

INTERNATIONAL PACIFIC



HALIBUT COMMISSION

IPHC Management Strategy Evaluation and Harvest Strategy Policy

Agenda item: 6.1

IPHC-2024-IM100-12 - MSE

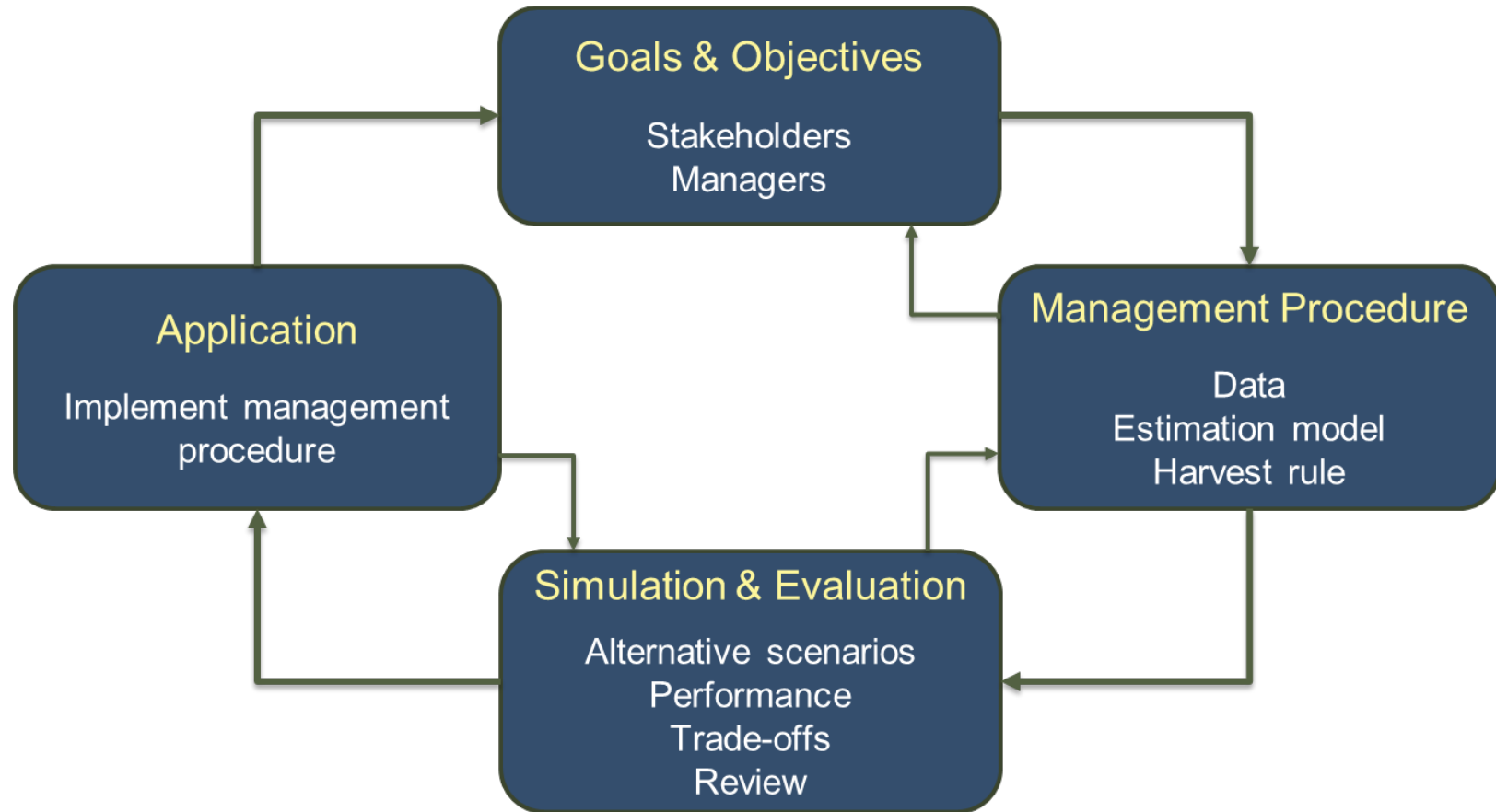
IPHC-2024-IM100-17 - HSP

(A. Hicks, I. Stewart, D. Wilson)



