



INTERNATIONAL PACIFIC



HALIBUT COMMISSION

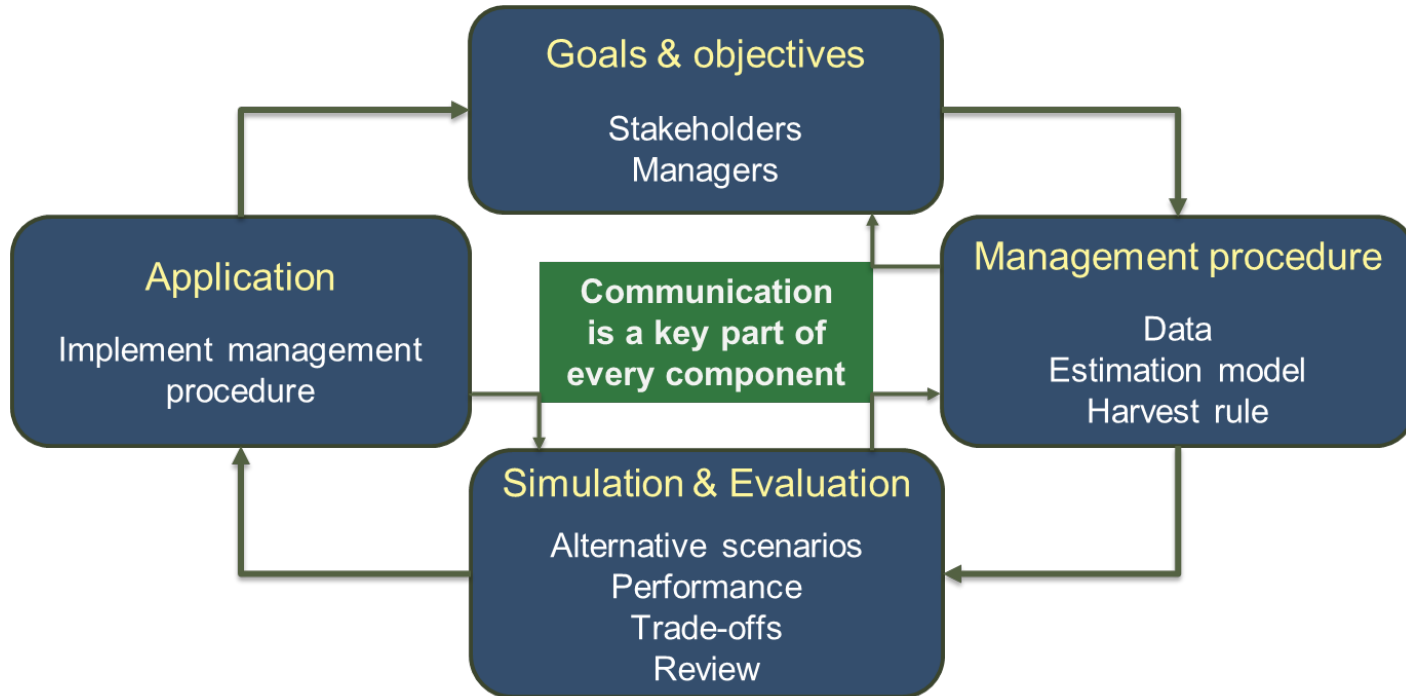
Management Strategy Evaluation

Agenda Item 10.1

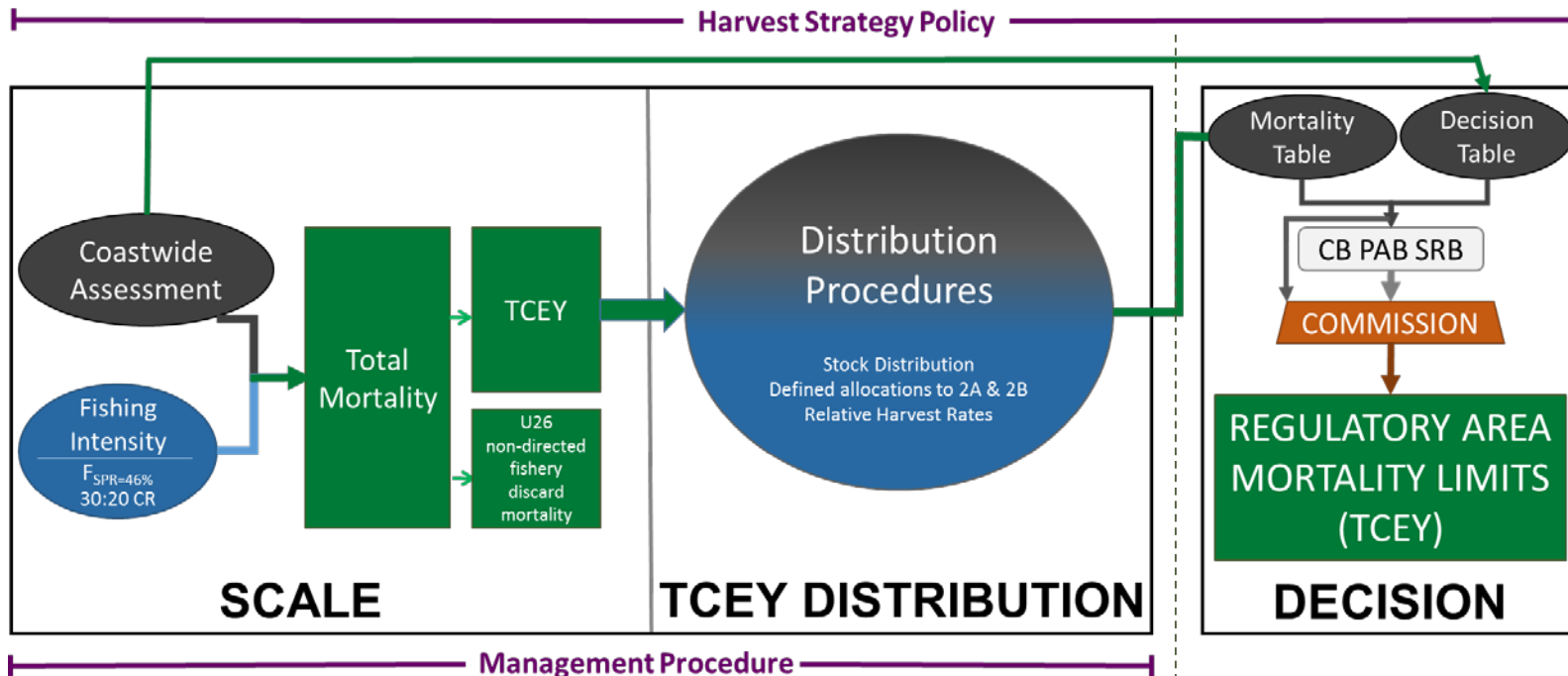
IPHC-2020-AM096-12

