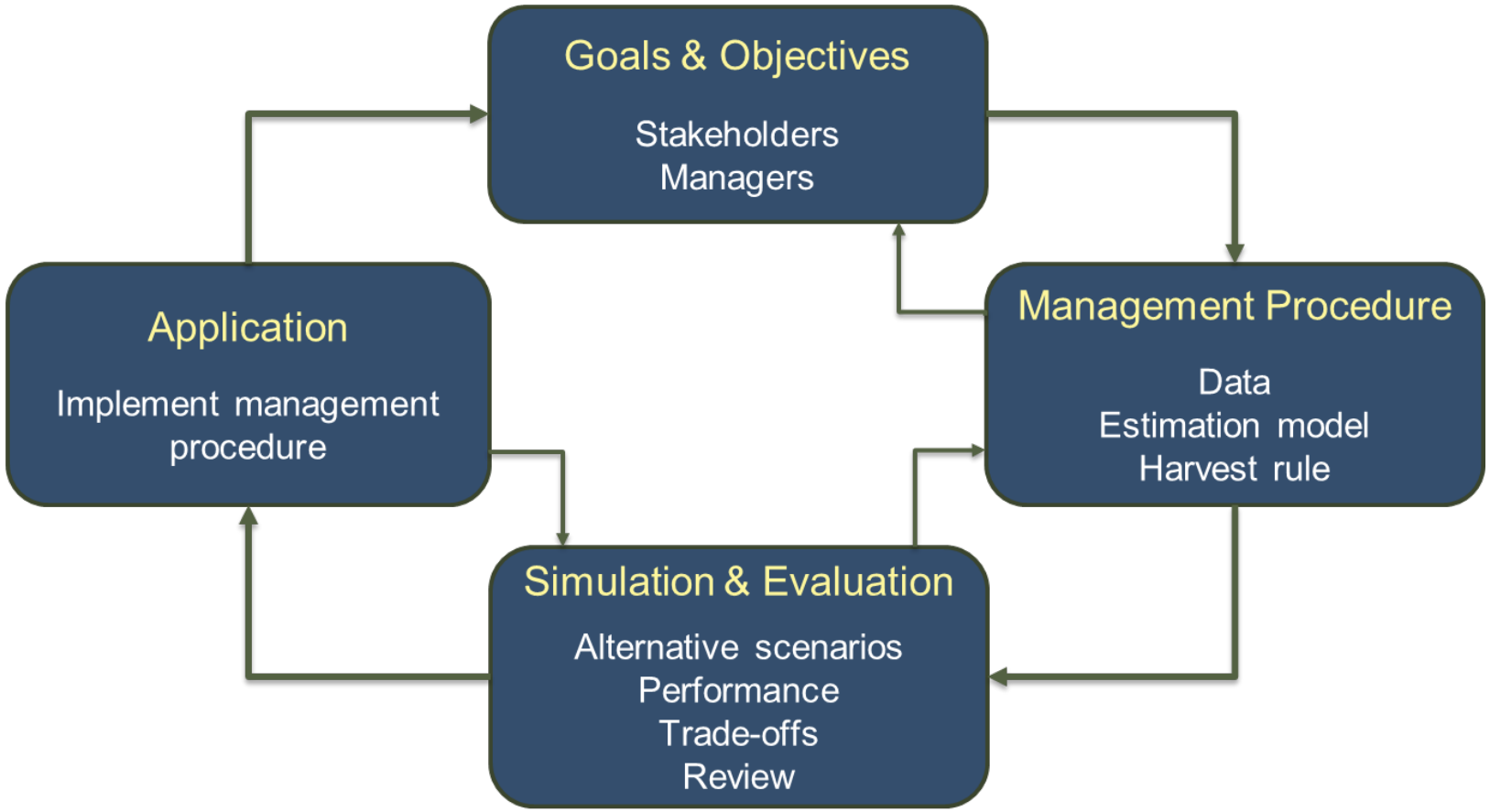
INTERNATIONAL PACIFIC HALIBUT COMMISSION

# IPHC Management Strategy Evaluation and Harvest Strategy Policy

Agenda item: 6.1
IPHC-2025-AM101-12
(A. Hicks , I. Stewart, D. Wilson)

