

Review of Assessment Methods for Data-Moderate Stocks

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Executive Summary

The workshop to Review of Assessment Methods for Data-Moderate Stocks had four terms of reference: 1) Review and evaluate documents detailing data-moderate and data-poor methodologies, 2) Evaluate the technical merits and deficiencies of the proposed method(s), 3) Evaluate and provide recommendations for the application of these methods for their utility in stock assessment and for their ability to monitor trends at the population level, 4) Decide through Panel discussions if the ToRs and goals of the peer review have been achieved. The Panel was able to complete all four terms of reference and came to consensus on all recommendations.

The workshop reviewed 1) evaluations of input parameters, 2) use of fishery independent and recreational indices as input, and 3) extensions of assessment methods to data-moderate (tier 2) stocks used previously in data-poor (tier 3) in the DB-SRA and EDB-SRA; from extensions from assessments of data-rich (tier 1) to data-moderate (tier 2) stocks in the exSSS and exSSSv models. Only one area of discussion lacked sufficient documentation and we were unable to evaluate it. NMFS has used priors on natural mortality, M , in previous assessments. The data sources on which these were based and protocols for their use were unavailable for our review

The panel reviewed inputs to the data-moderate and data-poor models including: B_{MSY}/B_0 ; F_{MSY}/M ; M/k ; Δ . Often times the available data on these life-history parameters are scarce or non-existent for a species. Scientists have compiled data in the RAM database that they are using in a meta-analysis of these life-history parameters to better inform data-poor species and include estimates of uncertainty in the differences between families and species within a family. Further work evaluating uncertainty would be productive. To improve catch-only methods such as DCAC and DB-SRA values of vulnerability from the Productivity-Susceptibility Analysis (PSA) were evaluated and used to improve the estimates of depletion.

The panel also deliberated over the value of standardized time series indices that could be used in data-moderate models. The panel decided that available fishery dependent and recreational surveys can provide additional indices upon further development. These surveys provide sparse coverage for abundance of many species, but could be valuable to establish range and presence/absence. We reached consensus that the count of positive tows and number of species in each tow can provide useful data. These data may be useful for post-hoc stratification to re-stratify by species occurrence. Overall, we agreed that the spatial extent of species occurrence can be used as a proxy for range of abundance. We had a further discussion on using habitat-guild abundances/presence as the response variable. In fisheries that are harvested recreationally, CPUE may provide data for assessments where other data are sparse or non-existent.

The panel concentrated on modifications of two models, SS3 and DB-SRA. Both models have advantages. exSSS easily models biology of a given stock because it is derived from SS3 and thus is based on a well-known package used widely on the West Coast. However, the model is

more complex and doesn't treat uncertainty as well. exDB-SRA is simpler and more straightforward model but is limited in the number of indices it can employ. Its Bayesian framework is better at dealing with uncertainty. The panel concluded that both the exSSS and EDB-SRA models are valuable in stock assessments of data-moderate stocks. Neither showed technical flaws that would preclude their use. One difficulty in comparing them was that they were applied to different data sets. The panel stated, and I concur strongly, that there should be a side-by-side comparison using both models on simulated data. The Panel reached consensus and recommended that two assessment approaches should be used for data-moderate stocks based on their performance at the workshop: EDB-SRA and exSSS.

Background

In 2006, reauthorization of the Magnuson-Stevens Fisheries Conservation and Management Act (MSFCMA) required that the regional management councils had to set annual catch limits (ACL) for all managed stocks. Additionally, the MSFCMA required that scientific and management uncertainty be considered when setting the ACL. Moreover, the over fishing limit (OFL) was defined as the catch that results from fishing at F_{msy} . These requirements have placed demands on stock assessment scientists to develop new models and methods to provide ACL for stocks that lack sufficient information for an age-structured analysis.

For the 90 stocks managed by the Pacific Fishery Management Council, approximately two-thirds are without formal stock assessments. Of these, 64 are managed within stock complexes (Cope et al 2011). These constitute data-poor and data-moderate stocks whose assessments could be improved by models designed to maximize information from the sparse data that is available.

To improve data available for assessment of these stocks, fisheries scientists have been using techniques such as meta-analysis to improve the quality and quantity of available data. For example when certain inputs such as steepness (h) or a reliable measure of natural mortality (M) are unavailable for a stock, then similar stocks (similar location, or family, or guild) could be used to provide a distribution of these metrics that can be used as a prior for a data-poor assessment.

Several models have been developed to maximize the use of catch histories and available indices, including DCAC, modifications of SS3 (exSSS; exSSS_v), and modifications of DB-SRA. These models provide estimates of OFL, biomass, and some modifications also provide measures of uncertainty. The workshop held in Seattle, Washington, from June 25-29, 2012 reviewed new modifications of these models to determine their performance in data-poor and -moderate stocks under PFMC management.

Description of the Individual Reviewer's Role in the Review Activities

My role as a CIE reviewer at was to participate in the Review of Assessment Methods for Data-Moderate Stocks workshop review meeting at the held at the National Marine Fisheries Service (NMFS), Alaska Fisheries Science Center (AFSC) in Seattle, Washington on 26-29 June 2012 (see Appendix 3 for meeting agenda) and to participate is discussions and deliberations and to assist in writing and editing the Panel Summary Report. Background documents were available at: running ftp://ftp.pcouncil.org/pub/GF_DataModerateMethodsReview_June2012/. To prepare, I read and became familiar with the relevant documents provided by the NEFSC scientists to the panel (Appendix 1).

