

# Report on the joint US-Canada Pacific/Whiting Stock Assessment 2009 STAR Panel Review

By

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## Executive Summary

Based on a thorough review of the model diagnostics and results the Panel recommended a particular configuration of the SS3 model as the final base model. The final choice of base model included a simpler time-blocking for the parameters determining the final values of the declining limbs of the dome-shaped selectivity curves of the US and Canadian fisheries (four-year rather than two-year blocks). It also differed from the preliminary model in that it estimated the value of the acoustic survey catchability coefficient rather than keeping this parameter set to a fixed value.

Although the Panel approved the stock assessment, there was unanimous agreement that the final SS3 base model has structural problems and is over-parameterized, and that the reliability of the model predictions therefore may be compromised. There were particular problems with the model fit of length compositions, as reflected in the non-random structure of the residuals. The targeted fishing practice suggests that the catch-at age and length strongly differs from the age composition of the population. Also, tuning series from the acoustic survey is a major source of uncertainty in the assessment of this stock. The uncertainty in the fitted survey  $q$  is partly accounted for, but the effects of bias and sampling errors in age- and length compositions and species compositions based on midwater trawl sampling is not accounted for in the acoustic biomass indices. The procedure for combining length and age by species from trawl samples with acoustic back-scatter data to produce biomass estimates is not well documented. Post-stratification of length samples based on their homogeneity does not follow standard survey practice, and likely introduce bias of the acoustic biomass estimates and its precision.

# 1. Background

This report briefly documents findings and recommendations following the review of the Pacific hake / whiting Stock Assessment presented during 3-6 February 2009 at a joint Canada-U.S. Review (STAR) Panel meeting held in Seattle, Washington. The STAR panel operated under the U.S. Pacific Fishery Management Council's Terms of Reference for the Groundfish Stock Assessment and Review Process for 2009-2010 (PFMC 2008). The STAR Panel has documented the review in a final report to the Pacific Fishery Management Council submitted on February 19, 2009.

## 2. Description of review activities

The STAR panel was competently chaired by Dr. David Sampson (Oregon State University and SSC representative), and included two reviewers from Center for Independent experts (Drs. Norman Hall and Jon H. Vølstad) and one from University of British Columbia (Dr. Tom Carruthers). Both members of the stock assessment team (Drs. Owen Hamel and Ian Stewart) participated actively in the meeting and responded competently to all requests made by the panel. The STAR Panel members received draft assessments and supporting materials two weeks prior to the meeting, and had prepared for the review of the assessment prior to the meeting. Data from the 2008 Canadian fishery were not incorporated into the model developed for the draft assessment document available before the meeting. The STAT presented a new preliminary base model at the start of the STAR Panel meeting. The STAR Panel followed the Terms of Reference and reviewed the stock assessment documents, data inputs, analytical models, and provided a complete STAR panel report for the Pacific Hake /Whiting stock assessment. The STAR Panel review report provides a detailed evaluation of the results of the stock synthesis 3 assessment model and the stock assessment. The STAR Panel's work included:

1. Reviewing draft stock assessment documents and any other pertinent information e.g., previous assessments and STAR panel reports, if available);
2. Working with the STAT Team to review and modify the model as needed;
3. Documenting meeting discussions; and
4. Reviewing revised stock assessment documents before they are forwarded to the SSC.

The meeting convened on Tuesday February 3rd and followed the agenda in Appendix 4. Dr. Elizabeth Clarke (U.S. National Marine Fisheries Service, NMFS) welcomed the group and provided an overview of the U.S. process for ratifying the new treaty, currently stalled pending changes in the implementing language. Dr. Sampson then provided a brief review of the agenda (Appendix 1), explanation of the Terms of Reference, and discussion of the review and reporting process. The Panel members and others in attendance then presented themselves. Mr. John DeVore and Mr. Barry Ackerman presented reviews of management needs for the U.S. and Canadian fisheries, respectively. Dr Stewart presented details of the input data used by the STAT in the 2009 stock assessment, Dr Chu presented progress made in improving acoustic estimates of Pacific Hake, and Drs Hamel and Stewart presented details of the approaches used and results obtained when applying Stock Synthesis III (SS3) to the data for Pacific hake.

