IPHC Secretariat Program of Work for MSAB Related Activities in 2020-21

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PURPOSE

To update the IPHC Program of Work for MSAB related activities for 2020-21, and options for possible future work.

1 INTRODUCTION

This Program of Work is a description of activities related to the Management Strategy Advisory Board (MSAB) that IPHC Secretariat staff will engage over the next 6 months, and options for future work. It describes each of the priority tasks, lists some of the resources needed for each task, and provides a timeline for each task.

It is important to have a set of working definitions, and this is especially true to the Management Strategy Evaluation (MSE) process since it involves many technical terms that may be interpreted or used differently by different people. A set of working definitions are provided in the IPHC Glossary of Terms and abbreviations: https://www.iphc.int/the-commission/glossary-of-terms-and-abbreviations

1.1 MANAGEMENT STRATEGY EVALUATION (MSE)

Management Strategy Evaluation (MSE) is a process to evaluate alternative management procedures and identify those that are robust to uncertainty and meet the defined objectives. This process, in general, involves the following:

1. defining fishery goals and objectives with the involvement of stakeholders and managers,
2. identifying management procedures to evaluate,
3. simulating a population with application of the management procedures,
4. evaluating and presenting the results in a way that examines trade-offs between objectives,
5. applying a chosen management procedure, and
6. repeating this process in the future to address changes in objectives, assumptions, and expectations.

Figure 1 shows these different components and that the process is not necessarily sequential, but may iterate between components as learning progresses. The involvement of stakeholders and managers in every component of the process is extremely important to guide the MSE and evaluate the outcomes.

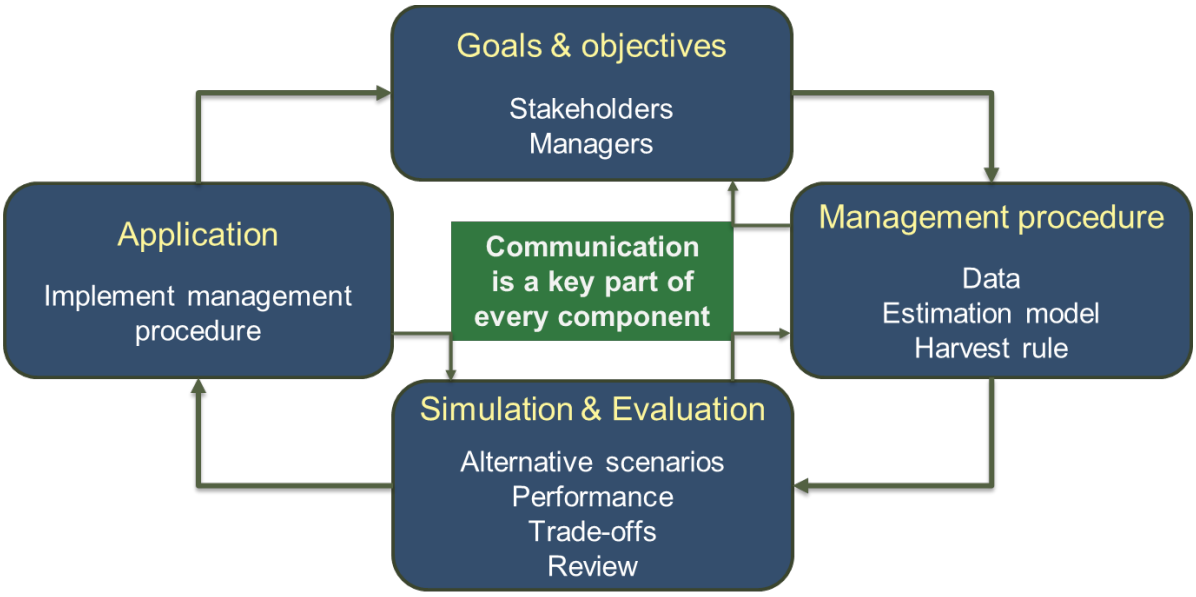

Figure 1: A depiction of the Management Strategy Evaluation (MSE) process showing the iterative nature of the process with the possibility of moving either direction between most components.

