IPHC Secretariat Program of Work for MSAB Related Activities 2019-23

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PURPOSE

To update the IPHC Program of Work for MSAB related activities for the period 2019-23.

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 in for the next five years. It describes each of the priority tasks, lists some of the resources needed for each task, and provides a timeline for each task. However, this work plan is flexible and may be changed throughout this period with the guidance of the MSAB, Science Review Board (SRB) members, and Commission. The order of the tasks in this work plan represents the sequential development of each task, and many subsequent tasks are dependent on previous tasks.

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

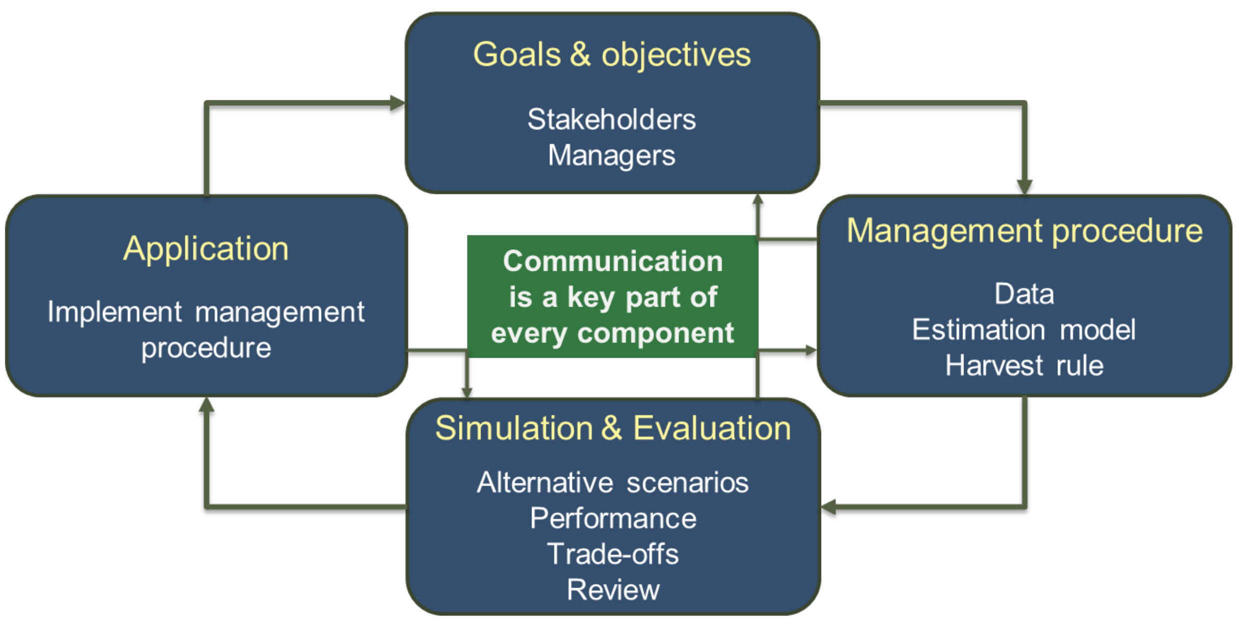

Figure 1: A depiction of the Management Strategy Evaluation (MSE) process showing the iterative nature of the process with the possibility of moving either direction between most components.

1.1 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 a sequential process, but there may be movement back and forth 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.

1.2 BACKGROUND

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

1. Familiarization with the MSE process.
2. Defining conservation and fishery goals.
3. Developing objectives and performance metrics from those goals.
4. Discussions about coast-wide (single-area) and spatial (multiple-area) models.
5. Presentation of results investigating coastwide fishing intensity.
6. Discussions of ideas for distributing the TCEY to Regulatory Areas.

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 addressed, more complex models are built, and results are updated. This time will include continued consultation with stakeholders and managers via the MSAB meetings, defining and refining goals and objectives, developing and coding models, running simulations, reporting results, and making decisions. Along the way, there will be useful outcomes that may be used to improve existing management and will influence recommendations for future work.

Overall, the plan is to use what has already been learned to continue making progress on the investigation of management strategies.

