Report on

STAR Panel 3

Black Rockfish Stock Assessment

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P.L. Cordue

Fisheries consultant

New Zealand

***For* CIE Independent System for Peer Review**

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Executive summary

During 20-24 July 2015, the third Stock Assessment Review (STAR) Panel met in Newport, Oregon, to review three draft black rockfish stock assessments. Black rockfish is an important recreational target species. There was an assessment for each of the west coast states: Washington, Oregon, and California. All assessments were performed using Stock Synthesis 3 (SS3). I was a member of the STAR Panel which consisted of two CIE reviewers, a US member, and an SSC representative as the Chair.

There were four main sources of data available to the assessment models. The catch history, commercial and recreational catch sampling (length and age), tag recapture data (and/or associated CPUE and composition data), and catch and effort data from commercial and recreational fisheries used to calculate CPUE indices. No fishery independent indices were available.

In the draft SAFE, supplied to the Panel, the population models were very similar for each stock being single-area, two-sex, age structured models (with length structure generated as required). Multiple fisheries were modelled, generally a trawl fishery, a recreational fishery, and two non-trawl fisheries (live-fish in addition to dead-fish). Generally, logistic length-based selectivities were used (except for live-fish fisheries). However, for some (dead-fish) fisheries an additional dome-shaped age-selection was specified because of the relative absence of old females in the data. In previous assessments, only length-based logistic selection had been used and the absence of old females was explained by ramping up the female natural mortality rate.

The draft base models used fixed estimates of natural mortality (M) which were derived outside the model from estimates of maximum age and growth parameters. These estimates were low (0.07–0.10) compared to estimates of M used in previous assessments (0.16 for males and young females ramping up to 0.24 for old females). The shift in natural mortality was because the new draft assessments had explained the relative absence of old females by "hiding them" using a domed-shaped selectivity. The previous assessments had explained their absence by "killing them".

The meeting focused on the Washington and California assessments, because the Oregon assessment was not ready to be reviewed. They had had problems getting their model to run and did not have a draft base model and sensitivities ready for review (despite what was printed in the draft SAFE). The Panel did help find two serious errors in the Oregon control file which were corrected by the end of the meeting. The Oregon assessment should now be able to be made ready for the "mop up" meeting in September.

The draft stock assessments for Washington and California used domed-shaped selection and did not estimate M within the model. The Panel requested that the proportion of "cryptic" spawning output be calculated for the base models. It was demonstrated that the proportion of spawning output from cryptic females (those unavailable to the fisheries) was 60–90% of the total spawning output. The STAT agreed to adopt new base models which used length-based logistic selection (except for the live-fish fisheries) and "killed off" the older females through sex-specific M which was estimated within the models (there was no need for a ramp on female M). I believe that the assessments based on these models represent the best scientific information available.

Background

During 20-24 July 2015, the third Stock Assessment Review (STAR) Panel met in Newport, Oregon, to review three draft black rockfish stock assessments. Black rockfish is an important recreational target species. There was an assessment for each of the west coast states: Washington, Oregon, and California. All assessments were performed using Stock Synthesis 3 (SS3).

I was one of two CIE reviewers appointed to the STAR Panel. The meeting was chaired by an SSC representative and a US reviewer was also on the Panel (*see* Appendix 3 for a list of participants). This report presents my review findings and recommendations in accordance with the Terms of Reference for the review (Appendix 2, annex 2). My views are consistent with those expressed in the STAR Panel report, which contains the agreed findings and recommendations of the Panel.

Review Activities

Pre-meeting

Meeting documents and materials were made available in electronic form in advance of the meeting (*see* Appendix 1). I familiarized myself with the background material and read the main assessment document (draft SAFE) in detail prior to the meeting. I also examined the SS3 input and report files for Washington (WA) and California (CA). I found some differences between values reported in the main assessment document and those given in the input or report files. For Oregon (OR), I attempted to examine the input and report files, but there was only an Excel spreadsheet that contained input information. I couldn't find a report file although lots of plots were available. I noted in the draft SAFE that the supposed 1 – SPR values in a table were spurious. They were all close to zero and looked like they might be the ratio of estimated 1 – SPR to the target 1 – SPR. However, the values did not correspond to those used in the plots. The 1 – SPR issue was raised informally with the WA-CA STAT near the start of the meeting.

