draft working paper for peer review only

Southern New England Mid-Atlantic winter flounder

2022 Management Track Assessment Report

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, Massachusetts

Compiled June 2022

This assessment of the Southern New England Mid-Atlantic winter flounder (Pseudopleuronectes americanus) stock is an operational assessment of the existing benchmark assessment (NEFSC 2011), and follows operational updates in 2015, 2017, and 2020. In each assessment since the benchmark the stock was overfished, but overfishing was not occurring (NEFSC 2015, 2017, 2022). The current assessment updates commercial fishery catch data, recreational fishery catch data (using new MRIP calibrated data), research survey indices of abundance, and the analytical ASAP assessment models and reference points through 2021. Additionally, stock projections have been updated through 2025.

State of Stock: Based on this updated assessment, the Southern New England Mid-Atlantic winter flounder (*Pseudopleuronectes americanus*) stock is not overfished and overfishing is not occurring (Figures 1-2). Retrospective adjustments were not made to the model results. Spawning stock biomass (SSB) in 2021 was estimated to be 3,353.2 (mt) which is 101% of the biomass target (3,314 mt), and 202% of the biomass threshold for an overfished stock ($SSB_{Threshold}$ = 1657 (mt); Figure 1). The 2021 fully selected fishing mortality was estimated to be 0.061 which is 23% of the overfishing threshold (F_{MSY} = 0.265; Figure 2).

Table 1: Catch and status table for Southern New England Mid-Atlantic winter flounder. All weights are in (mt), recruitment is in (000s), and F_{Full} is the fishing mortality on fully selected ages (ages 4 and 5). Model results are from the current updated ASAP assessment.

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
					Data					
Recreational discards	11	8	4	13	3	2	4	2	3	1
Recreational landings	126	15	99	39	61	10	10	0	9	5
Commercial discards	482	206	64	82	125	101	108	127	47	122
Commercial landings	132	857	659	654	519	515	337	212	120	87
Catch for Assessment	750	1,085	826	787	708	629	460	342	180	216
					Model Results					
Spawning Stock Biomass	6,186.4	6,631.6	5,173.6	4,528.1	3,819.4	3,573.6	3,569.7	3,271.2	3,522.3	3,353.2
F_{Full}	0.121	0.178	0.173	0.175	0.187	0.167	0.125	0.092	0.044	0.061
Recruits	4,226.8	2,379.5	4,032.7	4,861.5	4,641	3,186.6	4,622.6	3,001.3	3,263.7	4,364.5

Table 2: Comparison of reference points estimated in the 2020 operational assessment and from the current assessment update. F40% was used as a proxy for F_{MSY} and an SSB_{MSY} proxy was calculated from a long-term stochastic projection drawing from the last 20 years of empirical recruitment. Recruitment estimates are median values of the time-series. 90% CI are shown in parentheses.

	2020	2022
F_{MSY} *proxy*	0.284	0.265
SSB_{MSY} (mt)	12,322	3,314 (2,432 - 4,687)
MSY (mt)	3,906	1,025 (755 - 1,441)
Median recruits (000s)	16,649	15,742
Overfishing	No	No
Overfished	Yes	No

Projections: Short term projections of biomass were derived by sampling from a cumulative distribution function of the last 20 years of recruitment estimates. The annual fishery selectivity, maturity ogive, and mean weights at age used in the projection are the most recent 5 year averages; The model exhibited a minor retrospective pattern in F and SSB so retrospective adjustments were not applied in the projections.

Table 3: Short term projections of total fishery catch and spawning stock biomass for Southern New England Mid-Atlantic winter flounder based on a harvest scenario of fishing at F_{MSY} *proxy* between 2023 and 2025. Catch in 2022 was assumed to be 441 (mt), which is the 2022 ACL for the stock. 90% CI are shown next to SSB estimates.