2 MAIN TASKS FOR THE NEXT 5 YEARS (WITH PAGE NUMBER OF DESCRIPTION)

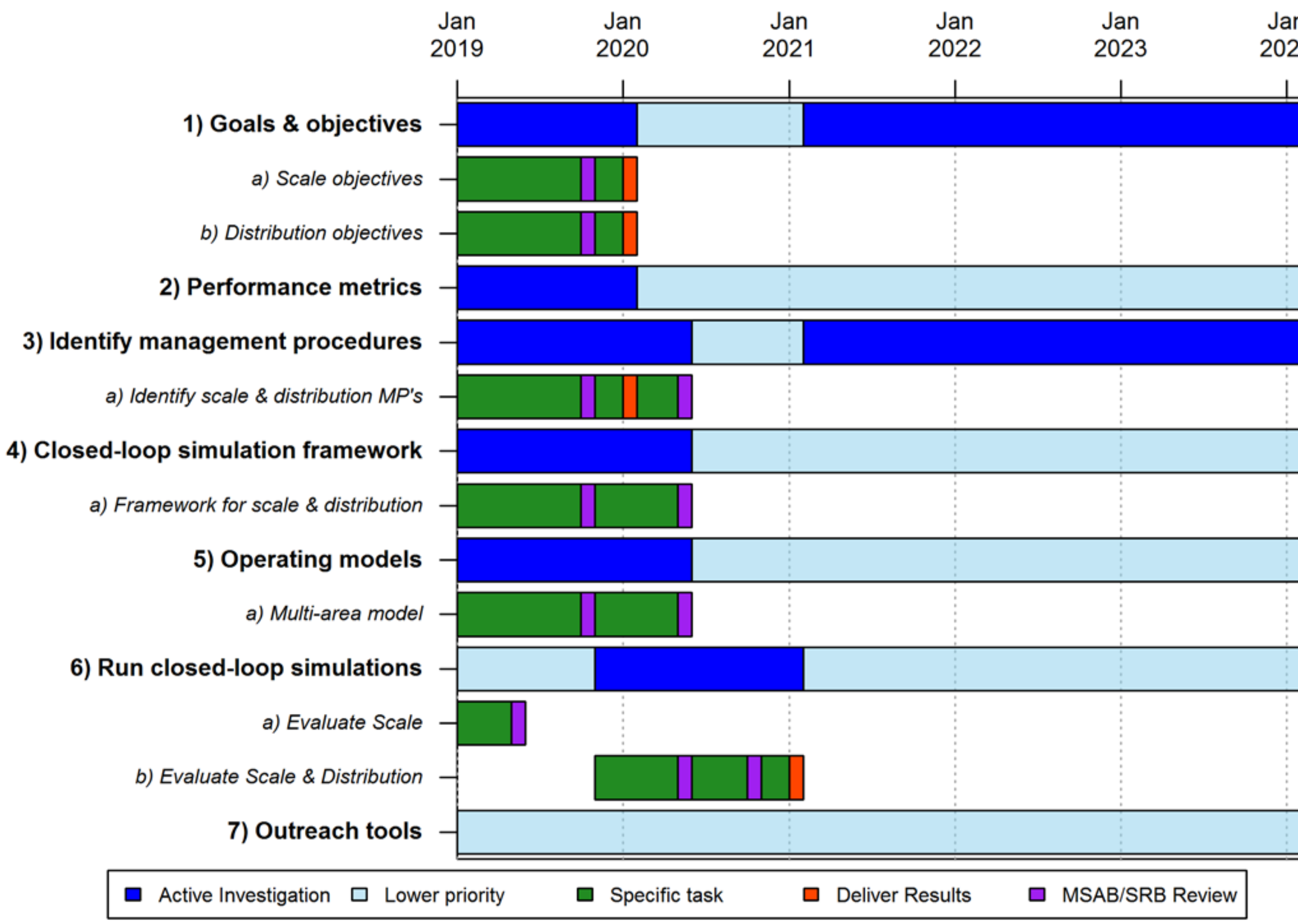

Figure 2: Gantt chart for the five-year work plan. Tasks are listed as rows. Dark blue indicates when the major portion of the main tasks work will be done. Light blue indicates when preliminary or continuing work on the main tasks will be done. Dark green indicates when the work on specific sub-topics will be done. Red areas show when results will be presented to the Commission. Purple areas show when the task will be reviewed by the MSAB and/or the SRB.

Task 1. REVIEW, UPDATE, AND FURTHER DEFINE GOALS AND OBJECTIVES

Timeline: Ongoing, but a focus on defining objectives occurring before January 2020.

Deliverables: A list of goals important to the management of the Pacific halibut fishery, and a set of measureable objectives associated with those goals. Some objectives may be prioritized over others.

Relevance: Relevant goals and measureable objectives are essential to the MSE process. They are necessary to determine what types of models are needed and to determine the performance metrics that will be used to rank management procedures. MSE is a process to identify management procedures that are robust to uncertainty and meet the defined objectives.

Resources: Time to review past meetings, MSAB members to confirm and verify intent of existing goals and objectives, MSAB members to assist in the development of additional goals and objectives, MSAB members to assist with the development of measureable objectives and performance metrics.

Relation to other tasks: Defining goals and objectives is critical to developing useful performance metrics (Task 2), determining applicable management procedures (Task 3), identifying the complexity needed in the operating model (Task 5), and evaluating simulation results (Task 6).

