draft working paper for peer review only

Summer flounder

2023 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

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This assessment of the Summer flounder (Paralichthys dentatus) stock is an update of the existing 2021 Management Track Assessment (NEFSC 2022). Based on the previous assessment the stock was not overfished and overfishing was not occurring. This 2023 Management Track Assessment updates fishery catch data, research survey indices of abundance, the ASAP assessment model, and biological reference points through 2022. Additionally, stock projections have been updated through 2025.

State of Stock: Based on this updated assessment, the Summer flounder (*Paralichthys dentatus*) stock is not overfished and overfishing is occurring (Figures 1-2). Retrospective adjustments were not made to the model results. Spawning Stock Biomass (SSB) in 2022 was estimated to be 40,994 mt which is 83% of the biomass target for this stock (SSB_{MSY} *proxy* = 49,561; Figure 1). The 2022 fully selected fishing mortality was estimated to be 0.464 which is 103% of the overfishing threshold proxy (F_{MSY} *proxy* = 0.451; Figure 2).

Table 1: Catch and model results for Summer flounder. All weights are in (mt), recruitment is in (000s), and F_{Full} is the fishing mortality on fully selected age 4. Model results are unadjusted values from the current updated ASAP assessment.

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
					Data					
Commercial landings	5,696	4,989	4,858	3,537	2,644	2,787	4,109	4,282	4,936	5,683
Commercial discards	863	830	703	772	906	979	783	1,163	873	680
Recreational landings	8,806	7,364	5,366	6,005	4,565	3,447	3,537	4,571	3,092	3,916
Recreational discards	2,119	2,092	1,572	1,482	1,496	1,003	1,379	1,141	997	1,336
Catch for Assessment	17,483	15,275	12,498	11,796	9,611	8,216	9,808	11,157	9,898	11,615
					Model Results					
Spawning Stock Biomass	52,155	47,841	42,424	39,209	37,040	37,599	38,846	43,024	41,615	40,994
F_{Full}	0.473	0.439	0.427	0.428	0.345	0.304	0.37	0.417	0.371	0.464
Recruits (age 0)	35,208	38,700	27,000	30,551	38,876	43,028	39,933	35,629	42,323	38,371

Table 2: Comparison of biological reference points estimated in the previous assessment and from the current assessment update. An $F_{35\%}$ proxy was used for the overfishing threshold and SSB and MSY proxies were based on long-term stochastic projections.

	2021	2023
F_{MSY} *proxy*	0.422	0.451
SSB_{MSY} (mt)	55,217	49,561 (38,181 - 64,301)
MSY (mt)	15,872	14,097 (11,020 - 18,114)
Median recruits (age 1) (000s)	49,954	46,966
Overfishing	No	Yes
Overfished	No	No

Projections: Short term projections of catch (OFL) and Spawning Stock Biomass (SSB) were derived by sampling from an empirical cumulative distribution function of the 12 most recent recruitment estimates from the ASAP model results (2011-2022). The annual fishery selectivity, maturity ogive, and mean weights at age used in projections are the most recent 5 year averages; no retrospective adjustments were applied in the projections.

Table 3: Short term projections of total fishery catch (OFL) and Spawning Sstock Biomass (SSB) for Summer flounder based on a harvest scenario of fishing at F_{MSY} *proxy* between 2024 and 2025. Catch in 2023 was assumed to be 15,023 (mt).

Year	Catch (mt)	SSB (mt)	F_{Full}
2023	15,023	37,233 (30,000 - 46,000)	0.622

Year	Catch (mt)	SSB (mt)	F_{Full}
2024	10,422	38,541 (32,000 - 46,000)	0.451
2025	10,839	39,127 (33,000 - 46,000)	0.451

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).

  Declining trends in growth rates and changes in the sex-ratio at age may change the productivity of the stock and in turn affect estimates of the biological reference points. Changes in growth, maturity, and recruitment may be environmentally mediated but mechanisms are unknown.

- 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 7-year Mohn's ρ, relative to SSB, was 0.03 in the 2021 assessment and was 0.06 in 2022. The 7-year Mohn's ρ, relative to F, was 0.01 in the 2021 assessment and was 0.03 in 2022. No retrospective adjustment of SSB or F in 2022 was 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 Summer flounder are reasonably well determined.