Year	Catch (mt)	SSB (mt)	F_{Full}
2022	441	3,472 (2,859 - 4,222)	0.114

Year	Catch (mt)	SSB (mt)	F_{Full}
2023	1,142	3,447 (2,845 - 4,156)	0.265
2024	1,276	3,894 (3,367 - 4,491)	0.265
2025	1,256	4,186 (3,666 - 5,011)	0.265

Special Comments:

- What are the most important sources of uncertainty in this stock assessment? Explain, and describe qualitatively how they affect the assessment results (such as estimates of biomass, F, recruitment, and population projections).

  A source of uncertainty is the estimate of natural mortality based on longevity, which is not well studied in Southern New England Mid-Atlantic winter flounder, and assumed constant over time. Natural mortality affects the scale of the biomass and fishing mortality estimates. Natural mortality was adjusted upwards from 0.2 to 0.3 during the last benchmark assessment (2011), assuming a max age of 16. However, there is still uncertainty in the true max age of the population and the resulting natural mortality estimate.

  Other sources of uncertainty include the length distribution of the recreational discards. The recreational discards are a small component of the total catch, but the assessment suffers from very little length information used to characterize the recreational discards (1 to 2 lengths in recent years). For this assessment a compiled discard length distribution over all years was used to characterize the recreational discards. In addtion, the poor sampling of recreational fishery information could be an issue for this assessment moving forward.

  The population projections are sensitive to the recruitment model chosen, as well as the temporal period selected from which recruitment estimates are drawn. In addition, recruitment and natural mortality are likely both dependant on environmental conditions, which can not be explored within the framework of ASAP

- Does this assessment model have a retrospective pattern? If so, is the pattern minor, or major? (A major retrospective pattern occurs when the adjusted SSB or F_{Full} lies outside of the approximate joint confidence region for SSB and F_{Full}

  The retrospective patterns for both Ffull and SSB are minor and a retrospective adjustment in 2021 was not required.

- Based on this stock assessment, are population projections well determined or uncertain? If this stock is in a rebuilding plan, how do the projections compare to the rebuilding schedule?

  Population projections for Southern New England Mid-Atlantic winter flounder are reasonably well determined. However, the results are sensitive to both the recruitment model and the time-period of recruitment used. In addition, while the retrospective pattern is considered minor (within the 90% CI of both F and SSB), the rho adjusted terminal value of F and SSB are close to falling outside of the confidence bounds, which would indicate a major retrospective pattern. This would lead to retrospective adjustments being needed for the projections.

  The stock is in a rebuilding plan with a rebuild date of 2023. The projections for this assessment update used a truncated stanza for recruitment, incorporating values from 2002-2021 (last 20 years). Previous assessments have used the entire time-series of recruitment, with historical recruitments that are well beyond

the current productivity of the stock. The truncated recruitment stanza led to a much reduced biomass target and as a result the overfished status of the stock has changed. The current status is that the stock is not overfished, overfishing is not occurring, and the stock has rebuilt by the 2023 deadline.

- Describe any changes that were made to the current stock assessment, beyond incorporating additional years of data and the effect these changes had on the assessment and stock status.

There has been a change in the commercial data processing for the NEFSC over the past few years. The NEFSC has switched to the Catch Accounting and Monitoring System (CAMS) from the AA table procedure. CAMS estimates of landings were available for 2020 and 2021. CAMS will be used going forward for commercial catch information and historical catch from 1981-2019 will remain based upon the AA table estimates.

A minor change was made to the assessment model data for this update. The NEFSC fall survey index was previously input as an age 2-7+ index. This input format was carried over from when the model was a VPA. The index was un-bumped to an age 1-7+ index, which did not have any noticeable impacts on model performance or estimates.

There was a change to the stanza of recruitment that is used in the projections for this update (which led to the level 3 review requirement). This new recruitment stanza uses the last 20 years of estimates (2002-2021) for both short term projections, and to estimate the biomass target (SSBMSY) from a long term (100yr) projection. Previous assessments have used the entire time-series of recruitment (1981-present). Many of the historical recruitment estimates are overly optimistic, if not impossible, for the current stock size and productivity to achieve. Very early recruitment estimates are 20 times the levels seen in recent years. At the 2020 management track review the main recommendation from the review panel was:

The Peer Review Panel notes, as had been done in previous reviews, that recruitment had been de- clining throughout the period and was currently very low. As for several other stocks under the purview of the NEFSC it would be helpful to evaluate if the previously observed high recruitment are possible; i.e., is it simply a matter of building back SSB and recruits will follow, or are there other factors at play. If the productivity of the resource(s) has decreased, it would be helpful to adjust reference points accordingly. This would be unlikely to change fisheries yield much but would be more realistic in terms of setting expectations.

