INTERNATIONAL PACIFIC HALIBUT COMMISSION

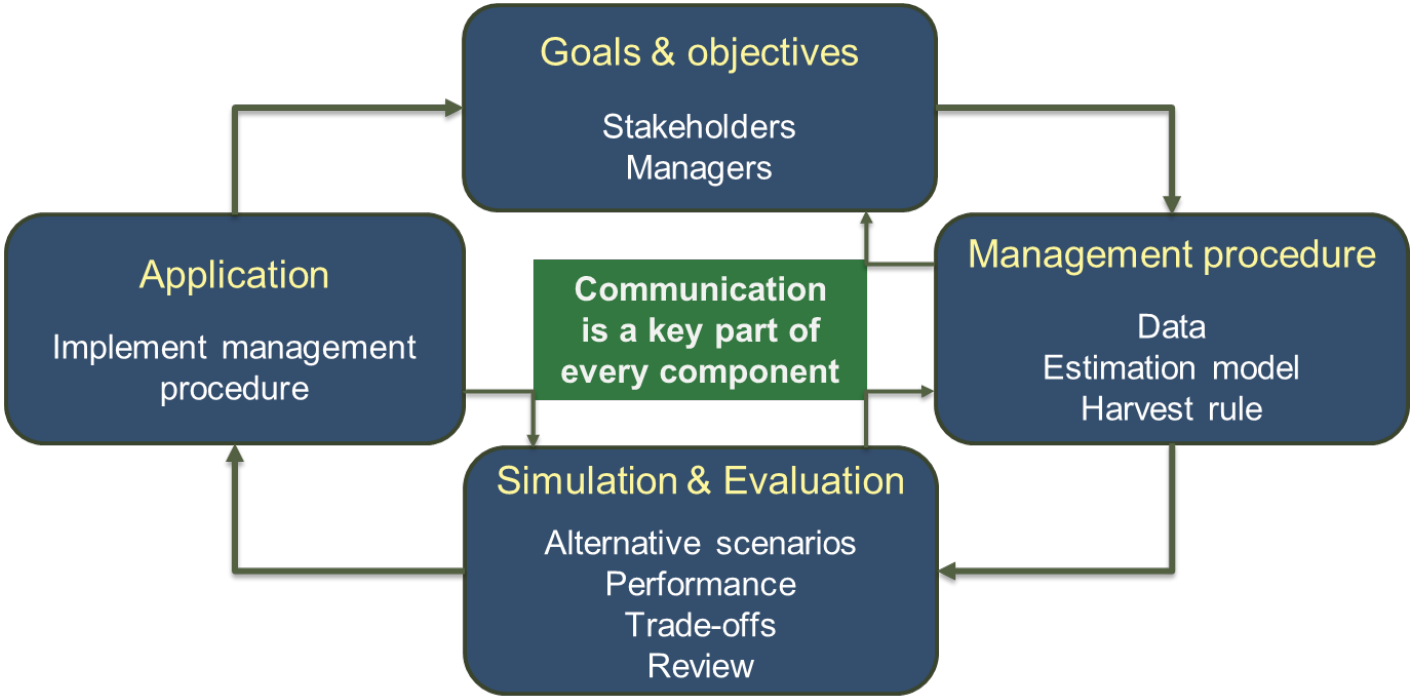
Management Strategy Evaluation