Review panel members were assigned to take notes from the discussions and provide minutes of the meeting (one day each). After careful review of the model diagnostics and results, but with concern that the reliability of the model predictions is compromised by structural inadequacy and over-parameterization, the Panel recommended a particular configuration of the SS3 model as the final base model. The STAT did not have sufficient time to conduct a Monte Carlo Markov Chain (MCMC) run to confirm convergence of the final base model and to develop a decision table for the assessment before the end of the review meeting in Seattle. They completed this work during the week following the STAR Panel and the decision table, based on preliminary converged MCMC results for the final base model, was distributed to the STAR Panelists by email.

### **3. Summary of findings**

#### **Summary of Findings for each ToR**

1. Become familiar with the draft Pacific hake stock assessment and background materials. Along with other members of the Panel, determine if the stock assessment document is sufficiently complete according to the Pacific Fishery Management Council's Terms of Reference for West Coast Groundfish Stock Assessment and STAR Panels (to be included once finalized).

The STAR Panel members received all draft assessments and supporting materials via an ftp site two weeks prior to the meeting. This was sufficient time to prepare for the review and become familiar with the draft Pacific hake stock assessment and background materials. Although data from the 2008 Canadian fishery were not incorporated into the model developed for the draft assessment document, the STAT had developed a new preliminary base model employing these data shortly before the start of the STAR Panel meeting (discussed further below). In all, the stock assessment document in conjunction with presentations by the STAT team during the review meeting was sufficiently documentation to conduct the review.

2. Evaluate, data collection operations and survey design and make recommendations for improvement

Although the acoustic survey team cleared up some of the deficiencies in the acoustic survey data identified by the 2008 STAR Panel, there remain important gaps in the acoustic survey documentation. The systematic allocation of transects in the acoustic survey is standard procedure in many regions, and has the advantage that the acoustic transects are spread out spatially, thus reducing the effects of autocorrelation between transects. The description of biological sampling routines for the acoustic survey was not sufficient to fully evaluate if the species and length compositions are unbiased. The selection of locations (stations) for midwater trawling appears to be ad-hoc, and not based on probabilistic sampling. The acoustic survey age- and length-compositions may be biased if biological sampling occurs disproportionately on dense aggregations of fish.

Such aggregations may have age-length compositions that differ from the general survey area and thus may not be representative if the station weights are not adjusted for on the estimation process. The ad-hoc sampling precludes the evaluation of sampling uncertainty by bootstrapping since the selection probabilities area unknown.

It is recommended that the spatial distribution of biological sampling in the acoustic survey be evaluated to determine whether these data are representative of the backscatter in the overall survey track. A simple first approach would be to plot mean length for each species, and the proportion of Pacific hake against the integrated value for the 1-mile survey tract just before the midwater trawl station was taken. If more stations are allocated to locations with high acoustic back-scatter registrations, and these stations have higher (or lower) proportion of hake, and mean length of hake, then a bias could result. If sections of the cruise track with high registrations account for most of the biomass, then the bias may be small. In contrast, if a significant portion of the total biomass is in a large area with relatively low acoustic back-scatter, then the weighting of trawl samples must be adjusted. A pooling of length and age samples with equal weights would be dominated by the many samples in high-scatter areas, and thus would introduce bias in length and age compositions. The raw data in the acoustic survey and the station-level trawl sample data need to be appropriately assembled to allow statistical analysis of these data and to develop appropriate methods for allocating the acoustic biomass to species by length. Any post-stratification should follow acceptable methods, and not be based on the observations as such. The sampling error in age and length compositions should be evaluated properly by taking into account clustering effects (ICES 2008, Pennington and Vølstad 1994). The effective sample size is often closer to the number of hauls in fisheries-independent surveys, and the number of sampled trips in fisheries-dependent data collections, than the total number of fish sampled for length or age. Thus, for the acoustic survey, the number of midwater trawl stations may be a good proxy for the effective sample size of the length-composition data if it can be assumed that the stations are randomly allocated. With biased selections the effective sample sizes may be even lower, but cannot be accurately computed.

### 3. Comment on quality of data used in the assessment.

See above for comments on the acoustic survey data. The US-Canada Pacific/Whiting Stock Assessment 2009 STAR Panel Review did not evaluate uncertainty in the length and age composition of the commercial catch in detail. It is commendable that uncertainty due to age-reading errors is taken into account. The accuracy (bias and precision) of the estimated age-composition of the catches could not be evaluated because of limited information about the catch sampling programs. Sex-differences in growth of Pacific hake are not accounted for in the stock assessment model. It is recommended that the use of gender- and length-based selection into the dynamics be explored in future assessment models.