1.2 BACKGROUND

Many important tasks have been completed or started regarding the MSE for Pacific halibut (*Hippoglossus stenolepis*). Much of the work proposed will use past accomplishments to further the MSE process. The past accomplishments include the following:

1. Familiarization with the MSE process.
2. Defining conservation and fishery goals.
3. Defining objectives and performance metrics for those goals.
4. Developing coast-wide (single-area) and spatial (multiple-area) models.
5. Identifying management procedures for the coastwide fishing intensity and distributing the TCEY to IPHC Regulatory Areas.
6. Presentation of results investigating coastwide fishing intensity (IPHC-2020-MSAB013-08) and results incorporating procedures to distribute the TCEY to IPHC Regulatory Areas (IPHC-2020-MSAB016-09).

Management Strategy Evaluation is a process that can develop over many years with many iterations. It is also a process that needs monitoring and adjustments to make sure that management procedures are performing adequately. Therefore, the MSE work for Pacific halibut fisheries will be ongoing as new objectives are defined, more complex models are built, new management procedures are defined, and results are updated. This time will include continued consultation with stakeholders and managers via the MSAB meetings. Along the way, there will be useful outcomes that may be used to improve existing management and will influence recommendations for future work. Embracing this iterative process, the program of work identifies the tasks to continue to make progress on the investigation of management strategies.