I attended the review meeting from 8:30 26 June until 11:45 29 June. NMFS scientists presented the results of simulations, exploration of various models, and results of the new approaches to modeling data-poor and moderate stocks in PowerPoint or Pdf presentations. During these presentations, the Review Panel members asked questions about the interpretations and received clarifications. We asked for additional work (shown on the ftp site) on the assessments in regard to evaluating how the models fit various taxonomic groups, handled different priors, and produced estimates of uncertainty. We worked together on NMFS TOR and on the Panel Summary Report. Formal presentations were finished by Thursday, presentations on our additional requests were made on Thursday and Friday, and the Review Panel wrote the preliminary Panel Summary Report as each relevant section was finished. At the time of this report, drafting the Panel Summary Report is still ongoing, with one section currently missing.

I was specifically assigned as rapporteur for the data indices portion of the panel review because, among the available indices, NMFS seeks to use recreational fisheries data as one component of its fishery-dependent indices. This is one of the areas of my expertise and I presented ideas that I hoped would improve the value of these indices.

The Review Panel reached consensus on the recommendations for the Panel Summary Report. At the time I write this report to the CIE, we do not have available other than a rough draft of the Panel Summary Report. The Panel Summary Report will include: comments on the technical merits and/or deficiencies of the methodologies: 1) catch only, 2) stock synthesis using catch and index time series, 3) extended depletion-based stock reduction analysis (XDB-SRA) with generalized stock-recruit relations. The Panel Report also includes discussion on developing standardized time-series methods. In this report to CIE, I add additional comments on areas of additional importance to me.

Summary of Findings for each ToR

ToR 1 – Review documents detailing data-moderate and data-poor methodologies according to the PFMC's ToR for the Methodology Review Process for Groundfish and Coastal Pelagic Species. Document the meeting discussions and contribute to a summary panel report. Evaluate

if the documented and presented information is sufficiently complete and represents the best scientific information available.

The workshop reviewed extensions of assessment methods to data-moderate (tier 2) stocks used previously in data-poor (tier 3) in the DB-SRA and EDB-SRA; from extensions from assessments of data-rich (tier 1) to data-moderate (tier 2) stocks in the exSSS and ex SSSv models. During the meeting we saw 15 presentations that were highly relevant to the discussions. Background material and additional readings were provided during the workshop and represented cutting-edge work on the issue of data-poor and data-moderate assessment approaches. Examples of these new methods are under peer-review or are in the process of publication and represent the best available science for the assessment of data-moderate stocks.

Only one area of discussion lacked sufficient documentation and we were unable to evaluate it. NMFS has used priors on natural mortality, M , in previous assessments. The data sources on which these were based and protocols for their use were unavailable for our review. In both EDB-SRA and exSSS, priors on M are important in evaluating uncertainty. We were unable to determine whether the priors were the product of multiple likelihoods or model averaging and were unable to obtain answers for our questions at this time. Another document concerning F_{msy} and M , model inputs, is in press, but was made available to us electronically.

The availability of a model comparison in the NMFS Toolbox was briefly discussed. I have seen such documentation in Table 2 of “Comparing NFT Models” on the toolbox website, but this table is inadequate for in-depth comparisons. It would be valuable to have a master comparison table that listed input and output variables, the model equations, and analytic methods (MCMC, likelihood) used to assess uncertainty similar to table 2 in the Panel Report but in greater detail. Such a comparison table may exist, but I could not locate one.

ToR 2 – Evaluate the technical merits and deficiencies of the proposed method(s) taking into consideration the data requirements of each method, the conditions under which the method is applicable, the assumptions of each method, and the robustness of model results to departures from model assumptions and atypical data inputs. Recommend alternative methods or modifications to the proposed methods, or both, during the panel meeting. Recommendations and requests for additional or revised analyses during the panel meeting must be clear, explicit, and in writing. Comment on the degree to which the methods describe and quantify the sources of uncertainty in the results.

The panel reviewed inputs to the data-moderate and data-poor models including: B_{MSY}/B_0 ; F_{MSY}/M ; M/k ; Δ . The ratio of B_{MSY}/B_0 was estimated from the shape parameter of the Pella-Thomlinson model and differed depending on family. Initially fits to the data were not provided, but were done subsequently upon request. Family estimates come from the RAM database and include estimates of uncertainty in the differences between families and species within a family. Further work evaluating uncertainty would be productive.

Historically, the fisheries literature suggested that F could be substituted for M to yield sustainable harvests. Within the last two decades, this view has been modified to reduce this ratio to 0.8 or less depending on the species. We reviewed recent studies by Zhou and others. It was noted that in choosing F , F was not controlled for selectivity. We saw results to show that Zhou et al, in press, did evaluate and quantify uncertainty. This paper is not yet available for detailed review, but should be soon.

Since the 1990s, fisheries scientists and evolutionary ecologists have used life-history invariants to search for general patterns across population ecology. In 1992, Beverton published on the differences in M/k between different families of exploited fish. As expected, it showed lower productivity for rockfishes than for other groups. In the workshop, Dr. Thorson provided a meta-analysis of West Coast stocks to provide posterior distributions of M and k , that could inform estimates for data-moderate species and permit measures of uncertainty. In these estimates, we were provided some results from a prior distribution on M , but insufficient information was given for us to evaluate the approach. No elaboration of how M was determined was available. It is important that the methodology used to achieve this prior on M be documented before it is used further.

