NOAA Technical Memorandum NMFS-NE-294

Management Track Assessment Spring 2021 - Level 1 Reports

US DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, Massachusetts
December 2022

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This series represents a secondary level of scientific publishing. All issues employ thorough internal scientific review; some issues employ external scientific review. Reviews are transparent collegial reviews, not anonymous peer reviews. All issues may be cited in formal scientific communications.

Management Track Assessment Spring 2021 - Level 1 Reports

by the Northeast Fisheries Science Center

NOAA Fisheries, Northeast Fisheries Science Center, 166 Water Street, Woods Hole, MA 02543 USA

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Editorial Notes

Editorial Treatment: In the interest of expedited publication, this report has undergone a truncated version of the NEFSC Editorial Office's typical technical and copy editing procedure. Aside from the front and back matter included in this document, all writing and editing have been performed by the authors included on the title page.

Information Quality Act Compliance: In accordance with section 515 of Public Law 106-554, the Northeast Fisheries Science Center (NEFSC) completed both technical and policy reviews for this report. These pre-dissemination reviews are on file at the NEFSC Editorial Office.

Species Names: The NEFSC Editorial Office's policy on the use of species names in all technical communications is generally to follow the American Fisheries Society's lists of scientific and common names for fishes, mollusks, and decapod crustaceans and to follow the Society for Marine Mammalogy's guidance on scientific and common names for marine mammals. Exceptions to this policy occur when there are subsequent compelling revisions in the classifications of species, resulting in changes in the names of species.

Statistical Terms: The NEFSC Editorial Office's policy on the use of statistical terms in all technical communications is generally to follow the International Standards Organization's handbook of statistical methods.

Summary of Assessment Oversight Panel Meeting

February 26, 2021
Via Video Conference

The NRCC Assessment Oversight Panel (AOP) met to review the operational stock assessment plans for 6 stocks/species on February 26, 2021. The assessments for stocks/species recommended for Level 2 and 3 peer reviews will be reviewed during a meeting the week of June 28, 2021.

The AOP consisted of:
Jason McNamee, Rhode Island Department of Environmental Management, representing the New England Fisheries Management Council

Michael Celestino, New Jersey Fish and Wildlife, representing the Atlantic States Marine Fisheries Commission

Paul Rago, Ph.D., member of the MAMFC Scientific and Statistical Committee, NOAA Fisheries (retired)

Russell W. Brown, Ph.D. (Chair), Northeast Fisheries Science Center, Woods Hole, Massachusetts.

Meeting Details:
This meeting was guided by the NRCC approved stock assessment guidance document. Three background documents were provided to the Panel: (1) an updated prospectus for each stock; (2) an overview summary of all the salient data and model information for each stock; and (3) the NRCC Guidance memo on the Operational Assessments. Prior to the meeting, each assessment lead prepared a plan for their assessments. The reports were consistent across species and reflected both the past assessment and initial investigations.

At the meeting, each lead scientist for each stock gave a presentation on the data to be used, model specifications, evaluation of model performance, the process for updating the biological reference points, the basis for catch projections, and an alternate assessment approach if their analytic assessment was rejected by the peer review panel. In some cases, stocks were already being assessed using an “index-based” or “empirical” approach.

Individual Stock Discussion Summaries:

Summer Flounder (AOP Lead: Jason McNamee)
Recommendation: Level 1 (Direct Delivery)
Dr. Mark Terceiro provided an excellent overview of the current stock assessment and his recommendations to the Assessment Oversight Panel (AOP) for the 2021 management track assessment. The stock is currently not overfished and overfishing is not occurring. The summer flounder stock is assessed with the ASAP model using multiple federal and state fishery

independent surveys and determines removals across four fleets (recreational and commercial discards and recreational and commercial landings).

The summer flounder model will be updated through 2019 as approved by the Northeast Region Coordinating Council (NRCC). This will require updating all fishery and survey data through 2019 and will use the current ASAP model configuration as approved during the 2018 Stock Assessment Workshop (SAW) 66 for summer flounder with no changes. Biological reference points (BRP) will be updated using the 2018 SAW 66 approved BRP configurations.

The AOP discussed the recruitment assumption for the projections. The 2018 SAW 66 and Mid Atlantic Fishery Management Council (MAFMC) Scientific and Statistical Committee (SSC) approved the use of a more contemporary period (most recent 7 below average recruitments) in the previous projections. Since the recommendation was for a more contemporary period rather than a specific number of years, the AOP approves the recommendation to extend the assumption to use the most recent 9 recruitments; this keeps the same start year for the recruitments used but adds the most recent two years to the assumption. Additionally, the projections will assume bridge year catches of a fully achieved Allowed Biological Catch (ABC) per the Population Dynamics Branch recommendation, and future catches will be set following the MAFMC risk policy for an overfishing limit (OFL) coefficient of variation (CV) of 60%.
The AOP agreed with the assessment analyst that a Level 1 assessment was appropriate for summer flounder. If an unforeseen problem arises, or if the assessment must default to the backup method which has not been through a formal review for this species, the stock assessment lead will summarize the issue and report findings to the AOP for consideration. In this instance, the AOP might recommend an increase to a Level 2 review.

Bluefish (AOP Lead – Michael Celestino):
Recommendation: Level 1 (Direct Delivery)
The bluefish stock assessment was last updated in 2019 with a management track assessment (MTA). The model was updated with commercial catch data, calibrated MRIP data, and survey indices, from 1985 through 2018. Biological reference points from the 2019 MTA were FMSY = F35% = 0.183, Bthreshold = ½ SSBMSY = 99,359 mt. Terminal year estimates from the model were F2018 = 0.146 and SSB2018 = 91,041 mt, resulting in a 2018 stock status of not overfishing, but the stock was overfished.

For the current MTA, the assessment lead is proposing to update all fishery and survey data through 2019 using the most recent (2019 MTA) ASAP model configuration with no changes; biological reference points (BRPs) will be updated, stock status determined relative to BRPs, and the lead will perform standard projections of OFL. As with many of the other species considered at this meeting, the analyst is proposing to use the 2020 and 2021 ABC as assumed catch for those years, and project 2022-2023 at F = FMSY. The lead proposed as an alternative assessment plan a LOESS smooth of the MRIP catch per angler index to infer catch advice modifications. In light of this work plan, the analyst proposed a level 1 assessment, direct delivery to the MAFMC's SSC.