- 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.

  No major changes, other than the addition of three years of data, were made to the Summer flounder assessment for this update. Minor changes to the survey input CVs and fishery and survey input Effective Sample Sizes improved model diagnostics but had limited affects on the model results.

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

  Overfishing status has changed since the last assessment for Summer flounder. The stock status remains as not overfished but overfishing is occurring.

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

  The current fishing mortality rate is near the threshold, and so recent near-average recruitment has resulted in relatively stable SSB. SSB is projected to remain relatively stable in the short term at current fishing rates.

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

  The Summer flounder assessment could be improved with more intensive and comprehensive sampling of the fishery catch by sex.

- Are there other important issues?

  Sufficent length and age sampling of the fishery catch needs to be maintained.

References:

NEFSC. 2022. Northeast Fisheries Science Center. Management Track Assessment June 2021. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 22-10; 79 p. http://www.nefsc.noaa.gov/publications/crd/crd2210/.

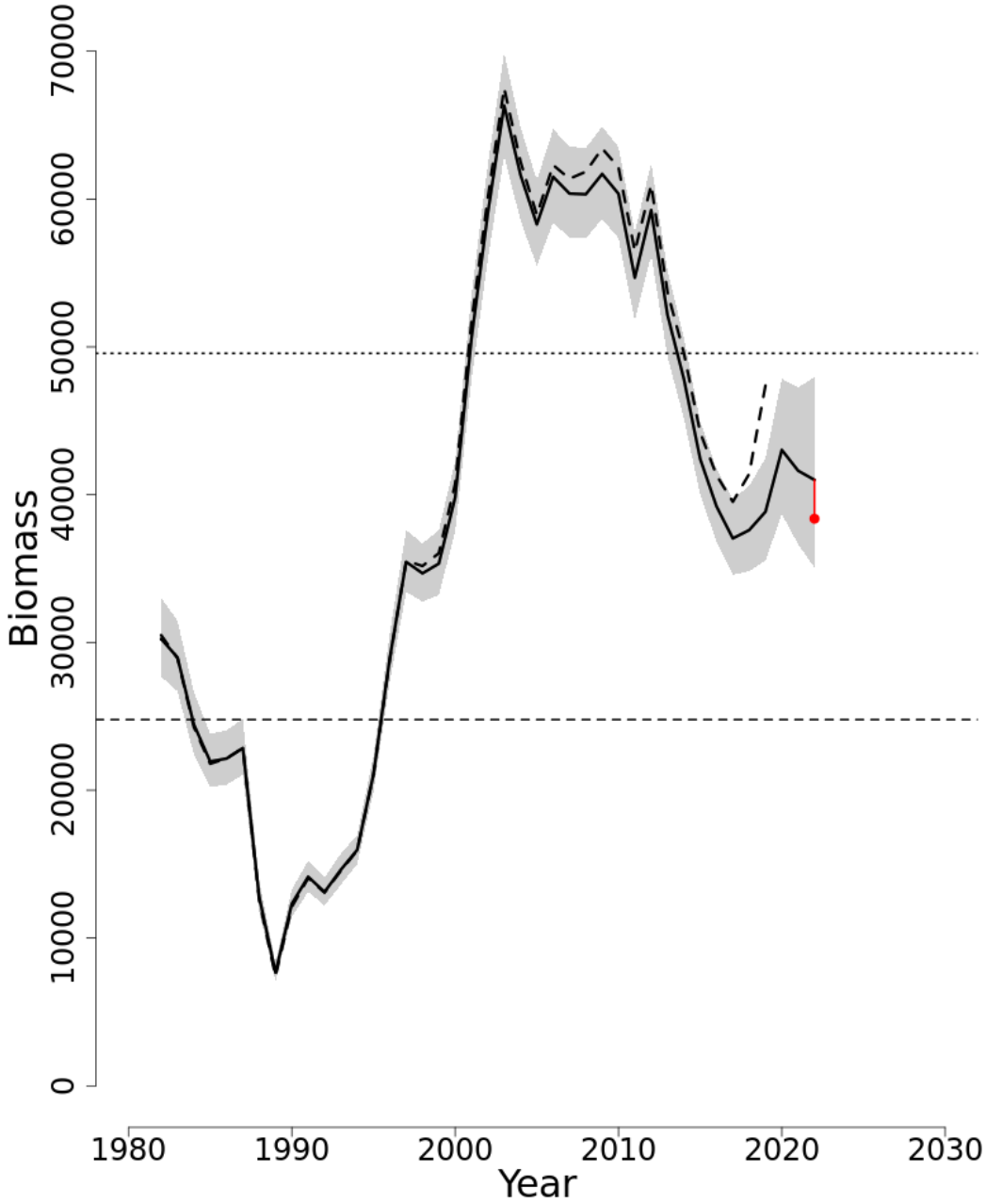

Figure 1: Trends in spawning stock biomass of Summer flounder between 1982 and 2022 from the current (solid line) and previous (dashed line) assessment and the corresponding $SSB_{Threshold}$ ($\frac{1}{2}$ SSB_{MSY} *proxy*; horizontal dashed line) as well as SSB_{Target} (SSB_{MSY} *proxy*; horizontal dotted line) based on the 2023 assessment. Biomass adjusted for a retrospective pattern is shown in red, but not used for stock status or projections. The approximate 90% lognormal confidence intervals are shown.

