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## **Canadian Science Advisory Secretariat (CSAS)**

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**Pacific Region**

**Proceedings of the Pacific Regional Peer Review on Redbanded Rockfish (*Sebastes Babcocki*) Stock Assessment for the Pacific Coast of Canada in 2014**

**December 9, 2014  
Nanaimo, BC**

**Chairperson and editor: Kate Rutherford**

Fisheries and Oceans Canada  
Science Branch  
3190 Hammond Bay Road  
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## Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

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## SUMMARY

These Proceedings summarize the relevant discussions and key conclusions that resulted from a Fisheries and Oceans Canada (DFO), Canadian Science Advisory Secretariat (CSAS) Regional Peer Review (RPR) meeting of December 9, 2014 at the Pacific Biological Station in Nanaimo, B.C. One working paper focusing on a stock assessment of Redbanded Rockfish for the Pacific coast of Canada was presented for peer review.

In-person and web-based participation included Fisheries and Oceans Canada (DFO) staff from the Science and Fisheries and Aquatic Management Sectors; and external participants from First Nations organizations, the commercial and recreational fishing sectors, environmental non-governmental organizations, and academia.

This RPR did not result in the provision of advice and a Science Advisory Report will not be produced.

The supporting Research Document will be made publicly available on the [Canadian Science Advisory Secretariat](#) (CSAS) website.

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## **Compte rendu de la réunion d'examen par des pairs régionale sur l'Évaluation du stock du sébaste à bandes rouges (*Sebastes babcocki*) sur la côte du Pacifique du Canada en 2014**

### **SOMMAIRE**

Le présent compte rendu résume les discussions et les principales conclusions de la réunion régionale d'examen par des pairs de Pêches et Océans Canada (MPO) et du Secrétariat canadien de consultation scientifique (SCCS) qui a eu lieu le 9 décembre 2014 à la station biologique du Pacifique de Nanaimo, en Colombie-Britannique. Un document de travail sur l'évaluation de stocks de sébaste à bandes rouges de la côte du Pacifique du Canada a été déposé aux fins d'examen par les pairs.

Au nombre des participants en personne ou par conférence Web, il y avait des représentants des secteurs de la gestion des sciences, des pêches et des océans du MPO, d'organisations des Premières nations, des secteurs de la pêche commerciale et récréative, des organismes non gouvernementaux environnementaux et des universités.

Cette réunion d'examen régional par des pairs n'a pas donné lieu à la prestation de conseils et aucun avis scientifique ne sera produit.

L'avis scientifique et le document de recherche à l'appui seront rendus publics sur le site Web du [Secrétariat canadien de consultation scientifique](#) (SCCS).

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## INTRODUCTION

A Fisheries and Oceans Canada (DFO) Canadian Science Advisory Secretariat (CSAS), Regional Peer Review (RPR) meeting was held on December 9, 2014 at the Pacific Biological Station in Nanaimo to review the stock assessment of Redbanded Rockfish (RBR, *Sebastes babcocki*) off the Pacific coast.

The Terms of Reference (TOR) for the science review (Appendix A) were developed in response to a request for advice from the Fisheries Management Branch of DFO. Notifications of the science review and conditions for participation were sent to representatives with relevant expertise from First Nations, commercial and recreational fishing sectors, environmental non-governmental organizations and academia.

The following working paper (WP) was prepared and made available to meeting participants prior to the meeting (abstract provided in Appendix B):

Redbanded Rockfish (*Sebastes babcocki*) Stock Assessment for the Pacific Coast of Canada in 2014, by Andrew M. Edwards, Rowan Haigh and Paul J. Starr. (CSAP WP2014-15/GF04).

The meeting Chair, Kate Rutherford, welcomed participants, reviewed the role of CSAS in the provision of peer-reviewed advice, and gave a general overview of the CSAS process. The Chair discussed the role of participants, the purpose of the various RPR publications (Science Advisory Report, Proceedings and Research Document), and the definition and process around achieving consensus decisions and advice. Everyone was invited to participate fully in the discussion and to contribute knowledge to the process, with the goal of delivering scientifically defensible conclusions and advice. It was confirmed with participants that all had received copies of the Terms of Reference, Agenda and working paper.