Description: A very important part of the MSE process is to define goals (general overarching goals) and turn those into measureable (ends) objectives. The first step is to define a set of goals that are important to stakeholders and managers, which has been done at past MSAB meetings. It is important to verify that these aspirations are still of interest to all MSAB members, and to determine if additional goals should be added to the list. Currently, there are four overarching goals.

1. Biological sustainability
2. Optimize directed fishing opportunities
3. Minimize discard mortality
4. Minimize bycatch and bycatch mortality

Measurable objectives can then be defined from these goals. Measurable objectives are objectives that have

1. a *measurable outcome* (a specific and measurable description of what is desired),
2. a *time frame* (over what period of time is this outcome desired, which can be how far in the future and/or over a period of years), and
3. a *tolerance* (the tolerance for failure expressed as a probability).

An example of defining a measurable objective may be to take an objective such as "avoid stock sizes from which the stock may not recover" and define the measurable objective as the simulated spawning biomass from the operating model is less than 20% of unfished equilibrium spawning biomass (*measurable outcome*) over a ten-year period far in the future (*time frame* incorporating both components) no more than 10% of the time (*tolerance*).

These measurable objectives define a performance metric that is used to evaluate alternative management strategies. Objectives that do not have all of these components defined may still be useful and are defined as statistics of interest. A statistic of interest may be the coastwide TCEY, for example, and may be informative to the evaluation of management procedures. The objectives may be prioritized as well with a requirement that certain objectives must be met before considering other objectives in the evaluation of management procedures. Statistics of interest and objectives not used in the primary evaluation may be used to supplement the evaluation when multiple management procedures meet the primary objectives similarly.

Measurable objectives can also be used to develop the specifics of a MSE simulation framework. For example, what spatial resolution is needed to evaluate the objectives (e.g., coast-wide single area vs. spatial operating model). The development of measurable objectives may be iterative, in that they may be revised as the MSE evolves and more is understood about the relative performance of various management procedures.

Task 2. DEVELOP PERFORMANCE METRICS TO EVALUATE OBJECTIVES

Timeline: Ongoing, but a focus on defining performance metrics occurring before January 2020.

Deliverables: A list of performance metrics linked to objectives from Task 1 that would be informative to stakeholders, managers, and scientists to effectively evaluate the performance of different management strategies and the trade-offs between them.

Relevance: The performance metrics are the key to evaluating management strategies and communicating outcomes to stakeholders. Determining performance metrics from the objectives and finding ways to present them effectively will help with the evaluation of the MSE results and finding a management procedure that best meets the objectives.

Resources: Time for Task 1, MSAB members to confirm and verify performance metrics developed from objectives, MSAB members to assist with methods to present and examine various performance metrics.

Relation to other tasks: Performance metrics are linked to objectives defined in Task 1 and are the key to presenting and evaluating results from the management strategy evaluations (Task 6). Performance metrics are also used to guide the development of the operating model and the closed-loop simulation programming (Task 4 and Task 5).

Description: Measurable objectives guide the development of the simulation framework for an MSE, and performance metrics are needed to gauge the performance of a management strategy relative to those objectives. For example, a measurable objective may be to keep the average mortality limit (i.e., TCEY) above a specific amount (the *measurable outcome*), in the long-term over a 10-year period (the *time frame*), at least 95% of the time (the *tolerance*). The performance metric, framed as a risk, could then be the probability that the average catch was less than that level in this time period (average here refers to the average over the 10-year period and the probability accounts for the many replicated simulations). Another example is that a potential aspirational goal would be to have stability in yield, which could be translated to a measurable objective as keeping the annual change in the mortality limit to less than 15% (*measurable outcome*) over a 10-year period (*time frame*) at least 75% of the time (*tolerance*).

The performance metric may then be, again framed as a risk, the proportion of simulations where the average change in the mortality limit over a ten-year period exceeded 15%.

Other performance metrics may not be directly associated with measureable objectives, but related to aspirational goals and objectives. These could be the average catch and the average annual variability in catch, and they do not have a probability associated with them. They do, however, provide a comparison between management procedures, but can be more ambiguous and subject to interpretation (e.g., compare an average catch of 101 tons to 100 tons, as opposed to a defined probability threshold for achieving a particular catch). If the objective is to maximize average catch or minimize average annual variability, then these performance statistics could be used to measure achievement of those objectives (or to examine the trade-offs between them), but it is more difficult to gauge the performance of a metric like average catch in light of uncertainty. An important component of performance metrics is the *distribution of outcomes* under different scenarios; some scenarios may confer much greater sensitivity of results than others and the understanding of this sensitivity is critical to the evaluation of the management procedures that are tested. This is also a key element in understanding the uncertainty associated with results.

