12. Assessment of Pacific ocean perch 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 occurrence 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) Pacific ocean perch maintaining its existing schedule. In 2022, a full assessment was conducted which can be found at https://apps-afsc.fisheries.noaa.gov/Plan_Team/2022/BSAIpop.pdf. A harvest projection 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. Therefore, this update does not incorporate any changes to the 2022 assessment methodology, but does update the catch estimates for 2022 and provides an estimated catch for 2023. The harvest projection assessment also includes estimates of catch/biomass (i.e., exploitation rates), using estimated total biomass from the 2022 assessment and updated projection model.

Summary of Changes in Assessment Inputs

Changes in input data: The updated information for this partial assessment includes replacing the estimated 2022 catch with the final catch value and revising the 2023 and 2024 catch estimates. The 2022 catch was 34,782 t, 1.6% higher than the estimate of 34,234 t that was used in the 2022 projection. The estimated 2023 catch of 37,257 t was obtained by summing the reported 2023 catch through September (29,906 t) and the product of the remaining amount of catch under the TAC (7,797 t) and an estimate of the proportion of the remaining Oct-Dec TAC which has been caught in recent years (94%, based on 2021 and 2022 data). The estimated 2023 catch is 11% larger than the value of 33,616 estimated in the 2022 projection model. The estimated 2024 and 2025 catches are assumed to result from fishing and average of the 2022 and 2023 *Fs,* resulting in 34,920 t and 34,300 t, respectively.

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

Summary of Results

For the 2024 fishery, we recommend the maximum ABC of 41,096 t and an OFL of 49,010 t based on the updated projection model. The recommended 2024 ABC is 2.2% less than the 2023 ABC of 42,038 and 0.5% less than the projected 2024 ABC of 41,322 from the 2022 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:	
	2023	2024	2024	2025
M (natural mortality rate)	0.056	0.056	0.056	0.056
Tier	3a	3a	3a	3a
Projected total (age 3+) biomass	888,722	876,140	871,892	858,751
Female spawning biomass (t)				
Projected	359,074	352,616	350,439	342,980
$B_{100\%}$	652,626	652,626	652,626	652,626
$B_{40\%}$	261,050	261,050	261,050	261,050
$B_{35\%}$	228,419	228,419	228,419	228,419
F_{OFL}	0.089	0.089	0.089	0.089
$maxF_{ABC}$	0.074	0.074	0.074	0.074
F_{ABC}	0.074	0.074	0.074	0.074
OFL (t)	50,133	49,279	49,010	48,139
maxABC (t)	42,038	41,322	41,096	40,366
ABC (t)	42,038	41,322	41,096	40,366
	As determined last year		As determined this year	
Status	2021	2022	2022	2023
Overfishing	No	n/a	No	n/a
Overfished	n/a		n/a	No
Approaching overfished	n/a		n/a	No

*Projections are based on estimated catches of 34,920 t and 34,300 t used in place of maximum permissible ABC for 2024 and 2025. Fishing reference points (i.e., max F_{abc} and F_{ofl}) are based on estimated average fishery selectivity at age from 2018-2022 estimated in the 2022 assessment model.

BSAI POP was not subjected to overfishing in 2022, and is not overfished or approaching an overfished condition.

BSAI POP exploitation rates have averaged 0.028 from 2004-2023 (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 2023 was updated from re-running the projection model with updated catch data, where biomass estimates for other years were obtained from the 2022 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 the BSAI subareas are generally similar to the overall BSAI exploitation rates, with the exception of low exploitation rates in the EBS area in the early 2000s and in the western Aleutians from 2017 - 2022, and higher exploitation rates in the central Aleutians since 2016. The similarity in exploitation rates between areas is expected because BSAI POP are managed with subarea ABCs based on the spatial distribution of survey biomass. Reduced catch in 2023 has reduced exploitation rates in all areas except the western AI, although the 2023 catch is through Sept. 16 and thus preliminary.