Management Strategy Evaluation (MSE)

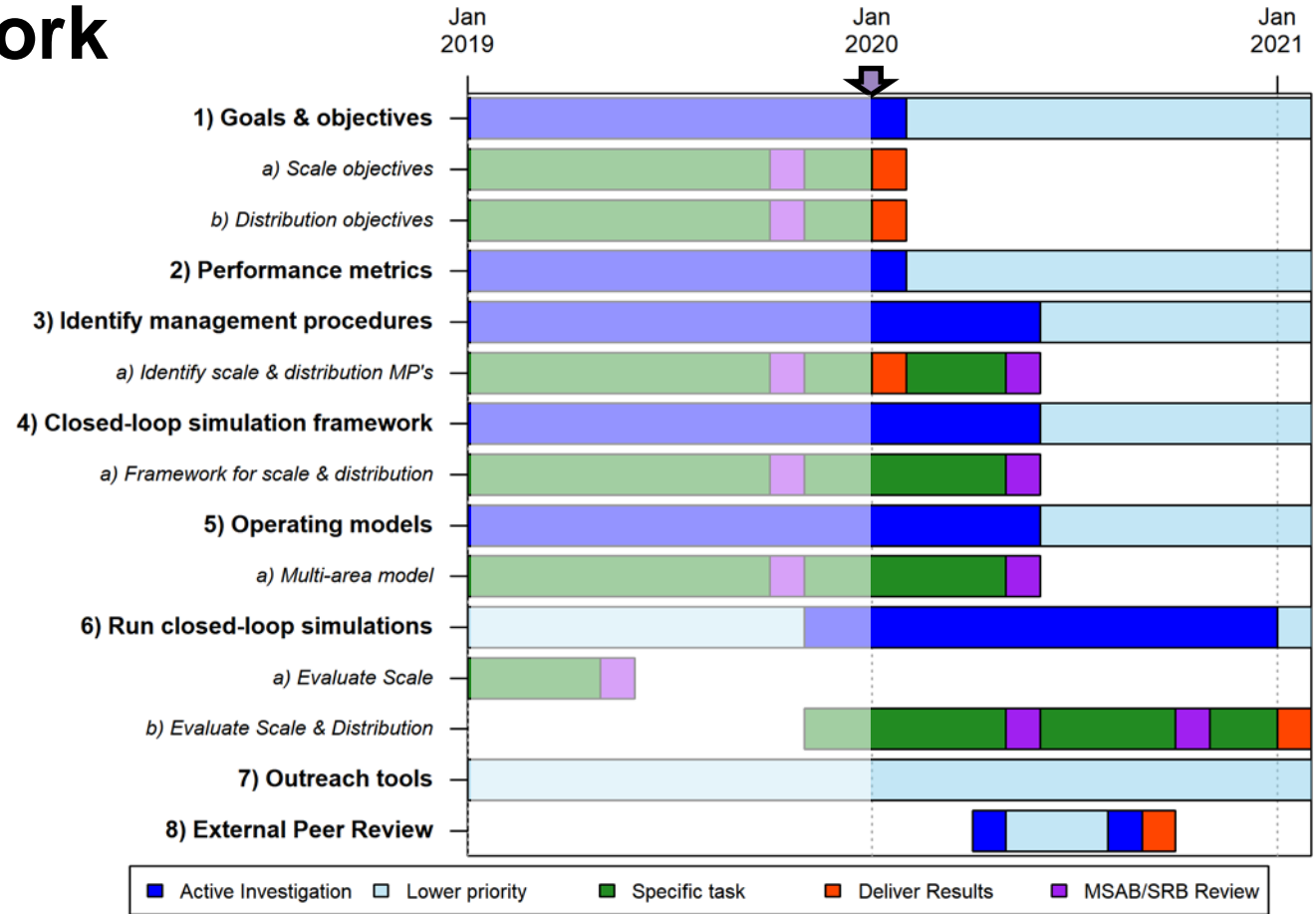
a process to evaluate harvest strategies and develop a management procedure that is robust to uncertainty and meets defined objectives