Often times the available data on these life-history parameters are scarce or non-existent for a species. This is when the meta-analytic approach used by NMFS is so valuable. As more data accumulate over time, I would encourage NMFS analysts not only to evaluate parameters regionally but also to investigate relationships among families and sub-families also. My research has shown that consistent patterns may exist at these levels also.

To improve catch-only methods such as DCAC and DB-SRA, Dr. Dick presented further study of the value of using the Productivity-Susceptibility Analysis (PSA) to improve the delta priors used in DB-SRA. He showed a negative linear relationship between vulnerability (from PSA) and depletion. This regression works well except with stocks that are only lightly exploited or stocks that are heavily exploited and have rare extreme recruitment events. Nonetheless, it provides additional information to establish the level of depletion for EDB-SRA. Again, this advances knowledge for data-poor and data-moderate stock assessments. It provides the best available science.

The panel also deliberated over the value of standardized time series indices that could be used in data-moderate models. Dr. MacCall presented a summary of the sources of abundance information for 65 unassessed stocks of West Coast groundfish from fishery dependent and independent surveys. The fishery-independent surveys included four groundfish trawl surveys, some with spotty coverage between slope and shelf: the AFSC triennial, AFSC slope, NMFS slope and NMFS shelf-slope surveys. These surveys have been difficult to use for these species because of changes in depth and timing of the surveys and because of the paucity of abundance data. We reached consensus that the count of positive tows and number of species in each tow can provide useful data. In one of the trawl surveys, the 1977 data are anomalous because a

greater number of samples were taken at greater depth than was done subsequently. Again, these data may be useful for post-hoc stratification to re-stratify by species occurrence. Overall, we agreed that the spatial extent of species occurrence can be used as a proxy for range of abundance. We had a further discussion on using habitat-guild abundances/presence as the response variable.

In fisheries that are harvested recreationally, CPUE may provide data for assessments where other data are sparse or non-existent. Recreational CPUE can be problematic to use as a proxy for abundance because anglers preferentially target certain species and sizes such that their harvests do not reflect abundance. Additionally, management measures changed in 2003 with implementation of bag limits and closed areas, thus further limiting the value of recreational harvest as a proxy for an abundance index. The panel discussed using other approaches such as GAMS, and other modeling approaches. Mention was made that scientists at the University of Miami's Rosenstiel School of Marine and Atmospheric Science (RSMAS) had made attempts to develop models to estimate CPUE when bag limits are enacted. However, I was unable to confirm this. Such an approach could be done if the data on released fish are reliable, as would be the case for memorable catches. The Partyboat Observer data has a bit more value because of site-specificity for catches and good species identification, but was discontinued after 1998. However, it is problematic because these data have mixed data types with dockside sampling and onboard sampling combined unclearly. One strength is that Southern California has been well sampled. County coverage is good. In Southern California there is more sampling effort that has used size of the partyboat fleet as a proxy for fishing effort. Taken together, these data can also be used to evaluate range changes in species and for presence/absence analyses.

We discussed various ways these data could be used. The data manipulation takes time, but analysis is quickly done. Time to develop the indices limits the number of species that can be evaluated. One promising approach is to use quartile probabilities. One suggestion made during the discussion was to post-stratify several of the surveys in ways that more closely match the species presence and distribution. The panel concurred that this could be a productive exercise. Proper post-stratification should achieve better precision. In general, we found value in pursuing the use of these surveys. These approaches are the best available science for these data.

The data-moderate models that we reviewed included DCAC, EDB-SRA, and exSSS, although we concentrated on the last two and recommended that they be used for data-moderate assessments. I have modified Table 2 of the Panel Report to include additional information about these models (Table 1).

Table 1. Partial synopsis of data-moderate and data-poor models							
Model	Input	Basic Model Structure	Assumptions	Parameter Estimation	Output	Limitations	Strengths
DCAC	Landings+discards F_{msy}/M M	Catch-only $Y_{sust}=Cn+WY_{pot}$	Known historic catches (landings + discards) without underreporting, but can include uncertainty	MCMC	Estimate of sustained yield	Incomplete catch reporting results in bias $M \leq 0.2$	Very simple inputs
XDB-SRA	B_{msy}/B_0 F_{msy}/M M $\Delta=1-B_T/K$ q Measures of σ	Index-based method: Biomass Difference $B_t=B_{t-1}+PB_t-a-C_{t-1}$	Known historic catches (landings + discards) without underreporting	Bayesian with AIS of posterior	Can be altered to produce biomass trajectory	Very intensive computation time on parallel machines	Simple model with well understood input and interaction
exSSS	M h B_0 q $\Delta=1-B_T/K$ Allows indices of age and length	Statistical catch at age Complex and flexible model structure (see SS3) manual but restricted model is index-based	Known historic catches (landings + discards) without underreporting Uses SS3 to provide estimate of R_0 based on estimates of fecundity and growth. Deterministic stock-recruit relation (BH).	MLE or MCMC	Biomass trajectory OFL with uncertainty	Flexible input configuration that can lead to poorly understood interactions	Widely used as SS3 and full model well vetted

Modifications of the SSS model are detailed in a paper by Cope et al. that is in press. The input parameters include M, h, R_0 and a depletion index. Parameters were estimated with MCMC and MLE. A further improvement on this model, exSSS had input parameters of M, h, R_0 and indices of abundance, with priors on the parameters. A set of these models was tested on species groups of rockfishes, flatfish, roundfish and elasmobranchs. The models were also tested on Canary and Greenstriped rockfish. Of the model modifications exSSS performed the best on these data. OFL tends to be overestimated on more depleted stocks and underestimated on less depleted stocks. exSSS was adroit in being able to readily include several indices of abundance. These analyses were all performed on only one year of data and evaluation of the model would be better served by using on a trajectory over time.

