INTERNATIONAL PACIFIC HALIBUT COMMISSION

Management Strategy Evaluation: update

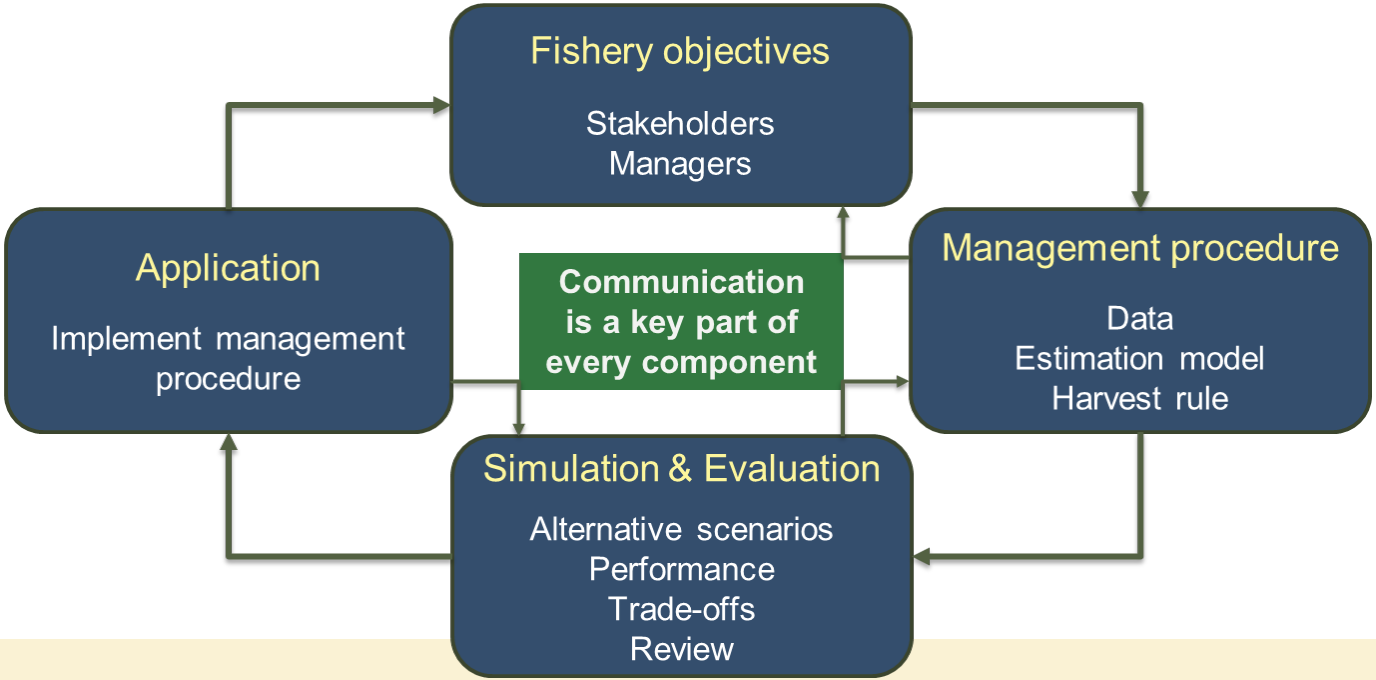
Agenda Item 10.1

(IPHC-2019-AM095-12)

D. Griffay

Management Strategy Evaluation (MSE)

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



Primary Biological objectives

1.1. The primary objective is to avoid a critical biomass below which the stock may not recover

- No more than a 10% risk of being below
- 20% of the dynamic unfished equilibrium biomass
- Long-term (and short-term is of interest)

Tolerance

Measurable Outcome

Time-frame

Short-term: 4-13 years	Medium-term: 14-23 years	Long-term: Equilibrium

Primary Fishery objectives

2.1. Limit annual changes in the TCEY

- No more than a 25% risk of being above
- 15% Average Annual Variability (AAV)
- Short-term (and long-term is of interest)