Meeting

The meeting began on schedule but did not really follow the agenda after about the first morning (Appendix 2, annex 3). This was not the fault of the Chair or anyone else; it simply reflected the way that the meeting unfolded.

On the first day, there were presentations from the WA-CA STAT (the same modeler was dealing with both stocks). The data sources were described with a brief description of analysis methods. Full catch reconstructions had been done, but only to the level of "best guess" without any measures of uncertainty. It was noted that the trawl catch landed in Astoria (OR), near the state boarder, was assigned to the Washington stock (for good reason). The biomass indices used in the assessments were briefly described. CPUE diagnostics were minimal and inadequate (as has been the case since at least 2003). The

STAT spent most time on the important issue of how they had explained the relative lack of old females in the data.

There are two main mechanisms for matching up the model's predicted estimates of females at age with the observation of females disproportionately disappearing from the data at older ages. The first option is to ensure that the model "kills 'em". In previous assessments (Sampson 2007, Wallace et al. 2008) an "M ramp" had been used for females, with the value of M ramping up from age 10 at 0.16 to a value of 0.24 for older females. The alternative option is to use domed selection at age to "hide 'em". The STAT spent much time explaining why the previously estimated values of M were too high (compared to other rockfish estimates and inconsistent with maximum ages seen for black rockfish) and that the hide 'em option was much better than the kill 'em option. A first set of data requests were drafted for the WA-CA STAT at the end of the day. We had not yet got to the modelling as such although there had been a preview of results.

The OR STAT indicated that there had been numerous changes to the "base model" in the draft SAFE. He also indicated that he still had major problems with the model and was getting all sorts of unexpected software errors.

On the Tuesday morning, the responses from the WA-CA STAT were presented. The STAT had responded to all requests and had done an excellent job. We then moved on to the WA-CA modelling. Various issues were raised on model structure and a new set of requests were drafted aiming at developing reference models to investigate model structure and the hide 'em and kill 'em hypotheses. Presentations then began for Oregon, starting with the data.

Available data types were similar for Oregon except that there was an excellent tagging data set for the area off Newport. The composition data were notable because it was eventually revealed that although the Astoria trawl catch had been given to Washington the associated composition data had been retained in Oregon (by mistake).

It was on Wednesday afternoon that the Oregon modelling was first presented although there had been plenty of warnings from the OR STAT about various issues. The OR STAT went over the software errors that were occurring. There were two types: the introduction of NAs (and such) into the results, and the occurrence of indexing errors (where the software is trying to access an array outside of the bounds of the array). The former error can happen from time to time because the minimizer goes into "bad space". However, the latter error is a software bug. It simply should not happen but it was attributed to non-printing characters in the SS input files, or some faulty formatting (given that SS3 is so sensitive to the format of the input files). In any case, the STAT was only getting about 1 in 4 runs to finish successfully. We looked at some results but they didn't make much sense.

It was on Thursday that we discovered that a value of 1 had inadvertently been added to the standard deviation of each index. Therefore, the model was ignoring all of the indices and being driven only by composition data. When this error was corrected, the results still

didn't make any sense. We eventually got a reference run completed, but the results were still very odd. It turned out that the prior on the tag q had been mis-specified. The STAT had specified the prior on q when the variable being estimated was actually log(q). It was agreed by all that the Oregon assessment would have to go to the mop-up meeting.

For WA-CA, the meeting had progressed satisfactorily with a new base model agreed and a dimension of uncertainty sorted out for the decision table by Thursday. Friday morning was used by the Panel to continue work on the STAR Panel report (which we had been working on individually during the evenings). A rough draft report was considered by the meeting over lunch, and the meeting concluded in the early afternoon.

Post-meeting

During Friday afternoon and evening, I continued work on my assigned sections of the STAR Panel report before flying home on Saturday. The Panel completed the draft report by email and I contributed as required.

I was copied into a number of emails that were initiated by complaints from the OR STAT that the Panel had not spent enough time on the Oregon assessment and that was the reason that it was going to the "mop-up" meeting. I refrained from getting involved with the dispute apart from giving my support to the Chair, who I thought had done a good job in difficult circumstances.