2 POTENTIAL ONGOING ACTIVITIES

Task 1: Review, update, and further define goals and objectives

Task 2: Develop performance metrics to evaluate objectives

Task 3: Identify realistic management procedures of interest to evaluate

Task 4: Design and code a closed-loop simulation framework

Task 5: Further the development of operating models

Task 6: Run closed-loop simulations and evaluate results

Task 7: Develop tools that will engage stakeholders and facilitate communication

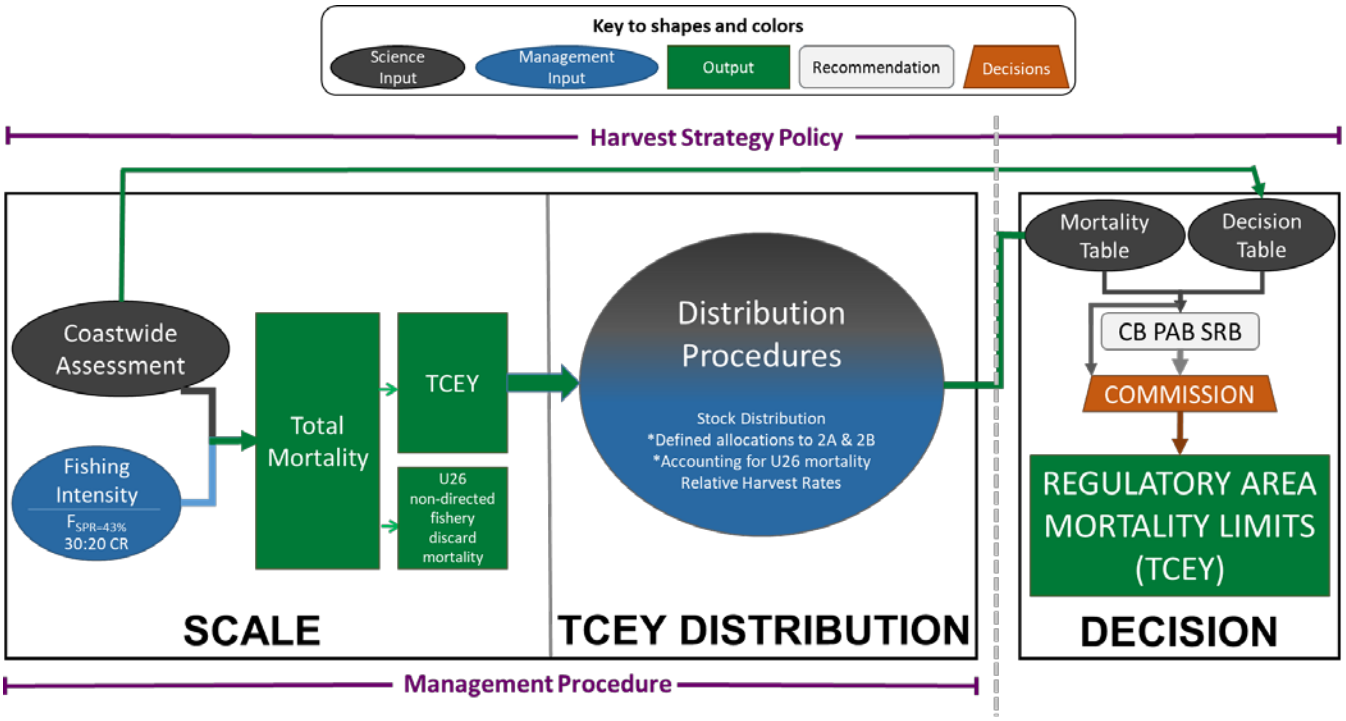

Figure 2: Illustration of the Commission interim IPHC harvest strategy policy (reflecting paragraph ID002 in IPHC CIRCULAR 2020-007) showing the coastwide scale and TCEY distribution components that comprise the management procedure. Items with an asterisk are three-year interim agreements to 2022. The decision component is the Commission decision-making procedure, which considers inputs from many sources.

3 PROGRAM OF WORK FOR 2020/21

The full MSE results incorporating coastwide scale and distribution components of the management procedure (Figure 2) will be presented at the 97th IPHC Annual Meeting (AM097) in January 2021. Therefore, results of simulations incorporating various management

procedures based on the framework shown in Figure 2 will be commented upon by the SRB and evaluated by the MSAB in 2020 before presentation to the Commission in January 2021. There are three main tasks to accomplish in 2020: 1) identify management procedures incorporating coastwide and distribution components to simulate, 2) condition a multi-area operating model and prepare a framework for closed-loop simulations, and 3) present results in various ways in order to evaluate the management procedures. These three main tasks are described below and Table 1 identifies the tasks that will be undertaken at each MSAB and SRB meeting in 2020.

Table 1: Tasks to complete in 2020/21 at the two scheduled MSAB meetings.

15th Session of the IPHC MSAB - May 2020
Review Goals and Objectives (Distribution & Scale)
Review simulation framework
Review multi-area model
Review preliminary results
Identify MPs (Distribution & Scale)
16th Session of the IPHC SRB - June 2020
Review simulation framework
Review multi-area model
Review preliminary results
17th Session of the IPHC SRB - September 2020
Review penultimate results
17th Session of the IPHC MSAB - October 2020
Review final results
Provide recommendations on MPs for scale and distribution
97th Session of the IPHC Annual Meeting (AM097)
Presentation of complete MSE product to the Commission Recommendations on Scale and Distribution MP
Implementation of Commission decisions arising from AM097

3.1 IDENTIFY MANAGEMENT PROCEDURES OF INTEREST TO EVALUATE

The coastwide MSE investigated management procedures related to the coastwide fishing intensity including the SPR associated with a fishing mortality rate (F_{SPR}), the trigger in a control rule determining at what level of relative spawning biomass the fishing intensity is linearly reduced, and various constraints that dampen the annual change in the TCEY. The results from the coastwide MSE provided insight into options and a range of SPR values to further evaluate along with distribution procedures. These are listed in paragraph 49 of IPHC-2019-MSAB014-R.

49. The MSAB RECOMMENDED that SPR values of 0.3, 0.34, 0.38, 0.40, 0.42, 0.46, and 0.50 with a 30:20 control rule be evaluated at MSAB015 along with constraints defined by a maximum change in the TCEY of 15%, a slow-up fast-down approach, and/or setting quotas every third year.

Various procedures related to distributing the TCEY were discussed at MSAB014 and listed in paragraphs 55, 57, and 58 of IPHC-2019-MSAB014-R.

*55. The MSAB **REQUESTED** that a number of elements in distribution management procedures be included for evaluation at MSAB015:*

a) *A coastwide constraint using a slow-up, fast-down approach with a maximum change in the TCEY of 15%;*

b) *evaluating different relative harvest rates across IPHC Regulatory Areas or Biological Regions;*

c) *distributing the TCEY directly to IPHC Regulatory Area;*

d) *A fixed shares concept for all or some IPHC Regulatory Areas, Biological Regions, or Management Zones with options to distribute the TCEY to the areas without a fixed share. The determination of these shares may be fixed or varying over time; and*

e) *A maximum fishing intensity defined by an SPR of 36% to act as a buffer when distributing the TCEY to IPHC Regulatory Areas.*

