Center for Independent Experts (CIE) Reviewer's Independent Peer Review Report on the 2015 Stock Assessment Review (STAR) Panel 2 on Assessments of China and Bocaccio Rockfish.

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Executive Summary

The 2015 Stock Assessment Review Panel 2 on assessments of China rockfish (*Sebastes nebulosus*) and Bocaccio rockfish (*Sebastes paucispinis*) met in Santa Cruz, California, from Monday, July 10 to Friday, July 16 2015. The meeting was chaired by Dr Martin Dorn from the Scientific and Statistical Committee. The review panel was composed Dr Paul Nitschke, Northeast Fisheries Science Center, and two scientists affiliated with the Center for Independent Experts: Dr Noel Cadigan and Dr Neil Klaer. After model presentations and general discussions, the first four days of the meeting were devoted to the examination of various aspects of the models through the request and response process. My own particular interests for the requests was justification for selection of stock boundaries, better accounting for discards for the Southern China rockfish model, to emphasize the reliance of rockfish models on choices for steepness and natural mortality (particularly China rockfish) and to more fully account for model uncertainty in axes of uncertainty for decision tables provided for management advice. Draft meeting reports were completed on the last day, and edited during the weeks following the meeting via email.

Findings for China rockfish

The relatively sedentary nature of China rockfish makes consideration of catches outside of US borders of less concern for this species compared to other rockfish. Choice of stock boundaries to delimit Northern, Central and Southern sub-stocks at the WA/OR border and Cape Mendocino were justified, although a more evidence-based and consistent approach across all rockfish species should be a consideration for the future.

Catch for all rockfish species is uncertain, particularly for historical period where unspecified rockfish catch needs to be separated by species using assumptions about species ratios. Further work can be done to evaluate catch uncertainty and to provide alternative plausible catch series for sensitivity testing using the assessment model.

As a three-area, length-based, age-structured statistical catch at age model, this assessment provides a considerable improvement on the previous two-area Bayesian XDB-SRA data moderate assessment. New data sources include age-at-length data, age and length compositions of landed and discarded catch. Good use has been made of recent revised catch histories for California, Oregon and Washington, and further research on developing priors for natural mortality and steepness. The models were simply structured and stable as they did not estimate recruitment deviations, but provided a good balance between parsimony and complexity given the available information. Models appeared stable primarily due to the size compositions being informative, therefore providing apparently robust estimation of growth and selectivity for particular input values for steepness and natural mortality. When natural mortality was allowed to be estimated, the Northern and Southern models provided plausible values. Models were applied in a technically sound manner given the limitations of available data.

Given the large number of available abundance indices, the Panel was unable to examine each in detail. The Panel was able to agree with standard procedures used and endorsed by the SSC for many of the indices: delta GLM for individual fishing operations, and Stephens-MacCall filtering of aggregated data by trip or stop followed by a delta GLM. A meeting was held for nearshore rockfish (including China) in March/April 2015 that included a closer examination of input data and standardization procedures and also some signoff on the methods to be used.

The Panel requested additional model runs as part of its review. However, none of those runs resulted in new information that required a change to the base case, except in fecundity relationships, updating the 2011/12 data in the onboard observer index, removal of observations north of 40°10' N in the Abrams data set, modeling discards as a separate fleet (Southern model), removal of the OR MRFSS index (Central model), adding north CA length composition data (Central model), and fixing selectivity parameters hitting bounds (Central model). The Panel considers the modified base case as presented during the meeting to adequately capture the best available science and the status of the stock.

The assessment outcome – particularly regarding the level of recent rebuilding – is largely driven by catches, and assumptions about steepness and natural mortality. As steepness and natural mortality were both chosen as fixed values (based on meta-analyses), these rightly remain as major assessment uncertainties. As in most/all stock assessments, the appropriate single value for steepness over the entire exploitation history of the fishery remains as a major uncertainty. In this assessment, prior values for steepness and natural mortality were available from a meta-analysis, allowing bracketing of the uncertainty in both of these dimensions. However, exploration of the Southern model during the meeting established that the range of uncertainty in current and projected biomass status provided by this bracketing was very similar for both steepness and natural mortality, allowing uncertainty to be indicated by bracketing natural mortality alone as the major axis of uncertainty for management advice.

In addition to research recommendations carried over from earlier reviews and those in the meeting report, I have made some recommendations for the development of an objective procedure for setting stock boundaries, procedures and diagnostics regarding bridging analysis and comparison of sensitivity analyses that might be considered as additions to standard assessment documentation, and additional work on the development of diagnostics for spatial models.

Findings for Bocaccio rockfish

Bocaccio rockfish range from Stepovak Bay on the Alaskan Peninsula (as well as Kodiak Island, Alaska) to Punta Blanca, Baja California, Mexico, but are historically most abundant in waters off central and southern California. Bocaccio move into shallow waters during their first year of life, then move into deeper water with increased size and age. Being partly pelagic during all life stages, Bocaccio are a reasonably mobile species. Additional work is required to better justify not using Cape Mendocino for the northern boundary and why Mexican catches (that are currently unknown) can be ignored.

There is considerable uncertainty in historical catch and a recent revision of the Californian groundfish catch reconstruction led to change in assessment results. Uncertainty in catch is not examined by the assessment and there is a need to develop alternative catch histories that encompass uncertainty for model sensitivity testing.

Given the large number of available abundance indices it was noted during the meeting that the Panel was unable to examine each in detail. The Panel was able to endorse standard procedures used and endorsed by the SSC for many of the indices: delta GLM for individual fishing operations, and Stephens-MacCall filtering of aggregated data by trip or stop followed by a delta GLM. An improved process would be for a data group to examine and approve input data and methods for standardization prior to stock assessments. A meeting such as was carried out for nearshore rockfish in March/April 2015 would better enable closer examination of procedures and also signoff on the methods to be used (see recommendations for the future below).

Comparable (in terms of selectivity) indices when plotted together show that abundance indices are generally noisy. The CalCOFI index provides the longest time-series and is used to index spawning

output, so is a very influential index for the assessment. Trends in the juvenile and powerplan indices are broadly consistent with CalCOFI, but individual peak years are not very consistent among those indices. For the southern Californian indices, there is some consistency in recent trends since 2000 for NWFSC Hook, Observer south and the NWFSC trawl indices, with a decline to about 2010 and then an increase.

The introduction of an area closed to fishing off California (CCA) in preferred habitat for Bocaccio has affected subsequent interpretation of abundance indices. Scientific survey sampling within CCA (e.g. NWFSC hook and line) has potential to improve this and other assessments in future for species with a considerable portion of their total biomass inside the CCA.

