Considerations for the Management Strategy Evaluation Program of Work for 2025-2026

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PURPOSE

To provide the MSAB with an overview of potential work topics for the IPHC MSE in 2025-2026.

1 INTRODUCTION

Work from the Management Strategy Evaluation (MSE) Program of Work for 2023–2025 that has been completed is reported in documents IPHC-2024-MSAB020-06 and IPHC-2025-AM101-12. This includes defining exceptional circumstances and actions to take when an exceptional circumstance occurs, evaluating a wide range of fishing intensities along with annual, biennial, and triennial assessment frequencies, and considering constraints on the annual change in the TCEY.

The potential topics for the MSE Program of Work presented in this paper support the continued understanding of managing Pacific halibut fisheries.

2 PROGRAM OF WORK TOPICS

2.1 Objectives

The Commission defined a small set of priority coastwide objectives and associated performance metrics for current evaluations.

> **IPHC-2023-AM099-R, para. 76.** *The Commission RECOMMENDED that for the purpose of a comprehensive and intelligible Harvest Strategy Policy (HSP), four coastwide objectives should be documented within the HSP, in priority order:*
>
> *a) Maintain the long-term coastwide female spawning stock biomass above a biomass limit reference point (B20%) at least 95% of the time.*
>
> *b) Maintain the long-term coastwide female spawning stock biomass at or above a biomass reference point (B36%) 50% or more of the time.*
>
> *c) Optimise average coastwide TCEY.*
>
> *d) Limit annual changes in the coastwide TCEY.*

> **IPHC-2023-AM099-R, para. 77**. *The Commission AGREED that the performance metrics associated with the objectives in Paragraph 76 are:*
>
> > *a) P(RSB): Probability that the long-term Relative Spawning Biomass (RSB) is less than the Relative Spawning Biomass Limit, failing if the value is greater than 0.05.*
> >
> > *b) P(RSB<36%): Probability that the long-term RSB is less than the Relative Spawning Biomass Reference Point, failing if the value is greater than 0.50.*
> >
> > *c) Median TCEY: the median of the short-term average TCEY over a ten-year period, where the short-term is 4-14 years in the future.*
> >
> > *d) Median AAV TCEY: the average annual variability of the short-term TCEY determined as the average difference in the TCEY over a ten-year period*.

These priority objectives and performance metrics come from a larger list of objectives which includes objectives specific to Biological Regions and IPHC Regulatory Areas (Appendix A).

2.2 An objective related to absolute spawning biomass

The spawning biomass reference points in the conservation objective to "maintain the long-term coastwide female spawning stock biomass above a biomass limit reference point..." and in the objective to "maintain the long-term coastwide female spawning stock biomass at or above a biomass reference point…" use relative spawning biomass, which is the estimated female spawning biomass divided by the estimated unfished female spawning biomass (dynamic relative spawning biomass, RSB). Furthermore, unfished female spawning biomass is estimated as the unfished spawning biomass that would have occurred if there was no fishing up to the year of interest. This metric, dynamic unfished spawning biomass (or dynamic B_0) reflects the changes in the population due to natural variability in the population, and RSB measures only the effects of fishing. RSB is useful for managing a fish species because it is consistent with other reference points (e.g. SPR), accounts for changes in biology, incorporates variation in recruitment, and allows for a clear determination of "overfished" without confounding stock changes with natural variability.

Pacific halibut have seen large changes in average weight-at-age and high variability in recruitment, which has changed the stock dynamics considerably. Figure 1 shows the dynamic unfished spawning biomass, the current spawning biomass, and the RSB since 1993. Dynamic unfished spawning biomass is lower than the late 1990's because weight-at-age has decreased considerably and dynamic unfished spawning biomass has decreased in recent years because of a recent period of low recruitment. The current spawning biomass trajectory (with fishing) has been stable in recent years, resulting in an increasing RSB. Therefore, the Pacific halibut stock is likely to be above the B_{lim} (20%), B_{trigger} (30%), and B_{thresh} (36%) reference points.

