9. Assessment of the Pacific ocean perch 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., 2015, available online at http://www.afsc.noaa.gov/REFM/Docs/2015/GOApop.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 Pacific ocean perch 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 (18,733 t) and new estimated catches for 2016-2018. Normally in off-cycle assessments the current year's catch (2016) is estimated with an expansion factor that is the average additional catch from the date of running the projection model (beginning of October) through the end of December from the previous three complete catch years (2013-2015). In 2014 the directed fishery for Pacific ocean perch in the Western Gulf did not occur until after October 15; in a typical year the large majority of TAC in the Western Gulf is caught by the end of August. This additional catch in October of 2014 resulted in an inflated expansion factor that estimated 2016 catch to exceed the gulfwide TAC by nearly 1,800 t. However, the catch of Pacific ocean perch as of October 8, 2016 remains nearly 1,350 t less than the gulfwide TAC, directed fishing has ceased in the GOA, and Pacific ocean perch has been placed on prohibited species catch (PSC) status in the Central Gulf. We find it highly unlikely that the 2016 catch will exceed the TAC by such an amount that is suggested by the expansion factor, thus, for this year's projection model we have set the 2016 estimated gulfwide catch at the 2016 TAC of 24,437 t. We expect in the future to return to the use of the expansion factor once the 2014 anomaly in the Western gulf has moved out of the three year averaging window. To estimate future catches (2017-2018), we updated the yield ratio to 0.87, which was the average of the ratio of catch to ABC for the last three complete catch years (2013-2015) and resulted in the same yield ratio as used in the 2015 full assessment. This yield ratio was multiplied by the projected ABCs from the updated projection model to generate catches of 20,806 t in 2017 and 20,201 t in 2018.

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 **23,918** t from the updated projection model. This ABC is 2% less than the 2016 ABC and 1% less than the projected 2017 ABC from last year's assessment. The corresponding reference values for Pacific ocean perch are summarized in the following table, with the recommended ABC and OFL values in bold. Overfishing is not occurring, the stock is not overfished, and it is not approaching an overfished condition.

Quantity	As estimated or *specified last* year for:		As estimated or *recommended this* year for:	
	2016	2017	2017*	2018*
M (natural mortality rate)	0.061	0.061	0.061	0.061
Tier	3a	3a	3a	3a
Projected total (ages 2+) biomass (t)	457,768	449,416	445,672	437,123
Projected Female spawning biomass (t)	157,080	158,124	156,563	156,444
$B_{100\%}$	285,327	285,327	285,327	285,327
$B_{40\%}$	114,131	114,131	114,131	114,131
$B_{35\%}$	99,865	99,865	99,865	99,865
F_{OFL}	0.119	0.119	0.119	0.119
$maxF_{ABC}$	0.102	0.102	0.102	0.102
F_{ABC}	0.102	0.102	0.102	0.102
OFL (t)	28,431	28,141	**27,826**	27,284
maxABC (t)	24,437	24,189	**23,918**	23,454
ABC (t)	24,437	24,189	**23,918**	23,454
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 20,806 t and 20,201 t used in place of maximum permissible ABC for 2017 and 2018.

Updated catch data (t) for Pacific ocean perch 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	West Yakutat	E. Yakutat/ Southeast	Gulfwide Total	Gulfwide ABC	Gulfwide TAC
2015	2,038	14,714		1,981	< 1	18,733	21,012	21,012
2016	2,581	17,671		2,827	< 1	23,078	24,437	24,437

Area Apportionment

The apportionment percentages are the same as in the 2016 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 Pacific ocean perch.

Area Apportionment	Western	Central	Eastern	Total
	11.2%	69.7%	19.1%	100%
2017 Area ABC (t)	**2,679**	**16,671**	**4,568**	**23,918**
2018 Area ABC (t)	**2,627**	**16,347**	**4,480**	**23,454**

Amendment 41 prohibited trawling in the Eastern area east of 140° W longitude. The ratio of biomass still obtainable in the W. Yakutat area (between 147° W and 140° W) is the same as last year at 0.61. This results in the following apportionment of the Eastern Gulf area:

	W. Yakutat (WYAK)	E. Yakutat/Southeast (SEO)	Total
2017 Area ABC (t)	**2,786**	**1,782**	**4,568**
2018 Area ABC (t)	**2,733**	**1,747**	**4,480**

In 2012, the Plan Team and SSC recommended combined OFLs for the Western, Central, and West Yakutat areas (W/C/WY) because the original rationale of an overfished stock no longer applied. However, because of concerns over stock structure, the OFL for SEO remained separate to ensure this unharvested OFL was not utilized in another area. The Council adopted these recommendations. This results in the following apportionment for the W/C/WYK area:

	Western/Central/W. Yakutat (W/C/WY)	E. Yakutat/Southeast (SEO)	Total
2017 Area OFL (t)	**25,753**	**2,073**	**27,826**
2018 Area OFL (t)	**25,252**	**2,032**	**27,284**

Summaries for Plan Team

Species	Year	Biomass[1]	OFL	ABC	TAC	Catch[2]
Pacific ocean perch	2015	416,140	24,360	21,012	21,012	18,733
	2016	457,768	28,431	24,437	24,437	23,078
	2017	445,672	27,826	23,918		
	2018	437,123	27,284	23,454		

Stock	Area	2016 OFL	2016 ABC	2016 TAC	2016 Catch[2]	2017 OFL	2017 ABC	2018 OFL	2018 ABC
Pacific ocean perch	W		2,737	2,737	2,581		2,679		2,627
	C		17,033	17,033	17,671		16,671		16,347
	WYAK		2,847	2,847	2,827		2,786		2,733
	SEO	2,118	1,820	1,820	0	2,073	1,782	2,032	1,747
	W/C/WY	26,313				25,753		25,252	
	Total	28,431	24,437	24,437	23,078	27,826	23,918	27,284	23,454

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

[2]Current as of October 8, 2016, Source: NMFS Alaska Regional Office via the Alaska Fisheries Information Network (AKFIN).

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. Several authors of the Pacific ocean perch assessment will be participating in this working group and the results will be examined to see if there is utility in using the geostatistical approach for POP.

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 Pacific ocean perch (AFSC bottom trawl survey), thus, for fishery-independent data sources this recommendation does not apply. However, one could investigate the use of a fishery-dependent index (e.g., CPUE). When recommendations are provided on how best to tailor the RE model to multiple indices they will be implemented into apportionment for this assessment.

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 Pacific ocean perch. 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 Plan Team recommends evaluation of how the data weights given to the various fishery and survey age and length composition data affect the estimates of recruitment and age composition." (Plan Team, September 2014)

Author's response in 2015 – We plan to do a more thorough evaluation of weighting age and length data by performing a sensitivity analysis for all of the GOA rockfish assessments rather than just Pacific ocean perch. However, similar to the input sample size evaluation requested by the SSC, this is an issue that

would be pertinent to any age-structured assessment performed by AFSC and should be conducted so that any weighting method developed is applicable across assessments. The results of this analysis for GOA rockfish will be presented in future assessments, although, this analysis may be more appropriately conducted by a Plan Team working group with a broader focus than just the GOA rockfish assessments. We will also consider the recommendations developed by the CAPAM workshop held in October 2015 with regards to data weighting.

The Team recommends increasing the plus group for the length compositions to evaluate model performance. (Plan Team, November 2015)

In September (2014), the PT and SSC recommended evaluating data weighting for fishery and survey age and length compositions with respect to estimates of recruitment and age compositions. The authors note that this issue pertains to all GOA rockfish assessments and plan to do a more thorough evaluation of this issue for future assessments. The SSC agrees and would recommend a broader look at the issue across all GOA rockfish species, and to consider relevant recommendations from the 2015 CAPAM workshop on data weighting. Further, the SSC concurs with the PT recommendations for the next full POP assessment to investigate 1) increasing the plus group for length compositions to evaluate model performance, 2) using an alternate trawl survey index, 3) using alternative length bins, 4) including sample sizes for composition data, and 5) relating fishery selectivity to average depth fished. (SSC, December 2015)

We have included the correspondence between the authors and Plan Team/SSC over the last 2 years in order to document the recommendations and responses made on these particular topics for future reference. While we maintain that the data weighting topic is applicable across all of the assessments performed by the AFSC (not just the rockfish assessments), we recognize that a generally applicable approach for data weighting of index, catch, age and length composition datasets may not be possible as species-specific considerations may need to be implemented. The data weighting methodology used for the GOA rockfish assessments in particular will be investigated prior to the 2017 full assessments, with recommendations being implemented into those assessments. The recommendations made by the Plan Team and SSC that are specific to the Pacific ocean perch assessment will be investigated prior to the full assessment in 2017.

The Team recommends evaluating harvest rates in West Yakutat to compare with F_{ABC} rates. (Plan Team, November 2015)

The SSC concurs with the PT recommendation to evaluate harvest rates in WYAK for comparison to F_{ABC} rates. (SSC, December 2015)

Prior to the 2017 full assessment the authors will investigate the WYAK harvest rates for comparison to F_{ABC}.

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