The model is mature and stable and was structured to assess the defined region for the stock as a single unit, and is similar in structure to previous assessments for Bocaccio. There is still considerable uncertainty about the appropriateness of the northern and southern stock boundaries. Composition data suggest spatial differences north to south within the current bounds for this stock that may be better resolved by moving to a spatially structured model (while also noting possible bias that may be introduced – e.g. see Punt et al. 2015).

This was a thorough assessment with good use of recent research results and sensitivity runs to evaluate alternative model assumptions. The assessment benefits from some long time-series of stock size indices and substantial length composition information. An additional and important data source for this assessment was substantial age-at-length composition information derived from several fisheries and surveys. The occurrence of sporadic but large year classes of Bocaccio also improves the assessment because these year classes provide substantial age information via length compositions. Natural mortality seems to be well estimated using the model when steepness is fixed. However, as usual natural mortality is confounded with steepness.

The Panel requested additional model runs as part of the review. However, none of those runs resulted in new information that required a change to the base case, except a time block in 2003 for the trawl (N&S) and recreational (C&S) fleets, and standardization of data weighting procedures following recommendations for China rockfish (Francis method for compositions, harmonic mean for age-at-length). The modified base case as presented during the meeting adequately employs the best available science to determine the status of the stock.

As in most/all stock assessments, the appropriate single value for steepness over the entire exploitation history of the fishery remains as a major uncertainty. In this assessment prior values for steepness and natural mortality were available from a meta-analysis. Sufficient data are available to the model to provide a robust estimate of natural mortality for steepness values within the range of the steepness prior. Steepness was chosen as the first major axis of uncertainty for Bocaccio, with remaining uncertainty regarding steepness is the appropriateness of the prior for this species in particular, and any further work that improves the steepness prior for this species would be valuable for the assessment.

Bocaccio rockfish are subject to episodic large recruitment events. Recent assessments have indicated a strong 2010 year class, but the estimated magnitude of that recruitment event may have decreased with successive assessments, suggesting that very recent high recruitments may initially be overestimated. The current assessment estimates a very strong year class for 2013, with good support from available data. However, given the possibility of early overestimation of strong year classes, the Panel and STAT agreed that uncertainty about the strength of the 2013 year class is a major uncertainty for this assessment, also having strong implications for projections. The STAT proposed and applied a method to determine an axis of uncertainty based on the 2013 year class strength that was combined with uncertainty in steepness as dual axes of uncertainty for management recommendations.

In addition to research recommendations carried over from earlier reviews and those in the meeting report, I have made some recommendations for the development of an objective procedure for setting stock boundaries, procedures and diagnostics regarding bridging analysis and comparison of sensitivity analyses that might be considered as additions to standard assessment documentation, and additional work on the development of diagnostics for spatial models.

1 Introduction

1.1 Background

The 2015 Stock Assessment Review (STAR) Panel 2 on assessments of China rockfish (*Sebastes nebulosus*) and Bocaccio rockfish (*Sebastes paucispinis*) met in Santa Cruz, California, from Monday, July 10 to Friday, July 16 2015. The meeting was chaired by Dr Martin Dorn from the Scientific and Statistical Committee. The review panel (the Panel) was composed of Dr Paul Nitschke, NMFS Northeast Fisheries Science Center and two scientists affiliated with the Center for Independent Experts: Dr Noel Cadigan and Dr Neil Klaer.

Draft stock assessment reports as well as all associated background documents were made available via a public FTP site to the Panel on 23 June 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 draft 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 Stock Assessment Review Panel Meeting Reports for each species. The Panel participated in the review of each Term of Reference (ToR) for the meeting.

1.2 Review Activities

After model presentations and general discussions, the first four days of the meeting were devoted to the examination of various aspects of the models through the request and response process.

There was some adjustment of data inputs and how they were accounted for by the models for both species that resulted in relatively minor changes to the base cases. The appropriate weighting method to use for conditional age-at-length data was shown to be a current technical uncertainty that requires resolution. My own particular interests for the requests was justification for selection of stock boundaries, better accounting for discards for the Southern China rockfish model, to emphasize the reliance of rockfish models on choices for steepness and natural mortality (particularly China rockfish) and to more fully account for model uncertainty in axes of uncertainty for decision tables provided for management advice. Draft STAR Panel Meeting Reports were completed on the last day, and edited during the weeks following the meeting via email.

Tasks were distributed among the reviewers for working towards a draft report during the meeting, so I provided a draft for China rockfish. Similarities in some of my comments below and the draft meeting report are due to that process.

2 Review of assessments of China and Bocaccio rockfish

2.1 Terms of reference

The Panel considered the assessments in light of the terms of reference provided as follows:

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.

2.2 Findings by term of reference for China rockfish

The comments below refer to aspects that were examined during the meeting, but include my own additional commentary for preparation of this CIE report.

2.2.1 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 PFMC (2014) Status of the Pacific Coast Groundfish Fishery: Stock Assessment and Fishery Evaluation report provides a very useful summary of the distribution and life history, and stock status and management history for the rockfish species, although less is known about China rockfish than for some others, with the previous assessment being data moderate. The previous assessment and associated STAR panel report provide a useful starting point for the evaluation of progress by the STAT in addressing previous concerns, and for noting those that remain. The PFMC Terms of Reference for the Groundfish and Coastal Pelagic Species Stock Assessment Review Process for 2015-16 (September 2014) includes an outline for stock assessment documents that is commendable. A section is included that addresses responses to previous STAR panel recommendations which was not in the draft China rockfish assessment, but was provided during the meeting.

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

Stock boundary

Stock boundaries might ideally be based on the following standards in priority order: (1) research information that provides direct evidence for chosen boundaries (e.g. genetic or movement studies), (2) biogeographic regions that appear to define strong boundaries for many stocks based on oceanographic conditions and/or apparent presence or absence of a variety of species, (3) indirect evidence of stock separation due to breaks in occurrence (possibly due to lack of suitable habitat, or apparent biological differences in growth and/or age composition), (4) lines drawn at prominent ocean features that may define biogeographic regions and (5) lines drawn for data aggregation or management convenience at fishery management region, state or national boundaries. Additional work to further develop an objective procedure for evaluating the chosen stock boundaries across all rockfish (and potentially all other) assessments may be beneficial, and also more directly point to required directions for future research or assessment collaboration across national/international political boundaries.

According to background documents China rockfish occur in nearshore and shelf waters at depths of 3 to 128m from Kachemak Bay in the Gulf of Alaska to Redondo Beach and Nicholas Island in the Southern California Bight but are most abundant from Prince William Sound to northern California. They are long-lived, solitary, territorial, associated with high-relief habitat and bear live larvae. Available studies suggest that adult individuals are likely to move 10m or less within their territories and that juveniles also show high site fidelity.

