IPHC Secretariat MSE Program of Work (2025) and an update on development of a Harvest Strategy Policy

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PURPOSE

To provide the SRB with an update of the IPHC Management Strategy Evaluation (MSE) and the Harvest Strategy Policy (HSP).

1 INTRODUCTION

Rapid investigation of different questions is possible with the fully developed MSE framework. The operating models (OMs) in this framework were conditioned using the 2022 stock assessment and will be reconditioned after the 2025 full stock assessment to reflect new understanding of the Pacific halibut population and fishery dynamics. Given that new OMs will be available in 2026, major investigations of Management Procedures (MPs) will be done after then. Checking for exceptional circumstances and investigations the effect of recruitment and weight-at-age on outcomes are presented. Additionally, a brief update on the development of a Harvest Strategy Policy (HSP) is provided.

2 EXCEPTIONAL CIRCUMSTANCES

Two exceptional circumstances are considered for inclusion in the HSP.

- The coastwide all-sizes FISS WPUE or NPUE from the space-time model is above the 97.5th percentile or below the 2.5th percentile of the simulated FISS index for two or more consecutive years.
- The realised coastwide mortality is above the 97.5th percentile or below the 2.5th percentile of the simulated realised coastwide mortality for two or more consecutive years.

Exceptional circumstances would be reviewed by the SRB to determine if one should be declared. In the event that an exceptional circumstance is declared, the following actions are to be completed. These actions have been recently updated to include how the Commission interacts with the process.

- Review the MSE simulations to determine if the OM can be improved and MPs should be re-evaluated.
- 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 with an updated OM.
- Present these recommendations to the Commission for a Commission recommendation whether to update the OM and re-evaluate the reference MP and alternative MPs.

- Further consult with the SRB and MSAB after simulations are complete to recommend a new MP to the Commission.
- Present these results to the Commission to identify whether a new MP is appropriate and the HSP should be updated.

Three quantities were examined for the years 2023 and 2024 since the OM was tuned to data through 2022. The observations from these years were compared to the simulations using an SPR=43% and a 30:20 control rule with an annual stock assessment. The observed coastwide NPUE from the space-time model in 2023 and 2024 was within the 95% prediction interval from the simulated coastwide FISS NPUE (Figure 1). The coastwide realised Total Mortality in 2023 and 2024 was within the 95% prediction interval from the simulated coastwide TM (Figure 2). Therefore, the exceptional circumstances are not triggered. Furthermore, the 95% prediction interval of spawning biomass from the ensemble stock assessment is within the projected 95% interval from the MSE simulations (Figure 3). Given these results, the simulations remain relevant, but there are a number of improvements to the understanding of Pacific halibut that make it useful to recondition the OM after the upcoming full stock assessment.