I recommend in general that a separate review of the data sources before the stock assessment review be considered in the future.

#### 4. Evaluate and comment on analytic methodologies

The acoustic survey biomass estimates are derived by combining the acoustic back-scatter data with biological sample data (composition by species, length and sex) collected by midwater trawls. The process of combining biological sample data with the acoustic back-scatter data was not well documented. The apparent post-stratification of tows partly based on similarity in the observed length-composition of the catches is particularly problematic, and is a likely source of bias (of unknown direction) in the length composition estimates, and a downward bias in the associated variance estimates.

5. Evaluate model assumptions, estimates, and major sources of uncertainty. Specifically, recommend improvements including alternative model configurations or formulations as appropriate during the panel meeting and comment on the primary sources of uncertainty in the assessment model.

The Stock Synthesis (SS3) model configuration selected for the final base model assumed a single coast wide stock, but the US and Canadian fisheries were separated, with specific length-composition, conditional age-at-length composition, and age-based selection curves. The primary tuning index was based on the trawl survey biomass index from the joint US-Canada acoustic / midwater fisheries independent surveys. Uncertainty in age-readings was incorporated. Time-varying growth parameters were estimated. The recruitment variability parameter ( $\sigma$ -R) was estimated in this assessment. Acoustic survey selection was assumed to be time-invariant, and the catchability coefficient for the acoustic survey was fitted. The selection curves for the two fisheries and the acoustic survey were estimated and not forced to be asymptotic. Fishery selection was time-blocked to accommodate targeting of strong year-classes and structural changes in the fisheries. The natural mortality coefficient was fixed at 0.23 yr<sup>-1</sup> for ages 0 to 13, and then was allowed to ramp to higher (or lower) values for age-14 and the age-15+ group.

Detailed critiques of the model parameterization and results are provided in the STAR panel report. The estimated age-composition of the catches is assumed to be unbiased, but this assumption could not be evaluated because of limited information about the catch sampling programs.

The targeted fishing for Pacific hake/whiting suggests that the catch-at age strongly differs from the age composition of the population at large. Also, tuning series from the acoustic survey is a major source of uncertainty in the assessment of this stock. Uncertainty in the survey  $q$  is of major concern. The survey  $q$  is a calibration parameter that adjusts for the discrepancy between the survey estimates for the stock biomass relative to what the model predicts should be there. In the initial base model presented during the first day of the STAR meeting the STAT team had fixed the value of survey  $q$  because they did not feel it could be well estimated. The current STAR Panelists were concerned that fixing the survey  $q$  parameter would grossly constrain the plausible set of model estimates, and the model would produce gross underestimation of uncertainty in the estimated status of this stock. As was done for the 2008 assessment, the survey  $q$  parameter was freely estimated so that the final model could more appropriately reflect the uncertainty associated with this crucial parameter. Hence, uncertainty associated with the acoustic survey  $q$  parameter was incorporated in the assessment results. This is a good thing, but

I personally think that since the model already is over-parameterized, the simplified approach of fixing  $q$  can be justified.

A set of 200 jitter runs of the model with widely dispersed starting values resulted in 27.5% converged runs, all with near identical estimates of depletion rates and spawning biomass. This corroborated that the model is stable, and that the converged estimates represent a global solution, and not local minima. The assessment team used the MCMC approach to integrate across the uncertainty (random errors) associated with all the estimated parameters, but the multiple sources of bias (structural errors) in several input parameters are not accounted for in this process.

6. Insert an explicit statement as to whether this stock assessment represents the best available science.

The STAT team has done a commendable job fitting the stock assessment model to available data, but I am concerned that the SS3 base model has a very large number of parameters, many of which are correlated. Even with the large number of parameters there were clear problems with the model fit, as reflected in non-random structure of residual plots for some parameters (e.g. length compositions). A simpler model such as ADAPT / VPA may be an alternative to the more complex model. However, any choice of model would depend on the quality of the tuning indices employed, in particular for more recent year estimates of spawning stock biomass.

7. Recommendations for any further improvements

Evaluate alternative, less complex, modeling approaches, and develop weighting of tuning indices based the effective sample size. The use of global sensitivity analysis (Saltelli et al. 2008) would be a recommended approach to evaluate the sensitivity of the model to uncertainty in a large number of parameters simultaneously. This could help reduce the number of parameters in the current model, and thus increase its utility for predictions. When parameters are correlated it is often beneficial to eliminate redundant parameters.