Although there may be some dependence among areas due to larval drift, available evidence (including apparent growth difference north to south) indicates that structuring the stock into a number of sub-populations for assessment is warranted.

It was stated during the meeting that Cape Mendocino at 40°10' N latitude does provide a line that separates biogeographic regions, satisfying (2) above, in the absence of direct research evidence for separate stocks. The southern boundary at Point Conception was justified as little catch occurs south of that boundary, satisfying (4) above. For the stock north of Cape Mendocino, the Washington region catches comparatively small amounts of China rockfish and has a different exploitation history to Oregon, so a boundary at the Washington/Oregon border and a northern boundary at the Canadian border are also justified under (3) above. It is also likely that Columbia River plume is a natural barrier to the north-south exchange of rockfish adults and larvae. The relatively sedentary nature of China rockfish makes consideration of catches outside of US borders of less concern for this species compared to other rockfish.

Catches

China rockfish are an important nearshore species caught by both commercial and recreational fisheries, principally by hook and line. There has been a recent development of a commercial live-fish fishery in regions that allow commercial nearshore fisheries (those other than Washington) that now takes a considerable portion of the catch.

Catch for all rockfish species is uncertain, particularly for historical period where unspecified rockfish catch needs to be separated by species using assumptions about species ratios. Further work can be done to evaluate catch uncertainty and to provide alternative plausible catch series for sensitivity testing using the assessment model.

Abundance indices

Given the large number of available abundance indices it was noted during the meeting that the Panel was unable to examine each in detail. The Panel was able to agree with standard procedures used and endorsed by the SSC for many of the indices: delta GLM for individual fishing operations, and Stephens-MacCall filtering of aggregated data by trip or stop followed by a delta GLM. A meeting was held for nearshore rockfish (including China) in March/April 2015 that included a closer examination of input data and standardization procedures and also some signoff on the methods to be used. (See recommendations for the future below).

Comparable (in terms of selectivity) indices when plotted together show that abundance indices are generally noisy.

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

As a three-area, length-based, age-structured statistical catch at age model this assessment provides a considerable improvement on the previous two-area Bayesian XDB-SRA data moderate assessment. New data sources include age-at-length data, age and length compositions of landed and discarded catch. Good use has been made of recent revised catch histories for California, Oregon and Washington, and further research on developing priors for natural mortality (O. Hamel, NWFSC; pers. comm.) and steepness (J. Thorson, NWFSC; pers. comm.). Recent work on spatially-referenced habitat-based revision of abundance indices for recreational CPUE, two new recreational dockside CPUE indices for northern Washington and Oregon, a new commercial logbook CPUE index for the southern Oregon nearshore fishery has been incorporated. Recommendations from previous STAR panels have been carefully considered.

Model configuration

The individual area models were simply structured and stable as they did not estimate recruitment deviations, but provided a good balance between parsimony and complexity given the available information. Models appeared stable primarily due to the size compositions being informative, therefore providing apparently robust estimation of growth and selectivity for particular input values for steepness and natural mortality. When natural mortality was allowed to be estimated, the Northern and Southern models provided plausible values. Models were applied in a technically sound manner given the limitations of available data.

There are opportunities for further development of the model – perhaps as a single integrated three-stock assessment model rather than separate models by area to accommodate sharing of common parameters, and further work that may allow estimation of recent recruitment deviations (this enables better projections – this may also be an SS limitation).

Steepness and natural mortality

Values for steepness and natural mortality chosen for the base case have been justified by the STAT, and the base cases do represent the best currently available assessment of the status of the fishery for management advice.

The assessment outcome – particularly regarding the level of recent rebuilding is largely driven by catches, and assumptions about steepness and natural mortality. As steepness and natural mortality were both chosen as fixed values (based on meta-analyses), these rightly remain as major assessment uncertainties. As in most/all stock assessments, the appropriate single value for steepness over the entire exploitation history of the fishery remains as a major uncertainty. In this assessment prior values for steepness and natural mortality were available from a meta-analysis, allowing bracketing of the uncertainty in both of these dimensions. However, exploration of the Southern model during the meeting established that the range of uncertainty in current and projected biomass status provided by this bracketing was very similar for both steepness and natural mortality, allowing uncertainty to be indicated by bracketing natural mortality alone for management advice.

For the Central model, the fitted value of natural mortality for the adjusted base case at 0.116 was judged by the STAT and Panel as unacceptable for a number of reasons. Age composition data are noisy but suggest that more young fish are observed than would be expected for lower values of M, outweighing the effect of older fish on the composition fits – leading to a preference towards a higher M in this model. There are a good number of observations of older fish that are arguably more important in terms of stock status that should be fitted by the model. Only the lower M values provide any fit to the oldest age observations. The Hoenig M estimate for this stock is 0.05. Higher M leads to biomass values that appear to conflict with the habitat-based relative biomass among models. Values of M above 0.09 lead to unrealistically large biomass values that seem implausible, indicating minimal effect of fishing. The Central model is data rich but not showing contrast compared to the North and South, providing additional justification for not accepting the M estimate from this model. There is potential for setting reasonable priors on "sensible" values for more of the model estimated parameters has potential to better resolve issues highlighted by the M likelihood profile.

Fit of abundance indices

Somewhat unusually, abundance indices have little influence on the assessment. Generally, abundance indices cover reasonably short periods of the stock history, and any trends shown by abundance indices are consistent with signals in composition data and assumptions made about stock productivity. Efforts particularly since 2003 to greatly reduce fishing mortality on this species are commendable, and rebuilding of the stock after such efforts is to be expected. It is unfortunate that the available data and the assessment are unable to provide good precision on the current level of rebuilding.

Priors

There is potential for setting reasonable priors on "sensible" values for more of the model estimated parameters (e.g., values of M of 0.09 and above lead to unrealistically high biomass and minimal effect of fishing).

Weighting procedures

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 STAT has used currently recommended procedures and further work was done during the workshop to establish an appropriate method for weighting age-at-length data. There is currently a lack of consensus on an agreed approach for weighting conditional age-at-length data. A workshop is planned for later this year that might provide guidance. For this assessment, the Panel chose to use the traditionally-used harmonic mean method which generally provides results intermediate to no weighting (otolith counts) and the Francis A method.

Convergence

Evidence for model convergence was based on jittering starting values for estimated parameters. Additional evidence is provided by the smooth transitions of the likelihood profiles. The Panel agreed that acceptable evidence of convergence was provided.

