draft working paper for peer review only

Atlantic Bluefish

2025 Management Track Assessment Report

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This assessment of the Atlantic Bluefish (Pomatomus saltatrix) stock is a management track update assessment of the 2022 research track assessment, and follows upon the 2023 management track assessment. Stock status for bluefish from the previous managment track assessment (data through 2022) found the stock was not overfished, and overfishing was not occurring. The current assessment updates commercial fishery catch data, recreational fishery catch data, research survey indices of abundance, and the analytical state-space WHAM assessment model and reference points through 2024. Additionally, stock projections have been updated through 2027.

State of Stock: Based on this updated assessment, the Atlantic Bluefish (*Pomatomus saltatrix*) stock is not overfished and overfishing is not occurring (Figures 1-2). Retrospective bias in model results was considered minor (mohn's rho: SSB = 0.15, F = -0.09) and retrospective adjustments were not necessary. Spawning stock biomass (SSB) in 2024 was estimated to be 77,065 (mt) which is 89% of the biomass target (SSB_{MSY} *proxy* = 86,627 (mt); Figure 1). The 2024 fully selected fishing mortality was estimated to be 0.108 which is 47% of the overfishing threshold (F_{MSY} *proxy* = 0.232; Figure 2).

Table 1: Catch and status table for Atlantic Bluefish. All weights are in (mt) recruitment is in (000s) and F_{Full} is the fishing mortality on fully selected ages. Model results are from the current updated WHAM assessment.

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
					Data					
Recreational landings	13,725	10,634	15,620	5,857	6,800	5,923	5,471	5,002	5,108	6,048
Recreational discards	2,710	2,689	3,322	1,177	2,138	1,913	2,063	2,690	2,356	1,534
Commercial landings	1,917	1,946	1,876	1,105	1,359	1,112	1,090	1,025	1,417	1,050
Commercial discards	14	14	7	8	10	7	12	9	15	5
Catch for Assessment	18,366	15,283	20,826	8,146	10,307	8,955	8,636	8,726	8,896	8,638
					Model Results					
Spawning Stock Biomass	40,396	39,762	36,186	30,436	38,915	41,522	40,336	51,324	74,029	77,065
Ffull	0.434	0.368	0.555	0.241	0.248	0.209	0.213	0.173	0.118	0.108
Recruits (age 0)	102,783	68,021	112,994	115,567	66,733	69,967	97,805	120,643	103,520	125,408

Table 2: Comparison of reference points estimated in the 2023 management track assessment and from the current assessment update. An $F_{35\%}$ proxy was used for the overfishing threshold and was based on SPR calculations. The SSBMSY is calculated using the value of SPR35% and mean recruitment.

	2023	2025
F_{MSY} *proxy*	0.239	0.232 (0.204 - 0.264)
SSB_{MSY} (mt)	88,131	86,627 (64,256 - 116,788)
MSY (mt)	18,979	20,100 (14,860 - 27,188)
Median recruits (age 0) (000s)	108,035	109,711
Overfishing	No	No
Overfished	No	No

Projections: Short-term projections were conducted in WHAM, and incorporate model uncertainty, auto-regressive processes, and uncertainty in recruitment and numbers-at-age. Removals in 2025 were assumed to be equal to the 2025 ABC (9,903 MT), and projections were carried forward for years 2026-2027 at FMSY= F35% = 0.232. Projected OFL catches in 2026 and 2027 based on this approach are 21,969 MT and 21,991 MT, respectively.

The projection used 5-year averages for natural mortality, maturity, fishery selectivity and weights-at-age. The 5-year average was selected for those parameters to capture the most recent conditions while still smoothing some

interannual variability. Projections were not retrospectively adjusted, as the adjusted terminal year estimates of F and SSB fell within the 90% confidence intervals of the unadjusted values.

Table 3: Short term projections of total fishery catch (OFL) and spawning stock biomass for Atlantic Bluefish based on a harvest scenario assuming the ABC (9,903 MT) was caught in 2025 and F35% (0.232) for 2026, and 2027.

