ASSESSMENT OF RECREATIONALLY IMPORTANT FINFISH STOCKS IN RHODE ISLAND WATERS

COASTAL FISHERY RESOURCE ASSESSMENT
TRAWL SURVEY
2024

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



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Division of Marine Fisheries

February 2025

Annual Performance Report

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

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

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

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

PERIOD COVERED: January 1, 2020 – December 31, 2024.

PROJECT SUMMARY: Job 1, summary accomplished (January 1- December 31, 2024):

A: 156 twenty-minute bottom trawls were successfully completed.

B: Data on weight, length, sex and numbers were gathered on 70 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 2024

SCHEDULE OF PROGRESS: On schedule.

SIGNIFICANT DEVIATIONS: All months were completed without delay.

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) 2024

PROJECT SUMMARY: Job 2, summary accomplished:

A: 44, twenty-minute tows were successfully completed during the Spring 2024 survey (26 NB. – 6 RIS – 12 BIS).

B: 44, twenty-minute tow were successfully completed during the Fall 2024 survey (26 NB. – 6 RIS – 12 BIS)

C: Data on weight, length, sex and numbers were gathered on

64 species. Hydrographic data were gathered as well. Additionally, anecdotal notations were made on other plant and animal species. Although not previously discussed, these notations are in keeping with past practice.

TARGET DATE: DECEMBER 2024.

SCHEDULE OF PROGRESS: On schedule.

SIGNIFICANT DEVIATIONS: None

JOBS 1 & 2

RECOMMENDATIONS: Continuation of both the Monthly and Seasonal Trawl surveys into 2025, Data provided by these surveys is used extensively in the Atlantic States Marine Fisheries Commission Fishery Management process and Fishery Management Plans.

RESULTS AND DISCUSSION: 156 tows were completed during 2024 Job 1 (Monthly survey). 70 species accounted for a combined weight of 6775.44 kgs. and 255,889 length measurements being added to the existing Narragansett Bay monthly trawl data set
By contrast, 88 tows were completed during 2024 Job 2 (Seasonal survey) 64 species accounted for a combined weight of 4590.27 kgs. and 204,346 length measurements added to the existing seasonal data set.

For the grant period between 2020 and 2024 a total of 1207 tows (767 monthly and 440 seasonal) and an additional 7 species were added to our database. With the completion of the 2024 surveys, combined survey(s) Jobs (1&2) data now reflects the completion of 8,203 tows with data collected on 156 species over the entire timeseries.

PREPARED BY: _____ _____

Christopher J. Parkins Date
Principal Marine Biologist
Principal Investigator

APPROVED BY: _____ _____

Scott Olszewski Date
Acting Chief
RIDEM – Division of Marine Fisheries

Coastal Fishery Resource Assessment – Trawl Survey

Introduction:

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

Since the inception of the Rhode Island Seasonal Trawl Survey (April 1979) and the Narragansett Bay Monthly Trawl Survey (January 1990), 8,203 tows have been conducted within Rhode Island territorial waters with data collected on 156 species. This performance report reflects the efforts of the 2024 survey year as it relates to the past 45 years. (Lynch T. R. Coastal Fishery Resource Assessment, 2007), (Olszewski S.D. Coastal Fishery Resource Assessment 2014)

Methods:

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

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

Depth Stratum Identification

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

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

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

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

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

RIDEM R/V John H. Chafee



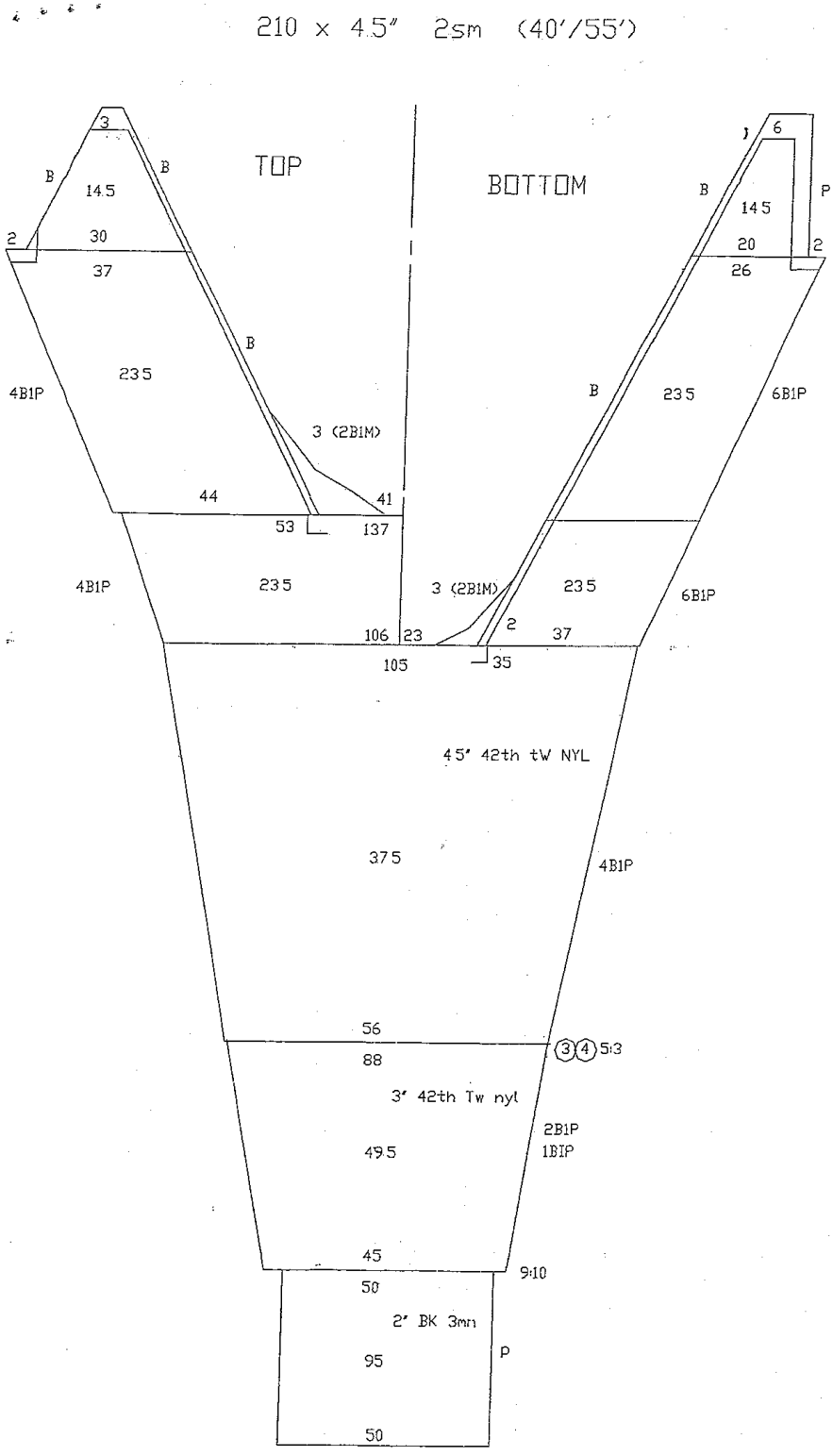
Acknowledgements:

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

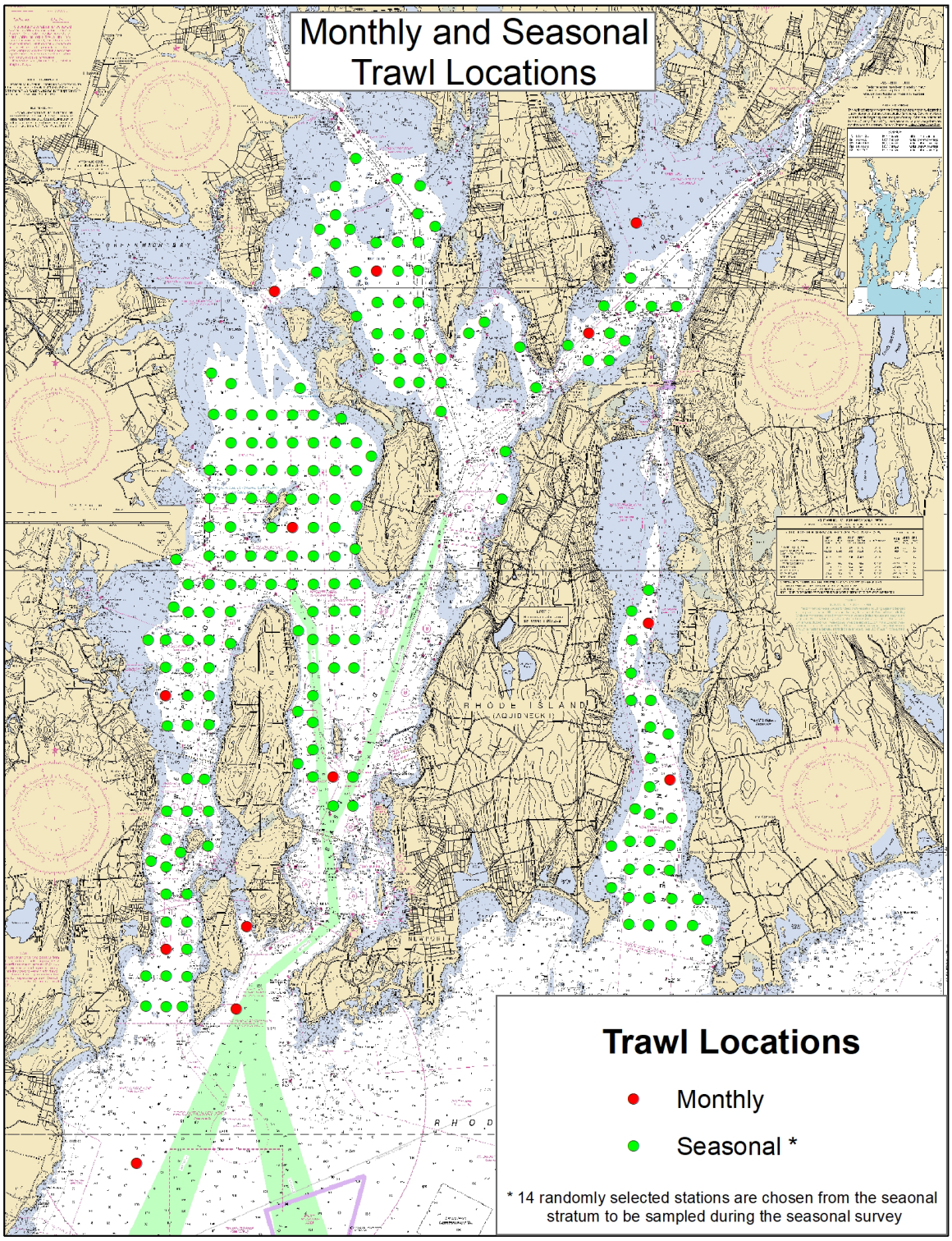




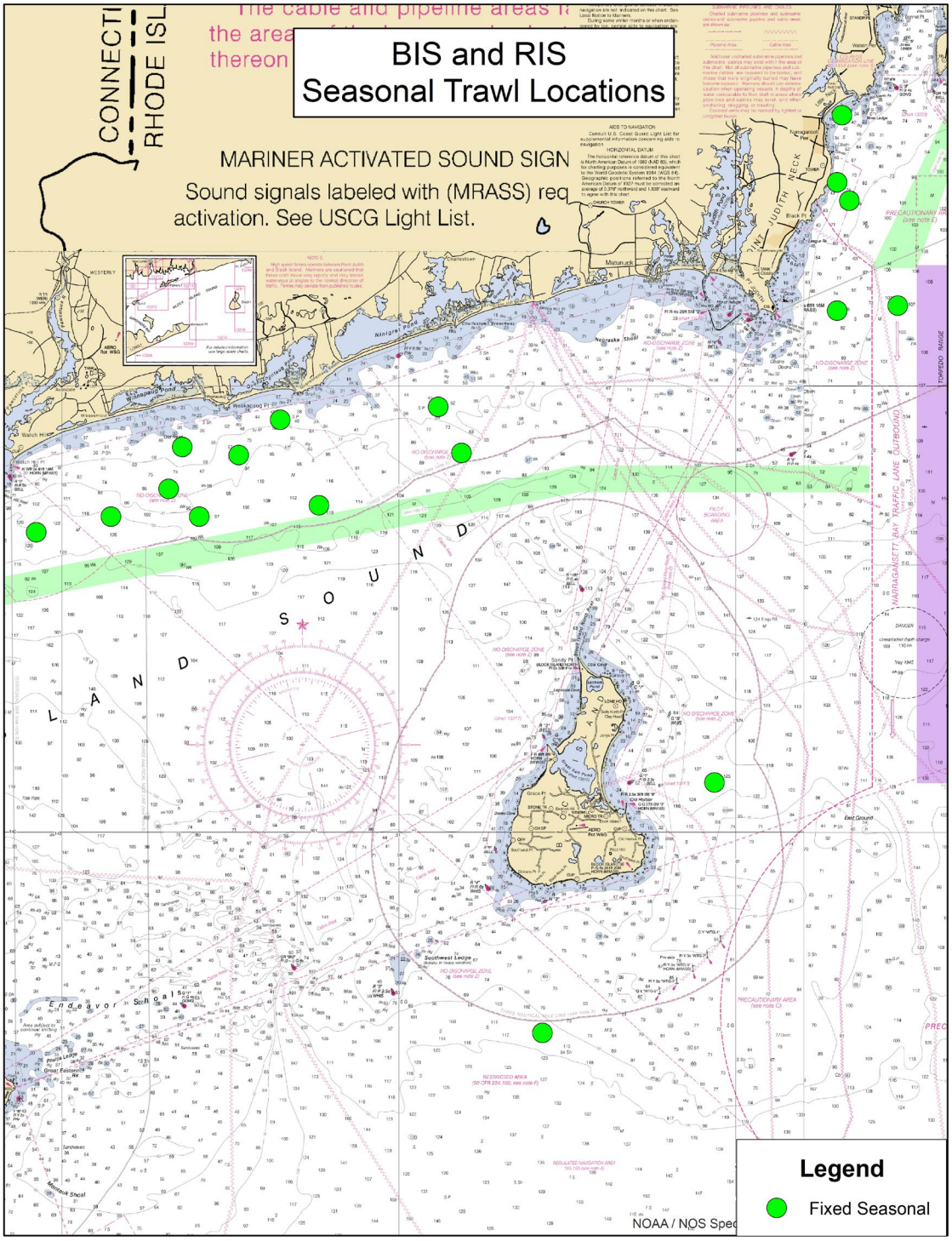
Figure 1


210 x 45" 2sm (40'/55')
TOP
BOTTOM
3
B
B
145
2
30
37
B
235
4B1P
3 (2B1M)
44
41
53
137
4B1P
235
106
23
105
45' 42th tW NYL
375
56
88
3' 42th Tw nyl
49.5
45
50
2' BK 3mn
95
50
6
B
145
P
20
2
26
B
235
6B1P
3 (2B1M)
235
6B1P
2
37
35
4B1P
2B1P
1B1P
9:10
P

Map 1: Monthly (fixed) and Seasonal (grid) Stations in Narragansett Bay



Map 2: Seasonal Fixed Stations in Rhode Island Sound and Block Island Sound



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

A total of 70 species were observed and recorded during the 2024 Narragansett Bay Monthly Trawl Survey totaling 255,889 individuals or 1640.3 fish per tow. In weight, the catch accounted for 6775.44 kg. or 43.43 kg. per tow. (Figures 2 and 3) The top ten species by number and catch are represented in figures 4 and 5. The catch between demersal and pelagic species is represented in figures 6 and 7and shows a clear shift from demersal species to a more pelagic or multi-habitat species.

Figure 2 (Total Catch in Number)

Scientific Name	Common Name	Total
ANCHOA MITCHILLI	Bay Anchovy	87451
CLUPEA HARENGUS	Atlantic Herring	53244
STENOTOMUS CHRYSOPS	Scup	27600
SELENE SETAPINNIS	Atlantic Moonfish	19111
DORYTEUTHIS PEALEII	Longfin Squid	18725
PEPRILUS TRIACANTHUS	Butterfish	10660
ALOSA PSEUDOHARENGUS	Alewife	8104
BREVOORTIA TYRANNUS	Atlantic Menhaden	7076
MENIDIA MENIDIA	Atlantic Silverside	6924
CYNOSCION REGALIS	Weakfish	6344
MERLUCCIUS BILINEARIS	Silver Hake	3256
POMATOMUS SALTATRIX	Bluefish	2859
LEIOSTOMUS XANTHURUS	Spot	1747
UROPHYCIS REGIA	Spotted Hake	543
ALOSA AESTIVALIS	Blueback Herring	349
UROPHYCIS CHUSS	Red Hake	271
LEUCORAJA ERINACEA	Little Skate	257
CENTROPRISTIS STRIATA	Black Sea Bass	210
PRIONOTUS EVOLANS	Striped Sea Robin	165
PLEURONECTES AMERICANUS	Winter Flounder	130
MUSTELUS CANIS	Smooth Dogfish	108
ALOSA SAPIDISSIMA	American Shad	103
CANCER IRRORATUS	Rock Crab	95
TAUTOGA ONITIS	Tautog	81
PARALICHTHYS DENTATUS	Summer Flounder	79
PRIONOTUS CAROLINUS	Northern Sea Robin	37
RAJA EGLANTERIA	Clearnose Skate	35
SCOPHTHALMUS AQUOSUS	Windowpane Flounder	28
HOMARUS AMERICANUS	American Lobster	26
MORONE SAXATILIS	Striped Bass	24
CITHARICHTHYS ARCTIFRONS	Gulfstream Flounder	19
DOROSOMA CEPEDIANUM	Gizzard Shad	18

CALLINECTES SAPIDUS	Blue Crab	18
LEUCORAJA OCELLATA	Winter Skate	16
TRACHURUS LATHAMI	Rough Scad	15
GADUS MORHUA	Atlantic Cod	12
CARANX CRYSOS	Blue Runner	11
MENTICIRRHUS SAXATILIS	Northern Kingfish	11
BUSYCOTYPUS CANALICULATUS	Channeled Whelk	10
PETROMYZON MARINUS	Sea Lamprey	9
SQUILLA EMPUSA	Mantis Shrimp	9
SQUALUS ACANTHIAS	Spiny Dogfish	8
SCOMBER SCOMBRUS	Atlantic Mackerel	7
SELAR CRUMENOPHTHALMUS	Bigeye Scad	7
CARANX HIPPOS	Crevalle Jack	7
ETROPUS MICROSTOMUS	Smallmouth Flounder	6
MYOXOCEPHALUS OCTODECEMSPINOS	Longhorn Sculpin	6
GASTEROSTEUS ACULEATUS	Threespine Stickleback	5
PRIACANTHUS ARENATUS	Bigeye	5
SPHYRAENA BOREALIS	Northern Sennet	5
ALOSA MEDIOCRIS	Hickory Shad	4
ENCHELYOPUS CIMBRIUS	Fourbeard Rockling	4
BUSYCON CARICA	Knobbed Whelk	4
TRICHIURIDAE	Cutlassfishes	4
PARALICHTHYS OBLONGUS	Fourspot Flounder	3
SPHOEROIDES MACULATUS	Northern Puffer	3
DECAPTERUS PUNCTATUS	Round Scad	3
ANCHOA HEPSETUS	Striped Anchovy	2
CONGER OCEANICUS	Conger Eel	2
LIMULUS POLYPHEMUS	Horseshoe Crab	2
LUTJANIDAE	Snappers	2
CANCER BOREALIS	Jonah Crab	2
MELANOGRAMMUS AEGLEFINUS	Haddock	1
SYNGNATHUS FUSCUS	Northern Pipefish	1
TRINECTES MACULATUS	Hogchoker	1
MORONE AMERICANA	White Perch	1
OPSANUS TAU	Oyster Toadfish	1
LOPHIUS AMERICANUS	Goosefish	1
ANGUILLA ROSTRATA	American Eel	1
HIPPOCAMPUS ERECTUS	Lined Seahorse	1

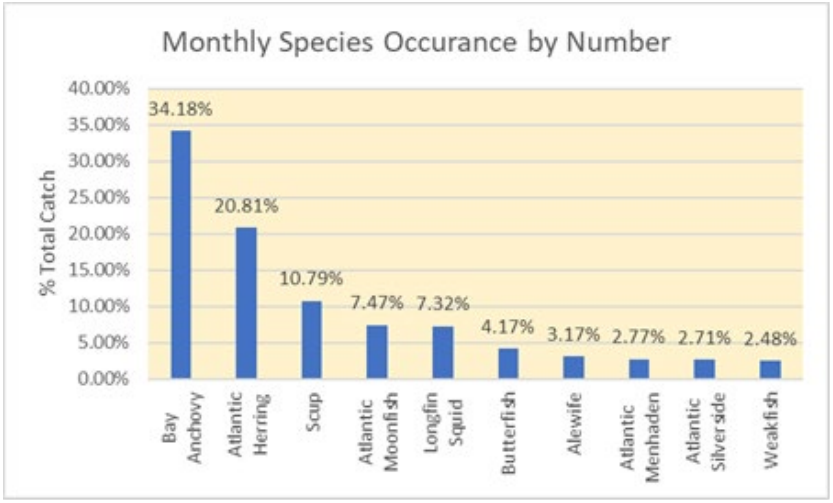
Figure 3 (Total Catch in Kilograms)

Scientific Name	Common Name	Total Weight (kg)
STENOTOMUS CHRYSOPS	Scup	3663.787
PEPRILUS TRIACANTHUS	Butterfish	591.555
CLUPEA HARENGUS	Atlantic Herring	394.133
DORYTEUTHIS PEALEII	Longfin Squid	217.572
MERLUCCIUS BILINEARIS	Silver Hake	197.156
ANCHOA MITCHILLI	Bay Anchovy	191.121
LEIOSTOMUS XANTHURUS	Spot	174.785
ALOSA PSEUDOHARENGUS	Alewife	154.383
LEUCORAJA ERINACEA	Little Skate	137.475
CYNOSCION REGALIS	Weakfish	122.805
TAUTOGA ONITIS	Tautog	116.44
SELENE SETAPINNIS	Atlantic Moonfish	112.7895
MUSTELUS CANIS	Smooth Dogfish	109.068
BREVOORTIA TYRANNUS	Atlantic Menhaden	86.346
MORONE SAXATILIS	Striped Bass	83.432
POMATOMUS SALTATRIX	Bluefish	60.463
CENTROPRISTIS STRIATA	Black Sea Bass	54.999
PARALICHTHYS DENTATUS	Summer Flounder	52.462
PRIONOTUS EVOLANS	Striped Sea Robin	45.221
RAJA EGLANTERIA	Clearnose Skate	40.935
MENIDIA MENIDIA	Atlantic Silverside	26.542
PLEURONECTES AMERICANUS	Winter Flounder	24.008
UROPHYCIS REGIA	Spotted Hake	20.943
UROPHYCIS CHUSS	Red Hake	18.514
CANCER IRRORATUS	Rock Crab	11.388
HOMARUS AMERICANUS	American Lobster	9.318
LEUCORAJA OCELLATA	Winter Skate	7.866
SQUALUS ACANTHIAS	Spiny Dogfish	7.71
PRIONOTUS CAROLINUS	Northern Sea Robin	5.203
LIMULUS POLYPHEMUS	Horseshoe Crab	4.59
GADUS MORHUA	Atlantic Cod	4.352
ALOSA SAPIDISSIMA	American Shad	4.214
SCOPHTHALMUS AQUOSUS	Windowpane Flounder	3.951
CALLINECTES SAPIDUS	Blue Crab	2.933
MYOXOCEPHALUS OCTODECEMSPINOS	Longhorn Sculpin	1.994
ALOSA AESTIVALIS	Blueback Herring	1.868
BUSYCOTYPUS CANALICULATUS	Channeled Whelk	1.486
BUSYCON CARICA	Knobbed Whelk	1.263
SCOMBER SCOMBRUS	Atlantic Mackerel	1.119

ALOSA MEDIOCRIS	Hickory Shad	1.048
MELANOGRAMMUS AEGLEFINUS	Haddock	1.01
MENTICIRRHUS SAXATILIS	Northern Kingfish	0.884
CARANX CRYSOS	Blue Runner	0.883
OPSANUS TAU	Oyster Toadfish	0.876
PARALICHTHYS OBLONGUS	Fourspot Flounder	0.517
DOROSOMA CEPEDIANUM	Gizzard Shad	0.493
SELAR CRUMENOPHTHALMUS	Bigeye Scad	0.47
TRACHURUS LATHAMI	Rough Scad	0.467
CANCER BOREALIS	Jonah Crab	0.358
SPHYRAENA BOREALIS	Northern Sennet	0.325
ANGUILLA ROSTRATA	American Eel	0.304
CARANX HIPPOS	Crevalle Jack	0.295
SQUILLA EMPUSA	Mantis Shrimp	0.239
CITHARICHTHYS ARCTIFRONS	Gulfstream Flounder	0.208
CONGER OCEANICUS	Conger Eel	0.182
PRIACANTHUS ARENATUS	Bigeye	0.104
LOPHIUS AMERICANUS	Goosefish	0.09
ENCHELYOPUS CIMBRIUS	Fourbeard Rockling	0.086
PETROMYZON MARINUS	Sea Lamprey	0.081
DECAPTERUS PUNCTATUS	Round Scad	0.07
SPHOEROIDES MACULATUS	Northern Puffer	0.048
ETROPUS MICROSTOMUS	Smallmouth Flounder	0.039
TRICHIURIDAE	Cutlassfishes	0.036
ANCHOA HEPSETUS	Striped Anchovy	0.031
LUTJANIDAE	Snappers	0.031
HIPPOCAMPUS ERECTUS	Lined Seahorse	0.026
TRINECTES MACULATUS	Hogchoker	0.025
MORONE AMERICANA	White Perch	0.014
GASTEROSTEUS ACULEATUS	Threespine Stickleback	0.008
SYNGNATHUS FUSCUS	Northern Pipefish	0.003

Figure 4 Monthly Survey Top Ten Species Catch in Number

Scientific Name	Common Name	%
ANCHOA MITCHILLI	Bay Anchovy	34.18%
CLUPEA HARENGUS	Atlantic Herring	20.81%
STENOTOMUS CHRYSOPS	Scup	10.79%
SELENE SETAPINNIS	Atlantic Moonfish	7.47%
DORYTEUTHIS PEALEII	Longfin Squid	7.32%
PEPRILUS TRIACANTHUS	Butterfish	4.17%
ALOSA PSEUDOHARENGUS	Alewife	3.17%
BREVOORTIA TYRANNUS	Atlantic Menhaden	2.77%
MENIDIA MENIDIA	Atlantic Silverside	2.71%
CYNOSCION REGALIS	Weakfish	2.48%



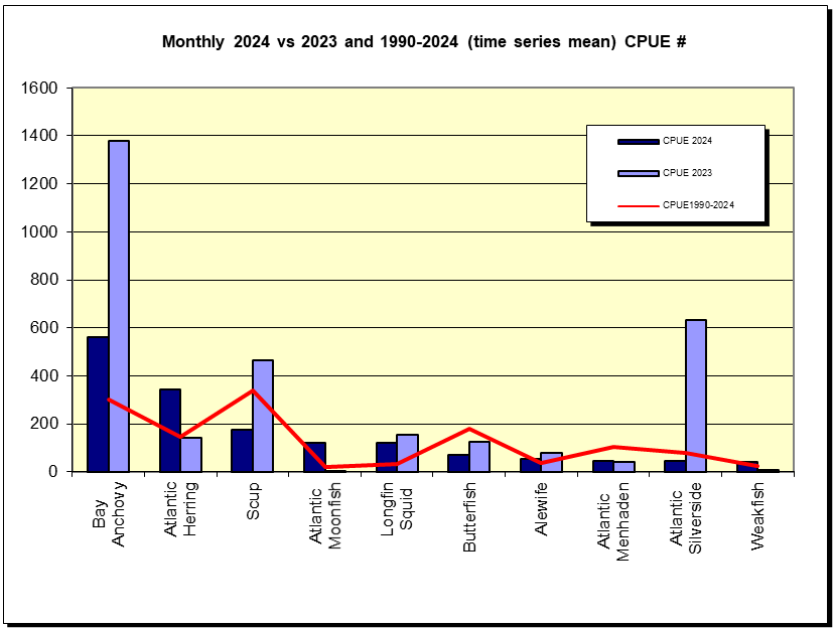
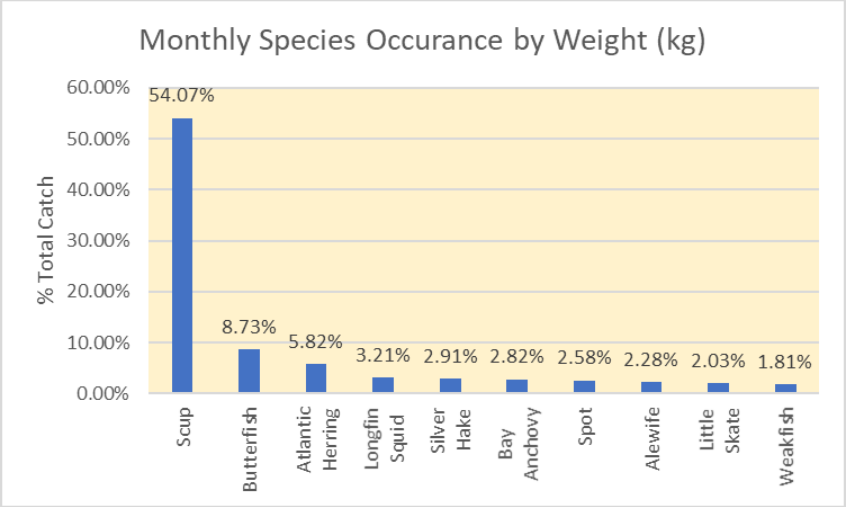


Figure 5 Top Ten Species Catch in Kilograms

Scientific Name	Common Name	%
STENOTOMUS CHRYSOPS	Scup	54.07%
PEPRILUS TRIACANTHUS	Butterfish	8.73%
CLUPEA HARENGUS	Atlantic Herring	5.82%
DORYTEUTHIS PEALEII	Longfin Squid	3.21%
MERLUCCIUS BILINEARIS	Silver Hake	2.91%
ANCHOA MITCHILLI	Bay Anchovy	2.82%
LEIOSTOMUS XANTHURUS	Spot	2.58%
ALOSA PSEUDOHARENGUS	Alewife	2.28%
LEUCORAJA ERINACEA	Little Skate	2.03%
CYNOSCION REGALIS	Weakfish	1.81%



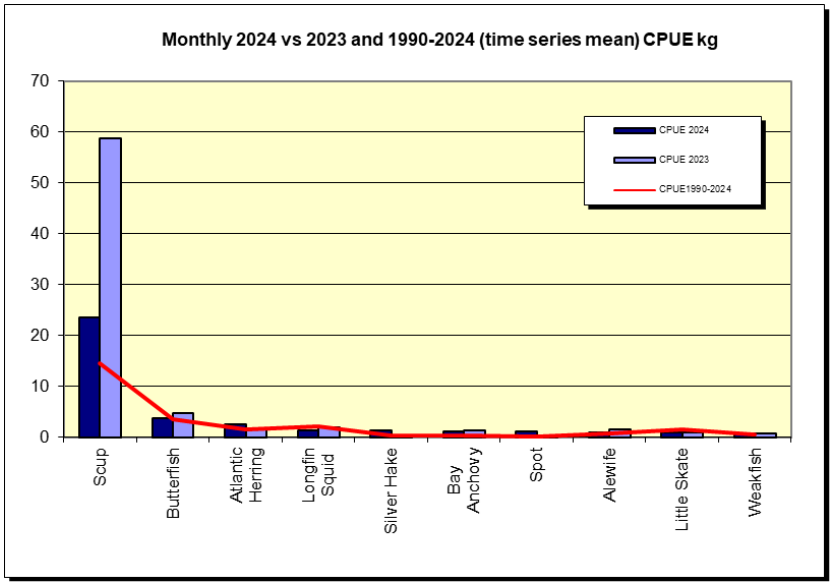
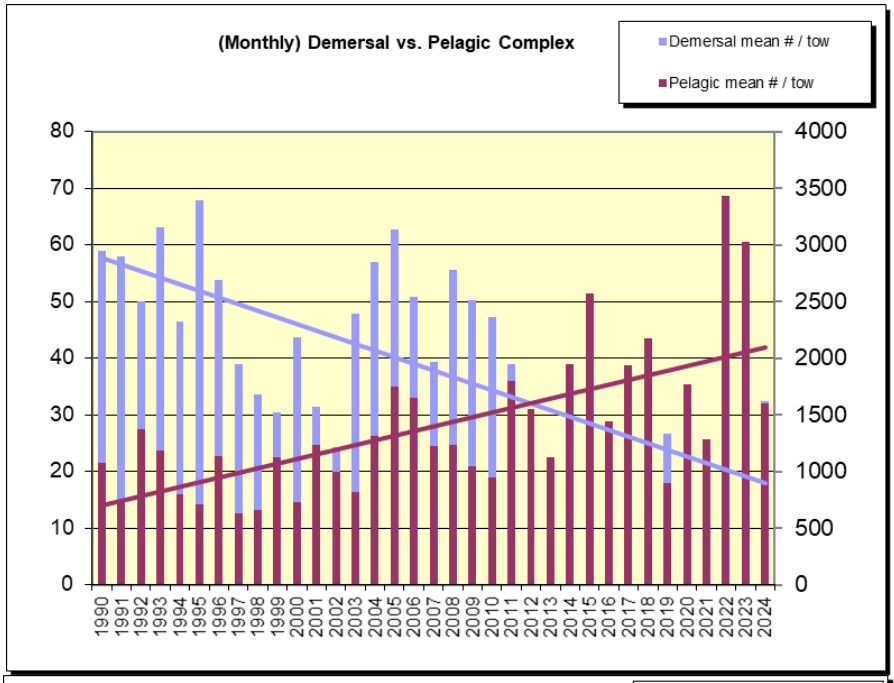
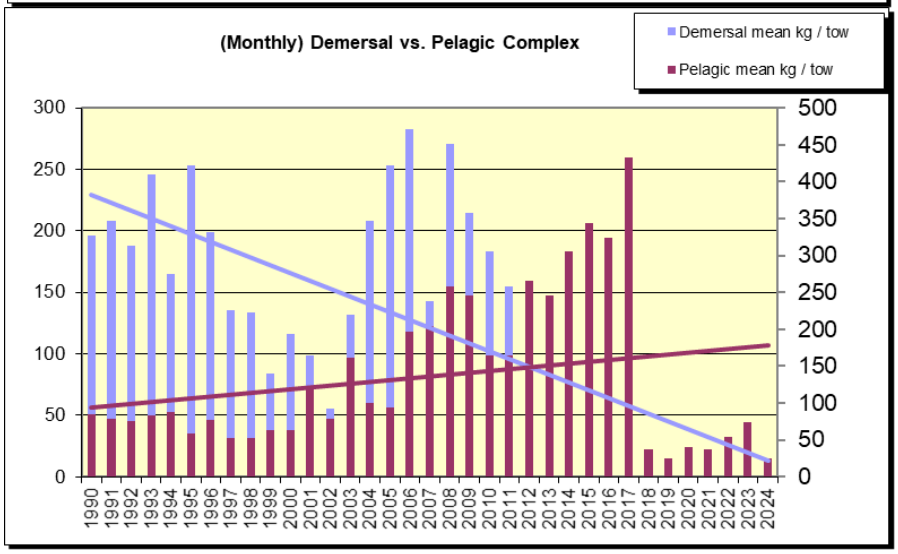


Figure 6 and 7: Demersal vs. Pelagic Species Complex

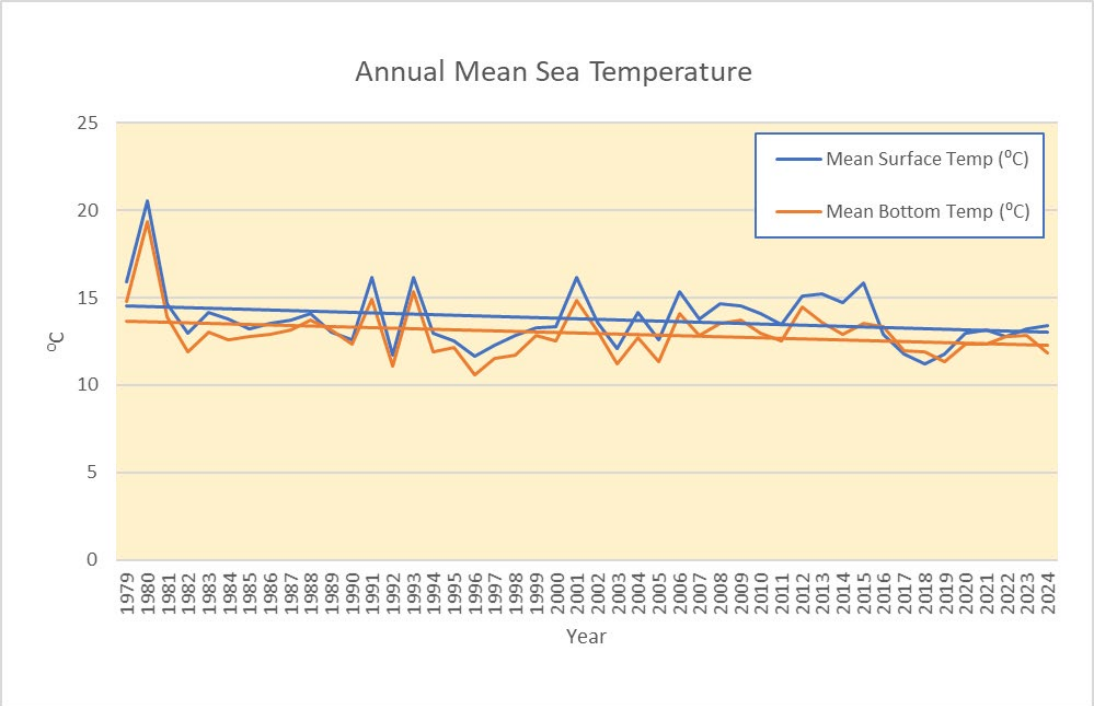
Demersal Species		Pelagic/Multi-Habitat Species	
Smooth Dogfish	Hogchoker	Atlantic Herring	Bluefish
Spiny Dogfish	Longhorn Sculpin	Alewife	Striped Bass
Skates	Sea Raven	Blueback Herring	Black Sea Bass
Silver Hake	Northern Searobin	Shad	Scup
Red Hake	Striped Searobin	Menhaden	Weakfish
Spotted Hake	Cunner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

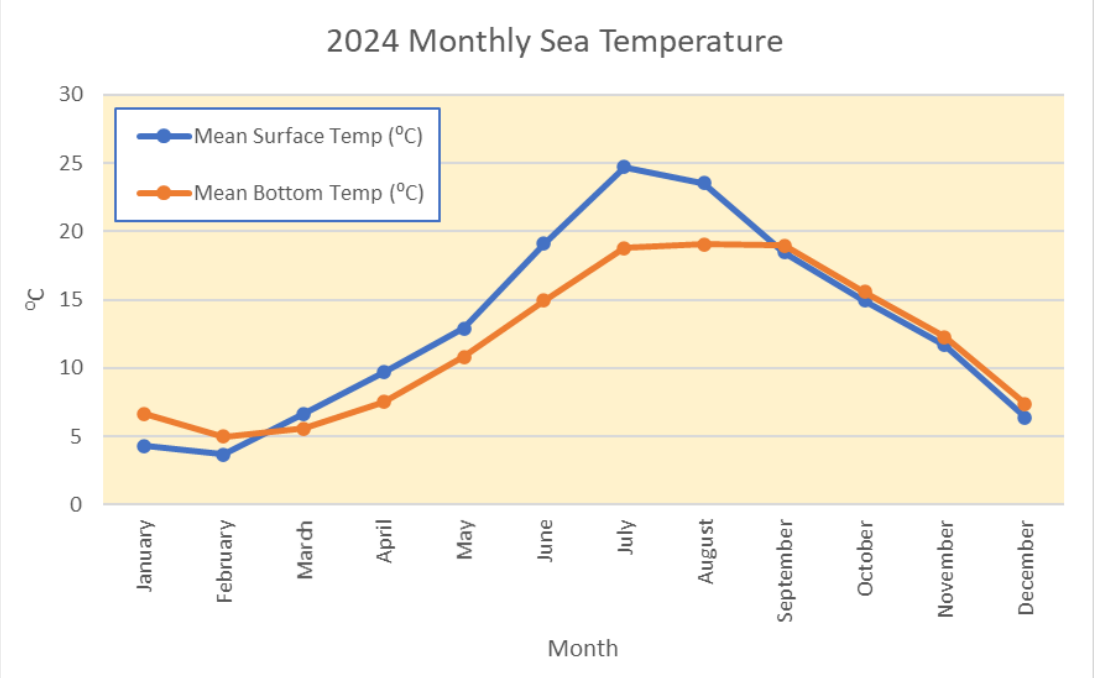




Monthly Survey Temperature Profile (Annual mean surface and bottom temperature)

Surface and bottom temperatures are collected at every station. The bottom temperature was collected by Niskin bottle until June 2019 at the average or maximum depth for each station. From June 2019 onward bottom temperature is the average over an entire tow as record by a Starmon TD® temperature and depth sensor attached to the footrope of the net.





Results: **Job 2**. The Seasonal Coastal Trawl Survey is defined by 12 fixed stations in Narragansett Bay, 14 random stations in Narragansett Bay, 6 fixed stations in Rhode Island Sound, 12 fixed stations in Block Island Sound. 64 species were observed and recorded during the 2024 Rhode Island Seasonal Trawl Survey, totaling 204,346 individuals or 2322.11 fish per tow. In weight, the catch accounted for 4590.27 kg. or 52.16 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 and shows a clear shift from demersal species to a more pelagic or multi-habitat species.

Figure 8 (Total Catch in Number)

Scientific Name	Common Name	Total
ANCHOA MITCHILLI	Bay Anchovy	85918
STENOTOMUS CHRYSOPS	Scup	31104
DORYTEUTHIS PEALEII	Longfin Squid	25621
SELENE SETAPINNIS	Atlantic Moonfish	16494
PEPRILUS TRIACANTHUS	Butterfish	12145
CLUPEA HARENGUS	Atlantic Herring	10714
POMATOMUS SALTATRIX	Bluefish	6810
ALOSA PSEUDOHARENGUS	Alewife	6585
CYNOSCION REGALIS	Weakfish	2354
MERLUCCIUS BILINEARIS	Silver Hake	2293
BREVOORTIA TYRANNUS	Atlantic Menhaden	1293
LEIOSTOMUS XANTHURUS	Spot	867
PRIONOTUS CAROLINUS	Northern Sea Robin	303
AMMODYTES AMERICANUS	Sand Lance	273
LEUCORAJA ERINACEA	Little Skate	192
CENTROPRISTIS STRIATA	Black Sea Bass	144
PLEURONECTES AMERICANUS	Winter Flounder	127
MUSTELUS CANIS	Smooth Dogfish	114
UROPHYCIS CHUSS	Red Hake	113
UROPHYCIS REGIA	Spotted Hake	103
PARALICHTHYS DENTATUS	Summer Flounder	93
ALOSA SAPIDISSIMA	American Shad	91
CANCER IRRORATUS	Rock Crab	68
RAJA EGLANTERIA	Clearnose Skate	67
SCOPHTHALMUS AQUOSUS	Windowpane Flounder	65
PRIONOTUS EVOLANS	Striped Sea Robin	64
ALOSA AESTIVALIS	Blueback Herring	54
LEUCORAJA OCELLATA	Winter Skate	49
TAUTOGA ONITIS	Tautog	21
ANCHOA HEPSETUS	Striped Anchovy	19
DOROSOMA CEPEDIANUM	Gizzard Shad	19

MENIDIA MENIDIA	Atlantic Silverside	17
SPHYRAENA BOREALIS	Northern Sennet	15
MENTICIRRHUS SAXATILIS	Northern Kingfish	12
TRACHURUS LATHAMI	Rough Scad	11
HOMARUS AMERICANUS	American Lobster	10
SPHOEROIDES MACULATUS	Northern Puffer	9
DECAPTERUS PUNCTATUS	Round Scad	9
SCOMBER SCOMBRUS	Atlantic Mackerel	8
SELAR CRUMENOPHTHALMUS	Bigeye Scad	8
CARANX HIPPOS	Crevalle Jack	7
CALLINECTES SAPIDUS	Blue Crab	7
MYOXOCEPHALUS OCTODECEMSPINOS	Longhorn Sculpin	6
CITHARICHTHYS ARCTIFRONS	Gulfstream Flounder	5
FISTULARIA TABACARIA	Cornetfish	5
LIMULUS POLYPHEMUS	Horseshoe Crab	5
BUSYCOTYPUS CANALICULATUS	Channeled Whelk	5
GADUS MORHUA	Atlantic Cod	4
TRICHIURIDAE	Cutlassfishes	4
PRIACANTHUS ARENATUS	Bigeye	3
ALOSA MEDIOCRIS	Hickory Shad	2
PARALICHTHYS OBLONGUS	Fourspot Flounder	2
MORONE SAXATILIS	Striped Bass	2
LOPHIUS AMERICANUS	Goosefish	2
CANCER BOREALIS	Jonah Crab	2
CARANX CRYSOS	Blue Runner	1
MULLUS AURATUS	Red Goatfish	1
MACROZOARCES AMERICANUS	Ocean Pout	1
PRISTIGENYS ALTA	Short Bigeye	1
LUTJANIDAE	Snappers	1
UPENEUS PARVUS	Dwarf Goatfish	1
SCOMBEROMORUS MACULATUS	Spanish Mackerel	1
BUSYCON CARICA	Knobbed Whelk	1
SQUILLA EMPUSA	Mantis Shrimp	1

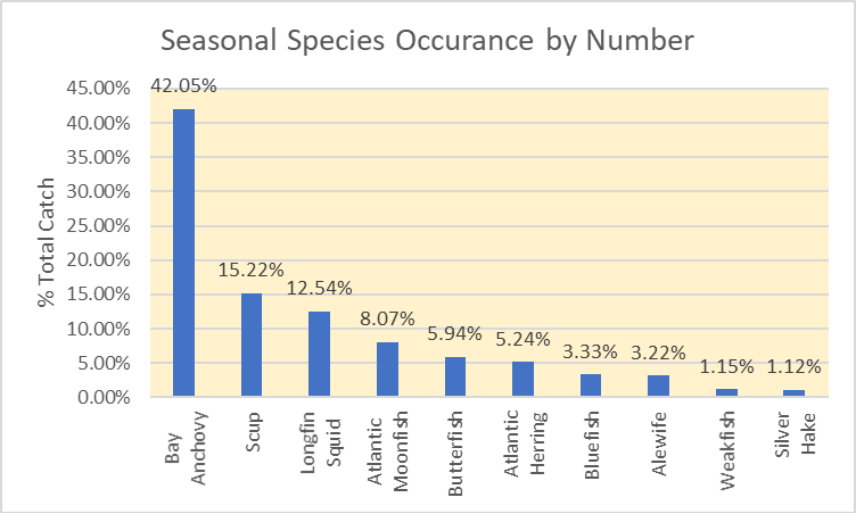
Figure 9 (Total Catch in Kilograms)

Scientific Name	Common Name	Total Weight (kg)
STENOTOMUS CHRYSOPS	Scup	2465.899
PEPRILUS TRIACANTHUS	Butterfish	578.165
DORYTEUTHIS PEALEII	Longfin Squid	181.07
LEIOSTOMUS XANTHURUS	Spot	129.345
ANCHOA MITCHILLI	Bay Anchovy	124.574
ALOSA PSEUDOHARENGUS	Alewife	120.852
SELENE SETAPINNIS	Atlantic Moonfish	105.14
RAJA EGLANTERIA	Clearnose Skate	104.74
LEUCORAJA ERINACEA	Little Skate	104.49
MUSTELUS CANIS	Smooth Dogfish	101.598
CYNOSCION REGALIS	Weakfish	89.355
POMATOMUS SALTATRIX	Bluefish	77.969
MERLUCCIUS BILINEARIS	Silver Hake	61.653
PRIONOTUS CAROLINUS	Northern Sea Robin	41.89
CLUPEA HARENGUS	Atlantic Herring	39.833
BREVOORTIA TYRANNUS	Atlantic Menhaden	37.781
PARALICHTHYS DENTATUS	Summer Flounder	37.431
PLEURONECTES AMERICANUS	Winter Flounder	28.435
CENTROPRISTIS STRIATA	Black Sea Bass	24.693
TAUTOGA ONITIS	Tautog	24.12
LEUCORAJA OCELLATA	Winter Skate	23.088
PRIONOTUS EVOLANS	Striped Sea Robin	18.756
SCOPHTHALMUS AQUOSUS	Windowpane Flounder	10.346
CANCER IRRORATUS	Rock Crab	9.912
UROPHYCIS REGIA	Spotted Hake	8.795
LIMULUS POLYPHEMUS	Horseshoe Crab	8.51
MORONE SAXATILIS	Striped Bass	5.25
UROPHYCIS CHUSS	Red Hake	4.131
HOMARUS AMERICANUS	American Lobster	3.792
ALOSA SAPIDISSIMA	American Shad	3.353
AMMODYTES AMERICANUS	Sand Lance	2.279
MYOXOCEPHALUS OCTODECEMSPINOS	Longhorn Sculpin	2.06
SCOMBER SCOMBRUS	Atlantic Mackerel	1.427
MENTICIRRHUS SAXATILIS	Northern Kingfish	1.164
CALLINECTES SAPIDUS	Blue Crab	1.001
SPHYRAENA BOREALIS	Northern Sennet	0.914
MACROZOARCES AMERICANUS	Ocean Pout	0.86
BUSYCOTYPUS CANALICULATUS	Channeled Whelk	0.747

ALOSA AESTIVALIS	Blueback Herring	0.664
DOROSOMA CEPEDIANUM	Gizzard Shad	0.48
CANCER BOREALIS	Jonah Crab	0.47
TRACHURUS LATHAMI	Rough Scad	0.428
SELAR CRUMENOPHTHALMUS	Bigeye Scad	0.425
PARALICHTHYS OBLONGUS	Fourspot Flounder	0.401
CARANX HIPPOS	Crevalle Jack	0.316
SPHOEROIDES MACULATUS	Northern Puffer	0.284
ANCHOA HEPSETUS	Striped Anchovy	0.255
BUSYCON CARICA	Knobbed Whelk	0.25
DECAPTERUS PUNCTATUS	Round Scad	0.218
LOPHIUS AMERICANUS	Goosefish	0.14
CITHARICHTHYS ARCTIFRONS	Gulfstream Flounder	0.112
FISTULARIA TABACARIA	Cornetfish	0.1
MENIDIA MENIDIA	Atlantic Silverside	0.081
PRIACANTHUS ARENATUS	Bigeye	0.069
CARANX CRYSOS	Blue Runner	0.054
TRICHIURIDAE	Cutlassfishes	0.036
SCOMBEROMORUS MACULATUS	Spanish Mackerel	0.03
UPENEUS PARVUS	Dwarf Goatfish	0.015
MULLUS AURATUS	Red Goatfish	0.01
PRISTIGENYS ALTA	Short Bigeye	0.005
LUTJANIDAE	Snappers	0.005
GADUS MORHUA	Atlantic Cod	0.004
SQUILLA EMPUSA	Mantis Shrimp	0.004
ALOSA MEDIOCRIS	Hickory Shad	0.003

Figure 10 Top Ten Species Catch in Number

Scientific Name	Common Name	%
ANCHOA MITCHILLI	Bay Anchovy	42.05%
STENOTOMUS CHRYSOPS	Scup	15.22%
DORYTEUTHIS PEALEII	Longfin Squid	12.54%
SELENE SETAPINNIS	Atlantic Moonfish	8.07%
PEPRILUS TRIACANTHUS	Butterfish	5.94%
CLUPEA HARENGUS	Atlantic Herring	5.24%
POMATOMUS SALTATRIX	Bluefish	3.33%
ALOSA PSEUDOHARENGUS	Alewife	3.22%
CYNOSCION REGALIS	Weakfish	1.15%
MERLUCCIUS BILINEARIS	Silver Hake	1.12%



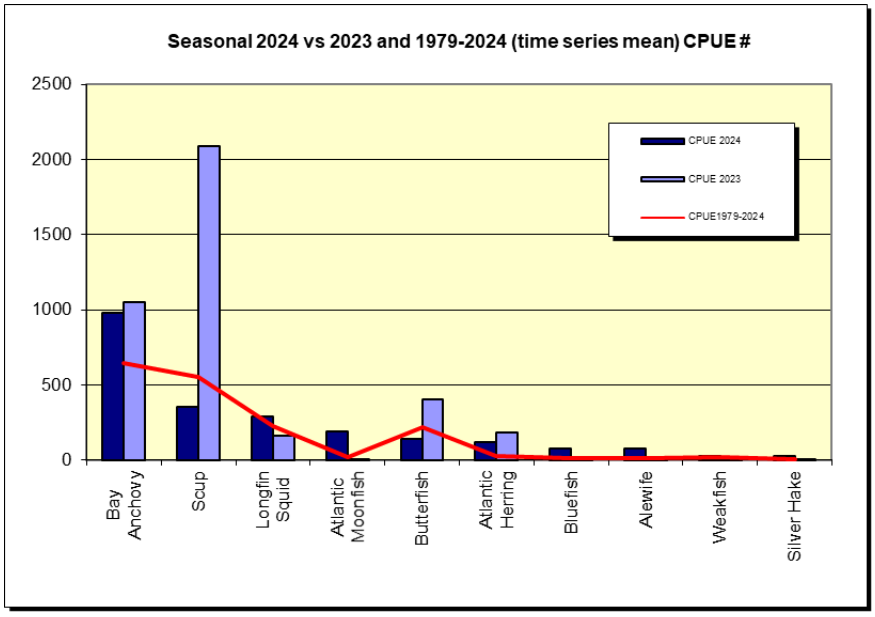
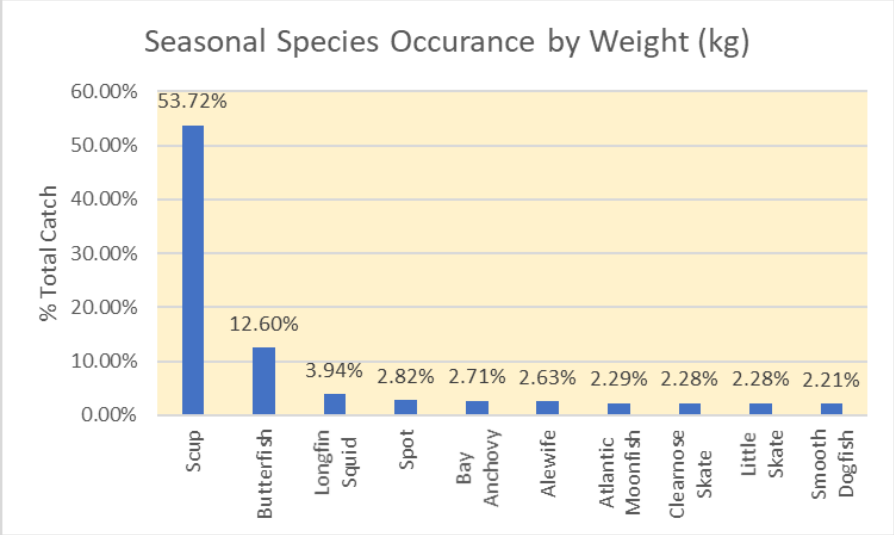


Figure 11 Top Ten Species Catch in Kilograms

Scientific Name	Common Name	%
STENOTOMUS CHRYSOPS	Scup	53.72%
PEPRILUS TRIACANTHUS	Butterfish	12.60%
DORYTEUTHIS PEALEII	Longfin Squid	3.94%
LEIOSTOMUS XANTHURUS	Spot	2.82%
ANCHOA MITCHILLI	Bay Anchovy	2.71%
ALOSA PSEUDOHARENGUS	Alewife	2.63%
SELENE SETAPINNIS	Atlantic Moonfish	2.29%
RAJA EGLANTERIA	Clearnose Skate	2.28%
LEUCORAJA ERINACEA	Little Skate	2.28%
MUSTELUS CANIS	Smooth Dogfish	2.21%



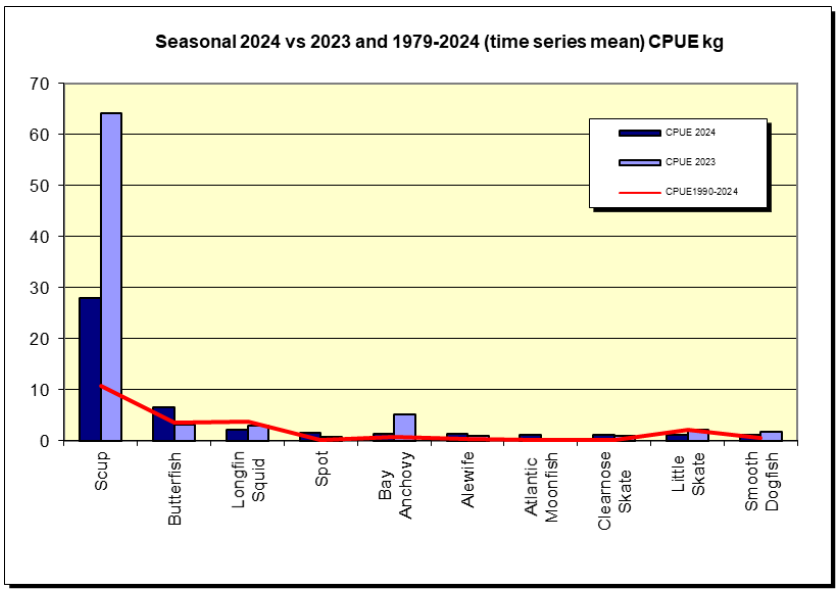
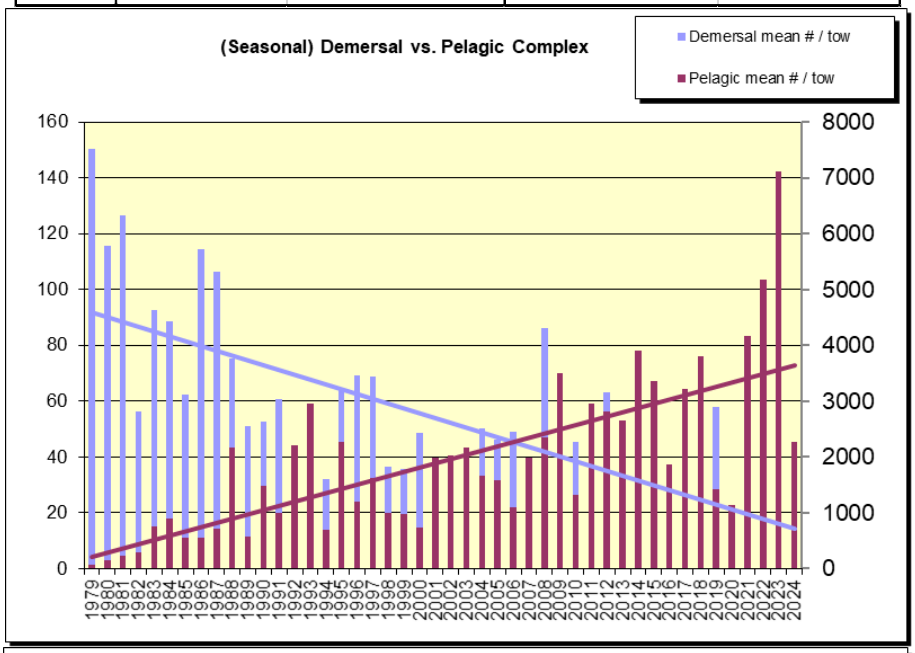
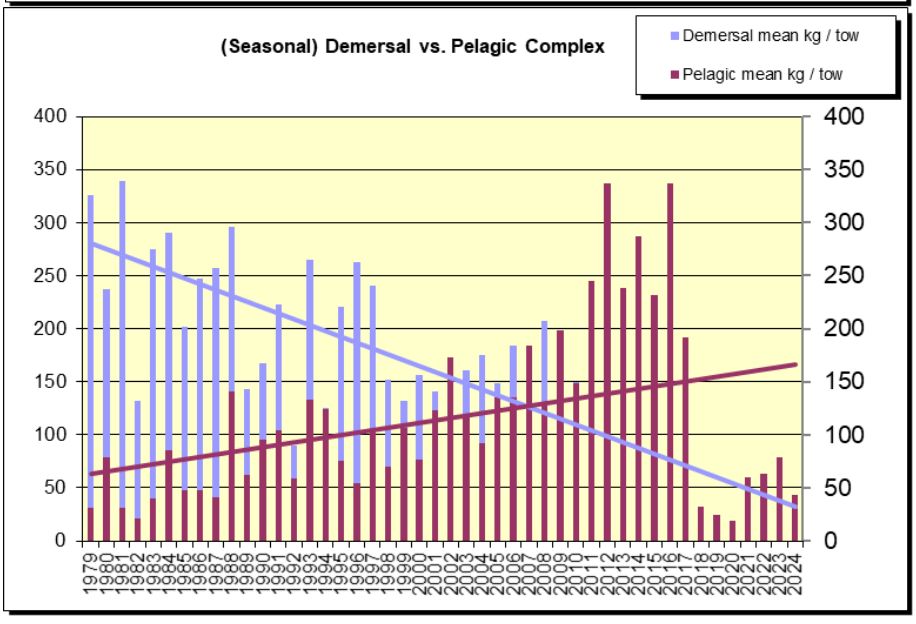


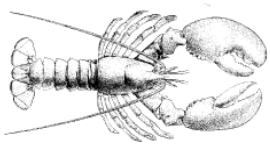
Figure 12 and 13: Demersal vs. Pelagic Species Complex

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



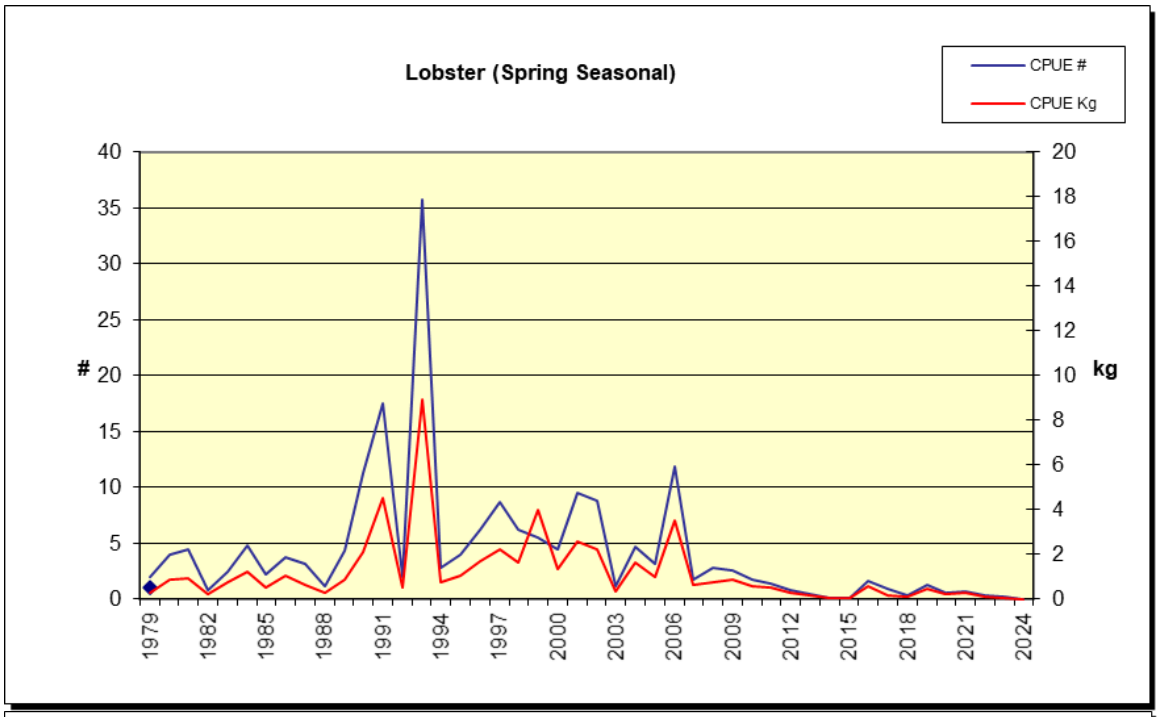


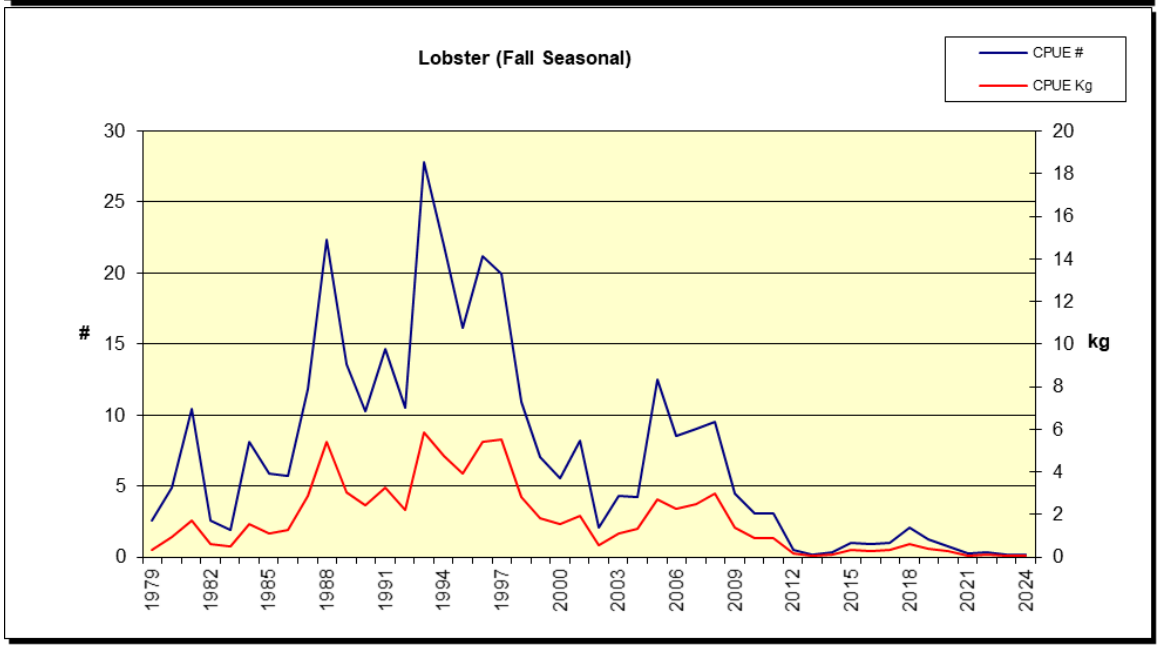
The following species represented are of high importance and are currently managed under fishery management plans through the Atlantic States Marine Fisheries Commission, New England Fishery Management Council, or the National Marine Fisheries Service. The seasonal portion of the Rhode Island Coastal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



American Lobster ***Homarus americanus***

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

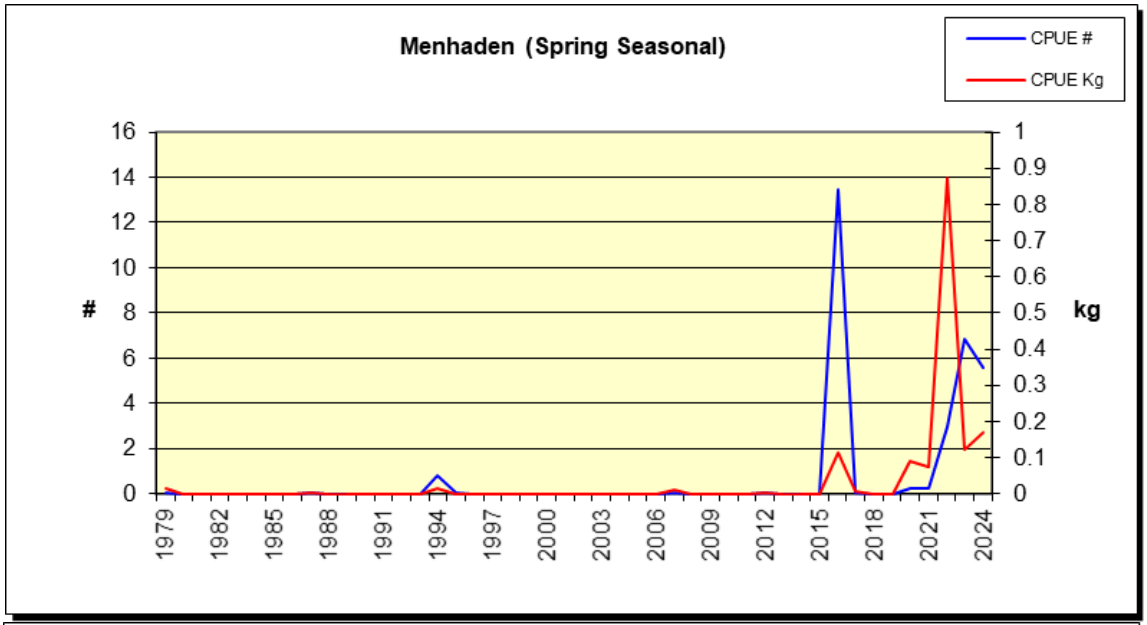


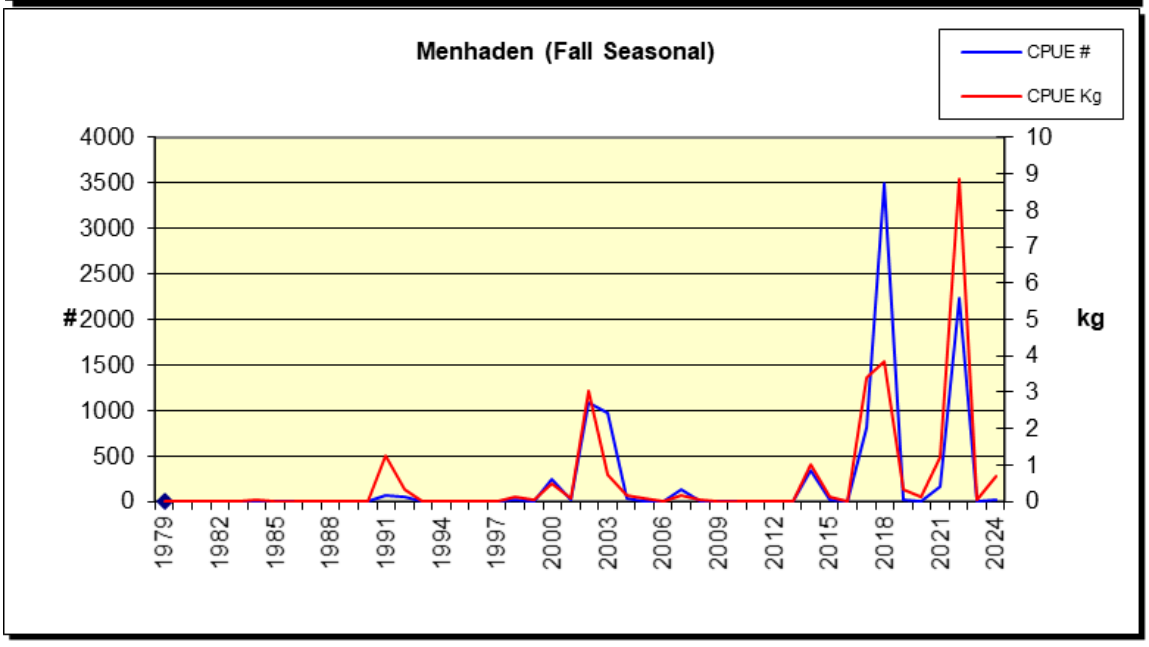




Atlantic Menhaden ***Brevoortia tyrannus***

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

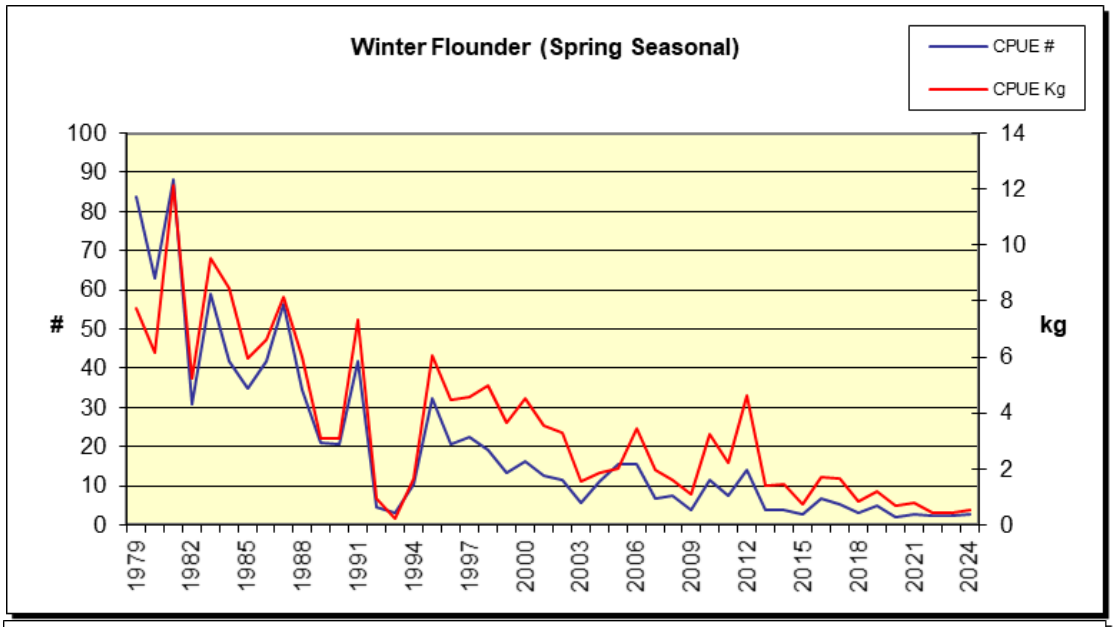


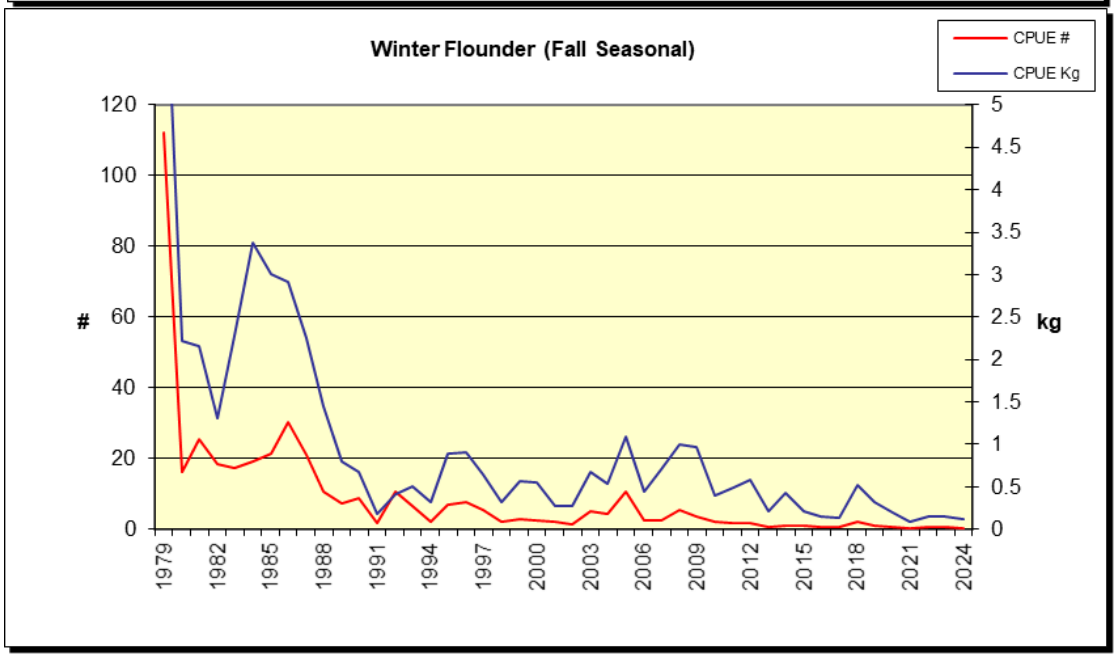


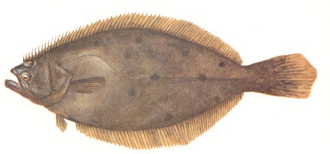


Winter Flounder ***Pleuronectes americanus***

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

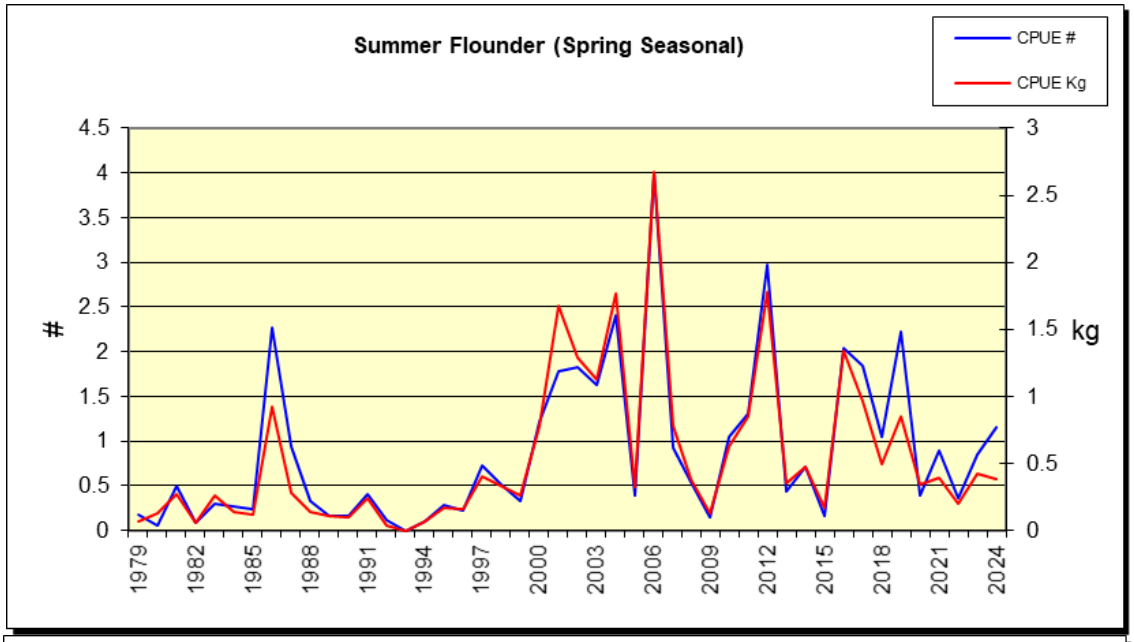


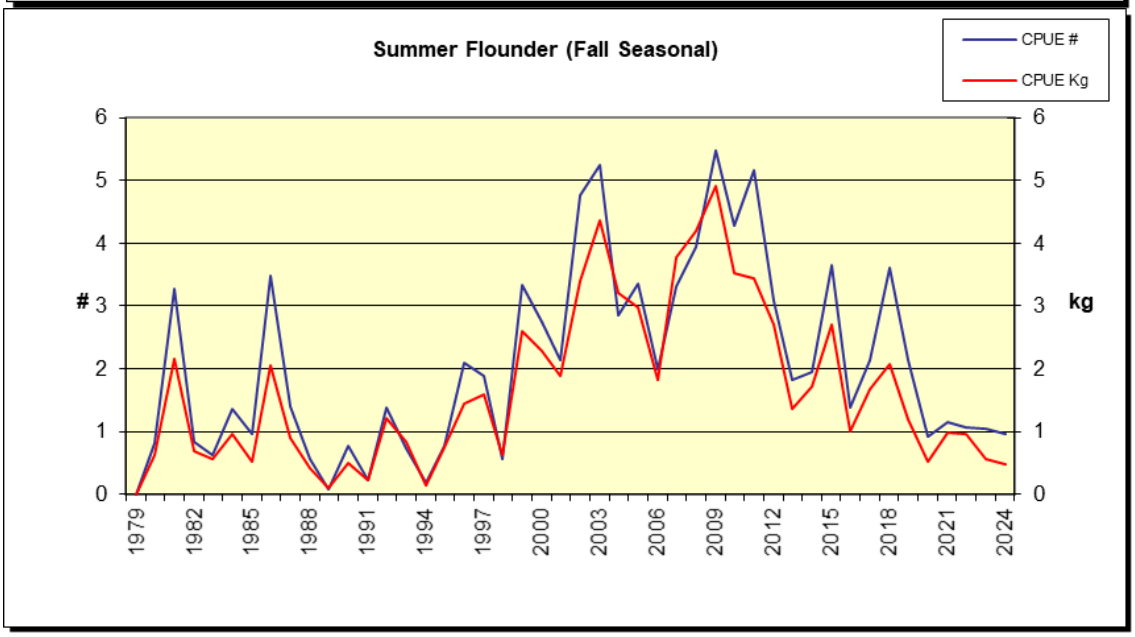




Summer Flounder ***Paralichthys dentatus***

Stock Status: Not overfished and overfishing is occurring.
Management: ASMFC Amendment XIII Addendum XXXII

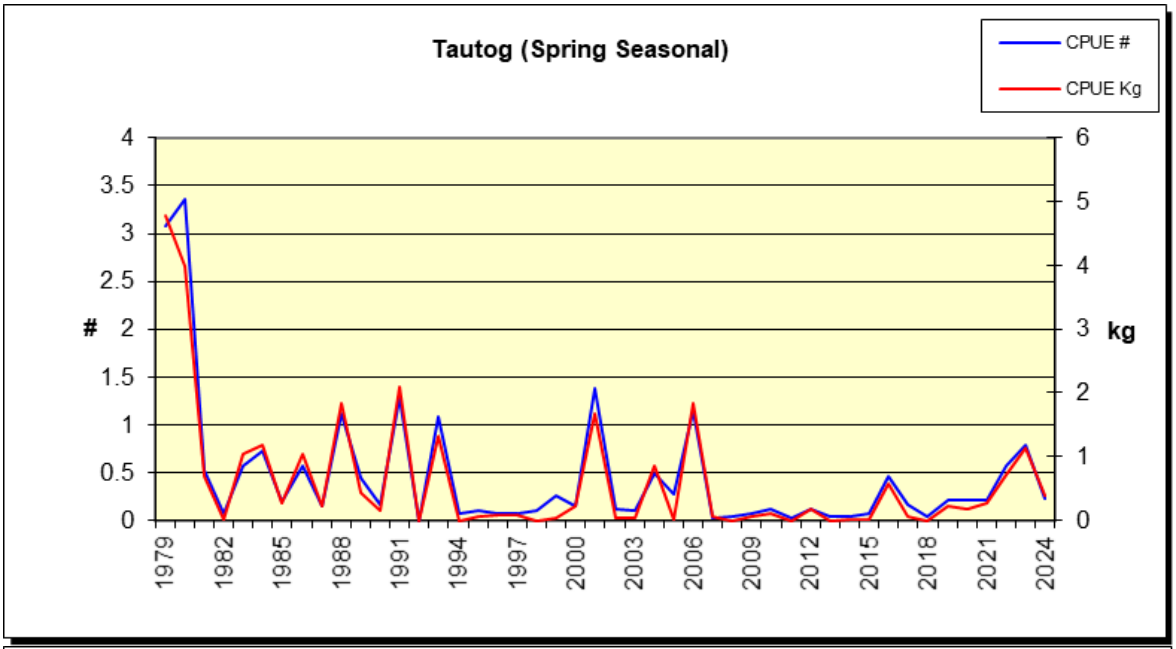


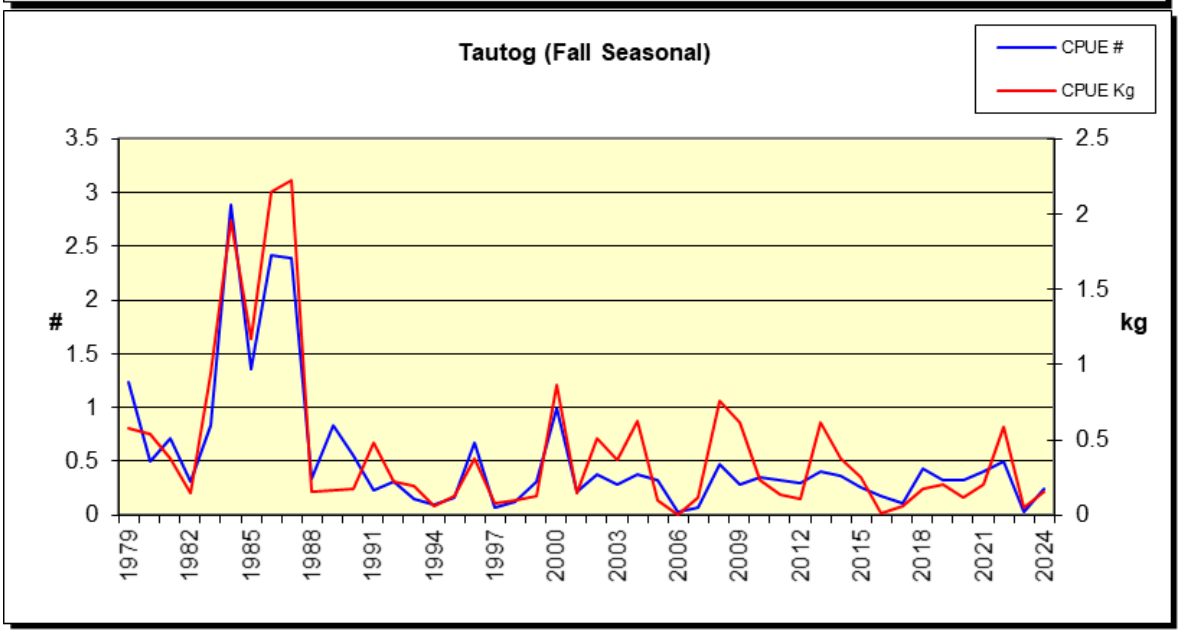


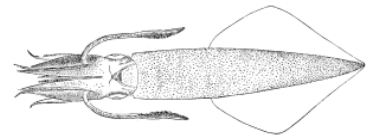


Tautog ***Tautoga onitis***

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

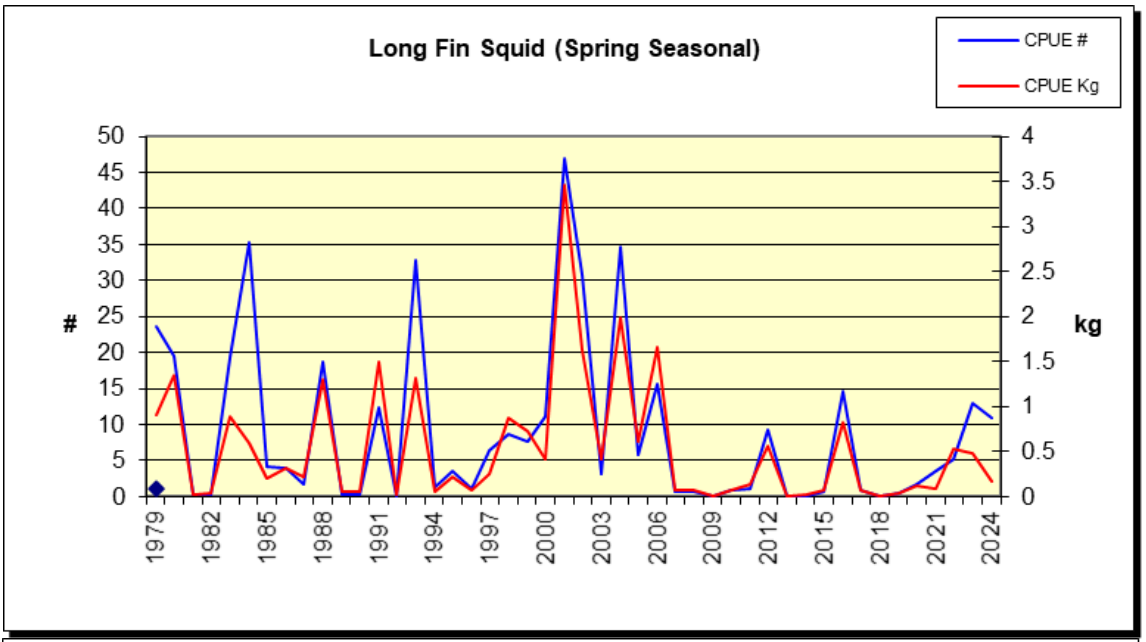


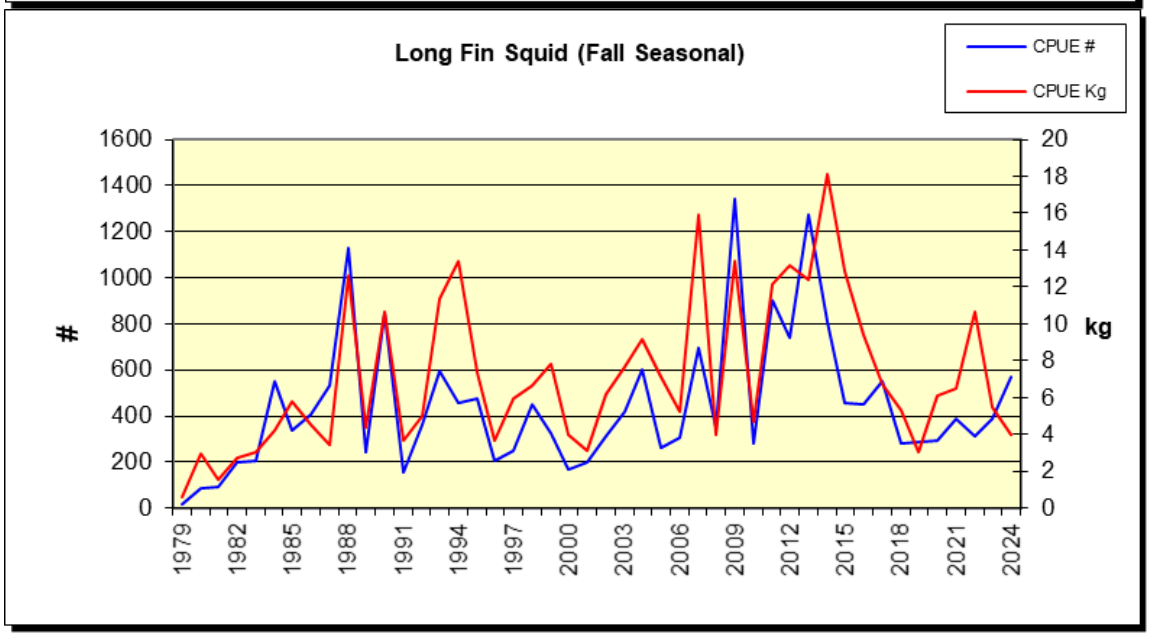




Longfin Squid ***Doryteuthis pealeii***

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

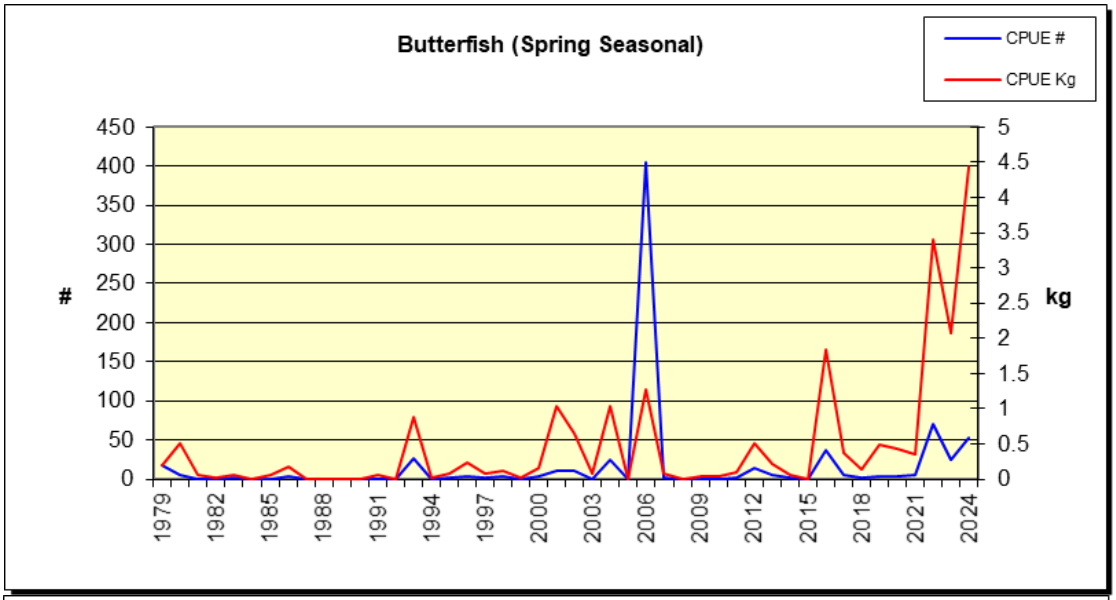


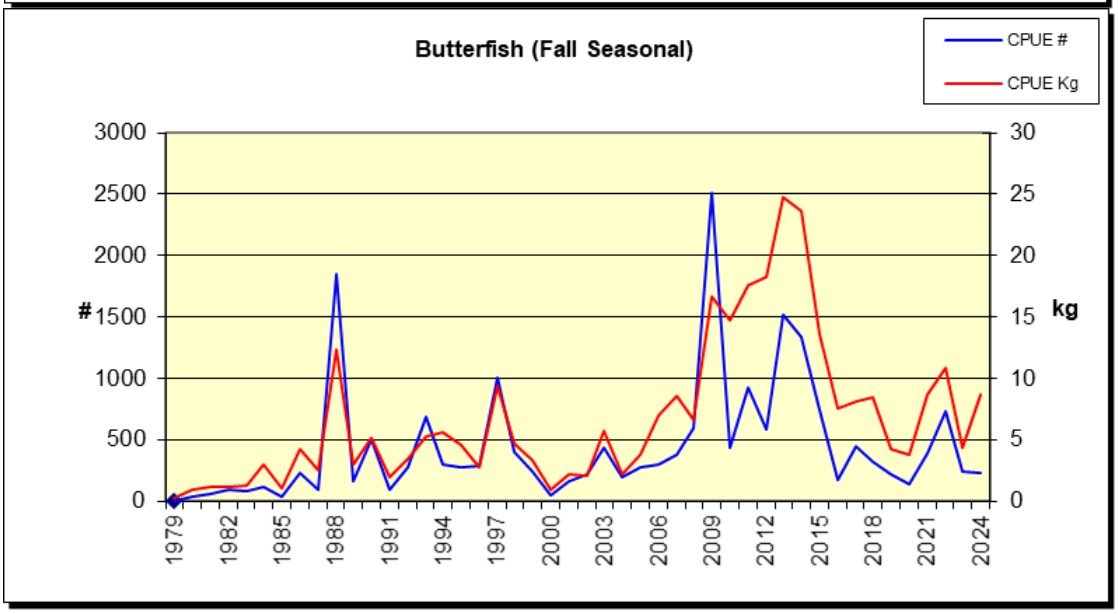




Butterfish ***Peprlilus triacanthus***

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

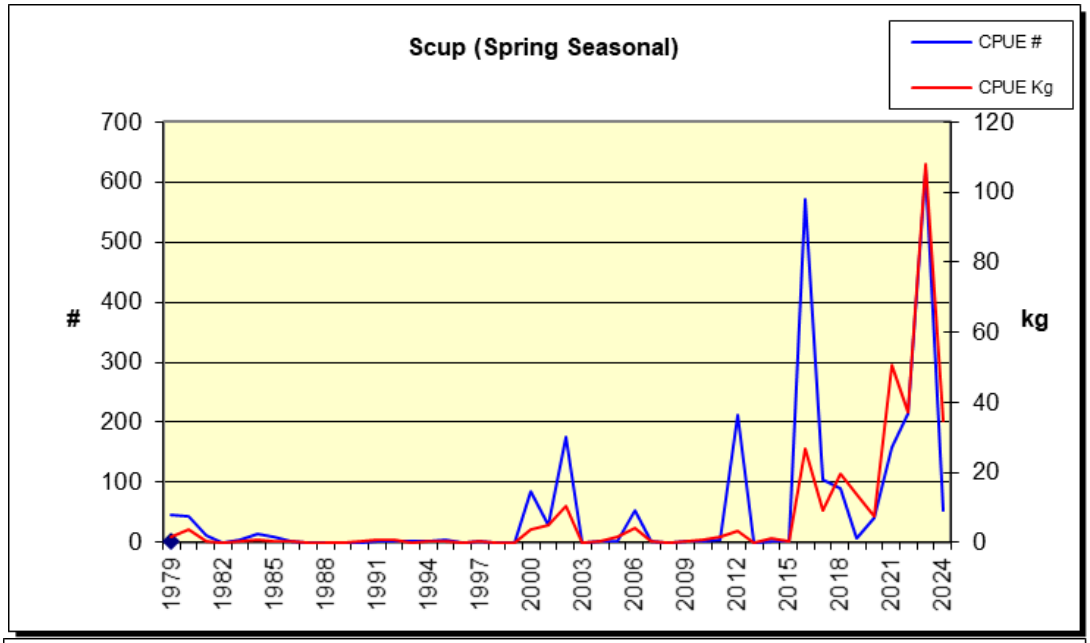


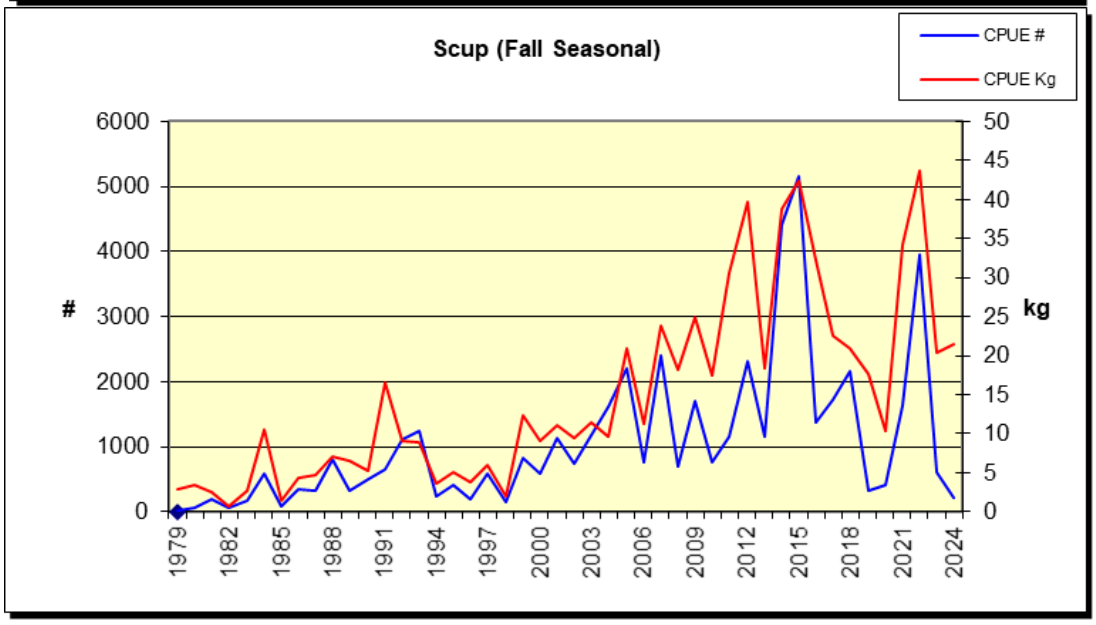




Scup ***Stenotomus chrysops***

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

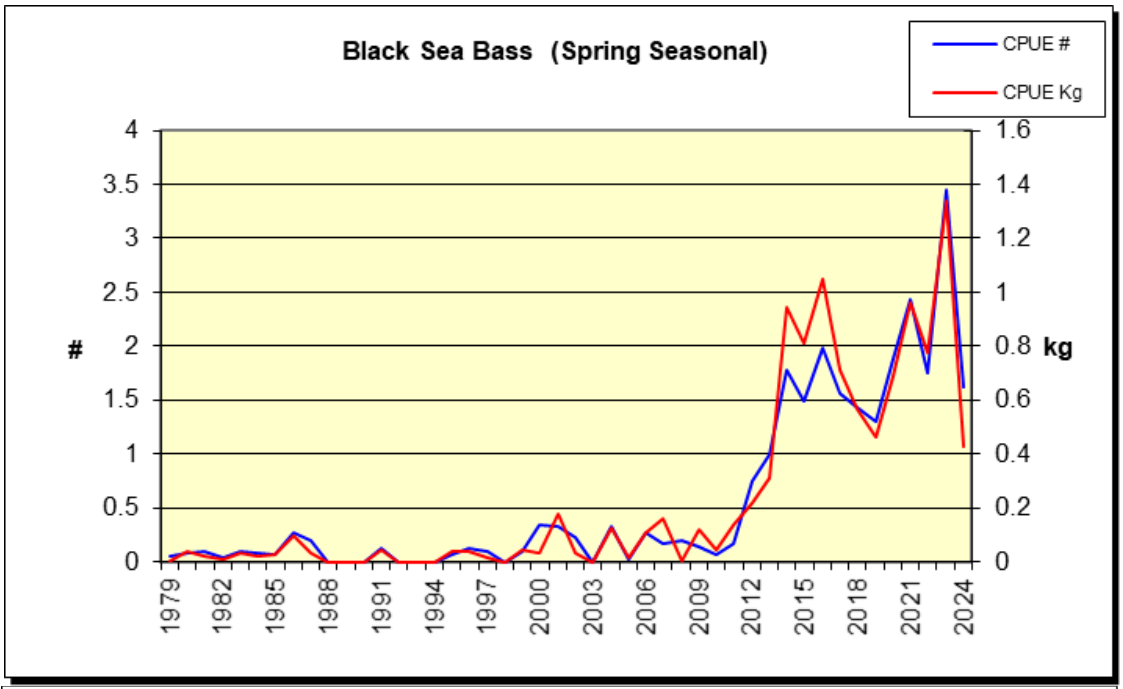


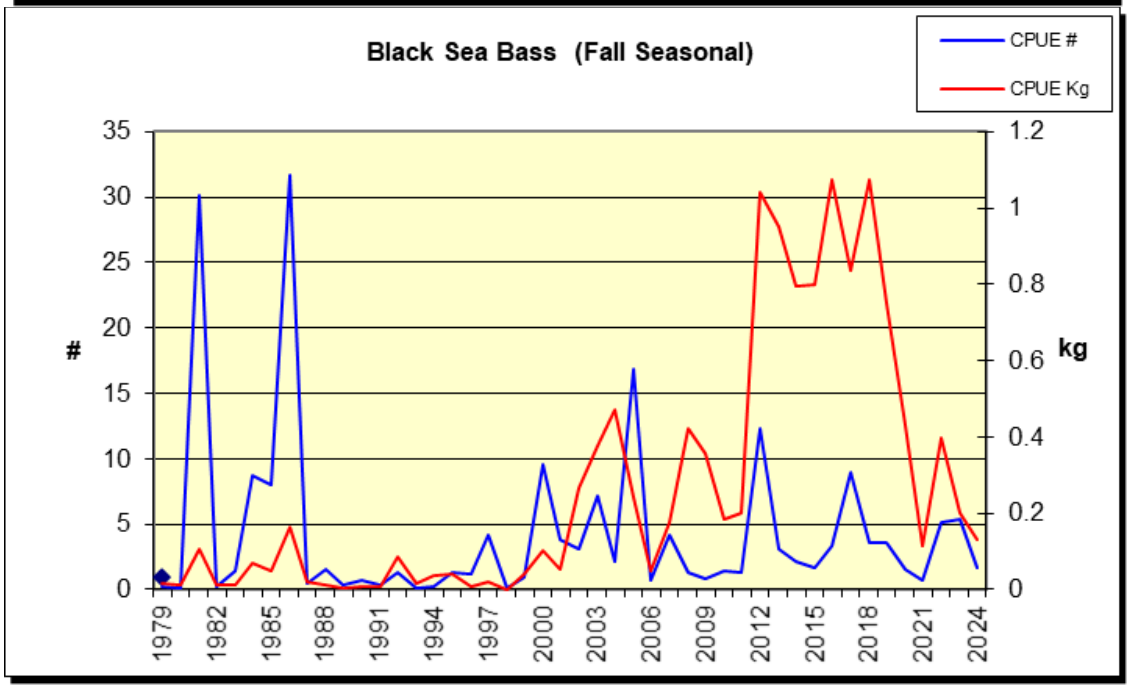




Black Sea Bass ***Centropristis striata***

Stock Status: Rebuilt, not overfished overfishing is not occurring
Management: ASMFC Amendment XIII, Addendum XXXI





References:

ASMFC 2014.Current Fishery Management Plans; Stock Status Reports

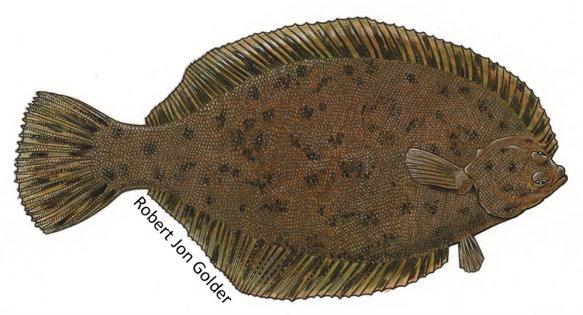
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Assessment of Recreationally Important Finfish Stocks in Rhode Island Coastal Ponds

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



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Division of Marine Fisheries
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Federal Aid in Sportfish Restoration
F-61-R

Performance Report - Job 3

March 2025

Performance Report

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

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

Period Covered: January 1, 2020 - December 31, 2024

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

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

Target Date: December 31, 2024

Status of Project: On schedule

Significant Deviations: There were no significant deviations in 2024.

Recommendations: Continue into the next segment with the project as currently designed; continue at each of the 24 sample stations.

Summary:

During 2024, investigators successfully sampled all twenty-four traditional stations in eight coastal ponds from May through October: Winnapaug Pond, Quonochontaug Pond, Charlestown Pond, Point Judith Pond, Green Hill Pond, Potter Pond, Pawcatuck River/Little Narragansett Bay and Narrow River (Figures 1-3).

All 144 seine samples were completed in 2024. In total, 60 different species representing 39 families were caught within the Washington County coastal ponds in 2024. The most frequently encountered species were Atlantic Silverside (78% occurrence, CPUE = 82.6 number/haul), Blue Crab (67% occurrence, CPUE = 2.5 number/haul), and Winter Flounder (63% occurrence, CPUE = 5.6 number/haul).

Over the grant period of 2020-2024, 720 seine hauls were completed catching a total of 87 different species from 44 families. The three most commonly encountered species over this period were Atlantic Silverside (86% occurrence, CPUE = 96.7 number/haul), Winter Flounder (64% occurrence, CPUE = 11 number/haul), and Mummichog (55% occurrence, CPUE = 27.2 number/haul). All seine samples were successfully completed during the grant period.

The Block Island juvenile finfish seine survey was completed by Diandra Verbeyst, Great Salt Pond Scientist, The Nature Conservancy. Appendix 1 displays the frequency of all species caught by station during the 2024 Coastal Pond Survey. Additional data is available by request.

Materials and Methods:

As in previous years, investigators attempted to perform all seining on an outgoing tide. To collect animals, investigators used a seine 130 ft. long (39.62m), 6 ft deep (1.67m) with ¼" mesh (6.4mm). The seine has a bag at its midpoint, a weighted foot rope and floats on the head rope. Figure 4 describes the area covered by the seine net. The beach seine is set in a semi-circle away from the shoreline and back again using an outboard powered 16' Polarkraft aluminum boat. The net is then hauled toward the beach by hand and the bag is emptied into a large water-filled tote. All animals collected are identified to species, measured, enumerated, and sub-samples taken when appropriate. Water quality parameters including temperature, salinity and dissolved oxygen are measured at each station. Figure 1 shows the location of the subject coastal ponds and embayments, while figures 2-3 indicate the location of the sampling stations within each waterbody.

The abundance indices for winter flounder targets only YOY individuals. For consistency, only individuals with a total length (TL) less than 12 cm are included in these analyses.

Results and Discussion:

Winter Flounder *(Pseudopleuronectes americanus)*

Juvenile winter flounder were collected at 23 of 24 stations over the course of the season. Winter flounder ranked fifth in species abundance (CPUE = 5.6 fish/haul, total=807) in 2024, with the highest mean abundance (fish/seine haul) occurring in July and June (Table 1). This timing is comparable to observed peaks in abundance in previous years. This early season peak in abundance was consistent across all ponds. As with previous years, a sharp decline in catch occurred as the survey season progressed.

Winter flounder abundance in 2024 was above the time series low of 4.1 fish/haul in 2018. The juvenile winter flounder abundance index (YOY WFL index) for 2024 measured using the mean fish/seine haul was 5.6 fish/haul, comparable to the last few years of the survey, but a linear regression still shows a continued decline (Figure 5). Table 1 and Figure 6 display the CPUE of winter flounder for each month by pond during the 2024 survey. Figure 8 displays winter flounder abundance against mean recorded water temperature, showing a negative correlation between winter flounder abundance and mean measured water temperature.

With increasing seasonal temperatures, Rhode Island waters have seen an ecological shift from resident demersal species (including winter flounder) to a pelagic community dominated by more southern species (Collie et al. 2008, Oviatt 2004). Over the course of this survey, average water temperature of the coastal ponds has steadily increased, while winter flounder YOY CPUE has decreased. Average water temperature measured during the survey has not been below 20°C since 2006 (19.3°C). The highest average temperature was observed in 2016 at 22.5 °C. The mean temperature in 2024 was slightly lower at 21.6 °C. Findings from this sampling are consistent with the overall warming trends occurring in northeast region and the observed declines in the winter flounder population. A clear negative trend is seen between mean coastal pond water temperature and winter flounder catch (Figure 8).

In 2024, juvenile winter flounder ranged in size from 2 to 16.6, representing ages 0-1+ (Figure 7). The size range of animals collected is similar to those caught in previous years. Length-frequency distributions indicate that 99.3% of individuals collected during sampling season were less than 12 cm TL and considered age 0 fish (801/807). 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).

Two other RIDMF surveys target juvenile and adult winter flounder: the Narragansett Bay Spring Seasonal Trawl Survey (Spring Trawl) and the Narragansett Bay Juvenile Finfish Survey (NBS). A comparison of the Coastal Pond Survey (CPS) to these other projects reveals that despite some slight differences, they display similar trends (Figure 9). Like the CPS, the NBS has seen a continued decline in CPUE of YOY winter, with only 0.8 fish/haul in 2024. The Spring Trawl Survey WFL index was slightly higher in 2024 compared to the last few years, at 4.3 fish/tow. However, winter flounder catch in the trawl continues to be near time-series lows and seems to continue to trend downwards. Regulations changed ending the prohibition on possession of winter flounder in federal waters of Southern New England in 2012. Federal possession limits were either unlimited or set to 5,000 lbs per trip depending on the permit category of the vessel. It is believed that these high limits encourage a directed fishery for winter flounder in the spring. NOAA Fisheries has changed their procedures for administration of common pool possession limit, restricting it to lower values during the year than allowed (typically 2,000 lbs per day) in 2013. Possession limits remain 50 pounds in State waters. Despite these low catch limits, abundance of adult winter flounder remains low.

Target Species

In 2024, Summer Flounder and Tautog were the most frequently caught species (22.9% and 18.1% of hauls respectively), and Tautog and Bluefish had the highest abundances (0.8 and 0.6 fish/haul respectively). Tautog, black sea bass, summer flounder, and scup continue to show

positive trends in abundance over the time series. Abundances of target recreational species are shown in Table 2 and Figures 11-15.

Clupeids

In 2024, four species of clupeids were caught in the coastal pond survey: Atlantic menhaden (Brevoortia tyrannus), Alewife (Alosa pseudoharengus), Atlantic herring (Clupea harengus), and Bay Anchovy (Anchoa mitchilli) (Table 3 and Figure 16). The most prevalent was the bay anchovy, with an overall CPUE of 11.9 fish/haul. No blueback herring were caught in 2023. Clupeid catches are highly variable. In many instances, high numbers of fish, especially YOY menhaden, are caught in a single seine haul due to their dense schooling nature and because such a school was present at a given station upon sampling. Due to the highly variable magnitude of catches, abundance is shown in log-scale (Figure 16).

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Table 1: Coastal Pond Survey winter flounder mean abundance indices (fish/seine haul) by pond and month for 2024. 95% confidence intervals are given in parentheses.

Waterbody	May	June	July	Aug	Sept	Oct
Charlestown Pond	10.2 (-5.1, 25.6)	5.2 (-0.6, 11.1)	36 (-26.8, 98.8)	0.8 (0.3, 1.2)	0.2 (-0.2, 0.7)	1 (-1, 3)
Green Hill Pond	4.5 (-2.4, 11.4)	1 (-1, 3)	0.5 (-0.5, 1.5)	0 (0, 0)	0 (0, 0)	0 (0, 0)
Narrow River	12 (3.2, 20.8)	14.7 (8, 21.3)	4.3 (1.1, 7.6)	5.3 (-2.4, 13)	1.3 (-1.3, 3.9)	1 (-1, 3)
Pawcatuck River	6.7 (-3.6, 16.9)	5.3 (1, 9.6)	17.7 (-12.1, 47.4)	3.3 (-0.6, 7.3)	1.3 (-1.3, 3.9)	3.3 (-0.6, 7.3)
Point Judith Pond	2.8 (0.3, 5.2)	2.8 (-0.6, 6.1)	4 (0.5, 7.5)	0 (0, 0)	1 (-0.4, 2.4)	1.5 (0.5, 2.5)
Potter's Pond	0 (0, 0)	0 (0, 0)	0 (0, 0)	0 (0, 0)	0 (0, 0)	0.5 (-0.5, 1.5)
Quonochontaug Pond	4.7 (-2.6, 11.9)	3.3 (-0.6, 7.3)	12.7 (0.2, 25.2)	16.3 (-7, 39.7)	6.3 (2, 10.6)	4.7 (0, 9.4)
Winnapaug Pond	1.7 (-0.1, 3.4)	14 (1.1, 26.9)	17.7 (1.2, 34.2)	7.7 (5.9, 9.4)	8 (-0.2, 16.2)	4 (2, 6)

Table 2: Coastal Pond Survey mean abundance indices (fish/seine haul) for target species by month for 2024. 95% confidence intervals are given in parentheses.

Species	May	June	July	Aug	Sept	Oct
Summer Flounder	0.8 (0.3, 1.3)	1 (0.3, 1.7)	0.7 (0.2, 1.1)	0.3 (0.1, 0.6)	0.2 (0, 0.4)	0 (0, 0)
Winter Flounder	5.7 (2.4, 8.9)	6.1 (3.3, 8.9)	13.2 (2.1, 24.4)	4.2 (0.8, 7.6)	2.3 (0.8, 3.9)	2.1 (1.1, 3.1)
Bluefish	0 (0, 0)	0.1 (0, 0.2)	3.5 (0.2, 6.8)	0 (0, 0.1)	0 (0, 0.1)	0.1 (-0.1, 0.2)
Black Sea Bass	0 (0, 0)	0 (0, 0)	0 (0, 0)	0.3 (-0.1, 0.8)	0.5 (-0.3, 1.2)	0.9 (-0.8, 2.6)
Scup	0 (0, 0)	0 (0, 0)	0 (0, 0.1)	0 (0, 0)	0 (0, 0)	0 (0, 0)
Tautog	0 (0, 0)	0.1 (0, 0.2)	0.8 (0.2, 1.4)	1.5 (0.2, 2.7)	1.3 (-0.5, 3.1)	0.8 (0, 1.7)

Table 3: Coastal Pond Survey mean abundance indices (fish/seine haul) for clupeid species by month for 2024. 95% confidence intervals are given in parentheses.

Species	May	June	July	Aug	Sept	Oct
Atlantic Herring	1.5 (-1.4, 4.4)	0 (0, 0)	0 (0, 0)	0 (0, 0)	0 (0, 0)	0 (0, 0)
Alewife	0 (0, 0)	30.5 (-28.1, 89.1)	15.1 (-8.7, 38.9)	0.3 (-0.1, 0.6)	0 (0, 0)	0 (0, 0)
Blueback Herring	0 (0, 0)	0 (0, 0)	5.5 (-4.3, 15.3)	0 (0, 0)	0 (0, 0)	0 (0, 0)
Atlantic Menhaden	0 (0, 0)	0 (0, 0)	0 (0, 0.1)	1.4 (-0.1, 2.8)	0.2 (0, 0.5)	0 (0, 0)
Bay Anchovy	0 (0, 0.1)	0 (0, 0)	0 (0, 0.1)	0 (0, 0.1)	0 (0, 0)	0 (0, 0.1)

Table 4: Coastal Pond Survey mean abundance indices (fish/seine haul) for forage and bait species by month for 2024. 95% confidence intervals are given in parentheses.

Species	May	June	July	Aug	Sept	Oct
Atlantic Silverside	10.3 (-3.9, 24.5)	18.9 (-0.4, 38.1)	104.3 (36.6, 172.1)	250.7 (66.3, 435.1)	57.2 (19.2, 95.1)	54.4 (15.3, 93.5)
Sheepshead Minnow	0 (0, 0)	0.2 (-0.1, 0.5)	1 (-0.7, 2.7)	1.9 (-0.3, 4.2)	1.7 (-0.7, 4)	4.7 (1.8, 7.5)
Mummichog	4.5 (-0.6, 9.6)	2.2 (0.4, 4.1)	12 (-2.6, 26.6)	3.6 (-0.1, 7.3)	0.9 (-0.2, 2.1)	9.5 (-0.4, 19.3)
Striped Killifish	1 (-0.8, 2.8)	4.5 (-4.3, 13.4)	1 (0.1, 1.9)	2.1 (0.1, 4.2)	3.4 (-0.8, 7.5)	11.4 (-3.3, 26)

Table 5: Mean measured water temperature (°C) by pond and month for 2024.

Waterbody	May	June	July	Aug	Sept	Oct
Charlestown Pond	18.6	25.2	28.7	23.2	23.4	17.0
Green Hill Pond	18.6	25.8	28.1	22.8	23.4	15.8
Narrow River	16.6	24.9	28.2	22.8	21.0	15.0
Pawcatuck River	18.9	23.8	25.0	21.4	19.0	14.6
Point Judith Pond	22.7	23.9	27.6	22.4	21.4	17.1
Potter's Pond	22.7	25.1	28.4	22.9	22.1	17.1
Quonochontaug Pond	17.0	22.8	25.5	24.6	19.1	13.5
Winnapaug Pond	17.8	24.8	23.6	23.3	18.0	14.1

Table 6: Mean measured salinity (ppt) by pond and month for 2024.

Waterbody	May	June	July	Aug	Sept	Oct
Charlestown Pond	25.6	28.3	25.1	26.5	27.4	28.2
Green Hill Pond	15.6	18.8	14.9	15.6	22.1	25.1
Narrow River	12.8	19.5	18.9	19.7	27.9	29.2
Pawcatuck River	26.9	19.5	20.7	21.7	28.3	27.4
Point Judith Pond	21.1	27.9	27.7	29.1	30.8	30.7
Potter's Pond	22.7	26.7	27.5	27.9	26.6	28.1
Quonochontaug Pond	27.5	29.9	30.4	30.4	30.8	31.4
Winnapaug Pond	19.7	27.4	30.0	29.2	30.5	31.3

Table 7: Mean measured dissolved oxygen (mg/L) by pond and month for 2024.