Tolerance

Measurable Outcome

Time-frame

2.2. Maintain a minimum TCEY

- Not sure of a minimum or a tolerance

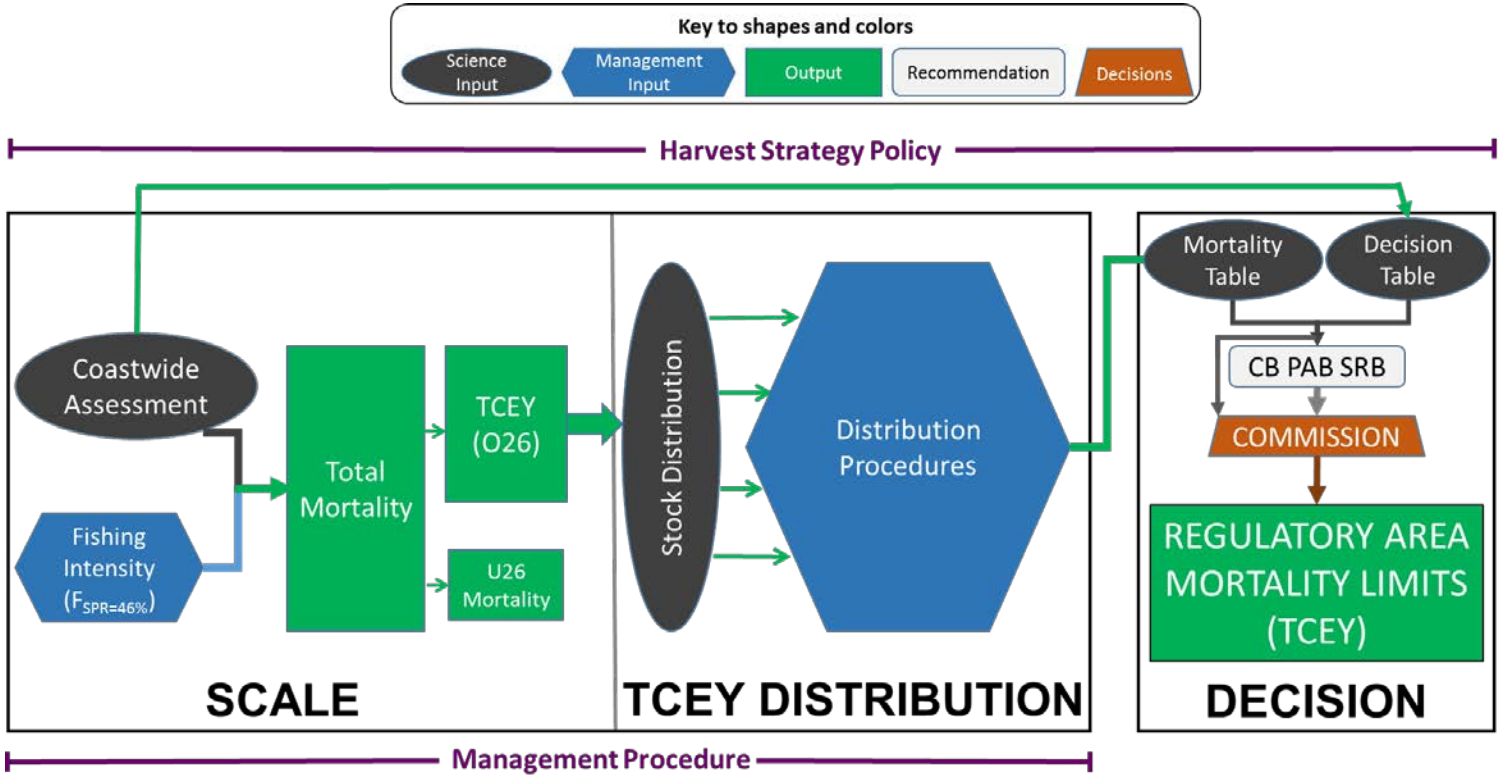
2.3. Maximize TCEY subject to above

Prioritized objectives

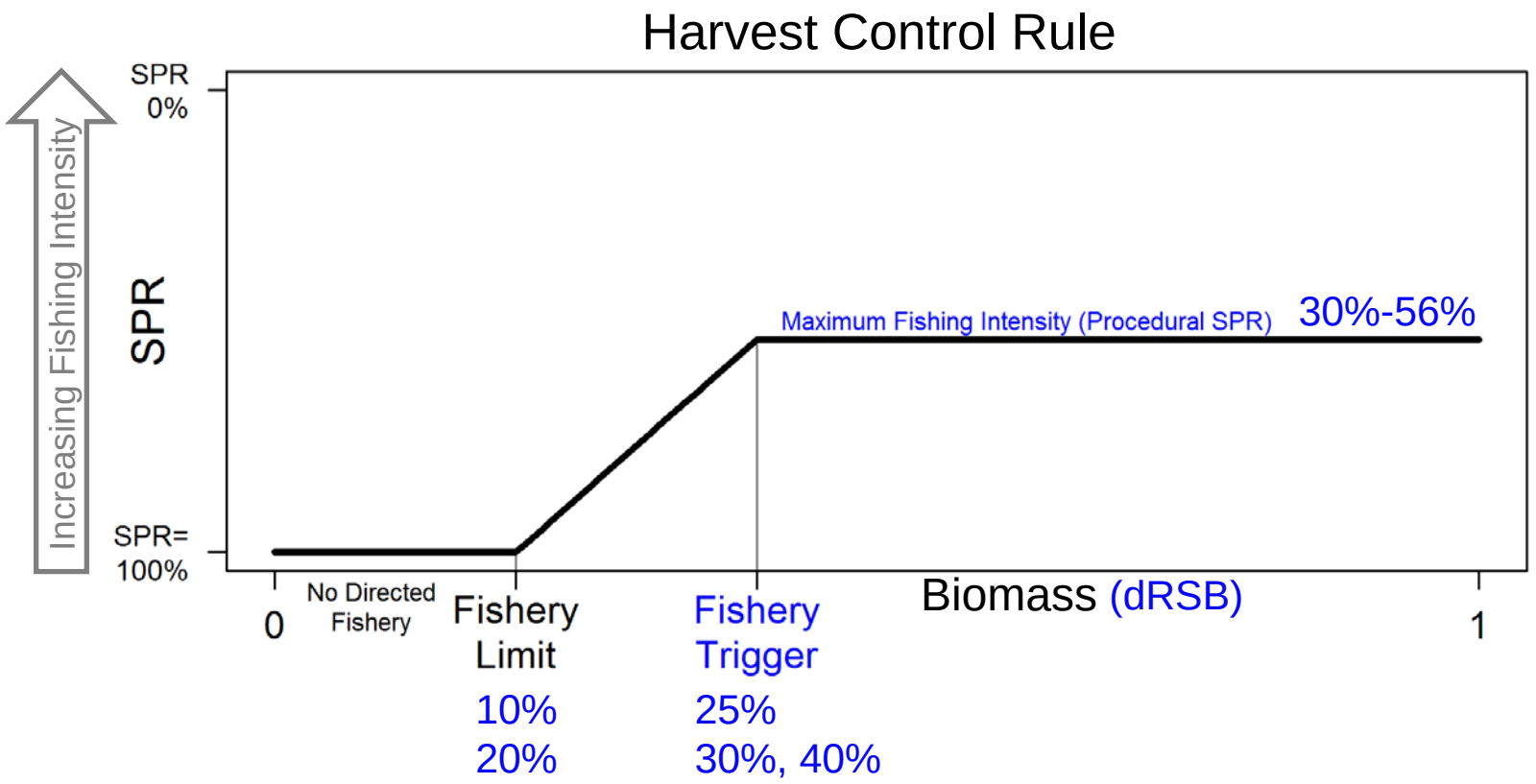
- Must meet long-term Biological Sustainability (1.1)
- Then meet short-term catch limit stability (2.1) and maintain a minimum catch limit (2.2)
- Then maximize short-term fishery yield subject to above

- Additional metrics can also be informative
  - For example. P(SB<30%), median AAV, or quantiles

