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## Management Strategy Evaluation Program of Work (2021–23)

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### PURPOSE

To provide the Commission with potential topics to include in a Management Strategy Evaluation (MSE) Program of Work (2021-23) for the IPHC Secretariat.

### BACKGROUND

Report of the 97<sup>th</sup> Session of the IPHC Annual Meeting ([IPHC-2021-AM097-R](#)), AM097-Req.02:

*(para. 70) The Commission REQUESTED that the IPHC Secretariat consider and develop a draft MSE Program of Work for review by the Commission. The MSE Program of Work should describe technical versus policy-oriented issues, linkages between/among specific work products, and sequencing considerations between/among items. The MSE Program of Work should describe the resources required to complete items.*

A draft Program of Work has been developed based on the request from AM097, including a description of activities related to the Management Strategy Evaluation (MSE) that the IPHC Secretariat may engage in over the next two years. It presents and describes many tasks categorized by topic and whether it is technical or policy related. It identifies the time and some of the resources needed for each task, and provides a linkages between tasks. As per the established IPHC peer review process, all MSE products would be reviewed by the Scientific Review Board (SRB). In addition, relevant tasks would be considered by the Management Strategy Advisory Board (MSAB).

It is important to have a set of working definitions, and this is especially true to the 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>

### ***Management Strategy Evaluation (MSE)***

Management Strategy Evaluation (MSE) is a process to evaluate alternative management procedures (MPs) 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.



**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.

A complete MSE for Pacific halibut (*Hippoglossus stenolepis*) was delivered to the Commission at the 97<sup>th</sup> Session of the IPHC Annual Meeting (AM097) (see [IPHC-2021-AM097-11](#)). Many of the tasks proposed in this program of work will use past accomplishments to further the MSE process. The past accomplishments include the following:

- Stakeholder familiarization with the MSE process.
- Defined conservation and fishery goals and objectives.
- Defined performance metrics for those objectives.
- Coast-wide (single-area) and spatial (multiple-region) models.
- Identified management procedures for the coastwide fishing intensity and distributing the TCEY to IPHC Regulatory Areas.
- Results investigating coastwide fishing intensity ([IPHC-2020-AM096-12](#)) and results incorporating MPs to distribute the TCEY to IPHC Regulatory Areas ([IPHC-2021-AM097-11](#)).

MSE is a process that can develop over many years with iterations to investigate different aspects of a harvest strategy with the goals of identifying robust management procedures as well as understanding the dynamics of Pacific halibut. 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 will be ongoing as new objectives are defined, more complex models are built, new management procedures are defined, results are updated, and defined exceptional circumstances are observed. Embracing this iterative process, this program of work identifies the tasks that are a continuation of past work and those that are new.

### ***General Categories***

The tasks are divided into five general categories, which are related to Figure 1.

1. **Objectives:** The goals and objectives that are used in the evaluation.
2. **Management Procedures (MPs):** Specific, well-defined management procedures that can be coded to produce simulated TCEYs for each IPHC Regulatory Area.
3. **Framework:** The specifications and computer code for the closed-loop simulations including the operating model (OM) and how it interacts with the MP.
4. **Evaluation:** The performance metrics and presentation of results. This includes how the performance metrics are evaluated (e.g. tables, figures, and rankings), presented to the Commission and its subsidiary bodies, and disseminated for outreach.
5. **Application:** Specifications of how a MP may be applied in practice and re-evaluated in the future.

The tasks, without rationale and importance, are listed in Table 1, and [Appendix I](#) provides a full description of each task. There are many tasks listed and only a few tasks, at most, can be completed in 2021. Therefore, a “time” indication is provided where 1 indicates a short amount of time (approximately one month) and a 10 indicates a full year (i.e. for presentation at IM097 in November 2021). Times can be added to indicate the total time for multiple tasks. Additionally, the completion of some tasks may be necessary or helpful to complete other tasks to their fullest extent. For example, the development of migration scenarios is necessary to fully understand the long-term effects of size limits, whereas the integration of length-at-age models would be useful but not entirely necessary (if willing to apply simplifying assumptions).

**Table 1.** Tasks for consideration in the development of an IPHC Secretariat Program of Work for MSE. Time is an estimate of the amount of time to complete that task without any prerequisites. The Total Time includes the time to complete (or partially complete) prerequisite tasks (where 10 indicates a full schedule up to IM097 in November 2021 and 20 a full schedule up to IM098 in November 2022).

