L. Boitor

INTERNATIONAL PACIFIC HALIBUT COMMISSION

MSE Results

Agenda Item 6

IPHC-2020-MSAB016-09

General Objectives

- Primary biological sustainability objectives
- Primary fishery objectives
  - Target Spawning Biomass to optimise fishing activities
  - Stability in mortality limits
  - Provide directed fishing yield

MSE Webpage:

https://www.iphc.int/management/science-and-research/management-strategy-evaluation

Primary Performance Metrics

Biological Sustainability

- Probability female SB > 20% of B0
- Probability female SB in R2 > 5% of coastwide SB
- Probability female SB in R3 > 33% of coastwide SB
- Probability female SB in R4 > 10% of coastwide SB
- Probability female SB in R4B > 2% of coastwide SB

Primary Performance Metrics

Fishery

- Probability coastwide female SB > 36% of B0
- Probability Annual Change in TCEY > 15% in any 3 yrs of 10
  - coastwide and by IPHC Regulatory Area
- Median AAV
  - coastwide and by IPHC Regulatory Area
- Median TCEY
  - coastwide and by IPHC Regulatory Area
- Median %TCEY in each IPHC Regulatory Area
- Minimum TCEY in each IPHC Regulatory Area
- Minimum %TCEY in IPHC Regulatory Area

Ad hoc MSAB meeting (1)

Para 11 to 14: Improvements to MSE Explorer

- Tables to summarise the simulations available;
- Clear identification of primary objectives and relative performance metrics;
- Ranking tables

Para 15 to 16: Performance Metrics

- Guided and unguided recreational (not possible at this time)
- TCEY at IPHC Regulatory Areas level
- Relative percentages of TCEY across IPHC Regulatory Areas
- Anything that is part of a catch-sharing plan

Ad hoc MSAB meeting (2)

Para 21: Potential bugs

- MP-B: *fixed*
- MP-C: *fixed*
- Total mortality: *now reporting TCEY*

Estimation Error

- Three methods for implementing estimation error
  1. No estimation error
     - For comparison, not to choose from
  2. Simulated estimation error (as with coastwide MSE)
     - Currently the best method
  3. Modelled estimation error (a stock assessment model)
     - For comparison

