INTERNATIONAL PACIFIC HALIBUT COMMISSION

MSE update and Program of Work for 2021-2023

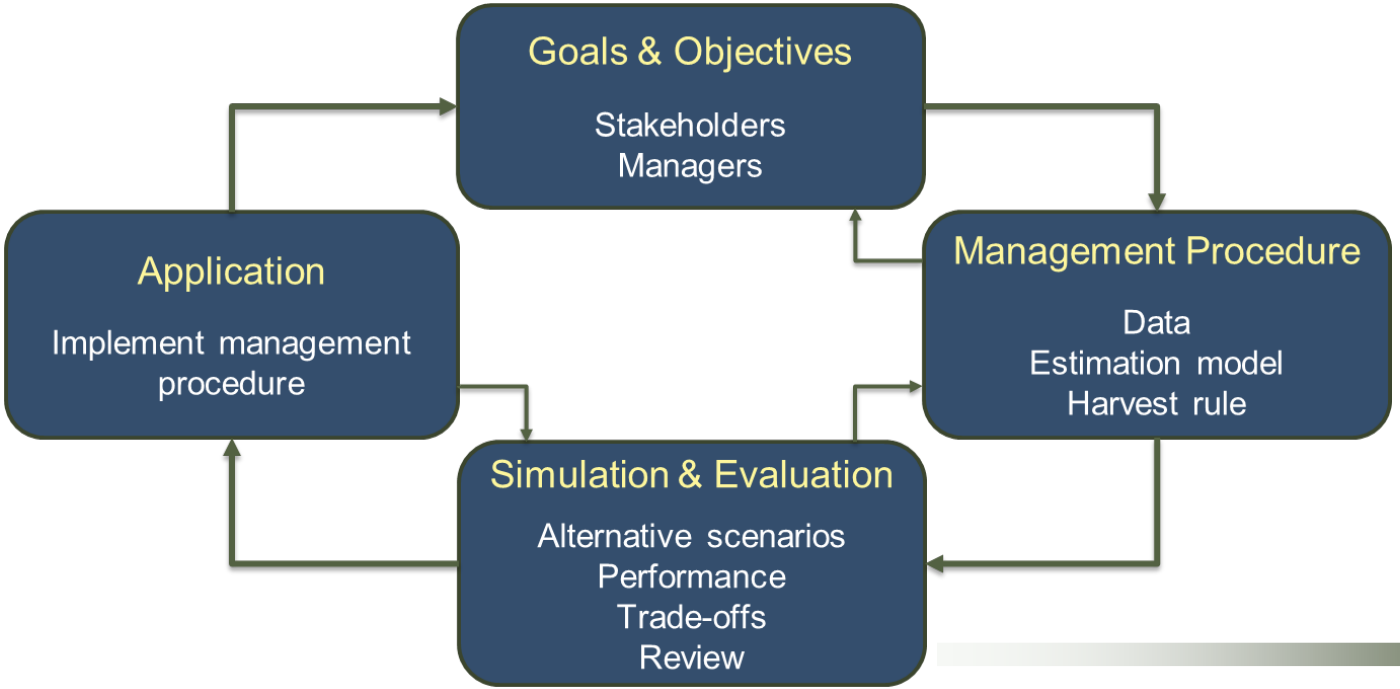
Agenda Item 7.1

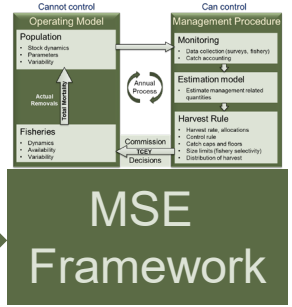
IPHC-2022-AM098-12

(A. Hicks & I. Stewart)

