9. Assessment of the Flathead Sole-Bering Flounder Stock Complex in the Bering Sea and Aleutian Islands

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Executive Summary

"Flathead sole" as currently managed by the North Pacific Fishery Management Council (NPFMC) in the Bering Sea and Aleutian Islands (BSAI) and represents a two-species complex consisting of true Flathead sole (*Hippoglossoides elassodon*) and its morphologically-similar congener Bering flounder (*Hippoglossoides* spp.). This species is currently assessed on a four-year cycle; the most recent full assessment was conducted in 2020 (Monnahan and Haehn, 2020) and will be updated in 2024. In years without a full assessment, we present an executive summary to recommend harvest levels for the next two years.

Flathead sole is assessed using an age-structured model and Tier 3 determination. The projection model is run using parameter values from the accepted 2020 assessment model, together with updated catch information for 2020-2022, estimated catches for 2023 and projected catches 2024-2025, to predict stock status for Flathead sole in 2024-2025, and to make ABC recommendations and set OFL for those years.

Description of Updated Catch

To run the projection model to predict ABCs for 2024 and 2025, we used true, observed catches for 2020-2022 and estimates for the total catches in 2023-2025. Note that the 2020 catch used in the last benchmark model was itself an estimate (8,556), about 9% less than the finalized observation used for projections here. The catch for 2023 (8,811 t) was estimated by adding the average catch between 27 September and December 31 over the years 2017-2022 to the 2023 catch as of 2023-09-27. The 2024 and 2025 catches (12,246 t) were estimated as the average catch over the previous 5 years (2017-2022).

Summary of Results

Quantity/Status	As estimated or specified *last* year for: 2023	2024	As estimated or recommended *this* year for: 2024*	2025*
M	0.2	0.2	0.2	0.2
Tier	3a	3a	3a	3a
Projected total (3+) biomass (t)	606,522	606,080	609,488	608,230
Projected Female spawning biomass (t)	158,962	164,594	165,629	169,452
maxF_{ABC}	0.37	0.37	0.37	0.37
F_{ABC}	0.37	0.37	0.37	0.37
OFL (t)	79,256	81,167	**81,605**	82,699
*max*ABC (t)	65,344	66,927	67,289	68,203
ABC (t)	65,344	66,927	**67,289**	68,203
Status	As determined *last* year for: 2022	2023	As determined *this* year for: 2023	2024
Overfishing	No	n/a	No	n/a

*Projections are based on an estimated catch of 8,811 t for 2023 and estimates of 12,246 t and 12,246 t used in place of maximum permissible ABC for 2024 and 2025.

Fishery

The most recent fishery data are summarized below, as catch (in tons) of Flathead sole and Bering flounder combined (*Hippoglossoides elassodon*) and Flathead sole only, and Bering flounder only. Observer data of species-specific extrapolated weight in each haul was summed over hauls within each year and used to calculate the proportion of the total *Hippoglossoides* spp. catch that was Flathead sole or Bering flounder. Proportions were multiplied by the total *Hippoglossoides* spp. (Flathead sole and Bering flounder combined) catches reported by AKFIN to obtain total catch of Flathead sole separately from that of Bering flounder. Note that the value for 2023 is the observed catch, current through 2023-09-27; the extrapolated catches used for this year in the projection model are higher. The catch to total (3+) biomass ratio has declined since 2007 (Figure 1).

Year	Total *Hippoglossoides* spp.	Flathead Sole	Bering Flounder
2022	14,690	14,687	3
2023	7,716	7,714	2

Survey

An Aleutian Islands survey was conducted in 2022, and the 2022 total BSAI estimate was 710,804 t, a roughly 6% increase over the 2021 regression estimate of 670,091 t (Figure 2). None of the interpolated or observed values from 2020 onwards are included in the base assessment model, nor the projection; they are provided here for reference only.