*57. The MSAB **NOTED** additional elements for distribution procedures to consider as sensitivities when developing management procedures for evaluation at MSAB015 as follows:*

a. a constraint applied to the TCEY for each IPHC Regulatory Area using a slow-up, fast-down approach with a maximum change in the TCEY of 15%;

b. using O32 estimates of stock distribution or "all sizes" estimates of stock distribution from the modelled survey results;

c. evaluating different relative harvest rates across IPHC Regulatory Areas or Biological Regions (e.g. harvest rates for Biological Region 2, IPHC Regulatory Areas 2A and/or 4CDE);

d. calculating shares across Biological Regions, Management Zones, or IPHC Regulatory Areas using approaches that blend multiple sources of information (e.g., using historical TCEYs and stock distribution results for all IPHC Regulatory Area, a 5-year window of estimated stock distribution, etc.);

e. the importance the order of applying elements in the distribution procedure when limiting the maximum SPR (i.e. using a buffer).

*58. The MSAB **NOTED** additional elements for distribution procedures to consider when developing management procedures for evaluation at MSAB016 as follows:*

a. *a constraint applied to the TCEY for each IPHC Regulatory Area using a slow-up, fast-down approach;*
b. *a constraint applied to the TCEY for each IPHC Regulatory Area implementing a maximum change in the TCEY of 15%;*
c. *a maximum fishing intensity defined by an SPR of 40% to act as a buffer when distributing the TCEY to IPHC Regulatory Areas;*
d. *adjusting relative harvest rates to reflect current stock productivity (note that this will be explored before MSAB015);*
e. *using trends in fishery CPUE to adjust allocation percentages by IPHC Regulatory Area (note that this will be explored before MSAB015);*
f. *additional approaches to first distribute the TCEY to Biological Region or Management Zone.*

There are many combinations of elements and it would be nearly impossible to simulate and evaluate all possible combinations. Therefore, eleven specific management procedures for distributing the TCEY to IPHC Regulatory Areas were identified in Appendix V of IPHC-2020-MSAB015-R. These management procedures will be simulated and evaluated throughout 2020.

4 POTENTIAL ELEMENTS FOR A PROGRAM OF WORK MOVING FORWARD

The MSE program has been focused on the delivery of simulation results examining management procedures incorporating scale and distribution components (Figure 2) in January 2021, but some items have been discussed for consideration after the MSE is complete. A discussion of potential work categorized by the seven tasks listed above is provided here.

4.1 REVIEW, UPDATE, AND FURTHER DEFINE GOALS AND OBJECTIVES

Well defined goals and objectives are the key to evaluating management procedures. Using performance metrics derived from the objectives, outcomes and tradeoffs can be examined to identify management procedures that best meet the defined objectives. For each iteration, objectives may be redefined, deleted, or added given changes in the fisheries, management paradigm, or insights from past results. Because objectives are the key to evaluating the management procedures, it is important to ensure that they are current, accurate, and useful. Therefore, after the first round of MSE results are presented in 2021, it would be useful to revisit objectives in the near future. Current objectives are provided in Appendix I.

4.2 DEVELOP PERFORMANCE METRICS TO EVALUATE OBJECTIVES

Objectives are the key to evaluating management procedures, but that evaluation occurs through the use of performance metrics derived from the objectives. These may be probabilities of an event occurring or a summary statistic of a quantity. Multiple performance objectives may be developed for a single objective that summarizes the results in slightly different ways. With well developed objectives, it is easy to derive useful performance metrics. However, additional

performance metrics may be useful to investigate the results in slightly different ways, to look at a different concept, or to even provide an alternative statistic that is not related to any primary objectives. A defined set of performance metrics that stakeholders and managers agree to, understand, and are familiar with is essential to the evaluation process. If new objectives are defined, performance metrics should be derived for those. Additionally, it would be useful to list the performance metrics found useful in the evaluation of the first round of MSE results to carry forward, and to identify potential performance metrics that may be useful in the future.

4.3 IDENTIFY REALISTIC MANAGEMENT PROCEDURES TO EVALUATE

The goal of an MSE is to identify management procedures that are robust to variability and uncertainty, and meet the defined objectives. Therefore, a set of management procedures is pre-defined for testing and evaluation. The process is also iterative and what is learned from previous evaluations will inform the development of additional management procedures to evaluate, especially in the early iterations of an MSE.