Management Strategy Evaluation

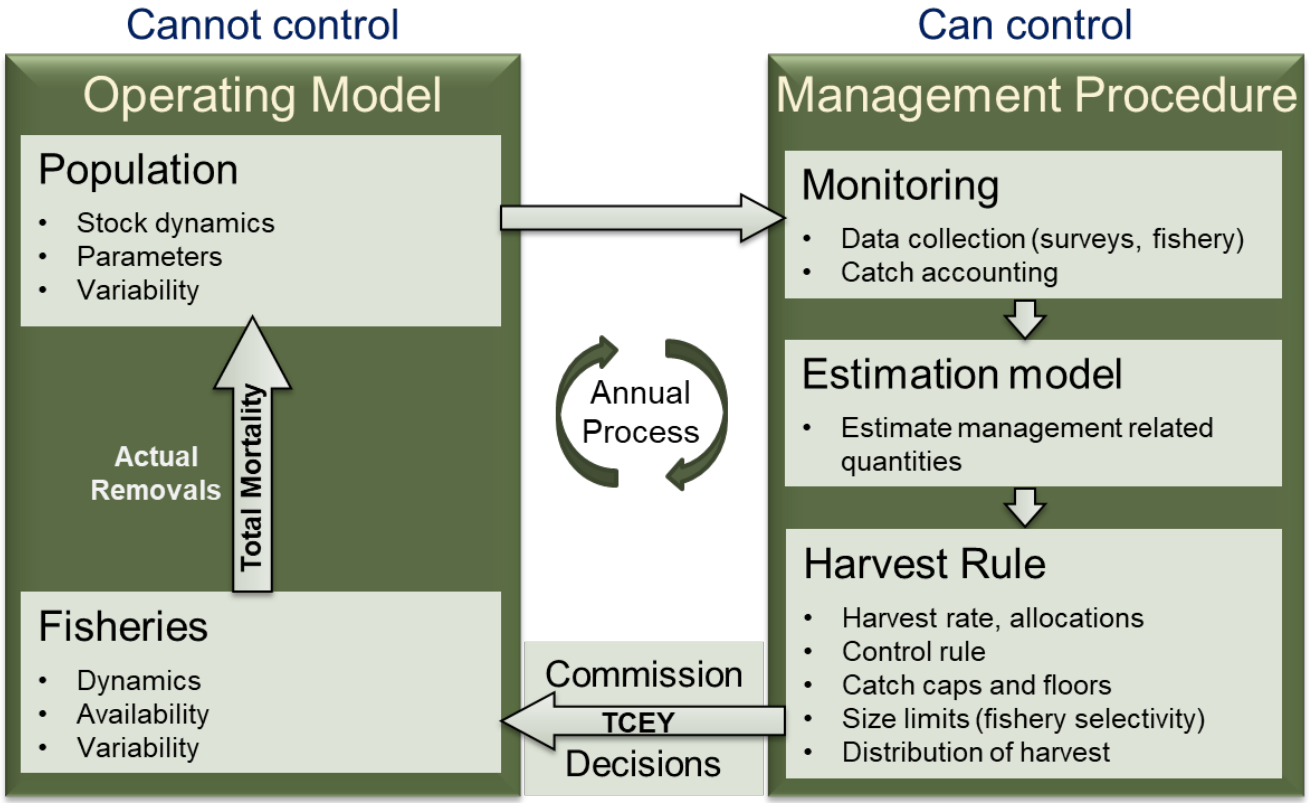
a process to evaluate harvest strategies and develop a management procedure that is robust to uncertainty and meets defined objectives