Agenda Item 8.1

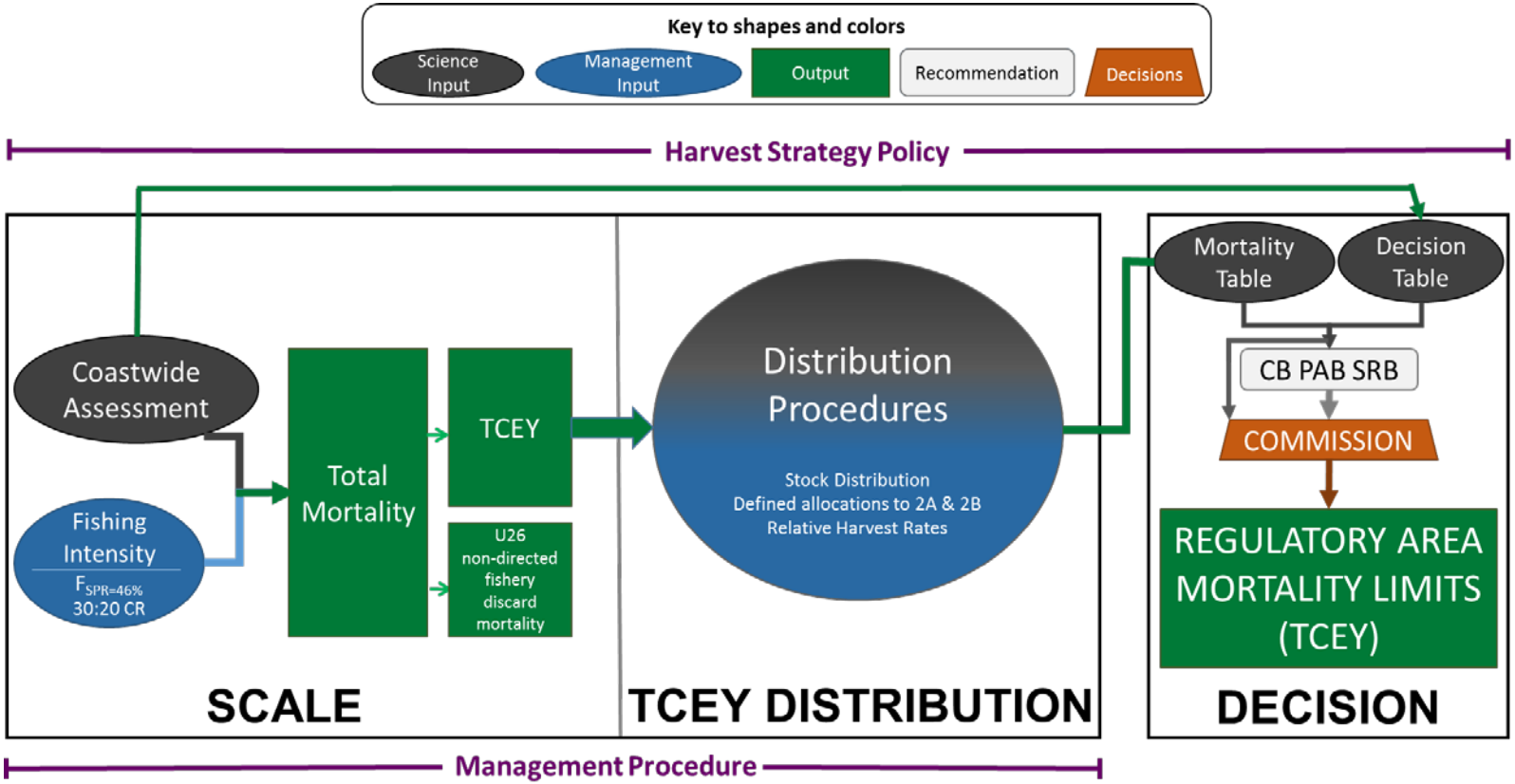
IPHC-2019-IM095-14

Management Strategy Evaluation (MSE)