Determining important and useful performance metrics, as well as how to present them, is key to communicating outcomes, interpreting MSE results, evaluating trade-offs, and ranking management procedures. Many performance metrics have already been defined, and this task will refine those, identify new metrics, and develop ways to present them. For example, Table 1 and Figure 3 show preliminary results from the IPHC MSE for Pacific halibut that were presented in IPHC document IPHC-2018-AM094-12. The probabilities and other details are apparent in Table 1, while the trade-offs are more easily seen in Figure 3. Additionally, performance metrics can be related to past performance, such as the observed average catch over the last 2 decades, and advice will be solicited to determine if there is a historical period for comparison.

Table 1: Performance metrics determined from outputs of the closed-loop simulations for various fishing intensities indicated by an Input Spawning Potential Ratio (SPR) and a 30:20 threshold:limit in the harvest control rule with a constraint on the annual change in the mortality limit (Constraint). Table reproduced from the presentation associated with IPHC document IPHC-2019-AM095-12. The lower portion of the table ranks the management procedures, and shows that some objectives were not met by some management procedures.

Input Control Rule	30:20													
Constraint	maxChange Both		maxChange Up		slowUp FastDown		slowUp FullDown		Cap80		Cap60		multiYear	
Input SPR	46%	40%	46%	40%	46%	40%	46%	40%	46%	40%	46%	40%	46%	40%
Biological Sustainability (Long-term)														
P(any dRSB_y<20%)	0.02	0.02	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
Fishery Sustainability (medium-term)														
P(all AAV > 15%)	0.04	0.05	0.27	0.35	0.07	0.14	0.13	0.26	0.58	0.61	0.45	0.48	0.14	0.26
Median average TM	46.1	49.5	44.0	45.3	45.0	49.5	44.7	49.3	46.4	50.7	46.1	50.0	46.5	50.5
Rankings (lower is better)														
Meet biological objective?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Meet stability objective?	Yes	Yes	No	No	Yes	Yes	Yes	No	No	No	No	No	Yes	No
Maximum catch (TM)	9	4	14	11	12	5	13	6	8	1	10	3	7	2
Overall Ranking	4	1	—	—	5	2	6	—	—	—	—	—	3	—

