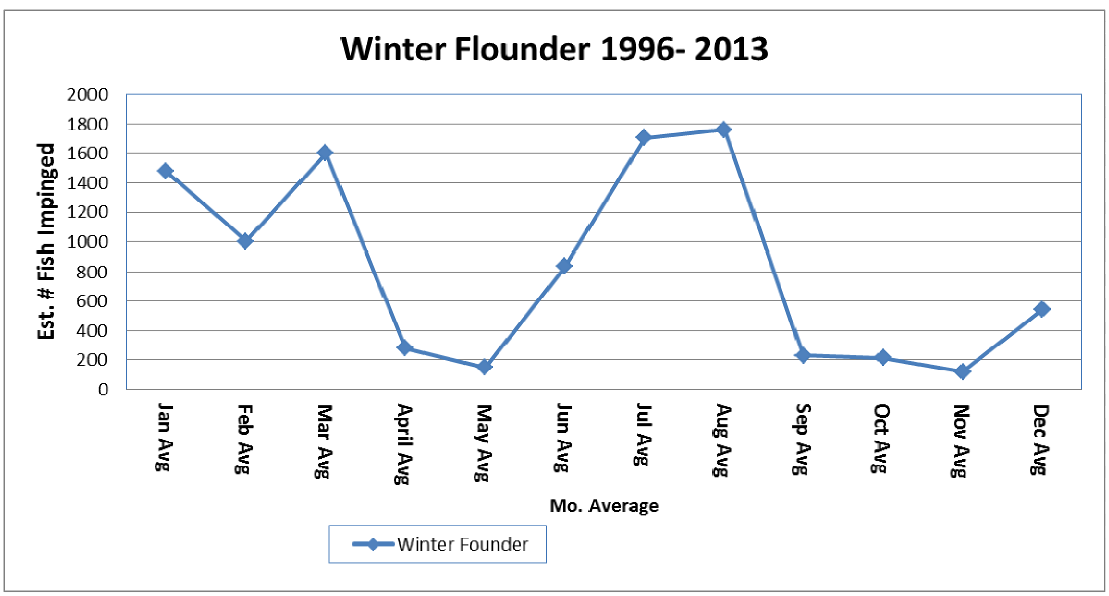


Fig.2. App.A. Average monthly impingement rate for Winter Flounder 1996-2013.

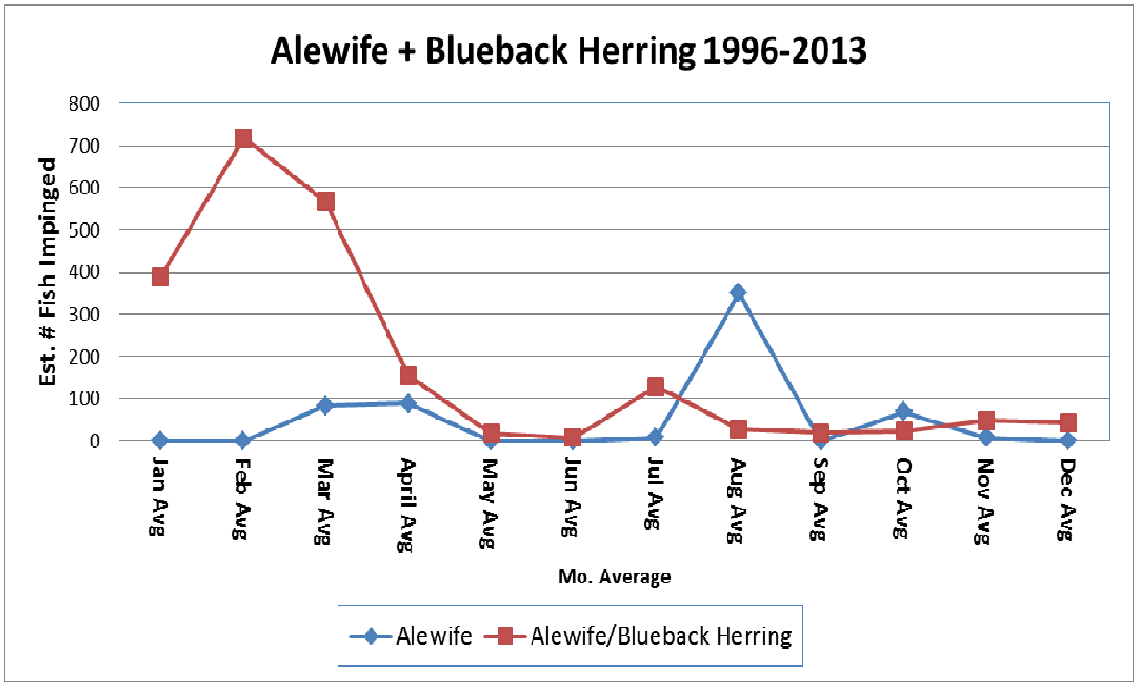


Fig.3. App.A. Average monthly impingement rates for Alewife and Blueback Herring 1996-2013.

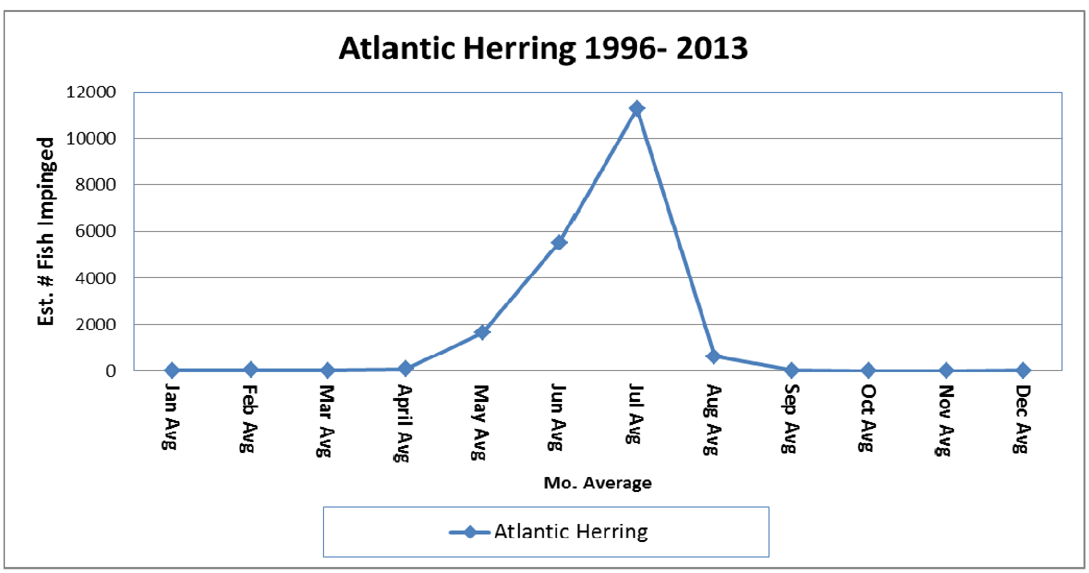


Fig.4. App.A. Average monthly impingement rate for Atlantic Herring 1996-2013.

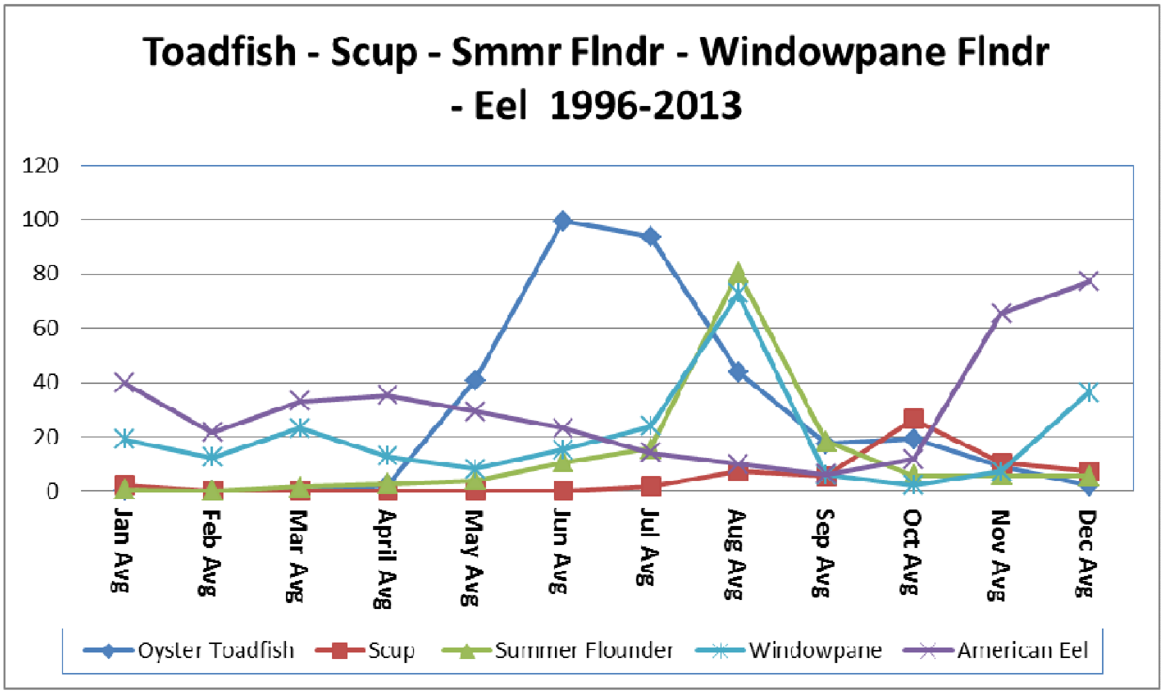


Fig.5. App.A. Average monthly impingement rate for Oyster Toadfish, Summer Flounder, Windowpane Flounder, and American Eel 1996-2010.

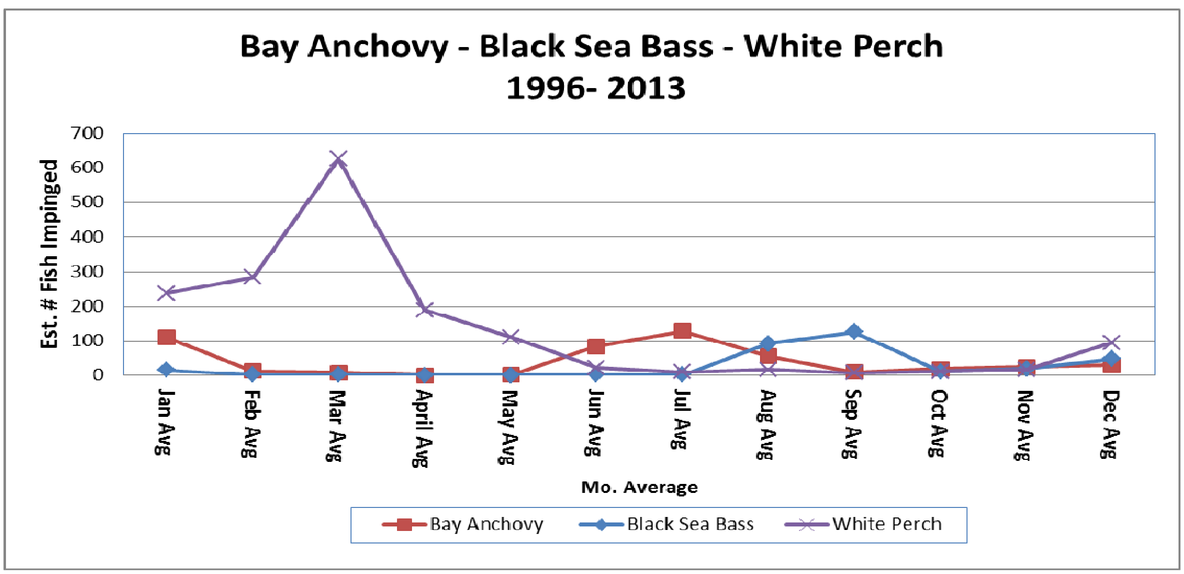


Fig.6. App.A. Average monthly impingement rate for Bay Anchovy, Black Sea Bass, and White Perch 1996 – 2013.

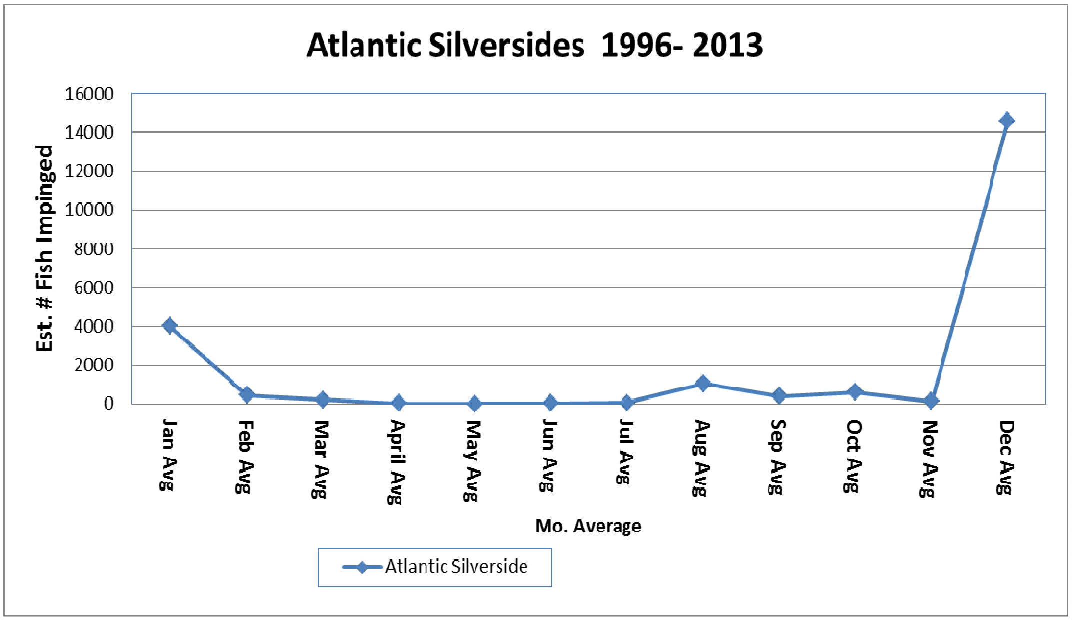


Fig.7. App.A. Average monthly impingement rate for Atlantic Silversides 1996 – 2013.

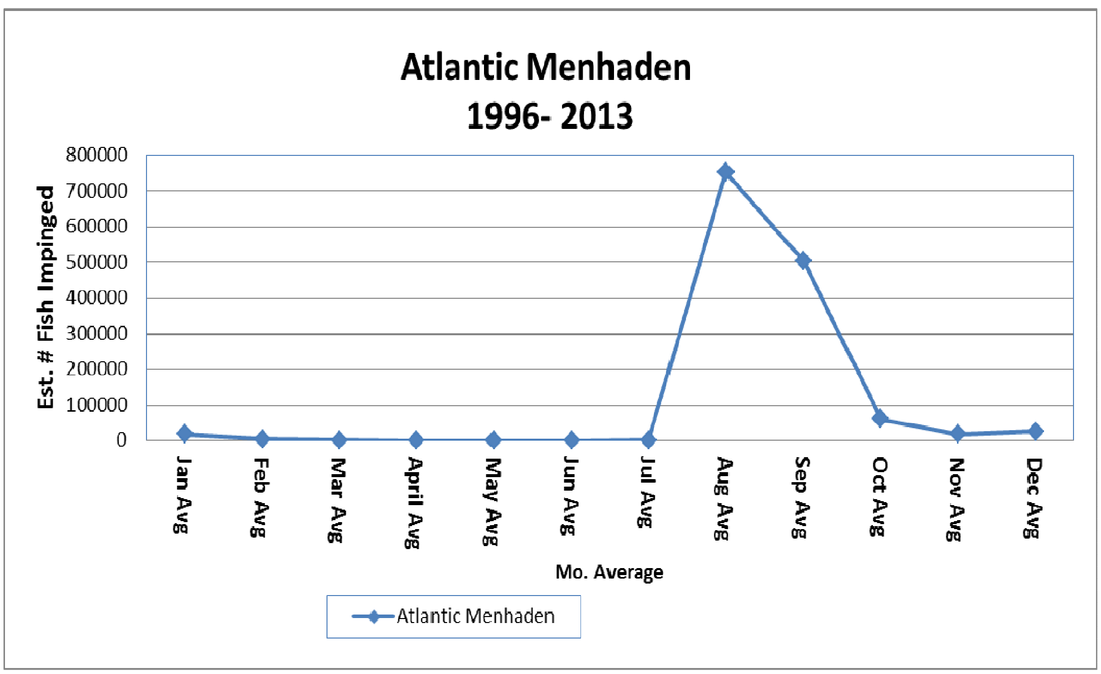


Fig.8. App.A. Average monthly impingement rate for Atlantic Menhaden 1996 – 2013.

RIDEM biological impact findings - Manchester St. Station RIPDES permit reissuance

- Presentation overview
  1. permitting project background
  2. impacts: winter flounder, tautog, American eel
  3. next steps

Permitting Project Background

- Project began in 2005
- Began project using 2004 EPA 316(b) Rule Impingement/Entrainment (I&E) framework –
  - initial information collection reports submitted in 2005 and 2006
  - historical I&E data submitted in 2008, with more recent annual updates
  - Technology Review submitted in August of 2009 – additional tech. info submitted in August and October of 2011; Variable Frequency Drive testing information submitted in June 2012 and June 2013
- 316(a) thermal demonstration scoping process began in May 2009
  - DO/T monitoring buoys placed in water in 2010
  - final report submitted Dec. 2011 including hydrothermal model
  - thermal threshold literature matrix submitted Feb. 2012

Section 316(b) of the Clean Water Act ("CWA")

•Section 316(b) of the CWA mandates "…that the location, design, construction, and capacity of cooling water intake structures reflect the *best technology available for minimizing adverse environmental impact*."

Biological Findings Overview

•presentation focuses on 316(b) impingment/entrainment impacts, not 316(a) thermal impacts

•RIDEM found 316(b) impacts to winter flounder, tautog, and American eel

Winter Flounder I&E losses

•Annual adult equivalent losses in 1996-2013 range from 3,728 to 223,917 for winter flounder (source: Table 23, Manchester St. Station 2013 Annual Report Impingement & Entrainment)

Tautog

•Annual adult equivalent losses in 1996-2013 range from 247 to 1,090 for age 3 tautog, and 134 to 697 for age 6 tautog (source: Table 7, Manchester St. Station 2013 Annual Report Impingement & Entrainment)

Winter Flounder and Tautog have local populations

•Research has shown that both winter flounder and tautog have high site fidelity, returning to their natal area for reproduction (i.e. have distinct subpopulations). E/I losses should be compared to appropriate subpopulations.

•References:

- •tautog: Cooper 1966
- •winter flounder: Buckley et. al 2008, Saucerman and Deegan 1991, Crivello et. al 2004
- •complete citations listed on handout

Winter Flounder local populations

•Winter flounder return to their natal area to reproduce, and have up to 14 geographically local genetic subpopulations in the Bay (Buckley et. al 2008).

Winter Flounder impingement

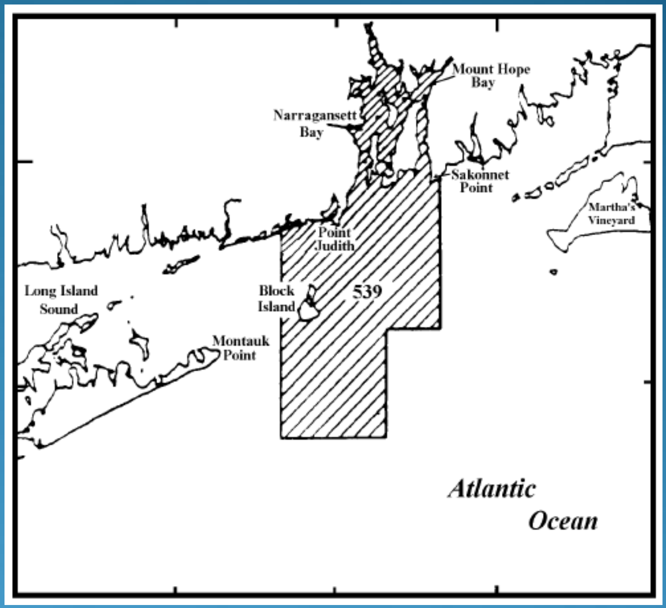
•Although the total winter flounder populations have decreased, the winter flounder mean impingement rate has significantly *increased* from an MSS:BP comparison ratio of ~ 4:1 to a rate of ~ 7:1 since the 1996 repowering (1996-2010).

•ratios based on raw impingment numbers; numbers are not flow adjusted

•These impingement losses are especially problematic for the large numbers of critically important juvenile winter flounder impinged in summer months. This group has survived the high natural mortality loss rate during the shift from water column to bottom lifestyle, when this species has major physiological changes and the left eye migrates to the right side.

Winter Flounder local populations

- figure on right illustrates Area 539 - area Dominion used to establish winter flounder population against which E/I impacts were compared
- Area 539 too large - does not recognize genetically distinct local subpopulations



Winter Flounder local populations

•However, even if one uses Dominion's unacceptable total RI waters population to evaluate EA losses, the percent mortality rate is significant and climbing, as shown in the figure below.

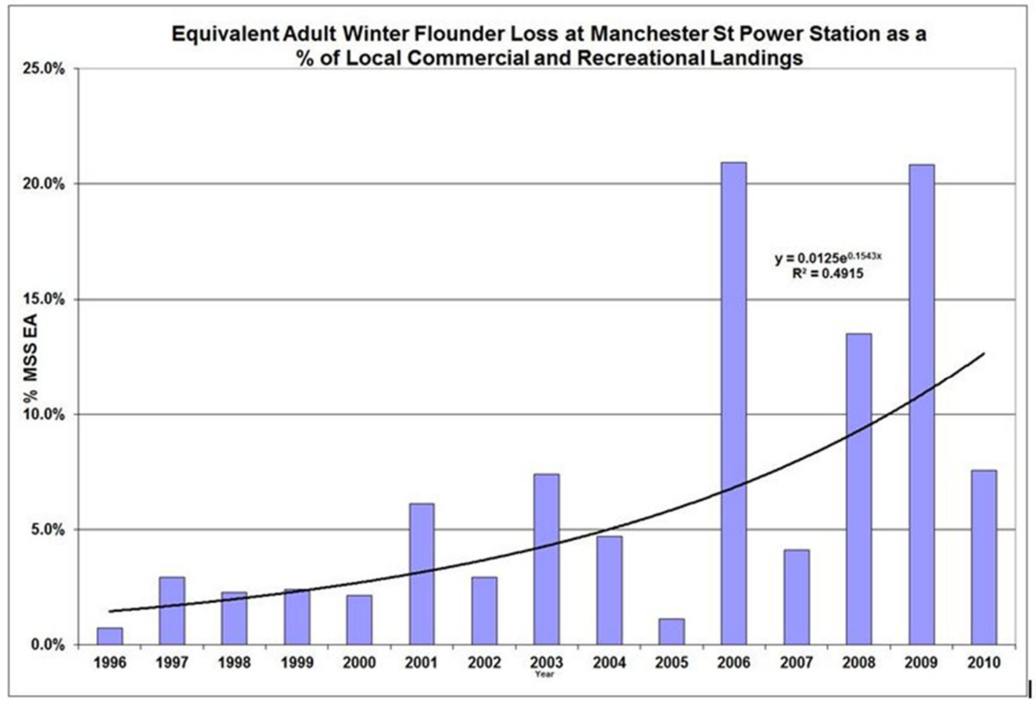
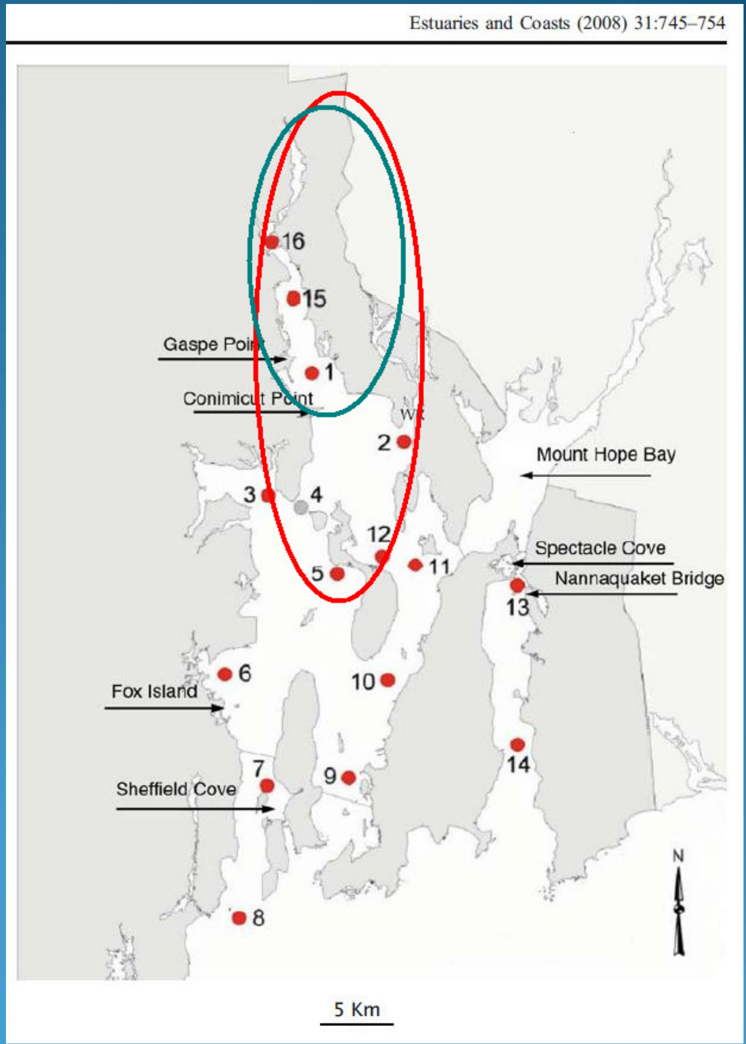


Fig. 11. Equivalent adult winter flounder at MSS as a percent of total RI landings showing a steady increase in catch rates.

RIDEM Nov. 10 2014 Manchester St. meeting presentation 111014.ppt - final

Winter Flounder local populations, cont.

- The green oval shows the estimated area likely encompassing the genetic subpopulation reproducing in the Seekonk/Providence Rivers.
- The red oval shows the area estimated to encompass both the Seekonk/Providence River and the next genetic subpopulation to the south.
- These population areas, which were identified by Buckley et. al, represent RIDEM's estimate of the appropriate subpopulation areas to compare with MSS impacts.



Tautog

•Research indicates that tautog also have high site fidelity, returning to the same area for reproduction. (Cooper 1966). Therefore, the subpopulation actually being impacted is that of the Providence River / Upper Bay area.

American Eel

- The MSS facility entrains a large number of glass eels (eels newly returning from the Sargasso Sea) and elvers.
- The mean value reported by Dominion for March (2000-2010) is over 600,000 glass eels and elvers.
- RIDEM F&W has never recorded an annual count of > 30,000 at two eel ramps in RI, so this represents a substantial number of entrained glass eels, and a likely high mortality rate.

American Eel, cont.

•Dominion's (EA) Equivalent Adult analysis used the EPA life table from a 2004 EPA rulemaking document.

•RIDEM is concerned about the accuracy of these estimates since discussions with the United States Geological Survey (USGS) have indicated that little is actually known about the true loss rate for the leptocephalous (Sargasso Sea to US coast) and glass eel stages.

•The US Fish and Wildlife Service is assessing the status of the American eel population and is considering designating it as threateaned and endangered.

•If designated as threatened and endangered, RIDEM would be required to close off the American eel fishery under federal law, and Dominion would have to achieve significant reductions in losses.

Biological Impacts Summary

- It is RIDEM's position is that currently available data and analysis is sufficient to document that MSS operations result in adverse environmental impact.
- Future efforts should focus on the determination/evaluation of Best Technology Available to Minimize Adverse Environmental Impact rather than refining the size of appropriate subpopulations to compare losses to.

Status of Impingement/Entrainment Technology Assessment

•January 24, 2011 letter to Dominion - RIDEM requested additional technology information as follow-up to August 2009 Technology Review

•May 2, 2011 meeting - RIDEM agreed to Dominion's request to defer additional steps of Technology Review until after RIDEM had evaluated biological impacts

•2012 and 2013 - Dominion evaluated impacts of operating variable speed pumps

Jan. 24, 2011 letter

- technologies deferred, more information needed:
  - cooling towers
    - engineering feasibility study of piping cooling water through hurricane barrier
    - engineering feasiblity study evaluating multi-mode operation
- level of detail for additional study of technologies
  - 10-12% design
  - construction requirements
  - cost information: capital cost, construction cost, O&M costs

Discussion Next Steps

- Assessment of Technologies
    - complete previously requested analysis
    - cogeneration
    - dry cooling towers for condenser cooling
    - improvements to fish return system
- Assessment of Operational Changes
    - heat output reductions
    - seasonal shutdowns
    - variable frequency drives
- Combinations of technologies and operational changes

Assessment of Recreationally Important Finfish
Stocks in Rhode Island Coastal Waters

2014 Annual Performance Report for Job VI, Part B:

Assessment, Protection, and Enhancement of Fish Habitat to Sustain Coastal and Marine Ecosystems and Healthy Stocks of Recreationally Important Finfish:

Investigating techniques to enhance degraded marine habitats to improve recreational fisheries

By

Eric Schneider
Principal Marine Fisheries Biologist
Rhode Island Department of Environmental Management
Division of Fish and Wildlife
Fort Wetherill Marine Fisheries Laboratory
3 Fort Wetherill Road
Jamestown, RI 02835

&

John F. OôBrien
Policy and Partnership Specialist
The Nature Conservancy
159 Waterman Street
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Federal Aid in Sportfish Restoration
F-61-R

2014 Performance Report for Job VI, Part B March 31, 2015

PERFORMANCE REPORT

STATE: Rhode Island

PROJECT NUMBER: F-61-R
SEGMENT NUMBER: 21

PROJECT TITLE: Investigating techniques to enhance degraded marine habitats to improve recreational fisheries

PERIOD COVERED: January 1, 2014 - December 31, 2014

JOB NUMBER AND TITLE: VI, Part B: Assessment, Protection, and Enhancement of Fish Habitat to Sustain Coastal and Marine Ecosystems and Healthy Stocks of Recreationally Important Finfish

STAFF: Eric Schneider (Principal Marine Fisheries Biologist, RI DEM, Div. of Fish and Wildlife) and John F. OʻBrien (Policy and Partnership Specialist, The Nature Conservancy Rhode Island Chapter)

JOB OBJECTIVE: This project aims to positively affect local fish populations by improving degraded marine habitat. Specifically, the goal of this project is to determine if oyster reef construction can be used to improve growth and survival (i.e., productivity) of early-life stages of recreationally important fishes such as black sea bass (*Centropristis striata*), tautog (*Tautoga onitis*), scup (*Stenotomus chrysops)*, summer flounder (*Paralichthys dentatus*), and winter flounder (*Pseudopleuronectes americanus*).

This goal will be addressed with the following objectives:
(1) Determine the appropriate location for reef establishment, considering oyster suitability modeling, present habitat quality and value, and connectivity to adjacent fish habitat;
(2) Create and establish oyster reefs in selected coastal ponds; and
(3) Conduct post-enhancement evaluation of the study site and control to establish baselines and determine if there are changes in fish productivity, such as changes in recruitment and survival of early life stages of recreationally important fish.

SUMMARY: This report summarizes all work conducted for this project between January 1 and December 31, 2014. During this period we focused on aspects needed to determine the appropriate location for establishment of the first of four fish habitat enhancement (FHE) reefs, considering oyster suitability modeling, present habitat quality and value, and connectivity to adjacent fish habitat. At the coastal pond system level, we determined that Ninigret Pond offered the best opportunity for success in 2015 given the logistical strengths, results from assessment of previous restoration work, and the amount of ongoing research occurring in at multiple sites within this coastal pond.

To evaluate potential sites within Ninigret Pond for the establishment of a FHE reef we reviewed results from TNCʻs oyster restoration suitability model along with DEMʻs juvenile fisheries data to evaluate not only oyster suitability but the likelihood of the habitat quality available for

juvenile fishes. We plotted pairs of 1-acre plots that could support the FHE reef and associated control site in areas with suitable substrates and conducted field surveys to delineate the exact transition between suitable and unsuitable substrate, as well as to get preliminary data on site conditions including bottom type, presence/absence of structure or rocks, and preliminary assessment of fish habitat type and quality. At present a final decision regarding the siting for the FHE reef has not been made. Further analyses of both the physical and fishery data is planned for early 2015. We also will seek feedback from Dr. Grabowski regarding the experimental design and possibility of creating several smaller reefs opposed to a single 1-acre reef, which may allow us to determine the functional response of reef density and services derived from FHE reefs created in different areas.

To help support this work TNC executed a research contract with Dr. Jon Grabowski, a well known fish ecologist, who is currently a professor with the Northeastern University Marine Science Center. Dr. Grabowski will provide special technical assistance and research services to TNC and DEM to assist with experimental habitat restoration site selection, experimental design and monitoring protocols, scientific review, technical assistance during monitoring, and data assessment necessary to evaluate the response to fish populations. We also revised the project timeline; however, these changes should not affect the overall timing of project completion.

TARGET DATE: December 2014

SIGNIFICANT DEVIATIONS: Although there were no significant deviations from the timeline proposed in the current grant, some tasks were not completed within the anticipated timeline. Deviations are shown in Table 1. Overall, the project is still on track to begin baseline monitoring and construction of the first reef in the summer and fall of 2015, respectively.

RECOMMENDATIONS: The lack of information regarding the current status of oyster reefs in the coastal pond system is a major impediment in our ability to link the TNC oyster habitat suitability model outputs and potential long-term reef sustainability. We are planning to address this data gap by coordinating resource assessment and data sharing with the Natural Resource Conservation Service (NRCS) funded oyster monitoring project that is surveying all former NRCS funded oyster restoration sites and natural oyster reefs sites during 2015.

Introduction

Alteration and loss of coastal habitats, such as saltmarshes, eelgrass, and oyster reefs, is believed to be one of the most important factors contributing to declines in populations of marine finfish (Deegan & Bucshbaum, 2005). For example, more than 70% of Rhode Islandφs recreationally and commercially important finfish spend part of their lives in coastal waters, usually when they are young (Meng & Powell, 1999). The shallow water, salt marshes, sea grasses, and oyster reefs provide excellent foraging and feeding areas as well as protection from larger, open-water predators. Juvenile finfish show a high degree of site fidelity, rarely moving far from shallow-water nursery habitats until either water cools in the late fall or resources are insufficient (Saucerman and Deegan, 1991). Habitats known to be important to early life stages of finfish include unvegetated soft sediments or tidal flats, submerged aquatic vegetation, and complex shellfish and oyster reefs (ASMFC 2007). It is broadly accepted that habitat restoration and enhancement improves coastal ecosystems; however, it remains unclear if coastal habitat restoration practices conducted here in RI would benefit the survival and growth of early life stages of finfish as in the mid-Atlantic.

In Rhode Island, complex shellfish reefs formed by oysters (*Crassostrea virginica*) and ribbed mussels (*Geukensia demissa*) are found in intertidal and shallow subtidal waters of coastal ponds and bays. Recent decades have witnessed declines in this habitat. For example, Beck *et al.* (2011) estimated that shellfish reefs are at less than 10% of their prior abundance and that ~85% of reefs have been lost globally. The decrease in oyster reef extent and condition has coincided with decreases in water quality and clarity, and loss of important nursery habitat for finfish and crustaceans (zu Ermgassen et al., 2013).

Numerous studies completed in the mid-Atlantic had identified shellfish reefs as essential fish habitat (EFH) for resident and transient finfish (Breitburg, 1999; Coen et al., 1999). Similarly, Wells (1961) collected 303 different species of marine life that utilized oyster reef habitat. Reef-dwelling organisms are then consumed by transient finfish of recreational and commercial importance (Grabowski *et al.,* 2005; Grabowski and Peterson, 2007). Harding and Mann (2001) suggested that oyster reefs may provide a higher diversity and availability of food or a greater amount of higher quality food compared to other marine habitats. Grabowski et al. (2005) found that oyster reefs constructed in soft sediments increased the growth and survival of juveniles fishes such as the black sea bass *Centropristis striata*.

The growing recognition of the ecological and economic importance of complex benthic habitat has led to an increase in the efforts to construct oyster reefs (Coen and Luckenback, 2000; Brumbaugh et al., 2006). In North Carolina, recreational fisherman value constructed oyster reefs as a place to find a large number and variety of fish. Grabowski and Peterson (2007) estimated that an acre of oyster reef sanctuary will result in ~$40,000 in additional value of commercial finfish and crustacean fisheries. Note that Grabowski and Peterson (2007) suggested that the recreational sector, like the commercial sector, would be positively affected by an oyster reef sanctuary; however, there was not a clear and convenient value metric for the recreational sector for assessment (i.e., value of landings for commercial species was used to assess commercial value).

