CIE independent review report on the 2013 STAR --- Darkblotched Rockfish and Petrale Sole Stock Assessment

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Prepared for

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Executive Summary

The 2013 assessments of darkblotched rockfish and petrale sole stocks along the US Pacific Coast, were reviewed by a Stock Assessment Review (STAR) Panel. The STAR Panel met at the Northwest Fisheries Science Center, Seattle, WA from May 13 - 17, 2013. The assessments of the stock done by the stock assessment team (STAT) (composed of stock assessment scientists from the Northwest Fisheries Science Center), were presented to the STAR Panel and the validity of the data, biological and geographical characteristics, assessment procedures, and results were discussed. The Panel operated under the U.S. Pacific Fishery Management Council's Terms of Reference (ToR) for the Groundfish and Coastal Pelagic Species Stock Assessment and Review Process for 2013-2014 (PFMC 2012).

The review aims to evaluate the modification/progress of the stock assessment made in the draft reports, and to ensure that the Pacific Fishery Management Council (PFMC) bases its decisions on the best available information when managing these two species, including providing a scientific basis for setting OFLs and ABCs as mandated by the Magnuson-Stevens Act. The NWFSC provided all the necessary logistic support, background information, documents and further data exploration that were requested by the review panel. The STAR Panel chair, Dr. Tien-Shui Tsou, led the STAR Panel report and communicated the report with the STAT panel members, the STAR Advisory Panel, and other attendees to avoid possible confusion. STAR Panel Members then prepared their individual reviews.

Darkblotched rockfish was declared overfished since the year 2000 and currently is managed under a rebuilding plan. A benchmark assessment for this species with several sensitivity runs were presented by Drs. Vladlena Gertseva and James Thorson on May 13. The draft stock assessment was well prepared with a short review on historical stock assessments and changes in the newly development stock assessment. The new stock assessment presented changed the fleet structure and survey abundance index structure and updated historical landings, comparing with the previous stock assessment, which is based on the observations by the west coast bottom trawl survey and most recent progress on data assimilation. The new stock assessment also used new maturity and fecundity functions based on either updated data or data collected with a wider spatial coverage. Compared with historical stock assessments, the new benchmark assessment also used a fixed natural mortality rate (0.05) based on the maximum observed age of the species, and a fixed stock-recruit steepness (0.779) which is the mean of the prior based on Thorson (2013). The models included in the draft stock assessment report, and those done during the review were solved using the Stock Synthesis platform version 3.24o.

The STAR panel requested a list of questions to explore the influence and rationale of using random vessel effect and ECE (extreme catch event modelled as mixed distributions) assumptions, and the influence of using the updated maturity and fecundity functions on darkblotched rockfish stock assessment. The STAR panel also requested the likelihood profiles given different natural mortality and stock-recruitment

steepness values to understand the influence of using the fixed values of these two parameters.

The darkblotched rockfish assessment was considered to be based on the best available data, and constitutes the best available information on this species along the U.S. West Coast. Some key recommendations for darkblotched rockfish assessment are summarized below:

- Continue the effort on a full Bayesian analysis.
    - Uncertainty considered in a full Bayesian analysis is based on all sources of the uncertainty involved in the model instead of only on natural mortality or steepness. The results from such an analysis should be readily used in a decision table (Punt 1997).
    - The current applications of using fixed natural mortality and steepness in the stock-recruitment relationship are of high uncertainty which can be seen from the likelihood profiles and the changing history of these values in the previous stock assessments.
    - Different MCMC algorithms may be explored in this case. Biological meaningful priors for many of the key parameters combine together with the selection of MCMC algorithms to help convergence of the model to biologically meaningful estimates.
- Estimability of selectivity and natural mortality can be explored in at least three ways: model comparison based on goodness-of-fit; simulation study to explore whether selectivity and/or natural mortality of darkblotched rockfish is estimable based on its data characteristics (Jiao et al. 2012); and data cloning (Lele et al. 2007; Lele 2010).
- Investigate the practical application of Bayesian delta-GLMM with random vessel effect and ECE approach. Consider evaluating 1) model error assumption, such as the assumed probability distributions; 2) model goodness-of-fit and model complexity, such as AIC or DIC depending on the statistical paradigms used in solving models; 3) model predictive ability, such as posterior p-value and cross validation. Simulations and multiple model selection criteria can be considered in the situations when only using one criterion causes lack of credibility.
- Uncertainty of the historical catch is one of the major uncertainties discussed during the review. Beyond continued effort on historical data reconstruction/synthesis, incorporating uncertainty of catch in the model should probably to be explored.
- The “new” maturity and fecundity functions need to be compared with those previously used and biological explanation needs to be provided if large differences were observed.
- Weighting of the data sources, especially when both length and age compositions or conditional age-at-length compositions are used, need to be further explored. Detailed sensitivity analysis should be provided to validate the proposed approach. A simulation study should help explore the influence of using both of them, the appropriate weighting method to be used, and the advantages/disadvantages of using both given different weighting methods.

- A more detailed description of model equations, symbols used in the equations, submodels used in different scenarios, and the priors used should be provided in future reports.

A benchmark assessment was also conducted and presented for petrale sole by the STAT team, Drs. Melissa Haltuch, Kotaro Ono and Juan Valero. Petrale sole was declared overfished in 2011 (stock status continued to be below the target of 25% of unfished biomass) and is currently managed under a rebuilding plan. The newly developed benchmark assessment accommodated restructured catch data, pre-1990s age error matrix and revised commercial CPUE and survey indices. The petrale sole STAT team was well-prepared, communicated the draft analyses effectively, and provided a thorough response to all requests. The STAR panel discussion and requests focused on better understanding the details of the survey index and commercial CPUE standardizations, and how the standardized indices/CPUE were treated in the benchmark stock assessment model. The base model estimate for 2013 spawning depletion (SSB_{2013}/SSB_0) is 22.3%. Both the STAT and STAR panel members agreed that these changes improved the assessment.

The petrale sole assessment done by STAT was considered to be the best scientific information and adequate for evaluating stock status. Some key recommendations for petrale sole assessment are summarized below:

- Devote some effort to a full Bayesian analysis. The current model did use informative priors on natural mortality and steepness in the posterior likelihood profile. However, the results from a full Bayesian analysis should be readily used in a decision table, and uncertainty considered should be based on all sources of the uncertainty involved in the model instead of only on natural mortality or steepness.
- Biological data sampling, such as maturity, fecundity and growth may be updated frequently given the concern of its possible variation across time and space.
- Investigate the practical application of Bayesian delta-GLMM with random vessel effect and ECE approach. Also see suggestion for darkblotched rockfish.
- Uncertainty of the historical catch was one of the major uncertainties discussed during the review. Beyond continued effort on historical data reconstruction/synthesis, incorporating uncertainty of catch in the model should probably be explored.
- Weighting of the data sources, especially when both length and age compositions or conditional age-at-length compositions are used, seem naïve to me although I do not have a solid scientific strategy to provide. Detailed sensitivity analysis should be provided to validate the proposed approach. A simulation study should help explore the influence of using both of them, the appropriate weighting method to be used, and the advantages/disadvantages of using both given different weighting methods.
- Connectivity of the U.S. and Canadian “stocks” has been a high concern. Before a joint US-Canada stock assessment team is organized, extra information on

catch history and CPUE time series from the Canadian side would be beneficial for the U.S stock assessment.

- A more detailed description on model equations, symbols used in the equations, submodels used in different scenarios, and the priors used should be provided in future reports.

1. BACKGROUND

This report reviews the 2013 stock assessments of darkblotched rockfish and petrale sole, off the Pacific Coast at the request of the Center for Independent Experts. I was provided with draft stock assessment reports and web access to relevant files and documents (Appendix 1) and participated in the Stock Assessment Review (STAR) Meeting. Extra documents were provided during the review upon request from the CIE peer review panel (Appendix 1).

Both species have been declared overfished and are currently under rebuilding plans. The last CIE peer reviews of these stock assessments were in 2007 (darkblotched) and 2011 (petrale), and there have been multiple modifications and developments in their assessment methodologies since then. The newly developed stock assessments will provide the basis for the management of these two species off the Pacific Coast.

The review committee was composed of Drs. Tien-Shui Tsou (Chair), Noel Cadigan, Yan Jiao, and Ian Stewart. The review was assisted by Dr. Stacey Miller, Jim Hastie, and John DeVore. The darkblotched rockfish stock assessment report was prepared and was presented at the meeting by Drs. Vladlena Gertseva and James Thorson; the petrale sole stock assessment report was prepared and was presented at the meeting by Drs. Melissa Haltuch, Kotaro Ono and Juan Valero.

2. REVIEW ACTIVITIES

The STAR Panel meeting took place at the Silver Cloud Inn, Seattle, WA from May 13 – 17, 2013. The meeting followed the "tentative agenda" of the STAR review (Appendix 4). The meeting was open to the public and was attended by observers including members of the fishing industry.

About two weeks before the meeting, assessment documents and supporting materials were made available to the review panel via emails and an ftp website. On the morning of May 13 before the meeting, the assessment review committee met with the STAT team to discuss the meeting agenda, reporting requirements, and meeting logistics. Dr. Tien-Shui Tsou (chair of the STAR panel) reviewed the Terms of Reference for Assessment and Review Panel, and tasks/components of the STAR panel report, and assigned reporting duties to each of the STAR members. During the STAR meeting, all documents, including extra documents requested during the review, were made available electronically through an ftp site (Appendix 1).

The draft assessments of these two species were presented by the STAT team to the Panel and other attendees, and the input data, models, parameter estimates, fishery and population status were evaluated through open discussion. The STAT members were always available when required for further discussion, for additional model runs for clarification, and for clarification of how the STAR ToRs were addressed. The ToRs for each species/stock were reviewed to ensure they had been fully addressed. A

conclusion was then drawn on which model to recommend, which data scenario as the base scenario, and whether to accept the assessment as a basis for management of this fishery.

