INTERNATIONAL PACIFIC HALIBUT COMMISSION

MSE Program of Work and Update on Progress

Agenda item: 5

IPHC-2022-SRB020-06 Rev_1

(A. Hicks)

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

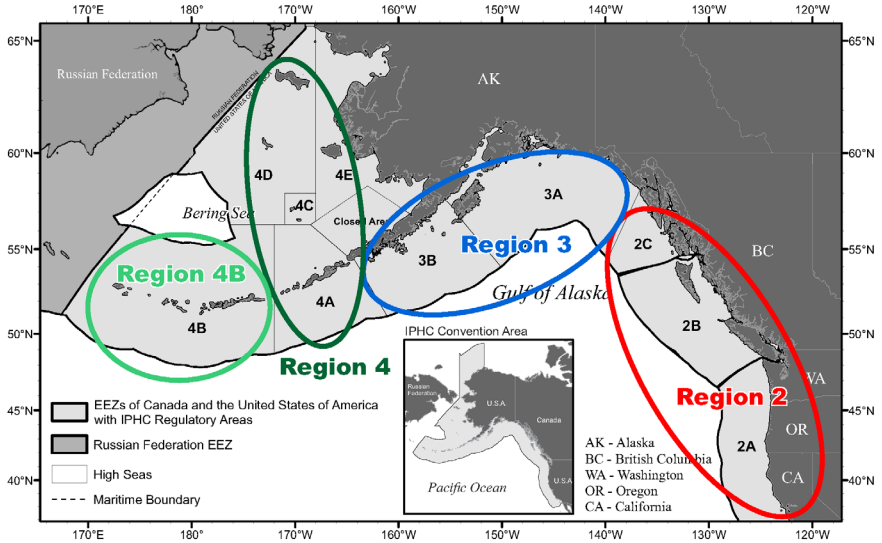
MSE Program of Work 2021-2023

IPHC-2021-MSE-02

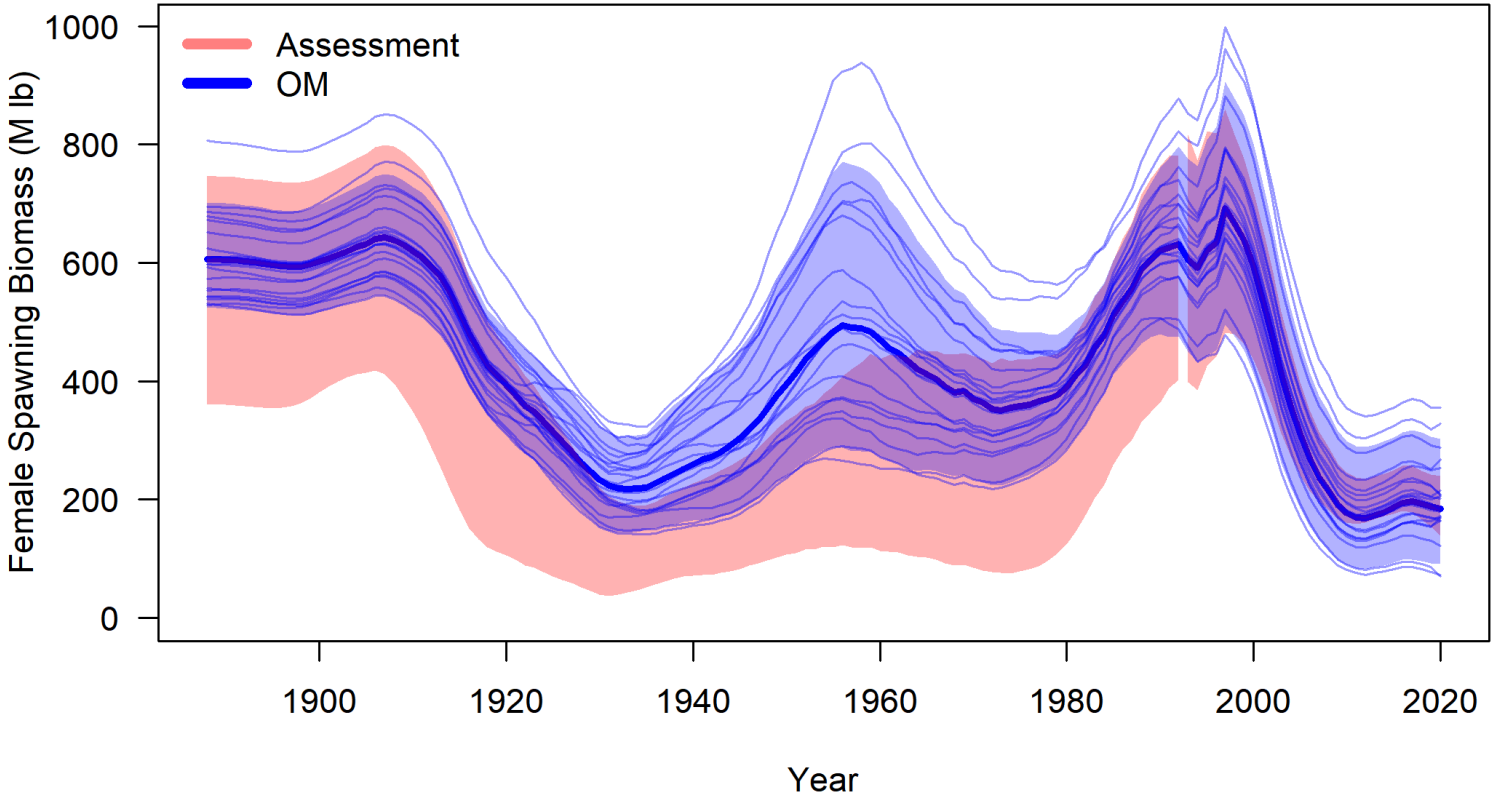
ID	Category	Task	Deliverable
F.1	Framework	Develop migration scenarios	Develop OMs with alternative migration scenarios
F.2	Framework	Implementation variability	Incorporate additional sources of implementation variability in the framework
F.3	Framework	Develop more realistic simulations of estimation 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

