Center for Independent Experts (CIE) Reviewer's Independent Peer Review Report on the 2015 Scientific and Statistical Committee's Groundfish Subcommittee Mop-up Stock Assessment Review Panel Meeting

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Prepared for

Center for Independent Experts

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Contents

Executive Summary

The 2015 Scientific and Statistical Committee's Groundfish Subcommittee Mop-up Stock Assessment Review Panel Meeting on the Oregon assessment of Black rockfish (*Sebastes melanops*) met from Monday September 28 to Friday October 2, 2015. The meeting was chaired by Dr John Field. The review panel was composed of Dr John Field, Dr Andy Cooper, Dr Martin Dorn, Dr Theresa Tsou, Mr John Budrick, Dr Owen Hamel, and Dr Neil Klaer. All reviewers were SSC members except for Dr Klaer, who represented the Center for Independent Experts (CIE).

A number of problems were found with the Oregon Black rockfish assessment during STAR Panel 3 that did not enable sufficient time to properly review that model (including full diagnostics) within the timeframe of the meeting. It was recommended that the Oregon model go to mop-up, to allow sufficient preparation of a base case for review.

There were two alternative Oregon Black rockfish draft base models provided for examination by the Panel, hereafter referred to as the draft base model (Cope et al.) and the alternative base model (Sampson). After model presentations and general discussions, the rest of the meeting was devoted to the examination of various aspects of the models through the request and response process.

Neither of the initial models presented to the meeting were seen as acceptable by the group, with key issues being the arbitrary setting of 50% selection on the descending limb of the ocean recreational selectivity for the draft base, and the implausibly high M estimates of the alternative model. The work of the meeting was to attempt to decide the most appropriate model structural assumptions and input data to arrive at a single agreed base model for Oregon that both of the developers of the two alternative models would find acceptable.

Various advantages and disadvantages of the two models were examined, primarily focusing on different procedures for dealing with input data, how to model natural mortality and selectivity, alternative weighting procedures for conditional age-at-length data, the interpretation of abundance estimates from the tag study, and whether the model should be given freedom to estimate annual recruitment deviations.

The Panel and STATs were able to generally agree on a preferred configuration for most aspects of a new agreed base model, with the most contentious remaining issue being whether to allow the agreed base model to estimate recruitment deviations. Evidence was provided that showed that recruitment deviations were being adjusted by the model mostly to fit patterns not evident in composition data. The Panel agreed to turn off recruitment deviations for the agreed base model. David Sampson did not believe that the agreed base model was an improvement over the 2007 assessment.

The agreed base model showed an unfished summary biomass of 12,135t and a final spawning output depletion in 2014 of 59.9%, indicating that the stock is not overfished. Using a target of SPR50%, the agreed base showed that annual fishing intensity has been below the target level throughout the entire time series, with a single year in the early 1990s at just above the target. For the past 20 years, fishing intensity has been fairly constant at 60 to 90% of the target level.

An axis of uncertainty is provided by bounds on tag q (fixed at 12.7%, base at 25% or estimated ~50%). This provides a wide range of overall biomass scale and current depletion levels that encompass other dimensions that might also be used, and can be described as high and low biomass scenarios. Another key dimension of uncertainty for the assessment is the fixed value for M that could be used to provide bounds on lower and higher stock productivity. However, the meeting agreed that the single axis of uncertainty provided by alternative values for tag q was sufficient to convey to management the scale of uncertainty for this assessment.

For future research, priority should be given to investigation of the most supportable procedure for implementation of the absolute abundance estimates provided by the tagging study, and gathering of supporting evidence for a considerable biomass of older females in the Black rockfish population currently unseen by the fisheries in Oregon. The development of an objective procedure for the evaluation of aberrant behavior of modeled recruitment deviations should also be considered.

1 Introduction

1.1 Background

The 2015 Scientific and Statistical Committee's (SSC's) Groundfish Subcommittee Mop-up Stock Assessment Review (STAR) Panel Meeting on the Oregon (OR) assessment of Black rockfish (*Sebastes melanops*) convened at National Marine Fisheries Service (NMFS) Western Regional Center's Sand Point Facility, Alaska Fisheries Science Center in Seattle, Washington, from Monday September 28 to Friday October 2, 2015. The meeting was chaired by Dr John Field. The review panel (the Panel) was composed of Dr John Field (NMFS Southwest Fisheries Science Center), Dr Andy Cooper (Simon Fraser University), Dr Martin Dorn (NMFS Alaska Fisheries Science Center), Dr Theresa Tsou (Washington Department of Fish and Wildlife), Mr John Budrick (California Department of Fish and Wildlife), Dr Owen Hamel (NMFS Northwest Fisheries Science Center) and one scientist affiliated with the Center for Independent Experts (CIE): Dr Neil Klaer. All reviewers were SSC members except for Dr Klaer.

A number of problems were found with the Oregon Black rockfish assessment during STAR Panel 3:

- On the first day the meeting was informed that the Oregon model was producing a good proportion of runs that crashed (producing QNAN and -1.#IND errors) on the last phase of estimation. During the course of the meeting two configuration issues were identified that were causing problems: (1) control file settings for abundance index sds inadvertently added a value of 1 to the sd for each index and (2) initial and prior bounds for the tagging index q were entered into the control file as linear rather than log values.