Following some AOP questions, the analyst noted that bluefish is scheduled for a research

track assessment (RTA) in 2022 and so viewed the 2021 MTA as a placeholder until more detailed changes could be explored in 2022 [e.g., incorporation of any newly available recreational release length frequency data (especially from southern states), explore data 5 support for a recreational release fleet in the model, re-examine recreational release mortality estimates, as well as any other workgroup ideas].

The AOP noted that the plan B assessment methodology has not been reviewed for bluefish as the primary assessment method (ASAP) was approved for management use at the 2019 MTA. In response to questions about retrospective patterning, the analyst offered that he does not anticipate terminal year estimates of the updated model to fall outside of the 90% confidence intervals that would necessitate adjustment.

There was discussion about the methodology used to estimate the weight of released fish – the analyst noted that he will continue to use what he views as the best scientific information available: length frequency of released fish to characterize their weight. It was noted that this methodology differs from that used by GARFO and MAFMC. There was also discussion about the utility of newly available release length frequency data if those data are of limited temporal duration; the analyst noted that data could be incorporated either into the base model or as a sensitivity run.

Since the bluefish stock is overfished the AOP discussed whether stock status should impact the level of review for this species. The AOP discussed that the intent behind the current stock assessment process guidelines is that the review level should be independent of stock status; moreover, the AOP discussed that a change in stock status, should one occur, was most likely in a projected year (not the terminal model year) and that a full RTA was planned in 2022, where among other things, reference points may be re-evaluated. This discussion led the AOP to consensus support for the analysts proposed level 1, direct delivery. Justification from the AOP included: irrelevance of stock status in the current guidance document, straightforward update of the model with one additional year of data and no planned model changes, and planned full model and data evaluation planned as part of scheduled 2022 RTA. The AOP noted that if the assessment relies on plan B methods, or if the terminal year estimates require adjustment due to retrospective patterning, the assessment would be elevated to level 2 (in a process described elsewhere in this summary).

A member of the public (G DiDomenico, Garden State Seafood Association) inquired about conditions necessary for SSB to rise above the current threshold, to which the analyst responded that if average recruitment is realized, catches remain stable, and fishing mortality is low. The analyst went on to note that in the most recent MTA the first year of projections indicated SSB above the threshold.

Atlantic Bluefish Management Track Assessment

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State of Stock: This assessment of Atlantic bluefish (*Pomatomus saltatrix*) is a Level 1 update of the existing 2015 benchmark assessment (NEFSC 2015). Based on the previous assessment, the stock was overfished and overfishing was not occurring (NEFSC 2019). This assessment updates commercial and recreational fishery catch data, research survey indices of abundance, and the analytical ASAP assessment model and reference points through 2019. Based on this updated assessment, the bluefish stock was overfished and overfishing was not occurring relative to the updated biological reference points (Figure 1). Spawning stock biomass (SSB) was estimated to be 95,742 MT in 2019, about 47.5% of the updated biomass target reference point SSB_{MSY} proxy = $SSB_{35\%}$ = 201,729 MT, and 95% of the $SSB_{threshold}$ = ½SSB_{MSY} proxy = 100,865 MT (Table 1, Figure 2). There is a 90% probability that SSB in 2019 was between 73,992 and 105,151 MT. Fishing mortality on the fully selected age 2 fish was estimated to be 0.172 in 2019, and 95% of the updated fishing mortality threshold reference point F_{MSY} proxy = $F_{35\%}$ = 0.181 (Table 1, Figure 3). There is a 90% probability that the fishing mortality rate in 2019 was between 0.140 and 0.230. The average age-0 recruitment from 1985 to 2019 was 46 million. The largest recruitment in the time series occurred in 1989 at 98 million fish, and the lowest recruitment was in 2016 at 29 million fish. Recruitment over the last 10 years has varied around the time series average. In both 2017and 2018, recruitment estimates were above the average at 52, and 48 million fish, respectively. However, recruitment dropped dramatically in 2019 by 42%, with an estimate of 28 million fish (Table 1, Figures 2 & 4). The 2019 model estimates of F and SSB adjusted for internal retrospective error are within the model estimated 90% confidence intervals and no adjustment of the terminal year estimates has been made for stock status determination or projections (Figure 1).

OFL Projections: Projections using the 2021 bluefish Operational Assessment ASAP model (data through 2019) were made to estimate the OFL catches for 2022-2023. Projections assumed that the 2020 ABC of 7,385 MT was harvested in both 2020 and 2021 and sampled from the distribution of recruitment for 1985-2019. The OFL projection uses F_{2022} and F_{2023} = updated F_{MSY} proxy = F35% = 0.181. The OFL catches are 21,729 MT in 2022 (CV = 10%) and 22,641 MT in 2023 (CV = 10%).

Atlantic bluefish OFL for 2022-2023
Catches and SSB in metric tons

Year	Total Catch (MT)	F	SSB (MT)
2020	7,385	0.075	113,672
2021	7,385	0.067	137,162
2022	21,729	0.181	146,890
2023	22,641	0.181	153,066

Catch: Reported 2019 commercial landings from ACCSP were 1,353 MT = 3.0 million lbs. Estimated MRIP 2019 recreational landings were 6,612 MT = 14.6 million lb. Total commercial and recreational landings in 2019 were 7,965 MT = 17.6 million lb. Estimated 2019 recreational discards were 6,992 MT = 15.4 million lbs. Commercial discards are not considered significant and not included in the assessment. The estimated total catch in 2019 was 14,957 MT = 33.0 million lbs.