The Chair reviewed the Agenda (Appendix D) and the Terms of Reference for the meeting, highlighting the objectives. The Chair then reviewed the ground rules and process for exchange, reminding participants that the meeting was a science review and not a consultation. The room was equipped with microphones to allow remote participation by web-based attendees, and in-person attendees were reminded to address comments and questions so they could be heard by those online

Members were reminded that everyone at the meeting had equal standing as participants and that they were expected to contribute to the review process if they had information or questions relevant to the paper being discussed. In total, 21 people participated in the RPR (Appendix E). Chris Grandin was identified as the Rapporteur for the meeting.

Participants were informed that Jason Cope (NOAA) had been asked before the meeting to provide a detailed written review of the working paper to assist everyone attending the peer-review meeting. Participants were provided with copies of the written review.

This RPR did not result in the provision of advice and a Science Advisory Report will not be produced. The supporting Research Document will be made publicly available on the [Canadian Science Advisory Secretariat](#) (CSAS) website.

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## REVIEW

Working Paper: Redbanded Rockfish (*Sebastes babcocki*) Stock Assessment for the Pacific Coast of Canada in 2014. CSAP WP2014-15/GF04.

Authors: Andrew M. Edwards, Rowan Haigh and Paul J. Starr

Reviewer: Jason Cope, Fishery Resource Analysis and Monitoring Division, Northwest Fisheries Science Center, NOAA, Seattle WA

Chairperson: Kate Rutherford (Groundfish Section, Marine Ecosystems and Aquaculture Division (MEAD), Pacific Biological Station (PBS), DFO)

Rapporteur: Chris Grandin (Groundfish Section, MEAD, PBS, DFO)

Presenter(s): Andrew Edwards (Groundfish Section, MEAD, PBS, DFO)  
Paul Starr (Canadian Groundfish Research and Conservation Society)

Meeting: Dec. 9, 2014, Seminar Room, Pacific Biological Station, Nanaimo BC

## PRESENTATION OF WORKING PAPER

The lead author started the presentation of the working paper (abstract appears in Appendix B). This is the first time that an assessment based on a population model for Redbanded Rockfish had been attempted for BC. The author provided background on the biology, area descriptions and distribution of fishing effort in the trawl and hook and line fisheries.

A slide of fishing effort prompted an industry participant to suggest that it would be useful to plot the Rockfish Conservation Areas and other closed areas on the charts to better understand if RBR is being caught in all possible open areas. With many of the historical hotspots closed there may be an impact on catch reconstructions. It was pointed out that trawl effort was concentrated in the gullies while hook and line was out on the edge.

The lead author summarized the Bayesian catch-at-age model primary inputs, including commercial catch, survey indices, biological data and ageing data. A reconstructed catch history starting in 1940, with pre-1996 catches based on ratios in modern catches, was presented. Catches from 1997 to 2013 were assumed to be known. Discard information was not included but it was thought that the discard rate is about 1% for both gears.

From 1997-2011 there was a combined trip limit for all non-TAC rockfish, which can be seen in the catch reconstruction. In 2011 a TAC of 590 t was set for RBR.

The third author presented a summary of the analyses of trawl survey data. Information on spatial distribution, depth coverage, range of annual CVs and relative biomass indices were presented.

The lead author continued with a presentation on the International Pacific Halibut Commission (IPHC) longline survey data. The main purpose of the IPHC survey is to assess Pacific Halibut (*Hippoglossus stenolepis*) but the author used the available information to obtain a standardized number of RBR per effective skate. An effective skate of 1 is defined as 100 circle hooks with 18-foot spacing. The author described the changes that occurred in survey geographic coverage as well as changes in data collection, such as enumerating only the first 20 hooks in some years and recent bait experiments. The author compared the spatial coverage of the surveys and there was good overlap for all years except for stations off the west coast of Vancouver Island (WCVI); for this reason WCVI data were removed from the analysis. For the remaining surveys there were two series of abundance indices created: Series A covered 1997-

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2012 and was based only on the first 20 hooks; Series B covered 1995, 1996, 2003-2012 and was based on all hooks. The analysis showed that the resulting indices were very similar and allowed the creation of a unified time-series from 1995-2012.