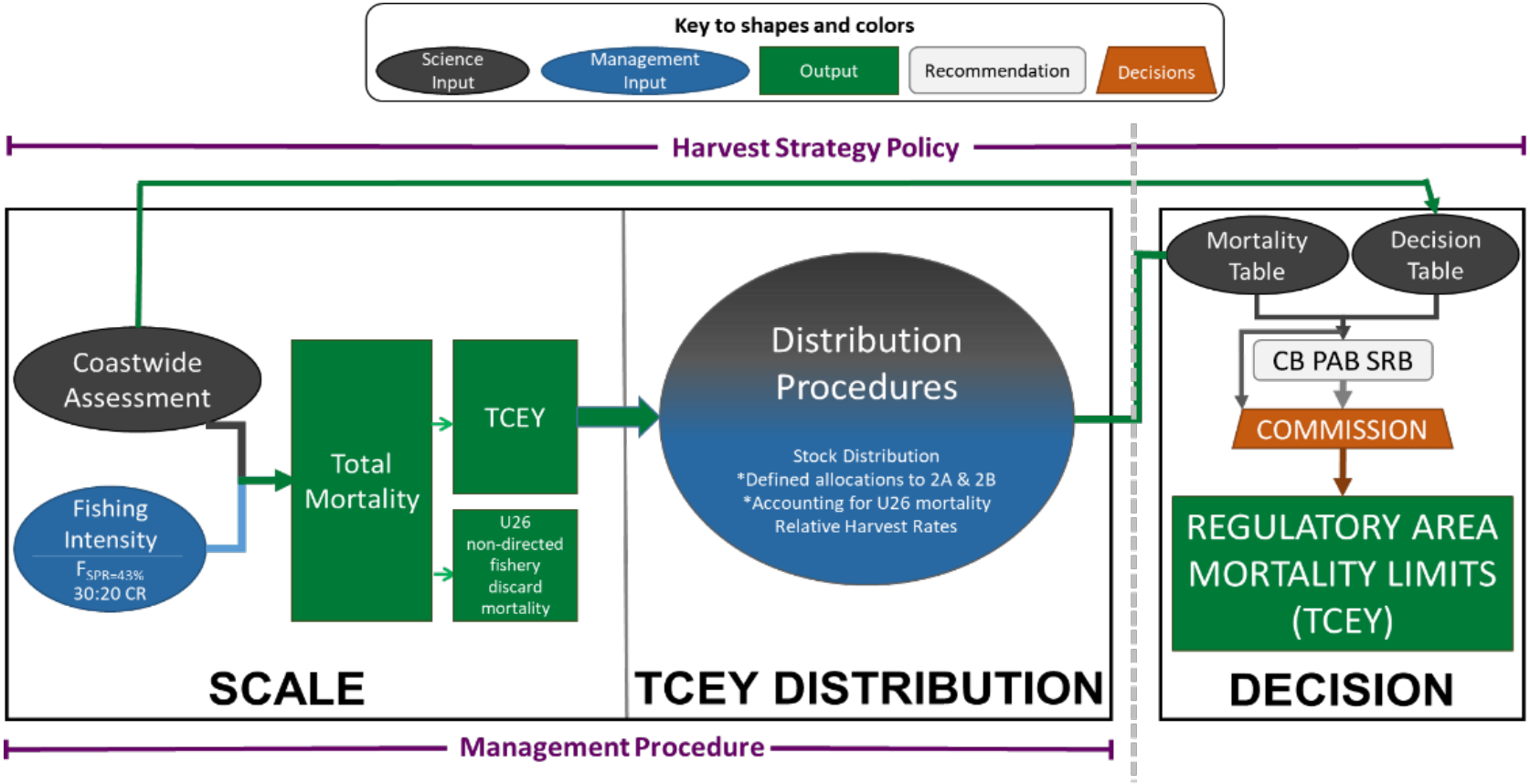


MSE Framework

MSE framework



Current Interim Harvest Strategy Policy



Management Procedures evaluated for AM097

Element	MP-A	MP-B	MP-C	MP-D	MP-E	MP-F	MP-G	MP-H	MP-I	MP-J	MP-K
TCEY constraint of 15%											
Max Fishing Intensity buffer 36%											
O32 stock distribution											
O32 stock distribution (5-year moving average)											
All sizes stock distribution											
Fixed shares updated in 5th year from O32 stock distribution											
Relative harvest rates of 1.0 for 2-3A, and 0.75 for 3B-4											
Relative harvest rates of 1.0 for 2-3, 4A, 4CDE, and 0.75 for 4B											
Relative harvest rates by Region: R2=1, R3=1, R4=0.75, R4B=0.75											
1.65 Mlbs fixed TCEY in 2A											
Formula percentage for 2B											
National Shares (2B=20%)											