- Some meeting and STAT time was devoted to the removal of input data associated with landings in Astoria that were actually caught in Washington.

- An initial model for Oregon may have become available on Friday morning, leaving insufficient time to properly review that model (including full diagnostics) within the timeframe of the meeting.

It was recommended that the Oregon model go to mop-up, to allow sufficient preparation of a base case for review.

Draft stock assessment reports as well as associated model runs were made available via a public FTP site to the Panel on 15 September prior to the review meeting. During the meeting, all documents were available electronically via the same FTP site, and additional documents and presentations made during the meeting were also posted there.

The meeting generally followed the proposed agenda, and included presentations by the stock assessment teams (STATs) mixed with questions and open discussion. Additional analyses were requested by the Panel from the STATs and the results of those were also subsequently presented. A summary of those requests, rationale and STAT responses is contained in the mop-up panel meeting report.

1.2 Review Activities

On the first day, I was assigned the task of writing a draft meeting report. At the time of writing, the meeting report was being reviewed and edited by the Panel and had not been finalized. However, due to this process, much of the wording here reflects or is the same as that in my initial draft meeting report.

There were two alternative Oregon Black rockfish draft base models provided for examination by the Panel, hereafter referred to as the draft base model (Cope et al.) and the alternative base model (Sampson). After model presentations and general discussions, the rest of the meeting was devoted to the examination of various aspects of the models through the request and response process, in order to arrive at agreed aspects of the two models that might be combined to produce a single agreed base case.

Various advantages and disadvantages of the two models were examined, and the Panel and STATs were able to agree on a preferred configuration for most aspects of a new agreed base model, with the most contentious remaining issue being whether to allow the agreed base model to estimate recruitment deviations.

2 Oregon Black rockfish stock assessments

2.1 Evaluation of the draft base model

Jason Cope provided a presentation of the Oregon Black rockfish assessment (Oregon black rockfish assessment_9_28_15.pdf) and Andi Stephens explained the data changes since the July STAR panel.

Changes to input data since the July STAR panel were relatively minor and included: (1) shore/estuary recreational fishery split into ocean and shore; (2) age bins extended from 30 to 40 to be more consistent with the Washington (WA) and California (CA) assessments; (3) length bins extended from 60 to 64 to match WA and CA assessments; and (4) unsexed compositional data were removed from the commercial fleets. Index changes were also relatively minor and were: (1) a reworking of the logbook index to include vessels that fished for at least 3 years; (2) ORBS charter boat CPUE index was revised to include auxiliary information on the reef fished and changes in bag-limits and depth openings; input data were limited to March through October; and (3) abundance estimates from the first three years of the tagging series were removed, because they were deemed to be biased low due to reduced first-year recapture probability. An overlay plot of the indices show that they are generally noisy but follow similar patterns, with most showing an uptick in recent years.

Recent OR catches have been greater than those in WA and CA, and the early trawl fishery was of reduced importance for OR.

It was noted that the Oregon MRFSS index was not used for China rockfish as multiple intercept interviews were done for single trips, meaning that the index is not trip-based as intended. This index was included for back rockfish and this known problem was examined in three different ways (see alternative model addendum Sampson-Addendum-Alt_Models_for_Oregon_Black_Rockfish.pdf). The model is not sensitive to the removal of any or all of the indices – explained by the indices being relatively noisy, but generally following the expected available biomass patterns from the assessment with all indices removed. Models to date have not been successful in following the recent increase shown by the indices.

The meeting agreed that the estimation of sex-specific M values (for all ages or just large fish) is appropriate as this is commonly done in other assessments. There was concern that the use of a maximum age of 56 in development of the M prior may have been too extreme, and that a lower percentile value, rather than the absolute maximum age observed could be more appropriate. It was also noted that the prior is rather broad anyway, and does not greatly restrict model estimates. Current models use estimated/fixed values for female M, with male M as an offset. An alternative that fixes/estimates male M with female as an offset was suggested as one that should be explored. The tag study data when analyzed in isolation gave M estimates in the 0.2-0.24 range (combined male and female).

The Francis method was used to weight length compositions; the CAAL data were only weighted by the number of age samples per length bin. Weighting approaches for these models needs further investigation. As noted in previous STAR Panel reports, there is still no generally agreed approach for weighting CAAL data, with a workshop planned for later this year that may help to resolve this issue (CAPAM, October). However, it was also generally

agreed that some form of re-weighting for CAAL data is preferred, and most/all available methods would result in an overall down-weighting of CAAL for the OR model. It is known that the current version of SS used for these assessments adjusts minimum sample sizes to 1 (now corrected for the most recent version), leading to a possible bias when down-weighting is applied to CAAL data, because they are more likely to have small initial sample numbers than length compositions. Because of this issue, no re-weighting was applied to CAAL data for the WA and CA models accepted by the STAR Panel in July.