Year	Catch (mt)	SSB (mt)	Ffull
2025	9,903	91,104 (62,002 - 133,865)	0.109

Year	Catch (mt)	SSB (mt)	Ffull
2026	21,969	98,160 (63,930 - 150,718)	0.232
2027	21,991	97,482 (60,715 - 156,514)	0.232

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).

  Some of the important sources of uncertainty relate to asessment data inputs and the availabilty of information that would help better understand the dynamics of bluefish. Research recommendations from the 2022 research track assessment fully detail these uncertaintities and data needs. A list of some of the research ideas designed to improve the bluefish stock assessment and reduce some of the uncertainties include:

  1. Expanding the collection of recreaional release length frequency data. The bluefish assessment stratifies recreational release lengths by region (North and South), and data in the southern region are lacking. These southern fish tend to be smaller and improved information related to the size distribution of the southern fish would help refine the estimate of recreational disard weight. The review panel from the 2023 managment track assessement emphasized the importance of this research recommendation:

  "Obtaining better data on recreational discard lengths would be valuable. This endeavor relies on volunteer angler reporting such as was done previously in South Carolina. NMFS should consider developing an app that can be used by anglers to report discard lengths. Because self-reporting can introduce bias, the statistical issues should also be explored."

  There are a number of recreational fishing apps now available or coming online in the near future to collect recreational release lengths. Information from these new apps could be explored in future assessments.

  2. Addressing the uncertainty around temporal availability of bluefish to the fisheries and surveys. The research track assessment made significant advancements in developing an index of bluefish availability based on forage fish in the diets of bluefish like predators. This forage fish index was incorporated into a companion assessment model as a covariate on MRIP CPUE catchability. Further developing this index will help improve the assessment model fit to the MRIP CPUE information, which is an important index that helps scale biomass estimates from the model. The advancement of this companion model will depend on consistent survey data availability going forward.

  The peer review panel from the 2023 management track also touched upon the importance of bluefish availability to the assessment:

  "The Panel discussed the value of the WHAM model to further explore environmental variables that might be driving availability of bluefish. Of particular interest is the episodic spatial distribution of large bluefish. Their presence inshore and availability to the fishery is inconsistent with attributed numbers and the drivers of this availability uncertain."

  The companion model was not considered or further developed during this management track because of the current on-going MRIP FES calibration that should be available in 2026. Once MRIP data are finlaized and data changes have been addressed in the current model, model advancements will then be explored. The

seasonal forage fish indices are updated annually for the State of the Ecosstem Report for the Northeast U.S Shelf and will be revisited within the companion model in future assessments.

3. Develop fishery dependent or independent sampling programs to provide information on larger, older bluefish. The dynamics of this size class are not well sampled or understood and the model relies heavily on the PSIGNS index for information about these older age classes.

4. Develop an updated recreational release mortality study to derive a more informed estimate of recreational discard mortality. Recreational discards are a significant proportion of the total catch so reducing the uncertainty around the release mortality is important.

- 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 5-year Mohn's ρ, relative to SSB, was 0.22 in the 2023 assessment and was 0.15 in 2024. The 5-year Mohn's ρ, relative to F, was -0.14 in the 2023 assessment and was -0.09 in 2024. This is considered a minor retrospective pattern for both SSB and F because the ρ adjusted estimates of 2024 SSB (SSB_{ρ}=67,013) and 2024 F (F_{ρ}=0.119) were within the approximate 90% confidence regions around SSB (54,499 - 108,976) and F (0.076 - 0.153). 5-year peels were chosen by the research track working group given the truncated age-structure (0-6+) used for the assessment model data inputs

- 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 Atlantic Bluefish are reasonably well determined. The WHAM model projections allows for the incorporation of model uncertainty, auto-regressive processes, and the uncertainty in recruitment and numbers-at-age. The retrospective pattern in F and SSB is considered minor (within the 90% CI of both F and SSB), and the rho values of F and SSB have decreased when compared to the previous management track assessment.