# Management Strategy Evaluation (MSE)

a process to **evaluate** harvest strategies and develop a **management procedure** that is **robust** to **uncertainty** and **meets defined objectives**




**An important process informing the development and application of a Harvest Strategy Policy**

# Harvest Strategy Policy

A framework for applying a consistent and transparent science-based approach to setting mortality limits while ensuring sustainability

- 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,
- may increase 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.

The Harvest Strategy Policy along with the *1979 Protocol amending the Convention* provide the basis to manage risk to Pacific halibut fisheries and the Pacific halibut population

# Interim Harvest Strategy Policy

- IPHC has operated under an interim HSP for 8 years
  - Reference coastwide mortality limit using a reference SPR
    - Adopted a reference SPR=43% with support of the MSE framework
  - A 30:20 control rule reduces fishing intensity with RSB is less than 30%
- The interim HSP is not formally documented and endorsed by the Commission

# Chapter 1: What is a Harvest Strategy Policy?

- Encompasses the entire management process
- The decision framework necessary to achieve defined biological and economic objectives
  - Objectives and key principles
  - Reference points and other quantities
  - Processes for monitoring and assessing the biological and economic conditions of the Pacific halibut population
  - Pre-determined rules that adjust reference fishing mortality accordingly
    - These rules are referred to as harvest control rules or decision rules
    - The final decision may deviate from this “reference”

# Chapter 2: Objectives & Key Principles

**Priority Order**

a) Maintain Pacific halibut female spawning biomass, above a female spawning biomass limit where the risk to the stock is regarded as unacceptable (RSBLIM), at least 95% of the time;

b) Maintain Pacific halibut female spawning biomass, at least 50% of the time, at or above a threshold reference (fixed or dynamic) female spawning biomass that optimises fishing activities on a spatial and temporal scale relevant to the fishery;

c) Optimise average coastwide yield given the constraints above;

d) Limit annual changes in the coastwide mortality limit (TCEY) given the constraints above.

# Optimise average coastwide TCEY (objective c)

**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".*

- Optimise is vague and cannot be evaluated
  - Was originally chosen to provide flexibility during evaluation

- IPHC-2024-MSAB020-R (para. 14). The MSAB **RECOMMENDED** that
  - the Commission priority objective "optimise average coastwide TCEY" be changed to "maximise average coastwide TCEY" and that
  - this objective along with the variability in yield objective be given equal consideration to allow for the evaluation of trade-offs between these two objectives.

# Maximise average coastwide TCEY

## DECISION POINT

- Evaluate trade-offs between maximising the TCEY and minimising interannual variability in the TCEY
- Offers flexibility but requires discussion and justification

| General Objective | Measurable Objective |
|---|---|
| OPTIMISE YIELD | 3a) Maximise average coastwide TCEY while considering 3b. |
| | 3b) Minimise annual changes in the coastwide TCEY while considering 3a. |

# At or above $B_{36\%}$ (objective b)

- Relative Spawning Biomass was above 36% in 2024
  - Measuring the effect of fishing
- 2023 FISS & Commercial WPUE lowest observed since 1993
  - Affected by the weight-at-age, recruitment, and fishing
- Adopted coastwide TCEY less than that determined from the interim reference fishing intensity (SPR=43%) in 2023 and 2024

- Catch-rates and absolute biomass seem to be important, especially when they are low, and even though stock status is above $RSB_{36\%}$

# Working towards a potential new objective

- 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 $RSB_{36\%}$ 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 $RSB_{MEY}$, and
  - is an objective that is often important to fishery certification agencies

# Summary of objectives
## DECISION POINT

- Keep the current priority objectives
- Change “optimise yield” to “maximise yield”
- Set equal priority for “maximise yield” and “reduce interannual variability”