Approach

Under a cooperative agreement between the Division of Fish and Wildlife and The Nature Conservancy (TNC) we will collaborate to examine the practice of establishing oyster reefs in shallow coastal waters as a tool to improve populations of recreationally important fishes. The project is broken into four components described in Table 1. In general, we will construct up to 4 acres of oyster reef habitat (1 acre per pond per year starting in 2015) to evaluate reef habitat function and services related to local fish populations. The project will be completed in four stages: (1) identify optimal project locations, and if not already in place promulgate regulatory protections for the ñto be createdò resource, and submit permit applications; (2) construct oyster reefs and engage the public; (3) monitor reefs and evaluate fish use and productivity; and (4) develop public outreach materials and reports.

More specifically, significant Stage-1 work includes finalizing the location of the first fish habitat enhancement (FHE) reef, finalizing the experimental design of the project, and submitting the required permit applications.   This project will be completed in the coastal ponds of South County, Rhode Island (Figure 1). The coastal pond ecosystems provide refuge and spawning areas for numerous estuarine and marine finfish and are popular fishing areas for recreational anglers. A thorough analysis of oyster and finfish habitat suitability will be completed prior to reef construction. This will be done at the pond and sanctuary scale to identify areas with appropriate physical and biological characteristics. We will use TNCôs oyster restoration suitability model along with DEMôs juvenile fisheries data to evaluate not only suitability but the likelihood of recruitment of juvenile fishes. Geospatial data developed in our suitability analysis will greatly inform this project and future fish habitat restoration projects in coastal pond ecosystems.

Reef construction will take place in state-designated Shellfish Management Areas, which encompass all of the coastal ponds. Within a given Shellfish Management Area the Division of Fish and Wildlife (DFW) has authority to conserve and enhance shellfish resources with appropriate management strategies including transplanting, area closures, establishment of spawner sanctuaries, and daily possession limits. If needed, the DFW will promulgate regulations to protect the ñto be createdò resource prior to placing shell in the water for reef creation. These rules and regulations are promulgated pursuant to Chapter 42-17.1, §20-1-4, §§20-2.1 and Public Laws Chapter 02-047, in accordance with §42-35 of the Rhode Island General Laws of 1956, as amended.

Results

This report summarizes all work conducted for this project between January 1 and December 31, 2014. During this period we focused on aspects needed to address Objective 1 which is to ñdetermine the appropriate location for reef establishment, considering oyster suitability modeling, present habitat quality and value, and connectivity to adjacent fish habitatò. Specifically we (1) determined the coastal pond system that will support the first of four FHE reefs, (2) assess potential locations for the FHE reef(s) and control site(s) within the selected coastal pond, (3) finalized a contract and Scope of Work with a well-regarded expert, Dr. Jon Grabowski of Northeastern University, who has extensive experience evaluating whether constructed oyster reefs can enhance fishery production, and (4) evaluated and planned aspects of work for 2015 and thereafter.

Location for the first fish habitat enhancement (FHE) reef

We assessed both logistical and biological attributes to determine the best coastal pond to create the first FHE reef in during 2015. In short, logistical aspects considered were the location for storage of equipment and cultch during reef construction, how site aspects could affect the deployment of shell and construction of the reef, familiarity with potential sites and other current restoration or oyster research in a given coastal pond, and presence of a DEM Shellfish Spawner Sanctuary or Oyster Restoration Reserve. Biological aspects considered included the suitability of a site for oyster restoration work, including the substrate, water quality, salinity, status of previous oyster restoration work, knowledge of the current marine resources present, as well as the general quality of and type of fish habitat present, and connectivity to other habitats.

Ninigret Pond seems to have many of the logistical pieces in place to support this type of work, including locations to stage equipment and store cultch, a slip in a marina, substantial fish sampling from other research projects, and one DEM Shellfish Spawner Sanctuary and two Oyster Restoration Reserves. Biological attributes also provide support for Ninigret Pond. Oyster habitat suitably modeling conducted by TNC shows that in general locations within Ninigret Pond have low to moderate potential for oyster restoration (Figure 2). However, data collected by Roger Williams University and TNC on former North Cape Restoration sites and NRCS EQIP sites, and new information collected on DEM-TNC reefs located in Ninigret Pond suggest that oysters can grow and survive in areas with lower suitability scores within Ninigret Pond (personal communications Matt Griffin, Roger Williams University and Bryan DeAngelis, TNC, respectively), but as in nearly every coastal pond mortality is outpacing recruitment (personal communication Matt Griffin, Roger Williams University). Overall, we felt that Ninigret Pond offered the best opportunity for success in 2015 given the logistical strengths, results from assessment of previous restoration work, and the amount of ongoing research occurring in at multiple sites within this coastal pond.

To assess the exact locations for creation of the FHE reef(s) and control site(s) within Ninigret Pond we reviewed the oyster restoration suitability model created by TNC along with DEMôs juvenile fisheries data to evaluate not only oyster suitability but the likelihood of the habitat quality available for juvenile fishes. In general the oyster restoration habitat suitability index (HSI) values generated from TNC oyster restoration suitability model was driven by the composition of marine sediment in pond (Figure 2, 3). We plotted pairs of 1-acre plots that could support the FHE reef and associated control site in areas with suitable HSI values (Figure 3). Discussions yielded the consensus that creating a new Shellfish Spawner Sanctuary would likely put the project behind schedule so we concentrated on areas in and adjacent to the current Shellfish Spawner Sanctuary in western Ninigret Pond (shown in Figure 3).

In this area we conducted field surveys to delineate the exact transition between suitable and unsuitable substrate and get preliminary data on site conditions including bottom type, presence/absence of structure or rocks, and preliminary assessment of fish habitat type and quality. Field survey techniques included snorkel surveys, video transects, sediment cores, and probing the sediment with a peat corer, or at times an oar, to determine the general firmness of the substrate. Preliminary findings suggest that the sediment maps are very accurate; however, we did find some areas mapped as suitable that were actually unsuitable due to the presence of soft sediments (Figure 4). We therefore refined our suitability maps to reflect this knowledge. Fish habitats present were mostly course sand; however, an area with good HSI values and verified firm sediment in the northern section of the Shellfish Spawner Sanctuary encompasses large boulders and some *Gracilaria* beds.

A very preliminary review of fin fish survey data collected by the RI DEM Division of Fish and Wildlife Coastal Pond Juvenile Finfish Survey suggests that the western end of the pond has lower species diversity and generally lower abundance of recreationally important fish such as tautog, black seabass, scup, and summer flounder compared to other sites in the pond. This area also lacks eelgrass and other critical habits that are abundant elsewhere in the pond. At present a final decision regarding the siting for the FHE reef has not been made.

Contract with Dr. Jon Grabowski (Northeastern University Marine Science Center) for technical assistance

In November TNC executed a research contract with Dr. Jon Grabowski, a well know fish ecologist, who is currently a professor with the Northeastern University Marine Science Center located in Nahant MA. Dr. Grabowski has had substantial experience as a fish ecologist, and has published reports, on fisheries habitat restoration projects, including restoring oyster reefs, designed to recover ecosystem services. Dr. Grabowski will work closely with the TNC/DEM project management team. He will provide special technical assistance and research services to TNC and DEM to assist with experimental habitat restoration site selection, experimental design and monitoring protocols, scientific review, technical assistance during monitoring, and data assessment necessary to evaluate the response to fish populations. Specifically the potential changes to fish productivity resulting from implementation of experimental restoration treatments. Dr. Grabowskiôs contract scope of work with TNC will continue until December of 2018.

Evaluation of timeline for 2015 and thereafter

Several changes were made to the project timeline; however, these changes should not affect the overall timing of project completion (see Table 1). In short, the timeline for evaluating pond and sanctuary suitability and incorporating fisheries data in to the model have been moved to December of 2015. Identifying reef and control sites has been revised to March of 2015 for Reef 1 and annually in December for the following reefs. We also revised the timeline for completing baseline surveys from June to August annually and submitting permit applications from July to January annually.

Discussion

Location for the first fish habitat enhancement (FHE) reef

Further analyses of both the physical and fishery data is planned for early 2015. We also will seek feedback from Dr. Grabowski regarding the experimental design and possibility of creating several smaller reefs as opposed to a single 1-acre reef (example of this approach shown in Figure 5). We believe that the experimental design may be modified to several smaller reefs in different areas, including those that have lower HSI values. This would allow us to determine the functional response of reef density and services derived from FHE reefs created in different areas. We also plan to solicit feedback from the RI Shellfish Restoration Working Group on preliminary sites in early 2015.

Evaluation of timeline for 2015 and thereafter

The changes made to the project timeline reflect lessons learned from 2014. For example, the evaluation of pond and sanctuary suitability would benefit from current information regarding the status of the oyster reefs and previous restoration practices in those areas. Therefore we are planning to coordinate resource assessment and data sharing with the Natural Resource Conservation Service (NRCS), which has funded an oyster monitoring project to survey all former NRCS funded oyster restoration sites and some natural oyster reefs sites during 2015. We hope to coordinate with the NRCS survey and supplement if needed in order to gain a complete picture of all potential FHE reef site locations.

We revised the timeline for identifying reef and control sites to annually in December so that we could incorporate field data collected from the previous year. We believe that baseline survey work can run through August since cultch probably will not be placed until September or October of a given year. Thus, we revised the timeline for completing baseline surveys accordingly. We also believe that permit applications can be submitted in January annually, following the December site selectin decision.

Conclusion

During 2014 we made substantial gains in planning the work for 2015. Although several key aspects need to be resolved in early 2015 we believe weœre in a strong position to move forward and keep on schedule. Coordinating all of the field work required to obtain the information needed to move forward in other coastal ponds will be both essential and challenging.

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Table 1. Updated timeline of project activities for the enhancement of degraded marine habitat.

Component	Activity	Timeline		Status
		Proposed (in original grant)	Current Track	
I. Site Identification & Permits	Evaluate pond & sanctuary suitability	May-14	December-15	Reef 1 (Ninigret Pond) completed. More data is needed to assess sites in all ponds. This will be collected and analyzed during 2015.
	Incorporate fisheries data into suitability models	June-14	December-15	Evaluating approach
	Identify reef & control sites	June-14	March-15 (Reef 1), Dec-15 (Reef 2), Annually in December (Reef 3, 4)	Ninigret Site (Reef 1) near complete. Other ponds pending.
	Complete baseline surveys	Annually, June	Annually, August	-
	Submit permit applications	Annually, July	Annually, January	Ninigret Site (Reef 1) will be submitted in April-15
II. Oyster Reef Construction	Host volunteer workdays to bag shell	Annually, May	-	-
	Secure contracts for reef construction	Annually, May	-	-
	Deliver shell bags to hatchery	Annually, July	-	-
	Grow seed in cages prior to deployment	Annually, July to September	-	-
	Delineate, construct & seed reefs	Annually, October	-	-
III. Monitoring, Evaluation, & Analysis	Post-construction bathymetry & elevation	Annually, *post-construction*	-	-
	Evaluate reef stability & succession	Seasonally, post-construction	-	-
	Evaluate fish & invert community structure	Seasonally, post-construction	-	-
IV. Submit Reports	Analyze data & submit reports	December 2014 - 2018	-	-

Figure 1. Coastal ponds located in Southern Rhode Island, as well as the Lower Pawcatuck River system. Red circles indicate sites sampled by the RI DEM Division of Fish and Wildlife Coastal Pond Juvenile Finfish Survey. The coastal ponds, which excludes the Lower Pawcatuck River, present potential areas for Fish Habitat Enhancement work under this project.

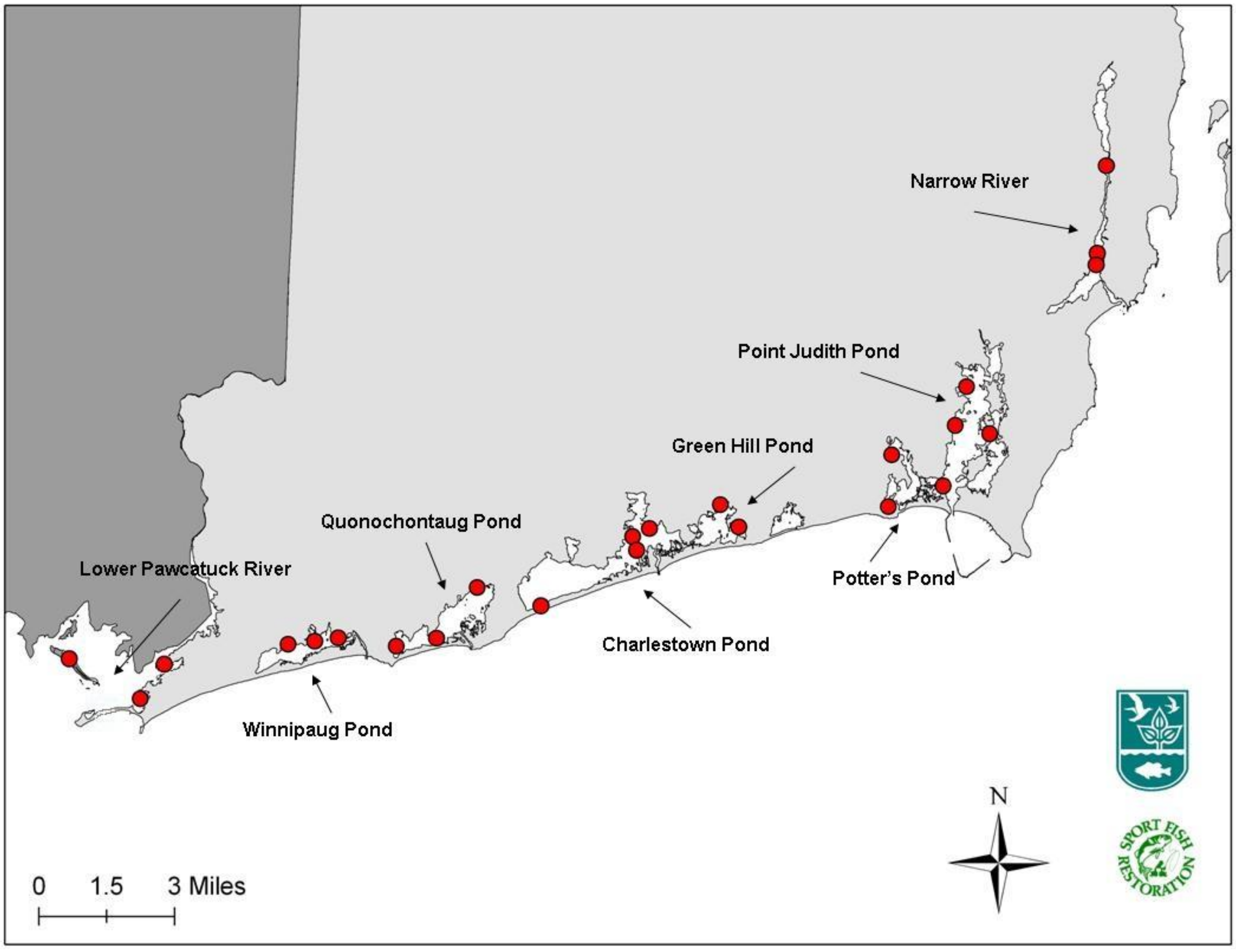


Figure 2. Oyster Habitat Suitably Index scores produced by the TNC oyster restoration suitability model for western- and central Ninigret Pond.

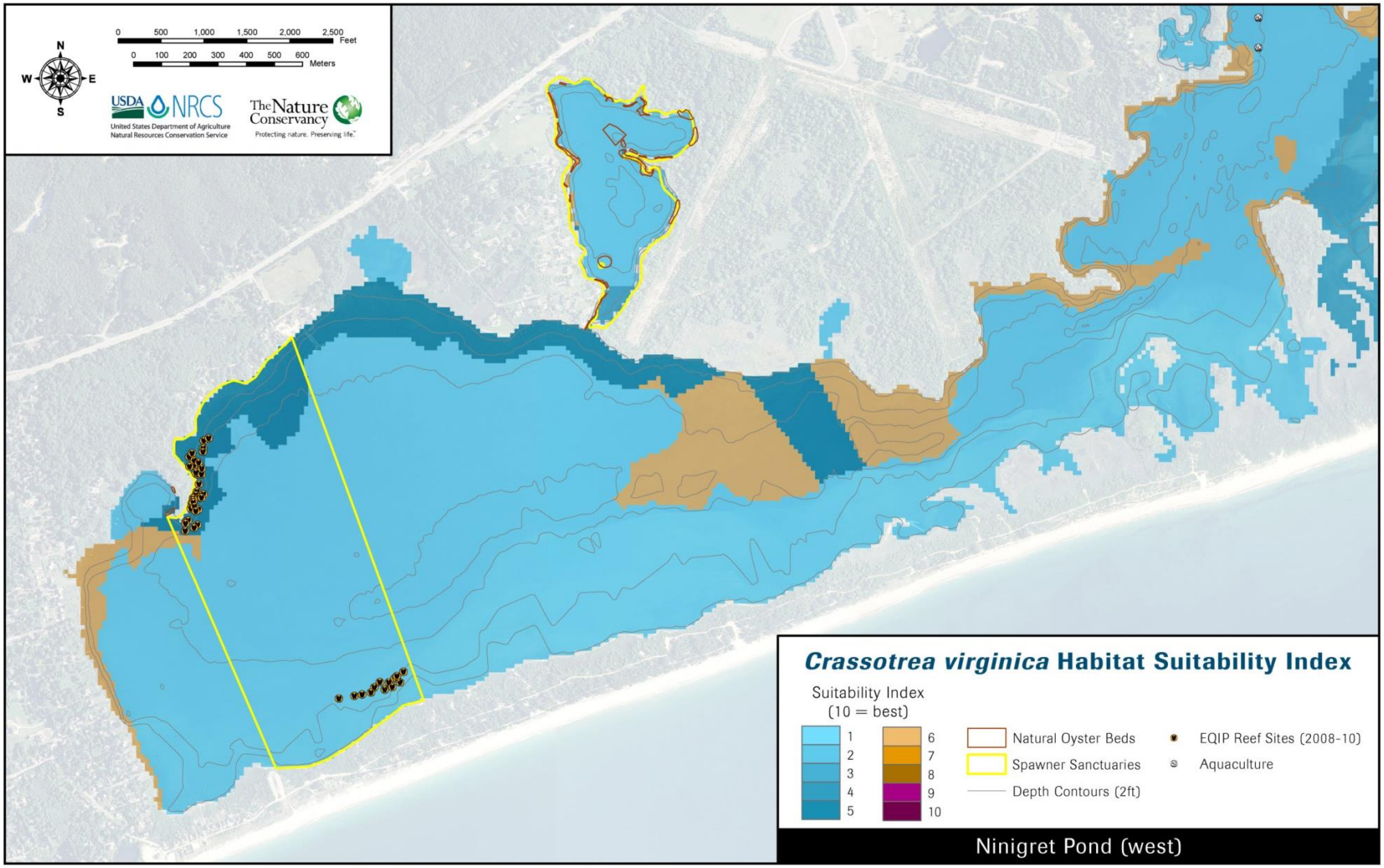


Figure 3. Output for TNCôs oyster restoration suitability model reflecting substrate suitability for Western- and Central-Ninigret Pond. This map conveys the first attempt of siting a 1-acre experimental (fish habitat enhancement oyster reef) and control plots.

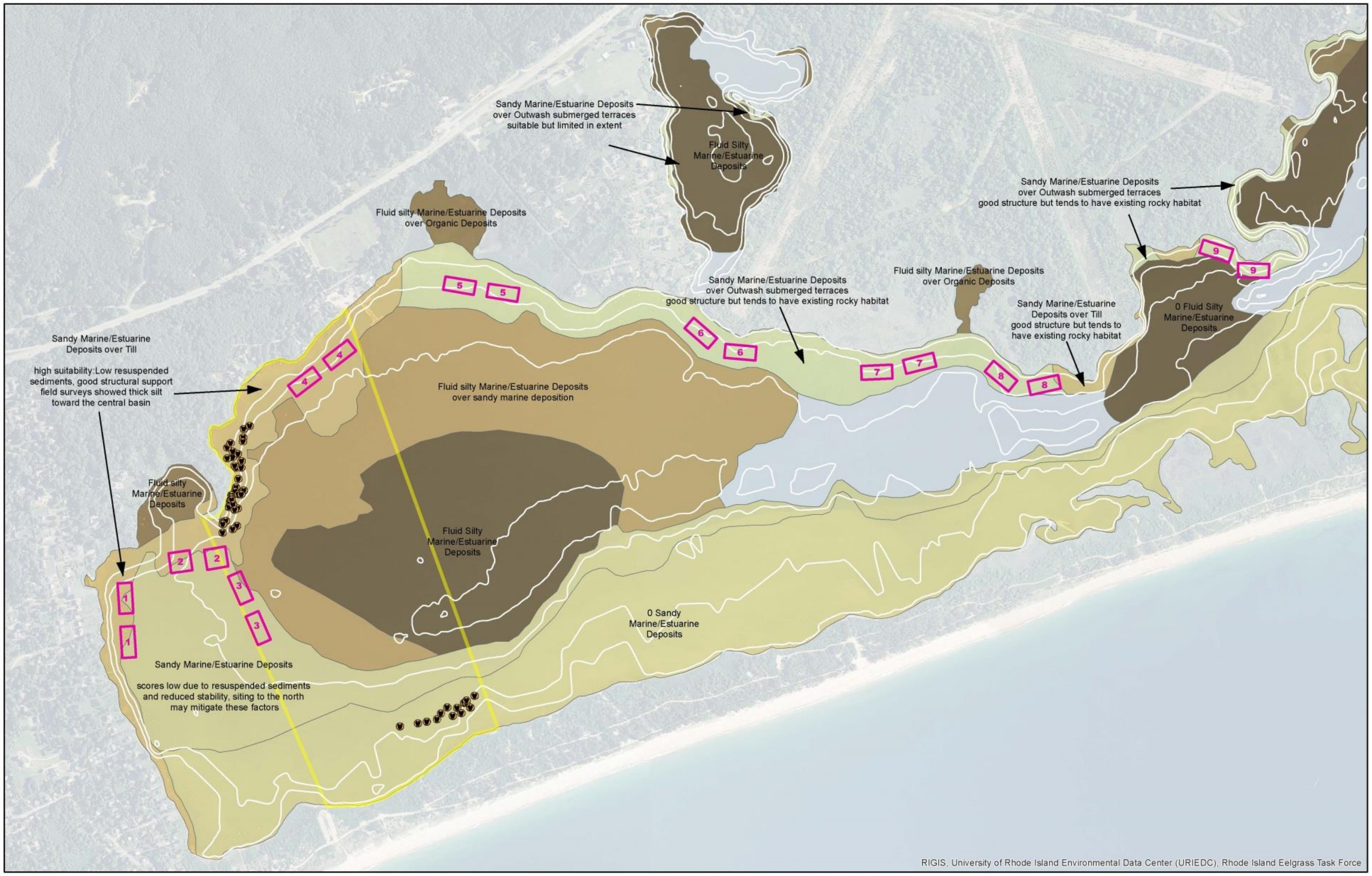


Figure 4. Output for TNCôs oyster restoration suitability model reflecting substrate suitability for the northern-end of the Ninigret Pond Shellfish Spawner Sanctuary. This map includes additional substrate information collected in the field during 2014 that was used to better define the transition from suitable to unsuitable substrates.

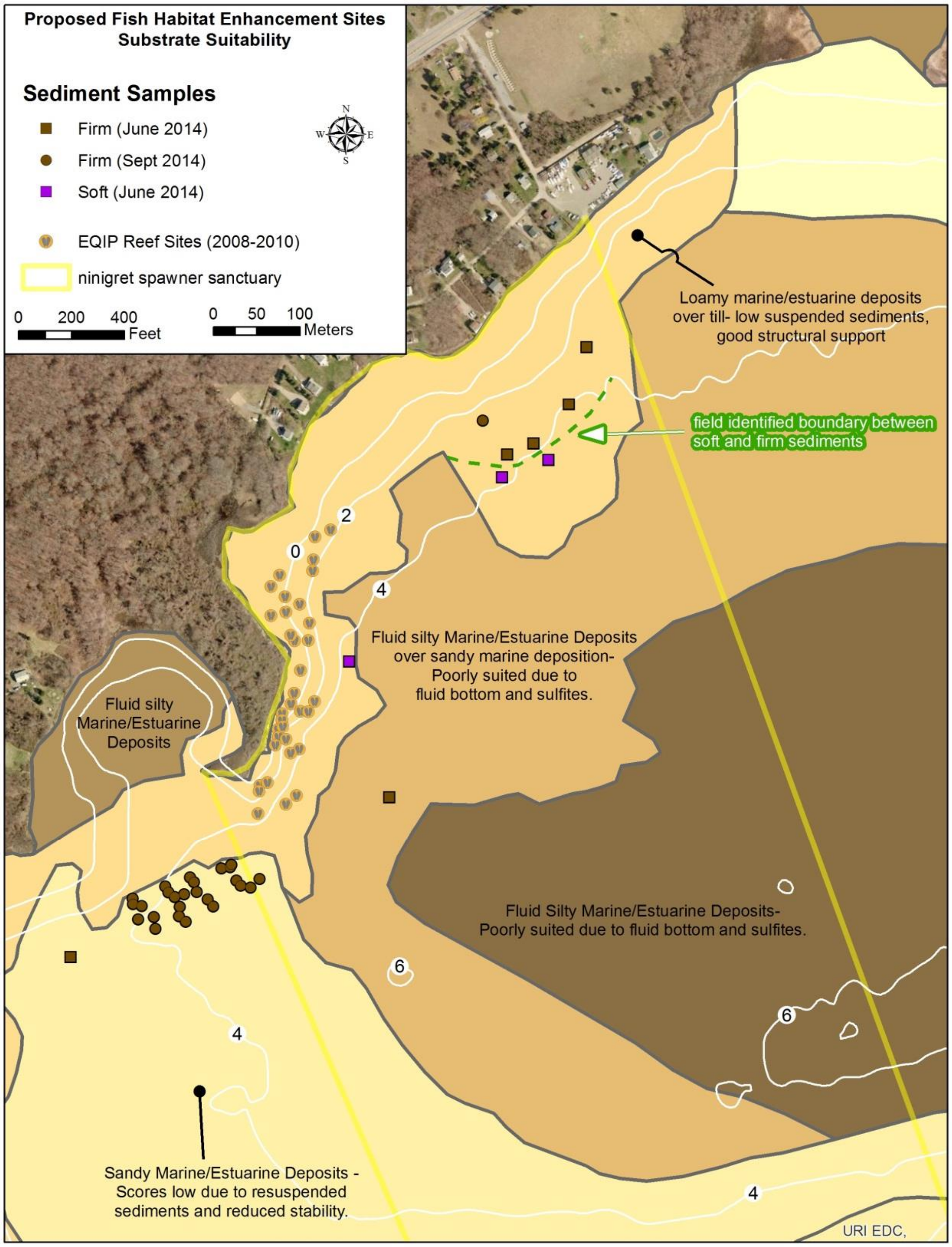


Figure 5. Output for TNCǒs oyster restoration suitability model reflecting substrate suitability, including additional information regarding substrates and boulder locations collected in the field during 2014 for northern-end of the Ninigret Pond Shellfish Spawner Sanctuary. This map depicts a *potential approach* that is being explored that could site several smaller reefs in areas with different substrate and suitability scores. This map is only conceptual at this time.

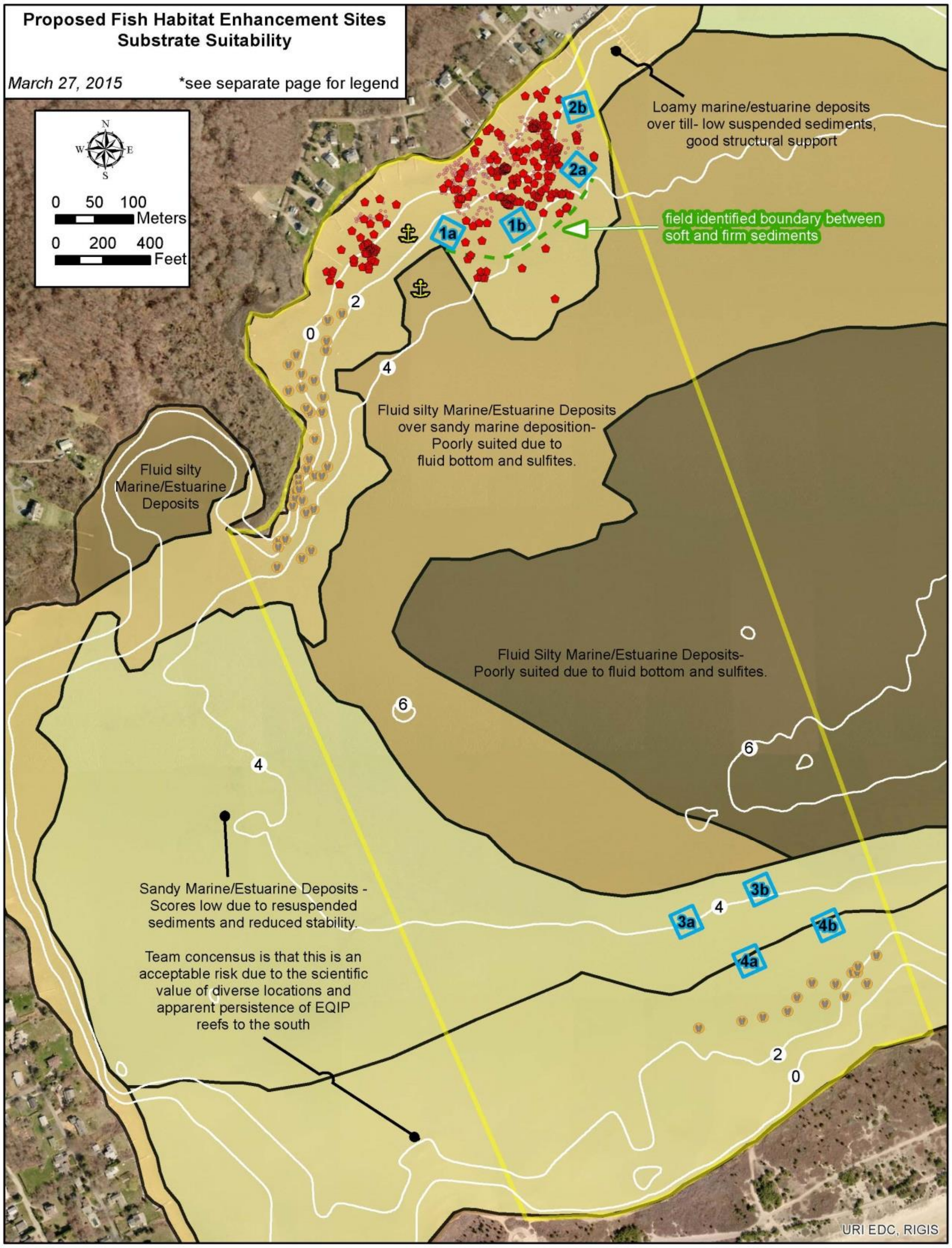
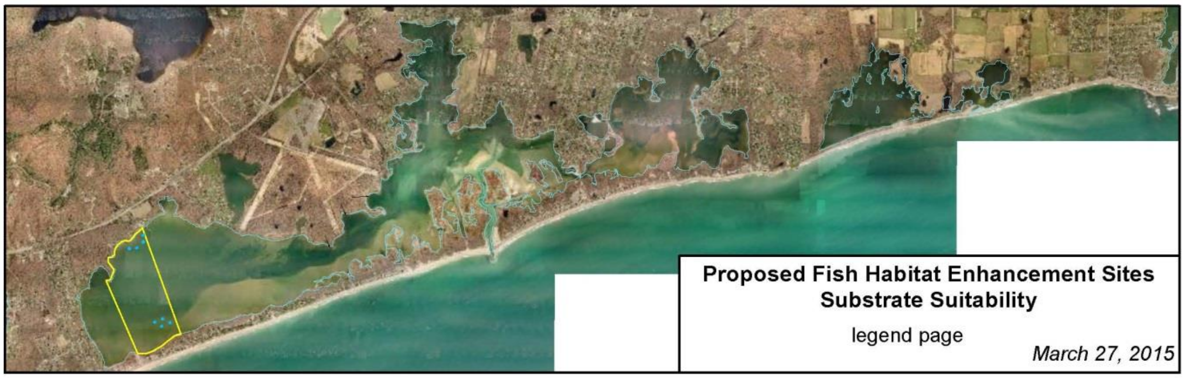


Figure 5. Continuedé



Ninigret Spawner Sanctuary

Proposed 1/4-acre Restoration Site Alternatives:
4 pairs (reef and control) of sites

site	SPF-X	SPF-Y	long	lat
1a	275,582	99,512	71 ° 41.474' W	41 ° 21.377' N
1b	275,876	99,545	71 ° 41.410' W	41 ° 21.383' N
2a	276,133	99,781	71 ° 41.354' W	41 ° 21.422' N
2b	276,132	100,044	71 ° 41.354' W	41 ° 21.465' N
3a	276,593	96,590	71 ° 41.252' W	41 ° 20.897' N
4a	276,860	96,424	71 ° 41.193' W	41 ° 20.869' N
4b	277,194	96,575	71 ° 41.120' W	41 ° 20.894' N
3b	276,906	96,726	71 ° 41.183' W	41 ° 20.919' N

Moorings Identified from 2012 Orthophotography
(not a comprehensive inventory)

EQIP Reef Sites (2008-2010)

2ft Bathymetric Contours

Rocks Identified from 2013 Pictometry Photograpghs
(visually identified only in the shallow region around sites 1 and 2)

Large

Small

Soil Parent Material

Sandy and gravelly marine/estuarine deposits over outwash

Sandy estuarine deposits; Sandy Estuarine Deposits

Loamy marine/estuarine deposits over till

Fluid silty estuarine deposits (thin) over sandy marine deposits

Fluid silty estuarine deposits over organic deposits

Fluid silty estuarine deposits (thick)

Sportfish Assessment and Management in Rhode Island Waters

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PROJECT NUMBER: F-61-R

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PROJECT TITLE: Assessment of Recreationally Important Finfish Stocks in Rhode Island Waters

PERIOD COVERED: January 1, 2014 ï December 31, 2014

JOB NUMBER 8 TITLE: Sportfish Assessment and Management in Rhode Island Waters
During this segment, several fish stock assessments were completed that included a tautog benchmark stock assessment, a menhaden benchmark stock assessment, a bluefish stock assessment update, and a summer flounder stock assessment update. In addition to completed stock assessments, there are several other stock assessments that have been initiated and are in progress including a scup benchmark stock assessment, a bluefish benchmark stock assessment, a multispecies stock assessment update, a benchmark sturgeon assessment, a black sea bass benchmark stock assessment, a weakfish benchmark stock assessment, and an American lobster benchmark stock assessment. RI also contributes local small scale stock assessments to help inform local management decisions, and these often rely on survey information that is derived from surveys funded by the sportfish restoration grant. Scientific advice to fisheries managers emerged from these assessments, particularly during the deliberations of the stateøs licensing provisions for 2014 as well as in the process for setting the recreational management plans for 2014 and 2015. The project leaders participated at the Atlantic States Marine Fisheries Commissionøs meetings relative to the management of recreationally important coastal stocks. They also participated in the National Marine Fisheries Service (NMFS) stock assessment meetings for species under their jurisdiction. Other project staff participated at fish stock assessment trainings conducted through ASMFC and NOAA. The status of the most important recreationally caught species in Rhode Island were presented in the finfish sector management plan which was submitted for public review and input for establishing management strategies for 2015 (Finfish Sector Management Plan 2015, see: http://www.dem.ri.gov/pubs/regs/regs/fishwild/mpfinfsh.pdf). The following is a summary of the activities that took place in 2014.

1. SUMMER FLOUNDER
Beginning when the new statistical catch at age stock assessment (ASAP = age structured assessment program) was introduced and peer reviewed in 2008, an annual update has been performed for the coastwide stock for summer flounder. These updates are less time consuming than full benchmark assessments, but still require some work to be able to perform the update. In 2013, a full benchmark assessment was performed and was peer reviewed at the SAW57 meeting (http://www.nefsc.noaa.gov/saw/saw57/Agenda-SAWSARC57-Rev%207242013.pdf). This assessment passed peer review and was updated for management use in 2014. The main tasks are to gather both catch and fishery independent information from the previous year, and stratify that information by age based on aging information from the NMFS trawl survey. RI contributes its Division of Fish and Wildlife trawl survey data (see job number 2 from this grant) to the assessment. Staff collects the information and age stratifies it for the assessment. Staff also participates in several meetings where the assessment information is released, and staff were active members of the southern

demersal working group that reviewed all of the update stock assessment information including data and research on summer flounder.