Population Model

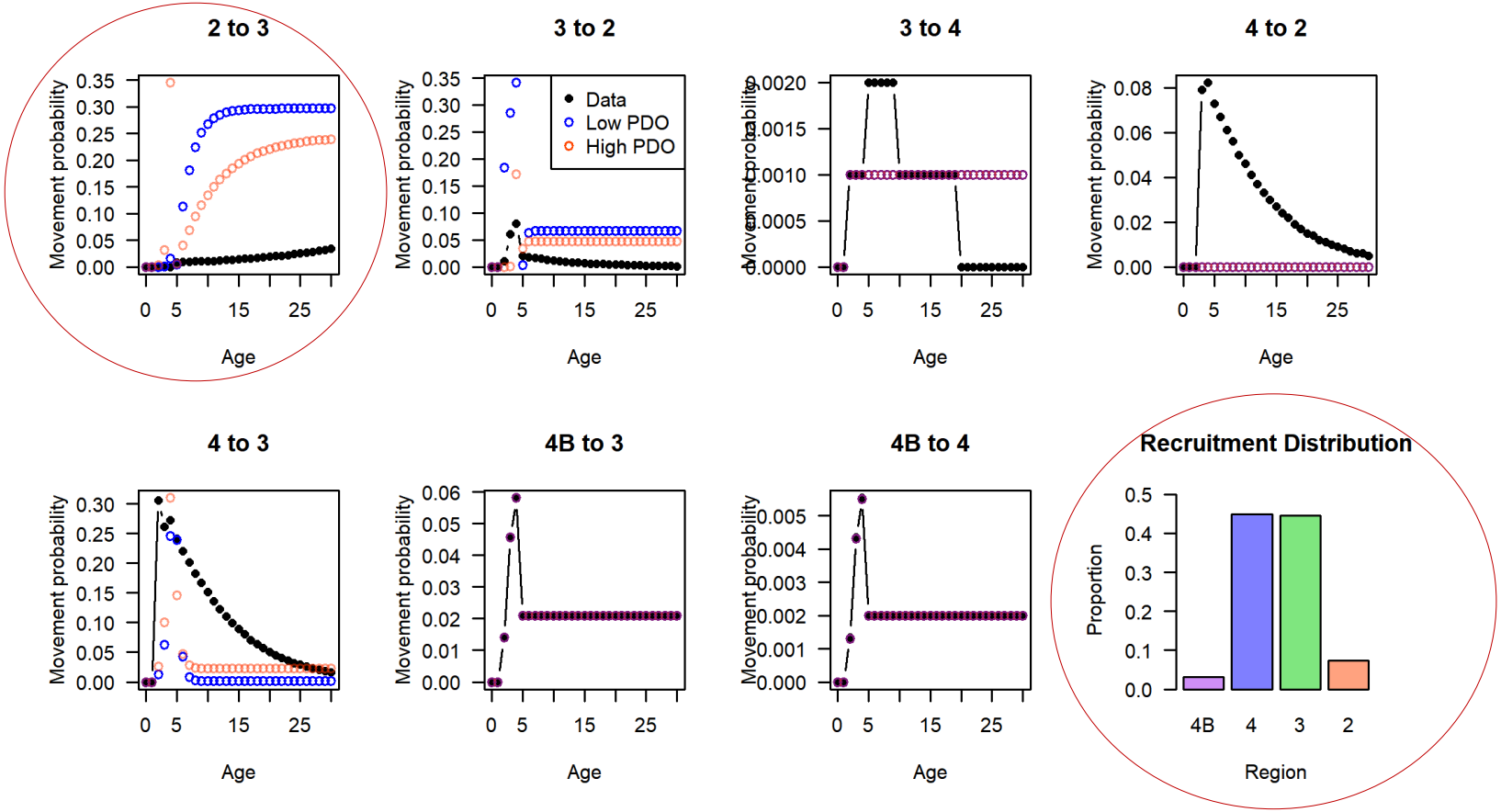
- Four Biological Regions to model biological processes
- Eight IPHC Regulatory Areas for fisheries
- Conditioned to various outputs