Catch and Status Table: Atlantic bluefish
(Weights in mt, recruitment in thousands, arithmetic means, includes New MRIP estimates)

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Commercial landings	3,304	2,453	2,212	1,974	2,236	1,902	1,929	1,873	1,105	1,353
Recreational landings	21,013	15,430	15,051	15,526	12,050	13,524	10,433	15,421	5,695	6,612
Recreational discards[2]	11,965	14,606	11,039	9,537	9,848	6,953	8,008	10,111	4,489	6,992
Catch used in assessment	36,281	32,489	28,303	27,037	24,135	22,379	20,370	27,404	11,288	14,957
Spawning stock biomass	115,365	112,514	109,466	106,880	90,295	81,315	90,615	85,423	83,410	95,742
Recruitment (age 0, thousands)	39,925	35,543	31,687	48,399	41,368	44,532	29,106	51,806	48,147	27,918
F full[3]	0.327	0.322	0.331	0.362	0.399	0.400	0.276	0.450	0.152	0.172

	Min[1]	Max[1]	Avg[1]
Commercial landings	1,105	7,162	3,807
Recreational landings	5,695	74,988	21,012
Recreational discards[2]	1,440	14,850	7,717
Catch used in assessment	11,288	84,201	32,536
Spawning stock biomass	74,547	183,843	102,587
Recruitment (age 0, thousands)	27,917	98,151	45,744
F full[3]	0.152	0.579	0.351

[1] Years 1985-2019

[2] dead discards

[3] F on fully selected age 2. Note that table values are not retro adjusted.

Stock Distribution and Identification: The Atlantic States Marine Fisheries Commission (ASMFC) and Mid-Atlantic Fishery Management Council (MAFMC) jointly developed the Fishery Management Plan (FMP) for the bluefish fishery and adopted the plan in 1989 (ASMFC 1989, MAFMC 1990). The Secretary of Commerce approved the FMP in March 1990. The FMP defines the management unit as bluefish (*Pomatomus saltatrix*) in U.S. waters of the western Atlantic Ocean.

Assessment Model: The assessment model for Atlantic bluefish is a complex statistical catch-at-

age model (ASAP SCAA; Legault and Restrepo 1998, NFT) incorporating a broad range of fishery and survey data (NEFSC 2015). The model assumes an instantaneous natural mortality rate (M) = 0.2. The fishery catch is modeled as two fleets: 1. Commercial landings, and 2. Combined recreational landings and recreational discards.

Indices of stock abundance included a recreational catch-per-unit-effort index developed from the MRIP intercept data. In addition, eight fishery-independent indices were included in the model. Age-0+ fishery-independent indices included the NEFSC fall Bigelow trawl survey, the New Jersey ocean trawl survey, the Connecticut Long Island Sound trawl survey (CTLISTS), the NEAMAP fall inshore trawl survey, and the North Carolina Pamlico Sound independent gillnet survey (PSIGN). Young-of-year indices included the SEAMAP fall trawl survey and a composite index developed from state seine indices from New Hampshire to Virginia. In 2019, there was no consistent trend across indices from 2018 values. SEAMAP, PSIGN, CTLISTS, and the composite YOY seine index all increased from 2018 values. The NEFSC Bigelow, MRIP, NEAMAP, and NJ Ocean, all decreased from 2018 values, with the NEFSC and NJ indices being the lowest estimates in their time-series.

There is not a major retrospective pattern in the bluefish assessment model. The minor internal model retrospective error underestimates F by 22% and overestimate SSB by 22% over the last 7 terminal years. The 2019 model estimates of F and SSB adjusted for internal retrospective error (F = 0.221; SSB = 78,093 MT) are within the model estimate 90% confidence intervals and no adjustment of the terminal year estimates was needed for stock status determination or projections. The 'historical' retrospective comparison between the SARC60 benchmark, a 2017 continuity run using old MRIP data, the 2019 OA, and this update, indicates similar trends for SSB, F, and recruitment for most of the time-series (Figure 5).

Biological Reference Points (BRPs): Reference points were calculated using the non-parametric yield and SSB per recruit long-term projection approach. The cumulative distribution function of the 1985-2019 recruitment estimates (corresponding to the period of input fishery catches-at-age) was re-sampled to provide future recruitment estimates for the projections used to estimate the biomass reference point.

The existing biological reference points for bluefish are from the 2019 operational update of the SAW 60 benchmark assessment (NEFSC 2015). The reference points are $F_{35\%}$ as the proxy for F_{MSY}, and the corresponding $SSB_{35\%}$ as the proxy for the SSBMSY biomass target. Based on the benchmark, the $F_{35\%}$ proxy for F_{MSY} = 0.183; the proxy estimate for SSBMSY = $SSB_{35\%}$ = 198,717 MT = 438 million lbs; the proxy estimate for the ½ SSB_{MSY} biomass threshold = ½ $SSB_{35\%}$ = 99,359 MT = 219 million lbs; and the proxy estimate for MSY = $MSY_{35\%}$ = 29,571 MT = 65 million lbs.

The $F_{35\%}$ and corresponding $SSB_{35\%}$ proxy biological reference points for bluefish were updated for this 2021 Operational Assessment. The updated fishing mortality threshold $F_{35\%}$ proxy for F_{MSY} = 0.181; the updated biomass target proxy estimate for SSB_{MSY} = $SSB_{35\%}$ = 201,729 MT = 445 million lbs; the updated biomass threshold proxy estimate for ½ SSB_{MSY} = ½ $SSB_{35\%}$ = 100,865 MT = 222 million lbs; and the updated proxy estimate for MSY = $MSY_{35\%}$ = 29,549 MT = 65 million lbs.

Qualitative status description:

The bluefish stock has experienced a slight increase in SSB over the past 5 years, coinciding with a dramatic drop in F. Recruitment has remained fairly steady, fluctuating just below the time-series mean of 46 million fish. Both commercial and recreational fisheries have had lower catches in recent years, with poor catch in 2016 (20,370 MT), 2018 (11,288 MT), and 2019 (14,957 MT), well below the time series average of 32,034 MT. With the low catch in 2019, fishing mortality (0.172) was again estimated below the reference point (0.181). These low catches in recent years could be due to lower bluefish availability. Anecdotal evidence suggests larger bluefish stayed offshore and inaccessible to most of the recreational fishery during the past few years.

Research and Data Issues:

The large increase in recreational landings and discards from the new MRIP calibration has further increased the importance of the recreational data to this assessment. Accurately characterizing the recreational discard lengths is an important component of the assessment and research that improves the methodology used to collect these data is recommended. Bluefish is scheduled for a Research track assessment in 2022, where discards and other data and model issues will be thoroughly explored.

References:

Atlantic States Marine Fisheries Commission (ASMFC).1989. Fishery Management Plan for Bluefish. 81 pp. + append.

