12. Assessment of the Dusky 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 (Lunsford et al., 2013, available online at http://www.afsc.noaa.gov/REFM/docs/2013/GOAdusky.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 dusky rockfish 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 catch estimates for this year's projection model are an updated 2013 catch of 3,158 t, and estimated 2014-2016 catches of 3,106 t, 3,379 t, and 3,124 t, respectively. The 2014 catch was estimated by multiplying the official catch as of October 1, 2014, by an expansion factor of 1.03, which represents the average fraction of catch taken between October 1 and December 31 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 aren't available at this time, an estimated 200 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 (0.67), 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 2013 assessment model to generate catches for those years. The yield ratio was higher than last year's ratio of 0.63 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 **5,109** t from the updated projection model. This ABC is 7% lower than the 2014 ABC of 5,486 t but similar to the ABC of 5,081 t projected for 2015 in the 2014 assessment. Recommended area apportionments of ABC are 296 t for the Western area, 3,336 t for the Central area, 1,288 t for the West Yakutat area, and 189 t for the Southeast/Outside area. The 2015 Gulf-wide OFL for dusky rockfish is **6,246 t**.

Reference values for dusky 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[1]	2016[1]
M (natural mortality rate)	0.07	0.07	0.07	0.07
Tier	3a	3a	3a	3a
Projected total (ages 4+) biomass (t)	69,371	66,104	66,629	64,295
Projected female spawning biomass (t)	29,256	27,200	27,345	25,344
$B_{100\%}$	52,264	52,264	52,264	52,264
$B_{40\%}$	20,906	20,906	20,906	20,906
$B_{35\%}$	18,292	18,292	18,292	18,292
F_{OFL}	0.122	0.122	0.122	0.122
$maxF_{ABC}$	0.098	0.098	0.098	0.098
F_{ABC}	0.098	0.098	0.098	0.098
OFL (t)	6,708	6,213	**6,246**	5,759
maxABC (t)	5,486	5,081	5,109	4,711
ABC (t)	5,486	5,081	**5,109**	4,711
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 3,379 t and 3,124 t used in place of maximum permissible ABC for 2015 and 2016.

Updated catch data (t) for dusky 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. The 2014 dusky rockfish catch as of October 1 was lower in the Western Gulf than previous years because in 2014 the rockfish trawl fishery in this region was not opened to directed fishing until October 15. Final catch estimates will likely be similar to previous years when the directed fishery catch from this region is included.

Year	Western	Central	Eastern	West Yakutat	E. Yakutat/ Southeast	Gulfwide Total	Gulfwide ABC	Gulfwide TAC
2013	217	2,929		4	8	3,158	4,700	4,700
2014	22	2,718		86	4	2,830	5,486	5,486

Area Apportionment

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

	Western	Central	West Yakutat[1]	E Yakutat / Southeast[1]	Total
Area Apportionment	5.8%	65.3%	25.2%	3.7%	100%
Area ABC (t)	**296**	**3,336**	**1,288**	**189**	**5,109**
OFL (t)					**6,246**

[1]Amendment 41 prohibited trawling in the eastern area east of 140° W longitude. To account for the portion of the dusky rockfish biomass in the West Yakutat area that is still open to trawling a ratio is calculated to apportion the eastern area into West Yakutat and East Yakutat/Southeast Outside. This ratio is the same as last year (0.87).

Summaries for Plan Team

Species	Year	Biomass[1]	OFL	ABC	TAC	Catch[2]
Dusky Rockfish	2013	63,515	5,746	4,700	4,700	3,158
	2014	69,371	6,708	5,486	5,486	2,830
	2015	66,629	6,246	5,109		
	2016	64,295	5,759	4,711		

Stock/ Assemblage	Area	2014 OFL	2014 ABC	2014 TAC	2014 Catch[2]	2015 OFL	2015 ABC	2016 OFL	2016 ABC
Dusky Rockfish	W		317	317	22		296		273
	C		3,584	3,584	2,718		3,336		3,077
	WYAK		1,384	1,384	86		1,288		1,187
	EYAK/SEO		201	201	4		189		174
	E		--	--	--				
	Total	6,708	5,486	5,486	2,830	6,246	5,109	5,759	4,711

[1]Total biomass (ages 4+) 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).

Responses to SSC and Plan Team Comments on Assessments in General

Because of the government shutdown in 2013, there was only sufficient time to compile SSC and Plan Team comments in last year's assessment. Since this is an "off" year and only an executive summary is presented, we respond here to priority comments. For comments relevant to or require a full assessment and/or model run, we will present responses in next year's full assessment.