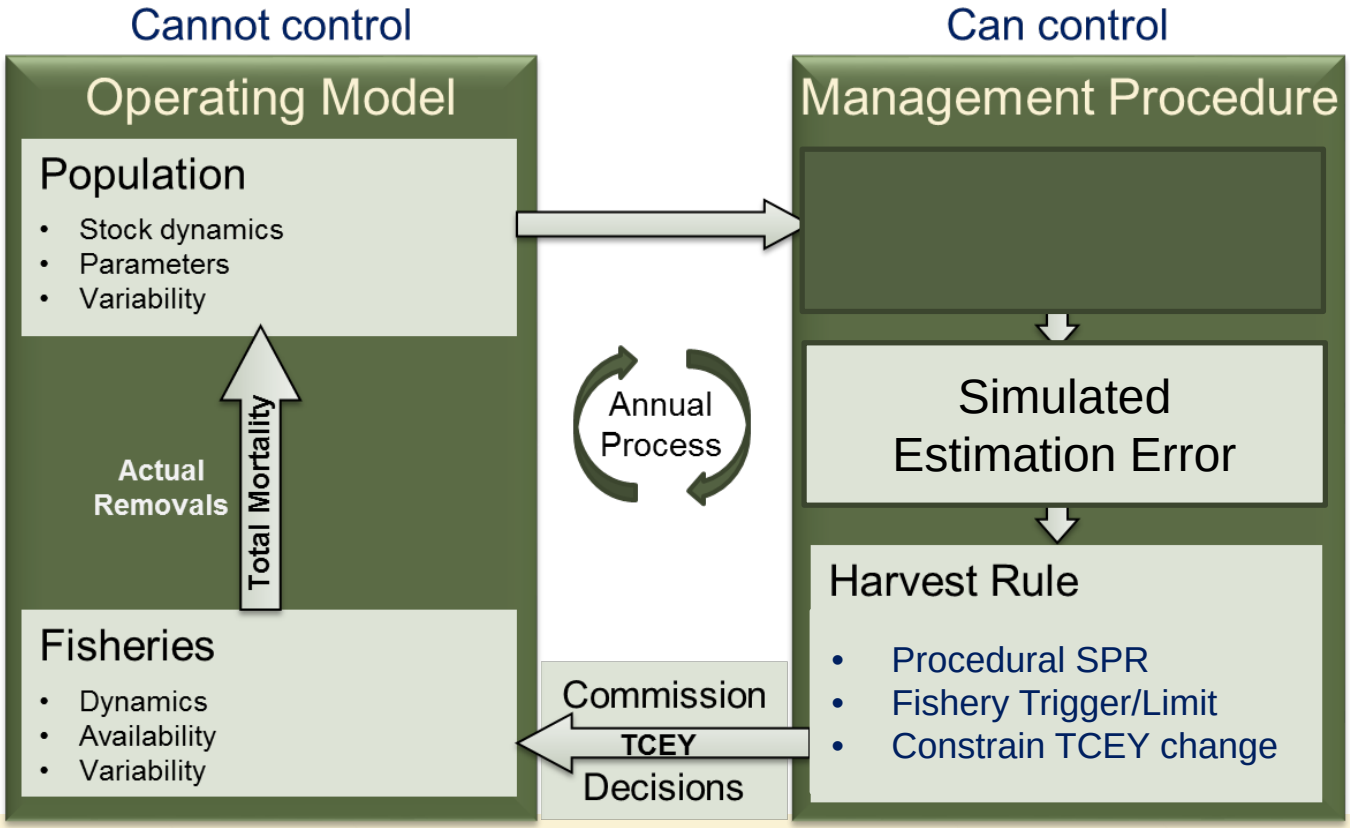
Management Procedure



Scale Management Procedure



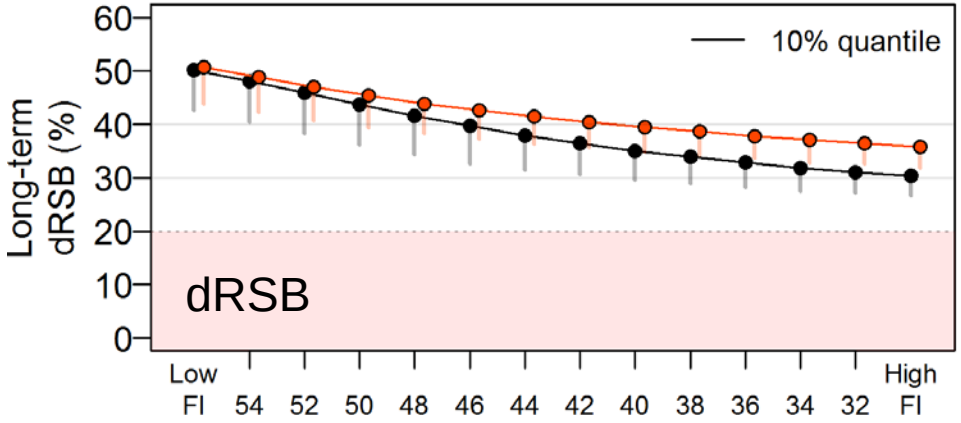
Closed-loop simulation framework

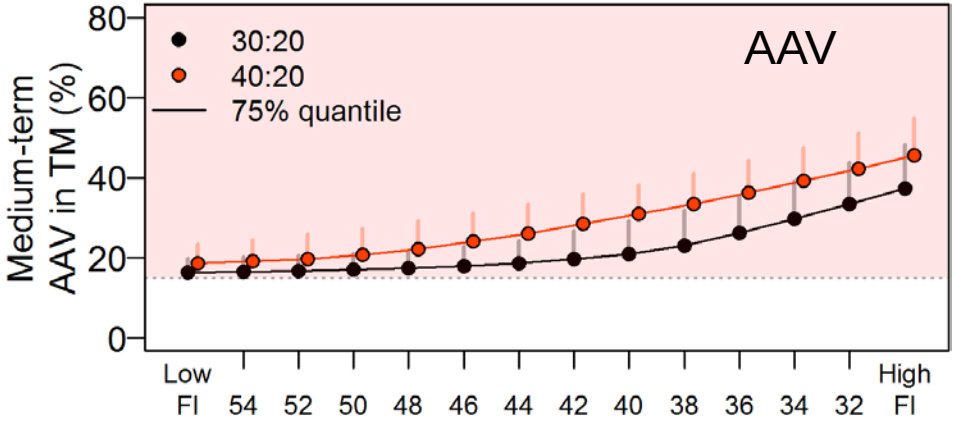


Simulation Results: Performance metrics

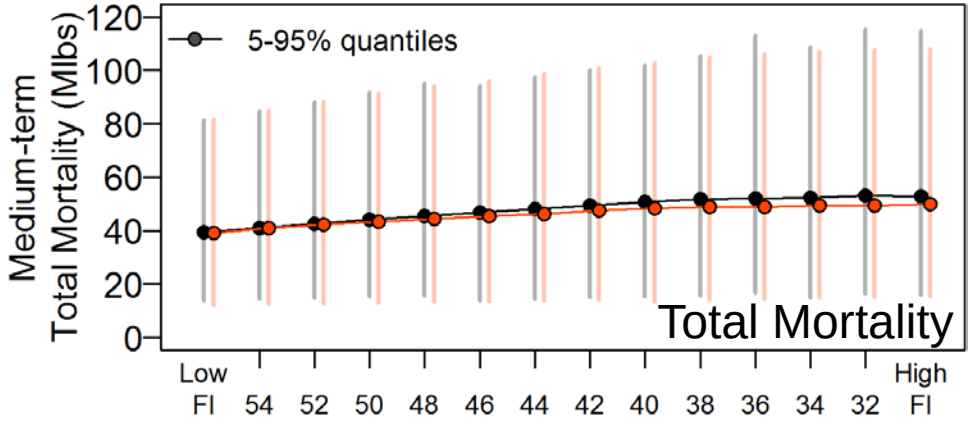
- Three performance metrics
  1. dRSB: dynamic relative spawning biomass, long-term
     - An appropriate measure of stock status
     - Avoid going below 20% more than 10% of the time
  2. AAV: average annual variability, medium-term
     - Average percent change in TM limit from year to year
     -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