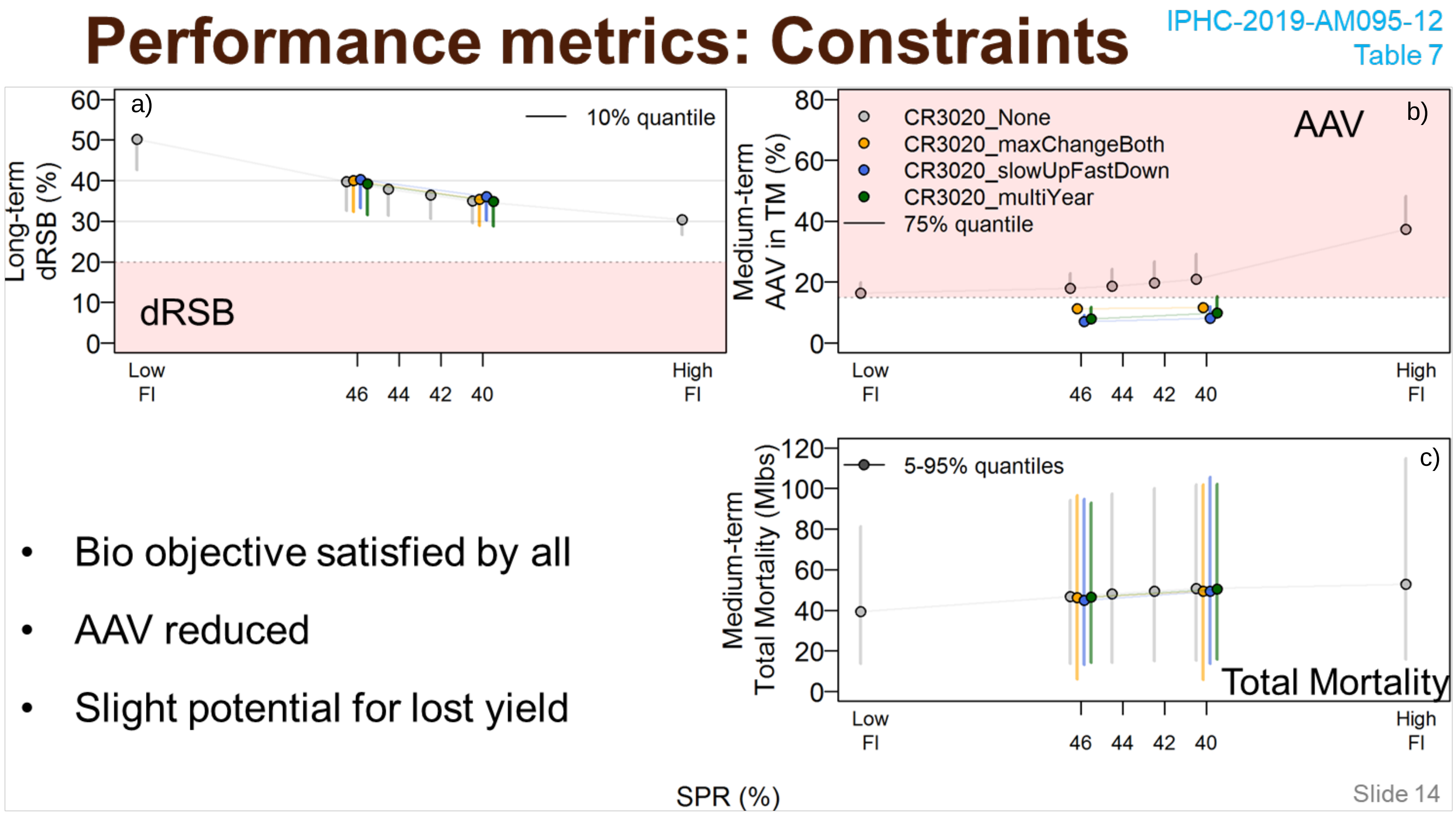

Figure 3: Performance metrics plotted against the procedural SPR (horizontal axis) for a 30:20 threshold:limit combination and different constraints on the annual change in mortality limits (colored circles). Panel a) shows the dynamic relative spawning biomass (biological sustainability goal), panel b) the average annual variability for total mortality (fishery stability goal) and panel c) shows the total mortality (fishery sustainability goal). Panels a) and b) have a red shaded area showing were the measurable outcome for that performance metric. The tolerance is shown by the line extending from the circle, and if any part of that line is in the red area, the objective is not met. The fishery sustainability objective was to simply maximize the total mortality subject to satisfying the other objectives. From the presentation associated with document IPHC-2019-AM095-12.

Task 3. IDENTIFY REALISTIC MANAGEMENT PROCEDURES OF INTEREST TO EVALUATE

Timeline: 2019, and then ongoing.

Deliverables: Various management procedures incorporating scale and TCEY distribution to be tested using closed-loop simulations.

Relevance: Identifying realistic management procedures that are of interest to stakeholders, managers, and scientists will ensure that the results of the MSE are pertinent and useful to managing the Pacific halibut stock.

Resources: Discussions between IPHC staff and MSAB members.

Relation to other tasks: This task will rely on defined goals and objectives (Task 1) and will feed into the closed-loop simulation programming (Task 4) and the evaluation task (Task 6).

Description: The purpose of MSE is to evaluate management procedures by examining and comparing the performance and trade-offs of each. A small enough set needs to be determined so that the simulations can be completed in a reasonable amount of time and be easily compared and contrasted. Management procedures can be identified by modifying the status quo, consulting with stakeholders, or examining other fisheries. Initially, many may be identified, and then reduced to a manageable size, which can occur through further consultation and investigation with simpler models and simple simulations.

A management procedure contains elements related to data collection, assessment, and harvest rules. Combined with objectives, this makes a management strategy. Some elements of management procedures that have been proposed by the MSAB are:

- **Total mortality**: Direct accounting by area for all sources of mortality in that area, including sub-legals and bycatch mortality.
- **Fishing Intensity**: SPR-based (spawning potential ratio).
- **Harvest rules**: 30:20 and 40:20 coast-wide control rules, stock distribution to region as a first step, harvest rate differences between eastern and western Biological Regions.

The management procedure that would be evaluated as part of the MSE process would contain all of the necessary elements to set catch levels for the stock. An example management procedure may be

- Annual survey to inform the stock assessment
- Status quo fishery data collected
- Annual assessment to determine total catch
- Coast-wide F_{SPR} with a 30:20 control rule to determine coast-wide total removals
- Coast-wide directed fishery mortality limit (TCEY) apportioned to biological regions based on the proportion of survey biomass
- Further distribution of TCEY to IPHC Regulatory Area within Region
- Status quo recreational, subsistence, and bycatch allocation

The Commission at its 2017 Annual Meeting (AM093) recommended investigating a management approach based-on Spawning Potential Ratio (SPR) to account for all mortality. Spawning Potential Ratio is the long-term equilibrium spawning biomass per recruit with fishing divided by the long-term equilibrium spawning biomass per recruit without fishing. An SPR-based approach is defining a fishing level that results in a specific SPR (reduction in spawning potential) and noted as $F_{SPR=XX\%}$, where XX% is the SPR. This $F_{SPR=XX\%}$ will be treated as an element of a management procedure and evaluated with closed-loop simulation to find a level that best satisfies the defined objectives. Management procedures related to distribution of the TCEY are also currently being evaluated. Discussions of potential management procedures are ongoing and need to be finalized by May 2020 to ensure enough time to perform the closed-loop simulations for presentation in January 2021.

