IPHC Management Strategy Evaluation and Harvest Strategy Policy Updates

PREPARED BY: IPHC SECRETARIAT (A. HICKS, I. STEWART & D. WILSON; 19 DECEMBER 2023)

PURPOSE

To provide the Commission with an update of the Management Strategy Evaluation (MSE) process and the Harvest Strategy Policy, and to seek guidance on the MSE Program of Work.

INTRODUCTION

The Management Strategy Evaluation (MSE) Program of Work for 2021–2023 (IPHC-2021-MSE-02) was completed in early 2023 and presented at the 99th Session of the IPHC Annual Meeting (AM099).

MSE is used to evaluate management procedures with the ultimate goal of identifying a harvest strategy, as part of a harvest strategy policy (HSP), that meets management objectives and is robust to uncertainty and variability. An HSP provides a framework for applying a science-based approach to setting harvest levels. At IPHC, this would be specific to the TCEY for each IPHC Regulatory Area throughout the Convention Area. Currently, IPHC has not formally adopted a harvest strategy policy, but has set harvest levels under an SPR-based framework with elements adopted at multiple Annual Meetings of the IPHC since 2017. To formally define and subsequently adopt an IPHC harvest strategy, a few tasks remain. This includes evaluating multi-year Management Procedures (MPs) and determining if the current reference fishing intensity (SPR=43%) still meets IPHC objectives. Additions and edits to the current draft harvest strategy policy document are also necessary for the adoption of a formal harvest strategy policy.

This summary document describes various tasks related to ongoing MSE work that would assist in adopting a harvest strategy policy. These tasks include:

1) updates to the operating model (OM);
2) considering new objectives and performance metrics;
3) evaluating various elements of MPs;
4) defining exceptional circumstances; and
5) updating the Harvest Strategy Policy document.

Potential decision points are listed at the end of each section and summarized in the final Recommendation/s section. Additional details are available in document IPHC-2024-MSE-01 on the MSE Research Page.

OUTCOMES OF THE 18TH SESSION OF THE IPHC MANAGEMENT STRATEGY ADVISORY BOARD

The 18th Session of the IPHC Management Strategy Advisory Board (MSAB018) occurred in May 2023 and members discussed membership, past evaluations, and a Program of Work.

The MSAB discussed MSAB member succession planning and the potential for the designation of alternate members. Some members expressed interest in having alternates available in case the member is unable to attend a meeting or ends their term. The MSAB requested that domestic agency staff consider providing text to update the IPHC Rules of Procedure.

> **IPHC-2023-MSAB018-R, para. 10:** ***NOTING*** *the extensive discussion surrounding MSAB member succession planning and how the appointment of alternates may be useful, the MSAB* ***REQUESTED*** *that domestic agency staff from the Contracting Parties consider drafting text to amend the IPHC Rules of Procedure to allow alternates to be designated for MSAB members, for Commission consideration in the future.*

A major outcome of MSAB018 was the request that the evaluation of annual and multi-year assessments be done subsequent to an agreement on a distribution procedure and include elements such as multi-year management procedures, constraints on the coastwide TCEY, smoothing elements on the calculation of stock distribution, and various SPR values.

> **IPHC-2023-MSAB018-R, para. 29:** *The MSAB* ***REQUESTED*** *that subsequent to an agreement on a distribution procedure by the Commission, the evaluation of annual and multi-year assessments include, but not limited to, the following concepts.*
>
> *a) Annual changes in the TCEY driven by FISS observations in non-assessment years of a multi-year MP;*
>
> *b) A constraint on the coastwide TCEY to reduce inter-annual variability and the potential for large changes in assessment years of a multi-year [MP]. This may be a 10% or 15% constraint, a slow-up fast-down approach, or similar approach;*
>
> *c) A smoothing element in the distribution procedure to account for uncertainty in the estimates of stock distribution and reduce the variability in area-specific TCEYs. For example, this may include a 3-year rolling average of stock distribution estimates;*
>
> *d) SPR values ranging from 30% to 56% and alternate trigger reference points in the harvest control rule.*

This is consistent with an agreement by the Commission at AM099.

> **IPHC-2023-AM099-R, para. 87:** The Commission **AGREED** that following agreement about a distribution procedure, the IPHC Secretariat and MSAB should reassess multi-year stock assessment management procedures, as well as coastwide elements of a management procedure such as the SPR value.

The MSAB also discussed exceptional circumstances and gained a better understanding of what an exceptional circumstance is and what details need to be defined.