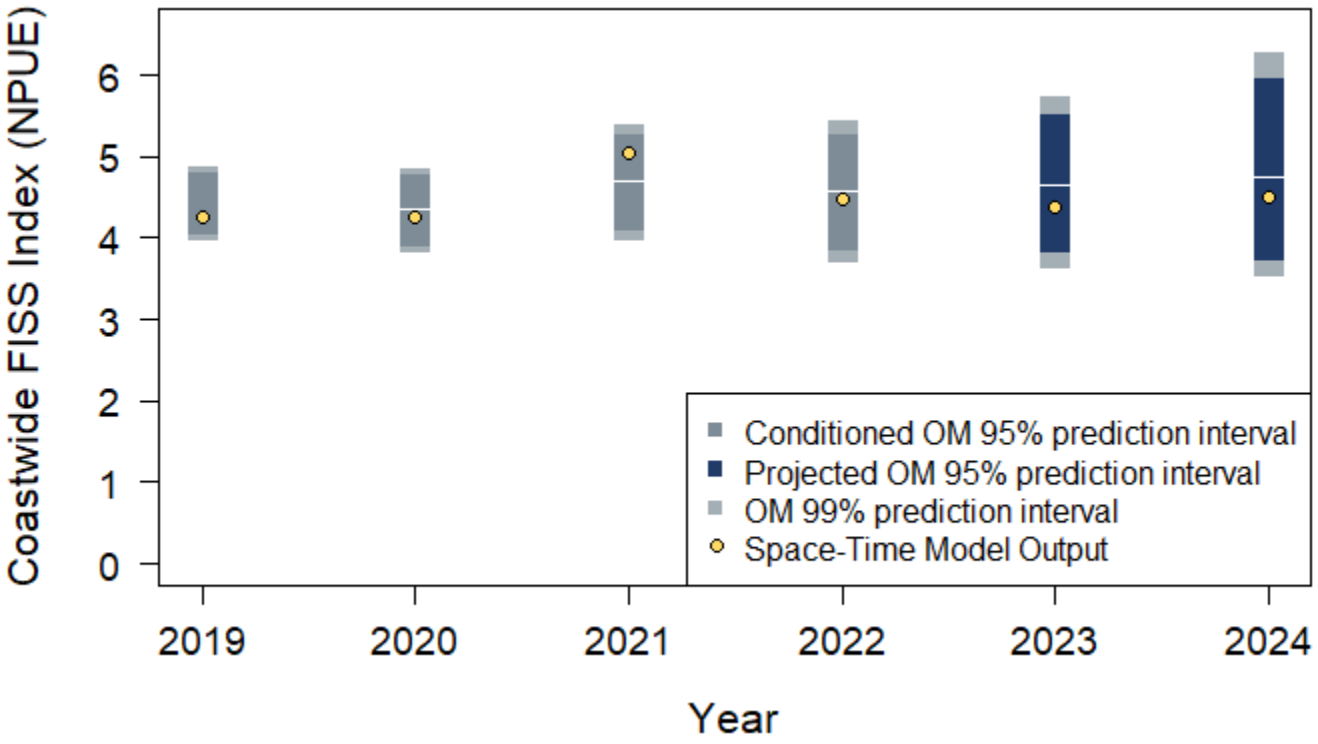

Figure 1. Simulated coastwide FISS NPUE (blue) from MSE simulations with an annual assessment, SPR=43%, and a 30:20 control rule. Space-time model output of FISS NPUE is shown in yellow.

