Report on Hawaii Deepslope Bottomfish

Prepared for the Center for Independent Experts
By

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EXECUTIVE SUMMARY

A Center of Independent Experts (CIE) review panel was convened to conduct a desk review of a stock assessment of the Hawaiian multispecies deepslope bottomfish resource. The current assessment provided an update to the previous analysis which had been reviewed in 2009 within the Western Pacific Stock Assessment Review (WPSAR) process. The previous review had identified a number of issues concerning data, analysis methods and model assumptions that limited the usefulness of the assessment to support management of the resource.

The current stock assessment has made some improvements over the version reviewed in 2009. However, there continue to be a number of issues that need to be addressed before the assessment should be accepted as support for management. The first recommendation from the previous panel on providing a credible CPUE standardization was not adequately dealt with here. A re-analysis of the CPUE data taking into account the issues raised above will be required. A number of serious issues concerning the Bayesian surplus production model were identified here. Further work is required here to clean up the modeling as was presented here. The assessment needs to properly deal with the previous recommendations plus the additional issues identified here before any evaluation is conducted of the use of these data for monitoring the population dynamics of the species in the Deep 7 bottomfish group.

BACKGROUND

In 2009, a stock assessment of the Hawaiian multispecies deepslope bottomfish resource was peer reviewed within the Western Pacific Stock Assessment Review (WPSAR) process. This process is a collaborative initiative of the NOAA Pacific Islands Fisheries Science Center (PIFSC), the Western Pacific Fishery Management Council (WPFMC), and the NOAA Pacific Islands Regional Office (PIRO). As a result of this review a number of recommendations were made with respect to improving the analysis of the data and improving the models used in the assessment. The objective of the current review was to conduct a follow-up peer review to determine if the recommendations have been adequately addressed and adequacy of the revised assessment for management purposes. Unlike the first review in which participants met in Hawaii to conduct the review, this review was conducted independently by three CIE reviewers within their individual home locales.

DESCRIPTION OF THE INDIVIDUAL REVIEWER'S ROLE IN THE REVIEW ACTIVITIES

This review was established to be a desk review (Appendix) and therefore solely dependent upon the background and assessment documentation as supplied. Originally, all background documents were to be sent by January 7 with the assessment document to follow on January 13. We were notified that there was going to be a delay in providing the material and the background information began arriving on January 17 with the assessment document actually arriving by email on January 21. The work schedule was adjusted so that the review report would be due on February 7.

SUMMARY OF FINDINGS BY TERM OF REFERENCE

1. Determine if recommendations from the June 2009 WPSAR/CIE review have been adequately addressed within the assessment update.

   The assessment document (Brodziak et al. 2010) lists the following as the recommendations to be addressed in the assessment update. These correspond to those determined as needed to be done in the immediate term in the previous CIE review (Stokes, 2009). The short and medium term recommendations were not explicitly addressed in the assessment document.

1.1. Comprehensively explore MHI CPUE data and qualitative information in close collaboration with HDAR and fishers throughout the process. Develop credible CPUE standardization, including if appropriate alternative indices.

The issue of what constitutes a bottomfish trip was discussed in the 2009 WPSAR/CIE review. The 2008 stock assessment had used the condition that 50% or more of the total catch of trip had to be bottomfish. This approach was not criticised *per se* by the panel but justification was sought based on the differences in results when all of the data was used. In the current document a new rule was developed using an objective function comprised of functions of variability of the catch and bottomfish sale value per trip, as well as the proportion of the total bottomfish catch and value of the bottomfish catch. It is difficult to determine whether this was a sensible approach because few details were given. It is not clear if all of the data over all years are used or if this was done year by year. Would area or quarter/seasonal differences be important here? It is difficult to know if there are time trends in the variability of bottomfish sale value that could complicate this measure. In addition it is unknown what the maxCV measures are calculated from, i.e., by area, quarter or year or over the whole data series.

