Mid-Atlantic Fishery Management Council
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Michael P. Luisi, Chairman | G. Warren Elliott, Vice Chairman
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MEMORANDUM

Date: July 23, 2019

To: Council

From: Jason Didden, staff

Subject: Updated Annual River Herring and Shad (RH/S) Progress and Cap Review including Mackerel, Squid, and Butterfish (MSB) Monitoring Committee Input

This document is designed to help facilitate Council decision making regarding RH/S. In October 2014, the Council approved a list of questions to form the basis of an annual RH/S Progress Review. The RH/S Committee requested that additional state indices and bycatch information be added to the 2018 update. Information has been updated to the extent available in mid-July 2019.

The MSB Monitoring Committee met on 7/9/19. Some discussions from that call are generally relevant to this Progress and Cap Review and integrated as appropriate. Other discussions are specific to potential 2020 RH/S cap options/modifications (evaluation of which was requested by the Council in June 2019), and are summarized under #4 below.

The Mackerel, Squid, and Butterfish (MSB) Monitoring Committee has often discussed the RH/S cap and observed the following on 5/23/17; the current Monitoring Committee shares the same general sentiments regarding technical evaluations of RH/S caps:

> *The MC noted that its perspective has not substantively changed from last year: given the lack of stock abundance information, a variety of cap options are likely justifiable as long as the Council clearly describes its rationale related to controlling incidental RH/S catch/bycatch - in situations like RH/S where biologically-based catch limits are unavailable, setting the cap is a policy choice. The MC noted that for any cap (and especially a constant cap), because it is not directly tied to RH/S abundance, possibilities exist that it may either become very hard for the fishery to avoid RH/S if their abundances increase, or if RH/S abundances decrease the fishery will not have to work hard to avoid RH/S because there will not be many RH/S around. The first situation would suggest that a cap increase may be warranted while the second would suggest a cap reduction may be warranted. Without better assessment information it is not possible to quantitatively determine the appropriateness of such changes however.*

1. How has the Atlantic mackerel RH/S cap performed?

The table below describes performance for 2015-2019. 2014 was the first year of the cap and a partial year of implementation, though the cap was estimated retroactively for the full year. The 2014 RH/S cap was set at 236 MT[1] and the estimated 2014 RH/S cap catch was 6 MT.

Table 1. Mackerel Fishery and RH/S Cap Performance 2015-2019

Catch Cap	Year	Permit Count	Trip Count	RHS Catch Rate[2]	Est. RHS (mt)	Herring (mt)	Mackerel (mt)	KALL (mt)	Inseason RHS Catch Rate[3]	Observed Trips	CV[4]	Coverage Percent
RHS Mackerel	2015	13	55	0.0014	12.5	3,564	4,591	8,739	0.0016	4	0.23	7.30%
	2016	13	55	0.0015	13.5	5,684	4,599	10,436	0.0015	13	0.68	23.60%
	2017	17	71	0.0033	39.5	6,360	5,822	12,396	0.0033	17	0.38	23.90%
	2018	12	57	0.0089	109	3,891	7,944	12,130	0.0101	4	0.34	7.00%
	2019[1]	10	31	0.0135	91.5	2,780	3,958	6,740	0.0153	2	0.03	6.50%

Source: GARFO DMIS and OBDBS databases as of 2019-05-21

[1]2019 data are preliminary.
[2]RHS catch rate used to extrapolate RHS catch. Transition rates are used when < 5 observed trips occur within the catch cap year and are highlighted in grey.
[3]RHS catch rate of observed trips occurring within catch cap year. Rate will be different than RHS CATCH RATE column when transition rates were used.
[4]Coefficient of Variation (CV) of inseason observed trips.

In 2019 there were 2 observed trips and the mackerel RH/S cap estimate stands at 91.5 MT. Since the fishery is closed that estimate should not substantially change. The catch rate for the two 2019 trips was 1.5%. When less than five trips are observed during a fishing year, a weighted transition rate is constructed from the prior and current year data. This yielded a 1.3% blended 2019 interaction rate (the 1.5% from the 2019 trips blended with the 2018 data). So 2019 started with the 2018 data (0.89%) and ended with the 1.3% blended rate. 2020 will start with just the 2019 data (1.5%). The overall 2019 fishery landings used for 2019 cap calculations was 59% mackerel and 41% Atlantic herring, which is not a major departure from the range of previous years.

Discussion regarding the transition method led to a conclusion that transition rate modifications could be pursued, but since the current methodology has gone through multiple peer reviews it would not be appropriate to modify it without substantial investigation. The same need for substantial investigation would apply to changing the fishing year, in order to understand impacts on the fishery and RH/S cap estimates.

As flagged in previous updates, due to the overlap in the Atlantic herring and mackerel fisheries, Atlantic herring and mackerel RH/S cap catch amounts cannot be summed - this would constitute a misleading double counting (the RH/S on a trip with both Atlantic herring and mackerel can count against both the Atlantic herring and mackerel RH/S caps). Because the cap amounts were set considering this circumstance, double counting is not a problem for monitoring within each

[1] 1 metric ton (MT) = 2204.62 pounds. For readability, quota breakdowns only use metric tons. Other ways of conceptualizing metric tons are that 1000 MT = about 2.2 million pounds and 100 MT = about 220,000 pounds.

cap. The Monitoring Committee has not found any technical/operational issues with the cap, but noted that low observer coverage has the potential to result in imprecise estimates. Continued investigation of incorporating portside sampling into cap estimates seems worthwhile, but may be statistically challenging because this source does not fully represent the mackerel fleet in both composition and geographic operation. The portside sampling is currently used by NMFS for qualitative ground-truthing around pending closures. For example, the portside data (representing more trips) had a similar or slightly higher RH/S catch rate in 2019 than the 2 observed trips, and NMFS reviewed this information before closing the fishery in 2019. Implementation of industry-funded monitoring in the Atlantic Herring fishery is targeted for April 2020, and should also lead to additional observer coverage in the mackerel fishery once implemented.

The Council asked in the past about the proportions of RH/S in the caps and size of fish in the caps. The portside sampling program run by the State of Massachusetts and SMAST provided their weighted 2015-2017 portside sampling data for mid-water trawl landings in Massachusetts and 2015-2016 bottom trawl data in Rhode Island, which should provide a general picture of the RH/S proportions and their sizes in the RH/S caps for those years. The table below is simply the proportions of RH/S within all the RH/S bycatch on sampled herring/mackerel trips, expanded within trips (but not the fisheries) and aggregated by cap types. No amount/weight of bycatch, or bycatch rates should be calculated using these tables. These tables also mask high year-to-year variability (annual data may violate data confidentiality requirements). The first columns are for the Atlantic herring fishery, and the last is for the mackerel fishery.

Table 2. Proportions of RH/S in portside sampling data by cap type (2015 to 2016/2017).

	Cap Strata					
	Area1A-MWT	Area2-MWT	Area2-SMBT	CC521-MWT	TOTAL from Herring trips in cap areas	TOTAL from Mackerel cap trips
Alewife	41%	15%	61%	60%	30%	36%
Blueback	53%	83%	36%	31%	66%	61%
Am Shad	6%	2%	3%	9%	4%	3%
Total	100%	100%	100%	100%	100%	100%

The three tables below show the RH/S fork length proportions, expanded for each trip, then numbers of fish aggregated by cap strata to find proportion at length. Again, it has not been (and should not be) expanded to landings.

Table 3. Proportions of alewife by length in portside sampling data by cap type (2015 to 2016/2017)

Alewife fork lengths					
length (cm)	Area1A-MWT	Area2-MWT	Area2-SMBT	CC521-MWT	Mackerel
10	0%	0%	0%	0%	0%
11	0%	1%	0%	0%	0%
12	0%	4%	2%	0%	0%
13	0%	6%	2%	1%	0%
14	0%	12%	8%	0%	1%
15	0%	9%	8%	1%	0%
16	1%	10%	14%	2%	0%
17	2%	10%	5%	3%	2%
18	5%	11%	11%	9%	12%
19	6%	7%	13%	9%	11%
20	9%	4%	10%	8%	8%
21	11%	2%	6%	5%	6%
22	25%	5%	6%	7%	13%
23	15%	6%	6%	16%	12%
24	10%	6%	4%	18%	12%
25	10%	3%	3%	10%	10%
26	2%	1%	2%	5%	5%
27	2%	1%	0%	7%	7%
28	2%	0%	0%	0%	1%
29	0%	0%	0%	0%	0%

Table 4. Proportions of blueback herring by length in portside sampling data by cap type (2015 to 2016/2017)

BLUEBACK fork lengths					
length (cm)	Area1A-MWT	Area2-MWT	Area2-SMBT	CC521-MWT	Mackerel
10	0%	0%	0%	0%	0%
11	0%	0%	0%	0%	0%
12	0%	0%	0%	0%	0%
13	0%	1%	1%	0%	0%
14	0%	1%	2%	0%	0%
15	1%	1%	1%	1%	0%
16	1%	4%	4%	1%	0%
17	3%	10%	7%	6%	2%
18	7%	19%	44%	9%	8%
19	6%	15%	24%	17%	15%
20	11%	11%	3%	14%	14%
21	23%	7%	3%	14%	17%
22	19%	9%	4%	21%	18%
23	19%	10%	1%	9%	12%
24	9%	8%	5%	6%	9%
25	2%	3%	0%	2%	4%
26	1%	1%	0%	1%	1%
27	0%	0%	0%	0%	0%
28	0%	0%	0%	0%	0%
29	0%	0%	0%	0%	0%

Table 5. Proportions of American shad by length in portside sampling data by cap type (2015 to 2016/2017)

	AMERICAN SHAD fork lengths				
length (cm)	Area1A-MWT	Area2-MWT	Area2-SMBT	CC521-MWT	Mackerel
13	0%	0%	0%	2%	0%
14	0%	7%	23%	0%	5%
15	3%	0%	0%	0%	0%
16	0%	2%	26%	0%	0%
17	0%	0%	0%	0%	0%
18	0%	0%	0%	3%	3%
19	0%	0%	0%	4%	0%
20	3%	0%	0%	0%	0%
21	16%	4%	0%	0%	0%
22	15%	28%	14%	7%	18%
23	13%	16%	0%	14%	20%
24	3%	29%	37%	17%	37%
25	5%	11%	0%	9%	8%
26	17%	0%	0%	10%	0%
27	4%	3%	0%	8%	7%
28	3%	0%	0%	3%	0%
29	7%	0%	0%	7%	3%
30	7%	0%	0%	0%	0%
31	3%	0%	0%	8%	0%
32	0%	0%	0%	0%	0%
33	0%	0%	0%	3%	0%
34	0%	0%	0%	0%	0%
35	0%	0%	0%	0%	0%
36	0%	0%	0%	0%	0%
37	0%	0%	0%	0%	0%
38	0%	0%	0%	0%	0%
39	0%	0%	0%	0%	0%
40	0%	0%	0%	0%	0%
41	0%	0%	0%	4%	0%
42	0%	0%	0%	0%	0%
43	0%	0%	0%	0%	0%
44	0%	0%	0%	0%	0%
45	0%	0%	0%	0%	0%
46	0%	0%	0%	0%	0%
47	0%	0%	0%	0%	0%
48	0%	0%	0%	2%	0%

2. What has recent coastal RH/S catch been? (This analysis is based on NMFS observer data expanded based on dealer/VTR data)

The NEFSC (Kiersten Curti) updated their RH/S incidental catch estimates through 2018. Following Amendment 14 approaches, total incidental catch of river herring (alewife and blueback herring) and hickory and American shad (RHS) was quantified by fleet. Fleets included in the analyses were those sampled by the Northeast Fisheries Observer Program (NEFOP) and were stratified by area fished (Mid-Atlantic versus New England), time (year and quarter), gear group, and mesh size. Region fished was defined using Statistical Areas for reporting commercial fishery data. The Mid-Atlantic region included Statistical Areas greater than 600, and New England included Statistical Areas 464 through 599.

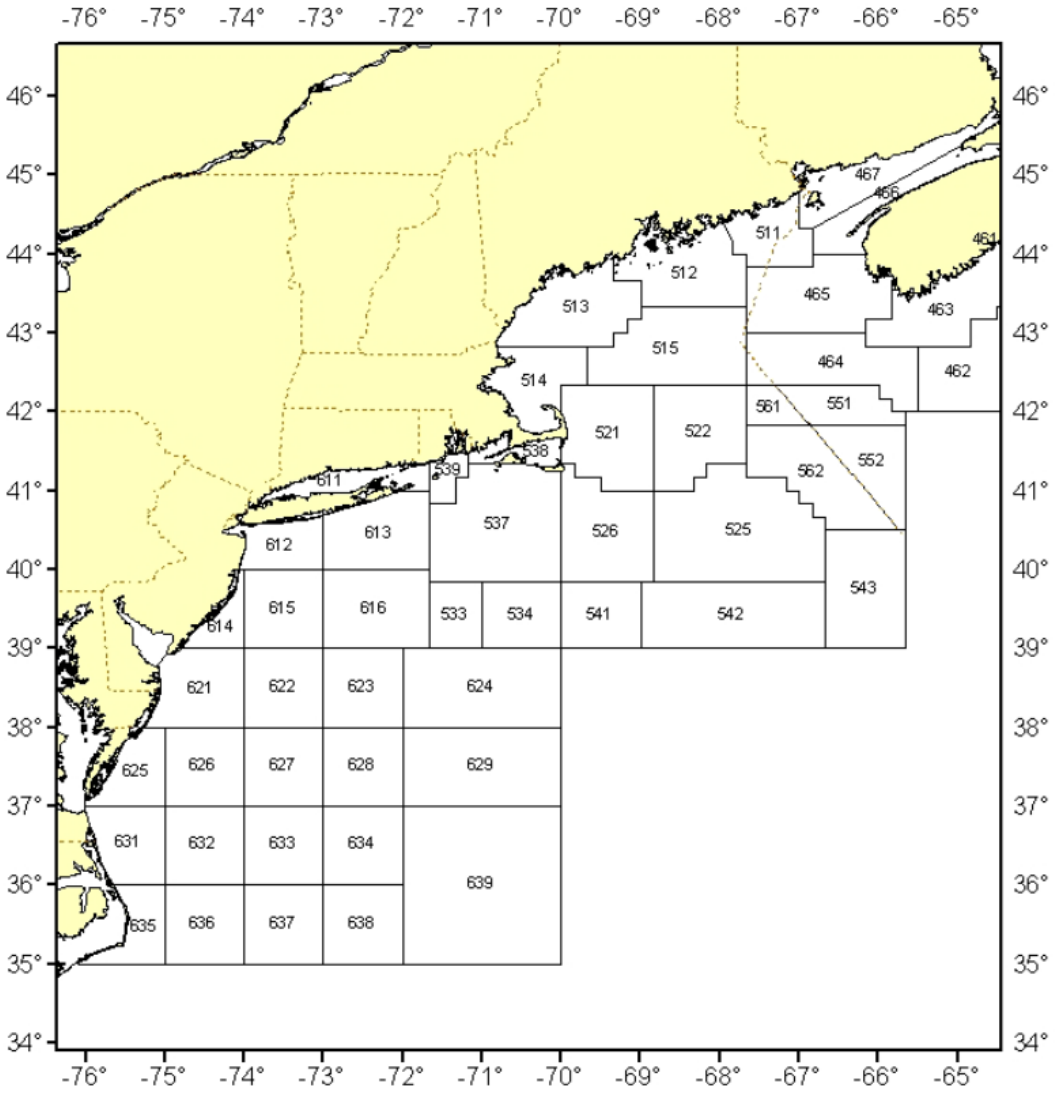

Figure 1. NMFS Statistical Areas

Gear groups included in the analyses were: bottom trawls, paired midwater trawls, single midwater trawls, gillnets, dredges, handlines, haul seines, longlines, pots/traps, purse seines, scallop trawl/dredge, seines and shrimp trawls. Bottom trawls and gillnets were further stratified into the following mesh categories:

Table 6. Gear Definitions

Mesh category	Bottom Trawl	Gillnet
small	mesh ≤ 3.5	mesh < 5.5
medium	3.5 < mesh < 5.5	---
large	mesh ≥ 5.5	5.5 ≤ mesh < 8
x-large	---	mesh ≥ 8

For bottom trawl fleets, mesh category was determined for trips with missing mesh information based on the primary species caught. For gillnets, trips with missing mesh information were assumed to come from the large mesh category.

Single and paired midwater trawls were split into separate fleets because the majority of both mackerel and herring landings during 2005-2010 were from paired midwater trawls, and the total catch-to-kept ratios varied between midwater trawl types. Incidental catch estimates for the midwater trawl fleets are only provided beginning in 2005 because these estimates are most accurate as a result of improved sampling methodologies.

For each trip, NEFOP data were used to calculate a total catch to kept (t/k) ratio, where t represents the total (retained+discarded) catch of an individual species (e.g., alewife, American shad) and k is the kept weight of all species. The t/k ratios were expanded using a raising factor to quantify total incidental catch. With the exception of the midwater trawl fleets, total landed weight of all species (from the dealer database) was used as the raising factor. VTR data were used as the expansion factor for the MWT fleets.

See tables and figures below. RH/S catches increased from 2017-2018 and were the highest since initiation of the cap, but still lower than the average of the cap base years (2005-2012). The increase from 2017-2018 was mostly higher alewife in bottom trawl and higher blueback herring in mid water trawl (a mix of New England and Mid-Atlantic areas for both species/gears), but the estimates at the species/gear/area level are much less precise than the overall combined RH/S estimate.

There was discussion of whether the Herring, NK (not known) or Fish, NK estimates produced through observer data could be ballparked as likely coming from a particular species. The Monitoring Committee is under the belief that the inability to make this determination is why these categories are used, but will contact the Observer Program for

clarification on when Herring, NK and/or Fish, NK designations are utilized. Staff noted that the spike in Herring, NK in 2017 was investigated by observer staff last year and it appeared not substantially related to the mackerel fishery. The Observer Program routinely evaluates species identification as part of its trip audit process, and similar future use of unknown species codes would be examined through that process.

