

INTERNATIONAL PACIFIC



HALIBUT COMMISSION

Further Investigation of Management Procedures Related to Coastwide Fishing Intensity

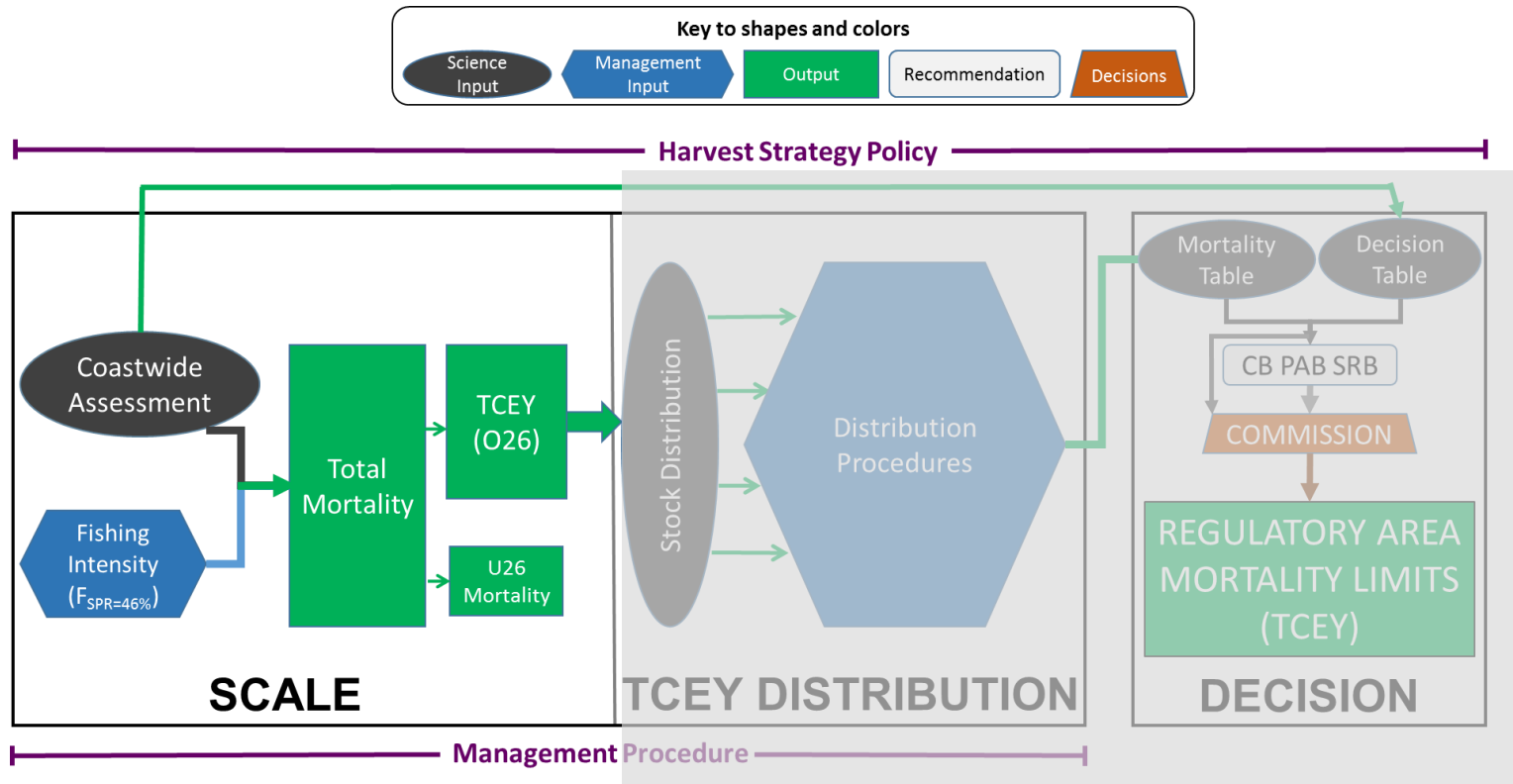
Agenda Item 5

IPHC-2019-MSAB013-08

Outline

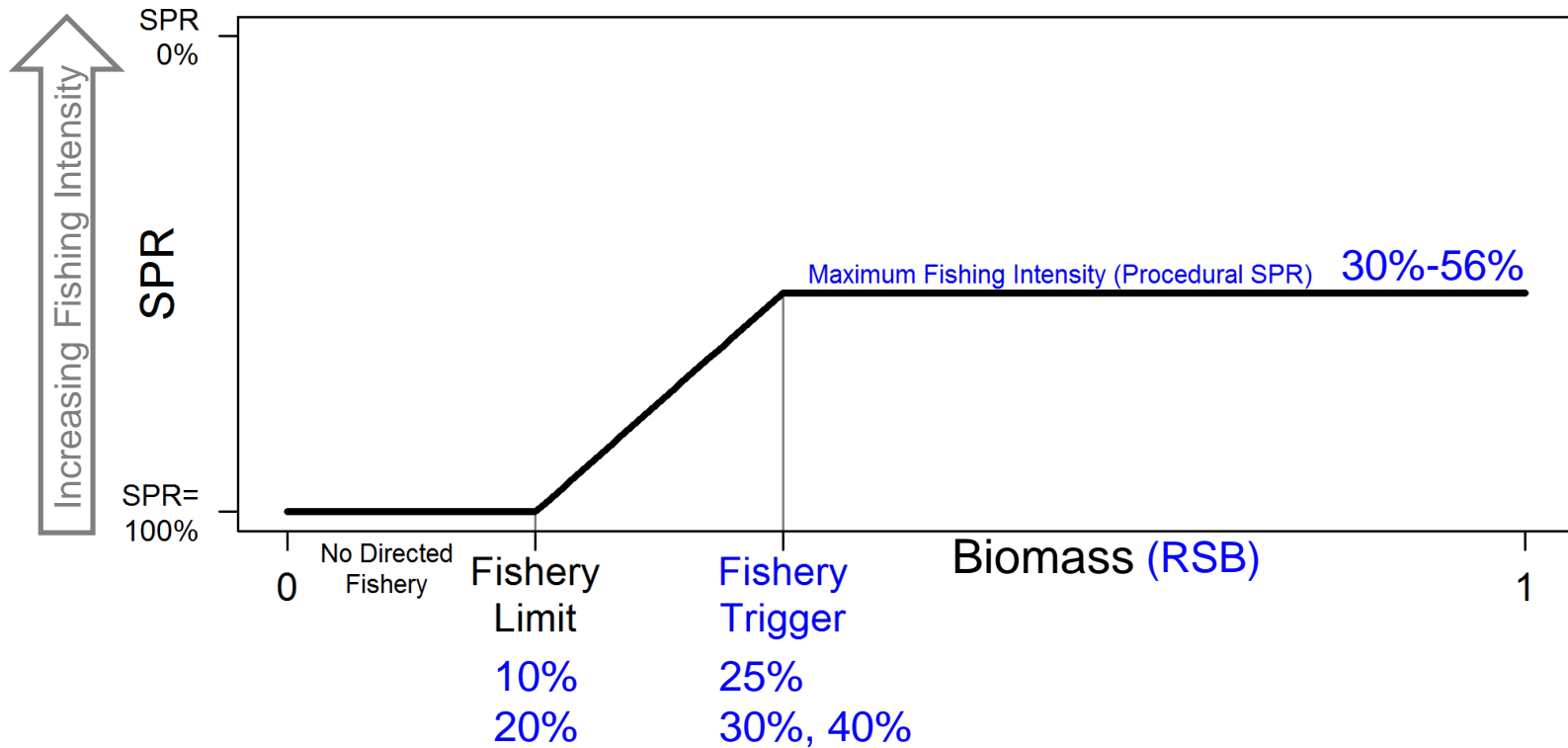
- Management procedures related to coastwide scale
 - MSAB012
 - Constraints on the annual change in the TCEY
- Results of MSE simulations

Management Procedure