It was noted that the OR model has a potential absolute abundance index provided by the tagging study. The draft base model estimated the tag q value at about 0.55, but examination of the proportion of available Black rockfish habitat in OR that the tag study applies to suggests a q value of about 0.1. Fixing tag q to lower values in the draft base model only led to an increase in the additional sd assigned to that index, with little change to the overall modeled biomass. A model run that fixed the tag index additional sd at the base estimate, not allowing additional sd to increase provided a means for closely fitting the tag q at near 0.1.

Recruitment deviations appear to be more driven by the pattern of historical removals, rather than reflecting signals in composition data. Mostly because of growth characteristics of Black rockfish (long-lived to a maximum age greater than 50, but with fast growth for young fish to about age 10, where they reach near maximum length), composition data are relatively uninformative about the scale of annual recruitment levels, giving the model freedom to adjust them in order to fit catch patterns and potentially abundance indices. Recruitment residuals showed a high level of autocorrelation, and an overall systematic pattern of low recruitment to about 1980, above average recruitment to about 2002, and then below average recruitment thereafter. The draft base OR model showed a considerable retrospective pattern, with spawning output being revised upwards as successive recent years of data were removed, apparently caused mostly by revisions of the scale of recruitments from about 1990 to 2004. Confirmation that revision of recruitment patterns was the main cause for the retrospective pattern was provide by a re-run of retrospectives for a model that turned recruitment deviations off. It is concerning that available data appears to be uninformative about the scale of auto-correlated recruitment levels over decadal time periods.

Recruitment at the end of the time series was always estimated to be poor, contributing to the model estimate a flat to declining biomass trend in available biomass associated with each index, despite most of the indices showing an upward trend in recent years. This is a relatively data-poor assessment given the lack of informative data on recruitment.

For the WA and CA models, the ocean recreational fleet selectivity was modeled as asymptotic. The draft base model OR ocean recreational fishery selectivity was forced to be semi-domed, with a fixed value of 0.5 used for the right-hand asymptote. Model results were very sensitive to this fixed value, which is an undesirable aspect of the draft base model. If freely estimated, this selectivity becomes fully dome-shaped, causing the population to crash in conflict with the abundance indices that do not exhibit such trends. A comparison of the likelihood components between the draft base and the freely estimated M and ocean recreational selectivity sensitivity run, showed that the length compositions (and lack of females) were the greatest driver for the difference in the estimated selectivity pattern. This may also account for the estimation of a higher male M than female M – also an undesirable feature of the draft base model. It was

pointed out that a different story is told with age-based female dome selectivity for the ocean recreational fishery as in the alternative model.

Estimated growth curves for the draft base model were consistent with known biology, with female Linf at near 56cm (CV ± 10cm at age 40), male at near 44cm (CV ± 7cm at age 40). There are very little data in the OR model to characterize growth of old females in particular.

Jittering for the draft base model (0.05) indicated that a global minimum was most likely obtained, although more than 50% of jitters converged at solutions more than 2 likelihood units lower than for the base model.

A likelihood profile for M showed that length and age data are most influential, with age data having a well-defined minimum for female M at about 0.26, but length only reaching a minimum at 0.4. It is recreational fishery length and age data that appears to be most influential. A request to compare these patterns with CA and WA showed that length provided a more defined minimum than age for CA, and length and age showed opposing trends for WA, crossing near the 0.16 value.

The draft base model only greatly differed from the structural assumptions of the CA and WA models accepted by the July STAR Panel in the following respects:

- Female M value fixed at 0.17 - the mean of the estimated WA (0.16) and CA (0.18) values.
- Oregon tagging abundance index and associated q (with prior) implemented as a potentially absolute abundance index.
- Semi-dome length-based selectivity for the ocean recreational fishery (asymptotic for WA/CA).

2.2 Evaluation of the alternative base model

David Sampson provided a presentation of his Black rockfish alternative assessment model (@OR_Black_RF-Oct_Mop-up.pdf).

It was highlighted that uncertainty in the determination of a mechanism to explain the disappearance of older females in the Black rockfish population is not new, and also occurs in other rockfish species (e.g. Canary, Chilipepper and Yellowtail rockfish). The two main alternatives to either kill older females using a higher natural mortality than for the males, or to hide them by making older females less available to the fishing gear than males through differential selectivity were articulated in the 2003 Canary rockfish rebuilding plan.

The ODFW tagging study off Newport provided annual estimates for 2002-2014 of the population size off Newport potentially providing scale for the OR population in the stock assessment. The tag q prior methodology received a lot of discussion during the meeting. Using estimated available habitat (from GIS analysis by Troy Buell ODFW and Melissa Monk SWFSC) in OR port areas in addition to Newport along with density estimates by port area from MRFSS charter boat CPUE (using all available years, Black rockfish target trips), it was estimated that 9.4% of the OR population occurs in the Newport tagging study area. A CV of 0.5 was then used to produce a lognormal tag q prior distribution for use in the assessment models (the CV of mean CPUE by port was about 0.2). Relative abundance data were unavailable for some port regions as they received little charter boat fishing effort. In particular, results are sensitive to the average abundance assumed for Port Orford as this was calculated to contain about 24% of the OR Black rockfish habitat area. About 24% of the recent-year state-wide landings of Black rockfish occurred off Newport, suggesting that exploitation of the state-wide population was disproportionately concentrated in the Newport area, and that some areas with suitable habitat were only relatively lightly exploited. Some panel members thought it would be an improvement to use only the CPUE that temporally overlaps with the tagging study to develop the prior, and this was done to produce a revised agreed prior.