  The Atlantic Bluefish stock is in a rebuilding plan with a rebuild date of 2028. A short term projection assuming the ABC (9,903 MT) for 2025, and fishing at $F_{35\%}$ for 2026 and 2027, indicates the stock is likely to be rebuilt this year, ahead of the 2028 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.

  The methodology for calculating recreational discard weight was updated to fully align with research track methods for this Atlantic Bluefish assessment update. The recreational discard weight of Atlantic bluefish is a key component of the recreational weight-at-age matrix and total weight vector used as input to the stock assessment model. In 2022, the research track working group developed a methodology to estimate recreational discard weight using a season-region level of stratification. However, during the 2023 management track assessment, it was discovered that the code used to generate these estimates did not fully implement the research track methodology.

  *For the previous management track (Continuity methodology), the raw regional length vectors were summed before the B2 number length expansion was done at the season level. This caused issues depending on how many release length observations were available, and the distribution of B2 numbers by season and region. When the number of season/region length observations is < 30, the cumulative season/region length frequency is used. In the terminal years of the time series where borrowing is often necessary in the Southern region, the information contributed by the Southern **cumulative** vector dominates the Northern **observed** vector, and results in a seasonal length distribution that is biased to smaller fish. The Continuity methodology results in a lower estimated release weight than the weight calculated using the Research Track Methodology in these years. The Research Track methodology carries out the B2 number length expansion at the season/region level, and sums the expanded regional vectors to get expanded lengths by season. This methodology better accounts for the regional size differences in the release weight calculations, and is the preferred methodology for the Atlantic bluefish assessment.*

A full analysis of the data and model results was conducted to compare the two methodologies. The analysis fully addresses the differences in methods, updates the data processing code to align with the peer-reviewed research track methodology, and conducts a sensitivity analysis to capture any differences between the methods (See working paper: SASINF).

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

  Stock status of Atlantic Bluefish has not changed from the status determined in the research track assessment.

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

  The Atlantic Bluefish stock has experienced an increase in SSB over the past 6 years, and is at 89% of the current SSB_{Target} Recruitment has generally increased since 2019, and the terminal year recruitment (125 million fish) is the highest value since 2005. Both commercial and recreational fisheries have had low catches since 2018, all well below the time series average of 25,313 MT. Coinciding with the low catches since 2018, fishing mortality has decreased and remained well below FMSY (0.232). These low catches could partially be the result of a reduced bag limit implemented in 2020, or stem from decreased bluefish availability in recent years.

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

  The 2022 bluefish research track identified several new research recommendations that would improve out understanding of bluefish dynamics and help better assess the population through the current or future models. These recommendations include: expand collection of recreational release length frequency data, continue development and refinement of the forage fish/availability index as well as incorporation of this index in to a base model for bluefish management advice, initiate additional fisheries-independent surveys or fishery-dependent sampling programs to provide information on larger, older bluefish, continue coastwide collection of length and age samples from fishery-independent and -dependent sources, and refinement of current or development of new indices of abundance (VAST).

- Are there other important issues?

  The most important issue currently facing this assessment is the upcoming MRIP FES calibration expected to be complete in 2026. The bluefish assessment relies heavily on MRIP data (90% of the information going into the assessment is from MRIP) and significant changes to the data could impact model results and reference point calculations. The new data is anticipated to be implemented in the 2027 management assessment.

  Another important topic will be to re-visit a companion model that was developed during the research track. This model leveraged the advanced capabilities of WHAM and investigated a forage fish index as a covariate on catchability of the MRIP CPUE. The model was included in the research track peer review and showed promise for continued development. Once the new MRIP data are finalized and incorporated into the assessment, advancements to the bluefish companion model will be explored.