EDB-SRA is a modified version of DB-SRA that includes a new parameter to better model latent productivity as a lag function (a) of age and mortality at recruitment to the fishery. We discussed various options for the prior on this lag function including uniform and log. Dr. Dick responded to one of our requests with an evaluation of model performance when using PSA. The panel

agreed that using the depletion value for three PSA bins improves the model's performance. EDB-SRA gives OFL as an output and could be modified to produce biomass trajectories. It produces a trajectory of median SSB in its current version. To estimate parameters this model uses a Bayesian framework using the SIR algorithm for sampling and AIS of the posterior distribution.

Both models have advantages. exSSS easily models biology of a given stock because it is derived from SS3 and thus is based on a well-known package used widely on the West Coast. However, the model is more complex and doesn't treat uncertainty as well. The exSSS did include measures of uncertainty for the OFL. Moreover, the Panel recommended that the Sample Importance Resample (SIR) algorithm should be based used to estimate uncertainty. The exDB-SRA is simpler and more straightforward model but is limited in the number of indices it can employ. Its Bayesian framework is better at dealing with uncertainty. Some on the panel saw the need for parallel computing power as a limitation, but I did not. Computers grow ever more powerful and the lack of capacity today will not be an issue in a few years when this model is integrated into standard stock assessments. The panel also recommended that uncertainty in population dynamics could be included in this model with the use of SIR to better understand process errors and their effects on uncertainty in OFL. I agree with this recommendation.

I had anticipated seeing the management strategy approach for data-moderate and data-poor assessments, but these were not available yet. The panel encouraged the evaluation SSS, DB-SRA, DCAC and XDB-SRA to quantify the uncertainty associated with OFL for different levels of P^* . A similar simulation exercise has been completed by Weidenmann and his colleagues using some of these models for data-poor species (Final Progress Report to the Mid-Atlantic Fishery Management Council, August 31, 2011). I found the Weidenmann report enlightening and think that such approaches are invaluable in understanding model performance.

ToR 3 – Evaluate and provide recommendations for the application of these methods for their utility in stock assessment and for their ability to monitor trends at the population level. Methods that have a flawed technical basis, or are questionable on other grounds, should be identified so they may be excluded from the set upon which stock assessments and other management advice is to be developed. Provide recommendations regarding what level of review is appropriate for assessments conducted using these methodologies.

The use of meta-analysis of life-history input parameters is a valuable addition to stock assessment methods. This approach permits the development for prior distributions on M , h , k , and other parameters that subsequently can be used to estimate uncertainty in the output parameters. These analyses are especially useful for data-poor stocks where parameters can be evaluated among regions, and major taxonomic groups and their uncertainty can be “borrowed” and used as a prior in a Bayesian framework. My recommendation is that these analyses be extended to families, and guilds when there is sufficient data to see if this will improve estimates. The level of review would be in a data workshop where the available knowledge on life history parameters can be presented and that this be followed with a modeling workshop to evaluate the performance of data-moderate models when this information is used in a Bayesian framework where possible.

Both the exSSS and EDB-SRA models are valuable in stock assessments of data-moderate stocks. Neither showed technical flaws that would preclude their use. One difficulty in comparing them was that they were applied to different data sets. The panel stated, and I concur strongly, that there should be a side-by-side comparison using both models on simulated data. These simulated data should include several different scenarios so that the models can be tested over a range inputs and indices that would reflect the stocks needing assessment. These simulations will provide clearer insight as to model performance. The level of review should be at the SSC, a peer-reviewed workshop or by publishing in the fisheries literature.

The DB-SRA methods (DB-SRA, EDB-SRA, and modifications) generally performed well except on rebuilding stocks (Honey et al, NMFS ftp site). Dick and MacCall have added a lag parameter to account for the lag and accumulated mortality between birth and subsequent recruitment and reproduction. MacCall stated that the model is miss-specified without this parameter and its inclusion is especially important in species where age of maturity is later in life. In a final report to the Mid-Atlantic Fishery Management Council, Wiedenmann and colleagues (August 31, 2011) reported that DB-SRA consistently produced simulated catches close to OFLs for data-poor stocks. They did not, however, have the newest model which accounts for mortality during delayed recruitment, but this modification should only improve the performance of this model for data-moderate stocks. It would be valuable to have such simulation models available for data-moderate stocks so that the performance of these models could be compared directly as in Wiedenmann et al. (August 31, 2011). This type of approach where models were compared on the same simulated data with a well thought through full comparison between models would have given me greater insight into the models performance.

exSSS and its modifications (exSSS_v) generally performed well and produces a distribution of OFL based on MLE and MCMC of the priors. However, MCMC did not perform well for data-poor and –moderate stocks. The vulnerability-based SSS (exSSS_v) performed the best on most, but not all, depleted stocks. When abundance indices were included, relative error was decreased. exSSS is also sensitive to the validity of the abundance indices.