3. ROLE OF INDIVIDUAL REVIEWER

My role as a CIE independent reviewer was to conduct an impartial and independent peer review in accordance with the SoW and the predefined ToRs (Appendix 2) herein. I reviewed reports and related documents provided by the STAR meeting coordinator before the review meeting, and reviewed the presentations and report and participated in the discussion on these documents/presentations during the panel review week. During the review, I helped the STAR panel to organize and prepare the Panel report. After the peer review meeting, I summarized the findings and recommendations according to the predefined ToRs. This review report is formatted according to my interpretation of the required format and content described in Annex 1 of Appendix 2.

4. SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS IN ACCORDANCE WITH THE TERMS OF REFERENCES

I participated in the Panel review meeting to conduct independent peer reviews of the assessments of darkblotched rockfish and petrale sole managed by the Pacific Fishery Management Council. Below I provide the summary of findings of each ToR for each species reviewed in which the weaknesses and strengths are described and conclusions and recommendations are presented in accordance with the ToRs.

4.1. Darkblotched rockfish

4.1.1 *ToR 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.

I reviewed reports and related documents provided by the STAR meeting coordinator before the review meeting, which mainly included the draft STAT stock assessment report, historical stock assessment reports, the last STAR panel report, the ToRs and the supporting documents on data syntheses or prior elicitations. The STAT draft report was well prepared, and included two well-organized sections on historical stock assessments, and the changes made over time in both data syntheses and model construction. These were very helpful in preparing the review.

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

When standardizing CPUE, the newly proposed methods should be further validated. The practical application of Bayesian delta-GLMM with random vessel effect and ECE approach should be explored in several aspects, such as whether the modelled random effect confounded with the "true" trend; whether the extra complexity of ECE is needed.

Uncertainty about the catch history was explored in the draft document, but not quantified or incorporated into the final assessment model or decision table. This may be a substantial source of uncertainty, and could require investigation of catch reconstructions with regard to uncertainty in order to better understand the plausible range for historical estimates. I would also recommend that uncertainty of catch be modelled if it is considerable.

The "new" maturity and fecundity functions were based on either updated data or data collected with a wider spatial coverage. However, the currently used overall spawning output between this stock assessment and the last one were not comparable in the draft report and for the figures provided during the review. The "new" maturity and fecundity functions, and the overall spawning output curve need to be compared with that previously used, and a biological explanation need to be provided if large differences were observed. If new data were used, plots with both observed data and mode fit need to be provided.

4.1.3 *ToR 3* – Evaluate model assumptions, estimates, and major sources of uncertainty.

Compared with historical stock assessments, the new benchmark assessment also used a fixed natural mortality rate (0.05 for female and male mortality was estimated) based on the maximum observed age of the species, and a fixed stock-recruit steepness (0.779), which is the mean of the prior based on Thorson (2013). Different values of these two parameters have been used over time in the previous stock assessments. I considered this as one of the major sources of uncertainty in estimating the fishery and stock status.

The catch is assumed to be deterministic without uncertainty but at the same time historical catch is one of the major uncertainties discussed during the review. So, beyond continued effort on historical data reconstruction/synthesis, incorporating uncertainty of catch in the model should probably to be explored.

The current axis on the decision table is based on natural mortality, which is assumed to be constant for females. Both natural mortality and steepness are of high uncertainty. Future decision analysis may focus on using both of them to indicate states of nature. Again, a full Bayesian analysis would make this step much easier and more scientific.

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

I suggest that more effort should be spent on the development of a full Bayesian analysis given my concerns in ToRs. The results from such an analysis should be readily used in a decision table and uncertainty considered is based on all sources of the uncertainty involved in the model instead of only on natural mortality or steepness. Informative priors on key life history or fishery related parameters can be incorporated in such an analysis also. Different MCMC algorithms may be explored in this case if the Metropolis-Hasting algorithm is not efficient.

Natural mortality, selectivity and catchability were all important parameters in the stock synthesis models. The stock assessment team explored alternative functional forms of selectivity in the newly developed models. Simulation studies are suggested to be used to explore questions in the future including 1) whether natural mortality should be fixed when steepness is fixed; 2) whether natural mortality can be estimated with the life history based empirical natural mortality estimates (such as Hoenig 1983 and Hamel 2013 provided in the background readings) used as priors; and 3) whether both natural mortality and steepness can be estimated with the life history based informative priors.

When applying Bayesian delta-GLMM with random vessel effect and ECE approach, model comparison and selection is needed to find a biologically meaning model and avoid overfitting. It should be worthwhile to consider evaluating 1) model error assumption, such as the assumed probability distributions; 2) model goodness-of-fit and model complexity, such as AIC or DIC depending on the statistical paradigms used in solving models; and 3) model predictive ability, such as posterior p-value and cross validation. If only using one criterion causes lack of credibility, the STAT team may consider simulations as a tool and combining multiple model selection criteria.

Uncertainty of the historical catch is one of the major uncertainties for many species along the Pacific Coast. Beyond continued effort on historical data reconstruction/synthesis, incorporating uncertainty of catch in the model should probably be explored instead of assuming no error in the model.

Weighting of the data sources, especially when both length and age compositions or conditional age-at-length compositions are used, need to be further explored. Detailed sensitivity analysis should be provided to validate the proposed approach. A simulation study to evaluate the weighting strategy and its influence on using both length and age compositions can be conducted for long-term exploration.

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

I consider the assessment represents the best scientific information available for the stock assessment of darkblotched rockfish although improvements or adjustments in model structure development are possible. The review panel considered the assessments sufficient to provide the basis for the management of this fishery.

4.1.6 *ToR 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.

Suggestions for short-term improvement include 1) the "new" maturity and fecundity functions need to be compared with those previously used and a biological explanation need to be provided if large differences were observed; the current overall spawning output between this stock assessment and the last one needs to be compared if different maturity and/or fecundity functions are used; 2) collect new maturity and fecundity data across space and time (a couple of years here) if possible to validate the functions; 3) explore the real application of Bayesian GLMM with ECE for this species based on its biological and geographical characteristics, and based on appropriate model selection criteria; 4) continue the effort on catch data reconstruction and update; and 5) provide the detailed modeling exploration procedure and results on how the catch uncertainty is considered.

Suggestions for long-term improvement include 1) develop a full Bayesian analysis and explore the differences of the results between maximum posterior likelihood estimation and the MCMC outputs for this species; 2) develop a simulation study to explore the estimability of natural mortality and steepness including the possible confounding relationship between them and with other key parameters such as catchability and selectivity; and 3) develop a simulation study to evaluate the weighting strategy and its influence when using both length and age compositions.

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

The STAR Panel meeting took place at the Silver Cloud Inn, Seattle, WA from May 13 – 17, 2013. The meeting followed the "tentative agenda" of the STAR review (Appendix 4) with some flexibility on the time for each species.

On the morning of May 13 before the meeting, the STAR panel met with the STAT team to discuss the meeting agenda, reporting requirements, and meeting logistics. Dr. Tien-Shui Tsou (chair of the STAR panel) reviewed the Terms of Reference for Assessment and Review Panel, and tasks/components of the STAR panel report, and assigned reporting duties to each of the STAR members.

Dr. Tsou also requested to post online all the presentations, the updated presentations, requests from the STAR panel and the responses from STAT teams. Dr. John DeVore posted all the materials from both the STAT and the STAT panels.

The STAT team for darkblotched rockfish stock assessment, Drs. Vladlena Gertseva and James Thorson, then started their presentations on the draft stock assessment. The presentation and discussion extended for the whole day. During their presentations, questions were asked from the STAR instead of waiting till the end of the presentation. The presentation was prepared according to biological and geographic characteristics of darkblotched rockfish, previous stock assessments and declared fishery/stock status from historical stock assessments, data and model structured, base case and sensitivity runs, and then model results. Questions were asked throughout the presentations by the STAR panel. The request from the STAR panels and the responses from the STAT team are listed in Appendix 5. I list the major pertinent discussions and recommendations below.

Questions on the CPUE standardization:

> Does the random vessel effect confound with the real trend of the stock? How to explore it? Is ECE really needed? Which evidence should be explored on whether it is needed or not? Is the estimated trend of the stock sensitive to CPUE standardizations models, here designed based index, GLMM with random vessel effect and Bayesian GLMM with random vessel effect and with ECE?
>
> The discussion on this issue was very effective. The STAR panel found according to STAT team's response on May 15 that 1) this "vessel effect" could be the random draw of survey sites or stations that may or may not have darkblotched; 2) there was no apparent need for ECE; 3) no significant model sensitivity to the ECE treatment. The panel recommended further exploration of ECE treatment in GLMM estimates with different criteria for model selection. This evaluation and the summary of the results used for assessment needs to be species specific.

Questions on the newly updated maturity and fecundity function, and also the overall spawning output function:

> How does the new relationship compare with that from the previous assessment? And how may it influence the stock assessment results?
>
> The discussion on this issue was very effective but the problem was not solved. On May 15, the STAT confirmed the Nichols (1990) study was part of E.J. Dick's maturation analysis of darkblotched rockfish. It was not clear to the STAR panel that the maturity comparison was done appropriately by the

STAT. The overall spawning outputs over weight seem not comparable in scales. This will be double checked for the post-STAR draft of the assessment.

Questions on using fixed natural mortality for both sex:

If the female M is fixed, will male M be estimable? How will this influence the model results?

The discussion on this issue was very effective. On May 15, the STAT provided "new" runs with female M fixed and male M estimated. Both STAR and STAT panels recommended this revision be incorporated into the base case model scenario.

Questions on the approaches to estimate CV for length-at-age:

The discussion on this issue was very effective. On May 15, the STAT provided four more sensitivity runs. Both STAR and STAT panels recommended this revision be incorporated into the base case model scenario. The STAT concluded that there was not enough conditional age data to reliably estimate the CV for older females and males either separately, or as a single parameter. The new proposed base model would fix the CV for older females and estimate CV for young males and females as a single parameter.

Extra explorations and discussions on model fitting and results include Pearson residual plot for conditional age-at-length, hake bycatch age-distributions, estimated full selected F, and model tuning and convergence diagnostics. The exploration and discussion went very well and I found them to be efficient and to contribute to the overall successfulness of the stock assessment review.