References:

Northeast Fisheries Science Center. 2023. Management Track Assessments Spring 2023 NOAA technical memorandum NMFS-NE; 308. https://doi.org/10.25923/nr1z-2p95

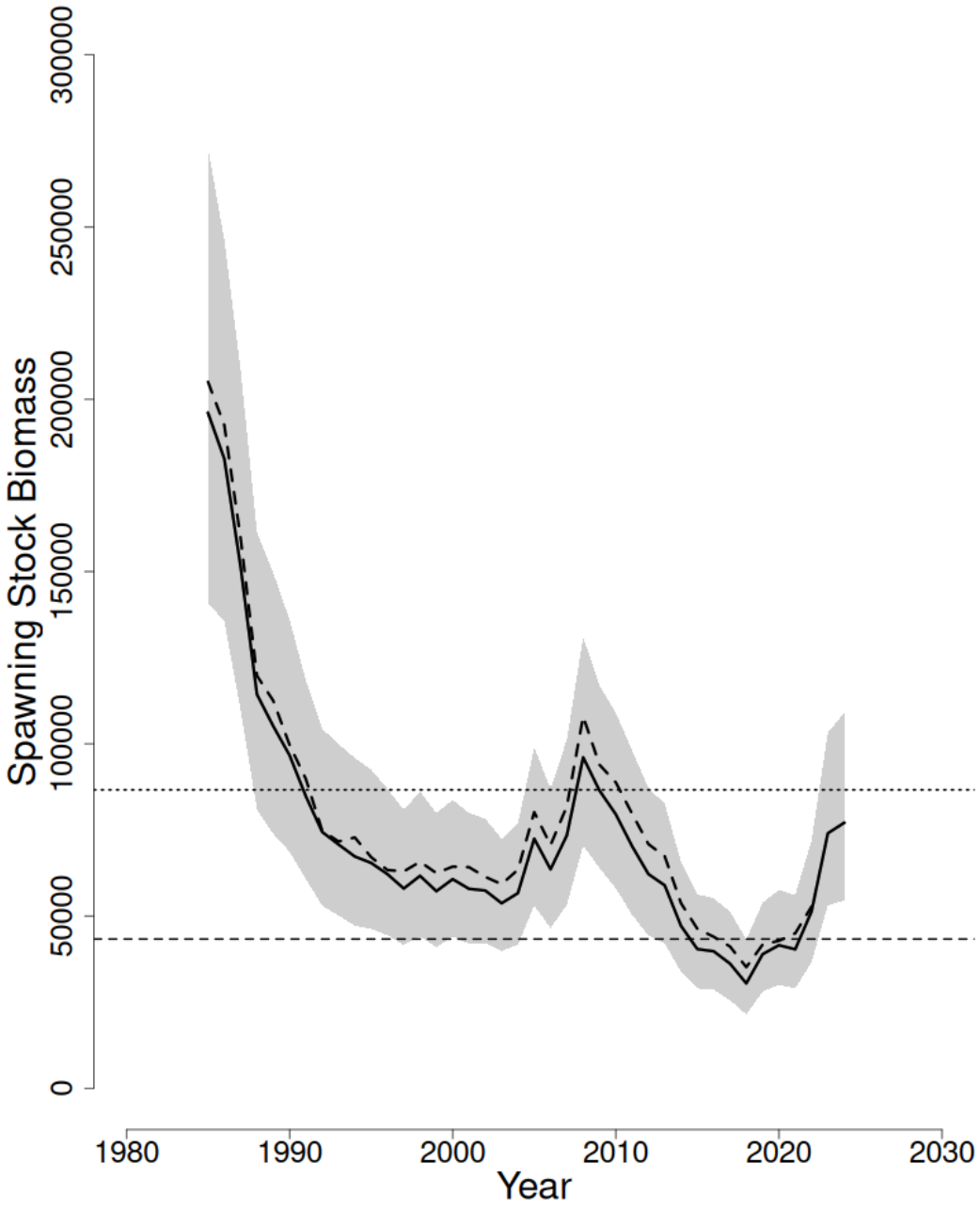

Figure 1: Trends in spawning stock biomass of Atlantic Bluefish between 1985 and 2024 from the current (solid line) and previous (dashed line) management track assessment and the corresponding $SSB_{Threshold}$ ($\frac{1}{2}$ SSB_{MSY} *proxy*; horizontal dashed line) as well as SSB_{Target} (SSB_{MSY} *proxy*; horizontal dotted line) based on the 2025 assessment. The approximate 90% lognormal confidence intervals are shown.