The final base level model for the CPUE data was determined to include fishing year, area, quarter, and area by quarter interaction terms in the linear predictor (Table 8, Brodziak et al. 2010).[1] The text does not explain how the interaction term was used in the construction of the standardized CPUE series. Main effects standardizations are straightforward to interpret because the annual trend would be parallel for the different areas and quarters when treated as main effects only. However, the implication of an interaction term is that these annual trends are no longer parallel and there will be different trends for different combinations of area and quarter. No information was presented in the documents about how different the trends were by area/quarter so it is impossible to assess the impact of the interaction terms on the annual trend.

Note that the "delta-glm" model of Piner and Lee (2010) did not include interaction terms. I do not know if the Poisson model referred to on page 14 of Brodziak et al.

[1] The text on page 13 Brodziak et al. (2010) refers to Single-R and multilevel R models which are out of place when discussing to the CPUE models; probably a cut-and-paste error. Text also states that ΔAIC > 200 for all models but this was not true as ΔAIC=133.5 for the Y+A+Q+Y*Q model.

(2010) included interaction terms because details on the model were not included in any of the documents supplied for review.

Pine and Lee (2010) used all of the single-trip Deep7 bottomfish handline gear dataset while Brodziak et al. (2010) used their 17% cutoff rule. Although not stated, the entire single trip data set was probably used for the Poisson model as zero records were included. Brodziak et al. (2010) stated that separate Poisson models were fit to the series pre- and post-1990, although 1989 was the breakpoint for the change in recording zero catches.

Piner and Lee (2010) refer to Lo et al. (1992) as their source for their binomial/lognormal "delta" model. Lo et al. (1992, eqn. 6) did not use a binomial model for the proportion of non-zero records, P_k and instead used an additional lognormal model for $\log(P_k+1)$. It was not clear how the jackknife method for estimating variances worked here but the authors may want to consult Candy (2004) on the application of Tweedie models to these kinds of data. Tweedie models augment positive valued distributions with zeroes in a generalized linear model approach allowing for model based estimates of variances. There is an R package available at http://www.r-project.org/package=tweedie.

The current stock assessment developed two CPUE scenarios (II and III) where fishing power was set as increasing functions over time. In the text on page 12, the authors state that "the annual incremental changes in fishing power (δ_T) were applied to adjust observed CPUE prior to fitting a CPUE standardization model as recommended by the WPSAR panel (Stokes, 2009)." Adjustments to the observed CPUE were made as follows.

$$CPUE_{ADJ,T} = CPUE_{OBS,T}/(1 + \sum_{i=1}^{T} \delta_i).$$

In fact, Stokes (2009) recommended that changes in power be modeled as an offset term which is not the same as dividing by the adjustment above. The above procedure will result in the $CPUE_{ADJ}$ series having a smaller variance than the original series, that is

$$Var(CPUE_{ADJ,T}) = (1 + \sum_{i=1}^{T} \delta_i)^{-2}\, Var(CPUE_{obs,T})\,.$$

This decrease in variance will become more pronounced in the more recent years as the correction term gets larger. Using the offset approach does not alter the variance of the observed CPUE. The offset term should be included in the predict function when extracting the Year effect, but it should be set to one value for the whole series, i.e., set equal to 1.0 (log(1)=0, so the same as not including it) or to the maximum of $(1 + \sum_{i=1}^{T} \delta_i)$ if the Year effect is to be expressed in terms of current conditions for fishing power.

The models proposed here for the effect of technological change on catch rate appear to be ad hoc with little obvious connection to the changes listed in Table 2 of Moffitt et al. (2008). The report of the CPUE workshop (Moffitt et al. 2008) supplied to this reviewer appeared to be incomplete (file name given as CPUE Workshop Proceedings - Short Version) and did not discuss how technological change could be included in the model. There is no evidence in the current stock assessment document that MHI CPUE data and qualitative information in the current assessment were explored in "close collaboration" with HDAR and fishers throughout the process as recommended. This may have been done but the process was not documented.

Given the issues listed identified above about the cutoff rule, interaction terms, fishing power formulation and questions concerning the alternative models, I do not believe that a credible CPUE standardization has been presented here.

