Assessment of Recreationally Important Finfish Stocks in Rhode Island Waters

2013 Annual Performance Reports F-61-R-21

Jobs 1-13

Note: Jobs 5 and 7 have been completed

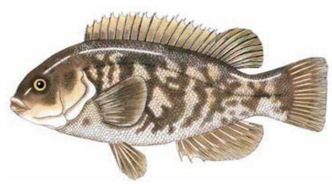
PERIOD: January 1, 2013 – December 31, 2013

Rhode Island Division of Fish and Wildlife


ASSESSMENT OF RECREATIONALLY IMPORTANT FINFISH STOCKS IN RHODE ISLAND WATERS

COASTAL FISHERY RESOURCE ASSESSMENT
TRAWL SURVEY
2013

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



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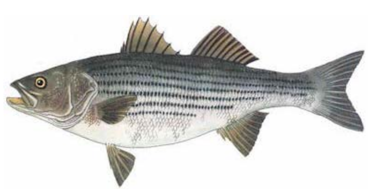
Division of Fish and Wildlife
Marine Fisheries

March 2014




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, 2013 – December 31, 2013.

PROJECT SUMMARY: Job 1, summary accomplished:

A: 156, twenty minute bottom trawl were successfully completed.

B: Data on weight, length, sex and numbers were gathered on 68 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 2013

SCHEDULE OF PROGRESS: On schedule.

SIGNIFICANT DEVIATIONS: None

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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 – May)/ Fall (September – October) 2013

PROJECT SUMMARY: Job 2, summary accomplished:

A: 44, twenty minute tows were successfully completed during the Spring 2013 survey (26 NB. – 6 RIS – 12 BIS).

B: 44, twenty minute tow were successfully completed during the Fall 2013 survey (26 NB. – 6 RIS – 12 BIS)

TARGET DATE: DECEMBER 2013.

SCHEDULE OF PROGRESS: On schedule.

SIGNIFICANT DEVIATIONS: None

JOBS 1 & 2

RECOMMENDATIONS: Continuation of both the Monthly and Seasonal Trawl surveys into 2014, 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: 156 tows were completed during 2013 Job 1 (Monthly survey). 69 species accounted for a combined weight of 5,684.4 kgs. and 178,558 length measurements being added to the existing Narragansett Bay monthly trawl data set

By contrast, 88 tows were completed during 2013 Job 2 (Seasonal survey) 61 species accounted for a combined weight of 4,455.1 kgs. and 236,380 length measurements added to the existing seasonal data set.

With the completion of the 2013 surveys, combined survey(s) Jobs (1&2) data now reflects the completion of 5,764 tows with data collected on 132 species.

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Coastal Fishery Resource Assessment – 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), 5,764 tows have been conducted within Rhode Island territorial waters with data collected on 132 species. This performance report reflects the efforts of the 2013 survey year as it relates to the past 34 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 – 18.28
	5	13.5	18.28 – 27.43
	6	9.75	>=27.43
Block Island Sound	7	3.50	<=9.14
	8	10.50	9.14 – 18.28
	9	11.50	18.28 – 27.43
	10	12.25	27.43 – 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 4.5”, 2 seam (40’ / 55’), the mesh size is 4.5” and the sweep is 5/16” chain, hung 12” 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 50’ Wesmac hull, powered by a 3406 Caterpillar engine generating 700 hp.

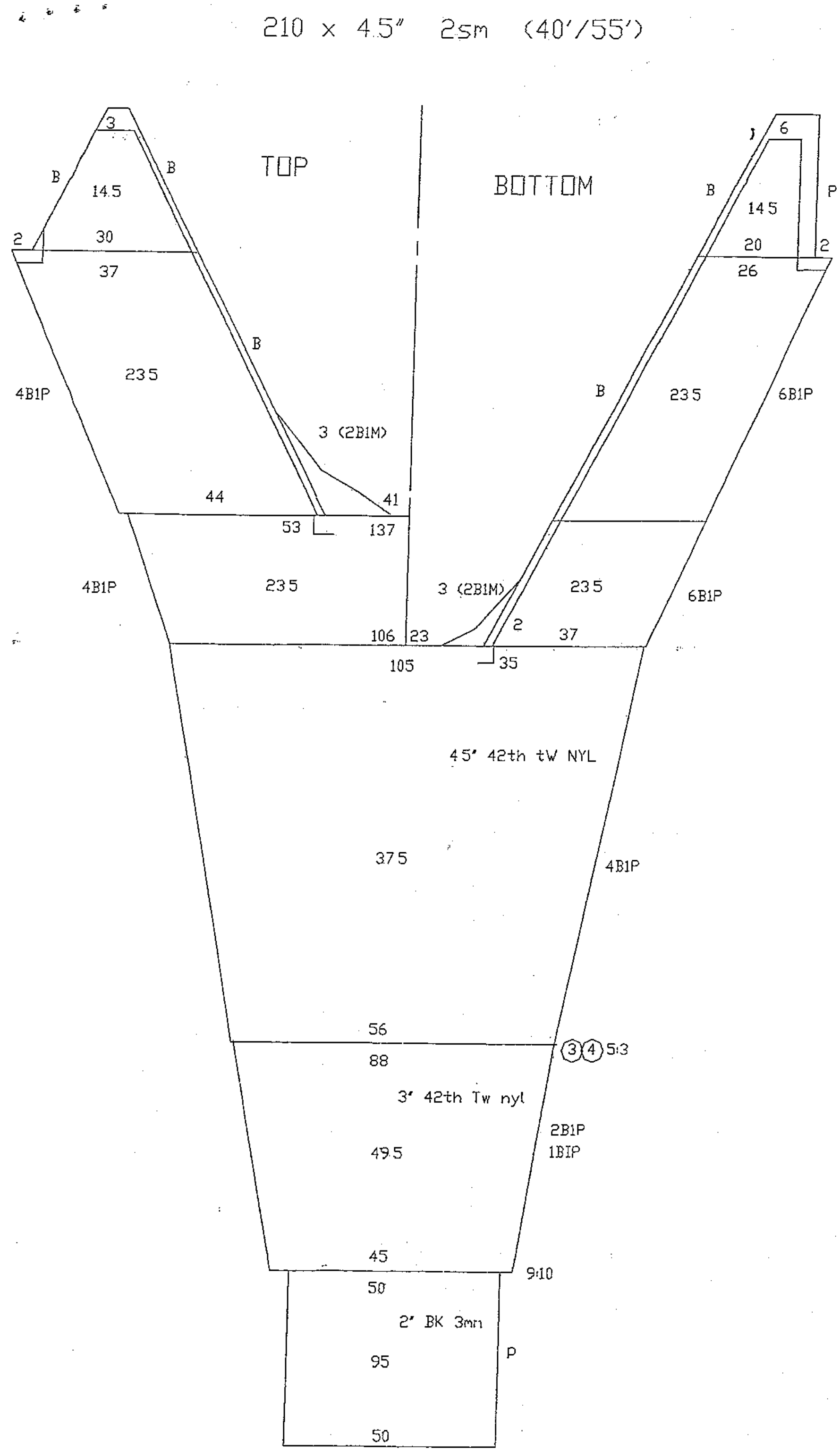
Data on wind direction and speed, sea condition, air temperature and cloud cover as well as surface and bottom water temperatures, are recorded at each station. Catch is sorted by species. Length (cm/mm) is recorded for all finfish, skates, squid, scallops, Whelk lobster, blue crabs and horseshoe crabs.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

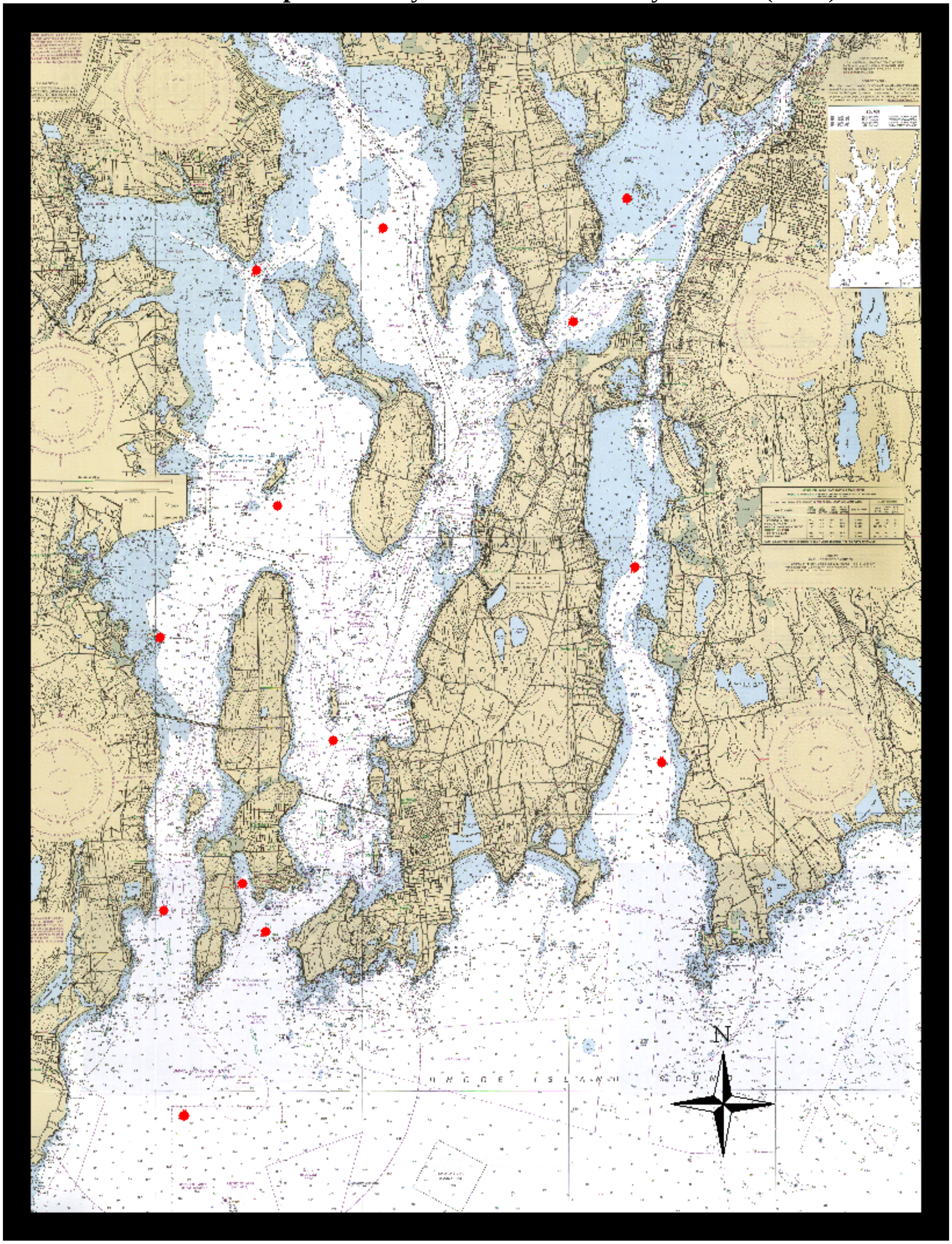
Acknowledgements:
Special thanks are again extended to Captain Richard Mello and Assistant Captain, Patrick Brown, and the entire seasonal staff and volunteers. The support given over the years has been greatly appreciated.

Figure 1



210 x 4.5" 2sm (40'/55')
TOP
BOTTOM
3
B
14.5
B
2
30
37
B
235
4B1P
3 (2B1M)
44
41
53
137
4B1P
235
106
23
6
B
P
145
20
2
26
B
235
6B1P
3 (2B1M)
235
6B1P
2
37
105
35
45' 42th tW NYL
375
4B1P
56
88
3 4 5:3
3' 42th Tw nyl
2B1P
1B1P
495
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 68 species were observed and recorded during the 2013 Narragansett Bay Monthly Trawl Survey totaling 178,558 individuals or 1144.6 fish per tow. In weight, the catch accounted for 5,684.4 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
Bay Anchovy	ANCHOA MITCHILLI	55237
Butterfish	PEPRILUS TRIACANTHUS	44493
Scup	STENOTOMUS CHRYSOPS	22271
Atlantic Herring	CLUPEA HARENGUS	21275
Longfin Squid	LOLIGO PEALEI	16384
Alewife	ALOSA PSEUDOHARENGUS	4433
Atlantic Silverside	MENIDIA MENIDIA	4361
Bluefish	POMATOMUS SALTATRIX	4120
Atlantic Moonfish	SELENE SETAPINNIS	1489
Weakfish	CYNOSCION REGALIS	958
Little Skate	LEUCORAJA ERINACEA	880
Blueback Herring	ALOSA AESTIVALIS	359
Summer Flounder	PARALICHTHYS DENTATUS	205
Spotted Hake	UROPHYCIS REGIA	204
Striped Searobin	PRIONOTUS EVOLANS	188
American Shad	ALOSA SAPIDISSIMA	181
Black Sea Bass	CENTROPRISTIS STRIATA	181
Winter Flounder	PLEURONECTES AMERICANUS	175
Silver Hake	MERLUCCIUS BILINEARIS	125
American Lobster	HOMARUS AMERICANUS	97
Windowpane Flounder	SCOPHTHALMUS AQUOSUS	75
Fourspot Flounder	PARALICHTHYS OBLONGUS	72
Smooth Dogfish	MUSTELUS CANIS	70
Spot	LEIOSTOMUS XANTHURUS	68
Rough Scad	TRACHURUS LATHAMI	67
Red Hake	UROPHYCIS CHUSS	62
Tautog	TAUTOGA ONITIS	62
Channeled Whelk	BUSYCOTYPUS CANALICULATUS	52
Pollock	POLLACHIUS VIRENS	44
Longhorn Sculpin	MYOXOCEPHALUS OCTODECEMSPINOS	40
Winter Skate	LEUCORAJA OCELLATA	40
Northern Kingfish	MENTICIRRHUS SAXATILIS	32
Atlantic Menhaden	BREVOORTIA TYRANNUS	32
Blue Crab	CALLINECTES SAPIDUS	28
Horseshoe Crab	LIMULUS POLYPHEMUS	26
Striped Bass	MORONE SAXATILIS	20
Northern Searobin	PRIONOTUS CAROLINUS	18

Haddock	MELANOGRAMMUS AEGLEFINUS	16
Dwarf Goatfish	UPENEUS PARVUS	15
Knobbed Whelk	BUSYCON CARICA	13
Hickory Shad	ALOSA MEDIOCRIS	12
Smallmouth Flounder	ETROPUS MICROSTOMUS	8
Clearnose Skate	RAJA EGLANTERIA	7
Inshore Lizardfish	SYNODUS FOETENS	7
Atlantic Cod	GADUS MORHUA	7
Bluntnose Stingray	DASYATIS SAY	6
Atlantic Torpedo Ray	TORPEDO NOBILIANA	5
Mantis Shrimp	SQUILLA EMPUSA	5
Spiny Dogfish	SQUALUS ACANTHIAS	5
Hogchoker	TRINECTES MACULATUS	3
Cunner	TAUTOGOLABRUS ADSPERSUS	3
White Hake	UROPHYCIS TENUIS	3
Northern Sennet	SPHYRAENA BOREALIS	2
Northern Puffer	SPHOEROIDES MACULATUS	2
Ocean Pout	MACROZOARCES AMERICANUS	2
Striped Anchovy	ANCHOA HEPSETUS	1
Conger Eel	CONGER OCEANICUS	1
Fourbeard Rockling	ENCHELYOPUS CIMBRIUS	1
Threespine Stickleback	GASTEROSTEUS ACULEATUS	1
Northern Pipefish	SYNGNATHUS FUSCUS	1
Atlantic Mackerel	SCOMBER SCOMBRUS	1
Bigeye	PRIACANTHUS ARENATUS	1
American Sand Lance	AMMODYTES AMERICANUS	1
Oyster Toadfish	OPSANUS TAU	1
Planehead Filefish	MONACANTHUS HISPIDUS	1
Bigeye Scad	SELAR CRUMENOPHTHALMUS	1
Gobies	GOBIIDAE	1
Bluespotted Cornetfish	FISTULARIA TABACARIA	1

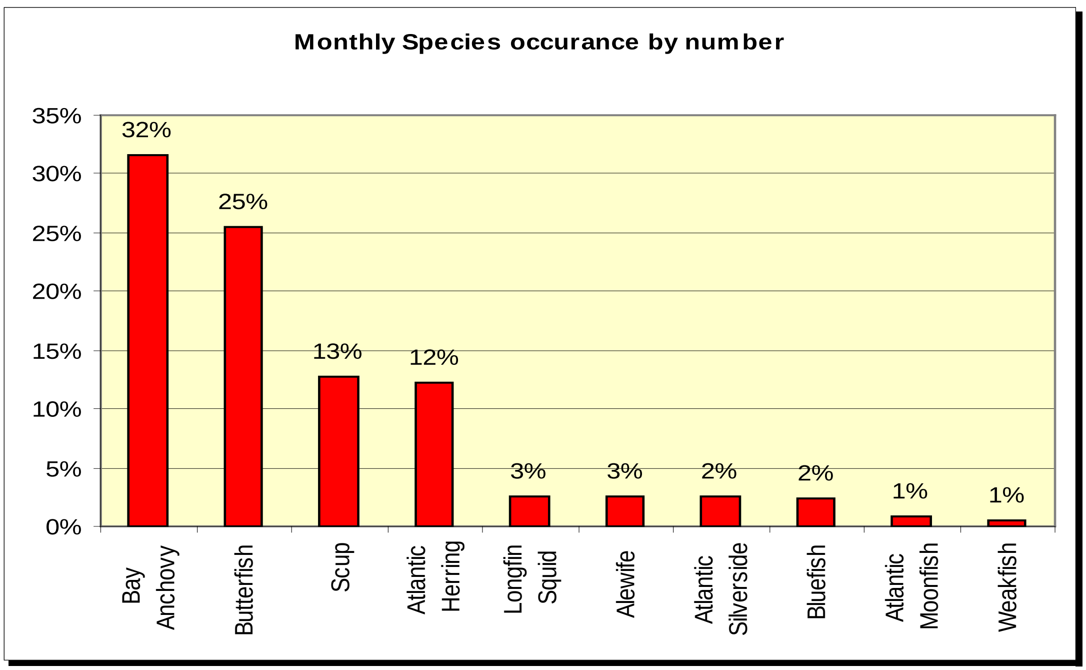
Figure 3 (Total Catch in Kilograms)

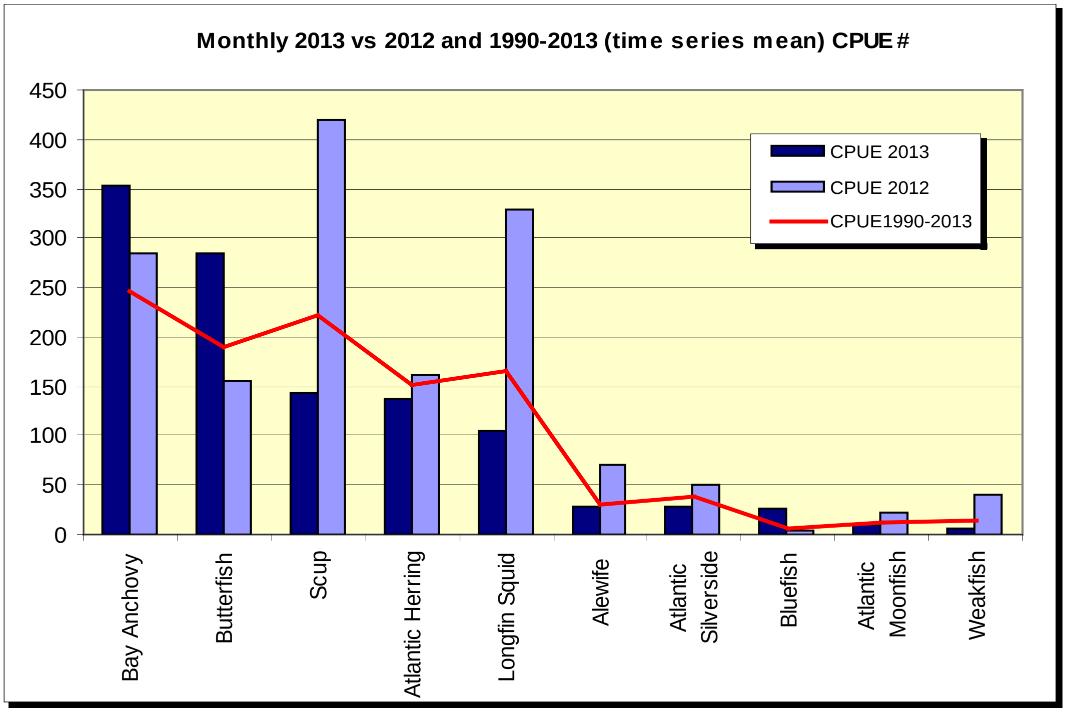
Fish Name	Scientific Name	Total Kg
Scup	STENOTOMUS CHRYSOPS	1719.865
Butterfish	PEPRILUS TRIACANTHUS	1290.926
Little Skate	LEUCORAJA ERINACEA	500.085
Atlantic Herring	CLUPEA HARENGUS	402.272
Bluefish	POMATOMUS SALTATRIX	277.195
Longfin Squid	LOLIGO PEALEI	275.410
Summer Flounder	PARALICHTHYS DENTATUS	157.220
Alewife	ALOSA PSEUDOHARENGUS	153.218
Bay Anchovy	ANCHOA MITCHILLI	108.420
Tautog	TAUTOGA ONITIS	92.110
Smooth Dogfish	MUSTELUS CANIS	78.670
Striped Searobin	PRIONOTUS EVOLANS	72.610
Black Sea Bass	CENTROPRISTIS STRIATA	68.273
Striped Bass	MORONE SAXATILIS	56.600
Horseshoe Crab	LIMULUS POLYPHEMUS	53.870
Weakfish	CYNOSCION REGALIS	52.755
Winter Flounder	PLEURONECTES AMERICANUS	47.515
Atlantic Torpedo Ray	TORPEDO NOBILIANA	35.700
American Lobster	HOMARUS AMERICANUS	35.450
Winter Skate	LEUCORAJA OCELLATA	27.970
Atlantic Silverside	MENIDIA MENIDIA	22.218
Windowpane Flounder	SCOPHTHALMUS AQUOSUS	17.835
Fourspot Flounder	PARALICHTHYS OBLONGUS	13.220
Longhorn Sculpin	MYOXOCEPHALUS OCTODECEMSPINOS	12.225
Bluntnose Stingray	DASYATIS SAY	11.850
Spiny Dogfish	SQUALUS ACANTHIAS	11.480
Spotted Hake	UROPHYCIS REGIA	11.141
Clearnose Skate	RAJA EGLANTERIA	10.070
Atlantic Moonfish	SELENE SETAPINNIS	9.496
Channeled Whelk	BUSYCOTYPUS CANALICULATUS	9.345
Spot	LEIOSTOMUS XANTHURUS	8.185
Blue Crab	CALLINECTES SAPIDUS	5.785
Silver Hake	MERLUCCIUS BILINEARIS	5.696
Red Hake	UROPHYCIS CHUSS	5.325
Northern Kingfish	MENTICIRRHUS SAXATILIS	4.405
American Shad	ALOSA SAPIDISSIMA	4.250
Hickory Shad	ALOSA MEDIOCRIS	3.960
Blueback Herring	ALOSA AESTIVALIS	2.506
Knobbed Whelk	BUSYCON CARICA	2.328
Atlantic Menhaden	BREVOORTIA TYRANNUS	2.318
Ocean Pout	MACROZOARCES AMERICANUS	1.500
Northern Searobin	PRIONOTUS CAROLINUS	0.470
Rough Scad	TRACHURUS LATHAMI	0.419
Haddock	MELANOGRAMMUS	0.418

	AEGLEFINUS	
Inshore Lizardfish	SYNODUS FOETENS	0.315
Hogchoker	TRINECTES MACULATUS	0.210
Atlantic Mackerel	SCOMBER SCOMBRUS	0.190
Dwarf Goatfish	UPENEUS PARVUS	0.160
Oyster Toadfish	OPSANUS TAU	0.155
Northern Sennet	SPHYRAENA BOREALIS	0.125
Mantis Shrimp	SQUILLA EMPUSA	0.125
Smallmouth Flounder	ETROPUS MICROSTOMUS	0.085
Cunner	TAUTOGOLABRUS ADSPERSUS	0.085
Planehead Filefish	MONACANTHUS HISPIDUS	0.070
Bigeye Scad	SELAR CRUMENOPHTHALMUS	0.065
Northern Puffer	SPHOEROIDES MACULATUS	0.050
Pollock	POLLACHIUS VIRENS	0.045
Fourbeard Rockling	ENCHELYOPUS CIMBRIUS	0.045
Conger Eel	CONGER OCEANICUS	0.030
White Hake	UROPHYCIS TENUIS	0.023
Bluespotted Cornetfish	FISTULARIA TABACARIA	0.015
Bigeye	PRIACANTHUS ARENATUS	0.015
Striped Anchovy	ANCHOA HEPSETUS	0.010
American Sand Lance	AMMODYTES AMERICANUS	0.010
Northern Pipefish	SYNGNATHUS FUSCUS	0.005
Threespine Stickleback	GASTEROSTEUS ACULEATUS	0.003
Atlantic Cod	GADUS MORHUA	0.002
Gobies	GOBIIDAE	0.001

Figure 4 Monthly Survey Top Ten Species Catch in Number

Fish Name	Scientific Name	%
Bay Anchovy	ANCHOA MITCHILLI	32%
Butterfish	PEPRILUS TRIACANTHUS	25%
Scup	STENOTOMUS CHRYSOPS	13%
Atlantic Herring	CLUPEA HARENGUS	12%
Longfin Squid	LOLIGO PEALEI	3%
Alewife	ALOSA PSEUDOHARENGUS	3%
Atlantic Silverside	MENIDIA MENIDIA	2%
Bluefish	POMATOMUS SALTATRIX	2%
Atlantic Moonfish	SELENE SETAPINNIS	1%
Weakfish	CYNOSCION REGALIS	1%

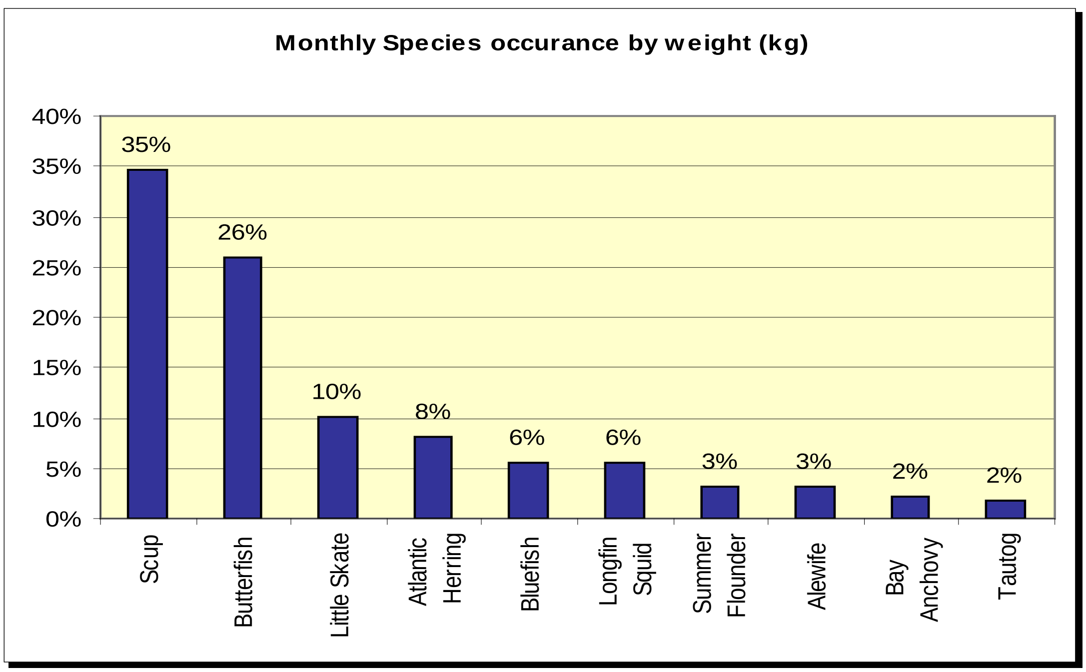


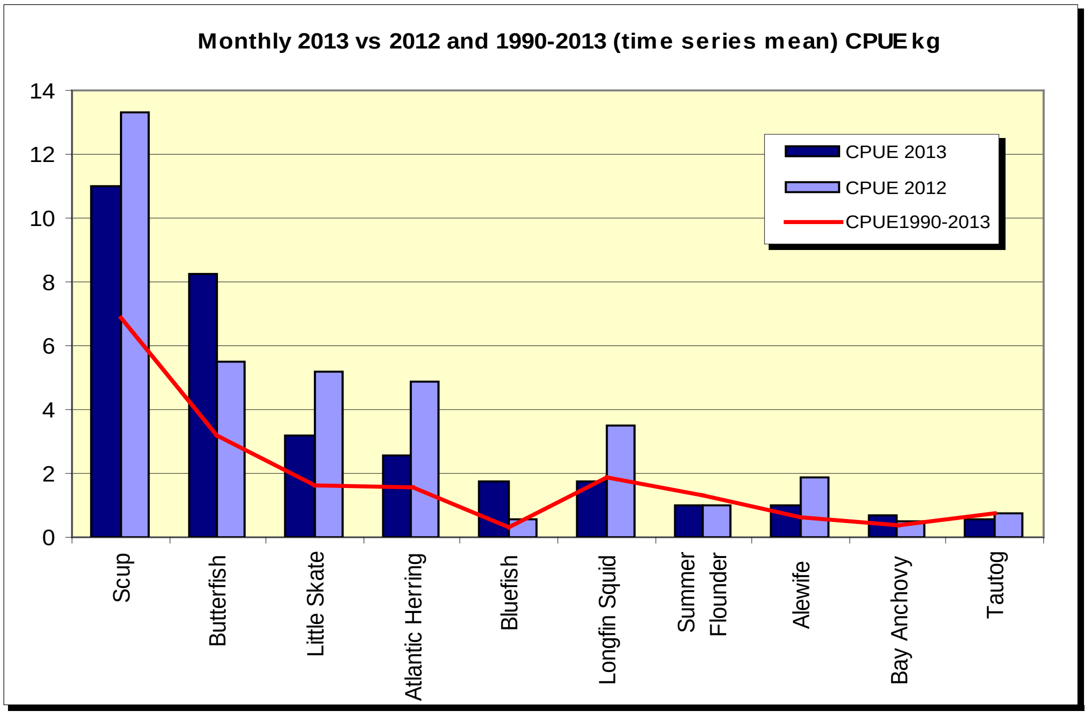


Monthly 2013 vs 2012 and 1990-2013 (time series mean) CPUE #
450
400
350
300
250
200
150
100
50
0
CPUE 2013
CPUE 2012
CPUE1990-2013
Bay Anchovy
Butterfish
Scup
Atlantic Herring
Longfin Squid
Alewife
Atlantic Silverside
Bluefish
Atlantic Moonfish
Weakfish

Figure 5 Top Ten Species Catch in Kilograms

Fish Name	Scientific Name	%
Scup	STENOTOMUS CHRYSOPS	35%
Butterfish	PEPRILUS TRIACANTHUS	26%
Little Skate	LEUCORAJA ERINACEA	10%
Atlantic Herring	CLUPEA HARENGUS	8%
Bluefish	POMATOMUS SALTATRIX	6%
Longfin Squid	LOLIGO PEALEI	6%
Summer Flounder	PARALICHTHYS DENTATUS	3%
Alewife	ALOSA PSEUDOHARENGUS	3%
Bay Anchovy	ANCHOA MITCHILLI	2%
Tautog	TAUTOGA ONITIS	2%



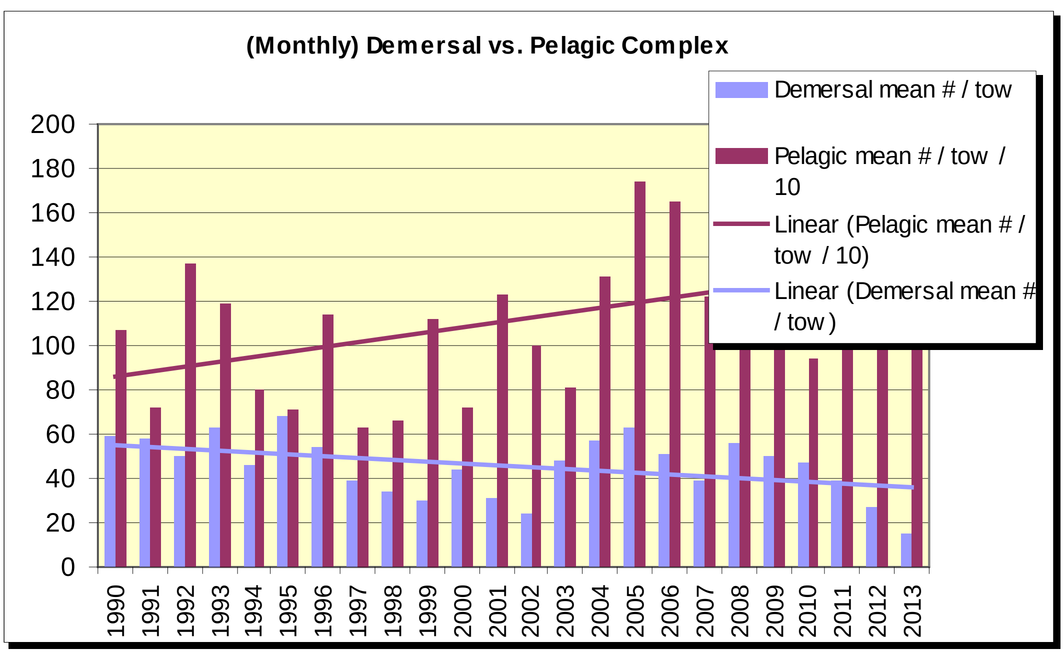


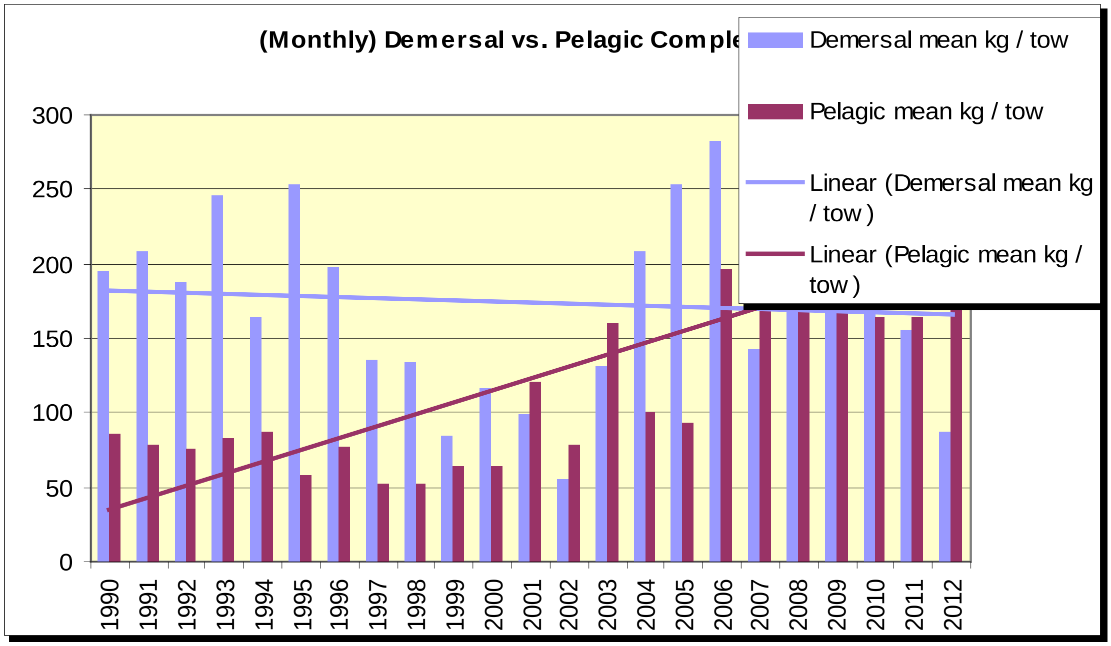
Monthly 2013 vs 2012 and 1990-2013 (time series mean) CPUE kg
14
12
10
8
6
4
2
0
CPUE 2013
CPUE 2012
CPUE1990-2013
Scup
Butterfish
Little Skate
Atlantic Herring
Bluefish
Longfin Squid
Summer Flounder
Alewife
Bay Anchovy
Tautog

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	

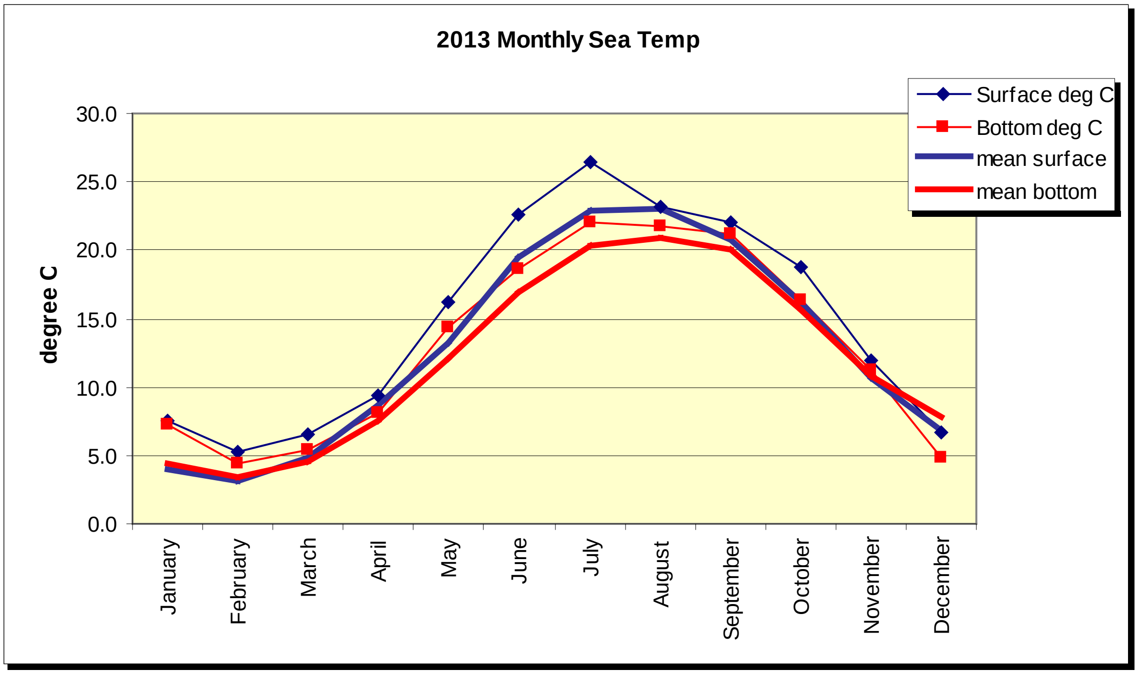
Figure 6 and 7

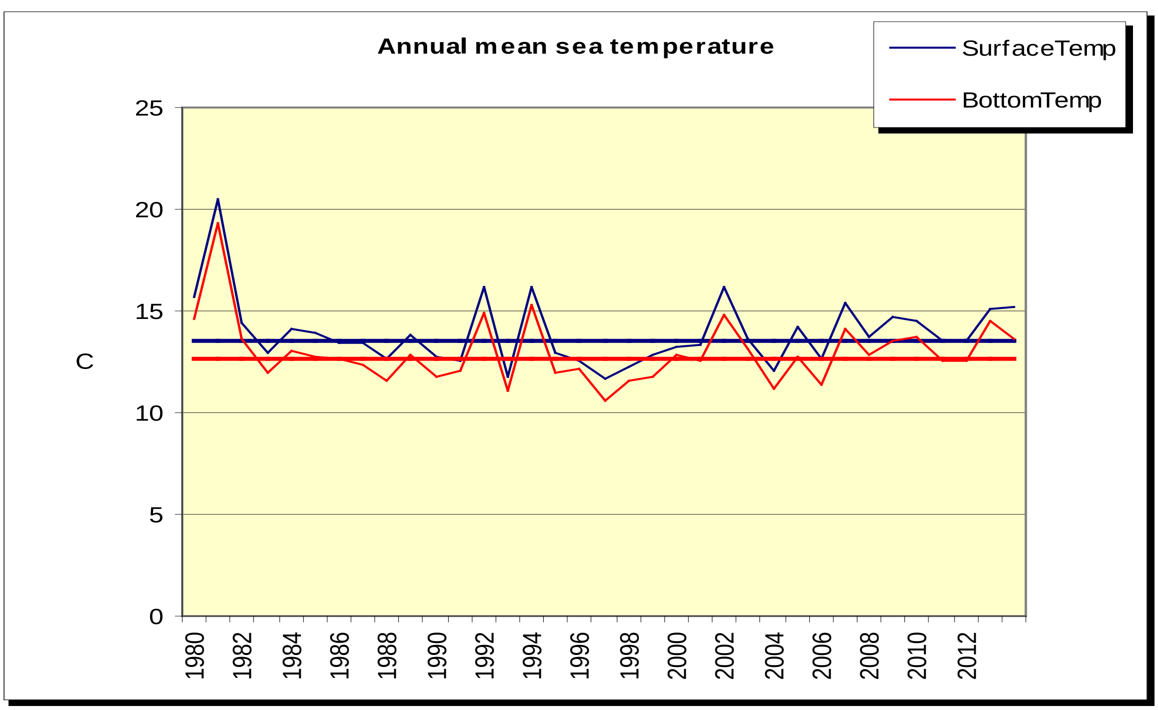



(Monthly) Demersal vs. Pelagic Comple
Demersal mean kg / tow
Pelagic mean kg / tow
Linear (Demersal mean kg / tow)
Linear (Pelagic mean kg / tow)
300
250
200
150
100
50
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012

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.
61 species were observed and recorded during the 2013 Rhode Island Seasonal Trawl Survey, totaling 236380 individuals or 2686.1 fish per tow. In weight, the catch accounted for 4455.1 kg. or 50.6 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
Butterfish	PEPRILUS TRIACANTHUS	67099
Longfin Squid	LOLIGO PEALEI	56080
Bay Anchovy	ANCHOA MITCHILLI	51683
Scup	STENOTOMUS CHRYSOPS	51021
Bluefish	POMATOMUS SALTATRIX	3575
Little Skate	LEUCORAJA ERINACEA	1418
Atlantic Moonfish	SELENE SETAPINNIS	1258
Atlantic Herring	CLUPEA HARENGUS	744
Weakfish	CYNOSCION REGALIS	582
Alewife	ALOSA PSEUDOHARENGUS	562
Winter Skate	LEUCORAJA OCELLATA	232
Rough Scad	TRACHURUS LATHAMI	186
Winter Flounder	PLEURONECTES AMERICANUS	184
Black Sea Bass	CENTROPRISTIS STRIATA	181
Blueback Herring	ALOSA AESTIVALIS	174
American Shad	ALOSA SAPIDISSIMA	167
Atlantic Silverside	MENIDIA MENIDIA	158
Longhorn Sculpin	MYOXOCEPHALUS OCTODECEMSPINOS	101
Summer Flounder	PARALICHTHYS DENTATUS	99
Pollock	POLLACHIUS VIRENS	99
Striped Searobin	PRIONOTUS EVOLANS	95
Red Hake	UROPHYCIS CHUSS	64
Spot	LEIOSTOMUS XANTHURUS	56
Northern Searobin	PRIONOTUS CAROLINUS	52
Windowpane Flounder	SCOPHTHALMUS AQUOSUS	50
Spotted Hake	UROPHYCIS REGIA	43
Clearnose Skate	RAJA EGLANTERIA	43
Northern Kingfish	MENTICIRRHUS SAXATILIS	42
Silver Hake	MERLUCCIUS BILINEARIS	42
Ocean Pout	MACROZOARCES AMERICANUS	37
Channeled Whelk	BUSYCOTYPUS CANALICULATUS	32
Horseshoe Crab	LIMULUS POLYPHEMUS	28
American Lobster	HOMARUS AMERICANUS	26
Fourspot Flounder	PARALICHTHYS OBLONGUS	22

Tautog	TAUTOGA ONITIS	20
Yellowtail Flounder	PLEURONECTES FERRUGINEUS	18
Smooth Dogfish	MUSTELUS CANIS	17
Round Scad	DECAPTERUS PUNCTATUS	17
Atlantic Cod	GADUS MORHUA	16
Dwarf Goatfish	UPENEUS PARVUS	10
Blue Crab	CALLINECTES SAPIDUS	7
American Sand Lance	AMMODYTES AMERICANUS	6
Smallmouth Flounder	ETROPUS MICROSTOMUS	5
Northern Puffer	SPHOEROIDES MACULATUS	4
Bigeye	PRIACANTHUS ARENATUS	3
Atlantic Torpedo Ray	TORPEDO NOBILIANA	2
Grubby	MYOXOCEPHALUS AENAEUS	2
Cunner	TAUTOGOLABRUS ADSPERSUS	2
Knobbed Whelk	BUSYCON CARICA	2
Striped Bass	MORONE SAXATILIS	2
Sea Scallop	PLACOPECTEN MAGELLANICUS	2
Oyster Toadfish	OPSANUS TAU	1
Bluntnose Stingray	DASYATIS SAY	1
Barndoor Skate	DIPTURIS LAEVIS	1
Crevalle Jack	CARANX HIPPOS	1
Goosefish	LOPHIUS AMERICANUS	1
Hogchoker	TRINECTES MACULATUS	1
Rainbow Smelt	OSMERUS MORDAX	1
Mantis Shrimp	SQUILLA EMPUSA	1
Haddock	MELANOGRAMMUS AEGLEFINUS	1
Planehead Filefish	MONACANTHUS HISPIDUS	1

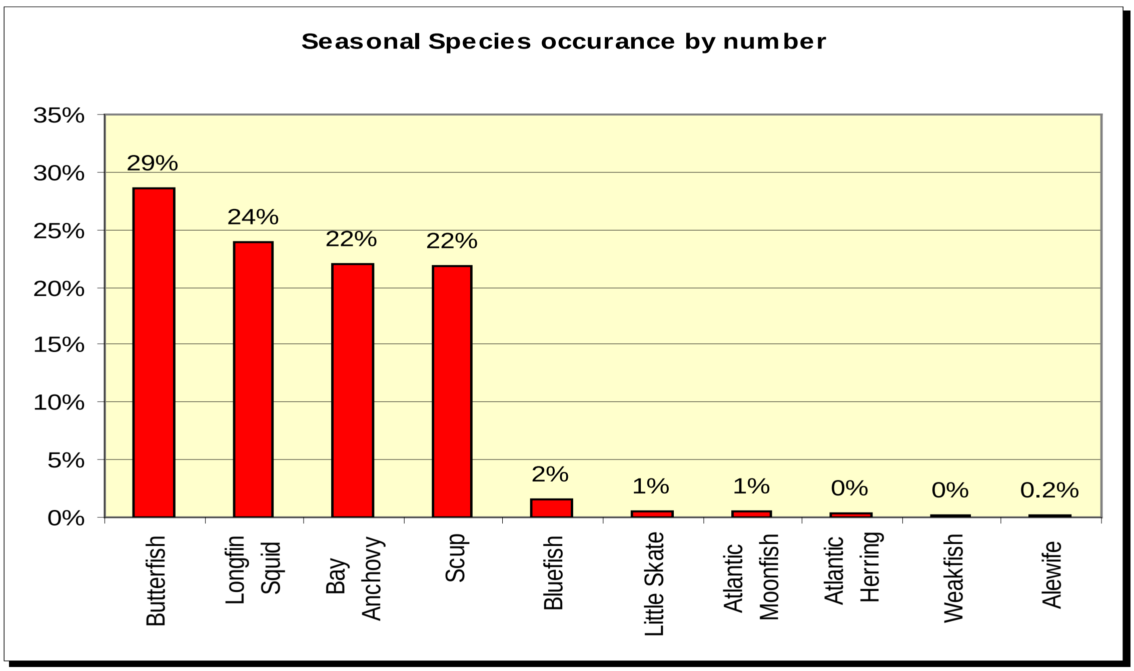
Figure 9 (Total Catch in Kilograms)

