13. Assessment of the Northern Rockfish Stock in the Bering Sea and Aleutian Islands

by

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Executive Summary

In 2005, BSAI rockfish were moved to a biennial assessment schedule with full assessments in even years to coincide with the frequency of trawl surveys in the Aleutian Islands (AI) and the eastern Bering Sea (EBS) slope. In 2017, the scheduled frequency for some stock assessments was changed in response to the National Stock Assessment Prioritization effort. Bering Sea/Aleutian Islands (BSAI) northern rockfish will maintain a biennial schedule but with full assessments in odd years, with the next full assessment scheduled for 2019. The 2016 full assessment can be found at http://www.afsc.noaa.gov/REFM/docs/2016/BSAInorthern.pdf. In years without a full assessment, a "partial assessment" is produced by revising the recent catch data and re-running the projection model using the results from the previous full assessment as a starting point. Therefore, this update does not incorporate any changes to the 2016 assessment methodology, but does update the catch estimates for 2016-2018 and provides an estimated catch for 2019. The partial assessment also includes estimates of catch/biomass (i.e., exploitation rates), using estimated total biomass.

Summary of Changes in Assessment Inputs

Changes in input data: The updated information for this partial assessment is replacing the estimated 2016 catch with the final catch value, and revising the 2017 and 2018 catch estimates. The 2016 catch was 4,541 t, 3.8% larger than the estimate of 4,375 t that was used in the 2016 projection. In 2016, the northern rockfish catch was slightly above the TAC (by 1%); thus, the catch in 2017 is assumed to be the TAC level of 5,000 t. The estimated 2018 and 2019 catches are assumed to result from fishing at the estimated 2017 *F*, resulting in 4,895 t and 4,794 t, respectively.

Changes in assessment methodology: There were no changes in assessment methodology since this was a partial assessment year.

Summary of Results

For the 2018 fishery, we recommend the maximum ABC of 12,975 t and an OFL of 15,888 t based on the updated projection model. The recommended 2018 ABC is 2.2% less than the 2017 ABC of 13,264 and 0.2% more than the projected 2017 ABC of 12,947 from the 2016 projection model. A summary of the updated projection model results is shown below.

Quantity	As estimated or specified last year for:		As estimated or recommended this year for:	
	2017	2018	2018*	2019*
M (natural mortality rate)	0.046	0.046	0.046	0.046
Tier	3a	3a	3a	3a
Projected total (age 3+) biomass	248,160	245,693	246,160	244,963
Female spawning biomass (t)				
Projected	107,660	106,184	106,486	104,699
$B_{100\%}$	164,674	164,674	164,674	164,674
$B_{40\%}$	65,870	65,870	65,870	65,870
$B_{35\%}$	57,636	57,636	57,636	57,636
F_{OFL}	0.080	0.080	0.080	0.080
$maxF_{ABC}$	0.065	0.065	0.065	0.065
F_{ABC}	0.065	0.065	0.065	0.065
OFL (t)	16,242	15,854	15,888	15,563
maxABC (t)	13,264	12,947	12,975	12,710
ABC (t)	13,264	12,947	12,975	12,710
	As determined last year for:		As determined this year for:	
Status	2015	2016	2016	2017
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 4,895 t and 4,794 t used in place of maximum permissible ABC for 2018 and 2019.

BSAI northern rockfish was not subjected to overfishing in 2016, and is not overfished or approaching an overfished condition.

BSAI northern rockfish exploitation rates have averaged 0.015 from 2004-2017 (Figure 1), which is below the exploitation rate associated from fishing at $F_{40\%}$ (defined as $U_{F40\%}$). Exploitation rates are computed as the ratio of catch within a year to the beginning year biomass (ages 3+). The estimate of biomass for 2017 was updated from re-running the projection model with updated catch data, where biomass estimate for other years were obtained from the 2016 stock assessment. Exploitation rates for BSAI subareas were obtained by using smoothed estimates of survey biomass from the random effects models to spatially partition the estimated total biomass. In general, exploitation rates from the BSAI subareas are also below $U_{F40\%}$, although are higher in the eastern AI than other subareas. The biomass estimates in the southern Bering Sea area are not viewed as reliable due to relatively large standard deviations and high variability between years, which accounts for the unusually high exploitation rates since 2009.

Summary table for the Plan Team

Year	Biomass[1]	OFL	ABC	TAC	Catch[2]
2016	213,674	14,689	11,960	4,500	4,541
2017	248,160	16,242	13,264	5,000	4,201
2018	246,160	15,888	12,975		
2019	244,963	15,563	12,710		

[1] Total biomass (ages 3+) from age-structured projection model.
[2] Catch as of September 30, 2017.

SSC and Plan Team comments are listed below. In general, responses to comments relating to analyses of the age-structured assessment model are deferred until the next full assessment, currently scheduled for 2019.

Responses to SSC and Plan Team Comments on Assessments in General

(Joint Plan Team, September 2017) *Partial assessments will be expanded versions of the "executive summaries" that were produced in off-years of assessments that were on 2-year cycles under the old assessment schedule, and will include catch/biomass ratios for all species. For the denominator in the catch/biomass ratios required in the new "partial" assessments, the Teams recommend that model biomass be used for Tiers 1-3 and survey biomass from the random effects model be used for Tiers 4-5, noting which survey/surveys was/were involved in the latter.*

Catch/Biomass ratios are reported in this partial assessment.

