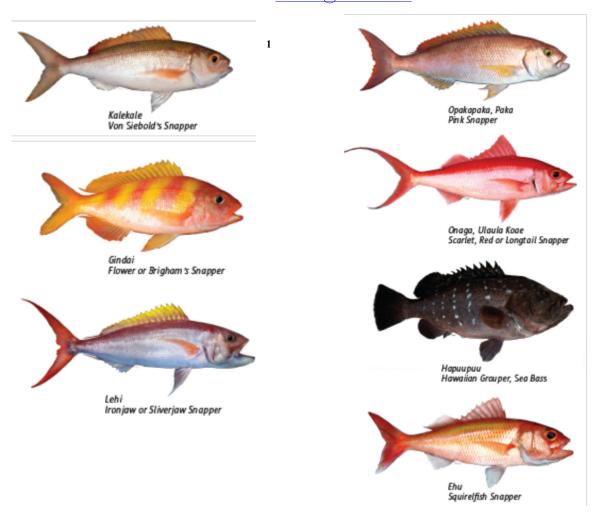***Stock Assessment Update for the Main Hawaiian Islands Deep7 Bottomfish Complex
Through 2013 With Projected Annual Catch Limits Through 2016***

Center for Independent Experts (CIE) Chair Summary Report prepared by:

John D. Neilson, Ph.D.
Independent Fisheries Consultant
10 Moss Drive
Chamcook, New Brunswick, Canada
E5B 3G7

Tel. 1 506 529-4922
Email: neilson@nbnet.nb.ca

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Kalekale
Von Siebold's Snapper

Opakapaka, Paka
Pink Snapper

Gindai
Flower or Brigham's Snapper

Onaga, Ulaula Koae
Scarlet, Red or Longtail Snapper

Lehi
Ironjaw or Sliverjaw Snapper

Hapuupuu
Hawaiian Grouper, Sea Bass

Ehu
Squirelfish Snapper

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[1] Source of Images: Bottomfish Fisheries in the Hawaiian Archipelago. Publication of the Western Pacific Fisheries Management Council, which in turn, credited Patrick Pepe Conley.

Executive Summary

An independent Center for Independent Experts (CIE) review of the stock assessment of the Deep 7 Bottomfish Complex was conducted in Honolulu, HI Dec. 9-12, 2014.The CIE Panel members were Dr. Panayiota Apostolaki, Dr. Noel Cadigan, Vivian Haist, and Dr. John Neilson (Chair). The document that was the main focus of the review was Brodziak et al. (2014), which described an update stock assessment of the Hawaiian bottomfish complex.

The Panel was presented with six Terms of Reference to structure its review. The first Term of Reference required the Panel to comment on the assessment methods that were used in stock assessment. The Panel concluded that the methods employed (Bayesian surplus production analyses) were generally appropriate. Under the second Term of Reference, the Panel was asked to consider the input data used. The Panel had strong reservations regarding the quality of the input catch data and CPUE index of abundance used for the stock assessment. Also, the Panel was concerned about the influence of highly informative priors, but the model formulation issues were viewed as secondary compared with the input data (catch, CPUE) concerns. Given the data quality issues, the Panel concluded that the stock assessment has serious flaws that compromised its utility for management. Considering the third Term of Reference (the scientific soundness of the estimated population benchmarks and management parameters), the Panel noted that given the conclusion the stock assessment model was not credible implied that the estimated population benchmarks and management parameters derived from the model are likely not reliable for addressing the management goals stated in the relevant Fisheries Management Plan. A similar conclusion was reached for the fourth Term of Reference, which required the Panel to evaluate the adequacy, appropriateness, and application of the methods used to project future population status. The Panel concluded that while the methods used to conduct the short-term projections were valid, population projections were not adequate for management purposes given the concerns with the assessment model. In addition, work completed by the Panel during the meeting showed that there are time trends in process error, which implied a less productive stock in the contemporary period. This will have implications for longer-term projections and the calculation of benchmarks.

The fifth Term of Reference was a broad-ranging one, and required the Panel to determine if the science reviewed was considered to be the best scientific information available. The Panel noted the availability of important new information on population dynamics that was not used in the proposed assessment model. Only limited changes to the previous assessment formulation established during the 2011 benchmark assessment were done due to the nature of the process where the assessment reviewed by the panel was an update only. Given this procedural constraint, as well as the areas for improvement in the index and the model, the science reviewed was not considered to be the best available information.