There were two runs of requests on the approaches to quantify the uncertain state of nature in the decision table from May 16 and 17. Because the model output was based on a likelihood paradigm, and both natural mortality and steepness were fixed, the likelihood profile given different Ms were flat. The STAT first proposed to use 12.5% and 87.5% quantiles of 2013 spawning output confidence intervals found in the "new" base run. It was not agreed by the STAR panel and the STAR then suggested using the likelihood profile for the lower M bound and the prior distribution for the upper M bound). This is a proxy for actually running a model with estimated natural mortality using the informative prior. The female natural mortalities used to bracket low and high states of nature were 0.037 and 0.082 respectively. It was clear that the range of the states of nature shown as depletion is wide given the proposed low and high states. The STAR panel recommend that the next assessment should focus on an informed M and h priors for darkblotched rockfish. I personally strongly

recommend a full Bayesian analysis to address the state of nature in the decision table.

4.2. Petrale Sole

4.2.1 *ToR 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.

I reviewed reports and related documents provided by the STAR meeting coordinator before the review meeting, which mainly included the draft STAT stock assessment report, historical stock assessment reports, the last STAR panel report, the ToRs and the supporting documents on data syntheses or prior elicitations. The STAT draft report was well prepared, and included two well-organized sections on historical stock assessments, and the changes made over time in both data syntheses and model construction. These were very helpful in preparing the review.

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

The STAR panel discussion and requests focused primarily on better understanding the details of the survey GLMM and fishery CPUE analyses, the appropriateness of the input and extra SDs of survey indices and fishery CPUE, and on the axis of uncertainty for the decision table. The changes made to the base model during the review were either minor (improving the treatment of the extra SD parameter for the survey) or based on new information/interpretation made available during the panel meeting (treatment of the CPUE series). Both the STAT and STAR panel members agreed that these changes improved the assessment.

4.2.3 *ToR 3* – Evaluate model assumptions, estimates, and major sources of uncertainty.

The STAT team was well prepared. The STAR panel recommended some minor changes (see above).

When standardizing commercial CPUE, the newly proposed methods should be further validated. I found the idea of using targeting covariates from PCA analysis interesting. Although the commercial CPUE standardization may not be of high interest for this species, it certainly can be considered for other species from an academic aspect.

Uncertainty about the catch history is a concern for many species. For petrale sole, catch uncertainty was explored through sensitivity analysis to fleet

reconstructions in the draft document, but not quantified or incorporated into the assessment model or decision table.

Connectivity of the U.S. and Canadian “stocks” has been a high concern.

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

A simulation study will help to validate the major concern of using targeting covariates from PCA analysis: does including targeting covariates from PCA analysis improve fit and at the same time improve model prediction?

For the uncertainty about the catch history, I would suggest to continue with historical data reconstruction/synthesis, but at the same time to consider incorporating uncertainty of catch in the model structure if it is still considerable.

Biological data sampling, such as maturity, fecundity and growth may be updated frequently given the concern regarding its possible variation across time and space.

Weighting of the data sources, especially when both length and age compositions or conditional age-at-length compositions are used, need to be further explored. Detailed sensitivity analysis should be provided to validate the proposed approach. A simulation study to evaluate the weighting strategy and its influence on using both length and age compositions can be conducted for long-term exploration.

Before a joint US-Canada stock assessment team is organized, extra information on catch history and CPUE time series from the Canadian side would be beneficial for the U.S stock assessment.

The current axis on the decision table is suggested to be based on natural mortality likelihood profile. A full Bayesian analysis would make the decision table easier to be constructed and more scientific.

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

I consider the assessment represents the best scientific information available for the stock assessment of petrale sole although I suggest that a full Bayesian analysis be developed in the future. The panel endorsed the base case model as the best available science for use in determining stock status and management decisions.

4.2.6 *ToR 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.

Suggestions for short-term improvement include 1) collect biological sampling data, such as maturity, fecundity and growth more frequently given the concern on its possible variation across time and space; 2) continue the effort on catch data reconstruction and update. Provide detailed modeling exploration procedure and results on how the catch uncertainty is considered; 3) explore the influence of the informative priors of natural mortality and steepness by increasing the variance of them.

Suggestions for long-term improvement include 1) develop a full Bayesian analysis and explore the differences of the results between maximum posterior likelihood estimation and the MCMC outputs for this species; 2) develop a simulation study to evaluate the weighting strategy and its influence when using both length and age compositions; 3) promote a joint US-Canada stock assessment team.

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

Members of the STAT team for petrale sole stock assessment, Drs. Melissa Haltuch, Kotaro Ono, and Juan Valero, started their presentations on the draft stock assessment on Tuesday morning, May 14. The presentation and discussion extended for the whole day. During their presentations, questions were asked from the STAR instead of waiting till the end of the presentation. The presentation were prepared according to biological and geographic characteristics of darkblotched rockfish, previous stock assessments and declared fishery/stock status from historical stock assessments, data (including data synthesis) and model structured (base case and sensitivity runs), and then model results. Questions were asked throughout the presentations by the STAR panel. The request from the STAR panels and the responses from the STAT team were listed in Appendix 5. Overall the discussions have been mainly on the details of the data, use of commercial CPUE and survey indices, and the appropriate axis of uncertainty for the decision table. The STAR recommended very limited changes to STAT's proposed base model in the draft stock assessment. Below, I list the major pertinent discussions and recommendations.

Questions on the CPUE standardization:

Does the random vessel effect confound with the real trend of the stock? How to explore it? Is the estimated trend of the stock sensitive to CPUE standardizations models, here designed based index and GLMMs with or without random year:strata effect. Is the data filtering approach appropriate when dealing with commercial CPUE and is the model validation on commercial CPUE standardization enough?

The discussion on this issue was very effective. The STAR panel found according to the STAT team's response on May 15 that 1) vessel effects were small and varied without trend over time which does not indicate a confounding problem; 2) no significant model sensitivity to the random/fixed effect treatment and model selection is provided; and 3) commercial CPUE standardization needs to be further validated.

Questions on dealing with input SEs and extra variance parameters when using survey indices and fishery CPUE in SS3:

The discussion on this issue was very effective. The STAR panel suggested to increase the input SE of the commercial CPUE to the level of survey index NWFSC, and set the prior of NWFSC extra variance parameter with a lower bound of zero because the estimation was less than zero without this prior. On May 15, the STAT provided "new" runs with above suggested modifications. Both STAR and STAT panels recommended these revisions be incorporated into the base case model scenario.

Extra explorations and discussions on further clarification of the work include the following: what depth selection was used by fishery CPUE index? Are there patterns in von Bertalanffy residuals by year? How is the pattern of the discarded catch by fleet over time? Check for model convergence for the sensitivity run with NWFSC 2012 age composition data removed? Report statistics on jitter analyses for the new base model. What component(s) produced the increase in the total likelihood profile for Ro? These explorations and discussions went very well and I found them to be efficient and to contribute to the overall successfulness of the stock assessment review.

There were two runs of requests on the approaches to quantify the uncertain state of nature in the decision table from May 16 and 17. The first one was to Provide M and h sensitivity analyses, based on their ranges from hessian-based intervals; the second one was to consider a wider range of M and h that are about 1.2 NLL points away from the base. The STAR panel felt that the asymptotic interval was too narrow and suggested the use of the likelihood profile for the lower and upper bounds of M (1.2NLL units).

5. SUGGESTIONS FOR IMPROVEMENTS OF NMFS REVIEW PROCESS AND PRODUCTS

The current review process looks very well designed. I consider the review proceedings and discussions effective and I believe that they will improve the stock assessment in the future. The review can be further improved if the presentations used in the review meeting can be distributed to the STAR panel a few days earlier before the meeting, if the agenda can be enforced to a degree,

and if a follow-up review can be conducted in the near future. A systematic sensitivity analysis will further help our understanding of this stock but full Bayesian analysis is time consuming and seems not appropriate to be required to finish in one to two nights. The STAR review and discussion should be implemented more effectively by this extra follow-up review.

6. Acknowledgements

I would like to thank all the Stock Assessment Team members contributing to the meeting for their informative presentations on the stock assessments of these two species and for providing helpful and patient responses to the review panel's questions. Many thanks also to the Panel Advisors and observers at the meeting for their contribution to the discussions throughout the meeting. Special thanks also go to the other members of the review panel for productive discussions on the assessments.

7. References

Dick, E.J. 2009. Modeling the reproductive potential of rockfishes (*Sebastes spp*.). Ph.D. Dissertation, University of California, Santa Cruz.

Hamel, O.S. 2013. Development of prediction intervals and priors for the natural mortality rate using multiple meta-analyses using life-history correlates. DRAFT for Data Moderate Assessment Review, April 2013.

Hoenig, J.M. 1983. Empirical use of longevity data to estimate mortality rates. Fishery Bulletin. 82: 898-902.

Jiao, Y., Smith, E., O'Reilly, R., and Orth, D. 2012. Modeling nonstationary natural mortality in catch-at-age models: an example using the Atlantic weakfish (*Cynoscion regalis*) fishery. ICES Journal of Marine Science 69:105-118.

Lele, S. R., Dennis. B., and Lutscher, F. 2007. Data cloning: easy maximum likelihood estimation for complex ecological models using Bayesian Markov chain Monte Carlo methods. Ecology Letters. 10: 551-563.

Lele, S.R. 2010. Model complexity and information in the data: Could it be a house built on sand? Ecology. 91: 3493-3496.

Nichol, D. 1990. Life history examination of darkblotched rockfish (*Sebastes crameri*) off the Oregon coast. M.S. Thesis. Oregon State University, Corvallis, OR.

Pacific Fishery Management Council. 2012. Terms of Reference for the Groundfish and Coastal Pelagic Species Stock Assessment and Review Process for 2013-2014.

Punt, A., and Hilborn, R. 1997. Fisheries stock assessment and decision analysis: the Bayesian approach. Reviews in Fish Biology and Fisheries. 7: 35-63.

Thorson. J. 2013. Estimating a Bayesian prior for steepness in Pacific rockfishes (*Sebastes spp.)* off the U.S. West Coast for the 2013 assessment cycle. Draft.

Appendix 1: List of Documents Provided as Background Material

Draft Stock Assessment Documents:

Haltuch, M.A., Ono, K., and Valero, J. 2013. DRAFT Status of the U.S. petrale sole resource in 2012. Pre-STAR version.

Gertseva, V., and Thorson, J.T. 2013. DRAFT Status of the darkblotched rockfish resource off the continental U.S. Pacific Coast in 2013. Pre-STAR version.