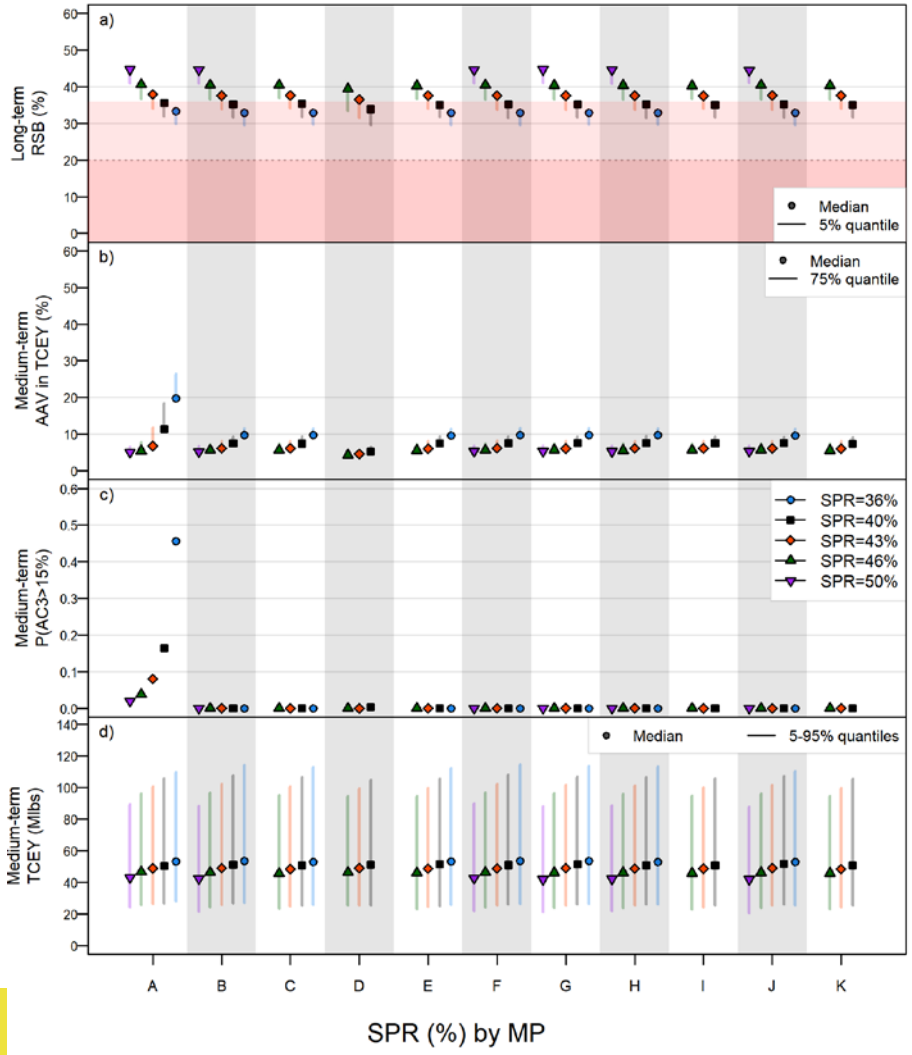
MP comparison

Element	MP-A	MP-B	MP-C	MP-D	MP-E	MP-F	MP-G	MP-H	MP-I	MP-J	MP-K
maxChange15%		■	■	■	■	■	■	■	■	■	■
max FI buffer (36%)				■							
O32 stock distribution	■	■	■	■	■	■	■	■			
O32 stock distribution (5-year moving avg)										■	
All sizes stock distribution									■		
5-year shares form O32 stock distribution									■		■
Relative harvest rates 1 for 2-3A, 0.75 for 3B-4	■	■		■	■	■	■		■	■	
Relative harvest rates 1 for 2-3, 4A, 4CDE, 0.75 for 4B								■			
1.65 Mlbs floor in 2A	■	■	■	■	■						
Formula percentage for 2B	■	■	■	■							
National Shares (2B=20%)						■					