The final Term of Reference asked the Panel to make recommendations for future research directions. The Panel responded with a number of recommendations, structured into "immediate" and "longer term" categories. Within the immediate group of

recommendations, the need for improved monitoring of the fishery was highlighted to ensure that improved catch and effort information are available for the assessment. The Panel suggested investigating the development of a catch rate series using known "highliners" that have a history of good logbook completion. Considering the longer-term recommendations, the Panel considered that given the problems with the development of a credible commercial catch rate series, development of alternative indices of abundance is needed. The Panel was encouraged to see that the National Marine Fisheries Service (NMFS) has recently started on such work. Continued development of the fisheries-independent surveys is critical for an improved assessment, and the Panel strongly endorsed the initiatives. The Panel recommended investigating the new length frequency information from biological sampling data and new age information by completing catch curve analyses. Such analyses would provide estimates of total mortality, which could then be compared with the current estimates of Z. However, the Panel cautioned that the program of biological sampling did not appear to follow a particular design, which may limit the utility of the data obtained. Given the significant additional information on the biology of the species complex that is arising from the new research conducted by NMFS, the Panel recommends the independent evaluation of priors such as the one assumed for r using this additional new information. Finally, the Panel supported the intention of NMFS to move towards assessing species individually, as the needed data become available to support this evolution of the assessment.

The summary report contains several recommendations concerning the review process. In particular, the Panel found that the "update" format for the stock assessment documentation was often too terse to allow a thorough assessment of the stock assessment. For example, it was very difficult to determine the details of the fishery evolution over time, and that in turn impacted the Panel's ability to comment on the suitability of the approach for catch rate standardization, a critical part of the stock assessment.

A. Background

Description of the Reviewer's Role

The author was contacted by the Center for Independent Experts (CIE) on Nov. 29, 2014 to conduct the following tasks:

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 as the chair during the panel review meeting in Honolulu, Hawaii during December 9-12, 2014, and facilitate the panel review maintaining the focus of the peer review in accordance with the ToRs (Annex 2);
3) Produce a Summary Report of the proceedings.

Prior to this review, the author has had no involvement with the stock assessment for this species complex.

In keeping with the role defined by the CIE, the author chaired an independent CIE review of the Deep 7 Bottomfish Complex in Honolulu, HI Dec. 9-12, 2014 (see Appendix 3 for the Final Agenda). The Chair was asked to be an active participant in the Panel as well as acting as an impartial Chair. The CIE Panel members comprising the balance of the Panel were Dr. Panayiota Apostolaki, Dr. Noel Cadigan, and Vivian Haist. The Panel members contributed substantially to this summary report, and each will also submit independent reports following the contractual obligations with the CIE.

The document that was the main focus of the review was Brodziak et al. (2014), which described an update stock assessment of the Hawaiian bottomfish complex. The update assessment was based on a more comprehensive benchmark stock assessment that was conducted in 2011 (Brodziak 2011). The latter document was also provided to the Panel, as part of a package of related material that described recent advances in population dynamics research, descriptions of the fisheries and previous assessments (see Appendix 1: Bibliography of materials provided for review).

B. Summary of Conclusions Referring to the Terms of Reference.

This Section of the report contains consensus views of the Panel, unless otherwise noted.

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

The stock assessment was based on an age-aggregated Bayesian generalized surplus production model. The Panel noted the modeling approach has process and catch error included, which seemed appropriate for the stock. The method appears to have been appropriately applied. Of course, the method is reliable only if the catch and CPUE data

are reasonably reliable. Inclusion of the production model shape parameter was appropriate for this relatively unproductive species complex, and the value estimated appeared realistic.

Although surplus production models can generally perform well in simulating the dynamic of the stock, they are not able to explicitly deal with age- or size-dependent processes and non-linear effects of stock size on recruitment. That could produce some misleading results under certain conditions and reduces the number of fisheries behaviors (e.g. size-specific selectivity) or management measures that can be simulated (Punt 1995). The Panel recognizes, however, that the available data for this stock complex are very limited and use of more complex models might not be an option in the short term.

2. *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.*

The assessment used catch data for the period from 1949 to 2013 and CPUE series for the same period but split into two indices. Estimates of unreported catches were available and were also included in the calculations. Information about the biology of the stock was used to construct prior pdfs for parameters such as r and M although while results from previous assessments informed the construction of prior pdfs for some of the other model parameters. The priors used for the parameters describing the dynamics of the stock and its size were informative or highly informative.