Waterbody	May	June	July	Aug	Sept	Oct
Charlestown Pond	10.0	9.2	8.6	9.1	8.1	9.8
Green Hill Pond	9.0	7.7	9.0	8.0	6.7	8.5
Narrow River	9.1	9.3	10.8	8.0	8.1	8.6
Pawcatuck River	9.0	10.3	9.2	7.8	8.0	10.1
Point Judith Pond	8.7	8.8	8.5	7.8	7.8	8.9
Potter's Pond	9.0	8.5	7.8	7.8	8.1	9.7
Quonochontaug Pond	9.3	8.2	8.3	9.1	8.9	9.1
Winnapaug Pond	9.2	9.5	7.7	9.0	8.1	8.4

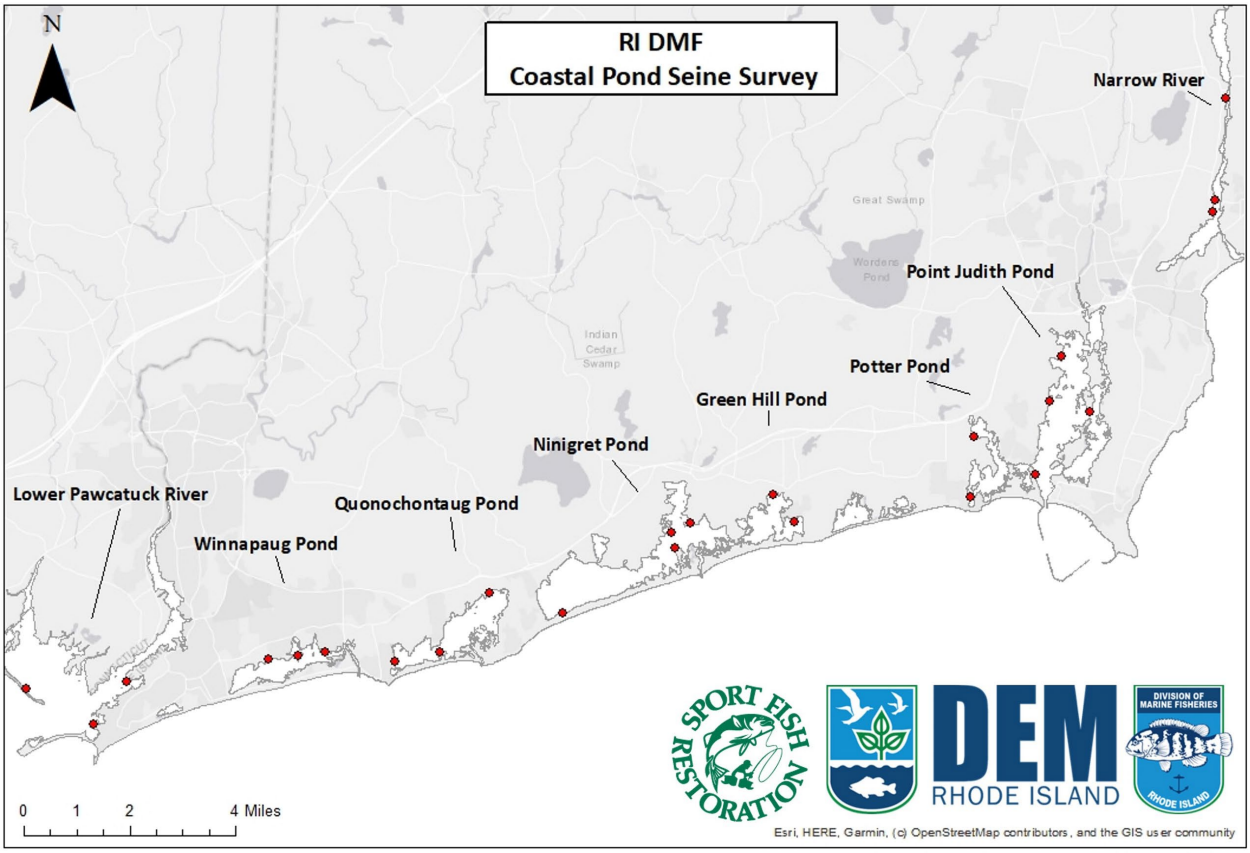


Figure 1: Location of coastal ponds sampled by the Coastal Pond Juvenile Finfish Survey in Southern Rhode Island.

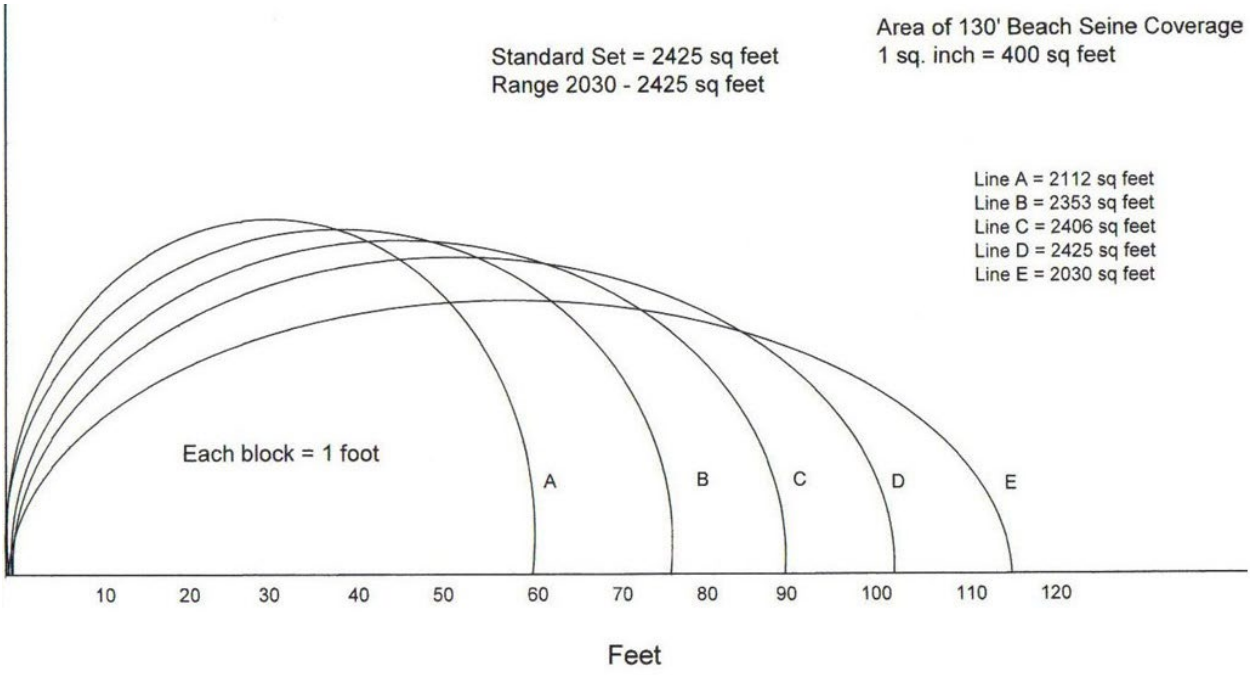


Figure 2: Approximate swept area of beach seine net.

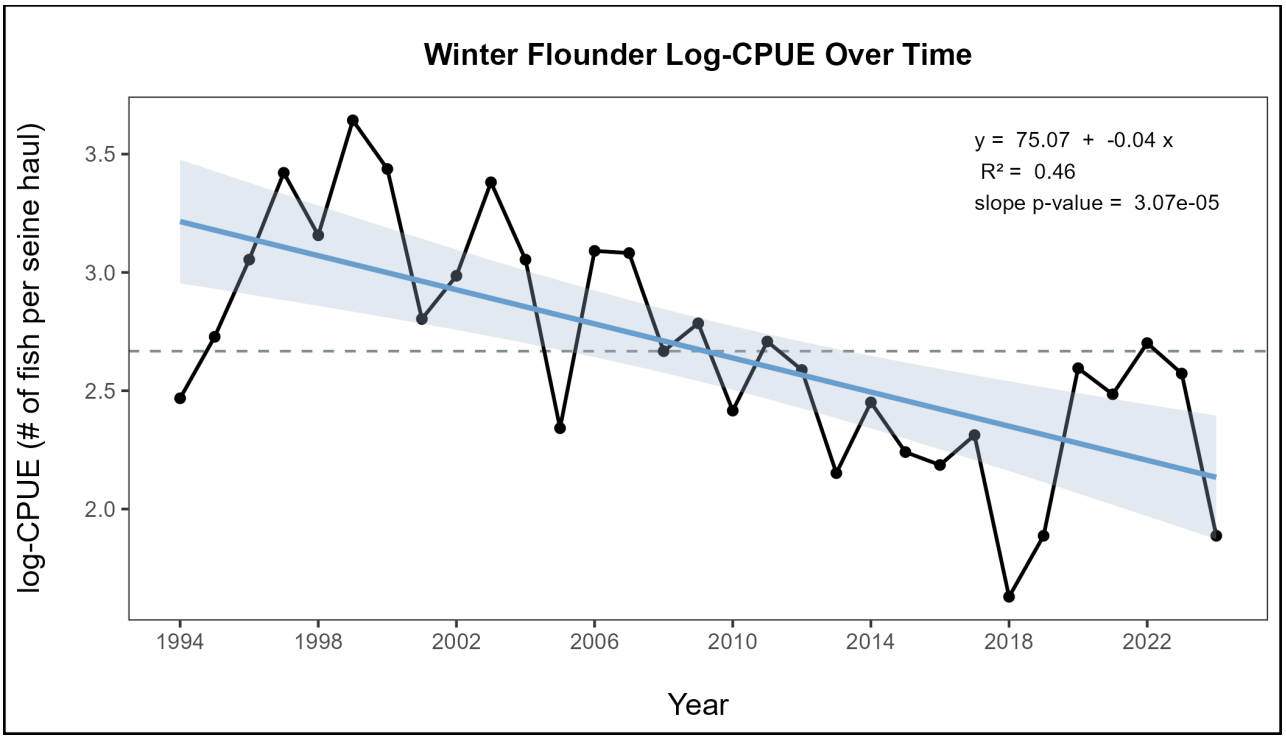


Figure 3: Time series of mean log-transformed abundance indices (fish/seine haul) for winter flounder young-of-year. The solid line is a linear regression, with shaded areas indicating the 95% confidence interval. The grey dashed line is the time series median.

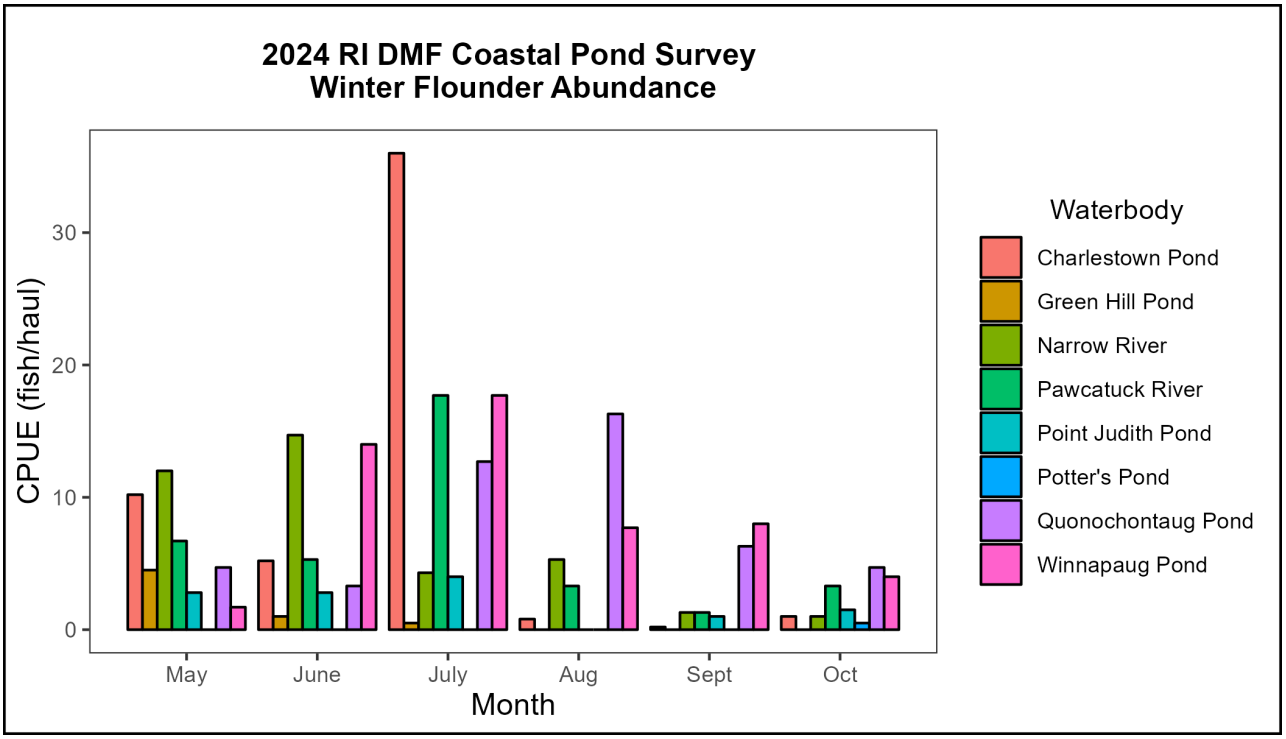


Figure 4: 2024 abundance indices (fish/seine haul) for YOY winter flounder for each pond by month.

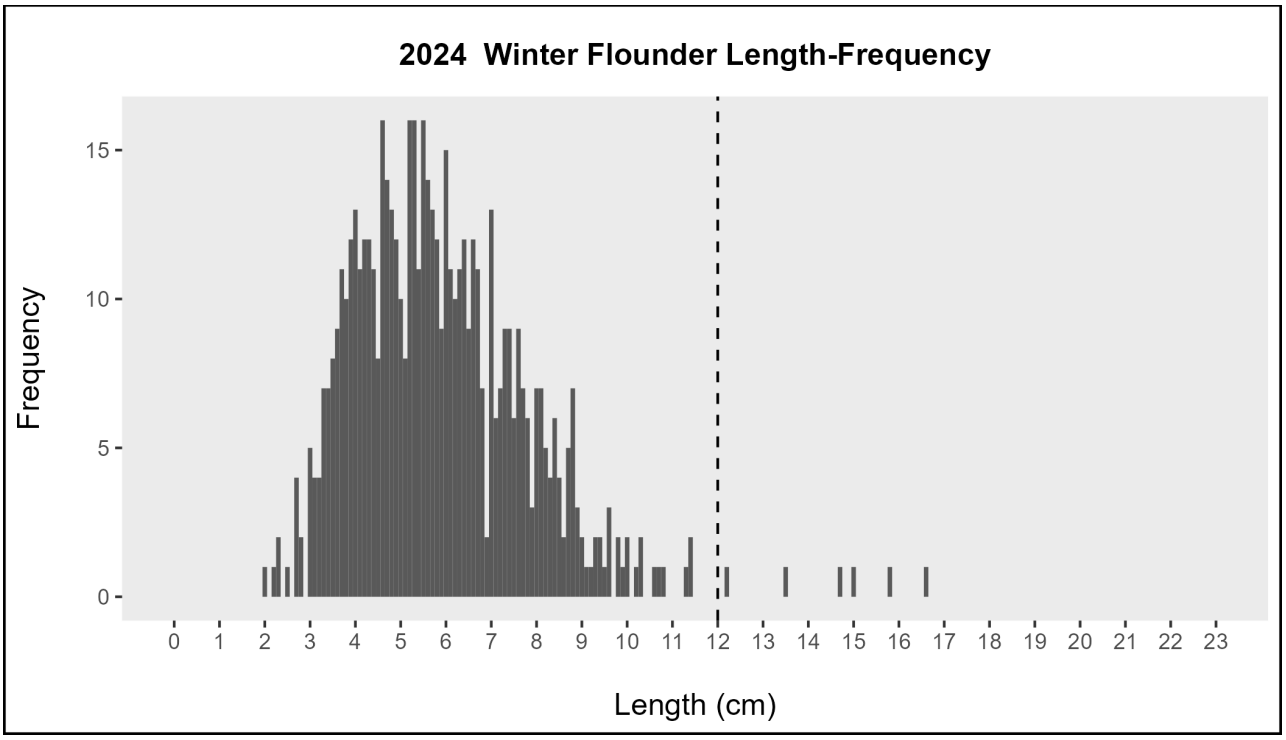


Figure 5: Length frequency of all winter flounder caught in Coastal Pond Survey during 2024. Note: YOY are to the left of the dashed line (<12cm TL)

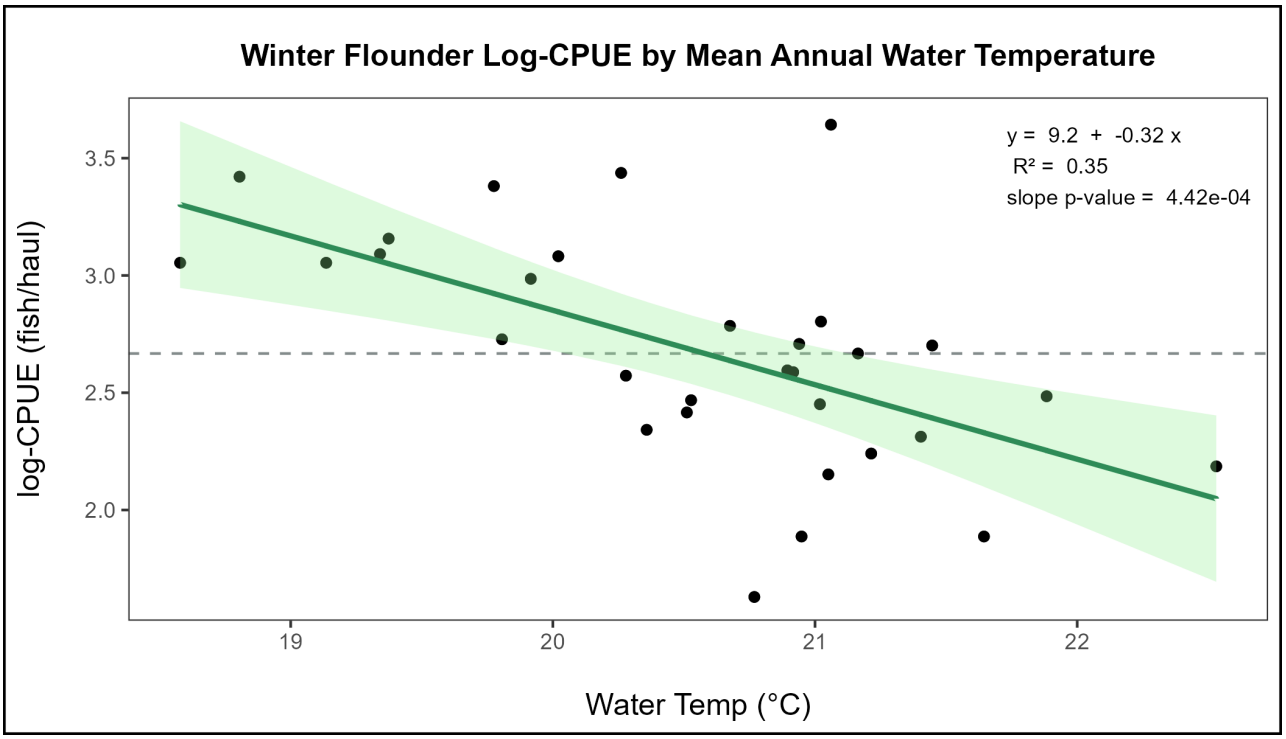


Figure 6: Winter flounder CPUE against mean measured water temperature. The solid line is a linear regression and shading represents 95% confidence intervals. The dashed grey line is the time-series median.

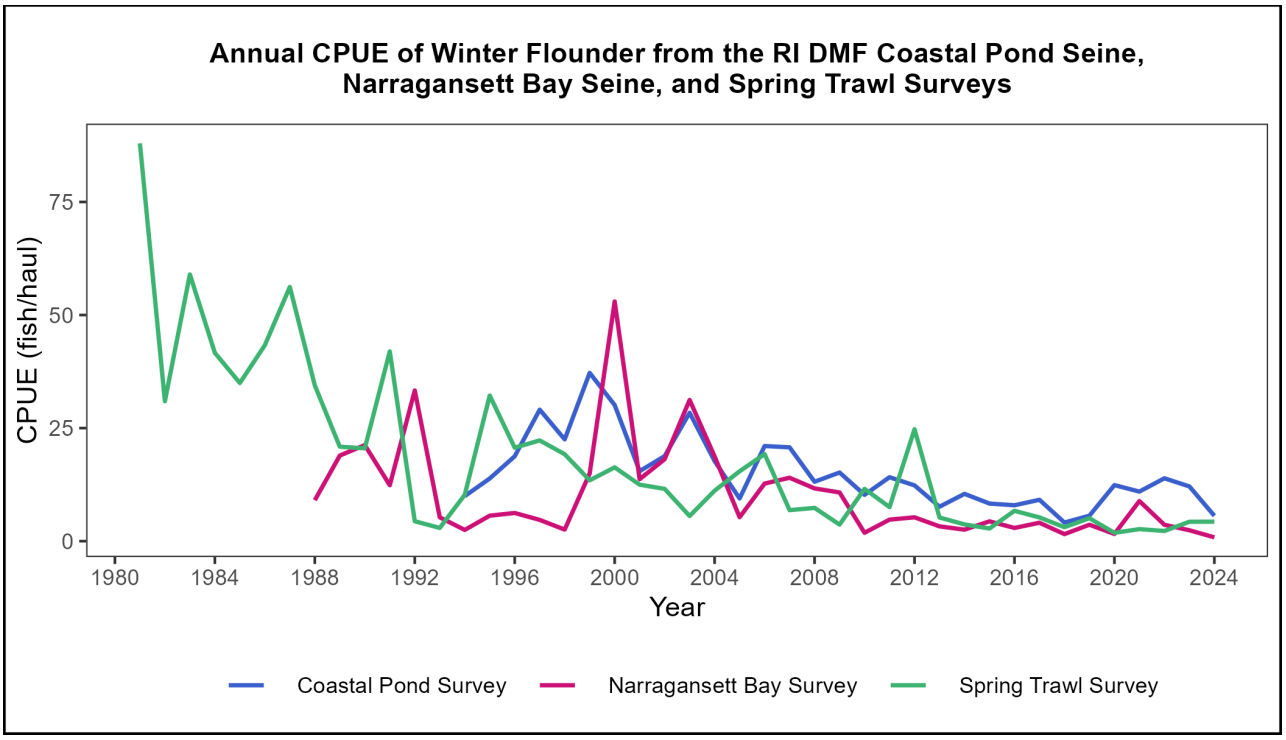


Figure 7: Abundance indices (fish/haul) from the RIDMF Coastal Pond Survey, Narragansett Bay Seine Survey, and Spring Trawl Survey for winter flounder.

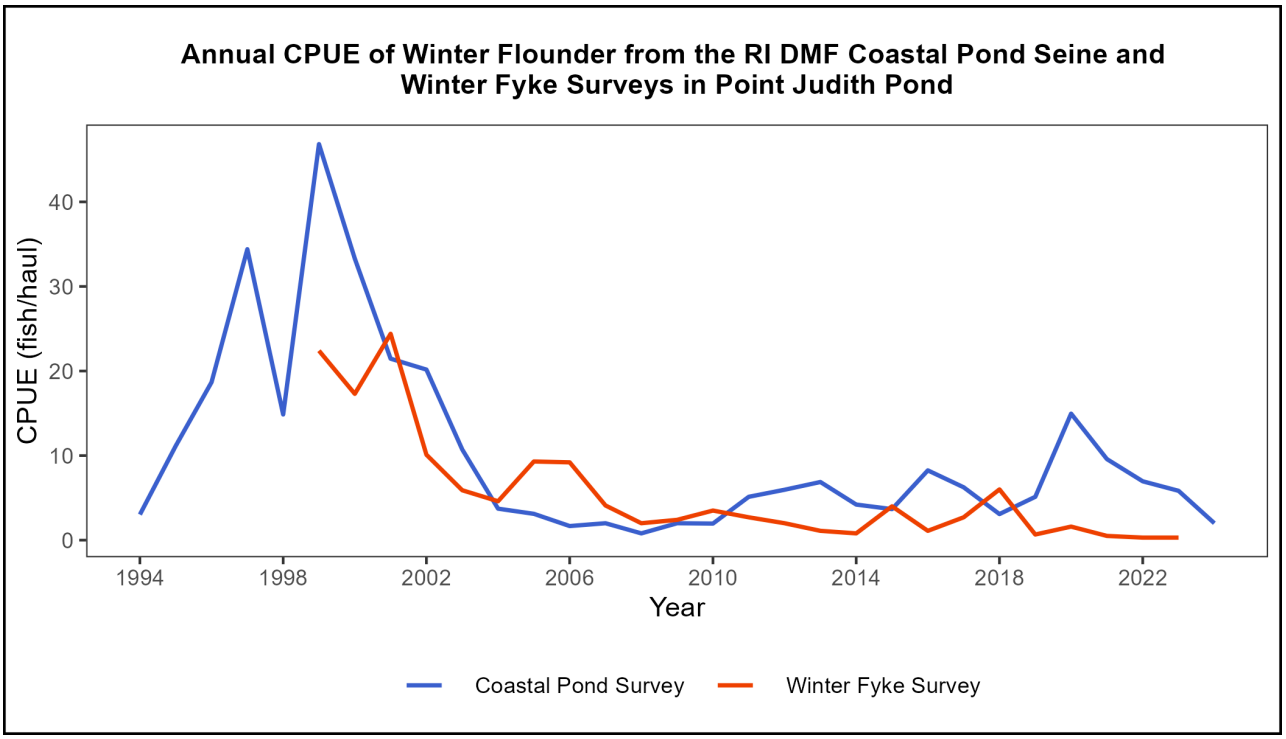


Figure 8: Abundance indices (fish/haul) from the Coastal Pond Survey and the Adult Winter Flounder Tagging Survey for winter flounder.

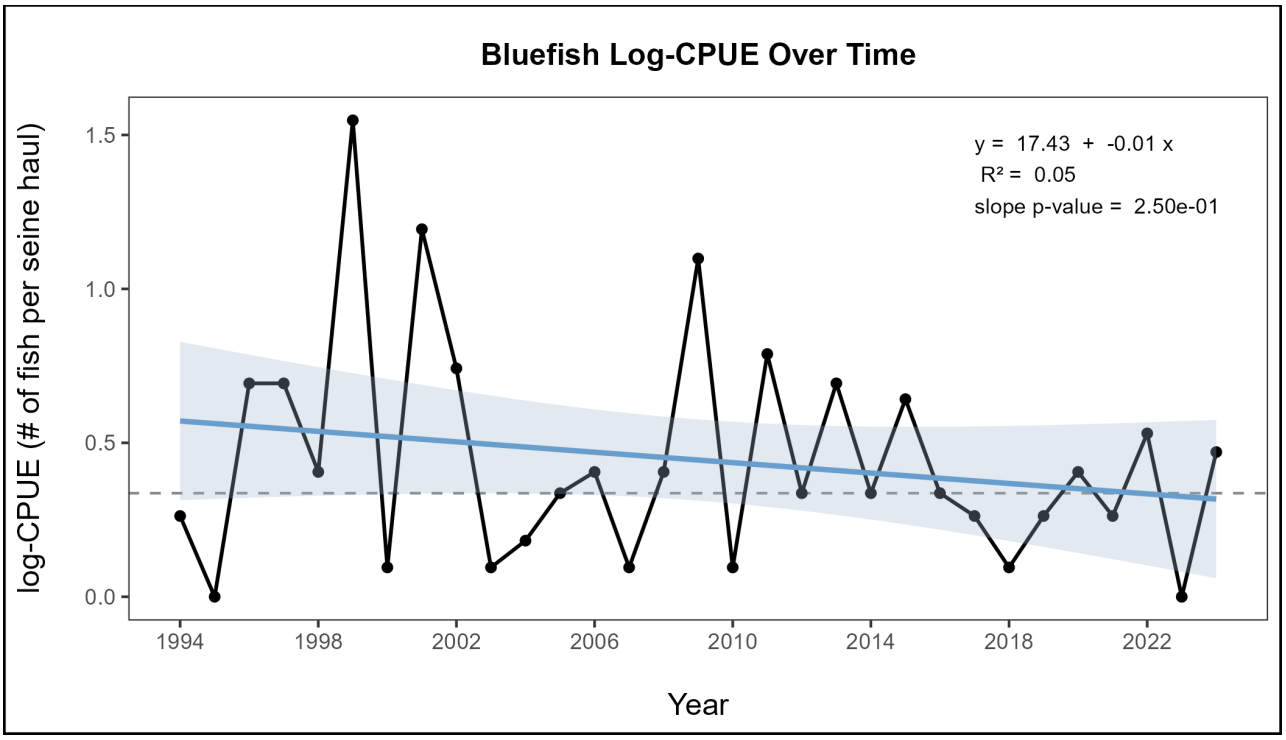


Figure 9: Time series of mean log-transformed abundance indices (fish/seine haul) for bluefish. The solid line is a linear regression, with shaded areas indicating the 95% confidence interval. The grey dashed line is the time series median.

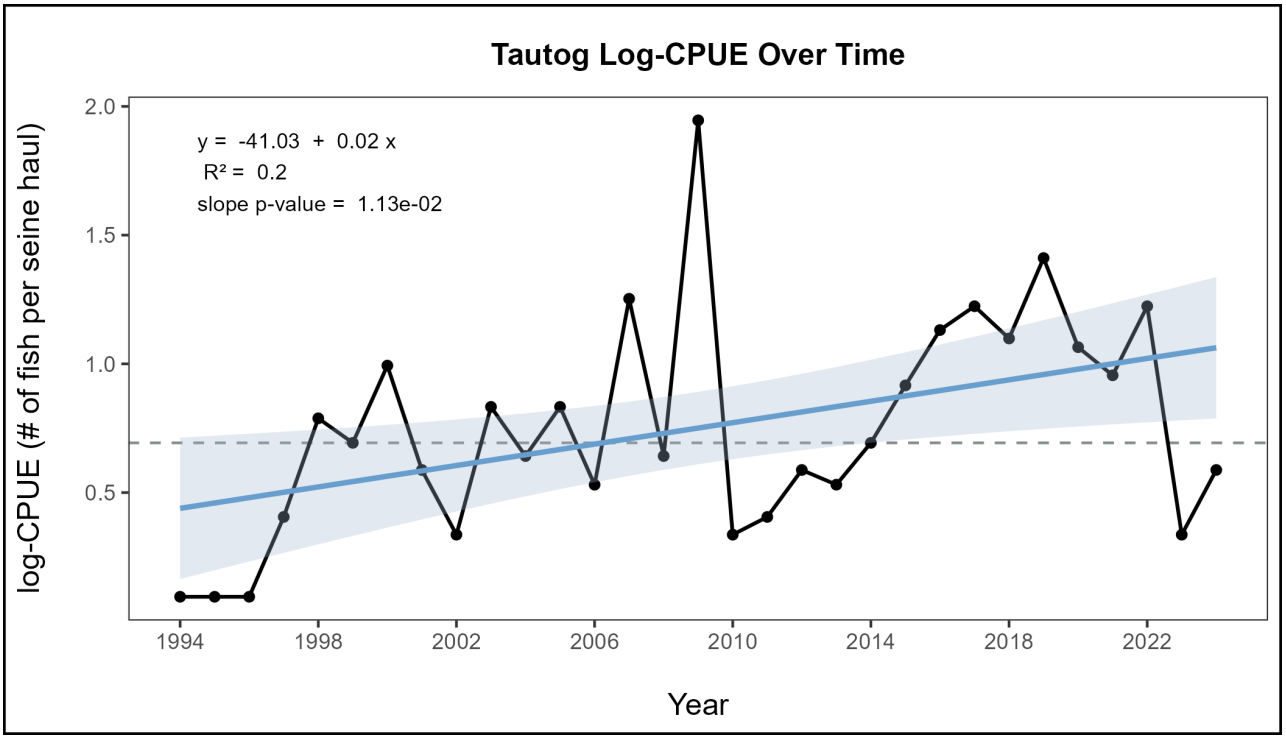


Figure 10: Time series of mean log-transformed abundance indices (fish/seine haul) for tautog. The solid line is a linear regression, with shaded areas indicating the 95% confidence interval. The grey dashed line is the time series median.

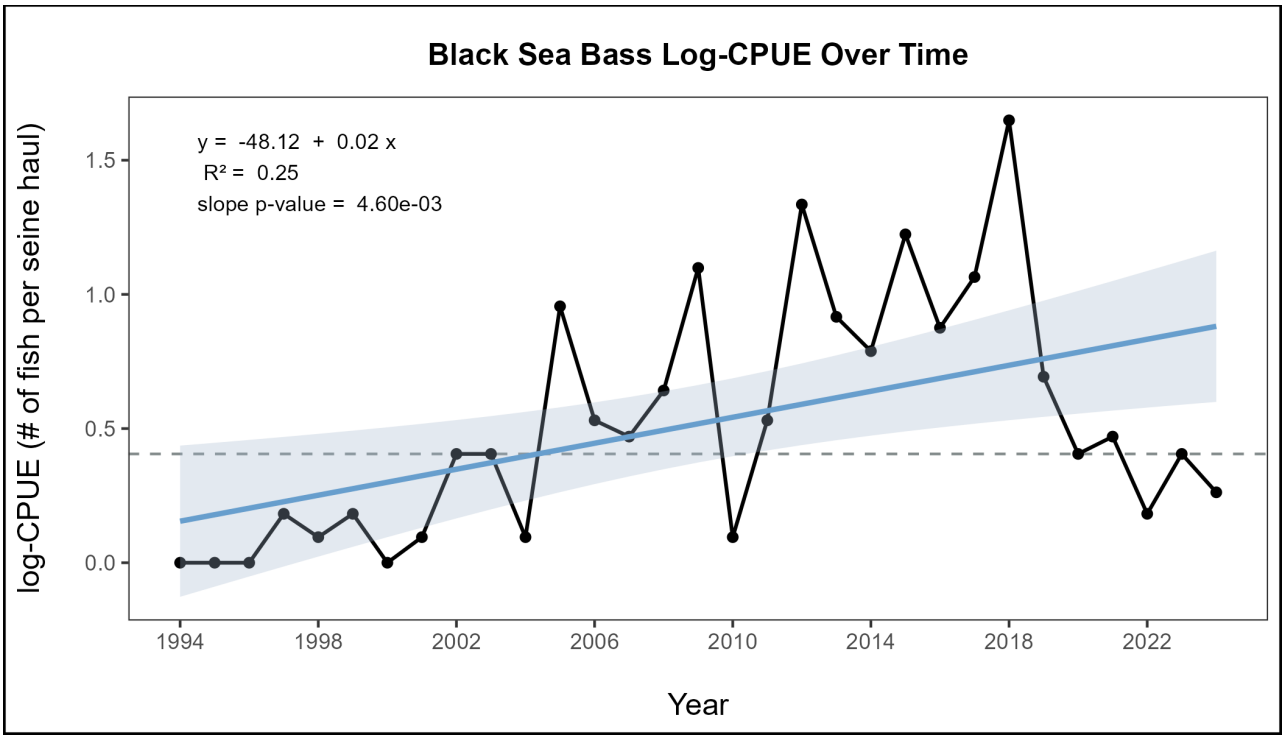


Figure 11: Time series of mean log-transformed abundance indices (fish/seine haul) for black sea bass. The solid line is a linear regression, with shaded areas indicating the 95% confidence interval. The grey dashed line is the time series median.

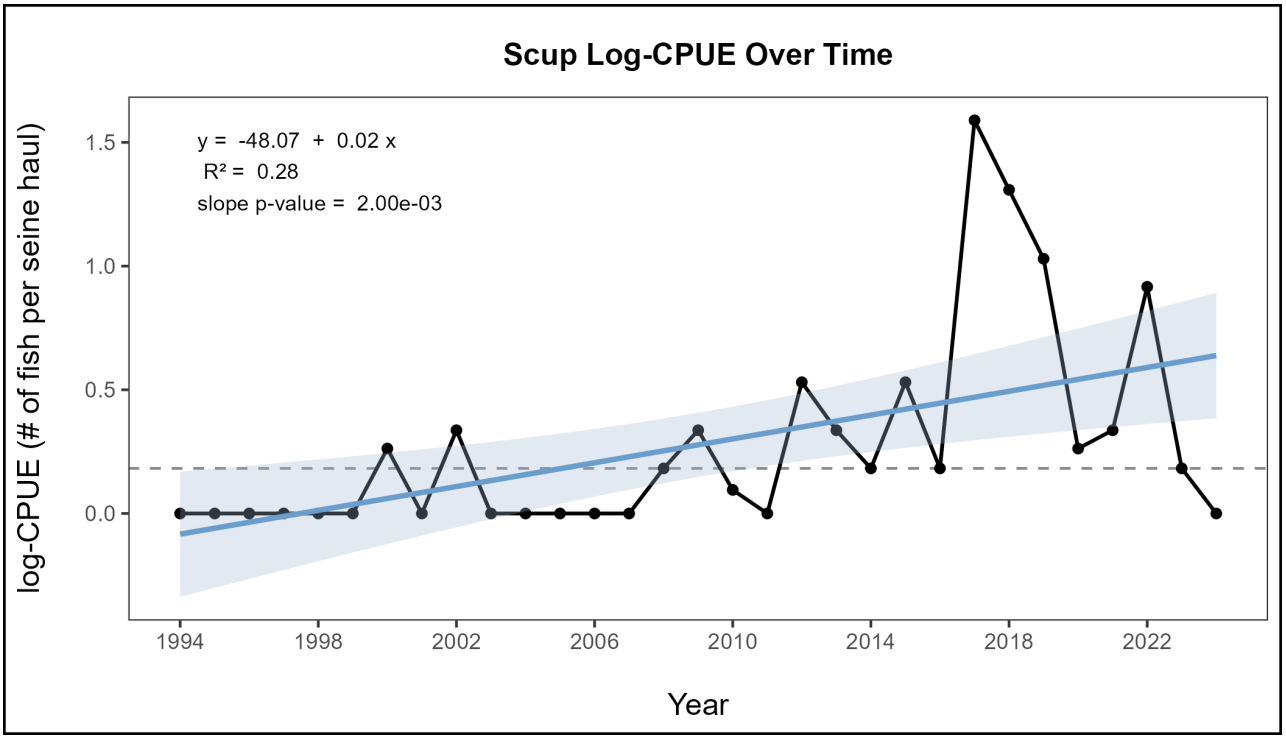


Figure 12: Time series of mean log-transformed abundance indices (fish/seine haul) for scup. The solid line is a linear regression, with shaded areas indicating the 95% confidence interval. The grey dashed line is the time series median.

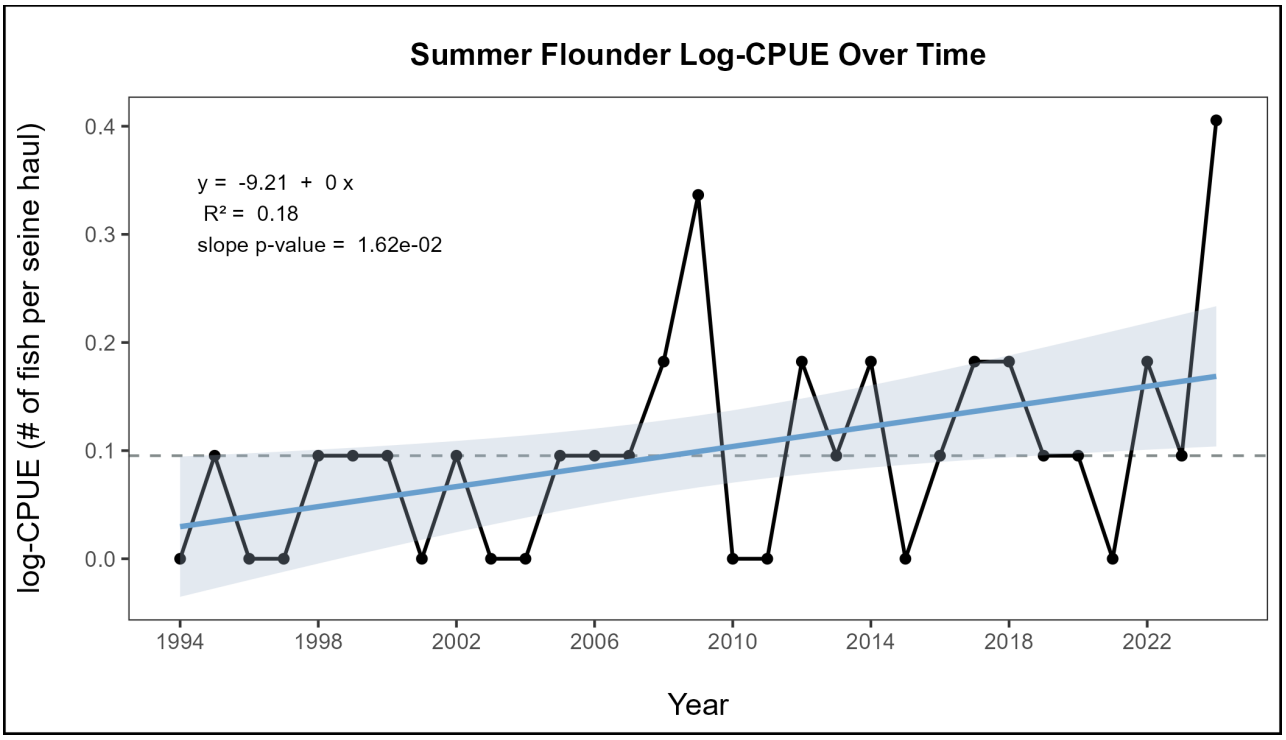


Figure 13: Time series of mean log-transformed abundance indices (fish/seine haul) for summer flounder. The solid line is a linear regression, with shaded areas indicating the 95% confidence interval. The grey dashed line is the time series median.

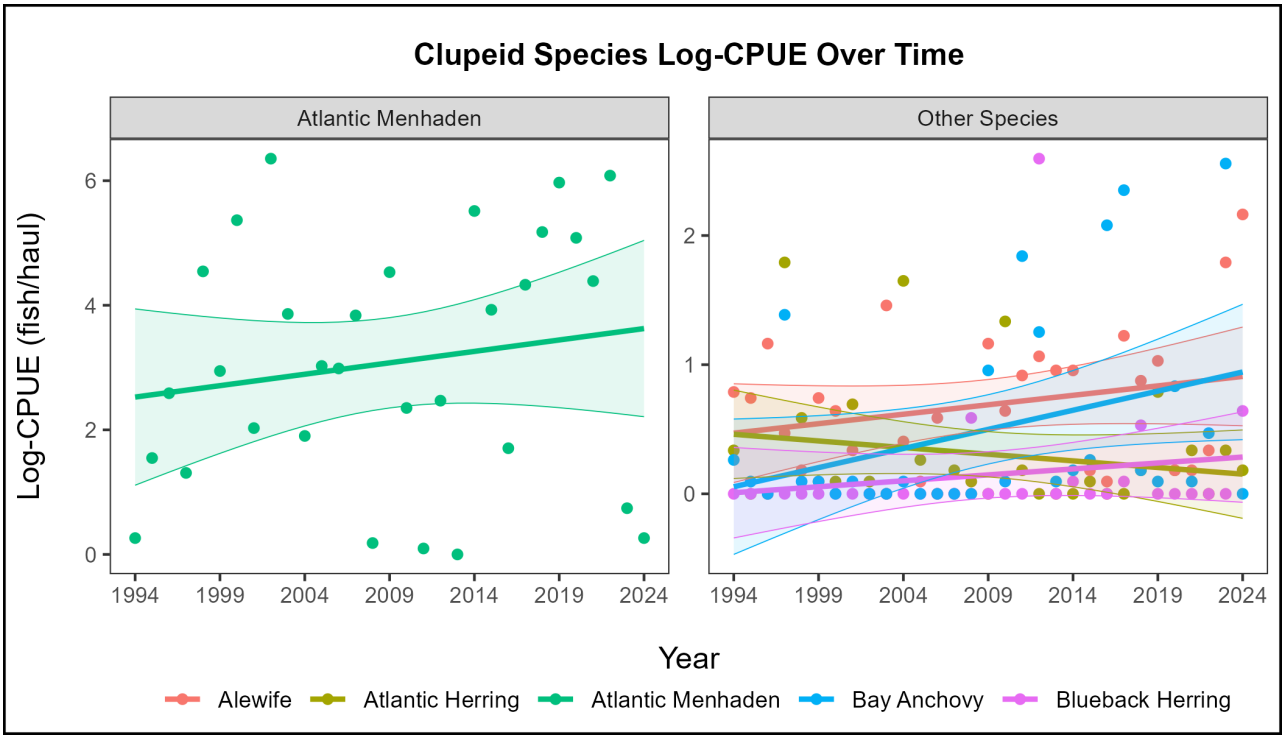


Figure 14: Time series of mean log-transformed abundance indices (fish/seine haul) for all Clupeid species. The solid lines are linear regressions, with shaded areas indicating the 95% confidence intervals.

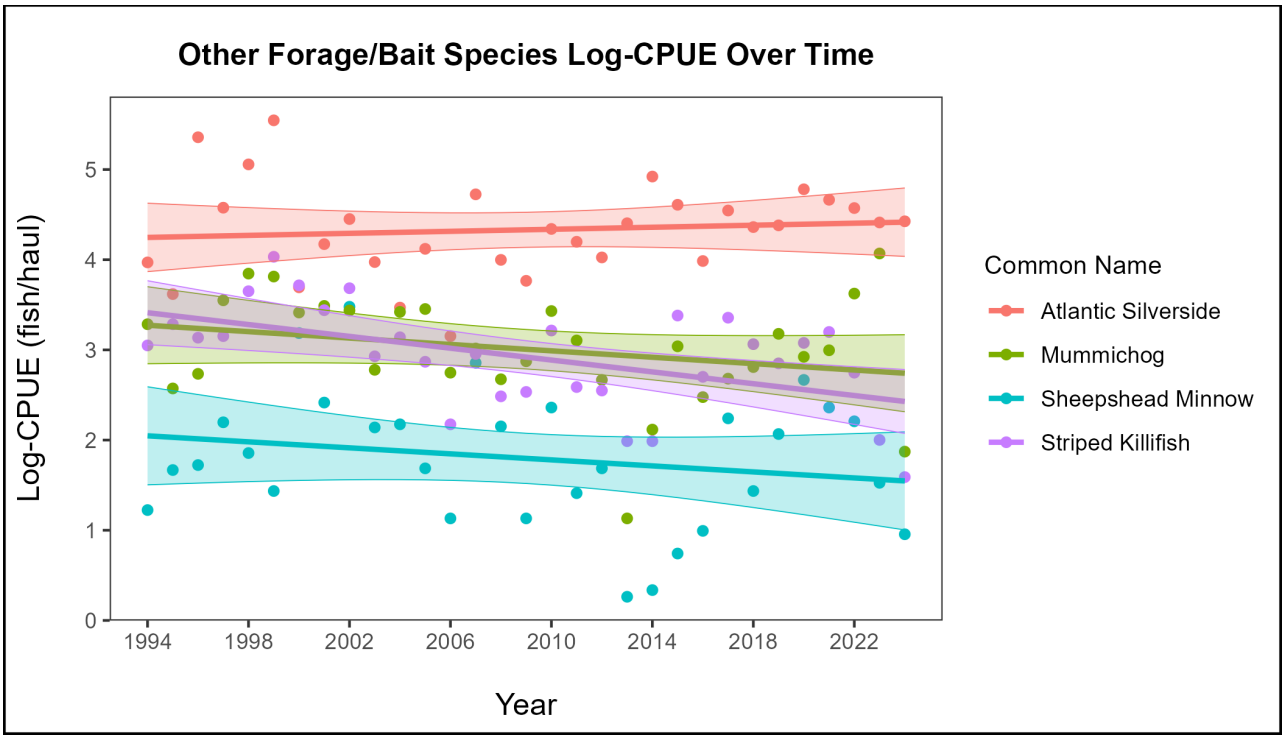


Figure 15: Time series of mean log-transformed abundance indices (fish/seine haul) for all bait/forage species. The solid lines are linear regressions, with shaded areas indicating the 95% confidence intervals.

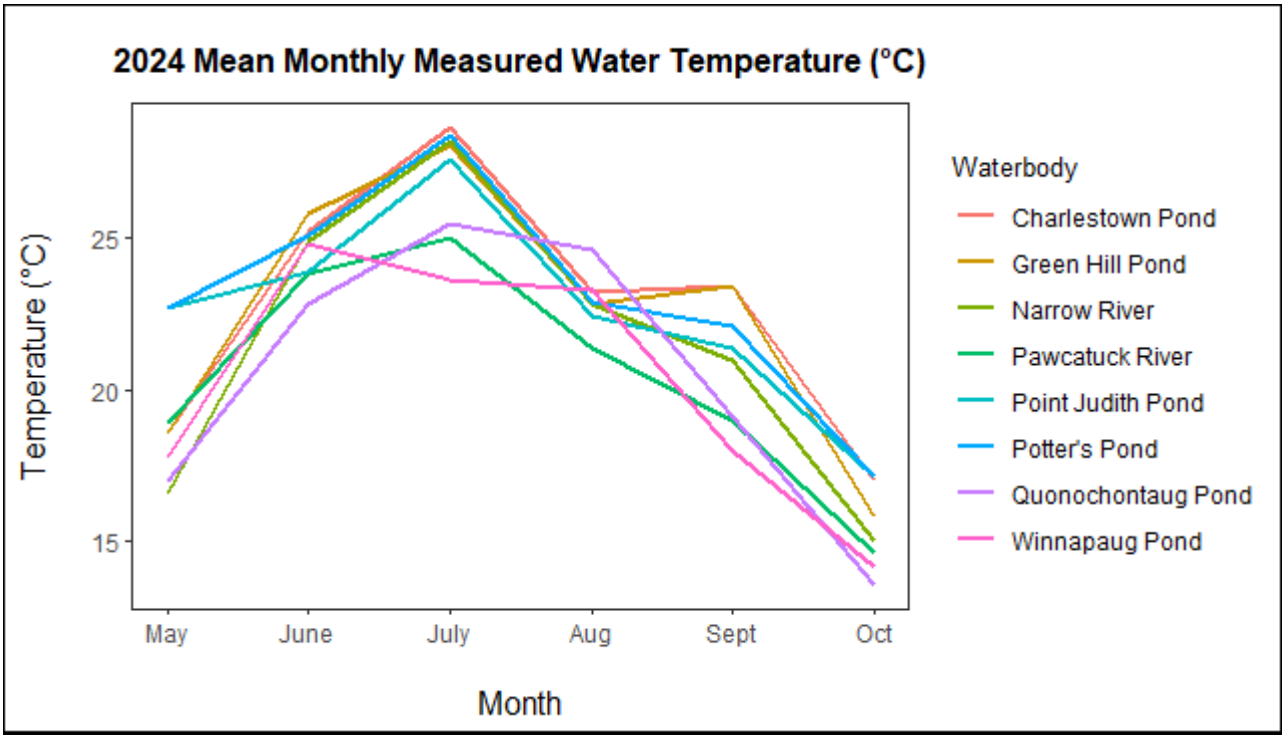


Figure 16: Average recorded water temperature in the coastal ponds by month for 2024.

Appendix 1: All species caught in 2024 by station.

Species	CP1	CP2	CP3	CP4	GH1	GH2	NR1	NR2	NR3	PJ1	PJ2	PJ3	PJ4	PP1	PP2	PR1	PR2	PR3	QP1	QP2	QP3	WP1	WP2	WP3
ALEWIFE (ALOSA PSEUDOHARENGUS)		3			4	3	29		1	718	7		13		292	2						31		
ANCHOVY BAY (ANCHOA MITCHILLI)			1			1									1			1						
Atlantic Rock Crab (Cancer irroratus)																			1					
BASS CRIMSON (ANTHIAS ASPERILINGUIS)							1																	
BASS STRIPED (MORONE SAXATILIS)									1														1	
BAY SCALLOP (ARGOPECTEN IRRADIANS)											1			1										
BIGEYE (PRIACANTHUS ARENATUS)																				1				
BLUE CRAB (CALLINECTES SAPIDIUS)	7	1			7		4		1	1			1	1		1			1	1	1	1	4	1
BLUE CRAB FEMALE (CALINECTES SAPIDIUS)	8	20	25	5	32	15	18	11	3	19	6	1	18	31	12		3	7	5	1	3		3	4
BLUE CRAB MALE (CALINECTES SAPIDIUS)	39	26	32	12	37	21	16	19	4	25	9	1	18	34	18	4	1	3	8	7	15	1	3	9
BLUEFISH (POMATOMUS SALTATRIX)		29	3		1					2	1					10	10					30		4
BROWN SHRIMP (Farfantepenaeus aztecus)	1	9	2	1	8		1			3				1				1	2					
BUTTERFLYFISH SPOTFIN (CHAETODON OCELLATUS)			1																					
CORNETFISH BLUESPOTTED (FISTULARIA TABACARIA)																1							6	
CUNNER (TAUTOGOLABRUS ADSPERSUS)								2												2				
EEL AMERICAN (ANGUILLA ROSTRATA)	1	1	2					3						1	10					2				
FLOUNDER SMALLMOUTH (ETROPUS MICROSTOMUS)	1		1					3	1		6		4			2			3		9	1		6
FLOUNDER SUMMER (PARALICHTHYS DENTATUS)		3		1	4	2	3	9			1	1	15	14	1		1	1	2	4	3	1	5	
FLOUNDER WINTER (PSEUDOPLEURONECTES AMERICANUS)	184	9	12	9	10	2	33	50	33	4	19	2	23	1		24	76	13	14	81	49	74	74	11
GOBY NAKED (GOBIOSOMA BOSC)	1	1	4		1	1	1	2	2	4	1		2	21	1	1	2		7	1	3	1		1
Green Crab (Carcinus maenas)	26	6	6				2	94	39	2	68	10	1	1	1	9			9	39	2	352	155	25
GRUBBY (MYOXOCEPHALUS AENAEUS)	1								1									2		2		3	3	1
HAKE SPOTTED (UROPHYCIS REGIA)			1														1							
HERRING ATLANTIC (CLUPEA HARENGUS)																			1	35				
HERRING BLUEBACK (ALOSA AESTIVALIS)		120														10						1		
HOGCHOKER (TRINECTES MACULATUS)					1																			
HORSESHOE CRAB FEMALE (LIMULUS POLYPHEMUS)																			1				1	1
HORSESHOE CRAB MALE (LIMULUS POLYPHEMUS)													1			1				1	3			
JACK CREVALLE (CARANX HIPPOS)	27	2			7		3			5				1					1					
JACKS (CARANGIDAE)	2	10	30		3		36			2	5			3	2		1				13	12	1	

Species	CP1	CP2	CP3	CP4	GH1	GH2	NR1	NR2	NR3	PJ1	PJ2	PJ3	PJ4	PP1	PP2	PR1	PR2	PR3	QP1	QP2	QP3	WP1	WP2	WP3
KILLIFISH STRIPED (FUNDULUS MAJALIS)			4	1	1						31	317	2	1	1	5	31		18	30	7	60	22	30
Lady Crab (Ovalipes ocellatus)																				1	3			
LIZARDFISH INSHORE (SYNODUS FOETENS)																					1			
Mantis shrimp (Squilla empusa)														1										
MENHADEN ATLANTIC (BREVOORTIA TYRANNUS)		2	2		2	3				1	16	1				1						2	10	
MINNOW SHEEPSHEAD (CYPRINODON VARIEGATUS)	6		21	15	5	1		15			3	1			5		6		9	26	32	20	26	36
MOJARRA SPOTFIN (EUCINOSTOMUS ARGENTEUS)		3	1				37	10	3	10			1								1	2	4	1
MULLET WHITE (MUGIL CUREMA)	101	108	177	6	2		3	13			88			5	1	1			8	6	3	405	1	
MUMMICHOG (FUNDULUS HETEROCLITUS)	197	73	42	13		2	29	36	5	27	120	4		4	56	2	10		2	38	5	54	18	49
NEEDLEFISH ATLANTIC (STRONGYLURA MARINA)	3	4	6	1	3	2			1				2	9		1			1	1		1		
PERCH WHITE (MORONE AMERICANA)							5																	
PIPEFISH NORTHERN (SYNGNATHUS FUSCUS)	1	1	3		1	1	1	4	6	1	1				6				1	3			1	
POLLOCK (POLLACHIUS VIRENS)																							1	
PUFFER BANDTAIL (SPHOEROIDES SPENGLERI)																			1					
PUFFER NORTHERN (SPHOEROIDES MACULATUS)	2	1	5				1		1				1	1	1	4	1		1	1	12		1	
RAINWATER KILLIFISH (LUCANIA PARVA)	17	8	83	4		7		14	6	2	2			2	24			1		3	1		2	1
SCUP (STENOTOMUS CHRYSOPS)			1																					
SEA BASS BLACK (CENTROPRISTIS STRIATA)	1							35	2													1	1	
SEAHORSE LINED (HIPPOCAMPUS ERECTUS)	1		1																					
SEAROBIN NORTHERN (PRIONOTUS CAROLINUS)			2																	1			4	
SEAROBIN STRIPED (PRIONOTUS EVOLANS)	1	2	1					2								1				1	1	1		1
SENNET NORTHERN (SPHYRAENA BOREALIS)			3							1	1		2		1				12					2
SHAD AMERICAN (ALOSA SAPIDISSIMA)						25																		
SILVERSIDE ATLANTIC (MENIDIA MENIDIA)	239	151	698	264	25	1279	357	249	233	251	223	524	636	360	39	154	448	74	253	287	354	1517	2361	921
SNAPPER GRAY (LUTJANUS GRISEUS)		1	1					1			1									3				
Spider Crab (Libinia emarginata)		1		1																1				
SPOT (LEIOSTOMUS XANTHURUS)				1												4								
STICKLEBACK FOURSPINE (APELTES QUADRACUS)	11	42	58	2	2	10	4	112	74	1	1			2	11	5	1	8	6	1	1	1	1	11
STICKLEBACK THREESPINE (GASTEROSTEUS ACULEATUS)																						1		
TAUTOG (TAUTOGA ONITIS)	1	1	2					38	11	2	8					4	4	7	7	22				1
TOADFISH OYSTER (OPSANUS TAU)			1			1		5	1		1			1	5			1						
TOMCOD ATLANTIC (MICROGADUS TOMCOD)								1	5									1						

The Rhode Island Chapter of The Nature Conservancy
Annual Performance Report

Submitted to

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

Title: Block Island Seine Survey

Cooperative Agreement Award Number: 3425240

Award Term: January 15, 2020 to December 31, 2024

Reporting Period: January 15, 2020 to December 31, 2024

Prepared By

Diandra Hall (Great Salt Pond Scientist)

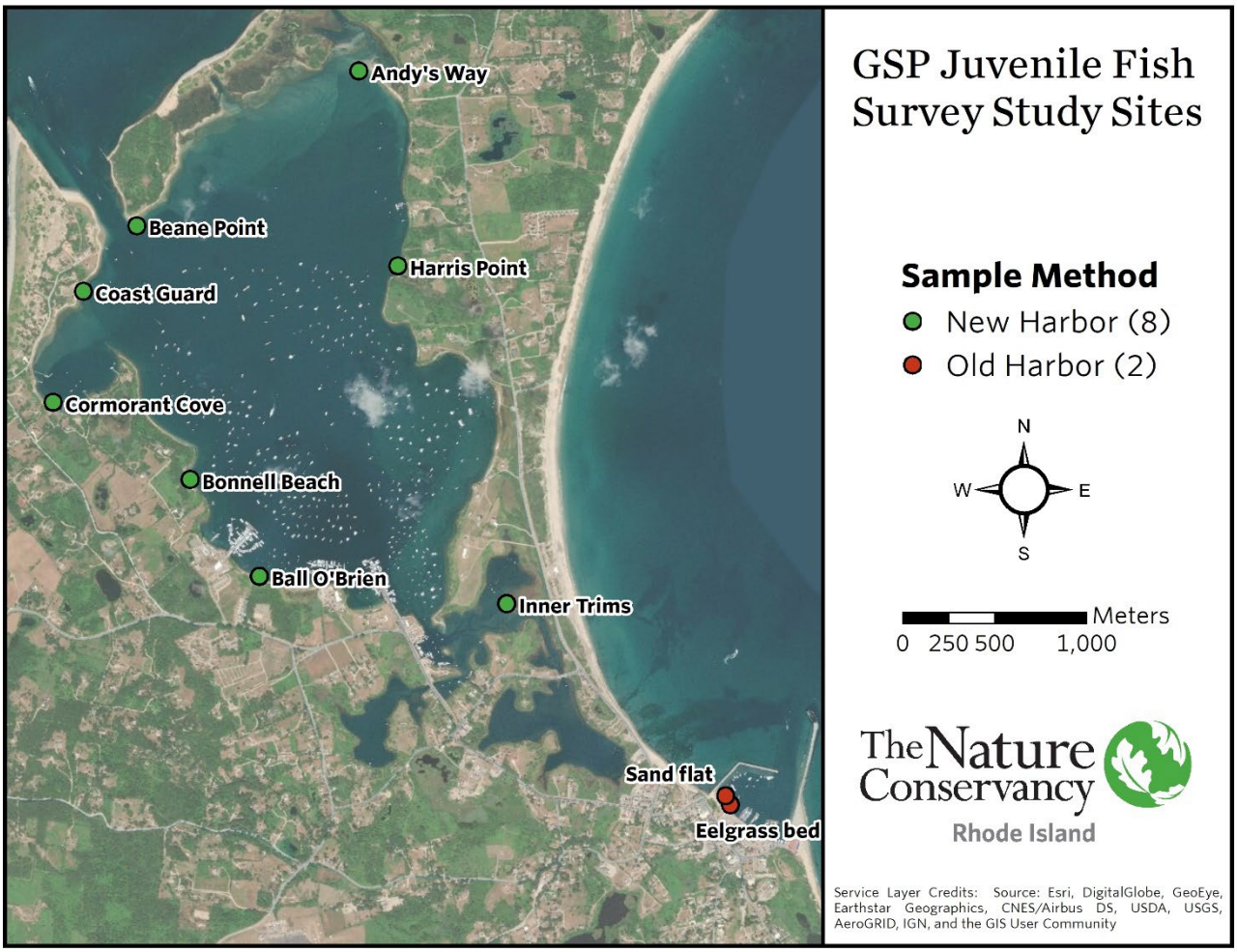
Approved By

Scott Comings, Associate State Director

The Nature Conservancy Rhode Island Chapter
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Providence, RI 02906



Map of study area and sampling locations.



SUMMARY

During the 2024 season a total of 60 seines were hauled across 10 sites in May through October resulting in the enumeration of 20,048 individuals. Of the animals caught, 19,482 of those individuals were finfish and 566 were other marine invertebrates. A total of 3,513 individuals were measured and 64 species were identified. During the grant period from 2020-2024, 300 seines were hauled resulting in the enumeration of 119,989 individuals across 84 species representing 40 families. All scoped work was completed. All raw data have been shared with the appropriate Rhode Island Department of Environmental Management, Division of Marine Fisheries staff for incorporation into existing datasets.

TARGET DATE

December 31, 2024

NEXT STEPS

Investigators intend to continue sampling with the same methodology during the field season of 2025 under a new cooperative agreement. The Block Island project team will continue coordinating with the primary investigators of the Coastal Ponds and Providence River Estuary juvenile fish surveys to evaluate variations in fish assemblages across study areas in Rhode Island.

REMARKS

For the entire Block Island time series (2014-2024), all individuals of the target species: winter flounder, summer flounder, tautog, scup, and black sea bass were enumerated and measured. The abundance indices for the target species only target young-of-the-year individuals. Other species of interest and their relative abundances were also included in this report. These species include members of the Clupeidae family: Atlantic menhaden and river herring (alewife and blueback herring), as well as four forage fish species: Atlantic silverside, mummichog, sheepshead minnow, and striped killifish. Adults and juveniles of these fish species were not differentiated for data analysis or descriptive purposes. Of all the species caught, only finfish were included in the results of this report. All crustaceans and other marine invertebrates were excluded.

INTRODUCTION

Estuaries are some of the most productive and ecologically significant ecosystems on Earth, yet they are also among the most threatened (Suchanek 1994; Lotze et al. 2006; Murphy et al. 2021). These coastal habitats are notably important to juvenile fishes, providing foraging opportunities, reduced predation risks, and a mosaic of habitats suitable for a variety of life stages (Able 2005; Seitz et al. 2020; Pessanha et al. 2021). Estuaries are also important spawning grounds for many fish species, and they contribute directly to the production of future recruits into recreational and commercial fisheries (Jänes et al. 2021). As such, these coastal habitats are commonly referred to as nurseries by fisheries scientists and managers, and assessing fish nursery function within estuarine and marine environments can help prioritize protection and restoration efforts (Beck et al. 2001; Peterson 2003).

Along the East Coast of the United States, estuaries are estimated to support more than two-thirds of the economically important finfish species (Boesch and Turner 1984; Lellis-Dibble et al. 2008). In Rhode Island, the commercial and recreational fishing industries have a longstanding history and are sustained by the natural resources and waterbodies of Narragansett Bay, Rhode Island Sound, and Block Island Sound (RIDEM DMF 2024). Block Island's waterbody, the Great Salt Pond, is one of the most unique examples of an estuary since it is located offshore and distinguished as a body of salt water surrounded by salt water. It is also positioned between Rhode Island Sound, Block Island Sound,

and two biogeographic regions, making it ideal grounds for fish seeking habitat that could not survive on the continental shelf (Able 2005). While past assessments have supported this clam, a subsequent literature review revealed limited historical and empirical data on fisheries assessments in the Great Salt Pond (Neumann 1993; Katz 2000). This missing information is critically important to have because it has been estimated that more than 70% of Rhode Island's recreationally and commercially important finfish spend at least one part of their life history in coastal habitats like the Great Salt Pond, particularly young-of-the-year (Meng et al. 1999; RIDEM DMF 2024).

In 2014, the Division of Marine Fisheries and The Nature Conservancy entered into a cooperative agreement to begin evaluating the Great Salt Pond and its role in supporting fish populations. Through a holistic approach to monitoring, investigators evaluated fish assemblages, water quality, and benthic and coastal habitats in the Great Salt Pond and Old Harbor on Block Island. Not only did initial results reveal that this study area supports recreationally and commercially important finfish, but it also recognized that Block Island could support habitat improvements aimed at increasing fish recruitment. Now that the Block Island seine survey has accrued over ten years of data, time series results continue to be a valuable tool for the Division of Marine Fisheries in managing fish populations.

As we move forward into the renewed cooperative agreement, investigators will continue to work together on incorporating datasets amongst the other established seine surveys: the Providence River Estuary and coastal salt ponds of southern Rhode Island. Investigators also acknowledge as habitat and water quality in these study areas continue to change, this long-term monitoring serves as a collective baseline to document how these changes affect fish assemblage in Rhode Island and will inform our future work together.

METHODS

Ten stations on Block Island were sampled at monthly intervals from May through October: eight stations in the Great Salt Pond and two stations in Old Harbor. Investigators attempted to perform all seining on an incoming tide and in the intertidal zone at depths shallower than two meters. At each site a 130' long, 6'deep, ¼" mesh net beach seine was used to collect species. This net was also outfitted with a midpoint pocket, weighted footrope, and a floated headrope, all consistent with the net used in the Young-of-the-Year Survey of Selected Rhode Island Coastal Ponds and Embayments (conducted as part of F-61-R-23, Job #3).

For sampling, the seine net was deployed by boat along the shoreline in a semicircle shape. The net was then hauled onto shore manually from both ends. All animals caught were transferred from the midpoint pocket of the net into water-filled totes. All collected animals were identified to genus or species and measured to the nearest centimeter, except for flounder and crustacean species which were measured in millimeters. All finfish were measured in total length and crustaceans were measured by carapace width. When appropriate, species were subsampled by measuring the first 20 individuals identified and the remaining individuals enumerated. Upon completion, all animals were released back into the water at the collection site. Additionally, water temperature (°C), salinity (ppt), dissolved oxygen (mg/L), water depth (m), and transparency (m) were measured using a Professional Plus series handheld YSI multiparameter meter and Secchi disk. The YSI multiparameter meter was calibrated monthly throughout the sampling season per manufacturer recommendations.

RESULTS & DISCUSSION

For the 2024 field season, a total of 60 seines were hauled across the ten sampling sites. A total of 19,482 finfish were identified and enumerated, and 2,947 of those were measured. A total of 20,048 species were caught (Table 1). Of the species caught, only finfish were included in the results below.

A mean of 324.70 ± 57.17 SE finfish was caught per haul in 2024. Catch per haul across sites for the Block Island survey was greatest at Andy's Way at 987.67 ± 269.91 SE and lowest at Ball O'Brien at 79.50 ± 36.39 SE (Figure 1). Catch per haul across months was greatest in July at 535.50 ± 173.07 SE and lowest in June at 60.70 ± 33.29 SE (Figure 2).

TARGET SPECIES

Winter Flounder (*Pseudopleuronectes americanus*)

Of the total 766 winter flounder caught in 2024 seines, 761 individuals were YOY, and 5 individuals were age 1+ (max length = 220 mm; Able and Fahay 1998; Berry et al. 1965; Meng et al. 2000). In 2024, winter flounder were collected during all months and caught at all sites except for Harris Point, Andy's Way, and Ball O'Brien in the Great Salt Pond. The most abundant site for winter flounder was the Sand Flat in Old Harbor at a catch per haul of 109.50 ± 81.49 SE (Figure 3a). The most abundant month for winter flounder was July at a catch per haul of 51.10 ± 50.21 SE fish/seine haul (Figure 3b). The 2024 juvenile winter flounder abundance index was 12.77 ± 8.63 SE fish/seine haul, which was higher than the 2023 index of 3.80 ± 1.04 SE. This year marked the highest abundance index of juvenile winter flounder for the Block Island time series.

Black Sea Bass (*Centropristis striata*)

A total of 24 black sea bass were caught in 2024, which was a decrease from the 284 individuals that were collected in 2023. Black sea bass were caught at five out of the ten sites for the survey: Coast Guard Station, Cormorant Cove, and Bonnell Beach in the Great Salt Pond and both sites in Old Harbor. They were most abundant at the Sand Flat in Old Harbor at a catch per haul of 1.67 ± 1.12 SE (Figure 4a). Most individuals were caught in September at a catch per haul of 1.30 ± 0.80 SE (Figure 4b). Black sea bass ranged in size between 4cm and 11cm in 2024. The abundance index for black sea bass in 2024 was 0.40 ± 0.16 SE fish/seine haul. This was lower than the 2023 index of 4.73 ± 2.59 SE fish/seine haul. In the last five years of the Block Island dataset, black sea bass abundance indices have been significantly lower than the indices recorded between 2015 and 2019. While investigators acknowledge that indices rise and fall, the presence of black sea bass has been increasingly prevalent across regional seine surveys and supported by recruitment signals observed along the Northern Atlantic Coast (NEFSC 2017; Tuckey and Fabrizio 2019).

Summer Flounder (*Paralichthys dentatus*)

A total of 14 summer flounder were caught in 2024 beach seines ranging in size from 4mm to 124mm. Summer flounder were caught at four of the ten sites: Beane Point and Cormorant Cove in the Great Salt Pond, and both sites in Old Harbor. Summer flounder were most abundant at the Sand Flat in Old Harbor at a catch per haul of 1.50 ± 1.50 SE (Figure 5a). Most individuals were caught in August at a catch per haul of 1.00 ± 0.89 SE (Figure 5b). The 2024 abundance index was 0.23 ± 0.15 SE, which was similar, but slightly higher than the 2023 abundance index of 0.22 ± 0.09 SE. Since the start of the Block Island seine survey, summer flounder has been the least abundant catch for the interest group.

Tautog (*Tautoga onitis*)

During the 2024 survey 72 tautog were collected and ranged in size from 1cm to 19cm. This total number was a decrease from the 2023 survey when 123 juveniles were collected. The 2024 abundance index was 1.20 ± 0.33 SE, a decrease from the 2023 index of 2.05 ± 0.92 SE. Tautog were caught at all sites except for two sites in the Great Salt Pond: Beane Point and Coast Guard Station. Of the eight sites they were caught at tautog were most abundant at the Sand Flat in Old Harbor at a catch per haul of 3.50 ± 2.08 SE (Figure 6a). Tautog were most abundant in August with a catch per haul of 2.40 ±

0.69 SE (Figure 6b). This season was one of the lowest abundance indices for the species since the start of the Block Island survey.

Scup (*Stenotomus chrysops*)

A total of 13 scup were caught in 2024 beach seines ranging in size from 5cm to 10cm. Scup were caught during August and September and only at the two stations in Old Harbor this year. They were most abundant at the Eelgrass Bed in Old Harbor with a catch per haul of 1.50 ± 0.96 SE (Figure 7a). Most individuals were caught in September at a catch per haul of 0.80 ± 0.53 SE in 2024 (Figure 7b). The total survey abundance in 2024 for scup was 0.22 ± 0.12 SE, which marked it as the lowest abundance index recorded for the species in the Block Island time series.

OTHER SPECIES OF INTEREST

Family Clupeidae

In 2024, three species of clupeids were collected during the sampling season: Alewife, Atlantic menhaden, and blueback herring. While other species of clupeids have been collected in past Block Island surveys such as Atlantic herring and hickory shad, they were not captured during the 2024 season. Due to the difficulty of separating juvenile alewives from juvenile blueback herring without sacrificing them, both species are collectively referred to as river herring. Investigators also acknowledge while large schools of clupeid species were not encountered during the 2024 season, they were most likely present in the system and may have been missed during sampling.

Atlantic Menhaden (*Brevoortia tyrannus*)

In the 2024 sampling season, 82 Atlantic menhaden were caught and ranged in size between 5cm and 12cm. The total survey mean abundance index was 1.37 ± 1.19 SE in 2024, which was higher than last year's mean abundance index of 0.37 ± 0.26 SE. Atlantic menhaden were found in August, September, and October this year and at three out of the ten sites: Beane Point and Coast Guard Station in the Great Salt Pond and the Sand Flat in Old Harbor. The species was most abundant at the Sand Flat with a catch per haul of 11.83 ± 11.83 SE. The highest number of individuals were caught in October at a catch per haul of 7.10 ± 7.10 SE.

River Herring: Alewife & Blueback Herring (*Alosa pseudoharengus & Alosa aestivalis*)

Both alewife and blueback herring are classified as river herring for the time series survey. A total of 10 river herring were caught in 2024 and ranged in size from 4cm to 8cm. They were found in July at two sites in the Great Salt Pond: Ball O'Brien and Inner Pond. The total survey mean abundance for blueback herring was 0.17 ± 0.12 SE fish/seine haul in 2024.

FORAGE FISH SPECIES

Forage fish species are commonly encountered across stations and months throughout the sampling season. In 2024, Atlantic silverside, mummichog, sheepshead minnow, and striped killifish comprised 87.8 % of the total fish catch. For the Block Island time series, forage fish species have accounted for about 85-90% of the total fish catch each season.

Atlantic Silverside (*Menidia menidia*)

A total of 13,964 Atlantic silversides were caught in 2024. The total mean abundance was 232.73 ± 47.11 SE in 2024 and was higher than last year's index of 210.65 ± 69.77 SE. The species was most abundant at the Andy's Way in Great Salt Pond with a catch per haul of 719.50 ± 234.61 SE in 2024. The highest number of silversides were caught in September at a catch per haul of 442.60 ± 148.91 SE

in 2024. Silversides ranged in size from 1cm to 16cm and were found in all months and at all sites. The species had the highest abundance of all species caught during the 2024 season and have ranked as the most abundant finfish species since the start of the Block Island survey in 2014.

Mummichog (*Fundulus heteroclitus*)

A total of 571 mummichogs were caught in 2024 and ranged in size from 2cm to 11cm. The species was caught at all sites this season except for the Sand Flat site in Old Harbor. Mummichogs had the highest abundance at Inner Pond in the Great Salt Pond with a catch per haul of 36.33 ± 23.90 SE in 2024. They were caught during all months in 2024 except for May. Mummichogs were most abundant in July at a catch per haul of 17.80 ± 13.68 SE. The total mean abundance was 9.52 ± 3.08 SE in 2024. Since the start of the Block Island time series, mummichogs have been consistently caught across most of the sampling sites and during all months of the season. This year yielded the highest number of mummichog individuals caught across sampling seasons since 2014.

Sheepshead Minnow (*Cyprinodon variegatus*)

Nine hundred and twenty-one sheepshead minnows were caught during the 2024 sampling season. Individuals ranged in size from 3cm to 5cm. The total mean abundance index for the species was 15.35 ± 14.86 SE in 2024. Sheepshead minnows were most abundant in October at a catch per haul of 91.70 ± 88.94 SE and Andy's Way was the most abundant site at a catch per haul of 149.33 ± 148.53 SE in 2024. This past sampling season caught the highest number of sheepshead minnows for the Block Island time series.

Striped Killifish (*Fundulus majalis*)

In 2024, a total of 1,913 striped killifish were collected during the sampling season and ranged in size from 2cm to 13cm. Striped killifish occurred during all months and at all sites except for the two sites in Old Harbor. The total mean abundance was 31.88 ± 10.09 SE in 2024, which was higher than the 2023 index of 12.43 ± 4.43 SE. In 2024, the highest number of striped killifish were caught in October at a catch per haul of 53.60 ± 31.85 SE, and they were most abundant at Inner Pond site in the Great Salt Pond with a catch per haul of 99.17 ± 65.31 SE. Each season since 2014, striped killifish have been consistently documented across all sampling events and sites. Their high abundances also contribute greatly to the total catches comprised for forage fish species each year.

WATER QUALITY DATA

Water quality data for the 2024 season can be found in Table 2. In the Great Salt Pond, water temperature ranged from 14.6°C in May to 27.1°C in July. In Old Harbor, water temperature ranged from 13.7°C in May and 23.4°C in August. The mean salinity of the eight sites in the Great Salt Pond was 29.91ppt ± 0.14 SE, and the mean salinity of the two sites in Old Harbor were 30.28ppt ± 0.19 SE. The lowest dissolved oxygen value recorded across the Great Salt Pond sites was 7.12mg/L in July at Beane Point, while the mean was 8.42mg/L ± 0.11 SE. In 2024, the Sand Flat site in Old Harbor recorded the lowest dissolved oxygen value at 7.69mg/L in June, with a mean of 8.86mg/L ± 0.30 SE between the Old Harbor sites.

TIME SERIES SUMMARY

Since the beginning of the time series in 2014, a total of 650 seines have been hauled across ten sites on Block Island. Since 2014, a total of 239,241 finfish individuals of 101 different species representing 45 families were documented throughout the Block Island seine survey. During the grant period from 2020-2024, 300 seines were hauled resulting in the enumeration of 119,989 individuals across 84

species representing 40 families. In 2024, six new species were recorded in the Block Island survey for the first time — fringed filefish, gray snapper, permit, short bigeye, snowy grouper, and spotfin butterfly. 2024 yielded the highest abundance of silversides, sheepshead minnow, and striped killifish, as well as the lowest abundance of black sea bass, scup, and tautog since the start of the survey in 2014. This year also documented the highest abundance index of juvenile winter flounder for the Block Island time series. Throughout the grant period, and the full time series, the abundance per haul has been highly variable. Investigators acknowledge notable peaks have been largely attributed to schools of forage fish and members of the Clupeid family being caught in the net. Figures displaying abundance and diversity can be found in the Appendix. Additional data is available upon request.

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FIGURES

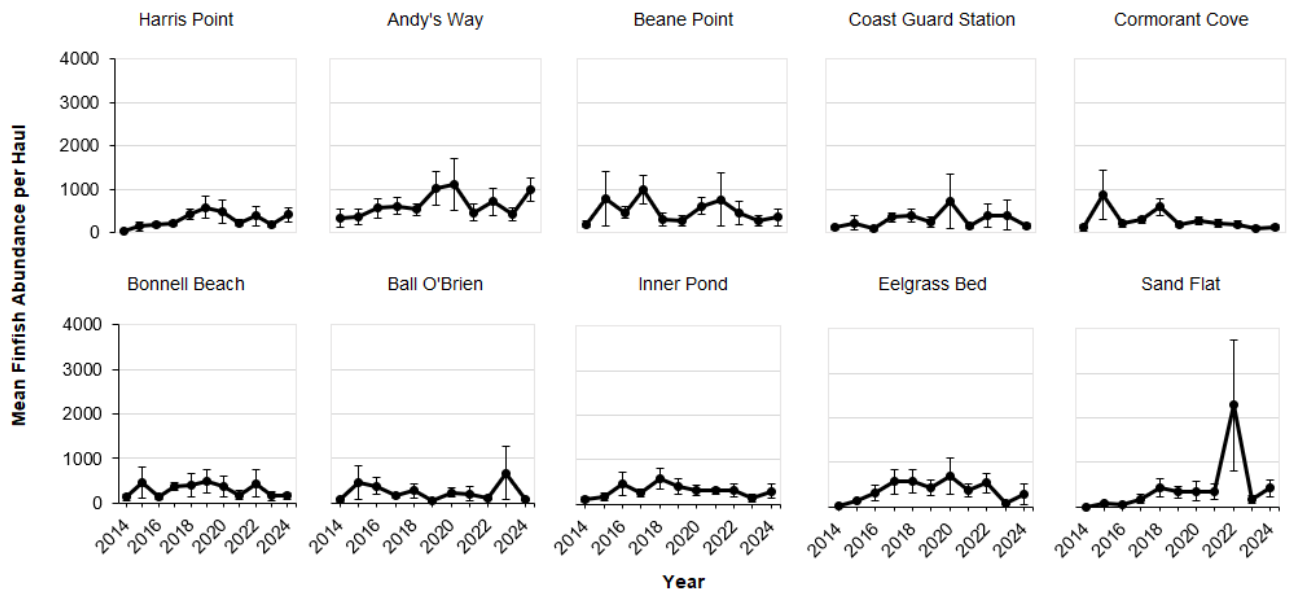


Figure 1. Mean abundance of finfish across sites (± SE) in 2014-2024 beach seines.

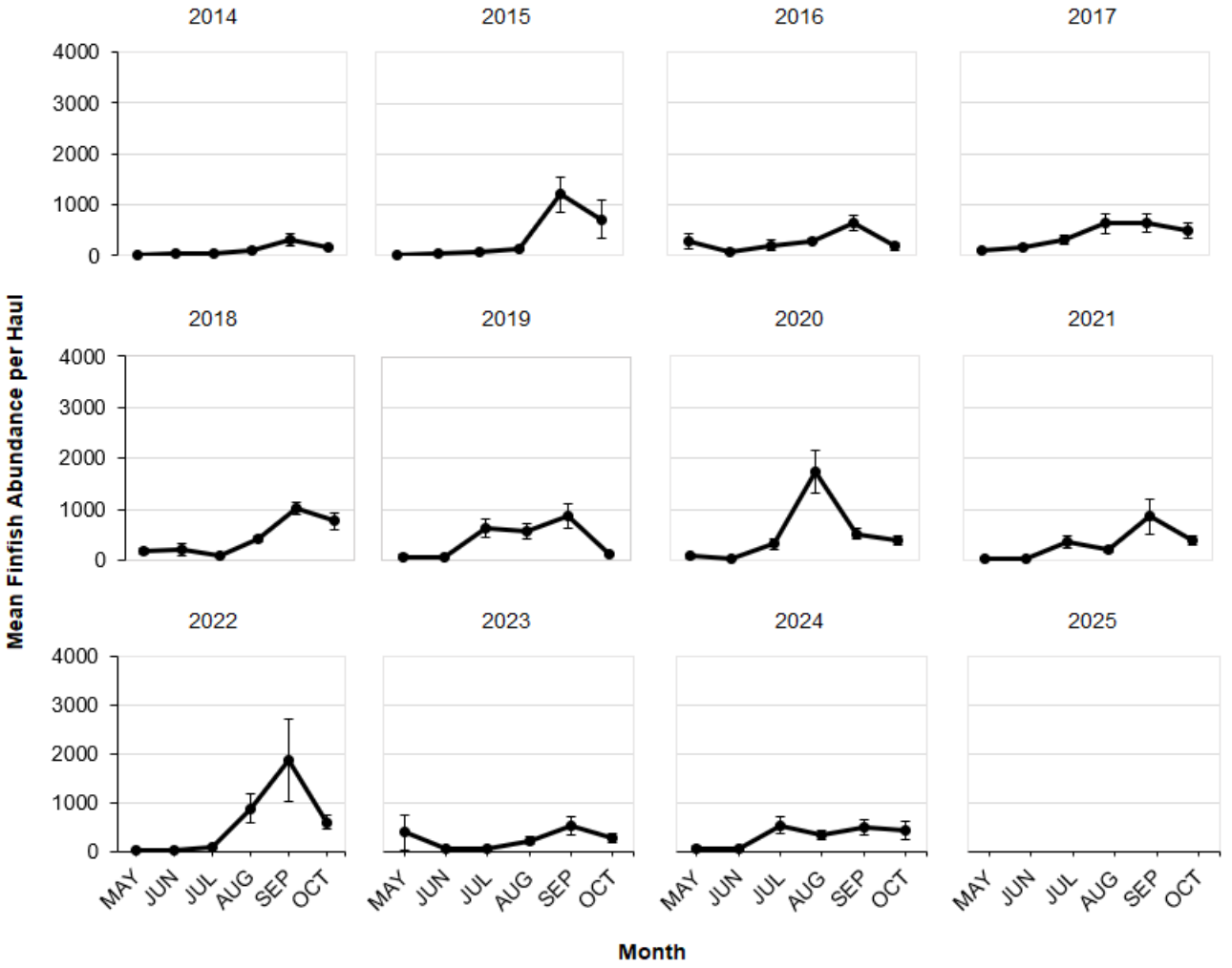


Figure 2. Mean abundance of finfish caught each month (± SE) in 2014-2024 beach seines.

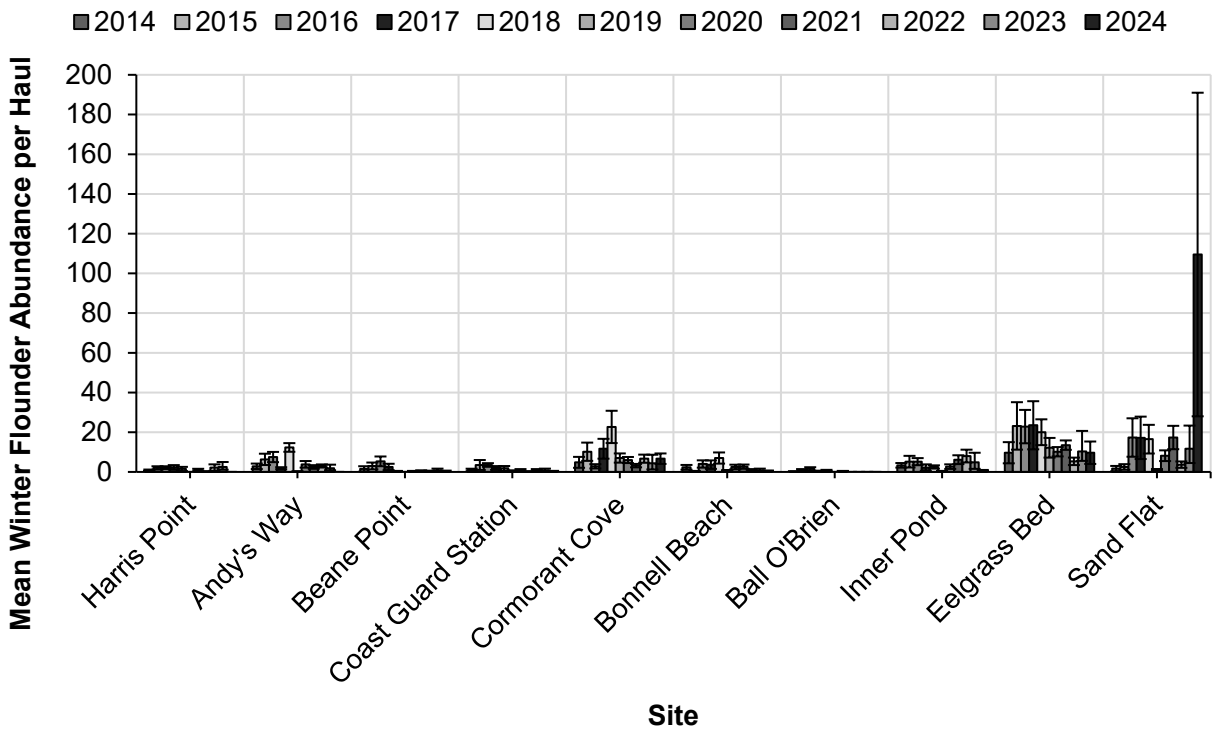


Figure 3a. Mean abundance of winter flounder caught by site (± SE) in 2014-2024 beach seines.

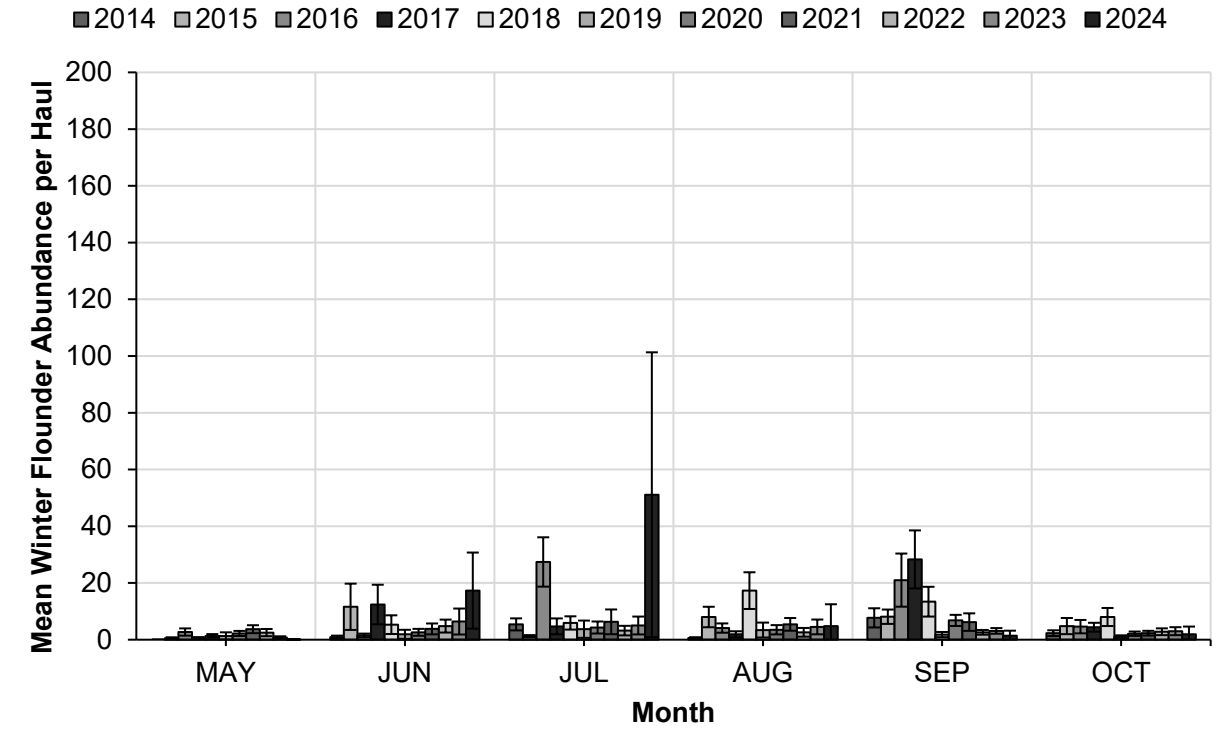


Figure 3b. Mean abundance of winter flounder caught by month (± SE) in 2014-2024 beach seines.

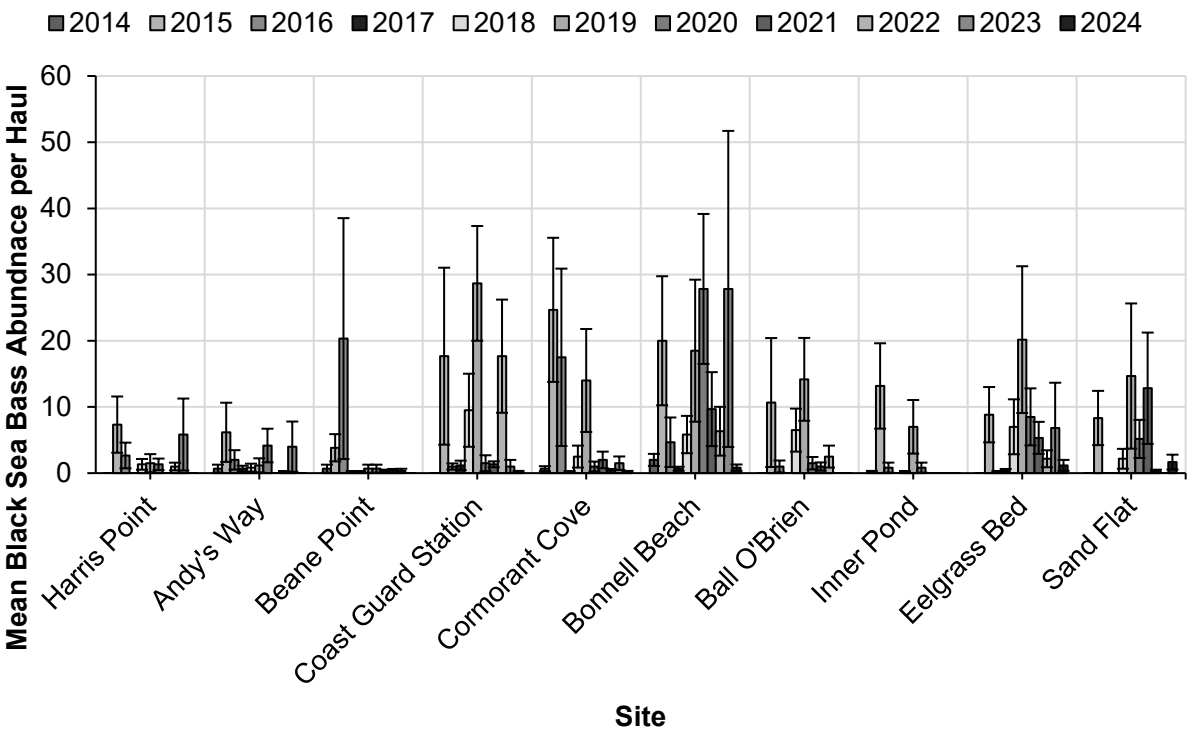


Figure 4a. Mean abundance of black sea bass caught by site (± SE) plotted for each month during the 2014-2024 field seasons.

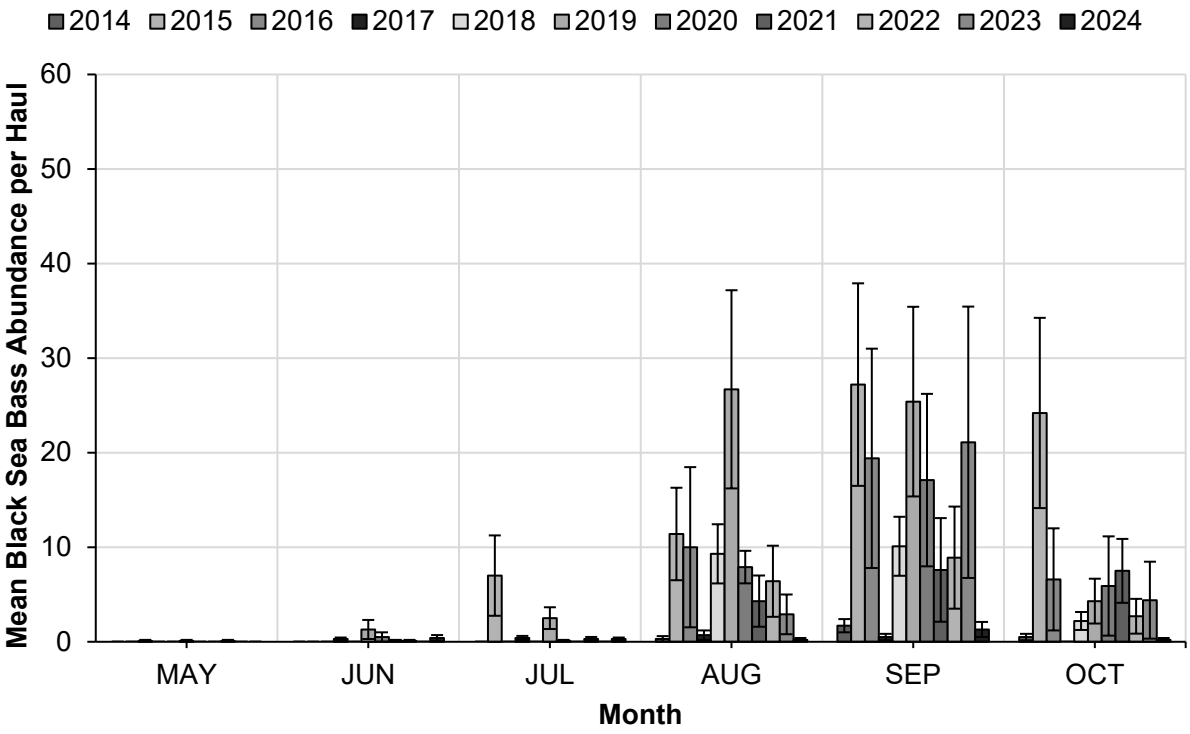


Figure 4b. Mean abundance of black sea bass caught by month (± SE) plotted for each month during the 2014-2024 field seasons.

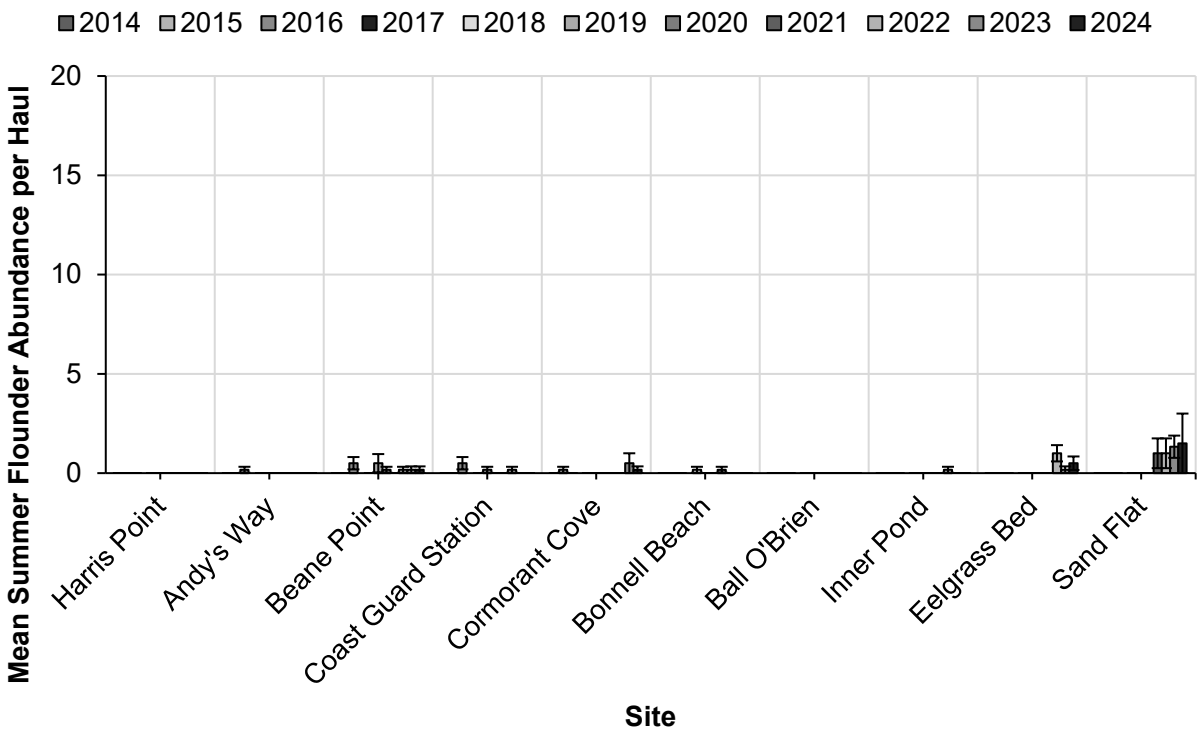


Figure 5a. Mean abundance of summer flounder caught by site (± SE) plotted for each month during the 2014-2024 field seasons.

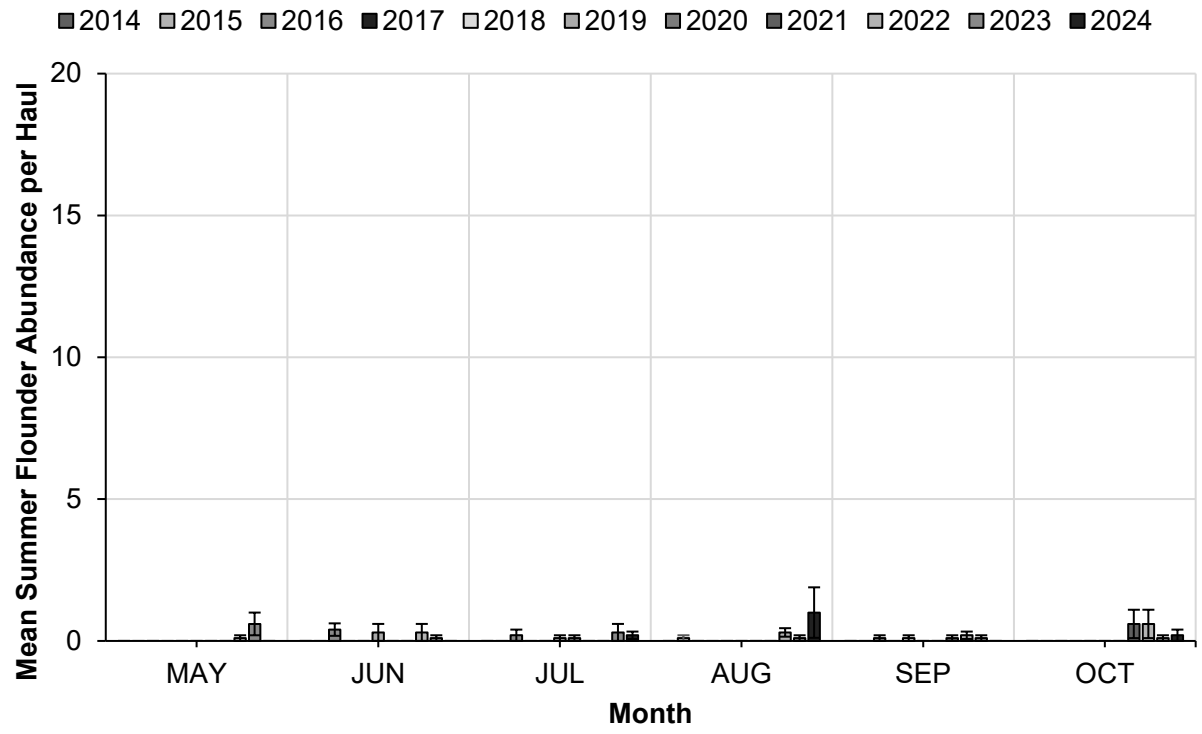


Figure 5b. Mean abundance of summer flounder caught by month (± SE) plotted for each month during the 2014-2024 field seasons.

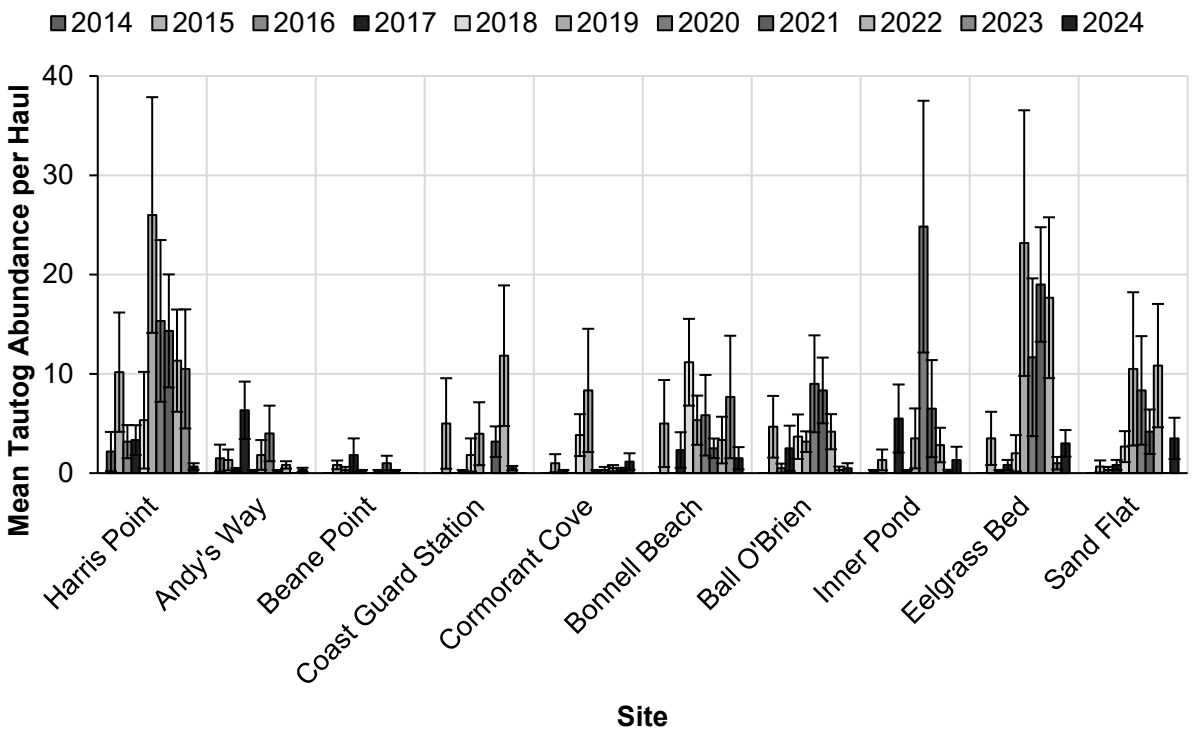


Figure 6a. Mean abundance of tautog caught by site (± SE) plotted for each month during the 2014-2024 field seasons.

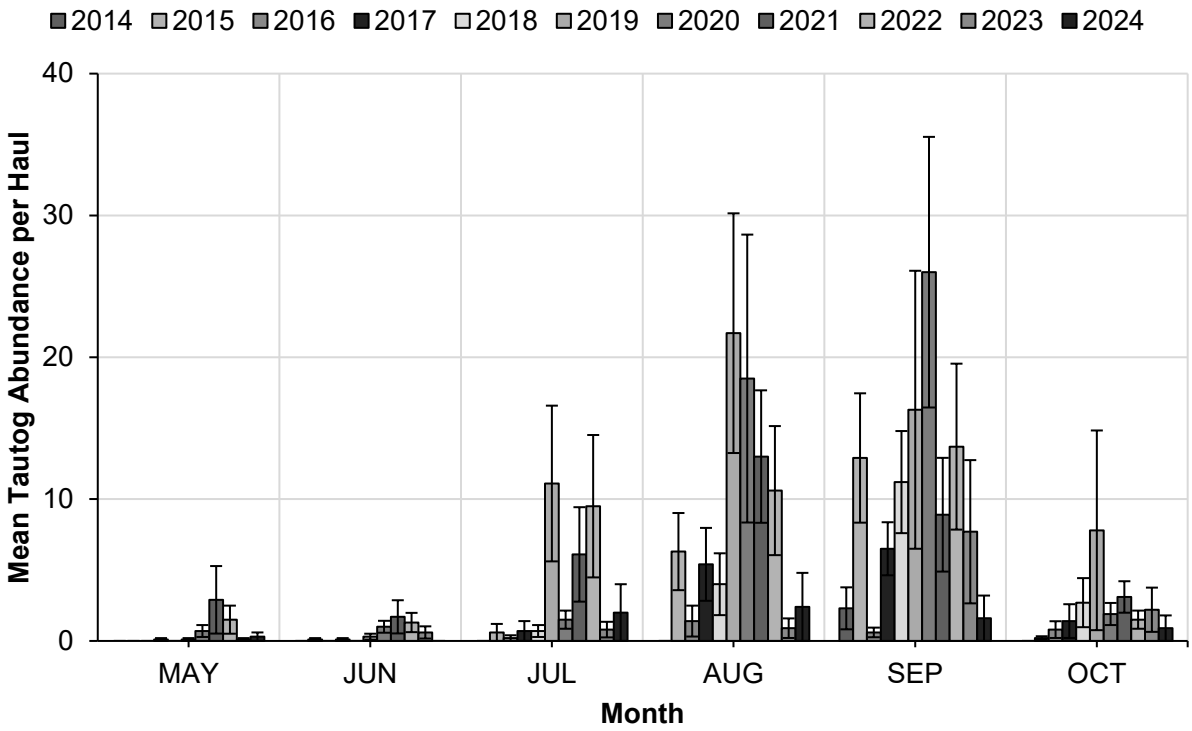


Figure 6b. Mean abundance of tautog caught by month (± SE) plotted for each month during the 2014-2024 field seasons.

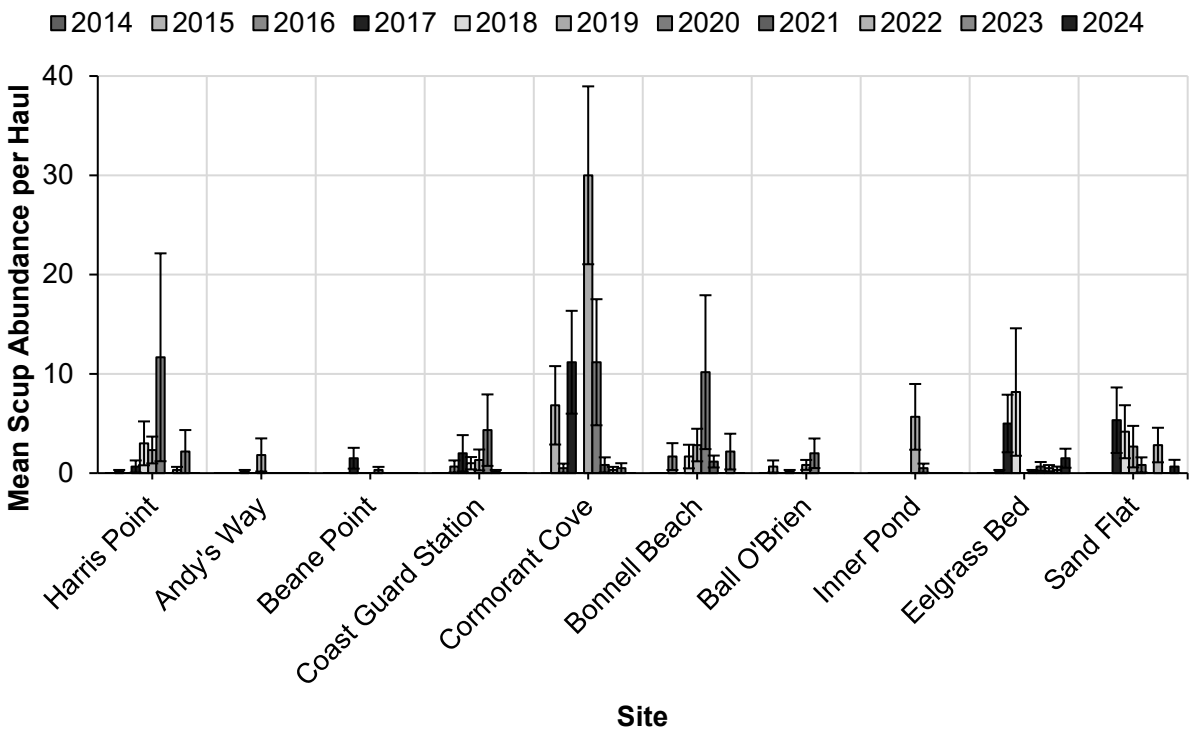


Figure 7a. Mean abundance of scup caught by site (± SE) plotted for each month during the 2014-2024 field seasons.

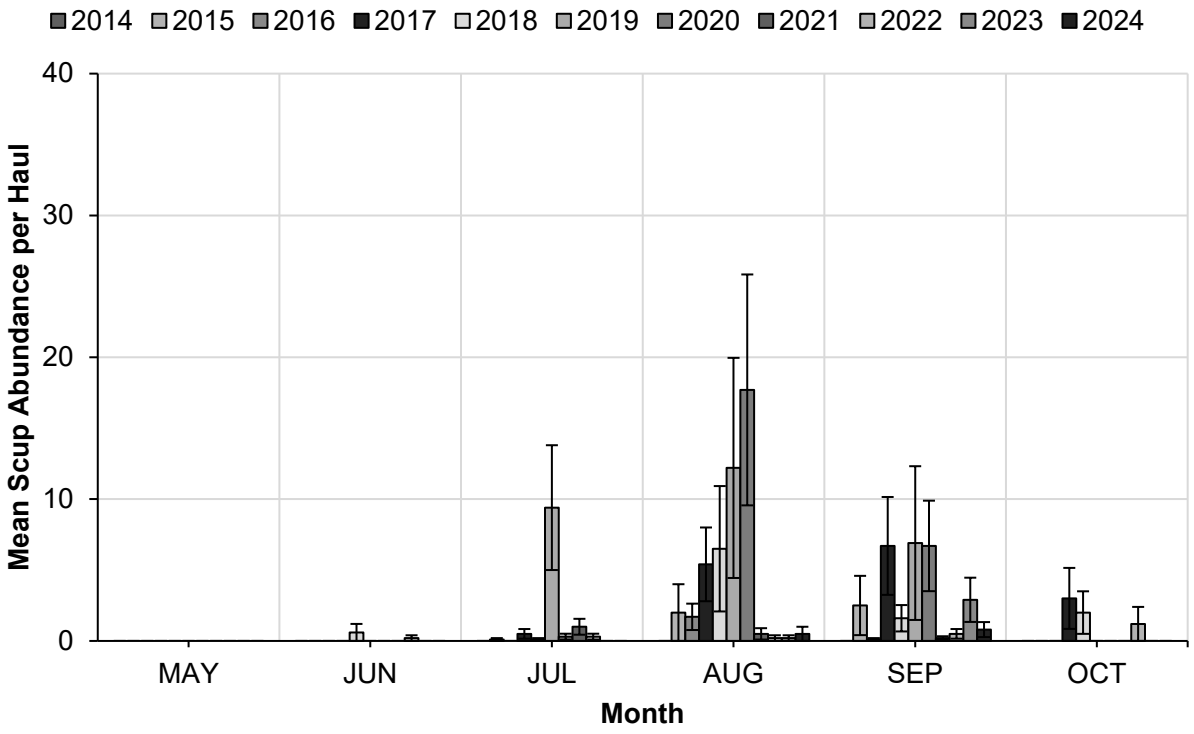


Figure 7b. Mean abundance of scup caught by month (± SE) plotted for each month during the 2014-2024 field seasons.

TABLES

Table 1. Scientific, common names, and total abundance of all species caught in beach seines during 2024.

Common Name	Scientific Name	Abundance
Atlantic Silverside	*Menidia menidia*	13964
Striped Killifish	*Fundulus majalis*	1913
Sheepshead Minnow	*Cyprinodon variegatus*	921
Winter Flounder	*Pseudopleuronectes americanus*	766
Mummichog	*Fundulus heteroclitus*	571
Bay Anchovy	*Anchoa mitchilli*	415
Green Crab	*Carcinus maenas*	413
White Mullet	*Mugil curema*	271
Northern Sennet	*Sphyraena borealis*	119
Atlantic Menhaden	*Brevoortia tyrannus*	82
Tautog	*Tautoga onitis*	72
Blue Crab	*Calinectes sapidus*	71
Rainwater Killifish	*Lucania parva*	57
Lady Crab	*Ovalipes ocellatus*	34
Pollock	*Pollachius virens*	26
Black Sea Bass	*Centropristis striata*	24
Silver Jenny	*Eucinostomus gula*	24
Northern Puffer	*Sphoeroides maculatus*	23
Mojarras spp.	*Gerreidae spp.*	21
Crevalle Jack	*Caranx hippos*	20
Striped Bass	*Morone saxatilis*	18
Cunner	*Tautogolabrus adspersus*	17
Longfin Squid	*Loligo pealei*	15
Summer Flounder	*Paralichthys dentatus*	14
Scup	*Stenotomus chrysops*	13
Pinfish	*Lagodon rhomboides*	12
Horseshoe Crab	*Limulus polyphemus*	11
Oyster Toadfish	*Opsanus tau*	11
Snakefish	*Trachinocephalus myops*	11
Spider Crab	*Libinia emarginata*	11
River Herring (Alewife & Blueback Herring)	*Alosa pseudoharengus & Alosa aestivalis*	10

Table 1. (continued)

Common Name	Scientific Name	Abundance
Northern Pipefish	*Syngnathus fuscus*	7
Chain Pipefish	*Syngnathus louisianae*	6
Grubby	*Myoxocephalus aenaeus*	6
Lined Seahorse	*Hippocampus erectus*	6
Short Bigeye	*Pristigenys alta*	6
Yellow Jack	*Caranx bartholomaei*	6
Horse-eye Jack	*Caranx latus*	5
Jonah Crab	*Cancer borealis*	5
Spotted Whiff	*Citharichthys macrops*	5
Gray Snapper	*Lutjanus griseus*	4
Lookdown	*Selene vomer*	4
Speckled Swimming Crab	*Arenaeus cribrarius*	4
American Sand Lance	*Ammodytes americanus*	3
Atlantic Cod	*Gadus morhua*	3
Sand Diver	*Synodus intermedius*	3
Bay Scallop	*Argopecten irradians*	2
Bluefish	*Pomatomus saltatrix*	2
Bluespotted Cornetfish	*Fistularia tabacaria*	2
Fourspine Stickleback	*Apeltes quadracus*	2
Fourspot Flounder	*Paralichthys oblongus*	2
Red Goatfish	*Mullus auratus*	2
Smooth Trunkfish	*Lactophrys triqueter*	2
Snowy Grouper	*Epinephelus niveatus*	2
Atlantic Croaker	*Micropogonias undulatus*	1
Bay Whiff	*Citharichthys spilopterus*	1
Fringed Filefish	*Monacanthus ciliatus*	1
Leopard Searobin	*Prionotus scitulus*	1
Naked Goby	*Gobiosoma bosc*	1
Northern Kingfish	*Menticirrhus saxatilis*	1
Permit	*Trachinotus falcatus*	1
Spotfin Butterflyfish	*Chaetodon ocellatus*	1
Threespine Stickleback	*Apeltes aculeatus*	1

Table 2. Water temperature, salinity, dissolved oxygen by site and month during the 2024 beach seines.

Site	Month	Temp. (°C)	Sal. (ppt)	DO (mg/L)	Site	Month	Temp. (°C)	Sal. (ppt)	DO (mg/L)
Harris Point	MAY	16.2	27.95	8.20	Cormorant Cove	MAY	16.0	29.04	8.38
	JUN	18.0	29.69	8.69		JUN	18.3	29.50	9.40
	JUL	26.2	30.01	7.22		JUL	24.2	29.88	7.27
	AUG	25.2	29.92	8.64		AUG	23.0	30.04	7.90
	SEP	21.1	30.38	9.37		SEP	19.9	30.73	7.69
	OCT	17.7	31.99	8.65		OCT	20.3	31.00	8.11
Andy's Way	MAY	17.0	28.34	7.85	Bonnell Beach	MAY	17.0	28.82	9.42
	JUN	17.9	30.80	7.56		JUN	18.7	29.43	9.84
	JUL	26.5	30.12	8.11		JUL	23.8	29.82	8.14
	AUG	27.0	29.85	7.99		AUG	23.3	29.69	8.95
	SEP	21.6	30.58	8.32		SEP	20.2	30.51	8.05
	OCT	19.7	31.25	7.87		OCT	18.7	31.17	7.92
Beane Point	MAY	16.0	28.56	8.55	Ball O'Brien	MAY	17.3	28.47	9.61
	JUN	17.6	29.48	8.73		JUN	19.3	29.28	9.98
	JUL	24.9	29.93	7.12		JUL	23.9	29.82	9.27
	AUG	23.5	29.40	8.03		AUG	24.3	29.99	10.00
	SEP	19.9	30.67	7.61		SEP	20.4	30.27	8.03
	OCT	19.5	30.99	7.77		OCT	18.7	31.12	7.74
Coast Guard	MAY	15.8	28.69	8.77	Inner Pond	MAY	14.6	26.92	8.63
	JUN	16.7	29.59	9.51		JUN	19.6	29.12	7.18
	JUL	24.2	29.89	8.96		JUL	27.1	29.91	9.65
	AUG	23.4	29.92	8.93		AUG	24.9	29.44	8.32
	SEP	20.9	30.64	8.15		SEP	21.2	30.68	8.05
	OCT	19.2	31.11	8.25		OCT	18.2	31.20	7.87
Eelgrass Bed	MAY	13.7	29.47	9.08	Sand Flat	MAY	14.3	30.20	8.39
	JUN	17.1	29.91	8.62		JUN	16.8	29.60	7.69
	JUL	22.4	30.42	9.00		JUL	21.9	30.33	7.85
	AUG	23.4	29.14	8.29		AUG	23.4	30.23	8.72
	SEP	20.6	30.87	10.14		SEP	21.5	30.88	11.48
	OCT	19.4	31.16	8.49		OCT	19.7	31.15	8.54

APPENDIX

Table 3a. Catch frequency of all species by site for the 2024 Block Island seine survey.

