INTERNATIONAL PACIFIC HALIBUT COMMISSION

MSE progress and development of a Harvest Strategy Policy

Agenda item: 4
IPHC-2024-MSAB020-06
(A. Hicks, I. Stewart, D. Wilson)

Outline

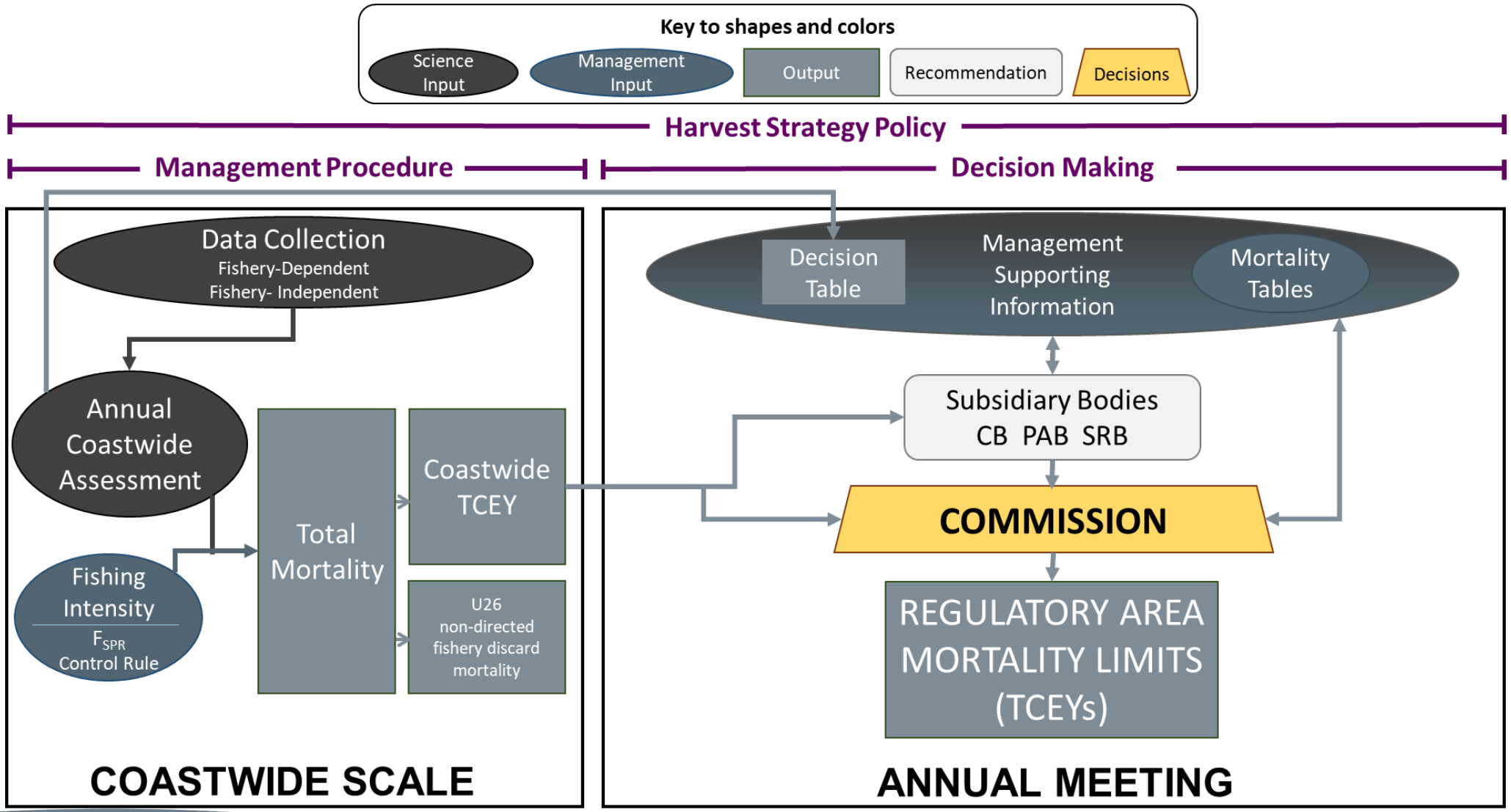
- Introduction to the Harvest Strategy Policy (HSP)
  - Agenda Item 5 will discuss this in more detail
- Goals and Objectives
- Management Procedures (MPs)
- FISS Designs
- Depensation scenario

Harvest Strategy Policy

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.).*

- Updated in the new draft Harvest Strategy Policy (HSP) available as info document IPHC-2024-SRB025-INF01

Harvest Strategy Policy



Draft Harvest Strategy Policy

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

- Some sections may be updated
  - Definition of overfishing
  - Goals and objectives
    - e.g. biomass threshold and optimizing yield
  - Any changes to the MP elements
    - e.g. SPR, assessment frequency, …

One Exceptional Circumstance

IPHC-2024-SRB024-R, para 25. ***RECALLING*** *paper IPHC-2024-SRB024-03, Appendix A, SRB023-Rec.08 (para. 27), the SRB* ***RECOMMENDED****:*

a) removing "exceptional circumstance" item c because the expected timeline of stock assessments and OM updates will automatically revise biological parameters and processes;

b) removing "exceptional circumstance" item b because:

- *even though the operating model is an adequate representation of the coastwide dynamics and is useful for development of a coastwide MP, additional work on the regional stock dynamics needs to be done to improve correspondence with regional observations;*
- *improving estimation of regional stock dynamics is a longer-term project that the Secretariat will continue to work on with input from the SRB;*
- *as per paragraph 21, the SRB suggests that the annual TCEY distribution should not be included in a MP.*

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

Additional Exceptional Circumstances

- **IPHC-2024-MSAB019-R, para. 53:** *The MSAB **NOTED** that the FISS is conducted to measure the population and that it may not be an accurate depiction of the fishery, and that fishery-dependent data may provide insights into fishery concerns that the FISS may not capture.*
- **IPHC-2024-MSAB019-R, para. 54:** *The MSAB **REQUESTED** that the SRB and Secretariat work together to consider different ways to incorporate fishery-dependent data into an exceptional circumstance.*

- A check that realised decisions are matching the MSE simulations

- Delineate between
  - changes in fishery-dependent data that fall within the scope of the MSE
    - Data reflecting population abundance, management measures in the MP, …

  and
  - those that are caused by management actions not reflective of dynamics modelled in the MSE
    - Changes in catch rates due to avoidance/targeting of other species, closed areas, …

Additional Exceptional Circumstance

- IPHC-2025-SRB025-R, para 30: The SRB **RECOMMENDED** adopting realised coastwide catch as a fishery-dependent indicator for testing exceptional circumstances. Realised coastwide catch each year can be compared to the projected distribution of future TCEY for that year to determine whether biological or management processes (e.g. decision variability) are leading to unexpected TCEY.