> **IPHC-2023-MSAB018-R, para. 42:** *The MSAB **AGREED** that FISS observations (coastwide or by area/region) are useful to define the limits defining an exceptional circumstance and that individual years may be used as well as observed trends over time.*
>
> **IPHC-2023-MSAB018-R, para. 43:** *The MSAB **NOTED** that the defined responses to an exceptional circumstance may include: a) reviewing the MSE framework including the operating model; IPHC-2023-MSAB018-R Page 12 of 19 b) examining objectives; c) evaluating additional MPs; d) completing a stock assessment at the next appropriate time.*
>
> **IPHC-2023-MSAB018-R, para. 44:** *The MSAB **AGREED** that there are other circumstances within the acceptable range simulated by the MSE when one may deviate from an adopted MP because of an unexpected event. For example, a high probability of predicted declines in the spawning biomass under the interim management procedure may have been contributing factors in the decision to depart from the interim management procedure in 2023, even though these declines were within the simulated range of MSE results.*

Finally, the MSAB requested that MSAB019 be held in the Spring of 2024.

> **IPHC-2023-MSAB018-R, para. 47:** The *MSAB **REQUESTED** that MSAB019 be held in May 2024, rather than October 2024, as previously noted by the Commission, and that future MSAB meetings occur prior to the June SRB meeting in that same year.*

Decision/Action
None

UPDATED 2023 OPERATING MODEL

The Scientific Review Board (SRB) has reviewed the IPHC's MSE Operating Model (OM) for 2023 at the 22nd Session of the SRB (SRB022) and the 23rd Session of the SRB (SRB023). The IPHC's MSE Operating Model for 2023 has been updated to reflect the 2022 stock assessment ensemble and is performing well for evaluating management procedures, noting that further adjustments may be made, at the request of the Commission. The SRB endorsed the 2023 OM.

Specific details of the OM are presented in the document *Technical Details of the IPHC MSE Framework* (IPHC-2023-MSE-02). Overall, the 2023 OM is ready to be used to investigate elements of MPs that will lead to the adoption of a harvest strategy. This may include, for example, multi-year assessments and fishing intensity. Additionally, the 2023 OM may be used to inform decisions regarding monitoring of the Pacific halibut stock, such as investigating the effects of FISS designs on management outcomes.

The 2023 OM is consistent with the assumptions used in the 2022 assessment (i.e. three of the four models in the stock assessment ensemble estimated female natural mortality at values greater than 0.18). Long-term performance metrics related to spawning biomass and short-term performance metrics for the TCEY from simulations using the 2022 OM and the 2023 OM with the same specifications of an MP (SPR=43%) were similar (Table 1). The short-term median average TCEY was approximately 59 million pounds and the median average annual variability (AAV) for the TCEY changed from 17 to 19%. The probability of the long-term spawning biomass being less than 36% of unfished spawning biomass changed from 0.31 to 0.35. Even though the 2022 stock assessment showed a large increase in the TCEY when compared to 2021 stock assessment outputs, the MSE outputs are very similar due to the inclusion of additional uncertainty on natural mortality in the 2022 and 2023 OMs. Therefore, past MSE results remain relevant.

Decision/Action

Note that the SRB endorsed the 2023 OM for use in MSE evaluations of MPs that would lead to the adoption of a harvest strategy, including assessment frequency, fishing intensity, and data monitoring.

Note that MSE results using the updated 2023 OM are similar to past MSE results, thus past MSE results remain relevant.

Table 1. Performance metrics for the same management procedure simulated with the 2022 OM and the 2023 OM. The MP uses an SPR=43%, a 30:20 control rule, and an annual assessment.

Performance Metric	2022 OM	2023 OM
Long-term		
P(RSB<20%)	PASS	PASS
P(RSB<36%)	0.31	0.35
Short-term		
Median average TCEY	59.0	59.2
Median AAV TCEY	18.8%	17.0%

OBJECTIVES AND PERFORMANCE METRICS

Four priority coastwide objectives are currently endorsed by the Commission for use in the IPHC's MSE process.

a. Maintain the long-term coastwide female spawning stock biomass above a biomass limit reference point ($B_{20\%}$) at least 95% of the time.

b. Maintain the long-term coastwide female spawning stock biomass above a biomass target reference point ($B_{36\%}$) at least 50% of the time.

c. Optimise average coastwide TCEY.

d. Limit annual changes in the coastwide TCEY.

Additional area-specific objectives are listed in Appendix A. The IPHC Secretariat is working with the SRB to develop a region-specific objective to conserve spatial structure that is informative of the changes in biomass within a region. This would be a secondary objective to consider after meeting all priority objectives.

> **IPHC-2023-SRB023-R, para 24.** *The SRB **RECOMMENDED** that an objective to maintain spatial population structure be added or redefined to maintain the spawning biomass in a Biological Region above a defined threshold relative to the dynamic unfished equilibrium spawning biomass in that Biological Region with a pre-defined tolerance. The percentage and tolerance may be defined based on historical patterns and appropriate risk levels recognizing the limited fishery control of biomass distribution.*

The result from the 2022 full stock assessment (IPHC-2023-SA-01) using the current interim management procedure with an SPR of 43% was a TCEY of 52.0 Mlbs. This TCEY was higher than expected from previous assessments largely because natural mortality (*M*) was estimated higher than a previously fixed value in one of four models in the ensemble, thus increasing the perceived productivity of the stock. In contrast to this optimistic advice, the coastwide FISS index of O32 WPUE was at its lowest value observed in the time-series, declining by 8% from the previous year, and a TCEY of 52.0 Mlbs in 2023 would have resulted in a 75% chance of a lower spawning biomass in 2024. The Commission departed from the current interim management procedure at AM099 and chose a TCEY of 36.97 Mlbs for 2023, noting