However, the coastwide FISS O32 WPUE and coastwide commercial WPUE has been declining in recent years (Figure 2), causing concern about the absolute stock size and fishery catch-rates. The coastwide FISS index of O32 WPUE was at its lowest value observed in the time-series, declining by 3% from the previous year and coastwide commercial WPUE is also at its lowest value in the recent time-series, declining by 10% from the previous year (and likely more as additional logbook information is obtained). In contrast, the stock assessment for 2023 estimates current stock status (42%, Figure 1) above reference levels and a high probability of further decline in spawning biomass at the reference fishing intensity (SPR=43%). The reference coastwide TCEY of 48.9 Mlbs predicts a greater than 70% chance that the spawning biomass in any of the next three years will be less than the spawning biomass in 2023. The long-term average RSB when fishing consistently at an SPR of 43% would be near 38%.

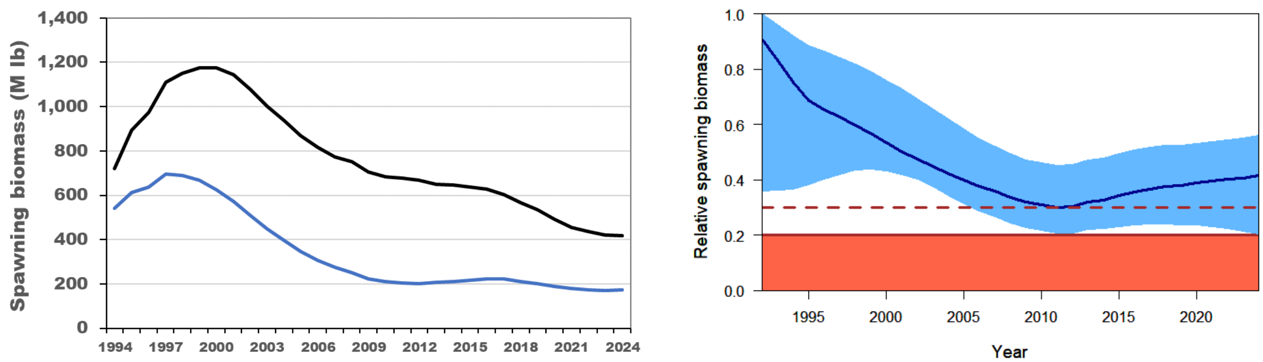

Figure 1. Dynamic unfished spawning biomass (black line) and current spawning biomass (blue line) from the 2023 stock assessment (left) and dynamic relative spawning biomass (right) with an approximate 95% credible interval in light blue and the control rule limit and trigger in red. Figures from IPHC-2024-SA-01.