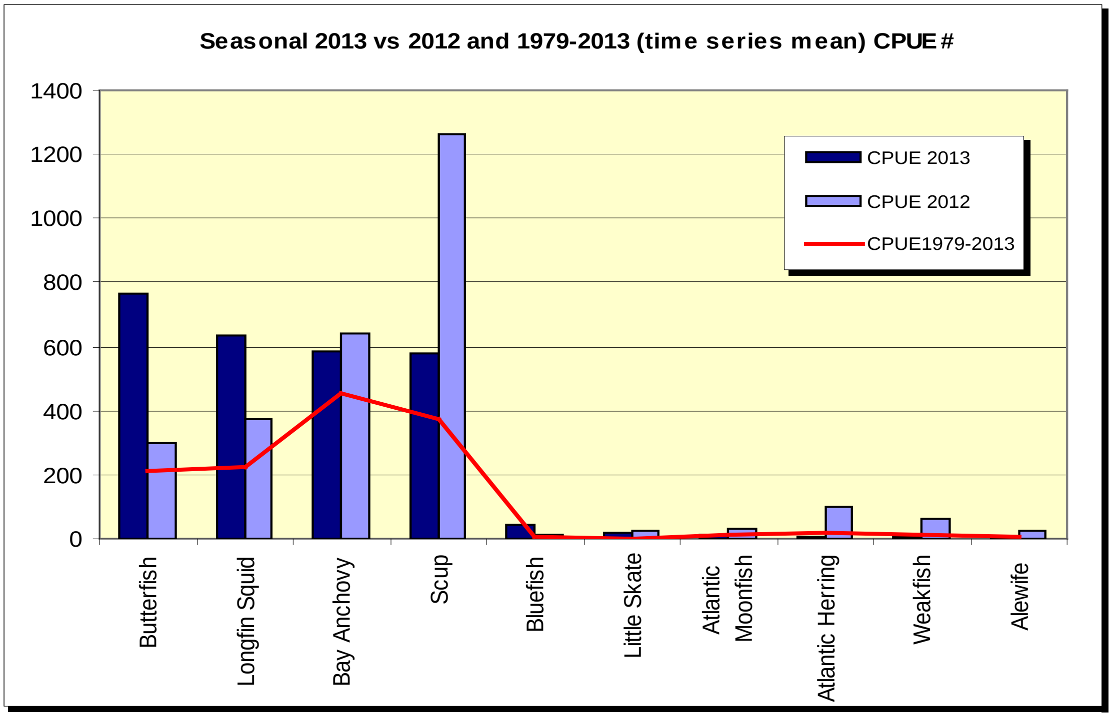
Fish Name	Scientific Name	Total Kg
Butterfish	PEPRILUS TRIACANTHUS	1099.08002
Scup	STENOTOMUS CHRYSOPS	816.4000002
Little Skate	LEUCORAJA ERINACEA	795.0599983
Longfin Squid	LOLIGO PEALEI	543.9449977
Bluefish	POMATOMUS SALTATRIX	246.4699997
Winter Skate	LEUCORAJA OCELLATA	153.5150002
Bay Anchovy	ANCHOA MITCHILLI	95.91399979
Summer Flounder	PARALICHTHYS DENTATUS	75.76499991
Clearnose Skate	RAJA EGLANTERIA	73.37999988
Winter Flounder	PLEURONECTES AMERICANUS	71.3050007
Horseshoe Crab	LIMULUS POLYPHEMUS	59.04499912
Black Sea Bass	CENTROPRISTIS STRIATA	55.53550029
Ocean Pout	MACROZOARCES AMERICANUS	40.90999842
Striped Searobin	PRIONOTUS EVOLANS	38.11500012
Longhorn Sculpin	MYOXOCEPHALUS OCTODECEMSPINOS	36.11500055
Atlantic Herring	CLUPEA HARENGUS	27.62650038
Tautog	TAUTOGA ONITIS	27.12500044
Weakfish	CYNOSCION REGALIS	26.28999987
Atlantic Torpedo Ray	TORPEDO NOBILIANA	25.89999962
Smooth Dogfish	MUSTELUS CANIS	20.21999979
Alewife	ALOSA PSEUDOHARENGUS	20.19500001
Striped Bass	MORONE SAXATILIS	13.79999971
Windowpane Flounder	SCOPHTHALMUS AQUOSUS	11.81000005
Bluntnose Stingray	DASYATIS SAY	9.899999619
American Lobster	HOMARUS AMERICANUS	9.03000012
Atlantic Moonfish	SELENE SETAPINNIS	8.030999922
Yellowtail Flounder	PLEURONECTES FERRUGINEUS	7.139999866
Spot	LEIOSTOMUS XANTHURUS	6.954999782
Northern Kingfish	MENTICIRRHUS SAXATILIS	5.859999925
Channeled Whelk	BUSYCOTYPUS CANALICULATUS	5.675000146
Rough Scad	TRACHURUS LATHAMI	4.844999901
Fourspot Flounder	PARALICHTHYS OBLONGUS	4.835000053
American Shad	ALOSA SAPIDISSIMA	3.884999994
Red Hake	UROPHYCIS CHUSS	3.289999946
Spotted Hake	UROPHYCIS REGIA	2.456
Goosefish	LOPHIUS AMERICANUS	1.960000038
Northern Searobin	PRIONOTUS CAROLINUS	1.859999995
Blueback Herring	ALOSA AESTIVALIS	1.281000013
Blue Crab	CALLINECTES SAPIDUS	1.160000019
Silver Hake	MERLUCCIUS BILINEARIS	0.818
Atlantic Silverside	MENIDIA MENIDIA	0.714999991
Knobbed Whelk	BUSYCON CARICA	0.379999995
Barndoor Skate	DIPTURIS LAEVIS	0.254999995
Round Scad	DECAPTERUS PUNCTATUS	0.204999998
Dwarf Goatfish	UPENEUS PARVUS	0.150000003

Oyster Toadfish	OPSANUS TAU	0.129999995
Hogchoker	TRINECTES MACULATUS	0.129999995
Sea Scallop	PLACOPECTEN MAGELLANICUS	0.105000003
Northern Puffer	SPHOEROIDES MACULATUS	0.084999999
Cunner	TAUTOGOLABRUS ADSPERSUS	0.084999998
Bigeye	PRIACANTHUS ARENATUS	0.070000001
Pollock	POLLACHIUS VIRENS	0.060249999
Crevalle Jack	CARANX HIPPOS	0.055
Smallmouth Flounder	ETROPUS MICROSTOMUS	0.054999999
Mantis Shrimp	SQUILLA EMPUSA	0.035
Grubby	MYOXOCEPHALUS AENAEUS	0.029999999
Planehead Filefish	MONACANTHUS HISPIDUS	0.029999999
American Sand Lance	AMMODYTES AMERICANUS	0.02
Haddock	MELANOGRAMMUS AEGLEFINUS	0.015
Atlantic Cod	GADUS MORHUA	0.01025
Rainbow Smelt	OSMERUS MORDAX	0.01

Figure 10   Top Ten Species Catch in Number

Fish Name	Scientific Name	%
Butterfish	PEPRILUS TRIACANTHUS	29%
Longfin Squid	LOLIGO PEALEI	24%
Bay Anchovy	ANCHOA MITCHILLI	22%
Scup	STENOTOMUS CHRYSOPS	22%
Bluefish	POMATOMUS SALTATRIX	2%
Little Skate	LEUCORAJA ERINACEA	1%
Atlantic Moonfish	SELENE SETAPINNIS	1%
Atlantic Herring	CLUPEA HARENGUS	0%
Weakfish	CYNOSCION REGALIS	0%
Alewife	ALOSA PSEUDOHARENGUS	0.2%

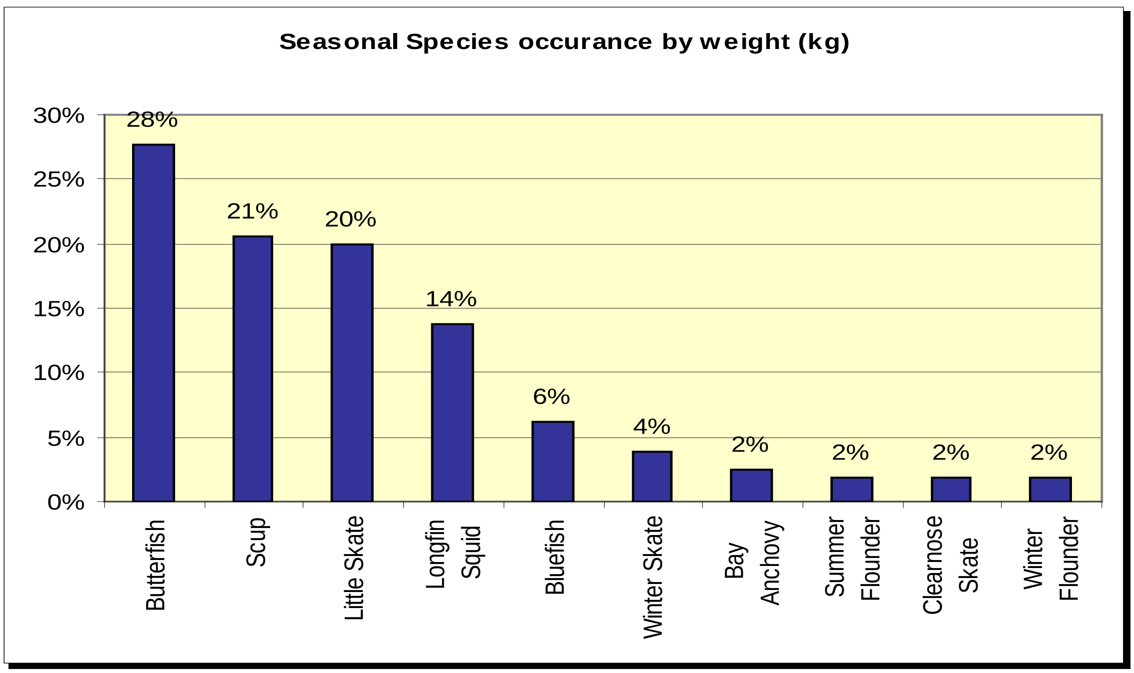


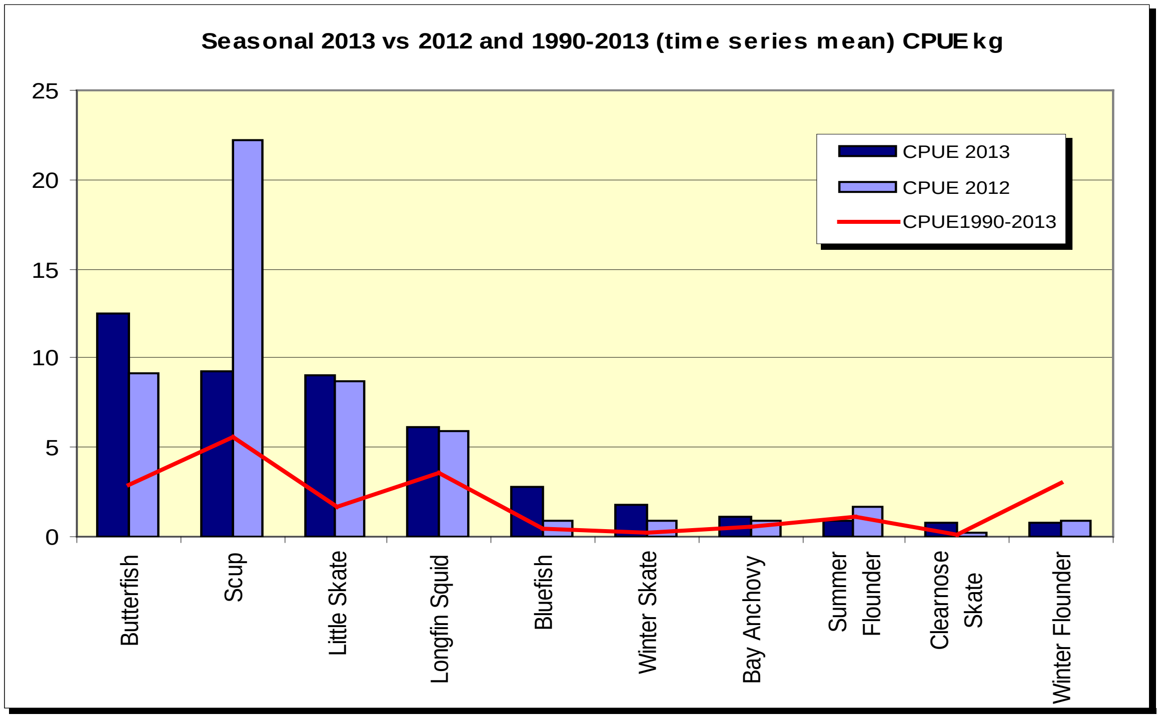


Seasonal 2013 vs 2012 and 1979-2013 (time series mean) CPUE#
1400
1200
1000
800
600
400
200
0
CPUE 2013
CPUE 2012
CPUE1979-2013
Butterfish
Longfin Squid
Bay Anchovy
Scup
Bluefish
Little Skate
Atlantic Moonfish
Atlantic Herring
Weakfish
Alewife

Figure 11 Top Ten Species Catch in Kilograms

Fish Name	Scientific Name	%
Butterfish	PEPRILUS TRIACANTHUS	28%
Scup	STENOTOMUS CHRYSOPS	21%
Little Skate	LEUCORAJA ERINACEA	20%
Longfin Squid	LOLIGO PEALEI	14%
Bluefish	POMATOMUS SALTATRIX	6%
Winter Skate	LEUCORAJA OCELLATA	4%
Bay Anchovy	ANCHOA MITCHILLI	2%
Summer Flounder	PARALICHTHYS DENTATUS	2%
Clearnose Skate	RAJA EGLANTERIA	2%
Winter Flounder	PLEURONECTES AMERICANUS	2%

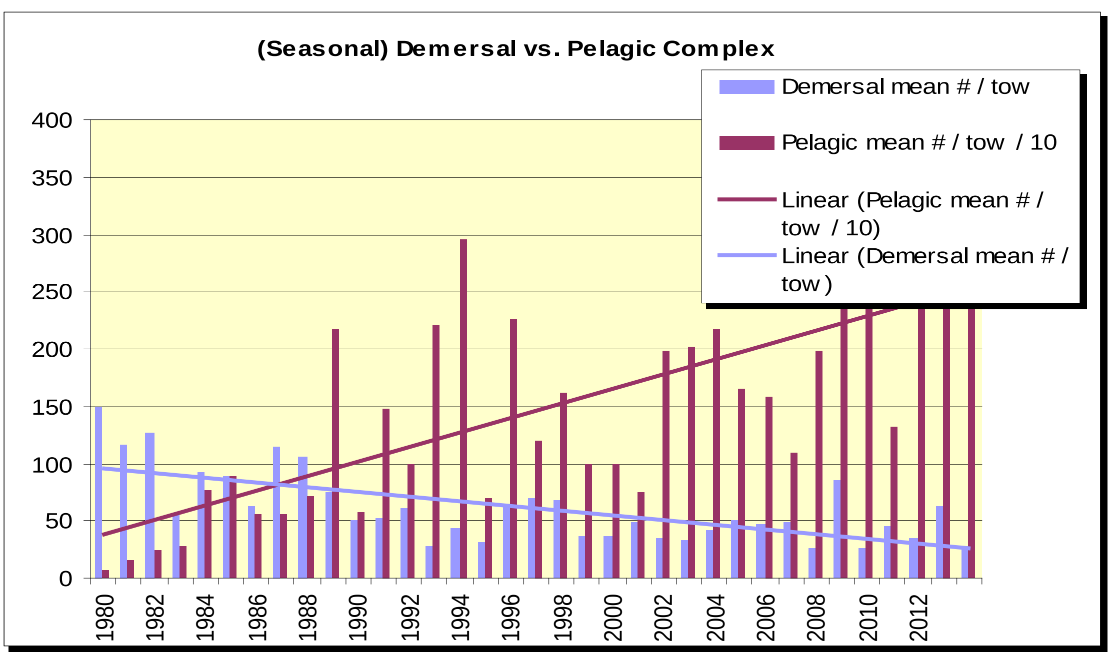


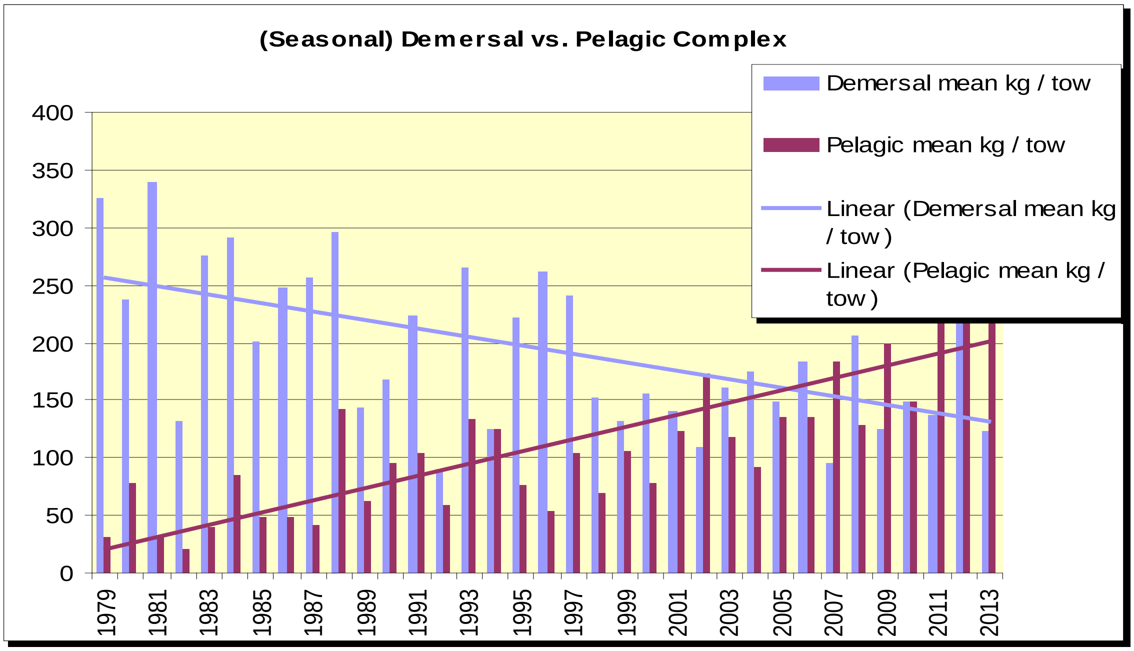

Seasonal 2013 vs 2012 and 1990-2013 (time series mean) CPUE kg
25
20
15
10
5
0
CPUE 2013
CPUE 2012
CPUE1990-2013
Butterfish
Scup
Little Skate
Longfin Squid
Bluefish
Winter Skate
Bay Anchovy
Summer Flounder
Clearnose Skate
Winter Flounder

Demersal vs. Pelagic Species Complex

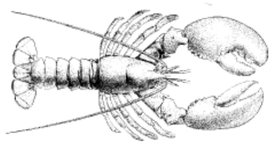
Demersal Species	Pelagic/Multi-Habitat Species
Cunner	Alewife
Four Spot Flounder	Atlantic Herring
Goosefish	Atlantic Moonfish
Hog Choker	Bay Anchovy
Lobster	Black Sea Bass
Longhorn Sculpin	Blueback Herring
Northern Searobin	Bluefish
Ocean Pout	Butterfish
Red Hake	Longfin Squid
Sea Raven	Menhaden
Silver 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 12 and 13



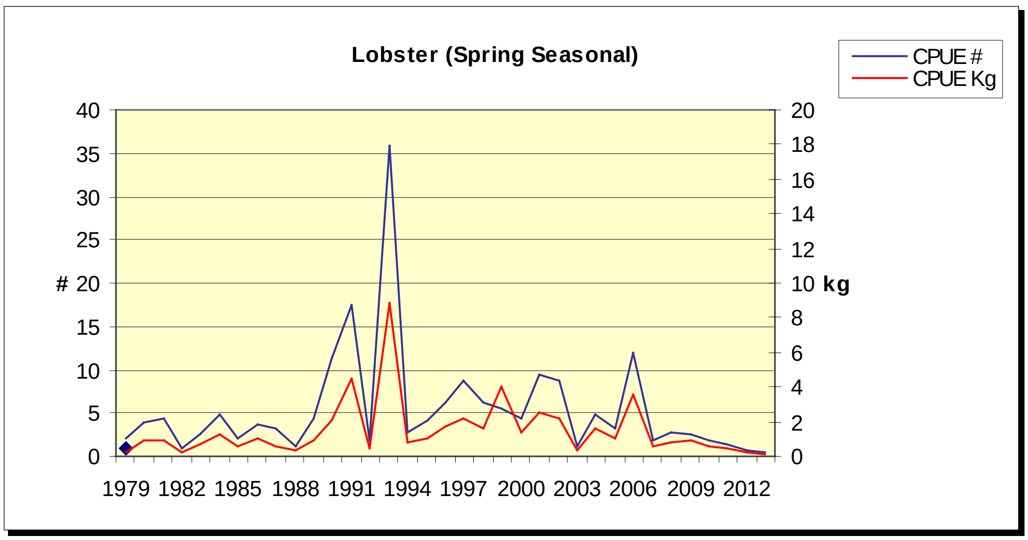

(Seasonal) Demersal vs. Pelagic Complex
Demersal mean kg / tow
Pelagic mean kg / tow
Linear (Demersal mean kg / tow)
Linear (Pelagic mean kg / tow)
400
350
300
250
200
150
100
50
0
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013

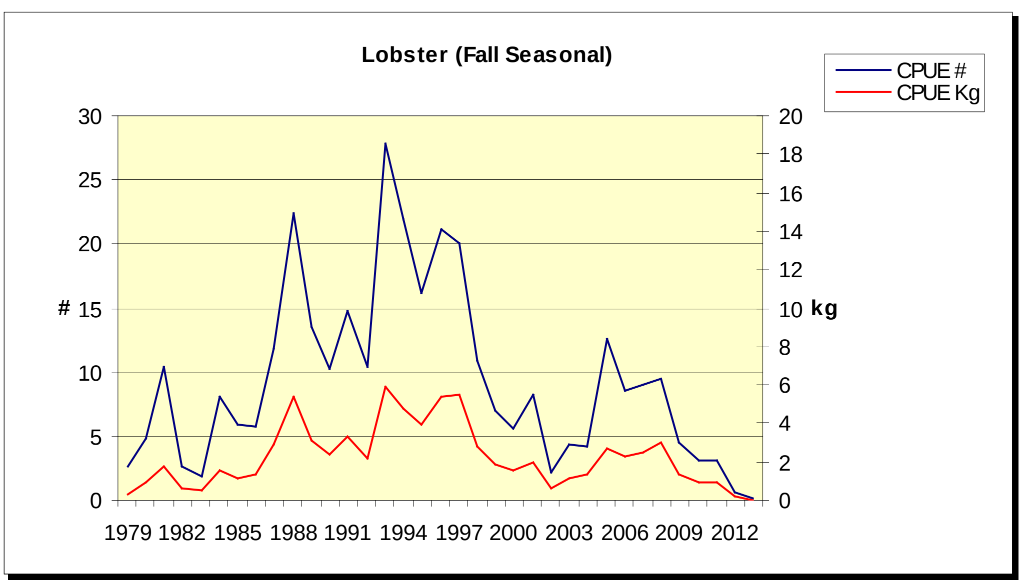
The following species represented are of high importance and are currently managed under fishery management plans through the Atlantic States Marine Fisheries Commission, New England Fishery Management Council, or the National Marine Fisheries Service. The seasonal portion of the Rhode Island Coastal 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.

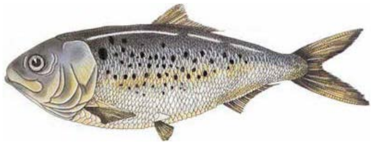


American Lobster ***Homarus americanus***

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

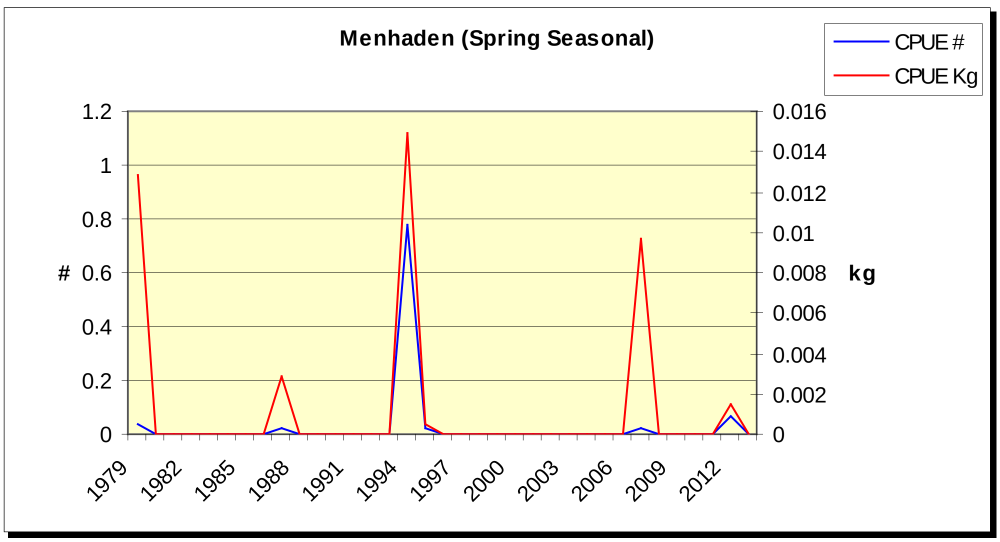


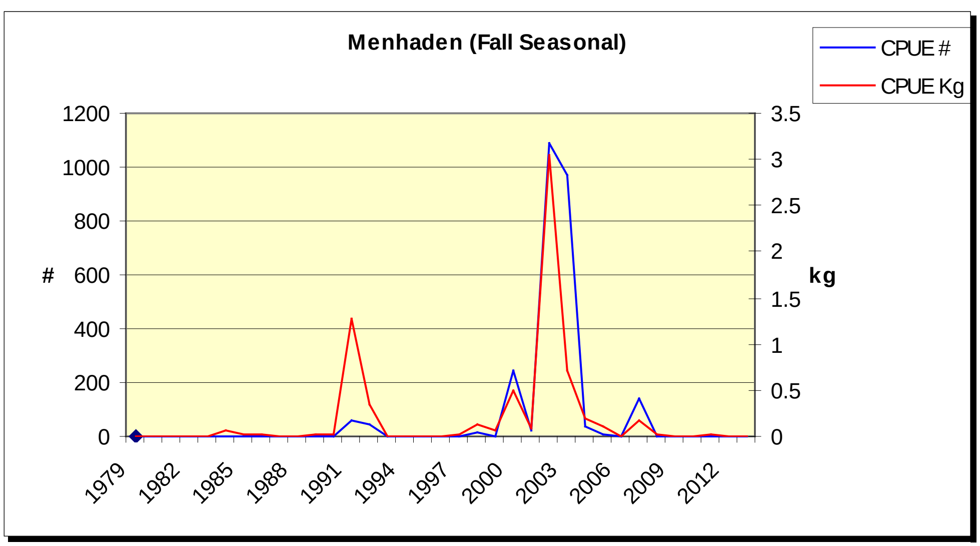




Atlantic Menhaden ***Brevoortia tyrannus***

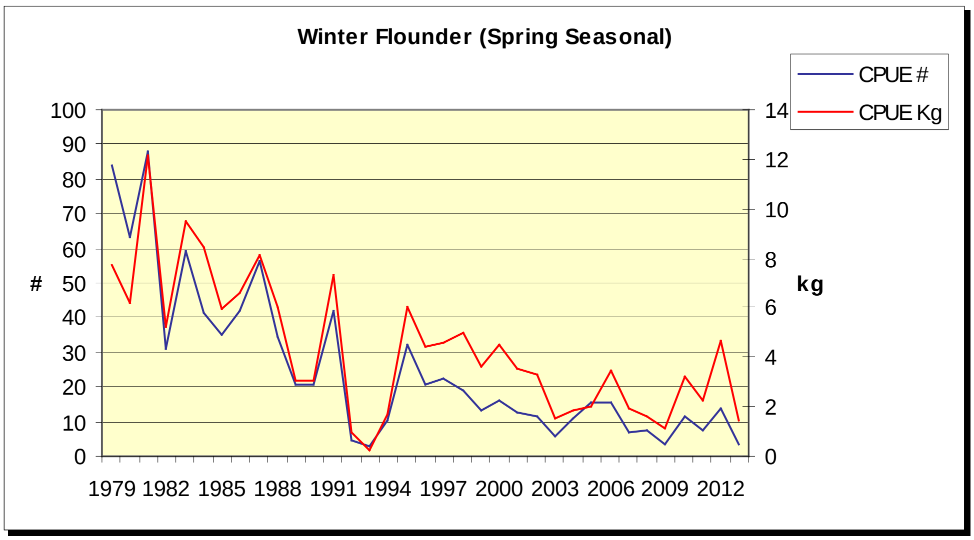
Stock Status: Overfished status unknown but overfishing is occurring.
Management: ASMFC Amendment II

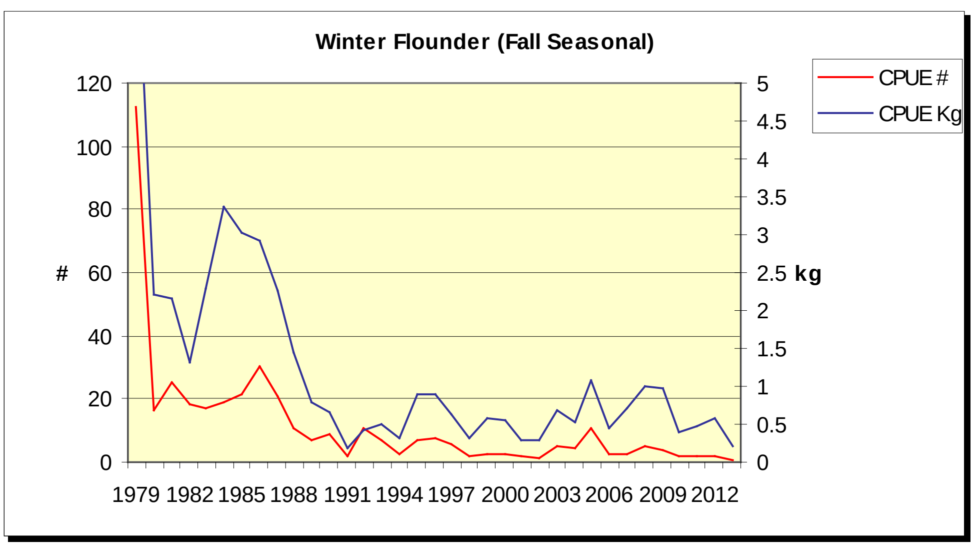




Winter Flounder ***Pleuronectes americanus***

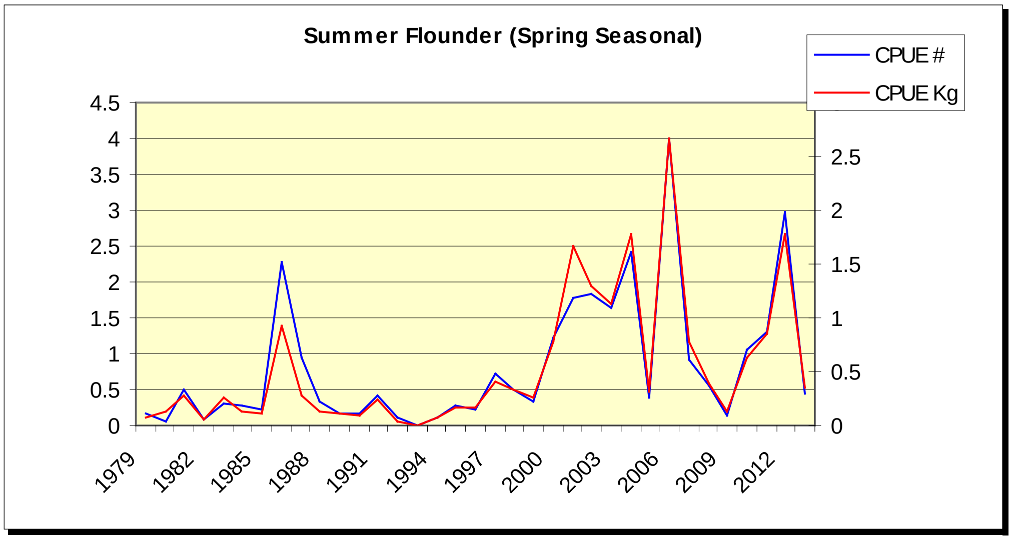
Stock Status: Overfished but overfishing is not occurring.
Management: ASMFC Amendment I, Addendum III

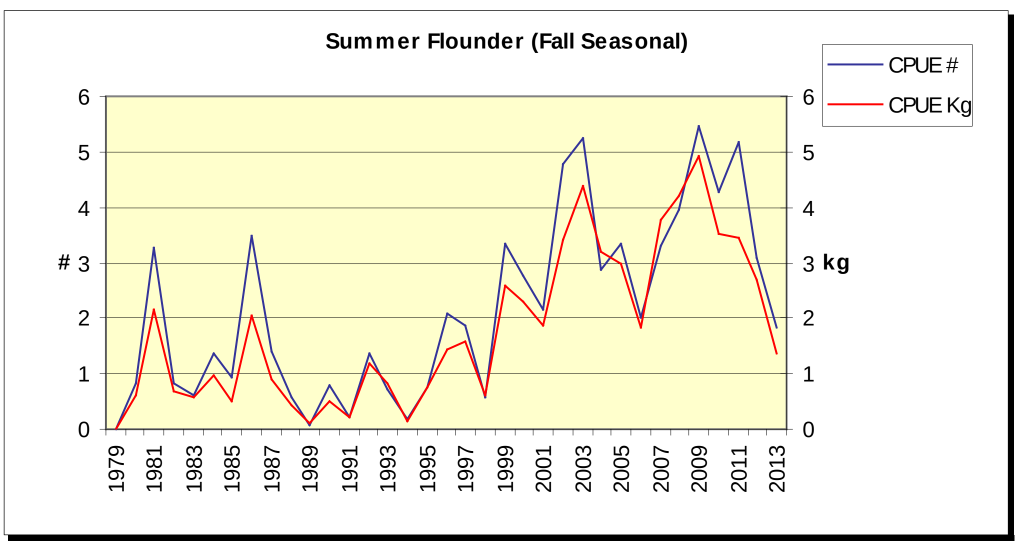




Summer Flounder ***Paralichthys dentatus***

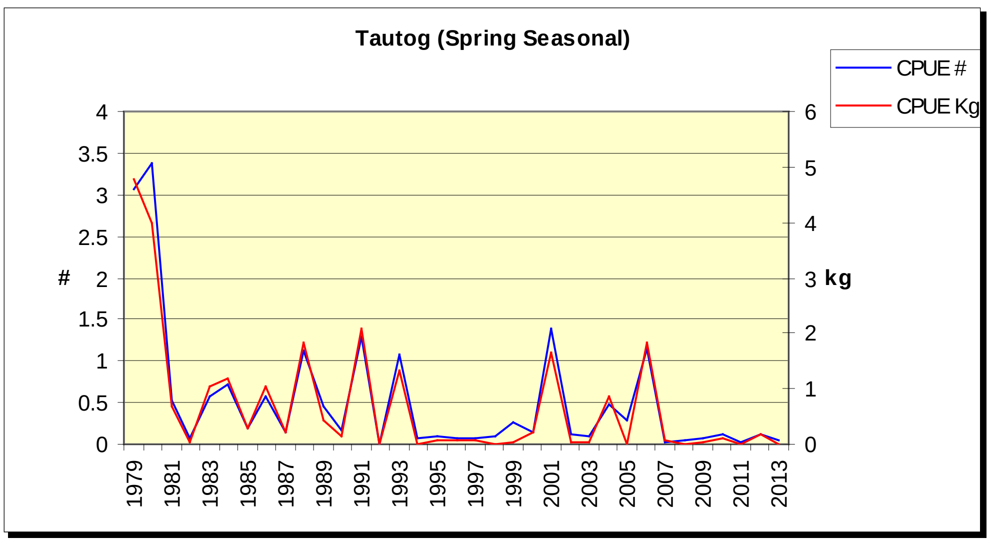
Stock Status: Not overfished and overfishing is not occurring.
Management: ASMFC Amendment XV Addendum XXV

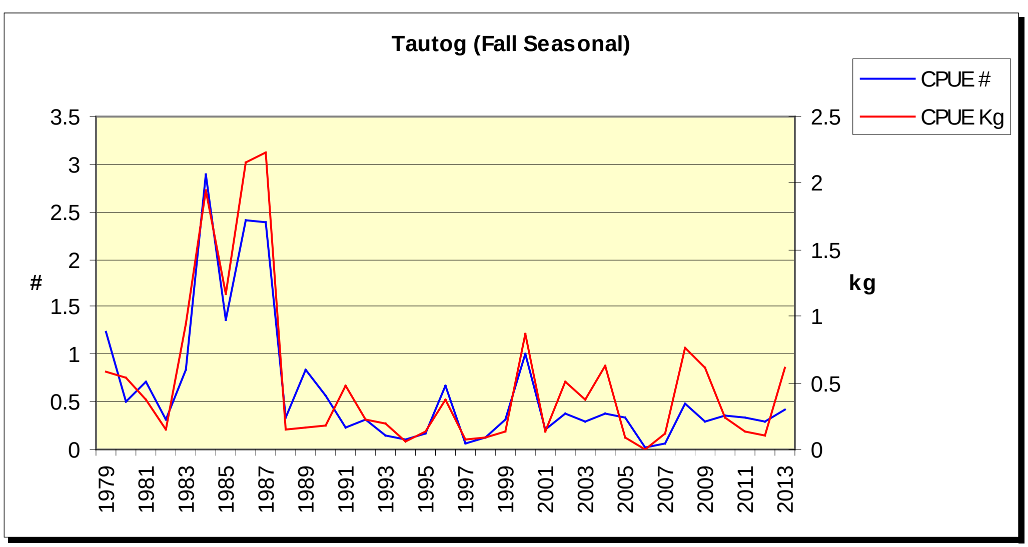


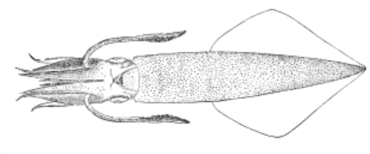


Tautog *Tautoga onitis*

Stock Status: Not Overfished, Overfishing is occurring based on Regional (Rhode Island and Massachusetts) Stock Assessment
Management: ASMFC Amendment I, Addendum V

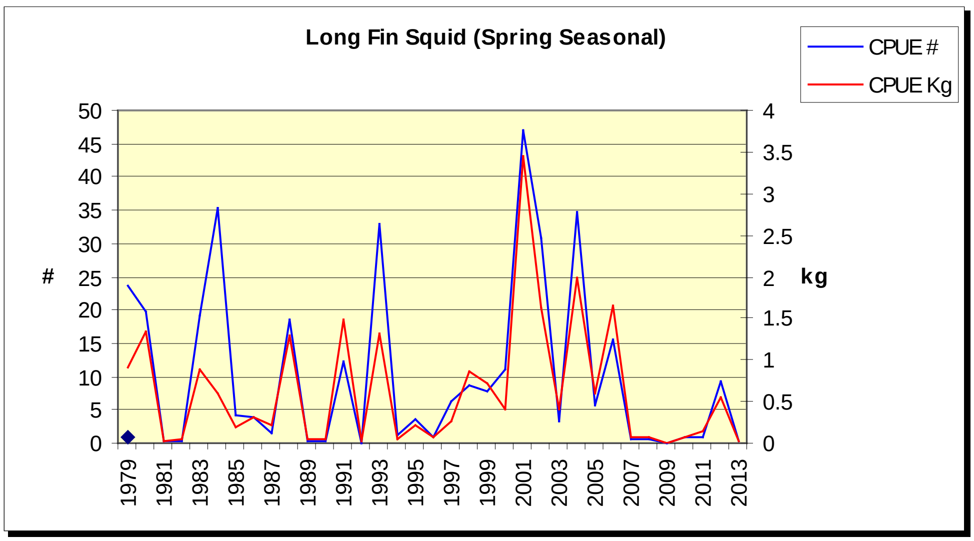


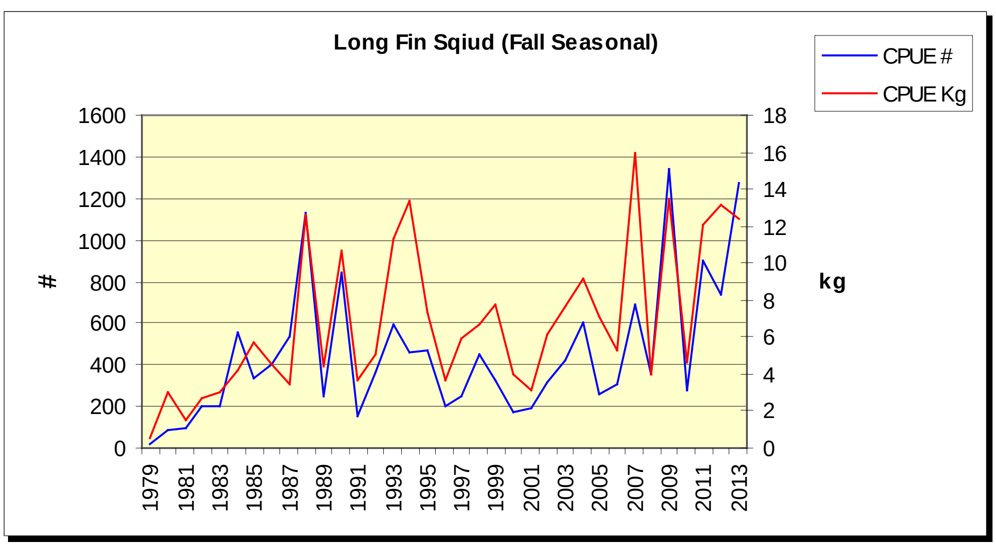




Longfin Squid ***Loligo pealei***

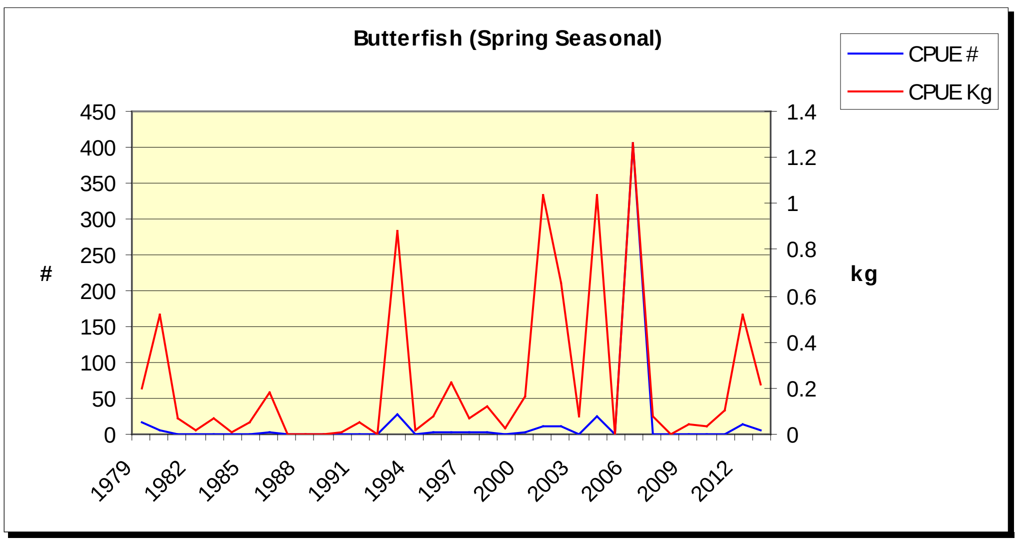
Stock Status: Overfishing undetermined not overfished
Management: NMFS, MAFMC, Atlantic Mackerel, Squid Butterfish FMP

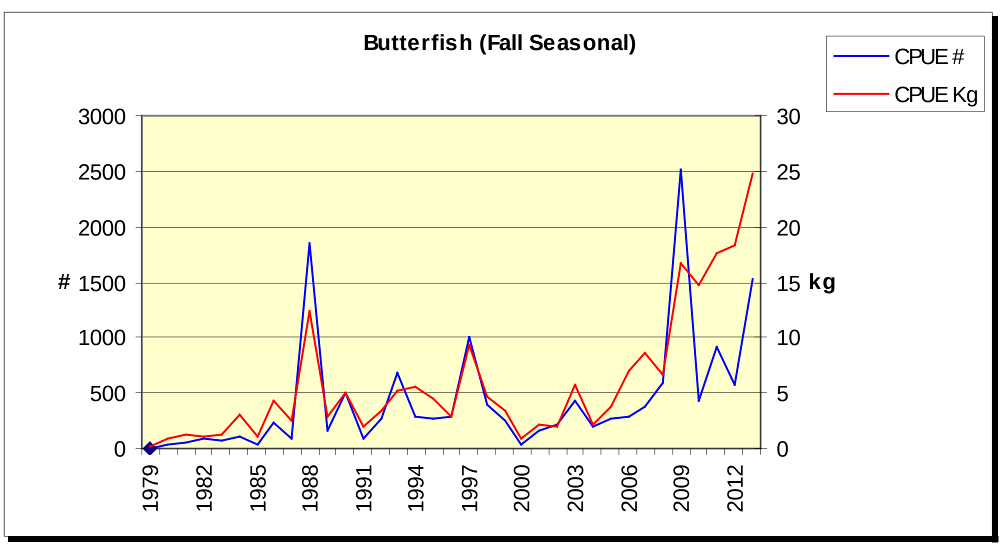




Butterfish ***Peprlilus triacanthus***

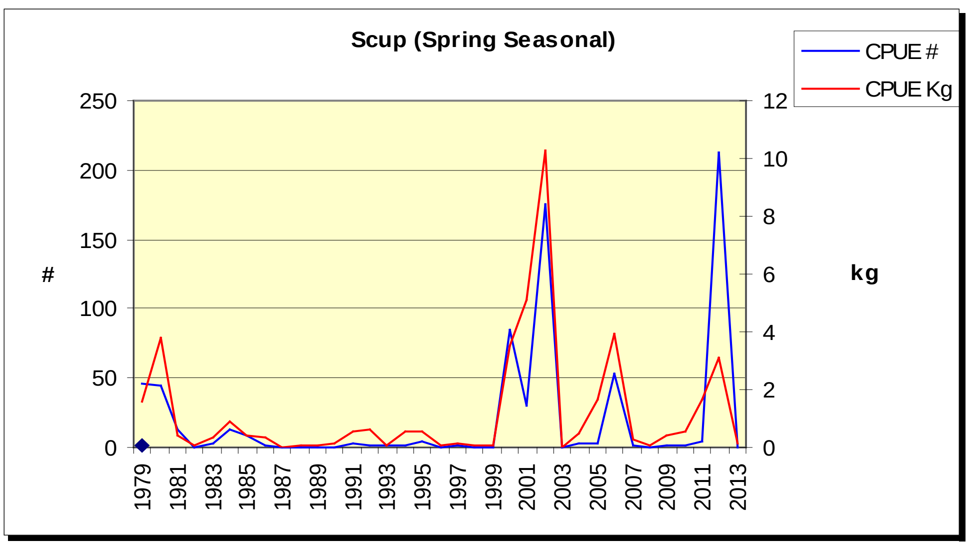
Stock Status: Variable / Uncertain
Management: Mid Atlantic Fishery Management Council, Atlantic Mackerel, Squid Butterfish FMP, ACL

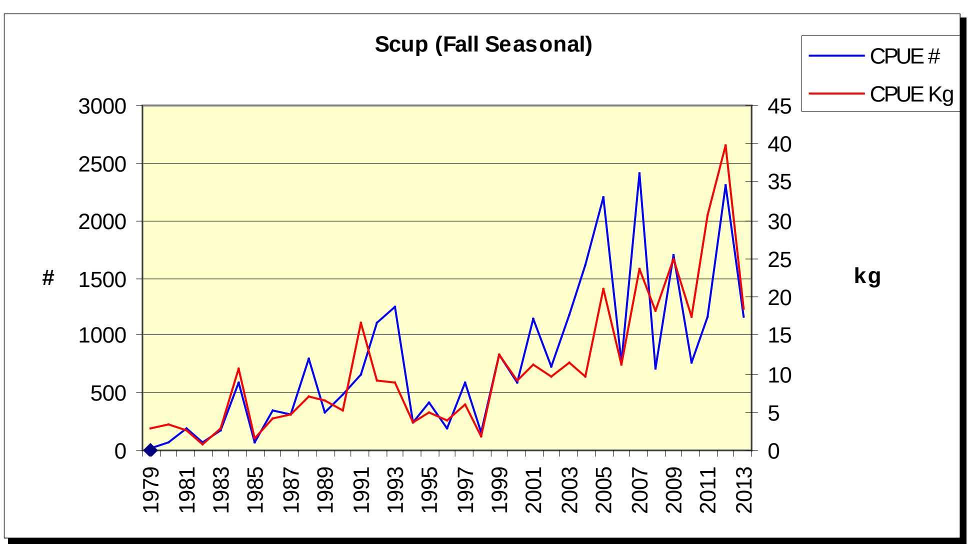




Scup ***Stenotomus chrysops***

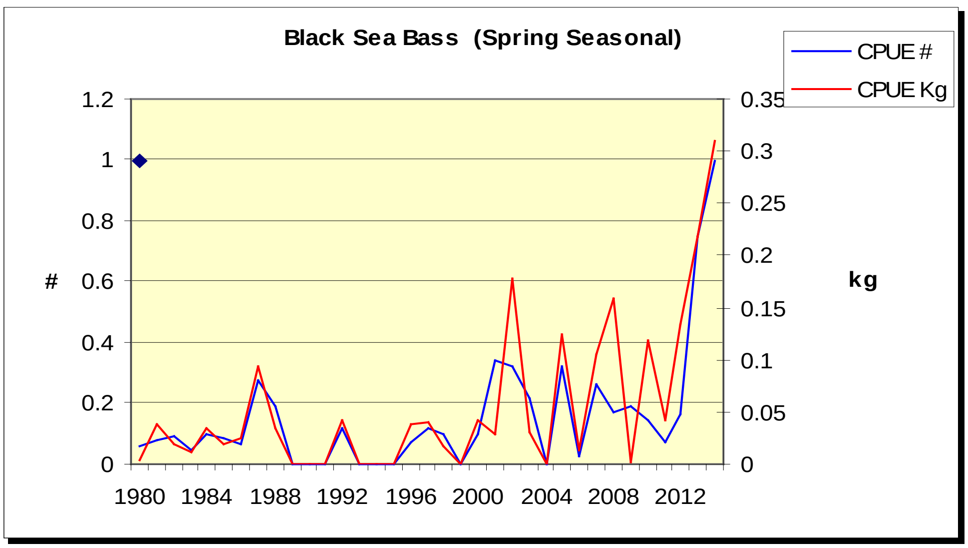
Stock Status: Rebuilt, overfishing is not occurring
Management: ASMFC Amendment XIIV, Addendum XXII, Summer Flounder, Scup
Black Sea Bass FMP

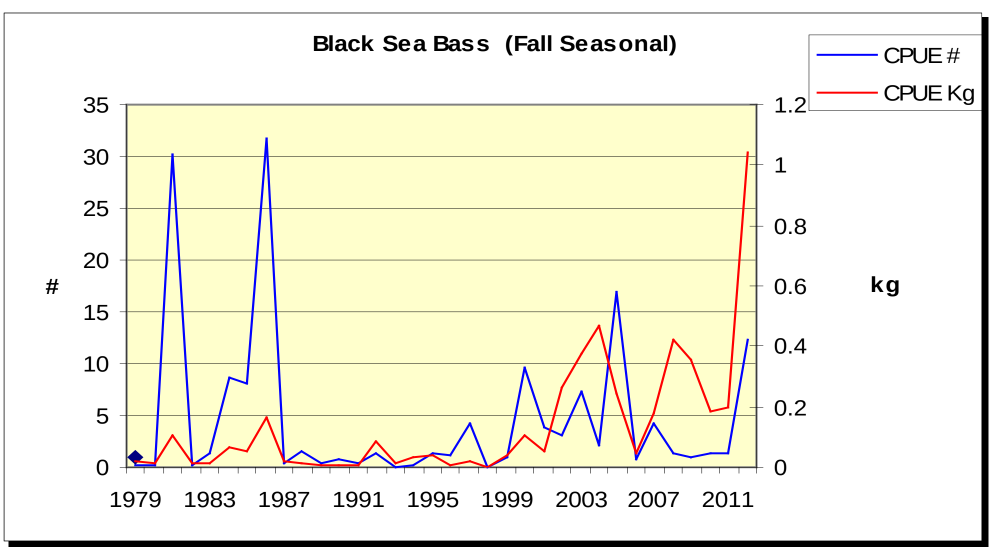




Black Sea Bass ***Centropristis striata***

Stock Status: Rebuilt, overfishing is occurring
Management: ASMFC Amendment XIIV, Addendum XXIII





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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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Division of Fish and Wildlife
Fort Wetherill Marine Fisheries Laboratory
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Federal Aid in Sportfish Restoration
F-61-R

Performance Report – Job#3 March 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: January 1, 2013 – December 31, 2013

Job Number & Title: Job 3 – Young of the Year Survey of Selected Rhode Island Coastal Ponds and Embayment's

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 2013, Investigators caught 48 species of finfish representing 33 families. This number is similar to the 49 species from 32 families that were collected during 2012. Additionally, the numbers of individuals landed in 2013 decreased from the 2012 survey; 16366 collected in 2013 and 20225 collected in 2012. This decrease in number of animals caught is reflective of the fact that several of the most abundant species experienced survey low index values. Winter Flounder, Mumichog, Striped Killifish, and Sheephead Minnow all had the lowest index values (CPUE) recorded since the inception of the survey.