Changes in depth regulations during the tagging study did not affect targeting practices for Black rockfish off Newport. While there is available evidence for movement of some Black rockfish over hundreds of kilometers, recaptures of tagged fish from Newport in other OR port areas shows that the Newport population is relatively closed, as assumed by the Brownie recapture model.

It was agreed that it was appropriate to remove the first 3 years of tag abundance information from the stock assessment due to probable bias caused by reduced first-year recapture probability.

The most appropriate selectivity to apply to the tagging study in the stock assessment was also discussed, with a suggestion that knife-edged flat selectivity from about length 32cm could better reflect the assumptions of the simplified methodology of the tagging study (no age-specific mortality, and no accounting for dome selectivity). It was agreed that this selectivity question was a difficult one, and should be the subject of further research.

The alternative model included mean body weight samples in addition to other composition data, particularly to supplement limited available composition data for commercial fleets. Those

were independently collected, so it was agreed that it is preferable to include them. CVs were estimated for mean body weight using available corresponding length-frequencies and the length-weight relationship. An appropriate method for reweighting such data is currently unknown, so no reweighting was applied.

As growth curves for males and females overlap considerably, the alternative model introduced dome age selection for females for most fleets as a more precise method of addressing disappearing females than possible via length selection alone as in the draft base model. Differential age-based selectivity implies a mechanism such as a change in the behavior of old females by age, making them less available to fishing gear. Selection in an integrated assessment necessarily includes a combination of both gear selection (usually assumed to be length-based) and availability that may potentially differ by age or length. An age-based mechanism for differing availability cannot be ruled out, although implementation of age- and length-based selection is more complex and requires justification if preferred over simple length-only selection. Justification here was that length selection alone does not allow the large change in available older females apparent in the OR data. Age-based selection was not required for the WA or CA models accepted by the July STAR Panel.

A ramp in female M was also implemented as had been done for Black rockfish assessments in previous years. The alternative model therefore implements both the hide and kill hypotheses for older females, allowing the model to balance the two. An M ramp was not required for the WA or CA models accepted by the July STAR Panel.

The question of whether it is appropriate at all to allow sex ratios other than 1:1 in an assessed population at ages less than maturity was seen as a broad one that could not be resolved at this meeting. This has implications for many stock assessments, and is an item recommended for future research.

The set of jitter runs for the alternative model indicated four different sets of solutions all producing a nearly equivalent goodness-of-fit to the overall data. Only small differences in model results were shown between the alternative model and the alternative solutions from the jitters.

A retrospective analysis for the alternative model did not indicate any systematic bias in the model results, in contrast to the draft base model.

The alternative base model differed from the structural assumptions of the draft base model in the following respects:

- Natural mortality for young females and males to age 10 freely estimated at 0.37, ramping to 0.5 at age 15, male M constant for all ages at the young female estimate of 0.37.
- Includes age-based dome selection for the trawl, dead, ocean recreational, and shore recreational fleets.
- Conditional age-at-length data reweighted from input sample numbers using the harmonic mean method.
- Inclusion of mean weight data.
- Recruitment deviations estimated from 1977.
- Some relatively minor differences in aspects of the input data (expanded below).

2.3 Development of an agreed base model

Neither of the initial models presented to the meeting were seen as acceptable by the group, with key issues being the arbitrary setting of 50% selection on the descending limb of the ocean recreational selectivity for the draft base, and the implausibly high M estimates of the alternative model. The work of the meeting was to attempt to decide the most appropriate model structural assumptions and input data to arrive at a single agreed base model for Oregon that both of the developers of the two alternative models would find acceptable.

Input data

In developing the alternative model, the STAT had taken time to remove some small composition samples that were obviously unrepresentative, to adjust input sample sizes to account for double-counting of trips for ORBS lengths, to use number of trips as input sample sizes for ORBS lengths, to include available mean weight data, and to not remove length samples for the overlap period for ORBS and MRFSS length compositions. Small fish lengths were not included, because they were not randomly sampled, and were only collected to inform growth. The meeting agreed with this approach, and recommended that the input data as prepared for the alternative model should be used in the development of an agreed base model.

Natural mortality

The meeting agreed that an overall M for OR was best fixed at 0.17 for females given: (a) estimated M for females in WA of 0.16 and CA of 0.18, (b) the maximum age of old fish observed for the males (and a small number of females) in OR, and (c) that both available models freely estimate implausibly high values that are biologically inconsistent with observed maximum age. The draft base model estimates male M as an offset to female M with no ramp/step in female M, while the alternative model used a single M for young males and females and a ramp in female M. The meeting agreed that there is little biological reason to suggest that the M for younger ages should be different for males and females, and that M should be the same value for young females and all ages for males.

