draft working paper for peer review only

Atlantic Herring

2026 Management Track Assessment Report

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National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, Massachusetts

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This assessment of the Atlantic Herring (Clupea harengus) stock is a management track assessment, and is the first application of the WHAM assessment platform following the 2025 research track assessment (NEFSC 2025). The last management track assessment was in 2024 and was conducted using the ASAP model. Based on that assessment, the stock was overfished but overfishing was not occurring. This assessment updated fishery catch data, survey indices, life history parameters (e.g., weights-at-age), and the WHAM assessment model and reference points (BRPs) through 2025. The change in assessment platforms from the 2024 management track makes comparisons among the assessments inappropriate. Several relatively minor changes have been made since the resarch track. Namely, a revised Canadian catch time series was used, a different approach was used for input effective sample sizes, and spawning stock biomass weight-at-age values were corrected.

State of Stock: Based on this management track assessment, the Atlantic Herring stock is overfished and overfishing is not occurring (Figures 1-2). Retrospective adjustments were not necessary (SSB Mohn's rho = 0.22 and F Mohn's rho = -0.04). Spawning stock biomass (SSB) in 2025 was estimated to be 35,258 (mt) which is 19% of the biomass target (SSB_{MSY} *proxy* = 188,214; Figure 1). The 2025 average, mobile fleet, fishing mortality for ages 7-8 (fully selected) was estimated to be 0.121 which is 44% of the overfishing threshold proxy (F_{MSY} *proxy* = 0.272; Figure 2).

Table 1: Catch and status table for Atlantic Herring. All weights are in mt, recruitment is in 000s, and $\bar{F}_{7-8}$ is the average, mobile fleet, fishing mortality on ages 7 to 8, which are fully selected. Model results are from the current WHAM assessment and no adjustment for retrospective pattern was necessary.

	2018	2019	2020	2021	2022	2023	2024	2025
				Data				
US Catch	45,527	12,792	9,864	5,210	4,239	10,165	10,447	3,265
Canadian Catch	13,426	6,496	6,965	4,877	4,347	1,960	2,965	3,884
Total Catch	58,953	19,289	16,829	10,087	8,586	12,125	13,412	7,149
				Model Results				
Spawning Stock Biomass	21,075	56,484	36,912	36,983	85,973	79,843	47,877	35,258
$\bar{F}_{7-8}$	1.656	0.4	0.445	0.199	0.109	0.222	0.315	0.121
recruits (age1)	559,391	4,457,469	2,278,256	799,145	706,515	743,734	456,155	1,966,904

Table 2: Reference points from the 2024 ASAP assessment and the current WHAM assessment are incomparable and are provided for information only. A fleet specific, mobile fleet $F_{40\%}$ proxy was used for the overfishing threshold, and the biomass proxy reference point was estimated using the mean of the recruitment process. 90% CI were reported in parentheses.

	2024	2026
F_{MSY} *proxy*	0.45	0.272
SSB_{MSY} (mt)	186,367 (95,900 - 340,000)	188,214 (123,672 - 286,439)
MSY mt	78,710 (45,000 - 128,800)	55,211 (35747 - 85273)
Median recruits (age 1)	2,493,500 (485,400 - 9,107,300)	2,324,046
Overfishing	No	No
Overfished	Yes	Yes

Projections: The projection results included here should be considered preliminary and subject to change based on future assessment and management decisions. This example projection applied the harvest control rule described in Amendment 8 of the hering Fishery Management Plan to the mobile fleet. The fixed gear catches are assumed constant during the projection period and equaled 5,283 mt. This fixed gear catch equals the sum of the ten year (2016-2025) averages of the Canadian (5,130 mt) and US (152 mt) fixed gear catches. The US fixed gear

catches are those from stop seines, weirs, and pound nets. The reported $\bar{F}_{7-8}$ are those for the mobile fleet. Projected recruitment continued the independent and identically distributed process estimated by WHAM. NAA random effects did not persist into the projection period.

Table 3: Projection results.