ToR 4 – Decide through Panel discussions if the ToRs and goals of the peer review have been achieved. If agreement cannot be reached, or if any ToR cannot be accomplished for any reason, then the nature of the disagreement or the reason for not meeting all the ToR must be described in the Summary Panel Report and CIE Reviewer's report. Describe the strengths and weaknesses of the review process and Panel recommendations.

Panel reached consensus and recommended that two assessment approaches should be used for data-moderate stocks based on their performance at the workshop: EDB-SRA and exSSS. We were unable to compare the performance of these models directly to one another because they were not run on the same species or with similar specifications. Hence, the panel recommended that simulated data be used as input to both models so that their strengths and weaknesses can be compared side by side. Moreover, an analysis of uncertainty in OFL for West Coast stocks had

progressed only to conceptual development and no analysis had yet been performed. For these reasons, I concluded that most but not all ToRs and goals had been completed. The report was not sufficiently finished; the summary of one panel member was not submitted for another week later and one of the life history discussions (M) could not be conducted because the expert was unavailable. Nonetheless, the most important goals were reached and the major components of the ToRs accomplished.

The panel was composed of knowledgeable and experienced stock assessment scientists and was a good mix of East and West Coast. The analysts that provided data and responded to our request were excellent and tireless. I cannot commend their efforts sufficiently. Having reviewed several drafts of the Panel Report, although not yet finished, I am in complete agreement with its recommendations. Clearly, the one weakness in the process is the lack of a finished report three weeks after the workshop ended. We worked actively on the report during the workshop, but efforts have lagged since. In part, this is due to conflicts with previously scheduled duties and vacations.

Subsequent to the deadline for submittal of my CIE report, panel discussion continued and the report was modified. I found this discussion improved my understanding of the model's performance. Nonetheless, this took place outside of the scope of my statement of work, and while I was glad to participate, I wish we could have had these discussions in person. I suggest, that we actually needed more time for the panel, by including Monday as a full work day. Another option would have been to conduct a brief follow-up virtually meeting (e.g. through Adobe Connect) to discuss our remaining concerns.

Appendix 1: Bibliography of materials provided for review

- Aalto, E., E.J. Dick, and A. MacCall. *Separating fecundity and mortality time lags for a data-poor production model.*
- Cope, J. M. *Extending catch-only Stock Synthesis models to include indices of abundance.*
- Cope J. M., *Implementing a statistical catch-at-age model (Stock Synthesis) as a tool for deriving overfishing limits in data-limited situations.* Fisheries Research (in press).
- DeYoreo, M., E.J. Dick, A. MacCall. *A Bayesian Approach to Estimating Sustainable Yields for Data-Poor Stocks.*Dick, E. J., A. MacCall, M. DeYoreo, and B. Soper. *Refinements to Depletion-Based Stock Reduction Analysis.*Dick, E. J., A. MacCall, B. Soper, and M. DeYorio. *Exploration of Bayesian Stock Reduction Analysis for Assessment of West Coast Groundfish.*
- Honey, K., A.M. Apel, J. Cope, E.J. Dick, A. MacCall, and R. Fujita. *Rags To Fishes II: Quantitative comparison of data-poor methods for fisheries management.*
- MacCall, A., E. J. Dick, B. Soper, and M. DeYoreo. *Sources of Abundance Information For 65 Unassessed Stocks of West Coast Groundfish.*
- Thorson, J. T., J. M. Cope, T. A. Branch, and O. P. Jensen. *Spawning biomass reference points for exploited marine fishes, incorporating taxonomic and body size information.*
- Thorson, J. T., I. Taylor, I. Stewart, A. E. Punt. *A statistically rigorous framework for testing life history theory, with application to the ratio of natural mortality to the individual growth coefficient in U.S. West Coast species.*
- Wetzel C. *Management strategy evaluation for the determination of uncertainty about current biomass for data-limited and data-poor West Coast groundfish stocks.*
- Zhou, S., Yin, S., Thorson, J., Smith, T., Fuller, M 2012. *Linking fishing mortality reference points to life history traits: an empirical study.* Canadian Journal of Fisheries and Aquatic Sciences (in press).

Materials on the ftp site that were reviewed

- [AgendaItemA_Aalto_separate_time_lags_revised.docx](#)
- [AgendaItemA_SC1_Refinements to DBSRA.pdf](#)
- [AgendaItemA_SC2_Aalto_time_lag_project_DRAFT.pdf](#)
- [AgendaItemA_Thorson et al In review submission proofs_R2.pdf](#)
- [AgendaItemA_Thorson et al Internal review.pdf](#)
- [AgendaItemB_Cope_exSSS.pdf](#)
- [AgendaItemB_SC3_De Yoreo et al Draft DBSRA Report scanned hard copy.pdf](#)
- [AgendaItemB_SC3_De Yoreo et al Draft DBSRA Report.pdf](#)
- [AgendaItemB_SC4_Exploration of BayesianSRAdraft.pdf](#)
- [AgendaItemB_Wetzel_DPW_Uncertainty.docx](#)
- [AgendaItemC_SC5_Review of Abundance Information.pdf](#)
- [AgendaItemD_Cope_Biomass_target_meta-analysis v7.docx](#)
- [AgendaItemD_Cope_FMSY_paper.pdf](#)
- [AgendaItemE2.HoneyEtAl_Ch3_R2F2-AppendicesFormattedSingleSpace.doc](#)
- [AgendaItemE_HoneyEtAl_Ch3_R2F2-AppendicesFormattedSingleSpace.doc](#)
- [AgendaItemE_HoneyEtAl_Ch3_R2F2-CJFASSubmissionFINAL.doc](#)