Summary of findings

Each of the Terms of Reference are considered 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) prior to review panel meeting.*

The background material and draft assessments were provided in a timely manner. The SS3 input files and report files were provided for Washington and California, but were incomplete for Oregon (with no report file). The draft SAFE was misleading for the Oregon assessment as there was no indication in the document that the presented assessment was very preliminary. It turned out that the OR-STAT had no intention that the documented model would be presented to the meeting, let alone be put forward as a base model. For Washington and California, the documented models were the STAT's base models and they came with a comprehensive range of sensitivity runs. For Oregon, the runs were irrelevant but the reviewers were not privy to this information. For OR, the draft SAFE was only useful from a data point of view.

I was already familiar with the previous STAR Panel reports from 2007, as I had been a reviewer for the black rockfish assessments in that round of STAR Panels.

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

There were four main sources of data available to the assessment models. The catch history, commercial and recreational catch sampling data (length and age), tag data, and catch and effort data analysed to produce CPUE indices.

Details of the historical catch reconstructions were familiar to most meeting participants. Every time that a rockfish stock is assessed it appears that each STAT undertakes another full catch reconstruction. This is good because it appears that every new reconstruction arrives at a different answer. It is also very bad as it is a huge waste of resources. The historical rockfish catch histories should have been sorted more than a decade ago. Certainly, recommendations to "do it once and do it right" pre-date my first involvement in STAR Panels in 2003. The latest reconstructions did not contain any estimates of uncertainty. All that was offered was the STAT's "best guess".

The basic problem is well understood. There is a large historical trawl catch (especially during World War II) of unidentified rockfish and the historical proportions are poorly known being estimated from species mix data collected no earlier than the 1960s. This is a tractable statistical problem: data can be analysed, species proportions estimated; combined with assumptions with regard to trends in proportions, to produce best guesses and alternative catch histories to be used in sensitivity analyses. This should be done at a fine enough scale so that if there are changes in stock boundaries it is still a simple matter to compute the different catch streams.

The production of composition data appears to have made no progress over the last 12 years despite numerous recommendations. The approach continues to be that the quality of the data is largely irrelevant, and that quantity will somehow triumph over less than ideal sampling design and almost complete ignorance of the factors driving variability in length, age, and conditional age-at-length. Detailed data preparation is required, not only in the production of biomass indices, but also for the composition data. Until this is done, there is always a concern that stock assessment results are being affected by poorly stratified and scaled data. A stock assessment is like the construction of a house. If you want the house to stay up after it is built, then there must be careful preparation of the foundations. The data are the foundations of a stock assessment. It doesn't matter how fancy the modelling is, if the data are rubbish, then so is the assessment.

The diagnostics presented for CPUE indices have also been the subject of reviewer comment for many years. The examination of trends by sub-area is a crucial component of CPUE analysis. For Washington and Oregon there are natural sub-areas in the analysis, yet only one of many CPUE analyses produced and presented the trends by area. Indeed, for the OR commercial logbook analysis the meeting was told that there wasn't really enough data to do a northern index. It turned out that a vessel filter had been applied to the data requiring that the final vessels had to have fished in each of the ten years of the index. This reduced the analysed dataset to just 18% of the catch. When a more appropriate filter was applied (vessels active for at least three years), then 90% of the catch was retained and there were plenty of data to produce a northern index. Furthermore, the northern index was very different from the southern index which

indicated that the relative weighting of the two trends was important in determining the overall average trend.

Tag data were available for WA and OR. The Washington data had been analysed in detail and it was determined that there were too many violations of assumptions for it to be used to estimate abundance. Instead, associated data collected as part of the tagging program were used to produce a CPUE index. The tagging program in Oregon appears to have been well designed and executed. It provides an abundance time series for the black rockfish population exploited by the recreational fishery off Newport. Calculations involving the available statewide habitat suggest that the proportionality constant for the time series is about 10%.

3. Evaluate model assumptions, estimates, and major sources of uncertainty.

The preliminary base models brought to the meeting by the STAT are discussed first. Then the final models for WA and CA are considered. The wording for this section and the next are very much that found in the STAR Panel report, because I drafted the relevant sections.

STAT preliminary base models

The stock assessments were done using SS3 (ver. 3.24v) to produce estimates from the mode of the joint posterior distribution (MPD estimates). Full Bayesian estimation, where the estimates are taken from the median of marginal posterior distributions, was not performed. The use of only MPD estimates is standard practice in west coast assessments. In New Zealand it is almost always considered unacceptable to produce only MPD estimates.