Background Materials:

NWFSC Observer Program (a.k.a.WCGOP). Data Products for Stock Assessment Authors. *Jan. 2013.*

Hamel, O.S. 2013. 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.

Thorson. J. 2013. Estimating a Bayesian prior for steepness in Pacific rockfishes (*Sebastes* spp.) off the U.S. West Coast for the 2013 assessment cycle. April 1, 2013.

Chen et al. 2011. Petrale Sole Stock Assessment Review (STAR) Panel Report. 20-24 June 2011.

Haltuch, M.A., Hicks, A., and See, K. 2013.Status of the U.S. petrale sole resource in 2010. 23 November, 2011.

Cook, R. et al. 2009. Petrale Sole STAR Panel Report. May 4-8, 2009.

Haltuch, M.A., and Hicks, A. 2009. Status of the U.S. petrale sole resource in 2008. 17 November, 2009.

Scientific and Statistical Committee. 2009. Scientific and Statistical Committee Report on Stock Assessments for 2011-2012 Groundfish Fisheries. PFMC, SSC. June, 2009.

Scientific and Statistical Committee. 2011. and Statistical Committee Report on Stock Assessments for 2013-2014 Groundfish Fisheries. PFMC, SSC. June, 2011.

Scientific and Statistical Committee. 2011. Scientific and Statistical Committee Report on Stock Assessments for 2013-2014 Groundfish Fisheries. PFMC, SSC. September 2011.

Scientific and Statistical Committee. 2011. Scientific and Statistical Committee Report on Stock Assessments for 2013-2014 Groundfish Fisheries. PFMC, SSC. November, 2011.

Stephens, A., Hamel, O., Taylor, I., and Wetzel, C. 2011. Status and Future Prospects for the Darkblotched Rockfish Resource in Waters off Washington, Oregon, and California in 2011. November, 2011.

Wallace J.R., and Hamel O.S. 2009. Status and Future Prospects for the Darkblotched Rockfish Resource in Waters off Washington, Oregon, and California as Updated in 2009. June 24, 2009.

Jagielo, T. et al. 2007. Darkblotched Rockfish STAR Panel Meeting Report. July 16-20, 2007.
Hamel, O.S. 2008. Status and Future Prospects for the Darkblotched Rockfish Resource in Waters off Washington, Oregon, and California as Assessed in 2007. January 24, 2008.
Karnowski, M., Gertseva, V. and Stephens, A. 2012. Historical Reconstruction of Oregon's Commercial Fisheries Landings. September, 2012.
Ralston, S., Pearson, D., Field, J., and Key, M. 2009. Documentation of the California Catch Reconstruction Project. April 20, 2009.
Wallace, J.R. 2013. DRAFT -Applying the U.S. West Coast's First Major Trawl Bycatch and Mesh Size Studies to Fishery data using Post-hoc Fishing Strategies and Geographical Area.

Additional Materials Provided During the Panel:

Methot, R.D. 2012. Stock Synthesis User Manual. NOAA Fisheries, Seattle, WA.
Methot, R.D. 2012. Stock Synthesis Technical Description. NOAA Fisheries, Seattle, WA.
Thorson, J.T., Stewart, I.J., and Punt, A.E. 2012. Development and application of an agent-based model to evaluate methods for estimating relative abundance indices for shoaling fish such as Pacific rockfish (*Sebastes spp.).* ICES Journal of Marine Science, 69(4), 635–647. doi:10.1093/icesjms/fss003.
Thorson, J.T., Stewart, I.J., and Punt, A.E. 2011. Accounting for fish shoals in single- and multi-species survey data using mixture distribution models. CJFAS – Proof.
Thorson, J.T. and Ward, E.J. *In press.* Accounting for space-time interactions in index standardization models.

Appendix 2: Statement of Work for Dr. Yan Jiao

External Independent Peer Review by the Center for Independent Experts

Stock Assessment Review (STAR) Panel for Darkblotched rockfish and Petrale Sole

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: A benchmark assessment will be conducted for darkblotched rockfish, a species declared overfished and currently managed under a rebuilding plan. The 2012 assessment update encountered dramatic changes in stock structure, as observed by the west coast bottom trawl survey. A benchmark assessment is needed to re-evaluate and resolve assessment issues related to these changes and their relationship to stock-recruit steepness.

A benchmark assessment will be also be conducted for Petrale sole, a species declared overfished and currently managed under a rebuilding plan. A benchmark assessment is required to accommodate a restructuring of the model's catch data. It is also expected that the 2013 assessment will indicate that the stock has been rebuilt.

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 2013, except for the than Pacific hake, to provide a level of consistency between the STAR panels. The 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: Each CIE reviewer shall conduct an independent peer review during the panel review meeting scheduled in Seattle, Washington during the dates of 13-17, May 2013.

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 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;
- Previous stock assessments and STAR Panel reports for Darkblotched rockfish and Petrale sole;
- 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 panel review meeting in Seattle, Washington during the dates of 13-17 May 20113.
3) In Seattle, Washington during the dates of 13-17 May 2013 as specified herein, and conduct an independent peer review in accordance with the ToRs (**Annex 2**).
4) No later than 31 May 2013, 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**.

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

April 8, 2013	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact
April 29, 2013	NMFS Project Contact sends the CIE Reviewers the pre-review documents
May 13-17, 2013	Each reviewer participates and conducts an independent peer review during the panel review meeting
May 31, 2013	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
June 14, 2013	CIE submits CIE independent peer review reports to the COTR
June 21, 2013	The COTR distributes the final CIE reports to the NMFS Project Contact and regional Center Director

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

Acceptance of Deliverables: Upon review and acceptance of the CIE independent peer review reports by the CIE Lead Coordinator, Regional Coordinator, and Steering Committee, these reports shall be sent to the COTR for final approval as contract deliverables based on compliance with the SoW and ToRs. As specified in the Schedule of Milestones and Deliverables, the CIE shall send via e-mail the contract deliverables (CIE independent peer review reports) to the COTR (William Michaels, via William.Michaels@noaa.gov).

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

(3) the CIE reports shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

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

Support Personnel:

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

Manoj Shivlani, CIE Lead Coordinator
Northern Taiga Ventures, Inc.
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shivlanim@bellsouth.net Phone: 305-383-4229

Roger W. Peretti, Executive Vice President
Northern Taiga Ventures, Inc. (NTVI)
22375 Broderick Drive, Suite 215, Sterling, VA 20166
RPerretti@ntvifederal.com Phone: 571-223-7717

Key Personnel:

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Phone: 541-867-3412

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 for Darkblotched rockfish and Petrale Sole

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.

Appendix 3: Panel Membership or other pertinent information from the panel review meeting

Participants
Stock Assessment Review Panel for
Petrale Sole and Darkblotched Rockfish

Silver Cloud University Inn
5036 25th Avenue NE,
Seattle, WA 98105
Phone: (206) 526-5200
May 13-17, 2013

Technical Reviewers
Tien-Shui Tsou, Scientific and Statistical Committee (SSC), Panel Chair
Yan Jiao, Center for Independent Experts (CIE)
Noel Cadigan, Center for Independent Experts (CIE)
Ian Stewart, International Pacific Halibut Commission

Panel Advisors
John DeVore, Pacific Fishery Management Council (PFMC), Staff Officer
Rob Jones, PFMC Groundfish Management Team (GMT)
Pete Leipzig, PFMC Groundfish Advisory Subpanel (GAP)

Stock Assessment (STAT) Teams
Petrale Sole STAT
Melissa Haltuch, Northwest Fisheries Science Center
Kotaro Ono, University of Washington
Juan Valero, Center for the Advancement of Population Assessment Methodology

Darkblotched Rockfish STAT
Vladlena Gertseva, Northwest Fisheries Science Center
James Thorson, Northwest Fisheries Science Center

Appendix 4: Agenda - Stock Assessment Review (STAR) Panel for Petrale Sole and Darkblotched Rockfish

Silver Cloud University Inn
5036 25th Avenue NE,
Seattle, WA 98105

May 13-17, 2013

Monday, May 13, 2013

8:30 a.m. Welcome and Introductions

9:15 a.m. Review the Draft Agenda and Discuss Meeting Format (T. Tsou, 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 Darkblotched rockfish Assessment (V. Gertseva)
- Overview of data and modeling

12:30 p.m. Lunch (On Your Own)

1:30 p.m. Q&A session with Darkblotched rockfish STAT

STAR Panel discussion
- Panel develops written request for additional model runs / analyses

3:30 p.m. Presentation of Petrale sole Assessment (M. Haltuch) (if time allows)
- Overview of data and modeling

5:30 p.m. Adjourn for Day.

Tuesday, May 14, 2013

8:30 a.m. Continue Presentation of Petrale sole Assessment (M. Haltuch)
- Overview of data and modeling

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

1:30 p.m. Q&A Session with Petrale sole-STAT

Panel Discussion
- Panel develops written request for additional model runs / analyses

4:30 p.m. Check in with Darkblotched rockfish -STAT

5:30 p.m. Adjourn for Day.

Wednesday, May 15, 2013

8:30 a.m. Presentation of First Set of Model Runs for Darkblotched (V. Gertseva)
- Q&A session with the Darkblotched -STAT & Panel discussion
- Panel develops written request for second round of model runs / analyses for Darkblotched -STAT

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

1:30 p.m. Presentation of First Set of Model Runs for Petrale sole (M. Haltuch)
- Q&A session with Petrale sole -STAT & Panel discussion

- Panel develops written request for second round of model runs / analyses for Petrale sole -STAT.

5:30 p.m. Adjourn for day.

Thursday, May 16, 2013

8:30 a.m. Presentation of Second Set of Model Runs for Darkblotched
- Q&A session with the Darkblotched -STAT & 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 for Petrale sole
- Q&A session with the Petrale sole -STAT & 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, May 17, 2013

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

10:00 a.m. Panel Report Drafting Session

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

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

4:00 p.m. Panel Agrees to Process for Completing Final STAR Report by Council's June Meeting Briefing Book Deadline (May 29th)

5:30 p.m. Review Panel Adjourn.

Appendix 5: list of requests from STAR panel and the STAT responses.