Legault CM, Restrepo VR. 1998. A flexible forward age-structured assessment program. ICCAT. Col. Vol. Sci. Pap. 49:246-253.

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Northeast Fisheries Science Center (NEFSC). 2015. 60th Northeast Regional Stock Assessment Workshop (60th SAW) Assessment Report. US Dept Commerce, Northeast Fish Sci Cent Ref Doc. 15-08; 870 p.

Northeast Fisheries Science Center (NEFSC). 2019. Operational Assessment of the Black Sea Bass, Scup, Bluefish, and Monkfish Stocks, Updated Through 2018. US Dept Commerce, Northeast Fish Sci Cent Ref Doc. 20-01; 164 p.

NOAA Fisheries Toolbox (NFT). Age Structured Assessment Program (ASAP) version 3.0.11. (Internet address: http://nft.nefsc.noaa.gov).

Table 1. Summary assessment results for Atlantic Bluefish; Spawning Stock Biomass (SSB) in metric tons (MT); Recruitment (R) at age 0 in thousands; Fishing Mortality (F) for age of peak fishery selection (S = 1) age 2.

Year	SSB	R	F
1985	183,843	66,052	0.323
1986	163,620	51,689	0.490
1987	136,954	37,877	0.579
1988	101,648	47,501	0.546
1989	94,923	98,151	0.492
1990	84,460	48,354	0.534
1991	77,579	55,160	0.507
1992	74,547	28,077	0.447
1993	74,846	30,086	0.419
1994	75,793	42,414	0.353
1995	76,526	32,508	0.306
1996	75,224	42,835	0.308
1997	79,665	42,017	0.332
1998	92,628	40,391	0.302
1999	96,285	62,117	0.298
2000	106,332	35,394	0.299
2001	116,170	55,078	0.355
2002	99,066	44,294	0.292
2003	103,768	59,639	0.272
2004	115,528	31,562	0.271
2005	129,375	59,342	0.263
2006	105,410	66,514	0.306
2007	107,083	45,824	0.300
2008	129,326	43,751	0.231
2009	118,914	35,987	0.269
2010	115,365	39,925	0.327
2011	112,514	35,543	0.322
2012	109,466	31,687	0.331
2013	106,880	48,399	0.362
2014	90,295	41,368	0.399
2015	81,315	44,532	0.400
2016	90,615	29,106	0.276
2017	85,423	51,806	0.450
2018	83,410	48,147	0.152
2019	95,742	27,918	0.172

Table 2. Total catch (metric tons) of Atlantic bluefish from Maine through Florida from 1985-2019. Does not include commercial discards as they are not considered significant for this stock. Includes the 'New' MRIP estimates of recreational catch.

Year	Commercial Landings	Recreational Landings	Recreational Discards	Total Catch
1985	6,124	47,376	1,655	55,154
1986	6,657	74,988	2,556	84,201
1987	6,579	63,834	3,198	73,610
1988	7,162	36,337	1,440	44,938
1989	4,740	36,250	2,029	43,019
1990	6,250	31,268	4,999	42,516
1991	6,138	26,485	6,137	38,760
1992	5,208	22,262	4,351	31,820
1993	4,819	16,170	5,955	26,943
1994	4,306	14,085	6,126	24,517
1995	3,629	13,228	4,400	21,257
1996	4,213	10,623	6,477	21,313
1997	4,109	12,516	7,829	24,455
1998	3,741	15,243	5,693	24,676
1999	3,325	10,501	11,809	25,634
2000	3,660	10,950	12,431	27,041
2001	3,953	14,888	14,850	33,691
2002	3,116	13,612	8,241	24,970
2003	3,359	14,758	7,281	25,398
2004	3,661	17,264	9,050	29,975
2005	3,211	17,661	9,571	30,443
2006	3,252	16,653	10,379	30,284
2007	3,390	18,077	10,136	31,603
2008	2,730	17,185	9,173	29,088
2009	3,119	18,040	10,071	31,231
2010	3,304	21,013	11,965	36,281
2011	2,453	15,430	14,606	32,489
2012	2,212	15,051	11,039	28,303
2013	1,974	15,526	9,537	27,037
2014	2,236	12,050	9,848	24,135
2015	1,902	13,524	6,953	22,379
2016	1,929	10,433	8,008	20,370
2017	1,873	15,421	10,111	27,404
2018	1,105	5,695	4,489	11,288
2019	1,353	6,612	6,992	14,957

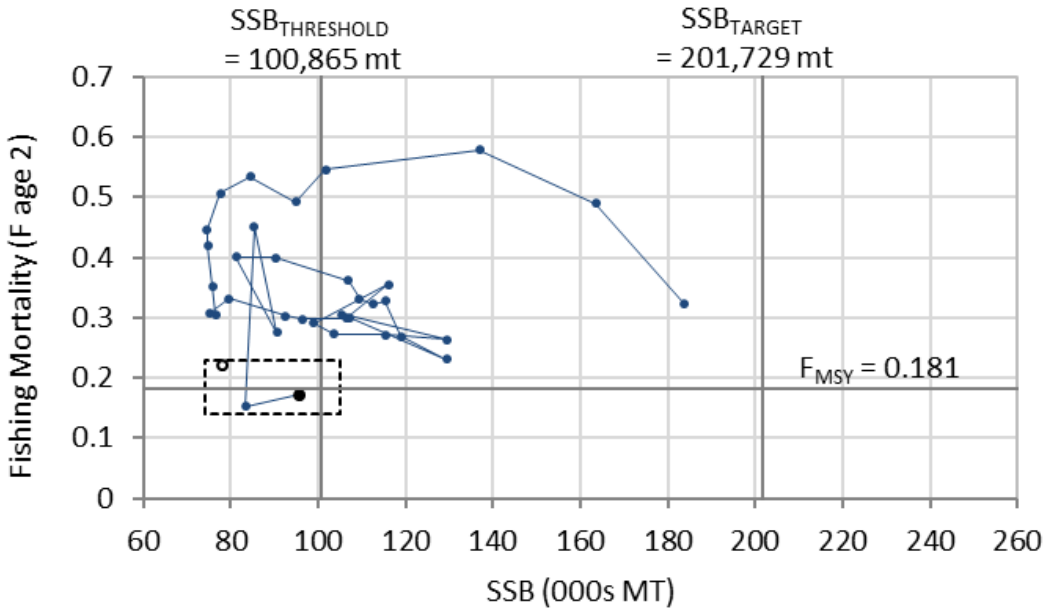

Figure 1. Estimates of Atlantic bluefish spawning stock biomass (SSB) and fully-recruited fishing mortality (F, peak at age 2) relative to the updated 2021 biological reference points. Black filled circle with 90% confidence intervals (dotted box) shows the assessment point estimates. The open circle shows the retrospective adjusted values.

