10. Assessment of the Northern Rockfish stock in the Gulf of Alaska

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Executive Summary

Rockfish are assessed on a biennial stock assessment schedule to coincide with the availability of new survey data. For Gulf of Alaska rockfish 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 (Hulson et al., 2013, available online at http://www.afsc.noaa.gov/REFM/docs/2013/GOAnorthern.pdf). A full stock assessment document with updated assessment and projection model results will be presented in next year's SAFE report.

We use a statistical age-structured model as the primary assessment tool for Gulf of Alaska northern rockfish stock which qualifies as a Tier 3 stock. For an off-cycle year, we do not re-run the assessment model, but do update the projection model with new catch information. This incorporates the most current catch information without re-estimating model parameters and biological reference points.

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 data added to the projection model included an updated 2013 catch and new estimated catches for 2014-2016. New estimates for this year's projection model are an updated 2013 catch at 4,879 t, and new estimated 2014-2016 catches. The 2014 catch was estimated by increasing the official catch as of October 1, 2014, by an expansion factor of 3%, which represents the average percentage of catch taken after October 1 in the last three complete years (2011-2013). Since the 2014 rockfish directed fishery did not occur in the Western Gulf until October 15 and those catches are not available at this time, an estimated 1000 t (maximum estimated catch by in-season management) was added to the corrected 2014 total catch to better reflect the 2014 estimated catch. To estimate future catches, we updated the yield ratio to 0.86, which was the average of the ratio of catch to ABC for the last three complete catch years (2011-2013). This yield ratio was multiplied by the projected ABCs for 2015 and 2016 from the updated projection model to generate catches for those years. The yield ratio was lower than last year's ratio of 0.95 whereas the expansion factor was the same as last year's expansion factor.

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

Summary of Results

For the 2015 fishery, we recommend the maximum allowable ABC of **4,999** t from the updated projection model. This ABC is 6% less than last year's ABC of 5,324 t but only slightly less than last year's 2015 projected ABC of 5,012 t. Recommended area apportionments of ABC are 1,226 t for the Western area, 3,772 t for the Central area, and 1 t for the Eastern area. The 2015 Gulf-wide OFL for northern rockfish is **5,961** t.

Reference values for northern rockfish are summarized in the following table, with the recommended ABC and OFL values in bold. The stock was not being subjected to overfishing last year, is not currently overfished, nor is it approaching a condition of being overfished.

Quantity	As estimated or *specified last* year for:		As estimated or *recommended this* year for:	
	2014	2015	2015	2016
M (natural mortality rate)	0.06	0.06	0.06	0.06
Tier	3a	3a	3a	3a
Projected total (ages 2+) biomass (t)	102,893	98,572	98,409	94,820
Projected Female spawning biomass (t)	42,960	40,004	39,838	37,084
$B_{100\%}$	75,183	75,183	75,183	75,183
$B_{40\%}$	30,073	30,073	30,073	30,073
$B_{35\%}$	26,314	26,314	26,314	26,314
F_{OFL}	0.073	0.073	0.073	0.073
$maxF_{ABC}$	0.061	0.061	0.061	0.061
F_{ABC}	0.061	0.061	0.061	0.061
OFL (t)	6,349	5,978	**5,961**	5,631
maxABC (t)	5,324	5,012	4,999	4,722
ABC (t)	5,324	5,012	**4,999**	4,722
Status	As determined *last* year for:		As determined *this* year for:	
	2012	2013	2013	2014
Overfishing	No	n/a	No	n/a
Overfished	n/a	No	n/a	No
Approaching overfished	n/a	No	n/a	No

[1] Projections are based on estimated catches of 4,333 t and 4,111 t used in place of maximum permissible ABC for 2015 and 2016.

Updated catch data (t) for northern rockfish in the Gulf of Alaska as of October 1, 2014 (NMFS Alaska Regional Office Catch Accounting System via the Alaska Fisheries Information Network (AKFIN) database, http://www.akfin.org) are summarized in the following table.

Year	Western	Central	Eastern	Gulfwide Total	Gulfwide ABC	Gulfwide TAC
2013	2,174	2,705		4,879	5,130	5,130
2014	60	3,297		3,357	5,322	5,322

Area Apportionment

The apportionment percentages are the same as in the 2013 full assessment. The following table shows the recommended apportionment of ABC for 2015 and 2016. Please refer to last year's full stock assessment report for information regarding the apportionment rationale for northern rockfish.