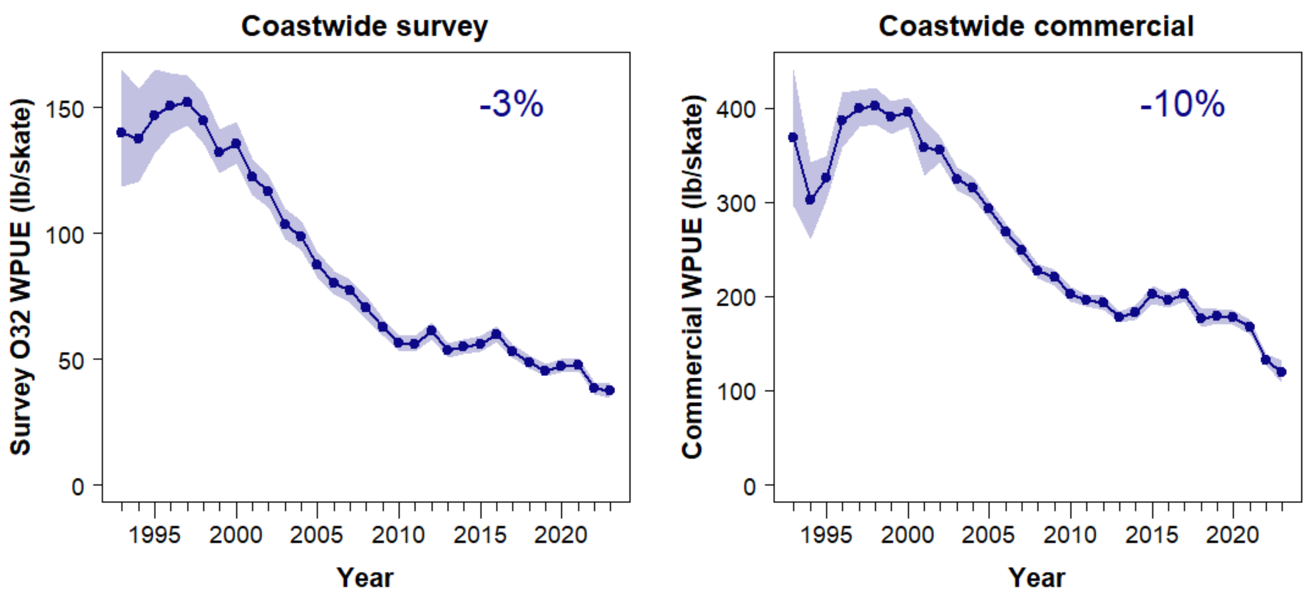

Figure 2. The coastwide FISS O32 WPUE index (left) and coastwide commercial WPUE (right) showing the percent change in the last year (from IPHC-2024-SA-02). Based on past calculations, additional logbooks collected in 2024 will likely further reduce the decline in commercial WPUE to -12%.

Recent Commission decisions (2023 and 2024) have set coastwide TCEYs less than the reference TCEY suggested by the stock assessment and current interim management strategy, noting the following.

> **IPHC-2024-AM100-R, para 38**. *The Commission NOTED that the estimated absolute spawning biomass is at a 35-year low and likely to remain low for several more years given recruitments currently in the water.*
>
> **IPHC-2024-AM100-R, para 56**. *The Commission NOTED that:*
>
> *a) the status quo coastwide TCEY of 36.97 million pounds corresponds to a 45/100 chance of stock decline over the next 1-3 years;*
>
> *b) coastwide TCEYs at or above 39.1 million pounds would have a greater than a 50% chance of stock decline over the next three years;*
>
> *c) fishing at the reference level (F43%) would equate to a coastwide TCEY of 48.9 million pounds in 2024 and have a high likelihood of stock decline over one-year (74/100) and three-years (72%).*
>
> **IPHC-2024-AM100-R, para 57**. *The Commission NOTED several additional risks not included in the harvest decision table:*
>
> *a) the estimated absolute spawning biomass is at a 30+-year low and likely to remain low for several more years given recruitments currently in the water;*
>
> *b) low 2023 catch-rates in the FISS and directed commercial fisheries compared to those observed over the last 30 years;*
>
> *c) Biological Region 3 is currently at the lowest observed proportion of the coastwide biomass since 1993 (the full historical range is unknown), and uncertainty associated with changes to the ecosystem and climate remains high.*
>
> **IPHC-2024-AM100-R, para 59**. *The Commission NOTED the wide uncertainty intervals around the estimated spawning biomass and that once a mortality limit is selected there is a correspondingly large amount of uncertainty in the actual fishing intensity.*
>
> **IPHC-2024-AM100-R, para 88**. *The Commission NOTED that the adopted mortality limits for 2024 correspond to a 41% probability of stock decline through 2025, and a 41% probability of stock decline through 2027.*
>
> **IPHC-2024-AM100-R, para 89**. *The Commission NOTED that the adopted mortality limits for 2024 correspond to a fishing intensity of F52%, equal to the estimate for 2023.*
>
> **IPHC-2025-AM101-R, para 77.** *The Commission NOTED that the adopted mortality limits for 2025 correspond to a 25% probability of stock decline through 2026, and a 29% probability of stock decline through 2028.*
>
> **IPHC-2025-AM101-R, para 78.** *The Commission NOTED that the adopted mortality limits for 2025 correspond to a fishing intensity of F51%, lower than the fishing intensity estimate for 2024.*

Main concerns noted by the Commission include 1) low absolute spawning biomass, 2) low catch-rates in the commercial fishery, 3) high probability of decline in absolute spawning biomass at the reference fishing mortality, and 4) a large amount of uncertainty in the projections.

The continued departure from the current interim MP and reduction in coastwide TCEY suggests that there may be an additional objective. Related to these concerns, 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.*

The MSAB made a similar recommendation at MSAB019 to discuss a new objective, which was also discussed at the 20th Session of the MSAB (MSAB020).

