PROGRESS REPORT

FEDERAL AID IN SPORTFISH RESTORATION

Assessment of Recreationally Important Finfish Stocks in Rhode Island Waters.

F-61-R-18

Division of Fish and Wildlife
Marine Section
3 Fort Wetherill Road
Jamestown RI 02835

This program receives Federal financial assistance from the Sprotfish Restoration Program of the U.S. Fish and Wildlife Service.

2011

STATE: **RHODE ISLAND**

PROJECT NUMBER: **F-61-R-18**

PERIOD: **01/01/2010 – 12/31/2010**

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

LIST OF ACTIVE JOBS

JOB 1.

TITLE: Seasonal Fishery Assessment in Rhode Island and Block Island Sound
Job focuses on spring and fall sampling of twenty-six stations in Narragansett Bay, six stations in Rhode Island Sound and 10 stations in Block Island Sound
Principal Investigator: Scott Olszewski

JOB 2.

TITLE: Narragansett Bay Monthly Fishery Assessment
Job focuses on monthly collection of finfish and hydrological data at thirteen fixed stations in Narragansett Bay
Principal Investigator: Scott Olszewski

JOB 3.

TITLE: Young of the Yeat Survey of Selected Rhode Island Coastal Ponds and Embayments
Job focuses on monthly collection of young of the year finfish species in four Rhode Island coastal embayments during spring, summer and fall seasons. The abundance and size composition of spawning adults are also monitored.
Principal Investigator: John Lake

JOB 4.

TITLE: Juvenile Marine Finfish Survey
Job focuses on monitoring juvenile production of marine finfish stocks in Narragansett Bay, Rhode Island, which are subject to recreational fishing. It examines multi-species interactions and identifies and recommends management measures likely to result in optimum production of those species.
Principal Investigator: Jason McNamee

JOB 6.

TITLE: Environmental Assessment Review
Job focuses on the review and evaluation of marine related development and Dredging proposals to evaluate the projects' impact to the marine fisheries and their habitat.
Principal Investigator: Eric Schneider

JOB 7.

TITLE: <u>Evaluation, Monitoring, and Development of Artificial Reefs in Rhode Island.</u>
Job focuses on the evaluation, monitoring, and development of artificial reefs in Rhode Island. The project will continue to monitor the two artificial reefs established by the R.I. Department of Transportation from the debris of the old Jamestown bridge.
Principal Investigator: Nicole Travisono

JOB 8.

TITLE: <u>Sportfish Assessment and Management in Rhode Island Waters</u>

Job focuses on fish stock assessment of important finfish stocks in Rhode Island waters of recreational importance and will provide scientific advice to fisheries managers. The project leader will participate in and comply with the Atlantic States Marine Fisheries Commission plan on interstate management of coastal stocks. Fish stock assessments will be conducted using an array of fish population dynamics models such as Virtual Population Analysis, Multi-Species Virtual Population Analysis, Production models, and other time series analysis.

Principal Investigators: Mark Gibson & Najih Lazar

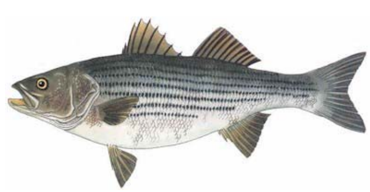
COASTAL FISHERY RESOURCE ASSESSMENT TRAWL SURVEY

PERFORMANCE REPORT
F-61-R SEGMENT 18
JOBS 1 AND 2

Scott D. Olszewski
Principle Marine Fisheries Biologist

Rhode Island Department of Environmental Management
Division of Fish and Wildlife
Marine Fisheries

March 2011



Annual Performance Report

STATE: Rhode Island
PROJECT NUMBER: F-61-R
SEGMENT NUMBER: 18

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, 2010 – December 31, 2010.

PROJECT SUMMARY: Job 1, summary accomplished:

A: 152, twenty minute bottom trawl were successfully completed.

B: Data on weight, length, sex and numbers were gathered on 80 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 2010

SCHEDULE OF PROGRESS: On schedule.

SIGNIFICANT DEVIATIONS: None .

JOB NUMBER: 2

TITLE: Seasonal Fishery Resource Assessment of Narragansett Bay, Rhode Island Sound and Block Island Sound

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

PERIOD COVERED: Spring(April – May)/ Fall (September – October) 2010

PROJECT SUMMARY: Job 2, summary accomplished:

A: 43, twenty minute tows were successfully completed during the Spring 2010 survey (26 NB. – 6 RIS – 11 BIS).

B: 42, twenty minute tow were successfully completed during the Fall 2010 survey (26 NB. – 6 RIS – 10 BIS)

TARGET DATE: DECEMBER 2010.

SCHEDULE OF PROGRESS: On schedule.

SIGNIFICANT DEVIATIONS: None.

JOBS 1 & 2

RECOMMENDATIONS: Continuation of both the Monthly and Seasonal Trawl surveys into 2011, Data provided by these surveys is used extensively in the Atlantic States Marine Fisheries Commission Fishery Management process and Fishery Management Plans. Update survey trawl doors and complete calibration tows to measure possible effects of survey gear changes.

RESULTS AND DISCUSSION: 152 tows were completed during 2010 Job 1. 80 species accounted for a combined weight of 6,084.7 kgs. and 151,576 length measurements being added to the existing Narragansett Bay monthly trawl data set.

By contrast, 85 tows were completed during 2010 Job 2. 64 species accounted for a combined weight of 3,626.1 kgs. and 118,001 length measurements added to the existing seasonal data set.
With the completion of the 2010 surveys, combined survey(s) Jobs (1&2) data now reflects the completion of 5,125 tows, with data collected on 132 species.

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 shore waters, 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), 5,125 tows have been conducted within Rhode Island territorial waters with data collected on 132 species. This performance report reflects the efforts of the 2010 survey year as it relates to the past 30 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 per depth stratum since 1979. With the addition of the Narragansett Bay monthly portion in 1990, an allocation system of fixed and randomly selected stations has been employed depending on the segment 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 42 stations are sampled each season, however this number has ranged from 26 to 72 over the survey time series. The stations sampled in Narragansett Bay are a combination of fixed and random sites. 13 fixed during the monthly portion and 26, (13 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

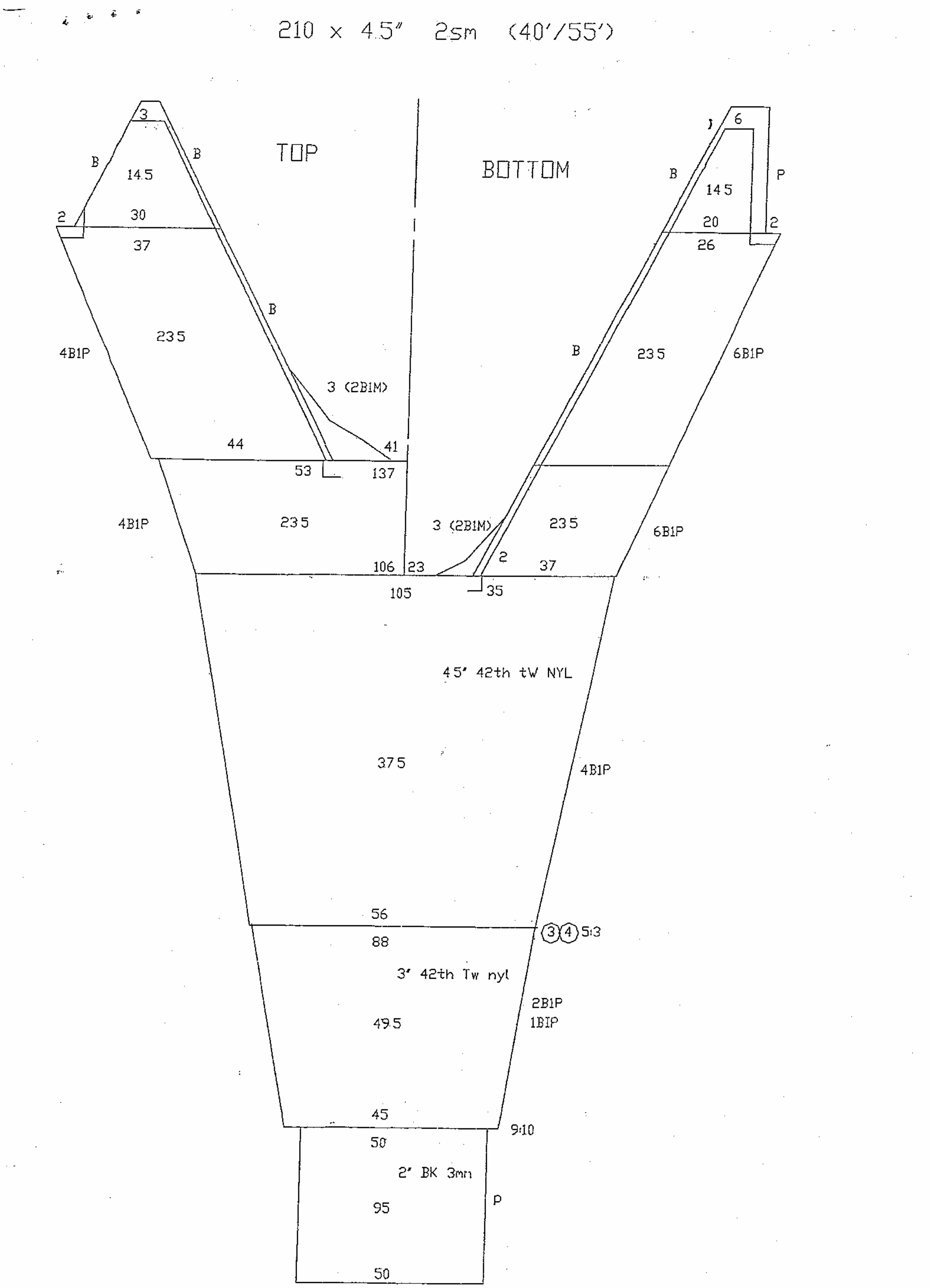
At each station, an otter trawl equipped with a ¼ inch liner is towed for twenty minutes. The Coastal Trawl survey net is 210 x 4.5" , 2 seam (40' / 55'), the twine size is 4.5" and the sweep is 5/16" pc chain, hung 12" spacing, 13 links per space. Figure 1 depicts the RI Coastal Trawl survey net plan. The research vessel used in the Coastal Trawl Survey is the R/V John H. Chafee. The R/V 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, 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.

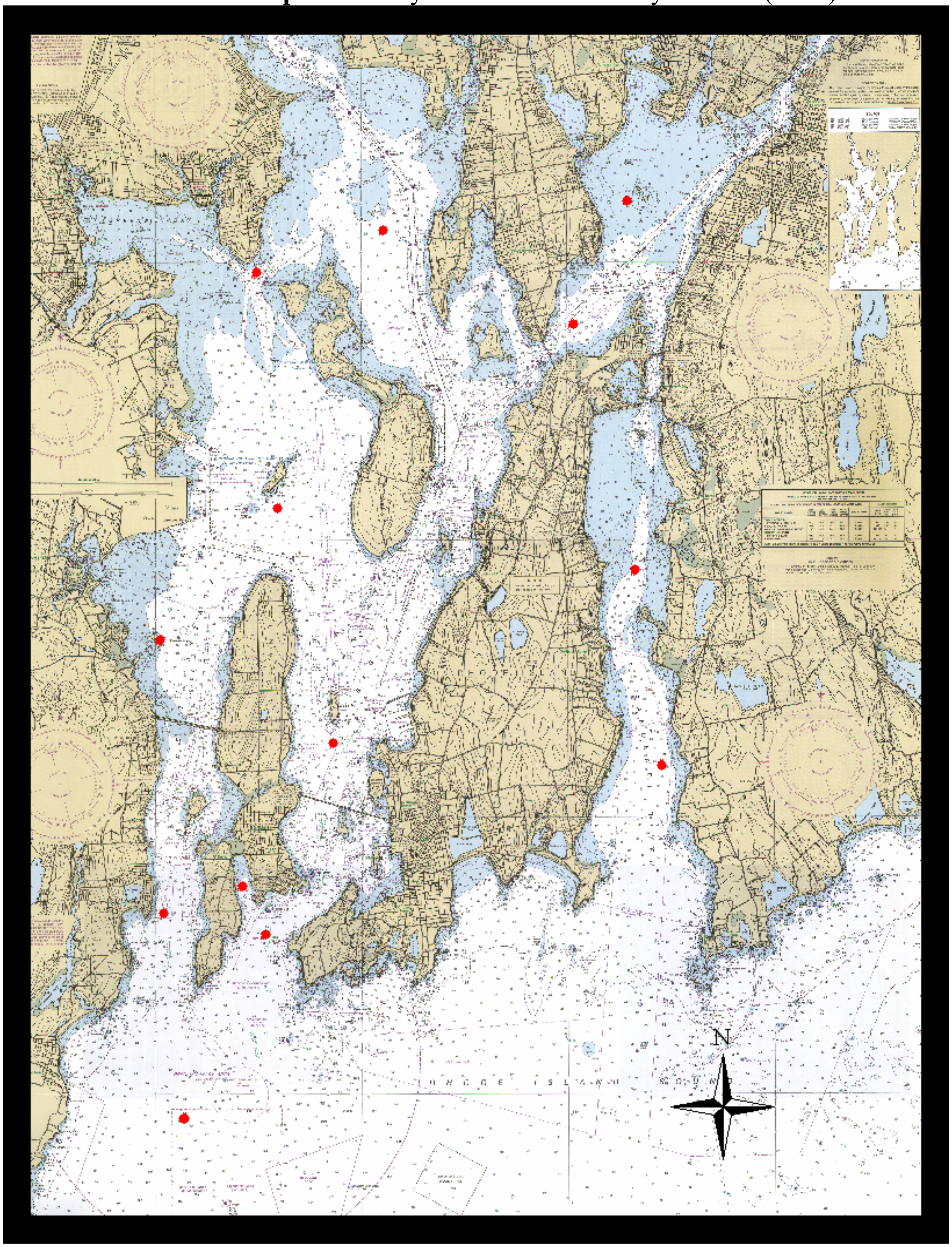
RI Department of Environmental Management
Marine Fisheries Section Research Vessel,
R/V John H. Chafee

Acknowledgements:
Special thanks are again extended to Captain Richard Mello, Associate Captain, Ken Benson, Daniel Costa, Eric Schneider, (Ret) Tim Lynch, seasonal employees, and volunteers.

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
105
6
B
P
14.5
20
2
26
B
235
6B1P
3 (2B1M)
235
6B1P
2
37
35
4.5' 42th tW NYL
375
4B1P
56
88
5:3
3' 42th Tw nyl
2B1P
1BIP
49.5
45
9:10
50
2' BK 3mn
P
95
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 80 species were observed and recorded during the 2010 Narragansett Bay Monthly Trawl Survey totaling 151576 individuals or 997.2 fish per tow. In weight, the catch accounted for 6084.7 kg. or 40.0 kg. per tow. (Figures 2 and 3) The top ten species by number and catch are represented in figures 4 and 5. The change 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	35220
Scup	STENOTOMUS CHRYSOPS	26780
Atlantic Herring	CLUPEA HARENGUS	26601
Butterfish	PEPRILUS TRIACANTHUS	21286
Longfin Squid	LOLIGO PEALEI	18355
Alewife	ALOSA PSEUDOHARENGUS	6160
Atlantic Silverside	MENIDIA MENIDIA	5179
Atlantic Moonfish	SELENE SETAPINNIS	2742
Little Skate	RAJA ERINACEA	1589
American Lobster	HOMARUS AMERICANUS	1164
Spotted Hake	UROPHYCIS REGIA	1139
Winter Flounder	PLEURONECTES AMERICANUS	1130
Silver Hake	MERLUCCIUS BILINEARIS	648
Blue Crab	CALLINECTES SAPIDUS	495
Weakfish	CYNOSCION REGALIS	452
Fourspot Flounder	PARALICHTHYS OBLONGUS	427
Summer Flounder	PARALICHTHYS DENTATUS	374
Bluefish	POMATOMUS SALTATRIX	220
Windowpane Flounder	SCOPHTHALMUS AQUOSUS	163
Red Hake	UROPHYCIS CHUSS	138
Mantis Shrimp	SQUILLA EMPUSA	123
Atlantic Cod	GADUS MORHUA	115
Horseshoe Crab	LIMULUS POLYPHEMUS	102
Black Sea Bass	CENTROPRISTIS STRIATA	87
Northern Searobin	PRIONOTUS CAROLINUS	78
Channeled Whelk	BUSYCOTYPUS CANALICULATUS	78
Pollock	POLLACHIUS VIRENS	74
Tautog	TAUTOGA ONITIS	70
Smooth Dogfish	MUSTELUS CANIS	60
Striped Searobin	PRIONOTUS EVOLANS	58
Grubby	MYOXOCEPHALUS AENAEUS	58
Winter Skate	RAJA OCELLATA	42
Smallmouth Flounder	ETROPUS MICROSTOMUS	42
Longhorn Sculpin	MYOXOCEPHALUS OCTODECEMSPINOS	40
Knobbed Whelk	BUSYCON CARICA	31
Rough Scad	TRACHURUS LATHAMI	26
Northern Pipefish	SYNGNATHUS FUSCUS	25
Spiny Dogfish	SQUALUS ACANTHIAS	24

Blueback Herring	ALOSA AESTIVALIS	17
Atlantic Menhaden	BREVOORTIA TYRANNUS	16
Striped Bass	MORONE SAXATILIS	13
Cunner	TAUTOGOLABRUS ADSPERSUS	13
American Shad	ALOSA SAPIDISSIMA	12
Rock Gunnel	PHOLIS GUNNELLUS	11
Inshore Lizardfish	SYNODUS FOETENS	10
Northern Kingfish	MENTICIRRHUS SAXATILIS	10
White Hake	UROPHYCIS TENUIS	8
Gulfstream Flounder	CITHARICHTHYS ARCTIFRONS	8
Oyster Toadfish	OPSANUS TAU	7
Rainbow Smelt	OSMERUS MORDAX	6
Short Bigeye	PRISTIGENYS ALTA	6
Hogchoker	TRINECTES MACULATUS	5
Atlantic Tomcod	MICROGADUS TOMCOD	4
Northern Sennet	SPHYRAENA BOREALIS	2
American Sand Lance	AMMODYTES AMERICANUS	2
Hickory Shad	ALOSA MEDIOCRIS	2
Conger Eel	CONGER OCEANICUS	2
Gobies	GOBIIDAE	2
Round Scad	DECAPTERUS PUNCTATUS	2
Ocean Pout	MACROZOARCES AMERICANUS	2
Threebeard Rockling	GAIDROPSARUS ENSIS	2
Bluespotted Cornetfish	FISTULARIA TABACARIA	1
Atlantic Torpedo Ray	TORPEDO NOBILIANA	1
Atlantic Mackerel	SCOMBER SCOMBRUS	1
Atlantic Seasnail	LIPARIS ATLANTICUS	1
Sea Raven	HEMITRIPTERUS AMERICANUS	1
Dotterel Filefish	ALUTERUS HEUDELOTI	1
Spot	LEIOSTOMUS XANTHURUS	1
Fawn Cusk-eel	LEPOPHIDIUM PROFUNDORUM	1
Planehead Filefish	MONACANTHUS HISPIDUS	1
Harvestfish	PEPRILUS ALEPIDOTUS	1
Fourbeard Rockling	ENCHELYOPUS CIMBRIUS	1
American Eel	ANGUILLA ROSTRATA	1
Bigeye	PRIACANTHUS ARENATUS	1
Bay Scallop	ARRGOPECTIN IRRADANS	1
Bobtail Squid	ROSSIA MOELLERI	1
Cusk	BROSME BROSME	1
Spotfin Butterflyfish	CHAETODON OCELLATUS	1
Crevalle Jack	CARANX HIPPOS	1
Goosefish	LOPHIUS AMERICANUS	1

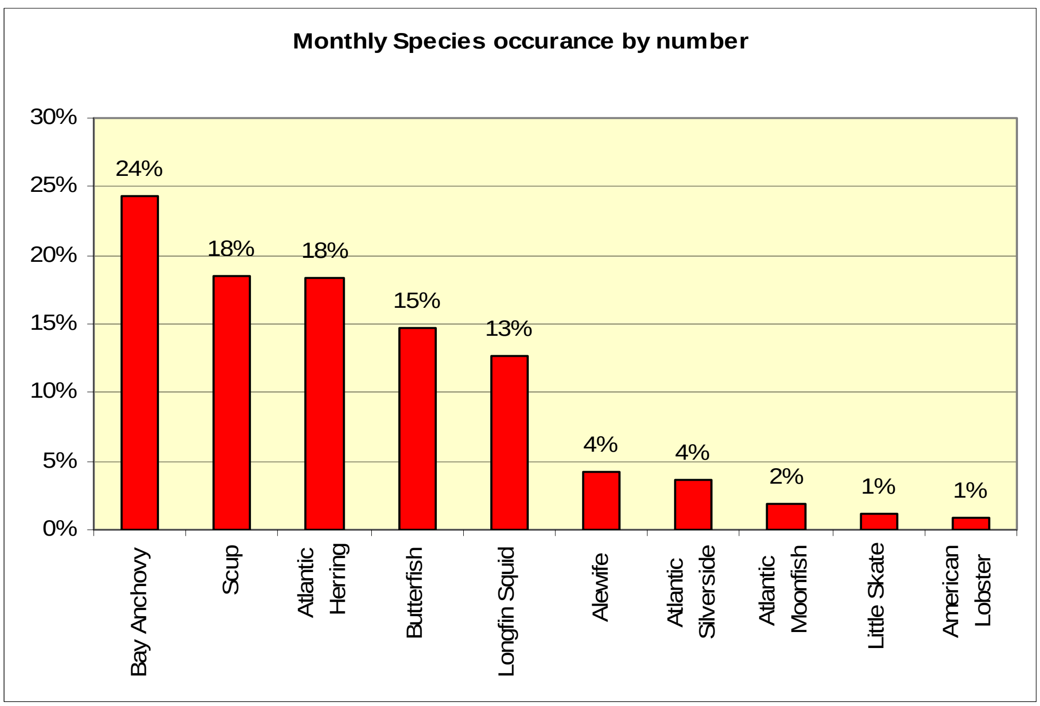
Figure 3 (Total Catch in Kilograms)

Fish Name	Scientific Name	SumOfnTotWeight
Scup	STENOTOMUS CHRYSOPS	1678.354994
Little Skate	Leucoraja erinacea	947.1350057
Butterfish	PEPRILUS TRIACANTHUS	739.3459963
American Lobster	HOMARUS AMERICANUS	374.444998
Summer Flounder	PARALICHTHYS DENTATUS	333.3249988
Atlantic Herring	CLUPEA HARENGUS	261.2722486
Longfin Squid	LOLIGO PEALEI	246.057002
Horseshoe Crab	LIMULUS POLYPHEMUS	226.4299972
Winter Flounder	PLEURONECTES AMERICANUS	218.436
Alewife	ALOSA PSEUDOHARENGUS	127.0719977
Tautog	TAUTOGA ONITIS	105.4560001
Fourspot Flounder	PARALICHTHYS OBLONGUS	93.4249996
Blue Crab	CALLINECTES SAPIDUS	76.38500037
Bay Anchovy	ANCHOA MITCHILLI	72.92800116
Spiny Dogfish	SQUALUS ACANTHIAS	64.79000068
Winter Skate	Leucoraja ocelllata	57.35000086
Smooth Dogfish	MUSTELUS CANIS	45.67500059
Spotted Hake	UROPHYCIS REGIA	43.95700017
Striped Bass	MORONE SAXATILIS	39.9399997
Silver Hake	MERLUCCIUS BILINEARIS	39.78699941
Bluefish	POMATOMUS SALTATRIX	37.92500081
Black Sea Bass	CENTROPRISTIS STRIATA	37.76649983
Windowpane Flounder	SCOPHTHALMUS AQUOSUS	32.99500009
Atlantic Moonfish	SELENE SETAPINNIS	28.83300014
Atlantic Silverside	MENIDIA MENIDIA	27.71499979
Striped Searobin	PRIONOTUS EVOLANS	24.48999983
Weakfish	CYNOSCION REGALIS	16.63000012
Longhorn Sculpin	MYOXOCEPHALUS OCTODECEMSPINOS	15.40000057
Channeled Whelk	BUSYCOTYPUS CANALICULATUS	12.34500009
Atlantic Cod	GADUS MORHUA	11.7282502
Northern Searobin	PRIONOTUS CAROLINUS	8.932000012
Atlantic Torpedo Ray	TORPEDO NOBILIANA	7.840000153
Red Hake	UROPHYCIS CHUSS	7.77799996
Knobbed Whelk	BUSYCON CARICA	3.77999993
Mantis Shrimp	SQUILLA EMPUSA	3.721999962
Ocean Pout	MACROZOARCES AMERICANUS	1.919999957
Oyster Toadfish	OPSANUS TAU	1.910000056
Atlantic Menhaden	BREVOORTIA TYRANNUS	1.582999998
Northern Kingfish	MENTICIRRHUS SAXATILIS	1.535000004
Cunner	TAUTOGOLABRUS ADSPERSUS	0.815000014
Rough Scad	TRACHURUS LATHAMI	0.796000022
Grubby	MYOXOCEPHALUS AENAEUS	0.724000003
Hickory Shad	ALOSA MEDIOCRIS	0.689999998
Smallmouth Flounder	ETROPUS MICROSTOMUS	0.543599997
Conger Eel	CONGER OCEANICUS	0.519999996
American Shad	ALOSA SAPIDISSIMA	0.489999998

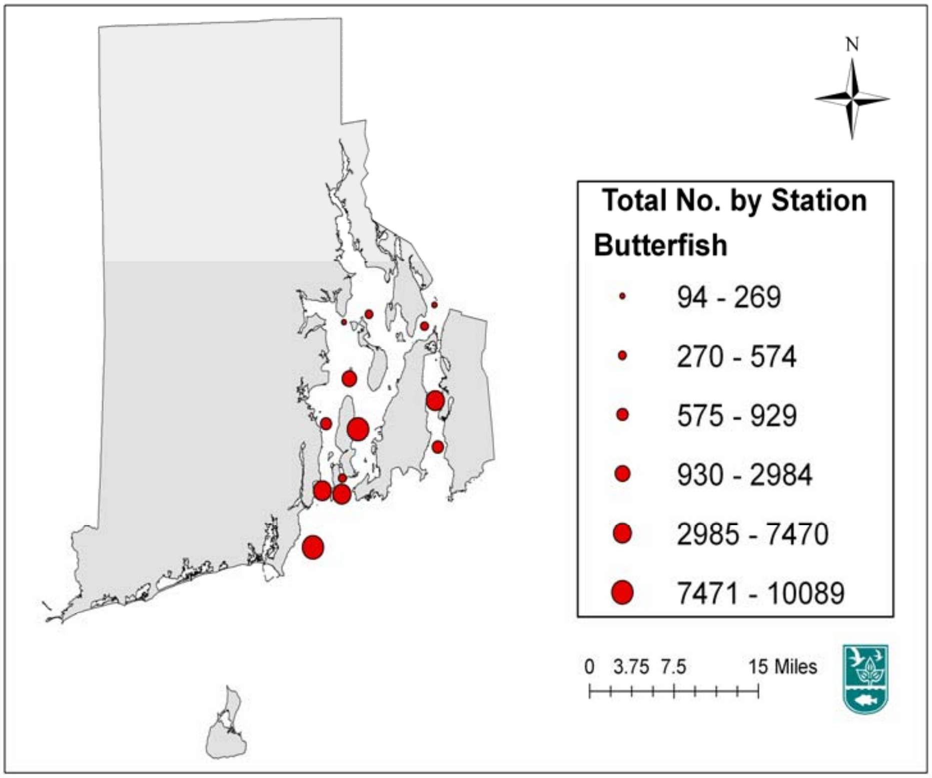
Spot	LEIOSTOMUS XANTHURUS	0.430000007
Sea Raven	HEMITRIPTERUS AMERICANUS	0.430000007
Hogchoker	TRINECTES MACULATUS	0.375000004
Atlantic Mackerel	SCOMBER SCOMBRUS	0.344999999
American Eel	ANGUILLA ROSTRATA	0.270000011
Inshore Lizardfish	SYNODUS FOETENS	0.245000005
Harvestfish	PEPRILUS ALEPIDOTUS	0.194999993
Atlantic Tomcod	MICROGADUS TOMCOD	0.169999996
Rainbow Smelt	OSMERUS MORDAX	0.165000003
Pollock	POLLACHIUS VIRENS	0.16375
Goosefish	LOPHIUS AMERICANUS	0.115000002
Fourbeard Rockling	ENCHELYOPUS CIMBRIUS	0.094999999
Short Bigeye	PRISTIGENYS ALTA	0.079999998
Blueback Herring	ALOSA AESTIVALIS	0.078000002
Gulfstream Flounder	CITHARICHTHYS ARCTIFRONS	0.07
Bluespotted Cornetfish	FISTULARIA TABACARIA	0.07
Rock Gunnel	PHOLIS GUNNELLUS	0.061999999
Cusk	BROSME BROSME	0.050000001
Dotterel Filefish	ALUTERUS HEUDELOTI	0.050000001
Threebeard Rockling	GAIDROPSARUS ENSIS	0.035199999
Northern Sennet	SPHYRAENA BOREALIS	0.035
Bay Scallop	ARRGOPECTIN IRRADANS	0.035
Northern Pipefish	SYNGNATHUS FUSCUS	0.032999999
Bigeye	PRIACANTHUS ARENATUS	0.025
Round Scad	DECAPTERUS PUNCTATUS	0.023
American Sand Lance	AMMODYTES AMERICANUS	0.02
Crevalle Jack	CARANX HIPPOS	0.02
Fawn Cusk-eel	LEPOPHIDIUM PROFUNDORUM	0.015
Planehead Filefish	MONACANTHUS HISPIDUS	0.015
White Hake	UROPHYCIS TENUIS	0.01
Bobtail Squid	ROSSIA MOELLERI	0.01
Spotfin Butterflyfish	CHAETODON OCELLATUS	0.005
Gobies	GOBIIDAE	0.003
Atlantic Seasnail	LIPARIS ATLANTICUS	0.003

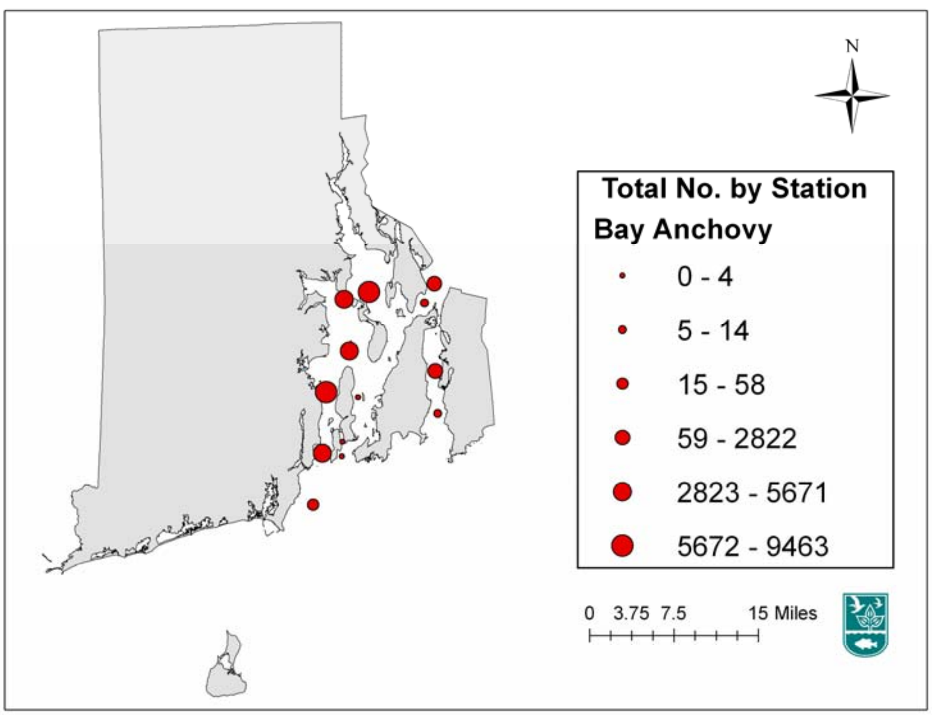
Figure 4 Top Ten Species Catch in Number

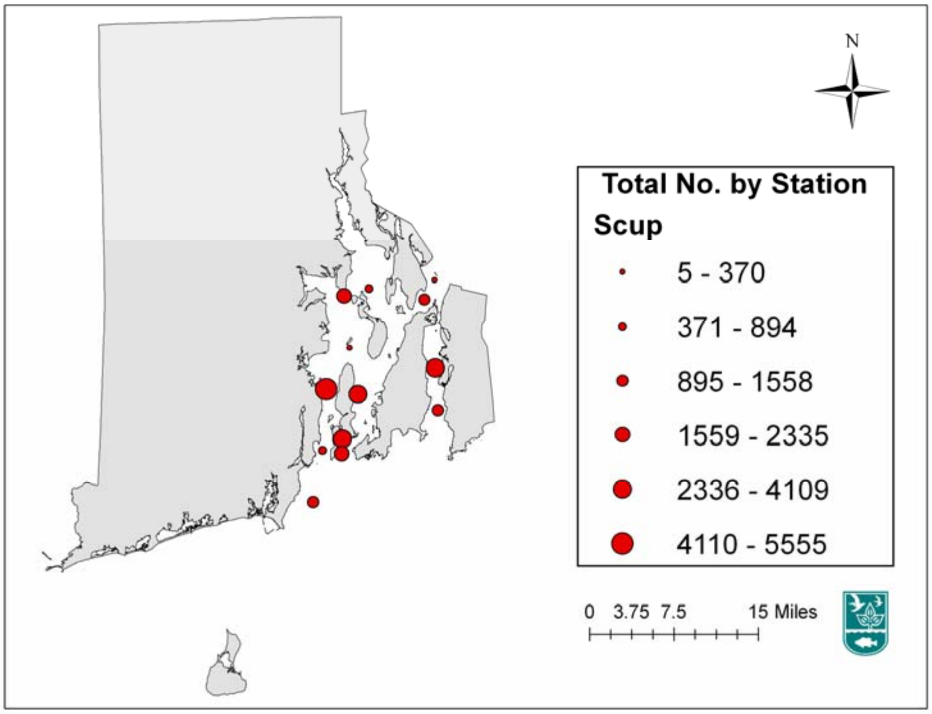
Fish Name	Scientific Name	%
Bay Anchovy	ANCHOA MITCHILLI	24%
Scup	STENOTOMUS CHRYSOPS	18%
Atlantic Herring	CLUPEA HARENGUS	18%
Butterfish	PEPRILUS TRIACANTHUS	15%
Longfin Squid	LOLIGO PEALEI	13%
Alewife	ALOSA PSEUDOHARENGUS	4%
Atlantic Silverside	MENIDIA MENIDIA	4%
Atlantic Moonfish	SELENE SETAPINNIS	2%
Little Skate	LEUCORAJA ERINACEA	1%
American Lobster	HOMARUS AMERICANUS	1%

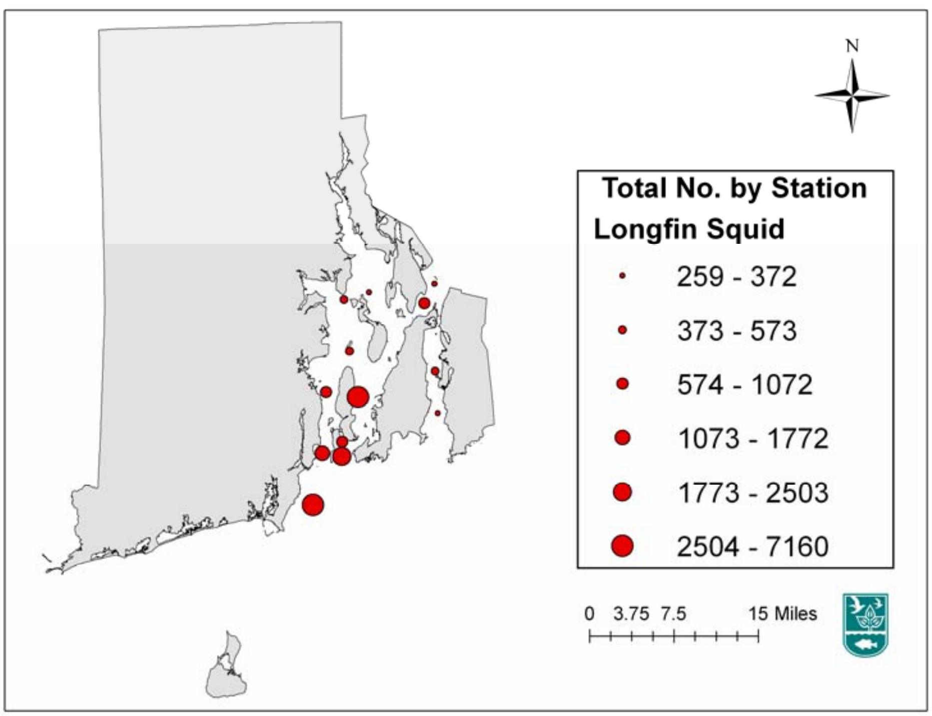


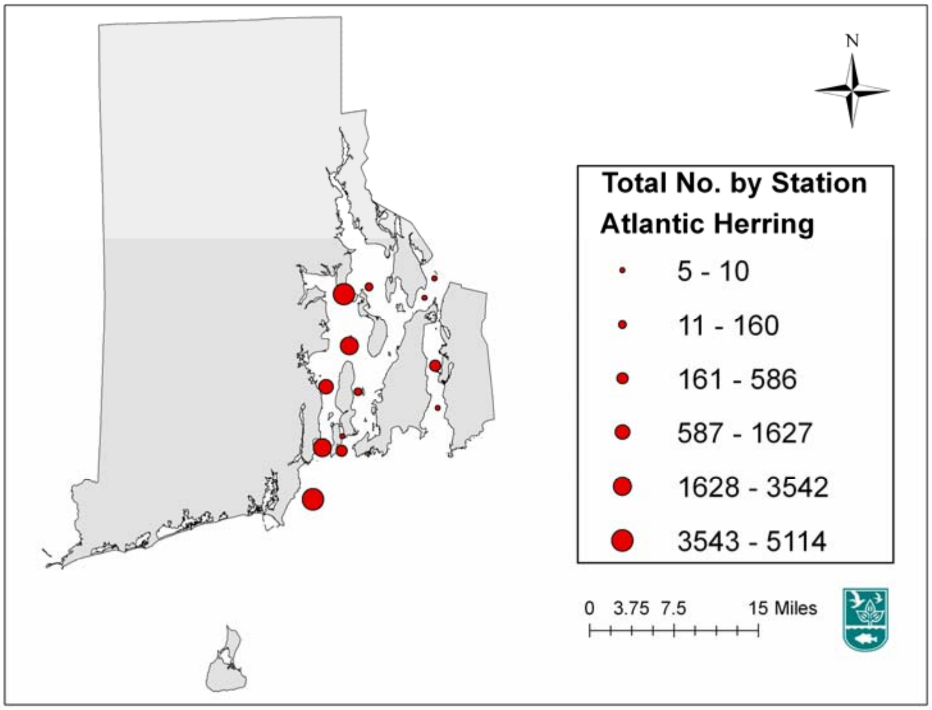
Maps 2 – 11 Top 10 species catch by area in the Narragansett Bay Monthly Coastal Trawl Survey

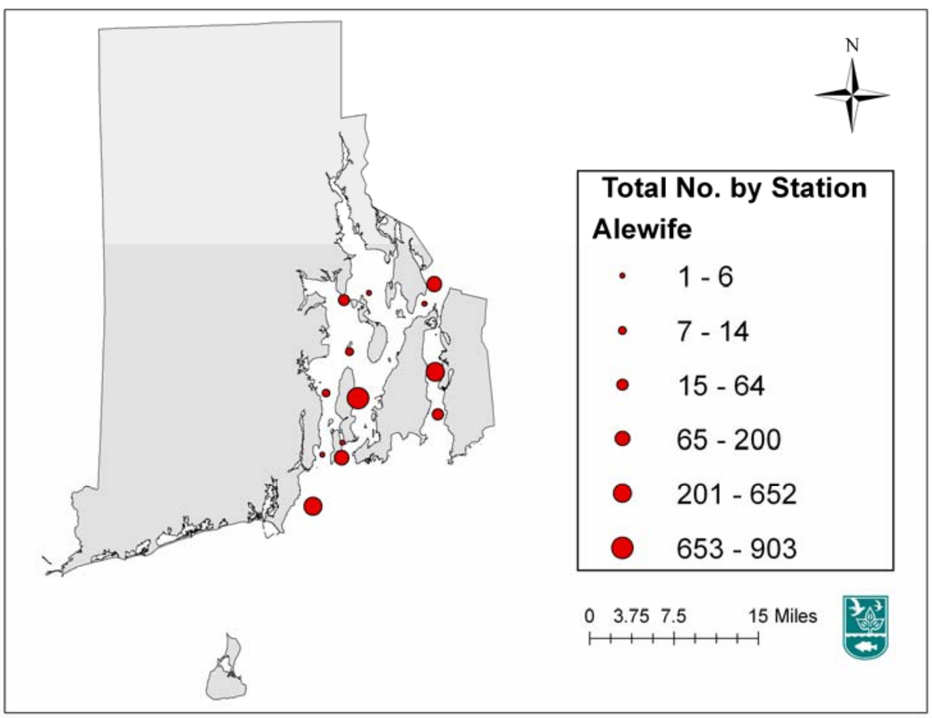


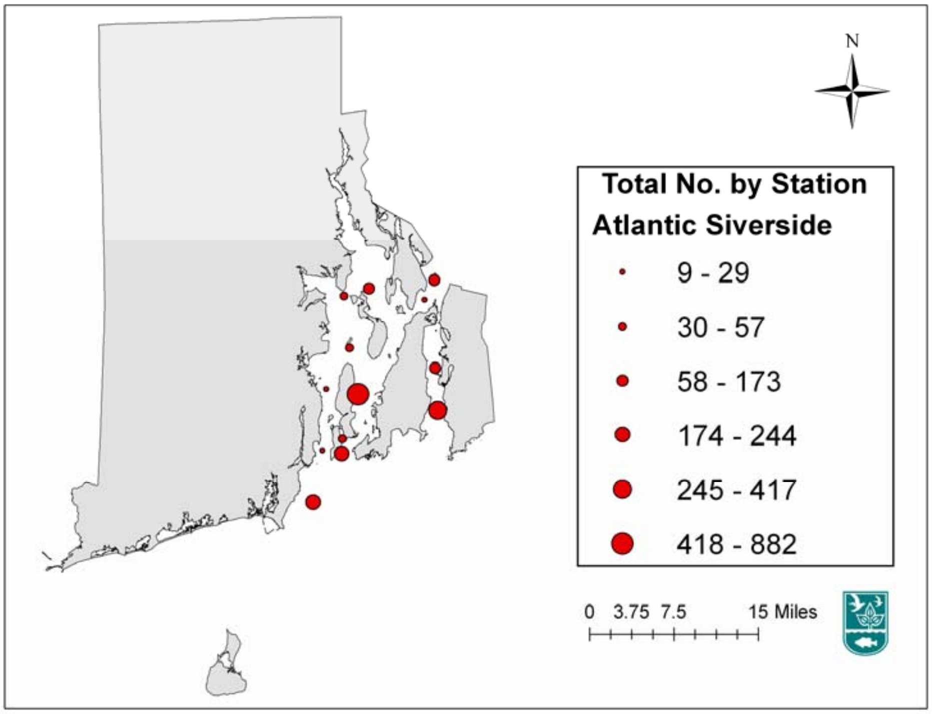


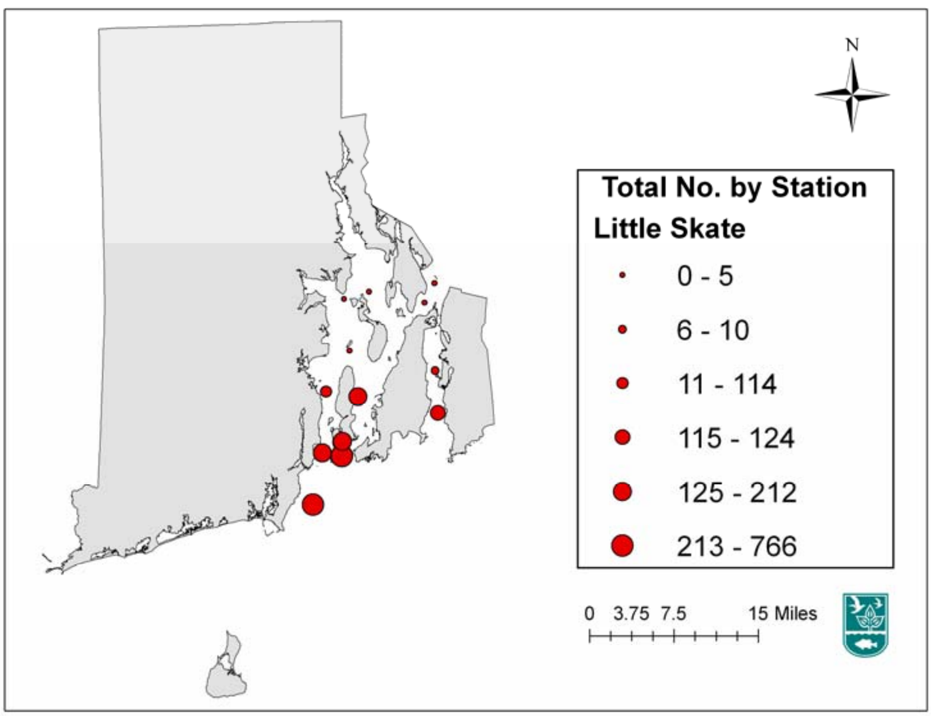

N
Total No. by Station
Scup
5 - 370
371 - 894
895 - 1558
1559 - 2335
2336 - 4109
4110 - 5555
0 3.75 7.5 15 Miles