Extensive work has been carried out to evaluate the effects of climate change on recruitment for southern New England winter flounder. Two assessment models that include environmental covariates have been developed: an environmental ASAP model (Bell et al 2018) and the transition of this environmental model into the state space Woods Hole Assessment Model (WHAM). In order to move to one of these alternative models for management, SNEMA winter flounder would have to go through a research track assessment. To help bridge the gap from now until the next research track (2026) more realistic reference points were estimated in this assesment. The environmental index (time-series of mean winter estuary temperatures) applied in the alternative assessment models was used as support in this assessment for choosing a more representative time period of recruitment for the projections.

- If the stock status has changed a lot since the previous assessment, explain why this occurred.

The stock status of Southern New England Mid-Atlantic winter flounder has changed since the previous operational updates and from the status determined at the last benchmark assessment in 2011. The overfished status of the stock has changed to not overfished, and the stock is now considered rebuilt by the 2023 deadline. The reason for this change in status determination is directly due to changing the recruitment stanza going into the projections. Previous assessments used the full time-series of recruitment, however, for this assessment a more recent range of recruitment (the last 20 years) was chosen. This truncated recruitment stanza eliminates the highest estimates of historical recruitment and greatly reduces the median recruitment used by the projections. The lower median recruitment estimates in the long term BRP projection results in a much lower SSB value for the SSBMSY reference point. While the stock status has changed, the perception of the stock has not, and recent model estimates and fishery independent survey indices all reveal a poor stock condition for southern New England winter flounder.

- Provide qualitative statements describing the condition of the stock that relate to stock status.

  The Southern New England Mid-Atlantic winter flounder stock shows an overall declining trend in SSB over the time series, with the current estimate (3,353 MT) at the second lowest in the time series. Estimates of fishing mortality have been declining since 2015 and the current value (0.061) is also the second lowest of the time-series. Recruitment has reamined low and steady over the past decade with a current value of 4.4 million fish, which is above the 10 year average of 3.9 million fish

- Indicate what data or studies are currently lacking and which would be needed most to improve this stock assessment in the future.

  The Southern New England Mid-Atlantic winter flounder assessment could be improved with additional studies on maximum age, as well as improved recreational discard length information. In addition, further investigation into the localized struture/genetics of the stock is warranted. Finally, a future shift to WHAM (during the next research track assessment) will provide the ability to model envirionmental factors that may influence recruitment and mortality, and help develop more informed population projections.

- Are there other important issues?
  None.

References:

Bell, R.J., A.D. Wood, J. Hare, D. Richardson, J. Manderson, and T. Miller.Rebuilding in the face of climate change. CJFAS 75(9) https://doi.org/10.1139/cjfas-2017-0085

Northeast Fisheries Science Center. 2011. 52^{nd} Northeast Regional Stock Assessment Workshop (52^{nd} SAW) Assessment Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 11-17; 962 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026.

Northeast Fisheries Science Center. 2015. Operational Assessment of 20 Northeast Groundfish Stocks, Updated through 2014. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 15-24; 251 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026.

Northeast Fisheries Science Center. 2017. Operational Assessment of 19 Northeast Groundfish Stocks, Updated through 2016. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 17-17; 264 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026.

Northeast Fisheries Science Center. 2022. Fall Management Track Assessments 2020US Dept Commer, Northeast Fish Sci Cent Ref Doc. 22-08; 168 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026.