Table 7. Species-specific total annual incidental catch (mt) and the associated coefficient of variation across all fleets and regions. Midwater trawl estimates were only included beginning in 2005. Total RHS represents the sum of the four river herring and shad species (alewife, American shad, blueback herring and hickory shad). (Update of Table A1 of Amendment 14 Appendix 2)

	Alewife		American shad		Blueback herring		Herring NK		Hickory shad		Total RHS	
	Catch	CV	Catch	CV	Catch	CV	Catch	CV	Catch	CV	Catch	CV
1989	44	0.49	229	0.98	38	0.42	18	1.13	0		311	0.73
1990	102	0.85	45	0.34	170	0.45	681	0.59	0		317	0.37
1991	149	0.44	176	0.25	285	0.40	266	0.51	39	0.00	649	0.23
1992	66	0.43	169	0.28	1,191	0.42	786	0.39	0		1,426	0.36
1993	381	2.42	211	1.00	746	0.28	136	4.83	0		1,338	0.76
1994	6	0.30	110	0.64	240	0.87	58	0.47	1	0.82	357	0.53
1995	8	0.61	127	0.38	348	0.44	100	1.23	1	0.64	485	0.34
1996	704	1.14	65	0.39	2,800	2.09	451	0.39	222	1.04	3,791	1.75
1997	49	1.36	66	0.61	1,594	0.69	90	5.09	21	1.25	1,730	0.64
1998	146	1.47	161	0.23	77	1.52	228	2.08	480	0.72	863	0.55
1999	6	1.16	82	0.41	359	0.60	3,457	0.74	209	0.94	656	0.44
2000	112	0.82	262	0.78	110	0.45	71	0.78	2	0.76	487	0.47
2001	190	0.84	68	0.39	310	0.32	3	0.44	330	0.27	898	0.30
2002	4	3.35	44	0.40	269	0.33	124	1.88	2	0.83	319	0.28
2003	388	1.43	60	0.54	527	0.56	26	1.17	19	0.85	994	0.63
2004	163	0.64	53	0.36	232	0.46	237	0.74	402	1.13	850	0.57
2005	404	0.40	94	0.28	255	0.34	29	0.58	27	0.34	781	0.27
2006	79	0.83	78	9.73	191	0.66	268	1.10	25	0.78	373	2.08
2007	544	0.71	79	0.56	188	1.42	357	0.91	17	0.90	828	0.79
2008	159	0.42	74	0.29	539	0.56	1,669	0.50	3	0.86	775	0.40
2009	154	0.26	107	2.00	195	0.30	351	0.66	10	0.72	465	0.50
2010	135	0.19	61	0.16	132	0.20	104	0.33	1	0.59	329	0.15
2011	97	0.34	104	0.12	28	0.30	127	0.28	0	0.77	229	0.16
2012	174	0.24	77	0.16	249	0.31	92	0.30	1	0.55	500	0.21
2013	239	0.33	73	0.41	29	0.46	75	0.69	0	0.76	342	0.26
2014	84	0.14	64	0.19	30	0.24	77	0.44	1	0.39	178	0.11
2015	124	0.31	46	0.15	83	0.48	40	0.75	2	0.75	255	0.23
2016	102	0.29	42	0.17	54	0.19	53	0.55	21	0.47	219	0.16
2017	141	0.19	44	0.14	82	0.26	182	0.30	3	0.32	271	0.15
2018	221	0.16	49	0.12	196	0.22	28	0.31	13	0.55	480	0.12

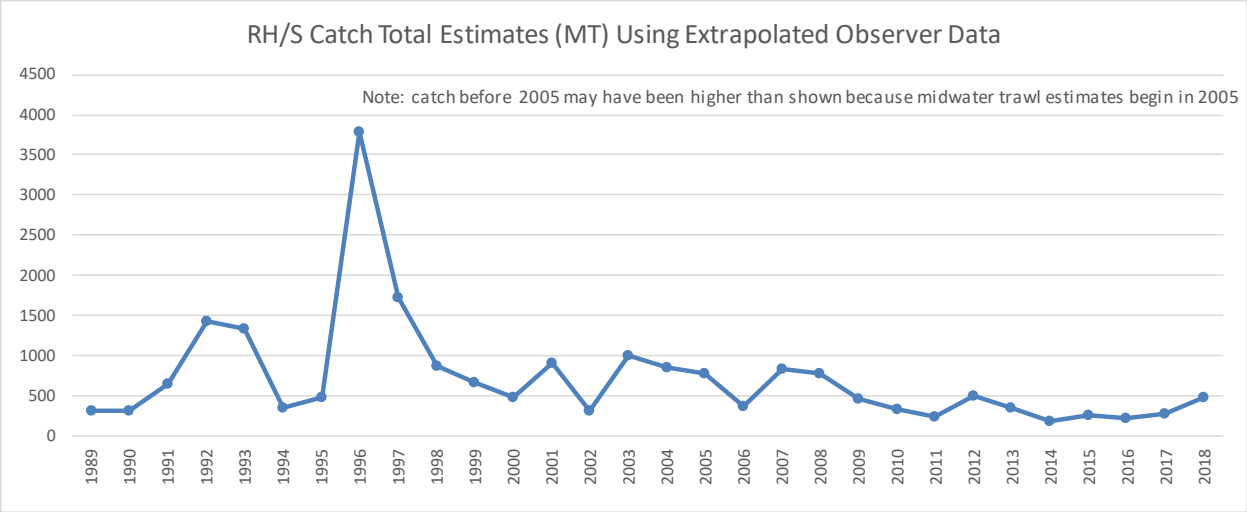

Figure 2. RH/S Catch Estimates 1989-2018 (from Table 7)

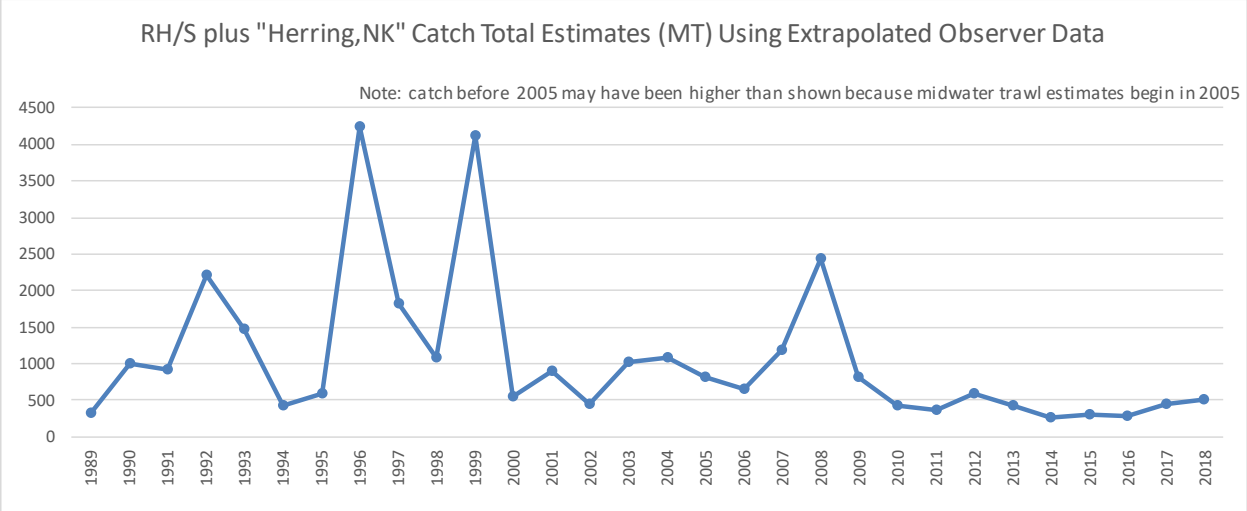

Figure 3. RH/S plus Herring, NK Catch Estimates 1989-2018 (From Table 7)

Table 8. Proportion of 2005-2018 incidental catch of all river herring and shad species (alewife, blueback herring, American shad and hickory shad) by region, fleet and quarter for the dominant gears. (Update of Table 3 of Amendment 14 Appendix 2)

		BT			Gillnet			Paired MWT	Single MWT	Total MWT	Grand Total
Area fished	Quarter	sm	med	lg	sm	lg	xlg				
MA	1	0.031	0.002	0.001	0.003	0.006	0.000	0.179	0.045	0.224	0.268
MA	2	0.022	0.001	0.001	0.000	0.005	0.000	0.009	0.004	0.013	0.042
MA	3	0.050	0.000	0.001	0.000	0.003	0.000	0.000	0.002	0.002	0.057
MA	4	0.021	0.002	0.001	0.001	0.004	0.000	0.004	0.000	0.005	0.034
MA		0.124	0.005	0.004	0.005	0.019	0.000	0.192	0.051	0.244	0.402
NE	1	0.080	0.000	0.006	0.000	0.005	0.000	0.023	0.010	0.033	0.124
NE	2	0.056	0.000	0.006	0.000	0.008	0.000	0.035	0.029	0.064	0.135
NE	3	0.086	0.000	0.005	0.000	0.018	0.000	0.042	0.013	0.055	0.164
NE	4	0.054	0.000	0.005	0.000	0.012	0.000	0.075	0.028	0.103	0.175
NE		0.276	0.001	0.022	0.000	0.044	0.000	0.175	0.080	0.255	0.598
Total		0.400	0.006	0.027	0.005	0.062	0.000	0.368	0.132	0.499	1.000

Table 9. Proportion of 2005-2018 incidental catch of American and hickory shad by region, fleet and quarter for the dominant gears. (Update of Table 4 of Amendment 14 Appendix 2)

		BT			Gillnet			Paired MWT	Single MWT	Total MWT	Grand Total
Area fished	Quarter	sm	med	lg	sm	lg	xlg				
MA	1	0.041	0.008	0.004	0.016	0.035	0.000	0.039	0.005	0.044	0.147
MA	2	0.038	0.004	0.003	0.002	0.025	0.000	0.003	0.000	0.004	0.076
MA	3	0.077	0.001	0.002	0.002	0.018	0.000	0.000	0.000	0.000	0.100
MA	4	0.026	0.005	0.003	0.007	0.024	0.000	0.001	0.000	0.001	0.065
MA		0.181	0.018	0.012	0.027	0.101	0.000	0.043	0.006	0.049	0.388
NE	1	0.047	0.001	0.020	0.000	0.026	0.000	0.007	0.002	0.010	0.104
NE	2	0.044	0.001	0.021	0.000	0.045	0.001	0.014	0.005	0.019	0.131
NE	3	0.066	0.001	0.016	0.000	0.098	0.001	0.020	0.009	0.029	0.211
NE	4	0.037	0.001	0.017	0.000	0.063	0.000	0.031	0.016	0.047	0.166
NE		0.193	0.005	0.075	0.000	0.232	0.002	0.072	0.033	0.105	0.612
Total		0.375	0.022	0.087	0.027	0.333	0.002	0.115	0.038	0.154	1.000

Table 10. Proportion of 2005-2018 incidental catch of river herring (alewife and blueback herring) by region, fleet and quarter for the dominant gears. (Update of Table 5 of Amendment 14 Appendix 2)

		BT			Gillnet			Paired MWT	Single MWT	Total MWT	Grand Total
Area fished	Quarter	sm	med	lg	sm	lg	xlg				
MA	1	0.029	0.001	0.001	0.000	0.000	0.000	0.211	0.055	0.265	0.296
MA	2	0.019	0.000	0.001	0.000	0.000	0.000	0.011	0.004	0.015	0.035
MA	3	0.044	0.000	0.001	0.000	0.000	0.000	0.000	0.002	0.003	0.047
MA	4	0.019	0.001	0.001	0.000	0.000	0.000	0.005	0.001	0.006	0.026
MA		**0.111**	**0.002**	**0.003**	**0.000**	**0.000**	**0.000**	**0.227**	**0.062**	**0.289**	**0.405**
NE	1	0.088	0.000	0.003	0.000	0.000	0.000	0.027	0.012	0.039	0.129
NE	2	0.058	0.000	0.003	0.000	0.000	0.000	0.039	0.035	0.074	0.135
NE	3	0.090	0.000	0.002	0.000	0.000	0.000	0.047	0.014	0.061	0.154
NE	4	0.058	0.000	0.002	0.000	0.000	0.000	0.086	0.031	0.116	0.177
NE		**0.295**	**0.000**	**0.010**	**0.000**	**0.000**	**0.000**	**0.199**	**0.091**	**0.290**	**0.595**
Total		**0.406**	**0.003**	**0.013**	**0.000**	**0.000**	**0.000**	**0.426**	**0.153**	**0.579**	**1.000**

The estimated catches and proportions above are by gear and area which follows the general SBRM estimation protocol and ensures trips are assigned to unique gear/area fleets. One question that often follows review of these tables is what directed fisheries were responsible for the small-mesh bottom trawl and large-mesh gillnet catches (mid-water trawl is going to be mackerel/herring). In order to get a general sense of the answer to this question, Council staff binned the raw observed catch data by whatever species was retained the most (by weight) on each trip. No extrapolations have been or should be done. After tagging each observer record with a "most retained species on the trip" label, the RH/S catch was sorted by these labels. Since the raw amount of observed RH/S depends on the encounter rate, fishery effort, and observer coverage, the order of the top species is not necessarily meaningful – but likely provide a general indication of which fisheries are most responsible for observed RH/S catch. The results are also likely highly sensitive to how the RH/S catch is binned. For river herring in bottom trawls, from 2013-2017 88% of the raw observed river herring were seen in trips where the top retained species included Atlantic herring, longfin squid, silver hake, and mackerel. For shad in bottom trawls, from 2013-2017 77% of the raw observed shad were seen in trips where the top retained species included longfin squid, silver hake, scup, Atlantic herring, and *Illex*. For shad in gillnets, from 2013-2017 82% of the raw observed shad were seen in trips where the top retained species included hickory shad, pollock, spiny dogfish, and menhaden. The update completed for the August 2018 Council Meeting contained tables with additional detail.

Taking yet another approach used for general fishery incidental catch description, the 2018-2020 squid specifications environmental assessment made rough RH/S catch extrapolations for the longfin squid fishery based on 2014-2016 landings and observer data, and estimated that around 57 MT of RH/S (mostly alewife and American shad) would be caught incidentally in a year if 14,000 MT of squid was landed in a year (14,000 MT was the average of longfin squid landings 2014-2016).

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The ASMFC annual fishery management plan reviews are available at http://www.asmfc.org/species/shad-river-herring. Summary landings data from 2012-2018 for river herring and American shad from ME-FL are provided below. The reviews have data on hickory shad but landings are relatively low. Most of these landings are in-river but there may be some incidental catch that is overlapped with the tables above, so the numbers cannot be added. Most of the recent river herring landings have been from Maine and South Carolina. Most of the recent shad landings have been from North Carolina, South Carolina, and Georgia.

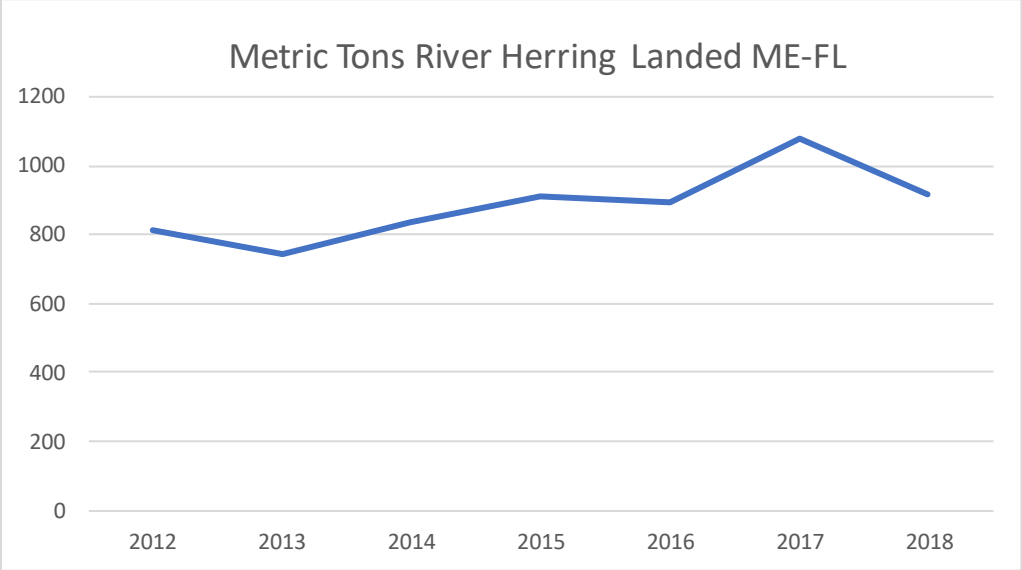


Figure 4. River herring landings reported by states

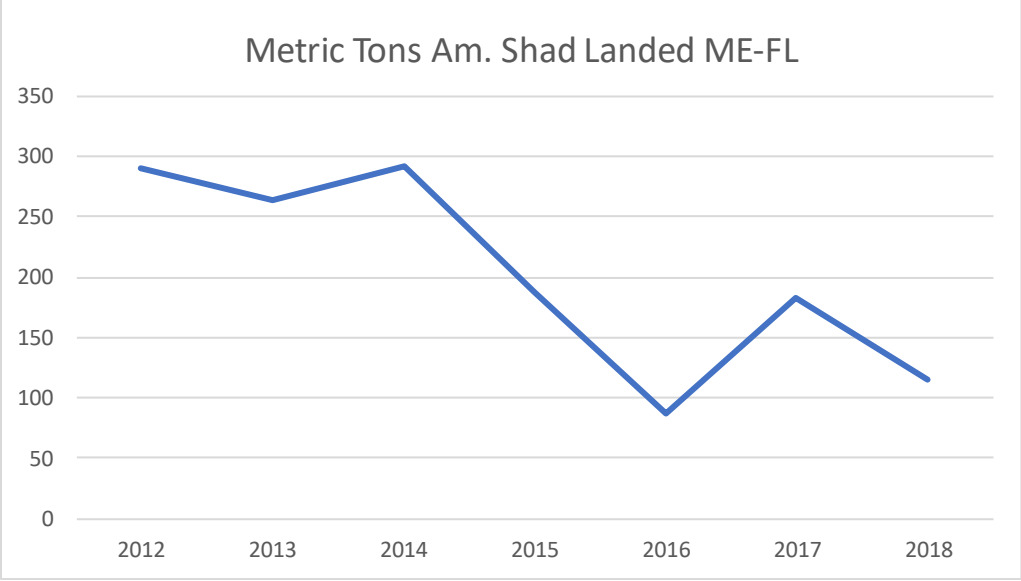


Figure 5. American shad landings reported by states

3. What levels of observer coverage have been achieved in relevant fisheries?

See the inventory of trip tables below by fleet (not by fishery) for observed trips versus total dealer/VTR trips. In 2018, coverage for the gears of most concern were: 21% of Mid-Atlantic small mesh bottom trawl trips; 17% of New England small mesh bottom trawl trips; 4% of Mid-Atlantic single mid-water trawl trips; 13% of Mid-Atlantic paired mid-water trawl trips; 5% of New England single mid-water trawl trips; and 4% of New England paired mid-water trawl trips.