> **IPHC-2023-AM099-R, para. 94.** *The Commission **NOTED** that the adopted mortality limits for 2023 correspond to a 38% probability of stock decline through 2024, and a 36% probability of stock decline through 2026.*

Although the status of the stock was above the target relative spawning biomass of 36% and had a small chance (25%) of falling below 30% at any TCEY up to 60 Mlbs, the Commission decided to reduce the TCEY from the TCEY consistent with the reference harvest level. This decision may be a precautionary measure given the changes in the stock assessment as well as other identified risks, but even though the reference mortality limit was larger than in previous assessments, the estimates of spawning biomass were similar to past stock assessments.

Related to these concerns at AM099, the SRB made a recommendation to re-evaluate what they called the target objective. This is objective (b): to maintain the relative spawning biomass above $B_{36\%}$.

> **IPHC-2023-SRB023-R, para. 25.** *The SRB **RECOMMENDED** that the Commission re-evaluate the target objective for long-term coastwide female spawning stock biomass given that estimated 2023 female spawning biomass (and associated WPUE), which was well-above the current target B36%, in part triggered harvest rate reductions from the interim harvest policy. Such ad-hoc adjustments limited the value of projections and performance measures from MSE.*

However, instead of updating the $B_{36\%}$ relative spawning biomass objective, it may be prudent to consider an absolute spawning biomass, or catch-rate, threshold in a new objective.

Most fisheries management authorities use an absolute spawning biomass threshold because they do not consider dynamic unfished spawning biomass (dynamic B_0). Instead, reference points are defined as a percentage of a static B_0 that is calculated using a pre-defined productivity regime. This, however, conflates environmental effects with fishing effects. A compromise is to determine status of the stock using a dynamic approach to account for only fishing effects, and to also define an absolute spawning biomass limit to avoid stock levels below a value that may result in unacceptably low catch-rates and the potential for reduced reproduction.

Clark and Hare (2006) noted that "[t]he Commission's paramount management objective is to maintain a healthy level of spawning biomass, meaning a level above the historical minimum that last occurred in the mid1970s." The Commission currently has conservation objectives to maintain the spawning biomass above certain thresholds, measured as relative spawning biomass, but these reference points are relative to dynamic unfished spawning biomass, thus may not indicate when spawning biomass is at a low level resulting from non-fishing effects (e.g. weight-at-age and recruitment). An absolute biomass threshold would ensure that the biomass of fish available is above a desired level.

An objective to maintain the absolute spawning biomass above a threshold may be a useful objective for several reasons. First, the level of spawning biomass likely correlates with catch-rates in the fishery, and a higher spawning biomass would likely result in a more efficient and economically viable fishery. Second, current priority conservation objectives use dynamic relative spawning biomass (accounting for the effects of fishing and not the environment) to determine stock status, and stock conditions may result in a low absolute spawning biomass with a satisfactory stock status. Third, a minimum absolute coastwide spawning biomass may be necessary to ensure successful reproduction. Lastly, an observed reference may have concrete meaning to stakeholders. For example, the recent estimated spawning biomass may be near or below the lowest spawning biomass estimated since the mid-1970's and the Commission noted historically low observed fishery catch rates in 2022.

> **IPHC-2023-AM099-R, para 56.** *The Commission **NOTED** that there are additional risks associated with the stock condition and mortality limit considerations for 2023 that are not quantitatively captured in the decision table, these include:*

a) Historically low observed fishery catch rates corresponding to reduced efficiency/performance in 2022;

The threshold and the tolerance for being below that threshold are not obvious choices. Clark and Hare (2006) used the estimated spawning biomass in 1974, which subsequently produced recruitment resulting in an increase in the stock biomass. However, there is a high uncertainty in the estimates of historical absolute spawning biomass before the 1990's. Recent estimates of spawning biomass may be reasonable as they are relevant to concerns of low catch-rates, but it is unknown how and if the stock will quickly recover from this current state. Setting an absolute spawning biomass to avoid low catch-rates may also *de facto* protect the stock from serious harm (i.e. avoid dropping below the current relative spawning biomass limit of 20%).

An alternative way to think about this is to define a population biomass limit reference point for relative spawning biomass as a threshold for which dropping below would cause serious harm to the stock (the Commission has adopted $SB_{20\%}$), and a fishery biomass limit reference point on some quantity that would result in serious hardships to the fishery. The fishery biomass limit reference point could be defined using absolute spawning biomass, CPUE, FISS WPUE, or some other metric. Note that a fishery biomass limit reference point is a different objective than a fishing intensity limit, where the former is a threshold used to maintain catch-rates and the latter is a threshold used to indicate the potential for overfishing. As mentioned above, a fishery absolute spawning biomass limit may add extra protection for the stock by further reducing the chance of the population dropping below the population biomass limit reference point.