Species	Harris Point	Andy's Way	Beane Point	Coast Guard	Cormorant Cove	Bonnell Beach	Ball O'Brien	Inner Pond	Eelgrass Bed	Sand Flat	
American Sand Lance			2			1					3
Atlantic Cod									3		3
Atlantic Croaker						1					1
Atlantic Menhaden			5	6						71	82
Atlantic Silverside	1660	4317	1572	841	525	843	436	804	1385	1581	13964
Bay Anchovy	393							22			415
Bay Scallop				1	1						2
Bay Whiff			1								1
Black Sea Bass				1	1	5			7	10	24
Blue Crab	6	2		1	1			8	11	42	71
Bluefish					1					1	2
Bluespotted Cornetfish				1	1						2
Chain Pipefish	3					2	1				6
Crevalle Jack									15	5	20
Cunner	6				1	4	2		4		17
Fourspine Stickleback								2			2
Fourspot Flounder			2								2
Fringed Filefish			1								1
Gray Snapper		1				1			2		4
Green Crab	5	5	11	24	31	18	87	15	47	170	413
Grubby	1					4				1	6
Horse-eye Jack									5		5
Horseshoe Crab		9	1	1							11
Jonah Crab			1	1	1		2				5
Lady Crab	3	2	6		3	20					34
Leopard Searobin						1					1
Lined Seahorse				1	4	1					6
Longfin Squid		12			3						15
Lookdown										4	4
Mojarras spp.	1					18		1		1	21
Mummichog	156	17	90	15	9	45	19	218	2		571
Naked Goby		1									1
Northern Kingfish		1									1
Northern Pipefish	1					1			1	4	7
Northern Puffer				5	7	9				2	23
Northern Sennet	12	7	29	1	2	6	1	30	28	3	119
Oyster Toadfish								11			11
Permit		1									1
Pinfish							1		11		12
Pollock									26		26
Rainwater Killifish	5	3	13			2		34			57
Red Goatfish									2		2
River Herring: Alewife & Blueback Herring							4	6			10
Sand Diver			3								3
Scup									9	4	13
Sheepshead Minnow	17	896	7				1				921
Short Bigeye			1						2	3	6
Silver Jenny	24										24
Smooth Trunkfish		1							1		2
Snakefish			11								11
Snowy Grouper			2								2
Speckled Swimming Crab		2	2								4
Spider Crab	1	1	1		5	1	1			1	11
Spotfin Butterflyfish									1		1
Spotted Whiff			5								5
Striped Bass								18			18
Striped Killifish	149	676	332	34	108	18	1	595			1913
Summer Flounder			1		1				3	9	14
Tautog	4	2			7	9	11		18	21	72
Threespine Stickleback								1			1
White Mullet		3	3	16					94	155	271
Winter Flounder			2	2	40	3		3	59	657	766
Yellow Jack									5	1	6

APPENDIX

Table 4a. Species presence by site for May 2024 beach seines.

MAY	Site										
Species	Harris Point	Andy's Way	Beane Point	Coast Guard	Cormorant Cove	Bonnell Beach	Ball O'Brien	Inner Pond	Eelgrass Bed	Sand Flat	**Total**
American Sand Lance						1					**1**
Atlantic Silverside	1	1	1			1	1	1			**6**
Blue Crab								1			**1**
Cunner							1				**1**
Green Crab			1	1		1	1	1	1	1	**7**
Horseshoe Crab		1	1								**2**
Jonah Crab			1	1							**2**
Pollock									1		**1**
Striped Killifish		1									**1**
Tautog							1				**1**
Threespine Stickleback								1			**1**
Winter Flounder									1		**1**

APPENDIX

Table 4b. Species by site for June 2024 beach seines.

JUN	Site										
Species	Harris Point	Andy's Way	Beane Point	Coast Guard	Cormorant Cove	Bonnell Beach	Ball O'Brien	Inner Pond	Eelgrass Bed	Sand Flat	**Total**
American Sand Lance			1								**1**
Atlantic Silverside	1	1	1	1		1		1	1		**7**
Bay Scallop				1							**1**
Bay Whiff			1								**1**
Black Sea Bass				1		1					**2**
Blue Crab									1		**1**
Green Crab	1	1	1	1	1		1		1	1	**8**
Horseshoe Crab				1							**1**
Jonah Crab					1						**1**
Lady Crab						1					**1**
Mummichog	1						1	1			**3**
Rainwater Killifish								1			**1**
Spider Crab							1				**1**
Striped Killifish		1		1				1			**3**
Winter Flounder					1				1	1	**3**

APPENDIX

Table 4c. Species presence by site for July 2024 beach seines.

JUL	Site										
Species	Harris Point	Andy's Way	Beane Point	Coast Guard	Cormorant Cove	Bonnell Beach	Ball O'Brien	Inner Pond	Eelgrass Bed	Sand Flat	**Total**
Alewife							1	1			**2**
Atlantic Silverside	1	1	1	1	1	1	1	1	1	1	**10**
Bay Anchovy	1							1			**2**
Bay Scallop					1						**1**
Black Sea Bass					1	1				1	**3**
Blue Crab	1			1	1			1		1	**5**
Blueback Herring								1			**1**
Chain Pipefish	1						1				**2**
Crevalle Jack									1	1	**2**
Cunner	1				1				1		**3**
Fourspine Stickleback								1			**1**
Green Crab	1	1	1	1	1	1	1	1	1	1	**10**
Lady Crab			1		1	1					**3**
Leopard Searobin						1					**1**
Longfin Squid		1									**1**
Mummichog	1	1				1		1			**4**
Naked Goby		1									**1**
Northern Pipefish									1	1	**2**
Northern Puffer						1				1	**2**
Northern Sennet	1	1	1	1	1	1	1	1	1		**9**
Pinfish							1		1		**2**
Rainwater Killifish	1							1			**2**
Red Goatfish									1		**1**
Short Bigeye			1								**1**
Snowy Grouper			1								**1**
Spider Crab			1		1						**2**
Spotted Whiff			1								**1**
Striped Killifish	1	1		1	1			1			**5**
Summer Flounder			1		1						**2**
Tautog	1				1	1	1		1	1	**6**
Winter Flounder			1		1	1				1	**4**

APPENDIX

Table 4d. Species presence by site for August 2024 beach seines.

AUG	Site										
Species	Harris Point	Andy's Way	Beane Point	Coast Guard	Cormorant Cove	Bonnell Beach	Ball O'Brien	Inner Pond	Eelgrass Bed	Sand Flat	**Total**
Atlantic Croaker						1					**1**
Atlantic Menhaden			1								**1**
Atlantic Silverside	1	1	1	1	1	1	1	1	1	1	**10**
Black Sea Bass										1	**1**
Blue Crab	1	1							1	1	**4**
Chain Pipefish						1					**1**
Cunner						1			1		**2**
Fourspot Flounder			1								**1**
Fringed Filefish			1								**1**
Gray Snapper		1							1		**2**
Green Crab		1	1	1	1	1	1		1	1	**8**
Grubby						1				1	**2**
Horse-eye Jack									1		**1**
Lady Crab		1	1			1					**3**
Lined Seahorse				1	1						**2**
Lookdown										1	**1**
Mojarras spp.	1					1				1	**3**
Mummichog	1	1	1	1	1	1		1	1		**8**
Northern Kingfish		1									**1**
Northern Pipefish	1									1	**2**
Northern Puffer				1	1	1					**3**
Northern Sennet		1			1	1				1	**4**
Permit		1									**1**
Rainwater Killifish	1	1	1			1					**4**
Red Goatfish									1		**1**
Sand Diver			1								**1**
Scup									1		**1**
Sheepshead Minnow		1									**1**
Short Bigeye									1	1	**2**
Smooth Trunkfish		1							1		**2**
Snakefish			1								**1**
Speckled Swimming Crab		1									**1**
Spider Crab										1	**1**
Striped Killifish	1	1	1	1	1		1				**6**
Summer Flounder									1	1	**2**
Tautog		1			1	1			1	1	**5**
White Mullet		1	1						1	1	**4**
Winter Flounder					1	1			1	1	**4**
Yellow Jack									1	1	**2**

APPENDIX

Table 4e. Species presence by site for September 2024 beach seines.

SEP	Site										
Species	Harris Point	Andy's Way	Beane Point	Coast Guard	Cormorant Cove	Bonnell Beach	Ball O'Brien	Inner Pond	Eelgrass Bed	Sand Flat	**Total**
Atlantic Menhaden				1							**1**
Atlantic Silverside	1	1	1	1	1	1	1	1	1	1	**10**
Black Sea Bass						1			1	1	**3**
Blue Crab								1	1	1	**3**
Bluefish					1					1	**2**
Bluespotted Cornetfish				1							**1**
Chain Pipefish						1					**1**
Gray Snapper						1					**1**
Green Crab	1	1		1		1	1	1	1	1	**8**
Grubby						1					**1**
Lady Crab						1					**1**
Lined Seahorse					1	1					**2**
Lookdown										1	**1**
Mojarras spp.						1		1			**2**
Mummichog	1	1	1	1	1	1	1		1		**8**
Northern Pipefish						1					**1**
Northern Puffer				1							**1**
Northern Sennet						1					**1**
Oyster Toadfish								1			**1**
Scup									1	1	**2**
Sheepshead Minnow		1									**1**
Short Bigeye										1	**1**
Snakefish			1								**1**
Speckled Swimming Crab			1								**1**
Spotfin Butterflyfish									1		**1**
Striped Killifish	1	1	1	1	1	1					**6**
Tautog	1					1			1	1	**4**
White Mullet				1					1	1	**3**
Winter Flounder				1	1	1		1	1	1	**6**

APPENDIX

Table 4f. Species presence by site for October 2024 beach seines.

OCT	Site										
Species	Harris Point	Andy's Way	Beane Point	Coast Guard	Cormorant Cove	Bonnell Beach	Ball O'Brien	Inner Pond	Eelgrass Bed	Sand Flat	**Total**
Atlantic Cod									1		**1**
Atlantic Menhaden										1	**1**
Atlantic Silverside	1	1	1	1	1	1	1		1	1	**9**
Bay Anchovy	1										**1**
Black Sea Bass									1		**1**
Blue Crab		1							1	1	**3**
Bluespotted Cornetfish					1						**1**
Cunner	1						1		1		**3**
Green Crab	1	1		1			1		1	1	**6**
Grubby	1										**1**
Jonah Crab							1				**1**
Lady Crab	1	1			1						**3**
Lined Seahorse					1						**1**
Longfin Squid					1						**1**
Mummichog	1	1	1		1		1				**5**
Oyster Toadfish								1			**1**
Sheepshead Minnow	1	1	1				1				**4**
Silver Jenny	1										**1**
Spider Crab	1	1				1					**3**
Striped Bass								1			**1**
Striped Killifish	1	1	1	1	1	1					**6**
Summer Flounder									1		**1**
Tautog	1	1							1		**3**
White Mullet									1		**1**
Winter Flounder				1	1			1	1	1	**5**

APPENDIX

Table 5a. Abundances of winter flounder in 2024 beach seines.

Winter Flounder

Month	Harris Point	Andy's Way	Beane Point	Coast Guard Station	Cormorant Cove	Bonnell Beach	Ball O'Brien	Inner Pond	Eelgrass Bed	Sand Flat	Mean	SD	SE	Total
	Site													
MAY	0	0	0	0	0	0	0	1	0	0	0.10	0.32	0.10	1
JUN	0	0	0	0	4	0	0	0	35	134	17.30	42.43	13.42	173
JUL	0	0	2	0	5	1	0	0	0	503	51.10	158.79	50.21	511
AUG	0	0	0	0	19	1	0	0	16	12	4.80	7.69	2.43	48
SEP	0	0	0	1	5	1	0	2	1	4	1.40	1.78	0.56	14
OCT	0	0	0	1	7	0	0	1	6	4	1.90	2.73	0.86	19
Mean	0.00	0.00	0.33	0.33	6.67	0.50	0.00	0.67	9.67	109.50				
SD	0.00	0.00	0.82	0.52	6.47	0.55	0.00	0.82	13.84	199.60		**Total Fish**		
SE	0.00	0.00	0.33	0.21	2.64	0.22	0.00	0.33	5.65	81.49		**766**		
Total	0	0	2	2	40	3	0	4	58	657				

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Table 5b. Abundances of summer flounder in 2024 beach seines.

Summer Flounder

Month	Harris Point	Andy's Way	Beane Point	Coast Guard Station	Cormorant Cove	Bonnell Beach	Ball O'Brien	Inner Pond	Eelgrass Bed	Sand Flat	Mean	SD	SE	Total
MAY	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0
JUN	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0
JUL	0	0	1	0	1	0	0	0	0	0	0.20	0.42	0.13	2
AUG	0	0	0	0	0	0	0	0	1	9	1.00	2.83	0.89	10
SEP	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0
OCT	0	0	0	0	0	0	0	0	2	0	0.20	0.63	0.20	2
Mean	0.00	0.00	0.17	0.00	0.17	0.00	0.00	0.00	0.50	1.50				
SD	0.00	0.00	0.41	0.00	0.41	0.00	0.00	0.00	0.84	3.67		**Total Fish**		
SE	0.00	0.00	0.17	0.00	0.17	0.00	0.00	0.00	0.34	1.50		**14**		
Total	0	0	1	0	1	0	0	0	3	9				

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Table 5c. Abundances of black sea bass in 2024 beach seines.

Black Sea Bass

Month	Harris Point	Andy's Way	Beane Point	Coast Guard Station	Cormorant Cove	Bonnell Beach	Ball O'Brien	Inner Pond	Eelgrass Bed	Sand Flat	Mean	SD	SE	Total
	Site													
MAY	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0
JUN	0	0	0	1	0	3	0	0	0	0	0.40	0.97	0.31	4
JUL	0	0	0	0	1	1	0	0	0	1	0.30	0.48	0.15	3
AUG	0	0	0	0	0	0	0	0	0	2	0.20	0.63	0.20	2
SEP	0	0	0	0	0	1	0	0	5	7	1.30	2.54	0.80	13
OCT	0	0	0	0	0	0	0	0	2	0	0.20	0.63	0.20	2
Mean	0.00	0.00	0.00	0.17	0.17	0.83	0.00	0.00	1.17	1.67				
SD	0.00	0.00	0.00	0.41	0.41	1.17	0.00	0.00	2.04	2.73		**Total Fish**		
SE	0.00	0.00	0.00	0.17	0.17	0.48	0.00	0.00	0.83	1.12		**24**		
Total	0	0	0	1	1	5	0	0	7	10				

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Table 5d. Abundances of scup in 2024 beach seines.

Scup

Month	Harris Point	Andy's Way	Beane Point	Coast Guard Station	Cormorant Cove	Bonnell Beach	Ball O'Brien	Inner Pond	Eelgrass Bed	Sand Flat	Mean	SD	SE	Total
MAY	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0
JUN	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0
JUL	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0
AUG	0	0	0	0	0	0	0	0	5	0	0.50	1.58	0.50	5
SEP	0	0	0	0	0	0	0	0	4	4	0.80	1.69	0.53	8
OCT	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0
Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	0.67				
SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.35	1.63		**Total Fish**		
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.96	0.67		**13**		
Total	0	0	0	0	0	0	0	0	9	4				

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Table 5e. Abundances of tautog in 2024 beach seines.

Tautog

Month	Harris Point	Andy's Way	Beane Point	Coast Guard Station	Cormorant Cove	Bonnell Beach	Ball O'Brien	Inner Pond	Eelgrass Bed	Sand Flat	Mean	SD	SE	Total
MAY	0	0	0	0	0	0	3	0	0	0	0.30	0.95	0.30	3
JUN	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0
JUL	2	0	0	0	5	1	0	8	1	3	2.00	2.67	0.84	20
AUG	0	1	0	0	2	1	0	0	7	13	2.40	4.30	1.36	24
SEP	1	0	0	0	0	7	0	0	3	5	1.60	2.55	0.81	16
OCT	1	1	0	0	0	0	0	0	7	0	0.90	2.18	0.69	9
Mean	0.67	0.33	0.00	0.00	1.17	1.50	0.50	1.33	3.00	3.50				
SD	0.82	0.52	0.00	0.00	2.04	2.74	1.22	3.27	3.29	5.09		**Total Fish**		
SE	0.33	0.21	0.00	0.00	0.83	1.12	0.50	1.33	1.34	2.08		**72**		
Total	4	2	0	0	7	9	3	8	18	21				

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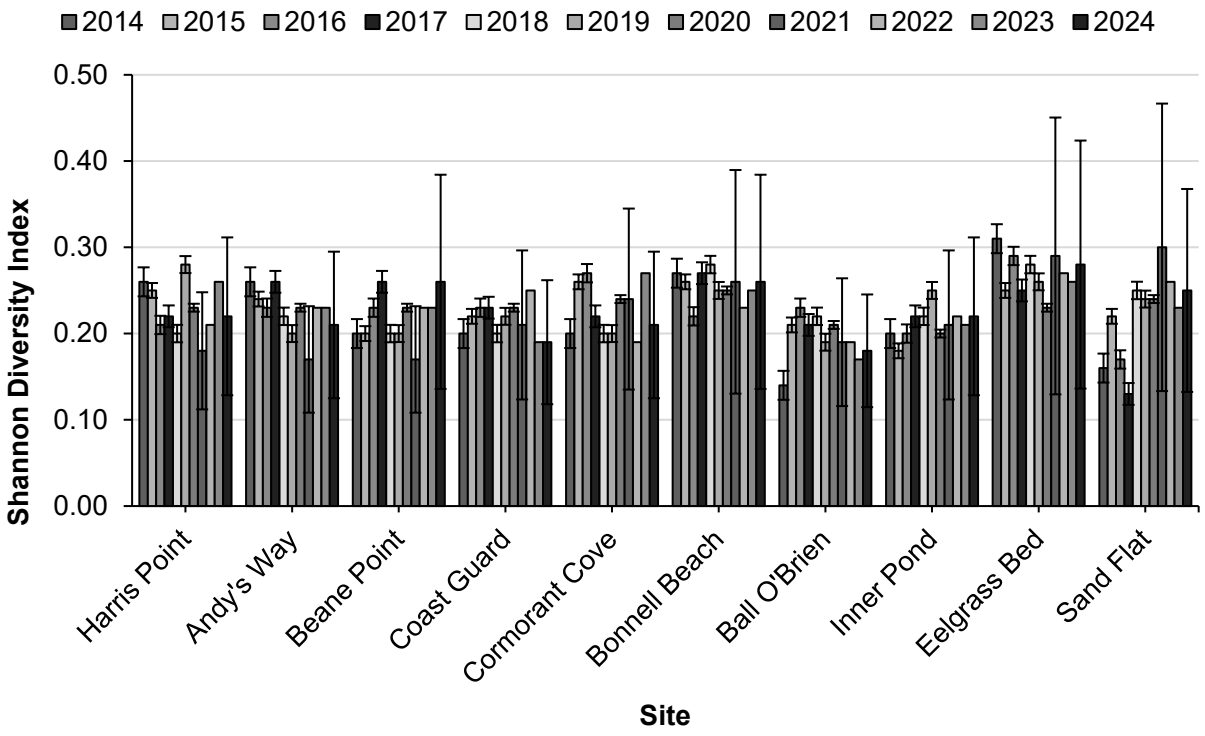


Figure 4. Mean Shannon diversity across sites in 2014-2024 beach seines.

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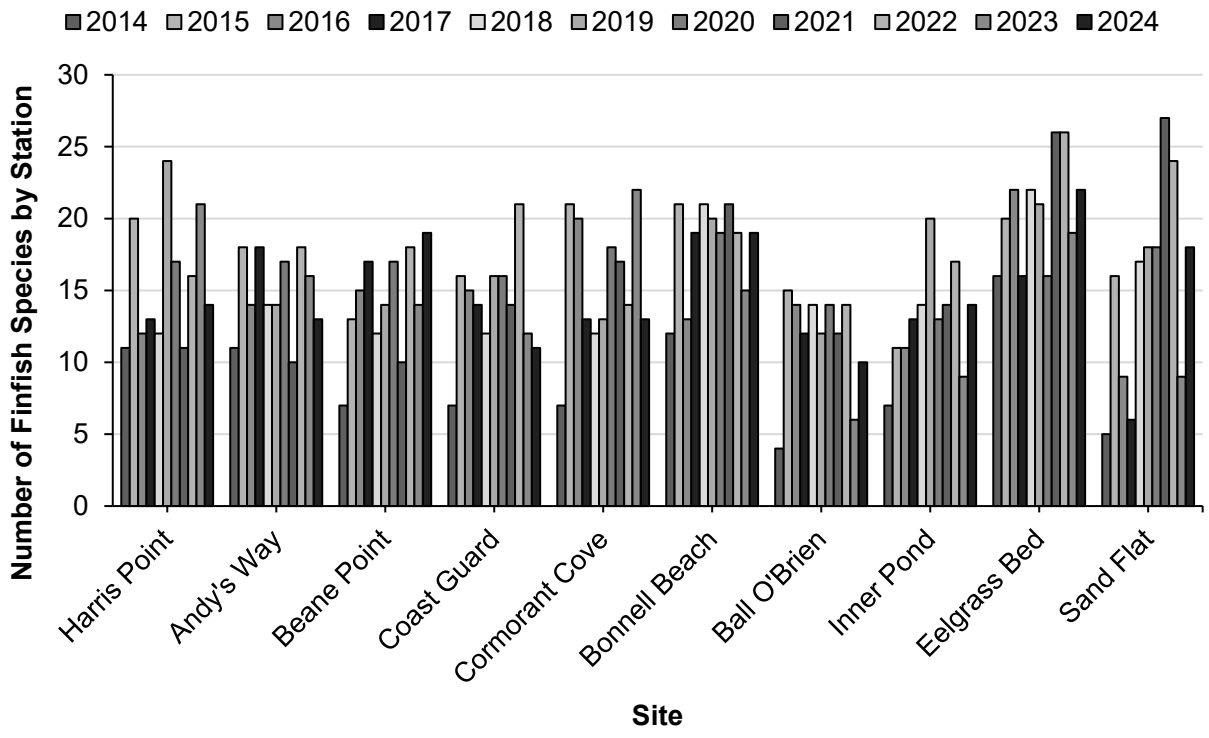


Figure 5. Cumulative number of finfish species by site in 2014-2024 beach seines.

ASSESSMENT OF RECREATIONALLY IMPORTANT FINFISH STOCKS IN RHODE ISLAND WATERS

NARRAGANSETT BAY JUVENILE FINFISH SURVEY

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2024

PERFORMANCE REPORT

STATE: Rhode Island **PROJECT NUMBER:** F-61-R
SEGMENT NUMBER: 24

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

PERIOD COVERED: 1 January 2020 - 31 December 2024

JOB NUMBER AND TITLE: IV - Juvenile Marine Finfish Survey

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

SUMMARY: Eighteen fixed stations (Figure 1) around Narragansett Bay were sampled once a month from June through October during 2020-2024 with the standard 61 x 3.05 m beach seine. Adults and juveniles of sixty species were collected during the 2024 survey, which is a decrease from the 2023 survey (77 species) and the lowest over the past five years. For comparison eighty species were collected in 2015, the highest number of species and families collected since the survey began. For the entire survey time series (1988 – 2024), all individuals of the target species: winter flounder, tautog, bluefish, weakfish, black sea bass, striped bass, scup, river herring, sea herring, and menhaden were enumerated and measured. With few exceptions (noted) all individuals of these species that were collected in the survey were juveniles. Adult and juveniles of other species collected were not differentiated for data analysis or descriptive purposes prior to 2009. Presence and relative abundance (few, many, abundant) of three forage species: Atlantic silversides (*Menidia menidia*), common mummichog (*Fundulus heteroclitus*) and striped killifish (*Fundulus majalis*) had been noted until 2009. Since 2009 all finfish species caught were enumerated and measured. Invertebrate species were noted and enumerated using the relative abundance scale as noted above (with the exception of blue crabs, lady crabs, horseshoe crabs and squid). Data on weather, water temperature, salinity, and dissolved oxygen were recorded at each station.

TARGET DATE: December 2024

SIGNIFICANT DEVIATIONS: There were no significant deviations to methodology in 2024. A new net was purchased in 2023 and was used during the June through October months of the survey.

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.

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

A non-parametric Mann-Kendall test for trend significance can be used to show annual abundance trends for species collected during this juvenile survey. Two iterations of this test were run on for a set of target species. The first iteration analyzed the entire dataset and then a second iteration of this non- parametric trend analysis was done using a shortened time period of 10 years. While most of the target species do not have any significant long-term trend, winter flounder (p = 3.434e-6) is showing a decreasing trend (Table 1a). None of the target species had a trend in the shortened 10-year analysis (Table 1b). Bluefish, Menhaden, River Herring, Tautog and Striped Bass show no abundance trend for either the full dataset or the past ten years (Table 1a, b).

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

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

METHODS, RESULTS & DISCUSSION: A 61m x 3.05m beach seine, deployed from a 22' 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 2020 - 2024.

Number of individuals and lengths were recorded for all finfish species. While both juveniles and adults were represented in the collections for many species, individuals collected for the target species were predominately young-of-the-year juveniles (YOY). Species and number of individuals (both juveniles and adults) of invertebrate species collected were also recorded with the use of a relative index of abundance (abundant, many, few). Tables 3 - 7 show the species occurrence and number caught at each station for June through October. Table 8 is a summary table for all stations and species collected during the 2024 survey. Tables 9-13 provide the number of fish/seine haul for each station along with the station mean, monthly mean, and annual abundance index for each target species. Figures 2 – 10 show the annual abundance index trends for a number of important species for both the original and standardized indices. It should be noted when interpreting these data, that the survey began in 1986 with fifteen stations. The data represented in the graphs begins in 1988 as the period of time when the survey began using consistent methodology with the 15 stations. Station 16 (Dyer Is.) was added in June 1990, station 17 (Warren R.) was added in July of 1993, and station 18 (Wickford) was added in July of 1995. The addition of the stations is standardized in the analysis, see appendix A.

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

Winter flounder

Juvenile winter flounder (*Pseudopleuronectes americanus*) were present in eighteen percent of the seine hauls for 2024. This is a decrease from 2023 when they were present in thirty percent of the hauls and the lowest over the past five years of the survey. A total of 27 fish were collected in 2024 (all of the fish collected in 2024 would be considered young-of-the-year (YOY) according to Table 2 winter flounder maximum size by month). This is a decrease from the 217 individuals collected during the 2023 survey and the lowest over the past five years. They were present at ten of the eighteen stations and were collected in all months (Table 9).

The 2024 juvenile winter flounder standardized abundance index was 0.30 ± 0.24 fish/seine haul; this is less than the 2023 index of was 2.41 ± 1.33 S.E. fish/seine haul and the lowest over the last five years of the survey. Figure 2 shows the standardized annual abundance indices since 1988. The Mann-Kendall test showed a significant decreasing abundance trend for this species for the full dataset, but no short-term trend in the last 10 years (Table 1a, b).

September 2024 had the highest mean monthly abundance of 0.44 ± 0.25 S.E. fish/seine haul. Hog Island (Sta. 9), Warren River (Sta. 17), and Patience Island (Sta. 5) had the highest mean station abundances of 1.40 ± 0.75, 1.20 ± 0.58 S.E., and 0.80 ± 0.80 S.E., respectively. Overall, upper and mid bay stations continue to have higher abundances than lower bay stations. This is expected since the primary spawning area for this species is believed to be in the Providence River followed by a secondary spawning area in Greenwich Bay where Station 3 is located.

Winter flounder length frequency data from the 2024 survey indicate that all of the winter flounder collected were young-of-the-year (YOY). The maximum lengths by month for YOY winter flounder used for this report are supported by growth rates in Rhode Island waters as

reported in the literature (Delong et al, 2001; Meng et al, 2000; Meng et al, 2001; Meng et al, 2008). See Table 2 for maximum YOY lengths by month.

Figure 2 shows the 2024 abundance index continues to be lower than most years since 2000, the survey high. The Division of Marine Fisheries' trawl survey data (sampling both adults and juveniles) saw a slight increase in winter flounder from 2020 to 2021. Over the course of the Narragansett Bay Juvenile Finfish Seine Survey the abundance index rose between 1995 and 2000, but then decreased with variability to 2018. The Mann-Kendall trend analysis shows a decreasing trend in the abundance of juvenile winter flounder in Narragansett Bay over the entire time series, and no trend indicated for the shortened 10-year time series in the terminal year of 2012 has dissipated, now showing no trend as we move away from the peak years of the early 2000's. The dramatic abundance fluctuations over the past ten years shown in Figure 2 and the declining trend over the last decade continue to be a concern to resource managers.

Tautog

During the 2024 survey 282 juvenile and 2 adult (>26 cm length) tautog (*Tautoga onitis*) were collected. This is a slight increase from the 2023 survey when 277 juveniles and 5 adults were collected. The 2024 abundance index was 3.13 ± 0.33 S.E. fish/seine haul, an increase from the 2023 index 3.07 ± 1.03 S.E. (Figure 3). As indicated in the introduction, based on this survey data, it can be concluded that the spawning closure enacted in 2006 and then extended in 2010 may be having an impact on the number of juveniles produced during the spring as there appears to be an increasing trend since this time period. It may take some time for a slow growing species such as tautog to recoup its spawning stock biomass to levels that will have significant impacts and major increases in biomass; therefore, we will continue to monitor this species closely in the coming years.

Juvenile tautog were collected in forty-seven percent of the seine hauls in 2024 (Table 10). This is a decrease from 2023 when they were present in fifty-five percent of the seine hauls. August and September had the highest mean monthly abundances of 7.67 ± 0.3 S.E. and 4.72 ± 0.47 S.E. fish per seine haul, which corresponds to the majority of the survey time series data which indicates August as being the month with the highest abundance. Hog Island (Sta. 9) had the highest mean station abundance of 16.60 ± 9.16 S.E. which was driven by higher sampling numbers in July, August, and September (14, 19, and 50 total fish respectively) when there was a large amount of seaweed accumulated at the sampling station, which provided preferred habitat to many juvenile finfish. Dyer Island (Sta. 16) and Spectacle Cove (Sta. 13) had the next highest abundances with a mean station abundance of 11.40 ± 7.76 S.E. and 5.80 ± 3.29 S.E. fish/seine haul respectively. The Mann-Kendall test showed no long-term or short-term (10-year time series) trend in juvenile abundance (Table 1a, b). It should be noted that this survey data was used as a young of the year index for the benchmark stock assessment for tautog by the Atlantic States Marine Fisheries Commission (ASMFC 2016).

Our Narragansett Bay trawl survey had an increase in biomass and abundance for tautog from 2020 to 2021. There would be a lag in time between when juveniles are caught in the seine survey and when the cohort shows up in the trawl survey, but the trends are worth monitoring.

Bluefish

During the 2024 survey 508 juvenile bluefish (*Pomatomus saltatrix*) were collected. This is a slight increase from the 389 juveniles collected in 2023 and the highest collected in 2021 over the past five years. Juveniles were present in twenty-eight percent of the seine hauls and were collected at fourteen of the eighteen stations (Table 11). They were present in July through September, with the highest abundance occurring in September. June 2024 had zero juvenile bluefish collected during the survey, which is most likely due to the colder water temperatures (18.3 – 22.6° C in June). Since this survey began and prior to 2016, only two hundred ninety-six juvenile bluefish have been collected in October, in eleven different years (1990, 1997, 1999, 2005, 2011, 2012, 2015, 2016, 2017, 2020, and 2021), and only when water temperatures were 16 – 21° C.

The abundance index for 2024 was 19.54 ± 5.23 S.E. fish/seine haul. This is a slight decrease from the 2023 abundance index of 21.61 ± 6.20 S.E. fish/seine haul (Figure 4). The Mann-Kendall test showed no trend in the 10-year abundance or the long-term abundance trend for this species (Table 1a, b).

September had the highest mean monthly abundance of 16.78 ± 8.89 S.E. fish/seine haul, which was driven by a large catch (143 and 77) at Dutch Island (Sta. 7) and Third Beach (Sta. 15), respectively (Table 11). July and August are typically the months of highest juvenile abundance for this species. There appears to be a shift to their presence in September as water temperatures remain warmer longer into the fall months, as observed in the 2022 through 2024 survey data.

Length frequency data for 2024 indicates that all juveniles collected were young-of-the-year individuals.

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

Striped Bass

During the 2024 survey 12 striped bass (*Morone saxatalis*) were collected. This is a slight increase from 2023 which had an abundance of 10 fish. 2023 and 2024 had the lowest abundance over the past five years with a high of 243 in 2022. Striped bass were present in eight percent of the seine hauls and were collected at six of the eighteen stations (Table 14). They were present in June, August and September.

The abundance index for 2024 was 0.13 ± 0.26 S.E. fish/seine haul. This is about the same as 2023, which had an abundance index of 0.1 ± 0.15 S.E. fish/seine haul (Figure 8). The Mann-Kendall test showed no abundance trend for this species for the entire dataset or the shortened 10-year series (Table 1a, b).

June had the highest mean monthly abundance of 0.44 ± 0.28 S.E. fish/seine haul (Table 12). October had the second highest mean monthly abundance at 0.11 ± 0.11 S.E. fish/seine haul. September is usually one of the months with the highest abundance for the entire time series. However, during 2024 there were no striped bass collected in the survey (Table 12).

In 2024, striped bass were only present at 6 stations. The highest abundance was found at the Warren River with 1.00 ± 1.00 S.E. fish/seine haul. The station with the highest abundance each year is variable, though it does tend to be the lower bay stations in general for the entire time series.

Length frequency data for 2024 indicates that a mix of juveniles and adults were collected. This is normal for the seine survey. The spatial distribution and abundance of striped bass in Narragansett Bay is highly variable and is most likely highly dependent on the availability of appropriate size prey species like Atlantic silversides (*Menidia menidia*) and juvenile menhaden (*Brevoortia tyrannus*) when fish enter the bay. The annual abundance indices since 1988 show fluctuations in abundance from year to year (Figure 8), but generally appears to have had an increasing trend during the late 90s to early 2000s, but now appears to be on a downward trajectory since 2008, although in recent years there seems to be a very slight upward trend. The standardized index, which accounts for some of these factors, follows a similar trend year to year as the straight catch per unit effort (CPUE) index.

Clupeidae

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

River Herring

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

River herring were present in twenty-two percent of the seine hauls and were collected at eleven of the eighteen stations during 2024 and were present during each month of the survey. A total of 172 juveniles were collected in 2024, a decrease from the number collected in 2023 (402).

The highest mean monthly abundance for 2024 occurred during August and was 6.11 ± 4.09 S.E. fish/seine haul. Wickford (Sta. 18) and Conimicut Point (Sta. 2) had the highest mean station abundance of 14.00 ± 14.00 S.E. and 6.60 ± 2.91 S.E., respectively (Table 13). Wickford experienced a single large catch in August (70 fish), which drove the mean station abundance. Single large catches of these species are due to their schooling behavior and is the reason for the high standard error associated with the indices.

The standardized abundance index for 2024 was 1.91 ± 1.89 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. Due to these fluctuations, there was no significant trend in the Mann-Kendall test for both the long-term and short-term (10-year) abundance data (Table 1a & 1b).

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 the fluctuating numbers of returning adult fish (Figure 6) and the abundance index generated by this survey (Figure 5) as the recent small increases and decreases in juvenile abundance in the data corresponds to an increase and decrease in returning adults, and vise versa. Due to an extended period of low abundance of river herring in Rhode Island, the taking of either species of river herring is currently prohibited in all state waters.

Menhaden

Forty-seven Atlantic menhaden (*Brevoortia tyrannus*) were collected during the 2024 survey, a significant decrease from 2023 (3,503 fish) and 2022 (14,984 fish). The 2017 abundance is one of the highest in recent years; the last high abundance was 2007, when eight thousand two hundred fifty-three juveniles were collected. They were present in twelve percent of the seine hauls and were collected at nine of the eighteen stations (Table 12).

The highest mean monthly abundance for 2024 occurred during September and was 1.83 ± 1.72 S.E. fish/seine haul. Wickford (Sta. 18) had the highest mean station abundance of 6.20 ± 6.20 S.E. (Table 14), which was driven by a single large catch in September of 31 fish. Single large catches of these species are due to their schooling behavior and is the reason for the high standard error associated with the indices.

The standardized abundance index for 2024 was 0.52 ± 1.26 S.E. fish/seine haul. This is a decrease from 2023 (38.92 ± 26.85 S.E. fish/seine haul, Figure 7). The standardized index indicates an increased abundance during the 2000s followed by lower numbers through the 2010s. In the most recent years an increasing abundance is evident. Our Narragansett Bay trawl survey showed a decrease in menhaden abundance from 2018 to 2019. The trawl survey catches juveniles as well as some age one fish. The Mann-Kendall test showed no long-term abundance trend and no 10-year trend for this species (Table 1a and 1b).

Similar to river herring, juvenile menhaden were also observed in very large schools around Narragansett Bay and as discussed earlier, this behavior often results in single large catches resulting in a high abundance index and large standard error. This schooling behavior also contributes to the variability of their spatial and temporal abundance from year to year. Because of these characteristics it is difficult to develop an abundance index that will accurately reflect the number of juveniles 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 (Appendix A).

Weakfish

There were zero, *Cynocion regalis,* collected during the 2024 survey. Weakfish were present in zero percent of the seine hauls and were not collected at any of the eighteen stations during 2024, This is the same as 2023 when there were zero caught. 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 typically collected most frequently.

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. There, have been 11 years since 1988 where no fish have been caught. Seven of the 11 total zero catch years occur after 2004. Possible reasons for this high variability in abundance, other than fishing pressure, may be environmental and anthropogenic factors that affect spawning and nursery habitat. Survival rate at each life history stage may also be influenced by these factors. The literature indicates this species spawns in calm coves within the estuary and juveniles move up the estuary to nursery areas of lower salinity. These are the same areas of the bay where anthropogenic impacts are high, often resulting in hypoxic and/or anoxic events that may increase mortality of the early life history stages of this species.

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

Black Sea Bass

Five black sea bass (*Centropristis striata*) were caught in 2024, a significant decrease from the fifteen fish that were collected in 2023. The number of black sea bass has been highly variable from year to year during the time series of this survey, but the high abundance during 2012 and 2015 (Figure 10) stand out as unique. Black sea bass were caught in three percent of the seine hauls in 2024.

The highest mean monthly abundances for 2023 occurred during August and September at 0.17 ± 0.51 S.E. fish/seine haul and 0.11 ± 0.47 S.E. fish/seine haul, respectively. Black sea bass were caught at 3 of the 18 stations (Table 15).

The abundance index for 2024 was 0.05 ± 0.03 S.E. fish/seine haul. This was a decrease from the 2023 index 0.17 ± 0.05 S.E. (Figure 10). Our Narragansett Bay trawl survey had an increase in the abundance of black sea bass from 2020 to 2021 in the spring and fall. The abundance was still much greater than it has been since the survey began in 1979. The fall index dropped down from the high values in 2012 and 2013 but did show a small increase in abundance from 2016 to 2018. This recruitment signal in recent years was seen not only in RI waters, but all along the Northern Atlantic coast.

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 (NEFSC 2016).

Other important species

Juveniles of other commercial or recreationally important species were also collected during the 2024 survey. These juveniles included scup (*Stenotomus chrysops*), and Northern kingfish (*Menticirrhus saxatilis*).

three hundred and twelve juvenile and adult scup were collected in 2024 during July, August, September, and October, a significant decrease from 2023 when 151 scup were collected. one hundred and eighty-nine Northern kingfish were collected in 2024 and were present in the greatest numbers during July and August. This is a decrease from 2023 when 220 Northern kingfish were caught. Nineteen summer flounder were caught in 2023. One smallmouth flounder were caught in 2024, relative to the sixty-eight smallmouth flounder that were caught in 2011, and the twenty-four that was caught in 2022, the decrease in abundance continued in 2024. 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. No juvenile Haddock were caught in 2024, unlike June 2016 when 44 juvenile haddock were caught, or June 2015 when 27 were caught. They were caught primarily in the lower portion of the bay. 2015 was the first recorded observance of juvenile Haddock in the history of the survey, this species will continue to be monitored in future years to see if there is an increasing abundance over time in Narragansett Bay. See Tables 3-8 for additional survey data on these species.

Physical & Chemical Data

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

Water temperatures during the 2024 survey ranged from a low of 16.5°C at Kickimuit River (Sta. 11) in October to a high of 27.8°C at Conimicut (Sta. 2) in August.

Salinities ranged from 9.3 *ppt* at Conimicut Point (Sta. 2) in July to 28.8 *ppt* at Third Beach (Sta. 15) in October.

Dissolved oxygen ranged from 4.8 *ppm* at the Dutch Island (Sta. 7) in August to a high of 10.5 *ppm* at Spar Island (Sta. 12) in August.

SUMMARY: In summary, data from the 2024 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, tautog, river herring, menhaden and striped bass, showed no long-term abundance trends but indicated a significant long-term decrease in winter flounder abundance. There are some species abundance trends from this survey that agree with those from our coastal pond survey and/or trawl survey, however, in some

instances they do not relate. This outcome is probably influenced by the species-specific use of habitat and looking at appropriate data lags between the juvenile life stages and the adult stages. Hopefully, juvenile survey abundance indices will be reflected later in the abundance of adults in the trawl survey, but this is not always the case.

Sixty species, both vertebrates and invertebrates, were collected in 2024. This is the survey mean for the past twenty-five years of sixty species. An initial audit of the earlier time series and information contained on the field logs was undertaken to determine if some of the species diversity was missing from the earlier time series. These issues were resolved from this analysis.

During 2024 there were no tropical species collected during the survey. While tropical and subtropical species are typically collected during this survey most years, the number of species and individuals is dependent upon the course of the Gulf Stream, the number of streamers and warm core rings it generates, and the proximity of these features to southern New England.

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

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

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FIGURES

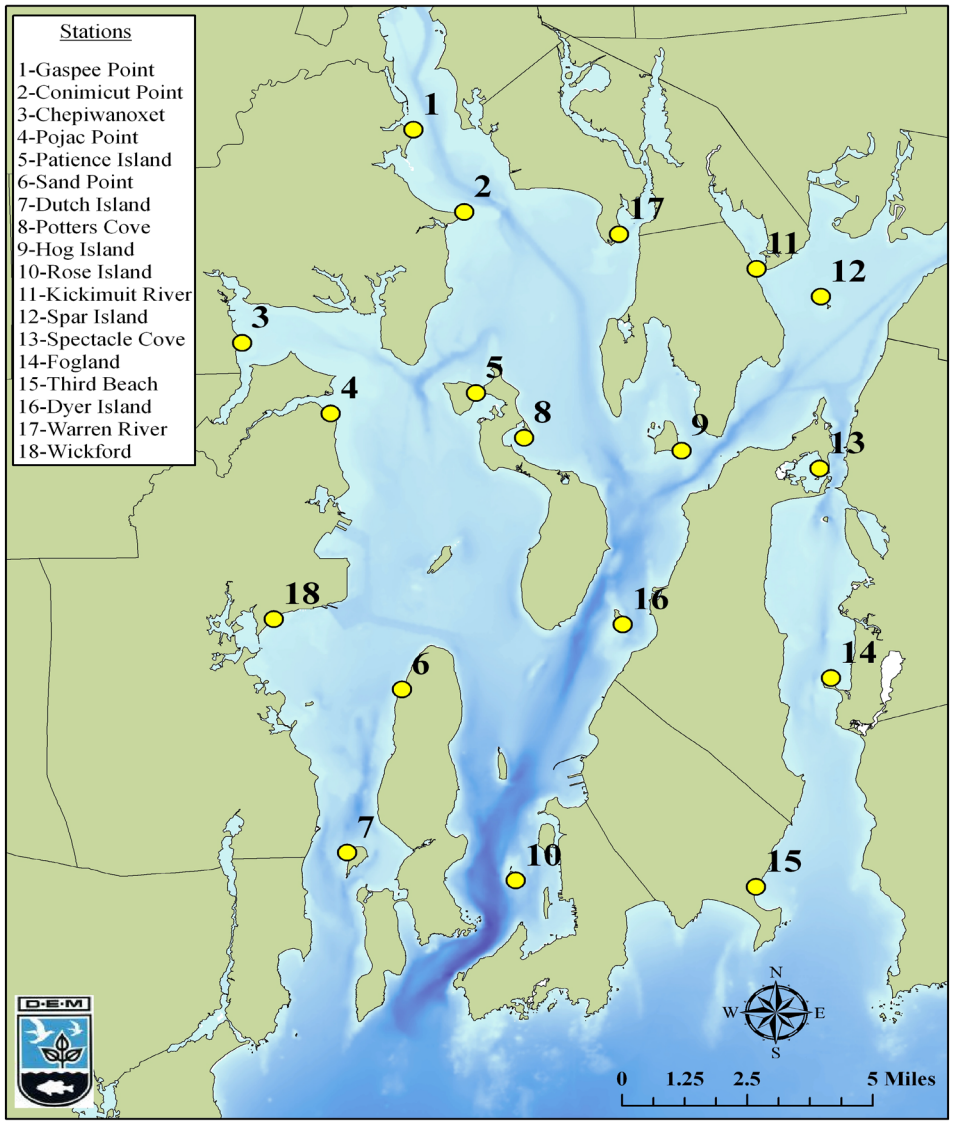


Figure 1. Survey station location map.

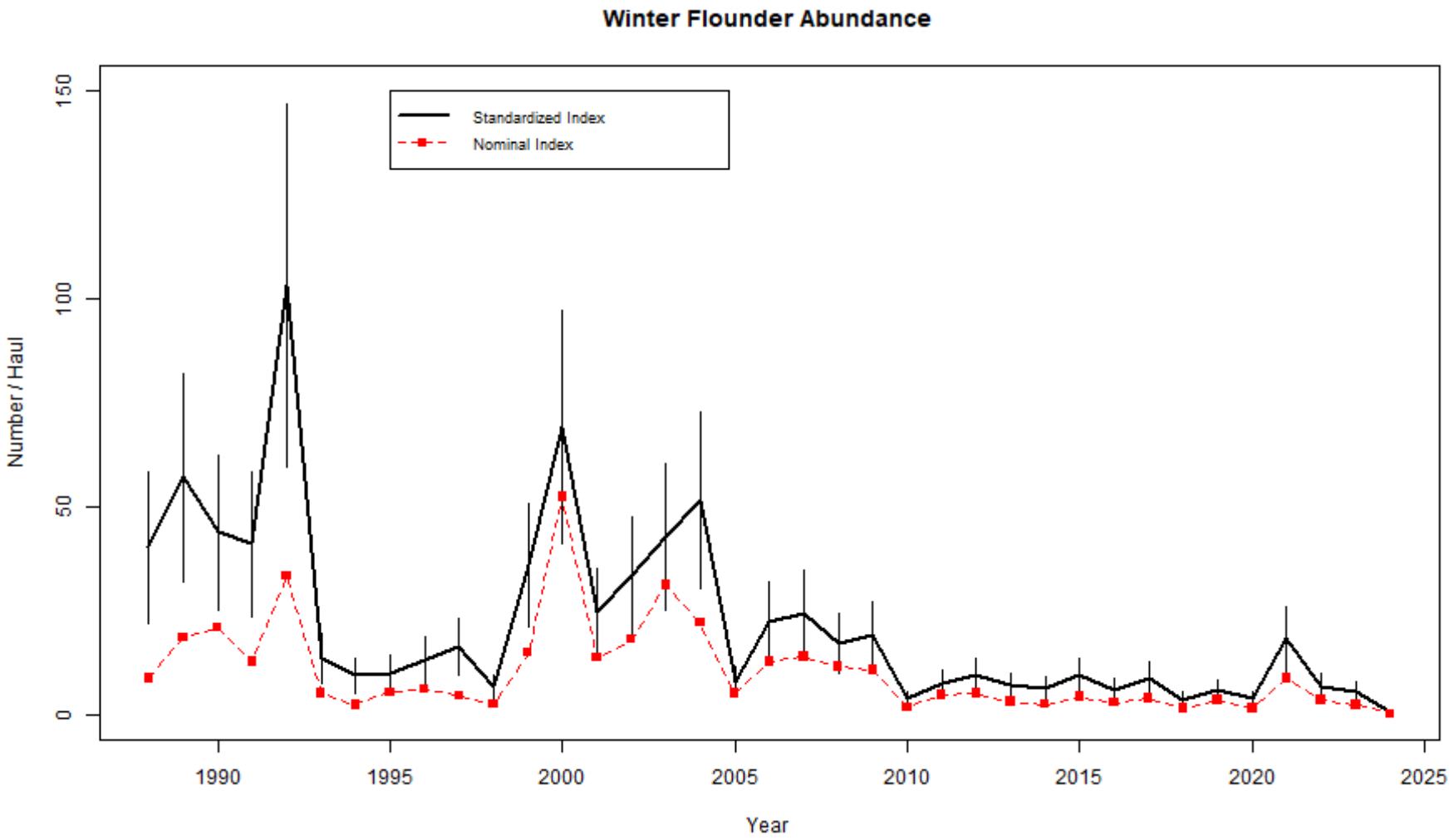


Figure 2. Juvenile winter flounder standardized abundance index 1988 – 2024 (see appendix A for standardization methodology).

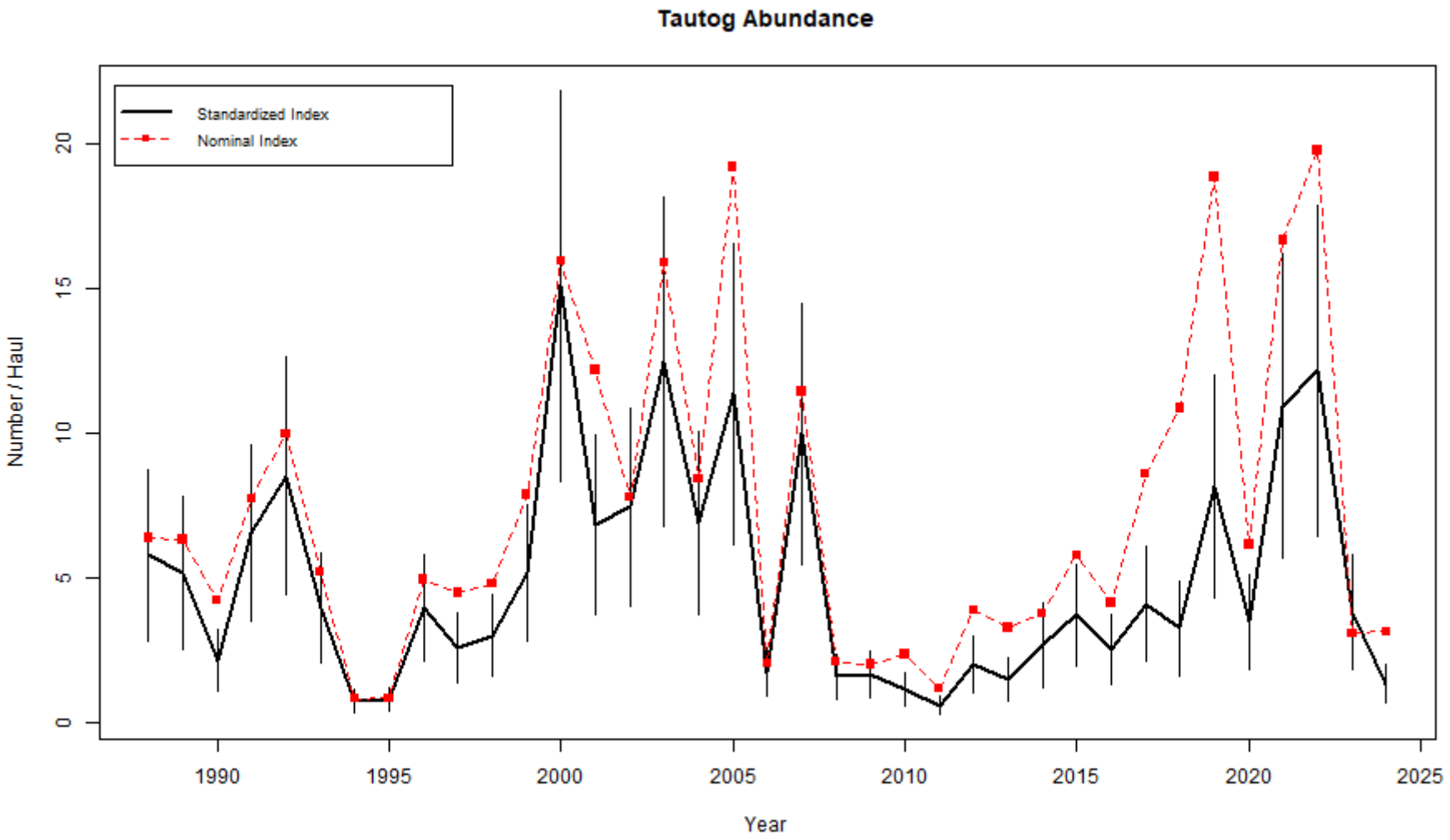


Figure 3. Juvenile tautog standardized annual abundance index 1988 – 2024 (see appendix A for standardization methodology).

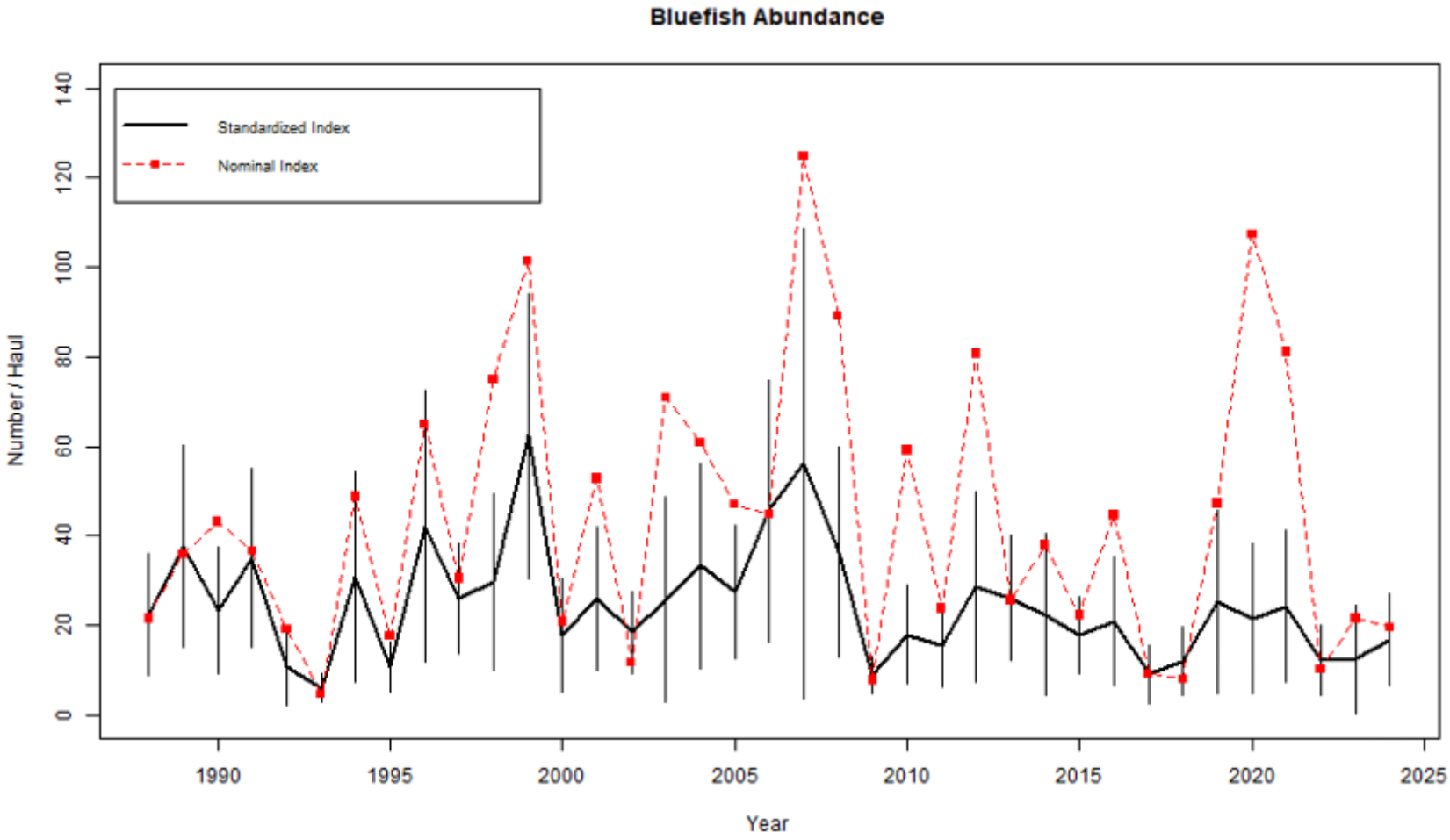


Figure 4. Juvenile bluefish standardized annual abundance index 1988 – 2024 (see appendix A for standardization methodology).

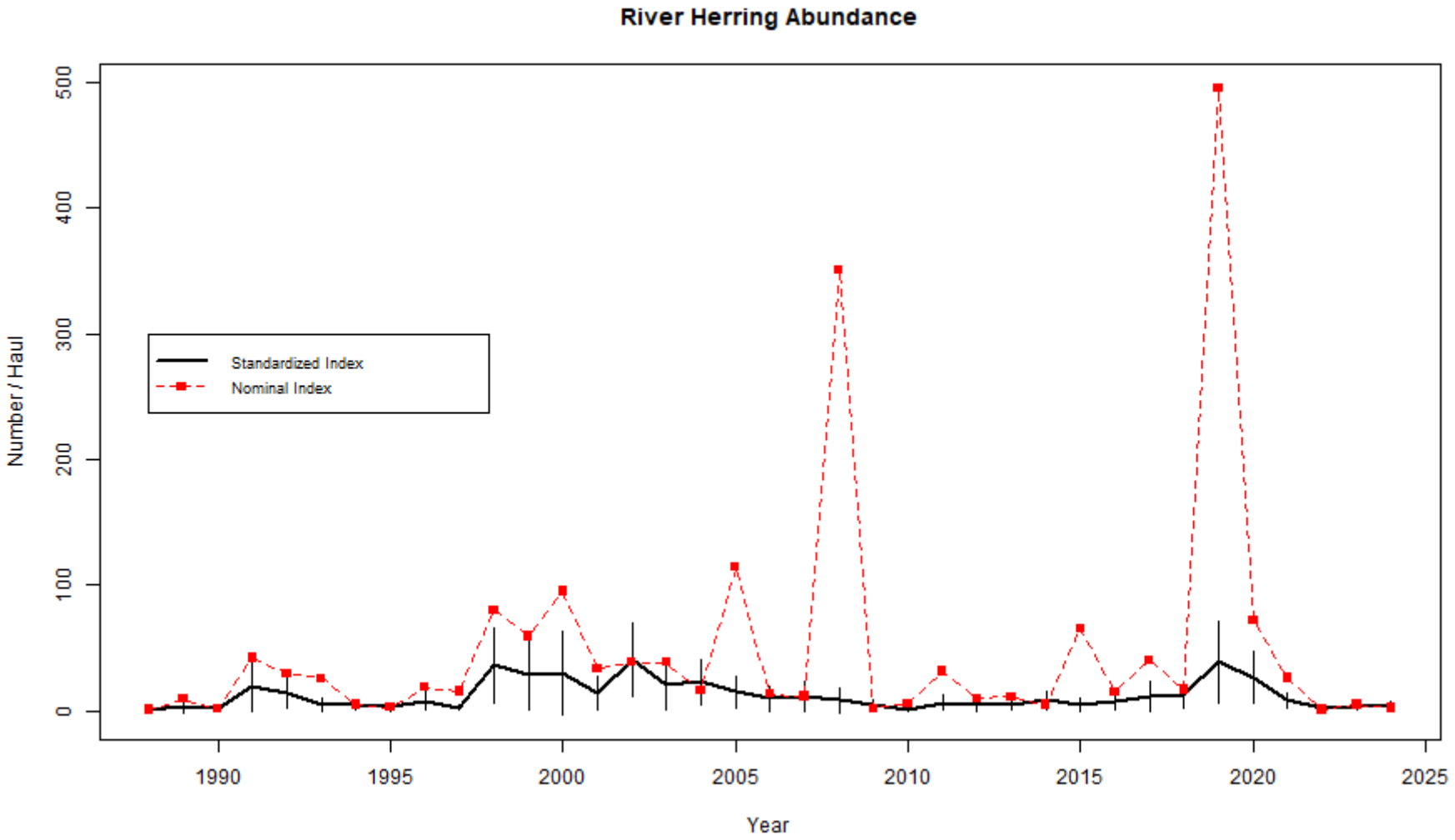
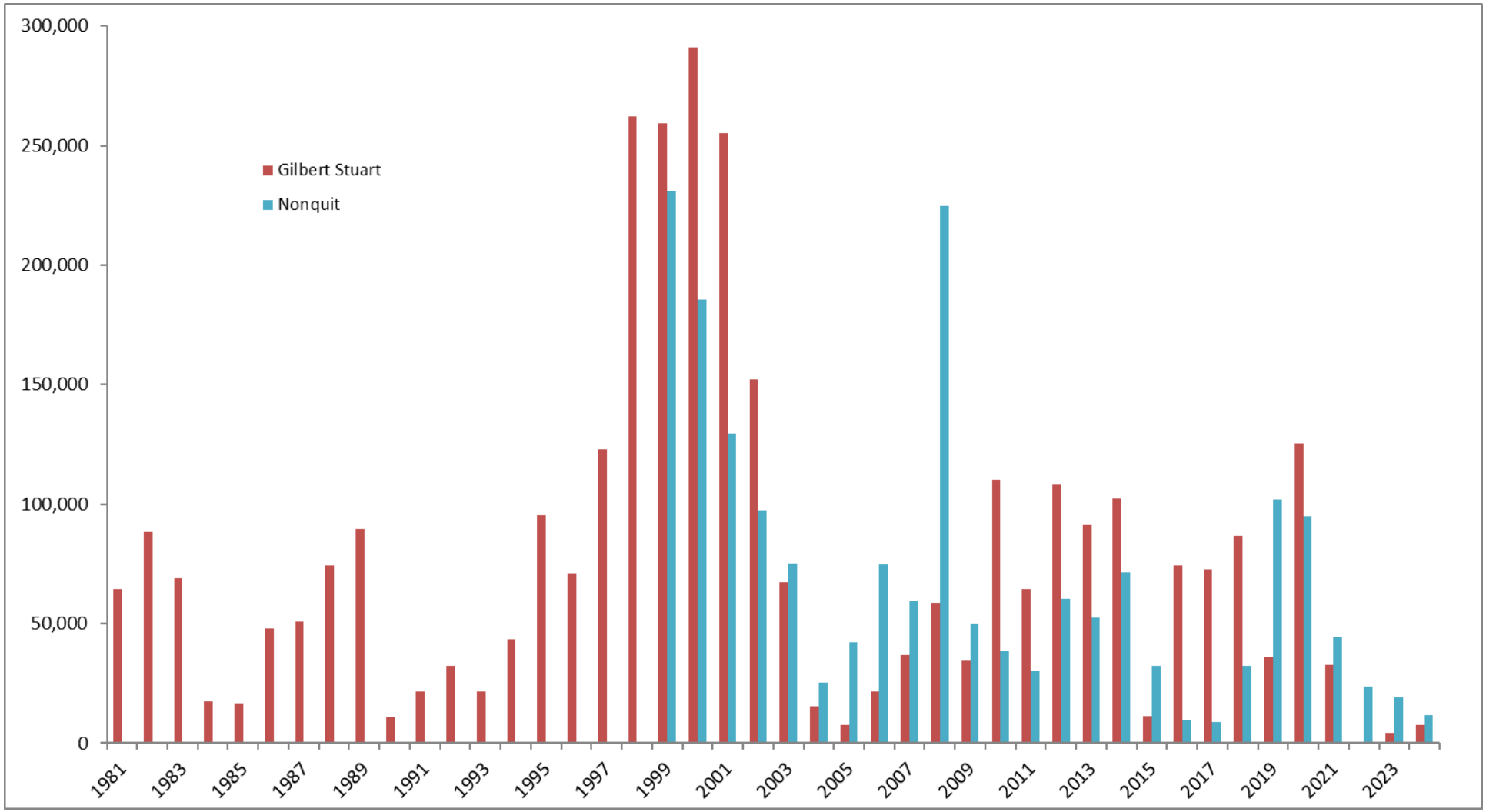


Figure 5. Juvenile river herring standardized annual abundance index 1988 – 2024 (see appendix A for standardization methodology).



Courtesy - Patrick McGee, RIF&W Anadromous Fish Restoration Program

Figure 6. River herring spawning stock size from monitoring at two locations 1999 – 2024.

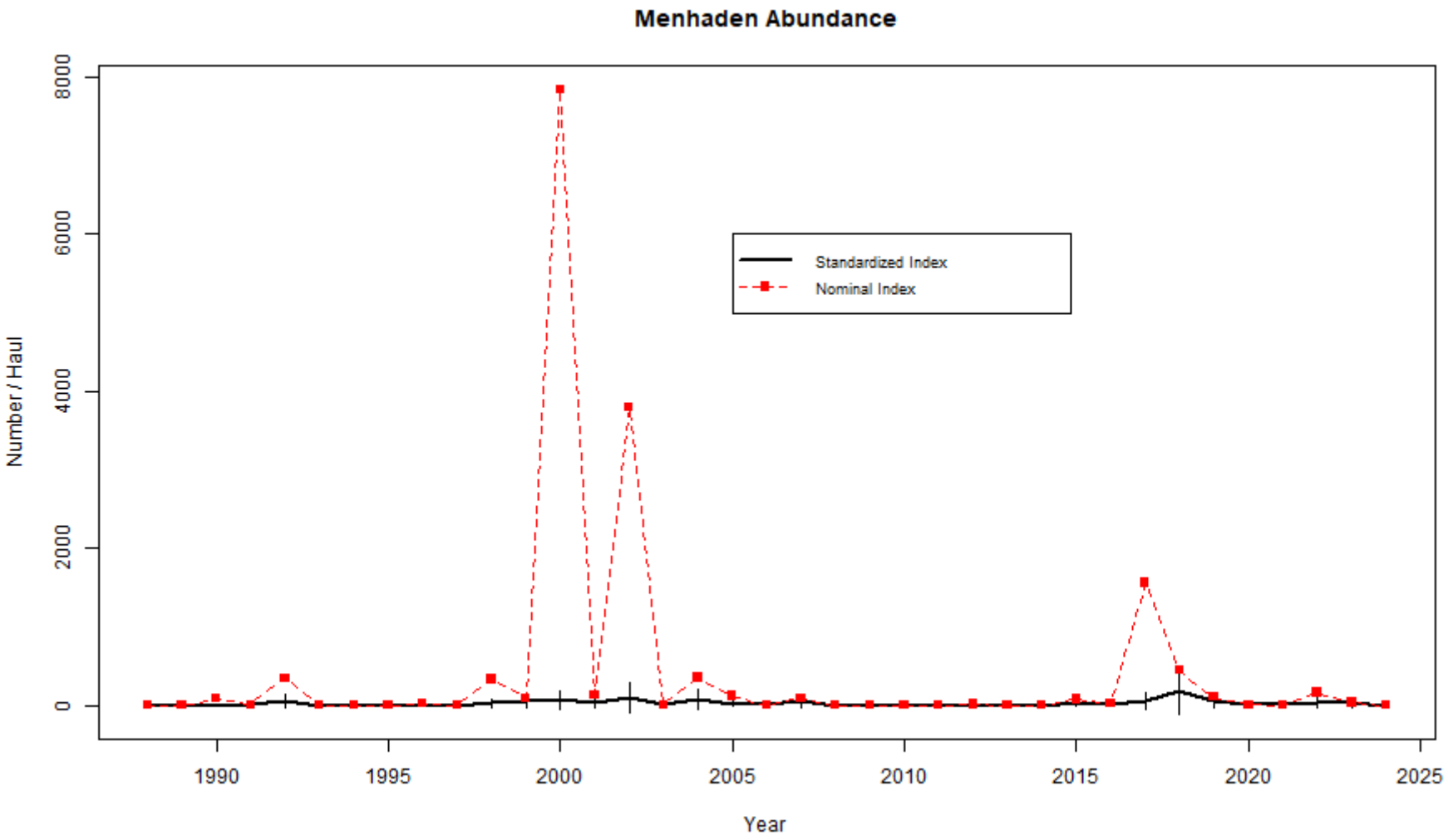


Figure 7. Juvenile menhaden standardized annual abundance index 1988 – 2024 (see appendix A for standardization methodology).

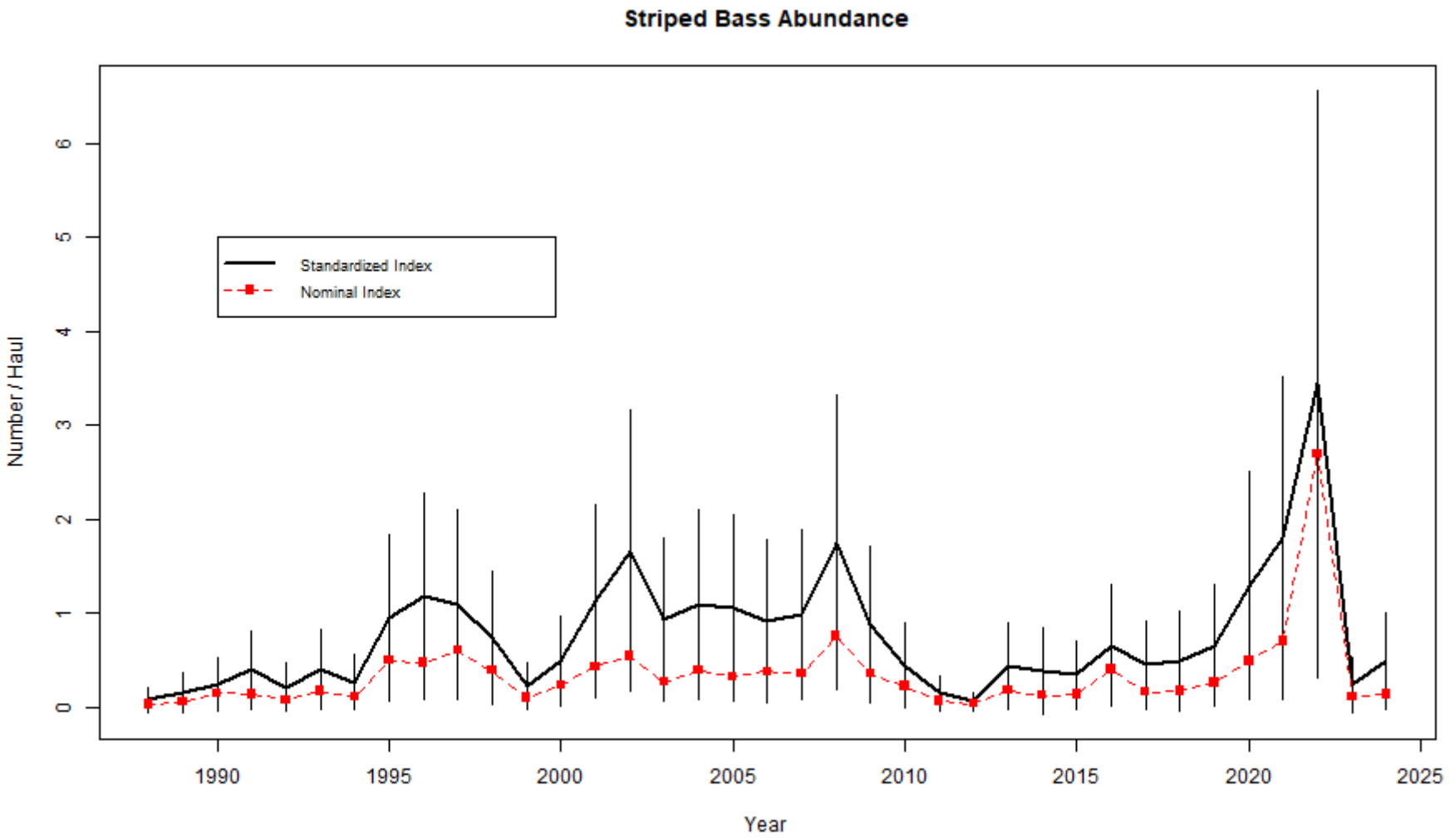


Figure 8. Striped bass standardized annual abundance index 1988 – 2024 (see appendix A for standardization methodology).

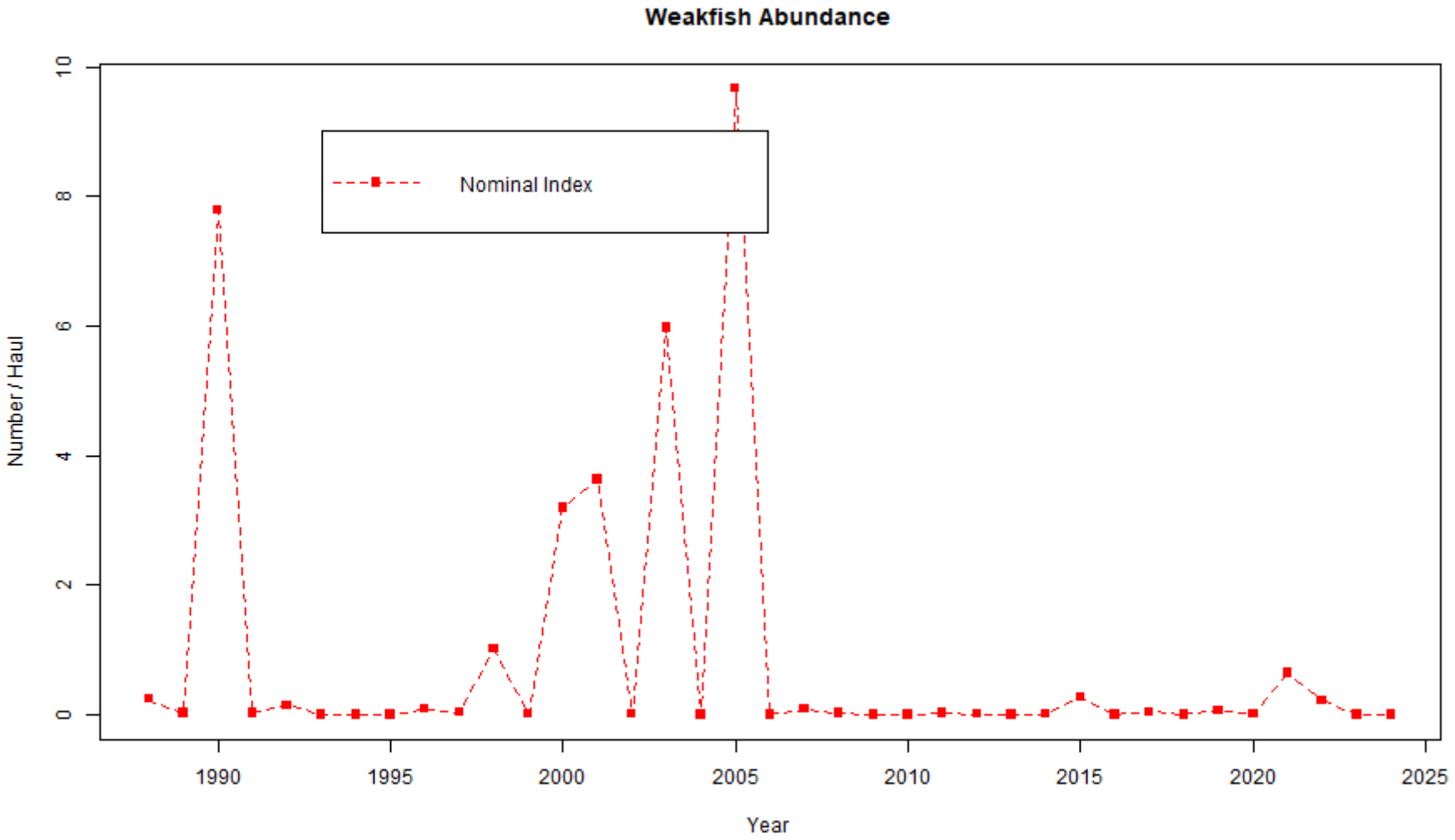


Figure 9. Weakfish annual abundance index 1988 – 2024.

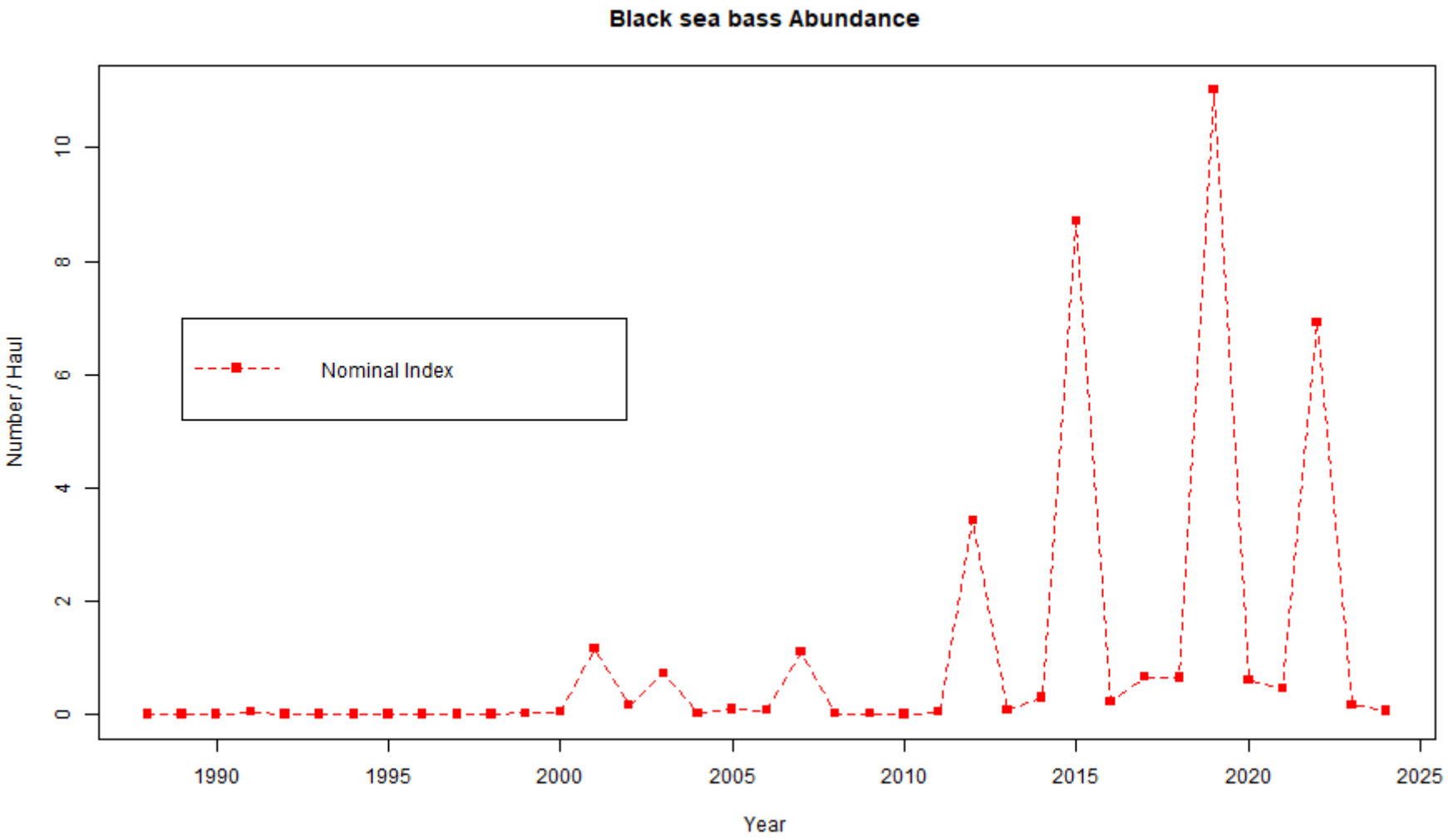


Figure 10. Black sea bass annual abundance index 1988 – 2024.

TABLES

Table 1a. Mann-Kendall test for target species abundance trend analysis (Full dataset; 1988 - 2023).

Mann-Kendall test	Winter Flounder	Tautog	Bluefish	River Herring	Menhaden	Striped Bass
S	-356	-17	-144	-2	98	108
n Observations	37	37	37	37	37	37
Variance	5846	165	5846	5846	5846	5846
Tau	-0.535	-0.309	-0.216	0.003	0.147	0.162
2-sided p value	3.4338e-06	0.8856	0.061445	0.98956	0.20457	0.16168
α	0.05	0.05	0.05	0.05	0.05	0.05
Significant Trend	Yes ↓	No	No	No	No	No

Table 1b. Mann-Kendall test for target species abundance trend analysis (2012 - 2023).

Mann-Kendall test	Winter Flounder	Tautog	Bluefish	River Herring	Menhaden	Striped Bass
S	-17	13	-3	-7	-5	17
n Observations	10	10	10	10	10	10
Variance	165	165	165	165	165	165
Tau	-0.309	0.236	-0.0545	-0.127	-0.0909	0.162
2-sided p value	0.21291	0.3502	0.87627	0.64043	0.7555	0.21291
α	0.05	0.05	0.05	0.05	0.05	0.05
Significant Trend	No	No	No	No	No	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 presence by station for June 2024.

JUNE	Station																		
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Grand Total
Alosa aestivalis &/or pseudoharengus		3		1		1													5
Amphipoda order					x														x
Calinectes sapidus			28														1		29
Carcinus maenus					x						x	x		0					x
Citharichthys arctifrons																		1	1
Crangon septemspinosa					x						x						x		x
Crepidula fornicata		x																	x
Ctenophora phylum	x	x		x							x	x	x				x	x	x
Fundulus heteroclitus			3			82			1				2						88
Fundulus majalis	36					33			5				4				4		82
Gobiosoma bosc												1							1
Libinia emarginata												x					x		x
Limulus polyphemus		1																	1
Lucania parva																	3		3
Menidia menidia	133	790	4	48	1	384	10		3		1		422				1	288	2085
Menticirrhus saxatilis																	2	1	3
Microgadus tomcod							1		1	1		2				5	1		11
Morone saxatilis					1			1					1				5		8
Nassarius obsoletus	x					x								x		x			x
Opsanus tau											1								1
Ovalipes ocellatus															1				1
Pagurus spp	x	x					x	x										x	x
Palaemonetes vulgaris	x	x	x		x							x					x		x
Panopeus spp	x	x	x		x		x												x
Paralichthys dentatus			5																5
Pollachius virens										44									44
Prionotus carolinus						1													1
Pseudopleuronectes americanus			1									1						1	3
Sphoeroides maculatus					2	2												60	64
Syngnathus fuscus			2		1					2	1	1				1	1		9
Tautoga onitis		1					1					1		1	1	1	2		8
Tautogolabrus adspersus							3			1									4
Grand Total	**169**	**795**	**43**	**49**	**5**	**503**	**15**	**1**	**10**	**48**	**3**	**6**	**429**	**1**	**2**	**7**	**20**	**351**	**2457**

* x indicates that the non-target species was collected but the abundance was recorded as abundant, many or few.

Table 4. Species presence by station for July 2024.

JULY	Station																		
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Grand Total
Alosa aestivalis &/or pseudoharengus		17					17		1								2		37
Amphipoda order	x		x																x
Anchoa genus																	1		1
Apeltes quadracus		1																	1
Calinectes sapidus		3	11					1				1	8				2		26
Caranx hippos		1																	1
Carcinus maenus		x														x			x
Crangon septemspinosa		x							x	x							x		x
Ctenophora phylum			x	x	x	x						x					x		x
Cyprinodon variegatus								1											1
Eucinostomus argenteus															3				3
Fundulus heteroclitus		1	2		3	6		6	5					5		5			33
Fundulus majalis	1	33	30	33	1			27	33		6			23			25	23	235
Gobiosoma bosc													1						1
Hemigrapsus sanguineus														x					x
Isopoda order														x	x				x
Libinia emarginata											x					x	x	1	1
Menidia menidia	366	875	271	47	61	31	44	72	1197	25	39	33	550	173	26	7	1732	417	5966
Menticirrhus saxatilis	2		1												1			2	6
Microgadus tomcod							1									1			2
Myoxocephalus aenaeus													1						1
Mytilus edulis							x												x
Nassarius obsoletus			x																x
Ovalipes ocellatus															3			4	7
Pagurus spp		x	x		x										x	x		x	x
Palaemonetes vulgaris	x		x											x	x	x			x
Panopeus spp		x	x		x						x	x							x
Pomatomus saltatrix	2	19	3					2	10		1						9	5	51
Pseudopleuronectes americanus							1		1			1	1					1	5
Sphoeroides maculatus		2				28	1		5				2		22	2	3	38	103
Sphyraena borealis							1							3	1				5
Stenotomus chrysops		1						6									14		21
Syngnathus fuscus										1						2			3
Tautoga onitis	2	2	4			1	3		14	1			6	2			11		46
Tautogolabrus adspersus							12			3		1							16
Grand Total	**373**	**955**	**322**	**80**	**65**	**66**	**80**	**115**	**1266**	**30**	**46**	**36**	**569**	**206**	**56**	**17**	**1799**	**491**	**6572**

* x indicates that the non-target species was collected but the abundance was recorded as abundant, many or few.

Table 5. Species presence by station for August 2024.

AUGUST	Station																		
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Grand Total
Alosa aestivalis &/or pseudoharengus				29	3	2	5			1								70	110
Anguilla rostrata							1						1						2
Apeltes quadracus				3					1										4
Arcopectin irradians									4										4
Brevoortia tyrannus				1		1	1		6							1			10
Calinectes sapidus	5	7	9	82			1						2			1	2	2	111
Caranx hippos	2																		2
Carcinus maenus				x					x	x	x		x						x
Centropristus striata																2			2
Crangon septemspinosa			x											x		x			x
Crepidula fornicata														x					x
Ctenophora phylum									x		x								x
Eucinostomus argenteus										3									3
Fundulus heteroclitus	65	37	3	170				10	8	1	7	1	3	99	1	8	4		417
Fundulus majalis	47	258	26	18		3		25	98	12	6		2	121	1	18	116		751
Hippocampus genus											1								1
Leiostomus xanthurus				1															1
Libinia emarginata									x							x	x		x
Lucania parva				6															6
Menidia menidia	3460	3449	40	283	23	7248	262	88	173	221	216	385	1704	3344	236	205	307	1819	23463
Menticirrhus saxatilis	5	8						1					1		49		24	6	94
Microgadus tomcod							1									1			2
Morone saxatilis				1									1						2
Myoxocephalus aenaeus																1			1
Mytilus edulis												0							0
Nassarius obsoletus									0		0								0
Opsanus tau											1		1						2
Pagurus spp			x	x					x			x	x	x		x		x	x
Palaemonetes vulgaris									x	x	x		x						x
Panopeus spp		x	x	x									x	x		x			x
Paralichthys dentatus													2						2
Pomatomus saltatrix	3	38				2			2								75	4	124
Pseudopleuronectes americanus									2							1	1		4
Sphoeroides maculatus	1					1							1	1	1		3		8
Sphyraena borealis						3	2			2									7
Stenotomus chrysops		11		1			141	3			1				3			2	162
Strongylura marina	8	14					3										2	1	28
Syngnathus fuscus				3			2			2	1		1			2			11
Tautoga onitis		3	1	20	8		17		19	1	1	4	18	2		41	3		138
Tautogolabrus adspersus							5									23	1		29
Grand Total	**3596**	**3825**	**79**	**618**	**34**	**7260**	**441**	**127**	**313**	**243**	**234**	**390**	**1737**	**3567**	**291**	**304**	**538**	**1904**	**25501**

* x indicates that the non-target species was collected but the abundance was recorded as abundant, many or few.

Table 6. Species presence by station for September 2024.

SEPTEMBER	Station																		
Species	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	5			1				1						2				10
Anchoa mitchilli												7							7
Brevoortia tyrannus			1							1								31	33
Calinectes sapidus	1		2	1				1					3						8
Carcinus maenus																1			1
Centropristus striata									2								1		3
Cliona celata	x																		x
Eucinostomus argenteus									1										1
Fistularia tabacaria										2									2
Fundulus heteroclitus		1		26					583				2			8	1		621
Fundulus majalis	101	15	3	53					79		1		11	2		81	10		356
Limulus polyphemus																	1		1
Lucania parva									2										2
Menidia menidia	1954	750	214	92	978	472	2799	435	286	173	345	64	1240	2710	480	815	1287	13	15107
Menticirrhus saxatilis	1		3												70		1	2	77
Morone saxatilis						2													2
Mugil curema			2							4	26								32
Nassarius obsoletus				x				x						x			x		x
Opsanus tau									2										2
Ovalipes ocellatus																		1	1
Pagurus spp			x	x				x			x				x			x	x
Palaemonetes vulgaris				x					x	x		x	x				x		x
Panopeus spp	x																		x
Pomatomus saltatrix	2	5		17			143	1		6			1		77			50	302
Prionotus evolans																		1	1
Pseudopleuronectes americanus									4							1	3		8
Sphoeroides maculatus			1	1		3			6				4			1	1		17
Stenotomus chrysops		29					2					3	2		20			71	127
Strongylura marina													2	5				1	8
Syngnathus fuscus				1					1										2
Synodus foetens	1														1				2
Tautoga onitis					1	2		3	50	4			5	3		13	4		85
Tautogolabrus adspersus										4						1			5
Trachinotus carolinus															15				15
Trachinotus falcatus															1				1
Grand Total	**2061**	**805**	**226**	**191**	**980**	**479**	**2944**	**440**	**1017**	**194**	**372**	**74**	**1270**	**2720**	**666**	**921**	**1309**	**170**	**16839**

* x indicates that the non-target species was collected but the abundance was recorded as abundant, many or few.

Table 7. Species presence by station for October 2024.

OCTOBER	Station																		
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Grand Total
Alosa aestivalis &/or pseudoharengus		8															2		10
Anchoa mitchilli				2															2
Brevoortia tyrannus			1			2											1		4
Calinectes sapidus			1																1
Caranx hippos			6																6
Carcinus maenus				x				x					x					x	x
Crepidula fornicata											x								x
Cyprinodon variegatus		2														9	1		12
Etropus microstomus																	1		1
Eucinostomus argenteus										1									1
Fundulus heteroclitus				3	1				4		5	1	3	9			5		31
Fundulus majalis	10	35	42	35				1	11		3		4	55	1	7	11	2	217
Gobiosoma bosc				1															1
Hemigrapsus sanguineus														x					x
Libinia emarginata													x						x
Menidia menidia	144	569	423	5507	8	2807	1919	68	340	299	935	145	767	184	81	32	2050	1168	17446
Menticirrhus saxatilis																		9	9
Mugil curema		4				1													5
Nassarius obsoletus	x		x											x					x
Ovalipes ocellatus																		1	1
Pagurus spp		x	x	x														x	x
Palaemonetes vulgaris	x	x	x	x	x			x		x			x	x			x		x
Panopeus spp				x															x
Pomatomus saltatrix			18	11		2													31
Prionotus carolinus		1			1														2
Prionotus evolans			1	4														1	6
Pseudopleuronectes americanus				1	4												2		7
Stenotomus chrysops	1	1																	2
Syngnathus fuscus	1			1	1					1	1								5
Synodus foetens																		1	1
Tautoga onitis				1				1		1						2			5
Trachinotus carolinus																		1	1
Grand Total	**156**	**620**	**492**	**5566**	**15**	**2812**	**1919**	**70**	**355**	**302**	**944**	**146**	**774**	**248**	**82**	**50**	**2073**	**1183**	**17807**

* x indicates that the non-target species was collected but the abundance was recorded as abundant, many or few.

Table 8. Summary of species occurrence by station in 2024. 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).

ALL MONTHS	Station																		
Species	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	33		30	4	3	22		2	1					2		4	70	172
Amphipoda order	x		x		x														x
Anchoa genus																	1		1
Anchoa mitchilli				2								7							9
Anguilla rostrata							1						1						2
Apeltes quadracus		1		3					1										5
Arcopectin irradians									4										4
Brevoortia tyrannus			2	1		3	1		6	1						1	1	31	47
Calinectes sapidus	6	10	51	83			1	2				1	13			1	5	2	175
Caranx hippos	2	1	6																9
Carcinus maenus		x		x	x			x	x	x	x	x	x	x		1		x	1
Centropristus striata									2							2	1		5
Citharichthys arctifrons																		1	1
Cliona celata	x																		x
Crangon septemspinosa		x	x		x				x	x	x			x		x	x		x
Crepidula fornicata		x									x			x					x
Ctenophora phylum	x	x	x	x	x	x			x		x	x	x				x	x	x
Cyprinodon variegatus		2						1								9	1		13
Etropus microstomus																	1		1
Eucinostomus argenteus									1	4					3				8
Fistularia tabacaria										2									2
Fundulus heteroclitus	65	39	8	199	4	88		16	601	1	12	2	10	113	1	21	10		1190
Fundulus majalis	195	341	101	139	1	36		53	226	12	16		21	201	2	106	166	25	1641
Gobiosoma bosc				1								1	1						3
Hemigrapsus sanguineus														x					x
Hippocampus genus											1								1
Isopoda order														x	x				x
Leiostomus xanthurus				1															1
Libinia emarginata									0		0	0	0			0	0	1	1
Limulus polyphemus		1															1		2
Lucania parva				6					2								3		11
Menidia menidia	6057	6433	952	5977	1071	10942	5034	663	1999	718	1536	627	4683	6411	823	1059	5377	3705	64067
Menticirrhus saxatilis	8	8	4					1					1		120		27	20	189

Microgadus tomcod							3		1	1		2				7	1		15
Morone saxatilis				1	1	2		1					2				5		12
Mugil curema		4	2			1				4	26								37
Myoxocephalus aenaeus													1			1			2
Mytilus edulis							x					x							x
Nassarius obsoletus	x		x	x		x		x	x		x			x		x	x		x
Opsanus tau									2		2		1						5
Ovalipes ocellatus															4			6	10
Pagurus spp	x	x	x	x	x		x	x	x		x	x	x	x	x	x		x	x
Palaemonetes vulgaris	x	x	x	x	x			x	x	x	x	x	x	x	x	x	x		x
Panopeus spp	x	x	x	x	x		x				x	x	x	x		x			x
Paralichthys dentatus			5										2						7
Pollachius virens										44									44
Pomatomus saltatrix	7	62	21	28		4	143	3	12	6	1		1		77		84	59	508
Prionotus carolinus		1			1	1													3
Prionotus evolans			1	4														2	7
Pseudopleuronectes americanus			1	1	4		1		7			2	1			2	6	2	27
Sphoeroides maculatus	1	2	1	1	2	34	1		11				7	1	23	3	7	98	192
Sphyraena borealis						3	3			2				3	1				12
Stenotomus chrysops	1	42		1			143	9			1	3	2		23		14	73	312
Strongylura marina	8	14					3						2	5			2	2	36
Syngnathus fuscus	1		2	5	2		2		1	6	3	1	1			5	1		30
Synodus foetens	1														1			1	3
Tautoga onitis	2	6	5	21	9	3	21	4	83	7	1	5	29	8	1	57	20		282
Tautogolabrus adspersus							20			8		1				24	1		54
Trachinotus carolinus															15			1	16
Trachinotus falcatus															1				1
Grand Total	**6355**	**7000**	**1162**	**6504**	**1099**	**11120**	**5399**	**753**	**2961**	**817**	**1599**	**652**	**4779**	**6742**	**1097**	**1299**	**5739**	**4099**	**69176**

* x indicates that the non-target species was collected but the abundance was recorded as abundant, many or few.

Table 9. Numbers of juvenile winter flounder per seine haul in 2024.

	Station																				
Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	Mean	St Dev	SE
JUN	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0.17	0.38	0.09
JUL	0	0	0	0	0	0	1	0	1	0	0	1	1	0	0	0	0	1	0.28	0.46	0.11
AUG	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	1	0	0.22	0.55	0.13
SEP	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	1	3	0	0.44	1.15	0.27
OCT	0	0	0	1	4	0	0	0	0	0	0	0	0	0		0	2	0	0.41	1.06	0.25
Mean	0.00	0.00	0.20	0.20	0.80	0.00	0.20	0.00	1.40	0.00	0.00	0.40	0.20	0.00	0.00	0.40	1.20	0.40			
St Dev	0.00	0.00	0.45	0.45	1.79	0.00	0.45	0.00	1.67	0.00	0.00	0.55	0.45	0.00	0.00	0.55	1.30	0.55		Total Fish	
SE	0.00	0.00	0.20	0.20	0.80	0.00	0.20	0.00	0.75	0.00	0.00	0.24	0.20	0.00	0.00	0.24	0.58	0.24		27	
Number	0	0	1	1	4	0	1	0	7	0	0	2	1	0	0	2	6	2			

Table 10. Numbers of juvenile tautog per seine haul in 2024.

	Station																				
Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	Mean	St Dev	SE
JUN	0	1	0	0	0	0	1	0	0	0	0	1	0	1	1	1	2	0	0.44	0.62	0.15
JUL	2	2	4	0	0	1	3	0	14	1	0	0	6	2	0	0	11	0	2.56	4.02	0.17
AUG	0	3	1	20	8	0	17	0	19	1	1	4	18	2	0	41	3	0	7.67	11.12	0.3
SEP	0	0	0	0	1	2	0	3	50	4	0	0	5	3	0	13	4	0	4.72	11.75	0.47
OCT	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	2	0	0	0.28	0.57	0.23
Mean	0.40	1.20	1.00	4.20	1.80	0.60	4.20	0.80	16.60	1.40	0.20	1.00	5.80	1.60	0.20	11.40	4.00	0.00			
St Dev	0.89	1.30	1.73	8.84	3.49	0.89	7.26	1.30	20.49	1.52	0.45	1.73	7.36	1.14	0.45	17.36	4.18	0.00		Total Fish	
SE	0.40	0.58	0.77	3.95	1.56	0.40	3.25	0.58	9.16	0.68	0.20	0.77	3.29	0.51	0.20	7.76	1.87	0.00		282	
Number	2	6	5	21	9	3	21	4	83	7	1	5	29	8	1	57	20	0			

Table 11. Numbers of juvenile bluefish per seine haul in 2024.

	Station																				
Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	Mean	St Dev	SE
JUN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00
JUL	2	19	3	0	0	0	0	2	10	0	1	0	0	0	0	0	9	5	2.83	5.09	1.20
AUG	3	38	0	0	0	2	0	0	2	0	0	0	0	0	0	0	75	4	6.89	19.17	4.52
SEP	2	5	0	17	0	0	143	1	0	6	0	0	1	0	77	0	0	50	16.78	37.70	8.89
OCT	0	0	18	11	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1.72	4.82	1.14
Mean	1.12	12.88	0.75	4.25	0.00	0.50	35.75	0.75	3.00	1.50	0.25	0.00	0.25	0.00	19.25	0.00	21.00	14.75			
St Dev	1.34	16.29	1.50	8.50	0.00	1.10	71.50	0.96	4.76	2.68	0.45	0.00	0.45	0.00	38.50	0.00	36.25	21.48		Total Fish	
SE	0.60	7.28	0.67	3.80	0.00	0.49	31.98	0.43	2.13	1.20	0.20	0.00	0.20	0.00	17.22	0.00	16.21	9.60		508	
Number	7	62	21	28	0	4	143	3	12	6	1	0	1	0	77	0	84	59			

Table 12. Numbers of striped bass per seine haul in 2024.

	Station																			
Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	Mean	St Dev	SE
JUN	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	5	0	0.44	1.20	0.28
JUL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00
AUG	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0.11	0.32	0.08
SEP	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0.11	0.47	0.11
OCT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00
Mean	0.00	0.00	0.00	0.20	0.20	0.40	0.00	0.20	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	1.00	0.00			
St Dev	0.00	0.00	0.00	0.45	0.45	0.89	0.00	0.45	0.00	0.00	0.00	0.00	0.55	0.00	0.00	0.00	2.24	0.00		Total Fish	
SE	0.00	0.00	0.00	0.20	0.20	0.40	0.00	0.20	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00	1.00	0.00		12	
Number	0	0	0	1	1	2	0	1	0	0	0	0	2	0	0	0	5	0			

Table 13. Numbers of juvenile river herring per seine haul in 2024.

	Station																			
Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	Mean	St Dev	SE
JUN	0	3	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.28	0.75	0.18
JUL	0	17	0	0	0	0	17	0	1	0	0	0	0	0	0	0	2	0	2.06	5.46	1.29
AUG	0	0	0	29	3	2	5	0	0	1	0	0	0	0	0	0	0	70	6.11	17.33	4.09
SEP	1	5	0	0	1	0	0	0	1	0	0	0	0	0	2	0	0	0	0.56	1.25	0.29
OCT	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0.56	1.92	0.45
Mean	0.20	6.60	0.00	6.00	0.80	0.60	4.40	0.00	0.40	0.20	0.00	0.00	0.00	0.00	0.40	0.00	0.80	14.00			
St Dev	0.45	6.50	0.00	12.86	1.30	0.89	7.37	0.00	0.55	0.45	0.00	0.00	0.00	0.00	0.89	0.00	1.10	31.30		Total Fish	
SE	0.20	2.91	0.00	5.75	0.58	0.40	3.30	0.00	0.24	0.20	0.00	0.00	0.00	0.00	0.40	0.00	0.49	14.00		172	
Number	1	33	0	30	4	3	22	0	2	1	0	0	0	0	2	0	4	70			

Table 14. Numbers of juvenile menhaden per seine haul in 2024.

	Station																			
Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	Mean	St Dev	SE
JUN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00
JUL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00
AUG	0	0	0	1	0	1	1	0	6	0	0	0	0	0	0	1	0	0	0.56	1.42	0.34
SEP	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	31	1.83	7.29	1.72
OCT	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0.22	0.55	0.13
Mean	0.00	0.00	0.40	0.20	0.00	0.60	0.20	0.00	1.20	0.20	0.00	0.00	0.00	0.00	0.00	0.20	0.20	6.20			
St Dev	0.00	0.00	0.55	0.45	0.00	0.89	0.45	0.00	2.68	0.45	0.00	0.00	0.00	0.00	0.00	0.45	0.45	13.86		Total Fish	
SE	0.00	0.00	0.24	0.20	0.00	0.40	0.20	0.00	1.20	0.20	0.00	0.00	0.00	0.00	0.00	0.20	0.20	6.20		47	
Number	0	0	2	1	0	3	1	0	6	1	0	0	0	0	0	1	1	31			

Table 15. Numbers of juvenile black sea bass per seine haul in 2024.

	Station																				
Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	Mean	St Dev	SE
JUN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00
JUL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00
AUG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0.11	0.47	0.11
SEP	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0.17	0.51	0.12
OCT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00
Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.25	0.00			
St Dev	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.50	0.00		Total Fish	
SE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.22	0.00		5	
Number	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	1	0			

Table 16. Temperature, salinity, and dissolved oxygen by station and month – 2024

Station		Month JUN	JUL	AUG	SEP	OCT	Total Average
1	Temperature (C)	19.3	24.6	27.3	21	18.3	22.1
	Salinity	21.8	22.9	17.6	25.8	25.4	22.7
	Dissolved Oxygen	8.2	5.1	7.5	7.7	7.9	7.28
2	Temperature (C)	20.2	24	27.8	20.7	17.8	22.1
	Salinity	21.5	9.3	22.9	25.8	25.2	20.94
	Dissolved Oxygen	8.2	5.5	6.6	7.3	8.1	7.14
3	Temperature (C)	22.6	26.6	23.7	22.1	18	22.6
	Salinity	24.1	25.1	24.9	26.5	26.5	25.42
	Dissolved Oxygen	8.7	5.6	5.2	7.1	7.5	6.82
4	Temperature (C)	21	25.3	21.9	21.1	18.2	21.5
	Salinity	25.2	25	19.5	26.8	26.7	24.64
	Dissolved Oxygen	8.4	6.7	7.1	7.2	7.9	7.46
5	Temperature (C)	18.6	24.7	25	20.8	18.6	21.54
	Salinity	24.5	26	10.7	27.4	27.5	23.22
	Dissolved Oxygen	6.5	6.3	6.7	7.8	8.2	7.1
6	Temperature (C)	21.2	23.4	24.5	20.7	17.4	21.44
	Salinity	26.3	26.9	26.9	27.6	26.9	26.92
	Dissolved Oxygen	7.6	7.8	5.9	6.9	7.9	7.22
7	Temperature (C)	19.9	22	22.8	21	18.5	20.84
	Salinity	27.1	27.3	27.6	27.8	28.2	27.6
	Dissolved Oxygen	7.8	6.4	4.8	8	9.2	7.24
8	Temperature (C)	20.9	24.2	25.6	20.5	17.1	21.66
	Salinity	23.6	24.2	26.4	27	27.7	25.78
	Dissolved Oxygen	6.6	5.5	7.7	7.5	7.5	6.96
9	Temperature (C)	20.1	24	22.9	22.4	0	17.88
	Salinity	24.8	12.5	26.1	27.2	0	18.12
	Dissolved Oxygen	8	7.3	6.4	8.7	0	6.08
10	Temperature (C)	18.7	20.1	23	21.1	17.6	20.1
	Salinity	26.4	28	27.1	28.3	28	27.56
	Dissolved Oxygen	9.8	7.2		9.3	6.6	8.225
11	Temperature (C)	21.5	25.7	24.3	22.6	16.5	22.12
	Salinity	22.5	24.4	25.6	26.4	26.7	25.12
	Dissolved Oxygen	6.9	6.9	7.1	7.3	7.5	7.14
12	Temperature (C)	21	24.9	24.4	22.2	17	21.9
	Salinity	22.2	24.5	22.8	26.6	27.2	24.66
	Dissolved Oxygen	9.7	8.9	10.5	8	10	9.42
13	Temperature (C)	20.2	24.9	24.6	22.8	16.7	21.84
	Salinity	25.4	26.7	26.9	27.3	27.7	26.8
	Dissolved Oxygen	7.5	8.5	8.2	7.7	9.4	8.26
14	Temperature (C)	20.2	25.1	25.3	22.1	16.8	21.9
	Salinity	26.5	27.1	27.5	27.7	28.1	27.38
	Dissolved Oxygen	7.2	7	8.4	7.8	8.8	7.84
15	Temperature (C)	19.7	24.6	24.9	20.6	17.9	21.54
	Salinity	27.3	27.4	27.8	28.1	28.8	27.88
	Dissolved Oxygen	7.8	6.9	7.8	6.5	7.4	7.28
16	Temperature (C)	18.3	23.7	24	21.4	18	21.08
	Salinity	25.9	26.2	26	27.7	28.2	26.8
	Dissolved Oxygen	7.5	8.1	8.3	8.5	8.5	8.18
17	Temperature (C)	20.1	24.9	27	20.4	18.4	22.16
	Salinity	23	12.2	25.1	26.8	27.2	22.86
	Dissolved Oxygen	7.3	5	5.49	7	7.9	6.538
18	Temperature (C)	20.9	23.8	24.3	21.5	19	21.9
	Salinity	26.9	26.6	25	27.4	27.7	26.72
	Dissolved Oxygen	6.2	6	5	7.2	10	6.88

*Zero values are from when the YSI was not working.

APPENDIX A

Standardized Index Development – Delta Lognormal

Menhaden, Bluefish, River Herring

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

Factor	**Levels**	**Value**
Year	37	1988-2024
Month	5	June - October
Temperature (°C)	Continuous	
Salinity (ppt)	Continuous	
Station	18	18 fixed stations throughout bay

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

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

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

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

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

Success = Year + Month + Station + Temperature + Salinity

Standardized Index Development – Negative Binomial Generalized Linear Model

Winter Flounder, Tautog, Striped Bass

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

Species	Factor	Levels	Value
Winter Flounder	Year	37	1988-2024
	Station Periods	4	Stations were added to the survey on 3 separate occasions (station 16 added June 1990, station 17 added July 1993, station 18 added July 1995)
	Temperature (°C)	Continuous	
	Salinity (ppt)	Continuous	
	Station	18	18 fixed stations throughout bay
Tautog	Year	37	1988-2024
	Station Periods	4	Stations were added to the survey on 3 separate occasions (station 16 added June 1990, station 17 added July 1993, station 18 added July 1995)
	Station	18	18 fixed stations throughout bay
Striped Bass	Year	37	1988-2024
	Station Periods	4	Stations were added to the survey on 3 separate occasions (station 16 added June 1990, station 17 added July 1993, station 18 added July 1995)
	Temperature (°C)	Continuous	
	Salinity (ppt)	Continuous	
	Station	18	18 fixed stations throughout bay
	Month	5	June - October

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

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

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

The final models for the analysis of catch rates were:

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

The Rhode Island Chapter of The Nature Conservancy
Annual Progress Report

Submitted to

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

Title: Holistic Fish Habitat Assessment and Fish Productivity Estimations of Artificial Reefs

Cooperative Agreement Award Number: 3374051

Award Term: 1/15/2020 – 12/31/2024

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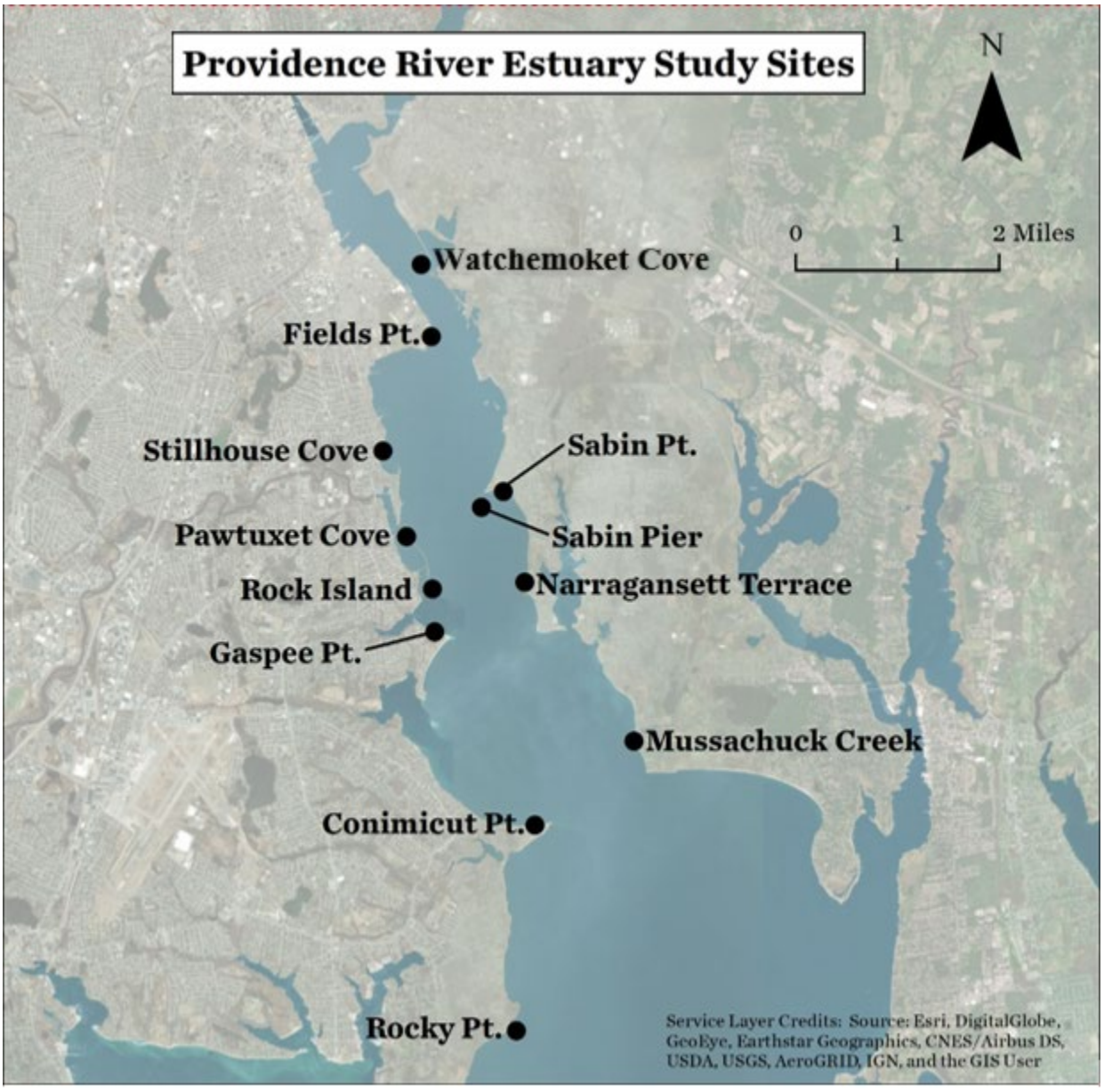
Scott Comings, Associate State Director

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Map of study area and sampling locations

(see Table 1 for descriptions of sampling method by site and Table A in the Appendix for coordinates).



SUMMARY

During the project period, a total of 9,557 specimens were captured (7,201 in the fish traps and 2,356 in the eel pots). Combined data from fish traps and eel pots collected between 2018 and 2024 reveal significant trends in key species, including scup, black sea bass, tautog, winter flounder, and summer flounder. Scup was predominantly captured in fish traps, with a peak in 2019 (481) and a total combined capture of 1,462 specimens. Black sea bass, with a combined total of 1,285 specimens, was more effectively captured in eel pots, peaking in 2021 (347), but has shown a decline in recent years across both methods. Tautog captures totaled 200, with steady numbers in fish traps until a decline in 2024 (13), while eel pot captures remained low but stable. Winter flounder was rarely captured, with a total of 19 specimens, primarily from eel pots, reflecting either limited abundance or poor capture efficiency. Similarly, summer flounder, with 88 combined captures, were mostly found in fish traps, peaking in 2020 (21).These trends suggest that gear type influences species catch rates, with eel pots better suited for structure-seeking species like black sea bass and tautog, and fish traps favoring open-water species like scup and summer flounder. The overall declines in black sea bass, tautog, and scup highlight the need for further investigation into habitat quality, population pressures, and environmental changes, while the low captures of winter and summer flounder suggest additional sampling methods may be required to better understand their distributions.

In 2024, there were 14 species caught in the fish traps including 401 finfish (7 species) and 873 invertebrates (7 species). All target species were caught in the fish traps except winter flounder. Eel pots placed at the artificial reef site and three control sites caught a total of 12 species including 102 finfish (6 species) and 78 invertebrates (6 species). Only two of the target species (tautog and black sea bass) were caught in the eel pots.

Water quality monitoring, including temperature, salinity, and dissolved oxygen, was conducted with HOBO Data Loggers placed within fish traps during each sampling period. In addition, a YSI ProPlus was used to record the same parameters during fish trap deployment and retrieval, allowing for data quality control. During the 2024 season, the mean temperature per month ranged from 15.61 ± 0.01°C to 23.52 ± 0.02°C, and the mean salinity per site ranged from 16.84 ± 0.36 ppt to 28.85 ± 0.04 ppt. The greatest percentage of hypoxic instances per site was 5% at Stillhouse Cove.

Investigators successfully conducted the fourth year of the post-enhancement productivity dive surveys on the Sabin Point Artificial Reef (SPAR) and paired control sites. Investigators collected video and photo evidence of the reefs' colonization and succession as well as the annual productivity dive surveys completed on October 29th and 30th 2024.

SIGNIFICANT DEVIATIONS

Additional permits for artificial reef installations were put on hold as the development of the state artificial reef plan continues. The sites highlighted in the Appendix are still potential reef locations to be further evaluated in the future.

INTRODUCTION

It is well known that fish habitat supporting spawning, breeding, feeding, and/or growth of the species is critically important to the sustainability of healthy commercial and recreational fisheries (SFA 1996). In Rhode Island, recreationally significant marine finfish are supported by a variety of naturally occurring habitat types including but not limited to, rocky outcroppings, oyster reefs, kelp, and eelgrass beds that typically exist along shorelines and in estuarine rivers. Effectively preserving and enhancing these habitats helps to sustain important finfish populations and associated recreational opportunities. In areas where habitats have been historically degraded by anthropogenic stressors, artificial means of enhancement are necessary to help rectify the damage caused by coastal urbanization and to help provide additional support to help reinvigorate functional ecosystems.

Since 2016, the Rhode Island Department of Environmental Management's Division of Marine Fisheries (RI DEM) and the Rhode Island chapter of The Nature Conservancy (TNC) have conducted benthic habitat and finfish surveys at selected sites in the Providence-Seekonk tidal rivers (Head of Narragansett Bay) to assess their suitability for various habitat enhancement techniques. These assessments have provided insight into the current habitat condition and fish assemblage in these areas and the ability to prioritize locations where such fish habitat enhancement work would be most successful.

In 2019, an artificial reef was constructed off the southern shore of Sabin Point to provide enhancement to this important estuarine area. Investigators deployed 64 Reef Balls™, creating 4 distinct patch reefs (4 x 4 clusters) that range from 120 to 225 feet from the end of the fishing pier at Sabin Point Park in East Providence. The Sabin Point artificial reef is divided into two nearshore and two bayside patch reefs designed to provide equal access to both shore and boat anglers. The permitted reef area can be found on the updated NOAA Nautical Chart 13224 (Providence River and Head of Narragansett Bay) denoted as the Fish Haven on the south side of Sabin Point Park. Divers from RIDEM DMF and TNC continue to monitor the succession of the reef on a yearly basis.

Artificial reefs were selected as the enhancement habitat type because they create complex benthic habitats and increase fish production in southern Atlantic estuaries and can be versatile for enhancing fish habitat (Powers et. al. 2003, Folpp et al. 2020). In addition, manmade structures like artificial reefs, jetties, and shipwrecks that provide similar services to naturally occurring structures for managed species are recognized by NMFS as valuable habitat (MSA 67 FR 2343). Limited information exists on the benefits of artificial reef enhancement in Rhode Island let alone New England. Therefore, an additional facet of this study will help determine how artificial reefs can be used as a fisheries resource and fish habitat enhancement tool in Rhode Island waters. Finally, there are varying ways to monitor the different important fish habitats around the state, making it challenging to create meaningful comparisons. In order to address this challenge, standardized survey methods and innovative analytical approaches are being used to help investigators gain insight into the relative differences in habitat type success in sustaining local fish populations. Outcomes from this study will provide guidance on future priorities for preserving and restoring these valued habitat types.

APPROACH

This report covers Objective 1 and 2 of Job V, Part B (Artificial Reef Installations). This work is conducted under a multi-year cooperative agreement with TNC and RI DEM. The agreement addresses the following tasks:

Objective 1 – Overview

The purpose and scope of this objective is to monitor the SPAR site constructed in October 2019 and compare it to adjacent sites in the Upper Narragansett Bay and Providence River. The differences in structural complexity and successional stage of these sites will be evaluated with respect to their influence on recreational finfish species. In addition, the artificial reef site will be more easily compared to other essential habitat types within Narragansett Bay. This will help determine how artificial reefs can be used as a fisheries resource and fish habitat enhancement tool in Rhode Island waters.

- Conduct monthly fish trap and eel pot survey (May – October)
- Manage and QA/QC collected fish trap and eel pot data
- Conduct annual dive survey at artificial reef study sites
- Submit annual report to RIDEM
- Attend team meetings

Objective 2 – Overview

The purpose and scope of this objective are to assess the success of the SPAR site, and identify and design plans to construct artificial reef habitat in different areas of Rhode Island (e.g., Narragansett Bay, Rhode Island Sound, South County Coastal Ponds) to assess the feasibility of artificial reefs as a cost-effective management strategy to increase the stock of important recreational finfish species

- Draft and submit necessary permit applications for an artificial reef project
- Attend permit-related meetings
- Conduct site assessments for potential artificial reefs
- Conduct any necessary stakeholder/community engagement

METHODS

Objective 1

<u>Water Quality Data Loggers</u>

HOBO Saltwater Conductivity/Salinity Data Loggers (Part # U24-002-C) and Dissolved Oxygen Data Loggers (Part # U25-001) were placed within one of the fish traps at each deployment from June - October. They were attached to the tops of the traps so that they hung ~ 0.5m from the bottom. The data loggers recorded temperature (°C), conductivity (uS/cm), and dissolved oxygen (mg/L) every 30 minutes. Data from the data loggers were uploaded monthly by connecting to a HOBO Waterproof Shuttle (Part # U-DTW-1) to upload information and resyncing the internal

clock. Any fouling to the loggers was gently removed and the loggers were prepared to be redeployed during the following months sampling.

Fish Traps and Eel Pots

Black sea bass traps (43.5" x 23" x 16" (L x W x H) and 1.5" x 1.5" coated wire mesh) were deployed at 12 sites throughout the season (May – October). The traps contained a single mesh entry head and single mesh inverted parlor nozzle consistent with the black sea bass traps used in the Narragansett Bay Ventless Pot, Multispecies Monitoring and Assessment Program (conducted as part of F-61-R-23, Job #12). At each site, two traps were deployed by boat approximately 20 meters apart and were left to soak for ~96 hours, unbaited. The traps were then hauled, all animals were identified to genus or species, measured to the nearest millimeter by fork length, enumerated, then returned the water. Water salinity (ppt), temperature (°C), and dissolved oxygen (mg/L) were taken at the trap depth at the time of deployment and retrieval with a YSI handheld multiparameter. In addition, HOBO Saltwater Conductivity/Salinity Data Loggers (Part # U24-002-C) and Dissolved Oxygen Data Loggers (Part # U25-001) were placed within one trap at each site (see Water Quality Data Loggers section).

