Independent peer review of the 2020 IPHC Management Strategy Evaluation process

Trevor A. Branch
Associate Professor, School of Aquatic and Fishery Sciences, University of Washington
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Summary

The management strategy evaluation (MSE) of IPHC is intended to simulation test rules for setting allowable catch for Pacific halibut and the allocation of catch and bycatch among IPHC Regulatory Areas. In my judgment the MSE is technically sound. Furthermore, the MSE team led by Allan Hicks was praised by all interviewed participants involved in the process for their technical work, collaboration with stakeholders in developing harvest control rules, and communication of results to stakeholders. However, the following issues need to be resolved to ensure the continued success and accuracy of MSE simulations for IPHC: (1) decide soon on the future of the MSE process beyond January 2021 and allocate necessary funding; (2) treat the MSE framework as an ongoing process that will be used over many years alongside the stock assessment, to test the effectiveness of data gathering, stock assessment assumptions, and catch-setting in IPHC; (3) require the Commission to codify the rules they used to adjust catch levels within each Regulatory Area after the harvest control rule is applied, so that the MSE framework accurately evaluates risk to the stock and catches within each such Area. Additional discussion, points, and thoughts are presented in full below.

Acronyms and terms used

HCR: harvest control rule
MSAB: management strategy advisory board
MSE: management strategy evaluation
SRB: scientific review board
TCEY: total constant exploitation yield

Background

Development of a management strategy evaluation (MSE) was started in 2013 at the IPHC, but progress has generally been slow until the most recent 2-3 years with the formation of the current MSE team comprising Allan Hicks, Piera Carpi, and Steve Berukoff. A key MSE milestone was the testing of different harvest control rules (HCRs) for setting coastwide allowable catch (Total Constant Exploitation Yield, or TCEY), presented in multiple documents during 2019 and 2020 (e.g. Hicks et al. 2020). This year, the MSE has focused on modeling the allocation of the TCEY among the IPHC Regulatory Areas. Preliminary results were presented at an informational meeting in August, with further results expected at the 22-24 September 2020 session of the Scientific Review Board (SRB) and 19–22 October 2020 meeting of the Management Strategy Advisory Board (MSAB). A final report has been requested by the Commission on MSE development testing rules for allocating the TCEY among IPHC Regulatory Areas for the 97th Annual Meeting of the IPHC in 25–29 January 2021.

Terms of reference

This review is intended to provide advice on and contribute to a subset of the following topics, both in terms of peer review and technical contribution:

1. Review the goals and objectives used to evaluate management procedures
2. Review the IPHC MSE closed-loop simulation framework

3. Review and advise on the operating model and how it is conditioned to mimic the Pacific halibut population
4. Review tools and methods used to communicate simulation results for the evaluation of management procedures.
5. Evaluate the process of soliciting objectives from stakeholders and managers and creating performance metrics from those objectives.
6. Assist with developing and defining reference points and management procedures
7. Advise on methods to communicate results of the simulations, the trade-offs between various management procedures, and the ranking of management procedures.

This report is a succinct written review of the IPHC MSE process, evaluating results, and any other aspects identified, including recommendations for the simulation framework and other aspects of the MSE framework.

Information gathering

In the process of writing this report, I reviewed documents and decisions from recent IPHC meetings (2019-20) including MSAB, SRB, and Commission meetings, including the independent peer review of the IPHC stock assessment, the second performance review of the IPHC, and the main stock assessment and MSE documents. I attended the August informational meeting presenting preliminary MSE results to members of the MSAB; conducted a series of informal conversations with a diverse array of MSAB members including the MSE team, scientists, managers, and industry representatives; and presented interim recommendations to the SRB meeting in September for feedback.

Findings

The MSE model framework was implemented according to international guidelines and standards for the evaluation of harvest control rules (e.g. Butterworth 2007, Plagányi et al. 2007, Punt et al. 2016), and comprises a simulated model of truth (the operating model), a simulation of the stock assessment process (estimation model) and a simulation of the catch setting and catch allocation process (the harvest control rule).

In my review and examination of the model structure and implementation, I did not identify any major technical issues or flaws, although some of the technical documentation of the MSE (Hicks et al. 2019) was incomplete. MSEs are notorious for the long time they take to run, but the IPHC addressed this known bottleneck by coding the operating model in C++ and the estimation model in AD Model Builder, both well known for their speed, by using parallelization, and accessing fast processors. In this way, the MSE simulations could be conducted relatively rapidly and be responsive in addressing topical questions. Statistical software R was used for reporting and visualization, as is standard practice.