Table 11. Mid-Atlantic Trawl Trips

	Number of trips									
	Bottom trawl						Midwater trawl			
	Small mesh		Medium mesh		Large mesh		Single		Paired	
Year	Observer	Dealer	Observer	Dealer	Observer	Dealer	Observer	VTR	Observer	VTR
1989	29	4,180	7	412	4	2,627				
1990	31	3,745	19	386	0	2,864			0	0
1991	61	3,994	20	361	4	3,699	5	0	0	0
1992	39	3,080	12	283	14	4,719			9	0
1993	9	2,965	7	103	12	5,904			14	0
1994	8	3,857	8	156	21	4,865	1	64	30	44
1995	60	4,731	3	330	55	6,745	0	120	33	50
1996	70	4,699	10	652	18	6,500	0	252	0	14
1997	41	5,174	10	692	9	6,554	0	205	0	6
1998	29	5,269	4	784	13	6,866	0	238	0	34
1999	28	4,655	9	777	8	6,712	0	207	0	26
2000	28	4,575	12	806	26	5,938	5	193	1	74
2001	42	3,783	13	879	50	6,493	0	169	0	58
2002	15	3,475	18	998	39	6,958	0	71	1	107
2003	21	2,168	53	795	16	7,107	0	115	5	196
2004	111	2,408	156	692	109	6,796	2	99	8	249
2005	74	1,422	109	466	93	8,441	4	75	11	224
2006	101	2,349	54	736	71	6,938	8	74	6	184
2007	86	2,197	139	711	160	5,982	1	86	2	84
2008	68	2,254	86	698	132	6,171	8	17	8	146
2009	169	2,507	126	654	167	6,953	5	27	20	166
2010	183	2,306	193	415	276	5,577	4	15	13	84
2011	235	2,285	155	584	254	6,319	4	3	22	44
2012	133	2,422	111	727	169	5,117	4	35	7	40
2013	219	2,232	195	942	251	4,755	1	45	2	33
2014	228	2,113	227	883	269	4,183	1	47	0	18
2015	176	1,718	201	805	231	4,366	2	32	1	25
2016	394	2,381	298	1029	286	4,182	2	26	1	14
2017	612	2,615	370	991	332	3,184	4	32	2	14
2018	527	2,535	328	938	281	3,293	1	27	4	31

Table 12. New England Trawl Trips

	Number of trips									
	Bottom trawl						Midwater trawl			
	Small mesh		Medium mesh		Large mesh		Single		Paired	
Year	Observer	Dealer	Observer	Dealer	Observer	Dealer	Observer	VTR	Observer	VTR
1989	72	5,060	15	528	57	21,439			0	0
1990	33	4,850	4	355	54	21,518			0	0
1991	84	4,372	13	156	78	22,429	2	0	0	0
1992	56	4,157	1	120	68	22,518	0	0	0	0
1993	21	5,054	10	153	44	21,468	0	0	7	0
1994	13	5,522	5	239	36	21,084	0	306	4	53
1995	37	4,217	3	154	68	20,376	4	785	2	11
1996	48	3,893	2	52	44	19,750	0	897	0	18
1997	19	3,788	4	100	29	17,417	0	701	0	93
1998	5	4,198	1	94	13	18,156	0	512	0	170
1999	19	3,915	0	214	41	16,345	1	521	2	164
2000	8	3,338	9	124	103	17,473	7	462	0	368
2001	8	2,834	11	173	157	17,372	1	336	0	629
2002	35	2,184	30	221	220	17,480	0	373	0	653
2003	46	2,226	27	184	387	16,813	2	251	18	617
2004	88	1,822	85	152	531	13,384	23	253	60	585
2005	84	1,507	173	131	1350	11,902	43	265	91	465
2006	49	1,939	37	299	619	10,612	10	194	21	490
2007	58	2,146	18	213	621	10,760	10	87	11	235
2008	46	2,382	16	176	753	11,012	11	33	36	185
2009	195	2,296	26	270	879	10,936	10	47	67	225
2010	206	2,600	55	253	1054	9,424	29	57	106	215
2011	164	1,854	31	246	1597	8,353	24	59	89	252
2012	138	2,146	30	390	1551	8,358	30	122	131	246
2013	191	1,856	56	510	1095	7,344	27	181	69	235
2014	281	1,972	56	540	1198	6,404	28	141	74	237
2015	242	2,093	60	538	897	6,106	6	154	10	193
2016	282	3,098	60	711	632	5,093	21	163	28	131
2017	589	2,616	166	597	633	5,070	12	92	17	124
2018	359	2,143	84	464	673	5,303	3	58	3	70

4. Was a cap set for RH/S? (See #1 above for cap estimates)

Cap History

2014 was the first year of the cap. The cap was set at 236 MT and the mackerel DAH was 33,821 MT. 236 MT was the median of the values generated when the annual RH/S catch to all retained catch ratios on mackerel trips 2005-2012 (from observer data) were applied to the quota (33,821 MT). The critical ratio of cap RH/S to mackerel was 0.70% and the ratio of cap to all catch on mackerel trips (accounting for mostly Atlantic herring) was 0.50%. This approach and the 236 MT cap was preferred because it created "a strong incentive for the fleet to avoid RH/S, allows for the possibility of the full mackerel quota to be caught if the fleet can avoid RH/S, and should reduce RH/S catches over time, compared to what would occur without a cap, given recent data." (2014 proposed rule - https://www.federalregister.gov/documents/2014/04/04/2014-07610/fisheries-of-the-northeastern-united-states-atlantic-mackerel-squid-and-butterfish-fisheries). The initial implementation of the cap rested on the assumption that a reduction of RH/S catch in the mackerel fishery, due either to avoidance or a closure, might have a potentially positive impact on RH/S stocks, noting that the connection between RH/S catch in the mackerel fishery (or other ocean fisheries) and RH/S populations is unknown. Above those ratios the fishery would have had an early shut down to some degree. The estimated cap catch in 2014 was 6 MT (the cap only operated for part of the year but the estimate was retroactive, i.e. for the full year).

In 2015 there was a slight adjustment to identifying cap trips made, but the same basic procedure was used to generate a cap of 155 MT for a mackerel DAH of 20,872 MT. The Council included a provision that the cap starts out lower, at 89 MT (the median of actual RH/S catches by the mackerel fishery from 2005-2012) until 10,000 MT of mackerel landings, so that there was still a strong incentive to avoid RH/S catches even at the low levels of mackerel catch then occurring. Until landings got above 10,000 MT the critical ratio of RH/S to mackerel was 0.89% and the ratio of RH/S to all catch overall on mackerel trips (accounting for mostly Atlantic herring) was 0.64%. To catch the full mackerel quota the critical ratio of cap to mackerel was 0.74% and the ratio of cap to all catch on mackerel trips (accounting for mostly Atlantic herring) was 0.53%. The estimated cap catch was 13 MT. If the 89 MT RH/S cap had been reached before 10,000 MT of mackerel had been landed, the fishery would be closed for the rest of the year, and based on past performance this would be expected to occur slightly less than 50% of years.

For 2016-2018 the mackerel DAH dipped below 10,000 MT to 9,177 MT. The Council applied the 0.89% ratio to that quota to get a cap of 82 MT. The ratio of cap to all catch on mackerel trips (accounting for mostly Atlantic herring) would be 0.64%. The estimated cap catch was 13 MT in 2016 and 39 MT in 2017. In 2018, the directed fishery caught 109 MT of RH/S when it was shut down and 8,072 MT of mackerel, for a ratio of 1.35% cap to mackerel or about 0.90% cap to all catch. In 2018 the cap operated as designed – the fishery was closed early due to the relatively high RH/S ratio. The overage was not large relative to the pace of mackerel landings and the precision of RH/S estimates.

NMFS quota-monitoring staff has noted it is worth highlighting that the RH/S cap is estimated by extrapolating RH/S catch rates to everything kept on mackerel trips. If the proportion of herring:mackerel catch increases relative the RHS cap reference years (2005-2012), the cap could potentially be exceeded sooner than anticipated (ex. higher amounts of herring on mackerel trips increases the total kept, thereby increasing RH/S the extrapolation). This effect is due to anchoring the catch cap to mackerel DAH and using a static RHS:mackerel rate. Alternatively, the inverse could be observed if the herring:mackerel catch ratio decreased. Since the mix of herring and mackerel was taken into account when setting the cap this effect is anticipated; operational issues would only arise if there was a substantial change in the proportions relative to historical performance.

For 2019, the Council approved a cap of 129 MT with the 89 MT trigger. A final rule has not yet been published (so the 2018 cap of 82 MT is still in effect), but the 89 MT trigger would have been activated since at closure in March the fishery was estimated to have caught 91.5 MT. In other words, the fishery would have closed at the same time under the continued 2018 regulations or under the proposed 2019 regulations.

2020 catch cap

Per the Council's request, the Monitoring Committee[2] discussed possible options for the 2020 RH/S cap, and staff provided a memo (included in this tab) to the Monitoring Committee reviewing the rationale from Amendment 14 that initiated the RH/S cap, 2019 cap performance and economic impacts, and several potential options for the 2020 RH/S cap, including staying at the planned 129 MT cap with the 89 MT trigger before the fishery lands 10,000 MT of mackerel. Because the mackerel specifications are only being set for 2020 and the Council's motion concerned 2020, the focus of the Monitoring Committee was on 2020 and what would be feasible for early 2020. Bigger picture modifications could be considered for future years if desired by the Council.

The Monitoring Committee endorsed the general italicized paragraph on the first page of this document, highlighting that without more quantitative assessment information with estimates of absolute abundance, we cannot know the level of mortality caused by incidental catch in federal fisheries and this becomes largely a policy/trade-off choice by the Council.

The Monitoring Committee discussed whether the recent river herring Endangered Species Act (ESA) determination to not list river herring provided any useful information for cap setting. The Monitoring Committee discussed that the qualitative threats assessment considered the adequacy

[2] The MSB Monitoring Committee met on 7/9/19. Monitoring Committee members included Jason Didden (MAFMC staff), Doug Christel (NOAA – GARFO-SF), Kiersten Curti (NOAA – NEFSC), Chuck Adams (NOAA – NEFSC), and Ben Galuardi (NOAA – GARFO-APSD). Other attendees included Brant McAfee (NOAA – GARFO-APSD), Aly Pitts (NOAA – GARFO-SF), Dan Luers (NOAA – GARFO-SF), Deirdre Boelke (NEMFC staff), Eric Reid (NEFMC), Fred Akers (RH/S AP), Gerry O'Neil (MSB AP), Jeff Kipp (ASMFC), Caitlin Starks (ASMFC), Katie Almeida (MSB & RH/S APs), Peter Hughes (MAFMC), Stew Michels (DE+MAFMC), Zack Greenberg, Joseph Gordon (MSB & RH/S APs), Brad Schondelmeier (MA), Pam Lyons Gromen (MSB & RH/S APs), Dave Bethoney (UMass-SMAST), Wes Eakin (NY), Corey Endres, Greg DiDomenico (MSB & RH/S APs), Marianne Ferguson (NOAA – GARFO-NEPA), and Jeff Kaelin (MSB & RH/S APs).

of existing regulations, and existing regulations affect ESA determinations. Discussion noted the intertwined nature of various RH/S actions/issues and that any one decision should not be considered in a vacuum since any one decision may impact other aspects of RH/S processes under various laws. While some recent court decisions have had decisions favorable to previous Council and NMFS decisions, a final determination on legal issues surrounding the "stock in the fishery" question is still outstanding, and may not be fully resolved for some time.

GARFO provided input that it has been a substantial amount of time since the original 236 MT cap (option #5 in staff memo) was considered from a National Environmental Policy Act perspective, and would likely need to be considered via an Environmental Assessment (EA), rather than using a shorter Supplemental Information Report (SIR) that could build off of the EA from the mackerel rebuilding framework (using a SIR would facilitate early 2020 implementation). Creating a new EA rather than using a SIR would make implementation within the first months of 2020 challenging and would require that staff (Council and GARFO) focus on this endeavor above most other tasks.

GARFO also noted that given more limited comment opportunities involved with specifications processes, at some point the degree of substantive change from the status quo may make a 2-meeting framework (or amendment) a more appropriate vehicle for changes rather than the 1-meeting specifications process. If actions are within the scope of objectives and methodologies previously considered (in Amendment 14 or subsequent actions) then there is a stronger case for making modifications within the specifications process.

There was discussion about whether additional trips in 2019 would be helpful for informing the assumed ratio in 2020. Given the current closure additional trips are not expected, and whether late season 2019 trips or early season 2019 trips would better represent early 2020 fishing has not been analyzed (and woud not be simple to analyze). Staff reviewed preliminary analyses of monthly RH/S catch rates over the last 5-10 years based on two trip definitions: 20,000 pounds of mackerel or 40,000 pounds combined mackerel and Atlantic herring. The latter 40,000 pound combined criterion includes more observed trips. Bottom and midwater trawl gear were grouped together. In general, December and January had the highest bycatch rates, followed by February and November, with other months having lower bycatch ratios – see example figure below for the combined 40,000 pound approach for 2009-2018 data. Given when the mackerel fishery occurs (also when interactions appear relatively high), seasonal effort timing doesn't appear to provide an easy solution to RH/S interaction issues. If time allows staff will add uncertainty information to the monthly analyses.

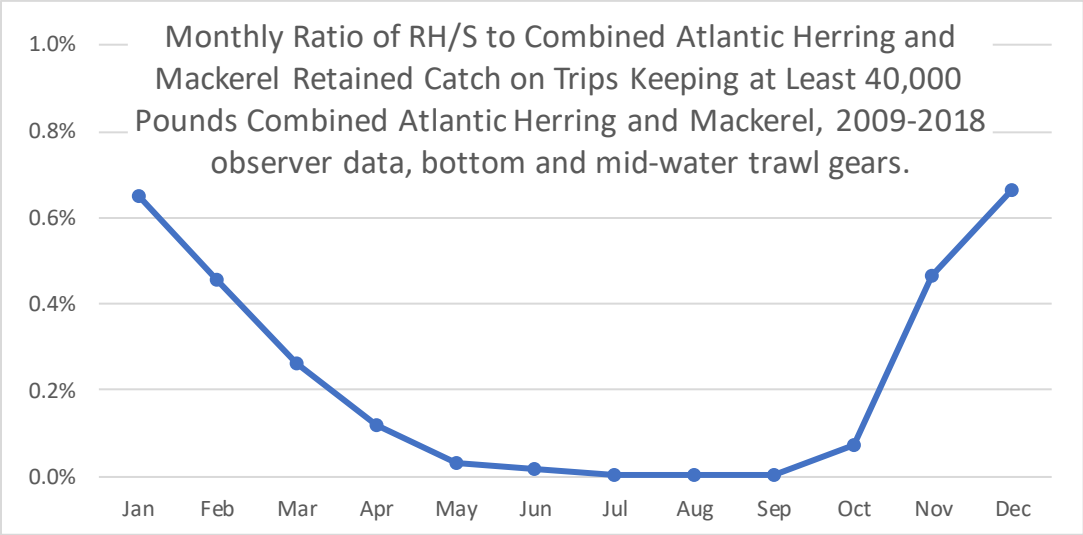


Figure 6. Monthly RH/S Interaction Rates

The Monitoring Committee discussed the possibility of using survey indices to set and/or adjust the RH/S cap (Staff Option 4). While using biological information is intuitively attractive to the Monitoring Committee, given the various uncertainties and assumptions involved, and considering RH/S life histories, more work would have to be done before the Monitoring Committee could endorse a particular approach to using one or more survey indices to set and/or adjust the RH/S cap. SSC or other review may be appropriate for methods that use indices to adjust the RH/S cap, and ASMFC assessment/technical staff involvement may also be useful and appropriate.

The Monitoring Committee also discussed the possible consequences of moving away from the current methodology given the Council's previous decisions for setting the cap (in specifications), including the 89 MT trigger. Concerns centered on rationale consistency, interactions with ESA decisions, interactions with stock in the fishery considerations/lawsuits, and the tradeoffs between RH/S catch and the mackerel fishery. Amendment 14 noted that the trade-offs would have to be considered, and the Council needs to clearly articulate its rationale for its policy choices. If those policy choices diverge from Amendment 14, then the appropriate procedure would be to consider changes via a framework or Amendment rather than specifications. Conversely, alternatives that are consistent with Amendment 14 and applicable law can likely be handled via the standard specifications process. It is also possible that the Council could take a dual track approach, recommending relatively narrow modifications that can probably be made for January/February 2020, and then prioritizing a separate action (framework or other) for 2020 to consider broader changes in the context of other priorities (e.g. the mackerel assessment update will also be occurring during the first half of 2020).

During that discussion, public comment suggested that higher encounter rates in the fishery, higher RH trends in the federal surveys and the fact that the observer coverage rates in place prior to these caps being set were much higher justify higher RH/S caps. There was also public input that the caps are set so low that it has created a race for fish and has taken away the ability of the fleet to make better decisions whether it is to stop fishing for a week, do shorter tows, etc. A question was

asked whether regional caps or regional cap closures could be considered (such measures could be considered via a framework or via specifications, but would need separate development and direction from the Council to guide development of options). Public comments stated that SBRM coverage doesn't assign enough days to capture the between-trip variability in RH/S bycatch, and that because the monitoring year starts during a time of high interaction rates, low-bycatch trips will not likely be observed in years where there are closures. This could lead to possibly artificially high transition rates in following years. The Monitoring Committee recognized this potential, but noted that the current monitoring program uses the best available scientific information and the preliminary analysis of monthly data described above suggests November and December RH/S interaction rates may also be high.

5. Was the cap based on recent catch or more directly tied to RH/S population dynamics?

To date, the cap has been tied to RH/S catch rates in the mackerel fishery, and adjusted based on mackerel quotas to maintain incentives for the mackerel fishery to reduce catch. RH/S population dynamics have not been utilized to set the cap given the lack of accepted reference points (see italicized intro paragraph on page 1).

6. What progress has been made on aligning cap operation with the Atlantic herring fishery's cap?

Catches of both Atlantic herring and mackerel are considered in the cap setting and estimation for all the RH/S caps. New England recently set the 2020-2021 RH/S caps for its Atlantic herring fishery, maintaining the RH/S caps set in 2016: https://s3.amazonaws.com/nefmc.org/Atlantic-Herring-NEFMC-Approves-Framework-6.pdf.

A cap based on the gears and areas (e.g. fleets) used to assign observer coverage in the SBRM would be optimal statistically and the Monitoring Committee believes this issue is worthy of reconsideration. Such action would likely need to take place via a framework or amendment, possibly joint with New England. A gear/area fleet-based cap might be relatively simple for mid-water trawl gear (given it would only involve the Atlantic herring and mackerel fisheries), but addressing small mesh bottom trawl fleets would likely be more complex given the wider variety of fisheries involved. Development of a white paper could explore options without initiating a formal action.

7. What other RH/S coordination with other management partners has occurred (NMFS, NEFMC, ASMFC, states, NGOs, academia, TEWG, etc.)?

The TEWG continues to keep a variety of parties engaged in RH conservation issues. TEWG information is available at https://www.greateratlantic.fisheries.noaa.gov/protected/riverherring/tewg/. Council staff has requested that updated meeting summaries be posted to that site, and updates are pending overall

NMFS web platform updates. Work has continued on a river herring review paper that summarizes recent science on river herring. J. Didden drafted a 2nd update to the Fisheries Subgroup *Data Gaps and Conservation Ideas* document, which should be finalized in 2019. To some degree there has been a pause in very recent months in case river herring were listed under the Endangered Species Act, but it is anticipated that TEWG work will now resume. Council and ASMFC staffs are in regular contact to keep each other updated on RH/S-relevant on-goings and issues.

Council staff also participates in various meetings to provide information on Council actions related to RH/S as well as general incidental catch information, e.g. Hudson River Estuary Management Advisory Committee, the 2018 American Fisheries Society (AFS) Annual Meeting River Herring Symposium, and the Smithsonian's Chesapeake Bay River Herring Workshop.

8. How has the Scientific and Statistical Committee (SSC) been involved?

There were preliminary discussions with the SSC regarding creation of a working group to evaluate the feasibility of developing a biologically-based cap but the lack of reference points has made progress difficult. The SSC has expressed willingness to evaluate any biologically-based caps or other relevant work.

