

6. Assessment of the Rex Sole Stock in the Gulf of Alaska (Executive Summary)

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6.1 Introduction

In 2006, the Gulf of Alaska rex sole (*Glyptocephalus zachirus*) stock was moved to a biennial stock assessment schedule to coincide with the expected receipt of new survey data. A discussion at the September 2006 Groundfish Plan Team meetings concluded the following two important points for updating information in off-year assessments:

- 1) Anytime the assessment model is re-run and presented in the SAFE Report, a full assessment document **must** be produced.
- 2) The single-species projection model **may** be re-run using new catch data without re-running the assessment model.

Thus, on alternate (even) years, parameter values from the previous year's assessment model and total catch information for the current and previous year are used to make projections via the single species projection model for the following two years and to recommend ABC levels for those years.

Because no new survey data was available this year, option 2 above was followed to update information for 2012. The single species projection model was run using parameter values from the base case 2011 assessment model, together with updated catch information for 2011 and 2012, to predict adult biomass for rex sole in 2013 and 2014 and to make ABC recommendations for those years. The 2011 assessment model is documented in Stockhausen et al. 2011¹.

6.2 Updated catch and projection

New information available to update the projection model consists of the total catch for 2011 (2,876 t) and the current catch for 2012 (2,048 t as of Sept. 22, 2012). The recommended ABC and OFL from last year's assessment were based on Tier 5 calculations applied to the assessment model estimates of adult biomass, because estimates for $F_{35\%}$ and $F_{40\%}$ were not considered reliable. The same Tier 5 approach based on adult biomass estimated using the projection model was used here. The projection model was run to generate estimates of total (age 3+) biomass for 2013-2014. In order to do this, estimates for the total catches to be taken in 2012 and 2013 were required. The final catch for 2012 was estimated by dividing the current catch by the ratio of the catch in the same week in 2011 as the current catch (week 38) to the final 2011 catch. The estimated final catch for 2012 (2,315 t) was also used as the estimate for the final 2013 catch. The resulting estimates of total biomass (2013-2014) were converted to adult biomass using a conversion factor determined from the 2011 assessment model, because numbers-at-age for 2013 and 2014 were not available from the projection model. ABC and OFL for 2013 and 2014 were then calculated based on Tier 5 specifications for F_{OFL} (=M) and max F_{ABC} (=0.75M) using estimates of adult biomass at the start of each year, $M=0.17$, and the Baranov catch equation. The recommended ABC's for 2013 and 2014 are 9,560 t and 9,460 t, respectively, while the OFL's are 12,492 t for 2013 and 12,362 t for 2014. Not surprisingly, the new OFL and recommended ABC values for 2013 are nearly identical to those adopted for 2013 using last year's full assessment model (12,326 t and 9,432 t, respectively).

¹Stockhausen, W., M. Wilkins and M. Martin. 2011. 6. Assessment of the Rex Sole Stock in the Gulf of Alaska. In: Stock assessment and fishery evaluation report for the groundfish resources of the Gulf of Alaska. North Pacific Fishery Management Council, PO Box 103136, Anchorage, AK. <http://www.afsc.noaa.gov/REFM/docs/2011/GOArex.pdf>.

Although it is not possible to use a Tier 3 approach to making harvest recommendations for rex sole because estimates of $F_{35\%}$ and $F_{40\%}$ are not considered reliable, the SSC has decided that it is possible to use a Tier 3 approach for determining overfished status because the estimate of $B_{35\%} = 0.35 \cdot B_{100\%}$ (i.e., 35% of the unfished spawning stock biomass) is considered reliable (it does not depend on the fishery selectivity), as is the estimate of current (2012) spawning stock biomass. Because the estimated spawning stock biomass for 2012 (53,164 t) is greater than $B_{35\%}$ (19,434 t), the stock is not considered overfished.