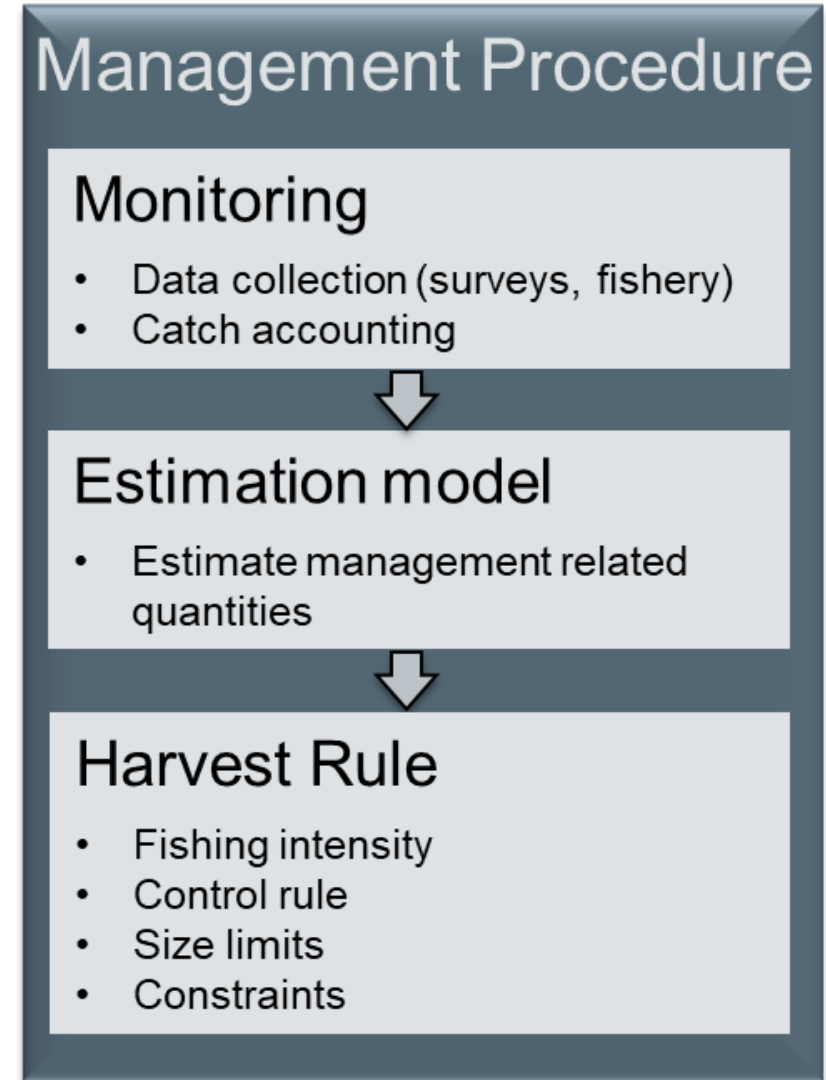
Management Strategy Evaluation (MSE)

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



Benefits of MSE

- Evaluate many different elements of MPs
 - Size limits
 - **Fishing intensity (i.e. SPR)**
 - **Assessment frequency**
- **Assist in the development a Harvest Strategy Policy**
- Meet requirements of certification agencies
 - Marine Stewardship Council
- Evaluate alternative monitoring strategies
 - **FISS designs**
- Examine scenarios
 - Environmental effects



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 *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
- The interim HSP is not formally documented and endorsed by the Commission
- Reference coastwide mortality limit using a reference SPR
 - Adopted a reference $SPR=43\%$ with support of the MSE framework