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



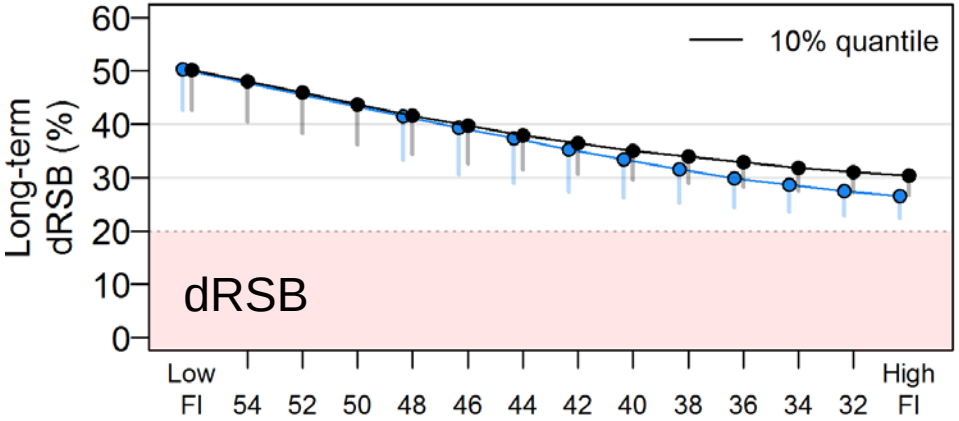


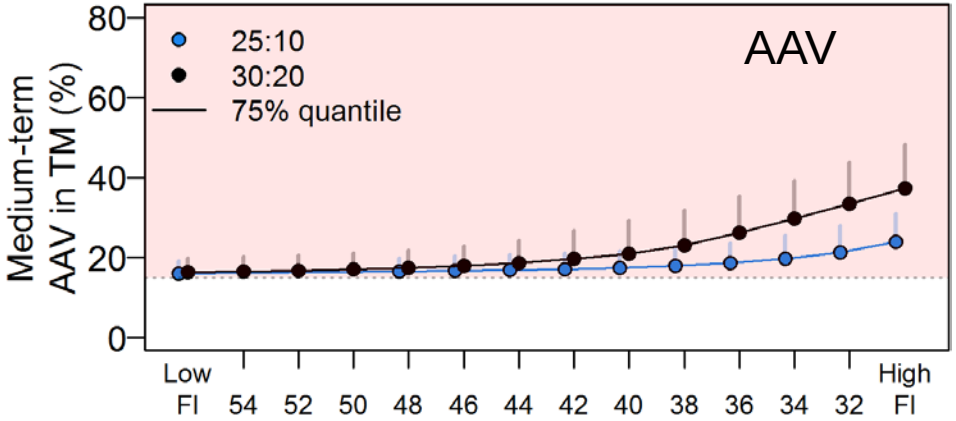
- Bio objective satisfied for all procedures
- AAV objective not satisfied for all procedures
- Median TM increases slightly and range increases with FI



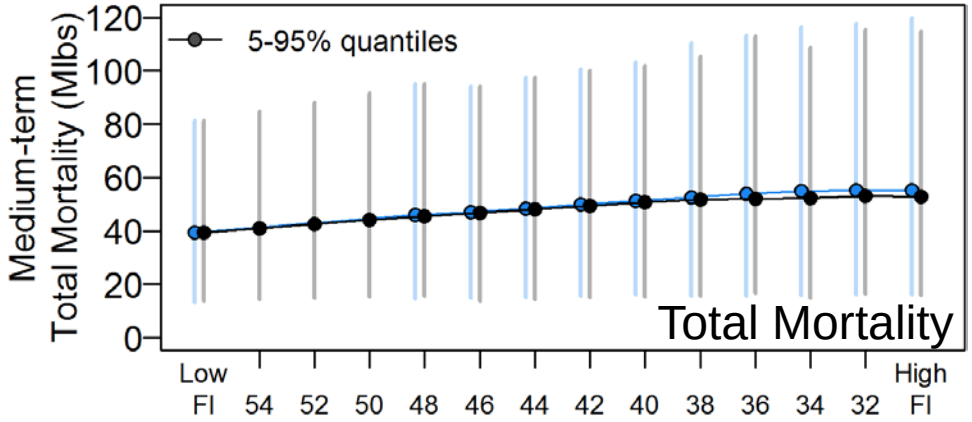
SPR (%)

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



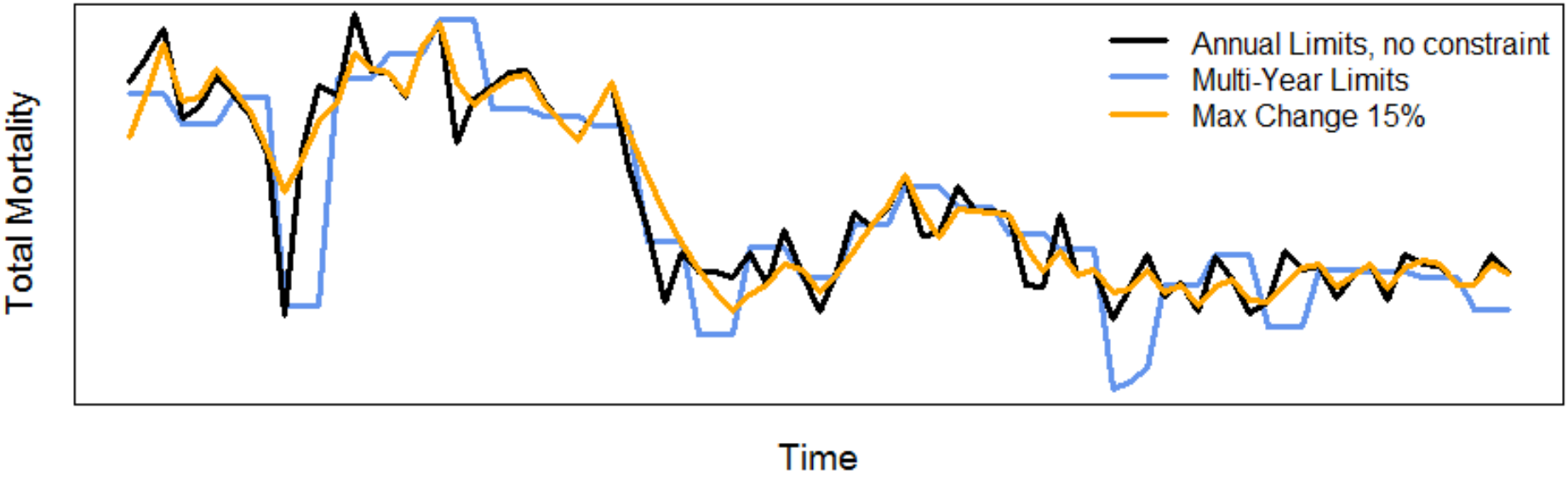
SPR (%)

Constrained Management Procedures

- Max Change
  - TM limit constrained to change no more than 15%
- Slow-Up, Fast- or Full-Down
  - TM limit constrained to increase or decrease less than the full Management Procedure outcome
- Cap
  - TM limit cannot exceed a maximum (60 Mlb or 80 Mlb)
- Multi-year
  - Set the TM limit every third year