Task 4. DESIGN AND CODE A CLOSED-LOOP SIMULATION FRAMEWORK

Timeline: 2019, and ongoing improvement after that.

Deliverables: A design for a computer program that can perform closed-loop simulations for various operating models and management procedures. Once the design and framework are determined, the computer program will be written and tested. Updates will then occur as needed.

Relevance: A computer program to perform closed-loop simulations is the engine for the MSE. It will perform the simulations and create the output needed to calculate performance metrics. A good design will ensure that the code is useful to address current questions and flexible to accommodate future questions.

Resources: IPHC staff, computer programmer, MSE researcher, computing time, consultation with MSAB and SRB.

Relation to other tasks: This task will incorporate performance metrics (Task 2), management procedures (Task 3), and spatial model complexity and operating models (Task 5). This framework will be used for evaluation (Task 6).

Description: Prior to 2017, the MSAB used an equilibrium model to introduce the concepts of a MSE. This model was used in a web-based application (the Shiny tool) because it produced results quickly and allowed MSAB members to change a few management options and see equilibrium outcomes related to biomass and yield. Those equilibrium outcomes are long-term averages of quantities that have natural variation (e.g., catches) if the fishery took place for an infinite amount of time.

Understanding the variability of the outcomes, such as yield and spawning biomass, is an important aspect of a MSE, but cannot be assessed with an equilibrium model. The equilibrium model is useful because it produces results quickly and can be used to see the general patterns of various management strategies. However, this equilibrium model does not include the variability around the projections, and does not incorporate a closed-loop simulation framework.

A closed-loop evaluation is the process of simulating the population dynamics with an operating model, as well as the feedback from the management strategy and decision-making process (Figure 4). The operating model consists of concepts that we cannot, or choose not to, control. For example, the operating model will contain the population dynamics and some of the fishery dynamics that are not a part of the management process. The management procedure is what we can and choose to control. The management procedure consists of data gathering, estimation models, and harvest rules, as well as anything else that informs the decisions affecting the fishery and fish population. Figure 4 shows the simulation process of a closed-loop simulation.

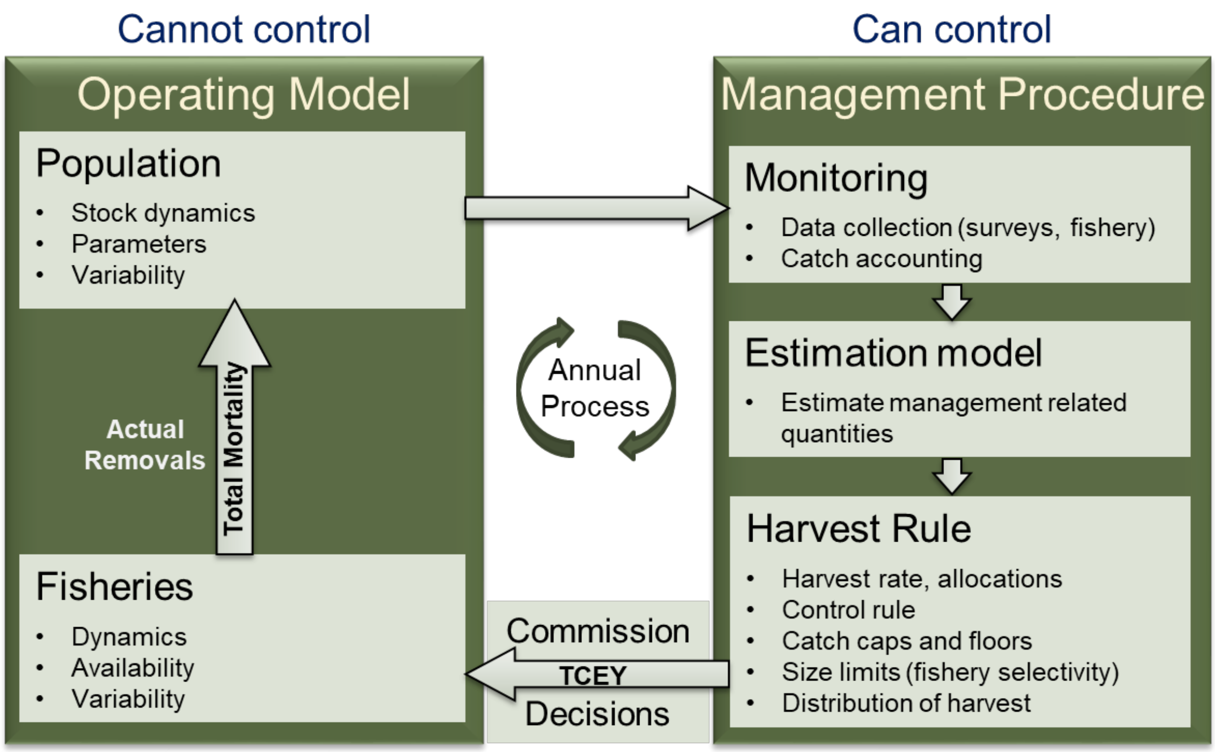

Figure 4: A flow chart of how the annual process is simulated in a closed-loop simulation.