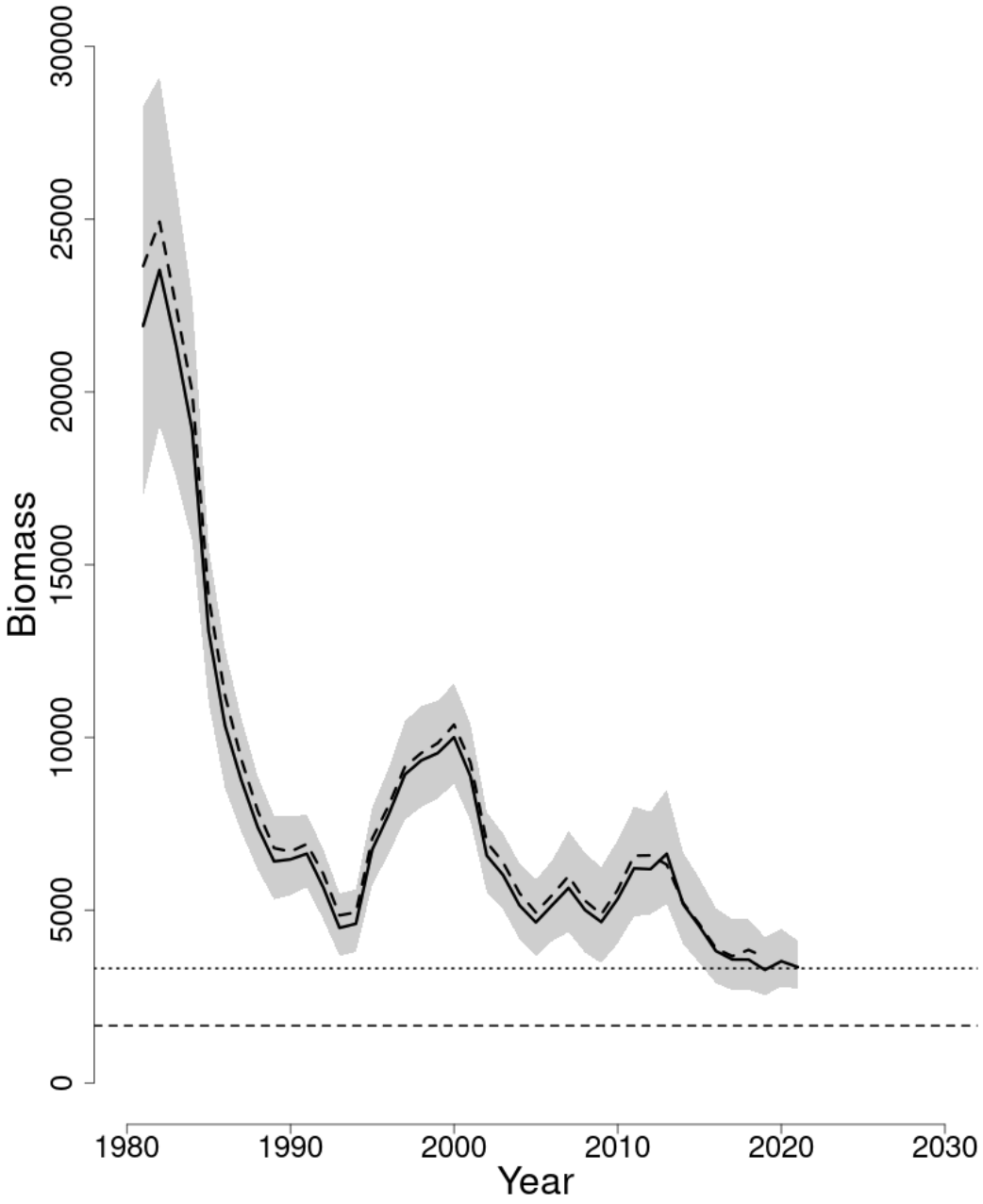

Figure 1: Trends in spawning stock biomass of Southern New England Mid-Atlantic winter flounder between 1981 and 2021 from the current (solid line) and previous (dashed line) assessment and the corresponding $SSB_{Threshold}$ ($\frac{1}{2}$ SSB_{MSY} *proxy*; horizontal dashed line) as well as SSB_{Target} (SSB_{MSY} *proxy*; horizontal dotted line) based on the 2022 assessment. The approximate 90% lognormal confidence intervals are shown.