The suite of performance metrics covers all aspects usually considered important in other MSEs: ensuring that biomass does not fall below some minimum level; examining spawning biomass relative to a target level; maximizing catches; and limiting catch variability from one year to the next. Additional metrics report the proportion of the total catch taken in each of the Biological Areas or Regulatory Area. Many metrics are computed and reported in addition to the core list, and the suite of performance metrics is comprehensive, was developed with extensive stakeholder input, and meets the needs of the MSE process.

The presentation of the results through reports follows standard practice, although it could additionally use some refinement to ensure that each scenario can be compared in as little space as possible (perhaps on a single page in a dashboard format). The use of the online visualization of results using the R Shiny app is encouraged, as it allows stakeholders to interact more directly with the results and understand the implications of changes to key model parameters, although the Shiny application would achieve broader uptake among stakeholders with more extensive instructional and example materials.

Overall, the science capability of the IPHC MSE team is strong, and trusted by all participants that I spoke to, often resulting in unsolicited comments praising the leadership from Allan Hicks and others on the team. In my experience, grudging acceptance is a more common reaction than open praise, which speaks highly to the work conducted by the MSE team over the last two years, both technically and in ensuring widespread participation and acceptance of the process among stakeholders.

The effectiveness of the Management Strategy Advisory Board is a particularly strong feature of the MSE process at IPHC. Despite diverse representation from multiple sectors, the overwhelming impression I received from interviews and participating in the informational meeting, was that the MSAB members are clearly committed to ensuring the best science possible, are motivated to participate fully, and have in-depth knowledge of the MSE models and the process around the models. It helps that many of the members have been attending meetings for several years, and that the meetings have been regular (twice a year or more often). A key step to ensuring well-functioning MSAB meetings was appointing two co-chairs who are not part of the MSE science team to facilitate discussions, which should be continued. Efforts should however be made to ensure that all sectors are represented in the MSAB, including crew, communities, and NGOs or environmental organizations, to ensure that any management changes arising from the MSE process are accepted by all parties benefiting from the halibut fishery. MSAB members also need time to report back to, and consult with, the stakeholder groups that they represent to ensure that all stakeholders accept decisions coming out of the MSE process.

The current MSE timeline is strict, with a final deadline for the MSE process being set for the January 2021 Annual Meeting of the IPHC. This strict deadline may arise from the long period from 2013 to the present over which the MSE process has developed, although it is only in the past 2-3 years with the expansion of the MSE team that rapid progress has been made. Given the amount of time needed to run the MSEs, and their complexity, I expect that results examining allocation of catches among Regulatory Areas, to be presented in January, will need one more round of modification before being finalized and ready for management implementation. For these reasons, it is likely that recommendations from the MSE process will need to be run in parallel with the current process for setting and allocating catches for 1-2 years, before any new rules replace current rules.

There is considerable uncertainty over the future role of the MSE process in the management of Pacific halibut. Two members of the science team (Carpi, Berukoff) are on short-term contracts, which would need to be extended to retain their expertise, but it was not clear what plans have been made by the Commission for ongoing MSE work beyond January 2021. The Commission needs to clearly delineate the amount of resources to be devoted to MSE work after January 2021 and, if deemed essential, act to retain personnel required to conduct future MSE simulations.

MSE simulations can be used in a wide variety of ways to provide advice useful to management. In some fisheries, the sole aim of MSEs is to identify a harvest control rule (HCR) that will be used to set annual catches in a more-or-less automatic manner: each year, data are collected, an assessment is

conducted, and the results are fed into the HCR to set the catch limit for the next year. This automated process is often touted as the most valuable feature of the MSE process: avoiding the annual haggling over catch-setting (e.g. Butterworth 2007). It is key to outline so-called "exceptional circumstances" that would allow managers to change the HCR from the rules tested by the MSE. In other words, the role of the MSE process is to ensure that the HCR is robust, and allows a good balance between sustainability and catches to meet the objectives of the management body. Thus far, this is how the MSE process at IPHC has been conducted, with the exception that the Commission retains the ability to make final adjustments to catch levels and allocations instead of these being set in an automated manner.