2020 Conditioned Operating Model (retired)



2020 Conditioned Model (Not used anymore)



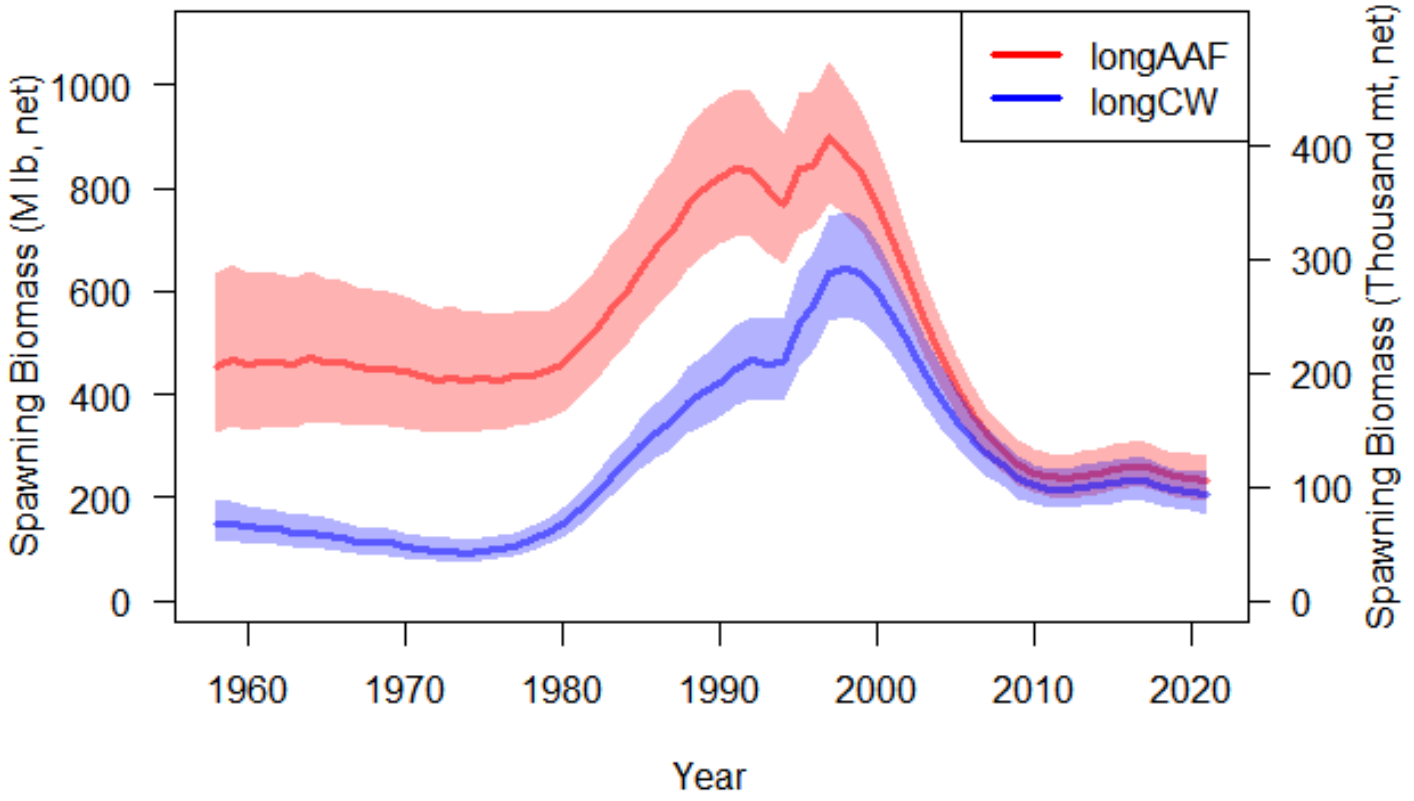
Changes from 2021 OM

- Two models: conditioned to AAF and CW assessment results
  - medAAF and medCW
- Start in 1958
- Recruitment distribution linked to low/high PDO