Year	Catch mt	SSB (mt)	$\bar{F}_{7-8}$
2026	13,165	26,102	0.383

Year	Catch mt	SSB (mt)	$\bar{F}_{7-8}$
2027	6,222	77,841	0.021
2028	18,297	140,644	0.171
2029	27,637	184,357	0.218
2030	32,854	214,543	0.218
2031	38,169	235,978	0.218

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 definitive explanation for the continued poor recruitment has not been identified. While identifying a causal mechanism for poor recruitment would be immensely beneficial, finding explanations for patterns in recruitment have been elusive in fisheries science for decades. The research track assessment explored several hypotheses to explain poor recruitment but no definitive answer was reached. The numbers-at-age random effects in this assessment also imply that abundance of older herring is declining at rates faster than fishing and natural mortality alone would suggest. Like recruitment, no definitive explanation is available. Another uncertainty in this assessment is natural mortality. In this assessment, natural mortality was assumed constant among ages and years. The research track assessment explored several options for time- and age-varying natural mortality, but available data did not support such a change. Stock structure, particularly mixing with Nova Scotian or Bay of Funday herring, is also an uncertainty, but data to inform migration and mixing rates are unavailable.

- 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 $\bar{F}_{7-8}$ lies outside of the approximate joint confidence region for SSB and $\bar{F}_{7-8}$).

  This assessment model had a retrospective pattern that could be classified as minor and no adjustments were 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?

  The projections are uncertain, especially in regards to recruitment and the treatment of numbers-at-age random effects. The data do not currently support autocorrelated recruitment even though recent recruitment has been consistently poor. The projections effectively assume an immediate return to mean recruitment, and if this is not realized, the projections are likely to be overly optimistic. Likewise, the data do not support temporal autocorrelation in the numbers-at-age random effects either, but there seems to be a long-term, negative trend. Numbers-at-age random effects do not continue into the projection period, but if they remain negative in the future, the projections will be overly optimistic. The projections updated for this management track confirm that the projections done for the research track were overly optimistic. The stock is currently in a rebuilding schedule, but that schedule was developed using previous assessments completed in the ASAP model. The methods for reference points and projections in the WHAM model are not comparable to those from ASAP, making a comparison of these projections to the existing rebuilding plan inappropriate.

- 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.

  Since the previous management track, this assessment transitioned from ASAP to WHAM. While WHAM differs in many ways from ASAP, the general conclusions about reduced productivity (e.g., poor recruitment) and stock status were unaffected. In addition to a switch to WHAM, a revised Canadian catch time series was used, a different approach was used for input effective sample sizes, and spawning stock biomass weight-at-age values were corrected. None of these changes had significant impacts on estimated quantities or stock status.

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

  The stock status has not changed a lot since the previous assessment.

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

  Continued poor recruitment and negative numbers-at-age random effects (e.g., poor survival) in recent years is the main issue driving stock status. Management decisions that reduced US catches had the effect of avoiding overfishing.

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

  The research track assessment explored several explanations for poor recruitment, and while no definitive answer was reached, continued consideration of various hypotheses (e.g., haddock predation on herring eggs, copepod abundance, temperature) is warranted. Terminal year recruitment estimates are likely to be over estimated without an index of age-1 abundance (or under estimated should recruitment be above average). An age-1 index based on bird diet has been developed, but several challenges remain before it can be included. State (ME/NH, MA) surveys catch age-1 herring, and combining those surveys with NMFS bottom trawl data may be worthwhile. Work to improve projections and address consistently overly optimistic results would be generally beneficial. In particular, studies that quantify projection accurarcy and how to treat recruitment and NAA random effects in the projection period would be highly informative.

- Are there other important issues?

  No other important issues were identified.

References:

NEFSC (Northeast Fisheries Science Center) . 2025. Atlantic herring research track assessment report. US Dept. of Commerce, NEFSC Tech Memo. 335; 91p.

