



Atlantic States Marine Fisheries Commission

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MEMORANDUM

TO: Northern Shrimp Section
FROM: Northern Shrimp Technical Committee
DATE: January 13, 2023
SUBJECT: Northern Shrimp 2022 Data Update

Background

In 2021, the Northern Shrimp Section extended the existing moratorium on commercial fishing through 2024. The three-year moratorium was set in response to the continued low levels of biomass and recruitment from the 2021 stock assessment update. This memo presents updated data from the most recent years of fishery independent surveys and environmental indices to keep managers and stakeholders informed about current stock trends.

The Northern Shrimp Technical Committee (NSTC) applied the Strict Traffic Light Approach to a suite of survey and environmental indicators. Fishery-independent survey indices included:

- Atlantic States Marine Fisheries Commission (ASMFC) Summer Survey (total abundance, total biomass, spawning stock biomass, and recruitment)
- Northeast Fisheries Science Center (NEFSC) Fall Survey
- Maine-New Hampshire Spring Inshore Survey

None of these surveys occurred in 2020, due to COVID-19, but all have resumed since then.

Environmental condition indicators included:

- A predation pressure index (PPI) calculated from the NEFSC Fall Survey data
- Spring bottom temperature from the NEFSC survey
- Summer bottom temperature from the ASMFC Summer Survey
- Winter surface temperature from Boothbay Harbor, ME

Two qualitative stock status reference levels were developed for the traffic light approach. For the abundance and biomass indices, being below the 20th percentile of the time series from 1984-2017 indicated an adverse state, and being above the 80th percentile of the time series from 1984-2017 indicated a favorable state. For the environmental indicators, the opposite was true: being below the 20th percentile of the time series from 1984-2017 indicated a favorable state while being above the 80th percentile of the time series indicated an adverse state, as higher temperatures and higher predation pressure have negative consequences for northern shrimp.

Results

The traffic light analysis of 2022 data indicated no improvement in status, with indices of abundance, spawning stock biomass, and recruitment at new time-series lows. Recruitment has been below the 20th percentile of the 1984-2017 reference period in 8 of the last 10 years.

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Recent environmental conditions continue to be unfavorable for Gulf of Maine northern shrimp.

Table 1. Fishery independent indicators (model-based survey indices) for Gulf of Maine northern shrimp traffic light analysis. Colors indicate status relative to reference levels, where: RED = at or below the 20th percentile; YELLOW = between the 20th and 80th percentiles; and GREEN = at or above the 80th percentile of the time series from 1984-2017. White indicates no data.