- Report an additional performance metric
  - Probability that the short-term Spawning Biomass is less than the Spawning Biomass in 2023

### Potential Commission objectives

1. Maintain the long-term coastwide female relative spawning biomass above a biomass limit reference point ($RSB_{20\%}$) at least 95% of the time
2. Maintain the long-term coastwide female relative spawning biomass at or above a biomass reference point ($RSB_{36\%}$) at least 50% or more of the time

3a. Maximise average coastwide TCEY

3b. Limit annual changes in the coastwide TCEY

*Objectives 3a and 3b are subject to evaluation after 1 and then 2 are met*

# Chapter 3: Development of the HSP

- Accounting for fishing mortality on all sizes and from all sources
- Variability in the environment and biological characteristics
- Monitoring standards
- Establishing and applying decision rules
- Balancing risk, cost and catch
- Reference points and proxies
- Technical evaluation
- Re-evaluating the HSP and MP

# Evaluation of Management Procedures

- Elements of MPs
  - Fishing intensity
    - SPR= various values between 35% and 63%
  - Assessment frequency and empirical management procedure
    - Annual
    - Biennial, Triennial
      - Non-assessment year: Change in TCEY proportional to recent change in FISS O32 WPUE
  - Constraints
    - 15% up/down
    - 15% up
  - FISS designs

- 30:20 control rule applied in all MPs
- Distribution of the TCEY is part of the decision-making process

https://apps.iphc.int/MSE-Explorer

# FISS Designs

- **Base Block**: sampling in all IPHC Regulatory Areas each year with rotation across charter regions to sample each, every 1-5 years
- **Core**: sample charter regions in IPHC Regulatory Areas 2B, 2C, 3A, & 3B. Other areas rarely surveyed.
- **Reduced Core**: sample a subset of higher catch-rate charter regions only in IPHC Regulatory Areas 2B, 2C, 3A, and 3B. Other areas rarely surveyed.

- Used space-time model and assessment simulations to determine assumptions of uncertainty and bias

# Summary of FISS design evaluation

- Lower TCEY and higher interannual variability with core and reduced core designs
- With an SPR of 43%
  - Median TCEY declined by 450,000 lbs moving to core design and another 450,000 lbs moving to reduced core.
  - At US$6.00/lb that equates to US$2.7 million reduction for each 450,000 lbs
  - Similar declines with SPR=52%
- There is a non-economic value to the FISS
  - Used when making decisions
  - Comparing to fishery-dependent trends
  - Better understanding of the population demographics, trends, and biology

# Assessment Frequency and SPR

- No conservation concern
- An SPR near 40% would result in a median RSB near 36%
- TCEY reduced about 1.3 Mlbs with an SPR increase of 1%
- Interannual variability in the TCEY minimised at $F_{SPR=46\%}$ and $F_{SPR=49\%}$
- Increase in median TCEY with Triennial
- Reduced interannual variability in the TCEY with Triennial
- Greater than 1 in 3 chance that SB will be less than $SB_{2023}$ for SPR=46%

Using FISS Base Block Design

| Assessment Frequency | Annual | | | | |
|---|---|---|---|---|---|
| SPR (%) | 40 | 43 | 46 | 49 | 52 |
| P(RSB<20%) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| P(RSB<36%) | 0.453 | 0.247 | 0.090 | 0.014 | 0.001 |
| Median TCEY | 64.26 | 60.11 | 56.08 | 52.03 | 47.87 |
| AAV | 25.3% | 24.2% | 23.5% | 23.5% | 23.7% |
| | | | | | |
| Short-term P(SB < $SB_{2023}$) | 0.490 | 0.428 | 0.362 | 0.316 | 0.282 |