The Secretariat will discuss objectives with the MSAB and SRB and a new one related to absolute spawning biomass may be phrased as

> Maintain the long-term coastwide female spawning stock biomass (or FISS WPUE or fishery catch-rates) above a threshold at least XX% of the time.

The IPHC Secretariat is currently reporting the priority Performance Metrics associated with the priority objectives, which is a subset from the range of metrics presented in Appendix A. The MSAB also requested that a new performance metric be developed to assist with evaluating multi-year MPs.

> **IPHC-2023-MSAB018-R, para. 38:** *The MSAB REQUESTED new performance metrics representing the change in the TCEY in non-assessment years and the change in TCEY in assessment years be developed for the evaluation of multi-year assessment MPs.*

The Secretariat will continue to work with the MSAB regarding how to calculate these new performance metrics, and will then report them in the MSE Explorer.

Decision/Action

Recommend that the Secretariat, working with the MSAB and SRB, develop a new coastwide objective related to absolute spawning biomass or catch-rates, to either replace the current $B_{36\%}$ objective or to be added as a fifth priority objective. The Secretariat supports developing a new objective that optimizes yield via maintaining commercial/FISS catch-rates above a threshold and/or maintaining opportunity for other sectors.

MANAGEMENT PROCEDURES (MPS)

The MSAB and the SRB have provided requests to investigate various MP elements.

> **IPHC-2023-SRB023-R, para. 29:** *The SRB **RECOMMENDED** evaluating fishing intensity and frequency of the stock assessment elements of management procedures and FISS uncertainty scenarios using the MSE framework. MP elements related to constraints on the interannual change in the TCEY and calculation of stock distribution may be evaluated for a subset of the priority management procedures as time allows*.

The following describes these elements of MPs that could be evaluated as part of the future MSE Program of Work.

Priority

- **Annual and multi-year stock assessment MPs:** These are management procedures that conduct a stock assessment annually or every 2nd or 3rd year and use an empirical MP based on the FISS survey trends to determine the TCEY in non-assessment years.
- **Fishing intensity:** A range of SPR values (i.e. fishing intensity, currently 43%) and alternative trigger reference points (currently 30%) in the harvest control rule.
- **FISS reductions:** Investigate scenarios where the FISS effort is reduced or occasionally eliminated in various IPHC Regulatory Areas.

Secondary

- **Constraints:** A constraint on the coastwide TCEY to reduce inter-annual variability. Past examples include a 15% constraint and a slow-up/fast-down approach.

Additional

- **Absolute spawning biomass**: Elements related to maintaining the spawning biomass above an absolute threshold.
- **Stock distribution:** A method to reduce the inter-annual variability in the estimates of stock distribution for use in the MP. This may include using the average of the stock distribution estimates over the past 3 years, for example.
- **TCEY distribution**: Procedures to distribute the TCEY to IPHC Regulatory Areas.

Decision/Action

Recommend the evaluation of multi-year management procedures along with fishing intensity, while incorporating uncertainty in how the TCEY is distributed. These are two MP elements that are necessary to evaluate for the adoption of a coastwide MP in the harvest strategy policy.

Recommend the evaluation of FISS design scenarios using the MSE framework, as recommended by the SRB. This will provide an understanding of how reductions in the FISS design may affect management outcomes.

Recommend evaluating additional management procedures at the request of the MSAB and SRB. This may include constraints on the coastwide TCEY, methods to smooth estimation of stock distribution, and procedures to provide a reference TCEY distribution to inform decision-making. These are additional MP elements that may be beneficial to the harvest strategy policy.

EXCEPTIONAL CIRCUMSTANCES

An exceptional circumstance is an event that is beyond the expected range of the MSE evaluation and triggers specific actions that should be taken to re-examine the harvest strategy. The IPHC interim harvest strategy policy has a decision-making step after the MP, thus the Commission may deviate from an adopted MP as part of the harvest strategy, and this decision-making variability is included in the MSE simulations. Potential exceptional circumstances (i.e. events) and the actions following the declaration of an exceptional circumstance are given below.

The Secretariat, with the assistance of the SRB and MSAB, is defining exceptional circumstances and prescribing the response that would be initiated, as well as identifying potential triggers in a management procedure that would result in a stock assessment being done (if time allows) in a year that would normally not have one scheduled (e.g. in multi-year MPs). Working with the SRB, the following potential exceptional circumstances have been described:

a) The coastwide all-sizes FISS WPUE or NPUE from the space-time model falls above the 97.5th percentile or below the 2.5th percentile of the simulated FISS index for two or more consecutive years.
b) The observed FISS all-sizes stock distribution for any Biological Region is above the 97.5th percentile or below the 2.5th percentile of the simulated FISS index over a period of 2 or more years.
c) Recruitment, weight-at-age, sex ratios, other biological observations, or new research indicating parameters that are outside the 2.5th and 97.5th percentiles of the range used or calculated in the MSE simulations.