Survey	ASMFC Summer	NEFSC Fall Albatross	NEFSC Fall Bigelow	ME-NH Spring	ASMFC Summer			
	Indicator	Total Abundance	Total Abundance	Total Abundance	Total Abundance	Total Biomass	Harvestable Biomass (>22 mm CL)	Spawner Biomass
1984	1.130				1.25	0.64	0.63	0.126
1985	1.460				1.70	1.46	0.74	0.250
1986	1.220	0.68			1.59	1.24	0.93	0.233
1987	0.871	0.40			1.08	0.86	0.57	0.197
1988	1.569	0.34			1.40	0.82	0.61	1.008
1989	1.344	0.78			1.53	0.88	0.69	0.255
1990	1.212	0.59			1.63	1.40	0.79	0.102
1991	0.856	0.32			1.01	0.82	0.69	0.350
1992	0.502	0.19			0.59	0.43	0.38	0.140
1993	1.149	1.04			0.84	0.46	0.36	0.750
1994	1.054	1.09			0.92	0.45	0.38	0.354
1995	1.138	0.59			1.18	0.82	0.76	0.253
1996	1.022	0.40			1.13	0.83	0.66	0.321
1997	1.019	0.53			0.92	0.60	0.52	0.515
1998	0.727	0.97			0.71	0.38	0.37	0.200
1999	0.681	1.21			0.73	0.52	0.44	0.200
2000	0.837	0.96			0.77	0.53	0.49	0.462
2001	0.300	0.50			0.34	0.18	0.20	0.036
2002	1.185	0.69			0.86	0.38	0.40	0.910
2003	0.835	0.40		0.51	0.88	0.45	0.52	0.126
2004	1.116	0.88		0.56	1.08	0.89	0.59	0.381
2005	2.540	2.85		1.70	1.97	1.04	0.95	1.236
2006	4.721	3.69		1.94	4.04	1.90	1.94	1.022
2007	1.795	2.41		1.82	1.84	1.21	1.05	0.226
2008	1.778	1.51		2.04	1.83	1.48	0.86	0.524
2009	1.882		4.15	2.18	2.00	1.47	1.16	0.690
2010	1.819		2.87	3.19	1.76	1.01	0.84	0.693
2011	1.004		2.57	2.88	1.07	0.63	0.64	0.280
2012	0.297		0.77	0.84	0.36	0.27	0.25	0.032
2013	0.078		0.20	0.12	0.12	0.12	0.10	0.004
2014	0.260		0.51	0.34	0.20	0.07	0.08	0.186
2015	0.074		0.19	0.14	0.10	0.08	0.08	0.005
2016	0.318		0.14	0.30	0.32	0.19	0.19	0.177
2017	0.048		0.14	0.16	0.07	0.05	0.04	0.001
2018	0.069		0.27	0.09	0.08	0.05	0.05	0.040
2019	0.052		0.17	0.06	0.07	0.05	0.05	0.002
2020								
2021	0.033		0.03	0.11	0.05	0.04	0.04	0.001
2022	0.004			0.02	0.01	0.01	0.01	0.00004
1984-2013 mean	1.24	1.00	2.11	1.62	1.24	0.81	0.65	0.40
2014-2022 mean	0.11	NA	0.21	0.15	0.11	0.07	0.07	0.05
80th percentile	1.50	1.16	2.69	2.07	1.66	1.10	0.81	0.59
20th percentile	0.43	0.40	0.17	0.27	0.50	0.34	0.31	0.13