9. What other actions have been taken by the Council that could affect RH/S?

Other than the RH/S cap for the mackerel fishery, the primary work from staff over the last year that could affect RH/S involves the TEWG and associated review paper, and tracking and supporting New England's RH/S actions. Council staff has also promoted the existing RH/S voluntary bycatch avoidance programs (SMAST/Cornell) through communication with industry. For a summary of New England's recent decision on its approach to RH/S, see http://s3.amazonaws.com/nefmc.org/NEFMC-Reaffirms-River-HerringShad-Approach-Launches-Atlantic-Herring-Specs-June-29-2018.pdf. Council staff also supports GARFO in developing updates or other relevant materials for ongoing RH/S lawsuits. Staff has also drafted an update for the TEWG Fisheries Data Gaps and Conservation Document, and has begun development of a story map site that could allow easy access to historical run count information of all monitored East Coast RH/S runs: https://drive.google.com/open?id=1qeyRPRGmAp0LE3cFKhKWcnSzbFpNVDJV&usp=sharing

10. What information is available on RH/S abundance trends?

RH had an assessment update in 2017 and American shad is undergoing a benchmark assessment, anticipated for finalization by August 2020. The ASMFC provides selected run counts in its FMP reviews, available at http://www.asmfc.org/species/shad-river-herring.

The 2017 RH assessment update, utilizing data through 2015, found that the coastwide meta-complex of river herring stocks on the US Atlantic coast remains depleted to near historic lows. Of the 54 in-river stocks of river herring for which data were available, 16 experienced increasing trends over the ten most recent years of the update assessment data time series, 2 experienced decreasing trends, 8 were stable, 10 experienced no discernible trend/high variability, and 18 did not have enough data to assess recent trends, including 1 that had no returning fish.

The last coastwide stock assessment for American shad was completed in 2007, which found that stocks were at all-time lows and did not appear to be recovering.

Staff provided relevant survey indices for the 2018 document, and updates of those indices are provided in Appendices below to the extent available (Massachusetts data is pending and will be updated when available).

River herring (alewife and blueback herring) and American shad indices from the NEFSC spring and fall bottom trawl surveys for fall 1975 - spring 2019

Northeast Fisheries Science Center

June 24 2019

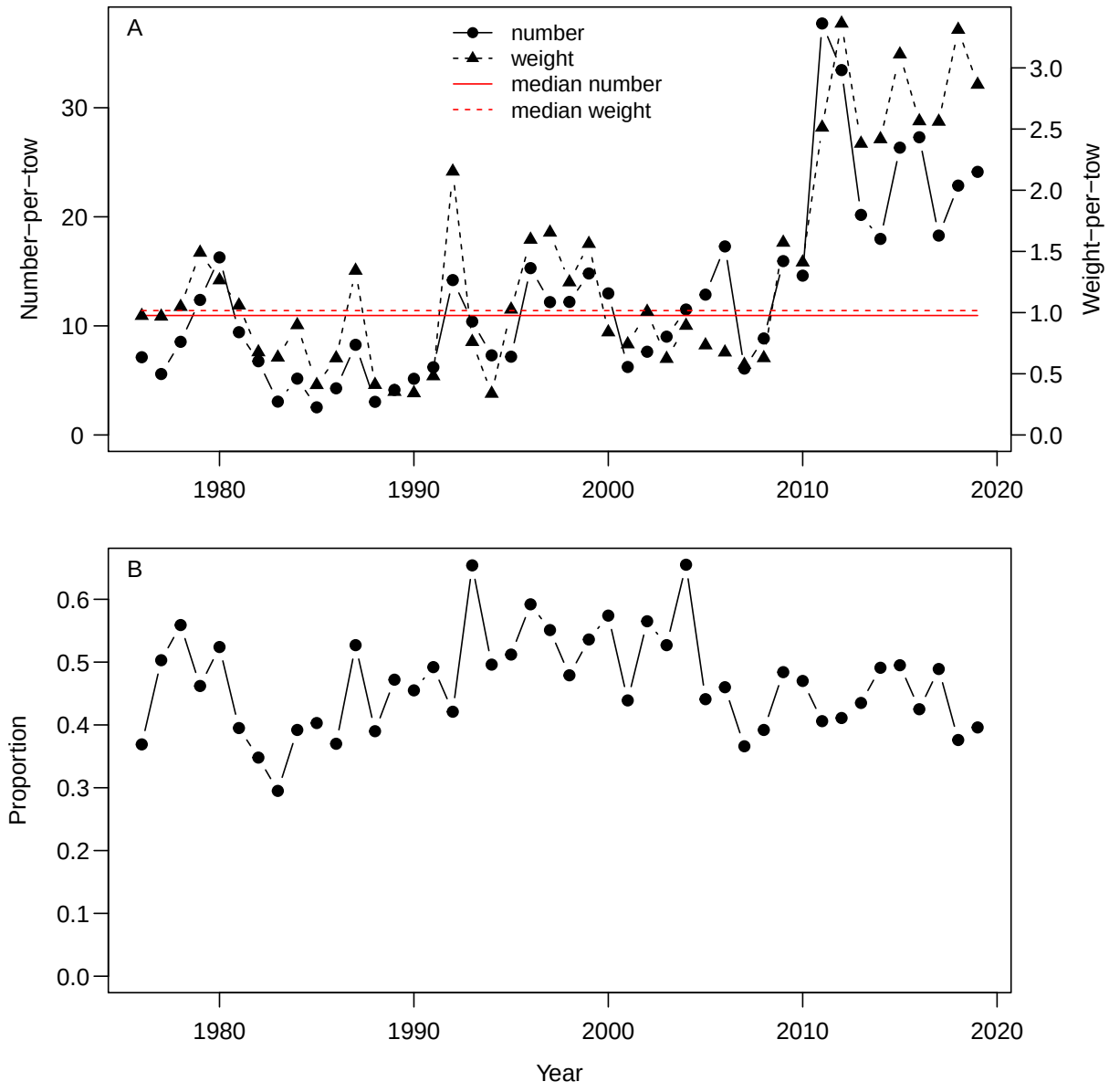


Figure 1: Alewife relative abundance (stratified mean number-per-tow) and biomass (stratified mean kg-per-tow) indices (A) and the proportion of positive tows (B) derived from the NEFSC spring bottom trawl survey for 1976-2019. Indices from 2009 onward were converted to Albatross units. The median number- and weight-per-tow values represent the median indices over 1976-2019. The full strata set was not sampled in 2014 due to delays in the survey (offshore strata 61-68 south of Maryland were not sampled).

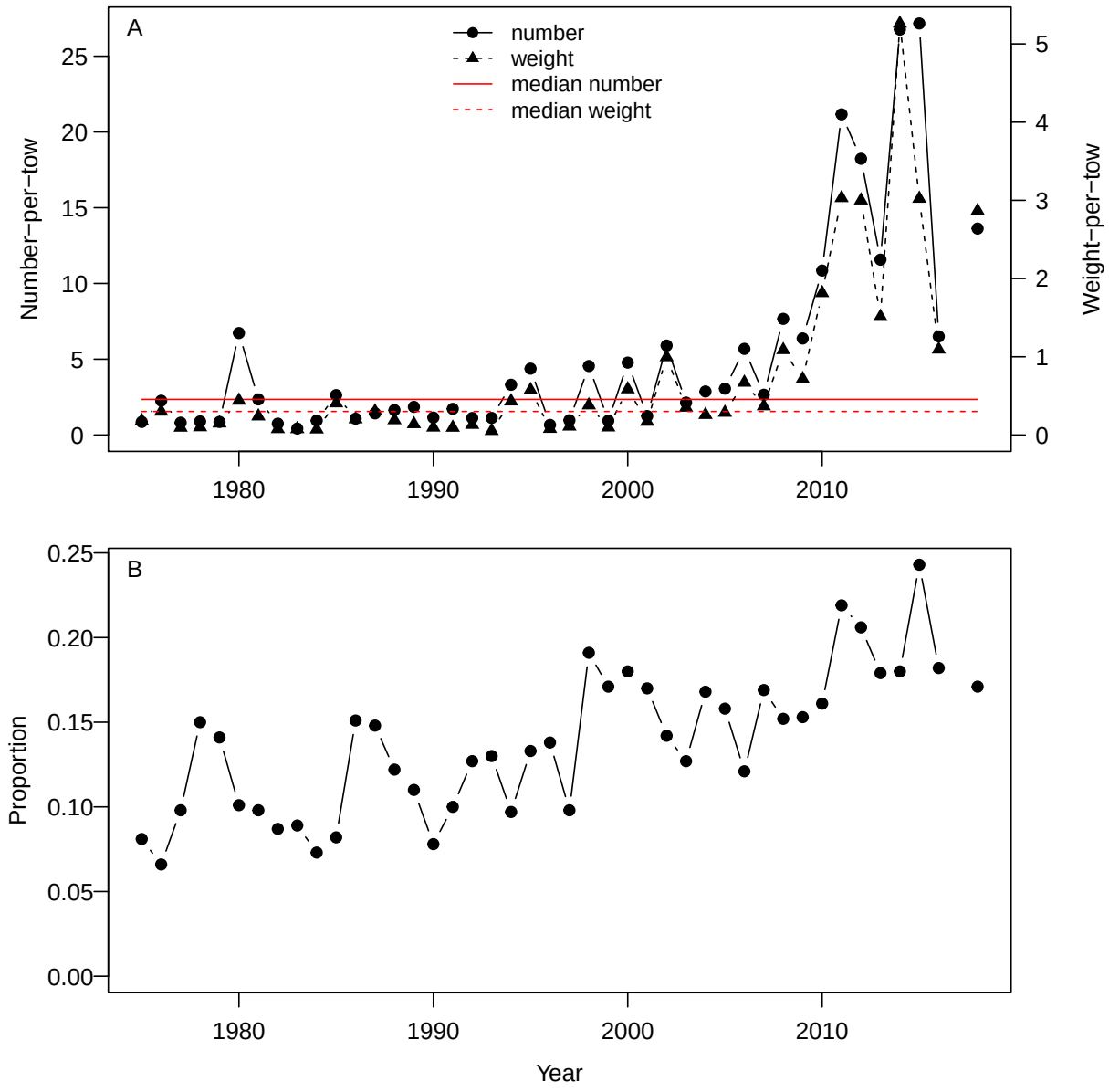


Figure 2: Alewife relative abundance (stratified mean number-per-tow) and biomass (stratified mean kg-per-tow) indices (A) and the proportion of positive tows (B) derived from the NEFSC fall bottom trawl survey for 1975-2018. Indices from 2009 onward were converted to Albatross units. The median number- and weight-per-tow values represent the median indices over 1975-2018. Indices from the 2017 fall bottom trawl survey are treated as missing because the full survey was not completed due to vessel mechanical issues.

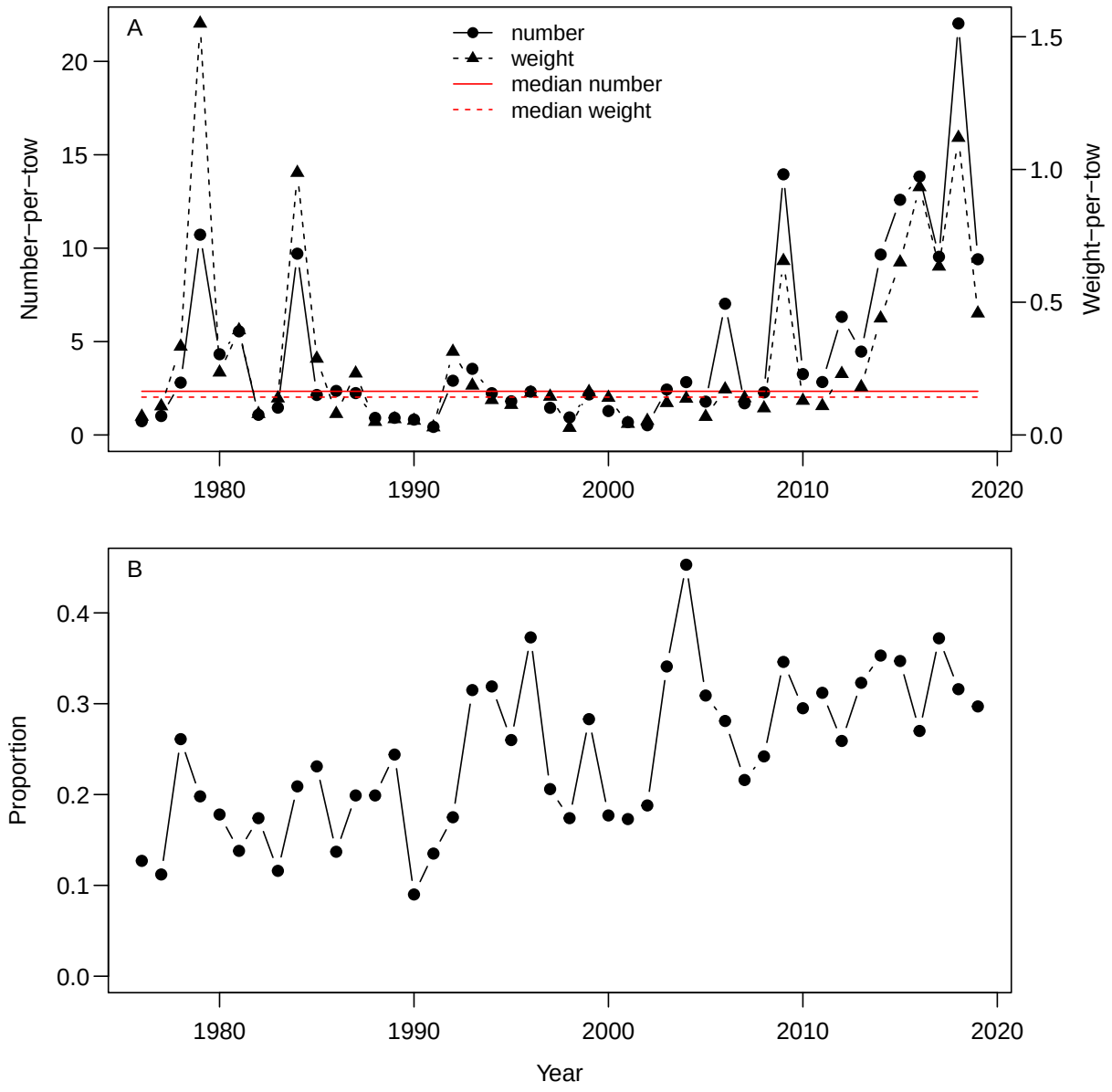


Figure 3: Blueback herring relative abundance (stratified mean number-per-tow) and biomass (stratified mean kg-per-tow) indices (A) and the proportion of positive tows (B) derived from the NEFSC spring bottom trawl survey for 1976-2019. Indices from 2009 onward were converted to Albatross units. The median number- and weight-per-tow values represent the median indices over 1976-2019. The full strata set was not sampled in 2014 due to delays in the survey (offshore strata 61-68 south of Maryland were not sampled).

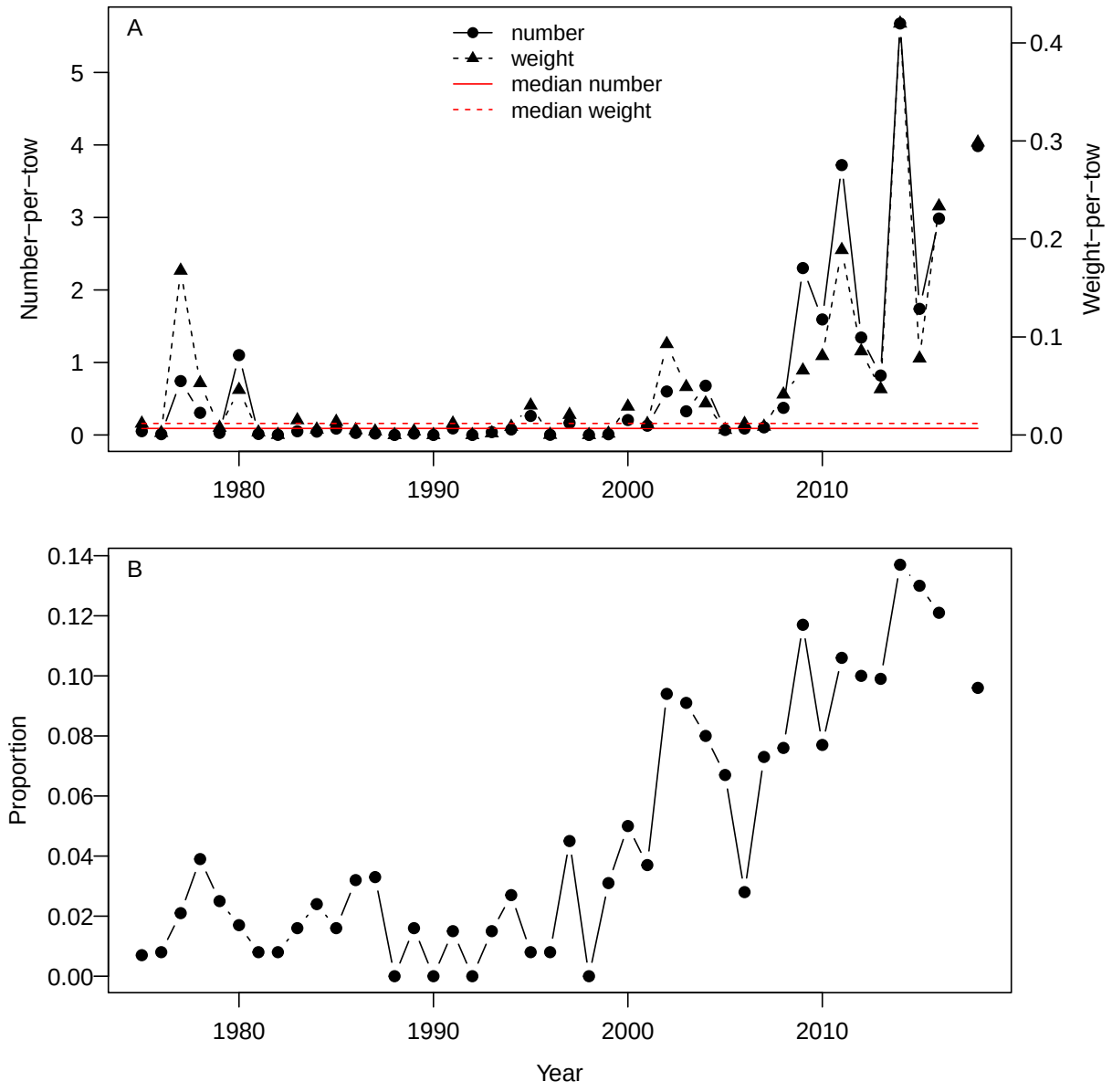


Figure 4: Blueback herring relative abundance (stratified mean number-per-tow) and biomass (stratified mean kg-per-tow) indices (A) and the proportion of positive tows (B) derived from the NEFSC fall bottom trawl survey for 1975-2018. Indices from 2009 onward were converted to Albatross units. The median number- and weight-per-tow values represent the median indices over 1975-2018. Indices from the 2017 fall bottom trawl survey are treated as missing because the full survey was not completed due to vessel mechanical issues.