Area Allocation of Harvests

The ABC for BSAI Pacific ocean perch is currently apportioned among four areas: the western, central, and eastern Aleutian Islands, and eastern Bering Sea, with the apportionments based on a random walk random effects model to smooth the survey time series. The estimated proportion of the stock in 4 subareas for the AI survey, and also the EBS slope survey, is shown below (the SBS and EBS slope areas contributed to the EBS subarea ABC).

ABC apportionments

| | Area | | | | |
	WAI	CAI	EAI	SBS	EBS slope
2022 smoothed biomass estimate	492,623	170,314	245,831	113,052	245,905
percentage	38.9%	13.4%	19.4%	8.9%	19.4%

Summaries for the Plan Team

The following table gives the projected OFLs and apportioned ABCs for 2024 and 2025, and the recent OFLs, ABCs, TACs, and catches.

Area	Year	Age 3 Bio (t)	OFL	ABC	TAC	Catch[1]
BSAI	2022	738,710	42,605	35,688	35,385	34,782
	2023	888,722	50,133	42,038	37,703	29,906
	2024	871,892	49,010	41,096	n/a	n/a
	2025	858,751	48,139	40,366	n/a	n/a
Eastern Bering Sea	2022			10,352	10,352	10,067
	2023			11,903	11,903	8,246
	2024			11,636	n/a	n/a
	2025			11,430	n/a	n/a
Eastern Aleutian Islands	2022			8,083	8,083	7,996
	2023			8,152	8,152	5,494
	2024			7,969	n/a	n/a
	2025			7,828	n/a	n/a
Central Aleutian Islands	2022			5,950	5,950	5,837
	2023			5,648	5,648	4,866
	2024			5,521	n/a	n/a
	2025			5,423	n/a	n/a
Western Aleutian Islands	2022			11,303	11,000	10,882
	2023			16,335	12,000	11,300
	2024			15,970	n/a	n/a
	2025			15,685	n/a	n/a

[1]Catch through September 16, 2023

Responses to SSC and Plan Team Comments on Assessments in General

(SSC, October 2023) *When there are time-varying biological and fishery parameters in the model, the SSC requests that a table be included in the SAFE that documents how reference points are calculated.*

We added a footnote to the Executive Summary table noting that a recent 5-year average of fishery selectivity was used to compute the fishing rate reference.

(SSC, October 2022) *Several assessment updates noted potential impacts of the recent lack of the EBS slope survey on abundance and size/ age composition data. The SSC acknowledges that these challenges result from ongoing survey resource limitations and that the 2018 SSC Sub-Committee on Trawl Survey Options and Priorities ranked the slope survey as the lowest priority. The SSC recommends that assessment authors continue to highlight instances where the lack of these data may degrade stock assessment performance.*

The EBS slope survey is used in both the assessment and for spatial allocation of the ABC. In the 2022 full assessment, we noted that this survey is the only fishery-independent data source for the portion of the stock in the EBS, and the lack of recent EBS slope survey biomass estimates causes uncertainty. This issue also pertains to a Plan Team comment below on estimation of the relative spatial distribution in the BSAI.

Responses to SSC and Plan Team Comments Specific to this Assessment

(BSAI Plan Team, September 2022) *The author recommended the following changes to be brought forward in November 1) fitting the model to survey abundance instead of biomass, 2) exploring stochastic initial age compositions, and 3) for equilibrium initial age composition, explore mortality rates other than that currently used in the model.*

In the 2022 assessment, we evaluated fitting the estimated survey abundances rather than the survey biomass estimates. Alternatives for modeling the initial age composition will be explored in future assessments.

(BSAI Plan Team, September 2022) *The Team noted the CIE request to explore estimating the age-length conversion matrix within the stock assessment model and mentioned the new work on the WHAM model that was presented in the Joint Plan Team. This stock could be a potential case study for testing the features of the new model.*

We agree that estimating size at age within the assessment model should be explored in future assessments, either as a modification of the existing assessment model or via assessment software such as WHAM or SS3.