1.2. Attempt to reconstruct non-commercial catch histories, possibly in the same collaborative process used for (1).

Four scenarios were considered for accounting for non-commercial catch into estimates of total removals. These scenarios ranged from having the non-commercial catch exceed the commercial catch through assuming minimal amounts to assuming no non-commercial catch. The estimates for non-commercial catch for each of the relevant scenarios were based upon published studies as discussed by Courtney (2010). The data are sparse and require many assumptions to be used. At present, these data seem to be the best available for meeting this recommendation.

1.3. Consider using meta-data to develop informative prior on Rmax. Develop prior for Binit in collaborative process above (1).

The current document has defined the prior for *R* based upon the recommendations of Musick (1999) and Musick et al. (2000) and the new information on the expected life span of the primary Deep7 species, opakapaka.

The prior means for the carrying capacity parameter *K* (B_{init}) were set to amounts thought necessary to support the fish catches reported for the low and high catch scenarios evaluated as a result of options for including non-commercial catch.

There were no details given on whether or not a collaborative process was followed when developing the prior for *K*.

1.4. Assess MHI as single stock to develop population benchmarks and management parameters. Ensure appropriate sensitivity testing to CPUE uncertainty.

The current stock assessment was limited to the "Deep 7" bottomfish species in the MHI area and therefore this recommendation was adequately addressed. I am not clear what was actually required of the authors to test the sensitivity to CPUE uncertainty in this context.

2. Review the assessment methods used: determine if they are reliable, properly applied, and adequate and appropriate for the species, fisheries, and available data.

Please refer to my discussion concerning the treatment of the CPUE data, catch data, etc., above in items 1.1, 1.2.

3. Evaluate the implementation of the assessment model: configuration, assumptions, and input data and parameters (fishery life history); more specifically determine if data are properly used, if choice of input parameters seem reasonable, if models are appropriately specified and configured, assumptions are reasonably satisfied, and primary sources of uncertainty accounted for.[2]

   There are a number of issues that need to be addressed with the WinBugs code given in Appendix 1. Firstly, PI (π) has been incorrectly set to 1.1415926 in Table A4 and A5 in the appendix; it should be set to 3.1415926. Since this is a constant term in the likelihoods defined on pages 7 and 10, this misspecification should have no effect on the results of the likelihood comparisons. However, there is another error in the log likelihoods that will be need to be corrected. The log likelihood for a lognormal random variable, x_i is defined as:

$$\frac{1}{2}\log(\sigma_i^2) - \frac{1}{2}\log(2\pi) - \log(x_i) - \frac{1}{2}(\sigma_i^{-2})\,(\log(x_i) - \mu)^2$$

   The variance term σ_i^2 has been indexed with *i* to correspond to the model for the CPUE data in the surplus production model used in this assessment. The authors have used the precision, i.e., σ_i^{-2} instead of the variance for the first term in the likelihood in the equations in the WinBUGS code on pages 7 and 10. That is,

```
LOG.LIKE[i] <- 0.5*(log(Precision_CPUE[i])) - 0.5*log(2*PI) -
log(CPUE[i]) + - 0.5*Precision_CPUE[i]*pow((log(CPUE[i]) -
CPUE_mean[i]),2).
```

   The use of AIC to compare model fits is not appropriate here. AIC requires calculating the deviance and knowing the exact number of parameters — NPAR in the WinBUGS code. The surplus production model used here is a state-space model and the state variables contribute to the parameter count. The value for NPAR is not given in the code nor in the paper (Brodziak et al., 2010), but the actual total number of parameters cannot be counted directly. Also, calculating the deviance for the CPUE observation model ignores the contribution of the process part of the model to the total deviance. A logical node called "deviance" is created automatically by WinBUGS: this stores -2 * log(likelihood), where 'likelihood' is the conditional probability of all data nodes given their stochastic parent nodes. While the authors could access this deviance calculation directly, they should consider using DIC where the effective number of parameters is estimated, for comparing models; see Spiegelhalter et al., (2002) and pages 182–184 in

