

13. Assessment of the Northern Rockfish Stock in the Bering Sea and Aleutian Islands

by

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Executive Summary

In 2005, Bering Sea/Aleutian Islands (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. Bering Sea/Aleutian Islands (BSAI) northern rockfish will maintain a biennial schedule but with full assessments in odd years, with the next full assessment scheduled for 2019. The 2016 full assessment can be found at <http://www.afsc.noaa.gov/REFM/docs/2016/BSAIinorthern.pdf>. In years without a full assessment, 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 catches for 2016-2018 and provides estimated catches for 2019-2020. 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 2017 catch with the final catch value and revising the 2018 and 2019 catch estimates. The 2017 catch was 4,699 t, 6% smaller than the estimate of 5,000 t that was used in the 2017 projection. The 2018 catch is projected to be 5,959 t, 22% larger than the estimate of 4,895 in the 2017 projection. The estimated 2019 and 2020 catches are assumed to result from fishing at the estimated 2018 F , resulting in 5,808 t and 5,684 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 2019 fishery, we recommend the maximum ABC of 12,664 t and an OFL of 15,507 t based on the updated projection model. The recommended 2019 ABC is 2% smaller than the 2018 ABC of 12,975 and 0.03% smaller than the projected 2018 ABC of 12,710 from the 2017 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: | |
|--------------------------------------|--|---------|--|---------|
| | 2018 | 2019 | 2019* | 2020* |
| <i>M</i> (natural mortality rate) | 0.046 | 0.046 | 0.046 | 0.046 |
| Tier | 3a | 3a | 3a | 3a |
| Projected total (age 3+) biomass (t) | 246,160 | 244,963 | 244,196 | 242,426 |
| Female spawning biomass (t) | | | | |
| Projected | 106,486 | 104,699 | 104,201 | 102,480 |
| <i>B</i> _{100%} | 164,674 | 164,674 | 164,674 | 164,674 |
| <i>B</i> _{40%} | 65,870 | 65,870 | 65,870 | 65,870 |
| <i>B</i> _{35%} | 57,636 | 57,636 | 57,636 | 57,636 |
| <i>F</i> _{OFL} | 0.080 | 0.080 | 0.080 | 0.080 |
| <i>maxF</i> _{ABC} | 0.065 | 0.065 | 0.065 | 0.065 |
| <i>F</i> _{ABC} | 0.065 | 0.065 | 0.065 | 0.065 |
| OFL (t) | 15,888 | 15,563 | 15,507 | 15,180 |
| maxABC (t) | 12,975 | 12,710 | 12,664 | 12,396 |
| ABC (t) | 12,975 | 12,710 | 12,664 | 12,396 |
| Status | As determined last year for: | | As determined this year for: | |
| | 2016 | 2017 | 2017 | 2018 |
| 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 5,808 t and 5,684 t used in place of maximum permissible ABC for 2019 and 2020.

BSAI northern rockfish was not subjected to overfishing in 2017 and is not overfished or approaching an overfished condition.

BSAI northern rockfish exploitation rates have averaged 0.015 from 2004-2018 (Figure 13.1), 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 estimates of biomass for 2017 and 2018 were 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. In general, exploitation rates from the BSAI subareas are also below $U_{F40\%}$. Since 2015, the exploitation rates in the eastern Aleutian Islands have been decreasing whereas those in the central Aleutian Islands have been increasing. The biomass estimates in the southern Bering Sea area are not viewed as reliable due to relatively large standard deviations and high variability between years, which accounts for the unusually high exploitation rates from 2009 - 2017.

Summary table for the Plan Team

| Year | Biomass ¹ | OFL | ABC | TAC | Catch ² |
|------|----------------------|--------|--------|-------|--------------------|
| 2017 | 248,160 | 16,242 | 13,264 | 5,000 | 4,699 |
| 2018 | 246,160 | 15,888 | 12,975 | 6,100 | 5,507 |
| 2019 | 244,196 | 15,507 | 12,664 | | |
| 2020 | 242,426 | 15,180 | 12,396 | | |

¹ Total biomass (ages 3+) from age-structured projection model.

² Catch as of October 6, 2018.

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 2020.

