Reports of the IPHC Scientific Review Board, 2015

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Introduction

In 2013, the International Pacific Halibut Commission (IPHC) formed a Scientific Review Board (SRB). The purpose of the SRB is to provide scientific review of Commission science products and programs, support and strengthen the use of a credible, effective stock assessment process. In the near term, this is expected to focus on a review of the annual stock assessment model and harvest policy prepared by IPHC staff. Over time, this emphasis will shift to broader review scientific programs, as well as of the annual stock assessment results and advice. The SRB will also conduct other key reviews, as determined by the Commission, which may include: the Five-Year Research Plan, updates and changes to survey methodology, white papers on selected critical issues, etc.

This report contains the results of two reviews conducted by the SRB during 2015: a review of the Commission stock assessment, migration analysis, and management strategy evaluation held in June; and, a review of progress on stock assessment issues and abundance-based bycatch management, held in October. The results of the two meetings are presented separately in this report.

IPHC Scientific Review Board Meeting

June 2015

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Overview

We met on 16-17 June 2015 to review the data and model development completed during 2015 and to provide strategic guidance for the upcoming 2015 stock assessment and management process. Additional topics included the ongoing analysis of movement rates, progress and planning on MSE modeling, and a new conceptual approach to account for the multiple sources of fishing intensity on the halibut stock.

This report is in response to the request by the IPHC staff to prepare a short report to the Commission summarizing meeting discussions and any conclusions reached. Also, we provide comments on research priorities as requested by the IPHC scientists.

1. <u>Aspects of data analysis that should be prioritized for the remainder of 2015, and in the future</u>

New data

We appreciate the rapid implementation and progress toward developing at-sea approaches to obtaining halibut sex information in the commercial catch. We strongly support further exploration and development of methods to estimate the sex composition of the catch since this is clearly important in understanding the dynamics of the stock (e.g., sexually dimorphic growth and effective spawning stock biomass).

We also support continuing the long-term research aimed at better understanding movement rates. The current wire-tagging program represents a practical step for tagging small fish at relatively low cost. Reporting rate issues will probably continue to present challenges for interpreting data from this program. We recognizes that more sophisticated tagging methods may become available in the future for assessing movement of small fish; however, some assessment needs to be made of the value (to stock assessment and management of halibut) of these programs prior to major research investments. Presumably, this value would be derived from better management of bycatch impacts on under-sized halibut; it could be yet another use of a MSE model. Size-specific distribution patterns relative to bottom temperature and other factors from the 30+ years of NMFS Bering Sea trawl survey could also shed light on ontogenetic movement patterns of Pacific halibut.

We also support the 2015 trawl calibration experiments and look forward to the results. As noted in earlier reports, the current setline survey is linked to the NMFS bottom-trawl survey based on a single year and improving information on the relative size compositions between the survey gears should improve data quality for that component of the Pacific halibut assessment.

Existing data

We suggest that IPHC prioritize processing and analyses of existing data, and consider supporting a graduate student to do tasks such as re-analysis of survey data prior to 1997, keypunching and re-processing historical fisheries data, and reconstructing historical recreational discards. IPHC scientists have continued to streamline and make accountable all sources of information used within the assessment. The SRB noted that this provides many benefits for traceability and future model developments and this work should continue to be encouraged.

Model development

Spatial models, as well as process-based models (e.g., for growth and recruitment), are important long-term development projects both as tools for future halibut assessments and for the operating model component of management strategy evaluation. However, we suggest that neither approach be given high priority for this coming year because spatial and process-based models currently involve either considerable uncertainty (e.g., movement for spatial models) or considerable modification to the existing halibut stock assessment code (e.g., time-varying growth) for conditioning alternative operating models. Rather, for our meeting in Fall 2015, we think it would be valuable to have staff develop a realistic workflow plan over the next 2-3 years and a preliminary outline of how development of spatial and process-based assessment and operating models could best proceed.

Relative to this year's modeling work, we greatly appreciate the efforts of the IPHC staff to respond to our request to have access to some of the model files to help understand the assessment application better. The move to include younger Pacific halibut in the assessment model is seen as a positive step. Perhaps including more bottom-trawl survey data (from the EBS and GOA) and bycatch data directly within the assessment model would help reveal inconsistencies and other possible environmental effects. Additionally, the approach to subsume discard mortality rates (DMRs) within the model was seen as an added benefit for evaluations for past conditions and future projections.