To reduce the number of older females, the simplest formulation that avoids additional complexity of a ramp slope is a step function. To objectively determine the female age at which the step should occur, the alternative model was used to produce a likelihood profile by age for the step year, using a fixed base M of 0.17, and an estimated female step M bounded to a maximum of 0.25. This likelihood profile showed a minimum at age 9, and all ages above 9 estimating an M at the bound of 0.25. It was agreed that the most appropriate age for a step in M was age 10. There was some hesitation from the draft base model STAT in allowing a step function in female M to high values such as 0.25, as that model already allowed for the disappearance of older females via selectivity. Others also considered that an M of 0.25 at any age for Black rockfish borders on the implausible. A procedure was devised to ensure consistency of a ramped M for females in OR with M values obtained in the WA and CA assessments. The value stepped to at age 10 of 0.2 was determined as the value that led to the same sex ratio at age 20, as for the sex-specific M values estimated in the WA assessment.

Allowing for a step in M for females to 0.2 at age 10 was acceptable to the STAT for both models.

Selectivity

Length-based selectivity alone does not appear to provide sufficient freedom for the model to specifically hide old females to the extent apparently required by the available input composition data for OR. The meeting agreed that the approach taken for the alternative model that used age-based dome selectivity provided this flexibility, and should be adopted for the most influential ocean recreational fishery. This also avoids arbitrary fixing of the semi-dome length selectivity in the draft base model. This was acceptable to the STAT for both models.

Conditional age-at-length data weighting

There was general agreement that some form of reweighting procedure should be applied to available conditional age-at-length data, while recognizing that standard procedures are a current area of research, and that a bias problem exists in the current code for sample sizes less than one. There was insufficient time during the meeting to investigate the extent of possible bias, but the harmonic mean method as implemented for the alternative model was agreed as the procedure to be used for the agreed base model.

Recruitment deviations

Model exploration during the meeting showed that most models showed a series of below average recruitment levels prior to the period where most composition data occurred (for the draft base that started recruitment deviations in 1960), followed by a period of above average recruitments in the 1990s, and then a period of generally below-average recruitments. Given that the composition data generally do not show any strong signals, the models have much freedom to alter periods of recruitment to better fit catch trends and possibly abundance indices. It was difficult to see any evidence of a very high recruitment residual outlier in 1982 for the alternative model in any of the composition data. Recruitment residuals are intended to be informed by compositions and not simply trends in catch or indices. Likelihood differences between models with and without recruitment deviations was mostly explained by a change for mean weight compositions when those were included. Models all showed a recent decline in spawning output. Recent below-average recruitment levels contributed to the inability of the model to not follow recent increases shown by several indices. The draft base model exhibited a strong retrospective pattern that was removed by turning off recruitment deviations. Turning off recruitment deviations for the draft base model also removed the behavior of a consistent recent decline in spawning output.

For the agreed base model (after request #22) with recruitment deviations turned on, the spawning output showed some strong dynamics, dipping below the target and back up again that seemed implausible given the biology of this species and the lack of indication of this in abundance indices. The likelihood component most improved by turning recruitment deviations on was mean weights, followed by the tag index. Age composition is the component that one would hope may be heavily influenced, but it was not. The estimated female Linf parameter was lowered significantly away from the more plausible value produced when recruitment deviations were turned off. After consideration of these sensitivities, and the earlier observation

that the draft base model recruitment trends were not being driven primarily by age and length composition data, the meeting agreed that recruitment deviations should be turned off. The meeting also agreed that with recruitment deviations turned off, that composition data are still highly informative with regard to growth and selectivity.

David Sampson did not agree to this decision for the agreed base model mainly: (1) as this causes much of the composition data information content to be ignored, and (2) the recruitment pattern exhibited by the agreed base model with recruitment deviations on were not as strongly auto-correlated, and showing decadal low and high averages as those previously seen for the draft base model.

Tag q

The OR Black rockfish habitat area combined with CPUE density estimates provides a means for scaling the absolute annual abundance indices from tagging for the Newport area to the coastwide population. The study when re-calculated using CPUE from the time period of the tagging study estimated that 12.7% of the coastwide population resided in the Newport area. An agreed base model that applied all of the above agreed changes estimates (given the updated prior) tag q at values near 50%. The meeting considered that if the calculated q value of 12.7% has made valid assumptions, and the interpretation of the tag q in the assessment (that uses dome selectivity for the ocean recreational fishery and sex-specific M values) is near correct, then the 50% value must be seen as implausible. The highest defensible value for tag q that was generally acceptable by the meeting was 25%. On this basis, a fixed value of 25% for tag q was recommended by the meeting for the agreed base model, with uncertainty in that value bounded by 12.7%, and the value freely estimated by the agreed base model.

Agreed base model

When all agreed changes were made to both the draft base model and the alternative model, both produced very similar results in terms of overall trend, final depletion, and biomass scale. There remained some differences – primarily in the selectivity characteristics for the dead and trawl fisheries for the alternative model that had not completely implemented length-only selection for those fleets. It was agreed to use the modified draft base model as a basis for the provision of management advice – hereafter called the agreed base model.

David Sampson wished to go on record as not endorsing this constrained agreed base model as an improvement over the 2007 assessment. He was not convinced that turning off recruitment deviations was the correct procedure.