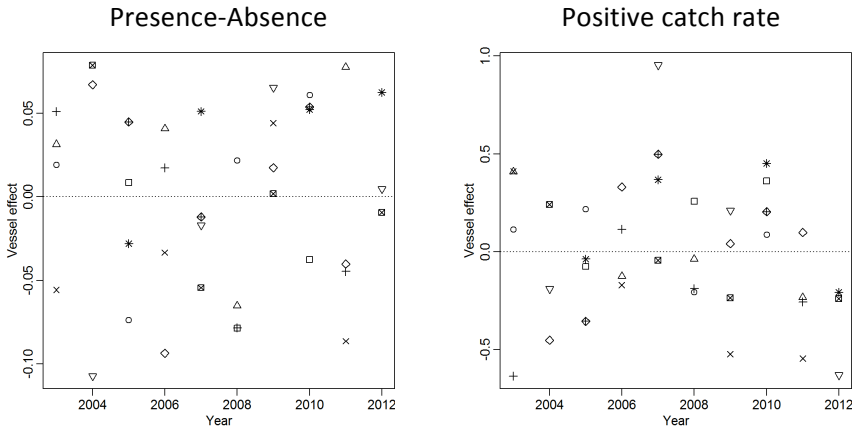
Requests by the STAR Panel for the darkblotched rockfish stock assessment

1. ***Request*:**
   a. Plot the estimated GLMM vessel effect coefficients over time from the two sides (presence-absence, positive catch rate) of the NWCOMBO model. Specifically, the posterior modes from each year from each vessel with a reference line at zero.
   b. Plot the mean of the log catches vs. the SD of the log catches, for each year and strata combination on one plot.
   c. Plot a comparison of the design-based index series, the GLMM-based result, and the GLMM with the ECE-based result for the NWCOMBO survey.

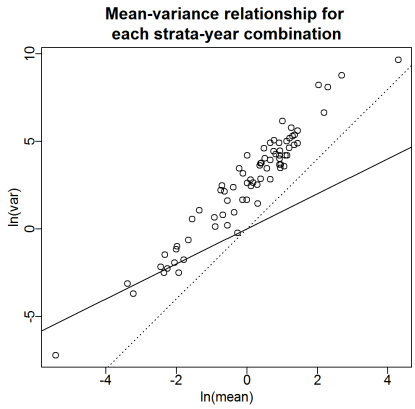
***Rationale*:** Request "a" could reveal potential confounding between random vessel effects and actual trends in the surveyed stock over time. Request "b" will illustrate the need for adding the ECE implementation to the standard GLMM. Request "c" will indicate the sensitivity of the resulting index to the method employed.

Results:

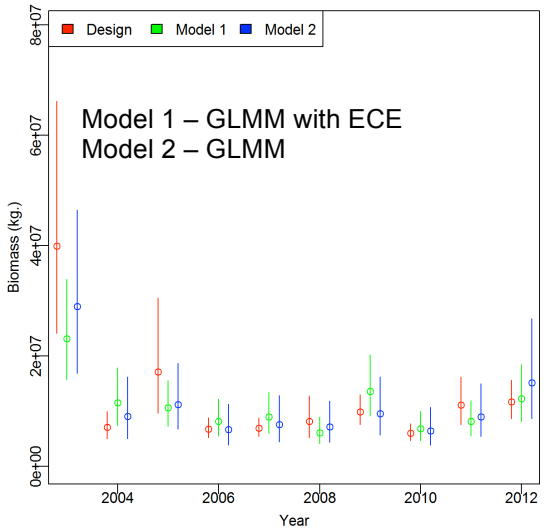
a. Vessel effects were small in the presence:absence of darkblotched (creating a relatively noisy survey), but larger for positive catch rates; however, there were some trends in the time series of vessel effects for positive catches (e.g. 2010-2012) which indicated the possibility of confounding with year effects. One reason for this "vessel effect" could be the random draw of survey sites or stations that may or may not have darkblotched. Therefore, there may not be a vessel effect on darkblotched catching efficiency; this may be more of a random station effect. Also see figures below:



b. No apparent needs for ECE.



c. Year 2003 was the extreme catch event year and all models showed this catch event that year, although the model with ECEs less so. The design-based model had consistently smaller confidence intervals for the lowest index values. However, the plot did not indicate significant model sensitivity to an ECE treatment.



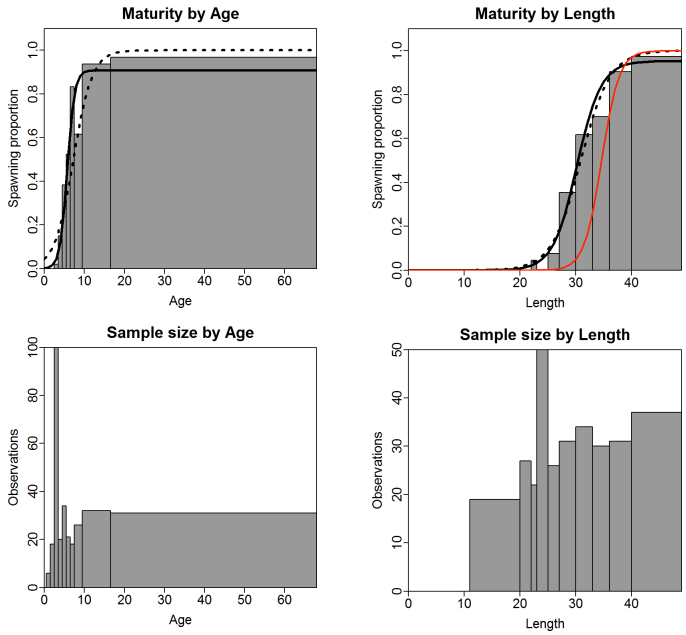
There were further discussions about model selection criteria. The darkblotched STAT chose between the ECE-based gamma and lognormal error distributions based on goodness-of-fit and matching the variance in the error distribution using Q-Q plots. A design-based model was summarily rejected since it does not include a random vessel effect. Model strata were chosen a priori. The panel recommended further exploration of ECE treatment in GLMM estimates with different criteria for model selection. This evaluation and the summary of the results used for assessment needs to be species specific.

2. **Plot the newly collected maturity data binned both by age and by size. On the age-plot, add the model fit. Overlay the 2011 maturity-at-size model on the size-plot.**

***Rationale*:** These are new unpublished data and (despite model constraints) it is important to establish that the logistic model is fitting the data adequately, and to evaluate how the new relationship compares with that from the previous assessment.

Results: Maturity as a function of length looks smooth and is the preferred approach compared to modeling maturity as a function of age. However, asymptotic proportion mature appears to be less than one. Atresia has been observed in mature darkblotched females. It is not possible to account for atresia in the current version of SS3 when maturity is a function of length. Therefore, maturity by age was modeled in this assessment. There was a substantial change in the maturity ogive compared to the 2011 assessment update, with the maturity shift at the peak of the stock's yield curve. The previous maturity ogive was based on an earlier study (circa 1990) in which maturity was determined histologically but was limited to one part of the OR coast. The newer maturity information shows a significantly higher maturity at younger ages and the presence of some atresia at older ages.

The new maturity parameters were used in the proposed base model because it provides samples from a broader range of the species' distribution.

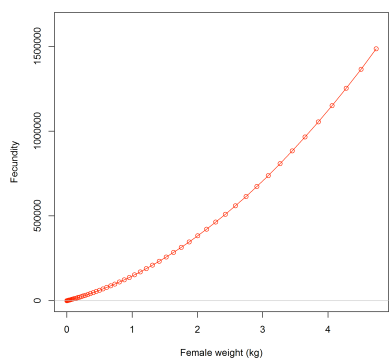


3. **Plot the 2011 fecundity relationship with the newer curve used this year; also show sensitivity of model output to this change if this was not reflected in the tabled sensitivity results.**

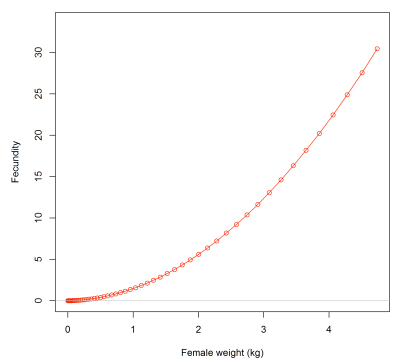
Rationale: The sensitivity in Table 14 appears to use fecundity proportional to spawning biomass and not the 2011 fecundity relationship, which differs from the curve used in this assessment.

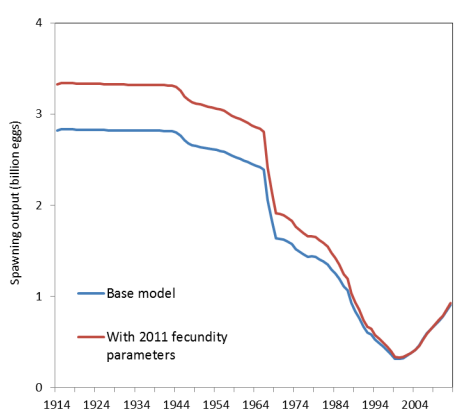
Results: There was more curvature in the 2011 fecundity-weight relationship; the 2013 assessment used the relationship provided by E.J. Dick in his dissertation. The STAT also plotted the spawning output time series varying only the fecundity-weight relationship from the 2011 assessment and that of the 2013 assessment. The big change was in the equilibrium, unfished spawning output; it was lower using the new fecundity-weight relationship which resulted in a lower depletion ratio clarification provided by the STAT indicated that the newer fecundity relationship included the data from which the older values had been derived in addition to several other sources. Exploring the darkblotched fecundity relationship is a research recommendation.