The SRB, MSAB, and Commission have highlighted some elements of management procedures that may be useful to examine in the future. The following are from various past reports.

> **IPHC-2018-SRB013-R, para. 29**: *The SRB REQUESTED that in future iterations of the MSE, the IPHC Secretariat and MSAB consider: […] c) the current conditioned operating model used to simulate coast-wide survey index and that such data be used to consider an alternative survey-based management procedure (this may provide a more transparent TMq-setting algorithm than the current SPR based control-rule and help with MSAB deliberations).*
>
> **IPHC-2020-AM096-R, para. 83.** *The Commission NOTED that MSE is the appropriate tool to evaluate management procedures related to discard mortality for non-directed fisheries (bycatch) because it can capture downstream effects, biological implications, and the management performance relative to objectives.*
>
> **IPHC-2020-MSAB015-R, para. 20.** *The MSAB REQUESTED that a procedure to distribute the coastwide TCEY be flexible to allow for distribution directly to IPHC Regulatory Areas, or to Biological Regions or Management Zones before distributing to IPHC Regulatory Areas. Methods of distribution may be based on stock distribution, relative fishing intensities, and other allocation adjustments.*
>
> **IPHC-2020-MSAB015-R, para. 22**. *The MSAB NOTED that alternative management procedures may use area-specific data (e.g. modelled survey results) without using a coastwide TCEY, rather than the procedure described in paragraph 21. This example is a sub-category of a broader category of management procedures that are data-based rather than assessment-based.*

Two investigations are highlighted here that have not been investigated in the current MSE. First, the Commission at AM096 (IPHC-2020-AM096-R, para. 83) indicated that the MSE would be an appropriate tool to investigate management procedures related to non-directed fishery discard mortality. Second, the SRB (IPHC-2018-SRB013-R) and MSAB (IPHC-2020-MSAB015-R) identified that it would be useful to investigate management procedures directly using FISS data in each IPHC Regulatory Area instead of integrating many sources of data in a stock assessment. Many other management procedures can be identified and evaluated.

4.4 DESIGN AND CODE A CLOSED-LOOP SIMULATION FRAMEWORK

The simulation framework includes all components that are necessary to conduct the closed-loop simulations including an operating model to simulate the Pacific halibut population and the elements of management procedures which generally includes monitoring, estimation, and rules (Figure 3). The first complete Pacific halibut MSE is being reviewed by the SRB as well as an independent reviewer, and many items have been identified for improvement. Most of these will require additions or modifications to the current framework. For example, how the weight-at-age are simulated, the ability to incorporate alternative management procedures, and the inclusion of alternative operating models are important improvements that could be made in the future. The current simulation framework was developed with future improvements in mind, thus is generalized and modular to allow for quick expansion and modification.