8. Brief description on panel review proceedings highlighting pertinent discussions, issues, effectiveness, and recommendations

All panel members actively participated in the discussions, and came up with request for the STAT team. The STAR panel requested several clarifications of the model approach based on the review of the draft assessment, and presentations of model output and diagnostics by the assessment team. The assessment team conducted many additional model runs at the request of the panel to help identify the most appropriate base model, and to evaluate the uncertainty of the stock assessment results and the assessment's sensitivity to model assumptions. The assessment team did an extraordinary job accommodating the additional model runs requested by the Panel during the meeting, and were open to suggestions and critique. This iterative process of model evaluation and development continued throughout the review meeting. The remaining review activities by the Panel were conducted via email correspondence after the meeting, and are documented in the final report to the Council. There were no major disagreements between panel

members, or between the panel and the STATS team. There were general concerns about the inclusion of data from large catches by the Canadian fishery late in 2008. This posed a big burden on the STATS team and delayed acquisition and processing of data and biological material. The STAR Panel acknowledged the extraordinary achievements of STAT team in bringing these data into the assessment, but cautioned that the analyses of such data under a tight time schedule comes at a risk because of limited time for QA/QC.

## **4. Recommendations**

Assessment models that rely heavily on fisheries-dependent data are susceptible to biases caused by misreporting, biased age- and length- sampling, and large changes in catchability related to the targeting of cohorts etc. (ICES 2008). The use of fisheries-independent survey indices for the tuning can greatly improve the accuracy of the stock assessments if the surveys are standardized and well designed. The acoustic survey appears to provide the best tuning indices for Pacific Hake, but some aspects of the survey could be improved. It is strongly recommended that the methods for combining acoustic data with biological samples for species and length compositions be scrutinized. The raw data in the acoustic survey, including the length samples, need to be appropriately assembled to allow statistical analysis of these data. The method for allocating length by species to acoustic back-scatter data should be reassessed. It is particularly important that biases related to trawling on registrations be adjusted for, for example by grouping the trawl stations by categories of acoustic density. If some categories are over-sampled, then the station weights could be adjusted so that the length-compositions are not dominated by categories with more frequent trawling. It is also important that the post-stratification of trawl stations not be based on the length-data. It is recommended that future acoustic surveys employ explicit criteria that determine the selection probabilities of the midwater tows, their duration, and explicit rules for how these biological sample data are then assigned to the various segments of the acoustic transects. A possible approach is to link the probability of sampling with the strength and characteristics of acoustic signals at a large number of pre-selected locations (with known probability). If trawling follows a rule where the actual selection probability at all stations can be estimated, then the selection bias would be eliminated by proper adjustments, and the propagation of sampling errors to the final acoustic biomass estimates could be estimated by bootstrapping. Also, the effective sample sizes for age-length compositions could be quantified.

## References

ICES (Pennington, M., J.H. Vølstad). 2008. Report of the Workshop on Methods to Evaluate and Estimate the Accuracy of Fisheries Data used for Assessment (WKACCU). ICES CM 2008\ACOM:32. 41pp.

Hamel, O.S., and I.J. Stewart (2009). Stock Assessment of Pacific Hake, *Merluccius productus*, (a.k.a Whiting) in U.S. and Canadian Waters in 2009.

Pacific Fishery Management Council (2008). Terms of Reference for the Groundfish Stock Assessment and Review Process for 2009-2010.

Pennington, M. and J.H. Vølstad. 1994. Assessing the effect of intra-haul correlation and variable density on estimates of population characteristics from trawl surveys. *Biometrics* 50: 725-732.

Saltelli, A., M. Ratto, T. Andres, F. Campolongo, J. Cariboni, D. Gatelli, M. Saisana and S. Tarantola. 2008. *Global Sensitivity Analysis. The Primer*. John Wiley & Sons.

## **Appendix 1. List of material reviewed**

Hamel, O.S., and I.J. Stewart (2009). Stock Assessment of Pacific Hake, *Merluccius productus*, (a.k.a Whiting) in U.S. and Canadian Waters in 2009.

Pacific Fishery Management Council (2008). Terms of Reference for the Groundfish Stock Assessment and Review Process for 2009-2010.