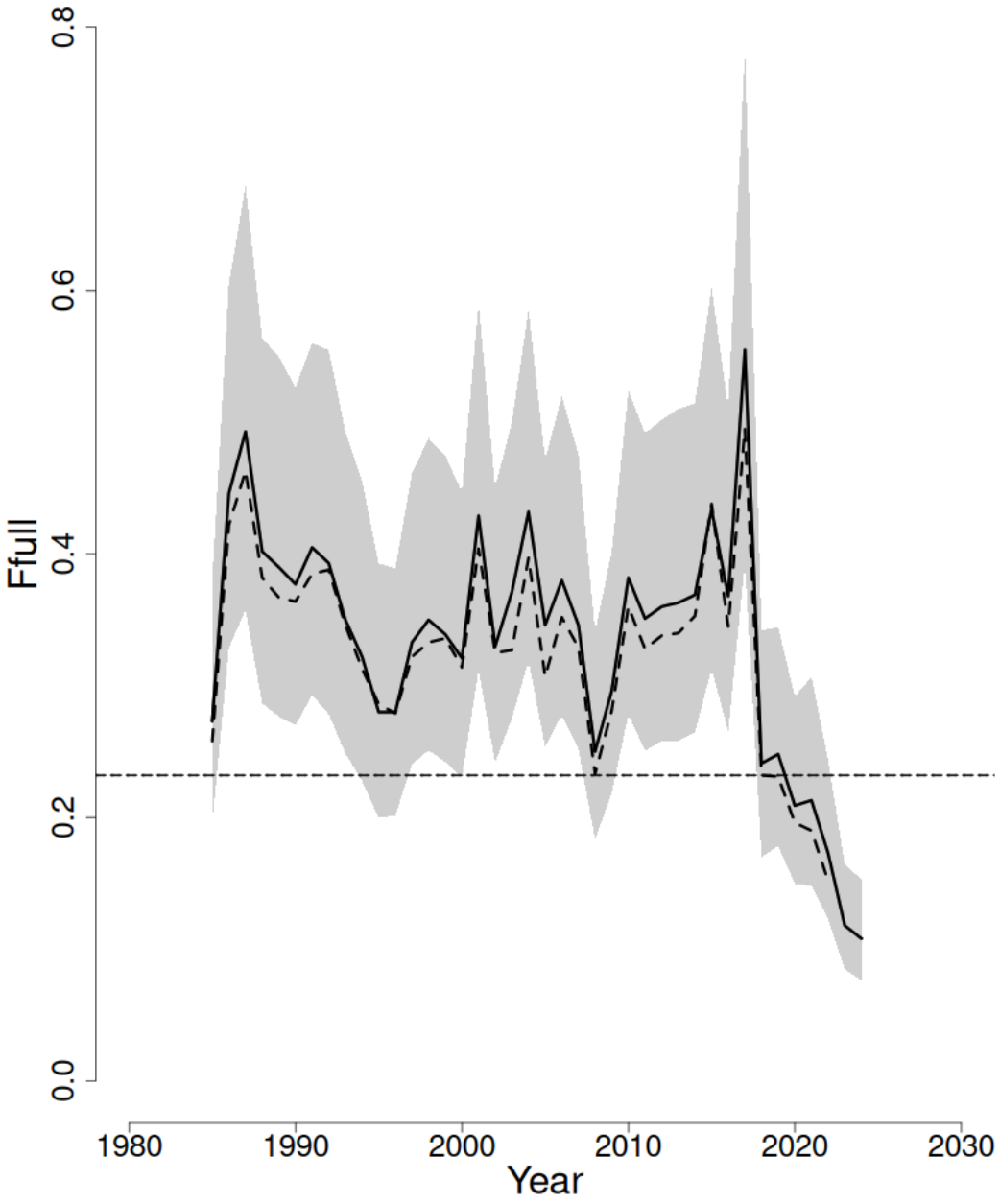

Figure 2: Trends in the fully selected fishing mortality (F_{Full}) of Atlantic Bluefish between 1985 and 2024 from the current (solid line) and previous (dashed line) management track assessment and the corresponding $F_{Threshold}$ (F_{MSY} *proxy*=0.232; horizontal dashed line). The approximate 90% lognormal confidence intervals are shown.