- Can compare:
  - Coastwide adopted TCEY to TCEY predicted from MSE simulations
  - Realized coastwide mortality compared to coastwide mortality from MSE simulations

- Would provide an indication that implementation variability and/or decision-making variability are not modelled well

Summary of Draft Harvest Strategy Policy

Timeline: Directives from WM2024

- Provide draft for MSAB020
- MSAB provide recommendation to Commission
- Commission discuss updated draft at IM100
- Commission to consider for endorsement at AM101

Priority Goals and Objectives

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	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 < Spawning Biomass Limit (B_{Lim}) B_{Lim}=20% unfished spawning biomass	Long-term	0.05	$P(B < B_{Lim})$ PASS/FAIL Fail if greater than 0.05
2.1 Maintain spawning biomass at or above a level that optimizes fishing activities	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<Spawning Biomass Reference (B_{Thresh}) $B_{Thresh}=B_{36\%}$ unfished spawning biomass	Long-term	0.50	$P(B < B_{Thresh})$ Fail if greater than 0.5
2.2. Provide Directed Fishing Yield	c) Optimize average coastwide TCEY	Median coastwide TCEY	Short-term		Median $\overline{TCEY}$
2.3. Limit Variability in Mortality Limits	d) Limit annual changes in the coastwide TCEY	Median coastwide Average Annual Variability (AAV)	Short-term		Median AAV

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.*

- 4th ad hoc meeting of the MSAB (IPHC-2024-MSAB020-INF01)
  - Met on 18 July 2024 to discuss objectives
  5. *The focus of the ad hoc working group is to explore potential new objectives to replace priority objective b) and c) that are consistent with recent decisions by the Commission to depart from the current interim harvest strategy using SPR=43%*

Optimize average coastwide TCEY (objective c)

- Optimize is vague and cannot be evaluated
  - Was originally chosen to provide flexibility during evaluation
- SRB recommended developing a quantifiable objective

- 4th ad hoc meeting of the MSAB
  12. *The objective "optimize yield" may include reducing interannual variability in yield*
  - Optimizing yield may include multiple factors such as high yields and low interannual variability

Discussion: Optimize average coastwide TCEY

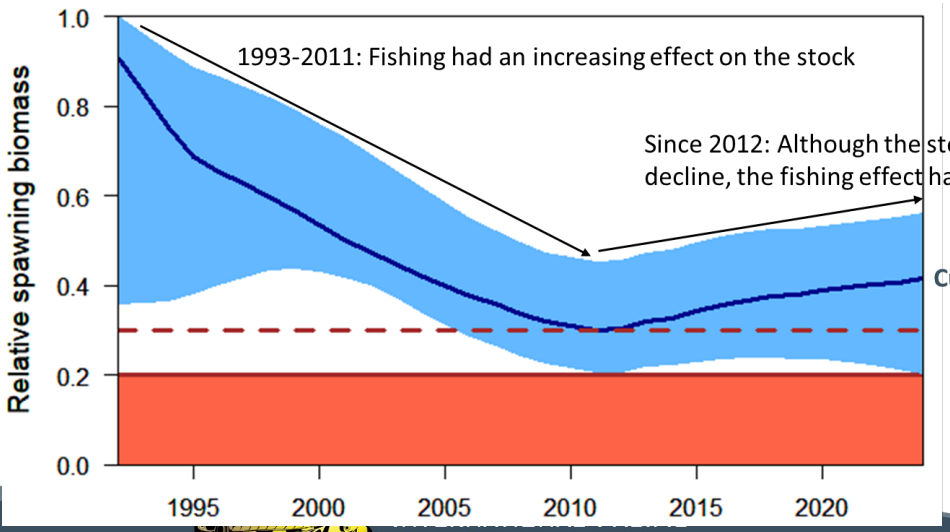
- Potential objective
  - Maximize subject to constraint (minimize AAV or AAV<XX%)
    - May result in prioritizing the variability over yield
  - Maintain TCEY above a specific value with a tolerance
    - And then may minimize the AAV
    - May find that the objective cannot be met

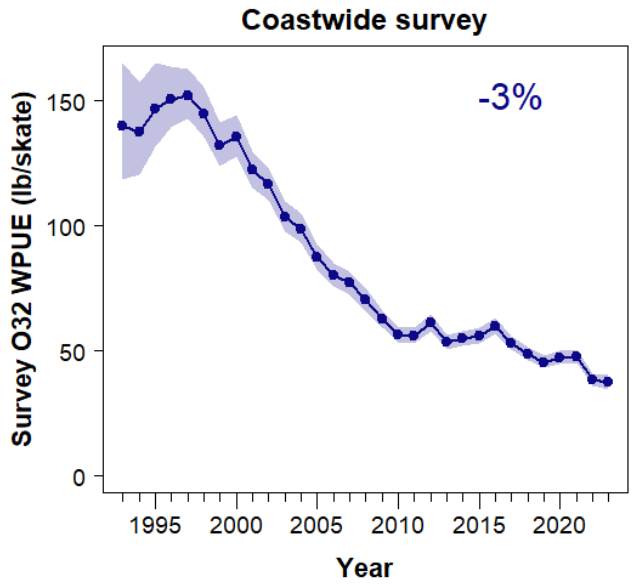
General Objective	Measurable Objective	Measurable Outcome	Time-frame	Tolerance	Performance Metric
2.2. Optimize Directed Fishing Yield	c) Maximize average coastwide TCEY relative to d)	Median coastwide TCEY	Short-term		Median $\overline{TCEY}$
	d) Minimize annual changes in the coastwide TCEY relative to c)	Median coastwide Average Annual Variability (AAV)	Short-term		Median AAV

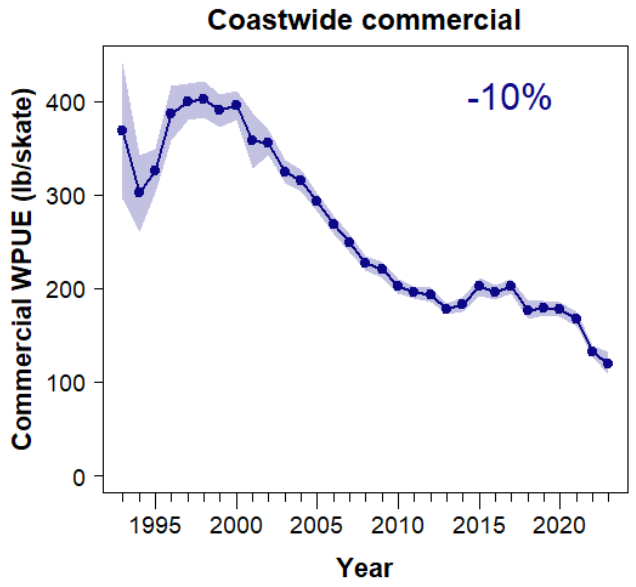
At or above $B_{36\%}$ (objective b)