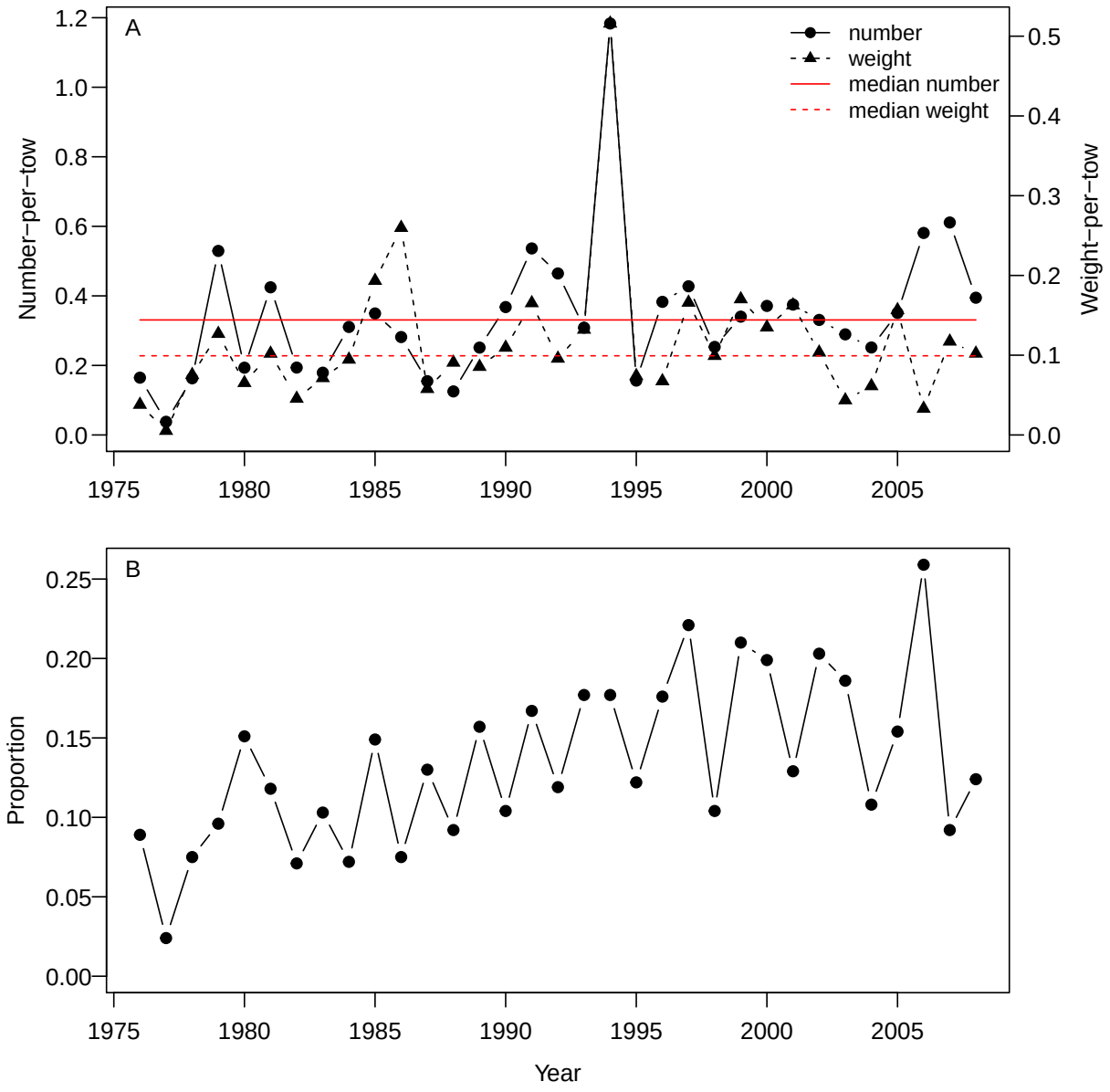


Figure 5: American shad relative abundance (stratified mean number-per-tow) and biomass (stratified mean kg-per-tow) indices (A) and the proportion of positive tows (B) derived from the NEFSC spring bottom trawl survey for 1976-2008. Vessel (Bigelow to Albatross) conversion coefficients are not available for American shad; therefore, the time series was split in 2008. The median number- and weight-per-tow values represent the median indices over 1976-2008.

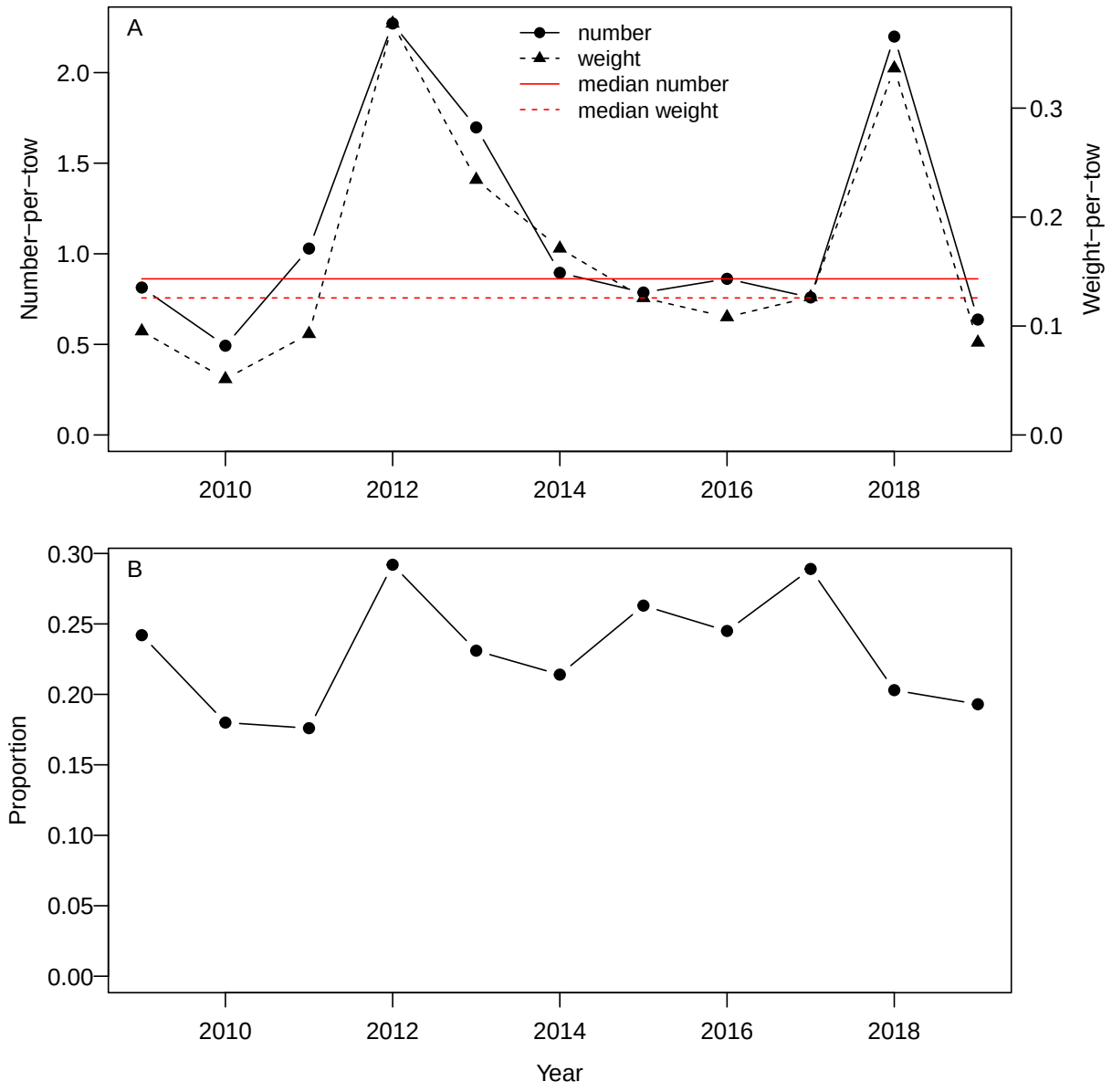


Figure 6: American shad relative abundance (stratified mean number-per-tow) and biomass (stratified mean kg-per-tow) indices (A) and the proportion of positive tows (B) derived from the NEFSC spring bottom trawl survey for 2009-2019 (Bigelow units). The median number- and weight-per-tow values represent the median indices over 2009-2019. The full strata set was not sampled in 2014 due to delays in the survey (offshore strata 61-68 south of Maryland were not sampled).

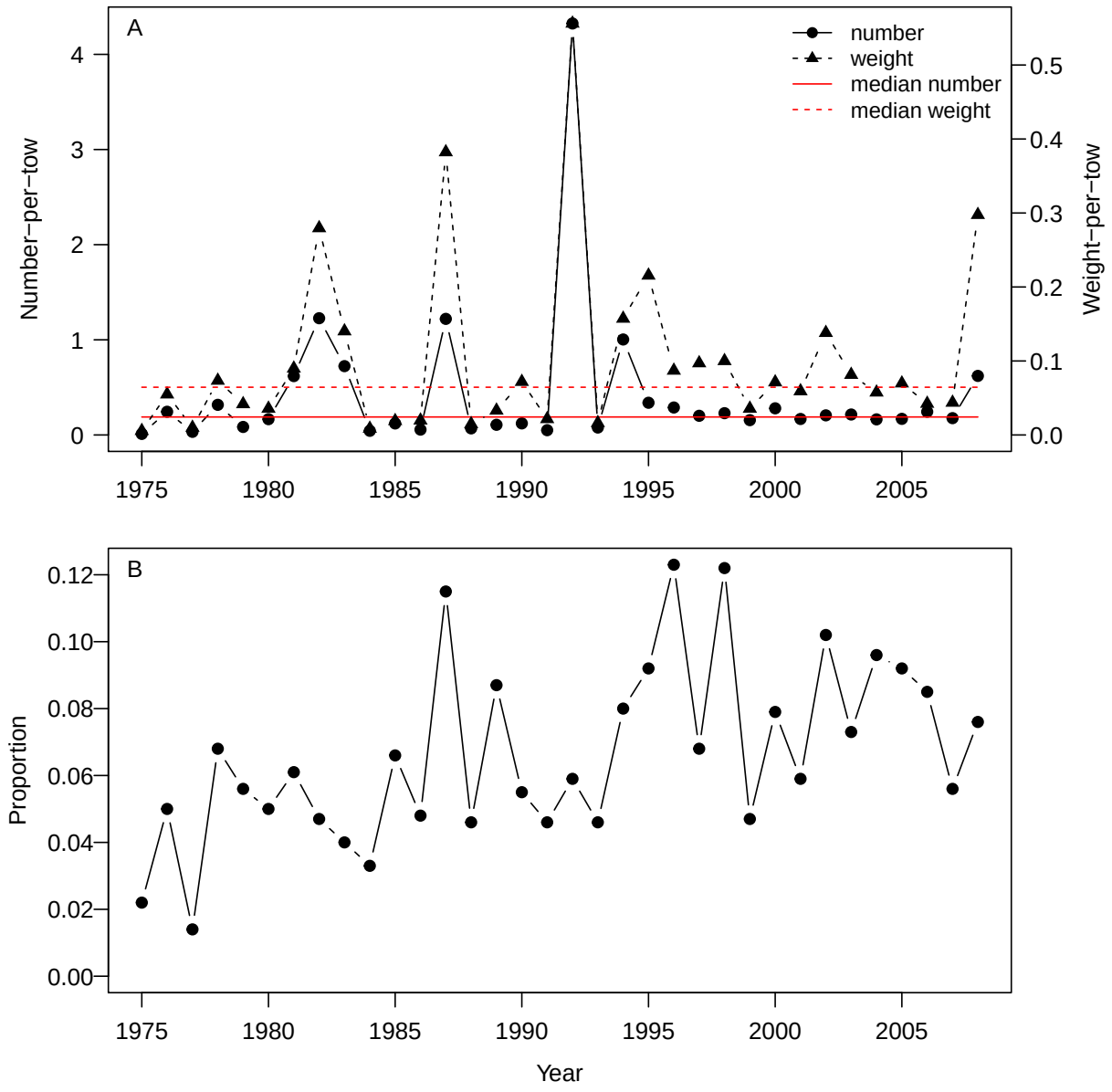


Figure 7: American shad relative abundance (stratified mean number-per-tow) and biomass (stratified mean kg-per-tow) indices (A) and the proportion of positive tows (B) derived from the NEFSC fall bottom trawl survey for 1975-2008. Vessel (Bigelow to Albatross) conversion coefficients are not available for American shad; therefore, the time series was split in 2008. The median number- and weight-per-tow values represent the median indices over 1975-2008.

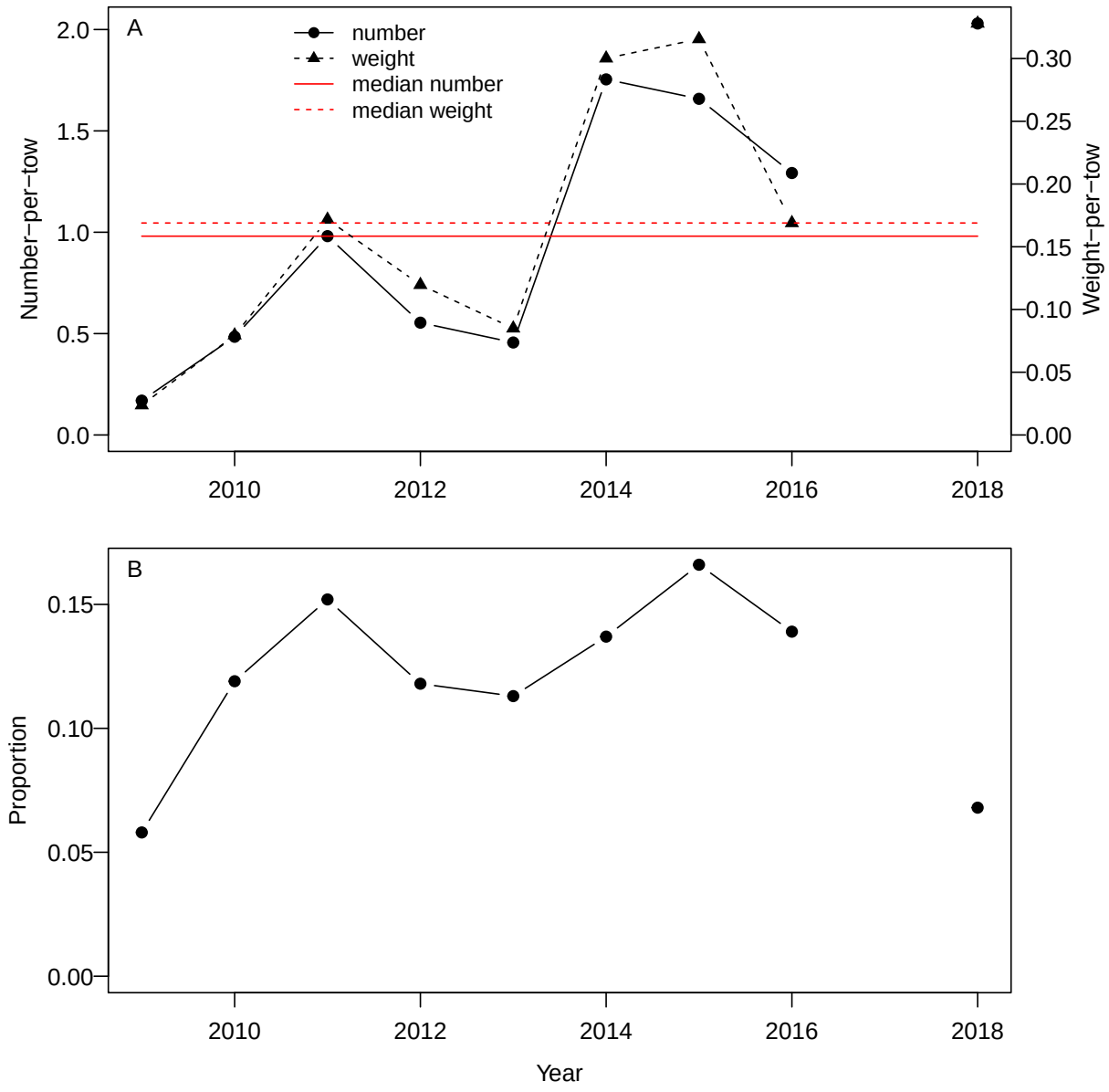


Figure 8: American shad relative abundance (stratified mean number-per-tow) and biomass (stratified mean kg-per-tow) indices (A) and the proportion of positive tows (B) derived from the NEFSC fall bottom trawl survey for 2009-2018 (Bigelow units). The median number- and weight-per-tow values represent the median indices over 2009-2018. Indices from the 2017 fall bottom trawl survey are treated as missing because the full survey was not completed due to vessel mechanical issues.

Appendix 2 – NEAMAP Trawl Indices

Note from VIMS: Spring 2017 data probably should be ignored because the survey was truncated to only 63 stations in the northern strata, due to both a funding shortfall and survey vessel fire.