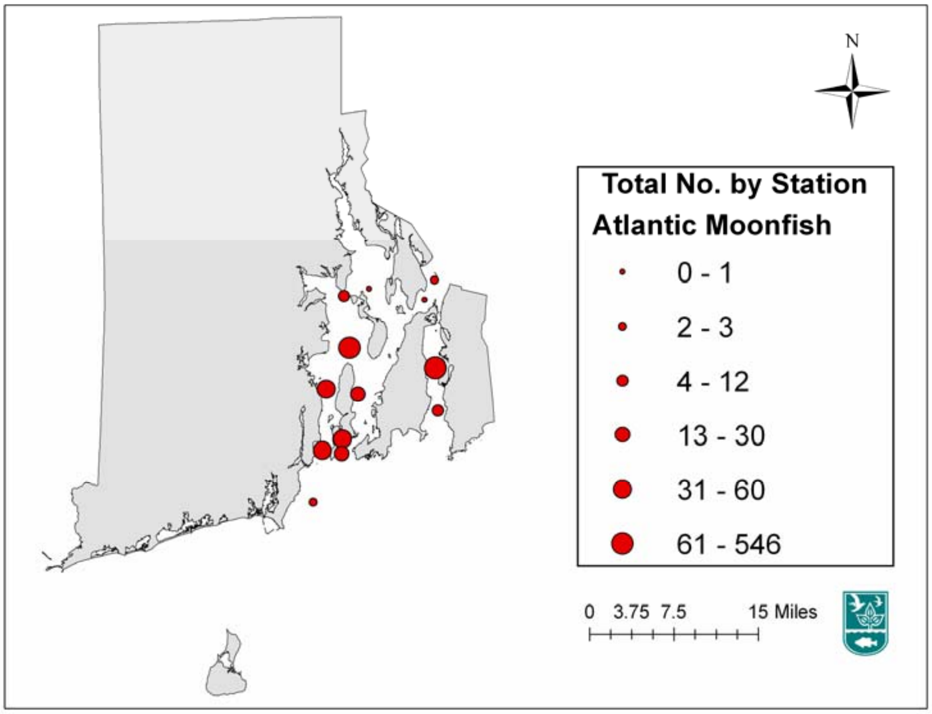

N
Total No. by Station
Longfin Squid
259 - 372
373 - 573
574 - 1072
1073 - 1772
1773 - 2503
2504 - 7160
0 3.75 7.5 15 Miles

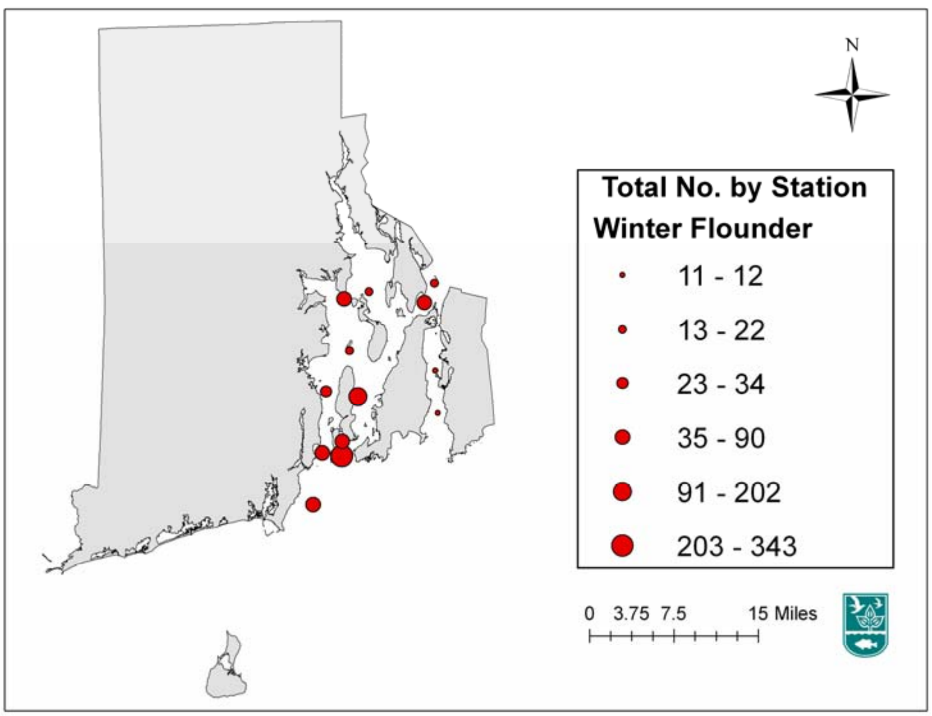

N
Total No. by Station
Atlantic Herring
5 - 10
11 - 160
161 - 586
587 - 1627
1628 - 3542
3543 - 5114
0 3.75 7.5 15 Miles

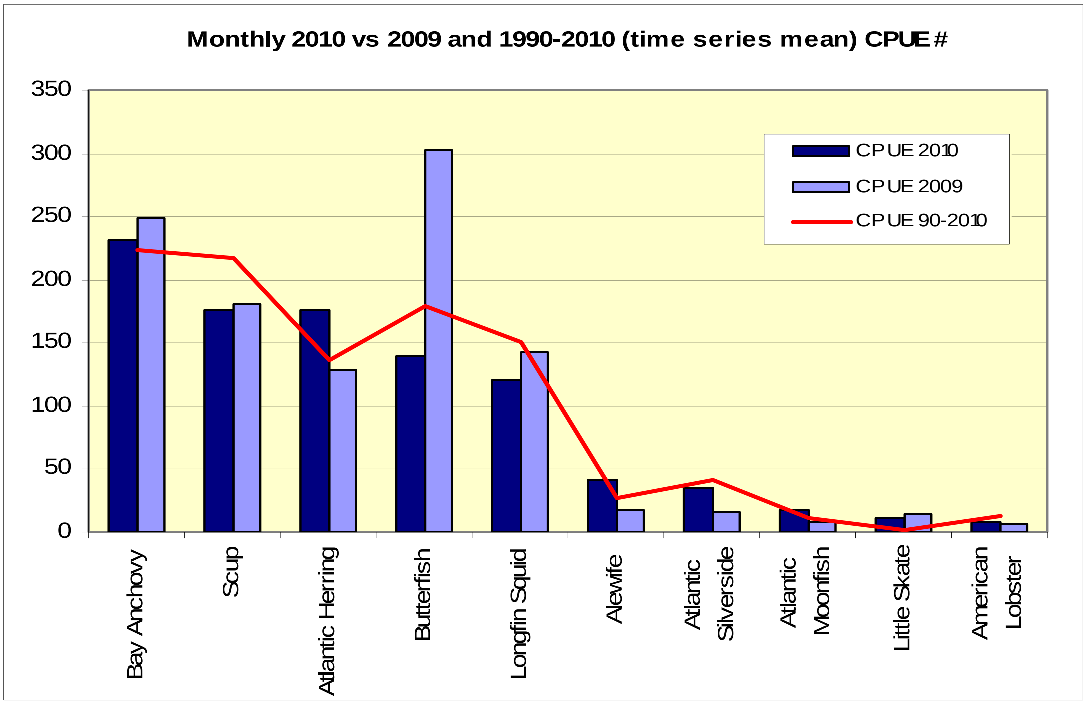

N
Total No. by Station
Alewife
1 - 6
7 - 14
15 - 64
65 - 200
201 - 652
653 - 903
0 3.75 7.5 15 Miles


N
Total No. by Station
Atlantic Siverside
9 - 29
30 - 57
58 - 173
174 - 244
245 - 417
418 - 882
0 3.75 7.5 15 Miles


N
Total No. by Station
Little Skate
0 - 5
6 - 10
11 - 114
115 - 124
125 - 212
213 - 766
0 3.75 7.5 15 Miles


N
Total No. by Station
Atlantic Moonfish
0 - 1
2 - 3
4 - 12
13 - 30
31 - 60
61 - 546
0 3.75 7.5 15 Miles

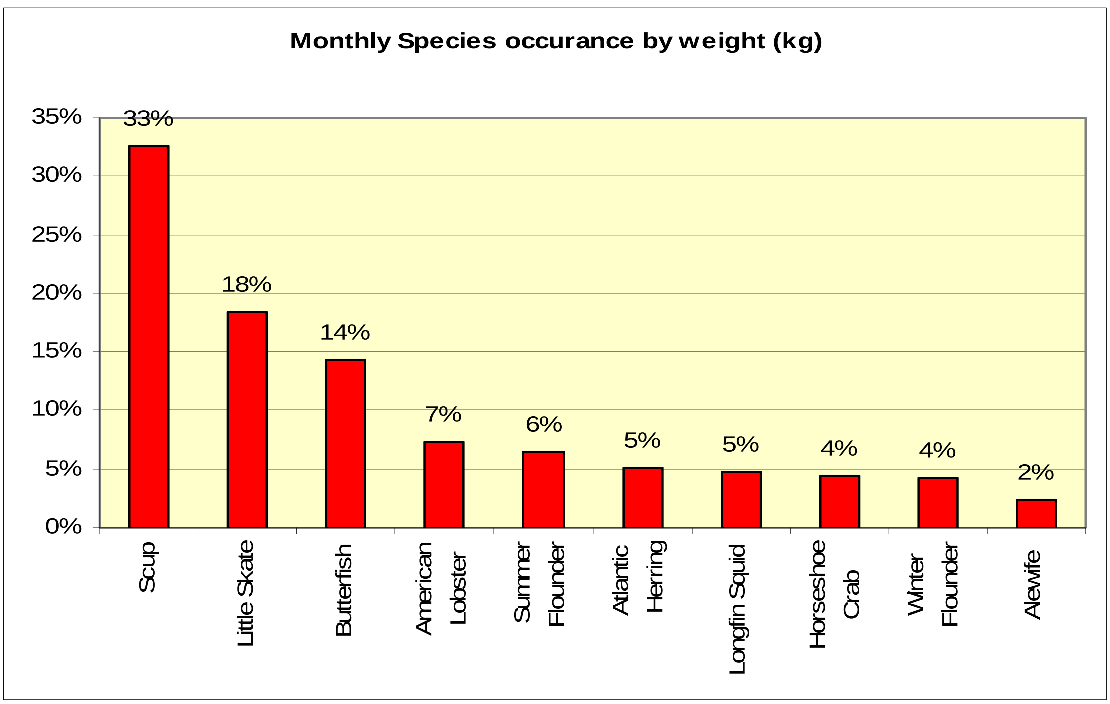

N
Total No. by Station
Winter Flounder
11 - 12
13 - 22
23 - 34
35 - 90
91 - 202
203 - 343
0 3.75 7.5 15 Miles

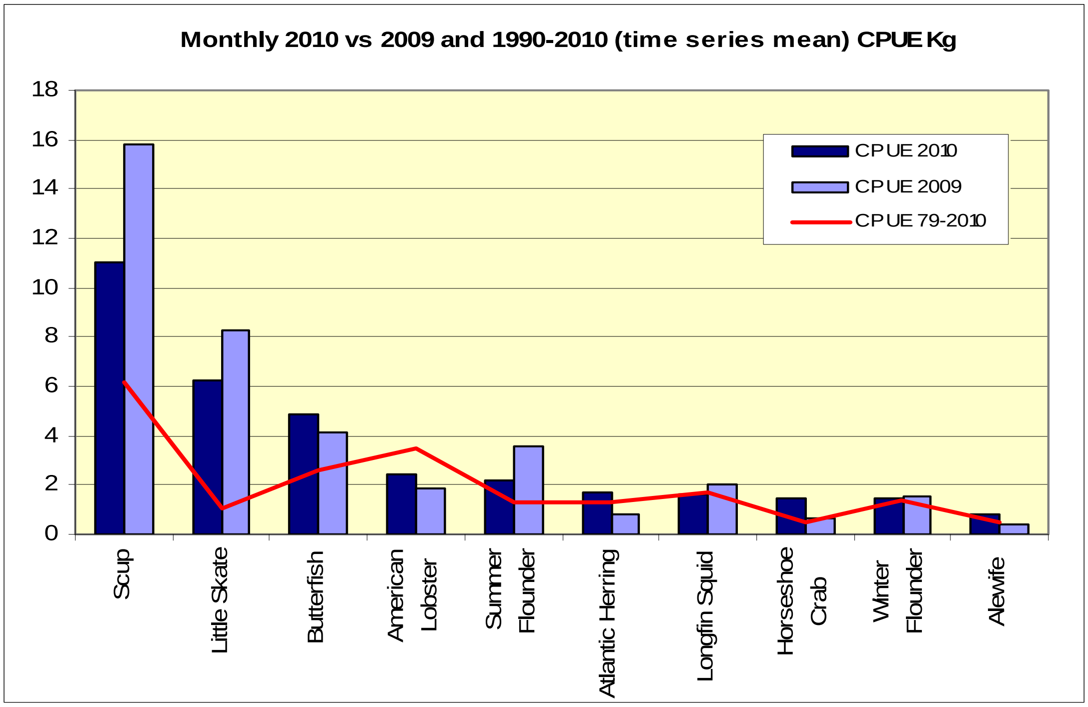


Monthly 2010 vs 2009 and 1990-2010 (time series mean) CPUE #
350
300
250
200
150
100
50
0
CPUE 2010
CPUE 2009
CPUE 90-2010
Bay Anchovy
Scup
Atlantic Herring
Butterfish
Longfin Squid
Alewife
Atlantic Silverside
Atlantic Moonfish
Little Skate
American Lobster

Figure 5 Top Ten Species Catch in Kilograms

Fish Name	Scientific Name	%
Scup	STENOTOMUS CHRYSOPS	33%
Little Skate	LEUCORAJA ERINACEA	18%
Butterfish	PEPRILUS TRIACANTHUS	14%
American Lobster	HOMARUS AMERICANUS	7%
Summer Flounder	PARALICHTHYS DENTATUS	6%
Atlantic Herring	CLUPEA HARENGUS	5%
Longfin Squid	LOLIGO PEALEI	5%
Horseshoe Crab	LIMULUS POLYPHEMUS	4%
Winter Flounder	PLEURONECTES AMERICANUS	4%
Alewife	ALOSA PSEUDOHARENGUS	2%



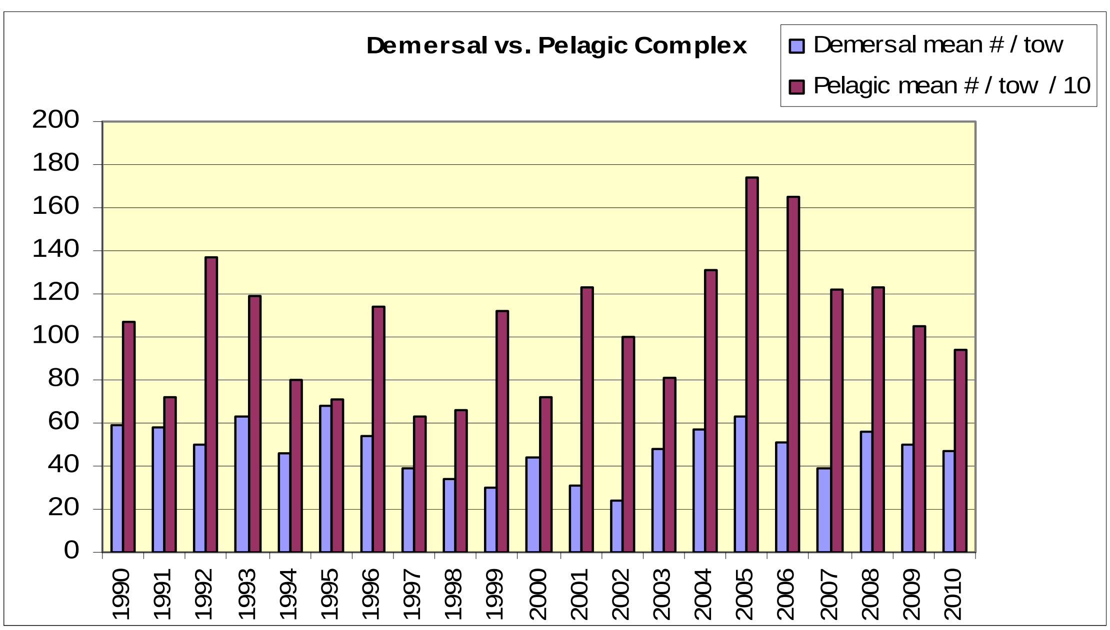

Monthly 2010 vs 2009 and 1990-2010 (time series mean) CPUE Kg
18
16
14
12
10
8
6
4
2
0
CPUE 2010
CPUE 2009
CPUE 79-2010
Scup
Little Skate
Butterfish
American Lobster
Summer Flounder
Atlantic Herring
Longfin Squid
Horseshoe Crab
Winter Flounder
Alewife

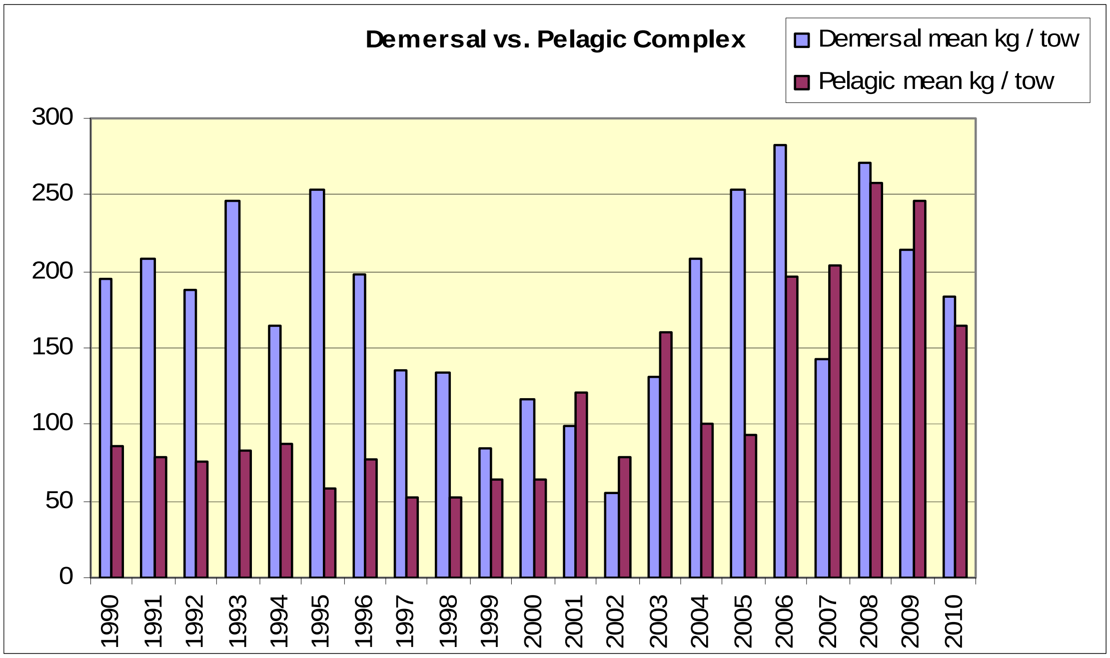
Demersal vs. Pelagic Species Complex

Demersal Species
Smooth Dogfish
Spiny Dogfish
Skates
Silver Hake
Red Hake
Spotted Hake
Summer Flounder
4 Spot Flounder
Winter Flounder
Windowpane Flounder
Hog Choker
Longhorn Sculpin
Sea Raven
Northern Searobin
Striped Searobin
Cunner
Tautog
Ocean Pout
Goosefish
Lobster

Pelagic/Multi-Habitat Species
Atlantic Herring
Alewife
Blueback Herring
Shad
Menhaden
Bay Anchovy
Rainbow Smelt
Silverside
Butterfish
Atlantic Moonfish
Bluefish
Striped Bass
Black Sea Bass
Scup
Weakfish
Longfin Squid

Figure 6 and 7

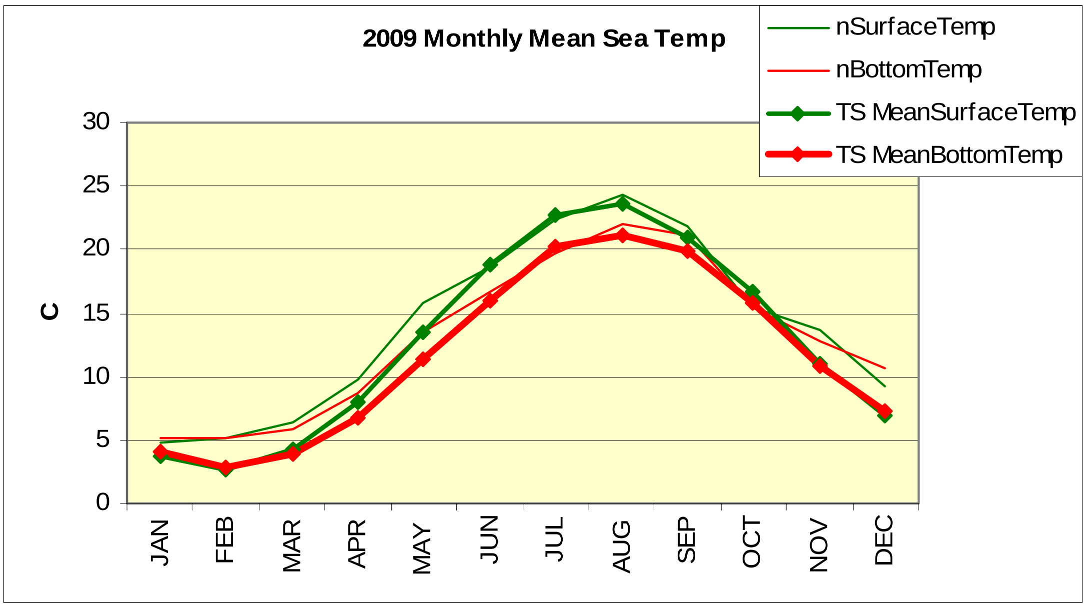


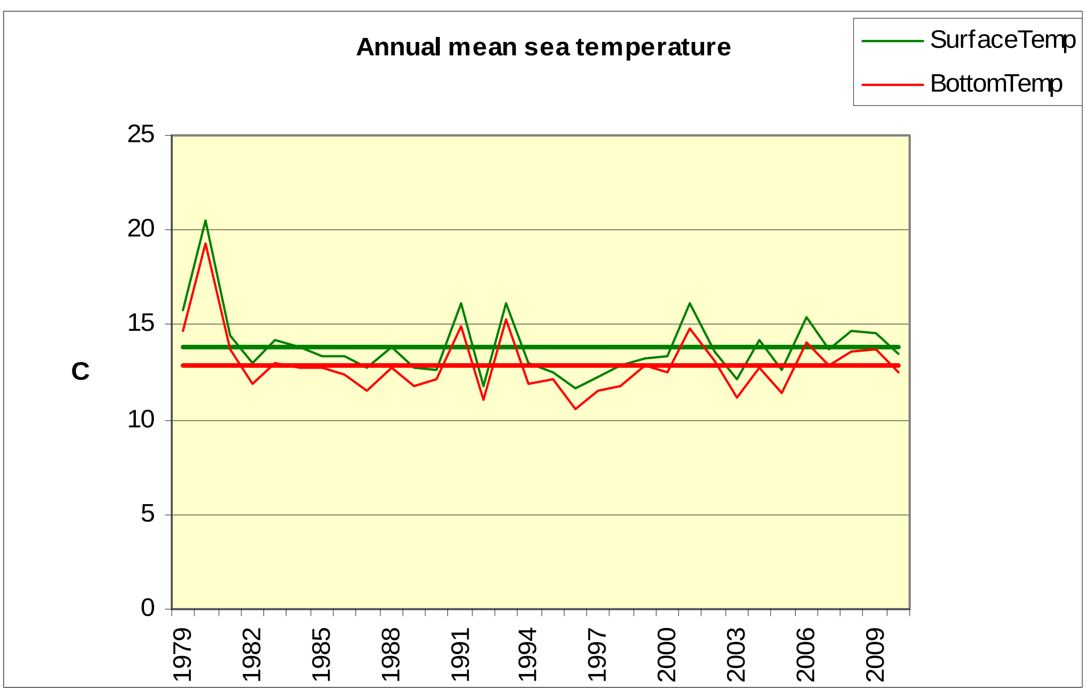


Demersal vs. Pelagic Complex
Demersal mean kg / tow
Pelagic mean kg / tow
300
250
200
150
100
50
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010

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, 10 fixed stations in Block Island Sound.

63 species were observed and recorded during the 2010 Rhode Island Seasonal Trawl Survey, totaling 118001 individuals or 1388.24 fish per tow. In weight, the catch accounted for 3626.2 kg. or 42.7 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
Bay Anchovy	ANCHOA MITCHILLI	44221
Scup	STENOTOMUS CHRYSOPS	32018
Butterfish	PEPRILUS TRIACANTHUS	18379
Longfin Squid	LOLIGO PEALEI	11782
Atlantic Moonfish	SELENE SETAPINNIS	2352
Atlantic Herring	CLUPEA HARENGUS	1737
Little Skate	LEUCORAJA ERINACEA	1435
Alewife	ALOSA PSEUDOHARENGUS	739
Atlantic Cod	GADUS MORHUA	724
Bluefish	POMATOMUS SALTATRIX	584
Winter Flounder	PLEURONECTES AMERICANUS	583
Silver Hake	MERLUCCIUS BILINEARIS	519
Blue Crab	CALLINECTES SAPIDUS	435
Spotted Hake	UROPHYCIS REGIA	384
Weakfish	CYNOSCION REGALIS	334
Rough Scad	TRACHURUS LATHAMI	300
Summer Flounder	PARALICHTHYS DENTATUS	225
American Lobster	HOMARUS AMERICANUS	206
American Sand Lance	AMMODYTES AMERICANUS	185
Northern Searobin	PRIONOTUS CAROLINUS	152
Winter Skate	LEUCORAJA OCELLATA	81
Windowpane Flounder	SCOPHTHALMUS AQUOSUS	80
Horseshoe Crab	LIMULUS POLYPHEMUS	73
Black Sea Bass	CENTROPRISTIS STRIATA	63
Red Hake	UROPHYCIS CHUSS	47
Longhorn Sculpin	MYOXOCEPHALUS OCTODECEMSPINOS	46
Round Scad	DECAPTERUS PUNCTATUS	39
Channeled Whelk	BUSYCOTYPUS CANALICULATUS	38
Striped Searobin	PRIONOTUS EVOLANS	34
Smallmouth Flounder	ETROPUS MICROSTOMUS	25
Smooth Dogfish	MUSTELUS CANIS	20
Tautog	TAUTOGA ONITIS	20
Clearnose Skate	RAJA EGLANTERIA	12
Fourspot Flounder	PARALICHTHYS OBLONGUS	11
Mantis Shrimp	SQUILLA EMPUSA	11

Northern Kingfish	MENTICIRRHUS SAXATILIS	10
Knobbed Whelk	BUSYCON CARICA	9
Atlantic Silverside	MENIDIA MENIDIA	8
Striped Bass	MORONE SAXATILIS	7
Cunner	TAUTOGOLABRUS ADSPERSUS	7
Grubby	MYOXOCEPHALUS AENAEUS	7
Ocean Pout	MACROZOARCES AMERICANUS	6
Crevalle Jack	CARANX HIPPOS	6
Bigeye	PRIACANTHUS ARENATUS	6
Oyster Toadfish	OPSANUS TAU	5
Sea Raven	HEMITRIPTERUS AMERICANUS	4
Inshore Lizardfish	SYNODUS FOETENS	4
Northern Sennet	SPHYRAENA BOREALIS	4
American Shad	ALOSA SAPIDISSIMA	3
Bluespotted Cornetfish	FISTULARIA TABACARIA	2
Striped Cusk Eel	OPHIDION MARGINATUM	2
Northern Puffer	SPHOEROIDES MACULATUS	2
Sea Scallop	PLACOPECTEN MAGELLANICUS	2
Atlantic Menhaden	BREVOORTIA TYRANNUS	2
Northern Pipefish	SYNGNATHUS FUSCUS	2
Hickory Shad	ALOSA MEDIOCRIS	1
American Eel	ANGUILLA ROSTRATA	1
Fourbeard Rockling	ENCHELYOPUS CIMBRIUS	1
Blueback Herring	ALOSA AESTIVALIS	1
Rainbow Smelt	OSMERUS MORDAX	1
Short Bigeye	PRISTIGENYS ALTA	1
Red Snapper	LUTJANUS CAMPECHANUS	1
Atlantic Tomcod	MICROGADUS TOMCOD	1
White Hake	UROPHYCIS TENUIS	1

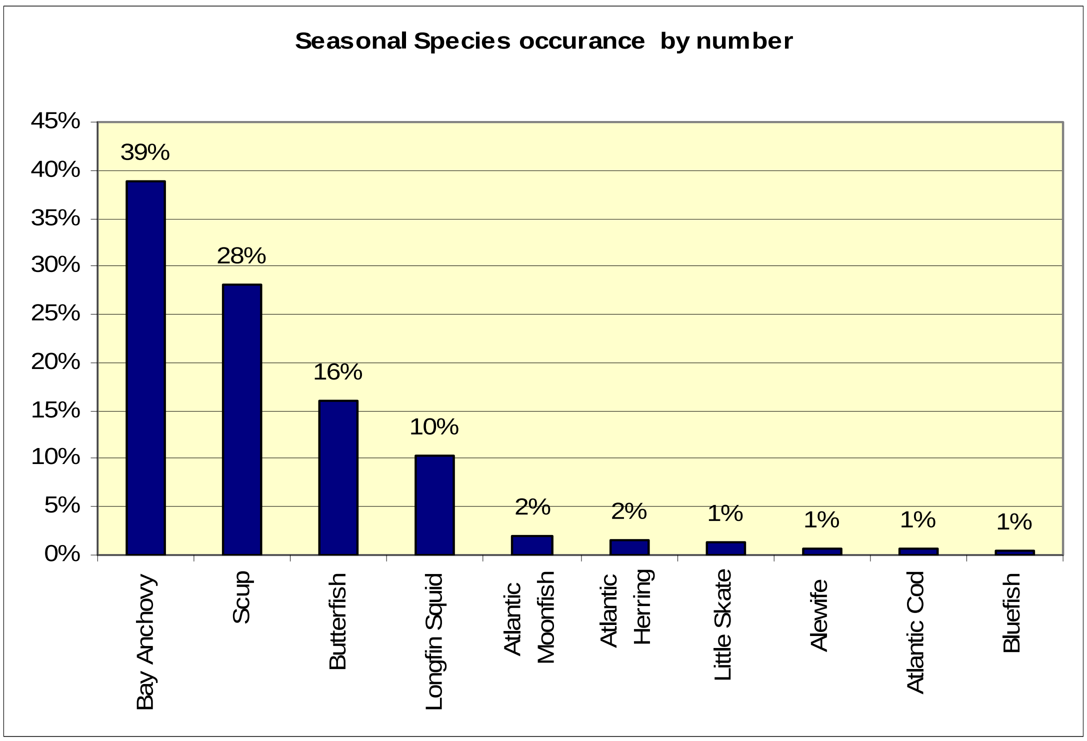
Figure 9 (Total Catch in Kilograms)

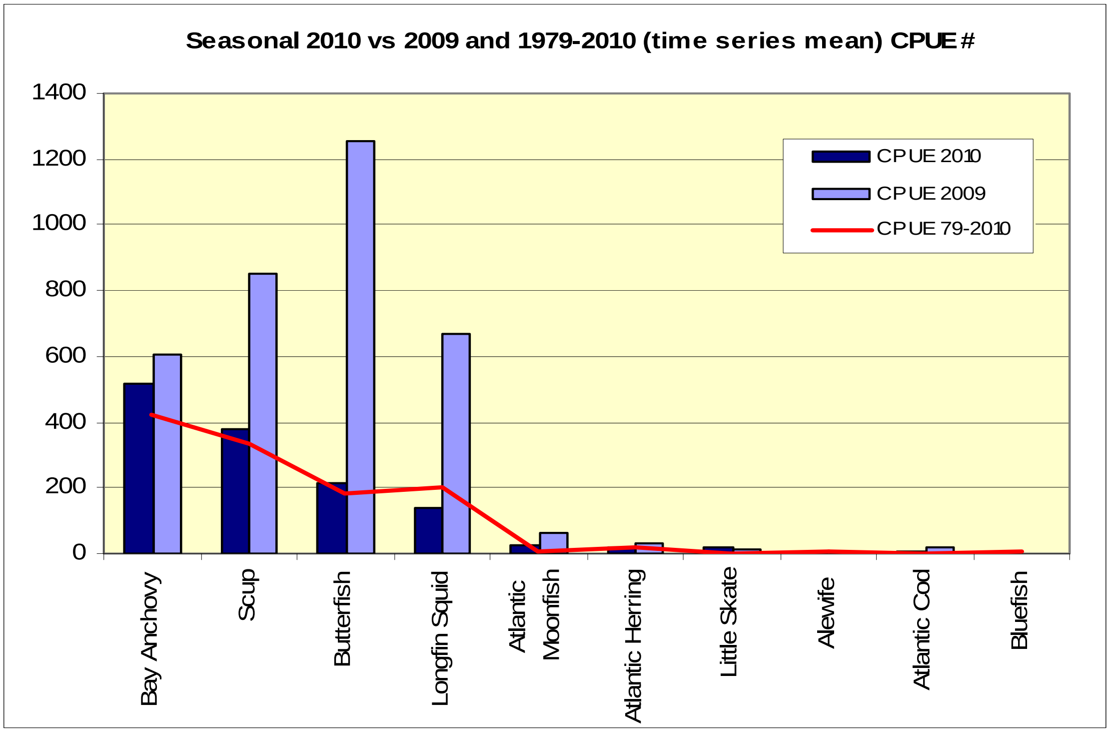
Fish Name	Scientific Name	Total Weight
Little Skate	LEUCORAJA ERINACEA	862.3300017
Scup	STENOTOMUS CHRYSOPS	754.6799979
Butterfish	PEPRILUS TRIACANTHUS	620.6399999
Longfin Squid	LOLIGO PEALEI	198.9600011
Summer Flounder	PARALICHTHYS DENTATUS	175.5099995
Winter Flounder	PLEURONECTES AMERICANUS	155.8149991
Horseshoe Crab	LIMULUS POLYPHEMUS	150.744998
Winter Skate	LEUCORAJA OCELLATA	135.2299999
Bay Anchovy	ANCHOA MITCHILLI	98.38399945
Blue Crab	CALLINECTES SAPIDUS	66.56500032
American Lobster	HOMARUS AMERICANUS	63.26499951
Smooth Dogfish	MUSTELUS CANIS	53.93000066
Bluefish	POMATOMUS SALTATRIX	49.8900009
Clearnose Skate	RAJA EGLANTERIA	27.60000038
Alewife	ALOSA PSEUDOHARENGUS	22.27000014
Striped Bass	MORONE SAXATILIS	22.21999979
Northern Searobin	PRIONOTUS CAROLINUS	19.84700062
Windowpane Flounder	SCOPHTHALMUS AQUOSUS	17.75499998
Longhorn Sculpin	MYOXOCEPHALUS OCTODECEMSPINOS	16.44500047
Atlantic Moonfish	SELENE SETAPINNIS	14.57800014
Tautog	TAUTOGA ONITIS	14.11200026
Weakfish	CYNOSCION REGALIS	13.1350001
Rough Scad	TRACHURUS LATHAMI	10.66900014
Black Sea Bass	CENTROPRISTIS STRIATA	9.656000011
Spotted Hake	UROPHYCIS REGIA	7.887999995
Silver Hake	MERLUCCIUS BILINEARIS	7.855000022
Striped Searobin	PRIONOTUS EVOLANS	5.730000077
Channeled Whelk	BUSYCOTYPUS CANALICULATUS	5.62499998
Ocean Pout	MACROZOARCES AMERICANUS	5.16
Sea Raven	HEMITRIPTERUS AMERICANUS	3.905000031
Atlantic Herring	CLUPEA HARENGUS	3.036000018
Knobbed Whelk	BUSYCON CARICA	1.809999987
Oyster Toadfish	OPSANUS TAU	1.570000052
American Sand Lance	AMMODYTES AMERICANUS	1.558999981
Fourspot Flounder	PARALICHTHYS OBLONGUS	1.409999985
Red Hake	UROPHYCIS CHUSS	1.069999999
Northern Kingfish	MENTICIRRHUS SAXATILIS	0.885000002
Atlantic Cod	GADUS MORHUA	0.869249979
Round Scad	DECAPTERUS PUNCTATUS	0.709999997
Hickory Shad	ALOSA MEDIOCRIS	0.465000004
American Shad	ALOSA SAPIDISSIMA	0.314999999
Crevalle Jack	CARANX HIPPOS	0.280000003
American Eel	ANGUILLA ROSTRATA	0.270000011
Cunner	TAUTOGOLABRUS ADSPERSUS	0.270000002
Mantis Shrimp	SQUILLA EMPUSA	0.210000003
Smallmouth Flounder	ETROPUS MICROSTOMUS	0.206999997

Inshore Lizardfish	SYNODUS FOETENS	0.139999997
Bigeye	PRIACANTHUS ARENATUS	0.134999999
Northern Sennet	SPHYRAENA BOREALIS	0.1
Bluespotted Cornetfish	FISTULARIA TABACARIA	0.09
Striped Cusk Eel	OPHIDION MARGINATUM	0.055
Grubby	MYOXOCEPHALUS AENAEUS	0.045
Northern Puffer	SPHOEROIDES MACULATUS	0.04
Fourbeard Rockling	ENCHELYOPUS CIMBRIUS	0.035
Sea Scallop	PLACOPECTEN MAGELLANICUS	0.029999999
Atlantic Silverside	MENIDIA MENIDIA	0.027
Blueback Herring	ALOSA AESTIVALIS	0.025
Rainbow Smelt	OSMERUS MORDAX	0.025
Short Bigeye	PRISTIGENYS ALTA	0.025
Atlantic Menhaden	BREVOORTIA TYRANNUS	0.02
Red Snapper	LUTJANUS CAMPECHANUS	0.02
Atlantic Tomcod	MICROGADUS TOMCOD	0.01
Northern Pipefish	SYNGNATHUS FUSCUS	0.007
White Hake	UROPHYCIS TENUIS	0.005

Figure 10 Top Ten Species Catch in Number

Fish Name	Scientific Name	%
Bay Anchovy	ANCHOA MITCHILLI	39%
Scup	STENOTOMUS CHRYSOPS	28%
Butterfish	PEPRILUS TRIACANTHUS	16%
Longfin Squid	LOLIGO PEALEI	10%
Atlantic Moonfish	SELENE SETAPINNIS	2%
Atlantic Herring	CLUPEA HARENGUS	2%
Little Skate	LEUCORAJA ERINACEA	1%
Alewife	ALOSA PSEUDOHARENGUS	1%
Atlantic Cod	GADUS MORHUA	1%
Bluefish	POMATOMUS SALTATRIX	1%

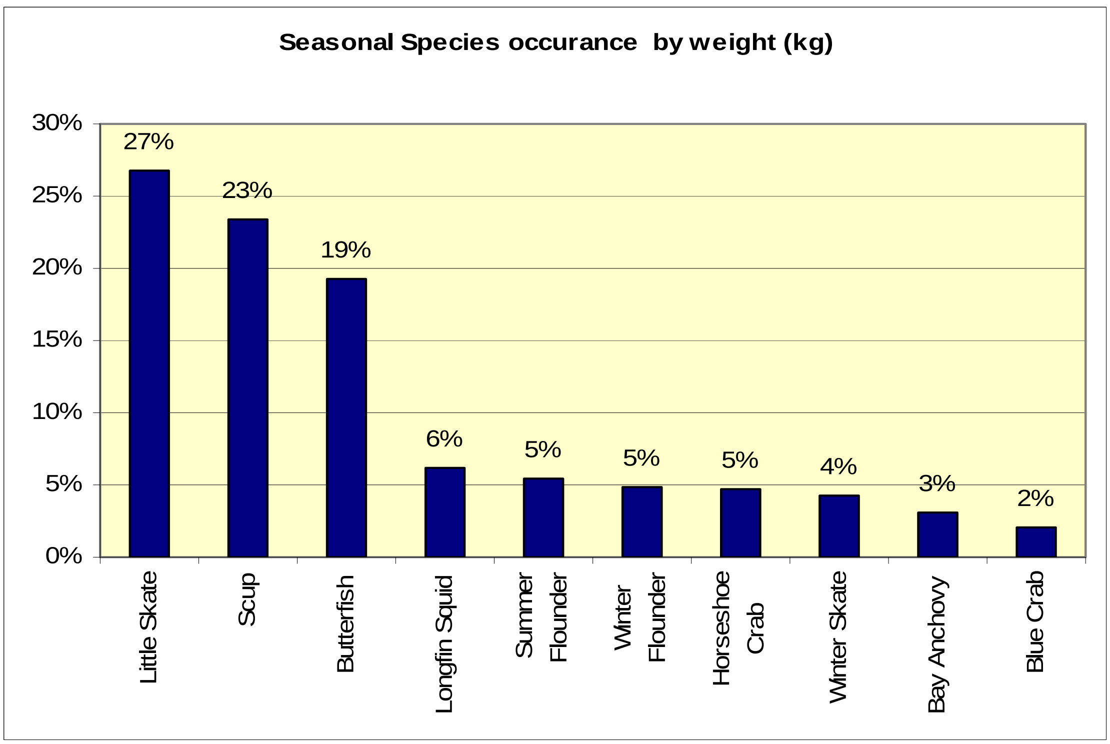


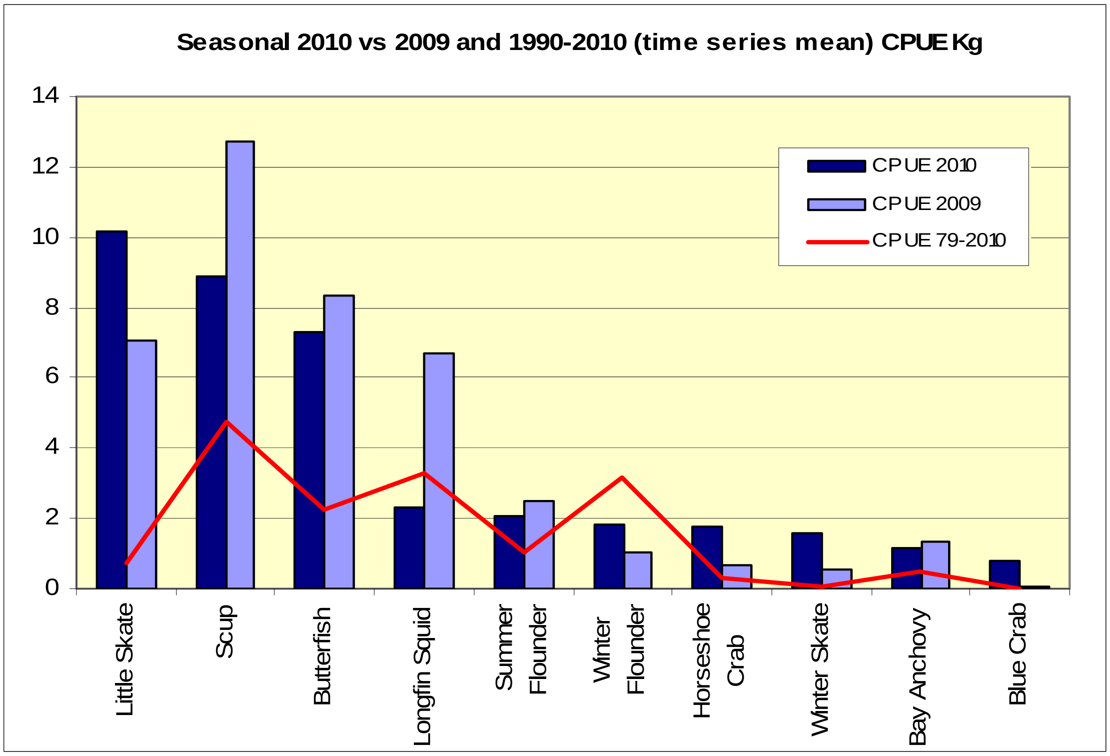


Seasonal 2010 vs 2009 and 1979-2010 (time series mean) CPUE#
1400
1200
1000
800
600
400
200
0
CPUE 2010
CPUE 2009
CPUE 79-2010
Bay Anchovy
Scup
Butterfish
Longfin Squid
Atlantic Moonfish
Atlantic Herring
Little Skate
Alewife
Atlantic Cod
Bluefish

Figure 11 Top Ten Species Catch in Kilograms

Fish Name	Scientific Name	%
Little Skate	LEUCORAJA ERINACEA	27%
Scup	STENOTOMUS CHRYSOPS	23%
Butterfish	PEPRILUS TRIACANTHUS	19%
Longfin Squid	LOLIGO PEALEI	6%
Summer Flounder	PARALICHTHYS DENTATUS	5%
Winter Flounder	PLEURONECTES AMERICANUS	5%
Horseshoe Crab	LIMULUS POLYPHEMUS	5%
Winter Skate	LEUCORAJA OCELLATA	4%
Bay Anchovy	ANCHOA MITCHILLI	3%
Blue Crab	CALLINECTES SAPIDUS	2%





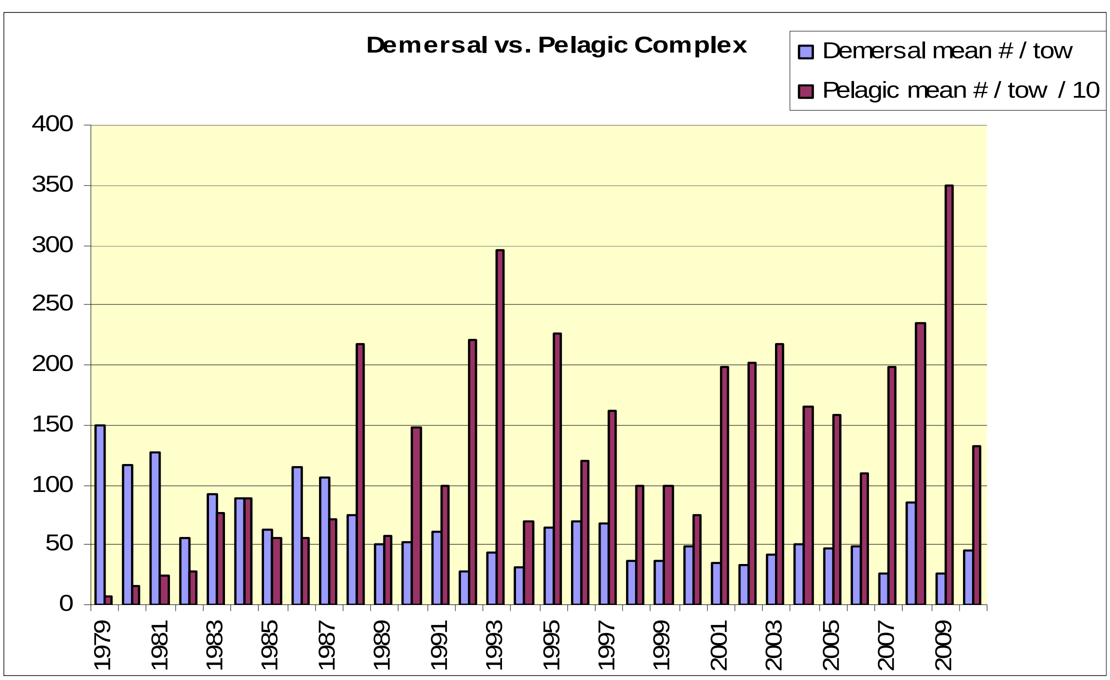
Seasonal 2010 vs 2009 and 1990-2010 (time series mean) CPUE Kg
14
12
10
8
6
4
2
0
CPUE 2010
CPUE 2009
CPUE 79-2010
Little Skate
Scup
Butterfish
Longfin Squid
Summer Flounder
Winter Flounder
Horseshoe Crab
Winter Skate
Bay Anchovy
Blue Crab