ID	Category	Task	Deliverable	Time	Total Time
O.1	Objectives	Revisit sustainability objectives	Updated coastwide and regional objectives	1–2	1–2
O.2	Objectives	Revisit fishery objectives	Updated coastwide and regional objectives	2–4	2–4
M.1	MPs	Size limits	Identification, evaluation of size limits	2–3	10–20
M.2	MPs	Survey-based MPs	Identification, evaluation of empirical MPs using FISS data directly	2–4	4–6
M.3	MPs	Multi-year assessments	Evaluation of multi-year assessments	1–2	2–4
M.4	MPs	Non-directed discard mortality	Evaluation of management procedures related to non-directed discard mortality.	2–4	3–6
M.5	MPs	Additional MPs with scale and distribution components	Evaluation of additional MPs incorporating scale and distribution elements	1–5	3–8
F.1	Framework	Develop migration scenarios	Develop OMs with alternative migration scenarios	3–7	3–7
F.2	Framework	Implementation variability	Incorporate additional sources of implementation variability in the framework	2–4	2–4
F.3	Framework	Develop more realistic simulations of estimation error	Improve the estimation model to more adequately mimic the ensemble stock assessment	3–8	3–8
F.4	Framework	Time-varying parameters	Code into the OM the option for more time-varying parameters.	2–4	2–4
F.5	Framework	Develop alternative OMs	Code alternative OMs in addition to the one already under evaluation.	3–4	5–8
F.6	Framework	Improve framework code	A more usable framework	1–10	1–10
F.7	Framework	Model length-at-age	OM that can model length specifically	6–10	6–10
E.1	Evaluation	Develop conservation and fishery performance metrics	Performance metrics linked to primary objectives. Additional performance metrics for evaluation beyond primary objectives	1	1–2
E.2	Evaluation	Add economic performance metrics	Develop economic performance metrics to link with the economic study and bring the human dimension into the MSE	2-3	2-4
E.3	Evaluation	Presentation of results	Develop methods and outputs that are useful for presenting outcomes to stakeholders and Commissioners	1–2	1–3
A.1	Application	Develop exceptional circumstances	A list of exceptional circumstances that would result in additional MSE evaluations	1–3	1–3

**RECOMMENDATION/S**

That the Commission:

- 1) **NOTE** paper IPHC-2021-SS011-03 which lists tasks that may be considered in the development of a Management Strategy Evaluation (MSE) Program of Work (2021-23) for the IPHC Secretariat;
- 2) **RECOMMEND** connecting the MSE with economics outcomes from the Pacific Halibut Multiregional Economic Impact Assessment (PHMEIA);
- 3) **RECOMMEND** and prioritize tasks for inclusion in a Program of Work for MSE related activities by the IPHC Secretariat.

**APPENDICES**

**Appendix I:** Descriptions of potential tasks for the IPHC MSE

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## APPENDIX I

### DESCRIPTIONS OF POTENTIAL TASKS FOR THE IPHC MSE

The tasks presented in Table 1 are listed below with a full description. The tasks are placed into three categories of priority.

- **High priority** contains tasks that affect other tasks, are necessary for a more scientifically defensible MSE, and have been identified in past reports of the Commission, subsidiary bodies, or peer reviews.
- **Mid priority** contains tasks that have been identified in past reports of the Commission, subsidiary bodies, or peer reviews.
- **Low priority** contains tasks that are of general interest and would be useful for development of a robust harvest strategy policy by the IPHC.

For each task from Table 1 the deliverable, time, and resources involved are listed. The linkages with other tasks are provided by describing the tasks that are dependent on the tasks being described (*dependent tasks*), the tasks that would concurrently benefit from the completion of the task (*concurrent tasks*), and tasks that are necessary to complete before the tasks described (*prerequisite tasks*).

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**HIGH PRIORITY****F.1. Develop migration scenarios**

*Type:* Technical

*Deliverable:* Operating models incorporating a range of migration hypotheses. These may be individual models with uncertainty in migration parameters, multiple models with specific hypotheses about migration/movement, or a combination of both.

*Time:* 3–7

*Resources:* IPhC Secretariat time to investigate data, write computer code, and run models.

