

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

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Executive Summary

In 2018 a full assessment was conducted for the BSAI blackspotted and rougheye rockfish complex (<http://www.afsc.noaa.gov/REFM/docs/2018/BSAI/BSAIrougheye.pdf>). A partial assessment is conducted this year by revising the recent catch data and re-running the projection model using the results from the previous full assessment as a starting point for the Aleutian Islands portion of the stock, with the eastern Bering Sea portion assessed with Tier 5 methods applied to survey biomass estimates. Therefore, this update does not incorporate any changes to the 2018 assessment methodology, but does update the catch estimates for 2018-2020 and provides an estimated catch for 2021. 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 2018 catch with the final catch value, and revising the 2019 and 2020 catch estimates. The 2018 AI catch was 223 t, 8% larger than the estimate of 206 t that was used in the 2018 projection. The estimated 2019 AI catch of 339 t was obtained by summing the reported 2019 catch through September (331 t) and the product of the remaining amount of catch under the ABC (179 t), an estimate of the proportion of the remaining Oct-Dec ABC which has been caught in recent years (5.5%, based on 2017 and 2018 data), and an estimate of proportion of the Oct-Dec catches obtained in the AI area (86%, based on 2017 and 2018 data). The estimated 2019 AI catch is 45% larger than the value of 234 estimated in the 2018 AI projection model. The estimated 2020 and 2021 catches are assumed to result from fishing at an average of the 2018 and 2019 *F* rates, resulting in 334 t and 377 t, respectively.

There were no changes to the input data for the Tier 5 calculation for the EBS portion of the stock.

Changes in assessment methodology: There were no changes in assessment methodology since this was a partial assessment year. Model 18.1 from the 2018 assessment was used to provide input for the projection model, as this model was selected by the SSC.

Summary of Results

For the 2020 fishery, the maximum AI ABC and OFL are 675 t and 817 t, respectively, based on the updated projection model. The maximum ABC for 2020 ABC is 29% greater than the 2019 ABC of 522 and 1% less than the projected 2020 ABC of 682 from the 2018 projection model. A summary of the updated projection model results for the AI portion of the stock is shown below.

	As estimated or <i>specified</i> last year for:		As estimated or <i>recommended</i> this year for:	
	2019	2020	2020	2021
<i>M</i> (natural mortality rate)	0.032	0.032	0.032	0.032
Tier	3b	3b	3b	3b
Projected total (age 3+) biomass	46,482	49,141	49,005	51,451
Female spawning biomass (t)				
Projected	8,980	10,260	10,213	11,551
<i>B</i> _{100%}	29,287	29,287	29,287	29,287
<i>B</i> _{40%}	11,715	11,715	11,715	11,715
<i>B</i> _{35%}	10,250	10,250	10,250	10,250
<i>F</i> _{OFL}	0.036	0.042	0.042	0.047
<i>maxF</i> _{ABC}	0.030	0.034	0.034	0.039
<i>F</i> _{ABC}	0.030	0.034	0.034	0.039
OFL (t)	632	824	817	1046
maxABC (t)	522	682	675	866
ABC (t)	522	682	675	866
Status	As determined <i>last</i> year		As determined <i>this</i> year	
	2017	2018	2018	2019
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 334 t and 377 t used in place of maximum permissible ABC for 2020 and 2021.

The projection model shows the projected 2020 maximum ABC to be a 29% increase from the 2019 ABC, and the projected 2021 maximum ABC is 28% larger than the projected 2020 maximum ABC. These increases are unusual for a long-lived stock, particularly in a partial assessment where there has not been major changes to the input data. The model accepted by the SSC in 2018 showed large proportion of young fish that have not been fully observed in the survey; 80% of the 2018 numerical abundance is at or below age 16, and these ages have less than 20% survey selectivity (with the estimated asymptotic survey selectivity curve). As these young fish increase in age and grow larger, they become more selected by the fishery and the ABC increases.

The population size and harvest levels for the EBS portion of the population were obtained by applying Tier 5 methods to recent survey biomass estimates. A random effects model was used to fit a random walk smoother to the survey biomass data from the EBS portion of the stock. A summary of the 2018 recommended ABC's for the EBS portion of the population is shown below.

Quantity	As estimated or <i>recommended</i> this year for:	
	2020	2021
M (natural mortality rate)	0.032	0.032
Tier	5	5
Biomass (t)	1371	1371
F_{OFL}	0.032	0.032
$maxF_{ABC}$	0.024	0.024
F_{ABC}	0.024	0.024
OFL (t)	44	44
maxABC (t)	33	33
ABC (t)	33	33
Status	As determined <i>this</i> year	
	2018	2019
Overfishing	No	n/a

BSAI blackspotted/rougheye rockfish was not subjected to overfishing in 2019, and is not overfished or approaching an overfished condition.

BSAI blackspotted/rougheye rockfish exploitation rates have averaged 0.009 from 2004-2019 (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 0.037 from 2004-2019. The WAI exploitation rates have increased since 2017. Exploitation rates are computed as the ratio of catch within a year to the beginning year biomass (ages 3+). The estimate of biomass for 2019 was updated from re-running the projection model with updated catch data, where the biomass estimates for other years were obtained from the 2018 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 2018, the exploitation rate in the EBS was below $U_{F40\%}$, but the exploitation in this area increased in 2019.