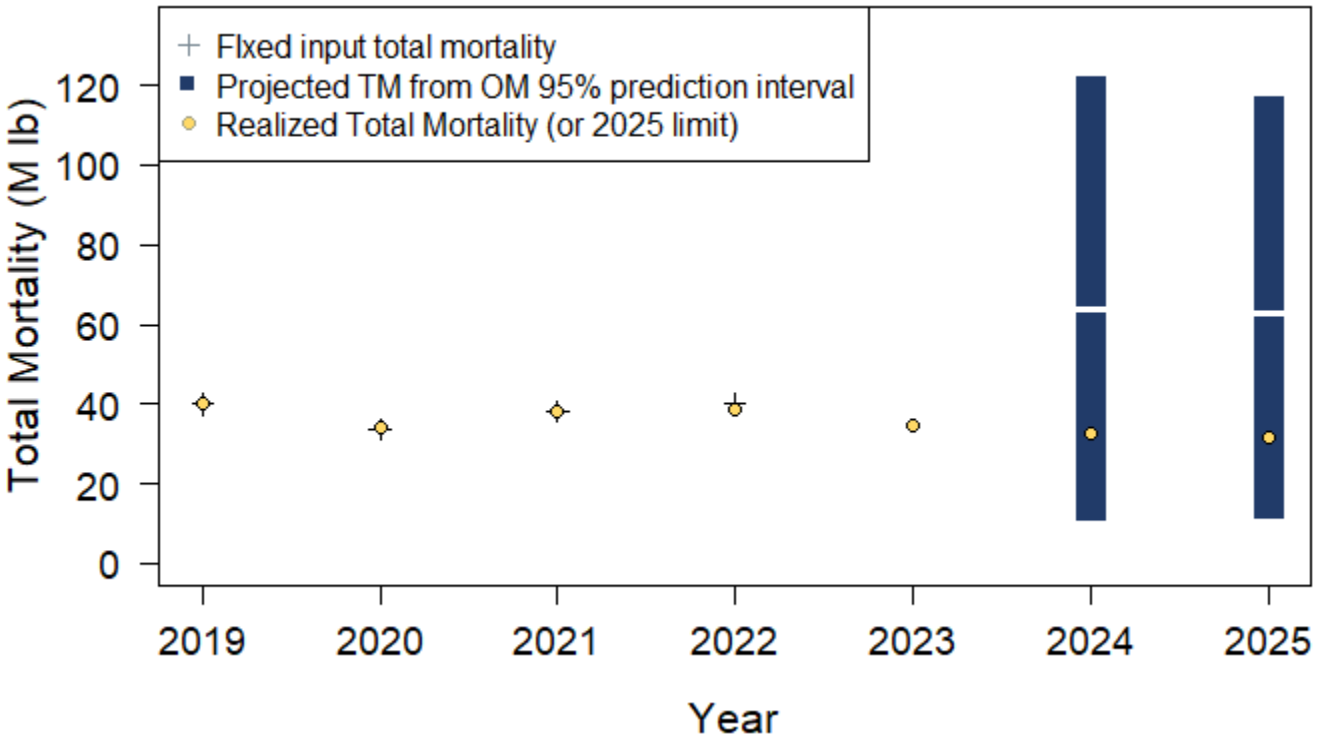

Figure 2. Simulated coastwide Total Mortality (TM, blue) from MSE simulations with an annual assessment, SPR=43%, and a 30:20 control rule. Realized TM is shown in yellow.

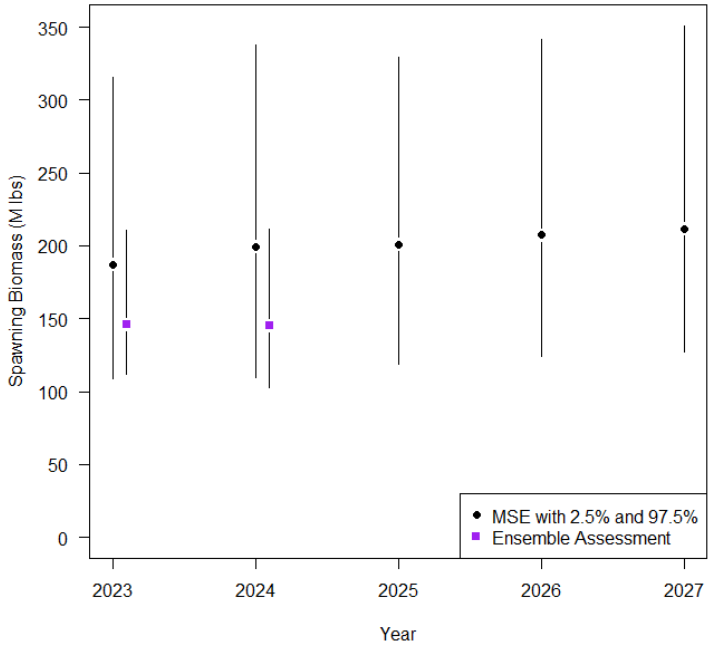

Figure 3. Simulated coastwide spawning biomass (blue) from MSE simulations with an annual assessment, SPR=43%, and a 30:20 control rule. Estimated spawning biomass with uncertainty from the ensemble assessment is shown in magenta.