Target Date: 2014

Status of Project: On Schedule

Significant Deviations: There were no significant deviations in 2013.

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 2013, 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 ¼" 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 second in overall species abundance (n=1096) in 2013, 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 May and June including Point Judith, Potter, Green Hill, Narrow River and the Pawcatuck River. Winnipaug, Quonochontaug, and Charlestown had their greatest mean abundance in July. It should be noted that the index for Quonochontaug was high in June as well. The greatest numbers of winter flounder in one haul were captured in June at Narrow River station NR1 where 161 individuals were captured.

During 2013, 1096 winter flounder were collected, down from the 1776 collected in 2012. The juvenile winter flounder abundance index (YOY WFL index) for the survey measured using the mean fish/seine haul decreased from 16.32 fish/seine haul in 2012 to 8.54 fish/seine haul in 2013. The 2013 index value is the lowest recorded since the surveys inception. 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 2012 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 Point Judith Ponds trended upward in 2013. While Winnipaug, Quonochontaug, Charlestown pond and trended downward. In fact, Winnipaug, Quonochontaug, and Charlestown ponds 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 mixed signals from the individual ponds all shared one characteristic in 2013. After the month of July YOY winter flounder numbers in each of the ponds drastically declined and never returned for the rest of the sampling season (figure 5b). The same pattern was observed in 2012. These results indicate that 2013 recruitment from the coastal ponds 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 2013 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 resulted in a directed fishery for winter flounder in the spring of 2013. Possession limits remained 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 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) and remained low in 2013 (cpue= 3.31), 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.

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 2013 , the overall YOY WFL index in Point Judith pond has increased to 6.33 WFL per haul in 2013. This increase in abundance might reflect the recent no possession rule in the pond as well as the former coast wide closure. Again as in 2012, 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 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 2013, juvenile winter flounder ranged in size from 2 to 15 cm, representing age groups 0-1+. Zero adult flounder (age 2+) were caught during the 2013 survey. The size range of animals collected is similar to those caught from 2004 through 2012 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 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 2013, 99.43% 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 and is best observed in 2013 in the Narrow River and Charlestown Pond (figures 7 and 9).

Winter Flounder YOY were caught in each of the new ponds and stations being sampled (Table 1). Green Hill pond and Potter Pond station 1 display similar patterns of abundance of YOY WFL with the highest numbers of fish caught in May and decreasing to no fish found in July . In 2013 Potter pond had WFL caught in May – July and October while Green Hill pond had no WFL caught after June. The WFL caught during May in Green Hill (Figure 8) and Potter's (Figure 9) Ponds are larger on average than WFL YOY caught in the other ponds (5 cm verses 4 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.

Bluefish *(Pomatomus saltatrix)*

One hundred forty four bluefish were collected in June, July, August, and September and occurred in each of the coastal ponds sampled in 2013. This is a increase from the 55 fish caught in 2012 and lower than the 176 individuals captured during 2011. The abundance index for 2013 was 1.00 fish/seine higher to the 2012 value of 0.38 fish/seine and lower than the value of 1.23 fish/seine haul observed in 2011. Table 4 contains the abundance indices for the survey by month and pond. Bluefish ranged in size from 5 cm to 20 cm. No adult bluefish were caught in 2012. Figure 18 displays the annual abundance index of bluefish for all stations combined.

Tautog (*Tautoga onitis*)

One hundred and one tautog were collected between May and October in each of the ponds except Green Hill and Potter's ponds in 2013. This is similar to the 2012 catch of 115 individuals. The total survey 2013 abundance index was 0.70 fish/seine haul down slightly from the 2012 abundance index of 0.79 fish/seine haul. Table 5 contains the abundance indices for the survey by month and pond. The highest abundances in 2013 occurred in Charlestown Pond. Tautog caught in 2013 ranged in size from 2 cm to 84 cm. Figure 19 displays the annual abundance index of tautog for all stations combined.

Black Sea Bass (*Centropristis striata*)

A total of 219 juvenile black sea bass were collected in June and then from August to October from each of the ponds except Potter's Pond in 2013. This is less than the 403 fish that were caught in 2012 and higher than the 97 fish collected in 2011. The highest abundances were found in Charlestown Pond. The total survey 2013 abundance index was 1.52 fish/seine haul down from the 2012 abundance index of 2.80 fish/seine haul and above the 2011 value of 0.68 fish/ seine haul. The population in the ponds has been trending upwards, the high BSB index value of 2013 represents another high value consistent with observations for other recent years. Black sea bass abundance throughout state waters was high again during 2013(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 1 cm to 8 cm. Figure 20 displays the annual abundance index of black sea bass for all stations combined.

Scup *(Stenotomus chrysops)*

Fifty two scup were collected during the 2013 in July, August, and September each of the ponds except green hill and Potter's. Although lower than the 106 scup caught in 2012 it is still a high count for the series. By contrast only 3 were caught in 2011. The total survey abundance index was 0.36 fish per haul. Table 7 contains the abundance indices for the survey by month and pond. Scup caught in 2013 ranged in size from 2 cm to 12 cm. Figure 21 displays the annual abundance index of scup for all stations combined.

Clupeids:

In 2013 three species of clupeids were caught in the coastal pond survey, Atlantic menhaden (*Brevoortia tyrannus*), American shad (*Alosa sapidissima*), and Alewife (*Alosa pseudoharengus*). Two hundred and twenty six alewives were captured in Pawcatuck and Narrow rivers, Charlestown, Point Judith, and Potter ponds between June and August. The total survey abundance was 1.57 fish / seine haul. One Atlantic menhaden was caught in

Narrow river in October during 2013. The total survey abundance was 0.01 fish /seine haul. There were several no schools of YOY menhaden captured in 2013. Six American shad were collected in the Pawcatuck river during June. The total survey abundance was 0.04 fish / seine haul. There were no Atlantic or Blueback herring caught in 2013. 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 highest abundance of all species with 11638 caught during the 2013 survey, up compared to the 7917 silversides collected in 2012. Silversides were collected in each of the ponds throughout the time period of the survey (May – October). The highest abundances were observed in Point Judith pond. The total survey abundance index was 80.82 fish / seine haul. Table 9 contains the abundance indices for the survey by month and pond. Atlantic silversides caught in 2013 ranged in size from 1 cm to 13 cm.

Striped Killifish *(Fundulus majalis)*

Striped killifish ranked third in species abundance with 907 fish caught during 2013. This is lower than the 1696 fish caught during 2012. 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 6.30 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 2013 ranged in size from 2 cm to 15 cm.

Common Mummichog *(Fundulus heteroclitus)*

The mummichog was fifth in overall abundance in 2013 with 301 individuals collected. This value is a decrease from 1929 mummichogs collected in 2012. Mummichogs occurred in each of the ponds and were caught each month during the survey. Point Judith Pond had the highest abundances of Mummichogs. The total survey abundance index was 2.09 fish / seine haul, the lowest recorded since the inception of the survey. Table 11 contains the abundance indices for the survey by month and pond. Mummichogs caught in 2013 ranged in size from 2 cm to 10 cm.

Sheepshead Minnow *(Cyprinodon variegatus)*

The Sheepshead minnow ranked nineteenth in overall abundance with 45 individuals collected. This is a decrease from the 636 fish caught in 2012. Sheepshead minnow occurred in each of the ponds and were caught each month during the survey. Pawcatuck River had the highest abundances of Sheepshead minnows. The total survey abundance index was 0.31 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 5 cm.

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

Physical and Chemical Data:

Physical and Chemical data for the 2013 Coastal Pond Survey is summarized in tables 13 – 15. Water temperature in 2013 averaged 20.9 ºC, with a range of 17.8ºC in May to 26.9 ºC in July. Salinity ranged from 14.25 ppt to 28.85 ppt, and averaged 24.93 ppt. Dissolved oxygen ranged from 12.88 mg/l to 6.98 mg/l, with an average of 8.95 mg/l. The YSI meter used to collect water quality data gradually lost functionality in 2013, hence the data gaps in salinity and DO. A new unit will be acquired for 2014.

New Station Preliminary Data

This year was the third year of sampling the three additional ponds. On a whole the samples were consistent with 2012. A brief description of each pond follows.

Green Hill Pond: 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 – 1 is in the northeastern quadrant of the pond on a small island. The bottom substrate is mud with shell hash. GH – 2 is in the southeastern quadrant of the pond on a sand bar. The bottom substrate is muddy fine sand. WFL YOY were caught in relatively high abundance during 2011, 29.0 fish/ seine haul, 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. 2012 and 2013 were similar to 2011 except that fewer winter flounder were caught and they did not return after leaving in June. Other species frequently present in the pond are the baitfish species, naked goby, and blue crabs.

Potter Pond: 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 – 1 is in the southwestern quadrant of the pond in a shallow cove. The bottom substrate is mud. PP – 2 is in the northwestern quadrant of the pond adjacent to a deep (~25') glacial kettle hole. The bottom substrate is fine sand with some cobble. WFL YOY have been caught at both stations but only PP – 1 with high frequency. Similarly to the Green Hill during both 2011 and 2012, stations WFL YOY were highest in May and decreased in abundance as the season progressed. The water temperature in Potter's Pond does not get as warm as Green Hill Pond but still may be a factor at station PP – 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.

Lower Pawcatuck River: 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 – 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 – 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 – 1, the highest catch number was observed in October. PR – 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 – 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 was sampled in all 6 months during 2012 and 2013. WFL YOY were 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.

<u>Point Judith Pond</u>: The new station PJ – 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 three 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 2013, Investigators caught 48 species of finfish representing 33 families. This number is similar to the 49 species from 32 families that were collected during 2012. Additionally, the numbers of individuals landed in 2013 decreased from the 2012 survey; 16369 collected in 2013 and 20225 collected in 2012. This decrease in number of animals caught is reflective of the fact that several of the most abundant species experienced survey low index values. Winter Flounder, Mumichog, Striped Killifish, and Sheephead Minnow all had the lowest index values (CPUE) recorded since the inception of the survey. Appendix 1 displays the frequency of all species caught by station during the 2013 Coastal Pond Survey. Additional data is available by request.

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Table 1: 2013 Coastal Pond Survey Winter Flounder Frequency by station and month

Station	May	Jun	Jul	Aug	Sep	Oct	Totals	Mean	STD
CP1	2	11	12	8	2	1	**36**	**6.00**	**4.94**
CP2	1	15	0	6	2	0	**24**	**4.00**	**5.83**
CP3	7	5	3	0	0	0	**15**	**2.50**	**3.02**
CP4	0	1	0	1	0	0	**2**	**0.33**	**0.52**
GH1	4	2	0	0	0	0	**6**	**1.00**	**1.67**
GH2	23	15	0	0	0	0	**38**	**6.33**	**10.13**
NR1	141	20	0	0	0	0	**161**	**26.83**	**56.50**
NR2	9	74	21	7	2	5	**118**	**19.67**	**27.41**
NR3	14	9	116	0	3	3	**145**	**24.17**	**45.27**
PJ1	19	3	1	2	2	0	**27**	**4.50**	**7.18**
PJ2	8	15	14	10	0	0	**47**	**7.83**	**6.59**
PJ3	2	29	9	3	0	0	**43**	**7.17**	**11.20**
PJ4	22	12	3	4	7	0	**48**	**8.00**	**7.97**
PP1	25	26	25		0	1	**77**	**15.40**	**13.61**
PP2	0	2	0	0	0	0	**2**	**0.33**	**0.82**
PR1	4	15	41	3	6	0	**69**	**11.50**	**15.32**
PR2	0	17	0	0	0	0	**17**	**2.83**	**6.94**
PR3	0	15	2	2	0	0	**19**	**3.17**	**5.88**
QP1	2	1	12	1	1	0	**17**	**2.83**	**4.54**
QP2	1	7	10	14	0	0	**32**	**5.33**	**5.92**
QP3	8	14	0	5	1	4	**32**	**5.33**	**5.13**
WP1	2	11	60	9	0	0	**82**	**13.67**	**23.17**
WP2	6	21	0	5	0	0	**32**	**5.33**	**8.14**
WP3	2	5	0	0	0	0	**7**	**1.17**	**2.04**
Totals	**302**	**345**	**329**	**80**	**26**	**14**			
Mean	**12.58**	**14.38**	**13.71**	**3.48**	**1.08**	**0.58**			
STD	**28.46**	**14.85**	**26.36**	**3.94**	**1.91**	**1.38**			

Table 2: 2013 Coastal Pond Survey winter flounder abundance indices (fish/seine haul) by pond and month

Pond	May	Jun	Jul	Aug	Sep	Oct
Charlestown Pond	2.5	8.0	3.8	3.8	1.0	0.3
Green Hill Pond	13.5	8.5	0.0	0.0	0.0	0.0
Narrow River	54.7	34.3	45.7	2.3	1.7	2.7
Point Judith Pond	12.8	14.8	6.8	4.8	2.3	0.0
Potter's Pond	12.5	14.0	12.5	0.0	0.0	0.5
Pawcatuck River	1.3	15.7	14.3	1.7	2.0	0.0
Quonochontaug Pond	3.7	7.3	7.3	6.7	0.7	1.3
Winnipaug Pond	3.3	12.3	20.0	4.7	0.0	0.0
Total	**12.6**	**14.4**	**13.7**	**3.3**	**1.1**	**0.6**

Table 3: 2013 Coastal Pond Survey average lengths of juvenile winter flounder by pond and month.

Pond	May	Jun	Jul	Aug	Sep	Oct
Charlestown Pond	4.2	6.0	5.8	7.0	6.2	6.7
Green Hill Pond	4.6	7.1				
Narrow River	3.6	5.0	4.8	4.9	5.3	6.1
Point Judith Pond	4.3	5.2	6.0	14.5	6.4	
Potter's Pond	4.8	7.2	8.6			14.4
Pawcatuck River	7.2	5.3	5.0	6.8	7.3	
Quonochontaug Pond	3.4	4.1	5.7	6.4	7.1	7.7
Winnipaug Pond	2.8	3.7	4.9	6.4		

Table 4: 2013 Coastal Pond Survey bluefish abundance indices (fish/seine haul) by pond and month

Pond	May	Jun	Jul	Aug	Sep	Oct
Charlestown Pond	0	0	1.25	3	4.5	0
Green Hill Pond	0	0	0	2	0	0
Narrow River	0	1	4	4.67	0.33	0
Point Judith Pond	0	0	3.75	1.5	0.25	0
Potter's Pond	0	0	1.5	1	1	0
Pawcatuck River	0	0.33	6.33	0.67	0	0
Quonochontaug Pond	0	0	2	1	0	0
Winnipaug Pond	0	0	1.33	1.33	2.33	0
Total pond index	**0**	**0.16**	**2.52**	**1.90**	**1.05**	**0**

Table 5: 2013 Coastal Pond Survey tautog abundance indices (fish/seine haul) by pond and month

Pond	May	Jun	Jul	Aug	Sep	Oct
Charlestown Pond	0	0	0.25	0	9.5	1.25
Green Hill Pond	0	0	0	0	0	0
Narrow River	0.33	0	0	0.33	2.33	1
Point Judith Pond	0	0	0	0.75	1.75	0.5
Potter's Pond	0	0	0	0	0	0
Pawcatuck River	0	2.67	0	1.33	0	0.33
Quonochontaug Pond	0	0	0	0	2.33	0.33
Winnipaug Pond	0	0	0	0.33	1.33	2.33
Total pond index	**0.04**	**0.33**	**0.03**	**0.34**	**2.16**	**0.72**

Table 6: 2013 Coastal Pond Survey black sea bass abundance indices (fish/seine hau l) by pond and month

Pond	May	Jun	Jul	Aug	Sep	Oct
Charlestown Pond	0	0	0	1	11.5	10.25
Green Hill Pond	0	0.5	0	0	0	0
Narrow River	0	0	0	0.67	5.33	4.67
Point Judith Pond	0	0	0	0	14.5	0
Potter's Pond	0	0	0	0	0	0
Pawcatuck River	0	0.33	0	0	0.33	0
Quonochontaug Pond	0	0	0	0.67	6	3
Winnipaug Pond	0	0	0	0	1	1
Total pond index	**0**	**0.10**	**0**	**0.29**	**4.83**	**2.36**

Table 7: 2013 Coastal Pond Survey Scup abundance indices (fish/seine haul) by pond and month

Pond	May	Jun	Jul	Aug	Sep	Oct
Charlestown Pond	0	0	1.75	2	3.25	0
Green Hill Pond	0	0	0	0	0	0
Narrow River	0	0	0	0.33	0	0
Point Judith Pond	0	0	1.5	0	0.5	0
Potter's Pond	0	0	0	0	0	0
Pawcatuck River	0	0	0	0	0.33	0
Quonochontaug Pond	0	0	0	0.33	0	0
Winnipaug Pond	0	0	0.67	3.33	0.33	0
Total pond index	**0**	**0**	**0.49**	**0.75**	**0.55**	**0**

Table 8: 2013 Coastal Pond Survey Clupeid abundance indices (fish/seine haul) by month

Species	May	Jun	Jul	Aug	Sep	Oct
Alewife	0	5.42	3.92	0.08	0	0
Atlantic Menhaden	0	0	0	0	0	0.04
Atlantic Herring	0	0	0	0	0	0
Blueback Herring	0	0	0	0	0	0
American Shad	0	0.25	0	0	0	0

Table 9: 2013 Coastal Pond Survey Atlantic Silverside abundance indices (fish/seine haul) by pond and month

Pond	May	Jun	Jul	Aug	Sep	Oct
Charlestown Pond	4.5	59	147.75	244	67.5	121
Green Hill Pond	24.5	3	23	26	36	622.5
Narrow River	0.67	1	27	67.33	237.33	70
Point Judith Pond	0	1.5	210.5	379.25	208.25	4.75
Potter's Pond	1	3	11	28.5	17	13.5
Pawcatuck River	26.33	2	78.33	132	35.67	26.33
Quonochontaug Pond	58	18.33	51	44	35.67	57.33
Winnipaug Pond	0.33	8.33	108.67	105	183	25.67
Total pond index	**14.42**	**12.02**	**82.16**	**128.26**	**102.55**	**117.64**

Table 10: 2013 Coastal Pond Survey Striped Killifish abundance indices (fish/seine haul) by pond and month

Pond	May	Jun	Jul	Aug	Sep	Oct
Charlestown Pond	3.25	0	5	1.25	4.25	1.75
Green Hill Pond	0	0	13	2	0	0
Narrow River	0	0	0	0.33	3	0
Point Judith Pond	0	0.25	0	13.5	90.75	1.5
Potter's Pond	0	0	2	0	0.5	0
Pawcatuck River	0	0	0	0	12.33	47.33
Quonochontaug Pond	0	0	4.67	0.67	5.67	0.33
Winnipaug Pond	0	0	10.33	13.67	21.67	8.67
Total pond index	**0.41**	**0.03**	**4.38**	**3.93**	**17.27**	**7.45**

Table 11: 2013 Coastal Pond Survey Mumichog abundance indices (fish/seine haul) by pond and month

Pond	May	Jun	Jul	Aug	Sep	Oct
Charlestown Pond	0.25	0	1	1	3.75	1.5
Green Hill Pond	0	0	3	2	1	1
Narrow River	0.33	0.67	3.33	0.33	1.67	2
Point Judith Pond	0	1.25	0.5	2.25	24.5	0
Potter's Pond	0	1.5	11.5	0.5	0.5	2.5
Pawcatuck River	0.67	6.67	1.33	1	3.67	0
Quonochontaug Pond	0	0	0	0	5.33	0
Winnipaug Pond	0	0	0	0.33	9.33	0
Total pond index	**0.16**	**1.26**	**2.58**	**0.93**	**6.22**	**0.86**

Table 12: 2013 Coastal Pond Survey Sheepshead Minnow abundance indices (fish/seine haul) by pond and month

Pond	May	Jun	Jul	Aug	Sep	Oct
Charlestown Pond	0	0.75	0.5	0.5	0.25	0.5
Green Hill Pond	0	0	0	0	0	0
Narrow River	0	0	0.67	0	0.33	2
Point Judith Pond	0	0	0	0	0	0
Potter's Pond	0	0	0	0	0	1.5
Pawcatuck River	0	0	0	0	0.33	6
Quonochontaug Pond	0	0	0	0	0.33	0
Winnipaug Pond	0	0	0	0	0	0
Total pond index	**0**	**0.09**	**0.14**	**0.06**	**0.16**	**1.25**

Table 13: 2013 Coastal Pond Survey average water temperature (degrees Celcius) by pond and month

Station	May	June	July	August	September	October
Charlestown Pond	19.20	22.70	29.05	22.78	22.55	16.60
Green Hill Pond	21.45	25.70	32.30	24.75	19.15	18.00
Narrow River	16.00	19.50	23.67	22.63	22.77	17.43
Point Judith Pond	17.48	20.08	25.88	23.78	19.85	17.33
Potter's Pond	18.50	21.35	27.80	24.60	20.00	17.40
Pawcatuck River	15.77	21.10	26.70	21.37	18.13	17.33
Quonochontaug Pond	17.00	22.63	27.13	22.17	17.53	17.07
Winnipaug Pond	17.00	19.03	22.67	22.73	22.50	16.90
Average	17.80	21.51	26.90	23.10	20.31	17.26

Table 14: 2013 Coastal Pond Survey average salinity (ppt) by pond and month
Note: No salinty measurements were taken in September.

Station	May	June	July	August	September	October
Charlestown Pond	27.62	25.21	26.77	27.60		28.85
Green Hill Pond	22.45	12.81	19.27	23.29		
Narrow River		14.25	19.78	21.42		23.97
Point Judith Pond	27.51	23.07	27.34	26.67		28.46
Potter's Pond	26.56		24.35	26.90		25.69
Pawcatuck River	23.94	23.64	18.66	22.13		
Quonochontaug Pond	29.27	27.99	26.45	28.54		
Winnipaug Pond	28.85	27.36		28.69		28.54
Average	26.60	22.04	23.23	25.66		27.10

Table 15: 2013 Coastal Pond Survey average dissolved oxygen (mg/l) by pond and month
Note: No dissolved oxygen measurements were taken after July.

Station	**May**	**June**	**July**	**August**	**September**	**October**
Charlestown Pond	8.63	8.28				
Green Hill Pond	6.98	8.48				
Narrow River		8.76	7.48			
Point Judith Pond	9.76	7.94	12.88			
Potter's Pond	8.34	10.55	8.70			
Pawcatuck River	9.11	8.95				
Quonochontaug Pond	8.18	8.91				
Winnipaug Pond	10.23	8.98	7.93			
Average	8.75	8.86	9.25			

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

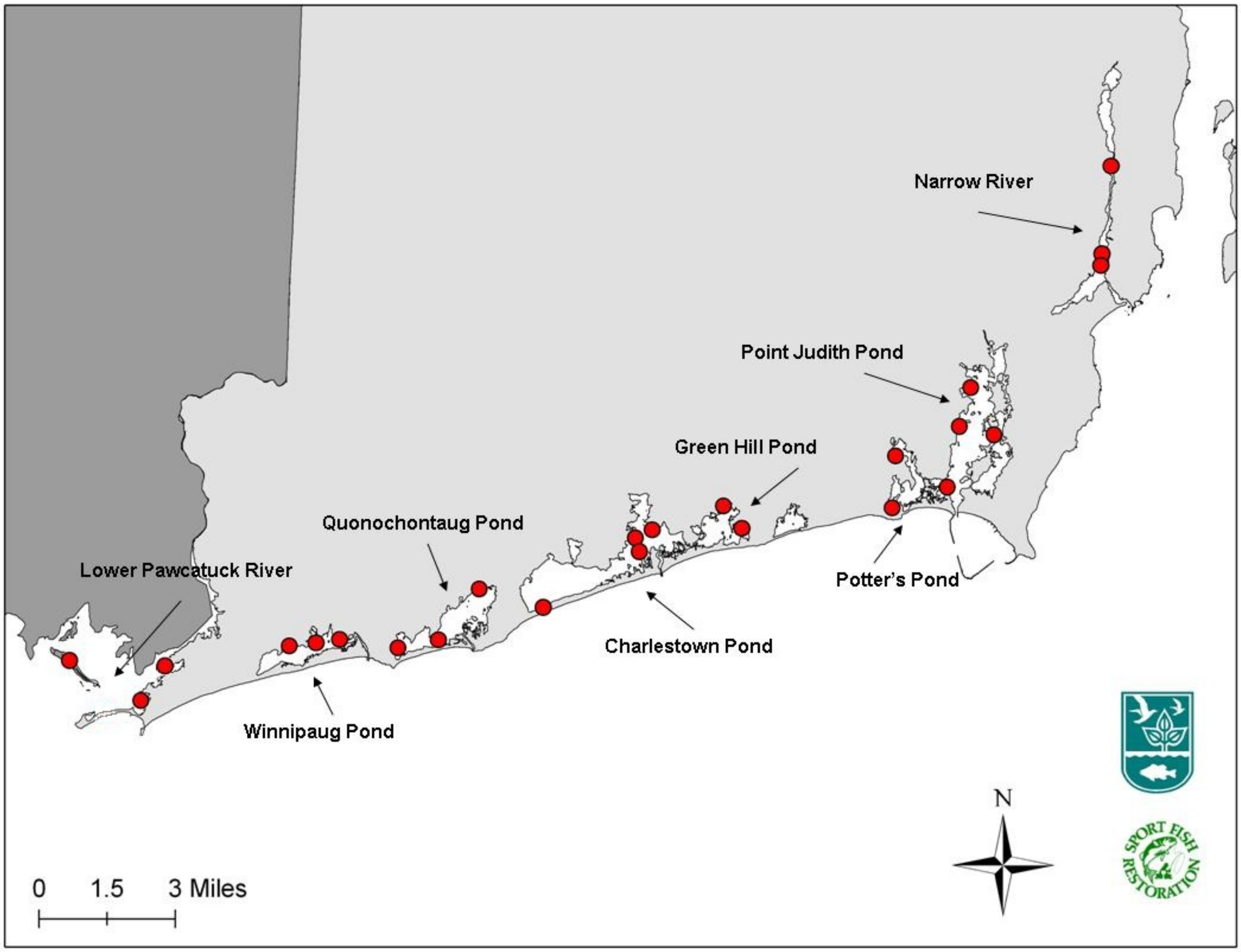


Figure 2: Coastal Pond Juvenile Finfish Survey station locations (western ponds).

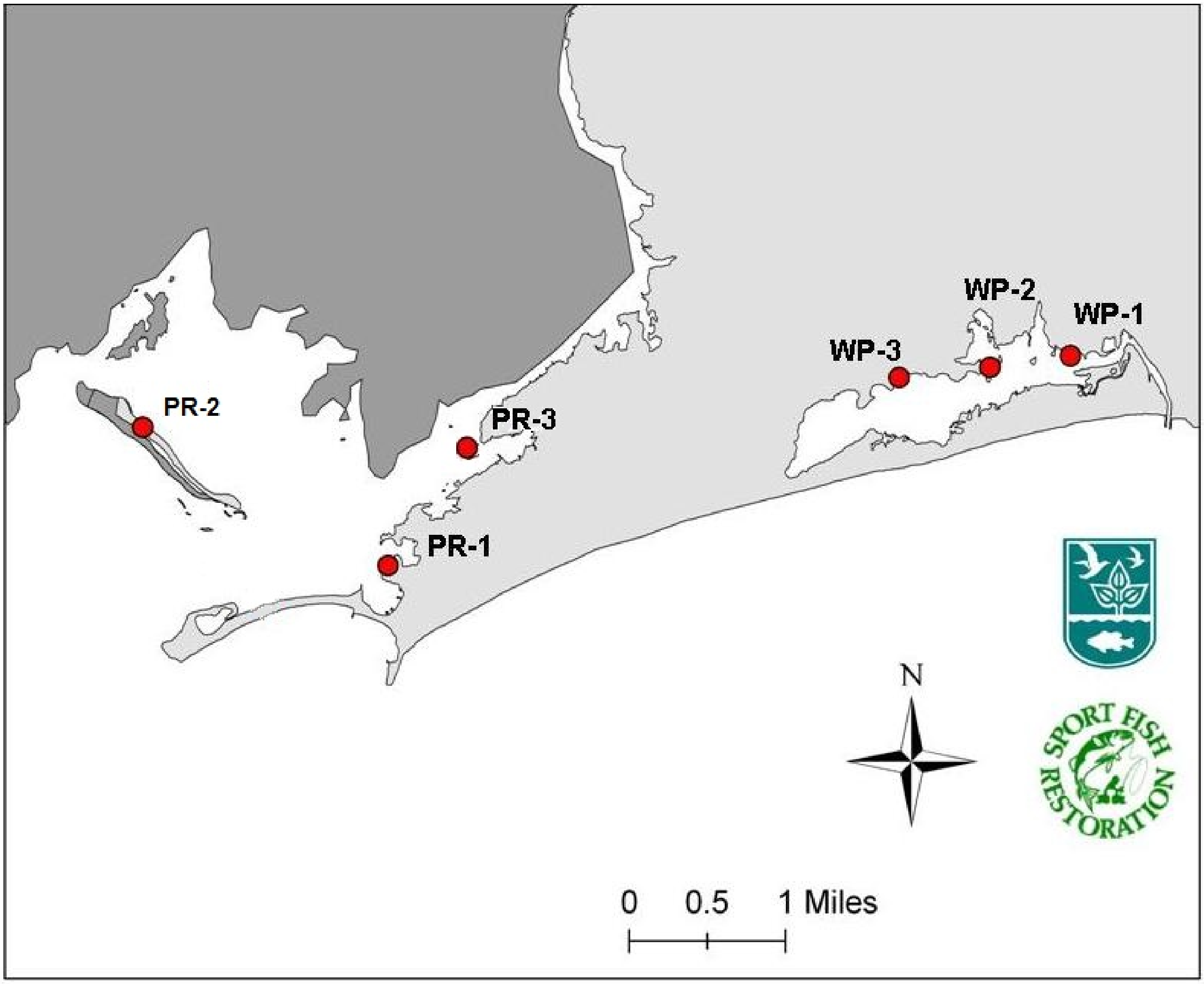


Figure 2 (cont): Coastal Pond Juvenile Finfish Survey station locations (western ponds).

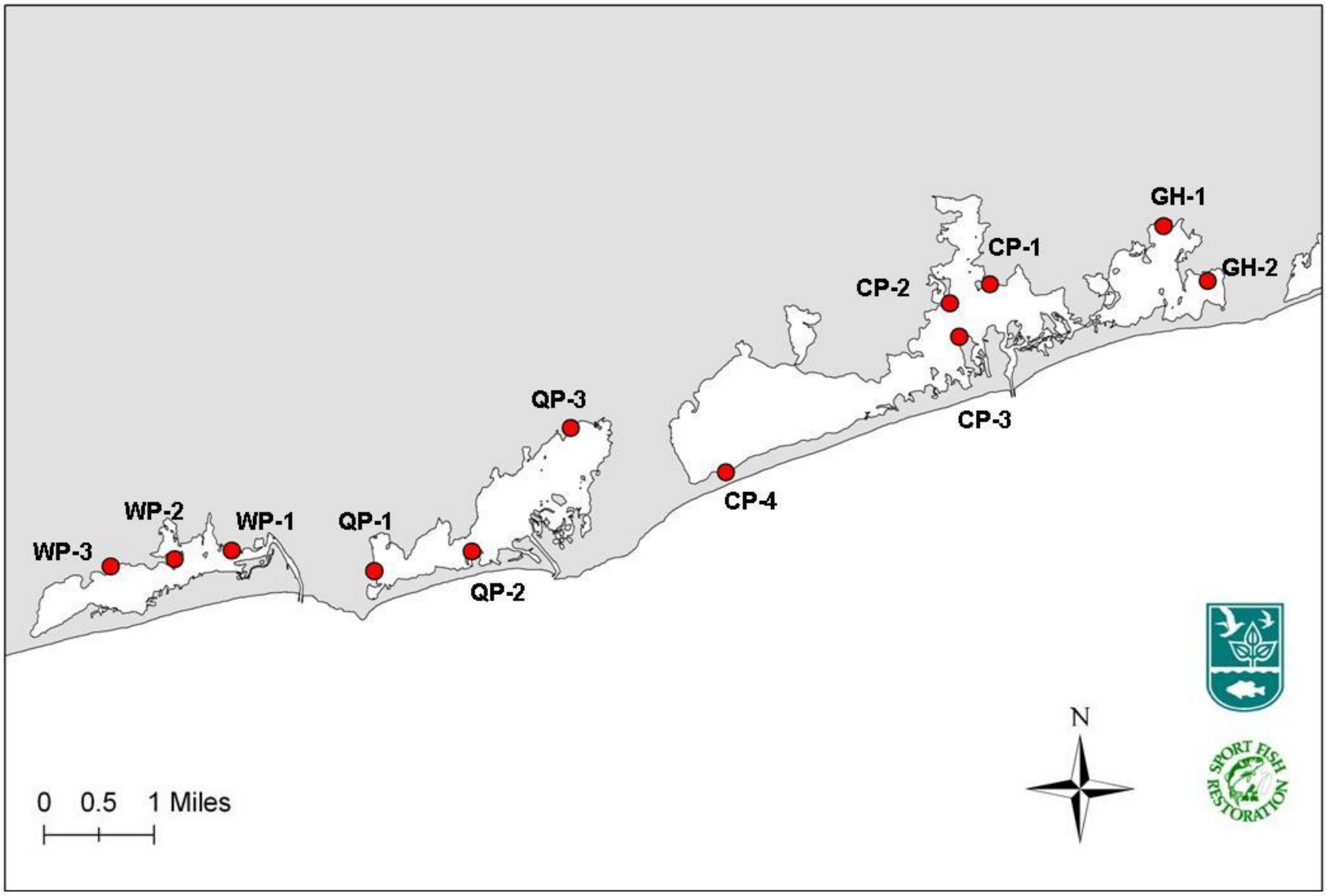


Figure 3: Coastal Pond Juvenile Finfish Survey station locations (eastern ponds).

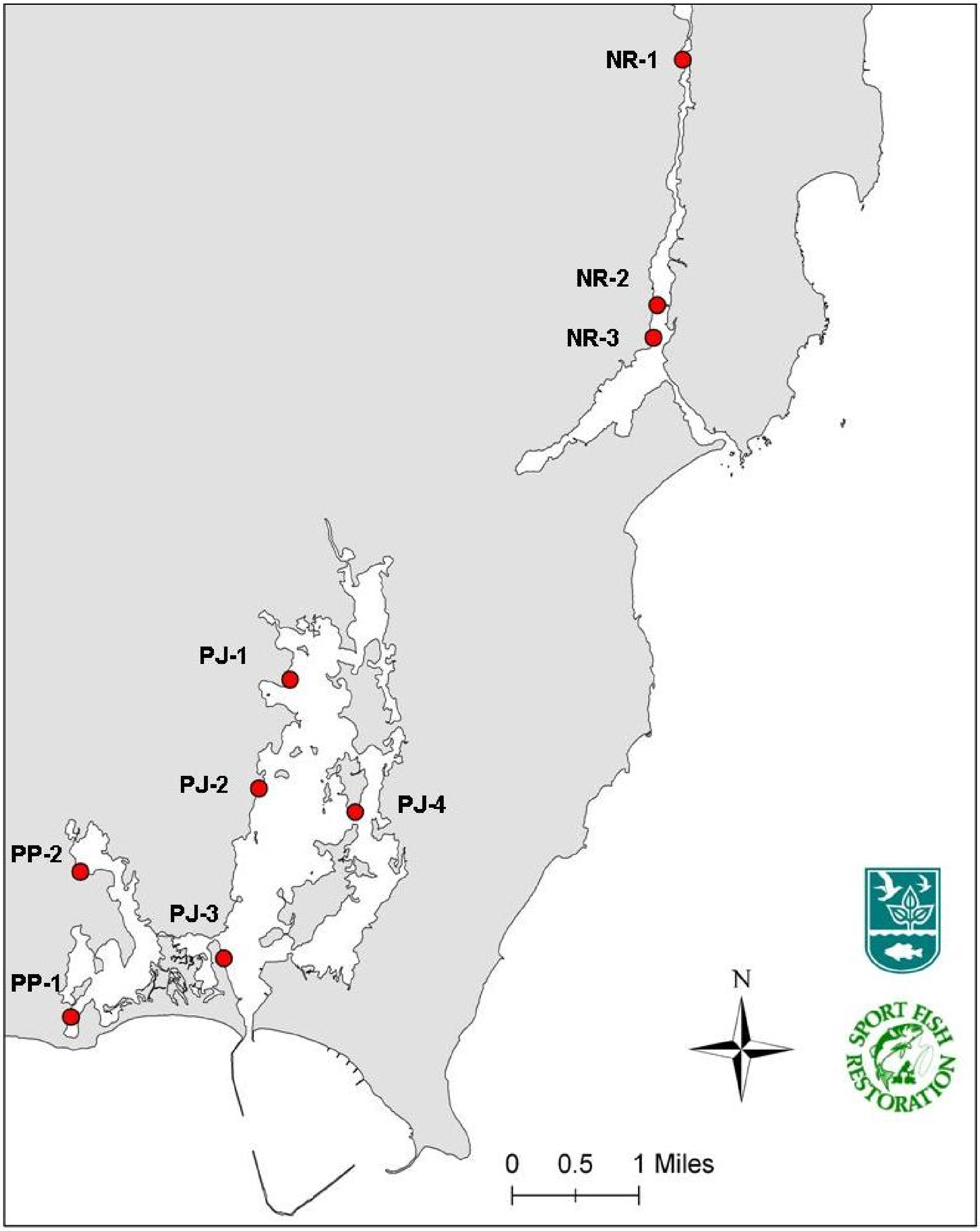


Figure 4
Coastal Pond Juvenile Finfish Survey

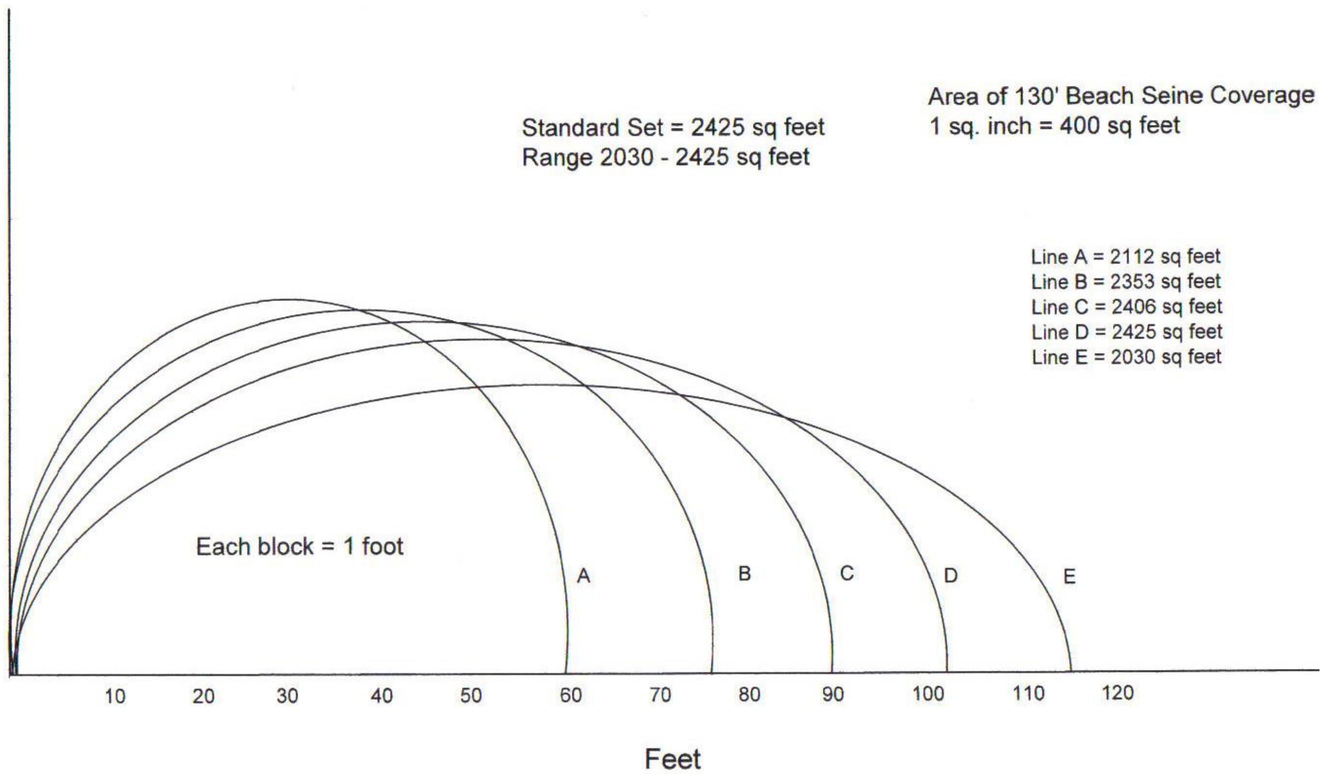


Figure 5a: Time series of abundance indices (fish/seine haul) for winter flounder YOY from each Coastal Pond in the survey.

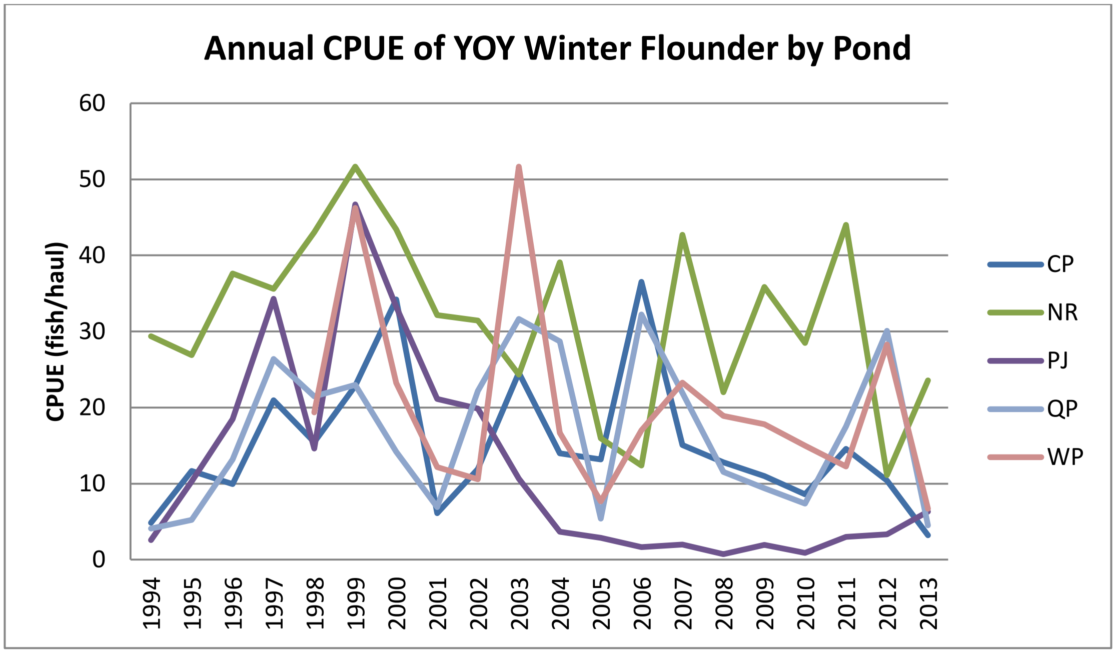


Figure 5b: 2013 time series of abundance indices (fish/seine haul) by month for winter flounder YOY for each Coastal Pond in the survey.

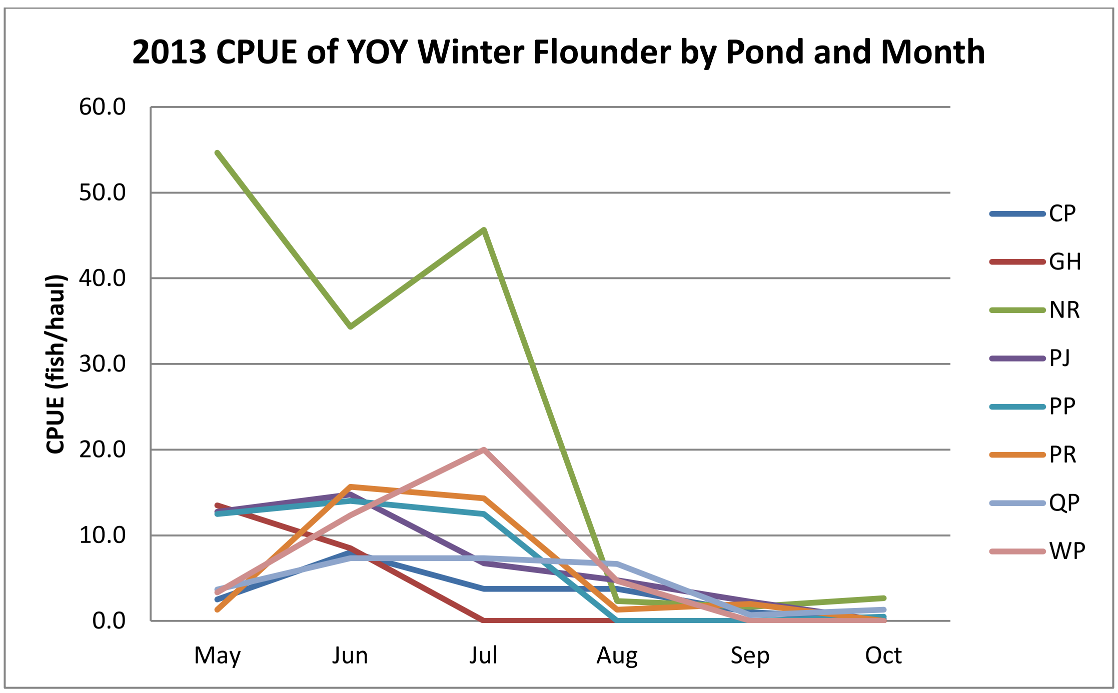


Figure 6: Length frequency of all winter flounder caught in Coastal Pond Survey during 2012.

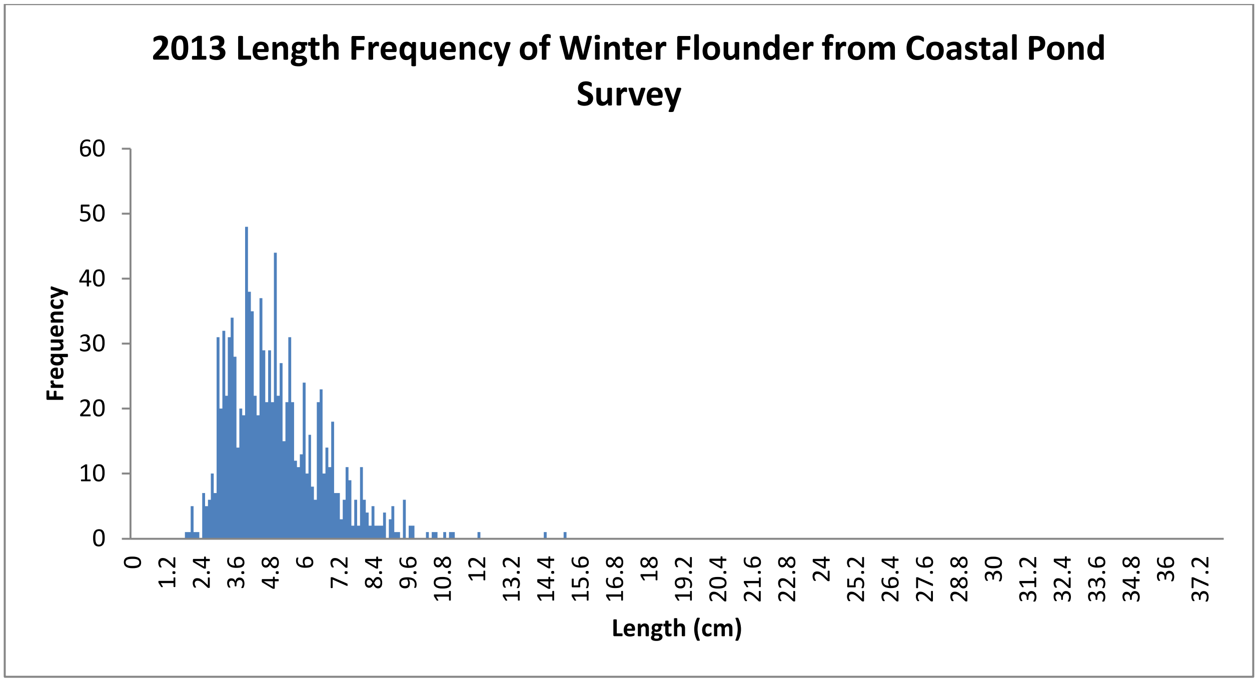


Figure 7: Monthly length frequency of winter flounder from Charlestown Pond, 2013.