A participant asked whether or not there was a change in the survey design in about 2001-2002 because there appeared to be a clear 'break' in the time series. As far as the authors knew, there were no such changes in the survey. An industry participant recalled that during that period the vessel changed some gear to count bycatch. The industry participant said that the reason for the change was to improve accuracy of the count of all species on the first 20 hooks. It was suggested that the authors should check with the IPHC on those dates, given the drastic change in the series.

A DFO participant pointed out that IPHC corrects for hook saturation when using the survey data in halibut assessments and the abundance of halibut may impact the catch of rockfish, including RBR. The lead author pointed out that there was a high proportion of sets that did not catch RBR and that in the future it may be helpful to use a delta-gamma approach to explicitly deal with zero catches.

The lead author presented a maturity ogive where the first nine years were set to zero, then progressed as a logistic function for older ages. Commercial age data are sparse but do indicate some very large plus groups (fish aged 60+). The survey index fits and the commercial bottom trawl age composition fits showed no clear cohorts.

Recruitment estimates were shown, with the authors pointing out that these estimates were very sensitive to the reweighting assumptions. For instance, large spurious spikes in recruitment were generated by different weighting assumptions, often in different cohorts and not supported by the age data. A short discussion of ageing practices ensued, in which one of the authors mentioned that potentially there was bias in the older ages due to difficulties in determining the precise age.

The lead author described the difficulties with the model. The model fit the surveys well and these fits were similar for all runs. However the model predictions of stock status were sensitive to reweighting of the age data. Several methods were used in an attempt to improve model performance, including paring down the model to the equivalent of a surplus-production model.

The Monte Carlo Markov Chain (MCMC) results (25,000,000 chain length) were unstable which was demonstrated with trace plots. A second MCMC run with a different random number seed was very different from the first. The authors indicated that this drifting in the model estimates showed that the MCMC results cannot be used to provide advice to management.

As an alternative to the model-approach, the authors conducted a trend analysis by fitting a linear regression to each survey series. Results were presented which demonstrated that no trends were significantly different than zero. The strongest trend was found in the IPHC survey which showed a non-significant downward trend.

In summary, due to the issues noted, the authors were unable to estimate current stock status for RBR. They noted that catches have been relatively constant for the last eight years with a TAC of 590 t.

## WRITTEN REVIEWS

### JASON COPE

The review (Appendix C) was presented by phone, accompanied by summary slides.



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The reviewer liked the catch reconstruction and the exploration of the indices of abundance. He agreed that the Bayesian MCMC results were not sufficiently converged for the production of advice to managers.

The reviewer suggested using the mode of the posterior density (MPD) results instead of the MCMC results, as that is acceptable in the U.S. assessments in which he takes part. He also pointed out that there wasn't a list of MPDs provided and that the base case and list of selectivity runs should also have been provided. Because there was no base case provided there was nothing to pivot the sensitivities off of. The reviewer mentioned that *some* recommendation for catch should be produced from this model instead of the status quo of 590 t.

*The authors responded that they could not come up with a base case because the model results were unstable. They also stated that there was no reason to trust the MPD results any more than the MCMC results.*

*One of the authors responded that MSY calculations were not currently implemented in the MPD code for the model. Another author commented that in Canada the MPD results are not used as they are often different from the MCMC results and are considered preliminary to the MCMC results. The MPD results in this model were not reliable either because of the reweighting sensitivity which tended to generate large recruitment spikes.*

The reviewer also suggested that selectivity could be blocked by time or that time varying selectivity could be explored to perhaps make the age composition data fit better.

*The authors responded that there were too few data to do any time-varying selectivity or time-blocked selectivity.*

The reviewer also wondered about the availability of length data for RBR and whether length data may improve the fits. The reviewer suggested using length data converted from ages instead of age data.