Furthermore, the following actions may take place if an exceptional circumstance is declared.

a) A review of the MSE simulations to determine if the OM can be improved and MPs should be reevaluated.
b) If a multi-year MP was implemented and an exceptional circumstance occurred in a year without a stock assessment, a stock assessment would be completed as soon as possible along with the re-examination of the MSE.
c) Consult with the SRB and MSAB to identify why the exceptional circumstance occurred, what can be done to resolve it, and determine a set of MPs to evaluate.
d) Further consult with the SRB and MSAB after simulations are complete to identify whether a new MP is appropriate.

Decision/Action

Recommend that the Secretariat continue to work with the SRB and MSAB to define exceptional circumstances (events) using FISS observations, biological observations, and new research.

Recommend that the Secretariat continue to work with the SRB and MSAB to prescribe the actions to take when an exceptional circumstance is triggered.

Recommend that following discussions with the MSAB and SRB, definitions of and actions for exceptional circumstances be included in the harvest strategy policy.

RESULTS

MSE simulations are currently being conducted, with a priority on multi-year assessments and SRB-requested FISS scenarios. Results will be added to the MSE Explorer website as they become available.

Results of MSE simulations assuming a persistent low or high PDO were presented at the 18th Session of the MSAB (MSAB018), the fifth conference for Effects of Climate Change on the Worlds Oceans (ECCWO5), and the PICES 2023 Annual Meeting (PICES-2023). These results showed that fishing and the environment affect the proportion of spawning biomass in each Biological Region in different ways.

Even though we cannot “manage” the PDO regime, it is useful to understand the effects of the PDO regime on the results, allowing for the separation of the effects of fishing from the effects of the environment. For Pacific halibut, the median relative spawning biomass (RSB) when fishing at an SPR equal to 43% was similar for the high and low PDO scenarios (Table 2). However, even though the median was near 38%, there was a higher probability that the RSB was less than 36% for the low PDO scenario. The long-term median TCEY was 22% less for the low PDO scenario and 26% more for the high PDO scenario when compared to the median TCEY for the base simulations that modelled PDO regime shifts. The TCEY for a persistent high PDO was 1.6 times greater than the TCEY for a persistent low PDO. Inter-annual variability in the TCEY was the same for the persistent low and high PDO scenarios, but less than the AAV when PDO regime shifts were modelled. Without decision-making variability, estimation error,

and observation error, the AAVs are less than when these additional sources of variation are included, as expected.

The environment, in some Biological Regions, may have a larger effect on the distribution of spawning biomass than fishing does (at an SPR of 43%). The percentage of spawning biomass in each Biological Region is affected by fishing under an SPR-based management procedure, and is also affected by the PDO regime because movement, recruitment distribution, and average recruitment are dependent on the PDO regime (Figure 1). Region 2 shows a reduction in the percentage of spawning biomass with fishing, and the low PDO scenario results in a higher percentage than the persistent high PDO scenario. Region 3 shows a similar percentage of spawning biomass with fishing and a higher percentage of spawning biomass with a high PDO. Region 4 shows a higher percentage of spawning biomass with fishing and is largely unaffected by the PDO regime. Region 4B has a higher percentage of spawning biomass with fishing and a higher spawning biomass for the low PDO scenario. These results are dependent upon the harvest strategy, and different fishing intensities or distribution procedures may produce different outcomes.

Decision/Action

None

Table 2. Long-term performance metrics related to primary objectives for scenarios with modeled cycles of PDO (both), always low PDO (Low), and always high PDO (High) with an annual assessment, SPR=43%, 32-inch size-limit, no decision-making variability, no estimation error, and no observation error.

PDO	Both	Low	High
Long-Term Metrics			
Median RSB	38.8%	37.6%	39.2%
P(RSB_y<20%)	<0.001	<0.001	<0.001
P(RSB<36%)	0.238	0.329	0.157
Median TCEY (Mlbs)	65.64	51.42	82.95
Median AAV TCEY	5.2%	4.5%	4.5%
Median TCEY Region 2 (Mlbs)	20.49	19.07	21.20
Median TCEY Region 3 (Mlbs)	33.67	22.98	48.74
Median TCEY Region 4 (Mlbs)	8.13	6.55	9.35
Median TCEY Region 4B (Mlbs)	2.40	2.24	2.63