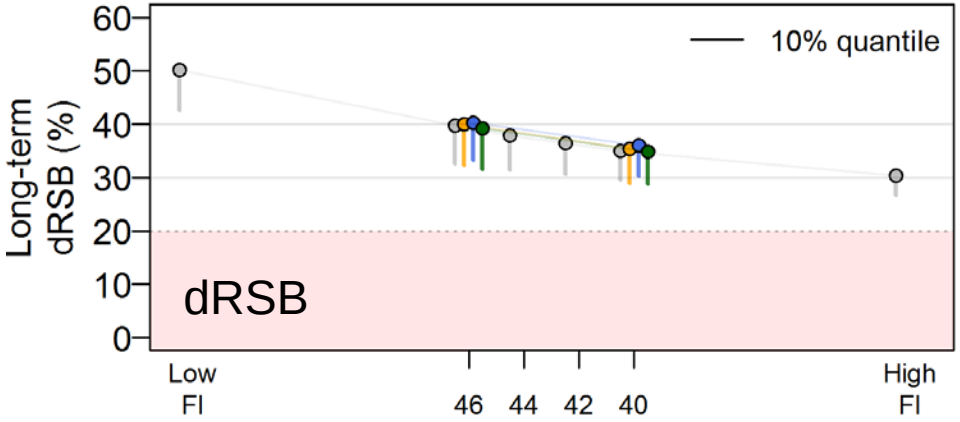
All use a 30:20 control rule

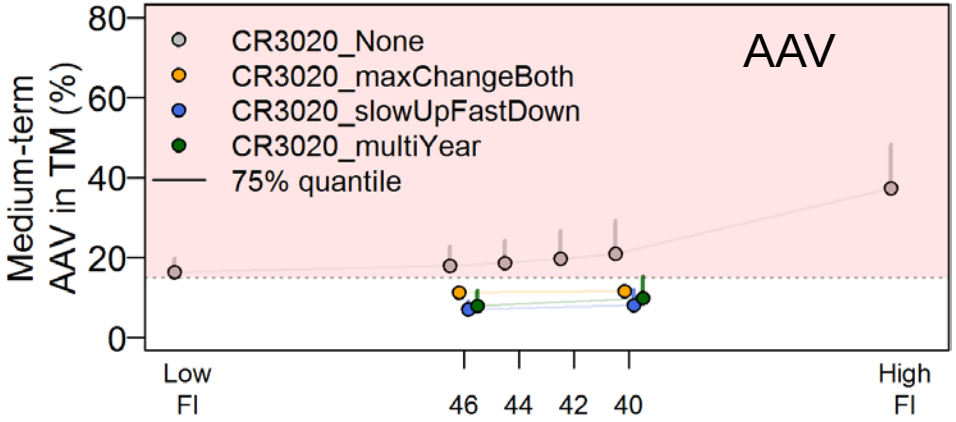
Constrained Management Procedures



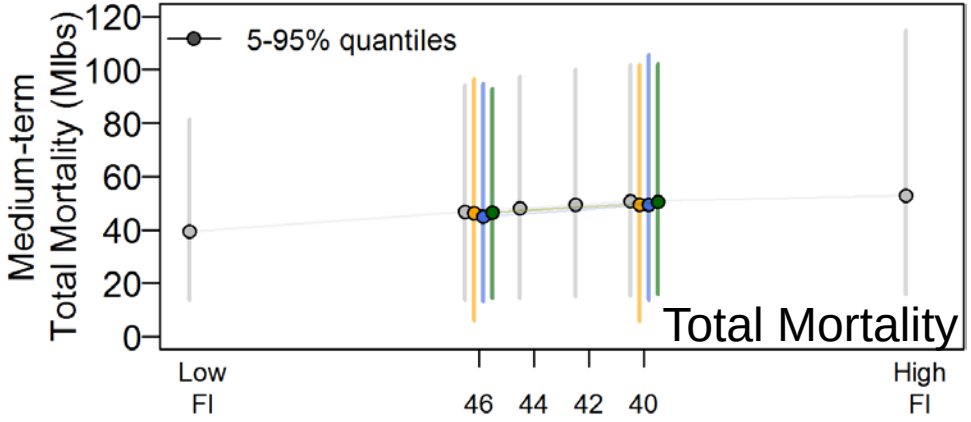
All use a 30:20 control rule

Performance metrics: Constraints





- Bio objective satisfied by all
- AAV reduced
- Slight potential for lost yield



SPR (%)

Constrained MPs

- Max Change
  - Has potential and able to meet all objectives
- Slow-up, fast or full down
  - Has potential and able to meet all objectives
- Caps
  - Reduced AAV when stock at high levels, but not at low levels
  - Does not take advantage of very high yield opportunities
- Multi-year
  - Has potential and able to meet all objectives for SPR>40%
  - The change every 3rd year is **27%**, on average, for SPR=46%
    - Compared to **25%** for every 3rd year when setting an annual limit

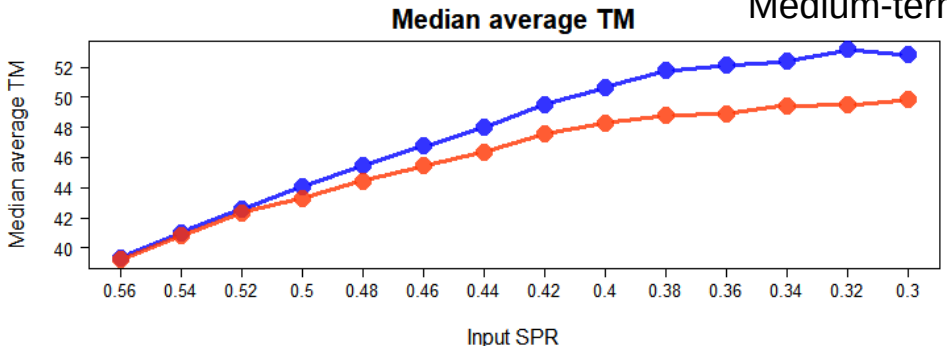
Scale evaluation summary

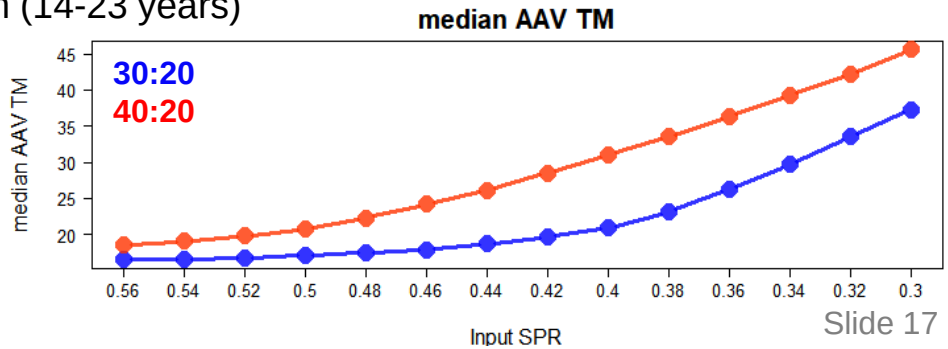
- All MPs met the long-term biological sustainability objective
  - Short-term biological risks were greater and many MPs showed a greater risk than tolerable (>10%)
- Only some constrained MPs met the variability objective in the medium-term
  - maxChangeBoth, slow-up fast-down, and MultiYear
- Median TM differed slightly between MPs
  - peaked around SPR=40%, and showed a wide range