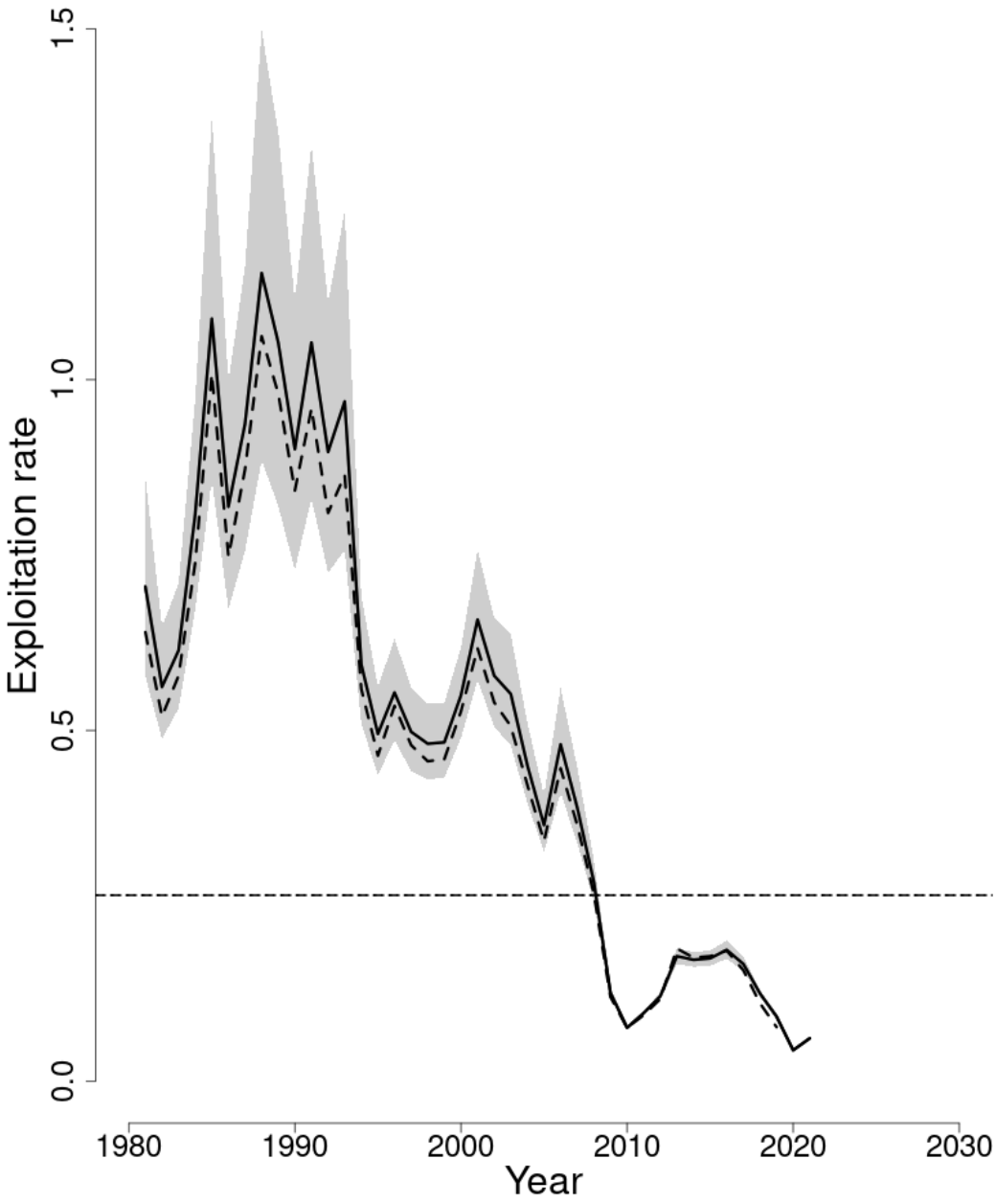

Figure 2: Trends in the fully selected fishing mortality (F_{Full}) of Southern New England Mid-Atlantic winter flounder between 1981 and 2021 from the current (solid line) and previous (dashed line) assessment and the corresponding $F_{Threshold}$ (F_{MSY}=0.265; horizontal dashed line) based on the 2022 assessment. The approximate 90% lognormal confidence intervals are shown.

