# Center for Independent Experts (CIE) Independent Peer Review Report

# On

# Black Rockfish Stock Assessment Review (STAR)

*Prepared by*

Yong Chen

Professor of Marine Science
School of Marine and Atmospheric Sciences
State University of New York at Stony Brook

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## I. Executive Summary

The External Independent Peer Review for the Stock Assessment (STAR) of Black Rockfish, *Sebastes melanops*, in Washington, Oregon and California was conducted on July 10-14, 2023 at the National Marine Fisheries Service (NMFS) Southwest Fisheries Science Center in Santa Cruz, California. The Pacific Fisheries Management Council prepared all the documentation and logistic supports, and two Stock Assessment Team (STAT) presented four separate stock assessments for Washington, Oregon, Northern California and Central California.

The STAR was conducted with respect to the Pacific Fishery Management Council's (PFMC) Terms of Reference for the Groundfish and Coastal Pelagic Species Stock Assessment Review Process for 2023-2024. As a CIE reviewer and a member of STAR Panel, I read all the materials provided before and during the STAR; attended the review in person to ask questions, request additional analyses, made suggestions/recommendations; and conducted an independent and impartial review of the four stock assessments carried out by the STATs.

Overall, the STATs have done excellent jobs in developing and parameterizing the four stock assessment models. In the stock assessment documents, key assumptions are described, key input data and their statistical properties are defined with justifications, and the process in developing the base model run for each stock assessment are well thought through with justifications. Various sensitivity runs were developed to evaluate the impacts of major sources of uncertainty on the estimation of key population statistics including reproductive output, exploitation and recruitment. During the STAR, additional analyses and model runs were requested by the STAR Panel and conducted by the STAT to further explore the impacts of various assumptions, data quality and quantity, as well as alternative model configurations on the assessment results. The requests for additional model runs and their justifications and model run results are documented in the STAR Panel Report. These additional model runs and relevant discussions resulted in an improved understanding of assessment uncertainty and model performance, leading to the development of the final base models and alternative models to assessment bracket uncertainty for developing catch advice.

Due to the limited time period for the review, there was no comprehensive evaluation of CPUE standardization during the review, and no alternative statistical models were explored during the STAR to evaluate possible impacts of various factors (e.g., first and second trip targets and some environmental variables) that might influence the CPUE standardization. For all four stock assessments, life history parameters were estimated based on the recent years of study (e.g., average weight, functional maturity), but were used in the early time period when such information is not available. Some data were borrowed from other areas (e.g., functional maturity in California). Assuming spatial/temporal stationarity for these life history processes may introduce biases in the assessment, given the large changes in the ecosystems over the stock assessment time period. Uncertainty remains large for some reconstructed historical fisheries data. Weighting the data of different sources remains challenging in the assessment. There is also limited ecosystem consideration (e.g., changing ecosystems and thermal habitats) in all the four assessments. The closed stock assumption may not be realistic, and there is a need to develop a spatially explicit stock assessment (e.g., explore a spatially explicit model to assess Black Rockfish in the Northern and Central California to consider observed movement from

Central to Northern California). Despite these challenges and remaining uncertainties, based on my independent review I conclude that overall, the four Black Rockfish stock assessments represent the best available science for our understanding of Black Rockfish population dynamics and fisheries on the U.S. West Coast, and are scientifically sound and adequate to provide catch advice to address the management needs of Black Rockfish in Washington, Oregon and California.

My detailed research recommendations to improve the future Black Rockfish stock assessments can be found under ToR 6 and in the section of Conclusions and Recommendations.

## II. Background

The distribution of Black Rockfish, or Sebastes melanops, spans from the Southern Bering Sea and Aleutian Islands to northern Baja California, but are most abundant in the area stretching from Kodiak, Alaska, down to northern California at depths shallower than 73 m (240 ft; Love et al. 2002). The Black Rockfish stock structure still needs to be studied and better defined, but previous studies suggest little genetic structure along the coastline, with some genetic differentiation identified between Alaska and the contiguous US West Coast (Hess et al. 2023). Tagging studies found long distance movement of Black Rockfish across boundaries defined in genetic studies, suggesting a certain degree of mixing and interconnectedness among Black Rockfish populations along the U.S. West Coast (Dick et al. 2023).

Conducted in 2015, the previous Black Rockfish stock assessment followed state boundaries, which resulted in the execution of three distinct stock assessments for Black Rockfish along the U.S. West coast: one for Washington, Oregon and California (Cope et al. 2023a, b; Dick et al. 2023). These assessments were used to inform the management and the OFL development for Black Rockfish in these areas. Based on the detailed analysis of key biological parameters, spatial variability in habitats, size composition data, and history of exploitation and management, the STAT decided that the assessment should be conducted for four separate areas: Washington, Oregon, Northern and Central California (divided by Point Arena, California). Thus, this STAR covers four separate stock assessments. The Washington and Oregon Black Rockfish stock assessments were led by Dr. Jason Cope of Northwest Fisheries Science Center (NWFSC). Dr. E.J. Dick of Southwest Fisheries Science Center (SWFSC) led the assessment of areas north (Northern California Assessment) and south (Central California Assessment) of Point Conception within the state of California. In combination, these four assessment areas covered the full range of the species within the Groundfish Fishery Management Plan (FMP).