Harvest Strategy Policy



Program of Work for delivery in 2021



2019 MSE-related tasks

13th Session of the IPHC MSAB (MSAB013) - May 2019	Status
Evaluate additional Scale management procedures	Completed
Review goals and objectives	Completed
Spatial model complexity	Completed
Identify management procedures (Scale & Distribution)	Completed
Review Framework	Completed
14th Session of the IPHC MSAB (MSAB014) - October 2019	
Review Framework	Completed
Review multi-area model development	Completed
Spatial Model Complexity	Completed
Define Goals and Objectives (Scale & Distribution)	Completed
Identify management procedures (Scale & Distribution)	Completed
96th Session of the IPHC Annual Meeting (AM096) – January 2020	
Update on progress	



2020 MSE-related tasks

15th Session of the IPHC MSAB (MSAB015) - May 2020	
Review goals and objectives (Scale & Distribution)	
Review simulation framework	
Review multi-area model	
Review preliminary results	
Identify management procedures (Scale & Distribution)	
16th Session of the IPHC MSAB (MSAB016) - October 2020	
Review final results	
Provide recommendations on management procedures	
97th Session of the IPHC Annual Meeting (AM097) – January 2021	
Presentation of complete MSE product to the Commission	
Recommendations on Scale and Distribution management procedures	



MSE team

- Dr. Steve Berukoff
 - Programmer
 - Two-year appointment ending October 2020
 - Simulation framework, Operating Model, etc.
- Dr. Piera Carpi
 - MSE Researcher
 - Two-year appointment ending April 2021
 - Analysis, literature review, running model, etc.



Primary Objectives

Four general categories

- 1.1. Keep female spawning biomass above a limit
- 2.1. Maintain spawning biomass around a level that optimizes fishing activities
- 2.2. Limit catch variability
- 2.3. Provide directed fishing yield

Goals & objectives

Stakeholders
Managers



Reference points

Interim management procedure:

Relative spawning biomass (compared to unfished)

- $SB_{20\%}$ Biological Limit
- $SB_{30\%}$ Fishery Trigger
- SB_{Target} – Currently not specified