*One author explained that models using length data in an age-structured model are not reliable because they perform the backwards conversion of ages to lengths by assuming that fish have average growth. However, it is known that some fish grow faster than others and that this will affect the true length distribution. Length-based models require growth models which calculate the probability of fish growing by length rather than using a simple age-length relationship.*

The reviewer questioned the prior being used on the steepness parameter ( $h=0.674$ ), and mentions that he and his US colleagues have trouble estimating it in their rockfish assessments; steepness often approaches  $h=1.0$ . A DFO participant commented on the steepness parameter, mainly that steepness is confounded with natural mortality and that setting steepness to 1.0 has implications which should be investigated.

*The authors responded that the same prior on steepness has been used since 2010 to model rockfish populations in B.C. and has been accepted previously by participants of the review meetings concerning. Also, previous stock assessments for other rockfish populations (e.g., Pacific Ocean Perch (*Sebastes alutus*), Silvergray Rockfish (*S. brevispinis*), Yellowtail Rockfish (*S. flavidus*)) have shown no correlation between steepness and natural mortality parameters.*

Data-limited methods were discussed, and the reviewer recommended that the authors do more work on these methods during the exploration phase in the future. Tom Carruthers (University of British Columbia) was mentioned, as he has done a lot of work on data-limited methods and authored a few tools to aid in this. An industry participant asked the reviewer if the US had used a DCAC (Depletion-Corrected Average Catch) approach for any analyses. The reviewer responded that they had, but now use a more evolved method of similar origin called DBSRA

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(Depletion-Based Stock Reduction Analysis), which is a Monte Carlo method and therefore requires a prior on the stock status parameter. Tom Carruthers' R package [DLMtool](#) can do either method.

The reviewer asked the authors to provide stronger guidance (detail) on the recommended need for further abundance sampling.

The reviewer suggested incorporation of catch uncertainty into uncertainty estimation as a sensitivity analysis, which could influence some of the problems with the model. He reiterated that if there was a base case then the effects of halving or doubling catch could be examined.

The authors displayed the RBR catch reconstruction plots, one of which excluded POP catch in estimating RBR catches, and the other which included POP catch in the estimation. The subcommittee also took another look at the catch charts, to show that there is not much catch of RBR outside the gullies and canyons eastward of the shelf break. An industry participant noted that there has not been targeting of RBR since 1997. Other species became more important and there were management measures that had an impact on fishing for RBR, including the implementation of the Glass Sponge reef protected areas in 2002, as RBR like these reef areas. A DFO participant had some concerns with the catch reconstruction because there was a lot of misreporting going on in the fishery, mainly in the recording of area of catch. The large amount of RBR caught in Queen Charlotte Sound was questioned.

The reviewer noted that there were a lot of questions around the catch data and suggested that there should be continued work on documenting historical catches and incorporating the uncertainty into the reconstruction.

*The authors responded that this is a fair recommendation but due to time constraints it did not happen for RBR.*

## GENERAL DISCUSSION

After the Reviewer's presentation, the meeting was opened to all participants for general discussion. The chair went through the three main points brought up by the reviewer:

1. This model is unable to provide reference points. What alternatives are there to simply average catch?
2. Can the authors explore other data-limited methods such as DCAC or DBSRA?
3. What advice can we give to managers that the current TAC of 590 t is not too much?
4. Do we accept the paper?

*The authors began with comments on the second point. The authors were aware that DCAC was considered for the 5-rockfish and Skates stock assessments, but had produced unreliable results. They felt that the main difficulty with these approaches is that they require a prior on the stock status parameter, which restricts the outcome to lie within this previously known constraint.*

An industry participant responded that the U.S. uses these methods so it is a valid option in the US that deals with their own management requirements. It is not known if these methods are acceptable in Canada.

*The authors reiterated their contention that the methods require a prior on the stock status which has a strong influence on the outcome.*

A DFO participant asked if the PHMA longline survey was examined for this assessment.

