5. Assessment of the Deepwater Flatfish Stock Complex in the Gulf of Alaska

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Executive Summary

The Gulf of Alaska deepwater flatfish complex (consisting of Dover sole, Greenland turbot, and deepsea sole) is assessed on a biennial stock assessment schedule to coincide with the availability of new survey data. For Gulf of Alaska deepwater flatfish, 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/GOAdeepflat.pdf). A full stock assessment document with updated assessment and projection model results will be presented in next year's SAFE report.

Dover 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 2013 accepted Dover sole assessment model (McGilliard et. al.2013), together with updated catch information for 2013 and 2014, to predict stock status for Dover sole in 2015 and 2016 and to make ABC recommendations for those years. Greenland turbot and deepsea sole fall under Tier 6. ABC's and OFL's for Tier 6 species are based on historical catch levels and therefore these quantities cannot be updated. ABC's and OFL's for the individual species in the deepwater flatfish complex are determined only as an intermediate step for the purpose of calculating complex-level OFL's and ABC's.

Summary of Changes in Assessment Inputs

Changes in the input data: There were no changes made to the assessment model inputs since this was an off-cycle year. New information available to update the Dover sole projection model consists of the total catch for 2013 (242 t) and the current catch for 2014 (338 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 18, 2014) as the current catch to the final 2013 catch. The estimated final catch for 2014 was 499 t and was also used as an estimate of the 2015 catch.

Changes in assessment methodology: There were no changes in assessment methodology since this was an off-cycle year.

Summary of Results

As in previous years (McGilliard et al. 2013), the species-level ABC is 179 t for Greenland turbot and the OFL is 238 t for both 2015 and 2016. The species-level ABC for deepsea sole is 4 t and the OFL is 6 t for both 2015 and 2016. The species-level ABC for Dover sole is 13,151 t in 2015 and 12,994 in 2016 and the OFL is 15,749 t in 2015 and 15,559 t in 2016.

Based on the updated projection model results, the recommended complex-level ABC's for 2015 and 2016 are 13,334 t and 13,177 t, and the OFL's are 15,993 t and 15,803 t. The new ABC recommendation and OFL for 2015 are similar to those developed using the 2013 full assessment model (13,303 t and 15,955 t). The principal reference values are shown in the following table:

Species	Quantity	As estimated or *specified last* year for: 2014	2015	As estimated or *recommended this* year for: 2015	2016
Dover sole	M (natural mortality rate)	0.085	0.085	0.085	0.085
	Tier	3a	3a	3a	3a
	Projected total (3+) biomass (t)	182,727	181,781	182,160	181,691
	Female spawning biomass (t)				
	Projected				
	Upper 95% confidence interval	66,181	67,078	67,233	68,022
	Point estimate	66,147	67,001	67,156	67,868
	Lower 95% confidence interval	66,126	66,945	67,100	67,752
	$B_{100\%}$	70,544	70,544	70,544	70,544
	$B_{40\%}$	28,218	28,218	28,218	28,218
	$B_{35\%}$	24,690	24,690	24,690	24,690
	F_{OFL}	0.12	0.12	0.12	0.12
	$maxF_{ABC}$	0.1	0.1	0.1	0.1
	F_{ABC}	0.1	0.1	0.1	0.1
	OFL (t)	15,915	15,711	15,749	15,559
	maxABC (t)	13,289	13,120	13,151	12,994
	ABC (t)	13,289	13,120	13,151	12,994
Greenland turbot	Tier	6	6	6	6
	OFL (t)	238	238	238	238
	maxABC (t)	179	179	179	179
	ABC (t)	179	179	179	179
Deepsea sole	Tier	6	6	6	6
	OFL (t)	6	6	6	6
	maxABC (t)	4	4	4	4
	ABC (t)	4	4	4	4
Deepwater Flatfish Complex	OFL (t)	16,159	15,955	15,993	15,803
	maxABC (t)	13,472	13,303	13,334	13,177
	ABC (t)	13,472	13,303	13,334	13,177
	Status	As determined in 2013 for: 2012	2013	As determined in 2014 for: 2013	2014
	Overfishing	no	n/a	no	n/a
	Overfished	n/a	no	n/a	no
	Approaching overfished	n/a	no	n/a	no

Area Apportionment

Area apportionment for ABC is currently based on the relative abundance (biomass) of Dover 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:

Quantity	Species	Western	Central	West Yakutat	Southeast	Total
Area Apportionment	Dover sole	1.18%	28.02%	41.54%	29.26%	100.00%
	Greenland turbot	81.17%	0.00%	6.40%	12.43%	100.00%
	Deepsea sole	0.00%	100.00%	0.00%	0.00%	100.00%
2015 ABC (t)	Dover sole	156	3,684	5,463	3,848	13,151
	Greenland turbot	145	0	11	22	179
	Deepsea sole	0	4	0	0	4
	Deepwater Flatfish	301	3,688	5,474	3,870	13,334
2016 ABC (t)	Dover sole	154	3,640	5,398	3,802	12,994
	Greenland turbot	145	0	11	22	179
	Deepsea sole	0	4	0	0	4
	Deepwater Flatfish	299	3,644	5,409	3,824	13,177

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 Dover 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, Nov. 2013: The Team recommended that the random effects survey averaging approach be explored for potential application to the apportionment calculations for this stock assessment.
The next full assessment of deepwater flatfish will explore using a survey averaging approach for apportionment calculations.

GPT, Nov. 2013: Based on suggestions from the author, the Team recommended that the next assessment include additional investigation of catchability, and natural mortality (perhaps not assuming a fixed value).

A joint likelihood profile of catchability and natural mortality will be presented in the 2015 Dover sole stock assessment. Estimating catchability or natural mortality with the use of a prior will be considered.

GPT, Nov. 2013: The Team requests the author complete the stock structure template for review in September.
A stock structure template will be completed for the September 2015 Groundfish Plan Team meeting.

GPT, Nov. 2013: The Team also recommended that the items listed for future research by the author be pursued.
The 2015 Dover sole assessment will address these topics.

SSC, Dec. 2013: The SSC looks forward to completion of the stock structure template for this complex next year as well as additional investigation of catchability and natural mortality in the next assessment of Dover sole.
As stated above, these topics will be pursued and presented at the September 2015 Groundfish Plan Team meeting.

Data Gaps and Research Priorities

The 2013 stock assessment incorporated ageing error by using an existing ageing error matrix for West Coast Dover sole. A priority for future assessments is to analyze ageing error data for GOA Dover 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. 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	173,853	6,834	5,126	5,126	242
2014	182,727	16,159	13,472	13,472	338
2015	182,160	15,993	13,334		
2016	181,691	15,803	13,177		

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	--	302	302	67	--	301	--	299
C	--	3,727	3,727	262	--	3,688	--	3,644
WYAK	--	5,532	5,532	5	--	5,474	--	5,409
SE	--	3,911	3,911	4	--	3,870	--	3,824
Total	16,159	13,472	13,472	338		13,334		13,177

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. 5. Gulf of Alaska Deepwater Flatfish. In Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Gulf of Alaska. pp. 403-536. 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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