*Dependent tasks:* This task is necessary for the evaluation of all MP tasks (MP.1 through MP.5) and will help to identify exceptional circumstances (A.1).

*Concurrent tasks:* Tasks F.4, F.5, and F.6 would be partially achieved with the completion of this task.

*Prerequisite tasks:* None.

*Description:* Migration of Pacific halibut is complex, and some aspects are still uncertain. Including multiple migration models in the simulations would assist in identifying MPs that are robust to this uncertainty. For example, paragraph 46b of [IPHC-2020-MSAB016-R](#) noted “it is uncertain if this MP is robust to alternative assumptions about movement, recruitment distribution, and productivity.” Additionally, this investigation will help identify reasonable methods to model the movement of Pacific halibut. Overall, this work is essential to the robust investigation of all management procedures.

**F.2. Incorporate additional sources of implementation variability**

*Type:* Technical

*Deliverable:* Incorporate additional sources of implementation variability in the framework.

*Time:* 2–4

*Resources:* IPhC Secretariat time to investigate data and write computer code. Some aspects, such as the deviations of realized mortality in various fisheries from the mortality limits, would benefit from input by the MSAB.

*Dependent tasks:* This task would be helpful for the evaluation of all MP tasks (MP.1 through MP.5) and will help to identify exceptional circumstances (A.1).

*Concurrent tasks:* Task F.6 would be partially achieved with the completion of this task.

*Prerequisite tasks:* None

*Description:* It is important to simulate implementation variability, the deviation of realized mortality limits from the limits determined by the MP, to identify MPs that are robust to all sources of variability. The current framework would benefit from adding other sources of implementation variability such as the final mortality limits departing from the MP determined mortality limits. This was a priority recommendation from the [independent peer review of the MSE](#).

**F.3. Develop more realistic simulations of estimation error**

*Type:* Technical

*Deliverable:* Improved estimation models to better mimic the ensemble stock assessment.

*Time:* 3–8

*Resources:* IPHC Secretariat time to investigate models and write computer code.

*Dependent tasks:* This task would be helpful for the evaluation of all MP tasks (MP.1 through MP.5) and will help to identify exceptional circumstances (A.1).

*Concurrent tasks:* Task F.6 would be partially achieved with the completion of this task.

*Prerequisite tasks:* None

*Description:* The current results are based on simulating estimation error, which is a useful assumption but may not represent the behavior of the ensemble stock assessment. A more realistic approach would be to use a simplified version of the current ensemble stock assessment. Work has already been completed for this task, but it will take some additional time to ensure a complete and accurate method.

**F.5. Develop alternative OMs**

*Type:* Technical

*Deliverable:* Implement additional OMs in addition to the current OM being used to represent a wider range of potential future states of the Pacific halibut population.

*Time:* 3–4

*Resources:* IPHC Secretariat time to evaluate data, investigate models, and write computer code

*Dependent tasks:* This task would be helpful for the evaluation of all MP tasks (MP.1 through MP.5) and will help to identify exceptional circumstances (A.1).

*Concurrent tasks:* Tasks F.1, F.4, and F.6 would be partially achieved with the completion of this task.

*Prerequisite tasks:* Partial completion of tasks F.1, F.4, and F.6 are necessary for this task.

*Description:* The OM represents the Pacific halibut population and fisheries, and incorporates uncertainty, variability, and alternative hypotheses. The coastwide MSE used two models to represent multiple hypotheses (a long and a short coastwide model), while the current multi-regional MSE incorporates a single model with variability in specific parameters. Improvements would include expanding the options for variability in a single model and developing additional OMs based on alternative hypotheses to use in the simulations.



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**MID PRIORITY TASKS****F.4. Time-varying parameters**

*Type:* Technical

*Deliverable:* Options in the OM for more time-varying parameters.

*Time:* 2–4

*Resources:* IPHC Secretariat time to write computer code.

*Dependent tasks:* This task would be helpful for the evaluation of all MP tasks (MP.1 through MP.5) and will help to identify exceptional circumstances (A.1).

*Concurrent tasks:* Task F.1 and F.6 would be partially achieved with the completion of this task

*Prerequisite tasks:* None

*Description:* Processes such as selectivity and movement likely change over time and currently are not completely implemented in the OM. Allowing for time-varying parameters with allow for incorporation of variability in the OMs resulting in a more robust analysis of MPs.