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*The authors replied that the PHMA inshore longline surveys were not included because they do not have a lot of rockfish catch and that the series was very short. They have been examined for previous assessments of other species of rockfish.*

An industry participant made remarks about industry's frustration with the lack of advice produced by this assessment, and the reviewer agreed with him and mentioned that perhaps this lack of advice should have been flagged in the working group stage of the assessment, before all the work and time was put into it.

*The authors commented that the assessment team ran out of time to investigate other methods after the catch-age-model, which had worked well for previous species, was found to be unacceptable for advice. In particular, analysis of the IPHC survey data was a particularly novel part of this work and took considerably longer than expected due to the need for extensive quality control. The authors spoke about the surplus-production equivalent model that was tried due to working group input.*

Meeting participants indicated that we really need a toolbox of many methods depending on the data at hand.

A participant suggested that the group brainstorm this situation to try and come up with some advice from this assessment. The reviewer wondered why this discussion did not happen at a much earlier time, to avoid lack-of-advice problems.

Another industry participant also expressed his frustration with the fact that there seems to have been a pattern of no-advice assessments coming out in the last two years. DFO participants responded to this line of questioning with the fact that many data-limited or data-constrained species have had assessment requests recently, and a pattern of no advice should not be expected into the future.

There was discussion among the group about using average catch as advice. One DFO participant commented that this may be non-precautionary because we know nothing about the recruitment dynamics. If there were suddenly a large hole in the recruitment time series, taking average catch could be harmful to the stock.

After a short group discussion among the authors and CSAP coordinators, the chair addressed participants, summarizing that a new working paper to examine data-limited approaches for Pacific groundfish species would best resolve problems like those encountered in the RBR assessment. This would be tentatively reviewed in May 2015.

The question of whether or not the subcommittee accepts the paper was asked of the group.

The group accepted the paper based on its sound scientific content. It was noted that there is no requirement that advice be provided for acceptance of the paper. The ageless catch-age model could be investigated further and analysts may come back with advice, if possible, in a second document in May 2015. The new working paper on data-limited approaches would help guide such work.

The authors agreed to:

1. Insert a table of model runs including initial spawning biomass, current spawning biomass, and their ratios.
2. Add Rockfish Conservation Areas (RCAs), sponge reef closed areas, and the trawl footprint to the trawl CPUE map.
3. More fully document the sponge reef closures as mentioned above.
4. Comment in the main document on catch uncertainty.

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5. Add a table/plot of length data.
  6. Provide stronger wording in the document on the need for more abundance indices, i.e., more surveys.

## **CONCLUSIONS**

### **CONSENSUS ON PAPER ACCEPTABILITY**

The working paper was accepted based on its scientific content being sound. Required revisions are outlined in the following sections.

### **CONSENSUS ON REDBANDED ROCKFISH ASSESSMENT**

- It was agreed that the paper was not able to provide harvest advice.

### **INSTRUCTIONS TO AUTHORS**

- The authors will insert a table of model runs including initial spawning biomass, current spawning biomass, and their ratios.
- The authors will add RCAs, sponge closures and the trawl footprint to the trawl CPUE map.
- The authors will add additional comments on catch uncertainty into the document.
- The authors will add a table or plot of available length composition data.
- The authors will add stronger wording on the need for more abundance indices.

## **RECOMMENDATIONS**

Authors were advised to examine data-limited approaches for RBR, including the ageless catch-age model.

## **ACKNOWLEDGEMENTS**

The Chair thanks the reviewer, Jason Cope, for his thorough review, as well as all the participants for their involvement, and Chris Grandin for taking on the task of rapporteur. The assistance of the CSAP office in providing support for the meeting is greatly appreciated.

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## APPENDIX A: TERMS OF REFERENCE

### Redbanded Rockfish (*Sebastes babcocki*) Stock Assessment for the Pacific Coast of Canada in 2014

#### Regional Peer Review – Pacific Region

December 9 - 10, 2014

Nanaimo, British Columbia

Chairperson: Kate Rutherford

#### Context

Redbanded Rockfish (*Sebastes babcocki*) is a commercially important species of rockfish that occurs along the entire coast of British Columbia, Canada. It is equally taken by the groundfish trawl fishery and hook and line fishery (including that for Pacific Halibut). The Fisheries Management Branch of DFO has requested that the Redbanded Rockfish coastwide stock be assessed relative to reference points that are consistent with the DFO Precautionary Approach (DFO 2009), and that decision tables be produced that forecast the impacts of varying harvest levels on stock status.