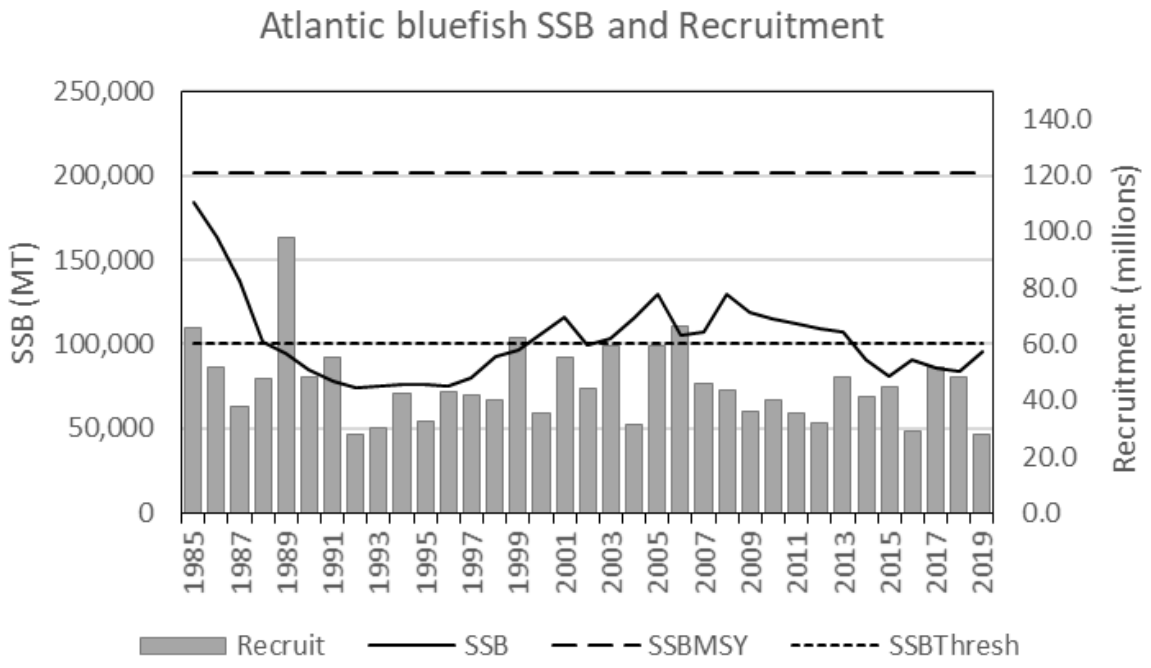

Figure 2. Atlantic bluefish spawning stock biomass (SSB; solid black line) and recruitment at age 0 (R; gray vertical bars) by calendar year. The horizontal dashed line is the updated SSB_{MSY} proxy = $SSB_{35\%}$ = 201,729 MT, and the dotted black line is the $SSB_{Threshold}$ = 100,865 MT.

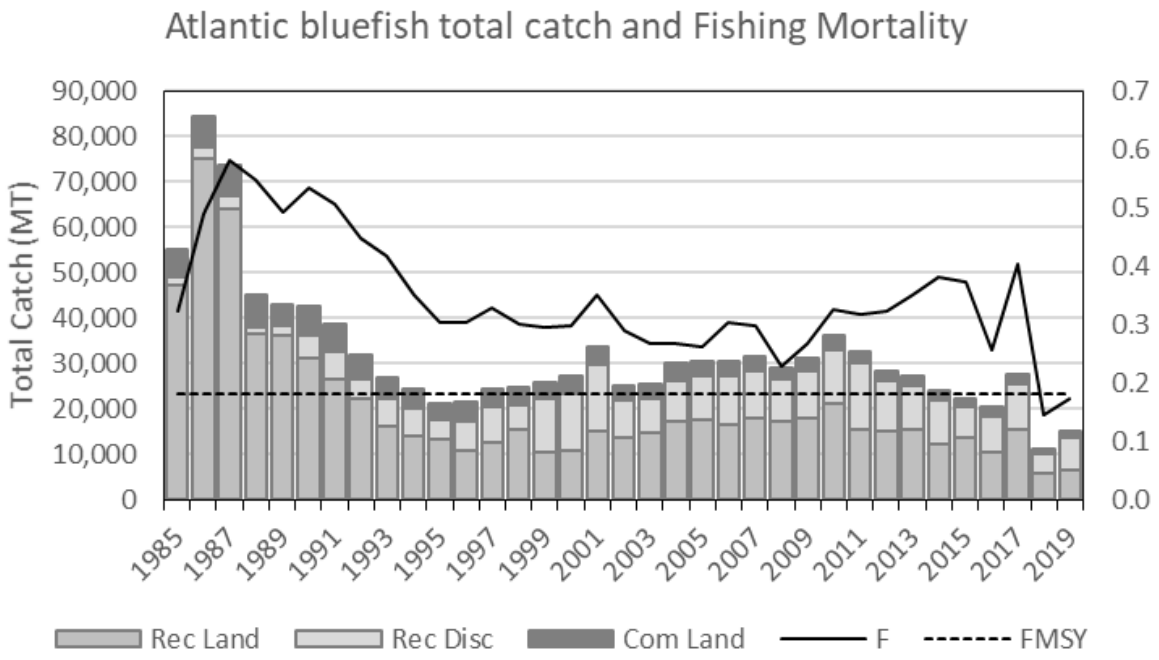

Figure 3. Total fishery catch (metric tons; MT; solid line) and fishing mortality (F, peak at age 3; squares) for Atlantic bluefish. The horizontal dashed line is the updated F_{MSY} proxy = $F_{35\%}$ = 0.181.