11th Special Session of the IPHC (SS011)

- 22 June 2021
- Presented a list of MSE related tasks
- Commission prioritized a smaller set of MSE tasks for completion to present at AM099 in 2023

MSE Program of Work 2021-2023

IPHC-2021-MSE-02

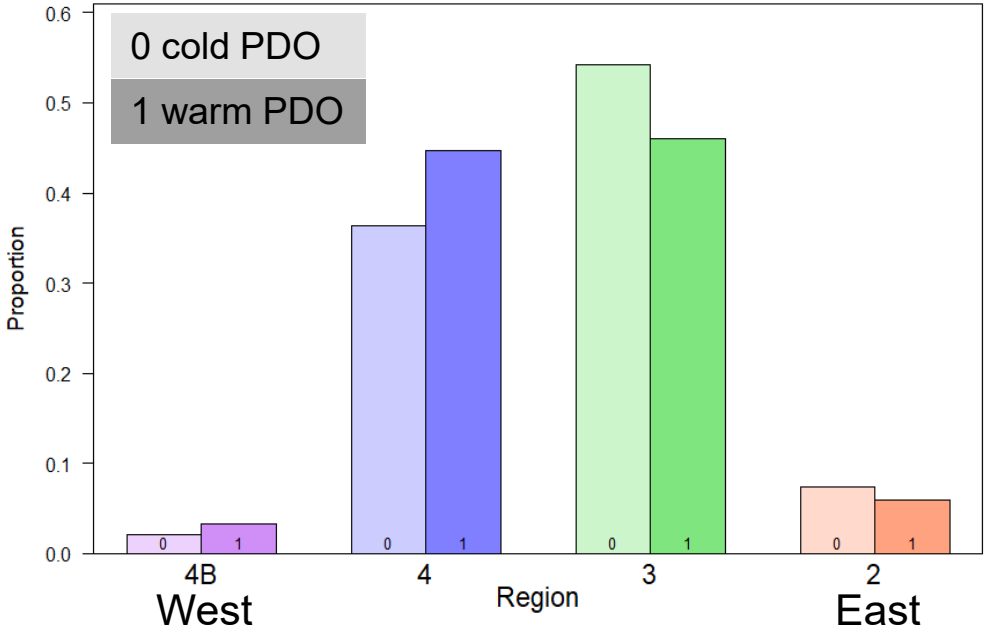
ID	Category	Task	Deliverable
F.1	Framework	Develop migration scenarios	Develop OMs with alternative migration scenarios
F.2	Framework	Implementation variability	Incorporate additional sources of implementation variability in the framework
F.3	Framework	Develop more realistic simulations of estimation error	Improve the estimation model to more adequately mimic the ensemble stock assessment
F.5	Framework	Develop alternative OMs	Code alternative OMs in addition to the one already under evaluation.
M.1	MPs	Size limits	Identification, evaluation of size limits
M.3	MPs	Multi-year assessments	Evaluation of multi-year assessments
E.3	Evaluation	Presentation of results	Develop methods and outputs that are useful for presenting outcomes to stakeholders and Commissioners

F.1. Migration Scenarios

- Improve OM treatment of movement
- Identify plausible hypotheses of migration
- Develop multiple scenarios to evaluate robustness of MPs
  - Part of Task F.5: develop alternative OMs