Compared with the 2011 assessment, the Panel agreed that the approach for catch rate standardization in 2014 was a considerable improvement. The primary change was to split the time series into two segments, which allowed inclusion of "fisher" effects in the post-1994 series. The Panel suggested that further potential gains could be made through exploring fields in the logbook data that provide a unique vessel identifier (HI Vessel Registration Number, which appears to have been recorded from 1960 to the present). To further reduce the possible inclusion of trips that were reported as single day trips but were actually multi-day trips in the catch and effort data used in the standardization, the assessment team could consider omitting monthly catch records that include only a single entry for the whole month. Based on the available information and discussions, it appears there is less confidence in the CPUE data in the early years of the series. It wasn't clear if the weight that that the CPUE indices for the early years received in the Bayesian production model was appropriate. The Panel also noted that the assessment did not account for technological improvements, which was a recommendation from the CPUE Workshop (Moffitt et al. 2008)

The estimation of some production model parameters caused the Panel difficulty. The Panel noted that for some parameters (K and P_1), the same data were used to derive the prior and posterior distributions. Empirical Bayes methods are commonly used in statistical inference but seemed to not be applied properly in this assessment.

The Panel considered that the sensitivity analyses should have included broader/less informative priors. At the request of the Panel, a sensitivity analysis of the abundance in the first year of the calculations (i.e. 1949) relative to carrying capacity parameter (P_0) was completed. The highly informative P_0 prior used in the base model did not appear to be driving the model results by itself in this specific case. The Panel noted that more comprehensive sensitivity runs would be needed to understand the effect of the priors on the model results but given greater issues with the assessment this was not explored further during the review.

The Panel was concerned that there might be bias in the pre-1990 estimates of unreported catch (which were considered in the stock assessment to be about 1.8 times reported catch). The values are derived from a 1990/91 Oahu survey, which accounted for <15% of the total reported catch, and expanded to the entire HWI area. The appropriateness of this areal expansion could be examined by calculating the reported to unreported catch ratios for each of the Hawaiian Islands from the 2005 unreported catch survey data. The current assessment practice of allowing a +/- 20% range of uncertainty around annual estimates of unreported catch values may not be adequately accounting for potential biases nor the additional uncertainty in the magnitude of unreported catch in the early part of the time-series.

The Panel requested a run with a constant ratio of unreported catch, the ratio was equal to that used for unreported catches in recent years (i.e. 1.08). For this run (as was also the case with the base case run), recent exploitation rates exceed H_{msy}, and the stock may be overfished contingent on the choice of natural mortality (M=0.25 vs 0.1).

The Panel also concluded that the CPUE index did not seem sufficiently reliable to use as an index of stock size for the entire assessment time-period. Although the assessment model assumed a change in catchability in 1994, the index for earlier years may be unduly affected by factors other than stock size. However, the CPUE series for the period after 1994 appears to be more credible as additional important information (Commercial Marine License Number) has been incorporated into the analyses.

More generally, the Panel had strong reservations regarding the quality of the input catch data and CPUE index of abundance for the stock assessment. Given the concerns with the input data, the Panel concluded that the stock assessment had serious flaws that compromised its utility for management. However, it is still an improvement in comparison to the 2011 assessment.

3. *Comment on the scientific soundness of the estimated population benchmarks and management parameters (e.g. MSY, F_{msy}, B_{msy}, 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.*

Management advice for the Hawaii Deep 7 bottomfish complex is provided with scenarios of realized catches projected forward for the fishing years 2014-2016 to estimate future probable stock status relative to biomass and exploitation level targets.

The methodology used for the projections and establishing the targets appeared appropriate.

However, the earlier conclusion that the stock assessment model was not credible implied that the estimated population benchmarks and management parameters are likely not reliable for addressing the management goals stated in the relevant Fisheries Management Plan.

The Panel notes that the estimate of natural mortality (M=0.25) currently used to establish the overfished threshold might be too high, given the new information on age, growth and longevity reported to the Panel. Based on the results of the base case run, a value for natural mortality that would be less that 0.15 will change the status of the stock from not been overfished to overfished (see also the Panel's report below for Term of Reference 4, describing its views on the appropriateness of the projection methodology).

The Panel observed that under recent catch levels, the CPUE of the stock complex has been stable, and that provides some reassurance that recent catch levels are sustainable.

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

The short-term projection methodology was reasonable. It did not include temporal dependency in process errors (see below) that seemed large for this assessment; however, because the projections were only for two years, this may not be an important issue. However, the Panel considered that given the concerns with the population model identified earlier, population projections are not adequate for management purposes.

The Panel asked the stock assessment team to rerun the projections for the base case model using M=0.1. That led to a more pessimistic outcome about catches that can be allowed in the future.

Work completed by a panel member during the meeting showed that there are time trends in process error, which implied a less productive stock in the contemporary period. This will have important implications for longer-term projections and the calculation of benchmarks.

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

The Panel noted the availability of important new information on population dynamics including new aging studies, and length frequency data. However, the Panel was informed that the assessment reviewed was an update only and that permitted only limited changes to the previous assessment formulation established during the 2011 benchmark assessment. Given this procedural constraint, as well as the areas for improvement in the index and the model, the science reviewed is not considered to be the best available.