2. ATLANTIC MENHADEN

The ASMFC began a benchmark assessment in 2013 for the coastwide stock for Atlantic menhaden. The Atlantic menhaden stock is assessed with a statistical catch at age model called BAM (Beaufort Assessment Model). This is a full benchmark assessment, therefore is more time consuming than an update assessment, so while it was begun in 2013, it concluded in 2014. The main tasks were to gather both catch and fishery independent information from the previous year, and stratify that information by age based on aging information from the NMFS menhaden sampling program, which RI contributed locally caught samples to. RI contributes its Division of Fish and Wildlife seine survey data (see job number 4 from this grant) to the assessment, and the use of the RI trawl survey data (jobs 1 and 2 from this report) was a new addition to the assessment data elements for this benchmark assessment. Staff collects the information and processes it for the assessment. Staff also participates in meetings where the assessment information is reviewed and are active members of the stock assessment sub-committee. The benchmark assessment passed peer review in December of 2014 and is now being used for management changes to be developed during 2015.

3. BLUEFISH

Beginning when the new statistical catch at age stock assessment (ASAP = age structured assessment program) was introduced and peer reviewed in 2005, an annual update has been performed for the coastwide stock for bluefish. These updates are less time consuming than full benchmark assessments, but still require some work to be able to perform the update. The main tasks are to gather both catch and fishery independent information from the previous year, and stratify that information by age based on aging information from the bluefish aging program, which RI contributes to. Staff collects the aging structures and processes them for aging. Staff has also started to participate in the aging process (see job 9 from this report). Staff also participates in meetings where the assessment update information is released. A full benchmark was initiated in 2014 and will conclude in 2015. RI will be contributing both the trawl survey and seine survey information for the benchmark assessment, and staff will be invested in the development of all of the assessment information for use in the benchmark assessment with our partners at the ASMFC and NMFS.

4. ATLANTIC STURGEON

The ASMFC began a benchmark assessment in 2013 for the various stocks for Atlantic sturgeon. The Atlantic sturgeon stock is difficult to assess due to a lack of data. This is a full benchmark assessment, therefore is very time consuming and given the multistock nature of sturgeon, this assessment will take time to complete. While it was begun in 2013, it will not conclude until 2015 or perhaps even later. The main tasks are to gather both catch and fishery independent information from previous years. Staff collects the information and processes it for the assessment. Staff also participates in meetings where the assessment information is reviewed and are active members of the stock assessment sub-committee.

5. STRIPED BASS

The ASMFC began a benchmark assessment in 2013 for the coastwide stock for striped bass. The Atlantic menhaden stock is assessed with a statistical catch at age model called SCAM (Statistical Catch-at-age Assessment Model), though different model configurations were tested for the benchmark. This was a full benchmark assessment, therefore was more time consuming than an update assessment. The full benchmark assessment was performed and was peer reviewed at the SAW57 meeting (http://www.nefsc.noaa.gov/saw/saw57/Agenda-SAWSARC57-Rev%207242013.pdf), along with summer flounder. This assessment passed peer review in 2013 and was used for fisheries management in 2014 and 2015. The main tasks are to gather both catch and fishery independent information from the previous year, and stratify that information by age based on aging information from various sources, which RI contributed locally caught samples to. RI attempted to contributes its Division of Fish and Wildlife seine survey data (see job number 4 from this grant) to the assessment, however this survey did not make it in to the accepted assessment. Staff collects the information and processes it for the assessment. Staff also participates in meetings where the assessment information is reviewed.

6. TAUTOG

The ASMFC began a benchmark assessment in 2013 for the tautog stock. The tautog stock had been assessed with a Virtual Population Analysis, but for the benchmark several other data rich and data poor models will be tested. This is a full benchmark assessment, therefore is more time consuming than an update. The main tasks are to gather both catch and fishery independent information from the previous year, and stratify that information by age based on aging information that is collected in each state, and which RI contributed locally caught samples to. RI contributes its Division of Fish and Wildlife seine survey data (see job number 4 from this grant), trawl survey data (see jobs 1 and 2 from this document), and hopes to contribute the new ventless pot survey info in the future to the assessment. Staff collects the information and processes it for the assessment. Staff also participates in several meetings where the assessment information is reviewed and are active members of the stock assessment sub-committee. RI is contributed a novel data poor modeling approach to the benchmark review, a Bayesian State Space Surplus Production model. The benchmark assessment passed peer review in 2014 and will be used for management in 2015 (http://www.asmfc.org/uploads/file//55131e862015TautogAssessmentOverview_Feb2015.pdf).

7. LOBSTER

The ASMFC began a benchmark assessment in 2013 for the three American lobster stock units (gulf of Maine, Georges Bank, and Southern New England). The American lobster stocks are assessed with a statistical catch at length model developed by researchers from the University of Maine. This is a full benchmark assessment, therefore is more time consuming than an update assessment, so while it was begun in 2013, it continues to be developed and will go to review in 2015. The main tasks are to gather both catch and fishery independent information from the previous year, and stratify that information by length based on biosampling information from numerous sources, which RI contributed locally caught samples to. RI contributes its Division of Fish and Wildlife trawl survey data (see job numbers 1 and 2 this grant) and ventless trap survey information to the assessment. Staff collects the information and processes it for the assessment. Staff also participates in meetings where the assessment information is reviewed and are active members of the stock assessment sub-committee.

8. MULTISPECIES ASSESSMENT

The ASMFC began a multispecies update assessment in 2013 to coincide with the benchmark assessment for Atlantic menhaden. The current multispecies assessment is performed using a Virtual Population Analysis called the MSVPA. This is only an update, but the multispecies assessment is very data intensive, and therefore is more time consuming than a normal single species update assessment. The main species modeled are menhaden, striped bass, bluefish, and weakfish, but there is also a slew of additional species that are modeled to make a realistic ecosystem. The main tasks are to gather both catch and fishery independent information from previous years. Staff collects the information and processes it for the assessment. Staff also participates in several meetings where the assessment information is reviewed and are active members of the stock assessment sub-committee. This updated ended in 2014. In addition to the MSVPA, RI staff are also developing a new approach for this same suite of recreationally important species, namely a multispecies statistical catch-at-age assessment. This new modeling approach will continued to be developed in to 2015.

9. BLACK SEA BASS

Beginning when the new statistical catch at length stock assessment (SCALE = statistical catch at length) was introduced and peer reviewed in 2008, an annual update has been performed for the coastwide stock for black sea bass. These updates are less time consuming than full benchmark assessments, but still require some work to be able to perform the update. In 2012, a full benchmark assessment was performed and was peer reviewed which switched to a statistical catch at age modeling framework. This assessment did not pass peer review so has not been used for management. A new benchmark assessment was initiated in 2014 and will go to review in 2015. The main tasks are to gather both catch and fishery independent information and stratify that information by age based on aging information from the NMFS trawl survey. RI contributes its Division of Fish and Wildlife trawl survey data (see job number 2 from this grant) to the assessment. Staff collects the information and age stratifies it for the assessment. Staff also participates in meetings where the assessment information is released, and staff are active members of the southern demersal working group. In addition to our participation with our federal and state partners, RI staff will be developing an alternative catch at age model that incorporates spatial considerations in to the modeling framework.

10. SCUP

Beginning when the new statistical catch at age stock assessment (ASAP = age structured assessment program) was introduced and peer reviewed in 2008, an annual update has been performed for the coastwide stock for scup. These updates are less time consuming than full benchmark assessments, but still require some work to be able to perform the update. In 2014, a full benchmark assessment was initiated for scup and will be reviewed in 2015. The main tasks are to gather both catch and fishery independent information from the previous year, and stratify that information by age based on aging information from the NMFS trawl survey. RI contributes its Division of Fish and Wildlife trawl survey data (see job number 2 from this grant) to the assessment. Staff collects the information and age stratifies it for the assessment. Staff also participates in meetings where the assessment information is released, and staff will be active members of the southern demersal working group that will review all of the update stock assessment information including data and research on scup.

11. 2015 SCHEDULE

As previously noted, several stock assessments were initiated in 2014, and are scheduled to conclude in 2014. A winter flounder benchmark assessment is scheduled for 2015, a black sea bass benchmark assessment is scheduled for 2015, a bluefish benchmark assessment is scheduled for 2015, a weakfish benchmark assessment is scheduled for 2015, and a scup update assessment is scheduled for 2015.

ASSESSMENT OF RECREATIONALLY IMPORTANT FINFISH STOCKS IN RHODE ISLAND WATERS

Age and Growth Study

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March 2015

PERFORMANCE REPORT

STATE: Rhode Island **PROJECT NUMBER:** F-61-R
SEGMENT NUMBER: 21

PROJECT TITLE: Assessment of Recreationally Important Finfish Stocks in Rhode Island Waters

PERIOD COVERED: January 1, 2014 ï December 31, 2014

JOB NUMBER AND TITLE: 9, Age and Growth Study

JOB OBJECTIVE: To collect age, growth, and diet composition data on recreationally and ecologically important finfish in Narragansett Bay for management purposes. Data collected in this study will be used in state, regional and coast-wide fisheries management.

SUMMARY: Investigators collected lengths, weights, and age structures from target species of recreationally important finfish. The type of age structure collected and the number of samples collected varied by species. Investigators were able to achieve most sampling targets in 2014; however some targets were not met due to staff limitations and cancellation of sampling trips due to adverse weather (i.e. tautog). Investigators continued to utilize recreational fishing groups in 2014, specifically, the Rhode Island Party and Charter Boat Association (RIPCBA), to obtain fish racks. The donation of fish racks decreases the amount of time that investigators need to be in the field collecting samples and allows more time for processing and ageing the collected structures. Work to age the structures collected in 2014 is complete, except for winter flounder. Once staff is able to receive training on ageing winter flounder, those samples will be aged.

Additionally, investigators initiated collection of stomach content and maturity stage data from these species in 2014.

TARGET DATE: Ongoing

STATUS OF PROJECT: On schedule

SIGNIFICANT DEVIATIONS: Stomach content and maturity stage data collection was added to this job in 2014.

RECOMMENDATIONS: Finish ageing structures collected in 2014 and move into the next project segment for 2015. Continue to train the new staff member on ageing hard parts and continue to participate in ageing workshops as they occur through the Atlantic States Marine Fisheries Commission (ASMFC).

REMARKS: For the remainder of 2015 investigators will focus on ageing the remaining structures collected in 2014 and begin the 2015 field sampling season.

INTRODUCTION

Age and growth information is essential in estimating the age-structure of a fish population. Understanding the age-structure of a population allows scientists to make informed management decisions regarding acceptable harvest levels for a species. In recent years, diet composition of finfish has become increasingly important in understanding the age and growth of a population. Diet composition of a species may help to inform managers on whether an observed change in a population may be due to prey availability. Understanding predator ï prey dynamics can also allow managers to utilize a multi-species modeling approach by which they can better understand not only the population dynamics of one particular target species, but other choke or prey species that may be associated with the target species.

This study is aimed to characterize the age-structure and diet composition of stocks whose ranges extend into Narragansett Bay and will supplement data collected in the Northeast Fisheries Science Center (NEFSC) spring and fall surveys, which limit their sampling to the mouth of Narragansett Bay. Data collected in this study is already used in several stock assessments and we expect that number to increase each year as benchmark stock assessments are conducted. Additionally, this study satisfies the requirements of the Atlantic States Marine Fisheries Commission (ASMFC) Fishery Management Plans (FMPös) for striped bass, tautog, bluefish and weakfish which require the state of Rhode Island to collect a minimum number of age and growth samples annually for stock assessment purposes. This study has also been designed to use other jobs in this grant as a platform for obtaining biological samples.

Collection of stomach content and maturity stage data for the species listed above was initiated in 2014. This task also included collection of both scale and otolith samples for ageing, except for menhaden for which only scale samples were taken and weakfish for which only otolith samples were taken.

METHODS, RESULTS & DISCUSSION

Seasonal port sampling of nine species of finfish considered to be extremely important to the recreational fishing community was conducted primarily from May through November of 2014. Data collected included lengths, weights and the appropriate age structure for the specific species (i.e. scale, otolith, or operculum). The number of samples and age structures collected varied depending on the species (Table 1). Investigators focused on obtaining samples from various locations throughout the state from various finfish dealers, recreational anglers, commercial floating fish trap companies, a commercial purse seine company, and RIDFW surveys (otter trawl and fish pot) (Table 2).

Diet composition data was collected for high priority species by excising fish stomachs from fish collected during the RIDEM seasonal and monthly bottom trawl surveys or from fish racks donated by recreational fishermen. Additional data collected from these samples included length, weight (if whole fish available), sex, and maturity. Once stomachs were removed, they were analyzed in the laboratory by sorting and identifying prey to the lowest taxonomic level possible and recording the wet mass for each taxon. All collected data were entered and stored in a database.

Black sea bass

A total of 125 black sea bass age samples were collected from multiple sources including floating fish traps, hook and line, and RIDFW otter trawl and fish pot surveys in 2014. Currently the use of scales is an acceptable ageing technique for black sea bass; however some labs that have fishery independent surveys along the Atlantic coast use a combination of scales and otoliths. In the future, scales will be the primary age structure collected by project staff and when available, otoliths may be collected as well. Black sea bass samples ranged in size size from 4-21 inches total length and were 2-8 years old (Figure 1). Stomach content and maturity stage data was collected from 49 black sea bass. Stomach contents included prey items from 6 taxonomic groups (Table 3). The proportional contribution of stomach contents encountered is shown in Figure 9.

Bluefish

The ASMFC requires that a minimum of 100 bluefish age samples be collected annually by the state of Rhode Island. Due to the assistance of the RIPCBA and RIDFW otter trawl survey, we successfully collected 92 bluefish age samples in 2014. Bluefish have very fragile otoliths, and due to breakage during otolith removal, we fell slightly short of our target of 100 structures. Bluefish samples ranged in total length from 11-35 inches and 0-9 years old (Figure 2). Stomach content and maturity stage data was collected from 6 bluefish. Stomach contents included prey items from 2 taxonomic groups (Table 3). The proportional contribution of stomach contents encountered is shown in Figure 9.

Menhaden

Atlantic menhaden age samples were collected in 2014 from floating fish trap and purse seine operations. Typically scale samples collected from menhaden are sent to the NMFS Southeast Fisheries Science Center (SEFSC) Beaufort Lab for ageing due to the degree of difficulty in ageing Atlantic menhaden. In 2014 however, the ASMFC conducted a hard parts exchange of menhaden scales and in early 2015 held an ageing workshop to train state and federal agencies on ageing menhaden. As a result, DFW staff aged all menhaden scales collected in 2014 but will also be sending scale samples to the NEFSC so that our ages can be validated. A total of 79 menhaden scale samples were aged. Menhaden samples ranged in length from 10-15 inches and 1-6 years old (Figure 3). Stomach content and maturity stage data was collected from 23 menhaden. Stomach contents encountered were all liquefied, with prey item(s) unable to be identified and classified (Table 3). The proportional contribution of stomach contents encountered is shown in Figure 9.

Scup

Scup age samples were collected in 2014 from multiple sources including floating fish traps, hook and line, and RIDFW otter trawl and fish pot surveys. Investigators successfully collected scales from 139 scup ranging in fork length from 6-14 inches and

1-9 years old (Figure 4). Stomach content and maturity stage data was collected from 27 scup. Stomach contents included prey items from 4 taxonomic groups (Table 3). The proportional contribution of stomach contents encountered is shown in Figure 9.

Striped Bass

A total of 168 striped bass scale samples were collected and aged in 2014. Each year investigators set a sampling target of 150 samples from floating fish traps and 150 samples from the rod and reel fishery. Floating fish traps have a minimum size of 26ò while the commercial rod and reel has a minimum size of 34ò. Sampling from both of these operations allows us to sample a wider size range striped bass. Additionally, 3 of the 168 striped bass age samples were collected from the DFW otter trawl survey. Striped bass sampled ranged from 13-48 inches fork length and 4-17 years old (Figure 5). Stomach content and maturity stage data was collected from 3 striped bass. Stomach contents included prey items from 2 taxonomic groups (Table 3). The proportional contribution of stomach contents encountered is shown in Figure 9.

Summer Flounder

A total of 50 summer flounder scale samples were collected in 2014. The majority of these samples were collected by DFW staff on board our DFW trawl survey (jobs 1 and 2 of this grant) and additional samples came from the floating fish trap fishery. Summer flounder samples collected varied in size from 7-26 inches and 0-5 years old (Figure 6). Stomach content and maturity stage data was collected from 26 summer flounder. Stomach contents included prey items from 4 taxonomic groups (Table 3). The proportional contribution of stomach contents encountered is shown in Figure 9.

Tautog

A total of 117 tautog operculum samples were collected in 2014 from the hook and line fishery and RIDFW fish pot survey. Tautog sampled ranged from 7-24 inches total length and 1-16 years old (Figure 7). Stomach content and maturity stage data was collected from 17 tautog. Stomach contents included prey items from 2 taxonomic groups (Table 3). The proportional contribution of stomach contents encountered is shown in Figure 9.

Weakfish

The state of Rhode Island is required to collect three age structures per metric ton of weakfish landed commercially in the state by the ASMFC. In 2014, this would have resulted in a sampling target of 43 fish. In recent years weakfish have become scarce in RI which has resulted in extreme difficulty in obtaining samples. Investigators now purchase fish directly from seafood dealers for market value to ensure that they can obtain samples. A total of 82 weakfish otolith samples were collected in 2014. Weakfish sampled ranged from 12-28 inches fork length and 1-5 years old (Figure 8). Stomach content and maturity stage data was collected from 13 weakfish. Stomach contents included prey items from 4 taxonomic groups (Table 3). The proportional contribution of stomach contents encountered is shown in Figure 9.

SUMMARY

In 2014 investigators were able to collect the target sample numbers for black sea bass, scup, and weakfish; target sample numbers were not achieved for bluefish (92/100), menhaden (79/100), striped bass (168/150 per gear type), summer flounder (50/100), and tautog (117/200). In most cases where the sample target was not achieved, this was due to staff availability, fish availability or inclement weather. In 2015, staff has already devised a more rigorous sampling protocol by reaching out to additional seafood dealers and recreational community to ensure that the target number of samples is met for each species. Additionally, staff will work to collect a greater number of fish stomachs for each species in 2015 now that the protocols begun in 2014 have been refined. Training of the new staff member assigned to this project is still ongoing and will continue into 2015. Processing and ageing of all hard parts is complete for 2014, except for winter flounder, which will require staff training. Staff participated in two ageing workshops in 2014, a scup and summer flounder workshop and an Atlantic menhaden workshop. Staff will continue to participate in ASMFC ageing workshops as they occur.

FIGURES

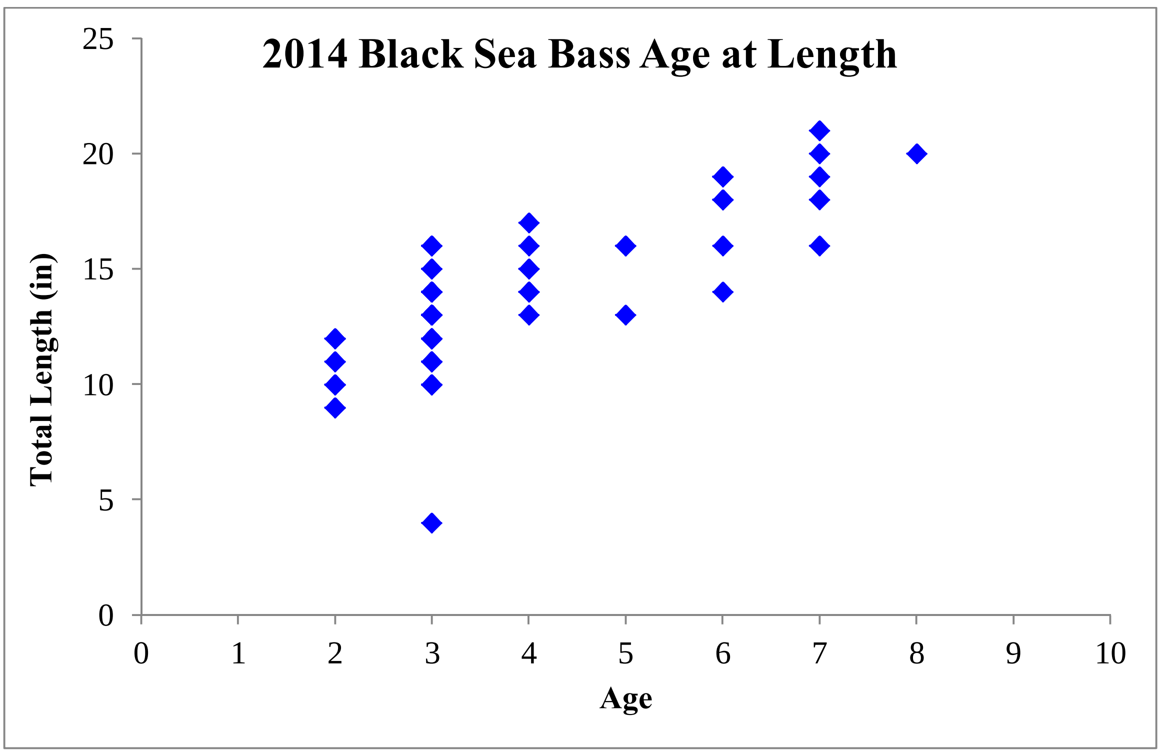


Figure 1. Black sea bass age at length.

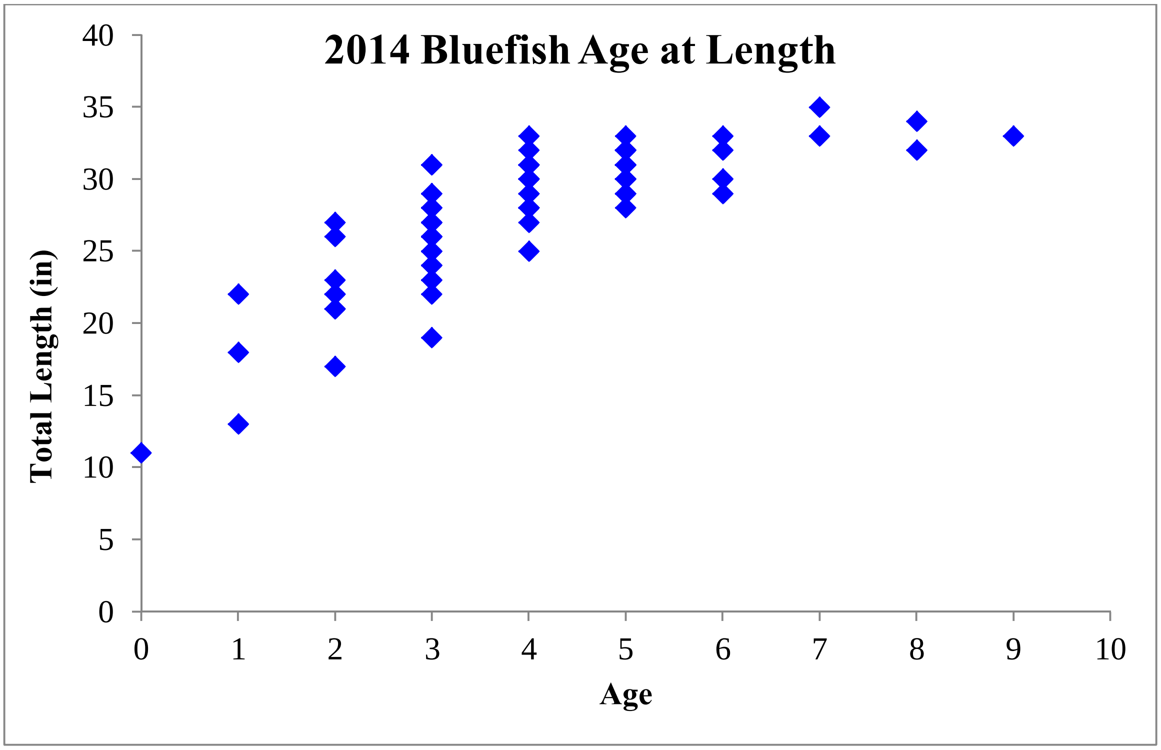


Figure 2. Bluefish age at length.

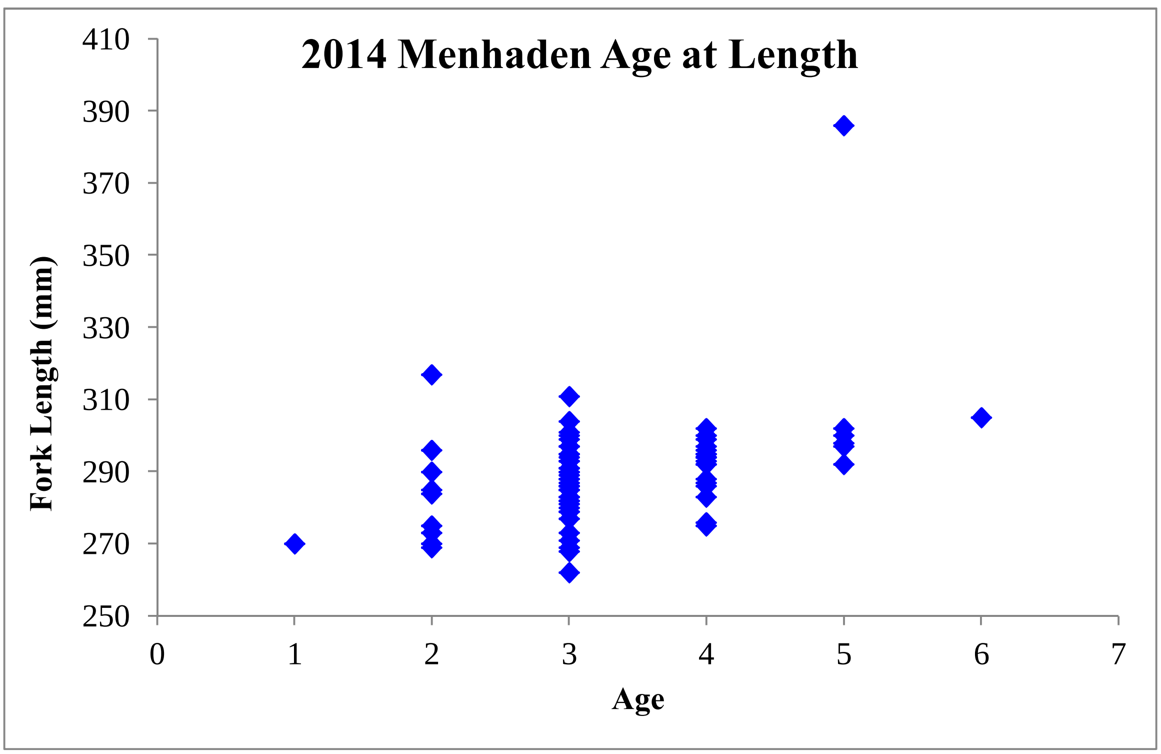


Figure 3. Menhaden age at length.

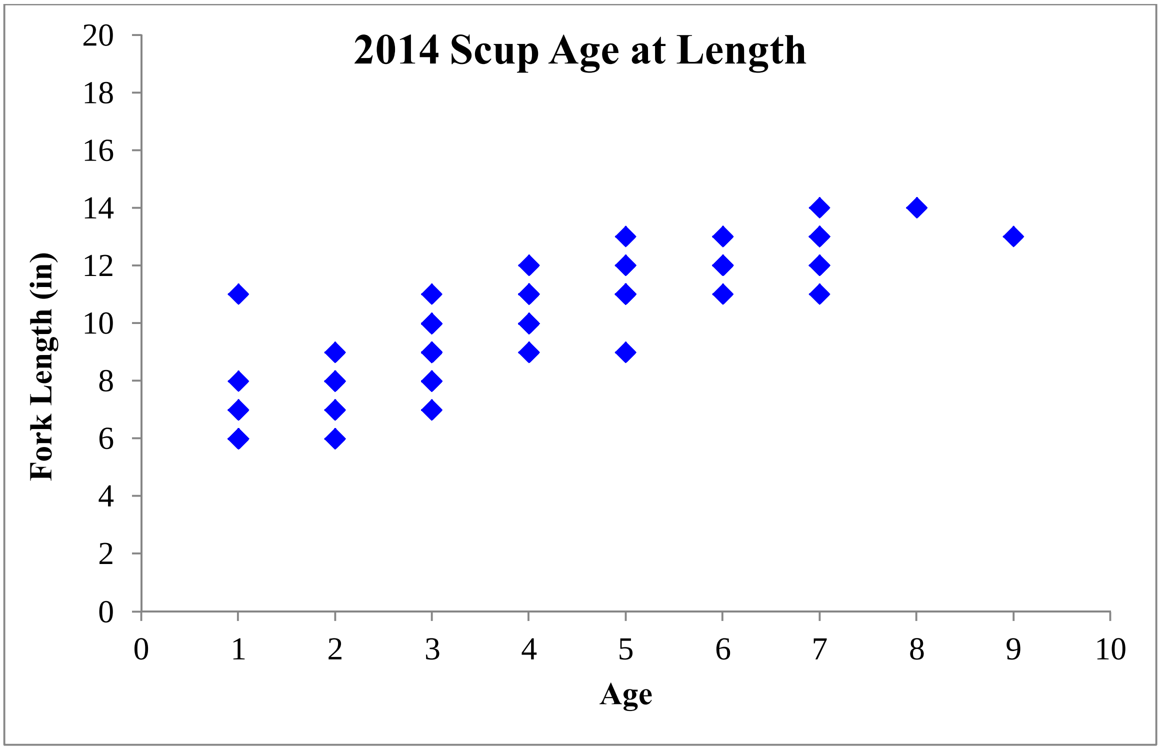


Figure 4. Scup age at length.

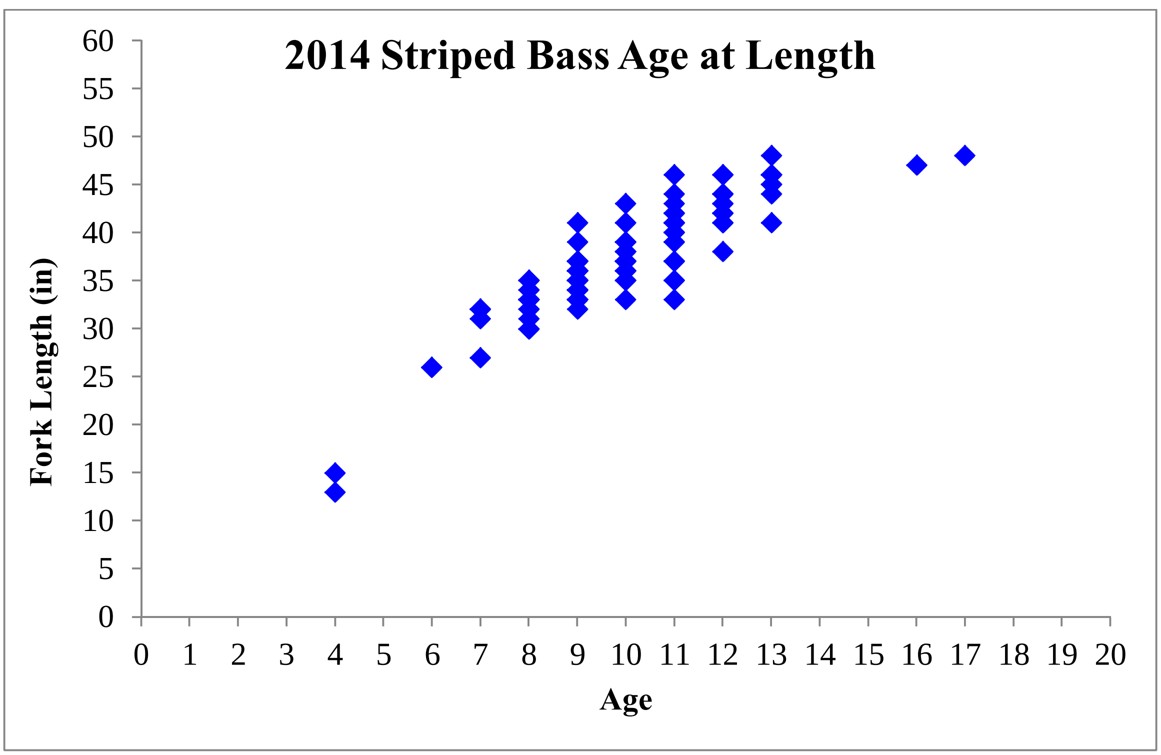


Figure 5. Striped bass age at length.

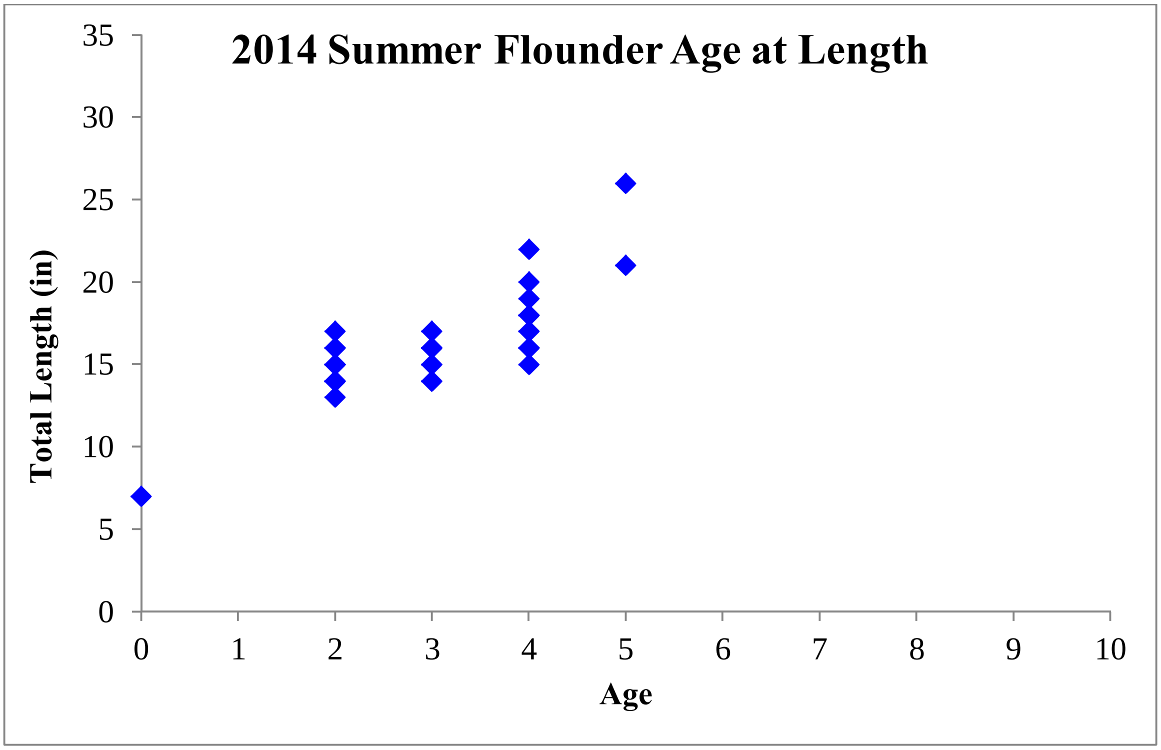


Figure 6. Summer flounder age at length.

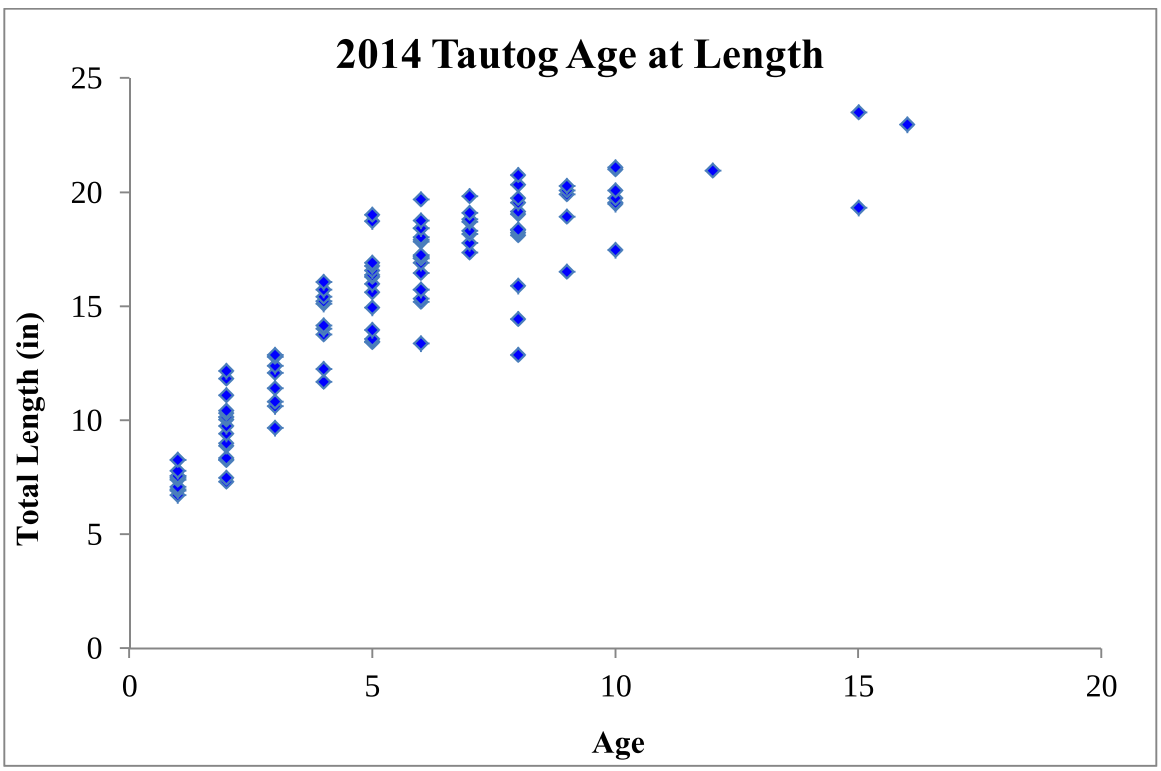


Figure 7. Tautog age at length.