Stock Synthesis (SS Version 3.30.21.00) was used as the modeling platform for all four stock assessments. The time step used in the assessment is one year. The main input data include annual commercial and recreational catch, length and age composition data for commercial and recreational fisheries and surveys, fishery-independent abundance indices, standardized fisheries-dependent abundance indices, and some key life history parameters (e.g., stock-recruitment steepness h, natural mortality M, and priors for some parameters). Various assumptions were made regarding fishery and survey selectivity and their temporal changes. Based on an extensive preliminary analysis, a base (or reference) stock assessment model was

developed and used for providing catch advice for each stock assessment. A suite of sensitivity analyses were developed and conducted to evaluate the possible impacts of uncertainties in various assumed values for life history parameters, assumed selectivity patterns for fisheries and surveys, and data quality and quantity on the stock assessment results. Many additional model runs were requested by the STAR Panel during the review to further evaluate impacts of data quality and quantity, alternative assumptions on fisheries and survey selectivity, uncertainties associated with key life history parameters and alternative model configurations on the assessment results. These additional models runs are documented in the STAR Panel Report.

As a CIE reviewer, I evaluated the Black Rockfish stock assessments conducted for the four areas: Washington, Oregon, Northern California, and Central California with respect to a set of predefined Terms of Reference (ToRs). This report includes an executive summary (Section I), a background introduction (Section II), a description of my role in the review activities (Section III), my comments on each item listed in the ToRs (Section IV), a summary of my comments and recommendations (Section V), and references (Section VI). The final part of this report (Section VII) includes a collection of appendices including the Performance Work Statement, as required by the CIE.

## III. Description of the Individual Reviewer's Role in the Review Activities

My role as a CIE independent reviewer is to conduct an impartial and independent peer review of the Black Rockfish stock assessment with respect to the defined ToRs as a member of STAR 2 Panel. This review includes four stock assessments for Black rockfish in the four areas along the U.S. West Coast.

Prior to the review, all the documents were made available to me through a shared Google folder (https://drive.google.com/drive/u/1/folders/1POWJKk5sqwgJ6OrAMS7slHRGfq8k1nDo). I read all four draft stock assessment reports, background information papers and reports/presentations, and other relevant documents (e.g., SSC review reports) that were sent to me (see the list in Appendix I). I also researched and organized references relevant to the topics covered in the reports and the Performance Work Statement (PWS) prior to my review.

The Stock Assessment Review (STAR) was conducted during July 10-14, 2023 at the National Marine Fisheries Service (NMFS) Southwest Fisheries Science Center in Santa Cruz California. The STAR Panel reviewed draft stock assessments for Black Rockfish in Washington, Oregon and California, under the Pacific Fishery Management Council's (PFMC) Terms of Reference for the Groundfish and Coastal Pelagic Species Stock Assessment Review Process for 2023-2024 (PFMC, December 2020). An online participation option was available to STAT members unable to attend in person, in addition to allowing for public comment. As a STAR Panel member and CIE reviewer, I asked questions, made the requests for additional analyses, asked for additional information, and suggested alternative model parameterization during the meeting. Dr. John Budtick of California Department of Fish and Wildlife chaired the Black Rockfish STAR Panel. The STAR Panel was assisted and advised by Marlene Bellman of Pacific Fisheries Management Council; Katie Pierson, Oregon Department of Fish and Wildlife

and Groundfish Management Team representative; and Gerry Richter, Groundfish Advisory Subpanel Representative.

## IV. Summary of Findings

My detailed comments on each item of the ToRs are provided under their respective subtitles from the ToRs (see below).

1) *Become familiar with the draft stock assessment documents, data inputs, and analytical models along with other pertinent information (e.g., previous assessments and STAR panel report when available), and the Pacific Fisheries Management Council Terms of Reference for the Groundfish Stock Assessment Review Process for 2023-2024 prior to review panel meeting.*

   This ToR has been adequately addressed. I was provided four draft reports and relevant background information and papers. I was also provided with the base model input data files and its SS3 program run and result files. All the materials were provided two weeks before the STAR. I was able to go through all the files and test-run the base model. I was able to evaluate the SS3 input and output data, in addition to examining the std files for unusually large CVs associated with estimated model parameters. I also became familiar with the assessment model parameterization and configuration, key biological and statistical assumptions, key input data, and main sources of uncertainty and justifications used to select the base (reference) assessment model and sensitivity runs for each stock assessment. The background information on the Pacific Fisheries Management Council's Terms of Reference for the 2023-2024 Groundfish Stock Assessment Review Process is very helpful.

2) *Discuss the technical merits and deficiencies of the input data and analytical methods during the open review panel meeting*

   This TOR was adequately addressed during the STAR via a large number of sensitivity, alternative model runs and additional analyses prior to and during the STAR and extensive discussion.

   Overall, the analytic methods used in all four assessments appear to be scientifically and technically sound. Both the STATs have done an excellent job compiling all available information for the four stock assessments. The input data appeared to be carefully evaluated for quality and quantity, and the choices made for the estimation of commercial and recreational catch data were appropriate, justified, and informed. Protocols were well-developed to filter and analyze the input data, with the filtered data carefully evaluated for their biological/fishery realisms. Both STATs also adequately described the spatial-temporal distributions of landings, discards, and fishing efforts in commercial and recreational fisheries, and provided information on the fishery-dependent CPUE standardizations in developing abundance indices. Both STATs should be commended for their excellent efforts in identifying, developing, and reconstructing historical fisheries data.

However, due to the constrained time frame for the STAR, no comprehensive evaluation of CPUE standardization was conducted during the review, and no alternative models were evaluated to assess the possible impacts of various factors (e.g., first and second trip targets and some environmental variables) that might influence the CPUE standardization. Although the STATs did evaluate possible interactions between recruitment steepness h and natural mortality M via likelihood profiling, we still do not have a full understanding of their joint distributions, which may influence their parameterization and estimation in the assessment. For all the four stock assessments, some life history parameters were estimated based on the recent years of studies (e.g., average weight, functional maturity), but some were used in the early time period when such information was not available. Some data were borrowed from other areas (e.g., functional maturity). Such spatial/temporal stationarity assumed for these life history parameters might introduce biases in the assessment, given the large changes in the ecosystems over the time period the stock assessments cover. There is also limited ecosystem consideration (e.g., changing ecosystems and climate-induced changes in thermal habitats) in all the four assessments.