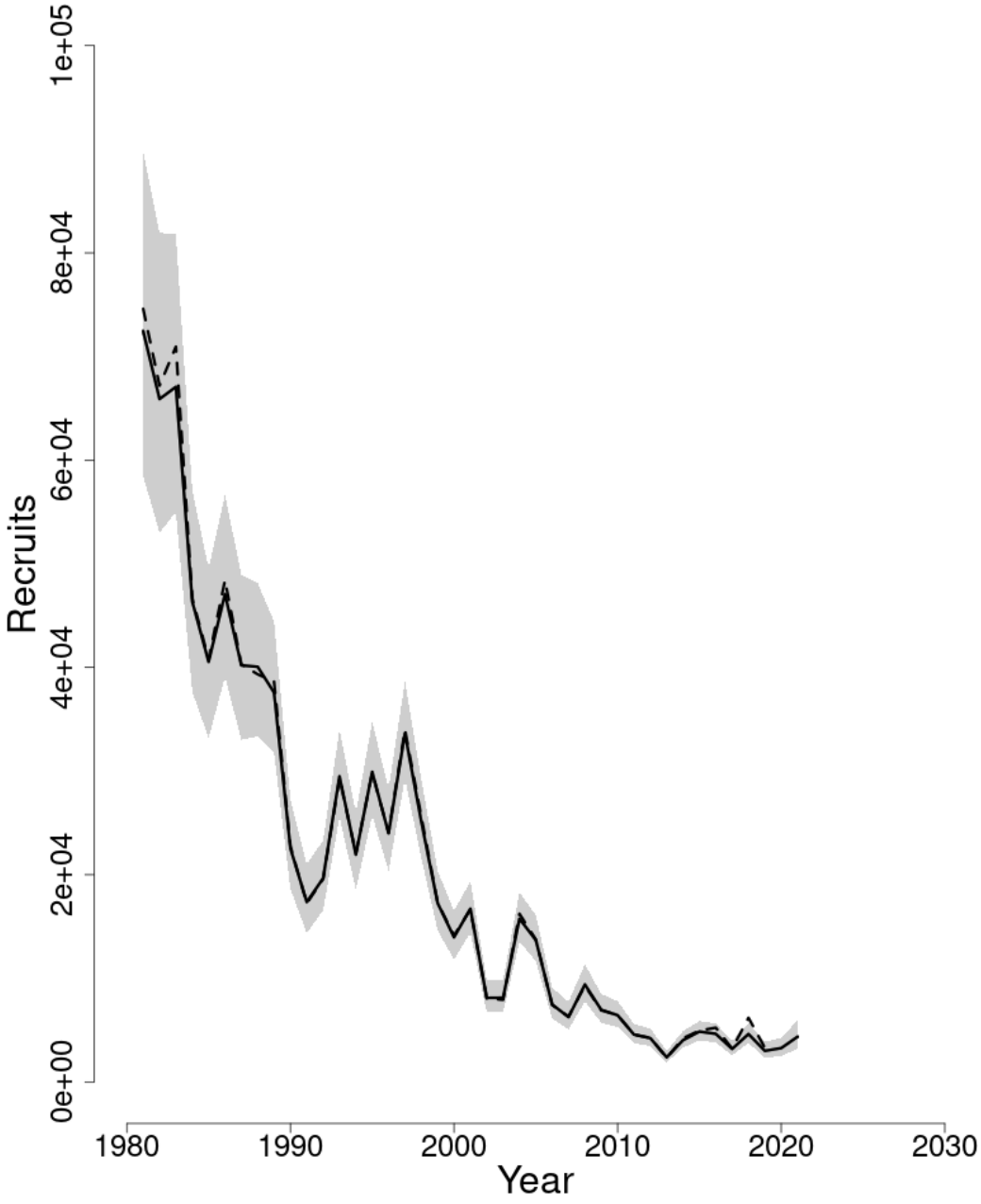

Figure 3: Trends in Recruits (000s) of Southern New England Mid-Atlantic winter flounder between 1981 and 2021 from the current (solid line) and previous (dashed line) assessment. The approximate 90% lognormal confidence intervals are shown.