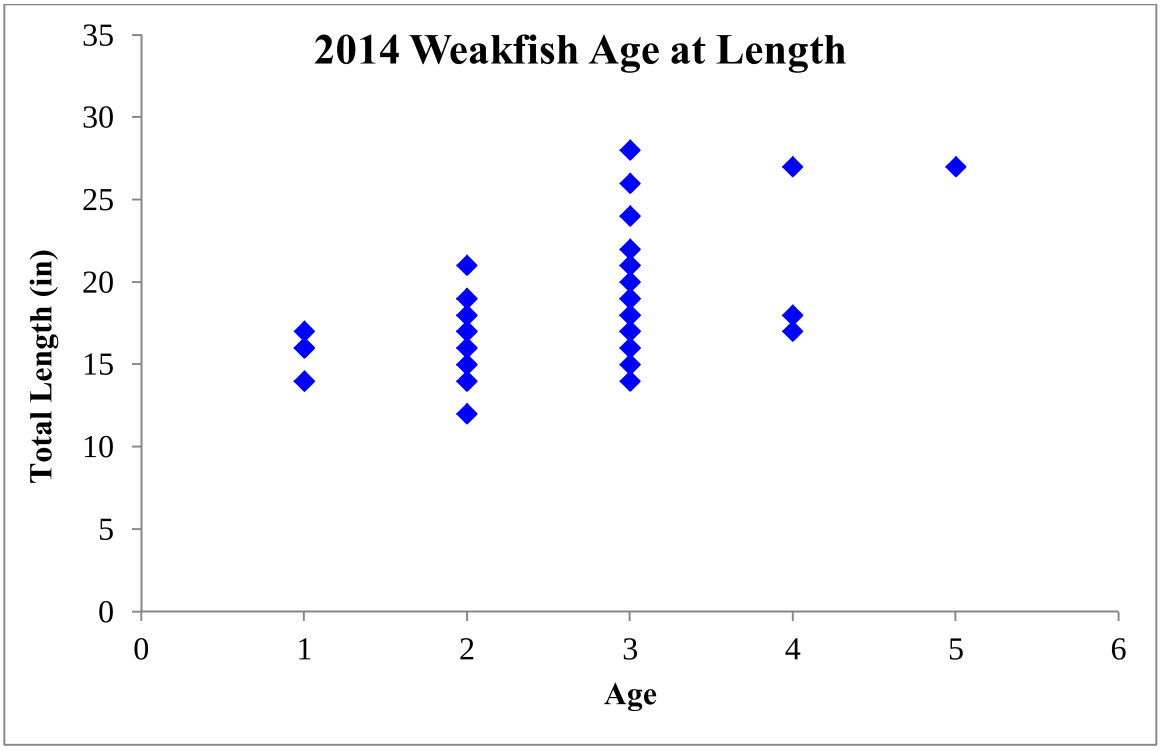


Figure 8. Weakfish age at length.

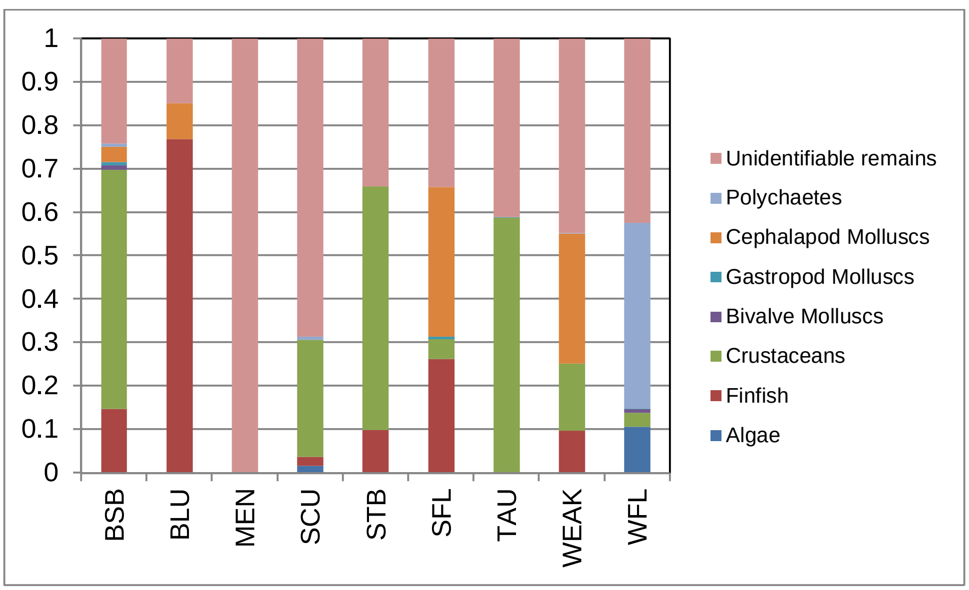


Figure 9. Proportional contribution of stomach content types by species.

TABLES

Table 1. Species, number of ageing structures, and number of fish sampled in 2014.

Common name	Ageing structure	Target number of ageing structures	Number of ageing structures collected
Black sea bass	Scale	100	125
Bluefish***	Otolith	100	92
Menhaden	Scale	100	79
Scup	Scale	100	139
Striped bass	Scale	150 fish/gear type**	168
Summer Flounder	Scale	100	50
Tautog	Operculum/Otolith	200	117
Weakfish	Otolith	3 fish aged per metric ton landed*	82
Winter Flounder	Scale	NA	19

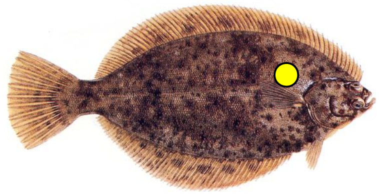
*Per ASMFC FMP requirements, 43 ages required for 2014
**Gear types include floating fish traps and rod & reel
***Required by ASMFC

Table 2. Gear type sampled for each species collected in 2014 (FFT=Floating Fish trap).

Common name	Gear Type
Black sea bass	FFT, Hook and Line, Fish Pot, Otter Trawl
Bluefish	Hook and Line, Otter Trawl
Menhaden	FFT, Purse Seine
Striped bass	FFT, Hook and Line, Otter Trawl
Scup	FFT, Hook and Line, Fish Pot, Otter Trawl
Summer Flounder	FFT, Hook and Line, Fish Pot, Otter Trawl
Tautog	Hook and Line, Fish Pot
Weakfish	Otter Trawl
Winter Flounder	Otter Trawl

Table 3. Summary of stomach content sampling by species.

SPECIES	# STOMACHS	# PREY TAXA
Black Sea Bass	49	6
Bluefish	6	2
Menhaden	23	0
Scup	27	4
Striped Bass	3	2
Summer Flounder	26	4
Tautog	17	2
Weakfish	13	4
Winter Flounder	19	5



Assessment of Recreationally Important Finfish Stocks in Rhode Island Coastal Waters

Winter Flounder Spawning Stock Biomass Survey in Pt. Judith Pond ,RI

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Rhode Island Department of Environmental Management
Federal Aid in Sportfish Restoration
F-61-R

Performance Report March, 2015

State:	Rhode Island	Project Number: F-61-R-21

Project Title: Assessment of Recreationally Important Finfish Stocks in Rhode Island Waters

Period Covered: January 1, 2005 - May 30, 2014

Job Number and Title: Job III - Spawning Stock Biomass (SSB) in Rhode Island Coastal Ponds.

Job Objective: To support a seasonal Young of the Year Winter flounder survey by providing data on the dynamics and abundance of the spawning population of winter flounder in Rhode Island coastal ponds.

Significant Deviations: None

Summary: In 1999 the Rhode Island Coastal Ponds Project was expanded to support an adult winter flounder monitoring and tagging project. This winter phase of the seasonal coastal pond juvenile flounder work was an opportunity to collect data on the adult spawning populations of winter flounder in the south shore coastal ponds. An experimental winter flounder tagging study and monitoring project could be conducted with little additional funding or manpower. A commercial fisherman who had historically fished for winter flounder in the coastal ponds agreed to assist the RI Marine Fisheries staff and get the survey off the ground.

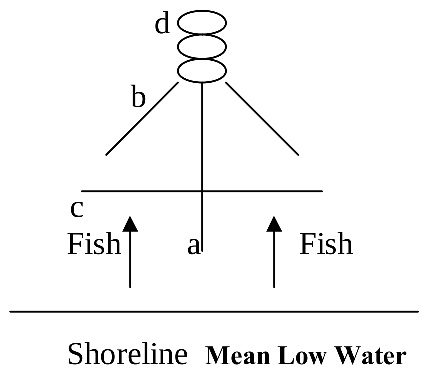
The research project runs from January - May annually. Fishing gear is deployed depending on ice cover in the ponds and the gear is generally hauled on three to seven night sets. There are a total of eight stations where data exists, all found in the Pt. Judith Pond system including Potters Pond. (NOAA Nautical Chart 13219) These two ponds use the same breach to connect to Block Island and Rhode Island Sounds.

Additional Research : In 2012 an additional coastal pond system was added to the survey. As adult winter flounder abundance in the Point Judith system declined to all time lows, an adjacent pond, Charlestown Pond, also know as Ninigret Pond (NOAA Nautical Chart 13205) was surveyed during the same time period and continued during the 2014 sampling year. Rhode Island Coastal Trawl Survey data (Spring Survey) shows a sharp increase in relative abundance in the Block Island Sound area. This appears to be a similar trend in the Charlestown Pond system. If, through this continuation of the multiple sampling areas, Point Judith continues to experience low abundance and recruitment while other area surveys show a diverging trend then the assumption would be that the Point Judith system is having localized winter flounder depletion from sources other than fishing mortality. Commercial fishing activity in Block Island Sound is also returning valuable tag recapture information from the Charlestown Pond sampling, that which is now missing from the Point Judith Pond survey due to the inability to catch enough fish to tag. The Environmental Protection Agency partners in this project on Charlestown Pond and currently has collected data during two winter survey seasons. In the future this data set will be added to the current Adult Winter Flounder time series which was existed since 1999.

Methods and Materials:

Fyke Nets are a passive fixed fishing gear, attached perpendicular to the shoreline at mean low water. A vertical section of net wall or leader directs fish toward the body of the net where the catch is funneled through a series of parlors, eventually being retained in the terminal parlor. The wings of the net accomplish further direction of the catch.

Net dimensions:
a. Leader - 100'
b. Wings - 25'
c. Spreader Bar - 15'
d. Net parlors ï 2.5ô
Mesh size - 2.5" throughout



Station water profile:
Depth / turbidity - feet
Dissolved oxygen - mg/l
Salinity - ppt
Temperature - degree C

Fieldwork:

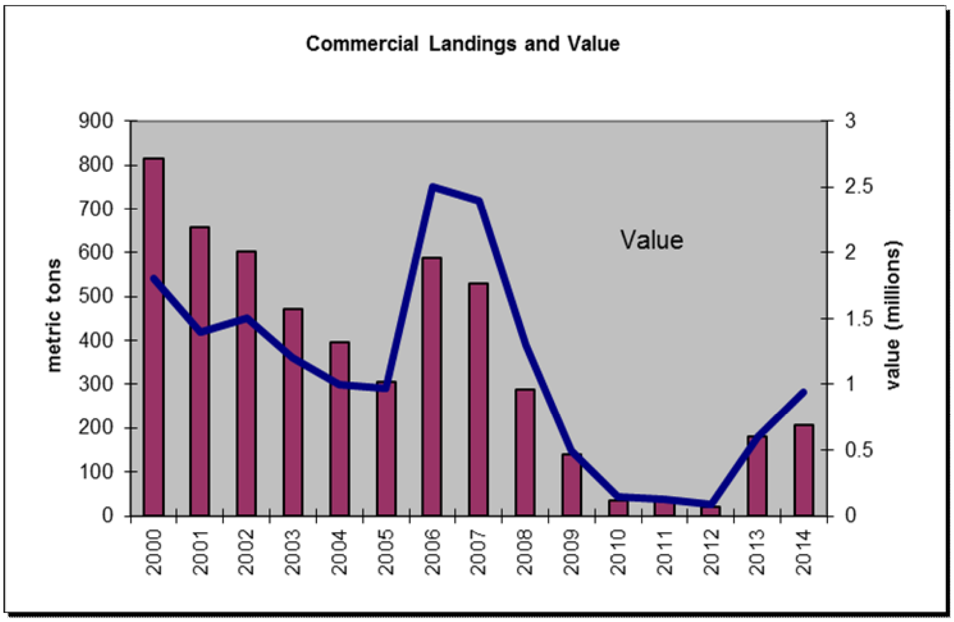
Three fyke nets were set at three fixed stations in Pt. Judith and Potter Ponds during January and April in 1999 - 2001 and two nets were set at four fixed stations from 2002 to present. The nets are fixed at mean low water and set perpendicular to the shoreline. Fyke nets are a passive fishing gear and allow the catch to be retained alive for a short period of time. Nets are tended from two to seven days depending on the size of the catch and weather conditions. Higher catches increase density inside the net and attract predators such as cormorants, seals and otters thus increasing survey-induced mortality.

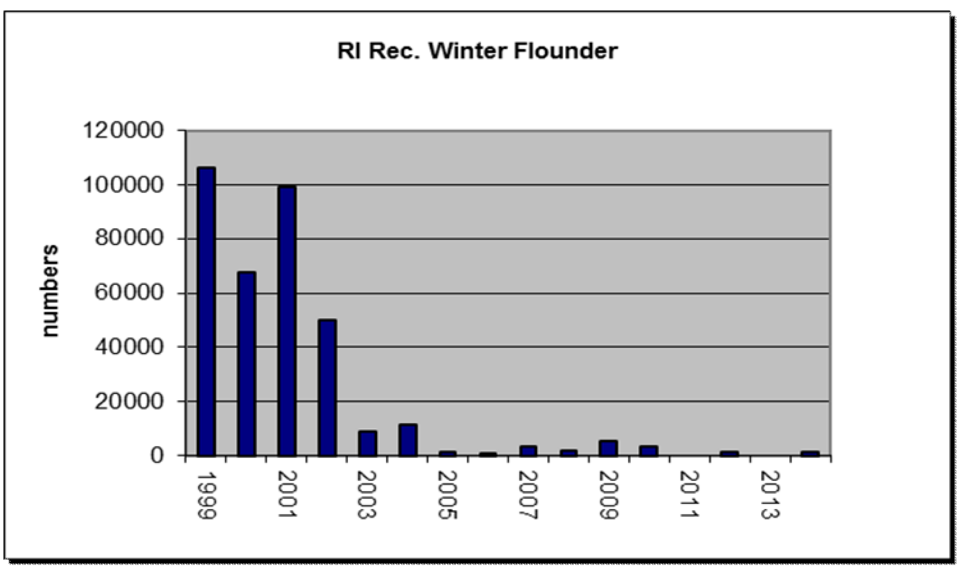
All fish captured are measured, sexed, enumerated and categorized to describe spawning stage. Spawning stage is defined as ripe (pre-spawn), ripe/running (active spawn), spent (post-spawn), resting (non-active spawn) and immature. These data illustrate how the spawning activity of flounder advances throughout the duration of the survey season. This is useful in determining the potential impacts of coastal zone activities such as harbor and breach way dredging and pier construction.

Fish of legal size, 30.48 cm or recruits to the fishery are tagged and released away from the capture area.

Fisheries:

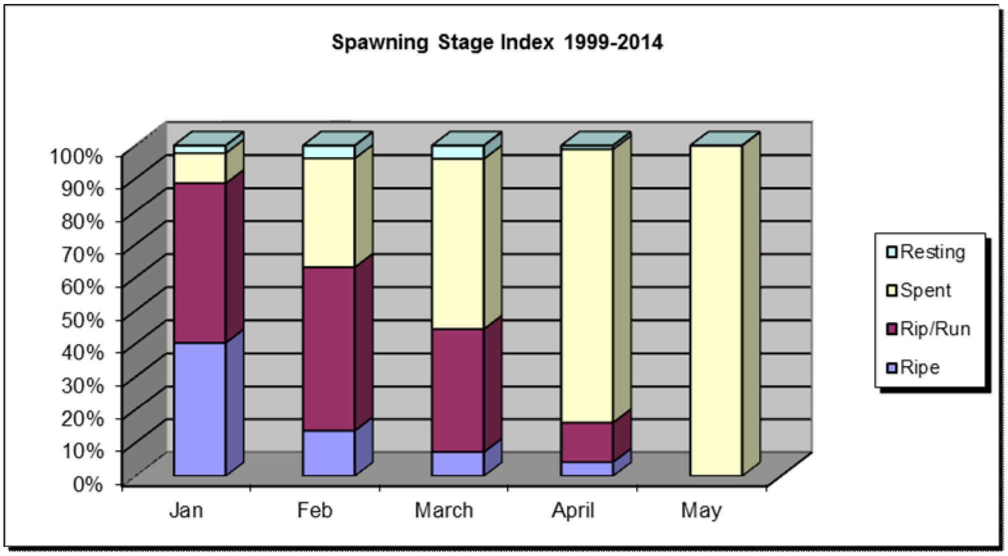
Winter Flounder (***Pseudopleuronectes americanus***) are both a commercially and recreationally important species to the State of Rhode Island. From 1999 - 2014 commercial landings of winter flounder in Rhode Island averaged over 300 metric tons and an average value of one million dollars annually. Recreational landings have declined rapidly throughout the period and remain low through 2014. (NMFS. 2014 Commercial landings query and MRFSS database)



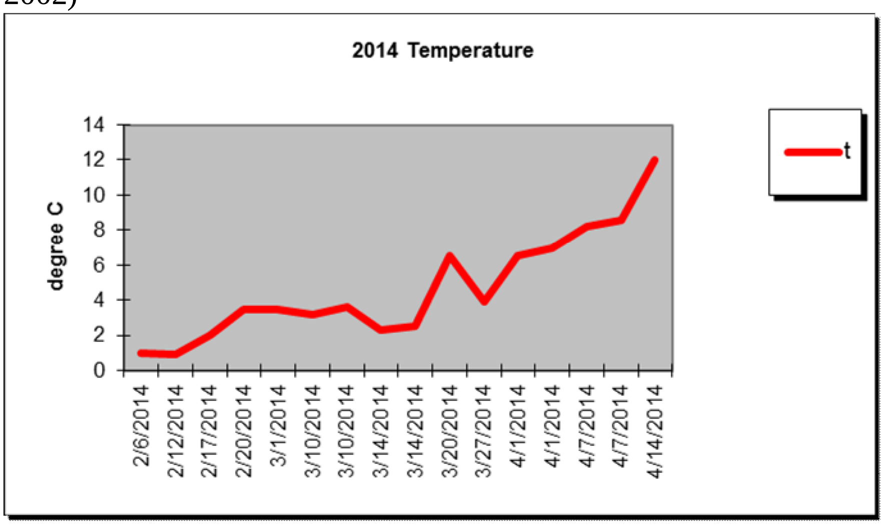


Spawning Behavior: Pt Judith / Potters Pond System

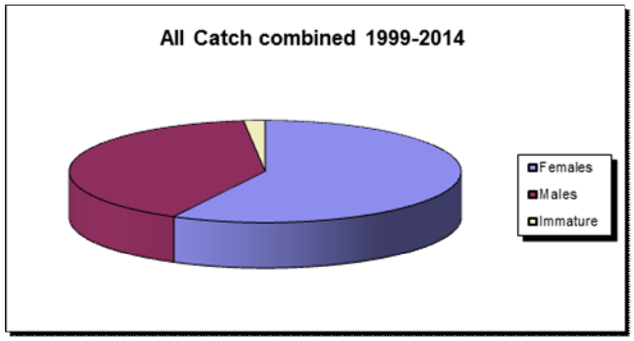
Winter Flounder enter the south shore coastal pond systems in Rhode Island to spawn in the early part of winter (November) and engage in spawning activity from January through May annually. Spawning and egg deposition takes place on sandy bottoms and algal accumulations. Winter Flounder eggs are non-buoyant and clump together on these substrates. Survey data indicate that peak-spawning activity takes place during the month of February, however this appears to vary annually in relation to average water temperatures.



Spawning occurs in inshore waters at close to seasonal minimal water temperatures of 0 - 1.7 degrees C and in estuarine salinities as low as 11.4 ppt. (Bigelow and Schroeder 2002)

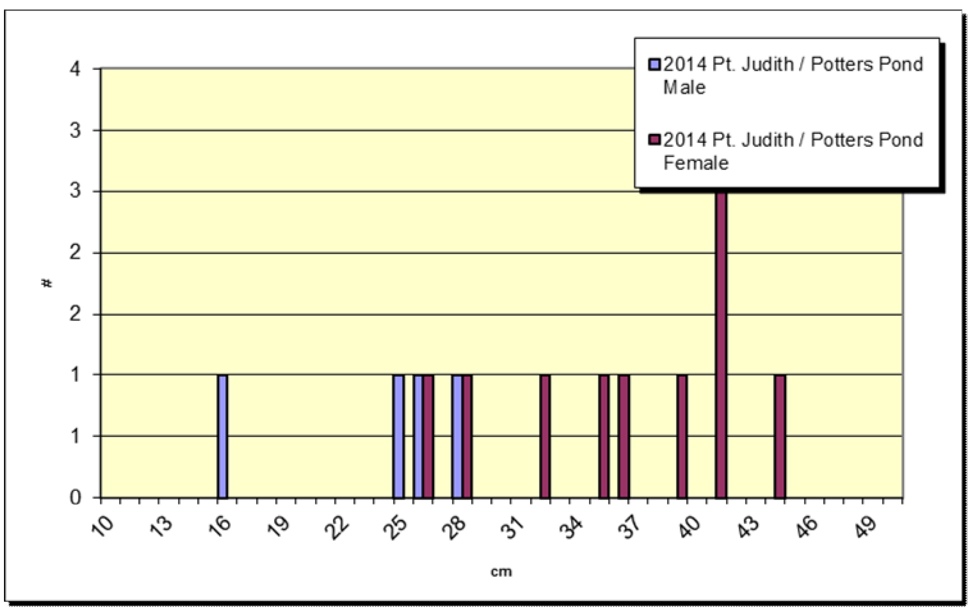


Sex ratios throughout the time series tend to favor females. Similar observations were made in Green Hill Pond, a neighboring coastal pond (Saila 1961), and in Narragansett Bay (Saila 1962).



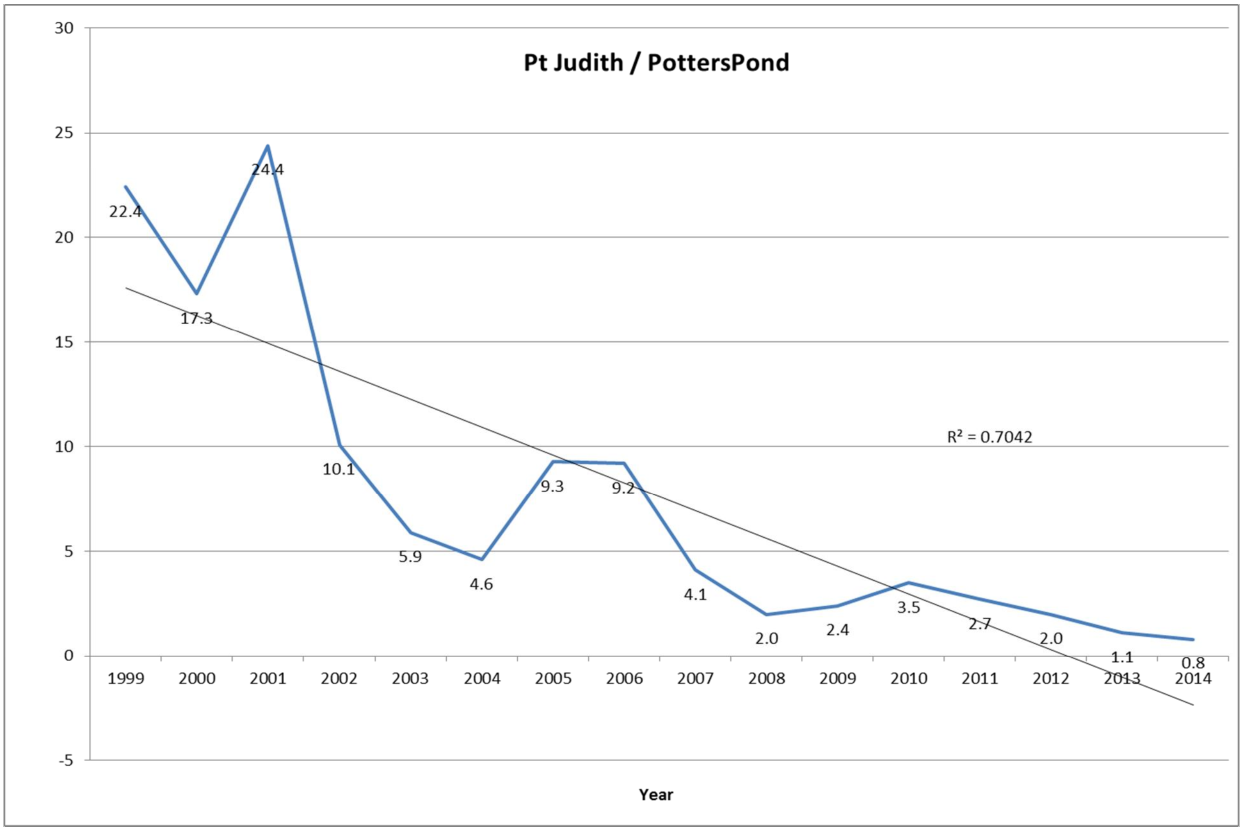
Size Distribution: Pt Judith / Potters Pond System

The total number of winter flounder sampled during the 2014 survey was 14. This was a 36% decrease from the 2013 survey. Sizes ranged from 16cm to 44cm. The mean size sampled was 32.7cm.



Results:

2014 Adult winter flounder CPUE in Pt Judith Pond decreased to 0.8 fish per net haul or a 29% decrease from the 2013 value of 1.1 fish per net haul. This value is well below the time series high of 24.4 in 2001. The catch rates have showed a downward trend throughout the time series with the 2014 CPUE being the lowest data point every recorded.



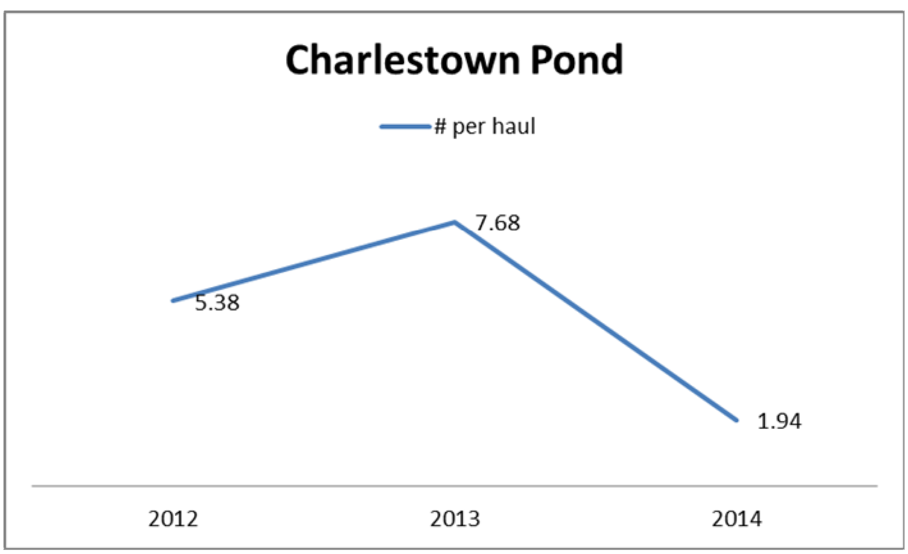


Table 1 Mark / recapture data 1999 - 2012 (Pt Judith system)

Year	Number	Number	Number recaptured
1999	1301	332	31
2000	417	208	31
2001	538	358	70
2002	265	182	18
2003	160	87	6
2004	102	64	14
2005	252	115	7
2006	416	91	9
2007	120	35	6
2008	42	14	2
2009	63	0	0
2010	85	19	0
2011	68	11	0
2012	41	15	0
2013	22	5	0
2014	14	3	0
Total	3906	1539	194

Table 2 Mark recapture in subsequent years (Survey and Fishing Recaptures) (Pt Judith system)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total	% recap
1999	31	8	10	1	0	1	0	0	0	0	0	0	0	0	0	0	51	0.15361
2000		23	17	5	1	0	0	0	0	0	0	0	0	0	0	0	46	0.22115
2001			43	11	1	2	0	0	0	0	0	0	0	0	0	0	57	0.15922
2002				1	3	1	0	0	0	0	0	0	0	0	0	0	5	0.02747
2003					1	1	2	0	0	0	0	0	0	0	0	0	4	0.04598
2004						9	1	2	0	0	0	0	0	0	0	0	12	0.1875
2005							4	4	2	1	0	0	0	0	0	0	11	0.09565
2006								3	2	0	0	0	0	0	0	0	5	0.05495
2007									2	1	0	0	0	0	0	0	3	0.08571
2008										0	0	0	0	0	0	0	0	0
2009											0	0	0	0	0	0	0	0
2010												0	0	0	0	0	0	0
2011													0	0	0	0	0	0
2012														0	0	0	0	0
2013															0	0	0	0
2014																0	0	0
Total	31	31	70	18	6	14	7	9	6	2	0	0	0	0	0	0	194	1.03125

Table 3 Mark recapture in subsequent years (Fishing Recaptures Only) (Pt Judith system)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total	% recap
1999	26	6	6	0	0	1	0	0	0	0	0	0	0	0	0	0	39	0.11747
2000		18	9	0	1	0	0	0	0	0	0	0	0	0	0	0	28	0.13462
2001			39	2	1	2	0	0	0	0	0	0	0	0	0	0	44	0.12291
2002				1	3	1	0	0	0	0	0	0	0	0	0	0	5	0.02747
2003					1	1	2	0	0	0	0	0	0	0	0	0	4	0.04598
2004						9	1	2	0	0	0	0	0	0	0	0	12	0.1875
2005							1	3	2	1	0	0	0	0	0	0	7	0.06087
2006								1	1	0	0	0	0	0	0	0	2	0.02198
2007									2	1	0	0	0	0	0	0	3	0.08571
2008										0	0	0	0	0	0	0	0	0
2009											0	0	0	0	0	0	0	0
2010												0	0	0	0	0	0	0
2011													0	0	0	0	0	0
2012														0	0	0	0	0
2013															0	0	0	0
2014															0	0	0	0
Total	26	24	54	3	6	14	4	6	5	2	0	0	0	0	0	0	144	0.8045

Table 1 Mark / recapture data 2012 - 2014

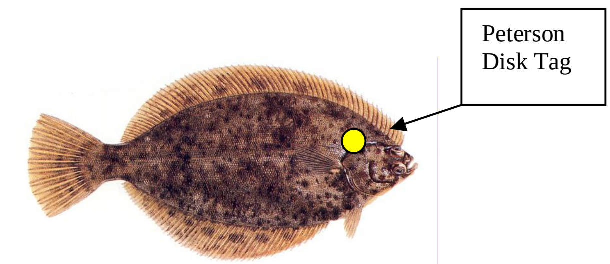
Charlestown Pond

Year	Number caught	Number tagged	Number recaptured	
2012	113	98	11	
2013	147	128	12	
2014	33	33	2	

	2012	2013	2014	Total	% recap
2012	10	0	1	11	0.0973451
2013		10	1	11	0.0748299
2014			1	1	0.030303

Discussion: Much lower catch rates are being observed in the later years of the adult coastal pond survey. For some time the data indicated that the problems found in nearby Narragansett Bay, were not as obvious in the south shore coastal ponds and that possibly, there were lower fishing mortality rates exhibited on the stocks that inhabit theses ponds and Block Island Sound.

Tag / Recapture data gives accurate estimations on population size and year class structure. These estimations depend on additional years and recapture data and therefore show the need for a more long-term approach to adult winter flounder assessments in Rhode Island south shore coastal ponds. Tag return rates for the survey time series are 13%. Almost the entire set of tag returns come from the recreational fishery which takes place in late April through early May in the coastal ponds, indicating the reluctance of the offshore commercial trawler fleet to supply information on flounder movements and mortality rates.



Recommendations: Continuation of all adult winter flounder work statewide in order to make accurate connections between coastal pond, Narragansett Bay and Rhode Island/Block Island Sounds winter flounder stocks. Continuation of the Charlestown Pond System to track local adult winter flounder abundance and use the catch as a source of tag able animals to gain information on population size, mortality and year class structure. Stress the importance of returning tag data from commercial trawl fleet in Rhode Island Sound and Block Island Sound as currently the majority of tag return data comes from recreational fishermen within the coastal pond.

Species captured:

Winter Flounder ***Pseudopleuronectes americanus***
Summer Flounder ***Paralicthes detatus***
Striped Bass ***Morone saxatilis***
White Perch ***Morone americana***
Atlantic Tomcod ***Microgadus tomcod***
Tautog ***Tautoga onitis***
Alewife ***Alosa pseudoharengus***
Atlantic Menhaden ***Brevortia tyrannus***
American Eel ***Anguilla rostrata***
Horseshoe Crab ***Limulus polyphemus***
American Lobster ***Homarus americanis***
Green Crab ***Carcinus maenas***
Atlantic Rock Crab ***Cancer irroratus***
Blue Crab ***Callinectes sapidus***
Longnose Spider Crab ***Libinia dubia***
Portly Spider Crab ***Libinia emarginata***

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Narragansett Bay Atlantic Menhaden Monitoring Program

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STATE: Rhode Island

PROJECT NUMBER: F-61-R

SEGMENT NUMBER: 21

PROJECT TITLE: Assessment of Recreationally Important Finfish Stocks in Rhode Island Waters

PERIOD COVERED: January 1, 2014 ï December 31, 2014

JOB NUMBER 11 TITLE: Narragansett Bay Atlantic Menhaden Monitoring Program

JOB OBJECTIVE: Continue administering an Atlantic menhaden monitoring program in Narragansett Bay that will use sentinel fishery observations (information of landings from floating fish traps), abundance information from spotter flights (both with a trained spotter and independent flights), removal information by tracking fishery landings, and a mathematical model (Depletion Model for Open Systems; see Gibson, 2007) to monitor the abundance of menhaden in Narragansett Bay in close to real-time and adjust access to the fishery as necessary through a dynamic regulatory framework.

SUMMARY: Atlantic menhaden (menhaden) undergo large coastwide migrations each year. After aggregating in the offshore waters of the Mid Atlantic region during the winter, menhaden migrate west and north stratifying by size and age the further north they migrate (Arenholz, 1991). Menhaden arrive in RI coastal waters beginning in the early spring, and in some years enter Narragansett Bay in large numbers, where they can reside for varying amounts of time until they begin their southward migration in the fall. During the period when they reside in Narragansett Bay, a number of user groups compete for the resource. Commercial bait companies begin to fish on the schools of menhaden and provide bait for both recreational fishing interests and for the lobster fishery. As well, recreational fishermen access the schools of menhaden directly and use the resource as bait for catching larger sport fish such as striped bass and bluefish. Large numbers of sport fishermen can be seen in their boats surrounding large schools of menhaden throughout the spring and summer using various methods to harvest them (snagging lures, cast nets, dip nets). The migration of menhaden to the north is also one factor which brings these larger sport fish to northern areas, as they are an important food resource for these species (Arenholz, 1991; ASMFC, 2010). During the period when the menhaden resource is within Narragansett Bay and multiple user groups are accessing it, user group conflicts are an inevitable outcome. These conflicts were further exacerbated in 2013 with the implementation of Technical Addendum I and Amendment 2 to the Interstate Fishery Management Plan for Atlantic menhaden. Amendment 2 established coast-wide state quotas for Atlantic menhaden while Technical Addendum I established an Episodic Event Set Aside program. Both of these new management measures have resulted in increased resource conflicts and make it important now more than ever for RI to accurately monitor the Atlantic menhaden resource in Narragansett Bay.