> **IPHC-2024-MSAB019-R, para 51.** *NOTING paragraph 48, the MSAB RECOMMENDED developing an objective and identifying a management procedure that addresses the current circumstances and differences in perception of the stock status.*

> **IPHC-2024-MSAB020-R, para 15.** *The MSAB NOTED that a new objective may be defined using absolute biomass, commercial catchrates, or coastwide TCEY. However, commercial catch-rates may not be the best option because they are dependent on other factors. The coastwide TCEY and/or a reference absolute spawning biomass IPHC-2024-MSAB020-R Page 9 of 19 based on what has been observed may be more meaningful, but all have downsides in being a holistic metric.*

> **IPHC-2024-MSAB020-R, para 16.** *The MSAB NOTED that a new objective to maintain the coastwide TCEY above a threshold may be useful because it is meaningful to stakeholders, may define a minimum coastwide TCEY necessary for economic viability, and may be a proxy for maintaining catch-rates and absolute spawning biomass above a threshold which may be important to stakeholders.*

> **IPHC-2024-MSAB020-R, para 17.** *The MSAB NOTED that the RSB36% objective (b in paragraph 12) is a useful objective because it separates fishing effects from environmental effects on the stock, scales with changes in productivity, defines a desired relative spawning biomass to be at or above, is based on a proxy for RSBMEY, and is an objective that is often important to fishery certification agencies.*

A higher $B_{36\%}$ reference point could be achieved with a lower reference fishing intensity or an alternative control rule, such as 40:20. 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.

Clark & 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 mid-1970s." Thompson (1937) stated the following.

> *In actual practice, capital is accumulated in order that interest may be secured from it, and an accumulated stock of fish may also be profitable.*
>
> *The most obvious gain is the greater economy of effort in obtaining a catch from a larger accumulated stock. It not only means less effort, but also less time at sea before the catch is landed. (William F. Thompson, International Fisheries Commission, 1937)*

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 absolute 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.

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 low stock levels (even if not caused by fishing) below a value that may result in unacceptably low catch-rates and/or the potential for reduced reproduction (Bessell-Browne et al. 2024).

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 which 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 (such a level is currently unknown for Pacific halibut). Lastly, an observed reference stock level 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 and 2023.

> **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%).

A second approach is to define an objective based on catch-rates in the fishery. If an efficient fishery is the objective, then catch-rates may be a reasonable choice for the same reasons listed above for an absolute level of spawning biomass. A subtle difference between catch-rates and spawning biomass are that catch-rates may increase or decrease due to many factors (e.g. improvements in technology, avoidance of non-target species) without a change in spawning biomass.

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 already adopted $SB_{20\%}$), and a second fishery biomass limit reference point for which dropping below would result in serious hardships to the fishery. The fishery biomass limit reference point could be defined using an absolute metric that could be in units of spawning biomass, fishery CPUE, FISS WPUE, or some other estimable quantity. Note that a fishery 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 probability of breaching existing limit and threshold reference points. A new objective related to fishery performance may be phrased as

> Maintain the coastwide female spawning stock biomass (or FISS WPUE or fishery catch-rates) above a threshold.

The threshold may be an absolute value of spawning biomass or a defined static biomass reference point such as the spawning biomass in 2023. It is important to first decide if this is a useful general objective. If it is, then specifying a measurable objective would require defining the threshold, the term, and a tolerance. From that, a performance metric would be developed.

2.3 Optimise yield

The SRB made a recommendation to quantify the objective to "optimise yield" so that it is meaningful and can have a performance metric that identifies the best performing MP.

> **IPHC-2024-SRB024-R, para 22**. *The SRB RECOMMENDED that the Commission develop a more specific and quantifiable catch objective to replace Objective c) (from AM099–Rec.02) "Optimize average coastwide TCEY".*

Optimising yield may include multiple objectives, such as maximising yield and minimising variability in yield, and evaluation may include examining trade-offs between multiple objectives.

The MSAB recommended that 'optimise' be changed to 'maximise' and this objective be given equal consideration along with minimising interannual variability in yield

> **IPHC-2024-MSAB020-R, para 14**. *The MSAB RECOMMENDED that the Commission priority objective "optimise average coastwide TCEY" (c in paragraph 12)*

be changed to “maximise average coastwide TCEY” and that this objective along with the variability in yield objective (d in paragraph 12) be given equal consideration to allow for the evaluation of trade-offs between these two objectives.