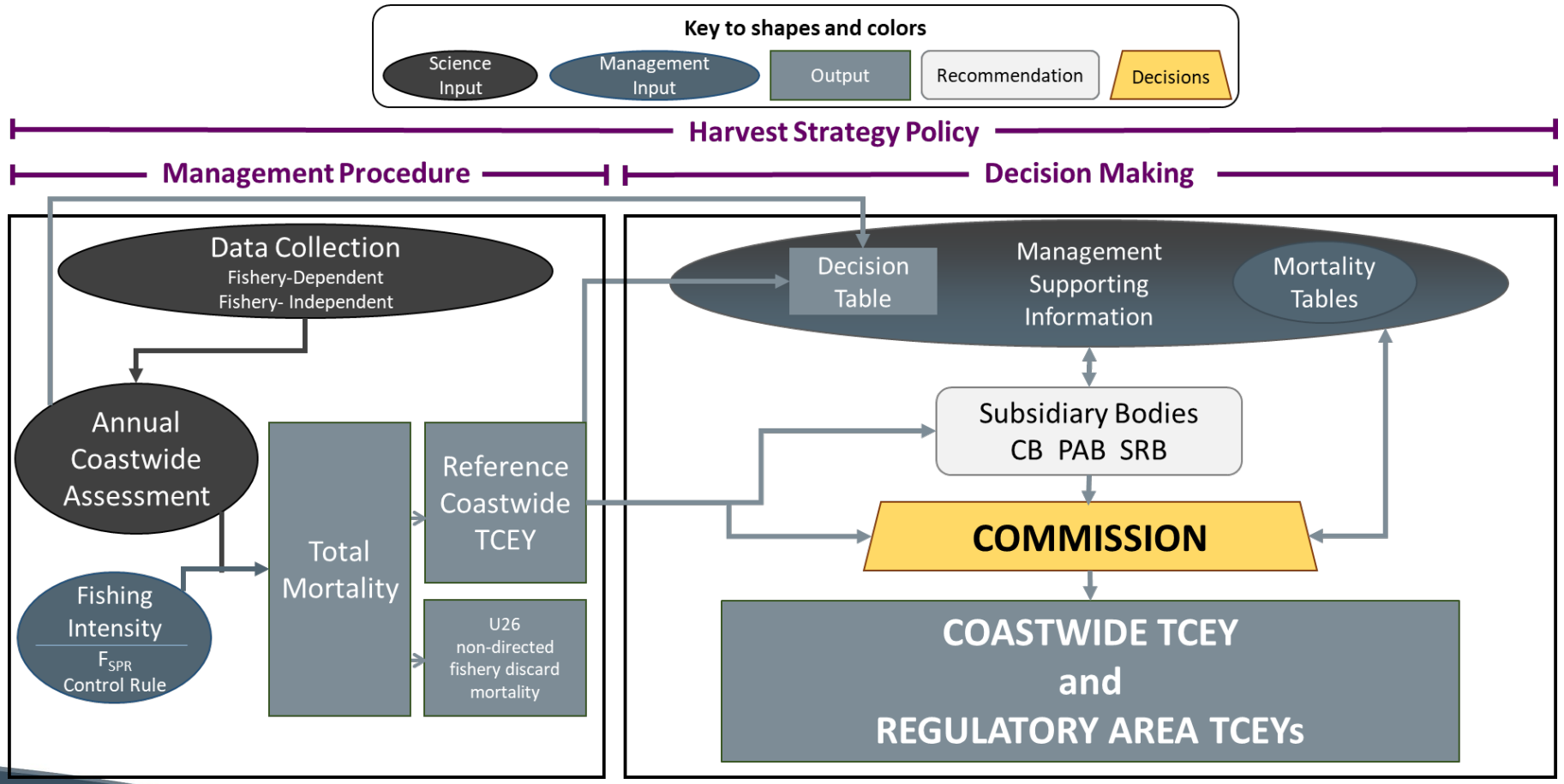
| Assessment Frequency | Triennial | | | | |
|---|---|---|---|---|---|
| SPR (%) | 40 | 43 | 46 | 49 | 52 |
| P(RSB<20%) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| P(RSB<36%) | 0.473 | 0.288 | 0.134 | 0.053 | 0.009 |
| Median TCEY | 65.50 | 61.04 | 56.96 | 53.57 | 49.11 |
| AAV | 20.7% | 20.1% | 20.0% | 20.5% | 21.0% |
| | | | | | |
| Short-term P(SB < $SB_{2023}$) | 0.510 | 0.484 | 0.394 | 0.340 | 0.292 |