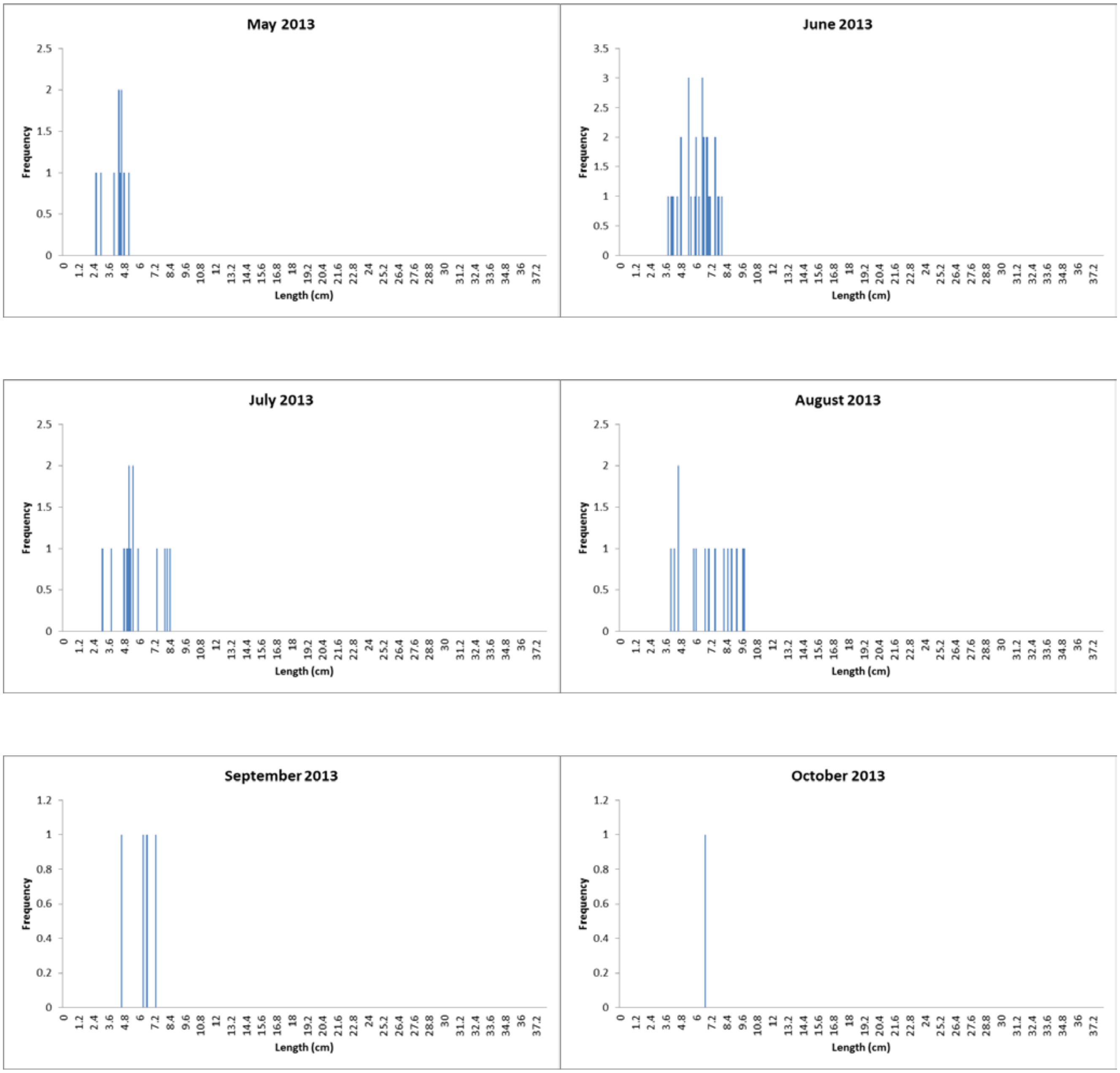


Figure 8: Monthly length frequency of winter flounder from Green Hill Pond, 2013.

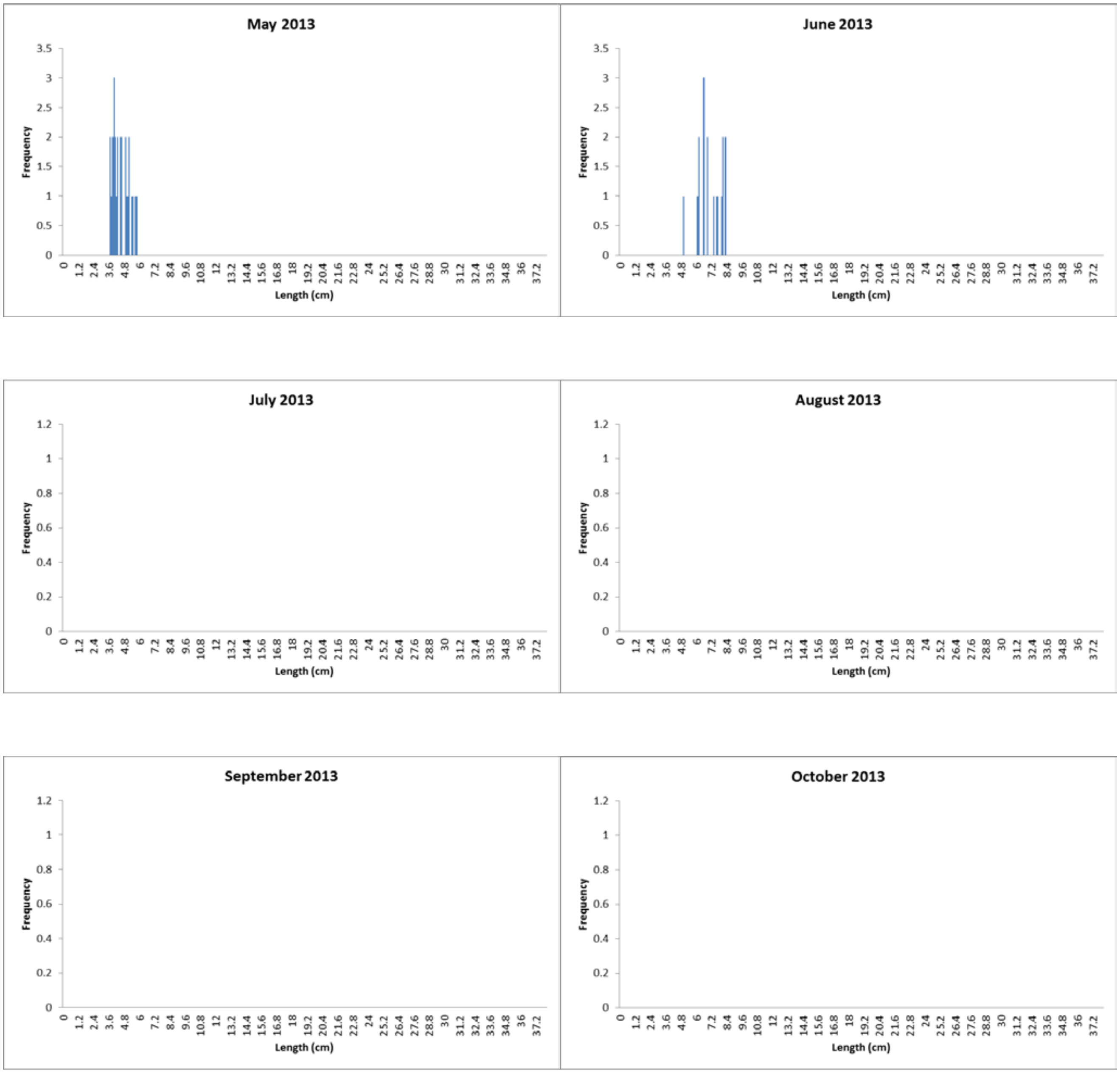


Figure 9: Monthly length frequency of winter flounder from Narrow River, 2013.

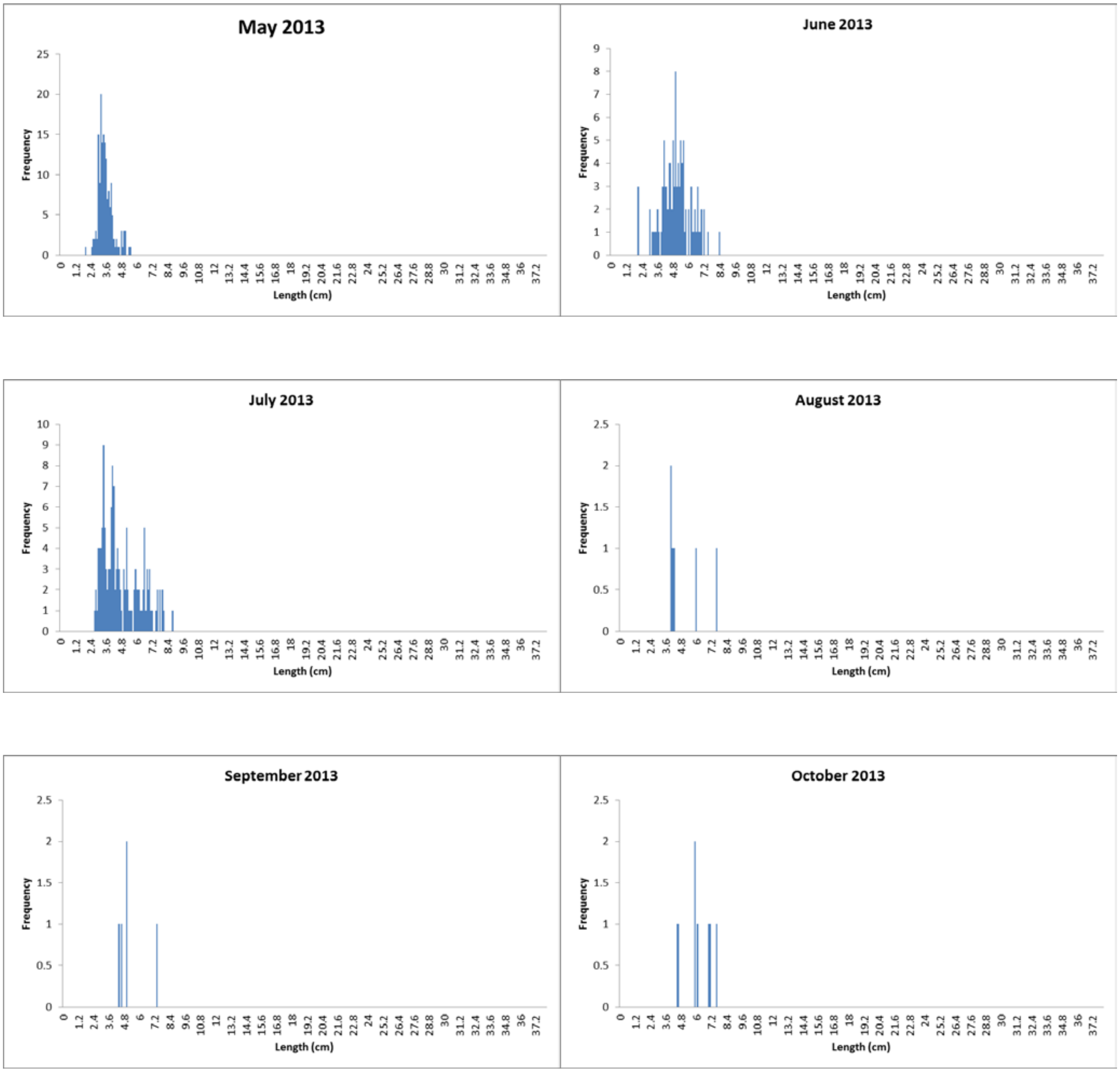


Figure 10: Monthly length frequency of winter flounder from Point Judith Pond, 2013.

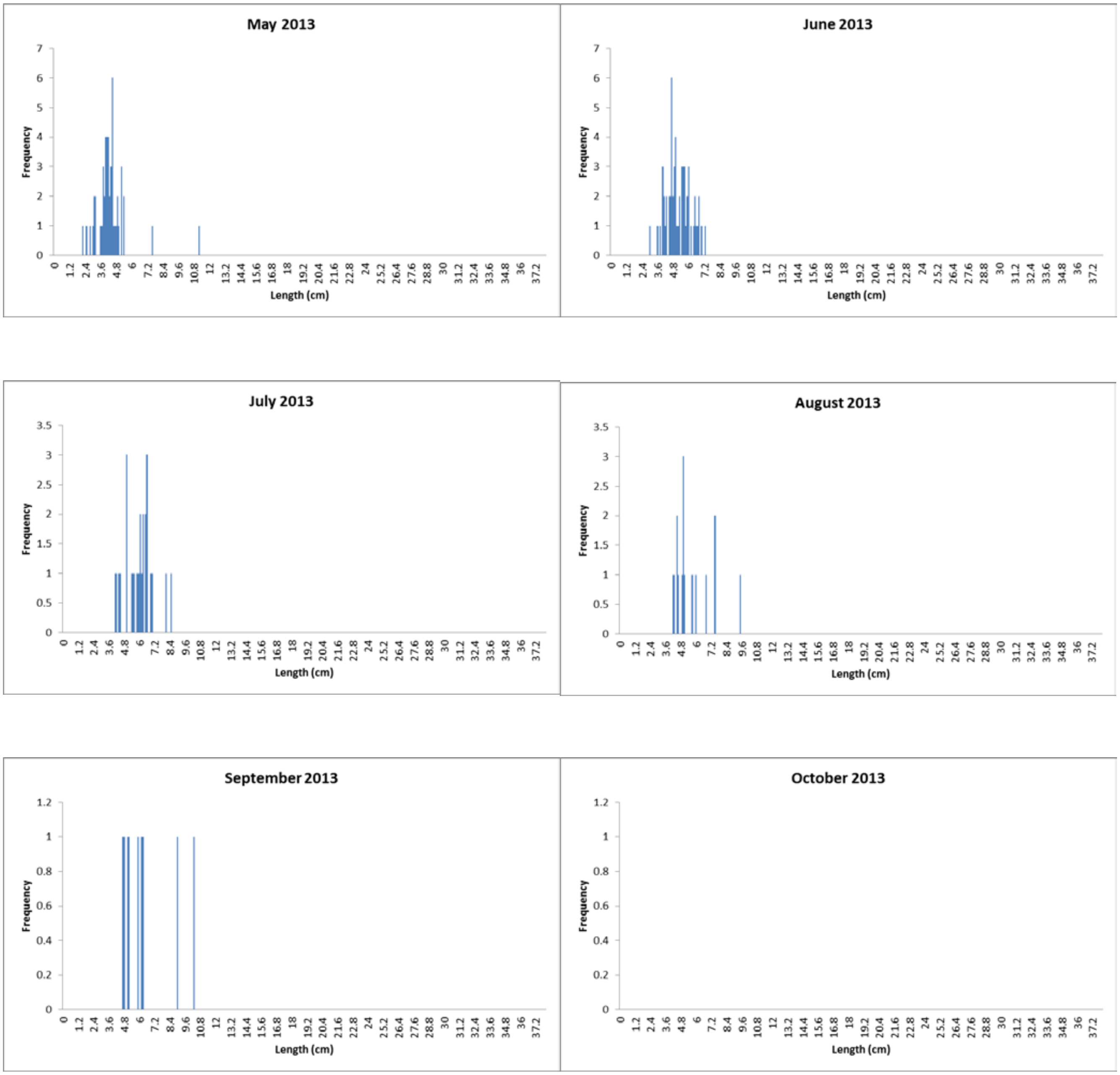


Figure 11: Monthly length frequency of winter flounder from Potter Pond, 2013.

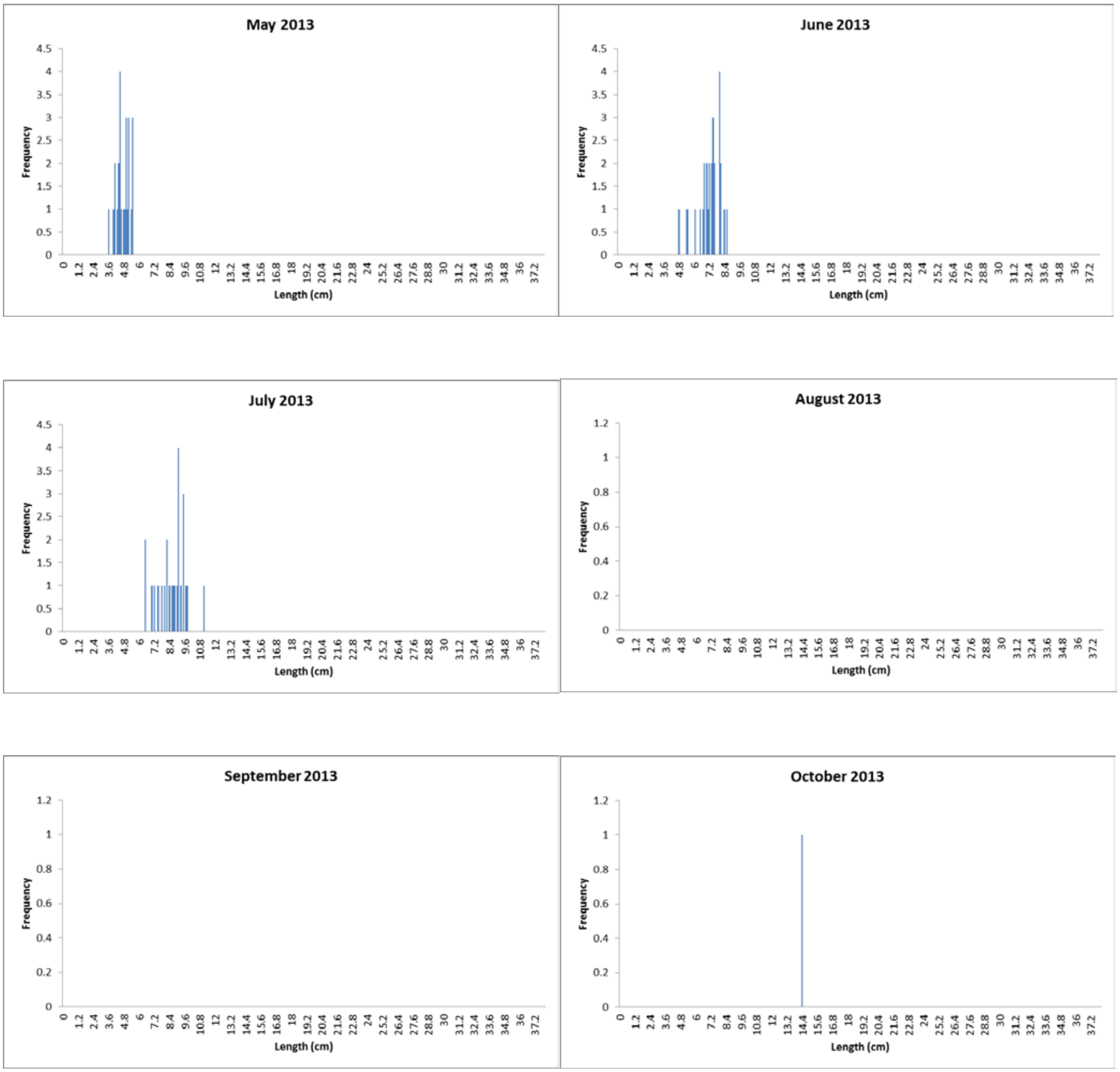


Figure 12: Monthly length frequency of winter flounder from Pawcatuck River, 2013.

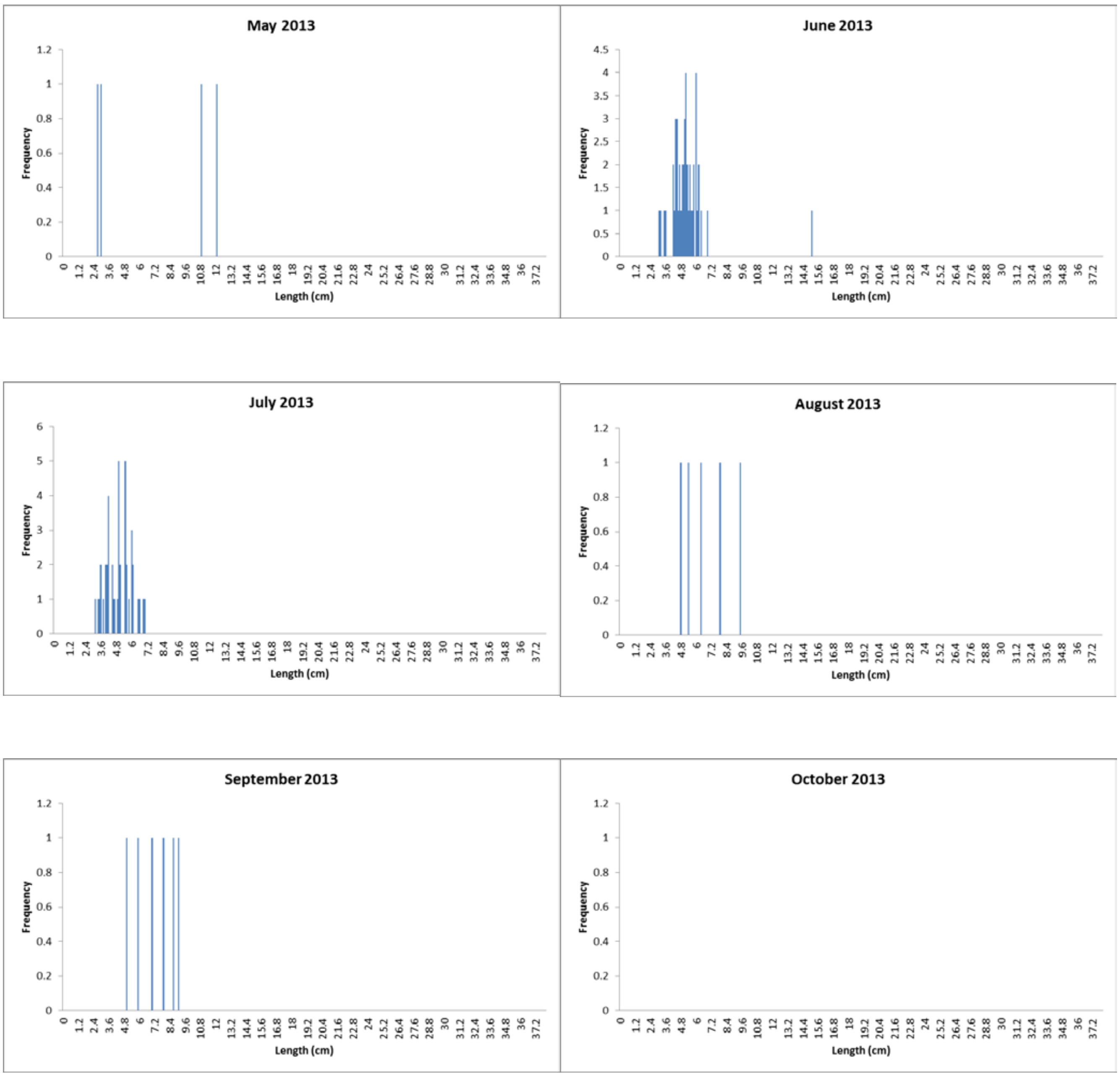


Figure 13: Monthly length frequency of winter flounder from Quonochontaug Pond, 2013.

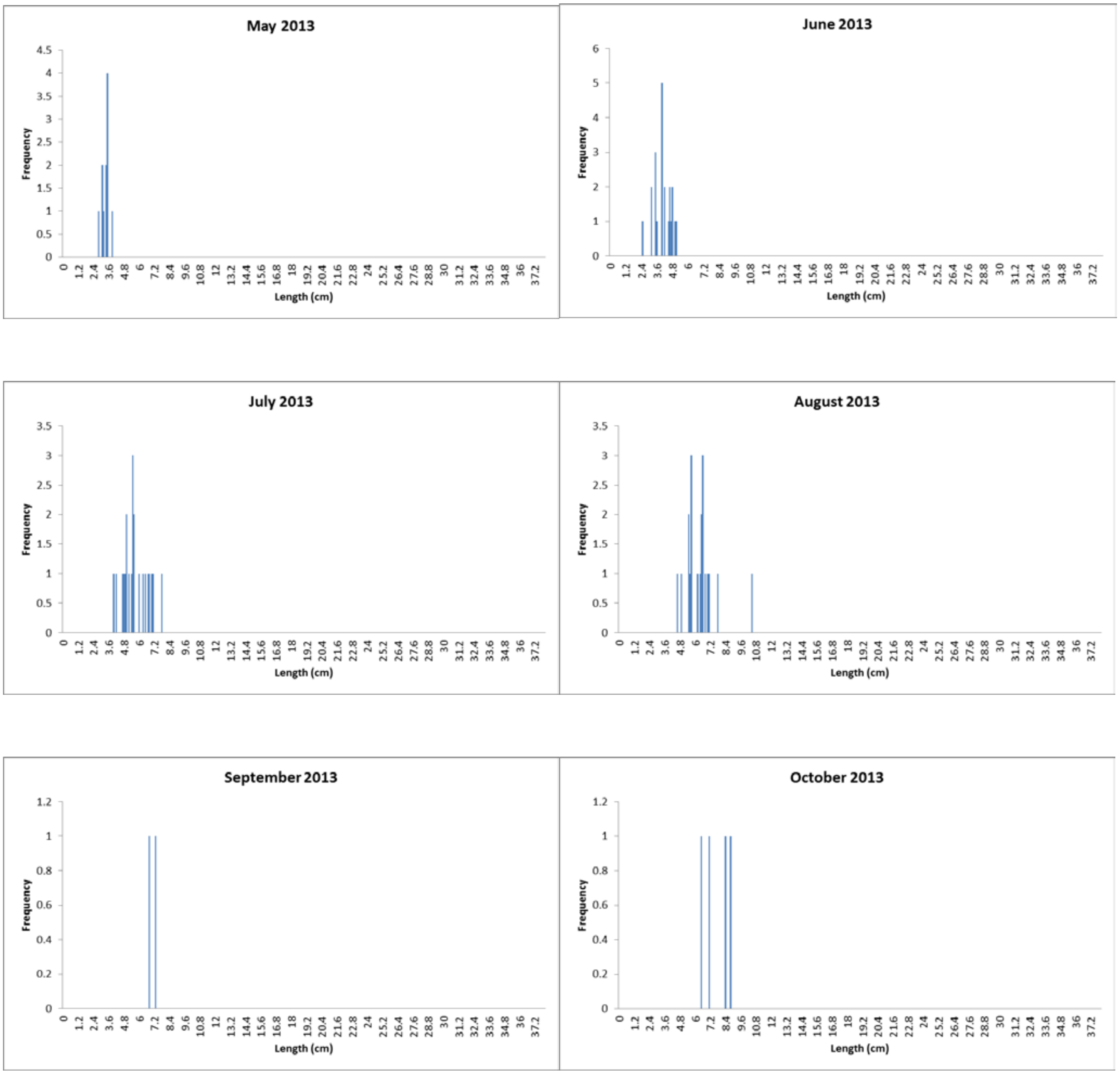


Figure 14: Monthly length frequency of winter flounder from Winnipaug Pond, 2013.

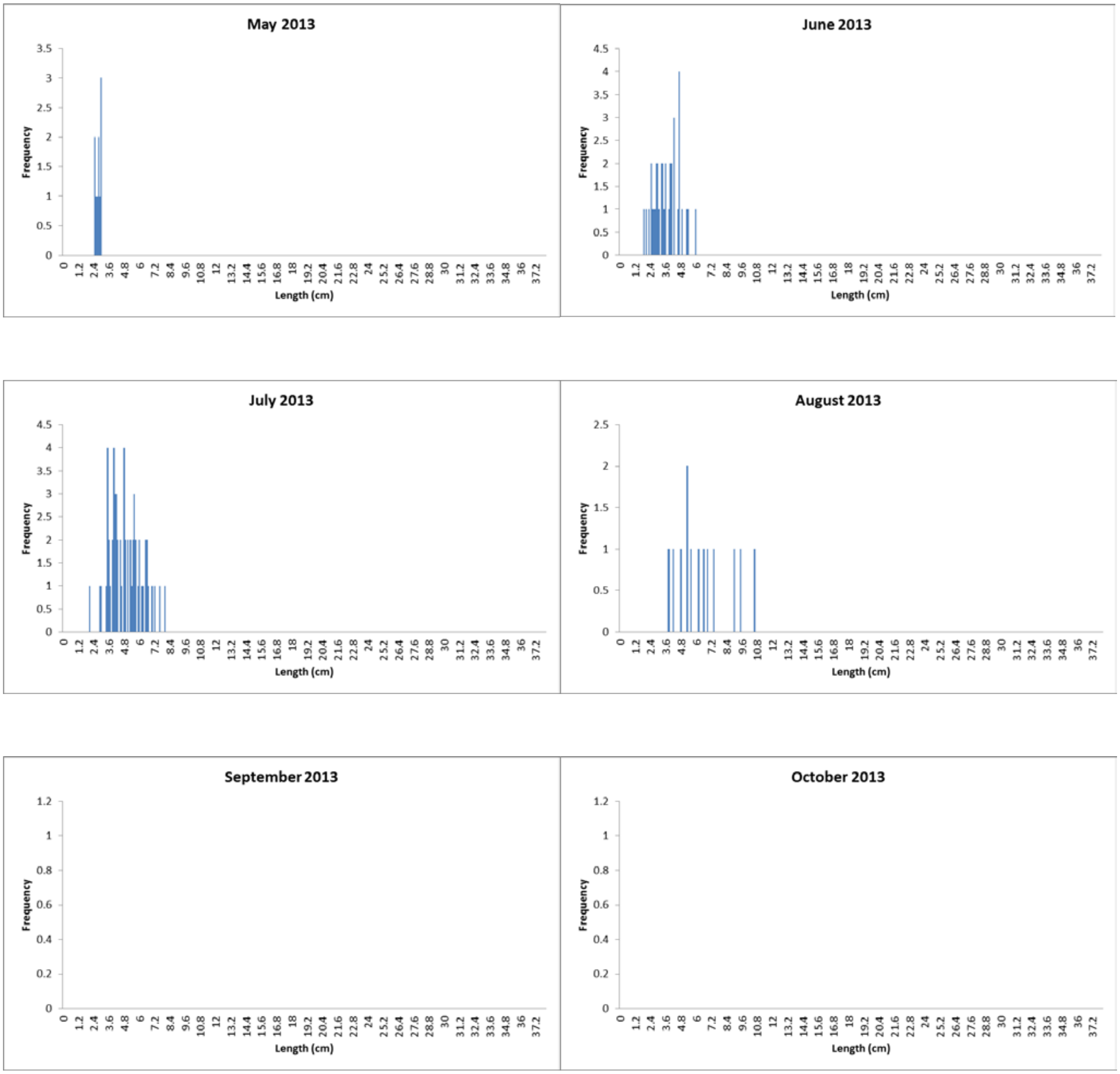


Figure 15: Time series of annual abundance indices for winter flounder YOY from the coastal pond survey.

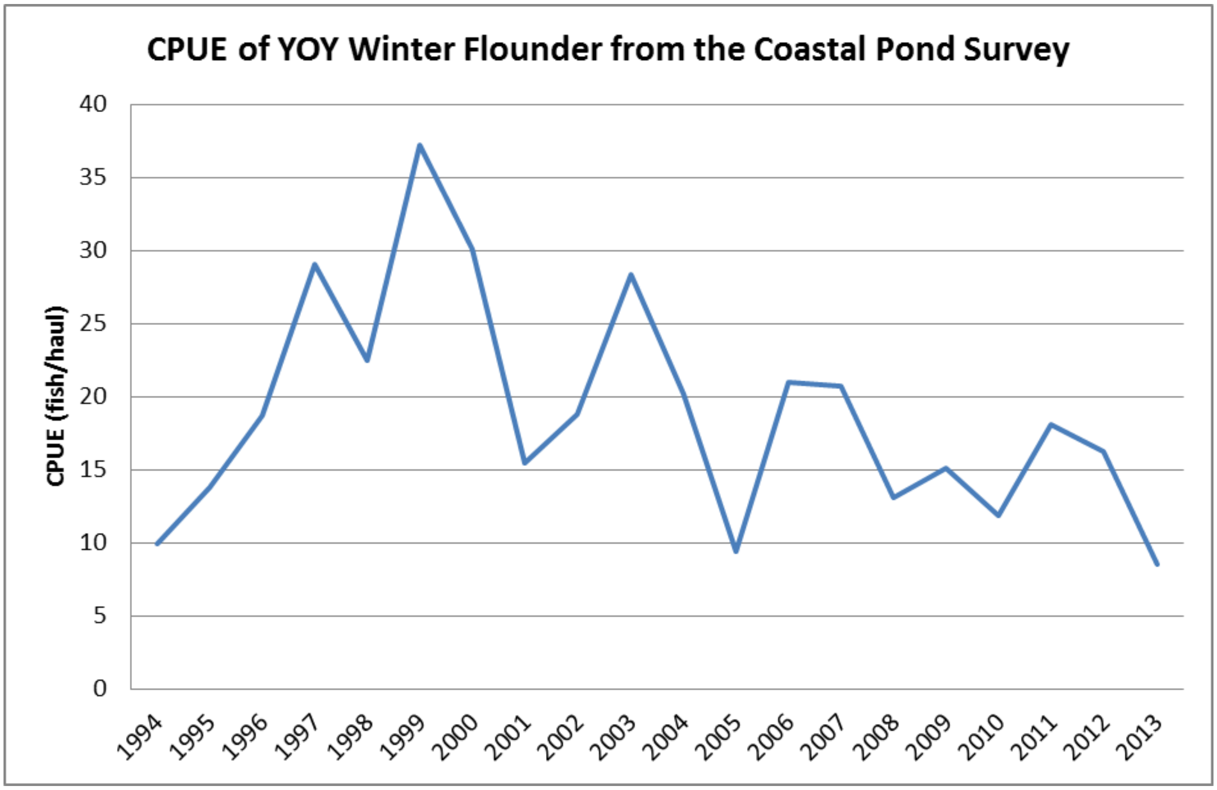


Figure 16: Abundance indices (fish/haul) from the Coastal Pond Survey, Narragansett Bay Seine Survey, and RIDFW Trawl Survey for winter flounder.

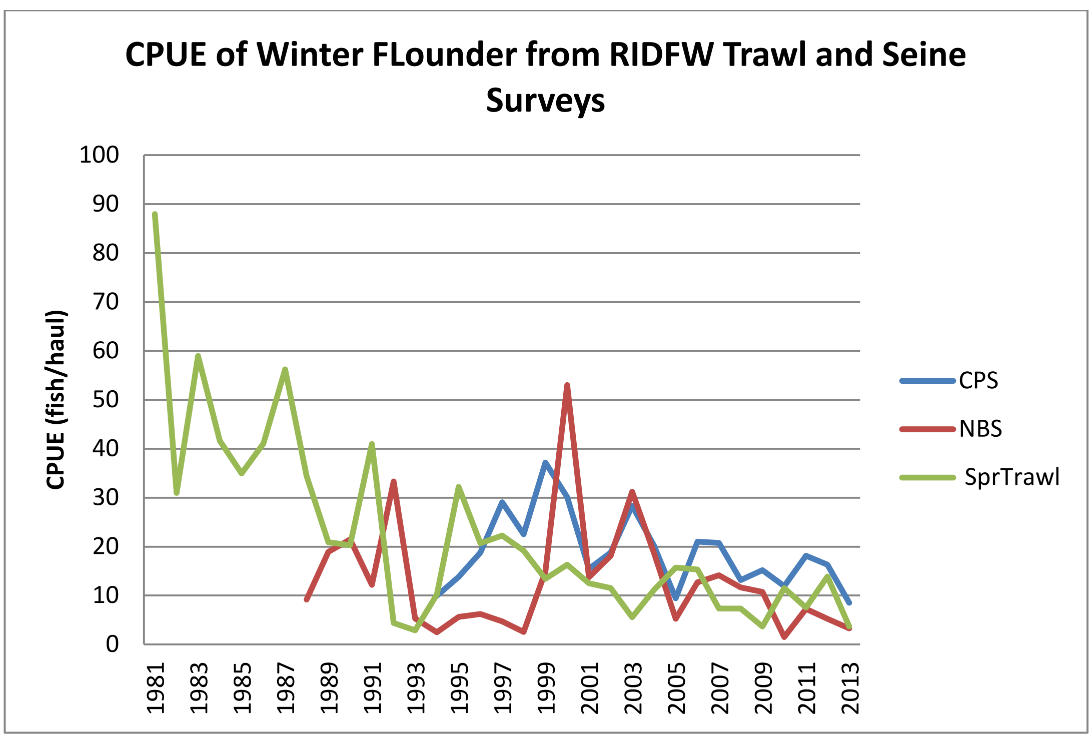


Figure 17: Abundance indices (fish/haul) from the Coastal Pond Survey and the Adult Winter Flounder Tagging Survey for winter flounder.

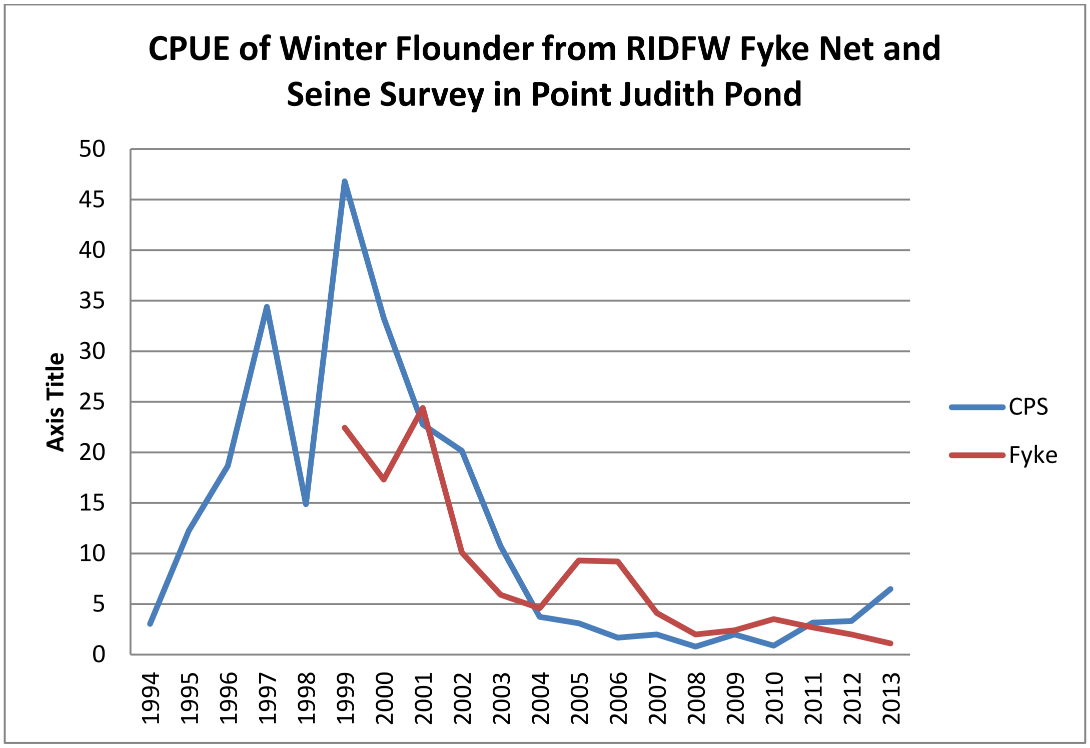


Figure 18. Time series of annual abundance indices for bluefish from the coastal pond survey.

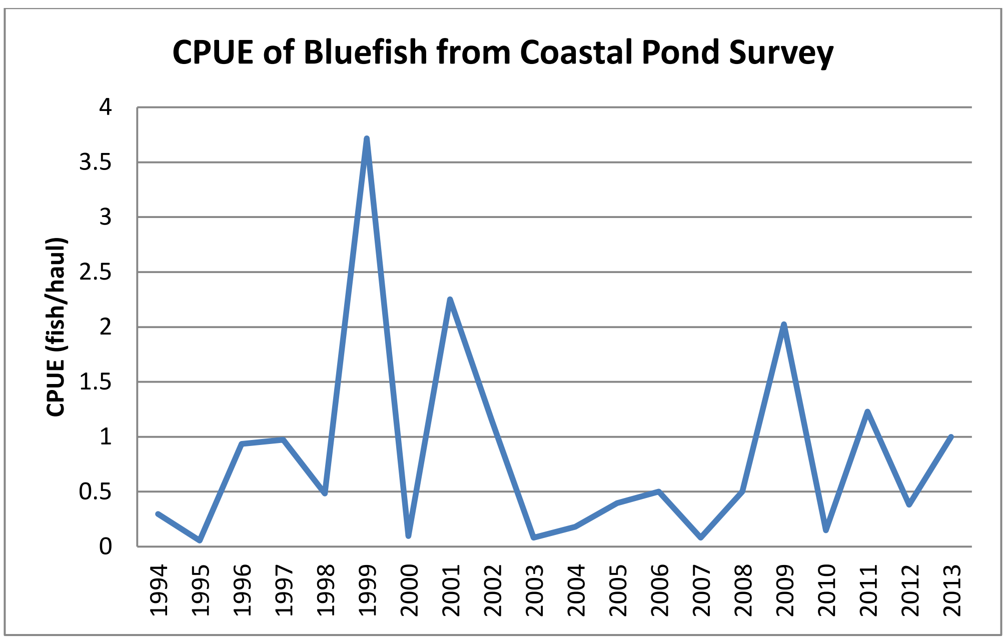


Figure 19. Time series of annual abundance indices for Tautog from the coastal pond survey.

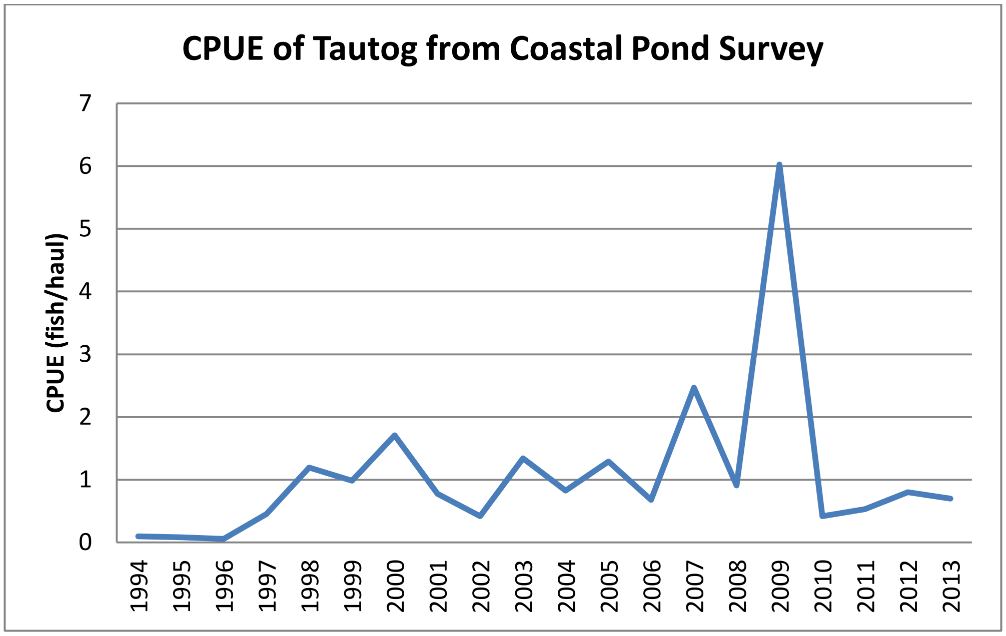


Figure 20. Time series of annual abundance indices for Black Sea Bass from the coastal pond survey.

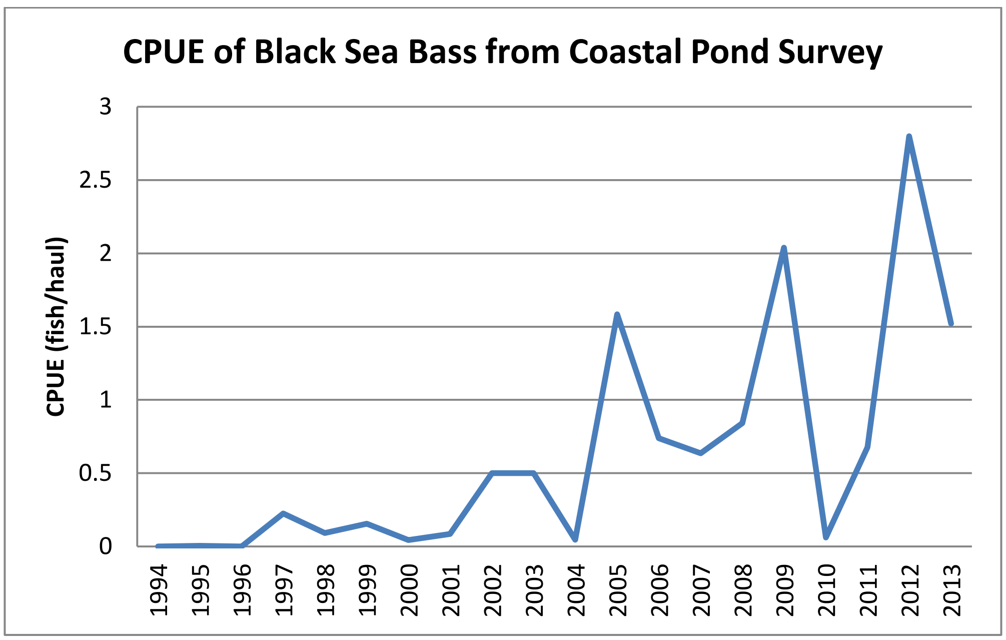


Figure 21. Time series of annual abundance indices for Scup from the coastal pond survey.

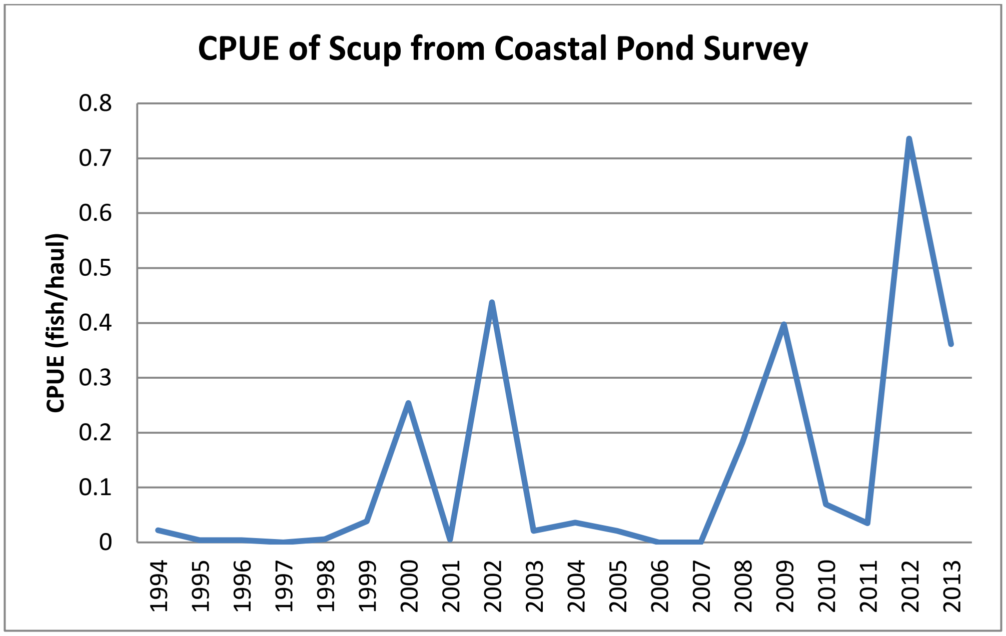


Figure 22. Time series of annual abundance indices for Clupeids from the coastal pond survey (menhaden on right y- axis)

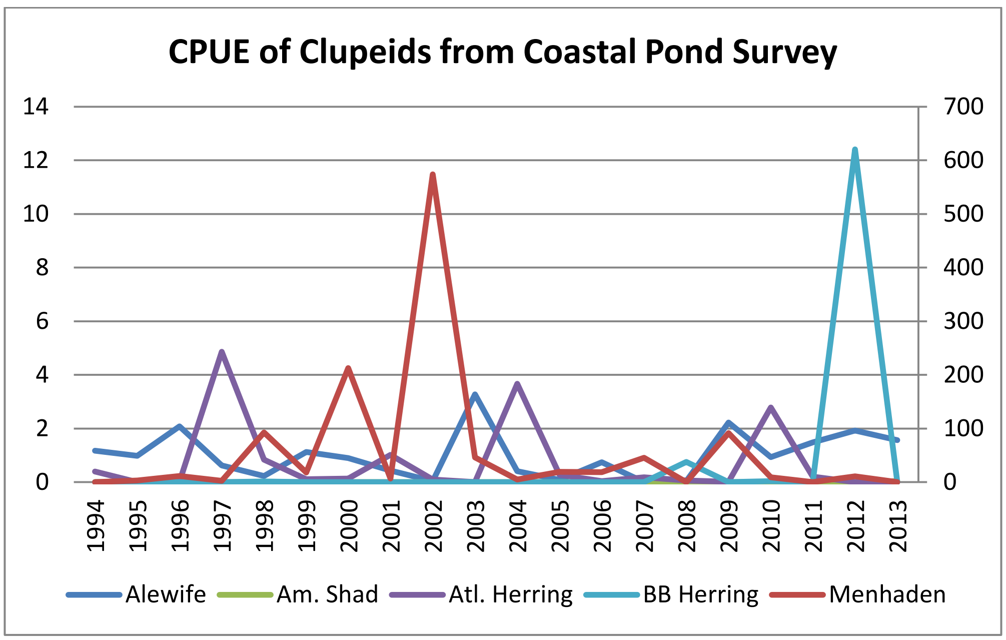
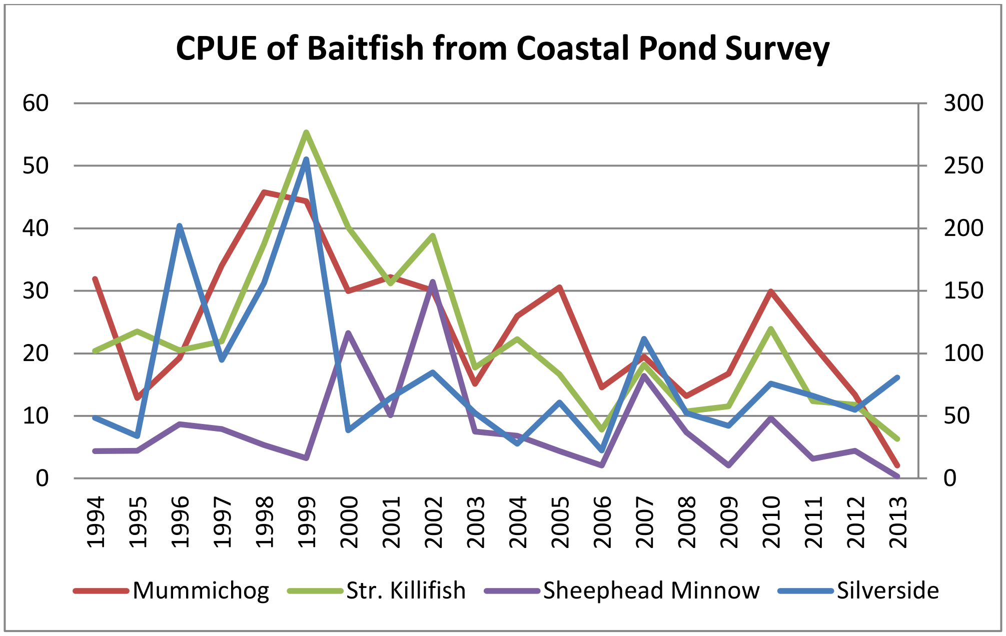


Figure 23. Time series of annual abundance indices for Baitfish from the coastal pond survey (silversides on right y- axis).