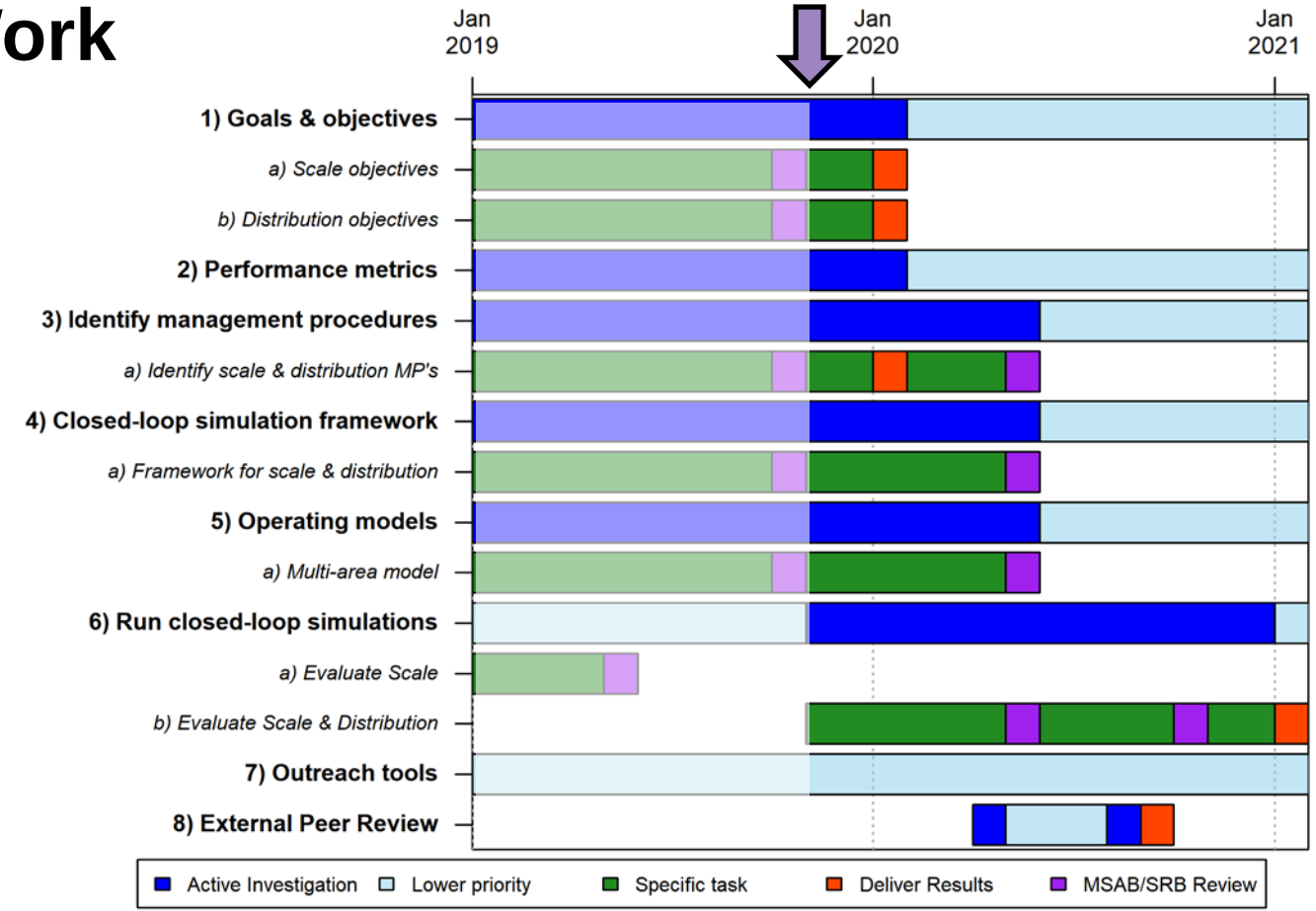
a process to evaluate harvest strategies and develop a management procedure that is robust to uncertainty and meets defined objectives



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

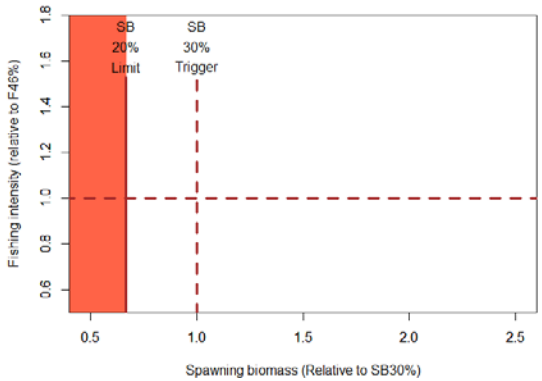
2.1. Maintain spawning biomass around a level that optimizes fishing activities

2.2. Limit catch variability

2.3. Provide directed fishing yield

Reference points (current interim)

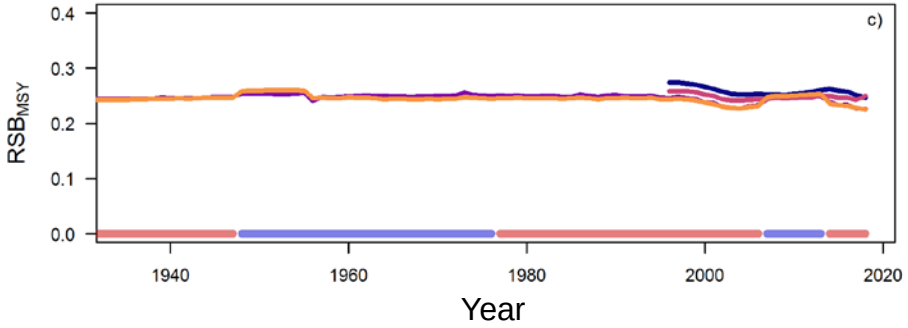
- Describe the Interim management procedure
  - $SB_{20\%}$ Biological Limit
  - $SB_{30\%}$ Fishery Trigger
  - SB_{Target} – Currently not specified
  - $F_{46\%}$ Reference level of fishing intensity
  - F_{limit} – Currently not specified