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



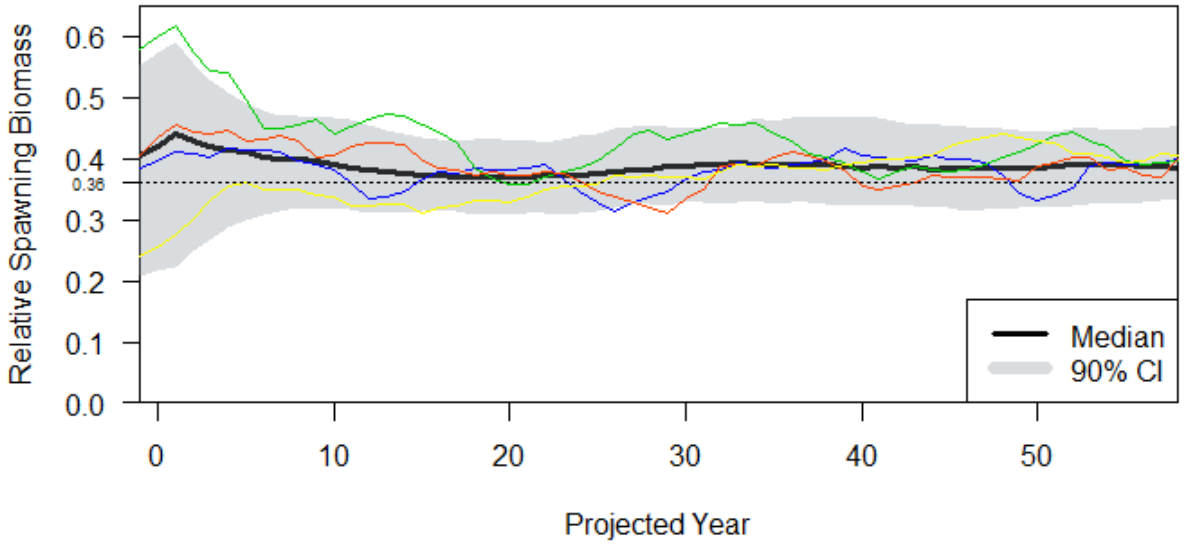


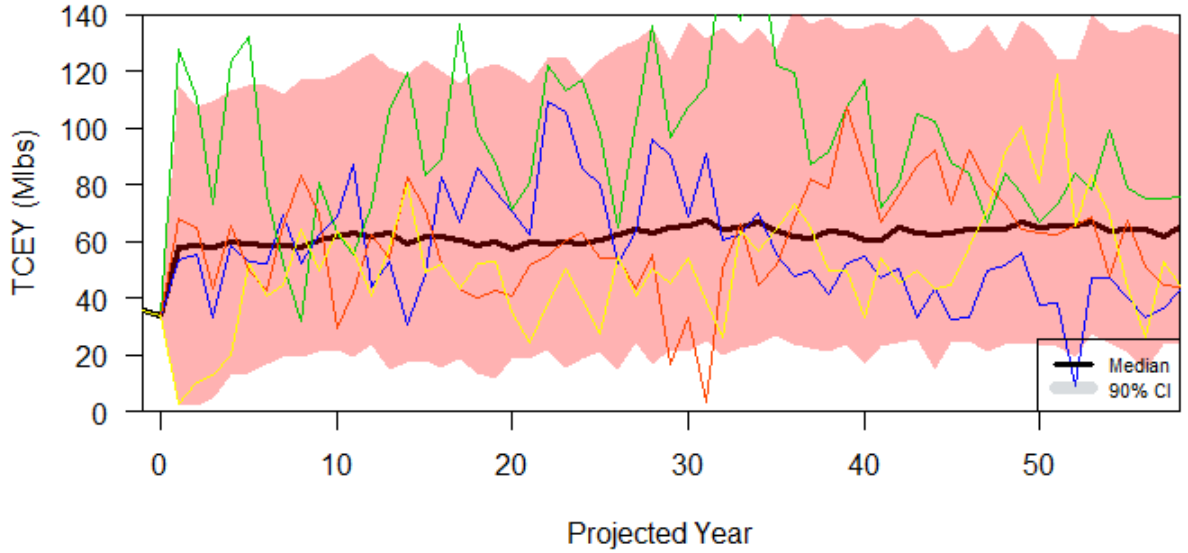


Maintain RSB at or above 36%

- SPR=43% results in a long-term median RSB of 38.8%
- SPR=40% results in a long-term median RSB of 36.6%
- Recent decisions equate to an SPR > 50%

Projections with SPR=43%





A potential new 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 ($RSB_{36\%}$) easily met, even when catch-rates and absolute spawning biomass are low

- 4th ad hoc meeting of the MSAB
  13. *A new objective may be defined using absolute biomass, commercial catch-rates, or TCEY. However, commercial catch-rates may not be the best option because they are dependent on other factors. TCEY and/or a reference absolute spawning biomass based on what has been observed may be more meaningful, but all have downsides in being a holistic metric. The MSAB should explore these metrics (and possibly FISS WPUE) for use in updating the objectives*
  15. *Objectives, such as avoiding low stock sizes or low catch-rates, may be met by adding elements to the MP, such as reducing fishing intensity when the SB is below a threshold.*
  17. *There is likely a desire to remain above the absolute spawning biomass in 2023 and the tolerance could be 80 or 90%*

Other thoughts

- 4th ad hoc meeting of the MSAB
  10. *A management procedure defined as a reference fishing intensity or more conservative would provide flexibility to the Commission to reduce fishing intensity when short-terms trends are of concern*
  14. *Evaluating MPs based on performance of the worst conditions (e.g. low productivity regime) may result in avoiding low stock sizes under any conditions*

Discussion: At or above ??? (objective b)

- What is a useful threshold?
  - SB_{2023}
  - WPUE
  - TCEY

General Objective	Measurable Objective	Measurable Outcome	Time-frame	Tolerance	Performance Metric
2.1 Maintain spawning biomass at or above a level that optimizes fishing activities	b) Maintain the long-term coastwide ????????????? at or above a biomass reference point ($B_{?????}$) at least ???% or more of the time	B<Spawning Biomass Reference (B_{Thresh}) $B_{Thresh}=B_{???}$	Long-term	0.??	$P(B < B_{Thresh})$ Fail if greater than 0.??