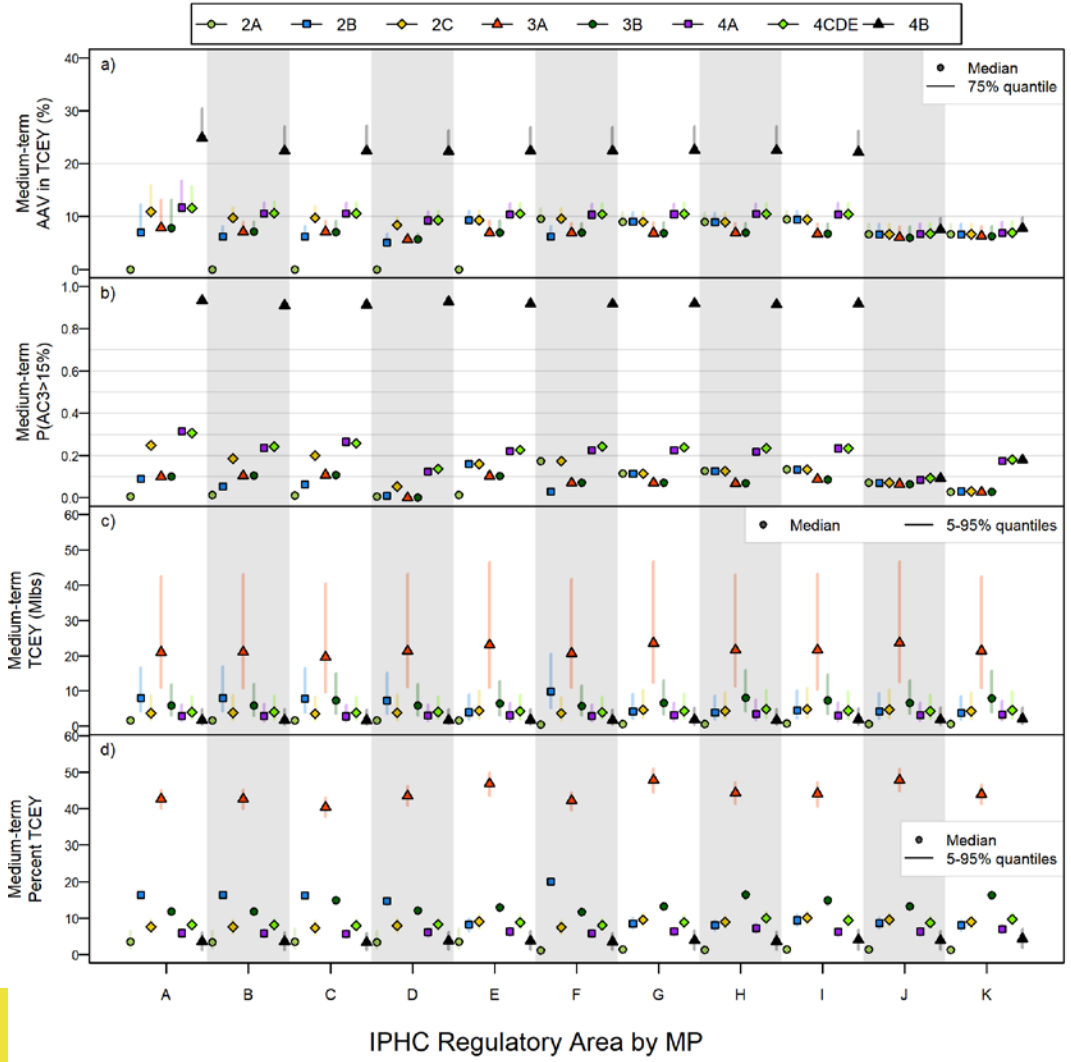
Coastwide Performance Metrics

Input SPR/TM	43	43	43	43	43	43	43	43	43	43	43
Management Procedure	A	B	C	D	E	F	G	H	I	J	K
Number of Simulations	500	500	400	300	300	500	500	500	300	500	300
Biological Sustainability											
P(any RSB_y<20%)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fishery Sustainability											
P(all RSB<36%)	0.25	0.28	0.28	0.45	0.29	0.28	0.28	0.29	0.29	0.28	0.29
Median average TCEY	48.89	49.10	48.56	49.14	48.82	48.90	49.08	48.73	48.65	49.01	48.43
P(any3 change TCEY > 15%)	0.18	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Median AAV TCEY	6.8%	6.1%	6.1%	4.6%	6.0%	6.2%	6.1%	6.1%	6.1%	6.1%	6.0%

Coastwide performance metrics



Regulatory Area Performance Metrics



Ranking Biological Sustainability objectives

Objective	PM	A	B	C	D	E	F	G
Maintain a coastwide female SB above a biomass limit reference point 95% of the time	$P(SB < SB_{Lim})$	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Maintain a minimum proportion of female SB	$P(\%SB_{R=2} < 5\%)$	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Maintain a minimum proportion of female SB	$P(\%SB_{R=3} < 33\%)$	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Maintain a minimum proportion of female SB	$P(\%SB_{R=4} < 10\%)$	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Maintain a minimum proportion of female SB	$P(\%SB_{R=4B} < 2\%)$	0.15	0.15	0.16	0.14	0.15	0.15	0.16

2.1 Fishery objective

Objectives	PMs	A	B	C	D	E	F	G	H
Maintain the coastwide female SB above a target at least 50% of the time	$P(SB < SB_{36\%})$	11	6	6	1	2	6	6	2