Meeting information provided to the panel included the US-Canada Treaty the Pacific hake / Whiting, the U.S. Pacific Whiting Act of 2006. Supporting background materials consulted included previous stock assessment documents and review panel reports, the 2003 Integrated Acoustic and Trawl Survey of Pacific Hake Tech Memo, as well as information on the Stock Synthesis version 3 (SS\_v3) modeling platform.

## **Appendix 2: Statement of Work**

### **External Independent Peer Review by the Center for Independent Experts**

#### **Joint US-Canada Technical Review Panel for the Pacific Hake / Whiting Stock Assessment**

**Scope of Work and CIE Process:** The National Marine Fisheries Service's (NMFS) Office of Science and Technology coordinates and manages a contract to provide external expertise through the Center for Independent Experts (CIE) to conduct impartial and independent peer reviews of NMFS scientific projects. This Statement of Work (SoW) described herein was established by the NMFS Contracting Officer's Technical Representative (COTR) and CIE based on the peer review requirements submitted by NMFS Project Contact. CIE reviewers are selected by the CIE Coordination Team and Steering Committee to conduct the peer review of NMFS science with project specific Terms of Reference (ToRs). Each CIE reviewer shall produce a CIE independent peer review report with specific format and content requirements (**Annex 1**). This SoW describes the work tasks and deliverables of the CIE reviewers for conducting an independent peer review of the following NMFS project.

**Project Description:** The Pacific hake (Whiting) stock assessment is a collaborative effort between U.S. and Canadian stock assessments to assess the stock status of the largest fishery along the West Coast of the U.S. and British Columbia. For example, in 2006 the Pacific whiting fishery accounted for 91% of the landed catch and 44% of the associated ex-vessel value in the groundfish fishery. The stock assessment provides the basis for the management of this fishery. The Magnuson Stevens Reauthorization Act (MSRA) of 2006 mandates that the national fishery conservation and management program utilizes, and is based upon, the best scientific information available. In addition, a treaty between the U.S. and Canada, ratified by the U.S. in the MSRA, establishes an annual assessment, review, and management process and is expected to be ratified by the end of 2008. The treaty will likely not be fully implemented by February 2008, therefore, the review of the international stock assessment will fall under the current Pacific Fishery Management Council's Stock Assessment Review (STAR) Panel.

The STAR panel is part of the Pacific Fishery Management Council's process to provide peer review as referenced in the 2006 Reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act, which states that " the Secretary and each Regional Fishery Management Council may establish a peer review process for that Regional Fishery Management Council for scientific information used to advise the Regional Fishery Management Council about the conservation and management of the fishery (see Magnuson-Stevens Act section 302(g)(1)(E)). If a peer review process is established, it should investigate the technical merits of stock assessments and other scientific information used by the Council's Scientific and Statistical Committee (SSC). The peer review process is not a substitute for the SSC and should work in conjunction with the SSC."

The Pacific Fishery Management Council's Terms of Reference for the West Coast Groundfish Stock Assessments and STAR Process for 2009-2010 requires that some reviewers be appointed

from the Center for Independent Experts (CIE). The terms of reference document will be included as background material once the document is finalized by the Pacific Fishery Management Council family.

The Terms of Reference (ToRs) for the CIE reviewer's role in the peer review are attached in **Annex 2**. The draft 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. The CIE reviewer's duties shall not exceed a maximum of 14 days to complete all work tasks of the peer review described herein. The CIE reviewers shall have the expertise, background, and experience to complete an independent peer review in accordance with the SoW and ToRs herein. The CIE reviewers shall have expertise in fish population dynamics, with experience in the integrated analysis modeling approach, using age-and size-structured models, use of MCMC to develop confidence intervals, and use of Generalized Linear Models in stock assessment models.

**Location of Peer Review:** The CIE reviewers shall conduct an independent peer review during the panel review meeting in Seattle, Washington during the tentative dates of February 3-6, 2009.

**Statement of Tasks:** The 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 (name, affiliation, and contact details) 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 information concerning other 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., name, contact information, birth date, passport number, travel dates, and country of origin) to the NMFS Project Clearance 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 all 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 on where to send documents. 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 Pacific hake stock assessment report(s);
- The most recent previous Pacific hake stock assessment and STAR Panel report;
- A copy of the “Pacific Whiting Act of 2006”;
- 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).

Additional background documents may also be provided.

