8. Assessment of the Flathead Sole Stock in the Gulf of Alaska

Maia S. Kapur

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Executive Summary

The Gulf of Alaska flathead sole stock is typically assessed every four years and was last assessed in 2022 (Kapur & Monnohan, 2022). In years without a full assessment, we present an executive summary of harvest projections to recommend harvest levels for the next two years. Please refer to the 2022 full stock assessment report for further information regarding the assessment model (available online at https://apps-afsc.fisheries.noaa.gov/Plan_Team/2022/GOAflathead.pdf).

Flathead sole is assessed using an age-structured model and Tier 3 determination. Thus, the single species projection model was run using parameter values from the accepted 2022 flathead sole assessment model, together with updated catch information for 2022, and estimated catches for 2022-2025 to predict stock status for flathead sole and to make ABC recommendations for those years. Projections are conducted using numbers-at-age for flathead sole from age 3-21+ and historical recruitment of age 3 individuals is used to calculate OFLs and ABCs.

Summary of Changes in Assessment Inputs

Changes in input data: The updated information for this harvest projection includes replacing the estimated 2022 catch with the final catch value from the Alaska Regional Office (https://www.fisheries.noaa.gov/sites/default/files/akro/car110_goa2020.html) (564 t), and estimating the 2023-2025 catches. The 2023 projected catch was calculated as the current catch as of 2023-09-28 added to the average 28 September – December 31 catches over the previous 5 years. The 2024 and 2025 projected catches were calculated as the average catch over the previous 5 years (1,611 t). These estimated catches for the present and two future years are input in place of *maxABC* for projections, which is appropriate given that recent catches are much less than the maximum ABC for this stock.

Summary of Results

The ABC for flathead sole is 40,503 t in 2024 and 41,258 t in 2025 and the OFL is 49,414 t in 2024 and 50,322 t in 2025. The new ABC recommendation and OFL values are similar to those developed in 2022 for 2024 (40,222 t and 49,073 t, respectively).

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)	294,188	293,277	294,616	292,639
Projected Female spawning biomass (t)	94,059	95,932	96,604	98,468
$B_{100\%}$	92,582	92,582	92,582	92,582
$B_{40\%}$	37,033	37,033	37,033	37,033
$B_{35\%}$	32,404	32,404	32,404	32,404
F_{OFL}	0.36	0.36	0.36	0.36
maxF_{ABC}	0.29	0.29	0.29	0.29
F_{ABC}	0.29	0.29	0.29	0.29
OFL (t)	48,161	49,073	**49,414**	50,322
*max*ABC (t)	39,480	40,222	40,503	41,258
ABC (t)	39,480	40,222	**40,503**	41,258
Status	As determined *last* year for: 2022	2023	As determined *this* year for: 2023	2024
Overfishing	No	n/a	No	n/a
Overfished	n/a	No	n/a	No
Approaching Overfished	n/a	No	n/a	No

*Projections are based on an estimated catch of 598 t for 2023 and estimates of 1,611 t and 1,611 t used in place of maximum permissible ABC for 2024 and 2025.

Area apportionment

Area apportionment for ABC of Flathead sole is currently based on the proportion of survey biomass projected for each area using the survey averaging random effects model REMA (`v0.1.0`) developed by the survey averaging working group (see https://github.com/afsc-assessments/rema for more information). Apportionment to the Eastern Gulf is partitioned among the West Yakutat and East Yakutat-Southeast Outside region using the most recent biomass ratio among those areas obtained from the bottom trawl survey.

The following table shows the recommended ABC apportionment for 2024 and 2025. The author notes that in previous projections of the Flathead sole model (including those done in 2021), the time series of recruitment and spawning biomass used for projections began in 1984 (the start of the main period for recruitment deviations), not 1977 is typically used. The Alaska Fisheries Science Center has recognized that an environmental "regime shift" affecting the long-term productive capacity of the groundfish stocks in the BSAI occurred during the period 1976-1977, thus most recruitment time series generally start in 1977 except in special cases. Inputs to the projection model continue to use the time series of recruitment and SSB beginning in 1984, which corresponds to the onset of most survey data. Projections assume recruitment at age 3.

				Eastern		
Quantity	Year	Western	Central	W. Yakutat	E. Yakutat/SEO	Total
Area Apportionment %		32.77	52.60	9.57	5.06	100.00
ABC (t)	2024	13,273	21,307	3,876	2,047	40,503
ABC (t)	2025	13,521	21,702	3,949	2,086	41,258

Tables

Table 10-1. Total catch (t) of GOA flathead sole by area since 2000. Catch for 2023 is current up to 2023-09-28. Columns left blank indicate confidential catch information by area. Bolded years are not used in, or differ from, the base model. Note that the value for 2023 is the observed catch and the extrapolated catches used for this year in the projection model are higher. Values have been rounded to the nearest whole number.

Year	Total Catch (t)	Western Gulf	Central Gulf	Eastern Gulf
2000	1,548	259	1,274	15
2001	1,912	600	1,311	<1
2002	2,146	420	1,725	<1
2003	2,459	525	1,934	<1
2004	2,398	828	1,571	<1
2005	2,552	611	1,941	<1
2006	3,142	462	2,679	1
2007	3,130	666	2,462	2
2008	3,446	297	3,149	<1
2009	3,663	303	3,359	1
2010	3,903	462	3,441	<1
2011	2,732	393	2,338	<1
2012	2,167	277	1,890	<1
2013	2,819	588	2,230	<1
2014	2,557	219	2,337	1
2015	2,001	199	1,802	1
2016	2,422	228	2,191	2
2017	2,050	73	1,978	<1
2018	2,202	150	2,051	<1
2019	2,668	210	2,457	<1
2020	1,911	100	1,811	<1
2021	708	111	596	1
2022	564	42	521	<1
2023	387	13	373	<1

Table 10-2. Biomass of flathead sole in the GOA groundfish bottom trawl survey (Bio, t) and coefficient of variation (CV) by year and regulatory area. Bolded years are not included in base model. Small discrepancies (<1 t) in Total column may occur due to rounding.