The agreed base model showed an unfished summary biomass of 12,135t and a final spawning output depletion in 2014 of 59.9%, indicating that the stock is not overfished. Using a target of SPR50%, the agreed base showed that annual fishing intensity has been below the target level throughout the entire time series, with a single year in the early 1990s at just above the target. For the past 20 years, fishing intensity has been fairly constant at 60 to 90% of the target level.

2.3 Axes of uncertainty

Bounds on tag q (fixed at 12.7% or estimated) provide a wide range of overall biomass scale and current depletion levels that encompass other dimensions that might also be used. These bounds may be described as high and low biomass scenarios. Another key dimension of uncertainty for the assessment is the fixed value for M that could be used to provide bounds on lower and higher stock productivity. However, the meeting agreed that the single axis of uncertainty provided by alternative values for tag q was sufficient to convey to management the scale of uncertainty for this assessment.

2.4 Research recommendations

Further details on research recommendations will appear in the meeting report, but priority should be given to investigation of the most supportable procedure for implementation of the absolute abundance estimates provided by the tagging study, and gathering of supporting evidence for a considerable biomass of older females in the Black rockfish population currently unseen by the fisheries in Oregon. The development of an objective procedure for the evaluation of aberrant behavior of modeled recruitment deviations should also be considered.

Appendix 1: Bibliography of materials provided for review

Draft Stock Assessment Documents:

Draft 2015 Assessments of Black Rockfish (*Sebastes melanops*) Stocks in California, Oregon and Washington Coastal Waters (Cope et al.).

2015 An Alternative Stock Assessment for Black Rockfish in Oregon (Sampson).

Anon. 2015. Spex projections for Arrowtooth and Yelloweye.

Thorson, J.T., Jannot, J, Somers, K. 2015. Developing spatial population growth models including individual movement to monitor harvest rates for exploited fishes.

Appendix 2

Statement of Work for CIE Reviewer

External Independent Peer Review by the Center for Independent Experts

STAR Mop-Up Panel for Pacific Coast Groundfish Assessments

Scope of Work and CIE Process: The National Marine Fisheries Service's (NMFS) Office of Science and Technology coordinates and manages a contract providing external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of NMFS scientific projects. The Statement of Work (SoW) described herein was established by the NMFS Project Contact and Contracting Officer's Technical Representative (COTR), and reviewed by CIE for compliance with their policy for providing independent expertise that can provide impartial and independent peer review without conflicts of interest. CIE reviewers are selected by the CIE Steering Committee and CIE Coordination Team to conduct the independent peer review of NMFS science in compliance the predetermined Terms of Reference (ToRs) of the peer review. Each CIE reviewer is contracted to deliver an independent peer review report to be approved by the CIE Steering Committee and the report is to be formatted with content requirements as specified in **Annex 1**. This SoW describes the work tasks and deliverables of the CIE reviewer for conducting an independent peer review of the following NMFS project. Further information on the CIE process can be obtained from www.ciereviews.org.

Project Description: : The mop-up panel is designed to provide a second forum for reviewing stock assessments reviewed during earlier 2015 STAR panels and SSC groundfish subcommittee meetings but were deemed to be inadequate and/or required additional analyses and review which could not be completed during the panel meeting. This panel meeting provides the last opportunity to review and accept benchmark or updated stock assessments to inform management specifications and measures. The technical review will take place during a formal, public, multiple-day meeting of fishery stock assessment experts. Participation of an external, independent reviewer is an essential part of the review process. The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**. The tentative agenda of the panel review meeting is attached in **Annex 3**.

Requirements for CIE Reviewer: One CIE reviewer shall conduct an impartial and independent peer review in accordance with the SoW and ToRs herein. We specifically request the participation of the reviewer who attended all previous 2015 STAR. The CIE reviewer's duties shall not exceed a maximum of 14 days to complete all work tasks of the peer review described herein. The CIE reviewer shall have the expertise, background, and experience to complete an independent peer review in accordance with the SoW and ToRs herein. The CIE reviewer shall have expertise in fish population dynamics, with experience in the integrated analysis modeling approach, using age-and size-structured models, use of MCMC to develop confidence intervals, and use of Generalized Linear Models in stock assessment models.

Requirements for CIE Reviewer: One CIE reviewer is requested to participate in all 2015 STAR panel meetings to provide scientific review and ensure consistency of analytical approaches among assessments, as appropriate. The reviewer shall be an active and engaged participant throughout panel discussions and able to voice concerns, suggestions, and improvements while respectfully interacting with other review panel members, advisors, and stock assessment technical teams. The CIE reviewer shall conduct an impartial and independent peer review in accordance with the SoW and ToRs herein. The CIE reviewer 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-structured models, use of MCMC to develop confidence intervals, and use of Generalized Linear Models in stock assessment models. The CIE reviewer's duties shall not exceed a maximum of 14 days for each panel meeting review to complete all work tasks of the peer review described herein.