(BSAI Plan Team, September 2022) *The Team discussed investigating the mortality rates by age particularly for the plus group as there were poor fits to this group in the eastern Bering Sea (EBS) slope survey. The Team noted that time blocks could be explored for the plus group or*

consider time-varying selectivity as there were younger fish in the AI BTS than the EBS slope survey.

Time-varying survey selectivity, and age-varying natural mortality, will be considered in future assessments.

(BSAI Plan Team, September 2022) *The Team also discussed the relative proportion of the EBS slope survey information into the future and encouraged the author to look at alternatives for estimating the apportionment on the EBS slope and comparing where the different surveys match up in the past for determining what the proportion should be moving forward.*

We agree that the absence of an EBS slope survey complicates any inferences in the relative distribution between the AI and EBS. There are 5 years in which both the AI trawl survey and the EBS slope survey were conducted: 2002, 2004, 2010, 2012, and 2016. BSAI POP were increasing during this time, so the correlation between the EBS and AI surveys biomass estimates is relatively large. However, the CVs of these estimates in the EBS survey (range of 0.33 to 0.68) were much larger than those in the AI survey (range of 0.11 to 0.17). The limited number of years of concurrent surveys, and the high CVs of the EBS survey estimates, increases uncertainty in the relationship between these areas. Additionally, given the spatial structure of POP, we would not necessarily expect the biomass trends in BSAI subareas to track each other in the future.

Work to "modernize" the EBS trawl surveys will be soon initiated by AFSC, and may include sampling on the EBS slope. This may provide survey observations in the future, although the timeframe for when these survey changes will become operational has not been fully resolved.
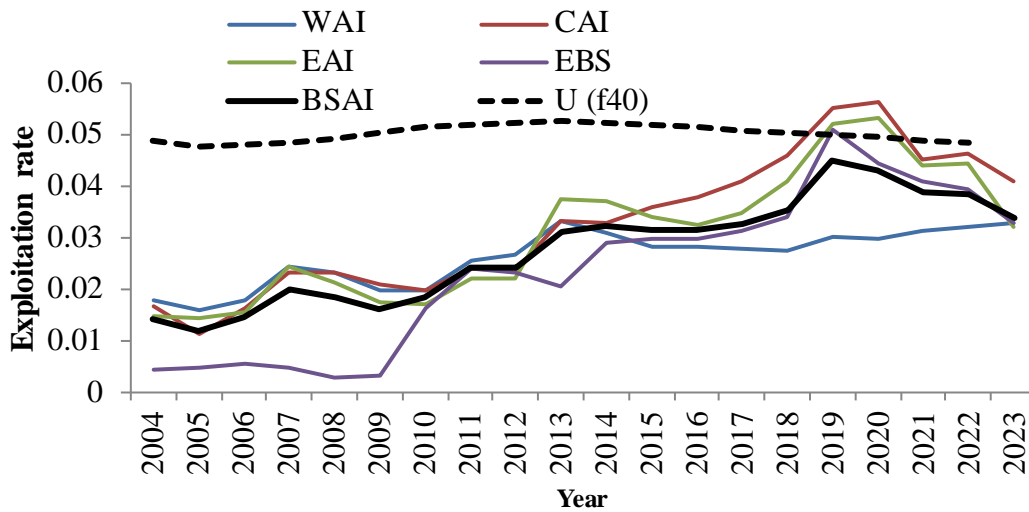

Figure 1. Exploitation rates for BSAI Pacific ocean perch. The $U_{F40\%}$ is the exploitation rate for each year that would occur from fishing at $F_{40\%}$, and is a function of the beginning year numbers at age, size at age, and fishing selectivity. Exploitation rates for 2023 are preliminary and based on catch through September 16, 2023.