Scale outcomes

- Some additional investigation of MP's may be useful
- A constraint may increase conservation risk, but would reduce variability in the mortality limit
- At SPR values lower than 40% (higher Fishing Intensity)
  - median mortality limit showed minimal increase
  - the variability in the mortality limit increased more quickly
  - **The highest ranked MP was SPR=40%, 30:20 CR, maxChange=15%**

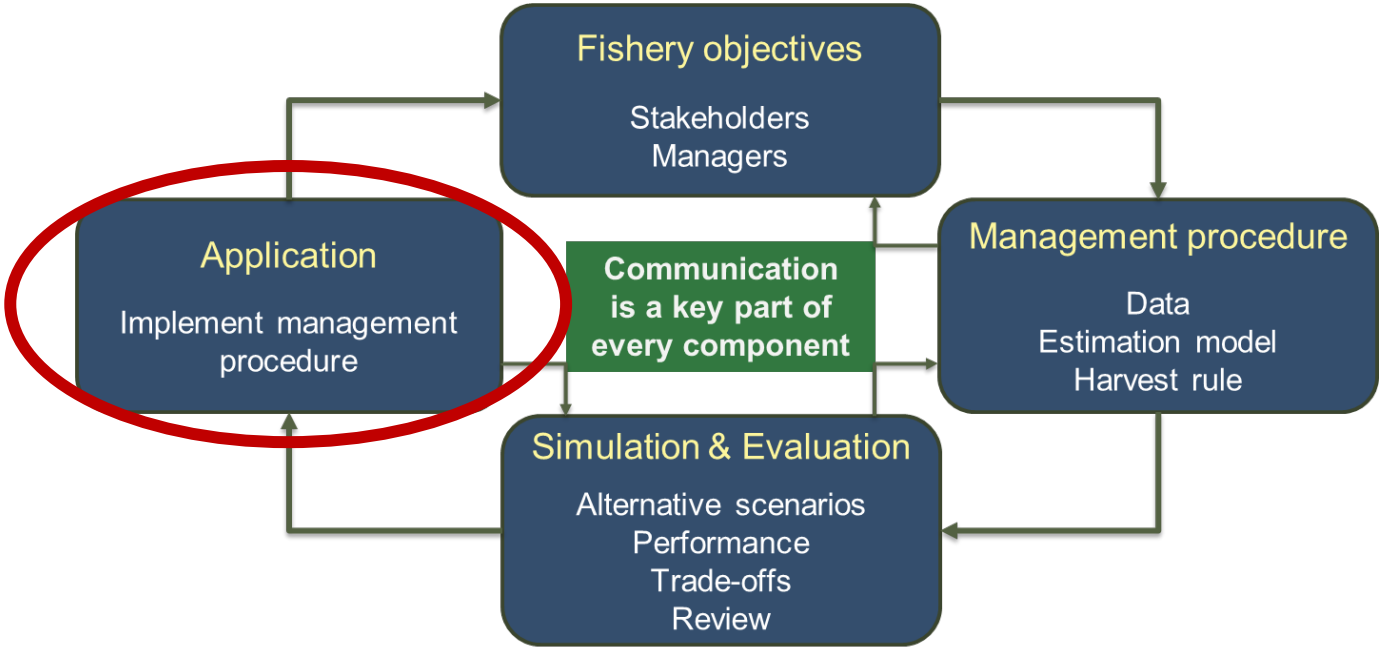
Medium-term (14-23 years)





Application of a Management Procedure

- Implement a MP as part of a harvest strategy policy
  - For example, the reference SPR in the decision table



Additional Objectives

- Some discussion at the MSAB meeting was about being comfortable keeping the stock around a specific biomass

Increasing Fishing Intensity

SPR	56%	46%	40%	36%	30%
Median relative biomass	49%	41%	36%	32%	27%

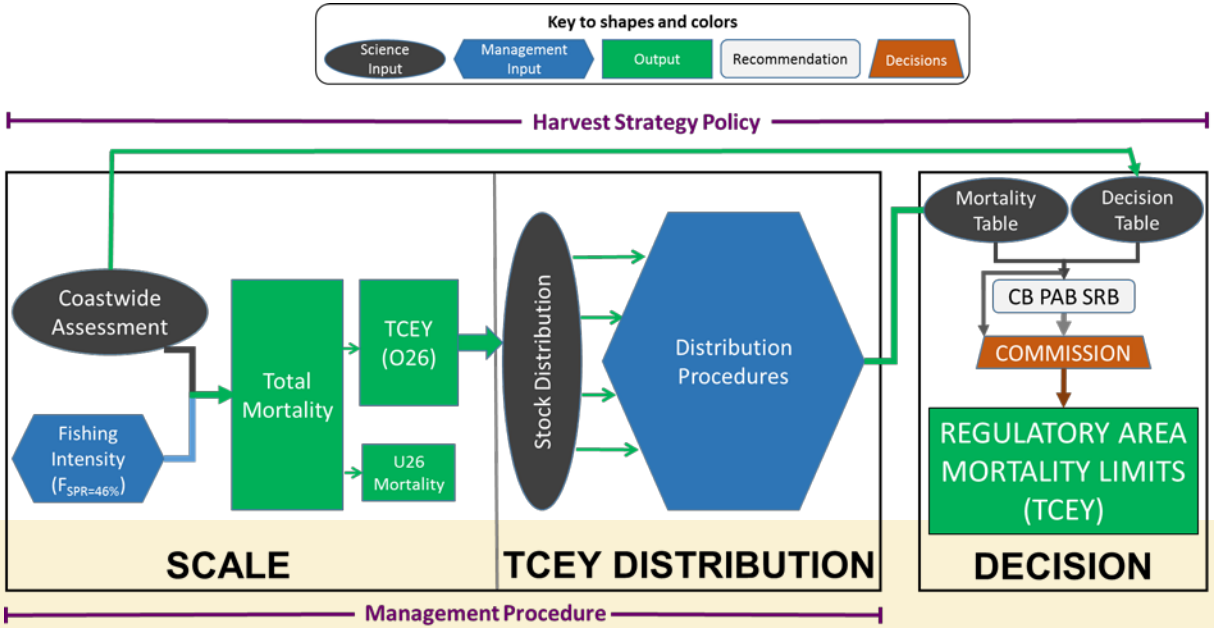
  - An unstated biological objective
  - The draft Harvest Strategy Policy states an objective to maintain the biomass at levels, on average, that produce maximum net economic returns