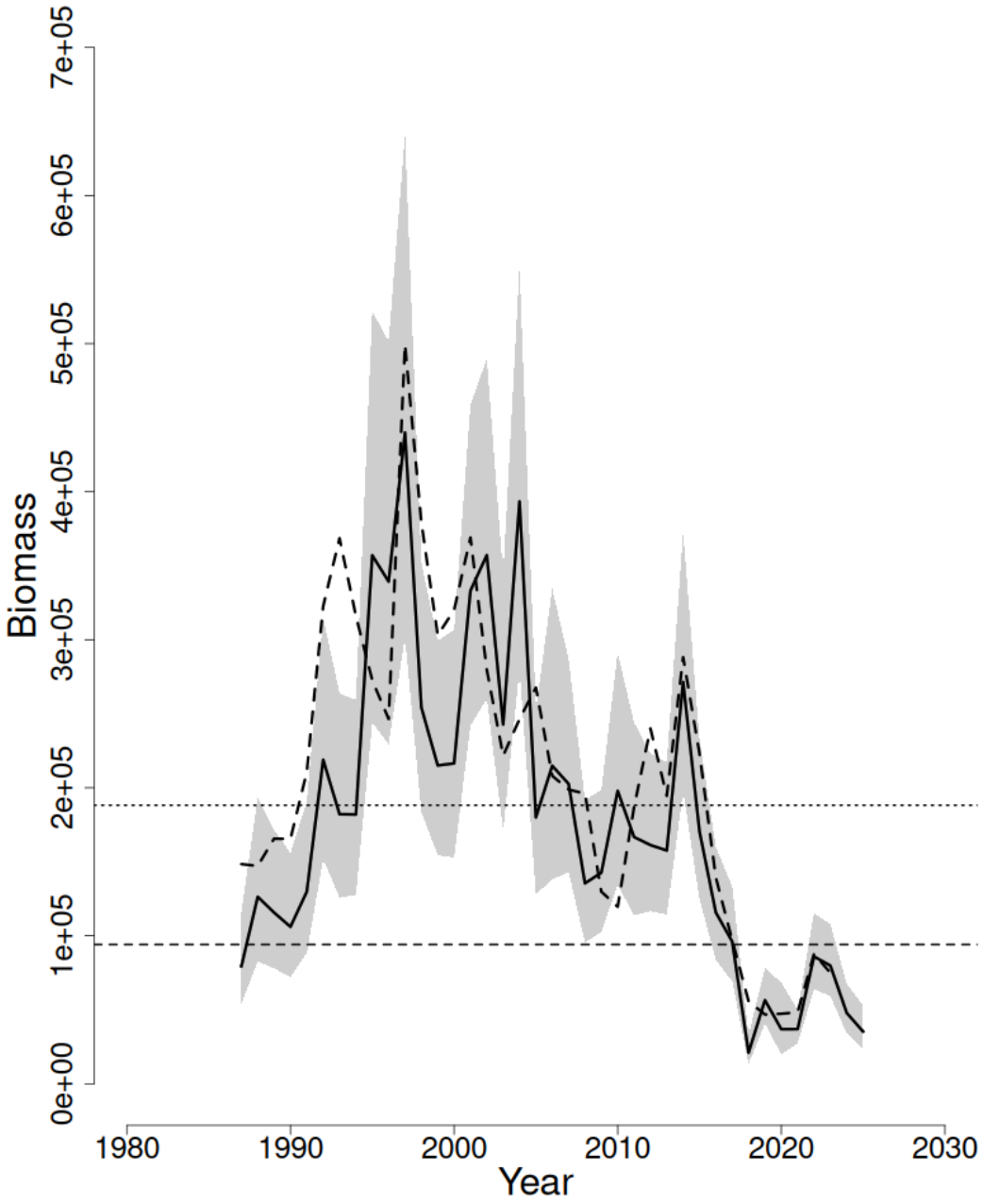

Figure 1: Trends in spawning stock biomass of Atlantic Herring between 1987 and 2025 from the current (solid line) and previous (dashed line) assessment and the corresponding $SSB_{Threshold}$ ($\frac{1}{2}$ SSB_{MSY} *proxy*; horizontal dashed line) as well as SSB_{Target} (SSB_{MSY} *proxy*; horizontal dotted line) based on the 2026 assessment. The approximate 90% confidence intervals are shown.