3 EFFECTS OF WEIGHT-AT-AGE AND RECRUITMENT REGIMES

Pacific halibut exhibit high variability in weight-at-age and recruitment. Over the past 100 years, the average weight of an age 12 Pacific halibut has ranged from below 20 pounds in recent years to near 40 pounds in the mid-1970's (Figure 4). In the last ten years, the weight of the oldest fish has been declining or stable, but the weight of younger fish has been increasing. Recruitment is variable as well, and 1987 was one of the largest recruitments on record, as estimated in both 'long' assessment models (Figure 5). The two "long time-series" models in the IPHC stock assessment (IPHC-2025-SA-01) estimated a link between the Pacific Decadal Oscillation (PDO, Mantua et al. (1997)) and average unfished equilibrium recruitment (R_0), with an estimated average recruitment more than 50% greater during a positive PDO . Previous analyses (Clark and Hare 2002; Stewart and Martell 2016) have also shown that a positive PDO phase is correlated with enhanced productivity, while productivity decreases in negative PDO phases. Although the PDO is strongly correlated with historical recruitments, it is unclear whether the effects of climate change and other recent anomalous conditions in both the Bering Sea and Gulf of Alaska are comparable to those observed in previous decades (Litzow et al. 2020).

To investigate the effects of these low and high weight-at-age and recruitment regimes, different scenarios were defined from past observations and the population was projected 70 years with an SPR of 43%, assuming constant weight-at-age and average recruitment defined by the scenario. Three levels were developed for weight-at-age: low weight-at-age was defined from a five-year period in the 2010s, high weight-at-age was defined from a five-year period in the 1970s, and current weight-at-age was defined as the most recent five-years (Figure 4). These three weight-at-age levels show different patterns and although the low weight-at-age and current weight-at-age scenarios were both low in general, they differed between the weight of young fish and older fish. The current weight-at-age scenario had larger young fish but smaller older fish. High and low recruitment regimes were defined based on the stock assessment estimates of average recruitment in positive and negative PDO regimes. The PDO also affects movement and distribution of newly recruited (age-0) Pacific halibut. Overall, there were six scenarios crossing current, low, and high weight-at-age with low and high PDO.