Eel traps (23" x 12" x 12" (L x W x H) and 0.5"x 0.5" coated wire mesh) were deployed at four sites (Sabin Pier, Sabin Point, Rock Island, and Gaspee Point) from May – October. The traps contained a single wire mesh entry funnel and were consistent with the eel traps used in the Assessment of Recreationally Important Finfish Stocks in Rhode Island Coastal Waters (conducted as part of F-61-R-21, Job #5 Part B). Two eel traps were deployed by boat approximately five meters from each black sea bass trap at each site and left to soak for ~96 hours, unbaited. The traps were then hauled, all animals were identified to genus or species, measured to the nearest millimeter by fork length, enumerated, then returned to the water.

Dive Survey

A survey of the floral and faunal communities was conducted by SCUBA at the Sabin Pier Artificial Reef (SPAR) site and three comparison sites (Sabin Point, Rock Island, and Gaspee Point) on October 29th & 30^{th,}, 2024. Data gathered before and after reef ball installation will be used to compare community composition pre- and post- enhancement. Data gathered from reference sites will allow comparison with relatively featureless habitats (Sabin Point and Gaspee Point) and a naturally rocky habitat (Rock Island).

Quadrat Sampling

Quadrat sampling was used to determine the abundance of common invertebrates, algae, and small cryptic fish. Along each transect an 1m^2 quadrat was placed every 8m, alternating between onshore and offshore sides of the transect, totaling six quadrats per transect. At each quadrat, all organisms and algae were identified to the lowest possible taxonomic level and enumerated.

Uniform Point Count

Uniform point count sampling was used to determine the percent cover of algae and sessile invertebrates. Along each transect a sample was taken every meter both one meter onshore and

offshore of the transect. At each sample, the substrate composition and all species found within the point (a 2cm estimated diameter) were recorded.

Swath Sampling

Swath sampling was used to determine the abundance of common algae, invertebrates, and demersal cryptic fish that could be easily counted. Along each transect a swath was performed in a 1m wide area on each side of the transect. The abundance of all target species was recorded and binned within four 20m subsections (two on each side) along the transect.

Fish Count

A fish count was used to determine the abundance of common fish along the transect. A diver slowly swam long each transect while recording the abundance and estimated size of all fish encountered within a predefined "cube" based on depth and visibility.

YSI Sampling

During the dive survey at each site, a YSI Handheld multiparameter water quality meter was used to record temperature (°C), salinity (ppt), and dissolved oxygen (mg/L) at the surface and bottom of the water column.

Data Analysis

Statistical Approaches for trap survey

Fish trap and eel pot data summaries for 2023 include all water hauls and evaluate each trap as its own data point. The catch rate (CPUE) was calculated using the following equation (see Table 1 for a description of effort at each station and month in 2022):

$$CPUE = \frac{Total\ catch\ at\ site}{Length\ of\ soak\ (days)\ \times\ Total\ number\ of\ samples}$$

The minimum account for a positive species presence was one individual found in the fish traps/eel pots at each site, every month. The total abundance and total abundance by station was calculated by removing all water hauls and bivalve data, then adding all remaining enumerated fish and invertebrates. Length frequency distributions for target species were also calculated and provided as histograms comparing trap type and sex when relevant. Finfish and invertebrate CPUE was calculated separately for both fish traps and eel pots. Species specific CPUE was also calculated for the target species by month and site using the same equation above. Length-weight relationships for available species were calculated using coefficients provided by DEM and FishBase using the following equation (Froese and Pauly 2020):

$$Weight\ =\ \alpha Length^{\beta}$$

Average trap depth is determined by calculating the mean depth of the trap when it is deployed and hauled to account for any tidal variation.

Statistical Approaches for dive survey

Benthic habitat characteristics were summarized for each transect by using the uniform point count data to derive both a geological and biological percent cover for each dive transect. The total number of observations were summarized for each species or substrate and then divided by the total number of uniform point counts collected along the length of each transect. Additionally, species richness and Shannon's Index of diversity were used to calculate the total number of unique species as well as at the weighted average, or diversity, of colonization algae and sessile invertebrate species at the SPAR and control locations. Algae and Invertebrate densities were summarized using the quadrat, and swath data sets when applicable, by averaging the total number of observations across all quadrats (n=4-6) within each transect. To evaluate how the artificial reef habitat compares to the unstructured and natural controls, the mean density of individuals per meter squared ± SE is calculated and grouped by habitat type and the corresponding controls, then facetted by survey method.

Using the fish count survey data, abundance at length was converted to total fish mass per transect by leveraging the DMF age and growth lab data to convert fish length in cm to weight in grams for our target species, using RI specific allometric growth models (see above equation). For species not currently dissected in the growth lab, the geometric mean a and B values estimated on Fishbase.org were used. To compare total fish biomass between the artificial reef, control, and natural control sites, the total fish mass was standardized by dividing the total area surveyed, to get grams per meter squared. The average fish biomass per meter squared is presented with mean ± S.E.

RESULTS

Objective 1:

Physical Data Summary

Achieving a consistent trap depth between sites can be challenging due to competing factors of desired site location, proximity to fishing areas, and bathymetric variation between each site, and tidal variation. Trap depth can impact species composition, abundance, and size since adults from certain species may be less likely to venture into shallower waters (e.g., scup (Bigelow and Schroeder 2002)). Investigators attempt to maintain an intra-site variation less than or equal to an expected tidal range of 1-2m and try to minimize the average variation in depth between sites as much as possible. This year, the greatest difference in average depth was 8.6' between Pawtuxet Cove (6.3') and Rocky Point (14.9'). The greatest within-site variation was 6.7' at Watchemoket Cove (Figure 1).

All data loggers were deployed within one trap from each sampling event starting in May. A total of 11,910 instances were recorded with dissolved oxygen data loggers and 12,688 instances with conductivity loggers across all sites. Similar to previous seasons, using the loggers only during the four-day soak period helped significantly reduce the equipment failure and unreliable data that occurred in 2017-2019. Due to an error in equipment start time, in August, there is no HOBO water quality data for Mussachuck and Sabin Pier and no dissolved oxygen data for Narragansett Terrace, Sabin Point, Rock Island, and Watchemoket Cove. Finally, only May-July water quality data for Pawtuxet was collected in 2024.

Temperature ranges were fairly consistent across sites (Figure 2). Mean temperature values by site ranged from 19.42 ± 0.07°C at Mussachuck Creek to 20.36 ± 0.06°C at Sabin Point during the sampled period. The mean temperature across sites was highest in July at 23.52 ± 0.02°C and lowest in October at 15.61 ± 0.01°C (Figure 3).

Mean salinity values by site ranged from 16.84 ± 0.32 ppt at Pawtuxet Cove to 28.85 ± 0.04 ppt at Rocky Point (Figure 4). Mean salinity across sites was highest in September at 29.37 ± 0.01 ppt and lowest in May at 21.29 ± 0.13 ppt (Figure 5). In 2024, Pawtuxet Cove had a large variation in salinity. This is not uncommon and could be due to the inflow from the Pawtuxet River. In addition, data was more limited at Pawtuxet with months Aug-Oct not being recorded which could have impacted the detection of outliers.

Dissolved Oxygen (DO) results appeared reasonably consistent with YSI recorded values. There were occasions where DO dropped to less than 2 mg/L at some sites, suggesting hypoxia (Figure 6). Data were missing during August from some sites which could have impacted results since this is the time of year when there tend to be higher instances of hypoxic conditions. By month, the most frequent and intense hypoxia occurred during July which contained 73% of all the hypoxia instances during the study period (Figure 7). In contrast, May, September and October had no hypoxic instances. Within each site, the percentage of readings indicating hypoxia (<2mg/L) ranged from 0% at Conimicut Point to 5% at Stillhouse Cove (only including sites monitored over the whole season).

Fish Trap Summary

There were 14 species caught in the fish traps including 401 finfish (7 species) and 873 invertebrates (7 species). All target species were caught except winter flounder (Table 2). The three most abundant finfish species were scup (343), summer flounder (15), and tautog (13). The top two most abundant invertebrate species were spider crabs (661), and blue crabs (177). The greatest number of finfish were caught in August (CPUE = 2.45 ± 0.98 SE) and the least in October (0.05 ± 0.03 SE) (Table 3). Rock Island and Conimicut Point had the highest catch rates overall (3.79 ± 2.66 SE and 2.83 ± 1.22 SE) and Watchemoket Cove had the lowest (0.04 ± 0.04 SE) (Figure 8). Total finfish catch rate in the fish traps this season was lower than the previous two years for many of the sites (Figure 9).

Eel Pot Summary

Eel pots were used at Gaspee Point, Rock Island, Sabin Pier (SPAR site), and Sabin Point. A total of 12 species were caught, including 102 finfish (6 species) and 78 invertebrates (6 species). The top three most abundant finfish species in the eel pots were black sea bass (40), oyster toadfish (29), and American eel (12). The top three most abundant invertebrate species were green and spider crabs (22), and blue crabs 79) (Table 2). Only two of the target species (tautog and black sea bass) were caught in the eel pots. The highest catch rate in the eel pots was during the month of September (2.05 ± 0.46 SE) and Gaspee Point had the highest average catch rate (1.25 ± 0.48 SE) compared to the other three sites (Table 4, Figure 10).

SPAR Summary

There were 13 species caught at the artificial reef site (9 finfish species). The most abundant species were black sea bass (30), blue crab (22), and mud crab (14). Black sea bass were also the most abundant fish species at the three control sites, making up the majority of the catch in 2024 (Figure 12). About 60% of the total fish caught (by abundance) and 71% of the inverts this season were found in the fish traps. At the SPAR site, finfish CPUE in the fish traps was 0.33 ± 0.12 SE and 1.12 ± 0.24 SE in the eel pots (Figure 11). Though values were close, the SPAR site had the highest species richness, and second to lowest diversity and evenness (Table 5).

Target Species Summary

Scup were the most abundant finfish species caught in the traps with a peak catch rate in June (2.25 ± 1.36 SE) (Table 6). Similar to previous years, scup accounted for any considerable variations in finfish catch rate between sites. Scup were caught at nine of the twelve sites (Table 7). Their sizes ranged from 7.6-31.4cm (FL) and had an estimated mean weight of 0.4 lbs (Figure 13). The highest catch rate was at Rock Island. Scup made up the largest percentage of fish catch by number (86%) and by weight (65.6%). There were no scup caught in the eel pots this season.

Tautog were the second most abundant finfish species caught in the traps with a peak catch rate in May (0.23 ± 0.13 SE) with sizes ranging from 31.0-54.0cm (FL) (Table 6 and Figure 14). Though they were second in catch rate, tautog had the greatest weight per fish of the target species at an average of 3.29lbs. Tautog were caught at four of the twelve sites and had the highest catch rate at Conimicut Point (Table 7). Tautog made up about 3% of the total fish catch by number which was the second highest percentage after scup. Tautog had the second highest percentage of all fish species by weight (22.1%). Tautog were found at two of the four eel pot sites with an average catch rate of 0.04 ± 0.01 SE (Table 6). Tautog size in the eel pots ranged from 5.9-9.9cm (Figure 14) (Avg biomass: 0.02lbs and 0.46% of the catch by weight).

Summer flounder were the second most abundant finfish species caught ranging in size from 17.0-43.5 cm. Summer flounder were third in weight out of the target species at an average of 0.82 lbs, had peak catch rates in September (0.14 ± 0.05 SE), and were caught at ten of the twelve sites (Table 6 and Table 7). Summer flounder made up the second highest percentage of total fish catch by number and third by weight (0.04% and 6.3% respectively). No summer flounder were caught in the eel pots.

Black sea bass were the fifth most abundant finfish species caught in the fish traps, ranging in size from 20.2-38.0cm and averaging at 0.91lbs (Figure 15). Black Sea Bass were caught most frequently in July with a catch rate of 0.10 ± 0.07 SE (Table 6 and Table 7). Black sea bass were the fifth highest percentage of total finfish catch by number and had the fourth highest percentage by weight (2% and 3.78% respectively). Black sea bass were the most abundant species caught in the eel pots with a higher average catch rate than all other species (CPUE = 0.41 ± 0.09 SE) and were caught at all four eel trap sampling sites (Table 8). The black sea bass caught in the eel pots ranged in size from 6.4-17.8cm (Figure 15) (Avg biomass: 0.05lbs and 13.7% of the catch by weight). The greatest number of black sea bass were caught in the eel pots at Sabin Point (CPUE = 0.63 ± 0.35 SE).

Blue crabs were the second most abundant invertebrate species caught in 2024 with a peak catch rate in August (1.43 ± 0.25 SE) and the highest rate by site at Watchemoket Cove (1.04 ± 0.42). Blue crabs were also sexed when possible and there was a higher ratio of males to females caught in the traps throughout the entire season. Blue crabs ranged in size from 7.0-7.9 cm with the females making up the smaller range of sizes (Figure 16). The average male blue crab size was 13.7 ± 0.2cm while the average female was 12.0 ± 0.4 cm. Blue crabs were the second most abundant invertebrate species caught in the fish traps and third most abundant in the eel pots (Table 2). Blue crabs were found at all four eel pot site and ranged in size from 3.0-16.7 cm.

Dive Survey

During October 2024, dive surveys were conducted to determine the baseline floral and faunal communities for use in productivity estimation at four locations near the mouth of the Providence River. The four sites included, Sabin Point Pier (artificial reef site, post enhancement), Sabin Point (unstructured control - east), Rock Island (natural rocky subtidal control - west), and Gaspee Point. (unstructured control – west). Using a multitude of dive transect methods, investigators were able to determine the substrate percent cover, mean proportion flora and fauna inhabiting the landscape, and the biomass of finfish utilizing these different habitats.

Investigators successfully conducted the third year of the post enhancement productivity dive surveys on the Sabin Point Artificial Reef (SPAR) and paired control sites. During each dive, staff removed gear from the reef, collected video and photo evidence of the reefs' colonization and succession, and the annual productivity dive surveys completed on October 10 and 11, 2024.

Percent cover at the two Providence River control sites, Gaspee Point and Sabin Point Control, were similar with respect to the substrate condition. Both sites were composed of primarily sand and fine sediment, with intermixed cobble, *Crepidula,* and quahog shells. The proportion, or percent cover, of sand and shell at the control sites ranged from 47.5 to 100% (Figure 17; GASP and SPCTR). Post deployment of the SPAR, the Reef Balls have taken up a 20-50 percent cover of the uniform point count transects. During each of the seven dives completed since 2020, no evidence of scouring or damage to the reef balls were observed. Compared the natural control, or Rock Island site, the percent cover of boulder substrate (45-74 percent boulder) was similar to that of the proportion of Reef Ball cover at the SPAR (40-60% reef ball). Both the SPAR and Rock Island sites have a higher proportion of more complex structure compared to the relatively sandy and flat control sites of Sabin Point Control and Gaspe Point. During the 2022 dive survey, investigators found that the Sabin Point reef site had 26.6% cover of blue mussels in 2021 but in 2022 the blue mussels had been eaten off the reef and shell was distrusted throughout the reef area (Figure 18).

In 2024, the overall species richness and diversity, with respect to the algae and sessile invertebrate species, were greater at the reference and Artificial Reef sites, relative to the controls (Table 9). The biggest difference between the rocky substrate locations and sand/mud flat controls is the abundance of branching and filamentous algae that are able to adhere to the firmer substrate as well as shellfish that have recruited to the artificial reef. Most notably *Fucus visiculous, Argardehlia subulate,* and blue mussels (Figure 18 and 19). Four years after

deployment, the algae and invertebrate community at Sabin Point AR has begun to look more similar to the rock island natural control site with increasing boring sponge, red beard sponge, blue mussels, eastern oysters, and *Argardehlia subulate* over time (Figure 19). Investigators found invertebrate densities to vary depending on the species and survey location. The control sites were dominated by eastern mud snails (12 - 120 ind./m^2) and long clawed hermit crabs (1-8 ind./m^2) (Figure 20-21). When comparing swath and quadrat survey techniques, it seems the quadrat method provides a higher estimate of shellfish densities across all locations, as was the case for the Northern Quahog densities (Figure 20 and 21). Greater abundance of rare or less occurring species like red beard sponge or the orange sheath tunicate was also more effectively documented with the swath method, whereas the quadrats were most helpful for species occurring in abundances so large that counting along the entire swath of the transect would be not worthwhile, for example eastern mud snails and crepidula (Figure 21).

In 2019, during the pre-enhancement survey, total fish biomass at the SPAR (0.27 ± 0.03 g/m^2) was equal to the two control sites (GASP 2.23 ± 2.15 and SPCTR 0.76 ± 0.68). After installation and initial colonization by benthic organisms, and subsequent blue mussel set, an increase in fish biomass relative to both the unstructured controls as well as the natural control sites was observed (Figure 22). Fish biomass at the SPAR experienced a 3-fold increase from 10.58 ± 5.6 g/m^2 to 31.31 ± 15.52 from the first to second year after reef construction (Figure 22). In 2022 fish biomass declined to 15.53 ± 9.85 g/m^2 but still remained greater than the control sites. In 2023 fish biomass declined to 1.19 ± 1.15 g/m^2 and was still greater than 2019. The same trend held true 2024 with biomass still greater at the AR sites than the controls. However, when comparing the effect of the artificial reef on fish biomass relative to the controls, Sabin Point AR has had positive effect relative to the unstructured controls each year since the deployment (Figure 23).

DISCUSSION:

Objective 1

Water Quality Data Loggers

Mean temperature, salinity, and dissolved oxygen fell within typical ranges associated with Upper Narragansett Bay (NBFSMN 2016; Reed and Oviatt 2006-2019). The periodic instances of hypoxia (<2mg/L) at various sites in 2024 are typical of the area, especially within the upper reaches of the PRE (Hale et al 2018). This year, the hypoxia rate was not as significant as the previous year. However, data from multiple sites were missing during August which has been the most common time for hypoxic events (see previous reports). The continued use of the HOBO data loggers at shorter (four-day) intervals was once again more successful than the fixed site (30-day) approach and led to less fouling and increased accuracy of readings.

Fish and Eel Traps

Consistent with documented scup life history patterns described in “Essential Fish Habitat Source Document: Scup, *Stenotomous chrysops*, Life History and Habitat Characteristics” by Steimle et al. 1999, this year’s fish trap data reflects expected trends. Data from the fish traps demonstrate two peaks in catch rate during June and August aligning with scup schooling

behavior and seasonal movement patterns. Similar to previous years, scup were captured in higher numbers relative to other species. This is likely due to their tendency to aggregate and move in large groups. This season recorded the highest number of scup caught since 2019. However, none were caught in the eel pots. This could be indicative of the gear type's lower efficiency in targeting this particular species or their somewhat incidental schooling behavior. Their group formations may occur unpredictably based on factors of food availability or chance encounters with other individuals (Steimle et al. 1999). Folpp et al. (2020) suggests that Sparid fish populations can experience localized increases following the installation of artificial reefs. This relationship is not always limited to the artificial structures themselves but often extends to adjacent natural reef habitats. This highlights the potential for artificial reefs to influence broader ecosystem dynamics and support the growth of nearby fish populations.

As in previous years, the majority of tautog (*Tautoga onitis*) were caught in May, with most individuals measuring over 30 cm, indicating a predominance of adult fish. Mature tautog are known to spawn in the upper estuary of Narragansett Bay between May-July (Steimle and Shaheen 1999; Dorf and Powell 1997). Many of the female adult tautog caught during the study were gravid, aligning with documented spawning behavior. Juvenile and YOY tautog were only occasionally caught in the eel pots, primarily during July, August and October. This seasonal pattern, seen over the course of the project, may reflect the gradual recruitment of younger fish into the study area as they transition from nursery habitats to more complex structures. The lack of larger tautog in the summer months is consistent with their known response to suboptimal environmental conditions, particularly increased warmer temperatures. Tautog are sensitive to thermal changes and tend to relocate to deeper, cooler water during periods of heat stress (Steimle and Shaheen 1999). This season recorded the lowest number of tautog caught in the fish traps since the study began, though not significantly different from prior years. Tautog are strongly associated with complex and structured habitats like rock piles and artificial structures. Observations during dive transects showed tautog utilizing the SPAR reef structures, underscoring their habitat preference. This behavior likely contributes to the reduced number of tautog near these areas due to habitat displacement (the fish forego the traps because the local habitat or artificial reef provides ample shelter and resources). These findings highlight the importance of understanding the spatial dynamics of structure-dependent species when interpreting trap data, as artificial reefs may inadvertently alter capture rates by providing alternative habitats.

Throughout this project, the catch rates for summer flounder (*Paralicthys dentatus*) and winter flounder (*Pseudopleuronectes americanus*) in the fish traps and eel pots have remained consistently low. This trend may be partially due to the inherent limitations of the trap's design, as the trap openings are not particularly wide, limiting the size and type of fish that can enter. In addition, although summer flounder do occasionally seek structured habitat for refuge, they tend to prefer sandy flat bottom habitats and therefore may not seek out traps like structure-associated fish (Packer et al. 1999). Winter flounder exhibit a similar preference for soft-bottom habitats making them less likely to seek out the traps. Another important consideration is the overall population status of these species. Both summer and winter flounder have experienced declines in abundance in recent decades due to overfishing, habitat degradation, and changing

environmental conditions, including warming water temperatures and shifting prey availability (Langan 2021). The consistently low capture rates observed for these species underscore the importance of considering species-specific behaviors and population trends when interpreting sampling data and highlights the value of the multiple sampling methods utilized in this study.

Black sea bass were caught in the fish traps in July, August, and October at the two southernmost PRE sites. Although total numbers were low, they were relatively consistent with previous years' data. Juveniles (7-11cm) were not documented in the eel pots until September and the total catch rate was lower than previous years. Year-1 and YOY black sea bass tended to be captured in the eel pots while none were caught in the fish traps. This suggests differences in gear selectivity or habitat preferences among size classes. Larger black sea bass (>19cm) typically remain in deeper water especially when there is limited structure available (Northeast Fisheries Service Center 2017). This behavior could explain why more were caught in the deeper southern sites, and none at the sites dominated by smaller fish. In addition, the smaller black sea bass are likely able to escape the larger traps. These observations align with trends recorded in previous years. Black sea bass are structure-seeking species and are influenced by habitat availability and quality. Their lower numbers could be due to habitat displacement phenomena (outlined above), a result of competition with other species, or natural fluctuations in abundance.

Dive Survey and Sabin Point Artificial Reef Deployment

The artificial reef structures will continue to undergo successional changes and colonized by different algae and invertebrate species, further promoting the base of the food web that will ultimately support more mid-trophic level sportfish. Research on Reef Balls™ have been shown to create a more robust benthic habitats, ultimately attracting more fish to the reef (Bohnsack 1994, Lindberg 2006, Jordan 2005, Rosemond 2018). The reef will also provide shelter and food resources for sub-legal size sportfish and aggregating forage fish, promoting both the growth and survival of these individuals (Powers 2003, Caddy 2011). The Sabin Point project has begun to enhance fishing in the nearby Sabin Point waters, which currently provides fishing access and until recently, little structure for demersal reef fish like tautog and black sea bass. Through this work we have increased complex structure of the Sabin Point Pier benthos by an average of 15-50 percent on average. The species richness and diversity at Sabin Point continues to remain higher than the control sites, and has received a massive set of blue mussels in 2021, averaging over 59 ind./m^2 with individual recordings up to 2,500 per meter squared. Fish biomass continues to be greatest at the new reef location as well, with increased juvenile and adult abundance of sportfish like cunner, tautog, and black sea bass. Additionally, in 2024 we documented our first Star Coral, *Astrangia poculata*, recruitment to our artificial reef. Our results support the findings from a recent meta-analysis of 39 artificial reef studies conducted around the globe, that found the effect size of artificial reefs on fish density to be greatest in the Atlantic Ocean and artificial reefs made with concrete materials (Paxton et al 2020). In addition to the ocean and material used, the effect size of artificial reefs relative to natural reefs increased with increasing latitude, with positive effects for reefs in temperate regions (Paxton et al 2020). The results also suggest that effect of artificial reefs on total fish biomass was positive relative to both the unstructured and natural rocky reefs, and that the strength of this effect varies with increasing and decreasing blue mussel coverage on the reefs.

Objective 2

In 2022, staff from TNC and DEM participated in meetings with the Narragansett Bay Commission to discuss the feasibility of three potential locations for future artificial reef installations. These discussions included providing guidance on a draft permit application and evaluating site-specific factors that could influence reef design, ecological outcomes and regulatory compliance (Appendix- Figure A). Despite initial progress, the permit application was put on hold due to limited capacity within the agencies involved. This pause also delayed further investigations into the proposed installations and the evaluation of alternative sites as focus shifted toward the development of a comprehensive statewide plan for artificial reef implementation. This statewide plan aims to establish clear guidelines and priorities for artificial reef projects, ensuring they align with ecological goals, regulatory standards, and community needs.

The data collected during this study will play a crucial role in shaping the statewide plan. It will provide valuable insights into fish behavior, habitat use, and species abundance in relation to existing artificial structures, helping to identify key considerations for future reef installations. These findings will also inform the evaluation of potential restoration sites by offering evidence-based metrics to assess habitat suitability and expected ecological benefits, particularly in the urban estuarine environment. By leveraging existing data and aligning restoration goals with long-term management plans, investigators have laid the groundwork for effective and sustainable habitat enhancement projects in RI's coastal waters.

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FIGURES:

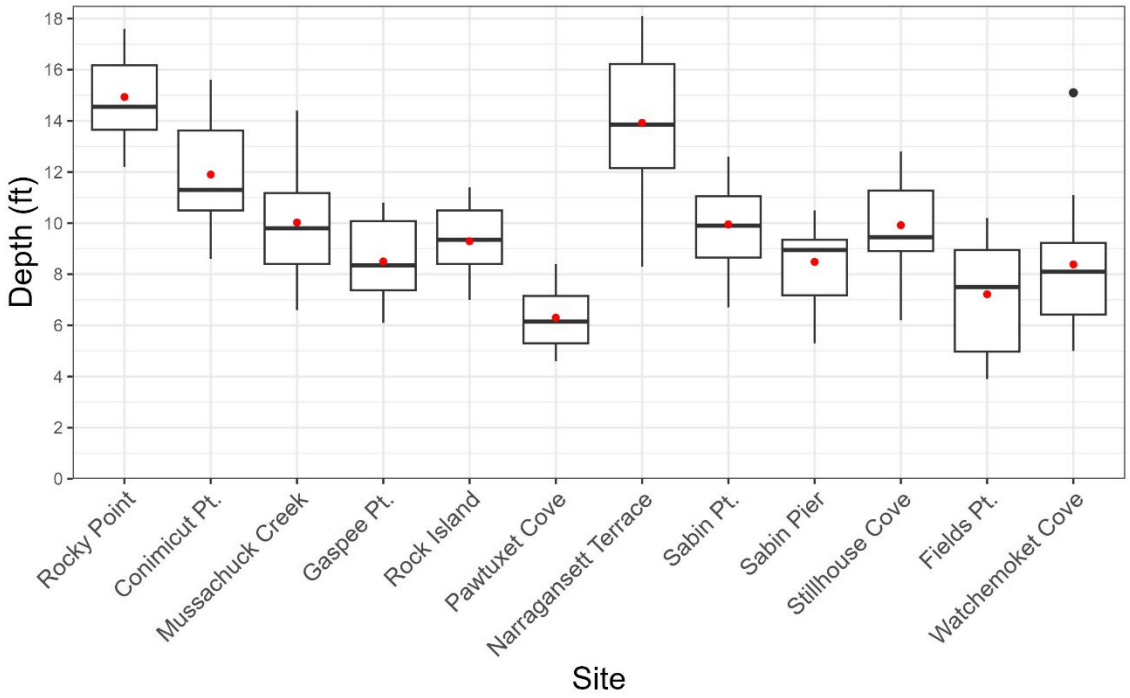


Figure 1. Boxplot of depth (ft) fish traps and eel pots were set at each site. Depth was recorded at the set and pull dates with red center points representing mean values.

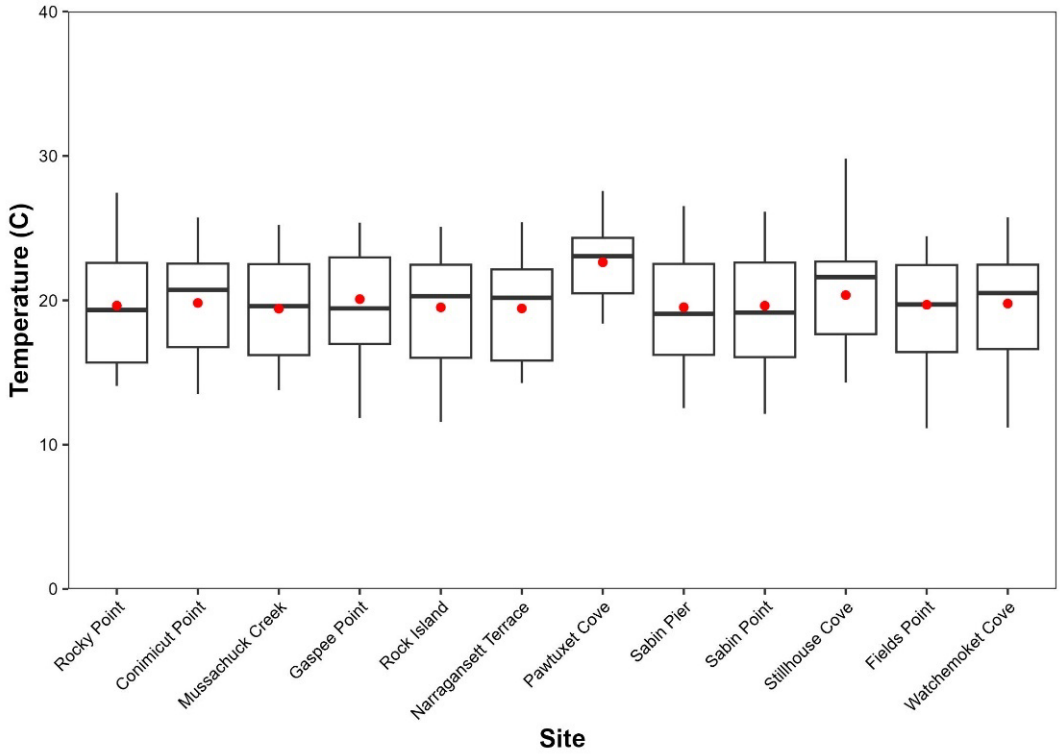


Figure 2. Boxplots of temperature (°C) recorded by the data loggers at sites during 2024 with red center points representing mean values.

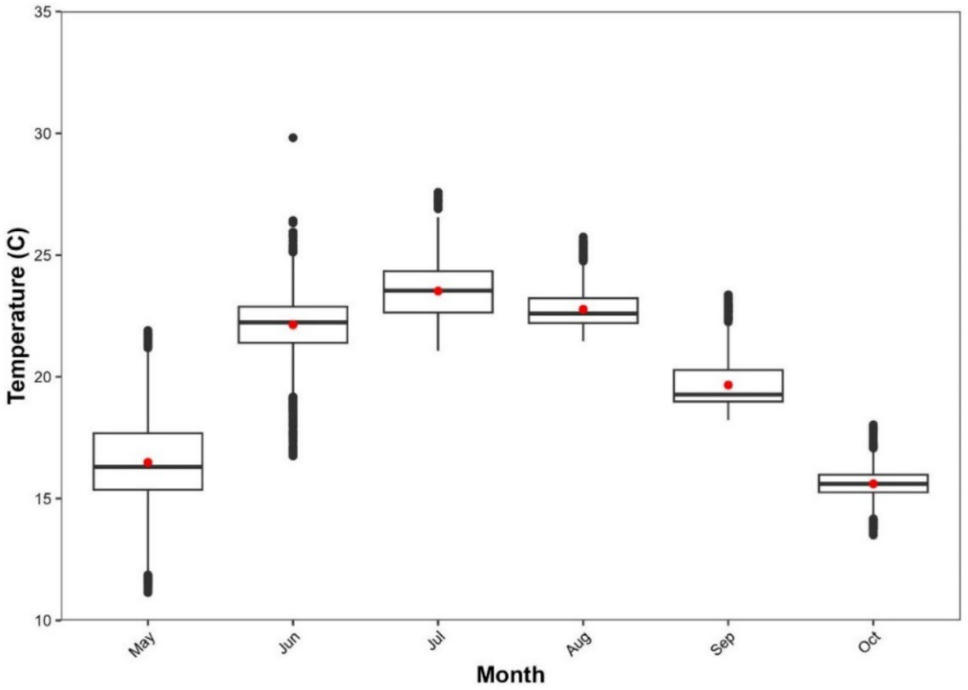


Figure 3. Boxplots of temperature (°C) recorded by the data loggers each month during 2024 with red center points representing mean values.

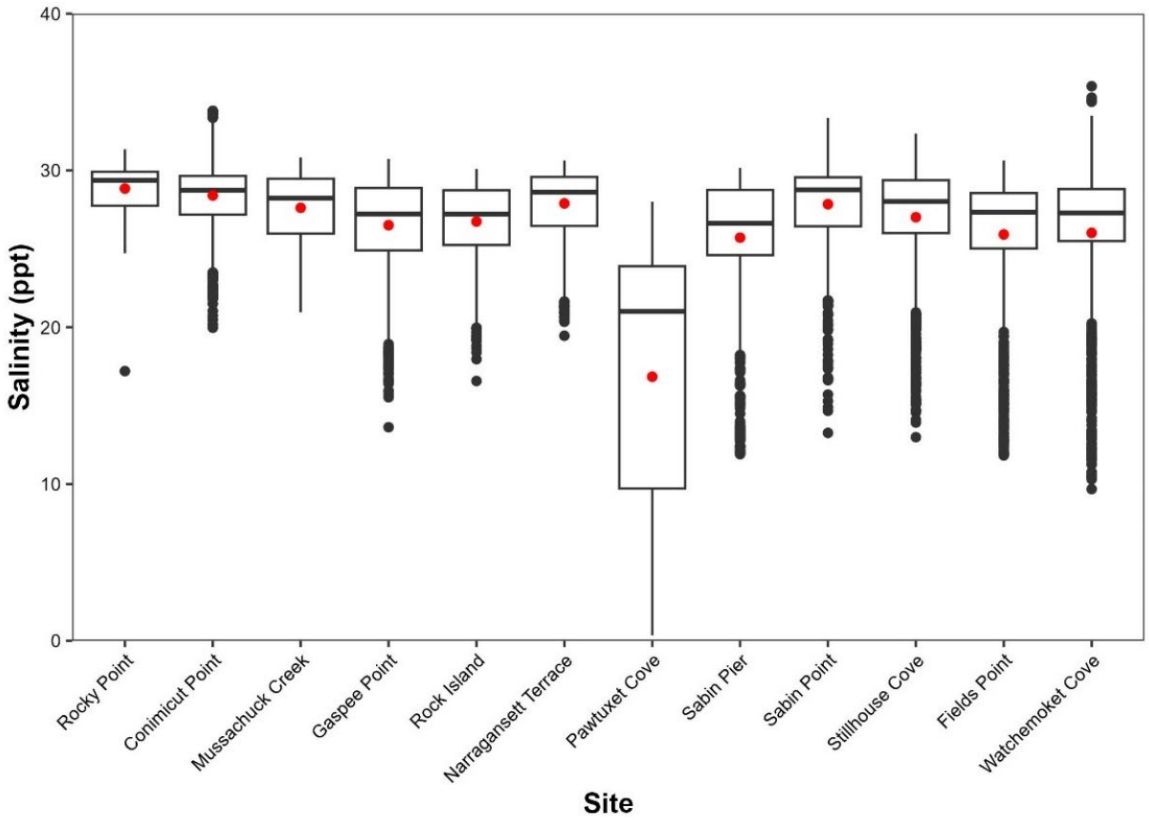


Figure 4. Boxplots of salinity (ppt) recorded by the data loggers at sites during 2024 with red center points representing mean values.

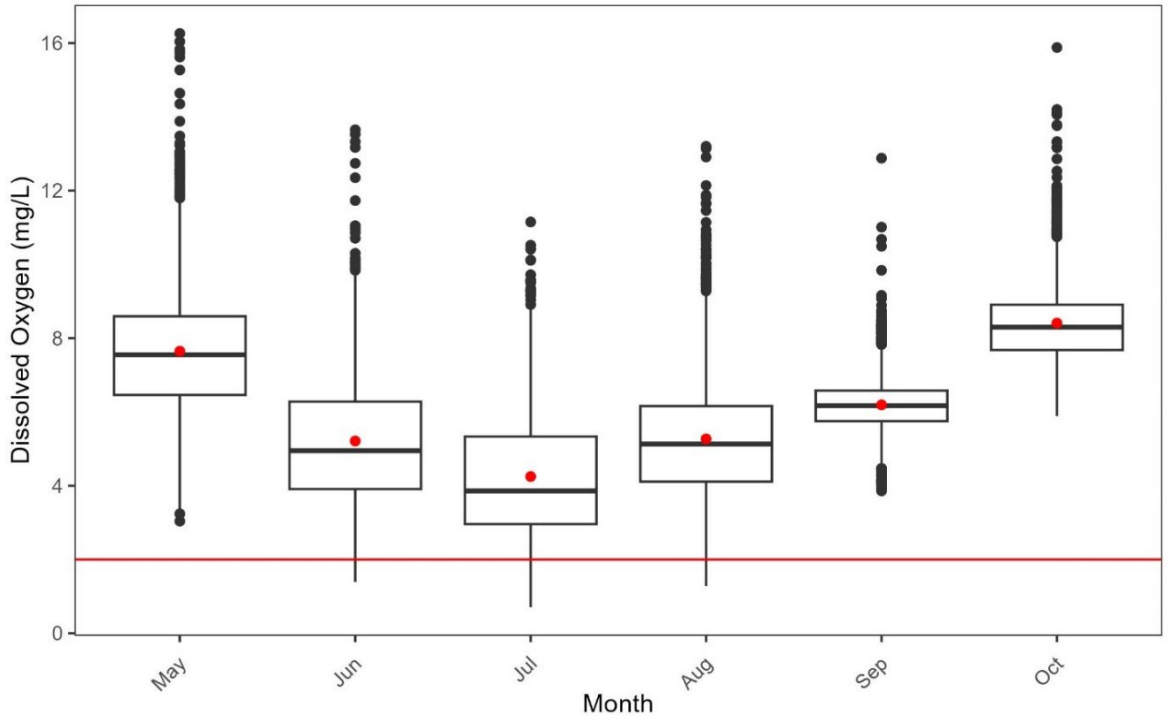


Figure 5. Boxplots of salinity (ppt) recorded by the data loggers across months during 2024 with red center points representing mean values.

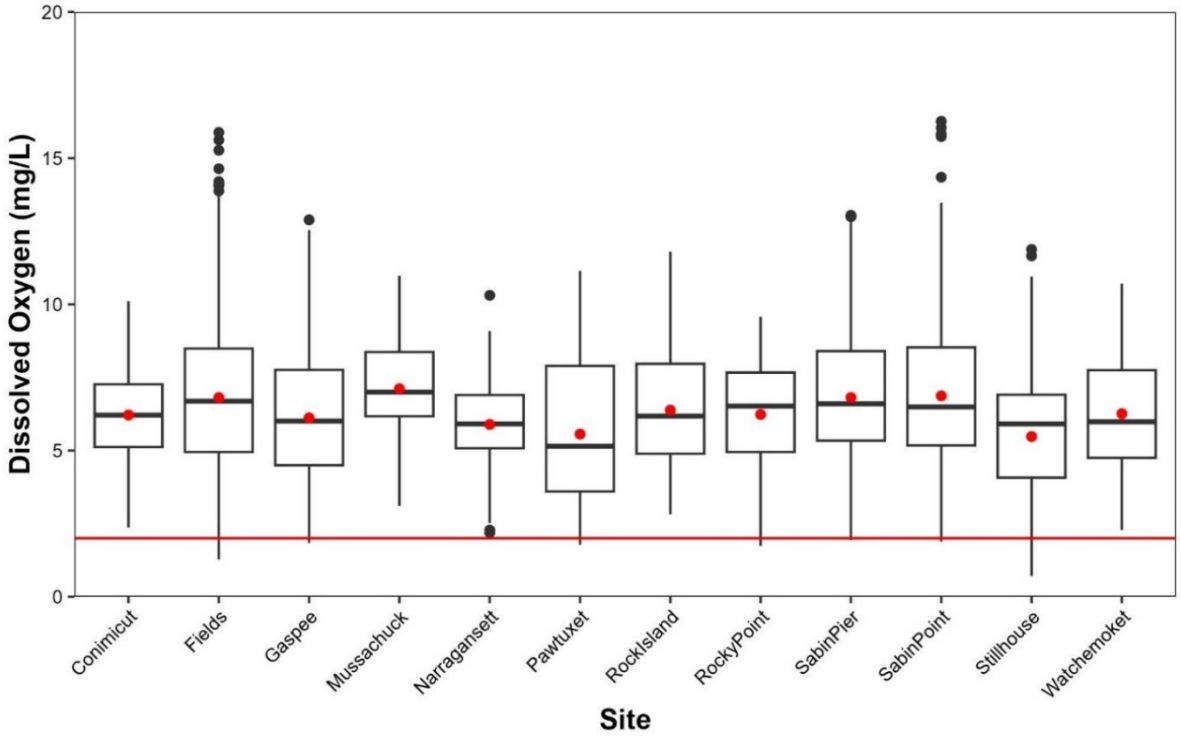


Figure 6. Boxplots of dissolved oxygen (mg/L) recorded by the data loggers at sites during 2024 with red center points representing mean values.

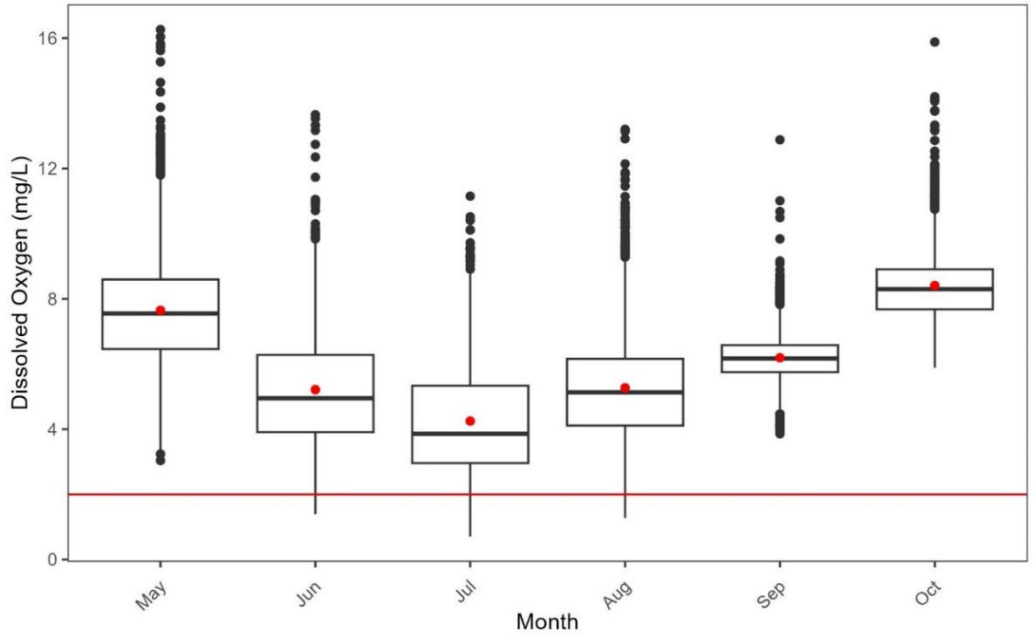


Figure 7. Dissolved oxygen (mg/L) values recorded by the data loggers each month during 2024.

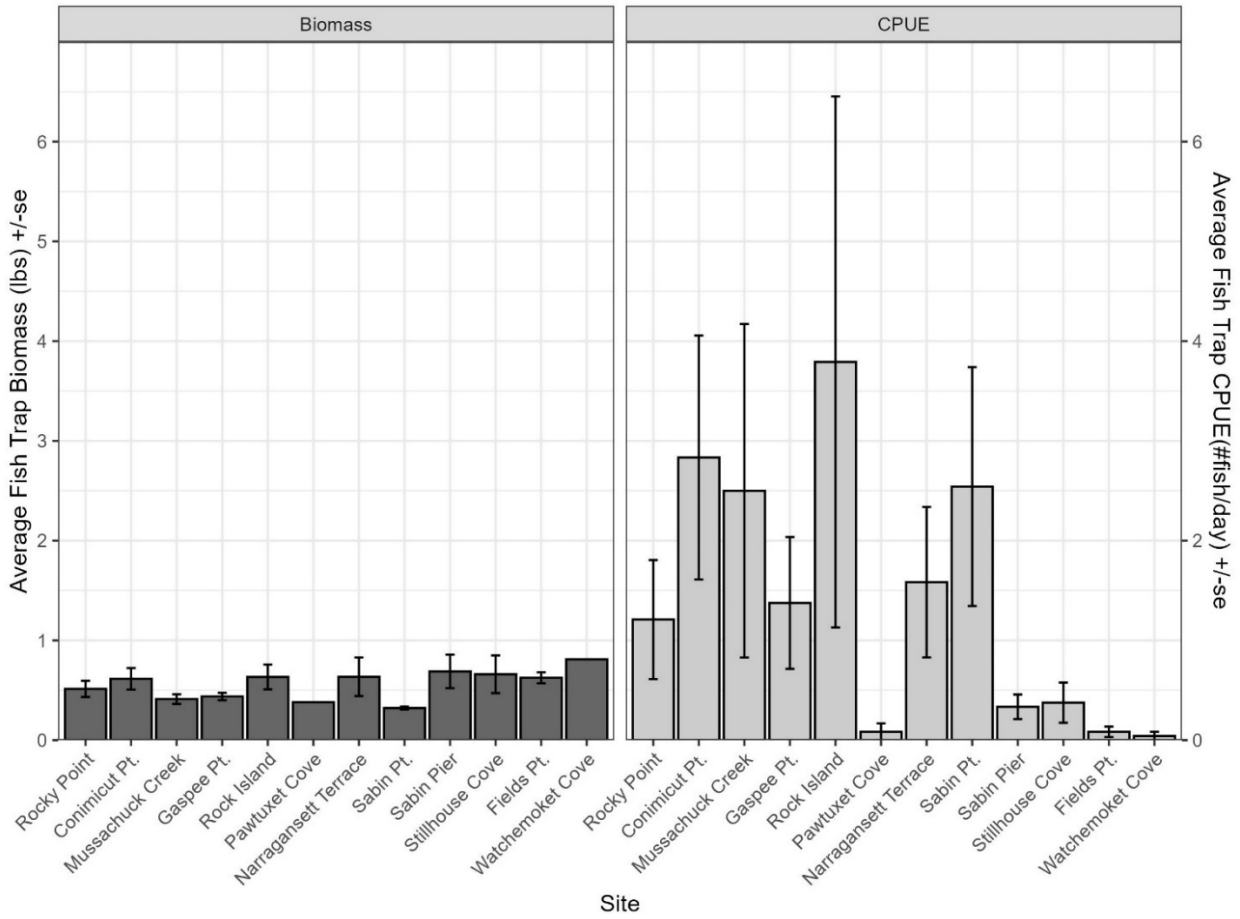


Figure 8. Average fish trap CPUE and biomass in 2024 across all sites. Error bars represent standard error.

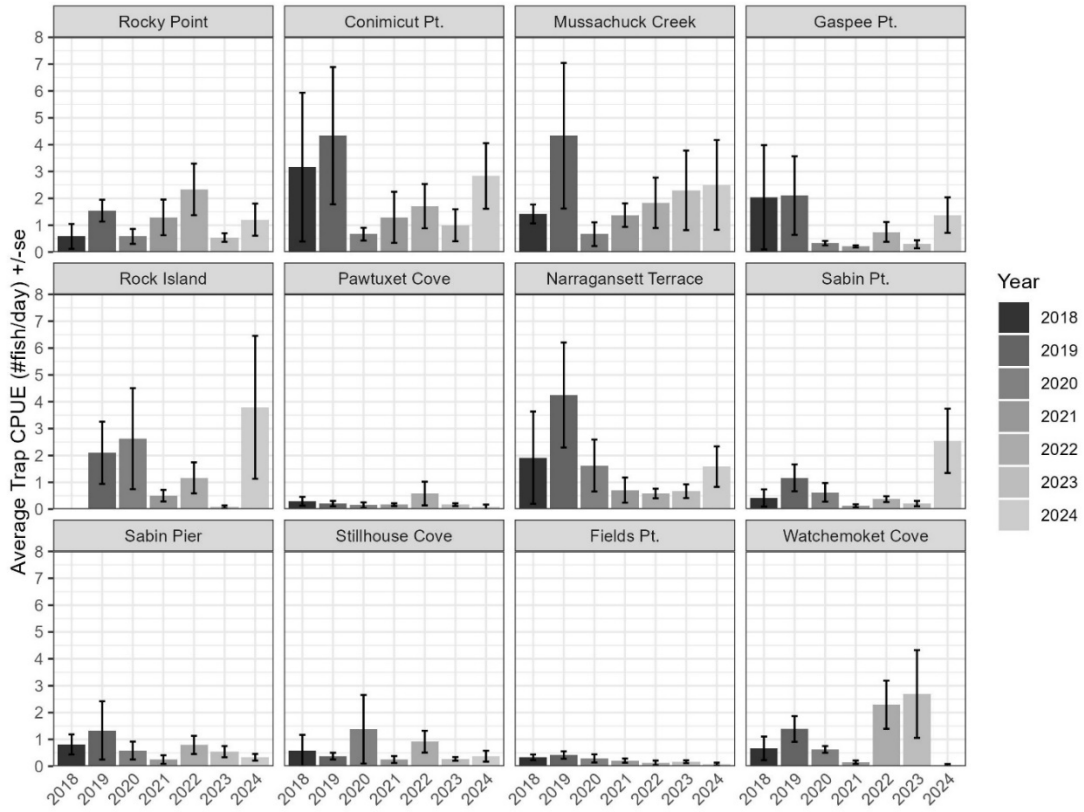


Figure 9. Average fish trap CPUE across all sites each year (2018-2024). Error bars represent standard error.

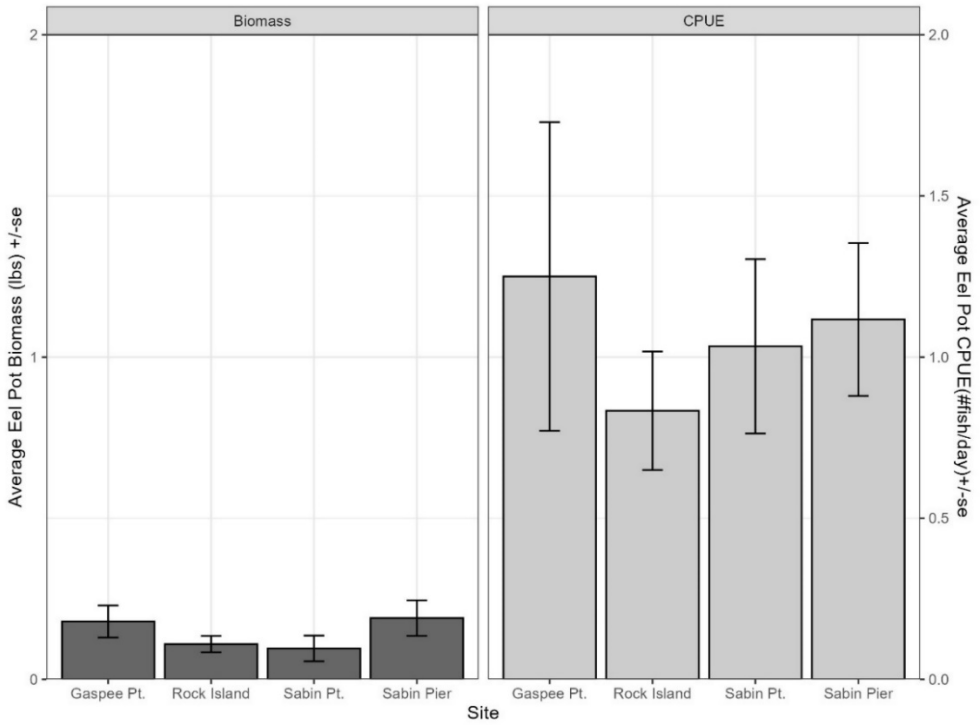


Figure 10. Average eel pot CPUE and biomass in 2024 across all stations. Error bars represent standard error.

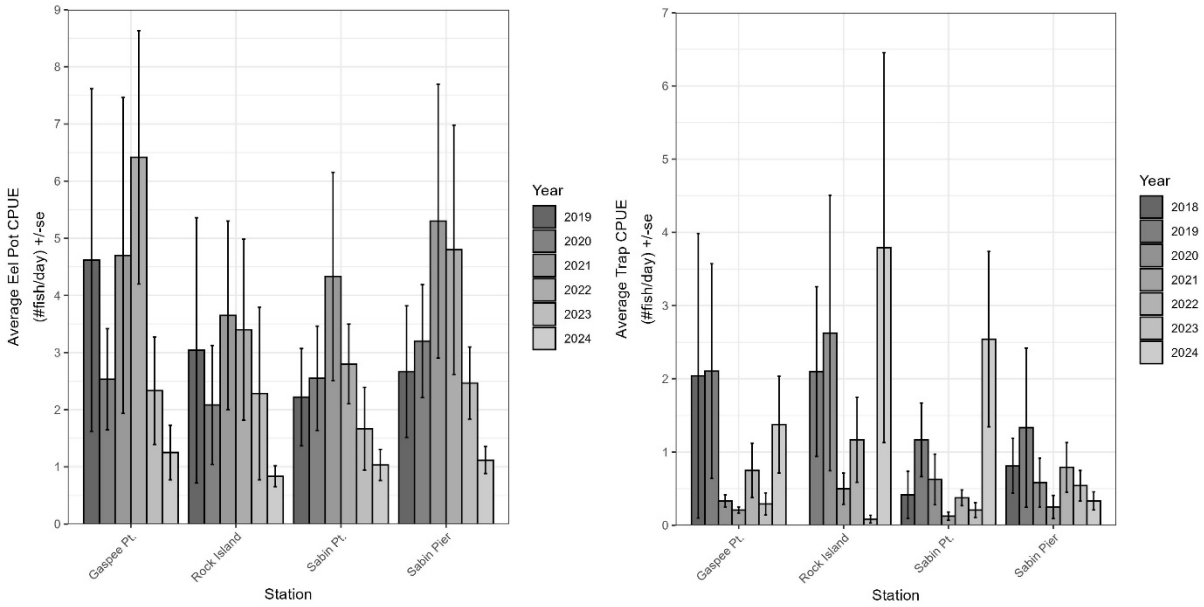


Figure 11. Average fish trap CPUE (left) and eel pot CPUE (right) across the four AR monitoring sites each year (2018-2023). Error bars represent standard error.

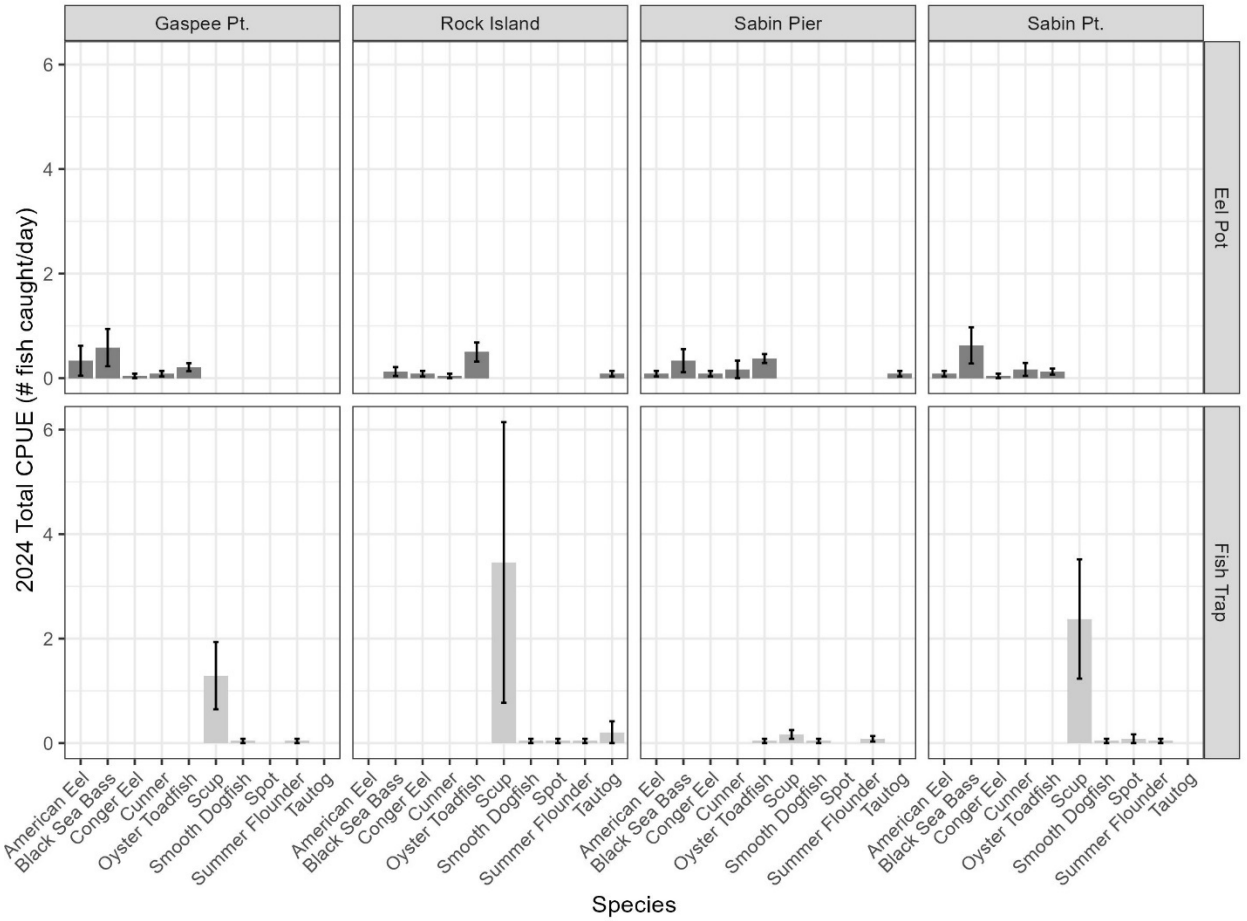


Figure 12. Average CPUE (# of fish/day) by species across all AR monitoring sites in 2024.

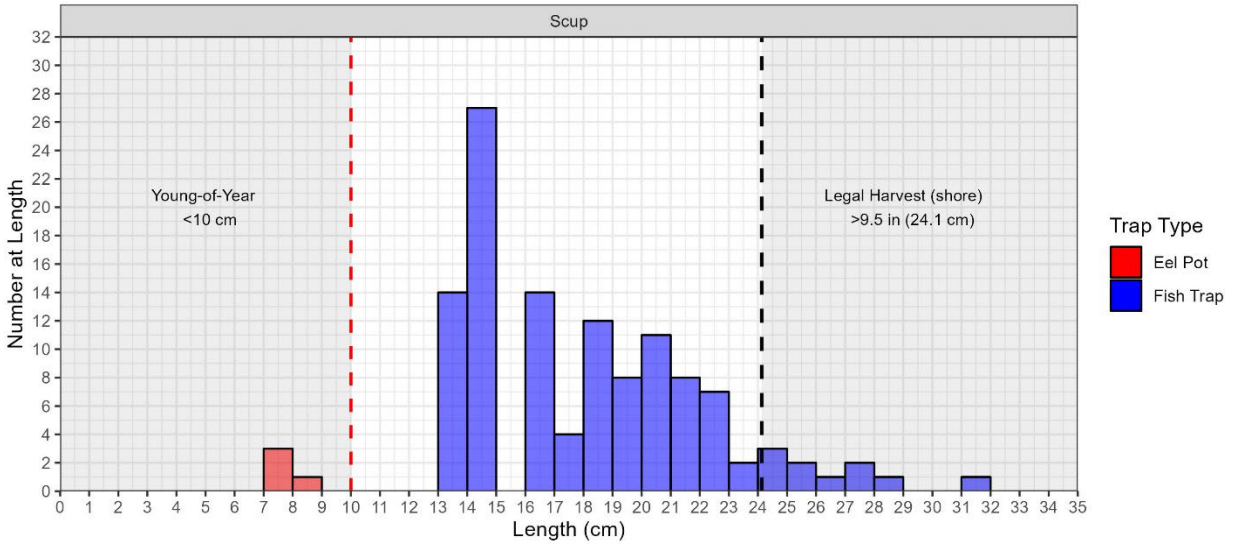


Figure 13. Histogram showing the size frequency at length of scup species caught in eel traps and fish traps.

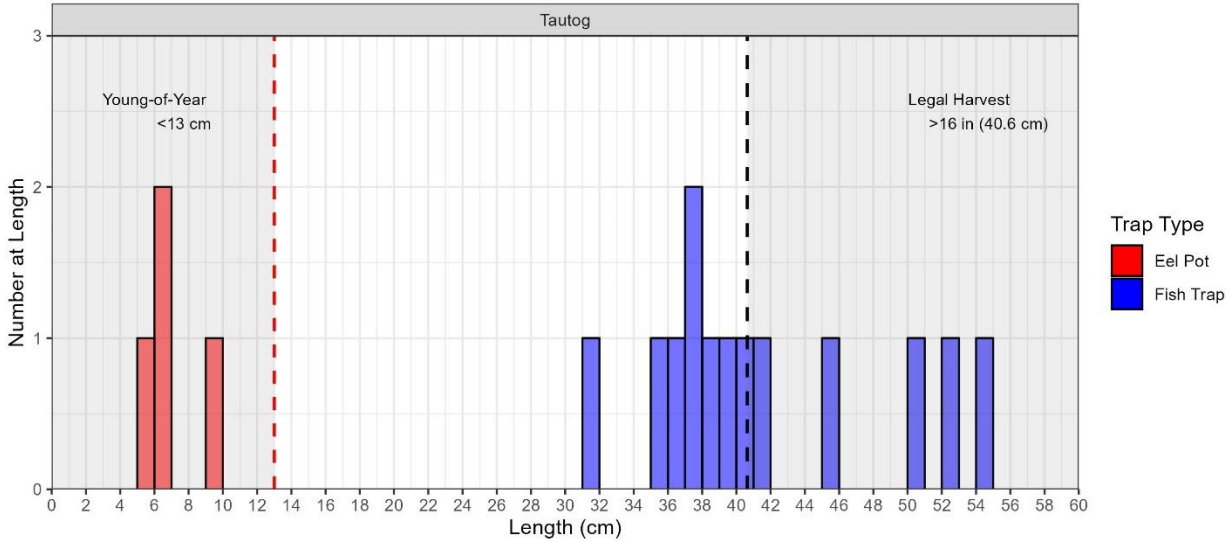


Figure 14. Histogram showing the size frequency at length of tautog species caught in eel traps and fish traps

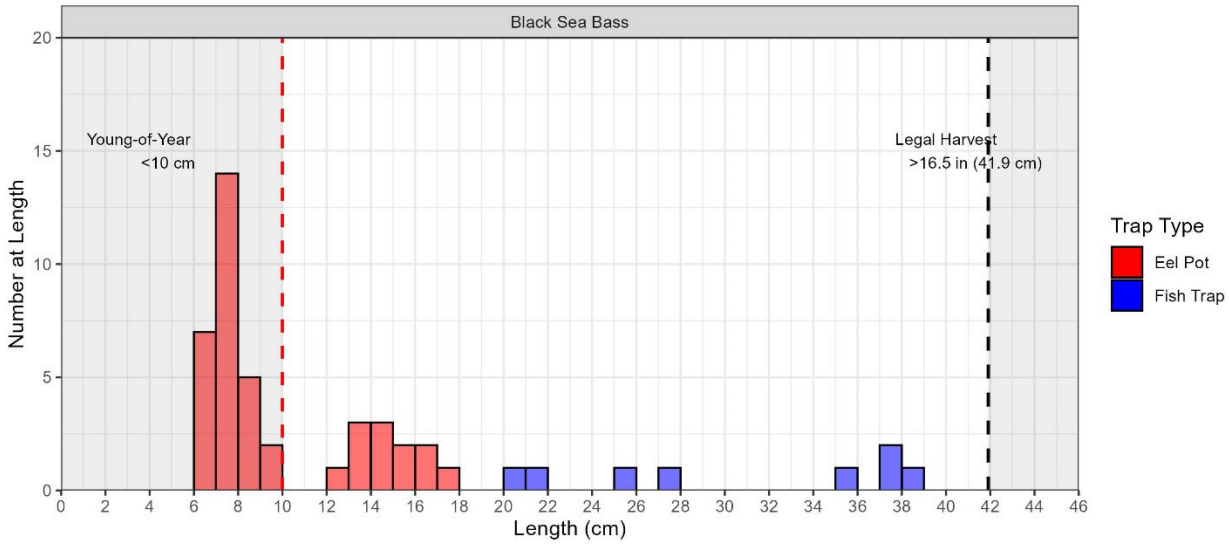


Figure 15. Histogram showing the size frequency at length of black sea bass species caught in eel traps and fish traps.

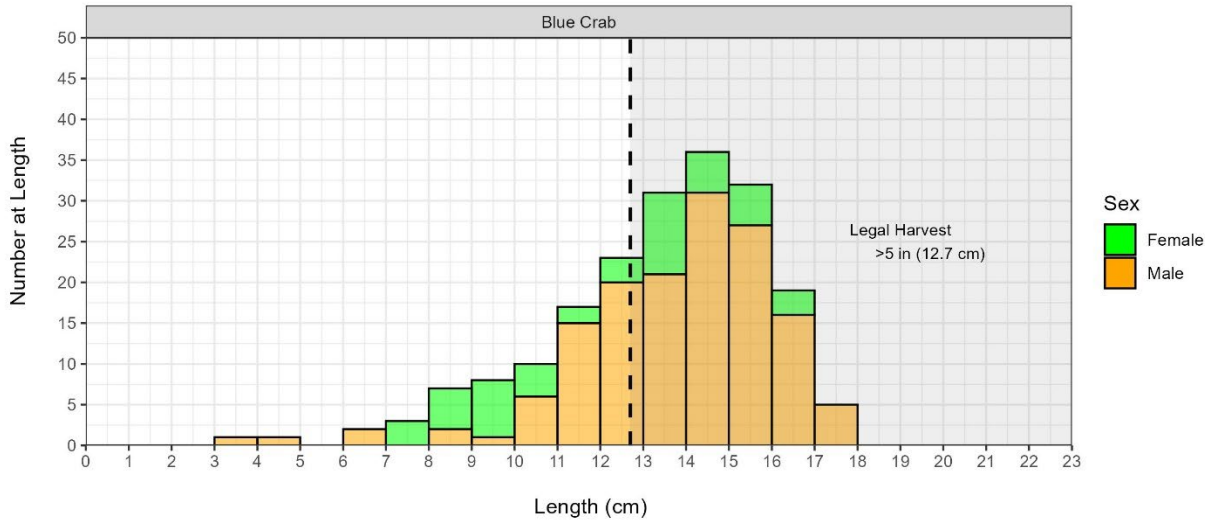


Figure 16. Histogram showing the size frequency at length of blue crabs caught in fish traps separated by sex.

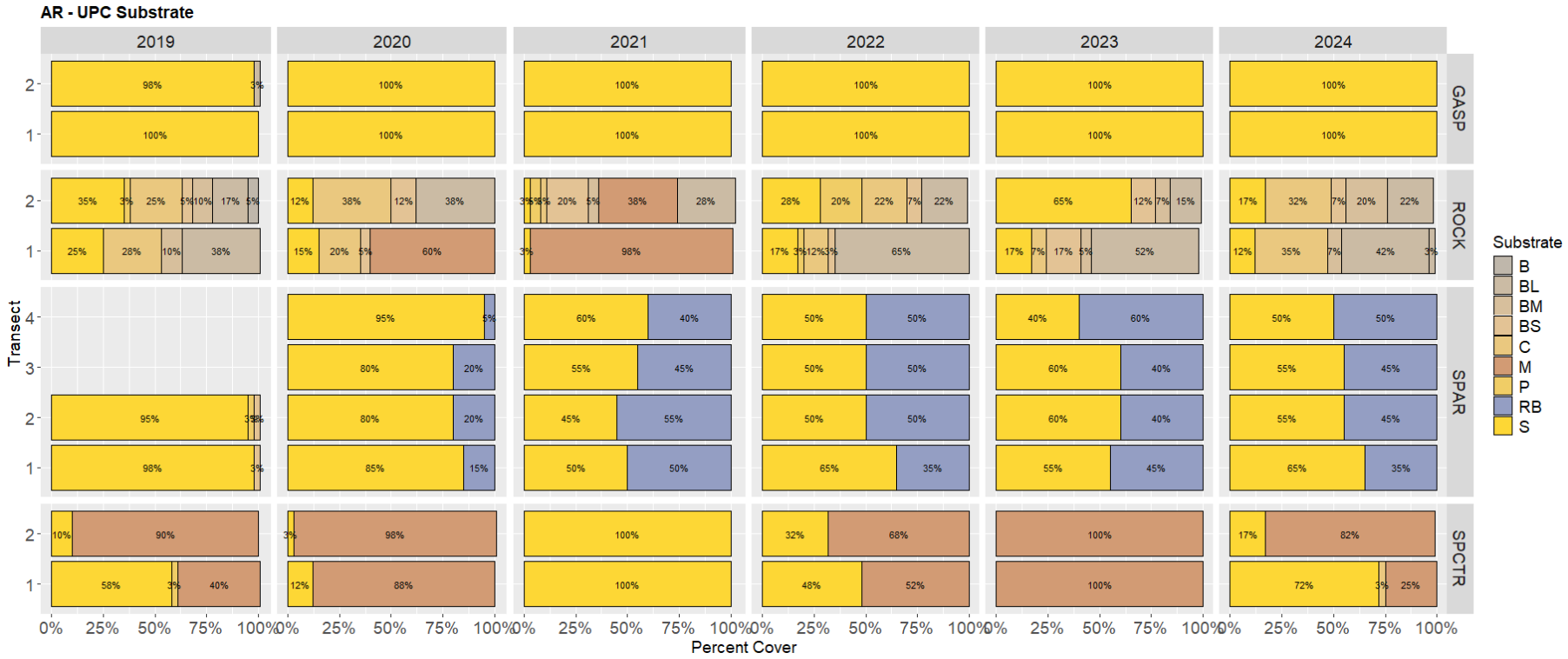


Figure 17. Percent cover of substrate along the y-axis plotted for each transect along the x-axis, for each 2020-2024 fish productivity survey. Percent cover is grouped by substrate type (BL = boulder large, BM = boulder medium, BS = boulder small, M = mud/fines, M_S = sandy mud mix, S = Sand, RB = Reef Ball) and faceted by Site (GASP = Gaspee Point (Control), ROCK = Rock Island (Natural Control), SPAR = Sabin Point Artificial Reef (Reef), SPCTR = Sabin Point Control (Control)

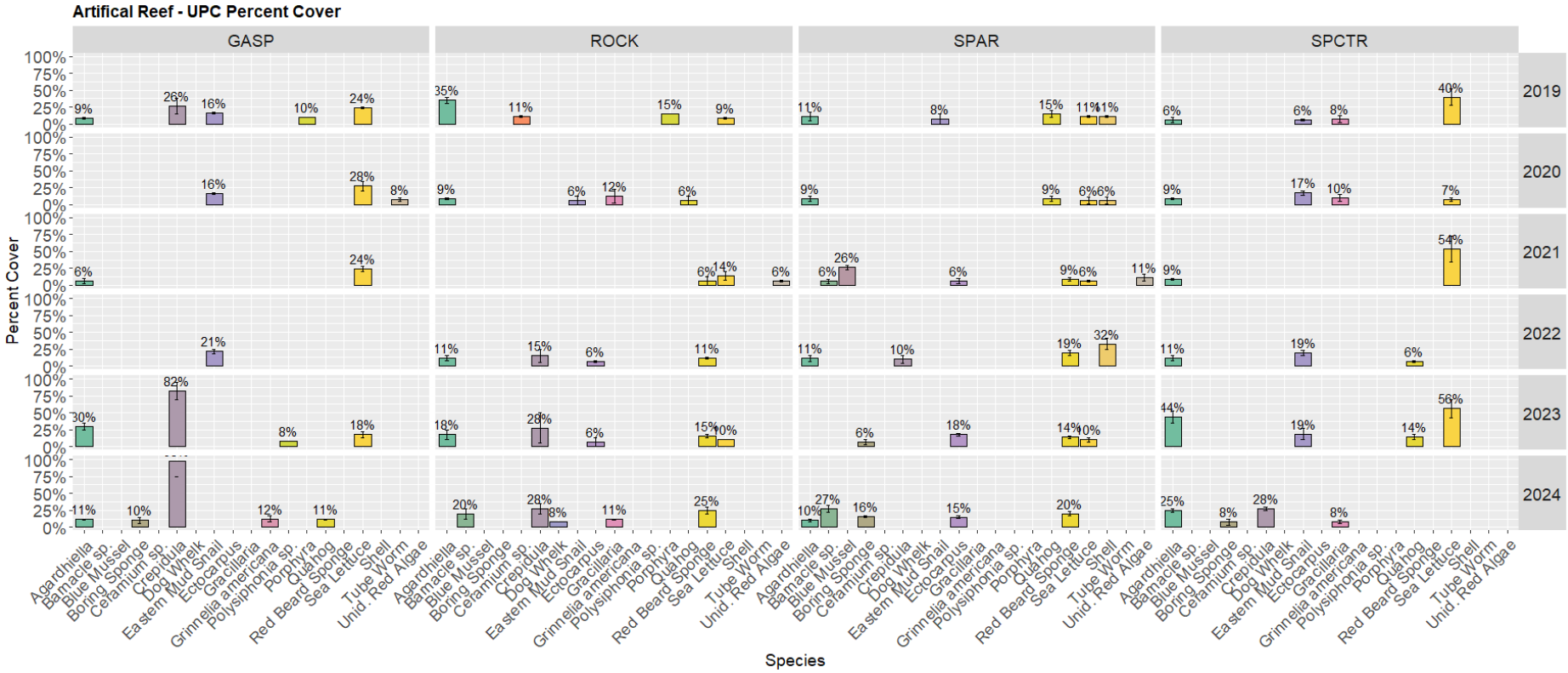


Figure 18. Mean algal and sessile invertebrate cover ± SE, greater than 2.5% cover, for all years of the study (2019-2024) at the Sabin Point Artificial Reef Survey Sites (GASP = Gaspee, ROCK = Rock Island, SPAR = Sabin Point AR, SPCTR = Sabin Point Control) Reef Balls were deployed after the 2019 dive survey.

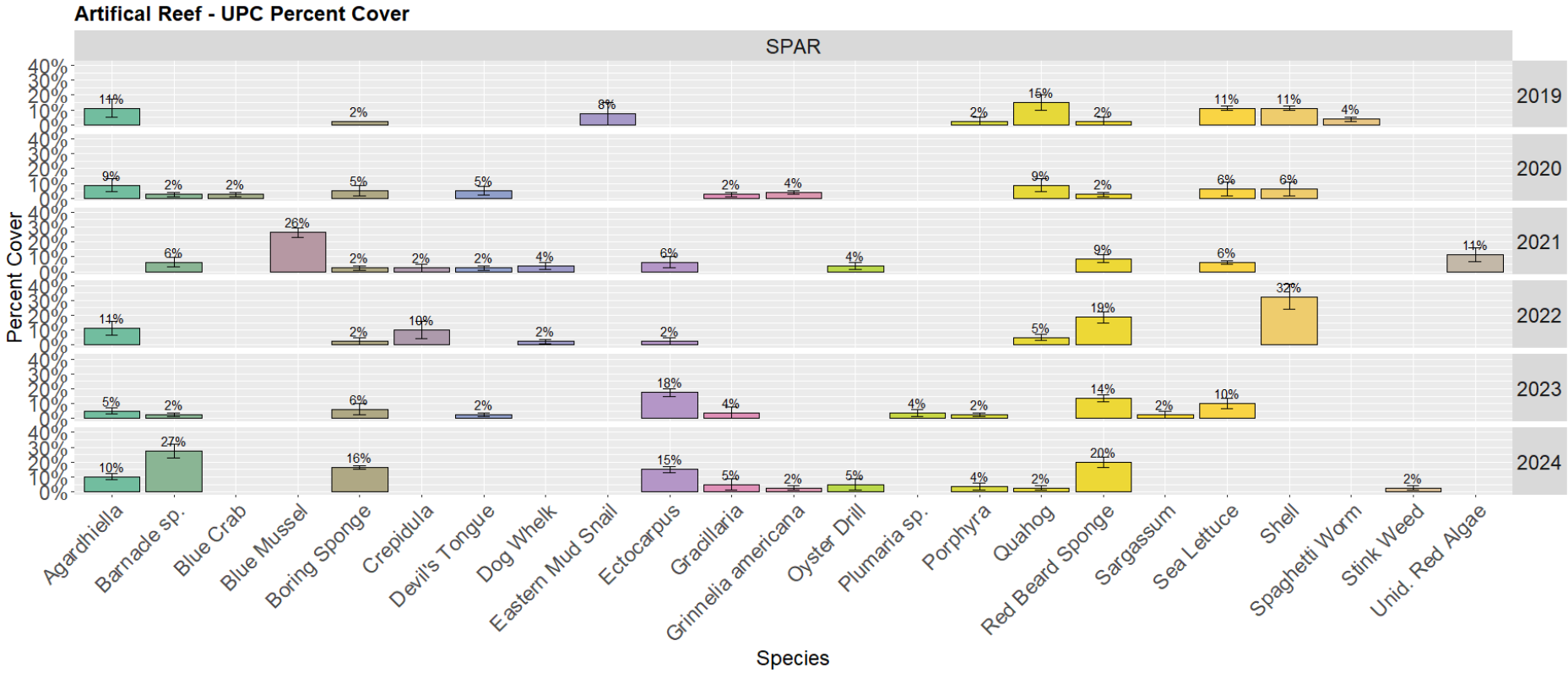


Figure 19. Mean algal and sessile invertebrate cover ± SE, greater than 2.5% cover, for all years of the study (2019-2024) at the Sabin Point Artificial Reef Sites (SPAR) Reef Balls were deployed after the 2019 dive survey.

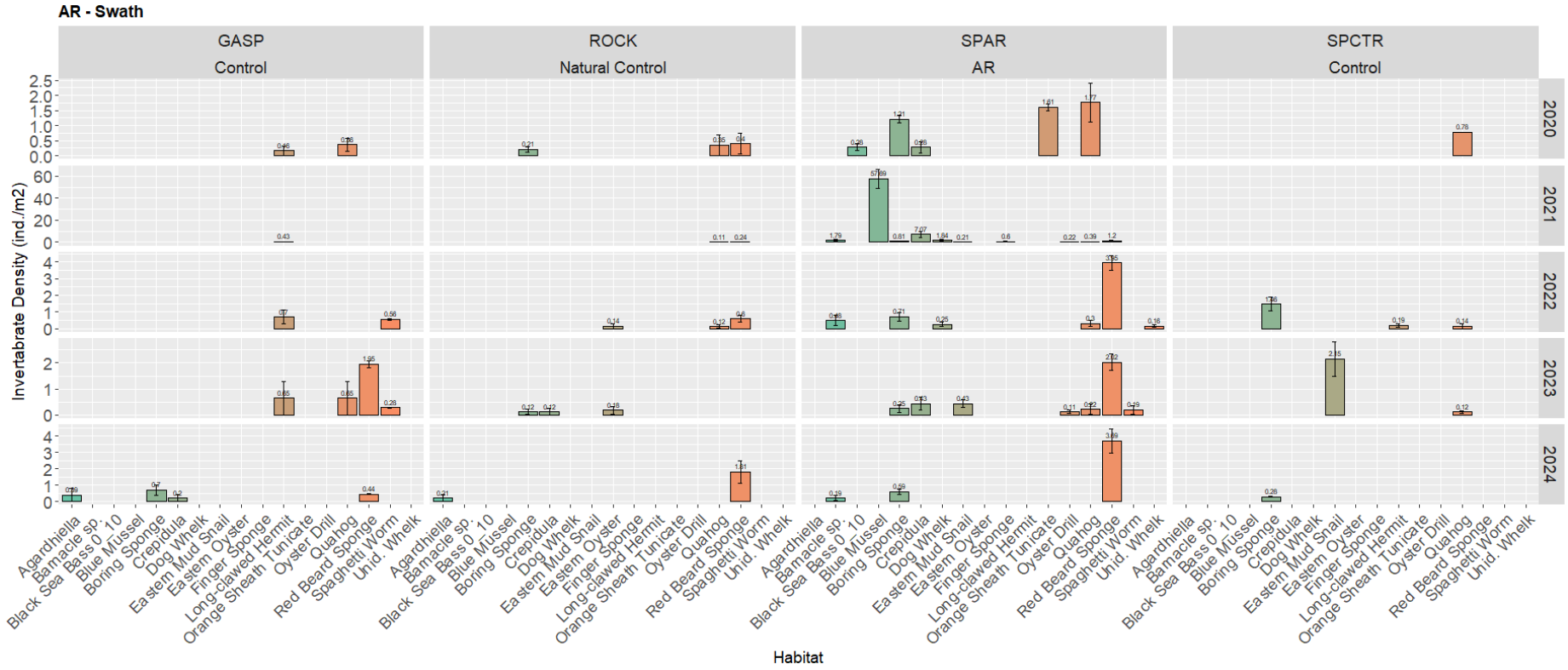


Figure 20. Mean algal and sessile invertebrate density ± SE, for all sites surveyed in 2020-2024 using the swath method.

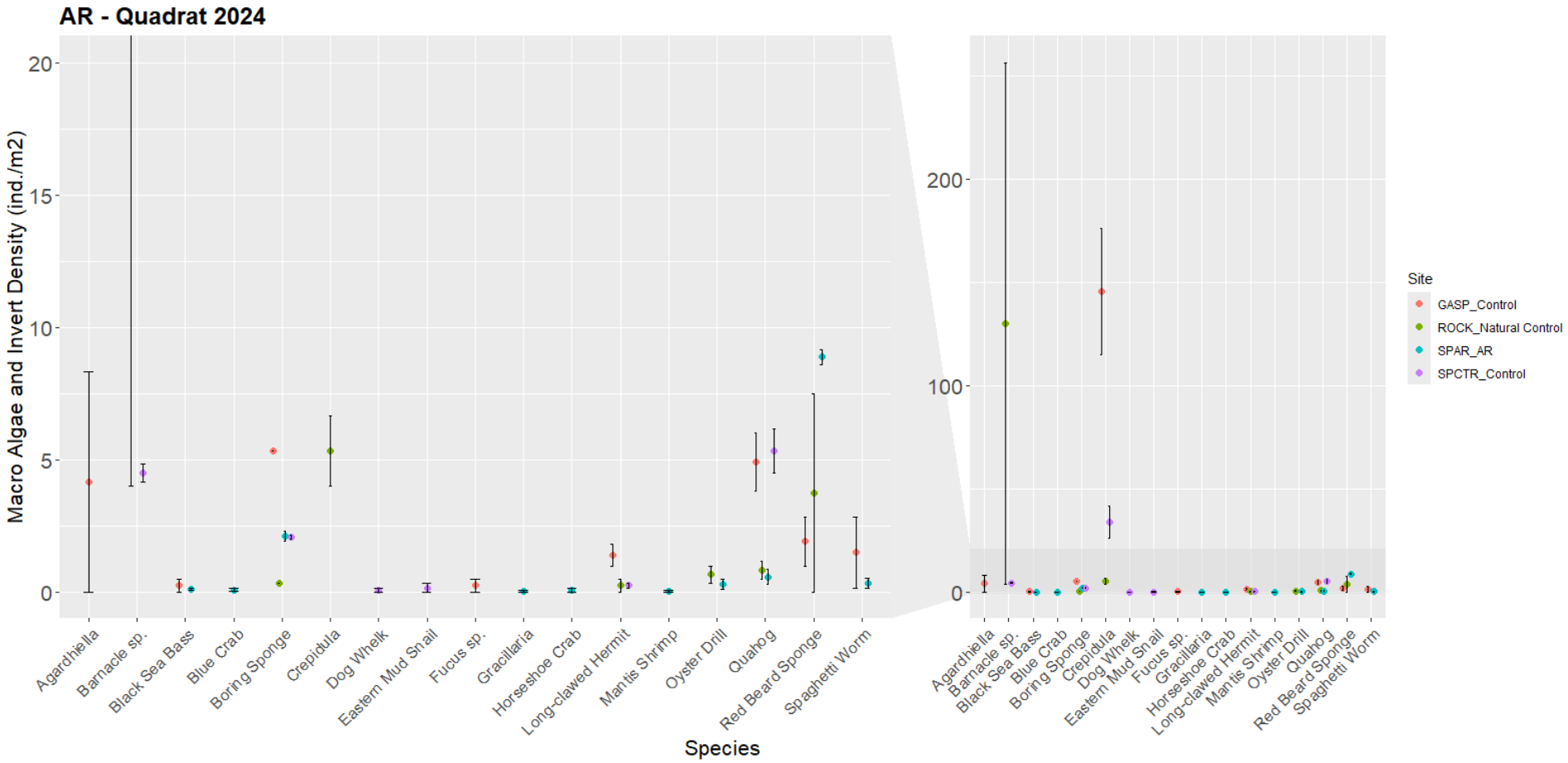


Figure 21. Mean invertebrate density ± SE, per habitat treatment (GASP = Gaspee Point (Control), ROCK = Rock Island (Natural Control), SPAR = Sabin Point Artificial Reef (Reef), SPCTR = Sabin Point Control (Control)), in the 2024 quadrat survey.

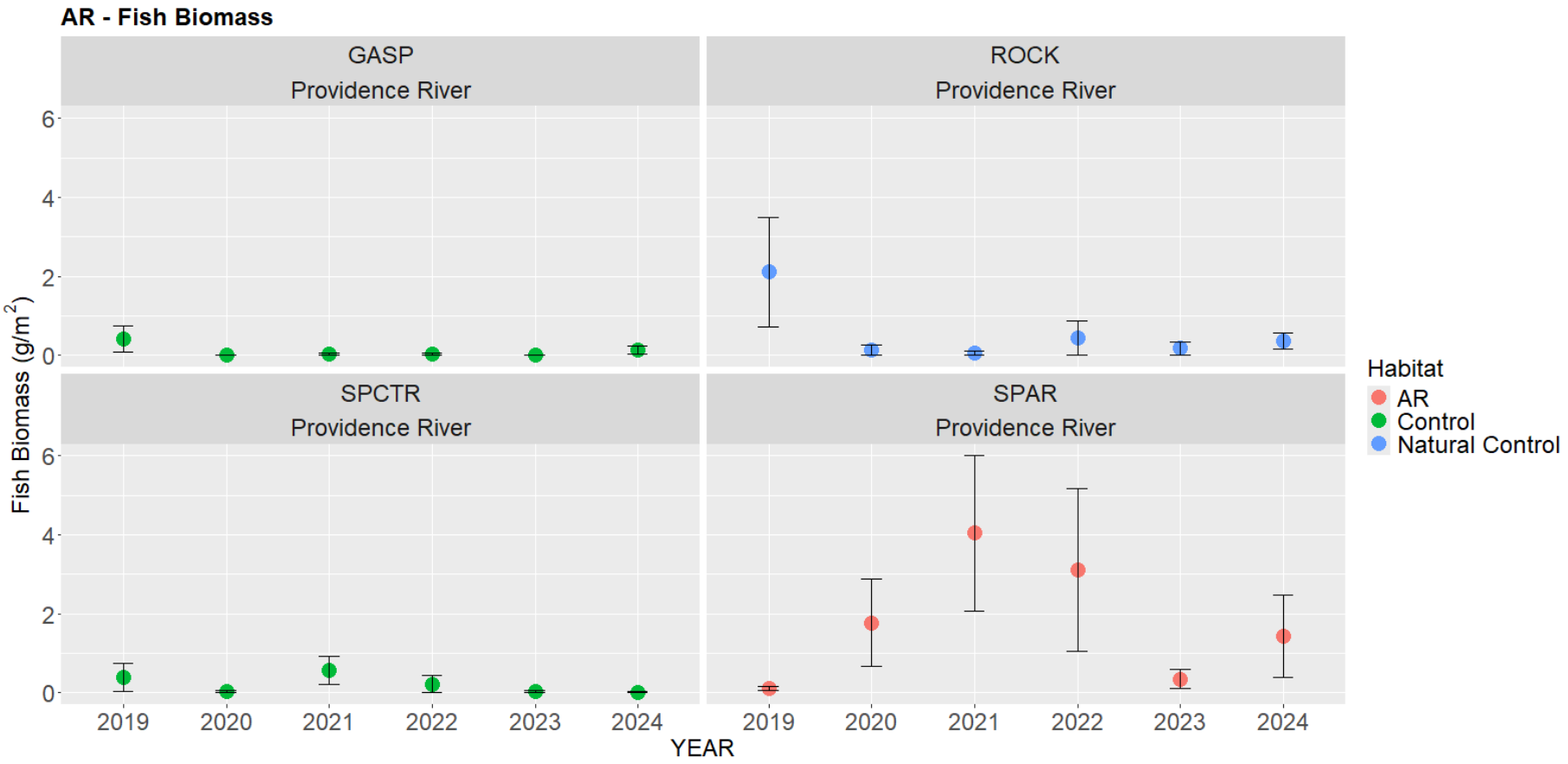


Figure 22. Mean fish biomass (g/m^2) before (2019) and after (2020 - 2024) the construction of the Sabin Point Artificial Reef. Fish biomass is standardized per meter squared and presented as the average biomass ± SE, for each habitat treatment (AR = red, Control = green, Natural Control = blue)

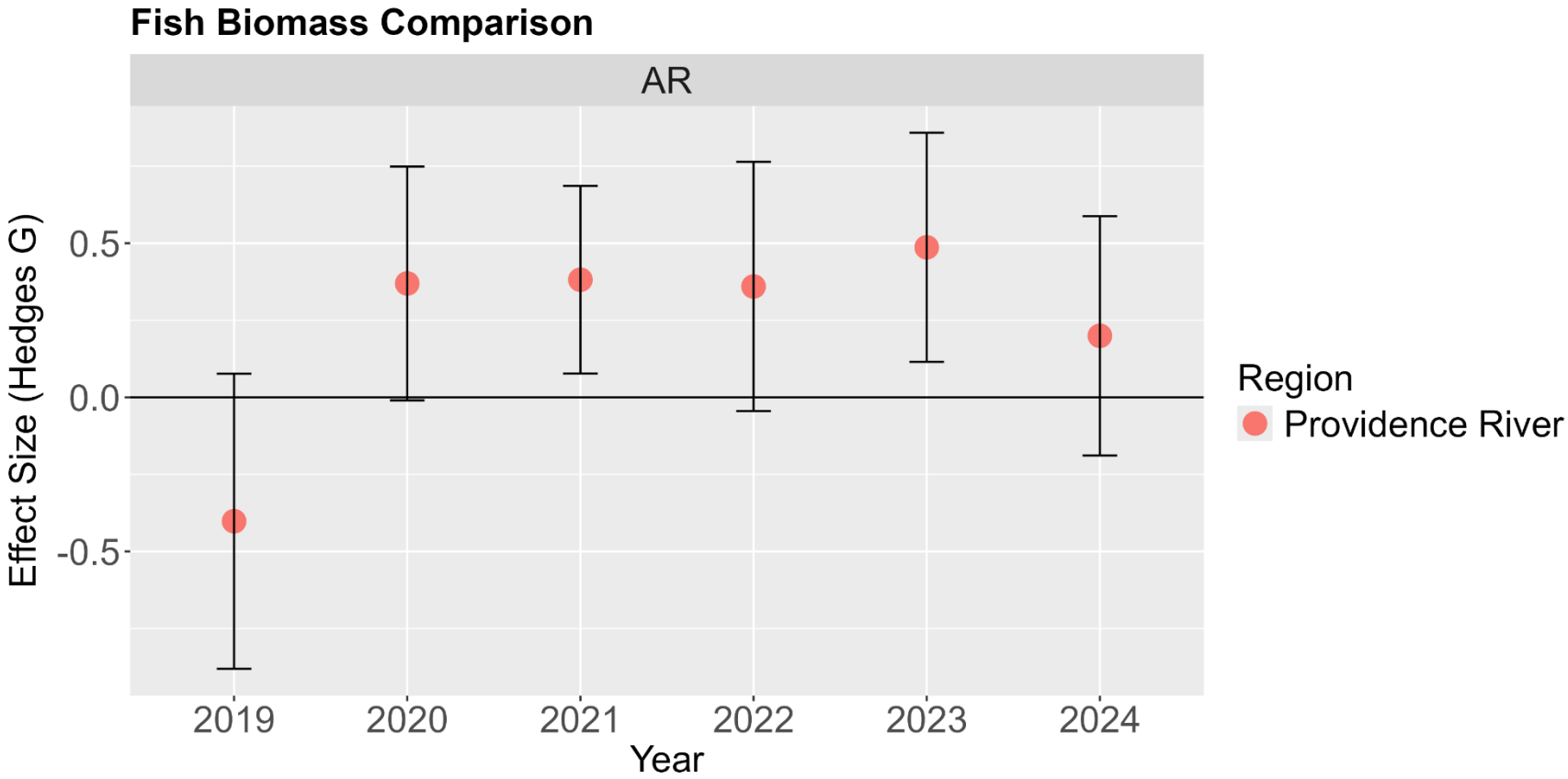


Figure 23. The effect size ± SE (Hedge's G) of fish biomass at Sabin Point Artificial Reef relative to the Sabin Control Site each year. 2019 represents the pre reef construction, and 2020-2024 were all conducted post construction of the Sabin Point Artificial Reef. Fish biomass is standardized per meter square

TABLES:

Table 1. Summary of fishing effort in 2024. X = two ventless un-baited black sea bass traps set ~20m apart and left to soak for 4 days (96 hours). XX = months where eel pots and fish traps were both used. * = indicates the traps were hauled one day late.

2024	May	June	July	Aug	Sept	Oct	Total fish trap samples by site	Total eel pot samples by site
Watchemoket Cove	X	X	X	X	X	X	6	0
Fields Point	X	X	X	X	X	X	6	0
Stillhouse Cove	X	X	X	X	X	X	6	0
Sabin Point	XX	XX	XX	XX	XX	XX	6	6
Sabin Pier	XX	XX	XX	XX	XX	XX	6	6
Pawtuxet Cove	X	X	X	-	-	-	3	0
Narragansett Terrace	X	X	X	X	X	X	6	0
Rock Island	XX	XX	XX	XX	XX	XX	6	6
Gaspee Point	XX	XX	XX	XX	XX	XX	6	6
Conimicut	X	X	X	X	X	X	6	0
Mussachuck	X	X	X	X	X	X	6	0
Rocky Point	X	X	X	X	X	X	6	0
Total fish trap samples per month	12	12	12	12	12	12	Total Trap Samples: 69	-
Total eel pot samples per month	4	4	4	4	4	4	-	Total Eel Pot Samples: 24

Table 2. Total number of each species caught at all sites in eel pots (four sites) and fish traps (12 sites) in 2024.

Common Name	Scientific Name	Eel Pot	Fish Trap
American Eel	*Anguilla rostrata*	12	0
Black Sea Bass	*Centropristus striata*	40	8
Conger Eel	*Conger oceanicus*	6	0
Cunner	*Tautogolabrus adspersus*	11	0
Oyster Toadfish	*Opsanus tau*	29	11
Diamondback Terrapin	*Malaclemys terrapin*	0	5
Scup	*Stenotomus chrysops*	0	343
Tautog	*Tautoga onitis*	4	13
Winter Flounder	*Pseudopleuronectes americanus*	0	0
Blue Crab	*Calinectes sapidus*	19	177
Green Crab	*Carcinus maenus*	24	22
Mud Crab	*Panopeus spp*	8	1
Spider Crab	*Libinia emarginata*	24	661
Mantis Shrimp	*Squilla empusa*	1	0
Smooth Dogfish	*Mustelus Canis*	0	5
Spot	*Leiostomus xanthurus*	0	6
Summer Flounder	*Paralichthys dentatus*	0	15
Channeled Whelk	*Busycotypus canaliculatus*	2	6
Quahog	*Mercinaria mercinaria*	0	2
Rock Crab	*Cancer irroratus*	0	4
Water Haul	-	0	15
Total Fish	-	102	401
Total Inverts	-	78	873
Other	-	0	5

Table 3. Fish trap CPUE (#fish/day) at all sites each month with calculated mean, standard error and standard deviations.

	Rocky Point	Conimicut Pt.	Mussachuck Creek	Gaspee Pt.	Rock Island	Pawtuxet Cove	Narragansett Terrace	Sabin Pt.	Sabin Pier	Stillhouse Cove	Fields Pt.	Watchemoket Cove	n	mean	SE	SD
May	4	7	0.5	0.25	1.25	0	0.5	0	0.25	0	0	0	12	1.15	0.62	2.16
June	1	0.25	3.25	0.75	17	0.25	3.25	2.5	0	1	0	0	12	2.44	1.37	4.75
July	1.5	5.75	0.5	2.75	2.5	0	4.5	6.5	0.75	0.25	0	0	12	2.08	0.68	2.34
August	0.25	3.25	10.5	4	1.25	NA	0.25	5.75	0.5	1	0.25	0	11	2.45	0.98	3.27
September	0.25	0.5	0.25	0.5	0.75	NA	1	0.5	0.5	0	0.25	0.25	11	0.43	0.08	0.28
October	0.25	0.25	0	0	0	NA	0	0	0	0	0	0	11	0.05	0.03	0.10
n	6	6	6	6	6	3	6	6	6	6	6	6				
mean	1.21	2.83	2.50	1.38	3.79	0.08	1.58	2.54	0.33	0.38	0.08	0.04				
SE	0.60	1.22	1.67	0.66	2.66	0.08	0.75	1.20	0.12	0.20	0.05	0.04				
SD	1.46	2.99	4.10	1.62	6.52	0.14	1.85	2.93	0.30	0.49	0.13	0.10				

Table 4. Eel pot CPUE (#fish/day) at all sites each month with calculated mean, standard error and standard deviations.

	Gaspee Pt.	Rock Island	Sabin Pt.	Sabin Pier	n	mean	SE	SD
May	0	0.2	0.2	1.2	4	0.40	0.27	0.54
June	2	0.5	1.2	0.5	4	1.05	0.36	0.71
July	0	1	0.8	0.8	4	0.65	0.22	0.44
August	1	1	0.8	1	4	0.95	0.05	0.10
September	3	0.8	2.2	2.2	4	2.05	0.46	0.91
October	1.5	1.5	1	1	4	1.25	0.14	0.29
n	6	6	6	6				
mean	1.25	0.83	1.03	1.12				
SE	0.48	0.18	0.27	0.24				
SD	1.17	0.45	0.66	0.58				

Table 5. Calculated species richness(S), Shannon diversity (*H'*), Pielou's evenness (*J'*), Simpson's index (λ)

Name	*S*	*H'*	*J'*	λ
Gaspee Pt.	12	2.01	0.81	0.84
Rock Island	12	1.57	0.63	0.68
Sabin Pt.	13	2.15	0.84	0.84
Sabin Pier	14	1.76	0.67	0.76

Table 6. Average fish trap CPUE (#fish/day) in 2024 by month ± standard error with overall mean and total CPUE for each target species.

Fish Traps	Scup	Black Sea Bass	Summer Flounder	Tautog	Winter Flounder
May	0.85 ± 0.52	0	0.04 ± 0.03	0.23 ± 0.13	0
June	2.25 ± 1.36	0	0.04 ± 0.04	0.04 ± 0.04	0
July	1.90 ± 0.68	0.10 ±0.07	0.04 ± 0.05	0	0
August	2.18 ± 0.89	0.05 ±0.05	0.07 ± 0.04	0	0
September	0.16 ± 0.07	0	0.14 ± 0.05	0	0
October	0	0.02 ± 0.02	0	0	0
Mean Overall	1.24 ± 0.32	0.05 ± 0.02	0.03 ± 0.01	0.05 ± 0.01	0
2023 Total CPUE	85.7	3.25	2	3.75	0

Table 7. Total abundance of species caught in fish traps by station in 2024.

Common Name	Watchemoket Cove	Fields Pt.	Stillhouse Cove	Sabin Pier	Sabin Pt.	Pawtuxet Cove	Narragansett Terrace	Rock Island	Gaspee Pt.	Conimicut Pt.	Mussachuck Creek	Rocky Point	Total
Scup	-	-	**8**	**4**	**57**	-	**30**	**83**	**31**	**60**	**49**	**21**	**343**
Summer Flounder	**1**	**2**	**1**	**2**	**1**	-	**2**	**1**	**1**	**3**	**1**	-	**15**
Tautog	-	-	-	-	-	-	**2**	**5**	-	**4**	-	**2**	**13**
Oyster Toadfish	-	-	-	1	-	1	1	-	-	1	5	2	11
Smooth Dogfish	-	-	-	1	1	-	-	1	1	-	1	-	5
Black Sea Bass	-	-	-	-	-	-	-	-	-	-	**4**	**4**	**8**
Spot	-	-	-	-	2	-	3	1	-	-	-	-	6
Total	1	2	9	8	59	1	35	90	33	68	60	29	401
Spider Crab	6	1	21	5	25	1	38	16	5	99	369	75	661
Blue Crab	**25**	**17**	**21**	**21**	**21**	**11**	**11**	**19**	**17**	**5**	**5**	**4**	**177**
Green Crab	-	-	-	5	1	-	-	-	15	-	1	-	22
Channelled Whelk	-	-	-	-	-	-	1	-	2	1	-	2	6
Diamondback Terrapin	1	-	-	-	-	5	-	-	-	-	-	-	5
Rock Crab	-	-	-	-	-	-	-	-	-	3	-	1	4
Quahog	-	-	-	-	-	-	1	-	-	-	1	-	2
Mud Crab	-	-	-	-	-	-	-	-	-	1	-	-	1
Total	32	18	42	31	47	17	51	35	39	109	376	82	878
Water Haul	2	2	1	1	3	1	1	2	1	1	-	-	15

Table 8. Average eel pot CPUE (#fish/day) in 2024 by month ± standard error with overall mean and total CPUE for each target species.

Eel Pots	Scup	Black Sea Bass	Summer Flounder	Tautog	Winter Flounder
May	0	0	0	0	0
June	0	0	0	0	0
July	0	0.19 ± 0.12	0	0.13 ± 0.07	0
August	0	0.44 ± 0.16	0	0.06 ± 0.06	0
September	0	1.44 ± 0.53	0	0	0
October	0	0.44 ± 0.19	0	0.06 ± 0.06	0
Mean Overall	0	0.41 ± 0.09	0	0.04 ± 0.01	0
2024 Total CPUE	0	10	0	1	0

Table 9. Species Richness (R) and Shannon H-index (H) of diversity for each Artificial Reef Dive Survey Site (SPAR – Sabin Point Artificial Reef, GASP – Gaspee Point, SPCTR – Sabin Point Control, ROCK – Rock Island) from 2019 to 2023.

YEAR	REGION	SITE	HABITAT	R	H
2019	Providence River	SPAR	AR	8 ± 1	1.87 ± 0.12
2019	Providence River	GASP	Control	9 ± 2	1.9 ± 0.25
2019	Providence River	SPCTR	Control	7.5 ± 0.5	1.49 ± 0.1
2019	Providence River	ROCK	Natural Control	10 ± 1	1.93 ± 0.03
2020	Providence River	SPAR	AR	6.75 ± 1.18	1.74 ± 0.2
2020	Providence River	GASP	Control	7.5 ± 1.5	1.66 ± 0.22
2020	Providence River	SPCTR	Control	6.5 ± 0.5	1.65 ± 0.08
2020	Providence River	ROCK	Natural Control	6.5 ± 1.5	1.56 ± 0.15
2021	Providence River	SPAR	AR	8.5 ± 1.26	1.89 ± 0.13
2021	Providence River	GASP	Control	5 ± 0	1.25 ± 0.07
2021	Providence River	SPCTR	Control	6 ± 1	1.06 ± 0.04
2021	Providence River	ROCK	Natural Control	8.5 ± 3.5	1.83 ± 0.47
2022	Providence River	SPAR	AR	6.25 ± 1.03	1.53 ± 0.12
2022	Providence River	GASP	Control	4 ± 0	0.92 ± 0.02
2022	Providence River	SPCTR	Control	6 ± 1	1.52 ± 0.21
2022	Providence River	ROCK	Natural Control	8.5 ± 1.5	1.97 ± 0.23
2023	Providence River	SPAR	AR	7.5 ± 1.19	1.83 ± 0.2
2023	Providence River	GASP	Control	6.5 ± 0.5	1.29 ± 0.13
2023	Providence River	SPCTR	Control	5.5 ± 0.5	1.37 ± 0.11
2023	Providence River	ROCK	Natural Control	9 ± 3	1.85 ± 0.15
2024	Providence River	SPAR	AR	9.25 ± 1.25	2.01 ± 0.11
2024	Providence River	GASP	Control	7 ± 1	1.26 ± 0.15
2024	Providence River	SPCTR	Control	7.5 ± 0.5	1.62 ± 0.01
2024	Providence River	ROCK	Natural Control	11 ± 1	2.06 ± 0.02

APPENDIX

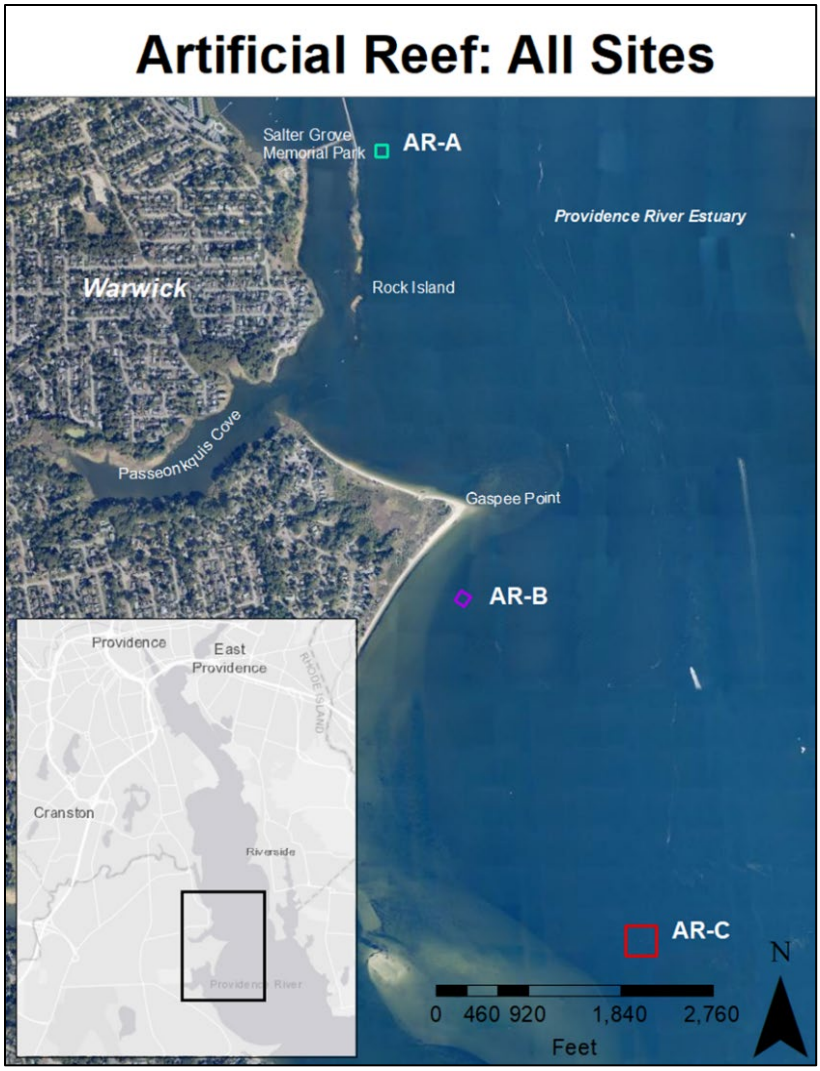


Figure A. NBC draft permit: aerial view of the three proposed artificial reef sites in the Providence River Estuary. Site AR-A (41.75394, -71.37949), Site AR-B (41.74185, -71.74185), Site AR-C (41.73268, -71.37011).

APPENDIX

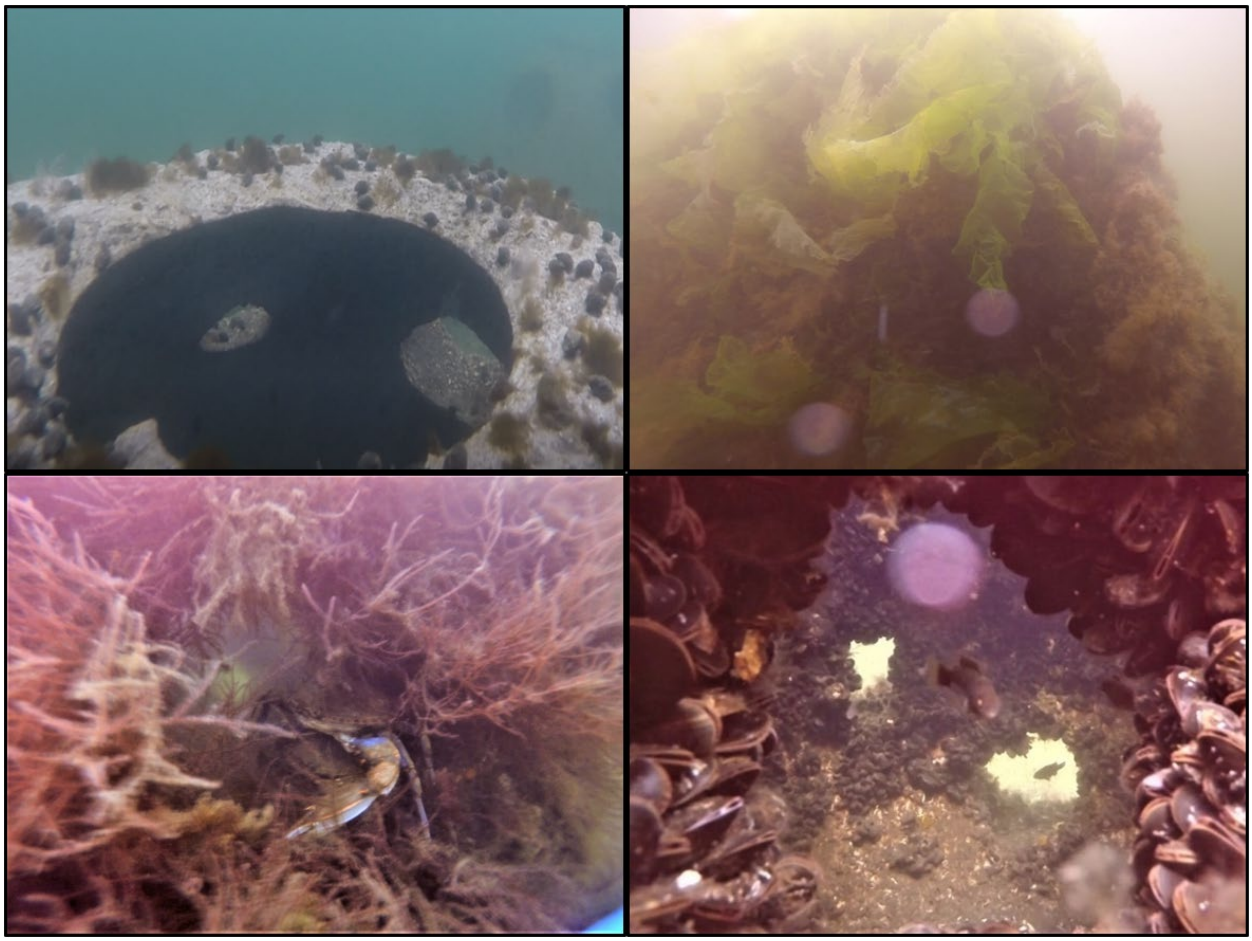


Photo: Succession of Reef Ball modules at Sabin Point Artificial Reef. (Top left – Fall 2019, Top Right – May 2020, Bottom left - September 2020, Bottom Right – September 2021)

Table A. Fish and Eel Pot Locations in 2024. [X] = indicates sites where eel pots were used.

Name	Latitude	Longitude
Fields Point	41.7868	-71.3722
Stillhouse Cove	41.7729	-71.3855
Sabin Point[X]	41.7631	-71.3669
Sabin Pier[X]	41.7636	-71.3686
Pawtuxet Cove	41.7590	-71.3854
Narragansett Terrace	41.7522	-71.3654
Rock Island[X]	41.7526	-71.3793
Gaspee Point [X]	41.7470	-71.3740
Mussachuck Creek	41.7278	-71.3431
Conimicut Point	41.7228	-71.3622
Kettle Point	41.7978	-71.3816
Rocky Point	41.6885	-71.3639

APPENDIX

Table B. Presence of finfish and crustaceans by month captured by the fish traps in 2023.

MAY	Site												
Species	Rocky Point	Conimicut Pt.	Mussachuck Creek	Gaspee Pt.	Rock Island	Pawtuxet Cove	Narragansett Terrace	Sabin Pt.	Sabin Pier	Stillhouse Cove	Fields Pt.	Watchemoket Cove	Total out of 12
Scup	1	1	1	0	0	0	0	0	0	0	0	0	**3**
Spider Crab	1	1	1	1	1	0	1	1	1	1	0	0	**9**
Tautog	0	1	0	0	1	0	1	0	0	0	0	0	**3**
Summer Flounder	0	0	1	1	0	0	0	0	0	0	0	0	**2**
Quahog	0	0	1	0	0	0	1	0	0	0	0	0	**2**
Blue Crab	0	0	0	0	1	1	0	1	0	0	0	0	**3**
Rock Crab	1	0	0	0	0	0	0	0	0	0	0	0	**1**
Oyster Toadfish	0	0	0	0	0	0	0	0	1	0	**0**	0	**1**

JUNE	Site												
Species	Rocky Point	Conimicut Pt.	Mussachuck Creek	Gaspee Pt.	Rock Island	Pawtuxet Cove	Narragansett Terrace	Sabin Pt.	Sabin Pier	Stillhouse Cove	Fields Pt.	Watchemoket Cove	Total out of 12
Channelled Whelk	1	1	0	0	0	0	1	0	0	0	0	0	**3**
Scup	1	1	1	1	1	0	1	1	0	1	0	0	**8**
Spider Crab	1	1	1	0	1	1	1	1	1	1	1	1	**11**
Blue Crab	1	0	0	1	1	1	0	1	1	1	1	1	**9**
Green Crab	0	0	1	0	0	0	0	0	1	0	0	0	**2**
Oyster Toadfish	1	0	1	0	0	1	1	0	0	0	0	0	**4**
Summer Flounder	0	0	0	0	1	0	1	0	0	0	0	0	**2**
Diamondback Terr	0	0	0	0	0	1	0	0	0	0	0	0	**1**
Tautog	1	0	0	0	0	0	0	0	0	0	0	0	**1**

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JULY	Site												
Species	Rocky Point	Conimicut Pt.	Mussachuck Creek	Gaspee Pt.	Rock Island	Pawtuxet Cove	Narragansett Terrace	Sabin Pt.	Sabin Pier	Stillhouse Cove	Fields Pt.	Watchemoket Cove	**Total out of 12**
Scup	1	1	0	1	1	0	1	1	1	1	0	0	**8**
Spider Crab	1	1	1	0	0	0	1	1	0	1	0	0	**6**
Summer Flounder	0	1	0	0	0	0	0	0	1	0	0	0	**2**
Blue Crab	0	0	1	1	1	1	1	1	1	1	1	1	**10**
Green Crab	0	0	0	1	0	0	0	1	0	0	0	0	**2**
Black Sea Bass	1	0	1	0	0	0	0	0	0	0	0	0	**2**
Diamondback Terra	0	0	0	0	0	1	0	0	0	0	0	0	**1**
Smooth Dogfish	0	0	0	0	0	0	0	1	1	0	0	0	**2**

AUGUST	Site												
Species	Rocky Point	Conimicut Pt.	Mussachuck Creek	Gaspee Pt.	Rock Island	Pawtuxet Cove	Narragansett Terrace	Sabin Pt.	Sabin Pier	Stillhouse Cove	Fields Pt.	Watchemoket Cove	**Total out of 12**
Blue Crab	1	1	1	1	1	0	1	1	1	1	1	1	**11**
Scup	1	1	1	1	1	0	1	1	1	1	0	0	**9**
Spider Crab	1	1	1	0	0	0	1	0	0	1	0	1	**6**
Summer Flounde	0	0	0	0	0	0	0	0	1	1	1	0	**3**
Channelled Whel	0	0	0	1	0	0	0	0	0	0	0	0	**1**
Smooth Dogfish	0	0	0	1	1	0	0	0	0	0	0	0	**2**
Black Sea Bass	0	0	1	0	0	0	0	0	0	0	0	0	**1**
Oyster Toadfish	0	0	1	0	0	0	0	0	0	0	0	0	**1**
Green Crab	0	0	0	0	0	0	0	0	1	0	0	0	**1**
Spot	0	0	0	0	0	0	0	1	0	0	0	0	**1**

APPENDIX

SEPTEMBER	Site												
Species	Rocky Point	Conimicut Pt.	Mussachuck Creek	Gaspee Pt.	Rock Island	Pawtuxet Cove	Narragansett Terrace	Sabin Pt.	Sabin Pier	Stillhouse Cove	Fields Pt.	Watchemoket Cove	**Total out of 12**
Blue Crab	1	1	1	1	1	0	1	1	1	1	1	1	**11**
Mud Crab	0	1	0	0	0	0	0	0	0	0	0	0	**1**
Spider Crab	0	1	1	1	1	0	0	1	0	0	0	0	**5**
Summer Flounder	0	1	0	0	0	0	1	1	0	0	1	1	**5**
Scup	0	0	0	1	1	0	0	1	1	0	0	0	**4**
Smooth Dogfish	0	0	1	0	0	0	0	0	0	0	0	0	**1**
Spot	0	0	0	0	1	0	1	0	0	0	0	0	**2**
Oyster Toadfish	1	0	0	0	0	0	0	0	0	0	0	0	**1**
Green Crab	0	0	0	0	0	0	0	0	1	0	0	0	**1**

OCTOBER	Site												
Species	Rocky Point	Conimicut Pt.	Mussachuck Creek	Gaspee Pt.	Rock Island	Pawtuxet Cove	Narragansett Terrace	Sabin Pt.	Sabin Pier	Stillhouse Cove	Fields Pt.	Watchemoket Cove	**Total out of 12**
Oyster Toadfish	0	1	0	0	0	0	0	0	0	0	0	0	**1**
Rock Crab	0	1	0	0	0	0	0	0	0	0	0	0	**1**
Spider Crab	1	1	1	0	0	0	0	0	0	0	0	1	**4**
Blue Crab	0	0	0	0	0	0	1	0	0	1	1	0	**3**
Green Crab	0	0	0	1	0	0	0	0	1	0	0	0	**2**
Black Sea Bass	1	0	0	0	0	0	0	0	0	0	0	0	**1**

PERFORMANCE REPORT

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

PROJECT TITLE: Holistic Fish Habitat Assessment and Fish Productivity Estimations

PERIOD COVERED: January 1, 2020 - December 31, 2024

JOB NUMBER AND TITLE: V, Part C: Oyster Monitoring and Productivity Assessment

STAFF: Patrick Barrett and Eric Schneider (RI DEM, Div. of Marine Fisheries)

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

SUMMARY: This report summarizes project activities conducted between January 1, 2020 and December 31, 2024. During this period, we continued previously established surveys at fish habitat enhancement (FHE) sites in Ninigret and Quonochontaug Ponds to monitor oyster status and fish abundance, while implementing new survey techniques, using habitat trays and dive transect surveys, to collect estimates of benthic and fish community biomass. These estimates will be used in combination with other metrics to quantify the degree to which FHE restored oyster reefs increase in production of juvenile sportfish.

TARGET DATE: December 2024

RECOMMENDATIONS:

None

INTRODUCTION

More than 70% of Rhode Island's recreationally and commercially important finfish spend part of their lives in coastal waters, usually when they are young (Meng & Powell, 1999). The shallow water, salt marshes, sea grasses, and oyster reefs provide excellent foraging and feeding areas as well as providing protection from larger, open-water predators. In Rhode Island, complex shellfish reefs formed by oysters (*Crassostrea virginica*) are found in intertidal and shallow subtidal waters of coastal lagoons and bays. Recent decades have witnessed declines in this habitat. For example, Beck *et al.* (2011) estimated that shellfish reefs are at less than 10% of their prior abundance and that ~85% of reefs have been lost globally. The growing recognition of the ecological and economic importance of these habitats have led to an increase in the efforts to

construct structed habitats, such as oyster reefs (Coen and Luckenback 2000, Brumbaugh et al. 2006).