To help assuage some of these conflicts, to allow for an amount of the menhaden resource to remain unharvested by commercial interests for use by the recreational community, and to allow

a portion of the menhaden resource to remain in Narragansett Bay to provide ecological services, the RI Division of Fish and Wildlife (DFW) administered a menhaden monitoring program in Narragansett Bay. The program collectively uses sentinel fishery observations (floating fish trap data), spotter flight information both with a trained spotter pilot and from independent helicopter flights, fishery landings information, computer modeling, and biological sampling information to open, keep track of, and close the fisheries on menhaden as conditions dictate.

TARGET DATE: December 2014

SIGNIFICANT DEVIATIONS: The only deviation to methodology in 2014 was the contracting of a new spotter pilot.

RECOMMENDATIONS: Continue spotter flights and data collection to create the estimate of Narragansett Bay Atlantic menhaden biomass. Continue to analyze and provide data for use in the RI menhaden fishery management program. Continued development of the assessment model and continue to move from a Microsoft excel framework in to an ADMB framework. An effort to create a consistent protocol for the spotter flights will be created so that if additional estimates are to be submitted, all estimates will be from flights undergoing similar flight paths at similar times of the day.

REMARKS: Abundance estimates derived from the menhaden monitoring program have been used to open and close the Narragansett Bay menhaden fishery. The management is performed to accommodate the recreational sportfish fishery that depends on menhaden as a source of bait for striped bass, bluefish, and weakfish, popular sportfish species in Narragansett Bay. In addition, the maintenance of a standing stock of menhaden biomass in Narragansett Bay meets other ecological services that this species performs.

The structure of the management is to maintain a biomass threshold of 1.5 million pounds in the Bay, which provides forage for the predatory species of striped bass and bluefish. Prior to the commencement of commercial fishing, the biomass needs to reach 2 million pounds to provide a body of fish for the fishery to remove without dropping below the 1.5 million pound threshold. Once fishing is authorized, the commercial fishery is allowed to remove 50% of the biomass above the 1.5 million pound threshold, leaving the rest for ecological services and for use as bait by recreational fishermen. If the biomass estimates based on the spotter flights drop below the 1.5 million pound threshold, the fishery will close. In addition, if landings by the commercial fishery reach the 50% cap, the fishery closes.

METHODS, RESULTS & DISCUSSION: The program in 2014 consisted of three main elements: collection of fishery landing information through call in requirements, computer modeling work, and field work (spotter fights and biological sampling). DEM regulations require that purse seine vessels fishing for menhaden in Narragansett Bay report their catches to DFW staff. The commercial fishery interests also agree to carry a DFW observer on the fishing vessel upon request, or allow a port sample to occur while the catch is being offloaded. In 2014, port samples were undertaken where DFW observers sampled the catch and recorded the weight of catch offloaded. Catch sampling includes length frequencies and body weights. The DFW also contracted with a trained spotter pilot to make abundance estimates of menhaden in Narragansett

Bay. When in the air, the pilot counts of the number of menhaden schools observed, the estimated weight within the schools, and the location of the schools is recorded. An additional series of flights were taken in a state helicopter independent of the contracted spotter pilot. During these flights, DFW staff recorded the number and location of schools, allowing for independent verification of the spotter pilot estimates of school number. Other commercial harvesters such as floating fish trap operators were required to file logbook reports monthly with the DFW that detailed daily fishing activities. These fishers were also contacted for information and biological sampling during periods of increased menhaden activity on a more frequent basis. These fixed gear fisheries are useful as sentinels, documenting the arrival and movements of menhaden in state waters. Other information on menhaden abundance and movements were obtained from scientific staff on DFW research cruises and a network of fishers working Narragansett Bay. Collectively, these sources of information were analyzed using the theory of depletion estimation as applied to open populations. All of the afore mentioned information was centrally collected and used in a computer modeling approach that allows the DFW to monitor the abundance of menhaden in Narragansett Bay. The existing regulatory framework governing state waters allows the DFW to use the output from the mathematical modeling approach to set a number of fishing activity parameters including a static amount of fish that need to be present to allow commercial fishing to commence, thus protecting recreational and ecological interests if only a small population enters the Bay, allows for only half of the standing population present in Narragansett Bay above the initial threshold amount to be harvested, thus maintaining an amount of unharvested fish even when commercial fishing has commenced, and subsequently allows the DFW to close the fishery when the standing population of menhaden in Narragansett Bay drops back below the threshold level of fish, again maintaining a portion of the population for recreational fishermen and ecological services. This program also allows DFW to accurately track the newly implemented state quota and provides justification for Rhode Island to participate in the Episodic Event Set Aside Program as it did in 2013 and 2014.

2014 Fishery Data

In 2014, one commercial menhaden fishing operation fulfilled requirements for fishing in Narragansett Bay and a second operation also participated in the fishery in state waters, but outside of the Narragansett Bay Management Area. After biomass levels were estimated and confirmed, commercial fishing was allowed to commence in the Management Area on May 12, 2014. Spotter flight estimates had commenced the week previous to the opening of fishing to make sure a number of biomass estimates were accomplished with which to initiate the model. The commercial bait fishery landing in RI under the RI state quota was closed on May 23, 2014, as it was determined that the entire RI state quota had been harvested. During this closure a bycatch allowance of 6,000 pounds/vessel/day was permitted for cast netters and floating fish traps. Additionally, this closure only applied to vessels landing menhaden in RI, the Narragansett Bay Management Area remained open and therefore non-byctach vessels were allowed to fish in the management area provided they were not landing their catch in RI.

As a result of exhausting our RI sate quota but still having a large biomass of fish residing in state waters, RI applied for inclusion in the Atlantic menhaden episodic event set aside program administered by the ASMFC. On May 30, 2014, after being allowed access to the episodic event set aside program, the commercial bait fishery for vessels landing in RI was re-opened at a possession limit of 120,000 pounds/vessel/day. A single vessel participated in this program with three landing events occurring in July, 2014.

On July 14, 2014, after menhaden biomass was observed to drop significantly below the threshold of 1.5 million lbs, the Narragansett Bay Management Area was closed. The fishery in the Narragansett Bay Management Area remained closed for the season.

In 2014 the landings cap was not exceeded and a total of 28 spotter flights were accomplished. The flights were spread throughout the season to make sure there were estimates that occurred before, during, and after the fishery occurred. This was done to achieve an accurate sense of the migratory patterns of this important species in to RI waters. Over time, these estimates could be used to improve the predictive power of the model. In addition to the professional spotter pilot estimates, helicopter flights were also undertaken. Only three helicopter flights were taken in 2014. The idea behind the helicopter flights is to add an additional independent observation in to the program. Given the early closure of the management area it was not deemed necessary to take additional flights. School counts are the metric used from the helicopter flights.

The model estimated a harvest cap of 3,157,000 pounds in 2014. This was driven by a couple of observations where 10-11 million pounds of menhaden was estimated to be in Narragansett Bay. This high level of biomass only remained in the Bay for a period of less than two weeks followed by a significant drop in biomass which persisted for the rest of the season (Figure 1). In the future staff hopes that moving the model in to a different software package (ADMB) will help improve the model performance.

SUMMARY: The menhaden monitoring program in Narragansett Bay opened in May. There was one in season closure, which persisted until the end of the season. Biomass estimates were continued throughout the season and ended in October. In total 28 spotter flights were taken and 3 helicopter flights were taken, giving ample data to use in the depletion model. Upon review, it was found that the harvest cap was not exceeded, therefore the program can be considered a success in 2014.

The RI State menhaden quota was exhausted, and thus the state waters fishery closed in May in 2014. Upon application to, and permission from the ASMFC to participate in, the Atlantic menhaden episodic event set aside program, RI state waters re-opened to the landing of menhaden and remained open until November 1, 2014.

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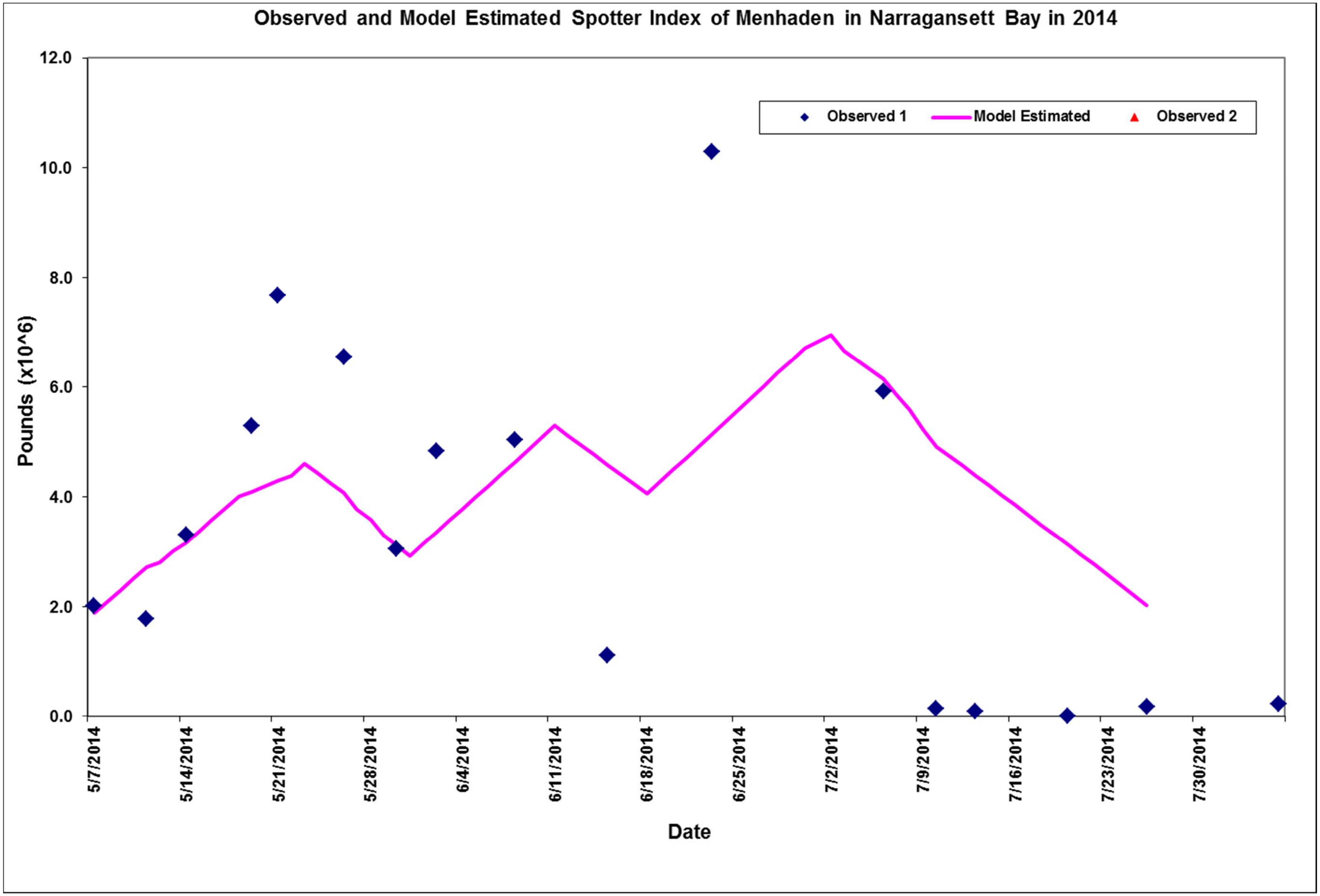

Figure 1 ï Predicted spotter pilot estimates and observed biomass in Narragansett Bay in 2014

Narragansett Bay Ventless Pot, Multi-species Monitoring and Assessment Program

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Rhode Island Department of Environmental Management
Division of Fish and Wildlife

Performance Report - Job - 12 March 2015

PERFORMANCE REPORT

State: Rhode Island

Project Number: F-61-R

Segment : 21

Project Type: Resource Monitoring

Project Title: Assessment of Recreationally Important Finfish Stocks in Rhode Island Waters

Period Covered: January 1, 2014 to December 31, 2014

Job Number & Title: 12- Narragansett Bay Ventless Pot, Multi-species Monitoring and Assessment Program

Job Objective: The goal of this project is to assess and standardize a time series of relative abundance for structure oriented finfish (scup, black sea bass, and Tautog) in Narragansett Bay. Investigators will also collect age and weight at length information for these species, as well as collect data on other biological characteristics while theyǿre in RI state waters. Abundance data will be integrated into both local and coastwide stock assessments for the target species.

Summary: Investigators couldnǿ haul the required number of scup pots or sea bass trawls each month, Table 1, due to vessel problems. Despite our very limited sampling season, we added substantially to the established database for Scup, Black Sea Bass, and Tautog. The majority of black sea bass, Scup, and Tautog caught were in excess of three or four years old. Which is what this project was designed to do. Investigators are confident that this project is working properly as designed and getting the desired results. In 2014, we caught 1984 Scup, 1022 Black Sea Bass, 239 Tautog, as well as 10 other species of finfish and five species of shellfish Table 2. Staff had an opportunity to statistically test the assumption that these species will be caught in greater numbers on structured bottom vs than non-structured bottom. Statistical analysis, ANOVA, of the data represented by the box plots reveal that there isn't any statical difference between structure and non-structure (Figures 3B, 7b, 11b).

Target Date: 2014

Status of Project: On Schedule

Significant Deviations: Investigators were unable to complete sampling during the entire sampling season due to vessel problems.

Recommendations: To continue on into the next segment.

Remarks: For the second year, we were unable to begin sampling in April. Due to scheduling problems with our vendor, we were unable to get the vessel in the water in time to sample in April. In May, we set and hauled ten Black Sea Bass Trawls, two in each sampling area, and 13 scup pots in the West Passage of Narragansett Bay when we picked up a line in the propeller. Subsequent to this, the motor would start and stall at which point the vessel was hauled and taken in for diagnosis. The vessel which had apparently spun a bearing on the driveshaft was repaired on 17 June in time to complete the June sampling. At which time, we set and hauled ten Black Sea Bass Trawls, two in each sampling area, and 39 scup pots. In July, we set and hauled ten Black Sea Bass Trawls, two in each sampling area, and 40 scup pots. In August, we set and hauled eight Black Sea Bass Trawls, two in four sampling area, and 10 scup pots, when we experienced additional vessel difficulties. We replaced the idler pulley and the serpentine belt and experienced chronic overheating and coolant loss. Again, the vessel was towed to a repair facility, diagnosed, repaired, and returned in early September. Investigators set and hauled eight Black Sea Bass Trawls, two in four sampling area, when the lower unit began making very loud banging sounds. The vessel was towed back to the lab until arrangements could be made to get it assessed. Mechanics assessed the lower unit and found a cracked gear in the upper section of the lower unit, which effectively ended the 2014 sampling season.

In spite of the vessel down time, the 2014 field season was fairly successful. Investigators captured and measured 3295 individual fish representing 13 species, Table 2, and 281 invertebrates representing 5 species, Table 2a. Additionally, we harvested 5323 Spider crabs, *Libinia spp*., 153 Green crabs, *Carcinus maenus*, 61 Rock crab, *Cancer irroratus*, 12 Hermit crabs, *Pagurus spp*., 1 Jonah crab, *Cancer borealis*, 1 moon snail, *Lunatia heros*, and a handful of blue mussels, *Mytilus edulis*. These aforementioned species are of little or no commercial or recreational importance and were merely counted and not measured.

The Division crafted and delivered a contract to Dr. John King of the URI, in November of 2014. As of this writing, we have obtained via the Office of Sponsored Projects at the URI two signed copies of the agreement on 3/25/15. We are currently awaiting output from Dr. Kings Lab before incorporating the results into the 2015 survey design. This would be available in both PDF and electronic format which could be utilized by our GPS machine.

Personnel worked with staff from our age and growth project in order to obtain scales, otoliths, and weights from fishes. Additionally, Black Sea Bass samples were brought back to the lab for stomach analysis aa well as Tautog, between 17 and 38 cm, were brought back to the lab for later operculum removal, weighting, etc.

Introduction: Working groups such as the Northeast Data Poor Stocks Working Group (2008), have reported that size classes of many species may be under represented in their assessments, particularly scup, black sea bass, and Tautog. All three of these species tend to associate with bottom structure for a major portion of the year and as a result tend to be unavailable to traditional trawl surveys.

Furthermore, this survey is an attempt to employ an alternative survey gear type for these species, e.g. fish traps, as recommended by Shepherd (2008) and Terceiro (2008) in order to attempt to index the abundance of older scup (ages 3 and older).

Methods: Narragansett Bay was divided into five sampling areas, The Providence/lower Seekonk River including portions of the Upper Bay/Greenwich Bay, West Passage, East Passage, Mount Hope Bay including portions of the Upper Bay, and the Sakonnet River including the area from Land's End to Sakonnet Point (Figure 1). Each area was subdivided into 0.5 deg of latitude and longitude squares and numbered. These numbered boxes were referred to as stations. Investigators then located areas of hard bottom, shipwreck, major bridge abutments, or pilings, etc., in each station. The areas of structure were noted in the stations containing structural elements and the goal for each month was to randomly sample half of the replicates in areas of known structure and half in areas without known structure.

All sampling stations were selected randomly. In order to maintain a consistent methodology with the URI/Sea Grant projects, investigators adopted the following sampling schedule which they anticipate will take approximately two to three weeks.

A monthly survey was conducted in the Narragansett Bay from May through September. The unvented scup pots (2'x2'x2') are constructed of 1.5"x 1.5" coated wire mesh. The unvented Black Sea Bass Pots (43.5"L, 23"W, and 16"H) are also constructed of 1.5"x 1.5" coated wire mesh, single mesh entry head, and single mesh inverted parlor nozzle.

> Beginning on Friday or Monday, investigators set black sea bass pots in five (5) pot trawls at two (2) randomly selected stations in two separate sampling areas. One trawl will be set on structured bottom and one on bottom without structure. These traps will be unbaited and allowed to fish for 96+/- 1 hr. After the four days, the traps will be hauled, the catch processed and the trawls held for 24 hours then moved to a new areas and allowed reset. This will be repeated until there are ten set in total for Narragansett Bay.
>
> In the intervening time, Investigators set scup pots at ten (10) randomly selected stations, five on structured bottom and five on bottom without structure, in one of the five sampling areas and left to soak for **24+/- 1 hr**. All pots were baited with sea clams. After 24 hrs. the pots set were hauled, the catch processed and gear either reset or removed from the water so investigators could tend trawls. This continues until 50 sets have been made throughout Narragansett Bay.

Upon hauling all gear types, the catch was sorted by species. Finfish were measured to the nearest millimeter, fork length (FL) or total length (TL). Invertebrates were measured using a species specific appropriate metric or counted. Personnel from the age and growth project have accompanied us in order to obtain scale samples and fish specimens from which to obtain stomach samples, otoliths and/or opercula. Going forward, it appears that this could become a normal part of this project. Project personnel have replaced the Yellow Springs instrument (YSI) model 85, which failed in May, 2014, with a Eureka Systems Manta 2 Multiprobe to collect data on water temperatures, salinities, dissolved oxygen, air temperature at each sampling station.

Results/Discussion:

Due to intermittent vessel problems, we were unable to set all of our pots as scheduled. We set the Black sea Bass Trawls 10 times, Table 1, or twice per area in May, June and July and only 8 times in August and September. In August Investigators Missed the East Passage and in September, the Sakonnet River. The scup pots were set 13 times in May, 39 times in June, 40 times in July, 10 times in August and not at all in September, Table 1. Table 2 enumerates the finfish species caught and the percentage of total catch, while Table 2a enumerates the shellfish caught. From this table, it is obvious that these gear types are very efficient at catching the target species. This table shows that scup dominated the catch with 1984 individuals which comprised 55.47% of the total catch. However, only 1022 black sea bass were caught which equaled 28.57%. In 2014, 239 Tautog were caught which equaled 6.68% of the total catch. Of the remaining species, Oyster Toad Fish and Summer Flounder were the only other species caught in any numbers, 21 and 13 animals respectively.

Despite our very limited sampling season, we accomplished our goals for the second year of the project. We added to the established database for Scup, Black Sea bass and Tautog with substantial numbers. Again, Investigators noted that according to the length at age graphs for these species, the majority of black sea bass caught were in excess of ten old which where we want to be sampling. Additionally, the scup we caught ranged from approximately one plus years of age to old as 12 or 13, however, the majority of the fish caught were in the three to six year old range. In 2014, we caught 239 Tautog throughout the season almost entirely in the sea bass trawls. Again utilizing the length at age graph, these fish ranged in age from approximately 2 years of age to approximately 28 or 29 years of age. Investigators are confident that this project is working properly as designed and getting the desired results.

Length frequency histograms for Black Sea Bass, Scup, and Tautog along with length at age graphs for each species are presented in figures 2a, 2b, 7a, 7b, and 10a, 10b respectively. Length frequency histograms, box plots, density of lengths are also provided for black sea bass, scup, and Tautog on structured bottom vs bottom with no structure (Figs. 3A,b,c,7a,b,c,11a,b,c). In all cases, Black Sea Bass, Scup, and Tautog structure doesn't appear to makes much difference to any of these species,. Statistical analysis, ANOVA, of the data represented by the box plots reveal that there isn't statically any difference between structure and non-structure (Figures 3B, 7b, 11b).

Figures 5a,b, 9a,b, and 13a,b. depict the frequency of black sea bass, scup, and Tautog by month. In the case of Black Sea Bass, (Fig 5b) there seems to be no differences by month except possibly in May where the sampling was truncated. The majority of scup were caught throughout the season with smaller fish dominating for the most part but with many large fish in attendance > 25 cm. However in September this trend seems to change to larger fish, fig 9b, perhaps due to the fact that staff wasn't able to set gear other than trawls. Tautog performed as expected, large fish were caught first in May and June followed by smaller fish later in the season. This is just the opposite of the other two species since Tautog are in a spawning run to the upper bay in April and May and we expect larger fish. In September all species were found within the bay, however, they were beginning to move. There were few caught in the upper bay and most fish were caught in the lower bay below Jamestown.

Figures 14, 15, and 16 Compares the Black Sea Bass Trawl data against the Scup Pot data for the three species, Black Sea Bass, Scup, and Tautog. For Black Sea Bass and Scup, there is no difference between the two methods of capture. However, for Tautog, they are overwhelmingly caught by trawl with only three caught by scup pot.

Figures 4, 8, and 12 depict the ANOVA of Black Sea Bass, Scup, and Tautog respectively. Black Sea Bass appears to not favor any area while Scup are found in area one in great numbers through most of the summer but move to the lower bay in August. Tautog are found in great numbers in area four and to a lesser degree area one. This is interesting, however, it doesn't take into consideration time of year as well, this is the upper bay and east passage and can probably be attributable to their spawning run in the spring. The Areas are as follows one is the Providence/lower Seekonk River including portions of the Upper Bay/Greenwich Bay, area two is the West Passage, area three is Mount Hope Bay including portions of the Upper Bay, area four is the East Passage, and area five is the Sakonnet River including the area from Landôs End to Sakonnet Point (Figure 1).

Temperature, Salinity, and Dissolved Oxygen:

Investigators were only able to measure these variables in May before the YSI failed. Surface water temperatures varied only slightly from station to station but rose constantly and ranged from a low of 10.0 °C on May 6 to as High of 22.5 °C on 15 May. This constant rise was probably attributable to the air temperatures which were intermittent throughout the time and ranged from 14 °C to 22.5 °C. Bottom temperatures ranged from 7.6 °C on 6 May to a high of 21.8 °C on 15 May. Surface salinities ranged from 9.21ă to 29.27ă and surface dissolved oxygen ranged from 2.29 mg/L to 15.55 mg/L. Bottom salinities ranged from 21.8ă to 29.29ă and dissolved oxygen ranged from 0.81 mg/L to 16.59 mg/L.

Box plots and statistics were generated by Jason McNamee.

References:

Shepherd, G. 2008. Black Sea Bass. Northeast Data Poor Stocks Working Group Meeting. Dec 8-12. National Marine Fisheries Service. Northeast Fisheries Science Center. 166 Water St., Woods Hole, MA 02543

Terceiro, M. 2008. Scup: Stock Assessment and Biological Reference Points for 2008. Northeast Data Poor Stocks Working Group Meeting. Dec. 8-12. Northeast Fisheries Science Center, 166 Water St. Woods Hole, MA 02543.

Working Group Report. 2008. The Northeast Data Poor Stocks. Dec 8-12. Northeast Fisheries Science Center Reference Document 09-02A & B. Northeast Fisheries Science Center. 166 Water St., Woods Hole, MA 02543

Table 1
Number and Type of Traps set Each Month during 2014

Trap Type	May	June	July	August	September
BSB Trawls	10	10	10	8	8
Scup Pots	13	39	40	10	0
Total	23	49	50	18	8

TABLE 2

Ranking by Abundance of all Finfish Species
Collected in Fish Traps in Narragansett Bay, R. I.
(May 2014 - September 2014)

Scientific Name	Common Name	Number	% Catch
Stenotomus chrysops	Scup	1,984	55.47
Centropristis striata	Sea Bass Black	1,022	28.57
Tautoga onitis	Tautog	239	6.68
Opsanus tau	Toadfish Oyster	21	0.59
Paralichthys dentatus	Flounder Summer	13	0.36
Conger oceanicus	Conger Eel	8	0.22
Prionotus evolans	Searobin Striped	2	0.56
Sphoeroides maculates	Puffer Northern	1	0.03
Tautogolabrus adspersus	Cunner	1	0.03
Mustelus canis	Smooth Dogfish	1	0.03
Balistes capriscus	Triggerfish Gray	1	0.03
Peprilus triacanthus	Butterfish	1	0.03
Prionotus carolinus	Searobin Northern	1	0.03

TABLE 2a

Ranking by Abundance of all Shellfish Species
Collected in Fish Traps in Narragansett Bay, R. I.
(May 2014 - September 2014)

Scientific Name	Common Name	Number	% Catch
Busycotypus canaliculatus	Channeled Whelk	125	3.49
Busycon carica	Knobbed Whelk	69	1.93
Homarus americanus	American Lobster	44	1.23
Callinectes sapidus	Blue Crab	34	0.95
Mercenaria mercenaria	Quahog	9	0.25

Figure 1. ï Chart of Narragansett Bay with Colregs line of demarcation and Location of Five Sampling Areas.

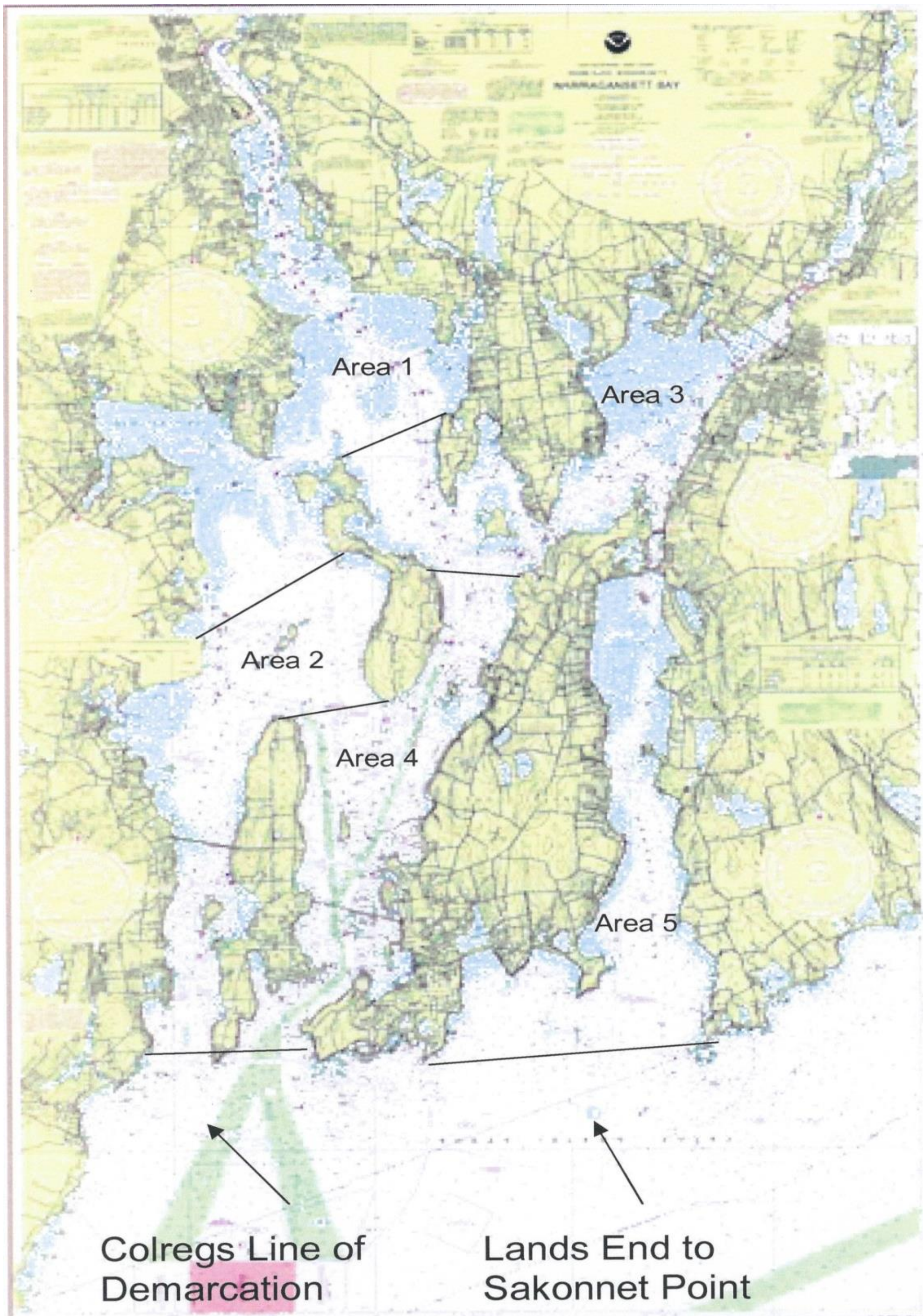


Figure 2a... Length Frequency Histogram for Black Sea Bass.

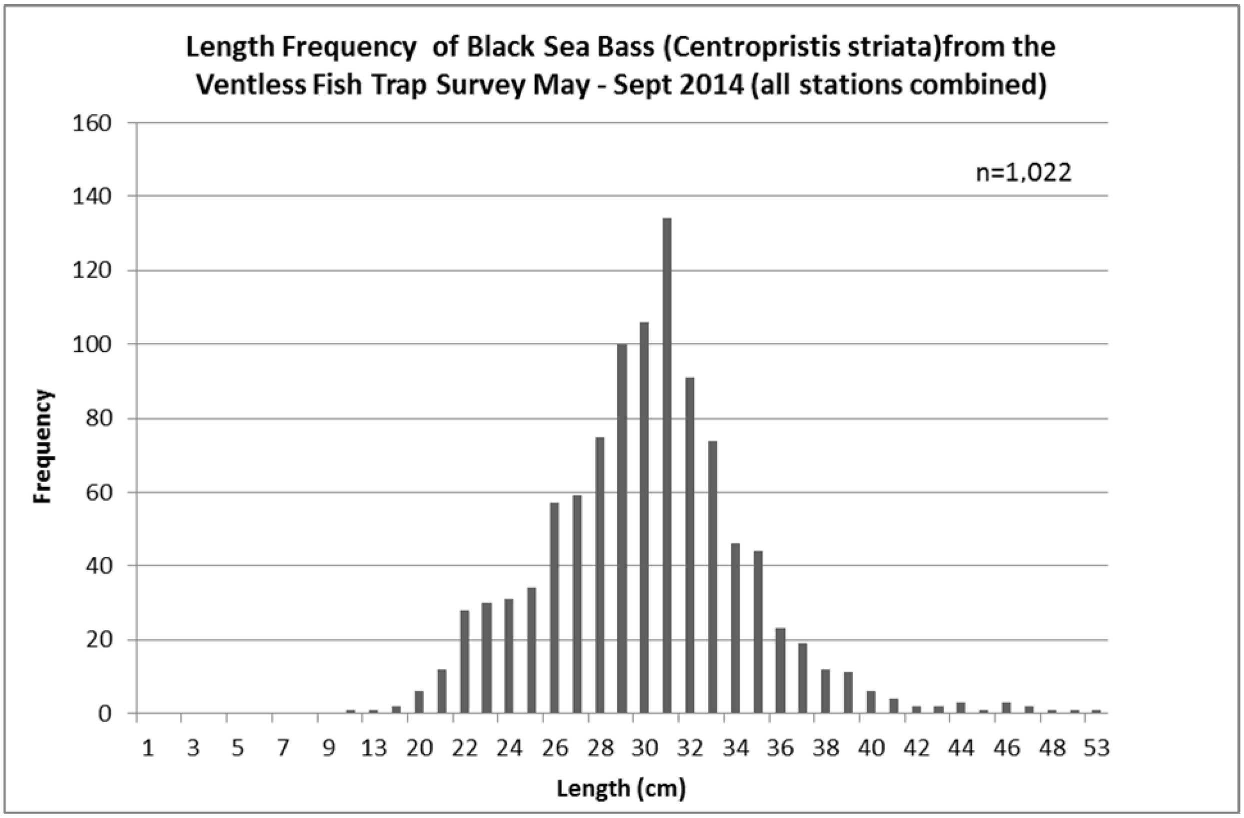


Figure 2b. Length at Age graph for Black Sea Bass

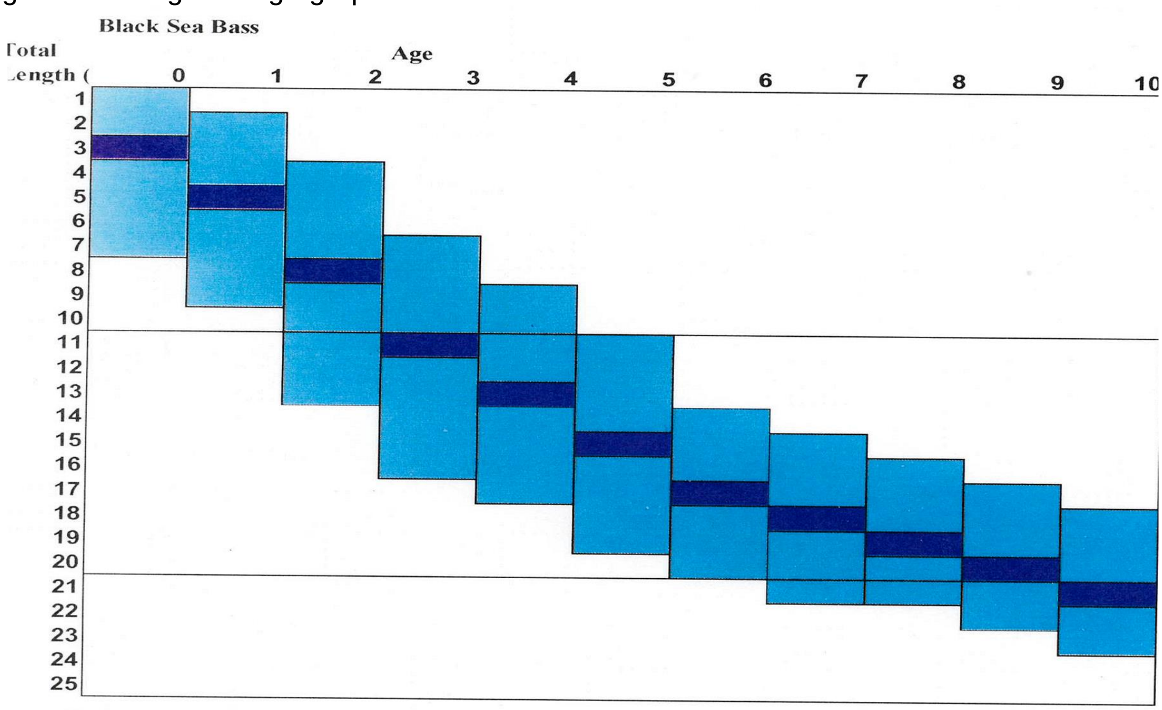


Figure 3a. Comparison of Structure vs Non-structure Data

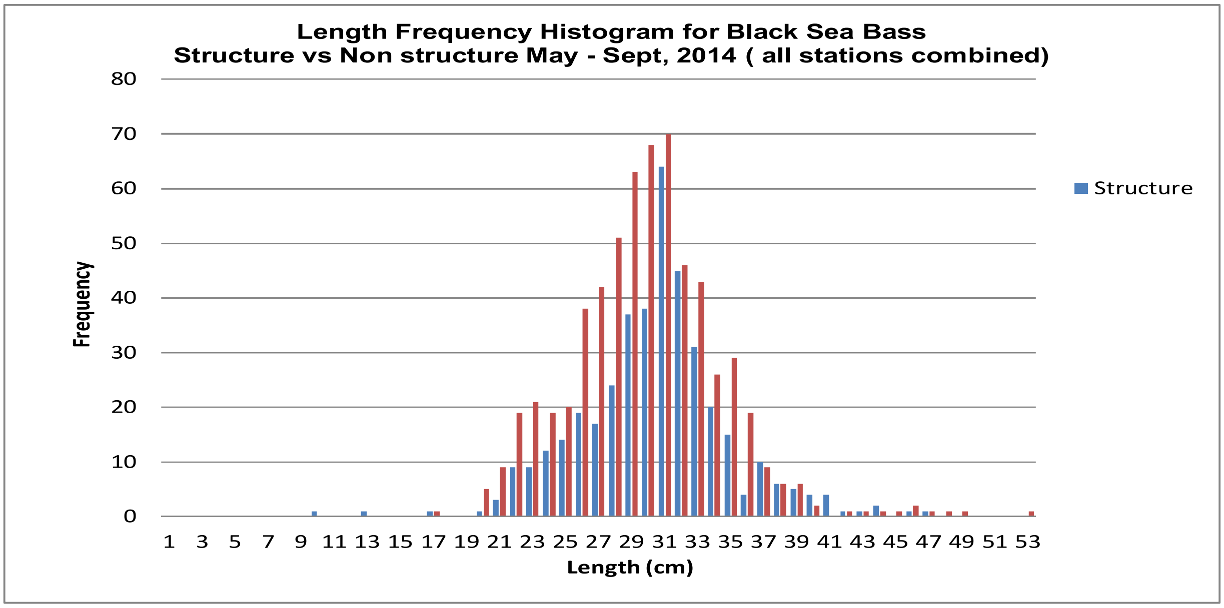


Figure 3b. Comparison of Structure vs Non-structure Data (Box Plot)