Appendix 1a: Catch frequency of all species by station for 2012 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)		1			4			33	1		74						
ANCHOVY BAY (ANCHOA MITCHILLI)	1	1	1										8			3	
BASS STRIPED (MORONE SAXATILIS)	2				1			1								2	1
BLUE CRAB (CALINECTES SAPIDIUS)	11	27	4	12	69	4		30	7	1	5	2	2	1		4	20
BLUEFISH (POMATOMUS SALTATRIX)	8	5	21	1	4	22	4	10	3	3	6	7	1	1	4	3	8
CORNETFISH BLUESPOTTED (FISTULARIA TABACARIA)	1	1							1								
CUNNER (TAUTOGOLABRUS ADSPERSUS)			4			2								1			
EEL AMERICAN (ANGUILLA ROSTRATA)	1	1	3										1			1	
FLOUNDER SMALLMOUTH (ETROPUS MICROSTOMUS)	4					3	7				2	3	1	11	1		1
FLOUNDER SUMMER (PARALICHTHYS DENTATUS)						1		1			2		1	1			1
FLOUNDER WINTER (PSEUDOPLEURONECTES AMERICANUS)	36	24	15	2	161	118	145	27	47	43	48	17	32	32	82	32	7
GOBY NAKED (GOBIOSOMA BOSC)					1			6	1		34		5				1
GRUBBY (MYOXOCEPHALUS AENAEUS)	2		6	1		2	2	1	7		1		12	2	3	5	1
GUNNEL ROCK (PHOLIS GUNNELLUS)																	
HOGCHOKER (TRINECTES MACULATUS)					17	1											
HORSESHOE CRAB (LIMULUS POLYPHEMUS)						1											1
JACK CREVALLE (CARANX HIPPOS)		1															
KILLIFISH STRIPED (FUNDULUS MAJALIS)	4	14	31	13		9	1	8	49	318	49	12	18	4	96	1	66
KINGFISH NORTHERN (MENTICIRRHUS SAXATILIS)	2	1				5								1			
LIZARDFISH INSHORE (SYNODUS FOETENS)	4				13		3	6	7		3	1		2			
MENHADEN ATLANTIC (BREVOORTIA TYRANNUS)					1												
MINNOW SHEEPSHEAD (CYPRINODON VARIEGATUS)	4	6			1	8							3	1			
MULLET WHITE (MUGIL CUREMA)	4	7				5						9			219		
MUMMICHOG (FUNDULUS HETEROCLITUS)	8	20	1	1	2	21	2	88	13	2	11		15	1	20		9
NEEDLEFISH ATLANTIC (STRONGYLURA MARINA)		1	7			1								1			
PERCH WHITE (MORONE AMERICANA)					22	7											
PERMIT (TRACHINOTUS FALCATUS)													14				
PIPEFISH NORTHERN (SYNGNATHUS FUSCUS)	3	9	11			1		4	7		11	2	1	3		5	8
POLLOCK (POLLACHIUS VIRENS)			2														
PUFFER NORTHERN (SPHOEROIDES MACULATUS)					2	1		2	1			1	1			1	
RAINWATER KILLIFISH (LUCANIA PARVA)	1	79	37	5				5	1				1				17
SAND LANCE AMERICAN (AMMODYTES AMERICANUS)																	
SCAD ROUGH (TRACHURUS LATHAMI)		3															
SCUP (STENOTOMUS CHRYSOPS)		23	5			1		6			2	1				1	12
SEA BASS BLACK (CENTROPRISTIS STRIATA)	37	25	29			15	17		30		28	2	23	4		2	4
SEAHORSE LINED (HIPPOCAMPUS ERECTUS)			1														
SEAROBIN NORTHERN (PRIONOTUS CAROLINUS)											1						
SEAROBIN STRIPED (PRIONOTUS EVOLANS)	2	2			1	1		2	1		2	1		3		4	1
SHAD AMERICAN (ALOSA SAPIDISSIMA)																	
SHEEPSHEAD (ARCHOSARGUS PROBATOCEPHALUS)																	1
SILVERSIDE ATLANTIC (MENIDIA MENIDIA)	358	179	1747	291	75	733	402	127	1783	304	1003	234	415	174	214	309	770
SNAPPER GRAY (LUTJANUS GRISEUS)			1														
SPOT (LEIOSTOMUS XANTHURUS)	14	4	2	2	12	9		2							1		4
SQUID LONGFIN (LOLIGO PEALEI)												1					
STICKLEBACK FOURSPINE (APELTES QUADRACUS)		46	56		4	1											11
TAUTOG (TAUTOGA ONITIS)	2	12	30		1	7	4	5	7			1	6	1			12
TOADFISH OYSTER (OPSANUS TAU)						2	2		2								14
TOMCOD ATLANTIC (MICROGADUS TOMCOD)			3														1

Appendix 1b: Catch frequency of all species by station for 2012 Coastal Pond Survey (new ponds).

Species	GH1	GH2	PP1	PP2	PR1	PR2	PR3
ALEWIFE (ALOSA PSEUDOHARENGUS)				23			90
ANCHOVY BAY (ANCHOA MITCHILLI)		6					
BASS STRIPED (MORONE SAXATILIS)							1
BLUE CRAB (CALINECTES SAPIDIUS)	44	32	15	7	2		7
BLUEFISH (POMATOMUS SALTATRIX)	2	2	1	6	8	6	8
CORNETFISH BLUESPOTTED (FISTULARIA TABACARIA)							
CUNNER (TAUTOGOLABRUS ADSPERSUS)					4	1	1
EEL AMERICAN (ANGUILLA ROSTRATA)	1	1					
FLOUNDER SMALLMOUTH (ETROPUS MICROSTOMUS)					3		
FLOUNDER SUMMER (PARALICHTHYS DENTATUS)	4		2		1	1	
FLOUNDER WINTER (PSEUDOPLEURONECTES AMERICANUS)	6	38	77	2	69	17	19
GOBY NAKED (GOBIOSOMA BOSC)	58	7	15	3			
GRUBBY (MYOXOCEPHALUS AENAEUS)					4		2
GUNNEL ROCK (PHOLIS GUNNELLUS)					1		
HOGCHOKER (TRINECTES MACULATUS)							
HORSESHOE CRAB (LIMULUS POLYPHEMUS)							
JACK CREVALLE (CARANX HIPPOS)						1	
KILLIFISH STRIPED (FUNDULUS MAJALIS)	16	14	2	3	97	77	5
KINGFISH NORTHERN (MENTICIRRHUS SAXATILIS)					4	1	
LIZARDFISH INSHORE (SYNODUS FOETENS)					1		
MENHADEN ATLANTIC (BREVOORTIA TYRANNUS)							
MINNOW SHEEPSHEAD (CYPRINODON VARIEGATUS)				3	19		
MULLET WHITE (MUGIL CUREMA)	3		2				
MUMMICHOG (FUNDULUS HETEROCLITUS)	1	13	14	19	2	1	37
NEEDLEFISH ATLANTIC (STRONGYLURA MARINA)							
PERCH WHITE (MORONE AMERICANA)							
PERMIT (TRACHINOTUS FALCATUS)							
PIPEFISH NORTHERN (SYNGNATHUS FUSCUS)	4	2		4	1		4
POLLOCK (POLLACHIUS VIRENS)							
PUFFER NORTHERN (SPHOEROIDES MACULATUS)					3		
RAINWATER KILLIFISH (LUCANIA PARVA)		3	2	19			
SAND LANCE AMERICAN (AMMODYTES AMERICANUS)						3	
SCAD ROUGH (TRACHURUS LATHAMI)							
SCUP (STENOTOMUS CHRYSOPS)							1
SEA BASS BLACK (CENTROPRISTIS STRIATA)	1					1	1
SEAHORSE LINED (HIPPOCAMPUS ERECTUS)	1						
SEAROBIN NORTHERN (PRIONOTUS CAROLINUS)							
SEAROBIN STRIPED (PRIONOTUS EVOLANS)					3	1	
SHAD AMERICAN (ALOSA SAPIDISSIMA)							6
SHEEPSHEAD (ARCHOSARGUS PROBATOCEPHALUS)							
SILVERSIDE ATLANTIC (MENIDIA MENIDIA)	128	1342	114	34	342	42	518
SNAPPER GRAY (LUTJANUS GRISEUS)							
SPOT (LEIOSTOMUS XANTHURUS)							
SQUID LONGFIN (LOLIGO PEALEI)							
STICKLEBACK FOURSPINE (APELTES QUADRACUS)		45		13	1	9	31
TAUTOG (TAUTOGA ONITIS)					1	1	11
TOADFISH OYSTER (OPSANUS TAU)		7	6	1			
TOMCOD ATLANTIC (MICROGADUS TOMCOD)					3	1	50

ASSESSMENT OF RECREATIONALLY IMPORTANT FINFISH STOCKS IN RHODE ISLAND WATERS

NARRAGANSETT BAY JUVENILE FINFISH SURVEY

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2013

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 2013 - 31 December 2013

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 2013 with the standard 61 x 3.05 m beach seine. Adults and juveniles of approximately sixty-six species were collected during the 2013 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 – 2013), 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 2013

SIGNIFICANT DEVIATIONS: There were no significant deviations to methodology in 2013.

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, menhaden, 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 23' 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 2013.

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 2013 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 – 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.

Winter flounder

Juvenile winter flounder (*Pseudopleuronectes americanus*) were present in forty-three percent of the seine hauls for 2013. This is a decrease from 2012 when they were present in fifty-six percent of the hauls. A total of 298 fish were collected in 2013 (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 474 individuals collected during the 2012 survey. They were present at all but three stations (no presence at stations 8, 15, 16), and were collected in all months (Table 9).

The 2013 juvenile winter flounder standardized abundance index was 4.51 ± 1.19 S.E. fish/seine haul; this is lower than the 2012 index of 8.31 ± 2.00 S.E. 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 10.22 ± 3.90 S.E. Spectacle Island (Sta. 13) and Pojac Pt (Sta. 4) had the highest mean station abundance of 17.8 ± 11.86 and 9.00 ± 6.10 S.E. respectively. Gaspee Pt. typically has the highest abundance of juveniles in most survey years; the high mean abundance of juvenile winter flounder at Pojac Pt. (Sta. 4) is not typical for the entire time series, but has happened over the past few survey years.

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, though not in 2013. 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 2013 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 Wildlife's trawl survey data (sampling both adults and juveniles) saw a decrease in abundance from 2012 to 2013 during the spring seasonal survey, while the fall trawl survey was flat from 2012 to 2013. 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 2013. 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 2013. 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 2013 survey 294 juvenile tautog (*Tautoga onitis*) were collected. This is a decrease from the 2012 survey when 350 juveniles were collected. The 2013 standardized abundance was one of the lower values in the survey time series, and was flat relative to the previous year. The 2013 abundance index was 6.39 ± 1.90 S.E. fish/seine haul, a slight increase from the 2012 index of 6.36 ± 1.75 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 forty-six percent of the seine hauls in 2013 (Table 10). This is a decrease from 2012 when they were present in fifty-six percent of the seine hauls. In 2013 August had the highest mean monthly abundance of 6.83 ± 3.77 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. Spectacle Island (Sta. 13) had the highest mean station abundance of 28.40 ± 11.63 S.E. followed by Gaspee Pt (Sta. 1) with a mean station abundance of 6.60 ± 3.31 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 will be used as a young of the year index for the upcoming benchmarks in both the coastwide stock assessment by the Atlantic States Marine Fisheries Commission as well as the regional tautog stock assessment.

Our Narragansett Bay spring trawl survey had a slight decrease in the abundance of tautog in 2013, while the fall trawl survey saw a slight increase. 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 2013 survey 897 juvenile bluefish (*Pomatomus saltatrix*) were collected. This is significantly lower than the 2,339 juveniles collected in 2012. Juveniles were present in thirty-seven percent of the seine hauls and were collected at sixteen of the eighteen stations (Table 11). They were present in all months with the exception of 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 – 21° C.

The abundance index for 2013 was 4.63 ± 1.75 S.E. fish/seine haul. This is higher than the 2012 abundance index of 3.52 ± 1.69 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 26.56 ± 7.81 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 2013, Potters Cove (Sta. 8) had the highest mean station abundance of 27.40 ± 18.90 S.E. fish/seine haul (Table 11).

Length frequency data for 2013 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 2012 survey 16 striped bass (*Morone saxatalis*) were collected. This is higher than the 3 fish collected in 2012. Striped bass were present in eighteen percent of the seine hauls and were collected at nine of the eighteen stations (Table 14). They were present in June, July, and October.

The abundance index for 2013 was 0.10 ± 0.06 S.E. fish/seine haul. This is higher than in 2012, which had an abundance index of 0.02 ± 0.017 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).

June had the highest mean monthly abundance of 0.50 ± 0.15 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, Gaspee Pt (Sta. 1) had the highest mean station abundances of 1.2 ± 0.80 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 Division's 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 Division's restoration efforts.

River herring were present in twenty-three percent of the seine hauls and were collected at fifteen of the eighteen stations during 2013. River herring were present in all months in 2013. A total of 973 juveniles were collected in 2013, an increase from the number collected in 2012 (843 fish).

The highest mean monthly abundance for 2013 occurred during June and was 40.06 ± 30.98 S.E. fish/seine haul. The Kickemuit River (Sta. 11) had the highest mean station abundance of 107.60 ± 107.60 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 2013 was 3.19 ± 1.83 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 Atlantic menhaden (*Brevoortia tyrannus*) was collected during the 2013 survey, a large decrease from 2012. They were present in one percent of the seine hauls and were collected at one 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 20123 occurred during July and was 0.06 ± 0.06 S.E. fish/seine haul. Potters Cove (Sta. 8) had the highest mean station abundance of 0.06 ± 0.06 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, though in 2013, only one fish was caught during the entire season.

The standardized abundance index for 2013 was 0 fish/seine haul. This is lower than recent years (Figure 7). There was one fish caught during 2013, but the standardization procedure rejects any years with less than 3 positive observations. 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 2013, while the fall trawl survey also decreased. The trawl survey catches juveniles as well as some age one fish. The Mann-Kendall test showed no long-term abundance trend for this species for the long term survey, but the 10 year time period indicated a decreasing trend (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. It should be noted that our survey data is one of five fishery independent surveys along the Atlantic coast used in the coastwide stock assessment by the Atlantic States Marine Fisheries Commission.

Weakfish

No weakfish, *Cynocion regalis,* were collected during the 2013 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, however, none were found at these stations since 2009.

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 2012 was 0 fish/seine haul. This was lower than the 2012 index of 0.01 ± 0.01 S.E (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

Six juvenile black sea bass (*Centropristis striata*) were collected in 2013 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 two percent of the seine hauls in 2013.

The highest mean monthly abundance for 2013 occurred during September and was 0.28 ± 0.28 S.E. fish/seine haul. Wickford (Sta. 18) had the highest mean station abundance of 1.00 ± 1.00 S.E. (Table 13). Single large catches is the reason for the high standard error associated with the indices.

The abundance index for 2013 was 0.07 ± 0.07 S.E. fish/seine haul. This was lower than the 2012 index of 3.42 ± 1.33 S.E (Figure 10). Our Narragansett Bay spring and fall trawl survey had large increases in the abundance of black sea bass in 2013. This recruitment signal 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

2012 survey. These juveniles included scup (*Stenotomus chrysops*), Northern kingfish (*Menticirrhus saxatilis*), and windowpane flounder (*Scophthalmus aquosus*).

Thirty-four juvenile scup were collected in 2013 during August and September. Two hundred and seventy-eight Northern kingfish were collected in 2013 with the majority collected in July and August. One windowpane flounder was collected in August of 2013. Ten summer flounder were collected in 2013 in June, July, August, and September. Fifty-one smallmouth flounder were caught in 2013. 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.

<u>Physical & Chemical Data</u>

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.

Water temperatures during the 2013 survey ranged from an average low of 15.9°C in October to an average high of 25.5°C in July.

Salinities ranged from an average of 19.9 in June to 27.9 *ppt* in October.

There were no periods during 2013 where readings of <1 mg/l of dissolved oxygen (DO) were taken during the survey. Hypoxia is defined as a DO <3 mg/l: anoxia is a DO <0.1 mg/l. There was one reading during 2013 that met the hypoxia definition; Wickford (Sta. 18) in July. DO ranged from 2.9 mg/l in July to 14.5 mg/l also in July.

<u>SUMMARY</u>: In summary, data from the 2013 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, menhaden, 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. 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-six species, both vertebrates and invertebrates, were collected in 2013. This is higher than, but fairly close to the survey mean for the past twenty-five years of 60.2 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 years.

During 2013 five 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 survey's 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

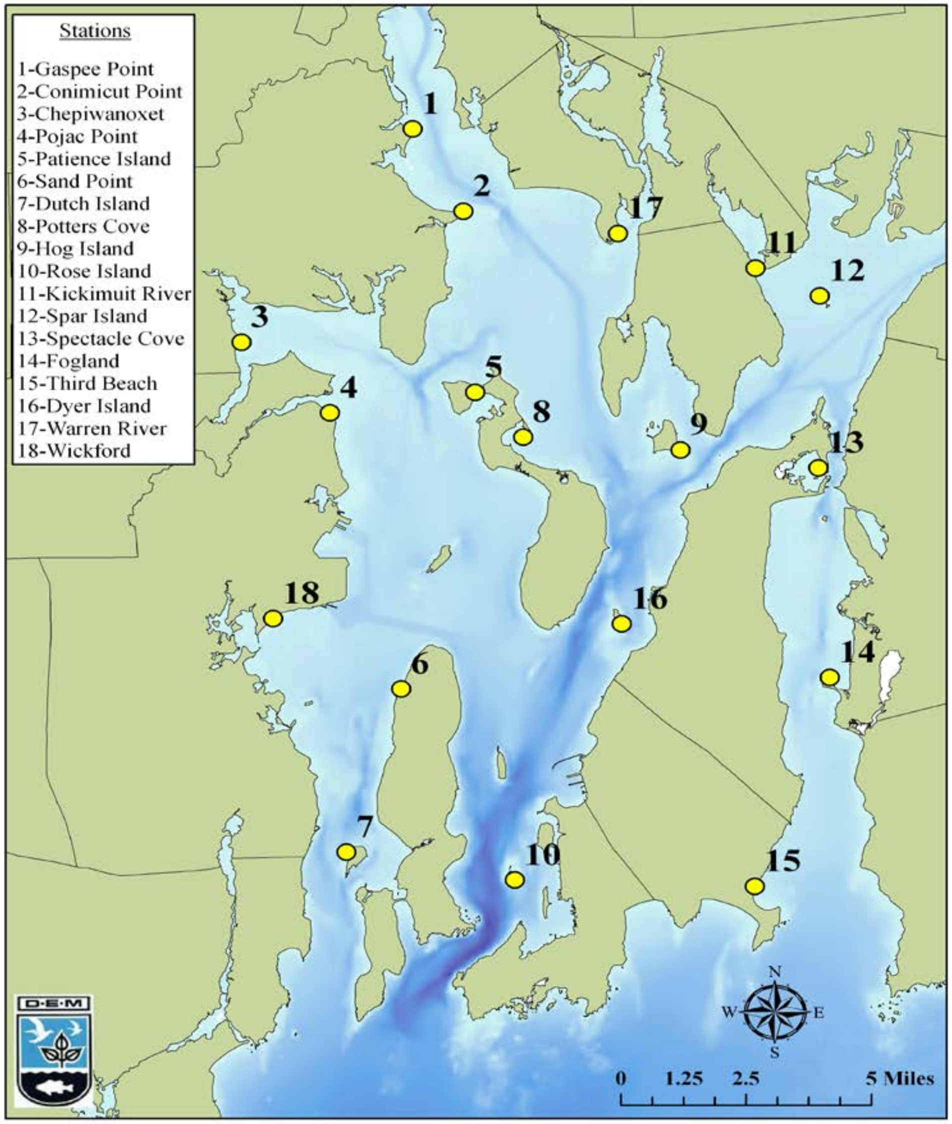


Figure 1. Survey station location map.

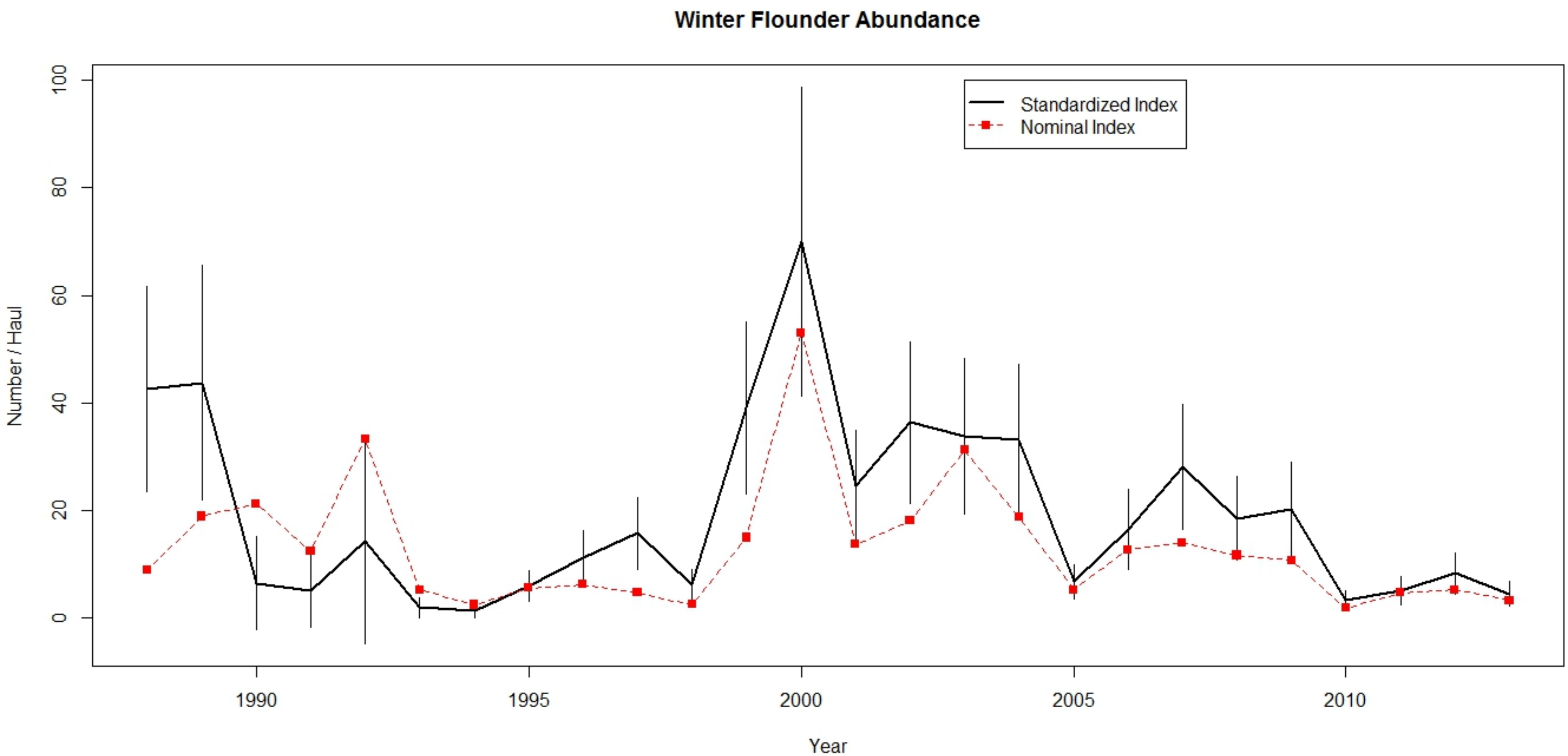


Figure 2. Juvenile winter flounder standardized abundance index 1988 – 2013 (see appendix A for standardization methodology).

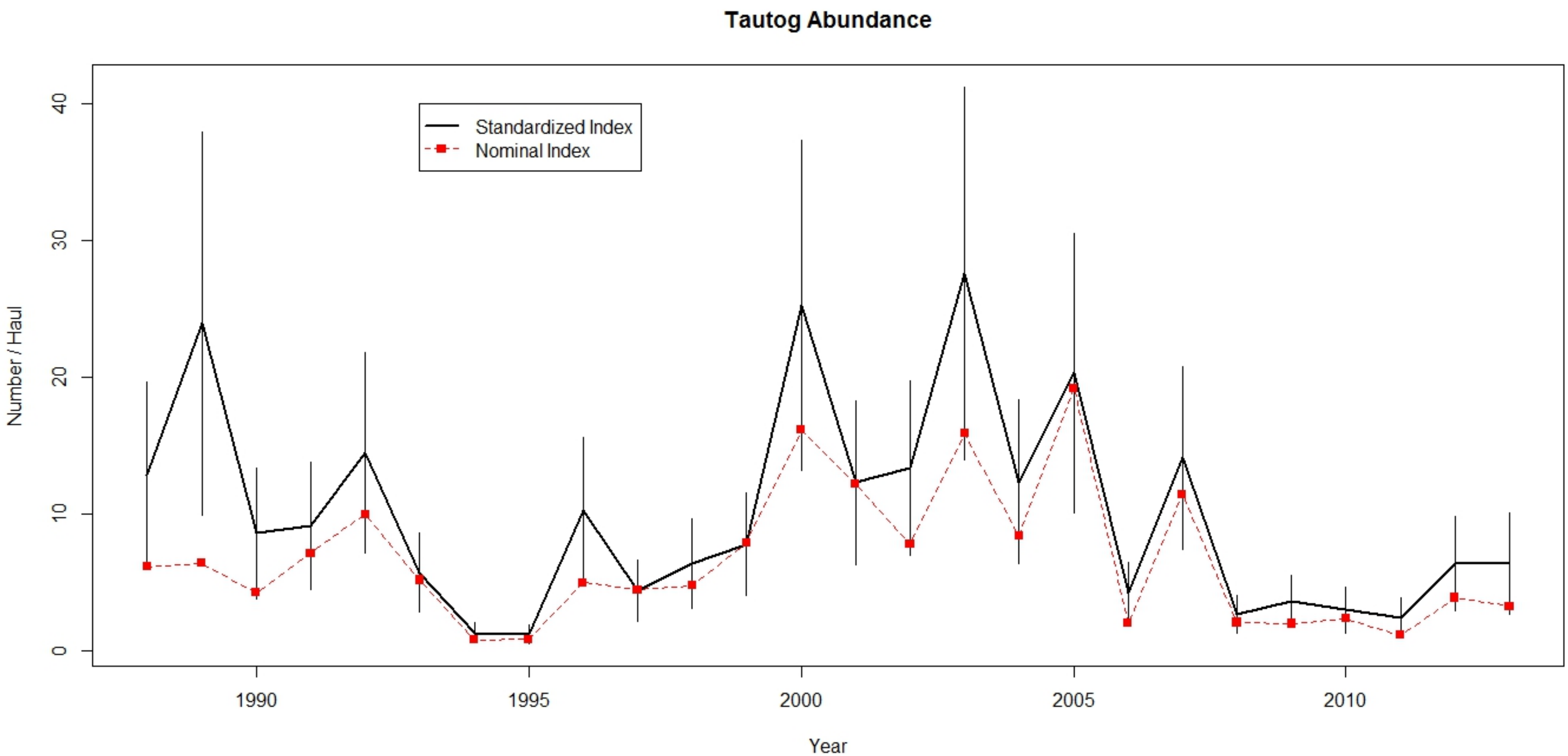


Figure 3. Juvenile tautog standardized annual abundance index 1988 – 2013 (see appendix A for standardization methodology).

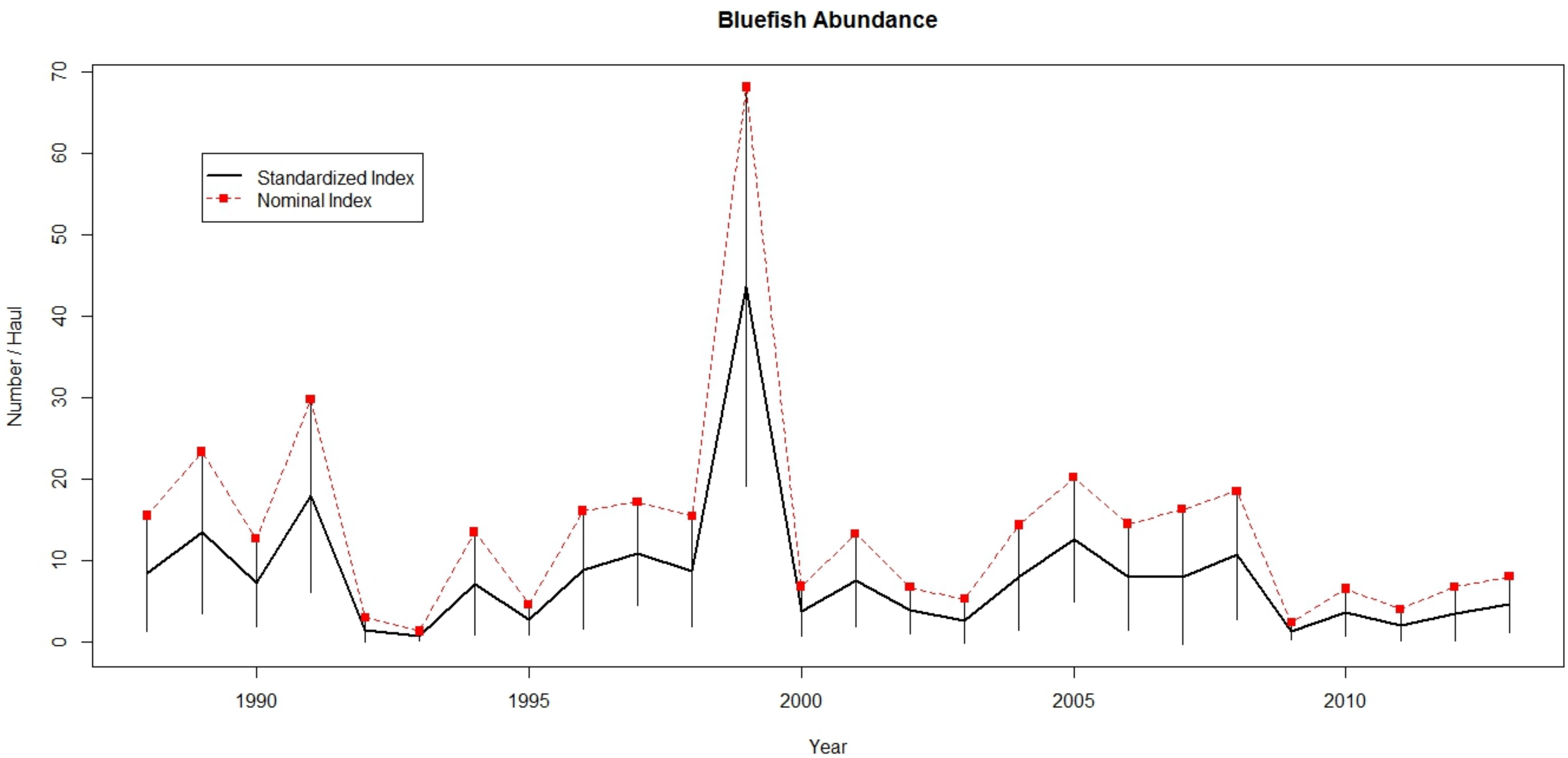


Figure 4. Juvenile bluefish standardized annual abundance index 1988 – 2013 (see appendix A for standardization methodology).

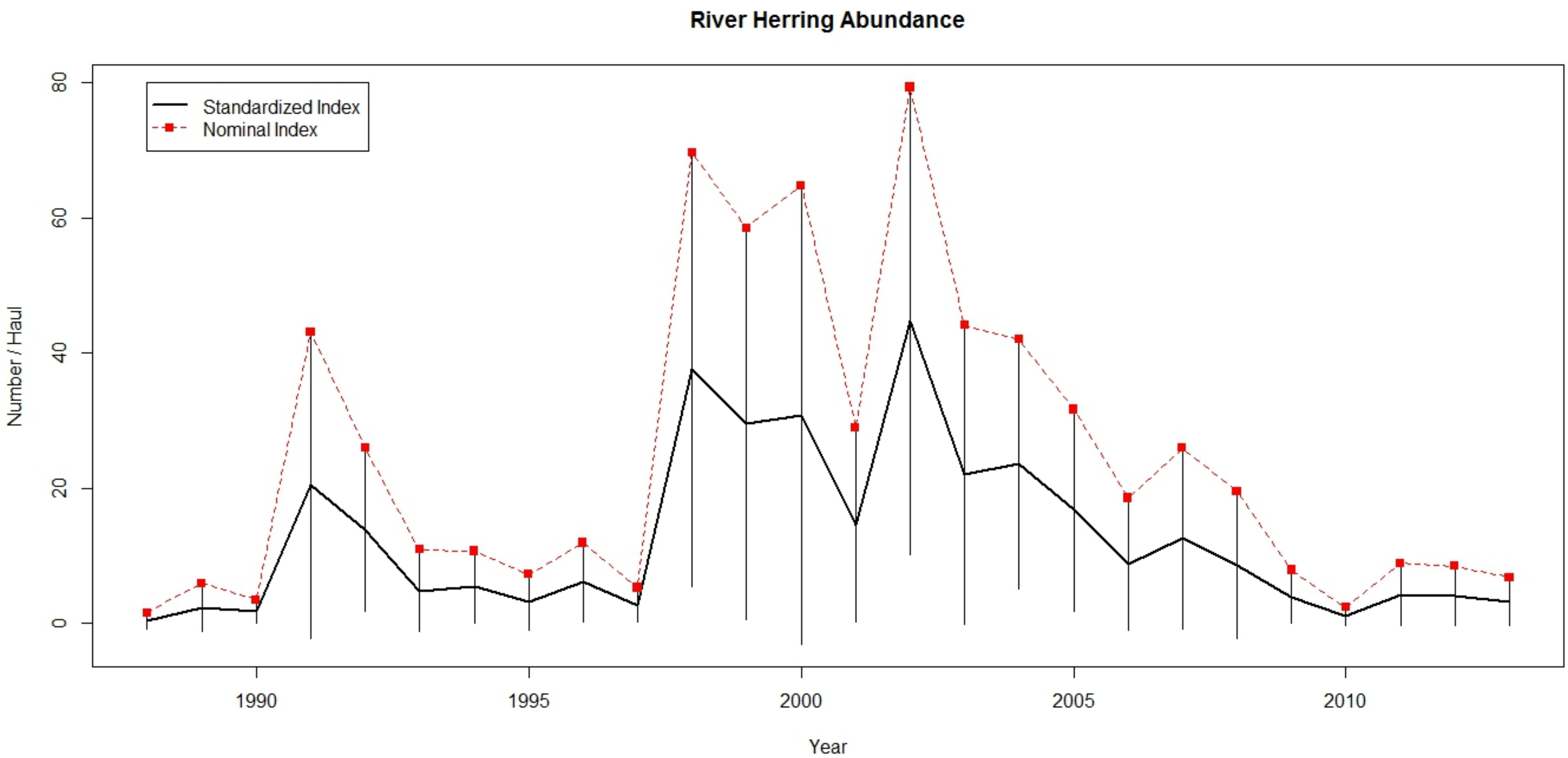
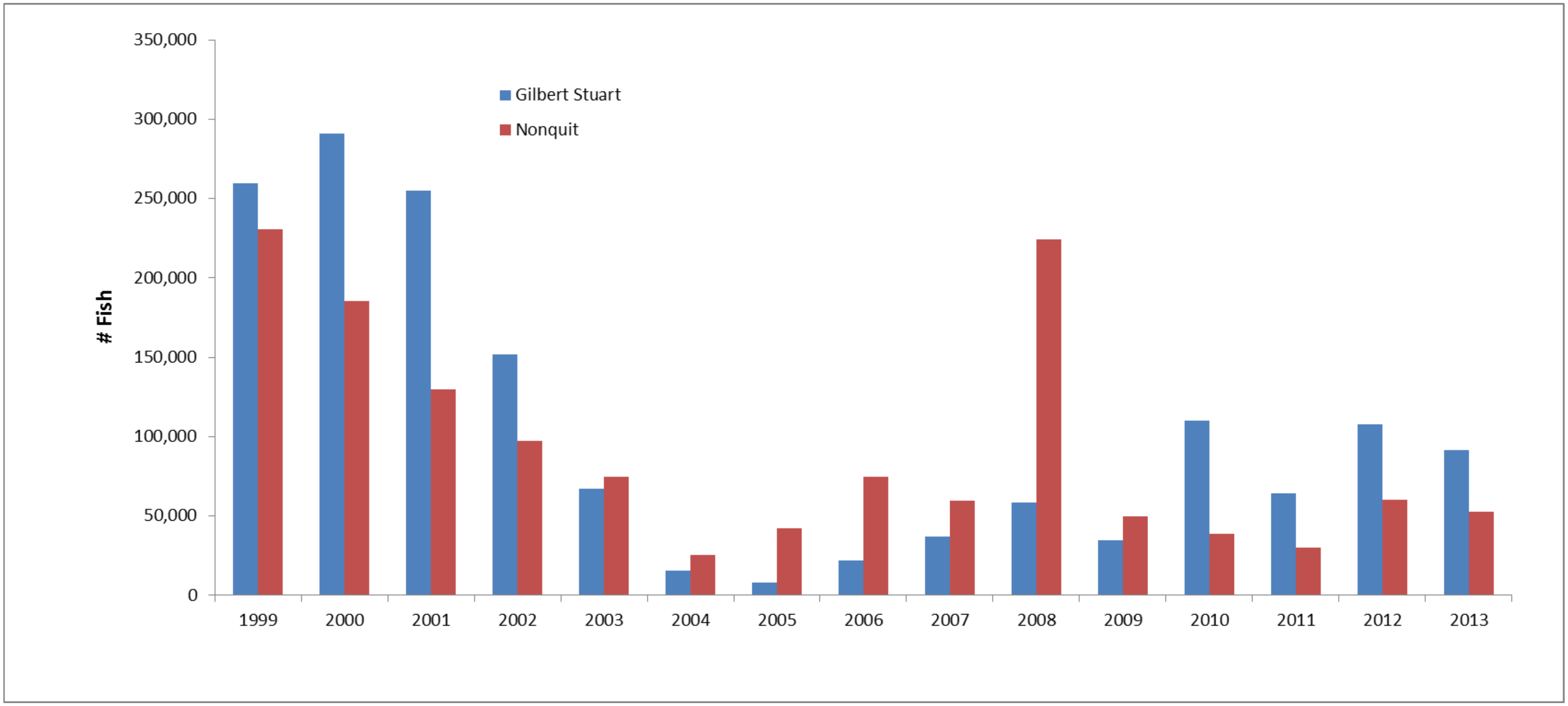


Figure 5. Juvenile river herring standardized annual abundance index 1988 – 2013 (see appendix A for standardization methodology).



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

Figure 6. River herring spawning stock size from monitoring at two locations 1999 – 2013.

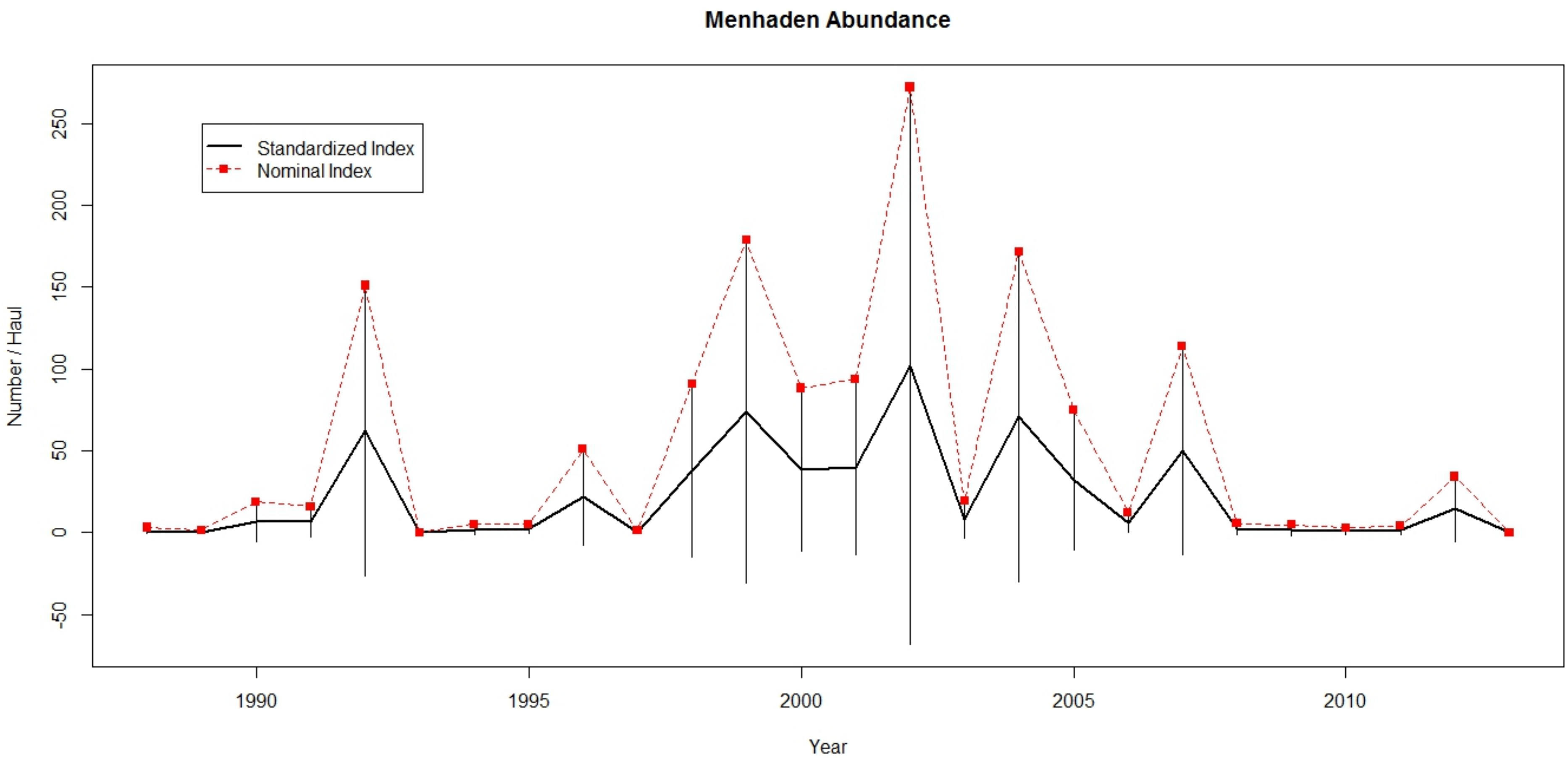


Figure 7. Juvenile menhaden standardized annual abundance index 1988 – 2013 (see appendix A for standardization methodology).

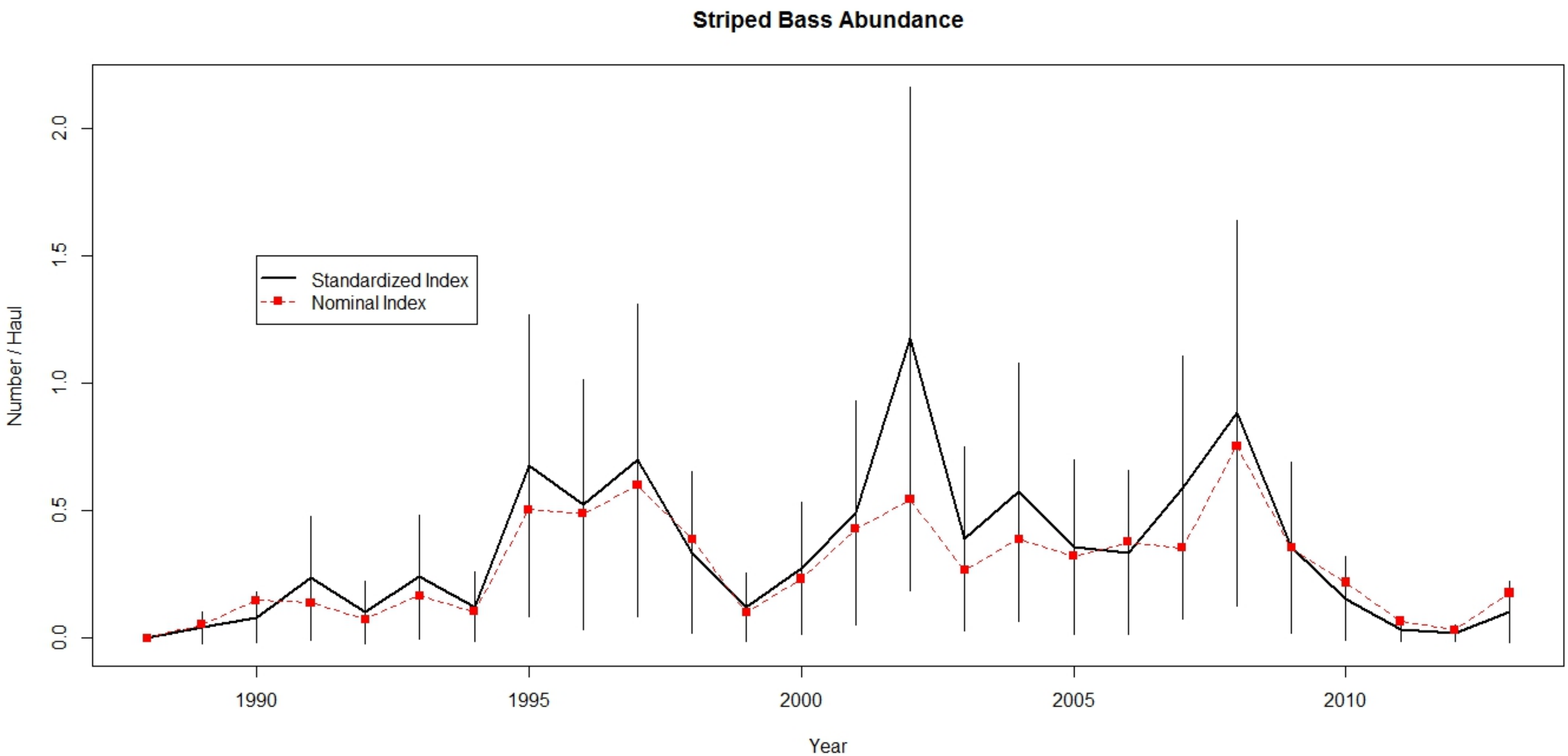


Figure 8. Striped bass standardized annual abundance index 1988 – 2013 (see appendix A for standardization methodology).

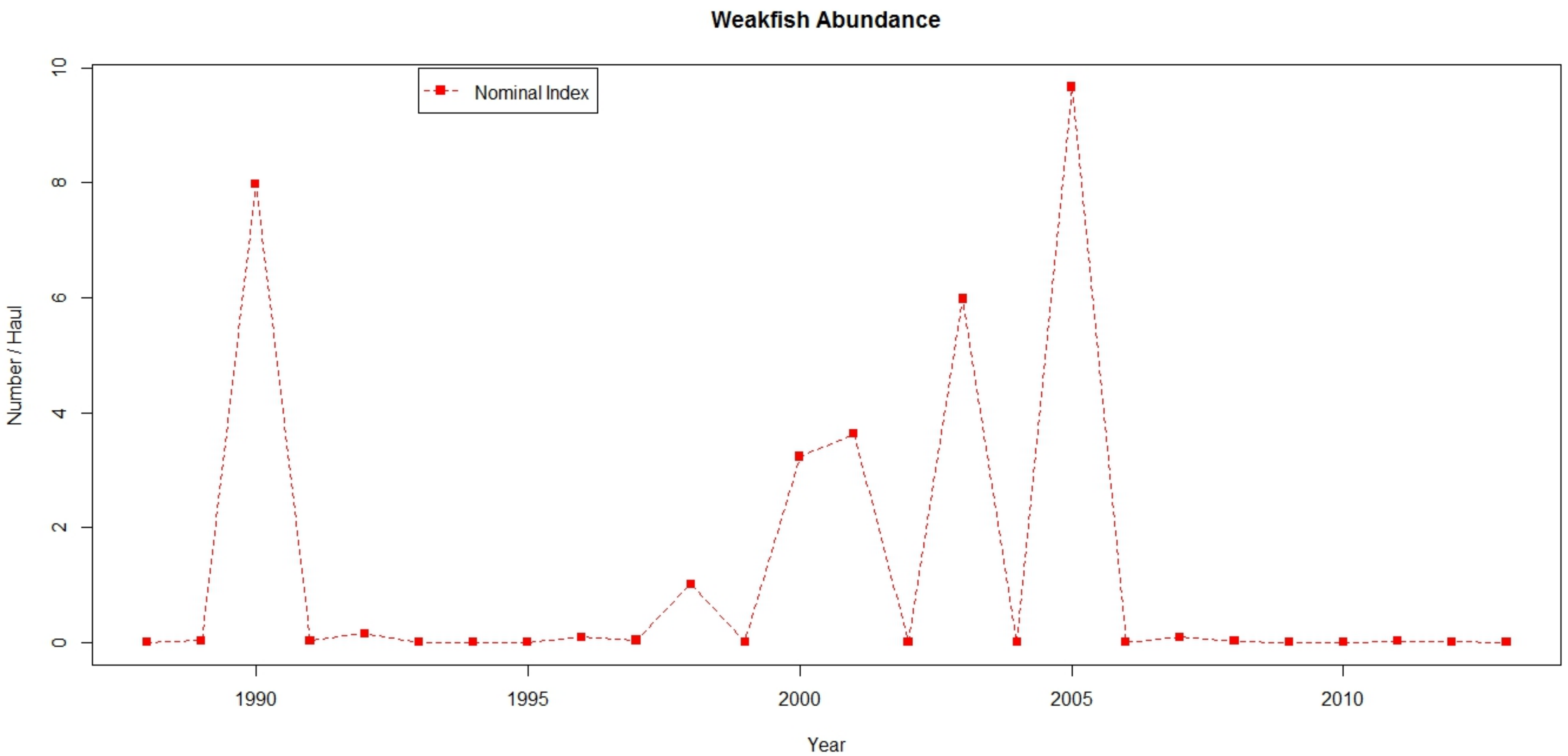


Figure 9. Weakfish annual abundance index 1988 – 2013.