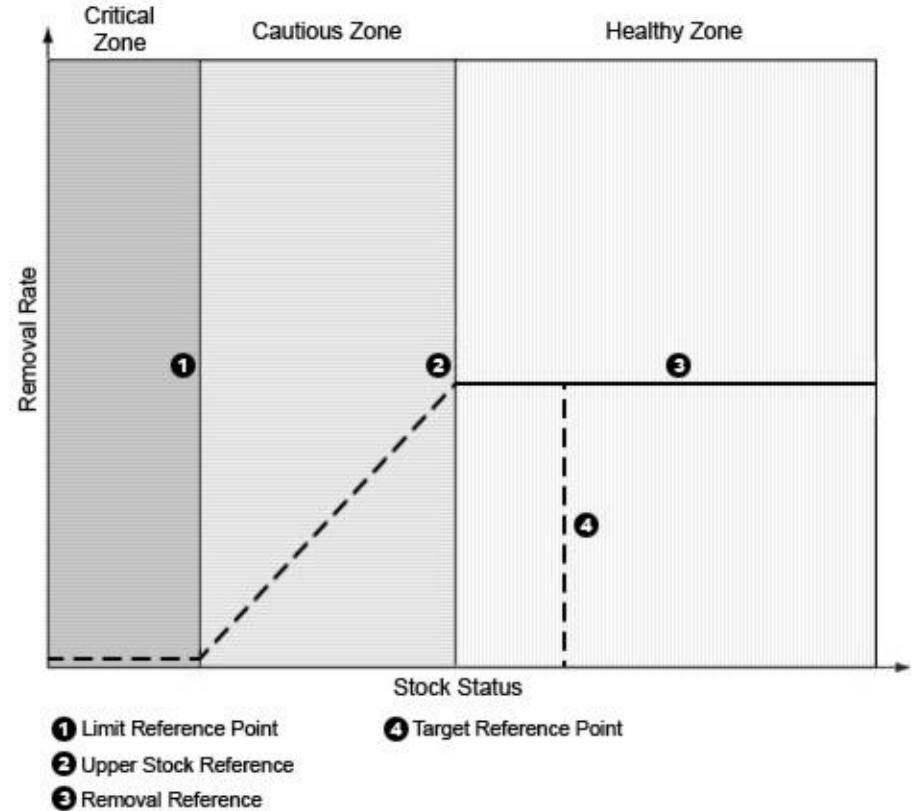
Scale Management Procedure

Harvest Control Rule



DFO harvest control rule

1. Biomass Limit and Fishery Limit
 2. Fishery Trigger
 3. Procedural SPR
 4. B_{Tar}
- Cautious zone = “on the ramp”



MSAB012: Recommendation

MSAB012–Rec.03 (para. 37) The MSAB **RECOMMENDED** that a coastwide fishing intensity SPR should not be lower than 40% nor higher than 46%, with a target SPR of 42%-43% with a 30:20 HCR.

