14. Assessment of the Blackspotted and Rougheye Rockfish Stock Complex in the Bering Sea and Aleutian Islands

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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, with Bering Sea/Aleutian Islands (BSAI) blackspotted/rougheye rockfish maintaining its existing schedule. The 2016 full assessment can be found at http://www.afsc.noaa.gov/REFM/docs/2016/BSAIrougheye.pdf. In years without a scheduled Aleutian Island survey, 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 158 t, 1.8% larger than the estimate of 155 t that was used in the 2016 projection. The estimated 2017 catch of 186 t was obtained by summing the reported 2017 catch through September (183 t) and the product of the remaining amount of catch under the TAC (42 t) and an estimate of the proportion of the remaining Oct-Dec TAC which has been caught in recent years (6.8%, based on 2015 and 2016 data). The estimated 2017 catch is 10% larger than the value of 169 estimated in the 2016 projection model. The estimated 2018 and 2019 catches are assumed to result from fishing at the estimated 2017 F, resulting in 202 t and 221 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, the maximum ABC and OFL is 613 t and 749 t, respectively, based on the updated projection model. The maximum ABC for 2018 ABC is 22% greater than the 2017 ABC of 501 and 0.2% less than the projected 2017 ABC of 614 from the 2016 projection model. A summary of the updated projection model results for the AI portion of the stock 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)	0.033	0.033	0.033	0.033
Tier	3b	3b	3b	3a
Projected total (age 3+) biomass	35,669	37,474	37,453	39,169
Female spawning biomass (t)				
Projected	7,305	8,188	8,208	9,163
$B_{100\%}$	20,777	20,777	20,777	20,777
$B_{40\%}$	8,311	8,311	8,311	8,311
$B_{35\%}$	7,272	7,272	7,272	7,272
F_{OFL}	0.048	0.054	0.054	0.055
$maxF_{ABC}$	0.039	0.044	0.044	0.045
F_{ABC}	0.039	0.044	0.044	0.045
OFL (t)	612	750	749	829
maxABC (t)	501	614	613	678
ABC (t)	501	614	613	678
	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 202 t and 221 t used in place of maximum permissible ABC for 2018 and 2019.

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

BSAI blackspotted/rougheye rockfish exploitation rates have averaged 0.009 from 2004-2017 (Figure 1), which is below the exploitation rate associated from fishing at $F_{40\%}$ (defined as $U_{F40\%}$). However, exploitation rates in the western AI (WAI) have been much higher than other areas, and averaged 0.042 from 2004-2017. The WAI exploitation rates have decreased since 2013. 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 the biomass estimates 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. Exploitation rates from BSAI subareas other than the WAI were below $U_{F40\%}$.

Area Allocation of Harvests

The ABC for BSAI blackspotted/rougheye is currently apportioned among two areas: the western and central Aleutian Islands, and eastern Aleutian Islands and eastern Bering Sea. A random effects model was used to smooth the time series of subarea survey biomass and obtain the proportions. The following table gives the projected OFLs and apportioned ABCs for 2018 and 2019 and the recent OFLs, ABCs, TACs, and catches.

Area/subarea	Year	Total Biomass (t)[1]	OFL	ABC	TAC	Catch[2]
BSAI	2016	43,944	693	561	300	158
	2017	35,669	612	501	225	183
	2018	37,453	749	613	n/a	n/a
	2019	39,169	829	678	n/a	n/a
Western/Central Aleutian Islands	2016			382	200	87
	2017			195	125	132
	2018			239	n/a	n/a
	2019			264	n/a	n/a
Eastern AI/Eastern Bering Sea	2016			179	100	71
	2017			306	100	51
	2018			374	n/a	n/a
	2019			414	n/a	n/a

[1] For 2016, the total biomass from AI age-structured model, and survey biomass estimates from EBS. For 2017-2019 the total biomass from a BSAI age-structured model
[2] BSAI catch as of September 30, 2017.