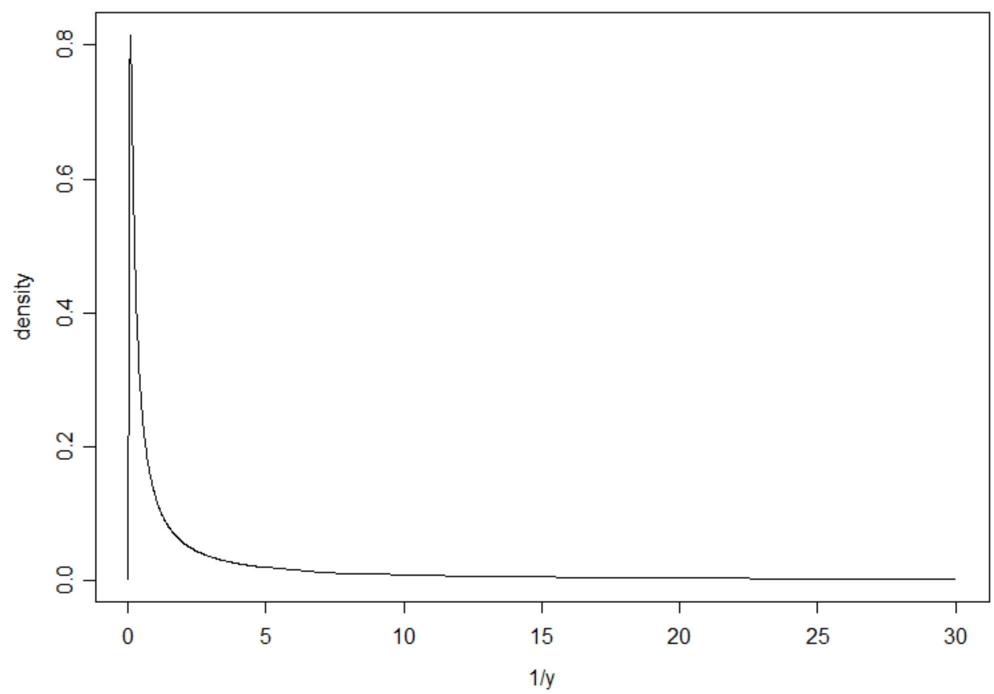
[2] Note that the section on the surplus production model contained material from previous documents, including the senior author's swordfish assessment from 2009. The word swordfish appears on pages 17 and 18.

Gelman et al. (2004). When using WinBUGS directly (i.e., not through R2WinBUGS), the DIC option on the Inference menu is greyed out but this condition only lasts until the model has finished "adapting" as indicated on the Update tool. DIC can be chosen and calculated by running the model for an additional number of runs once the model has converged.

Use of the BIC measure to evaluate the different formulations for *R* is akin to using Bayes Factors where it is assumed that there is one True model amongst the candidate models being compared (page 21 of Brodziak et al. (2010)). In addition, the actual number of parameters is required similar to AIC. Do the authors assume that there is one true model here amongst those considered or are they just evaluating goodness-of-fit similar to their investigations of the different CPUE models? If the latter is true then the DIC measure should the choice here as well. The authors should consult the references above and the DIC notes on the WinBUGS website to understand the differences between AIC, BIC and DIC, and the implications of using each.

The authors have used inverse gamma distributions as priors for the variance terms for the process error (σ_i^2) and observation error (τ_i^2). There seems to be some confusion in the text on expected values and CVs given the parameters chosen for the inverse gamma distributions in the bottom paragraph on page 20 of Brodziak et al. (2010). Note that if a random variable *y* has a gamma distribution with shape parameter α and scale parameter β, then $1/y$ has an inverse gamma division with shape parameter α and scale parameter β. The expected value for *y* is α/β, while the expected value for $1/y$ is $\beta/(\alpha-1)$ and is therefore undefined when $\alpha \leq 1$ (page 575, Gelman et al. 2004). Brodziak et al. (2010) set the shape parameter to be 0.2 for both observation and process error. Since this value is less than one, the mean for prior variances cannot be 0.5 and 5 as given on page 20. Further, the CVs for inverse gamma cannot be calculated in this case as the mean is undefined as shown above and the variance is undefined when $\alpha \leq 2$.