Responses to SSC and Plan Team Comments Specific to this Assessment

(November Plan Team, November 2016) *The Team recommends that the authors present plots of the predicted mean age and length compared to the observed age and length means over time (with confidence intervals). The Team recommends examining the residual pattern in the fit to the AI survey to see if there was a substantial change in the survey design or potential model misspecification that would explain the change in sign of the residuals between 2006 and 2010.*

(SSC, December 2016) *The SSC further recommends continued investigation into the poor retrospective pattern in this model.*

In addition to these comments, several aspects of estimation of size at age were discussed in the "Data Gaps and Research Priorities" section of the 2016 assessment as priorities for the next full assessment (with some originating from internal assessment reviews), including: 1) the plus group in the length composition data is consistently underestimated by the model for years 1996 and later, suggesting that either separate fishery and survey growth curves (and conversion matrices) should be evaluated; 2) although spatial differences in size at age exist, the model currently uses a global age-length key that does not weight each area by its fishery catch (or survey abundance); and 3) the aging error matrix is derived from GOA data, but the slower growth in the AI than in the GOA may result in increased aging error if the otolith age marks are more closely grouped together.
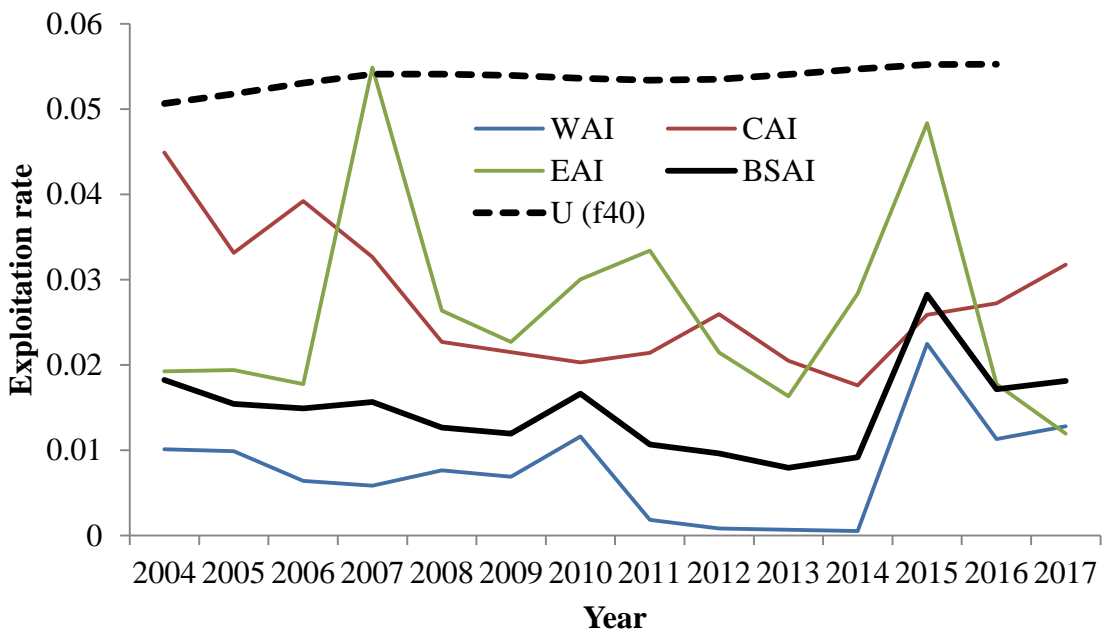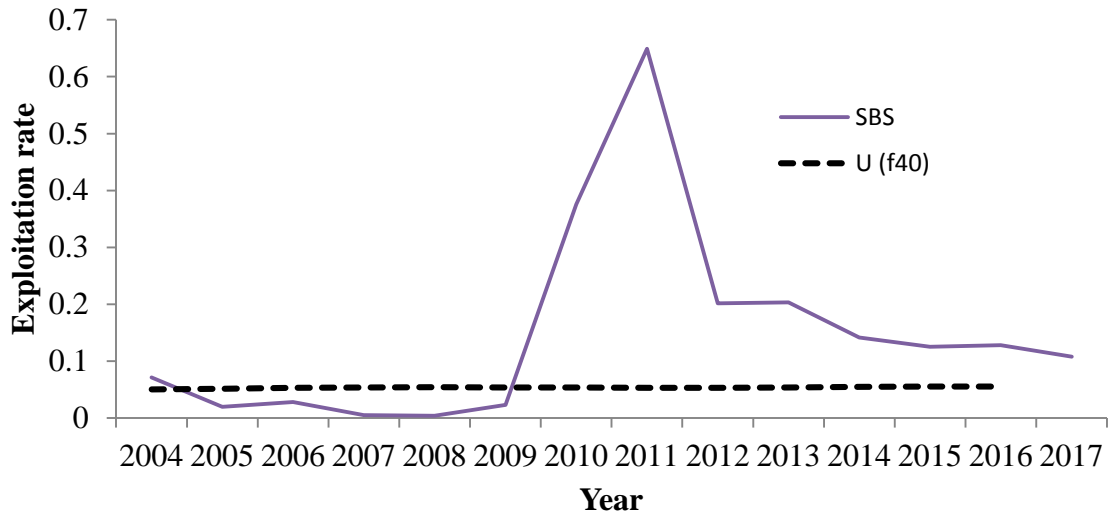
Figure 1. Exploitation rates for northern rockfish. The $U_{F40\%}$ is the exploitation rate for each year that would occur from fishing at $F_{40\%}$, and is a function of the beginning year numbers at age, size at age, and fishing selectivity. The high exploitation rates in the southern Bering Sea (SBS) area result from high variable survey biomass estimates for this area. Exploitation rates for 2017 are preliminary and based on catch through September 30, 2017.