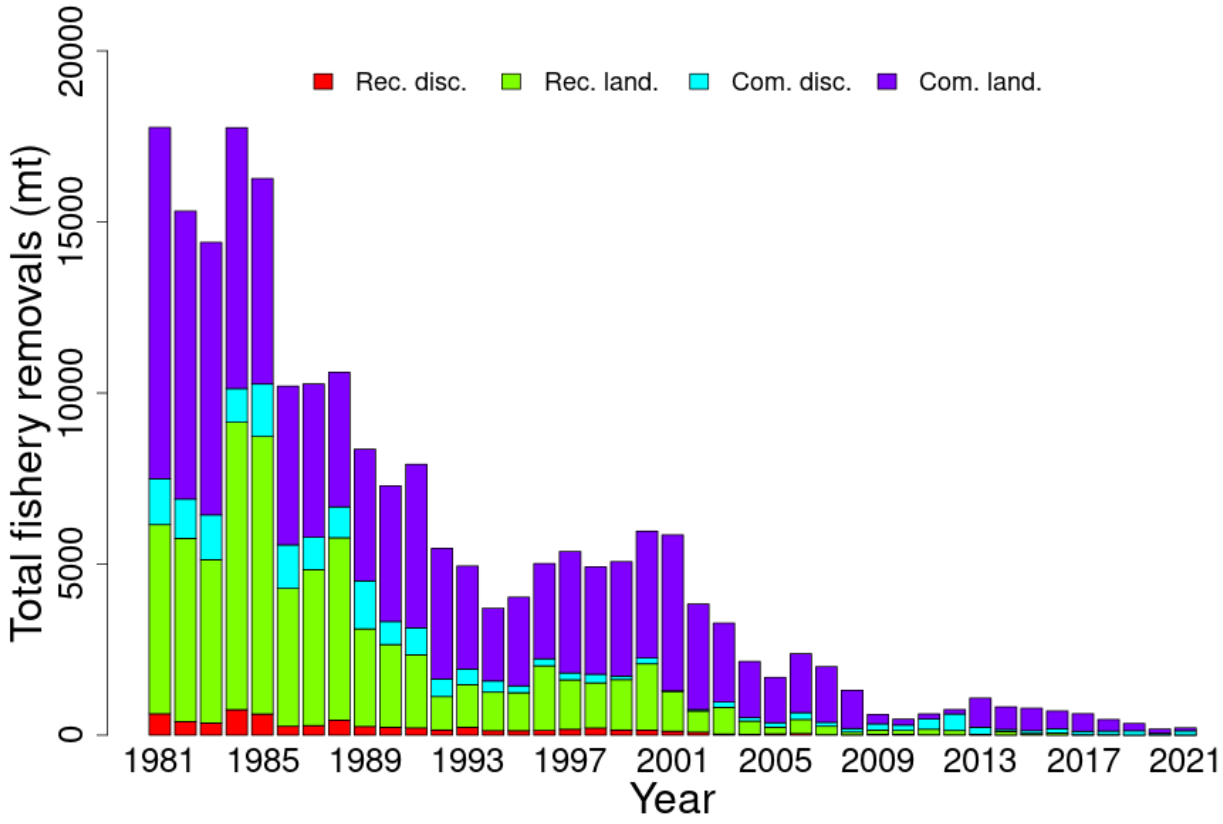

Figure 4: Total catch of Southern New England Mid-Atlantic winter flounder between 1981 and 2021 by fleet (commercial, recreational) and disposition (landings and discards).