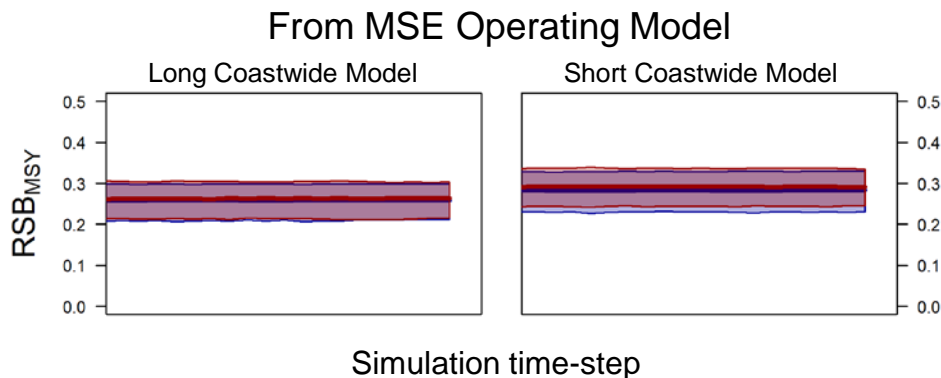
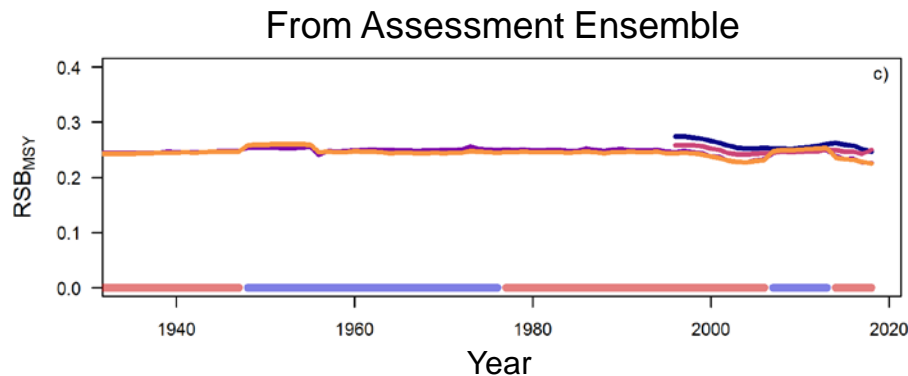
Fishing intensity

- $F_{46\%}$ Reference level
- F_{limit} – Currently not specified



Investigation of MSY-related reference points

- SB_0 and MSY vary depending on regime
- RSB_{MSY} and SPR_{MSY} are more stable
 - $RSB_{MSY} \sim 20-30\%$
 - $SPR_{MSY} \sim 30-35\%$



1.1. Primary biological objectives

MEASURABLE OBJECTIVE	MEASURABLE OUTCOME	TIME-FRAME	TOLERANCE
Maintain a female spawning stock biomass above a biomass limit reference point at least 95% of the time	<p>$SB < \text{Spawning Biomass Limit (SB}_{Lim})$</p> <p>$SB_{Lim} = 20\%$ unfished spawning biomass</p>	Long-term	0.05
Maintain a defined minimum proportion of female spawning biomass in each Biological Region	<p>$p_{SB,2} > 5\%$</p> <p>$p_{SB,3} > 33\%$</p> <p>$p_{SB,4} > 10\%$</p> <p>$p_{SB,4B} > 2\%$</p>	Long-term	0.05



2.1. Primary fishery objective (target SB)

Analysis of MSY-based reference points

- Relative spawning biomass (RSB) is consistent across regimes
- RSB=30% is a precautionary MSY proxy
- RSB=36% includes a buffer to avoid exceeding MSY and risk to SB

MEASURABLE OBJECTIVE	MEASURABLE OUTCOME	TIME-FRAME	TOLERANCE
Maintain the coastwide female spawning biomass above a biomass target reference point at least 50% of the time	SB < Spawning Biomass Target (SB _{Targ}) SB _{Targ} = SB _{36%} unfished spawning biomass	Long-term	0.50



2.2. Primary fishery objectives (stability)

MEASURABLE OBJECTIVE	MEASURABLE OUTCOME	TIME-FRAME	TOLERANCE
Limit annual changes in the coastwide TCEY	Annual Change (AC) > 15% in any 3 years	Short-term	
	Median coastwide Average Annual Variability (AAV)	Short-term	
Limit annual changes in the Regulatory Area TCEY	Annual Change (AC _A) > 15% in any 3 years	Short-term	
	Average AAV by Regulatory Area (AAV _A)	Short-term	



2.3. Primary fishery objectives (yield)

MEASURABLE OBJECTIVE	MEASURABLE OUTCOME	TIME-FRAME	TOLERANCE
Optimize average coastwide TCEY	Median coastwide TCEY	Short-term	
Optimize TCEY among Regulatory Areas	Median $TCEY_A$	Short-term	
Optimize the percentage of the coastwide TCEY among Regulatory Areas	Median $\%TCEY_A$	Short-term	
Maintain a minimum TCEY for each Regulatory Area	Minimum $TCEY_A$	Short-term	
Maintain a percentage of the coastwide TCEY for each Regulatory Area	Minimum $\%TCEY_A$	Short-term	