Previous work in the Mid-Atlantic and Gulf of Mexico found that oyster reefs can increase the growth and survival of juvenile finfish (e.g., Peterson et al. 2003, zu Ermgassen et al. 2016), as well as fish and invertebrate biomass (e.g., Grabowski et al. 2005, Humphries and La Peyre 2015, Ermgassen et al. 2016, Ermgassen et al. 2021) compared to unenhanced habitats. Work conducted from 2014-2019 via a partnership between RI DEM, Div. of Marine Fisheries (DMF), The Nature Conservancy (TNC), and Northeastern University (NU) during the last USFWS Sportfish Restoration (SPR) grant cycle (summarized in RI DEM 2019 F-61 Performance Report, Job 6-B) explicitly explored the response in the abundance and species assemblage of recreationally important finfish species to the creation of Fish Habitat Enhancement (FHE) oyster reefs in Rhode Island. Overall, fish abundances at FHE oyster reefs after reef construction increased relative to the pre-enhancement baseline habitat (Barrett et al. in prep). In addition, specific reef-dwelling species, such as tautog and black sea bass, were observed more frequently at FHE reefs sites compared to unseeded reefs and unenhanced control plots. Additional sampling and analyses are needed to better understand long-term fishery and habitat responses, and quantify the fisheries production provided by the FHE oyster reef habitat created by the previous USFWS SPR work.

APPROACH

Site Locations and Experimental Design

In partnership with Jonathan Grabowski, PhD, and A. Randall Hughes, PhD, of NU, we are utilizing oyster reefs created for fish habitat enhancement (hereafter, FHE reefs) to determine if oyster reef construction can be used to improve productivity of young of the year to juvenile stages of recreationally important fishes such as black sea bass (*Centropristis striata*), tautog (*Tautoga onitis*), scup (*Stenotomus chrysops)*, summer flounder (*Paralichthys dentatus*), and winter flounder (*Pseudopleuronectes americanus*). For this evaluation, we used FHE reefs created using two different, but similar, experimental designs in the coastal ponds of Rhode Island (Figure 1). In Ninigret Pond we had previously created four replicates of three distinct treatments that include a cultch only reef, a seeded reef, and bare plot control, to test the influence of not only enhanced structure (cultch only reefs), but enhanced biomass (seeded reefs), on the abundance of juvenile finfish that utilize these reef habitats. In the fall of 2019, we re-seeded both the cultch only and previously seeded reefs in Ninigret Pond with a new set of Green Hill Pond seed sourced oysters. In Quonochontaug Pond, the goal was to assess whether specific genetic lines (lineage) of oysters contain desirable traits for both fish habitat and reef longevity. To evaluate this effect, we used two 'wild' linages of oysters, spawned from adults collected from existing populations that will be compared against a commercial strain of oysters (eyed-larvae purchased from a commercial hatchery in Massachusetts) commonly used in oyster reef restoration and enhanced projects in RI. The commercial hatchery lineage in Quonochontaug Pond was the same used for all the 2015 Ninigret Pond FHE seeded reefs. The experimental design in Quonochontaug included creating three reefs, each seeded with one oyster linage, and a bare control plot at three different sites (replicates). In total, there were 12

sample locations, which is consistent with Ninigret Pond; however, the number of replicates from four to three (Figure 1).

Oyster reef monitoring

Consistent with monitoring conducted at these sites beginning in 2016, reef status was evaluated by monitoring each FHE reef twice a year (May and September) using methods consistent with (Griffin et al. 2012, Baggett et al. 2015). At each reef, a 0.25m^2 quadrat was haphazardly placed six times. Using standard cover practices, the percent cover of macroalgae was estimated, then all algae was brushed away to allow for percent cover estimation of benthic substrate. Relief, quadrat height relative to the bottom, was measured by finding the difference between the water depth at the reef edge and the depth from the center of the quadrat. All oysters and dead shell were then excavated from the quadrat. All live oysters and dead oysters per quadrat were counted as well as the presence of boring sponge. The shell height of a sub-sampled of 50 living and 30 recently dead oysters were also measured for each quadrat. Density was calculated for both living and recently dead oysters by multiplying abundance per quarter meter quadrat by 4. All material was then returned to the sampling location so as not to disturb the reef. An additional 30 oysters from each reef are collected for disease and pathological work conducted by the Hughes Lab at NU.

In addition to the standard oyster sampling, mean spat length and density at the time of seeding were collected by averaging a sub sampled of seeded cultch bags provided by the oyster growers during reef construction. This average length and density per bag was then multiplied by the total number of bags deployed per reef, and divided by the total area (m^2) of the reef to calculate initial seed length and density. These initial seeding density and length measurements are only used during the creation of the oyster growth and mortality curves discussed below.

Habitat Trays

Beginning in 2020, habitat trays were initiated as a new standardized sampling approach to quantify the abundance of finfish and invertebrates at FHE oyster reefs and control sites. Habitat trays were deployed for 30 days at FHE reefs once a year between July and September in 2020, 2021, 2022, and 2023. This approach builds on previous work conducted by NU in collaboration with DEM and summarized in Davenport et al. (2023).

Once annually from 2020 through 2023 habitat trays consisting of plastic bread trays (22" x 26" each, 0.369 m^2) lined with 1mm mesh, were deployed at FHE reefs and controls sites in Ninigret and Quonochontaug Ponds. Habitat trays deployed at oyster reefs were filled with 5 gallons of recycled oyster shell, whereas trays deployed at control sites were filled with 10 gallons of sand. The additional volume of sand compensated for sand loss during filling and deployment. Once deployed, trays at both locations contained the same volume of material. At each site, trays were placed adjacent to the reef edge to minimize its impact to the intact oyster reef, at one of 4 predetermined random locations (e.g., north, east, south, or west edge of the reef). During 2023, habitat trays were deployed at sites in Ninigret and Quonochontaug Pond on August 9 and 10, respectively. After 30 days trays were collected from each site by a diver at reef sites and pair of divers at control sites. The diver(s) would lift the tray directly up from the substrate, out of the

water, and into a vessel anchored nearby. Once on the vessel, the contents of the trays were transferred to small-mesh sampling bags. Samples were transported to the laboratory and all biological material was separated from the shell and sand. Fish, crabs, and all other macroinvertebrates were separated into separate jars, preserved with Ethyl Alcohol, and stored in a climate-controlled facility until processing.

All samples collected during 2020, 2021, 2022, and 2023 were processed at the Grabowski Lab at the Northeastern University Marine Science Center (Nahant, MA). For each sample jar (e.g., fish, crabs, or other) a subsample of 20 organisms were identified to species (if possible), measured, and weighed to the hundredth of a gram consistent with methods described in summarized in Davenport et al. 2023. Remaining organisms were counted and total biomass by species at size were extrapolated based on subsamples.

During the reporting cycle, habitat tray data collected on the FHE reefs were used analyzed for manuscript (Schneider et al. *in review*) that derived estimates of enhanced biomass production per square meter of restored oyster reef. Biomass production was estimated by applying species-specific growth and mortality models to fish and macroinvertebrate species found to be increased FHE reefs using identical methods to zu Ermgassen et al. (2016, 2021). This type of information could help inform how much restoration is needed to meet project goals related to enhancing local recreationally important fish populations.

Eel Pot and Minnow Trap Survey

During 2024, we continued the previously conducted fishery survey work, using eelpots and minnow traps, once each month from April through October in Ninigret Pond only, due to a recent oyster recruitment event that we observed on our restoration reefs. Fish pot sampling consisted of setting 2 eel pots and 3 minnow pots connected on a trot line at each site once per month. The pots were soaked (i.e., fished) for 24 hours before hauling. Environmental data such as temperature, salinity, and dissolved oxygen are collected using YSI Professional Plus Multiparameter instrument at each sampling station while hauling gear.

Fish Productivity Assessment

Using methods similar to those used for kelp, artificial reefs, and eelgrass, we conducted dive survey transects at FHE oyster reef and control sites once during mid to late summer (September 2024). To assess fish-habitat linkages at oyster reefs, the monitoring protocol utilized the same 5 dive transect methods outlined above (see Kelp section; 5A. Along each 10m transect a diver placed a 0.25m^2 PVC frame on the bottom (substrate or reef) at each the beginning and end of the transect, and two locations spaced in the middle of the transect on the targeted habitat (n = 4 quadrat per transect). Substrate beneath understory algae was searched, however, neither the substrate nor the organisms attached to it are removed. Due to the complex surface of an oyster reef, divers searched around and between oysters to locate and identify fish and invertebrates that may hide in crevasses. Substrate, reef habitat (i.e., oysters and shell), and organisms will not be removed or captured from the quadrant. The quadrant will remain in place for use in morphometrics. A subset of FHE oyster reefs are surveyed each year, with an expectation that

two reefs and one control per site (replicate) in Quonochontaug Pond (9 transects) and at one reef and one control per site in Ninigret Pond (8 transects) will be surveyed annually.

Analytical Approach

Prior to ANOVA analyses, all oyster data were tested for homogeneity of variance and conformance to a normal distribution using a Levine's test and Shapiro Wilks, respectively (Levene's $p > 0.05$, Shapiro Wilks $p > 0.05$). Oyster quadrat data that did not meet the assumptions was log transformed prior to analysis. We present values as mean oyster density and mean shell length ± one standard error and set level of significance for all tests at $p < 0.05$, unless stated otherwise. All significant differences between the ANOVA factors were denoted using letters derived from Tukey's post hoc tests on the ANOVA models.

Oyster density (ind./m^2) and mean length (mm) per quadrat were used to calculate a mean oyster density and length value for each oyster restoration reef. To evaluate if oyster density or length differed between monitoring events in Quonochontaug Pond, we used one-way ANOVAs testing the effect of time (monitoring event) on mean density and length per monitoring event. When only the main effects were significant, without a significant interaction, one-way ANOVAs were then run on the individual main effects. Since the treatments were changed during the 2019 re-seeding event in Ninigret Pond, mean density and oyster length for the 2021 season is presented as mean ± standard error and grouped by the new treatments (e.g. Green Hill Pond, and Green Hill Pond/Old Hatchery Reef). Before the Ninigret reefs were re-seeding in 2019, we determined the average oyster spat per tote deployed on each reef using the oyster spat on shell subsample collected before the reseeding began. By dividing by the average surface area of the FHE reefs in Ninigret, we were able to determine the oyster density per meter squared for the Fall of 2019 and compared that to the density of oysters that survived until the fall of 2021 to estimate 1st year survival of the Green Hill Pond brood stock spawned oysters that were set.

In 2020 we began the first year of post-reseeding fish monitoring at the FHE reef sites in Ninigret and began Year-4 of post-enhancement monitoring in Quonochontaug Pond. A Before-After-Control-Impact (BACI) approach was used to determine how reef construction can impact the fish assemblage, relative species abundance, and juvenile length distributions in the coastal ponds. We specifically assessed how relative species abundance and community assemblages have changed over time between our baseline surveys and up to 3 years post reef construction. For the BACI analysis we derived mean catch per haul by aggregating the number of fish caught per minnow trap plus eel pot haul (herein after, CPUE) and then finding the average CPUE for each month by habitat treatment. For each recreational species of interest, such as Black Sea Bass, Winter Flounder, Tautog, and Cunner, we created a mean CPUE plots from the aforementioned CPUE data, and analysis of augmented YOY abundance when data permitted. Ninigret and Quonochontaug Ponds were analyzed separately for each species.

Substrate and species cover were summarized for each fish habitat transect by using the uniform point count data to derive both a geological and biological percent cover for each dive transect. The total number of observations were summarized for each species or substrate and then divided by the total number of uniform point counts collected along the length of each transect ($n = 20$). We also estimated average species richness and Shannon's Index of diversity. Algae and

invertebrate densities were summarized using the quadrat, and swath datasets when applicable, by averaging the total number of observations across all quadrats (n=4) within each transect. To evaluate how enhanced oyster habitat compares to the unstructured and natural controls, we calculated the mean density of individuals per meter squared ± SE and present the averages grouped by habitat type (e.g. oysters and corresponding controls).

Using the fish count survey data, fish abundance at length was converted to total fish mass per transect by leveraging the DMF age and growth lab data to convert fish length in centimeters, to weight in grams, for the target sportfish species (i.e. Tautog, Black Sea Bass, Winter Flounder). To do this we used Rhode Island specific allometric growth models. For species not currently dissected in the growth lab, the geometric mean alpha and beta coefficient estimated on Fishbase.org were considered. To compare total fish biomass between the oyster reef enhancement sites and unenhanced controls the total fish mass was standardized by dividing the total area surveyed, to get grams per meter squared. Then we calculated the effect size of the oyster reef with respect to the control sites using the Hedge's g computed on the mean biomass per meter square estimates. Hedge's g effect size was calculated using the mean values and standard deviations from the mean biomass estimates.

RESULTS

Oyster Reef Performance

In 2024, we monitored the status of the Fall 2019 FHE reseeding efforts in Ninigret Pond as well as the Spring 2017 FHE seeded reefs in Quonochontaug Pond. In Ninigret Pond the Green Hill Pond oysters used to reseed the FHE reefs exhibited a 57.9% first year survival rate, and a mean density average of 682 and 564 ind./m^2 during the first two monitoring events following reef enhancement (Figure 2). Between spring and fall monitoring events in 2021, density on both the green hill only and the green hill overseeded reefs fell by over 125 ind./m^2 (Figure 2: Ninigret Pond). Survival 18 months post construction for the newly reseeded Ninigret reefs were 54.13% and 47.28% for the Green Hill Pond only and Green Hill Pond overseeded reefs respectively (Figure 2). In 2022 there was no change density between the spring and fall and the current densities at the two seeding treatments are 109.9 ±31.9 (Green Hill overseeded old Hatchery line) and 116.5 ± 46.63 ind./m^2 (Green Hill only). However, in 2023, density decreased to 48.25 ± 22.14 and 69.5 ±16.41, at the overseeded and green hill only reefs respectively. The density of the recruits also increased in 2023 and 2024 with the Ninigret Pond reefs receiving a significant recruitment pulse. In Quonochontaug Pond, we continued to see a significant effect of monitoring event on oyster density and shell length, with the Green Hill Pond treatments outperforming the other treatments with respect to overall density and mean length (Figure 2 and 3).

Consistent with habitat tray sampling, pathology sampling and analyses were completed during 2020, 2021, 2022, and 2023. During the terminal sampling year (i.e., 2023), mud blister worm prevalence was higher on the restored reefs in Quonochontaug Pond than in Ninigret Pond, with 68-83% of oysters sampled from Quonochontaug Pond having characteristic blisters from *Polydora websteri*, compared to 22-69% of oysters sampled from Ninigret Pond. Similar to 2022, during 2023 boring sponge prevalence was similar across sites, with 44-97% in Ninigret

Pond and 44-84% in Quonochontaug Pond. Overall, macroparasite prevalence in 2023 was generally similar to 2020 and 2021, and lower than 2022. During 2023, prevalence of Dermo was variable across reefs in both Ninigret Pond and Quonochontaug Pond. Intensity of Dermo was also variable in Quonochontaug, yet it was fairly consistent in Ninigret. As in 2022, some oysters sampled from both ponds during 2023 had detectable levels of MSX, *Haplosporidium nelsoni*, in contrast with zero prevalence of MSX in 2021 During 2023, SSO, *Haplosporidium costale*, prevalence was variable across blocks in both ponds, and particularly in Quonochontaug Pond

Pathology results are most informative when considered in the context of multiyear analyses, as well as reef- and habitat-level variables. Results from prior FHE pathology work were incorporated into a peer-review article Hanley et al. (2023). Briefly, Hanley et al. (2023) showed that the oyster seed source (i.e., lineage) used in restoration on the FHE reefs strongly predicted parasite community prevalence across all years, with sources varying in their relative susceptibility to different parasites. Oyster seed source also predicted parasite intensities at the reef level across space and through time. Overall, these findings show that the source population (i.e., source of seed oysters or lineage) is a critical aspect of designing a restoration practice and that there is probably no single source population that is best suited for the parasite communities commonly encountered in natural systems. Thus, using multiple oyster seed sources may be an effective strategy to ensure resilience to multiple parasites.

Habitat Trays

From 2020 – 2023, 13,922 individual organisms were collected using habitat trays, including 1,065 fish, 6,166 crabs, 6,165 shrimp, 29 bivalves, and 513 other organisms, representing 40 species, in Ninigret (6,821 individual organisms) and Quonochontaug (7,101 individual organisms) Ponds. Nearly all individuals (94.6%) were captured on restored oyster reefs, including 95.4%, 93.9%, 98.8%, and 51.9% of fish, crabs, shrimp, and other organisms, respectively. Fish species captured by habitat trays included American eel (*Anguilla rostrata*), black sea bass (*Centropristis striata*), naked goby (*Gobiosoma bosc*), seaboard goby (*Gobiosoma ginsburgi*), rainwater killifish (*Lucania parva*), oyster toadfish (*Opsanus tau*), tautog (*Tautoga onitis*), and cunner (*Tautoglobarus adsperus*). Habitat tray data collected by this grant was used to identify species that are augmented by oyster reefs creation and quantify the augmented annual production associated with each enhanced species. These estimates and results are summarized in Schneider et al. (in review).

Eel Pot and Minnow Trap Survey

Average CPUE per has been summarized for four target species, Black Sea Bass, Winter Flounders, Tautog, and Cunner for each coastal pond (Ninigret Pond: Figures 5; Quonochontaug Pond : Figure 6). These four species are the most frequently caught species in the eel pot and minnow trap survey. In Ninigret pond, mean CPUE during the 2022 field season was numerical greater than 2021 and about equal to 2020. Out of the treatments, Green Hill Pond reef had the greatest abundance of tautog, and both the Green Hill Pond and Green Hill Pond/Hatchery reefs had greater abundances of Black Sea Bass and Cunner than the control in Ninigret Pond (Figure 4). We found between both experiments, juvenile tautog were most positively augmented on the

oyster reefs relative to the control sites (Figure 4 and Figure 5, respectively). In 2022, we found mean CPUE in Ninigret to be greater for all target species relative to 2021 (Figure 4 and 6). Similarly, the mean CPUE at the Green Hill Pond oyster reefs in Quonochontaug Pond was greater than both the control and other reef treatment (Hatchery and Narrow River) for Black Sea Bass, Tautog, Cunner, and Winter Flounder. In 2023, we found all CPUE to decrease in all species beside black sea bass in Quonochontaug pond. (Figure 5).In 2024, we found that both Black Sea Bass and Winter Flounder had greater CPUE at the reef sites, which could be explain ed by the recent 2023 oyster recruitment event (Figure 5).

Fish Biomass Assessment

During September 2024, dive surveys were conducted to determine the baseline floral and faunal communities for use in biomass estimation at 9 enhancement reefs and 3 controls sites in Quonochontaug Pond. In Quonochontaug Pond, the percent cover at the three control sites varied depending on their location with Pond. In the northwest region of the pond, the control habitat (1A) was 100% mud or fine sediment, whereas the North and northeast control locations (2D, 3C) had increasingly more sand, gravel, and shell substrate. The northern region, or Site 2 control, is sandier than Site 3, which had a higher percent of mud and finer sediment mixed in (Figure 6). Site 3 also contains a greater proportion of natural boulders compared to Site 2 (3C = ~ 55%, 2D = ~20%. Figure 6).

In 2024, the overall species diversity, with respect to the algae and sessile invertebrate species, was equal between the oyster reef habitat than the controls. Diversity has slightly declined in Quonochontaug overtime as the reefs age (Table 2) The biggest difference between the reef substrate locations and controls is the abundance of branching and filamentous red algae sponge species are able to adhere to the firmer substrate. Most notably *Polysiphonia* species*, Ceramium* species*,* and Boring Sponge (Figure 7). Investigators found invertebrate densities to vary depending on the species and survey location. At the control sites, investigators found the highest abundance of mud snails (up to 30 ind./m^2) (Figure 8). The reef sites harbored a wider array of inverts, most notably increased abundance of barnacles, boring sponge, and red beard sponge (Figure 8). When comparing swath and quadrat survey techniques, it seems the swath method provides a lower estimate of shellfish densities across all locations. In the swath we found greater abundance of mud crabs on the oyster reefs and quahogs at the control sites (Figure 9). In 2020, the average total fish biomass at the oyster reef treatments (4.33 ± 1.07 g/m^2) was greater than the unenhanced control sites (0.24 ± 0.09 g/m^2). Again in 2021, the oyster reef sites had a greater biomass than the controls, but overall biomass was lower. From 2022- 2024 we found the fish biomass at the Quonochontaug reefs was about equal to controls and continued to decrease with decline oyster abundances on the reefs (Figure 10). Using Hedge's g effect size we compared the average biomass per meter squared of reef habitat to control habitats, and found the enhancement reef to have an effect size of 1.9 in 2020, 0.68 ± 0.68 in 2021, 0.23 ± 0.47 in 2022, 0.36 ± 0.67 in 2023, and 0.44 ± 0.50 in 2024 Effect size has a positive correlation with increasing oyster density, with a greater effect of fish biomass occurring during years when the reefs had a higher oyster density (Figure 11).

DISCUSSION

Oyster reef monitoring suggest our FHE reef establishment approaches have thus far been successful in both Ninigret and Quonochontaug Ponds. In Ninigret Pond, where surveys represented the first year of monitoring post re-seeding, we the Green Hill lineage exceeded the first-year survival of the previously used hatchery lineage by approximately 10 %. Various environmental and biological factors like predation play an important role in the survival of first year oysters, and determining how a given lineage may perform in certain environments provides crucial information for habitat restoration practitioners and resource managers. We will continue to look for evidence of enhanced performance in addition to susceptibility to different parasite borne diseases and the ability to enhance fish production. In Quonochontaug Pond, the oyster performance was status quo. We observed a slight drop in density and a slight increase in average oyster length suggesting that for the reefs that are successful are maintaining densities well above the minimum ecological threshold, with respect to augmented fish abundance, and that oyster growth is itself starting to plateau at about 4.5-5years of age.

Providing the health of these reefs are maintained, the quality of habitat provided should increase over time in response to successional changes on these reefs. That said, it's generally agreed that oyster reefs provide some level of enhancement to fish habitat beginning at time of reef creation. Consistent with this expectation, we observed that the abundance of fish increased across sites after reef creation, in comparison to preconstruction baseline monitoring. We also observed an increase in targeted species, such as black sea bass, tautog, and winter flounder.

In Ninigret Pond, we found lower overall catch rates for the target sportfish species between the habitat treatments. In Quonochontaug Pond, Black Sea Bass, Tautog, and Cunner all showed that enhancement potential of the oyster habitat, provided greater catch than their respective controls at the green hill pond reefs which still have sufficient oyster densities. Black Sea Bass and Winter Flounder were more positively influenced at the eastern basin that has a sandier and more rugose substrate, whereas Tautog were more positively increased at the western basin that is relatively flat and muddy between the reefs compared to the eastern sites. In accordance with reef production literature, Tautog are typically a recruitment enhanced species, as opposed to growth enhanced like black sea bass, and the placement of reefs in areas relatively devoid of other structured habitat may have a higher potential for fish augmentation by providing adequate substrate for juvenile tautog to recruit (Powers et al. 2003).

Scup and Summer Flounder have yet to show any strong trends at our FHE sites, which is similar to work in the Mid-Atlantic (Peterson et al. 2003) where It's possible that the methodology used to determine the CPUE on and off reefs was not sufficient to document the relative use for these different FHE treatments by striped bass, scup, and other pelagic (e.g., bluefish, menhaden).

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zu Ermgassen, P. S. E., B. DeAngelis, J. R. Gair, S. zu Ermgassen, R. Baker, A. Daniels, T. C. MacDonald, K. Meckley, S. Powers, M. Ribera, L. P. Rozas, and J. H. Grabowski. 2021. Estimating and Applying Fish and Invertebrate Density and Production Enhancement from Seagrass, Salt Marsh Edge, and Oyster Reef Nursery Habitats in the Gulf of Mexico. Estuaries and Coasts 44:1588–1603.

Table 1. Biological Cover, species richness and diversity. Average species richness (R) and diversity (Shanon's H index) derrived from the individual transect richness and diversity values for each site. This data only represents the diversity and richness observed via the uniform point count transect method and does not reflect mobile inverts and finfish species present at these locations.

YEAR	REGION	SITE	HABITAT	R	H
2020	Coastal Ponds	Quonochontaug Pond	Oyster	4 ± 0.55	1.17 ± 0.19
2021	Coastal Ponds	Quonochontaug Pond	Oyster	3.78 ± 0.32	1.13 ± 0.1
2022	Coastal Ponds	Ninigret Pond	Oyster	4.5 ± 0.19	1.26 ± 0.04
2022	Coastal Ponds	Quonochontaug Pond	Oyster	3.33 ± 0.37	1.03 ± 0.1
2023	Coastal Ponds	Quonochontaug Pond	Oyster	3.33 ± 0.41	1.07 ± 0.11
2024	Coastal Ponds	Quonochontaug Pond	Oyster	3.67 ± 0.62	1.01 ± 0.2

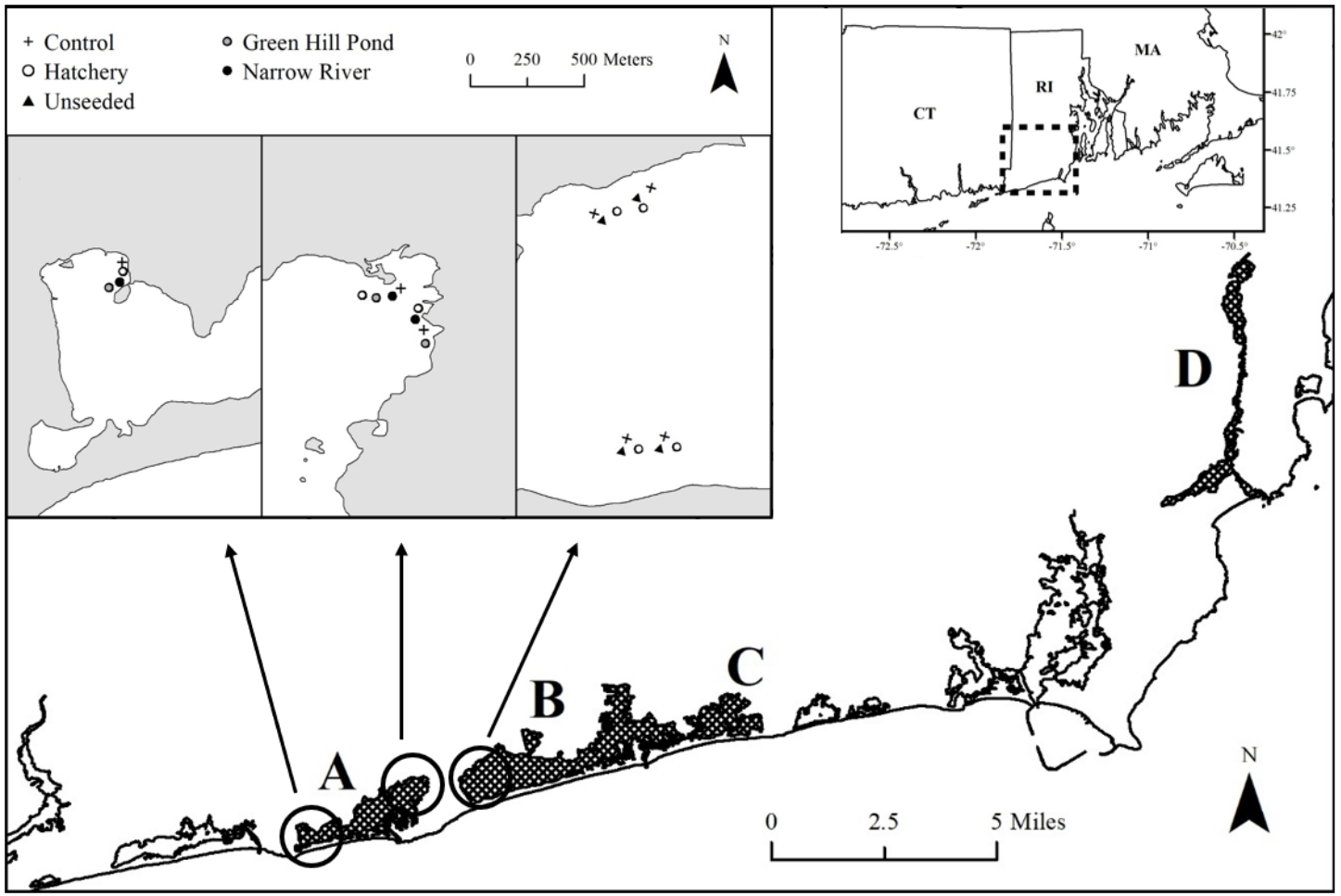


Figure 1: Map of the Rhode Island coastal ponds and rivers. Includes restoration locations (A = Quonochontaug Pond and B = Ninigret Pond), as well as oyster broodstock collection sites (C = Green Hill Pond and D = Narrow River). Restored oyster reefs for both experiments ordered from west to east. Quonochontaug Pond includes three seeded reefs (white = Hatchery, grey = Green Hill Pond, and black = Narrow River) per region. Ninigret Pond includes two unseeded (triangle) and two seeded (circle) reefs in each region. Both ponds also include unenhanced control (+) sites.

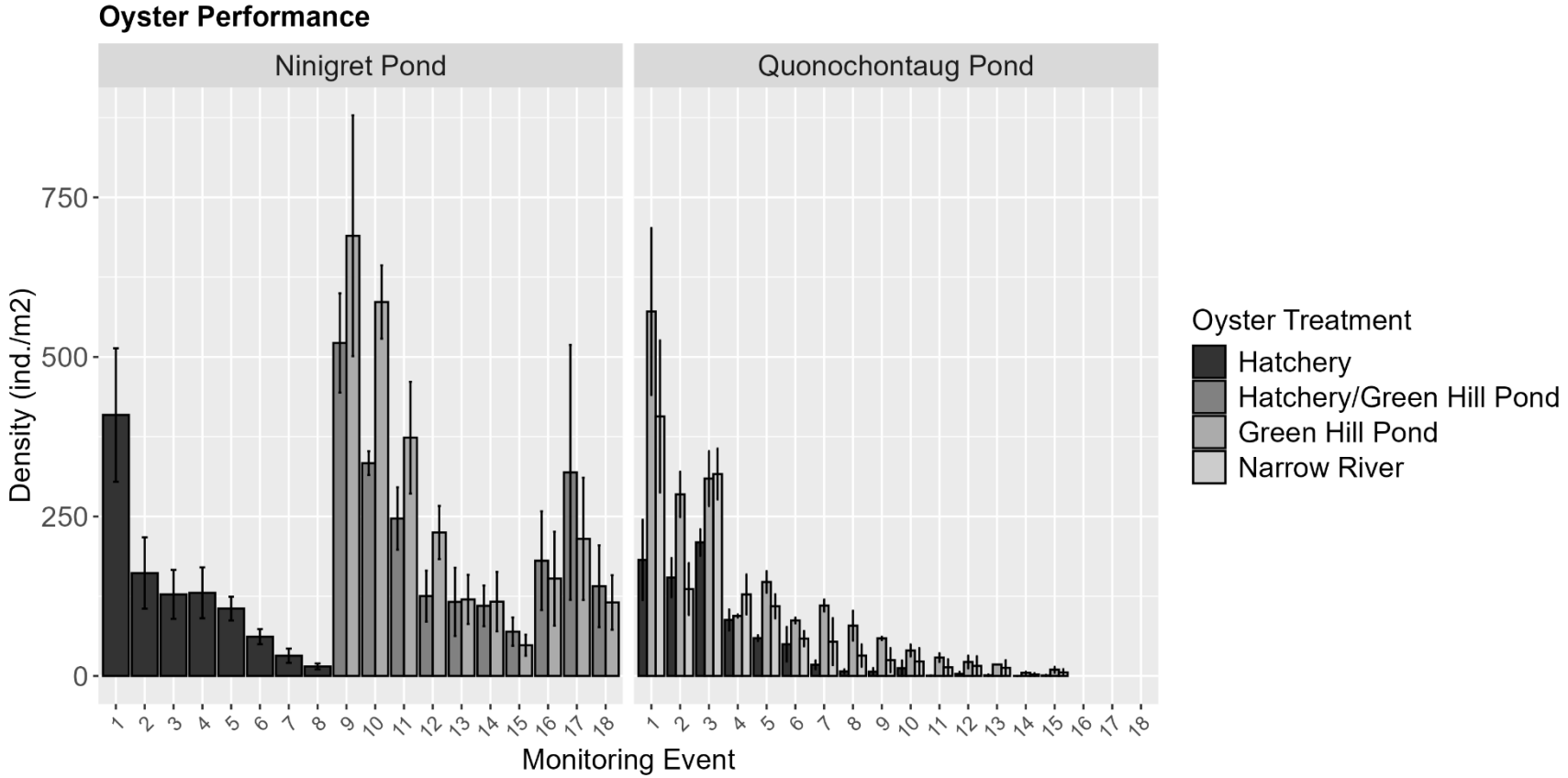


Figure 2: Bar graph of mean oyster density per meter squared, ± se, in Ninigret Pond as a function of oyster monitoring event (sampled twice annually spring and fall), grouped by oyster seed source (Ninigret Pond: black = original hatchery lineage seeded in 2016, dark grey = Green Hill Pond overseeding, grey = Green Hill Pond only; Quonochontaug Pond: black = hatchery, grey = Green Hill Pond, light grey = Narrow River), for Ninigret (left) and Quonochontaug Pong (Right)

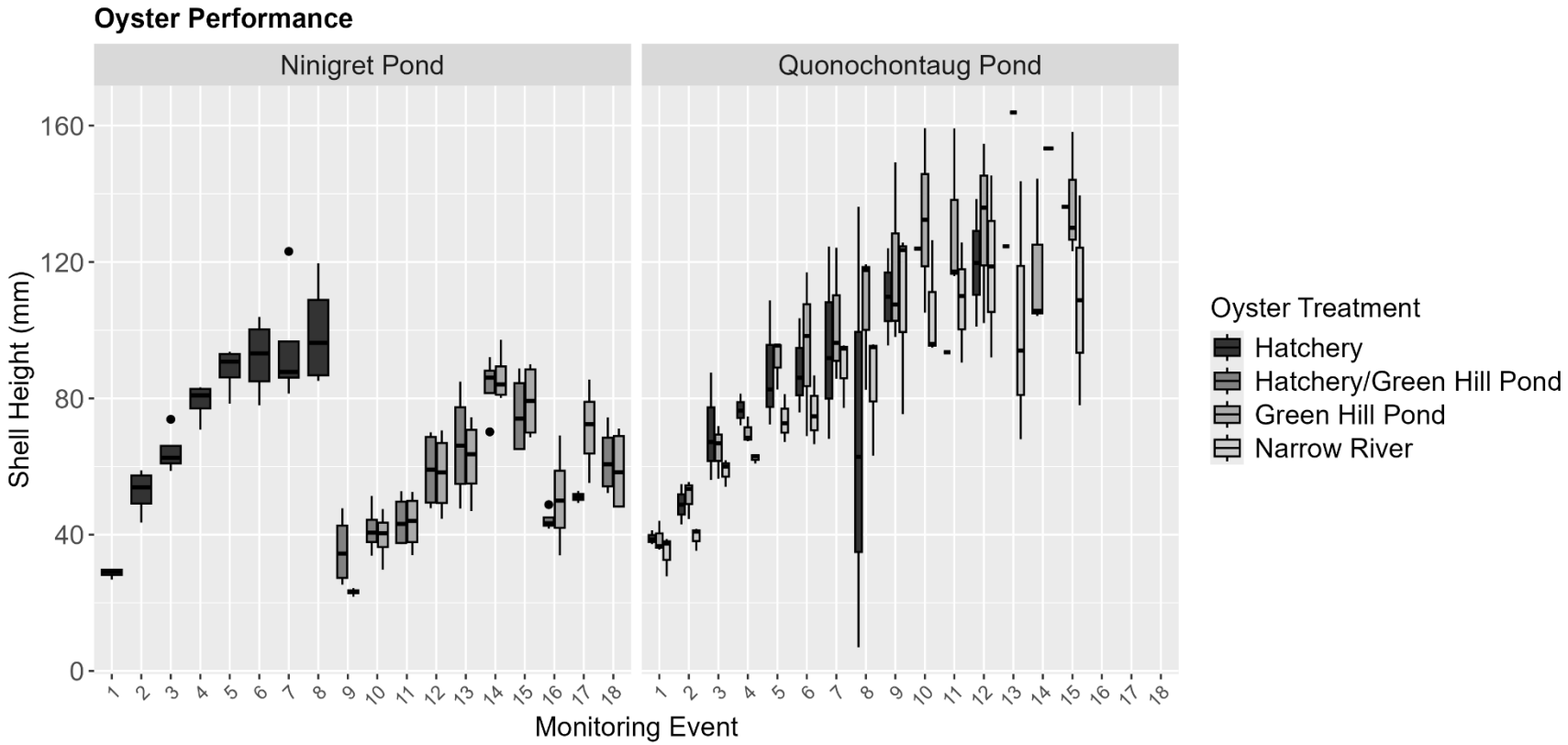


Figure 3: Box plot of mean oyster shell height (mm) per reef in both Ninigret Pond (left) and Quonochontaug Pond (right) as a function of oyster monitoring event (twice year, May and October), a proxy for time, and oyster seeding treatment (black = original hatchery, dark grey = green hill pond overseeding of old hatchery line, grey = Green Hill Pond only, light grey = Narrow River).

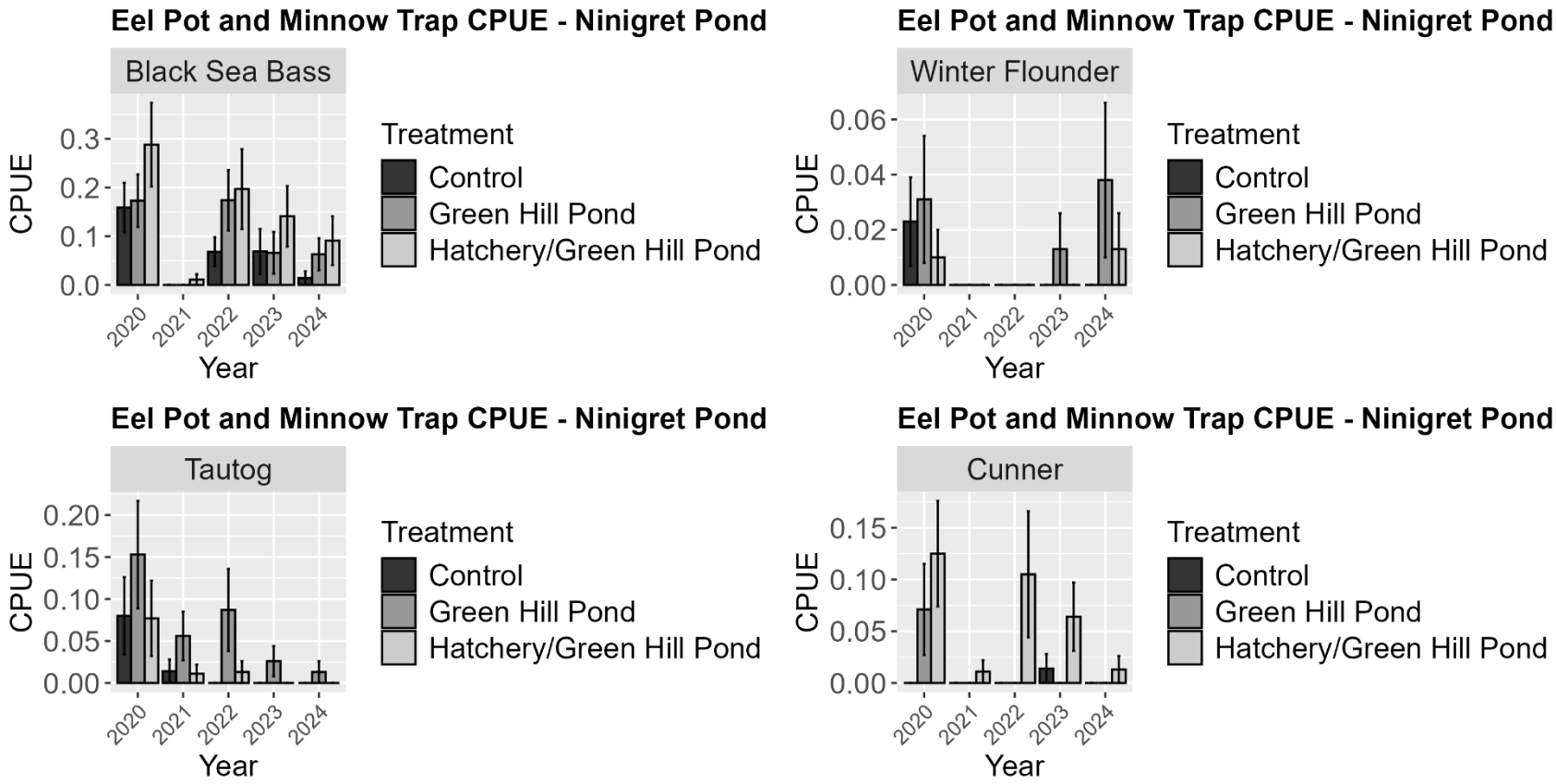


Figure 4: Ninigret Pond, mean catch per unit effort (CPUE) (ind./hours fished) ± se, observed during the 2020 – 2024 field seasons. Averages represent the average monthly CPUE from each habitat treatment. The average CPUE is plotted by year, grouped by habitat treatment (black = control, dark grey = Green Hill Pond seed source, light grey = former hatchery reefs over seeded with Green Hill Pond), and facetted by finfish species (Top left = Black Sea Bass, Top right = Winter Flounder, Bottom Left = Tautog, Bottom Right = Cunner).

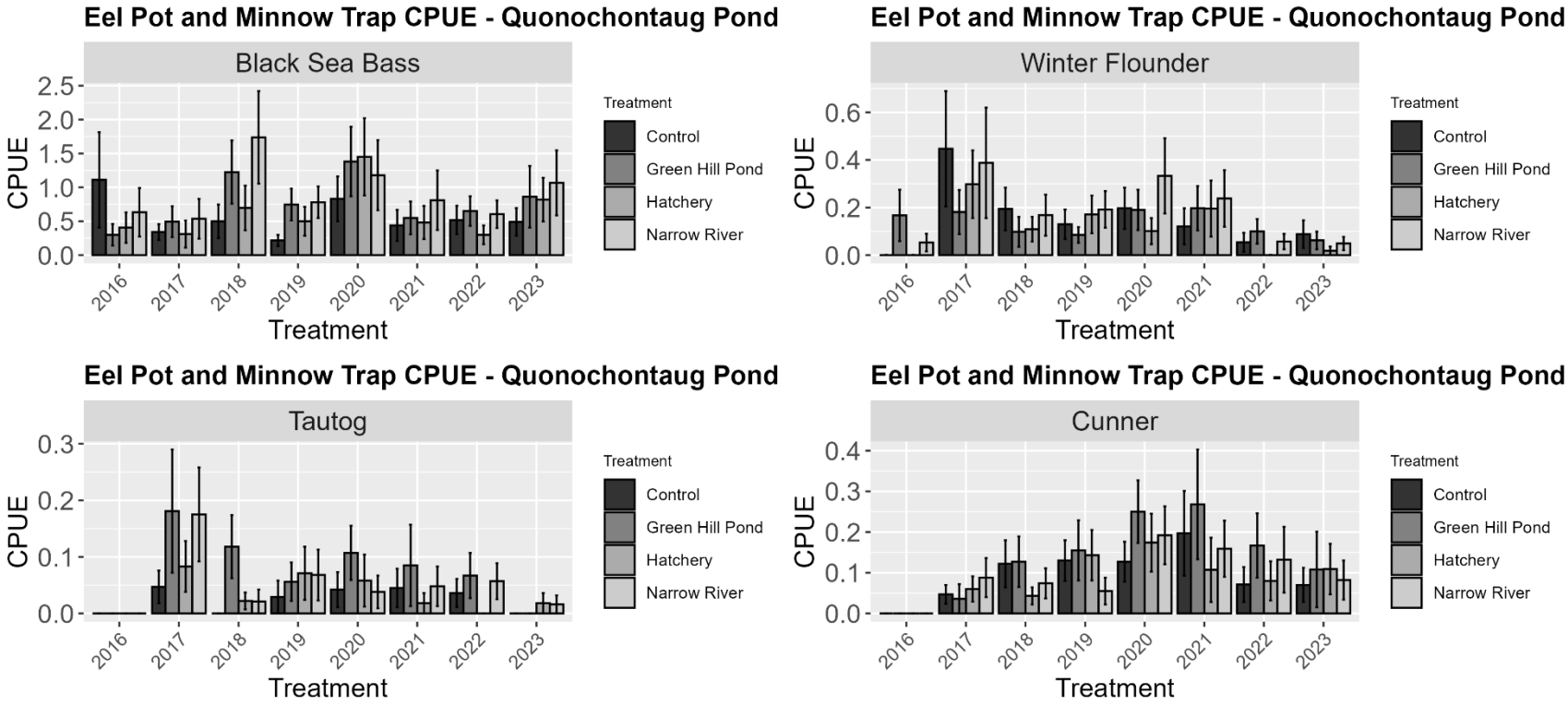


Figure 5: Quonochontaug Pond, mean catch per unit effort (CPUE) (ind./hours fished) ± se, observed during the 2016-2023 field seasons. Averages represent the average monthly CPUE from each habitat treatment. The average CPUE is plotted by year, grouped by habitat treatment (black = control, dark grey = Green Hill Pond seed source, grey = hatchery, light grey = narrow river seed source), and facetted by finfish species (Top left = Black Sea Bass, Top right = Winter Flounder, Bottom left = Tautog, Bottom Right = Cunner).

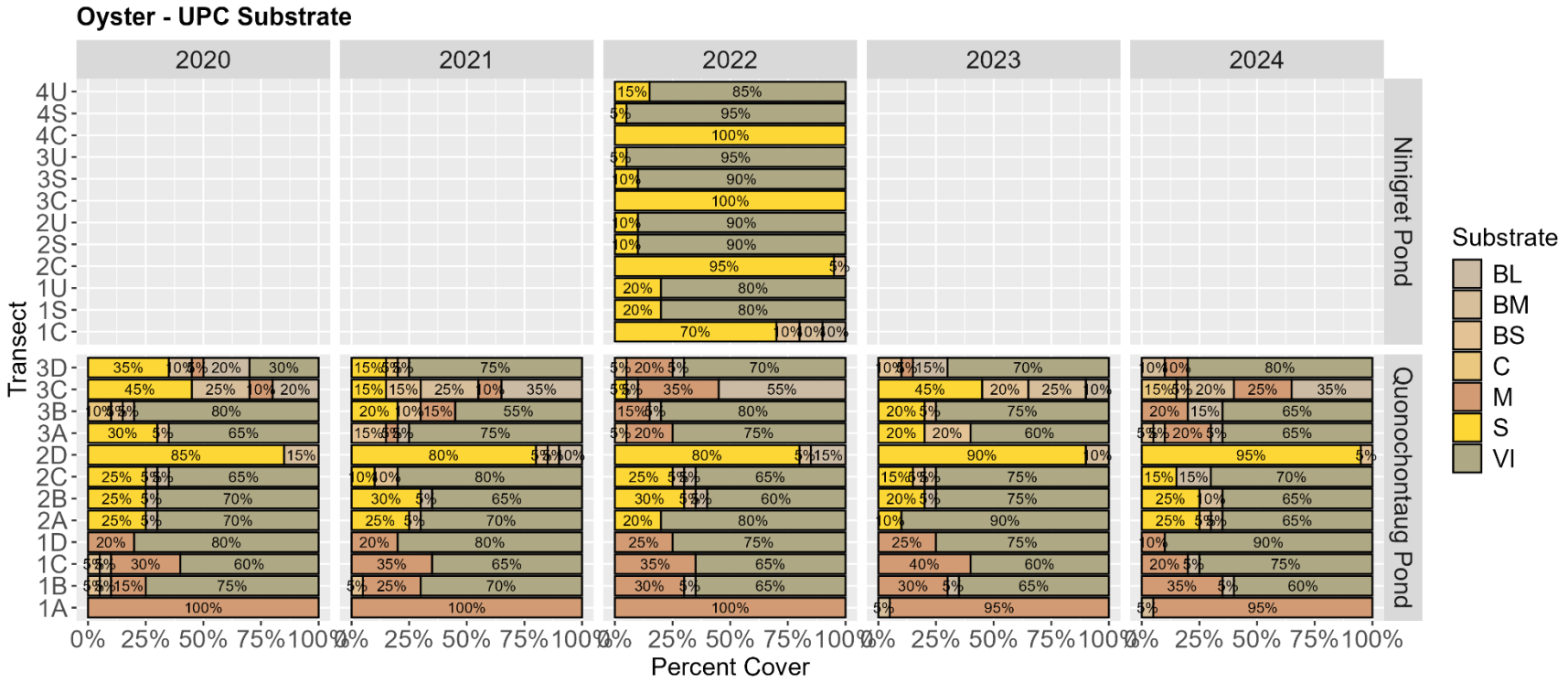


Figure 6. Percent cover of substrate along the y-axis plotted for each transect along the x-axis, for each 2020-2024 fish survey. Percent cover is grouped by substrate type (BL = boulder large, BM = boulder medium, BS = boulder small, M = mud/fines, M_S = sandy mud mix, C = cobble , S = Sand, VI = Oyster/ Oyster Shell).

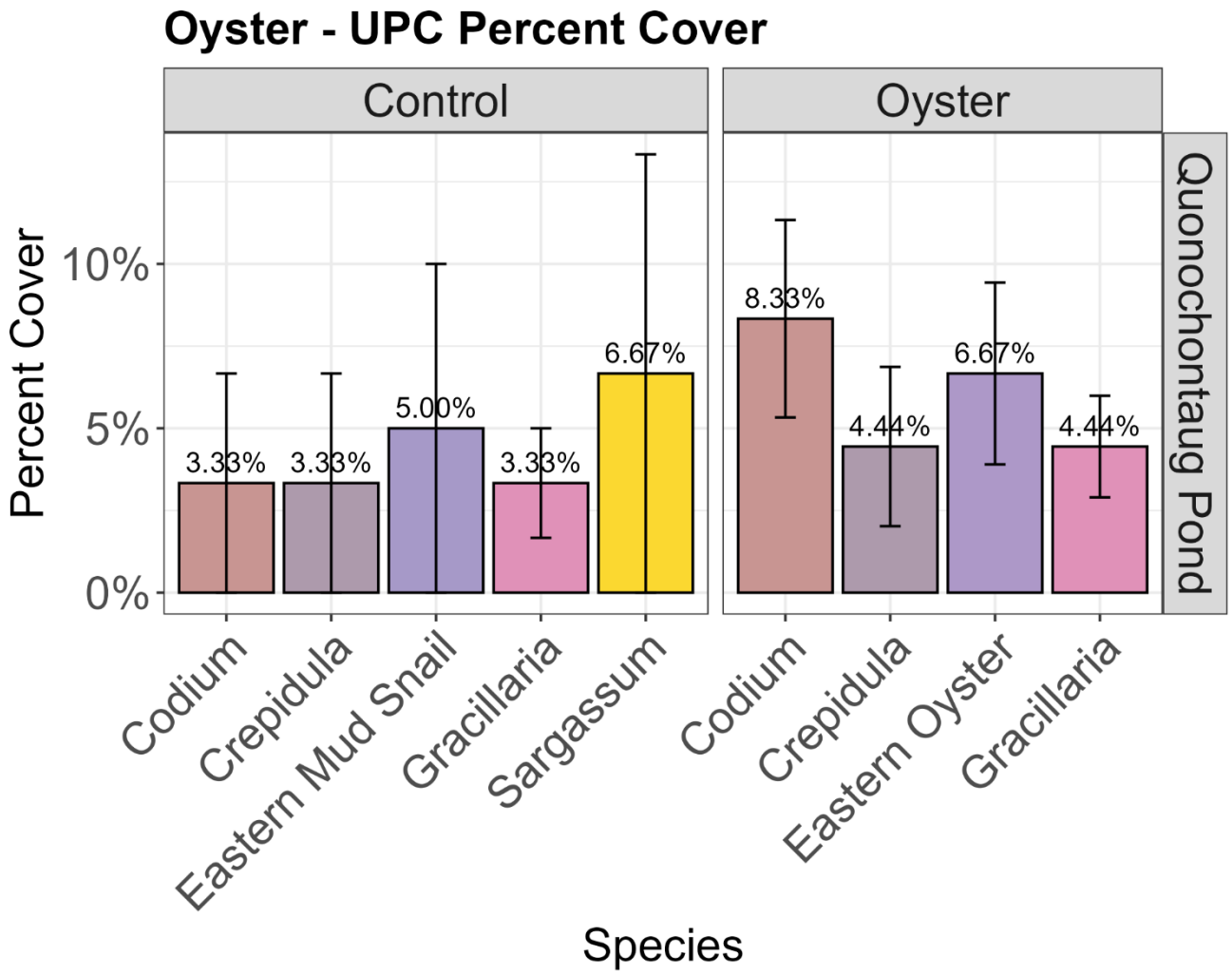


Figure 7. Quonochontaug Pond, mean algal and sessile invertebrate cover ± SE, for each habitat treatment (Control or Oyster Habitat) during the 2024 dive survey.

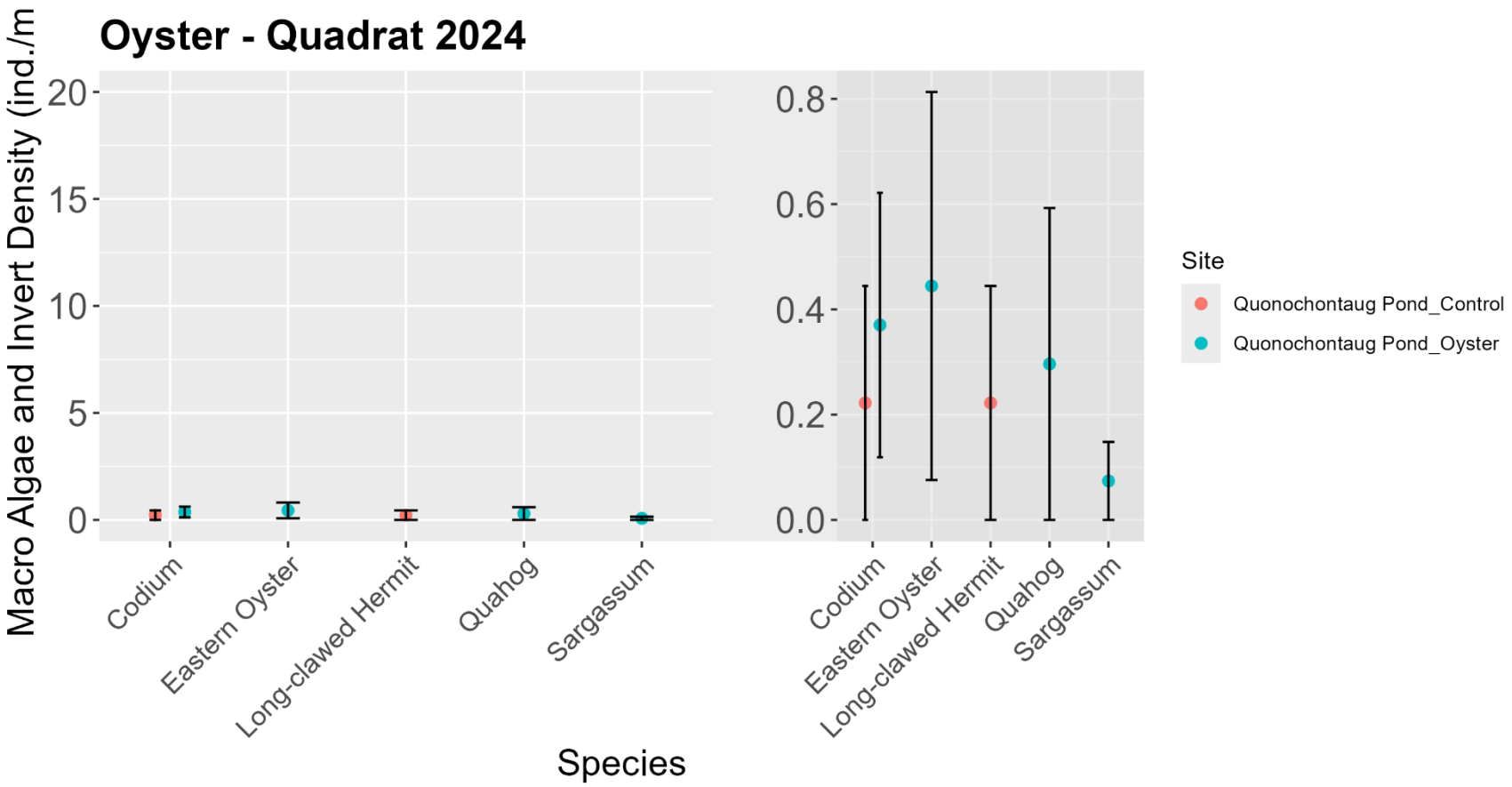


Figure 8. Quonochontaug Pond, mean invertebrate density ± SE, per habitat treatment (Control or Oyster Habitat) and Pond (Quonochontaug Pond) for the quadrat survey method in 2024.

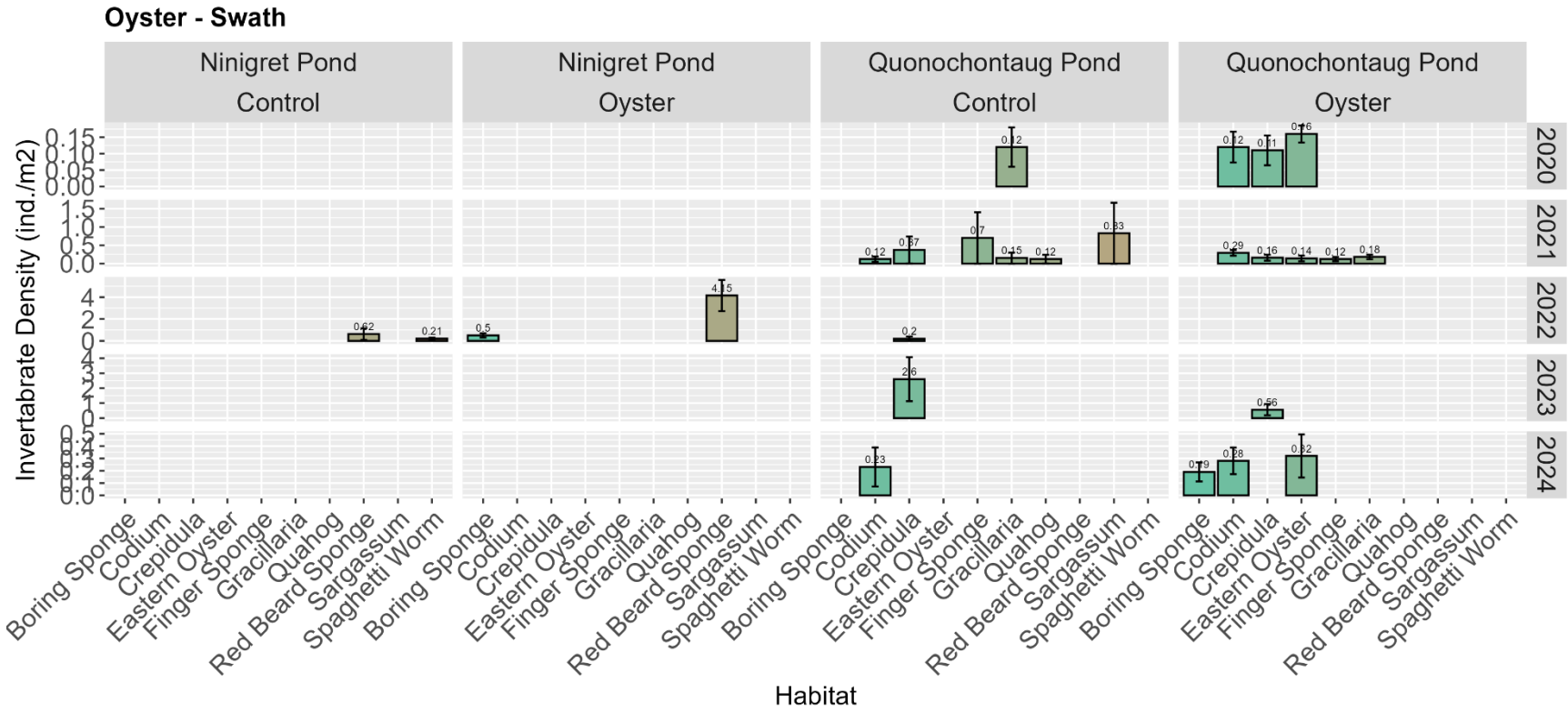


Figure 9. Quonochontaug Pond, mean invertebrate density ± SE, per habitat treatment (Control or Oyster Habitat) and pond (Quonochontaug Pond) for the swath transect method, faceted by year (2020-2024).

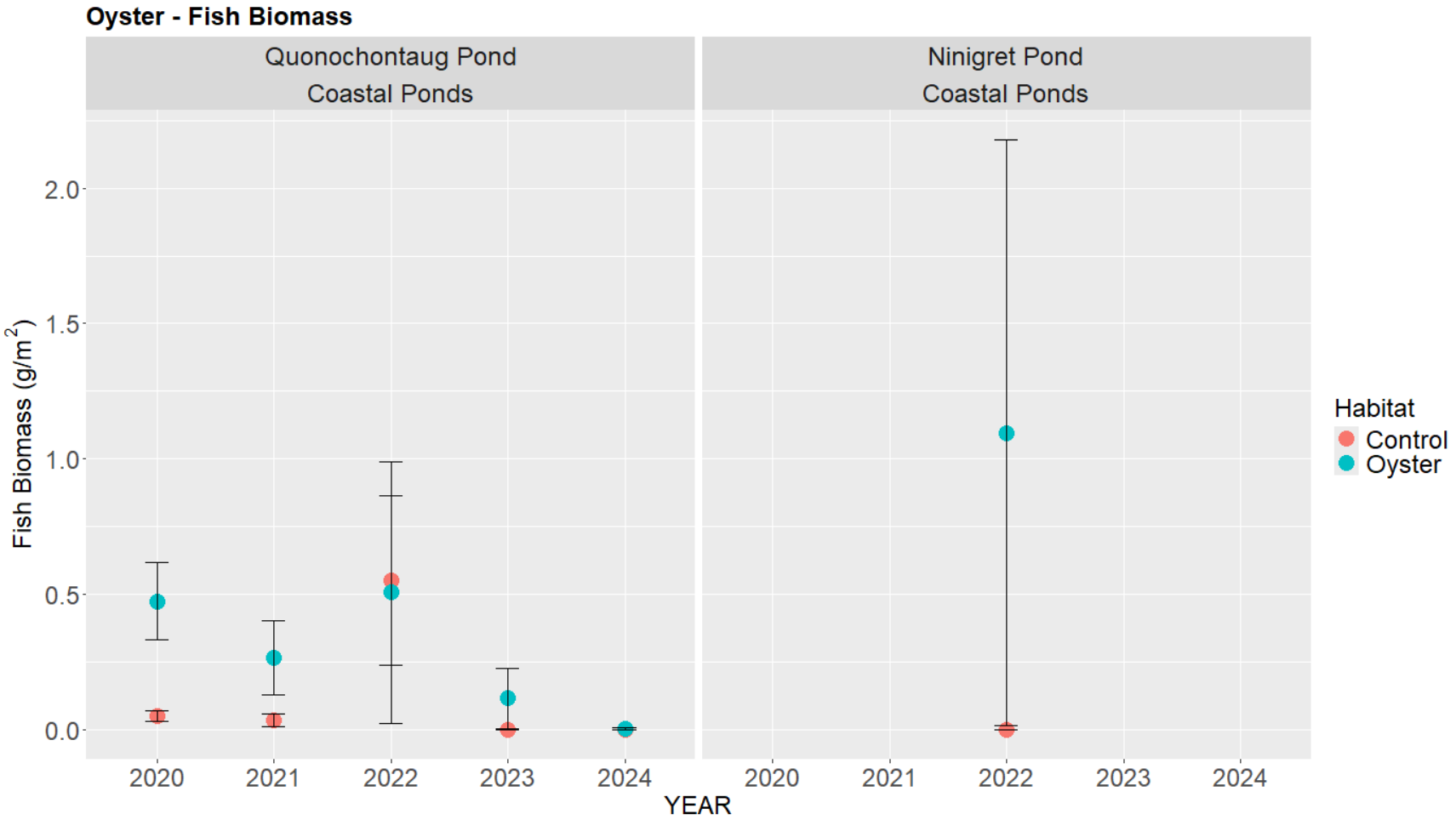


Figure 10. Quonochontaug Pond, mean fish biomass during the 2020-2024 dive surveys. Fish biomass is standardized per meter squared and presented as the average biomass ± SE, for each habitat treatment (Control = red, Oyster = blue)

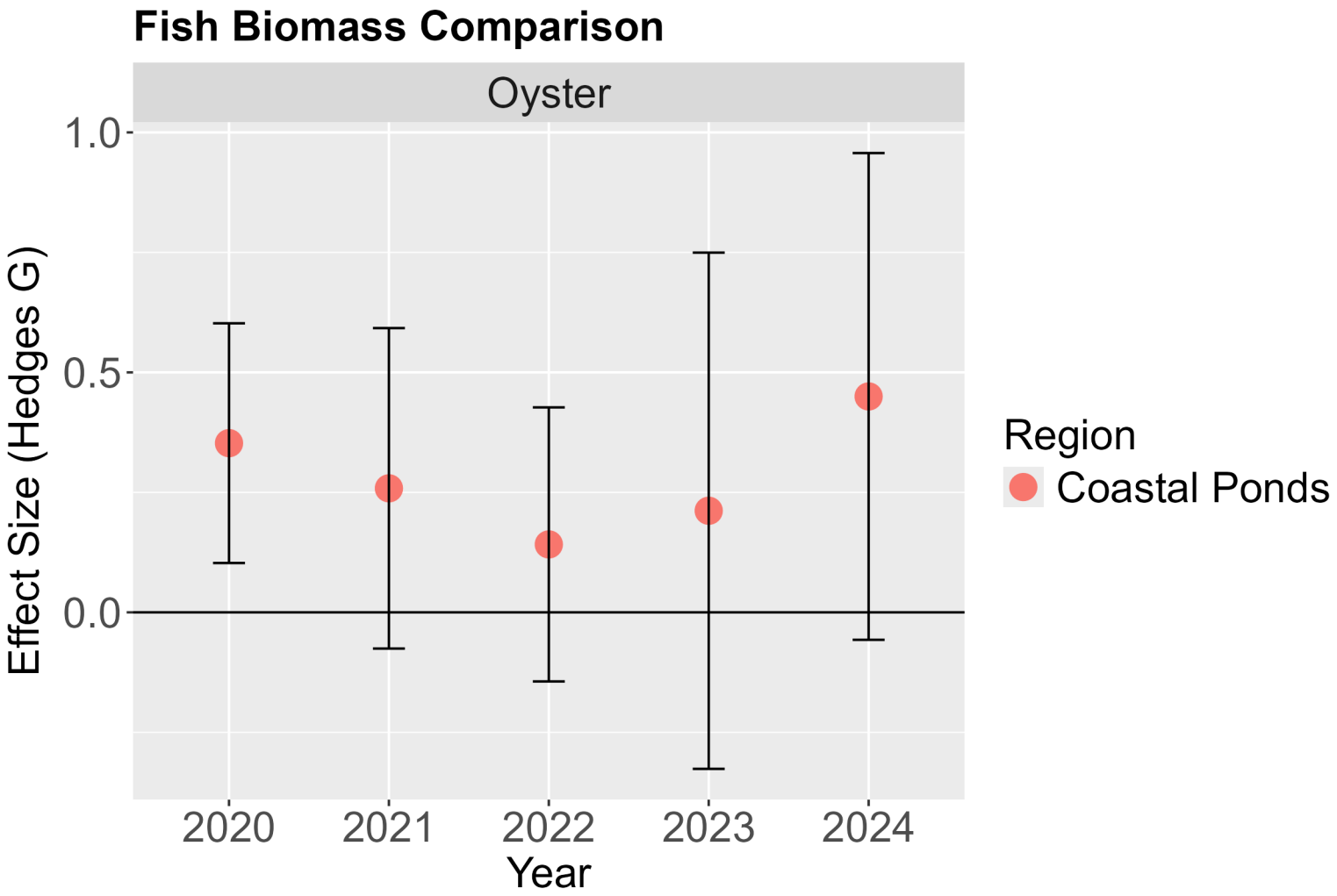


Figure 11. Quonochontaug Pond, effect size ± SE plotted as a function of average oyster density in Quonochontaug pond during the 2020-2024 dive surveys.

Protecting and Minimizing Adverse Impacts to Marine Fish Habitat

Eric Schneider, Anna Gerber-Williams, Katie Rodrigue, and Julia Livermore

Rhode Island Department of Environmental Management,
Division of Marine Fisheries

Eric.Schneider@dem.ri.gov

Federal Aid in Sportfish Restoration
F-61-R-21

2024 Performance Report: Summary of work conducted during 2020 - 2024

Performance Report: Job 6 **March 10, 2024**

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

Period Covered: January 1, 2020 - December 31, 2024

Job Number: Job 6: Protecting and Minimizing Adverse Impacts to Marine Fish Habitat

Staff: Eric Schneider, Anna Gerber-Williams, Katie Rodrigue, and Julia Livermore

Job Objectives:
The goal of this project is to protect important marine habitat to support healthy marine ecosystems and stocks of recreationally important sportfish by addressing the following objectives:

(1) Provide a comprehensive review of permit applications for projects that occur in Rhode Island waters and may directly or indirectly impact coastal and marine resources and their habitat, including economic development projects, such as energy, infrastructure, dredging, and dredge spoil disposal projects, as well as aquaculture and habitat restoration projects.

(2) In the event of a significant environmental incident: coordinate hazard mitigation, assessment of natural resource damages, and resulting habitat restoration.

(3) Collect and contribute data and staff expertise in municipal, state-wide, and regional planning processes, risk assessments, and habitat and/or spatial planning processes and committees to ensure marine habitat data is incorporated and/or impacts to marine habitat and recreational important sportfishing opportunities are adequately considered and addressed.

Target Date: December 31, 2024

Deviations: No deviations occurred during 2024.

Recommendations: *None*

Remarks: *None*

Summary:

Objective 1: As part of its environmental review program during 2024, Rhode Island (RI) Department of Environmental Management (DEM), Division of Marine Fisheries (DMF) reviewed 83 permit applications that contained approximately 148 separate activities that posed potential impacts to marine resources (Table 1). The number of applications reviewed in 2024 was similar to 2023 (n = 81) and within the range of projects reviewed during the last 5-years (range 81:118, $\bar{x}$ = 92.0, SD = 15.0, Table 2). The number of activities that posed potential impacts to marine resources in 2024 was less than 2023 (n = 169) and the 5-year average ($\bar{x}$ =

175.1, SD = 39.0, Table 2). Activities such as the modification to exiting or newly proposed residential docks and public works projects were below the five-year average (Table 2). Activities such as new and maintenance dredging and waterfront and bulkhead work were generally similar to the five-year average (Table 2). Potential impacts to submerged aquatic vegetation (SAV) and benthic habitat and salt marsh or coastal wetlands were less than the five-year average but similar to or greater than the ten-year average (Table 2).

During 2024, the. DMF provided formal, written responses for seven public noticed aquaculture lease applications. Four public noticed aquaculture applications were reviewed during RI Marine Fishery Council (RIMFC) Shellfish Advisory Panel (SAP) meetings to obtain input from industry and to provide scientific opinion to the RIMFC regarding the potential impact to marine resources, including conflicts with recreational fishing and marine habitat. Additionally, DMF provided mapping assistance to four applicants that submitted applications for site modifications.

Objective 2: In 2024, RI DMF responded to two of the four reported fish kill events. The species most affected was striped searobin. The three events involving this species were likely due to discarding of commercial fishing bycatch. One fish kill event in Narrow River involved river herring, but it is not known how many individuals were affected. This event was due to a naturally occurring turnover of deep anoxic bottom waters in the upper pond of the Narrow River system. These turnover events occur every few years depending on certain environmental conditions.

Objective 3: DMF staff participated in local, regional, and coastwide workshops and meetings focused on the assessment, management, restoration of habits important to recreationally import species of fish. For example, DMF participated in meetings for the Regional Wildlife Science Collaborative for Offshore Wind (RWSC) Habitat and Ecosystem Subcommittee, Acoustic Telemetry Subcommittee, East Coast SAV Collaborative, and Long Island Sound Eelgrass Collaborative, as well as several other collaborative workshops and meetings.

Objective No. 1

Objective 1 – Approach

To address Objective 1, the DMF provides a comprehensive review of any project or activity, including economic development projects (e.g., energy and infrastructure), dredging and dredge spoil disposal projects, as well as other activities (e.g., recreational and commercial fishing, aquaculture, habitat restoration, etc.) that occur in Rhode Island waters and could pose potential direct or indirect impacts to coastal and marine resources and their habitat. Reviews include all available data and provide important information to permitting agencies to allow for more informed permitting decisions.

Depending on the size, scope, and location of the proposed project or activity the review process involves determining the living and non-living resources present at or near the project site and evaluating the potential direct and indirect adverse effects of the proposed project or activity on fishery resources and marine habitat. More specifically, this process often requires a site visit and a review of fishery resource data and marine habitat data, including EFH, that were collected at or near the project site or in similar habitat conditions. These data may include data collected by

RI F&W finfish surveys funded by the USFWS Sport Fish Restoration Program (e.g. Narragansett Bay Monthly and Seasonal Fishery Resource Assessment, Winter Flounder Spawning Stock Biomass Survey, Young of the Year Survey of Selected RI Coastal Ponds and Embayments, and the Juvenile Marine Finfish Survey) and surveys related to finfish, shellfish, and ichthyoplankton conducted by RI F&W pursuant to other funding sources or other originations and institutions (e.g. MA DMF, NEMAP, NEFSC, URI GSO, etc.). Habitat data, including EFH data, may require leveraging data collected previously by RI F&W or other organizations and institutions.

In cases where site-specific habitat and marine resource data is limited, dated, or absent new data may need to be collected, analyzed, and summarized. Prior to data collection a sampling plan is designed to address specific permitting-related data deficiencies and outline anticipated field and data analyses methods. When possible, any information that would improve anticipated future reviews should be collected. Similarly, when possible this work takes advantage of collaborative efforts by other agencies. Collection of marine habitat and resource (finfish) data may require use of a vehicle, boat, research vessel, field equipment including but not limited to habitat surveying tools, such as submersible high-resolution digital cameras (video and still-shot), bottom samplers (benthic dredge/sled), water quality data sondes, meters, acoustic receivers, and associated equipment, and marine resource survey tools, including nets (bongo, seine), measuring boards, and foul weather gear. Data is assimilated and analyzed using statistical software, databases, imaging processing software, and GIS mapping and processing technologies. Other sources of habitat data may need to be purchased, such as aerial photography, lidar, side-scan sonar, or GIS data depicting habitat (e.g. eelgrass, submerged aquatic vegetation, sediment, or structures).

In most cases the aforementioned data sources must be compiled, reviewed, and analyzed before a permit can be issued. Given the regulatory timelines set up for permit reviews, being able to accomplish these tasks timely and accurately often requires a collaborative approach that utilizes present and cutting-edge technologies, and sometimes outside expertise.

Objective 1 – Results and Discussion

As part of its environmental review program during 2024, verbal and/or written comments were provided on general permit reviews through meetings with CRMC, RI DEM OWR, U.S. EPA, and USACE. As part of these reviews, RI DMF provided comments and time of year windows for all dredge-related all projects, as well any project that may result in potential impacts to marine resources. As part of its environmental review program during 2024, Rhode Island (RI) Department of Environmental Management (DEM), Division of Marine Fisheries (DMF) reviewed 83 permit applications that contained approximately 148 separate activities that posed potential impacts to marine resources (Table 1). The number of applications reviewed in 2024 was similar to 2023 (n = 81) and within the range of projects reviewed during the last 5-years (range 81:118, $\bar{x}$ = 92.0, SD = 15.0, Table 2). The number of activities that posed potential impacts to marine resources in 2024 was less than 2023 (n = 169) and the 5-year average ($\bar{x}$ = 175.1, SD = 39.0, Table 2). Activities such as the modification to exiting or newly proposed residential docks and public works projects were below the five-year average (Table 2). Activities such as new and maintenance dredging and waterfront and bulkhead work were

generally similar to the five-year average (Table 2). Potential impacts to submerged aquatic vegetation (SAV) and benthic habitat and salt marsh or coastal wetlands were less than the five-year average but similar to or greater than ten-year average (Table 2).

During the five-year reporting period, DMF continued to participate in the Manchester Street Power Station 316(b) review process, as well several additional large-scale projects. More specifically, DMF staff also participated in the review of offshore wind permit applications and project implementation measures for two projects occurring within RI state waters (i.e., Revolution Wind and South Coast Wind). Also, during the five-year reporting period DMF assisted the USACE to develop an eelgrass restoration plan for Winnapaug Pond and a draft Dredge Maintenance and Management Plan for the Providence River Federal Channel Maintenance project. DMF also worked with applicants to update the application for removal of the Upper and Lower impoundments in the Kickemuit River. This project aimed to reestablish aquatic connectivity between the freshwater and estuarine portions of the Kickemuit River to re-establish tidal estuarine habitat that was removed over 160 years ago when the impoundments were first created.

As part of DMF's responsibility to evaluate whether proposed aquaculture activities could impact recreational fisheries and the fish habitat, DMF participated in and formulated a response for seven public noticed aquaculture lease applications during 2024. Four public noticed aquaculture applications were reviewed during RI Marine Fishery Council (RIMFC) Shellfish Advisory Panel (SAP) meetings to gain input from industry and to provide scientific opinion to the RIMFC regarding the potential impact to marine resources, including conflicts with recreational fishing and marine habitat. Additionally, DMF provided mapping assistance to four applicants that submitted applications for site modifications.

During the five-year reporting period, DMF participated in the CRMC Bay SAMP Aquaculture Element Working Group that incorporated new policies into the management program. During this period DMF staff participated in working group meetings and seminars focused on best practices to minimize impacts to marine resources. DMF also continued internal review and editing to the aquaculture siting review protocol. The aquaculture siting review protocol was created to provide general guidance and justification for siting recommendations for the DMF. Justification includes peer-reviewed and gray literature, conversations with topic-specific experts, and analysis of DEM survey data. Recommendations presented within the protocol are effective for applications currently under review or under future review, including proposed expansions to existing leases. Factors addressed within the aquaculture siting review protocol included: fish habitat, shellfish habitat, proximity to long-term monitoring and habitat restoration sites, proximity to seal habitats, shellfish densities, and commercial and recreational fishing densities, which are areas under the DMF purview. The document is still in development and will be presented to the shellfishing and aquaculture industries for further feedback before being finalized. The Division also continued to update and improve an interactive map on the Department's website showing aquaculture related sites: http://ridemgis.maps.arcgis.com/apps/webappviewer/index.html?id=8beb98d758f14265a84d69758d96742f. This interactive map features mapping tools for future applicants to aid in the site selection process and help them avoid areas of public use or historic eelgrass habitat. Several

applicants utilized the interactive map since it was made available to the public and DMF plans to make further modifications and improvements.

Objective No. 2

Objective 2 - Approach

The DMF will provide available scientific information identifying important recreational fish habitat and pre-impact conditions in the event of a significant environmental incident classified as a Category 3 major environmental disaster incident (e.g., > 10,000 gal oil spill or wide coastal environmental impact likely). In addition, the DMF will provide a staff member with recreational fishery habitat expertise for coordination of DMF responses related to assisting the Office of Emergency Response Incident Command in assessing the environmental impacts of a major oil spill or incident on recreational habitat and biota in Rhode Island marine waters. The staff member will work with appropriate RIDEM and federal representatives in Incident Command during the response to provide needed DMF coordination and technical information during such an incident, including immediate responses related to impact assessment, monitoring of environmental conditions in the vicinity of a spill, immediate biota mortality estimates, as well as involvement in the Natural Resource Damage component of a major incident response following the "Bay Response Team" (BART) protocols. We will assess staff training needs and seek training and/or refreshers that include response protocols and techniques, as needed.

Objective 2 – Results and Discussion

In 2024, RI DMF responded to two of the four reported fish kill events. Table 3 shows a summary of these events. The species most affected was striped searobin (*Prionotus evolans)*. The three events involving this species were likely due to discarding of commercial fishing bycatch. One fish kill event in Narrow River involved river herring, but it is not known how many individuals were affected. This event was due to a naturally occurring turnover of deep anoxic bottom waters in the upper pond of the Narrow River system. These turnover events occur every few years depending on certain environmental conditions. The last turnover occurred in December, 2020.

During the five-year reporting period, most of the fish kill incidents reported were determined to be caused by natural events, including intermittent hypoxia or elevated-water temperatures. The species most frequently affected was Atlantic menhaden, which was affected in all years, except 2024. During the reporting period, other species affected included including blue mussel, striped killifish, mummichogs, Atlantic silverside, northern kingfish, summer flounder, American eel, striped bass, striped sea robin, and blue crab.

In the event of an incident that causes significant environmental impact, it is imperative for RI DMF to be able to respond quickly and efficiently to assess the effects on fish habitat in Rhode Island waters. Coordination with other state agencies (including RI DEM Office of Emergency Response, OWR, and Office of Law Enforcement) has proven fundamental to this fast response time and impact assessment. The continuation of this coordinated effort is necessary to ensure that a fast and efficient response is maintained. Also, continued emergency response training will allow further improved response to these incidents. Trainings that RI DMF staff have

participated in over the last few years include oil spill response training such as boom deployment and other geographic response protocols, Natural Resource Damage Assessment training, and FEMA's Incident Command System. RI DMF staff will continue to take advantage of training opportunities as they become available in the future to further hone our skills in emergency response.

Objective No. 3

Objective 3 – Approach

The DMF actively participates in municipal, state-wide, and regional planning processes, risk assessments, and habitat and/or spatial planning processes and committees, including but not limited to NOAA Environmental Assessment Indexes, Special Area Management Plans (SAMPs), Harbor Management Plans, state-side and regional Environmental Risk Assessments, Restoration Plans, and other plans and committees that include spatial management aspects with potential impacts to recreational sportfish activities and associated habitat. As needed, DMF provides marine habitat, recreational sportfish related data, survey data collected by DMF, and other pertinent marine data to these review and processes. DMF staff ensures that data is considered and used appropriately. As deemed necessary and appropriate, DMF provides analyses and technical assistance at various stages of these processes, as well as technical and logistical support for the activities that result in the collection of additional data that can increase the amount of information available to assess impacts (positive and negative) to recreational important sportfish. Support for data collection activities includes, but is not limited to, on-water assistance with maintaining water quality meters, acoustic receivers, and other measures used for fish and habitat qualification within these processes.

Objective 3 – Results and Discussion

During the 2024 reporting period, consistent with much of the five-year reporting period, DMF staff participated in local, regional, and coastwide workshops and meetings focused on the assessment, management, restoration of habits important to recreationally import species of fish. For example, DMF staff became members of the Regional Wildlife Science Collaborative for Offshore Wind (RWSC) Habitat and Ecosystem Subcommittee, Acoustic Telemetry Subcommittee, and contributed to the Integrated Science Plan for Offshore Wind, Wildlife, and Habitat in U.S. Atlantic Waters. The mission of the RWSC is to "collaboratively and effectively conduct and coordinate relevant, credible, and efficient regional monitoring and research of wildlife and marine ecosystems that supports the advancement of environmentally responsible and cost-efficient offshore wind power development activities in U.S. Atlantic waters".

RI DMF staff participated, as Steering Committee members, in the East Coast SAV Collaborative and Long Island Sound Eelgrass Collaborative. Both Collaboratives recognize the need for regionally-focused efforts to advance SAV science, monitoring, management, and advocacy. The goal for East Coast SAV Collaborative is to "bring together experts in SAV research and management from each of the U.S. East Coast states from NC to ME to share ideas and information, provide training and resources, and collaborate on efforts that bring actionable science to the forefront of our SAV management strategies". The Long Island Sound Eelgrass

Collaborative (LISEC) began as a bi-state initiative (NY and CT) to implement elements of the Long Island Sound 2022 Eelgrass Management and Restoration Strategy. As with recognized with the East Coast SAV Collaborative, eelgrass restoration in Long Island Sound would benefit from regional partnerships and collaborations, thus scientists and manager from Rhode and Massachusetts were invited to join and contribute to the LISEC.

During the five-year reporting period, RI DMF staff participated in the Collaborative Climate-Adaptive Restoration of Eelgrass (C-CARE) Workshop, hosted by Northeastern University. This in-person workshop brought together 20 eelgrass managers, restoration practitioners, and scientists from government, non-governmental organizations, and academia to develop a vision for climate-adaptive, experimental seagrass restoration in the Northeast. In additional to formation of potential future partnerships, this workshop crafted a collective vision to complement ongoing efforts to combat continued declines in eelgrass habitat. In addition, DMF staff contributed to the Narragansett Bay Estuary Program Science-Data Product "Seagrass Meadows – Forests Under the Sea" highlighting the importance of SAV habitats and the current status, including recent declines.

DMF staff also participated in the Northeast Regional Marine Fish Habitat Assessment (NRHA), which was a collaborative effort lead by the Mid-Atlantic Marine Fishery Management Council (MAMFC) in partnership with the New England Fishery Management Council (NRFMC) and Atlantic States Marine Fishery Council (ASFMC), to describe and characterize estuarine, coastal, and offshore fish habitat distribution, abundance, and quality in the Northeast. The project aimed to develop habitat science products that support habitat and fish stock assessments. Species habitat modeling was a core component of the assessment, aimed at improving our understanding of how environmental variables govern species distribution. Initial modeling work was completed in 2021, during which the inshore and offshore teams began joint and single species modeling efforts to determine species distributions and habitat use. The inshore working group continued work to link species assemblages to habitat types and using an online shinny App, mapped locations and extent of habitat utilization by focus species including inshore habitat types (SAV, oyster reefs etc.), building on existing databases, and began to develop species distribution maps and future predicted distribution. Assessment products, including an interactive data explorer, are available at: https://www.mafmc.org/nrha.

Table 1. Activities and potential impacts identified by RI DMF during the permit review process performed for 83 separate projects in 2024. Aquaculture-related reviews are excluded from this table.

		Narragansett Bay						
Activities & Potential Impacts	Coastal Ponds	Lower Bay	Upper Bay	Providence and Seekonk Rivers	Sakonnet River	Rivers	Coastal	Total
Potential Impacts to SAV or Benthic Habitat	7	7	2	1	2		2	21
Saltmarsh Restoration	2				1	1		4
Eelgrass Restoration	1							1
Artificial Reef								0
Maintenance Dredging	1	4	1	2				8
New Dredging		1		2	2	1		6
New Marina								0
Marina Expansion or Reconfiguration	2				1			3
Restoration of Tidal Flow or Dam Removal	1					1		2
Residential Docks (New)	8		4	3	3		2	20
Residential Docks (Modifications)	5	5	1	2	2			15
Commercial/Municipal Piers or Docks	2	2		1		1		6
Commercial/Municipal Mooring Field Expansion	1							1
Potentail Salt Marsh or Coastal Wetland Impacts	7	1	2	1	2			13
Beach Nourishment or Coastal Feature Resiliency				1				1
Waterfront Bulkhead/Riprap	3	3	4	4	3			17
Waterfront Development		1		3				4
Public Works, Utility, Energy		2			3			5
Fish Passage								0
Potential Shellfish Impacts		2		3	2			7
Channel Maintenance	1	1	1	1				4
Boat Ramps		2						2
Oyster Restoration								0
Recreational Access or Fishing (Improve/Impacts)	2	1		1				4
Impacts from Discharge or Stromwater			1	2		1		4
Total	43	32	16	27	21	5	4	148

Table 2. Activities and potential impacts identified during the permit review process by year from the current reporting period (i.e., 2020 – 2024) and the average (Avg) and standard deviation (SD) for the last five- and ten-years. Aquaculture-related reviews are excluded from this table.

						2020 - 2024 (5-Year)		2015 - 2024 (10-Year)	
Activities & Potential Impacts	2020	2021	2022	2023	2024	Avg	SD	Avg	SD
Potential Impacts to SAV or Benthic Habitat	30	36	24	27	21	27.6	5.8	16.8	12.6
Saltmarsh Restoration	4	5	3	3	4	3.8	0.8	4.0	1.1
Eelgrass Restoration	1	2	0	0	1	0.8	0.8	0.9	1.3
Artificial Reef	0	0	0	0	0	0.0	0.0	0.2	0.4
Maintenance Dredging	12	9	6	7	8	8.4	2.3	9.1	3.3
New Dredging	3	7	3	7	6	5.2	2.0	3.3	2.5
New Marina	0	0	0	0	0	0.0	0.0	0.4	0.8
Marina Expansion or Reconfiguration	8	3	2	0	3	3.2	2.9	2.9	2.2
Restoration of Tidal Flow to Coastal Pond	2	1	4	1	2	2.0	1.2	1.7	1.7
Residential Docks (New)	35	41	24	27	20	29.4	8.5	23.7	11.0
Residential Docks (Modifications)	30	5	35	19	15	20.8	12.0	20.4	14.3
Commercial/Municipal Piers or Docks	13	10	8	5	6	8.4	3.2	6.8	4.2
Commercial/Municipal Mooring Field Expansion	1	1	1	0	1	0.8	0.4	1.1	1.5
Salt Marsh or Coastal Wetland Impacts	21	15	26	18	13	18.6	5.1	13.1	8.4
Beach Nourishment or Coastal Feature Restoration	4	0	0	5	1	2.0	2.3	2.4	2.3
Waterfront Bulkhead or Riprap	18	6	9	15	17	13.0	5.2	9.6	5.9
Waterfront Development	2	6	3	3	4	3.6	1.5	2.3	2.1
Public Works or Utility	17	6	8	10	5	9.2	4.8	6.1	5.0
Fish Passage	12	6	3	3	0	4.8	4.5	2.4	3.9
Potential Shellfish Impacts	5	1	2	3	7	3.6	2.4	3.0	2.3
Channel Maintenance	6	7	2	5	4	4.8	1.9	3.4	2.5
Boat Ramps	10	1	2	0	2	3.0	4.0	2.1	2.9
Oyster Restoration	5	0	0	0	0	1.0	2.2	1.5	2.1
Recreational Use (Improve/Impacts)	8	7	2	3	4	4.8	2.6	3.4	3.1
Impacts from Discharge	3	6	3	8	4	4.8	2.2	3.5	2.6
Coastal Restoration Other	0	0	0	0	0	0	0	0.5	1.6
Total - Activities & Potential Impacts	250	181	170	169	148	183.6	39.0	144.6	59.1
Total - Projects Reviewed	118	87	91	81	83	92.0	15.0	82.3	17.8

Table 3. Summary of fish kill events in 2024.

Date Reported	Water Body	Persons/Agencies Notified	Response	Date of Response	Species Affected	Approximate number affected/dead	Water Quality Measured	Samples Taken	Photos	Cause	Comments
7/9/2024	Harbor of Refuge	DMF, DFW	DMF responded to the scene	7/9/2024	Striped searobin, *Prionotus evolans*	Minor	N	N	Y	Fishing bycatch/discards	2 fish observed on beach and 1 floating. Fishing discards that washed onto the beach at Camp Cronin.
8/5/2024	Harbor of Refuge	DMF, DLE, DFW	DMF responded to the scene	8/6/2024	Striped searobin, *Prionotus evolans*	Minor	N	N	Y	Fishing bycatch/discards	Reporter noted 50-100 dead fish. Staff investigated the following day and found 2 moderately decomposed fish on the beach.
9/12/2024	Harbor of Refuge	DMF, DFW, Parks	Response not deemed necessary	NA	Striped searobin, *Prionotus evolans*	Minor	N	N	Y	Fishing bycatch/discards	Many dead fish reported to media. Photos indicated a small number of dead searobins.
11/22/2024	Narrow River	DMF, DFW	Response not deemed necessary	NA	River herring	Minor	N	N	N	Anoxic turnover event in upper pond. Natural event that occurs every few years.	No action taken.

The Rhode Island Chapter of The Nature Conservancy
Annual Progress Report

Submitted to

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

Title: Providence River Estuary Seine Survey

Cooperative Agreement Award Number: 3481879

Award Term: January 15, 2020 to December 31, 2024

Reporting Period: January 15, 2020 to December 31, 2024

Prepared By

Sarah Paulson (Coastal Restoration Science Technician),
Heather Kinney (Coastal Restoration Scientist)

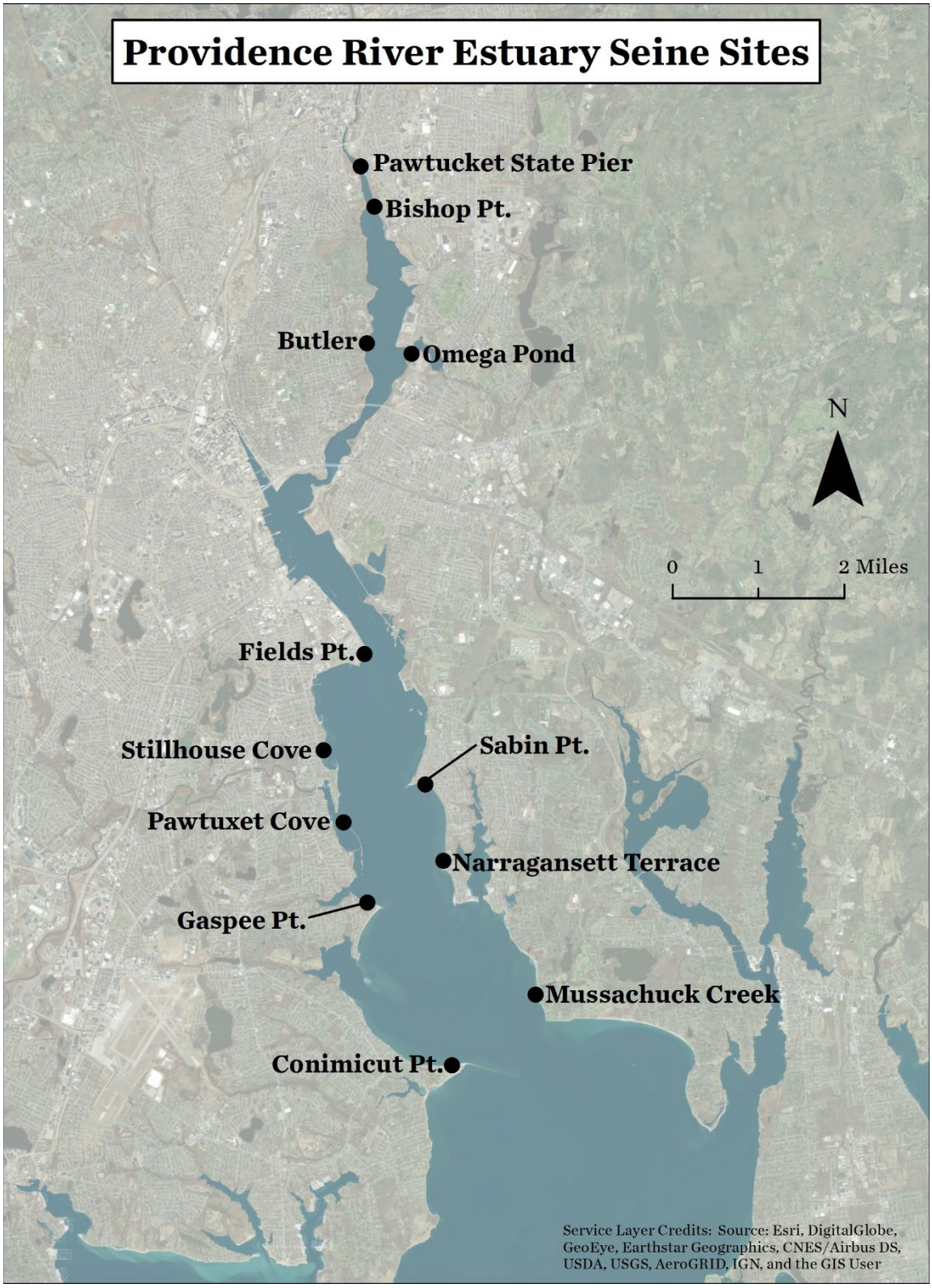
Approved By

Scott Comings, Associate State Director

The Nature Conservancy Rhode Island Chapter
159 Waterman Street
Providence, RI 02906

The Nature Conservancy
Protecting nature. Preserving life.

Map of the study area and sampling locations.



SUMMARY

During the 2024 season, a total of 72 seines were hauled across 12 sites from May through October resulting in the enumeration of 20,524 individuals. Of the animals caught, 4,857 were measured and 50 species were identified (see Table 1). All scoped work was completed. All raw data have been shared with the appropriate Division of Marine Fisheries staff for incorporation into existing datasets.

TARGET DATE

December 31, 2024

NEXT STEPS

Investigators intend to continue sampling with the same methodology during the field season of 2025 under a new cooperative agreement. The project team will continue coordinating with the primary investigators of the Coastal Ponds and Great Salt Pond juvenile fish surveys to evaluate variations in fish assemblages across regions.

INTRODUCTION

Estuaries are also known as “nurseries of the sea” because they provide critical habitat for many marine species in the early parts of their life cycle. Unfortunately, estuaries are also some of the most threatened natural systems across the globe, primarily due to human development and industrialization (Halpern et al. 2008; Lotze et al. 2006). Rhode Island’s Narragansett Bay, the defining water feature of the state, is no exception, and negative human impacts on the bay have been well-documented (NBEP 2017). Among the most heavily degraded waters of Narragansett Bay are the Providence and Seekonk rivers, found in the northern range of Narragansett Bay and collectively known as the Providence River Estuary (PRE). The PRE is located along the City of Providence and is fed by the Blackstone, Mosshasuck, and Woonasquatucket rivers.

For decades, nutrient over-enrichment has been found to have many negative effects on this area, including increases in hypoxic events and fish kills (Carey et al. 2005; Deacutis 2008). In recent years, improvements in wastewater treatment facilities have led to an estimated reduction in nutrient concentration of around 60% within the PRE (Oviatt et al. 2017). This notable and rapid improvement has been dubbed by Nixon et al. in 2008 as a “Grand Ecological Experiment” as not much was known about the impacts of this abrupt change. As a result of these reduced nutrient inputs and perceived improvements in water quality to support fish populations, interest from managers grew in evaluating the utilization of this historically important estuary by juvenile fishes. Additionally, a subsequent literature review revealed that very little empirical data existed on the fish assemblages within the estuary. In fact, the most recent fisheries resource study conducted by the Rhode Island Department of Environmental Management, Division of Marine Fisheries (DMF) within the Providence and Seekonk Rivers was in 1996 (Satchwill et al. 1997). This missing information is critically important because it has also been estimated that more than 70% of Rhode Island’s recreationally and commercially important finfish spend at

least part of their lives in estuarine and coastal waters, usually when young (Meng and Powell 1999).

In 2014, the DMF and The Nature Conservancy (TNC) entered into a cooperative agreement to begin evaluating the PRE and its role in supporting fish populations. Through a holistic approach the estuary's water quality, benthic and coastal habitat, and fish assemblages were evaluated. Not only did this monitoring reveal that the PRE supported recreationally and commercially important juvenile finfish, but it also recognized that the study area could support habitat improvements aimed at increasing fish recruitment.

Among the study's approaches, a juvenile fish seine survey was established in 2016. The results of this initial evaluation have shown the seine survey to be a valuable tool for DMF in managing fish populations. Continuation of this survey contributes to DMF's ability to evaluate juvenile fish populations across Rhode Island and aligns with other active, established seine surveys across the state within the coastal ponds along the southern shores of the state and Great Salt Pond on Block Island. As the habitat and water quality of the PRE continue to change, this seine survey will also serve to document how these changes affect the fish assemblage within the study area.

METHODS

Twelve sites were sampled at monthly intervals from May through October. At each site a 130' long, 6'deep, ¼" mesh net beach seine was used. This net was also outfitted with a bag at its midpoint for fish collection, a weighted footrope, and a floated headrope, all consistent with the net used in the Young of the Year Survey of Selected RI Coastal Ponds and Embayments (conducted as part of F-61-R-23, Job #3). For sampling, the net was deployed along the shoreline in a semicircle by boat. The net was then hauled onto shore from both ends toward the beach by hand. Animals caught were then emptied from the bag and transferred into a water-filled tote. All collected animals were identified to genus or species and measured to the nearest centimeter (except winter flounder which were measured to the nearest millimeter). Additionally, the sex, maturity, and molt stage of any blue crabs was recorded. When appropriate, species were subsampled by measuring the first 30 individuals identified then enumerating the remainder. Upon completion, all animals were discarded back into the water at the collection site. While at the sampling site, temperature (°C), salinity (ppt), and dissolved oxygen (mg/L) were recorded using a Professional Plus series handheld YSI multiparameter meter, which was calibrated monthly throughout the sampling season per manufacturer recommendations.

RESULTS

For the 2024 field sampling season, a total of 72 seines were hauled across 12 sampling sites. A total of 20,524 individuals were identified and enumerated, and 4,857 of those were measured. A total of 50 species were identified (Table 1). Of the species caught, only finfish were included in the results below (all crustaceans were excluded).

Mean catch per haul across sites was greatest at Omega Pond at 430 ± 155.64 SE and lowest at Gaspee Point at 127 ± 49.78 SE (Figure 1). Catch per haul across months was greatest in September at 464.83 ± 95.78 SE and lowest in June at 114.75 ± 35.77 SE (Figure 2).

TARGET SPECIES

Winter Flounder (*Pseudopleuronectes americanus*)
A total of 108 winter flounder were caught in 2024 beach seines, ranging in size from 33 mm to 125 mm. All but four were young of the year (max length = 94 mm; Able and Fahay 1998; Berry et al. 1965). Winter flounder were caught in all months except for May and at all sites. The most abundant site for winter flounder was Omega Pond at a catch per haul of 6.83 ± 4.65 SE. The most abundant month for winter flounder was August at a catch per haul of 4.83 ± 1.40 SE (Table 4a).

Summer Flounder (*Paralichthys dentatus*)
A total of 64 summer flounder were caught in 2024 beach seines, ranging in size from 3 cm to 21 cm. Summer flounder were caught at seven of the 12 sites: Pawtucket State Pier, Bishop Point, Butler, Omega Pond, Fields Point, Stillhouse Cove, and Pawtuxet Cove. Summer flounder were most abundant at Pawtucket State Pier, at a catch per haul of 4 ± 2.84 SE. Most individuals were caught in May at a catch per haul of 2.17 ± 0.63 SE (Table 4b).

Tautog (*Tautoga onitis*)
A total of 63 tautog were caught in 2024 beach seines, ranging in size from 4 cm to 28 cm. Tautog were caught at seven of the 12 sites: Fields Point, Stillhouse Cove, Sabin Point, Narragansett Terrace, Gaspee Point, Mussachuck Creek, and Conimicut Point. Of the seven sites they were caught, tautog were most abundant at Gaspee Point, with a catch per haul of 3.67 ± 2.32 SE. Most individuals were caught in May at a catch per haul of 2.08 ± 0.6 SE (Table 4e).

Black Sea Bass (*Centropristis striata*)
A total of 1 black sea bass was caught in 2024 beach seines, at 7cm in length. This fish was caught at Fields Point in October (Table 4c).

Scup (*Stenotomus chrysops*)
A total of 11 scup were caught in 2024 beach seines, ranging in size from 6 cm to 26 cm. Scup were caught in August and September at three out of 12 sites: Gaspee Point, Mussachuck Creek and Conimicut Point. They were most abundant at Gaspee Point, at an average catch per haul of 1.17 ± 1.07 SE. Most individuals were caught in August at an average catch per haul of 0.75 ± 0.22 SE (Table 4d).

OTHER SPECIES OF INTEREST

Atlantic Menhaden (*Brevoortia tyrannus*)
In the 2024 sampling season, 1,872 Atlantic menhaden were caught, ranging in size from 4 cm to 16 cm. The mean abundance per haul was 26 ± 14.27 SE. Atlantic menhaden were found June through October and at nine sampling sites (Pawtucket State Pier, Bishop Point, Omega Pond, Fields Point, Stillhouse Cove, Sabin Point, Narragansett Terrace, Mussachuck Creek, and Conimicut Point).

River Herring (*Alosa pseudoharengus* & *Alosa aestivalis*)

A total of 673 river herring were caught in 2024. Both Alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*) are classified as river herring in this survey. River herring ranged in size from 4 cm to 15 cm and were found in May through October. They were found at all sampling sites except for Sabin Point and Narragansett Terrace with an overall mean abundance per haul of 9.34 ± 4.23 SE.

Bluefish (*Pomatomus saltatrix*)
A total of 551 bluefish were caught in 2024. The total mean abundance per haul is 7.65 ± 6.78 SE ranging in size from 7 cm to 21 cm. Bluefish were found from July to October and at all sites.

Gizzard Shad (*Dorosoma cepedianum*)
A total of 439 gizzard shad were caught in 2024. The total mean abundance per haul was 6.1 ± 3.57 SE and individuals ranged in size from 7 cm to 17 cm. Gizzard Shad were found in August and September at three sites (Bishop Point, Butler, and Omega Pond).

Silverside (*Menidia spp.*)
A total of 13,554 silversides were caught in 2024. For the purposes of this survey, both Atlantic silversides (*Menidia menidia*) and inland silversides (*Menidia beryllina*) are categorized as silversides (*Menidia spp.*), although no inland silversides were caught this year. The total mean abundance was 188.25 ± 29.78 SE and individuals ranged in size from 4 cm to 13 cm. Silversides were found in all months and at all sites throughout the season.

Striped Killifish (*Fundulus majalis*)
A total of 1,423 striped killifish were caught in 2024, ranging in size from 4 cm to 14 cm. The total mean abundance per haul was 19.76 ± 4.34 SE, and they were found at all sites except Pawtucket State Pier and Bishop Point and from May through October.

Common Mummichog (*Fundulus heteroclitus*)
A total of 502 common mummichog were caught in 2024, ranging in size from 3 cm to 9 cm. The total mean abundance per haul was 6.97 ± 2.84 SE. They were found from May to October and at all sites except for Pawtucket State Pier, Bishop Point, and Fields Point.

WATER QUALITY DATA

Water quality data for the 2024 season can be found in Table 2. Water temperature ranged from 16.2°C at Fields Point in May to 28.6°C at Pawtuxet Cove in July. The mean salinity of the four sites within the Seekonk River was 13.53 ppt ± 1.55 SE and the mean salinity of the eight sites within the Providence River was 23.51 ppt ± 0.79 SE. The lowest dissolved oxygen value recorded across all sites was 2.33 mg/L in August at Pawtucket State Pier, while the mean was 8.76 mg/L ± 0.37 SE.

TIME SERIES SUMMARY
Since the beginning of the time series in 2017, a total of 569 seines have been hauled across 12 sites. In total, 718,552 individuals representing 65 species have been enumerated throughout the Providence River Estuary seine survey. During the grant period from 2020-2024, 360 seines were hauled resulting in the enumeration of 317,421 individuals across 57 species. In 2024, three

species were recorded in the PRE seine for the first time – fallfish, gray snapper, and speckled swimming crab. 2024 yielded the highest abundance of Atlantic needlefish, bay anchovy, jack crevalle, and northern pipefish as well as the lowest abundance of Atlantic menhaden, American eel, black sea bass, largemouth bass, and striped killifish since the survey started in 2017. Throughout the grant period as well as the full time series, the abundance per haul has been highly variable. Notable peaks have largely been attributable to schools of forage fish being caught in the net. Figures displaying abundance, diversity, and water quality data from the current grant period can be found in the Appendix. Data is available upon request.

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FIGURES:

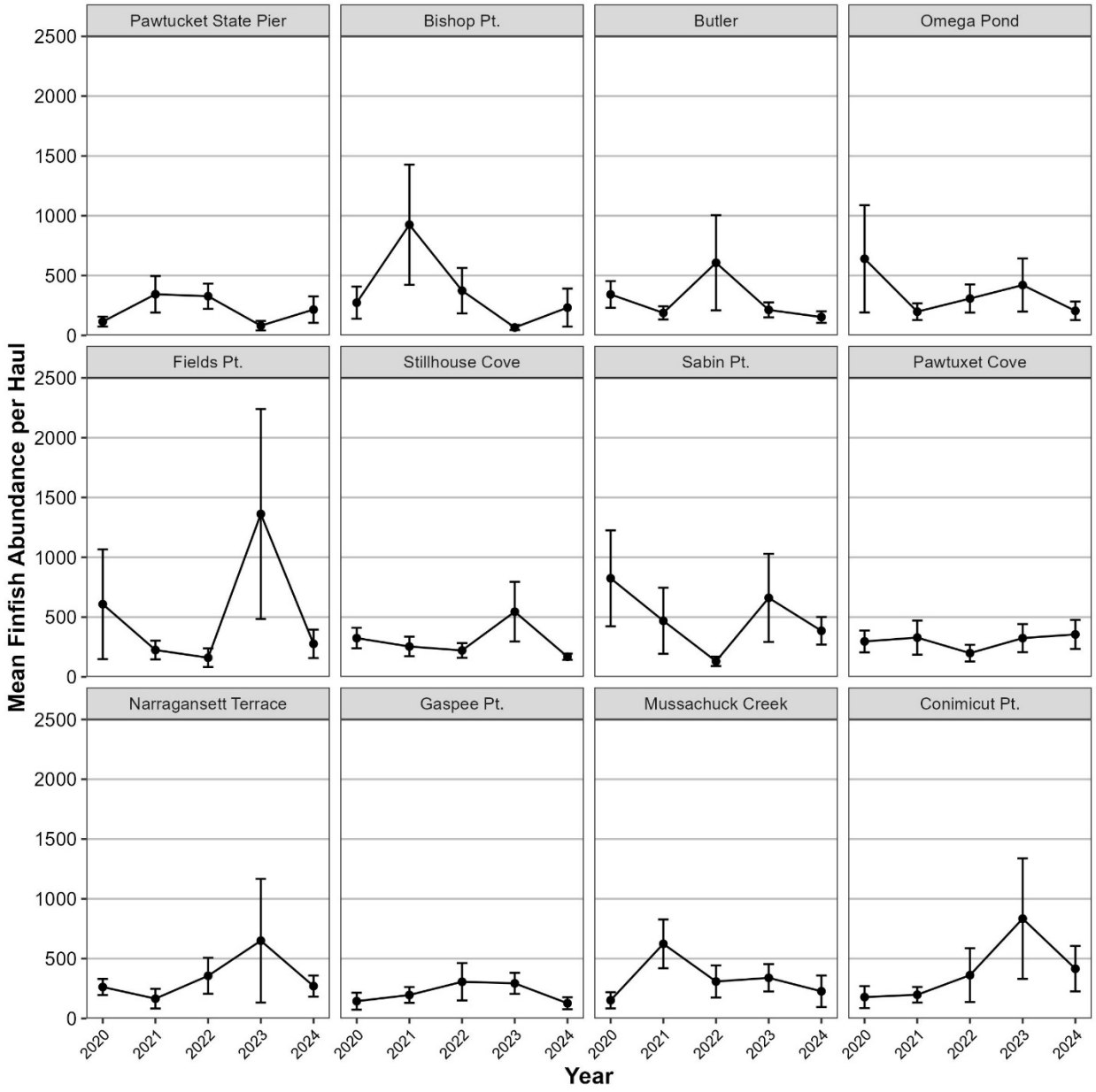


Figure 1. Mean abundance of finfish (excluding Atlantic Menhaden) across sites (±SE) in 2020-2024 beach seines.

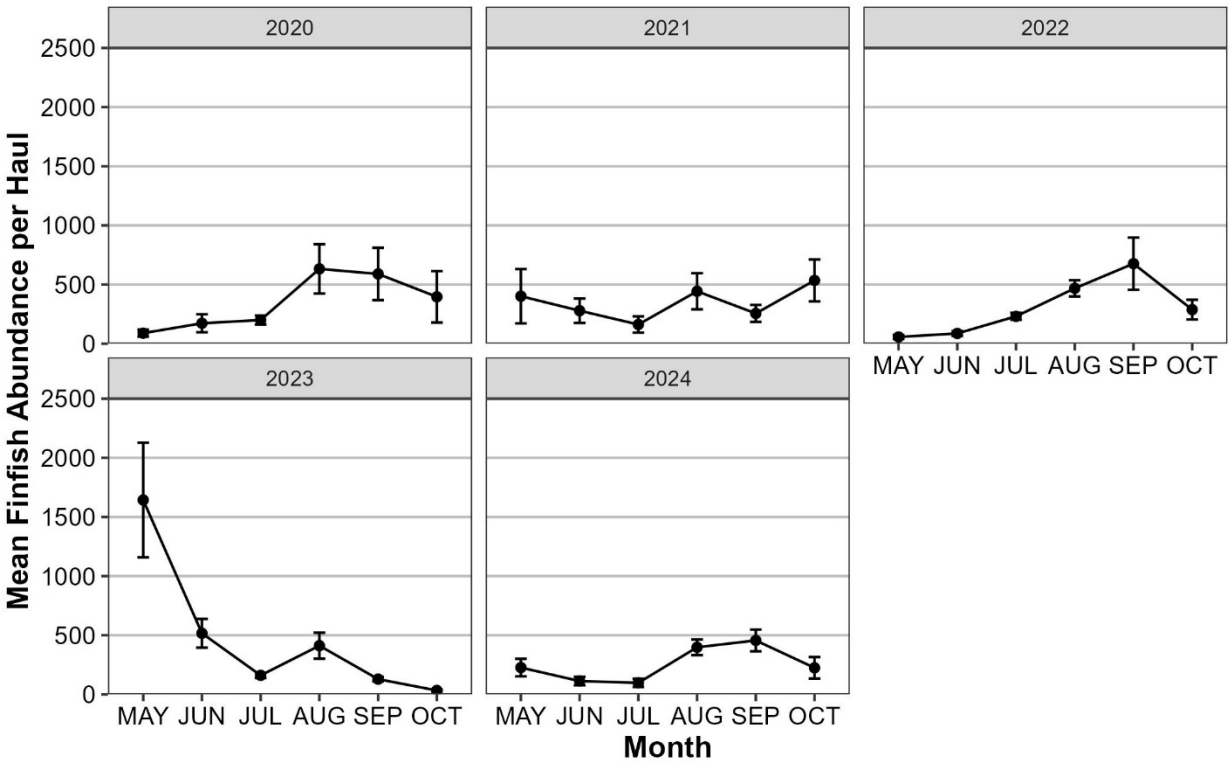


Figure 2. Mean abundance of finfish (excluding Atlantic Menhaden) caught each month (±SE) in 2020-2024 beach seines.

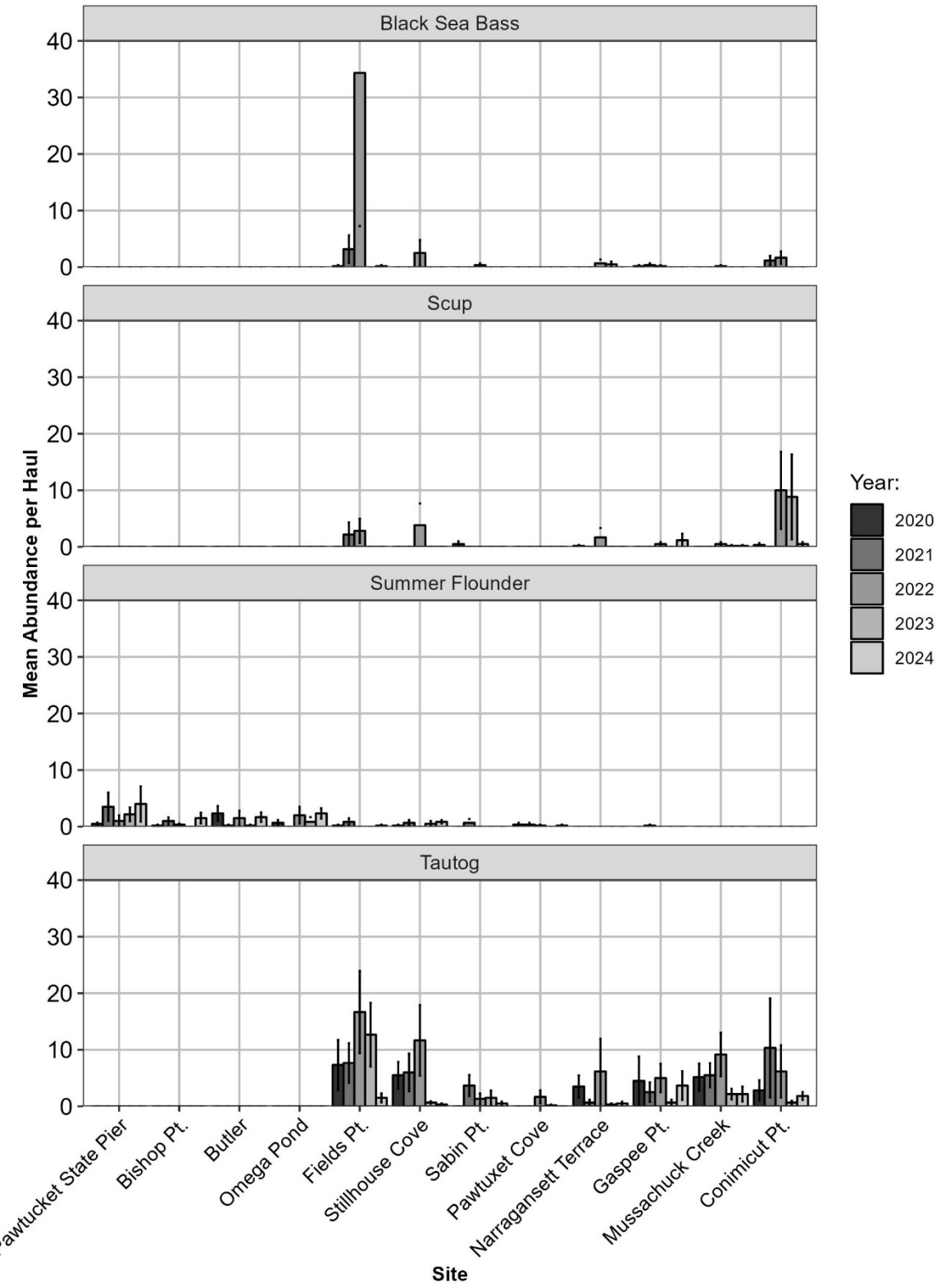


Figure 3a. Mean target finfish (black sea bass, scup, summer flounder, and tautog) abundance per haul (±SE) at each site ordered north to south, sampled during the 2020-2024 field seasons.

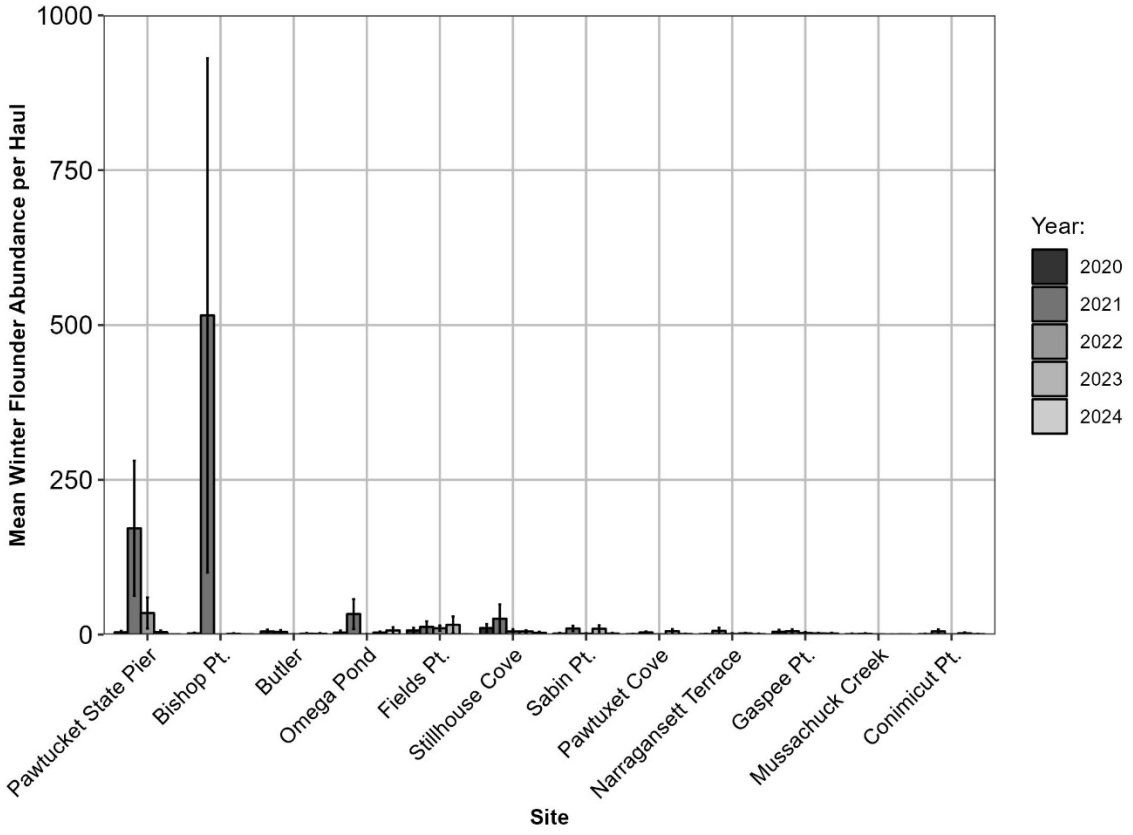


Figure 3b. Mean winter flounder abundance per haul (±SE) at each site ordered north to south, sampled during the 2020-2024 field seasons.