In spite of those criticisms, The Panel noted improvements in the current assessment compared to 2011 and unanimously agreed that the assessment team has made very important steps in improving the understanding of Deep 7 bottomfish population dynamics. Further, the assessment team has made admirable efforts to deal with the difficult problems presented in this assessment.

6. *Suggest research priorities to improve our understanding of essential population and fishery dynamics necessary to formulate best management practices. Comment on alternative data sources and modeling, including any potential fishery independent data sources that could be used to supplement fisheries data. 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.*

Immediate Priorities

- The Panel considers that a first priority would be to strengthen the program of fishery monitoring to ensure that the collection of catch and effort data is complete and accurate. Improved information on total removals by gear type, hours fished, and more area-specific data would be particularly useful. Species-specific data would be particularly important.

  An important step towards this objective has been made, as the Panel was informed that a series of regular meetings have been established with the fishing industry and NMFS. Such outreach efforts are likely to be very useful in developing new approaches for dealing with the troublesome data issues with this fishery. Given the reliance of the stock assessment process on data obtained by the State of Hawaii, it is strongly recommended that State officials be part of this initiative intended to improve basic catch and effort data.

- The Panel suggested investigating the development of a catch rate series using known "highliners" that have a history of good logbook completion. It may also be useful to consult with fishermen to see if there are specialists for Hawaiian Grouper, a species that appears to be more vulnerable to exploitation (based on new life history information presented to the Panel) and also seems to be less abundant over time (Table 4 of Brodziak et al. 2014). The current IUCN ranking for this species is "Near Threatened", but that assessment was made in 2003, and the new information presented to the Panel that indicated that Hawaiian Grouper are very long-lived may impact that evaluation.

- The Panel recommends investigating the new length-frequency information from biological sampling data and new age information by completing catch curve analyses. Such analyses would provide estimates of total mortality, which could then be compared with the current estimates of Z. This method will give approximate guidance only, given assumptions of the method.

- Biological sampling of the landings will give important information for the stock assessment. However, the Panel was concerned that the sampling did not appear to follow a particular design, which may limit the utility of the data obtained. It would also be desirable to obtain more detailed information on the location of the catch.

- Given the additional information on the biology of the species complex, we recommend the independent evaluation of priors such as r using this additional new information. For the same reason, we also recommend further work to assess whether the chosen value for natural mortality is still appropriate.

Longer Term Priorities

- Given the problems with the development of a credible commercial catch rate series, development of alternative indices of abundance is needed, and it is encouraging to see that NMFS has started on such work. Continued development of the fisheries-independent surveys is critical for an improved assessment, and the Panel strongly endorses the initiatives.

- The Panel also endorses a large-scale tagging program which can provide alternative (to the assessment model) information on harvest rates in the short-term, but notes that the design of such programs is critical to the utility of the data for harvest rate estimation.

- The Panel supports the intention of NMFS to move towards single species assessments, as the needed data become available to support this evolution of the assessment. The Panel also agrees with the treatment of Hawaiian Grouper as a single species assessment, given the new information on the longevity of this species, which suggests an even lower productivity than other members of the Deep 7 complex.

C. *Conclusions*

Overall, the Panel has concluded that the current stock assessment, although improved compared with the previous one, is flawed and does not provide a sound basis for the management of Hawaii Deep 7 bottomfish complex. However, the Chair of the Panel acknowledged that this is one of the more challenging stock assessments that he has had the opportunity to review. The combination of imprecise and possibly biased landings, a similarly questionable index of abundance derived from incomplete effort information, and a mixed species fishery presents an unquestionably difficult scenario for any team of stock assessment scientists. Regardless, it is clear that the PIFSC is committed to systematically improving the state of knowledge for this resource, leading to an improved basis for the stock assessment. The new initiatives for a fishery-independent survey, biological sampling in the market, and a move towards single species assessments are all particularly encouraging developments.

The specifications for the Chair's Summary Report indicates that "The Chair shall provide a critique of the NMFS review process, including suggestions for improvements of both process and products."

There were certain documents that were very relevant to the review that should have been included in the package of materials provided to the CIE Experts, including the Chair. These documents include the reports from the CIE reviews (see Appendix One) of the 2011 benchmark assessment (Brodziak et al. 2011), and the report of the CPUE standardization workshop. In the case of the former reviews, they are indeed available publically but at least one of the CIE reviewers for the current assessment was not aware that CIE reviews were done in 2011. In the case of the CPUE Workshop, while it was provided during the review week, having access to the important document earlier would have been helpful.