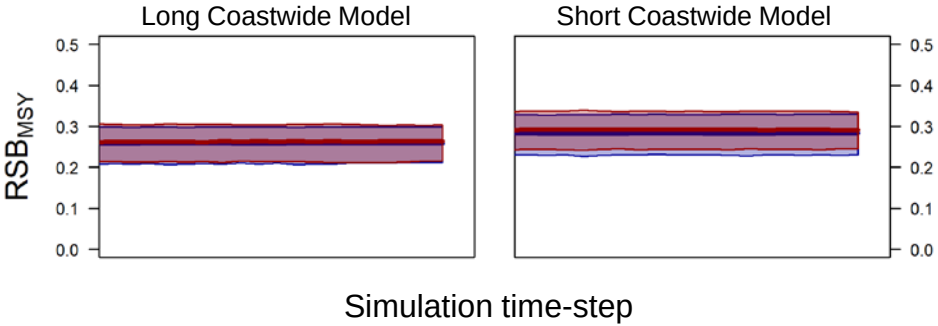
Investigation of MSY-related reference points

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

From Assessment Ensemble



From MSE Operating Model



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	SB < Spawning Biomass Limit (SB_{Lim}) SB_{Lim}=20% unfished spawning biomass	Long-term	0.05
Maintain a defined minimum proportion of female spawning biomass in each Biological Region	$p_{SB,2} > 5\%$ $p_{SB,3} > 33\%$ $p_{SB,4} > 10\%$ $p_{SB,4B} > 2\%$	Long-term	0.05

2.1. Primary fishery objective (1)

Analysis of MSY-based reference points

- Relative spawning biomass (RSB) is consistent across regimes
- RSB=30% is a precautionary MSY proxy
- RSB=36% 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 (2)

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 (3)

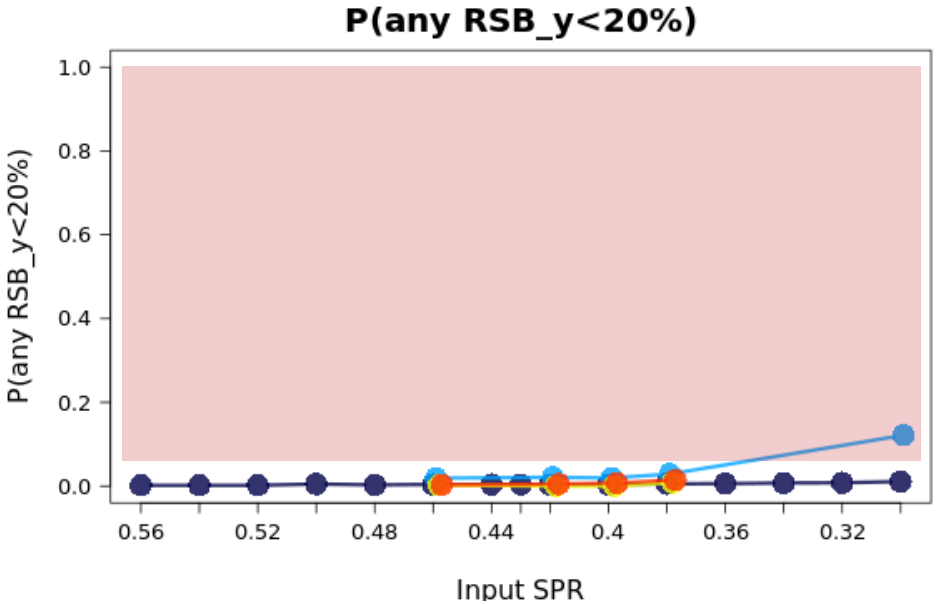
Measurable Objective	Measurable Outcome	Time-frame	Tolerance
Optimize average coastwide TCEY	Median coastwide TCEY	Short-term	
Optimize TCEY among Regulatory Areas	Median $TCEY_A$	Short-term	
Optimize the percentage of the coastwide TCEY among Regulatory Areas	Median $\%TCEY_A$	Short-term	
Maintain a 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	