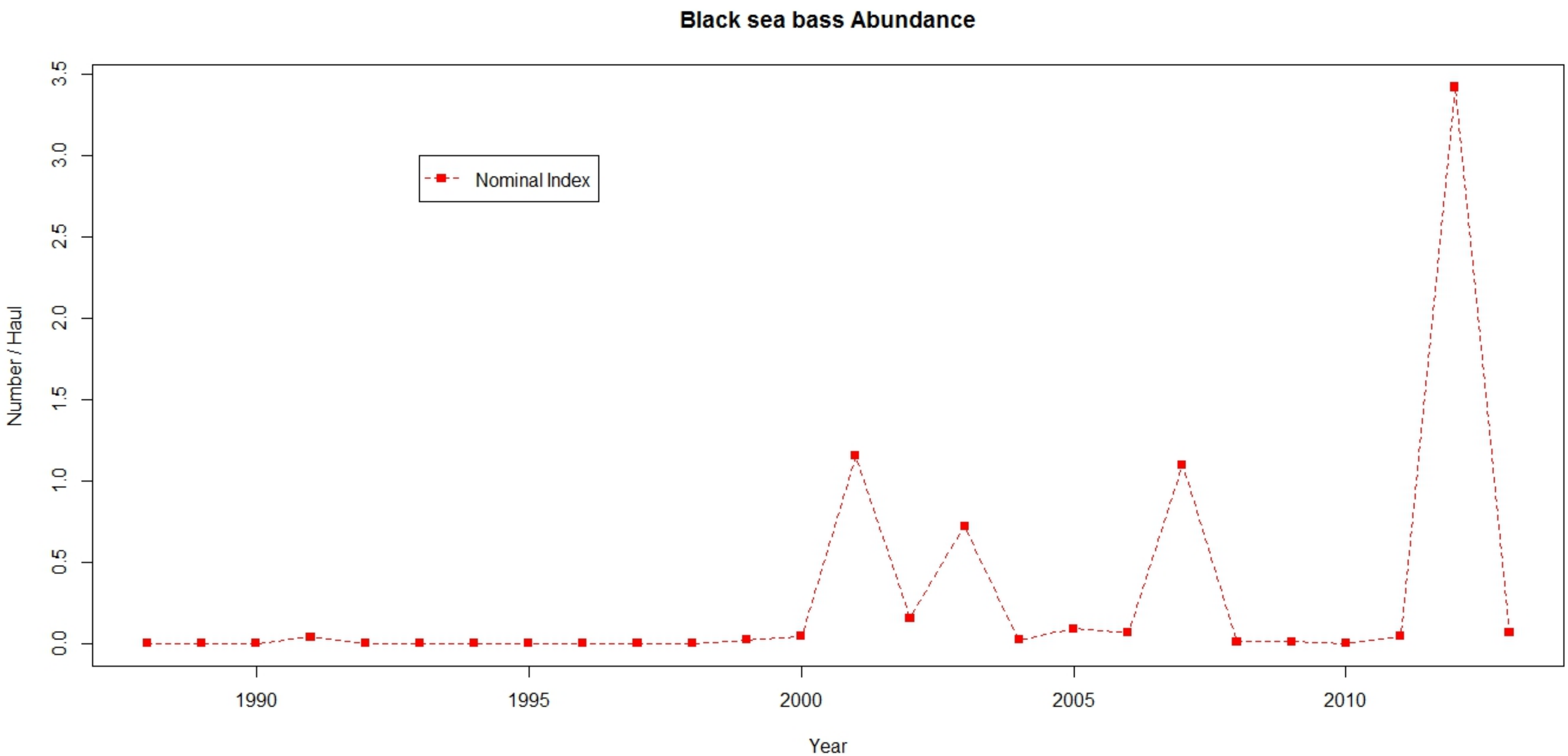


Figure 10. Black sea bass annual abundance index 1988 – 2013.

TABLES

Table 1a. Mann-Kendall test for target species abundance trend analysis (Full dataset; 1988 - 2013).

Mann-Kendall test	Winter Flounder	Tautog	Bluefish	River Herring	Menhaden	Striped Bass
S	-25	-51	-51	5	2	45
n Observations	26	26	26	26	26	26
Variance	2058.3	2058.3	2058.3	2058.3	2057.3	2058.3
Tau	-0.0769	-0.157	-0.157	0.015	0.006	0.138
2-sided p value	0.597	0.270	0.270	0.930	0.982	0.332
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 (2004-2013).

Mann-Kendall test	Winter Flounder	Tautog	Bluefish	River Herring	Menhaden	Striped Bass
S	-19	-13	-15	-33	-29	-25
n Observations	10	10	10	10	10	10
Variance	125	125	125	125	125	125
Tau	-0.422	-0.289	-0.333	-0.733	-0.644	-0.556
2-sided p value	0.107	0.283	0.210	0.004	0.012	0.032
α	0.05	0.05	0.05	0.05	0.05	0.05
Significant Trend	No	No	No	Yes↓	Yes↓	Yes↓

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 2013.

	Station																	
Scientific Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Alosa aestivalis &/or pseudoharengus					1						1			1				
Ammodytes americanus																		1
Amphipoda order									1									
Anguilla rostrata													1					
Aurelia aurita																		1
Calinectes sapidus	1		1	1	1			1					1				1	
Carcinus maenus								1			1		1					
Centropristus striata		1																
Crangon septemspinosa	1	1	1	1	1			1					1		1			1
Crepidula fornicata						1			1									
Ctenophora phylum	1		1				1	1	1			1	1	1	1	1	1	1
Cyprinodon variegatus			1															
Etropus microstomus															1			
Fundulus heteroclitus			1		1	1					1		1					
Fundulus majalis								1			1		1					1
Gobiosoma bosc											1		1					
Isopoda order							1		1						1			
Libinia emarginata				1	1				1		1	1	1	1			1	
Limulus polyphemus								1									1	
Littorina littorea					1	1								1				
Menidia menidia		1		1	1	1		1			1					1	1	
Microgadus tomcod										1			1					
Morone saxatilis	1	1	1				1	1	1	1							1	
Myoxocephalus aenaeus					1					1	1		1	1			1	
Nassarius obsoletus	1		1	1	1			1					1					
Pagurus spp			1	1	1	1		1	1					1	1	1		1
Palaemonetes vulgaris	1				1	1	1		1		1		1	1			1	1
Panopeus spp	1							1	1		1		1				1	
Paralichthys dentatus		1					1						1				1	
Pomatomus saltatrix								1			1							
Prionotus evolans		1	1			1											1	
Pseudopleuronectes americanus	1	1	1	1	1	1			1		1	1	1	1			1	1
Syngnathus fuscus					1						1	1	1					1
Tautoga onitis					1	1	1			1	1		1	1			1	
Tautogolabrus adspersus										1								
Nassarius trivittatus						1												
Gobiosoma genus												1						
Haminoea solitaria													1					
Pollachius virens										1					1			
Urophycis regia							1			1					1			

Table 4. Species presence by station for July 2013.

	Station																	
Scientific Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Alosa aestivalis &/or pseudoharengus	1	1		1			1	1	1	1			1			1	1	1
Anchoa mitchilli													1				1	
Apeltes quadracus		1																
Brevoortia tyrannus								1										
Calinectes sapidus	1	1	1	1				1				1			1		1	1
Carcinus maenus		1		1					1	1	1		1	1		1		
Crangon septemspinosa	1			1					1									1
Crepidula fornicata												1						
Ctenophora phylum					1		1	1		1		1		1		1	1	
Cyprinodon variegatus													1	1				
Emerita talpoida															1			
Etropus microstomus															1			
Fundulus heteroclitus	1	1		1					1		1		1	1			1	
Fundulus majalis	1	1	1					1	1				1	1			1	1
Gobiosoma bosc				1					1									
Isopoda order		1								1			1	1	1	1		
Libinia emarginata			1	1	1			1			1					1	1	1
Limulus polyphemus										1								
Littorina littorea													1	1				
Menidia menidia	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1
Menticirrhus saxatilis	1	1		1						1					1		1	1
Morone saxatilis	1								1									
Mytilus edulis					1													
Nassarius obsoletus											1		1					
Ovalipes ocellatus			1	1	1				1						1			1
Pagurus spp	1	1	1	1	1		1	1	1		1					1	1	1
Palaemonetes vulgaris	1		1	1	1	1					1	1	1	1			1	1
Panopeus spp	1			1					1		1	1	1				1	1
Paralichthys dentatus										1							1	1
Pomatomus saltatrix	1	1	1	1	1	1	1	1	1	1	1	1			1		1	1
Prionotus evolans										1								1
Pseudopleuronectes americanus	1	1		1	1				1	1	1		1				1	1
Sphoeroides maculatus																		1
Strongylura marina															1			
Syngnathus fuscus			1							1			1			1	1	1
Tautoga onitis	1	1			1		1			1			1			1	1	
Nassarius trivittatus														1				
Trachinotus falcatus															1			

Table 5. Species presence by station for August 2013.

	Station																	
Scientific Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Alosa aestivalis &/or pseudoharengus							1			1			1					
Ammodytes americanus	1																	
Calinectes sapidus	1		1	1										1				
Carcinus maenus		1						1	1	1	1		1	1				
Crangon septemspinosa	1		1	1		1												1
Ctenophora phylum		1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1
Etropus microstomus							1								1			1
Fundulus heteroclitus				1				1	1		1		1	1				
Fundulus majalis	1	1	1	1	1	1		1	1		1		1	1	1	1		1
Gobiosoma bosc				1														
Isopoda order										1								
Libinia emarginata					1		1		1	1								1
Littorina littorea	1	1												1				
Lutjanus aratus				1														
Menidia menidia	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Menticirrhus saxatilis	1	1	1	1	1			1			1	1			1			1
Mercenaria mercenaria			1						1									
Myoxocephalus aenaeus					1				1	1			1					
Mytilus edulis					1				1									
Nassarius obsoletus	1		1	1				1	1		1	1	1					
Opsanus tau												1						
Ovalipes ocellatus				1			1										1	1
Pagurus spp	1		1		1		1	1	1		1		1	1		1	1	1
Palaemonetes vulgaris	1			1		1			1	1	1	1	1			1		
Panopeus spp		1			1			1	1	1	1		1			1		1
Paralichthys dentatus													1					
Pomatomus saltatrix	1	1	1	1	1	1	1				1	1				1	1	
Prionotus evolans							1											1
Pseudopleuronectes americanus	1			1	1		1		1				1					1
Scophthalmus aquosus															1			
Sphoeroides maculatus									1							1		1
Stenotomus chrysops													1				1	
Strongylura marina		1															1	
Syngnathus fuscus				1			1						1					
Tautoga onitis	1	1				1			1	1			1				1	
Tautogolabrus adspersus										1								
Leiostomus xanthurus						1												
Nassarius trivittatus												1						

Table 6. Species presence by station for September 2013.

	Station																	
Scientific Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Alosa aestivalis &/or pseudoharengus		1					1											
Anguilla rostrata					1													
Calinectes sapidus	1		1		1													
Carcinus maenus	1	1		1	1	1		1	1		1		1	1				
Centropristus striata																		1
Crangon septemspinosa		1												1		1		
Ctenophora phylum				1		1	1	1			1	1		1		1	1	1
Cyprinodon variegatus		1														1		
Etropus microstomus															1			1
Fundulus heteroclitus	1	1	1			1			1		1		1	1				
Fundulus majalis	1	1	1	1	1				1		1		1	1	1		1	1
Gobiosoma bosc			1															
Hemigrapsus sanguineus												1						
Libinia emarginata	1		1															
Littorina littorea						1	1							1				
Menidia menidia	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Menticirrhus saxatilis	1		1	1	1		1		1						1			1
Mugil curema							1						1					
Myoxocephalus aenaeus									1									
Mytilus edulis																		
Nassarius obsoletus			1	1					1			1	1			1		
Opsanus tau					1													
Ovalipes ocellatus																		1
Pagurus spp	1	1	1	1	1	1		1	1	1	1		1	1		1	1	1
Palaemonetes vulgaris	1	1	1		1						1	1	1					1
Panopeus spp		1			1				1		1		1					
Paralichthys dentatus					1								1					
Pomatomus saltatrix	1	1	1	1									1					1
Prionotus evolans	1																	1
Pseudopleuronectes americanus	1	1			1				1				1					1
Sphoeroides maculatus																1		
Stenotomus chrysops													1		1		1	
Syngnathus fuscus		1							1									
Synodus foetens	1		1	1														1
Tautoga onitis	1	1			1	1	1		1	1		1	1			1		
Tautogolabrus adspersus										1								
Chrysaora quinquecirrha										1								
Fistularia tabacaria										1					1			
Gasterosteus aculeatus		1																

Table 7. Species presence by station for October 2013.

	Station																	
Scientific Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Alosa aestivalis &/or pseudoharengus			1														1	
Asteroidea												1						
Cancer irroratus																1		
Carcinus maenus	1			1	1	1		1	1	1	1	1	1			1		1
Crangon septemspinosa	1		1	1	1					1								
Crepidula fornicata	1					1			1				1	1				
Ctenophora phylum						1	1	1		1		1	1	1		1	1	1
Cyprinodon variegatus		1															1	
Etropus microstomus				1											1			1
Fundulus heteroclitus						1												
Fundulus majalis	1	1		1	1	1		1			1		1	1	1	1	1	1
Hemigrapsus sanguineus						1												
Libinia emarginata					1		1											
Littorina littorea						1					1		1	1				
Menidia menidia		1	1	1	1	1	1	1	1		1		1	1	1		1	1
Menticirrhus saxatilis			1	1														
Morone saxatilis														1				
Myoxocephalus aenaeus					1				1	1								
Mytilus edulis					1													
Nassarius obsoletus			1					1	1		1		1				1	1
Ovalipes ocellatus																	1	1
Pagurus spp			1			1	1	1	1		1	1	1	1	1	1	1	1
Palaemonetes vulgaris	1			1	1	1		1	1	1	1		1	1	1	1	1	1
Panopeus spp			1					1										
Pseudopleuronectes americanus	1	1																1
Syngnathus fuscus									1									
Tautoga onitis		1		1	1	1			1			1	1			1		
Tautogolabrus adspersus												1						
Tunicata										1								
Busycon carica												1						

Table 8. Summary of species occurrence by station in 2013.

	Station																	
Scientific Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Alosa aestivalis &/or pseudoharengus	1	2	1	1	1		3	1	1	2	1		2	1		1	2	1
Ammodytes americanus	1																	1
Amphipoda order									1									
Anchoa mitchilli													1				1	
Anguilla rostrata					1								1					
Apeltes quadracus		1																
Asteroidea												1						
Aurelia aurita																		1
Brevoortia tyrannus								1										
Calinectes sapidus	4	1	4	3	2			2				1	1	1	1		2	1
Cancer irroratus																1		
Carcinus maenus	2	3		3	2	2		4	4	3	5	1	5	3		2		1
Centropristus striata		1																1
Crangon septemspinosa	4	2	3	4	2	1		1	1	1			1	1	1	1		3
Crepidula fornicata	1					2			2			1	1	1				
Ctenophora phylum	1	1	2	2	2	3	5	5	2	3	2	5	2	5	2	5	5	4
Cyprinodon variegatus		2	1										1	1		1	1	
Emerita talpoida															1			
Etropus microstomus				1			1								5			3
Fundulus heteroclitus	2	2	2	2	1	3		1	3		4		4	3			1	
Fundulus majalis	4	4	3	3	3	2		4	3		4		5	4	3	2	3	5
Gobiosoma bosc			1	2					1		1		1					
Hemigrapsus sanguineus						1						1						
Isopoda order		1					1		1	2			1	1	2	1		
Libinia emarginata	1		2	2	4		2	1	2	1	2	1	1	1		1	2	2
Limulus polyphemus								1		1							1	
Littorina littorea	1	1			1	3	1				1		2	5				
Lutjanus aratus				1														
Menidia menidia	3	5	4	5	5	5	3	5	4	3	5	3	4	4	4	4	5	4
Menticirrhus saxatilis	3	2	3	4	2		1	1	1	1	1	1			3		1	3
Mercenaria mercenaria			1						1									
Microgadus tomcod										1			1					
Morone saxatilis	2	1	1				1	1	2	1				1			1	
Mugil curema							1						1					
Myoxocephalus aenaeus					3				3	3	1		2	1			1	
Mytilus edulis					3				1									
Nassarius obsoletus	2		4	3	1			3	3		3	2	5			1	1	1
Opsanus tau					1							1						
Ovalipes ocellatus			1	2	1		1		1						1		2	4
Pagurus spp	3	2	5	3	4	3	3	5	5	1	4	1	3	4	2	5	4	5
Palaemonetes vulgaris	5	1	2	3	4	4	1	1	3	2	5	3	5	3	1	2	3	4
Panopeus spp	2	2	1	1	2			3	4	1	4	1	4			1	2	2
Paralichthys dentatus		1			1		1			1			3				2	1
Pomatomus saltatrix	3	3	3	3	2	2	2	2	1	1	3	2	1		1	1	2	2
Prionotus evolans	1	1	1			1	1			1							1	3
Pseudopleuronectes americanus	5	4	1	3	4	1	1		4	1	2	1	4	1			2	5
Scophthalmus aquosus															1			
Sphoeroides maculatus									1							2		2
Stenotomus chrysops													2		1		2	
Strongylura marina		1													1		1	
Syngnathus fuscus		1	1	1	1		1		2	1	1	1	3			1	1	2
Synodus foetens	1		1	1														1
Tautoga onitis	3	4		1	4	4	3		3	4	1	2	5	1		3	3	
Tautogolabrus adspersus										3		1						
Tunicata										1								
Leiostomus xanthurus						1												
Nassarius trivittatus						1						1		1				
Trachinotus falcatus															1			
Gobiosoma genus												1						
Haminoea solitaria													1					
Pollachius virens										1					1			
Urophycis regia							1			1					1			
Busycon carica												1						
Chrysaora quinquecirrha										1								
Fistularia tabacaria										1					1			
Gasterosteus aculeatus		1																

* 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 2013.

	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	24	6	31	32	2	2	0	0	2	0	3	1	61	1	0	0	13	6	10.22	16.57	3.90
JUL	1	2	0	11	2	0	0	0	2	4	2	0	1	0	0	0	13	4	2.33	3.77	0.89
AUG	7	0	0	2	2	0	1	0	17	0	0	0	26	0	0	0	0	1	3.11	7.07	1.67
SEP	2	2	0	0	5	0	0	0	2	0	0	0	1	0	0	0	0	1	0.72	1.32	0.31
OCT	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.17	0.38	0.09
Mean	7.00	2.20	6.20	9.00	2.20	0.40	0.20	0.00	4.60	0.80	1.00	0.20	17.80	0.20	0.00	0.00	5.20	2.60			
St Dev	9.82	2.28	13.86	13.64	1.79	0.89	0.45	0.00	6.99	1.79	1.41	0.45	26.53	0.45	0.00	0.00	7.12	2.30			
SE	4.39	1.02	6.20	6.10	0.80	0.40	0.20	0.00	3.12	0.80	0.63	0.20	11.86	0.20	0.00	0.00	3.18	1.03		Total Fish	
Number	35	11	31	45	11	2	1	0	23	4	5	1	89	1	0	0	26	13		298	

Table 10. Numbers of juvenile tautog per seine haul in 2013.

	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	10	1	2	0	0	1	1	0	2	4	0	0	4	0	1.39	2.52	0.59
JUL	14	1	0	0	5	0	2	0	0	2	0	0	45	0	0	3	2	0	4.11	10.75	2.53
AUG	15	2	0	0	0	2	0	0	14	23	0	0	65	0	0	0	2	0	6.83	15.99	3.77
SEP	4	1	0	0	6	1	1	0	10	3	0	4	19	0	0	1	0	0	2.78	4.87	1.15
OCT	0	1	0	1	5	1	0	0	1	0	0	1	11	0	0	1	0	0	1.22	2.71	0.64
Mean	6.60	1.00	0.00	0.20	5.20	1.00	1.00	0.00	5.00	5.80	0.20	1.00	28.40	0.80	0.00	1.00	1.60	0.00			
St Dev	7.40	0.71	0.00	0.45	3.56	0.71	1.00	0.00	6.56	9.68	0.45	1.73	26.00	1.79	0.00	1.22	1.67	0.00			
SE	3.31	0.32	0.00	0.20	1.59	0.32	0.45	0.00	2.93	4.33	0.20	0.77	11.63	0.80	0.00	0.55	0.75	0.00		Total Fish	
Number	33	5	0	1	26	5	5	0	25	29	1	5	142	4	0	5	8	0		294	

Table 11. Numbers of juvenile bluefish per seine haul in 2013.

	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	41	0	0	19	0	0	0	0	0	0	0	3.33	10.41	2.45
JUL	31	32	85	40	96	2	11	96	22	2	3	32	0	0	1	0	21	4	26.56	33.12	7.81
AUG	18	65	10	3	1	2	14	0	0	0	1	5	0	0	0	13	30	0	9.00	16.26	3.83
SEP	4	159	19	1	0	0	0	0	0	0	0	0	1	0	0	0	0	13	10.94	37.32	8.80
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	10.60	51.20	22.80	8.80	19.40	0.80	5.00	27.40	4.40	0.40	4.60	7.40	0.20	0.00	0.20	2.60	10.20	3.40			
St Dev	13.59	66.00	35.66	17.48	42.82	1.10	6.93	42.26	9.84	0.89	8.14	13.92	0.45	0.00	0.45	5.81	14.32	5.64			
SE	6.08	29.52	15.95	7.82	19.15	0.49	3.10	18.90	4.40	0.40	3.64	6.23	0.20	0.00	0.20	2.60	6.41	2.52		Total Fish	
Number	53	256	114	44	97	4	25	137	22	2	23	37	1	0	1	13	51	17		897	

Table 12. Numbers of juvenile menhaden per seine haul in 2013.

	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	1	0	0	0	0	0	0	0	0	0	0	0.06	0.24	0.06
AUG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00
SEP	0	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	0.00	0.00	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	0.00	0.00	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	0.00	0.00	0.00		Total Fish	
Number	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0		1	

Table 13. Numbers of juvenile river herring per seine haul in 2013.

Month	Station 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	1	0	0	0	0	0	538	0	0	182	0	0	0	0	40.06	131.44	30.98
JUL	2	7	0	6	0	0	2	2	60	4	0	0	9	0	0	75	32	4	11.28	21.92	5.17
AUG	0	0	0	0	0	0	1	0	0	31	0	0	1	0	0	0	0	0	1.83	7.29	1.72
SEP	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0.17	0.51	0.12
OCT	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0.72	2.61	0.61
Mean	0.40	1.80	2.20	1.20	0.20	0.00	0.80	0.40	12.00	7.00	107.60	0.00	2.00	36.40	0.00	15.00	6.80	0.80			
St Dev	0.89	3.03	4.92	2.68	0.45	0.00	0.84	0.89	26.83	13.53	240.60	0.00	3.94	81.39	0.00	33.54	14.11	1.79			
SE	0.40	1.36	2.20	1.20	0.20	0.00	0.37	0.40	12.00	6.05	107.60	0.00	1.76	36.40	0.00	15.00	6.31	0.80		Total Fish	
Number	2	9	11	6	1	0	4	2	60	35	538	0	10	182	0	75	34	4		973	

Table 14. Numbers of striped bass per seine haul in 2013.

Month	Station 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Mean	St Dev	SE
JUN	2	1	1	0	0	0	1	1	1	1	0	0	0	0	0	0	1	0	0.50	0.62	0.15
JUL	4	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0.33	1.03	0.24
AUG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00
SEP	0	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	1	0	0	0	0	0.06	0.24	0.06
Mean	1.20	0.20	0.20	0.00	0.00	0.00	0.20	0.20	0.60	0.20	0.00	0.00	0.00	0.20	0.00	0.00	0.20	0.00			
St Dev	1.79	0.45	0.45	0.00	0.00	0.00	0.45	0.45	0.89	0.45	0.00	0.00	0.00	0.45	0.00	0.00	0.45	0.00			
SE	0.80	0.20	0.20	0.00	0.00	0.00	0.20	0.20	0.40	0.20	0.00	0.00	0.00	0.20	0.00	0.00	0.20	0.00		Total Fish	
Number	6	1	1	0	0	0	1	1	3	1	0	0	0	1	0	0	1	0		16	

Table 15. Temperature, salinity, and dissolved oxygen by station and month – 2013 (NA indicates a day where batteries failed on YSI).

Station	Data	JUN	JUL	AUG	SEP	OCT
1	Average of Salinity	8.3	15.2	24	22.4	25
	Average of DO	5.88	12.2	8.3	5.4	7.74
	Average of Temp (C)	19.1	27	23.1	23.6	14.8
2	Average of Salinity	7.6	17.6	24.8	NA	25.3
	Average of DO	9.6	14.47	6.62	NA	8.06
	Average of Temp (C)	20.2	28.6	22.4	17	14.1
3	Average of Salinity	18.6	24.4	26.7	26.2	27.3
	Average of DO	9.4	7.11	5.85	6.26	6.82
	Average of Temp (C)	19.5	27.4	24	21.7	16.1
4	Average of Salinity	5.7	21.3	26.8	27.1	27.6
	Average of DO	8.4	7.33	9.85	5.47	6.18
	Average of Temp (C)	19.1	27.1	23.3	20.1	15.5
5	Average of Salinity	26.3	24.8	27.4	27.4	28.1
	Average of DO	9.3	7.68	5.54	6.1	7.36
	Average of Temp (C)	18.8	25	23.5	21.9	16.2
6	Average of Salinity	24.2	25.9	27.3	27.8	28.4
	Average of DO	9.1	7.12	7.38	5.35	6.33
	Average of Temp (C)	17.7	23.3	22.8	19.9	17.2
7	Average of Salinity	25.9	26	28.2	28.4	28.4
	Average of DO	9.3	6.85	8.09	6.75	7.02
	Average of Temp (C)	18.1	22.8	21.6	19.6	17.2
8	Average of Salinity	16.6	22.2	26.1	27.1	28.3
	Average of DO	9.6	8.46	6.25	5.75	6.86
	Average of Temp (C)	20.6	27	22.2	19.7	16.3
9	Average of Salinity	22.9	23.7	26.7	27.4	28.4
	Average of DO	0	5.15	4.88	6.56	7.23
	Average of Temp (C)	20.5	24.9	22.5	21	16.5
10	Average of Salinity	24.9	28	27.6	28.7	29.2
	Average of DO	8.9	6.6	6.85	6.21	6.96
	Average of Temp (C)	17.9	19.7	21.1	19.4	16.3
11	Average of Salinity	15.5	23.8	25.7	25.7	27.6
	Average of DO	6.22	5.7	4.41	4.36	5.95
	Average of Temp (C)	22.9	27.2	22.8	22.2	14.9
12	Average of Salinity	16	23.9	22.2	26.3	27.5
	Average of DO	6.53	6.7	9.46	6.65	8.8
	Average of Temp (C)	20.8	26.4	23.1	21	15
13	Average of Salinity	24	26.6	26.6	27.3	28.3
	Average of DO	8	9.24	10.19	5.84	6.38
	Average of Temp (C)	21.8	29.7	24.2	21.3	16
14	Average of Salinity	26.4	27.7	27.4	27.9	28.7
	Average of DO	8.4	5.37	7.67	6.64	6.79
	Average of Temp (C)	20	25.5	23	20.9	15.7
15	Average of Salinity	27.8	27.5	28.3	28.5	29.2
	Average of DO	7.2	6.2	8.07	6.3	6.08
	Average of Temp (C)	18.3	25.7	22.6	19.6	15.7
16	Average of Salinity	22.5	24.6	27.3	27.9	28.9
	Average of DO	8.7	5.85	5.61	7.39	7
	Average of Temp (C)	20.1	23.9	21.8	20.1	16.8
17	Average of Salinity	20.1	21.4	24.3	25.8	27.6
	Average of DO	5.4	7.8	6.32	4.49	6.65
	Average of Temp (C)	20.3	27	23.5	22.6	16.6
18	Average of Salinity	24.1	26.6	27.6	27.7	28.3
	Average of DO	9.1	2.9	5.98	6.96	6.82
	Average of Temp (C)	17.8	21.8	22.3	22	15.6

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	1988-2013
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	1988-2013
	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	1988-2013
	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	1988-2013
	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 Massachusetts Division of Marine Fisheries (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 “log”, 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

2013 Annual Performance Report for Job VI:
Environmental Assessment Review

by
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Federal Aid in Sportfish Restoration
F-61-R

2013 Performance Report for Job VI March 27, 2013

PERFORMANCE REPORT

STATE: Rhode Island

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

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

PERIOD COVERED: January 1, 2013 - December 31, 2013

JOB NUMBER AND TITLE: VI: Environmental Assessment Review

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

JOB OBJECTIVE: This project is designed to allow for the timely and comprehensive review of development, dredging, and dredge spoil disposal projects that occur in Rhode Island waters. Reviews should include all available data and provide important information to permitting agencies to allow for more informed permitting decisions. In cases where site-specific habitat or marine resource data is limited, dated, or absent new data may need to be collected, analyzed, and summarized. Data collection and analyses should follow a sampling plan designed to address specific permitting-related data limitations for current and when possible, future project reviews.

SUMMARY: Healthy marine ecosystems are dependent on the careful stewardship of the both the living marine resources and the habitats upon which they depend. Development, dredging, and dredge spoil disposal projects within Rhode Island (RI) state waters can adversely impact these resources and their habitat. To minimize potential impacts Division of Fish and Wildlife (DFW) staff reviewed 91 projects and applications as part of its Environmental Review program during the 2013 calendar year. Of the 91projects reviewed, 56 (~62%) were considered to pose potential impacts and warranted comment. This was about the same number of projects to pose potential impacts as in 2011 and was 17% less and 47% more than in 2012 and 2010, respectively. During 2013, 47% of the projects reviewed were sited within an estuary, 32% in coastal ponds, 17% in coastal rivers, and 4% in the ocean. Since projects often involve multiple activities, the total number of activities and potential impacts (n = 157) can be greater than the number of projects reviewed (n = 91). Given the number of projects proposed within estuaries it was not surprising that estuaries had the greatest number of activities and/or impacts (43%), followed by coastal ponds (34%), coastal rivers (16%), and the ocean (7%). Of all potential impacts and proposed activities, the greatest number regarded impacts to SAV or Hard Bottom Habitat (12.7%) and modifications to residential docks (12.7%), followed by proposals for new residential docks (11.5%), and waterfront bulkhead or riprap maintenance (7.6%).

TARGET DATE: December 2013

SIGNIFICANT DEVIATIONS: There were no significant deviations to methodology in 2013; however, a new objective added to this job in 2013 was not completed during the granting cycle ending December of 2013. Specifically the *2013* Objective that was not completed pertained to *reviewing current and previous marine resource (finfish) and habitat data collected by the Division of Fish and Wildlife (DFW) to determine if data used in current environmental reviews is dated, potentially inaccurate, or even obsolete and needs to be updated.* In short, this objective aimed to evaluate (1) whether Ichthyoplankton data collected between 1999 and 2008 is representative of the current system considering potential changes to marine fish assemblages due to climate change, (2) whether new ichthyoplankton data should be collected, and (3) whether there are spatial and temporal gaps in geo-referenced marine habitat and finfish datasets, which in turn limits DFW's ability to protect coastal and marine resources and their habitat.

In retrospect adding these objective to the 2013 work plan was probably too ambitious without adjusting staffing levels earlier in the year. It also became apparent that simply addressing these three questions alone was not going to provide the level of information needed to appropriately advance protection and enhancement of RI's marine resources and their habitat. Therefore time was allocated to researching and preparing a revision of this job that essentially moves from the 2013 standalone *Environmental Review* job to a "Habitat Program" that is proactive and designed to *assess, protect, and enhance important marine habitat to support recreationally important sport fish and a healthy marine ecosystem* (see the Recommendations Section for more details).

Although DFW has considered expanding the scope of job-6 for some time, additional staff has not been available to support the added work. Fortunately, in the fall of 2013 DFW gained a new staff member (Dr. Chris Deacutis) that can work in partnership with current staff (Eric Schneider) to expand the "habitat job" into a "habitat program". It is important to note that we will evaluate aspects of the aforementioned objective as part of the revised "habitat job".

RECOMMENDATIONS: By design this project has been largely reactive and focused on "Environmental Review", meaning that in reaction to a proposed activity or permit application (e.g. dredge project) the Division of Fish and Wildlife (DFW) identifies potential impacts from the proposed activity and provides information to permitting agencies, which should minimize, if not avoid impacts to important marine resources and their habitat. Although this approach has been successful, the DFW recognizes that there needs to be a more holistic and proactive approach that aims to both continue providing short-term protections via "Environmental Review", while also building a "Habitat Program" that provides a long-term plan for assessing, protecting, and restoring sensitive and important marine habitat to support a healthy RI marine ecosystem.

These recommendations have been incorporated into Job-6 of the now approved "RI F-61-R-21 Assessment of Recreationally Important Finfish Stocks in Rhode Island Coastal Waters". This job (VI) is now entitled "*Assessment, Protection, and Enhancement of Fish Habitat to Sustain Coastal and Marine Ecosystems and Healthy Stocks of Recreationally Important Finfish*", which supports two (2) jobs: 6(a) "*Assessing, Monitoring, and Minimizing Impacts to Marine Habitat*" and 6(b) "*Investigating techniques to enhance degraded marine habitats to improve recreational fisheries*". As noted in the revised job-6 narrative:

> "… these revisions outline a program that (1) identifies, assesses, and monitors sensitive and important marine habitat (Part A-1 of revised job);

(2) protects and minimizes impacts to marine habitat and the associated fisheries via responding to environmental disasters and reviewing applications for economic development activities (Part A-2 and A-3 of revised job); and (3) enhances degraded habitats to support a more diverse assemblage of marine life, increase ecosystem services and productivity, and ultimately determine if this approach improves fish productivity by increasing recruitment and survival of early life stages of recreationally important fish (Part B of revised job)."

REMARKS: Summation of data is similar to previous years, although two waterbody types (coastal wetland and harbor) were removed from tables and figures. Coastal wetlands were not included as a waterbody type because these systems are connected, both physically and biologically, to the adjacent larger (parent) waterbody types (e.g. coastal river, coastal pond, estuary) and therefore, using the parent waterbody type is considered more informative. The use of "harbor" as a waterbody type was discontinued because that term is simply too ambiguous.

Introduction

Healthy marine ecosystems are dependent on the careful stewardship of the both the living marine resources and the habitats upon which they depend. Many marine fish and shellfish species are important to the quality of life of many Rhode Islanders and to the economics of the State. Recreational and commercial fishing plays a vital role in the economy of Rhode Island. Development, dredging, and dredge spoil disposal projects within Rhode Island (RI) state waters can adversely impact these resources and their habitat. The importance of fish habitat to the sustainability of healthy fisheries has been formally recognized with the advent of the Essential Fish Habitat component (EFH) of the Sustainable Fisheries Act (1996) and made a priority component of environmental reviews.

In order for marine resources to be properly assessed, evaluated, and protected from the adverse impacts of human activity RI Department of Environmental Management (DEM), Division of Fish & Wildlife (DFW) staff provides timely and comprehensive review all marine related development, habitat restoration, and dredging and dredge spoil disposal projects that occur in Rhode Island waters. Proper review by DFW has become an integral part of state and federal permitting processes. Other state and federal agencies actively seek the advice of DFW regarding potential impacts to marine resources and incorporate our comments and recommendations into their permits. Reviews and recommendations are aimed at avoiding, and when necessary minimizing and mitigating adverse impacts to marine resources.

Methods

The DFW reviews all RI Coastal Resource Management Council (CRMC) marine-related applications and DEM Water Quality Certification (WCQ) and dredging applications. The DEM Office of Technical and Customer Assistance (OCTA) usually coordinates the Department's reviews and responses for all environmental reviews; however, some requests are forwarded directly to DFW by CRMC, National Marine Fisheries Service (NMFS), and US Army Corps of Engineers (ACOE). The aforementioned agencies work cooperatively to address and resolve potential marine related impacts and permitting issues prior to rendering final decisions and permits.

The review process involves determining marine resources and the habitat present at or near the project site, as well as evaluating the potential direct and indirect adverse effects of the proposed project on fishery resources and marine habitat. More specifically, this process often requires reviewing scientific literature, fishery resource data, and marine habitat data that were collected at or near the project site or in similar habitat conditions. This often includes data collected by DFW 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 either DFW pursuant to other funding sources or other originations and institutions (e.g. NEMAP, NEFSC, and URI GSO trawl surveys).

A review may involve visiting the project site to characterize the habitat and biological community. Depending upon site attributes and available data, it may be necessary to obtain new or updated habitat, substrate, or shellfish samples (data) via wading from shore, or sampling from a research vessel, or conducting a dive (snorkel or SCUBA). Underwater video and digital cameras may be used to document conditions before, during, and after the project is completed. Other sources of habitat data may include aerial photography, lidar, or GIS analysis of data depicting habitat (e.g. eelgrass, SAV, sediment, and benthic structure). In addition, other DFW staff are consulted for advice, recommendations, and potential impacts to resources.

DFW provides comments and recommendations to the appropriate agency(s). Usually comments are in presented in a departmental memo to OCTA where they are incorporated into the DEM's comments and permit conditions. However, depending on the project status and severity of the potential impacts, comments may be presented in an email or in person during ACOE Programmatic General Permit (PGP) or project specific meetings.

Results

This report summarizes all projects received by DFW between January 1 and December 31, 2013. During this reporting period the DFW reviewed 91 projects and applications; 9 more than in 2011 and 2010 and 5 more than 2012. The DFW provided either written (n = 23) or oral (n = 33) comments on all projects that posed potential impacts to fisheries or marine resources (Table 1). Of the 91projects received, 56 (~62%) posed potential impacts and warranted comment (Table 1). Compared to previous years the number of projects that warranted comment this year (56 projects) was 17% less than 2012 (67 projects), about the same as 2011 (54 projects), and 47% more than 2010 (38 projects).

During 2013, of the 91 projects reviewed 43 (47%) were sited within an estuary, 29 (32%) in coastal ponds, 15 (17%) in coastal rivers, and 4 (4%) in the ocean (Figure 1A, Table 2). Not surprisingly projects within estuaries had the most activities and/or impacts (n = 67, 43%), followed by 54 (34%) in coastal ponds, 25 (16%) in coastal rivers, and 11 (7%) in the ocean (Figure 1B, Table 2). Unlike recent years, potential impacts to SAV or Hard Bottom Habitat (n =

20, 12.7%) were tied with modifications to residential docks (*n* = 20, 12.7%) as the most numerous potential impact and/or proposed activity. Proposals for new residential docks (*n* = 18, 11.5%) were followed by waterfront bulkhead or riprap maintenance (*n* = 12, 7.6%). The increase in bulkhead or riprap maintenance is largely due to damage from Super-storm Sandy.

Since projects often involve multiple activities, the total number of activities and potential impacts (*n* = 157) is greater than the number of projects received (*n* = 91) (see Tables 1, 2). For example, a proposed marina expansion project could include reconfiguration of commercial docks and piers, rebuilding a bulkhead or riprap, and maintenance dredging. These activities could impact critical habitat such as shellfish beds (ASMFC 2007) or submerged aquatic vegetation (ASMFC 1997), temporally increase turbidity and potentially reduce water quality, and subsequently impact egg viability, juvenile survival, and foraging or spawning behavior of fish species (Klein-MacPhee et al. 2004; Newcombe and Jensen 1996; Wilber and Clark 2001).

Discussion

The DFW's 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. That said, the general lack of information regarding both the location of complex or hard-bottom habitat and the quality of shallow-water habitats results in the DFW, and ultimately DEM making less than well informed decisions at times. This critical data gap is recognized by the DFW and will be addressed as part of the revisions made to Job-6 of the now approved "RI F-61-R-21 Assessment of Recreationally Important Finfish Stocks in Rhode Island Coastal Waters" (see the Recommendations Section for more details).

The following sub-sections briefly highlight three large and important environmental review projects that were addressed during 2013. In short, these sub-sections summarize: (1) modifications to the standard Time-Of-Year (TOY) restrictions incorporated into reviews by the RI DEM WQC program and ACOE *draft* New England General Permit; and review of a two very large and complicated permit reviews for (2) a power plant operating in the Narragansett Bay (i.e. Manchester Street Power Station) and (3) the first offshore wind farm on the US Atlantic Coast (i.e. Block Island Wind Farm). Note that permits for the latter two projects have not been finalized and thus, only a general overview of these reviews can be conveyed in this compliance report.

<u>Time-Of-Year (TOY) restrictions</u>:
The New England District of the ACOE is currently developing a regional general permit, known as the New England General Permit (NE GP), that will replace the six state general permits in our region. One aspect of the NE GP is to provide TOY restrictions (i.e. work windows or periods of time when work may occur) for authorized in-water work in streams and tidal waters for each state. During 2013 the DFW Marine and Freshwater Fisheries Sections cooperated to develop TOY windows (and restrictions) for tidal and non-tidal streams and waters with and without anadromous fish. These regulations provide both the applicant and the regulator (i.e. permit reviewer) a set TOY window based on the specific stretch of stream or waterbody.

For example, work proposed in a tidal section of the Woonasquatucket River, downstream of Manton Dam which supports anadromous fish, would be restricted to a work window of November 15 to January 31. This TOY window is an adjustment to the standard RI DEM dredge window (typically October 15 to January 31and protective of sensitive life stages of marine species) to provide additional protections for anadromous passage.

It's likely that the ACOE will adopt the proposed TOY restrictions as part of the NE GP when it is finalized in early 2015. It is worth noting that the RI DEM WQC program believed the specificity of these TOY windows would be valuable in their permit review process; however, they did not want to wait until 2015 to adopt them. Thus, the RI DEM WQC adopted them as standard policy in May of 2013.

<u>Manchester Street Power Station</u>
The Manchester Street Power Station 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. The cooling water is withdrawn from and then discharged back to the Providence River, which requires a Rhode Island Pollutant Discharge Elimination System (RIPDES) permit from DEM.

For several years the DFW has been assisting the RIPDES program with a technical review of materials related to whether operating practices of this power plant results in adverse environmental impacts to marine resources and habitat. During 2013 the DFW was at times heavily involved in this process; however, the addition of new staff in October (2013) allowed the DFW to fully commit (a staff's) attention to this large and complicated review. This directed effort allowed for substantial gains in the review process and at present, the DFW has a Final-draft of its review. Finalizing the DFW review will allow the RIPDES program to evaluate permit options and potential permit conditions during 2014. Since this permit has not been finalized details cannot be released. Details of this review will be discussed in subsequent F-61-R Compliance Report(s) after the permit is finalized.

<u>Block Island Wind Farm</u>
There is currently an application in review that proposes to create the Block Island (BI) Wind Farm. This 5 turbine offshore wind farm is proposed to be located within RI state waters roughly three miles southeast of BI, with connection via submarine cable to BI and the mainland. The proposed 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. During 2013 the DFW has been heavily engaged in reviewing an application by Deepwater Wind for the BI Wind Farm and Transmission System. As previously noted, this permit is still under review and therefore details cannot be released. Details of this review will be discussed in subsequent F-61-R Compliance Report(s) after the permit is finalized.

Conclusion

While DFW continues to make strides towards fisheries and habitat protection in RI waters, resource management agencies like DEM and CRMC continue to come under pressure to accommodate the applicant during the permitting process. To counter these efforts DFW will continue to use the best available data and published scientific literature to develop and defend our position. Discussions and meetings within DEM indicate that our permitting suggestions and concerns are taken very seriously. Similarly, DFW continues to achieve more influential status in the permit review process both within the state and with federal agencies. Through these efforts we are moving toward better protection of our marine fisheries and habitat.

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Table 1. The types of comments provided by the Division of Fish and Wildlife (DFW), and the type of activity and potential impact of projects reviewed by DFW during 2013. Given that projects often involve multiple activities or potential impacts the total number of activities and potential impacts (*n* =157) is greater than the number of projects received (*n* = 91). Note that unless the DFW was a co-applicant on a given project (see footnote below) the DFW provided either written or oral comments on all projects that posed potential impacts to fisheries, marine resources, or conflicts with recreational use.

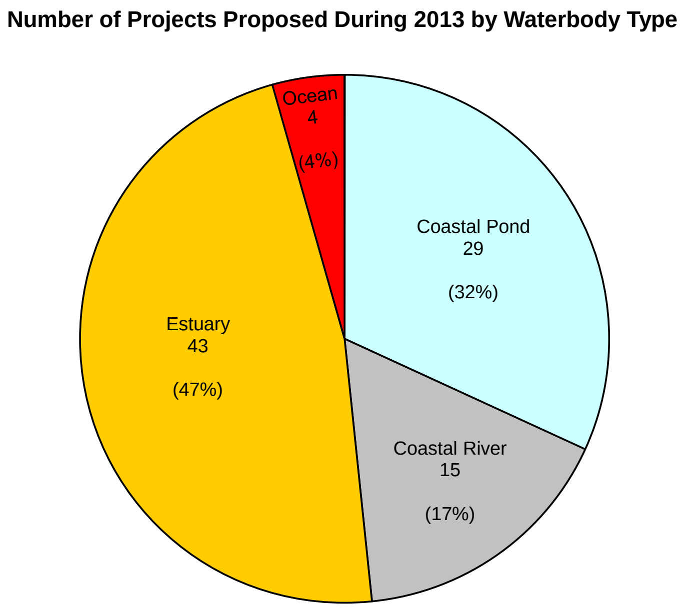
	Comment Type			
Project or Activity and Potential Impact	Written	Oral	None	Total Number
- Total Number of Projects Received -	23	33	35	91
- Percent of Total Projects Received -	25%	36%	38%	
Percent of Comment Type for each Activity and Potential Impact				
Potential Impacts to SAV or Benthic Habitat	35%	65%	0%	20
Eelgrass Restoration	0%	0%	0%	0
Maintenance Dredging	100%	0%	0%	8
New Dredging	100%	0%	0%	1
New Marina	0%	0%	0%	0
Marina Expansion or Reconfiguration	0%	40%	60%	5
Restoration of Tidal Flow to Coastal Pond	0%	100%	0%	1
Residential Docks (new)	6%	50%	44%	18
Residential Docks (modification)	0%	30%	70%	20
Commercial Piers or Docks	25%	75%	0%	8
Salt Marsh or Coastal Wetland Impacts	60%	40%	0%	5
Salt Marsh or Coastal Wetland Restoration	33%	67%	0%	9
Beach Nourishment or Coastal Feature Restoration	0%	100%	0%	1
Terrestrial Project - No Direct Marine Issues	0%	20%	80%	5
Waterfront Bulkhead/Riprap	33%	42%	25%	12
Waterfront Development	0%	0%	0%	0
Aquaculture	100%	0%	0%	8
Public Works or Utility	75%	25%	0%	8
Fish Passage	67%	33%	0%	6
Potential Shellfish Impacts	100%	0%	0%	3
Channel Maintenance	100%	0%	0%	5
Boat Ramp (New or Repair)	20%	40%	40%	5
Oyster Restoration	0%	0%	100% [A]	1
Conflict with Recreational Use	83%	17%	0%	6
Impacts from Discharge	50%	0%	50%	2
- Total Number of Activities and Potential Impacts Identified				157
[A] This refers to a Cooperative RI DEM Fish & Wildlife and The Nature Conservancy project; thus, as a co-applicant we did not comment.				

Table 2. The number of comments offered and proposed activities and potential impacts from projects reviewed by the Division of Fish & Wildlife (DFW) during 2013 for each waterbody. Waterbody types are classified as: coastal pond (CP), coastal river (CR), estuary (E), and ocean (O). Since projects often involve multiple activities, the total number of activities and potential impacts (n = 157) is greater than the number of projects received (n = 91). See text for more information.