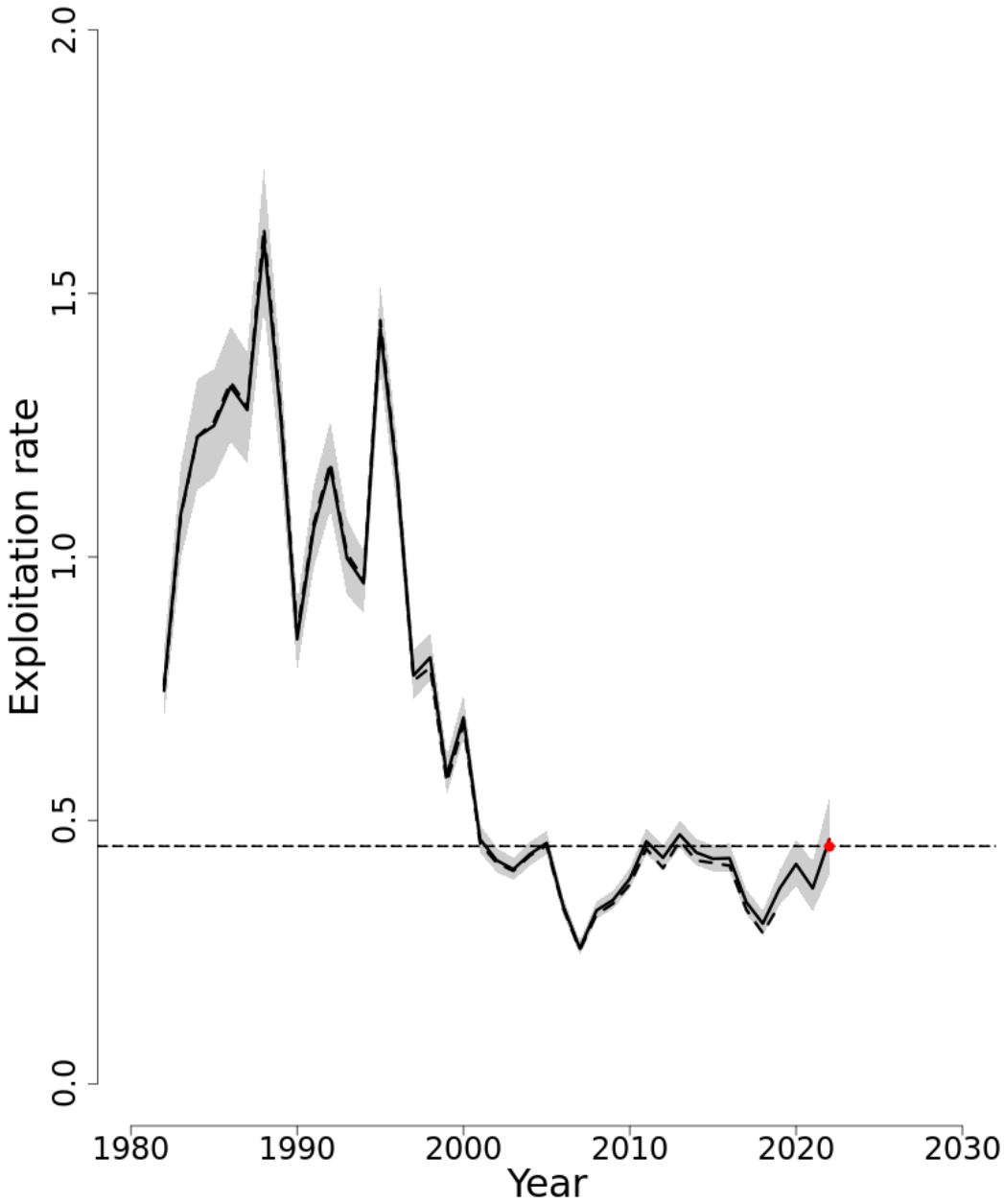

Figure 2: Trends in the fully selected fishing mortality (F_{Full}) of Summer flounder between 1982 and 2022 from the current (solid line) and previous (dashed line) assessment and the corresponding $F_{Threshold}$ (F_{MSY} *proxy*=0.451; horizontal dashed line). F_{Full} adjusted for a retrospective pattern is shown in red, but not used for status or projections. The approximate 90% lognormal confidence intervals are shown.