MSE activities in 2024

- Consider updating fishery objectives
 - **ID003**
- Evaluate MPs
 - **ID004**
- FISS design scenarios
 - **ID007**
- Draft Harvest Strategy Policy
 - **ID006**
- Consider exceptional circumstances
 - **ID005**

ID: Intersessional Decision ([IPHC Circular 2024-015](#))



Priority Goals and Objectives

MEASURABLE OBJECTIVE	MEASURABLE OUTCOME	TIME-FRAME
a) Maintain the long-term coastwide female spawning stock biomass above a biomass limit reference point ($B_{20\%}$) at least 95% of the time	$B < \text{Spawning Biomass Limit } (B_{Lim})$ $B_{Lim} = 20\%$ unfished spawning biomass	Long-term
b) Maintain the long-term coastwide female spawning stock biomass at or above a biomass reference point ($B_{36\%}$) at least 50% or more of the time	$B < \text{Spawning Biomass Reference } (B_{Thresh})$ $B_{Thresh} = B_{36\%}$ unfished spawning biomass	Long-term
c) Optimise average coastwide TCEY	Median coastwide TCEY	Short-term
d) Limit annual changes in the coastwide TCEY	Median coastwide Average Annual Variability (AAV)	Short-term



Goals and objectives

- [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”.
- [IPHC-2024-SRB024-R](#), para 23. The SRB **RECOMMENDED** that **the Commission consider revising Objective b)** (from AM099–Rec.02) “Maintain the long-term coastwide female spawning stock biomass at or above a biomass reference point (B36%) 50% or more of the time” to utilise a lower percentile than the 50th (median) to reflect concerns associated with the implications of low CPUE for the fishery at the 36% target for relative spawning biomass. A lower percentile better captures the role of uncertainty in this performance measure.
- **IPHC-2024-ID003:** The Commission **RECOMMENDED** that:
 - a) the Secretariat work with the MSAB and SRB to explore a potential new coastwide objective that uses spawning biomass and/or fishery catch-rates to indicate the status of the resource, potentially replacing the current B36% objective;



Optimise average coastwide TCEY (objective c)