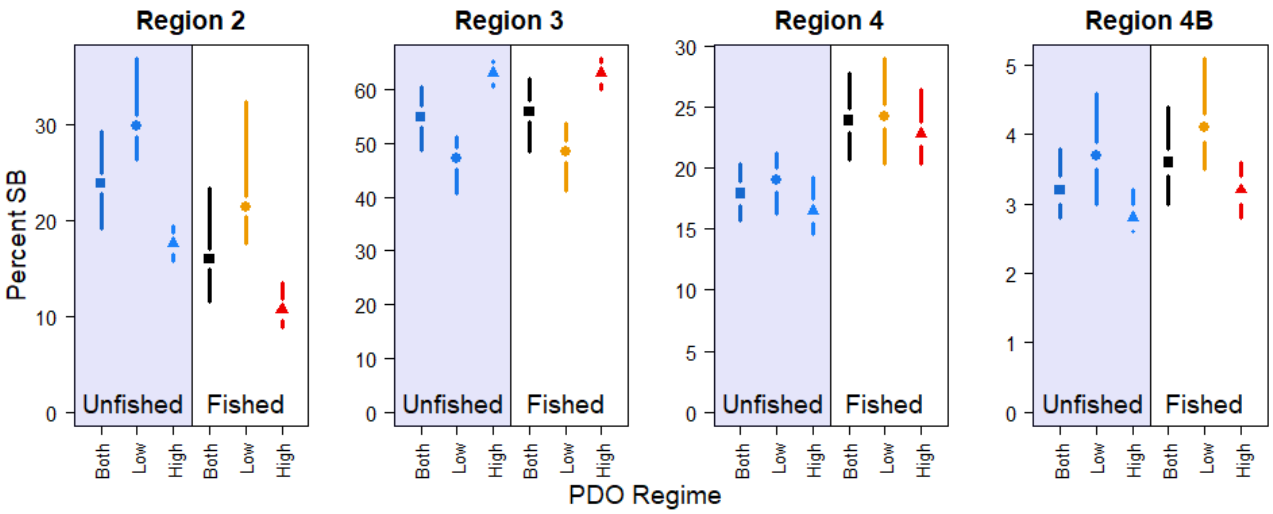

Figure 1. Percentage of spawning biomass in each Biological Region when fished with an SPR of 43% (no estimation error, no observation error, and no implementation error) and when not fished. The PDO is modelled with cyclical low and high periods in "Both", is persistently low in "Low", and is persistently high in "High".

IPHC HARVEST STRATEGY POLICY

A Harvest Strategy Policy (HSP) provides a framework for applying a science-based approach to setting harvest levels. At IPHC, this would be specific to the TCEY for each IPHC Regulatory Area throughout the Convention Area. Currently, the IPHC has not formally adopted a harvest strategy policy, but has set harvest levels under an SPR-based framework with elements adopted at multiple Annual Meetings of the IPHC since 2017.

Adopting an HSP is important for any fisheries management authority because it outlines the long-term vision for management and specifies the framework for a consistent and transparent science-based approach to setting mortality limits. An HSP

- identifies an appropriate method to manage natural variability and scientific uncertainty,
- accounts for risk and balances trade-offs,
- reduces the time needed to make management decisions,
- ensures long-term sustainability and profitability,
- increases market stability due to a more predictable management process,
- adheres to the best practices of modern fisheries management that is consistent with other fisheries management authorities and certification agencies, and
- allows for the implementation of the precautionary approach.

Overall, an HSP spells out the management process, which benefits the fish, the stakeholders, and other interested parties.

To move towards formally adopting a harvest strategy policy at the IPHC in the near term, the SRB recommended separating the coastwide TCEY management procedure from the distribution procedure.

> **IPHC-2023-SRB023-R, para. 30:** *The SRB **RECOMMENDED** that the Commission consider revising the harvest policy to (i) determine coastwide TCEY via a formal management procedure and (ii) negotiate distribution independently (e.g. during annual meetings). Such separated processes are used in other jurisdictions (e.g. most tuna RFMOs, Mid Atlantic Fishery Management Council, AK Sablefish, etc.).*

The coastwide TCEY determined from the MP in the harvest strategy would be an input into the allocation decision-making process.

An HSP can be divided into three components: management procedure, harvest strategy, and policy (Figure 2). A management procedure is an agreed upon procedure that determines an output that meets the objectives defined for management. The MP is reproducible and is codified such that it can be consistently calculated. The harvest strategy component contains the MP but is broader and encompasses the objectives as well as additional procedures that produce that final necessary outputs, but may not be procedural and pre-defined. For example, at the IPHC the harvest strategy consists of the procedure to determine the coastwide TCEY as well as the concept of distributing the TCEY to each IPHC Regulatory Area. Currently, the determination of the coastwide TCEY is defined using a harvest control rule and reference fishing intensity, but there is not an agreed upon procedure to distribute the TCEY. However, a reference TCEY distribution may be useful to inform the decision-making process. The policy component is the aspect of decision-making where management may deviate from the outputs of the harvest strategy to account for other objectives not considered in the harvest strategy. This may be to modify the coastwide TCEY and/or the distribution of the TCEY to account for economic factors, for example. At IPHC, the policy component occurs at the Annual Meeting of the IPHC where stakeholder input is considered along with scientific information to determine the mortality limits for each IPHC Regulatory Area.