Bayesian stock assessment methods

For our Fall 2015 meeting, the SRB requests more information on what has been done on Bayesian methods so far. For example, where feasible (e.g., the Short Coastwide and Short AAF models), some initial results of MCMC simulations could be helpful to determine how the current Hessian approximations differ from full Bayesian posterior distributions for elements of the Decision Table. Such an analysis may also provide some insight on the relative variability (and uncertainty) of historical SPR[1] rates.

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[1] SPR is defined here as the ratio of Spawning biomass Per Recruit of a fished population to that of the unfished population. A brief review of SPR can be found in Mangel et. al. 2013. A perspective on steepness, reference points, and stock assessment. Canadian Journal of Fisheries and Aquatic Sciences 70:930-940

Weighting components of the ensemble approach

The current models in the ensemble used for assessment are given equal weight. This affects the final decision table elements and IPHC staff requested some feedback on alternatives. For the near term, other practical methods for weighting models within the ensemble may include:

    i.   Monte-Carlo random re-weighting – Would involve simple random model weight simulations, say, based unit uniform distributions (renormalized to sum to 1). This may provide some perspective on the range of variability in cumulative distributions implied by the 4 models.

    ii.   5-year posterior predictive performance – requires MCMC sampling (as noted above for Short models). One could use posterior predictive coverage (or loss) to assign model weights

    iii.   Likelihood weights for comparable data sets (e.g., Short period setline survey fits)

We recognize that thorough exploration of weighting and its consequences for the ensemble results may require considerable time, but believe that it is worth spending 2-3 days prior to our Fall 2015 meeting exploring some of these ideas.

2. Current understanding and analysis of movement rates.

As part of the spatial assessment model development, we suggest reconciling the three presentations of movement matrices since they seem roughly consistent. If we understand the presentations properly, this is also something that could be done with a few days of work prior to the Fall 2015 meeting.

3. The spatial scales of MSE modeling

We are familiar with, and appreciate, the perception among stakeholders that MSE is a catch-all for everything that is difficult to cover in routine assessments. We also agree with the current IPHC approach that makes people aware of this and continues to clarify the role of scientists, stakeholders, and decision-makers in MSE.

Based on discussions and presentations, we consider it ill-advised to scrap the current spatially aggregated (coastwide) MSE operating model in favor of new efforts toward a spatially-explicit operating model. The MSAB notes that a spatial model is necessary to adequately address their current, within region, management needs. The suite of models in the assessment ensemble represents a reasonable set of scenarios that could be used to parameterize a coastwide operating model. Such a "conditioned" operating model could then be usefully used to evaluate management procedures and provide insight on alternative decision tables, F_{spr} rates, and existing harvest policies. It is important to emphasize that the MSE process is less about "predicting the future" and more about ranking management actions relative to trade-offs all given our current state of knowledge about the system and its inherent variability. Therefore, **we recommend that IPHC and MSAB move forward under MSAB's original charge of making progress on evaluating management procedures for the halibut fishery. We believe that there is considerable scope for improving understanding of halibut management and alternative management procedures given the current coastwide operating model.**

4. The SPR-based management framework.

IPHC scientists presented a new idea on ways to evaluate the relative contributions of fishing mortality in SPR terms in given years (and future management) from different fisheries. They showed an interesting approach that may incentivize bycatch avoidance that is more directed at resource conservation rather than the current approach which deals solely with tonnages of PSC in other groundfish fisheries. This approach would also be consistent with a (possible) transition to an SPR-based accounting during harvest policy decisions. We recommend further research on this topic and in particular, consider the relative magnitudes of the Pacific halibut catch when evaluating the tradeoffs (the presentation we received was based on roughly equal catches of PSC and directed fishery landings).

For the near-term, IPHC could present the probability distribution of F_{SPR} at the Blue Line, which could possibly help in eventually removing the dependence on the Blue Line. For instance, examining the F_{SPR} implied by Blue Line could lead to an interim F_{SPR} harvest policy for computing catch targets instead of the existing 16% and 21.5% harvest rates. The F_{SPR} approach would also better reflect bycatch and wastage effects compared to what is presently represented at Blue Line.

IPHC Scientific Review Board Meeting

October 2015

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Overview

We met on 15-16 October 2015 to review the data and model development completed during 2015 and to provide strategic guidance for the upcoming 2015 stock assessment and management process. Additional topics included the ongoing analysis of movement rates, progress and planning on MSE modeling, and a new conceptual approach to account for the multiple sources of fishing intensity on the halibut stock.