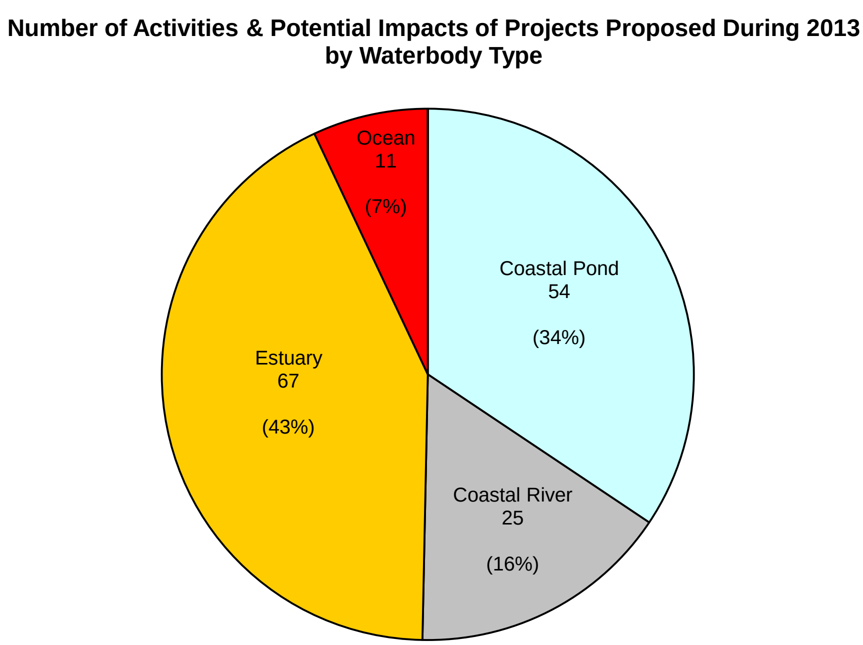
Proposed Activities and Potential Impacts	Great Salt Pond, BI	Green Hill Pond	Long Pond	Ninigret Pond	Point Judith Pond	Potter Pond	Quonochontaug Pond	Winnapaug Pong	Barrington River	Kickemuit River	Massachuck Creek	Narrow River	Seekonk River	Warren River	Woonasquatucket River	Greenwich Bay	Mt. Hope Bay	Narragansett Bay	Pawcatuck River	Sakonnett River	Ocean	Old Harbor, BI	Rhode Island Sound	Totals
Waterbody Type	CP	CP	CP	CP	CP	CP	CP	CP	CR	CR	CR	CR	CR	CR	CR	E	E	E	E	E	O	O	O	
Written Comments	1			3	4		1		1					1	1			8			1	1	1	23
Oral Comments		2	1	3	1	1	4	2	2		1	1	2			1		11					1	33
No Comments		1		1	3		1		1	1		2		2		3	1	15	1	3				35
Potential Impacts to SAV or Benthic Habitat	1	1		2		1	4	1										7			1	1	1	20
Eelgrass Restoration																								
Maintenance Dredging	1			1	1		1							1				2				1		8
New Dredging																					1			1
New Marina																								
Marina Expansion or Reconfiguration		1							1			1						2						5
Restoration of Tidal Flow to Coastal Pond			1																					1
Residential Docks (new)		2		3		1	3	1	1			1				1	1	2		2				18
Residential Docks (modification)				1	3	1	2	1		1				1		1		6	1	2				20
Commercial Piers or Docks													1					7						8
Salt Marsh or Coastal Wetland Impacts					1				1			1						2						5
Salt Marsh or Coastal Wetland Restoration			1		1				2		1							4						9
Beach Nourishment or Coastal Feature Restoration																							1	1
Terrestrial Project - No Direct Marine Issues											1	1		1				2						5
Waterfront Bulkhead/Riprap					1								1	1		2		6					1	12
Waterfront Development																								
Aquaculture				2	2													4						8
Public Works or Utility					1				1						1			3			1		1	8
Fish Passage				1	2						1		1		1									6
Potential Shellfish Impacts					1									1				1						3
Channel Maintenance	1			1	1													1				1		5
Boat Ramp (New or Repair)					1								1					3						5
Oyster Restoration							1																	1
Conflict with Recreational Use				2														3			1			6
Impacts from Discharge																		2						2
Totals	3	4	2	13	15	3	11	3	6	1	3	4	4	5	2	4	1	57	1	4	4	3	4	157

Figure 1. Number (percent of total) of [A] projects proposed during 2013 by waterbody type and [B] activities and/or potential impacts from projects. Table 2 details the composition of activities in [A] and [B].

[A]



[B]



Sportfish Assessment and Management in Rhode Island Waters

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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, 2013 – December 31, 2013

JOB NUMBER 8 TITLE: Sportfish Assessment and Management in Rhode Island Waters
During this segment, several fish stock assessments were completed that included a summer flounder benchmark stock assessment, a bluefish stock assessment update, and a striped bass benchmark stock assessment. In addition to completed stock assessments, there are several other stock assessments that have been initiated and are in progress including a tautog benchmark stock assessment, a menhaden benchmark stock assessment, a multispecies stock assessment update, a benchmark sturgeon 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 state's licensing provisions for 2013 as well as in the process for setting the recreational management plans for 2013 and 2014. The project leaders participated at the Atlantic States Marine Fisheries Commission's 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 2014 (Finfish Sector Management Plan 2014, see: http://www.dem.ri.gov/pubs/regs/regs/fishwild/mpfinfsh.pdf). The following is a summary of the activities that took place in 2013.

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). 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 benchmark stock assessment information including data and new 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), though different models and model configurations will be tested for the benchmark. This is a full benchmark assessment, therefore is more time consuming than an update assessment, so while it was begun in 2013, it will not conclude until 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 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. 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.

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. A bluefish aging workshop was also conducted in 2012. Staff collects the aging structures and processes them for aging. Staff has also started to participate in the aging process. Staff also participates in several meetings where the assessment update information is released.

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 2014 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 several 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. 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 several 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 assessment, so while it was begun in 2013, it will not conclude until 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 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 too 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 contributing a novel data poor modeling approach to the benchmark review, a Bayesian State Space Surplus Production model.

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 will not conclude until 2014. 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) 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.

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.

9. 2014 SCHEDULE

As previously noted, several stock assessments were initiated in 2013, and are scheduled to conclude in 2014. In addition to menhaden, tautog, lobster, multispecies, and sturgeon, a winter flounder benchmark assessment is scheduled for 2014, a black sea bass benchmark assessment is scheduled for 2014, and a scup update assessment is scheduled for 2014.

ASSESSMENT OF RECREATIONALLY IMPORTANT FINFISH STOCKS IN RHODE ISLAND WATERS

Age and Growth Study

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March 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: January 1, 2013 – December 31, 2013

JOB NUMBER AND TITLE: 9, Age and Growth Study

JOB OBJECTIVE: To collect age and growth 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 all sampling targets in 2013 due to the addition of an extra staff member to assist in port sampling and ageing. Additionally, investigators continued to utilize recreational fishing groups in 2013, 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 2013 is nearly complete and will continue throughout the spring of 2014.

TARGET DATE: Ongoing

STATUS OF PROJECT: On schedule

SIGNIFICANT DEVIATIONS: An additional full-time employee was added to this job in 2013 to assist in sampling, processing, and ageing.

RECOMMENDATIONS: Finish ageing structures collected in 2013 and move into the next project segment for 2014. 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 2014 investigators will focus on ageing the remaining structures collected in 2013 and begin the 2014 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.

This study is aimed to characterize the age-structure 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. Additionally, this study is designed to enhance the existing age and growth work conducted at the Ft. Wetherill Marine Laboratory. Past work has included collecting age and growth data from Menhaden, Scup, Striped Bass, Tautog, and Weakfish. This study includes the aforementioned species in addition to several new species including Black Sea Bass and Summer Flounder. Bluefish was added as a port sampling species in 2012 per Addendum I to Amendment I to the Fishery Management Plan for the Bluefish Fishery set forth by the Atlantic States Marine Fisheries Commission (ASMFC).

METHODS, RESULTS & DISCUSSION

Seasonal port sampling of seven species of finfish considered to be extremely important to the recreational fishing community was conducted primarily from May through November of 2013. 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, and commercial floating fish trap companies (Table 2).

<u>Black sea bass</u>

A total of 100 Black sea bass samples were collected from the floating fish trap and hook and line fisheries in 2013. 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 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. Prior to ageing black sea bass collected in 2013, investigators traveled to the National Marine Fisheries Service (NMFS) Northeast Fisheries Science Center (NEFSC) Woods Hole Lab to receive training in ageing black sea bass. This allowed investigators to accurately age black sea bass collected in 2013 which covered a size range of 10-24 inches total length and were 3 to 10 years old (Figure 1).

<u>Bluefish</u>

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, we successfully collected 158 bluefish samples in 2013. It is beneficial to collect additional samples of bluefish if possible due to the fragile nature of bluefish otoliths which frequently break during processing. Because the fish collected constituted recreational fish caught by the RIPCBA and were not fish sacrificed solely for this project, additional samples were collected. Bluefish varies in length from 15 to 30 inches with the highest frequency caught at the 20 inch size class (Figure 2). Ageing of bluefish otoliths is ongoing and will be completed this spring prior to the start of the 2014 sampling season.

Menhaden

Atlantic menhaden samples were collected in 2013 floating fish trap and purse seine operations. Scales samples that were collected were sent to the NMFS Southeast Fisheries Science Center (SEFSC) Beaufort Lab for ageing. Due to the degree of difficulty in ageing Atlantic menhaden, each year scale samples are sent to the staff at the Beaufort lab who are highly trained in ageing this species. Due to the quality of some scale samples, only 74 of the 107 scale samples could be aged accurately. These fish ranged from 26-31cm in length and 3 to 6 years old (Table 3).

Scup

Scup samples from 2013 were collected from floating fish traps and hook and line. Investigators successfully collected scales from 162 scup ranging from 7 to 17 inches in length and 2 to 12 years old (Figure 3).

Striped Bass

A total of 339 striped bass scale samples were collected and aged in 2013. 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 26" while the commercial rod and reel has a minimum size of 34". Sampling from both of these operations allows us to sample a wider size range striped bass. In 2013 due to the closure of one of the floating fish trap companies, the full striped bass quota for floating fish traps was not utilized. This made it challenging to obtain all 150 fish trap samples. As a result, and to ensure that we obtained our target number of samples, investigators supplemented fish trap samples with samples from the recreational rod and reel fishery. The recreational fishery has a minimum size of 28" which allowed us to sample smaller fish that sampling the commercial rod and reel fishery does not allow for.

Not only did sampling from the recreational rod and reel fishery allow us to meet our sampling target, but by fishermen donating their recreational fish racks, investigators were able to collect paired scale/otolith samples from recreational fish. Currently these otolith samples are still being processed however this paired sampling will allow investigators to compare scale and otolith ages and aid in refining ageing techniques for striped bass. Striped bass sampled ranged from 25 to 49 inches fork length and 5 to 18 years old (Figure 4). Three sub-legal fish were also seized by our law enforcement division and provided to us for sampling. These fish were less than 10 inches and can be seen in Figure 4.

Summer flounder

A total of 110 summer flounder scale samples were collected in 2013. 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 and hook and line fisheries. Due to the fact that investigators have not previously aged summer flounder and a summer flounder ageing workshop is being scheduled by the ASMFC for the fall of 2014, investigators felt that it would be beneficial to wait until they had received formal training on ageing summer flounder this fall before ageing 2013 samples. Summer flounder samples collected varied in size from 13 to 26 inches with the highest frequency caught at the 16" size class (Figure 5).

Tautog

A collaborative effort between DEM, the RIPCBA and the Narragansett Parks and Recreation Department in 2013 resulted in the collection of 282 tautog samples. The second annual tautog fishing event not only allowed investigators to collect the required number of samples, but allowed several families from the Narragansett Park and Recreation assistance program to go out for a fun day of fishing on the Bay. The families in the assistance program who participated were also allowed to keep the fillets from any of the fish they caught on the trip for food. Families were provided with a certificate of participation and given a tautog chowder recipe. This event would not have been possible without several members of the RIPCBA donating their time, skills and use of their equipment and vessel. DEM scientists who were on board the vessels and possess scientific collectors permits, collected tautog ranging from 7 to 24 inches and 1 to 20 years old (Figure 6).

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 2013, this would have resulted in a sampling target of 24 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. Due to a miscommunication with a seafood dealer, investigators only purchased 17 of the required 24 samples in 2013. When this error was discovered investigators looked to acquire 7 additional samples to meet their sampling target which were caught in early 2014. Weakfish samples are still being processed and will be completed this spring prior to the start of the 2014 sampling season.

SUMMARY

In 2013 investigators were able to collect all the target sample numbers for all species by utilizing a variety of resources and bringing on an additional staff member to the project. Training of the new staff member is still ongoing and will continue into 2013. Processing and ageing of all hard parts is nearly complete for 2013 and will continue into the spring. Staff will continue to participate in ASMFC ageing workshops as they occur with the next workshop scheduled for scup and summer flounder in the fall of 2014.

FIGURES

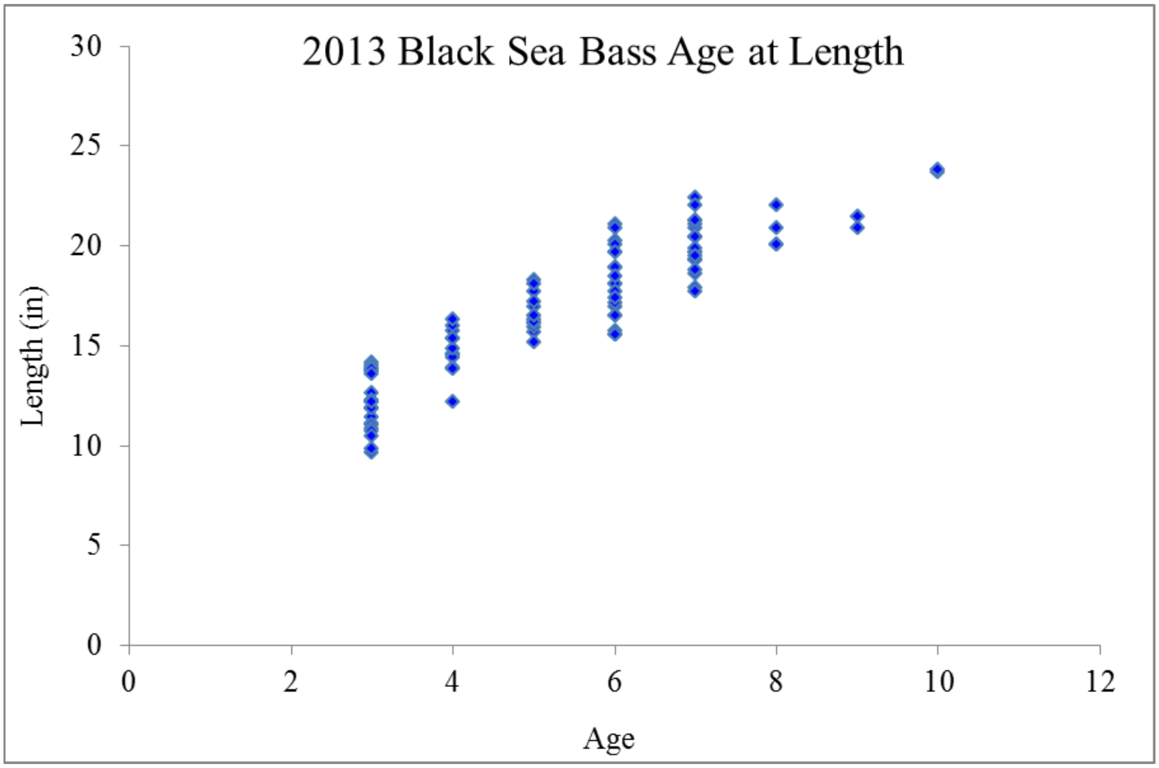


Figure 1. Black sea bass age at length.

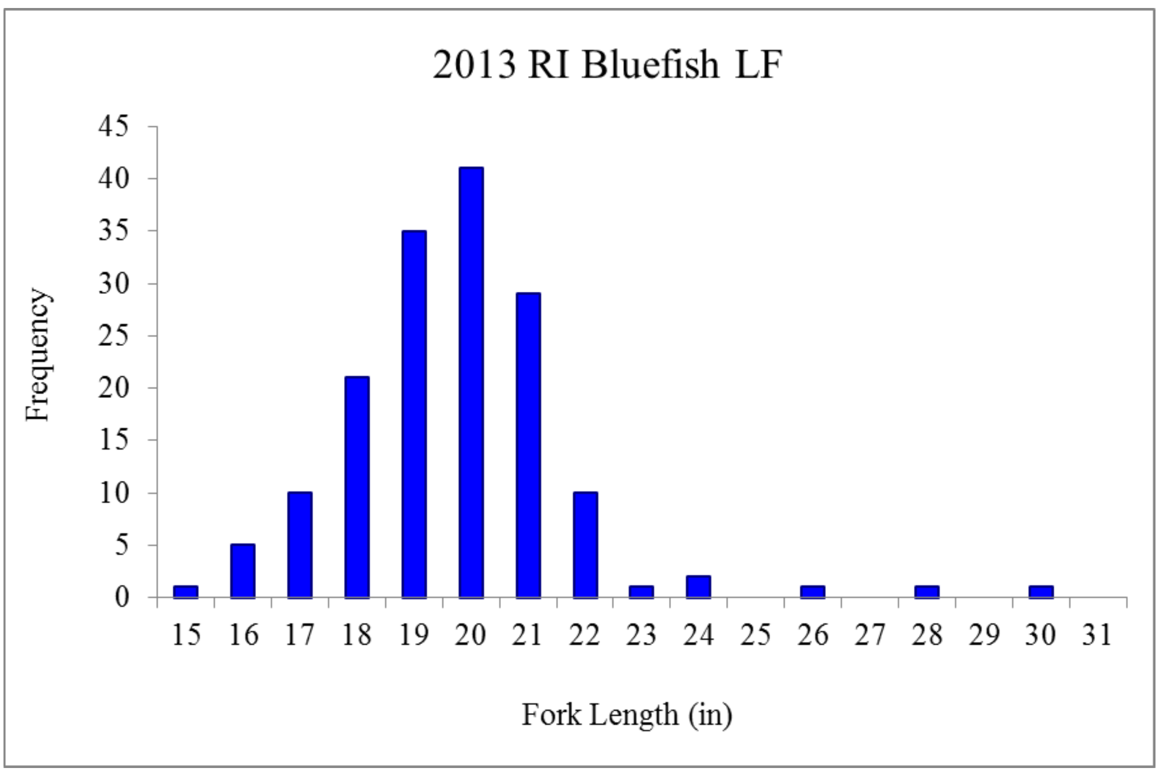


Figure 2. Bluefish length frequency.

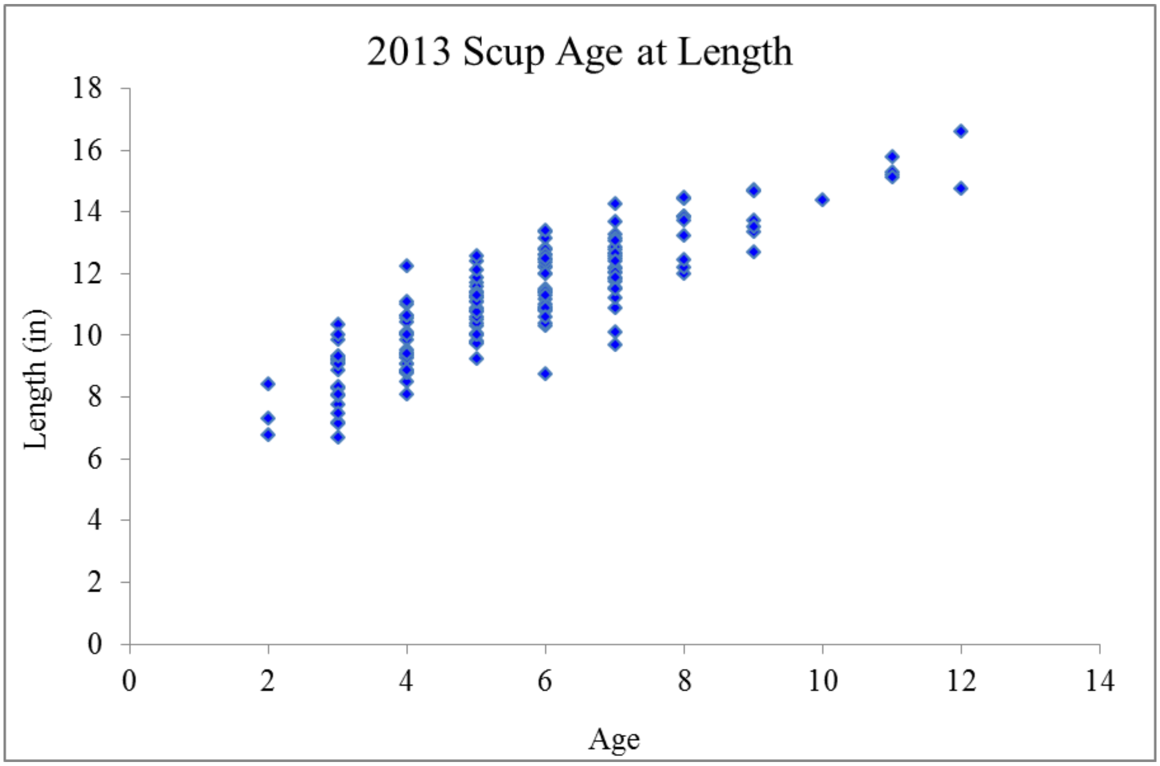


Figure 3. Scup age at length.

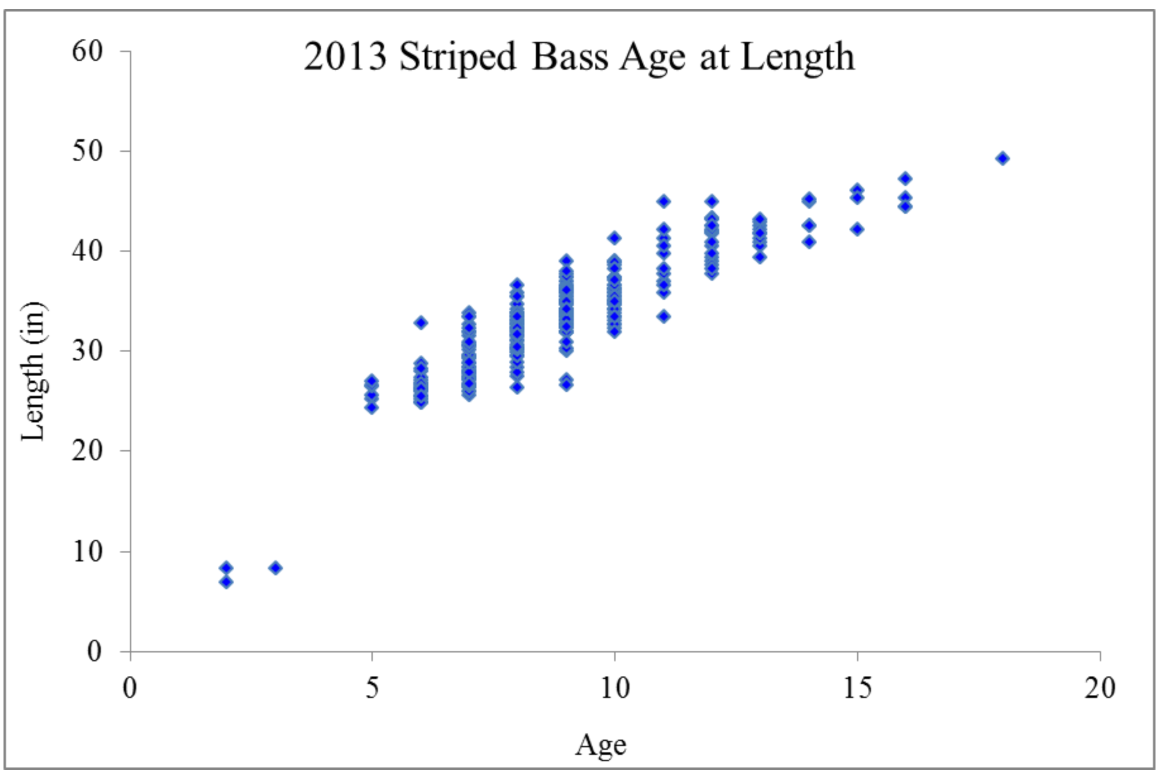


Figure 4. Striped bass age at length.

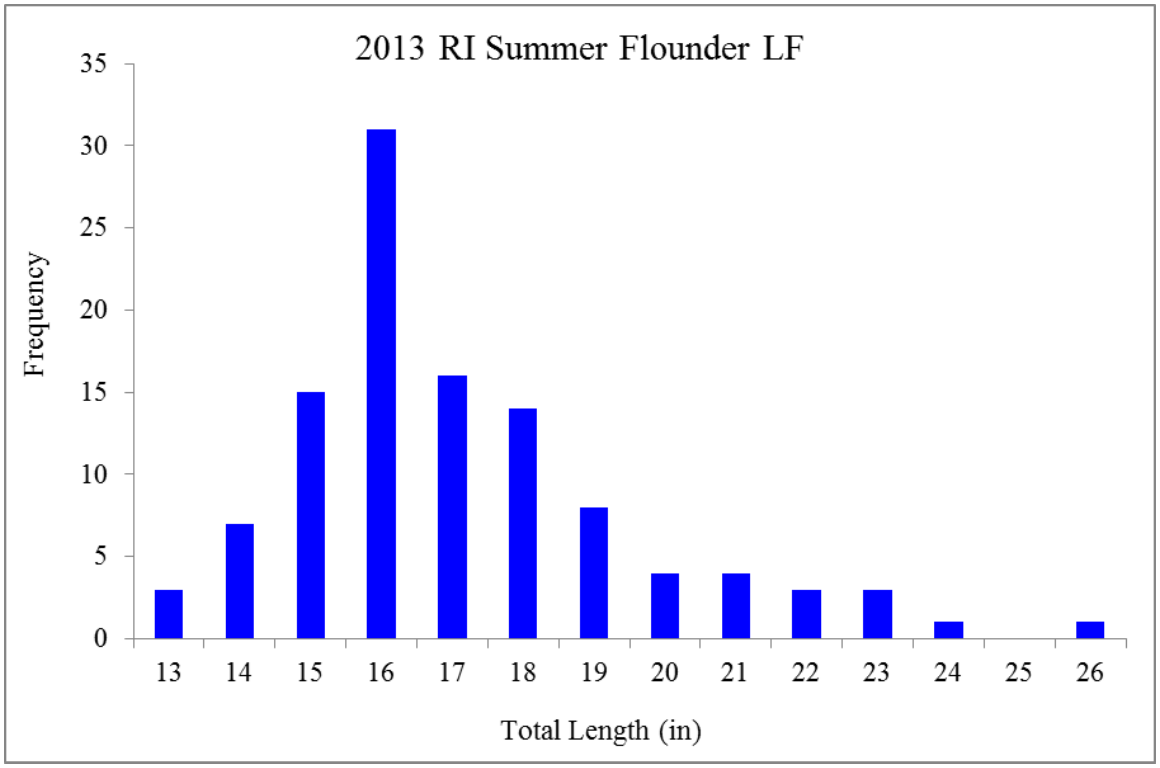


Figure 5. Summer flounder length frequency.

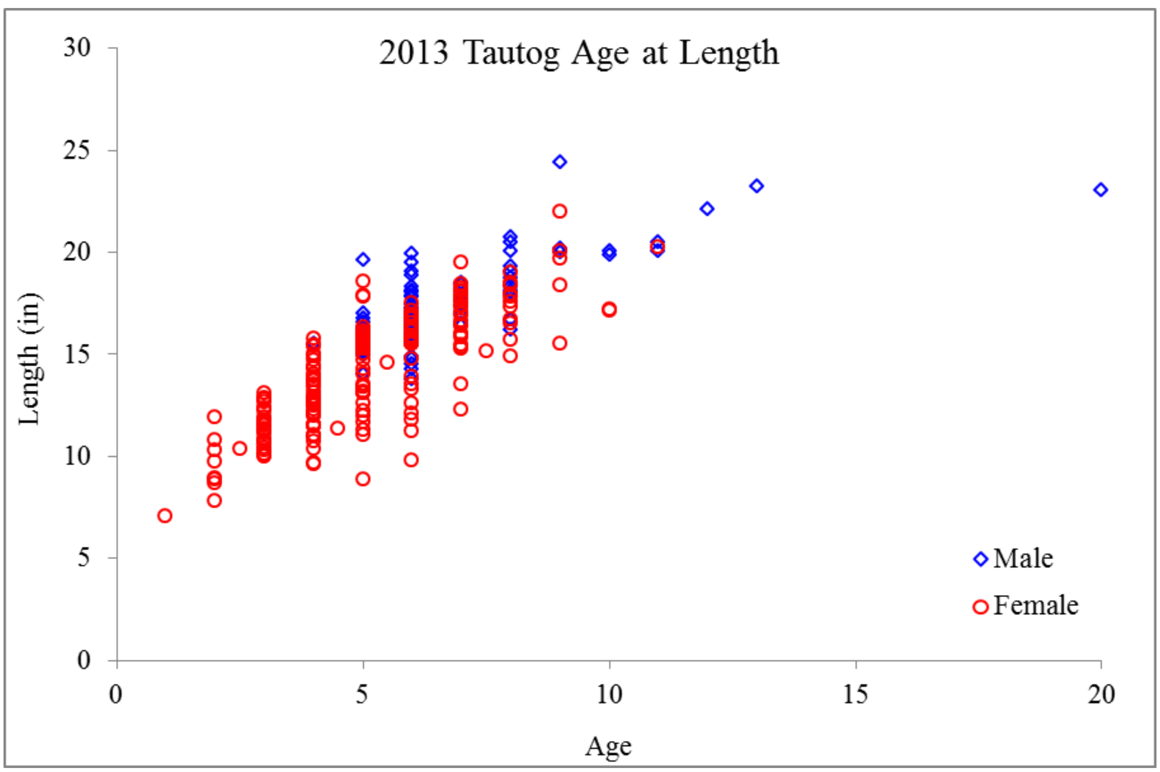


Figure 6. Tautog age at length.

TABLES

Table 1. Species, number of ageing structures, and number of fish sampled in 2013.

Common name	Ageing structure	Target number of ageing structures	Number of ageing structures collected
Black sea bass	Scale	100	100
Bluefish***	Otolith	100	158
Menhaden	Scale	100	107
Scup	Scale	100	162
Striped bass	Scale	150 fish/gear type**	339
Summer Flounder	Scale	100	110
Tautog	Operculum/Otolith	200	282
Weakfish	Otolith	3 fish aged per metric ton landed*	24

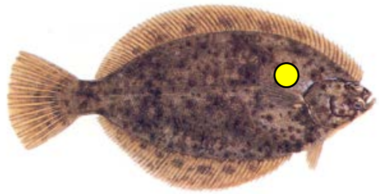
*Per ASMFC FMP requirements, 8 ages required for 2012
**Gear types include floating fish traps and rod & reel
***Required by ASMFC for 2012 and 2013

Table 2. Gear type sampled for each species collected in 2013 (FFT=Floating Fish trap).

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

Table 3. Age at length key for Atlantic menhaden provided by the NEFSC Beaufort Lab.

FL (cm) / Age	3	4	5	6	TOTAL
26	2				2
27	4	6	1		11
28		15	3		18
29	1	18	7	1	27
30		9	5		14
31			1	1	2
TOTAL	7	48	17	2	74



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-61-21

Performance Report March, 2014

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, 2013

Job Number and Title: Job X - 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.

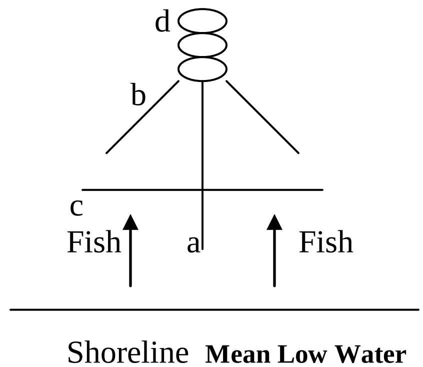
The research project runs from January - May annually. Fishing gear is deployed depending on ice cover in the ponds and the gear is generally hauled on three to seven night sets. There are a total of eight stations where data exists, all found in the Pt. Judith Pond system including Potters Pond. (NOAA 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 is continuing during the 2013 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 – 2.5’
Mesh size - 2.5" throughout



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

Fieldwork:

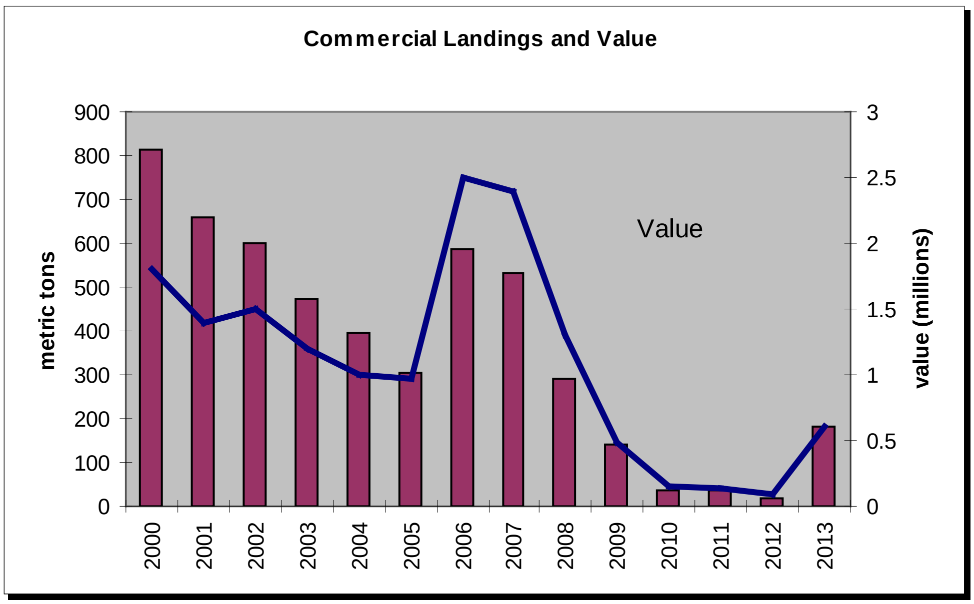
Three fyke nets were set at three fixed stations in Pt. Judith and Potter Ponds during January and April in 1999 - 2001 and two nets were set at four fixed stations from 2002 to present. The nets are fixed at mean low water and set perpendicular to the shoreline. Fyke nets are a passive fishing gear 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.

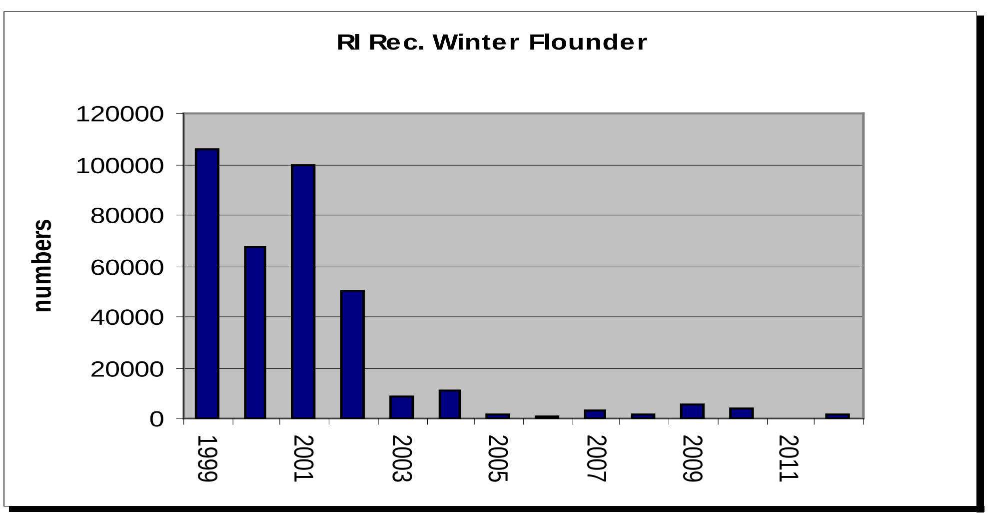
All fish captured are measured, sexed, enumerated and categorized to describe spawning stage. Spawning stage is defined as ripe (pre-spawn), ripe/running (active spawn), spent (post-spawn), resting (non-active spawn) and immature. These data illustrate how the spawning activity of flounder advances throughout 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:

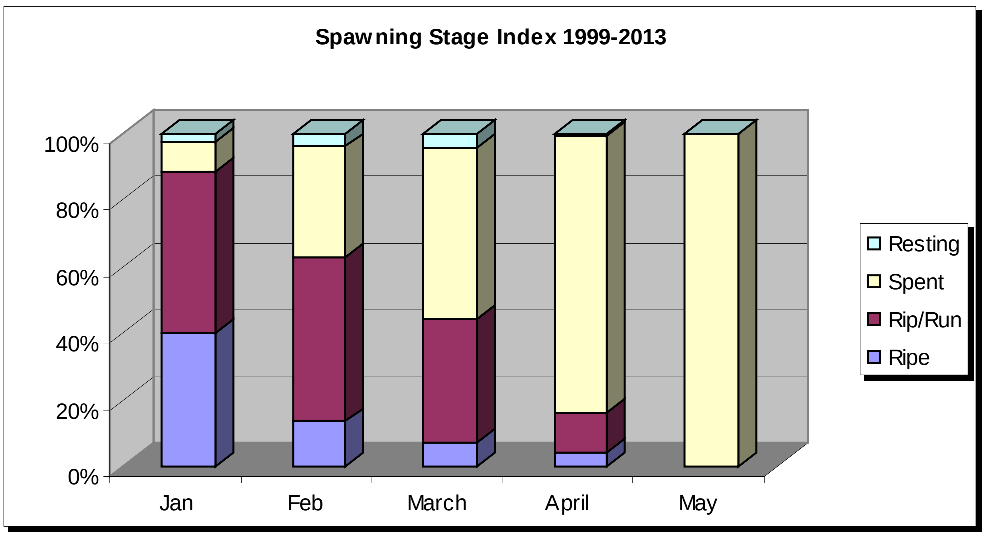
Winter Flounder (***Pseudopleuronectes americanus***) are both a commercially and recreationally important species to the State of Rhode Island. From 1999 - 2013 commercial landings of winter flounder in Rhode Island averaged over 300 metric tons and an average value of one million dollars annually. Recreational landings have declined rapidly throughout the period to a new time series low in 2011. (NMFS. 2013 Commercial landings query and MRFSS database)



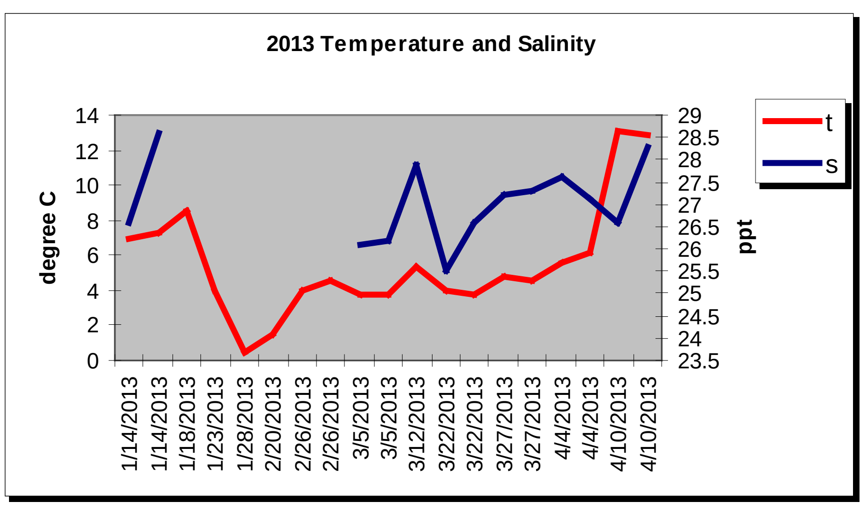


Spawning Behavior:

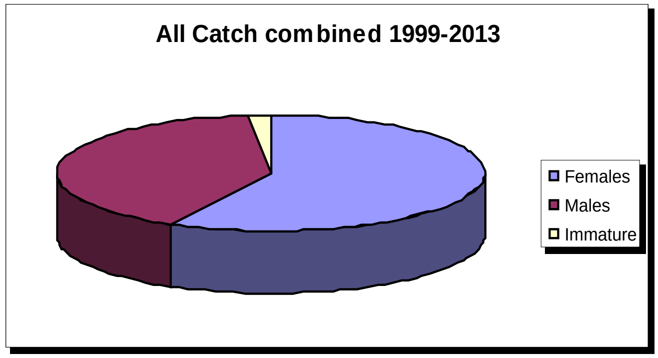
Winter Flounder enter the south shore coastal pond systems in Rhode Island to spawn in the early part of winter (November) and engage in spawning activity from January through May annually. Spawning and egg deposition takes place on sandy bottoms and algal accumulations. Winter Flounder eggs are non-buoyant 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) 1.

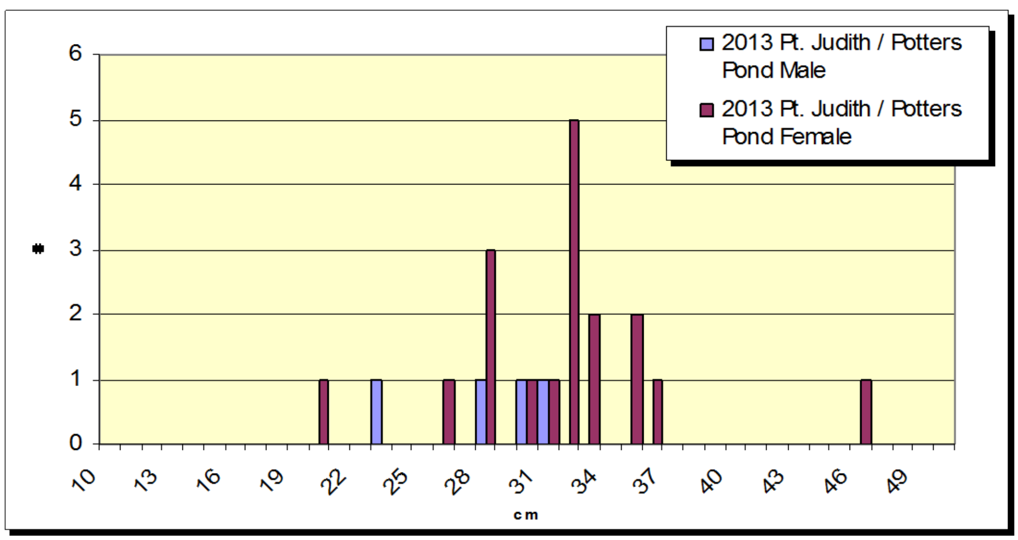


Sex ratios throughout the time series tend to favor females. Similar observations were made in Green Hill Pond, a neighboring coastal pond (Saila 1961), and in Narragansett Bay (Saila 1962).



Size Distribution:

The total number of winter flounder sampled during the 2013 survey was 22cm. This was a 50% decrease from the 2012 survey. Sizes ranged from 20cm to 46cm. The mean size sampled was 30.9cm.



Results:

2013 Adult winter flounder CPUE decreased to 1.1 fish per net haul or a 45% decrease from the 2012 value of 2.0 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 2013 CPUE being the lowest data point every recorded.

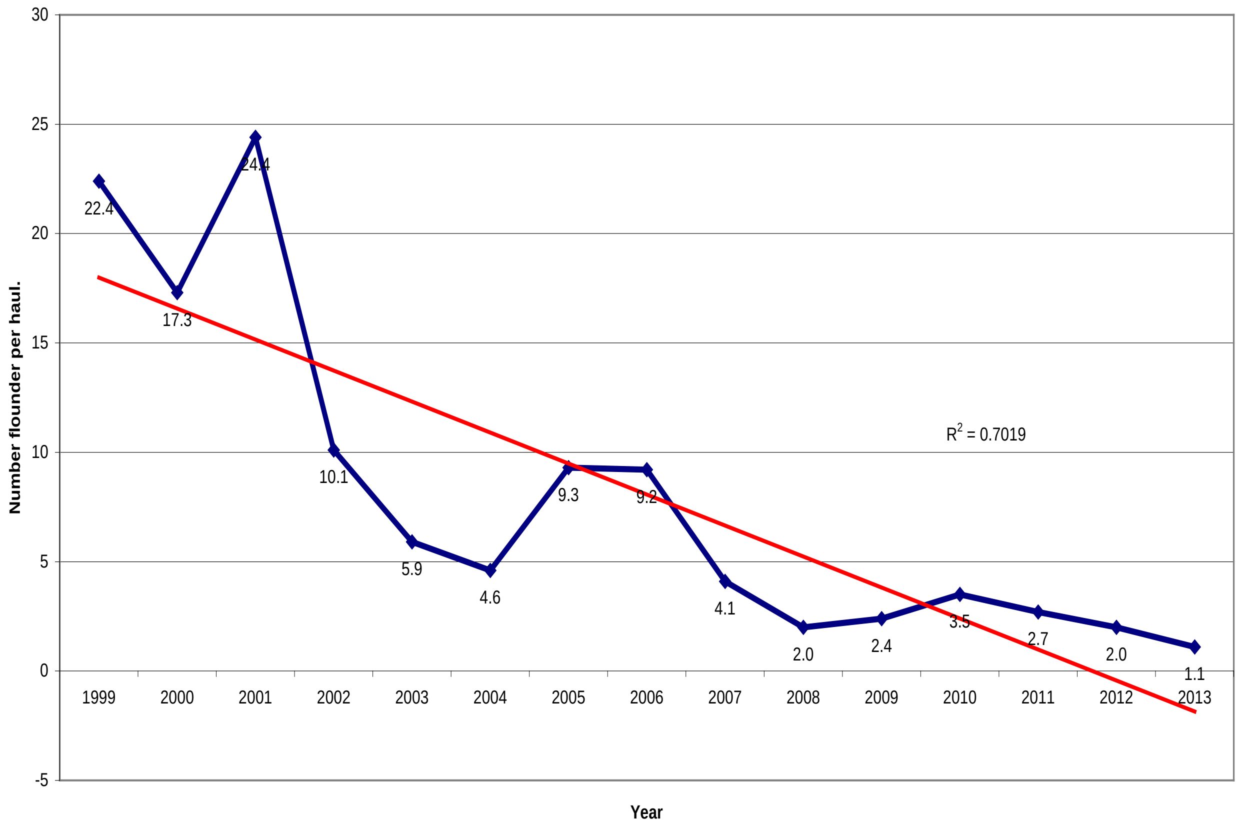


Table 1 Mark / recapture data 1999 - 2013 **(Pt Judith system)**

Year	Number caught	Number tagged	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
Total	3892	1536	194

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

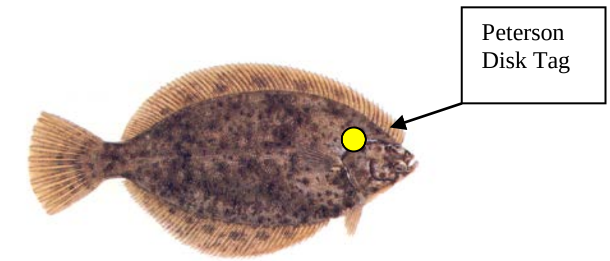
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
1999	31	8	10	1	0	1	0	0	0	0	0	0	0	0	0	51
2000		23	17	5	1	0	0	0	0	0	0	0	0	0	0	46
2001			43	11	1	2	0	0	0	0	0	0	0	0	0	57
2002				1	3	1	0	0	0	0	0	0	0	0	0	5
2003					1	1	2	0	0	0	0	0	0	0	0	4
2004						9	1	2	0	0	0	0	0	0	0	12
2005							4	4	2	1	0	0	0	0	0	11
2006								3	2	0	0	0	0	0	0	5
2007									2	1	0	0	0	0	0	3
2008										0	0	0	0	0	0	0
2009											0	0	0	0	0	0
2010												0	0	0	0	0
2011													0	0	0	0
2012														0	0	0
2013															0	0
Total	31	31	70	18	6	14	7	9	6	2	0	0				194

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	Total
1999	26	6	6	0	0	1	0	0	0	0	0	0	0	0	0	39
2000		18	9	0	1	0	0	0	0	0	0	0	0	0	0	28
2001			39	2	1	2	0	0	0	0	0	0	0	0	0	44
2002				1	3	1	0	0	0	0	0	0	0	0	0	5
2003					1	1	2	0	0	0	0	0	0	0	0	4
2004						9	1	2	0	0	0	0	0	0	0	12
2005							1	3	2	1	0	0	0	0	0	7
2006								1	1	0	0	0	0	0	0	2
2007									2	1	0	0	0	0	0	3
2008										0	0	0	0	0	0	0
2009											0	0	0	0	0	0
2010												0	0	0	0	0
2011													0	0	0	0
2012														0	0	0
2013															0	0
Total	26	24	54	3	6	14	4	6	5	2	0	0	0	0		144

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.



<u>Recommendations:</u> 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, 2013 – December 31, 2013

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.

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 2013

SIGNIFICANT DEVIATIONS: There were no significant deviations to methodology in 2013, with the exception of entertaining an additional spotter pilot biomass estimate in the model and weighting the different estimates.

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 2013 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 2013, 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, DFW observers recorded the pilot counts of the number of menhaden schools observed, the estimated weight within the schools, and the location of the schools. 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.

2013 Fishery Data

In 2013, only one commercial menhaden fishing operation fulfilled requirements for fishing in Narragansett Bay. In previous years a second operation also participated in the fishery, but has not come back to RI for the past 3 years. After biomass levels were estimated and confirmed, commercial fishing was allowed to commence on May 20, 2013. 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 closed on June 10, 2013, as it was determined that the biomass levels dropped below the threshold 1.5 million lbs. The fishery reopened on June 17, 2013 due to the influx of menhaden biomass in to the Bay. Flights and biomass estimates were continued even while the fishery had closed. The commercial bait fishery closed again on July 3, 2013, and remained closed for the season.

A figure of the cumulative landings is shown in Figure 1. The landings are transformed to protect confidentiality. The landings cap is also represented in the figure. In 2013 the landings cap was not exceeded. The precision of the model depends on the estimates that are being conveyed by the spotter pilot, and therefore overages of this nature are not unprecedented, and in this case the overage is equivalent to one day which is not too egregious when considering the magnitude of the fishery and biomass that is in the Bay.

There were 30 spotter flights accomplished in 2013. 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. Four helicopter flights were taken in 2013. The idea behind the helicopter flights is to add an additional independent observation in to the program. School counts are the metric used from the helicopter flights.

The model performed relatively well in 2013. A graph showing the spotter observations and the model estimated biomass trajectory are shown in Figure 2. A few of the late season estimates (not shown in figure 2) caused the model estimates to bias above the observed values in the earlier part of the season. It is hoped that this biasing can be avoided in the future with the use of historical biomass estimates from the program as well as using the helicopter school counts as a tuning index. In addition, moving the model in to a different software package (ADMB) will also help improve the model performance.