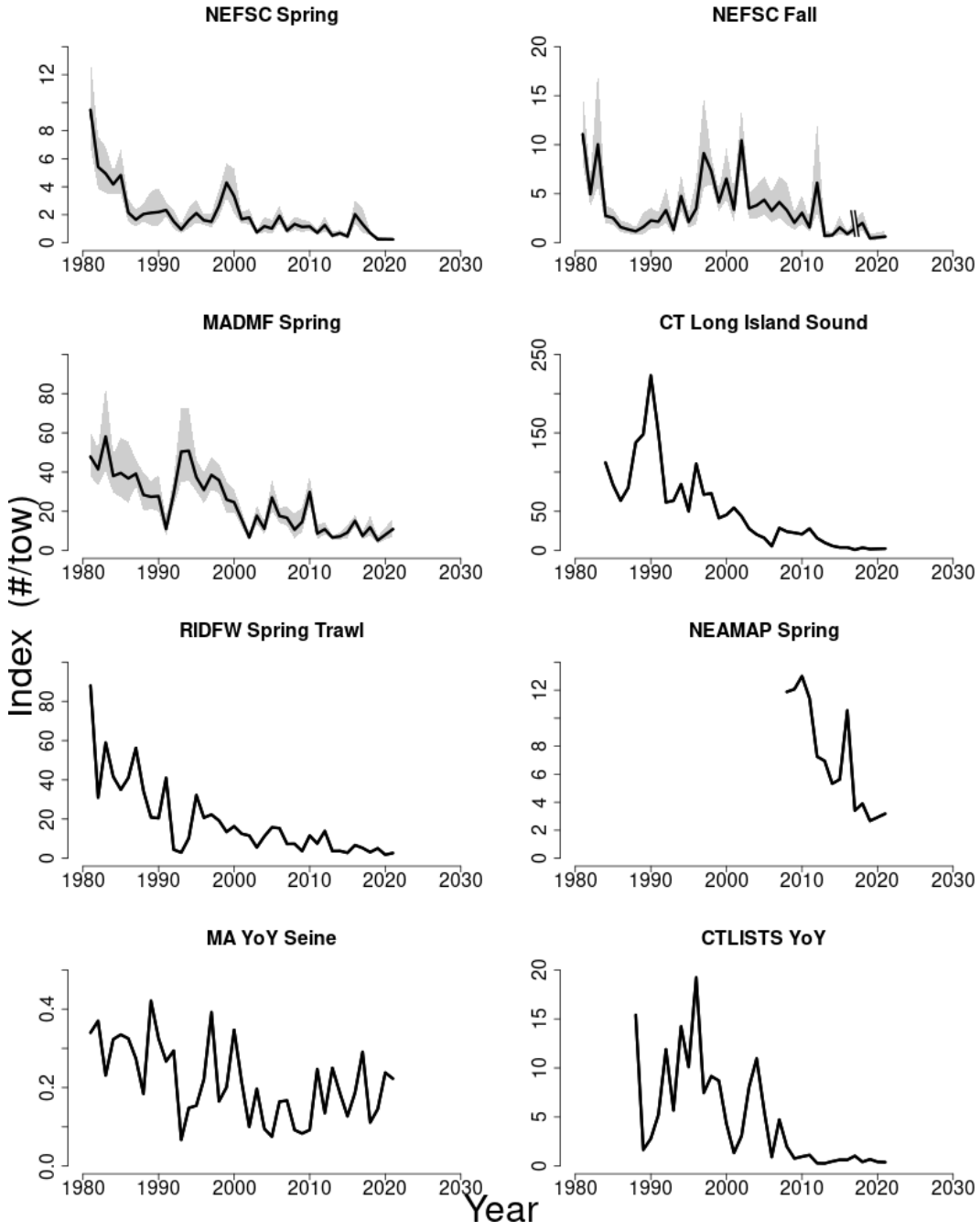

Figure 5: Indices of biomass for the Southern New England Mid-Atlantic winter flounder between 1981 and 2021 for the Northeast Fisheries Science Center (NEFSC) spring and fall bottom trawl surveys, the MADMF spring survey, the CT LISTS survey, the RIDFW Spring Trawl survey, the NJ Ocean Trawl survey, and two YoY surveys from MADMF and CT LISTS. Where available, the approximate 90% lognormal confidence intervals are shown. Slashes through the solid line indicate a hole in the survey time series.