Recruitment deviations

China rockfish models with deviations from the stock recruit curve turned off and fixed parameters of M and steepness are insensitive to changes in the abundance indices and length composition data. There is little evidence of cohort effects in the length frequency data and no evidence of size truncation in all three China rockfish stocks. Explorations during the meeting in turning estimation of recruitment deviations on demonstrated that the models were not able to estimate them – particularly early in the series. As recent recruitment levels may have considerable influence on the outcome of projections, future work is required to explore estimation of recruitment for the most recent in particular.

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

Other than adjustments to the base model configuration noted below under 2.2.5, the Panel had no specific suggestions for further changes, so the modified base case was the best currently available for the provision of management advice.

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

Responses to earlier review recommendations.

A required section of the draft stock assessment document is a response to STAR panel recommendations from the most recent previous assessment. The STAT adequately responded to several of those recommendations. Those that remain to be further addressed were a historical commercial catch reconstruction for Washington, consideration of linkages to ecosystem models, exploration of trans-boundary assessments with Canada, inclusion of catch uncertainty in the assessment, exploration of alternative stock-recruitment relationships, comparison of indices from the same fishery from onboard observers with those that apply the Stephens-MacCall filtering to data aggregated by trip (or stop), development of a private-mode index for the CA dockside survey.

Requests and responses during the meeting

The Panel requested additional model runs as part of its review. However, none of those runs resulted in new information that required a change to the base case, except in fecundity relationships, updating the 2011/12 data in the onboard observer index, removal of observations north of 40°10’ N in the Abrams data set, modeling discards as a separate fleet (Southern model), removal of the OR MRFSS index (Central model), adding north CA length

composition data (Central model), fixing selectivity parameters hitting bounds (Central model). The Panel considers the modified base case as presented during the meeting to adequately capture the best available science and the status of the stock.

2.2.6 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.

Research recommendations carried over from previous reviews (short-medium term)

A historical commercial catch reconstruction for Washington, consideration of linkages to ecosystem models, exploration of trans-boundary assessments with Canada, inclusion of catch uncertainty in the assessment, exploration of alternative stock-recruitment relationships, comparison of indices from the same fishery from onboard observers with those that apply the Stephens-MacCall filtering to data aggregated by trip (or stop), development of a private-mode index for the CA dockside survey.

Abundance indices (short-medium term)

- Consider the development of a fishery-independent survey for nearshore stocks. As the current base model structure has no direct fishery-independent measure of recent rebuilding of the adult portion of the stock, any work to commence collection of such a measure for nearshore rockfish, or use of existing data to derive such an index would greatly assist with this assessment.

- Develop a PR index.

- Perform a simulation study on the MRFSS CPUE index to address the effects of false positives and false negatives on the index. Determine the effects of changes in the proportion of discarded trips on the CPUE index.

- Conduct a simulation study to determine the effects of fixing full selection with length based asymptotic selectivity. Investigate the effects of derived age based selectivity that are not fully selected at the oldest ages as a result of the estimated asymptotic length based selectivity and slow growth rates as seen with China rockfish.

- Develop a trip based MRFSS CPUE index for OR (lower priority).

- Examine within-season depletion of CPUE indices.

Ageing

Collect and age otoliths from younger fish.

Examination of model input data (short-term)

A specific meeting to examine and sign off on assessment input data and procedures for standardizing abundance indices prior to the development of draft stock assessments would assist in the prevention of data issues becoming apparent later in the process – as has occurred this year for other rockfish species. A nearshore stock assessment workshop was carried out with this objective in 2015 for Black rockfish, China rockfish and Kelp greenling, so input data for China rockfish was subjected to earlier examination this year.

A specific data meeting perhaps for all rockfish could examine information across a broad range of species due for assessment, and would also assist with the development of more specific documentation of protocols used to compile best available data sets for stock assessment, continue acceptance of agreed procedures for standardization of abundance indices, and also begin work on procedures for the development of alternative data series that capture uncertainty – particularly for historical catch and discards.

Further investigation of appropriate values for natural mortality and steepness (short/medium term)

Basic life history research may help to resolve assessment uncertainties regarding appropriate values for natural mortality and steepness.

Further work on estimating recruitment deviations (short-term)

While the current models appear to provide implausible recruitment deviations particularly early in the series, further work to use available options in SS to force improved model behavior in that period may provide an acceptable resolution. In addition, this work may provide guidance for additional flexibility that might be added to SS to better handle the problems of recruitment estimation for this stock.

Stock boundaries (medium-term)

Additional work to further develop an objective procedure for evaluating the chosen stock boundaries across all rockfish (and potentially all other) assessments may be beneficial, and also more directly point to required directions for future research or assessment collaboration across national/international political boundaries.

Further investigation is required for whether the three China rockfish stocks developed in the assessment are appropriate reproductively isolated populations.

Assessment documentation (short-term)

It would assist in the review process if reviewers were routinely given access to model source code, so that they can run the draft base case prior to the review for themselves if they wish – particularly for SS assessments. It has been good practice to include the starter, data and control files in the draft assessment documentation so that settings can be examined directly in the document. However, there is advantage for reviewers to run the model and examine R4SS output – particularly as it may include diagnostics and plots that are not included in the

draft assessment document. As SS is constantly under development, it may also be the case (as here) that the SS version used is more recent than that available publicly from the NOAA toolbox. A simple solution would be to provide the draft base model input files and also the SS executable version used on the FTP site used for the review, at the same time as documents are made available prior to the meeting.

Standard inclusions in stock assessment documentation (short-term)

The Terms of Reference for the Groundfish and Coastal Pelagic Species Stock Assessment Review by the Pacific Fishery Management Council (September 2014) provides a good outline for stock assessment documents (Appendix B) that ensures consistency for draft assessments. While I hesitate to add to the standard requirements, and therefore the work required of the STAT prior to review, there are three items that could be considered, regarding examination of abundance indices, bridging analysis and tables for comparison of sensitivity analyses.

Examination of comparable abundance indices plotted together is a useful consistency check that should be included as part of all assessments with a large number of indices. R code was used by the China rockfish STAT that plotted all indices on the same graph as well as the available biomass for each index from the base model. Such an examination should be considered as a standard inclusion in R4SS.

Where assessments are regularly made for the same species using the same modeling framework, an opportunity arises to comprehensively and transparently provide an audit trail on model changes since the last assessment – commonly called a bridging analysis. Such a bridging analysis involves examination of absolute spawning biomass and recruitment trends over time after the application of sequential changes to model source code version revision, structural assumptions, changes to fixed parameter values or priors, and the inclusion of recent data (source by source where possible – catch, index, age and length composition by fleet). This provides a continuum from the previous assessment to the current base case. Such a process (or an improvement on it) could be considered in the future for any regular SS assessments in the US. It is understood that a detailed bridging analysis may not be required if the absolute biomass and recruitment series have changed little from one assessment to the next, but experience says that this is rarely the case. In the case of China rockfish here, the previous assessment was XDB-SRA, so a detailed bridging analysis was not possible given the different structural assumptions of the models, but should be a consideration for the next full assessment.