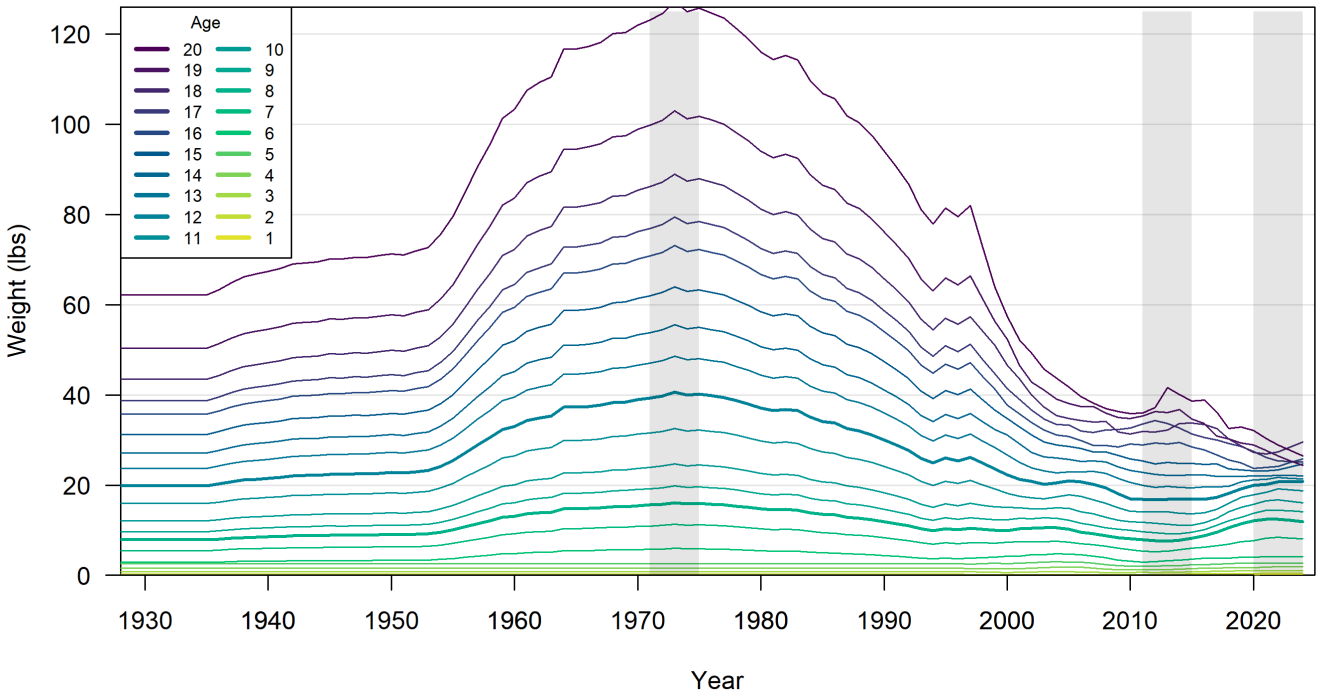

Figure 4. Average historical weight of Pacific halibut for ages one to twenty. Gray bands show three blocks of five years classified as high (1970s), low (2010s) and current (recent).

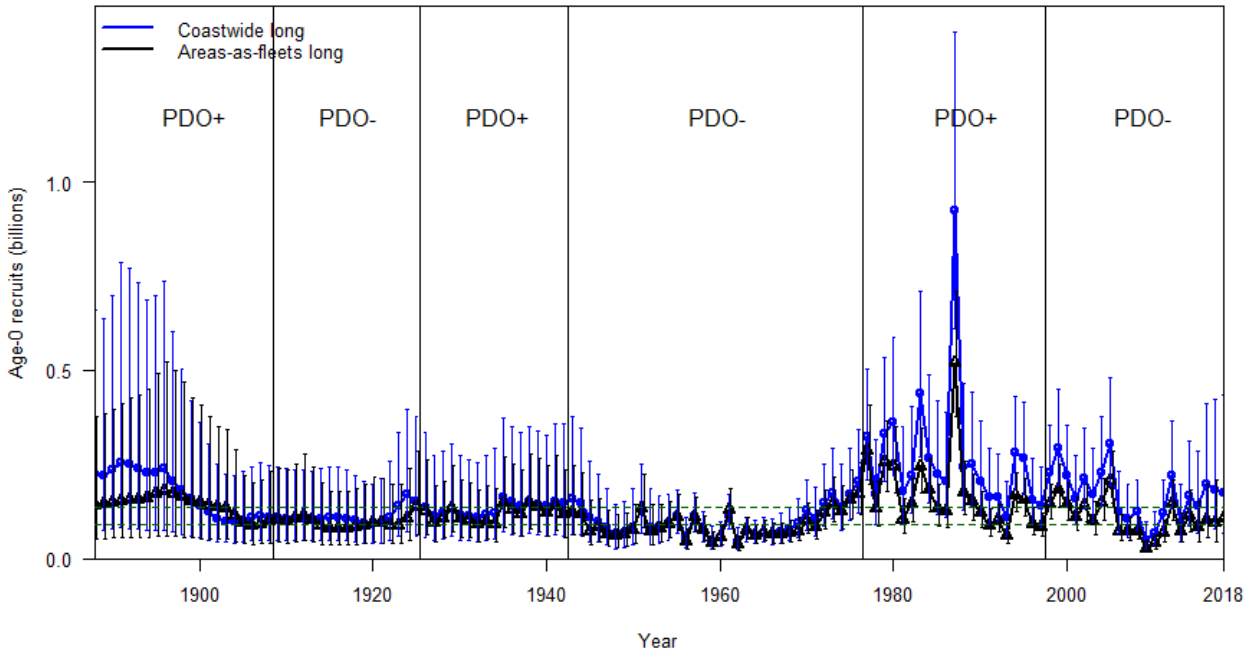

Figure 5. Trend in historical recruitment strengths (by birth year) estimated by the two long time-series stock assessment models, including the effects of the Pacific Decadal Oscillation (PDO) regimes. Figure reproduced from IPHC-2025-SA-01.

The spawning biomass differed substantially across different scenarios, but the high weight-at-age scenarios showed a considerable higher spawning biomass than the others (Figure 6). The sudden increase in the spawning biomass when the projections began indicates that weight-at-age is an important driver to the spawning biomass in the current year and future years. Average recruitment had a significant effect as well, but affected the spawning biomass in the longer term since the fish must age into the spawning biomass and was more prevalent with higher weight-at-age. For a given recruitment regime, the current weight-at-age scenario resulted in a smaller spawning biomass than the low weight-at-age scenario. This indicates the importance of the older fish in the spawning biomass.