The assessment-specific technical merits and deficiencies of the input data and analytical methods are described below.

*i)* *Washington Area*

The STAT did a comprehensive job in identifying and evaluating all available data sources and compiling the input data for the current assessment. Functional maturity was used in this assessment, which offers a more effective gauge of effective reproductive output compared to the commonly used physiological maturity. The protocols for filtering data in the CPUE standardization and identifying the base model run are well-developed, and the justifications for sensitivity runs were provided. The model diagnostics of CPUE standardization and stock assessment model runs were well-done and documented.

Most abundance indices (e.g., statewide surveys and tagging study) are rather limited in spatial and temporal coverages in this assessment. There is a lack of explicit consideration of ecosystem dynamics and possible changes in thermal habitats in the development of abundance indices and stock assessment. Given the long time series of data included in the stock assessment, it is unlikely that recruitment dynamics, key life history processes and natural mortality are temporally stationary, which was implicitly assumed in the current stock assessment.

*ii)* *Oregon Area*

A large number of data sets from fisheries-dependent and fisheries-independent sources were compiled for this assessment. A recent acoustic-visual survey appeared to play an important role in determining an absolute measure of stock abundance. The functional maturity used in this assessment is considered to be a better measure of effective reproductive output. The STAT provided a full set of sensitivity analyses

and model diagnostics to evaluate sources of uncertainties and model performance. The STAT conducted additional analyses requested during the review by the STAR Panel and addressed most of the concerns raised by the Panel.

However, the estimation of absolute values for stock abundance and reproductive output relies heavily on a single year of acoustic visual survey, leading to considerable uncertainty in this stock assessment. Various scenarios were considered prior to and during the review, but the estimation still appeared to be sensitive to the assumed catchability of this survey. Additional years of acoustic-virtual surveys are needed to address this problem. The uncertainty associated with the survey catchability may be improved by additional in-situ transducer calibration and use of species-specific target strength for black rockfish in the assessment area. A lack of the information on functional maturity in the early time series, which had very different environmental conditions from recent years when functional maturity information was available, may introduce biases in the estimation of reproductive outputs. Several long-term fishery-dependent indices were not very informative, which needs to be further studied to identify the reasons.

*iii)* *Northern California*

The California Black Rockfish stock assessment is improved by having two separate assessments for the Northern and Central California based on biological and tagging studies.

A comprehensive study was conducted to identify and develop fishery-dependent and fishery-independent data sets (e.g., catch, discard, size/age composition, abundance indices) for this assessment. This has greatly improved the input data for the assessment. The STAT developed a well-thought protocol to streamline the evaluation of data quality and quantity when analyzing historical data and developing standardized CPUEs, making the process repeatable and transparent. The STAT also developed various sensitivity runs to evaluate various sources of uncertainty and the robustness of assessment results with respect to alternative model assumptions, parameterization, and configuration (e.g., selectivity). This greatly improved our understanding of the model performance and sources of uncertainty, leading to an improved assessment.

The current assessment assumes the Black Rockfish in Northern California is a closed stock, which contradicts the tagging study results. Catch estimates were implicitly assumed to be error free, which is unlikely for historical catches. Most of the age/length/index data were collected after the year 2000, so all of the stock declines prior to that time are likely driven by the uncertain catches and prior perceptions of M and h, resulting in a large uncertainty in the estimation of historical population dynamics.

*iv)* *Central California*

A wide range of available data collected in the fishery-dependent and fishery-independent monitoring programs were examined. Historical information was carefully evaluated for their quality and quantity before they were included in the assessment. A well-defined protocol was developed and followed in the CPUE standardization.

Incorporating age/length data and indices of abundance from various sources including both fishery-dependent and fishery-independent programs in an integrated length/based assessment allows for a comprehensive evaluation of fish stock dynamics, leading to an improved understanding of the status of the stock and sustainable harvest levels.

The STAT team explored many alternative models with different configurations and parameterizations within the Stock Synthesis framework. These alternative models indicated that the STAT were reviewing and developing options to improve stock assessments in the future, as well as checking the robustness of the current approach being used for management advice. Exploring alternative model configurations and approaches used to assess these stocks improved the quality of the assessment overall and suggested potential solutions to several problems, such as uncertainty estimates of spawning output, exploitation and recruitment.

The STAT team evaluated life history and fishery-dependent and fishery-independent data collected along the coast of California, and proposed a finer spatial scale stock assessment for Black Rockfish in California. The newly defined two assessment areas have improved the stock assessment and reduced the uncertainty compared with the 2015 assessment.

There is a need to better quantify uncertainties from different model structures that represent plausible fisheries population dynamics. Ensemble modeling approaches may be considered in the future to quantify uncertainty in stock assessment models. The current assessment assumes that the Central Californian assessment area is closed with no immigration or immigration, which does not reflect the observed movement in tagging studies. The functional maturity was estimated from samples taken recently and outside California, which might introduce additional uncertainty given functional maturity is likely to vary with biotic and abiotic environmental conditions.

3) *Evaluate model assumptions, estimates, and major sources of uncertainty*

The ToR was adequately addressed. Overall, the STATs have done excellent jobs in developing and parameterizing the four stock assessment models. In the stock assessment documents, key assumptions are described, key input data and their statistical properties are well defined with justifications, and the process in developing the base model for each stock assessment are well thought through with justifications. Various sensitivity runs were developed to evaluate the impacts of major sources of uncertainty on the estimation of key population statistics. During the STAR, additional analyses and model runs were conducted to further explore the impacts of various assumptions and alternative model configurations on

the assessment results, resulting in an improved understanding of assessment uncertainty and the impacts of data quality and quantity on modeling results.