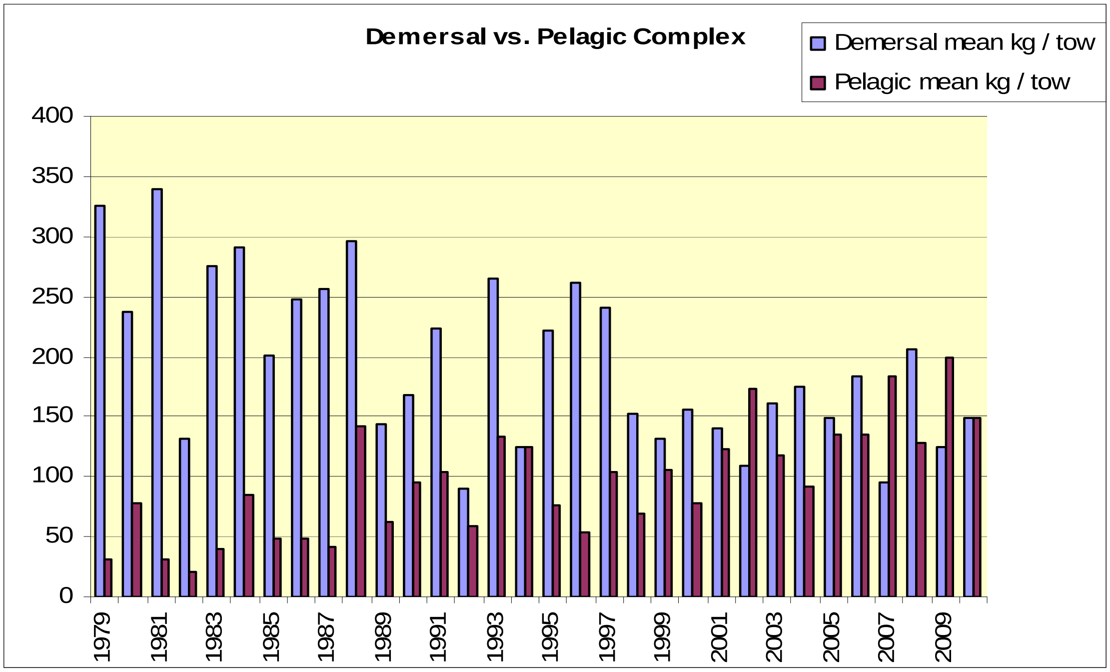
Demersal vs. Pelagic Species Complex

Demersal Species
Smooth Dogfish
Spiny Dogfish
Skates
Silver Hake
Red Hake
Spotted Hake
Summer Flounder
4 Spot Flounder
Winter Flounder
Windowpane Flounder
Hog Choker
Longhorn Sculpin
Sea Raven
Northern Searobin
Striped Searobin
Cunner
Tautog
Ocean Pout
Goosefish
Lobster

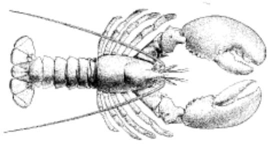
Pelagic/Multi-Habitat Species
Atlantic Herring
Alewife
Blueback Herring
Shad
Menhaden
Bay Anchovy
Rainbow Smelt
Silverside
Butterfish
Atlantic Moonfish
Bluefish
Striped Bass
Black Sea Bass
Scup
Weakfish
Longfin Squid

Figure 12 and 13



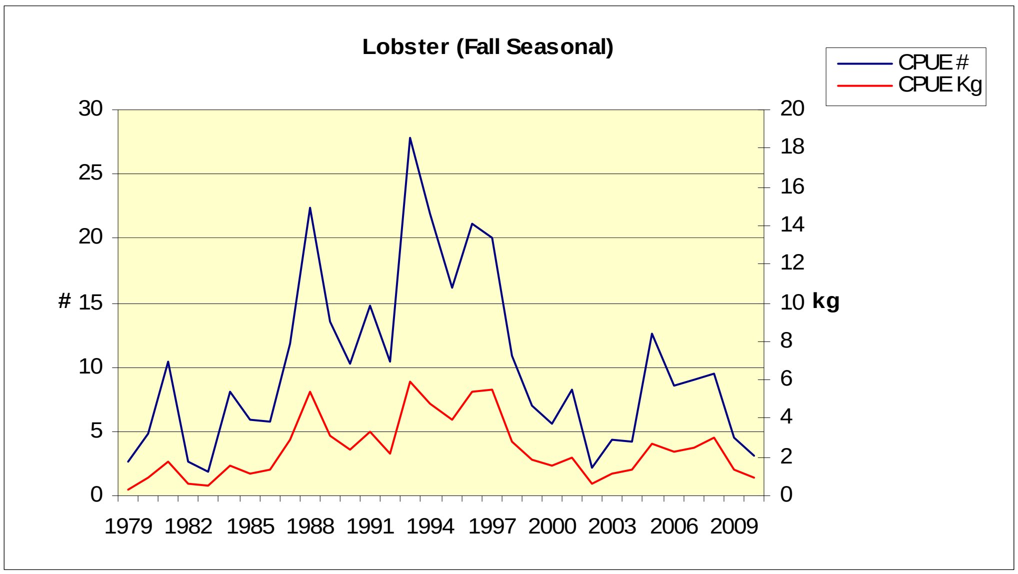

Demersal vs. Pelagic Complex
Demersal mean kg / tow
Pelagic mean kg / tow
400
350
300
250
200
150
100
50
0
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009

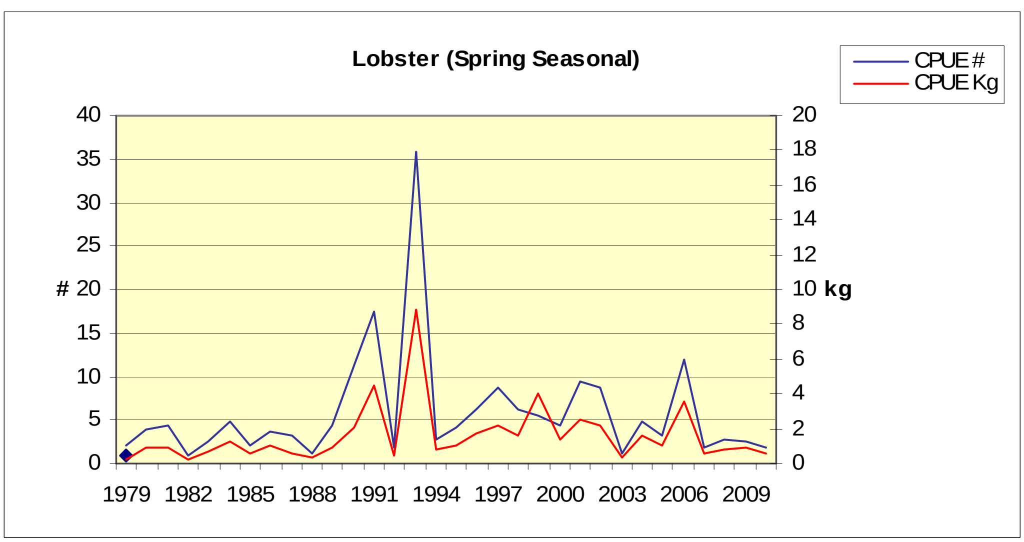
The following species represented are of high importance and are currently managed under fishery management plans through the Atlantic States Marine Fisheries Commission, New England Fishery Management Council, or the National Marine Fisheries Service. The seasonal portion of the Rhode Island Coastal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

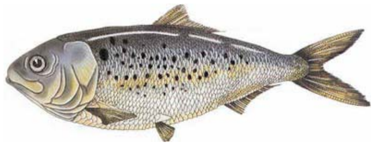


American Lobster ***Homarus americanus***

Stock Status: Southern New England Stock: overfished.
Management: ASMFC Amendment III, Addendum XVI

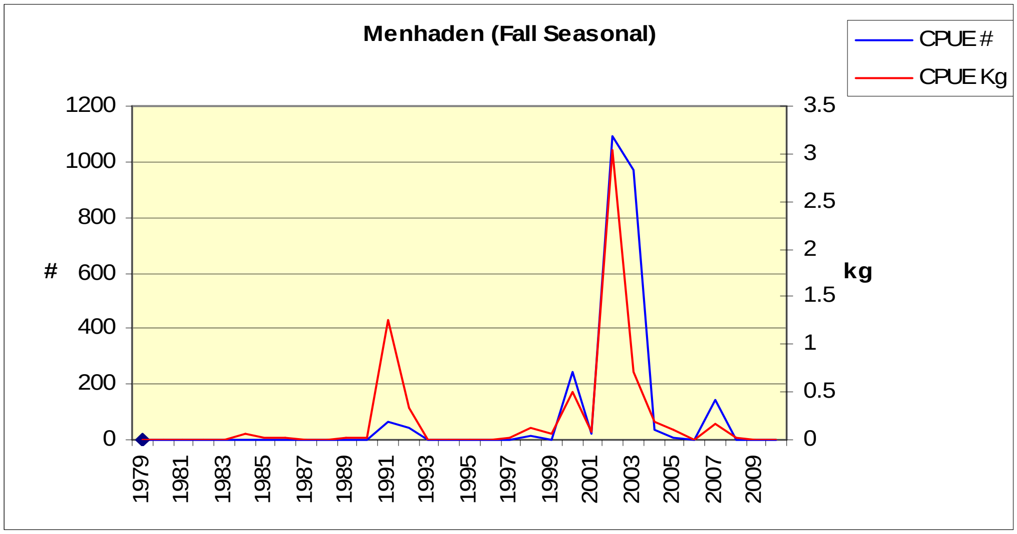


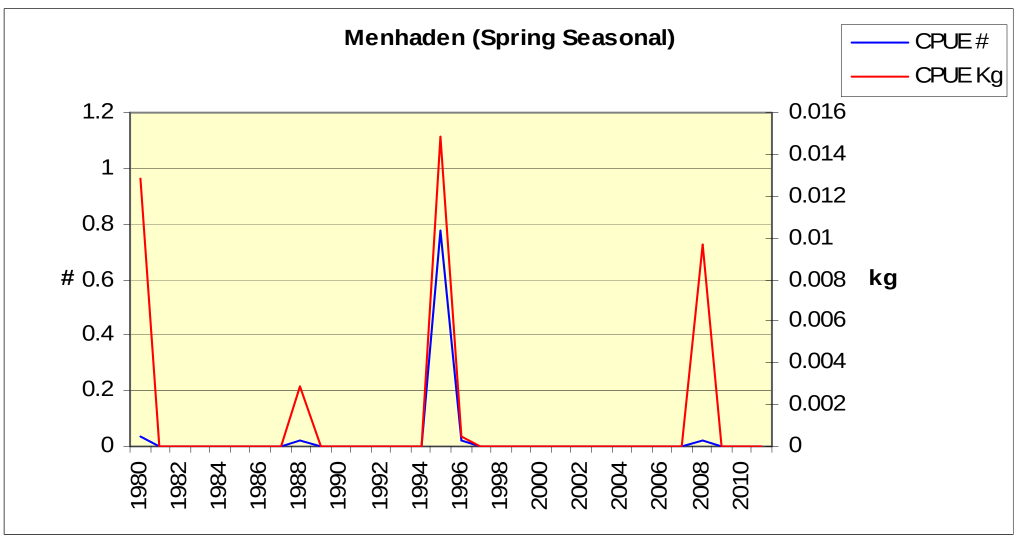




Atlantic Menhaden ***Brevoortia tyrannus***

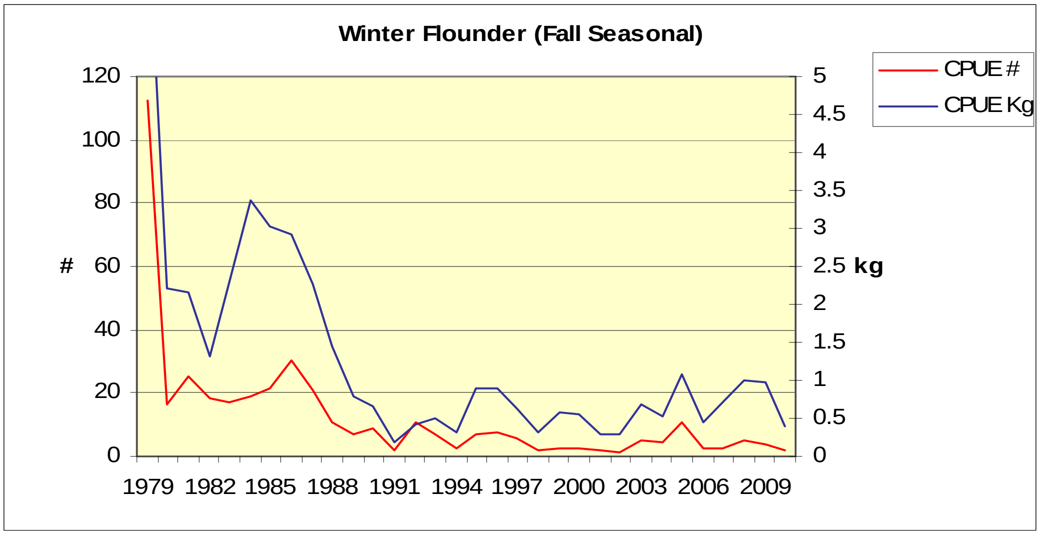
Stock Status: Not overfished and overfishing is not occurring.
Management: ASMFC Amendment I, Addendum IV

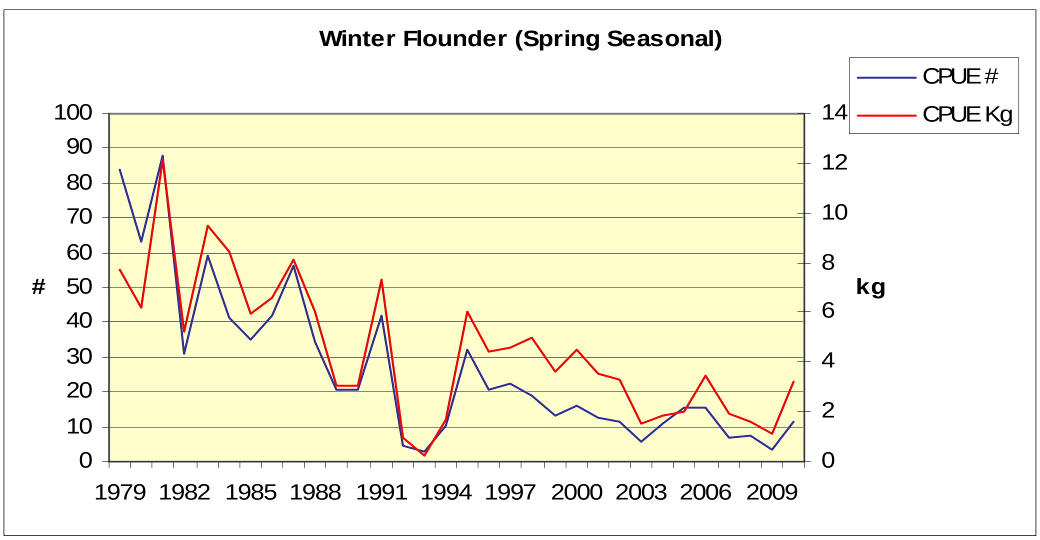




Winter Flounder ***Pleuronectes americanus***

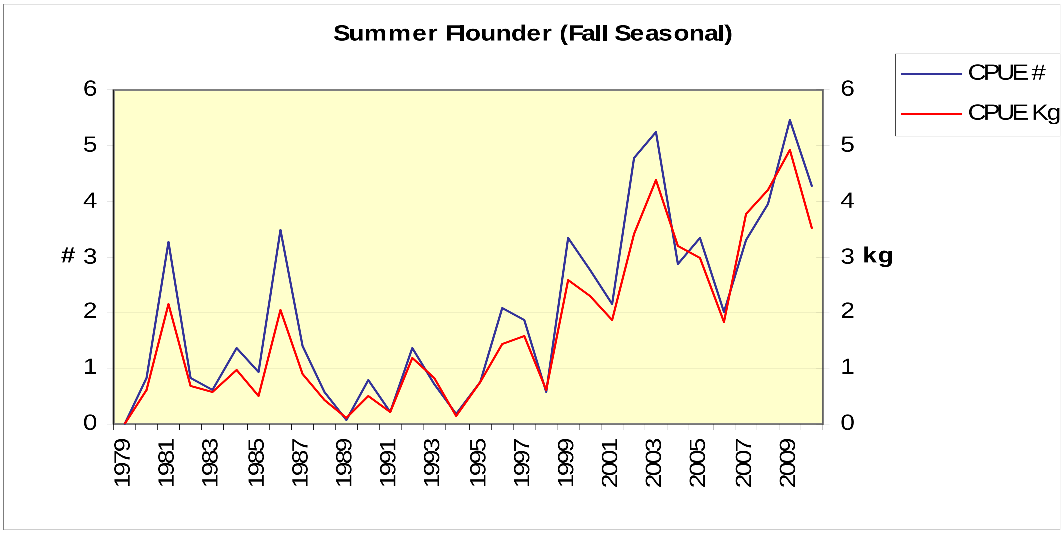
Stock Status: Overfished and overfishing is occurring.
Management: ASMFC Amendment I, Addendum I

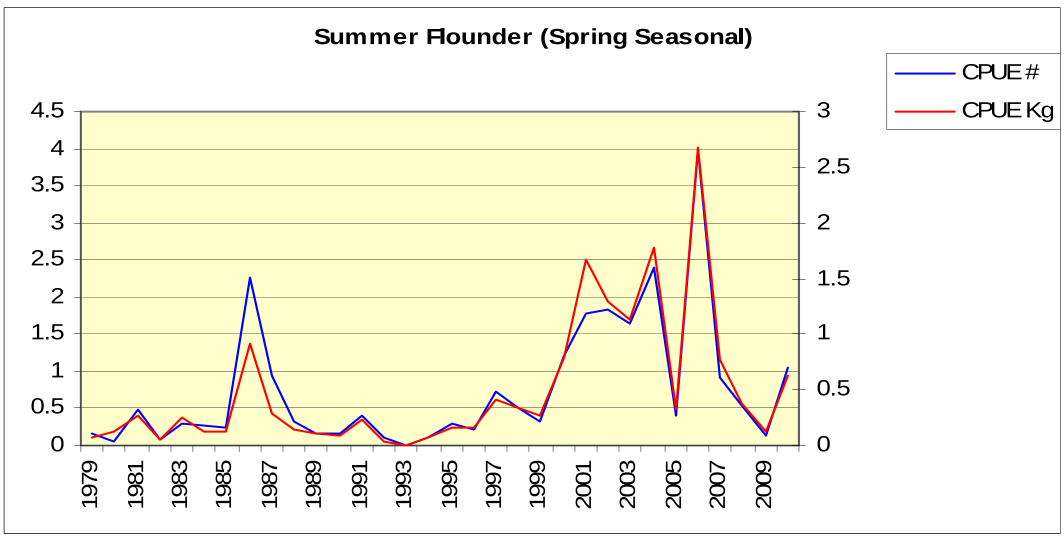




Summer Flounder ***Paralichthys dentatus***

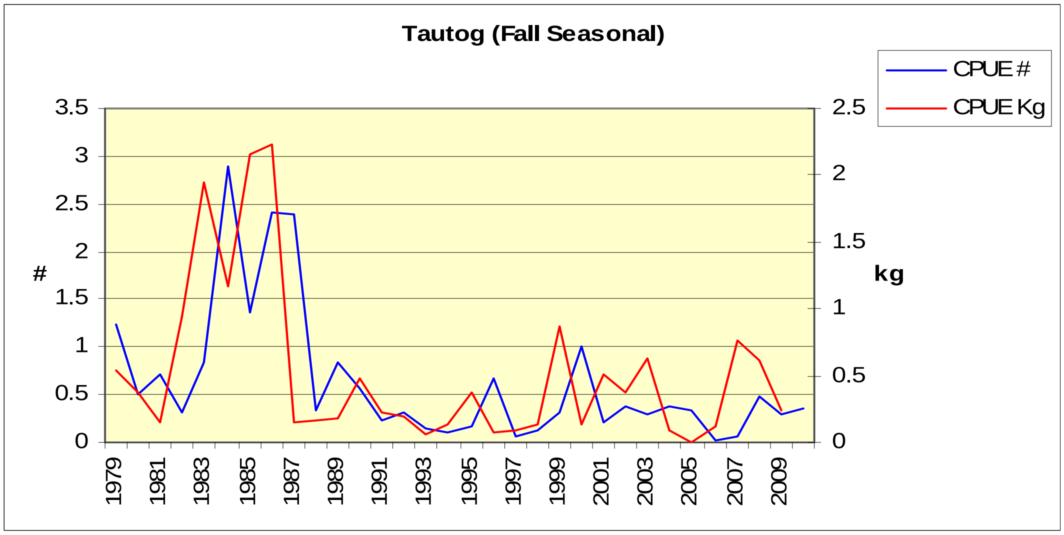
Stock Status: Not overfished and overfishing is not occurring.
Management: ASMFC Amendment XV

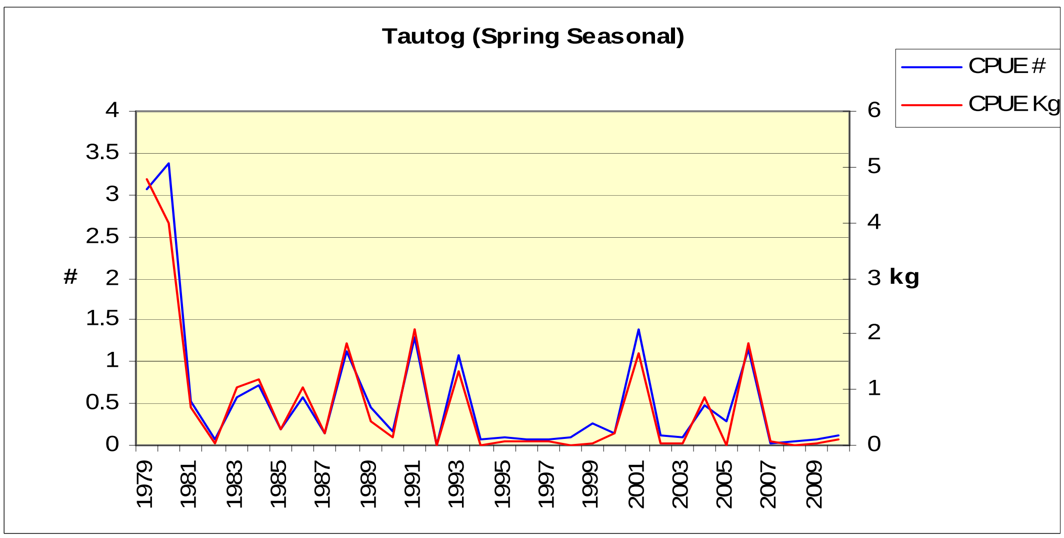


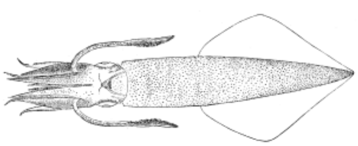


Tautog ***Tautoga onitis***

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

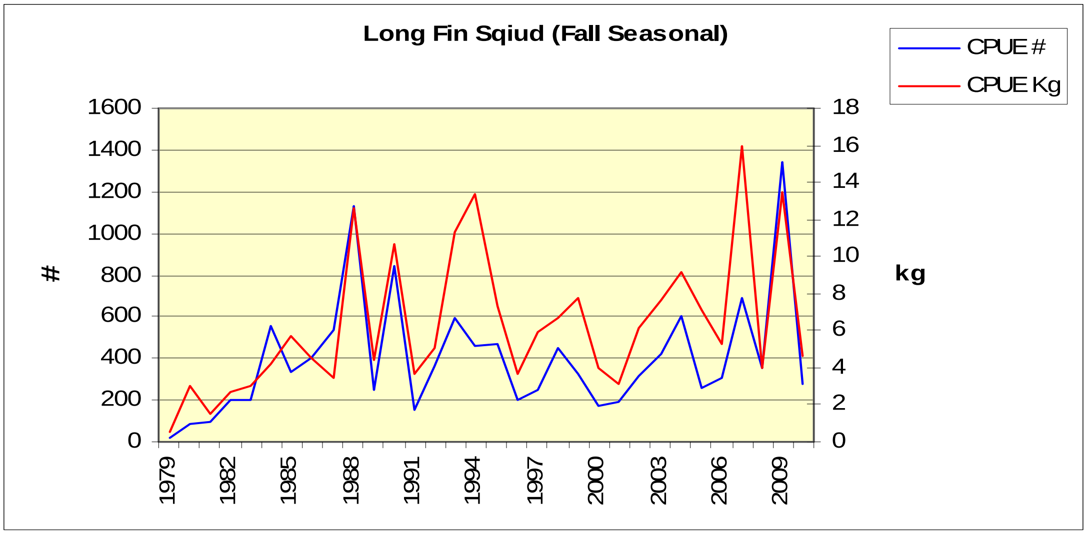


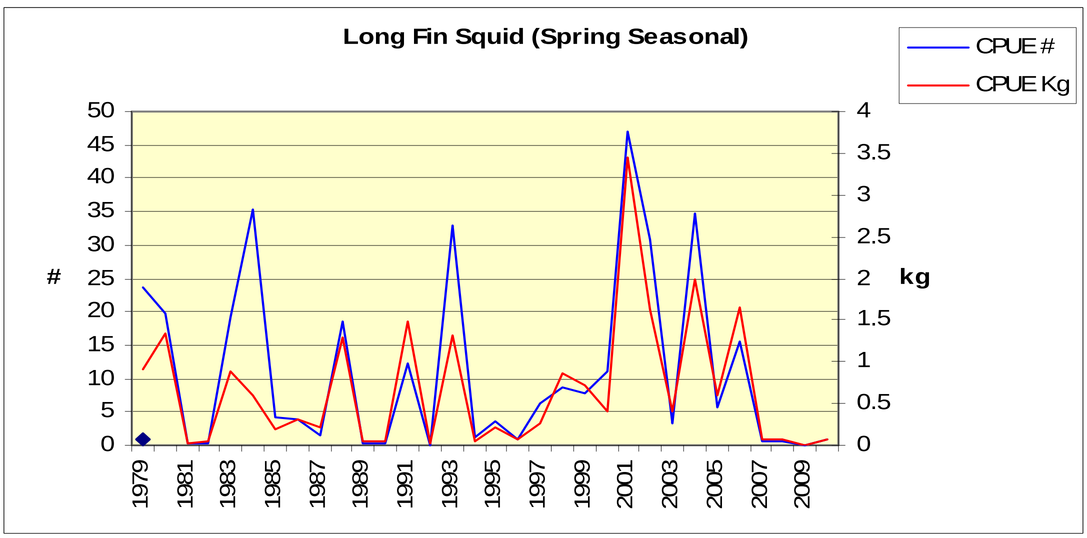




Longfin Squid ***Loligo pealei***

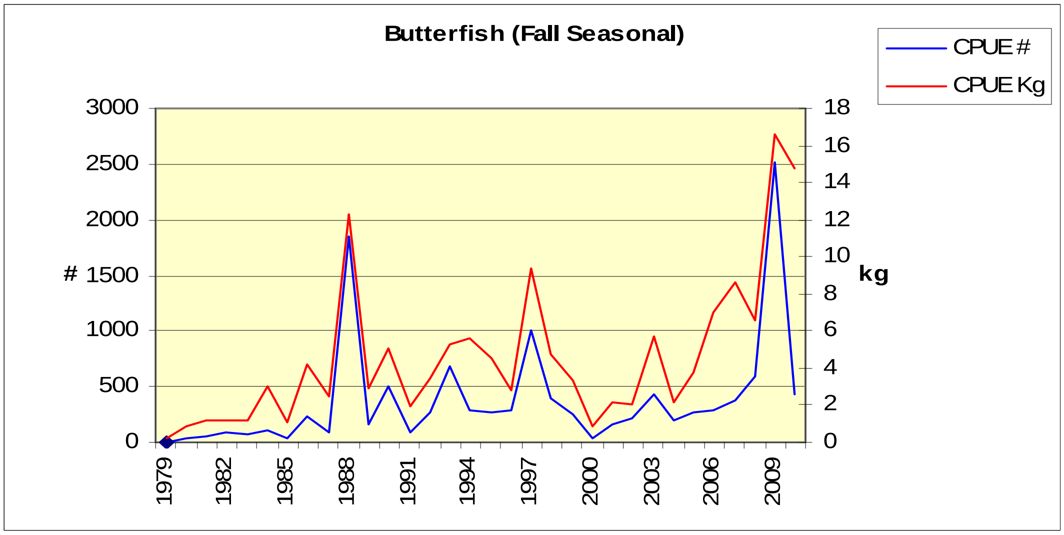
Stock Status: Undetermined
Management: NMFS, MAFMC, Atlantic Mackerel, Squid Butterfish FMP

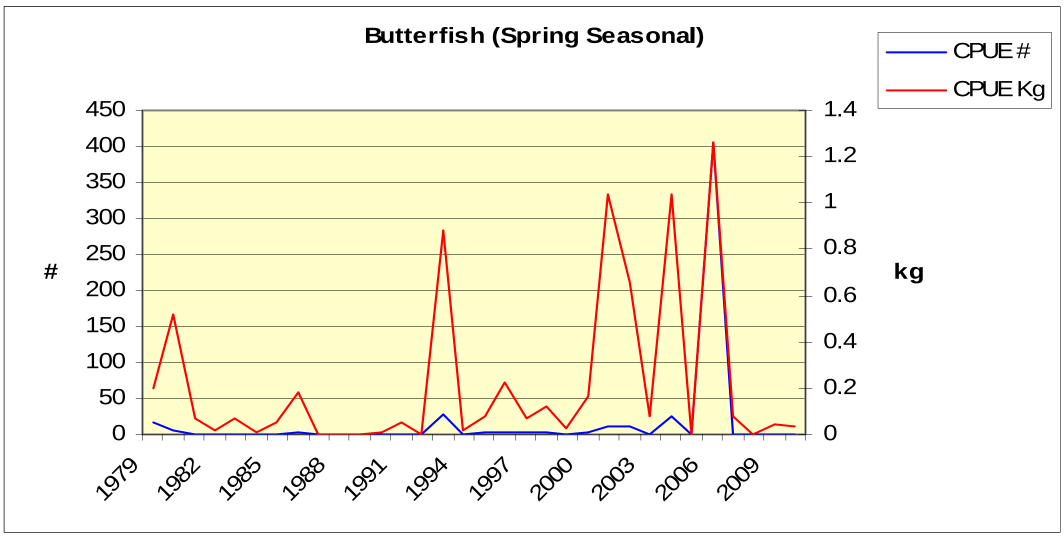




Butterfish ***Peprlilus triacanthus***

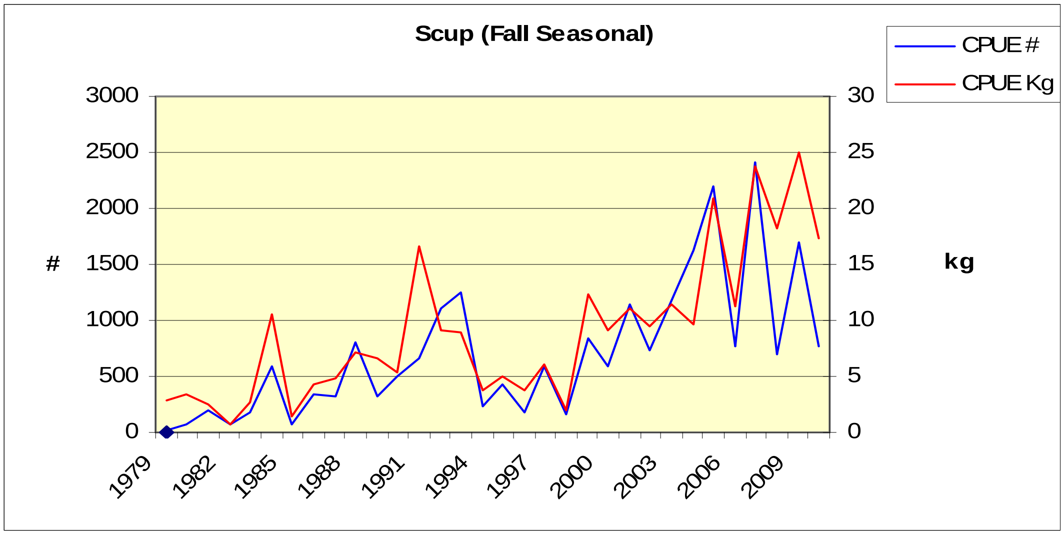
Stock Status: Variable / Uncertain
Management: Mid Atlantic Fishery Management Council, Atlantic Mackerel, Squid Butterfish FMP

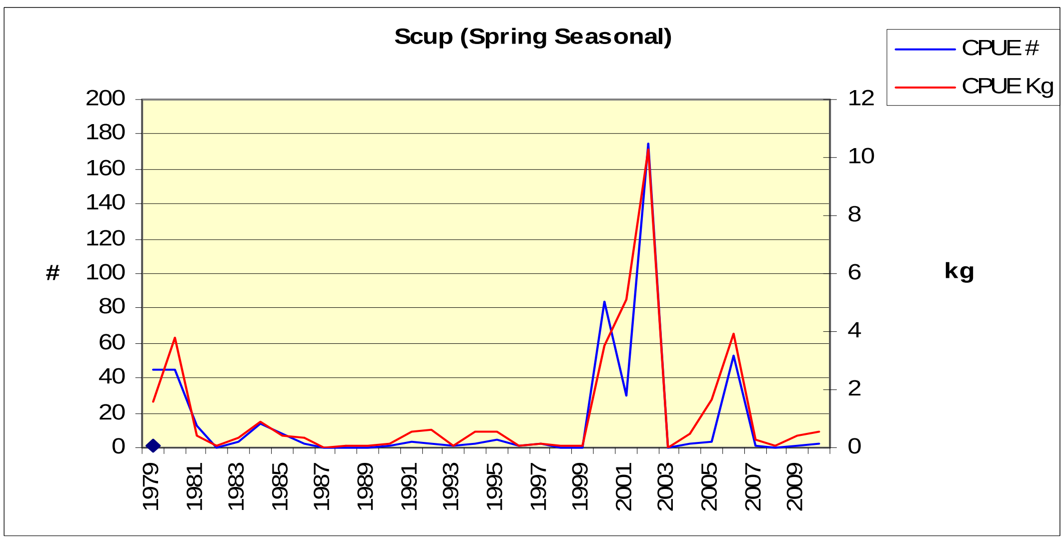




Scup ***Stenotomus chrysops***

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





References:

ASMFC 2009.Current Fishery Management Plans; Stock Status Reports

Bigelow and Schroeder 2002. Fishes of the Gulf of Maine; Third Edition

NMFS 2009. Current Fishery Stock Status.

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

Job 3

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

by
John Lake
Principal Biologist (Marine Fisheries)
john.lake@dem.ri.gov

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

Federal Aid in Sportfish Restoration
F-61-R

Performance Report – Job#3 March 2011

State: Rhode Island

Project Number: F-61-R
Segment Number: 18

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

Period Covered: January 1, 2010 – December 31, 2010

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 2010, Investigators caught 45 species of finfish representing 29 families. This number is similar to the 46 species from 30 families that were collected during 2009. Additionally, the numbers of individuals landed in 2010 increased from the 2009 survey by 24%, 20982 and 16885 individuals respectively.

Target Date: 2011

Status of Project: On Schedule

Significant Deviations: During the 2010 sampling station an additional station was added to Point Judith Pond which was sampled for the entire survey. Three other Ponds were also sampled (Green Hill, Potter's Pond, and the lower Pawcatuck river) in preparation of the survey expansion to be implemented in 2011.

Recommendations: Continue into the next segment with the project as currently designed; continue at each of the 16 sample stations. Additionally stations should be added in Point Judith Pond, Green Hill Pond, Potter's Pond, and the lower Pawcatuck River. These stations will provide additional information on population compositions in these ponds which are currently not being sampled.

Remarks:

During 2010, Investigators sampled the sixteen traditional stations in four coastal ponds, Winnapaug Pond, Quonochontaug Pond, Charlestown Pond, Point Judith Pond, and Narrow River. An additional station (PJ4) was also sampled all season long. This station was added to better classify the fish populations in Point Judith Pond which has seen a significant decline in winter flounder abundance in the last 5 years. The station was selected due to its proximity to three fyke net sampling locations used in the Adult Winter Flounder Spawning Survey conducted during the winter months. (Figures 1-3) In addition to the new station in Point Judith Pond, Green Hill Pond, Potter's Pond and the lower Pawcatuck River were sampled to determine potential sampling locations for the 2011 expansion. The new stations for 2011 are displayed in figures 1-3. Please see Appendix 2 the proposal "Expanding the RIDFW Coastal Pond Juvenile Fish Survey to include Potter's Pond, Green Hill Pond, and Little Narragansett Bay." for justification and methodology for expanding the survey into these new ponds. For purposes of this report with the exception the new station in Point Judith Pond, results taken from the new stations will not be included in the individual species to species indices found in the results and discussion section. The results from the new station added in Point Judith are included because the station is located in the same water body, has similar habitat characteristics, and was sampled concurrently with the existing stations in Point Judith Pond using the same sampling methodology. The species found at the new stations will be presented separately.

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 headrope. 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 18' Boston Whaler Skiff. 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. It should be noted that during the first three months of the survey the dissolved oxygen meter was not working, as a result no dissolved oxygen readings were recorded. 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. The stations explored in Green Hill Pond, Potter's Pond, and the lower Pawcatuck River were all sampled using the same methodology.

Results and Discussion:

Winter Flounder (*Pseudopleuronectes americanus*)

Juvenile winter flounder were collected at all stations except station 4 in Charlestown Pond. Winter flounder again ranked fourth in overall species abundance (n=1164) in 2010, with the highest mean abundance, fish/seine haul, occurring in August, influenced by high abundances in Narrow River (Table 1). Narrow River and Winnipaug Pond had their greatest mean abundance in August while Quonochontaug, Charlestown and Point Judith Ponds had their greatest mean abundance in July. The greatest numbers of winter flounder were captured in August at Narrow River station number 2 where 215 individuals were captured. In 2010 winter flounder were caught at each of the stations in the survey. The fewest winter flounder (n = 2) were collected at Point Judith Pond station1 during the year.

During 2010, 1,164 winter flounder were collected, down 1% from the 1,184 collected in 2009. The juvenile winter flounder abundance index for the survey measured using the mean fish/seine haul decreased from 15.6 fish/seine haul in 2009 to 11.41 fish/seine haul in 2010. Although similar numbers of winter flounder were collected in 2009 and 2010, the number of seine hauls in 2010 was greater (n= 102) than 2009 (n= 76). Table 2 displays the mean catch per seine haul (CPUE) of winter flounder for each month by pond during the 2010 survey. Figure 5 displays the abundance indices over the duration of the coastal pond survey. Most stations exhibit fluctuations of abundance over the course of the survey with the exception of Point Judith pond which has experienced a significant decline since 2000 and has bottomed out at 1.46 fish/seine haul (Gibson, 2010). In 2010, juvenile winter flounder ranged in size from 2 to 18 cm, representing age groups 0-2. No adult flounder were caught during the 2010 survey. The size range of animals collected is similar to those caught from 2004 through 2009 where the flounder ranged from 1 to 19 cm, 2 to 18 cm, 2 to 17 cm, 1 to 22, 1 to 19 cm and 2 to 19 respectively. Length frequency distributions indicate that the majority of individuals collected during sampling season were group 0 fish, less than 10 cm total length (Figure 6). During 2010, 98.28% of all winter flounder caught were <10 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). Length frequency distributions for coastal ponds by month are shown in Figures 7 -11. Mean monthly lengths for winter flounder are presented in Table 3.

When comparing the Coastal Pond Survey to the other projects which capture juvenile winter flounder, the Narragansett Bay Seasonal Trawl Survey and the Narragansett Bay Juvenile Survey, one notices slight differences however they display similar downward trends, especially the Narragansett Bay Juvenile Survey and Coastal Pond Survey (Figure 12). The trawl survey collects the greatest number of juveniles in May (Olszewski Pers Comm) and the juvenile survey collects them in June (McNamee Pers Comm). It should also 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. Additionally, McNamee reports that for the last four years, 2006 – 2010 inclusive, the highest monthly abundance of juvenile winter flounder occurred in June. Although, the 2010 Narragansett Bay Survey experienced its lowest abundance index value since its inception (cpue = 1.52)

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 fish/seine haul of juvenile winter flounder are compared to the relative abundance and number of fish/fyke net haul of the Adult Winter Flounder Tagging Survey, (Figure 13), 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. 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). Action has been initiated to close the pond to both recreational and commercial fishing for winter flounder (Gibson, 2010). Although not finalized, a recommendation has been made banning possession of winter flounder in Point Judith Pond.

Bluefish *(Pomatomus saltatrix)*

Fifteen bluefish were collected in June, July, August, and September and occurred in each of the ponds. This is a decrease from the 158 individuals captured during 2009. The abundance index for 2010 was 0.15 fish/seine haul down considerably from 2009 which had a value of 2.00 fish/seine haul. Table 4 contains the abundance indices for the survey by month and pond. Bluefish ranged in size from 4 cm in June to 18 cm in September. No adult bluefish were caught in 2010.

Tautog (*Tautoga onitis*)

Forty-eight tautog were collected between May and October in each of the ponds except Winnipaug and the Narrow River. This is a decrease from the 2009 catch of 470 individuals. The total survey 2010 abundance index was 0.47 fish/seine haul down considerably from the 2009 abundance index of 6.00 fish/seine haul. Table 5 contains the abundance indices for the survey by month and pond. The highest abundances in 2010 occurred in Quonochontaug Pond. Tautog caught in 2010 ranged in size from 3 cm to 14 cm.

Black Sea Bass (*Centropristis striata*)

A total of 7 juvenile black sea bass were collected from each of the ponds in 2010. This is much less than the 159 fish that were caught in 2009. The fish occurred during August in Charlestown and Winnipaug Ponds. The highest abundances were found in Charlestown Pond. The total survey 2010 abundance index was 0.07 fish/seine haul down considerably from the 2009 abundance index of 2.0 fish/seine haul. Table 5 contains the abundance indices for the survey by month and pond. Black sea bass caught in 2010 ranged in size from 3 cm to 5 cm.

Scup *(Stenotomus chrysops)*

Eight juvenile scup were collected during the 2010 in August and October in Charlestown, Point Judith, and Quonochontaug Ponds down from 31 caught in 2009. The total survey abundance index was 0.08 fish per haul. Table 7 contains the abundance indices for the survey by month and pond. Scup caught in 2010 ranged in size from 4 cm to 11 cm.

Clupeids:

In 2010 four species of clupeids were caught in the coastal pond survey, Atlantic menhaden (*Brevoortia tyrannus*), Atlantic herring (*Clupea harengus*), Blueback herring (*Alosa Aestivalis*) and Alewife (*Alosa pseudoharengus*). Ninety six alewives were captured in Charlestown and Winnipaug Ponds and the Narrow River between June and August. The total survey abundance was 0.94 fish / haul. One thousand eighty eight Atlantic menhaden were caught in Charlestown and Winnipaug Ponds as well as Narrow River between August and September during 2010. The total survey abundance was 10.67 fish / haul. This high value is being driven by one very high haul of 1080 fish. Three hundred and twenty Atlantic herring were collected in Point Judith and Charlestown Ponds during May and June. The total survey abundance was 3.14 fish / haul. Five Blueback Herring were caught in May from Point Judith Pond and the Narrow River. The total survey abundance was 0.07 fish / haul. Table 8 contains the abundance indices for culpeids by month pooled across all 5 ponds.

Baitfish Species:

Atlantic Silversides *(Menidia sp.)*

Silversides had the highest abundance of all species with 7937 caught during the 2010 survey, compared to the 3288 silversides collected in 2009. Silversides were collected in each of the ponds throughout the time period of the survey (June – October). The highest abundances were observed in Charlestown Pond. The total survey abundance index was 77.81 fish / haul. Table 9 contains the abundance indices for the survey by month and pond. Atlantic silversides caught in 2010 ranged in size from 2 cm to 14 cm.

Striped Killifish *(Fundulus majalis)*

Striped killifish ranked second in species abundance with 2665 fish caught during 2010. This value is higher than the 901 fish caught during 2009. 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 26.13 fish / haul. Table 10 contains the abundance indices for the survey by month and pond. Striped killifish caught in 2010 ranged in size from 2 cm to 14 cm.

Common Mummichog *(Fundulus heteroclitus)*

The mummichog was second in overall abundance in 2010 with 2,831 individuals collected. This value is an increase from 1,305 mummichogs collected in 2009. Mummichogs occurred in each of the ponds and were caught each month during the survey. Winnipaug Pond had the highest abundances of Mummichogs. The total survey abundance index was 27.75 fish / haul. Table 11 contains the abundance indices for the survey by month and pond. Mummichogs caught in 2010 ranged in size from 2 cm to 11 cm.

Sheepshead Minnow *(Cyprinodon variegatus)*

The Sheepshead minnow ranked sixth in overall abundance with 897 individuals collected. This is an increase from the 162 fish caught in 2009. Sheepshead minnow occurred in each of the ponds and were caught each month during the survey. Winnipaug Pond had the highest abundances of Sheepshead minnows. The total survey abundance index was 8.79 fish / haul. Table 12 contains the abundance indices for the survey by month and pond. Sheepshead minnow caught in 2010 ranged in size from 2 cm to 5 cm.

Physical and Chemical Data:

Physical and Chemical data for the 2010 Coastal Pond Survey is summarized in tables 13 – 15. Water temperature in 2010 averaged 21.2 ºC, with a range of 15.1ºC in October to 25.6 ºC in July. Salinity ranged from 26.0 ppt to 27.8 ppt, and averaged 27.2 ppt. Monthly average dissolved oxygen ranged from 7.4 mg/l in September to 7.9 mg/l in October, with an average of 7.81 mg/l.

New Station Preliminary Data

The attached proposal outlines new stations to be added to the survey for 2011 (Figures 1-3). During the 2010 survey some preliminary seine hauls were done in Potter's Pond and Green Hill Pond. The two stations in Potter's Pond were sampled from July through October (8 hauls) and the two stations in Green Hill were sampled during September and October (4 hauls). Table 16 shows the species caught at each of the stations. The species assemblage at the new stations is similar to that of the traditional stations with the exception that very few winter flounder were observed in these ponds. This result was expected as anecdotally it is perceived that the winter flounder populations in these ponds are very low. As mentioned in the attached proposal traditionally, prior to 1990, these ponds supported healthy winter flounder populations. Adding these two ponds should help to gauge if any recovery of former range is accomplished as a result of the Southern New England Winter Flounder closure enacted in 2009. The stations in the Pawcatuck River were observed by boat in October but not sampled due to very high winds. 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.

Summary
In 2010, Investigators caught 45 species of finfish representing 29 families. This number is similar to the 46 species from 30 families that were collected during 2009. Additionally, the numbers of individuals landed in 2010 increased from the 2009 survey by 24%, 20982 and 16885 individuals respectively. Appendix 1 displays the frequency of all species caught by station during the 2009 Coastal Pond Survey. Additional data is available by request.

References

Able, K., and M.P. Fahay. 1998. The First Year in the Life of Estuarine Fishes in the Middle Atlantic Bight. Rutgers University Press.

Berry, R.J. 1959. Critical growth studies of winter flounder, *Pseudopleuronectes Americanus* (Waldbaum), in Rhode Island waters. MS Thesis, Univ. of Rhode Island. 52 p.