	Total		Western		Central		Eastern	
Year	Bio (t)	CV	Bio (t)	CV	Bio (t)	CV	Bio (t)	CV
1984	249,341	0.12	45,100	0.41	158,539	0.14	45,703	0.18
1987	177,546	0.11	33,603	0.19	113,483	0.13	30,459	0.33
1990	243,055	0.12	58,740	0.19	161,257	0.16	23,059	0.31
1993	188,579	0.13	57,760	0.21	113,976	0.19	16,843	0.19
1996	205,521	0.09	66,732	0.18	122,730	0.11	16,059	0.16
1999	207,590	0.12	49,636	0.21	139,356	0.15	18,598	0.45
2001	153,594	0.12	68,164	0.20	85,430	0.14		
2003	257,294	0.08	67,055	0.13	170,852	0.10	19,388	0.14
2005	213,213	0.08	59,458	0.17	142,043	0.09	11,712	0.30
2007	281,402	0.08	78,361	0.16	177,641	0.11	25,400	0.28
2009	225,377	0.11	80,115	0.21	128,910	0.14	16,351	0.34
2011	235,639	0.09	76,049	0.16	128,428	0.12	31,162	0.34
2013	201,233	0.09	62,131	0.19	121,063	0.11	18,039	0.27
2015	218,548	0.08	67,665	0.18	126,200	0.09	24,684	0.14
2017	236,588	0.11	99,009	0.19	123,087	0.14	14,493	0.30
2019	185,840	0.09	66,710	0.17	94,280	0.13	24,849	0.24
2021	180,000	0.11	46,234	0.21	103,880	0.15	29,886	0.26
2023	140,862	0.12	38,409	0.31	79,945	0.12	22,508	0.37

Figures

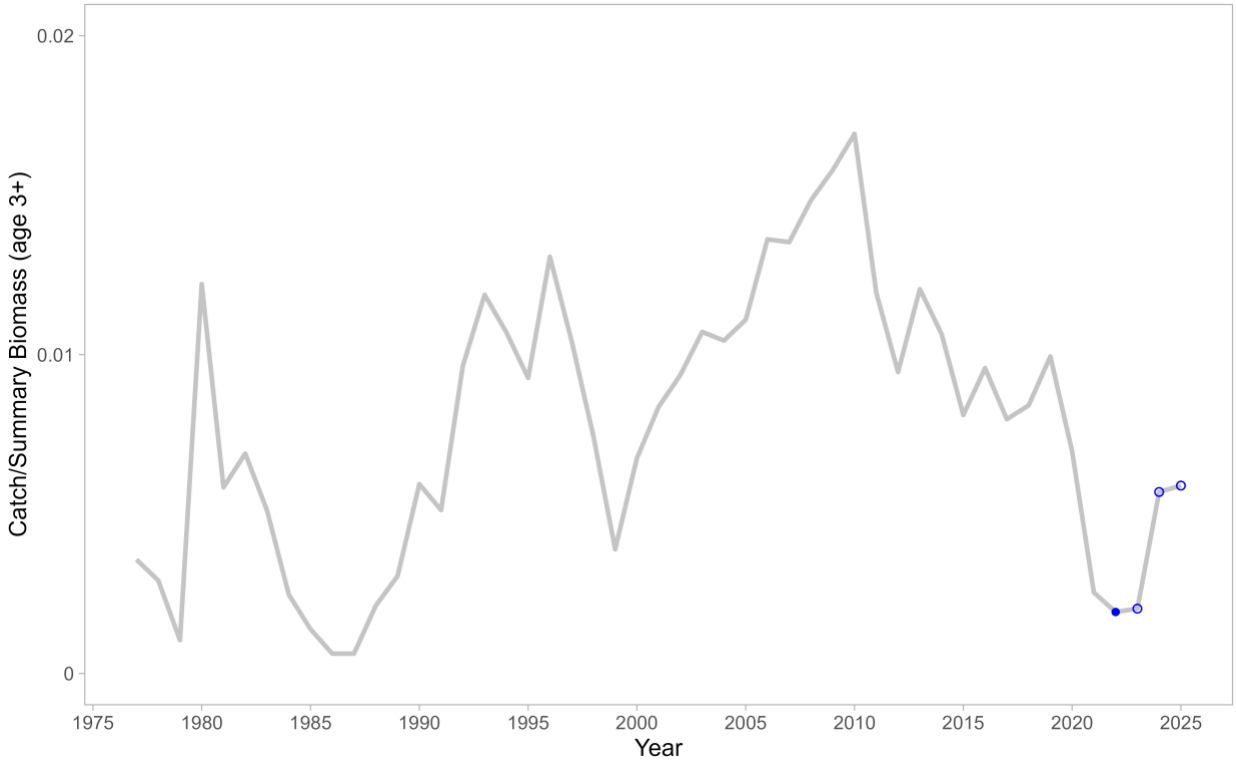

Figure 10-1. Catch to total biomass ratio using total biomass for age 3+ individuals for GOA flathead sole. Blue points are catches included in the projection model; open points are estimated or projected, whereas solid points are complete observed years.

References

Kapur, M. and Monnahan, C. 2022. Assessment of the Assessment of the Flathead Sole Stock in the Gulf of Alaska. North Pacific Fishery Management Council, Anchorage, AK. Available from https://apps-afsc.fisheries.noaa.gov/Plan_Team/2022/GOAflathead.pdf