The operating model incorporates variability in the system (process error or inherent variability) and additional variability can be added to various parts of the management procedure (e.g., sampling error, assessment uncertainty, and implementation error). This variability is characterized by replicate simulations, resulting in a distribution of outcomes, which can be described with statistics of interest (such as the mean) or by probability-based performance metrics (such as the proportion of time the catch was below a certain level). It is important to note that closed-loop simulations are different than assessment projections because they incorporate hypotheses about the system that may be beyond what is useful for tactical decision making.

The management procedure must be able to be coded in a computer program, although implementation error can be introduced to mimic a real process more closely (e.g., not consistently following the management procedure). The average of a long-term closed-loop simulation with a consistent management procedure should be very similar to the results of an equilibrium model. However, the closed-loop simulation will also provide an insight into the variability of the process.

The development of a closed-loop simulation framework has involved coding a program that incorporates the following:

1. The Operating Model (OM) is a representation of the population and the fishery with uncertainty and variability. It produces the numbers-at-age, accounting for mortality and any other important processes. It also incorporates uncertainty in the processes and may be composed of multiple models to account for structural uncertainty.

2. Management Procedure

    a. Monitoring (data generation) is the code that simulates the data from the operating model that is used by the estimation model. It can introduce variability, bias, and any other properties that are desired.

    b. The Estimation Model (EM) is analogous to the stock assessment and simulates estimation error in the process. Using the data generated, it produces an annual estimate of stock size and status and provides the advice for setting the catch levels for the next time step. However, simplifications may be necessary to keep simulation times within a reasonable time.

    c. Harvest Rule is the application of the estimation model output along with the scale and distribution management procedures (Figure 1) to produce the catch limit for that year.

The framework will have to be flexible and compartmentalized to allow changes to be made for each component.

The closed-loop simulation framework was first used to evaluate coastwide scale-related management procedures and were presented at the 95th Annual Meeting in 2019. After the development of multi-area models to include in an operating model, the updated framework will be used to evaluate scale and distribution management procedures for presentation at the 97th Annual Meeting in 2021. See Appendix A for a more specific timeline.

Task 5. FURTHER THE DEVELOPMENT OF THE OPERATING MODEL

Timeline: 2019 and early 2020

Deliverables: Individual models to make up an operating model (a collection of models depicting uncertainty, scenarios, and various hypotheses about the population and fisheries) that will satisfy the objectives defined by MSAB members.

Relevance: An operating model are necessary to examine structural uncertainty and to answer specific management questions.

Resources: IPHC staff, MSE researcher, computer programmer, computing time, review by the SRB and MSAB, external peer review.

Relation to other tasks: The further development of operating models will be guided by the tasks necessary to complete (Appendix A). In particular, expanding the spatial complexity will be necessary to appropriately evaluate management procedures (Task 3) related to TCEY distribution against goals and objectives (Task 1). These operating models will be used within the closed-loop simulation framework (Task 4).

Description: Management advice for Pacific halibut is currently developed using an ensemble of four different models to account for structural uncertainty. This same concept extends to MSE, and using an operating model consisting of various individual models with different assumptions can help to properly characterize the overall uncertainty in the management of Pacific halibut.

Currently, the operating model consists of coastwide models and cannot be used to evaluate area-specific objectives, which can only be answered with a multi-area model. For example, investigating the yield in each IPHC Regulatory Area would require simulating the biomass and fishery in Biological Regions, at a minimum. The spatial complexity of the model depends on the questions being asked, thus before developing an operating model it is useful to determine the extent of the objectives. This will determine the structure of the operating model; for example, whether it needs to be flexible to incorporate different area specifications, or if it can have a fixed set of areas with simple movement between them. Once the level of complexity is decided, the next step is to determine how to best model space, movement, and time. After the design of the model is complete, programming can begin. Finally, the model will need to be conditioned to halibut data before being used in an MSE to ensure that it is a reasonable depiction of reality (or at least what we understand of it), and that we have enough data and knowledge to actually define the complexity of the operating model.