Berry, R.J., S.B. Saila and D.B. Horton. 1965. Growth studies of winter flounder, *Pseudopleuronectes americanus* (Waldbaum), in Rhode Island. Trans. Amer. Fish. Soc. 94:259-264.

Buckley, L., J. Collie, L. Kaplan, and J. Crivello. 2008. Winter Flounder Larval Genetic Population Structure in Narragansett Bay, RI: Recruitment to Juvenile Young-of-the-Year. Estuaries and Coasts. 31:745-754.

Gibson, M. 2010. Salt Pond Winter Flounder Fishery Issue Paper, Internal document RI Division of Fish and Wildlife, 11p.

McNamee, Jason. 2009. Personal Communication

Olszewski, Scott. 2009. Personal Communication

Table 1: 2010 Coastal Pond Survey Winter Flounder Frequency by station and month

Station	May	June	July	August	September	October	**Total**	Mean	STD
WP1	0	48	69	4	6	5	**132**	22	29.1
WP2	31	14	7	47	3	7	**109**	18.1	17.3
WP3	5	8	5	8	3	1	**30**	5	2.8
QP1	0	7	11	10	7	11	**46**	7.7	4.2
QP2	9	11	26	3	10	3	**62**	10.3	8.4
QP3	1	6	15	3	0	1	**26**	4.3	5.6
CP1	22	8	115	11	9	2	**167**	27.8	43.2
CP2	2	4	1	2	0	1	**10**	1.7	1.4
CP3	2	21	3	3	0	1	**30**	5	7.9
CP4	0	0	0	0	0	0	**0**	0	0
NR1	15	14	0	0	0	0	**29**	4.8	7.5
NR2	14	25	79	215	10	4	**333**	55.5	76.3
NR3	8	4	117	1	20	4	**154**	25.7	45.2
PJ1	1	0	1	0	0	0	**2**	0.3	0.5
PJ2	1	5	2	1	2	0	**11**	1.8	1.7
PJ3	0	1	0	1	0	1	**3**	0.5	0.5
PJ4	6	4	1	7	1	0	**19**	3.2	2.9
Total	**117**	**180**	**452**	**303**	**71**	**41**	**1164**	194	156.9
Mean	6.9	10.6	26.6	17.8	4.2	2.4	68.5		
STD	8.9	11.9	41.1	48.5	5.5	3	87.3		

Table 2: 2010 Coastal Pond Survey winter flounder abundance indices (fish/seine haul) by pond and month

Station	May	June	July	August	September	October
Charlestown Pond	6.5	8.2	29.5	4	2.2	1
Narrow River	12	13.7	65.3	67	10	2.7
Point Judith Pond	2	2.5	1	2.2	0.8	0.2
Quonochontaug Pond	3.3	8	17.3	5.3	5.7	5
Winnipaug Pond	12	22.3	26	19.3	4	4.3
Total	**6.8**	**10.3**	**26.4**	**17.6**	**4.1**	**2.4**

Table 3: 2010 Coastal Pond Survey average lengths of juvenile winter flounder by pond and month.

	May	June	July	August	September	October
Charlestown Pond	4.1	6.3	5.7	6.3	6.9	8
Narrow River	4.3	6.1	5.4	3.8	4.8	5.9
Point Judith Pond	8	7	8.6	8.9	12.6	11
Quononchontaug Pond	4.3	5.4	6.3	7.7	8.2	9.8
Winnipaug Pond	3.8	4.3	5.6	5.8	7.1	6.4

Table 4: 2010 Coastal Pond Survey bluefish abundance indices (fish/seine haul) by pond and month

Station	May	June	July	August	September	October
Charlestown Pond	0	0	1	0.2	0.2	0

Narrow River	0	0	0.3	0	0	0
Point Judith Pond	0	0.8	0.5	0	0	0
Quonochontaug Pond	0	0.7	0.3	0	0	0
Winnipaug Pond	0	0	0	0	0	0
Total	**0**	**0.3**	**0.5**	**0.1**	**0.1**	**0**

Table 5: 2010 Coastal Pond Survey tautog abundance indices (fish/seine haul) by pond and month

Station	May	June	July	August	September	October
Charlestown Pond	3	0	0.8	0.8	0.2	0.2
Narrow River	0	0	0	0	0	0
Point Judith Pond	0.2	0.5	0	1.3	0.2	0
Quonochontaug Pond	0	0	0.3	0	5.7	0.3
Winnipaug Pond	0	0	0	0	0	0
Total	**0.8**	**0.1**	**0.2**	**0.5**	**1.1**	**0.1**

Table 6: 2010 Coastal Pond Survey black sea bass abundance indices (fish/seine haul) by pond and month

Station	May	June	July	August	September	October
Charlestown Pond	0	0	0	0.5	0	0
Narrow River	0	0	0	0	0	0
Point Judith Pond	0	0	0	0	0	0
Quonochontaug Pond	0	0	0	0.7	0	0
Winnipaug Pond	0	0	0	1	0	0
Total	**0**	**0**	**0**	**0.4**	**0**	**0**

Table 7: 2010 Coastal Pond Survey Scup abundance indices (fish/seine haul) by pond and month

Station	May	June	July	August	September	October
Charlestown Pond	0	0	0	0.2	0	0.2
Narrow River	0	0	0	0	0	0
Point Judith Pond	0	0	0	1	0	0
Quonochontaug Pond	0	0	0	0.7	0	0
Winnipaug Pond	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0.4**	**0**	**0.1**

Table 8: 2010 Coastal Pond Survey Clupeid abundance indices (fish/seine haul) by month

Species	May	June	July	August	September	October
Alewife	0	0.1	5.1	1.1	0	0
Atlantic Menhaden	0	0	0	63.6	0.4	0
Atlantic Herring	18.8	0.1	0	0	0	0
Blueback Herring	0.3	0	0	0	0	0

Table 9: 2010 Coastal Pond Survey Atlantic Silverside abundance indices (fish/seine haul) by pond and month

Station	May	June	July	August	September	October
Charlestown Pond	132.8	59	67.8	363.5	75.5	19.5
Narrow River	73	4.7	7	139.3	83	18
Point Judith Pond	129.8	45.2	25.5	27	295.8	30.2
Quonochontaug Pond	31.3	48.3	118.3	117.3	16.3	5
Winnipaug Pond	9.3	20.7	5	165.3	76.3	12
Total	**81.8**	**37.5**	**44.9**	**166.4**	**118.4**	**17.88**

Table 10: 2010 Coastal Pond Survey Striped Kilifish abundance indices (fish/seine haul) by pond and month

Station	May	June	July	August	September	October
Charlestown Pond	41	0.2	11.2	69	7.25	6.5
Narrow River	0	0.3	1.7	0.7	0.7	4.7
Point Judith Pond	1.2	48	28.5	87.5	32	62.5
Quonochontaug Pond	0	0	99.3	14.7	16.3	15.7
Winnipaug Pond	1	0.7	15	147	38	6
Total	**10.1**	**11.5**	**29.8**	**65.5**	**18.9**	**20.9**

Table 11: 2010 Coastal Pond Survey Mumichog abundance indices (fish/seine haul) by pond and month

Station	May	June	July	August	September	October
Charlestown Pond	2.5	40	20.25	23.25	2.5	7
Narrow River	11.7	149	7	1	1	7
Point Judith Pond	4.2	5.5	24.5	1.5	12.25	5.25
Quonochontaug Pond	0	3.3	96.3	2.3	0.7	0.7
Winnipaug Pond	0	3	21.3	436.3	4.7	0
Total	**3.6**	**38.1**	**32.5**	**83.4**	**4.6**	**4.2**

Table 12: 2010 Coastal Pond Survey Sheepshead Minnow abundance indices (fish/seine haul) by pond and month

Station	May	June	July	August	September	October
Charlestown Pond	5	6.8	1.5	0.8	0.2	12.2
Narrow River	0	4.7	0.7	0	0.7	72.3
Point Judith Pond	0.5	0	0	0	0.5	0
Quonochontaug Pond	0	0	1.3	0.3	1.7	21.3
Winnipaug Pond	0	0	3.3	130.3	12.7	13
Total	**1.3**	**2.4**	**1.3**	**23.2**	**2.8**	**21.7**

Table 13: 2010 Coastal Pond Survey average water temperature (degrees Celcius) by pond and month

Station	May	June	July	August	September	October
Charlestown Pond	18.1	22.2	22.2	24.4	19.6	15.7

Narrow River		19.5	26.2	22	19.8	14.9
Point Judith Pond		20	24.6	21.9	21.5	14.9
Quonochontaug Pond	19.2	20.8	25.8	25.5	19.9	13.6
Winnipaug Pond	13.2	18.5	26.3	24.2	19.9	16.2
Average	**16.8**	**20.2**	**25.6**	**23.6**	**20.1**	**15.1**

Table 14: 2010 Coastal Pond Survey average salinity (ppt) by pond and month

Station	May	June	July	August	September	October
Charlestown Pond	25.5	27.1	27.1	27.2	27.4	27.3
Narrow River		18	28.3	25.5	26.3	26.5
Point Judith Pond		27	28.4	27.8	27.4	27.7
Quonochontaug Pond	29.3	30	25.7	28.95	28.7	28.8
Winnipaug Pond	28.8	27.7	28.3	28.5	28.1	28.7
Average	**27.7**	**26**	**27.6**	**27.6**	**27.6**	**27.8**

Table 15: 2010 Coastal Pond Survey average dissolved oxygen (mg/l) by pond and month Note: No dissolved oxygen measurements were taken between May and July due to faulty equipment.

Station	May	June	July	August	September	October
Charlestown Pond				8.3	7.4	8
Narrow River				7.2	6.8	8.1
Point Judith Pond				7.6	7.9	8.6
Quonochontaug Pond				7.4	7.2	7.7
Winnipaug Pond				7.9	7.4	7.3
Average				**7.7**	**7.4**	**7.9**

Table 16: Total species caught at the new coastal pond stations in Potter's and Green Hill Ponds. Potter's pond was sampled between July and October (8 Hauls) and Green Hill Pond between September and October (4 hauls).

Species	GH1	GH2	PP1	PP2
ALEWIFE (ALOSA PSEUDOHARENGUS)			11	
ANCHOVY BAY (ANCHOA MITCHILLI)	3		5	3
BLUE CRAB (CALINECTES SAPIDIUS)	16	18	74	31
BLUEFISH (POMATOMUS SALTATRIX)	1			
EEL AMERICAN (ANGUILLA ROSTRATA)			1	
FLOUNDER WINTER (PLEURONECTES AMERICANUS)			1	
GOBY NAKED (GOBIOSOMA BOSC)	5		2	
JACK CREVALLE (CARANX HIPPOS)			8	10
KILLIFISH STRIPED (FUNDULUS MAJALIS)	1	11	22	19
MINNOW SHEEPSHEAD (CYPRINODON VARIEGATUS)		81	95	34
MOONFISH ATLANTIC (SELENE SETAPINNIS)				1
MULLET WHITE (MUGIL CUREMA)		2	89	2
MUMMICHOG (FUNDULUS HETEROCLITUS)		290	140	80
NEEDLEFISH ATLANTIC (STRONGYLURA MARINA)			1	
PIPEFISH NORTHERN (SYNGNATHUS FUSCUS)			2	2
RAINWATER KILLIFISH (LUCANIA PARVA)		2	1	28
SILVERSIDE ATLANTIC (MENIDIA MENIDIA)	184	151	168	213
STICKLEBACK FOURSPINE (APELTES QUADRACUS)		26		
TOADFISH OYSTER (OPSANUS TAU)			1	4

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

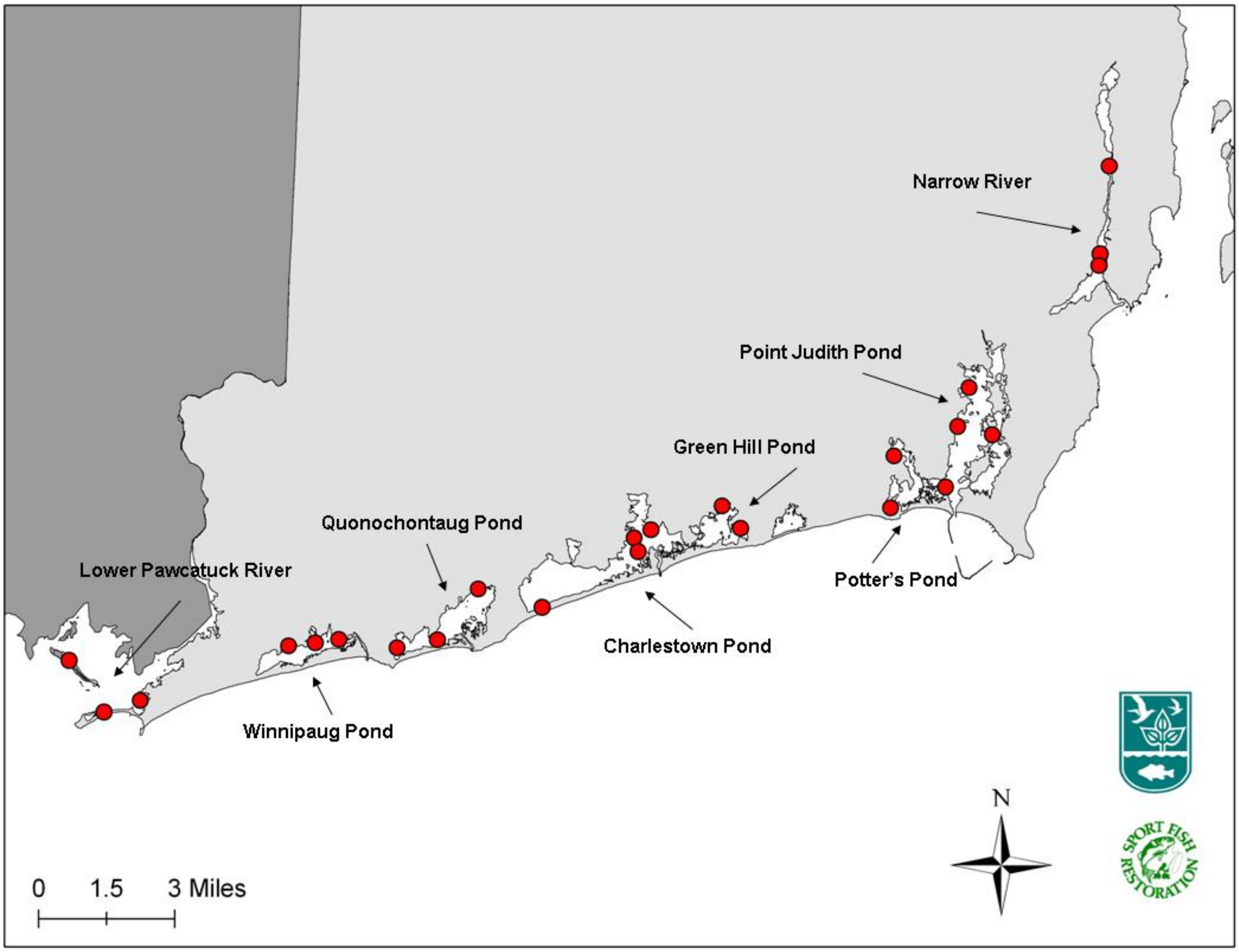


Figure 2: Coastal Pond Juvenile Finfish Survey station locations (western ponds).

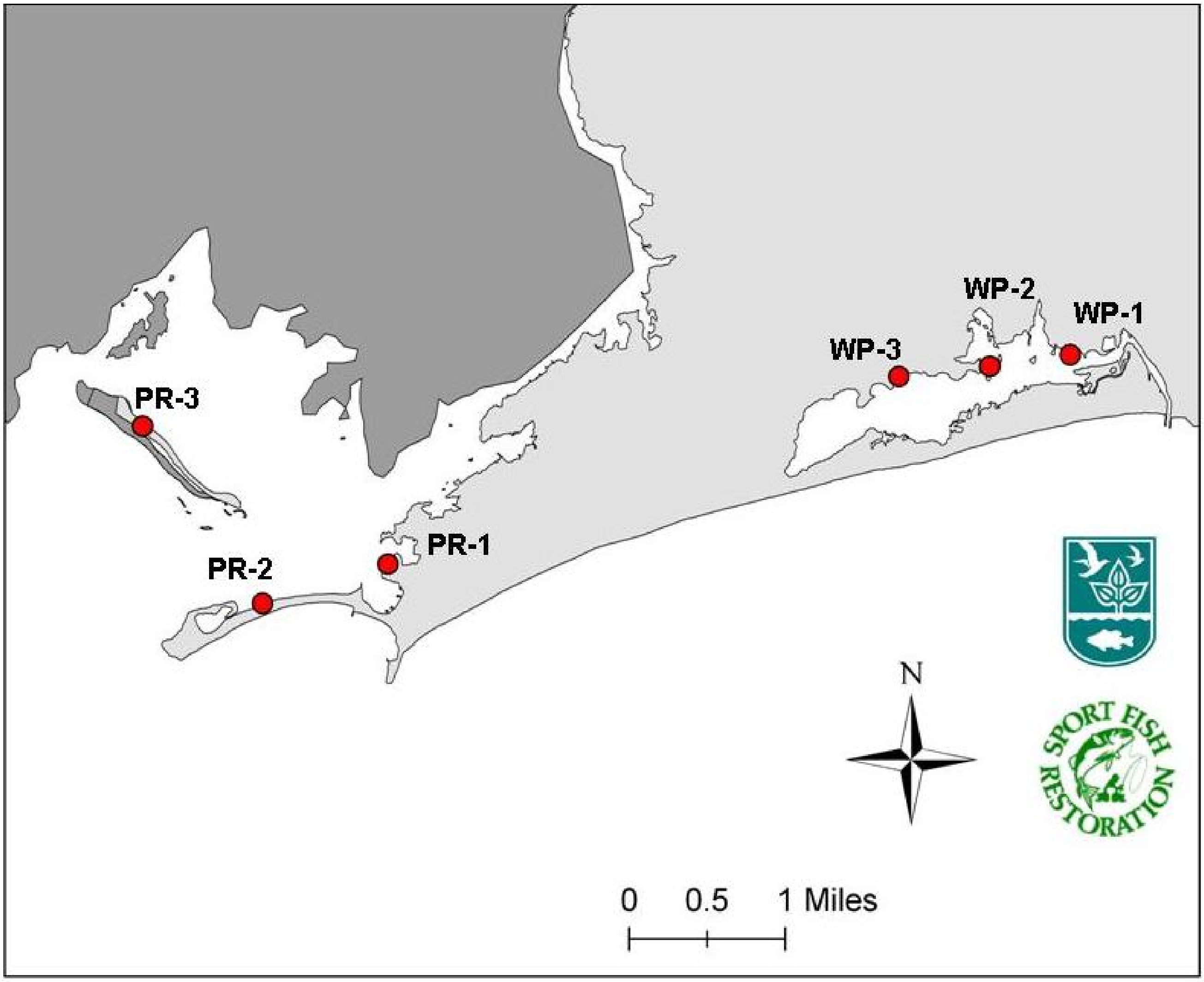


Figure 2 (cont): Coastal Pond Juvenile Finfish Survey station locations (western ponds).

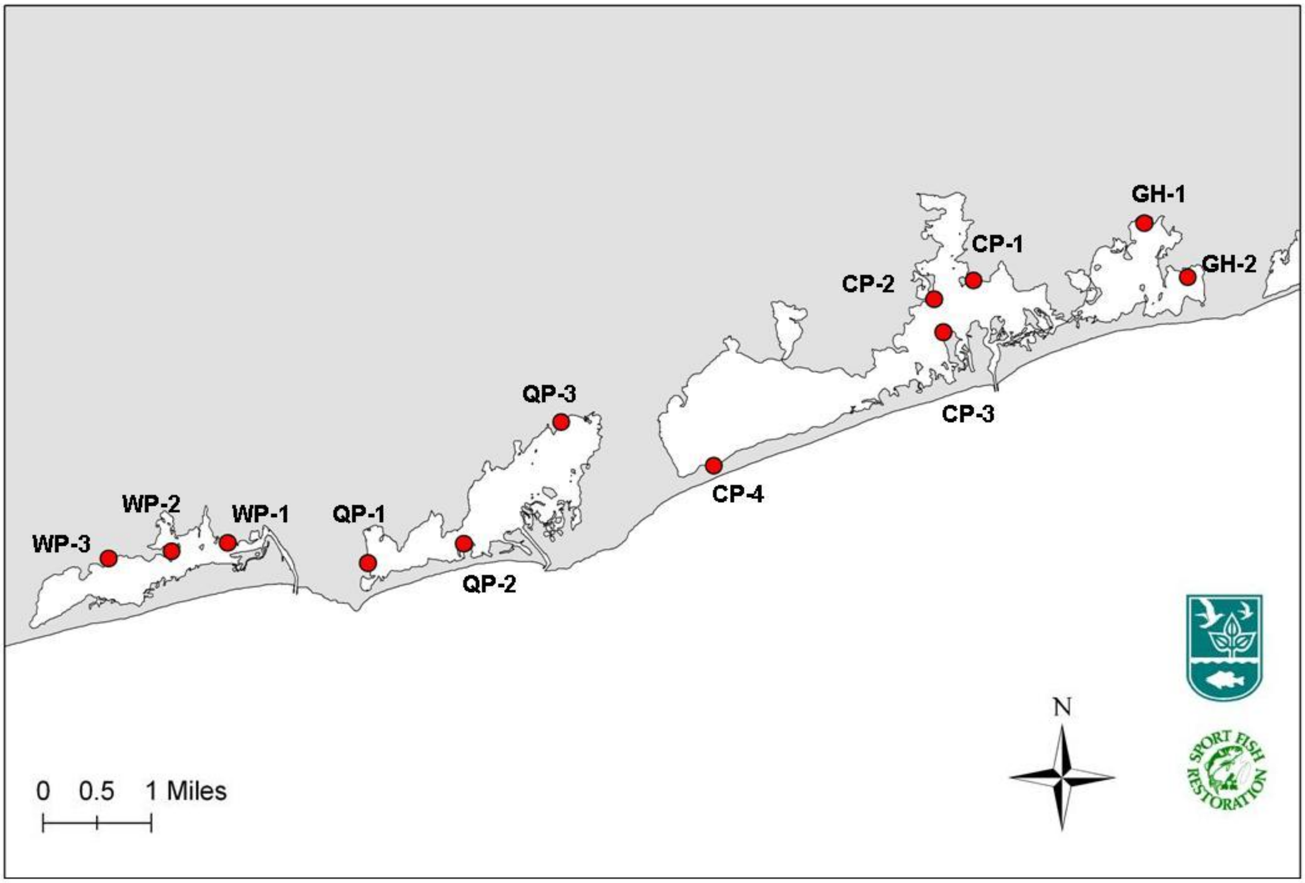


Figure 3: Coastal Pond Juvenile Finfish Survey station locations (eastern ponds).

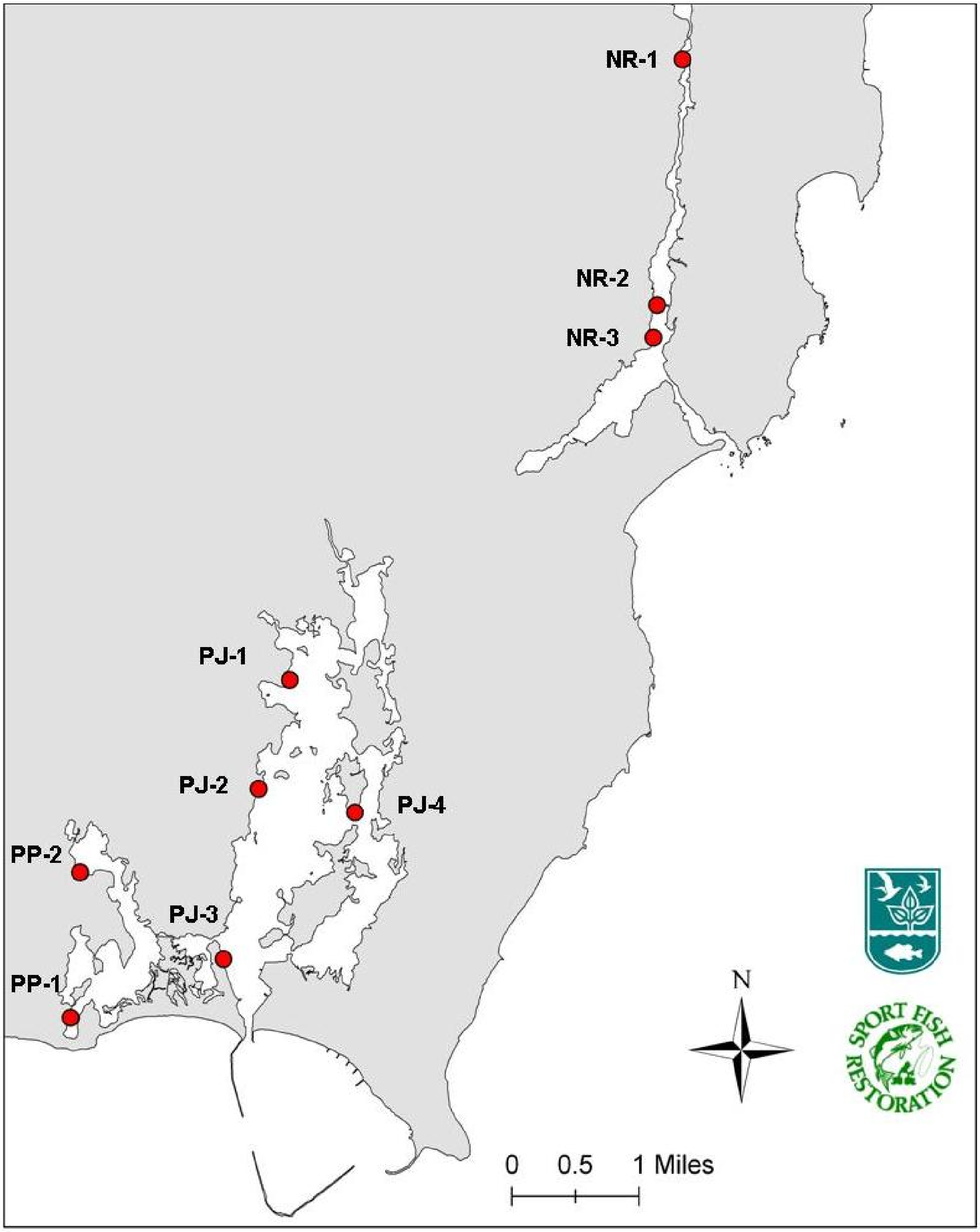


Figure 4
Coastal Pond Juvenile Finfish Survey

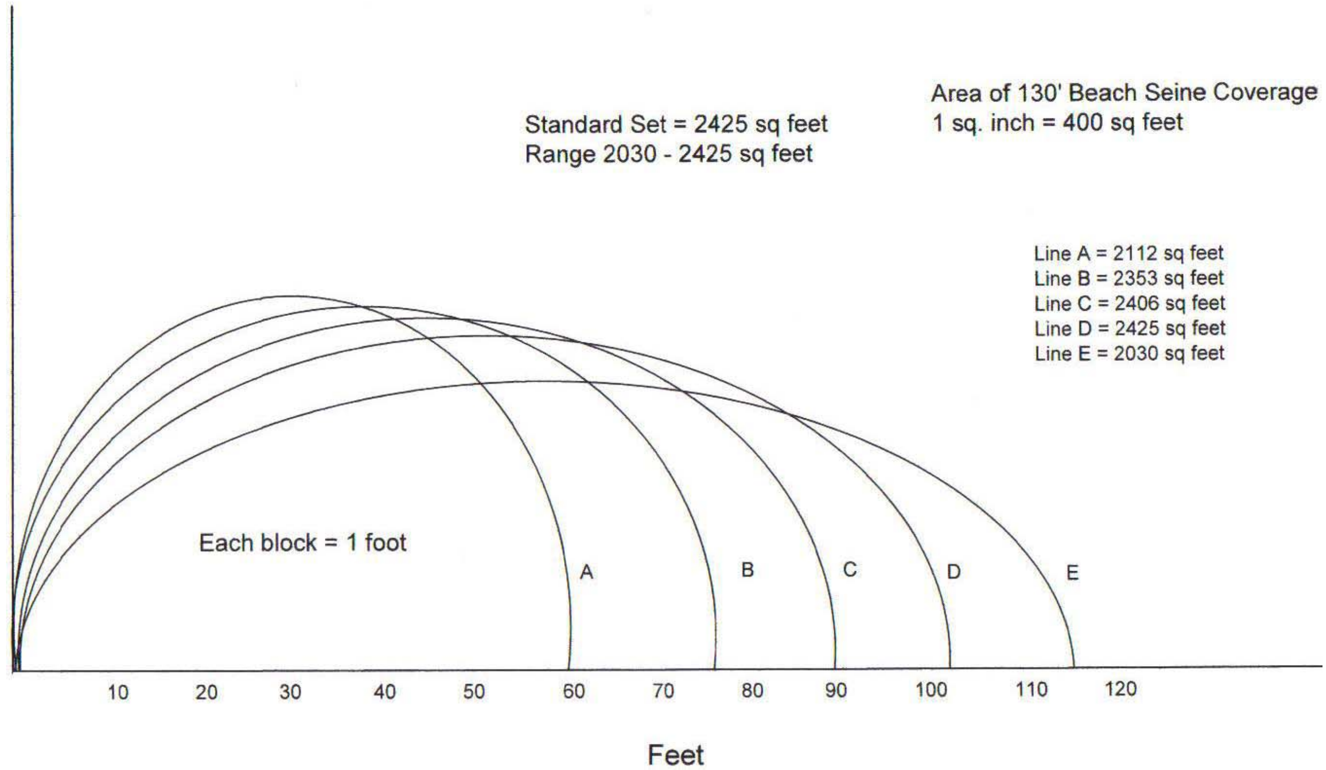


Figure 5: Time series of abundance indices (fish/seine haul) for winter flounder from each Coastal Pond in the survey.

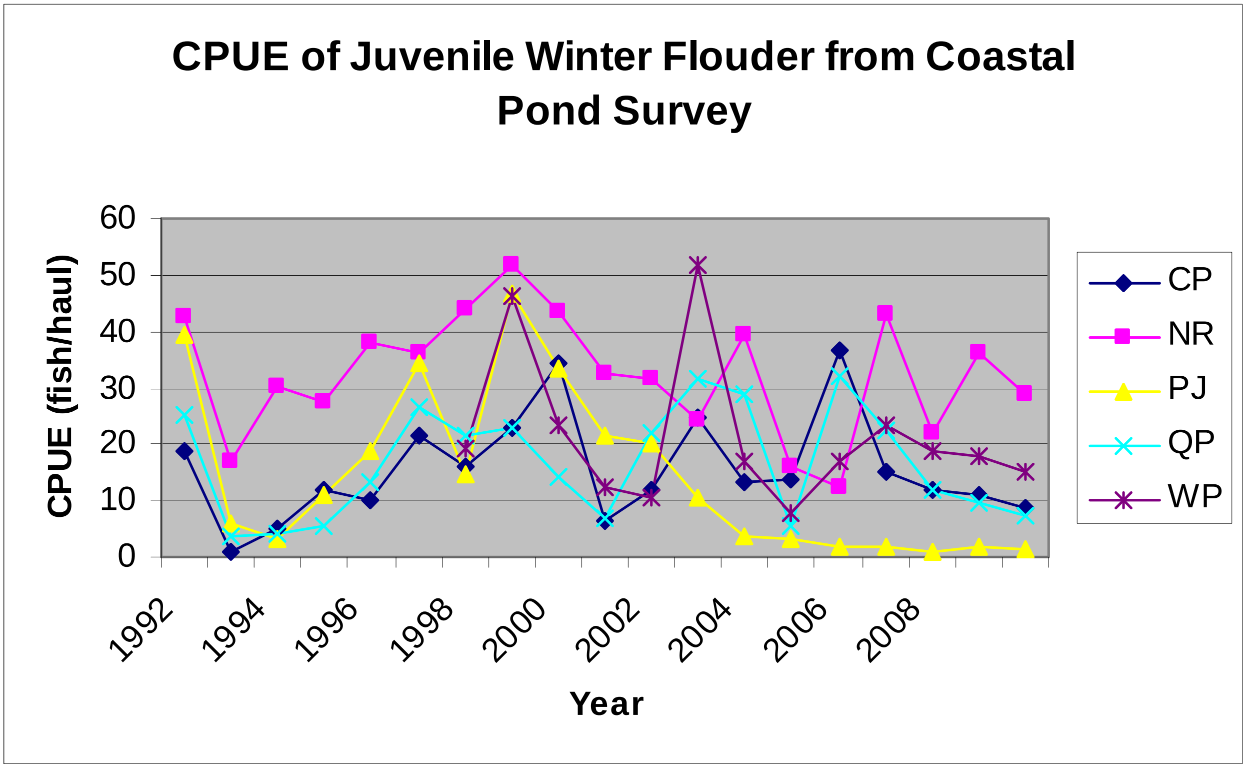


Figure 6: Length frequency of all juvenile winter flounder caught in Coastal Pond Survey during 2009.

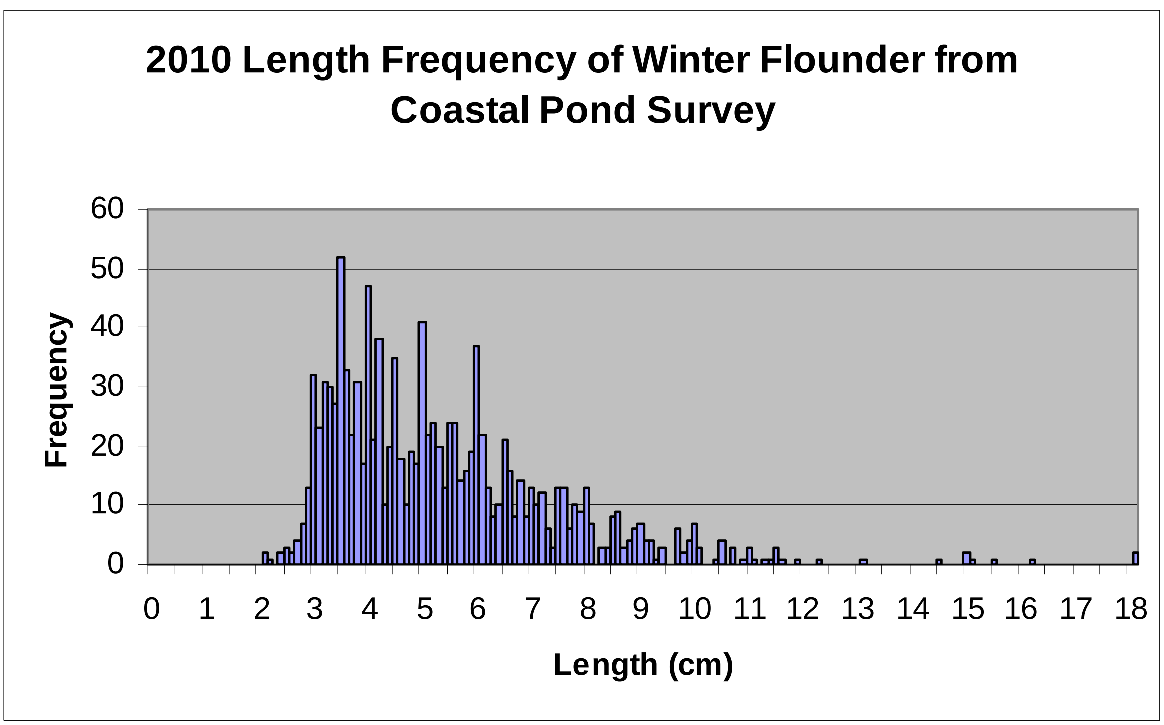


Figure 7: Monthly length frequency of winter flounder from Charlestown Pond, 2010.

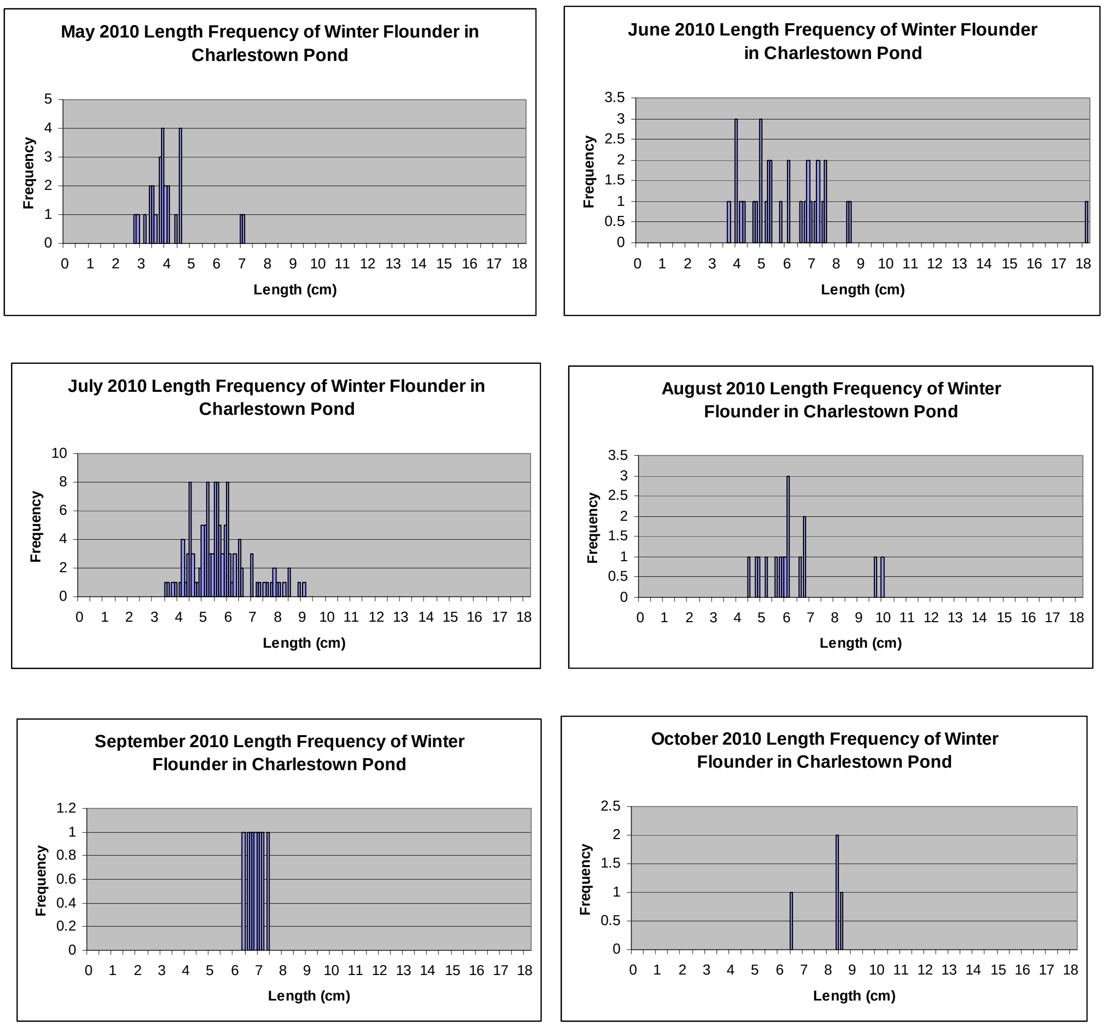


Figure 8: Monthly length frequency of winter flounder from Narrow River, 2010.

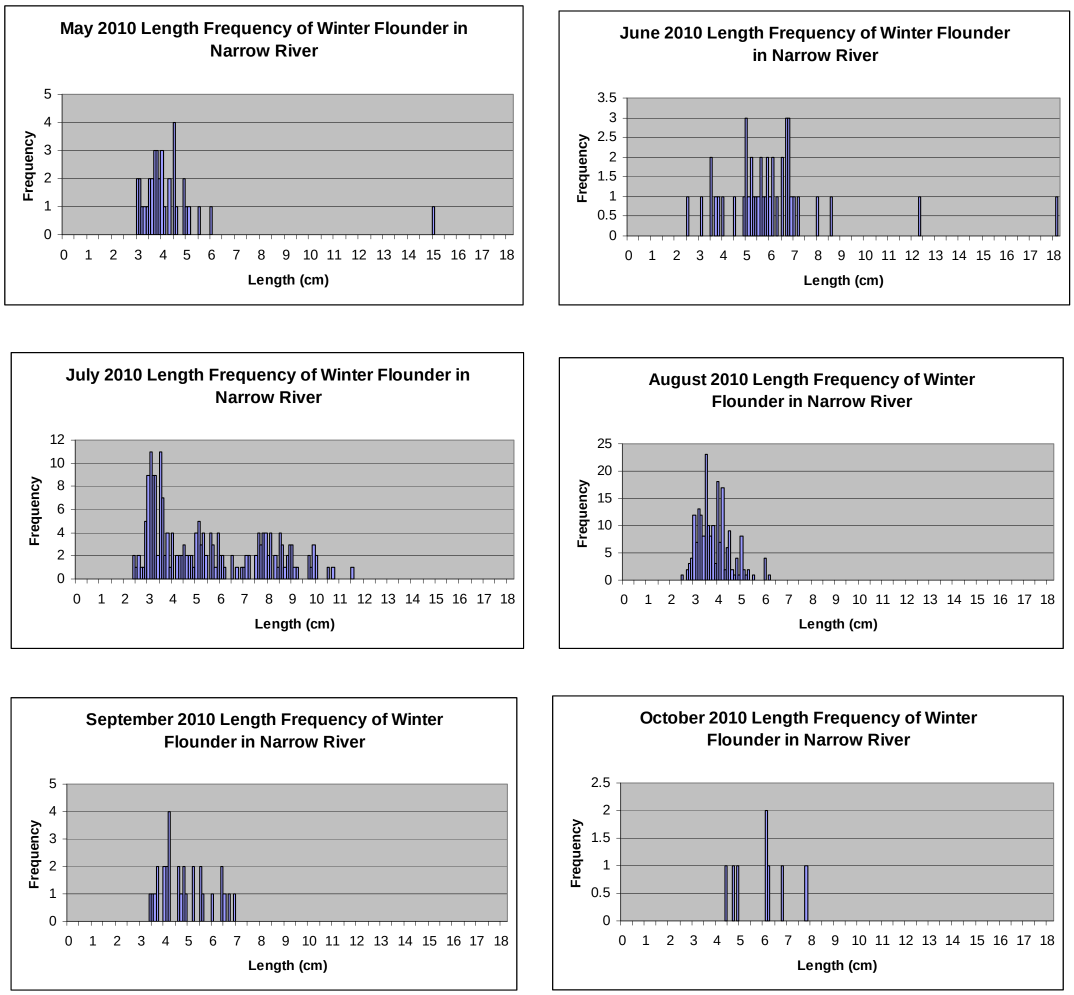


Figure 9: Monthly length frequency of winter flounder from Point Judith Pond, 2010.

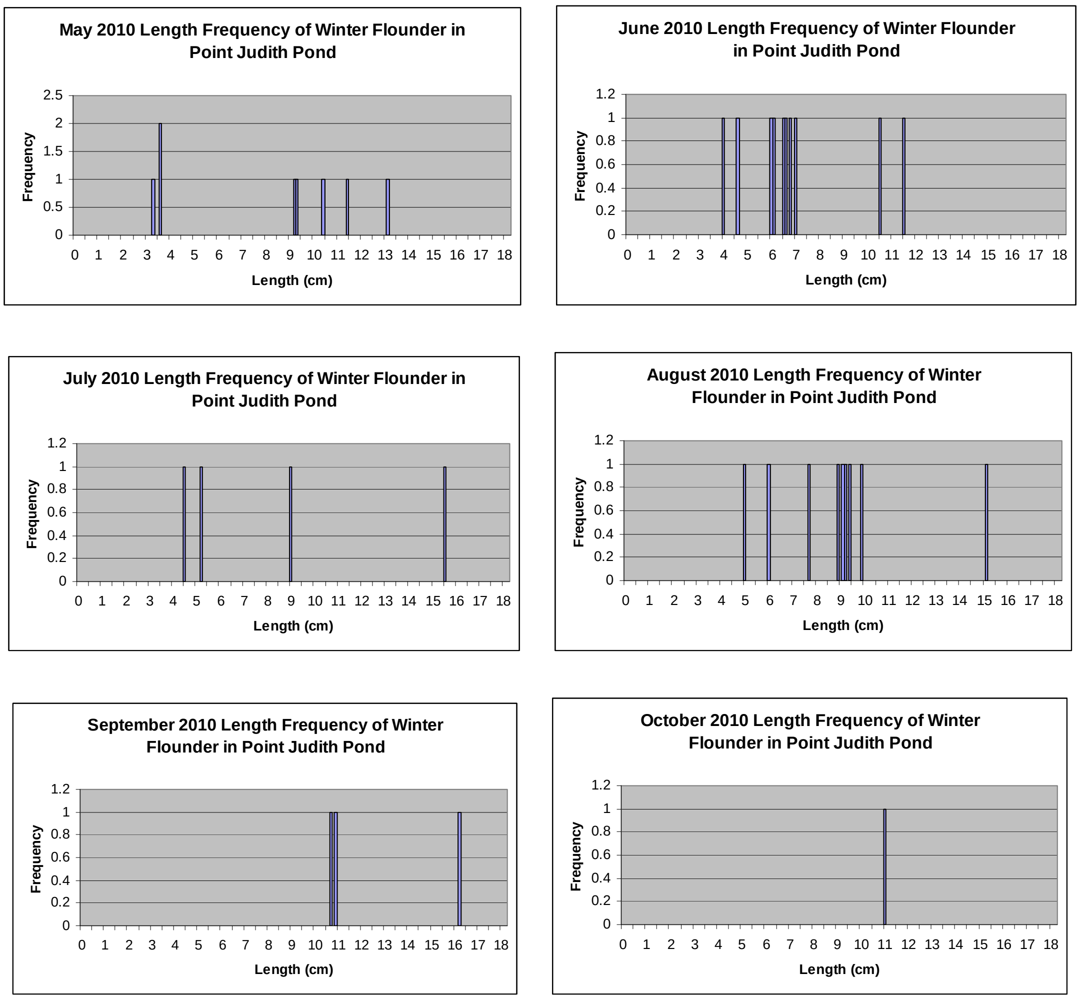


Figure 10: Monthly length frequency of winter flounder from Quonochontaug Pond, 2010.