[Agenda_Data-ModerateReviewPanel_6-13-12.doc](#)
[Background_Brooks_et_al_2010.pdf](#)
[Background_Cope_et_al_2011-PSA_GF.PDF](#)
[Background_Cope_SSS_2012.pdf](#)
[Background_Data-Poor_Panel_Report_April2011.pdf](#)
[Background_Dick_and_MacCall_2010_SWFSC_Tech_Memo_460_revised.pdf](#)
[Background_Dick_and_MacCall_2011.pdf](#)
[Background_MacCall_2009_DCAC.pdf](#)
[Background_SS3_Assessments_BlueRF_Jan08.pdf](#)
[Background_SS3_Assessments_Bocaccio_Final_Jan15_2010.pdf](#)
[Background_SS3_Assessments_ChilipepperJan2009final.pdf](#)
[Background_SS3_Assessments_Darkblotched_2011_Assessment.pdf](#)
[Background_SS3_Assessments_GOPHER_rf_Key_August05.pdf](#)
[Background_SS3_Assessments_Widow_2011_Assessment.pdf](#)
[Background_SS3_Assessments_cowcod_update_assessment_2009.pdf](#)
[Background_Walters_et_al_2005.pdf](#)
[Background_Wetzel_and_Punt_2011.pdf](#)

Presentations during the workshop

[AgendaItemA_DB-SRA_meta-analysis.pptx](#)
[AgendaItemA_Aalto_presentation_NOAA.pptx](#)
[AgendaItemA_SC_Refinements_to_catch-based_method.pptx](#)
[AgendaItemA_SC1_Refinements_to_DBSRA.pdf](#)
[AgendaItemB_SC_Extended_DB-SRA_generalized_SRRs.pptx](#)
[AgendaItemB_Wetzel_Uncertainty_v1.pdf](#)
[AgendaItemE_Arnold_retrospective_application.pptx](#)
[AgendaItemE_Honey_DataModerateWorkshop_NOAAFisheriesSeattleWA_06-28-2012_FINAL.pdf](#)
[Cope_STAR_2012_data-limited.pdf](#)
[Overview_Dorn_Data-Moderate_Panel.ppt](#)
[Request#1_Cope.docx](#)
[Request#1_Dick_Calibrating_DB-SRA_with_assessment_results.pptx](#)
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[Request#2_Dick_Extended_DB-SRA_dogfish_&_lingcod.pptx](#)
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Appendix 2: A copy of the CIE Statement of Work

Attachment A: Statement of Work for Dr. Cynthia Jones

External Independent Peer Review by the Center for Independent Experts

Review of Assessment Methods for Data-Moderate Stocks

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. The CIE reviewer is 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. The 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: The requirement in the re-authorized Magnuson-Stevens Act (2007) to set annual catch limits (ACLs) based on science recommendations implies some kind of basic assessment is required for all stocks in Fishery Management Plans (FMPs). This mandate has led to an increased focus on assessing “data-poor” stocks. Many data-poor stocks are of minor economic importance and assessing all of them using size/age structured models would be difficult given data limitations as well as cost-prohibitive. Simple assessment methods that use historical catches and available trend or size-composition information could potentially be applied to many data-poor or data-moderate stocks. These methods could be used to set ACLs, and to identify stocks which may be at risk of depletion that would be elevated to high priority for more detailed assessments. At the September Council meeting, the Pacific Fisheries Management Council (PFMC) approved a data-poor/data-moderate species assessment workshop to be held in June of 2012 in Seattle. The workshop is a follow-up to the review panel meeting held in April 2011 that reviewed assessment methods for data-poor stocks. At that meeting, the panel endorsed the use of Depletion-Corrected Average Catch (DCAC) methods AC and Depletion-Based Stock Reduction Analysis (DB-SRA) for category 3 stocks, but did not endorse any new assessment method for data-moderate category 2 stocks. The defining distinction between category 3 and category 2 stocks is that trend information is incorporated in the assessment for category 2 stocks. Several methods for category 2 stock were proposed, but these methods were not sufficiently developed to be endorsed by the review panel. The panel recommended the following:

“To continue the progress that has been made, the Panel recommends that a similar off-year STAR Panel review be scheduled to further develop and finalize methods and to review example applications. The Panel suggests a few common data sets be used across all candidate methods. The meeting would

involve participants from at least the NWFSC, the SWFSC, and various academic institutions. Methods should be sufficiently developed by the 2015-16 groundfish management cycle that it would be reasonable to bring forward a number of candidate category 2 stock assessments using simple assessment models for review at a STAR Panel in 2013.”

The objectives of the methodology review meeting are 1) evaluate inclusion of trend information into simple assessment methodologies and validate model performance by providing examples for assessed stocks or operating models for which the assumptions of the simpler models are not met; and 2) provide a list of endorsed methods for use on data-moderate stocks in Pacific Fishery Management Council’s Groundfish FMP. This workshop would also provide opportunity to refine methods used for category 3 stocks, and review progress on evaluating methods for determining uncertainty (σ) for each of three categories of stock assessment uncertainty used by the Council.

It is anticipated that reviewers will provide endorsement of specific data-moderate methodology so that a number of candidate category 2 stock assessments using simple assessment models can be conducted and reviewed during the 2013 stock assessment cycle for use in 2015-16 management cycle.