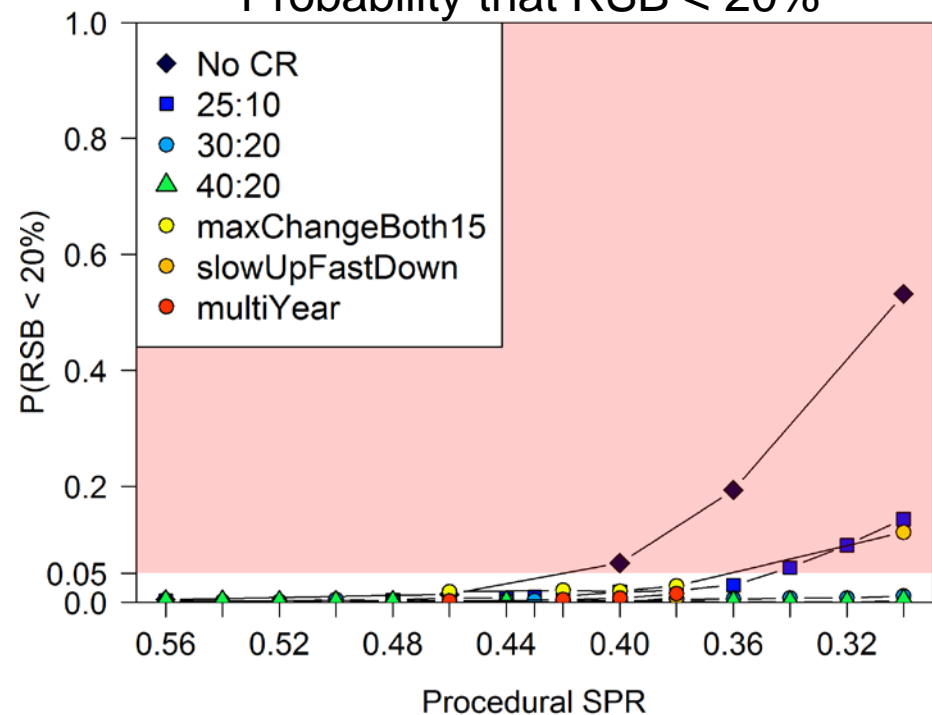
Examining objectives

- Tolerance defined for primary biological and fishery target objectives
 - Can determine if a management procedure fails
- Performance metrics will be reported for fishery stability and fishery yield objectives
 - Evaluate trade-offs
- Additional performance metrics and statistics of interest will be reported to assist with evaluation