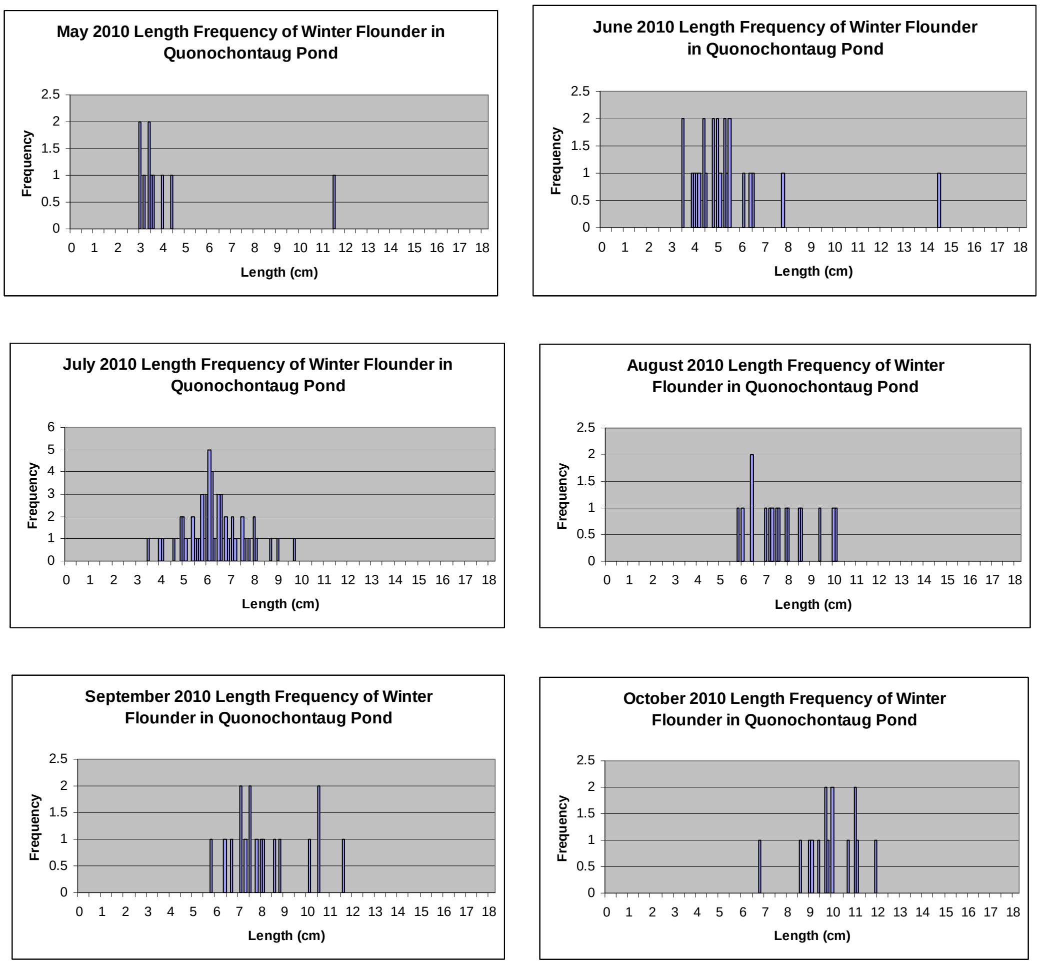


Figure 11: Monthly length frequency of winter flounder from Winnipaug Pond, 2010.

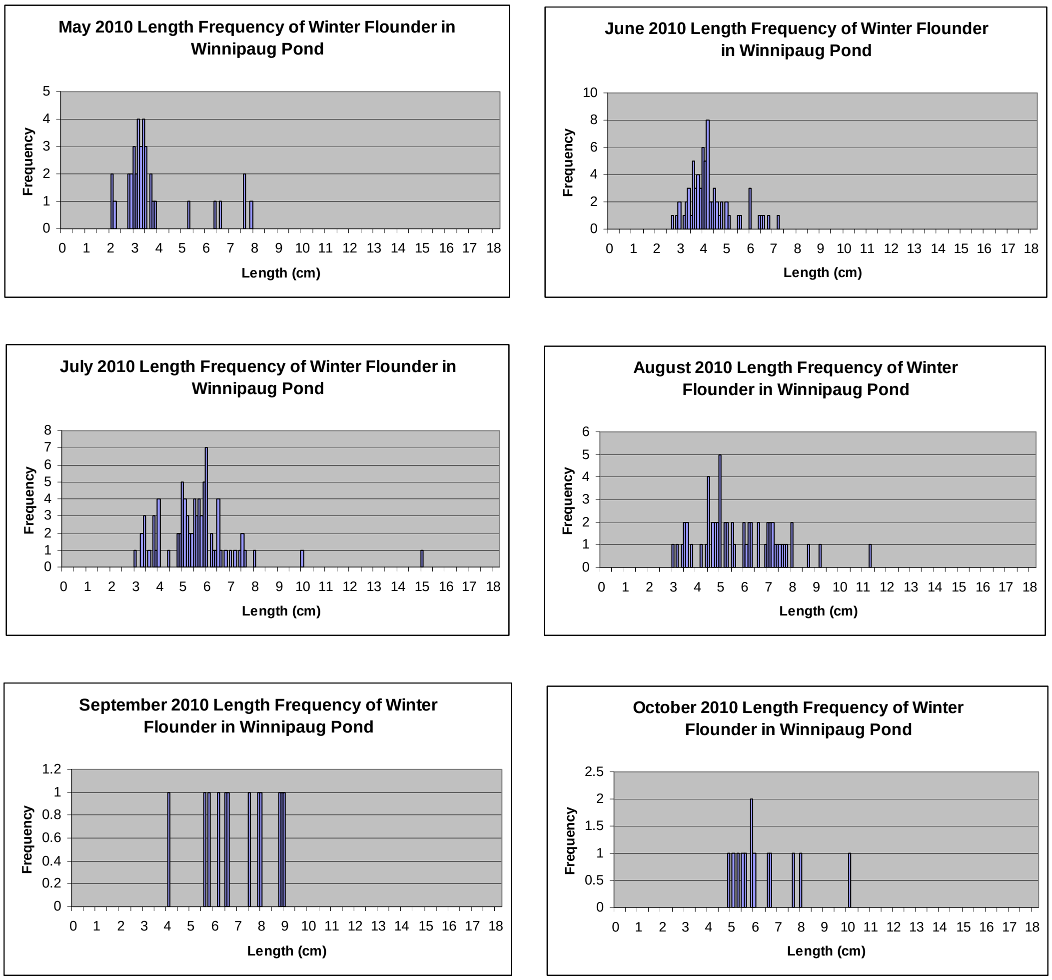


Figure 12: Abundance indices (fish/haul) from the Coastal Pond Survey, Narragansett Bay Seine Survey, and RIDFW Trawl Survey for winter flounder.

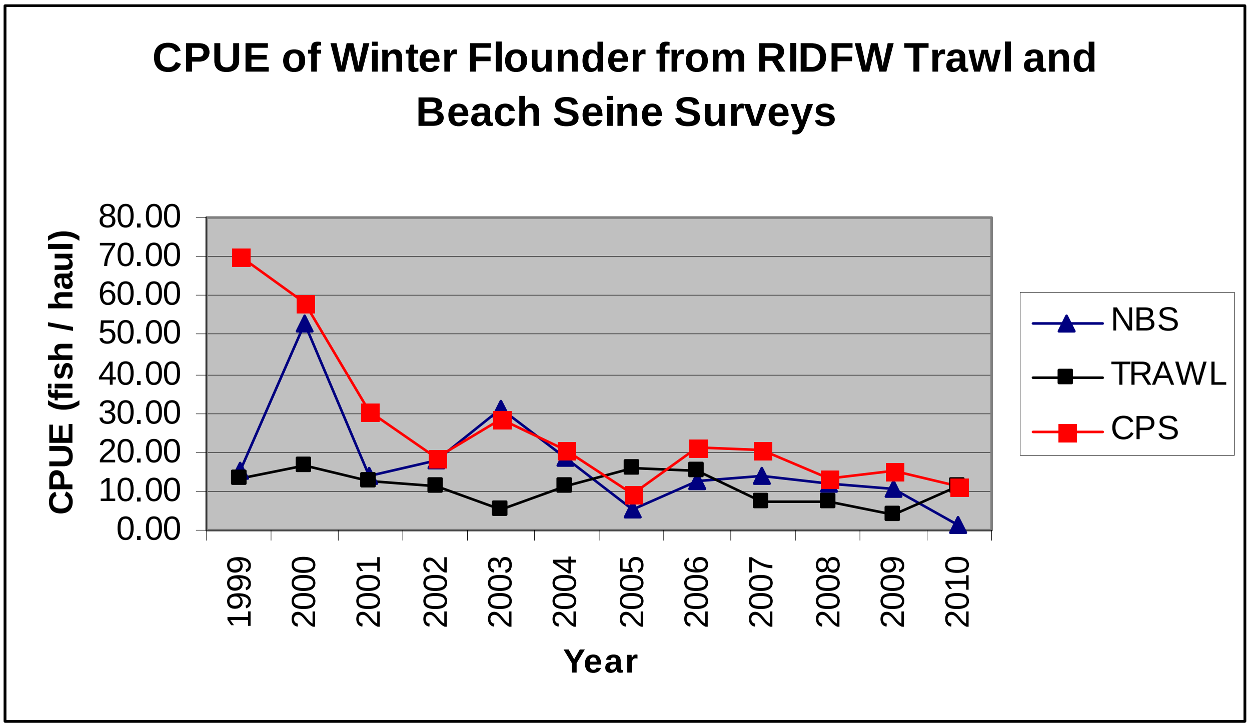
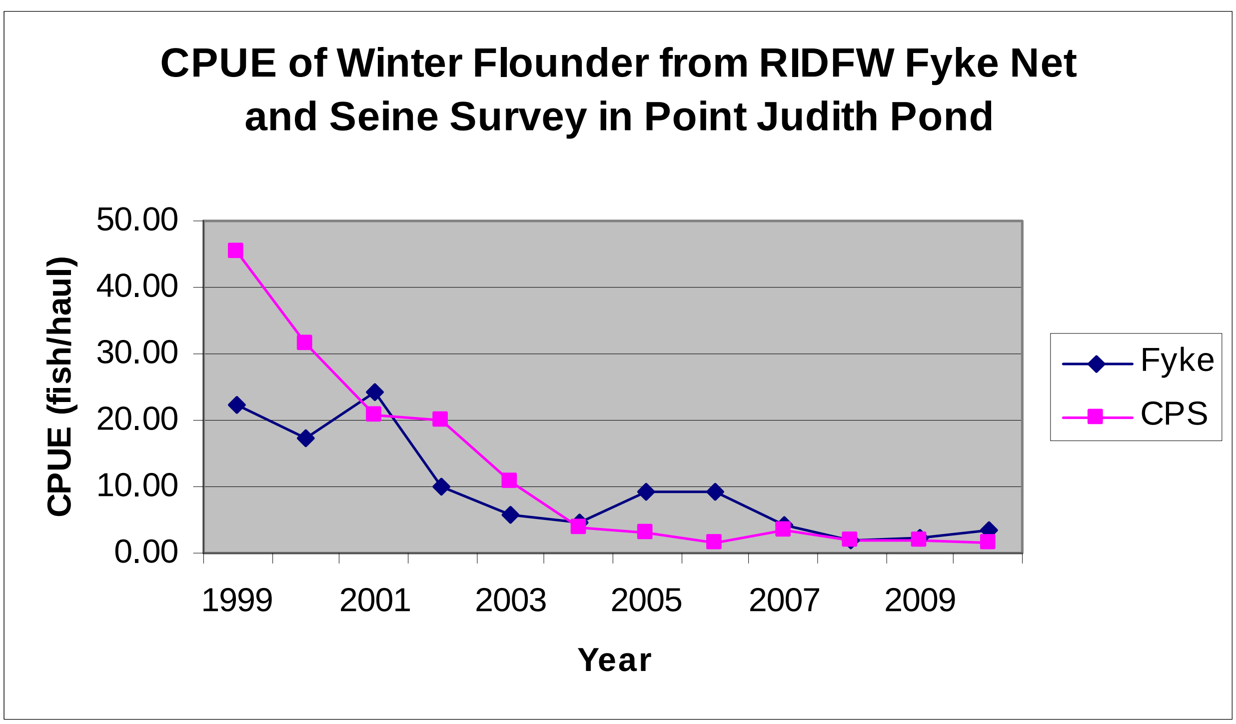


Figure 13: Abundance indices (fish/haul) from the Coastal Pond Survey and the Adult Winter Flounder Tagging Survey for winter flounder.



APPENDIX 1:

Catch frequency of all species by station for entire 2010 Coastal Pond Survey.

Species	CP1	CP2	CP3	CP4	NR1	NR2	NR3	PJ1	PJ2	PJ3	PJ4	QP1	QP2	QP3	WP1	WP2	WP3
ALEWIFE (ALOSA PSEUDOHARENGUS)		1				19	75										1
ANCHOVY BAY (ANCHOA MITCHILLI)										1	5						
BASS STRIPED (MORONE SAXATILIS)								1			1						
BLUE CRAB (CALINECTES SAPIDIUS)	29	33	31	29	74	55	9	34	3	3	16	59	18	33	3	5	50
BLUEFISH (POMATOMUS SALTATRIX)	4	1	1				1	1	1		3			3			
CUNNER (TAUTOGOLABRUS ADSPERSUS)		4	2						4				5				
EEL AMERICAN (ANGUILLA ROSTRATA)	1		3			3											1
FLOUNDER SMALLMOUTH (ETROPUS MICROSTOMUS)	4		5							2				3			12
FLOUNDER SUMMER (PARALICHTHYS DENTATUS)											3						1
FLOUNDER WINTER (PLEURONECTES AMERICANUS)	167	10	30		29	333	154	2	11	3	19	46	62	26	132	109	30
GOBY NAKED (GOBIOSOMA BOSC)		3	1		1	3		3			3	22		35			
GRUBBY (MYOXOCEPHALUS AENAEUS)			1			2	7			1			44	1	17	5	
HAKE SPOTTED (UROPHYCIS REGIA)			1														
HERRING ATLANTIC (CLUPEA HARENGUS)		3	250					66			1						
HERRING BLUEBACK (ALOSA AESTIVALIS)					1			4									
HORSESHOE CRAB (LIMULUS POLYPHEMUS)											1				1	1	1
JACK CREVALLE (CARANX HIPPOS)		3			5									18			5
KILLIFISH STRIPED (FUNDULUS MAJALIS)	36	23	184	298	8	14	2	14	132	834	59	81	324	33	99	8	516
KINGFISH NORTHERN (MENTICIRRHUS SAXATILIS)							1										
LIZARDFISH INSHORE (SYNODUS FOETENS)				2	1	2			13		3	1		3			
MENHADEN ATLANTIC (BREVOORTIA TYRANNUS)				1		1086											1
MINNOW SHEEPSHEAD (CYPRINODON VARIEGATUS)	22	15	41	28	141	84	10		1		3	29	13	32	24	35	419
MULLET WHITE (MUGIL CUREMA)	18	1		6	15	101	3	7	6				31	3			11

Species	CP1	CP2	CP3	CP4	NR1	NR2	NR3	PJ1	PJ2	PJ3	PJ4	QP1	QP2	QP3	WP1	WP2	WP3
MUMMICHOG (FUNDULUS HETEROCLITUS)	27	162	172	21	25	413	92	69	16	76	52	24	285	1	57	5	1334
NEEDLEFISH ATLANTIC (STRONGYLURA MARINA)				3													2
PERMIT (TRACHINOTUS FALCATUS)													10				
PIPEFISH NORTHERN (SYNGNATHUS FUSCUS)	10	26	21	1		5	4	4	15	1	7	3	12		1	2	6
POLLOCK (POLLACHIUS VIRENS)	2	5	39														
POMPANO AFRICAN (ALECTIS CILIARIS)							1										
RAINWATER KILLIFISH (LUCANIA PARVA)	16	38	109	3				9	1				9	1	2		21
SCAD BIGEYE (SELAR CRUMENOPHTHALMUS)											1						
SCUP (STENOTOMUS CHRYSOPS)		1	1						4			2					
SEA BASS BLACK (CENTROPRISTIS STRIATA)	1		1										1	1		3	
SEAROBIN STRIPED (PRIONOTUS EVOLANS)	1		1		2								1	1		3	
SILVERSIDE ATLANTIC (MENIDIA MENIDIA)	163	159	426	2124	736	129	110	438	207	111	1458	263	392	355	223	436	207
SNAPPER GRAY (LUTJANUS GRISEUS)			1														
SQUID LONGFIN (LOLIGO PEALEI)												2			1		
STICKLEBACK FOURSPINE (APELTES QUADRACUS)	7	148	105		2	17	2	1				26	15	1			9
STICKLEBACK NINESPINE (PUNGITIUS PUNGITIUS)						1											
STICKLEBACK THREESPINE (GASTEROSTEUS ACULEATUS)	2	18	21			1									1		
TAUTOG (TAUTOGA ONITIS)		6	14					1	1	1	6		19				
TOADFISH OYSTER (OPSANUS TAU)						1											
TOMCOD ATLANTIC (MICROGADUS TOMCOD)		39	51			4	1		4						1		
WINDOWPANE (SCOPHTHALMUS AQUOSUS)	2													1			

APPENDIX 2

Proposal to expand the Coastal Pond Juvenile Finfish Survey into Potter's Pond, Green Hill Pond, and the Lower Pawcatuck River.

Title: Expanding the RIDFW Coastal Pond Juvenile Fish Survey to include Potter's Pond, Green Hill Pond, and Little Narragansett Bay.

Goals and Objectives

The primary objective of the Coastal Pond Survey is 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. The goal of this proposal is to expand the RIDFW Coastal Pond Survey by adding 7 stations to the annual survey in Green Hill Pond, Potters Pond, and Little Narragansett Bay (lower Pawcatuck River) (Figures 1-3).

Background

The RIDFW coastal pond survey is being carried out in Winnipaug Pond, Quonochontaug Pond, Ninigret Pond, Point Judith Pond and the Narrow River (Figures 4 and 5). The Survey has been conducted at these 16 sites since 1993 between the months of May and October annually. The survey has proven to be an effective method to track juvenile fish populations in the coastal ponds particularly the main target species, winter flounder. Juvenile fish abundance indices derived from the survey are provided to stock assessment biologists.

The population of target species, winter flounder, is currently assessed to be at historically low levels. According to the 2008 stock assessment the Southern New England winter flounder stock is overfished with overfishing occurring. Fishing mortality (F) in 2007 was estimated to be 0.649, over twice the FMSY proxy = F40% = 0.248. Spawning Stock Biomass (SSB) in 2007 was estimated to be 3,368 mt, about 9% of SSBMSY = 38,761 mt. (NEFSC 2008). These results have prompted a winter flounder fishing closure in SNE federal waters and a 50 lb possession limit in State waters for sampling purposes only.

Locally the effects of this decline in winter flounder can be seen in a population crash within Point Judith Pond, RI. In addition to the coastal pond survey an annual fyke net survey is conducted aimed at collection of adult spawning winter flounder. When relative abundance, number of fish/seine haul, of juvenile winter flounder are compared to the relative abundance, number of fish/fyke net haul, of the Adult Winter Flounder Tagging Survey, (Figure 6), the 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. 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). Action will be initiated to close the pond to both recreational and commercial fishing for winter flounder (Gibson, 2010).

The recovery of the SNE stock only starts with reducing fishing effort; anthropogenic and environmental facts can also have adverse effects on the population. Aside from overfishing, anthropogenic factors include nutrient loading, intertidal construction, and dredging. Environmental factors include warming water temperatures and potential species assemblage switches brought on by climate change.

The life history strategy of winter flounder makes local populations very susceptible to both large and small scale anthropogenic and environmental disturbances. Research on winter flounder life history in Narragansett Bay has revealed that winter flounder tend to show affinity to certain spawning locations resulting in smaller meta stocks throughout Narragansett Bay (Buckley et. al.

2008). Winter flounder spawn and lay their eggs which attach to silty sand or algal mats on the bottom. This activity takes place between January and May usually coinciding with cold water temperatures (Bigelow and Schroder 1953). After hatching the juveniles spend a period of time in the water near where the eggs hatch and metamorphose and settle to the bottom at around 13 mm (Laroche 1981). Once settled, juveniles believed to be relatively stationary with affinity to sites near spawning locations. (Gray 1990) (Buckley et. al. 2008).

Nutrient loading, intertidal construction and dredging can have local effects on juvenile fish habitat, including that of winter flounder, which can result in potential adverse on eggs, larvae, and juveniles. Loss or disturbance of habitat due to low dissolved oxygen or sedimentation during early life stages when the fish are present in a generally small area could have a significant effect on survival rates especially at key times of the year.

Climate change effects most notable increased sea surface temperatures have potential adverse effects on the assemblages of the fish communities living in the coastal ponds and their biology. These effects are not limited to winter flounder but all fish populations living in the coastal ponds. Hsieh et. al. (2008), suggests that exploited populations are more sensitive to climate variations and more likely to display shifts in larval distributions, notably in species with more localized distributions. Studies on long term data set inside and out of Rhode Island have documented shifts in production and species assemblages correlated with warming ocean temperatures (Brander 2006). Long term trawl survey data collected between 1959 and 2005 in Narragansett Bay, RI documents a shift in species assemblages from benthic to pelagic species as well as from vertebrates to invertebrates. Species diversity also increased during this time period. Theses shifts in species composition are correlated strongly with increased surface water temperatures as well as North Atlantic Oscillation and chlorophyll concentration all associated with climate change (Collie et. al. 2008). Climate change may have indirect effects on juvenile fish populations in the coastal ponds by adversely impacting their some of their preferred habitats such as eelgrass. Warming sea surface temperature stressors on the plants physiology and physical environment has potential to shift eelgrass (*Zostra spp*) distribution. (Shorta and Neckles 1999). A lack of or reduced distributions of eelgrass in the pond would potentially increase predation on juvenile populations that use eel grass as a refuge.

Rising sea surface temperatures effect on the ecology, particularly predation on larval and juvenile winter flounder could potentially reduce population size or prevent a rebound in abundance in the ponds. Sand Shrimp (*Crangon septemspinosa*) predation on winter flounder eggs, larvae and juveniles is postulated to have a strong influence on year class strength (Taylor 2005). Young of the year winter flounder use shallow waters (< 1 m) as a refuge from predation particularly from piscovores (Manderson et. al. 2004). The sand shrimp migrate into the same shallow waters in the early spring based on water temperature. If this influx of sand shrimp into the shallow waters overlaps with the timing of winter flounder settlement high predation rates can occur on the YOY flounder (Taylor 2005). Warm winters result in sand shrimp migrating into the ponds earlier in the year and thus the probability that the shrimp and newly settled flounder overlap in the shallow water increases. Furthermore, it has been documented that sand shrimp predation rates increase with higher water temperatures (Taylor and Collie 2003) (Witting and Able 1995). It is suspected that other crustacean predators display a similar increase in predation rates such as green crabs (*Carcinus maenas*), rock crabs (*Cancer irroratus*), and lady crabs (*Ovalipes ocellatus*) (Witting and Able 1995). Depending on population levels and the temporal and spatial overlap in distribution of the crustacean predators, local populations of newly settled juveniles can be significantly impacted (Taylor 2005) (Taylor and Collie 2003). Juveniles that have settled at larger sizes or grow rapidly after settlement have a better chance of survival (Witting and Able 1995, Chambers et. al. 1988) presumably because they grow out of the size most susceptible to predation. Elevated sea surface temperatures effect on the larval biology of winter flounder could exacerbate predation on YOY winter flounder. Chambers and Legget (1987) found that temperature had an effect on larval winter flounder growth rates and the timing of metamorphosis. Higher temperatures resulted in more rapid growth rates, shorter larval periods, and smaller size at settlement. Keller and MacPhee (2000) found that winter flounder egg survival, percent hatch, time to hatch and initial size decreases with increasing temperature and that increased predation and food assemblage shifts at higher temperature compounded the problem resulting in high mortality rates.

Historically all of the coastal ponds including Green Hill Pond, Potters Pond, and the Pawcatuck River have supported fisheries for winter flounder. Spawning locations have also been identified in the past in Green Hill and Potters Pond (Saila 1961) (Crawford 1990). RIDFW has not sampled for juvenile saltwater fish in these areas since the early 1990's Satchwill and Sisson 1990, Satchwill and Sisson 1991). It remains unclear as to why these water bodies were not continued when the annual Coastal Pond Survey began in 1993. During the 2010 survey, an additional station was added in Point Judith Pond to provide better geographic coverage as well as to further characterize the juvenile winter flounder population in that pond (figure 1). Preliminary results from the new station indicate higher abundances of juvenile wither flounder in the pond than would be calculated from just the three original pond stations. Preliminary results from this station increases the diversity of the species collected in the pond more so than would be observed from just the original three stations. These results validate our approach of adding stations to get better abundance and diversity data from all of the coastal ponds.

Need

The depressed state of the SNE winter flounder stock is of great concern to RIDFW as well as commercial and recreational fishing interests in Rhode Island. The significant change in management measures makes monitoring the winter flounder population essential to determine their effectiveness. RIDFW feels it would further the objective of the survey and complement the survey even further to evaluate the juvenile winter flounder population in additional coastal ponds in southwestern Rhode Island. By expanding the range of the survey into other water bodies, more potential changes in pond specific populations could be detected. There is uncertainty whether local winter flounder spawning aggregations can recover after they have not been detectable for long periods of time. It is unclear if as the stock recovers the fish will expand back into previously populated spawning and settlement grounds. Alternatively the distinct localized structure of the various meta populations may only return to their preferred locations and thus not repopulate areas used by other distinct spawning aggregations. In areas where winter flounder abundance is low, environmental factors directly (e.g. higher sea surface temperatures) or indirectly (e.g. increased predation rates) associated with climate change may be too severe for the local population to re-establish at previous abundances. By monitoring additional these water bodies the current distributions of winter flounder juveniles can be better determined as well as whether their numbers are increasing or declining into the future.

The benefit of more comprehensive geographic distribution of stations in the coastal ponds would benefit the juvenile abundance indices, for all the target species not just winter flounder. Expanding the scope of the survey has potential to reveal juvenile assemblages that would otherwise go undocumented. An expansion of scope in the survey would also allow for more innovative modeling for stock assessment. The data from this survey complements habitat mapping work in progress by the University of Rhode Island (MapCoast) and other researchers in the coastal ponds. The existing ponds as well as the additional ponds proposed to be sampled are being mapped by URI's MapCoast and fed into a geographic database which houses other data sources from the ponds such as water quality and sediment composition. The survey data in conjunction with this geographic database will allow for more robust modeling of population size and structure of all of the target species using ecosystem based approaches which take into account many factors in addition to single species abundance. Additionally, more comprehensive data can be gathered on species assemblages and their associated habitats in the southern Rhode Island coastal ponds and incorporated into the management decision process. Examples of the utility of this type of ecosystem approach ranges from better decision making information when evaluating proposed projects at specific locations on the ponds to providing more comprehensive data for the creation of a state wide climate change plan.

Approach

RIDFW proposes to add 7 additional stations to the annual Coastal Pond Juvenile Fish Survey to be sampled concurrently with the existing stations during the months of May – October. Theses stations will be added to Potters Pond (figure 1), Green Hill Pond (figure 2), and Little Narragansett Bay (figure 3). The current stations for the Coastal Pond Juvenile Fish Survey can be found in figures 4 and 5. Proposed station locations were selected when possible at locations where previous survey work had been done in the past for comparative purposes. There is an existing freshwater seine survey already in progress in the upper Pawcatuck River; this survey does not extend into Little Narragansett bay.

The current survey design requires 5 days of field sampling, one day for each pond. It is estimated that the addition of the new stations would only increase the workload by one sampling day as some of the new stations are in the vicinity of the existing stations that they could be sampled on the same day. Data entry and analysis tasks associated with the additional stations would be minimal.

The sampling methodology in place for the current Coastal Pond Juvenile Fish Survey will be used at the proposed sampling locations. All seining will be attempted on incoming tides. 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 has a bag at its midpoint, a weighted footrope and floats on the head rope. The beach seine is set in a semi-circle, away from the shoreline and back again using an outboard powered 16' Aluminum boat. The net is then hauled toward the beach by hand and the bag emptied into a large water-filled tote. All animals collected are identified to species, measured, enumerated, and sub-samples are taken when appropriate. Water quality parameters, (temperature, salinity and dissolved oxygen) are measured at each station.

The abundance indices for the target species are a key end product of the coastal pond survey. The addition of more stations into the index could have potential effects on the integrity of the time series. It is unknown whether adding the data collected at the new stations will skew the results either positively or negatively if at all. In the interest of keeping the time series consistent, the abundance indices will be calculated with and without the additional stations. As the survey progresses and more data are gathered at the new stations, the differences in the indices can be modeled to create a new abundance index which includes the new stations in the entire time series. Ideally this index will be standardized such that it is comparable to other fisheries independent surveys being conducted in Rhode Island. One method likely to be used is being developed by Jason McNamee for the Narragansett Bay seine survey abundance indices (McNamee 2010). The abundance index under development is a zero adjusted negative binomial two part model. The model is designed to handle data sets which have many zero values by breaking out the data into two sets one only containing frequency of occurrence, the other containing the counts for each station (Zuur et. al. 2009). The advantage of using this technique is that the new stations can be incorporated into the time series and compared with abundance indices from other surveys which use the same model.

References

Bigelow, H. B. and W.C. Schroeder. 1953. Fishes of the Gulf of Maine. U.S. Fish and Wildlife Serv., Fish. Bull. 53, 577p.

Brander, K. 2006. Assessment of Possible Impacts of Climate Change on Fisheries. *Externe Expertise für das WBGU-Sondergutachten "Die Zukunft der Meere--zu warm, zu hoch, zu sauer"*, Berlin WBGU, 27pp.

Buckley, L., J. Collie, L. Kaplan, and J. Crivello. 2008. Winter Flounder Larval Genetic Population Structure in Narragansett Bay, RI: Recruitment to Juvenile Young-of-the-Year. Estuaries and Coasts. 31:745-754.

Collie, J. S., A. D. Wood, H.P. Jeffries. 2008. Long-term Shifts in the Species Composition of a Coastal Fish Community. Can. J. Fish. Aquat. Sci. 65: 1352 – 1365.

Chambers, R. C., and W. C. Leggett. 1987. Size and age at metamorphosis in marine fishes: an analysis of laboratory-reared winter flounder (*Pseudopleuronectes americanus*) with a review of variation in other species. Can. J. Fish. Aqut. Sci. 44:1936-1947.

Chambers, R. C., W. C. Leggett, J. A. Brown. 1988. Variation in and among early life history traits of laboratory reared winter flounder (*Pseudopleuronectes americanus*). Mar. Ecol. Prog. Ser. 47:1-15.

Crawford, R. 1990. Winter Flounder in Rhode Island Coastal Ponds. National Sea Grant Depository Publication # RIU-G-90-001. 24pp.

Gray, C.L. 1990. Species Profile – Winter Flounder (*Pseudopleuronectes americanus*). RI Div. of Fish
And Wildlife, Marine Fisheries, NMFS and NBP. 52p.

Gibson, M. 2010. Salt Pond Winter Flounder Fishery Issue Paper, Internal document RI Division of Fish and Wildlife, 11p

Hsieh, C, C. S. Reiss, R. P. Hewitt, and G. Sugihara. 2008. Spatial Analysis Shows that Fishing Enhances the Climatic Sensitivity of Marine Fishes. Can. J. Fish. Aquat. Sci. 65: 947–961

Keller A. A. and G. Klein-MacPhee. 2000. Impact of elevated temperature on the growth, survival, and trophic dynamics of winter flounder larvae: a mesocosm study. Can. J. Fish. Aquat. Sci. 57:2382-2392.

Laroche, W. A. 1981. Development of Larval Smooth Flounder, (*Liopsetta putnami*), with a Redescription of Development of Winter Flounder, (*Pseudopleuronectes americanus*) (Family Pleuronectidae). Fish, Bull. 78:897-909.

McNamee, J. 2010. Personal Communication.

NEFSC. 2008. Report of the 3rd Groundfish Assessment Review Meeting (GARM III): I. Gulf of Maine Winter Flounder. NEFSC Ref. Doc. 08-16.

Saila, S. B. 1961. A study of winter flounder movements. Limnol. Oceanogr. 6:292-298.

Satchwill, R. J. and R. T. Sisson. 1990. Survey of eighteen tidal rivers, coastal ponds, and embayments in Rhode Island. Performance Report. Rhode Island Div. Fish and Wildlife. F-51-R-2.

Satchwill, R. J. and R. T. Sisson. 1991 The fisheries resources of Point Judith and Potter Pond South Kingstown and Narragansett, Rhode Island. Performance Report. Rhode Island Div. Fish and Wildlife. F-51-R.

Shorta, F. T. and H. A. Neckles. 1999. The effects of global climate change on seagrasses. Aquatic Botany. 63:169-196.

Taylor D. L. and J. S. Collie. 2003. Effect of temperature on the functional response and foraging behavior of the sand shrimp *Crangon Septemspinosa* preying on juvenile winter flounder *Pseudopleuronectes americanus*

Taylor D. L. 2005. Predation on post-settlement winter flounder (*Pseudopleuronectes americanus*) by sand shrimp (*Crangon septemspinosa*) in NW Atlantic estuaries. Mar. Ecol. Prog. Ser. 289: 245–262.

Witting, D. A. and K. W. Able. 1995. Predation by sevenspine bay shrimp (*Crangon septemspinosa*) on winter flounder (P*leuronectes americanus*) during settlement: laboratory observations. Mar. Ecol. Prog. Ser. 123:23-31.

Zuur, A. F., E. N. Leno, N. J. Walker, A. A. Saveliev, G. M. Smith. 2009. *Mixed Effects Models and Extensions in Ecology* with R. Springer Science+ Business Media LLC. 574 pp.

Figure 1. Proposed station locations in and Potters Pond (1 and 2) and new station added in Point Judith Pond during 2010 (3).

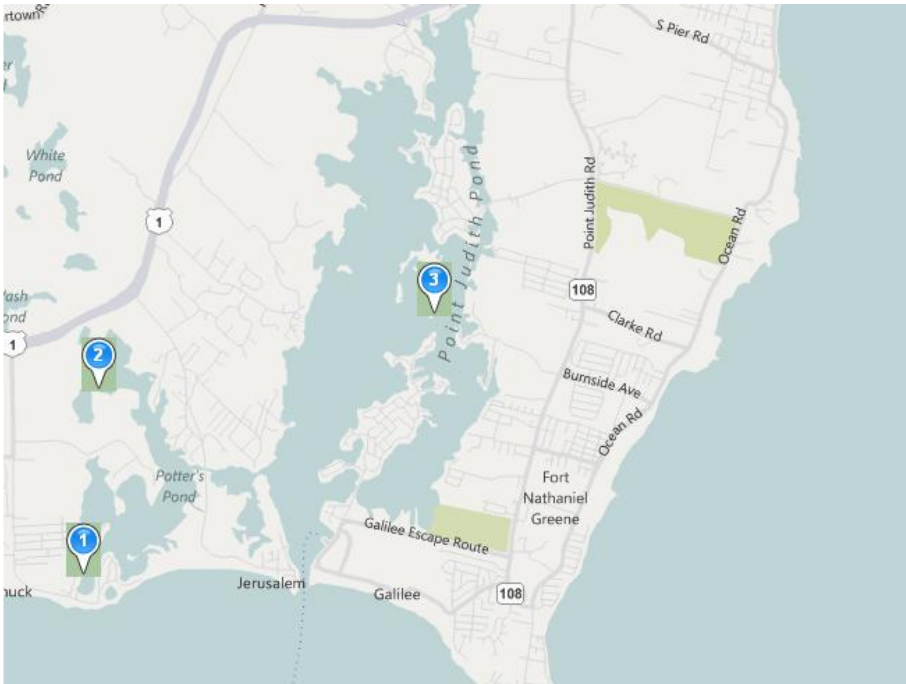


Figure 2. Proposed station locations in Green Hill Pond (4 and 5).

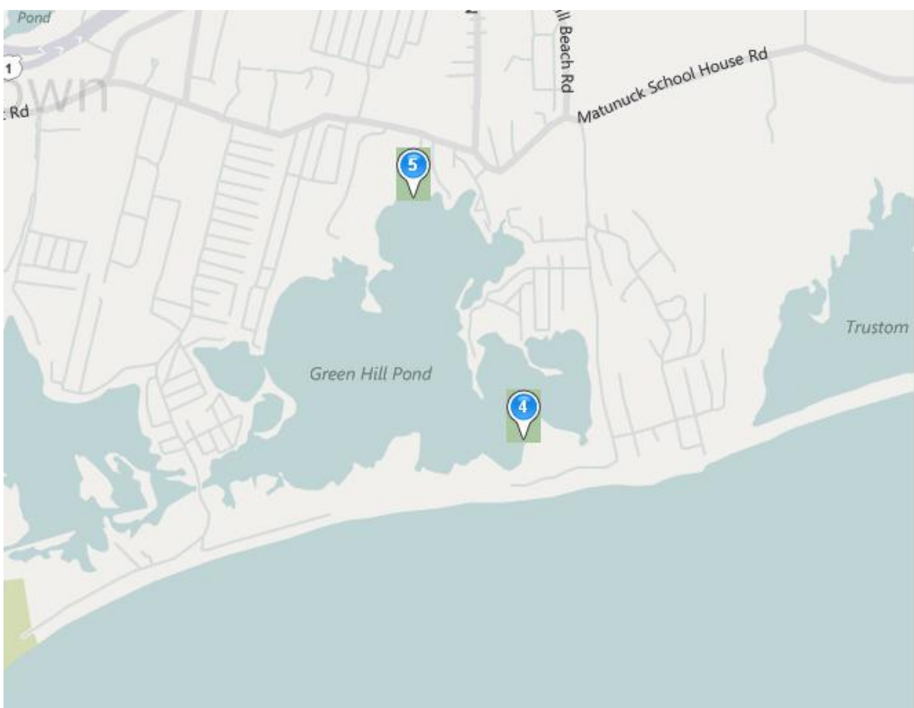


Figure 3. Proposed station locations in Little Narragansett Bay (6, 7, and 8).

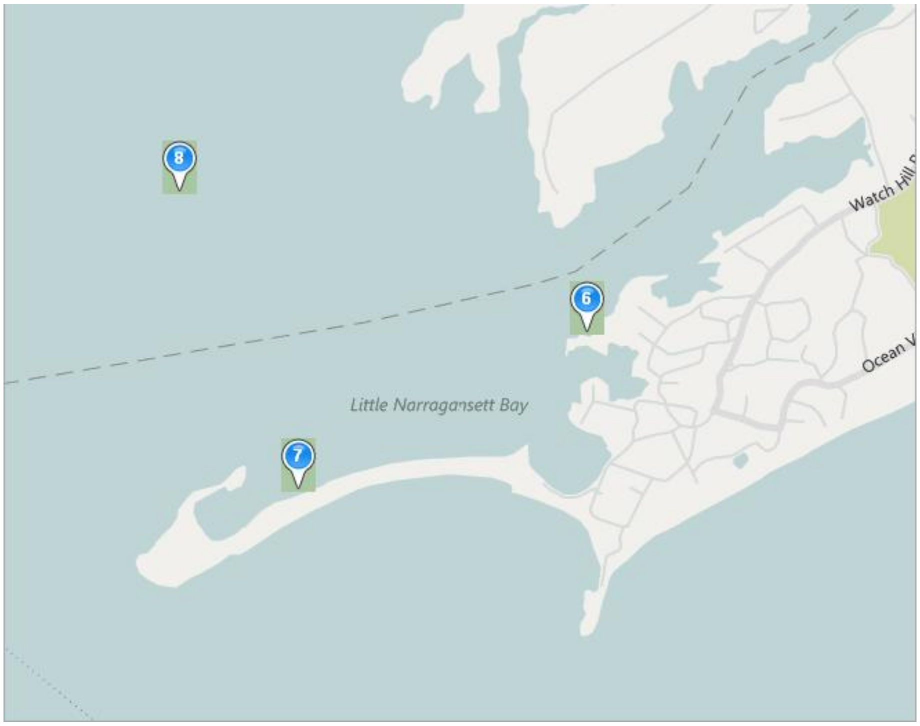


Figure 4. Existing stations in Point Judith Pond and the Narrow River.

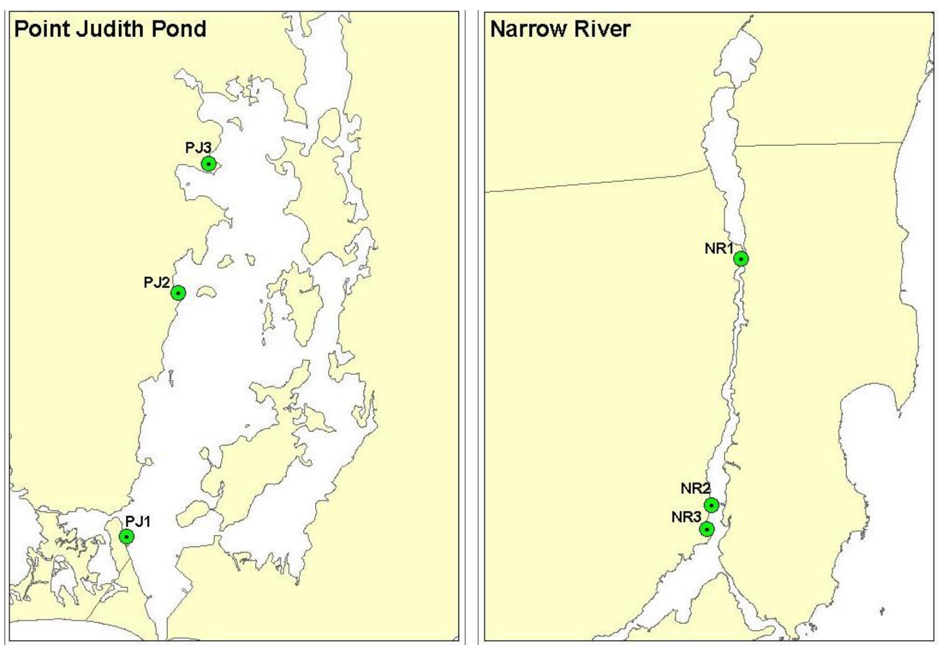


Figure 5. Existing Station Locations in Ninigret Pond, Quonochontaug Pond, and Winnipaug Pond.

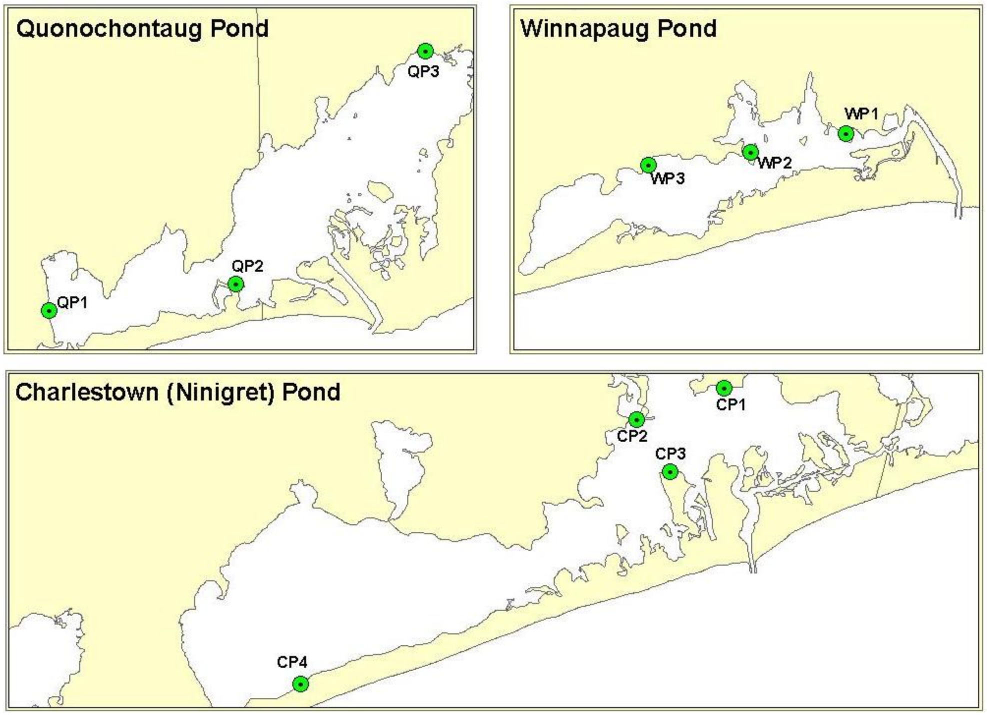
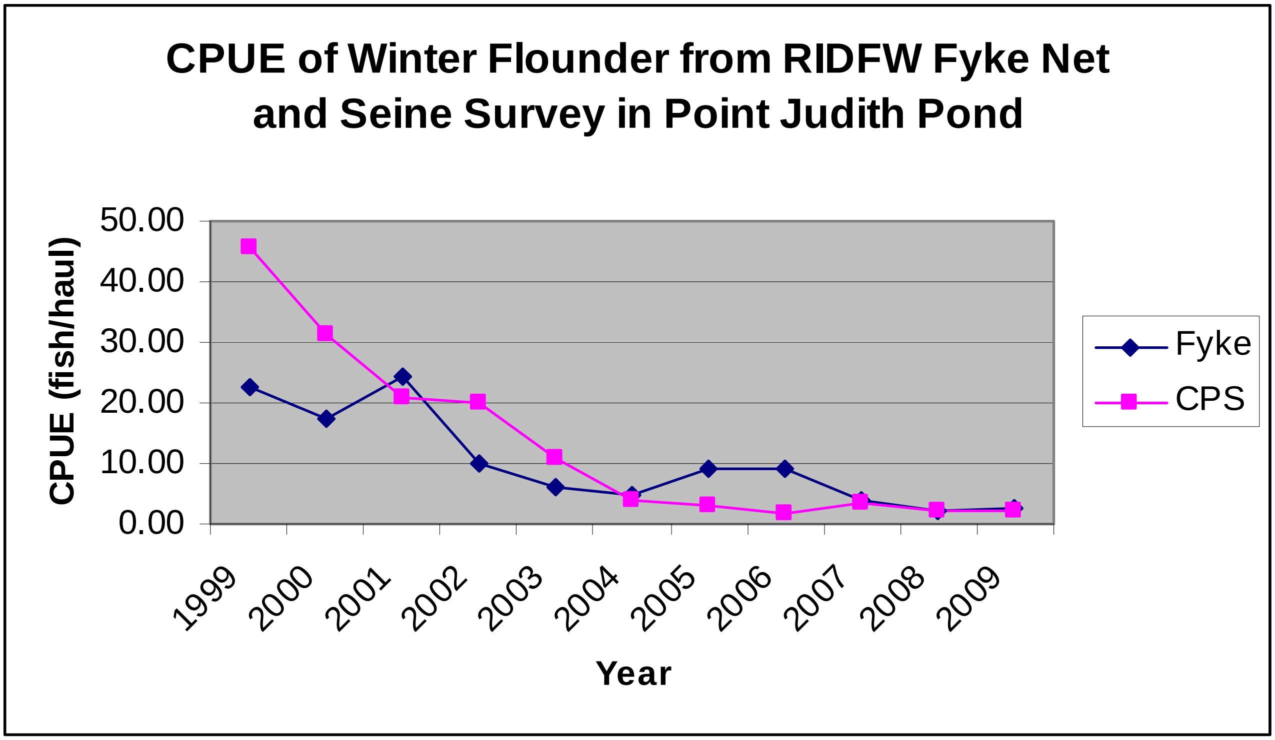


Figure 13: Abundance indices (fish/haul) from the Coastal Pond Survey and the Adult Winter Flounder Tagging Survey for winter flounder.