Location of Peer Review: The CIE reviewer shall conduct independent peer reviews during the following panel review meetings:

1) STAR Panel 1 for canary rockfish and darkblotched rockfish assessments scheduled for April 27 through May 1, 2015 in Seattle, Washington.
2) STAR Panel 2 for bocaccio and china rockfish assessments scheduled for July 6-10, 2015 in Santa Cruz, California.
3) STAR Panel 3 for black rockfish stock assessment scheduled for July 20-24, 2015 in Newport, Oregon.
4) STAR Panel 4 for widow rockfish and kelp greenling stock assessments scheduled for July 27-31, 2015 in Newport, Oregon.
5) **Mop-Up Panel for any stock assessments not accepted during initial STAR panel review. Location and dates to be determined.**

Statement of Tasks: The CIE reviewer shall complete the following tasks in accordance with the SoW 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 COTR, who forwards this information to the NMFS Project Contact no later the date specified in the Schedule of Milestones and Deliverables. The CIE is responsible for providing the SoW and ToRs to the CIE reviewers. The NMFS Project Contact is responsible for providing the CIE reviewers with the background documents, reports, foreign national security clearance, and other information concerning pertinent meeting arrangements. The NMFS Project Contact is also responsible for providing the Chair a copy of the SoW in advance of the panel review meeting. Any changes to the SoW or ToRs must be made through the COTR prior to the commencement of the peer review.

Foreign National Security Clearance: When CIE reviewers participate during a panel review meeting at a government facility, the NMFS Project Contact is responsible for obtaining the Foreign National Security Clearance approval for CIE reviewers who are non-US citizens. For this reason, the CIE reviewers shall provide requested information (e.g., first and last name, contact information, gender, birth date, passport number, country of passport, travel dates,

country of citizenship, country of current residence, and home country) to the NMFS Project Contact for the purpose of their security clearance, and this information shall be submitted at least 30 days before the peer review in accordance with the NOAA Deemed Export Technology Control Program NAO 207-12 regulations available at the Deemed Exports NAO website: http://deemedexports.noaa.gov/sponsor.html).

Pre-review Background Documents: Two weeks prior to the scheduled peer review meetings, the NMFS Project Contact will send (by electronic mail or make available at an FTP site) to the CIE reviewer 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. The CIE reviewer is responsible only for the pre-review documents that are delivered to the reviewer in accordance to the SoW scheduled deadlines specified herein. The CIE reviewer shall read all documents in preparation for the peer review.

Documents to be provided to the CIE reviewer 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 SoW and ToRs, and shall not serve in any other role unless specified herein. **Modifications to the SoW and ToRs can not be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall be approved by the COTR and CIE Lead Coordinator.** The CIE reviewer shall actively participate in a professional and respectful manner as a member of the meeting review panel, 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., conference room for panel review meetings or teleconference arrangements). The NMFS Project Contact is responsible for ensuring that the Chair understands the contractual role of the CIE reviewer as specified herein. The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements, including the meeting facility arrangements.

Contract Deliverables - Independent CIE Peer Review Reports: The CIE reviewer shall complete an independent peer review report in accordance with the SoW. The 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 may assist the Chair of the panel review meeting with contributions to the Summary Report, based on the terms of reference of the review. The CIE reviewer is not required to reach a consensus, 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.

Specific Tasks for CIE Reviewers: The following chronological list of tasks shall be completed by each CIE reviewer in a timely manner as specified in the **Schedule of Milestones and Deliverables**.

1) Conduct necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact in advance of the peer review.
2) Participate during the mop-up panel review meeting as scheduled from 28 September – 2 October 2015 as specified herein, and conducts an independent peer review in accordance with the ToRs (**Annex 2**).
3) No later than two weeks after each panel review meeting, the CIE reviewer shall submit an independent peer review report addressed to the "Center for Independent Experts," and sent to Dr. Manoj Shivlani, CIE Lead Coordinator, via email to mshivlani@ntvifederal.com, and to Dr. David Die, CIE Regional Coordinator, via email to ddie@rsmas.miami.edu.
4) Each CIE report shall be written using the format and content requirements specified in Annex 1, and address each ToR in **Annex 2**.

14 September 2015	NMFS Project Contact sends the CIE Reviewer the pre-review documents
28 September – 2 October 2015	The CIE reviewer participates and conducts an independent peer review during the panel review meeting
16 October 2015	The CIE reviewer submit draft CIE independent peer review report to the CIE Lead Coordinator and CIE Regional Coordinator
30 October 2015	CIE submits CIE independent peer review report to the COR
6 November 2015	The COR distributes the final CIE report to the NMFS Project Contact and regional Center Director

Modifications to the Statement of Work: Requests to modify this SoW must be approved by the Contracting Officer at least 15 working days prior to making any permanent substitutions. The Contracting Officer will notify the COR within 10 working days after receipt of all required information of the decision on substitutions. The COR can approve changes to the milestone dates, list of pre-review documents, and ToRs within the SoW as long as the role and ability of the CIE reviewers to complete the deliverable in accordance with the SoW is not adversely impacted. The SoW and ToRs shall not be changed once the peer review has begun.

Acceptance of Deliverables: Upon review and acceptance of the CIE independent peer review reports by the CIE Lead Coordinator, Regional Coordinator, and Steering Committee, these reports shall be sent to the COR for final approval as contract deliverables based on compliance with the SoW and ToRs. As specified in the Schedule of Milestones and Deliverables, the CIE

shall send via e-mail the contract deliverables (CIE independent peer review reports) to the COR (Allen Shimada, via Allen.Shimada@noaa.gov).