The availability and treatment of the input data was similar across all three stocks. Only fishery dependent biomass indices were available and these were fitted assuming lognormal observation error. Length compositions were fitted assuming multinomial distributions and age data were almost exclusively used as conditional age-at-length (allowing the estimation of growth within the models).

The population models were very similar across all three stocks. The models were single-area, single-growth morph, and two-sex, with a maximum age of 40 years (with a plus group). Multiple fisheries were modelled for each stock, generally a trawl fishery, a recreational fishery, and two non-trawl fisheries (live-fish and dead). Generally, logistic length-based selectivities were used (except for live-fish fisheries). However, for some fisheries an additional dome-shaped age-selection was specified because of the relative absence of old females in the data. In previous assessments only length-based logistic selection had been used and the absence of old females was explained by ramping up the female natural mortality rate (Sampson 2007, Wallace et al. 2008).

The previous assessments used a "kill 'em" model to explain the absence of old females. The alternative is to "hide 'em" by using age-based domed selection in the fisheries where the old females were missing. Domed-shaped age selection, for females in particular, may be problematic in that a proportion of the old female spawning biomass is protected from exploitation. That is, domed-shape selection can lead to a substantial

"cryptic biomass" (it exists but is never seen). The kill 'em alternative is normally preferred unless there is strong ancillary evidence that a cryptic biomass could exist.

The preliminary base models provided to the STAR Panel all had fixed values of natural mortality (*M*) which were derived externally from estimates of maximum age and growth parameters (using methods in Hamel 2015, Then et al. 2015). The fixed values of *M* ranged from 0.07–0.10 with male values being slightly higher than those for females. In the 2007 assessments, *M* had been estimated at 0.16 for males (of all ages) and "young" females with a ramp going up to 0.24 for "old" females (Sampson 2007, Wallace et al. 2008). The contrasting *M*s between the assessments are due to the shift from kill 'em to hide 'em. The low *M*s are inconsistent with the age data unless domed selection is invoked. The STAT were concerned that the use of domed selection would prevent the estimation of *M* within the models (because of the confounding of the domed selection and the right-hand-limb of age frequencies). The Panel and WA-CA STAT considered it to be preferable to estimate *M* within the models as there appeared to be adequate age data available (definitely for Washington and Oregon) and logistic selection for the males prevented a confounding with the domed selection for females.

The models all assumed a Beverton-Holt stock recruitment relationship with a fixed steepness (*h*) of 0.773 (the median of the latest rockfish prior; Thorson, pers. comm.). Attempts to estimate *h* within the models had, as expected, been unsuccessful with *h* hitting the bound at 1.

The female maturity at length in the models was set equal to an estimate of "functional" maturity rather than the more usual "sexual" maturity. The distinction is important for small fish which, early in the season, appear to be able to spawn but do not do so. Functional maturity removes these small fish and gives a better representation of the effective maturity curve. However, during the meeting there was concern that L_{50} was too high (compared to L_{inf}). It was decided to re-estimate the maturity curve after excluding large females (> 45cm) that were deemed to be "immature". These fish were considered to be mature but not spawning in the year they were sampled.

Recruitment deviations were estimated for all models but the earliest cohorts for which deviations were estimated were not observed in the composition data. The purpose of this approach was to allow the uncertainty in the early cohorts to "flow through" into assessment outputs. However, the Panel suggested that a deviation should only be estimated when there was evidence that the data contained information on the cohort. This avoids the situation where the MPD estimates of the early cohorts were all less than 1 because of the assumed lognormal prior. It was suggested that the variance plot, produced to determine the bias corrections, should also be used to decide which deviations should be estimated.

The base models had been tuned to balance the relative weights of the different data sets and also to determine a final value for sigma-R (the log standard deviation for the lognormal prior on recruitment deviations). Panel members were concerned that for California, in particular, the resulting sigma-R (at 0.25) was far too low and was unnecessarily restricting the ability of the model to fit the data. It was suggested that anything below 0.5 was unlikely to be appropriate.

Effective sample sizes for conditional age-at-length data were not tuned for any of the stocks. For Washington, extra variance was added to the CPUE indices and length frequencies were tuned using Francis (2011). A similar approach was tried for California but the addition of variance to the biomass indices resulted in them being given increasing high CVs (so high that they were essentially without information). Therefore, in the California base model, the only variance tuning was for the length frequencies. For the Oregon model, extra variance was added to indices (unintentionally as it happened), length frequencies were tuned using the harmonic mean, and conditional age at length were not tuned.