Table 2. Environmental condition indicators for Gulf of Maine northern shrimp traffic light analysis. Colors indicate status relative to reference levels, where: RED = at or above the 80th percentile; YELLOW = between the 80th and 20th percentiles; and GREEN = at or below the 20th percentile of the time series from 1984-2017. White indicates no data.

Survey	NEFSC	ASMFC	NEFSC	NEFSC	NEFSC	Boothbay Harbor, ME
Indicator	Predation Pressure Index	Summer Bottom Temp.	Spring Bottom temp. anomaly	Fall Bottom temp. anomaly	Spring Surface temp. anomaly	Feb-Mar Surface temp.
1984	434.3	4.1	0.6	0.8	-0.1	2.9
1985	597.8	4.0	0.1	0.6	0.1	2.8
1986	608.1	6.3	1.2	0.7	0.8	2.6
1987	387.8	6.0	0.0	0.0	-0.6	1.8
1988	503.1	6.5	1.3	-0.1	-0.2	2.7
1989	520.4	5.6	-0.1	-0.3	-0.6	1.9
1990	631.3	3.6	0.2	0.1	0.0	2.6
1991	501.8	6.1	0.5	0.1	0.6	3.4
1992	486.7	6.3	0.6	-0.2	-0.9	3.2
1993	470.1	5.8	-0.8	-0.3	-0.7	1.2
1994	351.9	6.8	0.6	1.3	0.2	1.8
1995	638.5	6.6	0.8	0.5	0.1	3.3
1996	564.8	7.1	1.0	1.1	-0.2	3.3
1997	378.1	6.8	1.4	0.5	0.0	3.7
1998	466.6	6.3	1.3	-0.4	0.5	2.9
1999	738.7	6.1	0.3	0.6	0.9	2.9
2000	813.7	6.7	1.1	0.7	0.9	3.1
2001	723.3	6.5	0.7	0.1	0.4	2.9
2002	1,305.8	7.1	1.3	1.3	1.2	4.1
2003	1,040.8	5.6	-0.2	-0.1	-0.6	2.4
2004	487.8	4.7	-0.8	-1.1	-0.9	3.0
2005	471.3	4.9	0.1	0.5	0.2	3.0
2006	663.5	7.1	1.3	1.2	0.9	5.5
2007	704.7	5.9	0.5	-0.3	0.0	2.0
2008	846.3	5.9	0.5	0.4	1.2	2.3
2009	740.6	6.0	0.4	0.7	0.4	2.6
2010	1,126.5	7.4	0.9	1.7	1.7	4.1
2011	1,150.4	7.7	2.3	1.4	0.9	2.9
2012	1,156.6	7.9	2.0	2.0	1.9	5.5
2013	769.3	7.1	1.3	1.2	1.8	3.9
2014	955.1	6.2	0.5	1.4	0.5	2.2
2015	832.2	5.8	0.1	0.3	0.1	1.4
2016	1,518.4	7.2	1.4	2.0	1.7	4.2
2017	948.2	6.9	1.0	1.3	0.9	3.8
2018	927.2	6.7	1.1	1.3	1.5	4.5
2019	674.4	7.1	1.4	1.4	0.7	3.5
2020						4.6
2021	1255.8	7.6	2.1	3.6	1.9	4.0
2022		7.6	2.5		1.0	3.7
1984-2013 mean	676.0	6.1	0.7	0.5	0.3	3.0
2014-2022 mean	1,015.9	6.9	1.3	1.6	1.0	3.6
20th percentile	480.5	5.7	0.1	-0.1	-0.2	2.3
80th percentile	950.9	7.1	1.3	1.3	0.9	3.8