The IPHC Secretariat is currently in the process of updating the IPHC harvest strategy policy document, which was last edited in 2019, and a draft HSP is available for consideration by the Commission (outline in Appendix B). This draft may be adopted as an interim HSP, but some additional MSE work is necessary for a final HSP, noting that the HSP may be updated at any time following additional MSE-related work. The necessary MSE tasks to complete include investigating multi-year assessments with empirical rules to determine the coastwide TCEY in non-assessment years, and examining additional fishing intensities (i.e. SPR values) for each of those options. The draft HSP includes a description of the decision-making process and the flexibility that the Commission would have when making management decisions. This decision-making uncertainty is included in the MSE analysis of risk.

Decision/Action

Recommend that the Secretariat continue developing an updated Harvest Strategy Policy document, noting that decisions regarding the assessment frequency and potentially a change to the reference fishing intensity are to be made at AM101.

Adopt an interim harvest strategy policy given the current interim management procedure (i.e. annual assessment and a reference SPR=43%).

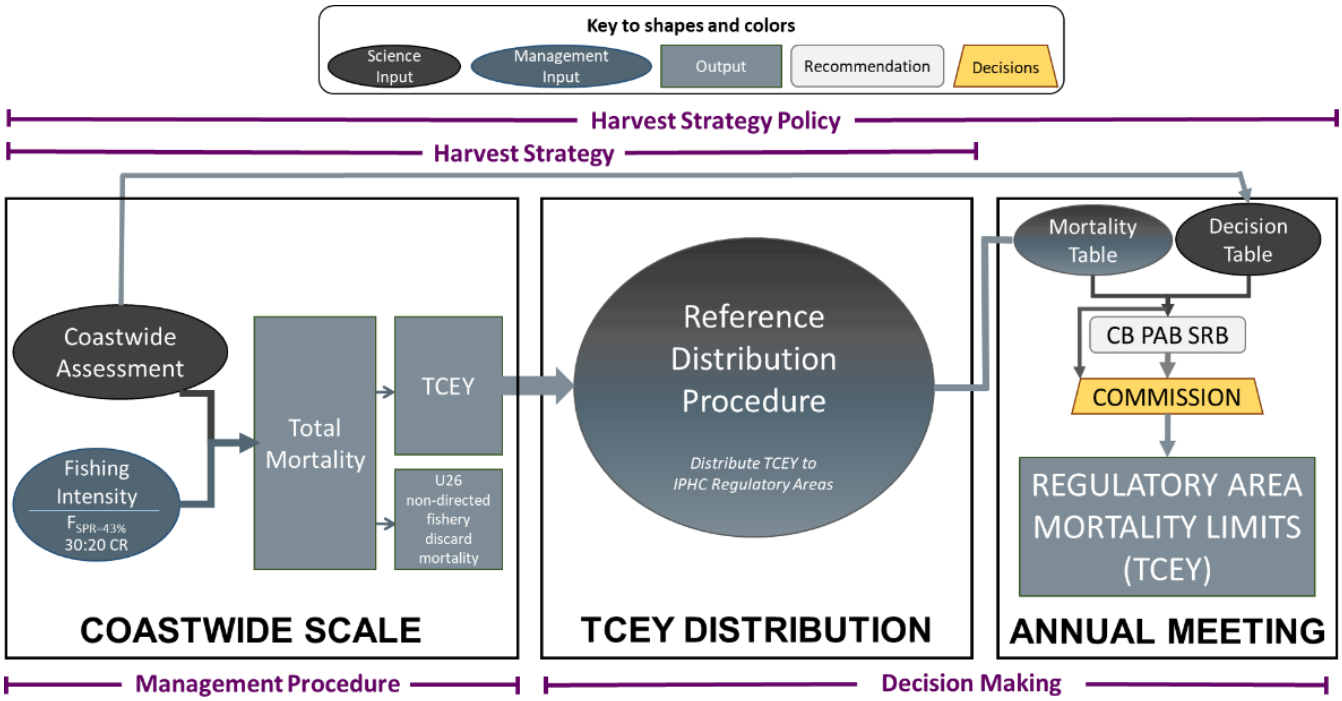

Figure 2. Illustration of the harvest strategy policy for IPHC showing the coastwide scale (management procedure), the TCEY distribution (part of the harvest strategy), and the policy component that mainly occurs at the Annual Meeting.