This list of pre-review documents may be updated up to two weeks before the peer review. Any delays in submission of pre-review documents for the CIE peer review will result in delays with the CIE peer review process, including a SoW modification to the schedule of milestones and deliverables. Furthermore, the CIE reviewers are responsible only for the pre-review documents that are delivered to the reviewers in accordance to the SoW scheduled deadlines specified herein.

Panel Review Meeting: The CIE reviewers shall conduct the independent peer review in accordance with the SoW and ToRs. **Modifications to the SoW and ToRs can not be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall be approved by the COTR and CIE Lead Coordinator.** The CIE reviewers 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 in the contract SoW. The NMFS Project Contact is responsible for any facility arrangements (e.g., conference room for panel review meetings or teleconference arrangements). The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements, including the meeting facility arrangements.

In most circumstances a STAR Panel will include a chair appointed from the SSC's Groundfish Subcommittee and three other experienced stock assessment analysts. The STAR panel chair is responsible for: 1) developing an agenda for the STAR panel meeting, 2) ensuring that STAR panel members and STAT teams follow the Terms of Reference, 3) participating in the review of the assessment, 4) guiding the STAR panel and STAT team to mutually agreeable solutions, and 5) coordinating review of final assessment documents.

The CIE reviewer's role includes being an active panel participant and participants are strongly encouraged to voice all comments regarding the assessment data, model configurations, and uncertainty during the STAR Panel so the assessment teams can address the comments during the Panel meeting and incorporate changes when appropriate. The assessments are finalized by the end of the Panel meeting and comments made after the fact will not be able to be included in the final assessment document. The CIE reviewers shall also contribute to the final STAR Panel Review Report. Additional details regarding the STAR Panel reviewer's responsibilities will be included in the Pacific Fishery Management Council's final Terms of Reference for Groundfish Stock Assessments and STAR Panel meetings.

Contract Deliverables - Independent CIE Peer Review Reports: The CIE reviewers shall complete an independent peer review report in accordance with the SoW. The CIE reviewers shall complete the independent peer review according to required format and content as described in Annex 1. The CIE reviewers shall complete the independent peer review addressing each ToR as described in Annex 2.

Other Tasks – Contribution to Summary Report: The CIE reviewers will assist the Chair of the panel review meeting with contributions to the Summary Report. The CIE reviewers are not required to reach a consensus and may provide dissenting opinions.

**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 at the Deca Hotel, Seattle, Washington on February 3-6, 2009, and conduct an independent peer review in accordance with the ToRs (Annex 2);
- 3) No later than February 20, 2009, the CIE reviewers shall submit an independent peer review report addressed to the "Center for Independent Experts," and sent to Manoj Shivlani, CIE Lead Coordinator, via email to [shivlanim@bellsouth.net](mailto:shivlanim@bellsouth.net), and CIE Regional Coordinator, via email to David Die at [ddie@rsmas.miami.edu](mailto:ddie@rsmas.miami.edu).
- 4) The CIE report shall be written using the format and content requirements specified in Annex 1, and address each ToR in Annex 2;
- 5) The CIE reviewers shall address changes as required by the CIE review in accordance with the schedule of milestones and deliverables.

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

28 December 2008	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact
19 January 2009	NMFS Project Contact sends the CIE Reviewers the pre-review documents
3-6 February 2009	Each reviewer participates and conducts an independent peer review during the panel review meeting
20 February 2009	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
5 March 2009	CIE submits CIE independent peer review reports to the COTR
12 March 2009	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 made through the Contracting Officer's Technical Representative (COTR) who submits the modification for approval to the Contracting Officer at least 15 working days prior to making any permanent substitutions. The Contracting Officer will notify the CIE 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 Terms of Reference (ToR) of the SoW as long as the role and ability of the CIE reviewers to complete the SoW deliverable in accordance with the ToRs and deliverable schedule are not adversely impacted. The SoW and ToRs cannot 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. As specified in the Schedule of Milestones and Deliverables, the CIE shall send via e-mail the contract deliverables (the CIE independent peer review reports) to the COTR (William Michaels, via [William.Michaels@noaa.gov](mailto: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) the CIE report shall have the format and content in accordance with Annex 1, (2) the CIE report shall address each ToR as specified in Annex 2, (3) the CIE report shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

**Distribution of Approved Deliverables:** Upon notification of 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 approved CIE reports to the NMFS Project Contact and regional Center Director.