- Fix movement from 2 to 3 at rates estimated from observations
- Ability to model discards for each directed commercial fishery

Long AAF and Long CW assessment models

ASSESSMENT MODELS

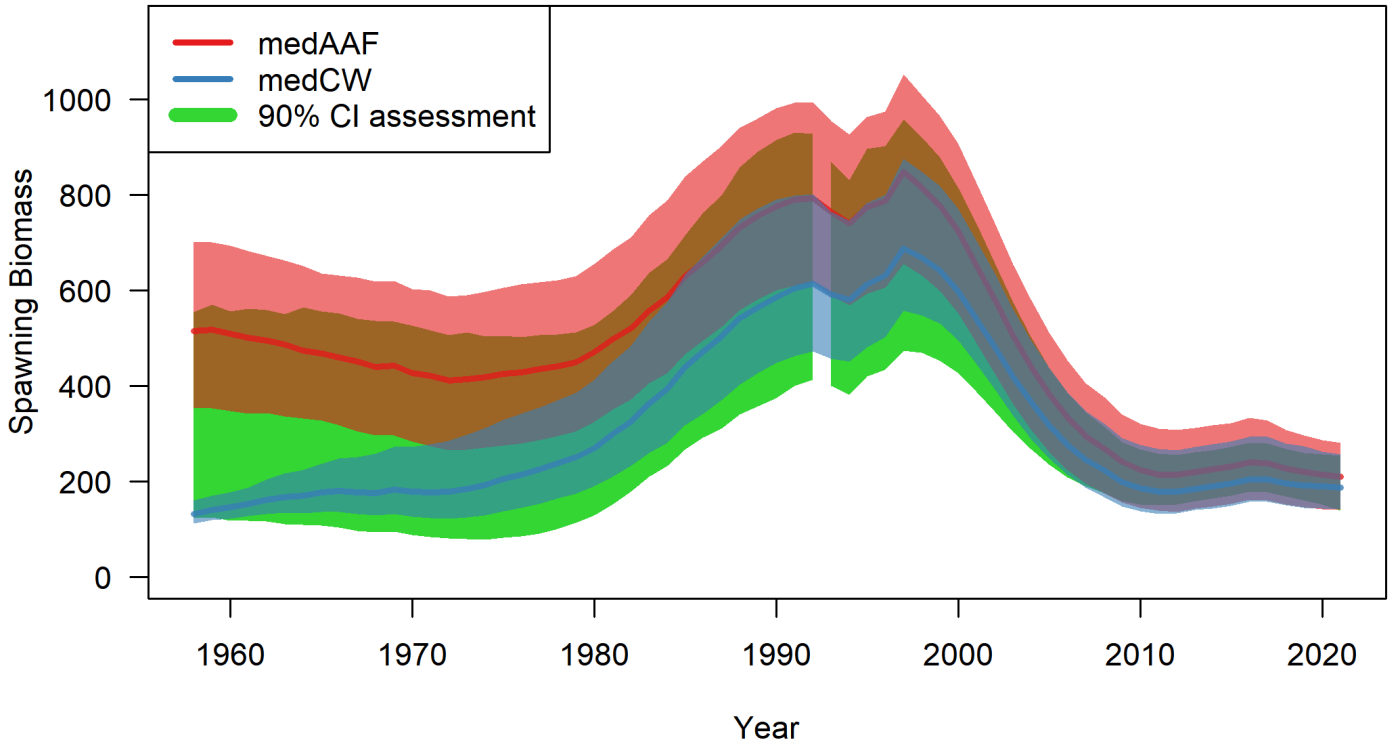
- Different explanations of how stock was distributed and connected via movement given historical fishing mortality