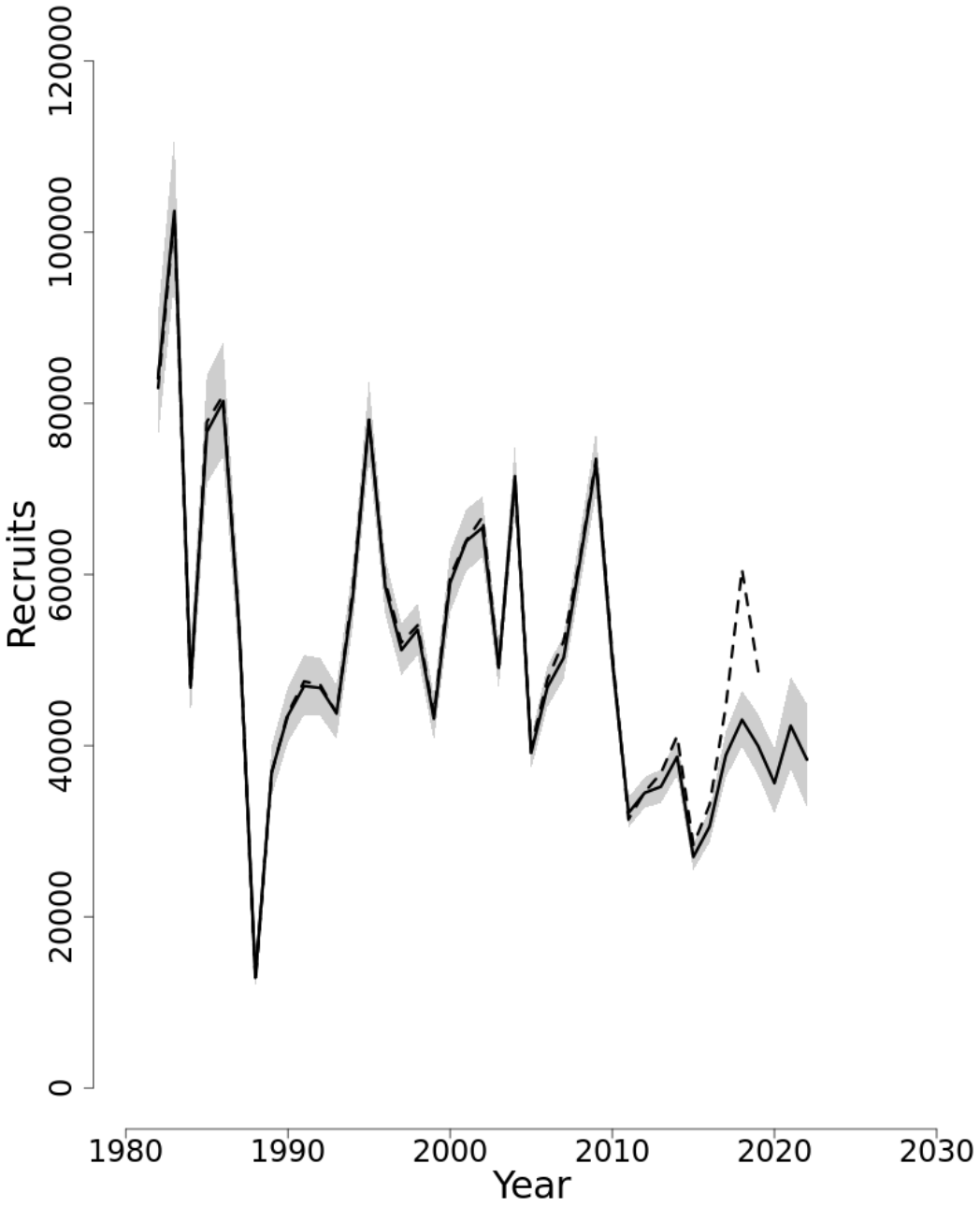

Figure 3: Trends in Recruits (age 0) (000s) of Summer flounder between 1982 and 2022 from the current (solid line) and previous (dashed line) assessment.