Responses to SSC and Plan Team Comments on Assessments in General

Comments from the October 2017 SSC meeting

SSC1: “The SSC recommends that, for those sets of environmental and fisheries observations that support the inference of an impending severe decline in stock biomass, the issue of concern be brought to the SSC, with an integrated analysis of the indices in future stock assessment cycles. To be of greatest value, to the extent possible, this information should be presented at the October Council meeting so that there is sufficient time for the Plan Teams and industry to react to the possible reduction in fishing opportunity.”

To facilitate a coordinated response to this request, the co-chairs and coordinators of the BSAI and GOA Groundfish Plan Teams, with concurrence from stock assessment program leadership at the AFSC, have suggested that authors address it by using the previous year’s Ecosystem Status Report (ESR) as follows:

“No later than the summer of each year, the lead author of each assessment should review the previous year’s ESR and determine whether any factor or set of factors described in that ESR implies an impending severe decline in stock/complex biomass, where “severe decline” means a decline of at least 20% (or any alternative value that may be established by the SSC), and where biomass is measured as spawning biomass for Tiers 1-3 and survey biomass as smoothed by the standard Tier 5 random effects model for Tiers 4-5. If an author determines that an impending severe decline is likely and if that decline was not anticipated in the most recent stock assessment, he or she should summarize that evidence in a document that will be reviewed by the respective Team in September of that year and by the SSC in October of that year, including a description of at least one plausible mechanism linking the factor or set of factors to an impending severe decline in biomass, and also including an estimate or range of estimates regarding likely impacts on ABC. In the event that new survey or relevant ESR data become available after the document is produced but prior to the October Council meeting of that year, the document should be amended to include those data prior to its review by the SSC, and the degree to which they corroborate or refute the predicted severe decline should be noted, with the estimate or range of estimates regarding likely impacts on ABC modified in light of the new data as necessary.”

Evaluation of information in the ESR will be conducted in summer, 2019, prior to the next full assessment for BSAI northern rockfish.

SSC2: “The SSC also recommends explicit consideration and documentation of ecosystem and stock assessment status for each stock ... during the December Council meeting to aid in identifying stocks of concern.”

This recommendation was subsequently clarified, at some length, in the minutes of the December 2017 SSC meeting and then re-clarified in the minutes of the June 2018 SSC meeting. In the interest of efficiency, the clarification from the December 2017 minutes is not included here. The relevant portion of the clarification from the June 2018 minutes reads as follows:

“This request was recently clarified by the SSC by replacing the terms ‘ecosystem status’ and ‘stock assessment status’ with ‘Ecosystem Status Report information’ and ‘Stock Assessment Information,’ where the potential determinations for each will consist of ‘Okay’ and ‘Not Okay,’ and by issuing the following guidance:

- The SSC clarifies that ‘stock assessment status’ is a fundamental requirement of the SAFEs and is not really very useful to this exercise, because virtually all stocks are never overfished nor is overfishing occurring.*
- Rather the SSC suggests that recent trends in recruitment and stock abundance could indicate warning signs well before a critical official status determination is reached. It may also be useful to consider some sort of ratio of how close a stock is to a limit or target reference point (e.g., B/B35). Thus, additional results for the stock assessments will need to be considered to make the ‘Okay’ or ‘Not Okay’ determinations.*
- The SSC retracts its previous request for development of an ecosystem status for each stock/complex. Instead, while considering ecosystem status report information, it may be useful to attempt to develop thresholds for action concerning broad-scale ecosystem changes that are likely to impact multiple stocks/complexes.*
- Implementation of these stock and ecosystem determinations will be an iterative process and will require a dialogue between the stock assessment authors, Plan Teams, ecosystem modelers, ESR editors, and the SSC.”*

The iterative process described in the final bullet above is scheduled to begin at this year’s September meeting of the Joint BSAI and GOA Plan Teams. We will revisit this recommendation when the criteria for these determinations are finalized.

Comments from the December 2017 SSC meeting

SSC3: “The SSC reminds authors of the need to balance the desire to improve model fit with increased risk of model misspecification.” This recommendation was subsequently clarified in the minutes of the June 2018 SSC meeting as follows: “In the absence of strict objective guidelines, the SSC recommends that thorough documentation of model evaluation and the logical basis for changes in model complexity be provided in all cases.”

Any proposed changes in the complexity of the BSAI northern rockfish assessment model will be documented in the next full assessment in 2019.