MSAB012: additional MPs

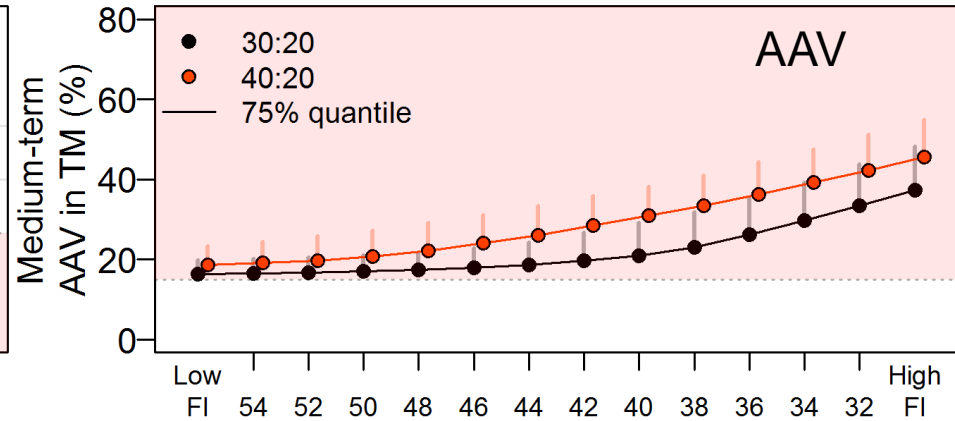
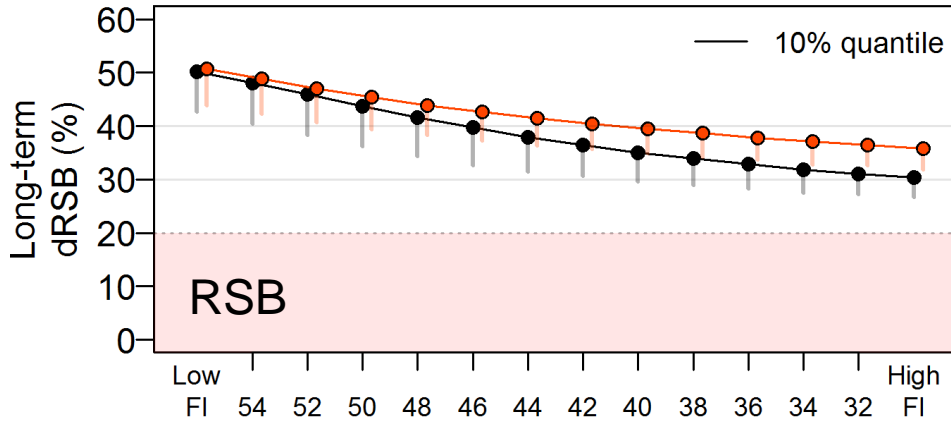
MSAB012–Req.03 (para. 40) The MSAB **REQUESTED** that additional MPs components be considered to meet the objective of catch stability. The IPHC Secretariat may consider the following MPs, but is **ENCOURAGED** to explore other options to report at MSAB013.

- a) 25:10 control rule, and other control rules, as possible, potentially including 30:10 and 30:15 and 30:20;
- b) Multi-year quotas, defined as setting the TCEY in one year and sticking with the same TCEY in one or more following years, noting that AAV may not be an appropriate metric to measure variability
- c) Limiting change in catch limits from the previous year to +/-15% per year, in addition to other relevant percentages, with the goal of finding MPs that meet the main objectives
- d) Limiting change in catch limits from the previous year to a maximum increase of 15% per year with no limit on decreasing the catch limit
- e) Slow up (33% of the change in TCEY), fast down (-50% of the change in TCEY).

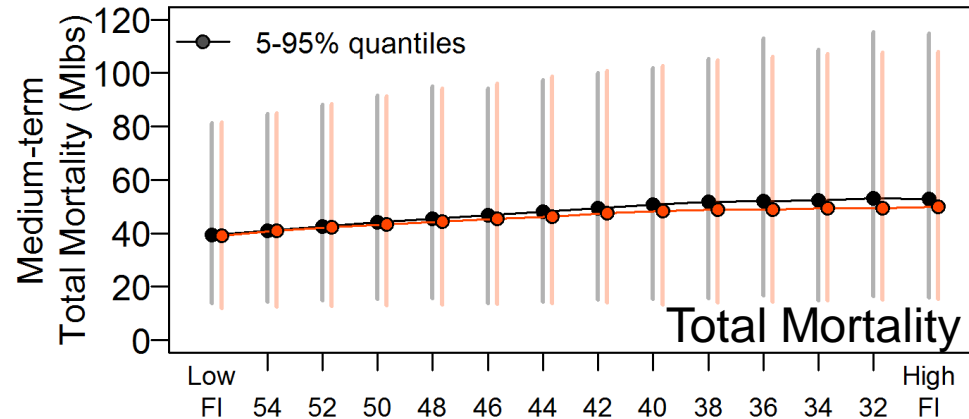
Simulation Results: Performance metrics

- Three performance metrics
 1. RSB: dynamic relative spawning biomass, long-term
 - A measure of stock status
 - Avoid going below 20% more than 10% of the time
 2. AAV: average annual variability, medium-term
 - Average percent change in TM limit from year to year
 - Avoid going above 15% more than 25% of the time
 3. TM: total mortality limit, medium-term
 - Maximize the median value

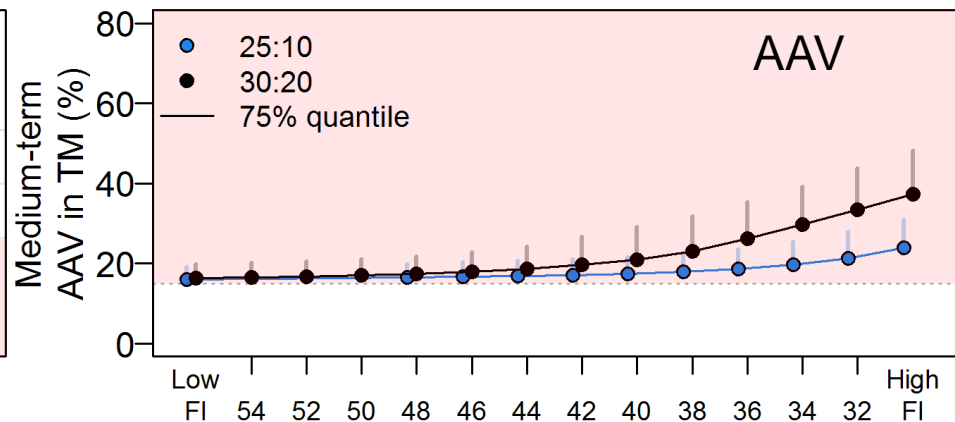
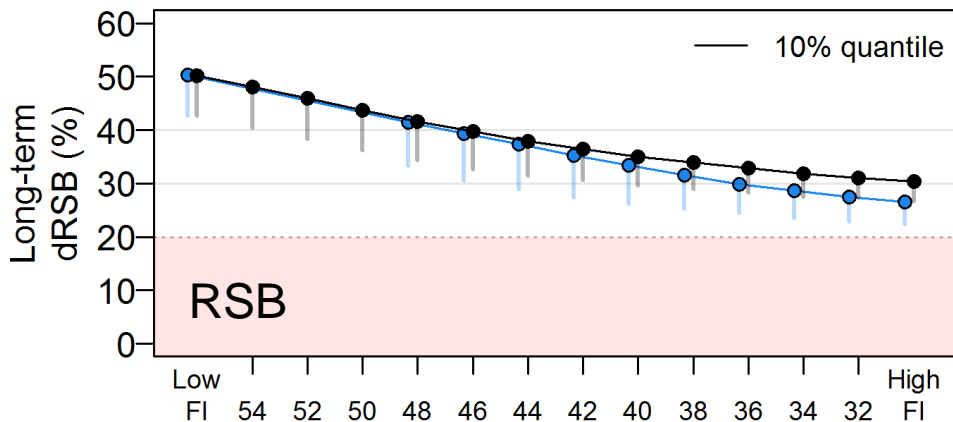
Performance metrics (40:20 & 30:20 CRs)