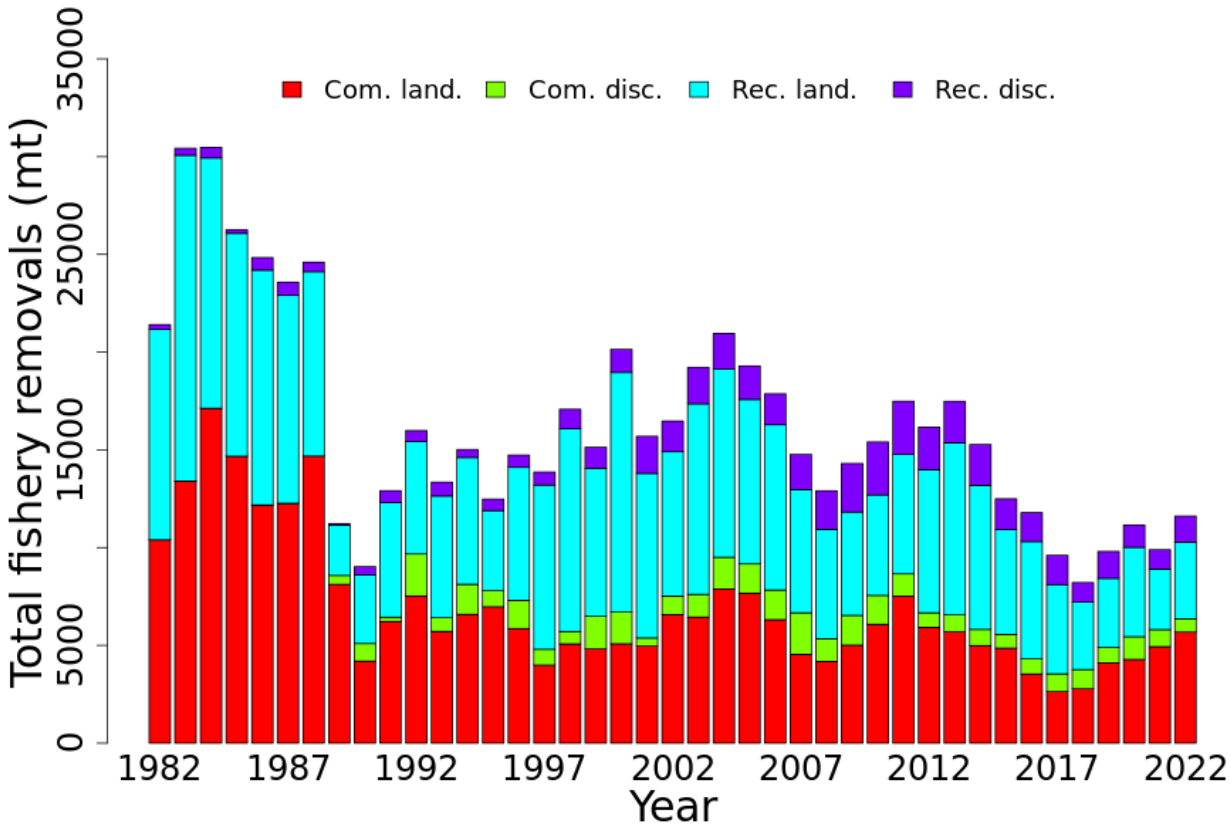

Figure 4: Total catch of Summer flounder between 1982 and 2022 by fishery (commercial and recreational) and disposition (landings and discards).