A strong feature of the current stock assessment and underlying population dynamics research is the logical and thorough response by NMFS to the 2009 Stokes CIE review, which appears to have been highly influential in establishing the research directions and priorities over the past five years. However, it is less clear to the author what impacts the 2011 reviews had. It would have been helpful to see a response to the 2011 CIE reviews from NMFS.

It would be desirable to more formally include fishermen's perceptions of the fishery into the stock assessment process, and perhaps the-newly instituted regular meetings with the fishing industry will accomplish this. It was interesting to note that fishermen have strong views that the overall efficiency of the fishing fleet has decreased over time, with a greater proportion of less-experienced fishermen currently in the current fishery compared with the past. Available data should be examined to test this hypothesis, and if supported, the stock assessment should include scenarios to reflect this.

The nature of the presentations made for the benefit of the CIE Review was in general, of high quality and assisted the Panel in their work. The Panel also greatly appreciated the responsiveness of the NMFS stock assessment team to undertake some additional model runs, which helped test some of the Panel's concerns about the model formulation.

Regarding the products of the stock assessment process, the documentation could have been more comprehensive. Even though the document is meant to be an update of the 2011 benchmark stock assessment, certain sections of the report (such as the catch rate standardization section) seemed too terse. It would have also been useful to include some exploratory data analyses of the catch and effort information (for example, cross tabulations of catch by area, year, gear, etc.). The document could have also benefitted from graphical representations of basic data such as catch by species over time. Such plots allow the evaluation of the appropriateness of both main factors and interaction terms in the catch rate standardization model and an understanding of the evolution of the fishery, and would have been helpful to be included in the documentation.

Literature Cited in the Summary Report

Brodziak, J., D. Courtney, L. Wagatsuma, J. O'Malley, H. Lee, W. Walsh, A. Andrews, R. Humphreys, and G. DiNardo. 2011. Stock assessment of the Main Hawaiian Islands Deep7 bottomfish complex through 2010. U.S. Dep. Commer., NOAA Tech. Memo., NOAA-TM- NMFS-PIFSC-29, 176 p. + Appendix.

Brodziak, J., A. Yau, J. O'Malley, A. Andrews, R. Humphreys, E. DeMartini, M. Pan, M. Parke, and E. Fletcher. 2014. Stock Assessment Update for the Main Hawaiian Islands Deep7 Bottomfish Complex Through 2013 With Projected Annual Catch Limits Through 2016. 59p.

Moffitt, R., G. DiNardo, J. Brodziak, K. Kawamoto, M. Quach, M. Pan, K. Brookins, C. Tam, and M. Mitsuyatsu. 2011. Bottomfish CPUE standardization workshop proceedings August 4-6, 2008. Pacific Islands Fish. Sci. Cent., Natl. Mar. Fish. Ser., NOAA, Honolulu, HI 96822-2396. Pacific Islands Fish. Sci. Cent. Internal Rep. IR-11-003, 17 p.

Punt, A.E. 1995. The performance of a production-model management procedure. Fish. Res. 21: 349-374

Stokes, K. 2009. Report on the Western Pacific stock assessment review 1 Hawaii deep slope bottomfish. Center for Independent Experts, stokes.net.nz Ltd., Wellington 6035, New Zealand, 27 p.

Appendix 1: Bibliography of materials provided for review

Andrews, A. H., R. L. Humphreys, E. E. DeMartini, R. S. Nichols, and J. Brodziak. 2011. Bomb radiocarbon and lead-radium dating of opakapaka (Pristipomoides filamentosus). Pacific Islands Fish. Sci. Cent., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Pacific Islands Fish. Sci. Cent. Admin. Rep. H-11-07, 58 p. + Appendices.

Andrews, A. H., R. L. Humphreys, E. E. DeMartini, R. S. Nichols, and J. Brodziak. 2012. Comprehensive validation of a long-lived life history for a deep-water snapper (Pristipomoides filamentosus) using bomb radiocarbon and lead-radium dating, with daily increment data. Can. J. Fish. Aquat. Sci. 69:1-20. doi:10.1139/f2012-109.

Brodziak, J., D. Courtney, L. Wagatsuma, J. O'Malley, H. Lee, W. Walsh, A. Andrews, R. Humphreys, and G. DiNardo. 2011. Stock assessment of the Main Hawaiian Islands Deep7 bottomfish complex through 2010. U.S. Dep. Commer., NOAA Tech. Memo., NOAA-TM- NMFS-PIFSC-29, 176 p. + Appendix.

Brodziak, J., A. Yau, J. O'Malley, A. Andrews, R. Humphreys, E. DeMartini, M. Pan, M. Parke, and E. Fletcher. 2014. Stock Assessment Update for the Main Hawaiian Islands Deep7 Bottomfish Complex Through 2013 With Projected Annual Catch Limits Through 2016. 59p.