Standardized procedures for relative weighting within and across different data sources (particularly length and age composition, age at length composition and abundance indices) are currently an area of active research. The approach used in the assessments was consistent with currently accepted methods. There is yet to be full consensus on how to weight data sets and there are particular problems with down-weighting conditional age-at-length data. Because the data are spread across many cells, down-weighting may result in sample sizes within cells that are less than 1. In SS3 this creates a particular problem because all scaled sample sizes less than 1 will be set equal to 1 (thus the proportional numbers at age for given length can become severely distorted).

The Panel requested that reference models be produced for each of the three stocks which included cumulative changes to the base models:

- Use the functional maturity estimate from the modified dataset
- Set sigma-R to 0.5 and do not tune it
- Use the variance plot to determine which recruitment deviations to estimate
- Estimate *M* for females with a small fixed positive offset for males (consistent with the sex difference for the external estimates of *M*); with the domed age selection for females.

A sensitivity run for each of the reference models, excluding domed-selection and using a ramp for female *M* was also requested. For this run, in California and Washington, the *M* for higher ages was estimated to be lower than the *M* for younger ages. This suggested that a ramp was not needed and a new run was requested, excluding domed selection and simply estimating separate *M*s (constant at age) for males and females.

Other sensitivity runs were also requested by the Panel and also initiated by the STAT. The final outcome of the explorations was a joint decision by the Panel and the WA-CA STAT to move to new base models. A base model was not achieved for the Oregon assessment due to the errors in the SS3 input files.

Final WA and CA base models

The main differences between the Washington and California base models brought to the STAR Panel and the final base models were:

- The exclusion of domed-shaped selection except for the live-fish fishery

- The estimation of sex-specific *M* within the model
- Only estimating recruitment deviations for which the model appeared to contain information.
- A fixed value of sigma-R = 0.5 with no tuning of sigma-R.

A summary of the technical merits and deficiencies of both models is given below:

Technical merits of the assessments

The main merits of the Washington and California assessments are:

- The use of SS3 which is a well-tested package that allows the integration of multiple data sources in a well-understood estimation procedure
- Multiple sources of indices and composition data are used
- There are substantial age data in the Washington assessment which supports the estimation of *M* within the model
- The use of "functional maturity" rather than "sexual maturity" was used to determine spawning output
- The relative absence of older females was explored through two alternative hypotheses (hide 'em or kill 'em). This was an improvement on past assessments that had automatically used a kill 'em model (with the unrealistic and over-parameterized ramp on female *M*).

Technical deficiencies of the assessments

The following deficiencies apply to all three stock assessments:

- No alternative catch histories were supplied despite large uncertainty in historical catches.
- The lack of careful data preparation is of concern. It is noted that standard west coast practice was adopted in this regard. However, best practice requires a careful analysis of available composition data, including conditional age-at-length data, to determine whether post-stratification and scaling are required. The objective is to use all available composition data that can be formed into consistent time series. This may require that some data are excluded from a time series when sampling was inadequate (e.g., spatially and/or temporally).
- No fishery-independent biomass indices were available.
- With only one exception, the diagnostics supplied for CPUE indices were inadequate.
- The SS3 input files are unnecessarily complicated and errors in input files, which affect the assessment results, may go undetected.
- The base models brought to the STAR Panel were modified during the meeting. This substantially reduced the time available to explore sensitivities to the new base models.

The California assessment is marginal in the amount of age data that is supporting the estimation of *M* (it may be better to borrow an *M* estimate from one of the other stocks given they have vastly more age data).

Several problems were detected for the draft Oregon assessment during the meeting:

- A value of 1 was inadvertently added to the standard deviation of each of the biomass indices (due to an error in the control file).
- The composition data from the trawl catches landed in Astoria were used (the catches had been transferred to Washington but not the composition data).
- The informed prior on the tag q was incorrectly specified (the bounds and lognormal prior were appropriate for q but wrong given that log(q) was the parameter being estimated).

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

The bullet points below apply to the Washington and California assessments. Clearly there are unresolved problems for the Oregon assessment, but hopefully that assessment can benefit from borrowing some of the model structure that worked successfully for Washington and California.