Changing this objective from ‘optimise’ to ‘maximise’ would not change the overall goal of the Commission to optimise yield. In fact, the two objectives “maximise yield” and “minimizer interannual variability in yield” are both a part of optimising yield. Giving equal consideration to both objectives would better meet the general goal of the Commission to optimise yield.

2.4 Hierarchical grouping of Commission objectives

An important part of the four priority objectives of the Commission is that they are hierarchical. The objectives can be categorized into two groups (Table 1). The first group contains long-term objectives a) and b), in priority order, which define the overarching objectives of the Commission (ensuring sustainability of the stock and optimising fishing activities and opportunities) and unambiguously identifies MPs that do not support long-term objectives of the Commission. All MPs that do not meet these two objectives would not be considered as a potential reference MP. Furthermore, the sustainability objective (a) may be used to define an ‘overfished’ status, and the fishing opportunity objective (b) may be associated with an ‘overfishing’ status. The first group also clearly defines the boundaries of the management space over which Commission decision-making can apply.

The second group contains short-term objectives c) and d) which define the management objectives of the Commission related to optimal yield. A reference MP will represent a trade-off between the amount of yield and the interannual variability in that yield. The optimal trade-off may be considered differently by different users and stakeholders and may change over time, thus there is no inherent priority between these two objectives when selecting a reference MP. Justification of a reference MP is therefore provided after evaluation of this trade-off. This trade-off may also be considered during the annual decision-making process while also incorporating many other objectives.

Table 1. Commission priority objectives for the long-term sustainable management of Pacific halibut that supports optimal fishing opportunities. Light grey text shows potential additions/changes that are not in the current Commission objectives.

PURPOSE	TYPE	GOAL	GENERAL OBJECTIVE	MEASURABLE OBJECTIVE
LONG-TERM OVERARCHING OBJECTIVES DEFINING MPS TO AVOID	CONSERVATION	SUSTAINABILITY	**1.** KEEP FEMALE SPAWNING BIOMASS ABOVE A LIMIT TO AVOID CRITICAL STOCK SIZES	**a)** Maintain the long-term coastwide female relative spawning biomass above a biomass limit reference point ($RSB_{20\%}$) at least 95% of the time
	FISHERY	OPTIMISE FISHING ACTIVITIES AND OPPORTUNITIES	**2.** MAINTAIN SPAWNING BIOMASS AT OR ABOVE A LEVEL THAT SUPPORTS OPTIMAL FISHING ACTIVITIES AND OPPORTUNITIES	**b)** Maintain the long-term coastwide female relative spawning biomass at or above a biomass threshold reference point ($RSB_{36\%}$) 50% or more of the time.
				) Maintain the long-term coastwide female absolute spawning biomass at or above a biomass threshold reference point (XX) YY% or more of the time.
SHORT-TERM MANAGEMENT OBJECTIVES DEFINING A REFERENCE MP	FISHERY	OPTIMISE YIELD	**3.** PROVIDE DIRECTED FISHING YIELD WHILE LIMITING VARIABILITY IN MORTALITY LIMITS	**c)** Maximise average coastwide TCEY
				d) Limit annual changes in the coastwide TCEY

2.5 Management Procedures

Various levels of fishing intensity, assessment frequencies, and some constraints were evaluated in 2024. Based on these results, the MSAB made a recommendation to modify the current interim management procedure.

> **IPHC-2024-MSAB020-R, para 41**. *The MSAB RECOMMENDED updating the reference MP for one three-year cycle on a trial basis using a triennial stock assessment frequency (synchronised with the full stock assessment scheduled in 2025 to inform 2026 mortality limits). The coastwide TCEY would be based on SPR=46% in assessment years and based on the proportional change in the FISS O32 WPUE index in non-assessment years. The triennial stock assessment frequency may increase the median coastwide TCEY and reduce the interannual variability in the coastwide TCEY. A lower fishing intensity would also reduce the probability that the spawning biomass is less than the 2023 spawning biomass in the short- and longterm, and result in lower interannual variability as noted in paragraph 26.*

The Commission has not updated the reference MP at this time, but is considering the draft Harvest Strategy Policy. Additional analysis were also recommended by the MSAB at MSAB020.