- 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

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

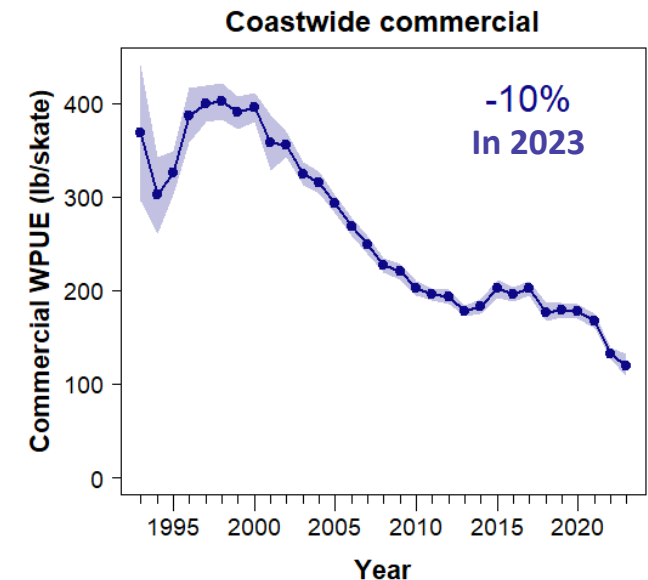
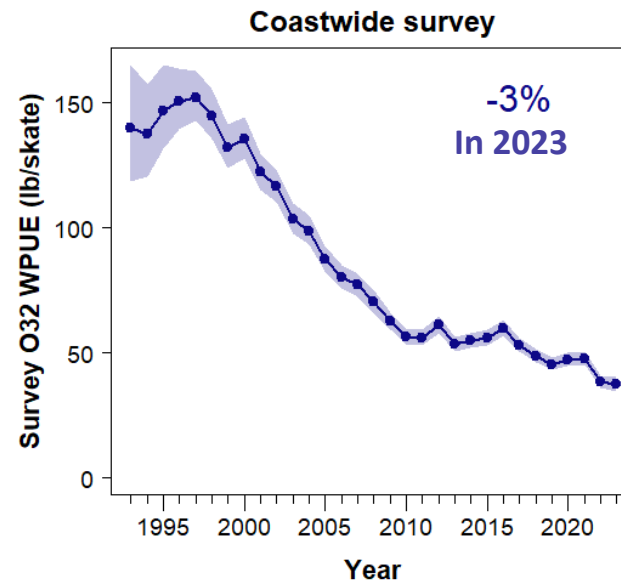
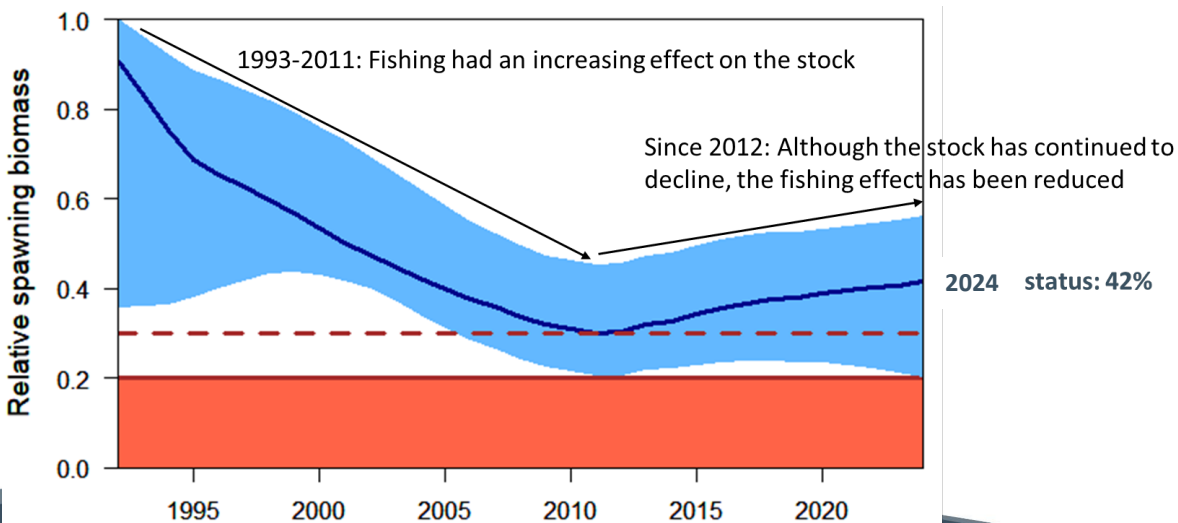
MEASURABLE OBJECTIVE	MEASURABLE OUTCOME	TIME-FRAME
3a) Maximise average coastwide TCEY while considering 3b.	Median coastwide TCEY	Short-term
3b) Minimise annual changes in the coastwide TCEY while considering 3a.	Median coastwide Average Annual Variability (AAV)	Short-term



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

2023 Stock Assessment Results

- 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



Important concepts for biomass objective

- Catch-rates and absolute biomass seem to be important, especially when they are low, and even though stock status is above $RSB_{36\%}$
- Threshold objective ($RSB_{36\%}$) can be met, even when catch-rates and absolute spawning biomass are low
- SPR=43% results in a long-term median RSB of 38.8%
- SPR=40% results in a long-term median RSB of 36.6%



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

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



Evaluation of Management Procedures

- Elements of MPs
 - Fishing intensity
 - SPR= 35%, 40%, 43%, 46%, 49%, 52%
 - Assessment frequency and empirical management procedure
 - Annual, Biennial, Triennial
 - Change in TCEY proportional to change in FISS O32 WPUE
 - Constraints
 - 15% up/down
 - 15% up
 - FISS designs
- Distribution of the TCEY is part of the decision-making process