The unresolved problems are:

- It is not known with certainty that the SS3 input files are completely correct given the specification that the STAT were trying to achieve (this is because of the complexity of the input file format)
- The input data have had minimal preparation. The CPUE indices may contain spatial trends which require re-weighting using habitat based weights. The composition data may require post stratification and scaling, and the removal of data in years when sampling was inadequate.

The first problem can be tackled in a number of ways. The most efficient method is probably to write an "expert-system" checker for SS3 input files. It would make sure that the format was correct and would flag any potential errors (e.g., a row of "1"s being added to the standard deviations of the indices).

The second problem can be dealt with by adopting best practice in terms of data preparation (that is, in the preparation of CPUE indices and diagnostics, including alternative indices derived from alternative weightings if there are different trends in different areas; together with an analysis of composition data to determine appropriate post-stratification and scaling).

The major uncertainties are:

- The level of cryptic biomass is unknown. The base model, using the kill 'em hypothesis, has assumed that there is none but this is unlikely to be true. It is unlikely that the alternative hide 'em model represents reality either. The truth is likely to be some level of domed selection and some level of increased female M.

- Historical catch history is very uncertain. Sensitivity to this was explored only for plus/minus 50% on the trawl catches. The results were not sensitive in that case, but results could be sensitive to different trends in the historical catch.
- Natural mortality may be poorly determined, especially for California.
- The stock recruitment relationship is unknown.

These uncertainties can be further explored through additional sensitivity analysis.

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

In my opinion, the final base models for Washington and California represent the best scientific information available on which to base management advice. The base models should be taken through to full MCMCs to check that the MPD estimates are not too different from the medians of the marginal posteriors.

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.*

Short-term recommendations:

CPUE:

- Better diagnostics for each CPUE analysis: plots of the binomial and positive catch rate year effects in addition to the combined year effects; plots of all estimated effects; production of year:area interactions and a comparison of the trends by area. In cases where the trend in CPUE index differs across areas, the aggregate CPUE index is affected by the method used to weight the CPUE from the areas. Evaluation of the effect of alternative weighting methods on the aggregate standardized CPUE index should be evaluated in these cases.
- The effects of the standardization on the "nominal" or unstandardized indices should also be shown and explained (i.e., which variables have caused a shift in the trend).

Composition data:

- Length, age, and conditional age-at-length data should be analysed to determine the drivers of variability. When these factors are determined, then the data can be appropriately post-stratified and scaled. Until this is done, there is always a concern that unrepresentative data are impacting on stock assessment results.

SS3:

- The addition of extra standard deviation for biomass indices should be correctly implemented. Standard deviations do not add arithmetically. To apply a constant process error to a time series of biomass indices requires that the variances be added (i.e., square the standard deviations, add them together, and take the square root).
- The SS3 input interface needs to be substantially improved. Many of the problems could be solved by creating an "expert system" front end which creates the input files exactly how SS3 needs them (i.e., no erroneous white space or unprintable characters) transforms parameters from arithmetic space as needed, and checks for obvious user errors (e.g., a row of 1s being added to the standard deviations).

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- The plots showing the fits to the indices should also include useful information such as the estimated *q* and whether extra variance was added to the input variance (users look at the plots but they may not look at the report file).

Long-term recommendations:

- Continued research on appropriate stock boundaries.
- The creation of a fishery independent biomass/abundance time series for nearshore reef species including black rockfish.

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

This was covered under "Review Activities" above.

Critique of the NMFS review process

The STAR process used for the black rockfish review was very similar to other STAR meetings that I have participated in as a CIE reviewer. As is often the case, the STAT's preliminary base models were found to be technically deficient because of data issues or model assumptions. When the STAT is willing, the Panel typically spends much of the meeting constructing acceptable runs rather than reviewing the runs that were offered by the STAT. This is exactly what happened with regard to the Washington and California assessments.

However, it has been my experience that this process does lead to much improved stock assessments. Also, the critically intensive process does provide a spur for incremental improvements in analytical and stock assessment methods.

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Appendix 2: Statement of Work for Patrick Cordue

External Independent Peer Review by the Center for Independent Experts

Stock Assessment Review (STAR) Panel 3

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 National Marine Fisheries Service and the Pacific Fishery Management Council will hold four 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 OFLs, ABCs, ACLs, (HGs), and 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.