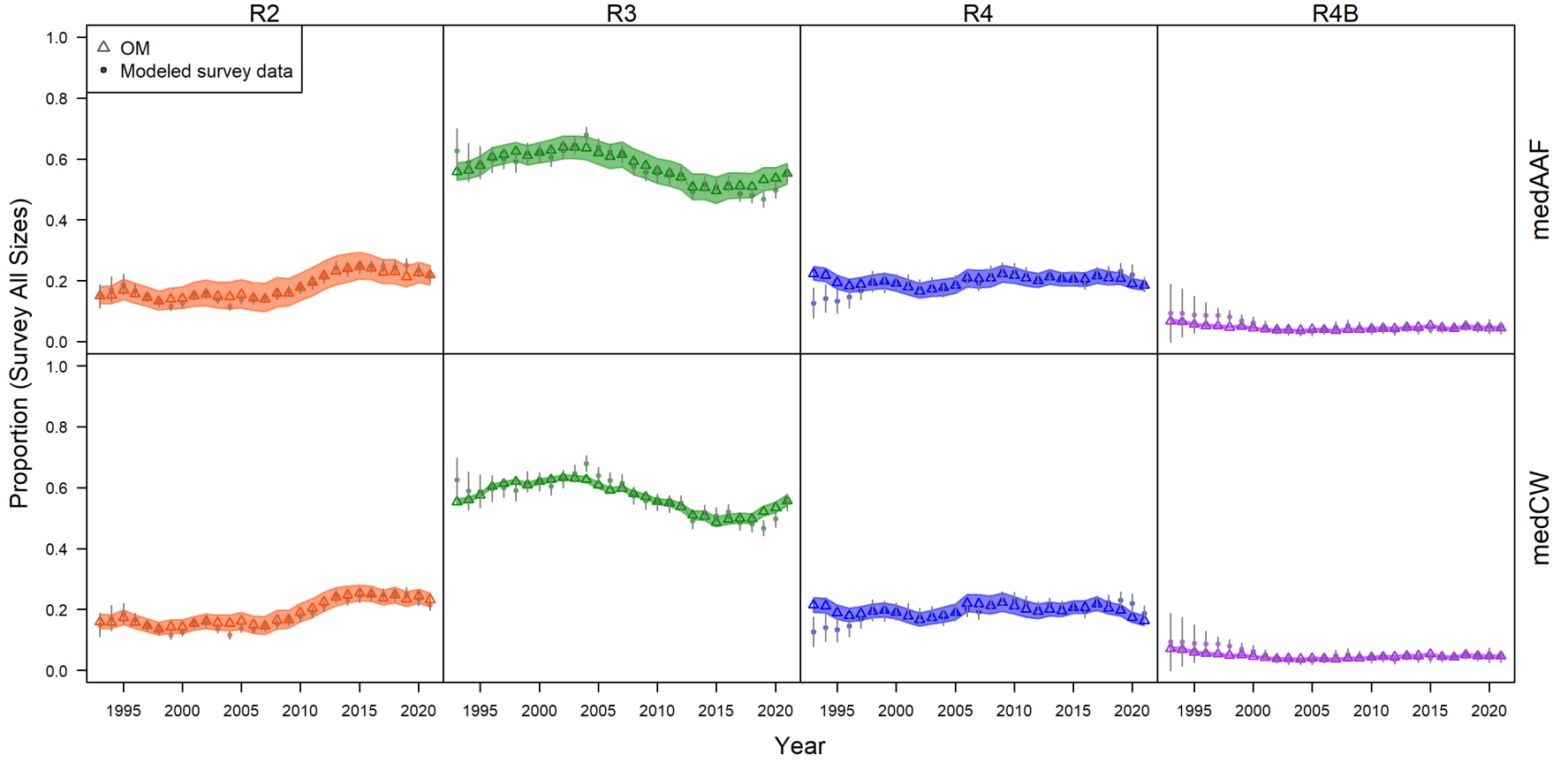
medAAF and medCW OM models

OM MODELS

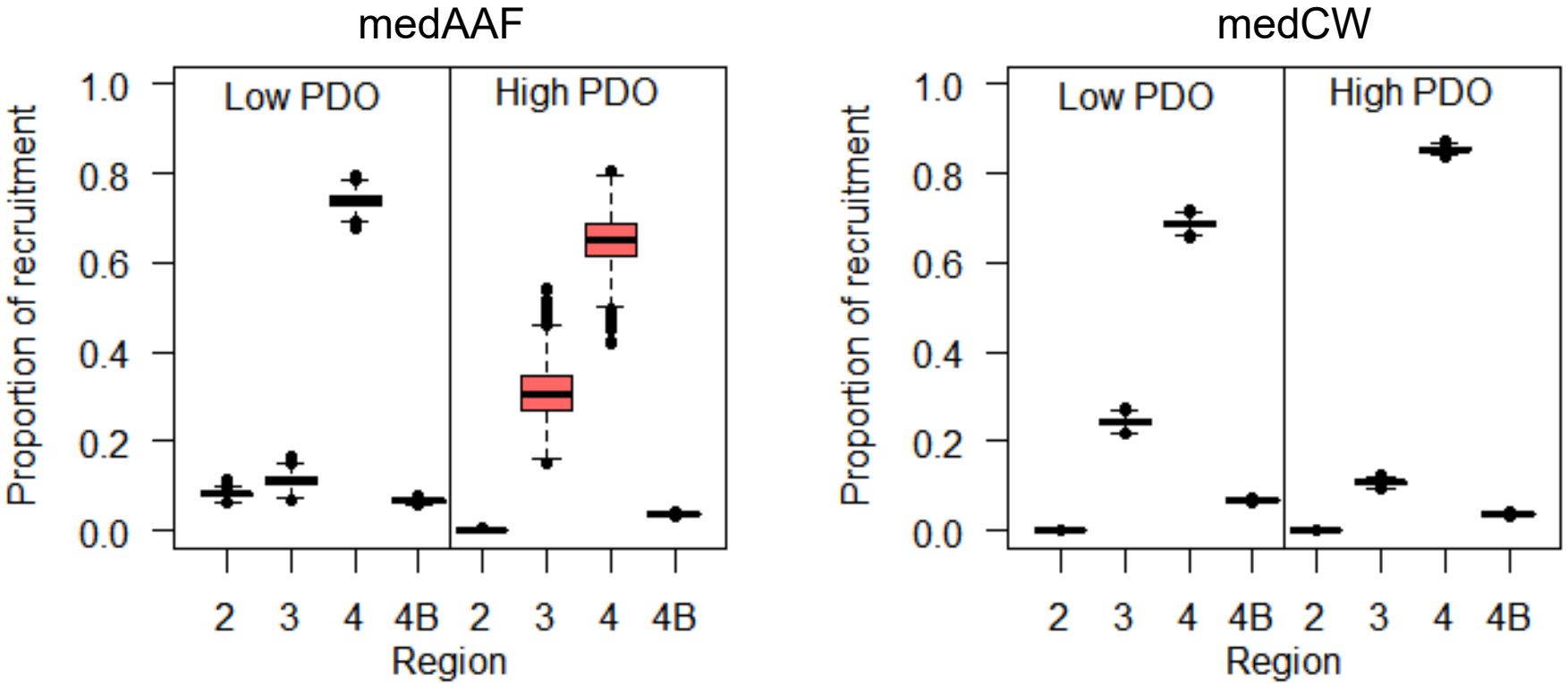
- Different starting abundance in 1958
- Different parameters
- Same fishing mortality history