2013 assessment



2011 assessment





Model	Base	With 2011 fecundity parameters
Negative log-likelihood		
Total	1400.71	1400.91
Indices	-12.34	-12.40
Length frequencies	445.05	445.24
Age frequencies	1004.82	1004.80
Selected parameters		
Ln(R_0)	7.67	7.67
Steepness (h)	0.779	0.779
Female M	0.05	0.05
Male M	0.05	0.05
Female L at A_{min}	2.27	2.27
Female L at A_{max}	42.72	42.72
Male L at A_{min}	2.27	2.27
Male L at A_{min}	37.97	37.97
Female von Bert K	0.198	0.198
Male von Bert K	0.239	0.239
Management quantities		
Equilibrium spawning output (million eggs)	2,821	3,327
2013 Spawning depletion	32%	28%

4. **Run an alternate model with sex-specific M; specifically estimate the value for males holding the value for females at 0.05. Compare this with the base case.**

***Rationale*:** Dimorphic growth is often accompanied by different rates of natural mortality. Although the data are insufficient to estimate M for both males and females, if female M is fixed then the compositional data should be informative about the difference in M between the sexes. Estimating at least one sex would capture more of the uncertainty in the model results. The anticipation is that the male natural mortality is likely to be greater than that for females.

Results: Male M was estimated to be 0.67, which is higher than female M (0.05) as expected. The total negative log likelihood was lower and the model converged well. The STAT recommended this model change. SSB depletion for this model is 35%.

5. **Report tuning results by fleet and data source; specifically, input vs. harmonic mean effective sample sizes, input σs vs. RMSE for surveys, mean body weights, and discard ratios.**

***Rationale*:** Need to see the results of the methods that were documented and applied.

Results: The AFSC slope survey tuning exhibited the biggest change of fit. However, since that survey only had 4 data points and was a flat fit, it had little effect on model results. Discard ratios had a big tuning difference since the years were time blocked (for the retention curve asymptote) to approximate the WCGOP annual total mortality estimates of darkblotched discards.

6. **Add to the table listing parameter estimates, the error distributions assumed for each data source.**

***Rationale*:** The data summary figure (Figure 7 in the draft assessment) is helpful, but a tabular summary would help specify the specific approach used in this stock assessment.

Results:

Data sources used	Error distribution assumption
Catch	Assumed to be known without error (uncertainty explored via sensitivity analysis)
Abundance	Lognormal
Length composition	Multinomial
Age composition	Multinomial
Mean body weight	Normal
Discard	Normal

7. **Run an alternate sensitivity assuming a single CV young parameter for both sexes. Then, in a second run, try estimating the CV for old fish freely, but only one parameter for both sexes. If time permits, (and the second run was successful) estimate the CV for old fish for each sex separately, and consider adjusting Amax.**

***Rationale*:** The CV for length at age is often an important parameter in defining equilibrium unfished biomass levels. Estimating the CV for young (Age-0) males seems redundant. SS can be configured to use the same value for females, even when parameters are directly estimated for each sex. This may improve the estimability of the CVs for old fish, especially if Amax is reduced from -999 to something within the range of the data.

Results: The STAT concluded that there was not enough conditional age data to reliably estimate the CV for older females and males either separately, or as a single parameter. Estimating CVs for all life stages caused an implausible growth gradient. Also, the estimated values for CV old were very close to those estimated outside the model and fixed in the base case.

The new proposed base model would fix the CV old for both sexes at the value estimated outside the model, and estimate CV young for males and females as a single parameter (female CV young is estimated and male CV young is set to be equal to estimated value of female CV young). Including more of the historical age data (particularly from California) via a reconfiguration of the fleet structure and/or ageing of additional historical samples may solve this problem and allow free estimation of CVs for young and old fish in future assessments. A new base case would also include a slight change in setting of A1 and A2 (ages associated with L1 and L2 in the von Bertalanffy growth model used in the model).

Model	Base	CVyoung the same for both sexes	Female CVold estimated	CVold estimated for both sexes	With 2011 A_1 andA_2 settings
Negative log-likelihood					
Total	1400.71	1401.56	1400.14	1399.74	1391.31
Indices	-12.34	-12.35	-12.37	-12.39	-12.50
Length frequencies	445.05	444.92	450.53	449.48	452.53
Age frequencies	1004.82	1005.80	998.93	999.64	987.75
Selected parameters					
Ln(R_0)	7.67	7.67	7.66	7.66	7.66
Steepness (h)	0.779	0.779	0.779	0.779	0.779
Female M	0.05	0.05	0.05	0.05	0.05
Male M	0.05	0.05	0.05	0.05	0.05
Female L at A_{min}	2.27	2.24	2.26	2.25	2.27
Female L at A_{max}	42.72	42.71	42.82	42.76	42.72
Male L at A_{min}	0.00	0.00	0.00	0.00	0.00
Male L at A_{min}	37.97	37.98	38.02	38.03	37.97
Female CV young	0.127	0.132	0.137	0.137	0.112
Male CV young	0.139	0.000	0.000	0.000	0.000
Female CV old	0.046	0.046	0.042	0.044	0.045
Male CV old	0.046	0.046	0.000	0.041	0.041
Female von Bert K	0.198	0.198	0.197	0.198	0.198
Male von Bert K	0.239	0.239	0.238	0.238	0.239
Management quantities					
Equilibrium spawning output (million eggs)	2,821	2,819	2,803	2,803	2,821
2013 Spawning depletion	32%	32%	31%	31%	32%

8. **Plot the Pearson residuals for conditional age-at-length for NWCOMBO survey ages.**

Rationale: If fixed CVs for old fish are causing lack of fit it should be evident in the residuals.

Results: There were some large residuals, especially for male age-at-length samples in some years which indicates noisy data. The error assumption may not be particularly robust which can be addressed with the previous research recommendation to supplement the ageing samples by ageing older and larger fish.

9. **If time permits, plot the at-sea hake bycatch age-distributions.**

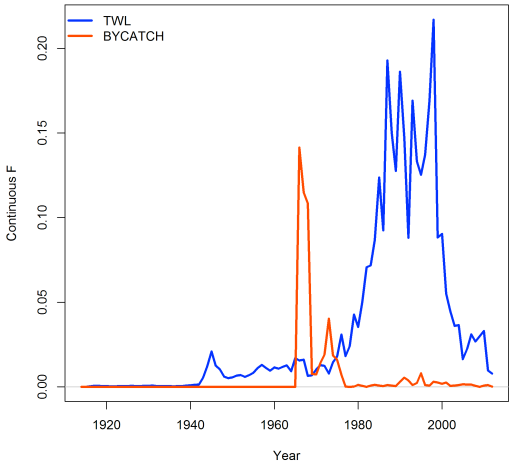
Rationale: These data might provide information on the degree of dome-shape for the trawl fishery.

Results: Sample sizes are small, yet the annual patterns did not appear to be significantly different that for bottom trawl. The patterns and comparisons did not provide compelling evidence of dome-shaped fishery selectivity. It is recognized that the age data are limited in this model reinforcing the recommendation to enhance the ageing of historical samples.

10. **Plot the fishing mortality rates (fully selected F, or sum of Fs) by fleet.**

Rationale: To assist in understanding the length and age composition time series.

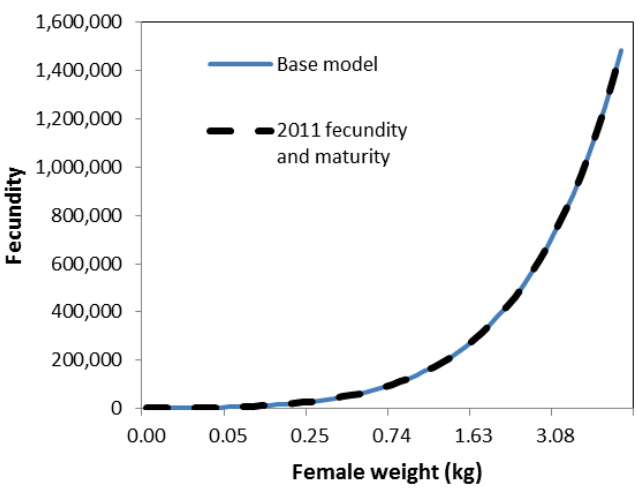
Results:

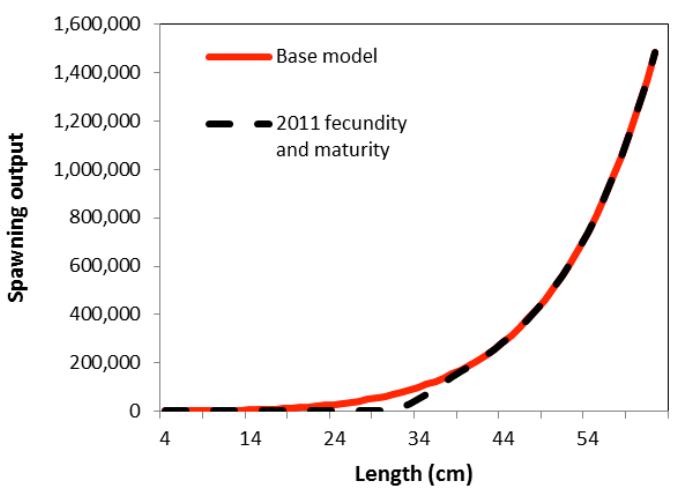


11. **Plot the fecundity at weight relationship used in this assessment and the relationship used in 2011 in the same units (slide 6 of STAT day 1 response-combine the two plots into 1 panel). Make a second plot which adds the spawning output at length based on the 2011 base case model fecundity and maturity parameters to the data plotted in figure 46 (in the draft document), again using equivalent units.**

***Rationale*:** It would be helpful to be able to make a direct comparison of the changes that have been made between the two models.

Results: The STAT confirmed the Nichols 1990 study was part of E.J.'s maturation analysis of darkblotched. The graphs (provided after the review) below show that the estimates are identical for fecundity at weight and extremely similar for spawning output per length.





12. **Present a comprehensive set of results and diagnostics (fit to data and residuals) for the revised base case model reflecting changes made as a result of the Day 1 analyses.**

***Rationale*:** In order to review the revisions, the STAR panel needs to see a reasonably complete set of results.

Results: The NLLs for the new base case indicated improved fits to all data with a total NLL improvement of about 20 units. The changes in the modeling of growth parameters did not change the von Bertalanffy growth functions for males and females but did improve the fits, which is a good outcome. The STAT team reported that convergence diagnostics also looked better for the revised approach.

