# 12. Assessment of Pacific ocean perch in the Bering Sea and Aleutian Islands

by

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November 2017

## 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) Pacific ocean perch maintaining its existing schedule. The 2016 full assessment can be found at http://www.afsc.noaa.gov/REFM/docs/2016/BSAIpop.pdf.  In years without a scheduled Aleutian Islands 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 includes replacing the estimated 2016 catch with the final catch value and revising the 2017 and 2018 catch estimates.  The 2016 catch was 31,319 t, 0.3% lower than the estimate of 31,411 t that was used in the 2016 projection. The estimated 2017 catch of 34,280 t was obtained by summing the reported 2017 through September (27,098 t) and the product of the remaining amount of catch under the TAC (7,802 t) and an estimate of the proportion of the remaining Oct-Dec TAC which has been caught in recent years (92%, based on 2015 and 2016 data). The estimated 2017 catch is 11% larger than the value of 30,835 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 33,324 t and 32,307 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 42,509 t and an OFL of 51,675 t based on the updated projection model. The recommended 2018 ABC is 2.8% less than the 2017 ABC of 42,509 and 0.5% less than the projected 2018 ABC of 42,735 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) | 0.058 | 0.058 | 0.058 | 0.058 |
| Tier | 3a | 3a | 3a | 3a |
| Projected total (age 3+) biomass | 767,767 | 753,302 | 749,925 | 734,431 |
| Female spawning biomass (t) | | | | |
|    Projected | 314,489 | 307,808 | 305,804 | 295,593 |
|    $B_{100\%}$ | 536,713 | 536,713 | 536,713 | 536,713 |
|    $B_{40\%}$ | 214,685 | 214,685 | 214,685 | 214,685 |
|    $B_{35\%}$ | 187,849 | 187,849 | 187,849 | 187,849 |
| $F_{OFL}$ | 0.101 | 0.101 | 0.101 | 0.101 |
| $maxF_{ABC}$ | 0.082 | 0.082 | 0.082 | 0.082 |
| $F_{ABC}$ | 0.082 | 0.082 | 0.082 | 0.082 |
| OFL (t) | 53,152 | 51,950 | 51,675 | 50,098 |
| maxABC (t) | 43,723 | 42,735 | 42,509 | 41,212 |
| ABC (t) | 43,723 | 42,735 | 42,509 | 41,212 |
| | As determined last year | | As determined this year | |
| Status | 2015 | 2016 | 2016 | 2017 |
| 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 33,324 t and 32,307 t used in place of maximum permissible ABC for 2018 and 2019.

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

BSAI POP exploitation rates have averaged 0.028 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. Exploitation rates from the BSAI subareas are similar to the overall BSAI exploitation rates, with the exception of low

exploitation rates in the EBS area in the early 2000s). 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.

## 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 each subarea is shown below.

| | Area | | | |
| --- | --- | --- | --- | --- |
| | WAI | CAI | EAI | EBS |
| Estimated 2016 biomass (from random effects model) | 356,896 | 216,425 | 278,507 | 329,647 |
| Percentage of Biomass | 30.21% | 18.32% | 23.57% | 27.90% |

## Summaries for the Plan Team

The following table gives the projected OFLs and apportioned ABCs for 2018 and 2019, and the recent OFLs, ABCs, TACs, and catches.

| Area | Year | Age 3 Bio (t) | OFL | ABC | TAC | Catch[1] |
| --- | --- | --- | --- | --- | --- | --- |
| BSAI | 2016 | 557,886 | 40,529 | 33,320 | 31,900 | 31,319 |
| | 2017 | 767,767 | 53,152 | 43,723 | 34,900 | 27,098 |
| | 2018 | 749,925 | 51,675 | 42,509 | | |
| | 2019 | 734,431 | 50,098 | 41,212 | | |
| Eastern Bering Sea | 2016 | | | 8,353 | 8,000 | 8,221 |
| | 2017 | | | 12,199 | 11,000 | 5,553 |
| | 2018 | | | 11,861 | n/a | n/a |
| | 2019 | | | 11,499 | n/a | n/a |
| Eastern Aleutian Islands | 2016 | | | 7,916 | 7,900 | 7,444 |
| | 2017 | | | 10,307 | 7,900 | 5,786 |
| | 2018 | | | 10,021 | n/a | n/a |
| | 2019 | | | 9,715 | n/a | n/a |
| Central Aleutian Islands | 2016 | | | 7,355 | 7,000 | 6,765 |
| | 2017 | | | 8,009 | 7,000 | 6,868 |
| | 2018 | | | 7,787 | n/a | n/a |
| | 2019 | | | 7,549 | n/a | n/a |
| Western Aleutian Islands | 2016 | | | 9,696 | 9,000 | 8,888 |
| | 2017 | | | 13,208 | 9,000 | 8,891 |
| | 2018 | | | 12,840 | n/a | n/a |
| | 2019 | | | 12,449 | n/a | n/a |

[1]Catch through 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 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 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 appreciates the work addressing several SSC comments from the December 2014 minutes and looks forward to continued work on several of these topics including:*

- *Continued investigation into the large and problematic retrospective pattern observed for this model.*
- *Further examine the evidence supporting the survey selectivity changes in the most recent years in the model.*
- *Explore estimates of biological parameters like maturity to see if there are trends in these estimates.*
- *Continue work on empirical studies of rockfish densities on trawlable and untrawlable grounds to help inform a prior distribution for survey catchability.*
- *The Plan Team's recommendation to further investigate the poor residual pattern observed in the fit to the AI survey index.*

*The SSC also recommends continued investigation into the estimation of natural mortality and the apparently constraining effect of the current prior.*
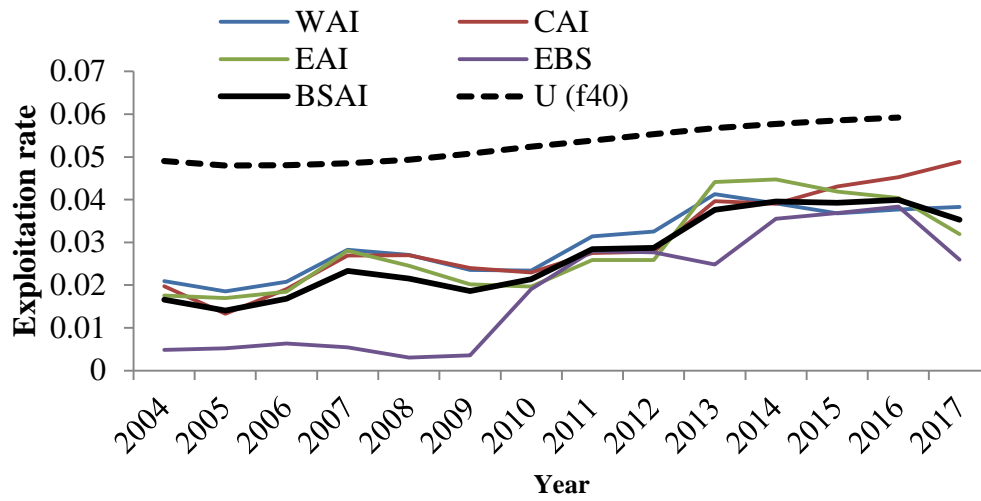
Figure 1. Exploitation rates for BSAI Pacific ocean perch. The $U_{F40\%}$ is the exploitation rate for each year that would occur from fishing at $F_{40\%}$, and is a function of the beginning year numbers at age, size at age, and fishing selectivity. Exploitation rates for 2017 are preliminary and based on catch through September 30, 2017.