The principal reference values for this update and from last year's assessment are summarized in the following table, with the recommended values for 2013 in bold:

Quantity	As estimated or specified last year (2011) for:		As estimated or recommended this year (2012) for:	
	2012	2013	2013	2014
M (natural mortality)	0.17	0.17	0.17	0.17
Specified/recommended tier	5	5	5	5
Biomass (adult; t)	87,162	85,528	86,684	85,778
$F_{OFL} = M$	0.170	0.170	0.170	0.170
$max F_{ABC} = 0.75 * M$	0.128	0.128	0.128	0.128
recommended F_{ABC}	0.128	0.128	0.128	0.128
OFL (t)	12,561	12,326	12,492	12,362
max ABC (t)	9,612	9,432	9,560	9,460
ABC (t)	9,612	9,432	9,560	9,460
Status	As determined last year (2011) for:		As determined this year (2012) for:	
	2010	2011	2011	2012
Overfishing	no	n/a	no	n/a
$B_{35\%}$		19,434		19,434
Female spawning biomass (t)		52,849		53,164
Overfished	n/a	no	n/a	no

6.3 Area Apportionment

In September 2012 the Plan Teams recommended that assessment authors retain status quo assessment approaches for the November 2012 SAFE report but also apply the Kalman filter or random effects survey averaging methods for Tier 5 stocks and summarize the analytical results for comparison purposes only. Because this is an executive summary, the status quo assessment approach (most recent survey) was retained. Next year the full assessment will evaluate and apply the recommended survey averaging approach for apportionment.

The area apportionments are based on the distribution of biomass from the most recent survey (in this case the 2011 GOA bottom trawl survey). The recommended area apportionment percentages are identical to last year because there is no new survey information. The following table shows the recommended ABC area apportionment for 2013-2014:

	West		Southeast		Total
	Western	Central	Yakutat	Outside	
Area Apportionment	13.6%	66.7%	8.7%	11.0%	100.0%
2013 ABC (t)	1,300	6,376	832	1,052	9,560
2014 ABC (t)	1,287	6,310	823	1,040	9,460

6.4 Research Priorities

The rex sole fishery is, at present, primarily a bycatch fishery that takes mainly older, larger fish. As a consequence, current estimates of optimum harvest levels based on Tier 3 calculations (e.g., at $F_{40\%}$ harvest rates) are very large but highly uncertain. The rex sole fishery should continue to be monitored to

assess whether a directed rex sole fishery has developed because quantities such as $F_{40\%}$ ($=F_{ABC}$ in Tier 3a) will be sensitive to the characteristics of the resulting fishery selectivity curves. Monitoring fishery size and age compositions will be crucial. A new assessment model is under development that incorporates length-based approaches to fishery and survey selectivity, size-based natural mortality, environmental predictors of recruitment or catchability (e.g., temperature), density-dependent stock-recruit functions, multiple fisheries and surveys, ageing error, and temporally-varying parameter values. The new model will allow the incorporation of additional data sources into the model, including ADFG surveys (as suggested by the SSC) and fishery age compositions.

6.5 Summaries for Plan Team

Species	Year	Biomass ¹	OFL ^{2,3}	ABC ^{2,3}	TAC ^{2,3}	Catch ⁴
Rex sole	2011	86,974	12,499	9,565	9,565	2,876
	2012	87,162	12,561	9,612	9,612	2,048
	2013	86,684	12,492	9,560		
	2014	85,778	12,362	9,460		

¹ Adult biomass from the assessment and projection models.

² http://www.fakr.noaa.gov/sustainablefisheries/specs11_12/goa_table1.pdf

³ http://www.fakr.noaa.gov/sustainablefisheries/specs12_13/goa_table1.pdf

⁴ As of Sept. 22, 2012.

Stock/ Assemblage	Area	2012				2013		2014	
		OFL ¹	ABC ¹	TAC ¹	Catch ²	OFL ³	ABC ³	OFL ³	ABC ³
Rex sole	W	--	1,307	1,307	215	--	1,300	--	1,287
	C	--	6,412	6,412	1,833	--	6,376	--	6,310
	WYAK	--	836	836	0	--	1,052	--	1,041
	SEO	--	1,057	1,057	0	--	832	--	822
	Total		12,561	9,612	9,612	2,048	12,492	9,560	12,362

¹http://www.fakr.noaa.gov/sustainablefisheries/specs12_13/goa_table1.pdf

² As of Sept. 22, 2012.

³ Based on Tier 5 calculations using adult biomass estimates from the assessment and projection models.

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