For comparison and evaluation of sensitivity analyses, it has become standard practice elsewhere to construct tables as detailed for the Canary rockfish assessment in my report for STAR Panel 1 that I think should be considered as standard procedure. The China rockfish assessment did provide this information for some individual sensitivities examined during the review, but not as tables for all sensitivities.

The outline for stock assessments (Appendix B in the 2014 Terms of Reference) includes a section for addressing previous STAR Panel recommendations. If a data workshop precedes the stock assessment, as here for China rockfish, the outline should also include a section on how the recommendations from the data workshop were addressed.

Standard diagnostics for spatial models (medium-term)

A recent paper by Punt et al. (2015) highlights that adding spatial model structural components (allowing separate stock dynamics by area, including distdevs (estimated annual proportions of total recruitment to distribute among areas), area-specific selectivity, allowing mixing) have the potential for the introduction of bias. How far this process should be taken depends on available data. There is a question of what standard diagnostics might assist with making the decision on how far to go with a spatial analysis, and what structural aspects are supported by available data. Punt et al. (2015) say "we propose conducting sensitivity analyses based on several model configurations to select the appropriate structure for an assessment" and "the capacity to examine model residuals spatially remains valuable for inferring problems with model specification". What additional standard diagnostics (specifically that could be added to R4SS) might assist with this is an open question. New spatial models are likely to become more commonly proposed as the best currently available, and standard objective procedures for evaluation of spatial models are a work in progress.

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

Terms of Reference and assignment of reporting duties.

The agenda had assignment of reporting duties for the first day. As the proceedings tend to concentrate on STAR Panel requests and responses for the first four days, with drafting of the report on the last day, the assignment of duties concentrated more specifically on the recording of the Panel requests and responses. Duties were assigned across reviewers and satisfactory progress was made, allowing initial wording for the meeting report to be provided as a basis for drafting on the last day. At other US independent reviews I have been involved with, the terms of reference for the review are more specifically broken down into sections that look at (1) appropriateness of the compilation and use of available input data, (2) appropriate and best practice in application of the assessment model and (3) appropriate capture of data and model uncertainty in recommendations for management, with very specific questions to be answered under each. Given such clear delimitation of aspects of the assessment that require comment in the final report, on the first day it makes for efficient use of all reviewers in assigning the drafting of comments on these aspects separately to different reviewers, depending on their expertise. That allows a better compilation of comments about most important aspects of the stock assessment on the final day when drafting the report. However, the final report for this meeting did capture the important aspects of items (1) to (3) above, so having very specific questions in the terms of reference was not an issue for this review.

Agreement on the STAR Panel Meeting Report

All three Panel reviewers and the Chair provided consensus on the language that appears in the STAR Panel Meeting Report.

2.3 Findings by term of reference for Bocaccio rockfish

The comments below refer to aspects that were examined during the meeting, but include my own additional commentary for preparation of this CIE report.

2.3.1 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.

The PFMC (2014) Status of the Pacific Coast Groundfish Fishery: Stock Assessment and Fishery Evaluation report provides a very useful summary of the distribution and life history, and stock status and management history for the rockfish species. The previous assessment and associated STAR panel reports provide a useful starting point for the evaluation of progress by the STAT in addressing previous concerns, and for noting those that remain. The inclusion of a specific section in the draft assessment document regarding how previous recommendations have been addressed is commendable.

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

Stock boundary

Stock boundaries might ideally be based on the following standards in priority order (1) research information that provides direct evidence for chosen boundaries (e.g. genetic or movement studies), (2) biogeographic regions that appear to define strong boundaries for many stocks based on oceanographic conditions and/or apparent presence or absence of a variety of species, (3) indirect evidence of stock separation due to breaks in occurrence (possibly due to lack of suitable habitat, or apparent biological differences in growth and/or age composition), (4) lines drawn at prominent ocean features that may define biogeographic regions and (5) lines drawn for data aggregation or management convenience at fishery management region, state or national boundaries. Additional work to further develop an objective procedure for evaluating the chosen stock boundaries across all rockfish (and potentially all other) assessments may be beneficial, and also more directly point to required directions for future research or assessment collaboration across national/international political boundaries.

According to background documents Bocaccio rockfish range from Stepovak Bay on the Alaskan Peninsula (as well as Kodiak Island, Alaska) to Punta Blanca, Baja California, Mexico, but are historically most abundant in waters off central and southern California. The southern Bocaccio stock is most prevalent in the 54-82 fm depth zone. They live to a maximum age of at least 40 years, bear live larvae, are semi-demersal and adults and juveniles are associated with a wide variety of habitats. Larvae and small juveniles are pelagic and are commonly found in the upper 100 m of the water column, often far from shore. Bocaccio move into shallow waters during their first year of life, then move into deeper water with increased size and age. Being partly pelagic during all life stages, Bocaccio are a reasonably mobile species.

Cape Mendocino at 40°10' N latitude does seem to provide a line that separates biogeographic regions, and has been used in the past as a separation line for northern and southern stocks of Bocaccio. There is some evidence of two demographic clusters in the population centered on southern/central California and the West coast of British Columbia, but genetic information suggests a panmictic stock. There is a region of historical low catch of Bocaccio at about Cape Mendocino. The current assessment of the southern stock uses boundaries of Cape Blanco at 43°00' N, Oregon as the northern and the Mexican border as the southern, aggregating the INPFC areas of Conception, Monterey and Eureka. The choice of northern boundary appears to be at level (3) or higher above, and (5) in the south. Additional work is required to better justify not using Cape Mendocino for the northern boundary and why Mexican catches (that are currently unknown) can be ignored.

Catches

Bocaccio rockfish are an important commercial (principally by trawl) and recreational (principally by hook and line) species, accounting for 25-30% of commercial all rockfish species historical catch. A decline in commercial catch from about 1980 to 2000 due to stock decline and management action means that the relatively low catches since 2000 are largely taken by the recreational fishery. There is considerable uncertainty in historical catch and a recent revision of the Californian groundfish catch reconstruction led to change in assessment results. Uncertainty in catch is not examined by the assessment and there is a need to develop alternative catch histories that encompass uncertainty for model sensitivity testing.