SUMMARY: The menhaden monitoring program in Narragansett Bay opened in May. There was one in season closure, which ended in June when a second pulse of biomass entered the Bay. The fishery closed for the season in July. Biomass estimates were continued throughout the season and ended in September. In total 30 spotter flights were taken and 4 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 2013.

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Atlantic States Marine Fisheries Commission (ASMFC). 2010. Atlantic Menhaden Stock Assessment and Review Panel Reports. Stock Assessment Report No. 10-02. Pp 326.

Gibson, M. 2007. Estimating Seasonal Menhaden Abundance in Narragansett Bay from Purse Seine Catches, Spotter Pilot Data, and Sentinel Fishery Observations. http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/menabnnb.pdf

Figures

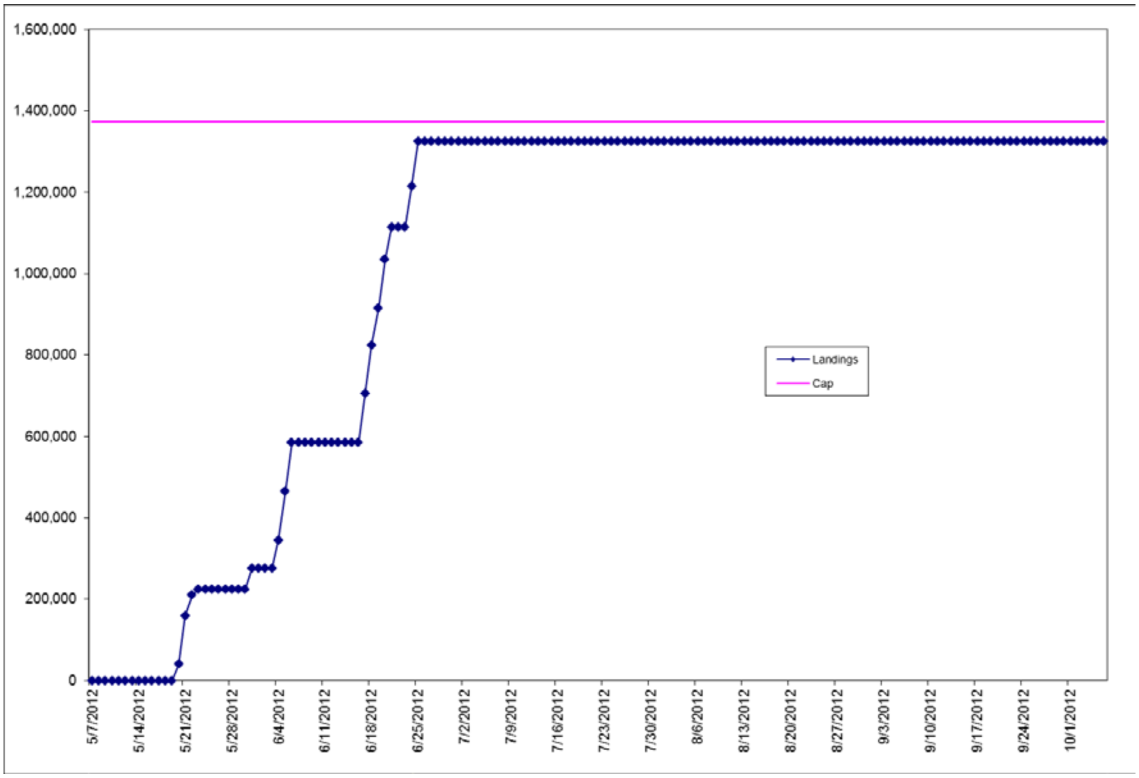

Figure 1 – Cumulative landing index for the RI commercial menhaden fishery versus the landings cap.

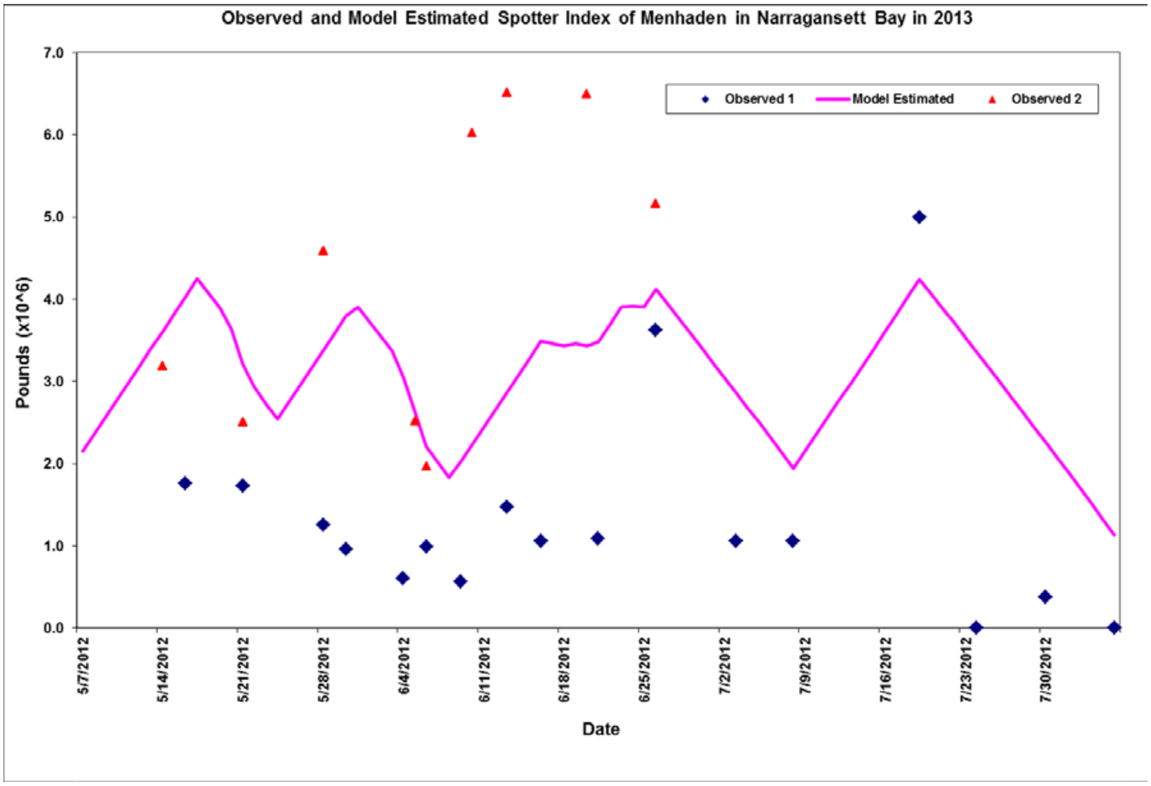

Figure 2 – Spotter pilot estimates of menhaden biomass and model derived prediction of biomass.

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 2014

PERFORMANCE REPORT

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

Project Type: Resource Monitoring

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

Period Covered: January 1, 2009 to December 31, 2009

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 they're in RI state waters. Abundance data will be integrated into both local and coastwide stock assessments for the target species.

Summary: Investigators hauled 10 unvented scup pots in each of five sampling areas in Narragansett Bay from August through October, 2013. The aforementioned pots were set 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**. One half of the pots were baited with sea clams and the others remained unbaited. The unvented black sea bass pots in five (5) pot trawls were set at two (2) randomly selected stations in two separate sampling areas each day. One trawl will was set on structured bottom while the second was set on bottom without structure. These traps were unbaited as was the methodology in the Sea Grant project and allowed to fish for **96+/- 1 hr.** These trawls were fished during the month of October.

Target Date: 2014

Status of Project: On Schedule

Significant Deviations: Investigators were unable to complete sampling during the entire sampling season, April through November, as originally scheduled.

Recommendations: To continue on into the next segment.

Remarks: Efforts to begin sampling on schedule on April 1, 2013, were hampered by our inability to acquire fish traps, incidental equipment, supplies, and refit our vessel to haul the fish pots in a timely manner. These efforts were exacerbated by the close proximity of the end of the State fiscal year which invites a plethora of like purchase orders from around the state from every Division trying to beat purchasing deadlines. Once all of the traps and associated gear, lines and buoys, etc., had been acquired and the vessel modified with an 10" hydraulic pot hauler, the vessel developed leaks in the oil pan and was immediately taken out of service for repair.

At this time, Investigators had used approximately one half of the sampling year gathering and rigging equipment. It was decided to utilize an 18' vessel to set the scup pots and to forego setting the sea bass trawls until the 26' privateer was back in service. Due to the small size of the vessel and the large amount of gear, 20 scup pots were carried per trip, and limited fuel capacity investigators felt it prudent to trailer the vessel to boat ramps nearest the areas being sampled. Sampling began in August and continued through October when the fish declined to zero in Narragansett Bay and only a few fish caught at the mouth of the Sakonnet River, at which time sampling was halted.

The 26' Privateer was returned to service at the end of September and investigators began setting the black sea bass trawls in October. Trawls were set in each of the five sampling areas, one trawl on bottom with structure and one trawl on bottom with no structure. All traps were unbaited.

The Division continues to obtain an electronic chart from Dr John King of the URI, who has a side scan sonar profile of the Narragansett Bay, which would provide the Division with known areas of structure as determined through his extensive survey of Rhode Island territorial waters. This portion of the project while seemingly ready to go is currently in the hands of Department attorneys who are drafting an agreement in order to pay the University.

Personnel were unable to take scales and otoliths from fishes or were they able to weigh animals during the first year of the project due to lack of time and space available aboard the 18' vessel. Going forward, this should not be a problem since the normal vessel, 26' privateer, is again available to the project.

Introduction: The Division of Fish and Wildlife began a seasonal bottom trawl survey in 1979 in Rhode Island territorial waters to address aspects of the Magnuson Act. This project was undertaken in order to inventory and collect data on finfish species of recreational and commercial importance. In 1990, this survey was supplemented with a monthly bottom trawl survey which towed 12 fixed stations per month. Additionally, the Division began monitoring juvenile finfish stocks in Narragansett Bay and the south shore coastal ponds in 1988 and 1993 respectively. These surveys provide valuable data on the groundfish and juvenile finfish resources Rhode Island's coastal zone.

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 indexing 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 and numbered. These numbered boxes werebe 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 will be selected using a random number generator. 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 ventless black sea bass and scup pot survey was conducted in the Narragansett Bay from August through October. The scup pots (2'x2'x2') are constructed of 1.5" x 1.5" coated wire mesh and are unvented. Black Sea Bass Pots (43.5" L, 23" W, and16" H) are also constructed of 1.5" x 1.5" coated wire mesh, single mesh entry head, and single mesh inverted parlor nozzle. Additionally, the sea bass pots are unvented and will be covered with vexar in August and September in an attempt to capture age 1 sea bass. The sampling schedule is as follows:

> Week one, day one: beginning on Friday or Monday, investigators set unvented 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 while the second will be set on bottom without structure. These traps will be unbaited and allowed to fish for **96+/- 1 hr**.
>
> Day two: Investigators set unvented 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**. One half of the pots were baited with sea clams.
> Day three: the pots set on day two were hauled and the catch processed and gear removed from the water**.**
>
> Day four: haul the four trawls of black sea bass pots set on day two and process the catch. The four trawls will then be held for 24 hours and then moved to two new areas, and allowed to fish for **96+/- 1 hr.**
>
> Week two activities will mirror those of week one in order to sample the remaining sampling areas. Given previous research performed by the Division of Fish and Wildlife, it is believed that the scup pots will be the preferred gear type for capturing tautog, but this will be examined at the completion of the first year's survey and the methodology may be altered if this is not found to be the case.

Upon hauling all gear types, the catch will be sorted by species. Finfish were be measured to the nearest millimeter, fork length (FL) or total length (TL). Scup will have both measurements taken for a comparison study. Invertebrates were measured using a species specific appropriate metric or counted. Scales, otoliths, and opercula could not be taken due to the size of the vessel used for the first two months. Project personnel will collect data on water temperatures, salinities, dissolved oxygen, air temperature at each sampling station using a yellow springs instrument (YSI) model 85 with 100' detachable probe and mercury thermometer

Results/Discussion:

We set the scup pots 10 times per area each month during August, September, and October, or 50 times per month. Additionally, we set the black sea bass trawls twice per area during October, or 10 times. Table 1 enumerates the finfish species caught and the percentage of total catch, while table 2 enumerates the shellfish caught. From this table, it is obvious that this gear type is very efficient at catching the target species. This table shows that scup dominated the catch with 887 individuals which comprised 68.9% of the total catch. However, only 356 black sea bass were caught which equaled 27.65%. Tautog and Conger eel were the only other species caught in any numbers, 14 and 15 respectively. Investigators suspect that the tautog were caught in the trawls as they were leaving the bay in October. These fish were juveniles and investigators will withhold comments until they have had at least one full year of sampling to determine if the protocol should be modified. .

Temperature, Salinity, and Dissolved Oxygen:

Surface water temperatures varied only slightly from station to station and ranged from a high of 24.4 °C in August to as low of 13.1 °C in October. While bottom temperatures ranged from 23.3 °C in August to a low of 13.1 °C in October. Surface salinities ranged from 7‰ to 31.2‰ and surface dissolved oxygen ranged from 2.9 mg/L to 11.97 mg/L.

Despite our very limited sampling season, we accomplished our goals for the first year of the project. We were able to establish a database for scup, black sea bass and tautog. Investigators noted that according to the length at age graph, the majority of black sea bass caught were in excess of five or six years old which is what we had expected. Additionally, we started catching scup at approximately one and one half years old, however, the majority of the fish caught were in the three year old class and older which again is our target range. The only disappointment was Tautog, only 14 fish were caught, 13 in one trawl in October, and these fish were one to two years old. Investigators believe that our inability to get the black sea bass trawls out sooner contributed to the lack of adult Tautog. However, this remains to be resolved in the next sampling season.

Length frequency data for Scup, Black Sea Bass, and Tautog are presented in figures 2 - 4. Length frequency histograms are also provided for scup and black sea bass from trawls on structured bottom vs bottom with no structure (Figs. 7&8). In both cases it doesn't appear that structure makes much difference to either species except that if the fish are already there they will utilize the trap vs traversing open bottom and discovering the trap. Figures 5 and 6 depict the frequency of scup and black sea bass by month. In the case of scup (Fig 5) the majority of scup were caught in August and September. However, in October the numbers fall off rapidly and no scup were to be found in Narragansett Bay above the bridges, Jamestown, Newport. Black sea bass appears to be most plentiful in September and October. In September the fish were found within the bay, however, they were beginning to move. There were none caught in the upper bay and all fish were caught in the lower bay below Jamestown. In October, All black sea bass were caught at the mouth of Narragansett bay or the Sakonnet River which is the reason that the project was stopped at the end of October instead of continuing through November as planned. Investigators did provide for years that the fish remain in the bay through November by retaining the ability to extend the survey either partially or in full as necessary.

Figure 9 is an attempt by investigators to assist coastal assessment biologists to update the conversion equation which they currently use for stock assessment and regulatory calculations. This graph and equation 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

Ranking by abundance of all finfish species
Collected in fish traps in Narragansett Bay, R. I.
(August 2013 - October 2013)

Scientific Name	Common Name	Number	% Catch
Stenotomus chrysops	Scup	887	68.91
Centropristis striata	Sea Bass Black	356	27.65
Conger oceanicus	Conger Eel	15	1.17
Tautoga onitis	Tautog	14	1.08
Opsanus tau	Toadfish Oyster	4	0.30
Menticirrhus saxatilis	Kingfish Northern	3	0.26
Balistes capriscus	Triggerfish Gray	2	0.16
Paralichthys dentatus	Flounder Summer	1	0.08
Callinectes sapidus	Blue Crab	1	0.08
Morone saxatilis	Bass Striped	1	0.08
Prionotus evolans	Searobin Striped	1	0.08
Sphoeroides maculates	Puffer Northern	1	0.08
Anguilla rostrata	American Eel	1	0.08

TABLE 2

Ranking by abundance of all shellish species
Collected in fish traps in Narragansett Bay, R. I.
(August 2013 - October 2013)

Scientific Name	Common Name	Number
Busycon carica	Knobbed Whelk	25
Busycotypus canaliculatus	Channeled Whelk	13
Homarus americanus	American Lobster	8
Callinectes sapidus	Blue Crab	5

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

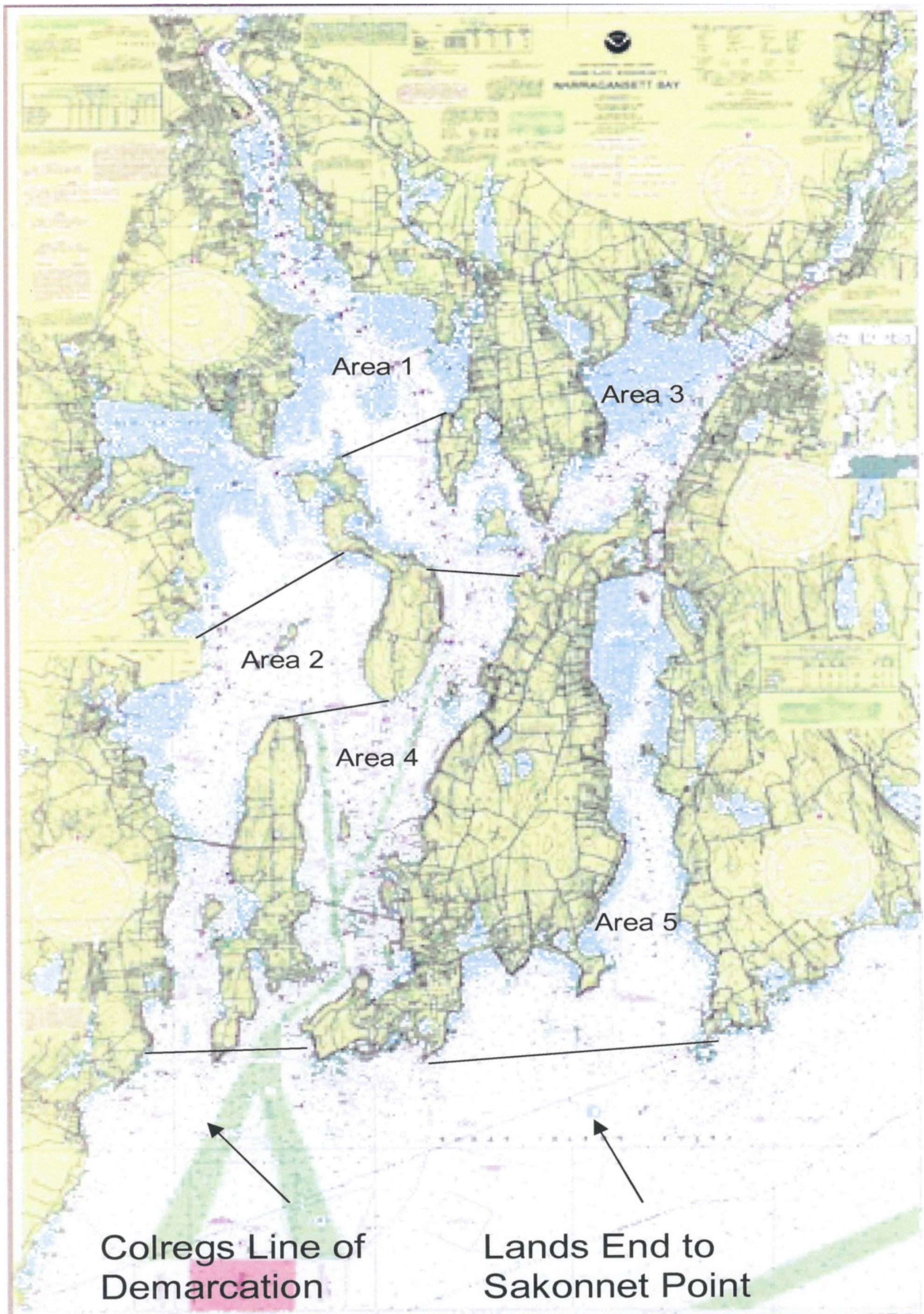


Figure 2a. Length Frequency Histogram for Black Sea Bass (all stations combined).

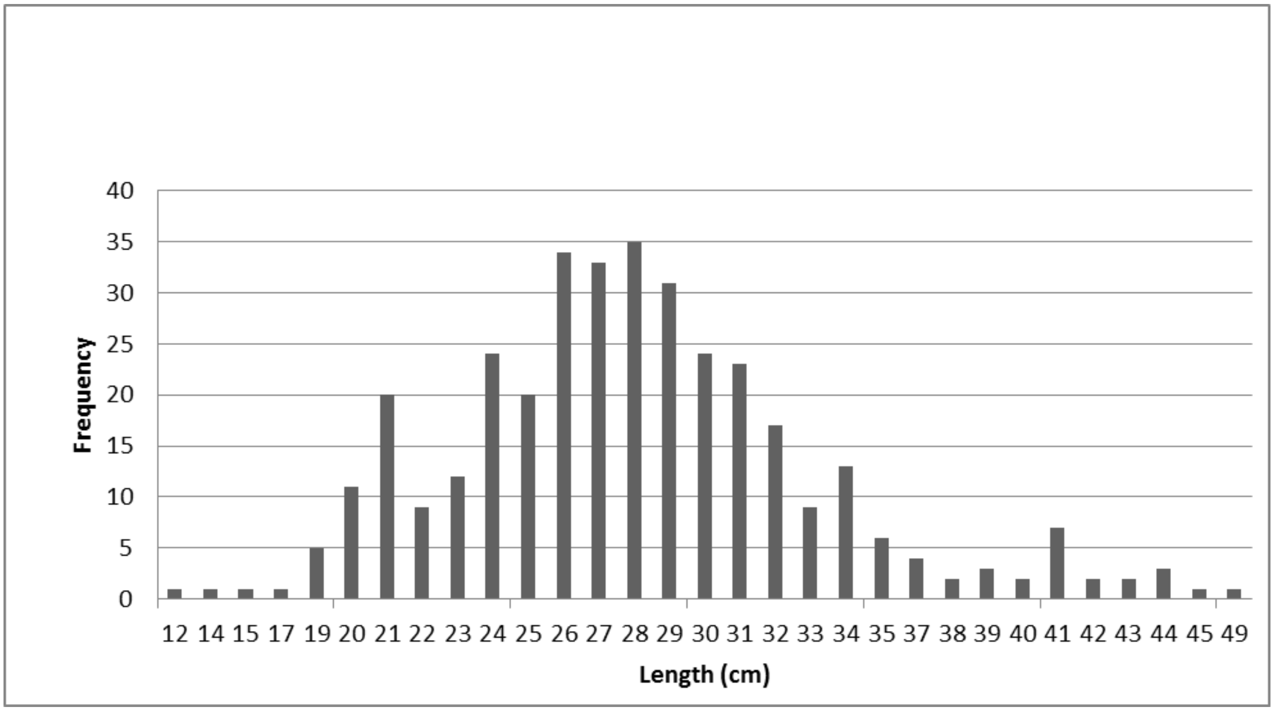


Figure 2b. Length at Age graph for Black Sea Bass

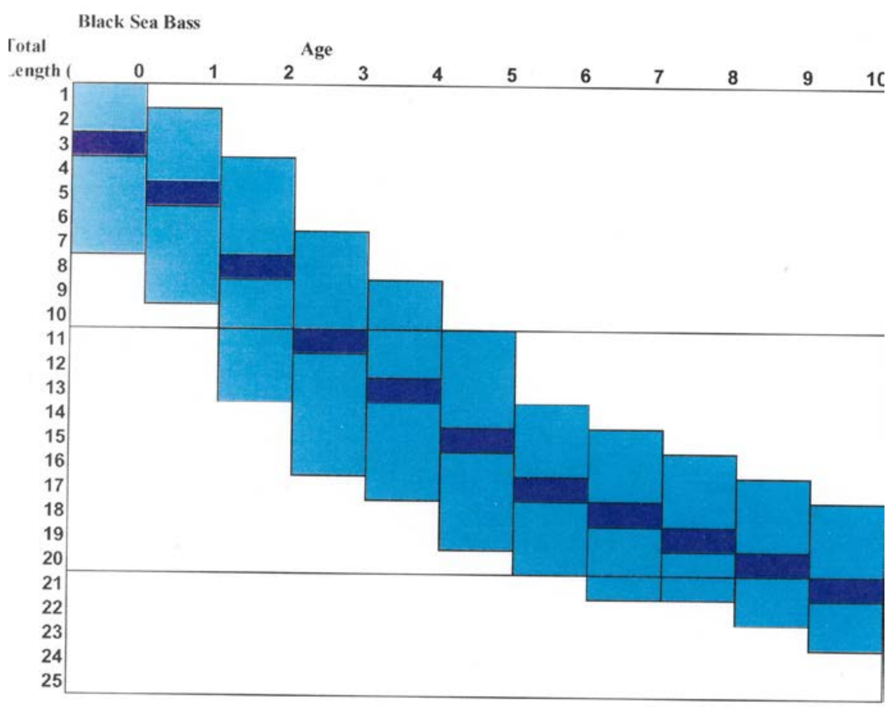


Figure 3a. Length Frequency Histogram for Scup (all stations combined)

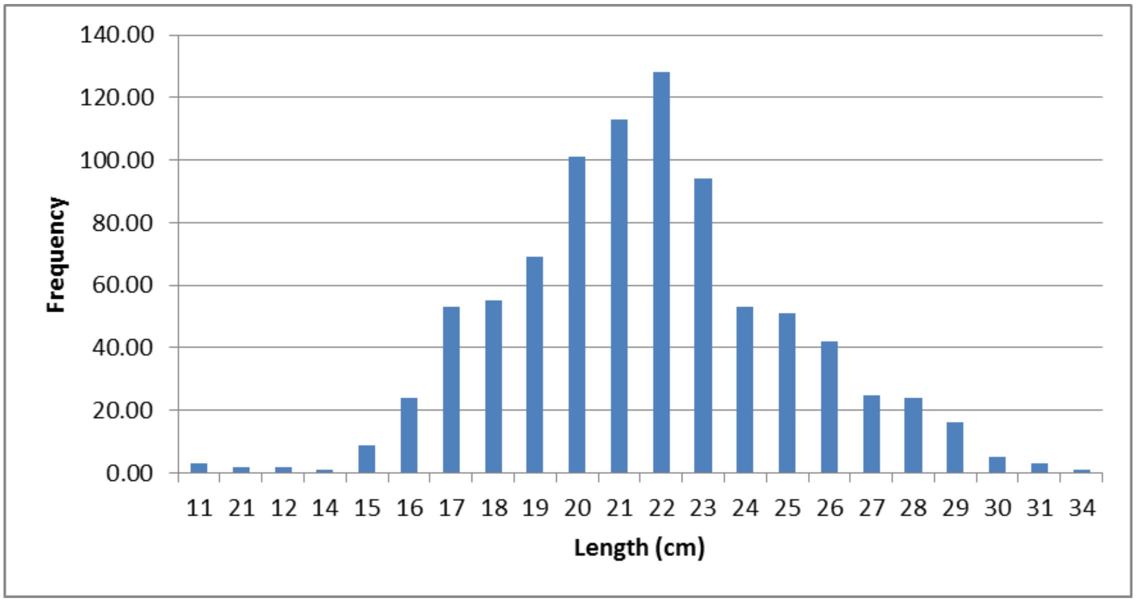


Figure 3b. Length at age graph for scup

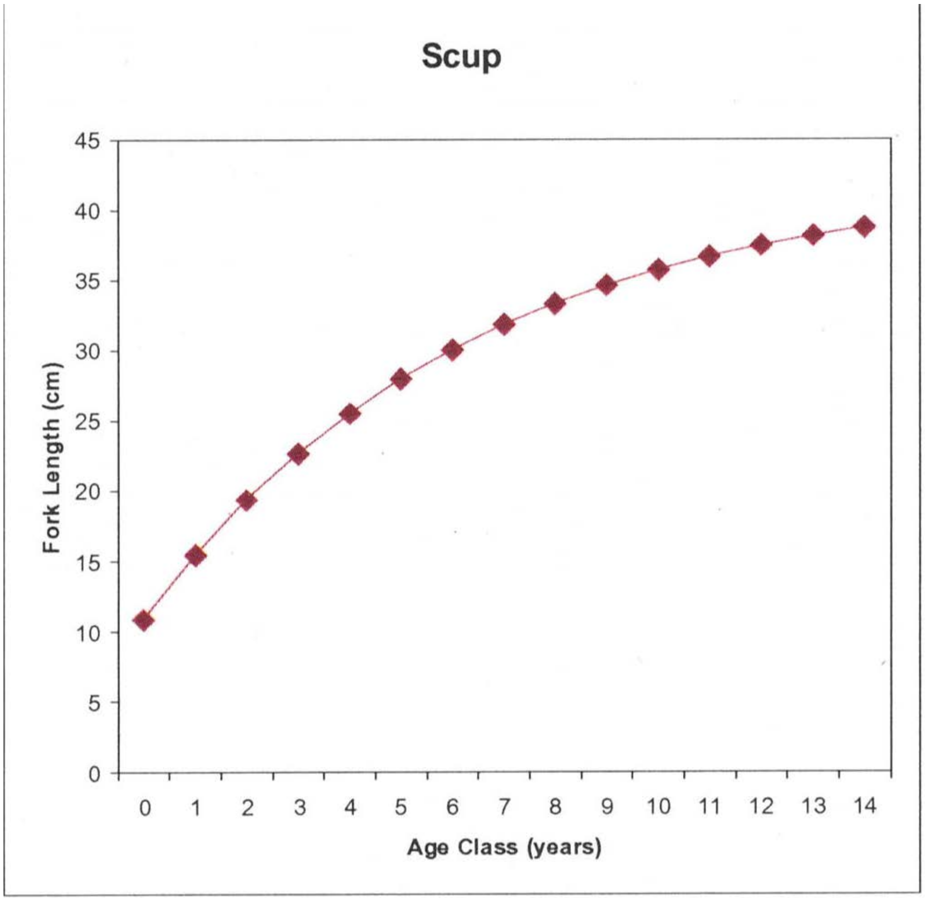


Figure 4a. Length Frequency Histogram for Tautog (all stations combined)

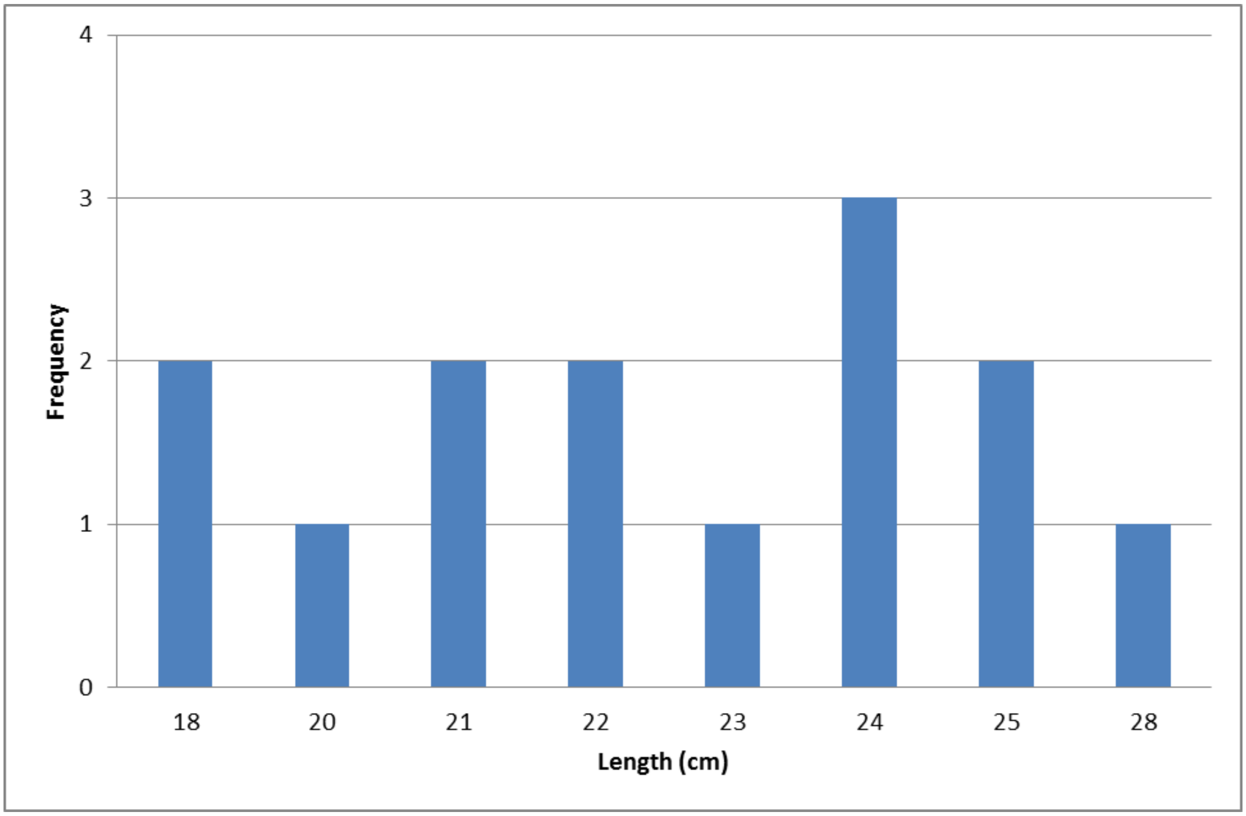


Figure 4b. Length at age graph for tautog

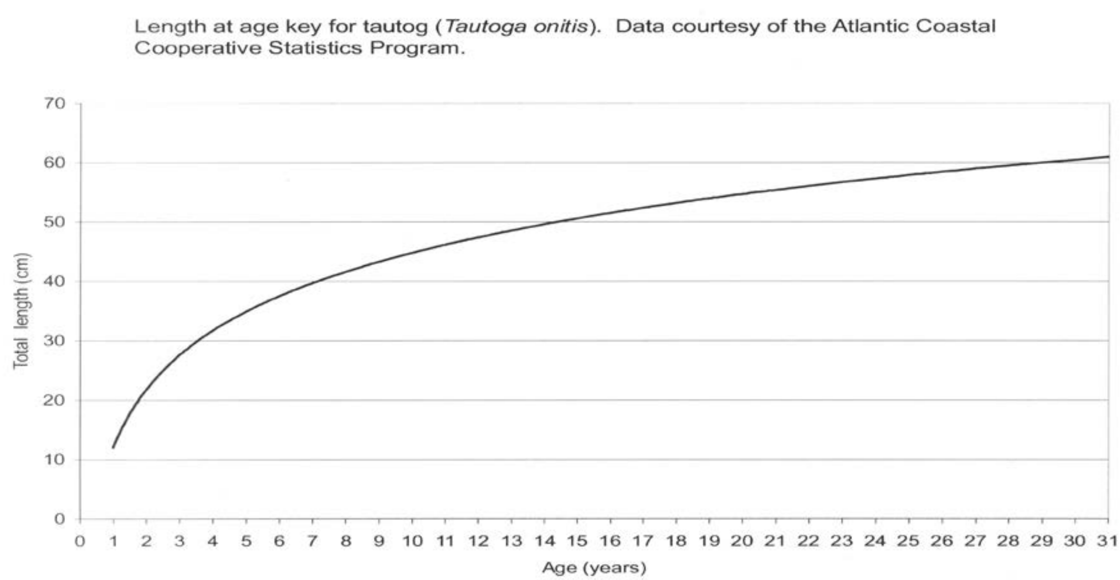


Figure 5. Length Frequency Histogram for Scup by month

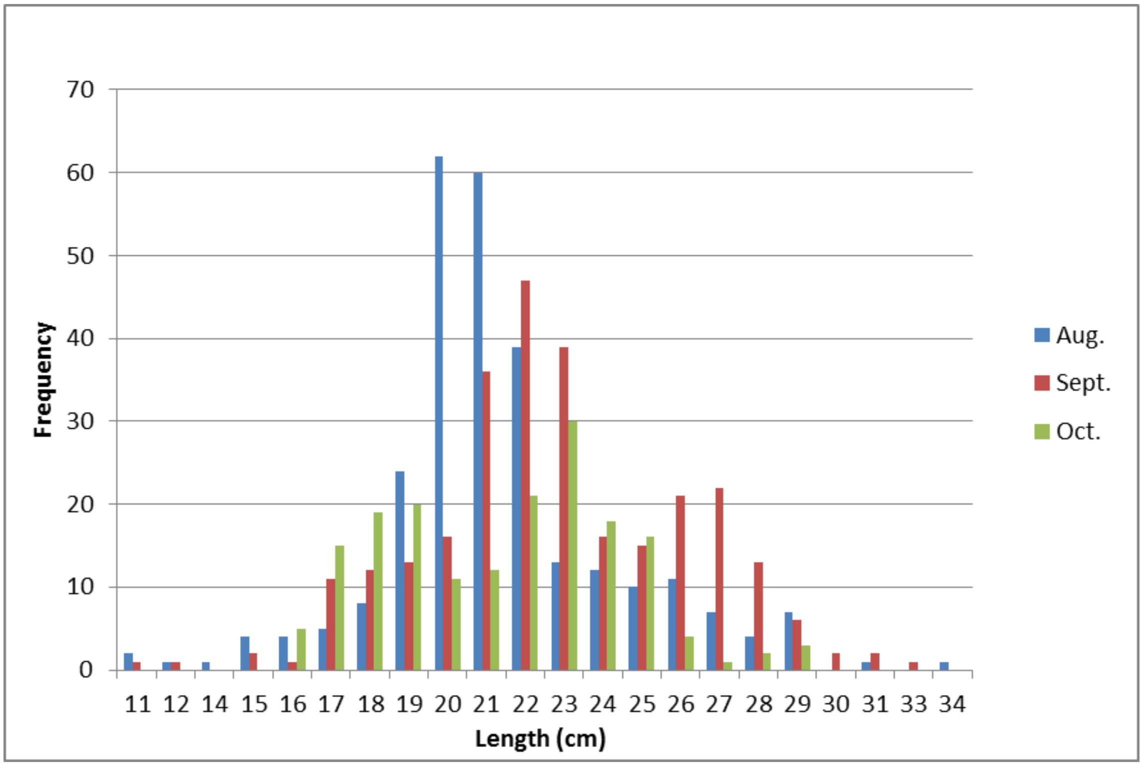


Figure 6. Length Frequency Histogram for Black Sea Bass by month

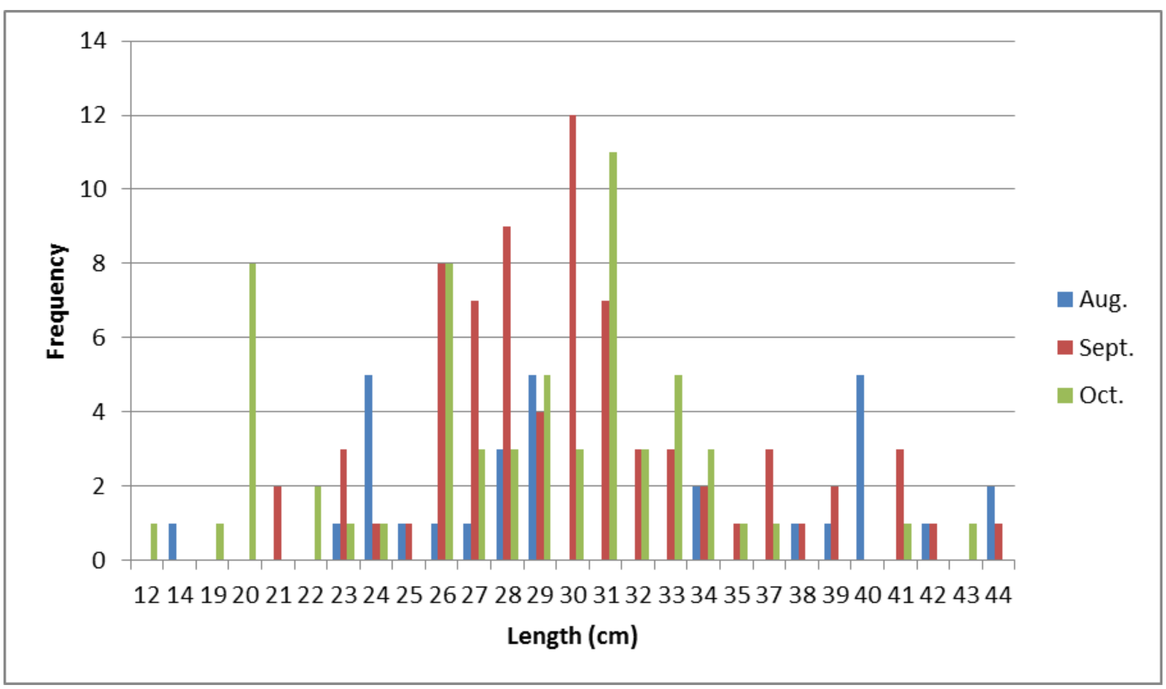


Figure 7. Length Frequency Histogram for Scup from trawls (all stations combined)

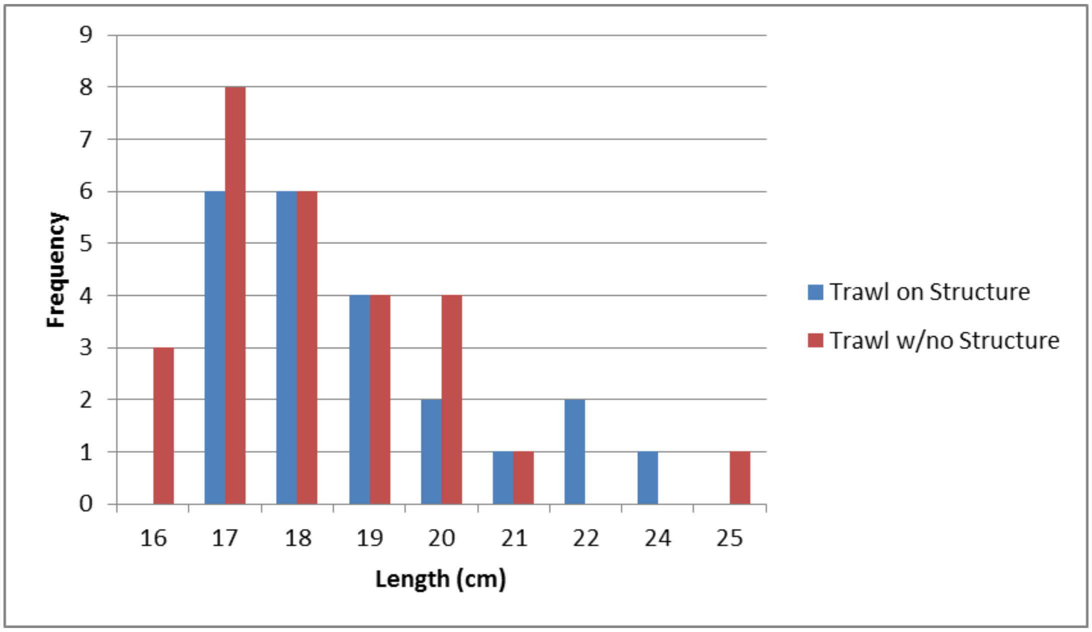


Figure 8. Length Frequency Histogram for Black Sea Bass from trawls (all stations combined)

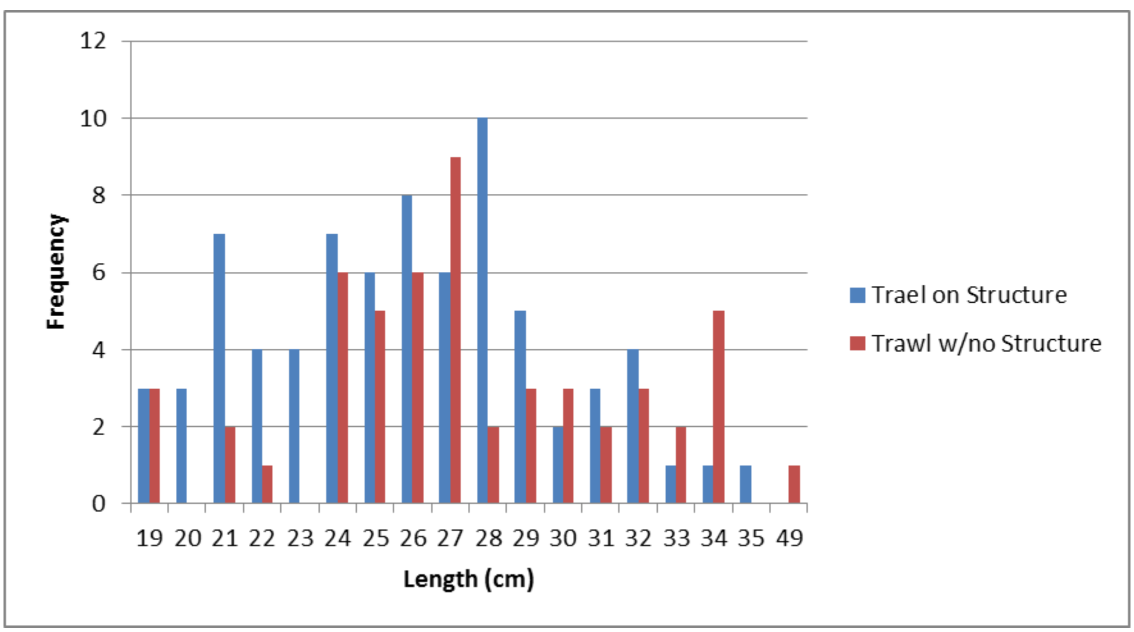
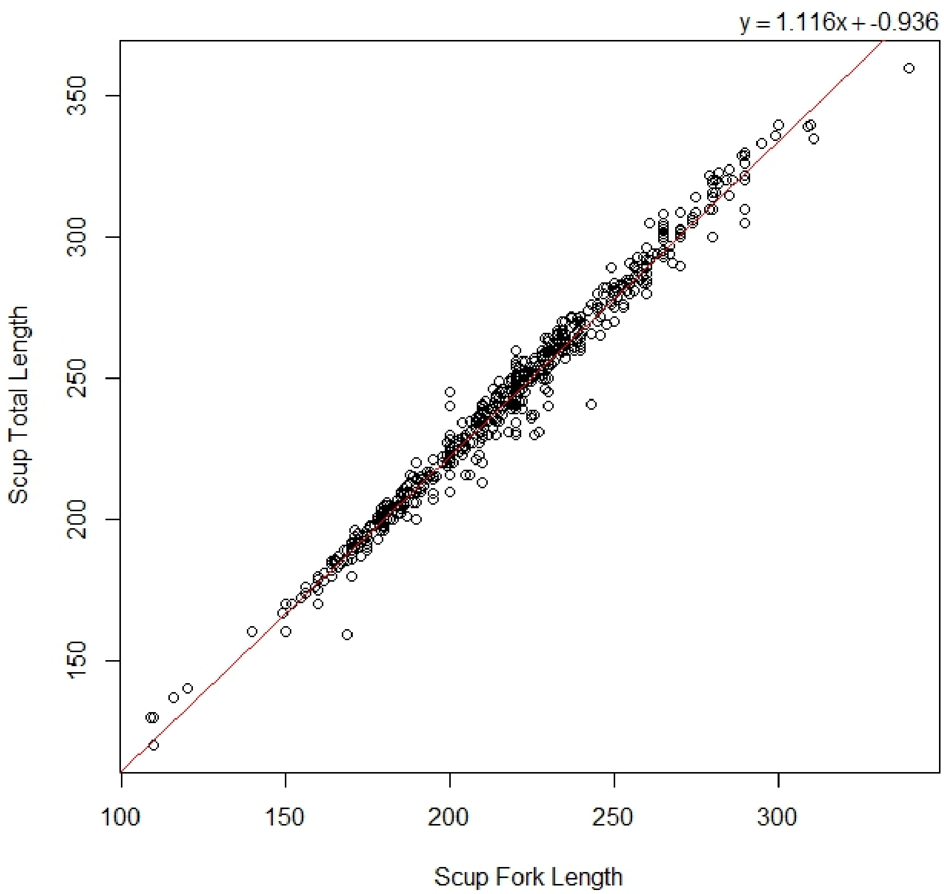


Figure 9. Fork Length vs. Total Length for Scup



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 2014

PERFORMANCE REPORT

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

Project Type: Resource Monitoring

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

Period Covered: January 1, 2013 to December 31, 2013

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

Job Objective: The goal of this project will be to produce a manuscript which will act as a reference text for recreational fishermen, fisheries scientists, and commercial fishermen. 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 stand alone manuscript but also to be compatible with and be a companion volume to the Fresh Water Fishes of Rhode Island

Summary: We conferred with the Fresh water staff and the Federal Aid Coordinator who recently completed the "Inland fisheries of Rhode Island" for advice on putting together this manuscript. As a result, investigators purchased and installed Adobe CS6 Publishing suite in order to begin the project. Additionally, a purchase order was submitted to hire the same scientific illustrator who worked on the aforementioned book for purposes of continuity and integrity. This instrument is still making its' way through the system and should be resolved within several months.

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Target Date: 2014

Status of Project: Behind Schedule

Significant Deviations: Personnel were unable to complete significant amounts of work on this project. They were engaged in getting the project entitled "Narragansett Bay Ventless Pot, Multi-species Monitoring and Assessment Program" up and running.

Recommendations: To continue on into the next segment.

Remarks: Personnel spent the majority of the year engaged in ordering equipment, supplies, rigging said equipment and fishing for scup, black sea bass, and Tautog. When the ventless pot project ended at the end of October, we began populating a table of contents along with various cover pages into Microsoft Publisher. We conferred with Alan Libby and Veronica Masson concerning publishing software, book art, and procedures. At this time, we searched the internet for quotes and worked with the IT section of the Department to purchase and Adobe CS6 suite of programs which should make work on this project more seamless. This product has been installed and personnel are beginning to master its' use. we have been converting the work already completed into PDF files and importing them into "Indesign".

We have also submitted a purchase order for original art, attempting to utilize the same artist that Libby used for "Inland Fisheries of Rhode Island". We await that contract. At which time, investigators will work with the scientific illustrator to produce drawings of the various fish. Life history information will be gathered from various texts and the internet. We will also accompany field projects to photograph various fish for publication Investigators will work with fish trap operators and other industry interests to collect fisheries data both current and historical. Additional grant monies will be secured, e.g. State Wildlife Grant funds, in order to work on non-federal aid species which will be included in the manuscript.