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

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November 2016

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., 2015, available online at http://www.afsc.noaa.gov/REFM/Docs/2015/GOAnork.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 2015 catch (3,944 t) and new estimated catches for 2016-2018. The 2016 catch was estimated by increasing the official catch as of October 8, 2016 by 10%, which represents the average percentage of catch taken after October 8 in the last three complete years (2013-2015). This resulted in an estimated catch for 2016 of 3,533 t. To estimate future catches, we updated the yield ratio to 0.85, which was the average of the ratio of catch to ABC for the last three complete catch years (2013-2015). This yield ratio was multiplied by the projected ABCs from the updated projection model to generate catches of 3,214 t in 2017 and 2,923 in 2018. The yield ratio was lower than last year's ratio of 0.89 whereas the expansion factor was the same as last year's expansion factor.

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

Summary of Results

For the 2017 fishery, we recommend the maximum allowable ABC of **3,790** t from the updated projection model. This ABC is 5% less than last year's ABC of 4,008 t but slightly larger than last year's 2017 projected ABC of 3,772 t. Recommended area apportionments of ABC are 432 t for the Western area, 3,354 t for the Central area, and 4 t for the Eastern area. The 2017 Gulf-wide OFL for northern rockfish is **4,522** 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:	
	2016	2017	2017*	2018*
M (natural mortality rate)	0.059	0.059	0.059	0.059
Tier	3a	3a	3a	3a
Projected total (ages 2+) biomass (t)	77,596	74,722	75,028	73,248
Projected Female spawning biomass (t)	31,313	29,033	29,198	27,344
$B_{100\%}$	69,957	69,957	69,957	69,957
$B_{40\%}$	27,983	27,983	27,983	27,983
$B_{35\%}$	24,485	24,485	24,485	24,485
F_{OFL}	0.074	0.074	0.074	0.074
$maxF_{ABC}$	0.062	0.062	0.062	0.062
F_{ABC}	0.062	0.062	0.062	0.062
OFL (t)	4,783	4,501	**4,522**	4,175
maxABC (t)	4,008	3,772	**3,790**	3,512
ABC (t)	4,008	3,772	**3,790**	3,512
Status	As determined *last* year for:		As determined *this* year for:	
	2014	2015	2015	2016
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 3,214 t and 2,923 t used in place of maximum permissible ABC for 2017 and 2018.

Updated catch data (t) for northern rockfish in the Gulf of Alaska as of October 8, 2016 (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
2015	979	2,965		3,944	4,998	4,998
2016	112	3,086		3,198	4,004	4,004

Area Apportionment

The apportionment percentages are the same as in the 2015 full assessment. The following table shows the recommended apportionment of ABC for 2017 and 2018. Please refer to last year's full stock assessment report for information regarding the apportionment rationale for northern rockfish.

Area Apportionment	Western	Central	Eastern*	Total
	11.4%	88.5%	0.1%	100%
2017 Area ABC (t)	**432**	**3,354**	**4**	**3,790**
2018 Area ABC (t)	**400**	**3,108**	**4**	**3,512**

*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*	TAC	Catch[2]
Northern rockfish	2015	98,409	5,961	4,998	4,998	3,944
	2016	77,596	4,783	4,004	4,004	3,198
	2017	75,028	4,522	3,790		
	2018	73,248	4,175	3,512		

Stock/ Assemblage	Area	2016 OFL	ABC	TAC	Catch[2]	2017 OFL	ABC	2018 OFL	ABC
Northern rockfish	W		457	457	112		432		400
	C		3,547	3,547	3,086		3,354		3,108
	E*						4		4
	Total	4,783	4,004	4,004	3,198	4,522	3,790	4,175	3,512

[1]Total biomass (ages 2+) from the age-structured model

[2]Current as of October 8, 2016. Source: NMFS Alaska Regional Office Catch Accounting System via the AKFIN database (http://www.akfin.org).

*For management purposes, the small ABC for northern rockfish in the Eastern Gulf of Alaska is combined with other rockfish. Thus, for 2016 the Eastern Gulf ABC (and associated TAC) is not reported in these tables, but the Eastern Gulf ABC for 2017 and 2018 are included as future recommendations.