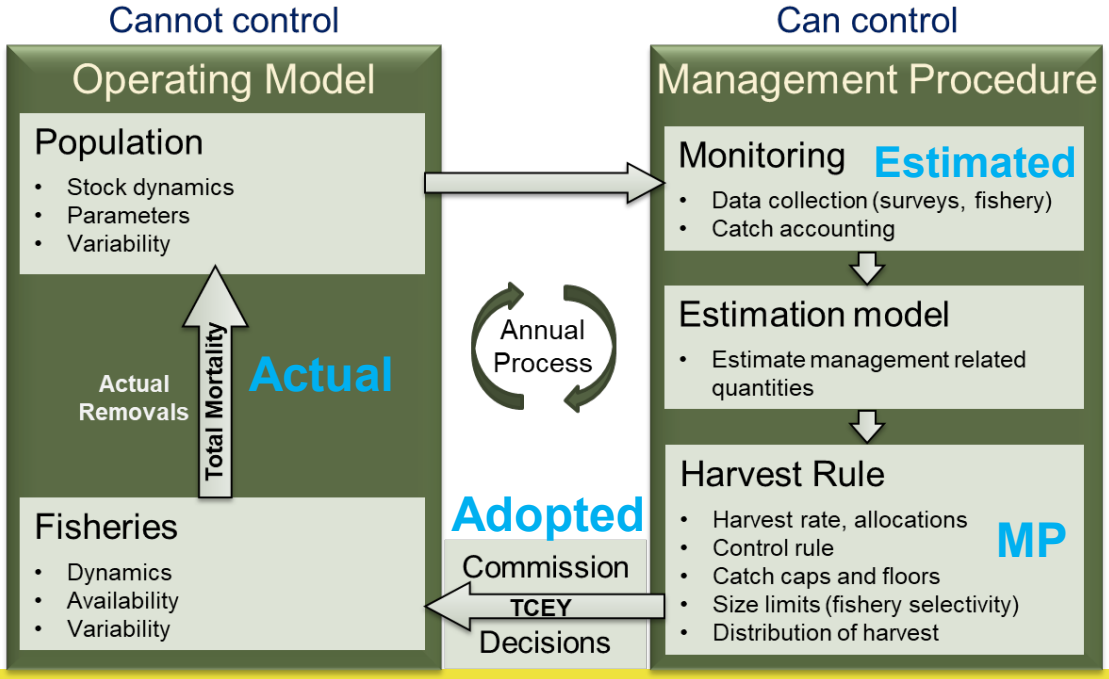
Time-varying recruitment distribution

- Research (Sadorus et al 2020) found that “cold years” likely have less dispersal to the west
- Conditioned model showed similar results



Implementation variability & uncertainty

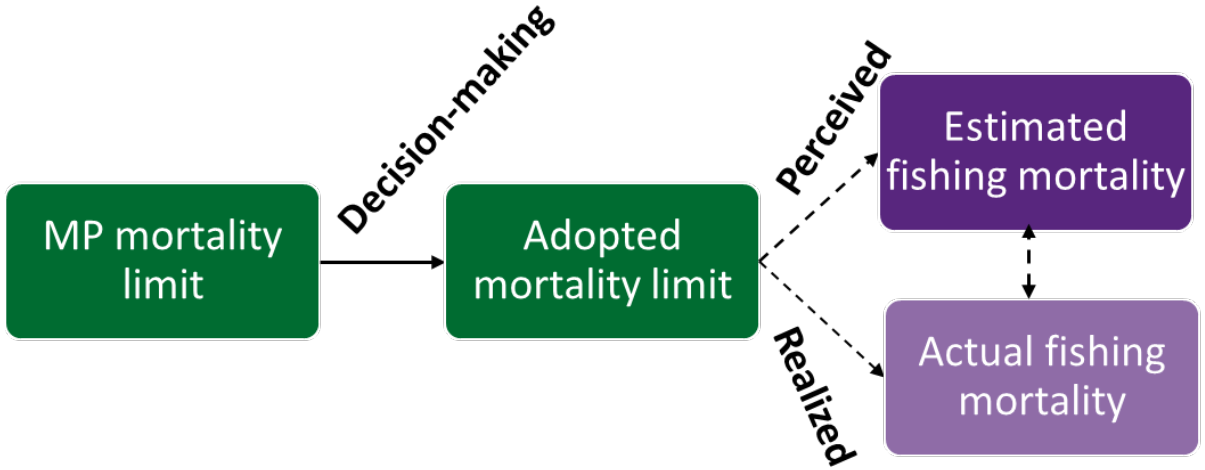
- The deviation of the fishing mortality from the mortality limit determined from an MP
- **Variability**: inherent heterogeneity observed in the past
- **Uncertainty**: incomplete understanding what may happen in the future