The inverse gamma has been recommended in the past as the conjugate prior distribution for the normal variance by a number of reputable researchers with the non-informative distribution obtained as $\alpha,\beta \rightarrow 0$. Recently, Gelman (2006) has pointed out that the inverse gamma even with small parameter values may actually be a very informative prior. Consider the following probability density curve for the inverse gamma prior distribution for process errors using the authors' parameter values of α=0.2 and β=0.1.



As Gelman (2006) points out, the inverse gamma can become very informative when estimating variances close to zero. However, Brodziak et al. (2010) did not report what the process and observations errors were so I cannot evaluate how serious the issue will be. Gelman (2006) recommends using a uniform prior (e.g., unif(0,100)) for the standard error instead. Also see the Seeds example in the WinBUGS package for a comparison of using the uniform and the inverse gamma for variance terms.

The model diagnostics concentrate on the fit to the CPUE data (time trends for observed/expected and residual plots). Other informative diagnostics not included here would be comparisons of the prior and posterior distributions for the variance terms, and R, M and K. As noted above the inverse gamma prior may be quite informative for the variance estimates and it would be useful to evaluate the impact of the prior for these parameters. The influence of the priors on the other parameters including derived values (e.g., B_{msy}), should be investigated as well. Note that the previous CIE review asked for prior/posterior plots to be included in the next assessment.

The procedure for calculating residuals in the log scale seems a little convoluted. The following should be appropriate to the task.

```
(log(CPUE[i])-CPUE_mean[i])*sqrt(Precision_CPUE[i])
```

A very useful diagnostic for evaluating whether the model is consistent with the data (in the original scale of measurement) is posterior predictive checking as discussed in Gelman et al. (2004, pages 159–177). This approach usually provides more insight into goodness of fit than calculating the CPUE residuals in the original scale as was done in the WinBUGS script.

I could not find any discussion about the results for the estimates of the production shape parameter *M* in the text, although estimates for the different options were given in Tables 13 and 14[3]. On page 16 of Brodziak et al. (2010) there was the general statement that "In practice, estimates of the shape parameter M for Deep 7 biomass production in the MHI tended to be greater than unity". Given the standard errors associated with these estimates, it is likely that there is no evidence against assuming M=1. Having the credible limits of the posterior distribution for *M* at the 90 or 95% level would help to assess whether this parameter is actually needed.

4. Comment on the scientific soundness of the estimated population benchmarks and management parameters (e.g. MSY, Fmsy, Bmsy, MSST, and MFMT) and their potential efficacy in addressing the management goals stated in the relevant FMP or other documents provided to the review panel.

   No FMP or other management documents were provided to the review panel. Brodziak et al. (2010) did provide estimates for F_{msy}, B_{msy} and H_{msy} based on the surplus production model. These reference points were used in the standard way for stocks under NMFS jurisdiction to determine whether the stocks were overfished or if overfishing was occurring. Given the issues identified here with the CPUE series, the code used to fit the model and the other model related issues, it is premature to comment on whether these estimates are appropriate given the data and what is known about these species.

5. Evaluate the adequacy, appropriateness, and application of the methods used to project future population status.

   I assume that the code at the bottom of page 11 and top of page 12 of Appendix I was used to help generate Tables 17.1 to 18.3 and that `proj_C1[1:NTAC]` and `proj_C2[1:NTAC]` were supplied to the program as potential catches for 2012 and 2013, respectively. In turn, `proj_pH1` and `proj_pH2` returned by WinBUGS for each potential catch were used outside of WinBUGS to interpolate catches corresponding to the 5% intervals for the probabilities in the tables. If so, then this is a reasonable approach to evaluate the range of potential TACs. More explanation in the text would be helpful to the reader when assessing how the projections were evaluated.

   Again, assuming the projection code in table A5 was used here, there is an inconsistency that could affect the validity of the results. Note that in fitting the model, the mean log biomass (scaled by the estimate of *K*) for year *i* was generated by the surplus production model,

```
Pmean[i] <- log(max(P[i-1] + r*P[i-1]*(1-pow(P[i-1],M))
- Catch[i-1]/K,0.0001))
```

[3] Note *M* also used to designate natural mortality on page 6 of Brodziak et al. (2010).