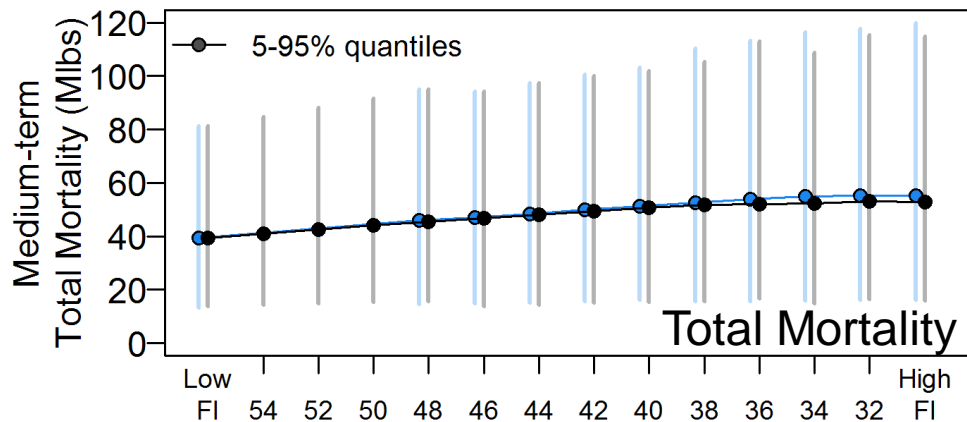
- Bio objective satisfied for all procedures
- AAV objective not satisfied for all procedures
- Median TM increases slightly and range increases with FI



Performance metrics (25:10 & 30:20)



- Bio objective satisfied for all procedures
- AAV objective not satisfied for all procedures (but lower)
- Median TM slightly higher for 25:10 CR



Results table

| Input Control Rule | 30:20 | 30:20 | 30:20 | 30:20 | 30:20 | 30:20 | 30:20 | 30:20 | 30:20 | 30:20 | 30:20 | 30:20 |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Input SPR | 56% | 48% | 46% | 44% | 42% | 40% | 38% | 36% | 34% | 32% | 30% | |
| Biological Sustainability (Long-term) | | | | | | | | | | | | |
| P(all RSB<20%) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 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 | 0.01 |
| Fishery Sustainability (medium-term) | | | | | | | | | | | | |
| P(all AAV > 15%) | 0.60 | 0.66 | 0.69 | 0.72 | 0.76 | 0.80 | 0.84 | 0.88 | 0.93 | 0.96 | 0.98 | 0.98 |
| Median average TM | 39.4 | 45.5 | 46.8 | 48.0 | 49.5 | 50.6 | 51.8 | 52.1 | 52.4 | 53.2 | 52.8 | |
| Rankings (lower is better) over all management procedures without a constraint (Table 3, Table 4, and Table 5) | | | | | | | | | | | | |
| Meet biological objective? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Meet stability objective? | No | No | No | No | No | No | No | No | No | No | No | No |
| Maximum catch (TM) | 30 | 27 | 24 | 21 | 14 | 11 | 9 | 8 | 7 | 4 | 5 | |
| Overall Ranking | — | — | — | — | — | — | — | — | — | — | — | — |

Ranking results (lower is better)

| CR | Input SPR | 56% | 48% | 46% | 44% | 42% | 40% | 38% | 36% | 34% | 32% | 30% |
|-------|----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 30:20 | Meet biological objective? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | Meet stability objective? | No | No | No | No | No | No | No | No | No | No | No |
| | Maximum catch (TM) rank | 30 | 27 | 24 | 21 | 14 | 11 | 9 | 8 | 7 | 4 | 5 |
| | Overall Ranking | — | — | — | — | — | — | — | — | — | — | — |
| 40:20 | Meet biological objective? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | Meet stability objective? | No | No | No | No | No | No | No | No | No | No | No |
| | Maximum catch (TM) rank | 32 | 29 | 27 | 25 | 22 | 20 | 18 | 17 | 16 | 14 | 13 |
| | Overall Ranking | — | — | — | — | — | — | — | — | — | — | — |
| 25:10 | Meet biological objective? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | No |
| | Meet stability objective? | No | No | No | No | No | No | No | No | No | No | No |
| | Maximum catch (TM) rank | 30 | 26 | 23 | 19 | 12 | 10 | 6 | 3 | 2 | 1 | — |
| | Overall Ranking | — | — | — | — | — | — | — | — | — | — | — |

Constrained Management Procedures

All use a
30:20 control rule

- MaxChangeBoth15%
 - TM limit constrained to change no more than 15%
- MaxChangeBoth20%
 - TM limit constrained to change no more than 20%
- MaxChangeUp15%
 - TM limit constrained to increase no more than 15%