**F.6. Improve the framework code**

*Type:* Technical

*Deliverable:* A more complete, general, and usable MSE framework for use at the IPHC and potentially by Contracting Party domestic agencies.

*Time:* 1–10

*Resources:* IPHC Secretariat time to research elements of MSE and write computer code

*Dependent tasks:* This task would be helpful for the evaluation of all MP tasks (MP.1 through MP.5).

*Concurrent tasks:* This encompasses all framework tasks but is more general than those.

*Prerequisite tasks:* None

*Description:* An improved framework would allow for more robust and rapid investigations, as well as usability in other fisheries. There are many aspects that could be improved including updating the code for easier future modifications, improving the user interface for easier use by others, adding additional options that may be useful now or in the future, and improving outputs for a more thorough investigation of the results.

**F.7. Model length-at-age**

*Type:* Technical

*Deliverable:* An OM with the option to model length-at-age as an intermediate step to determine the weight-at-age.

*Time:* 6–10

*Resources:* IPHC Secretariat time to research elements of MSE and write computer code.

*Dependent tasks:* The task would be especially helpful for task MP.1 (size limits), but may benefit the investigation of other MPs.

*Concurrent tasks:* This task could benefit task F.6.

*Prerequisite tasks:* None

*Description:* The IPHC MSE framework currently uses weight-at-age to translate the numbers of fish into biomass. This is useful for Pacific halibut because the variability in length-at-age is high, is not well characterized, and there are many observations of weight-at-age. An alternative is to model length-at-age and weight-at-length to translate numbers of fish to biomass, which allows for the specific application of size-based processes such as length sampling, length-based selectivity, and length-based management options such as size limits. This is a considerable task because not only would the code need to be added, but research is needed to characterize the length processes and condition the OMs. An alternative to using specific length-based models is to make assumptions of the proportion of fish greater than a specific length at each age. This is useful, but less accurate and understandable.

### **M.1. Size limits**

*Type:* Policy

*Deliverable:* Identification and evaluation of size limits.

*Time:* 2–3

*Resources:* IPHC Secretariat time to implement computer code, develop MPs, and tabulate results. MSAB to identify potential MPs.

*Dependent tasks:* None

*Concurrent tasks:* None

*Prerequisite tasks:* Tasks F.1 and F.7 are essential to a robust analysis. Tasks F.2 through F.6 would be useful.

*Description:* The Commission has identified size limits as a potential topic to investigate using a MSE approach to evaluate long-term effects of different size limit options, as mentioned in [IPHC-2021-AM097-R](#).

*para 50: The Commission NOTED that the evaluation provided decision-making information for consideration of the current MinSL and/or a MaxSL. The focus is on short-term yield, fishery and stock performance while retaining all other aspects of the IPHC's interim management procedure. It is not intended to provide a comparison of long-term performance of size limits as one part of a comprehensive management procedure. Such a comprehensive analysis may be done through management strategy evaluation (MSE). Questions regarding long-term change in spatial distribution and scale of recruitment and spawning biomass require the full 'closed-loop' approach used in the MSE.*

Some additions to the MSE framework code would be necessary, as identified in F.7. Furthermore, the integration of multiple hypothesis for migration would allow for a more robust evaluation (task F.1). Any of the other framework tasks would improve the evaluation further.

## **M.2. IPHC Fishery-Independent Setline Survey (FISS)-based MPs**

*Type:* Policy

*Deliverable:* Identification and evaluation of empirical MPs using IPHC Fishery-Independent Setline Survey (FISS) data directly

*Time:* 2–4

*Resources:* IPHC Secretariat to develop MPs and implement them in the computer code. MSAB to identify MPs.

*Dependent tasks:* None

*Concurrent tasks:* None

*Prerequisite tasks:* None are essential, although any of the framework tasks (F.1 through F.7) may benefit this task.

*Description:* Paragraph 41 of [IPHC-2019-SRB015-R](#) and paragraph 21, 22, and 51 of [IPHC-2020-MSAB015-R](#) mentioned the use of FISS observations to determine mortality limits directly within an IPHC Regulatory Area. This would be a different paradigm than the current interim harvest strategy policy where a coastwide TCEY is distributed to IPHC Regulatory Areas. This task would take a considerable amount of time developing potential MPs.