Black rockfish is an extremely important species to both the commercial and recreational fisheries and has not been assessed since 2007. A benchmark stock assessment will be conducted and reviewed for black rockfish that will encompass its coast-wide range. In

2007, independent assessment models were developed for northern and southern portions of the coast. The 2015 assessment will reconsider how best to model this stock, in light of any regional differences biology, exploitation, and data availability, maintaining consistent modeling approaches, where possible. Because of the expected number of regional models, as well as the availability of new data series and approaches to modeling available tagging data, the SSC has recommended that this assessment be afforded a full STAR panel for its review.

This assessment will provide the basis for the management of the black rockfish stock off the West Coast of the U.S., including providing the 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 meeting of fishery stock assessment experts. Participation of 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 Reviewers: Two CIE reviewers shall conduct an impartial and independent peer review in accordance with the SoW and ToRs herein. One of the CIE reviewers will participate in all STAR panels held in 2015 to provide a level of consistency between the STAR panels. 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, and stock assessment technical teams. 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-structured models, use of MCMC to develop confidence intervals, and use of Generalized Linear Models in stock assessment models. Each CIE reviewer's duties shall not exceed a maximum of 14 days to complete all work tasks of the peer review described herein.

Location of Peer Review: For the **STAR panel 3** review, each CIE reviewer shall conduct an independent peer review during the panel review meeting scheduled in Newport, Oregon during the dates of July 20-24, 2015.

Statement of Tasks: Each CIE reviewers 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 than 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 before the peer review, the NMFS Project Contact will send (by electronic mail or make available at an 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 SoW scheduled deadlines specified herein. The CIE reviewers 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;
- 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: Each 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.** Each 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 reviewers 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: Each CIE reviewer shall complete an independent peer review report in accordance with the SoW. Each CIE reviewer shall complete the independent peer review according to required format and content as described in Annex 1. Each CIE reviewer shall complete the independent peer review addressing each ToR as described in Annex 2.

Other Tasks – Contribution to Summary Report: Each 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. Each 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 STAR Panel 1 review meeting **scheduled in Newport, Oregon during the dates of July 20-24, 2015** as specified herein, and conduct an independent peer review in accordance with the ToRs (**Annex 2**).
3) No later than, each CIE reviewer shall submit an independent peer review report addressed to the "Center for Independent Experts," and sent to Mr. Manoj Shivlani, CIE Lead Coordinator, via email to *shivlanim@bellsouth.net*, and to Dr. David Die, CIE Regional Coordinator, via email to *ddie@rsmas.miami.edu*. Each CIE report shall be written using the format and content requirements specified in Annex 1, and address each ToR in **Annex 2**.

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

June 1, 2015	CIE sends reviewer contact information to the COR, who then sends this to the NMFS Project Contact
June 22, 2015	NMFS Project Contact sends the CIE Reviewers the pre-review documents
July 20-24, 2015	Each reviewer participates and conducts an independent peer review during the panel review meeting
August 7, 2015	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
August 21, 2015	CIE submits CIE independent peer review reports to the COR
August 28, 2015	The COR distributes the final CIE reports 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 COTR within 10 working days after receipt of all required information of the decision on substitutions. The COTR 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 COTR 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 COTR (William Michaels, via William.Michaels@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) each CIE report shall completed with the format and content in accordance with **Annex 1**,
(2) each CIE report shall address each ToR as specified in **Annex 2**,
(3) the CIE reports 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.

Support Personnel:

William Michaels, COTR
NMFS Office of Science and Technology
1315 East West Hwy, SSMC3, F/ST4, Silver Spring, MD 20910
William.Michaels@noaa.gov Phone: 301-713-2363 ext 136

Allen Shimada, COTR
NMFS Office of Science and Technology
1315 East West Hwy, SSMC3, F/ST4, Silver Spring, MD 20910
Allen.Shimada@noaa.gov Phone: 301-427-8174

Manoj Shivlani, CIE Lead Coordinator
Northern Taiga Ventures, Inc.
10600 SW 131st Court, Miami, FL 33186
shivlanim@bellsouth.net Phone: 305-383-4229

Key Personnel:
Jim Hastie
National Marine Fisheries Service,
2725 Montlake Blvd. E,
Seattle WA 98112
Jim.Hastie@noaa.gov Phone: 206-860-3412

Stacey Miller, NMFS Project Contact
National Marine Fisheries Service,
55 Great Republic Drive,
Gloucester, MA 01930
Phone: 978-281-9203

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) Panel 3

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.