#### Objectives

Guided by the DFO Sustainable Fisheries Framework, particularly the *Fishery Decision-making Framework Incorporating the Precautionary Approach* (DFO 2009), meeting participants will review the following working paper to provide the basis for discussion and advice on the specific objectives outline below:

*Edwards, A. M., R. Haigh, and P. J. Starr. Redbanded Rockfish (Sebastes babcocki) stock assessment for the Pacific coast of Canada in 2014. CSAP Working Paper 2014-15/GF04.*

The working paper will be used to provide advice with respect to the following objectives:

- Recommend reference points consistent with the DFO Precautionary Approach. Include the biological considerations and rationale used to make such a determination.
- Evaluate the current status of the Redbanded Rockfish stock relative to the recommended reference points.
- Provide reasons if formal assessment is not possible.
- Evaluate the consequences of varying constant catches on future population status, providing decision tables and figures of projected biomass.

#### Expected Publications

- CSAS Science Advisory Reports (1)
- CSAS Research Documents (1)
- CSAS Proceedings (1)

#### Participation

- DFO (Science, Fisheries Management, Oceans, Habitat)
- Aboriginal communities
- Province of British Columbia
- External reviewers

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- Industry
  - Non-governmental organizations and other scientists and stakeholders.

**References**

DFO. 2009. [A fishery decision-making framework incorporating the Precautionary Approach](#)

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## APPENDIX B: ABSTRACT OF WORKING PAPER

Redbanded Rockfish (*Sebastes babcocki*) is found along the entire outer coast of British Columbia. It is caught by both the trawl and the hook-and-line commercial fisheries. The average annual commercial catch over the last 10 years (2004-2013) is 407 t, and over the last five years (2009-2013) is 342 t. Catches peaked at an estimated 1,360 t in 1992. The stock of Redbanded Rockfish along the Pacific coast of Canada has never been assessed using a population model.

We attempted to assess the status of the coastwide stock using an annual two-sex catch-at-age model, implemented in a Bayesian framework. The model was tuned to the following data: seven fishery-independent trawl survey series, one fishery-independent hook-and-line survey series, annual estimates of commercial catch since 1940 from the trawl and hook-and-line fisheries, and age-composition data from the commercial fishery and surveys. The same modelling approach has been successfully used to assess stocks of other species of rockfish in Canadian Pacific waters.

However, for Redbanded Rockfish the data proved insufficient to yield reliable results from the model, despite numerous attempts using different assumptions and exclusion of various components of the data. In the simplest configurations we removed all of the age data, somewhat analogous to a surplus production model, but the Markov Chain Monte Carlo algorithm proved unstable.

We are therefore unable to provide specific quantitative advice to fisheries management, such as decision tables involving evaluation of current and future stock status relevant to reference points. We document all available data, including information on the species' biology, catch, fisheries management and our calculations of indices of abundance for the eight fishery-independent surveys. Catches have remained steady over the past eight years. We also present results of linear regressions on the survey indices. None of the regressions show a significant increasing or decreasing trend.

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## APPENDIX C: WORKING PAPER REVIEWS

### REVIEWER – JASON COPE

The assessment team explores the feasibility of providing a stock assessment for the redbanded rockfish (*Sebastes babcocki*) in Canadian waters and I found the purpose of their exploration clearly stated. They outline catch history reconstruction and provided several possible indices of abundance. Age compositions are analyzed and prepared for inclusion in a statistical catch at age model using Bayesian methods to characterize distributions of derived quantities. Several sensitivity runs are explored. The stock assessment team concludes that the behaviour of the Bayesian exploration of likelihood space behaves too poorly to use the results to help inform management. Below I will provide specific areas that could use either clarification or further discussion during the review to hopefully enhance the current working paper.