2.2 Fishery stability objectives

Objectives	PMs	A	B	C	D	E	F	G	H	I	J	K
Limit TCEY AC	P(AC$_s$ > 15%)	11	1	1	10	1	1	1	1	1	1	1
Limit TCEY AAV	Median AAV TCEY	11	4	4	1	2	10	4	4	4	4	2
Limit AC in Reg Areas TCEY	P(AC$_s$ 2A > 15%)	1	1	1	1	1	11	8	9	9	7	6
	P(AC$_s$ 2B > 15%)	7	4	5	1	11	2	8	9	9	6	2
	P(AC$_s$ 2C > 15%)	11	9	10	2	7	8	4	5	5	3	1
	P(AC$_s$ 3A > 15%)	8	8	11	1	8	4	4	4	7	3	2
	P(AC$_s$ 3B > 15%)	8	8	11	1	8	4	4	4	7	3	2
	P(AC$_s$ 4A > 15%)	11	9	10	2	4	6	6	4	6	1	3
	P(AC$_s$ 4CDE > 15%)	11	7	10	2	4	7	7	4	4	1	3
	P(AC$_s$ 4B > 15%)	10	3	3	10	6	6	6	3	6	1	2
Limit AAV in Reg Areas TCEY	Median AAV 2A	1	1	1	1	1	11	9	8	10	6	6
	Median AAV 2B	7	2	2	1	10	2	9	8	11	5	5
	Median AAV 2C	11	9	9	3	6	8	5	4	7	1	1
	Median AAV 3A	11	9	9	1	5	5	5	5	4	2	3
	Median AAV 3B	11	9	9	1	5	5	5	5	4	2	3
	Median AAV 4A	11	10	9	3	5	4	5	5	5	1	2
	Median AAV 4CDE	11	9	9	3	5	4	5	5	5	1	2
	Median AAV 4B	11	5	5	4	5	5	10	9	3	1	2

2.3 Fishery yield objectives

Objectives	PMs	A	B	C	D	E	F	G	H	I	J	K
Optimize TCEY	Median TCEY	5	1	9	1	7	5	1	8	9	4	11
Maintain minimum TCEY by Reg Areas	Median Min 2A	1	1	1	1	1	11	7	7	6	7	7
	Median Min 2B	4	2	3	5	9	1	8	10	6	7	10
	Median Min 2C	11	8	10	7	4	8	2	6	1	2	4
	Median Min 3A	10	8	11	4	3	9	2	6	5	1	6
	Median Min 3B	11	9	3	8	7	10	6	1	3	5	1
	Median Min 4A	11	8	9	5	5	9	3	1	5	3	1
	Median Min 4CDE	10	8	10	5	5	8	5	2	3	4	1
	Median Min 4B	11	8	8	3	3	8	3	3	3	2	1
Optimize Reg Areas TCEY	Median TCEY2A	1	1	1	1	1	11	6	9	6	6	9
	Median TCEY2B	2	2	4	5	9	1	7	9	6	7	11
	Median TCEY2C	9	7	11	7	4	10	3	5	1	2	6
	Median TCEY3A	9	8	11	7	3	10	2	4	5	1	6
	Median TCEY3B	9	9	4	8	7	11	6	1	3	5	2
	Median TCEY4A	8	8	11	6	3	8	3	1	6	3	2
	Median TCEY4CDE	7	7	11	7	5	10	4	1	2	5	2
	Median TCEY4B	6	6	11	6	3	6	3	6	2	3	1