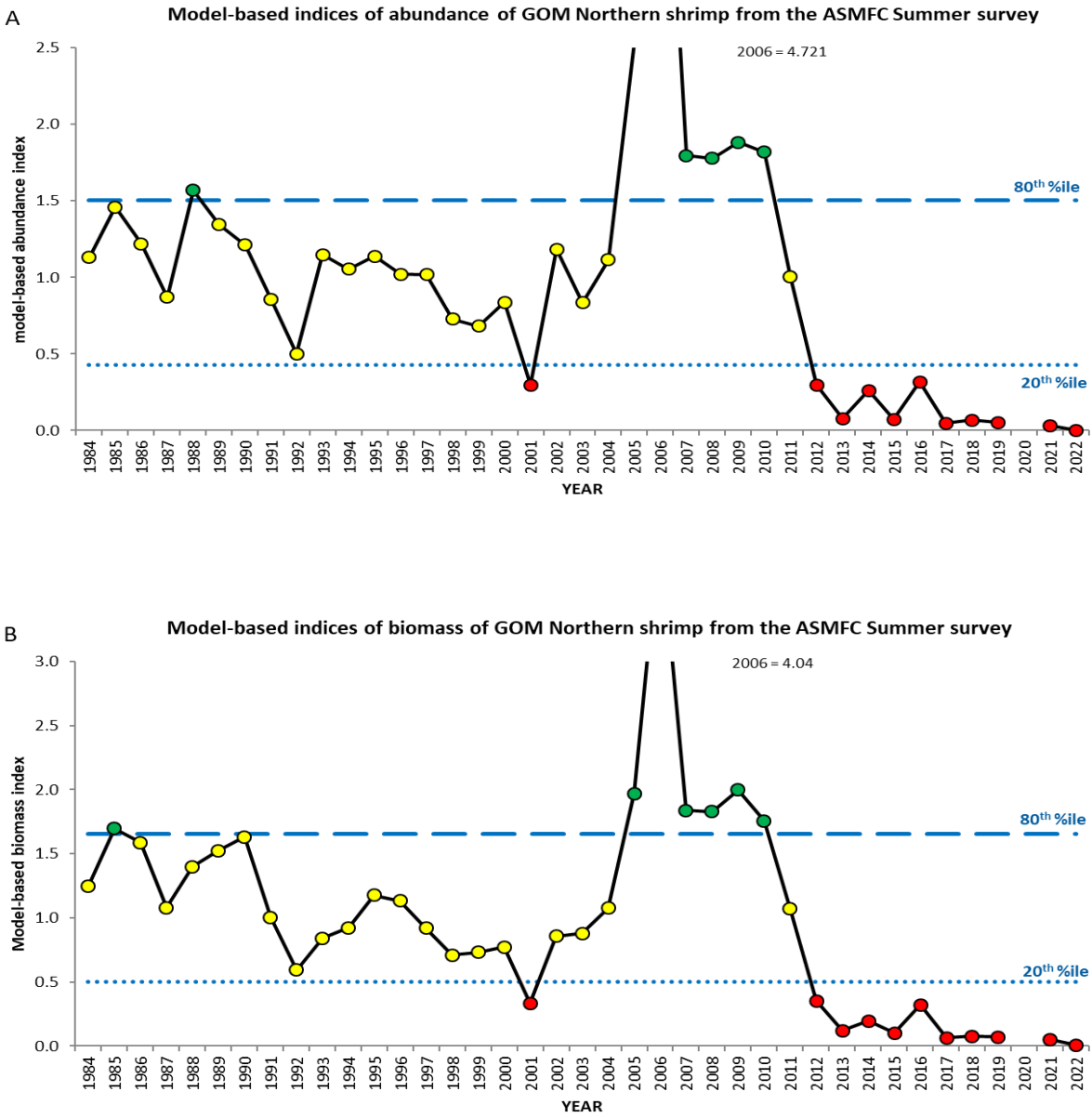


Figure 1. Traffic light analysis for the model-based index of Gulf of Maine northern shrimp from the ASMFC Summer survey 1984-2022 for total abundance (A) and total biomass (B). The 20th percentile of the time series from 1984-2017 delineated an adverse state, and the 80th percentile of the time series from 1984-2017 delineated a favorable state.