#### Major topics

\*While I don't disagree with the conclusion that there is some odd behaviour in the Bayesian outputs (especially the sensitivity to the seeds), I am curious why the authors chose not to use MPD estimates and asymptotic variance for management advice. Given the common constraints that Bayesian models can take a long time to run and can limit sensitivity analysis, maximum likelihood estimates/MPD are very commonly put forth for management advice. Despite the subpar Bayesian performance, even those runs did not produce posterior derived quantities that seemed unreasonable. A discussion on what the MPD runs for a proposed base case would look like would be very helpful. MPD discussion is provided for a run and the fits to the indices looked just fine. The age composition fits not so much (see discussion below), but that could be explored further. Selectivity and/or ageing error could be issues (see discussion below). A few other MPDs were discussed, but not anything resembling a proposed base case run. It seems a very important question to ask whether advice from this assessment (which is a substantial amount of work) can better inform a catch limit than what is already being proposed (590 t, the origin of which is not explained). If so, and I think it could, the MPD, various sensitivities, and decision tables are probably the way to go. To be honest, this doesn't look all that different from

\*The fits to the age data were troubling (in the run that was presented), but it seems very likely that could be due to either ageing error or selectivity. I did not see enough of the model runs to know if this was a systematic problem, or one for this particular run, so unable to tell how much of an issue this is. The ageing error runs were a bit ad-hoc

\*I know this is an age structured model, but I was surprised to not see any length compositions included. It is not clear to me if this is a limitation of the modelling framework or just wasn't considered. Selectivity is forced to be age-based, but that may not be a better option than assuming length-based selectivity. Adding length information could also increase data availability (lengths often more available than ages) and integration of uncertainty within the model (e.g., via fitting age and length data directly in the model).

#### Minor topics

\*The stock assessment team does a great job of covering the many possible indices available for this species. The design based approach is standard, but I was surprised the GLM or delta-GLM approaches were not used for all cases. Beyond just the number of zeros (which were not always an issue with some surveys) and decreasing variance (which was likely underestimated anyway), other factors (e.g., vessels, depth, etc.) could affect catchability and thus justify a GLM approach.



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\*I didn't find the reason for not exploring other data-limited methods compelling. Because they were not used in the elasmobranch examples does not seem a good reason to preclude them from possible application for redbanded rockfish. It is not explained what "unreliable results" means. There are also other possible approaches that could have been used. Sensitivity to assumptions should not automatically disqualify a method—there are ways to incorporate such uncertainty into catch recommendations. If the current statistical catch-at-age and even production model versions are not good enough, more reasoning and detail should be provided as to why the other data-limited approaches are also not appropriate.

\*Figure B.1: Is it reasonable to think that catches in the 1990s were at least 3 times the catches in the unregulated and highly active period in the 1960s? I understand and don't dispute the general approach to catch reconstruction, but does this seem reasonable beyond the pure calculations and the increase in Canadian fishing intensity (as mentioned on page 6)? A bit more information explaining or referencing this time period would be beneficial.

### **Edits**

\*In general, I found the attempt to streamline the document by putting all of the detailed information into appendices much more difficult compared to having it in the main document. Maybe a short executive summary could be used to get the main points across, followed by the main document will all of the details. Appendices could then larger bits of information not critical to the understanding of the assessment (e.g. Table B.2).

\*The survey descriptions on pages 6-7 do not match the order presented in the Appendices. Having the order of presentation be the same in both sections would make it easier for the reader to follow. An overall map showing the general coverage of each survey would also be very useful.

\*Outlining all of the sensitivities and the major outputs (e.g., spawning biomass, stock status, MSY, parameter estimates, etc) that were explored would be very useful to know what was looked at and how they affected model output. While the discussion on a few key runs is nice, a table containing important outputs would greatly aid reviewing model performance.

\*Page 34: It is unclear if (or surprising that) no discards are really assumed in all years prior to catch limits. A reference of something supporting this assumption would be very useful.