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

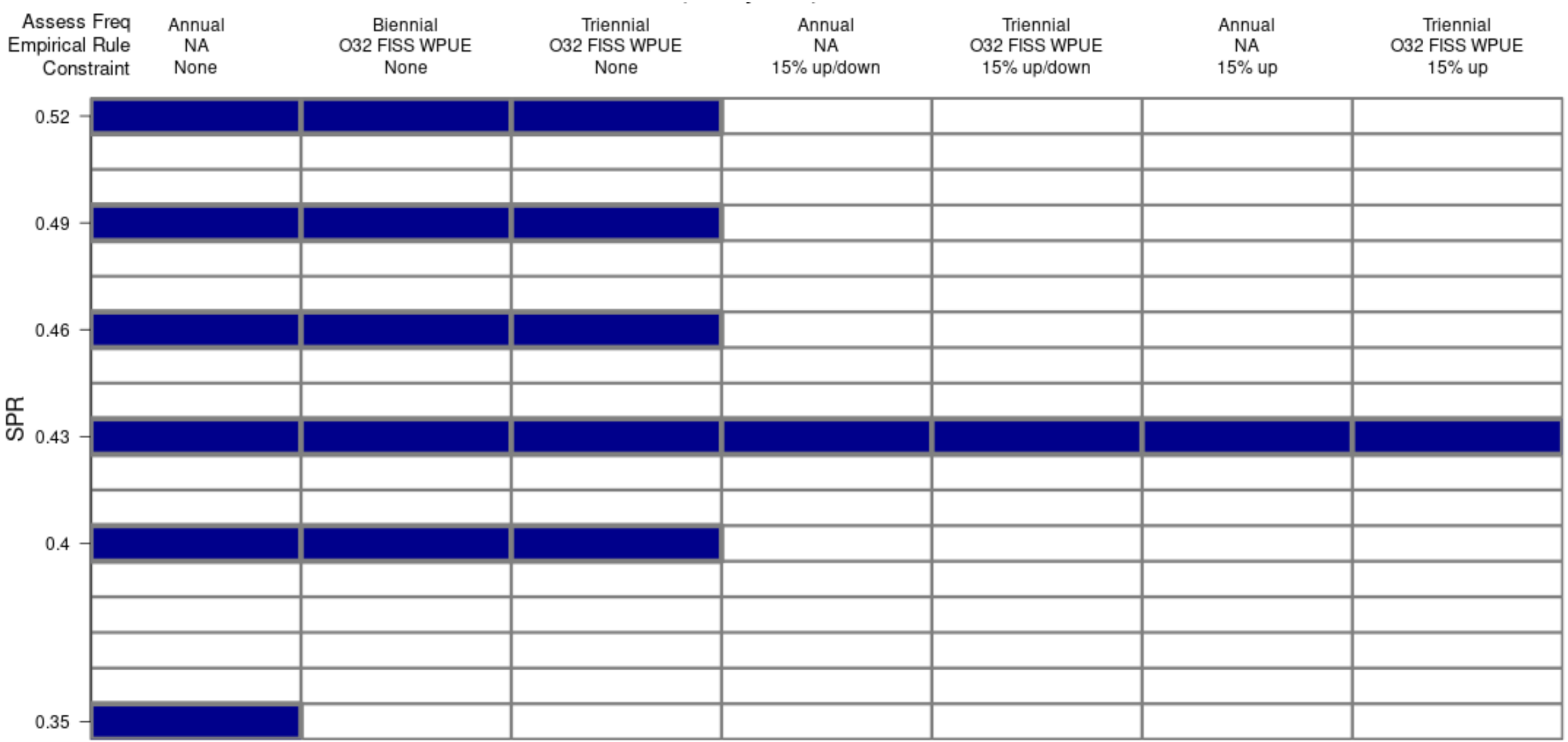
  https://iphcapps.westus2.cloudapp.azure.com/MSE-Explorer/

Distribution of the TCEY

***IPHC-2024-SRB24-R*, para 24**. *NOTING that the Operating Model (OM) requires a distribution of harvest across the IPHC Regulatory Areas even though distribution of the TCEY is not a recommended part of the MP, the SRB RECOMMENDED capturing uncertainty in future TCEY distribution via the approach described in IPHC-2024-SRB024-07, where the TCEY is distributed similar to what is done annually as part of the decision table construction process in the stock assessment.*

- TCEY in 2A = 1.65
- TCEY in 2B random draw between 17% and 21% with mode at 18.3%
  - triangle distribution
- TCEY in AK distributed based on random draw of percentages from a specific year
  - 2013-2024

Assessment Frequency, SPR, and Constraints



Assessment Frequency

- Using FISS Block Design
- No conservation risk
- P(RSB < 36%) = 50% is at SPR less than 40%
  - Similar across assess frequency
- TCEY reduced about 4 Mlbs with SPR increase of 3% (in this range)
  - Increase in median TCEY with Biennial and Triennial
- AAV high
  - Three types of input errors
    - Assessment, FISS, decision
  - Similar or increased for SPR 49% and greater
  - Reduced more with Triennial

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%)	0.4534	0.2466	0.0896	0.0144	0.0012
Median TCEY	64.26	60.11	56.08	52.03	47.87
AAV	25.3%	24.2%	23.5%	23.5%	23.7%
Assessment Frequency	Biennial				
SPR (%)	40	43	46	49	52
P(RSB<20%)	<0.001	<0.001	<0.001	<0.001	<0.001
P(RSB<36%)	0.4638	0.2912	0.1294	0.0400	0.0066
Median TCEY	64.96	60.38	56.28	52.27	48.17
AAV	23.3%	22.6%	22.5%	22.8%	23.5%
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%)	0.4734	0.2882	0.1338	0.0526	0.0094
Median TCEY	65.50	61.04	56.96	53.57	49.11
AAV	20.7%	20.1%	20.0%	20.5%	21.0%

Additional PMs

IPHC-2024-MSAB019-R, para 47

- Greater than 1 in 3 chance that SB will be less than SB_{2023}
- 15-year metrics do not contain much additional information
- Max Change
  - Higher with lower SPR and biennial/triennial
- Max Duration
  - Longer duration with triennial
  - Would expect longer for higher SPR (lower fishing intensity)
    - Short-term results show an increasing population with lower fishing intensity
    - Long-term result are more expected

Assessment Frequency	Annual				
SPR	40	43	46	49	52
Long-term P(SB < SB_{2023})	0.308	0.272	0.230	0.196	0.164
Short-term P(SB < SB_{2023})	0.490	0.428	0.362	0.316	0.282
AAV 10-year	25.3%	24.2%	23.5%	23.5%	23.7%
AAV 15-year	26.4%	24.5%	23.9%	24.0%	24.6%
Max Change (15-yr, absolute Mlbs)	47.7	40.3	36.1	32.7	30.2
Mean Max Duration < 15% AC (15-yr)	2.53	2.55	2.52	2.48	2.45
Assessment Frequency	Biennial				
SPR	40	43	46	49	52
Long-term P(SB < SB_{2023})	0.322	0.278	0.248	0.212	0.168
Short-term P(SB < SB_{2023})	0.488	0.442	0.372	0.322	0.288
AAV 10-year	23.3%	22.6%	22.5%	22.8%	23.5%
AAV 15-year	23.0%	22.9%	22.4%	22.6%	22.7%
Max Change (15-yr, absolute Mlbs)	48.2	42.6	38.5	34.9	32.5
Mean Max Duration < 15% AC (15-yr)	3.00	3.02	2.95	2.84	2.79
Assessment Frequency	Triennial				
SPR	40	43	46	49	52
Long-term P(SB < SB_{2023})	0.316	0.282	0.232	0.202	0.172
Short-term P(SB < SB_{2023})	0.510	0.484	0.394	0.340	0.292
AAV 10-year	20.7%	20.2%	20.0%	20.5%	21.0%
AAV 15-year	23.0%	21.6%	21.6%	21.7%	22.0%
Max Change (15-yr, absolute Mlbs)	49.5	43.8	40.4	37.8	34.6
Mean Max Duration < 15% AC (15-yr)	3.26	3.29	3.31	3.22	3.12