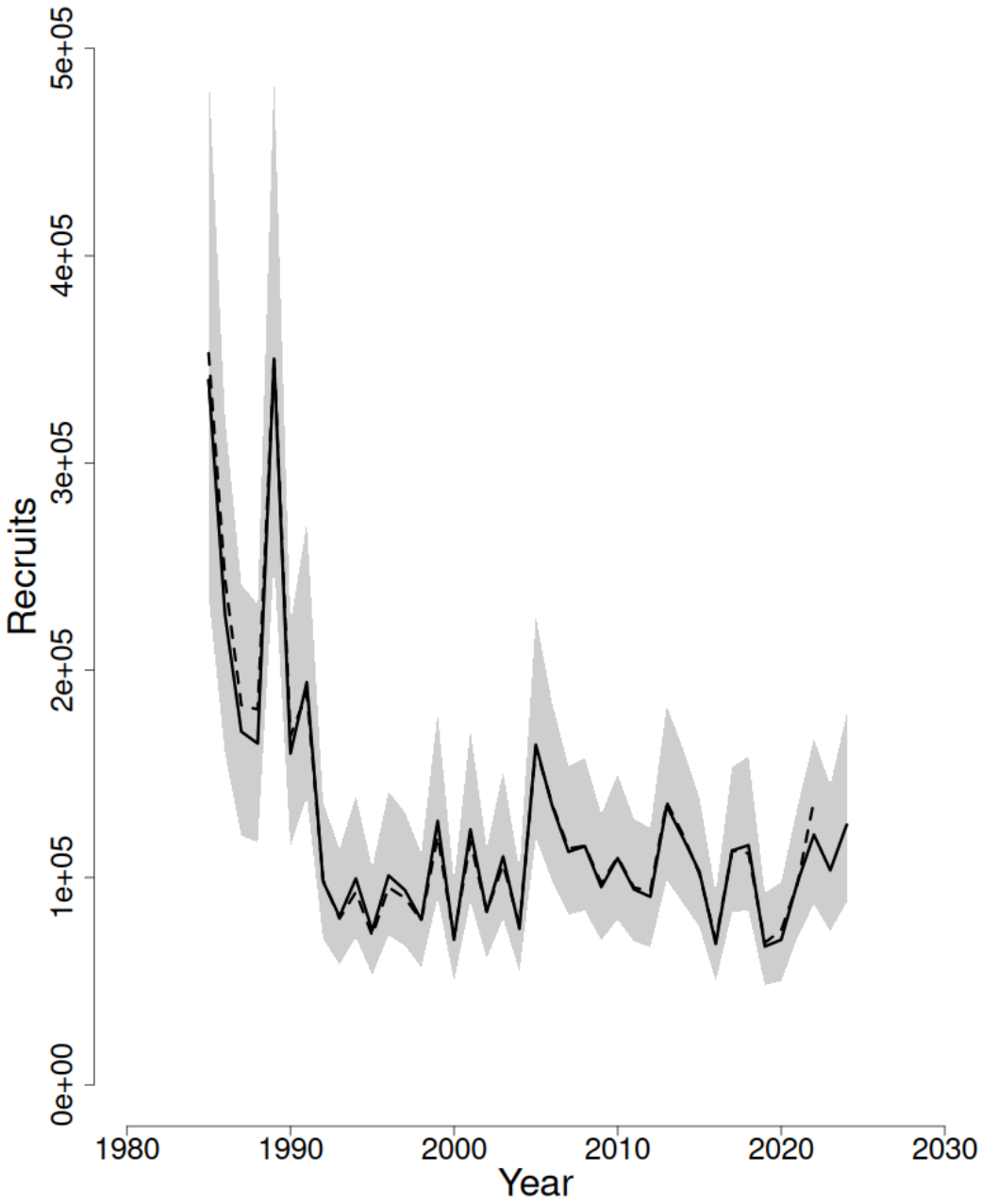

Figure 3: Trends in Recruits (age 0) (000s) of Atlantic Bluefish between 1985 and 2024 from the current (solid line) and previous (dashed line) management track assessment. The approximate 90% lognormal confidence intervals are shown.