The biomass estimate for year *i* was estimated by `B[i]<-P[i]*K`, where the P[i] was a draw from the lognormal distribution with variance σ^2,

```
P[i] ~ dlnorm(Pmean[i],isigma2)I(0.0001,10000).
```

The projected biomasses for 2011, 2012 and 2013 were estimated only using the first of the above two steps, e.g.,

```
proj_P[1] <- max(P[T] + r*P[T]*(1-pow(P[T],M)) - Catch[T]/K,0.0001)

B[T+1] <- proj_P[1]*K
```

This will likely result in the biomass projections being more precise than what was expected for the annual biomass estimates within the model. Generally, one would expect the opposite to hold. It would be informative to see a comparison of the distribution of projections using this current method with that from adding the additional step of sampling from the lognormal to see what the impact is of skipping this step.

There is another approach that can help evaluate how well the model performs when projecting forward in time. That is, fit the model up to year *t* (e.g., 2000) and project forward for year *t*+1 using the actual catch. Compare the biomass estimate for 2001 for the model fit to the year 2000 with that estimated when fitting the model to the data including 2001. Repeat this process up the present time. This analysis can offer insight into the stability of the process for projecting ahead to 2011 and beyond.

6. Suggest research priorities to improve our understanding of essential population and fishery dynamics necessary to formulate best management practices. Include guidance on single species models, and whether this is possible given the current nature of this multispecies fishery, and difficulties in partitioning fishing effort between species.

The current stock assessment has made some improvements over the version reviewed in 2009. However, there remain a number of issues that need to be addressed before the assessment should be accepted as support for management. The first recommendation from the previous panel on providing a credible CPUE standardization was not adequately dealt with here. A re-analysis of the CPUE data taking into account the issues raised above will be required.

A number of serious issues concerning the Bayesian surplus production model were identified here. Further work is required here to clean up the modeling as was presented here.

The final paragraph of the Summary section in Brodziak et al. (2010) suggests that single species models may be possible in the future if the data currently being collected were augmented with more species specific information including the initiation of a multispecies fishery-independent survey. While all of this will be useful for going forward with single-species models, it is not obvious how this will help disentangle single species information from the data available to date. There is an extensive literature on partitioning fishing effort by species in a multispecies fishery (e.g., Tascheri et al. (2010) for a recent paper) as well as literature on whether it is appropriate to use species-specific reference points in managing multispecies fisheries (e.g., Walters et al. 2005). I really cannot judge what the next steps would be for this fishery given only the information presented for this review.

CONCLUSIONS and RECOMMENDATIONS

This stock assessment is completely dependent upon the information contained in the CPUE series. The previous review (Skillman 2009, Stokes 2009) identified many problems with the analysis of the CPUE data in the 2008 assessment and recommended that priority be given to developing a credible CPUE standardization. The re-analysis of the CPUE data presented in the current assessment falls short of developing this standardization. The new analysis included interaction terms which would result in different annual trends for different combinations of area and quarter but the paper reports only one annual trend for the model. Alternative models were introduced to account for the zero observations but few details were given and no interaction terms were included making it difficult to evaluate or compare with the first model used.

The previous review had recommended using the offset approach in the CPUE model to include temporal changes in the relationship between CPUE and population(s) biomass as formulated in the assessment, but the authors appear to have ignored this recommendation. The corrections proposed to account for these changes do not appear to be directly related to information gathered on what technological changes have occurred in this fishery.

The other three recommendations from the previous review were addressed within the limitations of available data however, there were no details on the collaborative process that was supposed to have been pursued.

A number of issues with the modeling approach were raised here including errors in the WinBUGS code, errors in the text concerning the expected mean and CV for inverse gamma random variables, problems with using AIC and BIC to screen Bayesian models and the potential of the inverse gamma priors used for the variance terms being informative. In addition, lack of model diagnostics such as prior/posterior plots and posterior predictive plots make it difficult to fully evaluate how well the model fits the data. Finally the impact of ignoring the process variance, σ^2 in the projections needs to be evaluated.