SSC4: “Report a consistent metric (or set of metrics) to describe fish condition among assessments and ecosystem documents where possible.” Fish condition will be considered in future assessments.

SSC5: “Projections ... clearly illustrate the lack of uncertainty propagation in the ‘proj’ program used by assessment authors. The SSC encourages authors to investigate alternative methods for projection that incorporate uncertainty in model parameters in addition to recruitment deviations. Further, the SSC noted that projections made on the basis of fishing mortality rates (Fs) only will tend to underestimate the

uncertainty (and perhaps introduce bias if the population distribution is skewed). Instead, a two-stage approach that first includes a projection using F to find the catch associated with that F and then a second projection using that fixed catch may produce differing results that may warrant consideration.”

Following a consensus recommendation from the co-chairs and coordinators of the BSAI and GOA Groundfish Plan Teams, stock assessment program leadership at the AFSC has agreed to take the following steps:

1. Notify assessment authors that, for the purpose of the standard projection scenarios, the previous requirements for use of the standard Tier 3 projection model and measurement of spawning biomass at the time of peak spawning no longer apply, thereby enabling authors to use Stock Synthesis (SS) or other software to make the projections.
2. Task one or more individuals with modifying the current standard projection code so as to accommodate this request for non-SS Tier 3 assessments, with the understanding that it may not be possible to accomplish this in time for use in the 2018 assessments.
3. Task the authors of Tier 1 assessments with modifying their projection code so as to accommodate this request for Tier 1 assessments, with the understanding that it may not be possible to accomplish this in time for use in the 2018 assessments.

This recommendation will be revisited when the set of individuals tasked with modifying the projection code completes this task. Additionally, for some rockfish stocks there may be a period of several years in which rockfish are partially selected to either a fishery or survey, so incorporating the uncertainties in the recruitment strengths is also of interest for the projection model.

Comments from the October 2018 SSC meeting

SSC6: “Stock assessment authors are encouraged to work with ESR analysts to identify a small subset of indicators prior to analysis, and preferably based on mechanistic hypotheses.”

Prior to the next full assessment for BSAI northern rockfish, we will work with ESR analysts for assess whether a small set of informative indicators can be identified.

SSC7: “The SSC supports the PT recommendation to make the use of model-based survey estimates at the individual author’s discretion for 2018.”

The minutes of the September 2017, Joint Plan Team contained several research recommendations for model-based survey estimates and plans to create an AFSC workgroup to address these recommendations are developing. Several of these recommendations can be addressed by developing a detailed simulation framework that incorporates the catchability and availability for Alaska surveys. Model-based survey estimates will be considered as these Plan Team research recommendations are addressed.

SSC8: “The SSC also noted that, in order to save resources, authors should not conduct additional assessments beyond the prioritized schedule unless they specifically trigger one or more of the criteria identified.”

In future off-years for BSAI northern rockfish, the criteria identified for triggering a full assessment will be evaluated.

SSC9: “The general approach to accounting for costs and benefits of this [stock] prioritization during the initial four years seems to be a reasonable response to the SSCs request. However, specific benefits (e.g., ‘additional’ analyses completed) may be difficult to assign unambiguously to reduced assessment frequency. The SSC recognizes these challenges in light of its previous requests.”

The frequency of BSAI rockfish age-structured stock assessments has not been reduced, but the scheduling has changed such that no more than 2 full age-structured assessments are conducted within a single year (reduced from 3 full age-structure assessments in a single year). For this year’s assessment, this allowed time to more fully investigate the retrospective patterns and and mortality rates in the BSAI Pacific ocean perch and blackspotted/rougheye assessments.

Responses to SSC and Plan Team Comments Specific to this Assessment

BSAIPT1 (November 2016): “The Team recommends that the authors present plots of the predicted mean age and length compared to the observed age and length means over time (with confidence intervals). 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.”

SSC10 (December, 2016): “The SSC supports the two Plan Team recommendations to: 1) present plots of the predicted mean age and length compared to the observed age and length means over time (with confidence intervals); and 2) examine 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. The SSC further recommends continued investigation into the poor retrospective pattern in this model.”

These comments will be address in the next full assessment for BSAI northern rockfish, scheduled for 2019.