Courtney, D. and J. Brodziak. 2011. Review of unreported to reported catch ratios for bottomfish resources in the Main Hawaiian Islands. Pacific Islands Fish. Sci. Cent., Natl. Mar. Fish. Ser., NOAA, Honolulu, HI 96822-2396. Pacific Islands Fish. Sci. Cent. Internal Rep. IR-11-017, 45 p.

Hospital, J., and C. Beavers. 2013. Catch shares and the Main Hawaiian Islands bottomfish fishery: Linking fishery conditions and fisher perceptions. Marine Policy http://dx.doi.org/10.1016/j.marpol.2013.08.006.

Stokes, K. 2009. Report on the Western Pacific stock assessment review 1 Hawaii deep slope bottomfish. Center for Independent Experts, stokes.net.nz Ltd., Wellington 6035, New Zealand, 27 p.

Additionally, at Dr. Neilson's request, the CIE provided the following documents (also may be found at https://www.st.nmfs.noaa.gov/science-quality-assurance/cie-peer-reviews/cie-review-2011):

Chen, Y. 2011. Stock Assessment of the Main Hawaiian Islands Deep7 Bottomfish Complex Through 2010 **,** Center for Independent Experts, 26 p.

Smith, S. 2011. Report on Hawaii Deepslope Bottomfish, Center for Independent Experts, 20 p.

Klaer, N. 2011. CIE Reviewer's External Independent Report on the assessment of Hawaii deepslope bottomfish. Center for Independent Experts, 26 p.

Appendix 2

Statement of Work for Dr. John Neilson

External Independent Peer Review by the Center for Independent Experts

Stock Assessment Update for the Main Hawaiian Islands Deep7 Bottomfish Complex Through 2013 With Projected Annual Catch Limits Through 2016

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 stock assessment update of the Main Hawaiian Islands (MHI) Deep7 bottomfish complex was conducted through fishing year 2013. This update used the previous benchmark assessment data analysis, modeling, and stock projection approaches with one minor improvement in CPUE standardization. This update was conducted using up-to-date re-audited bottomfish catch and effort data from Hawaii state commercial catch reports for the years 1948-2013. Unreported catch was estimated and included in the model using catch and effort data from the deep-water bottomfish handline fishery. Model selection techniques were applied to select the best structural form to standardize CPUE. An important improvement to this stock assessment model is the inclusion of information on individual fishermen's skill, or license effect, to standardize CPUE from 1994-2013; this resulted in a significant increase in the explanatory power of the CPUE standardization model but did not have a substantial effect on the estimated trend in CPUE. CPUE in the model was split into two time series (1949-1993, and 1994-2013) in order to accommodate the inclusion of license effect, which could only be tracked starting in 1994 when licenses became uniquely assigned to a fisher/vessel through time. A Bayesian production model was used to estimate time series of Deep7 bottomfish exploitable biomasses and harvest rates and was also used to conduct stochastic short-term projections of future catches, stock status conditions, and associated risks of overfishing in 2015-2016. These projections explicitly included uncertainty in the distribution of estimated bottomfish biomass in 2014 and population dynamics parameters. Results of the catch and CPUE analyses, production modeling, and stock projections are summarized and are used to characterize uncertainty of Deep7

ACLs for fishing years 2015-2016 assuming alternative commercial catch amounts in 2014. Overall, the Deep7 complex in the Main Hawaiian Islands is not currently experiencing overfishing and is not currently depleted relative to the best available information on biological reference points.

The scientific information and assessment to be reviewed have not undergone independent peer review   and there is a need to evaluate the data and assessment methods to improve the scientific basis for management. Further, the scientific information to be reviewed has a large potential impact on a valuable fishery important to commercial and recreational fishers in Hawaii and fish consumers in the state. It will be the foundation 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**. The tentative agenda of the panel review meeting is attached in **Annex 3**.

Requirements for CIE Chair: One CIE chair shall serve as an external expert to chair the panel review under the auspices of the Western Pacific Stock Assessment Review (WPSAR) process, and in accordance with the SoW and ToRs herein. CIE chair shall have excellent oral and written communication skills in addition to working knowledge in fish population dynamics, with experience in the application of stock assessment models in data poor situations sufficient to complete the primary task of facilitating, as an impartial chair, the panel review in accordance with the SoW tasks and Terms of Reference (ToRs) as specified herein. The CIE chair's duties shall not exceed a maximum of 14 days to complete all work tasks as described herein.

Location of Peer Review: The CIE chair shall participate during the Hawaiian islands bottomfish panel review meeting scheduled in Honolulu, Hawaii during 9-12 December 2014.