JOB 4

NARRAGANSETT BAY JUVENILE FINFISH SURVEY

Jason McNamee
Principal Marine Fisheries Biologist

R. I. Division of Fish & Wildlife
Marine Fisheries
Ft. Wetherill Marine Laboratory
3 Ft. Wetherill Road
Jamestown, Rhode Island 02835

PERFORMANCE REPORT

STATE: Rhode Island

PROJECT NUMBER: F-61-R
SEGMENT NUMBER: 18

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

PERIOD COVERED: 1 January 2010 - 31 December 2010

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 (*Alsoa aestivalis*), Atlantic menhaden (*Brevoortia tyrannus*), Atlantic herring (*Clupea harengus)* 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 2010 with the standard 61 x 3.05 m beach seine. Adults and juveniles of approximately sixty-one species were collected during the 2010 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 – 2010), 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. During 2009 all finfish species caught were enumerated and measured, which was also the protocol in 2010. 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 2010

SIGNIFICANT DEVIATIONS: There were no significant deviations to methodology in 2010. One change that will occur is in the analysis of the data and is presented in detail below and in appendix A.

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 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. Menhaden, a pelagic species, showed significant trends of decreasing abundance during the past 10 years and striped bass have showed a significant increasing trend over the entire dataset. The other species such as juvenile winter flounder, bluefish, 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. A second iteration of this non parametric trend analysis was done using a shortened time period of 10 years (Table 1b), from which only menhaden indicated a significant trend (decreasing).

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. 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 2010.

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 (YOYs). 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 2008 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 – 8 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, and then 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.

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 thirty-seven percent of the seine hauls for 2010. This is a decrease from 2009 when they were present in sixty-one percent of the hauls. A total of 141 fish were collected in 2010 (including 4 that were not young-of-the-year (YOY) according to Table 2 winter flounder maximum size by month). This was a decrease from the 969 individuals collected during the 2009 survey. They were present at all stations, and were collected in all months (Table 9).

The 2010 juvenile winter flounder abundance index was 1.57 ± 0.43 S.E. fish/seine haul; this is lower than the 2009 index of 10.8 ± 2.4 S.E. The 2010 index was the lowest in the time series. Figure 2 shows the annual abundance indices since 1988. The Mann-Kendall test showed no significant abundance trend for this species (Table 1a, b).

July had the highest mean monthly abundance of 3.3 ± 1.5 S.E. Spectacle Cove (Sta. 13) had the highest mean station abundance of 10.6 ± 4.7 S.E. followed by Gaspee Pt. (Sta. 1) and Kickemuit River (Sta. 11), with 4.4 ± 3.4 S.E. and 2.6 ± 2.1 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 Chepiwanoxet Pt. (Sta. 3) and this year at Spectacle Cove (Sta. 13) is not typical for the entire time series.

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 continues to have consistently high numbers of juveniles. This station is located just outside Wickford Harbor, an area believed to be an important winter flounder spawning area.

Winter flounder length frequency data from the 2010 survey indicate the majority of juveniles collected were young-of-the-year (YOY). Only four individuals were greater than the maximum length estimated for YOY during each month of the survey. 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 2a - b shows the 2009 abundance index continues to be lower than most years since 2000, the survey high. The standardized index follows a similar trend year to year as the straight catch per unit effort (CPUE) index, however, it seems to have a bit more variability in recent years, whereas the straight CPUE index shows a flatter trend in recent years. Our juvenile finfish coastal pond survey showed a decrease in abundance from 2009 (15.2 fish/haul) to 2010 (10.2 fish/haul), and it remains low relative to the entire time series. The Division of Fish and Wildlife's trawl survey data (sampling both adults and juveniles) saw a large increase in abundance from 2009 to 2010. Over the course of the Narragansett Bay Juvenile Finfish Seine Survey the abundance index rose between 1995 and 2000, fluctuated between 2000 and 2005, had a slow increasing trend to 2007 and a decrease to 2010. While the Mann-Kendall trend analysis shows no trend in the abundance of juvenile winter flounder in Narragansett Bay over both the entire time series and the shortened 10 years time series, the dramatic abundance fluctuations over the past ten years shown in Figure 2a, b continues to be a concern to resource managers.

One important note to account for in 2010 was the historic spring time flooding which occurred in the Narragansett Bay watershed. This flooding occurred during the season where any spawned winter flounder would have been in the water column as ichthyoplankton. A hypothesis could be made that the influx of fresh water, sediment, and any contaminants from untreated sewage which ended up in the Bay may have had a detrimental impact on any potential juvenile winter flounder. The juveniles that did show up in the 2010 survey were found predominately in sheltered areas and may have been spared the full impact of the floods.

Tautog

During the 2010 survey 201 juvenile tautog (*Tautoga onitis*) were collected. This is an increase over the 2009 survey when 180 juveniles were collected. The 2010 abundance was one of the six lowest values since the beginning of the survey time series. The 2010 abundance index was 2.23 ± 0.62 S.E. fish/seine haul, an increase from the 2009 index of 2.00 ± 0.45 S.E. (Figure 3a - b). The standardized index follows a similar trend year to year as the straight catch per unit effort (CPUE) index, however, it has less variability in the early part of the 2000s. The most recent years decreasing trend is evident in both indices. As indicated in the introduction, based on this survey data, it can be concluded that the spawning closure enacted in 2006 does not appear to be having a significant impact on the number of juveniles produced during the spring.

Juvenile tautog were collected in thirty-three percent of the seine hauls in 2010 (Table 10). This is a decrease from 2009 when they were present in forty-one percent of the seine hauls. In 2010 July had the highest mean monthly abundance of 2.8 ± 1.1 fish per seine haul, in contrast to the majority of the survey time series data which indicates August as being the month with the highest abundance. Patience Island (Sta. 5) had the highest mean station abundance of 12.6 ± 6.0 S.E. followed by Spectacle Cove (Sta. 13) with a mean station abundance of 9.0 ± 3.8 S.E. fish/seine haul. The Mann-Kendall test showed no long-term abundance trend for juvenile tautog (Table 1a, b). It should be noted that this survey data is used as a young of the year index in both the coastwide stock assessment by the Atlantic States Marine Fisheries Commission as well as the RI/MA regional tautog stock assessment.

Our coastal pond juvenile seine survey had a decrease in the abundance of juvenile tautog in 2010. The monthly trawl survey indicated an increasing abundance from 2009 to 2010. Again it should be noted that the trawl survey samples both juveniles and adult tautog.

Bluefish

During the 2010 survey 2,072 juvenile bluefish (*Pomatomus saltatrix*) were collected. This is significantly higher than the 201 juveniles collected in 2009. Juveniles were present in thirty-nine percent of the seine hauls and were collected at seventeen of the eighteen stations (Table 11). They were present in all months except October, a month when their absence is probably due to lower water temperatures. It should be noted that since this survey began only one hundred thirty-two juvenile bluefish have been collected in October, in four different years (1990, 1997, 19999 & 2005), and only when water temperatures were 16 – 21° C.

The abundance index for 2010 was 23.0 ± 14.6 S.E. fish/seine haul. This is significantly higher than the 2009 abundance index of 2.2 ± 0.9 S.E fish/seine haul (Figure 4a - b). The Mann-Kendall test showed no long-term or 10 year abundance trend for this species (Table 1a, b).

August and September had the highest mean monthly abundances of 21.1 ± 11.3 S.E. fish/seine haul and 88.4 ± 71.4 S.E. fish/seine haul, respectively (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 and 2010.

In 2010 the Dutch Island (Sta. 7) had the highest mean station abundance of 259.0 ± 259.0 S.E. fish/seine haul. This high abundance and high standard error are due to a single large catch during September (Table 11).

Length frequency data for 2010 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 4a - b). The standardized index, which accounts for some of these factors, follows a similar lack of trend year to year as the straight catch per unit effort (CPUE) index. The most recent years increasing abundance is evident in both indices, which is also corroborated by the RI trawl survey index (majority are juveniles). The RI coastal pond seine survey saw a decrease in bluefish abundance in 2010.

Striped Bass

During the 2010 survey 20 striped bass (*Morone saxatalis*) were collected. This is slightly lower than the 32 juveniles collected in 2009. Striped bass were present in ten percent of the seine hauls and were collected at five of the eighteen stations (Table 14). They were present in all months.

The abundance index for 2010 was 0.22 ± 0.1 S.E. fish/seine haul. This is within the error level that occurred in 2009, which had an abundance index of 0.36 ± 0.16 S.E fish/seine haul (Figure 8a - b). The Mann-Kendall test showed an increasing abundance trend for this species for the entire dataset (Table 1a), but this trend goes away if the dataset is truncated to 10 years (Table 1b).

September and October had the highest mean monthly abundances of 0.44 ± 0.39 S.E. fish/seine haul and 0.39 ± 0.33 S.E. fish/seine haul, respectively (Table 14).

In 2010 the Spar Island (Sta. 12) and Third Beach had the highest mean station abundances of 1.6 ±

1.4 S.E. and 1.2 ± 1.2 fish/seine haul, respectively. (Table 14).

Length frequency data for 2010 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 8a - b), but generally appears to have an increasing trend since 1994. 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. This long term trend is supported by the Mann-Kendall test. The RI trawl survey and the RI coastal pond seine survey saw small increases in striped bass abundance in 2010.

Clupeidae

Four species of clupeids were collected during the 2010 survey. Alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*), collectively referred to as river herring, and Atlantic menhaden (*Brevoortia tyrannus*) were most common. Atlantic herring (*Clupea harengus*) were also collected 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 eleven percent of the seine hauls and were collected at nine of the eighteen stations during 2010. River herring were present in June, July, and October in 2010. Five hundred and ten juveniles were collected in 2010, a significant increase from the number collected in 2009 (151 fish).

The highest mean monthly abundance for 2010 occurred during July and was 27.8 ± 22.8 S.E. fish/seine haul. Spatial distribution of river herring was also greatest during July when juveniles were collected at five of the eighteen stations. Spar Island (Sta. 12) had the highest mean station abundance of 82 ± 82 S.E. followed by the Kickimuit (Sta. 11) and Hog Island (Sta. 9) with mean station abundance indices of 13.8 ± 13.8 S.E. and 3.6 ± 3.4 S. E. respectively (Table 13). Single large catches of these species are due to their schooling behavior and is the reason for the high standard error associated with these indices.

The abundance index for 2010 was 5.67 ± 4.6 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, which attempts to account for some of this variability, follows a fairly different trend year to year relative to the straight catch per unit effort (CPUE) index. Both indices seem to indicate an increased abundance in recent years, however the Mann-Kendall test showed no long-term abundance trend for river herring (Table 1a, b). Potential upward trends in abundance, though not statistically significant, are corroborated by the RI trawl survey index. The RI coastal pond seine survey saw a decrease in river herring abundance in 2010.

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 5a, b) as the possible increasing trend in the data corresponds to an increase in returning adults. 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.

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- ***Menhaden***

Eleven Atlantic menhaden (*Brevoortia tyrannus*) were collected during the 2010 survey. They were present in three percent of the seine hauls and were collected at three of the eighteen stations (Table 12). By comparison eight thousand two hundred and fifty three juveniles were collected in 2007, which was an order of magnitude higher than in both 2009 and 2010.

The abundance index for 2010 was 0.12 ± 0.08 S.E. fish/seine haul. This was lower than the 2009 index of 1.4 ± 1.3 S.E (Figure 7). The standardized index, which attempts to account for some of the variability inherent with the schooling behavior of this species, follows a fairly different trend year to year relative to the straight catch per unit effort (CPUE) index, however both indicate an increased abundance during the 2000s. The most recent years decreasing abundance is evident in both indices, which is also corroborated by the RI trawl survey index. The RI coastal pond seine survey saw a decrease in menhaden abundance in 2010. The Mann-Kendall test showed no long-term abundance trend for this species, but it did indicate a decreasing trend over the past 10 years (Table 1a, b).

Similar to river herring, juvenile menhaden were also observed in very large schools around Narragansett Bay (though not in 2010) 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 2010 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 in 2010 or in 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 RI trawl survey for 2010, which samples both juveniles and adults, showed a significant increase in abundance of this species. The RI coastal pond seine survey did not catch any weakfish in 2010 and has not since 2001. 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.

Black Sea Bass

No juvenile black sea bass (*Centropristis striata*) were collected in 2010 compared to ninety-nine collected during the 2007 survey, an order of magnitude higher than 2008, 2009, and 2010. The number of black sea bass has been highly variable from year to year during the time series of this survey.

One hundred five juveniles were collected in 2001, the survey high, with eighty-three individuals collected in September at Chepiwanoxet (Sta. 3) in Greenwich Bay. The RI trawl survey saw a decrease in abundance of this species from 2009 to 2010. The coastal pond seine survey indicated a decrease in abundance from 2009 to 2010, as well. 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 2010 survey. These juveniles included scup (*Stenotomus chrysops*), Northern kingfish (*Menticirrhus saxatilis*), summer flounder (*Paralichthys dentatus*), and windowpane flounder (*Scophthalmus aquosus*).

Twenty-nine juvenile scup were collected in 2010 during July, August, and September. One hundred and seventy-three Northern kingfish were collected in 2010 with the majority collected in August at Wickford (Sta. 18). Two windowpane flounder were collected in July at Third Beach (Sta. 15). Three summer flounder were collected in 2010. See Tables 3-8 for additional survey data on these species. Thirty-three smallmouth flounder were caught in 2010. Relative to the twelve smallmouth flounder that were caught in 2009 this is an increase in abundance, but the overall trend appears to be increasing. 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.

Physical & Chemical Data

Previous to 2010 a YSI 85 was used to collect water temperature, salinity and dissolved oxygen data from the bottom water at all stations on each sampling date. This meter was upgraded in 2010 to a YSI Professional Plus Multiparameter instrument 6050000. The instrument collects the same suite of information as the YSI 85, but is an improved meter with better functionality. The water quality data collected are shown in Table 15.

Water temperatures during the 2010 survey ranged from a low of 14.6°C at Chepiwanoxet (Sta. 3) in October to a high of 28°C at Pojac Pt. station (Sta. 4) in July.

Salinities ranged from 21.3 *ppt* at Gaspee Pt. (Sta. 1) in June to 29.4 *ppt* at Rose Island (Sta. 10) in July.

There were no periods during 2010 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, no readings during 2010 meet either of these criteria. DO ranged from 3.23 mg/l at Conimicut Pt. (Sta. 2) in August to 14 mg/l at Gaspee Pt. (Sta. 1) in June.

SUMMARY: In summary, data from the 2010 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, and bluefish showed no long-term abundance trends. Only menhaden showed a decreasing abundance trend when analyzed over the past 10 years and striped bass indicate an increasing trend over the entire dataset. 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-one species, both vertebrates and invertebrates, were collected in 2010. This is higher than, but fairly close to the survey mean for the past twenty-one 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 year.

During 2010 seven tropical and subtropical species were collected during the survey. While tropical and subtropical species are collected during this survey every year, the number of species and individuals is dependent upon the course of the Gulf Stream, the number of streamers and warm core rings it generates, and the proximity of these features to southern New England.

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

An ongoing effort to increase populations of important species must embrace a comprehensive approach that takes into account the above factors, their synergy and the changing fish community in the Bay. A continued effort to identify and protect essential fish habitat (EFH) and improve water quality is essential to this effort. The Division through our permit review program does represent the interests of fish and habitat preservation and protection. As well, properly informed management decisions are tantamount to preserving spawning stock biomass in order to create and maintain sustainable populations. This 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.

References

DeLong. A.K., Collie, J.S., Meise, C.J., and Powell, J.C. 2001. Estimating growth and mortality of juvenile Winter Flounder, *Pseudopleuronectes americanus* with a length-based model. Canadian Journal of Fisheries and Aquatic Sciences. 58: 2233-2346.

Lo, N.C., Jacobson, L.D., and Squire, J.L. 1992. Indices of relative abundance from fish spotter data based on delta-lognormal models. Canadian Journal of Fisheries and Aquatic Sciences. 49: 2515-2526.

Meng, L., Taylor, D.L., Serbst, J., and Powell, J.C. 2008. Assessing habitat quality of Mount Hope Bay and Narragansett Bay using growth, RNA:DNA, and feeding habits of caged juvenile winter flounder (Pseudopleuronectes americanus Walbaum). Northeast Naturalist. 15(1): 35 – 56.

Meng, L., Powell, J.C., and Taplin, B. 2001. Using Winter Flounder growth rates to assess habitat quality across an anthropogenic gradient in Narragansett Bay, Rhode Island. Estuaries. 24:576-584.

Meng, L., Gray, C., Taplin, B., and Kupcha, E. 2000. Using Winter Flounder growth rates to assess habitat quality in Rhode Island's coastal lagoons. Marine Ecology Progress Series. 201:287-299.

Kennish, M.J. 1992. Ecology of Estuaries: Anthropogenic Effects. CRC Press. 495 pp.

Zuur, AF, Ieno, EN, Walker, NJ, Saveliev, AA, Smith, GM. 2009. Mixed effects models and extensions in ecology with R. Springer Science and Business Media. 596 pp.

FIGURES

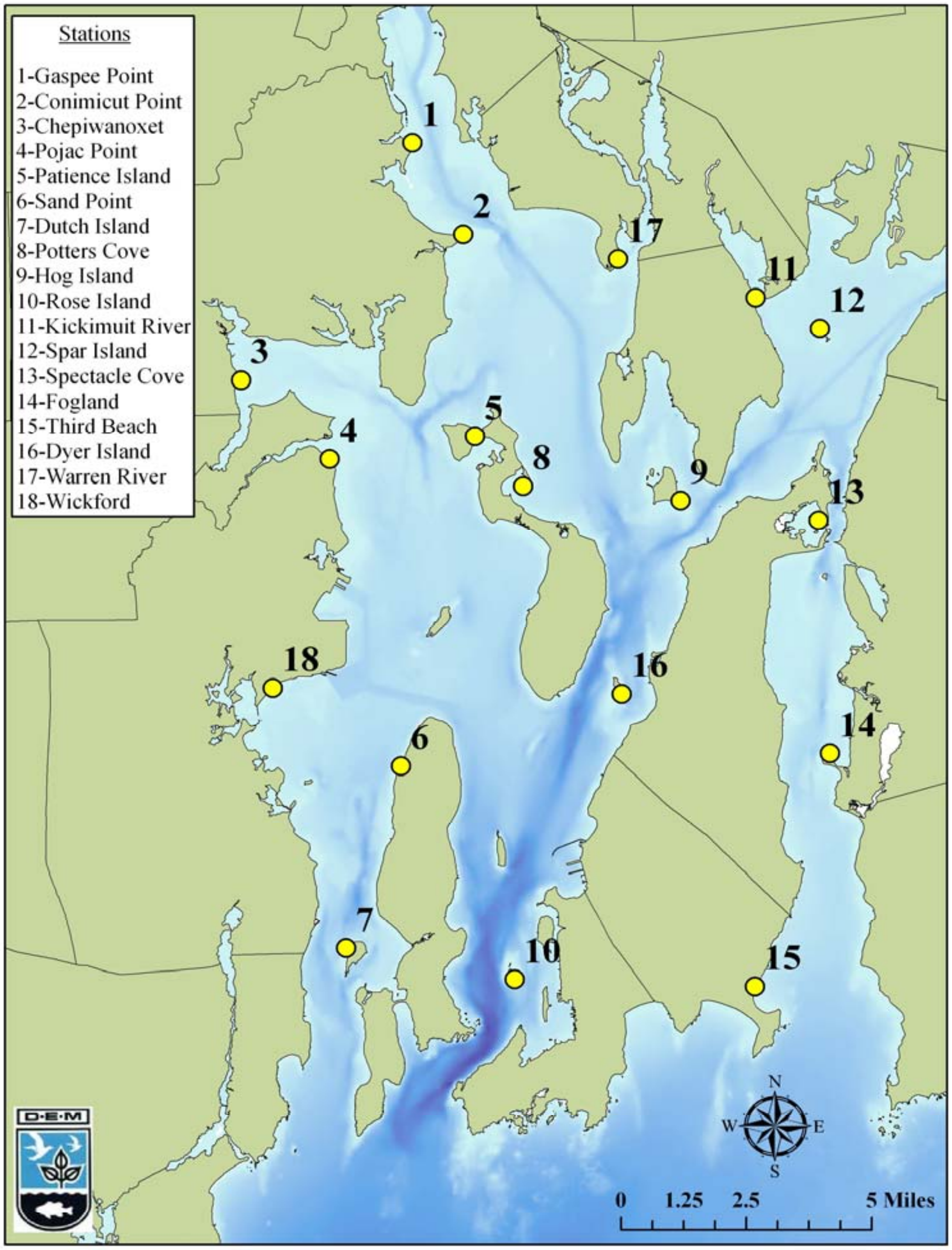


Figure 1. Survey station location map.

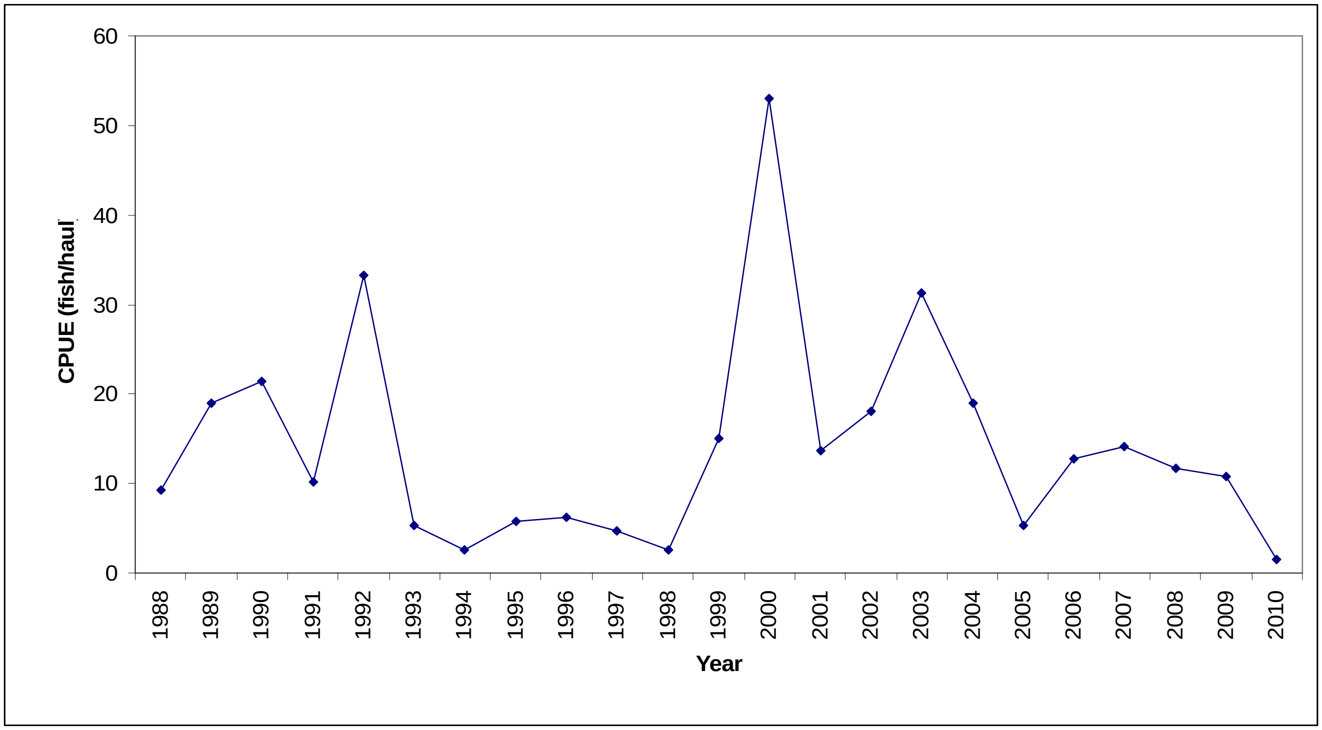


Figure 2a. Juvenile winter flounder annual abundance index 1988 - 2010.

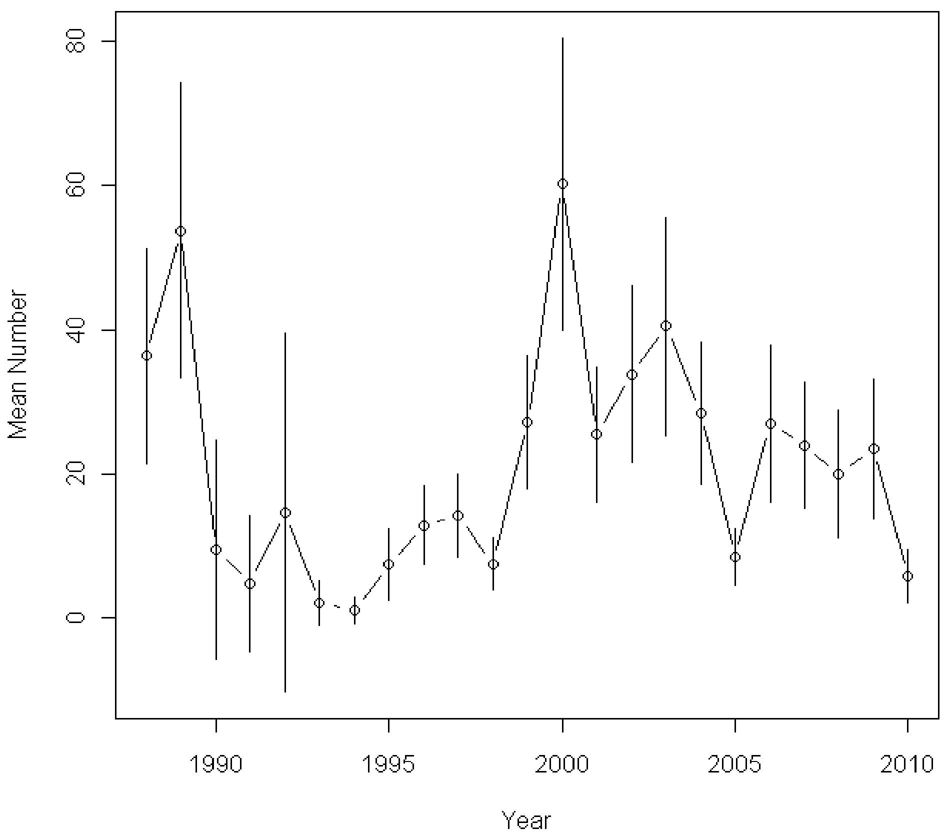


Figure 2b. Juvenile winter flounder standardized abundance index 1988 – 2010 (see appendix A for standardization methodology).

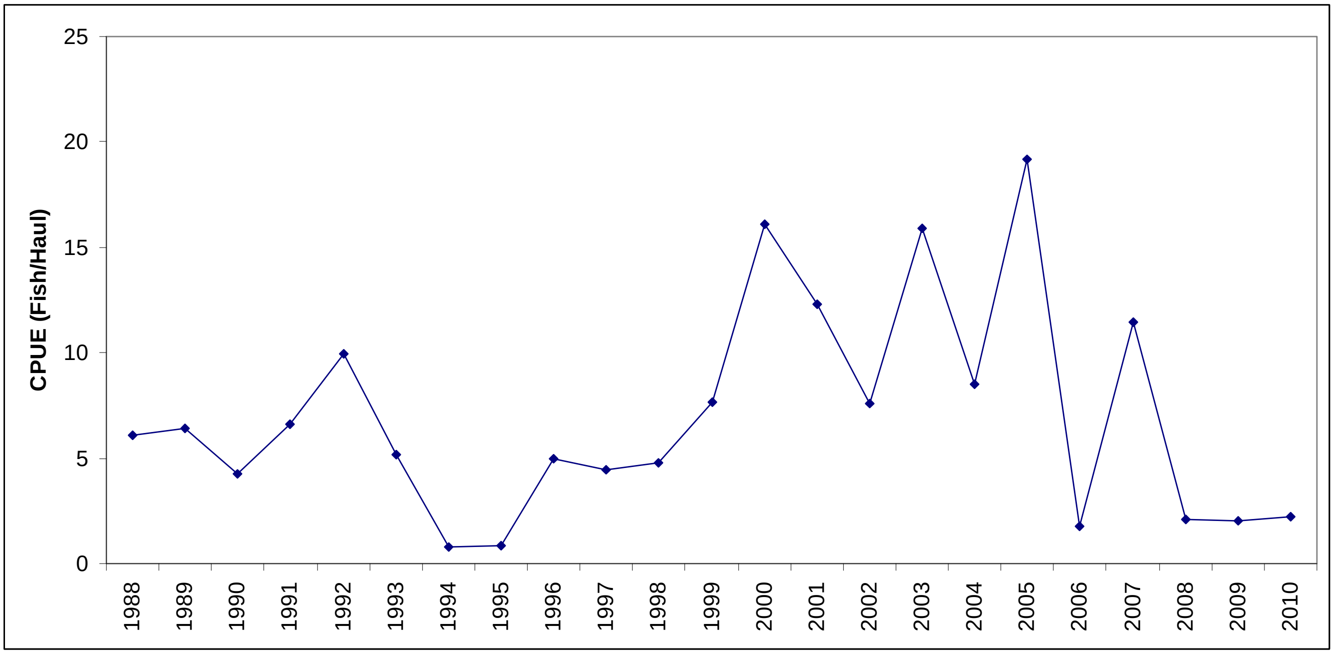


Figure 3a. Juvenile tautog annual abundance index 1988 - 2010.

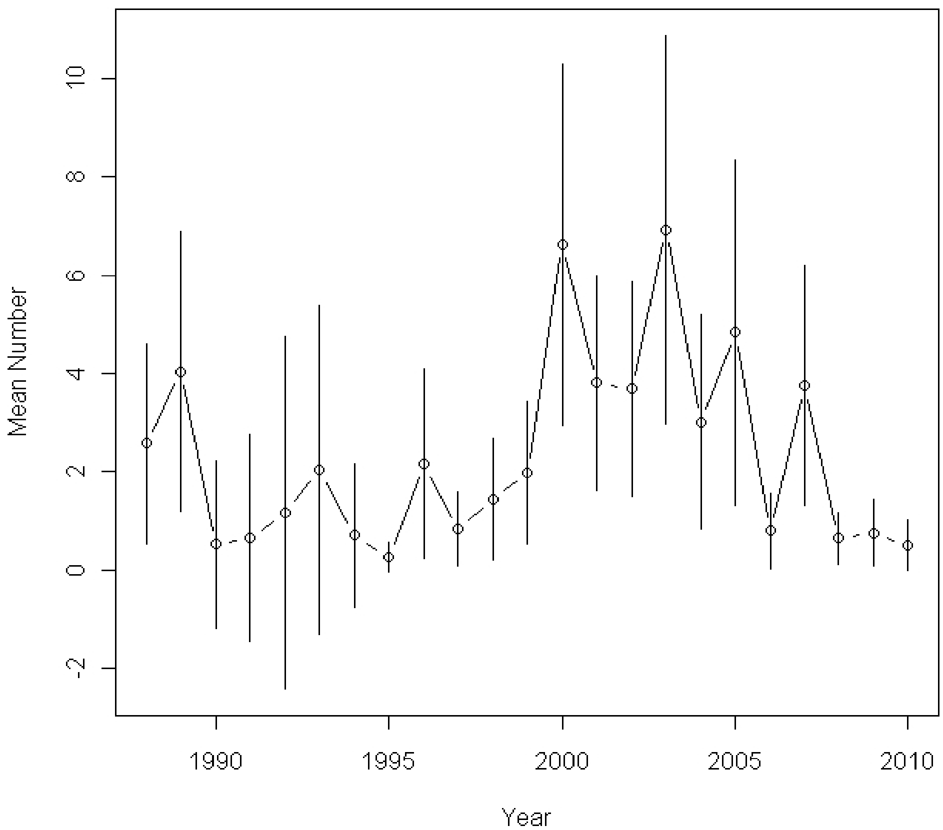


Figure 3b. Juvenile tautog standardized annual abundance index 1988 – 2010 (see appendix A for standardization methodology).

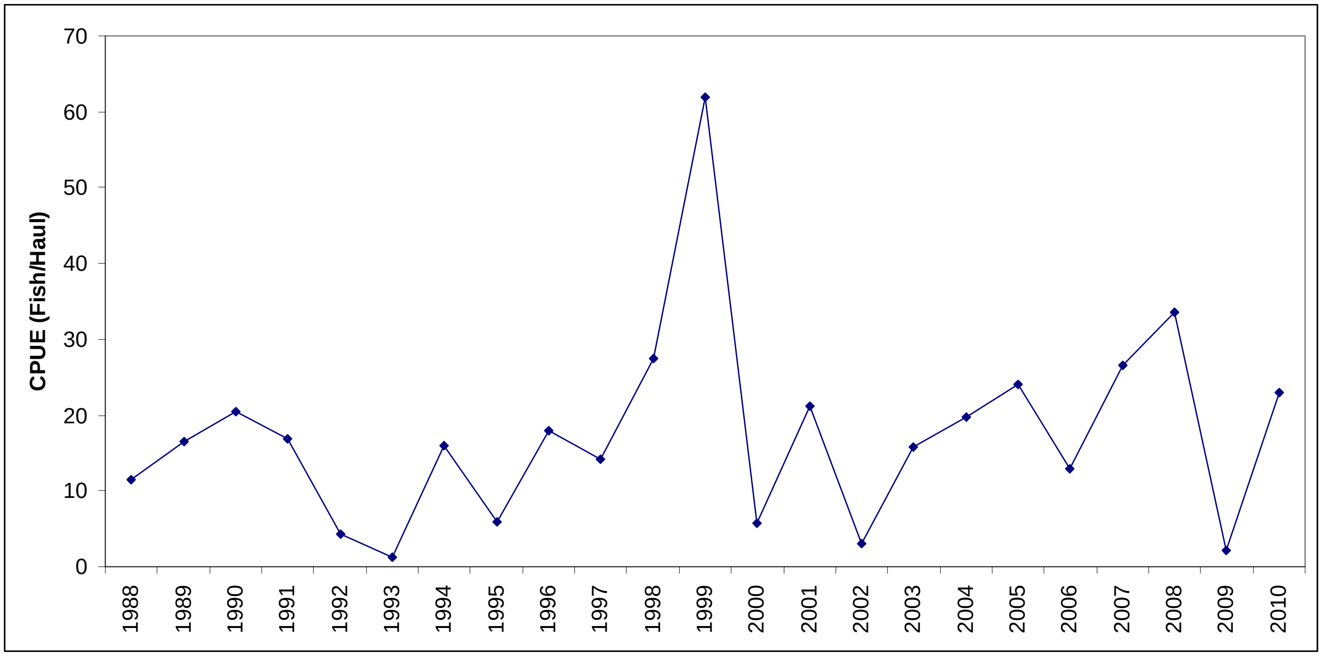


Figure 4a. Juvenile bluefish annual abundance index, 1988 – 2010

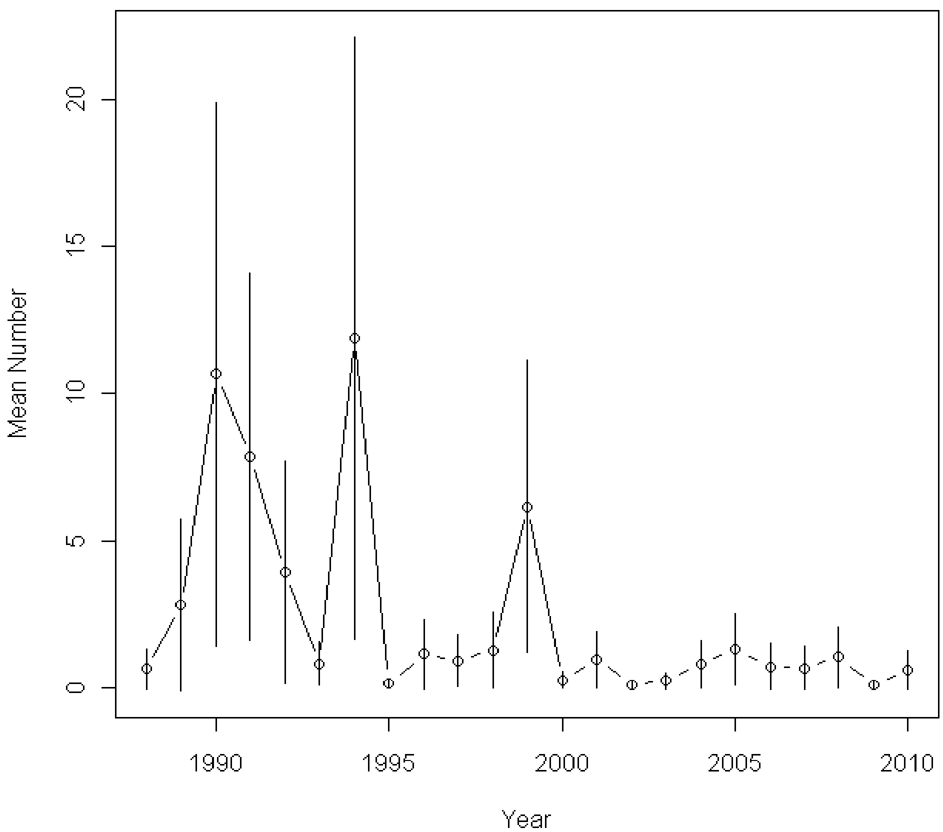


Figure 4b. Juvenile bluefish standardized annual abundance index 1988 – 2009 (see appendix A for standardization methodology).

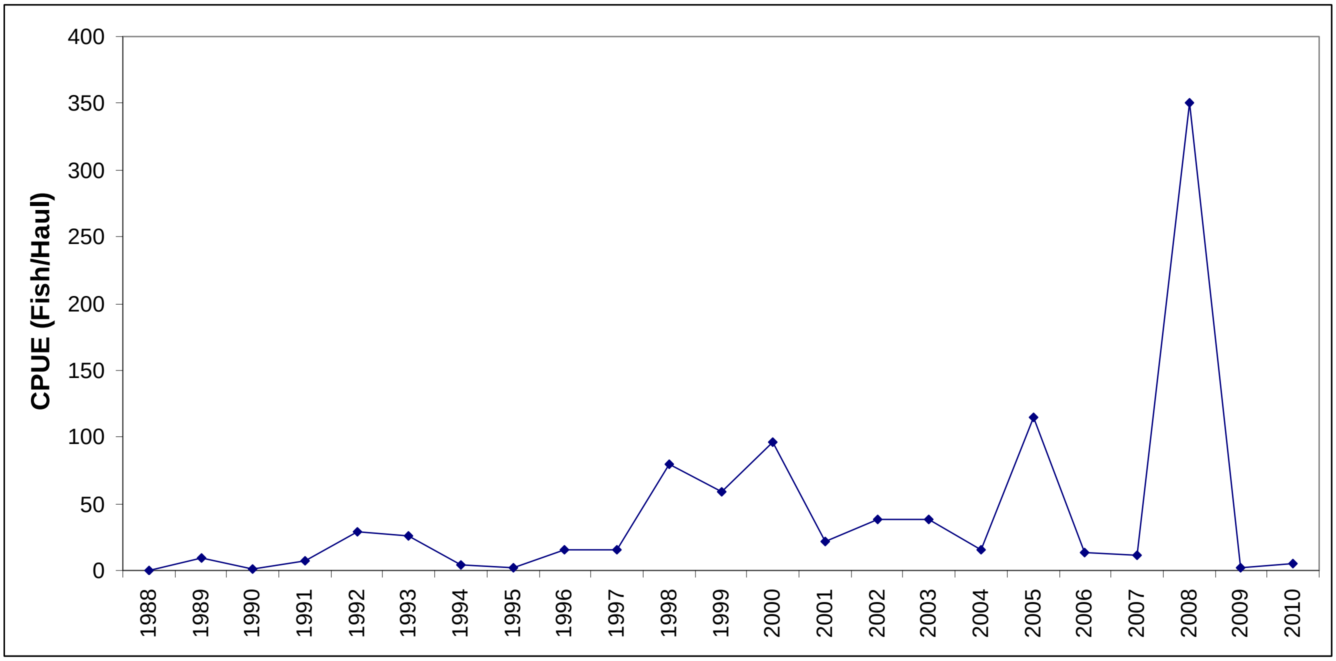


Figure 5a. Juvenile river herring annual abundance index, 1988 – 2010.

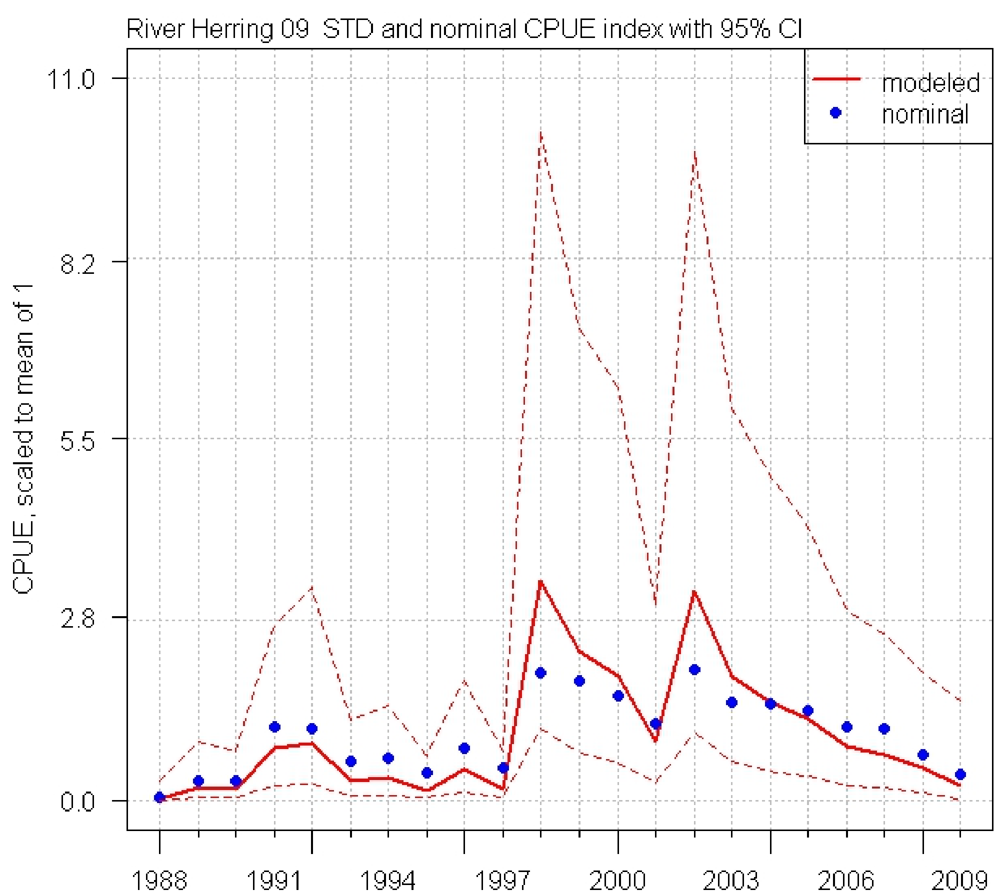
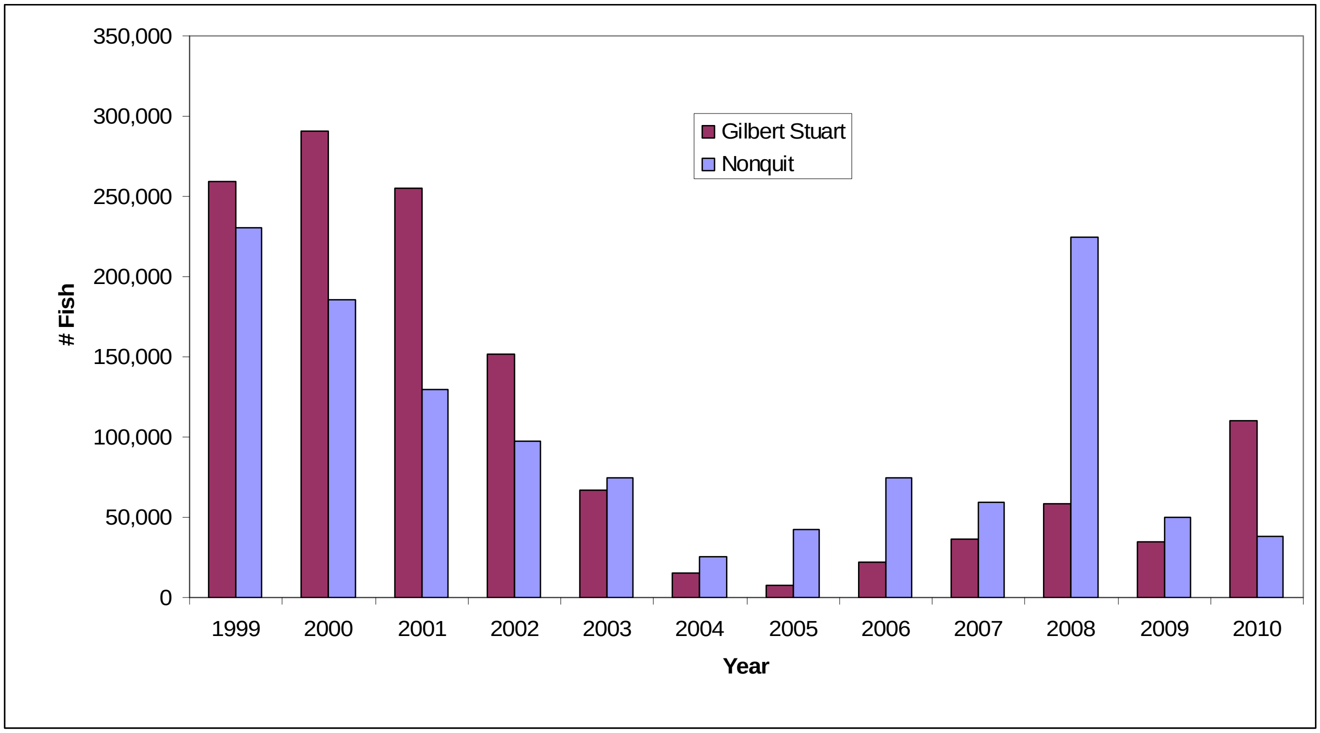


Figure 5b. Juvenile river herring standardized and nominal annual abundance index 1988 – 2009 (see appendix A for standardization methodology).



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

Figure 6. River herring spawning stock size from monitoring at two locations 1999 – 2010.