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 Reviewer: Two CIE reviewers shall conduct an impartial and independent peer review in accordance with the SoW and ToRs herein. The CIE reviewers shall have working knowledge and recent experience in the application of fishery stock assessment methods, especially for data-moderate or data-limited stocks. Each CIE reviewer’s duties shall not exceed a maximum of 14 days to complete all work tasks of the peer review described herein.

Location of Peer Review: Each CIE reviewer shall conduct an independent peer review during the panel review meeting tentatively scheduled in Seattle, Washington during 26-29 June 2012.

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

Prior to the Peer Review: Upon completion of the CIE reviewer selection by the CIE Steering Committee, the CIE shall provide the CIE reviewer information (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 reviewer with the background documents, report, foreign national security clearance, and other information concerning pertinent meeting arrangements. The NMFS Project Contact is also responsible for providing the Chair a copy of the SoW in advance of the panel review meeting. Any changes to the SoW or ToRs must be made through the COTR prior to the commencement of the peer review.

Foreign National Security Clearance: When the CIE reviewers participate during a panel review meeting at a government facility, the NMFS Project Contact is responsible for obtaining the Foreign National Security Clearance approval for each CIE reviewer if a non-US citizens. For this reason, each CIE reviewer shall provide requested information (e.g., first and last name, contact information, gender, birth

date, passport number, country of passport, travel dates, country of citizenship, country of current residence, and home country) to the NMFS Project Contact for the purpose of their security clearance, and this information shall be submitted at least 30 days before the peer review in accordance with the NOAA Deemed Export Technology Control Program NAO 207-12 regulations available at the Deemed Exports NAO website: <http://deemedexports.noaa.gov/sponsor.html>).

Pre-review Background Documents: Two weeks before the peer review, the NMFS Project Contact will send (by electronic mail or make available at an FTP site) to each CIE reviewer the necessary background information and report 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. Each CIE reviewer is responsible only for the pre-review documents that are delivered to the reviewer in accordance to the SoW scheduled deadlines specified herein. Each CIE reviewer shall read all documents in preparation for the peer review.

Panel Review Meeting: Each CIE reviewer shall conduct the independent peer review in accordance with the SoW and ToRs, and shall not serve in any other role unless specified herein. Modifications to the SoW and ToRs can not be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall be approved by the COTR and CIE Lead Coordinator. Each CIE reviewer shall actively participate in a professional and respectful manner as a member of the meeting review panel, and their peer review tasks shall be focused on the ToRs as specified herein. The NMFS Project Contact is responsible for any facility arrangements (e.g., conference room for panel review meetings or teleconference arrangements). The NMFS Project Contact is responsible for ensuring that the Chair understands the contractual role of the CIE reviewer as specified herein. The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements, including the meeting facility arrangements.

Contract Deliverables - Independent CIE Peer Review Report: 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 Reviewer: The following chronological list of tasks shall be completed by the CIE reviewers 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 report provided by the NMFS Project Contact in advance of the peer review.
- 2) Participate during the panel review meeting in Seattle, WA during 26-29 June 2012.
- 3) During the review meeting in Seattle, WA during 26-29 June 2012 as specified herein, and each CIE reviewer shall conduct an independent peer review in accordance with the ToRs (**Annex 2**).
- 4) No later than 13 July 2012, 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 CIE Regional Coordinator, via email to David Die 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.

30 May 2012	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact
12 June 2012	NMFS Project Contact sends the CIE Reviewer the pre-review documents
26-29 June 2012	The reviewer participates and conducts an independent peer review during the panel review meeting
13 July 2012	The CIE reviewer submits draft CIE independent peer review report to the CIE Lead Coordinator and CIE Regional Coordinator
27 July 2012	The CIE submits CIE independent peer review report to the COTR
3 August 2012	The COTR distributes the final CIE report to the NMFS Project Contact and regional Center Director

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

Acceptance of Deliverables: Upon review and acceptance of the CIE independent peer review 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 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 report) 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 reports shall be completed with the format and content in accordance with **Annex 1**,
- (2) the CIE reports 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.

Key Personnel:

William Michaels, Program Manager, COTR

NMFS Office of Science and Technology

1315 East West Hwy, SSMC3, F/ST4, Silver Spring, MD 20910

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Jim Hastie

NMFS Northwest Fisheries Science Center,

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Jim.Hastie@noaa.gov Phone: 206-860-3412

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

1. The CIE independent report shall be prefaced with an Executive Summary providing a concise summary of the findings and recommendations, and specify whether the science reviewed is the best scientific information available.
2. The main body of the reviewer report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Summary of Findings for each ToR in which the weaknesses and strengths are described, and Conclusions and Recommendations in accordance with the ToRs.
 - a. The reviewer should describe in their own words the review activities completed during the panel review meeting, including providing a brief summary of findings, of the science, conclusions, and recommendations.
 - b. The reviewer should discuss their independent views on each ToR even if these were consistent with those of other panelists, and especially where there were divergent views.
 - c. The reviewer should elaborate on any points raised in the Summary Report that they feel might require further clarification.
 - d. The reviewer shall provide a critique of the NMFS review process, including suggestions for improvements of both process and products.
 - e. The CIE independent report shall be a stand-alone document for others to understand the weaknesses and strengths of the science reviewed, regardless of whether or not they read the summary report. The CIE independent report shall be an independent peer review of each ToRs, and shall not simply repeat the contents of the summary report.
3. The reviewer report shall include the following appendices:
 - Appendix 1: Bibliography of materials provided for review
 - Appendix 2: A copy of the CIE Statement of Work
 - Appendix 3: Panel Membership or other pertinent information from the panel review meeting.