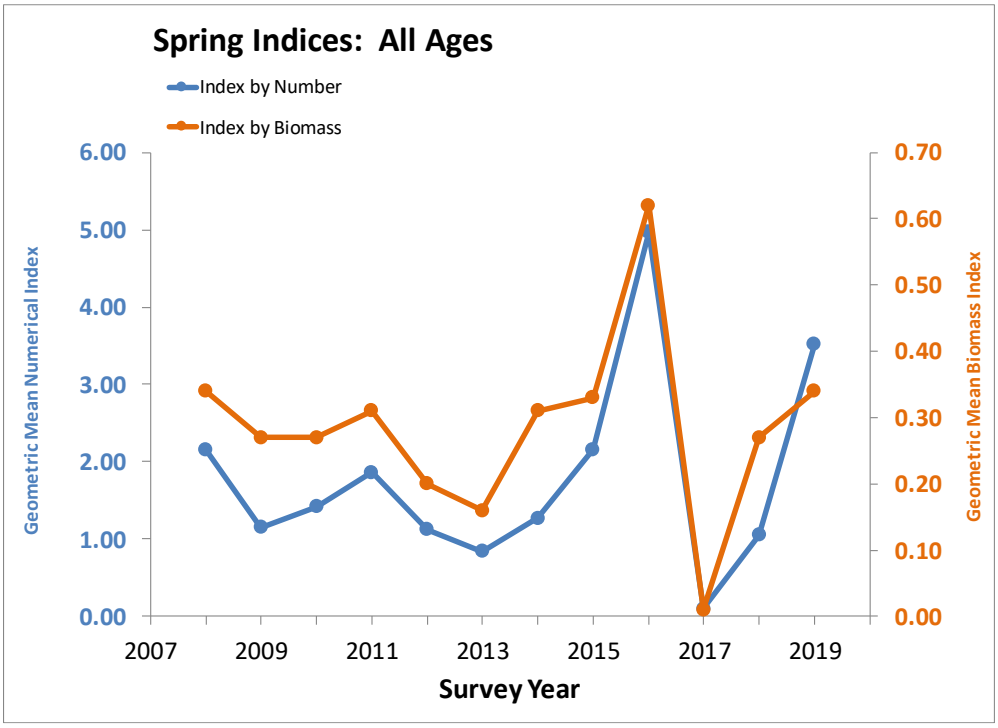


Figure 1. Spring Alewife (ends 2019)

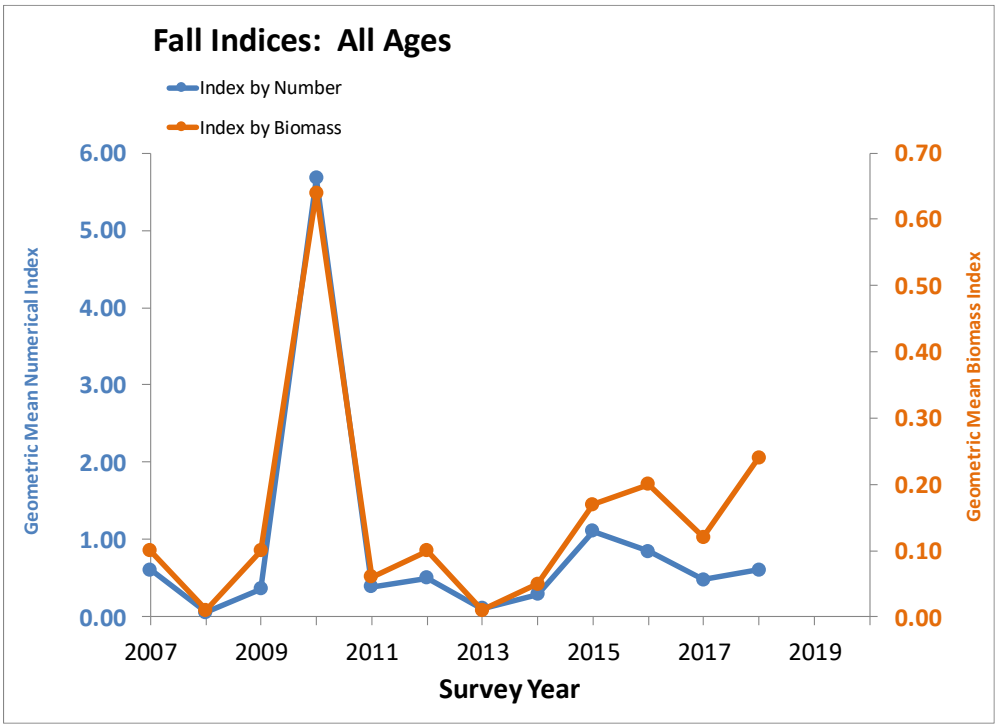


Figure 2. Fall Alewife (ends 2018)

Appendix 2 Continued – NEAMAP Trawl Indices

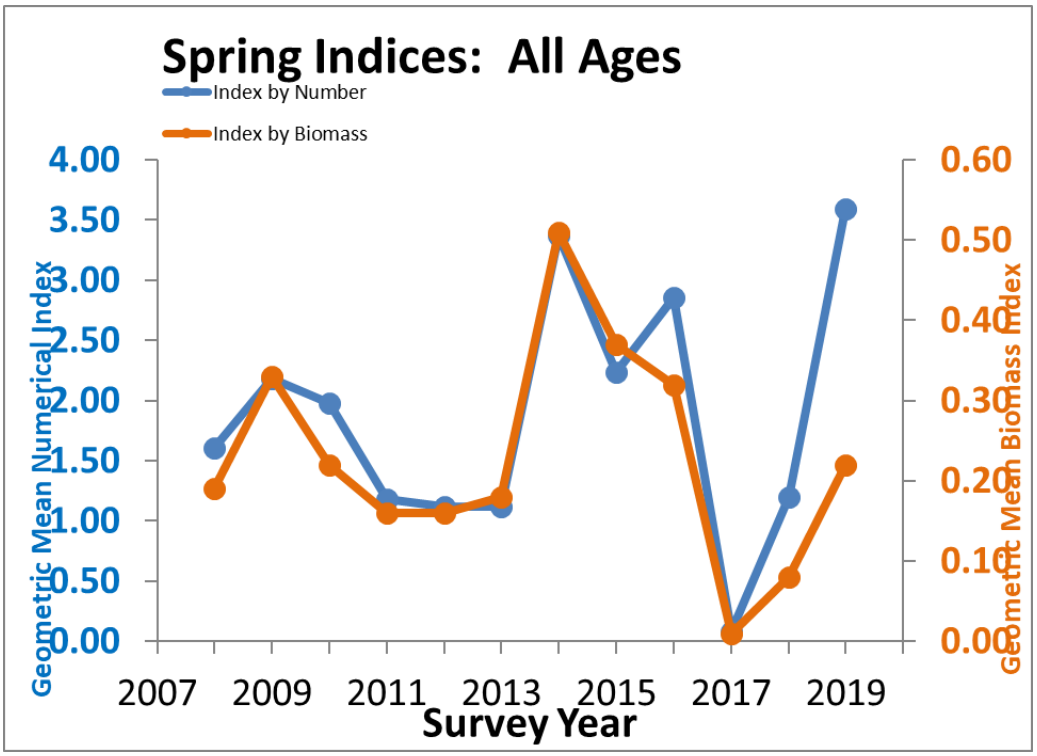


Figure 3. Spring Blueback (ends 2019)

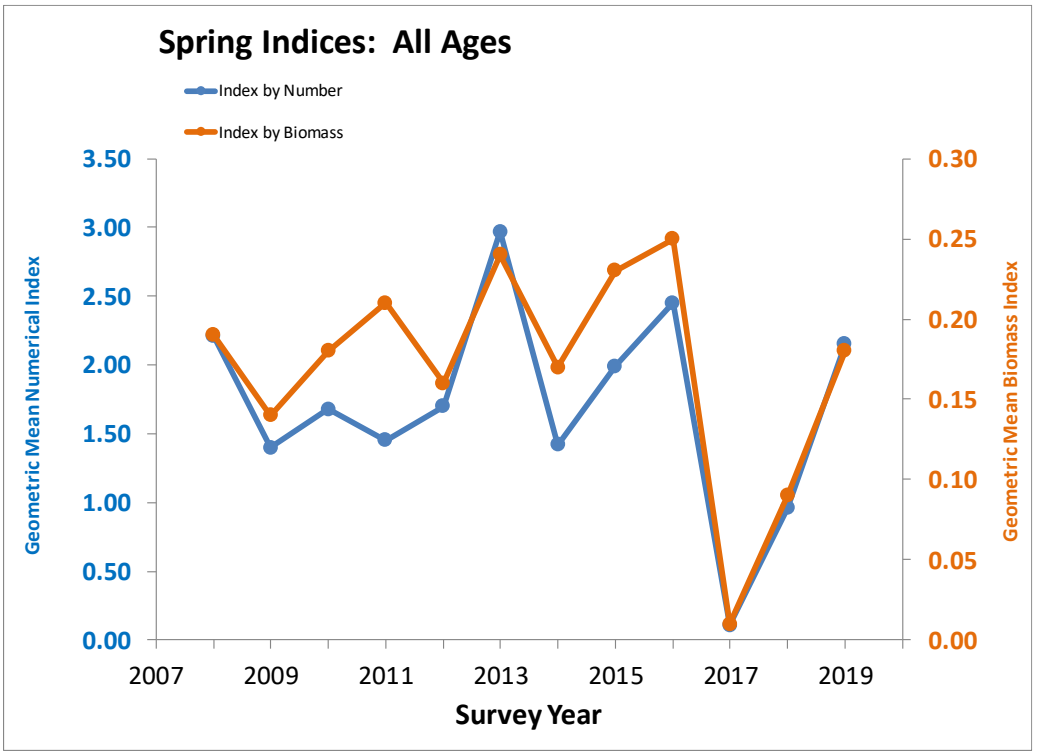


Figure 4. Spring Am Shad (ends 2019)

Appendix 3 – NC Indices (through 2018)
Staff Notes:

It's important to note that for American shad, adequate sampling of the areas utilized by this species has not occurred, nor the specific areas determined. The eleven core seine sites are designed to specifically sample river herring habitat and may not be suitable for juvenile American Shad. Trends and abundance for American Shad from these surveys should be used with caution.

Description of work - Juvenile Abundance Index (JAI)
Eleven seine stations were sampled by DMF monthly with an 18.5 m (60 ft.) bag seine. Juvenile Abundance Indices (JAI) for Blueback Herring, Alewife, and American Shad were calculated for the eleven core stations sampled from 1972 through 2017. One unit of effort is one haul of the seine.

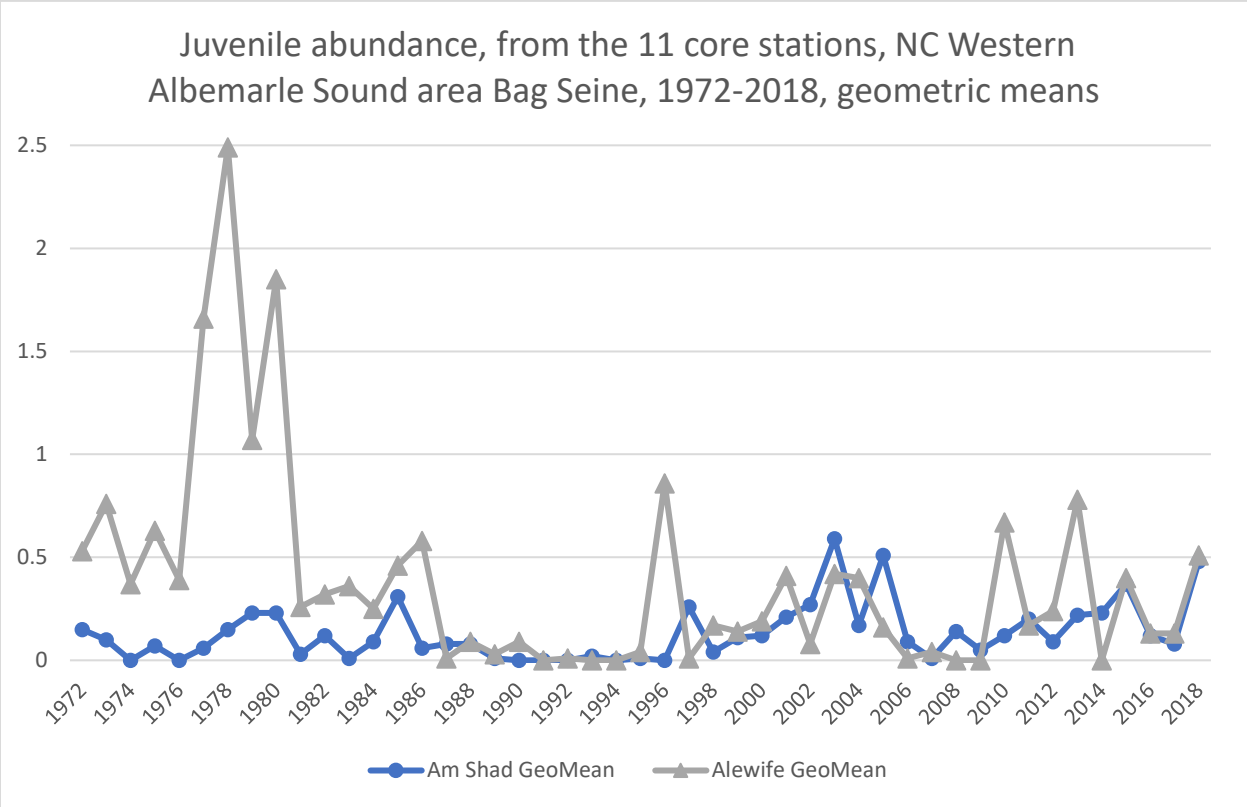


Figure 1 – NC Seine Am Shad and Alewife

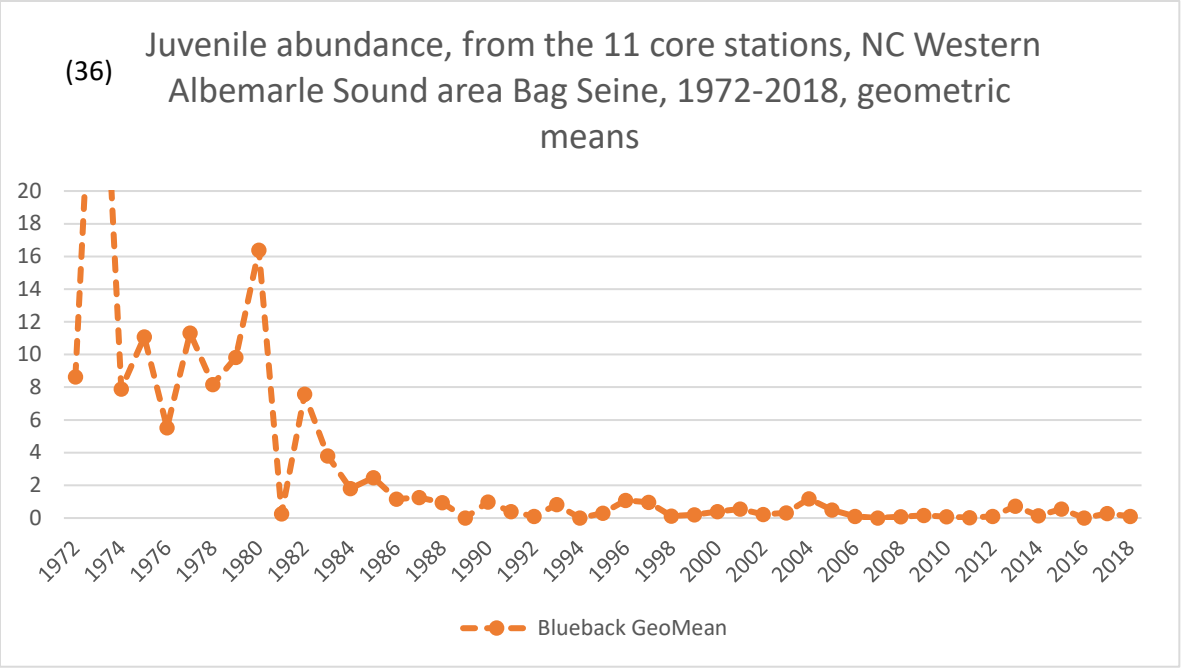


Figure 2 – NC Seine Blueback Herring

Since 1990, DMF has been conducting an independent gill net survey (IGNS) throughout the Albemarle Sound area. The survey was designed for Striped Bass data collection.

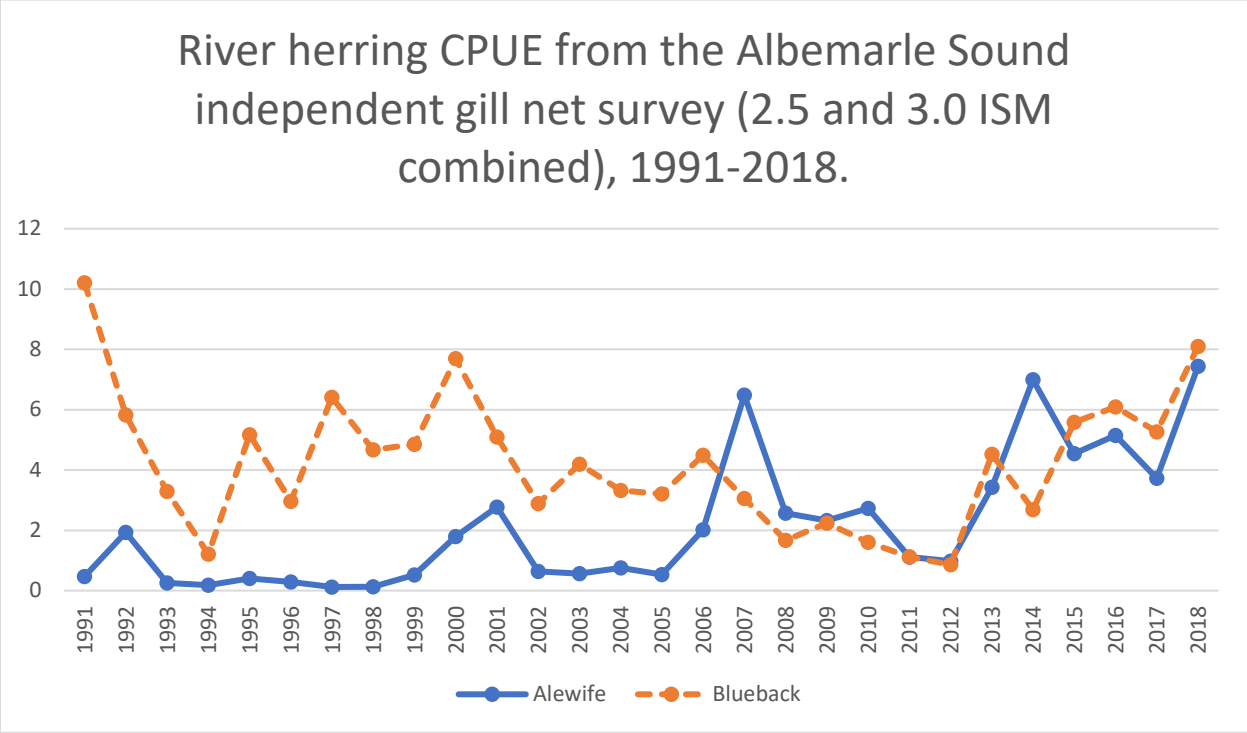


Figure 3 – NC Gillnet Survey River Herrings

Appendix 4–Massachusetts State Trawl Indices(through spring 2019)