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

Prior to the Peer Review: Upon completion of the CIE expert selection by the CIE Steering Committee, the CIE shall provide the CIE chair 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 chair. The NMFS Project Contact is responsible for providing the CIE chair 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 CIE Chair a copy of the SoW in advance of the panel review meeting, and the CIE Chair read and understand the CIE contractual requirements of the CIE reviewers. 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 experts 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 experts who are non-US citizens. For this reason, the CIE experts 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/ http://deemedexports.noaa.gov/compliance_access_control_procedures/noaa-foreign-national-registration-system.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 expert 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. The CIE chair is responsible only for the pre-review documents that are delivered in accordance to the SoW scheduled deadlines specified herein. The CIE expert shall read all documents in preparation for the peer review, including:

Andrews, A. H., R. L. Humphreys, E. E. DeMartini, R. S. Nichols, and J. Brodziak. 2011. Bomb radiocarbon and lead-radium dating of opakapaka (Pristipomoides filamentosus). Pacific Islands Fish. Sci. Cent., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Pacific Islands Fish. Sci. Cent. Admin. Rep. H-11-07, 58 p. + Appendices.

Andrews, A. H., R. L. Humphreys, E. E. DeMartini, R. S. Nichols, and J. Brodziak. 2012. Comprehensive validation of a long-lived life history for a deep-water snapper (Pristipomoides filamentosus) using bomb radiocarbon and lead-radium dating, with daily increment data. Can. J. Fish. Aquat. Sci. 69:1-20. doi:10.1139/f2012-109.

Brodziak, J., D. Courtney, L. Wagatsuma, J. O'Malley, H. Lee, W. Walsh, A. Andrews, R. Humphreys, and G. DiNardo. 2011. Stock assessment of the Main Hawaiian Islands Deep7 bottomfish complex through 2010. U.S. Dep. Commer., NOAA Tech. Memo., NOAA-TM- NMFS-PIFSC-29, 176 p. + Appendix.

Brodziak, J., A. Yau, J. O'Malley, A. Andrews, R. Humphreys, E. DeMartini, M. Pan, M. Parke, and E. Fletcher. 2014. Stock Assessment Update for the Main Hawaiian Islands Deep7 Bottomfish Complex Through 2013 With Projected Annual Catch Limits Through 2016. 59p.

Courtney, D. and J. Brodziak. 2011. Review of unreported to reported catch ratios for bottomfish resources in the Main Hawaiian Islands. Pacific Islands Fish. Sci. Cent., Natl. Mar. Fish. Ser., NOAA, Honolulu, HI 96822-2396. Pacific Islands Fish. Sci. Cent. Internal Rep. IR-11-017, 45 p.

Hospital, J., and C. Beavers. 2013. Catch shares and the Main Hawaiian Islands bottomfish fishery: Linking fishery conditions and fisher perceptions. Marine Policy http://dx.doi.org/10.1016/j.marpol.2013.08.006.

Stokes, K. 2009. Report on the Western Pacific stock assessment review 1 Hawaii deep slope bottomfish. Center for Independent Experts, stokes.net.nz Ltd., Wellington 6035, New Zealand, 27 p.

Panel Review Meeting: The CIE expert shall facilitate the panel review in the role as an impartial chair ensuring the reviewers conduct a scientific 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 cannot 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 chair shall actively participate in a professional and respectful manner as an impartial member of the meeting review panel ensuring the peer review 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 and the CIE Coordinator are responsible for ensuring that the Chair understands the contractual role of the CIE reviewers and ToRs as specified herein. The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements, including the meeting facility arrangements.

Independent CIE Peer Reviewer Reports: The CIE Chair must understand each CIE reviewer shall complete an independent peer review report in accordance with the SoW and ToRs as described in Annex 2. The independent CIE peer review reports are independently reviewed and independently approved in accordance with the ToRs by the CIE Steering Committee, hence the independent CIE reports not the responsibility of the CIE Chair.

Summary Report: The CIE chair is responsible for developing the Summary Report, and 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. The CIE reviewers and the CIE chair are 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 Chair: The following chronological list of tasks shall be completed in a timely manner as specified in the **Schedule of Milestones and Deliverables**.

4) 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;
5) Participate as the chair during the panel review meeting in Honolulu, Hawaii during December 9-12, 2014, and facilitate the panel review maintaining the focus of the peer review in accordance with the ToRs (Annex 2);
6) Produce a Summary Report of the proceedings. The summary report shall not be a consensus report. The independent CIE reviewers should have an opportunity to review and provide comments or elaboration on any points raised in the summary report that they feel might require further clarification. No later than January 2,

2015, the CIE Chair shall submit a Summary 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. The 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.