**Key Personnel:**

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## **Annex 1: Format and Contents of CIE Independent Peer Review Report**

1. The CIE independent report shall be prefaced with an Executive Summary providing a concise summary of the findings and recommendations.
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, 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 detailed summary of findings, 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 proceedings and findings of the meeting, 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 as separate appendices as follows:
  - 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**

### **Joint US-Canada Technical Review Panel for the Pacific Hake / Whiting Stock Assessment**

1. *Become familiar with the draft Pacific hake stock assessment and background materials. Along with other members of the Panel, determine if the stock assessment document is sufficiently complete according to the Pacific Fishery Management Council's Terms of Reference for West Coast Groundfish Stock Assessment and STAR Panels (to be included once finalized).*
2. *Evaluate, data collection operations and survey design and make recommendations for improvement*
3. *Comment on quality of data used in the assessment.*
4. *Evaluate and comment on analytic methodologies*
5. *Evaluate model assumptions, estimates, and major sources of uncertainty. Specifically, recommend improvements including alternative model configurations or formulations as appropriate during the panel meeting and comment on the primary sources of uncertainty in the assessment model.*
6. *Insert an explicit statement as to whether this stock assessment represents the best available science.*
7. *Recommendations for any further improvements*
8. *Brief description on panel review proceedings highlighting pertinent discussions, issues, effectiveness, and recommendations*

*Note – CIE reviewers typically address scientific subjects, hence ToRs usually do not involve CIE reviewers with regulatory and management issues unless this expertise is specifically requested in the SoW.*

## Appendix 3: Final Meeting Agenda

### Joint US-Canada Technical Review Panel for the Pacific Hake / Whiting Stock Assessment

February 3-6 2009,  
Hotel Deca  
4507 Brooklyn Avenue NE  
Seattle, WA 98105

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#### Tuesday, February 3, 2008

- 9:00 a.m. Welcome and Introductions (Elizabeth Clarke, NMFS).
- 9:15 a.m. Review the Agenda and Discussion of Meeting Format (David Sampson, Panel Chair, SSC rep.).
- Review U.S. Management Needs (John DeVore, PFMC)
  - Review Canadian Management Needs (Barry Ackerman, DFO)
  - Review Terms of Reference for Assessment and Review Panel
  - Discuss Process to Incorporate 2008 Canadian Lengths/Ages
  - Assignment of reporting duties
  - Discuss and agree to format for the final assessment document.
- 10:00 a.m. Overview of 2008 Whiting Fisheries
- U.S. Fishery (Ian Stewart, NMFS)
  - Canadian Fishery (Chris Grandin, DFO)
- 10:15 a.m. STAT Presentations of Pacific hake / Whiting Stock Assessment.
- Review of input data for the assessment (Ian Stewart, NMFS).
- 12:00 p.m. Lunch (On Your Own)
- 1:00 p.m. STAT Presentations of Pacific hake / Whiting (continued).
- Plans and progress for improving Pacific hake biomass estimate (Dezhang Chu, NMFS)
  - Stock Synthesis Modeling (Owen Hamel and Ian Stewart, NMFS).
- 3:00 p.m. Q&A session with the STAT & Panel discussion.
- 4:30 p.m. Panel develops first list of model runs / analyses for the STAT team(s).

5:30 p.m. Adjourn for day.

**Wednesday, February 4, 2009**

9:00 a.m. STAT Presentation(s) of first set of requested model runs/analyses.

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

1:00 p.m. Panel discussion.

- Panel develops second list of model runs / analyses for the STAT team(s).
- Panel begins drafting report.

5:30 p.m. Adjourn for day.

**Thursday, February 5, 2009**

9:00 a.m. STAT presentation(s) of second set of requested model runs/analyses.

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

1:00 p.m. Panel discussion.

- Identification of base model and elements for the decision table.
- Panel develops third list of model runs for decision table and begins drafting STAR report.

5:30 p.m. Adjourn for day.

**Friday, February 6, 2009**

9:00 a.m. STAT presentation(s) of third set of requested model runs/analyses.

10:00 a.m. Panel discussion.

- Discuss MCMC runs for base case model and decision table
- Panel agree to process for completing final STAR report by Council Briefing Book deadline (2/18 for mailed BB).
- Panel finishes report.

12:00 p.m. Review Panel Adjourn.