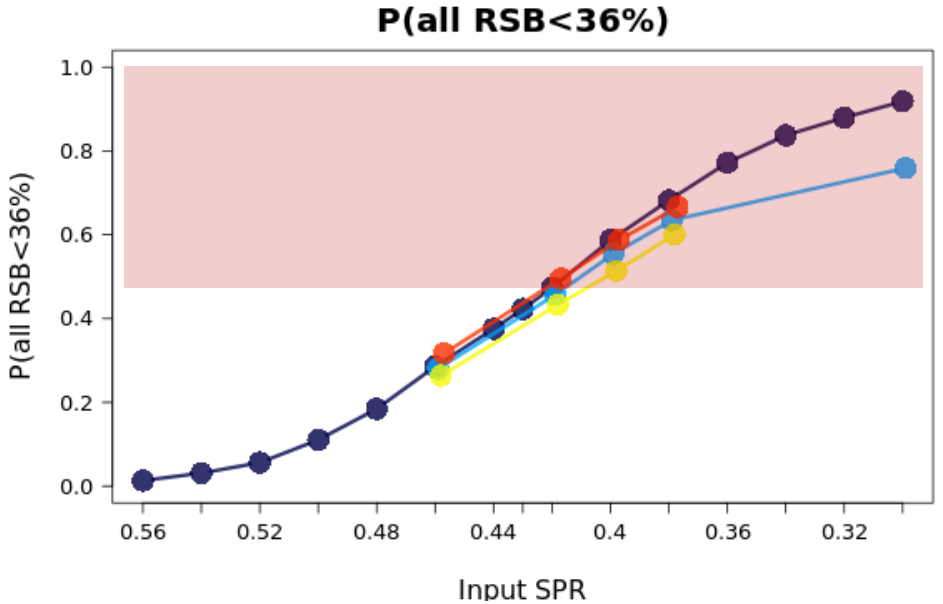
Examining objectives

- 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

No constraint
Max change 15%
Slow-up, fast down
Multi-year (3)

