Management Strategy Evaluation Procedures and Milestones for 2022

Prepared by: IPHC Secretariat (Hicks A, Stewart I; 14 February 2022)

PURPOSE

To provide the Commission with milestones throughout 2022 and potential management procedures to investigate as part of the Management Strategy Evaluation (MSE) for presentation at the 99th Session of the IPHC Annual Meeting (AM099).

BACKGROUND

This document presents a list of candidate management procedures representing distribution of the TCEY as well as size limits and multi-year stock assessments that are part of the MSE Program of Work for 2021–2023 (IPHC-2021-MSE-02). Milestones for various elements of the MSE Program of Work are also provided followed by potential methods to present and evaluate MSE results.

MANAGEMENT PROCEDURES

A management procedure (MP) is a defined set of elements that specifically determines mortality limits (i.e. TCEY) for each IPHC Regulatory Area. Size limits and multi-year stock assessments are the two MP elements defined in the MSE Program of Work for 2021–2023. However, these are only part of a management procedure which contains other aspects such as data collection, estimation models, and harvest rules (Figure 1). Simulating all of the elements of a management procedure is necessary to evaluate any single element. Data collection and estimation models are not currently under investigation and are simulated to mimic the current IPHC paradigm. However, the frequency of estimation models (i.e. multi-year stock assessments) will be simulated and evaluated. TCEY distribution procedures are also not currently being investigated but are required to appropriately distribute the fishing mortality which may affect the performance of other MP elements.

The harvest rule elements (Figure 2) consist of the coastwide scale (SPR value and the control rule) and the TCEY distribution (O32 distribution from FISS data, relative harvest rates, and current interim agreements). SPR values will be varied within the range of 40–46% and only the 30:20 control rule will be considered. However, the distribution of the TCEY in the current interim management procedure contains elements that are set to expire at the end of 2022. Multiple distribution procedures will be used to capture the range of potential TCEY distribution procedures considered in the future, noting that these distribution procedures are not necessarily intended for evaluation, but instead are simply representing the range of possibilities. Various size limits for legally retaining Pacific halibut will be evaluated.

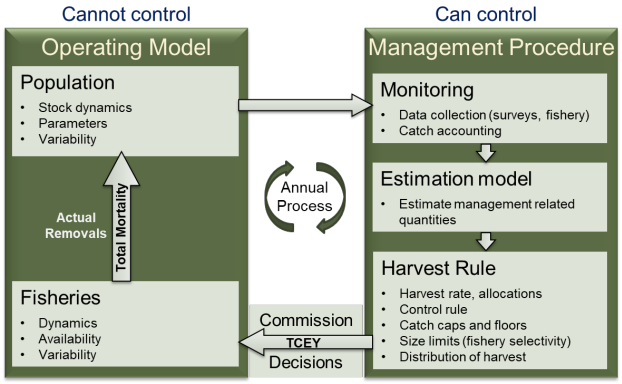

Figure 1. The relationship between the operating model (OM) and management procedure (MP) in the simulation of the annual process of setting mortality limits.