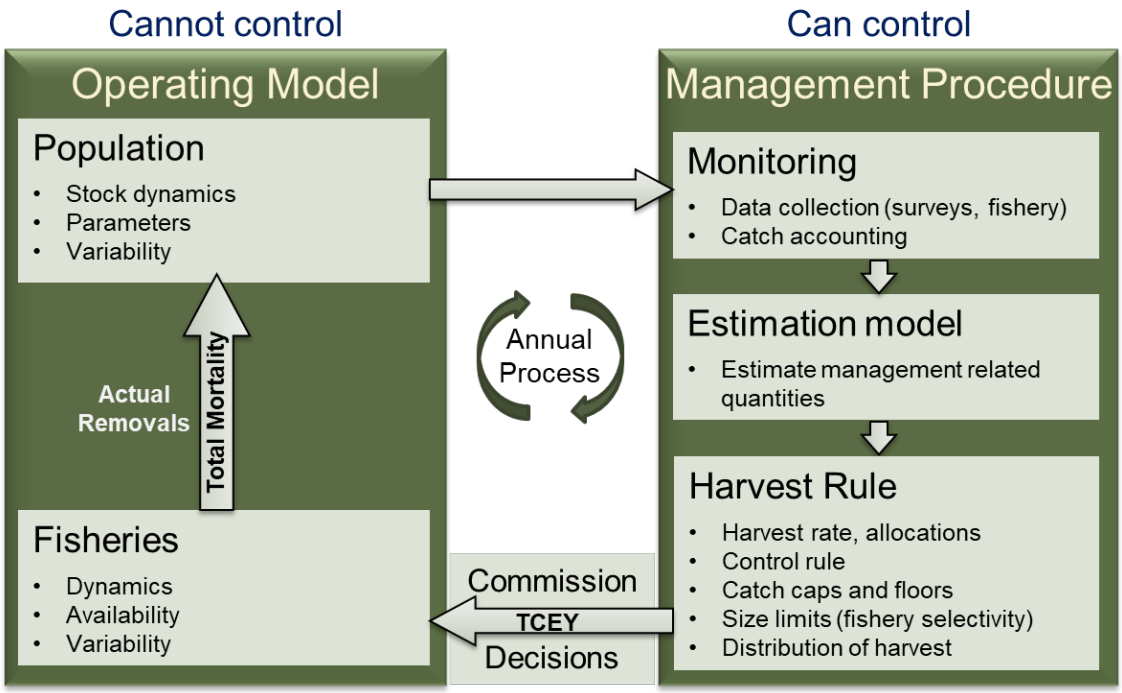

Figure 3: Illustration of the closed-loop simulation framework with the operating model (OM) and the Management Procedure (MP). This is the annual process on a yearly timescale.

4.5 FURTHER THE DEVELOPMENT OF OPERATING MODELS

The operating model simulates the Pacific halibut population and interacts with simulated management in the closed-loop simulations. The assumptions of productivity, movement, and other population processes as well as variability are included in the operating model, which are unknown but represent reasonable hypotheses based on past observations. The operating model may be based on multiple hypotheses by incorporating multiple models, as the stock assessment ensemble does. The coastwide MSE used two models to represent multiple hypotheses, but the current multi-regional MSE incorporates a single model with variability. It would be useful to investigate alternative hypotheses about the Pacific halibut population to either include as a model within the operating model or as a specific scenario to investigate an exceptional circumstance (e.g. an assumption that is unlikely but would be examined to provide a picture of the robustness of a management procedure).

4.6 RUN CLOSED-LOOP SIMULATIONS AND EVALUATE RESULTS

Given progress on the above tasks, it will be necessary to run new simulations to incorporate those changes and additions. The simulation framework is complex and each simulation takes time to complete. Additionally, the variability included requires a large number of simulations to adequately characterize the outcomes. Therefore, it is necessary to consider the time it takes to run simulations and compile results in the program of work.

4.7 DEVELOP TOOLS THAT WILL ENGAGE STAKEHOLDERS AND FACILITATE COMMUNICATION

Involvement from stakeholders and managers is essential for the success of an MSE, thus communication is imperative. Tools to assist in that communication must be developed jointly between the developers and end users. Currently, results are communicated through tables and figures in documents, online via the MSE Explorer interactive tool, and through presentation at IPHC meetings. Iteration with stakeholders and managers to determine beneficial tools to aid with evaluation is essential to the success of the MSE.

5 RECOMMENDATION/S

That the MSAB:

1) **NOTE** paper IPHC-2020-MSAB016-10 which describes the IPHC Program of Work for MSAB related activities for 2020-21, and options for possible future work.
2) **NOTE** the delivery date of January 2021 (97th Annual Meeting) for the complete MSE results including Scale and Distribution components of the management procedure for potential adoption by the Commission and subsequent implementation.
3) **SUGGEST** tasks to investigate beyond 2021.

6 ADDITIONAL DOCUMENTATION / REFERENCES

IPHC-2018-SRB013-R. 2018. Report of the 13th Session of the IPHC Scientific Review Board (SRB013). Seattle, WA, U.S.A. 25-27 September 2018. 17 pp. https://iphc.int/uploads/pdf/srb/srb013/iphc-2018-srb013-r.pdf

IPHC-2019-MSAB013-08. 2019. Further Investigation of Management Procedures Related to Coastwide Fishing Intensity. 5 April 2019. 18 pp. https://www.iphc.int/uploads/pdf/msab/msab13/iphc-2019-msab013-08.pdf

IPHC-2019- MSAB014-09. 2019. IPHC Secretariat Program of Work for MSAB Related Activities 2019-23. 20 September 2019. 17 pp. https://iphc.int/uploads/pdf/msab/msab014/iphc-2019-msab014-09.pdf