"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)

Retrospective analyses for the author's recommended model were included in the retrospective investigation group's Plan Team report in September, 2013 (Hanselman et al., 2013.

http://www.afsc.noaa.gov/REFM/stocks/Plan_Team/2013/Sept/Retrospectives_2013_final3.pdf). We will include further examination of retrospective analysis in next year's full assessment.

"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 of 1.03, which represents the average additional catch taken between October 1 and December 31 in the last three complete years (2011-2013). (*Section: Executive Summary: Summary of Results*).

"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)

Preliminary analysis of including length composition data in the model has been conducted for GOA POP and was presented September, 2014. Additional analyses for three rockfish species including dusky are presented as an appendix in this year's POP assessment. Following Plan Team and SSC review on this, we plan to explore similar sensitivity analyses for the 2015 dusky rockfish assessment.

"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 GOA rockfish will be completed in 2015 and CIE review comments will be addressed at that time. Additionally, an AFSC response to the rockfish CIE review was prepared that addresses some of their concerns. Please refer to the "Summary and response to the 2013 CIE review of the AFSC rockfish" document presented to the September 2013 Plan Team for further details (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)

For the 2013 dusky rockfish assessment we used the same weight-at-age estimates, age-length transition matrix, and aging error conversion matrix as the 2011 assessment which used survey data from 1984-2007. This was an update from previous assessments (2001-2009) which used values from the 2001 Pelagic Shelf Rockfish SAFE document (Clausen and Heifetz, 2001). We hope to update with the most recent data for the 2015 full 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 to begin next year and will incorporate relevant results into the dusky rockfish model following further review. An analysis of including the survey length data into the dusky rockfish model is included in this year's Pacific ocean perch assessment, and we plan to take the forthcoming recommendations into account in next year's full assessment.

"The Team noted the low recruitment estimates (with high uncertainty) for recent year classes, and requests a retrospective analysis to evaluate how changes in available data affect estimated year-class strength." (Plan Team, November 2011)

A retrospective analysis is planned for next year and year class strength changes will be evaluated at that time.

"Results from model 3 showed the age at 50% maturity from model 3 was approximately 10 years, a decline from the value of approximately 11 years used in previous assessments. This resulted in an increase in the recommended F_{OFL} and F_{ABC}. The SSC asks the author to consider whether this downward adjustment in the age at 50% maturity is warranted." (SSC, December 2011)

In 2011 a new age at maturity value was presented. The previous value was from opportunistic sampling of sixty-four female dusky rockfish. The proposed maturity-at-age was modeled with the logistic function and parameter estimates were obtained by combining the data from the sixty-four specimens with the results of a newly published study on dusky rockfish in the GOA. This approach utilized the best available information combining data from the two studies. Additionally, these parameter estimates were estimated conditionally within the model allowing for uncertainty in age-at-maturity to be incorporated into uncertainty for key model results such as ABC. This approach has also been adopted for GOA and BSAI POP and GOA northern rockfish where multiple age-at-maturity estimates from different studies were available.

"The authors noted that if area specific OFLs were in place they would have been exceeded in the western GOA. The SSC encourages the authors to continue to track this in future years." (SSC, December 2012)

The western GOA catch did not exceed TAC in 2013 and is not expected to exceed TAC in 2014. In-season management has worked with the rockfish fleet to ensure overages do not occur in the western GOA rockfish fishery. We will continue to monitor and report if these catches exceed TAC.

"The Team recommends exploration of extending the modeled ages beyond the plus group in the data in order to improve the fits to the age composition data." (Plan Team, November 2013)

The GOA rockfish stock assessment authors hope to address these comments as a whole for all of the rockfish species that have age-structured assessments. We expect to present an analysis in September, 2015 for inclusion in next year's stock assessments.

"In order to evaluate the relative precision of area-specific biomass estimates, the Team recommends that the authors include the survey CVs by region when presenting apportionment estimates." (Plan Team, November 2013)

For 2015, when apportionments are re-calculated, we will include survey CVs by region.

"The SSC concurs with the Plan Team that exploration of the impacts of extending the plus-group in the assessment, and trying the random effects models for spatial allocation, would be potentially useful enhancements to the assessment. The SSC notes that the CIE reviewers provided comments on the use of survey data in stock assessments and encourages the author to evaluate comments relevant to the dusky assessment." (SSC, December 2013)

We hope to have a rockfish analysis on the plus-group issue in September, 2015. We plan to include the random effects model in apportionment calculations for 2015, per the September 2014 SSC recommendation for GOA POP. We will also address CIE review comments in next year's assessment.