Constraint on the interannual change in TCEY

- A constraint reduces
  - the P(RSB<36%),
  - the TCEY, and
  - the AAV
    - Above 15% due to decision-making variability
- Triennial with constraint
  - Very low TCEY
    - We'll examine this further in a few slides

SPR=43%

Assessment Frequency	Annual		
Constraint	None	15% up/down	15% up
P(RSB<20%)	<0.001	<0.001	<0.001
P(RSB<36%)	0.2466	0.0506	0.0528
Median TCEY	60.11	49.51	51.55
AAV	24.2%	16.6%	16.7%
Assessment Frequency	Triennial		
P(RSB<20%)	<0.001	<0.001	<0.001
P(RSB<36%)	0.2882	<0.001	0.0340
Median TCEY	61.04	31.19	43.12
AAV	20.1%	21.7%	16.2%

Effects of 3 types of uncertainty

- Assessment error
  - Error on the TCEY and the status
- FISS error
  - Affects assessment error
  - Three designs
- Decision-making variability
  - With or without
  - With assumes a constant standard deviation of 7Mlbs across all TCEYs

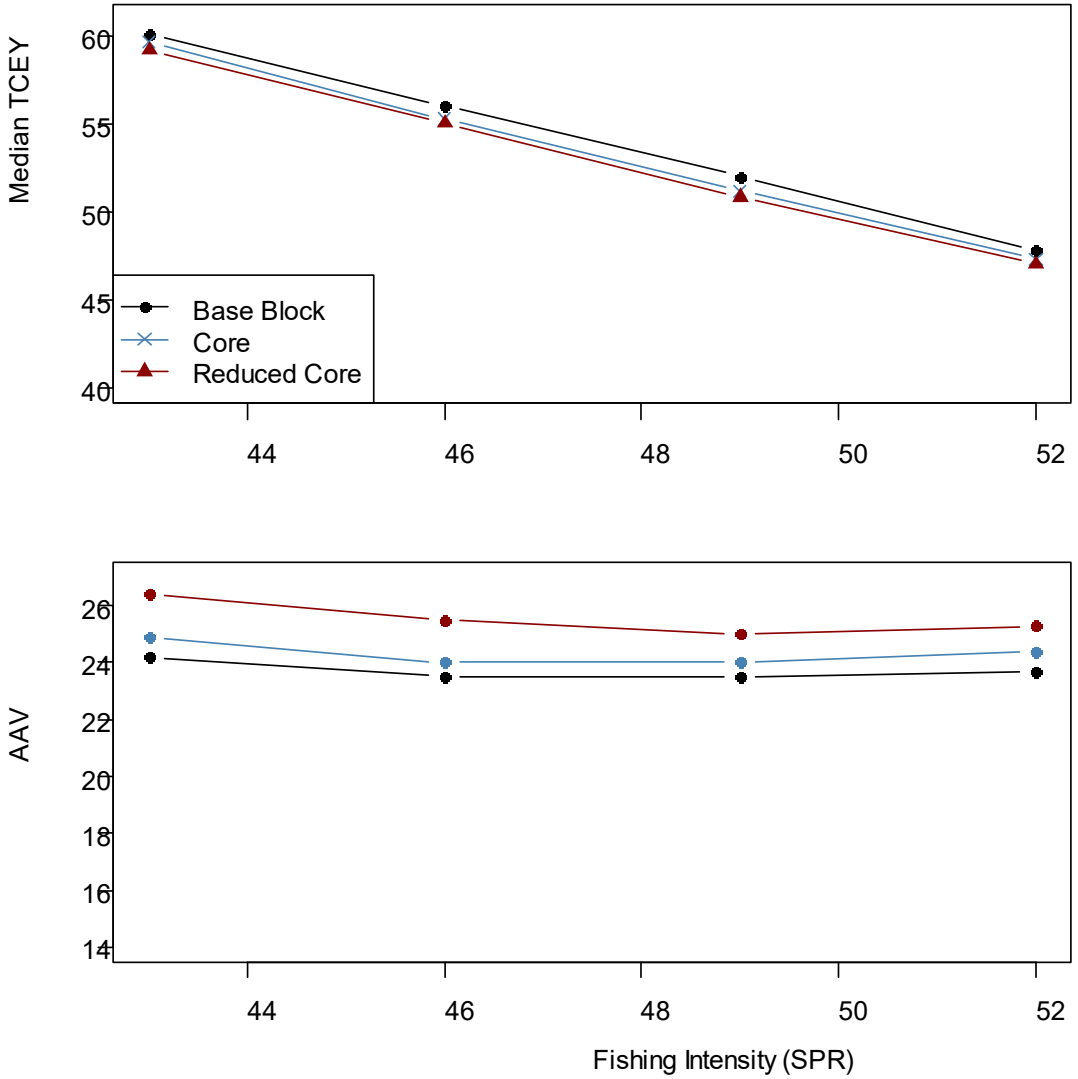
FISS Designs

- **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
- Core and Reduced Core designs were simulated with annual assessment frequency and four SPR levels from 43% to 52%

FISS design results

- No conservation concern
- P(RSB<36%) slightly reduced with smaller designs
  - Slightly more biomass
- Median TCEY reduced with smaller designs
  - 5th percentile similar
  - 95th percentile less with smaller designs (107 to 104 Mlbs)
- AAV increased with smaller designs



Summary of FISS design evaluation

- Lower TCEY and higher interannual variability
- Long-term results account for surviving fish to be caught in later years
- 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 $6.00/lb that equates to $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

With and without decision-making variability

- No Constraint
  - Similar TCEY
  - Lower AAV
  - Triennial has a lower AAV
- With Constraint
  - Smaller absolute change when at lower TCEY
    - Keeps TCEY at lower levels

SPR=43%

Assessment Frequency	Annual			
Constraint	None		15% up/down	
Decision-making variability	Yes	None	Yes	None
P(RSB<20%)	<0.001	<0.001	<0.001	<0.001
P(RSB<36%)	0.2466	0.2420	0.0506	0.0564
Median TCEY	60.11	59.92	49.51	52.30
AAV	24.2%	20.8%	16.6%	14.5%
Assessment Frequency	Triennial			
Decision-making variability	Yes		None	
Constraint	None	15% up/down	None	15% up/down
P(RSB<20%)	<0.001	<0.001	<0.001	<0.001
P(RSB<36%)	0.2882	0.2634	<0.001	<0.001
Median TCEY	61.04	61.00	31.19	31.28
AAV	20.1%	17.2%	21.7%	15.5%