Constrained Management Procedures

All use a

30:20 control rule

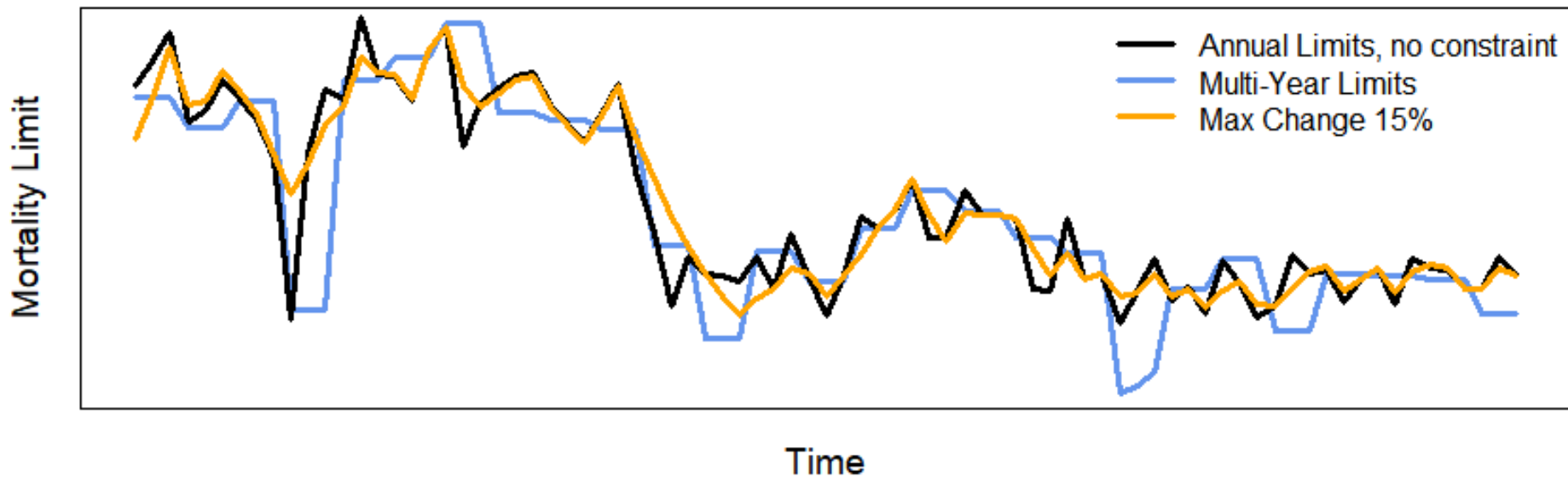
- **SlowUpFastDown**
 - TM limit increases by $1/3^{\text{rd}}$ of increase suggested by harvest control rule
 - TM limit decreases by $1/2$ of decrease suggested by harvest control rule
- **SlowUpFullDown**
 - TM limit increases by $1/3^{\text{rd}}$ of increase suggested by harvest control rule
 - TM limit decreases by full decrease suggested by harvest control rule

Constrained Management Procedures

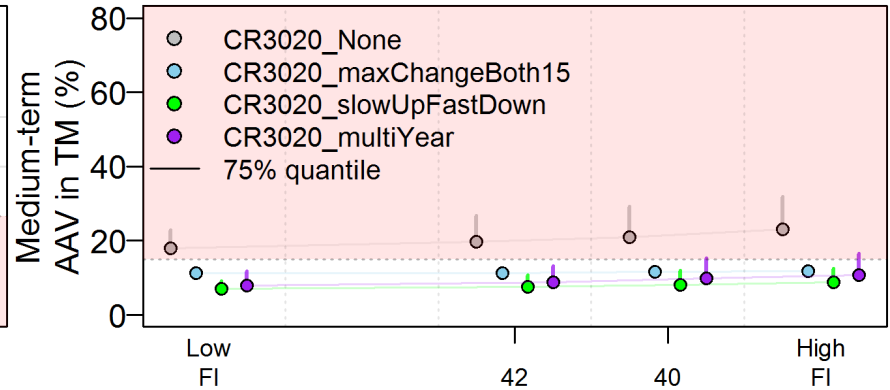
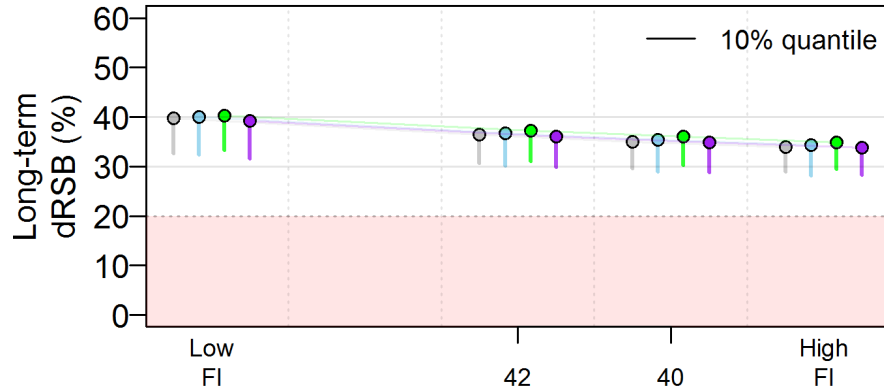
- Cap60
 - TM limit cannot exceed 60 Mlb
- Cap60
 - TM limit cannot exceed 80 Mlb
- Multi-year
 - Set the TM limit every third year