Increasingly, however, MSE simulations are being used in much more varied ways than just deciding on a harvest control rule for catch setting. MSEs can be used to assess the impact of changing survey frequency, altered effort on each survey, different frequency of stock assessments, and different structural models of the truth. For example, MSEs can assess whether different migration models will affect long-term sustainability, the impact of bycatch in other fisheries, and whether some Russian catches should be included in the stock assessment. MSEs can evaluate the consequences of making incorrect assumptions in the model about natural mortality, steepness, or trends in weight-at-age. For IPHC-specific problems, MSEs could be used to assess whether four stock assessment models are needed, and if so, how to weight them; whether Bayesian methods would improve management; how to tune the models to fit to age composition data vs. surveys; and the impact of changes in size limits and bycatch management. Finally, MSEs can be used to identify areas of research that should be prioritized by IPHC in the future though a cost-benefit analysis that weighs research cost against the benefits of more precise stock assessments (e.g. Muradian et al. 2019).

Given the potential array of applications of the MSE process, the IPHC should think of MSE as a tool for evaluating the long-term sustainability of Pacific halibut and the fishery under a variety of scenarios, rather than just a tool for deciding on a harvest control rule. In other words, MSE should be treated as an integral part of the assessment and management cycle to better predict long-term consequences of decisions about the stock assessment, data gathering, and management processes. This path is the one followed by the Pacific Hake/Whiting Treaty organization, where every year a different suite of questions are answered by MSE simulations. This requires a stable team and sufficient in-house expertise to ensure that the MSE models can be applied to new questions each year.

One of the trickier aspects of the MSE process in IPHC is the inherent tension between testing harvest control rules, and Commission flexibility in deviating from any specific control rule. One of the core assumptions of MSE is that it captures the key rules used to (1) gather data, (2) conduct an assessment, and (3) set catches (e.g. Punt et al. 2016). Only then can it accurately evaluate the long-term consequences of an entire management system. In other jurisdictions, considerable time is spent ensuring that every aspect of these rules is included in the MSE process. However, in IPHC, there is an additional step not included in the MSE simulations, which involves the Commission adjusting catches in each Regulatory Area to account for other objectives (social, economic, etc.). In the EU, this kind of final tinkering step has led to decades of overfishing—politicians there set catches 20% higher than scientific advice during 2001–15 (Carpenter et al. 2016). Elsewhere, notably for the Commission for the Conservation of Southern Bluefin Tuna (e.g. Hillary et al. 2016), and in South African fisheries (e.g. Plagányi et al. 2007), the MSE process was carefully designed to replace annual haggling over catch limits with an automated and transparent process. For the IPHC, the impacts of such policy adjustments have not recently been evaluated, but in 2013-16, adopted mortality limits were higher than the recommended "blue line" catches. A careful

analysis (ideally using the MSE process itself) is needed to determine the long-term impacts of Commission discretion in setting final mortality limits that differ from those recommended by a prescribed harvest control rule. While this is flagged here by me, I should also note that MSAB participants are in favor of retaining Commission discretion in modifying final mortality limits in each Regulatory Area, and this aspect of management was not currently regarded as problematic.

In the MSE evaluation of harvest control rules, "exceptional circumstances" rules are currently missing from the discussion. Such rules are invoked when circumstances in the fishery, surveys, data gathering, or stock assessment fall outside those modelled in the MSE process (e.g. Hillary et al. 2016). For example, if large levels of unreported catch are discovered, then exceptional circumstances could be invoked. When exceptional circumstances are invoked, a new MSE should be conducted to replace the current harvest control rule with a new (and hopefully better) harvest control rule for the changed circumstances. Rules governing exceptional circumstances need to be pre-specified so that the harvest control rule is not arbitrarily overruled in setting catches.

Priority recommendations

1. I recommend that the Commission plans ahead for the future of the MSE process beyond January 2021, and allocates required funding and personnel accordingly.
2. The MSE process will be most useful to IPHC in the future if it is considered to be an ongoing process that is used each year alongside the stock assessment itself, to test different features of the data gathering, stock assessment, and catch-setting components of Pacific halibut.
3. Analysis is needed of the impact of the Commission modifying catch levels in each Regulatory Area after the TCEY recommendation from the harvest control rule. Preferably such analysis should be conducted using the MSE process and be based empirically on past Commission modifications. Since catch-setting is an integral part of the MSE, the MSE framework will be most accurate when it accurately models the decision-making process of the Commission.

Additional recommendations

1. MSAB membership could be expanded to include representatives for crew members, fishing communities, and environmental organizations.
2. The current documentation of technical details of the IPHC MSE framework (Hicks et al. 2019) is described as a working document that will be revised often. As it stands, it is incomplete. To ensure the methods can be repeated, a full description of the methods used to obtain the results presented in January 2021 should be presented at the same time as the results.

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