Abundance indices

Given the large number of available abundance indices it was noted during the meeting that the Panel was unable to examine each in detail. The Panel was able to endorse standard procedures used and endorsed by the SSC for many of the indices: delta GLM for individual fishing operations, and Stephens-MacCall filtering of aggregated data by trip or stop followed by a delta GLM. An improved process would be for a data group to examine and approve input data and methods for standardization prior to stock assessments. A meeting such as was carried out for nearshore rockfish in March/April 2015 would better enable closer examination of procedures and also signoff on the methods to be used (see recommendations for the future below).

Comparable (in terms of selectivity) indices when plotted together show that abundance indices are generally noisy. The CalCOFI index provides the longest time-series and is used to index spawning output, so is a very influential index for the assessment. Examinations during the meeting of gear and methodological changes through time for the CalCOFI index did not present any obvious reason to consider breaking that index at any point in time. Trends in the juvenile and powerplan indices are broadly consistent with CalCOFI, but individual peak years are not very consistent among those indices. For the southern Californian indices, there is some consistency in recent trends since 2000 for NWFSC hook, observer south and the NWFSC trawl indices, with a decline to about 2010 and then an increase. Examination of comparable abundance indices plotted together is a useful

consistency check that should be included as part of all assessments with a large number of indices (see recommendations for future below).

The introduction of an area closed to fishing off California – the Cowcod Conservation Area (CCA) in preferred habitat for Bocaccio has affected subsequent interpretation of abundance indices. Scientific survey sampling within CCA (e.g. NWFSC hook and line) has potential to improve this and other assessments in future for species with a considerable portion of their total biomass inside the CCA.

Age-at-length composition

The addition of age-at-length data normally has many benefits for age-based assessments such as for Bocaccio. The development of ageing criteria via cross-examination of northern (more easily aged) and southern otoliths allowed the establishment of standards that were then used to age otoliths from the southern Bocaccio stock for the first time. This work is very commendable. Extension of this work to remaining samples, and to the inclusion of age data from the hook and line survey are encouraged.

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

This was a thorough assessment with good use of recent research results and sensitivity runs to evaluate alternative model assumptions. The assessment benefits from some long time-series of stock size indices and substantial length composition information. An additional and important data source for this assessment was substantial age-at-length composition information derived from several fisheries and surveys. The occurrence of sporadic but large year classes of Bocaccio also improves the assessment because these year classes provide substantial age information via length compositions. Natural mortality seems to be well estimated using the model when steepness is fixed. However, as usual natural mortality is confounded with steepness.

Model configuration

The model is mature and stable and was structured to assess the defined region for the stock as a single unit, and is similar in structure to previous assessments for Bocaccio. As noted for the stock boundaries above, there is still considerable uncertainty about the appropriateness of the northern and southern stock boundaries. Composition data suggest spatial differences north to south within the current bounds for this stock that may be better resolved by moving to a spatially structured model (while also noting possible bias that may be introduced – e.g. see Punt et al. 2015).

Examination of the effect of catch uncertainty on assessment results

High and low historical catch scenarios were not specifically developed by the STAT as sensitivities as part of the assessment. Further work can be done to better capture uncertainty particularly in historical catches as this remains as a considerable uncertainty for the Bocaccio assessment.

Steepness

As in most/all stock assessments, the appropriate single value for steepness over the entire exploitation history of the fishery remains as a major uncertainty. In this assessment prior values for steepness and natural mortality were available from a meta-analysis. Sufficient data are available to the model to provide a robust estimate of natural mortality for steepness values within the range of the steepness prior. Remaining uncertainty regarding steepness is the appropriateness of the prior for this species in particular, and any further work that improves the steepness prior for this species would be valuable for the assessment.

Fit of abundance indices

Efforts particularly since 2000 to greatly reduce fishing mortality on this species are commendable, and rebuilding of the stock after such efforts is to be expected. There is some agreement among abundance indices of an increasing trend since 2010 at least.

A more objective procedure for ranking of abundance indices is desirable. This may be addressed at a data meeting prior to the development of the stock assessment.

Additional priors

There is potential for setting reasonable priors on “sensible” values for more of the model estimated parameters. As there are so many fishing fleets, there is scope for more work to reduce model flexibility in setting selectivity patterns where this can be justified.

Weighting procedures

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 STAT has used currently recommended procedures and further work was done during the workshop to establish an appropriate method for weighting age-at-length data. There is currently a lack of consensus on an agreed approach for weighting conditional age-at-length data. A workshop is planned for later this year that might provide guidance. For this assessment, the Panel chose to use the traditionally - used harmonic mean method which generally provides results intermediate to no weighting (otolith counts) and the Francis A method.

Convergence

Evidence for model convergence was based on jittering starting values for estimated parameters. Additional evidence is provided by the smooth transitions of the likelihood profiles. The Panel agreed that acceptable evidence of convergence was provided.

Additional evidence of convergence and potentially improved characterization of model uncertainty is provided by MCMC or bootstrap runs. The potential for using MCMC or bootstrapping with this assessment should be investigated in future (noting comments from the STAT that such runs would take considerable time to run).

Recruitment deviations

Bocaccio rockfish are subject to episodic large recruitment events. Recent assessments have indicated a strong 2010 year class, but the estimated magnitude of that recruitment event may have decreased with successive assessments, suggesting that very recent high recruitments may initially be overestimated. The current assessment estimates a very strong year class for 2013, with good support from available data. However, given the possibility of early overestimation of strong year classes, the Panel and STAT agreed that uncertainty about the strength of the 2013 year class is a major uncertainty for this assessment, also having strong implications for projections. The strength of the 2013 year class is sensitive to the weighting method used for composition data. Based on discussions during the meeting for China rockfish and for consistency, the Francis method for composition data and the harmonic mean method for age-at-length was recommended by the Panel for the base case and agreed by the STAT. To develop an axis of uncertainty for the 2013 year class strength, the STAT proposed to vary the base by fixing the 2013 recruitment to lower and upper levels according the 12.5 and 87.5 percentiles of the estimated uncertainty from the base case. To fix the recruitment level in 2013 a dummy survey was added to absolutely estimate age 0 in 2013 with very high precision, with the knowledge that this method will result in small differences in other aspects of the model fit in addition to the 2013 recruitment.

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

Other than adjustments to the base model as documented below under 2.3.5, the Panel had no specific suggestions for further changes. The modified base case is the best currently available for the provision of management advice.

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

Responses to earlier review recommendations.

A required section of the draft stock assessment document is responses to STAR panel recommendations from the most recent previous assessment. Earlier recommendations that remain to be further addressed were: in resolution of trans-national stock boundaries (via otolith elemental analysis, parasitology, and co-operative research with Canadian and Mexican colleagues), further efforts to improve the reliability of the recCEN index, continued processing of historical CalCOFI samples from northern transects, development of a fishery-independent survey more suited to Bocaccio, further histological investigation of reproductive ecology.