13. **Re-create the sensitivity analyses corresponding to levels proposed by the STAT for the axes of uncertainty for the decision table using the revised base case model.**

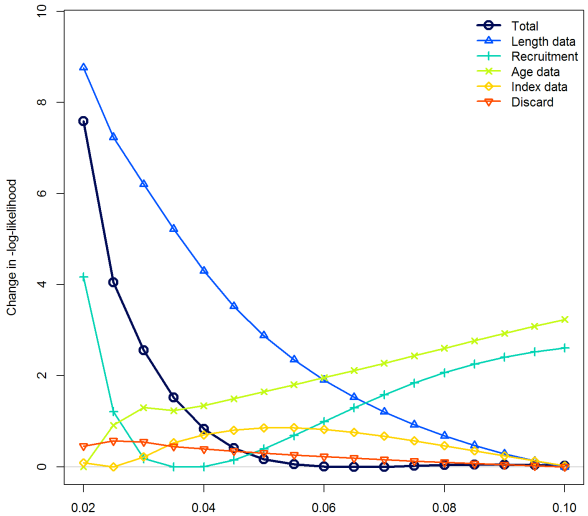
Rationale: This will be helpful in selecting the final format for the decision table.

Results: The STAT varied female M, which is the major axis of uncertainty, to determine spawning output that corresponded to the 12.5% and 87.5% quantiles of 2013 spawning output confidence intervals found in the 'new' base run. These values of female M are 0.045 and 0.06 (base case of 0.05). The STAT proposed these values as the high and low states of nature for the decision table. The STAR Panel rejected these bounds because they did not properly account for uncertainty due to M. This is because the spawning output confidence intervals found in the 'new' base run, which were proposed to generate a range of female M's for the decision table, were based on a fixed female M=0.05. Alternate methods for determining the appropriate quantiles were provided by the STAT and discussed.

14. **Re-create the natural mortality and steepness likelihood profiles using the revised base case model.**

Rationale: This will provide background for potential decision table levels for these parameters.

Results: The profile on M showed a reasonable pattern. However, the length data seem to be driving the model towards high M. The M profile is appreciably flatter with male M being estimated (i.e., model improvement). The logical inconsistency is high M does not comport with a long-lived species like darkblotched. Fixing female M may have created some other mis-specification in the model that has not been discovered. The additional (early) age data could provide information for the model to estimate natural mortality. It was recommended that future research could ascertain whether additional otoliths exist and whether they could be aged using current ageing methods.



15. **Find the lower and upper states of nature for natural mortality that are approximately half as likely as the base case based on the methods presented. Use the likelihood profile for the lower M bound and the prior distribution for the upper M bound). This is a proxy for actually running a model with estimated natural mortality using the informative prior. Run and summarize the sensitivity analyses (high and low) for each of these.**

***Rationale*:** These runs will serve as the basis for the decision table.

***Results*:** The female natural mortalities used to bracket low and high states of nature were 0.036 and 0.082 respectively. The rationale for selecting these values is provided in the section "Description of base model and alternative models used to bracket uncertainty". It was clear that the range of the states of nature shown as depletion is wide given the proposed low and high states. The next assessment should focus on an informed M and h priors for darkblotched. A more representative age sample over time may also assist in directly estimating M.

16. **Present the decision table results for at least one catch stream, for all three states of nature.**

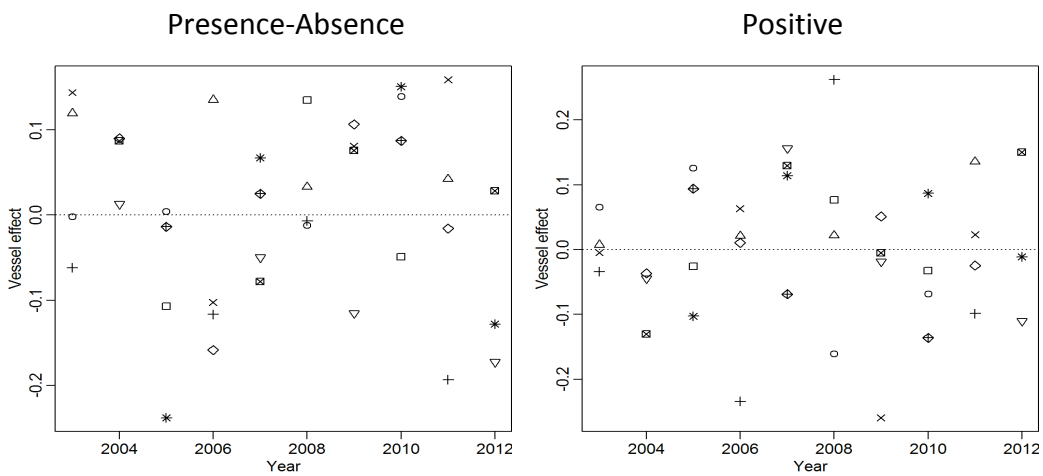
***Rationale*:** This will allow a final look at the range of results coming from the states of nature, leaving additional catch alternatives for the STAT to identify in consultation with the GMT, council, etc.

***Results*:** updated results provided by STAT. See table in the next page.

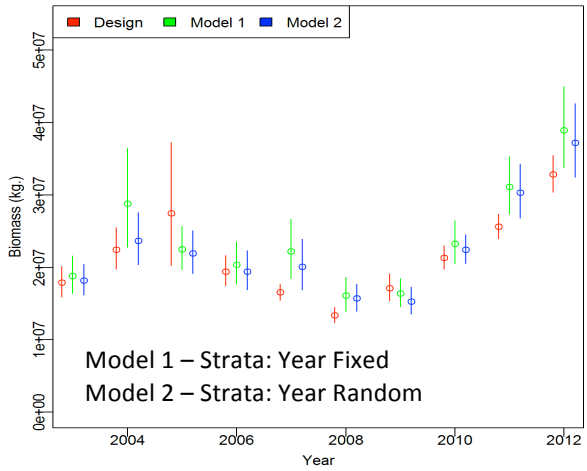
			State of nature					
			Low *Female M=0.036*		Base case Female M=0.05		High *Female M=0.082*	
Management decision	Year	Catch (mt)	Spawning output (million eggs)	Depletion	Spawning output (million eggs)	Depletion	Spawning output (million eggs)	Depletion
Catch calculated using SPR of 71.9% applied to the base model	2013	223	607	18%	1,214	36%	3,606	82%
	2014	240	648	19%	1,294	39%	3,770	85%
	2015	252	688	20%	1,374	41%	3,922	89%
	2016	260	722	21%	1,441	43%	4,032	91%
	2017	266	751	22%	1,496	45%	4,101	93%
	2018	271	776	23%	1,541	46%	4,135	94%
	2019	276	798	23%	1,578	47%	4,147	94%
	2020	280	821	24%	1,613	48%	4,150	94%
	2021	285	844	25%	1,646	49%	4,149	94%
	2022	289	867	25%	1,678	50%	4,146	94%
	2023	293	891	26%	1,709	51%	4,140	94%
	2024	297	915	27%	1,739	52%	4,133	94%
Catch calculated using current rebuilding SPR of 64.9% applied to the base model	2013	302	607	18%	1,214	36%	3,606	82%
	2014	323	641	19%	1,288	38%	3,764	85%
	2015	339	674	20%	1,360	41%	3,909	88%
	2016	347	701	20%	1,420	42%	4,011	91%
	2017	353	722	21%	1,467	44%	4,073	92%
	2018	358	738	21%	1,504	45%	4,101	93%
	2019	363	752	22%	1,533	46%	4,106	93%
	2020	368	766	22%	1,560	46%	4,102	93%
	2021	372	780	23%	1,586	47%	4,096	93%
	2022	377	796	23%	1,611	48%	4,087	93%
	2023	381	811	24%	1,635	49%	4,076	92%
	2024	385	826	24%	1,657	49%	4,064	92%
2014 ACL catch assumed for years between 2015 and 2024	2013	317	607	18%	1,214	36%	3,606	82%
	2014	330	640	19%	1,287	38%	3,762	85%
	2015	330	672	20%	1,358	40%	3,907	88%
	2016	330	699	20%	1,418	42%	4,010	91%
	2017	330	722	21%	1,467	44%	4,073	92%
	2018	330	740	22%	1,506	45%	4,103	93%
	2019	330	756	22%	1,538	46%	4,111	93%
	2020	330	773	23%	1,567	47%	4,110	93%
	2021	330	791	23%	1,597	48%	4,106	93%
	2022	330	811	24%	1,626	48%	4,101	93%
	2023	330	830	24%	1,654	49%	4,094	93%
	2024	330	850	25%	1,681	50%	4,085	92%

Requests by the STAR Panel for the petrale sole stock assessment

1. For the survey GLMM, plot random vessel-year effects versus year.
   Rationale: could reveal potential confounding between random vessel effects and actual trends in stock over time
   Results: vessel effects were small and varied without trend over time which does not indicate a confounding problem.



2. Compare NWFSC indices and error bars when year-strata effects are random or fixed, and also compare with design-based indices.
   Rationale: error bars have implications on the weighting indices get in SS3.
   Results: All models show similar trends.



3. Report what depth selection was used by fishery CPUE index.
   Rationale: Clarity
   Results: The filters were depth ≤ 75 fm in the summer and 150 fm ≤ depth ≤ 400 fm in the winter.

4. Look at von Bertalanffy residuals by year.
   Rationale: Examine for evidence of time variation in growth rates for NWFSC survey data
   Results: Neither series of plots showed patterns indicating time-varying growth.

5. Set the NWFSC extra variance parameter to zero.
   Rationale: The extra variance is to account for process error. The estimate from the draft base model was less than zero; and it is an improvement to either set this parameter to zero or set the prior with a lower bound of zero.
   Results: Little effects on model outputs. The extra variance parameter will be set to zero in the final base model.

6. Provide a time-series plot of discarded catch by fleet.
   Rationale: Discards are estimated in the model. The plot is useful to understand model output.
   Results: graphics showed the discards time series vs. a total catch time series. Discards were an order of magnitude less than total catches.

7. Check for convergence the sensitivity run removes NWFSC 2012 age composition data.
   Rationale: There is a significant difference in B_0 after the NWFSC 2012 age composition data were removed. Checking for convergence will validate results from this sensitivity run.
   Results: The version in the draft document was with *all* NWFSC survey age data removed. The correct outputs from model run with only the 2012 age data removed showed low sensitivity to this change.