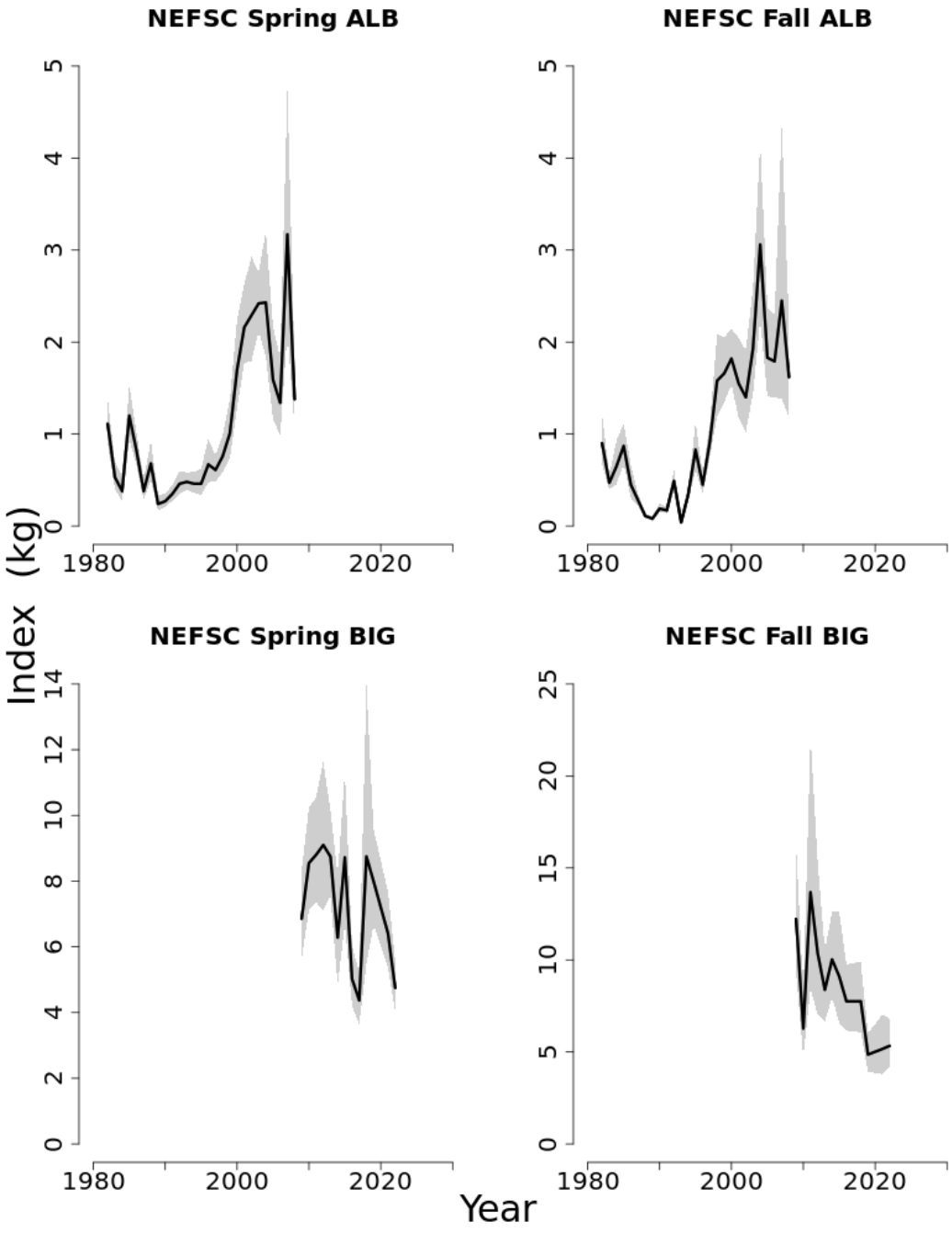

Figure 5: Indices of biomass for the Summer flounder between 1982 and 2022 for the Northeast Fisheries Science Center (NEFSC) Albatross IV (ALB) and Henry B Bigelow (BIG) spring and fall research bottom trawl survey series. The approximate 90% lognormal confidence intervals are shown.