

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

Paul D. Spencer and Wayne Palsson

November 2021

## Executive Summary

In 2020 a full assessment was conducted for the BSAI blackspotted and rougheye rockfish complex (<https://apps-afsc.fisheries.noaa.gov/refm/docs/2020/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 2020 assessment methodology, but does update the catch estimates for 2020-2022 and provides an estimated catch for 2023. 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 2020 catch with the final catch value, and revising the 2021 and 2022 catch estimates. The 2020 AI catch was 464 t, 9% larger than the estimate of 427 t that was used in the 2020 projection. The estimated 2021 AI catch of 351 t was obtained by summing the reported 2021 catch through September (342 t) and the product of the remaining amount of catch under the ABC (107 t), an estimate of the proportion of the remaining Oct-Dec ABC which has been caught in recent years (17%, based on 2019 and 2020 data), and an estimate of the proportion of Oct-Dec catches obtained in the AI area (49%, based on 2019 and 2020 data). The estimated 2021 AI catch is 19% smaller than the value of 432 estimated in the 2020 AI projection model. The estimated 2022 and 2023 catches are assumed to result from fishing at an average of the 2020 and 2021 *F* rates, resulting in 420 t and 426 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.

### Summary of Results

For the 2022 fishery, the maximum AI ABC and OFL are 453 t and 531 t, respectively, based on the updated projection model. The maximum ABC for 2022 ABC is 5% greater than the 2021 ABC of 432 and 0.7% larger than the projected 2022 ABC of 450 from the 2020 projection model. A summary of the updated projection model results for the AI portion of the stock is shown below.

<b>Quantity</b>	As estimated or <i>specified</i> last year for:		As estimated or <i>recommended</i> this year for:	
	2021	2022	2022*	2023*
<i>M</i> (natural mortality rate)	0.049	0.049	0.049	0.049
Tier	3b	3b	3b	3a
Projected total (age 3+) biomass	17,632	17,729	17,774	17,862
Female spawning biomass (t)				
Projected	3,372	3,457	3,468	3,568
<i>B</i> <sub>100%</sub>	8,811	8,811	8,811	8,811
<i>B</i> <sub>40%</sub>	3,524	3,524	3,524	3,524
<i>B</i> <sub>35%</sub>	3,083	3,083	3,083	3,083
<i>F</i> <sub>OFL</sub>	0.038	0.038	0.039	0.039
<i>maxF</i> <sub>ABC</sub>	0.032	0.033	0.033	0.033
<i>F</i> <sub>ABC</sub>	0.032	0.033	0.033	0.033
OFL (t)	509	528	531	548
maxABC (t)	432	450	453	467
ABC (t)	432	450	453	467
<b>Status</b>	As determined <i>last</i> year		As determined <i>this</i> year	
	2019	2020	2020	2021
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 420 t in 2022, and 426 t used in place of maximum permissible ABC for 2023.

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 2022 recommended ABCs for the EBS portion of the population is shown below, and is unchanged from the 2020 assessment because the EBS slope survey has not been conducted since 2016.

Quantity	As estimated or <i>recommended</i> this year for:	
	2022	2023
$M$ (natural mortality rate)	0.049	0.049
Tier	5	5
Biomass (t)	1,371	1,371
$F_{OFL}$	0.049	0.049
$maxF_{ABC}$	0.037	0.037
$F_{ABC}$	0.037	0.037
OFL (t)	67	67
maxABC (t)	50	50
ABC (t)	50	50
Status	As determined <i>this</i> year	
	2020	2021
Overfishing	No	n/a

BSAI blackspotted/rougheye rockfish was not subjected to overfishing in 2021, and is not overfished or approaching an overfished condition.

BSAI blackspotted/rougheye rockfish exploitation rates have averaged 0.015 from 2004-2021 (Figure 1), which is below the exploitation rate associated with 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 0.065 from 2004-2021. The WAI exploitation rates have increased since 2017; the large WAI exploitation rate in 2020 results from the catch of 165 t exceeding the 2020 WAI “maximum subarea species catch” (MSSC) of 48 t. Exploitation rates are computed as the ratio of catch within a year to the beginning year biomass (ages 3+). The estimate of biomass for 2021 was updated from re-running the projection model with updated catch data, where the biomass estimates for other years were obtained from the 2020 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 2020, the exploitation rates for all subareas except the eastern Aleutian Islands were above  $U_{F40\%}$ . Catches and exploitation rates in 2021 have declined from their 2020 values, although the 2021 catch is through Sept 25 and thus preliminary.