## **M.3. Multi-year assessments**

*Type:* Policy

*Deliverable:* Evaluation of setting mortality limits at a period greater than annually.

*Time:* 1–2

*Resources:* IPHC Secretariat time to implement computer code and tabulate results.

*Dependent tasks:* None

*Concurrent tasks:* Tasks E.1 and E.2 would be useful to complete for a thorough evaluation.

*Prerequisite tasks:* None are essential, although any of the framework tasks (F.1 through F.7) may benefit this task.

*Description:* The 2<sup>nd</sup> Performance Review of the IPHC ([PRIPHC02-Rec.10](#), para 82) recommended the investigation of multi-year decision-making. Yearly revisions of harvest policies lead to fluctuation in quota, which in turn affects harvest and investment decisions of fishers. Multiannual quotas, on the other hand, increases the risk of periodical substantial adjustments to quota. The current MSE has performed preliminary evaluations of a MP setting mortality limits every fifth year. This type of MP would allow time for more in-depth research on the assessment and MSE. Continued investigation of this topic would be easy to do, although it would benefit from completion of any of the framework tasks and developing performance metrics more meaningful to this type of MP.

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**M.4. Non-directed discard mortality**

*Type:* Policy

*Deliverable:* Evaluation of management procedure related to non-directed discard mortality

*Time:* 2–4

*Resources:* IPHC Secretariat time to implement computer code and tabulate results.

*Dependent tasks:* None

*Concurrent tasks:* None

*Prerequisite tasks:* None are essential, although any of the framework tasks (F.1 through F.7) may benefit this task.

*Description:* Paragraph 83 of [IPHC-2020-AM096-R](#) noted that the MSE is an appropriate tool to investigate non-directed discard mortality. Paragraph 89 of [IPHC-2020-AM096-R](#) requested topics of work beyond AM097, including work on non-directed discard mortality. The MSE framework is capable of investigating any aspect of mortality on Pacific halibut.

**M.5. Additional MPs with scale and distribution components**

*Type:* Policy

*Deliverable:* Additional evaluation of MPs incorporating scale and distribution components.

*Time:* 1–5

*Resources:* IPHC Secretariat to develop MPs and implement them in the computer code. MSAB to identify MPs.

*Dependent tasks:* None

*Concurrent tasks:* None

*Prerequisite tasks:* None are essential, although any of the framework tasks (F.1 through F.7) may benefit this task.

*Description:* The MSE completed for AM097 provided many useful results as well as insights into potential MPs using the SPR-based approach of determining a coastwide TCEY and distributing it to IPHC Regulatory Areas. Evaluating additional MPs may provide further insight into implementing an IPHC harvest strategy policy. Paragraph 53 of [IPHC-2020-MSAB016-R](#) identified two additional MPs for evaluation. There are many other possible MPs.

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## LOW PRIORITY TASKS

### **O.1. Revisit sustainability objectives**

*Type:* Policy

*Deliverable:* Updated biological sustainability objectives for the entire stock and for each Biological Region.

*Time:* 1–2

*Resources:* IPhC Secretariat time to determine sensible objectives.

*Dependent tasks:* Tasks E.1 and E.3 would be affected by any change to the primary objectives.

*Concurrent tasks:* None

*Prerequisite tasks:* None

*Description:* The current biological sustainability objectives are useful for the evaluation of MPs, but the minimum proportions of spawning biomass in each Biological Region were determined in an *ad hoc* manner. Additional research could be done to determine reasonable minimums for this biological sustainability objectives, or to redefine the measurable objectives for the general objective to conserve spatial population structure.

### **O.2. Revisit fishery objectives**

*Type:* Policy

*Deliverable:* Updated fishery objective for the entire range of Pacific halibut and for each IPhC Regulatory Area.

*Time:* 2–4

*Resources:* IPhC Secretariat time to develop objectives and an MSAB meeting for identification and discussion of fishery objectives.

*Dependent tasks:* Tasks E.1 and E.3 would be affected by any change to the primary objectives.

*Concurrent tasks:* None

*Prerequisite tasks:* None

*Description:* The MSE is currently using a wide range of pertinent fishery objectives. However, these fishery objectives are minimally defined, although purposefully to allow for examination of trade-offs between objectives, especially between IPhC Regulatory Areas. It may be worthwhile to revisit these fishery objectives to determine if new objectives have been identified in the MSE process and if any additional details can be supplied for the current objectives.