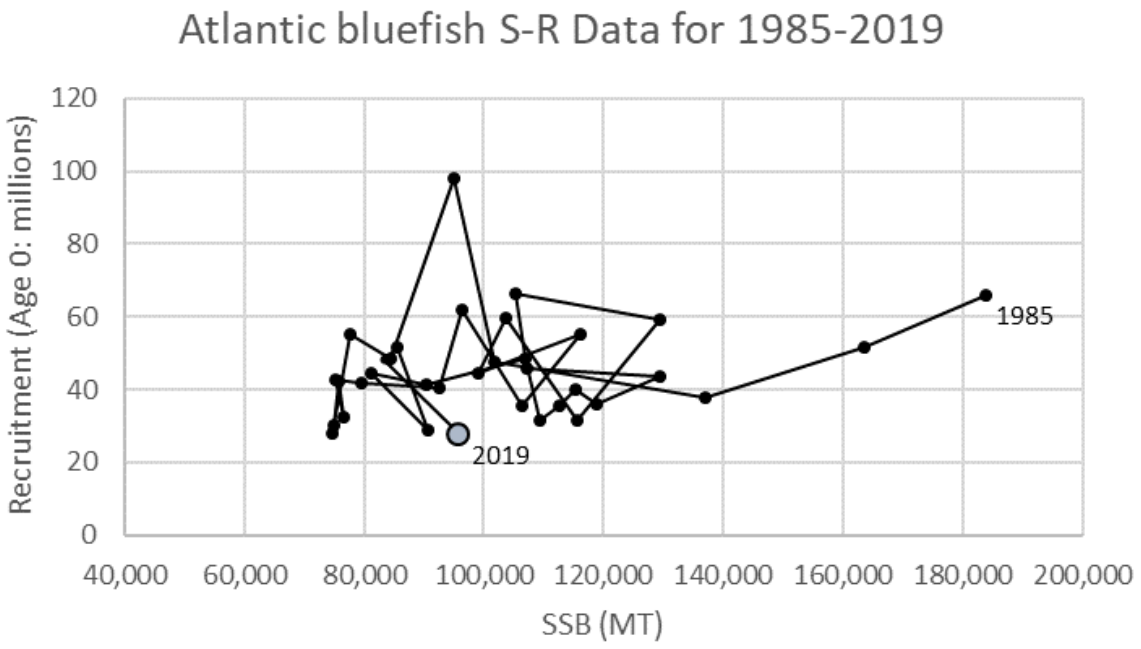

Figure 4. Spawning Stock Biomass (SSB) and Recruitment (R) scatter plot for Atlantic bluefish.

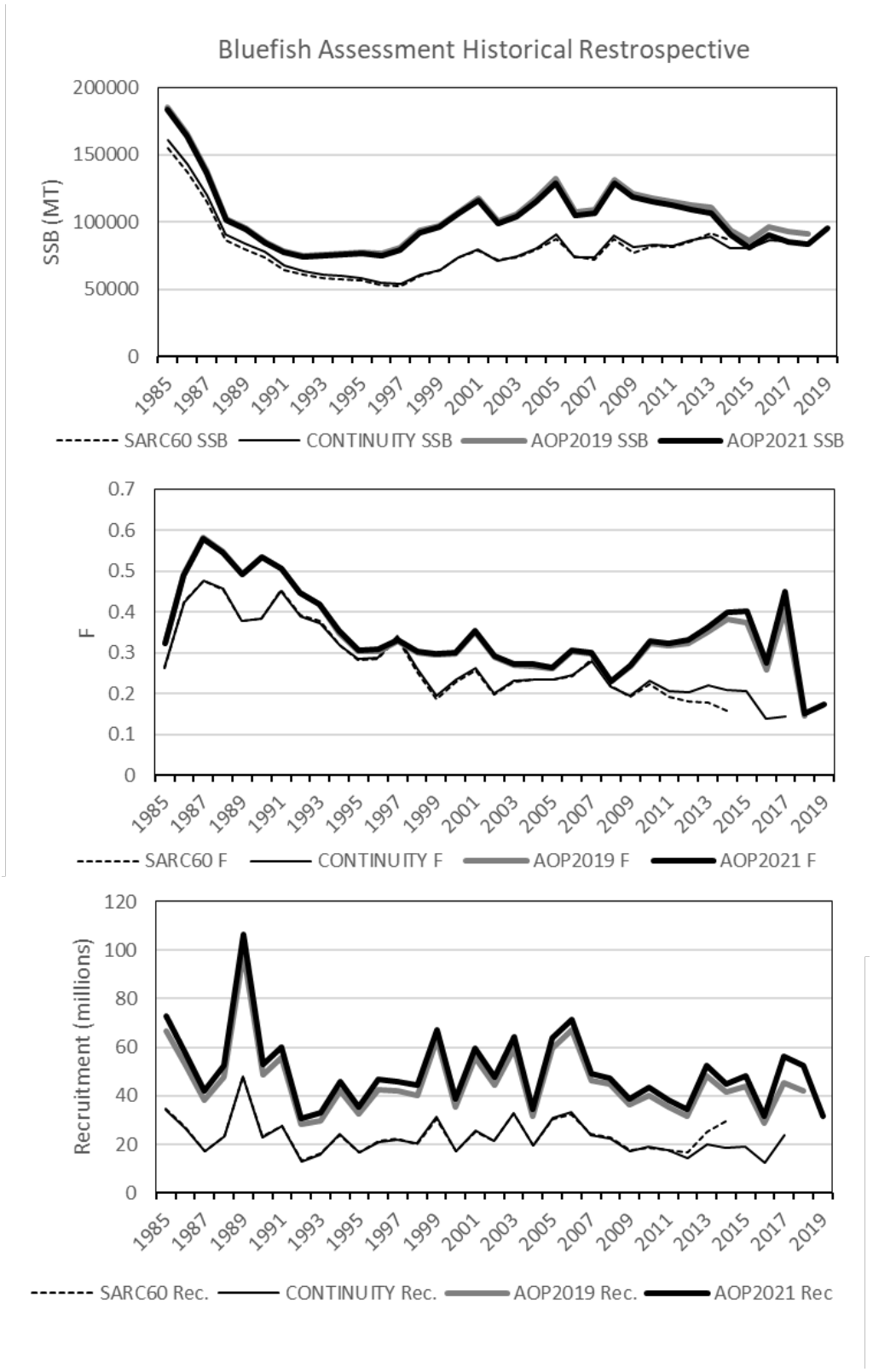

Figure 5. Historical retrospective analysis of the 2015 benchmark (dotted), 2017 (continuity run: slim black line), 2019 OA (bold grey line), and 2021 OA stock assessments of Atlantic bluefish.