**All use a
30:20 control rule**

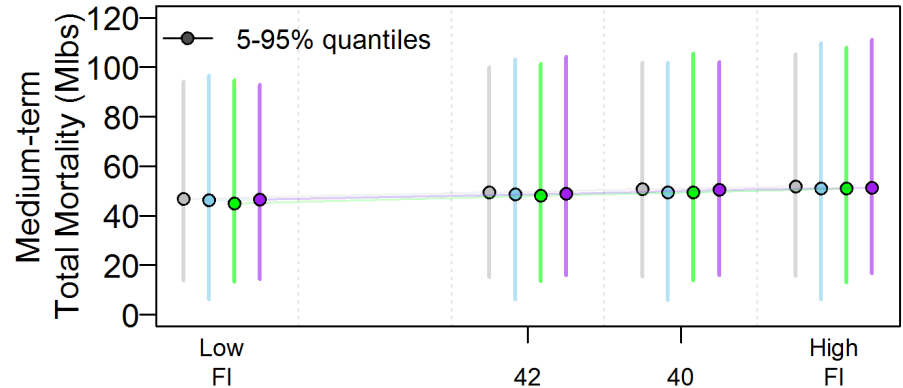
Constrained Management Procedures



Constrained results



- Bio objective satisfied for all procedures
- AAV objective satisfied for some constraints
- Median TM slightly higher with increasing FI



SPR (%)

MSAB013

Slide 17

Ranking constrained results (lower is better)

| Constraint Input SPR | maxChangeBoth15% | | | | slowUp FastDown | | | | multiYear | | | |
|----------------------------|------------------|----------|----------|----------|-----------------|----------|----------|----------|-----------|----------|-----|-----|
| | 46% | 42% | 40% | 38% | 46% | 42% | 40% | 38% | 46% | 42% | 40% | 38% |
| Meet biological objective? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Meet stability objective? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | No | No |
| Maximum catch (TM) | 20 | 14 | 9 | 4 | 23 | 15 | 9 | 2 | 17 | 13 | 6 | 1 |
| Overall Ranking | 10 | 6 | 3 | 2 | 11 | 7 | 3 | 1 | 9 | 5 | --- | --- |

| Constraint Input SPR | maxChangeBoth20% | | | | maxChangeUp | | slowUp FullDown | | | Cap80 | | Cap60 | |
|----------------------------|------------------|-----|-----|-----|-------------|-----|-----------------|----------|-----|-------|-----|-------|-----|
| | 46% | 42% | 40% | 38% | 46% | 40% | 46% | 42% | 40% | 46% | 40% | 46% | 40% |
| Meet biological objective? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Meet stability objective? | No | No | No | No | No | No | Yes | Yes | No | No | No | No | No |
| Maximum catch (TM) | 17 | 12 | 8 | 2 | 25 | 22 | 24 | 16 | 11 | 19 | 5 | 20 | 7 |
| Overall Ranking | --- | --- | --- | --- | --- | --- | 12 | 8 | --- | --- | --- | --- | --- |

Some insights on the meaning of SPR within an MSE framework

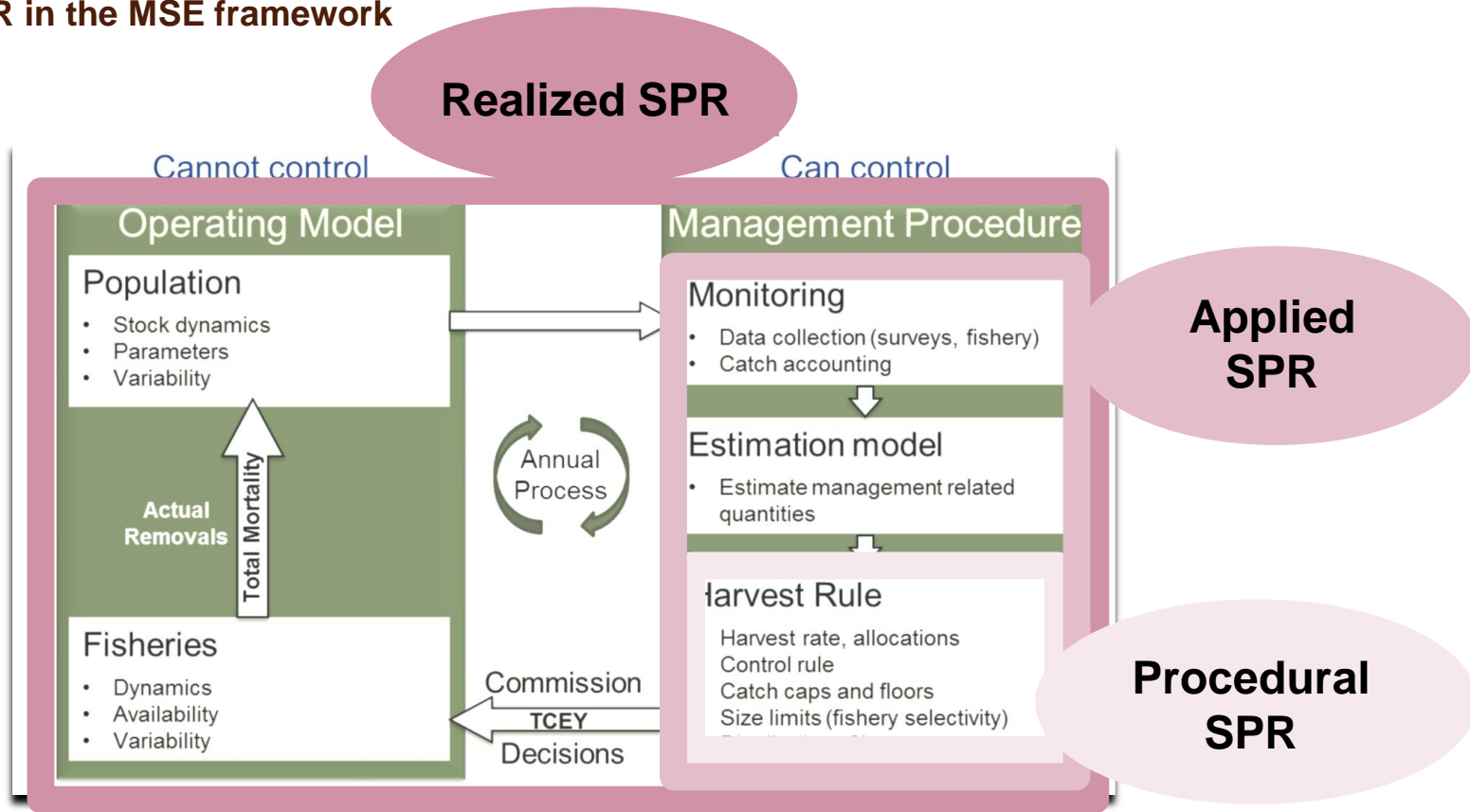
A quick recap

- SPR (Spawning Potential Ratio): measure of the decrease in reproductive potential of the stock
- $$SPR = \frac{\text{Spawning biomass per recruit *with* fishing}}{\text{Spawning biomass per recruit *without* fishing}}$$
- SPR=100% is no fishing