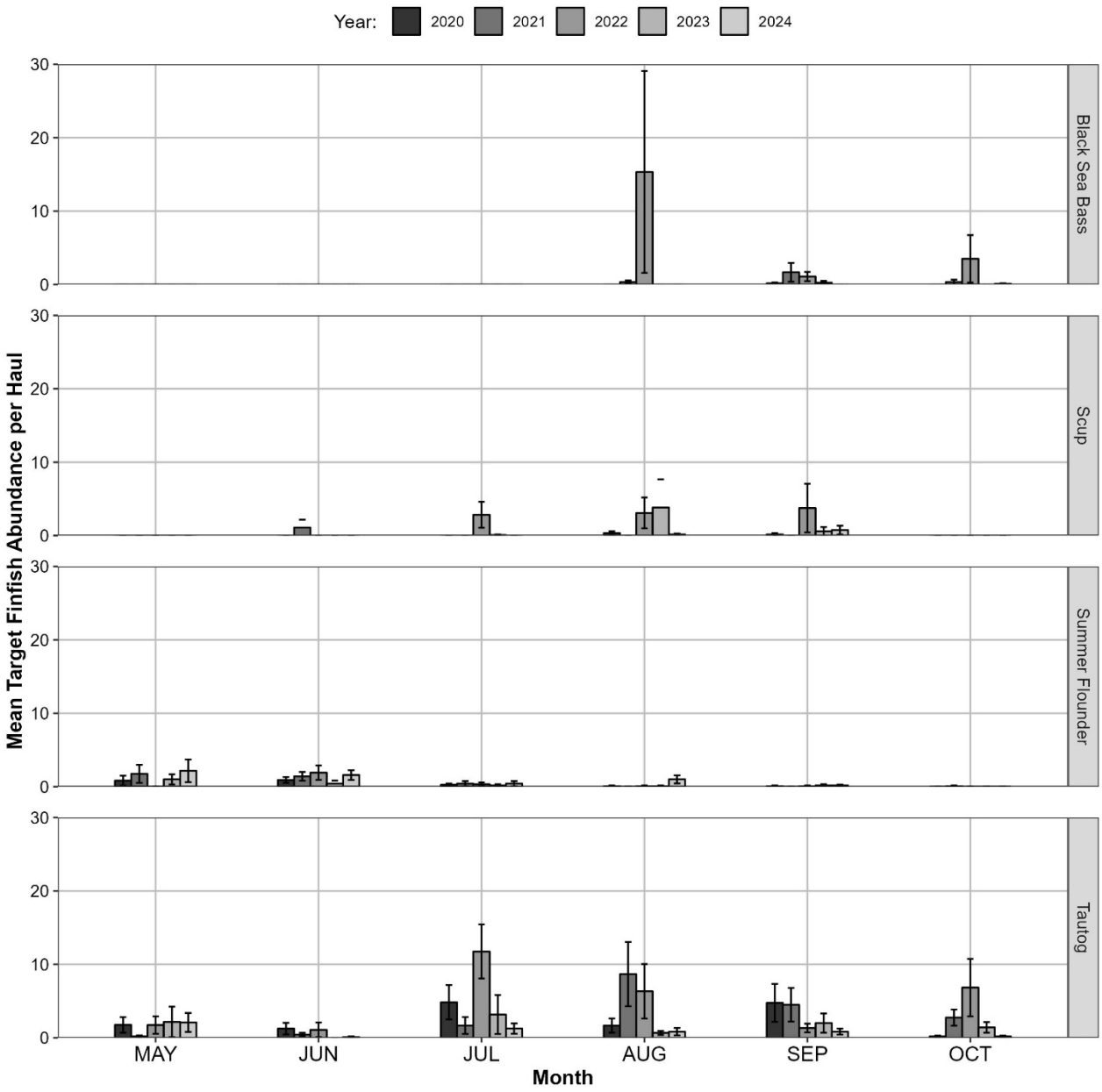


Figure 4a. Mean target finfish (black sea bass, scup, summer flounder, and tautog) per seine haul (± SE) plotted for each month sampled during the 2020-2024 field seasons.

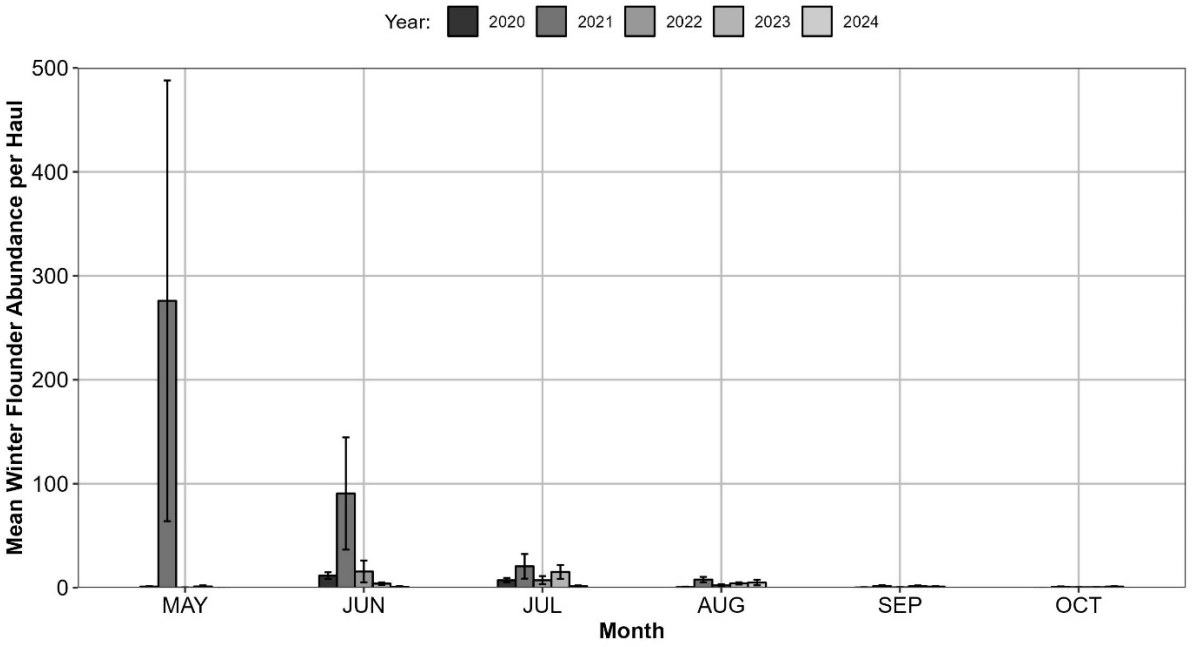


Figure 4b. Mean winter flounder abundance per seine haul (± SE) plotted for each month sampled during the 2020-2024 field seasons.

Table 1. Common, scientific names, and total abundance of all species collected in beach seines during 2024.

Common Name	Scientific Name	Abundance
Atlantic Silverside	*Menidia menidia*	13554
Atlantic Menhaden	*Brevoortia tyrannus*	1872
Striped Killifish	*Fundulus majalis*	1423
River Herring	*Alosa aestivalis* &/or *pseudoharengus*	673
Bluefish	*Pomatomus saltatrix*	551
Common Mummichog	*Fundulus heteroclitus*	502
Blue Crab	*Calinectes sapidus*	440
Gizzard Shad	*Dorosoma cepedianum*	439
Northern Kingfish	*Menticirrhus saxatilis*	214
Crevalle Jack	*Caranx hippos*	179
Winter Flounder	*Pseudopleuronectes americanus*	108
Bay Anchovy	*Anchoa mitchilli*	101
Summer Flounder	*Paralichthys dentatus*	64

Tautog	*Tautoga onitis*	63
Hogchoker	*Trinectes maculatus*	62
Northern Puffer	*Sphoeroides maculatus*	35
Atlantic Needlefish	*Strongylura marina*	29
White Perch	*Morone americana*	27
White Sucker	*Catostomus commersonii*	25
Northern Pipefish	*Syngnathus fuscus*	23
Rainwater Killifish	*Lucania parva*	19
Atlantic Tomcod	*Microgadus tomcod*	12
Mud Crab	*Panopeus spp*	12
Bluegill	*Lepomis macrochirus*	11
Scup	*Stenotomus chrysops*	11
Green Crab	*Carcinus maenus*	9
Spot	*Leiostomus xanthurus*	9
Searobins	*Prionotus genus*	8
Horseshoe Crab	*Limulus polyphemus*	6
Oyster Toadfish	*Opsanus tau*	6
Fallfish	*Semotilus corporalis*	5
Sheepshead Minnow	*Cyprinodon variegatus*	5
American Eel	*Anguilla rostrata*	3
Striped Bass	*Morone saxatilis*	3
4-Spine Stickleback	*Apeltes quadracus*	2
Banded Killifish	*Fundulus diaphanus*	2
Inshore Lizardfish	*Synodus foetens*	2
Japanese Shore Crab	*Hemigrapsus sanguineus*	2
White Mullet	*Mugil curema*	2
Black Sea Bass	*Centropristus striata*	1
Cunner	*Tautogolabrus adspersus*	1
Gobies	*Gobiosoma genus*	1
Golden Shiner	*Notemigonus crysoleucas*	1
Grey Snapper	*Lutjanus griseus*	1
Largemouth Bass	*Micropterus salmoides*	1
Speckled Swimming Crab	*Arenaeus cribrarius*	1
Spider Crab	*Libinia emarginata*	1
Weakfish	*Cynoscion regalis*	1
Windowpane Flounder	*Scophthalmus aquosus*	1
Yellow Perch	*Perca flavescens*	1

Table 2. Temperature, salinity, and dissolved oxygen by site and month during 2024 beach seines.

Site	Month	Temp (C)	Salinity (ppt)	DO (mg/L)	Site	Month	Temp (C)	Salinity (ppt)	DO (mg/L)
Pawtucket State Pier	MAY	20.7	5.22	7.6	Sabin Pt.	MAY	16.7	14.61	10.05
	JUN	22.4	1.02	8.81		JUN	19.5	23.54	11.66
	JUL	24.3	12.31	5.81		JUL	24.5	23.23	5.37
	AUG	23.8	24.35	2.33		AUG	24.8	26.62	3.94
	SEP	23	6.21	9.2		SEP	22.5	27.01	10.8
	OCT	19.4	26.59	3.93		OCT	18.6	28.67	12.65
Bishop Pt.	MAY	18.2	5.3	8.17	Pawtuxet Cove	MAY	18.3	2.88	9.59
	JUN	20.6	11.79	9.43		JUN	19.9	13.04	9.22
	JUL	24.1	16.17	4.64		JUL	28.6	15.15	6.65
	AUG	25.2	13.69	6.78		AUG	26.5	23.34	6.23
	SEP	23.6	16.9	16.41		SEP	22.5	15.14	10.76
	OCT	19	22.33	5.52		OCT	19.5	27.64	7.96
Butler	MAY	20.1	4.92	7.66	Narragansett Terrace	MAY	17.9	20.68	12.56
	JUN	22.9	9.34	13.06		JUN	19	25.02	9.05
	JUL	22.8	21.78	4.35		JUL	25.2	22.46	6.9
	AUG	26.3	11.32	18.6		AUG	24.2	25.67	3.84
	SEP	22.2	22.4	9.53		SEP	20.9	28.69	8.91
	OCT	17.9	19.55	12.65		OCT	18.8	28.45	8.16
Omega Pond	MAY	20.5	4.59	7.31	Gaspee Pt.	MAY	17.8	16.36	12.82
	JUN	22.8	3.27	9.14		JUN	20.1	23.59	12.12
	JUL	26.4	10.5	10.01		JUL	25.6	22.91	5.55
	AUG	25.8	13.13	15.48		AUG	27	24.43	8.6
	SEP	22.4	20.66	11.74		SEP	21	28.27	11.03
	OCT	18.1	21.26	9.86		OCT	18.7	27.1	7.71
Fields Pt.	MAY	16.2	13.62	11.56	Mussachuck Creek	MAY	17.3	20.85	12.24
	JUN	18.2	24.2	9.77		JUN	20.1	24.98	8.44
	JUL	22.3	25.1	3.89		JUL	24.9	25.63	6.12
	AUG	23.6	27.39	2.53		AUG	24.2	27.03	3.88
	SEP	22.6	27.61	11.67		SEP	20.6	28.77	7.99
	OCT	18.9	28.25	7.48		OCT	17.8	28.55	8.54
Stillhouse Cove	MAY	18	14.38	10.73	Conimicut Pt.	MAY	17.6	19.55	10.09
	JUN	19	24.03	10.4		JUN	19.4	25.98	7.73
	JUL	26.7	20.13	6.39		JUL	24.5	26.21	7.86
	AUG	27.9	23.5	11.79		AUG	26.1	26.28	5.77
	SEP	21.5	27.71	9.23		SEP	20.9	28.32	9.5
	OCT	18.8	28.17	7.7		OCT	18.2	27.8	8.95

APPENDIX

Table 3a. Species presence by site for May 2024 beach seines.

MAY	Site												
Species	Pawtucket State Pier	Bishop Pt.	Butler	Omega Pond	Fields Pt.	Stillhouse Cove	Sabin Pt.	Pawtuxet Cove	Narragansett Terrace	Gaspee Pt.	Mussachuck Creek	Conimicut Pt.	**Total**
River Herring		1		1									**2**
Summer Flounder	1	1	1	1		1							**5**
Windowpane Flounder									1				**1**
Atlantic Silverside			1	1	1	1	1	1	1	1	1	1	**10**
Northern Pipefish						1	1			1	1		**4**
Hogchoker	1	1		1									**3**
Striped Bass		1											**1**
White Perch	1	1											**2**
Cunner									1				**1**
Tautog					1		1		1	1	1	1	**6**
American Eel							1						**1**
Atlantic Tomcod					1					1	1		**3**
Sheepshead Minnow								1					**1**
Common Mummichog				1		1		1			1	1	**5**
Striped Killifish				1			1	1					**3**
4-Spine Stickleback					1			1					**2**
Gobies							1						**1**
Bluegill	1		1	1									**3**
Rainwater Killifish							1						**1**
Golden Shiner				1									**1**
Green Crab						1					1		**2**
Blue Crab	1	1	1	1			1						**5**
Fallfish	1												**1**
Banded Killifish								1					**1**
Japanese Shore Crab					1								**1**

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Table 3b. Species presence by site for June 2024 beach seines.

JUNE	Site												
Species	Pawtucket State Pier	Bishop Pt.	Butler	Omega Pond	Fields Pt.	Stillhouse Cove	Sabin Pt.	Pawtuxet Cove	Narragansett Terrace	Gaspee Pt.	Mussachuck Creek	Conimicut Pt.	**Total**
River Herring			1	1	1	1							**4**
Atlantic Menhaden					1	1	1						**3**
Bay Anchovy			1		1								**2**
Summer Flounder		1	1	1	1	1		1					**6**
Winter Flounder		1				1	1				1		**4**
Atlantic Silverside			1		1	1	1	1	1	1	1	1	**9**
Northern Pipefish							1			1			**2**
Hogchoker				1									**1**
Spot					1								**1**
Tautog										1			**1**
Northern Puffer										1			**1**
Common Mummichog				1				1			1		**3**
Striped Killifish						1	1			1			**3**
Rainwater Killifish								1				1	**2**
Horseshoe Crab					1					1			**2**
Green Crab										1			**1**
Blue Crab	1	1	1	1	1		1	1	1	1			**9**
Fallfish	1												**1**

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Table 3c. Species presence by site for July 2024 beach seines.

JULY	Site												
Species	Pawtucket State Pier	Bishop Pt.	Butler	Omega Pond	Fields Pt.	Stillhouse Cove	Sabin Pt.	Pawtuxet Cove	Narragansett Terrace	Gaspee Pt.	Mussachuck Creek	Conimicut Pt.	**Total**
River Herring	1	1								1	1		**4**
Atlantic Menhaden				1									**1**
Bay Anchovy		1	1		1								**3**
Summer Flounder		1		1									**2**
Winter Flounder				1		1			1	1		1	**5**
Atlantic Silverside			1	1	1	1	1	1	1	1	1	1	**10**
Hogchoker	1												**1**
Bluefish		1	1	1		1			1	1	1		**7**
Striped Bass				1									**1**
White Perch	1			1				1					**3**
Northern Kingfish				1	1	1	1	1	1	1		1	**8**
Tautog									1	1	1	1	**4**
Northern Puffer						1			1	1	1	1	**5**
Common Mummichog			1					1	1	1			**4**
Striped Killifish					1	1	1	1	1	1		1	**7**
Crevalle Jack			1	1	1								**3**
Bluegill	1			1									**2**
Rainwater Killifish								1		1			**2**
Yellow Perch	1												**1**
White Sucker	1												**1**
Horseshoe Crab					1				1				**2**
Spider Crab												1	**1**
Green Crab							1						**1**
Mud Crab					1				1				**2**
Blue Crab	1	1	1	1	1		1	1	1			1	**9**

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Table 3d. Species presence by site for August 2024 beach seines.

AUGUST	Site												
Species	Pawtucket State Pier	Bishop Pt.	Butler	Omega Pond	Fields Pt.	Stillhouse Cove	Sabin Pt.	Pawtuxet Cove	Narragansett Terrace	Gaspee Pt.	Mussachuck Creek	Conimicut Pt.	**Total**
River Herring		1											**1**
Atlantic Menhaden		1		1		1	1				1	1	**6**
Bay Anchovy	1		1	1									**3**
Summer Flounder	1		1	1		1							**4**
Winter Flounder			1	1	1		1	1		1			**6**
Atlantic Silverside	1	1	1	1	1	1	1	1	1	1	1	1	**12**
Northern Pipefish					1								**1**
Hogchoker	1		1	1									**3**
Bluefish		1						1	1		1	1	**5**
Striped Bass			1										**1**
White Perch	1												**1**
Scup											1	1	**2**
Weakfish				1									**1**
Northern Kingfish			1	1	1	1	1	1	1	1		1	**9**
Spot				1									**1**
Searobins							1		1				**2**
Tautog					1		1			1			**3**
Oyster Toadfish					1								**1**
Northern Puffer							1			1	1	1	**4**
American Eel						1							**1**
Gizzard Shad		1	1	1									**3**
Atlantic Needlefish							1	1	1		1	1	**5**
Sheepshead Minnow								1		1			**2**
Common Mummichog				1		1	1	1		1		1	**6**
Striped Killifish			1	1	1	1	1	1	1	1	1	1	**10**
Crevalle Jack			1	1	1	1	1	1		1			**7**
White Mullet								1					**1**
Rainwater Killifish						1							**1**
Largemouth Bass				1									**1**
Horseshoe Crab			1										**1**
Speckled Swimming Crab												1	**1**
Mud Crab		1			1								**2**
Blue Crab	1	1	1	1	1	1	1	1		1	1	1	**11**
Japanese Shore Crab		1											**1**

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Table 3e. Species presence by site for September 2024 beach seines.

SEPTEMBER	Site												
Species	Pawtucket State Pier	Bishop Pt.	Butler	Omega Pond	Fields Pt.	Stillhouse Cove	Sabin Pt.	Pawtuxet Cove	Narragansett Terrace	Gaspee Pt.	Mussachuck Creek	Conimicut Pt.	**Total**
River Herring		1			1			1				1	**4**
Atlantic Menhaden	1	1		1	1	1			1		1	1	**8**
Bay Anchovy	1	1											**2**
Summer Flounder				1		1							**2**
Winter Flounder			1	1		1		1		1		1	**6**
Atlantic Silverside	1	1	1	1	1	1	1	1	1	1	1	1	**12**
Hogchoker	1	1	1										**3**
Bluefish	1	1			1	1	1	1			1	1	**8**
White Perch		1											**1**
Scup										1		1	**2**
Northern Kingfish				1	1		1		1	1			**5**
Spot		1											**1**
Searobins						1			1				**2**
Tautog					1	1					1	1	**4**
Oyster Toadfish					1								**1**
Northern Puffer											1	1	**2**
Gizzard Shad		1	1	1									**3**
Inshore Lizardfish			1							1			**2**
Atlantic Needlefish					1			1					**2**
Common Mummichog			1	1			1	1					**4**
Striped Killifish			1	1	1	1	1	1	1	1	1	1	**10**
Crevalle Jack			1	1	1		1		1				**5**
Green Crab												1	**1**
Blue Crab		1	1	1	1	1		1				1	**7**

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Table 3f. Species presence by site for October 2024 beach seines.

OCTOBER	Site												
Species	Pawtucket State Pier	Bishop Pt.	Butler	Omega Pond	Fields Pt.	Stillhouse Cove	Sabin Pt.	Pawtuxet Cove	Narragansett Terrace	Gaspee Pt.	Mussachuck Creek	Conimicut Pt.	**Total**
River Herring	1					1						1	**3**
Atlantic Menhaden	1						1						**2**
Bay Anchovy	1	1											**2**
Winter Flounder	1			1		1	1	1				1	**6**
Atlantic Silverside	1	1	1	1	1	1	1	1	1	1	1	1	**12**
Northern Pipefish						1							**1**
Hogchoker	1			1									**2**
Bluefish					1	1							**2**
White Perch	1			1									**2**
Black Sea Bass					1								**1**
Northern Kingfish							1		1				**2**
Striped Searobin							1				1		**2**
Tautog						1						1	**2**
Common Mummichog				1			1	1					**3**
Striped Killifish				1	1	1	1	1	1	1	1	1	**9**
Crevalle Jack	1					1							**2**
Grey Snapper									1				**1**
Rainwater Killifish			1										**1**
Blue Crab	1	1	1	1				1					**5**

Table 4a. Abundances of winter flounder in 2024 beach seines.

		Site															
	Month	Pawtucket State Pier	Bishop Pt.	Butler	Omega Pond	Fields Pt.	Stillhouse Cove	Sabin Pt.	Pawtuxet Cove	Narragansett Terrace	Gaspee Pt.	Mussachuck Creek	Conimicut Pt.	Mean	SD	SE	Total
Winter Flounder	MAY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	JUN	0	1	0	0	0	7	1	0	0	0	1	0	0.83	1.91	0.24	10
	JUL	0	0	0	1	0	8	0	0	5	1	0	1	1.33	2.43	0.38	16
	AUG	0	0	6	32	2	0	7	3	0	8	0	0	4.83	8.69	1.40	58
	SEP	0	0	2	4	0	2	0	1	0	1	0	2	1.00	1.22	0.29	12
	OCT	1	0	0	4	0	1	2	2	0	0	0	2	1.00	1.22	0.29	12
	Mean	0.17	0.17	1.33	6.83	0.33	3	1.67	1	0.83	1.67	0.17	0.83				
	SD	0.37	0.37	2.21	11.4	0.75	3.27	2.49	1.15	1.86	2.87	0.37	0.90	**Total fish:**			
	SE	0.15	0.15	0.9	4.65	0.3	1.33	1.02	0.47	0.76	1.17	0.15	0.37	108			
	Total	1	1	8	41	2	18	10	6	5	10	1	5				

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Table 4b. Abundances of summer flounder in 2024 beach seines.

Summer Flounder	Site															
	Month	Pawtucket State Pier	Bishop Pt.	Butler	Omega Pond	Fields Pt.	Stillhouse Cove	Sabin Pt.	Pawtuxet Cove	Narragansett Terrace	Gaspee Pt.	Mussachuck Creek	Conimicut Pt.	Mean	SD	SE	Total
	MAY	19	2	2	2	0	1	0	0	0	0	0	0	2.17	5.15	0.63	26
	JUN	0	6	3	6	1	2	0	1	0	0	0	0	1.58	2.18	0.46	19
	JUL	0	1	0	4	0	0	0	0	0	0	0	0	0.42	1.11	0.12	5
	AUG	5	0	5	1	0	1	0	0	0	0	0	0	1.00	1.83	0.29	12
	SEP	0	0	0	1	0	1	0	0	0	0	0	0	0.17	0.37	0.05	2
	OCT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mean	4	1.5	1.67	2.33	0.17	0.83	0	0.17	0	0	0	0				
	SD	6.95	2.14	1.89	2.05	0.37	0.69	0	0.37	0	0	0	0	**Total fish:**			
	SE	2.84	0.87	0.77	0.84	0.15	0.28	0	0.15	0	0	0	0	64			
	Total	24	9	10	14	1	5	0	1	0	0	0	0				

Table 4c. Abundances of black sea bass 2024 beach seines.

Black Sea Bass	Site															
	Month	Pawtucket State Pier	Bishop Pt.	Butler	Omega Pond	Fields Pt.	Stillhouse Cove	Sabin Pt.	Pawtuxet Cove	Narragansett Terrace	Gaspee Pt.	Mussachuck Creek	Conimicut Pt.	Mean	SD	SE	Total
	MAY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	JUN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	JUL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	AUG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	SEP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	OCT	0	0	0	0	1	0	0	0	0	0	0	0	0.08	0.28	0.02	1
	Mean	0	0	0	0	0.17	0	0	0	0	0	0	0				
	SD	0	0	0	0	0.37	0	0	0	0	0	0	0	**Total fish:**			
	SE	0	0	0	0	0.15	0	0	0	0	0	0	0	1			
	Total	0	0	0	0	1	0	0	0	0	0	0	0				

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Table 4d. Abundances of scup in 2024 beach seines.

Scup	Site: Pawtucket State Pier	Bishop Pt.	Butler	Omega Pond	Fields Pt.	Stillhouse Cove	Sabin Pt.	Pawtuxet Cove	Narragansett Terrace	Gaspee Pt.	Mussachuck Creek	Conimicut Pt.	Mean	SD	SE	Total
Month																
MAY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JUN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JUL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AUG	0	0	0	0	0	0	0	0	0	0	1	1	0.17	0.37	0.05	2
SEP	0	0	0	0	0	0	0	0	0	7	0	2	0.75	1.96	0.22	9
OCT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean	0	0	0	0	0	0	0	0	0	1.17	0.17	0.50				
SD	0	0	0	0	0	0	0	0	0	2.61	0.37	0.76	**Total fish:**			
SE	0	0	0	0	0	0	0	0	0	1.07	0.15	0.31	11			
Total	0	0	0	0	0	0	0	0	0	7	1	3				

Table 4e. Abundances of tautog in 2024 beach seines.

Tautog	Site: Pawtucket State Pier	Bishop Pt.	Butler	Omega Pond	Fields Pt.	Stillhouse Cove	Sabin Pt.	Pawtuxet Cove	Narragansett Terrace	Gaspee Pt.	Mussachuck Creek	Conimicut Pt.	Mean	SD	SE	Total
Month																
MAY	0	0	0	0	2	0	2	0	1	16	1	3	2.08	4.31	0.6	25
JUN	0	0	0	0	0	0	0	0	0	1	0	0	0.08	0.28	0.02	1
JUL	0	0	0	0	0	0	0	0	2	1	8	4	1.25	2.35	0.36	15
AUG	0	0	0	0	5	0	1	0	0	4	0	0	0.83	1.67	0.24	10
SEP	0	0	0	0	2	1	0	0	0	0	4	3	0.83	1.34	0.24	10
OCT	0	0	0	0	0	1	0	0	0	0	0	1	0.17	0.37	0.05	2
Mean	0	0	0	0	1.5	0.33	0.5	0	0.5	3.67	2.17	1.83				
SD	0	0	0	0	1.8	0.47	0.76	0	0.76	5.68	2.97	1.57	**Total fish:**			
SE	0	0	0	0	0.74	0.19	0.31	0	0.31	2.32	1.21	0.64	63			
Total	0	0	0	0	9	2	3	0	3	22	13	11				

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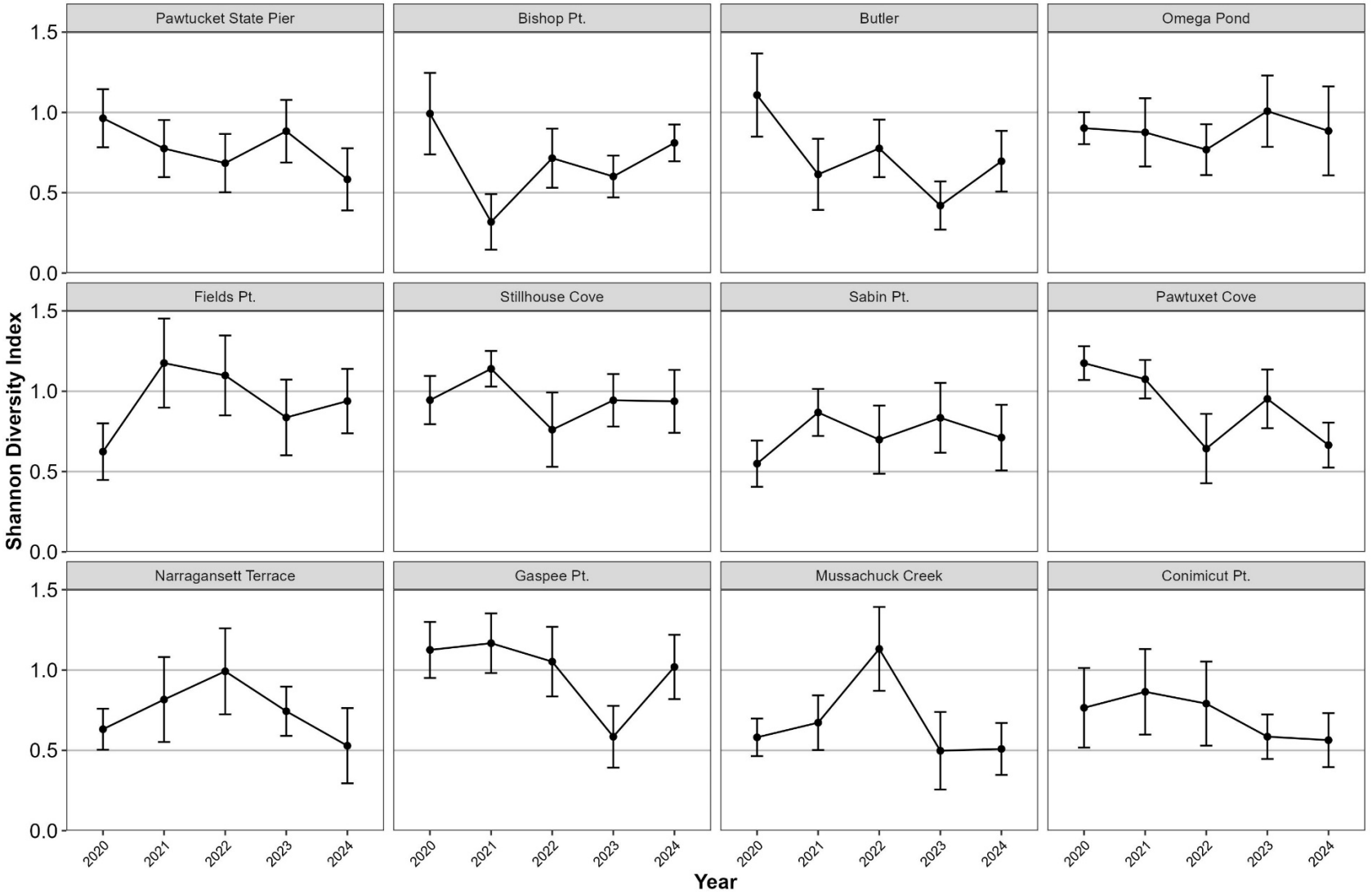


Figure 5. Mean Shannon diversity across sites in 2020-2024 beach seines.

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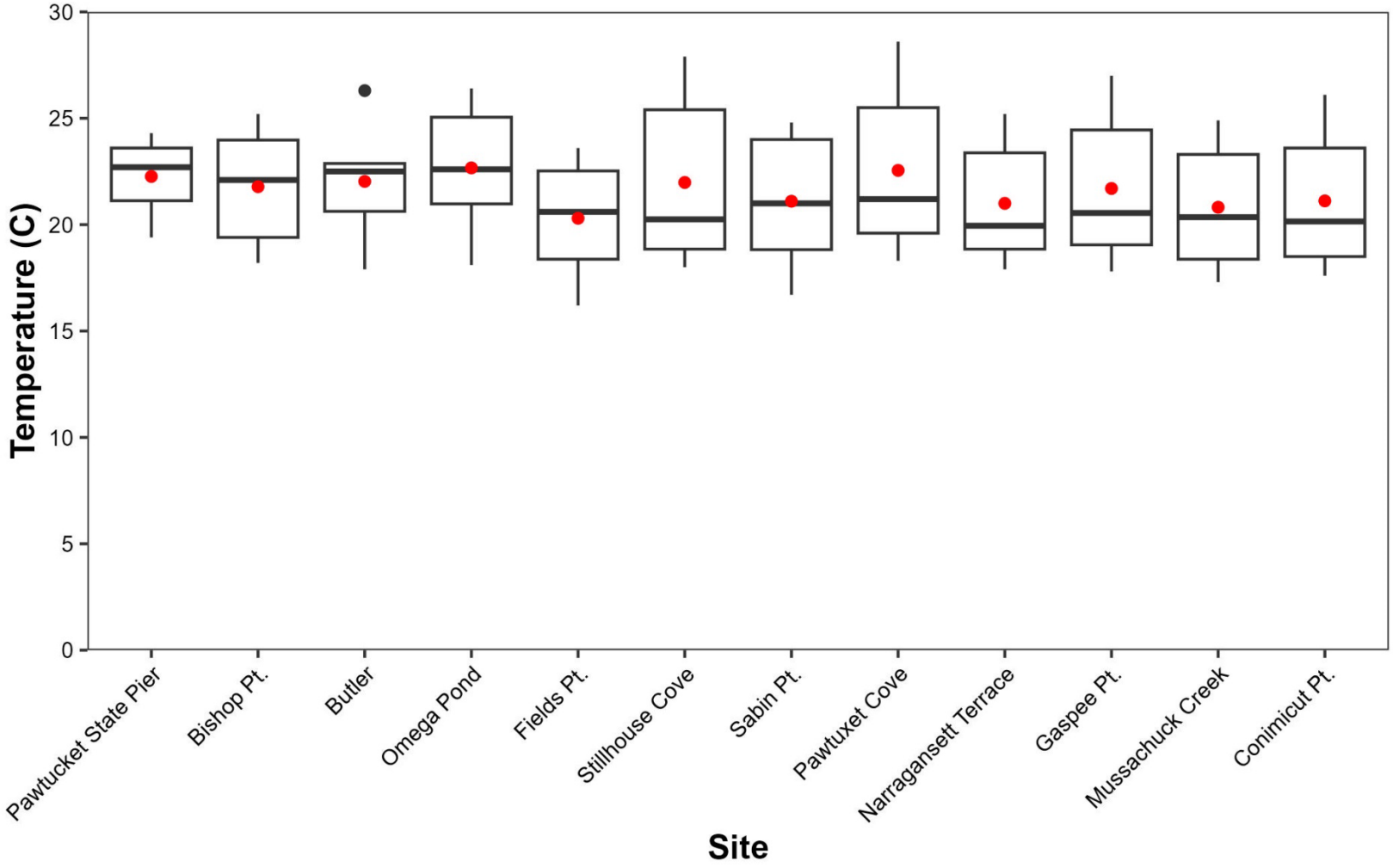


Figure 6. Boxplot of temperature (C) recorded by handheld YSI across all seine stations in 2024 at the time of sample (red dot indicates mean).

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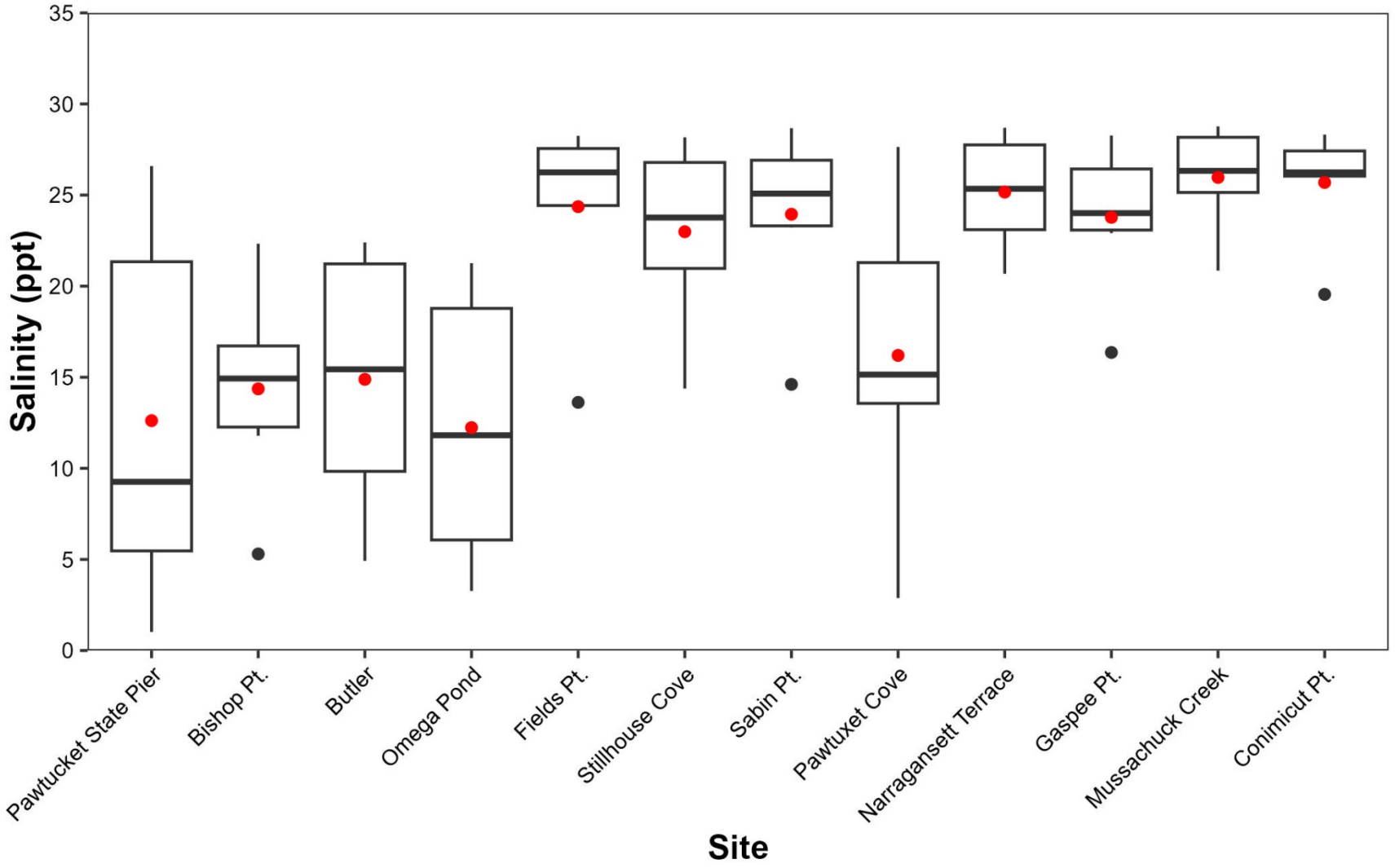


Figure 7. Boxplot of salinity (ppt) recorded by handheld YSI across all seine stations in 2024 at the time of sample (red dot indicates mean).

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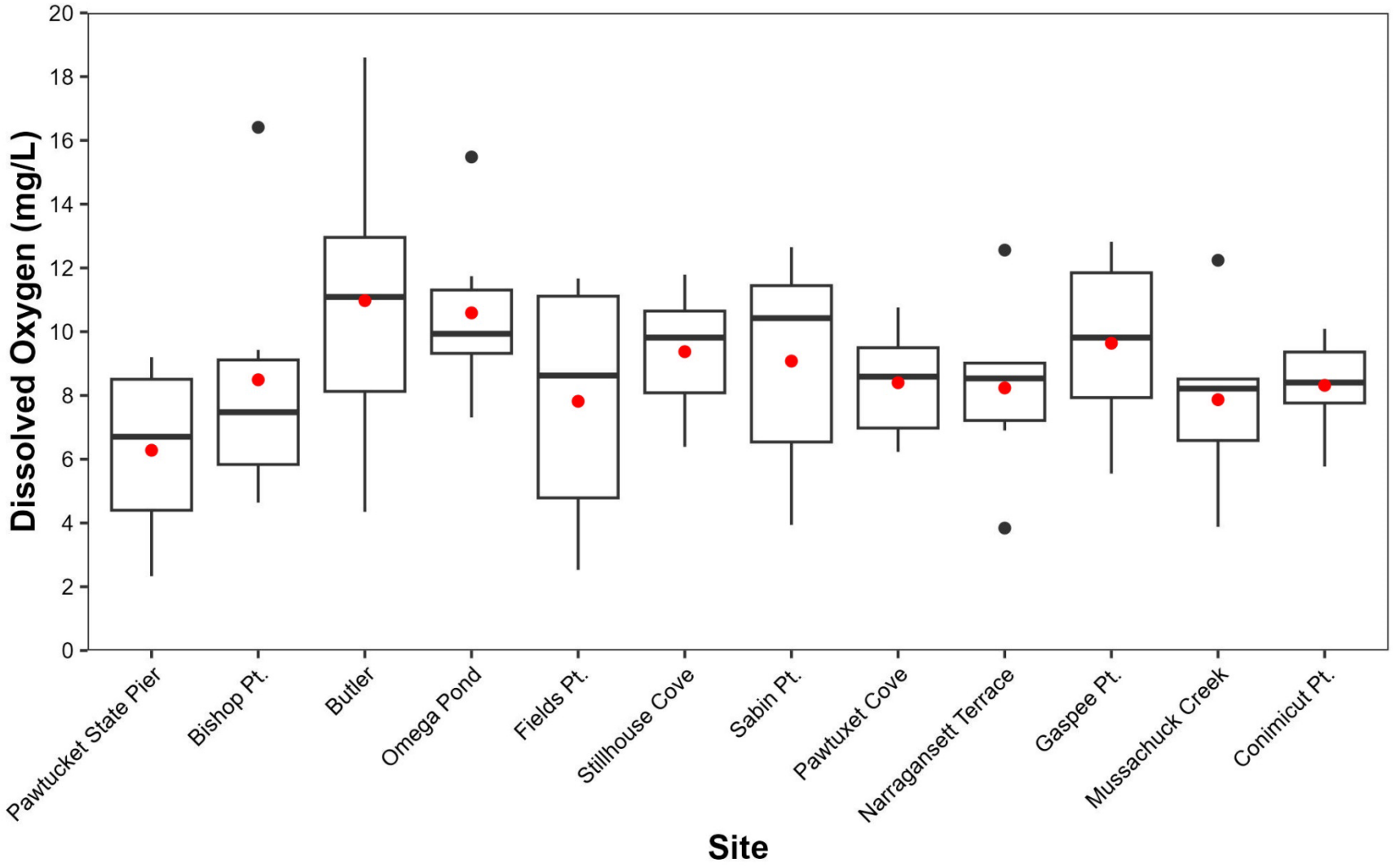


Figure 8. Boxplot of dissolved oxygen (mg/L) recorded by handheld YSI across all seine stations in 2024 at the time of sample (red dot indicates mean).

Sportfish Assessment and Management in Rhode Island Waters

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STATE: Rhode Island

PROJECT NUMBER: F-61-R

SEGMENT NUMBER: 21

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

PERIOD COVERED: January 1, 2020 – December 31, 2024

JOB NUMBER 8 TITLE: Assessment of Recreationally Important Finfish Stocks in Rhode Island Waters

During this period, several stock assessments for recreationally significant finfish species were conducted that RI staff participated in, either as stock assessment committee participants or by contributing data that were derived from surveys funded by the sportfish restoration grant to the stock assessment process. The project leaders participated at the Atlantic States Marine Fisheries Commission's (ASMFC) meetings relative to the management of recreationally important coastal stocks. They also participated in the National Oceanographic and Atmospheric Administration (NOAA) stock assessment process for species under their jurisdiction by contributing data from jobs listed in this grant report, participating in stock assessment subcommittees, or via membership in the Scientific and Statistical Committee of the New England Fishery Management Council. The status of the most important recreationally caught species in Rhode Island were presented in the annual finfish sector management plan. The following information by species highlights some of the major contributions during this period.

1. SUMMER FLOUNDER

A management track stock assessment for summer flounder was completed in the summer of 2023. This assessment used the same methods and data as the 2019 benchmark assessment, with updated commercial and recreational catch data and research survey indices through 2021. The 2019 benchmark assessment process included multiple modeling frameworks such as sex specific and state-space models. The main tasks performed by staff were to gather both catch and fishery independent information from previous years and stratify that information by age based on aging information from the NOAA trawl survey. RI contributed its Division of Marine Fisheries trawl survey data (see job number 2 from this grant) and the University of Rhode Island Trawl Survey information (see job number 14 from this grant) to the assessment.

In 2022, the Atlantic States Marine Fisheries Commission and Mid-Atlantic Fishery Management Council approved changes to the recreational fisheries management programs for summer flounder, scup, black sea bass, and bluefish, including new processes to setting recreational management measures. The Council and Commission

continue to consider and evaluate refinements of the recreational management process for these fisheries and have convened a Fishery Management Action Team/Plan Development Team (FMAT/PDT) to do so. RIDEM staff were directly involved in this working group, and developed a modeling framework using MRIP data (see jobs 16 and 17) to support analyses of alternative fisheries management processes. A separate sector separation and data collection amendment was re-initiated in 2024, for which RI is represented on the FMAT/PDT.

Summer flounder 2023 management track assessment report: https://static1.squarespace.com/static/511cdc7fe4b00307a2628ac6/t/64aef1109816d5619f77771d/1689186576496/e_Summer_flounder_MTA_2023_06_08.pdf

2. STRIPED BASS

The stock assessment update for Atlantic striped bass was conducted in 2022 and found that the stock is overfished but overfishing is no longer occurring relative to the updated biological reference points (ASMFC, 2022). Female spawning stock biomass in 2021 was estimated to be 143 million pounds, below both the SSB target and SSB threshold, 235 million pounds and 188 million pounds respectively. SSB has been declining since 2003 and has been below the threshold since 2013. F in 2021 was estimated to be 0.14, below both F target and F threshold, 0.17 and 0.20 respectively.

Staff spent a considerable amount of time in 2022 on the striped bass plan development team (PDT) working on Amendment 7 to the Atlantic Striped Bass Fishery Management Plan and Draft Addendum I to Amendment 7. Amendment 7 was adopted by the Board in May 2022 and Draft Addendum I is still in development. Amendment 7 addressed management triggers, recreational release mortality, stock rebuilding, and conservation equivalency. Other work on striped stock assessments in 2022 included providing biological data and commercial catch-at-age data to the Chesapeake Bay Laboratory (CBL). The CBL is working on a migration model for striped bass and DMF staff have been collaborating on those efforts.

Staff contributed time in 2023 to the development and adoption of Addendum I to Amendment 7 to address commercial quota transfers. The Board approved Addendum I in May of 2023. Additional time in 2023 was spent on the striped bass technical committee (TC) and plan development team (PDT) working on updated stock projections and Addendum II to Amendment 7 to the Atlantic Striped Bass Fishery Management Plan. The 2022 stock assessment update included data through 2021. Due to concerns about recreational striped bass removals increasing 38% in 2022 compared to 2021, the TC was tasked with updating stock projections to determine the impact, if any, on the current rebuilding timeline. Updated projections indicated that the probability of rebuilding the striped bass stock by the 2029 deadline decreased to 15% with the addition of the 2022 removal estimates. In response, the ASMFC striped bass board initiated Addendum II to reduce fishing mortality to the target in 2024 and increase the probability of rebuilding by 2029.

Addendum II was adopted by the Board in January 2024 and required coastal fishery states to reduce their commercial quotas by 7%, maintain a 28-31" slot and 1 fish bag limit for the recreational fishery, and implement restrictions on at-sea and shore-side filleting. A stock assessment update was presented to the Board in October 2024 and indicated the striped bass stock is overfished and overfishing is not occurring relative to biological reference points (BRPs). Fishing mortality (F) was estimated to be 0.18 in 2023, below the F threshold = 0.21 and above the F target = 0.17. Spawning stock biomass (SSB) was estimated to be 191 m lbs in 2023, below both the threshold and target (197 m lbs and 247 m lbs respectively). Strong recruitment of age-1 fish was estimated in 2012, 2015, 2016, and 2019. The assessment update also estimated that there was less a 50% probability of rebuilding the stock by 2029, the current rebuilding timeline.

As a result, the striped bass tasked the technical committee (TC) with developing options for 2025 to aid in rebuilding the stock. Staff spent a considerable amount of time on analyses to support these TC tasks. A special Board meeting in December 2024, considered management changes for 2025 based on the TC analyses. Ultimately, the Board decided to not make any changes in 2025 and instead initiated an Addendum to explore management changes for 2026.

2022 Striped bass update assessment:
https://asmfc.org/uploads/file/63cb200fAtlStripedBassAssessmentUpdate_Nov2022.pdf

3. ATLANTIC MENHADEN AND MULTISPECIES MODELS

The ASMFC completed a benchmark stock assessment in 2020 and an assessment update in 2022 for the coastwide stock of Atlantic menhaden. The Atlantic menhaden stock is assessed with a statistical catch at age model called BAM (Beaufort Assessment Model). The main tasks for the assessment were to gather both catch and fishery independent information from previous years and stratify that information by age based on aging information from the NOAA menhaden sampling program, which RI contributed locally caught samples to. RI contributed its Division of Marine Fisheries seine survey data (see job number 4 from this grant) and its trawl survey data (jobs 1 and 2 from this report), collecting the information and processing it for the assessment. Staff also participated in meetings where the assessment information was reviewed and served as active members of the stock assessment sub-committee.

In addition to the single-species menhaden assessment, a series of multispecies models were produced for peer review along with the 2020 assessment. These models included an Ecopath with Ecosim model, a Steele-Henderson multispecies surplus production model, a Bayesian time-varying surplus production model, and RI staff have created a multispecies statistical catch-at-age model (MSSCAA). The MSSCAA model features menhaden, striped bass, bluefish, weakfish, spiny dogfish, and Atlantic herring as the modeled species, all of which are important species in the ecosystem and of interest to recreational sportfish fisheries. The goal for these models was to incorporate more

ecosystem and trophic interaction information into the assessment process, and to create ecological reference points, which were ultimately accepted for use in management by the Atlantic Menhaden Management Board. These ecological reference points are currently used to guide harvest limits for the fishery. Originally planned as a benchmark, the 2025 single species assessment process for menhaden was changed to an update assessment, which is currently underway. The ecological reference point group is working on a benchmark assessment, to be completed in2025, and the MSSCAA model will be included in that process. Rhode Island DEM staff continues to be actively engaged in this assessment process.

In November 2023 staff also participated in an ASMFC sponsored Atlantic Menhaden Ageing Workshop. The goal of the workshop was to bring together agers from Maine through Florida to discuss the current and future ageing of menhaden for stock assessment purposes. Workshop participants conducted an exchange of hard parts to practice the ageing techniques learned at the workshop. The exchange is complete and a report is being drafted and will be made available with the results of the workshop and exchange as well as any recommendations for the future ageing of Atlantic menhaden.

Atlantic menhaden 2021 single species stock assessment update report:
http://www.asmfc.org/uploads/file/63d289bc2022AtlanticMenhadenStockAssessmentUpdate_TOR_Report.pdf

Atlantic menhaden 2019 ecological reference point assessment:
http://www.asmfc.org/uploads/file/5e4c4064AtlMenhadenERPAssmt_PeerReviewReports.pdf

3. BLACK SEA BASS

A management track assessment for black sea bass was completed in the summer of 2021. This assessment used the same methods and data as the 2019 assessment, with updated commercial and recreational catch data and research survey indices through 2019. Spatial statistical stock assessment models with separate northern and southern stocks were developed in the 2016 benchmark assessment and have been used in the updates and operational assessments since.

A research track stock assessment was completed in December 2023. For this assessment, new datasets were evaluated for their utility to inform or be used in stock assessment models for the species. Rhode Island DEM staff contributed trawl survey (see job 2 from this grant) and seine survey data (see jobs 3 and 4) to be evaluated along with age and growth data (job 9) for use in the assessment. Additionally, RIDEM DMF contributed new ventless pot survey information to the assessment (job 12). A final composite index was created using the technique called Vector Autoregressive Spatio-Temporal (VAST), and the RI trawl survey information was incorporated into this composite index. The

other surveys that were contributed were reviewed and did play roles of informing and corroborating final model outputs. The result of the 2023 research track was the acceptance of a new model for use in management, called the Woods Hole Assessment Model (WHAM), which is a state space spatial age-structured statistical model. The 2024 management track assessment used the methods of the research track assessment to provide stock and fishery status updates to inform black sea bass fishery management. Another management track assessment will be completed in 2025, aligning the assessment timelines between scup, summer flounder, and black sea bass.

Black sea bass 2021 management track assessment:
https://static1.squarespace.com/static/511cdc7fe4b00307a2628ac6/t/60f03955e00eb31d7cf06ab7/1626356053324/c_BSB_Management+Track+Assessment_2021.pdf

Black sea bass 2024 management track assessment:
https://asmfc.org/wp-content/uploads/2025/01/2024_BSB_UNIT_REPORT-3.pdf

5. SCUP

A management track stock assessment for scup was completed in the summer of 2023. This assessment used the same method (statistical catch-at-age model) and data as the 2021 operational assessment, with updated commercial and recreational catch data and research survey indices through 2021. The main tasks were to gather both catch and fishery-independent information from previous years and stratify that information by age based on aging information that is collected by NOAA. RI contributes its Division of Marine Fisheries trawl survey data (see jobs 1 and 2 from this document) and the University of Rhode Island Trawl Survey information (see job 14 from this grant) and hopes to contribute the new ventless pot survey info in the future to the assessment (job 12). Staff collects the information and processes it for the assessment. Staff participated in several meetings where the assessment information was reviewed, with additional responsibilities for developing management analyses after the assessment was completed.

Scup 2023 management track stock assessment report:
https://static1.squarespace.com/static/511cdc7fe4b00307a2628ac6/t/64aeef1bc86ac24289ec1b18/1689186075851/e_Scup_2023_MTA_2023_06_05.pdf

6. BLUEFISH

An operational stock assessment was conducted by the Northeast Fisheries Science Center (NEFSC) in 2021. The assessment estimated spawning stock biomass (SSB) in 2019 to be 95,742 MT, which is less than the SSB threshold (100,865 MT) indicating the stock is overfished. Fishing mortality in 2019 was estimated to be 0.172, below the Fthreshold, indicating the stock is not experiencing overfishing (Fmsy proxy = F35%SPR = 0.181) (Northeast Fisheries Science Center (NEFSC) 2020).

In 2022, DMF staff contributed data through 2021 for the 2022 Bluefish Research Track Assessment. Data included recreational release length-frequency data, age and growth

port sampling data, young-of-year (YOY) abundance index data from the fall component of the RI Seasonal Trawl Survey, and YOY abundance index data from the Narragansett Bay Juvenile Finfish Seine Survey. The assessment was peer reviewed in December of 2022.

A management track assessment conducted by the Northeast Fisheries Science Center (NEFSC) in 2023 indicates the bluefish stock is not overfished and overfishing is not occurring. The assessment estimated spawning stock biomass (SSB) in 2022 to be 52,747 mt, which is below the SSB target of 88,131 mt. Fishing mortality in 2022 was estimated to be 0.152, below the fishing mortality threshold of 0.239 (Fmsy proxy = F35%SPR = 0.239) (Northeast Fisheries Science Center (NEFSC) 2023).

In 2023, DMF staff contributed data through 2022 for the 2023 Bluefish Management Track Assessment. Data included recreational release length-frequency data, age and growth port sampling data (job 9 of this grant), young-of-year (YOY) abundance index data from the fall component of the RI Seasonal Trawl Survey (job 14), and YOY abundance index data from the Narragansett Bay Juvenile Finfish Seine Survey (job 4). In 2024, staff also worked on the bluefish monitoring committee setting annual specifications

Bluefish 2023 management track stock assessment:
https://asmfc.org/uploads/file/65c38974BF_2023_Management_Track_Assessment.pdf

7. TAUTOG

A stock assessment update was completed in 2021 and approved for management use using the same methodology as the 2015 benchmark stock assessment and the 2017 update. The assessment update uses the Age Structured Assessment Program v. 3.0.17, part of the NOAA Fisheries Toolbox for the four management regions coastwide (RI is in a region with Massachusetts, MARI). Data from 2016-2020 was added, and the newly calibrated MRIP data was included in the update. The main tasks were to gather both catch and fishery independent information from the previous years for and stratify that information by age based on aging information that was collected in each state, and which RI contributed locally caught samples to. RI staff served on the stock assessment subcommittee and provided support in the main tasks and ensuring the model was successfully completed. RI contributed its Division of Fish and Wildlife seine survey data (see job number 4 from this grant), trawl survey data (see jobs 1 and 2 from this document) and hopes to contribute the new ventless pot survey info in the future to the assessment.

Tautog 2021 stock assessment update:
http://www.asmfc.org/uploads/file/618584cc2021TautogRegionalStockAssessmentUpdate_WithAppendices.pdf

8. WINTER FLOUNDER

A management track stock assessment for the Southern New England/Mid-Atlantic (SNE/MA) winter flounder stock was completed in 2022. This assessment revised the 2011 benchmark stock assessment that was peer reviewed at the SAW52 meeting (http://www.asmfc.org/uploads/file/parta.pdf). The 2022 assessment passed peer review and had been previously updated through operational assessments for management use in 2015, 2017, and 2020. The 2022 assessment indicated the SNE/MA stock of winter flounder is not overfished and not experiencing overfishing relative to the updated biological reference points defined in the assessment. This is a change in stock status compared to previous assessments and was due to a change in the years of recruitment estimates used to estimate biological reference points. Instead of drawing upon the entire time series of recruitment estimates, the projections now only use recruitment estimates from the past 20 years (2002-2021). The winter flounder stock is most likely not capable of achieving the high levels of recruitment prior to 2000; therefore, using a truncated recruitment time series of only the past 20 years better reflects the current state of the stock. A research track stock assessment was initiated in 2024 with an objective to include environmental correlates in future winter flounder stock projections, including the SNE stock. The research track stock assessment is scheduled to be completed in 2026.

During this grant period, the main tasks for RI were to gather both catch and fishery independent information and stratify that information by age based on aging information from the NMFS trawl survey. Staff were active participants in the NEFMC Groundfish Plan Development Team and ASMFC winter flounder TC that discussed both federal and state water management measures for the SNE/MA winter flounder stock. The RI representative serves as the chair of the ASMFC winter flounder TC and is a participant in the winter flounder research track stock assessment working group.

Winter flounder 2022 management track stock assessment update report:
http://www.asmfc.org/uploads/file/63d6c2f85_2022_FLW_SNEMA_RPT.pdf

9. WEAKFISH

Historically, weakfish had not had an approved assessment for many years and management had long been based on external, non-analytical indicators. In 2016, a full benchmark assessment was performed and was peer reviewed which switched to a statistical catch at age modeling framework that used Bayesian statistical applications to account for time varying natural mortality, which is unique amongst the many sportfish species assessments that RI participates in. Other models were also tested, including a standard statistical catch at age model (using the ASAP software package), but the Bayesian model was selected as the preferred model by the assessment team. The main tasks associated with the assessment were to gather both catch and fishery independent information and stratify that information by age. RI contributes its Division of Fish and Wildlife trawl survey data (see job number 2 from this grant) to the assessment. The new

assessment model has allowed for an ability to get back to better informed management processes for this species. Since the last assessment RIDEM staff have participated in periodical meetings of the weakfish technical committee, and have served on the ecological reference point working group which incorporates weakfish in an ecosystem-level modeling framework.

Weakfish 2019 stock assessment update:
http://www.asmfc.org/uploads/file/5de7fc7c2019WeakfishAssessmentUpdate.pdf

10. SPINY DOGFISH

In 2022, staff participated in the research track stock assessment for spiny dogfish, often a recreationally intercepted species by Rhode Island anglers. The assessment's goal was to construct a new data-rich assessment model for use in guiding future management advice for the Northwest Atlantic spiny dogfish stock. One result of the research track stock assessment was the previously used model (the stochastic estimator model) was replaced with a new length-based, data-rich assessment model framework, Stock Synthesis (v3). Staff helped in building this model and preparing for it to be peer-reviewed in December 2022. Also, in support of the assessment, several analyses were conducted by staff to meet the assessment's Terms of Reference, such as understanding environmental drivers on the abundance, distribution, and life history rates. Additional work was done to understand the efficacy of fishery-dependent data to infer population fluctuations. The assessment passed peer-reviewed, and these new science and modeling tools were utilized in the next management track assessment, which was accepted in 2023 and used to adjust harvest levels for the stock.

Spiny dogfish 2023 management track stock assessment:
https://static1.squarespace.com/static/511cdc7fe4b00307a2628ac6/t/65328221ecf1151363521421/1697808930472/e1_2023+Spiny+Dogfish+MT+assessment+report.pdf

ASSESSMENT OF RECREATIONALLY IMPORTANT FINFISH STOCKS IN RHODE ISLAND COASTAL WATERS

Age and Growth Study

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March 2025

PERFORMANCE REPORT

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

SEGMENT NUMBER: 22

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

PERIOD COVERED: January 1, 2024 – December 31, 2024 and
January 1, 2020 – December 31, 2024

JOB NUMBER AND TITLE: 9, Age and Growth Study

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

SUMMARY: Investigators collected lengths, weights, and age structures from target species of recreationally important finfish. The type of age structure collected, and the number of samples collected varied by species. Investigators were able to collect, or exceed, the target sample numbers for the majority of species in 2024, however in some cases fell short on target sample numbers due to the availability of fish. Investigators had difficulty in obtaining samples for certain species, particularly bluefish, striped bass, and winter flounder due to the dynamics of the fisheries and the availability of fish. Work to age the primary ageing structures collected in all years is nearly complete. Otoliths are now the only age structure collected for all species, except for menhaden with scales also collected and tautog with only the first pelvic fin spine collected.

In addition to the collection of age and growth data, investigators continued the collection of stomach content, sex, and maturity stage data from target species. This data was collected through collaboration with investigators on the Rhode Island Division of Marine Fisheries (RIDMF) Monthly and Seasonal trawl surveys (Jobs 1 and 2), RIDMF Fyke Net survey (Job 10), commercial otter trawlers, commercial hook & line, and recreational hook and line fishers.

TARGET DATE: December 31, 2024

STATUS OF PROJECT: On schedule

SIGNIFICANT DEVIATIONS: Only 93 of the 100 age sample target for bluefish were collected. Striped bass sampling fell short for each gear type, 148 out of 150 floating fish trap and 100 out of 150 rod and reel. Samples were supplemented with fishery-independent samples collected from the Monthly and Seasonal trawl surveys (Jobs 1 and 2) and RIDMF Fyke Net survey (Job 10). Only 2 of the 40 targeted stomach content samples were collected for winter flounder.

RECOMMENDATIONS: Move into the next grant award and project segment and continue data collection in 2025.

REMARKS: None

INTRODUCTION

Age and growth information is essential in estimating the age structure of a fish population. Understanding the age structure of a population allows scientists to make informed management decisions regarding acceptable harvest levels for a species. In recent years, the diet composition of finfish has become increasingly important in understanding the age and growth of a population. The diet composition of a species may help to inform managers on whether an observed change in a population may be due to prey availability. Understanding predator-prey dynamics can also allow managers to utilize multi-species modeling approaches by which they can better understand not only the population dynamics of one particular target species, but other choke or prey species that may be associated with the target species. Most recently, ASMFC adopted an ecosystem-based management approach for assessing Atlantic menhaden. The data collected in this study will help contribute to the aforementioned efforts.

This study is aimed to characterize the age structure and diet composition of stocks whose ranges extend into Narragansett Bay and will supplement data collected in the Northeast Fisheries Science Center (NEFSC) spring and fall surveys as well as the NorthEast Area Monitoring and Assessment Program (NEAMAP), which do not sample within Narragansett Bay. Data collected in this study is already used in several stock assessments and we expect that number to increase each year as benchmark stock assessments are conducted and ecosystem-based modeling approaches are further developed. Additionally, this study satisfies the requirements of ASMFC Fishery Management Plans (FMP's) for tautog, bluefish, menhaden, and weakfish which require the state of Rhode Island to collect a minimum number of age and growth samples annually for stock assessment purposes. This study has also been designed to use other jobs in this grant as a platform for obtaining biological samples.

Collection of stomach content, sex, and maturity stage data for the species listed above was continued in 2024. Currently, only otoliths are collected for ageing purposes, with the exception of menhaden with scales also collected and tautog with only the first pelvic fin spine collected.

METHODS, RESULTS & DISCUSSION

Seasonal port sampling of nine species of finfish considered to be extremely important to the recreational fishing community was conducted primarily from May through December of 2024. Data collected included lengths, weights, and the appropriate age structure for the specific species (i.e., scale, otolith, pelvic spine). The number of samples and age structures collected varied depending on the species (Table 1A). Investigators focused on obtaining samples from various locations throughout the state including various finfish dealers, recreational hook & line anglers, commercial otter trawlers, commercial hook & line fishers, and RIDMF surveys (otter trawl, fyke net, and fish pot) (Table 2A).

Diet composition data was collected for high priority species by excising fish stomachs from fish collected during the RIDMF seasonal and monthly bottom trawl surveys, from fish racks and whole fish collected during port sampling, or fish racks and whole fish which were donated. For each species, the target number of stomachs to be examined is 40 (Table 3A). Additional data collected from these samples included length, weight (if whole fish available), sex, maturity, and age structures. Once stomachs were removed, they were analyzed in the laboratory by sorting and identifying prey to the lowest taxonomic level possible and recording the wet mass for each taxon. All collected data were entered and stored in a Microsoft Access database.

Black sea bass

For 2024, a total of 130 black sea bass age samples (otoliths only) were collected from multiple sources including the RIDMF otter trawl survey, RIDMF finfish ventless trap survey, and recreational hook and line fishers (Tables 1A and 2A). Black sea bass samples ranged in size from 12.1-21.4 inches (30.8-54.3 cm) total length and 3 - 12 years old (Figure 1A).

Stomach content data was collected from 55 fish and maturity stage data from 130 fish. Stomach contents included prey items from 5 taxonomic groups (Table 3A). The proportional contribution of **all** stomach contents encountered in 2024 is shown in Figure 9A and summarized in Table 4A as percentage. Identifiable stomach contents were dominated by crustaceans (65.1%) and finfish (8.8%), with smaller amounts of cephalopod molluscs (1.3%), bivalve molluscs (1.1%), and gastropod molluscs (0.5%) accounting for the remainder; "unidentifiable" contents accounted for 23.2%. Removal of "unidentifiable" contents from the analysis resulted in crustaceans accounting for 84.8% and finfish for 11.5%, with cephalopod molluscs (1.7%), bivalve molluscs (1.4%), and gastropod molluscs (0.65%) accounting for the remainder (Figure 9B, Table 4B).

For the 5-year grant award period, a total of 1,031 black sea bass age samples (719 scales + 312 otoliths) were collected from multiple sources including the RIDMF otter trawl and finfish ventless trap surveys, and recreational hook and line fishers (Tables 1B and 2B). Samples ranged in size from 6.1-21.4 inches (15.5-54.3 cm) total length and 3 – 13 years old (Figure 1B). Of the black sea bass collected, 719 were collected as part of a collaborative project with the Commercial Fisheries Research Foundation (CFRF). As the CFRF samples were not part of this project they were aged by the Virginia Institute of Marine Science and those ages are not included in Figures 1A and 1B.

Stomach content data were collected from 541 fish and maturity stage data from 1,031 fish. Stomach contents included prey items from 10 taxonomic groups (Table 3B). The proportional contribution of **all** stomach contents encountered during this period is shown in Figure 10A and summarized in Table 5A as percentage. Identifiable stomach contents were dominated by crustaceans (36.6%), cephalopod molluscs (15.3%), and finfish (9.9%) with smaller amounts of gastropod molluscs (1.0%), polychaetes (0.8%), aquatic plants (0.2%), and algae (0.2%) accounting for the remainder; "unidentifiable" contents accounted for 31.9%. Removal of "unidentifiable" contents from the analysis resulted in crustaceans accounting for 53.8%, cephalopod molluscs for 22.4%, and finfish for 14.5% with gastropod molluscs (1.4%), polychaetes (1.2%), aquatic plants (0.3%), and algae (0.2%) accounting for the remainder (Figure 10B, Table 5B).

Bluefish

The ASMFC requires that a minimum of 100 bluefish age samples be collected annually by the state of Rhode Island. In 2024, 93 bluefish age samples (otoliths only) were collected from the RIDMF otter trawl survey and recreational hook and line fishers (Tables 1A and 2A). Two of the otolith samples collected were broken and unable to be aged. Bluefish samples ranged in size from 7.3-32.5 inches (18.5-82.5 cm) fork length and 0 - 10 years old (Figure 2A).

Stomach content and maturity stage data were collected from 61 bluefish; stomach contents included prey items from 3 taxonomic groups (Table 3A). The proportional contribution of **all** stomach contents encountered in 2024 is shown in Figure 9A and summarized in Table 4A as percentage. Identifiable stomach contents encountered included finfish (75.5%), cephalopod molluscs (5.7%), algae (0.1%), and aquatic plants (0.04%); "unidentifiable" contents accounted for 18.6%. Removal of "unidentifiable" contents from the analysis resulted in finfish accounting for 92.8% and cephalopod molluscs for 7.0% with algae (0.2%) and aquatic plants (0.05%) accounting for the remainder (Figure 9B, Table 4B).

For the 5-year grant award period, a total of 479 bluefish age samples (otoliths only) were collected from multiple sources including the RIDMF otter trawl survey, commercial gillnet and floating fish trap operations, and recreational hook and line fishers (Tables 1B and 2B). Samples ranged in size from 6.8-33.6 inches (17.3-85.3 cm) fork length and 0 – 10 years old (Figure 2B).

Stomach content data was collected from 264 fish and maturity stage data from 479 fish. Stomach contents included prey items from 5 taxonomic groups (Table 3B). The proportional contribution of **all** stomach contents encountered during this period is shown in Figure 10A and summarized in Table 5A as percentage. Identifiable stomach contents were dominated by finfish (70.3%) and cephalopod molluscs (2.6%) with minimal amounts of algae (0.02%) and aquatic plants (0.01%) accounting for the remainder; "unidentifiable" contents accounted for 27.1%. Removal of "unidentifiable" contents from the analysis resulted in finfish accounting for 96.4% and cephalopod molluscs for 3.5% with algae (0.03%) and aquatic plants (0.01%) accounting for the remainder (Figure 10B, Table 5B).

Menhaden

A total of 274 Atlantic menhaden age samples (138 scales + 138 otoliths) were collected in 2024 from the RIDMF otter trawl survey and commercial otter trawl and floating fish trap operations (Tables 1A and 2A). Samples can only be collected from commercial purse seine operations when the Narragansett Bay menhaden management area is open to commercial fishing. In 2024, the menhaden management area opened briefly from April 29th through May 12th allowing for a minimal number of purse seine samples to be collected. Additional samples were collected from commercial otter trawl and floating fish trap operations and supplemented with samples from the RIDMF otter trawl survey. Menhaden samples ranged in fork length from 5.5-12.5 inches (14.0-31.7 cm). Age samples will be sent to the NOAA Fisheries Beaufort Laboratory for processing and ageing. A menhaden ageing workshop took place in November 2023 to discuss ageing protocols followed by a coastwide exchange of hard parts. The results of this workshop are still pending and will inform staff on the appropriate age structure to collect moving forward.

Maturity stage data were collected from 137 fish. Due to the fact that menhaden are filter feeders, all stomach contents encountered in previous years of this study were liquefied, with prey item(s) unable to be identified and classified. Due to this, no menhaden stomachs were examined during 2024. Generally, menhaden stomach contents should reflect the dominant planktonic species present at the time of sample collection.

For the 5-year grant award period, a total of 882 Atlantic menhaden age samples (441 scales + 441 otoliths) were collected from multiple sources including the RIDMF otter trawl survey, and commercial otter trawl, floating fish trap, and purse seine operations (Tables 1B and 2B). Samples ranged in size from 5.5-12.5 inches (14-31.7 cm) fork length.

Scup

In 2024, a total of 110 scup age samples (otoliths only) were collected from fish caught by the RIDMF otter trawl and fish pot surveys and recreational hook and line fishers (Tables 1A and 2A). Scup samples ranged in fork length from 7.2 -14 inches (18.3-35.5 cm) and age from 2 - 14 years old (Figure 3A).

Stomach content data was collected from 55 fish and maturity data from 110 fish. Stomach contents included prey items from 7 taxonomic groups (Table 3A). The proportional contribution of **all** stomach contents encountered in 2024 is shown in Figure 9A and summarized in Table 4A as percentage. Identifiable stomach contents included finfish (45.3%), cephalopod molluscs (11.2%), crustaceans (5.5%), gastropod molluscs (1.6%), bivalve molluscs (1.3%), algae (0.96%), and polychaetes (0.24%); "unidentifiable" contents accounted for 33.9%. Removal of "unidentifiable" contents from the analysis resulted in finfish accounting for 68.6%, cephalopod molluscs for 17.0%, crustaceans for 8.3%, gastropod molluscs for 2.4%, bivalve molluscs for 2.0%, algae (1.5%), and polychaetes for 0.4% (Figure 9B, Table 4B).

For the 5-year grant award period, a total of 880 scup age samples (335 scales + 545 otoliths) were collected from multiple sources including the RIDMF otter trawl and finfish ventless trap surveys and recreational hook and line fishers (Tables 1B and 2B). Samples ranged in size from 6.0-15.3 inches (15.3-38.9 cm) fork length and 1 - 17 years old (Figure 3B).

Stomach content data was collected from 235 fish and maturity stage data from 545 fish. Stomach contents included prey items from 10 taxonomic groups (Table 3B). The proportional contribution of **all** stomach contents encountered during this period is shown in Figure 10A and summarized in Table 5A as percentage. Identifiable stomach contents were dominated by finfish (22.5%), cephalopod molluscs (13.5%), and crustaceans (10.2%) with smaller amounts of bivalve molluscs (5.6%), polychaetes (4.92%), algae (2.4%), gastropod molluscs (1.5%), sipunculids (1.2%), cnidarians (1.3%), and echinoderms (0.03%) accounting for the remainder; "unidentifiable" contents accounted for 36.8%. Removal of "unidentifiable" contents from the analysis resulted in finfish accounting for 35.6%, cephalopod molluscs for 21.4%, crustaceans for 16.2%, bivalve molluscs for 8.9%, polychaetes for 7.8%, algae for 3.7%, gastropod molluscs for 2.4%, sipunculids for 2.0%, cnidarians for 2.0%, and echinoderms for 0.04% (Figure 10B, Table 5B).

Spiny Dogfish

Spiny dogfish are not routinely sampled as they are not frequently encountered on the RIDMF otter trawl survey. No spiny dogfish were sampled in 2024.

Striped Bass

A total of 303 striped bass age samples (239 scale + 64 otolith) were collected in 2024. Although otoliths remain the primary ageing structure, scales are frequently collected from commercial samples when staff are unable to collect otoliths due to the damage it would cause to the fish. Each year investigators set a sampling target of 150 samples from floating fish traps and 150 samples from the general category fishery. Floating fish traps have a minimum size of 26" while the commercial general category fishery has a minimum size of 34". Sampling from both of these operations allows us to sample a wider size range of striped bass. In recent years there have been a very limited number of floating fish traps in operation making obtaining striped bass samples from this fishery difficult. A total of 91 samples were obtained from the general category fishery and 148 samples from floating fish traps, for a total of 239 fishery-dependent samples. Staff supplemented traditional sampling by collecting a total of 64 striped bass age samples from the recreational fishery (n=9), RIDMF otter trawl (n=15) and fyke net (n=40) surveys (Tables 1A and 2A). Fisheries-independent survey samples were generally below legal minimum size(s) but helped to expand the length-frequency distribution sampled. Striped bass samples ranged from 10.6-50.0 inches fork length (27.0-127.0 cm). Striped bass ageing has only been completed for otoliths. Staff has difficulties with pressing striped scales due to a new acetate that was purchased for making scale impressions. Due to these issues, ageing of scales has not been completed. Staff are investigating new vendors to purchase a different acetate and will finish ageing once that is acquired. Otolith ages ranged from 3 - 10 years old (Figure 4A).

Stomach content and maturity stage data were collected from 64 striped bass. Stomach contents included prey items from 7 taxonomic groups (Table 3A). The proportional contribution of **all** stomach contents encountered in 2024 is shown in Figure 9A and summarized in Table 4A as percentage. Identifiable stomach contents were dominated by finfish (80.0%) and crustaceans (5.3%), with small quantities of cephalopod molluscs (1.1%), sand/rocks (1.0%), aquatic plants (0.03%), algae (0.01%), and gastropod molluscs (0.01%) accounting for the remainder; "unidentifiable" contents accounted for 12.6%. Removal of "unidentifiable" contents from the analysis resulted in finfish accounting for 91.5% and crustaceans accounting for 6.1%, with small quantities of cephalopod molluscs (1.3%), sand/rocks (1.1%), aquatic plants (0.04%), algae (0.02%), and gastropod molluscs (0.01%) accounting for the remainder (Figure 9A, Table 5A).

For the 5-year grant award period, a total of 1,399 striped bass age samples (1,224 scales + 175 otoliths) were collected from multiple sources including the RIDMF otter trawl, fyke net, and Narragansett Bay beach seine surveys and commercial floating fish trap and hook and line operations (Tables 1B and 2B). Samples ranged in size from 10.6-50.0 inches (27.3-127.0 cm) fork length and 2 – 22 years old (Figure 4B).

Stomach content data was collected from 175 fish and maturity stage data was collected from 64 fish. Stomach contents included prey items from 10 taxonomic groups (Table 3B). The proportional contribution of **all** stomach contents encountered during this time period is shown in Figure 10A and summarized in Table 5A as percentage. Identifiable stomach contents were dominated by finfish (68.5%) and crustaceans (16.8%) with smaller amounts of cephalopod

molluscs (1.0%), polychaetes (0.5%), sand/rocks (0.4%), algae (0.3%), gastropod molluscs (0.05%), aquatic plants (0.05%), and bivalve molluscs (0.02%) accounting for the remainder; "unidentifiable" contents accounted for 12.3%. Removal of "unidentifiable" contents from the analysis resulted in finfish accounting for 78.1% and crustaceans for 19.1%, with smaller amounts of cephalopod molluscs (1.2%), polychaetes (0.6%), sand/rocks (0.4%), algae (0.4%), gastropod molluscs (0.05%), aquatic plants (0.05%), and cnidarians (0.01%) accounting or the remainder (Figure 10B, Table 5B).

Summer Flounder

A total of 113 summer flounder age samples were collected in 2024 from the RIDMF otter trawl and finfish ventless trap surveys, commercial operations (unknown gear type), and recreational hook and line (Tables 1A and 2A). Summer flounder samples varied in size from 10.9-28.1 inches (27.7-71.4 cm) total length and 1 - 11 years old (Figure 5A).

Stomach content and maturity stage data were collected from 76 summer flounder. Stomach contents included prey items from 3 taxonomic groups (Table 3A). The proportional contribution of **all** stomach contents encountered in 2024 is shown in Figure 9A and summarized in Table 4A as percentage. Identifiable stomach contents were dominated by finfish (27.3%) and crustaceans (12.9%), with negligible amounts of cephalopod molluscs (0.5%); "unidentifiable" contents accounted for 59.3%. Removal of "unidentifiable" contents from the analysis resulted in finfish accounting for 67.2%, crustaceans for 31.6%, and cephalopod molluscs for 1.3% (Figure 9B, Table 4B).

For the 5-year grant award period, a total of 709 summer flounder age samples (263 scales + 446 otoliths) were collected from multiple sources including the RIDMF otter trawl and finfish ventless pot surveys, commercial operations (unknown gear type), and recreational hook and line anglers (Tables 1B and 2B). Samples ranged in size from 8.9-28.1 inches (22.6-71.4 cm) total length and 0 - 11 years old (Figure 5B).

Stomach content data was collected from 281 fish and maturity stage data was collected from 112 fish. Stomach contents included prey items from 6 taxonomic groups (Table 3B). The proportional contribution of **all** stomach contents encountered during this time period is shown in Figure 10A and summarized in Table 5A as percentage. Identifiable stomach contents were dominated by finfish (46.4%), cephalopod molluscs (16.5%), and crustaceans (7.3%) with algae (0.03%), polychaetes (0.01%), and bivalve molluscs (0.01%) accounting for the remainder; "unidentifiable" contents accounted for 29.7%. Removal of "unidentifiable" contents from the analysis resulted in finfish accounting for 66.1%, cephalopod molluscs for 23.4%, and crustaceans for 10.4% with algae (0.04%), polychaetes (0.02%), and bivalve molluscs (0.02%) accounting for the remainder (Figure 10B, Table 5B).

Tautog

A total of 225 tautog age samples were collected in 2024. In 2021, staff began transitioning to using spines as the preferred ageing structure. This was due to a recommendation from the ASMFC Age committee that the operculum was no longer the preferred structure due to high error rates. In 2024, samples were primarily collected from the recreational hook and line fishery (n=186), with additional samples obtained from the RIDMF otter trawl survey (n=32), and

RIDMF fish pot survey (n=7) (Tables 1A and 2A). Tautog samples are typically collected in the fall months when the party and charter boat vessels are targeting them. The ability to obtain samples during this period of time can be quite variable due to weather conditions such as strong winds and high seas. Tautog samples ranged from 6.1-21.9 inches (15.6-55.6 cm) total length and 1 – 13 years old (Figure 6A).

Stomach content and maturity stage data were collected from 44 tautog in 2024. Stomach contents included prey items from 6 taxonomic groups (Table 3A). The proportional contribution of **all** stomach contents encountered in 2024 is shown in Figure 9A and summarized in Table 4A as percentage. Identifiable tautog diet was primarily comprised of bivalve molluscs (40.9%) and crustaceans (25.1%), with smaller quantities of gastropod molluscs (6.5%), maxillopods (4.5%), finfish (0.9%), and algae (0.23%) also observed; "unidentifiable" contents accounted for 21.7%. Removal of "unidentifiable" contents from the analysis resulted in bivalve molluscs accounting for 52.3% and crustaceans for 32.1%, with smaller quantities of gastropod molluscs (8.3%), maxillopods (5.8%), finfish (1.2%), and algae (.03%) (Figure 9B, Table 4B).

For the 5-year grant award period, a total of 3,177 tautog age samples (755 operculum + 1,151 otoliths + 1,271 1st pelvic fin spine) were collected from multiple sources including the RIDMF otter trawl, finfish ventless pot, fyke net, Narragansett Bay beach seine, and recreational spear fishers (Tables 1B and 2B). Samples ranged in size from 6.1-28.0 inches (15.6-71.1 cm) and 1 - 19 years old (Figure 6B).

Stomach content data was collected from 225 fish and maturity stage data was collected from a total of 1,278 fish. Stomach contents included prey items from 14 taxonomic groups (Table 3B). The proportional contribution of **all** stomach contents encountered during this time period is shown in Figure 10A and summarized in Table 5A as percentage. Identifiable stomach contents were primarily composed of bivalve molluscs (40.7%), crustaceans (27.1%), and gastropod molluscs (6.0%) with maxillopods (1.2%), algae (0.2%), finfish (0.2%), sand/rocks (0.1%), polychaetes (0.1%), bryozoa (0.05%), ascidiacea (0.04%), echinoderms (0.02%), aquatic plants (0.01%), and porifera (0.01%) accounting for the remainder; "unidentifiable" contents accounted for 24.3%. Removal of "unidentifiable" contents from the analysis resulted in bivalve molluscs accounting for 53.8%, crustaceans for 35.8%, and gastropod molluscs for 7.9% with maxillopods (1.5%), algae (0.24%), finfish (0.23%), sand/rocks (0.15%), polychaetes (0.13%), bryozoa (0.06%), ascidiacea (0.06%), echinoderms (0.03%), aquatic plants (0.01%), and porifera (0.01%) accounting for the remainder (Figure 10B, Table 5B).

Weakfish

Rhode Island is required by the ASMFC to collect three age structures and six lengths per metric ton of weakfish landed in the state. In 2024, this would have resulted in a sampling target of 99 fish lengths and 50 ages. The weakfish stock assessment sub-committee and management board have requested that length samples come from the commercial fishery as these data are used in developing the commercial age-length keys. In recent years, weakfish have become more abundant but are landed in small quantities making it a challenge to obtain samples. Investigators continue to attempt to purchase fish directly from seafood dealers at market value to ensure that they can obtain adequate samples. In 2024, a total of 77 age structures were collected, from the commercial fishery (n=38) the fishery-independent RIDMF otter trawl survey (n=39). Additional

lengths were collected from the commercial fishery (n=12) for a total 50 commercial lengths and 39 fishery-independent lengths. The required number of samples has increased over the last two years due to an increase in recreational harvest. It should be noted that these high estimates of recreational catch are associated with high percent standard error (PSE) and therefore could be an overestimation of harvest. Weakfish samples ranged in size from 11.0-29.6 inches (28.0-75.3 cm) total length and were 1 – 3 years old (Figure 7A).

Stomach content data was collected from 51 fish and maturity stage data was collected from 77fish. Stomach contents included prey items from 3 taxonomic groups (Table 3A). The proportional contribution of **all** stomach contents encountered in 2024 is shown in Figure 9A and summarized in Table 4A as percentage. Of the weakfish stomachs examined in 2024, identifiable stomach contents were dominated by finfish (76.5%), with minor contributions from cephalopod molluscs (1.3%) and crustaceans (0.3%)%); "unidentifiable" contents accounted for 21.9%. Removal of "unidentifiable" contents from the analysis resulted in finfish accounting for 98.0%, with minor contributions from cephalopod molluscs (1.6%) and crustaceans (0.41%) (Figure 9B, Table 4B).

For the 5-year grant award period, a total of 229 weakfish age samples (otoliths only; 101 fishery-dependent, 128 fishery-independent) were collected from multiple sources including the RIDMF otter trawl, commercial FFT, and commercial/unknown gear type (Table 1B and 2B). Samples ranged in size from 7.7-29.6 inches (19.6-75.3 cm) total length and 1 - 5 years old (Figure 7B).

Stomach content and maturity stage data was collected from a total of 189 fish. Stomach contents included prey items from 5 taxonomic groups (Table 3B). The proportional contribution of **all** stomach contents encountered during this time period is shown in Figure 10A and summarized in Table 5A as percentage. Identifiable stomach contents were dominated by finfish (64.8%) and cephalopod molluscs (13.0%) with smaller amounts of crustaceans (1.6%), polychaetes (0.5%), and algae (0.2%) accounting for the remainder; "unidentifiable" contents accounted for 19.9%. Removal of 'unidentified" contents from the analysis resulted in finfish accounting for 80.9% and cephalopod molluscs for 16.2% with crustaceans (2.0%), polychaetes (0.6%), and algae (0.3%) accounting for the remainder (Figure 10B, Table 5B).

<u>Winter Flounder</u>

A total of 2 winter flounder age samples were collected in 2024. These samples were collected entirely by RIDMF staff on board the RIDMF otter trawl survey. Winter flounder samples collected varied in size from 10.9-11.3 inches (27.7-28.6 cm) total length and were 2 years old (Figure 8A).

Stomach content and maturity stage data were collected from 2 winter flounder. Stomach contents included prey items from 2 taxonomic groups (Table 3A). The proportional contribution of **all** stomach contents encountered in 2024 is shown in Figure 9A and summarized in Table 4A as percentage. Of the winter flounder stomachs examined in 2024, identifiable stomach contents were composed of crustaceans (39.6%) and polychaetes (20.7%) with "unidentifiable" contents accounting for 39.7%. Removal of "unidentifiable" contents from the analysis resulted in crustaceans accounting for 65.7% and polychaetes for 34.3% (Figure 9B, Table 4B).

For the 5-year grant award period, a total of 384 winter flounder age samples (186 scales + 198 otoliths) were collected entirely by RIDMF staff on board the RIDMF otter trawl and fyke net surveys (Tables 1B and 2B). Samples ranged in size from 9.4-17.8 inches (24.0-45.1 cm) total length and 2 - 10 years old (Figure 8B).

Stomach content and maturity stage data were collected from a total of 105 fish. Stomach contents included prey items from 10 taxonomic groups (table 3B). The proportional contribution of **all** stomach contents encountered during this time period is shown in Figure 10A and summarized in Table 5A as percentage. Identifiable stomach contents were dominated by cnidarians (53.8%), followed by polychaetes (10.2%) and crustaceans (7.8%) with smaller amounts of gastropod molluscs (3.4%), algae (1.3%), bivalve molluscs (0.7%), nemerteans (0.5%), sipunculids (0.12%), echinoderms (0.02%), and sand/rocks (0.02%); "unidentifiable" contents accounted for 22.2%. Removal of "unidentifiable" contents from the analysis resulted in cnidarians accounting for 69.1%, polychaetes for 13.1%, and crustaceans for 10.1% with smaller amounts of gastropod molluscs (4.3%), algae (1.7%), bivalve molluscs (0.8%), nemerteans (0.6%), sipunculids (0.1%), echinoderms (0.03%), and sand/rocks (0.03%) accounting for the remainder (Figure 10B, Table 5B).

SUMMARY

In 2024 investigators were able to meet, or exceed, the target age structure sample numbers for black sea bass (130/100), menhaden (138/100), scup (110/100), summer flounder (112/100), and tautog (225/200). While under-achieving target sample numbers for bluefish (93/100), weakfish (50 fishery-dependent lengths, 38 fishery-dependent ages), and winter flounder (2/40). In the cases where the sample targets were not achieved, this was due to the dynamics of the fisheries, inclement weather, and availability of fish. Processing and ageing of all hard parts is complete for 2024. In 2025, staff will continue reaching out to additional seafood dealers and the recreational community to ensure that the target number of samples is met for each species. Staff will continue to participate in ASMFC ageing workshops as they occur.

FIGURES

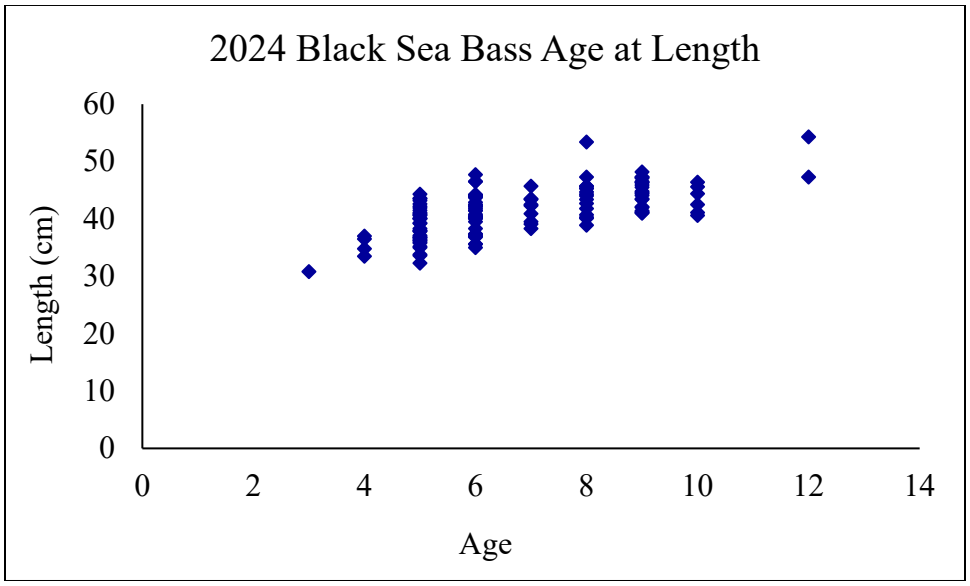


Figure 1A. 2024 Black sea bass age at length.

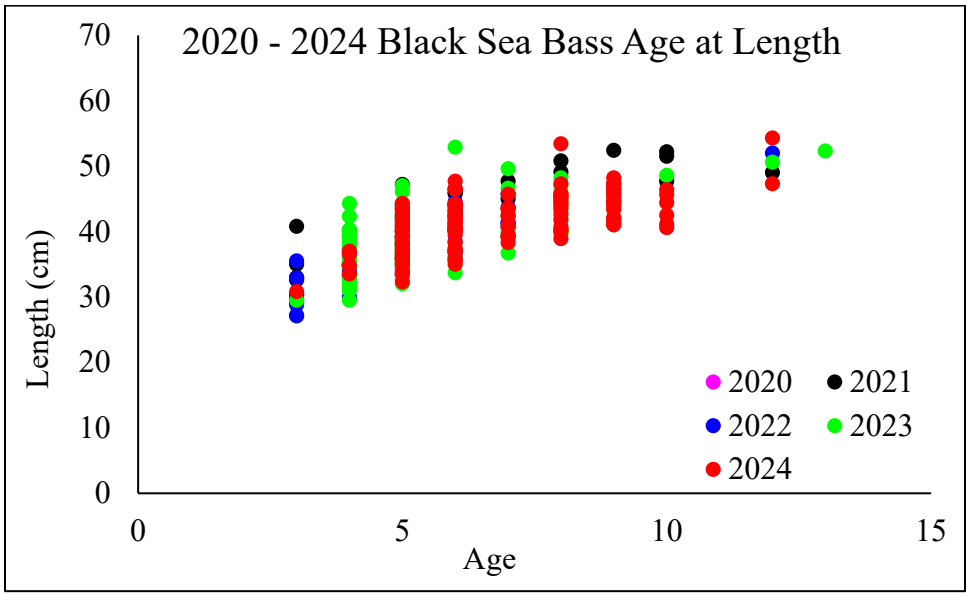


Figure 1B. 2020-2024 Black sea bass age at length.

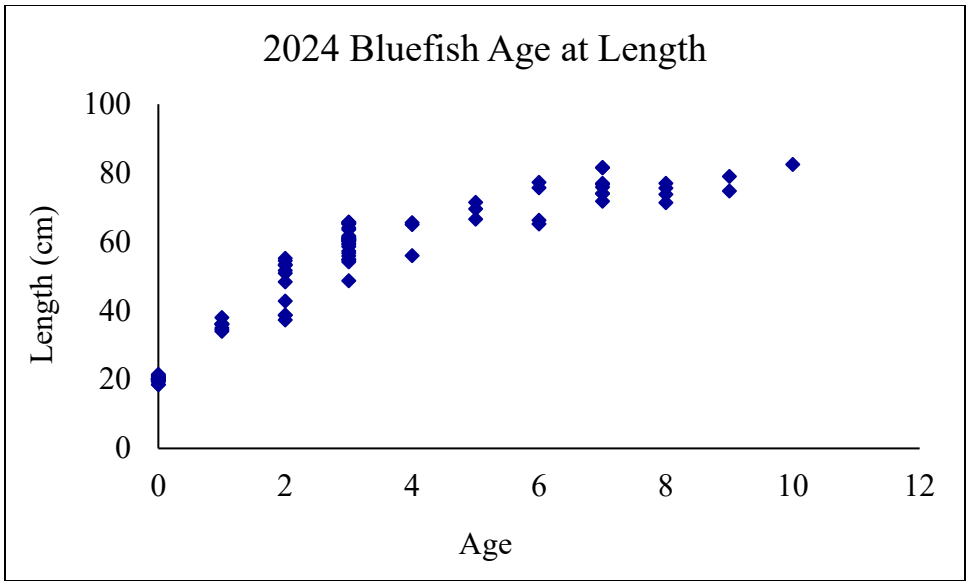


Figure 2A. 2024 Bluefish age at length.

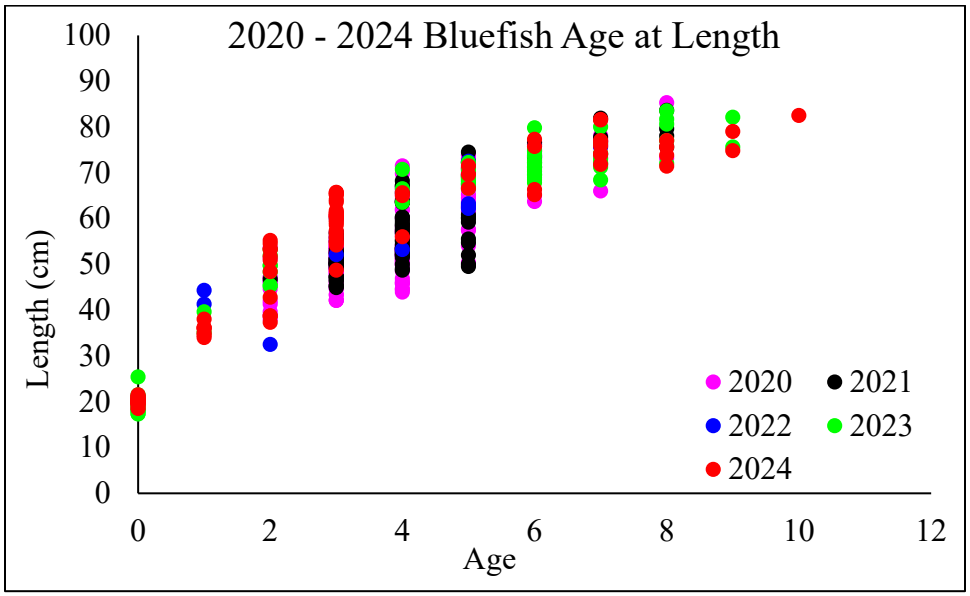


Figure 2B. 2020-2024 Bluefish age at length.

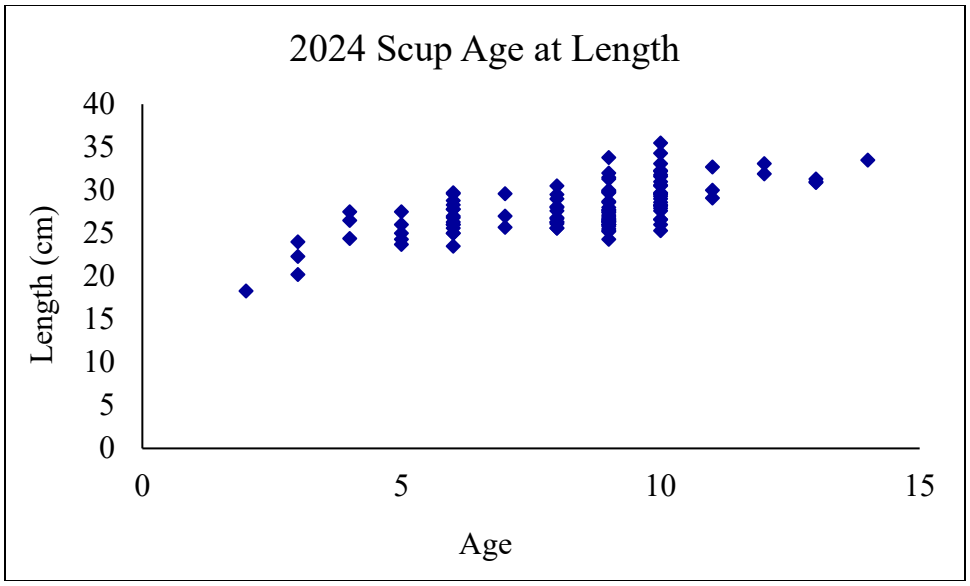


Figure 3A. 2024 Scup age at length.

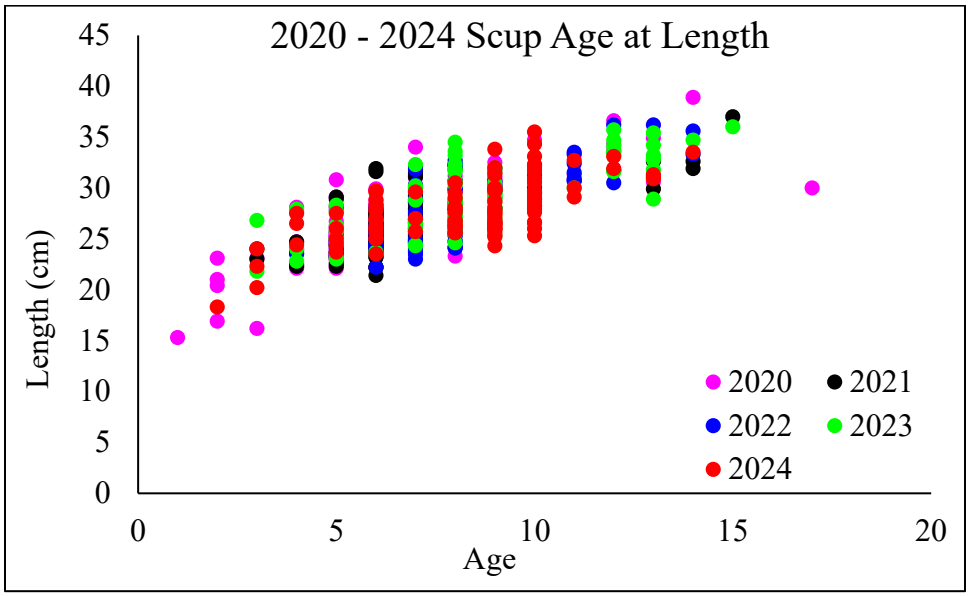


Figure 3B. 2020-2024 Scup age at length.

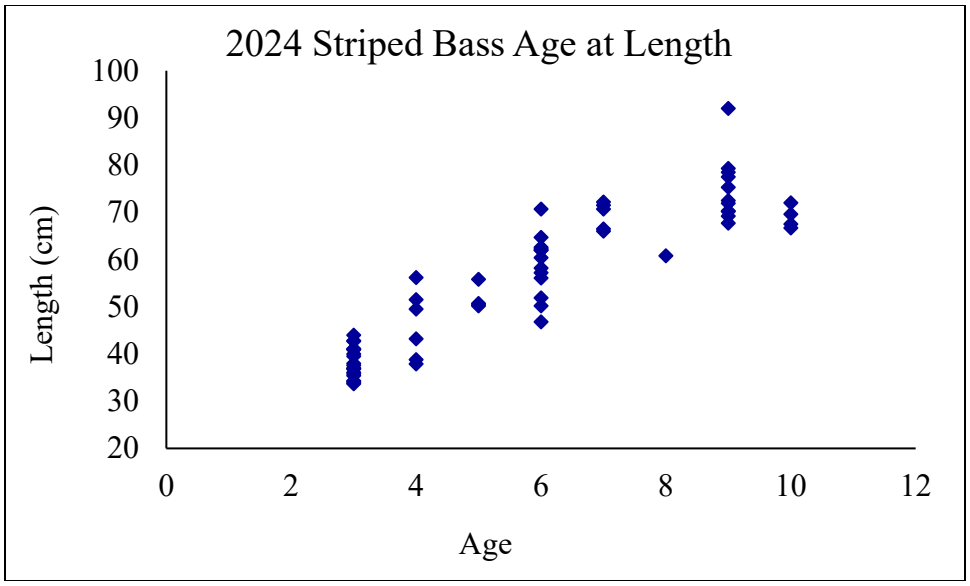


Figure 4A. 2024 Striped bass age at length.

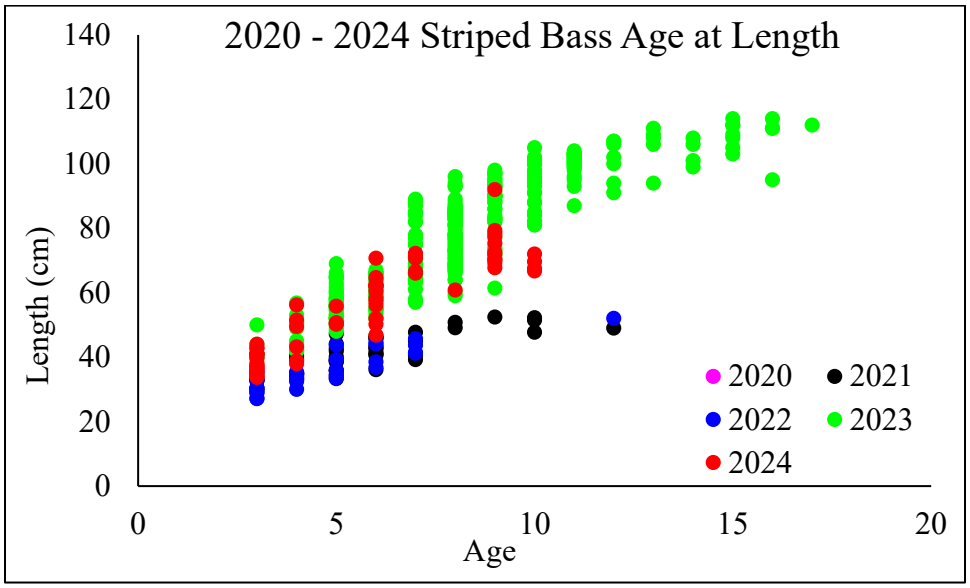


Figure 4B. 2020-2024 Striped bass age at length.

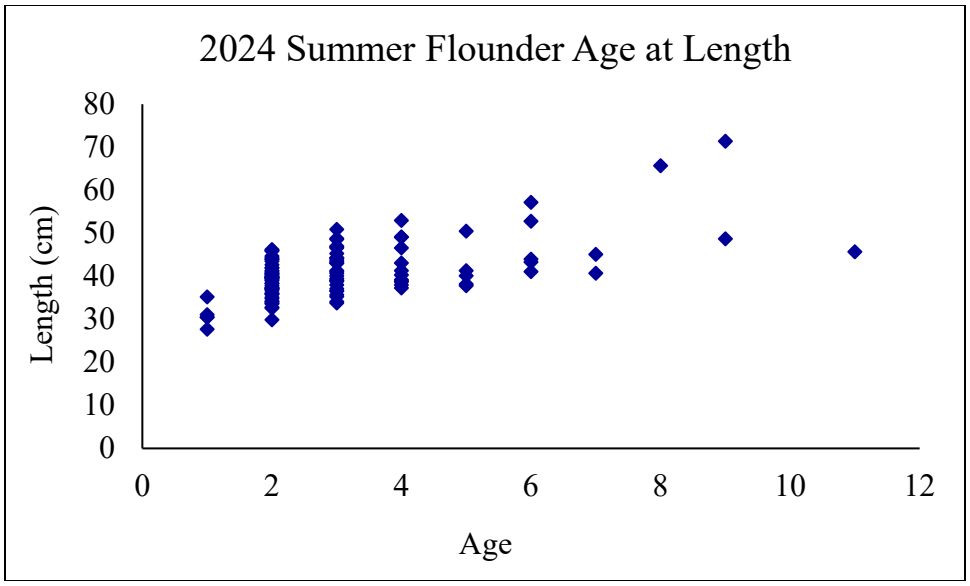


Figure 5A. 2024 Summer flounder age at length.

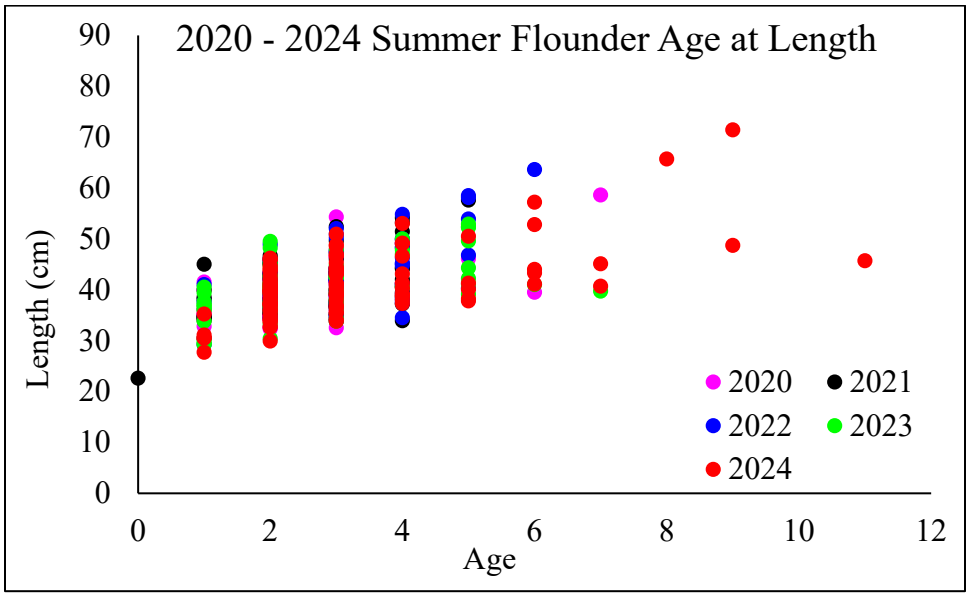


Figure 5B. 2020-2024 Summer Flounder age at length.

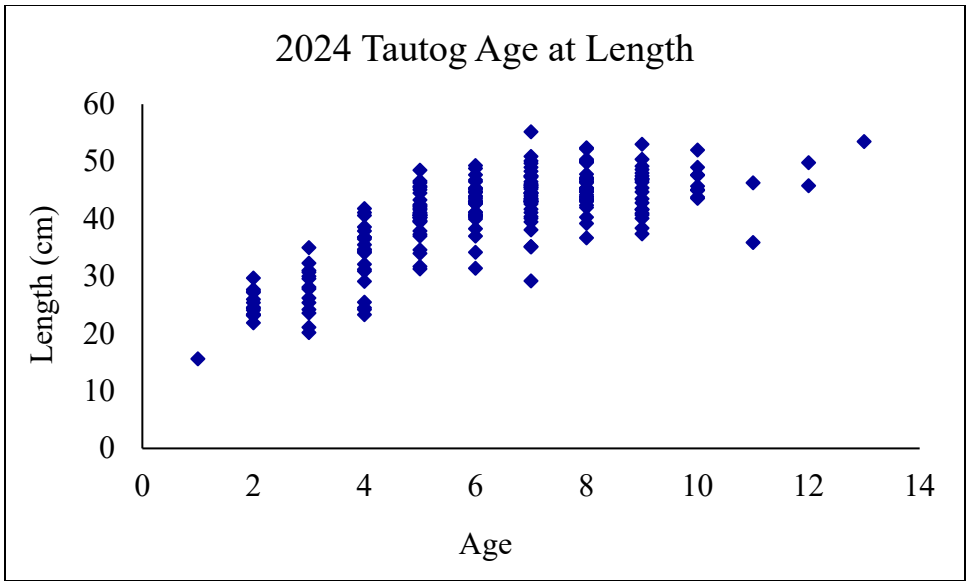


Figure 6A. 2024 Tautog age at length.

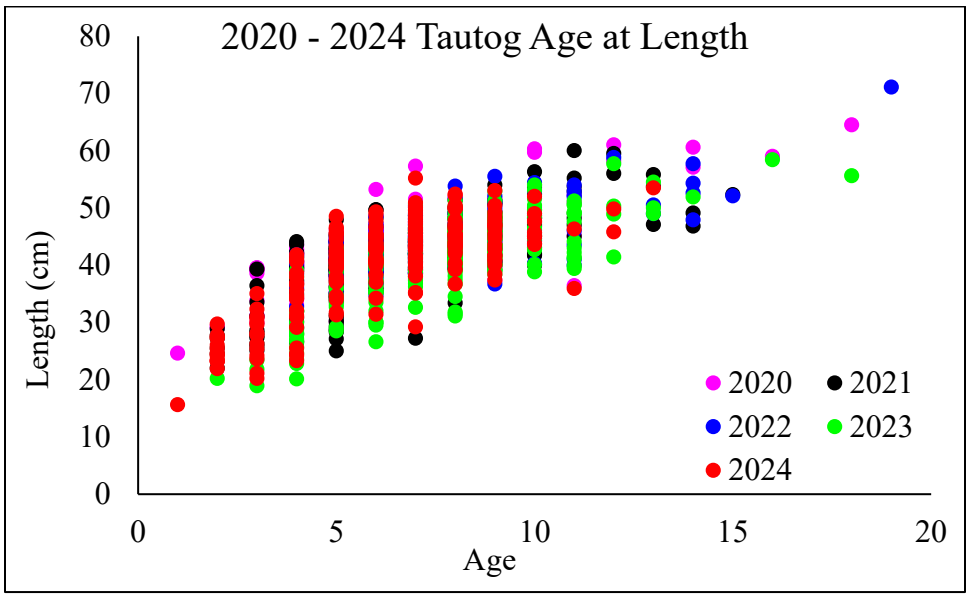


Figure 6B. 2020-2024 Tautog age at length.

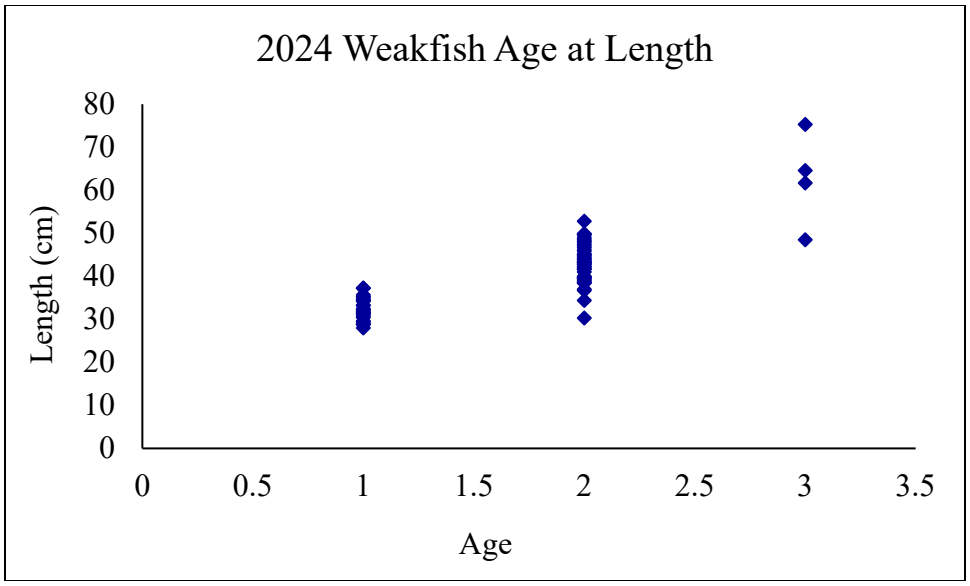


Figure 7A. 2024 Weakfish age at length.

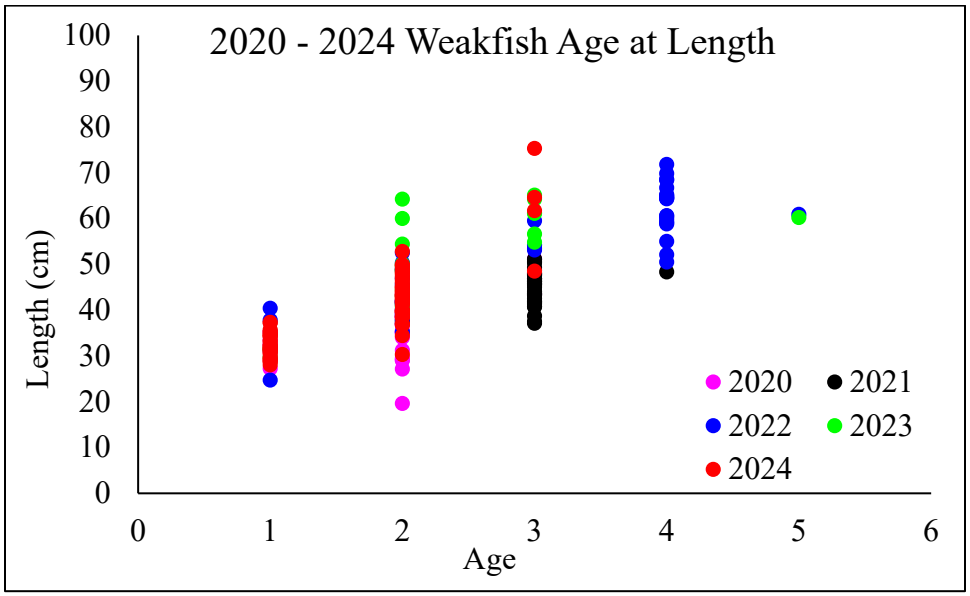


Figure 7B. 2020-2024 Weakfish age at length.

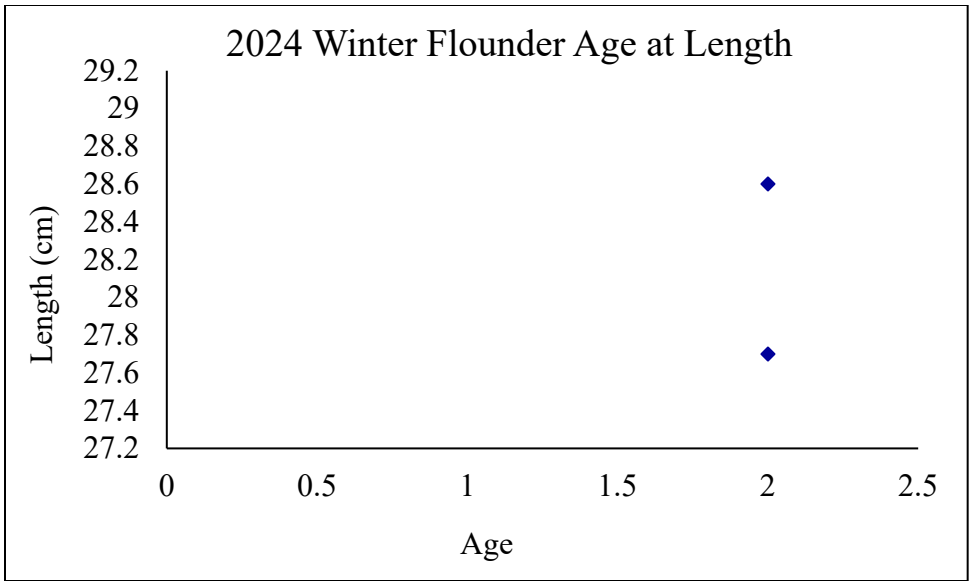


Figure 8A. 2024 Winter flounder age at length.

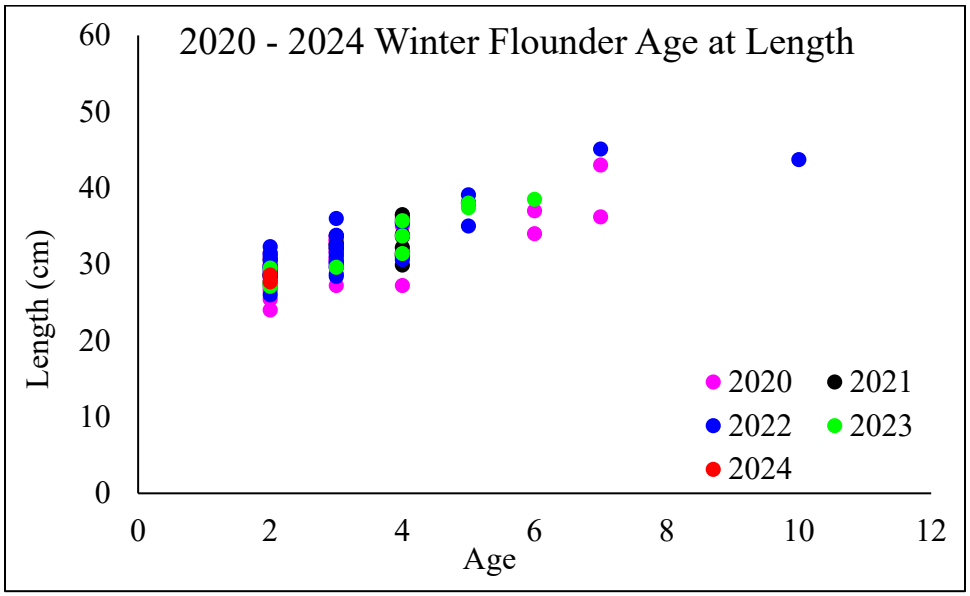


Figure 8B. 2020-2024 Winter flounder age at length.