Summer flounder Management Track Assessment

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Fishery and Survey Data

Reported 2021 landings in the commercial fishery were 4,731 mt = 10.430 million lb, an increase of 14% from 2020, and 83% of the 2021 commercial quota (Figure 1). Estimated 2021 landings in the recreational fishery were 3,092 mt = 6.817 million lb, a decrease of 32% from 2020, and 82% of the 2021 recreational harvest limit (Figure 1). Total commercial and recreational landings in 2021 were 7,823 mt = 17.247 million lb, a decrease of 10% from 2020. Final estimates of fishery discards for 2020-2021 are not yet available.

There were no NEFSC bottom trawl surveys conducted in 2020. The NEFSC spring survey index of summer flounder stock biomass decreased by 41% from 2019 to 2022; the fall index increased by 6% from 2019 to 2021 (Figure 2). The NEFSC fall survey length frequency distributions suggest that an above average year class (mode at about 20 cm total length) recruited to the stock in 2018 with average to below average recruitment since (Figure 3).

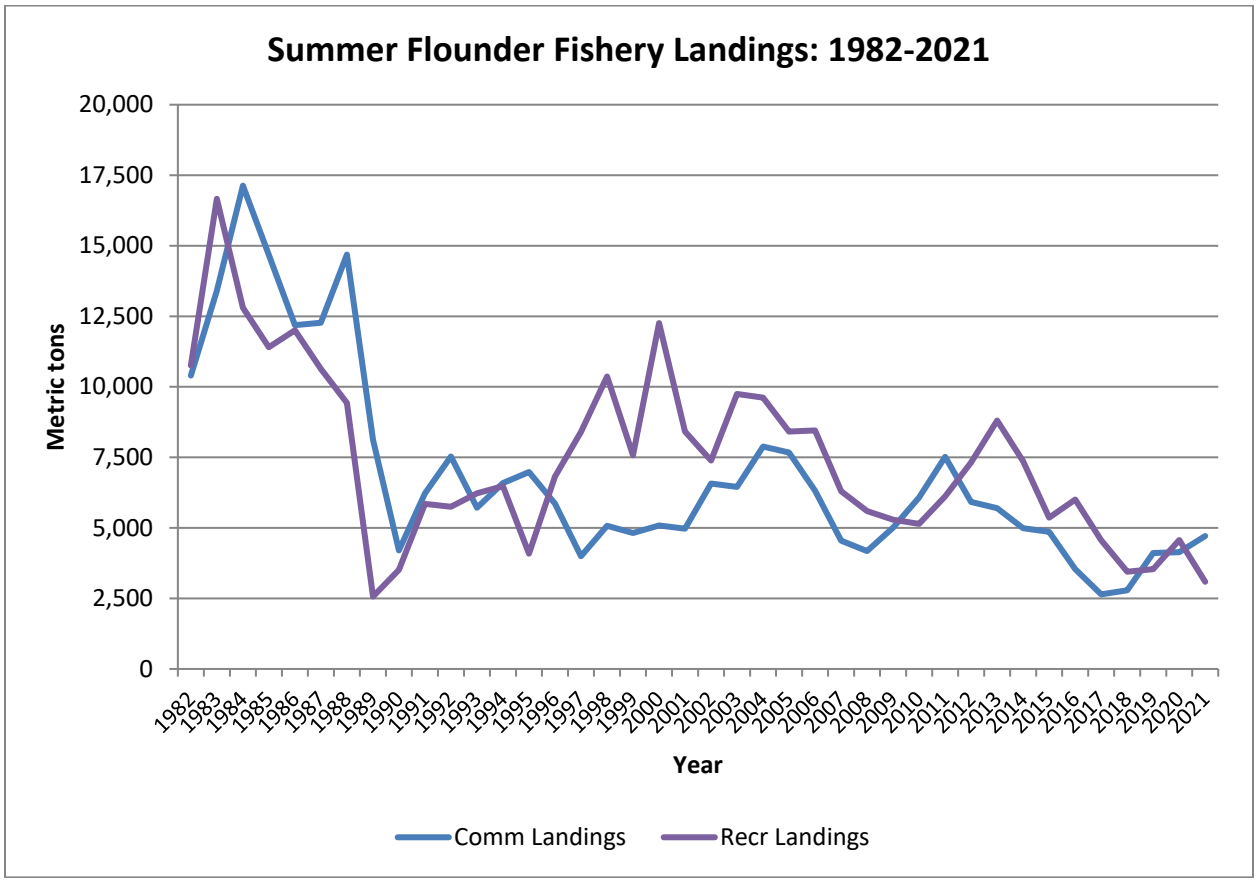

Figure 1. Summer flounder fishery landings.