Taking the time to develop the specifications of an operating model is very important. The development of a multi-area model was part of the annual assessment process, and a multi-area model developed in Stock Synthesis as part of that process may be useful to begin to investigate various hypotheses related to movement between broad areas. That progress will provide some of the framework for future operating model development. Given the complexity of this task, a fully developed multi-area model is not likely to be completed before 2020.

Task 6. RUN CLOSED-LOOP SIMULATIONS AND EVALUATE RESULTS

Timeline: 2019 (scale) and 2020 (distribution). Ongoing after 2020 depending on MSAB and Commission recommendations.

Deliverables: Performance metrics from simulations presented in tables and plots using various tools (Task 7) for evaluation and ranking of management procedures.

Relevance: The results are gained from the running of the simulations, and will inform the evaluation of the management procedures.

Resources: IPHC staff, MSE researcher, computer programmer

Relation to other tasks: The simulations consist of the closed-loop simulation framework (Task 4) and the operating model (Task 5). Performance metrics (Task 2) are presented, which are linked to objectives (Task 1) and are used to evaluate and rank the management procedures (Task 3). Various tools (Task 7) are used to investigate the results, understand trade-offs between objectives, and rank the management procedures.

Description: Once the other tasks are complete, the simulations are run to produce the outputs (i.e., performance metrics) used to evaluate management procedures. These simulations take a considerable amount of computing power, disk space, time, and organization. Personal computers and cloud-based servers will be used to complete the simulations. At least one month will be necessary to complete the simulations and collate the results.

Task 7. DEVELOP TOOLS THAT WILL ENGAGE STAKEHOLDERS AND FACILITATE COMMUNICATION

Timeline: 2019 and ongoing

Deliverables: Materials, programs (web-based or installed), examples, etc. that will allow users to understand the MSE process through reading or interaction, and to communicate the MSE results to interested stakeholders.

Relevance: For a stakeholder driven process to be effective, an understanding of the process and how to interpret results is necessary. These tools will facilitate communication and allow users to understand trade-offs between performance metrics given alternative management procedures.

Resources: IPHC staff, MSE researcher, computer programmer, feedback from MSAB.

Relation to other tasks: Effective understanding and communication is key to interpreting results (Task 6) and fostering communication between science, stakeholders, and management. Because MSE is an iterative process where all components are revisited, these tools will be useful for all tasks.

Description: An interactive tool has been developed using the equilibrium model (called the Shiny tool) and has been useful for education and the investigation of some management procedures. The development of the MSE Explorer incorporates results from closed-loop simulations and includes variability. The MSE Explorer tool will be used to report performance metrics using various graphics and tables.

In addition, with the guidance of MSAB members, the development of materials that are useful to MSAB members and their constituents to assist with understanding the MSE process and facilitate communication will be done.

3 RECOMMENDATION/S

That the MSAB:

1) **NOTE** paper IPHC-2019-MSAB013-10 which updates the IPHC Program of Work for MSAB related activities for the period 2019–23.
2) **NOTE** the delivery date of January 2021 (97th Annual Meeting) for the first complete MSE results including Scale and Distribution components of the management procedure for potential adoption by the Commission and subsequent implementation.
3) **CONSIDER** the seven tasks, descriptions, and timeline.
4) **RECOMMEND** additions or deletions to this Program of Work, or changes to the timeline, priorities, and deliverables.

4 ADDITIONAL DOCUMENTATION / REFERENCES

IPHC. 2019. Report of the 95th Session of the IPHC Annual Meeting (AM095). Victoria, British Columbia, Canada, 28 January to 1 February 2019. IPHC-2019-AM095-R. 46 pp. https://www.iphc.int/uploads/pdf/am/2019am/iphc-2019-am095-r.pdf

IPHC. 2019. IPHC Management Strategy Evaluation (MSE): update. IPHC-2019-AM095-12. 36 pp. https://www.iphc.int/uploads/pdf/am/2019am/iphc-2019-am095-12.pdf

5 APPENDICES

Appendix A: MSE Program of Work (2019-21): Timeline (from IPHC-2019-AM095-12)

APPENDIX A: MSE PROGRAM OF WORK (2019-21): TIMELINE

May 2019 MSAB Meeting
Evaluate additional Scale MP's
Review Goals
Spatial Model Complexity
Identify MP's (Distn Scale)
Review Framework
October 2019 MSAB Meeting
Review Goals
Spatial Model Complexity
Identify MP's (Distn Scale)
Review Framework
Review multi-area model development
Annual Meeting 2020
Update on progress
May 2020 MSAB Meeting
Review Goals
Review multi-area model
Review preliminary results
October 2020 MSAB Meeting
Review Goals
Review preliminary results
Annual Meeting 2021
Presentation of first complete MSE product to the Commission Recommendations on Scale and Distribution MP