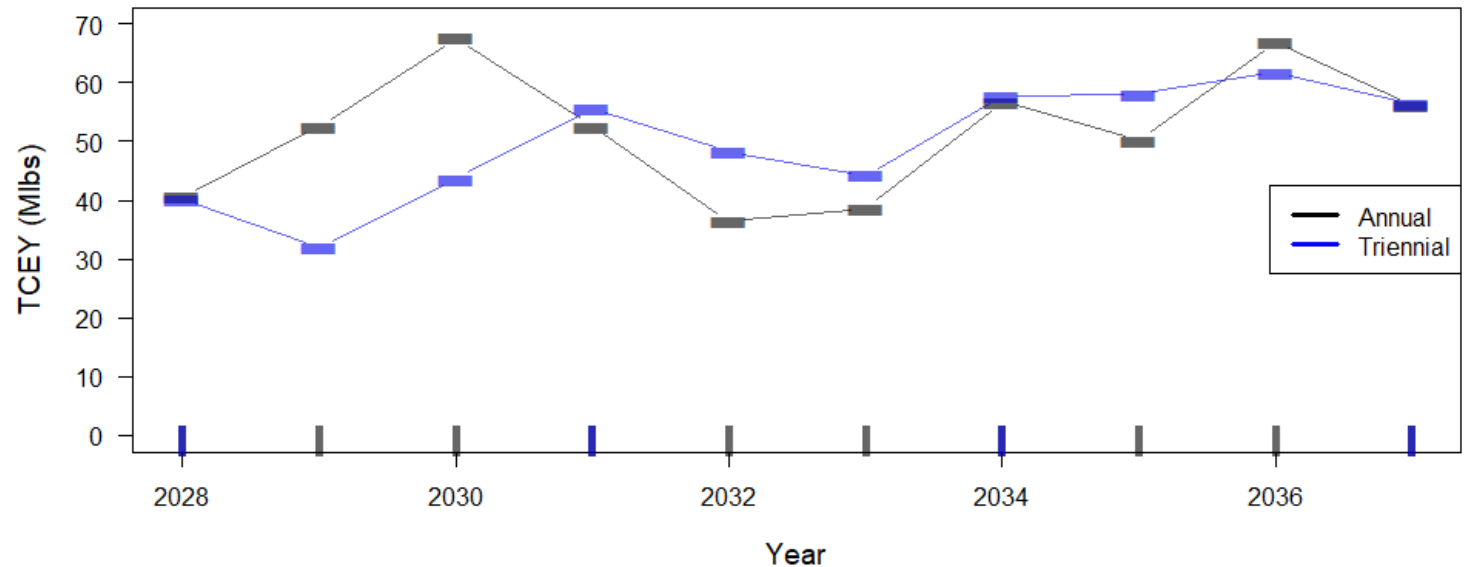
Empirical Rule in Non-Assessment Years

- Determine the reference coastwide TCEY without a stock assessment
- The reference coastwide TCEY changes in proportion with the FISS O32 WPUE

$$TCEY_{2025} = TCEY_{2024} \times \frac{WPUE_{2024}}{WPUE_{2023}}$$

- There are other options

Example TCEYs for Annual and Triennial assessment frequencies from the same simulation



Assessment Frequency and SPR

Using FISS Base Block Design

- No conservation risk
- P(RSB < 36%) passes for SPR>40%
- TCEY reduced about 4 Mlbs with an SPR increase of 3%
- Increase in median TCEY with Triennial
- Interannual variability in the TCEY reduced with Triennial
- Greater than 1 in 3 chance that SB will be less than SB₂₀₂₃ for SPR=46%

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



Constraint on the interannual change in TCEY

- No conservation risk
- Reduced $P(\text{RSB} < 36\%)$
- Reduced TCEY
- Reduced interannual variability