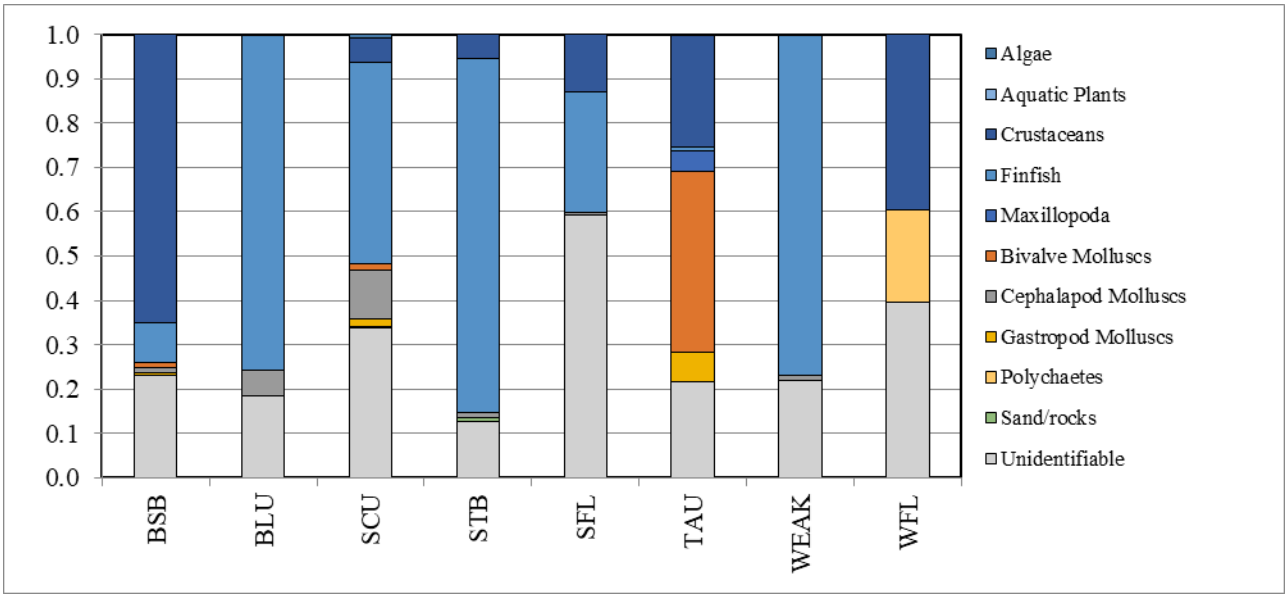


Figure 9A. 2024 Proportional contribution of **all** stomach content types by species (see Table 4A).

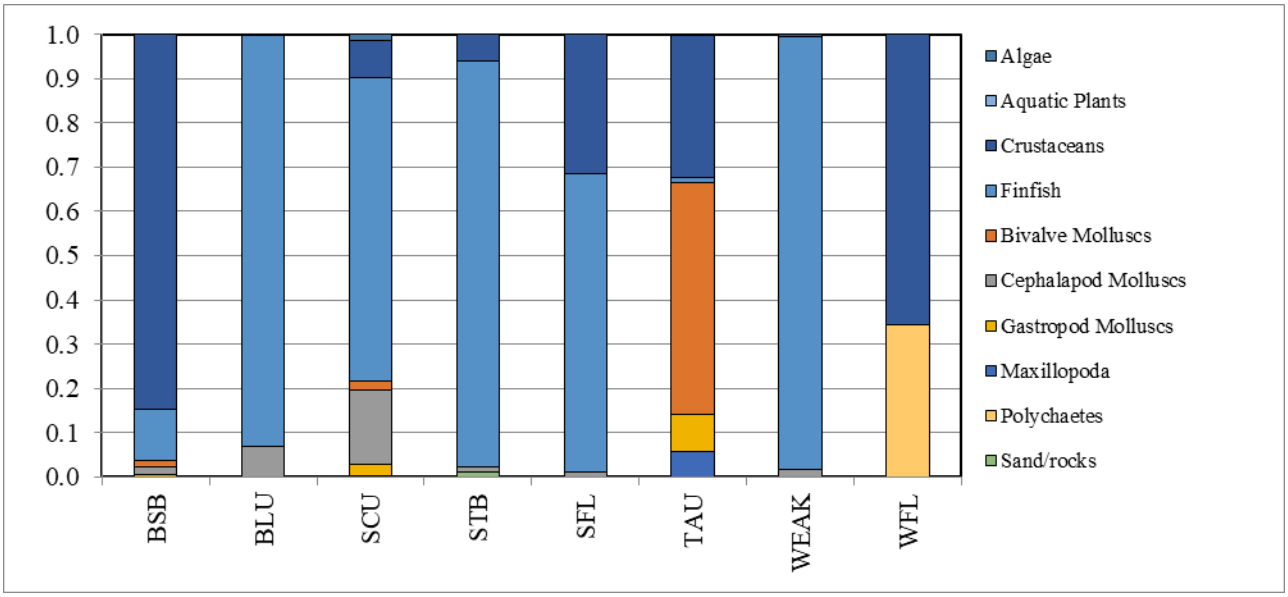


Figure 9B. 2024 Proportional contribution of stomach content types by species; "unidentifiable" contents not included (see Table 4B).

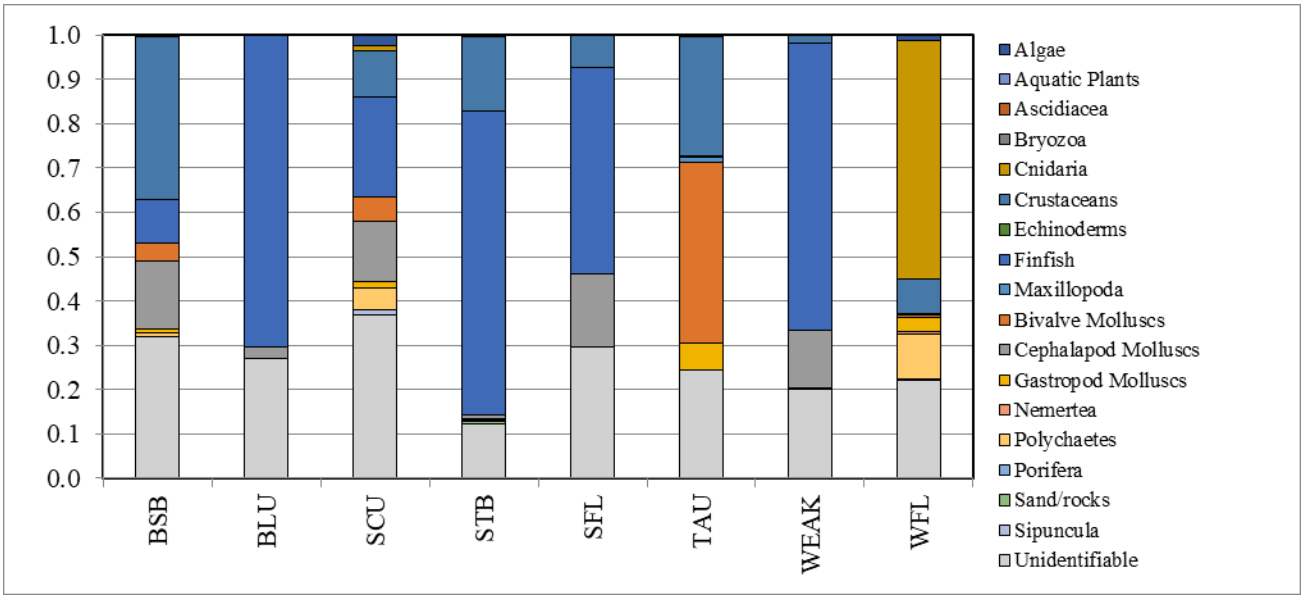


Figure 10A. 2020-2024 Proportional contribution of **all** stomach content types by species (see Table 5A).

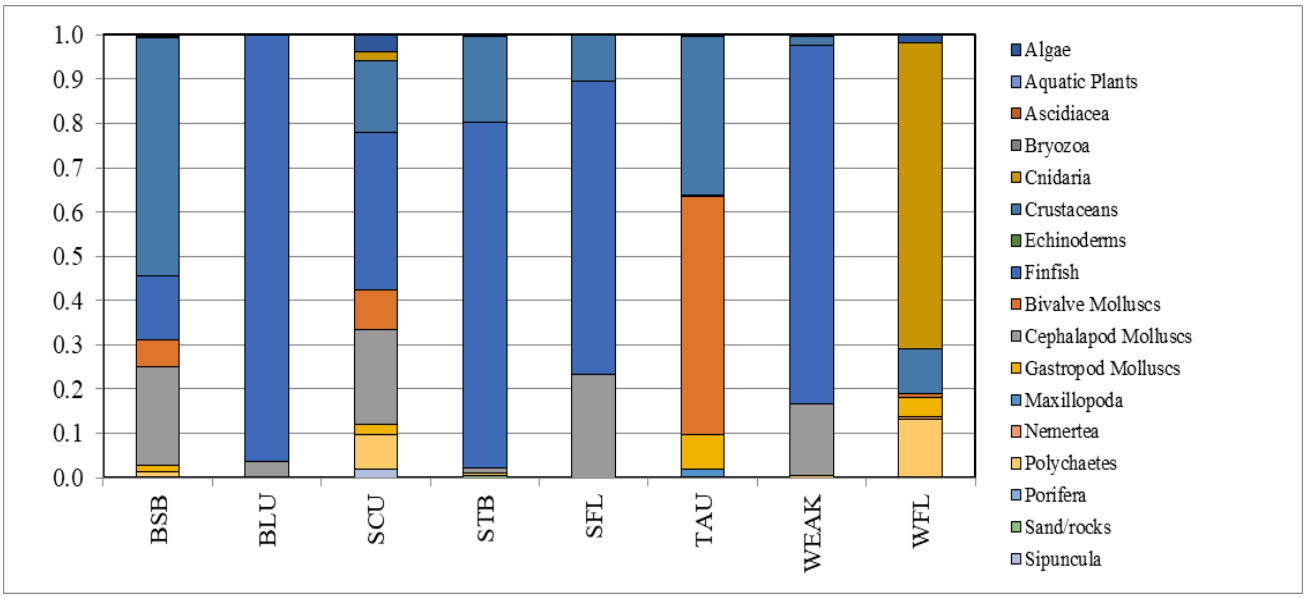


Figure 10B. 2020-2024 Proportional contribution of stomach content types by species; "unidentifiable" contents not included (see Table 5B).

TABLES

Table 1A. Number of ageing structures collected by species in 2024.

Common name	Ageing structure(s)	Target number of ageing structures	Number of ageing structures collected
Black sea bass	Otolith	100	130 otolith
Bluefish***	Otolith	100	93 otolith
Menhaden***	Scale, Otolith	100	138 scale, 138 otolith
Scup	Otolith	100	110 otolith
Striped bass	Scale, Otolith	150 fish/gear type**	239 scale, 64 otolith
Summer Flounder	Otolith	100	113 otolith
Tautog***	Otolith, 1st pelvic	200	105 otolith, 225 pelvic spine
Weakfish***	Otolith	3 fish aged per metric ton landed*	77 otoliths (38 commercial, 39 fishery independent
Winter Flounder	Otolith	NA	2 otolith

*Per ASMFC FMP requirements, 99 commercial lengths and 50 ages required for 2024
**Gear types include floating fish trap and general category
***Required by ASMFC

Table 1B. Number of ageing structures collected by species, 2020-2024.

Common name	Ageing structure(s)	Target number of ageing structures	Number of ageing structures collected
Black sea bass	Otolith	500	719 scale, 312 otolith
Bluefish***	Otolith	500	479 otolith
Menhaden***	Scale, Otolith	500	441 scale, 441 otolith
Scup	Otolith	500	335 scale, 545 otolith
Striped bass	Scale, Otolith	750 fish/gear type**	1224 scale, 175 otolith
Summer Flounder	Otolith	500	263 scale, 446 otolith
Tautog***	Operculum, Otolith, 1st pelvic	1000	755 operculum, 1151 otolith, 1271 1st pelvic spines
Weakfish***	Otolith	3 fish aged per metric ton landed*	229 otolith (101 commercial, 128 fishery independent)
Winter Flounder	Otolith	NA	186 scale, 198 otolith

*Per ASMFC FMP requirements
**Gear types include floating fish trap and general category
***Required by ASMFC

Table 2A. Gear type sampled for each species collected in 2024 (FFT=Floating Fish trap).

Common name	**Gear Type**
Black sea bass	Otter Trawl, Fish Pot, Hook and Line
Bluefish	Otter Trawl, Hook and Line
Menhaden	Otter Trawl, FFT
Scup	Otter Trawl, Fish Pot, Hook and Line
Striped bass	Otter Trawl, Hook and Line, FFT, Fyke Net
Summer Flounder	Otter Trawl, Fish Pot, Hook and Line, Commercial unknown
Tautog	Otter Trawl, Hook and Line, Fish Pot
Weakfish	Otter Trawl, FFT, Commercial unknown
Winter Flounder	Otter Trawl

Table 2B. Gear type sampled for each species, 2020-2024 (FFT=Floating Fish Trap).

Common name	**Gear Type**
Black sea bass	Otter Trawl, Crab Pot, Fish Pot, Hook and Line
Bluefish	Otter Trawl, Hook and Line, Gillnet, FFT, Commercial unknown
Menhaden	Otter Trawl, FFT, Purse Seine
Scup	Otter Trawl, Fish Pot, Hook and Line
Striped bass	Otter Trawl, Hook and Line, FFT, Fyke Net, Beach Seine
Summer Flounder	Otter Trawl, Fish Pot, Hook and Line, Commercial unknown
Tautog	Otter Trawl, Hook and Line, Fish Pot, Fyke Net, Beach Seine, Spear
Weakfish	Otter Trawl, FFT, Gillnet, commercial unknown
Winter Flounder	Otter Trawl

Table 3A. 2024 Summary of stomach content sampling by species (* Sand/rocks and "unidentifiable" stomach contents not included in number of prey taxa).

SPECIES	Target # Stomachs	# Stomachs sampled	# PREY TAXA*
Black Sea Bass	40	60	5
Bluefish	40	58	3
Scup	40	55	7
Striped Bass	40	64	7
Summer Flounder	40	76	3
Tautog	40	44	6
Weakfish	40	51	3
Winter Flounder	40	2	2

Table 3B. 2020-2024 Summary of stomach content sampling by species (* Sand/rocks and "unidentifiable" stomach contents not included in number of prey taxa)

SPECIES	Target # Stomachs	# Stomachs sampled	# PREY TAXA*
Black Sea Bass	200	541	10
Bluefish	200	264	5
Scup	200	235	10
Striped Bass	200	175	10
Summer Flounder	200	281	6
Tautog	200	225	14
Weakfish	200	189	5
Winter Flounder	200	105	10

Table 4A. 2024 Percent (%) contribution of **all** stomach content types by species (see Figure 9A).

	BSB	BLU	SCU	STB	SFL	TAU	WEAK	WFL
Algae	0	0.14	0.96	0.01	0	0.23	0	0
Aquatic Plants	0	0.04	0	0.03	0	0	0	0
Ascidiacea	0	0	0	0	0	0	0	0
Bryozoa	0	0	0	0	0	0	0	0
Cnidaria	0	0	0	0	0	0	0	0
Crustaceans	65.12	0	5.48	5.32	12.86	25.11	0.32	39.65
Echinoderms	0	0	0	0	0	0	0	0
Finfish	8.83	75.54	45.30	79.98	27.35	0.95	76.55	0
Bivalve Mollusc	1.09	0	1.32	0	0	40.95	0	0
Cephalopod Mollusc	1.27	5.72	11.20	1.11	0.52	0	1.27	0
Gastropod Mollusc	0.50	0	1.57	0.01	0	6.47	0	0
Maxillopoda	0	0	0	0	0	4.54	0	0
Nematoda	0	0	0	0	0	0	0	0
Nemertea	0	0	0	0	0	0	0	0
Platyhelminthes	0	0	0	0	0	0	0	0
Polychaetes	0	0	0.24	0	0	0	0	20.69
Porifera	0	0	0	0	0	0	0	0
Sand/rocks *	0	0	0	0.96	0	0	0	0
Sipuncula	0	0	0	0	0	0	0	0
Urochordata	0	0	0	0	0	0	0	0
Unidentifiable *	23.18	18.56	33.92	12.58	59.27	21.75	21.86	39.66

Table 4B. 2024 Percent (%) contribution of stomach content types by species; “unidentifiable” stomach contents not included (see Figure 9B).

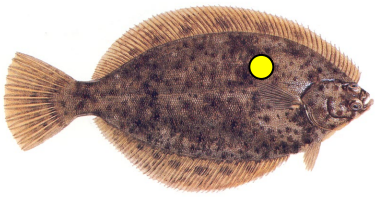
	BSB	BLU	SCU	STB	SFL	TAU	WEAK	WFL
Algae	0	0.17	1.46	0.02	0	0.29	0	0
Aquatic Plants	0	0.05	0	0.04	0	0	0	0
Ascidiacea	0	0	0	0	0	0	0	0
Bryozoa	0	0	0	0	0	0	0	0
Cnidaria	0	0	0	0	0	0	0	0
Crustaceans	84.78	0	8.30	6.08	31.57	32.09	0.41	65.71
Echinoderms	0	0	0	0	0	0	0	0
Finfish	11.49	92.76	68.55	91.49	67.16	1.22	97.96	0
Bivalve Mollusc	1.42	0	2.01	0	0	52.33	0	0
Cephalopod Mollusc	1.66	7.02	16.96	1.27	1.27	0	1.63	0
Gastropod Mollusc	0.65	0	2.37	0.01	0	8.27	0	0
Maxillopoda	0	0	0	0	0	5.80	0	0
Nematoda	0	0	0	0	0	0	0	0
Nemertea	0	0	0	0	0	0	0	0
Platyhelminthes	0	0	0	0	0	0	0	0
Polychaetes	0	0	0.36	0	0	0	0	34.29
Porifera	0	0	0	0	0	0	0	0
Sand/rocks *	0	0	0	1.10	0	0	0	0
Sipuncula	0	0	0	0	0	0	0	0
Urochordata	0	0	0	0	0	0	0	0

Table 5A. 2020-2024 Percent (%) contribution of **all** stomach content types by species (see Figure 10A).

	BSB	BLU	SCU	STB	SFL	TAU	WEAK	WFL
Algae	0.17	0.02	2.37	0.35	0.03	0.18	0.22	1.35
Aquatic Plants	0.20	0.01	0	0.05	0	0.01	0	0
Ascidiacea	0	0	0	0	0	0.04	0	0
Bryozoa	0	0	0	0	0	0.05	0	0
Cnidaria	0	0	1.28	0	0	0	0	53.78
Crustaceans	36.63	0	10.23	16.77	7.30	27.11	1.59	7.84
Echinoderms	0	0	0.03	0	0	0.02	0	0.02
Finfish	9.86	70.27	22.52	68.49	46.44	0.18	64.80	0
Bivalve Mollusc	4.12	0	5.65	0.02	0.01	40.72	0	0.66
Cephalopod Mollusc	15.26	2.58	13.51	1.01	16.46	0	12.99	0
Gastropod Mollusc	0.98	0	1.51	0.05	0	5.99	0	3.37
Maxillopoda	0	0	0	0	0	1.17	0	0
Nematoda	0	0	0	0	0	0	0	0
Nemertea	0	0	0	0	0	0	0	0.47
Platyhelminthes	0	0	0	0	0	0	0	0
Polychaetes	0.80	0	4.92	0.54	0.01	0.10	0.46	10.21
Porifera	0	0	0	0	0	0.01	0	0
Sand/rocks *	0.07	0.04	0	0.38	0	0.12	0	0.02
Sipuncula	0	0	1.23	0	0	0	0	0.12
Urochordata	0	0	0	0	0	0	0	0
Unidentifiable *	31.90	27.08	36.76	12.35	29.74	24.31	19.94	22.16

Table 5B. 2020-2024 Percent (%) contribution of stomach content types by species; “unidentifiable” stomach contents not included (see Figure 10B).

	BSB	BLU	SCU	STB	SFL	TAU	WEAK	WFL
Algae	0.24	0.03	3.74	0.39	0.04	0.24	0.28	1.74
Aquatic Plants	0.29	0.01	0	0.05	0	0.01	0	0
Ascidiacea	0	0	0	0	0	0.06	0	0
Bryozoa	0	0	0	0	0	0.06	0	0
Cnidaria	0.01	0	2.02	0.01	0	0	0	69.09
Crustaceans	53.79	0	16.17	19.14	10.39	35.82	1.98	10.08
Echinoderms	0	0	0.04	0	0	0.03	0	0.03
Finfish	14.48	96.37	35.61	78.14	66.11	0.23	80.94	0
Bivalve Mollusc	6.06	0	8.94	0.02	0.02	53.79	0	0.85
Cephalopod Mollusc	22.41	3.53	21.36	1.16	23.43	0	16.22	0
Gastropod Mollusc	1.44	0	2.39	0.05	0	7.92	0	4.32
Maxillopoda	0	0	0	0	0	1.54	0	0
Nematoda	0	0	0	0	0	0	0	0
Nemertea	0	0	0	0	0	0	0	0.60
Platyhelminthes	0	0	0	0	0	0	0	0
Polychaetes	1.18	0	7.78	0.62	0.02	0.13	0.58	13.11
Porifera	0	0	0	0	0	0.01	0	0
Sand/rocks *	0.10	0.06	0	0.43	0	0.15	0	0.03
Sipuncula	0	0	1.94	0	0	0	0	0.15
Urochordata	0	0	0	0	0	0	0	0



Assessment of Recreationally Important Finfish Stocks in Rhode Island Coastal Waters

Winter Flounder Spawning Stock Biomass Survey

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Federal Aid in Sportfish Restoration
F-61-24

Performance Report: Job 10 March 2025

State: Rhode Island Project Number: F-61-R-24

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

Period Covered: January 1, 2020 – December 31, 2024

Job Number and Title: Job X – Winter Flounder Spawning Stock Biomass (SSB) in Rhode Island Coastal Ponds.

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

Significant Deviations: 2024 was the first year in the time series Point Judith Pond was discontinued from the survey. This was due to unacceptably high survey induced mortality through seal predation.

Summary:

In 1999, the Rhode Island young of the year coastal pond and embayment project (Job 3) was expanded to support an adult winter flounder (*Pseudopleuronectes americanus*) monitoring and tagging project. This winter phase of the seasonal coastal pond juvenile flounder work presented an opportunity to collect data on the adult spawning populations of winter flounder in Rhode Island south shore coastal ponds. A commercial fisherman who had historically fished for winter flounder in the coastal ponds agreed to assist the Rhode Island Marine Fisheries staff to operationalize the survey.

From 1999 through 2011 only Point Judith Pond and, intermittently, Potter Pond were sampled as part of this survey. As adult winter flounder abundance in the Point Judith system declined to all-time lows, Ninigret Pond (also known as Charlestown Pond) was added to the survey from 2012 through 2015 in partnership with the US Environmental Protection Agency. Ninigret Pond was added to the survey again in 2019 and will continue to be sampled in the future. Point Judith Pond was discontinued as a sampled system at the end of the 2023 sampling year due to extremely high survey related mortality of winter flounder by seal predation. Rates of seal related mortality of survey captured winter flounder remain low in the other survey systems for the time being. There are eighteen stations where data has been collected over the course of the survey, with seven found in Point Judith Pond, four in Potter Pond, and seven in Ninigret Pond (Figure 1). The survey runs from approximately December through April annually. Fyke net fishing gear is deployed depending on ice cover in the ponds and the gear is generally hauled on three to seven-night sets.

Additional Research:

Beginning in the winter of 2021/2022 a passive acoustic tag monitoring project was initiated in Ninigret Pond. An array of 12 acoustic receivers was deployed throughout Ninigret Pond to detect locations and movements of tagged winter flounder and any other tagged species

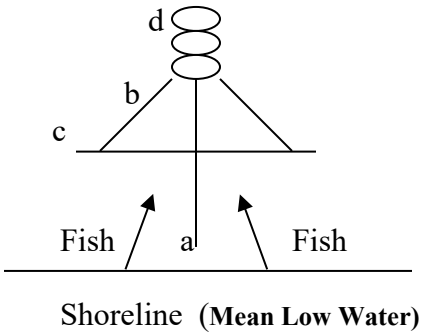
that may enter the pond. A total of 30 winter flounder were tagged with acoustic tags in 2024. In total 85 winter flounder were acoustically tagged from 2021/22 through 2023/24. The winter of 2024/25 is the final winter these tagged fish will be monitored using the Ninigret Pond array based on the battery life of the tags used in the study.

Beginning in the winter of 2023/2024 fin clips began to be collected from all caught winter flounder to support potential genetics studies including, but not limited to, close kin mark-recapture studies. Fin clips are cheap to collect and add relatively minimal effort to field work, particularly when dry-stored.

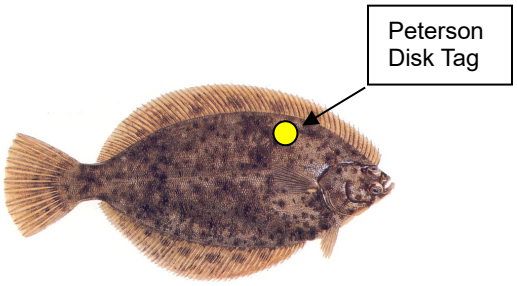
Methods and Materials:

Fyke nets are a passive fixed fishing gear, attached perpendicular to the shoreline at mean low water. A vertical section of net wall referred to as a leader directs fish toward the body of the net where the catch is funneled through a series of parlors, eventually being retained in the terminal parlor. The wings of the net accomplish further direction of the catch. Adult winter flounder are tagged using Peterson Disk Tags (all years) and/or Vemco V13 acoustic tags (2021/22 through 2023/24).

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



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



Fieldwork:

From 2020 through 2023 two to three nets were concurrently set in Point Judith Pond and/or Potter Pond and two to three nets were set concurrently in Ninigret Pond and in 2024 two to three nets were concurrently set in Potter Pond and two to three nets were set concurrently in Ninigret Pond, for a total of four to six concurrently set nets between the three systems. A total of 480 fyke net sets were conducted from 2020 through 2024 (Tables 1-3). 124 fyke net sets were conducted in 2024, which was the greatest effort in the time series. Nets were tended every two to nine days depending on the anticipated size of the catch and weather conditions. Higher

catches increase density inside the net and attract predators such as cormorants, seals, and otters thus potentially increasing survey-induced mortality.

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

Fish of legal size (30.48 cm) or recruits to the fishery are tagged and released away from the capture area. Tagging and recapture data is presented in Tables 1-3.

Fisheries:

Winter flounder were historically a commercially and recreationally important species to the State of Rhode Island. From 1999-2023, commercial landings of winter flounder in Rhode Island averaged 259 metric tons and had an average value of just below $900,000 dollars annually (Table 4, Figure 2). Throughout the time series, landings have shown an overall and precipitous downward trend. Commercial landings in 2023 (~$36,600) were the lowest in the time series for the second consecutive year. Recreational harvest as monitored through NOAA Fisheries' Marine Recreational Information Program (MRIP) has declined rapidly throughout the study period and remains extremely low through 2024 (Table 5, Figure 3) (NMFS 2023 commercial landings query and MRIP database through 2024). Note that due to the rarity of the MRIP Access Point Angler Intercept Survey encountering anglers who have captured winter flounder since 2005, the percent standard error (PSE) for these data points is commonly very high and MRIP does not support the use of these estimates (Table 5).

The Northeast Fisheries Science Center and Atlantic States Marine Fisheries Commission 2022 SNE/MA management track stock assessment update report indicates the stock is not overfished and overfishing is not occurring (NOAA 2022). This is a change in stock status compared to previous assessments and is due to a change in the years of recruitment estimates used to estimate biological reference points. Instead of drawing upon the entire time series of recruitment estimates, the projections now only use recruitment estimates from the past 20 years (2002-2021). The SNE/MA winter flounder stock is most likely not capable of achieving the high levels of recruitment prior to 2000; therefore, using a truncated recruitment time series of only the past 20 years better reflects the current state of the stock. Spawning stock biomass in 2021 was estimated to be 3,353 metric tons, which is 101% of the biomass target and 202% of the biomass threshold. The 2022 fishing mortality was estimated to be 0.061 which is 23% of the overfishing threshold.

Spawning Behavior:

Winter flounder enter the Rhode Island south shore coastal pond systems to spawn in the early part of winter and engage in spawning activity from approximately December through May annually (Figures 4-5). Spawning and egg deposition takes place on sandy bottoms and algal accumulations (Collette and Klein-MacPhee 2002). Winter flounder eggs are non-buoyant and clump together on these substrates. Survey data indicate that peak-spawning activity takes place during the month of February, however this appears to vary annually. Figures 4 (all survey years), 5 (2020-2024), and 6 (2024) display the ratios of spawning stages of winter flounder captured by month.

Sex ratios throughout the time series tend to skew slightly female dominant (Figures 7-9). Many decades ago similar observations were made in Green Hill Pond, a neighboring coastal pond (Saila 1961), and in Narragansett Bay (Saila 1962).

Results:

A total of 480 fyke net sets were conducted from 2020 through 2024 (Tables 1-3). The total number of winter flounder sampled during the 2020 through 2024 surveys was 1,400. Sizes ranged from 12.6 cm to 49.6 cm from 2020 through 2024, with the five largest individuals all caught in 2021 and 2022 in Ninigret Pond (Figures 10-14).

A total of 124 fyke net sets were conducted in 2024 (Tables 1-3). The total number of winter flounder sampled during the 2024 survey was 500. This was a 59% increase of total catch from the 2023 survey. Sizes ranged from 12.6 cm to 46.2 cm in 2024 (Figures 9-13). The CPUE across all ponds in 2024 was 4.0 fish/net haul. 2024 was the first year Point Judith Pond was not sampled in this survey (Figure 15). 2024 adult winter flounder CPUE in Potter Pond was 3.9 fish per net haul (Figure 16). This value is above the time series median. 2024 winter flounder CPUE in Ninigret Pond was 4.5 fish per net haul (Figure 17).

From 2020 through 2024, a total of 9 mature fish were tagged in Point Judith Pond, 106 mature fish were tagged in Potter Pond, and 411 were tagged in Ninigret Pond. Sixty six (66) tagged winter flounder were recaptured from 2020 through 2024 by both research surveys and commercial harvesters.

In 2024, a total of 43 mature fish were tagged in Potter Pond and 115 were tagged in Ninigret Pond. Twelve tagged winter flounder were recaptured in 2024 by both research surveys and commercial harvesters. In addition to the Peterson disc tags, 30 Vemco V13 acoustic tags were mounted on winter flounder in Ninigret Pond in 2024. All 30 of these individuals were monitored throughout the season on the acoustic receiver array. Tagged fish utilized all parts of Ninigret Pond including the far west basin. The majority of acoustic tagged fish from 2021/22 exited the Ninigret Pond Breachway in May (Figure 18).

Discussion:

Low catch rates in all systems surveyed have been observed in the recent decade of the adult coastal pond survey. CPUE trends indicate that despite both commercial and recreational harvest limits put in place to reduce mortality, localized coastal pond winter flounder populations are not recovering. Continued sampling in the Potter Pond, and Ninigret Pond systems is necessary to monitor these trends. Extremely low catch rates and seal interactions in Point Judith Pond has made sampling effort in that pond unsustainable and was not continued in 2024. A summary manuscript was published in 2024 on this survey's findings from over 20 years of sampling Point Judith Pond (Balouskus et al. 2024). Increased sampling effort conducted in 2024 revealed similar population trends to those seen in the past few years.

Recommendations:

Continuation of all adult winter flounder work statewide in order to make accurate connections between coastal ponds, Narragansett Bay, and Rhode Island/Block Island Sound winter flounder stocks is necessary. In addition, the acoustic tagging survey in the Ninigret Pond System will be concluding in 2024 in order to track local adult winter flounder abundance and use the catch as a source of taggable animals to gain information on population size, mortality, and year class structure. The importance of returning tag data from the commercial trawl/gill net

fleet in Rhode Island Sound and Block Island Sound should be stressed in order to facilitate continued reporting of recaptured fish. Utilization of the Division's Marine Fisheries listserv is recommended to alert commercial and recreational anglers to the continued efforts of this survey.

Due to moratoriums on commercial and recreational fishing in Point Judith Pond and Potter Pond, it is recommended that additional effort be placed in Ninigret Pond and potentially another system moving forward to increase the likelihood of tag returns for fish within those systems. Additionally, the past several years has seen higher mortality rates of winter flounder within fyke nets in Point Judith Pond compared with the other sampled systems. This is likely due to predation by seals and otters. In an effort to reduce survey related mortalities, sampling effort will eliminated in Point Judith Pond moving forward.

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Table 1 – Winter flounder tagging/recapture totals in Point Judith Pond by year. Number recaptured indicates the number of tagged fish that were recaptured in that year, regardless of what year that tagged fish had been released. Point Judith Pond was not sampled in 2024 and is not planned to be sampled in the future due to seal predation.

Year	Number of Fyke Sets	Number Caught	Number Tagged	Number Recaptured
1999	39	1059	313	51
2000	14	350	189	43
2001	22	540	354	59
2002	27	282	165	7
2003	27	160	87	4
2004	23	102	64	13
2005	27	252	116	10
2006	44	410	89	6
2007	31	121	35	3
2008	19	39	14	0
2009	26	62	0	0
2010	24	85	21	1
2011	23	60	5	0
2012	16	32	11	0
2013	14	12	0	0
2014	14	11	1	0
2015	7	10	4	0
2016	11	6	1	0
2017	1	0	0	0
2018	3	0	0	0
2019	12	8	0	0
2020	33	53	3	0
2021	20	9	3	0
2022	9	3	2	1
2023	11	3	1	0
2024	0	0	0	0
Total	**497**	**3669**	**1478**	**198**

Table 2 – Winter flounder tagging/recapture totals in Potter Pond by year. Number recaptured indicates the number of tagged fish that were recaptured in that year, regardless of what year that tagged fish had been released.

Year	Number of Fyke Sets	Number Caught	Number Tagged	Number Recaptured
1999	19	244	20	1
2000	10	67	13	2
2001	0	0	0	0
2002	0	0	0	0
2003	0	0	0	0
2004	0	0	0	0
2005	0	0	0	0
2006	0	0	0	0
2007	0	0	0	0
2008	0	0	0	0
2009	0	0	0	0
2010	0	0	0	0
2011	2	8	6	0
2012	5	9	3	0
2013	5	10	5	0
2014	3	3	2	0
2015	7	46	10	0
2016	2	8	1	0
2017	3	8	2	0
2018	3	35	5	0
2019	4	5	4	0
2020	14	14	8	2
2021	36	92	35	0
2022	29	49	12	0
2023	34	30	8	1
2024	56	218	43	3
Total	**232**	**846**	**177**	**9**

Table 3- Winter flounder tagging/recapture totals in Ninigret Pond by year. Number recaptured indicates the number of tagged fish that were recaptured in that year, regardless of what year that tagged fish had been released.

Year	Number of Fyke Sets	Number Caught	Number Tagged	Number Recaptured
2012	19	113	98	10
2013	21	146	109	11
2014	14	33	33	4
2015	16	143	67	4
2016	0	0	0	0
2017	0	0	0	0
2018	0	0	0	0
2019	5	34	17	0
2020	16	103	6	3
2021	40	121	79	0
2022	53	140	87	7
2023	69	282	124	17
2024	68	283	115	9
Total	**321**	**1398**	**735**	**65**

Table 4 - Commercial landings and value of winter flounder in Rhode Island by year from 1999-2023.

Year	Landings (metric tons)	Value (millions of dollars)
1999	525	1.4
2000	813.1	1.8
2001	658.5	1.4
2002	602	1.5
2003	470.6	1.2
2004	394.5	1
2005	306.4	0.97
2006	586.4	2.5
2007	530.1	2.4
2008	289.3	1.3
2009	140.2	0.49
2010	34.1	0.15
2011	37.9	0.13
2012	20.1	0.09
2013	181.7	0.6
2014	206.2	0.94
2015	167.4	0.74
2016	135.7	0.82
2017	135.8	0.9
2018	86.7	0.58
2019	53.1	0.37
2020	41.9	0.19
2021	30.6	0.18
2022	13.7	0.08
2023	8.9	0.04
Average	**258.8**	**0.87**

Table 5 - MRIP Estimated Recreational Harvest for winter flounder in Rhode Island. Results from this query for 1999-2022 contain estimates resulting from the full application of both the Access Point Angler Intercept Survey (APAIS) and Fishing Effort Survey (FES) calibration. PSE values greater than 50 indicate a very imprecise estimate. Results display harvest (Type A + B1). Values from 2020 are 100% contributed from imputed data. '*' indicates no data available.

Year	Harvest (A+B1) Total Weight (lbs)	PSE
1999	196,351	25
2000	96,789	30.7
2001	155,171	31.6
2002	43,058	29
2003	38,300	49.1
2004	20,544	47.5
2005	103	61.5
2006	65	73.5
2007	1,321	99.1
2008	4,219	105.6
2009	27,455	79.3
2010	4,342	106.3
2011	*	*
2012	*	*
2013	*	*
2014	713	94
2015	91	102.5
2016	3,520	96.2
2017	9,419	105.7
2018	453	68.6
2019	4	99.3
2020	143	64.2
2021	1,952	92.2
2022	52	102
2023	*	*
2024	191	67.2

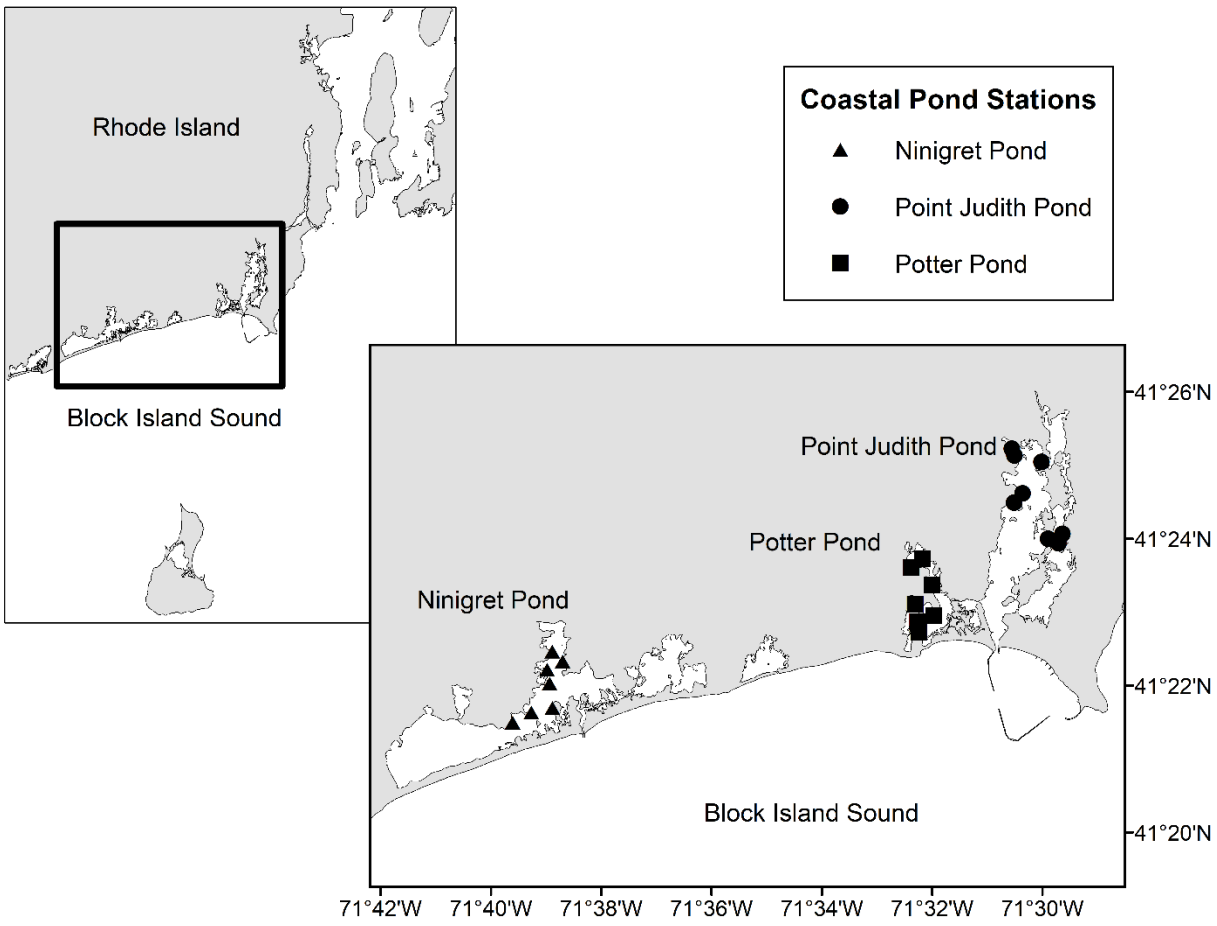


Figure 1 – Fyke net survey locations – 1999 through 2024.

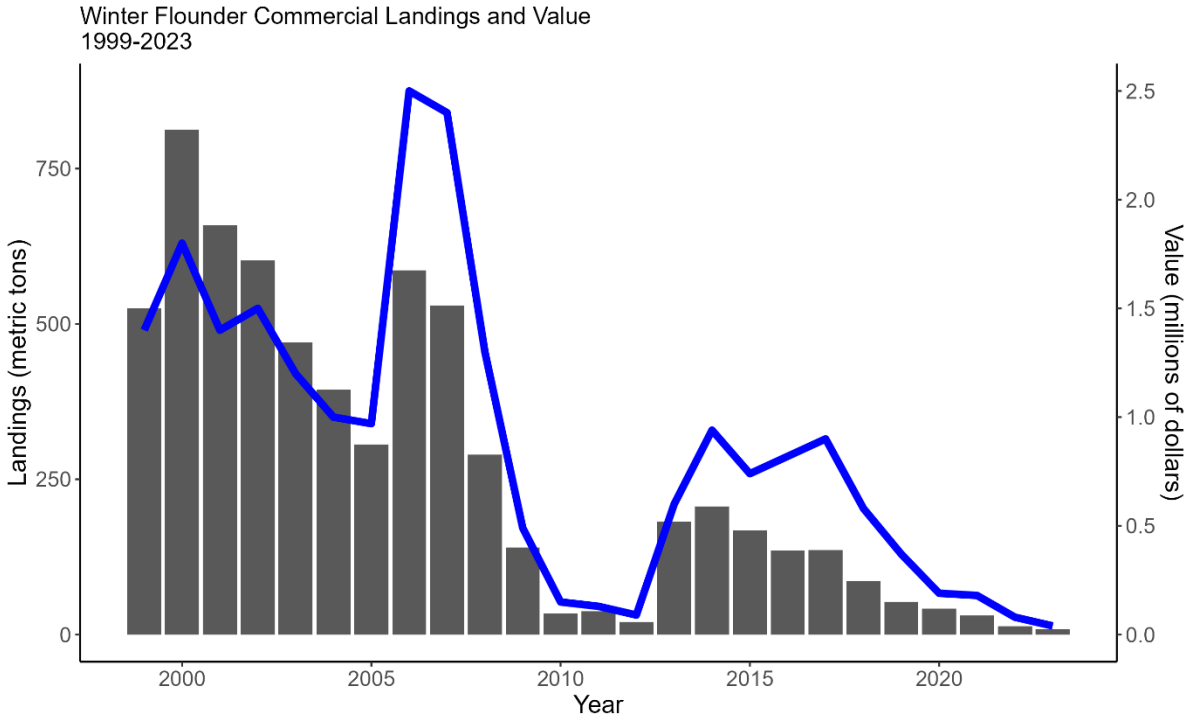


Figure 2 – Winter flounder commercial landings from 1999-2023 in Rhode Island. Grey bars indicate landings (mt) and the blue line indicates value (millions of dollars). Data from public ACCSP Data Warehouse.

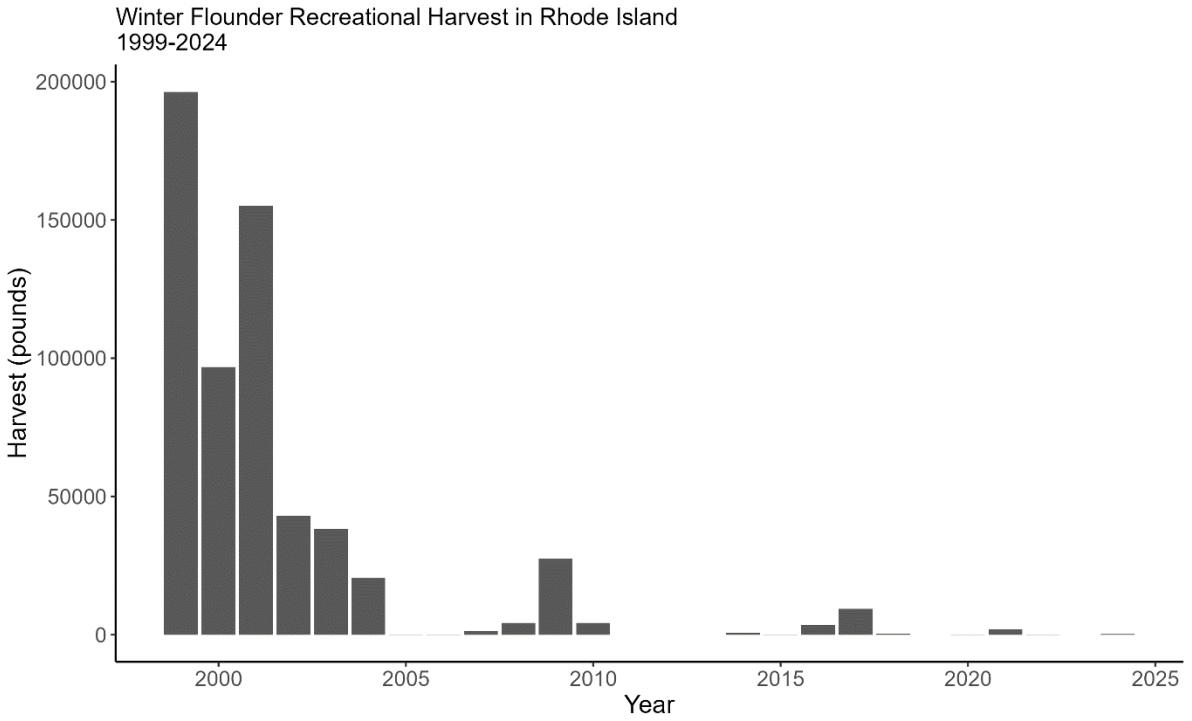


Figure 3 – Winter flounder recreational harvest (Type A + B1 lbs) from 1999 to 2024. Data from public MRIP data query.

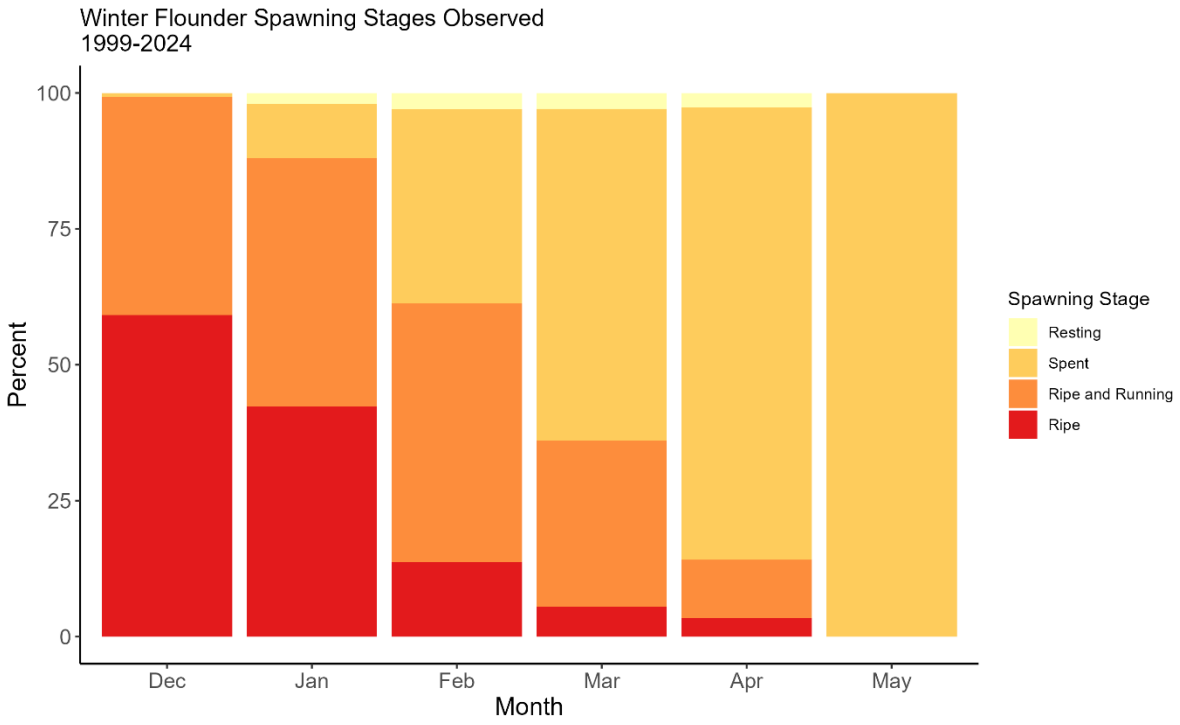


Figure 4 – Winter flounder spawning stages by percentage of caught fish observed by month from 1999-2024 across all surveyed coastal ponds.

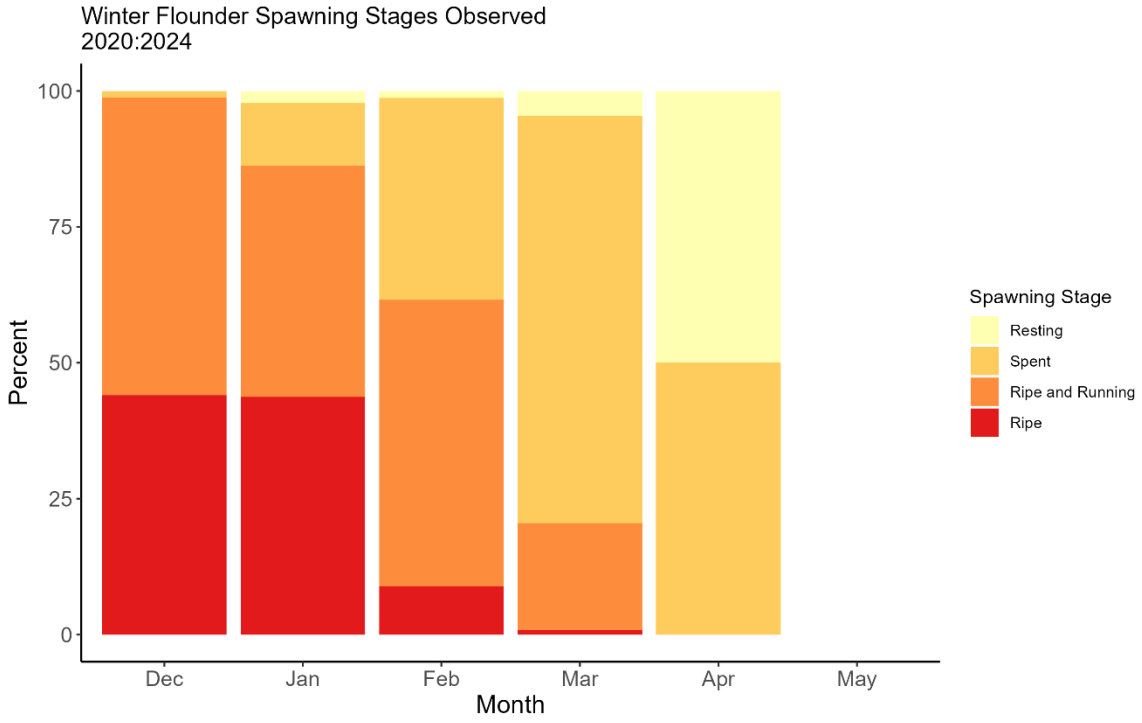


Figure 5 – Winter flounder spawning stages by percentage of caught fish observed by month from 2020-2024 across all surveyed coastal ponds.

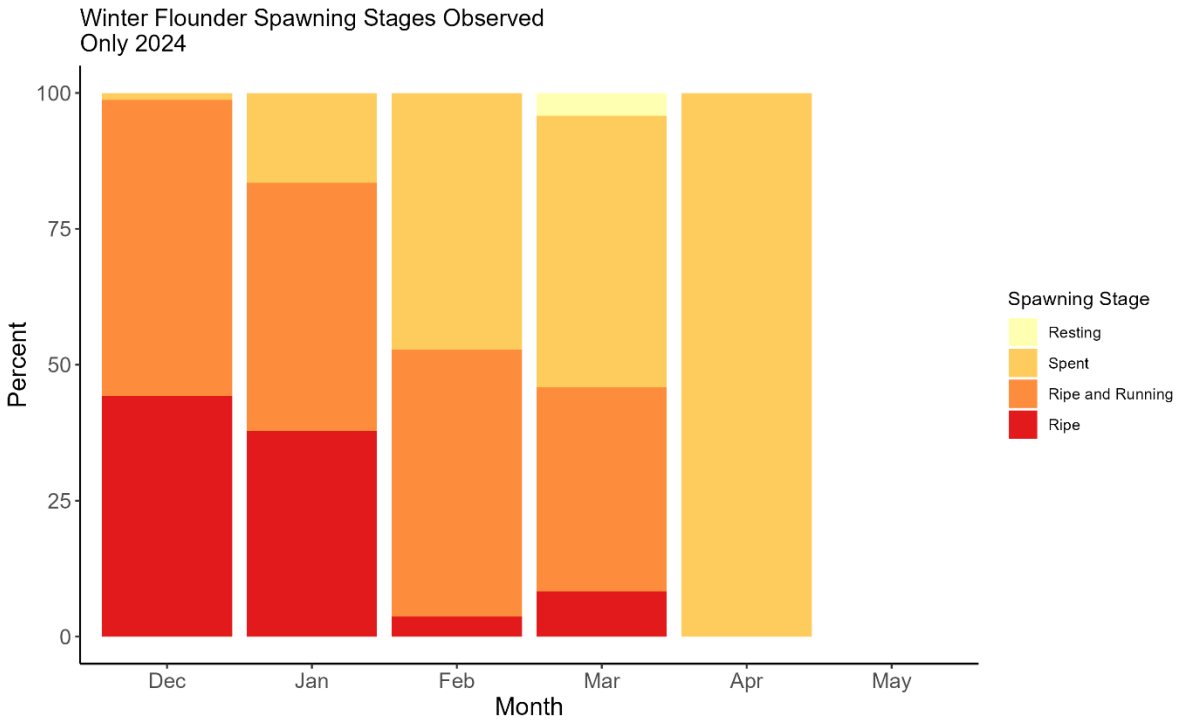


Figure 6 – Winter flounder spawning stages by percentage of caught fish observed by month from 2024 across all surveyed coastal ponds.

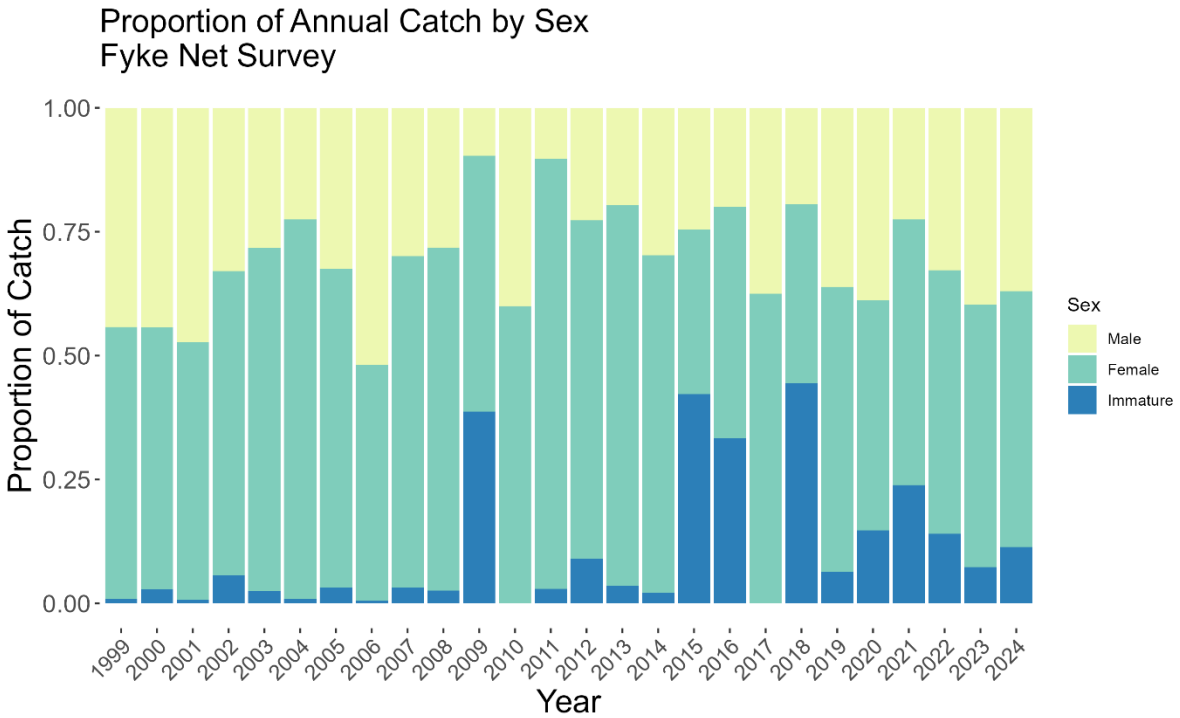


Figure 7 – Winter flounder sex ratio from 1999-2024 across all three surveyed coastal ponds.

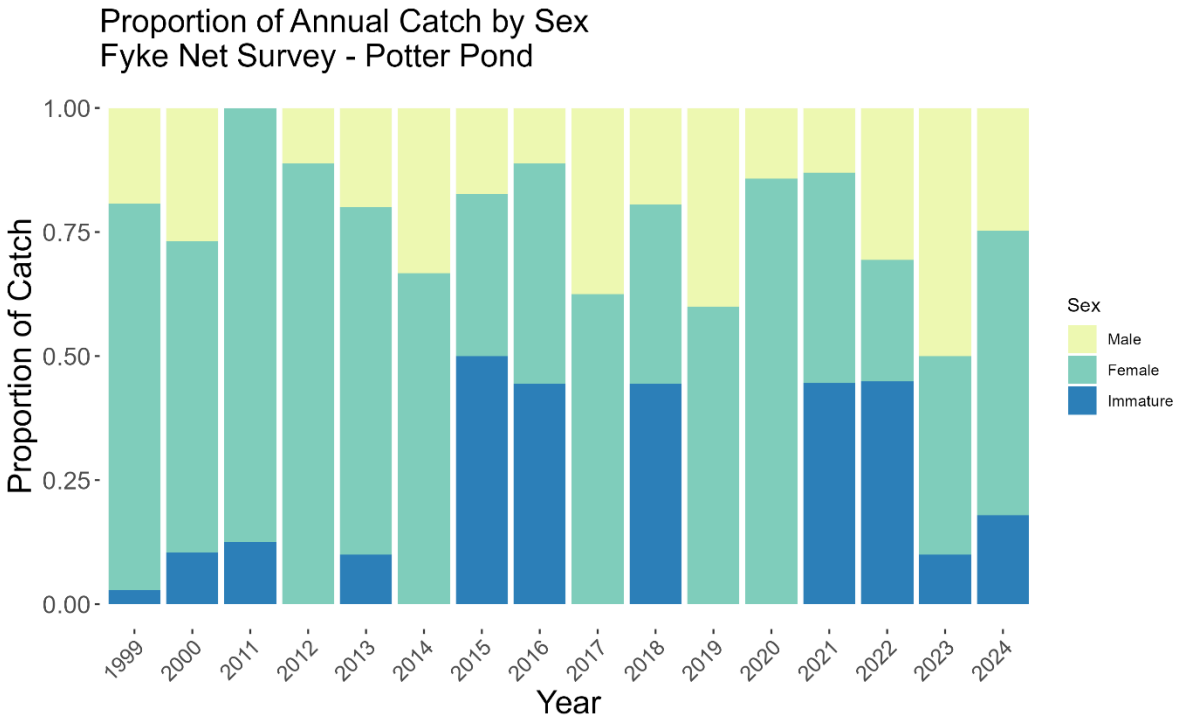


Figure 8 – Winter flounder sex ratio from 1999-2024 (note missing unsampled years on the X-axis) in Potter Pond.

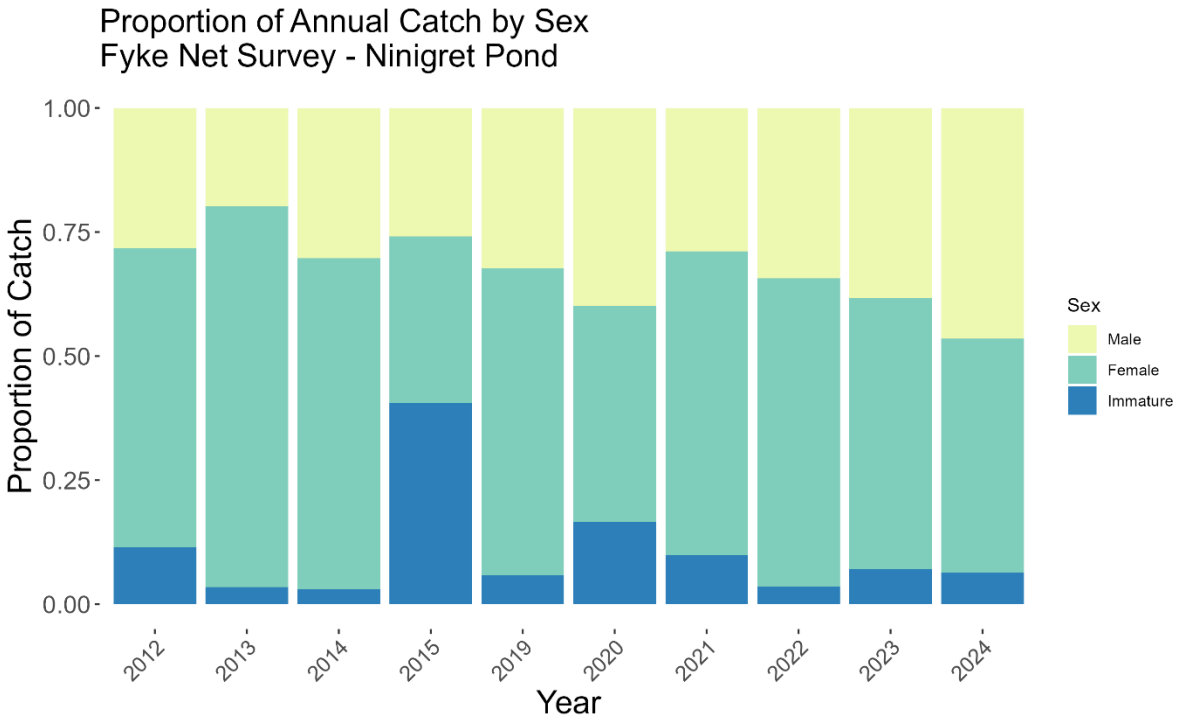


Figure 9 – Winter flounder sex ratio from 2012-2024 (note missing unsampled years on the X-axis) in Ninigret Pond.

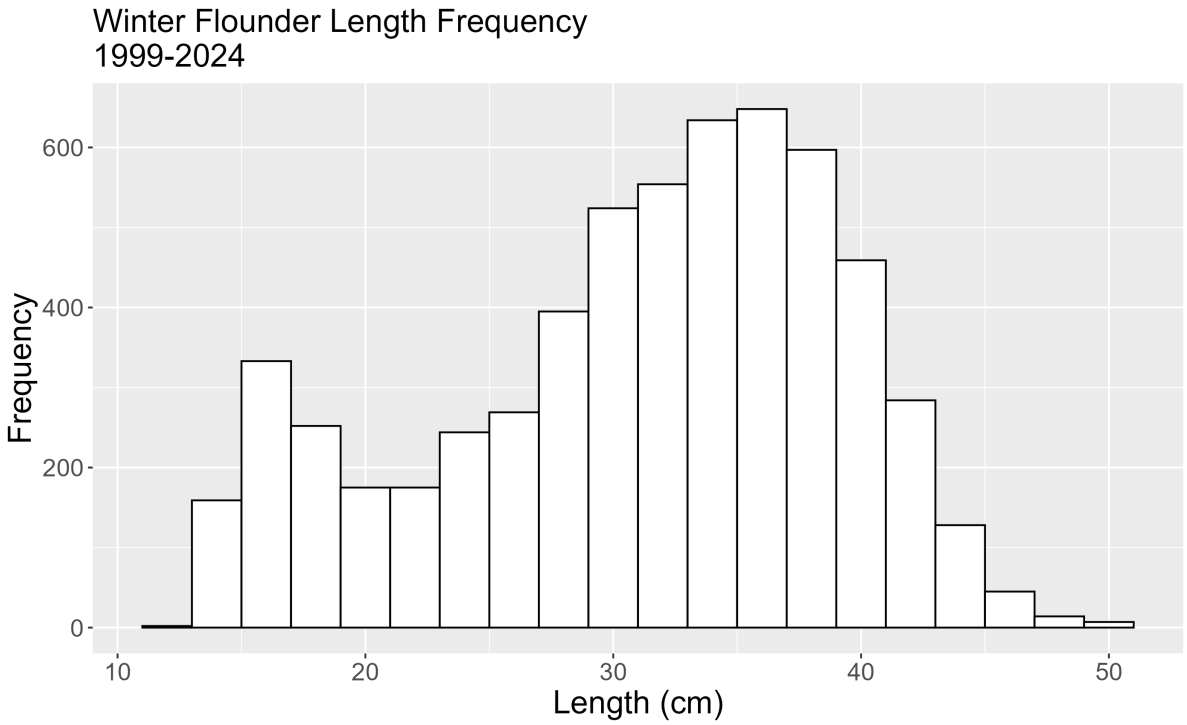


Figure 10 – Winter flounder length-frequency from 1999-2024 across all sampled coastal ponds.

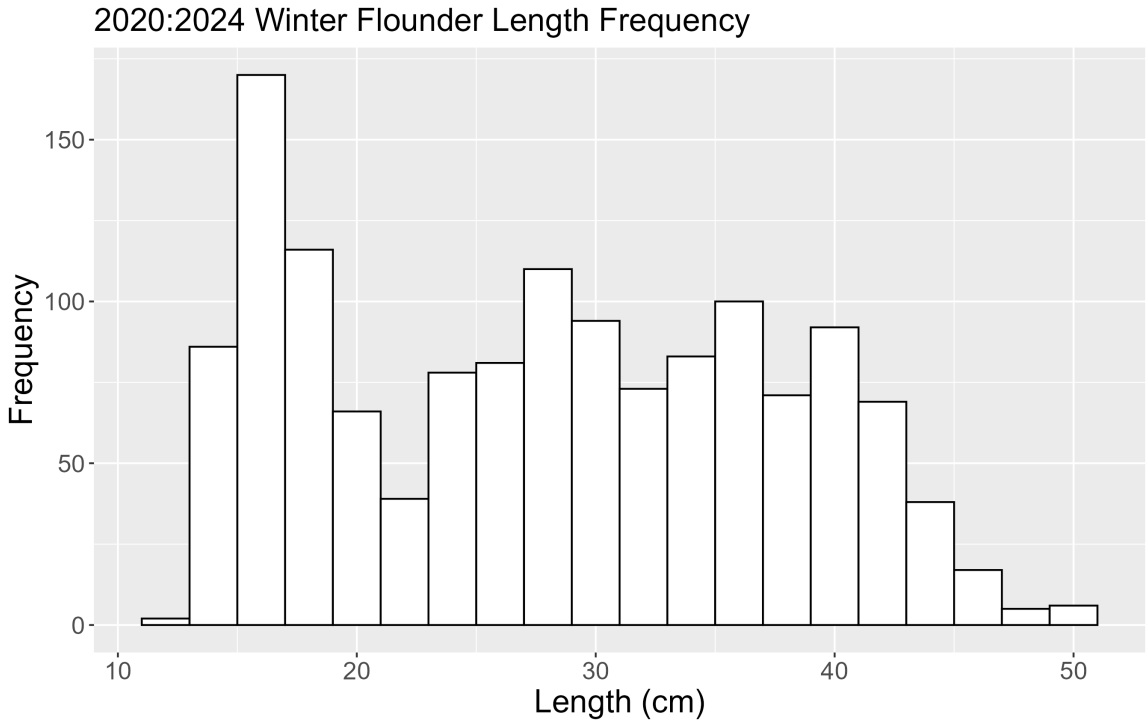


Figure 11 – Winter flounder length-frequency from 2020-2024 across all sampled coastal ponds.

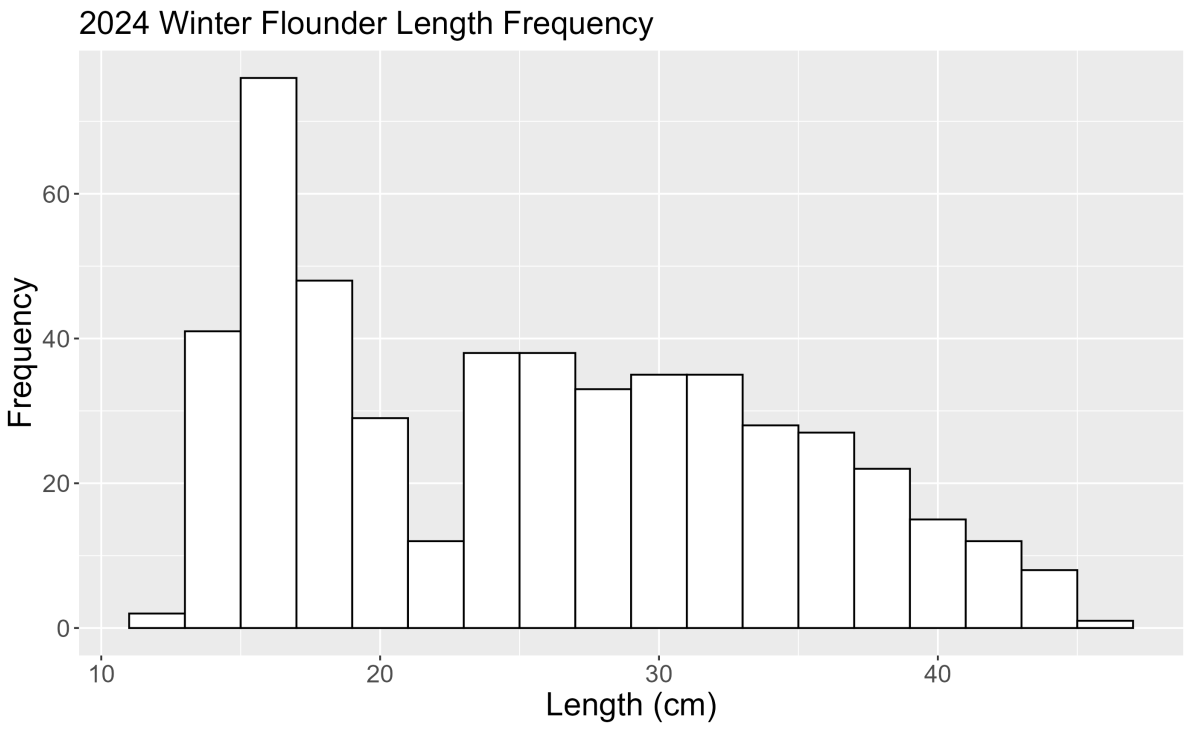


Figure 12 – Winter flounder length-frequency for 2024 survey across all sampled coastal ponds.

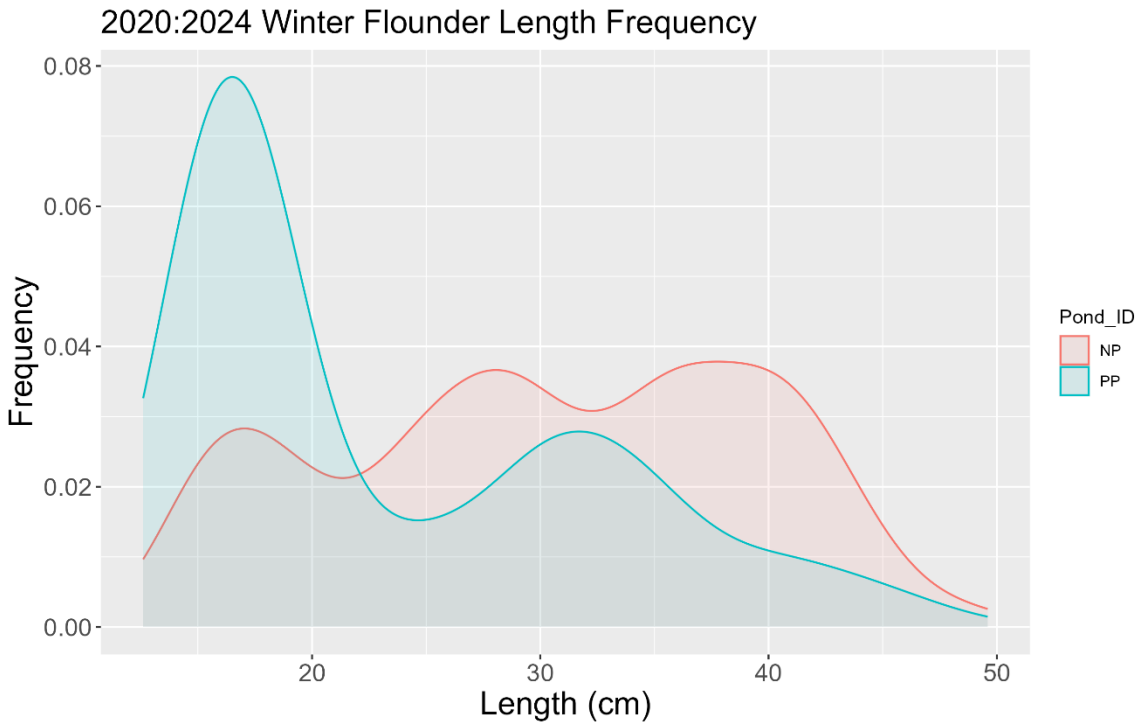


Figure 13 – Winter flounder length-frequency density plot for 2020 through 2024 comparing Potter Pond and Ninigret Pond.

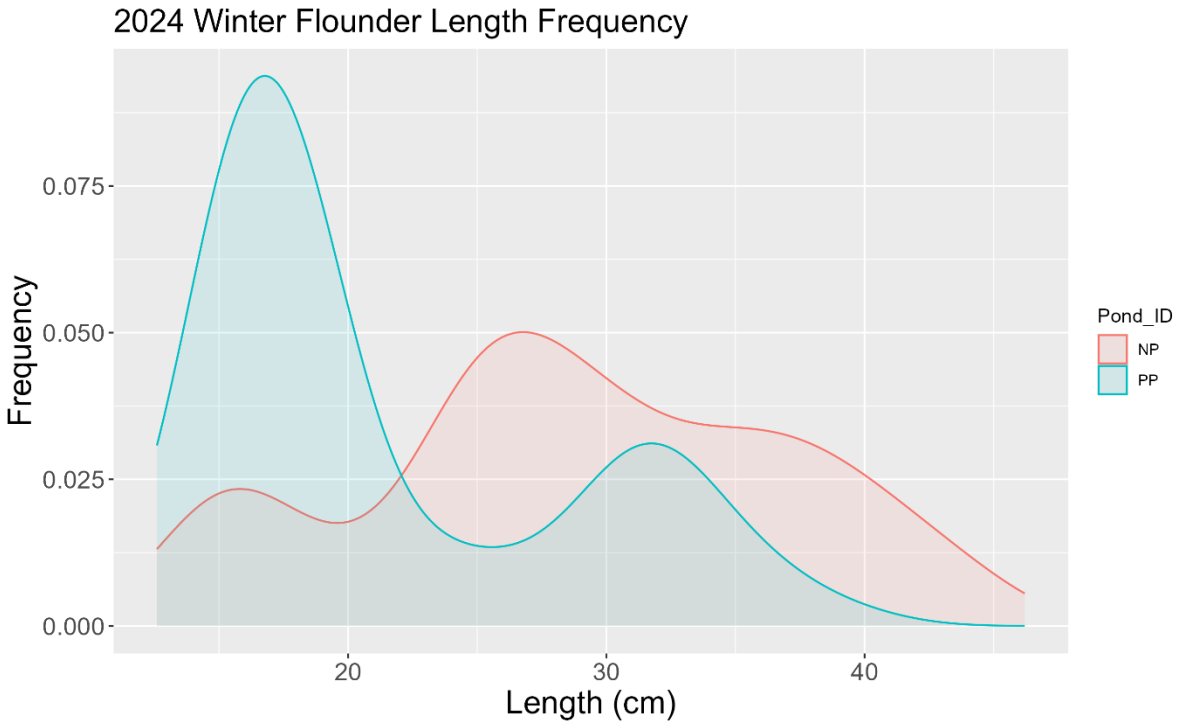


Figure 14 – Winter flounder length-frequency density plot for 2024 comparing Potter Pond and Ninigret Pond.

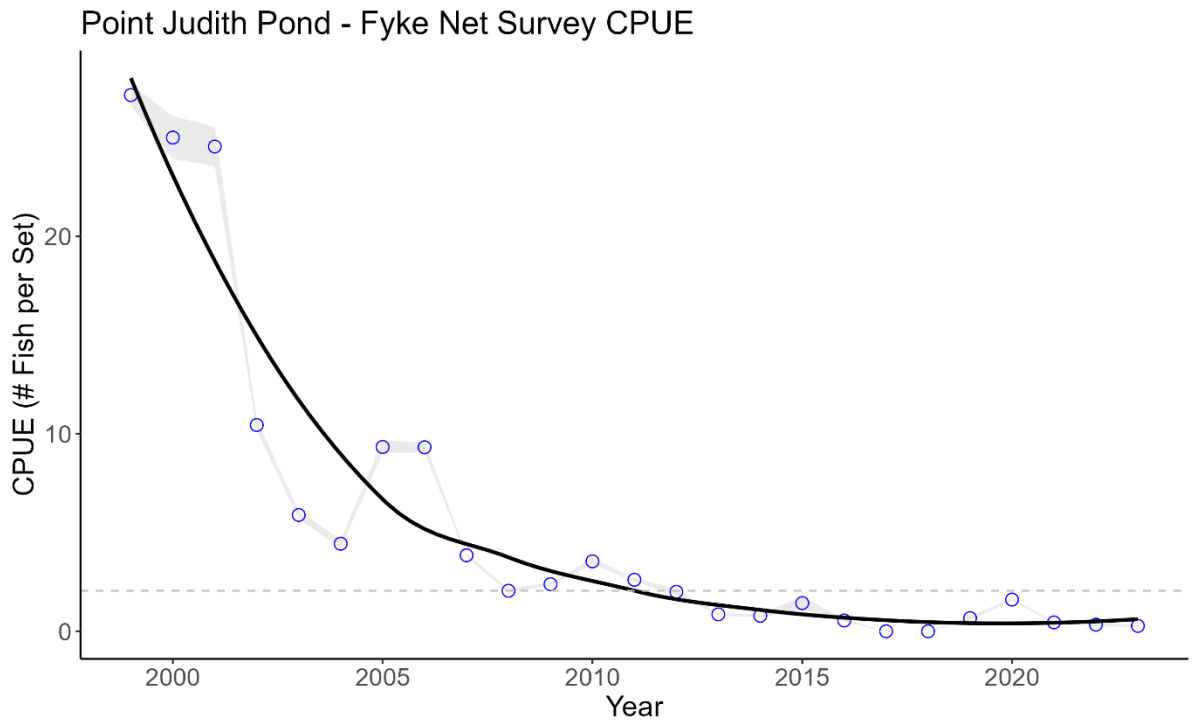


Figure 15 – Winter flounder smoothed abundance index for Point Judith Pond. Gray dashed line is time series median; black line is time series Loess regression fit; and gray shaded area is the standard error around each annual CPUE.

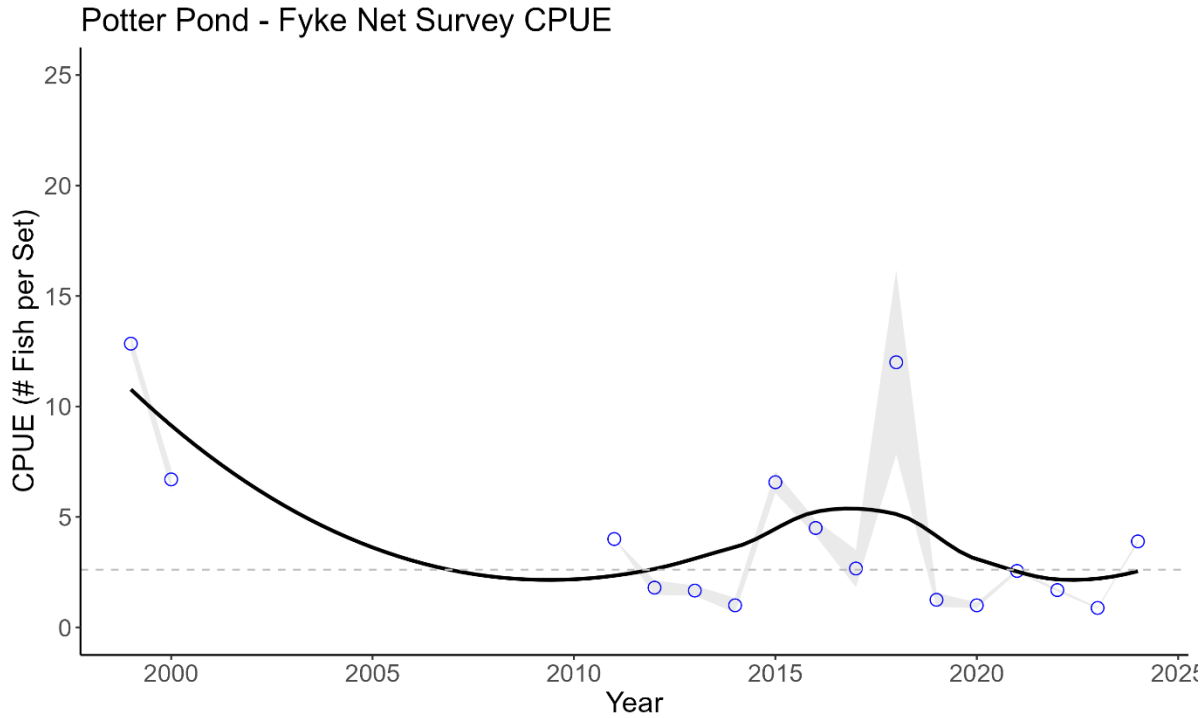


Figure 16 – Winter flounder smoothed abundance index for Potter Pond. Gray dashed line is time series median; black line is time series Loess regression fit; and gray shaded area is the standard error around each annual CPUE.

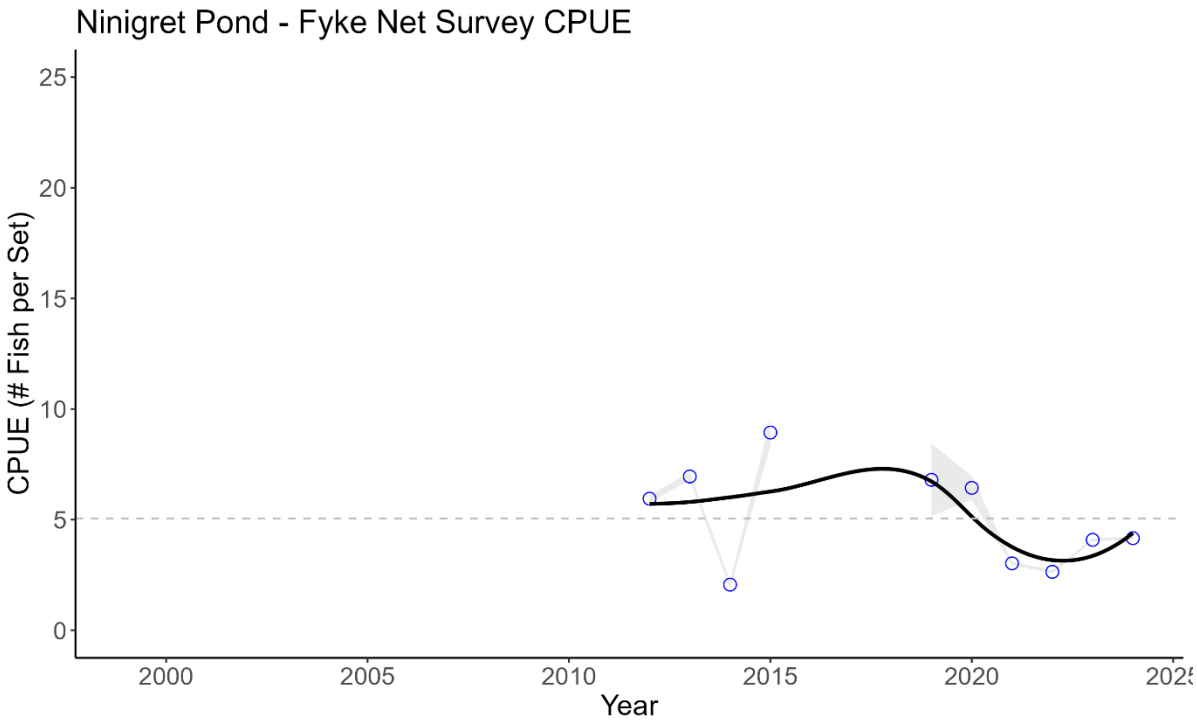


Figure 17 – Winter flounder smoothed abundance index for Ninigret Pond. Gray dashed line is time series median; black line is time series Loess regression fit; and gray shaded area is the standard error around each annual CPUE.

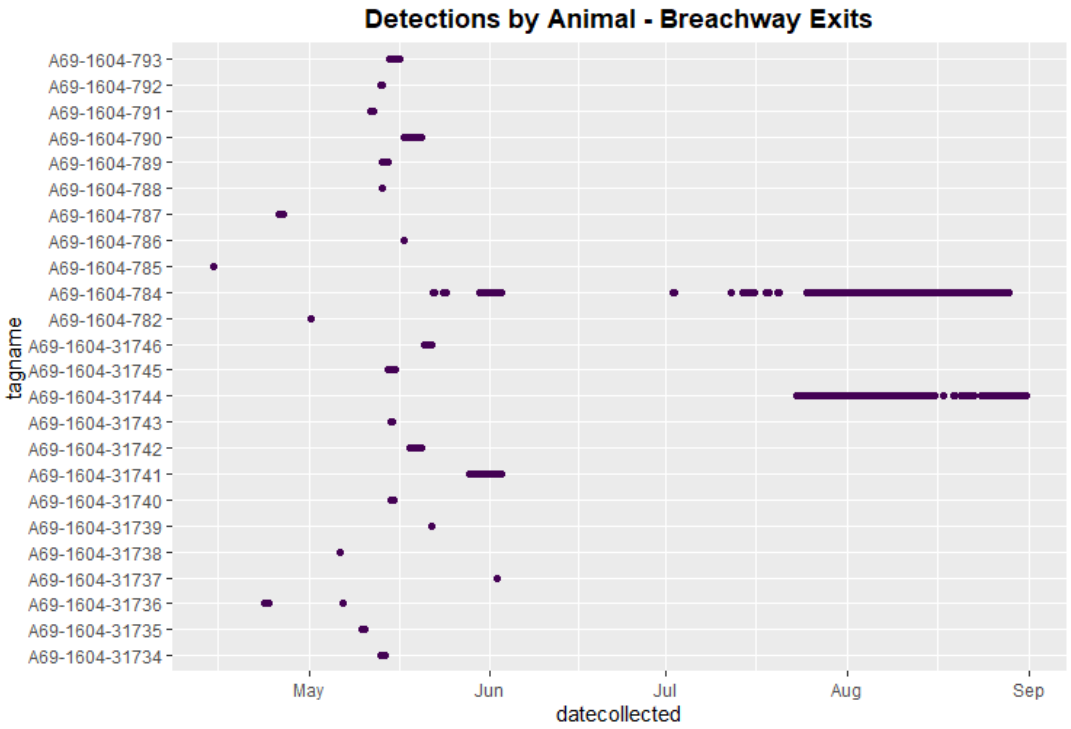


Figure 18 – Acoustic pings of winter flounder at the Ninigret Pond Breachway entrance/exit during the first half of 2022.

Narragansett Bay Atlantic Menhaden Monitoring Program

Nicole Lengyel Costa

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STATE: Rhode Island

PROJECT NUMBER: F-61-R

SEGMENT NUMBER: 22

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

PERIOD COVERED: January 1, 2024 – December 31, 2024

JOB NUMBER 11 TITLE: Narragansett Bay Atlantic Menhaden Monitoring Program

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

SUMMARY: Atlantic menhaden (menhaden) undergo large coastwide migrations each year. After aggregating in the offshore waters of the Mid-Atlantic region during the winter, menhaden migrate west and north stratifying by size and age the further north they migrate (Arenholz, 1991). Menhaden arrive in RI coastal waters beginning in the early spring, and in some years, enter Narragansett Bay in large numbers, where they can reside for varying amounts of time until they begin their southward migration in the fall. During the period when they reside in Narragansett Bay, a number of user groups compete for the resource. Commercial bait companies begin to fish on the schools of menhaden and provide bait for both recreational fishing interests and for the lobster fishery. As well, recreational fishermen access the schools of menhaden directly and use the resource as bait for catching larger sport fish such as striped bass and bluefish. Large numbers of sport fishermen can be seen in their boats surrounding large schools of menhaden throughout the spring and summer using various methods to harvest them (snagging lures, cast nets, dip nets). The migration of menhaden to the north is also one factor which brings these larger sport fish to northern areas, as they are an important food resource for these species (Arenholz, 1991; ASMFC, 2017). During the period when the menhaden resource is within Narragansett Bay and multiple user groups are accessing it, user group conflicts are an inevitable outcome.

To help assuage some of these conflicts, to allow for an amount of the menhaden resource to remain unharvested by commercial interests for use by the recreational community, and to allow a portion of the menhaden resource to remain in Narragansett Bay to provide ecological services, the RI Department of Environmental Management Division of Marine Fisheries (Division) administers a menhaden monitoring program in Narragansett Bay. The program collectively uses sentinel fishery observations (floating fish trap data), spotter flight information with a trained spotter pilot, fishery landings information, computer modeling, and biological sampling information to open, keep track of, and close the fisheries on menhaden as conditions dictate.

TARGET DATE: December 2024

SIGNIFICANT DEVIATIONS: No significant deviations.

RECOMMENDATIONS: Continue spotter flights and data collection to create the estimate of Narragansett Bay Atlantic menhaden biomass. Continue to analyze and provide data for use in the RI menhaden fishery management program.

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

The management structure maintains a biomass threshold of 1.5 million pounds in the Bay, which provides forage for the predatory species of striped bass and bluefish. Prior to the commencement of commercial fishing, the biomass needs to reach 2 million pounds to provide a body of fish for the fishery to remove without dropping below the 1.5 million pound threshold. Once fishing is authorized, the commercial fishery is allowed to remove 50% of the biomass above the 1.5 million pound threshold, leaving the rest for ecological services and for use as bait by recreational fishermen. If the biomass estimates based on the spotter flights drop below the 1.5 million pound threshold, the fishery will close. In addition, if landings by the commercial fishery reach the 50% cap, the fishery closes. Beginning in 2015, DEM adopted a regulation that opens the fishery annually on September 1st in the lower portion of Narragansett Bay at a reduced possession limit, despite the level of biomass present in the Bay. This opening is contingent upon the state having unharvested state quota remaining or having opted into the Episodic Event Set Aside program through ASMFC.

METHODS, RESULTS & DISCUSSION: The program consists of three main elements: collection of fishery landings information through call in and logbook requirements, field work (spotter flights and biological sampling), and computer modeling work. DEM regulations require that commercial vessels fishing for menhaden in Narragansett Bay report their catches to Division staff daily. All RI licensed commercial harvesters, including floating fish trap and purse seine operators, are required to file logbook reports quarterly with the Division that details daily fishing activities.

Each year the Division contracts a trained spotter pilot to make biomass estimates of menhaden in Narragansett Bay. When in the air, the pilot records counts of menhaden schools observed, the estimated weight within the schools, and the location of the schools.

Each year biological port samples are collected from commercial purse seine operations, floating fish traps that operate in state waters outside of the menhaden management area, or from the Divisions trawl survey (Jobs 1 and 2 of this grant). Sampling includes length frequencies, body weights, and collecting scales and otoliths for age determination (see Age and Growth Study, Job 9 of this F-61R grant progress report).

Collectively, these sources of information are analyzed using the theory of depletion estimation as applied to open populations. All of the aforementioned information is centrally collected and used in a computer modeling approach that allows the Division to monitor the abundance of menhaden in Narragansett Bay. The existing regulatory framework governing state waters allows the Division to use the output from the mathematical modeling approach to set a number of fishing activity parameters including a static amount of fish needed to be present to allow commercial fishing to commence, thus protecting recreational and ecological interests if only a small population enters the Bay. The framework also authorizes half of the standing population present in Narragansett Bay above the initial threshold amount to be harvested, thus maintaining an amount of unharvested fish even when commercial fishing has commenced. The Divisions ability to close the fishery when the standing population of menhaden in Narragansett Bay drops back below the threshold level of fish helps to maintain a portion of the population for recreational fishermen and ecological services. This program also allows the Division to accurately track the state quota and provides justification for Rhode Island to participate in the Episodic Event Set Aside Program.

2024 Fishery Data

In 2024, biomass within the management area reached the minimum 2 million pound threshold in late April and the commercial menhaden fishery inside the management area opened on April 29, 2024. The management area subsequently closed on May 15, 2024, when the biomass dropped below the 1.5 million pound threshold and remained closed for the rest of 2024. State waters outside of the management area remained open throughout the year. RI did not harvest its full quota in 2024 and transferred 500,000 pounds to other states. A total of 44 contractor spotter flights were completed in 2024 to accurately monitor biomass levels of menhaden within the management area (Figure 1).

SUMMARY: The menhaden management area in Narragansett Bay opened on April 29, 2024 when biomass reached the 2 million pound threshold. It was subsequently closed on May 15, 2024, when the biomass dropped below the 1.5 million pound threshold and remained closed for the rest of 2024. RI did not fully harvest its initial 2024 commercial quota allocation and transferred 500,000 pounds to other states. Total landings for RI from all sources totaled approximately 1,904,865 pounds.

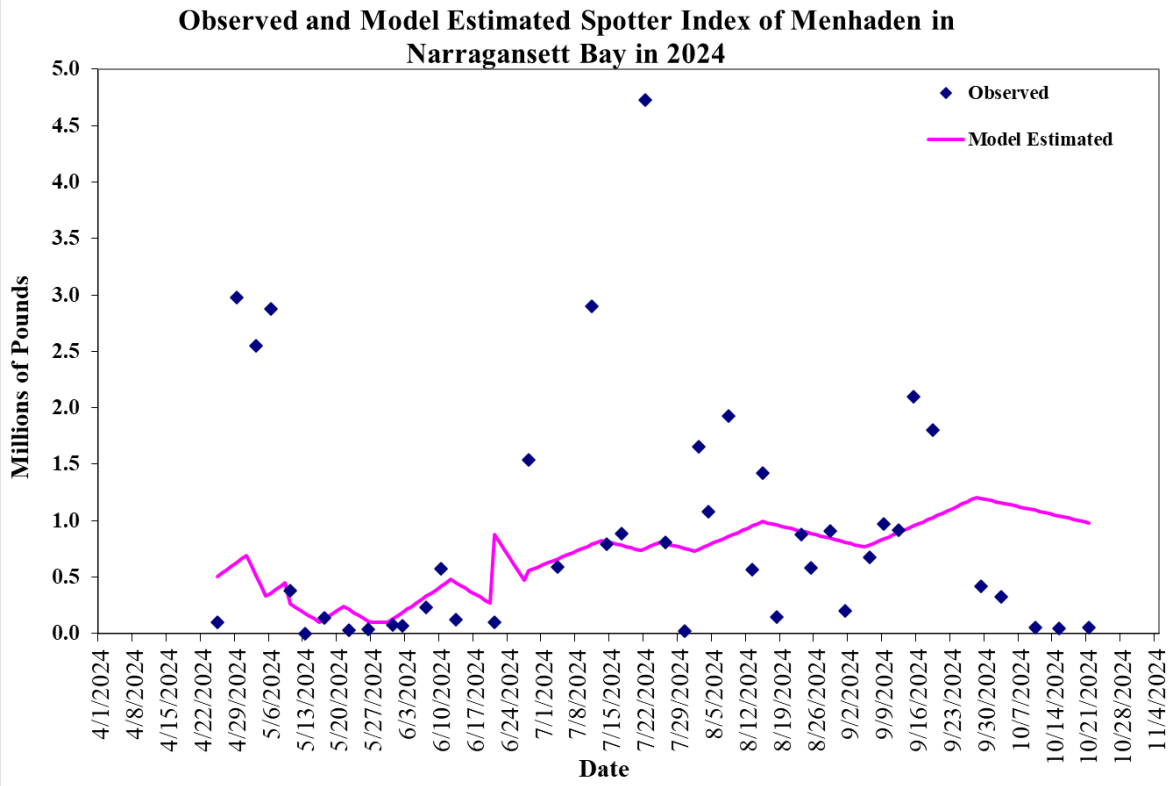


Figure 1. Predicted spotter pilot estimates and observed biomass in Narragansett Bay in 2024.

References

Arenholz, D.W. 1991. Population biology and life history of the North American menhadens, *Brevoortia spp*. Mar. Fish. Rev. 53: 3-19.

Atlantic States Marine Fisheries Commission (ASMFC). 2017. Atlantic Menhaden Stock Assessment Update. ASMFC, Arlington, VA. 182p.

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



ASMFC

Narragansett Bay Ventless Fish Pot Multi-Species Monitoring and Assessment Program

Ventless Fish Pot Survey

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Federal Aid in Sportfish Restoration
F-61-24

Performance Report: Job 12 March 2025

State: Rhode Island Project Number: F-61-R-24

Project Title:	Assessment of Recreationally Important Finfish Stocks in Rhode Island Waters
Period Covered:	January 1, 2020 – December 31, 2024
Job Number	Job XII - Narragansett Bay Ventless Fish Pot Multi-Species Monitoring and Assessment Program
Job Objective:	To assess and standardize a time series of relative abundance for structure-oriented finfish (black sea bass, tautog, and scup) in Narragansett Bay. Additional collection of age, weight at length, and other biological information for these species.
Significant Deviations:	Nothing to report.

Summary:

Finfish species that associate with bottom structure while in nearshore ecosystems may have relatively low catchability in traditional bottom trawl gear. As such, traditional fisheries-independent survey designs are often imperfect in assessing the relative abundance of structure-oriented marine species due to their inability to sample such habitats. Various stock assessments for structure-oriented fish including black sea bass (NEFSC 2011) and scup (NEFSC 2002) have recommended exploring alternatives to trawl surveys to provide better analytical assessment data for these species. Additionally, working groups such as the Northeast Data Poor Stocks Working Group (NEFSC 2008, Shepard 2008, Terceiro 2008), have reported that size classes of many species may be under-represented in their assessments, particularly scup, black sea bass, and tautog. Most recently, the 2023 black sea bass research track assessment concluded that "given that the VTS [ventless trap survey] indices [from MA and RI] represent a unique approach to sampling that could provide an alternative perspective on stock dynamics, the working group suggests consideration of these surveys in coming years as the trap time series continues to grow." All three of these species, each of which is an important recreational finfish in Rhode Island waters, tend to associate with bottom structure for a large portion of the year and as a result may have low catchability in traditional bottom trawl surveys.

To address this concern, the Rhode Island Division of Marine Fisheries (RIDMF) conducted an exploratory ventless fish pot (referred to alternately as 'pots' and 'traps') survey in Narragansett Bay from 2013 through 2016 and again in 2019. Based on data gathered during the exploratory survey, RIDMF designed a standardized monitoring and assessment survey of recreationally important finfish utilizing ventless fish pot gear and began the survey in 2021. The goal of this survey program is to assess and standardize a time series of relative abundance for structure-oriented finfish in Rhode Island state waters, particularly black sea bass, tautog, and scup. Relative abundance indices derived from this survey will ideally be integrated into both local and coastwide assessments for the target species and will supplement state and regional trawl survey abundance indices.

Fisheries:

Black sea bass, tautog, and scup are commercially and recreationally important species in RI. Summaries of RI commercial landings and values are found in Tables 1 through 3 and summaries of recreational harvest of each species are found in Tables 4 through 6. Throughout the time series, landings have shown generally stable (scup, tautog) or slightly increasing (black sea bass) trends for each of these species.

The Atlantic States Marine Fisheries Commission (ASMFC) 2021 black sea bass northern stock operational stock assessment indicates the stock was not overfished and overfishing was not occurring in 2019 relative to reference points (ASMFC 2021a). Starting in 2007, spawning stock biomass (SSB) increased rapidly and reached a peak in 2014 at over 76 million pounds, then decreased slightly. In 2023 SSB was estimated at 24,572 metric tons million pounds, 2.19 times the 2019 biomass target of 31.84 million pounds. (NEFSC 2024).

Based on the 2021 tautog ASMFC stock assessment update, the Massachusetts-Rhode Island stock of tautog is not overfished and overfishing is not occurring (ASMFC 2021b). A 3-year average F is 0.23 which is below the target F of 0.28. Spawning stock biomass in 2020 was estimated to be 14.9 million pounds, above the target spawning stock biomass of 10.09 million pounds. Similarly, for scup the 2023 management track stock assessment update indicated the stock is considered rebuilt and not experiencing overfishing, with 2022 SSB estimated at 193,087 metric tons, about 2.5 times the SSB target of 78,593 metric tons (NEFSC 2023).

Methods and Materials:

Seven subareas are sampled within RI state waters: the Providence River including portions of the Upper Bay/Greenwich Bay, West Passage, East Passage, Mount Hope Bay including portions of the Upper Bay, Sakonnet River including the area from Land's End to Sakonnet Point, eastern RI Sound and western RI Sound (Figure 1). Each area is subdivided into 0.5-degree latitude and longitude squares and numbered; each respective grid cell is referred to as a 'station'. At the start of each year three sampling stations are selected within each subarea and those stations are sampled May through October through the year (Figure 2). Investigators located areas of structured hard bottom (e.g., rocky outcropping, boulders/large cobble, wreck, bridge abutments, pilings) within each station when possible. The specific locations of structure were noted in the stations containing structural elements. The RI Sound stations are also sampled in April. Each of the stations within a subarea are further stratified by depth with a 'shallow', 'deep', and 'fixed' are sampled within each subarea. 'Fixed' stations are sampled in the same location across all years. 'Shallow' and 'deep' stations are randomly selected each year.

Traps fished are unvented black sea bass pots (43.5" x 23" x 6") constructed of 1.5" x 1.5" coated wire mesh, single mesh entry head, and single mesh inverted parlor nozzle. Baited (clam bellies) trawls of five traps are fished for an overnight soak (~24 hours) at each sampling station. After the 24-hour soak the trap sets were hauled, the catch processed, and gear either reset at a new station or removed from the water.

Upon hauling trap trawls, the catch is sorted by species. Finfish are measured to the nearest millimeter, fork length (FL) or total length (TL) as species appropriate. Invertebrates are measured using a species-specific appropriate metric and counted. Weight of each species is taken. Water temperature is collected using loggers on each trawl. Major and minor bottom types present at each sampling station are noted each month based on data from an onboard Furuno transducer.

Results:

From 2020 through 2024 a total of 418 trawl sets were sampled, totaling 2,090 individual fish pots set and processed. Thirty-one unique fish and invertebrate species were collected from 2020 through 2024 with 13,599 fish and 10,506 invertebrate individuals caught. Black sea bass was the most caught fish species with 6,783 individuals trapped (50% of fish catch) (Table 7). Scup were the second most caught fish species (5,885 individuals, 43% of fish catch) followed by tautog (396 individuals, 3% of total catch). These three species together accounted for over 96% of the total finfish catch. From 2020 through 2024 spider crabs were the most frequently caught invertebrate representing over 81% of the total invertebrate catch (Table 8). American lobster were the second most frequently caught invertebrate species.

In 2024 a total of 132 trawl sets were sampled, totaling 660 individual fish pots set and processed. Twenty-six unique fish and invertebrate species were collected in 2024 with 4,960 fish and 2,327 invertebrates caught. Black sea bass was the most caught fish species with 2,903 individuals trapped (59% of fish catch) (Table 9). Scup were the second most caught fish species (1,723 individuals, 35% of fish catch) followed by tautog (189 individuals, 4% of total catch). These three species together accounted for over 97% of the total finfish catch. Spider crabs were the most frequently caught invertebrate representing over 75% of the total invertebrate catch (Table 10). American lobster was the second most frequently caught invertebrate species.

Across the timeseries black sea bass were caught in greatest abundance over structured bottom, while tautog and scup were caught in similar abundance over structured and unstructured bottom types (Figure 3). In general, black sea bass were caught in greater abundances at cooler bottom temperatures (10-14C) compared with scup (20-25C) (Figure 4). Likewise, black sea bass were caught in greatest abundances at moderate depths (50-75ft) compared with scup which were most common at shallow sampled depths (0-24ft) (Figure 5). Likely interrelated with depth and bottom temperature, black sea bass were caught in greatest abundance at more southern latitudes samples while scup were most common in the Upper Bay (Figure 6).

Discussion:

Results from 2020 through 2024 include four years (with two 'complete' years) of the new long-term ventless pot multi-species monitoring and assessment program, indicate that fish pots effectively target the three species of interest for this job; black sea bass, tautog, and scup as well as several other species of interest including cunner and conger eel. Based on the continued importance of these species to RI, both recreationally and commercially, it is critical that these species be accurately assessed. Compared with the earlier exploratory studies, this expanded and modified survey design will better allow this project to meet its goals. These goals include:

- Collect fishery independent data to provide a relative index of abundance for species that may not be fully sampled by RIDMF bottom trawl.
    - Collected data to be used in state and federal stock assessments and management.
- Provide relatively high-density spatiotemporal coverage of gear selected black sea bass, scup, and tautog cohorts within state waters.
    - Identify spatiotemporal trends of migration and abundance.
    - Track annual cohorts.
    - Track abundance consistency with other surveys (RIDMF trawl, NMFS trawl).
    - Determine age structure of fish sampled.
- Collect additional information on species biological characteristics.
- Track the prevalence of trap prone mid-Atlantic/southern species (e.g., grey triggerfish,

blue runner, pinfish, Atlantic croaker).

Data collected thorough this survey will be instrumental in meeting these objectives. It is hoped that the survey will also provide numerous pathways for cross-collaborations with other state and federal agencies and departments in the future.

Recommendations:

Continuation of this survey will provide invaluable data on structure-oriented species to support effective management. Data analysis and consultation with stock assessment scientists will be conducted in 2025 to optimize sampling design moving forward and meet required budget cuts for this survey.

Trap sets conducted in April 2022 indicated significant issues with sampling within Narragansett Bay at that time of year. Catch was very low across all stations and there was substantial damage to gear due to seals. In 2023 the month of April was sampled only in the East and West Rhode Island Sound subareas which successfully alleviated gear interactions with seals and should allow for the catch of black sea bass as they reenter the region in the spring.

The 2019 exploratory survey examined soak time, gear type, and fishing baited vs. unbaited traps. It did not address potential differences among bait types. It is recommended that a 'bait preference' study be conducted to explore the differences in species interactions with different bait types. This survey would be conducted using baited remote underwaters video systems (BRUVS). Bait types to be considered include clam bellies, green crab, squid, mussels, and unbaited. This research may also help inform the commercial fish pot community about alternate bait efficacy.

In the winter of 2023/2024 the Division purchased a TimeZero bottom mapping unit for the survey vessel. Data collected from this unit will allow for a more detailed analysis of rugosity at each sampling site. Efforts should be made to incorporate this information into both future site selection as well as data analysis.

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Table 1 - Commercial landings (pounds) and value (dollars) of black sea bass landed in Rhode Island by year (NMFS 2024).

Year	Landings (lbs)	Value (dollars)
2010	241,886	779,001
2011	211,597	734,732
2012	204,360	735,346
2013	265,691	988,877
2014	267,703	884,332
2015	238,647	808,797
2016	294,343	1,091,991
2017	458,153	1,603,746
2018	374,637	1,433,963
2019	399,085	1,508,814
2020	553,749	1,332,449
2021	660,033	2,024,679
2022	824,258	2,336,772
2023	634,588	1,845,098
Average	**402,052**	**1,293,597**

Table 2 - Commercial landings (pounds) and value (dollars) of tautog landed in Rhode Island by year (NMFS 2024).

Year	Landings (lbs)	Value (dollars)
2010	44,054	101,431
2011	47,426	124,739
2012	50,126	151,036
2013	53,428	168,479
2014	53,384	182,347
2015	47,140	172,694
2016	50,680	195,296
2017	52,844	194,380
2018	51,450	196,276
2019	46,562	168,046
2020	52,561	161,720
2021	50,164	180,723
2022	51,919	204,707
2023	50,829	202,182
Average	**50,183**	**171,718**

Table 3 - Commercial landings (pounds) and value (dollars) of scup landed in Rhode Island by year (NMFS 2023).

Year	Landings (lbs)	Value (dollars)
2010	4,298,488	2,833,017
2011	6,335,920	3,311,832
2012	6,310,689	3,904,255
2013	7,345,771	3,666,438
2014	6,948,870	4,117,991
2015	6,793,854	4,278,299
2016	6,808,917	4,053,288
2017	5,973,305	3,077,934
2018	4,713,742	2,739,752
2019	4,583,835	2,570,825
2020	4,302,324	2,418,396
2021	4,272,466	2,734,994
2022	3,622,626	2,563,334
2023	4,001,925	2,386,266
Average	**5,450,909**	**3,189,759**

Table 4 - MRIP Estimated Recreational Harvest for black sea bass in Rhode Island. Results from this query contain estimates resulting from the full application of both the Access Point Angler Intercept Survey (APAIS) and Fishing Effort Survey (FES) calibration. PSE values greater than 50 are highlighted red and indicate a very imprecise estimate. Preliminary data is highlighted yellow.

Year	Harvest (A+B1) Total Weight (lb)	PSE
2010	643,348	26.8
2011	236,607	53.0
2012	645,039	21.7
2013	313,315	19.2
2014	659,562	19.6
2015	807,840	19.7
2016	1,124,414	21.4
2017	747,262	21.2
2018	1,628,875	15.3
2019	1,225,058	16.0
2020	1,480,782	20.1
2021	1,116,032	13.3
2022	618,968	16.2
2023	566,092	14.6
2024	588,394	14.6

Table 5 - MRIP Estimated Recreational Harvest for tautog in Rhode Island. Results from this query contain estimates resulting from the full application of both the Access Point Angler Intercept Survey (APAIS) and Fishing Effort Survey (FES) calibration. PSE values greater than 50 are highlighted red and indicate a very imprecise estimate. Preliminary data is highlighted yellow.

Year	Harvest (A+B1) Total Weight (lb)	PSE
2010	1,933,773	38.9
2011	328,959	54.3
2012	1,512,425	32.1
2013	2,602,962	47.6
2014	1,017,780	33.4
2015	1,105,259	24.3
2016	1,290,428	24.7
2017	600,869	25.3
2018	1,075,131	51.4
2019	1,483,123	24.1
2020	853,470	19.2
2021	2,623,172	19.1
2022	1,617,445	15.2
2023	3,816,532	13.1
2024	1,546,061	18

Table 6 - MRIP Estimated Recreational Harvest for scup in Rhode Island. Results from this query contain estimates resulting from the full application of both the Access Point Angler Intercept Survey (APAIS) and Fishing Effort Survey (FES) calibration. Preliminary data is highlighted yellow.

Year	Harvest (A+B1) Total Weight (lb)	PSE
2010	771,713	22.5
2011	1,269,888	29.4
2012	1,119,378	22.7
2013	2,622,654	32.5
2014	2,650,482	22.9
2015	1,370,141	25.7
2016	1,552,395	33.1
2017	1,113,035	23.5
2018	2,030,258	13.1
2019	2,856,459	15.3
2020	1,330,398	17.4
2021	2,467,932	14.7
2022	2,898,790	16.5
2023	2,073,822	13.7
2024	2,464,462	19.1

Table 7 – Ten most frequently caught fish species from the ventless fish pot survey from 2020 - 2024. Mean catch is average number of individuals per trawl (5 trap string) ± standard error. Mean mass is average kilograms (kg) of individuals per trawl (5 trap string) ± standard error. Total catch is the total number of individuals caught during the reporting period.

Species	Mean Catch ± SE	Mean Mass ± SE	Total Catch
Black Sea Bass	17.3 ± 1.0	5.1 ± 5.8	6783
Scup	15.0 ± 1.0	2.9 ± 0.2	5885
Tautog	1.0 ± 0.2	0.5 ± 0.1	396
Cunner	0.6 ± 0.1	0.1 ± <0.1	254
Oyster Toadfish	0.3 ± <0.1	0.1 ± <0.1	115
Conger Eel	0.2 ± <0.1	0.2 ± <0.1	62
Summer Flounder	<0.1 ± <0.1	<0.1 ± <0.1	18
Grey Triggerfish	<0.1 ± <0.1	<0.1 ± <0.1	15
Atlantic Cod	<0.1 ± <0.1	<0.1 ± <0.1	13
Red Hake	<0.1 ± <0.1	<0.1 ± <0.1	12

Table 8 – Invertebrate catch from the ventless fish pot survey from 2020 - 2024. Mean catch is number of individuals per trawl (5 trap string) ± standard error. Mean mass is average kilograms (kg) of individuals per trawl (5 trap string) ± standard error. Total catch is the total number of individuals caught during the reporting period.

Species	Mean Catch ± SE	Mean Mass ± SE	Total Catch
Spider Crab	21.8 ± 2.5	3.4 ± 0.3	8586
American Lobster	2.4 ± 0.3	0.9 ± 0.1	954
Channeled Whelk	1.4 ± 0.2	0.2 ± <0.1	548
Rock Crab	0.6 ± 0.3	0.1 ± 0.1	247
Knobbed Whelk	0.2 ± <0.1	<0.1 ± <0.1	63
Jonah Crab	0.2 ± <0.1	<0.1 ± <0.1	62
Green Crab	0.1 ± <0.1	<0.1 ± <0.1	23
Blue Crab	<0.1 ± <0.1	<0.1 ± <0.1	16
Quahog	<0.1 ± <0.1	<0.1 ± <0.1	6

Table 9 – Ten most frequently caught fish species from the ventless fish pot survey from 2024. Mean catch is average number of individuals per trawl (5 trap string) ± standard error. Mean mass is average kilograms (kg) of individuals per trawl (5 trap string) ± standard error. Total catch is the number of individuals caught in 2024.

Species	Mean Catch ± SE	Mean Mass ± SE	Total Catch
Black Sea Bass	23.3 ± 2.1	6.8 ± 0.6	2898
Scup	13.8 ± 1.6	2.8 ± 0.3	1723
Tautog	1.5 ± 0.5	0.6 ± 0.2	188
Oyster Toadfish	0.4 ± 0.1	0.2 ± <0.1	50
Cunner	0.3 ± 0.1	0.1 ± <0.1	39
Conger Eel	0.1 ± <0.1	0.1 ± <0.1	13
Summer Flounder	<0.1 ± <0.1	<0.1 ± <0.1	9
Grey Triggerfish	<0.1 ± <0.1	0.1 ± <0.1	8
American Eel	<0.1 ± <0.1	<0.1 ± <0.1	6
Spot	<0.1 ± <0.1	<0.1 ± <0.1	5

Table 10 – Invertebrate catch from the ventless fish pot survey from 2024. Mean catch is number of individuals per trawl (5 trap string) ± standard error. Mean mass is average kilograms (kg) of individuals per trawl (5 trap string) ± standard error. Total catch is the number of individuals caught in 2024.

Species	Mean Catch ± SE	Mean Mass ± SE	Total Catch
Spider Crab	13.9 ± 2.3	2.7 ± 0.5	2665
American Lobster	2.0 ± 0.4	0.8 ± 0.2	206
Rock Crab	1.5 ± 0.7	0.3 ± 0.2	172
Channeled Whelk	0.7 ± 0.2	0.1 ± <0.1	21
Jonah Crab	0.1 ± <0.1	<0.1 ± <0.1	21
Knobbed Whelk	0.1 ± <0.1	<0.1 ± <0.1	14
Green Crab	<0.1 ± <0.1	<0.1 ± <0.1	13
Blue Crab	<0.1 ± <0.1	<0.1 ± <0.1	2
Lady Crab	<0.1 ± <0.1	<0.1 ± <0.1	1

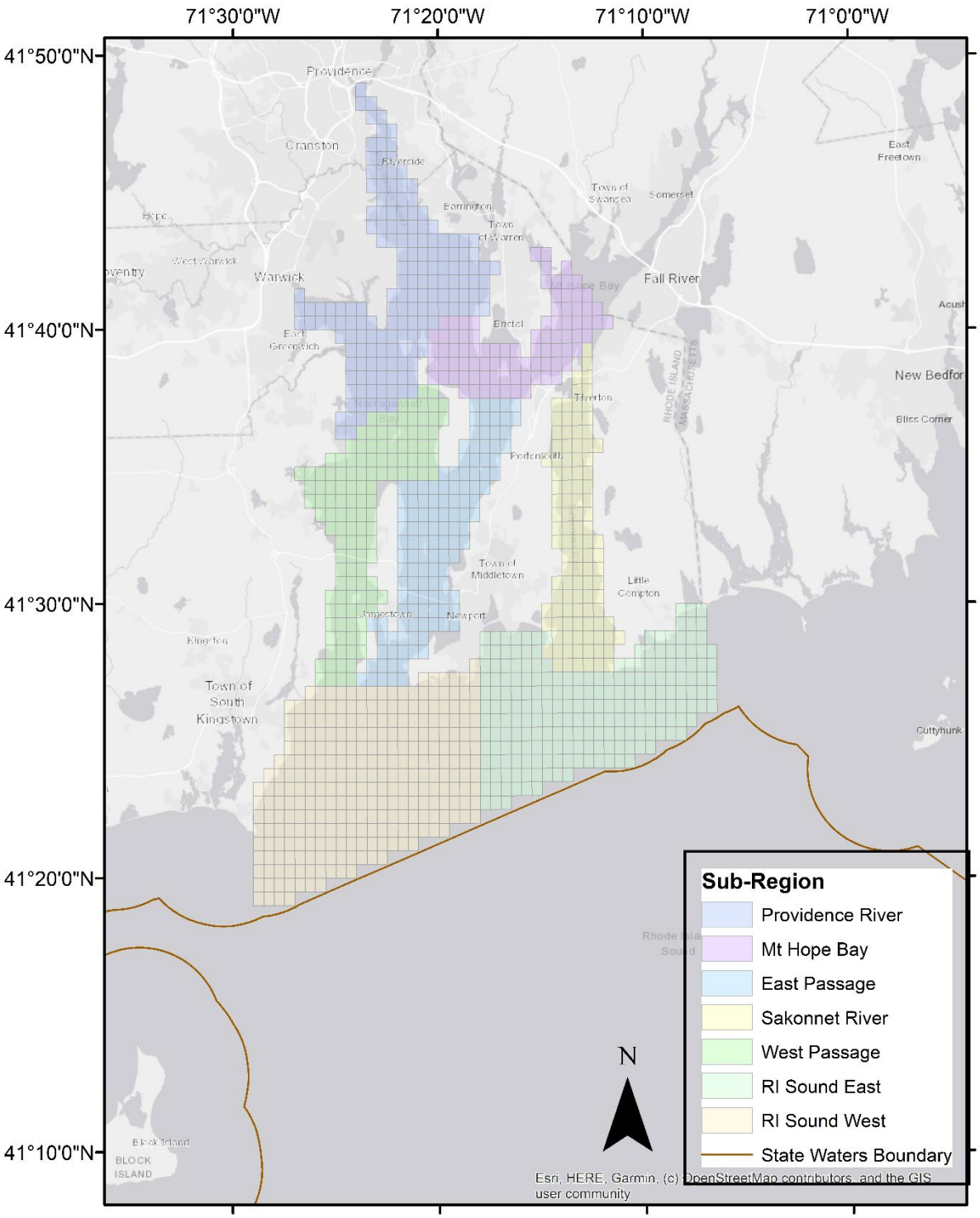


Figure 1 – Ventless pot multi-species monitoring and assessment program subregions and 0.5 degree grid.