The assessment-specific evaluation of model assumptions, estimates, and major sources of uncertainty is described below.

*i)* *Washington*

The biological (i.e., stock structure, life history and population dynamics) and statistical assumptions (i.e., statistical distributions of various errors associated with observational models linking model predictions and observations for various data such as compositional data and abundance indices) in stock assessment modeling are rather typical. However, some key life history parameters such as longevity, natural mortality, and stock-recruitment steepness tend to have large uncertainties. Although research efforts to rebuild historical landing data were productive, the estimated historical trawl catch remains uncertain. The implicit assumption of temporal stationarity of key life history parameters may also be questionable because large changes in the ecosystem and population would be likely to make key life historical parameters such as growth and natural mortality change over time. There seems to be conflicting information from age- and length-composition data with age composition data, providing a more pessimistic perspective on the population dynamics. This is rather strange, because age composition data were supposed to derive from subsampling of the length data. If there were no large differences in growth over time and space, and if subsampling of length data for age determination was representative, the age and length-composition data would provide some insights about stock status. More studies may be needed to understand such a lack of coherence between the age-and length composition data.

*ii)* *Oregon*

The temporal stationarity assumption for key life history parameters over the assessment period may not be realistic, but a lack of historical information makes the evaluation of this assumption difficult, if not impossible. During the STAR, additional analyses were conducted with different weighting values for length composition data and a single year of acoustic-visual survey estimate, leading to drastically different interpretations of the stock status. More studies are needed to better understand the uncertainty resulting from different weight schemes for the length data and acoustic-visual survey data. The stock assessment is also sensitive to the large uncertainty associated with the acoustic-visual survey catchability. More surveys need to be done to improve the estimates of this survey catchability.

*iii)* *Northern California*

The previous stock assessment in 2015 assumes a single stock along the coast of California, but this assessment has two separate assessment for Northern and Central California. However, the connections between the two areas were not explicitly

considered in both the assessments, which might introduce errors in the assessment. Much of the habitat and ecological information on the California Black Rockfish are from Alaska, Washington, and Oregon. There is a relatively short time series of abundance indices available in this assessment, which may be less informative. The development of recruitment indices (RREAS and SWFSC SCUBA) was not successful. More studies are needed to understand observed skewed sex ratios (e.g., emigration and/or natural mortality) for large Black Rockfish.

*iv)* *Central California*

Black Rockfish in the assessment areas north and south of Point Arena were assessed as separate non-mixing stocks, but there is likely larval or juvenile dispersal and movement of adult black rockfish between the two stock areas. Existing tagging studies have shown northward movement of adult black rockfish between the northern and central assessment areas. Dispersal and movement rates are not well known. A more comprehensive understanding of the northward movement of Black Rockfish is needed to support the development of spatially explicit modeling for a coastal-wide integrated California stock assessment (e.g., 2-box models or other spatially explicit stock assessment models considering regional differences as well as northward movement of adult Black Rockfish).

A lack of understanding for missing large/old Black Rockfish in the surveys and fisheries is a source of major uncertainty in stock assessment. This may result from high natural mortality, emigration out of the central area, and/or inadequate monitoring programs in catching them during the surveys and fisheries. During the review, the lack of large/old individuals in this stock was hypothesized to result from large/old fishes moving out to the northern area. This hypothesis is supported by the tagging study, although more data are probably still needed to continue testing this hypothesis. However, both northern and central Black Rockfish stock assessments consider no immigration/emigration. It is less likely that the lack of large/old fish resulted from poor selectivity for the large/old black rockfish, given all the monitoring programs and commercial and recreational fisheries. Thus, selectivities are more likely to follow logistic functions. The loss of large/old fish, presumably due to movement, may be captured by having M estimated. Thus, a natural mortality M estimated in the Central California might represent natural mortality and emigration. A sensitivity run was conducted (Request No. 7) involving the replacement of dome-shaped selectivities with asymptotic selectivities to evaluate alternative selectivities (except for CCFRP that was mainly in shallow water and Lea et al. data) while having M estimated. In this sensitivity run (Request No. 7), female natural mortality was allowed to be estimated with a fixed male offset. Female natural mortality was estimated much higher than the prior. Spawning output decreased substantially across the time series. Ending stock status is just below the minimum threshold. Female Lmax increased dramatically with the estimated values,

making it biologically unrealistic. More studies are needed to continue exploring the potential causes of missing large/old females.

Some historical data may be problematic (e.g., average weight estimate early in the time series), which might result in additional biases in estimating catch.

Functional maturity data were borrowed from Oregon and Washington areas. However, the functional maturity-length relationships are likely to differ among the areas, and the use of functional relationships derived from the data collected in other areas may introduce additional uncertainties.

4) *Provide constructive suggestions for current improvements if technical deficiencies or major sources of uncertainty are identified*

This ToR was adequately addressed. No major technical deficiencies that could reject a stock assessment were identified during the STAR. I conclude that the assessments are technically and scientifically sound and provide the best available information to develop catch advice. However, there are some issues identified for some of the pre-STAR draft assessments that should be addressed to improve the base models.

I suggested that a pairwise plot (and correlation analysis) be conducted for abundance indices to evaluate possible inconsistencies between different abundance indices and that the hypotheses (e.g., different spatial coverage, different seasons, and/or different targeted size groups) be developed to explain possible observed inconsistencies for each stock assessment area. I also recommended conducting retrospective analyses for recruitment and presenting them according to Legault (2009).

The assessment-specific description for current improvements to develop the base assessment models is described below.

*i) Washington*

A careful evaluation of alternative scenarios and additional model runs and diagnostics during the STAR suggests that the pre-STAR draft base stock assessment model provides the best available information that is adequate for providing management advice.