SPR=43% and Base Block FISS

Assessment Frequency	Annual		
	None	15% up/down	15% up
Constraint			
$P(\text{RSB} < 20\%)$	<0.001	<0.001	<0.001
$P(\text{RSB} < 36\%)$	0.2466	0.0506	0.0528
Median TCEY	60.11	49.51	51.55
AAV	24.2%	16.6%	16.7%
Short-term $P(\text{SB} < \text{SB}_{2023})$	0.428	0.316	0.314



Summary of MP evaluation

- No conservation concern across options investigated
- An SPR near 40% would result in a median RSB near 36%
- An increase in SPR of 1% (reduction in fishing intensity) resulted in an approximate 1.3 Mlbs decrease in TCEY
- Interannual variability in the TCEY increased at a faster rate for fishing intensities $F_{SPR=43\%}$ and greater
- A triennial assessment frequency increased the TCEY and reduced interannual variability in the TCEY
- A 15% constraint reduced the TCEY and interannual variability

<https://iphcapps.westus2.cloudapp.azure.com/MSE-Explorer/>



MSAB Recommendation

[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.

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 as noted in paragraph 26.

2026

AM102

Stock Assessment

2027

AM103

FISS O32

2028

AM104

FISS O32

2029

AM105

Stock Assessment



FISS Designs

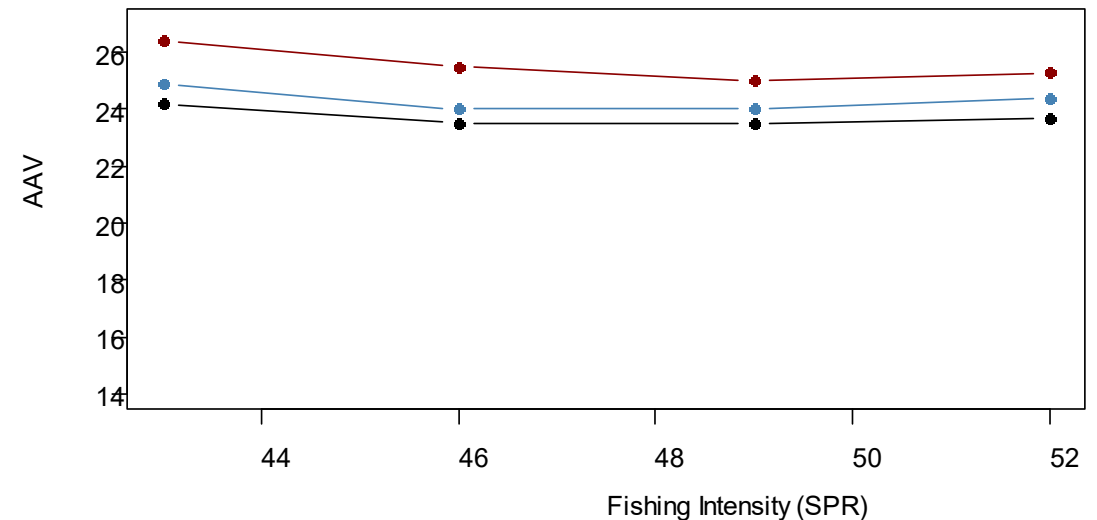
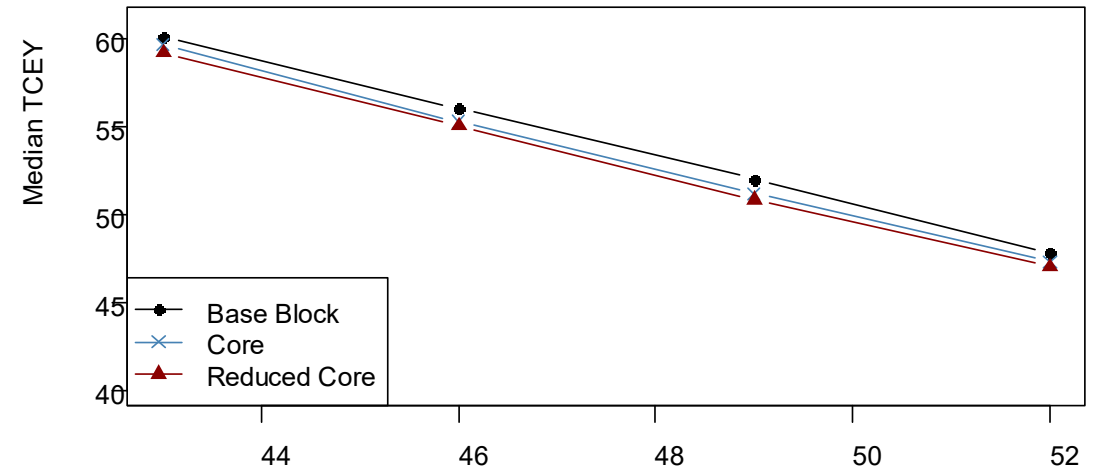
- **Base:** ideal sampling approach with random selection in all area
 - Not simulated here, but was assumed previously
- **Base Block:** sampling in all IPHC Regulatory Areas each year with rotation across charter regions to sample each, every 1-5 years
- **Core:** sample charter regions in IPHC Regulatory Areas 2B, 2C, 3A, & 3B. Other areas not surveyed
- **Reduced Core:** sample a subset of higher catch-rate charter regions only in IPHC Regulatory Areas 2B, 2C, 3A, and 3B
- Used space-time model and assessment simulations to determine assumptions of uncertainty and bias