Program of Work

AM095 (2019): Results on Scale

AM096 (2020): Update on Distribution and Scale

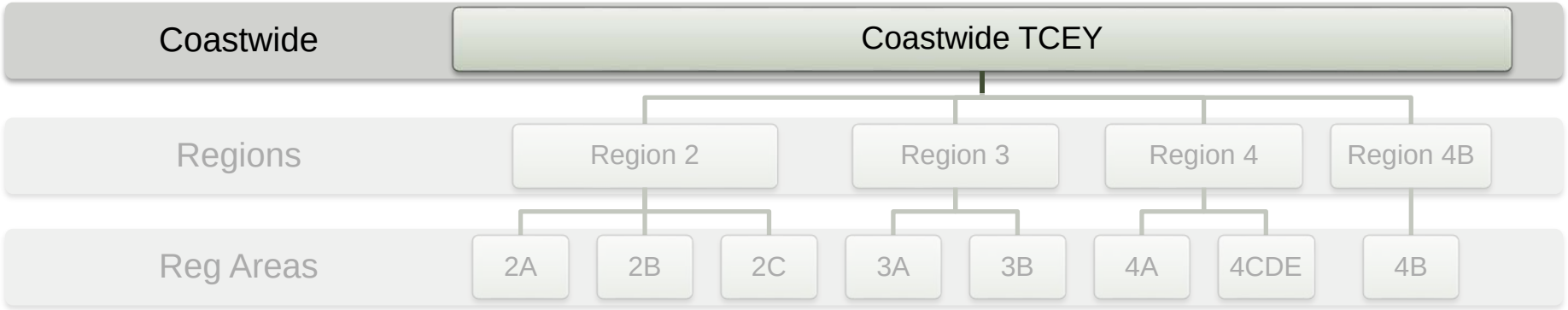
AM097 (2021): Results on Distribution and Scale



A procedure for distributing the TCEY (1)

Coastwide Target Fishing Intensity

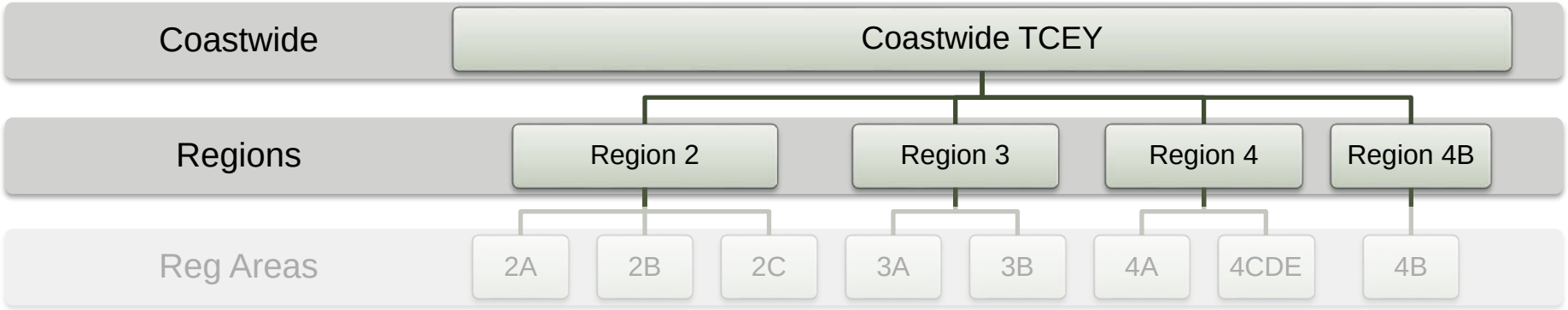
- Determine coastwide Total Mortality from Scale MP
- Separate TM into O26 (TCEY) and U26 components



A procedure for distributing the TCEY (2)

Regional Stock Distribution

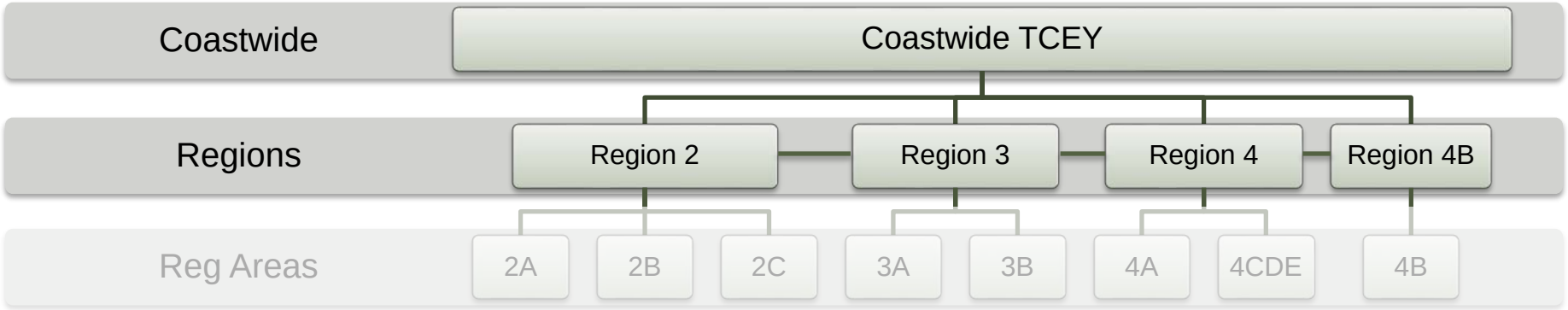
- Distribute the coastwide TCEY to biologically-based Regions
  - Use proportion of the stock estimated in each Region for “all sizes” WPUE index from IPHC fishery-independent setline survey
- Biological Sustainability objectives



A procedure for distributing the TCEY (3)

Regional Allocation Adjustment

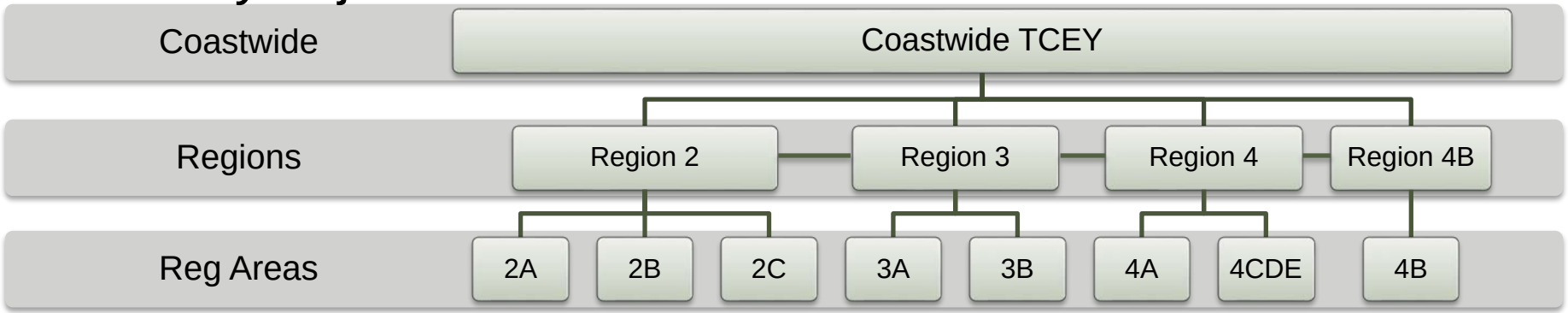
- Adjust the distribution of the TCEY among Regions
  - For example, use relative target harvest rates by Region
- Biological Sustainability and Fishery objectives