Stock distribution from OM models

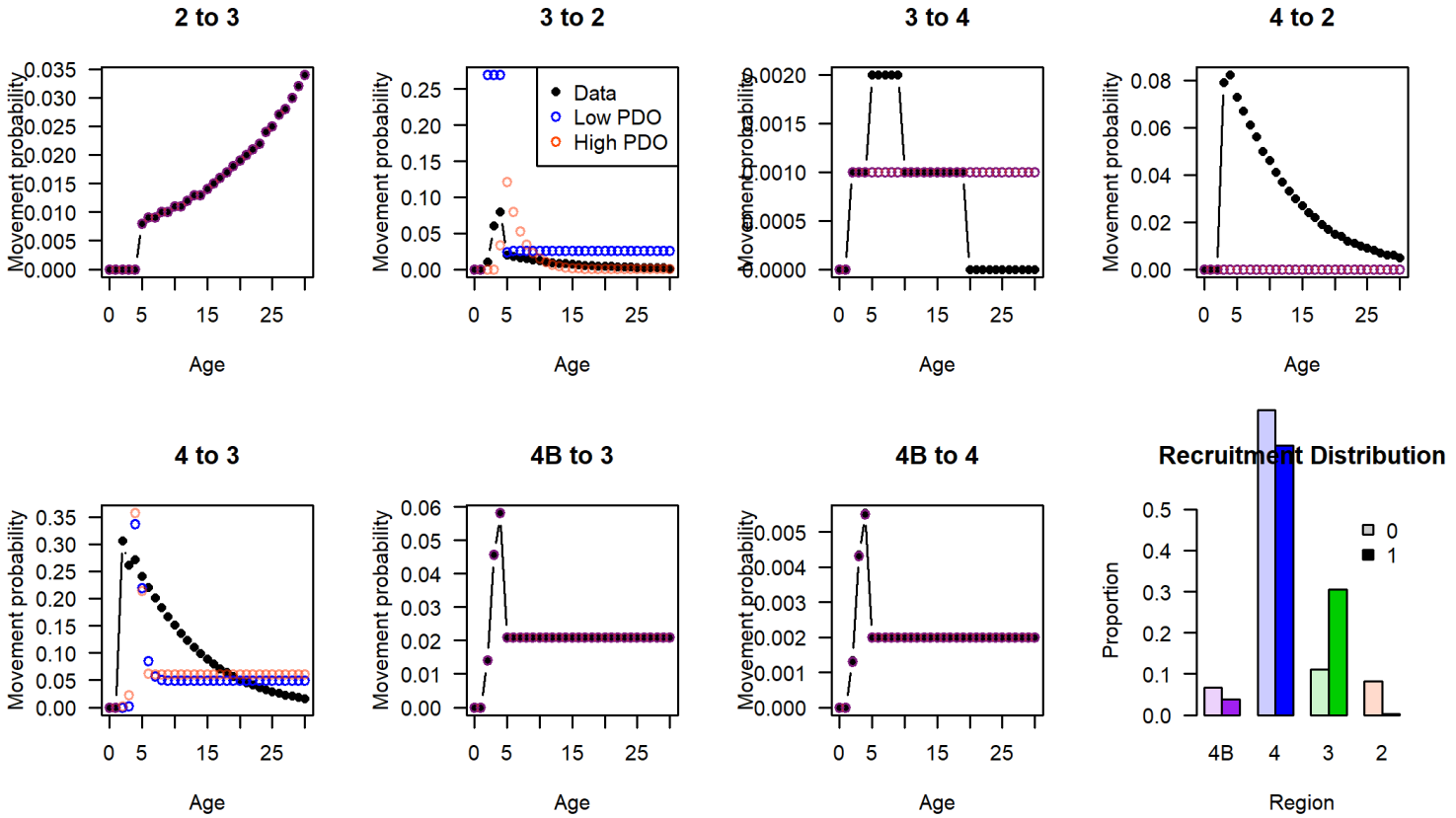


Distribution of age-0 recruits

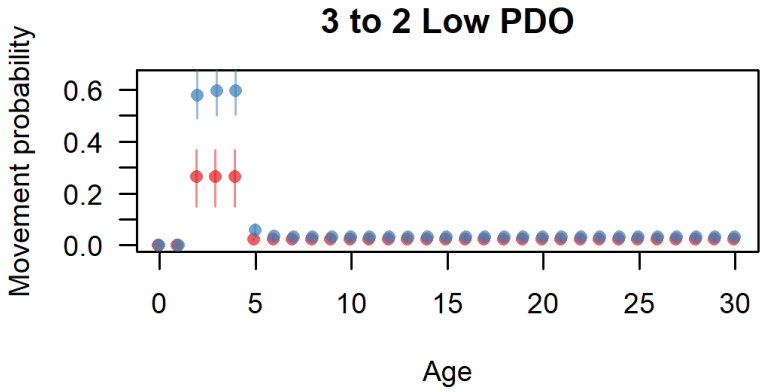


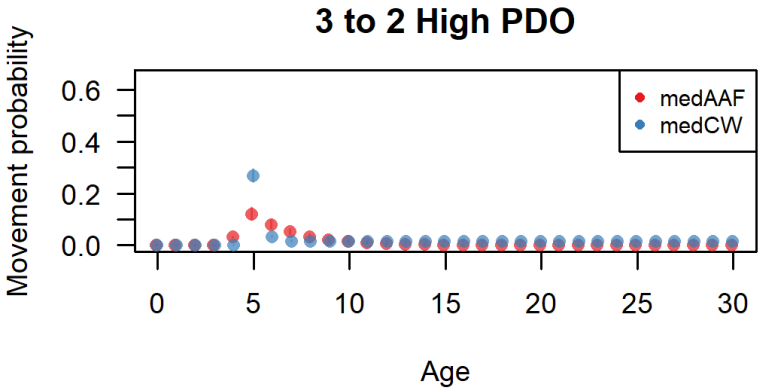