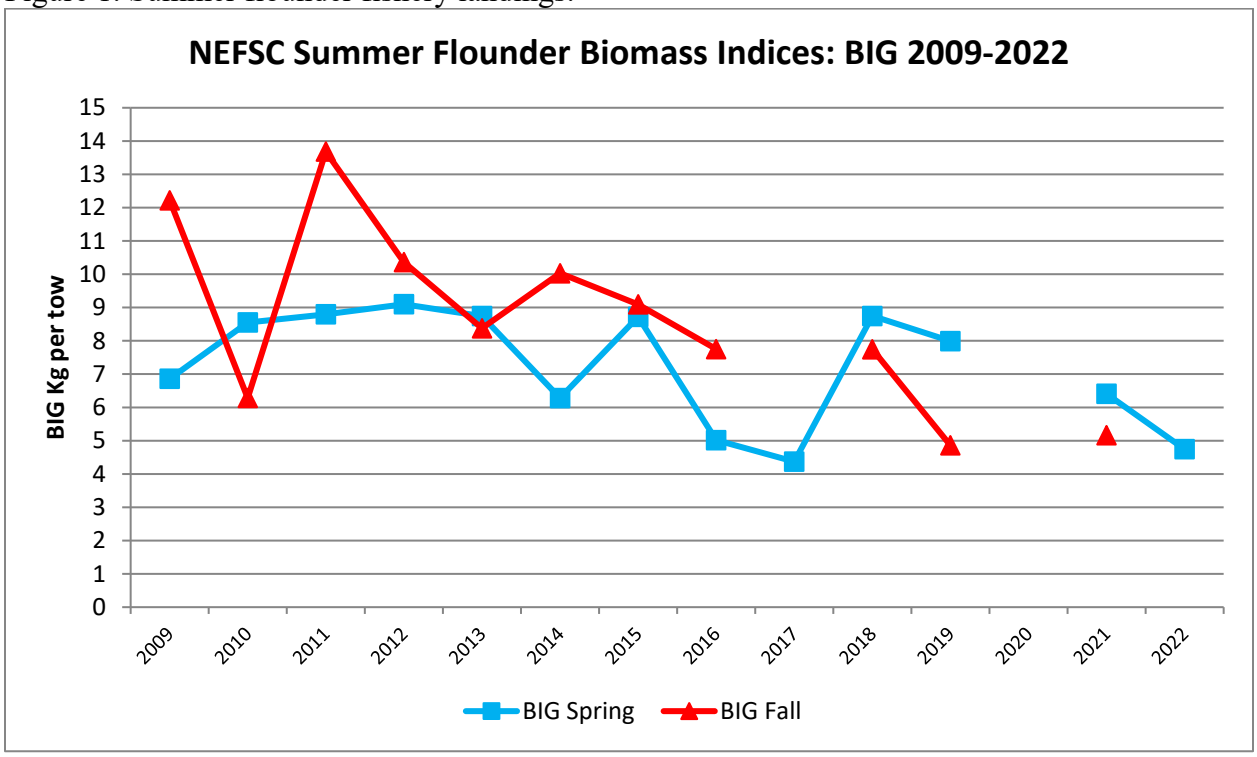

Figure 2. Northeast Fisheries Science Center (NEFSC) bottom trawl survey aggregate biomass indices for summer flounder. There are no valid fall 2017 or spring and fall 2020 indices for summer flounder. Surveys have been conducted with the FSV HB Bigelow (BIG) during 2009-2022.

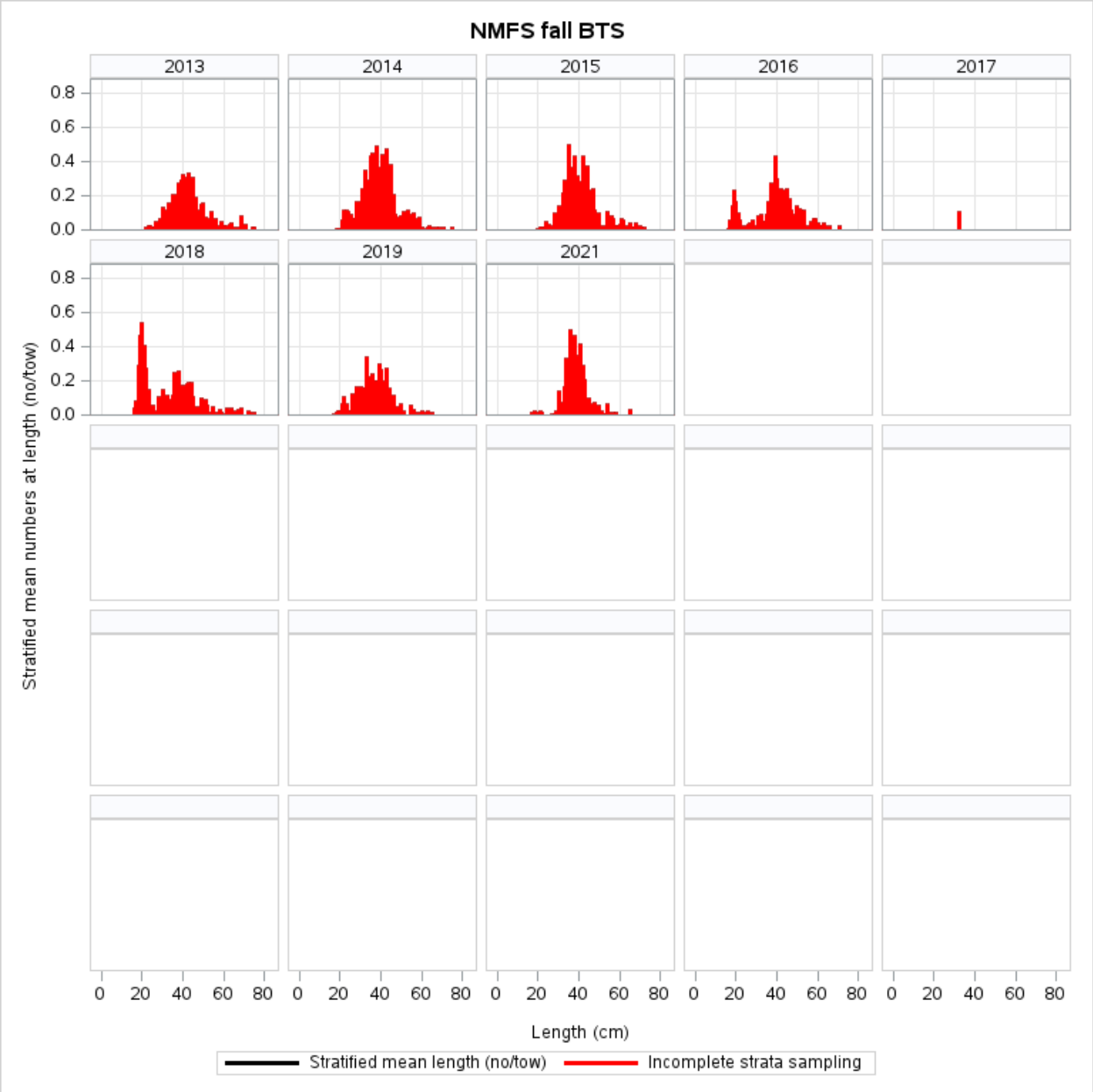

Figure 3. Northeast Fisheries Science Center (NEFSC) fall bottom trawl survey FSV HB Bigelow indices at length since 2013. There was an incomplete survey conducted in 2017 and no survey conducted in 2020.

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