### 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 2022 and 2023 and the recent OFLs, ABCs, TACs, and catches.

Area/subarea	Year	Total				
		Biomass (t) <sup>1</sup>	OFL	ABC	TAC	Catch <sup>2</sup>
BSAI	2020	50,376	861	708	349	517
	2021	19,003	576	482	482	375
	2022	19,145	598	503	n/a	n/a
	2023	19,233	615	517	n/a	n/a
Western/Central Aleutian Islands	2020			264	264	368
	2021			169	169	268
	2022			177	n/a	n/a
	2023			183	n/a	n/a
Eastern AI/Eastern Bering Sea	2020			444	85	149
	2021			313	313	107
	2022			326	n/a	n/a
	2023			334	n/a	n/a

<sup>1</sup>The total biomass is from an AI age-structured model and survey biomass estimates from EBS.

<sup>2</sup>BSAI catch as of September 25, 2021.

#### ***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 2022 and 2023 MSSC values are shown below.

	WAI MSSC	CAI MSSC
2022 MSSCs	32	145
2023 MSSCs	33	150

#### **Responses to SSC and Plan Team Comments on Assessments in General**

(SSC, October 2021) The SSC developed guidance for the use of risk tables, with 14 comments/recommendations.

Author’s response: This guidance will be used when updating the risk table in the next full assessment.

#### **Responses to SSC and Plan Team Comments Specific to this Assessment**

(SSC, December 2020) *The SSC continues to be strongly concerned about the disproportionate spatial harvest including catch in excess of the WAI/CAI subarea ABC in 2019 and 2020, and notes that despite the limited information on stock structure this rockfish complex may be*

*vulnerable to localized depletion. The SSC recommends that the MSSCs continue to be used as a means to monitor and give industry a target maximum catch and offers the following comments:*

- *The SSC supports the BSAI GPT recommendation that the authors explore the distribution of the survey samples to evaluate trends by depth, to help determine risk considerations and potentially help inform the industry on how to reduce incidental catch.*
- *Similarly, the SSC recommends an exploration of the spatial footprint of the AI survey and incidental catch fisheries with an eye towards potential mismatches due to untrawlable habitat that might provide context for interpreting conflicting survey abundance and fishery size/ age composition. We note that a graduate research project investigating the survey – fishery alignment along with recent changes in Atka mackerel and POP fishing behavior is underway at Alaska Pacific University. In addition, the SSC pointed out that a NMFS – University – Industry cooperative effort entitled “The Science-Industry Rockfish Research Collaboration in Alaska” being led by Dr. Madison Hall is currently underway. While this effort is primarily focused on GOA rockfish, it may provide important analytical tools and insights for application to the BSAI BS/RE complex.*
- *The SSC supports the BSAI GPT suggestion to explore other survey data (e.g. NMFS and IPHC long-line or ADF&G survey data) to augment abundance and size/ age composition information. We note that a new graduate research project looking at combining data from different surveys and gears is underway at the College of Fisheries and Ocean Sciences at the University of Alaska Fairbanks.*
- *The SSC notes that the values of  $M$  used in the AI assessment are very high, especially for a long-lived species, and requests that the authors fully explore the ranges and interactions of catchability and  $M$  in the AI assessment model.*
- *The SSC requests an update on work (e.g. genetics) to further refine BS/RE stock structure in the AI.*
- *Given the information regarding shifts in fishing effort to shallower areas provided in public testimony, the SSC requests that the authors investigate the effects of fleet behavior on apparent size/ age compositions, and to what extent this may be influencing fishery selectivity*
- *The JGPT proposed a Council workshop in 2021 to evaluate both the fishing mortality rates by gear associated with different apportionment schemes as well as the management and socio-economic considerations of alternatives. The SSC concurs with the JGPT’s note that the area apportionment approach currently used for the BSAI BS/RE complex should be included in the Spatial Management Workshop proposed for 2021.*

Some of these issues were discussed in the September 2021 Plan Team meeting, and the October 2021 SSC meeting, during a discussion of updated genetic information:

(BSAI Plan Team, September, 2021) *For blackspotted rockfish, the Team made the following recommendations:*

- *The costs and benefits of a tagging study should be evaluated by the AFSC.*
- *The costs and benefits of an IBM specific to answering the questions surrounding blackspotted rockfish larval dispersion and potential stock replenishment rates in the Aleutian Islands should be evaluated by the AFSC.*