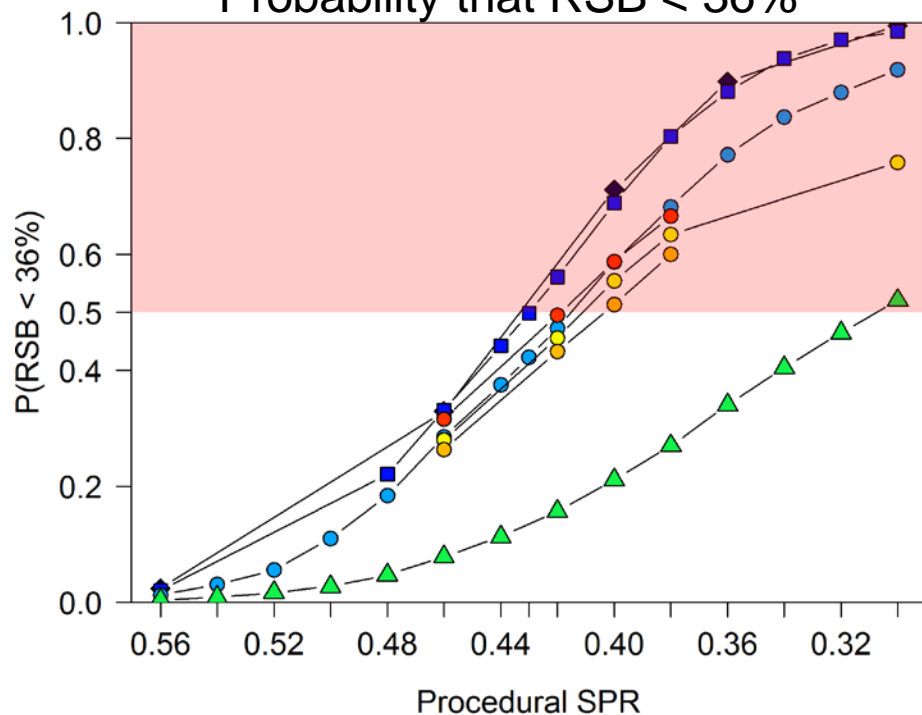


Coastwide results

Probability that RSB < 20%

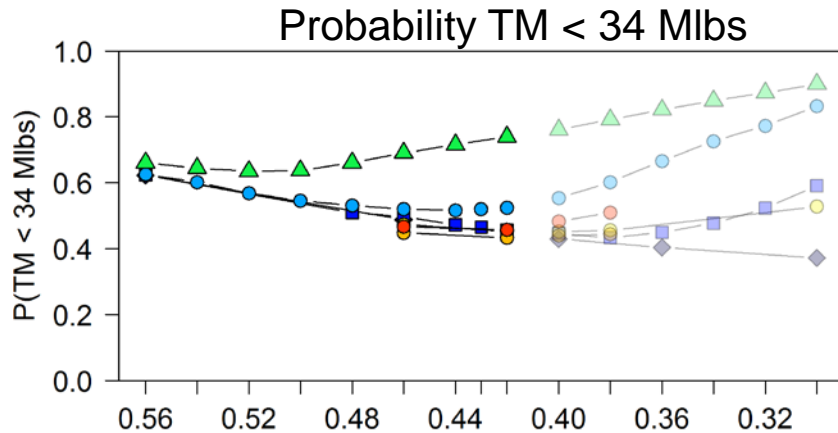
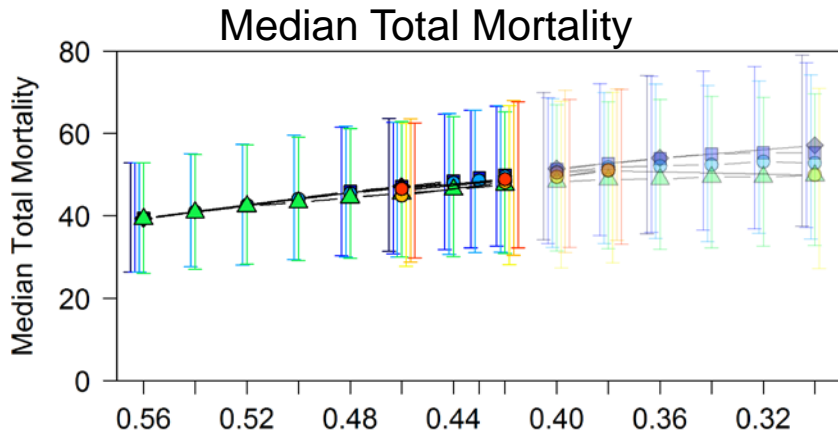


Probability that RSB < 36%

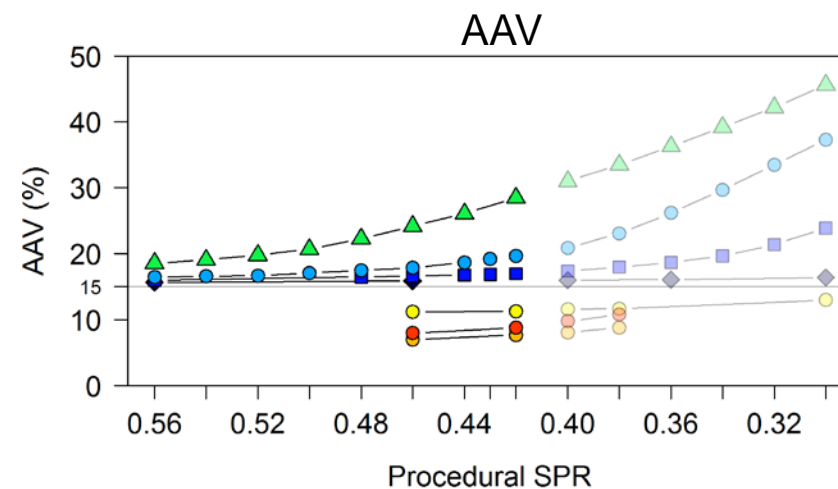
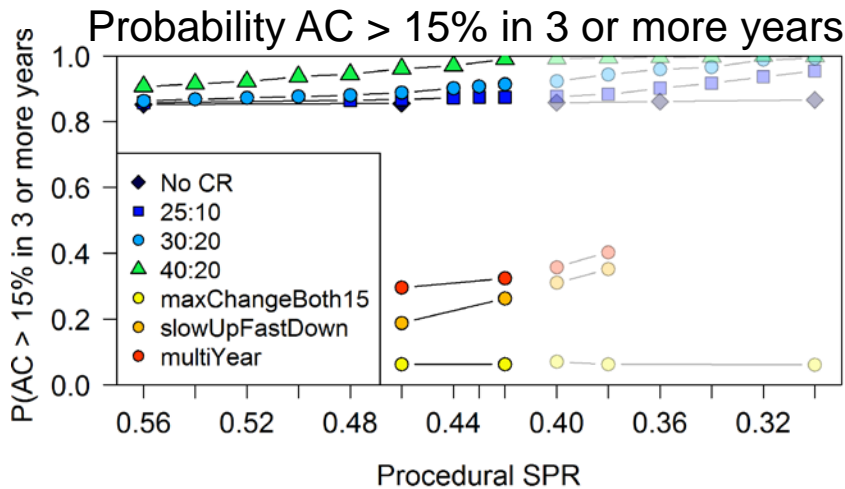