Figures

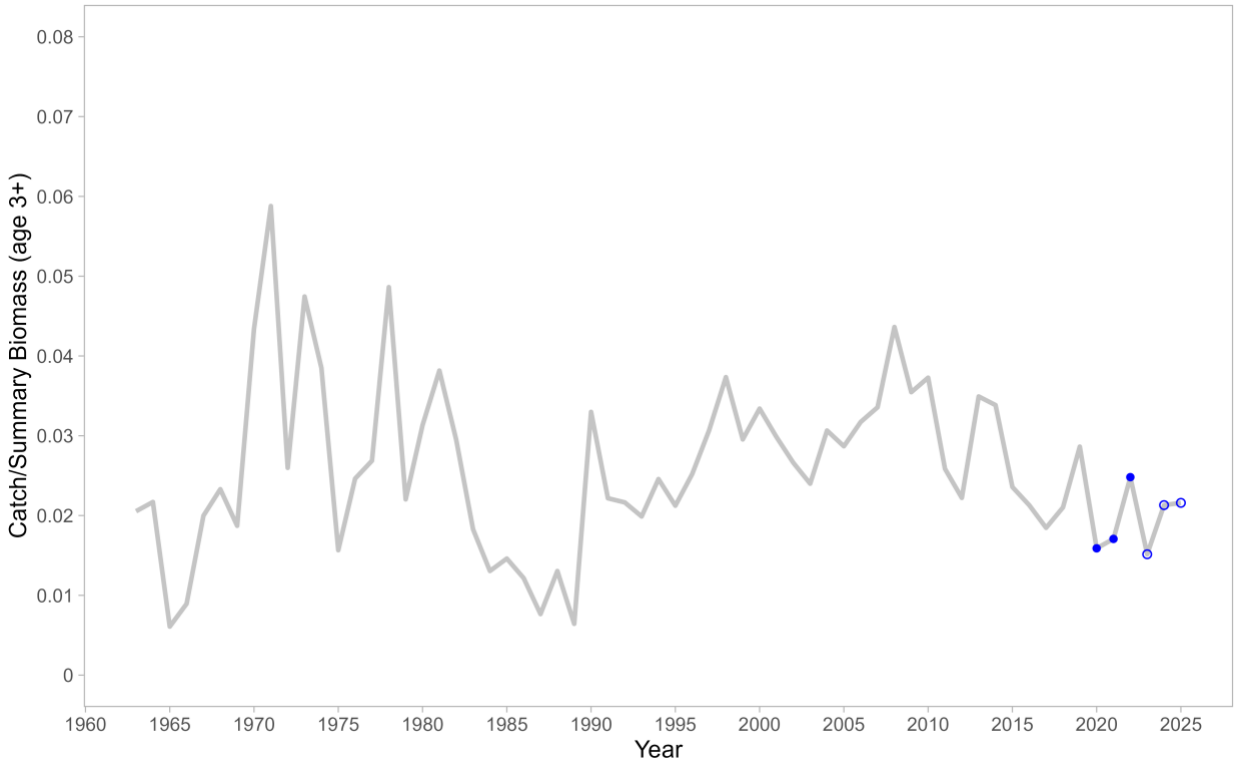

Figure 2. Modeled catch divided by modeled total (3+) biomass, where catch and biomass estimates for any updated year come from the projection model to incorporate newly complete or expanded catches. Blue points are catches included in the projection model; open points are estimated or projected, whereas solid points are complete observed years.