*ii) Oregon*

The draft base model developed prior to the STAR needs a small modification. Given the importance of the acoustic-visual survey, there is a need to increase the importance of the acoustic-visual survey in model fitting relative to the size composition data. . The length selectivities were suggested to be estimated in an initial model run and then fixed, and marginal age data are added to likelihood and the model is rerun. This approach reduces the importance of size composition data, relative to the acoustic-visual survey. This updated base model reflects the best available science for the final stock assessment and is considered adequate for providing management advice.

*iii)* *Northern California*

A proposal for the base model was presented in the draft assessment document for northern California Black Rockfish assessment area. The STAR Panel explored alternatives to these proposed assessment model configurations as noted in the analytical requests in the STAR Panel report. The model for the northern California assessment area was rerun with the spline maturity function and updated ageing error matrix. This updated base model reflects the best available science for the final stock assessment and is considered adequate for providing management advice.

*iv)* *Central California*

A proposal for the base model was presented in the draft assessment document for the central California Black Rockfish assessment area. The STAR Panel explored alternatives to these proposed assessment model configurations as noted in the analytical requests in the STAR Panel report. The model for the central California assessment area was rerun with the spline maturity function and updated ageing error matrix. This updated base model reflects the best available science for the final stock assessment and is considered adequate for providing management advice.

5) *Determine whether the science reviewed is considered to be the best scientific information available*

I would like to commend both of the STATs for their excellent work on the Washington, Oregon, Northern and Central California Black Rockfish stock assessments. I was impressed by the breadth of expertise in their review; the amount of effort spent to rebuild historical data and compile all of the data for the assessment; the considerations of plausible scenarios; the openness of discussion on stock assessment uncertainty; the discussion of alternative approaches, additional runs and suggestions; and the constructive dialogues among the STATs, the STAR Panel and other participants during the STAR.

Overall, based on the stock assessments presented, the materials provided, and additional runs conducted during the STAR, I believe that both of the STATs have adequately addressed this ToR. For the Oregon Black Rockfish assessment, there was a scale issue in estimating stock abundance because the modeling results tend to be sensitive to the assumed catchability values for a single year of acoustic-visual survey. More studies are needed to better understand the stock structure in California and spatial-temporal variability in life history parameters. Comprehensive analyses prior to and during the STAR suggest that the stock assessment results and stock status are rather robust to the uncertainty in the data and stock assessment model configurations. I conclude that the science reviewed is the best scientific information available. The four base stock assessments for Washington, Oregon, Northern California, and Central California finalized during the STAR are scientifically sound and adequately addresses management needs.

6) *When possible, provide specific suggestions for future improvements in any relevant aspects of data collection and treatment, modeling approaches and technical issues, differentiating between the short-term and longer-term time frame*

I fully support the research recommendations made by the STATs included in the pre-STAR draft assessments for all the four assessment areas. I also support additional research recommendations made during the STAR that were included in the STAR Panel Summary Report. In addition, I provide the following research recommendations that the STATs may consider to further improve the Black Rockfish stock assessment in the U.S. West Coast:

(a) Provide an explicit protocol for the CPUE standardization to make the modeling process more transparent and consistent over time and stocks.
(b) Develop habitat suitability models and species distributional models to better understand the spatio-temporal dynamics of suitable habitat and distributions of Black Rockfish in the U.S. West Coast, and the possible impacts changing distribution (e.g., climate-induced change) on the effectiveness of various monitoring programs.
(c) Continue coast-wide tagging studies to better understand the movement, distribution and phenology of Black Rockfish among the four assessment areas, in particular the movement between the northern and central California assessment areas.
*(d)* Continue developing and conducting fishery-independent survey programs to monitor the spatio-temporal dynamics of Black Rockfish.
*(e)* Synthesize the coast-wide data available to evaluate possible shifting distributions and spatial/temporal stationarity of key life history parameters (e.g., maturation, growth and mortality) in a changing ecosystem.
*(f)* Consider an ensemble modeling approach to account for possible uncertainty associated with assessment model structure.
*(g)* Develop spatially explicit stock assessment model for an integrated assessment of Northern and Central California.

7) *Provide a brief description on panel review proceedings highlighting pertinent discussions, issues, effectiveness, and recommendations*

This STAR is a CIE review for the Black Rockfish in Washington, Oregon and California. The reviewers were provided with all the necessary logistical support, documentation, data, and background information. The STAR Panel was composed of two scientists selected by the Center for Independent Experts, one invited scientist, and one chaired by a PFMC SSC member. The Panel was assisted and advised by Marlene Bellman of PFMC, Katie Pierson of the Groundfish Management Team, and Gerry Richter of Groundfish Advisory Subpanel. Documentations and presentations were prepared and given by the two STATs led by Dr. Jason Cope (for Washington and Oregon) and Dr. E.J. Dick (for northern and Central California). Presentations were given during the Review on stock assessment input data, information on model configuration and parameterization, management, stock assessment modeling outputs and results, Biological Reference points (BRP) and stock status determination, as well as model projections. The STAT members and public also provided valuable information and insights during the discussion. The STATs were open to suggestions and provided additional information and analyses upon request. The STATs

engaged in collegial discussion with the STAR Panel and worked hard to accommodate each one of the Panel's requests. The whole process was open and constructive.

This STAR covers four independent full stock assessments, which may be too many for a regular STAR Panel. The tight schedule at times might have limited some more extensive in-depth discussion during the STAR. For example, the Panel was not able to have an in-depth review of CPUE standardization, which provides important abundance indices from fishery-dependent sources for the four stock assessments.

## V. Conclusions and Recommendations

Based on the materials and the information provided for this review, I found that the STATs have adequately addressed the ToRs for the Black Rockfish in Washington, Oregon and California. However, there remain concerns regarding the assumptions of temporal/spatial stationarity of life history parameters and data quality and quantity. There was little explicit consideration of ecosystem dynamics and climate changes in modeling the Back Rockfish stock dynamics in the assessment. Analytical stock assessment results tend to have large uncertainties regarding different model configurations and parameterizations.