Annex 2: Terms of Reference for the Peer Review of Assessment Methods for Data-Moderate Stocks

The reviewers will participate in the Panel review meeting to conduct independent peer reviews of the data-moderate and data-poor assessment methods to apply to groundfish stocks managed by the Pacific Fishery Management Council. The review solely concerns technical aspects of the methods, and addresses the following ToR:

ToR 1 – Review documents detailing data-moderate and data-poor methodologies according to the PFMC’s ToR for the Methodology Review Process for Groundfish and Coastal Pelagic Species. Document the meeting discussions and contribute to a summary panel report. Evaluate if the documented and presented information is sufficiently complete and represents the best scientific information available.

ToR 2 – Evaluate the technical merits and deficiencies of the proposed method(s) taking into consideration the data requirements of each method, the conditions under which the method is applicable, the assumptions of each method, and the robustness of model results to departures from model assumptions and atypical data inputs. Recommend alternative methods or modifications to the proposed methods, or both, during the panel meeting. Recommendations and requests for additional or revised analyses during the panel meeting must be clear, explicit, and in writing. Comment on the degree to which the methods describe and quantify the sources of uncertainty in the results.

ToR 3 – Evaluate and provide recommendations for the application of these methods for their utility in stock assessment and for their ability to monitor trends at the population level. Methods that have a flawed technical basis, or are questionable on other grounds, should be identified so they may be excluded from the set upon which stock assessments and other management advice is to be developed. Provide recommendations regarding what level of review is appropriate for assessments conducted using these methodologies.

ToR 4 – Decide through Panel discussions if the ToRs and goals of the peer review have been achieved. If agreement cannot be reached, or if any ToR cannot be accomplished for any reason, then the nature of the disagreement or the reason for not meeting all the ToR must be described in the Summary Panel Report and CIE Reviewer's report. Describe the strengths and weaknesses of the review process and Panel recommendations.

Annex 3: Tentative Agenda

Review of Assessment Methods for Data-Moderate Stocks

Alaska Fisheries Science Center

7600 Sand Point Way NE, Seattle, WA 98115

Phone: (206) 526-4000

26-29 June 2012

The meeting agenda has not yet been drafted, but will be forwarded by the project contact as soon as it becomes available.

<i>26 June 2012</i>	Presentations by technical teams
<i>27 June 2012</i>	Continuation of presentations, Panel requests to technical teams
<i>28 June 2012</i>	Panel requests, Assignments for drafting panel report
<i>29 June 2012</i>	Panel requests, Finish draft panel and reviewer reports.

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

Methodology Review Panel Members:

Mathew Cieri, Center for Independent Experts

Martin Dorn (Chair), Scientific and Statistical Committee (SSC), NMFS, AFSC

Vladena Gertseva, SSC, NMFS, Northwest Fisheries Science Center

Cynthia Jones, Center for Independent Experts

André Punt, SSC, University of Washington

Panel advisors:

John DeVore, PFMC Staff

Corey Niles, Groundfish Management Team

Gerry Richter, Groundfish Advisory Panel

Technical Team:

Emil Aalto, University of California, Davis

Linsey Arnold, Oregon State University

Jason Cope, NMFS, NWFSC

Edward Dick, NMFS, SWFSC

Kristen Honey, Stanford University

Alec MacCall, NMFS, SWFSC

James Thorson, NMFS, NWFSC

Chantell Wetzel, NWFSC, University of Washington

June 26-29, 2012
Alaska Fisheries Science Center
7600 Sand Point Way NE, Seattle, WA 98112

Tuesday, June 26, 2012

- 8:30 a.m. Welcome and Introductions Martin Dorn
- 8:45 a.m. Review and Approve Meeting Agenda Martin Dorn
Review Terms of Reference for Assessments Methods Review
Assignment of reporting duties
- A. Refinements to Catch-Only Methods for Category 3 stocks**
- 9:00 a.m. Using meta-analysis to refine input distributions for data-poor methods, improvements to DB-SRA stock-production models E.J. Dick
- 11:00 a.m. Panel discussion / Panel requests to technical team
- 12:00 p.m. Lunch
- B. Review and potential adoption of data-moderate methods**
- 1:00 p.m. Stock Synthesis using only Catch and Index Time Series (SS-CI) Jason Cope
- 3:00 p.m. Extended Depletion-Based Stock Reduction Analysis (XDB-SRA); using models with generalized stock recruit relationships E.J. Dick
- 4:45 p.m. Panel requests to technical team
- 5:00 p.m. Meeting adjourns for the day

Wednesday, June 27, 2012

- B. Continued. Review and potential adoption of data-moderate methods**
- 8:30 a.m. Morning welcome and announcements
- 8:45 a.m. Progress report on evaluating uncertainty (σ) for category 2 and 3 stocks using simulation modeling Chantel Wetzel / André Punt
- C. Developing standardized time series for index methods**
- 9:45 a.m. Review of abundance information for data-limited stocks E.J. Dick
- 12:00 p.m. Lunch
- D. Extensions to data-moderate methods**
- 1:00 p.m. Adding length composition data to data-moderate assessments Jason Cope
- 2:00 p.m. Review work assignments / Further requests to technical team / Panel discussion regarding data-moderate methods
- 5:00 p.m. Meeting adjourns for the day