IPHC-2019-MSAB014-R. Report of the 14th Session of the IPHC Management Strategy Advisory Board (MSAB014). Seattle, WA, U.S.A. 21–24 October 2019. 27 pp. https://iphc.int/uploads/pdf/msab/msab014/iphc-2019-msab014-r.pdf

IPHC-2020-AM096-R. 2020. Report of the 96th Session of the IPHC Annual Meeting (AM096). Anchorage, Alaska, USA. 3–7 February 2020. https://iphc.int/uploads/pdf/am/2020am/iphc-2020-am096-r.pdf

IPHC-2020-MSAB015-R. 2020. Report of the 15th Session of the IPHC Management Strategy Advisory Board (MSAB015). Meeting held electornically. 11–14 May 2020. 23 pp. https://iphc.int/uploads/pdf/msab/msab015/iphc-2020-msab015-r.pdf

IPHC-2020-MSAB016-09. 2020. Results investigating fishing intensity and distributing the total constant exploitation yield (TCEY) for Pacific halibut fisheries.

7 APPENDICES:

Appendix I: Primary objectives defined by the Commission for the MSE

APPENDIX I
PRIMARY OBJECTIVES DEFINED BY THE COMMISSION FOR THE MSE

Primary measurable objectives, evaluated over a simulated ten-year period, accepted by the Commission at the 7th Special Session of the Commission (SS07). Objective 1.1 is a biological sustainability (conservation) objective and objectives 2.1, 2.2, and 2.3 are fishery objectives.

GENERAL OBJECTIVE	MEASURABLE OBJECTIVE	MEASURABLE OUTCOME	TIME-FRAME	TOLERANCE	PERFORMANCE METRIC
1.1. KEEP FEMALE SPAWNING BIOMASS ABOVE A LIMIT TO AVOID CRITICAL STOCK SIZES AND CONSERVE SPATIAL POPULATION STRUCTURE	Maintain a female spawning stock biomass above a biomass limit reference point at least 95% of the time	*SB* < Spawning Biomass Limit (SB_{Lim}) SB_{Lim}=20% unfished spawning biomass	Long-term	0.05	$P(SB < SB_{Lim})$
	Maintain a defined minimum proportion of female spawning biomass in each Biological Region	$p_{SB,2} > 5\%$ $p_{SB,3} > 33\%$ $p_{SB,2} > 10\%$ $p_{SB,2} > 2\%$	Long-term	0.05	$P(p_{SB,R} < p_{SB,R,min})$
2.1 MAINTAIN SPAWNING BIOMASS AROUND A LEVEL THAT OPTIMIZES FISHING ACTIVITIES	Maintain the coastwide female spawning biomass above a biomass target reference point at least 50% of the time	*SB*<Spawning Biomass Target (SB_{Targ}) SB_{Targ}=$SB_{36\%}$ unfished spawning biomass	Long-term	0.50	$P(SB < SB_{Targ})$
2.2. LIMIT CATCH VARIABILITY	Limit annual changes in the coastwide TCEY	Annual Change (*AC*) > 15% in any 3 years	Short-term		$P(AC_3 > 15\%)$
		Median coastwide Average Annual Variability (AAV)	Short-term		*Median AAV*
	Limit annual changes in the Regulatory Area TCEY	Annual Change (*AC*) > 15% in any 3 years	Short-term		$P(AC_3 > 15\%)$
		Average AAV by Regulatory Area (AAV_A)	Short-term		*Median* AAV_A
2.3. PROVIDE DIRECTED FISHING YIELD	Optimize average coastwide TCEY	Median coastwide TCEY	Short-term		*Median* $\overline{TCEY}$
	Optimize TCEY among Regulatory Areas	Median $TCEY_A$	Short-term		*Median* $\overline{TCEY_A}$
	Optimize the percentage of the coastwide TCEY among Regulatory Areas	Median %$TCEY_A$	Short-term		*Median* $\left(\overline{\frac{TCEY_A}{TCEY}}\right)$
	Maintain a minimum TCEY for each Regulatory Area	Minimum $TCEY_A$	Short-term		*Median Min(TCEY)*
	Maintain a percentage of the coastwide TCEY for each Regulatory Area	Minimum %$TCEY_A$	Short-term		*Median Min(%TCEY)*