Simulated TCEYs showed the same pattern for high weight-at-age, but different patterns for low and current weight-at-age scenarios. Weight-at-age and recruitment both had a profound effect on the TCEY with the high weight-at-age and high recruitment scenario supporting TCEYs near 120 Mlb and the high weight-at-age and low recruitment scenario supporting TCEYs near 75 Mlb. The low and current weight-at-age scenarios resulted in TCEYs in the range of 30 to 60 Mlb, on average. The TCEY showed a different pattern in the low and current weight-at-age scenarios when compared to the spawning biomass. The TCEY was higher for the current weight-at-age scenario while the spawning biomass was higher for the low weight-at-age scenario. Young Pacific halibut are more influential to the TCEY than to the spawning biomass because some are selected by the fishery before they become mature.

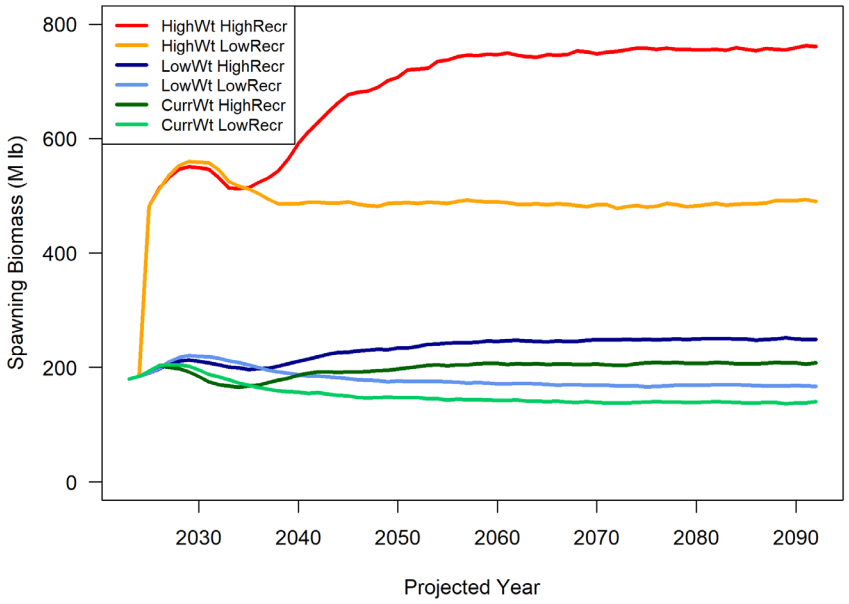

Figure 6. Simulated projections of spawning biomass assuming six different regimes for combinations of weight-at-age and recruitment and an SPR of 43%. Each projection held the weight-at-age and average recruitment at the defined level for all projected years.