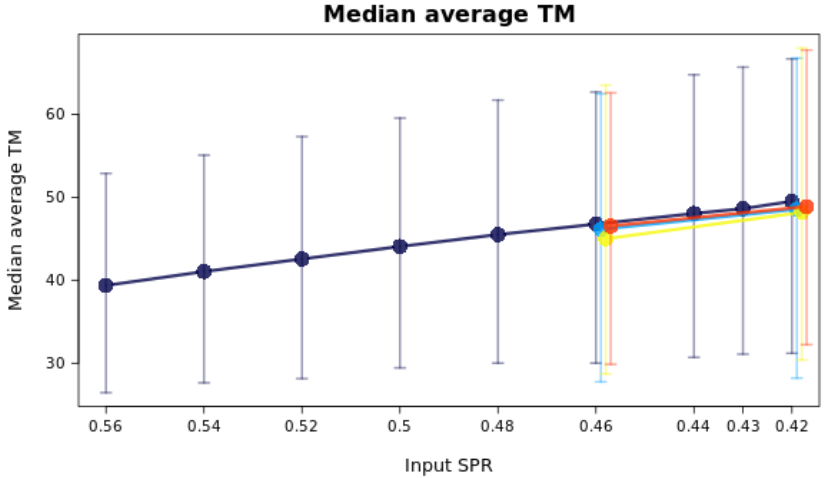


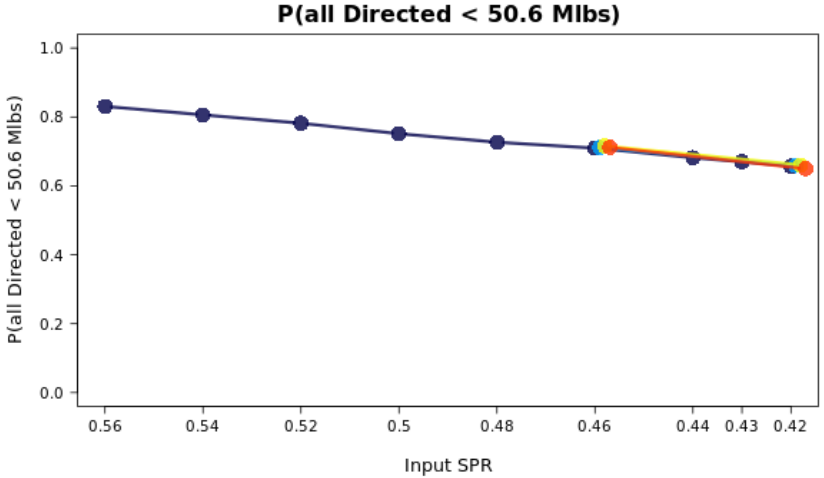


Coastwide results

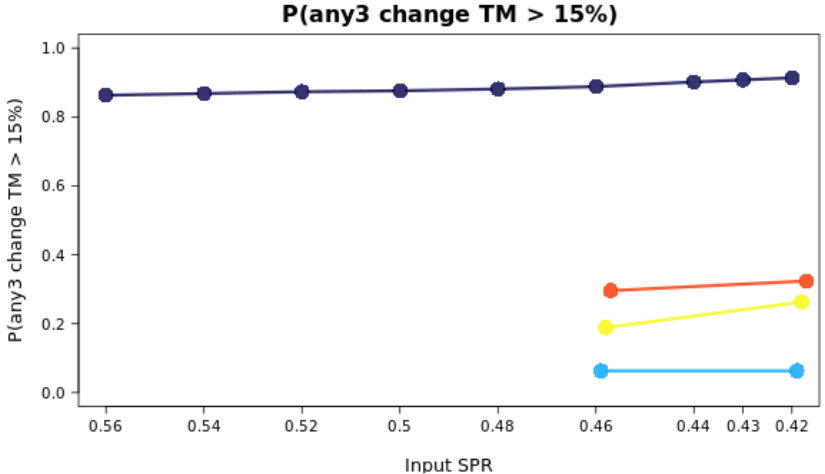
No constraint
Max change 15%
Slow-up, fast down
Multi-year (3)