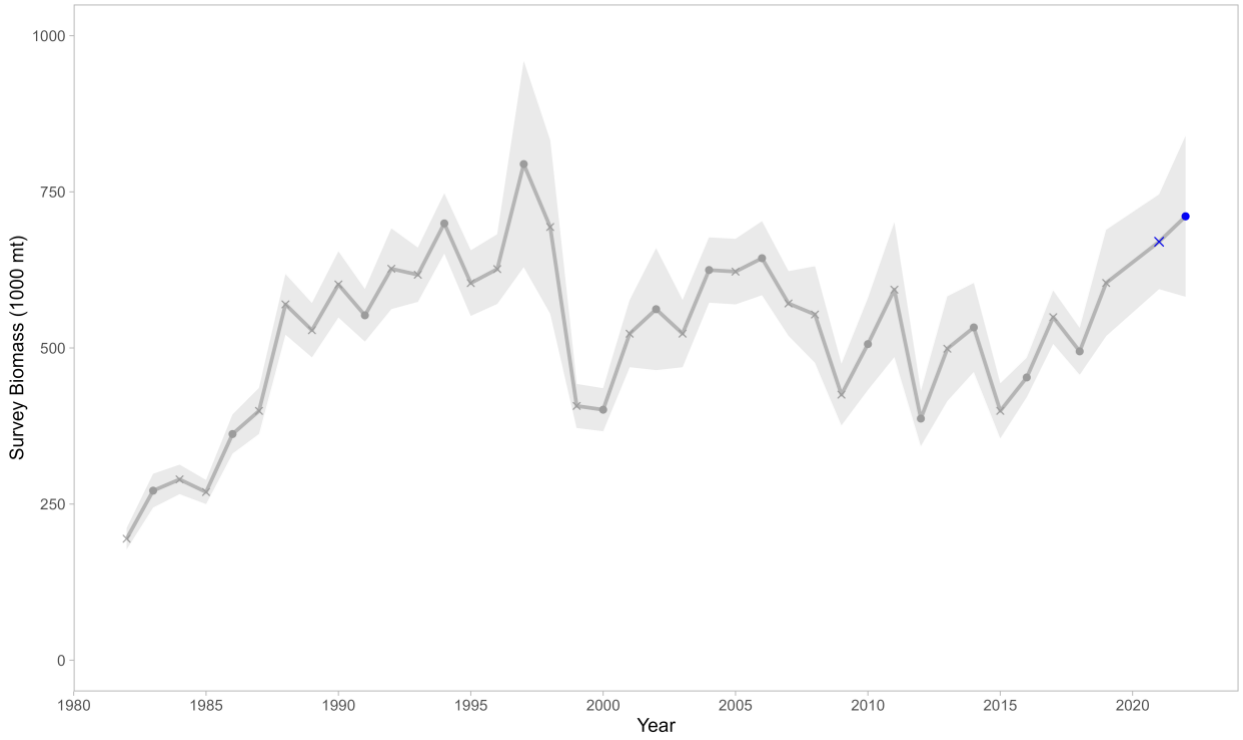

Figure 2. Survey biomass from the EBS shelf and Aleutian Islands surveys for station depths less than or equal to 200 meters. Grey and blue points include true observations. A linear regression was used to estimate a relationship between EBS shelf *Hippoglossoides spp*. survey biomass estimates and AI survey biomass estimates in years when no AI survey occurred ('x' marks). Grey shading indicates ± 1 standard error. None of the interpolated or observed values from 2020 onwards (blue points/'x' marks) are included in the base assessment model, nor the projection; they are provided here for reference only.

Author's note: Changes have been made to the survey data in the stratum-area files, which affects biomass and abundance estimates for EBS data (all years and species, Duane Stevenson, AFSC). A visual comparison of EBS Flathead survey values from a 2021 data pull vs. the values shown above indicated that the effect of the strata update was negligible. Future benchmark assessments for this species should update the entire survey time series, for consistency.

References

Kapur, M.S. 2022. Assessment of the Flathead Sole-Bering flounder Stock in the Bering Sea and Aleutian Islands. In Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Bering Sea/Aleutian Islands Region. North Pacific Fishery Management Council, P.O. Box 103136, Anchorage, Alaska 99510. Available at https://apps-afsc.fisheries.noaa.gov/Plan_Team/2022/BSAIflathead.pdf.

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Monnahan, C., and Haehn, R. 2020.Assessment of the Flathead sole-Bering flounder stock complex in the Bering Sea and Aleutian Islands. In Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Bering Sea/Aleutian Islands Region. North Pacific Fishery Management Council, P.O. Box 103136, Anchorage, Alaska 99510. Available at https://apps-afsc.fisheries.noaa.gov/refm/docs/2020/BSAIflathead.pdf