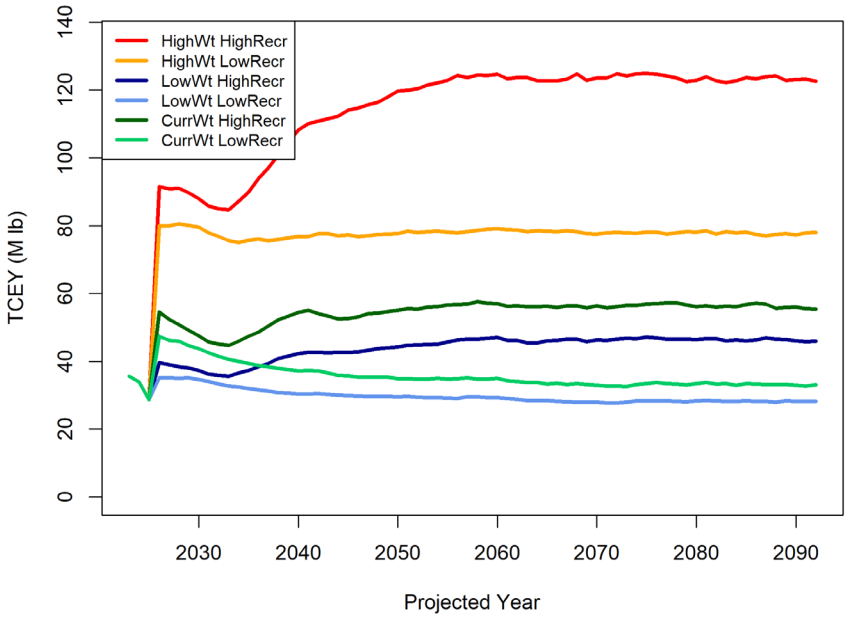

Figure 7. Simulated projections of the TCEY assuming six different regimes for combinations of weight-at-age and recruitment and an SPR of 43%. Each projection held the weight-at-age and average recruitment at the defined level for all projected years.

4 HARVEST STRATEGY POLICY (HSP)

A workshop with Commissioners occurred in April 2025 to discuss potential changes to the draft HSP and how to move it forward for adoption. Many edits were suggested and the next steps are for the Commission to review the edits, possibly hold another work session, consider a new draft at the Work Meeting, and move the HSP forward for adoption at the next Interim Meeting or Annual Meeting.

The hierarchical nature of the objectives was discussed at the workshop. In particular, the concepts of and trade-offs between the sustainability of the stock, maximising yield, and minimising yield were considered. Figure 8 shows the hierarchical nature of the objectives and new wording to identify how the trade-offs are considered.

A second important discussion was the inclusion of a timeframe for specific events such as stock assessments and re-evaluation of MPs. The IPHC currently operates off a schedule of three-years for full stock assessments, with update stock assessments in the intervening two years, and the MSE OM is updated following each full stock assessment to maintain consistent approaches and paradigms. Therefore, MPs are re-evaluated at a minimum of three years after implementation, and shall not exceed two cycles (six years as shown in Table 1). An exceptional circumstance may trigger a re-evaluation of the MP.