The comprehensive research done by the STATs and additional runs and analyses conducted during the STAR suggests that the stock assessment results are likely to be rather robust regarding uncertainty in data and stock assessment modeling, in spite of the uncertainties (with the exception of the Oregon assessment). The base and alternative models selected to bracket uncertainties for each of the four assessments appear to be adequate in quantifying uncertainties associated with the assessments. Although I have some concerns (see my comments for each ToR), I conclude that overall, the assessments are scientifically sound and reflect the best available scientific information. I support all the research recommendations made by the STATS in pre-STAR assessment reports and by the STAR Panel during the START. In addition, I also have provided a list of research recommendations for the U.S. West Coast Black Rockfish that the STATs may consider to further improve their stock assessments. My specific research recommendations/comments can be found in ToR 6.

### VI. References


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## VII. Appendices

### VII-1. Bibliography of materials provided for review

Cope, J.M., A.D. Whitman, A.M. Berger, L.R. Rasmuson. 2023. Status of Black Rockfish (Sebastes melanops) in 2023 in state and federal waters off Oregon. Pacific Fishery Management Council, Portland, Oregon. 224 p.

Cope, J.M., L.K. Hillier, C.B. Niles , T. Tsou, K.E. Hinton, F.P. Caltabellotta. 2023. Status of Black Rockfish (Sebastes melanops) in 2023 in state and federal waters off Washington state. Pacific Fishery Management Council, Portland, Oregon. 219 p.

Dick, E.J., C. Barnes, J. Coates, N. Grunloh, M. Monk, and T. Rogers. 2023. The Status of Black Rockfish in U.S. Waters off California in 2023. Pacific Fishery Management Council, Portland, OR. Available from http://www.pcouncil.org/groundfish/stock-assessments/

The SS3 model files for the base models for the Washington, Oregon, Northern and Central California Black Rockfish assessments.

**Appendix VII-2. Performance Work Statement**

# Stock Assessment Review (STAR) Panel 2 (CLIN 0002)
# Black Rockfish

**Background**

The National Marine Fisheries Service (NMFS) is mandated by the Magnuson-Stevens Fishery Conservation and Management Act, Endangered Species Act, and Marine Mammal Protection Act to conserve, protect, and manage our nation's marine living resources based upon the best scientific information available (BSIA). NMFS science products, including scientific advice, are often controversial and may require timely scientific peer reviews that are strictly independent of all outside influences. A formal external process for independent expert reviews of the agency's scientific products and programs ensures their credibility. Therefore, external scientific peer reviews have been and continue to be essential to strengthening scientific quality assurance for fishery conservation and management actions.

Scientific peer review is defined as the organized review process where one or more qualified experts review scientific information to ensure quality and credibility. These expert(s) must conduct their peer review impartially, objectively, and without conflicts of interest. Each reviewer must also be independent from the development of the science, without influence from any position that the agency or constituent groups may have. Furthermore, the Office of Management and Budget (OMB), authorized by the Information Quality Act, requires all federal agencies to conduct peer reviews of highly influential and controversial science before dissemination, and that peer reviewers must be deemed qualified based on the OMB Peer Review Bulletin standards (https://www.whitehouse.gov/wp-content/uploads/legacy_drupal_files/omb/memoranda/2005/m05-03.pdf

**Scope:**

The National Marine Fisheries Service and the Pacific Fishery Management Council will hold three stock assessment review (STAR) panels and potentially one mop-up panel (if needed), to evaluate and review benchmark assessments of Pacific coast groundfish stocks. The goals and objectives of the groundfish STAR process are to:

1) ensure that stock assessments represent the best available scientific information and facilitate the use of this information by the Council to adopt Overfishing Limits (OFLs), Allowable Biological Catches (ABCs), Annual Catch Limits (ACLs), Harvest Guidelines (HGs), and Annual Catch Targets (ACTs);
2) meet the mandates of the Magnuson-Stevens Fisheries Conservation and Management Act (MSA) and other legal requirements;
3) follow a detailed calendar and fulfill explicit responsibilities for all participants to produce required reports and outcomes;
4) provide an independent external review of stock assessments;
5) increase understanding and acceptance of stock assessments and peer reviews by all members of the Council family;

6) identify research needed to improve assessments, reviews, and fishery management in the future; and
7) use assessment and review resources effectively and efficiently.

A benchmark stock assessment will be conducted and reviewed for Black Rockfish, which was identified within the top twenty-five rankings for assessment consideration during the Pacific coast groundfish regional stock assessment prioritization process: (https://www.pcouncil.org/documents/2022/05/f-3-attachment-2-nmfs-assessment-prioritization-workbook-electronic-only.xlsx/)

which was based on the national stock assessment prioritization framework (http://www.st.nmfs.noaa.gov/Assets/stock/documents/PrioritizingFishStockAssessments_FinalWeb.pdf).

Black Rockfish (*Sebastes melanops*) is a nearshore species exhibiting internal fertilization and bearing live young. Adults tend to occur in schools over rocky structure at depths less than 40 fathoms, and sometimes feed actively on or near the surface. Black Rockfish begin recruiting to nearshore fisheries at 3-4 years of age, corresponding to a fork length of about 25-30 cm, and 50% of females attain maturity at about 6-8 years, corresponding to a fork length of about 38-42 cm. Adult females grow 3-5 cm larger than males, with a few females attaining fork lengths greater than 55 cm. Black Rockfish are taken mainly in recreational fisheries, so the indices of abundance are different from the standard trawl-based indices commonly used in West Coast groundfish assessments.