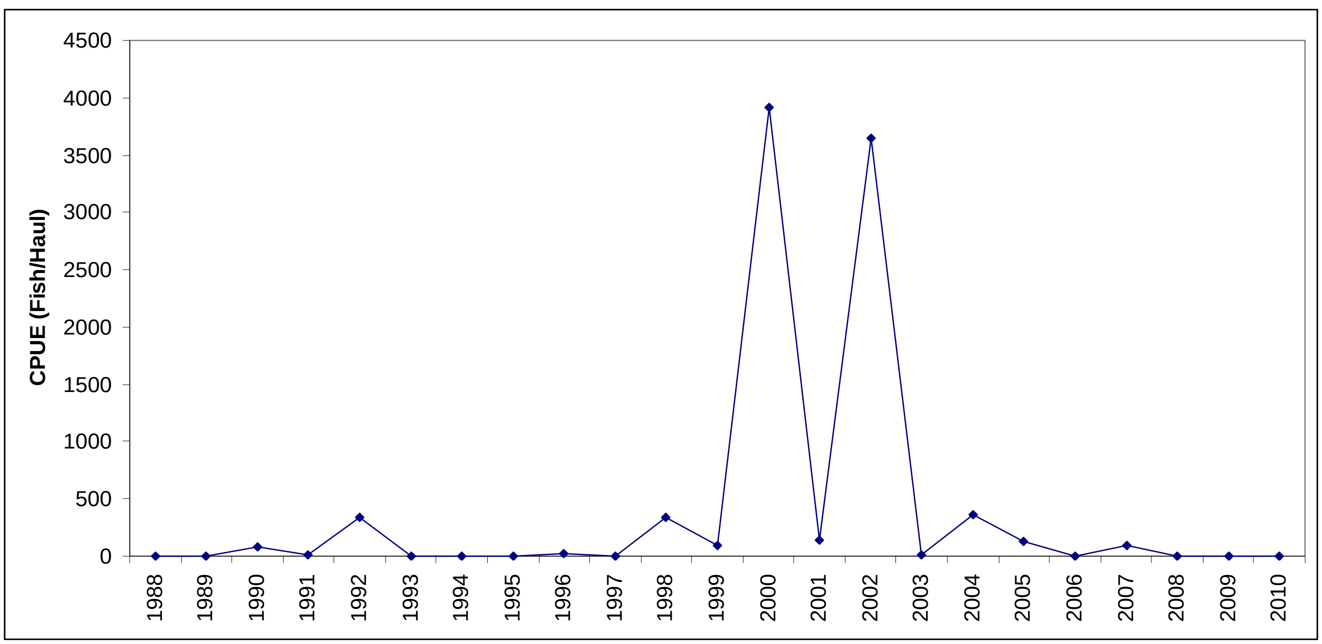


Figure 7a. Juvenile Atlantic menhaden annual abundance index, 1988 – 2010.

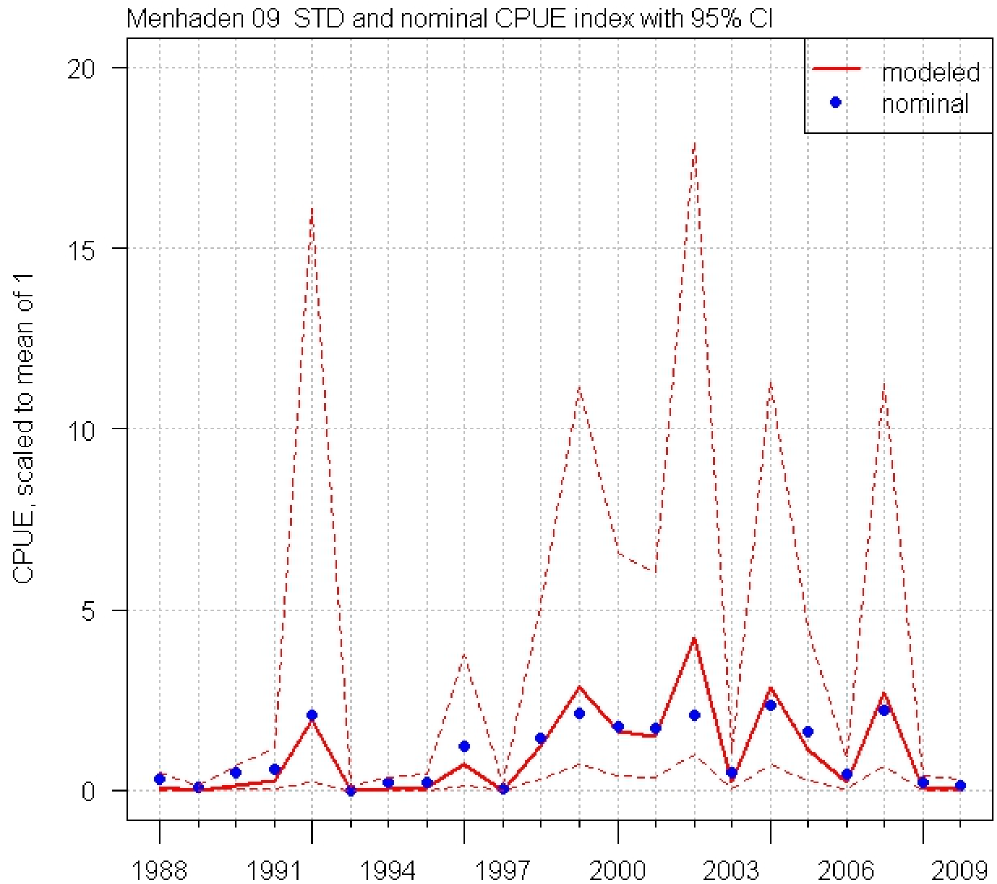


Figure 7b. Juvenile menhaden standardized and nominal annual abundance index 1988 – 2009 (see appendix A for standardization methodology).

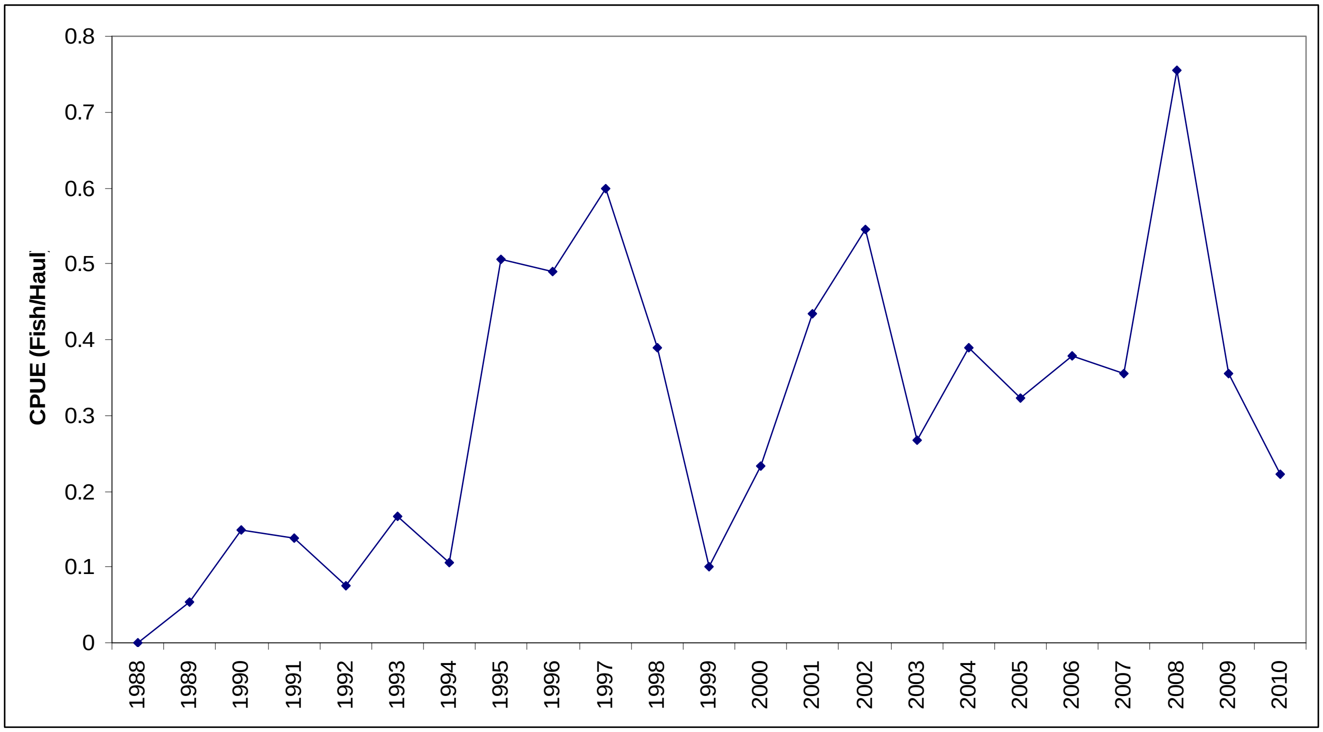


Figure 8a. Striped bass annual abundance index, 1988 – 2010.

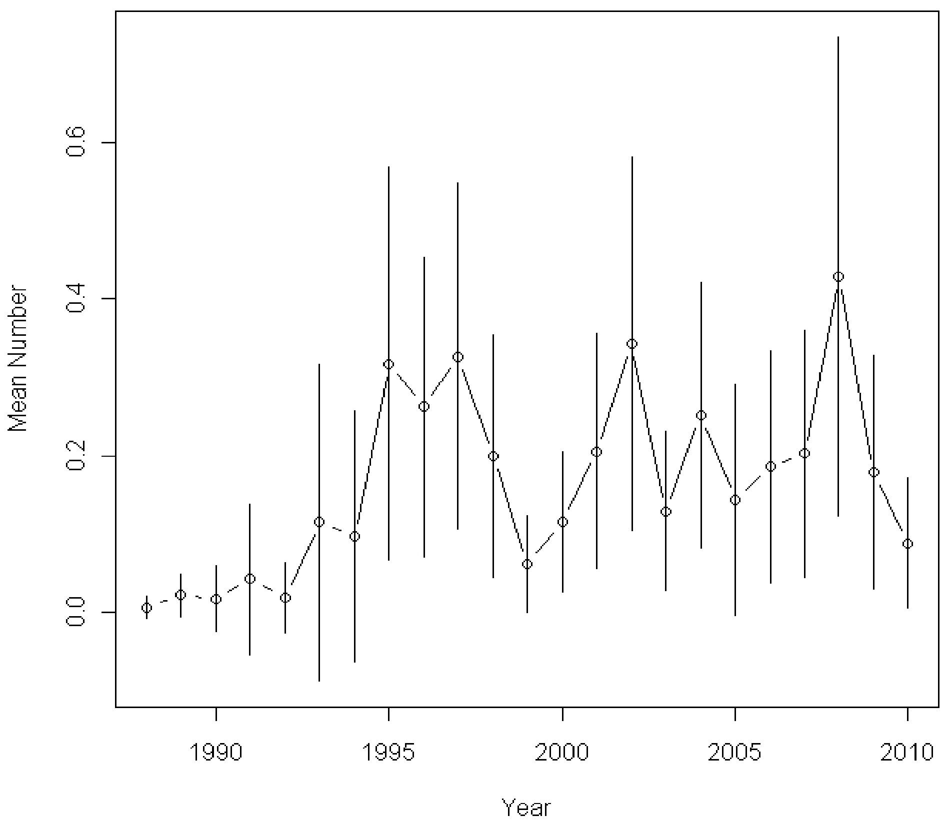


Figure 8b. Striped bass standardized annual abundance index 1988 – 2010 (see appendix A for standardization methodology).

TABLES

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

Mann-Kendall test	Winter Flounder	Tautog	Bluefish	River Herring	Menhaden	Striped Bass
S	-16	17	47	59	25	87
n Observations	23	23	23	23	23	23
Variance	1433.7	1433.7	1433.7	1433.7	1433.7	1431.7
Tau	-0.0634	0.067	0.186	0.233	0.0988	0.345
2-sided p value	0.692	0.672	0.224	0.126	0.526	.023
α	0.05	0.05	0.05	0.05	0.05	0.05
Significant Trend	No	No	No	No	No	Yes↑

Table 1b. Mann-Kendall test for target species abundance trend analysis (2001-2010).

Mann-Kendall test	Winter Flounder	Tautog	Bluefish	River Herring	Menhaden	Striped Bass
S	-23	-15	9	-15	-29	-12
n Observations	10	10	10	10	10	10
Variance	125	125	125	125	125	124
Tau	-0.511	-0.333	0.2	-0.333	-0.644	-0.270
2-sided p value	0.491	0.210	0.474	0.211	0.012	0.323
α	0.05	0.05	0.05	0.05	0.05	.05
Significant Trend	No	No	No	No	Yes↓	No

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 abundance by station for June 2010.

	Station																	
Scientific Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Grand Total
Alosa aestivalis &/or pseudoharengus		6													1				7
Amphipoda order			0													0			0
Anchoa mitchilli				1			1											112	114
Anguilla rostrata			5																5
Apeltes quadracus											3								3
Asteroidea										0							0		0
Calinectes sapidus	8	31	155	60	7			11	1		125		8				3		409
Carcinus maenus	0		0					0		0		0	0						0
Clupea harengus			2				1						4	3				3	13
Crangon septemspinosa	0		0	0	0			0	0	0		0			0		0	0	0
Crepidula fornicata									0										0
Ctenophora phylum	0			0	0		0		0			0	0			0	0	0	0
Cyprinodon variegatus					1												4		5
Etropus microstomus															12			4	16
Fundulus heteroclitus	1		430	1	16	1		1	1		188		4				38	1	682
Fundulus majalis			1	1					6				29	1			10		48
Gadus morhua																3			3
Gobiosoma bosc		1						2	1		1		1						6
Isopoda order															0				0
Libinia emarginata			0		0			0									0	0	0
Limulus polyphemus			1																1
Littorina littorea							0		0					0					0
Lucania parva													4						4
Menidia menidia	104	37		20	400	6		45	40		825	2	122	400	7	11	134	70	2223
Microgadus tomcod					50	2					11		5	8			1	1	78
Morone saxatilis												1						1	2
Mya arenaria	0																		0
Myoxocephalus aenaeus					24				1	1	5		34						65
Mytilus edulis									0										0
Nassarius obsoletus			0																0
Opsanus tau											1								1
Ovalipes ocellatus				0			0												0
Pagurus spp				0	0		0	0	0	0			0	0	0	0		0	0
Palaemonetes vulgaris	0		0		0				0				0				0		0
Panopeus spp			0		0			0									0		0
Paralichthys dentatus			1																1
Pholis gunnellus					1														1
Pomatomus saltatrix																		1	1
Pseudopleuronectes americanus	1	1		1				2	1				15		3			7	31
Syngnathus fuscus			1	1	1		1				3	1	3						11
Tautoga onitis					30	1					3		2						36
Urophycis regia															3				3
Grand Total	114	76	596	85	530	10	3	61	51	1	1165	4	231	412	26	14	190	200	3769

* The 0 (zeroes) in the above table indicate species presence with only relative abundance (few, many, abundant) taken.

Table 4. Species abundance by station for July 2010.

	Station																		
Scientific Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Grand Total
Alosa aestivalis &/or pseudoharengus								2	17		69	410		2					500
Amphipoda order											0								0
Anchoa mitchilli	2					2					4	1						1	10
Anguilla rostrata											1		1						2
Apeltes quadracus											9								9
Asteroidea	0																		0
Calinectes sapidus	234	53	394	149	30			7	8		67	1	47		1		18	21	1030
Caranx hippos					1									1	2			4	8
Carcinus maenus	0	0		0			0	0	0	0	0		0	0			0		0
Clupea harengus							1												1
Crangon septemspinosa	0		0		0			0	0		0		0	0	0	0		0	0
Ctenophora phylum				0		0	0	0	0		0	0				0	0	0	0
Cyprinodon variegatus	1					1			43				1						46
Etropus microstomus										1					11				12
Fundulus diaphanus									1										1
Fundulus heteroclitus	63	4	153	44	60	3		21	130		1		124	27			1		631
Fundulus majalis	215	54	99	6					10		4		134	4		4	22	3	555
Gobiosoma bosc	1	1						2	3								1		8
Hemigrapsus sanguineus					0											0			0
Isopoda order										0			0	0				0	0
Libinia emarginata	0		0		0				0								0		0
Limulus polyphemus							1												1
Littorina littorea							0		0					0					0
Lucania parva													1						1
Menidia menidia	35	154	9	67	626	72	21	92	667		60	86	55	436	654	101	106	74	3315
Microgadus tomcod					6				1	1	5	2	4	6		1			26
Morone saxatilis																		1	1
Mya arenaria	0																		0
Myoxocephalus aenaeus					6		1	3		1	4	3	3				6		27
Mytilus edulis					0														0
Nassarius obsoletus			0	0				0					0						0
Opsanus tau					1						8								9
Ovalipes ocellatus			0		0										0			0	0
Pagurus spp	0				0		0			0			0			0	0	0	0
Palaemonetes vulgaris	0		0					0			0		0				0		0
Panopeus spp	0				0				0		0			0		0		0	0
Paralichthys dentatus																		1	1
Pholis gunnellus														1					1
Pomatomus saltatrix					6	1			1		1		2		165			15	191
Prionotus genus													5						5
Pseudopleuronectes americanus	1	3			4					1	11		24		1	2	11	1	59
Scophthalmus aquosus															2				2
Sphoeroides maculatus								1									1		2
Stenotomus chrysops							3							16					19
Syngnathus fuscus		2			1				7	1	8	1	6			1	5		32
Tautoga onitis	1				9		3			2	6	5	19	3			2		50
Tautogolabrus adspersus							40			2				5					47
Grand Total	553	271	655	266	750	79	70	128	888	9	258	509	426	501	836	109	173	121	6602

* The 0 (zeroes) in the above table indicate species presence with only relative abundance (few, many, abundant) taken.

Table 5. Species abundance by station for August 2010.

Scientific Name	Station 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Grand Total
Asteroidea	0	0			0					0							0		0
Brevoortia tyrannus					1														1
Calinectes sapidus	28	4	71		6	1		7	3	1	9	1	13				10	2	156
Caranx hippos			14										1		1				16
Carcinus maenus	0	0							0								0		0
Crangon septemspinosa		0						0	0										0
Crepidula fornicata													0						0
Ctenophora phylum			0	0		0			0	0		0			0	0	0	0	0
Cyprinodon variegatus				1					2		13						1		17
Emerita talpoida															0				0
Etropus microstomus															2				2
Fistularia tabacaria															1				1
Fundulus heteroclitus	267	32	4	13	5			83	3		67	1		77		18	8	1	579
Fundulus majalis	521	157	112	29	16			21	38		56		21	35		178	101	4	1289
Hemigrapsus sanguineus			0									0							0
Isopoda order															0				0
Libinia emarginata											0	0					0	0	0
Littorina littorea						0								0					0
Lucania parva													1						1
Menidia menidia	439	1766	177	174	171	26	167	371	208	27	211	233	378	249	562	577	584	335	6655
Menticirrhus saxatilis	2			2											7		1	139	151
Monacanthidae family															1				1
Morone saxatilis				1	1														2
Myoxocephalus aenaeus					1			1											2
Mytilus edulis					0				0										0
Nassarius obsoletus				0					0				0						0
Opsanus tau								1					1					1	3
Ovalipes ocellatus	0	0		0					0									0	0
Pagurus spp	0	0	0		0	0	0	0	0	0	0					0	0	0	0
Palaemonetes vulgaris	0		0					0			0	0	0					0	0
Panopeus spp			0		0			0			0	0							0
Paralichthys dentatus		1																	1
Pomatomus saltatrix			1	2	5	4			4			166	2		131	2	19	43	379
Pseudopleuronectes americanus	18			2				1	1		2		14		3		1		42
Sphoeroides maculatus						2										1			3
Stenotomus chrysops							7												7
Syngnathus fuscus		2													2				4
Tautoga onitis	8	2	1		1	1			1		7		17	3			1		42
Trachinotus falcatus															6				6
Grand Total	1283	1964	380	224	207	34	174	485	260	28	365	401	448	364	716	776	726	525	9360

* The 0 (zeroes) in the above table indicate species presence with only relative abundance (few, many, abundant) taken.

Table 6. Species abundance by station for September 2010.

	Station																		
Scientific Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Grand Total
Asteroidea	0	0															0		0
Calinectes sapidus	4	1		3	2			3			0		1				2	1	17
Carangidae family											3							2	5
Carcinus maenus		0			0				0	0	0		0	0		0			0
Crangon septemspinosa	0		0																0
Crepidula fornicata				0								0							0
Ctenophora phylum	0		0	0		0	0		0	0	0	0	0	0	0	0	0	0	0
Emerita talpoida															0				0
Etropus microstomus							1												1
Fundulus heteroclitus	18		1			1		1	2		1	2	37	3		5	2	20	93
Fundulus majalis	14	5	9	3	13	5		32	12		40	25	6	32	115	89	78	28	506
Hyporhamphus unifasciatus																		1	1
Isopoda order															0				0
Libinia emarginata					0														0
Limulus polyphemus			1																1
Littorina littorea														0					0
Lucania parva																	1		1
Menidia menidia	38	32	20	259	556	156	495	454	142	36	322	441	81	161	56	175	774	790	4988
Menticirrhus saxatilis	6			5	1						4				6				22
Morone saxatilis					1							7							8
Mugil curema	2			1							11							35	49
Myoxocephalus aenaeus					17					1									18
Nassarius obsoletus				0							0		0						0
Opsanus tau					2														2
Ovalipes ocellatus	0	0	0					0							0		0	0	0
Pagurus spp		0	0		0	0	0	0	0	0	0					0	0	0	0
Palaemonetes vulgaris	0	0						0			0		0				0		0
Panopeus spp		0	0		0				0										0
Pomatomus saltatrix	8	6	4	64	3	3	1295	58	3		2	6	8	5	1		34	1	1501
Pseudopleuronectes americanus		1													2				3
Stenotomus chrysops															3				3
Strongylura marina													5						5
Syngnathus fuscus				1	1														2
Tautoga onitis		2			23	1			8				6						40
Trachinotus falcatus															7				7
Grand Total	90	47	35	336	619	166	1791	548	167	37	383	481	144	201	190	269	891	878	7273

* The 0 (zeroes) in the above table indicate species presence with only relative abundance (few, many, abundant) taken.

Table 7. Species abundance by station for October 2010.

	Station																		
Scientific Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Grand Total
Alosa aestivalis &/or pseudoharengus				1		1			1										3
Anchoa mitchilli																	2		2
Asteroidea	0	0	0																0
Brevoortia tyrannus				6		4													10
Calinectes sapidus		1																	1
Carcinus maenus	0	0		0		0		0	0	0		0	0			0			0
Crangon septemspinosa	0		0					0			0		0					0	0
Crepidula fornicata	0											0		0					0
Ctenophora phylum	0	0			0	0	0	0	0	0	0			0		0	0	0	0
Cyprinodon variegatus	1																1		2
Etropus microstomus							1								1				2
Fundulus heteroclitus	4		7				2	13	1				19					1	47
Fundulus majalis	180	141	72	13	1			20	16	2			25	101	13	1	5	9	599
Gobiosoma bosc		1																	1
Hemigrapsus sanguineus												0							0
Littorina littorea						0					0			0					0
Loligo pealei								4											4
Menidia menidia	14	8	21	45	5	5	52	55	29	14	84	3	16	90	26	61	127	6	661
Morone saxatilis															6			1	7
Mya arenaria	0																		0
Nassarius obsoletus		0	0										0						0
Ovalipes ocellatus							0	0							0			0	0
Pagurus spp		0	0		0	0				0	0			0		0		0	0
Palaemonetes vulgaris	0	0						0	0	0	0		0			0			0
Panopeus spp	0				0				0	0	0			0					0
Pseudopleuronectes americanus	2	1		1		1	1												6
Syngnathus fuscus			1		1				1										3
Tautoga onitis									32				1						33
Tautogolabrus adspersus									2										2
Trachinotus falcatus															1				1
Grand Total	201	152	101	66	7	11	56	92	82	16	84	3	61	191	47	62	135	17	1384

* The 0 (zeroes) in the above table indicate species presence with only relative abundance (few, many, abundant) taken.

Table 8. Summary of species occurrence by station in 2010.

	Station																		
Scientific Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Grand Total
Alosa aestivalis &/or pseudoharengus		1		1		1		1	1		1	1		1	1				9
Amphipoda order			1								1					1			3
Anchoa mitchilli	1			1		1	1				1	1					1	1	8
Anguilla rostrata			1								1		1						3
Apeltes quadracus											1								1
Asteroidea	1	1	1		1					1							1		6
Brevoortia tyrannus				1	1	1													3
Calinectes sapidus	1	1	1	1	1	1		1	1	1	1	1	1		1		1	1	15
Carangidae family											1							1	2
Caranx hippos			1		1								1	1	1			1	6
Carcinus maenus	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1		16
Clupea harengus			1				1						1	1				1	5
Crangon septemspinosa	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	16
Crepidula fornicata	1			1					1			1	1	1					6
Ctenophora phylum	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18
Cyprinodon variegatus	1			1	1	1			1		1		1				1		8
Emerita talpoida															1				1
Etropus microstomus							1			1					1			1	4
Fistularia tabacaria															1				1
Fundulus diaphanus									1										1
Fundulus heteroclitus	1	1	1	1	1	1	1	1	1		1	1	1	1		1	1	1	16
Fundulus majalis	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	17
Gadus morhua																1			1
Gobiosoma bosc	1	1						1	1		1		1				1		7
Hemigrapsus sanguineus			1		1							1				1			4
Hyporhamphus unifasciatus																		1	1
Isopoda order										1			1	1	1			1	5
Libinia emarginata	1		1		1			1	1		1	1					1	1	9
Limulus polyphemus			1				1												2
Littorina littorea						1	1		1		1			1					5
Loligo pealei								1											1
Lucania parva													1				1		2
Menidia menidia	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18
Menticirrhus saxatilis	1			1	1						1				1		1	1	7
Microgadus tomcod					1	1			1	1	1	1	1	1		1	1	1	11
Monacanthidae family															1				1
Morone saxatilis				1	1							1			1			1	5
Mugil curema	1			1							1							1	4
Mya arenaria	1																		1
Myoxocephalus aenaeus					1		1	1	1	1	1	1	1				1		9
Mytilus edulis					1				1										2
Nassarius obsoletus		1	1	1				1	1		1		1						7
Opsanus tau					1			1			1		1					1	5
Ovalipes ocellatus	1	1	1	1	1		1	1	1						1		1	1	11
Pagurus spp	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	17
Palaemonetes vulgaris	1	1	1		1			1	1	1	1	1	1			1	1	1	13
Panopeus spp	1	1	1		1			1	1	1	1	1		1		1	1	1	13
Paralichthys dentatus		1	1															1	3
Pholis gunnellus					1									1					2
Pomatomus saltatrix	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	17
Prionotus genus													1						1
Pseudopleuronectes americanus	1	1		1	1	1	1	1	1	1	1		1		1	1	1	1	15
Scophthalmus aquosus															1				1
Sphoeroides maculatus						1		1								1	1		4
Stenotomus chrysops							1							1	1				3
Strongylura marina													1						1
Syngnathus fuscus		1	1	1	1		1		1	1	1	1	1		1	1	1		13
Tautoga onitis	1	1	1		1	1	1		1	1	1	1	1	1			1		13
Tautogolabrus adspersus							1		1	1				1					4
Trachinotus falcatus															1				1
Urophycis regia															1				1
Grand Total	23	20	24	21	28	17	18	21	27	18	30	20	27	20	23	17	25	26	405

* 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 2010.

	Station																				
Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Mean	STDV	S.E.
JUN	1	1	0	1	0	0	0	2	1	0	0	0	15	0	3	0	0	7	1.722	3.739	0.881
JUL	1	3	0	0	4	0	0	0	0	1	11	0	24	0	1	2	11	1	3.278	6.220	1.466
AUG	18	0	0	2	0	0	0	1	1	0	2	0	14	0	3	0	1	0	2.333	5.099	1.202
SEP	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0.167	0.514	0.121
OCT	2	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0.333	0.594	0.140
Mean	4.40	1.20	0.00	0.80	0.80	0.20	0.20	0.60	0.40	0.20	2.60	0.00	10.60	0.00	1.80	0.40	2.40	1.60	2010 index	STDV	S.E.
STDV	7.64	1.10	0.00	0.84	1.79	0.45	0.45	0.89	0.55	0.45	4.77	0.00	10.43	0.00	1.30	0.89	4.83	3.05	1.567	4.070	0.429
S.E.	3.41	0.49	0.00	0.37	0.80	0.20	0.20	0.40	0.24	0.20	2.14	0.00	4.66	0.00	0.58	0.40	2.16	1.36			
# Fish	22	6	0	4	4	1	1	3	2	1	13	0	53	0	9	2	12	8		Total fish =	141

Table 10. Numbers of juvenile tautog per seine haul in 2010.

	Station																				
Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Mean	STDV	S.E.
JUN	0	0	0	0	30	1	0	0	0	0	3	0	2	0	0	0	0	0	2.000	7.038	1.659
JUL	1	0	0	0	9	0	3	0	0	2	6	5	19	3	0	0	2	0	2.778	4.797	1.131
AUG	8	2	1	0	1	1	0	0	1	0	7	0	17	3	0	0	1	0	2.333	4.352	1.026
SEP	0	2	0	0	23	1	0	0	8	0	0	0	6	0	0	0	0	0	2.222	5.663	1.335
OCT	0	0	0	0	0	0	0	0	32	0	0	0	1	0	0	0	0	0	1.833	7.532	1.775
Mean	1.80	0.80	0.20	0.00	12.60	0.60	0.60	0.00	8.20	0.40	3.20	1.00	9.00	1.20	0.00	0.00	0.60	0.00	2010 index	STDV	S.E.
STDV	3.49	1.10	0.45	0.00	13.39	0.55	1.34	0.00	13.72	0.89	3.27	2.24	8.46	1.64	0.00	0.00	0.89	0.00	2.233	5.877	0.620
S.E.	1.56	0.49	0.20	0.00	5.99	0.24	0.60	0.00	6.14	0.40	1.46	1.00	3.78	0.73	0.00	0.00	0.40	0.00			
# Fish	9	4	1	0	63	3	3	0	41	2	16	5	45	6	0	0	3	0		Total fish =	201

Table 11. Numbers of juvenile bluefish per seine haul in 2010.

	Station																				
Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Mean	STDV	S.E.
JUN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.056	0.236	0.056
JUL	0	0	0	0	6	1	0	0	1	0	1	0	2	0	165	0	0	15	10.611	38.704	9.123
AUG	0	0	1	2	5	4	0	0	4	0	0	166	2	0	131	2	19	43	21.056	47.907	11.292
SEP	8	6	4	64	3	3	1295	58	3	0	2	6	8	5	1	0	34	1	83.389	303.000	71.418
OCT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	0.000	0.000
Mean	1.60	1.20	1.00	13.20	2.80	1.60	259.00	11.60	1.60	0.00	0.60	34.40	2.40	1.00	59.40	0.40	10.60	12.00	2010 index	STDV	S.E.
STDV	3.58	2.68	1.73	28.41	2.77	1.82	579.14	25.94	1.82	0.00	0.89	73.61	3.29	2.24	81.77	0.89	15.45	18.41	23.022	138.722	14.623
S.E.	1.60	1.20	0.77	12.71	1.24	0.81	259.00	11.60	0.81	0.00	0.40	32.92	1.47	1.00	36.57	0.40	6.91	8.23			
# Fish	8	6	5	66	14	8	1295	58	8	0	3	172	12	5	297	2	53	60		Total fish =	2072

Table 12. Numbers of juvenile menhaden per seine haul in 2010.

	Station																				
Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Mean	STDV	S.E.
JUN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	0.000	0.000
JUL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	0.000	0.000
AUG	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0.056	0.236	0.056
SEP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	0.000	0.000
OCT	0	0	0	6	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0.556	1.653	0.390
Mean	0.00	0.00	0.00	1.20	0.20	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2010 index	STDV	S.E.
STDV	0.00	0.00	0.00	2.68	0.45	1.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.122	0.762	0.080
S.E.	0.00	0.00	0.00	1.20	0.20	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
# Fish	0	0	0	6	1	4	0	0	0	0	0	0	0	0	0	0	0	0		Total fish =	11

Table 13. Numbers of juvenile river herring per seine haul in 2010.

Month	Station 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Mean	STDV	S.E.
JUN	0	6	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0.389	1.420	0.335
JUL	0	0	0	0	0	0	0	2	17	0	69	410	0	2	0	0	0	0	27.778	96.792	22.814
AUG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	0.000	0.000
SEP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000	0.000	0.000
OCT	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0.167	0.383	0.090
Mean	0.00	1.20	0.00	0.20	0.00	0.20	0.00	0.40	3.60	0.00	13.80	82.00	0.00	0.40	0.20	0.00	0.00	0.00	2010 index	STDV	S.E.
STDV	0.00	2.68	0.00	0.45	0.00	0.45	0.00	0.89	7.50	0.00	30.86	183.36	0.00	0.89	0.45	0.00	0.00	0.00	5.667	43.744	4.611
S.E.	0.00	1.20	0.00	0.20	0.00	0.20	0.00	0.40	3.36	0.00	13.80	82.00	0.00	0.40	0.20	0.00	0.00	0.00			
# Fish	0	6	0	1	0	1	0	2	18	0	69	410	0	2	1	0	0	0		Total fish =	510

Table 14. Numbers of striped bass per seine haul in 2010.

Month	Station 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Mean	STDV	S.E.
JUN	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0.111	0.323	0.076
JUL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.056	0.236	0.056
AUG	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0.111	0.323	0.076
SEP	0	0	0	0	1	0	0	0	0	0	0	7	0	0	0	0	0	0	0.444	1.653	0.390
OCT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	1	0.389	1.420	0.335
Mean	0.00	0.00	0.00	0.20	0.40	0.00	0.00	0.00	0.00	0.00	0.00	1.60	0.00	0.00	1.20	0.00	0.00	0.60	2010 index	STDV	S.E.
STDV	0.00	0.00	0.00	0.45	0.55	0.00	0.00	0.00	0.00	0.00	0.00	3.05	0.00	0.00	2.68	0.00	0.00	0.55	0.222	0.992	0.105
S.E.	0.00	0.00	0.00	0.20	0.24	0.00	0.00	0.00	0.00	0.00	0.00	1.36	0.00	0.00	1.20	0.00	0.00	0.24			
# Fish	0	0	0	1	2	0	0	0	0	0	0	8	0	0	6	0	0	3		Total fish =	20

Table 15. Temperature, salinity, and dissolved oxygen by station and month – 2010.

	JUN			JUL			AUG			SEP			OCT		
Station	Salinity (ppt)	DO (mg/l)	Temp (°C)	Salinity (ppt)	DO (mg/l)	Temp (°C)	Salinity (ppt)	DO (mg/l)	Temp (°C)	Salinity (ppt)	DO (mg/l)	Temp (°C)	Salinity (ppt)	DO (mg/l)	Temp (°C)
1	21.3	14	19.7	26	6.6	26.6	24.1	7.1	25.6	25.3	5.68	19.8	22.9	7.54	15.5
2	24.9	10.67	19.3	27.4	9.2	25.8	26	3.23	24.3	25.6	8.37	19.8	23.8	7.71	15.3
3	26.1	10.6	21.3	27.5	3.3	27.4	26.7	4.83	25.2	26.7	8.65	20.7	26.2	10.05	14.6
4	26.7	7.68	21.1	26.1	8.74	28	26.5	7.05	26.3	26.9	9.22	20	26.9	6.66	16.9
5	25.9	9.5	20.4	28.1	9.33	27	27.3	6.58	24.1	27.4	6.62	20.2	26.9	6.72	17.2
6	28.2	8.88	21.1	28.8	6.1	22.5	27.6	5.64	23.3	28	7.17	20.2	27.8	6.62	16.4
7	28.3	9.19	18.6	29.1	8.23	22.3	27.7	6.86	21.7	28.3	6.6	19.9	28.1	7.91	17
8	26.7	4.35	19.5	27.9	7.2	26.9	26.7	5.96	25.8	27.4	6.9	21.4	NA	NA	NA
9	27	NA	18	27.8	8.25	25.1	26.7	6.5	25.1	27.3	6.37	21	NA	NA	NA
10	28.8	8.93	15.9	29.4	7.32	20.9	27.4	7.56	20.1	28.3	6.7	19.2	28.4	6.31	17
11	25.6	3.77	20.8	26.8	7.32	27.9	26.7	4.79	24.4	26.4	5.43	26	26	8.32	16.6
12	26	9.86	21.2	27.1	7.86	26.9	26.6	6.81	25.2	26.6	6.49	21.2	25.3	8.23	16.6
13	27.6	7.3	19.7	28.4	8.2	26.3	27.3	6.46	25.6	27.5	6.76	21.4	27.3	8.83	17.3
14	28.3	8.7	19.6	28.5	8.74	26.7	27.4	7.26	24.8	27.7	8.21	21.1	27.8	9.04	17.5
15	21.5	9.6	18.4	29.3	7.62	24.6	27.9	7.35	23.4	28.5	7.04	20.4	28.4	9.47	17.2
16	27.9	5.34	17	28.4	7.82	21.8	27.3	6.71	22.1	28	6.35	19.8	NA	NA	NA
17	25.8	9.8	19.2	26.2	7.43	26.7	25.8	4.93	26	26.4	5.33	21.7	NA	NA	NA
18	28.1	7.5	18.9	25	5.63	26.2	27.4	5.38	24.5	27.9	7.4	19.9	27.6	6.58	16.9

APPENDIX A

Standardized Index Development – Delta Lognormal

Menhaden, 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	23	1988-2010
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

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, the code of which was modified from Walters, McCarthy, and Cass-Calay of the Southeast Fishery Science Center (personal communication).

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 linking function selected was "identity", and the response variable was ln(catch) for each individual haul where winter flounder were 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 on successful trips, in all cases except for menhaden, were:

Ln(catch) = Year + Temperature Category + Month + Station (in the case of menhaden, the final model did not include Temperature Category)

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

Success = Year + Temperature Category + Month + Station

Standardized Index Development – Zero Inflated Negative Binomial

Winter Flounder, Tautog, Bluefish, Striped Bass

The standardized indices for 4 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	23	1988-2010
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

The zero inflated negative binomial model approach (Zuur et al, 2009) 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, the code of which was modified from Nelson and Coreia of the Northeast Fishery Science Center (personal communication).

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 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 were 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 on successful trips, in all cases were:

Abundance = Year + Station Periods + Temperature + Salinity + Station

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

Success = Year + Station Periods + Temperature + Salinity + Station

JOB 5
DISCONTINUED

JOB 6

ENVIRONMENTAL ASSESSMENT REVIEW

State: Rhode Island
Project No.: F-61-R
Segment No.: 18
Project title: Assessment of Recreationally Important Finfish Stocks in Rhode Island Waters
Job No. : VI - Environmental Assessment Review
Title: Environmental Assessment Review
Target Date: March 30, 2010
Staff: Eric Schneider, Principal Marine Fisheries Biologist **Eric.Shneider@dem.ri.gov**

View from the deck of the CURRITUCK during the dredging of the Great Salt Pond Federal Navigation Channel, Block Island (RI) on June 1, 2010 (picture by Eric Schneider, DFW). The CURRITUCK is a special government owned (U.S. Army Corps. of Engineers) small hopper vessel with a split-haul and two hydraulic dredges.

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 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 Rhode Island Department of Environmental Management (RI 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

DFW reviews all Rhode Island Coastal Resource Management Council (RI CRMC) marine-related applications and RI DEM Water Quality Certification (RI WCQ) and dredging applications. The RI DEM Office of Technical and Customer Assistance (RI OCTA) usually coordinates the Department's reviews and responses for all environmental reviews; however, some requests are forwarded directly to DFW by RI 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.

Depending on the size, scope, and location of the proposed project, the review process may involve determining marine resources and the habitats present at or near the project site and evaluating the potential direct and indirect adverse affects 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. MA DMF, NEMAP, NEFSC, URI GSO, etc.).

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. A standard field data sheet is completed for each site. 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 RIDEM'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.

It's worth noting that in past years two full-time staff members were involved in project reviews. At that time one staff member was responsible for projects in Narragansett Bay and the other responsible for projects in the Coastal Ponds and the Narrow River. Staff jointly reviewed projects on Block Island. Changes in staff and staffing levels resulted in this position being vacant for much of 2008-2009 and projects were reviewed by various staff members as needed. Beginning in October 2009 one full-time staff member (Eric Schneider) was assigned to this project and has been reviewing all projects since.

Results

This report summarizes all projects received by DFW between January 1 and December 31, 2010. During this period DFW received 82 marine related projects and was able to complete the review of 79 projects by year's end. DFW was in the process of reviewing the 3 remaining projects when the calendar year ended, therefore these 3 projects will be included in the 2011 Annual Report. Of the 82 projects received, 38 (46%) posed potential impacts to fisheries or marine habitat in Rhode Island waters and warranted responses (Table 1). DFW provided oral and written comments on 7 and 28 projects, respectively (Table 1), and plans to provide written comments for the 3 projects currently in review.

During 2010, of the 82 projects received 37 (45%) were sited in Narragansett Bay, 26 (32%) in Coastal Ponds, 12 (15%) in Coastal Rivers, 4 (5%) in open ocean, and 3 (4%) in coastal wetlands (Table 2). Not surprisingly projects in Narragansett Bay had the most activities 62 (52%), followed by 32 (27%) in Coastal Ponds, 18 (15%) in Coastal Rivers, 4 (3%) in open ocean, and 3 (3%) in coastal wetlands (Table 2). The majority of projects received were for new residential docks (24%), followed by Maintenance Dredging (10%), and Marina Expansion or Reconfiguration (7%) (Table 2).

Since projects often involve multiple activities (e.g. a marina expansion may also have maintenance dredging and potential shellfish impacts) the total number of activities (117) is greater than the number of projects received (82) (see Table 2). Similarly, it's important to note that a given activity may be both the purpose of the project and pose potential impacts to fisheries and marine habitat. For example, Maintenance Dredging may be he purpose of the project; however, the activity could impact critical habitat and water quality potentially impacting egg viability, juvenile survival, and foraging and spawning behavior.

Discussion

The greatest challenge that Marine Fisheries has in protecting fish and fish habitat from adverse anthropogenic impact is the Department's willingness to negotiate a compromise on resource protective conditions proposed for a given permit. RI DEM is often asked to allow modifications to mitigation plans or deviate from environmental protective measures stipulated in original comments. Economic hardship, and in particular the sluggish economy, are often presented as rational for the applicants inability or resistance to meet the proposed measures.

Dredging projects present both the greatest potential for impacts to fisheries and marine habitat as well as the greatest resistance by applicants to restrictive permitting related to the timing of in-water work and required mitigation, which ultimately increases cost. Therefore, it's extremely important that DFW provide concise, well written, science-based recommendations. The following sub-sections highlight a new mitigation approach for SAV impacts, as well as illustrate problems with the permitting process and existing policies that need to be addressed in the coming year.

<u>A New Approach to SAV Mitigation - Conservation Moorings</u>

An application was received during October 2009 for the Bonnet Shores Fire District (BSFD) Boat Ramp Maintenance Dredging Project; however, by year's end the applicant had yet to submit a SAV mitigation and monitoring plan. Early in 2010 the requested materials were received and DFW entered into a series of meetings and correspondence that resulted with a dredge permit and SAV mitigation and monitoring plan that was determined satisfactory by all parties. The following paragraphs summarize the potential impacts and mitigation required, which includes an alternative SAV mitigation approach used for the first time in RI.

In short, the purpose of this project was to restore the boat ramp fairway to deeper water to provide safe transit for emergency operations of the BSFD and the boating users of the adjacent beach. Potential dredge-related impacts were identified during the initial review process and included removal of ~1600 ft^2 of SAV (i.e. eelgrass), potential loss of shellfish habitat and broodstock, and potential impact to sensitive life stages of several marine finfish species depending on the timing of in-water work. Typically with projects like this, assuming that the impact to eelgrass could not be avoided by altering dredge plans, the impacted eelgrass would be harvested from the dredge footprint prior to dredging and transplanted adjacent to or in close proximity to the project site. However, DFW and NMFS determined using GIS analysis in combination with site visits that nearly, if not all suitable habitat for eelgrass was presently occupied at the site and estimated little to no chance of success if a transplant of was to occur in or around the site area.

DFW and NMFS noted that there appeared to be holes throughout the main eelgrass bed due to chain-scour from moorings and proposed that conventional moorings located within the eelgrass bed that were owned by BSFD be converted to conservation (style) moorings (see Figure 1) in lieu of attempting to conduct a transplant that would likely be unsuccessful and ultimately result in significant costs with no successful mitigation. As part of the SAV mitigation and monitoring plan the applicant was required to harvest the eelgrass located within the dredge footprint and donate the harvested eelgrass to a local non-profit origination (Save the Bay) for use in a large scale transplant in an area that has shown good success over time. Note this was logistically challenging, because it required the harvest of eelgrass 2-days prior to the scheduled transplant. The applicant is also required to conduct annual surveys (i.e. monitor) to document current bottom conditions and temporal and spatial changes in portions of the eelgrass bed underlying the new conservation moorings and submit results in an annual report. It's worth noting that the Atlantic Coast Fish Habitat Partnership has endorsed a similar project in Tisbury, MA that involves replacing traditional chain and block-anchor mooring systems with new conservation mooring technology (ACFHP 2010).

In an attempt to quantify, and hopefully eliminate other impacts DFW conducted a shellfish survey at the project site and found practically no shellfish within the dredge footprint (<0.25 clams/m^2). Thus, DFW determined that the project would result in no biological impact to shellfish habitat or potential broodstock. Similarly, DFW required all in-water work to be conducted during the RI DEM Dredge Window, which is designed to greatly reduce and possibly eliminate impacts to fish sensitive life stages.

An unfortunate and avoidable challenge to the permitting of this project was that the applicant was steered down a specific mitigation path early during the permitting process by RI CRMC without consulting or communicating with other agencies (e.g. DFW, NMFS, ACOE). The problem was later exacerbated by RI CRMC not partaking in discussions and meetings related to the conservation mooring approach and drafting a report suggesting a transplant should be conducted, without providing justification. Ultimately, upon request of the applicant RI CRMC modified their report and issued an Assent consistent with RI DEM and ACOE permits. Including other agencies (DFW, ACOE, NMFS) early during the permitting process would have greatly reduced the time and conflict associated with permitting this project.

Site or Project Specific Long-term Dredge Permits

At present, dredging of federal navigation channels in RI is a reactive process that can result in in-water work being conducted during periods outside of the RI DEM Dredge Window. There a couple of federal navigation channels that are dredged annually or biannually in order to maintain a safe and viable channel for navigation. Establishing long-term permits or a memorandum of understanding (MOU) for such projects should improve project planning, as well as protection of marine resources.

For example, a dredge permit application for the Great Salt Pond Federal Navigation Channel at Block Island, RI was submitted by ACOE early during 2010. This project was last conducted during May of 2008. The ACOE application requested in-water work during a two-week period beginning as early as mid-April through June. To minimize resuspension of sediment that typically occurs when using mechanical bucket dredging, the ACOE proposed using the CURRITUCK, a special government owned (ACOE) small hopper vessel with a split-haul and two hydraulic dredges (see picture on cover page). Unfortunately, the CURRITUCK is only available to the Northeast (i.e. RI) during the spring and summer and isn't available during the RI DEM Dredge Window, which is protective of winter flounder sensitive life periods including egg and larval life stages.

The DFW would prefer the CURRITUCK be used for this project and tried to provide a work window that would be both protective of both winter flounder sensitive life periods and yet satisfy the ACOE scheduling needs for the CURRITUCK. Although DFW does not have data from Great Salt Pond, during 2006 DFW collected ichthyoplankton data at locations inside and outside Old Harbor, Block Island. This data showed larval winter flounder present in the water column during the first week of May. Due to lack of site specific data at Great Salt Pond, DFW assumed that sensitive life periods for winter flounder spawning in Great Salt Pond are similar to Old Harbor, and there is suitable habitat for larval and juvenile winter flounder adjacent to parts of the channel.