> **IPHC-2025-MSAB020-R, para 42:** *The MSAB RECOMMENDED further evaluations of the following MP elements: d) A triennial assessment frequency with each of the three FISS designs; e) Various empirical rules to determine the reference coastwide TCEY in nonassessment years; f) Constraints on the interannual change in the reference coastwide TCEY, such as a maximum change in the coastwide TCEY of 15%, a slow-up fast down approach, or a fixed TCEY in non-assessment years.*

Adding some elements to the already evaluated MPs would be useful, as would be further understanding the trade-offs between the elements already evaluated. Some of this is presented in IPHC-2025-MSAB021-07. However, given that a full assessment is scheduled for 2025, the MSE OM is likely to be updated in early 2026, and a full evaluation of MPs would be warranted then to reflect any new understanding of the Pacific halibut population and fisheries.

2.6 References points and understanding variability

Past analyses (IPHC-2019-SRB015-11) showed that, for Pacific halibut, biomass-based reference points, such as MSY and B_0, are affected by a change in environmental regime, but relative reference points, such as relative spawning biomass (RSB) and SPR_{MSY}, are similar across regimes. This indicates that a consistent SPR-based management regime is likely robust across different environmental regimes. Analyses investigating persistent high and low PDO regimes show similar results, and also provide performance metrics specific to the IPHC MSE.

Results of MSE simulations assuming a persistent low or high PDO were initially 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). Results were recently updated and showed that fishing and the environment affect the proportion of spawning biomass in each Biological Region in different ways. This analysis was performed with two levels on average recruitment, and integrated over variability in weight-at-age. A recent analysis showed highly variable outcomes with low or high average recruitment crossed with low or high weight-at-age (IPHC-2025-MSAB021-07).

These analyses were done with OMs conditioned to assessment results before the most recent stock assessment. Some assumptions have recently changed, especially regarding the productivity of Pacific halibut. It may be worthwhile to repeat these analyses after the 2025 full stock assessment with a newly conditioned operating model to reflect the most recent understanding of the Pacific halibut stock as fisheries.

RECOMMENDATION/S

That the MSAB:

1) **NOTE** paper IPHC-2025-MSAB021-08, which details potential topics for an MSE Program of Work in 2025-2026, including topics related to objectives, management procedures, and further understanding variability.
2) **REQUEST** adding or updating an objective related to optimising fishing activities and opportunities to the priority objectives of the IPHC.
3) **REQUEST** further evaluations of the following MP elements: a) A triennial assessment frequency with each of the three FISS designs; b) Various empirical rules to determine the reference coastwide TCEY in non-assessment years; c) Constraints on the interannual change in the reference coastwide TCEY, such as a maximum change in the coastwide TCEY of 15%, a slow-up fast down approach, or a fixed TCEY in non-assessment years.
4) **REQUEST** conducting further analyses of reference points and the effects of recruitment regimes and variable weight-at-age after conditioning the OM following the full 2025 stock assessment.

REFERENCES

Bessell-Browne P, Punt AE, Tuck GN, Burch P. Penney A. 2024. Management strategy evaluation of static and dynamic harvest control rules under long-term changes in stock productivity: A case study from the SESSF. Fisheries Research 273. https://doi.org/10.1016/j.fishres.2024.106972

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Thompson WF. 1937. Theory of the effect of fishing on the stock of halibut. Report of the International Fisheries Commission, number 12. https://www.iphc.int/uploads/pdf/sr/IPHC-1937-SR012.pdf

APPENDIX A
PRIMARY OBJECTIVES USED BY THE COMMISSION FOR THE MSE EVALUATIONS

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 relative spawning biomass above a biomass limit reference point ($RSB_{20\%}$) at least 95% of the time	*RSB* < Spawning Biomass Limit (RSB_{Lim}) RSB_{Lim}=20% unfished spawning biomass	Long-term	0.05	$P(RSB < RSB_{Lim})$ 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 relative spawning biomass at or above a biomass reference point ($RSB_{36\%}$) 50% or more of the time	*RSB*<Spawning Biomass Reference (RSB_{Thresh}) $RSB_{Thresh}=RSB_{36\%}$ unfished spawning biomass	Long-term	0.50	$P(RSB < RSB_{Thresh})$ 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

$$AAV_t = \frac{\sum_{t+1}^{t+9} |TCEY_t - TCEY_{t-1}|}{\sum_t^{t+9} TCEY_t}$$

$$AC_t = \frac{|TCEY_t - TCEY_{t-1}|}{TCEY_{t-1}}$$