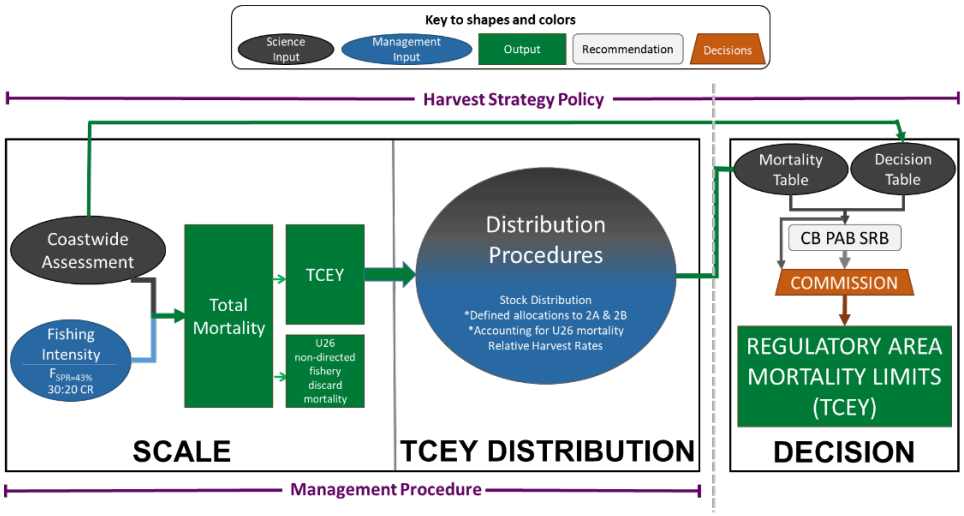

Figure 2. Illustration of the Commission interim IPHC harvest strategy policy (reflecting paragraph ID002 in IPHC-2020-CR-007) showing the coastwide scale and TCEY distribution components that comprise the management procedure. Items with an asterisk are interim agreements in place through 2022. The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

Multi-year stock assessments

There are two components to multi-year assessment approaches to consider. First is the frequency of the stock assessment, which is currently completed annually. A biennial assessment will be simulated and, if time allows, and triennial assessment will be included. The second component is the determination of the mortality limits in the non-assessment years. Options here include retaining the same mortality limits from the previous year in which an assessment occurred (i.e. constant), applying an empirical rule using FISS results to the coastwide TCEY and distributing that TCEY using the previous year's distribution proportions, applying an empirical rule using FISS data to the coastwide TCEY and updating the distribution with the distribution procedure using annual FISS data, or applying an empirical rule using FISS results at the IPHC Regulatory Area level (Table 1).

Table 1. Multi-year stock assessment management procedures for simulation and evaluation in 2022. MPs with a triennial frequency or empirical rules applied to IPHC Regulatory Areas individually (in italics) are lower priority and will be simulated as time allows.

Frequency	Non-assessment years
Biennial	Constant
	Empirical coastwide TCEY with no change to distribution proportions
	Empirical coastwide TCEY, updated distribution with distribution procedure*
	Empirical rule in each IPHC Regulatory Area
Triennial	*Constant*
	Empirical coastwide TCEY with no change to distribution proportions
	Empirical coastwide TCEY updated distribution with distribution procedure
	IPHC Regulatory Area empirical rule

*Only the elements of the distribution procedure that do not need a stock assessment will be applied

Many fisheries agencies operate with multi-year stock assessments, and use a variety of methods for intervening years. For example, the U.S.A. Pacific Fisheries Management Council (PFMC) sets most groundfish catch limits with a biennial process, and some stocks are assessed less frequently depending on priority and time available (PFMC 2020).

There are many benefits to multi-year stock assessments, including short-term stability in mortality limits, transparency in the mortality limit setting process, time for analysts to conduct research on stock assessment models and management procedures, and the possibility of additional collaboration between quantitative scientists and research biologists. The key benefits to multi-year stock assessments are stability and transparency. One possible MP is to set mortality for all years until the next stock assessment, which offers short-term stability. If the MP operates with an empirical rule in intervening years (a procedure based on data alone), the process is transparent, based on observed data, and does not require the interpretation of a complex stock assessment. However, the Commission may still exercise the decision-making step in Figure 2 and deviate from the management procedure.

Size limits

Evaluating size limits can be as simple as implementing various size limits that are the same across IPHC Regulatory Areas, or implementing size limits that are different across IPHC Regulatory Areas. The current MSE framework was developed to be congruous with the stock assessment and utilize the understanding of the Pacific halibut population and fisheries in the most efficient and parsimonious way possible. Growth of Pacific halibut is inherently variable and uncertain, thus the stock assessment bypasses length-at-age modelling to avoid this uncertainty and instead use observed weight-at-age to translate from numbers-at-age to biomass. The MSE framework also does not model length, thus approximations are necessary to simulate length-based size limits.