Based on DFW recommendations, the dredge permit stated that dredging shall be conducted no earlier than May 15 and have all work completed by June 30. Similarly, to minimize impacts on nearby eelgrass (no eelgrass in dredge footprint), eelgrass beds must be avoided at all times (no anchoring, etc) by the dredging contractor.

From a permitting standpoint this was likely successful for 2010, but could present an ongoing annual battle pinning resource protection against scheduling needs. Thus, a long-term agreement (~10 year) would be in the best interest of both parties. DFW has stated that it can not move the work window earlier in the year without conducting a site-specific study to quantify potential impacts to winter flounder and other marine resources. Early in 2011, the ACOE submitted an application for a long-term permit. Presently, DFW and ACOE are discussing what type of studies would be needed to further define the work window. DFW is hopeful that this will result in the first of many site-specific long-term projects.

General Comments and Recommendations

It's worth noting that despite recent successes, the permitting process for some dredge projects has been an arduous process for both applicants and some regulatory agencies. Given the potential impacts of these projects this isn't totally unexpected, but the process and in some case frustration has been exacerbated by a lack of communication during pre-application meetings held by RI CRMC. As with the aforementioned case regarding the Bonnet Shores Fire District Maintenance Dredge Project, options have been presented to applicants during RI CRMC pre-application meetings that have been inconsistent and unacceptable to other regulatory agencies. Ultimately, this resulted in reports, recommendations, and draft permits being inconsistent and necessitating additional interagency discussions, which could have resulted in a compromise of environmental safeguards. Agencies recognize this short coming and have suggested that RI CRMC include other agencies (DFW, ACOE, NMFS) early during the permitting process and be less finalistic during their pre-application meetings.

On a positive note, for the second consecutive year DFW didn't receive any applications for residential dock dredging. Given that residential dock dredging involves the removal of shallow water habitat, which is important to spawning and juvenile fish, this activity would require rigorous review by Marine Fisheries. In recent years, it's been determined that residential dock dredging has presented greater impact to public resources (fishery and marine habitat) compared to benefits and have not been permitted. RI CRMC staff purportedly have been persuading applicants seeking to dredge a channel for residential docks to pursue an alternative approach that doesn't involve dredging.

Conclusion

While DFW continue to make strides towards fisheries and habitat protection in RI waters, resource management agencies like RIDEM and CRMC continue to come under political and economic pressures during the permitting process to accommodate the applicant. To counter these efforts we will continue to provide sound data and published scientific literature to defend our position. Discussions and meetings within RI DEM indicate that our concerns are taken seriously and we are making headway towards resolving some of our concerns. Notably 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.

Literature Cited

ACFHP. 2010. Atlantic Coast Fish Habitat Partnership endorse project: Eelgrass Conservation Moorings Demonstration. http://www.atlanticfishhabitat.org/endorsedProjects.cfm

Table 1. Summery of types of responses to projects received during 2010. Of the 82 projects received, 38 (46%) posed potential impacts to fisheries or marine habitat in Rhode Island waters and warranted responses.

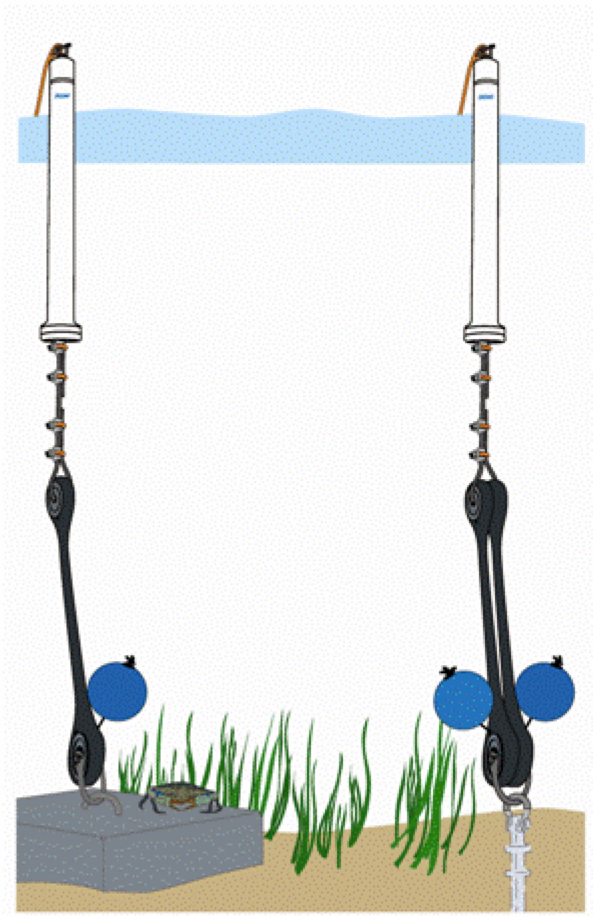
	Projects with Response	
Type of Response to Application	No.	%
None (not warrented, no issues)	44	54%
Oral	7	9%
Written	28	34%
In review (will receive written comment)	3	4%
Total No. of Projects Reviewed	82	

Table 2. Summary of activities included in permits received by DFW during 2010. Note that projects often involve multiple activities; therefore, the total number of activities (117) is greater than the number of projects received (82). See text for an example and further discussion.

Waterbody			Activity Category Types Addressed in Projects																								
Name	Type	No. of Projects	Eelgrass Removal	Eelgrass Restoration	Maintenance Dredging	New Dredging - Non-residential Dock	New Marina	Marina Expansion or Reconfiguration	Restoration - Tidal Flow to Coastal Pond	Residential Docks (new)	Residential Docks (modification)	Commercial Piers	Salt Marsh Impact	Salt Marsh Restoration	Terrestrial Project - No Marine Issues	Waterfront Bulkhead/Riprap	Waterfront Development	Wetland Alteration (Freshwater)	Aquaculture	Public Works or Utility	Fish Passage	Potential Shellfish Impacts	Channel Maintenance	Other	Total	Percent by Waterbody
Barrington River	CR	2								1			1							1	1				4	3%
Blackstone River	CR	2																		2	1				3	3%
Cards Pond	CP	1							1																1	1%
Coastal Wetlands	CW	3							1						1			1							3	3%
Kickemuit River	CR	1								1															1	1%
Mud Pond	CP	1							1																1	1%
Nannaquaket Pond	CP	1																	1						1	1%
Narragansett Bay	NB	37	4	4	9		2	2		13	5	7				4			1	1		7	3		62	52%
Narrow River	CR	1								1															1	1%
Ninigrit Pond	CP	8						5						1					2						8	7%
Ocean (Atlantic)	OO	4			1														1					2	4	3%
Pawtuxet River	CR	1													1			1							2	2%
Pawcatuck River, Little Narr. Bay	CR	2			1					1						1							1		4	3%
Potters Pond	CP	2								2															2	2%
Pt Judith Pond	CP	7						1		6											1				8	7%
Quonochontaug Pond	CP	4	1	1	1				1	2									1			1	1		9	8%
Seekonk River	CR	1																		1					1	1%
South Easton Pond	CP	1																			1				1	1%
Weekapaug Pond	CP	1								1															1	1%
Woonasquatucket River	CR	2																		2					2	2%
Total		82	5	5	12	0	2	8	4	28	5	7	1	1	2	5	0	2	6	7	4	8	5	2	119	
Percent by Waterbody			4%	4%	10%	0%	2%	7%	3%	24%	4%	6%	1%	1%	2%	4%	0%	2%	5%	6%	3%	7%	4%	2%		

Figure 1: Depiction of a conservation mooring attached to a typical mooring block [A] and a helical anchor [B]. Image was taken from http://www.hazelettmarine.com/download .

(A) (B)



JOB 7

Evaluation, Monitoring, and Development of Artificial Reefs in Rhode Island Territorial Waters

by

Nicole Travisono
Principal Marine Fisheries Biologist

R. I. Division of Fish & Wildlife
Marine Fisheries
Ft. Wetherill Marine Laboratory
3 Ft. Wetherill Road
Jamestown, Rhode Island 02835

STATE: Rhode Island **PROJECT NUMBER:** F-61-R
SEGMENT NUMBER: 18

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

PERIOD COVERED: January 1, 2010 – December 31, 2010

JOB NUMBER AND TITLE: 7, Evaluation, Monitoring, and Development of Artificial Reefs in Rhode Island Territorial Waters

JOB OBJECTIVE: To manage two artificial reef sites in Rhode Island waters for the benefit of the recreational fishing public and to a lesser degree, commercial fisherman and scuba divers. To monitor the succession of biological organisms through Performance Monitoring according to the "Post-Development Monitoring Plan for the Jamestown Bridge Artificial Reef Sites". To perform compliance monitoring by completing the first multibeam bathymetric survey of the sites. To write an artificial reef plan for the state of Rhode Island as requested by the Coastal Resources Management Council. To continue to develop the two reef sites as necessary following the completion and acceptance of the artificial reef plan for the state of Rhode Island.

SUMMARY: Investigators contracted a team of professional divers with biological credentials to survey the reef sites during the 2010 field work season. On June 21st, a single mooring was installed on each of the artificial reefs. On July 26th, a fish census survey was conducted at each reef site. Investigators had planned on conducting additional monthly fish census surveys as well as hauling two cryptic habitat units in the fall however were unable to due to inclement weather, diver availability, and financial constraints. A multibeam bathymetric survey was conducted at each reef site on November 2, 2010, by Substructure, Inc. Investigators completed extensive literature reviews and research in preparation for writing an artificial reef plan for the state of Rhode Island.

TARGET DATE: 2011

STATUS OF PROJECT: Behind schedule

SIGNIFICANT DEVIATIONS: Investigators were unable to conduct additional monthly fish census surveys as well as hauling two cryptic habitat units in the fall as scheduled.

RECOMMENDATIONS: To continue into the next segment to write the artificial reef plan for the state of Rhode Island.

REMARKS: Investigators were unable to complete several field work tasks scheduled for 2010 due to inclement weather, diver availability, and financial constraints. As a result, in the final year of the project, investigators plan on focusing solely on writing a final summary report of the project as well as an artificial reef plan for the state of Rhode Island.

INTRODUCTION

When the Old Jamestown Bridge was closed to traffic in 1992 following the opening of the Jamestown-Verrazano Bridge, the fate of the Old Jamestown Bridge had not yet been decided. The state had several options to consider including sending the materials to the landfill for disposal, recycling the materials, or a combination of the two. In the end, the state chose the third option, recycling the majority of the material and sending the remaining material to the landfill. Once this was decided, the Rhode Island Department of Transportation in partnership with the Rhode Island Department of Environmental Management (RIDEM) devised a plan to recycle the concrete slabs and rubble from the bridge to create two inshore artificial reef sites. Construction of Gooseberry Island reef and Sheep Point reef was completed in August, 2007. Since the completion, the RIDEM has been performing annual compliance and performance monitoring of the inshore reefs.

BACKGROUND

The Gooseberry Island reef is located 1.5 miles south of Newport, RI while the Sheep Point reef is located 1.1 miles east of Newport, RI (Figure 1). Both reefs span an area of 0.03 km^2 with the Gooseberry Island reef being the deepest in approximately 80 feet of water and the Sheep Point reef slightly shallower in approximately 65 feet of water. Upon completion of the artificial reefs a single transect line composed of white sinking line was deployed at each reef site spanning 650 feet across in a northwest-southeast direction to serve as a guide for research divers. In March 2008, 22 cryptic habitat units were deployed at the two reef sites, 11 at each site. Each cryptic habitat unit stands approximately 5.5 feet tall and is composed of a concrete base, a concrete pedestal, and a plastic-coated wire mesh cage. The wire cage holds 150 surf clam shells which provide interstitial spaces for small organisms such as juvenile fish and lobster to hide.

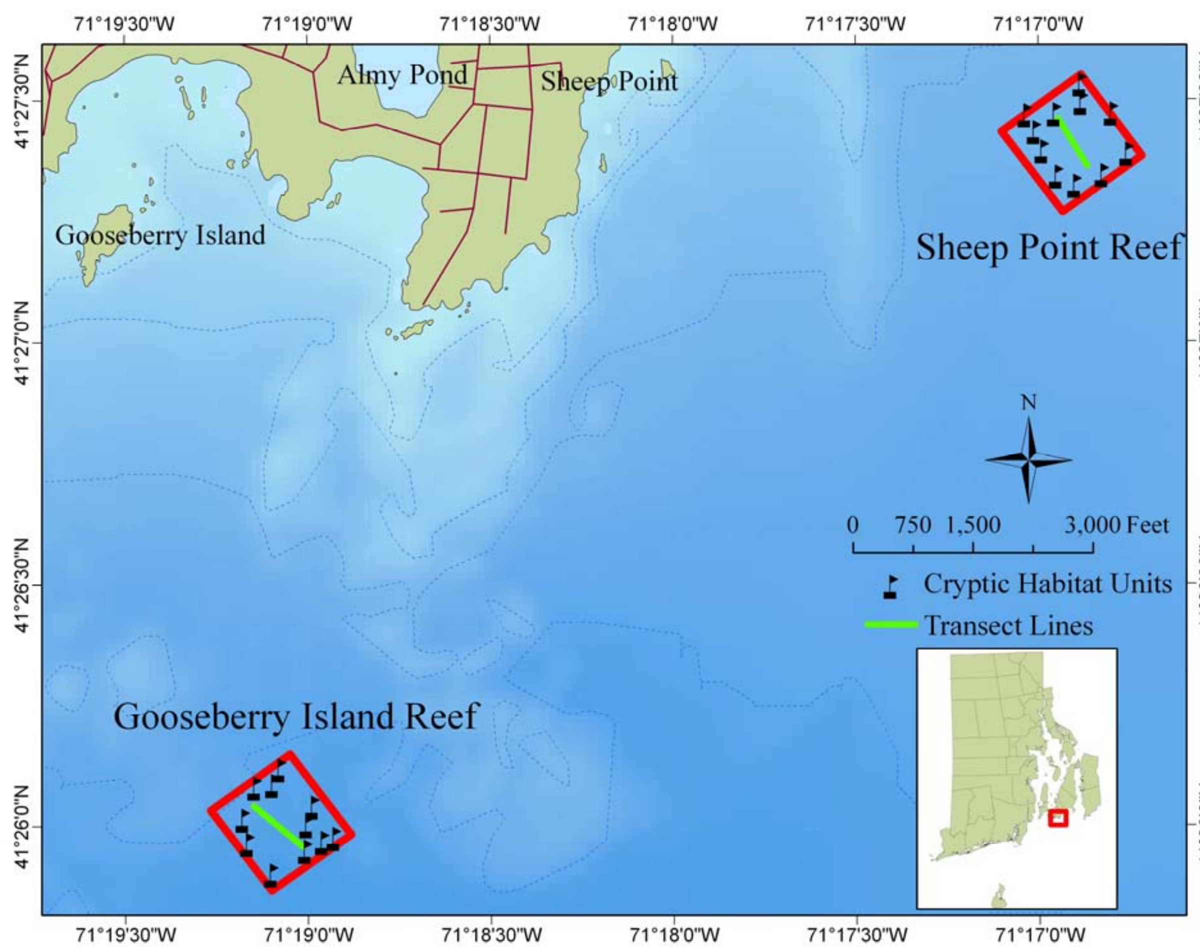


Figure 1. Map showing the location of Gooseberry Island reef and Sheep Point reef in RI waters.

MATERIALS AND METHODS

Two moorings were constructed out of available materials in June, 2010 (Figure 2). Each mooring consisted of a mooring buoy, long-link chain, and ¾" nylon line. The scope of each mooring was designed to be 1 ½ times the depth. A 12" section of 1" PVC pipe was placed over the nylon line to allow for easy cleaning. On June 21st, the R/V Privateer was used to take investigators and the dive team to each reef site to install the moorings. Once the installation was complete, the diver used his remaining bottom time to inspect the transect line that was installed in 2007. The transect line at both sites appeared to be in good condition with no obvious problems. Divers did note however that several of the red canvas tags that had been placed in 25' increments along each transect were missing. Although divers did not have sufficient time to conduct a complete fish census, they did make several notes regarding the colonization of reef debris and schools of finfish present.

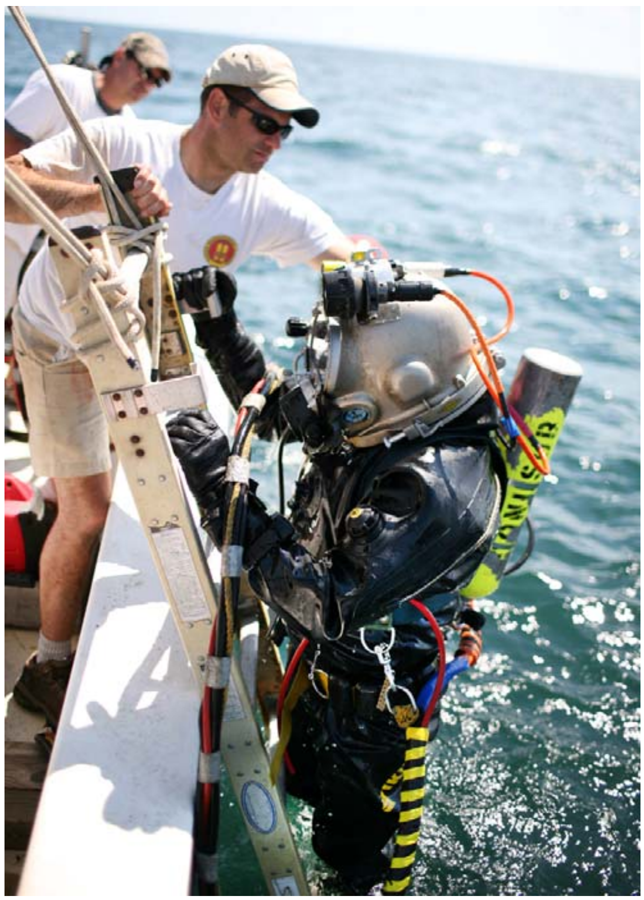


Figure 2. Diver being assisted out of the water after installing a mooring on Sheep Point reef. Photo courtesy of Steve Moy, CONUSUB.

A complete fish census survey was performed on July 26th, 2010, at Sheep Point reef and Gooseberry Island reef. The deeper of the two reefs, Gooseberry Island reef, was surveyed first. Using surface supply oxygen, the diver was lowered to the bottom and swam to the 250 foot marker to begin the survey. After arriving at the marker, the diver waited a brief period of time for conditions to settle before starting the fish census. Once the census began, the diver identified and enumerated all finfish observed in a 360 degree view for a period of three minutes. All observations were communicated to a biologist on the surface who recorded the data. The extent of the divers view was limited by the visibility conditions which varied from 2-4 feet at Gooseberry Island. At the end of the three minutes the diver was instructed to swim fifty feet to the 300 foot marker. This marker was missing from the transect, thus the diver swam to the next visible marker at 325 feet, where a three minute fish census was completed. At this point the diver only had sufficient time to swim twenty-five feet instead of the preferred fifty feet. The final fish count was performed at the 350 foot marker. Once the survey at Gooseberry Island reef was completed, the team then moved on to Sheep Point reef. A fish census was conducted at Sheep Point reef following the same procedure as that stated for Gooseberry Island reef above. The only exception was that due to the shallow depth at Sheep Point, there was sufficient bottom time to perform four fish counts compared to three at Gooseberry Island.

On November 2, 2010, a multibeam hydrographic survey of both reef sites was conducted by Substructure, Inc. (Appendix A). The primary objective of this survey was to ensure that no significant sinking or shifting of reef material occurred since the last survey was conducted in 2008. It should be noted however that the survey done in 2008 was not a full, comprehensive bathymetric survey. Sufficient data was collected however to allow comparisons between the two surveys, 2008 compared to 2010.

RESULTS AND DISCUSSION

Although a formal fish census was not performed during the mooring installation, divers did see several species of finfish including black sea bass, cunner, and summer flounder (Figure 3). Divers also saw a large number of sea stars on the reef debris at both sites (Figure 4).

Figure 3. A black sea bass seen on Sheep Point reef on June 21st, 2010, after the mooring installation. Photo courtesy of Steve Moy, CONUSUB.

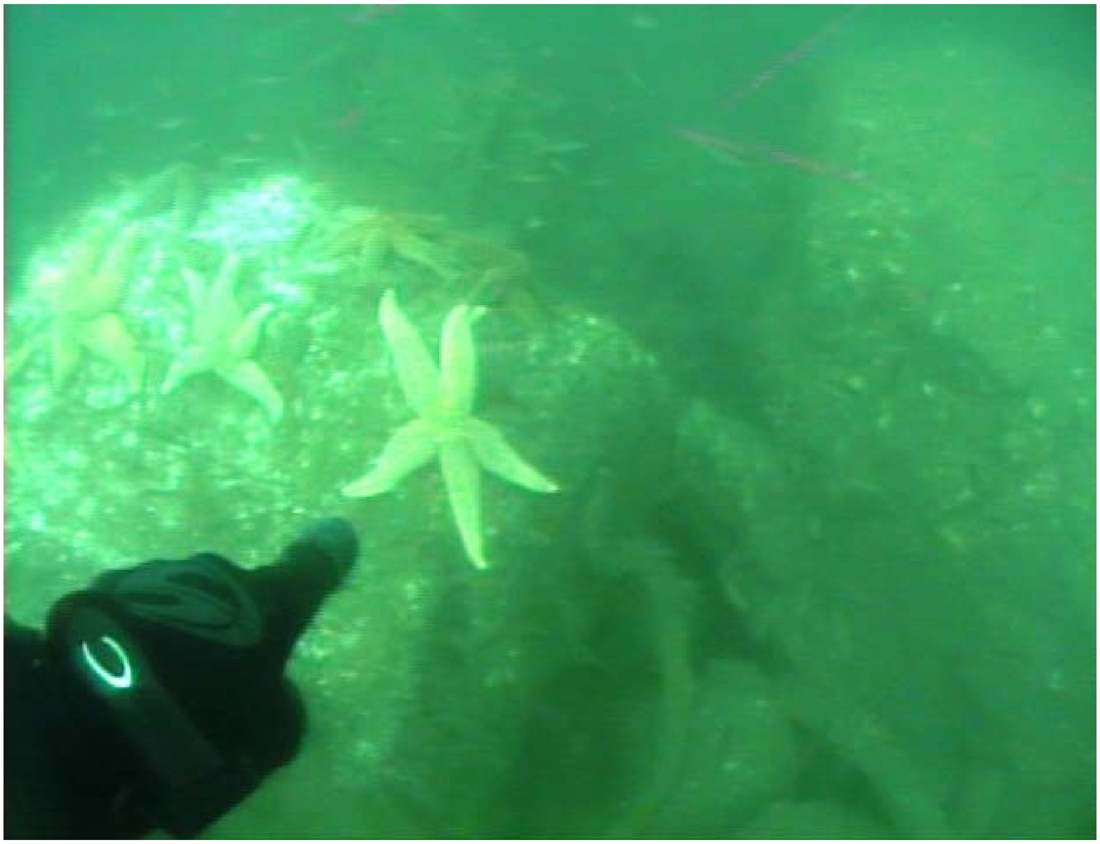


Figure 4. Diver pointing out a sea star during the mooring installation on Sheep Point reef on June 21st, 2010. A school of finfish is also visible in the background. Photo courtesy of Steve Moy, CONUSUB.

In the July 26th, 2010, fish census survey three different species of finfish were observed. Banded rudderfish, cunner, and summer flounder were all seen at Gooseberry Island reef, whereas at Sheep Point reef, cunner was the only species observed (Table 1). Gooseberry Island reef also had a higher abundance of fish than Sheep Point reef, 38 compared to 18 respectively. This higher species richness and abundance observed at the Gooseberry Island reef could be in part due to the greater depths at this site compared to Sheep Point reef. Divers noted seeing a large abundance of banded rudderfish schooling around the mooring line at each reef site, although these fish were not included in the fish census. A number of invertebrate species were observed during the fish census including barnacles, clams, mussels, and sea stars.

Table 1. Species and frequency of occurrence of finfish observed during July 26th, 2010, fish census survey.

REEF	SPECIES	# OF FISH
GB	Banded Rudderfish	3
GB	Cunner	34
GB	Summer Flounder	1
SP	Cunner	18

The multibeam bathymetry survey conducted on November 2nd, 2010, did not show any significant movement of reef material at either reef site (Figures 5-6). The rectangles in Figures 5 and 6 represent the target area of where reef material was to be deposited when constructing the reefs in 2006. In looking at Figure 5, a portion of the material deposited at Sheep Point reef was accidentally deposited outside of the target area.

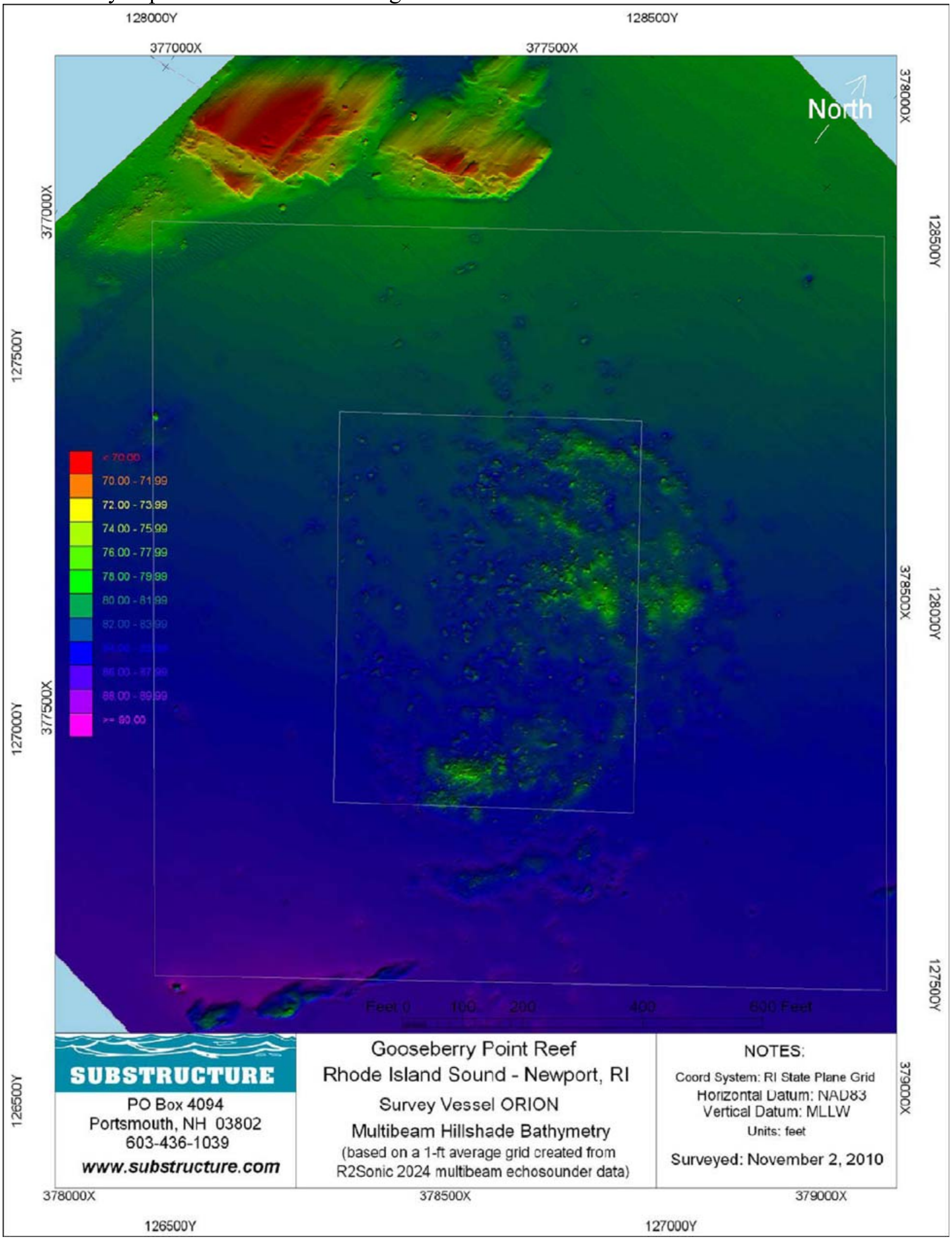


Figure 5. Map showing the multibeam hillshade bathymetry at Gooseberry Island reef.

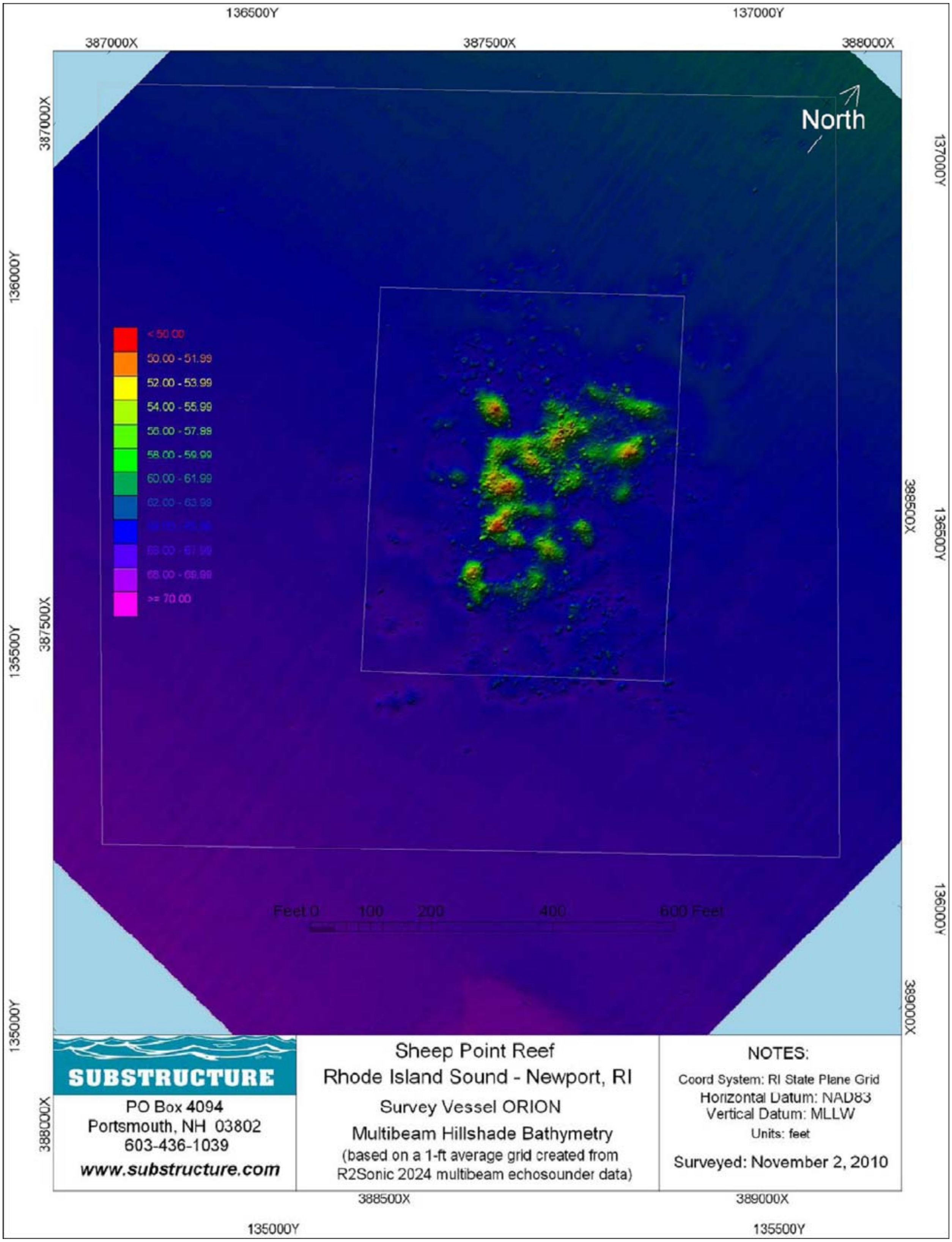


Figure 6. Map showing the multibeam hillshade bathymetry at Sheep Point reef.

APPENDIX A

Monitoring Multibeam Survey: Gooseberry Point and Sheep Point Reefs, Rhode Island Sound

At the request of the Rhode Island Department of Environmental Management (RIDEM), Substructure recently completed multibeam hydrographic surveys around the Gooseberry Point and Sheep Point Reefs.
The following is a brief discussion of the methods employed during that survey. In addition, page-sized plots presenting the results of this survey are also attached.

1. Prior to the start of the survey, Substructure established a local survey control point in the immediate Newport area. An eight-hour static observation session was conducted with a Trimble R7 dual-frequency Global Positioning System (GPS) receiver to establish a precise NAD83 geographic position and NAVD88 elevation for this control point. During the multibeam survey operations, the R7 GPS receiver was set-up over the control point and configured to broadcast continuous real-time kinematic differential GPS (DGPS) correctors to the navigation system on the vessel (via a cell phone modem connection). This set-up provided cm-level horizontal and vertical accuracies on the survey vessel throughout the survey. During the survey, the NAD83 horizontal datum with a RI State Plan coordinate system (feet), and a Mean Lower Low Water (MLLW) vertical datum (feet) were used. The MLLW elevation for the control point was based on the published NOAA offset (0.62 m) between NAVD88 and MLLW for the benchmarks associated with the NOAA tide station in Newport, RI.

2. Substructure conducted the multibeam survey aboard their survey vessel *Orion* on Tuesday, November 2, 2010. Both survey areas were mostly protected from the 15-20 knot N winds, and seas were generally less than one foot during the survey. The mainscheme survey lines in both areas were oriented towards the north-northeast to align with the prevailing wind and sea conditions during the survey period. In addition, three cross-check lines were also run in each area perpendicular to the mainscheme alignment. Standard survey equipment on *Orion* included an R2Sonic 2024 multibeam echosounder, an Applanix 320 POSMV vessel motion reference and navigation unit, a Valeport conductivity-temperature-depth (CTD) sensor mounted near the multibeam array, an Odom Digibar speed of sound profiler, and HYPACK / HYSWEEP hydrographic data acquisition and processing software.

3. Prior to the start of survey operations and at routine intervals during the survey day, water column speed of sound profiles were acquired with the Odom Digibar and entered directly into the data acquisition package. The R2Sonic 2024 also included a near surface CTD sensor that provided a continuous speed of sound measurement near the multibeam sonar head. The near surface speed of sound readings compared well between the CTD sensor and the speed of sound profiler throughout the survey. In addition, the speed of sound profiles were very consistent throughout the day, with negligible changes in the speed of sound throughout the entire water column.

4. Initial processing of the multibeam data included reviewing the raw sensor and navigation data, reviewing and editing the RTK tidal height data, reviewing and applying the speed of sound cast data, cleaning the raw acoustic data, and creation of preliminary gridded products to assess data coverage and conduct cross-check comparisons. There were no unusual circumstances encountered during this survey and the final results completely covered the required areas. The overlapping bathymetric data agreed well throughout the survey area and the cross-check comparisons were also consistent. In addition, the RTK GPS-derived tidal heights on the survey boat agreed well with the observations at the NOAA tide station in Newport.

5. Final processing of the multibeam data included final area-based editing focused on the standard deviation surfaces, creation of final gridded bathymetric datasets (e.g., 1-ft average and minimum grids), and development of hillshade surface models, selected sounding files, contour files, and overview data images. In addition, an imagery mosaic was also created from the recorded multibeam backscatter intensity data.

JOB 8

Sportfish Assessment and Management in Rhode Island Waters

Mark Gibson
Najih Lazar
Jason McNamee
John Lake
Eric Schneider

R. I. Division of Fish & Wildlife
Marine Fisheries
Ft. Wetherill Marine Laboratory
3 Ft. Wetherill Road
Jamestown, Rhode Island 02835

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During this segment, several fish stock assessments were completed. Scientific advice to fisheries managers emerged from these assessment, particularly during the deliberations of the state's licensing provisions for 2011. The project leader participated at the Atlantic States Marine Fisheries Commission's meetings relative to the management of recreationally important coastal stocks. Other project staff participated at the fish stock assessment meetings and 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 2011. The following is a summary of those findings (Finfish Sector Management Plan, 2010).

1. **SCUP**

Stock Status: The scup stock is no longer considered overfished and overfishing is not occurring. Previously, the scup resource was defined as overfished when the three-year average of the spawning stock biomass (SSB) index, based on the Northeast Fisheries Science Center's (NEFSC) spring survey, was below the threshold biomass index. A new assessment was introduced and peer reviewed in 2008 that uses a forward projection modeling technique called ASAP (age structured assessment program). This model indicated that the 2008 SSB level for the scup stock is 157,000 mt, well above the SSB target of 92,044 mt (NEFSC 2009). SSB remains above the target as indicated in the most recent assessment update (SSB_{2009} = 155,000 mt). The overfishing definition for the scup resource is defined as the fishing mortality (F) $F_{40\%} = F_{msy}$ = 0.177. The most recent formally reviewed stock assessment for scup concluded that overfishing was not occurring with F_{2009} = 0.043 (NEFSC, 2010a).

2. **SUMMER FLOUNDER**

Stock Status: In 2008, the stock assessment and biological reference points for the summer flounder stock were updated and reviewed (NEFSC 2008a). The new assessment results, using the ASAP modeling approach similar to scup, indicated that the summer flounder resource is not experiencing overfishing and is not overfished (NEFSC 2008a). The most recent stock assessment update continues to indicate no overfishing, not overfished, however it also indicates that the stock is not yet fully rebuilt (NEFSC 2010b). The summer flounder stock is defined as overfished if the stock's SSB falls below the biomass (SSB) threshold, currently defined as ½SSB_{MSY} = 30,037 mt. The SSB estimate for 2009 was 53,458 mt, an increase from the 2008 estimate (SSB_{2008} = 46,029 mt). This is still below the $SSB_{target} = SSB_{msy}$ = 60,074 mt. The overfishing definition for the summer flounder stock is defined as $F_{35\%} = F_{msy}$ = 0.31. The 2009 fishing mortality rate estimate (F_{2009} = 0.237) is below the fishing mortality reference point. Fishing mortality in 2009 may have been higher, as a retrospective analysis indicated that the current assessment method tends to underestimate F in recent years. This retrospective pattern, however, is reduced compared to the previous stock assessment that used a different assessment method.

3. TAUTOG

Stock Status: The ASMFC Tautog Technical Committee completed the most recent coastwide assessment of tautog in 2006 (ASMFC 2006). Results indicated that coastwide fishing mortality rates have declined since 1993. The stock was found not to be experiencing overfishing in 2004; however, the estimated fishing mortality rate in 2004 ($F_{2004} = 0.28$) was very near the target *F* rate ($F_{Target} = 0.30$). The assessment through 2005 indicated a slight increase in biomass and recruitment for recent years, however the biomass increases were not adequate to rebuild the stock in a reasonable time frame. There are also indications that a considerable proportion of the recent growth in the stock is from fish younger than spawning age. The main contributor to the fishing mortality rates appears to be recreational landings, which comprised approximately 75–90% of total landings over the past six years when viewed coastwide. Rhode Island is at the higher end of that range comprising approximately 90% of the landings. Two addenda were initiated in 2007 that added a spawning stock biomass target to the FMP as well as a decrease in the fishing mortality target, both addenda were approved by the start of the 2008 fishing year.
A regional approach to tautog management was also approved by the ASMFC in 2008, allowing MA and RI to assess the tautog stock in the two state's waters region. Even though this regional assessment allowed for a status quo management scenario, MA and RI decided on a proactive approach and did implement reduction measures in 2008. Despite these reduction measures the tautog stock continues to be subject to high recreational landings specifically in Rhode Island in the fall months. The most recent regional stock assessment indicated an increase in fishing mortality to $F_{2008} = 0.36$, well above the $F_{target} = 0.2$, thus overfishing is occurring. In addition, spawning stock has not responded and remains below the SSB target of 8,750 mt with the 2008 estimate being $SSB_{2008} = 4{,}009$ mt, thus the stock is overfished. Commercial landings have not risen appreciably since plan implementation in RI due to the constraint of a quota. Indices of abundance based on the RIDFW trawl survey indicate a recent increase in abundance locally (Olszewski 2009). Abundance indices for young-of-year tautog, however, point to
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sporadic changes in abundance over the past several years, overall indicating a downward trend (McNamee 2009).

4. STRIPED BASS

Stock Status: The most recent stock assessment of the striped bass stock showed that total catch (recreational and commercial) has increased since the mid- to late 1980s, though total abundance remains high (ASMFC 2009). The assessment results led the ASMFC Striped Bass Technical Committee to also conclude that abundance of striped bass age-13 and older has increased since 2003, when Amendment 6 was adopted.
The 2009 assessment applied a statistical catch-at-age method (SCA) to estimate fishing mortality rates for striped bass and compared those estimates with estimates derived from tagging data. Relative to the biological reference points accepted by the Striped Bass Management Board in 2008 (SSB threshold = 30,000 metric tons (mt); F threshold = 0.34), the striped bass stock complex is not overfished and overfishing is not occurring. This conclusion is based on a 2008 female spawning stock biomass estimate of 55,500 mt

and average age 8-11 F=0.21 from the statistical catch at age (SCA) model results (ASMFC 2009).

5. **BLACK SEA BASS**

Stock Status: Due to the use of a new stock assessment technique for stock status analysis, the black sea bass stock is no longer considered overfished and overfishing is not occurring. Previously, the black sea bass resource was defined as overfished when the three-year average of the spawning stock biomass (SSB) index, based on the NEFSC spring survey, was below the threshold biomass index. A new assessment was introduced and peer reviewed in 2008 that uses a forward projection modeling technique called SCALE (Statistical Catch at Length). This model indicated that the 2008 SSB level for the black sea bass stock is 12,892 mt, above the SSB target of $SSB_{msy} = SSB_{40\%} = 12,537$ mt (NEFSC 2009) and the most recent update indicates that biomass remains at high levels ($SSB_{2009} = 12,978$ mt) (NEFSC 2010). The overfishing definition for the black sea bass resource is defined as the fishing mortality (F) $F_{40\%} = F_{msy} = 0.42$. The most recent formally reviewed stock assessment for black sea bass concluded that overfishing was not occurring ($F_{2009} = 0.29$) (NEFSC 2010c). Despite the improved stock status, the MAFMC Science and Statistical Committee (SSC) instituted a status quo allowed biological catch; therefore the black sea bass quota did not increase for 2010. The reason for remaining at status quo was due to the uncertainty calculations associated with the assessment which categorized the new assessment in a lower tier, which required remaining at status quo.

WINTER FLOUNDER

Stock Status: In 2008, the NEFSC conducted the Groundfish Assessment Review Meeting (GARM3) and updated the Southern New England/Mid-Atlantic (SNE/MA) complex of winter flounder stock assessment. The previous assessment was completed in 2005 at GARM2 (NEFSC 2005). Results from GARM3 concluded that the Southern New England/Mid-Atlantic (SNE/MA) winter flounder stock complex is overfished and overfishing is occurring (NEFSC 2008b).

The 2008 GARM3 assessment applied an updated version of a Virtual Population Analyses (ADAPT VPA vers. 2.8.0), which is a backward-projecting age-structured population dynamics model, and updated catch data (1981-2007) to the same set of calibration models used in the GARM2 (2005). The base-run model exhibited a strong retrospective pattern, though improved relative to the GARM2 assessment. To correct the retrospective pattern all series were split pre/post 1994, which acts as a proxy for fishery and biological factors that could have changed in the mid-1990's. The split-run model showed a reduced retrospective pattern, with a shift from an under estimation of F during 1996-1999 terminal years, and lack of long-term trend thereafter (NEFSC 2008b). The GARM3 Review Panel recommended the split-run as the FINAL model.

Results from the split-run model estimated fishing mortality (F) in 2007 to be 0.649, more than 2½ times the FMSY proxy = F40% = 0.248. SSB in 2007 was estimated to be 3,368 mt, about 9% of SSBMSY = 38,761 mt. There is an 80% probability that in 2007 F and SSB were between 0.522 and 0.861 and 2,936 mt and 3,825 mt, respectively. The 2006 year class of 3.6 million (age 1 in 2007) is estimated to be the smallest on record and the 2007 year class (age 1 in 2008) is estimated to be 8.8 million fish. Projections at F in 2009-2014 = F40% = 0.248 indicate a <1% chance that the stock will rebuild to

SSBMSY = 38,761 mt by 2014). Projections further indicate that fishing at F = 0.000 during 2009-2014 will provide only a 1% chance to rebuild the stock to SSBMSY = 38,761 by 2014 (NEFSC 2008b). Nonetheless, substantial increases in SSB can be achieved if F can be kept under 0.248.

Based in part on the high site fidelity of winter flounder and long history of state landings from RI, RIDFW assessed the local winter flounder stock within state waters in 2007 (M.R. Gibson, RIDFW Marine Fisheries, unpublished data). RIDFW determined that the fishing mortality rate has remained above F_{MSY} = 0.26 since 1978, indicating that rates of fishing were above levels that would achieve maximum sustainable yield. Estimates of biomass have fluctuated over the time period 1959–2007, with two peaks occurring in the mid-to late-1960s and early 1980s, but showed a steady decline from 1983-1993, with the estimate for 1993 being the lowest in the time series. Estimates of biomass have remained well below B_{MSY} = 5,726 since 1988, despite a slight increase between 1994 and 1995.

6. BLUEFISH

Stock Status: Due to the use of a new stock assessment technique for stock status analysis, the bluefish stock is not considered overfished and overfishing is not occurring. A new assessment was introduced and peer reviewed in 2005 that uses a forward projection modeling technique called ASAP (age structured assessment program) (NEFSC 2005b). The model was rerun in 2010 and indicated that the 2009 biomass level for the bluefish stock is 155,991 mt, which is above the biomass threshold = 73,526 mt (NEFSC 2010d). The overfishing definition for the bluefish resource is defined as the fishing mortality ($F_{threshold}$) = F_{msy} = 0.19. The most recent stock assessment model run for bluefish concluded that overfishing was not occurring (F_{2009} = 0.10) (NEFSC 2010d).

7. MENHADEN

Stock Status: Menhaden are a highly migratory species that undergo a large amount of mixing off the coast of North Carolina in the winter months. The ASMFC Atlantic Menhaden Stock Assessment Subcommittee last assessed the menhaden stock in 2010. The 2010 assessment concluded that the species was not overfished and overfishing was not occurring (ASMFC 2010). The ASMFC Atlantic Menhaden Technical Committee went on to state that because the stock is assessed as a single coastwide unit, the assessment might not account for factors affecting the stock at the local level such as fishing, predation, or climatological events. The Technical Committee made a number of important research recommendations that need to be addressed before these more localized questions can be answered. Some of these research recommendations have been funded and are currently being worked on. As well, the Technical Committee has begun work on looking at new reference points which may lead to a reconsideration of stock status in the future. A final item being worked on by the Technical Committee is the consideration of ecosystem based reference points. These items will be studied and may be important factors for future stock status determinations.