	Western	Central	Eastern*	Total
Area Apportionment	24.52%	75.45%	0.03%	100%
2015 Area ABC (t)	**1,226**	**3,772**	**1**	**4,999**
2016 Area ABC (t)	**1,158**	**3,563**	**1**	**4,722**

*For management purposes the small ABC in the Eastern area is combined with other rockfish.

Summaries for Plan Team

Species	Year	Biomass[1]	OFL	ABC[3]	TAC[3]	Catch[2]
Northern rockfish	2013	99,089	6,124	5,130	5,130	4,879
	2014	102,893	6,349	5,322	5,322	3,357
	2015	98,409	5,961	4,999		
	2016	94,820	5,631	4,722		

Stock/ Assemblage	Area	2014 OFL	ABC[3]	TAC[3]	Catch[2]	2015 OFL	ABC	2016 OFL	ABC
Northern rockfish	W		1,305	1,305	60		1,226		1,158
	C		4,017	4,017	3,297		3,772		3,563
	E						1		1
	Total	6,349	5,322	5,322	3,357	5,961	4,999	5,631	4,722

[1]Total biomass (ages 2+) from the age-structured model
[2]Current as of October 1, 2014. Source: NMFS Alaska Regional Office Catch Accounting System via the AKFIN database (http://www.akfin.org).
[3]For management purposes, the small ABC for northern rockfish in the Eastern Gulf of Alaska is combined with other rockfish. Thus, for 2014 the Eastern Gulf ABC (and associated TAC) is not reported in these tables, but the Eastern Gulf ABC for 2015 and 2016 are included as future recommendations.

SSC and Plan Team Comments on Assessments in General

"The SSC is pleased to see that many assessment authors have examined retrospective bias in the assessment and encourages the authors and Plan Teams to determine guidelines for how to best evaluate and present retrospective patterns associated with estimates of biomass and recruitment. We recommend that all assessment authors (Tier 3 and higher) bring retrospective analyses forward in next year's assessments." (SSC, December 2011)
"For the November 2012 SAFE report, the Teams recommend that authors conduct a retrospective analysis back 10 years (thus, back to 2002 for the 2012 assessments), and show the patterns for spawning biomass (both the time series of estimates and the time series of proportional changes relative to the 2012 run). This is consistent with a December 2011 NPFMC SSC request for stock assessment authors to conduct a retrospective analysis. The base model used for the retrospective analysis should be the author's recommended model, even if it differs from the accepted model from previous years." (Plan Team, September 2012)

In response to both of these comments, retrospective analyses for the author's recommended model were included in the retrospective investigation group's Plan Team report. We will include further examination of retrospective analysis in next year's full assessment.

"The SSC concurs with the Plan Teams' recommendation that the authors consider issues for sablefish where there may be overlap between the catch-in-areas and halibut fishery incidental catch estimation (HFICE) estimates. In general, for all species, it would be good to understand the unaccounted for catches and the degree of overlap between the CAS and HFICE estimates, and to discuss these at the Plan Team meetings next September." (SSC, December 2011)

The degree of overlap between catch-in-areas and the HFICE estimates are negligible for northern rockfish (see Table 10A.2 in the 2013 SAFE report).

"The Teams recommend that authors continue to include other removals in an appendix for 2013. Authors may apply those removals in estimating ABC and OFL; however, if this is done, results based on the approach used in the previous assessment must also be presented. The Teams recommend that the "other" removals data set continue to be compiled, and expanded to include all sources of removal." (Plan Team, September 2012)
"The Teams recommend that the whole time series of each category of 'other' catches be made available on the NMFS "dashboard," so that they may be listed in all SAFE chapters." (Plan Team, November 2012)

In response to these two comments, other removals are available on the dashboard. These removals were included the 2013 SAFE report and will continue to be included in future full-assessments.

"The Teams recommended that each stock assessment model incorporate the best possible estimate of the current year's removals. The Teams plan to inventory how their respective authors address and calculate total current year removals. Following analysis of this inventory, the Teams will provide advice to authors on the appropriate methodology for calculating current year removals to ensure consistency across assessments and FMPs." (Plan Team, September 2013)

We estimated current year's removals by multiplying the official catch as of October 1, 2014, by an expansion factor, which represents the average additional catch taken after October 1 and through December 31 in the last three complete years (2011-2013). Further description is provided in the 'Specified catch estimation' section in the 2013 SAFE report.