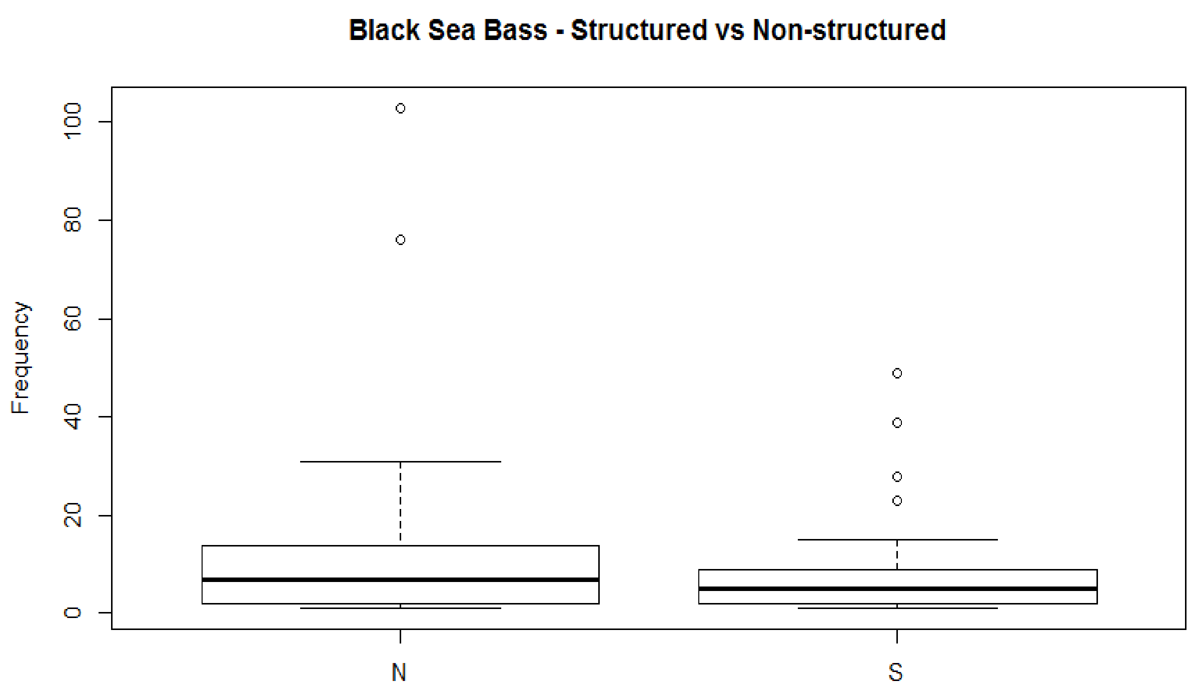


Figure 3c. Comparison of Structure vs Non-structure Data (Density)

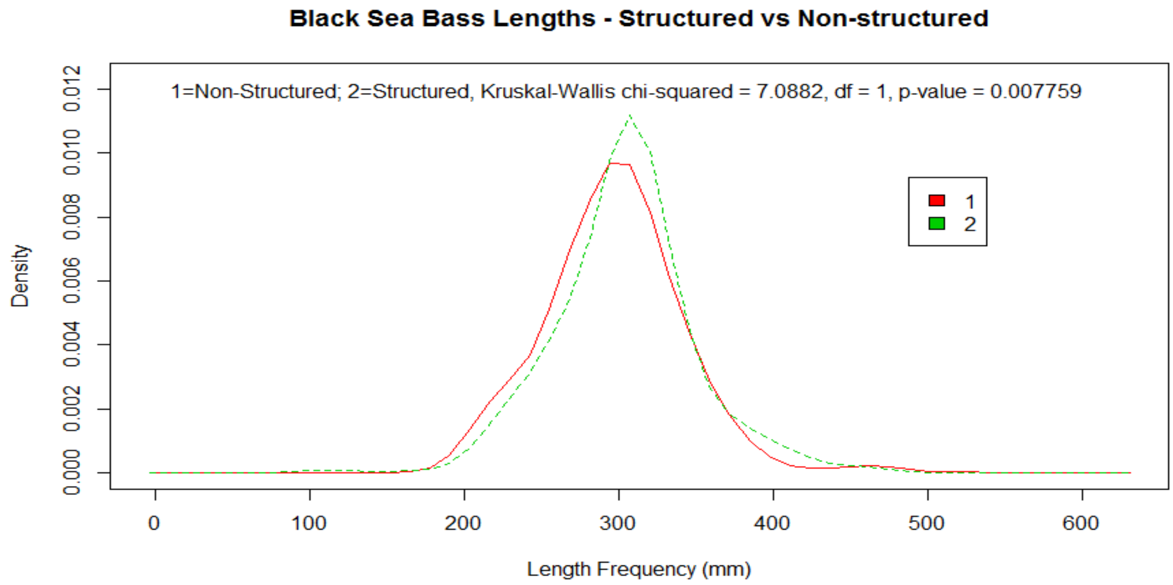


Figure 4. Comparison of Black Sea Bass Catch by Area (Box Plot)

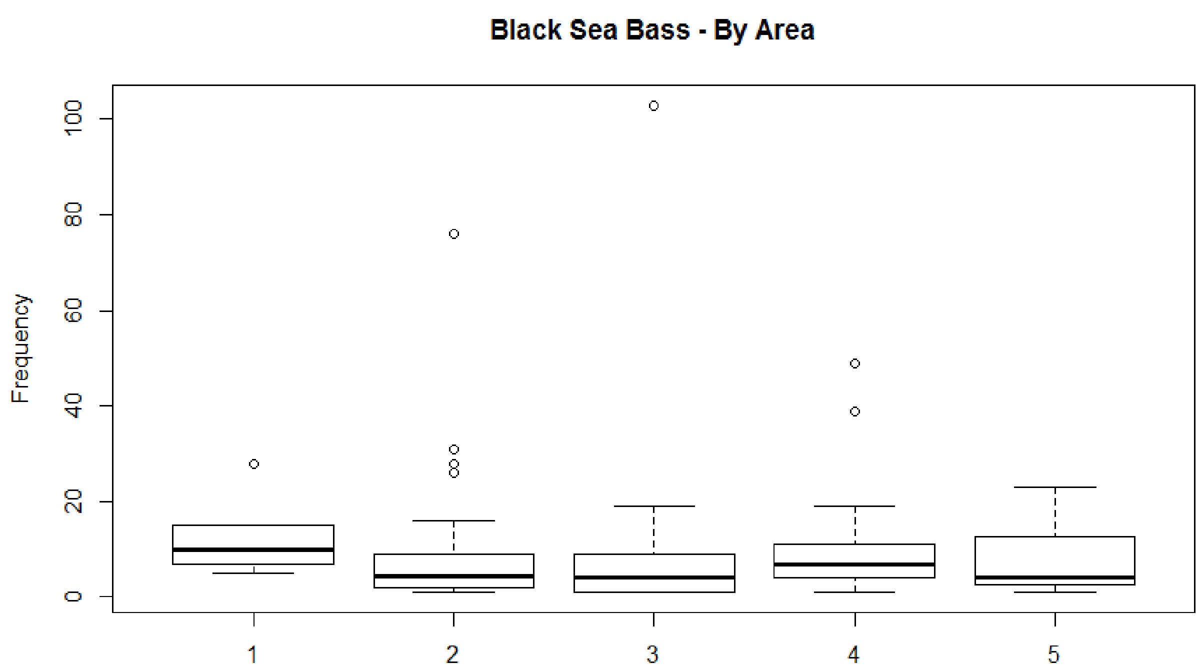


Figure 5a. Comparison of Black Sea Bass Lengths by Month

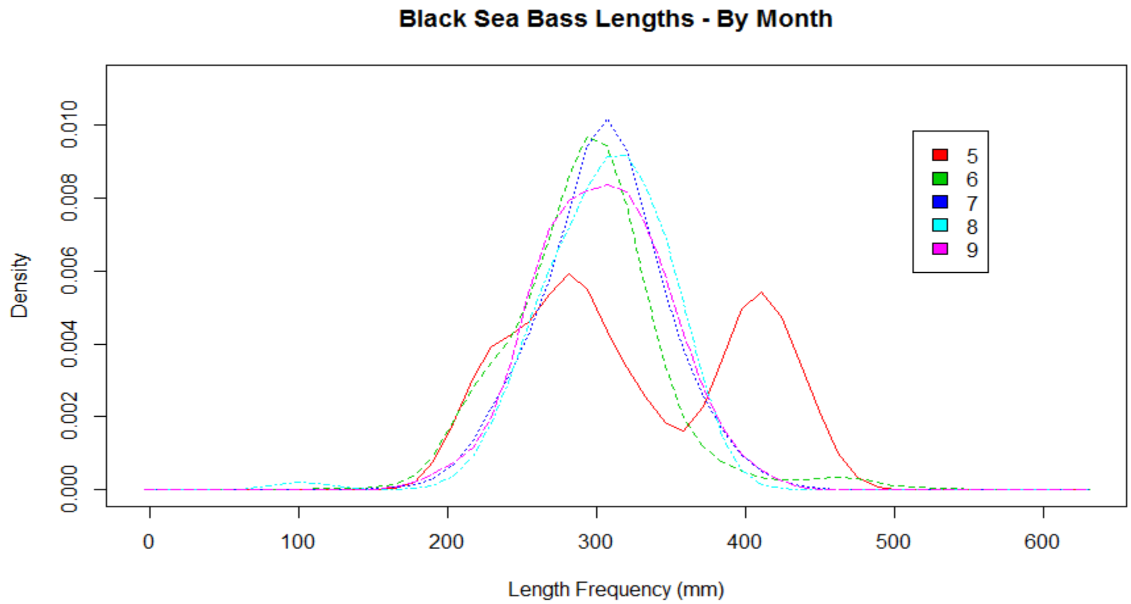


Figure 5b. Comparison of Black Sea Bass Lengths by Month (Box Plot)

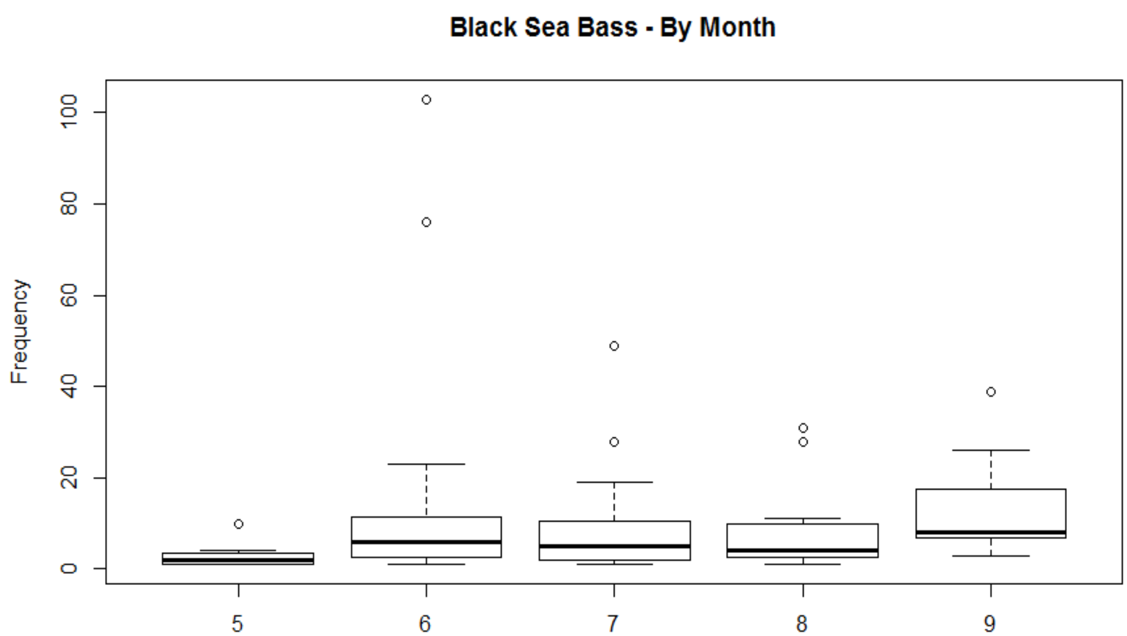


Figure 6a. Length Frequency Histogram for Scup.

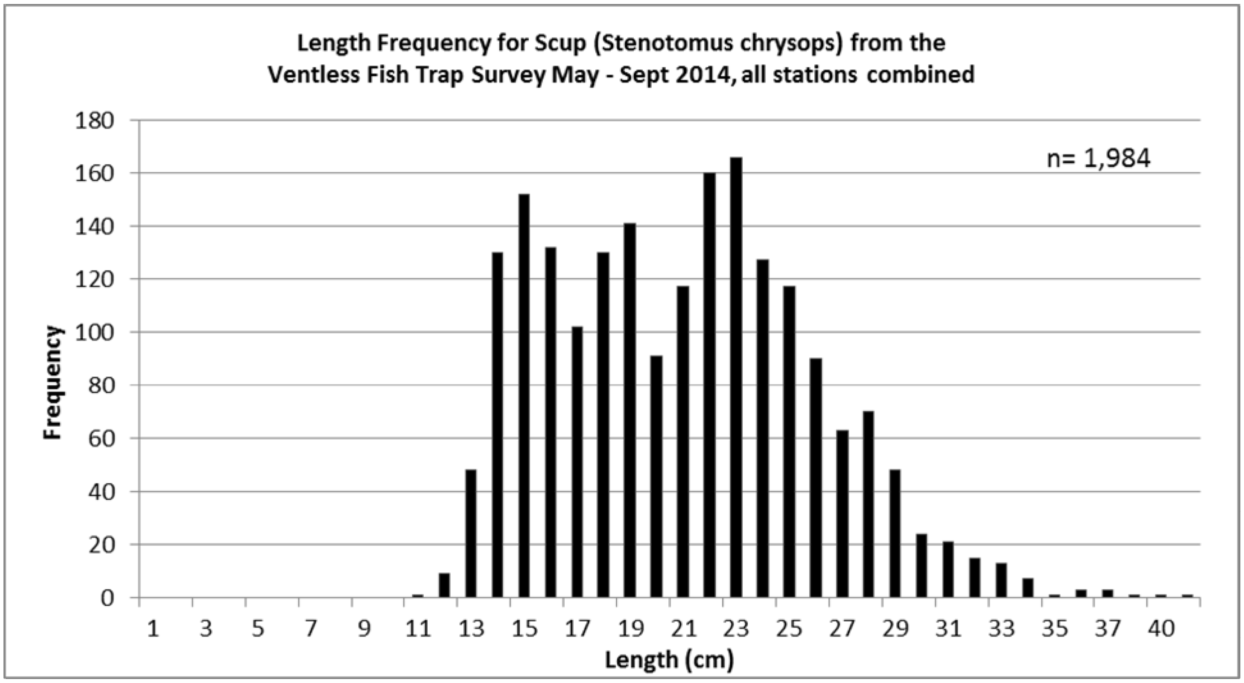


Figure 6b. Length at age graph for scup

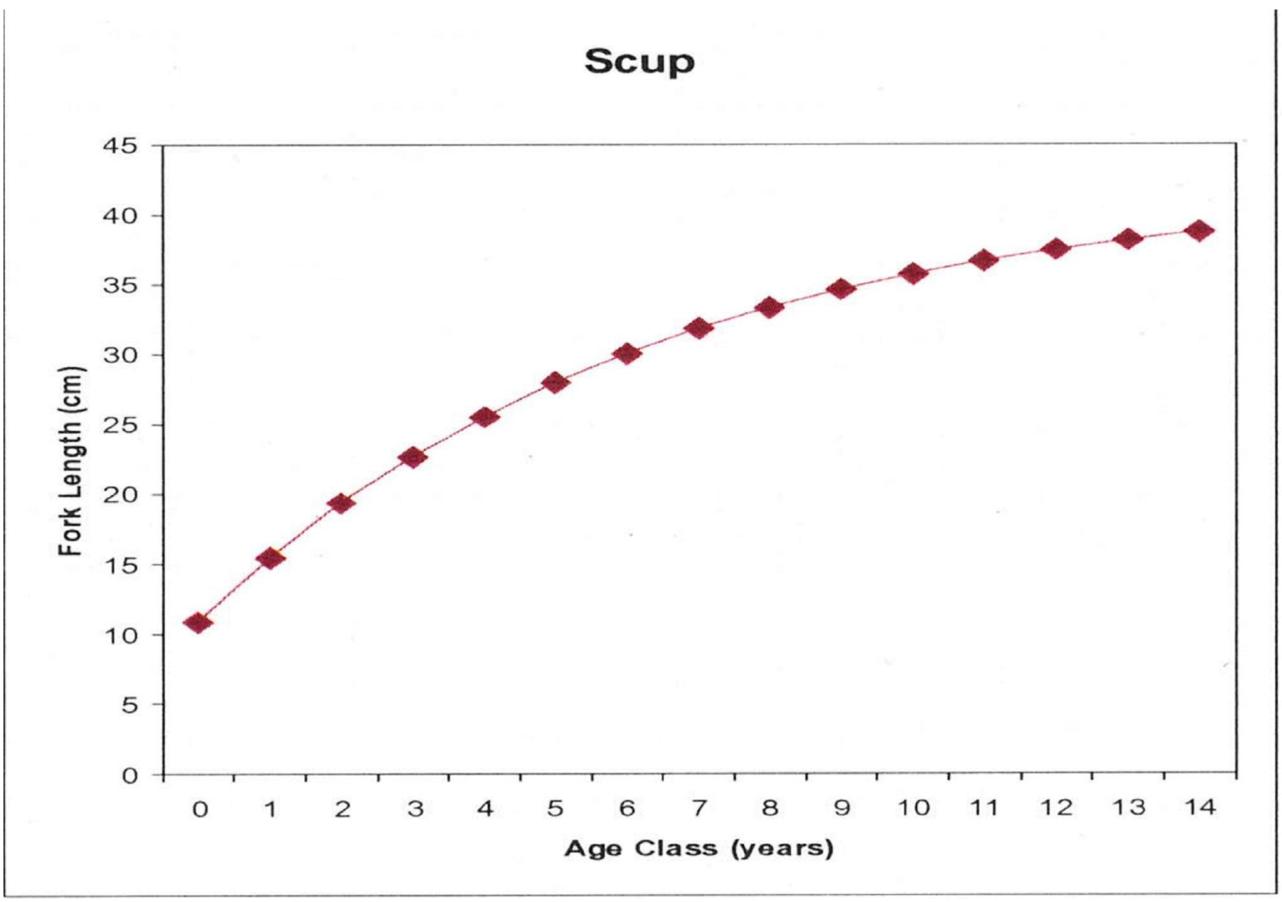


Figure 7a Comparison of Structure vs Non-structure Data for Scup

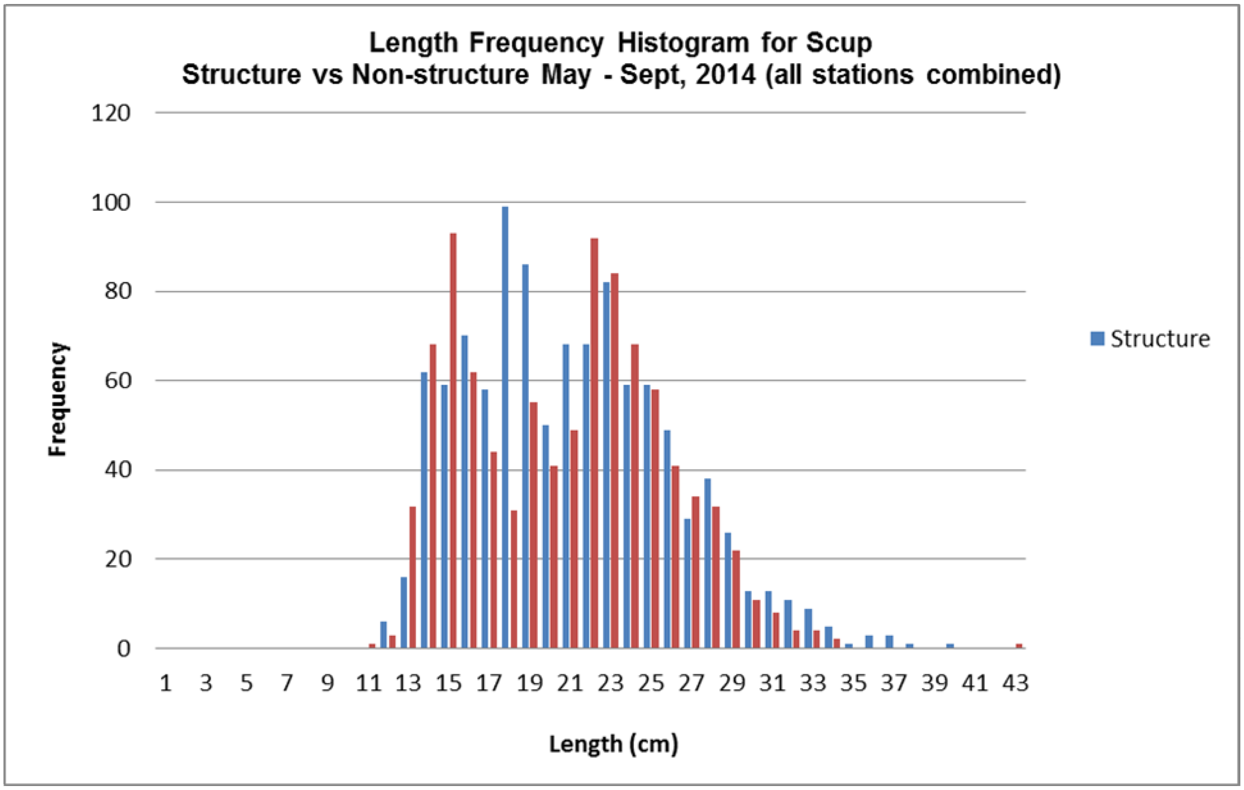


Figure 7b. Comparison of Structure vs Non-structure Data for Scup(Box Plot)

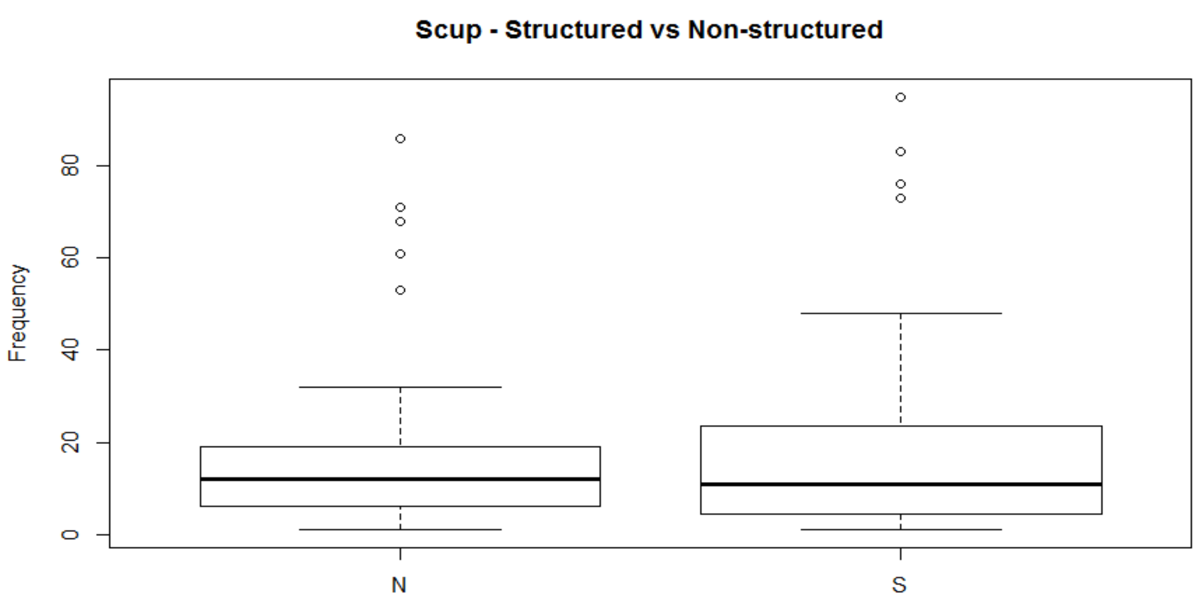


Figure 7c. Comparison of Structure vs Non-structure Data for Scup (Density)

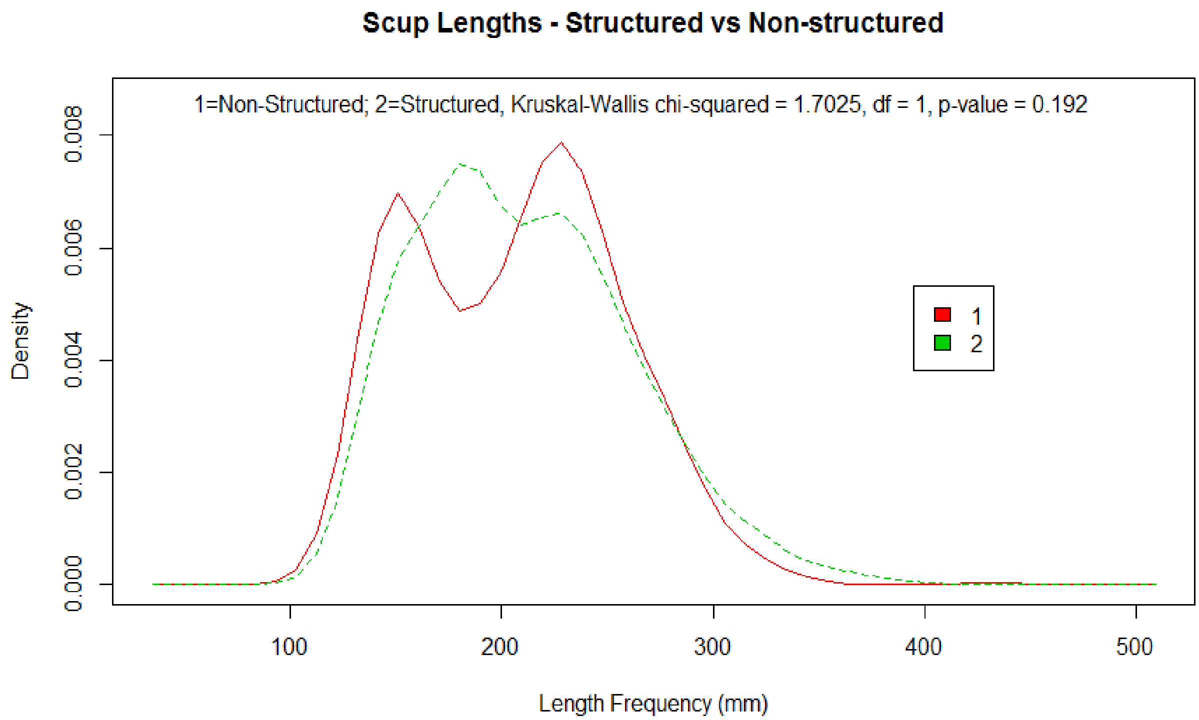


Figure 8. Comparison of Scup Data by Area (Box Plot)

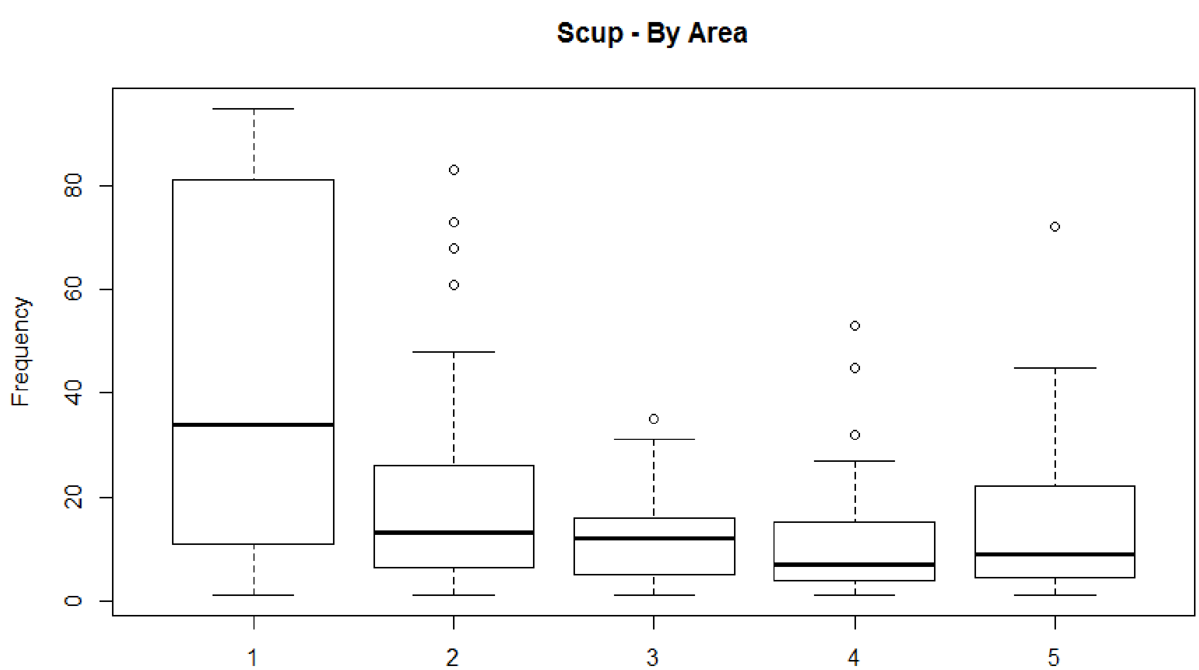


Figure 9a. Comparison of Scup Lengths by Month

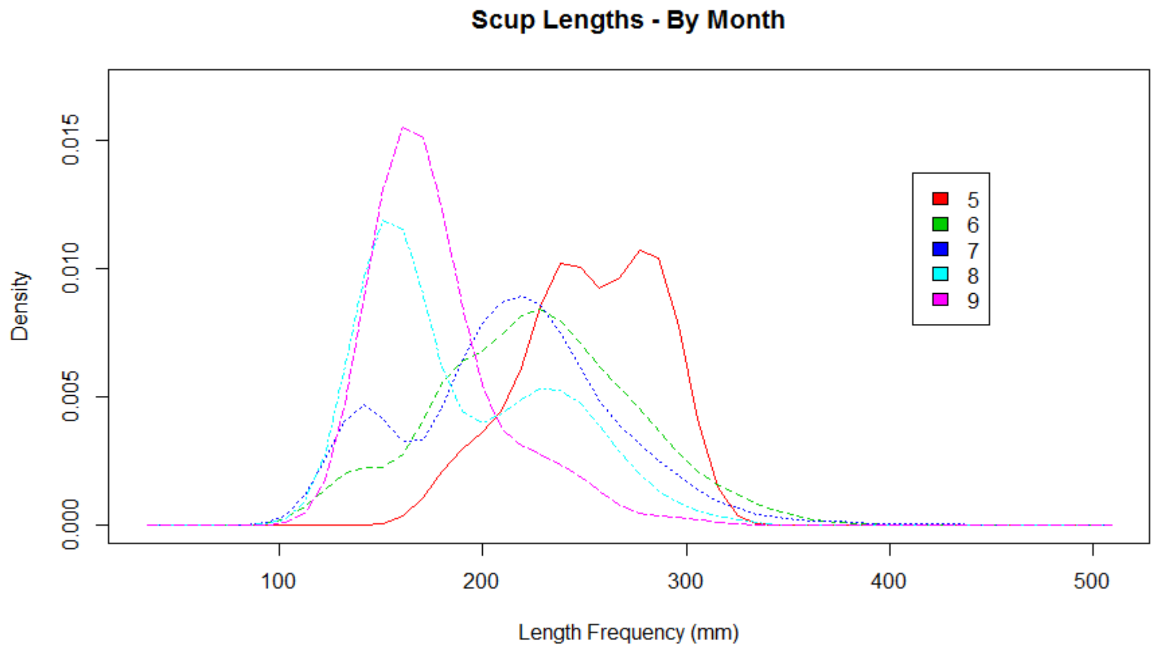


Figure 9b. Comparison of Scup Lengths by Month (Box Plot)

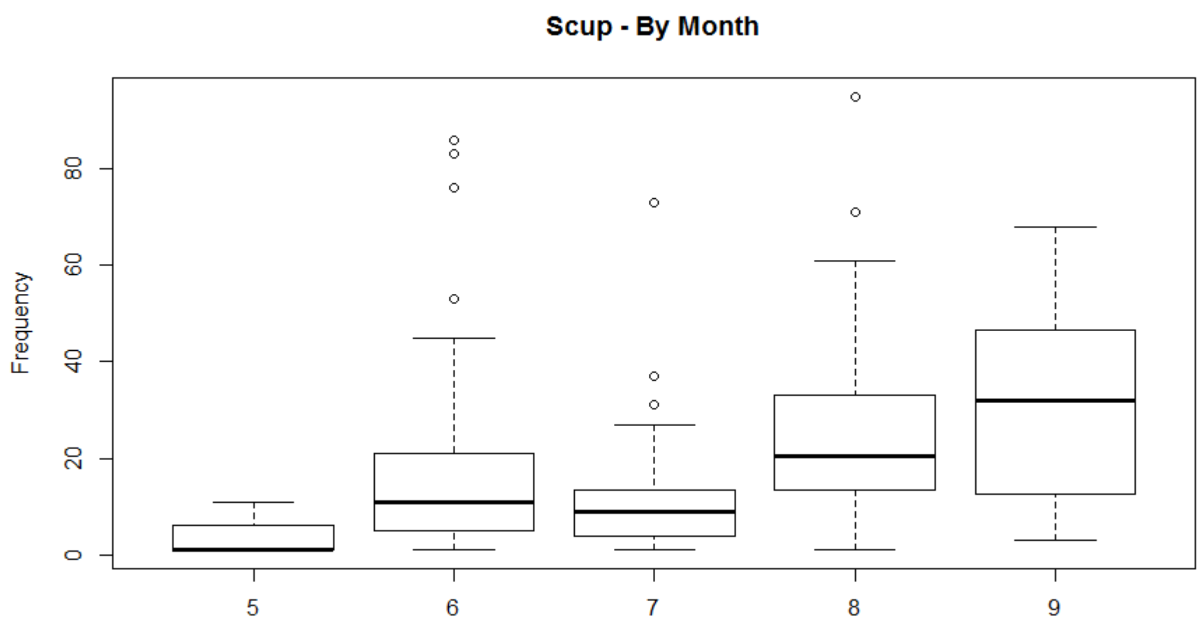


Figure 10a. Length Frequency Histogram for Tautog.