Insight into a percentage constraint

- Smaller absolute change when at lower TCEY
  - Keeps TCEY at lower levels
  - If decision results in a low TCEY, it can be more difficult to increase because 15% constraint based on previous year TCEY is a small increase
    - In other words, when at low TCEY it takes longer to increase to larger TCEYs so you tend to stay at lower TCEYs
    - WPUE may change due to weight-at-age, which may reduce the TCEY even when TCEY is low and population is high
- Why does 15% up have a greater TCEY than 15% up/down
  - 15% up can take a large cut when necessary, while 15% up/down may stay at a slightly higher level resulting in a lower biomass and a longer time-series of declining TCEYs, which then may result in a lower TCEY that is more difficult to climb out of

None of 3 uncertainties

- Assessment, FISS, decision-making
- Still natural variability
  - Recruitment, wt-at-age, etc.
- TCEY is slightly greater
- AAV is much less
  - AAV with O32 WPUE empirical rule is greater than annual assessment
    - Some difference between O32 WPUE and TCEY

Assessment Frequency	Annual			
3 Uncertainties	Yes		No	
Empirical Rule	NA		NA	
P(RSB<20%)	<0.001		<0.001	
P(RSB<36%)	0.2466		0.2438	
Median TCEY	60.11		60.34	
AAV	24.2%		6.2%	
Max Change (15yr, absolute Mlbs)	40.3		10.7	
Mean Max Duration<15% AC (15yr)	2.55		11.62	
Assessment Frequency	**Triennial**			
3 Uncertainties	Yes		No	
Empirical Rule	O32 WPUE	Fixed	O32 WPUE	Fixed
P(RSB<20%)	<0.001		<0.001	<0.001
P(RSB<36%)	0.2882		0.2652	0.2728
Median TCEY	61.04		61.69	60.23
AAV	20.1%		12.0%	4.7%
Max Change (15yr, absolute Mlbs)	43.8		22.2	17.8
Mean Max Duration<15% AC (15yr)	3.29		6.50	8.50

Summary of MP evaluation

- No conservation concern across SPR values investigated
- An SPR near 39% would result in a median RSB = 36%
- An increase in SPR of 1% (reduction in fishing intensity) resulted in an approximate 1.3 Mlbs decrease in TCEY
- AAVs higher than previous simulations due to increased uncertainty in FISS and assessment, and decision-making variability
- A 15% constraint reduced the TCEY and AAV
  - Slower increases from low TCEY tends to keep the TCEY lower, on average

Summary of MP evaluation (2)

- Triennial assessment frequency resulted in increased TCEY and reduced AAV
  - Also occurred without decision-making variability
  - However, a constraint resulted in a very low TCEY, on average
    - The constraint needs more investigation

IPHC-2024-SRB025-R, para 29: The SRB ACCEPTED that

1) there are significant benefits of moving to a triennial assessment frequency in terms of freeing Secretariat resources to conduct other quantitative analyses (see para. 22); and
2) the MSE analysis showed no apparent cost of triennial assessment in terms of lost yield or increased interannual variability in TCEY

- Decision-making variability is an important component (and difficult to determine how to model)

Depensation

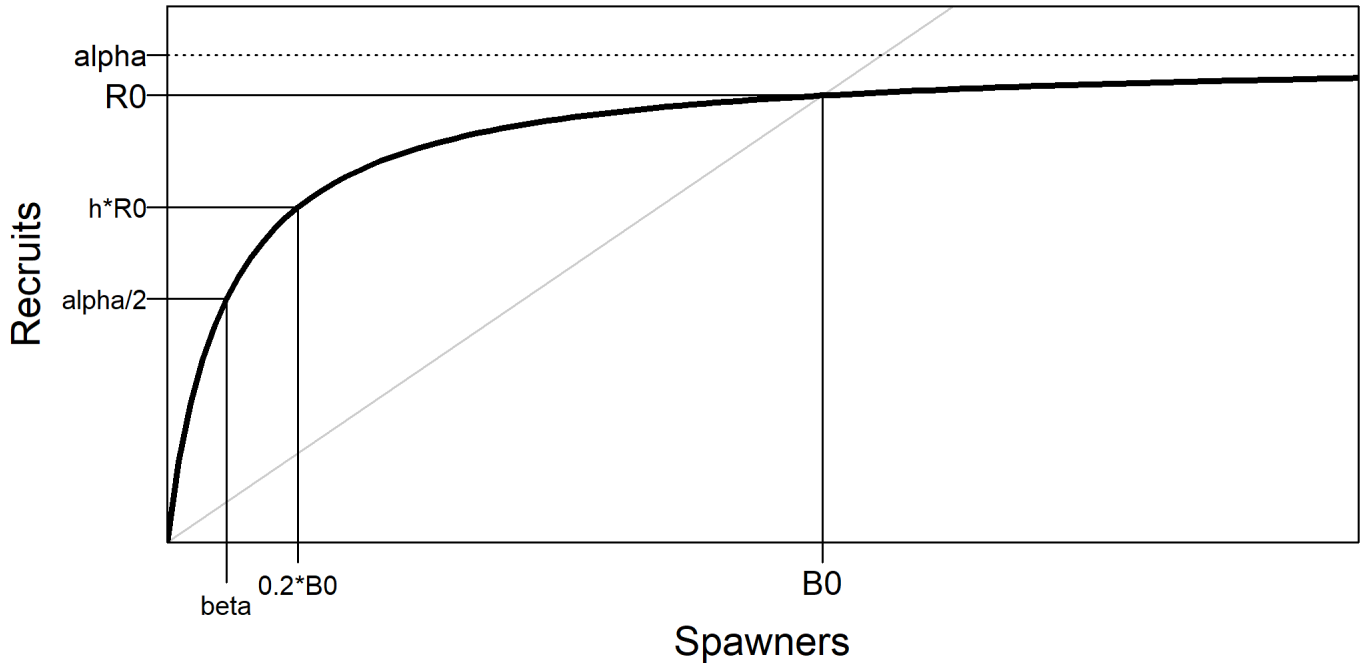
- **IPHC-2024-SRB024-R, para** 29. *The SRB **NOTED** the analysis of depensation presented in paper IPHC-2024-SRB024-07, and **RECOMMENDED**:*
  - *a) fitting a depensatory stock-recruitment model to estimate the depensation parameter value;*
  - *b) operating model stress tests in the MSE with and without depensation across a range of plausible fishing intensities.*