Meaning of SPR in the MSE framework

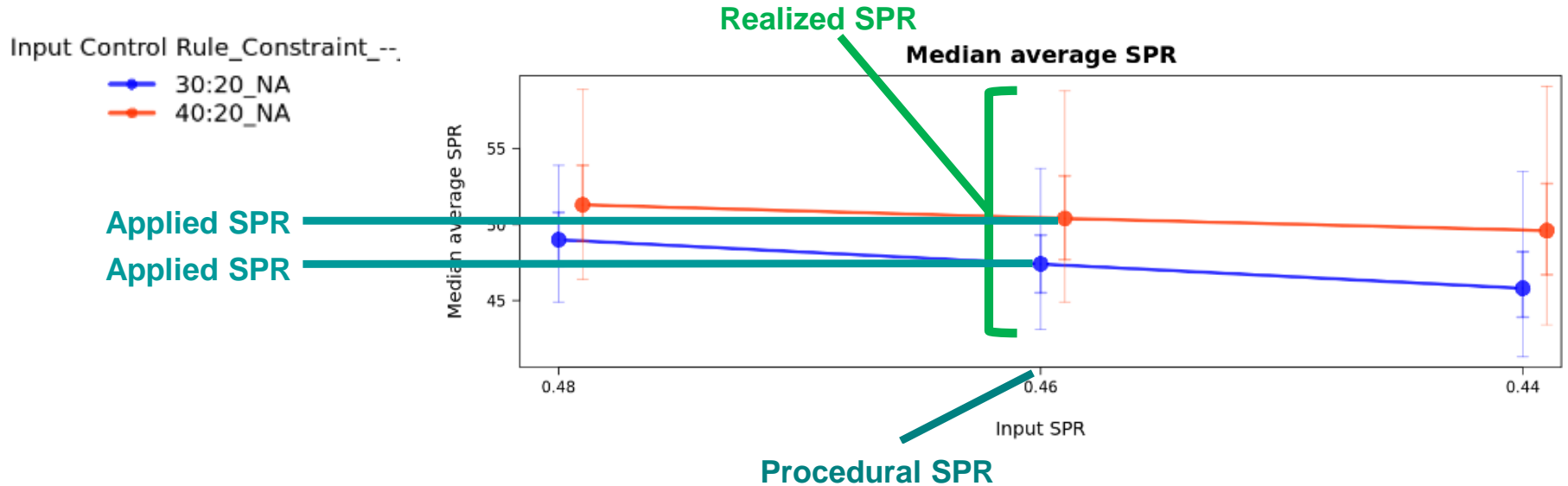
- **Procedural SPR (pSPR):** the biological target of the management strategy.
- **Applied SPR (aSPR):** the SPR generated from the management procedure after the application of the harvest control rule, which includes uncertainty on stock status.
- **Realized SPR (rSPR):** the resulting SPR that includes all the uncertainties (OM + Assessment + application of control rule).

Meaning of SPR in the MSE framework



Example 1

Effect of two different CRs on the aSPR and on the rSPR.

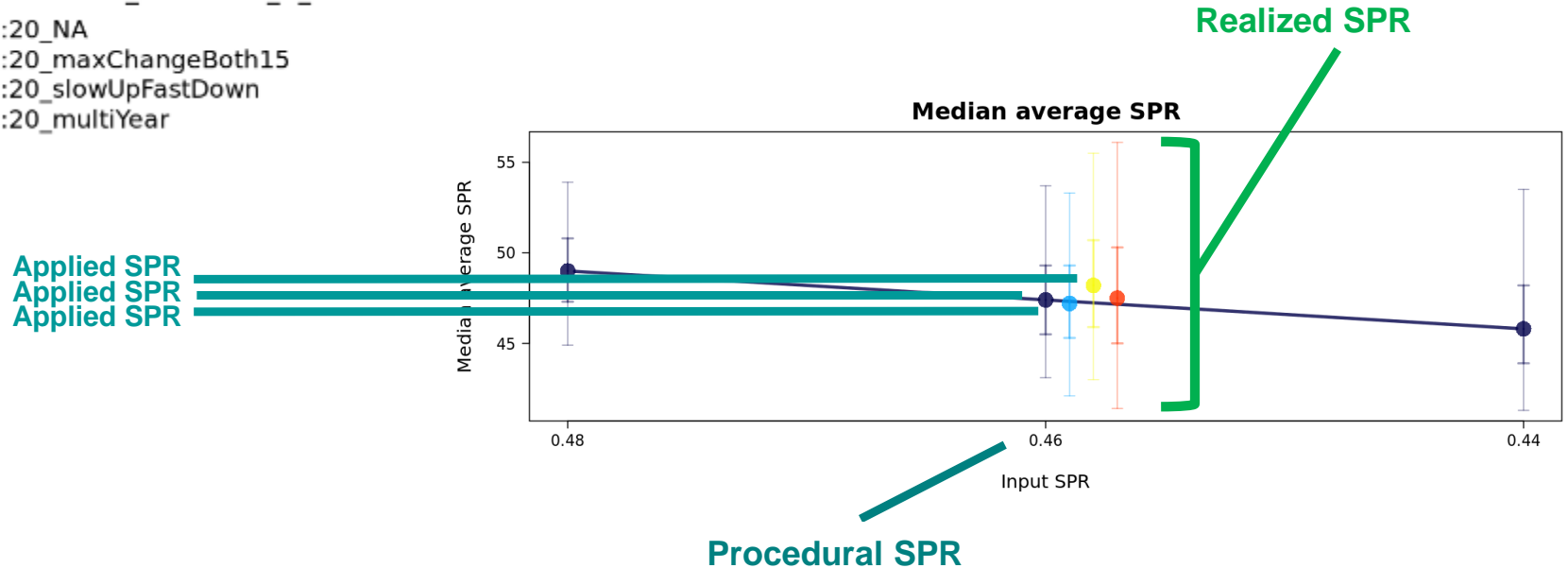


Example 2

Effect of the 30:20 CR with different constraint.