IPHC staff asked us to prepare a brief commentary to the Commission summarizing our discussions and any conclusions reached. Also, as requested by the IPHC scientists we provide comments on research priorities for early 2016

To begin, however, we note that in the last 2.5 years, IPHC scientists and the SRB have developed a successful routine in which the June meeting is the major one for input from the SRB, giving IPHC scientists the time between June and October to develop the ideas we discuss. The October in-person meeting and the December teleconference are then effectively used to fine-tune the developments before the Annual meeting. We consider that this pattern of non-confrontational, but critical advice, become the norm for SRB interactions with IPHC scientists.

1. Aspects of data analysis that should be prioritized for 2015

Bering Sea Setline Calibration

The Bering Sea Setline Calibration establishes a relationship between NMFS trawl survey catch rates (and size composition) and setline catch rates for halibut in the eastern Bering Sea. The calibration generates a WPUE series to account for the lack of a full-coverage setline survey in this region. This is particularly important for indexing trends in adult halibut in this region and for the apportionment calculations.

Although the calibration is a reasonably straightforward and acceptable scientific exercise, we recommend that the IPHC take the time to carefully explain the implications for apportionment calculations to stakeholders. Our reasoning is that, without a clear explanation, some stakeholders may see the addition of this calibrated survey as a threat to their apportionment of halibut biomass.

We concur with combining the 2006 and 2015 calibration experiments because the evidence suggests that the calibration relationships have not changed over that time. Nevertheless, we also recommend revisiting the calibration with the same (i.e., 6 year) or perhaps longer (e.g., 10-year) window.

Sex ratio sampling in commerical catch

Information about sex ratios in the commercial could substantially improve the stock assessment for Pacific halibut. Therefore, we were pleased with the progress in 2015 on the research focused on data collection systems. Although the timeline for genetic samples looks good, these things always take longer than one anticipates so Commissioners and scientists should not be disappointed if there are some delays.

Prioritizing research on bycatch and wastage

Bycatch and wastage are also key topics that affect stock assessment estimates. This year, IPHC staff attempted to characterize the risks associated with different sources of bycatch and wastage. IPHC staff developed a potentially useful approach to identifying the key fisheries for which better estimates of bycatch and wastage are needed. Their approach separates **uncertainty in the estimates** from the **magnitude of possible impacts.** This is important because, while low sampling rates in some fisheries result in high uncertainty, the size of the bycatch is generally low, which limits the magnitude of impact on the assessment. We encourage further development of this approach. In particular, further development on the method of presentation is key. The topic is complicated and takes time to fully understand the ideas.

Movement analysis

At our June 2015 meeting, we recommended that IPHC staff assemble existing data on halibut movement for the purpose of constructing a baseline movement matrix (i.e., proportions of halibut moving from one regulatory area to another by age). We were pleased to see this first step completed and we now encourage staff to experiment with possible models for spatial assessment. At this point, we envision the spatial model as an operating model for testing management procedures, rather than serving as a stand-alone stock assessment model or alternative to apportionment calculations.

Bering Sea halibut model

Last year, IPHC staff presented an interesting model and results for halibut dynamics in the Bering Sea. At this point, however, the model leaves more questions than answers since much of the stock in that area is young and not seen by other fisheries and surveys for several years. For instance, increasing recruitment suggested by the model could indicate increasing juvenile abundance, changing movement behavior, or a change of spatial distribution for halibut. The implications for coast-wide model projections would be very sensitive to whichever one happened to be correct.

2. <u>Aspects of model development that should be prioritized for the 2015 assessment.</u>

Bayesian integration and model weighting for the ensemble are moving in an interesting direction, but for the 2015 assessment we recommend using equal weights in the ensemble. Further work is needed to determine how observation error is incorporated into the weights since the weighting is very sensitive to how observation error and process stochasticity are characterized in the assessment models within the ensemble.

3. Data and model research for the June 2016 review and beyond

We recommend the order of workflow should be

i) development of the spatial model and

ii) development of a process model for growth (i.e. modeling growth instead of using empirical weights-at-age). Furthermore, IPHC scientists should take time in the development of the process model, since this is an unique opportunity given the richness of the data.

We consider that the MSE modeling and links of those models to the MSAB are progressing very well and encourage their continuation. Similarly, a rate based harvest policy should be viewed as a medium-term goal, but a very important one because it will allow presentation of risk tolerances and choices of risk indicators. In this regard, we recommend that a background presentation be developed showing previous risk tolerances and indicators that were implicit in past interim and annual meetings.