This MSE will investigate three size limits (no size limit, 26 inches, and 32 inches) that are the same across IPHC Regulatory Areas. The specifications of the MSE operating model (OM) make it simple to investigate the current size limit and no size limit, but approximations of length-at-age associated with

any other size limits are necessary. Additional time is necessary to code and test these approximations, thus the 32 inch and no size limit options will be given priority. It is expected that the 26 inch size limit will be completed in time for the 21st Session of the Scientific Review Board in September 2022. However, Pacific halibut under 26 inches are a very small component of the directed commercial catch (< 2%), thus results simulating a 26 inch size limit may not differ much from no size limit.

Distribution procedures

The distribution procedure (TCEY distribution in Figure 2) is used to distribute the TCEY among IPHC Regulatory Areas. The current baseline interim distribution procedure consists of using the estimated O32 stock distribution from FISS recent observations and applying relative harvest rates of 0.75 to IPHC Regulatory Area 3B, 4A, 4CDE, and 4B. Current agreements for IPHC Regulatory Areas 2A and 2B (paragraph 97 of IPHC-2020-AM096-R), set to expire at the end of 2022, consist of a fixed 1.65 Mlbs for 2A, and a percentage of the coastwide TCEY for IPHC Regulatory Area 2B based on 20% (with a weight of 0.7) and O32 stock distribution and relative harvest rate (with a weight of 0.3). Furthermore, an additional component is added to the IPHC Regulatory Area 2B TCEY accounting for 50% of the estimated yield lost due to projected U26 discard mortality in non-directed fisheries (aka 'bycatch') in waters off Alaska, U.S.A.

The distribution element of the MP is not specifically being investigated in the current MSE Program of Work but is necessary to define when investigating other elements of the MP. For example, when investigating size limits, the TCEY still must be distributed across regions and fisheries and removed from the population appropriately. Furthermore, simulating the fisheries in each IPHC Regulatory Area allows for the calculation of performance metrics for those specific fisheries and IPHC Regulatory Area combinations. If the distribution procedure that will be used in the future is uncertain, multiple distribution procedures representing a range of options is necessary. Results can then be integrated across these distribution procedures to capture the uncertainty and provide a robust analysis of the MP elements being investigated.

Potential distribution procedures for consideration are listed in Table 2 and include distribution to IPHC Regulatory Areas as well as an alternative paradigm of distribution to Biological Regions. Distribution to Biological Regions may remove the complications of choosing specific distribution procedures to IPHC Regulatory Areas, while maintaining the general distribution of the TCEY (options 3 & 4). The OM is spatially defined by Biological Regions with fisheries occurring within a Biological Region. However, allocation between sectors within a Biological Region is specifically defined by IPHC Regulatory Area (e.g. directed commercial and recreational fishery catch sharing plans) and would need approximations. Additionally, regional distribution would not be able to capture specific agreements for specific IPHC Regulatory Areas, although those could be somewhat captured using fixed amounts for distribution (option 7). Finally, fishery performance metrics specific to IPHC Regulatory Areas would not be available, although fishery performance metrics in each Biological Region could be calculated.

The distribution procedures for IPHC Regulatory Areas (options 1a-l in Table 2) use different elements from MPs investigated previously (see Table 4 in IPHC-2021-AM097-11) and were intended to bracket the potential range of future distribution procedures. A fourth category is presented (option 2) that uses

fixed proportions across IPHC Regulatory Areas, and those fixed proportions can bracket any desired range. However, the distribution would not scale appropriately with shifts in distribution among IPHC Regulatory Areas. Table 3 shows the proportion of TCEY in each IPHC Regulatory Area or Biological Region over a range of years.

Table 2. Potential distribution procedures for bracketing future possible distribution of the TCEY for investigating size limits and multi-year assessment management procedures.