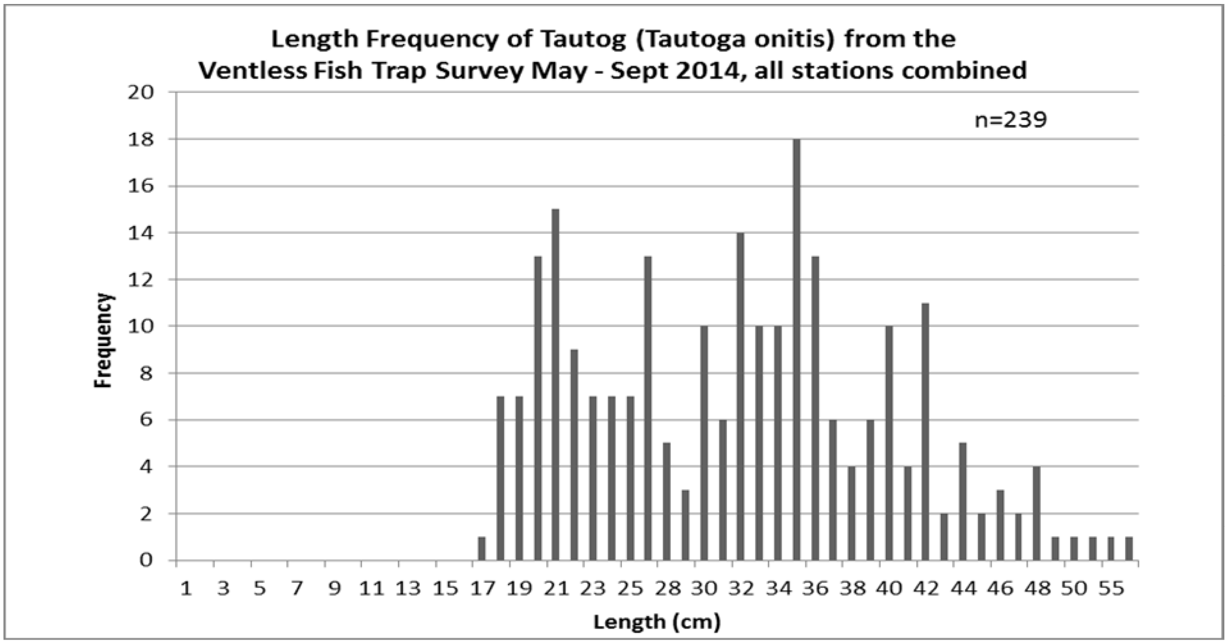


Figure 10b. Length at age graph for Tautog

Length at age key for tautog (*Tautoga onitis*). Data courtesy of the Atlantic Coastal Cooperative Statistics Program.

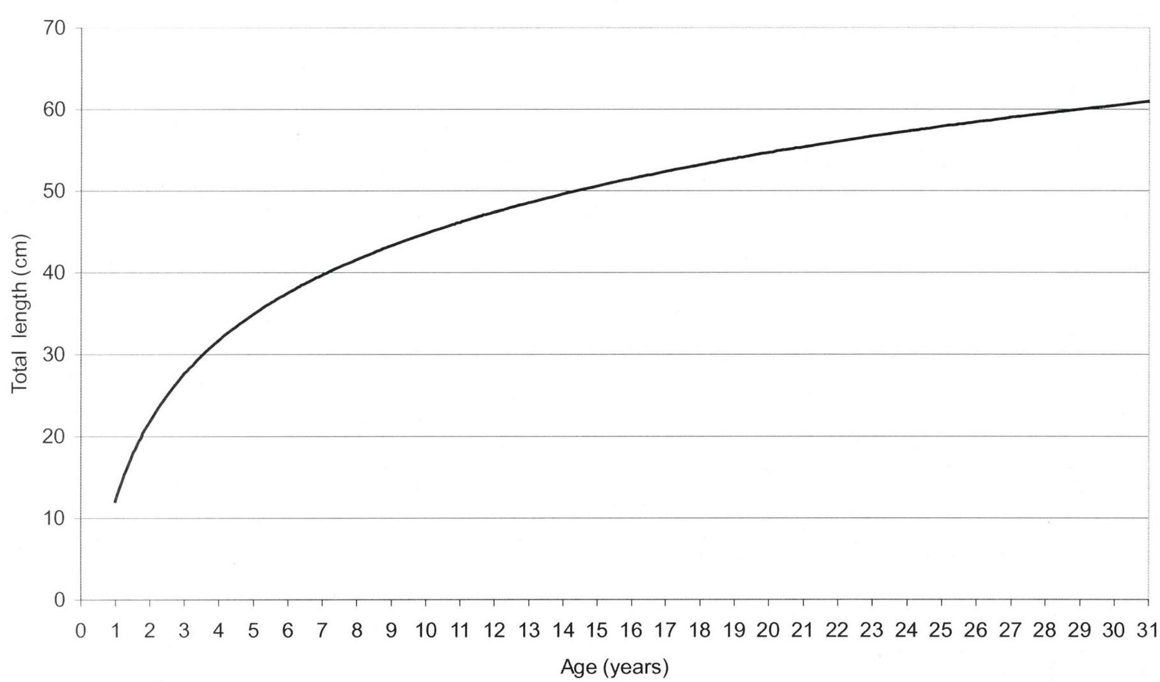


Figure 11a. Comparison of Structure vs Non-structure Data for Tautog

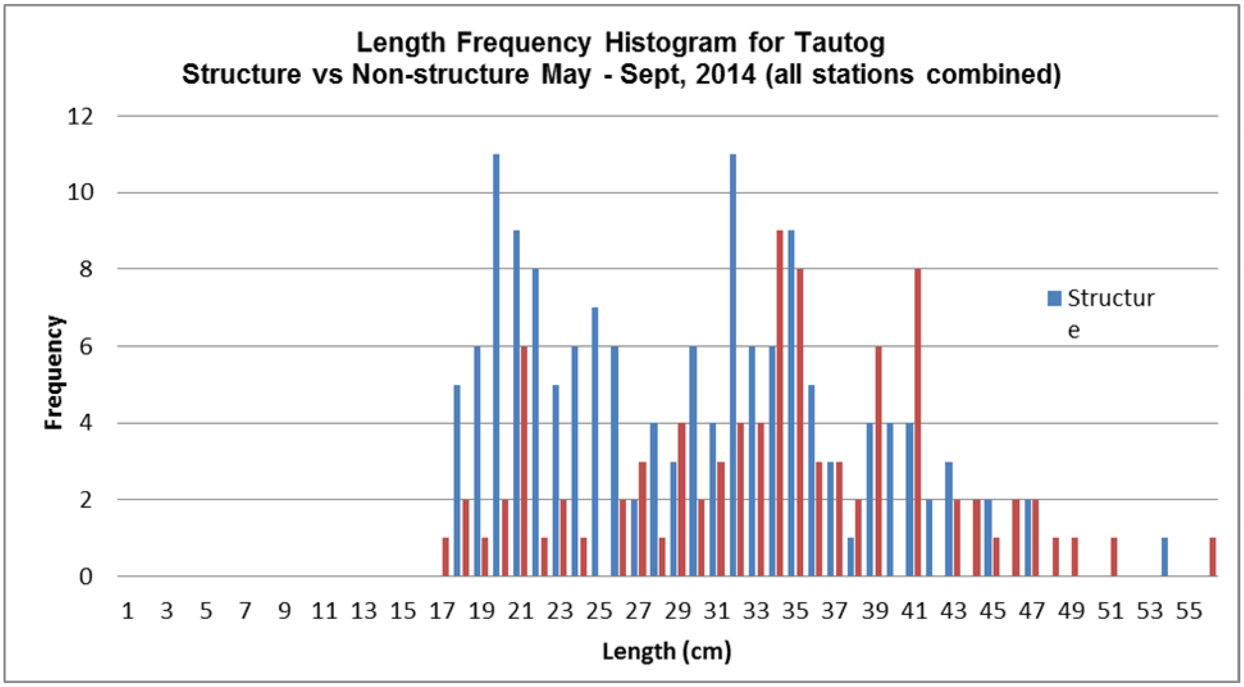


Figure 11b. Comparison of Structure vs Non-structure Data for Tautog (Box Plot)

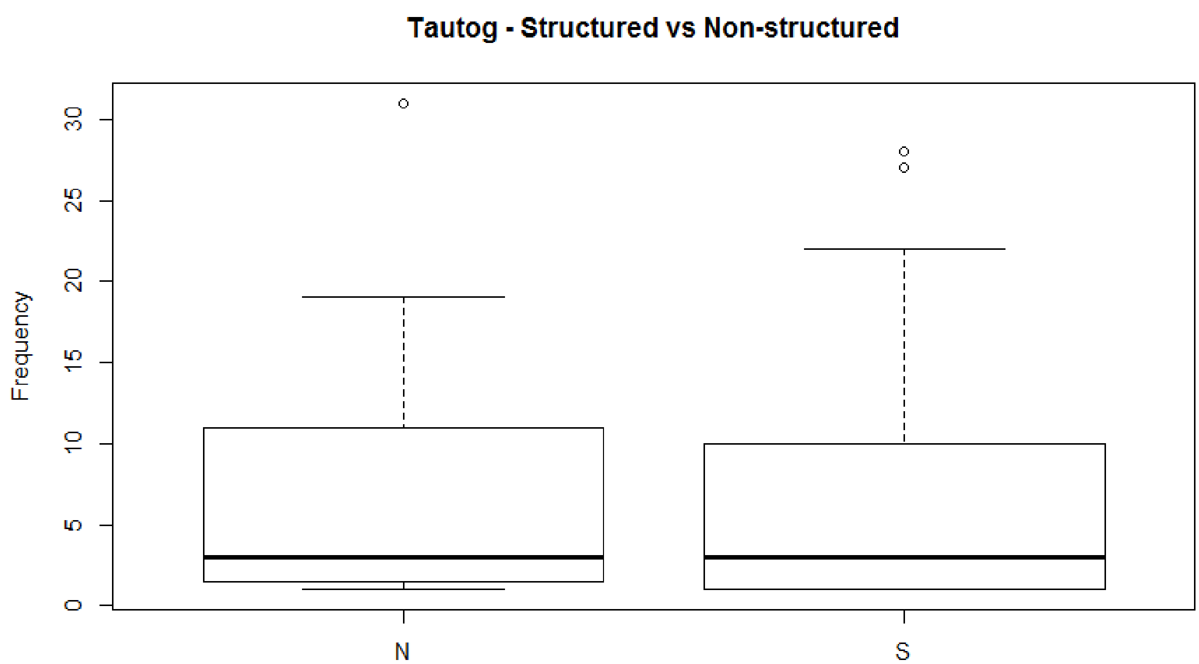


Figure 11c. Comparison of Structure vs Non-structure Data for Tautog (Density)

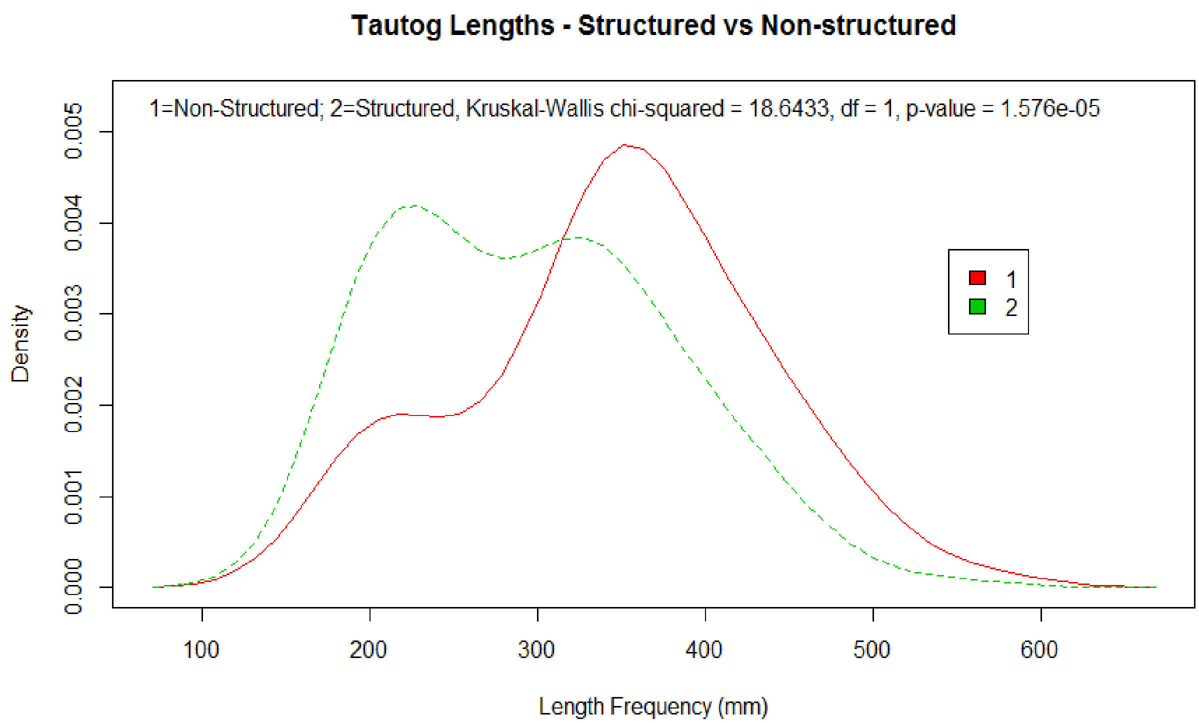


Figure 12. Comparison of Tautog Data by Area (Box Plot)

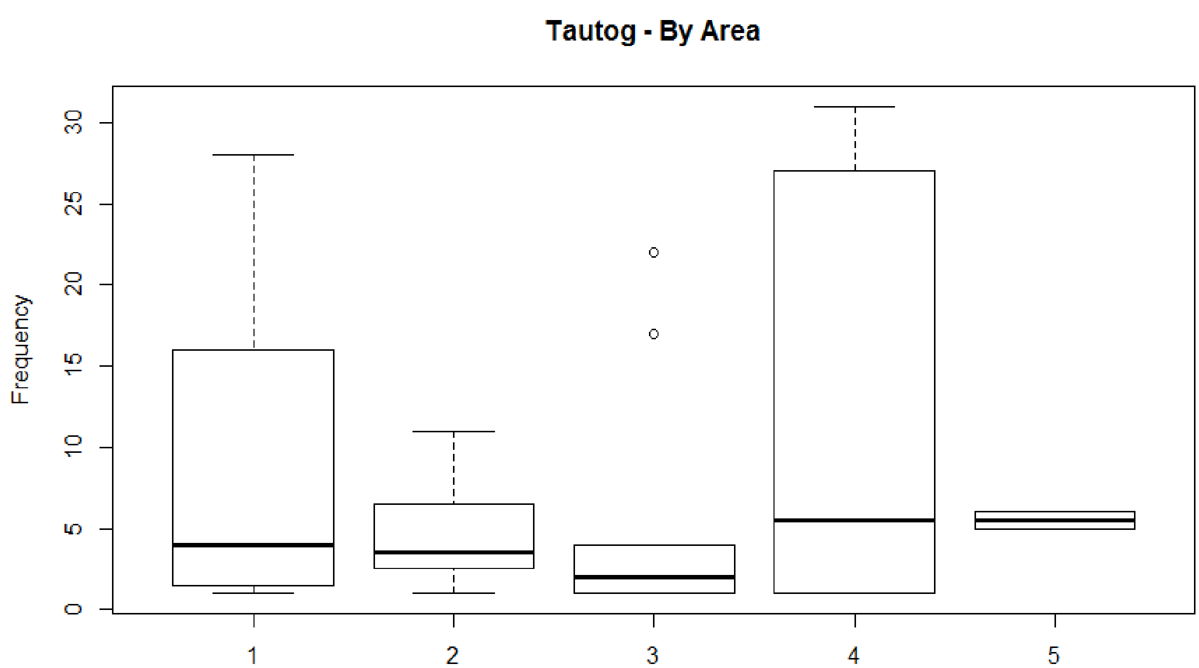


Figure 13a. Comparison of Tautog Lengths by Month (Box Plot)

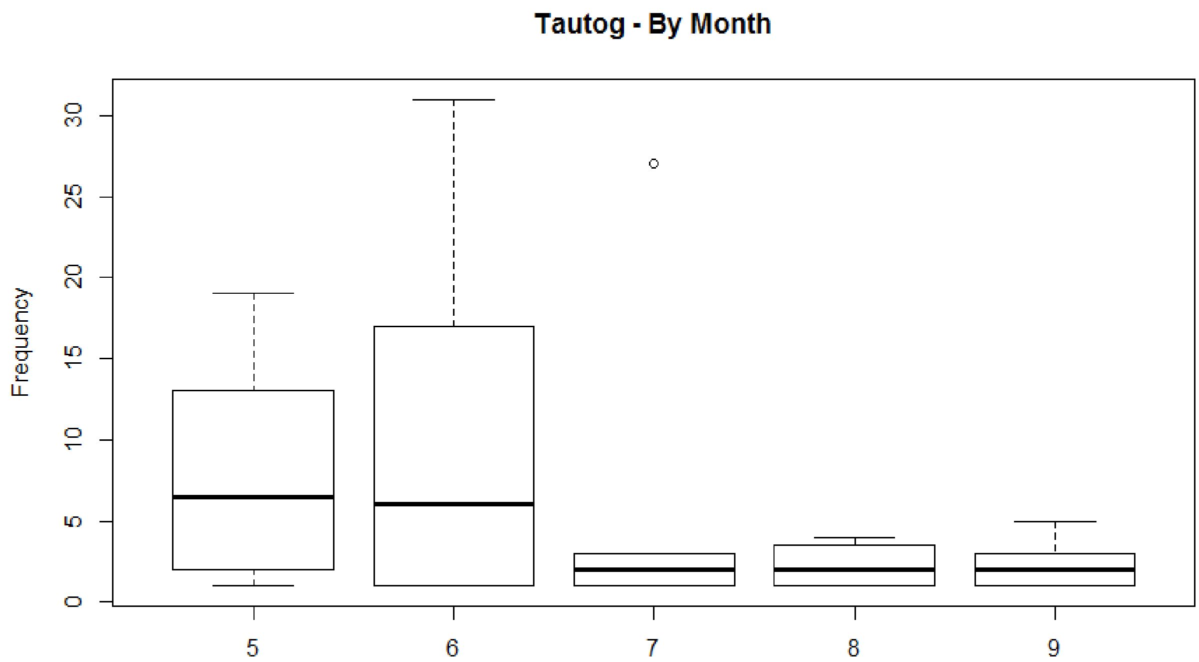


Figure 13b. Comparison of Tautog Lengths by Month

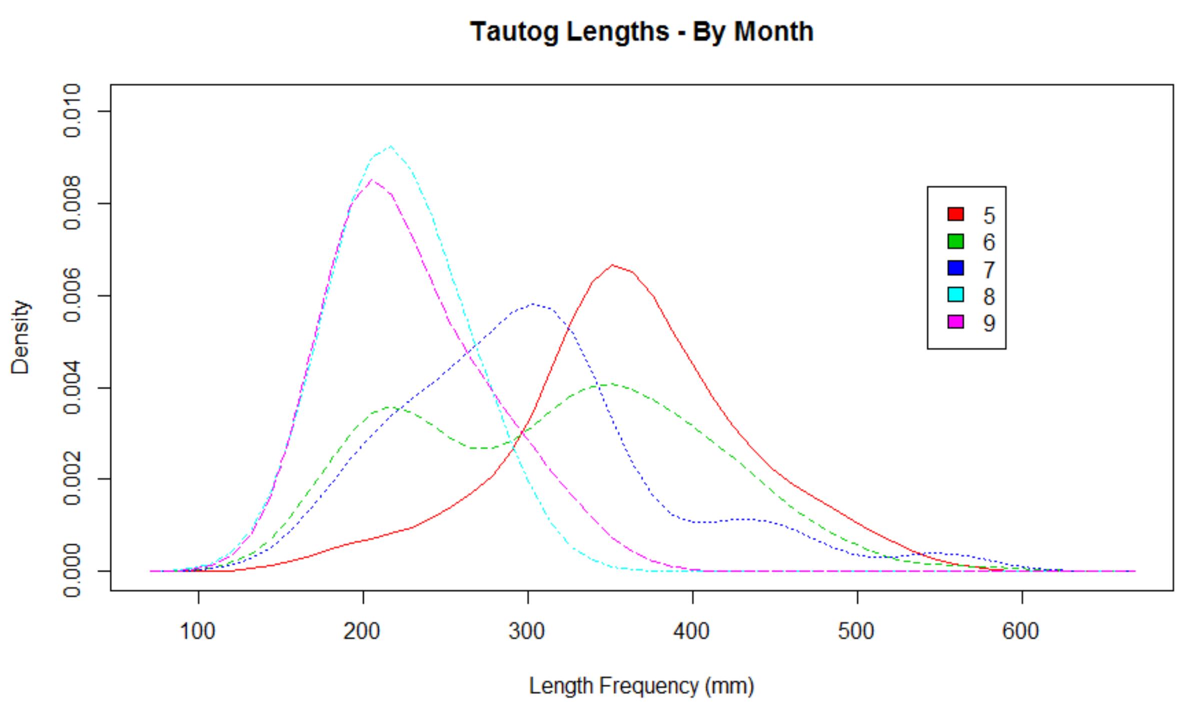


Figure 14. Comparison of Trawl Data vs Scup Pot Data for Black Sea Bass

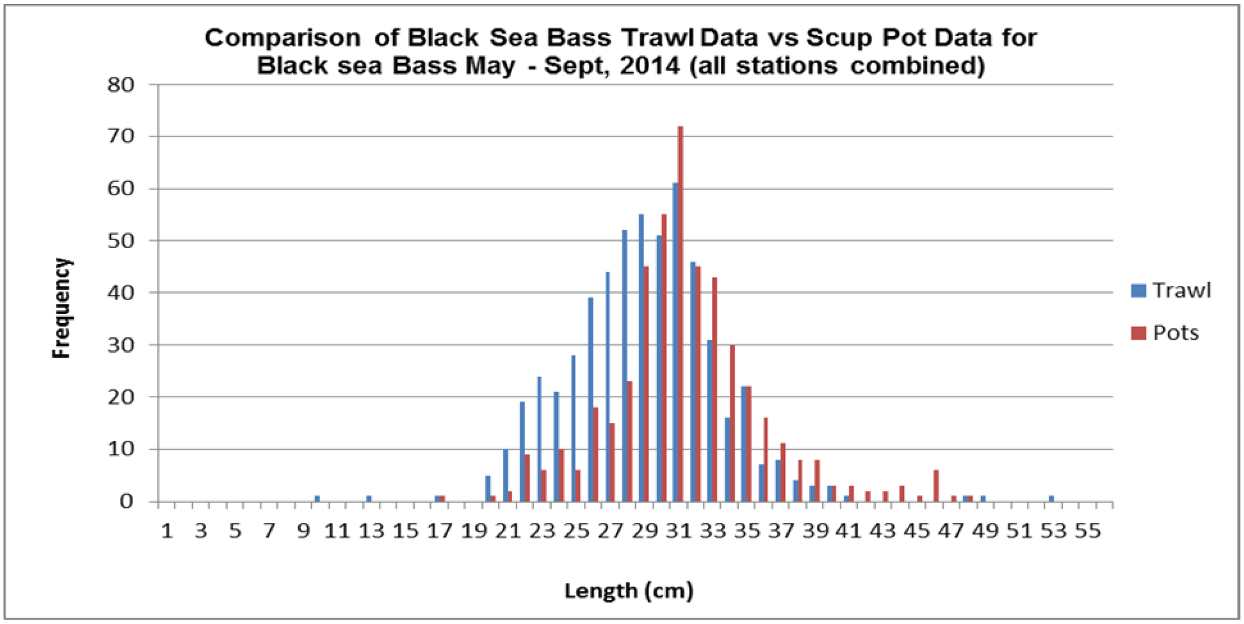


Figure 15. Comparison of Trawl Data vs Scup Pot Data for Scup

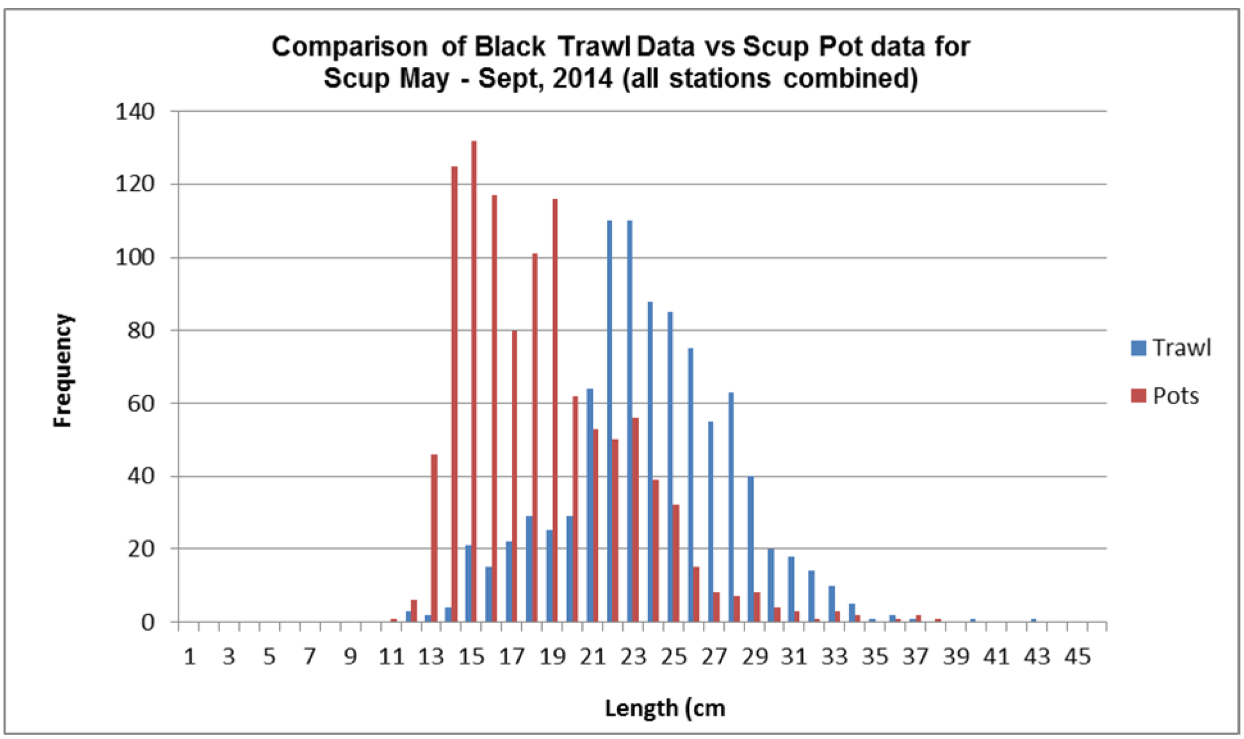
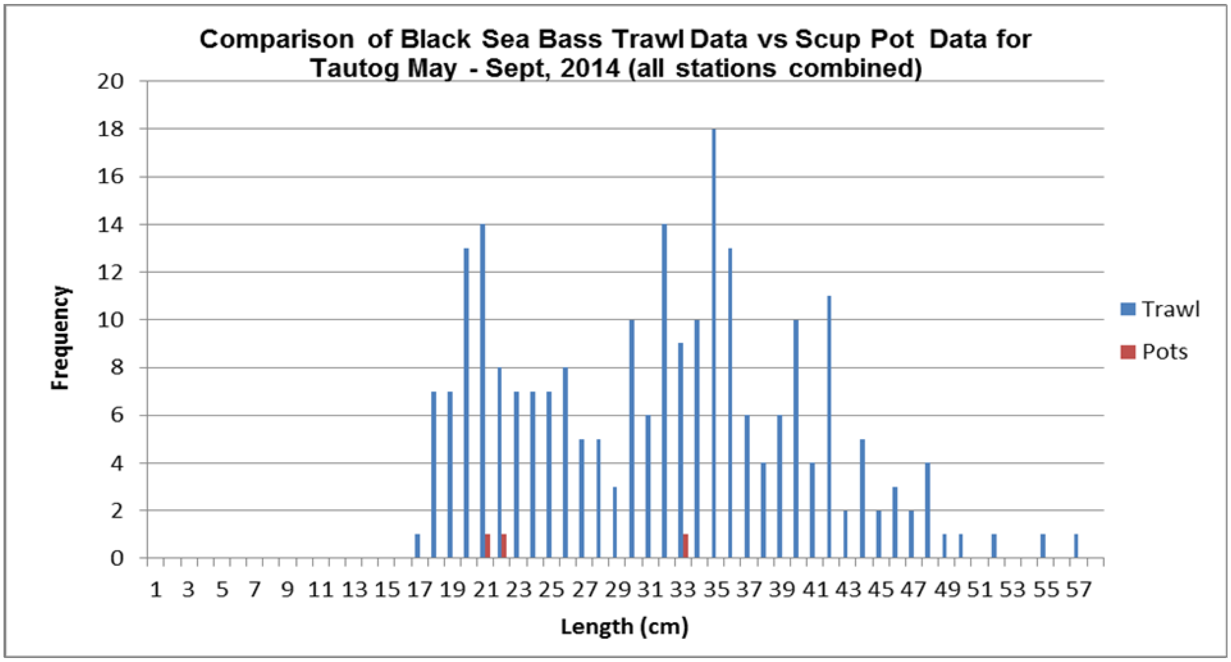


Figure 16. Comparison of Trawl Data vs Scup Pot Data for Tautog



Marine Fishes of Rhode Island

By
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Rhode Island Department of Environmental Management
Division of Fish and Wildlife

Performance Report - Job - 13 March 2015

PERFORMANCE REPORT

State: Rhode Island

Project Number: F-61-R

Segment: 21

Project Type: Resource Monitoring

Project Title: Assessment of Recreationally Important Finfish Stocks in Rhode Island Waters

Period Covered: January 1, 2014 to December 31, 2014

Job Number & Title: 13- Marine Fishes of Rhode Island

Job Objective: The goal of this project is to produce a manuscript which will act as a reference text for recreational fishermen, fisheries scientists, and commercial fishermen alike. The finished product will summarize existing knowledge on the appearance, distribution, and life history information where such information exists, including growth, reproduction, food habits, and longevity of fishes caught within the marine waters of Rhode Island. The results will be listed systematically and the manuscript will include scientific illustrations and photographs of fish and distribution maps delineating range of fishes within the state. This volume will be designed to be a standalone manuscript but also to be compatible with and be a companion volume to the Fresh Water Fishes of Rhode Island

Summary: We installed Adobe CS6 Publishing suite, obtained a purchase order to hire the same scientific illustrator and awarded the contract as well as assigned the first series of 14 species. We spent considerable time on the internet gathering life history and management information for approximately 25 species to date.. We have also begun to write specific species accounts for the first 14 species assigned to the artist
.

Target Date: 2016

Status of Project: Behind Schedule

Significant Deviations: Personnel were unable to complete significant amounts of work on this project. They were engaged in ñNarragansett Bay Ventless Pot, Multi-species Monitoring and Assessment Programòsampling and vessel repair.

Recommendations: To continue on into the next segment.

Remarks: Personnel spent the majority of the year, April through September October, working on the Narragansett Bay Ventless Pot project, either completing field work or working to restore our vessel to working order to resume sampling. When the ventless pot project ended in September, it was because of vessel issues which had to be resolved ASAP and which continue to this day. However, in January of 2014 we purchased Adobe CS6 suite of programs publishing software which should make work on this project more seamless. This product has been installed and personnel have converted the work already completed into PDF files and importing them into ñIndesignò

We received a purchase order for original art in June and have retained Robert Golder the same artist who did the art work for ñInland Fisheries of Rhode Islandò A contract has been awarded and the first series of 14 species were assigned to the artist. Incidentally, these are the same species that are included on the poster ñCommon Salt Water Fishes of Rhode Islandò The Division intends to reprint this valuable poster when the artist has completed this task. Investigators will work with the scientific illustrator, as necessary, to provide specimens, photographs, etc., of the various fish to assist the artist in his task.

We have spent considerable time on the internet gathering life history information, management information and other pertinent information for approximately 25 species to date. We have also begun to write specific species accounts for the first 14 species assigned to the artist. We will seek additional grant monies, e.g. State Wildlife Grant funds, for the non-federal aid species which will be included in the manuscript as we get closer to working on those particular species.

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ASSESSMENT OF RECREATIONALLY IMPORTANT FINFISH STOCKS IN RHODE ISLAND WATERS

University of Rhode Island Graduate School of Oceanography Weekly Fish Trawl
2014

PERFORMANCE REPORT
F-61-R SEGMENT 21
JOB 14

Jeremy Collie, PhD
Professor of Oceanography

March 2015

Annual Performance Report

STATE: Rhode Island PROJECT NUMBER: F-61-R
SEGMENT NUMBER: 21

PROJECT TITLE: Assessment of Recreationally Important Finfish Stocks in Rhode Island Waters

JOB NUMBER: 14

TITLE: University of Rhode Island Graduate School of Oceanography Weekly Fish Trawl

JOB OBJECTIVE: To collect, summarize and analyze bottom trawl data for biological and fisheries management purposes.

PERIOD COVERED: January 1, 2014 ï December 31, 2014.

TARGET DATE: December 2014

SCHEDULE OF PROGRESS: On schedule.

SIGNIFICANT DEVIATIONS: None

RECOMMENDATIONS: Continuation of the weekly trawl survey into 2015, data provided by the survey is used extensively in the Atlantic States Marine Fisheries Commission and NOAA Fisheries fishery management process and fishery management plans. Work elements for 2015 will include the development of a shared database between URI and RIDEM, and a comparative study between the RIDEM trawl survey (see jobs 1 and 2 in this report) and the URIGSO fish trawl.

Introduction:
The University of Rhode Island Graduate School of Oceanography, began monitoring finfish populations in Narragansett Bay in 1959, continuing through 2014. These data provided weekly identification of finfish and crustacean assemblages. Since the inception of the weekly fish trawl survey tows have been conducted within Rhode Island territorial waters at two stations, one representing in bay habitat and one representing more open water type habitats. The weekly time step of this survey and time series are two unique characteristics of this survey. The short duration time step (weekly) has enough definition to capture migration periods and patterns of important finfish species and the length of the time series allows for the characterization of these patterns back into periods of time that may represent different productivity or climate regimes for many of these species. This performance report reflects the efforts of the 2014 survey year as it relates to the past 55 years.

Methods:
A weekly trawl survey is conducted on the URI research vessel Capôn Bert. Two stations are sampled each week: one off Wickford represents conditions in mid Narragansett Bay and one at the mouth of Narragansett Bay represents conditions in Rhode Island Sound. A hydrographic profile at each station measures temperature, salinity and dissolved oxygen. The same otter trawl net design has been used for the past 55 years. A half hour tow is made at each station at a speed of 2 knots. All species are counted and weighed with an electronic balance. Winter flounder are routinely measured and the sex ratio determined. When present on board, an undergraduate intern measures all other species with an electronic measuring board.

The gear dimensions for the net are as follows:

Net type	2-seam with bag
Length of headrope	39 feet (11.9 meters)
Otter boards	steel, 24 inches tall, 48 inches long (61 centimeters by 1.24 meters)
Distance from otter boards to net	60 feet (18.3 meters)
Mesh size: net	3 inches (7.6 centimeters)
Mesh size: codend	2 inches (5.1 centimeters)
Distance between otter boards while fishing	52 feet (15.8 meters) at Fox Island 64.5 feet (19.7 meters) at Whale Rock

The following are the station locations for the survey:

Site	Location	Coordinates	Depth Range at Low Tide (North to South Along Tow Line)	Bottom Substrate
Fox Island	Adjacent to Quonset Point and Wickford	41°34.5' N, 71°24.3' W	20 feet (6.1 meters) to 26 feet (7.9 meters)	Soft mud and shell debris
Whale Rock	Mouth of West Passage	41°26.3' N, 71°25.4' W	65 feet (19.8 meters) to 85 feet (25.9 meters)	Coarse mud/fine sand

Results:
A number of species of recreational importance were collected during 2014 by the URI Fish trawl survey. Represented below are a number of important species and their abundance trends throughout the time series of this survey. On each graph, the species abundance at the two stations is represented separately for each station.

Winter flounder
Winter flounder are one of the target species for the survey. The population of winter flounder has declined dramatically during the time period of the survey with 2014 being one of the lowest estimates on record for both stations (Figure 1). The survey information is used during the stock assessment process for winter flounder.

Tautog
Tautog are another important recreational species caught by the survey. The population of tautog has declined dramatically during the time period of the survey, but does show some small improvement in the most recent period of time (Figure 2). Despite the improvement, the population according to the survey has not rebounded to former levels. Tautog are mainly caught at the Fox Island station, with only random and infrequent catches occurring at Whale Rock. The survey information was reviewed during the stock assessment process for tautog.

Summer Flounder
Summer flounder are another important recreational species caught by the survey. The population of summer flounder has increased dramatically during the time period of the survey, but does showing a fair amount of variabilioty in the most recent time period (Figure 3). Summer flounder are caught at both sampling stations pretty consistently. The survey information was reviewed during the stock assessment process for summer flounder, and the trends indicated by the survey are similar to those indicated by the overall population trends.

Black Sea Bass
Black sea bass are another important recreational species caught consistently by the survey. The population of black sea bass has increased dramatically during the time period of the survey much like summer flounder, and also shows a fair amount of variability in the most recent time period (Figure 4). Black sea bass are caught at both

sampling stations pretty consistently. The survey information will be reviewed during the stock assessment process for black sea bass.