Annex 3: Tentative Agenda

Final Agenda to be provided two weeks prior to the meeting with draft assessments and background materials.

Stock Assessment Review (STAR) Panel 3

NMFS Northwest Fisheries Science Center
Newport Research Station, Bld. 955
2032 SE OSU Drive,
Newport, Oregon 97365
Phone: 541-867-0500

July 20-24, 2014

Monday, July 20

8:30 a.m.	Welcome and Introductions
9:15 a.m.	Review the Draft Agenda and Discuss Meeting Format (Chair) - Review Terms of Reference (TOR) for assessments and STAR panel - Assign reporting duties - Discuss and agree to format for the final assessment document - Agree on time and method for accepting public comments
9:30 a.m.	Presentation of Assessment 1 - Overview of data and modeling
12:30 p.m.	Lunch (On Your Own)
1:30 p.m.	Q&A session with STAT_1 STAR Panel discussion - Panel develops written request for additional model runs / analyses
3:30 p.m.	Presentation of Assessment_2 (if time allows) - Overview of data and modeling
5:30 p.m.	Adjourn for Day.

Tuesday, July 21

8:30 a.m.	Continue Presentation of Assessment_2 - Overview of data and modeling
12:00 p.m.	Lunch (On Your Own)
1:30 p.m.	Q&A Session with STAT_ 2 Panel Discussion - Panel develops written request for additional model runs / analyses
4:30 p.m.	Check in with –STAT_1
5:30 p.m.	Adjourn for Day.

Stock Assessment Review (STAR) Panel 3

Wednesday, July 22

8:30 a.m. Presentation of First Set of Model Runs
- Q&A session with STAT_1 & Panel discussion
- Panel develops request for second round of model runs / analyses – STAT_1

12:00 p.m. Lunch

1:30 p.m. Presentation of First Set of Model Runs
- Q&A session –STAT_2 & panel discussion
- Panel develops request for second round of model runs / analyses – STAT_2.

5:30 p.m. Adjourn for day.

Thursday, July 23

8:30 a.m. Presentation of Second Set of Model Runs
- Q&A session –STAT_1 & panel discussion
- Agreement of preferred model and model runs for decision table
- Panel continues drafting STAR report.

12:00 p.m. Lunch (On Your Own)

1:00 p.m. Presentation of Second Set of Model Runs
- Q&A session –STAT_2 & panel discussion
- Agreement of preferred model and model runs for decision table
- Panel continues drafting STAR report.

4:00 p.m. Continue Panel Discussion or Drafting STAR Panel Report

5:30 p.m. Adjourn for day.

Friday, July 24

8:30 a.m. Consideration of Remaining Issues
- Review decision tables for assessments

10:00 a.m. Panel Report Drafting Session

12:00 p.m. Lunch (on your own)

2:00 p.m. Review First Draft of STAR Panel Report

4:00 p.m. Panel Agrees to Process for Completing Final STAR Report by Council's June Meeting Briefing Book Deadline

5:30 p.m. Review Panel Adjourn.

Appendix 3: Panel membership and STAR meeting participants

STAR Panel Members

Dr. Andrew Cooper, Simon Fraser University, SSC (Chair)
Dr. Neil Klaer, Center for Independent Experts
Mr. Patrick Cordue, Center for Independent Experts
Dr. Paul Spencer, National Marine Fisheries Service Alaska Fisheries Science Center

Stock Assessment Team (STAT) Members:

Dr. Jason Cope, National Marine Fisheries Service Northwest Fisheries Science Center
Dr. Andi Stephens, National Marine Fisheries Service Northwest Fisheries Science Center, GMT
Dr. David Sampson, Oregon State University, SSC
Dr. Megan Stachura, National Marine Fisheries Service Northwest Fisheries Science Center
Dr. Theresa Tsou, Washington Department of Fish and Wildlife, SSC
Mr. Troy Buell, Oregon Department of Fish and Wildlife
Mr. Brett Rodomsky, Oregon Department of Fish and Wildlife
Mr. Patrick Mirick, Oregon Department of Fish and Wildlife
Mr. Phil Weyland, Washington Department of Fish and Wildlife
Ms. Kari Fenske, Washington Department of Fish and Wildlife

STAR Panel Advisors

Mr. John Holloway, GAP
Ms. Heather Reed, Washington Department of Fish and Wildlife, GMT
Mr. John DeVore, Pacific Fishery Management Council