- *The Team continues to support the ranking of “strong concern” for this stock.*
- *The Team’s retains its recommendation from 2020, viz.: “The Team requests guidance from the SSC and Council on how to reduce incidental catch in areas with disproportionate spatial exploitation because the MSSC tool has not provided enough protection.”*
- *Except for the genetic study, which has now been completed, the other items on the SSC’s list from December 2020 should be pursued, including the convening of another workshop on spatial management, which should address both BSAI blackspotted rockfish in particular and spatial management issues in general. One objective of such a workshop should be the consideration and development of alternative management tools for dealing with stocks or portions of stocks with rankings of “strong concern” due to their prevalence as bycatch.*

*(SSC, October, 2021) Despite not detecting genetic stock structure, the SSC continues to be concerned about the disproportionate spatial harvest, including catch in excess of the WAI/CAI subarea MSSC in recent years, and the potential vulnerability of this rockfish complex to localized depletion.*

*. . . the SSC reiterates its recommendation to the Council to consider moving to Step 2 of the Spatial Management Policy. The SSC recommends reconstituting a spatial management working group to develop a white paper that addresses how the Spatial Management Policy can be used to address conservation and management concerns for BSAI BS/RE.*

*The SSC also recommends that the white paper explore what level of depletion would be cause for conservation concern given the lack of genetic structure.*

*. . . the SSC concurs with the BSAI GPT recommendation to evaluate the cost and benefits of these additional studies and suggests that the tagging study has a higher priority than the larval study.*

The comments/recommendations above that are related to the stock assessment will be addressed in the 2022 full assessment model.

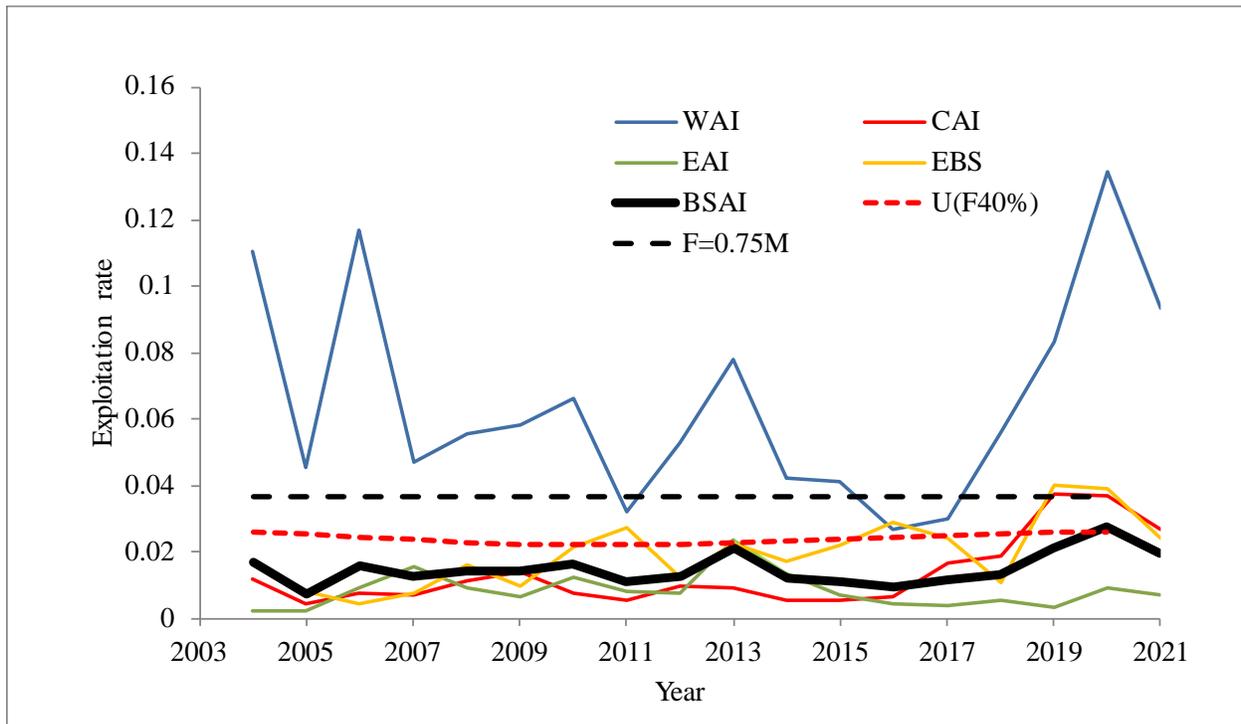


Figure 1. Exploitation rates for BSAI blackspotted and rougheye rockfish. The  $U_{F40\%}$  is the exploitation rate for each year that would occur from fishing at  $F_{40\%}$ , and is a function of the beginning year numbers at age, size at age, and fishing selectivity. Exploitation rates for 2021 are preliminary and based on catch through September 25, 2021.