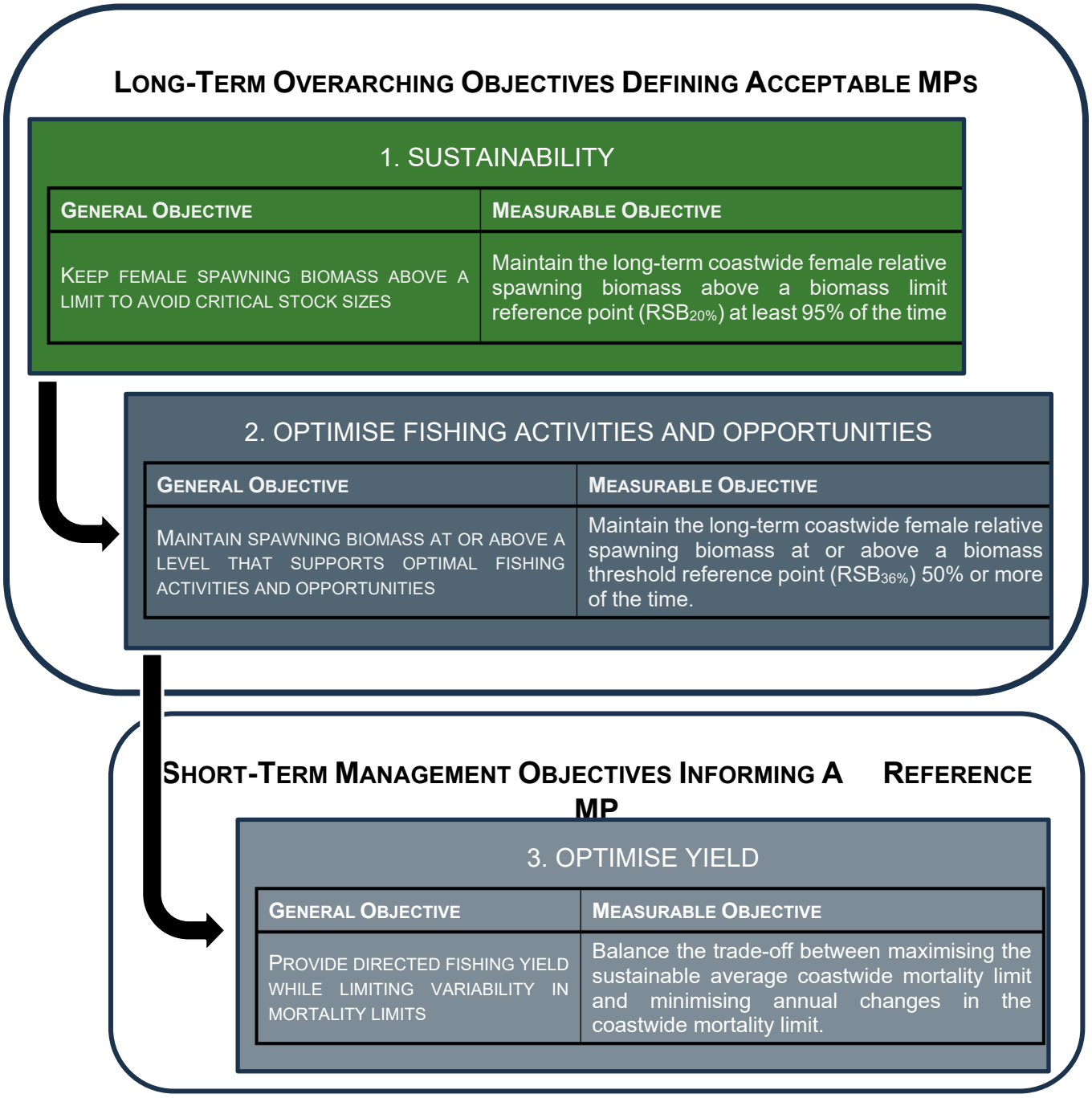

Figure 8. Priority objectives for the long-term sustainable management of Pacific halibut that support optimal yield and fisheries opportunities. The hierarchy of the objectives is shown by the arrows. The green colour indicates a conservation goal while the blue colours indicate fishery goals.

Table 1. Stock assessment, MSE, exceptional circumstances check, review, and decision processes on an annual basis. Year 1 could correspond to 2025, 2028, 2031, and so on. Upper case 'Y' indicates that the task is done, a lower case 'x' indicates that the task may be done. 'EC' refers to Exceptional Circumstance and 'FISS' to Fishery-Independent Setline Survey.

Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Example Year	2025	2026	2027	2028	2029	2030	2031	2032
FISS coastwide index	Y	Y	Y	Y	Y	Y	Y	Y
Full stock assessment	Y			Y			Y	
Update stock assessment		Y	Y		Y	Y		Y
Commission TCEY decision	Y	Y	Y	Y	Y	Y	Y	Y
MSE OM updated		Y			x			Y
MP re-evaluated		Y			x			Y
Exceptional circumstances checked	Y		Y	Y	x[1]	Y	Y	
- Consult with SRB and MSAB			x	x	x	x	x	
- Present to Commission			x	x	x	x	x	
- Re-evaluate MP due to EC			*	*	Y[2]	x*	x*	
Update HSP			x			x		

[1] The exceptional circumstance would be checked only if a new MSE OM was not updated.

[2] The MP would be re-evaluated as part of the normal three-year cycle due to an exceptional circumstance occurring in two sequential years.

* An exceptional circumstance can be declared after two sequential instances, thus re-evaluation of an MP would have a delay, unless recommended by the Commission outside of the normal process.

RECOMMENDATION/S

That the SRB:

1) **NOTE** paper IPHC-2025-SRB026-08 which details testing for exceptional circumstances, recent work done using the management strategy evaluation framework, and progress on the Harvest Strategy Policy.
2) **REQUEST** any topics to add to the 2025-2026 MSE Program of Work.

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