The 2025 FISS design is a compromise between Base Block and Core designs and is not directly comparable



FISS design results

- No conservation concern
- $P(\text{RSB} < 36\%)$ slightly reduced with smaller designs
- TCEY reduced with smaller designs
- Interannual variability increased with smaller designs



Summary of FISS design evaluation

- Lower TCEY and higher interannual variability
- 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



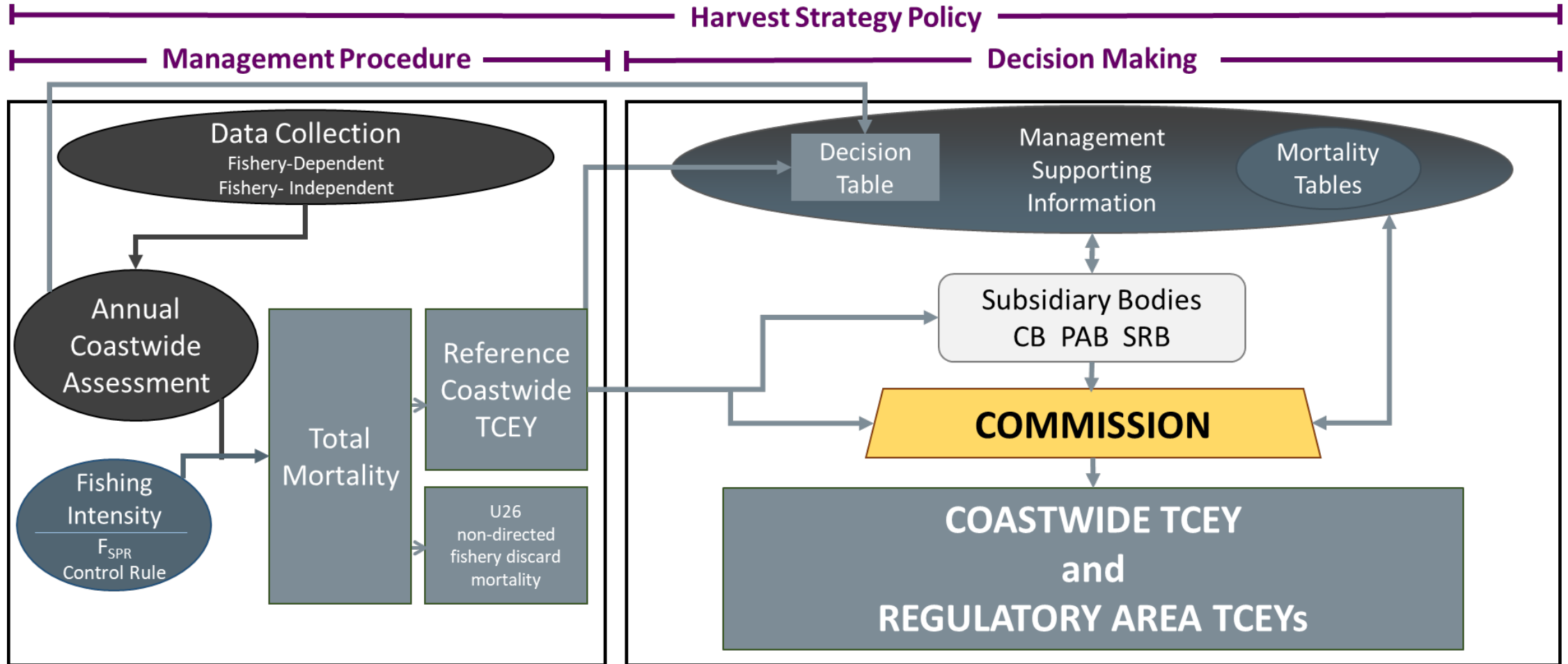
Draft Harvest Strategy Policy

- Four chapters
 - Introduction
 - Objectives and key principles
 - Development of the HSP
 - Applying the HSP

- Some sections may be updated
 - Goals and objectives
 - e.g. maximise yield
 - Any changes to the MP elements
 - e.g. SPR, assessment frequency, ...



Annual mortality limit setting process



Updating the Harvest Strategy Policy

- Updates may be applied before consideration at AM101
 - Decisions to update current draft
- Updates may occur as more information is obtained