Scup

Scup is another of the Mid-Atlantic species caught consistently by the survey, along with summer flounder, black sea bass, bluefish, and menhaden. The population of scup has increased dramatically during the time period of the survey much like summer flounder and black sea bass, showing a high degree of variability going all the way back to the mid 70s (Figure 5). Scup are caught at both sampling stations pretty consistently, though the Fox Island station catches a much higher magnitude than does the Whale Rock station. Some of this variability and magnitude difference for scup is driven by high recruitment events, the young of the year recruits being susceptible to the trawl gear. The survey information will be reviewed during the stock assessment process for scup.

Bluefish

Bluefish is another of the Mid-Atlantic species caught consistently by the survey. The population of bluefish has increased during the middle of the time period of the survey , but has since declined, with some potential improvement in recent years. There is high variability for this species in the survey data, again mainly due to catching young of the year bluefish as opposed to adults (Figure 6). Bluefish are caught at both sampling stations pretty consistently. v

Weakfish

Weakfish is another of the Mid-Atlantic species caught consistently by the survey, as weakfish use Narrgansett Bay as a nursery habitat. The population of weakfish has been variable through the time period of the survey with periods of high abundance and periods of very low abundance. There is high variability for this species in the survey data, again mainly due to catching young of the year weakfish as opposed to adults (Figure 7), so this survey is probably a better indicator of recruitment than adult population size. Weakfish are caught at both sampling stations pretty consistently.

Striped Bass

Striped bass is probably the premier recreational species caught by the survey. The catch of striped bass has been variable throughout the time period of the survey. There is high variability for this species in the survey data, but the survey catches both juveniles and adults (Figure 8). Striped bass are caught in greater abundance and frequency at Fox Island than at Whale Rock.

Menhaden

Menhaden is another of the Mid-Atlantic species caught consistently by the survey. The catch of menhaden has been variable throughout the time period of the survey, mainly due to the schooling pelagic nature of this species. There is high variability for this species in the survey data, but the survey mainly catches juveniles (Figure 9). Menhaden are caught in greater abundance and frequency at Fox Island than at Whale Rock. The survey information was reviewed during the stock assessment process for menhaden.

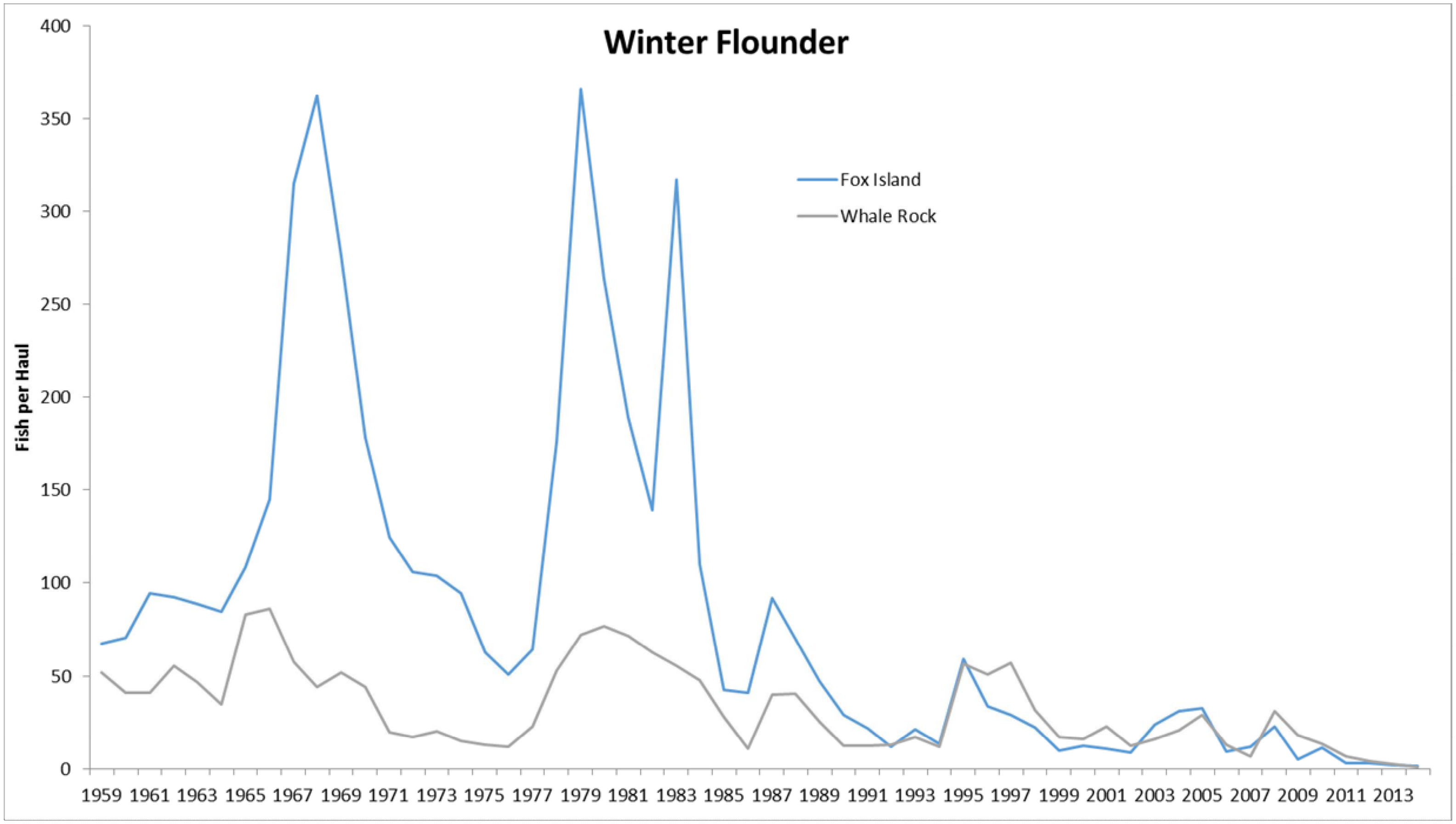

Figure 1 ï Survey data for entire time series for winter flounder at both sampling stations (Fox Island and Whale Rock).

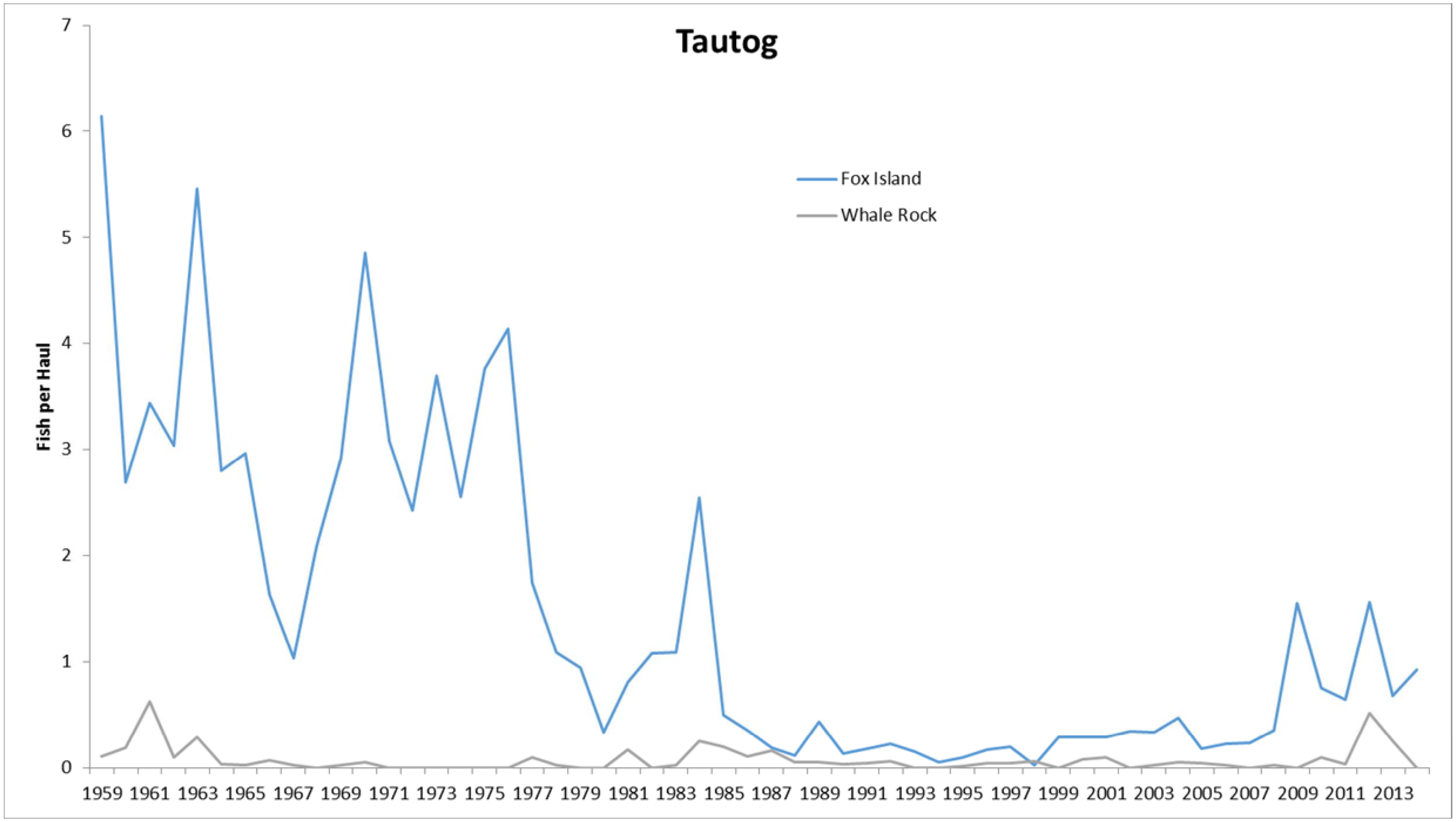

Figure 2 ï Survey data for entire time series for tautog at both sampling stations (Fox Island and Whale Rock).

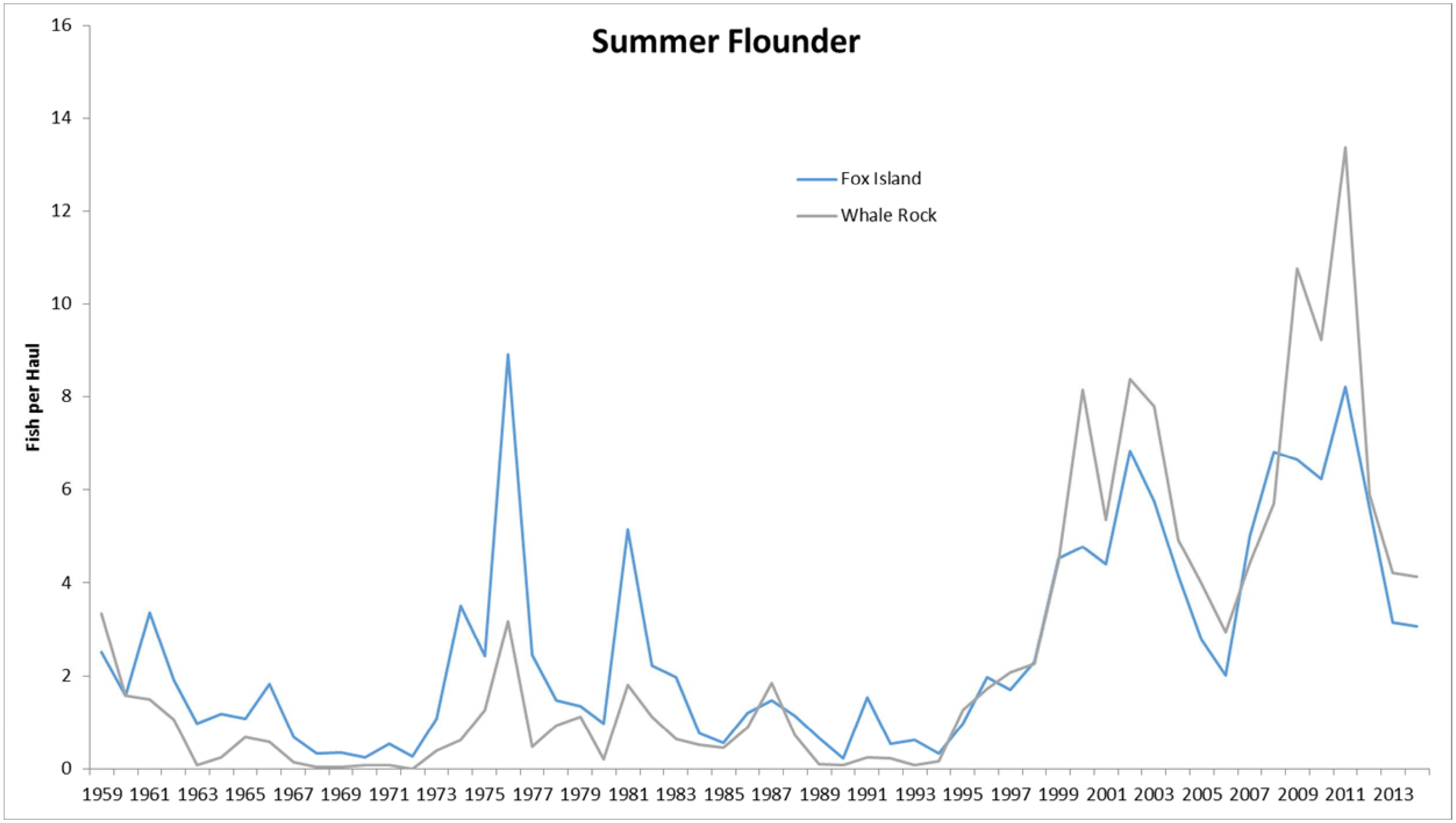

Figure 3 ï Survey data for entire time series for summer flounder at both sampling stations (Fox Island and Whale Rock).

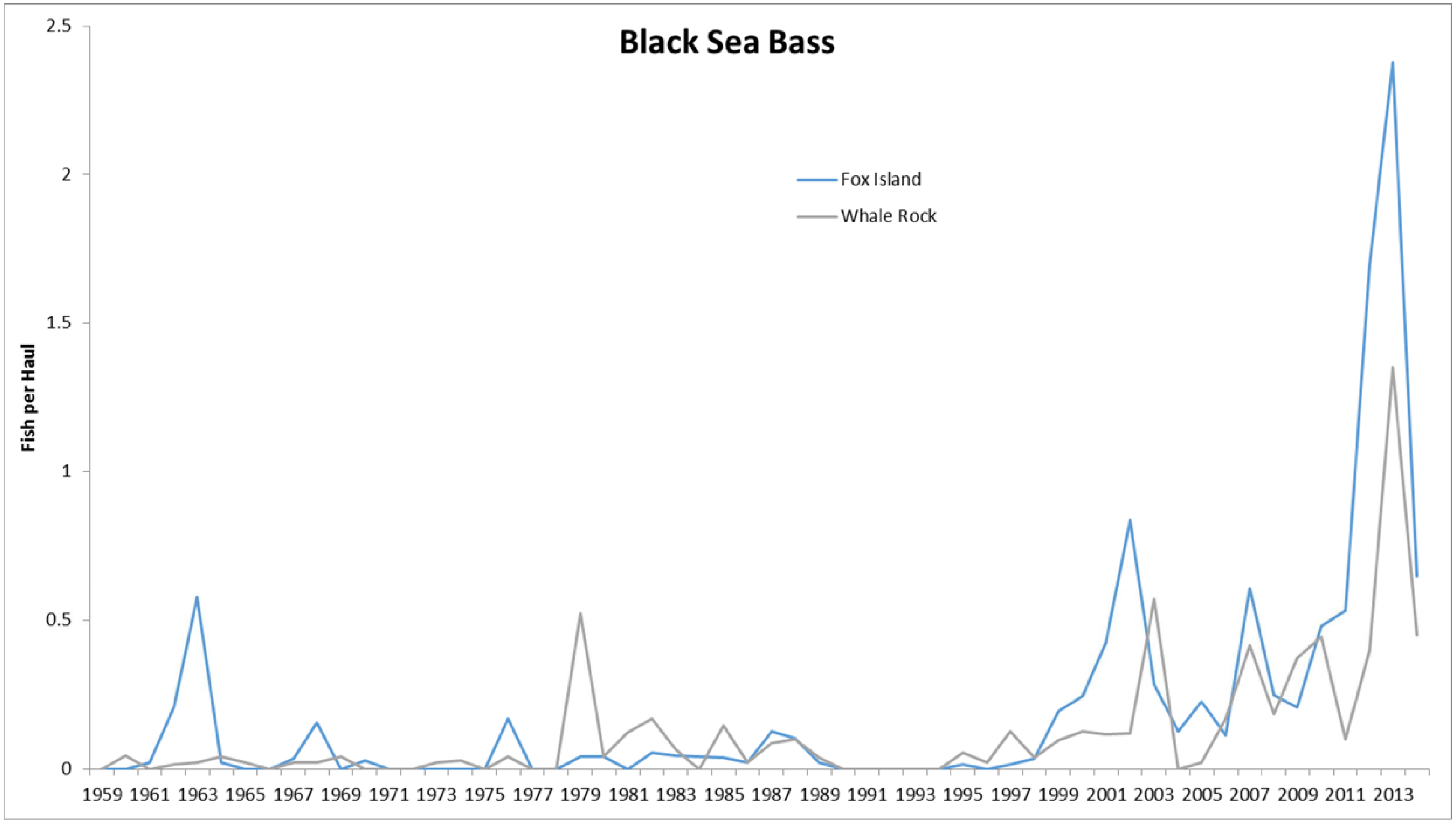

Figure 4 ï Survey data for entire time series for black sea bass at both sampling stations (Fox Island and Whale Rock).

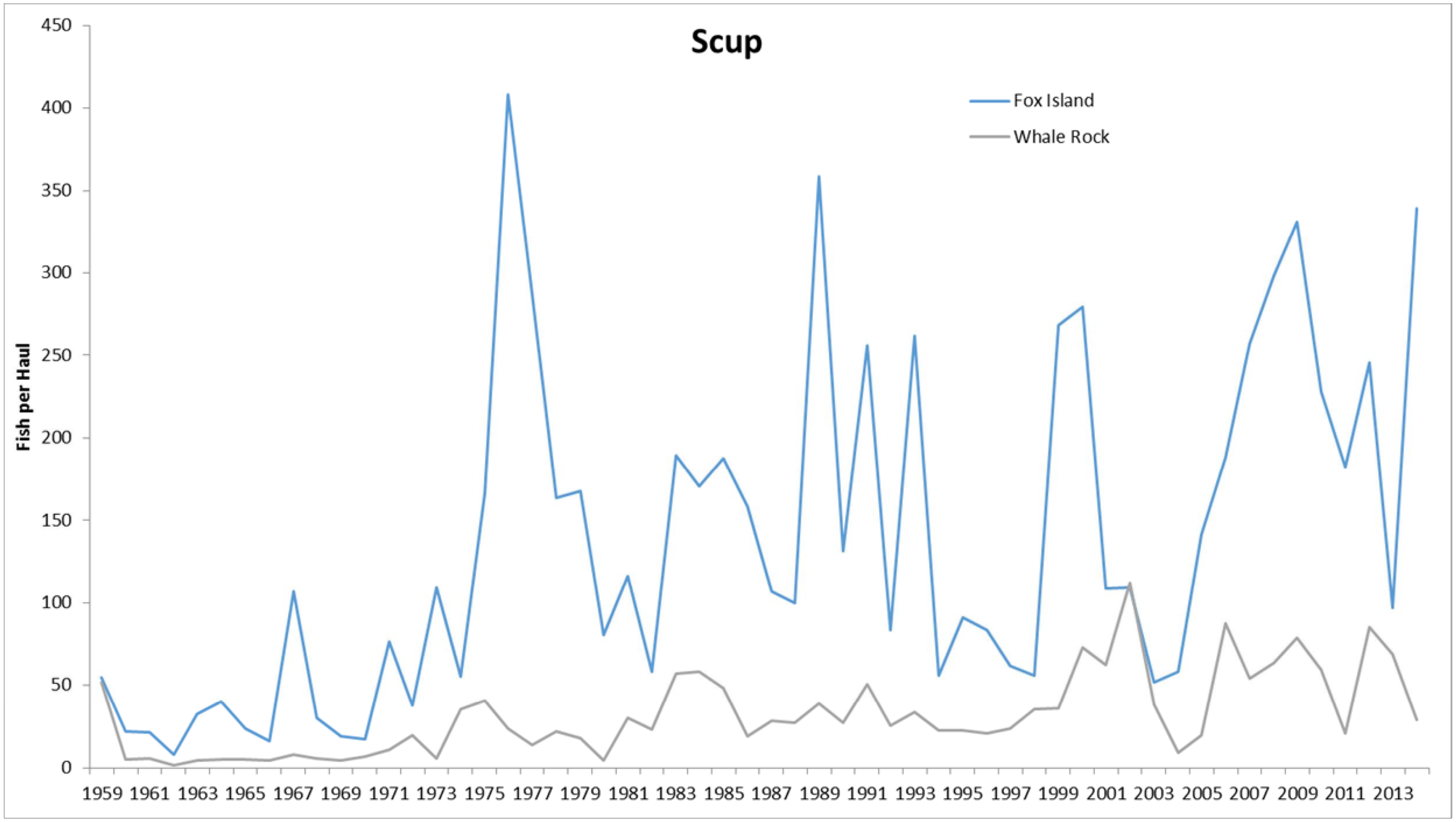

Figure 5 ï Survey data for entire time series for scup at both sampling stations (Fox Island and Whale Rock).

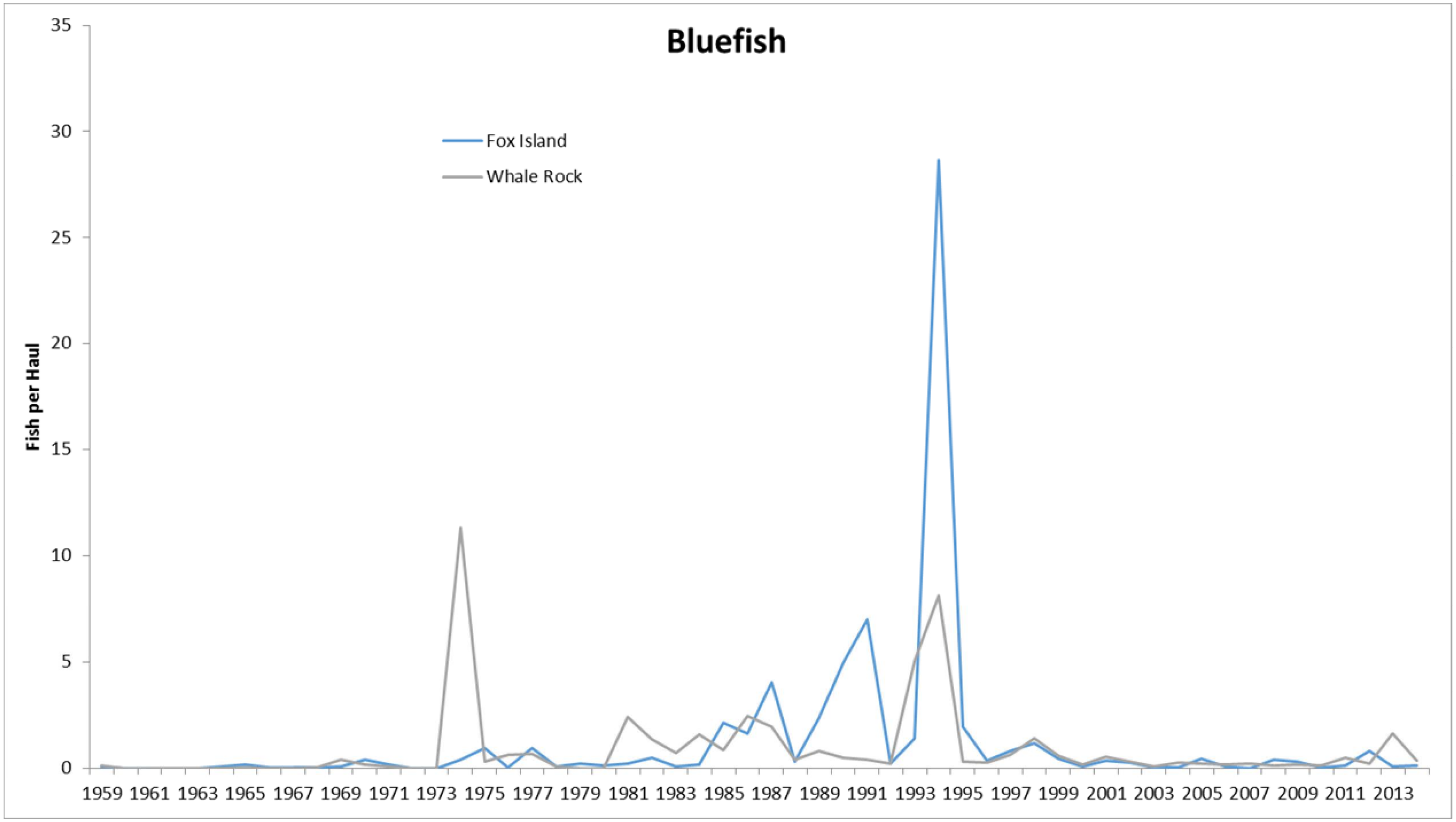

Figure 6 ï Survey data for entire time series for bluefish at both sampling stations (Fox Island and Whale Rock).

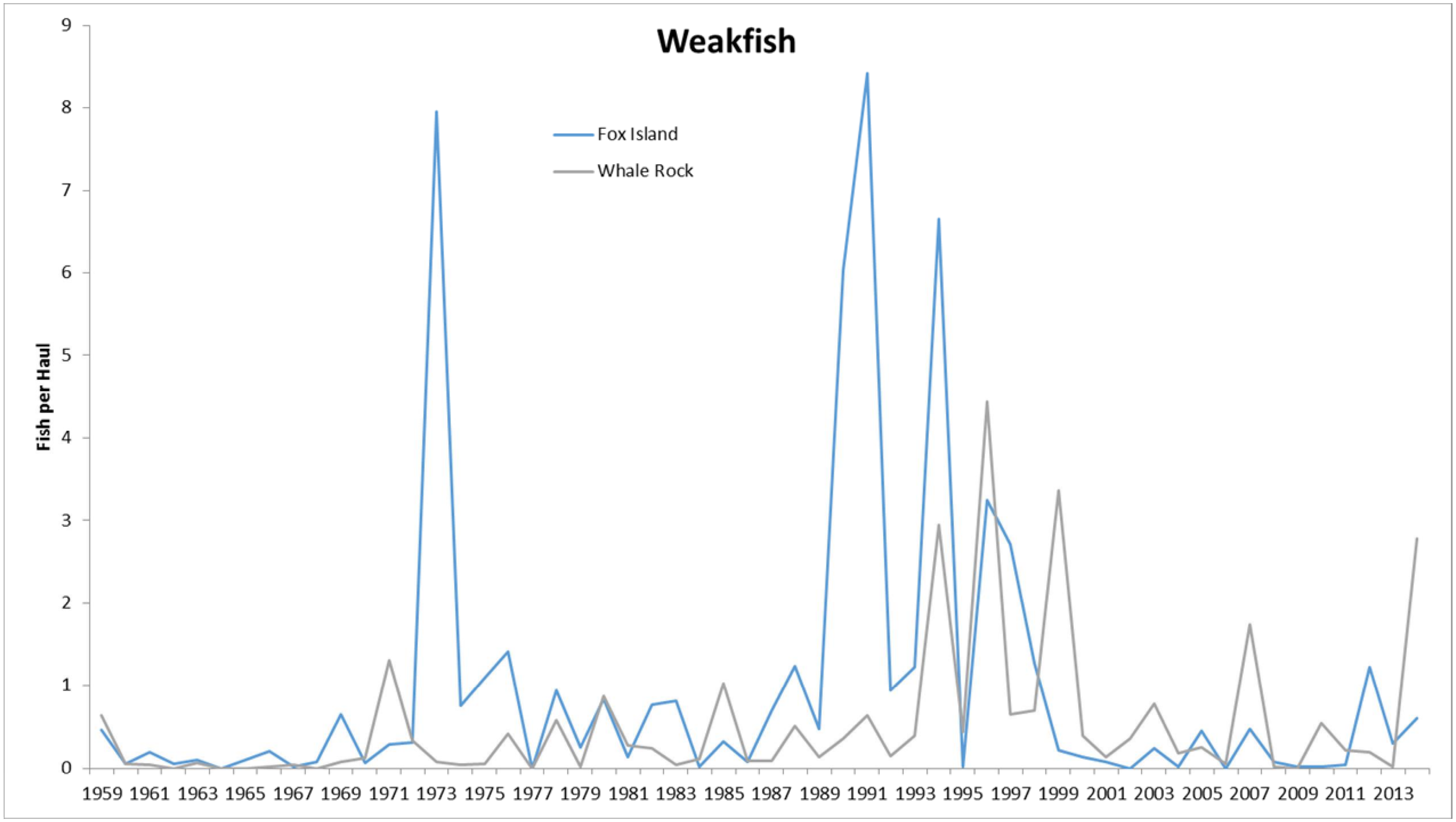

Figure 7 ï Survey data for entire time series for weakfish at both sampling stations (Fox Island and Whale Rock).

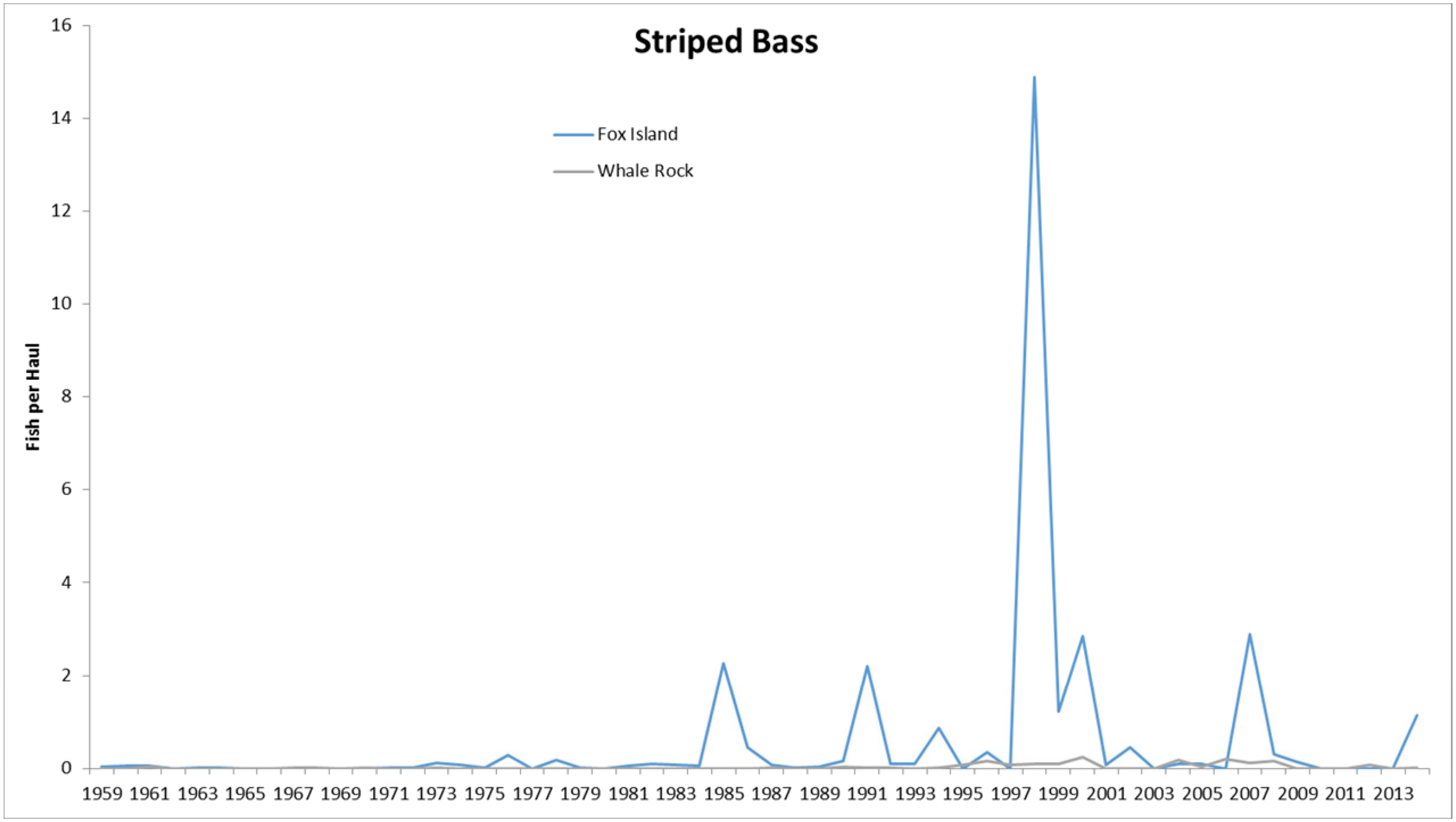

Figure 8 ï Survey data for entire time series for striped bass at both sampling stations (Fox Island and Whale Rock).

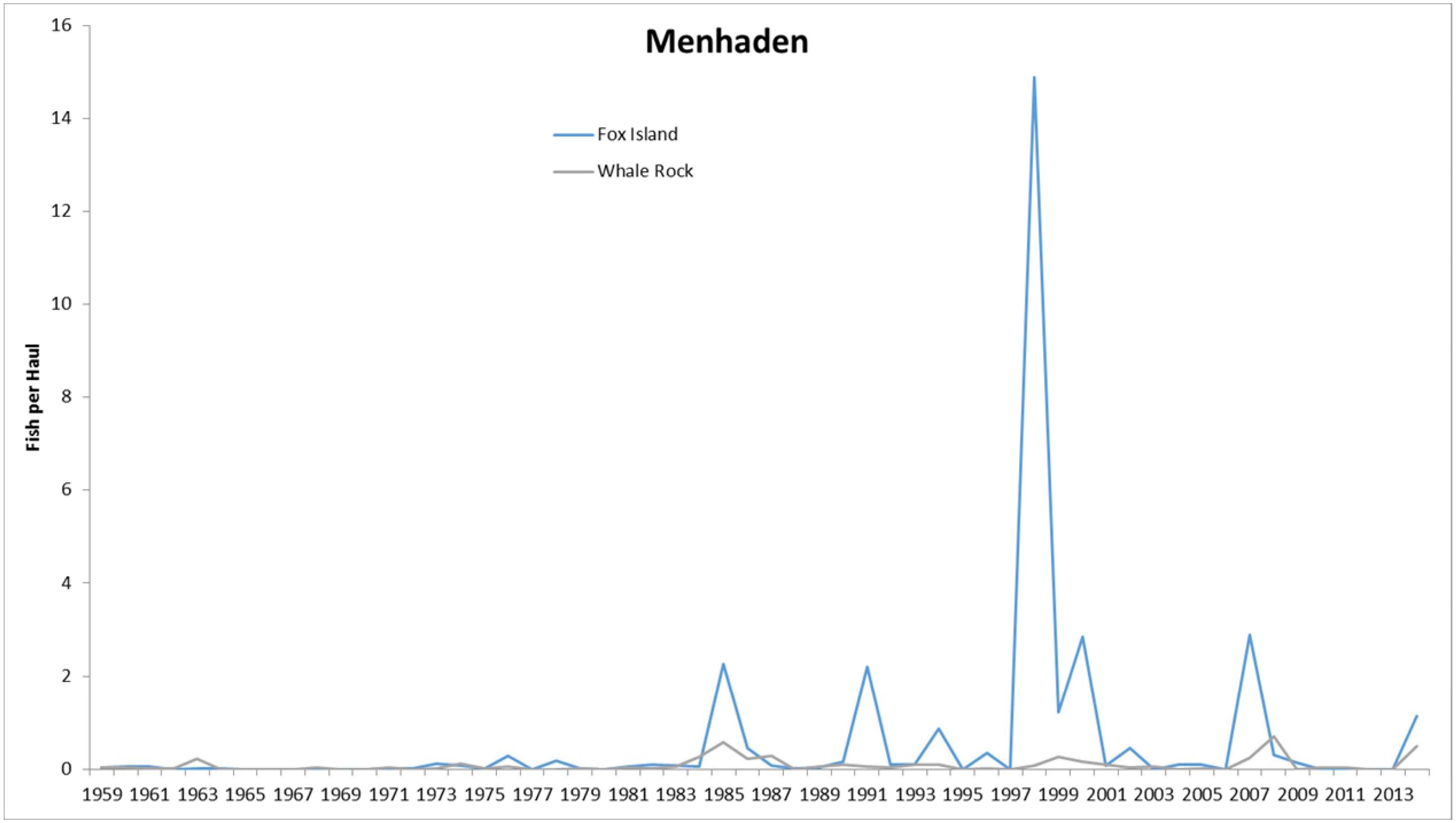

Figure 9 ï Survey data for entire time series for menhaden at both sampling stations (Fox Island and Whale Rock).

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