$$R_t = \frac{\alpha S^{\delta}}{\beta^{\delta} + S_t^{\delta}}$$

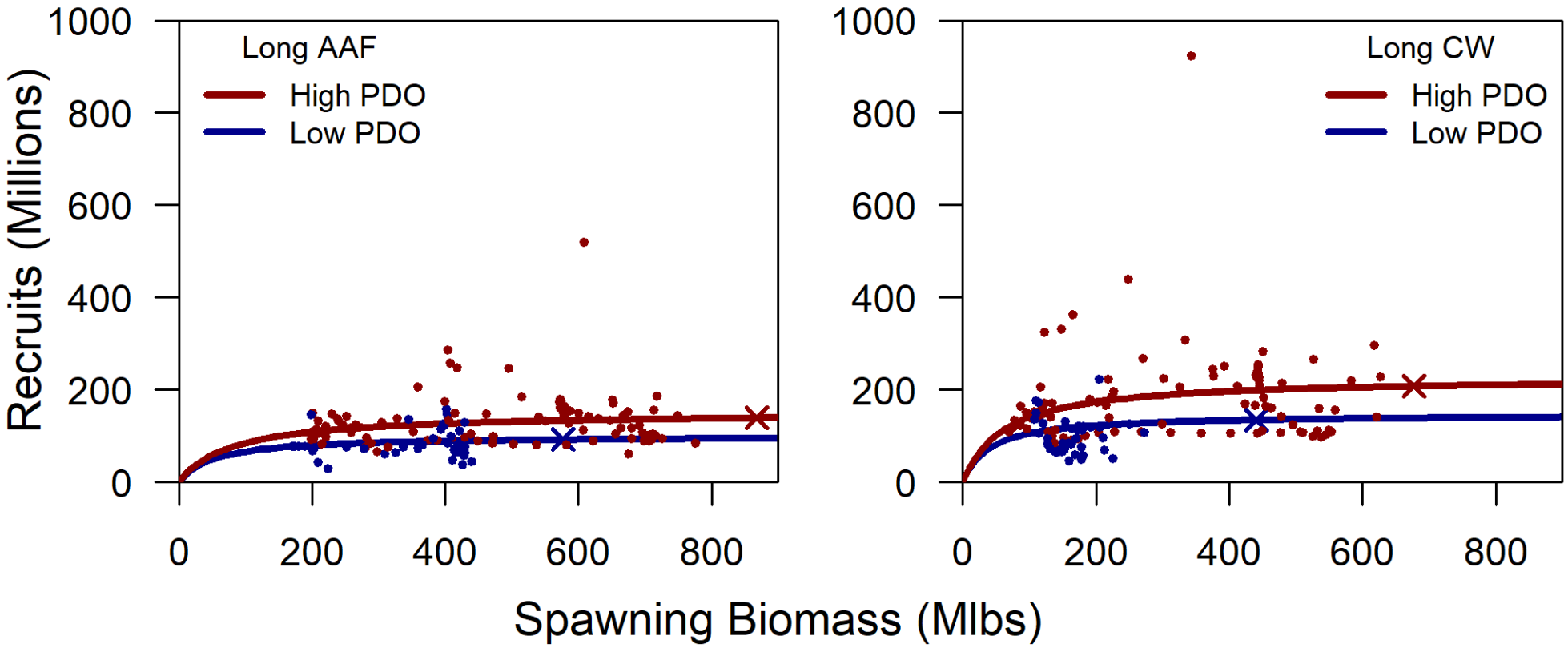
$$\alpha = \frac{(5^{\delta} - 1)R_0 h}{5^{\delta} h - 1}$$

$$\beta^{\delta} = \frac{B_0^{\delta}(1-h)}{5^{\delta} h - 1}$$

Parameterized using steepness

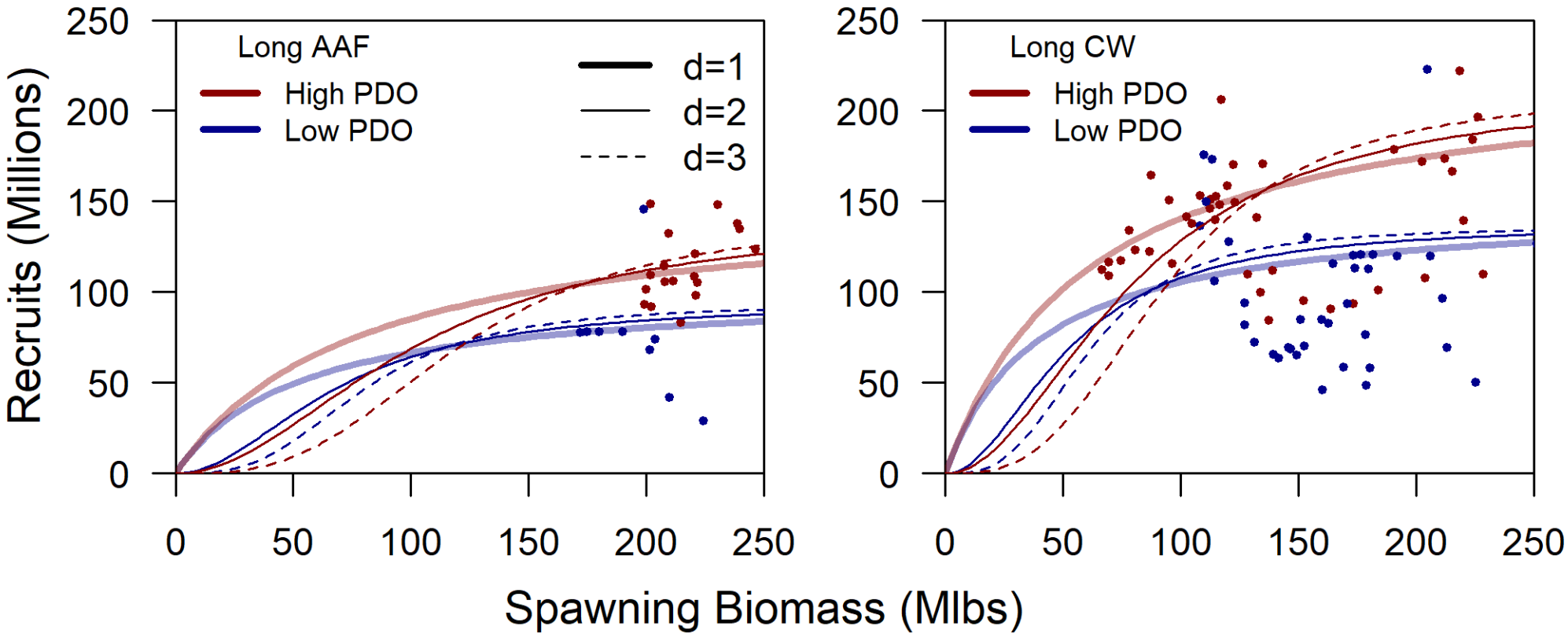


Estimated Beverton-Holt curves



- Estimated B-H stock-recruit curves from assessment models
- Two environmental regimes
- X marks unfished equilibrium