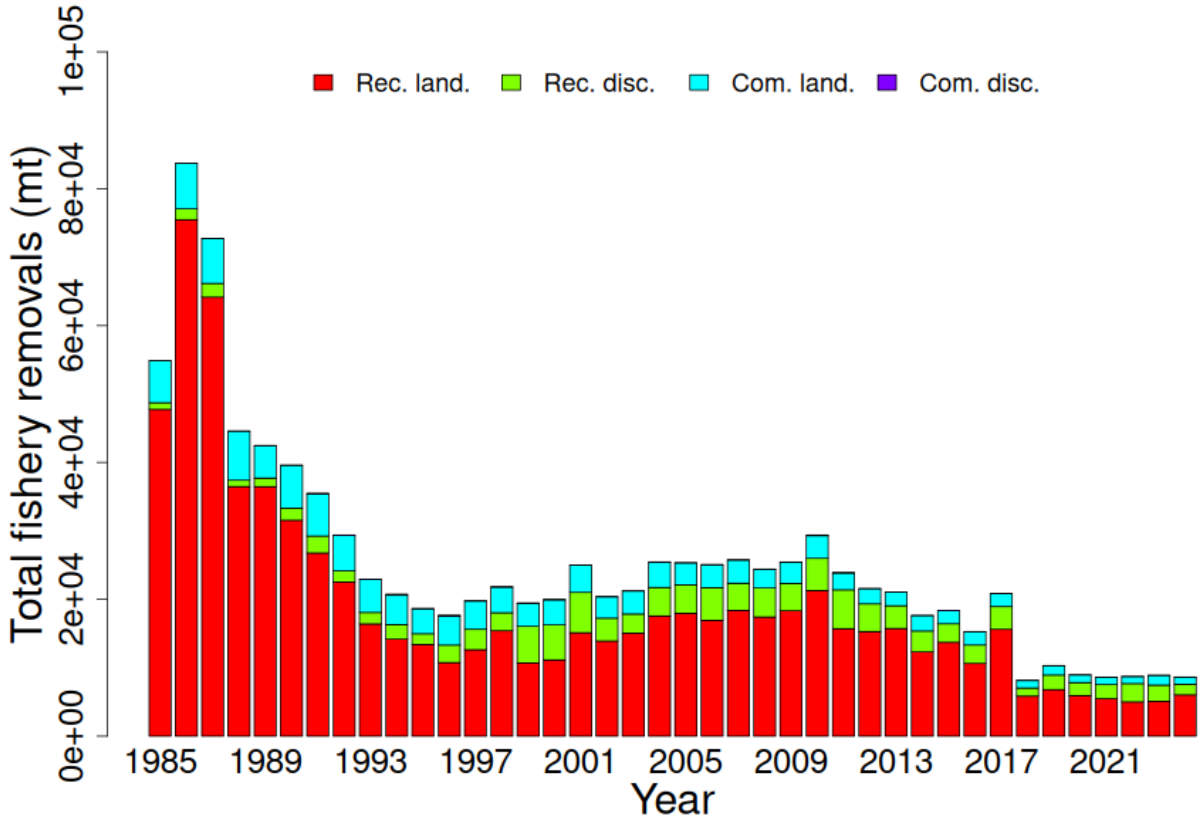

Figure 4: Total catch of Atlantic Bluefish between 1985 and 2024 by fleet (Recreational and Commercial) and disposition (landings and discards).