 - Commission decisions are reflected in an 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*

Not yet included in HSP



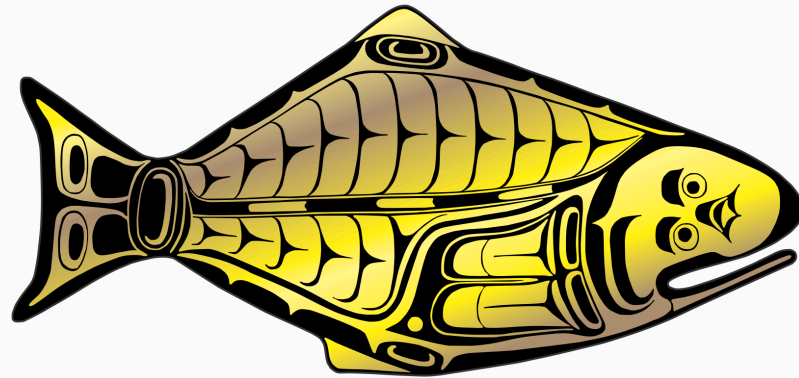
Recommendations

That the Commission

- 1) **NOTE** paper IPHC-2024-IM100-12 presenting recent MSE work including exceptional circumstances; goals and objectives; evaluating assessment frequency, a constraint and fishing intensity; and investigating the effects of reduced FISS designs.
- 2) **RECOMMEND** adding a measurable objective related to absolute 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) **RECOMMEND** redefining the optimise yield objective to maximise yield and to have equal priority with 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) **NOTE** the MSE results evaluating FISS designs when deciding on future FISS designs.
- 6) **RECOMMEND** further analyses to support the development of the Harvest Strategy Policy.
- 7) **RECOMMEND** any edits or modifications to the Harvest Strategy Policy.
- 8) **REQUEST** any further analyses to be provided at AM101.



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