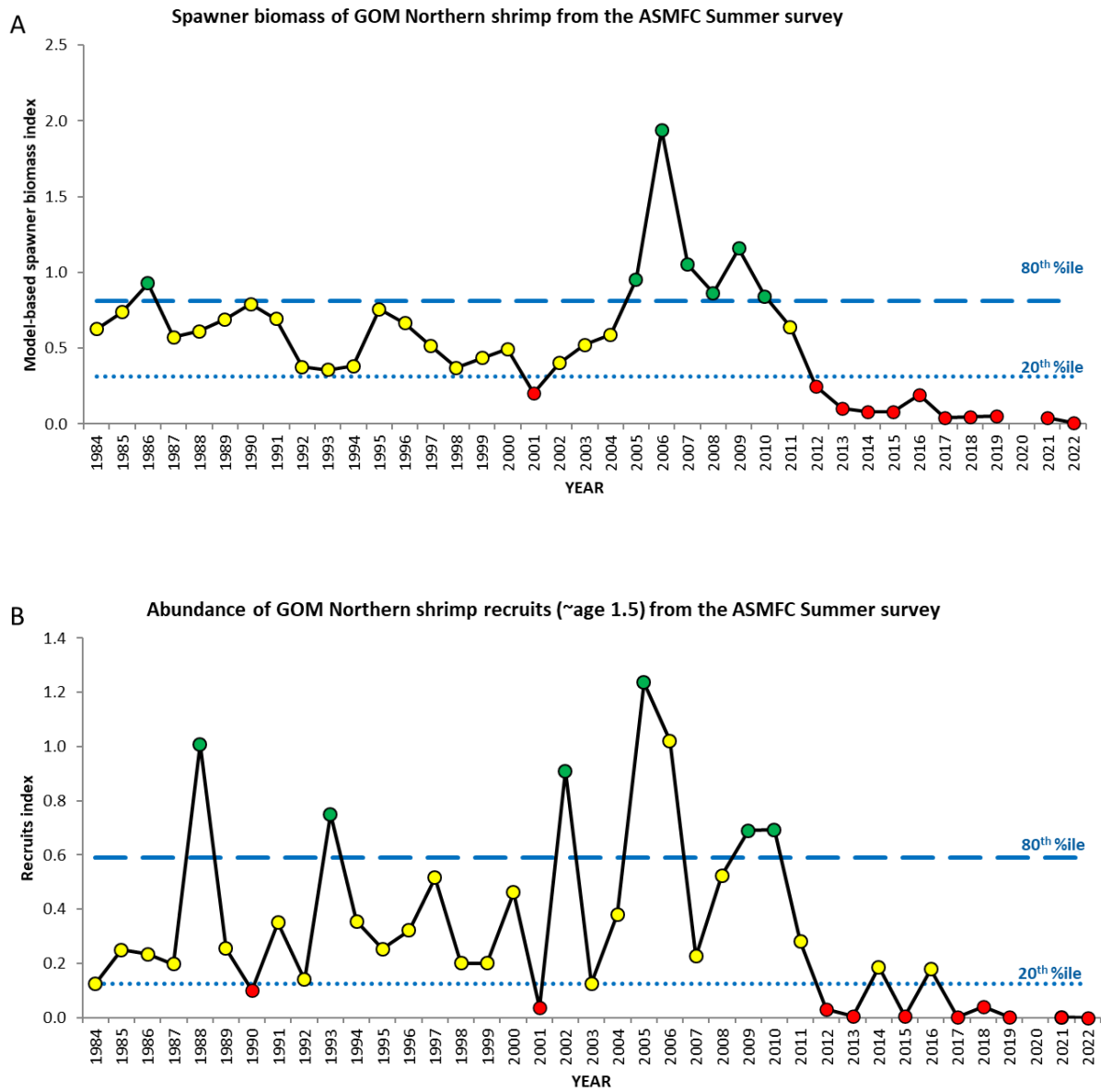


Figure 2. Traffic light analysis of spawning biomass (A) and recruitment (B) of Gulf of Maine northern shrimp from the ASMFC Summer survey 1984-2022. The 20th percentile of the time series from 1984-2017 delineated an adverse state, and the 80th percentile of the time series from 1984-2017 delineated a favorable state.