Requests and responses during the meeting

The Panel requested additional model runs as part of the review. However, none of those runs resulted in new information that required a change to the base case, except a time block in 2003 for the trawl (N&S) and recreational (C&S) fleets, and standardization of data

weighting procedures following recommendations for China rockfish (Francis method for compositions, harmonic mean for age-at-length). The modified base case as presented during the meeting adequately employs the best available science to determine the status of the stock.

2.3.6 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.

Research recommendations carried over from previous reviews (short-medium term)

Resolution of trans-national stock boundaries (via otolith elemental analysis, parasitology, and co-operative research with Canadian and Mexican colleagues), further efforts to improve the reliability of the recCEN index, continued processing of historical CalCOFI samples from northern transects, development of a fishery-independent survey more suited to Bocaccio, further histological investigation of reproductive ecology.

Further work on capturing uncertainty in recent recruitment levels (short-term)

The strength of recent recruitments is a major uncertainty for Bocaccio rockfish. There is an opportunity to explore technical means for capturing this uncertainty within SS (especially for axes of uncertainty), perhaps with an improved procedure to fix particular recent recruitment deviations.

Examination of model input data (short-term)

A specific meeting to examine and sign off on assessment input data and procedures for standardizing abundance indices prior to the development of draft stock assessments would assist in the prevention of data issues becoming apparent later in the process – as has occurred this year for other rockfish species.

A specific data meeting perhaps for all rockfish could examine information across a broad range of species due for assessment, and would also assist with the development of more specific documentation of protocols used to compile best available data sets for stock assessment, continue acceptance of agreed procedures for standardization of abundance indices, and also begin work on procedures for the development of alternative data series that capture uncertainty – particularly for historical catch and discards.

Stock boundaries (medium-term)

Additional work to further develop an objective procedure for evaluating the chosen stock boundaries across all rockfish (and potentially all other) assessments may be beneficial, and also more directly point to required directions for future research or assessment collaboration across national/international political boundaries.

Assessment documentation (short-term)

It would assist in the review process if reviewers were routinely given access to model source code so that they can run the draft base case prior to the review for themselves if they wish – particularly for SS assessments. It has been good practice to include the starter, data and control files in the draft assessment documentation so that settings can be examined directly in the document. However, there is advantage for reviewers to run the model and examine R4SS output – particularly as it may include diagnostics and plots that are not included in the draft assessment document. As SS is constantly under development, it may also be the case (as here) that the SS version used is more recent than that available publicly from the NOAA toolbox. A simple solution would be to provide the draft base model input files and also the SS executable version used on the FTP site used for the review, at the same time as documents are made available prior to the meeting.

Standard inclusions in stock assessment documentation (short-term)

The Terms of Reference for the Groundfish and Coastal Pelagic Species Stock Assessment Review by the Pacific Fishery Management Council (September 2014) provides a good outline for stock assessment documents (Appendix B) that ensures consistency for draft assessments. While I hesitate to add to the standard requirements, and therefore the work required of the STAT prior to review, there are three items that could be considered, regarding examination of abundance indices, bridging analysis and tables for comparison of sensitivity analyses.

Examination of comparable abundance indices plotted together is a useful consistency check that should be included as part of all assessments with a large number of indices. R code was used by the China rockfish STAT that plotted all indices on the same graph as well as the available biomass for each index from the base model. Such an examination should be considered as a standard inclusion in R4SS.

Where assessments are regularly made for the same species using the same modeling framework, an opportunity arises to comprehensively and transparently provide an audit trail on model changes since the last assessment – commonly called a bridging analysis. Such a bridging analysis involves examination of absolute spawning biomass and recruitment trends over time after the application of sequential changes to model source code version revision, structural assumptions, changes to fixed parameter values or priors, and the inclusion of recent data (source by source where possible – catch, index, age and length composition by fleet). This provides a continuum from the previous assessment to the current base case. Such a process (or an improvement on it) could be considered in the future for any regular SS assessments in the US. It is understood that a detailed bridging analysis may not be required if the absolute biomass and recruitment series have changed little from one assessment to the next, but experience says that this is rarely the case. In the case of Bocaccio rockfish here, the previous assessment was done using SS, so a detailed bridging analysis was possible.

For comparison and evaluation of sensitivity analyses it has become standard practice elsewhere to construct tables as detailed for the Canary rockfish assessment in my report for STAR Panel 1 that I think should be considered as standard procedure. The Bocaccio

rockfish assessment did provide this information for some individual sensitivities examined during the review, but not as tables for all sensitivities.

Standard diagnostics for spatial models (medium-term)

The current Bocaccio rockfish assessment is not spatially structured, but should further development lead to a spatial model, then this item becomes relevant.

A recent paper by Punt et al. (2015) highlights that adding spatial model structural components (allowing separate stock dynamics by area, including distdevs, area-specific selectivity, allowing mixing) have the potential for the introduction of bias. How far this process should be taken depends on available data. There is a question of what standard diagnostics might assist with making the decision on how far to go with a spatial analysis, and what structural aspects are supported by available data. Punt et al. (2015) say “we propose conducting sensitivity analyses based on several model configurations to select the appropriate structure for an assessment” and “the capacity to examine model residuals spatially remains valuable for inferring problems with model specification”. What additional standard diagnostics (specifically that could be added to r4ss) might assist with this is an open question. New spatial models are likely to become more commonly proposed as the best currently available, and standard objective procedures for evaluation of spatial models are a work in progress.

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

Terms of Reference and assignment of reporting duties.

Additional detail on this item has been provided under 2.2.7 for China rockfish.

Agreement on the STAR Panel Meeting Report

All three Panel reviewers and the Chair provided consensus on the language that appears in the STAR Panel Meeting Report.

References

Hamel, O. Development of prediction intervals and priors for the natural mortality rate using multiple meta-analyses using life-history correlates. NOAA Fisheries, Northwest Fisheries Science Center, Seattle. 4/28/2013.

Punt, A.E., Haddon, M., Tuck, G.N. 2015. Which assessment configurations perform best in the face of spatial heterogeneity in fishing mortality, growth and recruitment? A casestudy based on pink ling in Australia. Fisheries Research 168:85–99

Appendix 1: Bibliography of materials provided for review

Draft Stock Assessment Documents:
Draft 2015 China rockfish assessment
Draft 2015 Bocaccio rockfish assessment

Background Materials
2009 Bocaccio assessment
2011 Bocaccio update assessment
2013 Bocaccio update assessment
2009 Bocaccio STAR Panel report
2013 Data-moderate STAR Panel report

Cope, J., Dick, E.J., MacCall, A., Monk. M., Soper, B., Wetzel, C. 2015. Data-moderate stock assessments for brown, China, copper, sharpchin, stripetail, and yellowtail rockfishes and English and rex soles in 2013.