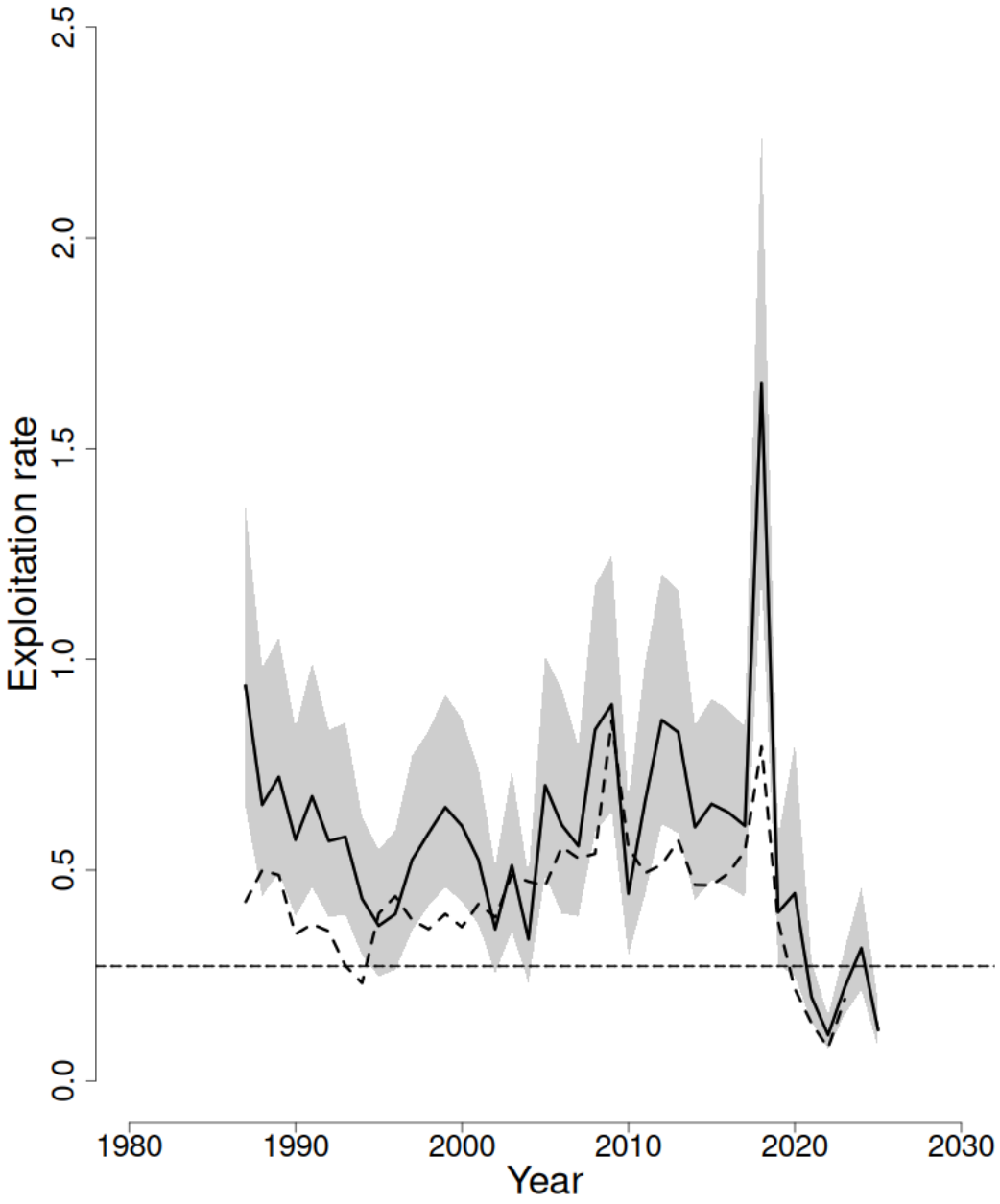

Figure 2: Trends in the average fishing mortality rate for ages 7-8, which are fully selected by the mobile fleet ($\bar{F}_{7-8}$), between 1987 and 2025 from the current (solid line) and previous (dashed line) assessment and the corresponding $F_{Threshold}$ (F_{MSY} *proxy*=0.272; horizontal dashed line). The approximate 90% confidence intervals are shown.