Applicable Performance Standards: The contract is successfully completed when the COTR provides final approval of the contract deliverables. The acceptance of the contract deliverables shall be based on three performance standards:
(1) The CIE report shall completed with the format and content in accordance with **Annex 1**,
(2) The CIE report shall address each ToR as specified in **Annex 2**,
(3) The CIE report shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

Distribution of Approved Deliverables: Upon acceptance by the COTR, the CIE Lead Coordinator shall send via e-mail the final CIE reports in *.PDF format to the COTR. The COTR will distribute the CIE reports to the NMFS Project Contact and Center Director.

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 Statement of Work
   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) Panels

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) 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.
8. Communicate analytical approaches and findings of STAR panels held earlier in the process to subsequent STAR panel reviews to promote consistency of analytical approaches among assessments, as appropriate.

Annex 3: Tentative Agenda

Note: Final Agendas will be provided to all panel participants two weeks prior to the meeting along with draft assessments and background materials.

Appendix 3

Proposed Agenda
Scientific and Statistical Committee's Groundfish Subcommittee
Mop-up Stock Assessment Review Panel Meeting

National Marine Fisheries Service
Western Regional Center's Sand Point Facility
Alaska Fisheries Science Center
Building 4, Traynor Room 2076, September 28 – October 1
Building 4, Observer Training Room 1055, October 2
7600 Sand Point Way NE
Seattle, WA 98115

September 28 – October 2, 2015

A meeting of the Pacific Fishery Management Council's Scientific and Statistical Committee (SSC) Groundfish Subcommittee will be held to review an assessment of black rockfish off Oregon, a new rebuilding analysis for yelloweye rockfish, new projections of overfishing limits for arrowtooth flounder, a new methodology for estimating overfishing limits for big skate, and other miscellaneous tasks. This meeting is a work session which is open to the public.

Monday, September 28

8:30 a.m.	Welcome and introductions	John Field
9 a.m.	Review the draft agenda and discuss meeting format - Assign reporting duties - Agree on time and method for accepting public comments	
9:15 a.m.	Presentation of the black rockfish assessment, including recommended models for Washington and California, and a comporting model for Oregon	Jason Cope
12 p.m.	Lunch	
1 p.m.	Q&A session with black rockfish stock assessment team (STAT) - Panel develops written request for additional model runs/analyses	
2 p.m.	Presentation of the alternate black rockfish assessment or of additional selectivity analysis to the Oregon model	Dave Sampson
4:30 p.m.	Q&A session with the alternate black rockfish STAT - Panel develops written request for additional model runs/analyses	
5:30 p.m.	Adjourn for the day.	

Tuesday, September 29

8:30 a.m.	Review of the arrowtooth flounder projections	John Wallace
9:30 a.m.	Review an updated yelloweye rockfish rebuilding analysis	John Wallace
10:30 a.m.	Review new methodology for determining a big skate OFL	Jim Thorson
12 p.m.	Lunch	
1 p.m.	Presentation of the first set of requested model runs by the black rockfish STAT - Panel develops written request for additional model runs/analyses	
3 p.m.	Presentation of the first set of model runs by the alternate black rockfish STAT - Panel develops request for second round of model runs/analyses for the alternate black rockfish STAT	
5:30 p.m.	Adjourn for the day.	

Wednesday, September 30

8:30 a.m. Presentation of the second set of model runs by the black rockfish STAT

- Panel develops request for any additional model runs/analyses for the black rockfish STAT

10 a.m. Presentation of the second set of model runs by the alternate black rockfish STAT

- Panel develops request for any additional model runs/analyses for the alternate black rockfish STAT

12 p.m. Lunch

1 p.m. Panel discusses the structure of the report and other meeting details

5:30 p.m. Adjourn for day.

Thursday, October 1

8:30 a.m. Presentation of any additional analyses from Oregon models

12 p.m. Lunch

1 p.m. Agreement of the preferred model and model runs for the decision table

4 p.m. Panel discussion or drafting of the review panel report

5:30 p.m. Adjourn for the day.

Friday, October 2

8:30 a.m. Consideration of remaining issues, if needed

5:30 p.m. Review panel adjourns

Appendix 4: List of participants

Reviewers Present:
Dr. John Field, NMFS Southwest Fisheries Science Center, SSC, Chair
Dr. Andy Cooper, Simon Fraser University, SSC
Dr. Martin Dorn, NMFS Alaska Fisheries Science Center, SSC
Dr. Theresa Tsou, Washington Department of Fish and Wildlife, SSC
Mr. John Budrick, California Department of Fish and Wildlife, SSC
Dr. Neil Klaer, Center of Independent Experts
Dr. Owen Hamel, NMFS Northwest Fisheries Science Center, SSC

STAT Present:
Dr. Jason Cope, NMFS Northwest Fisheries Science Center
Dr. Andi Stephens, NMFS Northwest Fisheries Science Center
Dr. David Sampson, Oregon State University, SSC

Advisors Present:
Ms. Lynn Mattes, Oregon Department of Fish and Wildlife, GMT
Mr. Gerry Richter, Pt. Conception Groundfishermen's Association, GAP
Mr. John DeVore, Pacific Fishery Management Council