### **Additional research recommendations**

\*Exploring additional modelling frameworks is highly recommended. Having more flexibility in selectivity options, ageing error, and possibly other factors could greatly improve the ability to integrate all of the data sources. Stock Synthesis is one example of a potential consideration.

\*More exploration of data-limited methods would be an insightful exercise, if not one directly needed to get catch limits.

\*While the call for more biomass surveys is not a bad one (in the sense that ongoing collection of that information should be a priority), there is not guidance provided as to how many years the assessment team recommends. Some idea of how many years they feel is needed is

\*Additional characterization of catch uncertainty for sensitivity analyses is recommended.

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## APPENDIX D: AGENDA

### Regional Peer Review Meeting (RPR)

### Redbanded Rockfish (*Sebastes babcocki*) stock assessment for the Pacific coast of Canada in 2014

December 9-10, 2014

Pacific Biological Station  
Nanaimo, BC

Chair: Kate Rutherford

#### DAY 1 Tuesday, December 9, 2014

Time	Subject	Presenter
09:00	Introductions Review Agenda & Housekeeping CSAS Overview and Procedures	Chair
09:15	Review Terms of Reference	Chair
09:30	Presentation of Working Paper	Author
10:30	<b>Break</b>	
10:50	Overview Written Reviews	Chair + Reviewers & Authors
12:00	<b>Lunch Break</b>	
13:00	Identification of Key Issues for Group Discussion	Group
13:30	Discussion & Resolution of Technical Issues	RPR Participants
14:45	<b>Break</b>	
15:00	Discussion & Resolution of Results & Conclusions	RPR Participants
16:30	Develop Consensus on Paper Acceptability & Agreed-upon Revisions	RPR Participants
17:00	Adjourn for the Day	

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**DAY 2 Wednesday, December 10, 2014**

<b>Time</b>	<b>Subject</b>	<b>Presenter</b>
08:30	Introductions Review Agenda & Housekeeping Review Status of Day 1	Chair
08:45	<i>(As Necessary)</i> Carry forward outstanding issues from Day 1	RPR Participants
09:30	Science Advisory Report (SAR) Develop consensus on the following for inclusion: <ul style="list-style-type: none"><li>• Sources of Uncertainty</li><li>• Results &amp; Conclusions</li><li>• Additional advice to Management (as warranted)</li></ul>	RPR Participants
10:30	<b><i>Break</i></b>	
10:50	Science Advisory Report (SAR) <ul style="list-style-type: none"><li>• Continued</li></ul>	RPR Participants
11:30	Next Steps – Chair to review <ul style="list-style-type: none"><li>• SAR review/approval by participants and timelines</li><li>• Research Document &amp; Proceedings timelines</li><li>• Other follow-up or commitments (<i>as necessary</i>)</li></ul>	Chair
11:45	Other Business arising from the review	Chair & Participants
12:00	<b><i>Adjourn meeting</i></b>	

## APPENDIX E: PARTICIPANTS

Last Name	First Name	Affiliation
<b>DFO</b>		
Acheson	Schon	Science, Groundfish Section
Ackerman	Barry	Fisheries Management, Groundfish
Edwards	Andrew	Science, Groundfish Section
Forrest	Robyn	Science, Groundfish Section
Grandin	Chris	Science, Groundfish Section
Haigh	Rowan	Science, Groundfish Section
Hargreaves	Marilyn	Science, CSAP
Holt	Kendra	Science, Groundfish Section
Tadey	Rob	Fisheries Management, Groundfish
Krishka	Brian	Science, Groundfish Section
Yamanaka	Lynne	Science, Groundfish Section
Rutherford	Kate	Science, Groundfish Section
Workman	Greg	Science, Groundfish Section
Wyeth	Malcolm	Science, Groundfish Section
<b>EXTERNAL</b>		
Cope	Jason	NOAA
Lecomte	Jean-Baptiste	NSERC Visiting Fellowship
Mose	Brian	CIC Trawl
Starr	Paul	Canadian Groundfish Conservation Society & External Expert
Turris	Bruce	Canadian Groundfish Conservation Society
Thompson	Jason	Council of the Haida Nation
Wallace	Scott	David Suzuki Foundation