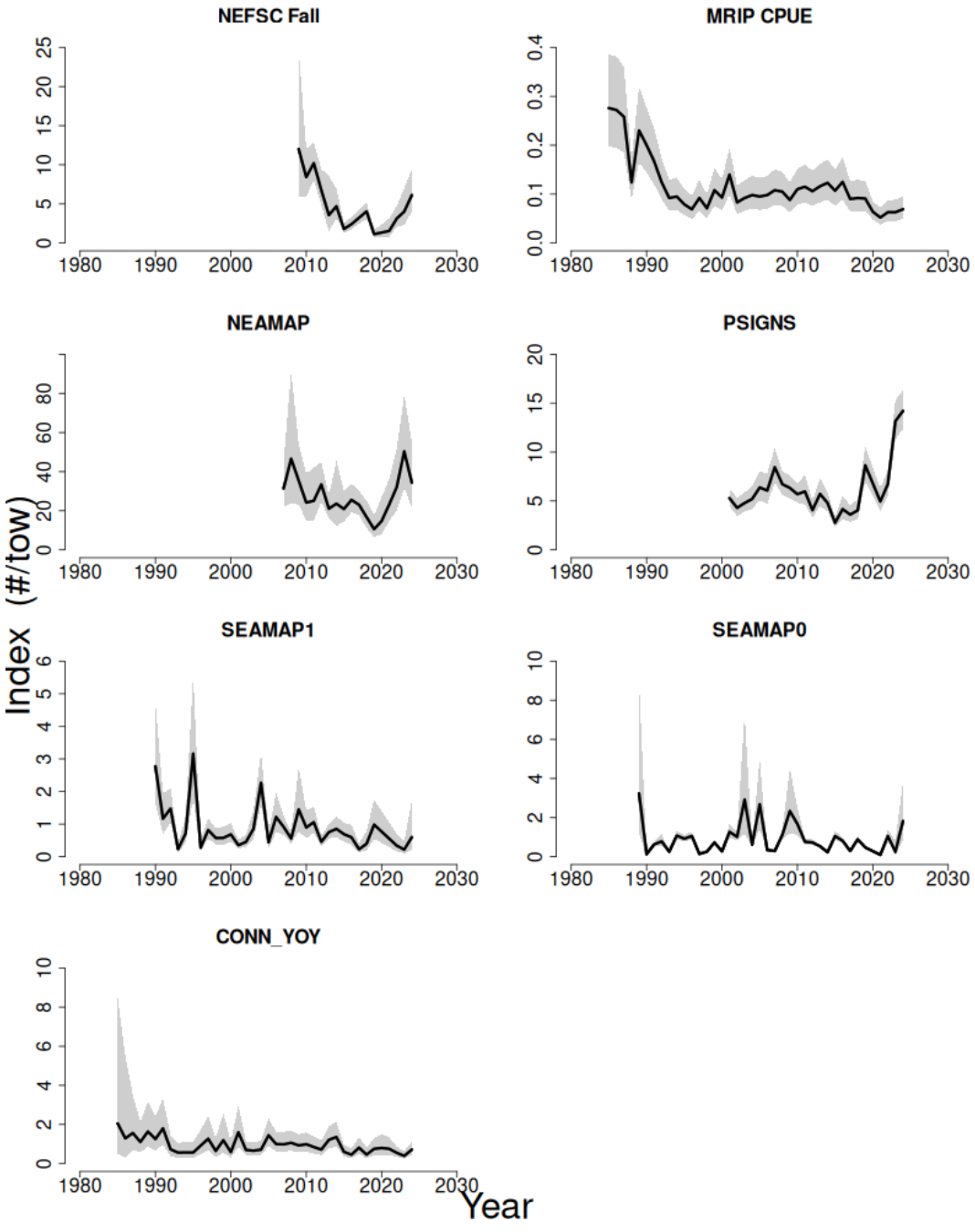

Figure 5: Atlantic Bluefish indices of abundance for the most important regional and state surveys. The approximate 90% lognormal confidence intervals are shown.