	Stock distribution Relative harvest rates	**Years in stock distribution**	**2A & 2B Agreements**	**Elements from**
1a	Baseline O32	Recent year	None	MP-G
1b	Baseline O32	Recent year	Interim	MP-A
1c	Baseline All Sizes	Recent year	None	MP-G, MP-I
1d	Baseline All Sizes	Recent year	Interim	MP-A, MP-I
1e	Baseline O32	5-year moving average	None	MP-J
1f	Baseline O32	5-year moving average	Interim	MP-B, MP-J
1g	Baseline All Sizes	5-year moving average	None	MP-I, MP-J
1h	Baseline All Sizes	5-year moving average	Interim	MP-A, MP-I, MP-J
1i	Baseline O32 for AK	Recent year	2A 1.65, 2B 20%	MP-A, MP-F
1j	Baseline O32 for AK	5-year moving average	2A 1.65, 2B 20%	MP-A, MP-F, MP-J
1k	Baseline All Sizes for AK	Recent year	2A 1.65, 2B 20%	MP-A, MP-F, MP-I
1l	Baseline All Sizes for AK	5-year moving average	2A 1.65, 2B 20%	MP-A, MP-F, MP-I, MP-J
2	Regulatory Area Fixed	NA	Possible	
3a	Regional O32	Recent year	None	MP-C, MP-G
3b	Regional All Sizes	Recent year	None	MP-C, MP-G, MP-I
3c	Regional O32	5-year moving average	None	MP-C, MP-G, MP-J
3d	Regional All Sizes	5-year moving average	None	MP-C, MP-G, MP-I, MP-J
4	Regional Fixed	NA	Implied	

Table 3. Average proportion of TCEY distributed to each IPHC Regulatory Area or Biological Region over various ranges of years.

Year	**2A**	**2B**	**2C**	**3A**	**3B**	**4A**	**4CDE**	**4B**
2020-2022	4.3%	18.3%	15.1%	34.8%	8.7%	5.0%	10.3%	3.6%
		37.6%		43.5%		15.3%		3.6%
2019-2022	4.3%	18.7%	15.4%	34.9%	8.4%	5.0%	10.3%	3.6%
		37.8%		43.2%		15.3%		3.6%
2014-2017	3.1%	20.5%	16.1%	32.4%	9.5%	4.6%	10.1%	3.7%
		39.7%		41.9%		14.7%		3.7%

Table 4. Easily implemented and representative distribution procedures for bracketing and integrating future possible distribution of the TCEY for investigating size limits and multi-year assessment management procedures.

	Stock distribution Relative harvest rates	Years in stock distribution	2A & 2B Agreements	Elements from
1a	Baseline O32	Recent year	None	MP-G
1b	Baseline O32	Recent year	Interim	MP-A
1i	Baseline O32 for AK	Recent year	2A 1.65, 2B 20%	MP-A, MP-F

Table 4 presents three distribution procedures from Table 2 that can be easily implemented in the MSE simulations and would represent a range of potential distribution procedures. Any may be chosen from Table 2 and other distribution procedures could be developed to represent future possibilities. These distribution procedures are not specifically under evaluation but would be integrated into the results to represent the uncertainty in the future distribution of the TCEY.

Implementation uncertainty will also be included in these simulations. In particular, decision-making uncertainty will be an additional source of variability in the distribution of the TCEY.

A summary of management procedures

There are at least three multi-year stock assessment MPs and three size limit MPs to investigate. These do not need to be investigated simultaneously, but it may be useful to combine them into one or two MPs for a complete look at these options and how they may interact. Therefore, there will likely be eight or more MPs to simulate and evaluate. Combining these with the distribution procedures and various SPR values between 40% and 46% will be a full workload of simulations to conduct and summarize for 2022. If a specific MP is desired for a combination of size limit and multi-year assessment that is not in the simulated set, it may be possible to fulfill requests of the Commission in late 2022 for one or two specific combinations.