Mortality types in blue

Types of implementation variability

1. **Decision-making variability**: difference between MP mortality limits and the adopted mortality limits set by the Commission.
2. **Realized variability**: difference between the adopted mortality limits set by the Commission and the actual mortality resulting from fishing.
3. **Perceived variability**: difference between the actual & estimated fishing mortality

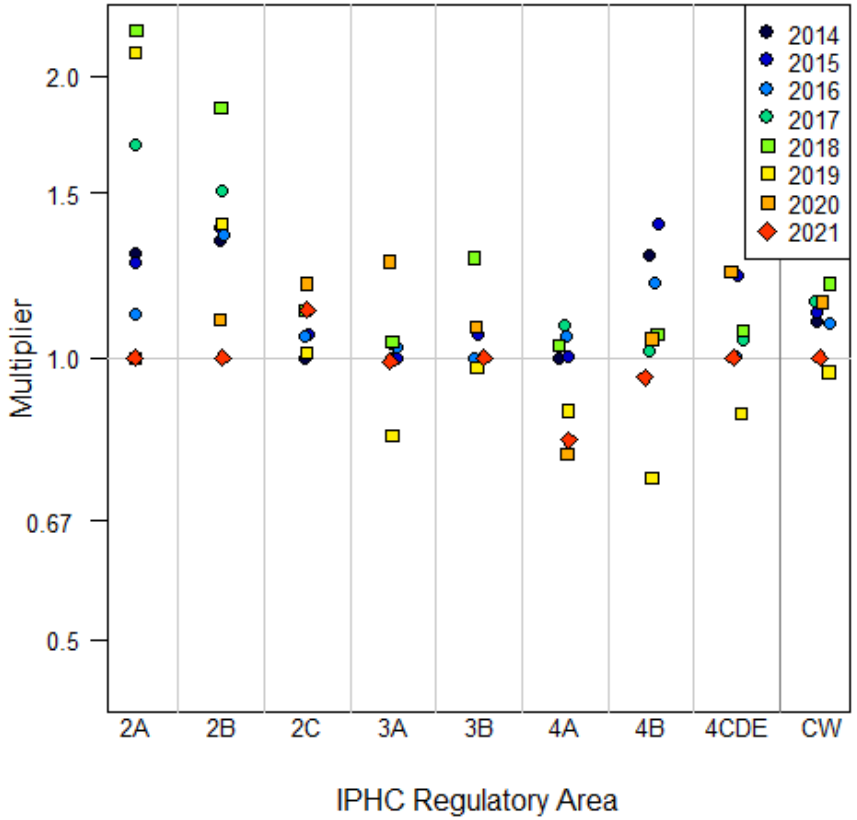


Decision-making variability

- Historically, the adopted TCEY has differed from the MP TCEY
- Can model this as a multiplier to the MP mortality limit