2.3 Fishery yield objectives (percentage)

Objectives	PMs	A	B	C	D	E	F	G	H	I	J	K
Maintain minimum % TCEY by Reg Areas	Median Min % 2A	5	2	1	2	2	11	8	10	6	6	8
	Median Min % 2B	2	2	4	5	10	1	8	11	6	7	8
	Median Min % 2C	9	8	11	7	5	10	3	6	2	1	4
	Median Min % 3A	9	8	11	7	3	10	2	5	6	1	4
	Median Min % 3B	10	9	3	8	7	11	6	2	4	5	1
	Median Min % 4A	8	8	11	7	5	8	4	2	5	3	1
	Median Min % 4CDE	8	8	11	7	6	10	5	2	3	3	1
	Median Min % 4B	7	7	11	5	5	10	3	7	3	2	1
Optimize TCEY percentage among Reg Areas	Median % TCEY2A	1	4	1	4	1	11	7	9	6	7	9
	Median % TCEY2B	2	2	2	5	9	1	7	11	6	7	10
	Median % TCEY2C	8	8	11	7	4	10	3	6	1	2	5
	Median % TCEY3A	9	8	11	7	3	10	1	4	5	1	6
	Median % TCEY3B	9	9	3	8	7	11	5	1	4	5	2
	Median % TCEY4A	8	8	11	7	4	10	3	1	6	4	2
	Median % TCEY4CDE	8	9	11	7	4	10	4	1	3	6	2
	Median % TCEY4B	8	8	11	5	5	10	3	5	2	3	1

Average ranks

Objectives	PMs	A	B	C	D	E	F	G	H	I	J	K
Maintain the coastwide female SB above a target at least 50% of the time	P(SB < $SB_{36\%}$)	2	4	4	1	4	11	4	4	3	4	4
Limit AC in coastwide TCEY	P(AC_3 > 15%)	11	1	1	10	1	1	1	1	1	1	1
Limit AC in coastwide TCEY	Median AAV TCEY	11	4	4	1	2	10	4	4	4	4	2
Optimize average coastwide TCEY	Median TCEY	5	1	9	1	7	5	1	8	9	4	11
Limit AC in Reg Areas TCEY	P(AC_3 > 15%) RegAreas	9.25	6.75	6.62	2.12	5.25	5.5	6.62	6.12	6.12	2.38	3
Limit AAV in Reg Areas TCEY	Median AAV TCEY RegAreas	8.38	6.12	7.62	2.5	6.12	6	5.88	5.25	6.62	3.12	2.62
Optimize Reg Areas TCEY	Median TCEY RegAreas	7.25	6.5	7.88	6	5.38	8.88	4.88	5.62	4.38	3.5	3.5
Optimize TCEY % among Reg Areas	Median % TCEY RegAreas	8.62	6.5	6.88	4.75	4.62	8	4.5	4.5	4	3.88	3.88
Maintain minimum TCEY by Reg Areas	Median Min(TCEY) RegAreas	6.38	6	8	5.88	4.38	8.38	4.25	4.5	3.88	4	4.88
Maintain minimum % TCEY by Reg Areas	Median Min(% TCEY) RegAreas	6.62	7	7.62	6.25	4.62	9.12	4.12	4.75	4.12	4.38	4.62

Simulations and Results

http://shiny.westus.cloudapp.azure.com/shiny/sample-apps/MSE-Explorer/

Recommendations

a) **NOTE** paper IPHC-2020-MSAB016-09 which provides performance metrics for primary objectives for MSE simulations using six priority 1 management procedures.

b) **RECOMMEND** management procedures that meet primary objectives and perform best given consideration of trade-offs and possibly additional performance metrics.

c) **RECOMMEND** additional performance metrics that would be useful for the evaluation of management procedures.

d) **RECOMMEND** alternative ways to display and communicate results to assist in the evaluation of management procedures.

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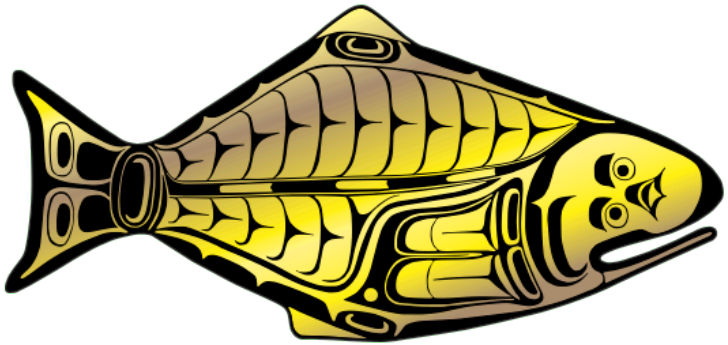

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