RECOMMENDATION/S

That the Commission

1) **NOTE** paper IPHC-2024-AM100-11 presenting outcomes of MSAB018 and SRB023, recent MSE progress, potential additions to the MSE Program of Work for 2023–2025, and a draft Harvest Strategy Policy document.
2) **NOTE** that the SRB endorsed the 2023 OM for use in MSE evaluations of MPs that would lead to the adoption of a harvest strategy, including assessment frequency, fishing intensity, and data monitoring.
3) **NOTE** that MSE results using the updated 2023 OM are similar to past MSE results, thus past MSE results remain relevant.
4) **NOTE** the current priority objectives and **RECOMMEND** that the Secretariat, working with the MSAB and SRB, develop a new coastwide objective related to absolute spawning biomass or catch-rates, to either replace the current $B_{36\%}$ objective or to be added as a fifth priority objective. The Secretariat supports developing a new objective that optimizes yield via maintaining commercial/FISS catch-rates above a threshold and/or maintaining opportunity for other sectors.
5) **RECOMMEND** the evaluation of multi-year management procedures along with fishing intensity, while incorporating uncertainty in how the TCEY is distributed. These are two MP elements that are necessary to evaluate for the adoption of a coastwide MP in the harvest strategy policy.
6) **RECOMMEND** the evaluation of FISS design scenarios using the MSE framework, as recommended by the SRB. This will provide an understanding of how reductions in the FISS design may affect management outcomes.
7) **RECOMMEND** evaluating additional management procedures at the request of the MSAB and SRB. This may include constraints on the coastwide TCEY, methods to smooth estimation of stock distribution, and procedures to provide a reference TCEY distribution to inform decision-making. These are additional MP elements that may be beneficial to the harvest strategy policy.
8) **RECOMMEND** that the Secretariat continue to work with the SRB and MSAB to define exceptional circumstances (events) using FISS observations, biological observations, and new research.
9) **RECOMMEND** that the Secretariat continue to work with the SRB and MSAB to prescribe the actions to take when an exceptional circumstance is triggered.
10) **RECOMMEND** definitions of and actions for exceptional circumstances be included in the harvest strategy policy following discussions with the MSAB and SRB.
11) **RECOMMEND** that the Secretariat continue developing an updated Harvest Strategy Policy document, noting that decisions regarding the assessment frequency and potentially a change to the reference fishing intensity are to be made at AM101.

12) **ADOPT** an interim harvest strategy policy given the current interim management procedure (i.e. annual assessment and a reference SPR=43%)

APPENDICES

Appendix A: Objectives used by the Commission for the MSE

Appendix B: Outline of a draft IPHC harvest strategy policy

Appendix C: Supplementary material

APPENDIX A
OBJECTIVES USED BY THE COMMISSION FOR THE MSE

Table A1. Primary 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. Priority objectives are shown in green text.

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 the long-term coastwide female spawning stock biomass above a biomass limit reference point ($B_{20\%}$) at least 95% of the time	*B* < Spawning Biomass Limit (B_{Lim}) B_{Lim}=20% unfished spawning biomass	Long-term	0.05	$P(SB < SB_{Lim})$ Fail if greater than 0.05
	Maintain a defined minimum proportion of female spawning biomass in each Biological Region	$p_{SB,2} > 5\%$ $p_{SB,3} > 33\%$ $p_{SB,4} > 10\%$ $p_{SB,4B} > 2\%$	Long-term	0.05	$P(p_{SB,R} < p_{SB,R,min})$
2.1 MAINTAIN SPAWNING BIOMASS AT OR ABOVE A LEVEL THAT OPTIMIZES FISHING ACTIVITIES	Maintain the long-term coastwide female spawning stock biomass at or above a biomass reference point ($B_{36\%}$) 50% or more of the time	*B*<Spawning Biomass Reference (B_{Thresh}) B_{Thresh}=$B_{36\%}$ unfished spawning biomass	Long-term	0.50	$P(SB < SB_{Thresh})$ Fail if greater than 0.5
2.2. 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* $\overline{\left(\frac{TCEY_A}{TCEY}\right)}$
	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)*
2.3. LIMIT VARIABILITY IN MORTALITY LIMITS	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

APPENDIX B
OUTLINE OF A DRAFT IPHC HARVEST STRATEGY POLICY

Chapter 1 Introduction

1.1 Scope

1.2 What is a Harvest Strategy Policy (HSP)?

1.3 What is a Harvest Strategy?

Chapter 2 Objectives and Key Principles

Chapter 3 Development of the Harvest Strategy

3.1 Accounting for fishing mortality on all sizes and from all sources

3.2 Variability in the environment and biological characteristics

3.3 Monitoring Standards

3.4 Establishing and applying decision rules

3.5 Balancing risk, cost and catch

3.6 Reference points and proxies

3.7 Technical evaluation of the harvest strategy

3.8 Re-evaluating the harvest strategy and management procedure

Chapter 4 Applying the harvest strategy

4.1 Jointly-managed domestic stocks

4.2 Jointly-managed international stocks

4.3 Stock assessment

4.4 Coastwide mortality limit

4.5 Rebuilding if the stock becomes overfished

4.6 Mortality limits for each IPHC Regulatory Area

4.7 Common outputs used for decision-making

4.8 Stakeholder and scientific input

4.9 Annual process

APPENDIX C
SUPPLEMENTARY MATERIAL

The IPHC MSE Research website contains additional documents with more detailed information.

https://www.iphc.int/management/science-and-research/management-strategy-evaluation

This includes a technical description in document (IPHC-2023-MSE-02) and a full description of MSE related activities in 2023 (IPHC-2024-MSE-01).

The MSE Explorer will be updated as additional results are produced. Links to the current MSE Explorer as well as archived results are available at

http://iphcapps.westus2.cloudapp.azure.com/