Awaiting spring update…

Appendix 5 – New Jersey State Indices

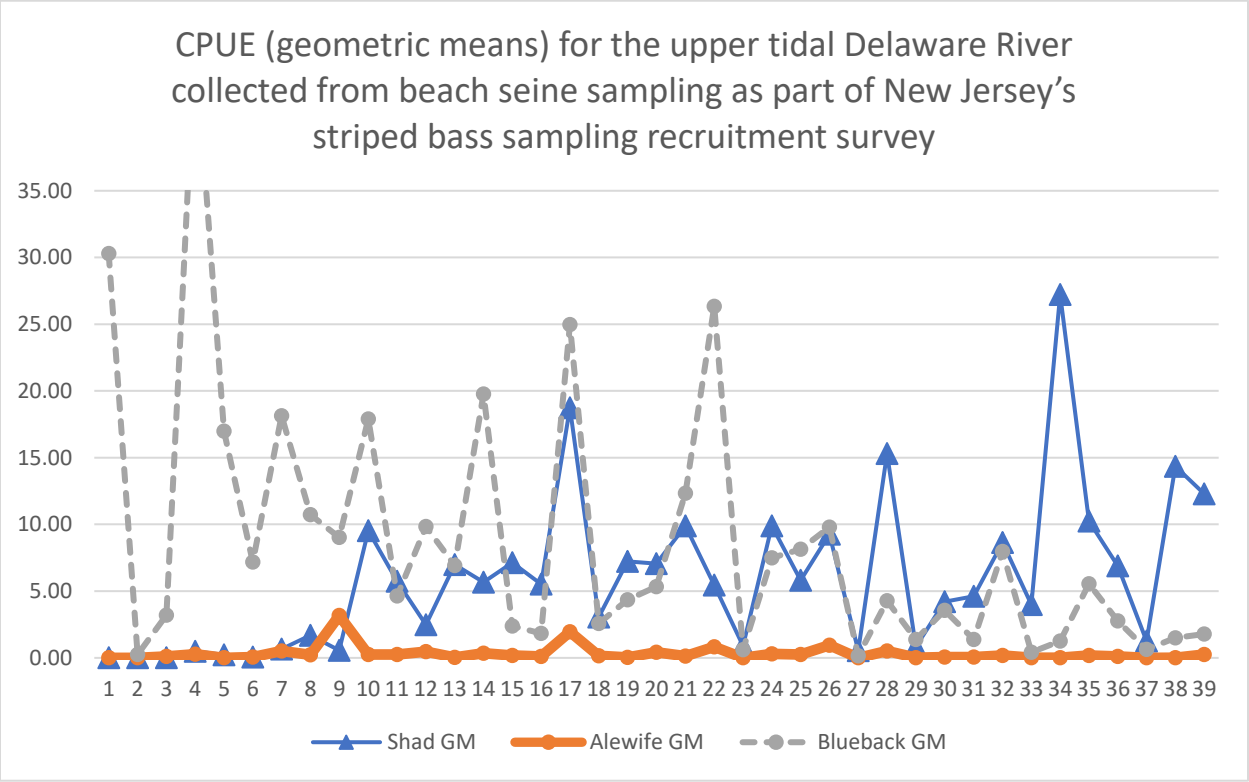


Figure 1. NJ DE River Tidal Seine

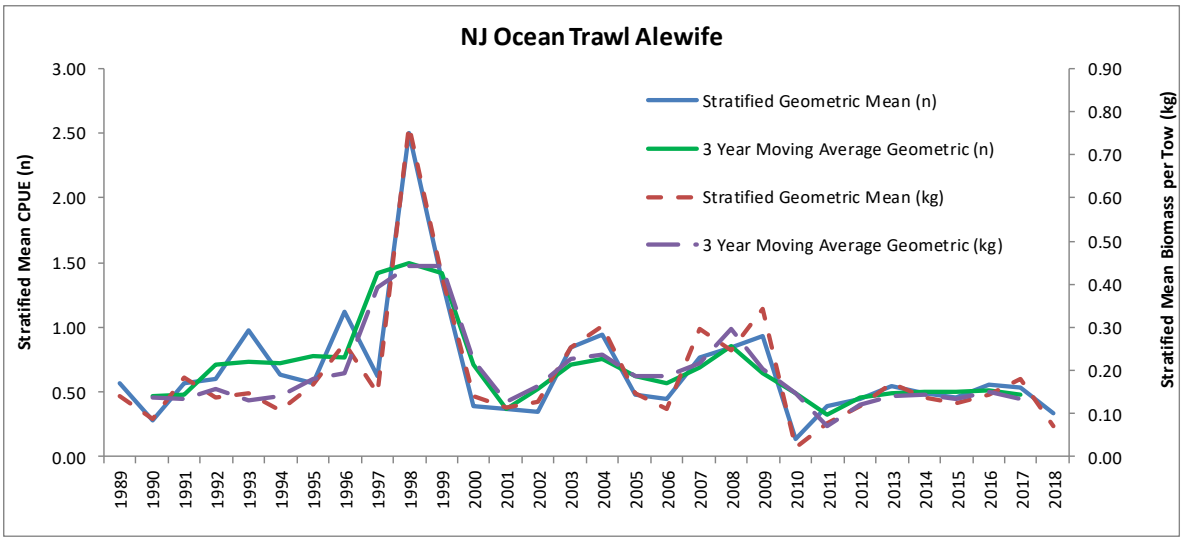


Figure 2. NJ Ocean Alewife

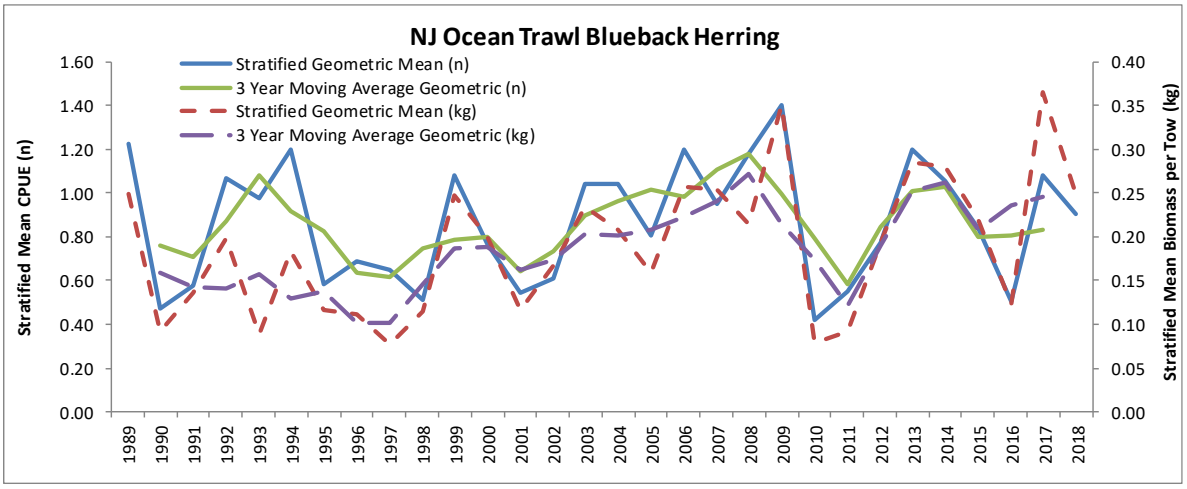


Figure 3. NJ Ocean Blueback Herring

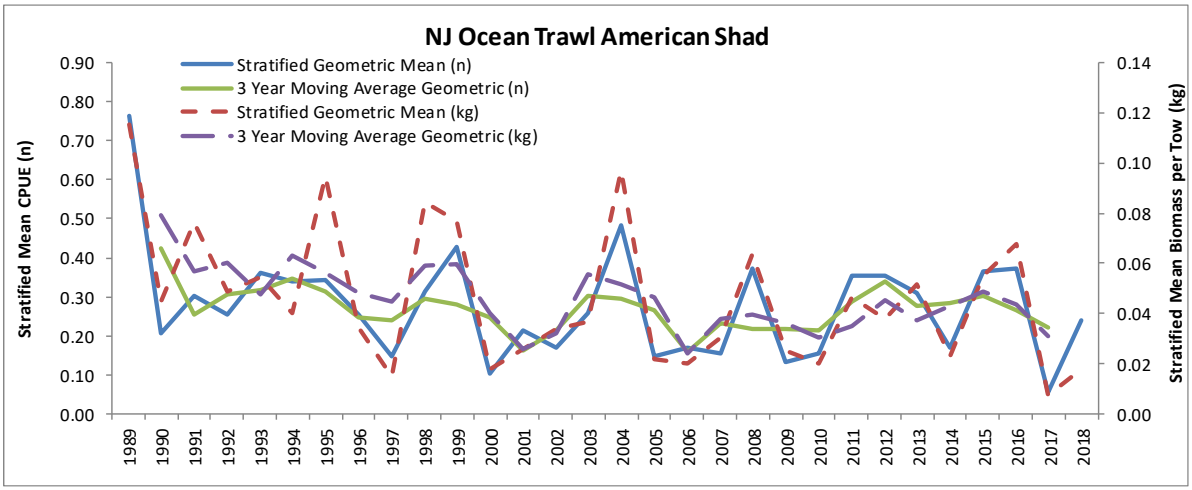
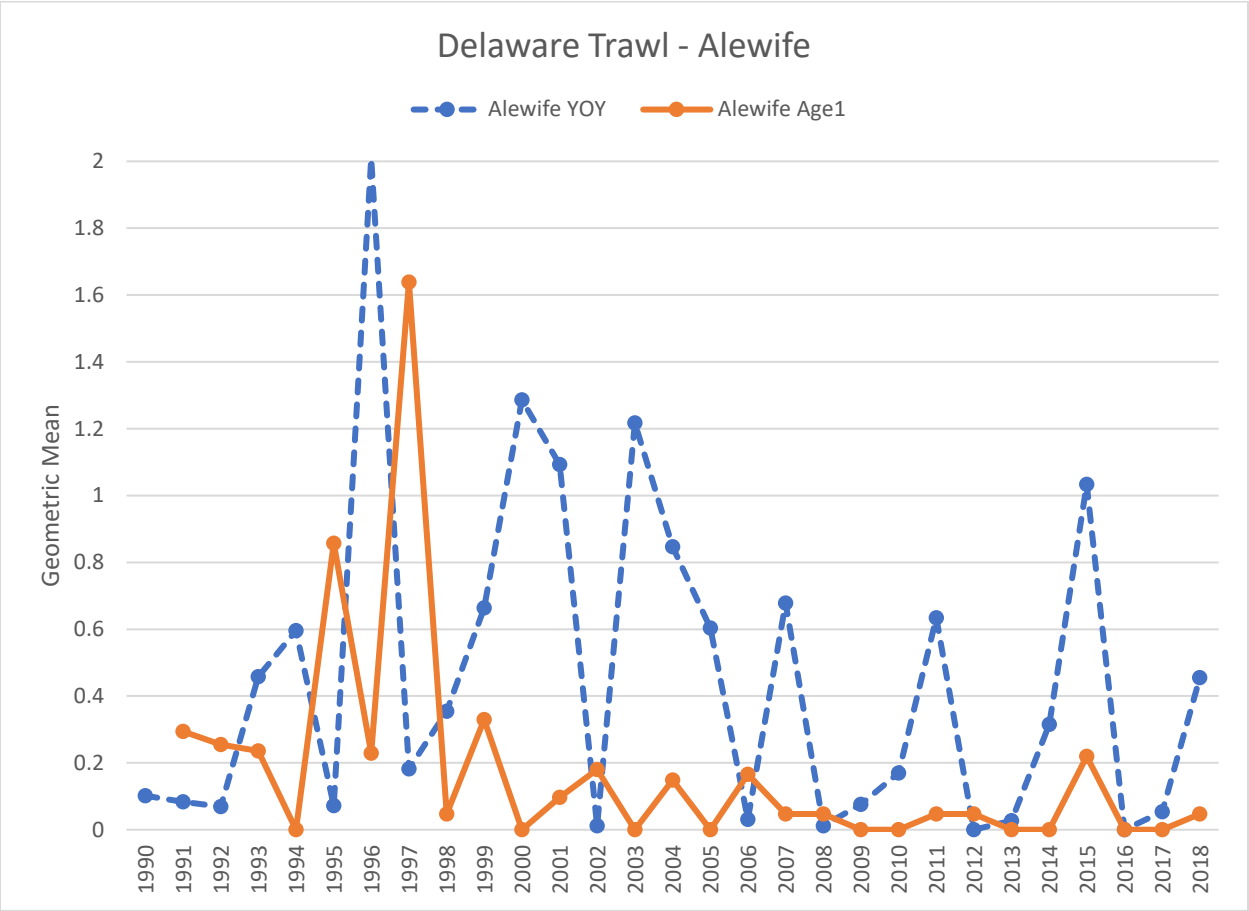
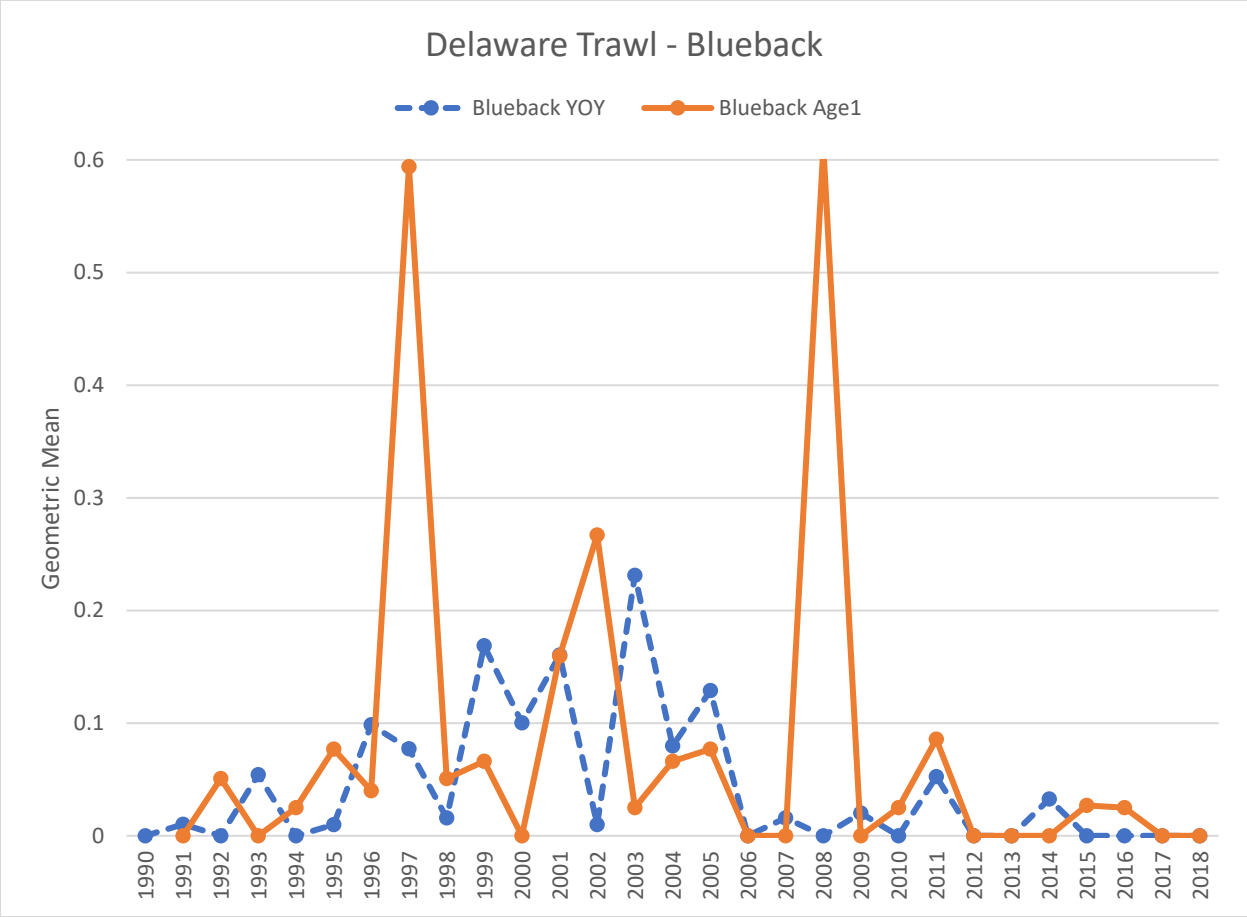
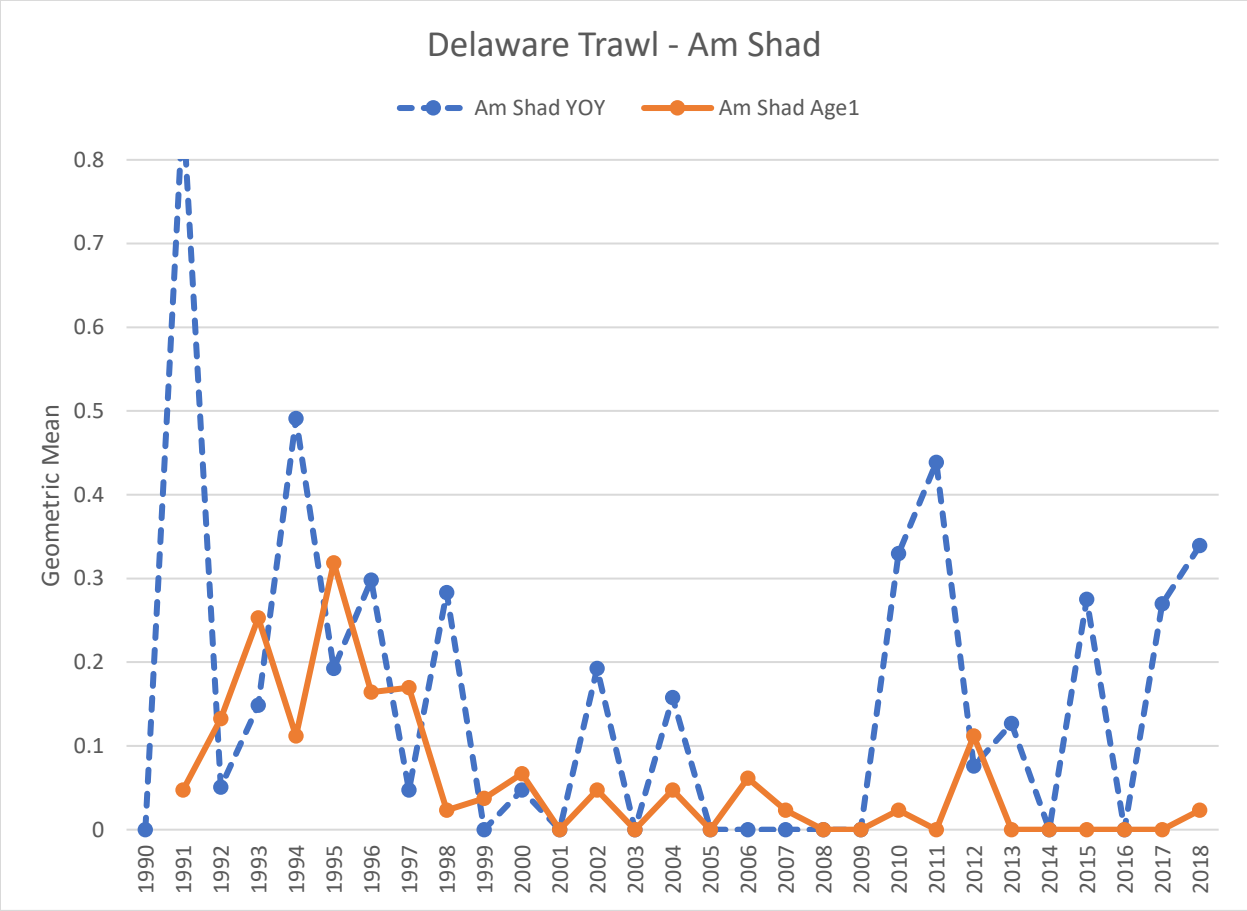


Figure 4. NJ Ocean Am Shad

Appendix 6 – Delaware State Trawl Indices




Delaware Trawl - Blueback
Blueback YOY
Blueback Age1
Geometric Mean
0.6
0.5
0.4
0.3
0.2
0.1
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018


Delaware Trawl - Am Shad
Am Shad YOY
Am Shad Age1
Geometric Mean
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018

Appendix 7 – VA State Indices

From 2019 Annual Report: Monitoring the Abundance of American Shad and River Herring in Virginia's Rivers. (RH/S starting in 2017)

Figure 7. Recent (1998-2018) and historic values of the catch index of female American shad on the James River.