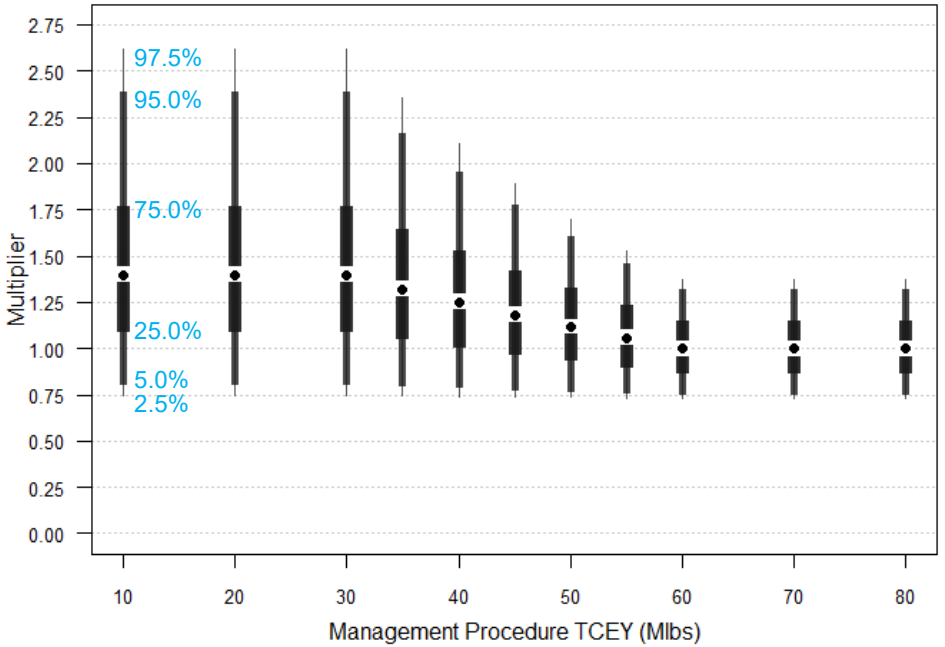
$$\widetilde{TCEY}_t = TCEY_t \times \varepsilon_I$$

Adopted MP Multiplier



Decision-making uncertainty

- Must be simulated because it is a part of the process
- Multiplier dependent on TCEY and the MP



Management Procedures (MPs)

- M.1. Size limits
  - Investigate various size limits
  - Account for how markets may react
- M.3. Multi-year assessments
  - Evaluation of MPs with assessments not being done annually
  - Consideration of what stability means

Size limits

Implement length approximation in the OM

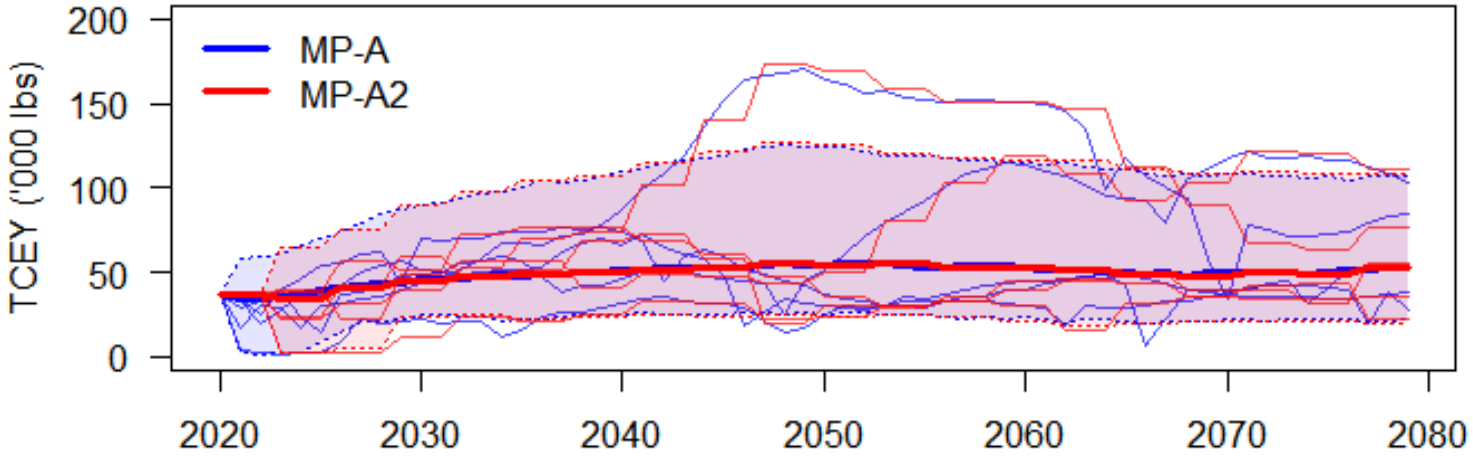
1. Model length processes independently and not linked to population processes
   - Link mean length-at-age to the mean weight-at-age
   - An approximation, but likely useful