1 November 2014	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact
26 November 2014	NMFS Project Contact sends the CIE Chair the pre-review documents
9-12 December 2014	The CIE Chair participates and facilitates in the role as chair the panel review meeting in accordance with the ToRs
2 January 2015	The CIE Chair submits the draft Summary Report to the CIE Lead Coordinator, CIE Regional Coordinator, and each independent CIE reviewer for review and comments.
12 January 2015	CIE submits the CIE independent peer review reports and Summary Report to the COTR
16 January 2015	The COTR distributes the final independent CIE reports from each CIE reviewer and the Chair's Summary Report to the NMFS Project Contact and regional Center Director.

Modifications to the Statement of Work: This 'Time and Materials' task order may require an update or modification due to possible changes to the terms of reference or schedule of milestones resulting from the fishery management decision process of the NOAA Leadership, Fishery Management Council, and Council's SSC advisory committee. A request to modify this SoW must be approved by the Contracting Officer at least 15 working days prior to making any permanent changes. The Contracting Officer will notify the COTR within 10 working days after receipt of all required information of the decision on changes. 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) The CIE report shall completed with 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 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:

Allen Shimada
NMFS Office of Science and Technology
1315 East West Hwy, SSMC3, F/ST4, Silver Spring, MD 20910
Allen Shimada@noaa.gov   Phone: 301-427-8174

William Michaels
NMFS Office of Science and Technology
1315 East West Hwy, SSMC3, F/ST4, Silver Spring, MD 20910
William.Michaels@noaa.gov   Phone: 301-427-8155

Manoj Shivlani, CIE Lead Coordinator
Northern Taiga Ventures, Inc.
10600 SW 131st Court, Miami, FL 33186
mshivlani@ntvifederal.com   Phone: 305-968-7136

Key Personnel:

NMFS Project Contact:

Gerard DiNardo
Stock Assessment Program Leader
Fisheries Research and Monitoring Division
National Marine Fisheries Service
Pacific Islands Fisheries Science Center
1845 Wasp Boulevard., Bldg. #176
Honolulu, Hawaii 96818
gerard.dinardo@noaa.gov   Phone: (808) 725-5397

Annex 1: Format and Contents of Summary Report

1. The Summary 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 Summary Report shall consist of a Background, Description of the Chair'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. The Chair should describe in 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. The Chair should discuss views on each ToR including differences of views among other panelists, and especially where there were divergent views.

   c. The Chair should elaborate on any points raised in the Summary Report that they feel might require further clarification.

   d. The Chair shall provide a critique of the NMFS review process, including suggestions for improvements of both process and products.

   e. The Chair's report shall be a stand-alone document for others to understand the weaknesses and strengths of the science reviewed in regard to each ToRs, and shall not simply repeat the contents of the independent reports submitted by the independent CIE reviewers.

3. The CIE Chair's Summary Report shall also 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 Update for the Main Hawaiian Islands Deep7 Bottomfish
Complex Through 2013 With Projected Annual Catch Limits Through 2016**

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

2. 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.

3. 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.

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

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

6. Suggest research priorities to improve our understanding of essential population and fishery dynamics necessary to formulate best management practices. Comment on alternative data sources and modeling, including any potential fishery independent data sources that could be used to supplement fisheries data. 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.

7. Draft a report of the CIE Panel conclusions and findings, addressing each Term of Reference.

Appendix 3: Final Agenda
Stock Assessment Update for the Main Hawaiian Islands Deep7 Bottomfish
Complex Through 2013 With Projected Annual Catch Limits Through 2016

Honolulu Service Center, NOAA Fisheries Pier 38, Honolulu Harbor, 1139 N.
Nimitz Hwy, Suite 220,

9-10 December 2014

University of Hawaii at Manoa, Hemenway Hall, Room 204

11-12 December 2014

Tuesday December 9 (9:00 am – 4:00 pm)

1. Introduction (DiNardo)

2. Objectives and Terms of Reference (DiNardo; Neilson)

3. Fishery (Alton Miyasaka, HI DAR)

4. Data

   State of Hawaii System (Miller, HI DAR

   Biological data

   Age & Growth (Andrews, PIFSC)

   Biosampling (Sundberg)

   F-I Survey (Richards)

5. Management - implementation of assessment results (Makaiau /Sabater)

   Historical Perspective - NMHI/MHI

   Recent Management Objectives – MHI Focus

   P* Process

Wednesday December 10 (9:00 am – 4:00 pm)

6. Review of Stock Assessment (Brodziak/Yau)

Thursday December 11 (9:00 am – 4:00 pm)

7. Continue Assessment Review (1/2 day)

8. Panel discussions (Closed)

Friday December 12 (9:00 am – 4:00 pm)

9. Panel Discussions (1/2 day)

10. Present Results (afternoon)

11. Adjourn