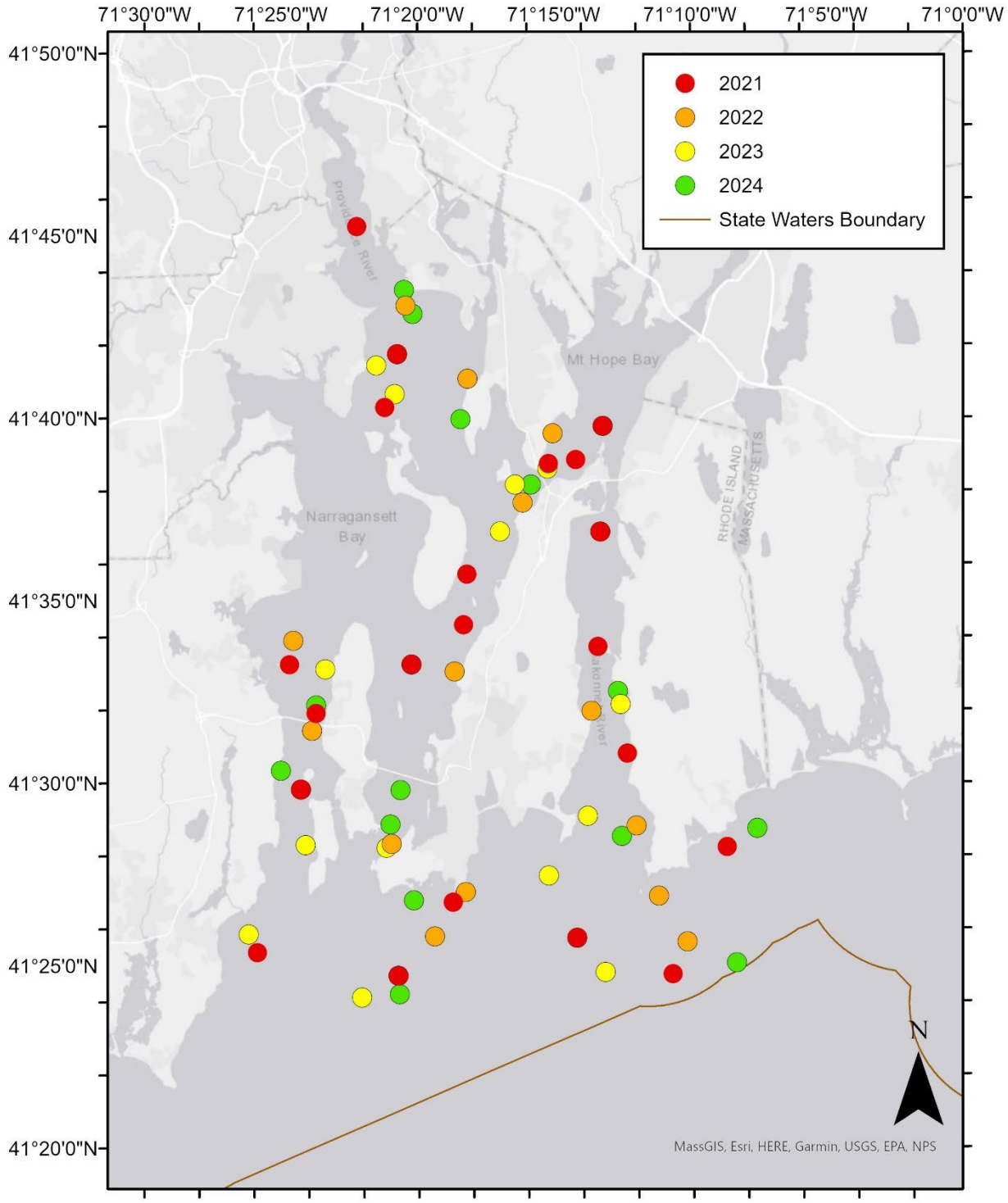


Figure 2 – Ventless pot multi-species monitoring and assessment program sampling locations 2021-2024.

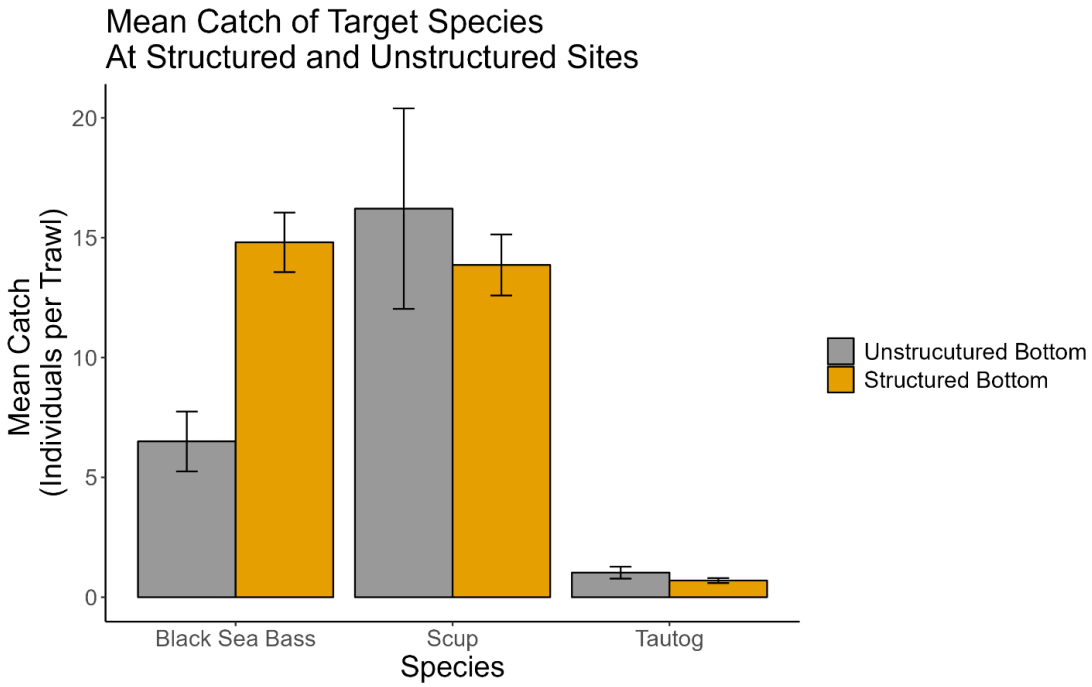


Figure 3 – Target fish species mean catch over structured and unstructured bottom types. Bars represent mean catch and error bars represent standard error.

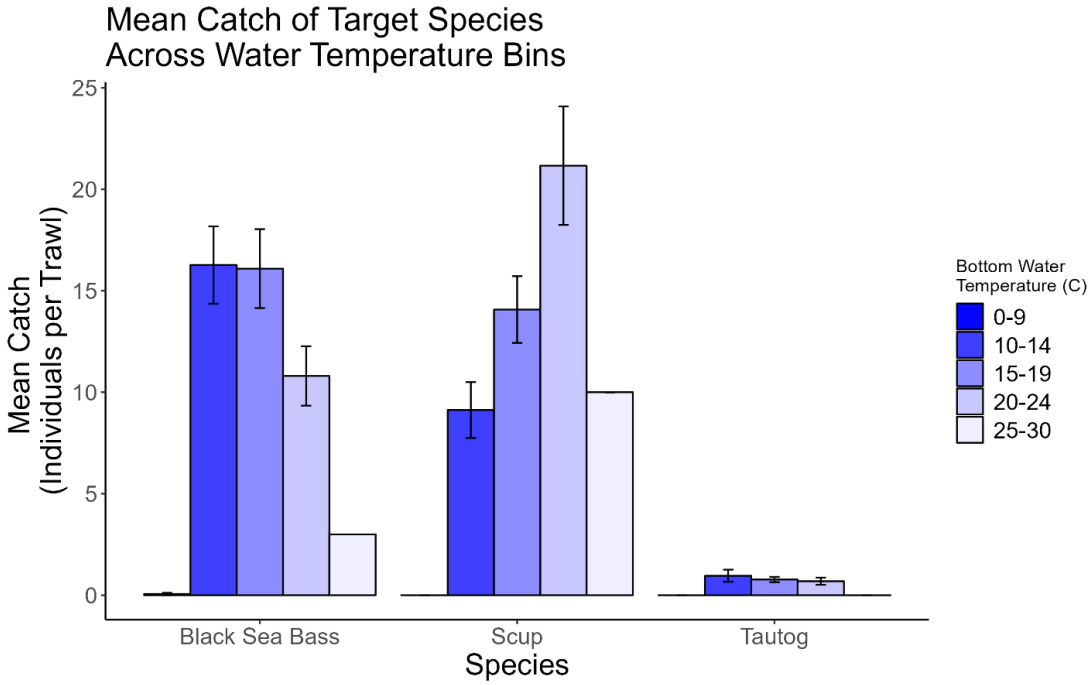


Figure 4 – Target fish species mean catch across bottom temperature bins. Bars represent mean catch and error bars represent standard error.

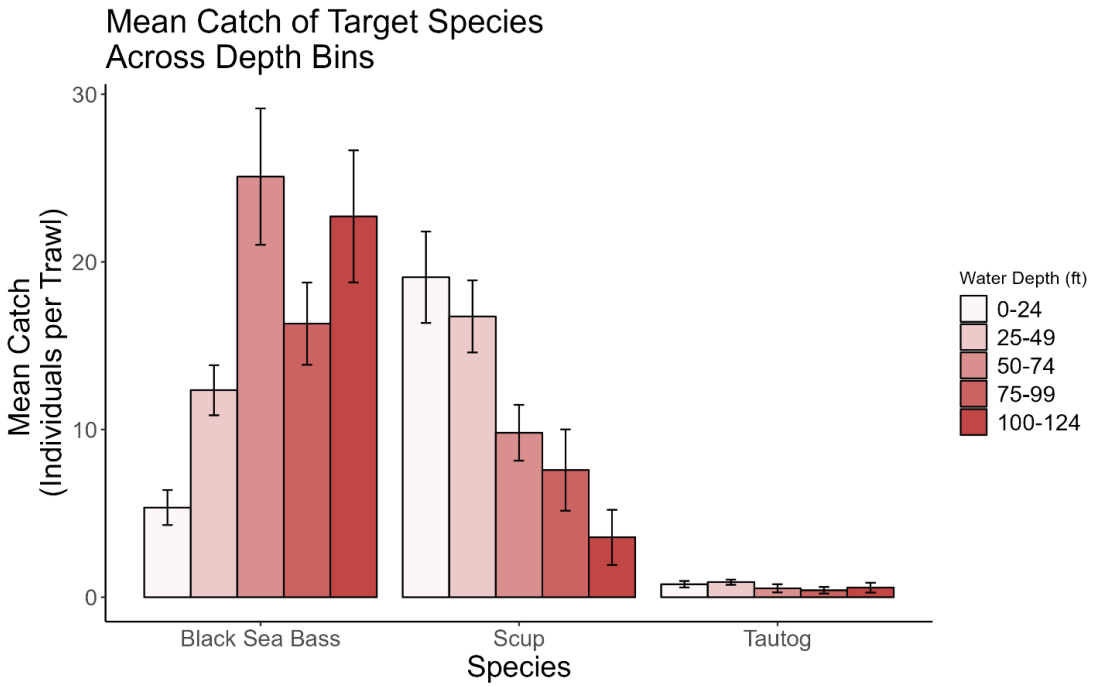


Figure 5 – Target fish species mean catch across bottom depth bins. Bars represent mean catch and error bars represent standard error.

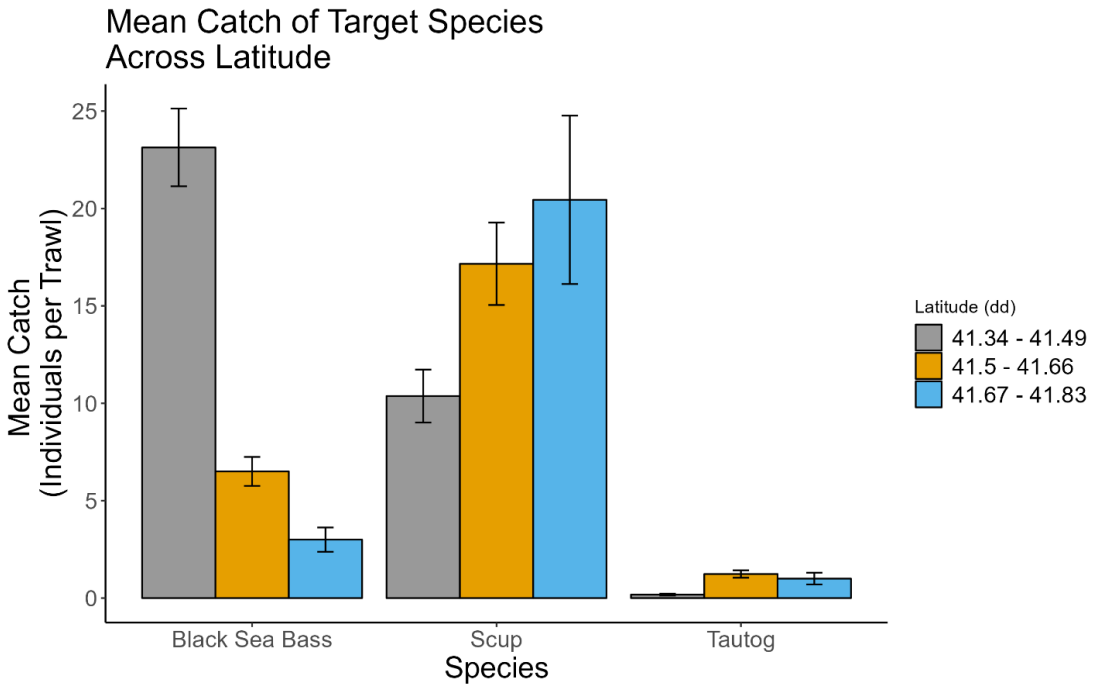


Figure 6 – Target fish species mean catch across latitude bins. Bars represent mean catch and error bars represent standard error.

ASSESSMENT OF RECREATIONALLY IMPORTANT FINFISH STOCKS IN RHODE ISLAND COASTAL WATERS

2024 PERFORMANCE REPORT

Federal Aid in Sportfish Restoration
F-61-R
SEGMENT 22, JOB 13

MARINE FISHES OF RHODE ISLAND

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March 2025

STATE: Rhode Island

PROJECT NUMBER: F-61-R
SEGMENT NUMBER: 22

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

JOB NUMBER: 13

JOB TITLE: Marine Fishes of Rhode Island

PERIOD COVERED: January 1, 2024 – December 31, 2024 and
January 1, 2020 – December 31, 2024

JOB OBJECTIVE:

The goal of this project is to produce a manuscript which will act as a reference for recreational fishermen, commercial fishermen, and fisheries scientists alike. The finished product will summarize existing knowledge on the occurrence and distribution of fish species observed within Rhode Island marine waters, based on information collected through several field surveys conducted by Rhode Island Division of Marine Fisheries (RIDMF). The information will be presented systematically, and the manuscript will include scientific illustrations of fish species encountered occasionally to commonly in RIDMF surveys; rare species will not be illustrated. This work is designed to be a stand-alone manuscript, but also to be compatible with and be a companion volume to the “Inland Fishes of Rhode Island” book produced by the Rhode Island Division of Fish and Wildlife (RIDFW) in 2013.

SUMMARY:

The basic format and foundation of the book was laid out in 2017 during the previous grant award period for this project (January 1, 2014 – December 31, 2019) and included the following components: cover page, table of contents, acknowledgements, dedication, introduction, description of the data sources (field surveys) that collected the data with maps of survey sampling locations and survey activity photographs, tabular lists of species observed in RIDMF surveys (all surveys combined and by individual survey) and species reported to be observed historically by others with environmental and life history classifications, family descriptions, species names (including scientific and common name(s), species identification and description characteristics, species distribution (general and in RI), species diet, species importance, current species management in RI and/or other locations (where applicable)), current RI sportfish and all-tackle (worldwide) records (where applicable), references, glossary, and a taxonomic index.

EXPECTED BENEFITS:

The “Marine Fishes of Rhode Island” book will serve recreational and commercial fishermen alike as a guide to assist in proper identification of marine fish species that are encountered. It will also provide information regarding locations where anglers are likely to find each species, as well as indicating to and alerting fishermen of any fishery management measures that are in effect.

SUMMARY OF TASKS COMPLETED:

The following sections and portions of the book were completed during the previous grant award period for this project (January 1, 2014 – December 31, 2019) (Table 1):

- cover page,
- acknowledgements,
- dedication page,
- table of contents,
- introduction,
- data source descriptions for 9 RIDMF field sampling surveys (including maps of sampling locations),
- tables of species (scientific and common name) caught in recent RIDMF surveys (all surveys combined and by individual survey) or observed by others historically, environmental and occurrence classifications, and relative abundance level by species and survey (abundant, common, occasional, rare),
- scientific names,
- current RI sportfish record for each species (if applicable),
- all-tackle worldwide record for each species (if applicable),
- data to create species distribution maps has been compiled from GPS sampling location data for each species for each RIDMF survey. To date, species distribution information has been compiled for all 9 RIDFW / RIDMF field sampling surveys being used for the book, and
- illustrations for 55 species (1 species with male and female illustrations) for a total of 56 illustrations completed previously for “Inland Fishes of Rhode Island” book)

The glossary, references, and index sections are near completion but will need occasional revision/updates as more text is added. Tables 1-3 summarize the book sections completed to date. In the March 2023 F-61-R annual report, the initial draft of the book’s text was reported as completed. After the submission of that report (March 2023), an additional finfish survey database was discovered leading to the inclusion of thirteen (13) new species previously unreported in RI state waters. The text for those species was prepared during 2023 and 2024 (Tables 2, 3).

A total of 301 species will appear in the “Marine Fishes of Rhode Island” book. Of these, 202 species were observed in recent RIDMF surveys, and 99 species were reported to be observed by entities other than RIDMF, either recently or historically. Of these 301 species, a total of 100 species will be professionally illustrated, including 5

species with both sexes illustrated, for a total of 105 professional illustrations. There were 102 species observed rarely and 99 species never observed in RIDMF surveys but were reported to be observed by other sources (201 species total) that will not be professionally illustrated. If available, online images will be used to depict these 201 species.

A total of 56 illustrations previously completed for the RIDFW's "Inland Fishes of Rhode Island" book (55 species; 1 species with both sexes illustrated; 2 species with only 1 of the sexes illustrated) will be utilized for this book, being species found in both agency's sampling surveys, leaving 45 species with 50 species illustrations (5 species with both sexes illustrated) to be completed for this book.

For this reporting period (January 1, 2024 – December 31, 2024), a total of two (2) species illustrations were completed by the illustrator (Robert Jon Golder) and three (3) illustrations are in progress. There have been numerous email correspondences (≈15) and one (1) in-person meeting with the illustrator during this report period when completed illustrations and invoices were delivered to RIDMF and additional frozen fish specimens were provided for illustration reference (Table 4).

TARGET DATE: December 31, 2024

SIGNIFICANT DEVIATIONS: None

RECOMMENDATIONS: Continue into the next grant award period (2025-2029).

REMARKS:

- It is anticipated that the process of publishing the book will begin during late 2024 but will continue into the next grant award period (January 1, 2025 – December 31, 2029. All efforts will be made to have the book published during the first year of the next grant award period, more specifically before December 31, 2025.

Table 1. Summary of book sections completed during previous grant award, January 1, 2014 - December 31, 2019.

Book Sections	**Number completed**	**Total Number**
Cover page	1	1
Table of Contents	1	1
Acknowledgements	1	1
Dedication	1	1
Introduction	1	1
Description of Data Sources	7	7
Survey sampling maps	7	7
Survey activity photos	4	4
Tables	6	6
Glossary	In progress	1
Taxonomic Index	1	1
Family Description	60	117
Common / Species Name	284	284
Other Name(s)	204	284
RI Sportfish Record	284	284
All-Tackle Record	284	284
Species ID / Description	70	284
General / Local Distribution	73	284
Diet	71	284
Importance	73	284
Management	178	284
Illustrations	56 (55 species)	105 (100 species)
Species - text completed	66	284
Species - text incomplete	218	284

Table 2. Summary of book sections completed during current grant segment reporting period, January 1, 2024 - December 31, 2024, with total number completed* (January 1, 2014 – December 31, 2024*) and total number required (* includes previous grant award).

Book Sections	**Number completed 1/1/2024-12/31/2024**	**Total Number Completed***	**Total Number Required***
Cover page	0	1	1
Table of Contents	0	1	1
Acknowledgements	0	1	1
Dedication	0	1	1
Introduction	0	1	1
Description of Data Sources	0	9	9
Survey sampling maps	9	9	9
Survey activity photos	0	4	4
Tables	0	6	6
Glossary	1	1	1
Taxonomic Index	0	1	1
Family Descriptions	0	120	120
Common / Species Name	3	301	301
Other Name(s)	3	301	301
RI Sportfish Record	3	301	301
All-Tackle Record	3	301	301
Species ID / Description	3	301	301
General / Local Distribution	3	301	301
Diet	3	301	301
Importance	3	301	301
Management	3	301	301
Illustrations	2 (1 species)	102 (100 species)	105 (100 species)
Species - text completed	3	301	301
Species - text incomplete	0	-	-

Table 3. Summary of book sections completed by species and illustration status for previous grant award (January 1, 2014 – December 31, 2019; x, done), current grant award (January 1, 2020 – December 31, 2024; **X**, **done**), and current grant reporting period (January 1, 2024 – December 31, 2024; **X**, **done**).

SPECIES	Family Description	Common / Species Name	Other Names	RI sportfish	All-Tackle	ID / Description	General / Local Distribution	Diet	Importance	Management	Text Status	Illustration	Illustration Status
Alosa aestivalis	x	x	x	x	x	x	x	x	x	x	done	YES	done
Alosa mediocris	x	x	x	x	x	x	x	x	x	x	done	YES	done
Alosa pseudoharengus	x	x	x	x	x	x	x	x	x	x	done	YES	done
Alosa sapidissima	x	x	x	x	x	x	x	x	x	x	done	YES	done
Ameiurus nebulosus	X	x	x	x	x	X	X	X	X	X	done	YES	done
Ammodytes americanus	x	x	x	x	x	x	x	x	x	x	done	YES	done
Anchoa hepsetus	x	x	x	x	x	x	x	x	x	x	done	YES	done
Anchoa mitchilli	x	x	x	x	x	x	x	x	x	x	done	YES	done
Anguilla rostrata	x	x	x	x	x	x	x	x	x	x	done	YES	done
Apeltes quadracus	x	x	x	x	x	x	x	x	x	x	done	YES	done
Bairdiella chrysoura	X	x	X	x	x	X	X	X	X	X	done	YES	done
Brevoortia tyrannus	x	x	x	x	x	x	x	x	x	x	done	YES	done
Caranx crysos	x	x	x	x	x	x	x	x	x	x	done	YES	done
Caranx hippos	x	x	x	x	x	x	x	x	x	x	done	YES	done
Catostomus commersoni	x	x	x	x	x	x	x	x	x	x	done	YES	done
Centropristis striata (F)	X	x	x	x	x	X	X	x	X	X	done	YES	done
Centropristis striata (M)	X	x	x	x	x	X	X	x	X	X	done	YES	done
Citharichthys arctifrons	x	x	x	x	x	x	x	x	x	x	done	YES	done
Clupea harengus	x	x	x	x	x	x	x	x	x	x	done	YES	done
Conger oceanicus	x	x	x	x	x	x	x	x	x	x	done	YES	done
Cynoscion regalis	X	x	X	x	x	X	X	X	X	X	done	YES	done
Cyprinodon variegatus (F)	x	x	x	x	x	x	x	x	x	x	done	YES	done
Cyprinodon variegatus (M)	x	x	x	x	x	x	x	x	x	x	done	YES	done
Decapterus punctatus	x	x	x	x	x	X	X	X	X	x	done	YES	done
Dorosoma cepedianum	x	x	x	x	x	x	x	x	x	x	done	YES	done
Enchelyopus cimbrius	x	x	x	x	x	x	x	x	x	x	done	YES	done
Esox niger	x	x	x	x	x	x	x	x	x	x	done	YES	done
Etropus microstomus	X	x	X	x	x	X	X	X	X	X	done	YES	done
Eucinostomus argenteus	X	x	x	x	x	X	X	X	X	x	done	YES	done
Fundulus diaphanus (F)	x	x	x	x	x	x	x	x	x	x	done	YES	done
Fundulus heteroclitus (F)	x	x	x	x	x	x	x	x	x	x	done	YES	done
Fundulus heteroclitus (M)	x	x	x	x	x	x	x	x	x	x	done	YES	done
Fundulus majalis (F)	x	x	x	x	x	x	x	x	x	x	done	YES	done
Fundulus majalis (M)	x	x	x	x	x	x	x	x	x	x	done	YES	done
Gadus morhua	x	x	x	x	x	X	X	X	X	x	done	YES	done
Gasterosteus aculeatus	x	x	x	x	x	X	X	X	X	x	done	YES	done
Gobiosoma bosc	X	x	x	x	x	X	X	X	X	x	done	YES	done
Hemitripterus americanus	X	x	x	x	x	X	X	X	X	x	done	YES	done
Hippocampus erectus (F)	X	x	x	x	x	X	X	X	X	x	done	YES	done

SPECIES	Family Description	Common / Species Name	Other Names	RI sportfish	All-Tackle	ID / Description	General / Local Distribution	Diet	Importance	Management	Text Status	Illustration	Illustration Status
Hippocampus erectus (M)	X	x	x	x	x	X	X	X	X	x	done	YES	done
Lagodon rhomboides	x	x	X	x	x	X	X	X	X	X	done	YES	done
Leiostomus xanthurus	X	x	X	x	x	X	X	X	X	X	done	YES	done
Lepomis auritus	x	x	x	x	x	X	X	X	x	x	done	YES	done
Lepomis gibbosus	x	x	x	x	x	X	X	X	X	x	done	YES	done
Lepomis macrochirus	x	x	x	x	x	X	X	X	X	x	done	YES	done
Leucoraja erinacea	X	x	X	x	x	X	X	X	X	X	done	YES	
Leucoraja ocellata	X	x	X	x	x	X	X	X	X	X	done	YES	
Lophius americanus	X	x	x	x	x	X	X	X	X	x	done	YES	done
Lucania parva	x	x	x	x	x	x	x	x	x	x	done	YES	done
Lutjanus griseus	X	x	X	x	x	X	X	X	X	x	done	YES	done
Luxilus cornutus	x	x	x	x	x	x	x	x	x	x	done	YES	done
Menidia beryllina	x	x	x	x	x	x	x	x	x	x	done	YES	done
Menidia menidia	x	x	x	x	x	x	x	x	x	x	done	YES	done
Menticirrhus saxatilis	X	x	X	x	x	X	X	X	X	X	done	YES	done
Merluccius bilinearis	X	x	x	x	x	X	X	X	X	x	done	YES	done
Microgadus tomcod	x	x	x	x	x	X	X	X	X	x	done	YES	done
Micropterus dolomieu	x	x	x	x	x	X	X	X	X	x	done	YES	done
Micropterus salmoides	x	x	x	x	x	x	X	X	X	x	done	YES	done
Morone americana	X	x	x	x	x	X	X	X	X	x	done	YES	done
Morone saxatilis	X	x	x	x	x	X	X	X	X	x	done	YES	done
Mugil curema	X	x	x	x	x	X	X	X	X	x	done	YES	done
Mustelus canis	X	x	X	x	x	X	X	X	X	X	done	YES	done
Myoxocephalus aenaeus	x	x	x	x	x	x	x	x	x	x	done	YES	done
Myoxocephalus octodecemspinosus	x	x	x	x	x	X	X	X	X	x	done	YES	done
Notemigonus crysoleucas	x	x	x	x	x	x	x	x	x	x	done	YES	done
Opsanus tau	x	x	x	x	x	x	x	x	x	x	done	YES	done
Osmerus mordax	X	x	x	x	x	X	X	X	X	x	done	YES	done
Paralichthys dentatus	X	x	x	x	x	X	X	X	X	x	done	YES	done
Paralichthys oblongus	X	x	X	x	x	X	X	X	X	X	done	YES	done
Peprilus triacanthus	X	x	X	x	x	X	X	X	X	X	done	YES	done
Petromyzon marinus	x	x	x	x	x	x	x	x	x	x	done	YES	done
Pholis gunnellus	X	x	x	x	x	X	X	X	X	X	done	YES	done
Pollachius virens	x	x	x	x	x	X	X	X	X	x	done	YES	done
Pomatomus saltatrix	X	x	X	x	x	X	X	X	X	X	done	YES	done
Pomoxis nigromaculatus	x	x	x	x	x	x	x	x	x	x	done	YES	done
Priacanthus arenatus	X	x	X	x	x	X	X	X	X	x	done	YES	done
Prionotus carolinus	X	x	X	x	x	X	X	X	X	X	done	YES	done
Prionotus evolans	X	x	X	x	x	X	X	X	X	X	done	YES	done
Pseudopleuronectes americanus	X	x	X	x	x	X	X	X	X	X	done	YES	done
Pungitius pungitius	x	x	x	x	x	X	X	X	X	x	done	YES	done
Raja eglanteria	X	x	X	x	x	X	X	X	X	X	done	YES	
Rhinichthys atratulus	x	x	x	x	x	x	x	x	x	x	done	YES	done
Salmo salar	X	x	X	x	x	X	X	X	X	X	done	YES	done

SPECIES	Family Description	Common / Species Name	Other Names	RI sportfish	All-Tackle	ID / Description	General / Local Distribution	Diet	Importance	Management	Text Status	Illustration	Illustration Status
Salmo trutta	X	x	X	x	x	X	X	X	X	X	done	YES	done
Salvelinus fontinalis	X	x	X	x	x	X	X	X	X	X	done	YES	done
Scomber scombrus	X	x	X	x	x	X	X	X	X	X	done	YES	done
Scophthalmus aquosus	X	x	X	x	x	X	X	X	X	X	done	YES	done
Selene setapinnis	x	x	x	x	x	X	X	X	X	x	done	YES	done
Selene vomer	x	x	x	x	x	X	X	X	X	x	done	YES	done
Sphoeroides maculatus	x	x	x	x	x	X	X	X	X	x	done	YES	done
Sphyraena borealis	X	x	X	x	x	X	X	X	X	X	done	YES	done
Squalus acanthias	X	x	X	x	x	X	X	X	X	X	done	YES	done
Stenotomus chrysops	x	x	x	x	x	X	x	X	X	x	done	YES	done
Strongylura marina	x	x	x	x	x	X	X	X	X	x	done	YES	done
Syngnathus fuscus	X	x	x	x	x	X	X	X	X	x	done	YES	done
Synodus foetens	x	x	x	x	x	x	x	x	x	x	done	YES	done
Tautoga onitis (F)	X	x	x	x	x	X	X	X	X	X	done	YES	done
Tautoga onitis (M)	X	x	x	x	x	X	X	X	X	X	done	YES	done
Tautogolabrus adspersus	X	x	x	x	x	X	X	X	X	x	done	YES	done
Trachurus lathami	x	x	x	x	x	X	X	X	X	x	done	YES	done
Trinectes maculatus	x	x	x	x	x	x	x	x	x	x	done	YES	done
Upeneus parvus	X	x	x	x	x	X	X	X	X	x	done	YES	done
Urophycis chuss	X	x	x	x	x	X	X	X	X	x	done	YES	done
Urophycis regia	X	x	x	x	x	X	X	X	X	x	done	YES	done
Urophycis tenuis	X	x	x	x	x	X	X	X	X	x	done	YES	done
Zoarces americanus	X	x	X	x	x	X	X	X	X	X	done	YES	done
Ablennes hians	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Abudefduf saxatilis	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Acanthostracion polygonius	x	x	x	x	x	X	X	X	X	X	done	NO	N/A
Acanthostracion quadricornis	x	x	x	x	x	X	X	X	X	X	done	NO	N/A
Acanthurus chirurgus	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Acipenser brevirostrum	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Acipenser oxyrinchus oxyrinchus	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Acipenser sturio	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Albula vulpes	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Alectis ciliaris	x	x	x	x	x	X	X	X	x	x	done	NO	N/A
Alepisaurus ferox	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Alopias vulpinus	x	x	x	x	x	X	X	X	X	X	done	NO	N/A
Aluterus heudelotii	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Aluterus monoceros	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Aluterus schoepfii	x	x	x	x	x	x	X	x	x	x	done	NO	N/A
Aluterus scriptus	x	x	x	x	x	X	X	X	X	x	done	NO	N/A

SPECIES	Family Description	Common / Species Name	Other Names	RI sportfish	All-Tackle	ID / Description	General / Local Distribution	Diet	Importance	Management	Text Status	Illustration	Illustration Status
Amblyraja radiata	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Ammodytes dubius	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Anarhichas lupus	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Antigonia capros	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Apogon imberbis	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Archosargus probatocephalus	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Ariopsis felis	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Aspidophoroides monopterygius	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Astroscopus guttatus	X	x	X	x	x	X	X	X	X	x	done	NO	N/A
Auxis thazard	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Bagre marinus	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Balistes capriscus	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Balistes vetula	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Bothus robinsi	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Brosme brosme	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Calamus bajonado	x	x	X	x	x	X	X	X	X	X	done	NO	N/A
Carangoides bartholomaei	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Caranx latus	x	X	X	X	X	X	X	X	X	X	done	NO	N/A
Carcharhinus obscurus	x	x	x	x	x	X	X	X	X	X	done	NO	N/A
Carcharhinus plumbeus	x	x	x	x	x	X	X	X	X	X	done	NO	N/A
Carcharias taurus	x	x	x	x	x	x	x	x	x	X	done	NO	N/A
Carcharodon carcharias	X	x	x	x	x	X	X	X	X	X	done	NO	N/A
Caulolatilus microps	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Centrolophus niger	x	x	x	x	x	X	x	X	X	x	done	NO	N/A
Centropristis philadelphica	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Cetorhinus maximus	x	x	x	x	x	X	X	X	x	X	done	NO	N/A
Chaetodipterus faber	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Chaetodon capistratus	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Chaetodon ocellatus	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Chaetodon striatus	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Cheilopogon furcatus	x	x	x	x	x	X	x	X	X	x	done	NO	N/A
Cheilopogon heterurus	x	X	X	X	X	X	X	X	X	X	done	NO	N/A
Chilomycterus schoepfii	x	x	x	x	x	X	x	X	X	x	done	NO	N/A
Chloroscombrus chrysurus	x	X	X	X	X	X	X	X	X	X	done	NO	N/A
Citharichthys macrops	x	X	X	X	X	X	X	X	X	X	done	NO	N/A
Citharichthys spilopterus	x	X	X	X	X	X	X	X	X	X	done	NO	N/A
Coryphaena hippurus	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Cryptacanthodes maculatus	x	x	x	x	x	X	x	X	X	x	done	NO	N/A
Ctenogobius boleosoma	X	x	x	x	x	X	X	X	X	x	done	NO	N/A
Cyclopsetta fimbriata	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Cyclopterus lumpus	x	x	x	x	x	X	X	X	X	X	done	NO	N/A
Dactylopterus volitans	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Dasyatis centroura	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Dasyatis say	x	x	x	x	x	X	X	X	X	x	done	NO	N/A

SPECIES	Family Description	Common / Species Name	Other Names	RI sportfish	All-Tackle	ID / Description	General / Local Distribution	Diet	Importance	Management	Text Status	Illustration	Illustration Status
Decapterus macarellus	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Dibranchus atlanticus	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Diodon hystrix	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Dipturus laevis	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Echeneis naucrates	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Echeneis neucratoides	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Elops saurus	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Engraulis eurystole	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Epinephelus niveatus	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Etrumeus teres	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Eucinostomus gula	X	x	x	x	x	X	X	X	X	x	done	NO	N/A
Euleptorhamphus velox	x	x	x	x	x	X	X	X	x	x	done	NO	N/A
Euthynnus alletteratus	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Fistularia tabacaria	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Gaidropsarus ensis	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Galeocerdo cuvier	x	x	x	x	x	X	X	X	X	X	done	NO	N/A
Gasterosteus wheatlandi	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Ginglymostoma cirratum	X	x	x	x	x	X	X	X	X	X	done	NO	N/A
Glyptocephalus cynoglossus	X	x	x	x	x	X	X	X	X	X	done	NO	N/A
Gobiosoma ginsburgi	X	x	x	x	x	X	X	X	X	x	done	NO	N/A
Gymnura altavela	X	x	x	x	x	X	X	X	X	x	done	NO	N/A
Haemulon striatum	x	x	x	x	x	X	X	X	X	X	done	NO	N/A
Helicolenus dactylopterus	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Heteropriacanthus cruentatus	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Hippoglossoides platessoides	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Hippoglossus hippoglossus	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Hirundichthys speculiger	x	X	X	X	X	X	X	X	X	X	done	NO	N/A
Histrio histrio	x	x	x	x	x	X	x	x	x	x	done	NO	N/A
Holocentrus adscensionis	X	x	x	x	x	X	X	X	X	x	done	NO	N/A
Hyperoglyphe perciformis	x	x	x	x	X	X	X	X	X	x	done	NO	N/A
Hyporhamphus roberti	x	X	X	X	X	X	X	X	X	X	done	NO	N/A
Hyporhamphus unifasciatus	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Isurus oxyrinchus	X	x	x	x	x	X	X	X	X	X	done	NO	N/A
Kajikia albida	X	x	x	x	x	X	X	X	X	X	done	NO	N/A
Katsuwonus pelamis	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Kyphosus sectator	X	x	x	x	x	X	X	X	X	X	done	NO	N/A
Lactophrys trigonus	x	x	x	x	x	X	X	X	X	X	done	NO	N/A
Lactophrys triqueter	x	x	x	x	x	X	X	X	X	X	done	NO	N/A
Lagocephalus laevigatus	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Lamna nasus	X	x	x	x	x	X	X	X	X	X	done	NO	N/A
Lampris guttatus	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Lepophidium profundorum	X	x	X	x	x	X	X	X	X	x	done	NO	N/A
Leptoclinus maculatus	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Leucoraja garmani	X	x	X	x	x	X	X	X	X	X	done	NO	N/A

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Limanda ferruginea	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Liopsetta putnami	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Liparis atlanticus	X	x	x	x	x	X	X	X	X	x	done	NO	N/A
Liparis liparis	X	x	x	x	x	X	X	X	X	x	done	NO	N/A
Lobotes surinamensis	X	x	x	x	x	X	X	X	X	x	done	NO	N/A
Lopholatilus chamaeleonticeps	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Lutjanus analis	X	x	X	x	x	X	X	X	X	x	done	NO	N/A
Lutjanus aratus	X	x	X	x	x	X	X	X	X	x	done	NO	N/A
Lutjanus campechanus	X	x	x	x	x	X	X	X	X	x	done	NO	N/A
Lycenchelys verrillii	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Lycodes reticulatus	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Macroramphosus scolopax	X	x	x	x	x	X	X	X	X	x	done	NO	N/A
Makaira nigricans	X	x	x	x	x	X	X	X	X	X	done	NO	N/A
Malacoraja senta	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Manta birostris	X	x	x	x	x	X	X	X	X	x	done	NO	N/A
Melanogrammus aeglefinus	X	X	X	X	X	X	X	X	X	X	done	NO	N/A
Megalops atlanticus	X	x	x	x	x	X	X	X	X	x	done	NO	N/A
Micropogonias undulatus	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Mobula hypostoma	X	x	x	x	x	X	X	X	X	x	done	NO	N/A
Mola mola	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Monacanthus ciliatus	x	x	X	x	x	X	X	X	X	X	done	NO	N/A
Mugil cephalus	X	x	x	x	x	X	X	X	X	x	done	NO	N/A
Mullus auratus	X	x	x	x	x	X	X	X	X	x	done	NO	N/A
Mycteroperca microlepis	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Mycteroperca phenax	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Myliobatis freminvillii	X	x	x	x	x	X	X	X	X	X	done	NO	N/A
Myoxocephalus quadricornis	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Myoxocephalus scorpius	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Naucrates ductor	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Nomeus gronovii	X	x	x	x	x	X	X	X	X	X	done	NO	N/A
Oligoplites saurus	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Ophidion marginatum	X	x	X	x	x	X	X	X	X	x	done	NO	N/A
Opisthonema oglinum	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Orthopristis chrysoptera	X	x	x	x	x	X	X	X	X	x	done	NO	N/A
Paralichthys albigutta	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Parexocoetus hillianus	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Parexocoetus mento	x	X	X	X	X	X	X	X	X	X	done	NO	N/A
Peprilus paru	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Perca flavescens	X	X	X	X	X	X	X	X	X	X	done	NO	N/A
Peristedion miniatum	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Pogonias cromis	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Prionace glauca	x	x	x	x	x	X	X	X	X	X	done	NO	N/A
Prionotus rubio	X	x	x	x	x	X	X	X	X	X	done	NO	N/A
Prionotus scitulus	x	X	X	X	X	X	X	X	X	X	done	NO	N/A

SPECIES	Family Description	Common / Species Name	Other Names	RI sportfish	All-Tackle	ID / Description	General / Local Distribution	Diet	Importance	Management	Text Status	Illustration	Illustration Status
Prionotus tribulus	x	X	X	X	X	X	X	X	X	X	done	NO	N/A
Pristigenys alta	X	x	X	x	x	X	X	X	X	x	done	NO	N/A
Prognichthys gibbifrons	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Pseudupeneus maculatus	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Rachycentron canadum	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Remora brachyptera	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Remora osteochir	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Remora remora	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Rhinoptera bonasus	X	x	x	x	x	X	X	X	X	X	done	NO	N/A
Rypticus bistrispinus	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Sarda sarda	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Sardinella aurita	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Sargocentron vexillarium	X	x	x	x	x	X	X	X	X	x	done	NO	N/A
Sciaenops ocellatus	X	x	X	x	x	X	X	X	X	x	done	NO	N/A
Scomber colias	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Scomberesox saurus	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Scomberomorus maculatus	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Scomberomorus regalis	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Scyliorhinus retifer	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Sebastes norvegicus	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Selar crumenophthalmus	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Seriola lalandei	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Seriola zonata	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Sphoeroides spengleri	x	x	x	x	x	x	X	x	x	x	done	NO	N/A
Sphoeroides testudineus	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Sphyraena barracuda	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Sphyraena guachancho	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Sphyrna lewini	X	x	x	x	x	X	X	X	X	X	done	NO	N/A
Sphyrna tiburo	X	x	x	x	x	X	X	X	X	X	done	NO	N/A
Sphyrna zygaena	X	x	x	x	x	X	X	X	X	X	done	NO	N/A
Squatina dumeril	X	x	x	x	x	X	X	X	X	X	done	NO	N/A
Stegastes leucostictus	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Stegastes partitus	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Stephanolepis hispidus	x	x	X	x	x	X	X	X	X	X	done	NO	N/A
Syngnathus floridae	x	X	X	X	X	X	X	X	X	X	done	NO	N/A
Syngnathus louisianae	x	X	X	X	X	X	X	X	X	X	done	NO	N/A
Syngnathus pelagicus	x	X	X	X	X	X	X	X	X	X	done	NO	N/A
Synodus intermedius	x	X	X	X	X	X	X	X	X	X	done	NO	N/A
Synodus saurus	x	X	X	X	X	X	X	X	X	X	done	NO	N/A
Synodus synodus	x	x	X	x	x	x	x	x	x	x	done	NO	N/A
Thunnus alalunga	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Thunnus albacares	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Thunnus obesus	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Thunnus thynnus	X	x	X	x	x	X	X	X	X	X	done	NO	N/A

SPECIES	Family Description	Common / Species Name	Other Names	RI sportfish	All-Tackle	ID / Description	General / Local Distribution	Diet	Importance	Management	Text Status	Illustration	Illustration Status
Torpedo nobiliana	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Trachinocephalus myops	x	x	x	x	x	x	x	x	x	x	done	NO	N/A
Trachinotus carolinus	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Trachinotus falcatus	x	x	x	x	x	X	X	X	X	x	done	NO	N/A
Trichiurus lepturus	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Tylosurus crocodilus	x	x	x	x	x	X	X	X	X	X	done	NO	N/A
Ulvaria subbifurcata	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Xiphias gladius	X	x	X	x	x	X	X	X	X	X	done	NO	N/A
Zenopsis conchifera	x	x	x	x	x	x	x	x	x	x	done	NO	N/A

Table 4. Summary of species illustrations completed during current grant reporting period (January 1, 2024 - December 31, 2024; **X**, **done**), current grant award (January 1, 2020 - December 31, 2024; **X**, **done**), and species previously illustrated for the "Inland Fishes of Rhode Island" book to be used in the "Marine Fishes of Rhode Island" book (x, done).

SPECIES	COMMON NAME	Draft pencil sketches	Final pencil sketch	Draft INK illustration	Final INK illustration	Draft COLOR illustration	Final COLOR illustration	ILLUSTRATIONS COMPLETED	Book
Ammodytes americanus	American sand lance	X	X	X	X	X	X	done	Marine Fishes of RI
Anchoa hepsetus	Striped anchovy	X	X	X	X	X	X	done	Marine Fishes of RI
Bairdiella chrysoura	Silver perch	X	X	X	X	X	X	done	Marine Fishes of RI
Caranx crysos	Blue runner	X	X	X	X	X	X	done	Marine Fishes of RI
Centropristis striata (F)	Black sea bass	X	X	X	X	X	X	done	Marine Fishes of RI
Centropristis striata (M)	Black sea bass	X	X	X	X	X	X	done	Marine Fishes of RI
Citharichthys arctifrons	Gulfstream flounder	X	X	X	X	X	X	done	Marine Fishes of RI
Clupea harengus	Atlantic herring	X	X	X	X	X	X	done	Marine Fishes of RI
Conger oceanicus	Conger eel	X	X	X	X	X	X	done	Marine Fishes of RI
Cyprinodon variegatus (F)	Sheepshead minnow	X	X	X	X	X	X	done	Marine Fishes of RI
Decapterus punctatus	Round scad	X	X	X	X	X	X	done	Marine Fishes of RI
Euthynnus alletteratus	False albacore	X	X	X	X	X	X	done	Marine Fishes of RI
Enchelyopus cimbrius	Fourbeard rockling	X	X	X	X	X	X	done	Marine Fishes of RI
Etropus microstomus	Smallmouth flounder	X	X	X	X	X	X	done	Marine Fishes of RI
Fundulus heteroclitus (F)	Mummichog	X	X	X	X	X	X	done	Marine Fishes of RI
Gadus morhua	Atlantic cod	X	X	X	X	X	X	done	Marine Fishes of RI
Hemitripterus americanus	Sea raven	X	X	X	X	X	X	done	Marine Fishes of RI
Hippocampus erectus (F)	Lined seahorse	X	X	X	X	X	X	done	Marine Fishes of RI
Hippocampus erectus (M)	Lined seahorse	X	X	X	X	X	X	done	Marine Fishes of RI
Leiostomus xanthurus	Spot	X	X	X	X	X	X	done	Marine Fishes of RI
Leucoraja erinacea	Little skate	X	X	X	X				Marine Fishes of RI
Leucoraja ocellata	Winter skate	X	X	X	X				Marine Fishes of RI
Lophius americanus	American goosefish	X	X	X	X	X	X	done	Marine Fishes of RI
Merluccius bilinearis	Silver hake	X	X	X	X	X	X	done	Marine Fishes of RI
Mustelus canis	Smooth dogfish	X	X	X	X	X	X	done	Marine Fishes of RI
Myoxocephalus aenaeus	Grubby sculpin	X	X	X	X	X	X	done	Marine Fishes of RI
Myoxocephalus octodecemspinosus	Longhorn sculpin	X	X	X	X	X	X	done	Marine Fishes of RI
Opsanus tau	Oyster toadfish	X	X	X	X	X	X	done	Marine Fishes of RI
Paralichthys dentatus	Summer flounder	X	X	X	X	X	X	done	Marine Fishes of RI
Paralichthys oblongus	Fourspot flounder	X	X	X	X	X	X	done	Marine Fishes of RI
Pholis gunnellus	Rock gunnel	X	X	X	X	X	X	done	Marine Fishes of RI
Pollachius virens	Pollock	X	X	X	X	X	X	done	Marine Fishes of RI
Priacanthus arenatus	Bigeye	X	X	X	X	X	X	done	Marine Fishes of RI
Prionotus evolans	Striped searobin	X	X	X	X	X	X	done	Marine Fishes of RI
Raja eglanteria	Clearnose skate	X	X	X	X				Marine Fishes of RI
Sarda sarda	Atlantic bonito	X	X	X	X	X	X	done	Marine Fishes of RI

SPECIES	COMMON NAME	Draft pencil sketches	Final pencil sketch	Draft INK illustration	Final INK illustration	Draft COLOR illustration	Final COLOR illustration	ILLUSTRATIONS COMPLETED	Book
Scomber scombrus	Atlantic mackerel	X	X	X	X	X	X	done	Marine Fishes of RI
Selene setapinnis	Atlantic moonfish	X	X	X	X	X	X	done	Marine Fishes of RI
Sphoeroides maculatus	Northern puffer	X	X	X	X	X	X	done	Marine Fishes of RI
Sphyraena borealis	Northern sennet	X	X	X	X	X	X	done	Marine Fishes of RI
Squalus acanthias	Spiny dogfish	X	X	X	X	X	X	done	Marine Fishes of RI
Stenotomus chrysops	Scup	X	X	X	X	X	X	done	Marine Fishes of RI
Synodus foetens	Inshore lizardfish	X	X	X	X	X	X	done	Marine Fishes of RI
Tautoga onitis (F)	Tautog	x	x	x	x	x	X	done	Marine Fishes of RI
Tautoga onitis (M)	Tautog	x	x	x	x	x	X	done	Marine Fishes of RI
Tautogolabrus adspersus	Cunner	x	x	x	x	x	X	done	Marine Fishes of RI
Trachurus lathami	Rough scad	x	x	x	x	x	X	done	Marine Fishes of RI
Upeneus parvus	Dwarf goatfish	x	x	x	x	x	X	done	Marine Fishes of RI
Urophycis chuss	Red hake	X	X	X	X	X	X	done	Marine Fishes of RI
Urophycis regia	Spotted hake	X	X	X	X	X	X	done	Marine Fishes of RI
Urophycis tenuis	White hake	X	X	X	X	X	X	done	Marine Fishes of RI
Zoarces americanus	Ocean pout	X	X	X	X	X	X	done	Marine Fishes of RI
Alosa aestivalis	Blueback herring	x	x	x	x	x	x	done	Inland fishes of RI
Alosa mediocris	Hickory shad	x	x	x	x	x	x	done	Inland fishes of RI
Alosa pseudoharengus	Alewife	x	x	x	x	x	x	done	Inland fishes of RI
Alosa sapidissima	American shad	x	x	x	x	x	x	done	Inland fishes of RI
Ameiurus nebulosus	Brown bullhead	x	x	x	x	x	x	done	Inland fishes of RI
Anchoa mitchilli	Bay anchovy	x	x	x	x	x	x	done	Inland fishes of RI
Anguilla rostrata	American eel	x	x	x	x	x	x	done	Inland fishes of RI
Apeltes quadracus	Fourspine stickleback	x	x	x	x	x	x	done	Inland fishes of RI
Brevoortia tyrannus	Atlantic menhaden	x	x	x	x	x	x	done	Inland fishes of RI
Caranx hippos	Crevalle jack	x	x	x	x	x	x	done	Inland fishes of RI
Catostomus commersoni	White sucker	x	x	x	x	x	x	done	Inland fishes of RI
Cynoscion regalis	Weakfish	x	x	x	x	x	x	done	Inland fishes of RI
Cyprinodon variegatus (M)	Sheepshead minnow	x	x	x	x	x	x	done	Inland fishes of RI
Dorosoma cepedianum	American gizzard shad	x	x	x	x	x	x	done	Inland fishes of RI
Esox niger	Chain pickerel	x	x	x	x	x	x	done	Inland fishes of RI
Eucinostomus argenteus	Spotfin mojarra	x	x	x	x	x	x	done	Inland fishes of RI
Fundulus diaphanus	Banded killifish	x	x	x	x	x	x	done	Inland fishes of RI
Fundulus heteroclitus (M)	Mummichog	x	x	x	x	x	x	done	Inland fishes of RI
Fundulus majalis (F)	Striped killifish	x	x	x	x	x	x	done	Inland fishes of RI
Fundulus majalis (M)	Striped killifish	x	x	x	x	x	x	done	Inland fishes of RI
Gasterosteus aculeatus	Threespine stickleback	x	x	x	x	x	x	done	Inland fishes of RI
Gobiosoma bosc	Naked goby	x	x	x	x	x	x	done	Inland fishes of RI
Lagodon rhomboides	Pinfish	x	x	x	x	x	x	done	Inland fishes of RI
Lepomis auritus	Redbreast sunfish	x	x	x	x	x	x	done	Inland fishes of RI
Lepomis gibbosus	Pumpkinseed	x	x	x	x	x	x	done	Inland fishes of RI
Lepomis macrochirus	Bluegill	x	x	x	x	x	x	done	Inland fishes of RI

SPECIES	COMMON NAME	Draft pencil sketches	Final pencil sketch	Draft INK illustration	Final INK illustration	Draft COLOR illustration	Final COLOR illustration	**ILLUSTRATIONS COMPLETED**	Book
Lucania parva	Rainwater killifish	x	x	x	x	x	x	done	Inland fishes of RI
Lutjanus griseus	Gray snapper	x	x	x	x	x	x	done	Inland fishes of RI
Luxilus cornutus	Common shiner	x	x	x	x	x	x	done	Inland fishes of RI
Menidia beryllina	Inland silverside	x	x	x	x	x	x	done	Inland fishes of RI
Menidia menidia	Atlantic silverside	x	x	x	x	x	x	done	Inland fishes of RI
Menticirrhus saxatilis	Northern kingfish	x	x	x	x	x	x	done	Inland fishes of RI
Microgadus tomcod	Atlantic tomcod	x	x	x	x	x	x	done	Inland fishes of RI
Micropterus dolomieu	Smallmouth bass	x	x	x	x	x	x	done	Inland fishes of RI
Micropterus salmoides	Largemouth bass	x	x	x	x	x	x	done	Inland fishes of RI
Morone americana	White perch	x	x	x	x	x	x	done	Inland fishes of RI
Morone saxatilis	Striped bass	x	x	x	x	x	x	done	Inland fishes of RI
Mugil curema	White mullet	x	x	x	x	x	x	done	Inland fishes of RI
Notemigonus crysoleucas	Golden shiner	x	x	x	x	x	x	done	Inland fishes of RI
Osmerus mordax	Rainbow smelt	x	x	x	x	x	x	done	Inland fishes of RI
Peprilus triacanthus	Butterfish	x	x	x	x	x	x	done	Inland fishes of RI
Petromyzon marinus	Sea lamprey	x	x	x	x	x	x	done	Inland fishes of RI
Pomatomus saltatrix	Bluefish	x	x	x	x	x	x	done	Inland fishes of RI
Pomoxis nigromaculatus	Black crappie	x	x	x	x	x	x	done	Inland fishes of RI
Prionotus carolinus	Northern searobin	x	x	x	x	x	x	done	Inland fishes of RI
Pseudopleuronectes americanus	Winter flounder	x	x	x	x	x	x	done	Inland fishes of RI
Pungitius pungitius	Ninespine stickleback	x	x	x	x	x	x	done	Inland fishes of RI
Rhinichthys atratulus	Blacknose dace	x	x	x	x	x	x	done	Inland fishes of RI
Salmo salar	Atlantic salmon	x	x	x	x	x	x	done	Inland fishes of RI
Salmo trutta	Brown trout	x	x	x	x	x	x	done	Inland fishes of RI
Salvelinus fontinalis	Brook trout	x	x	x	x	x	x	done	Inland fishes of RI
Scophthalmus aquosus	Windowpane flounder	x	x	x	x	x	x	done	Inland fishes of RI
Selene vomer	Lookdown	x	x	x	x	x	x	done	Inland fishes of RI
Strongylura marina	Atlantic needlefish	x	x	x	x	x	x	done	Inland fishes of RI
Syngnathus fuscus	Northern pipefish	x	x	x	x	x	x	done	Inland fishes of RI
Trinectes maculatus	Hogchocker	x	x	x	x	x	x	done	Inland fishes of RI

ASSESSMENT OF RECREATIONALLY IMPORTANT FINFISH STOCKS IN RHODE ISLAND WATERS

University of Rhode Island
Graduate School of Oceanography
Weekly Fish Trawl
2024

PERFORMANCE REPORT
F-61-R SEGMENT 21
JOB 14

Jeremy Collie, PhD
Professor Emeritus of Oceanography
February 2025

Annual Performance Report

STATE: Rhode Island PROJECT NUMBER: F-61-R
SEGMENT NUMBER: 22

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

JOB NUMBER: 14

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

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

PERIOD COVERED: January 1, 2024 – December 31, 2024.

TARGET DATE: December 2024

SCHEDULE OF PROGRESS: On schedule.

SIGNIFICANT DEVIATIONS: None

RECOMMENDATIONS: Continuation of the weekly trawl survey into 2025; data provided by the survey are used extensively in the Atlantic States Marine Fisheries Commission and NOAA Fisheries fishery management process and fishery management plans.

Commented [JC1]: Alex Asks: Should this Segment Number be the same as the one on the title page?

Commented [JC2R1]: Yes, but I'm not sure which one is correct.

Introduction:

The University of Rhode Island, Graduate School of Oceanography, began monitoring finfish populations in Narragansett Bay in 1959, and has continued through 2024. These data provide weekly identification of finfish and crustacean assemblages. Since the inception of the weekly fish trawl, survey tows have been conducted within Rhode Island territorial waters at two stations, one representing habitat of Narragansett Bay and one representing more open-water type habitats, characteristic of Rhode Island Sound. The weekly time step of this survey and its long duration are two unique characteristics of this survey. The short duration time step (weekly) has enough definition to capture migration periods and patterns of important finfish species and the length of the time series allows for the characterization of these patterns back into periods of time that may represent different productivity or climate regimes for many of these species. This performance report reflects the efforts of the 2024 survey year as they relate to those of the past years since the beginning of the survey.

Methods:

A weekly trawl survey is conducted on the URI research vessel *Cap'n Bert*. Two stations are sampled each week (Figure 1): one off Wickford, RI represents conditions in mid Narragansett Bay (Fox Island) and one at the mouth of Narragansett Bay represents conditions in Rhode Island Sound (Whale Rock). A hydrographic profile at each station measures temperature, salinity, and dissolved oxygen. The same otter trawl net design has been used since the survey began. A 30-minute tow is made at each station at a speed of 2 knots. All species are counted and weighed with an electronic balance. Winter flounder are routinely measured and their sex is determined by external examination. When present on board, an undergraduate intern measures all other species with an electronic measuring board.

The gear dimensions of the net are as follows:

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

The following are the station locations for the survey:

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

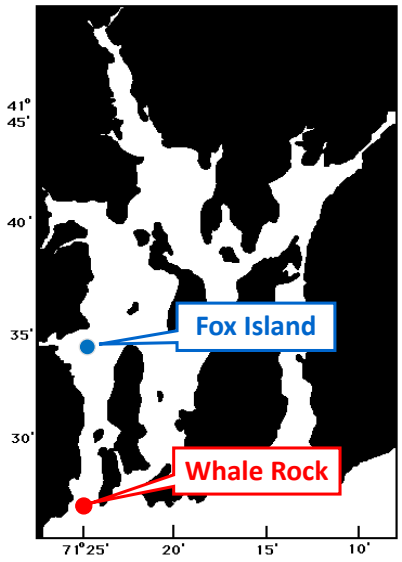


Figure 1. Location of trawl stations in Narragansett Bay.

(For more information about the GSO fish trawl go https://web.uri.edu/gso/research/fish-trawl/)

Results:

50 weekly tows were made at the bay (Fox Island) station and 51 were made at the sound (Whale Rock) station. Three weeks of sampling were missed at Fox Island due to ongoing offshore wind development, surface and bottom temperatures were still taken on these dates. Two weeks of sampling were missed at Whale Rock, due to a rip in the net on one date and unsafe weather conditions on the other, surface and bottom temperatures were not taken on these dates.

Environmental conditions

Weekly water temperatures at both stations were overall comparable to the historic average throughout the year (Figure 2), with the fall and winter slightly warmer. Surface temperature at Whale Rock was not measured on two dates in September and October because of an equipment issue and unsafe weather conditions.

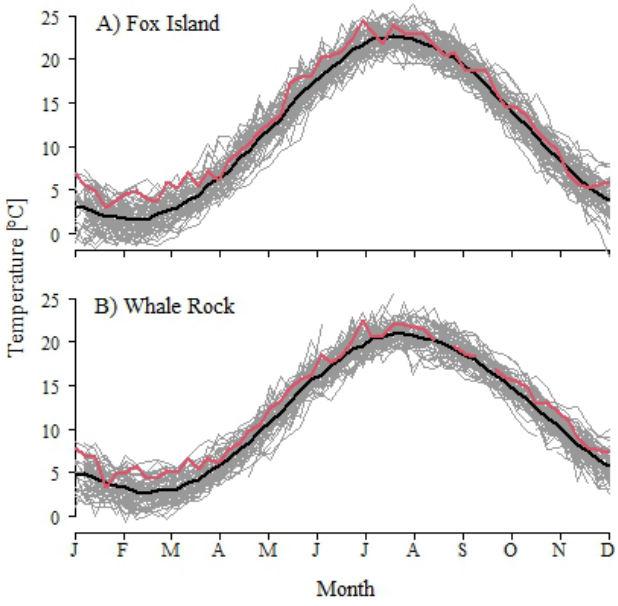


Figure 2. Weekly sea surface temperature of Narragansett Bay at each sampling station. The gray lines represent the seasonal temperature cycle for each previous year. The black line is the average temperature over all years. The most recent year, 2024, is labeled red.

Summary catch statistics

Table 3. Total catch by species at Fox Island (FI) and Whale Rock (WR) for the top 25 species caught in 2024.

Species	**FI**	**WR**	**Total**
SCUP (*Stenotomus chrysops*)	4385	2434	6819
SILVER HAKE (*Merluccius bilinearis*)	4	6236	6240
LONGFIN SQUID (*Loligo peali*)	1359	1861	3220
BUTTERFISH (*Peprilus triancanthus*)	1257	1758	3015
SPOT (*Leiostomus xanthurus*)	391	2196	2587
ATLANTIC ROCK CRAB (*Cancer irroratus*)	13	747	760
LITTLE SKATE (*Raja erinacea*)	6	732	738
SPIDER CRAB (*Libinia emarginata*)	232	463	695
SUMMER FLOUNDER (*Paralichthys dentatus*)	397	270	667
ATLANTIC MOONFISH (*Vomer setapinnis*)	542	32	574
STRIPED SEAROBIN (*Prionotus evolans*)	81	312	393
WINTER FLOUNDER (*Pseudopleuronectes americanus*)	29	361	390
NORTHERN SEAROBIN (*Prionotus carolinus*)	75	273	348
WINDOWPANE (*Scophthalmus aquosus*)	7	312	319
SPOTTED HAKE (*Urophycis regia*)	1	259	260
MENHADEN (*Brevootia tyrannus*)	28	227	255
SMALLMOUTH FLOUNDER (*Etropus microstomus*)	8	198	206
SMOOTH DOGFISH (*Mustelus canis*)	112	80	192
SPONGE (*Suberites spp*)	123	1	124
WEAKFISH (*Cynoscion regalis*)	63	40	103
NORTHERN PUFFER (*Sphaeroides maculatus*)	26	64	90
HERMIT CRABS (*Pagurus pollicaris*)	86	3	89
BLACK SEA BASS (*Centropristes striatus*)	5	78	83
BLUE CRAB (*Callinectes sapidus*)	47	30	77
ATLANTIC SILVERSIDE (*Menidia menidia*)	75	0	75
Total	**9352**	**18967**	**28319**

The top 10 species caught in 2024 (and the station where they were most numerous) were: Silver hake (WR), Scup (FI), Scup (WR), Spot (WR), Longfin squid (WR), Butterfish (WR), Longfin squid (FI), Butterfish (FI), Atlantic rock crab (WR), and Little skate (WR).

A number of species of recreational importance were collected during 2024 by the URI Fish trawl survey. Represented below are a number of important species and their abundance trends throughout the time series of this survey. On each graph, the species abundance at the two stations is represented separately for each station.



Winter flounder

Winter flounder are one of the target species for the survey. The population of winter flounder has declined dramatically during the time period of the survey with some of the lowest estimates on record for both stations occurring in the last decade (Figure 3). Since 2020 there has been a slight increase in winter flounder at Whale Rock but not at Fox Island. The survey information is used during the stock assessment process for winter flounder.

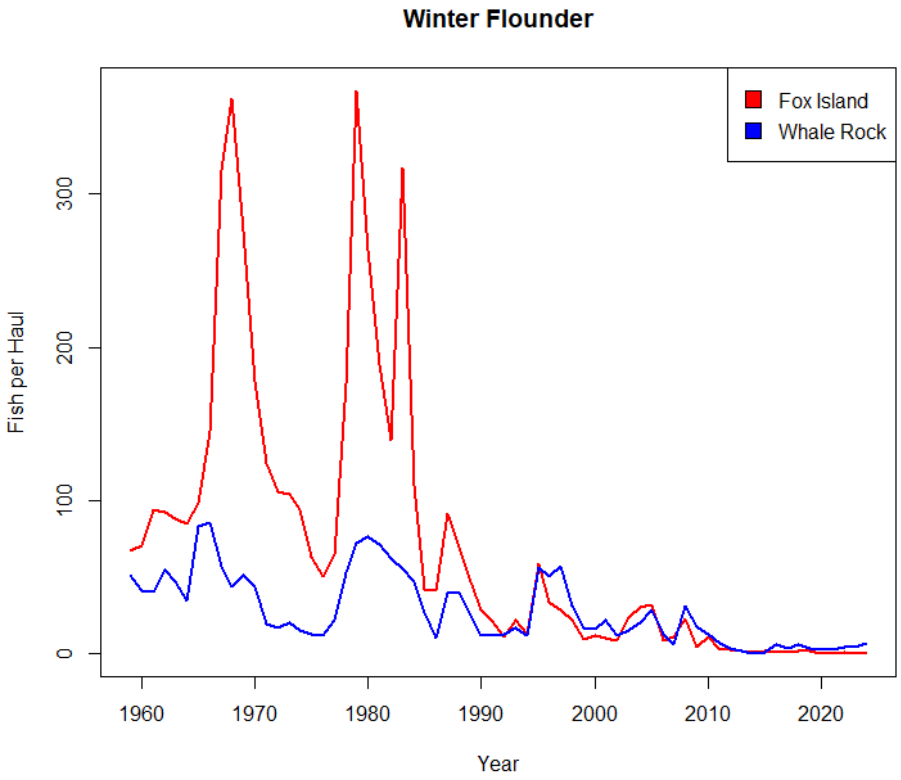


Figure 3 – Survey data for entire time series for winter flounder at both sampling stations (Fox Island and Whale Rock).



Tautog

Tautog are another important recreational species caught by the survey. The population of tautog has declined dramatically during the time period of the survey but does show some small improvement in the most recent period of time (Figure 4). Despite the improvement, the population according to the survey has not rebounded to former levels. Tautog are mainly caught at the Fox Island station, with only random and infrequent catches occurring at Whale Rock. The survey information was reviewed during the stock assessment process for tautog.

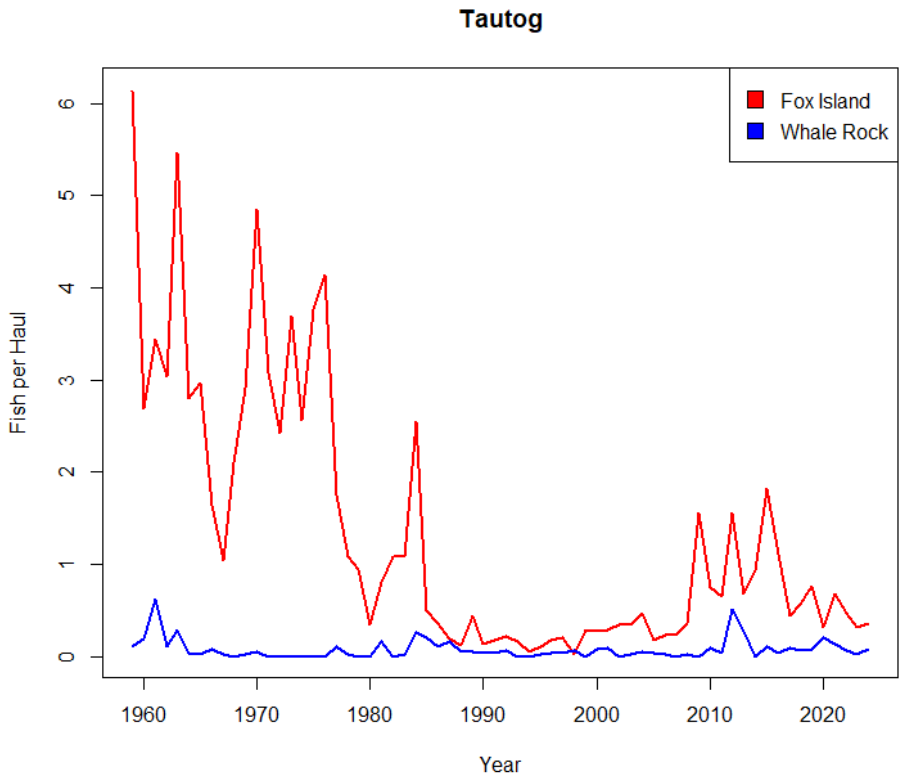


Figure 4 – Survey data for entire time series for tautog at both sampling stations (Fox Island and Whale Rock).



Summer Flounder

Summer flounder are another important recreational species caught by the survey. The population of summer flounder has increased dramatically during the time period of the survey but does show a fair amount of variability in the most recent time period (Figure 5). Summer flounder are caught at both sampling stations consistently, although abundance at Whale Rock has mostly been higher than at Fox Island during the second half of the timeseries. The survey information was reviewed during the stock assessment process for summer flounder, and the trends indicated by the survey are similar to those indicated by the overall population trends.

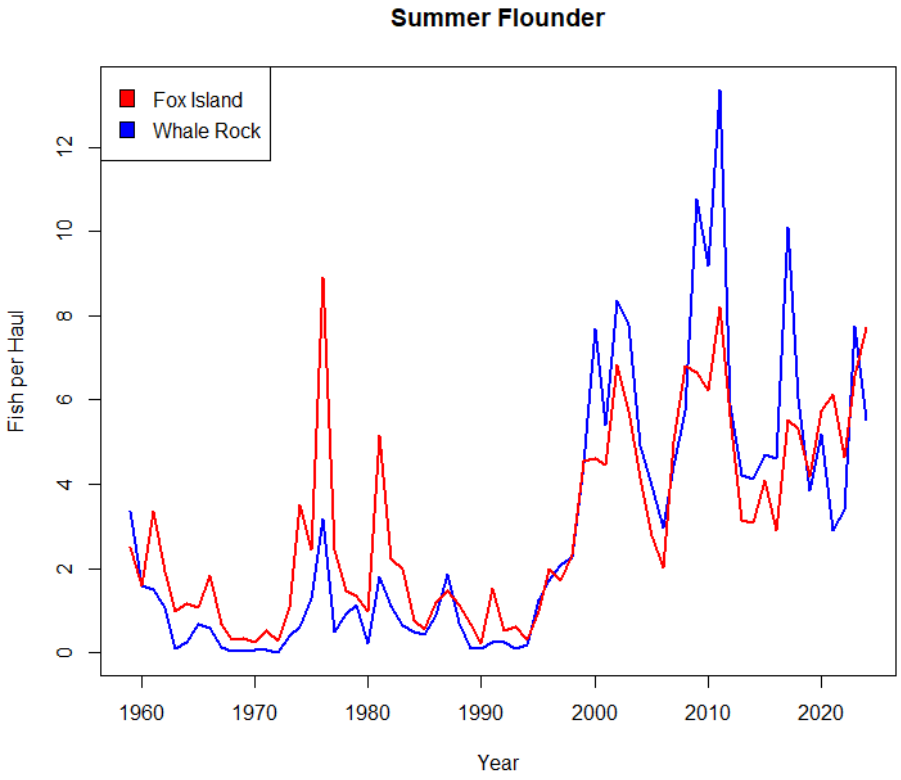


Figure 5 – Survey data for entire time series for summer flounder at both sampling stations (Fox Island and Whale Rock).



Black Sea Bass

Black sea bass are another important recreational species caught consistently by the survey. The population of black sea bass has increased dramatically during the time period of the survey much like summer flounder, and also shows a fair amount of variability in the most recent time period (Figure 6). Black sea bass are caught at both sampling stations fairly consistently.

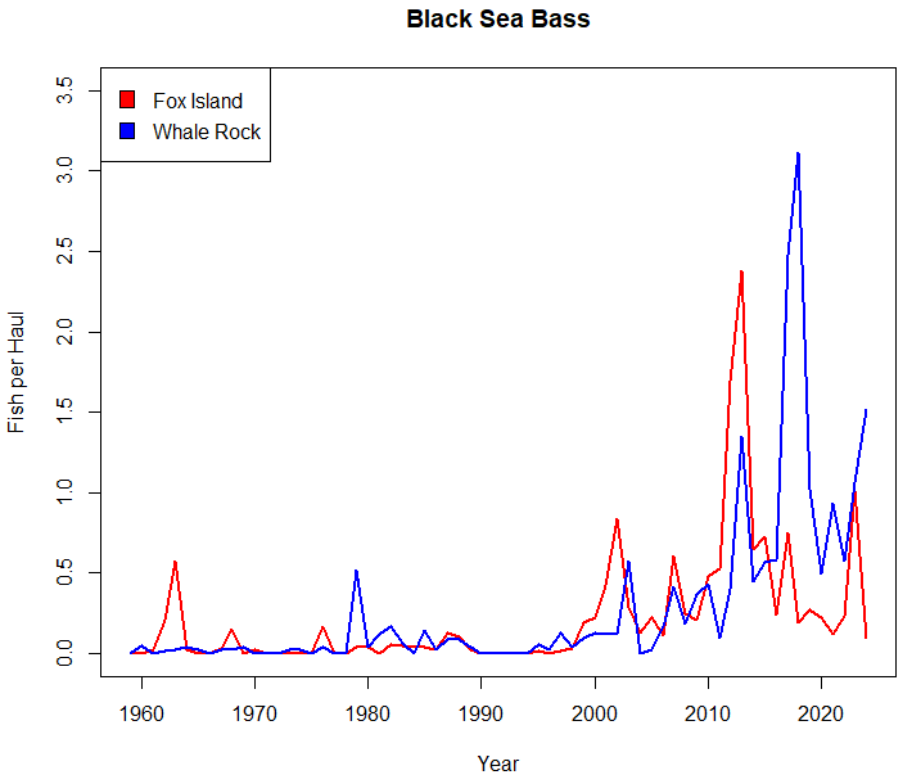


Figure 6 – Survey data for entire time series for black sea bass at both sampling stations (Fox Island and Whale Rock).



Scup

Scup is another of the Mid-Atlantic species caught consistently by the survey, along with summer flounder, black sea bass, bluefish, and menhaden. The population of scup has increased dramatically during the time period of the survey much like summer flounder and black sea bass, showing a high degree of variability going all the way back to the mid-1970s (Figure 7). Scup are caught at both sampling stations consistently, although the Fox Island station catches a much higher magnitude than does the Whale Rock station. Some of this variability and magnitude difference for scup is driven by high recruitment events, the young-of-the-year recruits being susceptible to the trawl gear. The survey information was reviewed during the stock assessment process for scup.

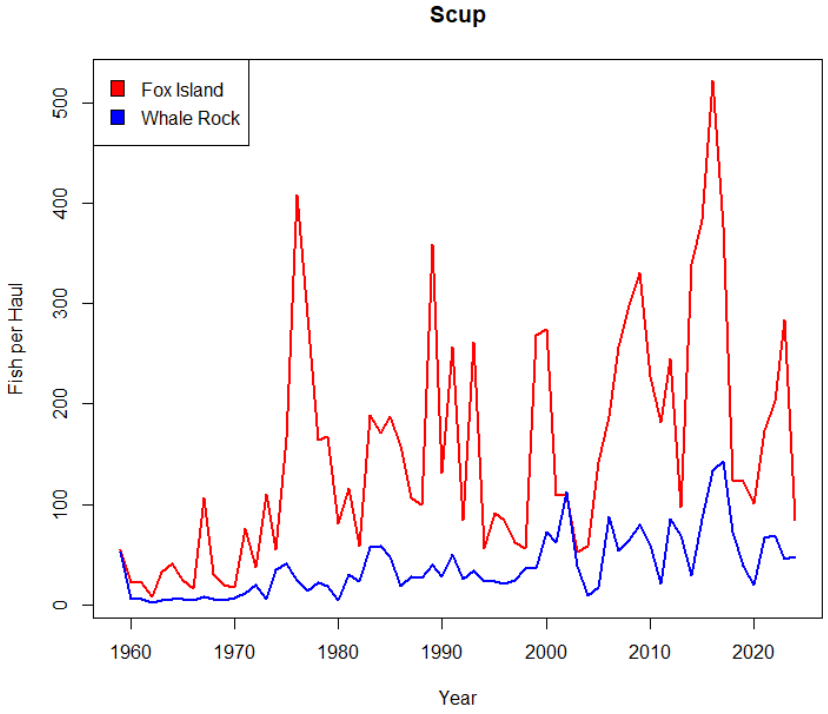


Figure 7 – Survey data for entire time series for scup at both sampling stations (Fox Island and Whale Rock).



Bluefish

Bluefish is another of the Mid-Atlantic species caught consistently by the survey. The population of bluefish increased during the middle of the survey time period, but has since declined, with some potential improvement in recent years. There is high variability for this species in the survey data, again mainly due to catching young-of-the-year bluefish as opposed to adults (Figure 8). Bluefish are caught at both sampling stations fairly consistently.

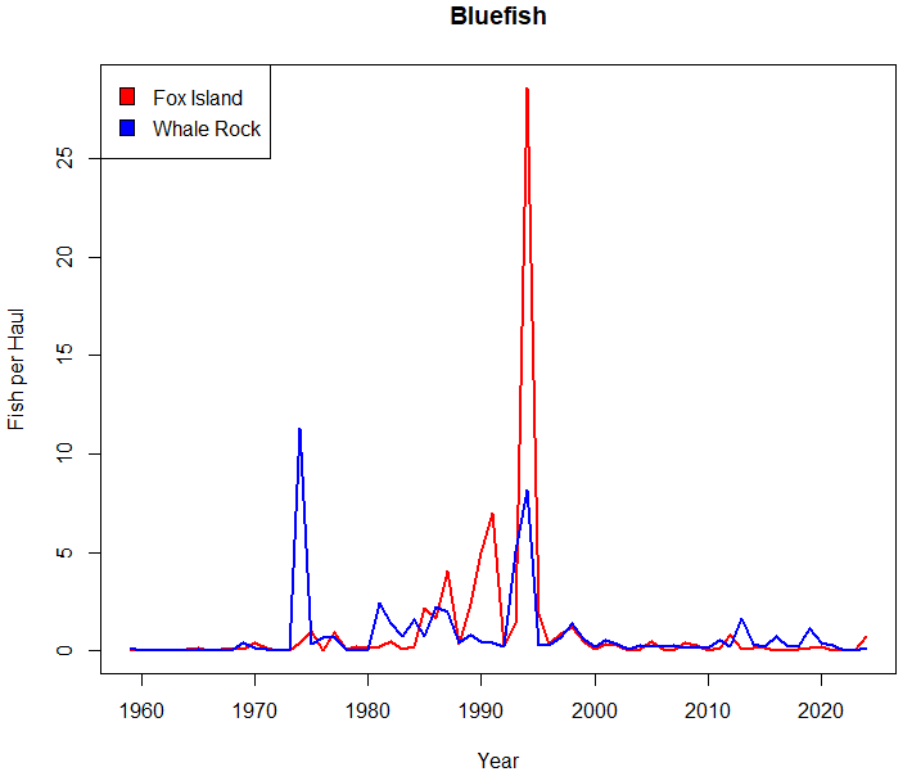


Figure 8 – Survey data for entire time series for bluefish at both sampling stations (Fox Island and Whale Rock).



Weakfish

Weakfish is another of the Mid-Atlantic species caught consistently by the survey, as weakfish use Narragansett Bay as a nursery habitat. The population of weakfish has been variable through the time period of the survey with periods of high abundance and periods of very low abundance. There is high variability for this species in the survey data, again mainly due to catching young-of-the-year weakfish as opposed to adults (Figure 9), so this survey is probably a better indicator of recruitment than adult population size. Weakfish are caught at both sampling stations fairly consistently, with a shift from Fox Island to Whale Rock since the 1990s.

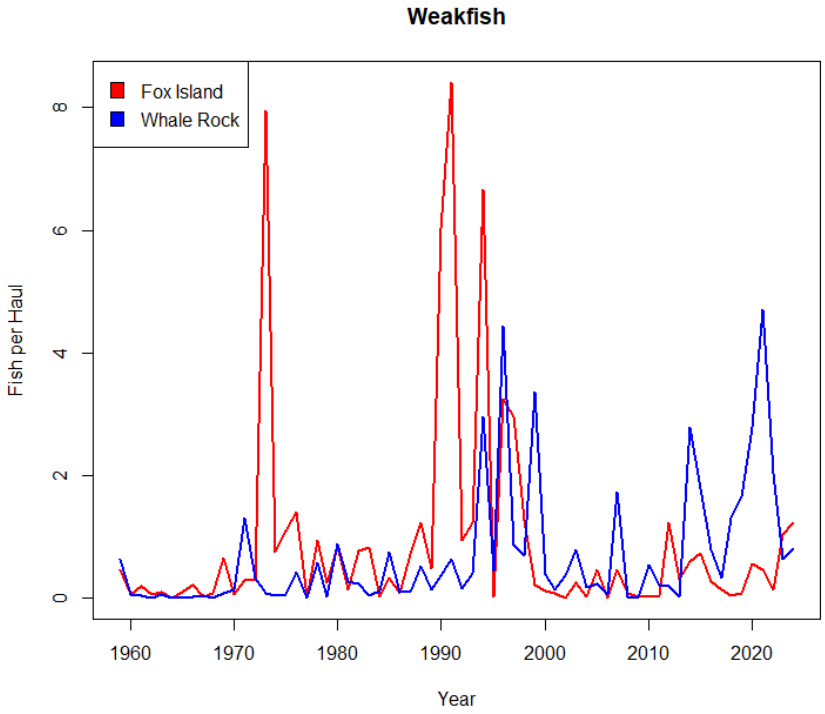


Figure 9 – Survey data for entire time series for weakfish at both sampling stations (Fox Island and Whale Rock).



Striped Bass

Striped bass is probably the premier recreational species caught by the survey. The catch of striped bass has been variable throughout the time period of the survey, with peaks between 1990 and 2010, and recently in 2018. There is high variability for this species in the survey data (Figure 10), but the survey catches both juveniles and adults. Striped bass are caught in greater abundance and frequency at Fox Island than at Whale Rock.

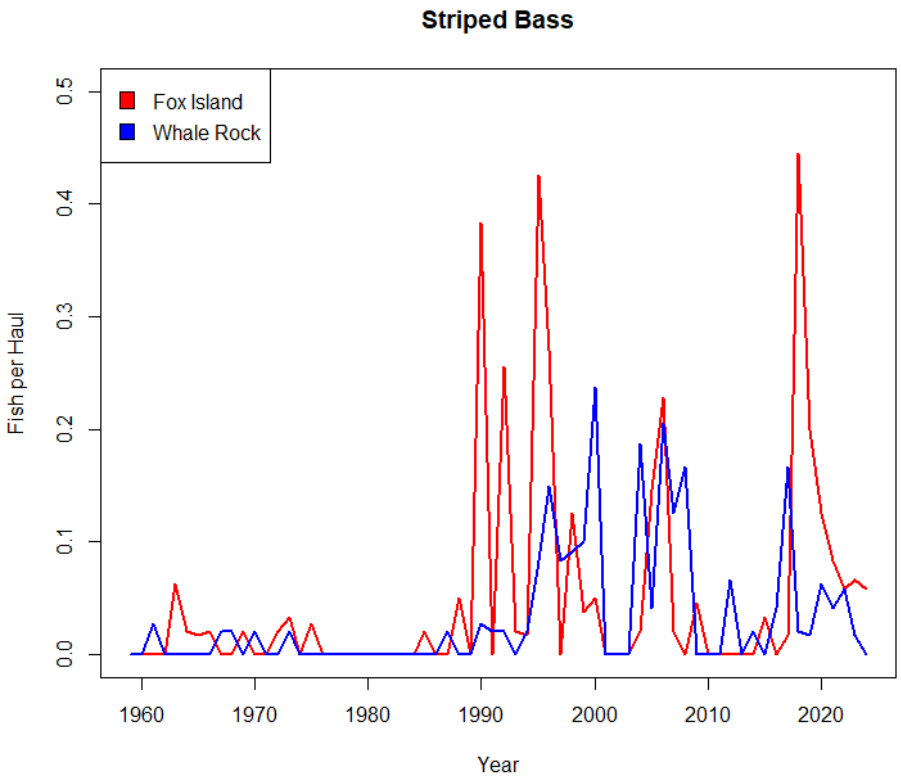


Figure 10 – Survey data for entire time series for striped bass at both sampling stations (Fox Island and Whale Rock).



Menhaden

Menhaden is another of the Mid-Atlantic species caught consistently by the survey. The catch of menhaden has been variable throughout the time period of the survey, mainly due to the schooling pelagic nature of this species. There is high variability for this species in the survey data (Figure 11), but the survey mainly catches juveniles. Until recently, menhaden were caught in greater abundance and frequency at Fox Island than at Whale Rock. The survey information was reviewed during the stock assessment process for menhaden.

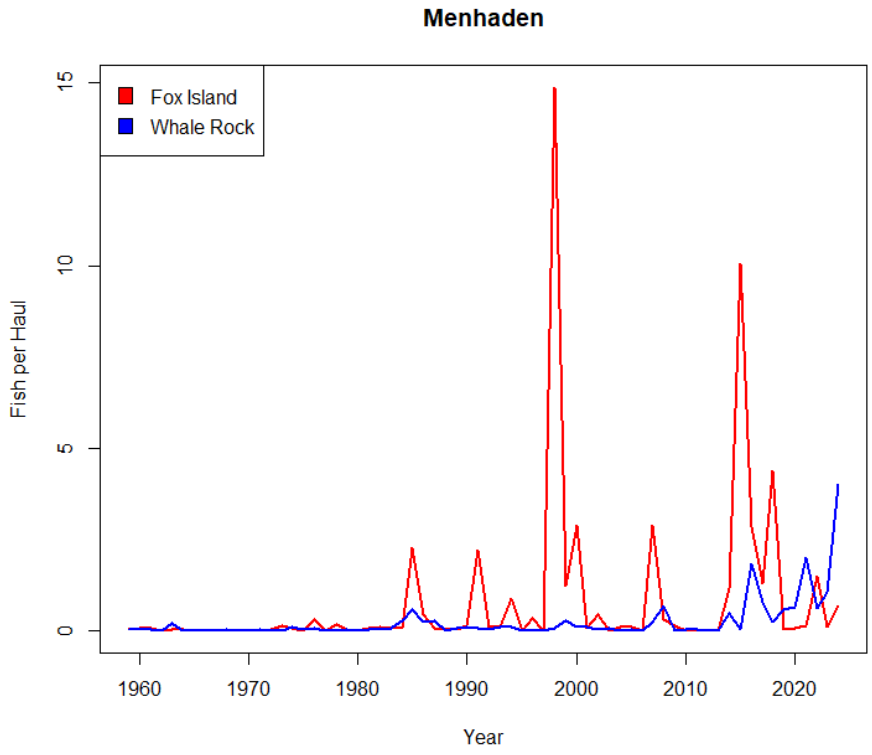


Figure 11 – Survey data for entire time series for menhaden at both sampling stations (Fox Island and Whale Rock)

Special Projects

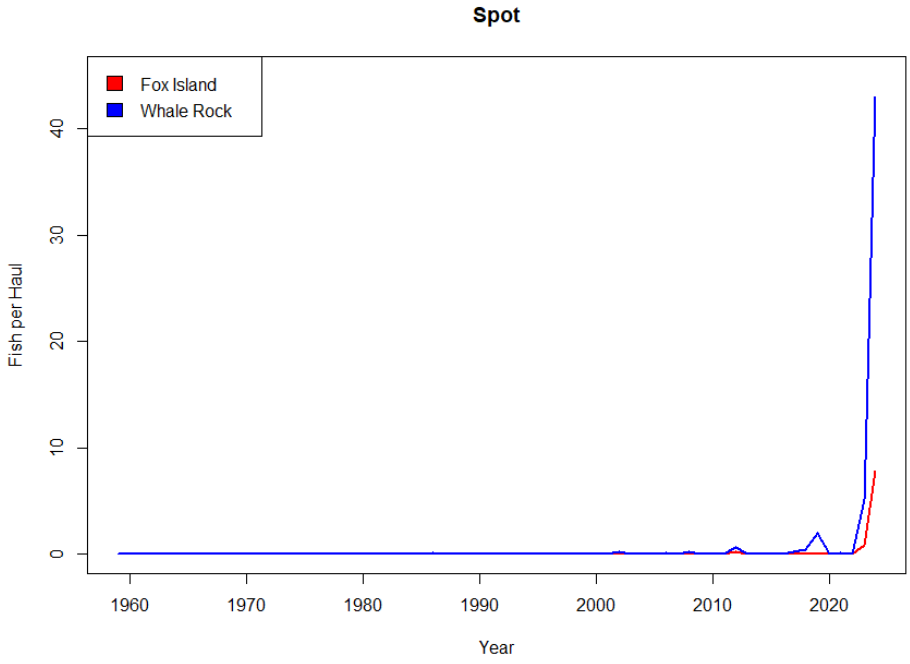
Commented [JC3]: Rachel Asks: Are there any special projects that should be included in this section?

Commented [JC4R3]: Hmm, there must be something to mention here

Time Series of Spot



Spot (*Leiostomus xanthurus*) is typically a southerly distributed species with its northern range extending to New England. In recent years as southerly species migrate northwards in response to warming water temperatures, there has been an increase in occurrence of spot caught in the Fish Trawl. Spot was first recorded on the Fish Trawl in 1978 but had since been rare. However, in Summer and Fall of 2024 the abundance of spot dramatically increased in Narragansett Bay, far surpassing previous levels of incidence. Spot is a recreationally targeted species, whose increasing abundance presents new opportunities for Rhode Island anglers. Spot are caught in greater amounts at Whale Rock than at Fox Island. Monitoring the abundance of spot in Narragansett Bay should be continued, as this year's dramatic increase may persist into the future.



Undergraduate Research Assistants

Undergraduate assistants were recruited from URI for the spring, summer, and fall semesters to gain experience and provide extra assistance on the Fish Trawl Survey. 2024 Undergraduate assistants included: Anna Dubey and Mary McKenna.

List of references that have used the GSO Fish Trawl Survey data:

Commented [JC5]: Rachel Asks: Are there any more references to add for this year?

Commented [JC6R5]: I added one reference below

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Recreational Coastal Sharks Monitoring

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Federal Aid in Sportfish Restoration
F-61-21

Performance Report:	Job 15	March 2025
State:	Rhode Island	Project Number: F-61-R-21
Project Title:	Recreational Coastal Sharks Monitoring	
Period Covered:	January 1, 2020 – December 31, 2024	
Job Number	Job XV – Recreational Coastal Sharks Monitoring	
Job Objective:	To assess the movement patterns and presence of coastal sharks in and adjacent to Rhode Island state waters using electronic tagging technologies.	
Significant Deviations:	Tag Deployment Breakdown To-Date Under the Project: 66 of 73 Vemco V-16 acoustic tags purchased are now deployed, and 8 of 10 SPOT tags purchased are now deployed. In 2024, 15 Vemco tags were deployed.	

Justification and Objective:

Coastal pelagic sharks of the North Atlantic Ocean are keystone species in regulating lower tropic levels, serving as an important service in marine ecosystems. As top predators and larger fish, these species have also been long sought after by recreational harvesters throughout the eastern United States, including Rhode Island. Many of these species frequent state waters through various months of the year, primarily during the warmer months of July through October in New England. Several species of coastal sharks can be observed in Rhode Island state waters, including smooth dogfish (*Mustelus canis*), blue sharks (*Prionace glauca*), shortfin mako sharks (*Isurus oxyrinchus*), thresher sharks (*Alopias vulpinus*) and spinner sharks (*Carcharhinus brevipinna*). These and other species have supported pastimes of recreational fishing amongst avid anglers for leisure, as well as party and charter businesses and shark diving tours during certain times of the year. In addition to recreational harvest, several coastal shark species can be caught and sold commercially, although these instances are few for Rhode Island. As such, the roles that coastal sharks serve in the marine ecosystem, recreation, and local economies is widely evident. Fisheries managers are charged to ensure adequate, healthy stocks of these species for sustainable harvest. To do so, comprehensive data on the species' life history, population trends, and harvest rates must be available to construct effective stock assessments and management plans. For coastal sharks, few data exist on the species' abundance trends given the major fisheries-independent data surveys that are plentiful across the species range or stock bounds (e.g. trawl surveys) do not catch them efficiently. This has been quite challenging for state fisheries programs that are charged with trying to understand the life history patterns of these fish in their waters.

Through a collaboration between Rhode Island Department of Environmental Management (RIDEM) Division of Marine Fisheries (DMF), the Atlantic Shark Institute (ASI), and charter captains, the objective of this work is to initiate coastal shark monitoring for recreationally-significant species to the state of Rhode Island. Data from this project are intended to provide information on these species use of state waters, the habitat they are associated with, and for broad use in informing their sustainability. Given shark abundance data is often sparse within state waters (particularly for northeast U.S. states), we hope to improve this data gap through our tagging endeavor.

Progress Summary:

ASI supported several research trips for shark tagging purposes in 2024. Fifteen Vemco V-16 acoustic tags were deployed in 2024. To-date, four tags have been lost in the act of tagging sharks. This results in 66 of the 73 total purchased acoustic tags as a part of this five-year grant now having been deployed on sharks (Figure 1, Table 1). The metadata on these tags have been entered in the Atlantic Cooperative Telemetry (ACT) Network and Mid-Atlantic Acoustic Telemetry Observation System (MATOS) database, so if telemetry scientists detect the species on their receivers, we will be able to receive those detections. We will also be checking to see if we get any detections on the preexisting RIDEM DMF-ASI receiver array. No SPOT tags were deployed in 2024 (Table 2).

All acoustic tags to-date have been deployed in southern New England waters that Rhode Island recreational shark fishermen operate in, and/or are adjacent to Rhode Island state waters. For acoustic tags in 2024, 11 were deployed on shortfin mako sharks, two were deployed on a blue shark, one was deployed on a common thresher shark, and one was accidentally deployed on a dusky shark (Table 2). At the time of this report (last MATOS data push: November 2024), 42 of the sharks acoustically tagged from this project to-date have been detected: five threshers, five blue sharks, one dusky shark, and 31 shortfin makos. This corresponds to 64% of tagged sharks having been detected on acoustic receivers across the northwest Atlantic. Detections from these sharks ranged from single to hundreds of individual detections over time periods of a single day to several months. Of the 31,997 total detections from these sharks, 3,554 came from shortfin makos, 25,618 from blue sharks, 241 from a dusky shark, and 2,584 from thresher sharks. Detections ranged from as far south as Georgia and as north as Atlantic Canada. The inferred movement paths have begun to be explored, with some examples provided (Figures 2-4). The next MATOS data push is anticipated to occur in late March 2025, at which time we believe even more detections will be provided for these sharks and those newly tagged in 2024. More sophisticated movement analyses will be presented in future reports.

Movement paths are provided for the 2022 deployed SPOT tagged sharks. The shortfin mako was tagged in June 2022. The shark moved southward from southern New England and then northwest across the Atlantic Ocean. The shark was last detected by satellite on September 5, 2022, located at latitude but east of Newfoundland (Figure 5). One of the blue sharks (tagged the same day as the mako shark) moved southward and offshore. The shark was last detected later that month in June 2022 at latitude with Delaware Bay (Figure 5). The second blue shark tagged in the fall of 2022 moved south far off the continental shelf at latitude with the Bahamas, but in

early January 2023, it moved back north towards Bermuda (Figure 5). It was last heard from on February 16, 2023.

Table 1. Sharks tagged with Vemco V-16 acoustic transmitters with their corresponding tagging date, species (common name), and sex (F=female; M=male; U=unknown).

Date	Species	Sex
7/24/2020	Shortfin Mako	F
8/28/2020	Blue Shark	M
10/4/2020	Blue Shark	M
10/4/2020	Shortfin Mako	F
6/15/2021	Thresher	M
6/17/2021	Shortfin Mako	F
6/24/2021	Blue Shark	M
6/24/2021	Blue Shark	M
6/24/2021	Shortfin Mako	F
7/1/2021	Shortfin Mako	U
7/1/2021	Shortfin Mako	M
7/1/2021	Shortfin Mako	F
7/1/2021	Shortfin Mako	M
7/8/2021	Shortfin Mako	U
7/8/2021	Shortfin Mako	F
7/8/2021	Shortfin Mako	M
7/8/2021	Shortfin Mako	M
7/14/2021	Shortfin Mako	F
7/29/2021	Shortfin Mako	F
8/6/2021	Shortfin Mako	F
9/3/2021	Shortfin Mako	U
10/6/2021	Shortfin Mako	M
6/16/2022	Blue Shark	M
6/16/2022	Shortfin Mako	M
6/23/2022	Shortfin Mako	F
6/24/2022	Shortfin Mako	F
6/26/2022	Shortfin Mako	F
6/28/2022	Blue Shark	F
6/29/2022	Blue Shark	F
7/1/2022	Shortfin Mako	M
7/4/2022	Blue Shark	F
7/11/2022	Shortfin Mako	F
7/13/2022	Shortfin Mako	F
7/14/2022	Shortfin Mako	M
7/24/2022	Shortfin Mako	F
8/12/2022	Thresher	F
8/15/2022	Shortfin Mako	M
9/4/2022	Thresher	F

6/15/2023	Thresher	F
6/26/2023	Shortfin Mako	F
6/29/2023	Shortfin Mako	M
6/29/2023	Shortfin Mako	M
7/25/2023	Shortfin Mako	M
7/29/2023	Shortfin Mako	F
8/3/2023	Shortfin Mako	M
8/3/2023	Shortfin Mako	M
8/18/2023	Shortfin Mako	F
8/22/2023	Thresher	M
8/24/2023	Shortfin Mako	U
9/4/2023	Shortfin Mako	F
9/7/2023	Shortfin Mako	F
5/26/2024	Thresher	M
6/12/2024	Blue Shark	F
6/12/2024	Blue Shark	M
6/18/2024	Shortfin Mako	F
6/28/2024	Shortfin Mako	M
6/28/2024	Shortfin Mako	M
7/2/2024	Shortfin Mako	M
7/2/2024	Shortfin Mako	F
7/4/2024	Shortfin Mako	M
7/10/2024	Shortfin Mako	F
7/14/2024	Shortfin Mako	M
7/19/2024	Shortfin Mako	F
7/27/2024	Shortfin Mako	F
7/31/2024	Dusky	M
9/7/2024	Shortfin Mako	U

Table 2. Sharks tagged with SPOT satellite tags with their corresponding tagging date, species common name, size, and sex. Date of last detection are also presented (as of 3/9/2025).

Date	Species	Total Length (in)	Sex	Date of Last Detection
10/6/2021	Shortfin Mako Shark	90	M	3/9/2022
10/6/2021	Blue Shark	126	M	2/21/2022
10/6/2021	Blue Shark	102	M	3/9/2022
7/29/2021	Blue Shark	72	F	8/28/2021
7/29/2021	Blue Shark	72	F	9/19/2021
6/16/2022	Shortfin Mako Shark	78	M	9/5/2022
6/16/2022	Blue Shark	104	M	6/27/2022
10/24/2022	Blue Shark	120	M	2/16/2023

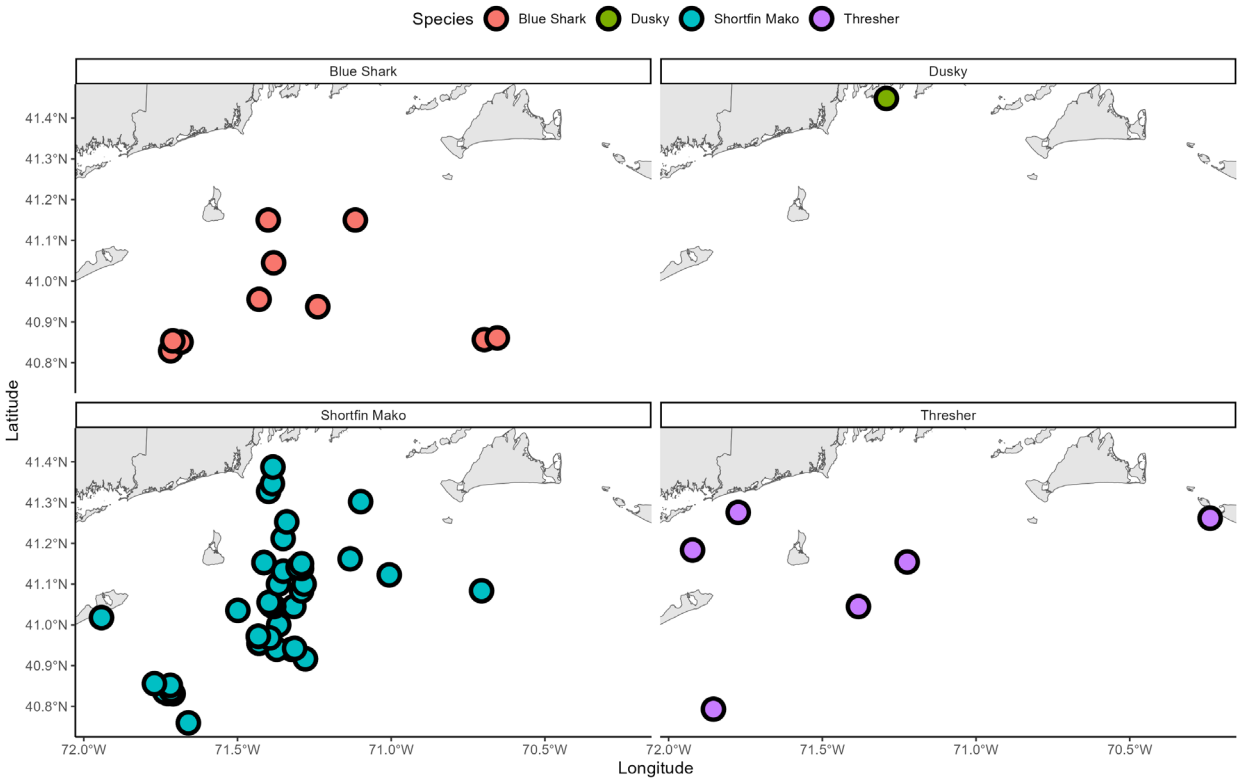


Figure 1. Release locations of sharks tagged with acoustic tags by species.

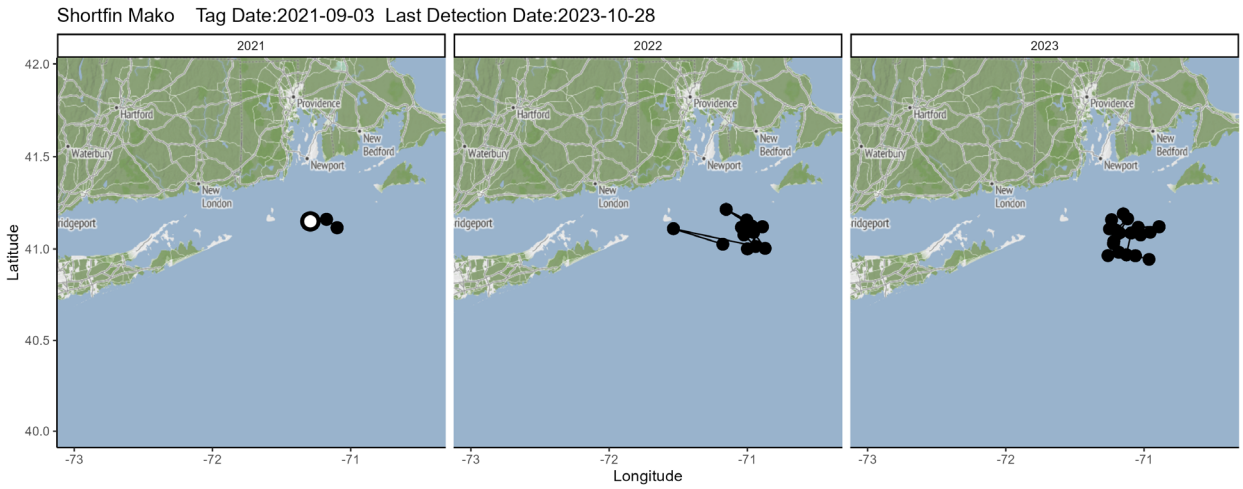


Figure 2. Inferred path for a shortfin mako.

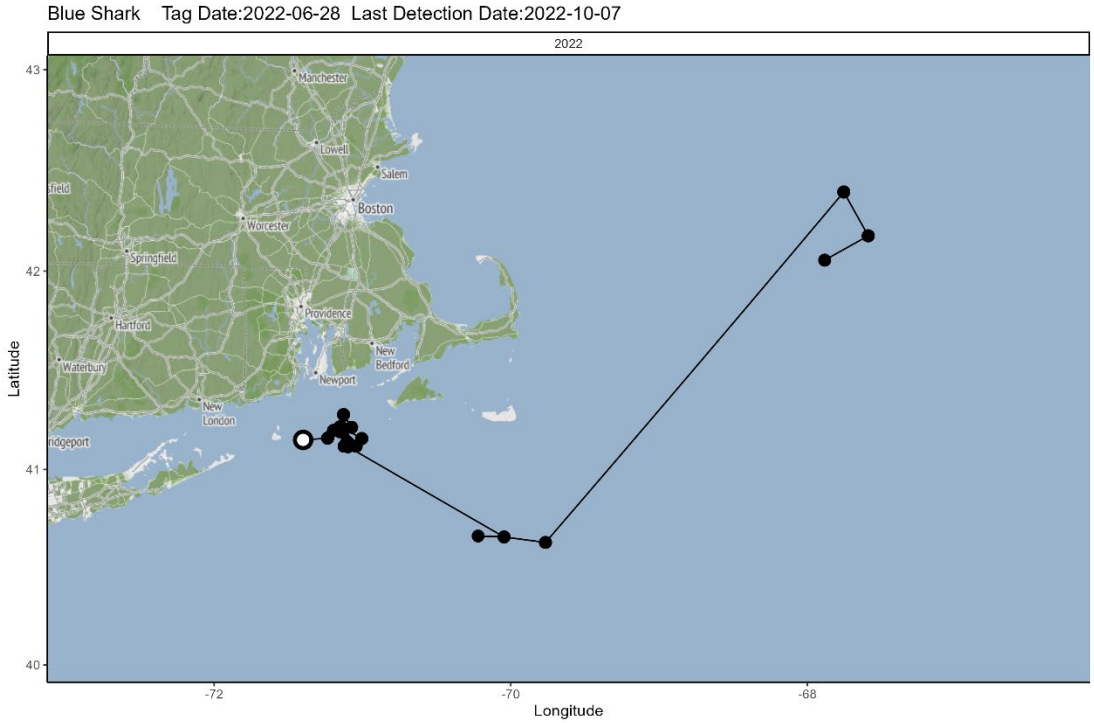


Figure 3. Inferred path for a blue shark.

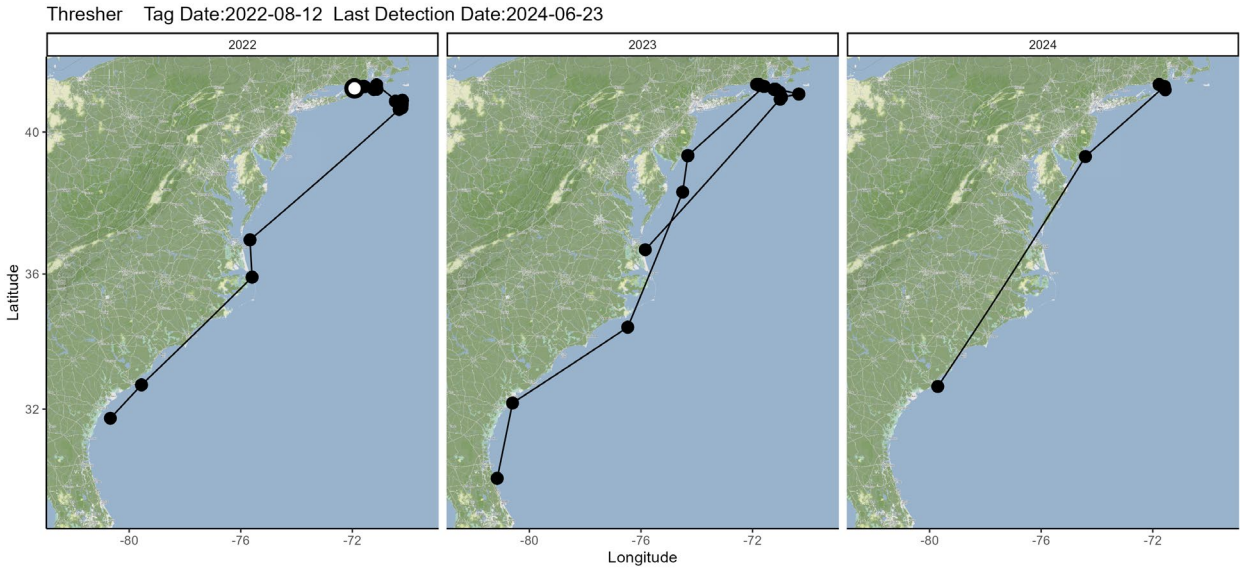


Figure 4. Inferred path for a threser shark.



Figure 5. Movement path for the shortfin mako (#213761) and two blue sharks (#213762 and #213760) tagged with SPOT tags in 2022. See Table 3 for further descriptions.

Enhancements to MRIP Data Collection

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STATE: Rhode Island

PROJECT NUMBER: F-61-R

SEGMENT NUMBER: 22

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

PERIOD COVERED: January 1, 2020 – December 31, 2024

JOB NUMBER 16 TITLE: Enhancements to MRIP Data Collection

Job 16: Enhancements to MRIP Data Collection

Each year during this segment the RIDMF Access Point Angler Interview Survey (APAIS) hired 6 additional seasonal staff members and provided 2 months of a full time employees time in support of the survey. These additional staff complement the staff that is provided by the NOAA MRIP base funding and allows RIDMF to order additional assignments from the NOAA Marine Recreational Information Program (MRIP). The additional staff members are contracted through the Atlantic States Marine Fisheries Commission, the same as the NOAA funded staff. Between 2020 – 2024 RIDMF APAIS was able to add on approximately between 200- 250 assignments in shore, private/rental and Party charter modes. Additionally, each year in this segment, RIDMF APAIS added approximately additional 20-25 samples in Head Boat mode for ride along. Staff hired via this grant are also used to preform scouting assignments of existing and potentially new sites to determine site pressures and sampling feasibility.

Currently, the 2020-2024 MRIP estimates are available on the NOAA Fisheries web site. A detailed summary of the total 2020-2024 APAIS assignments is provided in table one. This table shows the assignments broken down by mode, the response statistics and the productivity rate which is the number of completed interviews over the number of assignments. Table 2 provides a summary of APAIS interview statistics from 2020-2023 by wave. The program continues to improve on interview statistics with a goal to maintain similar levels as seen in 2019 or better.

Table 1. APAIS Interview Statistics from 2020-2024 Assignments. (CH = Party/Charter, PR = Private/Rental Boat, SH = Shore, HB = Head Boat)

Year	Wave	Mode	Assignments	Completed	Initially Refused	Language Barrier	Missed Anglers	Productivity
2020	2	CH	0	0	0	0	0	0
2020	2	HB	1	6	3	5	0	6
2020	2	PR	8	0	0	0	0	0
2020	2	SH	28	40	9	3	17	1.43
2020	3	CH	35	155	269	5	66	4.43
2020	3	HB	0	0	0	0	0	0
2020	3	PR	46	234	80	57	66	5.09
2020	3	SH	60	272	77	66	95	4.53
2020	4	CH	60	523	831	8	249	8.72
2020	4	HB	0	0	0	0	0	0
2020	4	PR	82	638	183	60	172	7.78
2020	4	SH	48	302	68	79	65	6.29
2020	5	CH	36	274	297	27	65	7.61
2020	5	HB	0	0	0	0	0	0
2020	5	PR	69	524	109	45	119	7.59
2020	5	SH	54	317	116	83	77	5.87
2020	6	CH	9	42	80	0	9	4.67
2020	6	HB	0	0	0	0	0	0
2020	6	PR	10	4	1	0	0	0.4
2020	6	SH	25	72	24	7	32	2.88
			571	**3403**	**2147**	**445**	**1032**	**5.96**

Year	Wave	Mode	Assignments	Completed	Initially Refused	Language Barrier	Missed Anglers	Productivity
2021	2	PR	21	40	8	6	10	1.9
2021	2	SH	24	95	18	16	19	3.96
2021	3	CH	46	311	462	5	103	6.76
2021	3	HB	6	69	46	0	0	11.5
2021	3	PR	65	430	139	94	151	6.62
2021	3	SH	55	332	98	64	132	6.04
2021	4	CH	75	523	807	31	305	6.97
2021	4	HB	16	268	131	34	0	16.75
2021	4	PR	97	611	279	82	184	6.3
2021	4	SH	41	226	98	74	82	5.51
2021	5	CH	50	191	377	32	72	3.82
2021	5	HB	10	110	66	32	0	11
2021	5	PR	73	488	186	87	131	6.68
2021	5	SH	54	199	91	105	84	3.69
2021	6	CH	15	75	224	15	32	5
2021	6	HB	4	41	22	4	0	10.25
2021	6	PR	15	14	6	4	0	0.93
2021	6	SH	26	95	29	2	52	3.65
			693	**4118**	**3087**	**687**	**1357**	**5.94**

Year	Wave	Mode	Assignments	Completed	Initially Refused	Language Barrier	Missed Anglers	Productivity
2022	2	HB	3	26	6	1	0	8.67
2022	2	PR	17	15	1	0	5	0.88
2022	2	SH	32	71	26	54	17	2.22
2022	3	CH	49	221	358	10	52	4.51
2022	3	HB	11	156	62	8	0	14.18
2022	3	PR	63	423	131	55	110	6.71
2022	3	SH	57	215	68	108	56	3.77
2022	4	CH	80	657	1102	66	255	8.21
2022	4	HB	19	350	351	20	0	18.42
2022	4	PR	104	987	453	116	255	9.49
2022	4	SH	45	269	113	77	64	5.98
2022	5	CH	50	218	650	25	85	4.36
2022	5	HB	8	55	41	14	0	6.88
2022	5	PR	69	368	195	78	114	5.33
2022	5	SH	39	248	134	95	91	6.36
2022	6	CH	15	74	195	11	22	4.93
2022	6	HB	6	43	17	13	0	7.17
2022	6	PR	16	9	6	0	5	0.56
2022	6	SH	28	66	18	7	23	2.36
			711	**4471**	**3927**	**758**	**1154**	**6.29**

Year	Wave	Mode	Assignments	Completed	Initially Refused	Language Barrier	Missed Anglers	Productivity
2023	2	HB	4	25	6	2	0	6.25
2023	2	PR	19	148	43	10	34	7.79
2023	2	SH	29	122	24	13	14	4.21
2023	3	CH	52	362	447	17	121	6.96
2023	3	HB	14	236	44	11	0	16.86
2023	3	PR	63	416	131	35	94	6.6
2023	3	SH	58	380	112	103	130	6.55
2023	4	CH	79	730	955	32	259	9.24
2023	4	HB	17	344	234	30	0	20.24
2023	4	PR	104	1100	425	170	418	10.58
2023	4	SH	44	264	99	108	77	6
2023	5	CH	52	229	346	21	74	4.4
2023	5	HB	9	70	16	5	0	7.78
2023	5	PR	78	469	181	100	121	6.01
2023	5	SH	55	416	116	136	142	7.56
2023	6	CH	16	30	181	3	5	1.88
2023	6	HB	4	35	14	4	0	8.75
2023	6	PR	16	31	10	2	14	1.94
2023	6	SH	28	51	19	27	21	1.82
2023			**741**	**5458**	**3403**	**829**	**1524**	**7.36**

Year	Wave	Mode	Assignments	Completed	Initially Refused	Language Barrier	Missed Anglers	Productivity
2024	2	HB	4	32	13	5	0	8.00
2024	2	PR	24	119	39	43	32	4.96
2024	2	SH	26	59	3	14	25	2.27
2024	3	CH	46	282	488	25	110	6.13
2024	3	HB	12	212	127	16	0	17.67
2024	3	PR	66	344	190	124	104	5.21
2024	3	SH	58	263	136	205	97	4.53
2024	4	CH	82	634	681	48	270	7.73
2024	4	HB	17	319	392	24	0	18.76
2024	4	PR	105	738	380	180	238	7.03
2024	4	SH	44	236	105	179	65	5.36
2024	5	CH	49	134	363	77	53	2.73
2024	5	HB	12	190	113	42	0	15.83
2024	5	PR	72	329	115	96	124	4.57
2024	5	SH	39	149	78	64	52	3.82
2024	6	CH	15	48	156	9	56	3.20
2024	6	HB	6	81	62	18	0	13.50
2024	6	PR	16	12	3	0	0	0.75
2024	6	SH	28	86	21	16	19	3.07
2024			**721**	**4267**	**3465**	**1185**	**1245**	5.92

Table 2. Summary of APAIS interview Statistics from 2020 – 2024 assignments by wave.

Year	Wave	Completed	Refused	Language Barriers	Missed	Percent Refused	Percent Complete / Total Anglers
2020	2	46	12	8	17	20.69%	55.42%
2020	3	661	426	128	227	39.19%	45.84%
2020	4	1463	1082	147	486	42.51%	46.04%
2020	5	1115	522	155	261	31.89%	54.31%
2020	6	118	105	7	41	47.09%	43.54%
2020		**3403**	**2147**	**445**	**1032**	**38.68%**	**48.43%**
2021	2	135	26	29	29	16.15%	61.64%
2021	3	1142	745	163	386	39.48%	46.88%
2021	4	1628	1315	221	571	44.68%	43.59%
2021	5	988	720	256	287	42.15%	43.89%
2021	6	225	281	25	84	55.53%	36.59%
2021		**4118**	**3087**	**687**	**1357**	**42.85%**	**44.52%**
2022	2	112	33	55	22	22.76%	50.45%
2022	3	1015	619	181	218	37.88%	49.93%
2022	4	2263	2019	279	574	47.15%	44.07%
2022	5	889	1020	212	290	53.43%	36.87%
2022	6	192	236	31	50	55.14%	37.72%
2022		**4471**	**3927**	**687**	**1154**	**46.76%**	**43.67%**
2023	2	295	73	25	48	19.84%	66.89%
2023	3	1394	734	166	345	34.49%	52.82%
2023	4	2438	1713	340	754	41.27%	46.48%
2023	5	1184	659	262	337	35.76%	48.48%
2023	6	147	224	36	40	60.38%	32.89%
2023		**5458**	**3403**	**829**	**1524**	**38.40%**	**48.67%**
2024	2	210	55	62	57	20.75%	54.69%
2024	3	1101	941	370	311	46.08%	40.43%
2024	4	1927	1558	431	573	44.71%	42.93%
2024	5	802	669	279	229	45.48%	40.53%
2024	6	227	242	43	75	51.60%	38.67%
2024		**4267**	**3465**	**1185**	**1245**	**44.81%**	**41.99%**

Recreational Fisheries Management Support

John Lake
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Division Marine Fisheries
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STATE: Rhode Island

PROJECT NUMBER: F-61-R

SEGMENT NUMBER: 22

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

PERIOD COVERED: January 1, 2020 – December 31, 2024

JOB NUMBER 17 TITLE: Outreach and Support for MRIP Data Collection

Job 17: Recreational Fisheries Management Support

Each year during this segment, RIDMF provided staff and support for state and regional recreational fishing program coordination, planning, and outreach meetings. These meetings include the ACCSP Recreational Technical committee, the Rhode Island Marine Fisheries Council, ASMFC technical and stock assessment committees for various recreationally important species, RIDEM Boating and Access point workgroup, and local stake holder meetings. Additionally, the Division published and produced recreational angler outreach materials including the annual saltwater recreational magazine, a one page informational brochure, APAIS staff uniforms, and stickers for handing out at events and during APAIS interviews. The RI Saltwater Fishing magazine can be viewed here: http://www.eregulations.com/rhodeisland/fishing/saltwater/ . The Division conducts an annual kids fish camp each year in this period. The Event will takes place in late June each year in conjunction with the Rhode Island Saltwater Anglers Association (RISAA). RIDMF attended other youth fishing events such as "vamanos pescalar". Vamanos pescalar is a program run by the Central Falls RI School system in conjunction with RIDFW which fosters inner city youth interest in fishing. The Division also provides staff for Governor's bay day the annual free fishing day, the annual RISAA recreational fishing show, and various other small community based events to promote the RIDMF SW recreational fishing program. The Division is anticipating all outreach activities on schedule for normal operation in 2025 and beyond.