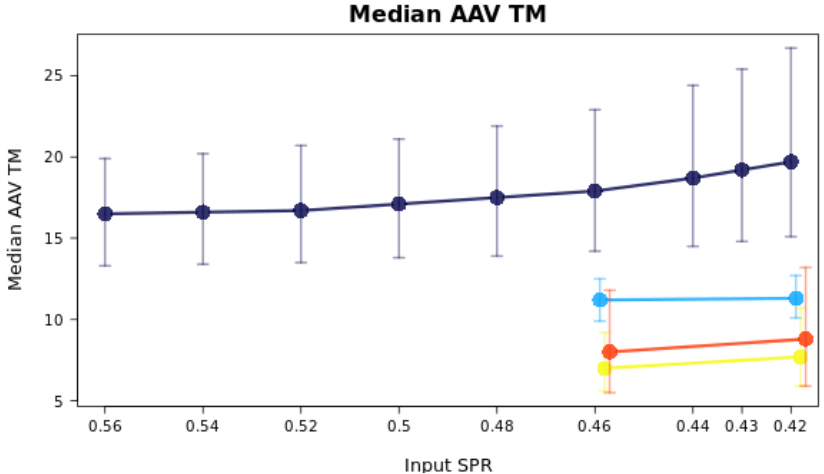
Yield





Stability



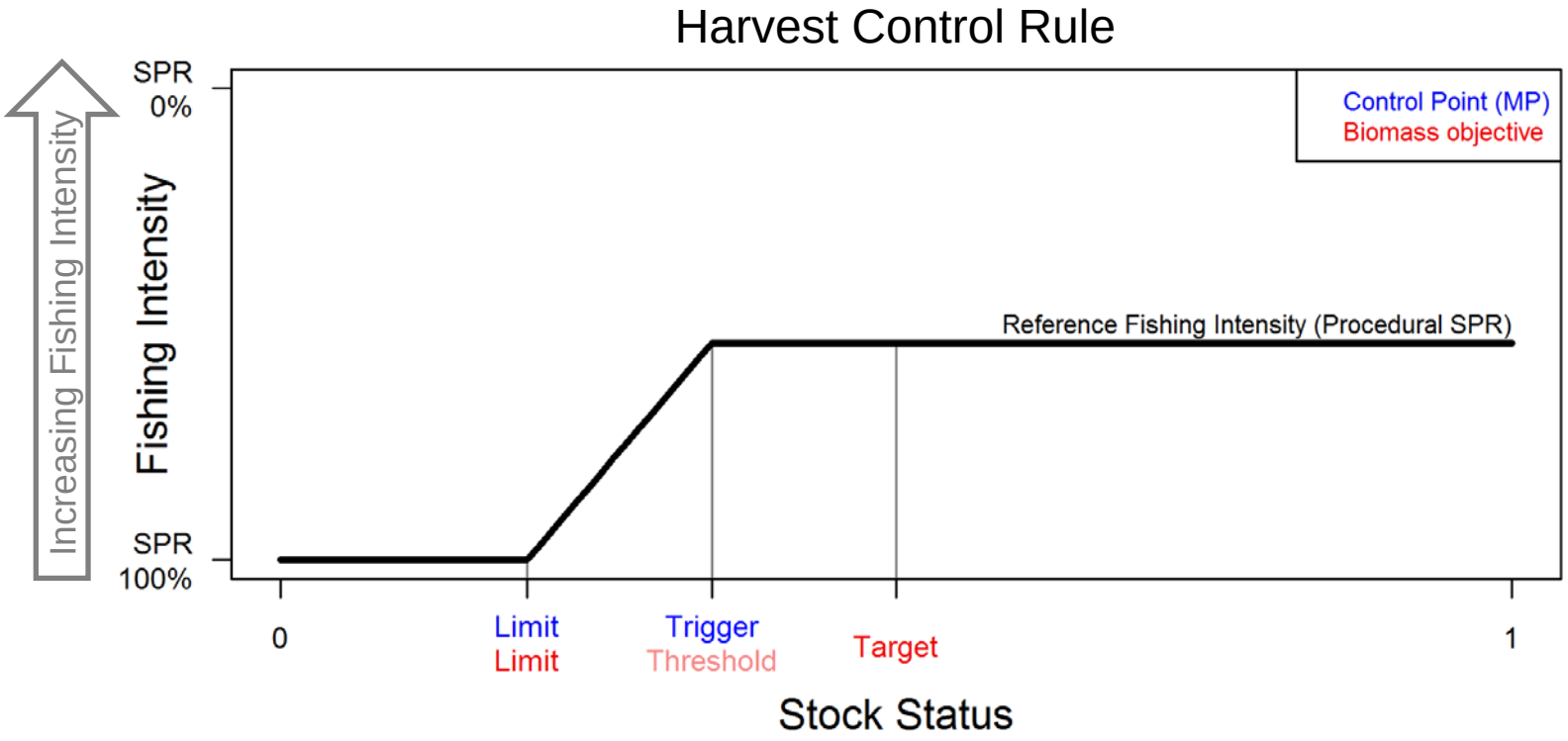


Reference points

- $SB_{20\%}$ Biological Limit and Fishery Limit
- $SB_{30\%}$ Fishery Trigger
- $SB_{36\%}$ Biological Target
- $F_{43\%}$ Reference level of fishing intensity (update in 2021)
- F_{limit} Maximum fishing intensity ($F_{36\%}$)

Part of Management Procedure
Part of Objective

Reference Points and Control Points



Management Procedures: 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

Management Procedures: DISTRIBUTION

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 productivity by region

- Yield per Recruit (YpR) analysis
- Each region analysed separately (2, 3, 4, 4B)

		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

- Supports lower relative HR in western areas in the past
- Changes in productivity over time may affect appropriate relative harvest rates
- Movement, uncertainty, and other factors may also be important

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}
- 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-e) **NOTE** the twelve primary objectives including a fishery objective to maintain the spawning biomass around a target of 36%

f) **NOTE** that SPR values greater than 40% with a 30:20 control rule and one of three types of constraints meet the coastwide objectives

g) **NOTE** the scale and distribution elements that will be evaluated and presented at AM097 in in 2021

h) **NOTE** that the Operating Model will model movement across Biological Regions and IPHC Regulatory Areas

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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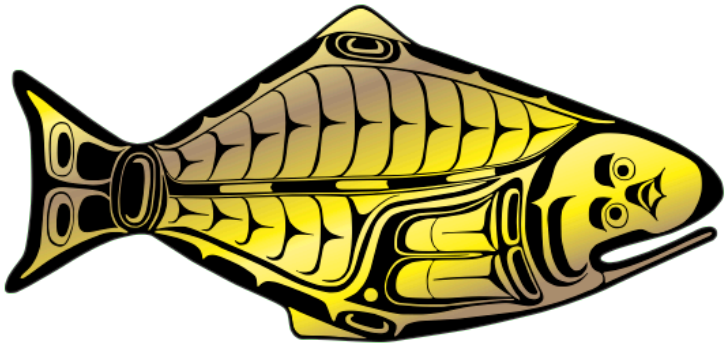

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