Multi-year assessments

Element	MP-A	MP-A2	MP-D	MP-J
Maximum coastwide TCEY change of 15%				
Maximum Fishing Intensity buffer (SPR=36%)				
O32 stock distribution				
O32 stock distribution (5-year moving average)				
All sizes stock distribution				
Fixed shares updated in 5th year from O32 stock distribution				
Relative harvest rates of 1.0 for 2-3A, and 0.75 for 3B-4				
Relative harvest rates of 1.0 for 2-3, 4A, 4CDE, and 0.75 for 4B				
Relative harvest rates by Region: 1.0 for R2-R3, 0.75 for R4-R4B				
1.65 Mlbs fixed TCEY in 2A				
Formula percentage for 2B				
National Shares (2B=20%)				
Frequency of stock assessment & mortality limits (biennial)				

Mortality limit constant between assessments
SPR = 43% for all simulations

Simulated trajectories



Coastwide performance metrics

- Improved stability with a slightly smaller average TCEY

Management Procedure	A	A2	D	J
Biological Sustainability				
P(any RSB_y<20%)	<0.01	<0.01	0.01	<0.01
Fishery Sustainability				
P(all RSB<36%)	0.25	0.28	0.44	0.28
Median average TCEY (Mlbs)	39.92	38.31	40.22	37.90
P(any3 change TCEY > 15%)	0.44	0.36	0.10	0.00
Median AAV TCEY	12.1%	9.0%	5.9%	9.5%

Alternative stability metrics

- How stability is defined may change interpretation

	Short-term			
Management Procedure	A	A2	D	J
P(any1 change TCEY > 15%)	0.75	0.93	0.56	0.00
P(any2 change TCEY > 15%)	0.63	0.74	0.26	0.00
P(any3 change TCEY > 15%)	0.44	0.36	0.10	0.00

Multi-year assessment

- Trade-offs between
  - annual changes and
  - multi-year stability but may be larger changes in assessment year
- Fixing the TCEY for multiple years ignores data
  - Empirical approaches in non-assessment years
    - Fix coastwide TCEY but update distribution
    - TCEY updated using trend of recent years
    - Use current FISS results to update TCEY and distribution
- Triennial, quadrennial, quinquennial, …

Recommendations

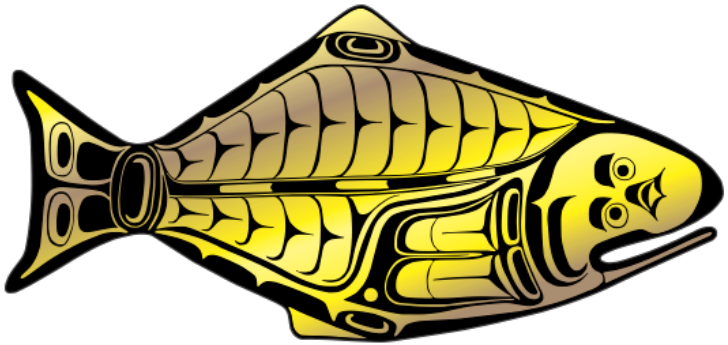
a) **NOTE** paper IPHC-2022-AM098-12

b) **NOTE** that implementation uncertainty will be incorporated to evaluate the robustness of MPs to plausible departures from the MP determined TCEY.

c) **RECOMMEND** elements of size limit management procedures for evaluation, which may include no size limits, minimum size limits, and maximum size limits.

d) **RECOMMEND** elements of management procedures related to multi-year assessments, including holding the TCEY constant, incorporating empirical approaches in non-assessment years, and the number of years between stock assessments.

INTERNATIONAL PACIFIC



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