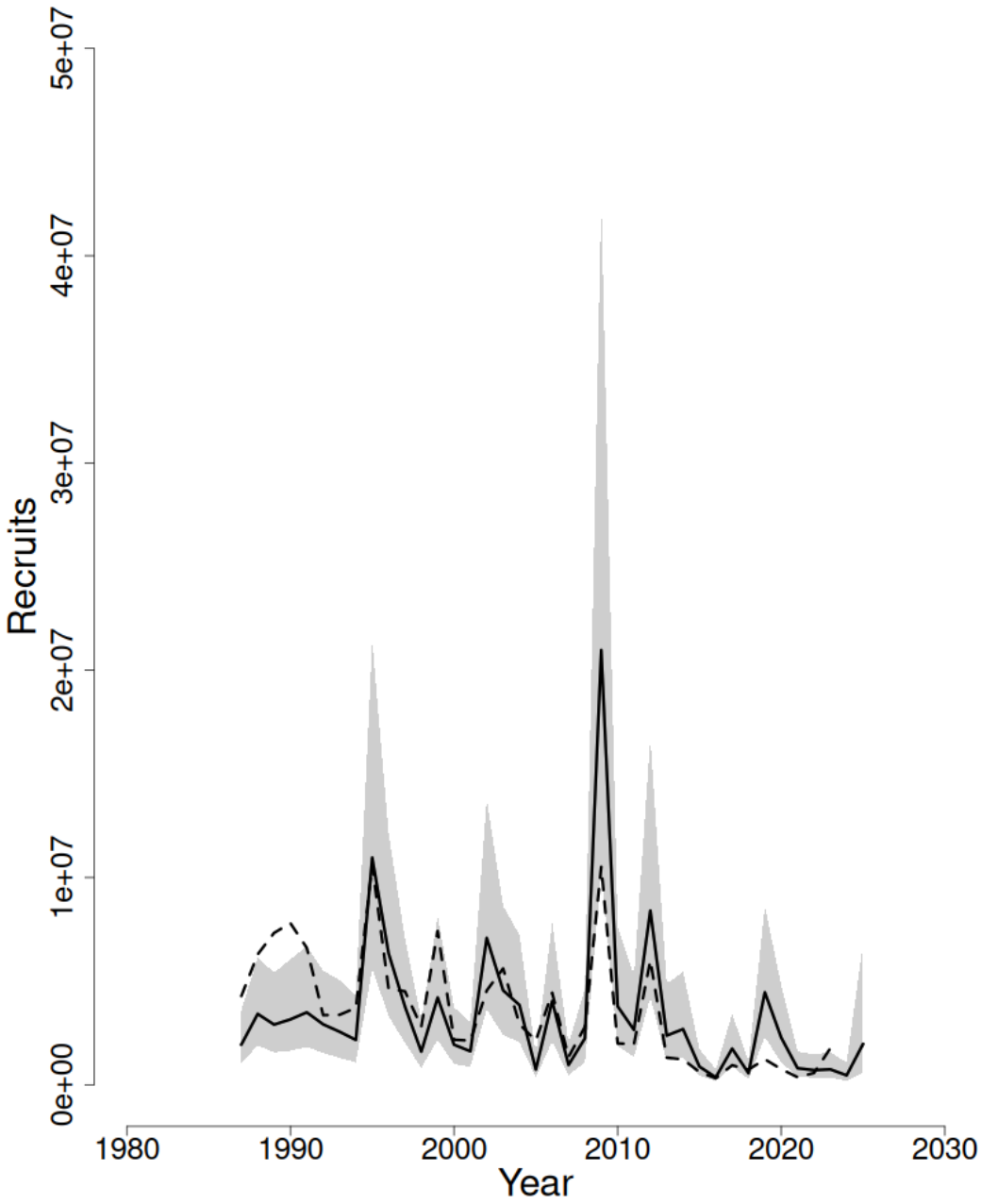

Figure 3: Trends in recruits (age-1)(000s) of Atlantic Herring between 1987 and 2025 from the current (solid line) and previous (dashed line) assessment. The approximate 90% confidence intervals are shown.