Black Rockfish was last assessed in 2015. The stock assessment team prepared separate geographic assessments that were spatially stratified with boundaries at the CA/OR border (42°00' N latitude) and OR/WA border (46°15' N latitude). This spatial stratification was chosen based on two observations: (a) that nearshore species do not exhibit much adult movement and (b) exploitation and management histories have varied significantly among the three states. Together these features would likely create appreciable state-to-state differences in age composition. The 2015 stock assessment for Washington found the stock to be above the management target of 40% of initial spawning stock biomass, and the California stock above the minimum size threshold of 25% of initial spawning stock biomass. The Oregon stock assessment was found to be above the 40% target, but with very high uncertainty such that the assessment was downgraded for management purposes.

Assessments for these stocks will provide the basis for the management of the groundfish fisheries off the West Coast of the U.S., including providing scientific basis for setting OFLs and ABCs as mandated by the Magnuson-Stevens Act. The technical review will take place during a formal, public, multiple-day virtual meeting of fishery stock assessment experts. Participation of external, independent reviewers is an essential part of the review process. The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**.

**Requirements:**
Two CIE reviewers will participate in the stock assessment review panel. One CIE reviewer, requested herein, shall conduct an impartial and independent peer review of the assessments described above and in accordance with the Performance Work Statement (PWS) and ToRs herein. Additionally, one "common" CIE reviewer will participate in all STAR panels held in 2023 and the PWS and ToRs for the "common" CIE reviewer are included in **Attachment A**.

The CIE reviewers shall be active and engaged participants throughout panel discussions and able to voice concerns, suggestions, and improvements, while respectfully interacting with other review panel members, advisors, stock assessment technical teams, and other participants. The CIE reviewers shall have excellent communication skills in addition to working knowledge and recent experience in fish population dynamics; with experience in the integrated-analysis modeling approach, using age- and size- (and possibly spatially-) structured models, and methods for quantifying uncertainty. Familiarity with environmental, ecosystem and climatic effects on population dynamics and distribution may also be beneficial. The CIE reviewer's duties shall not exceed a maximum of 14 days to complete all work tasks of the peer review described herein.

**Tasks for Reviewers:**
The CIE reviewer shall complete the following tasks in accordance with the PWS and Schedule of Milestones and Deliverables herein.

Prior to the Peer Review: Upon completion of the CIE reviewer selection by the CIE Steering Committee, the CIE shall provide the CIE reviewer information (full name, title, affiliation, country, address, email) to the NMFS Contracting Officer Representative (COR), who forwards this information to the NMFS Project Contact no later than the date specified in the Schedule of Milestones and Deliverables. The CIE is responsible for providing the PWS and ToRs to the CIE reviewer. The NMFS Project Contact is responsible for providing the CIE reviewer with the background documents, reports, and other information concerning pertinent meeting arrangements. The NMFS Project Contact is also responsible for providing the Chair a copy of the PWS in advance of the panel review meeting. Any changes to the PWS or ToRs must be made through the COR prior to the commencement of the peer review.

Pre-review Background Documents: Two weeks before the peer review, the NMFS Project Contact will send (by electronic mail or make available at a File Transfer Protocol (FTP) site) to the CIE reviewers the necessary background information and reports for the peer review. In the case where the documents need to be mailed, the NMFS Project Contact will consult with the CIE Lead Coordinator on where to send documents. CIE reviewers are responsible only for the pre-review documents that are delivered to the reviewer in accordance to the PWS scheduled deadlines specified herein. The CIE reviewer shall read all documents in preparation for the peer review.

Documents to be provided to the CIE reviewers prior to the STAR Panel meeting include:

- The current draft stock assessment reports;
- Previous stock assessments and STAR Panel reports for the assessments to be reviewed;
- The Pacific Fishery Management Council's Scientific and Statistical Committee's Terms of Reference for Stock Assessments and STAR Panel Reviews;
- Stock Synthesis (SS) Documentation;
- Additional supporting documents as available;
- An electronic copy of the data, the parameters, and the model used for the assessments (if requested by reviewer).

Panel Review Meeting: The CIE reviewer shall conduct the independent peer review in accordance with the PWS and ToRs, and shall not serve in any other role unless specified herein. **Modifications to the PWS and ToRs cannot be made during the peer review, and any PWS or ToRs modifications prior to the peer review shall be approved by the COR and CIE Lead Coordinator.** Each CIE reviewer shall actively participate in a professional and respectful manner as a member of the review panel's virtual meeting, and their peer review tasks shall be focused on the ToRs as specified herein. The NMFS Project Contact is responsible for any facility arrangements (e.g., video or teleconference arrangements). The NMFS Project Contact is responsible for ensuring that the Chair understands the contractual role of the CIE reviewers as specified herein. The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements, including the meeting facility arrangements. The agenda will be made available two weeks prior to the start of the Panel Review Meeting.

Contract Deliverables - Independent CIE Peer Review Reports: The CIE reviewer shall complete an independent peer review report in accordance with the PWS. Each CIE reviewer shall complete the independent peer review according to required format and content as described in **Annex 1**. The CIE reviewer shall complete the independent peer review addressing each ToR as described in **Annex 2**.

Other Tasks – Contribution to Summary Report: The CIE reviewer should assist the Chair of the panel review meeting with contributions to the Summary Report, based on the terms of reference of the review. The Chair is not provided by the CIE under this contract. A CIE reviewer is not required to reach a consensus with other members of the Panel, and should provide a brief summary of the reviewer's views on the summary of findings and conclusions reached by the review panel in accordance with the ToRs.

**Place of Performance:**
The CIE reviewers shall conduct an independent peer review during the panel review meeting scheduled for the dates of July 10-14, 2023. The meeting shall take place in Santa Cruz, California. In the event that conditions at the time warrant, this meeting will be conducted instead as a virtual meeting, with technical assistance provided by staff from the Pacific Fishery Management Council.

