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

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Executive Summary

Flathead sole (*Hippoglossoides elassodon*) are assessed on a biennial stock assessment schedule to coincide with the availability of new survey data. For Gulf of Alaska flathead sole in alternate (even) years we present an executive summary to recommend harvest levels for the next two years. Please refer to last year's full stock assessment report for further information regarding the assessment model (McGilliard et al., 2015, available online at http://www.afsc.noaa.gov/REFM/Docs/2015/GOAflathead.pdf). A full stock assessment document with updated assessment and projection model results will be presented in next year's SAFE report.

GOA Flathead sole is managed in Tier 3a. The single species projection model was run using parameter values from the accepted 2015 assessment model (McGilliard et al. 2015), together with updated catch information for 2015 - 2016, to predict stock status for flathead sole in 2017 and 2018 and to make ABC recommendations for those years.

Summary of Changes in Assessment Inputs

New information available to update the projection model consists of the total catch for 2015 (2,000 t) and the current catch for 2016 (2,164 t as of October 8, 2016). To run the projection model to predict ABC's for 2017 and 2018, estimates are required for the total catches in 2016 and 2017. The final catch for 2016 was estimated by taking the average tons caught between October 8 and December 31 over the previous 5 years (2011-2015) and adding this average amount to the catch-to-date as of October 8 for 2016. The estimated final catch for 2016 was 2,544 t. The 2017 catch was estimated as the average of the total catch in each of the last 5 years (2011-2015). The estimated catch for 2017 was 2,454 t.

Summary of Results

Based on the updated projection model results, the recommended ABC's for 2017 and 2018 are 35,243 t and 35,829 t, respectively, and the OFL's are 43,128 t and 43,872 t. The new ABC recommendation and OFL for 2017 are similar to those developed using the 2015 full assessment model (35,187 t and 43,060 t). The principal reference values are shown in the following table:

Quantity	As estimated or *specified last* year for:		As estimated or *recommended this* year for:	
	2016	2017	2017*	2018*
M (natural mortality rate)	0.2	0.2	0.2	0.2
Tier	3a	3a	3a	3a
Projected total (3+) biomass (t)	265,088	269,388	269,638	272,323
Projected Female spawning biomass (t)	82,375	82,690	82,819	84,273
$B_{100\%}$	92,165	92,165	92,165	92,165
$B_{40\%}$	36,866	36,866	36,866	36,866
$B_{35\%}$	32,258	32,258	32,258	32,258
F_{OFL}	0.4	0.4	0.40	0.40
$maxF_{ABC}$	0.32	0.32	0.32	0.32
F_{ABC}	0.32	0.32	0.32	0.32
OFL (t)	42,840	43,060	43,128	43,872
maxABC (t)	35,020	35,187	35,243	35,829
ABC (t)	35,020	35,187	35,243	35,829
Status	As determined in 2015 for:		As determined in 2016 for:	
	2014	2015	2015	2016
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 estimated catches of 2,544 t and 2,454 t used in place of maximum permissible ABC for 2016 and 2017, as well as the final catch for 2015 of 2,000 t.

Area Apportionment

The table below shows apportionment of the 2017 and 2018 ABCs and OFLs among areas, based on the proportion of survey biomass projected for each area in 2017 and 2018 estimated using the survey averaging random effects model developed by survey averaging working group. The recommended ABC area apportionment percentages are identical to last year because the last GOA groundfish survey was conducted in 2015.

Quantity	Western	Central	West Yakutat	Southeast	Total
Area Apportionment	31.49%	57.71%	8.37%	2.43%	100.00%
2017 ABC (t)	11,098	20,339	2,949	857	35,243
2018 ABC (t)	11,282	20,677	2,998	872	35,829

Responses to SSC and Plan Team Comments on Assessments in General

SSC, December 2015: The SSC reminds the authors and PTs to follow the model numbering scheme adopted at the December 2014 meeting.
Author Response: The author will follow the new numbering scheme in the next full assessment.

SSC, December 2015: Many assessments are currently exploring ways to improve model performance by re-weighting historic survey data. The SSC encourages the authors and PTs to refer to the forthcoming CAPAM data-weighting workshop report.
Author Response: Two data-weighting methods that were discussed at the CAPAM data-weighting workshop have been applied to GOA flathead sole previously: the Francis data-weighting method (Francis 2011) and the McAllister and Ianelli method (McAllister and Ianelli 1997). Developers of Stock Synthesis are working on adding additional distributions for age- and length-composition likelihood components that may better address data-weighting. The author will follow future developments and apply best available practices for future assessments.

Responses to SSC and Plan Team Comments Specific to this Assessment

SSC Dec 2015: "The SSC concurs with the PT and author that a priority for future assessments is to analyze ageing error data for GOA flathead sole using methods described in Punt et al. (2008) and to incorporate a resulting ageing error matrix into the assessment. In addition, the SSC supports the PT and author's recommendations that future analyses should explore the relationship between natural mortality and catchability in the model, alternative parameter values, and the effects of these parameters on estimation of selectivity and other parameters. Finally, the SSC encourages the author to explore ways to better account for scientific uncertainty, especially uncertainty associated with parameters that are currently fixed in the model."
Author Response: The author plans to analyze ageing error using the methods described in Punt et al. (2008) prior to the next full assessment. In addition, the author is working with an M.S. student to explore the relationship between natural mortality and catchability in the model and will include a likelihood profile over M and q in the next full assessment. The author will also consider doing a sensitivity analysis, assigning priors to currently fixed parameters and running the assessment model as a Bayesian analysis to better account for uncertainty in parameters that are currently fixed. The "Data Gaps and Research Plans" section of this document addresses these concerns as well.

Data Gaps and Research Priorities

The 2015 stock assessment incorporated ageing error by using an existing ageing error matrix for BSAI flathead sole. A priority for future assessments is to analyze ageing error data for GOA flathead sole using methods described in Punt et al. (2008) and to incorporate a resulting ageing error matrix into the

assessment. A sensitivity analysis in the 2013 assessment showed that more reasonable estimates of selectivity occurred when natural mortality was estimated; future analyses should explore the relationship between natural mortality and catchability in the model and the effects of these parameters on estimation of selectivity and other parameters. The assessment would benefit from an exploration of ways to better account for scientific uncertainty, especially uncertainty associated with parameters that are currently fixed in the model.

Literature Cited

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