### **E.1. Develop conservation and fishery performance metrics**

*Type:* Policy and technical

*Deliverable:* Performance metrics linked to primary objectives, and additional performance metrics for evaluation beyond primary objectives

*Time:* 1

*Resources:* IPHC Secretariat time to develop performance metrics and implement them into the framework.

*Dependent tasks:* None

*Concurrent tasks:* Tasks O.1 and O.2 would determine primary performance metrics. Task E.3 would be affected because performance metrics are used to present results.

*Prerequisite tasks:* Possibly tasks O.1 and O.2 if they are undertaken and result in changes to the primary objectives.

*Description:* Performance metrics are used to present results and evaluate MPs. Therefore it is very important to have meaningful performance metrics that are easily understood.

## ***E.2. Develop economic performance metrics***

*Type:* Policy and technical

*Deliverable:* Additional performance metrics for evaluation.

*Time:* 2-3

*Resources:* IPHC Secretariat time to work with the Fisheries Policy & Economics Branch (FPEB) on integrating the Pacific halibut multiregional economic impact assessment (PHMEIA) model results into the MSE (e.g. adopting economic metrics based on the PHMEIA model to present alongside already developed biological/ecological performance metrics).

*Dependent tasks:* Relies on the work by the FPEB.

*Concurrent tasks:* This task would complement task O.2 and be added to the set of performance metrics to present. Task E.3 would be affected because performance metrics are used to present results.

*Prerequisite tasks:* None within MSE, unless the economics component will be used to revisit fishery objectives (task O.2). It is dependent on the development of the PHMEIA model.

*Description:* Performance metrics are used to present results and evaluate MPs. Therefore it is very important to have meaningful performance metrics that are easily understood. Economic performance metric would bring the human dimension to the MSE framework. Potential metrics include: 1) contribution to the gross domestic product/GDP, 2) contribution to labor compensation (wages), 3) contribution to employment and 4) impact on households. These economic performance metrics can be separated into economic impact in the region where harvest occurs and spillover effects to other regions. The MSE OM could be aggregated to the PHMEIA model regions of AK, BC, and West Coast. Overall, economics performance metrics would provide an important additional evaluation of management procedures.

### **E.3. Presentation of results**

*Type:* Technical

*Deliverable:* Methods and outputs that are useful for presenting outcomes to stakeholders and Commissioners

*Time:* 1–2

*Resources:* IPHC Secretariat time to develop methods and create outputs. MSAB to identify preferred methods.

*Dependent tasks:* None

*Concurrent tasks:* None

*Prerequisite tasks:* If tasks O.1, O.2, E.1, and E.2 are to be undertaken, they would need to be completed before the full completion of this task.

*Description:* Presenting results in a way that can be easily interpreted will assist with evaluation, as well as increase understanding and acceptance of MSE results. Identify useful ways to communicate results to stakeholders and the Commission will help identify candidate MPs for a harvest strategy policy. This task includes figures and tables for reports, oral presentation methods, distributed media, and interactive tools such as [MSE Explorer](#).

### **A.1 Develop exceptional circumstances**

*Type:* Policy

*Deliverable:* A list of exceptional circumstances that would result in additional MSE evaluations.

*Time:* 1–3

*Resources:* IPHC Secretariat time to develop exceptional circumstances and determine how they would be monitored. MSAB to review and suggest additional exceptional circumstances of interest to stakeholders.

*Dependent tasks:* None

*Concurrent tasks:* None

*Prerequisite tasks:* None

*Description:* The [independent peer review of the MSE](#) and paragraph 60 of [IPHC-2020-SRB017-R](#) recommended that exceptional circumstances be developed to trigger further MSE research, if observed. From paragraph 60 of [IPHC-2020-SRB017-R](#), an exceptional circumstance is “*defined to determine whether monitoring information has potentially departed from their expected distributions generated by the MSE. Declaration of exceptional circumstances may warrant re-opening and revising the operating models and testing procedures used to justify a particular management procedure.*” This process would be used once a harvest strategy policy is determined from MSE results and applied in the management process. Exceptional circumstances may relate to any process simulated in the MSE including population processes, fishing mortality, implementation variability, data generation, and estimation error.