# Chapter 4: Applying the HSP

- Coordinated management of domestic stocks
- Coordinated management of international stocks
- Stock assessment
- Coastwide mortality limit
- Rebuilding the stock if overfished
- Mortality limits for each IPHC Regulatory Area
- Stakeholder and scientific input
- Annual process

# Ch4: Mortality limits for each IPHC Regulatory Area

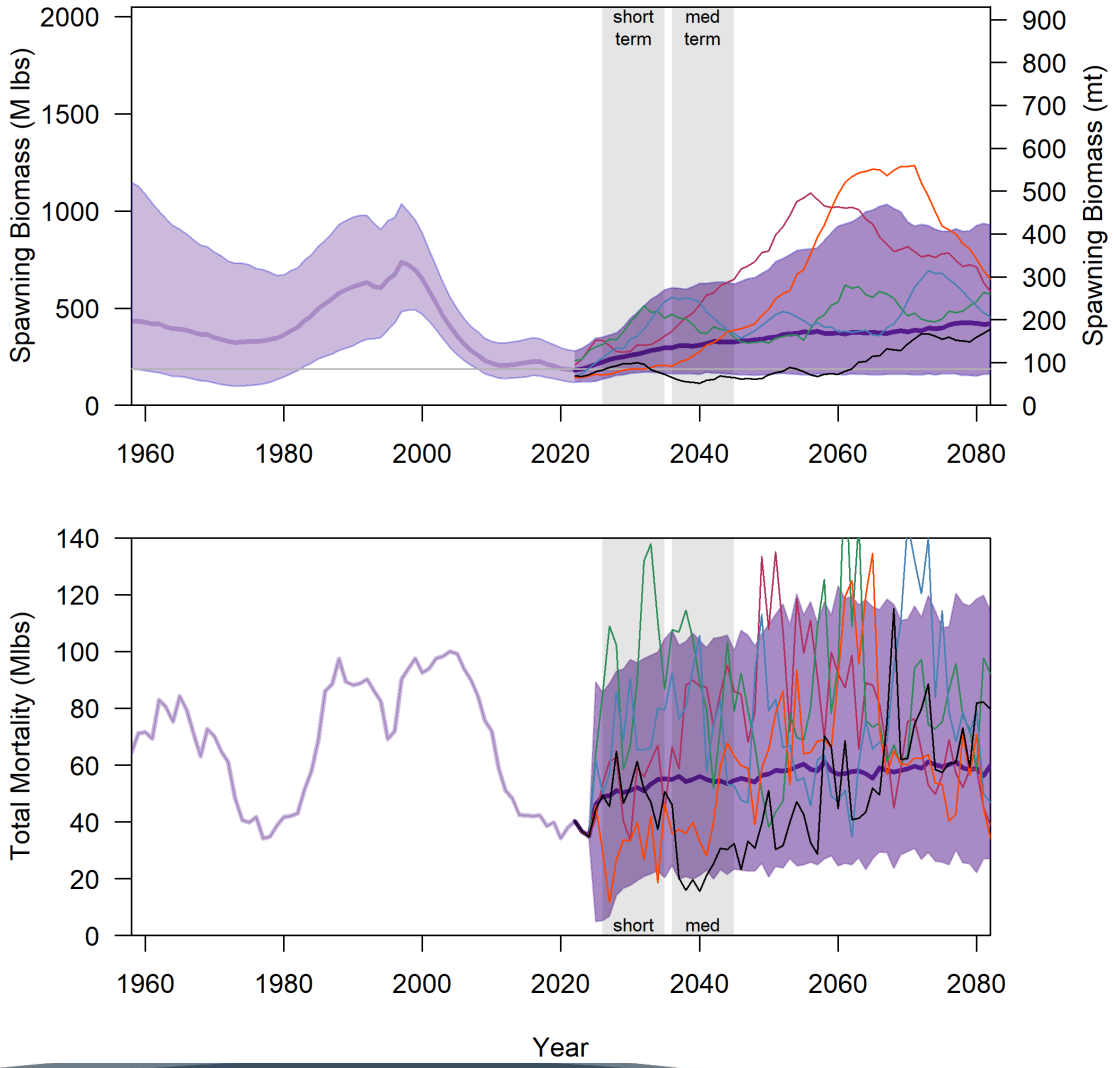
- Final output before domestic management is applied
- Commission decision with the input of management supporting information