Coastwide results

Yield



Stability



Reference points

Part of Management Procedure
Part of Objective

Interim management procedure:

Relative spawning biomass (compared to unfished)

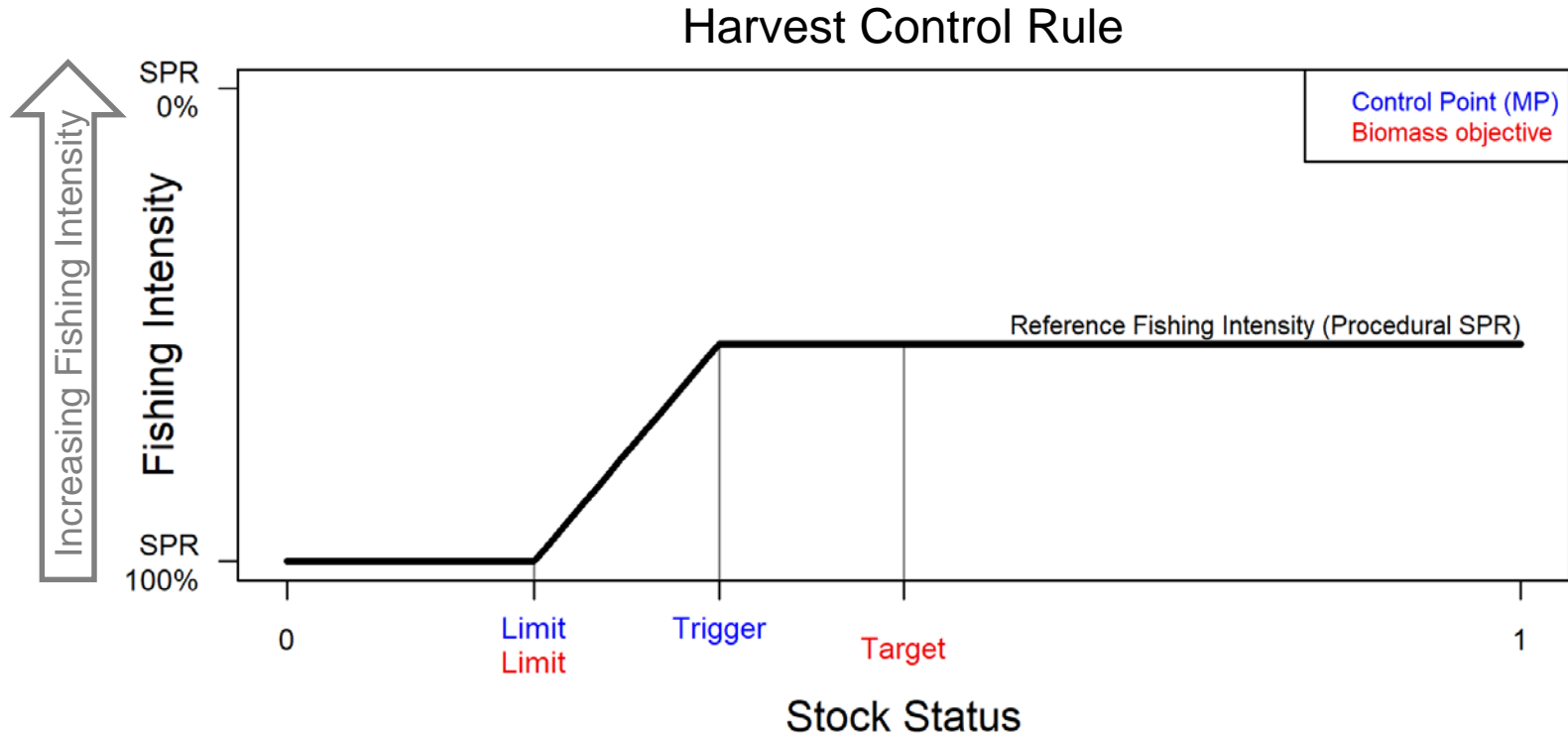
- $SB_{20\%}$ **Biological Limit and Fishery Limit**
- $SB_{30\%}$ **Fishery Trigger**
- $SB_{36\%}$ **Biological target**