**Period of Performance:**
The period of performance shall be from the time of award through **August 2023**. The CIE reviewers' duties shall not exceed 14 days to complete all required tasks.

**Schedule of Milestones and Deliverables:**
CIE shall complete the tasks and deliverables described in this PWS in accordance with the following schedule.

| | |
|---|---|
| Within two weeks of the award | Contractor selects and confirms reviewers. This information is sent to the COR, who then transmits this to the NMFS Project Contact |
| Approximately two weeks later | Contractor provides the pre-review documents to the CIE reviewers |
| **July 10-14, 2023** | **Panel Review Meeting, Santa Cruz, California** |
| Approximately two weeks later | Contractor receives draft reports |
| Within two weeks of receiving draft reports | Contractor submits final CIE independent peer review reports to the COR |

Note: The Chair's Summary Report shall not be submitted to, reviewed, or approved by the Contractor.

**Applicable Performance Standards**
The acceptance of the contract deliverables shall be based on three performance standards: (1) The reports shall be completed in accordance with the required formatting and content; (2) The reports shall address each TOR as specified; and (3) The reports shall be delivered as specified in the schedule of milestones and deliverables.

**Travel:**
All travel expenses shall be reimbursable in accordance with Federal Travel Regulations (http://www.gsa.gov/portal/content/104790). International travel is authorized for this contract. Travel is not to exceed $12,000.00.

**Restricted or Limited Use of Data:**
The contractors may be required to sign and adhere to a non-disclosure agreement.

**NMFS Project Contact:**
Andi Stephens, NMFS Project Contact
National Marine Fisheries Service,
Newport, OR 97365
Andi.Stephens@noaa.gov
Phone: 843-709-9094

## Annex 1: Format and Contents of CIE Independent Peer Review Report

1. The CIE independent report shall be prefaced with an Executive Summary providing a concise summary of the findings and recommendations, and specify whether the science reviewed is the best scientific information available.

2. The main body of the reviewer report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Summary of Findings for each ToR in which the weaknesses and strengths are described, and Conclusions and Recommendations in accordance with the ToRs.

    a. Reviewers should describe in their own words the review activities completed during the panel review meeting, including providing a brief summary of findings, of the science, conclusions, and recommendations.
    b. Reviewers should discuss their independent views on each ToR even if these were consistent with those of other panelists, and especially where there were divergent views.
    c. Reviewers should elaborate on any points raised in the Summary Report that they feel might require further clarification.
    d. Reviewers shall provide a critique of the NMFS review process, including suggestions for improvements of both process and products.
    e. The CIE independent report shall be a stand-alone document for others to understand the weaknesses and strengths of the science reviewed, regardless of whether or not they read the summary report. The CIE independent report shall be an independent peer review of each ToRs, and shall not simply repeat the contents of the summary report.

3. The reviewer report shall include the following appendices:

Appendix 1: Bibliography of materials provided for review
Appendix 2: A copy of the CIE Performance Work Statement
Appendix 3: Panel Membership or other pertinent information from the panel review meeting.

## Annex 2: Terms of Reference for the Peer Review

### Stock Assessment Review (STAR) Panel 2

The specific responsibilities of the STAR panel are to:

1. Become familiar with the draft stock assessment documents, data inputs, and analytical models along with other pertinent information (e.g., previous assessments and STAR panel report when available), and the Pacific Fisheries Management Council Terms of Reference for the Groundfish Stock Assessment Review Process for 2023-2024 prior to review panel meeting.
2. Discuss the technical merits and deficiencies of the input data and analytical methods during the open review panel meeting.
3. Evaluate model assumptions, estimates, and major sources of uncertainty.
4. Provide constructive suggestions for current improvements if technical deficiencies or major sources of uncertainty are identified.
5. Determine whether the science reviewed is considered to be the best scientific information available.
6. When possible, provide specific suggestions for future improvements in any relevant aspects of data collection and treatment, modeling approaches and technical issues, differentiating between the short-term and longer-term time frame.
7. Provide a brief description on panel review proceedings highlighting pertinent discussions, issues, effectiveness, and recommendations

## Appendix VII-3: List of Participants

**STAR 2 Panel Members**
John Budrick, California Department of Fish and Wildlife (Chair)
Martin Dorn, University of Washington
Yong Chen, Center for Independent Experts
Joseph Powers, Center for Independent Experts

**Stock Assessment Team (STAT) Members**
E.J. Dick, National Marine Fisheries Service Southwest Fisheries Science Center
Melissa Monk, National Marine Fisheries Service Southwest Fisheries Science Center
John Field, National Marine Fisheries Service Southwest Fisheries Science Center
Tanya Rogers, National Marine Fisheries Service Southwest Fisheries Science Center
Jason Cope, National Marine Fisheries Service Northwest Fisheries Science Center
Aaron Berger, National Marine Fisheries Service Northwest Fisheries Science Center
Julia Coates, California Department of Fish and Wildlife
Alison Whitman, Oregon Department of Fish and Wildlife
Lief Rasmuson, Oregon Department of Fish and Wildlife
Cheryl Barnes, Oregon Department of Fish and Wildlife
Kristen Hinton, Washington Department of Fish and Wildlife
Theresa Tsou, Washington Department of Fish and Wildlife
Corey Niles, Washington Department of Fish and Wildlife
Lisa Hillier, Washington Department of Fish and Wildlife
Fabio Caltabellotta, Washington Department of Fish and Wildlife
Clair Rosemond, Oregon State University

**STAR Panel Advisors**
Katie Pierson, Oregon Department of Fish and Wildlife,
Groundfish Management Team representative
Gerry Richter, B&G Seafoods, Groundfish Advisory Subpanel representative
Marlene A. Bellman, Pacific Fishery Management Council representative