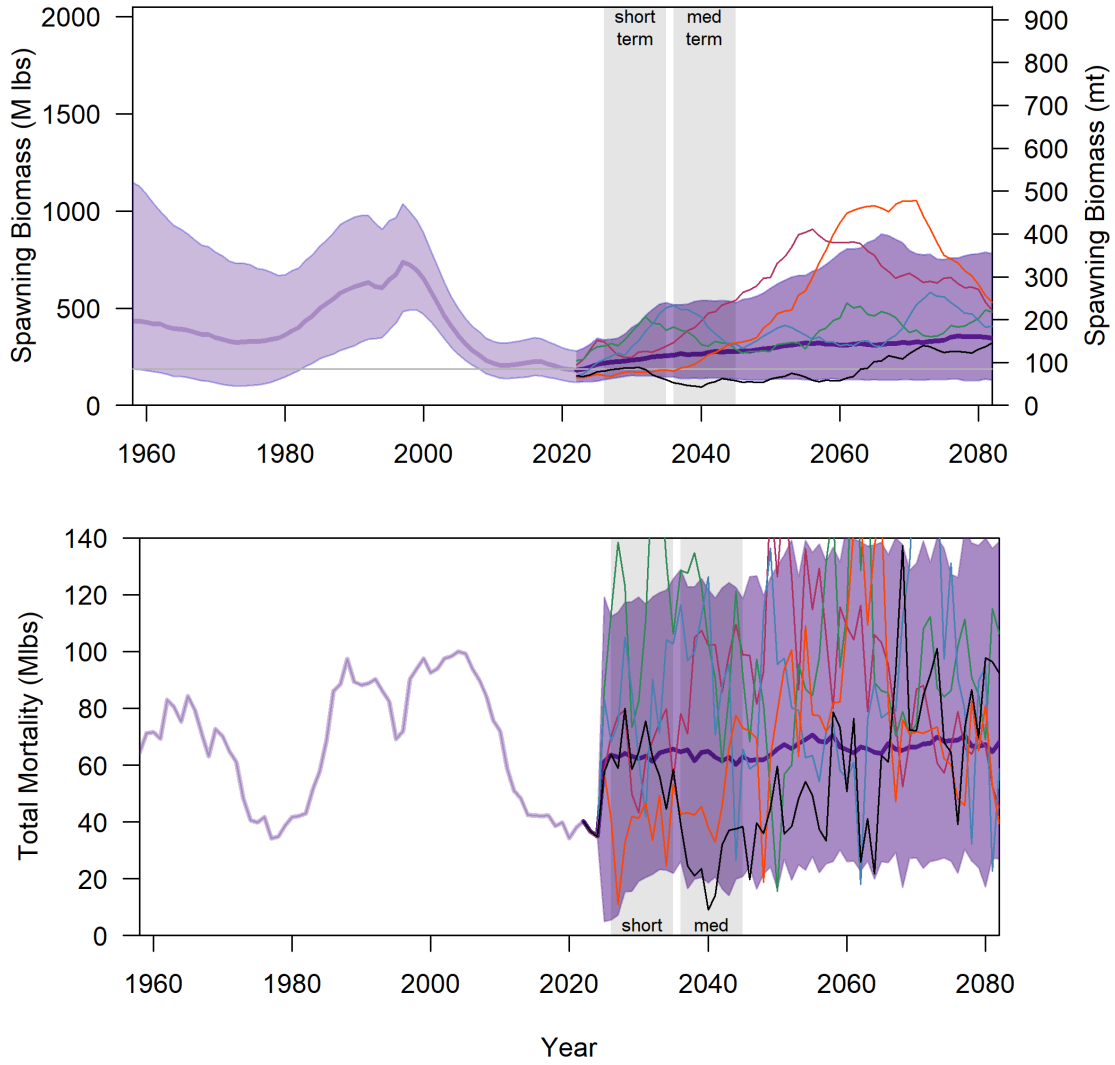
# Trace Plots

https://apps.iphc.int/MSE-Explorer/

## SPR = 51%




## SPR = 43%



# Harvest Strategy Policy Table

| 2025 Alternative | No Directed | | Status quo -25% | Status quo -15% | Status quo -10% | Status quo -5% | Status quo | SPR 46% | 3-Year Surplus | Status quo +10% | Reference 43% | MEY Proxy | MSY proxy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fixed Input SPR** | **No Directed** | **63** | **55** | **51** | **50** | **48** | **47** | **46** | **45** | **44** | **43** | **40** | **35** |
| | | | | | | | | | | | | | |
| **Long-term Metrics** | | | | | | | | | | | | | |
| **P(RSB < 20%)** | | | | <0.001 | | | | | | | <0.001 | | |
| **P(RSB < 36%)** | | | | 0.003 | | | | | | | 0.250 | | |
| P(long-term SB < SB2023) | | | | 0.178 | | | | | | | 0.272 | | |
| **Short-term Metrics (2028-2037)** | | | | | | | | | | | | | |
| **Median TCEY** | | | | 49.24 | | | | | | | 60.11 | | |
| **Median AAV** | | | | 23.7% | | | | | | | 24.2% | | |
| P(short-term SB < SB2023) | | | | 0.290 | | | | | | | 0.428 | | |
| 5th-95th% TCEY | | | | (21.3-85.8) | | | | | | | (25.4-107.2) | | |