"For the GOA age-structured rockfish assessments, if length composition data are withheld, the Team recommends exploratory model runs to test sensitivity. This should include any year of fishery or survey length composition data which could serve as a proxy for the age composition, not simply the most recent survey year." (Plan Team, November 2013)

A sensitivity analysis of including the most recent year's survey length composition has been performed for northern rockfish and is included in Appendix 9B of the Pacific ocean perch SAFE. The results of that analysis suggests that in some cases using the most recent year's survey length composition in the northern rockfish assessment improves results. We will further investigate this results in the full assessment provided in 2015. Fishery length compositions are utilized in the northern rockfish assessment in years for which fishery age data is not available.

"For assessments involving age-structured models, this year's CIE review of BSAI and GOA rockfish assessments included three main recommendations for future research: Authors should consider: (1) development of alternative survey estimators, (2) evaluating selectivity and fits to the plus group, and (3) re-evaluating natural mortality rates. The SSC recommends that authors address the CIE review during full assessment updates scheduled in 2014." (SSC, December 2013)

Because of the Government shutdown in 2013, comments were not fully addressed in last year's assessment. Full assessment updates for all the GOA rockfish stocks will be completed in 2015 and CIE review comments will be addressed at that time. Please refer to the Summary and response to the 2013 CIE review of the AFSC rockfish document presented to the September 2013 Plan Team (http://www.afsc.noaa.gov/REFM/stocks/Plan_Team/2013/Sept/2013_Rockfish_CIE_Response.pdf).

"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." (SSC December 2013)

These projections are available in the executive summary table and will be added to the phase-plane plots in future full assessments.

SSC and Plan Team Comments Specific to this Assessment

"The Team asks the [rockfish] *authors to investigate whether the conversion matrix has changed over time. Additionally, the Team requests that the criteria for omitting data in stock assessment models be based upon the quality of the data (e.g. bias, sampling methods, information content, redundancy with other data, etc.) rather than the effect of the data on modeled quantities."* (Plan Team, November 2011)

The conversion matrix and all growth information were updated in the 2011 assessment. Many of the issues regarding temporal changes in the conversion and error matrices are similar across the age-structured rockfish assessments. In order to properly address this comment we plan to conduct an investigation on developing methods for updating conversion and error matrices for these long-lived species as a group and to perform sensitivity analyses on the timeliness of updates. We anticipate this future investigation to begin next year and will incorporate relevant results into the northern rockfish model following further review. Analysis of including the survey length data into the northern rockfish model is included in the Pacific ocean perch assessment, and recommendations from which will be taken into account in next year's full assessment.

"The SSC also looks forward to an update of weight-at-age, length and age transition matrices, ageing error matrix, and length bins for fishery length compositions during the next assessment cycle." (SSC, December 2011)

An alternative method to incorporate ageing error was presented at the November 2013 Plan Team meeting. This method will be further explored and incorporated into the 2015 rockfish assessments. Upon implementation of the new ageing error method the age and length bins will be further investigated and any changes suggested by these analyses will be implemented in the 2015 assessments.

"The SSC supports the inclusion of the maturity data within the model to estimate an intermediate maturity schedule as an interim solution to dealing with two conflicting studies. However, we encourage the authors to further explore the reasons for differences seen between the two studies of maturity that formed the basis of the estimated maturity schedule in the model." (SSC, December 2011)

We agree with the SSC that the reasons for such differences found in maturity should be explored to refine the method of incorporating maturity into the assessment model. However, additional studies for northern rockfish must be conducted to make any such analysis fruitful, as it is unclear whether the change seen in northern rockfish maturity between these two studies was due to maturity changing over time, observation error in maturity observations, or a combination of both. Additional studies would help to clarify the reasons behind changing maturity.

"The SSC recommends that the authors explore and evaluate alternative approaches to constructing the trawl survey biomass and consider recommendations from the survey averaging work group for apportionment. The SSC recommends including work on maturity for northern rockfish as a research priority." (SSC, December 2013)

We hope to explore and present alternative approaches to constructing trawl survey biomass for the 2015 full assessment. In the 2015 assessment we will explore using the random effects model for apportionment similar to the approach used for this year's POP assessment. We also agree that additional information on northern rockfish maturity would be useful.

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