Estimated Beverton-Holt curves



- Estimated B-H stock-recruit curves from assessment models
- Two environmental regimes
- Three depensation levels

Simulation design

Parameter	Values
Depensation (δ)	δ = 1 or 2
SPR	35%, 43%, 52%
FISS design	Base block

Notes

- Very little information of potential depensation for Pacific halibut
- OM not reconditioned with depensation

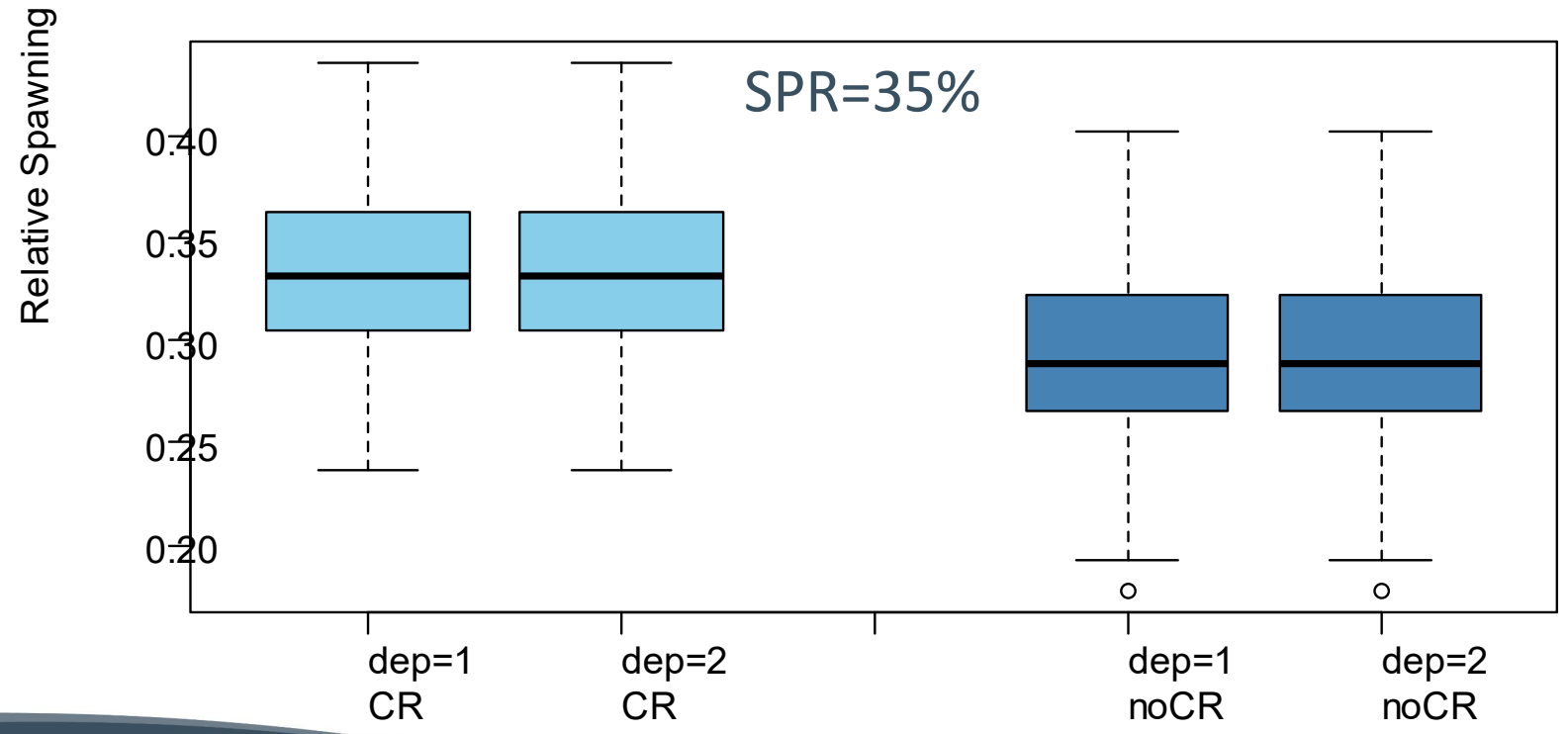
MSE simulations with depensation

- No difference to performance metrics with depensation (δ=2)
- 5th percentiles nearly identical as well

Depensation	δ=1			δ=2		
SPR	35%	43%	52%	35%	43%	52%
P(RSB<20%)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
P(RSB<36%)	0.7106	0.2466	0.0012	0.7102	0.2462	0.0012
Median TCEY	71.78	66.55	57.81	71.78	66.55	57.81

Depensation with high fishing intensity

- No Control Rule (CR) results in higher fishing intensity and lower RSB
- No difference in performance metrics with depensation = 2 & SPR = 35%



Summary of depensation stress test

- High uncertainty in possibility of depensation because population has not likely reached low levels when assessment results are available
- History has shown high recruitment and rapid recovery from potential low population sizes
- Depensation in not likely to have a large effect because the MPs being considered do not reduce the population to low levels

Recommendations

1) **NOTE** paper IPHC-2024-MSAB020-06 presenting recent MSE work including exceptional circumstances; goals and objectives; evaluating assessment frequency, a constraint and fishing intensity; investigating the effects of reduced FISS designs; and simulating a scenario with depensation.

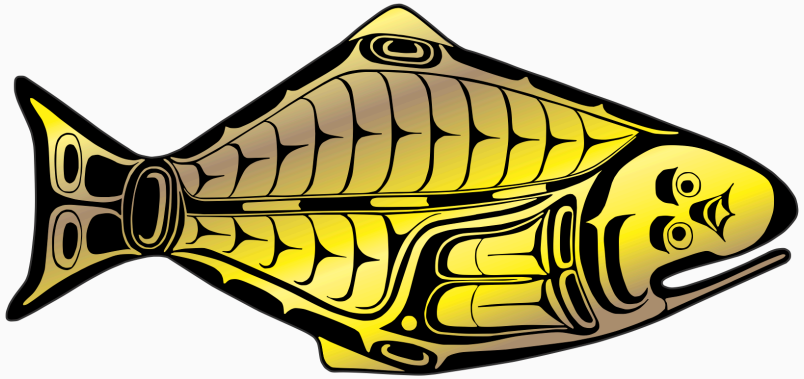
2) **RECOMMEND** adding a measurable objective related to absolute spawning biomass under the general objective 2.1 “maintain spawning biomass at or above a level that optimizes fishing activities” to be included in the priority Commission objectives after, or in place of, the current biomass threshold objective.

3) **RECOMMEND** further analyses to support the development of the harvest strategy policy.

4) **REQUEST** any further analyses to be provided to the Commission or at MSAB021.

5) **RECOMMEND** redefining the general objective to optimize yield to include measurable objectives with specifics related to amount of yield and variability in yield.

INTERNATIONAL PACIFIC



HALIBUT COMMISSION

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