8. Report statistics on jitter analyses for the new base model.
   Rationale: Validate results.
   Results: Jitter of 0.01 for base model was run 100 times. 75% of the jitter runs ended at the base case, 17.5% ended at local minima, and 7.5% of jitter runs crashed. This was a satisfactory jitter test although a more aggressive jitter could be done.

9. Provide M and h sensitivity analyses, based on range from hessian-based intervals.
   Rationale: Improved understanding of potential axes for decision table.
   Results: The runs showed confounding of M and h, which is expected. However, there may be a concern with estimating both parameters with informative priors. A wider range of M and h should be considered that are ~1.2 NLL points away from the base.

10. Provide a sensitivity run with no commercial CPUE

Rationale: There is considerable uncertainty in how to standardize commercial catch rates.

Results: Removing the index fits the age composition slightly worse and the length composition slightly better. There are also small changes to M and h with this run. Growth parameters do not change. The population status of year 2013 shown as SSB depletion changed from 0.289 to 0.222. It is noted that the "survey" component of the objective function is not comparable between these alternate models because it includes all indices of abundance, and CPUE data have been removed.

Label	Base	NoCommCPUE
TOTAL_like	1459.8	1502.2
Survey_like	-74.9	-22.2
Discard_like	-142.8	-143.2
Mean_body_wt_like	-75.8	-75.7
Length_comp_like	824.4	814.4
Age_comp_like	947.8	950.2
SR_BH_steep	0.84	0.85
NatM_p_1_Fem_GP_1	0.16	0.15
L_at_Amin_Fem_GP_1	15.8	15.9
L_at_Amax_Fem_GP_1	54.3	54.3
VonBert_K_Fem_GP_1	0.13	0.13
CV_young_Fem_GP_1	0.18	0.18
CV_old_Fem_GP_1	0.03	0.03
NatM_p_1_Mal_GP_1	0.18	0.17
L_at_Amin_Mal_GP_1	16.3	16.3
L_at_Amax_Mal_GP_1	42.5	42.5
VonBert_K_Mal_GP_1	0.21	0.21
CV_young_Mal_GP_1	0.13	0.13
CV_old_Mal_GP_1	0.05	0.05

11. If time permits, provide an explanation of what component(s) produced the increase in the total likelihood profile for Ro.

Rationale: Validate results.

Results: The priors NLLs were missing in the original plot which was causing the total NLL curve to shift. Revised figure was presented.

12. Increase input standard error for commercial log CPUE. Make the standard error about the same as the standard error for the NWFSC survey log index. Do an SS3 run with extra standard error estimated, but with a lower bound of zero on the extra standard error.

Rationale: Although the extra variance parameter for each CPUE index in the draft base model was estimated, the panel wanted to confirm that input

standard errors were not influencing final model weighting. Generally, the input standard errors for the commercial CPUE seemed too small given the structural uncertainty associated with the CPUE standardization and method of bootstrapping performed. It seemed reasonable that fishery CPUE should be considered, *a priori*, no more precise than the NWFSC survey.

Results: The petrale STAT provided two runs in response. The first run added the average SE from the NWFSC survey and estimated the added SD. This run was essentially the same as the base model in the draft due to a value of zero estimated for the added SD. Therefore the STAT did a second run with the maximum SD from the NWFSC survey added to the bootstrapped CPUE SD's and turn off the estimation of the added SD for the commercial CPUEs. Adding the maximum SE to the CPUE index degraded the fit to the index itself, but improved the fit to the length comps. All the other data fits were no different. This sensitivity reduced depletion to 0.275, and the run without extra SE reduced depletion further to 0.248. The bottom line is the addition of extra SE to commercial CPUE did not affect model results much.

Label	Base	NoComm-CPUE	IncCommCPUESd-NWFSCMean-EstExtraSD	IncCommCPUE-NWFSCSurvMax-NoEstExtraSD
TOTAL_like	1459.81		1459.45	1463.58
Survey_like	-74.88		-72.79	-63.91
Discard_like	-142.80	-143.21	-142.89	-143.06
Mean_body_wt_like	-75.83	-75.74	-75.82	-75.79
Length_comp_like	824.41	814.41	822.30	817.80
Age_comp_like	947.77	950.15	948.06	948.89
Parm_priors_like	0.18	0.36	0.21	0.30
SR_BH_steep	0.84	0.85	0.84	0.85
NatM_p_1_Fem_GP_1	0.16	0.15	0.16	0.16
L_at_Amin_Fem_GP_1	15.77	15.88	15.78	15.82
L_at_Amax_Fem_GP_1	54.30	54.26	54.30	54.29
VonBert_K_Fem_GP_1	0.13	0.13	0.13	0.13
CV_young_Fem_GP_1	0.18	0.18	0.18	0.18
CV_old_Fem_GP_1	0.03	0.03	0.03	0.03
NatM_p_1_Mal_GP_1	0.18	0.17	0.18	0.17
L_at_Amin_Mal_GP_1	16.30	16.34	16.30	16.32
L_at_Amax_Mal_GP_1	42.54	42.55	42.54	42.54
VonBert_K_Mal_GP_1	0.21	0.21	0.21	0.21
CV_young_Mal_GP_1	0.13	0.13	0.13	0.13
CV_old_Mal_GP_1	0.05	0.05	0.05	0.05

13. Change CPUE catchability model to include an unconstrained random walk in *q* since trip limits were implemented (since 2006).

Rationale: Trip limits may affect catchability. This is an attempt to apply the same logic/treatment of winter CPUE as summer CPUE. Data informing commercial CPUE indices were filtered to minimize the effect of management actions on the index. Winter indices were developed to include only trawl trips during January-February in waters seaward of 150 fm that were identified as petrale fishing grounds via spatial analysis. While there was agreement that management actions affecting the winter fishery were minimal in comparison to those impacting the summer fishery, two management actions were discussed during the STAR panel that were unable to be considered prior to the STAR panel. First, trip limits for petrale sole were specified for the years 2006-2009 (**Error! Reference source not found.**). The STAT was asked to explore the effect of these trip limits on the index by allowing time-varying catchability (q) for the years 2006-2009.

Table 1. January-February petrale sole trip limits through 2009 for large footrope gear.

Prior to 2006	2006	2007	2008	2009
Unlimited	30,000 lb/mo.	50,000 lbs/2 mo.	40,000 lbs/2 mo.	25,000 lbs/2 mo.

Results: Time varying unconstrained *q* unsurprisingly fits the CPUE index nearly perfectly, but with little improvement in the likelihood (overfitting) and without improving fits to the other data. Mr. Leipzig, the GAP representative, remarked this was not surprising since trip limits > 10,000 lbs/mo. did not seem to affect the fishery; vessels rarely landed more than 10,000 lbs of petrale per delivery.

In addition to trip limits, the vessel buyback program was also discussed during the panel, a factor that had not been previously considered. The STAT therefore did an additional run with a *q* time block in 2006-2009 to address these potential effects (i.e. effort reduction) on CPUE. The block-*q* run improved overall fits to the interim new base run with input commercial CPUE standard errors equal to the bootstrap estimates plus the maximum from the NWFSC survey (total NLL reduced from 1463.58 to 1458.81). The fits improved for length-compositions (NLL reduced from 817.8to 815.0) and the survey index (NLL reduced from -63.91 to -66.68).

After the initial sensitivity runs were conducted, it was brought to the panel's attention that the time block should have been two years earlier, since the buyback was implemented in 2004. The time block for *q* was

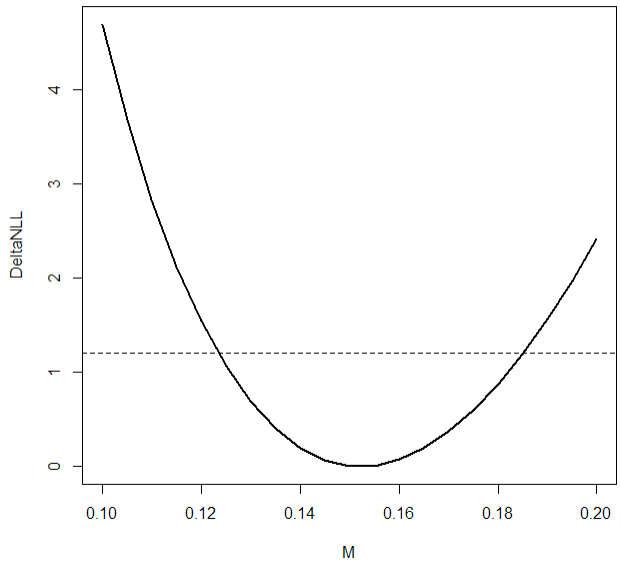
therefore moved back 2 years to the beginning of the buyback program in 2004. This improved the total NLLs by 4 points relative to the first Block *q* model. This is the new proposed base model. The depletion is essentially identical to the Block *q* 2006 model, which is below B_{MSY} (~22.3%).

The magnitude of the survey *q*'s generated much discussion in the 2009 and 2011 assessments of this stock. Values obtained for flatfish stocks off the east coast of Canada are presented in Appendix A. The panel concludes that, although the range provided in Appendix A is large, the value of *q* for petrale sole (3.4) is plausible.

14. Axis of uncertainty should include a range of M values derived from the likelihood profile. Make sure the range of M is wide enough to capture 1.2 log likelihood units. Verify how this range compares to interval based on asymptotic normal approximation with hessian-based standard error.
    Rationale: There was a concern that the asymptotic interval was too narrow.
    Results: See request 16.

15. Profile full suite of output for new base case.
    Rationale: Validate new base model outputs.
    Results: Various diagnostic plots were presented. The new base model seems to perform well.

16. Rerun likelihood profile for M and update low- and high-M sensitivity runs.
    Rationale: to bracket the alternative state of nature.
    Results: Based on the change of 1.2NLL units in base model profile, Low and high M are set at 0.12 and 0.19, respectively.



17. Projections based on models in 16) using the catch stream assuming the default ABC buffer (ABC = OFL - 4.4%) and then application of the 25-5 ACL control rule.
    Rationale: For constructing decision table.
    Results: The results appeared to show expected behavior and contrast among the states of nature, consistent with the sensitivity analyses previously presented. The panel concluded this decision table structure would be appropriate for management use.