NWFSC. 2014. Terms of Reference for the Groundfish and Coastal Pelagic Species Stock Assessment Review Process for 2015-2016. NOAA Pacific Fishery Management Council Report.

Pearson, D.E., Lefebvre, L.S. and He, X. 2015. Developing Age Determination Criteria for Bocaccio (*Sebastes paucispinus*). NOAA Technical Memorandum NMFS 541.

PFMC. 2013. Pacific Coast Fishery Ecosystem Plan for the U.S. Portion of the California Current Large Marine Ecosystem. PFMC Report.

PFMC. 2014. Status of the Pacific Coast Groundfish Fishery: Stock Assessment and Fishery Evaluation. PFMC Report.

PFMC. 2015. Report on the Nearshore Stock Assessments Workshop.

Ralston et al. 2015. Coastwide Pre-Recruit Indices for select Sebastes species from SWFSC and NWFSC/PWCC Midwater Trawl Surveys (2001-2014).

Sivasundar, A. and Palumbvi, S.R. 2010. Life history, ecology and the biogeography of strong genetic breaks among 15 species of Pacific rockfish, *Sebastes*. Mar Biol 157:1433-1452.

Thorston, J. 2015. Estimating a Bayesian prior for steepness in Pacific rockfishes (Sebastes spp.) off the U.S. West Coast for the 2015 assessment cycle.

Stock Synthesis Model-Related Documents

Methot, R. D. 2012. User Manual for Stock Synthesis Model Version 3.24s. Updated February 11, 2015. NOAA Fisheries, Seattle, Washington.

Methot, R.D. and Wetzel, C. 2013. Appendix A: Technical Description of the Stock Synthesis assessment program.

Appendix 2:

Statement of Work

External Independent Peer Review by the Center for Independent Experts

Stock Assessment Review (STAR) Panel 2

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.

Benchmark stock assessments will be conducted and reviewed for bocaccio and china rockfish. Bocaccio is a species that has been declared overfished and is has been managed under a rebuilding plan for more than a decade. The last full assessment of bocaccio rockfish was conducted in 2009 and it was subsequently updated in 2011 and 2013. The 2013 update assessment estimated depletion at 31.4 percent; an improvement over that forecasted by the 2011

assessment (approximately 28 percent). Improvement in stock status is attributed to higher estimates of 2010 recruitment. Bocaccio was predicted in the last assessment to be rebuilt by 2015; however, the SSC recommends that this be confirmed with a full assessment during 2015.

China rockfish is a valuable groundfish species to both commercial and recreational hook-and-line fishermen, but its status had never been assessed before 2013. A data-moderate assessment, comprised by northern and southern models, was conducted for China rockfish in 2013. As per the Terms of Reference for such assessments, no length or age data were included in that assessment, even though considerable length data and some age structures were available. Following the assessment review, concern was expressed that not all possible sources of abundance index information had been considered for inclusion in the models, and that indices from one area had been inappropriately used to represent trends in another. In order to facilitate a thorough review of the available data and the development of the best possible models to characterize the range of the stock, the SSC recommends that a benchmark assessment be conducted in 2015.

Assessments for these two stocks will provide the basis for the management of the groundfish fisheries off the West Coast of the U.S. including providing scientific basis for setting OFLs and ABCs as mandated by the Magnuson-Stevens Act. The technical review will take place during a formal, public, multiple-day 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 2** review, each CIE reviewer shall conduct an independent peer review during the panel review meeting **scheduled in Santa Cruz, California during the dates of July 6-10, 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 in **scheduled in Santa Cruz, California during the dates of July 6-10** as specified herein, and conduct an independent peer review in accordance with the ToRs (**Annex 2**).
3) No later than **July 24, 2015**, 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.

	CIE sends reviewer contact information to the COR, who then sends this to the NMFS Project Contact
	NMFS Project Contact sends the CIE Reviewers the pre-review documents
July 6-10, 2015	Each reviewer participates and conducts an independent peer review during the panel review meeting
July 24, 2015	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
August 7, 2015	CIE submits CIE independent peer review reports to the COR
August 14, 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:

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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 2

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 2
Santa Cruz, California

SWFSC, Fisheries Ecology Division
110 Shaffer Road
Santa Cruz, CA 95060
Phone: 831-420-3900
July 6-10, 2015

Monday, July 6

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 7

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 2
Santa Cruz, CA

Wednesday, July 8

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 9

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 10

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 September Meeting Briefing Book Deadline
5:30 p.m.	Review Panel Adjourn.

Appendix 3: List of participants

STAR Panel Members

Dr. Martin Dorn, National Marine Fisheries Service Alaska Fisheries Science Center, SSC (Chair)
Dr. Neil Klaer, Center for Independent Experts
Dr. Noel Cadigan, Center for Independent Experts
Dr. Paul Nitschke, National marine Fisheries Service Northeast Fisheries Science Center

Stock Assessment Team (STAT) Members China rockfish

Dr. E.J. Dick, National Marine Fisheries Service Southwest Fisheries Science Center, STAT Lead
Dr. Melissa Monk, National Marine Fisheries Service Southwest Fisheries Science Center, GMT
Dr. Ian Taylor, National Marine Fisheries Service Northwest Fisheries Science Center
Dr. Melissa Haltuch, National Marine Fisheries Service Northwest Fisheries Science Center
Mr. Patrick Mirick, Oregon Department of Fish and Wildlife
Dr. Theresa Tsou, Washington Department of Fish and Wildlife, SSC

Stock Assessment Team (STAT) Members Bocaccio rockfish

Dr. Xi He, National Marine Fisheries Service Southwest Fisheries Science Center, STAT Lead
Dr. John Field, National Marine Fisheries Service Southwest Fisheries Science Center, SSC
Mr. Don Pearson, National Marine Fisheries Service Southwest Fisheries Science Center
Ms. Lyndsey Lefebvre, National Marine Fisheries Service Southwest Fisheries Science Center
Dr. Steve Lindley, National Marine Fisheries Service Southwest Fisheries Science Center

STAR Panel Advisors

Mr. Gerry Richter, Pt. Conception Groundfish Fishermen's Association, GAP
Mr. John Budrick, California Department of Fish and Wildlife, GMT
Mr. John DeVore, Pacific Fishery Management Council