# Harvest Strategy Policy Table

| 2025 Alternative | No Directed | | Status quo -25% | Status quo -15% | Status quo -10% | Status quo -5% | Status quo | SPR 46% | 3-Year Surplus | Status quo +10% | Reference 43% | MEY Proxy | MSY proxy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fixed Input SPR** | **No Directed** | **63** | **55** | **51** | **50** | **48** | **47** | **46** | **45** | **44** | **43** | **40** | **35** |
| | | | | | | | | | | | | | |
| **Long-term Metrics** | | | | | | | | | | | | | |
| **P(RSB < 20%)** | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| **P(RSB < 36%)** | 0.000 | 0.000 | 0.000 | 0.003 | 0.005 | 0.034 | 0.057 | 0.090 | 0.130 | 0.190 | 0.250 | 0.453 | 0.711 |
| P(long-term SB < SB2023) | 0.000 | 0.082 | 0.136 | 0.178 | 0.182 | 0.204 | 0.224 | 0.230 | 0.240 | 0.250 | 0.272 | 0.308 | 0.358 |
| **Short-term Metrics (2028-2037)** | | | | | | | | | | | | | |
| **Median TCEY** | 3.65 | 34.33 | 43.96 | 49.24 | 50.63 | 53.39 | 54.68 | 56.08 | 57.48 | 58.84 | 60.11 | 64.26 | 71.53 |
| **Median AAV** | 5.3% | 27.5% | 24.4% | 23.7% | 23.6% | 23.4% | 23.3% | 23.5% | 23.4% | 23.9% | 24.2% | 25.3% | 29.3% |
| P(short-term SB < SB2023) | 0.064 | 0.154 | 0.242 | 0.290 | 0.302 | 0.334 | 0.352 | 0.362 | 0.386 | 0.416 | 0.428 | 0.490 | 0.594 |
| 5th-95th% TCEY | (3.0-4.3) | (15.2-58.8) | (19.0-76.2) | (21.3-85.8) | (22.0-88.3) | (22.9-93.6) | (23.4-96.4) | (23.8-99.1) | (24.3-101.8) | (24.9-104.6) | (25.4-107.2) | (26.4-115.7) | (28.9-128.3) |