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 2020 and 2021 and the recent OFLs, ABCs, TACs, and catches.

Area/subarea	Year	Total				
		Biomass (t) ¹	OFL	ABC	TAC	Catch ²
BSAI	2018	37,453	749	613	225	238
	2019	47,853	676	555	279	376
	2020	50,376	861	708	n/a	n/a
	2021	52,822	1,090	899	n/a	n/a
Western/Central Aleutian Islands	2018			374	75	172
	2019			204	204	304
	2020			264	n/a	n/a
	2021			339	n/a	n/a
Eastern AI/Eastern Bering Sea	2018			239	150	66
	2019			351	75	72
	2020			444	n/a	n/a
	2021			560	n/a	n/a

¹ For 2018, the total biomass is from a BSAI age-structured model. For 2019-2021, the total biomass is from an AI age-structured model and survey biomass estimates from EBS.

² BSAI catch as of September 28, 2019.

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 2020 and 2021 MSSC values are shown below.

	WAI MSSC	CAI MSSC
2020 MSSCs	48	216
2021 MSSCs	61	278

Responses to SSC and Plan Team Comments on Assessments in General

(SSC, October 2019) *The SSC recommends the authors complete the risk table and note important concerns or issues associated with completing the table.*

We will complete the risk table in the 2020 full assessment.

Responses to SSC and Plan Team Comments Specific to this Assessment

(BSAI Plan Team, November 2018) *For the next assessment, the Team recommends:*

- *updating the age error matrix, as this has helped with the corresponding model in the GOA.*
- *evaluating dome-shaped selectivity for the survey, to better account for the survey’s difficulty in sampling large/old fish accurately.*
- *examining larger bounds on M and investigating a profile of M and its subsequent impacts on model results.*

We will conduct these analyses in the 2020 full assessment.

(SSC, December 2018) *A recent paper by Dr. Christina Conrath provides new estimates for maturity-at-age for both rougheye and blackspotted rockfish. The study suggests that the maturity-at-age is older for blackspotted rockfish (than rougheye) and may have an effect on reference points for this assessment. However, it is the understanding of the SSC that these specimens were not genetically ID-ed so there is some uncertainty. The SSC recommends that the authors explore whether these new maturity results should be used in this assessment.*

We will evaluate these data for inclusion in the 2020 full assessment.

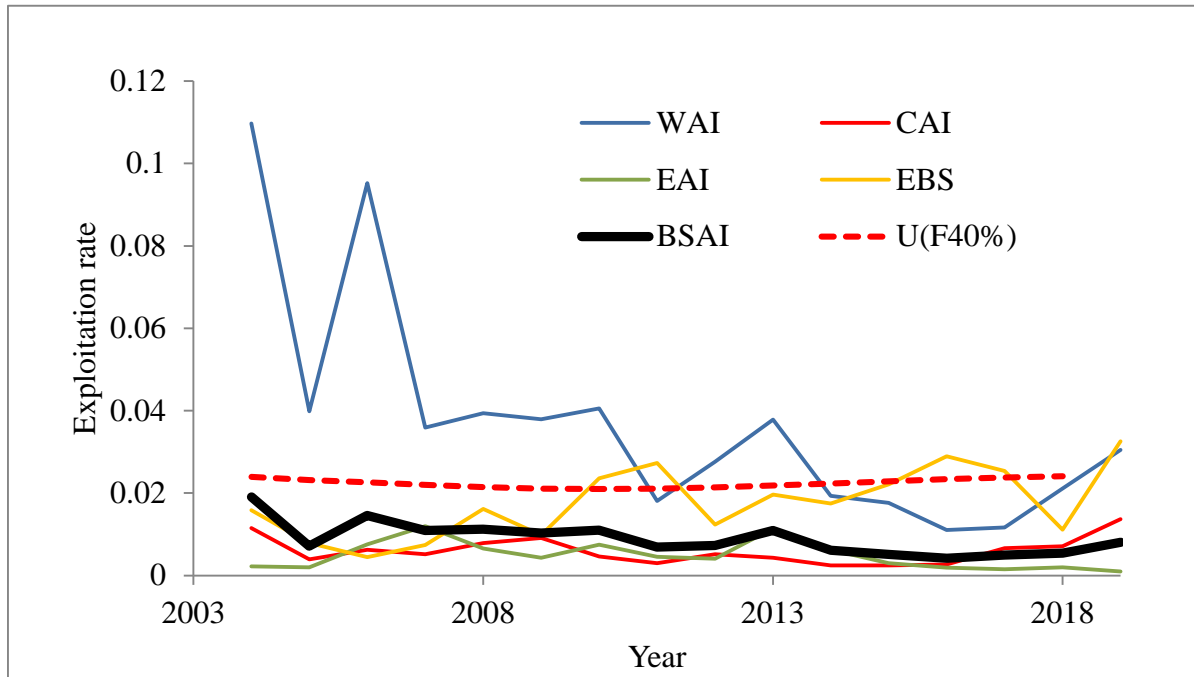


Figure 1. Exploitation rates for BSAI blackspotted and rougheye rockfish. The $U_{F40\%}$ is the exploitation rate for each year that would occur from fishing at $F_{40\%}$, and is a function of the beginning year numbers at age, size at age, and fishing selectivity. Exploitation rates for 2019 are preliminary and based on catch through September 28, 2019.