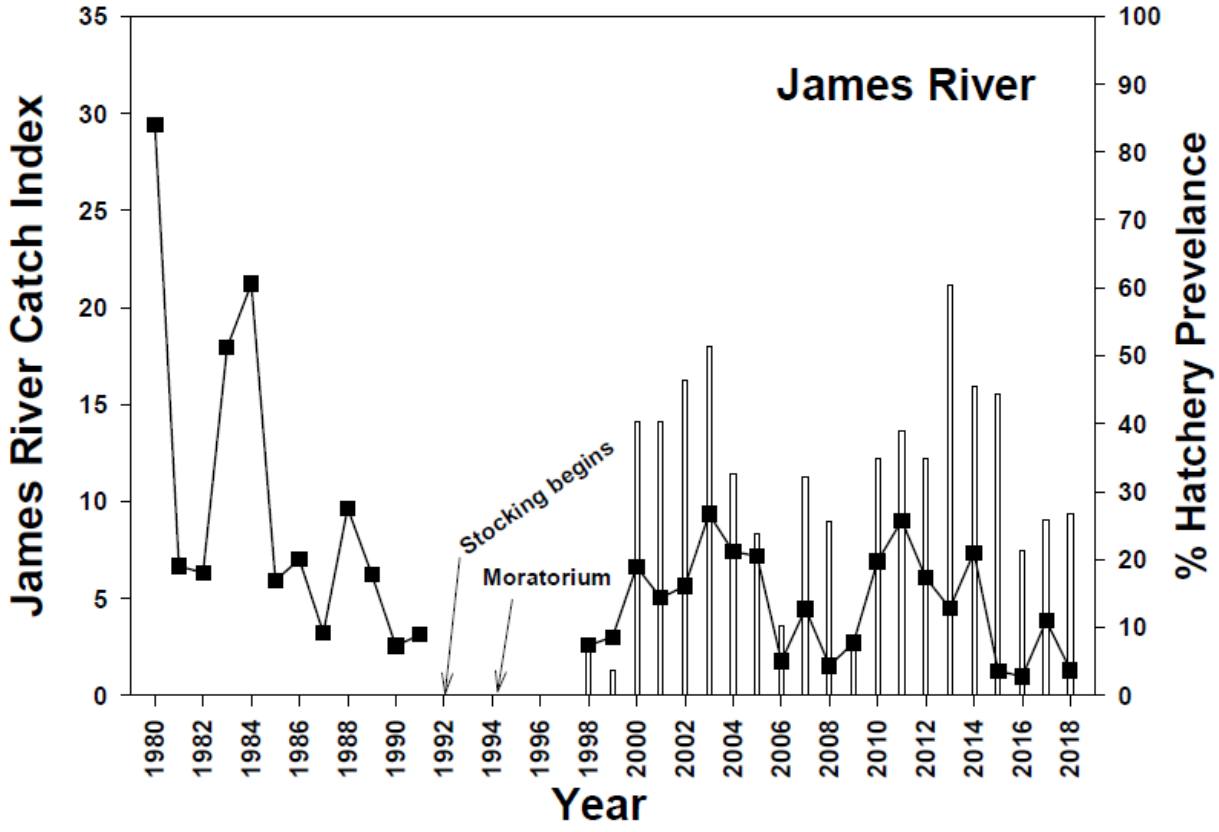


Figure 8. Recent (1998-2018) and historic values of the catch index of female American shad on the York River.

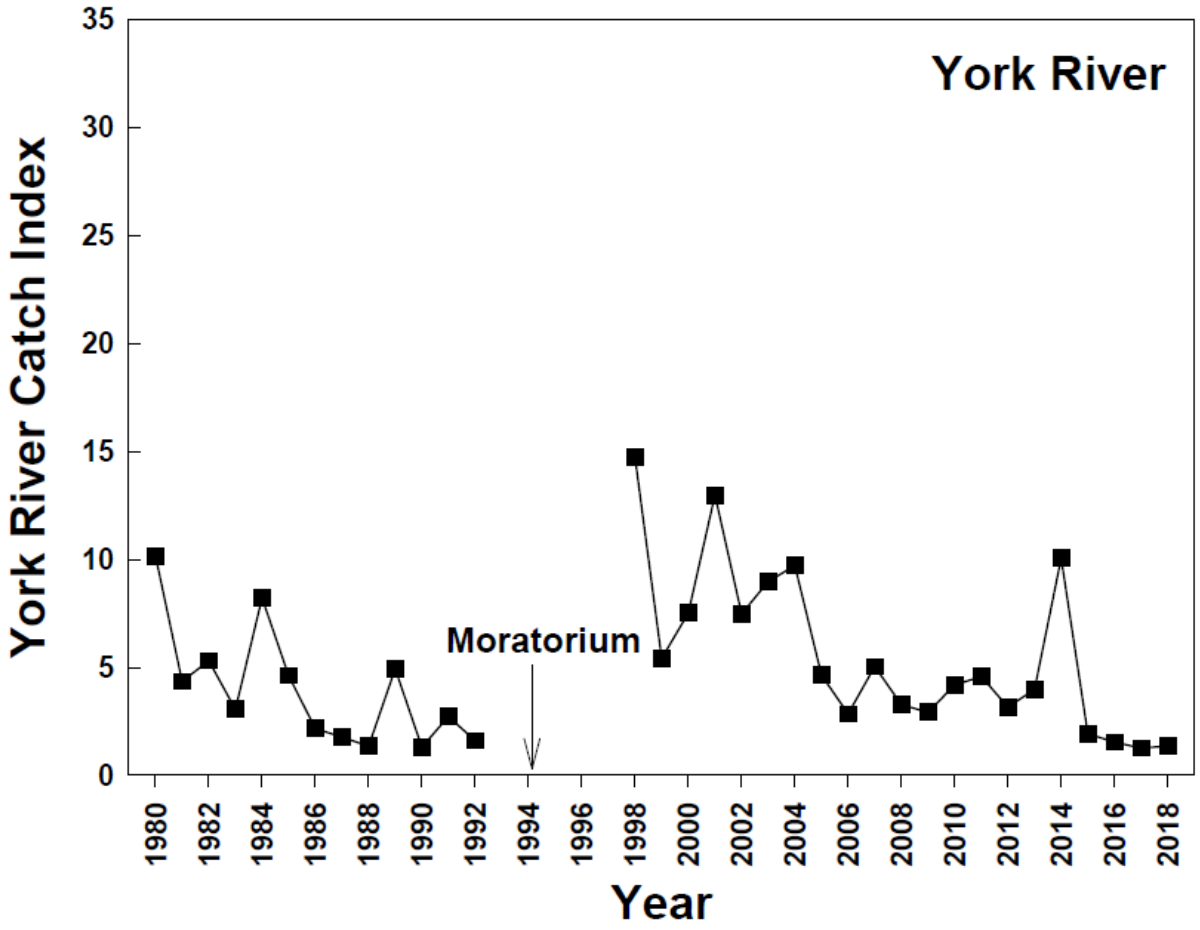
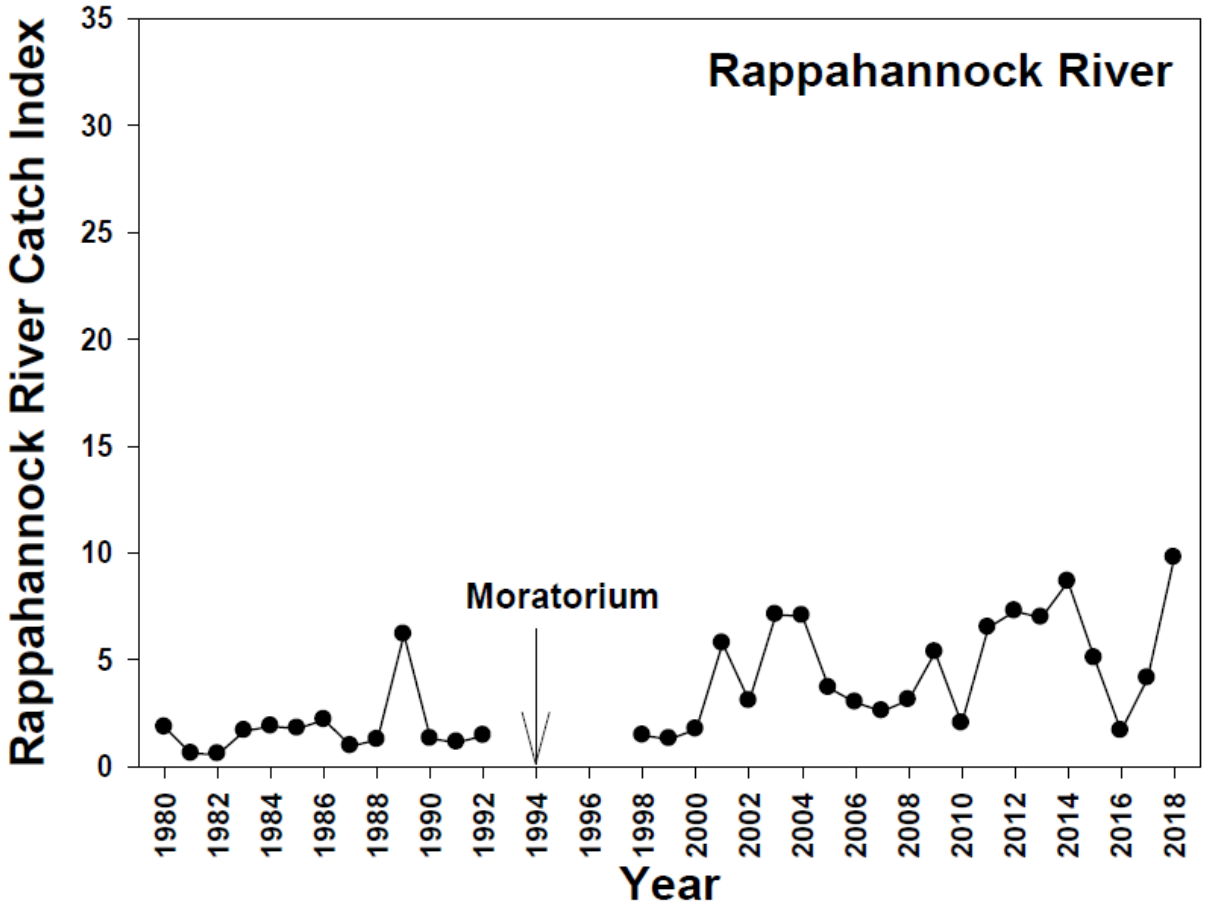
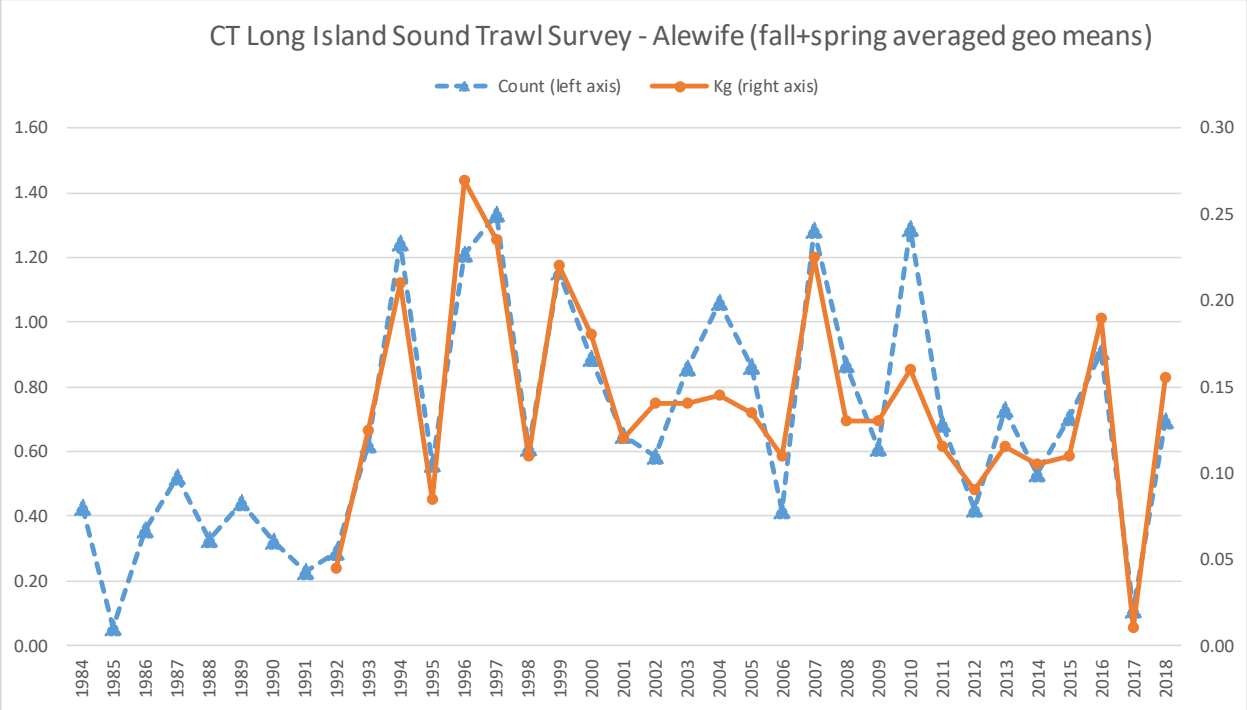
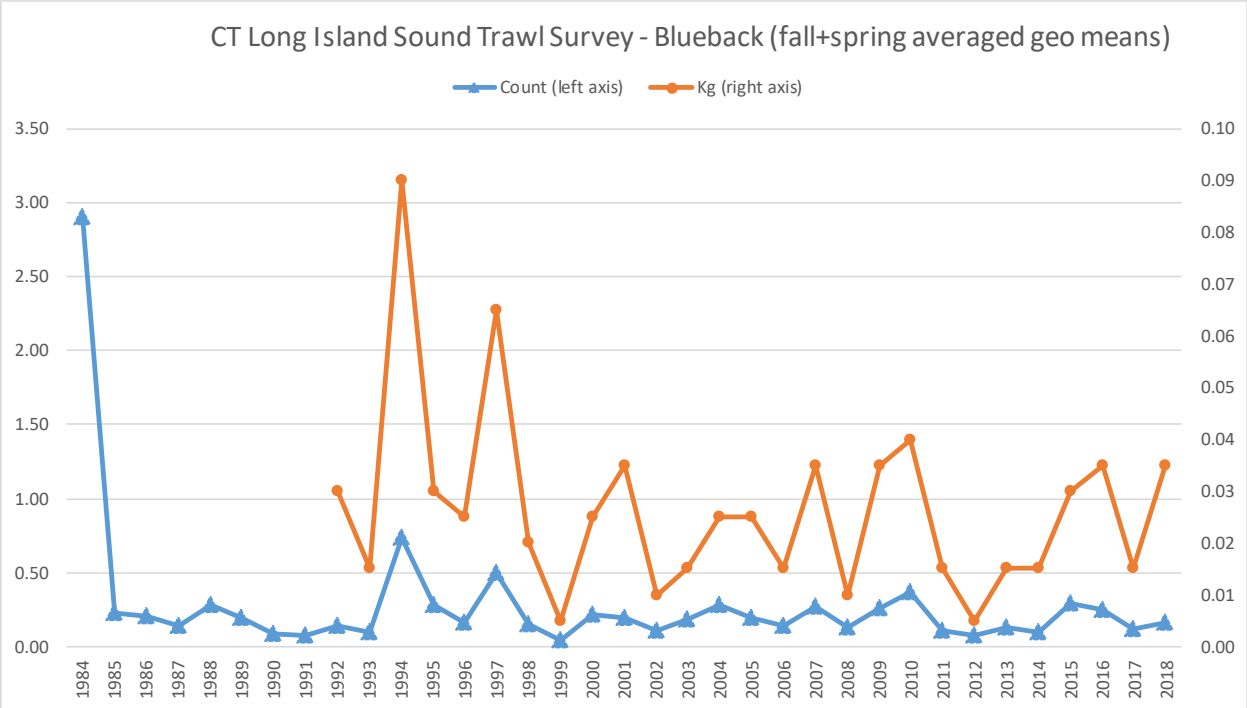


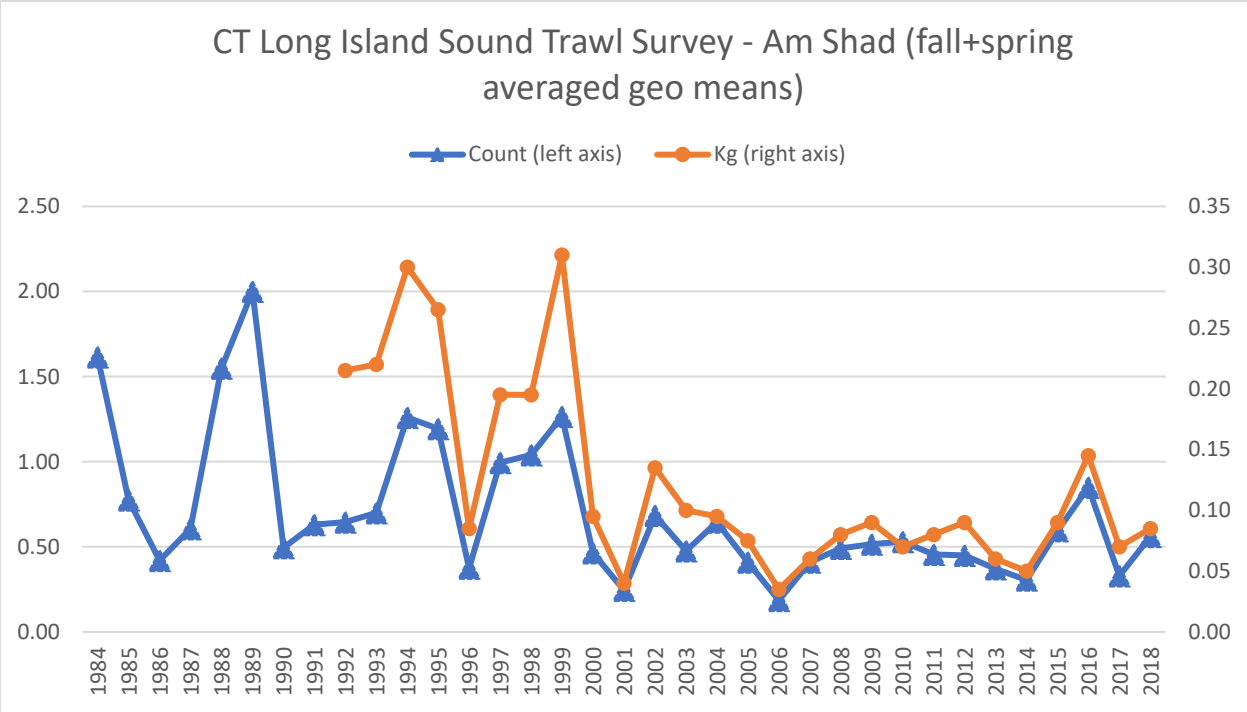
Figure 10. Recent (1998-2018) and historic values of the catch index of female American shad on the Rappahannock River.



Appendix 8 – CT Long Island Sound State Indices






CT Long Island Sound Trawl Survey - Am Shad (fall+spring averaged geo means)
Count (left axis)
Kg (right axis)
2.50
2.00
1.50
1.00
0.50
0.00
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
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2016
2017
2018