A procedure for distributing the TCEY (4)

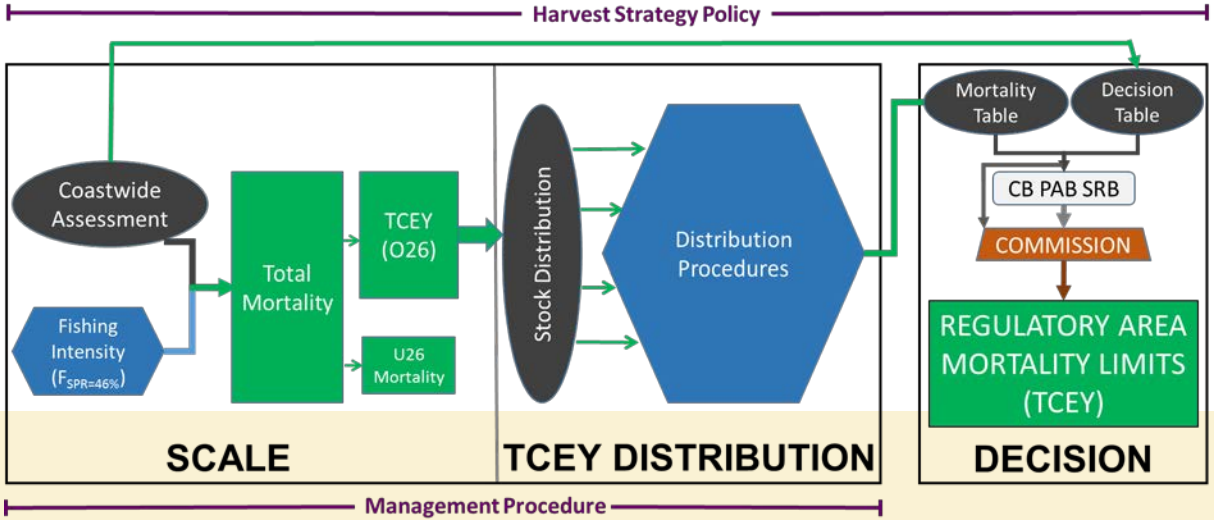
Regulatory Area Allocation

- Apply allocation percentages for each Regulatory Area within a Region
- Based on policy, data, observations, or agreement
- Fishery objectives



Distributing the TCEY

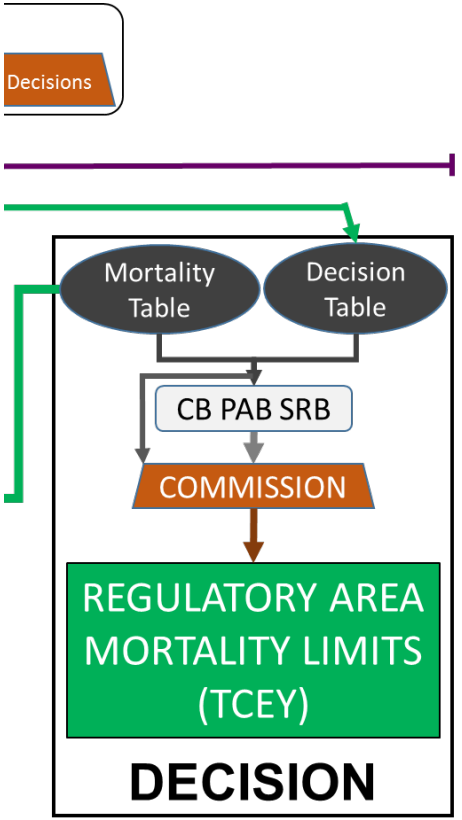
- Coastwide target fishing intensity
- Regional Stock Distribution
- Regional Allocation Adjustment
- Regulatory Area Allocation



Decision-Making

Annual Regulatory Area Adjustment

- Adjust Regulatory Area TCEY's to account for other factors as needed
- Policy part of the harvest strategy policy
- May deviate from the management procedure
  - Will have unpredictable consequences



Recommendations

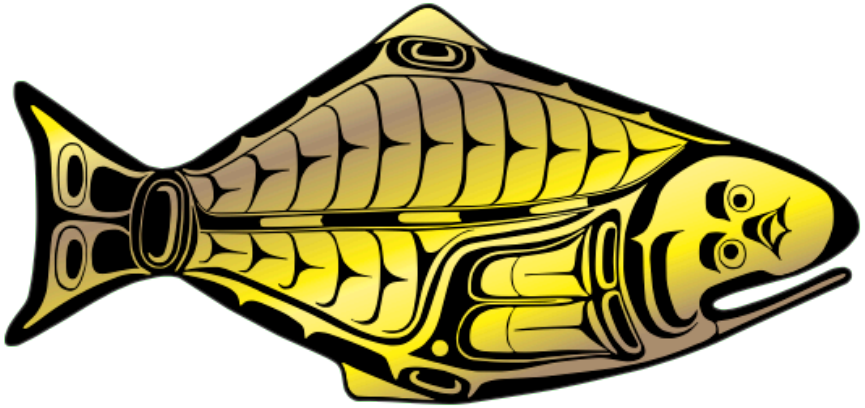
- **ENDORSE** the primary objectives and associated performance metrics
- **RECOMMEND** additional goals and objectives
  - Minimum Total Mortality Limit (Objective 2.2)
  - Objective related to a target biomass
- **RECOMMEND** a management procedure for the Scale portion of the harvest strategy be adopted in the interim
  - An SPR of XX% with a fishery trigger of XX% and a fishery limit of XX%
  - An annual constraint of XX%
- **RECOMMEND** additional Scale MPs to evaluate in 2019 using the coastwide framework
  - SPR values of XX%, Fishery trigger values of XX%, Fishery limit values of XX%
  - Constraints in the form of XX
- **RECOMMEND** using the distribution framework for evaluation

MSE Explorer

- View the results and make comparisons
- Create tables that can be downloaded
- Create plots that can be saved

http://bit.ly/iphc-msab012

INTERNATIONAL PACIFIC



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