Fishing intensity

- $F_{43\%}$ **Reference level**
- F_{limit} – Currently not specified (testing $F_{36\%}$)



Reference Points and Control Points



Management Procedures to investigate

SCALE

- SPR
 - 0.3 to 0.5
- Control rule
 - 30:20
- Constraint
 - Maximum change in TCEY of 15%
 - Slow-up, fast-down
 - Multi-year catch limits
 - Combinations



Management Procedures to investigate

DISTRIBUTION framework

1. Coastwide

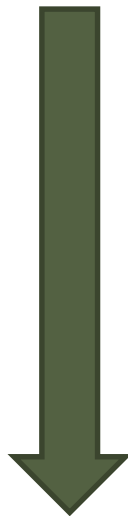
- Stock Assessment
- Target Fishing Intensity

2. Regional

- Stock Distribution
- Relative Fishing Intensity
- Allocation Adjustment

3. Regulatory Area Allocation

4. Annual Regulatory Area Adjustment (policy)



Only
1. and 3.
are required



Relative harvest rate by region

- Considerations for relative harvest rates:
 - Movement (immigration and emigration rates)
 - Trends in data
 - Uncertainty in the observations
 - Productivity by Region (e.g. Yield per Recruit (YpR) analysis)

		Biological Region			
Weight-at-age	Selectivity	2	3	4	4B
1985	1985	1.0	1.0	0.7	0.5
1999	1999	1.0	1.0	0.8	0.5
2018	2018	1.0	1.0	1.0	0.5

- MSE is the appropriate tool to include all of these factors



Some DISTRIBUTION elements for evaluation

MSAB015

- Distributing to IPHC Regulatory Areas directly or first distributing to Biological Regions
- Various relative harvest rates by Reg Area or Bio Region
- Buffer on coastwide SPR to not exceed $F_{limit=36\%}$
- Defined catch limit for 2A
- Defined percentage of coastwide limit for 2B

Post-MSAB015

- Constraints on annual change at the Reg Area level
- Trends in fishery CPUE
- Allocation to management zones



Evaluation of Management Procedures

- Many combinations of MP elements
 - 21+ SCALE combinations
 - 10 DISTRIBUTION procedures identified
- Focus on informative combinations
- Preliminary results at MSAB015
 - Refine the management procedures

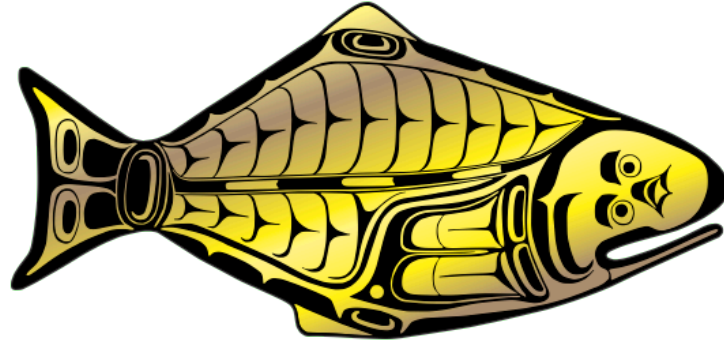


Recommendations

- a) **NOTE** paper IPHC-2020-AM096-12
- b-e) **RECOMMEND** the ten primary objectives & metrics including a fishery objective to maintain the spawning biomass around a target of 36%
- f) **RECOMMEND** that SPR values greater than 40% with a 30:20 control rule and one of three types of constraints meet coastwide objectives
- g) **RECOMMEND** a reference SPR of 43% with 30:20 control rule be used to update interim harvest policy
- h) **NOTE** the scale and distribution elements that will be evaluated and presented at AM097 in in 2021
- i) **NOTE** that an independent peer review is scheduled to take place in April and August 2020
- j) **NOTE** that the SRB and MSAB will review scale and distribution MSE results in fall 2020, which will be presented to the Commission at AM097 in January 2021



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