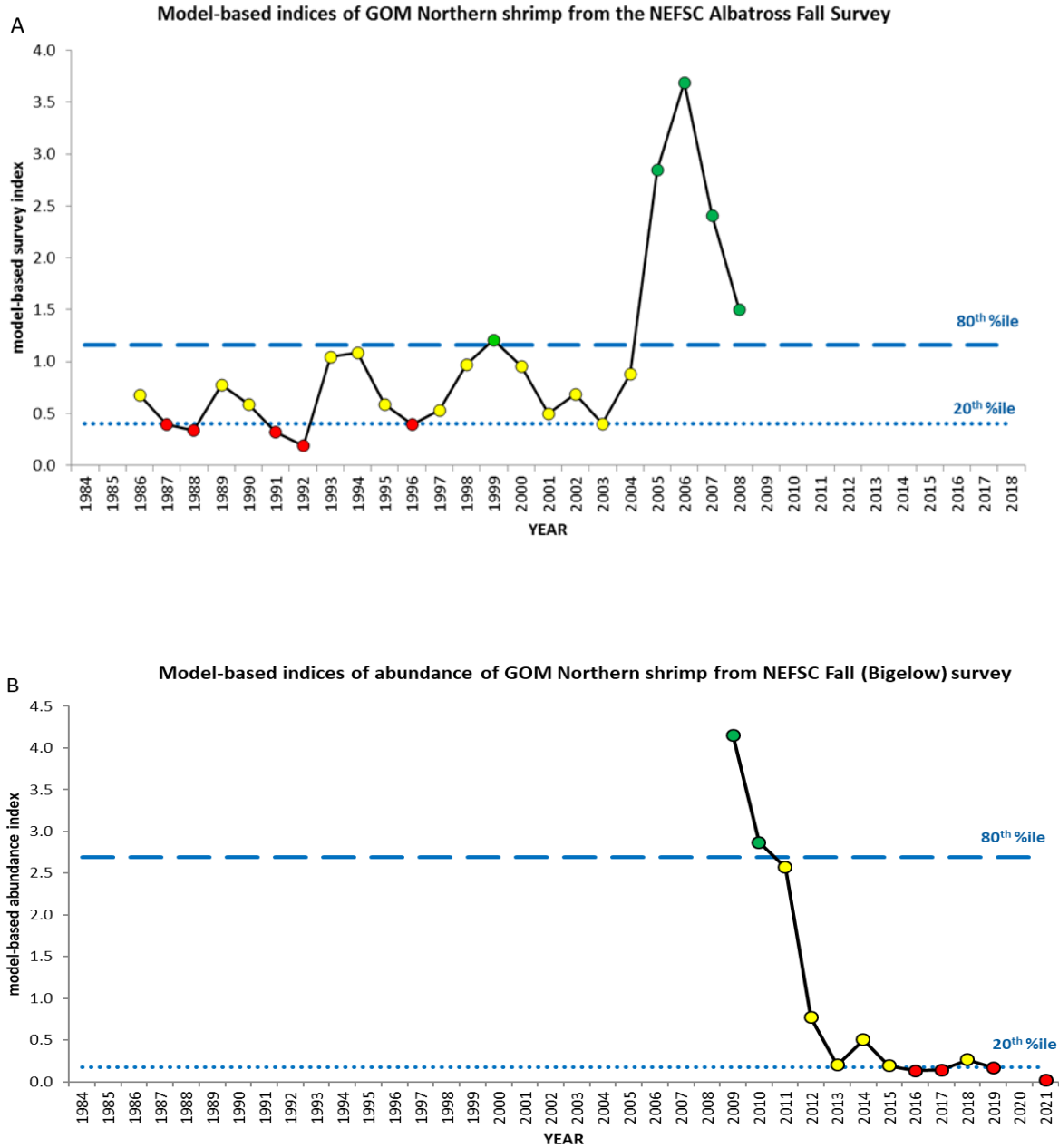


Figure 3. Traffic light analysis of abundance of Gulf of Maine northern shrimp from the NEFSC Fall survey for the Albatross (A) and Bigelow (B) years. The 20th percentile of the time series from 1984-2017 delineated an adverse state, and the 80th percentile of the time series from 1984-2017 delineated a favorable state.

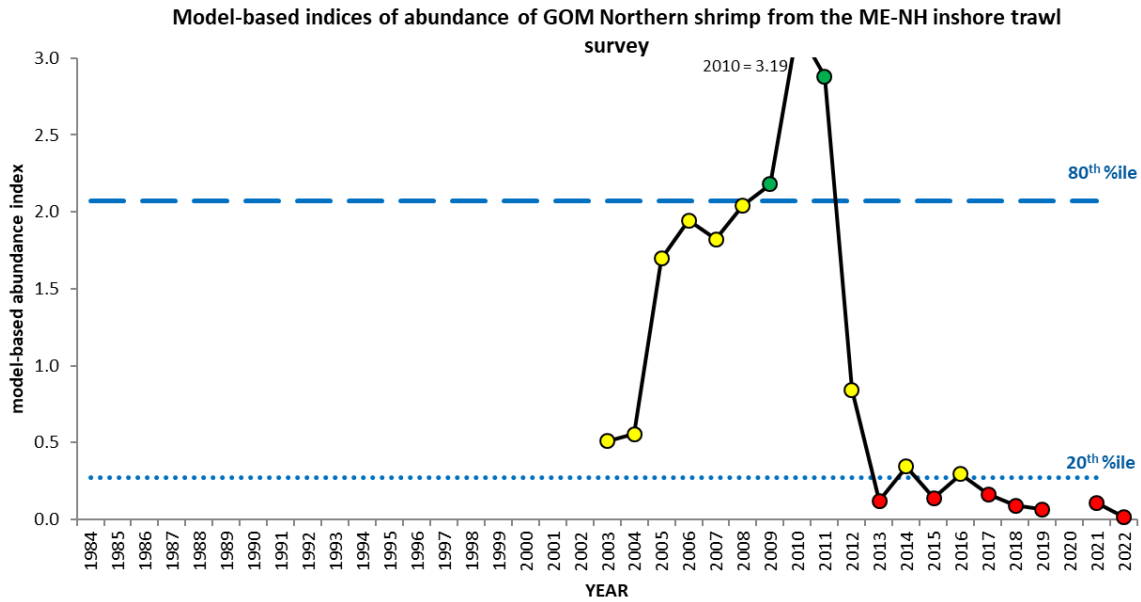


Figure 4. Traffic light analysis of total abundance of Gulf of Maine northern shrimp from the Maine-New Hampshire Inshore Spring survey 2003-2022. The 20th percentile of the time series from 1984-2017 delineated an adverse state, and the 80th percentile of the time series from 1984-2017 delineated a favorable state.