The current assessment did not adequately address the recommendations from the previous panel on the analysis of the CPUE data. The assessment needs to properly deal with the previous recommendations plus the additional issues identified here before any evaluation is conducted of the use of these data for monitoring the population dynamics of the species in the Deep 7 bottomfish group. Further, the modeling issues identified here need to be addressed before evaluating how useful the Bayesian surplus production model could be for supporting management of these species.

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Appendix 1: Bibliography of materials provided for review

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Appendix 2: Statement of Work for Stephen Smith

External Independent Peer Review by the Center for Independent Experts

Hawaii Deepslope Bottomfish

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: A peer review of the Hawaiian multispecies deepslope bottomfish resource is required using the CIE process. The scientific information and assessment for Hawaiian deepslope bottomfish was peer reviewed in June 2009 providing recommendations to increase the accuracy of the assessment. The objective of this review is to conduct a follow-up peer review to determine if the recommendations have been adequacy addressed and adequacy of the revised assessment for management purposes. The assessment has a large potential impact on a valuable fishery important to commercial and recreational fishers in Hawaii and fish consumers in the state. It forms the basis of bottomfish management decisions by the Western Pacific Regional Fishery Management Council (WPFMC), NMFS, and the State of Hawaii. The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**.

Requirements for CIE Reviewers: Three CIE reviewers shall conduct an impartial and independent peer review in accordance with the SoW and ToRs herein. Each CIE reviewer's duties shall not exceed a maximum of 10 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. CIE reviewer expertise shall include fish stock assessment, mathematical modeling, and statistical computing.

Location of Peer Review: Each CIE reviewer shall conduct an independent peer review as a desk review, therefore no travel is required.

Statement of Tasks: The CIE reviewer shall complete the following tasks in accordance with the SoW and Schedule of Milestones and Deliverables herein.

<u>Prior to the Peer Review</u>: 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, and other pertinent information. Any changes to the SoW or ToRs must be made through the COTR prior to the commencement of the peer review.

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 reviewers in accordance to the SoW scheduled deadlines specified herein. The CIE reviewers shall read all documents in preparation for the peer review.

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, each CIE reviewer is responsible only for the pre-review documents that are delivered to the reviewers in accordance to the SoW scheduled deadlines specified herein.

Desk Review: 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.** The CIE Lead Coordinator can contact the Project Contact to confirm any peer review 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.

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) Conduct an independent peer review in accordance with the ToRs (**Annex 2**).
3) No later than 28 January 2011, 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 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.

4 January 2011	CIE sends each reviewer contact information to the COTR, who then sends this to the NMFS Project Contact
7 January 2011	NMFS Project Contact sends the CIE Reviewers the pre-review background documents
13 January 2011	Project contact provides the CIE reviewers with the report to be peer reviewed
14-28 January 2011	Each reviewer conducts an independent peer review as a desk review
28 January 2011	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
11 February 2011	CIE submits CIE independent peer review reports to the COTR
Feb. 15 2011	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 report by the CIE Lead Coordinator, Regional Coordinator, and Steering Committee, this report 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).

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 report 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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NMFS Project Contact:

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808-983-5397

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.

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

Annex 2: Terms of Reference for the Peer Review

Hawaii Deepslope Bottomfish

1. Determine if recommendations from the June 2009 WPSAR/CIE review have been adequately addressed within the assessment update. .

2. Review the assessment methods used: determine if they are reliable, properly applied, and adequate and appropriate for the species, fisheries, and available data.

3. Evaluate the implementation of the assessment model: configuration, assumptions, and input data and parameters (fishery life history); more specifically determine if data are properly used, if choice of input parameters seem reasonable, if models are appropriately specified and configured, assumptions are reasonably satisfied, and primary sources of uncertainty accounted for.

4. Comment on the scientific soundness of the estimated population benchmarks and management parameters (e.g. MSY, Fmsy, Bmsy, MSST, and MFMT) and their potential efficacy in addressing the management goals stated in the relevant FMP or other documents provided to the review panel.

5. Evaluate the adequacy, appropriateness, and application of the methods used to project future population status.

6. Suggest research priorities to improve our understanding of essential population and fishery dynamics necessary to formulate best management practices. Include guidance on single species models, and whether this is possible given the current nature of this multispecies fishery, and difficulties in partitioning fishing effort between species.