- The SPR is fixed and TCEY is determined
- Short-term metrics are 4-13 years into the future
- The OM is conditioned to 2022 stock assessment

- Additional uncertainty is included
- Weight-at-age and recruitment are unknown
- Best for comparison rather than prediction

# MSAB Recommendation

DECISION POINT

**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 reference 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.

**Justification**

- 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 long-term, and
- result in lower interannual variability

| 2026 | 2027 | 2028 | 2029 |
|---|---|---|---|
| AM102 | AM103 | AM104 | AM105 |
| Stock Assessment | FISS O32 | FISS O32 | Stock Assessment |

# Updating the Harvest Strategy Policy

- Updates may be based on decisions at AM101
  - Decisions to update current draft
- Updates may occur as more information is obtained
  - Commission decisions are reflected in future updated Harvest Strategy Policy
  - May be useful to define a process for these updates
- Updates may occur if there is an Exceptional Circumstance
  - MSE simulations are not reflective of realised observations and additional analyses are done
    1. 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
    2. The realised coastwide total fishing mortality falls above the 97.5th percentile or below the 2.5th percentile of the simulated coastwide total mortality for two or more consecutive years

# Next Steps

DECISION POINT

**IM100-Rec.01 (para. 37)** *The Commission **RECOMMENDED** that the IPHC Secretariat continue to develop a way forward that would facilitate the Commission adoption of an HSP in 2025. This should involve presentations at AM101, a post-AM101 workshop involving the Secretariat, Commissioners, and key advisors, followed by a Special Session later in 2025 to adopt an HSP*

- This presentation at AM101
- Workshop in early 2025
- Special Session in 2025

# General MSE Recommendations

**That the Commission**

1) **NOTE** paper IPHC-2025-AM101-12
2) **RECOMMEND** adding a measurable objective related to absolute female spawning biomass under the general objective 2.1 “maintain spawning biomass at or above a level that optimizes fishing activities” to be included in the priority Commission objectives after, or in place of, the current biomass threshold objective.
3) **NOTING** that optimising yield remains a general objective of the Commission, **RECOMMEND** to redefine the measurable objective “optimise yield” to “maximise yield”, and evaluate this measurable objective equally with the measurable objective to minimise interannual variability in yield.
4) **RECOMMEND** updating the current interim reference MP with a new SPR value (currently 43%) and a longer period between stock assessments (currently annual).
5) **RECOMMEND** further MSE work to support modifications to the management procedure determining the reference coastwide TCEY.
6) **RECOMMEND** further MSE analyses to evaluate FISS designs and methods to present outcomes of these analyses.
7) **RECOMMEND** any updates and edits to the draft Harvest Strategy Policy
8) **RECOMMEND** further analyses to support the development of the harvest strategy policy
9) **RECOMMEND** dates for an HSP workshop and Special Session

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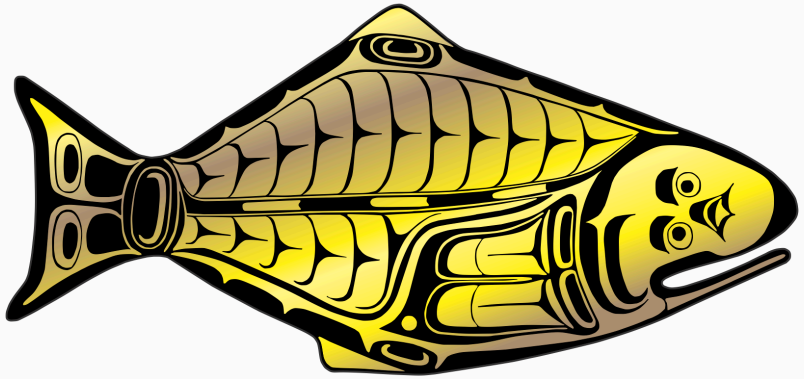

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