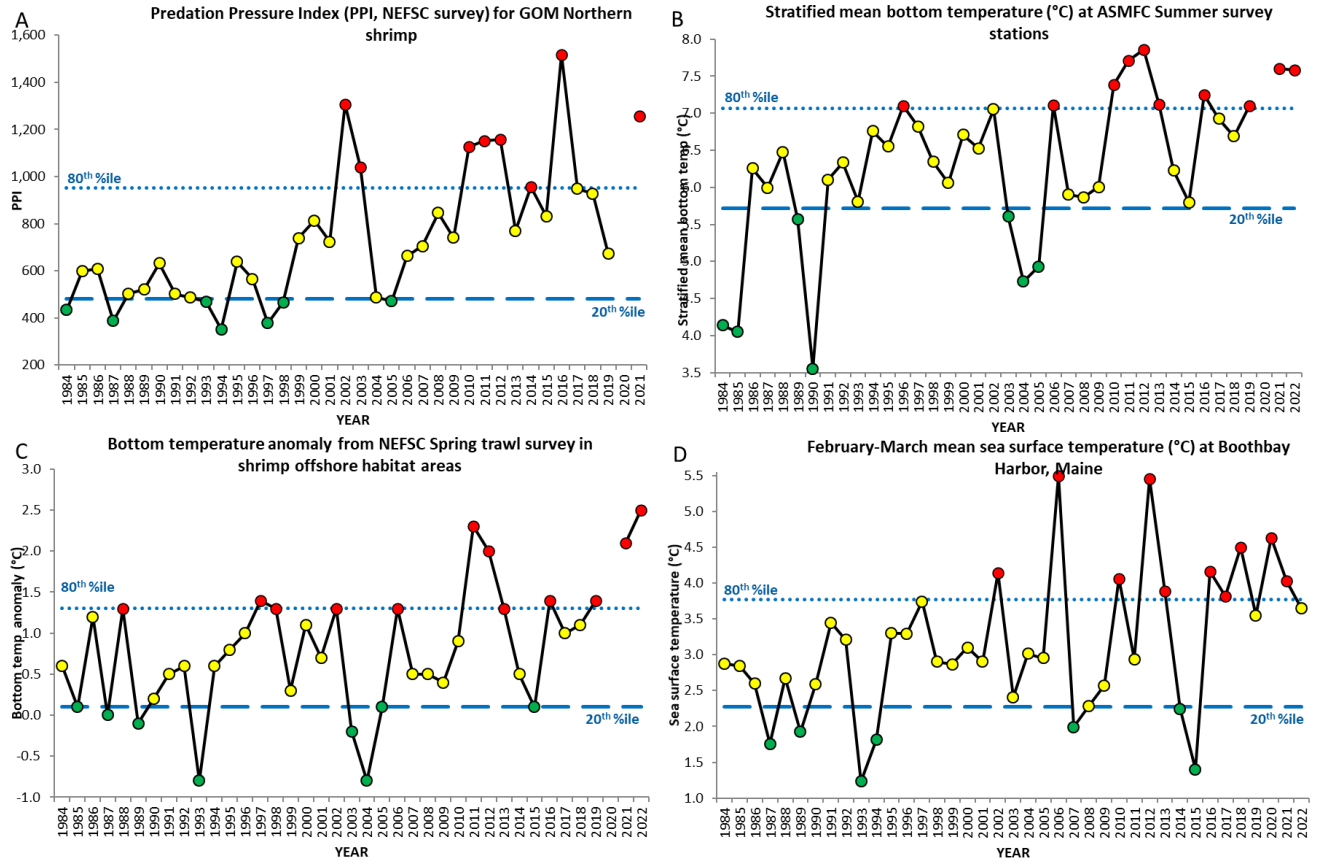


Figure 5. Traffic light analysis of environmental conditions in the Gulf of Maine, including predation pressure (A), summer bottom temperature (B), spring bottom temperature (C), and winter sea surface temperature (D). The 20th percentile of the time series from 1984-2017 delineated a favorable state, and the 80th percentile of the time series from 1984-2017 delineated an adverse state.