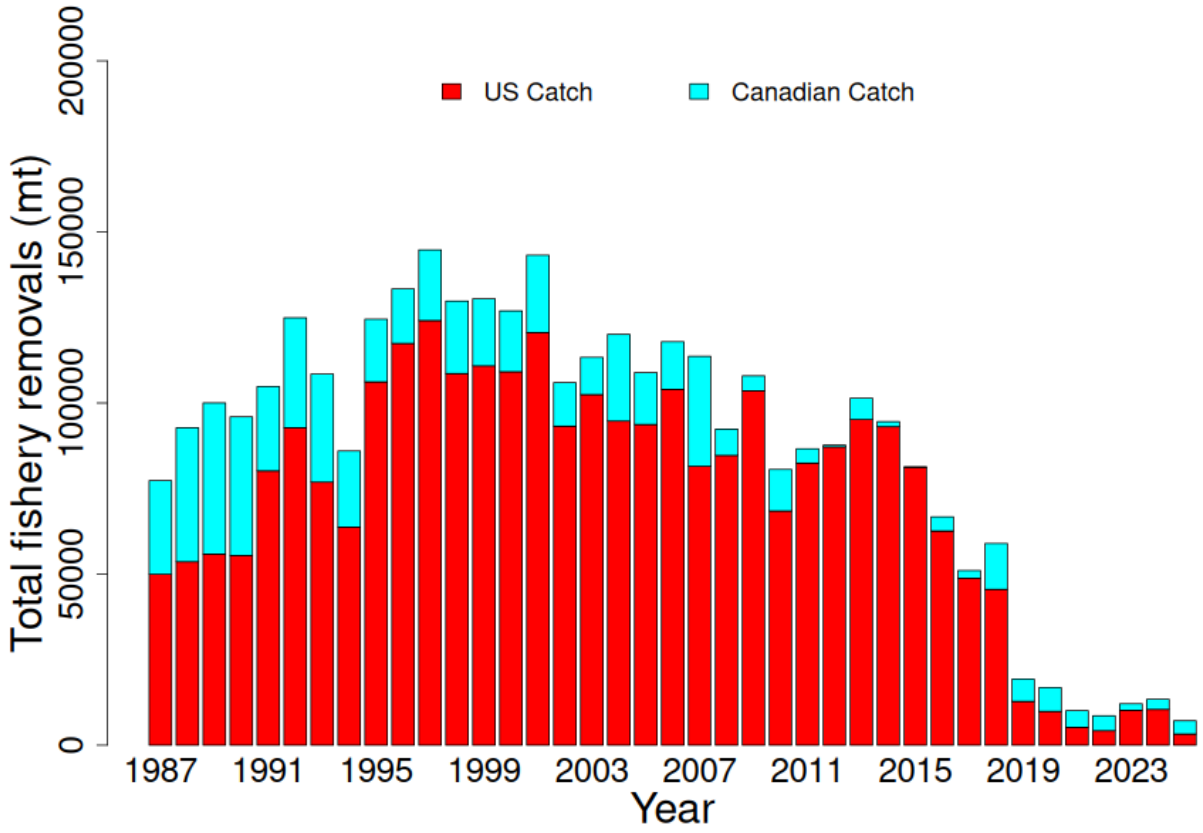

Figure 4: Total catch of Atlantic Herring between 1987 and 2025 by US and Canadian fleets.

