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., 2013, available online at http://www.afsc.noaa.gov/REFM/Docs/2013/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 2013 accepted assessment model (McGilliard et al. 2013), together with updated catch information for 2013 - 2014, to predict stock status for flathead sole in 2015 and 2016 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 2013 (2,816 t) and the current catch for 2014 (2,317 t as of October 19, 2014).). To run the projection model to predict ABC's for 2015 and 2016, estimates are required for the total catches in 2014 and 2015. The final catch for 2014 was estimated by dividing the current catch by the ratio of the catch on the same date in 2013 (October 19, 2013) as the current catch to the final 2013 catch. The estimated final catch for 2014 was 2,619 t and was also used as an estimate of the 2015 catch.

Summary of Results

Based on the updated projection model results, the recommended ABC's for 2015 and 2016 are 41,349 t and 41,378 t, respectively, and the OFL's are 50,792 t and 50,818 t. The new ABC recommendation and OFL for 2015 are similar to those developed using the 2013 full assessment model (41,007 t and 50,376 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:	
	2014	2015	2015*	2016*
M (natural mortality rate)	0.2	0.2	0.2	0.2
Tier	3a	3a	3a	3a
Projected total (3+) biomass (t)	252,361	253,418	254,602	256,029
Female spawning biomass (t)				
Projected				
Upper 95% confidence interval	84,076	83,287	83,900	83,606
Point estimate	84,058	83,204	83,818	83,342
Lower 95% confidence interval	84,045	83,141	83,754	83,135
$B_{100\%}$	88,829	88,829	88,829	88,829
$B_{40\%}$	35,532	35,532	35,532	35,532
$B_{35\%}$	31,090	31,090	31,090	31,090
F_{OFL}	0.61	0.61	0.61	0.61
$maxF_{ABC}$	0.47	0.47	0.47	0.47
F_{ABC}	0.47	0.47	0.47	0.47
OFL (t)	50,664	50,376	50,792	50,818
maxABC (t)	41,231	41,007	41,349	41,378
ABC (t)	41,231	41,007	41,349	41,378
Status	As determined in 2012 for:		As determined in 2013 for:	
	2011	2012	2012	2013
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 2,619 t used in place of maximum permissible ABC for 2014 and 2015.

Area Apportionment

Area apportionment for ABC is currently based on the relative abundance (biomass) of flathead sole found within each management area in the last GOA groundfish survey. The recommended ABC area apportionment percentages are identical to last year because the last GOA groundfish survey was conducted in 2013. The following table shows the recommended area apportionments for 2015 and 2016 are:

Quantity	Western	Central	West Yakutat	Southeast	Total
Area Apportionment	30.88%	60.16%	8.55%	0.41%	100.00%
2015 ABC (t)	12,767	24,876	3,535	171	41,349
2016 ABC (t)	12,776	24,893	3,538	171	41,378

Responses to SSC and Plan Team Comments on Assessments in General

SSC Dec 2013: "During public testimony, it was proposed that assessment authors should consider projecting the reference points for the future two years (e.g., 2014 and 2015) on the phase diagrams. It was suggested that this forecast would be useful to the public. The SSC agrees. The SSC appreciated this suggestion and asks the assessment authors to do so in the next assessment."
An additional two projection years will be included on future phase diagrams for the GOA flathead sole stock.

GPT, Sept 2013: The Teams recommend retaining use of the mean to estimate the central tendency in recruitment, at least for the time being.
The mean is used to estimate the central tendency in recruitment in this assessment.

GPT, Sept. 2013: The Teams recommend that authors choose a method <for catch estimation when doing stock projections> that appears to be appropriate for their stock, and this method be clearly documented. The Teams recommend authors establish their best available estimate of catch in the current year and the next two years. The Teams recommend that authors should also document how those projected catches were determined in the Harvest Recommendations section (ideally Scenario 2).
The methods for catch estimation used for the projections used in this update are based on the author's best available estimate in the current year and next two years. The methods for catch estimation are documented in the text of this update.

Responses to SSC and Plan Team Comments Specific to this Assessment

GPT, November 2013: The Team agreed with the author and recommends that the next assessment should include exploration of natural mortality and survey catchability. This effort might also include how selectivity is treated, and potentially place a prior on natural mortality based on maximum observed age. Additional model development should include estimation of a stock-specific ageing error matrix and exploration of strong patterns exhibited in early recruitment deviations.
The "Data Gaps and Research Priorities" section of this assessment details plans for investigating each of these issues for the September 2015 Groundfish Plan Team Meeting.

SSC, Dec. 2013: The SSC encourages development of a stock-specific aging error matrix and encourages exploration of the extreme patterns in early recruitment deviations.
A stock-specific ageing error matrix and an exploration of extreme patterns in early recruitment deviations will be investigated for the 2015 flathead sole assessment.

Data Gaps and Research Priorities

The 2013 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. In addition, the 2013 assessment adjusted the relative effective sample sizes among years of fishery length composition data to the number of hauls each year; future assessments will investigate changing relative effective sample sizes among years of survey length composition data to the number of survey hauls in each year. 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. Future research should explore potential causes of patterns in early recruitment deviations that were estimated by some alternative models. 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.

Summaries for Plan Team

Year	Biomass[1]	OFL[2]	ABC[2]	TAC[2]	Catch[3]
2013	236,745	61,036	48,738	30,496	2,816
2014	252,361	50,664	41,231	27,746	2,317
2015	254,602	50,792	41,349		
2016	256,029	50,818	41,378		

1. Age 3+ biomass from the assessment and projection models
2. From http://alaskafisheries.noaa.gov/frules/79fr12890.pdf and http://alaskafisheries.noaa.gov/frules/78fr13162.pdf
3. As of October 18, 2014

Area	2014				2015		2016	
	OFL[1]	ABC[1]	TAC[1]	Catch[3]	OFL[2]	ABC[2]	OFL[2]	ABC[2]
W	--	12,730	8,650	202	--	12,767	--	12,776
C	--	24,805	15,400	2,114	--	24,876	--	24,893
WYAK	--	3,525	3,525	1	--	3,535	--	3,538
SE	--	171	171	0	--	171	--	171
Total	50,664	41,231	27,746	2,317	50,792	41,349	50,818	41,378

1. From http://alaskafisheries.noaa.gov/frules/79fr12890.pdf
2. From assessment and projection model
3. Catch as of October 18, 2014

Literature Cited

McGilliard, C.R. ,Palsson, W., Stockhausen, W., and Ianelli, J. 2013. 8. Assessment of the Flathead Sole Stock in the Gulf of Alaska. In Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Gulf of Alaska. pp. 611-756. North Pacific Fishery Management Council, P.O. Box 103136, Anchorage AK 99510.

Punt, A.E., Smith, D.C., Krusic-Golub, K., Robertson, S. 2008. Quantifying age-reading error for use in fisheries stock assessments, with application to species in Australia's southern and eastern scalefish and shark fishery. Can. J. Fish. Aquat. Sci. 65(9): 1991-2005.

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