Figures

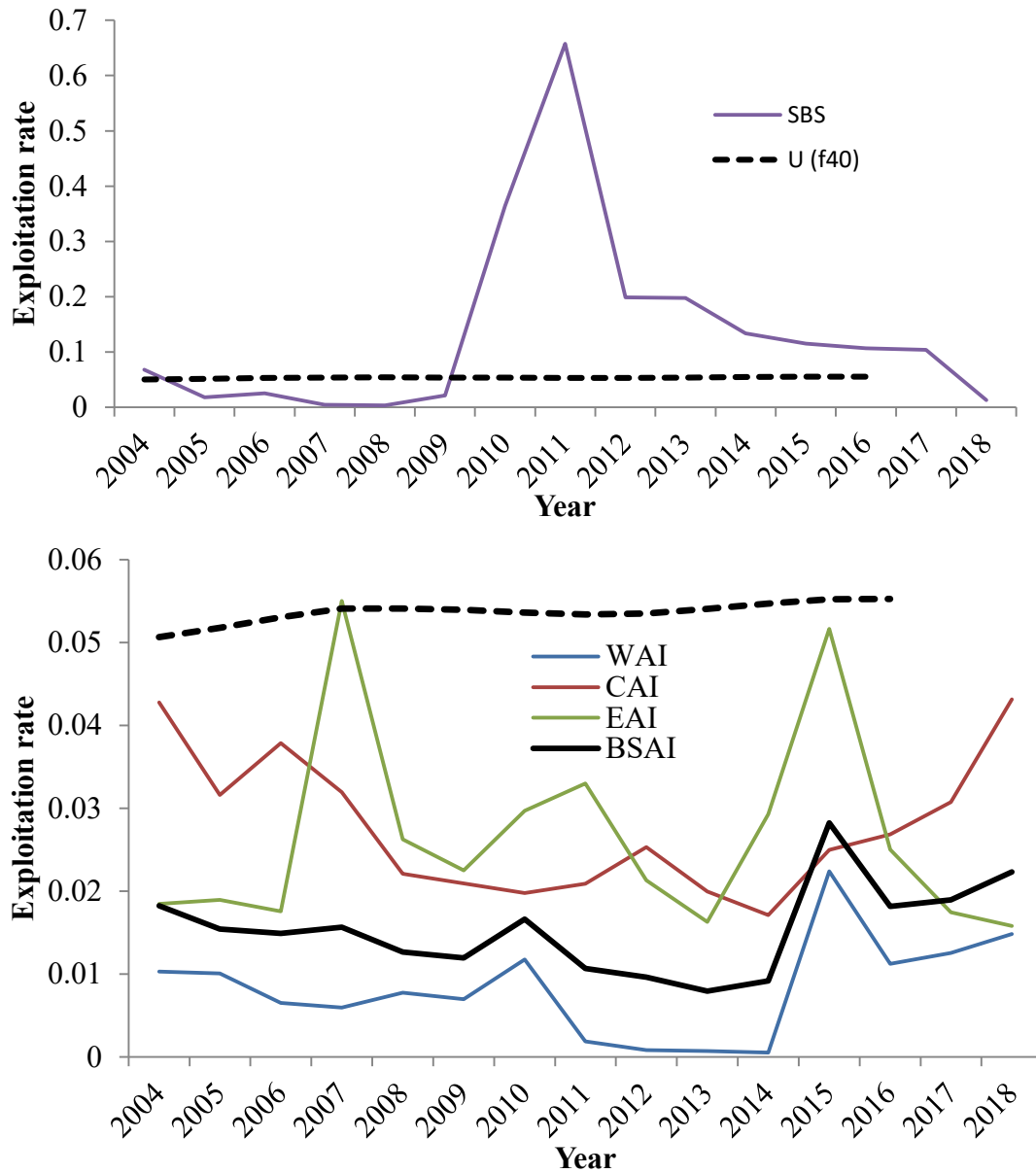


Figure 13.1. Exploitation rates for northern rockfish. The $U_{F40\%}$ is the exploitation rate for each year that would occur from fishing at $F_{40\%}$ and is a function of the beginning year numbers at age, size at age, and fishing selectivity. The high exploitation rates in the southern Bering Sea (SBS) area result from high variable survey biomass estimates for this area. Exploitation rates for 2018 are preliminary and based on catch through October 6, 2018.