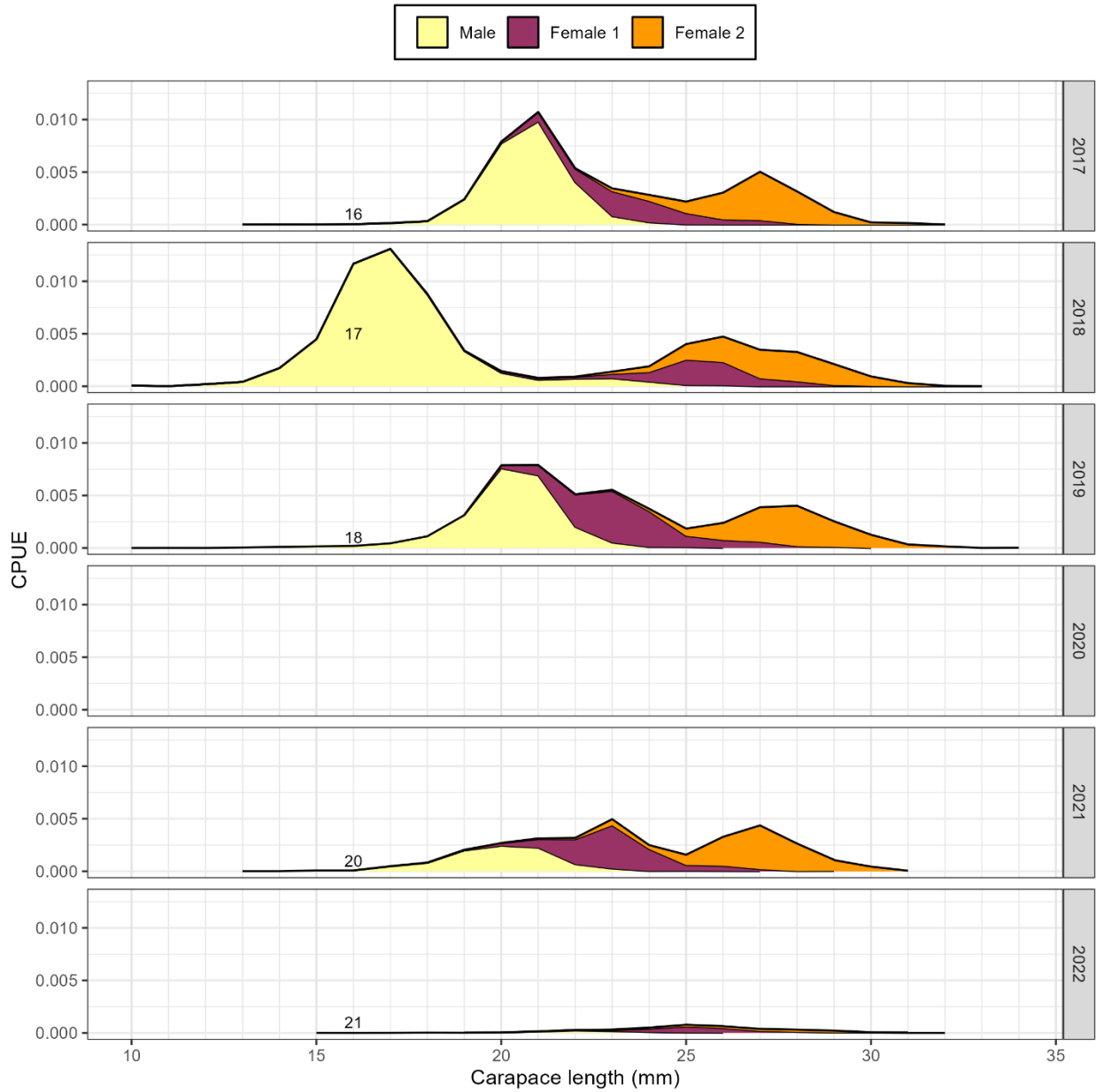


Figure 6. Gulf of Maine northern shrimp abundance from the ASMFC Summer survey by year, length, and development stage for 2017 – 2022 with expanded axes to show detail. Two-digit years are year class at assumed age 1.5.