Apportionment within the WAI/CAI area

In recent years, the WAI/CAI has been partitioned into "maximum subarea species catch" for the WAI and CAI areas. A random effects model was used to smooth the time series of subarea survey biomass and obtain proportions used for this partitioning, and the 2018 and 2019 MSSC values are shown below.

	WAI MSSC	CAI MSSC
2018 MSSCs	35	204
2019 MSSCs	39	225

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 2018.

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

(BSAI Plan Team, November, 2016) *The Team recommends that, in the next assessment, the author explore the interplay of catchabilities with availabilities in the incorporation of the slope survey into the model. The Team also recommends that the author revisit whether a single age-structured Bering Sea/Aleutian Islands model is the most appropriate approach.*

(SSC, December, 2016) *The SSC noted the very large retrospective pattern observed in this assessment and recommends continued investigation to try to reduce or at least better understand this problem.*

Although the use of a single model for the whole area (AI and BS) was recommended this year by the SSC, it may not represent the best approach. The SSC recommends that this choice be reevaluated, with particular investigation into which aspects of adding the EBS data, and how treatment of these data in a combined analysis, are most influencing the model results.
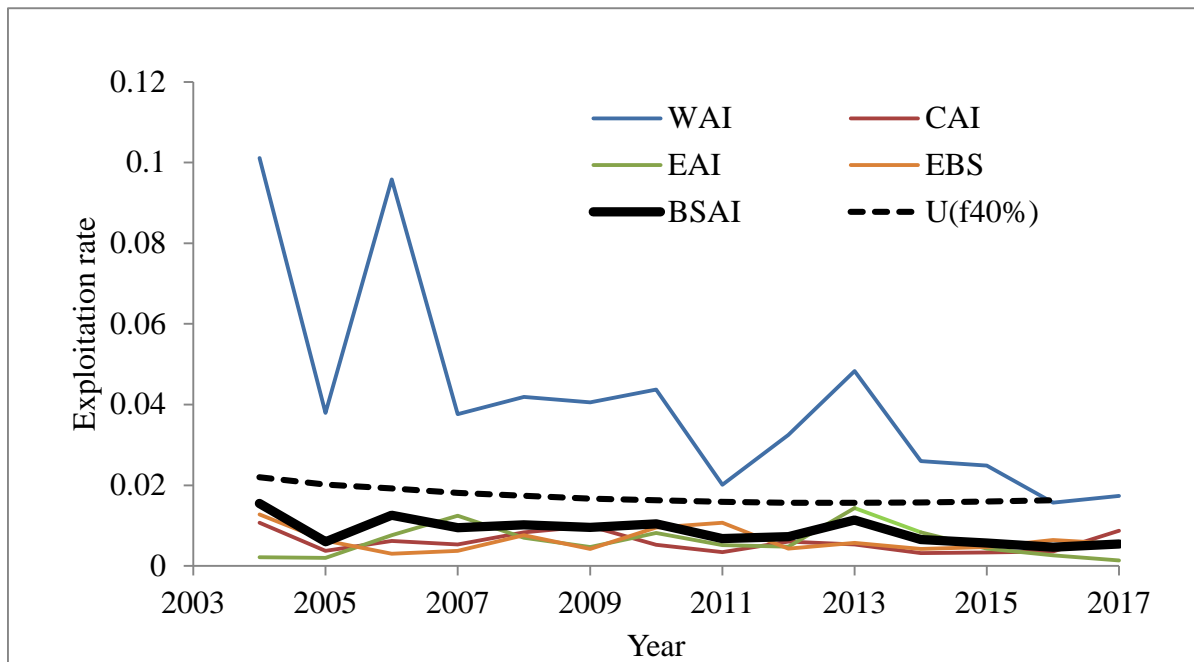

Figure 1. Exploitation rates for BSAI blackspotted and rougheye rockfish. The $U_{F40\%}$ is the exploitation rate for each year that would occur from fishing at $F_{40\%}$, and is a function of the beginning year numbers at age, size at age, and fishing selectivity. Exploitation rates for 2017 are preliminary and based on catch through September 30, 2017.