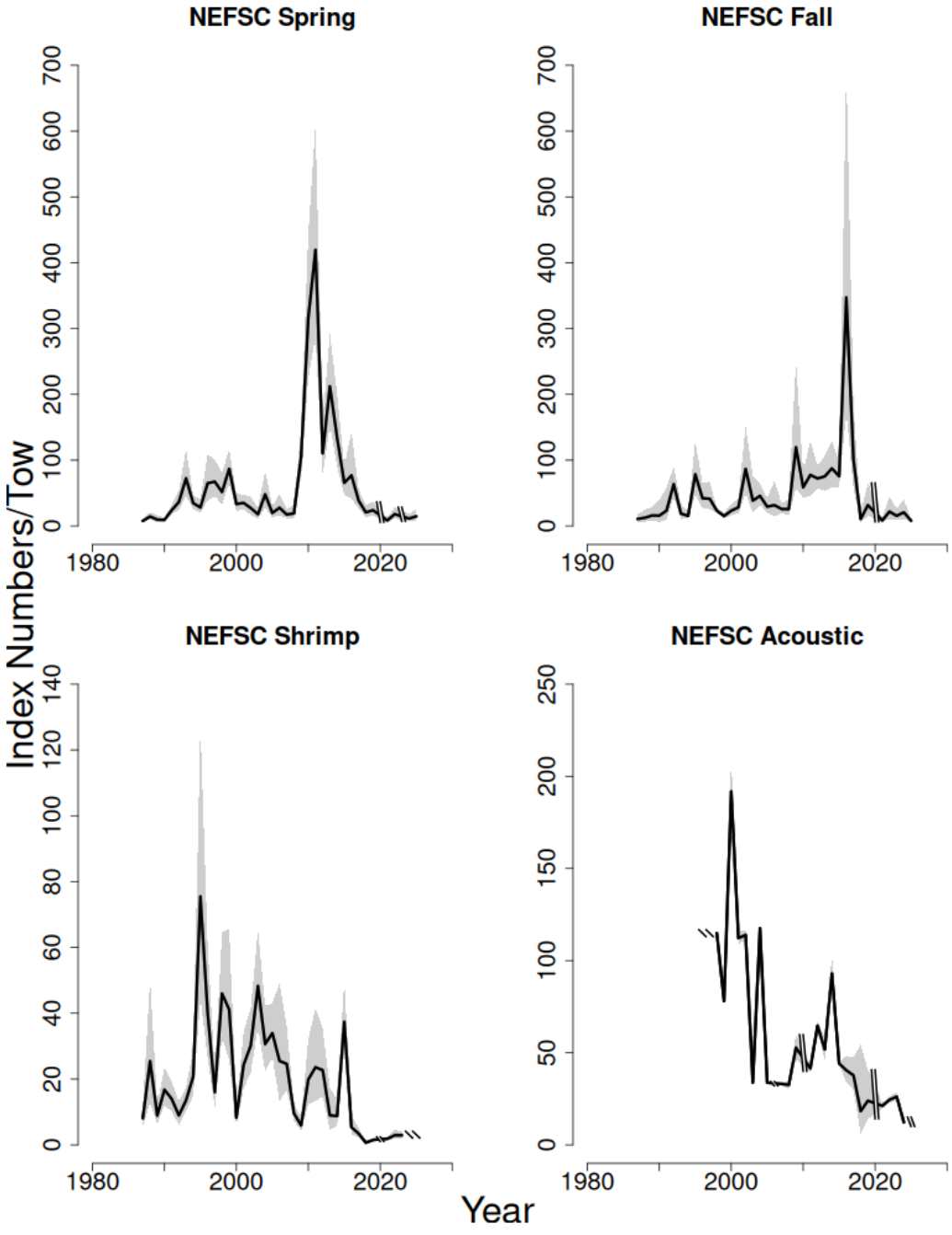

Figure 5: Indices of abundance for Atlantic Herring between 1987 and 2025 for the Northeast Fisheries Science Center (NEFSC) spring, fall, and shrimp bottom trawl surveys. The NEFSC acoustic index is collected during the fall bottom trawl survey and is in units of acoustic backscatter, not absolute numbers. The approximate 90% confidence intervals are shown.