Input Control Rule_Constraint_--_---

- 30:20_NA
- 30:20_maxChangeBoth15
- 30:20_slowUpFastDown
- 30:20_multiYear



Where can we find it?

The MSE Explorer

IPHC MSE Results

Description

Table

Plots

Trade-offs

Help

MP Elements

Control Rule

30:20 40:20

SPR

| | | | | |
|------|------|------|------|------|
| 0.3 | 0.32 | 0.34 | 0.36 | 0.38 |
| 0.4 | 0.42 | 0.43 | 0.44 | 0.46 |
| 0.48 | 0.5 | 0.52 | 0.54 | 0.56 |

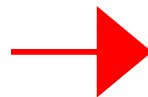
Constraint

Time-period

Duration

Long-term

Expert Mode



Time-period

Duration

Long-term

Expert Mode

nSims

Median average SPR

Biological Sustainability

Median average RSB

Median average # mature Females

P(all RSB<20%)



Median AAV Directed

Median AAV Commercial

Median AAV Recreational

Quantiles

5th% average SPR

25th% average SPR

75th% average SPR

95th% average SPR

5th% average RSB

25th% average RSB

75th% average RSB

95th% average RSB

5th% average TM

Where can we find it?

The MSE Explorer

IPHC MSE Results

Description

Table

Plots

Trade-offs

Help

MP Elements

Control Rule

30:20 40:20

SPR

0.44 0.46 0.48

Constraint

Time-period

Duration

Long-term

Expert Mode

Tabular Results

Download Table

| Input Control Rule | 30:20 | 30:20 | 30:20 | 40:20 | 40:20 | 40:20 |
|--------------------|-------|-------|-------|-------|-------|-------|
| Input SPR | 0.48 | 0.46 | 0.44 | 0.48 | 0.46 | 0.44 |
| Constraint | -- | | | | | |
| | --- | | | | | |
| | ---- | | | | | |
| Median average SPR | 49.0% | 47.4% | 45.8% | 51.3% | 50.4% | 49.6% |
| 5th% average SPR | 44.9% | 43.1% | 41.3% | 46.4% | 44.9% | 43.4% |
| 25th% average SPR | 47.3% | 45.5% | 43.9% | 48.9% | 47.7% | 46.7% |
| 75th% average SPR | 50.8% | 49.3% | 48.2% | 53.9% | 53.2% | 52.7% |
| 95th% average SPR | 53.9% | 53.7% | 53.5% | 58.9% | 58.8% | 59.1% |

Biological Sustainability

| | | | | | | |
|------------------|--------|--------|--------|--------|--------|--------|
| P(all RSB<20%) | 0.0022 | 0.0026 | 0.0037 | 0.0010 | 0.0010 | 0.0010 |
| P(any RSB_y<20%) | 0.0030 | 0.0040 | 0.0040 | 0.0010 | 0.0010 | 0.0010 |

Fishery Sustainability

| | | | | | | |
|-------------------|--------|--------|--------|--------|--------|--------|
| P(all AAV > 15%) | 0.6890 | 0.7165 | 0.7670 | 0.8800 | 0.9210 | 0.9480 |
| Median average TM | 37.39 | 37.56 | 38.08 | 37.27 | 37.60 | 37.73 |
| Median AAV TM | 17.5% | 18.4% | 19.6% | 23.2% | 25.9% | 28.2% |

Procedural SPR

Applied SPR

Realized SPR

MSE Explorer

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

Additional Management Procedures

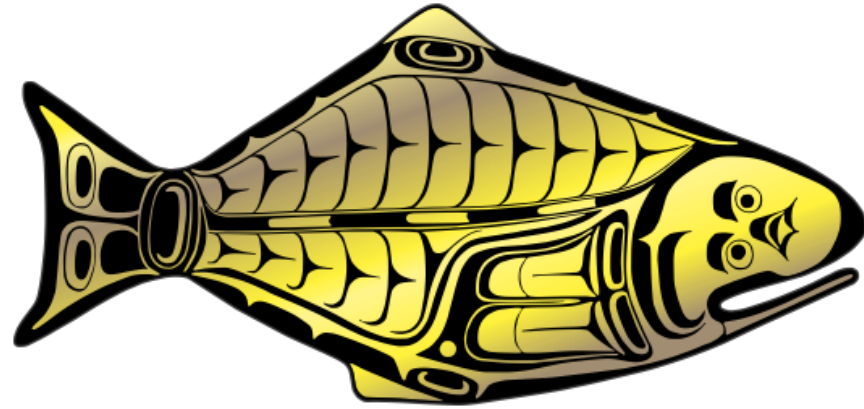
- Other control rules
- MP based on coastwide survey index

52. The Commission **NOTED** the potential benefits in terms of transparency and simplicity, of a management procedure setting mortality limits directly from modelled survey results, particularly for long-lived species where year-to-year demographic change will be relatively minor.

MSAB013

- **NOTE** paper IPHC-2019-MSAB013-08
- **NOTE** that no management procedure without constraints met the stability objective.
- **NOTE** that the three different constraints were ranked in the top 5 management procedures
 - a slow-up fast-down approach, a maximum change of 15%, a multi-year limit
- **RECOMMEND** additional ways to present the results and examine trade-offs between objectives.
- **RECOMMEND** management procedure approaches to consider when examining scale and distribution components of the harvest strategy policy.
- Does the MSAB want to update their recommendation from MSAB012

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