SSC and Plan Team Comments on Assessments in General

The Team recommends that a workgroup or subset of authors investigate applying the geostatistical approach to selected stocks. (Plan Team, November 2015)

The SSC supports the GOA PT recommendation to form a study group to explore the criteria necessary for adopting the geostatistical generalized linear mixed model approach in assessments. If this study group is formed, the SSC requests that the group be expanded to include BSAI assessment authors and members from the AFSC survey program. Among the many questions this group could address, the SSC suggests including the following questions:

1. Is the stratified random survey design used for the surveys correctly configured for application of the geostatistical approach?

2. Should the geostatistical approach be applied to all species or a select suite of species that exhibit aggregated spatial distributions and rockfish-like life histories? If application of this approach is recommended for only a subset of managed species, what life history characteristics or biological criteria would qualify a species for this approach?

3. What level of aggregation is necessary for application of the geostatistical approach?

4. If the geostatistical approach is adopted should results also be used for area apportionments?

(SSC, December 2015)

We have grouped these two comments together as they deal with the same topic. A working group is currently being formed and will investigate the criteria for use of the geostatistical generalized linear mixed model within assessments performed by the AFSC. Some authors of the northern rockfish assessment will be participating in this working group and the results will be applied in this assessment as soon as they are available as this is a stock for which the geostatistical model would be especially pertinent.

The Team recommends an evaluation on how best to tailor the RE model to accommodate multiple indices. (Plan Team, November 2015)

There is only a single fishery-independent index for northern rockfish (AFSC bottom trawl survey), thus, for fishery-independent data sources this recommendation does not apply.

Many assessments are currently exploring ways to improve model performance by re-weighting historic survey data. The SSC encourages the authors and PTs to refer to the forthcoming CAPAM data-weighting workshop report. (SSC, December 2015)

The SSC recommends that the Gulf of Alaska Groundfish Plan Team (GOA GPT), BSAI GPT, and CPT encourage the continued use of multiple approaches to data weighting (not just the Francis (2011) method, but also including the harmonic mean and others). (SSC, October 2016)

We have grouped these two comments together as they deal with the same topic. We agree with the SSC's recommendation and, as discussed below in the comments specific to this assessment, weighting investigations will be conducted prior to next year's full assessment taking into considerations the results of the CAPAM data-weighting workshop report.

Finally, an area apportionment approach using the RE model which specifies a common "process error" has been developed and should be considered. (Plan Team, November 2015)

A common "process error" approach will be considered in the apportionment for the next full assessment. Further investigations into apportionment that are specific to this assessment are discussed below.

The SSC requests that stock assessment authors bookmark their assessment documents and commends those that have already adopted this practice. (SSC, October 2016)

We have adopted the guideline SAFE document format for headings in both the full assessment and executive summaries for northern rockfish. This should allow for development of a consistent table of contents across SAFE chapters in the future.

SSC and Plan Team Comments Specific to this Assessment

The Team recommends evaluating how the definition of the length composition plus group, and alternative data-weighting methods, affect model performance. (Plan Team, November 2015)

The Team recommends continuing to evaluate geostatistical estimators of survey biomass for this stock. (Plan Team, November 2015)

Based on the model changes made for 2015, the PT recommended further examination of how the definition of the length composition plus group and alternative data-weighting methods affect model performance. They also expressed concern about the high inter-annual variation for survey biomass, and recommended the authors continue to evaluate geostatistical estimators of survey biomass for future assessments. Length bins for fishery length compositions have not been examined, but the authors plan to continue exploring this for the next full assessment. A past recommendation from the SSC and assessment authors was to investigate maturity and the potential for time-dependent changes in maturity, and the authors note that they are working on a sampling project proposal that would collect the data necessary to evaluate this research priority. The SSC agrees that these remaining issues are still applicable and recommend that the authors continue investigations into these issues, particularly the explorations of geostatistical GLMM for the survey biomass estimates, given the high variability in the survey biomass estimates. (SSC, December 2015)

For the 2017 assessment the authors plan to investigate: (1) the effect of different plus-group specification for length composition data, (2) alternative length bin designations, (3) different data weighting methods, and (4) application of geostatistical GLMM approaches to create different bottom trawl survey biomass indices. Additional northern rockfish maturity data is needed to evaluate changes over time and this continues to be a data gap and research priority for this stock.