MILESTONES

A draft MSE Program of Work was developed for 2021-2023 (Table 5) describing activities related to the Management Strategy Evaluation (MSE). It presents and describes priority tasks categorized by topic. 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).

The meeting schedule for 2022 relevant to the MSE tasks is shown in Table 6. The MSE framework tasks and preliminary simulation of MPs will be finished before the MSE Info Session (Spring 2022), the simulations will be completed before SRB021 (Fall 2022), and the tasks related to evaluation and presentation will be worked on throughout 2022. Results will be presented to the Commission at the 99th Session of the IPHC Annual Meeting (AM099).

Table 5. Tasks recommended by the Commission at SS011 (IPHC-2021-SS011-R para 7) for inclusion in the IPHC Secretariat MSE Program of Work for 2021–2023.

ID	Category	Task	Deliverable
F.1	Framework	Develop migration scenarios	Develop OMs with alternative migration scenarios
F.2	Framework	Implementation variability	Incorporate additional sources of implementation variability in the framework
F.3	Framework	Develop more realistic simulations of estimation error	Improve the estimation model to more adequately mimic the ensemble stock assessment
F.5	Framework	Develop alternative OMs	Code alternative OMs in addition to the one already under evaluation.
M.1	MPs	Size limits	Identification, evaluation of size limits
M.3	MPs	Multi-year assessments	Evaluation of multi-year assessments
E.3	Evaluation	Presentation of results	Develop methods and outputs that are useful for presenting outcomes to stakeholders and Commissioners

Table 6. Meeting schedule relevant to the MSE program of work for 2022

Jan	Feb-Apr	May	June	Jul-Aug	Sep	Oct	Nov
AM098		MSE Info Session	SRB020		SRB021	MSAB018	IM098
MSE PoW update		*OMs MPs Presentation*	*Framework OMs MPs Presentation*		*Results Evaluation*	*Results Evaluation*	*Results Evaluation*

PRESENTATION AND EVALUATION OF RESULTS

Many methods of presenting and evaluating MSE simulation results have been developed with input from the Management Strategy Advisory Board (MSAB) and the Commission. This includes the MSE Explorer online tool (http://shiny.westus.cloudapp.azure.com/shiny/sample-apps/MSE-Explorer/) which allows a user to investigate specified MPs through tables and plots. In 2020, a simple ranking procedure was implemented in the MSE Explorer to quickly identify MPs that performed well relative to the set of MPs.

Throughout 2022, the presentation and evaluation of MSE simulation results will be improved to provide methods that are useful to inform the Commission. This includes clear descriptions of the performance metrics and how they relate to objectives, improved plots, and alternative methods for quickly evaluating MPs which may or may not include ranking procedures.

REFERENCES

PFMC. 2020. Pacific coast groundfish fishery management plan for the California, Oregon, and Washington groundfish fishery. Pacific Fishery Management Council. Portland. OR. https://www.pcouncil.org/documents/2016/08/pacific-coast-groundfish-fishery-management-plan.pdf/

RECOMMENDATIONS

That the Commission **NOTE** paper IPHC-2022-SS012-04 which describes elements of management procedures to be used in MSE simulations in 2022 including TCEY distribution procedures representing a range of future potential future states, milestones in 2022, and improvements to be made on the presentation and evaluation of results.

That the Commission **RECOMMEND** integrating the following distribution procedures into the MSE simulations investigating size limits and multi-year assessments.

- Baseline based on recent year O32 FISS results with no agreements for IPHC Regulatory Areas 2A and 2B,
- Baseline based on recent year O32 FISS results with current interim agreements for IPHC Regulatory Areas 2A and 2B,
- Baseline based on recent year O32 FISS results with 1.65 Mlbs to 2A and 20% national share of the coastwide TCEY to IPHC Regulatory Area 2B.

APPENDICES

Nil