Movement Rates: medAAF

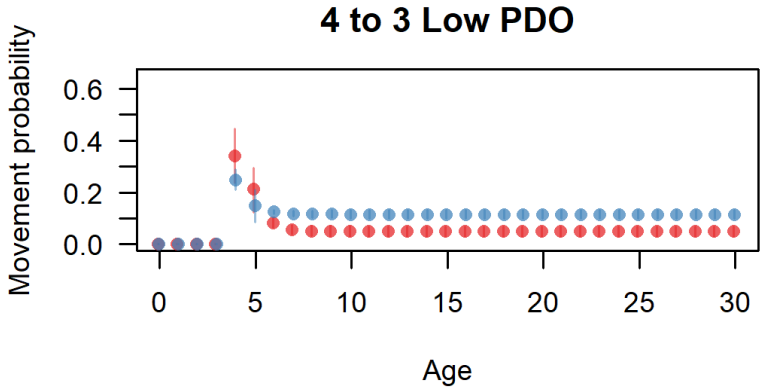
- All but 3 to 2 and 4 to 3 fixed

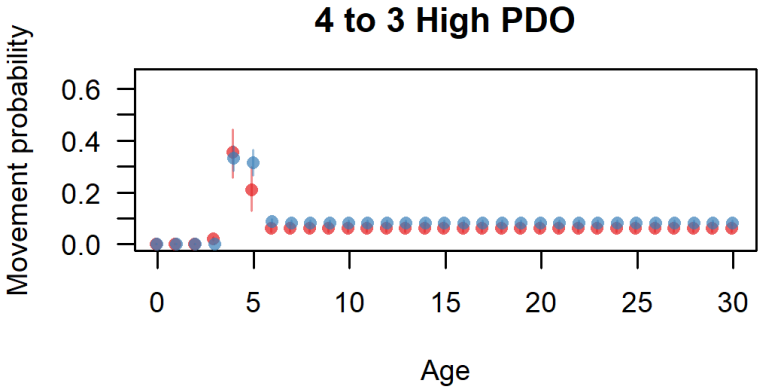


Movement Rates

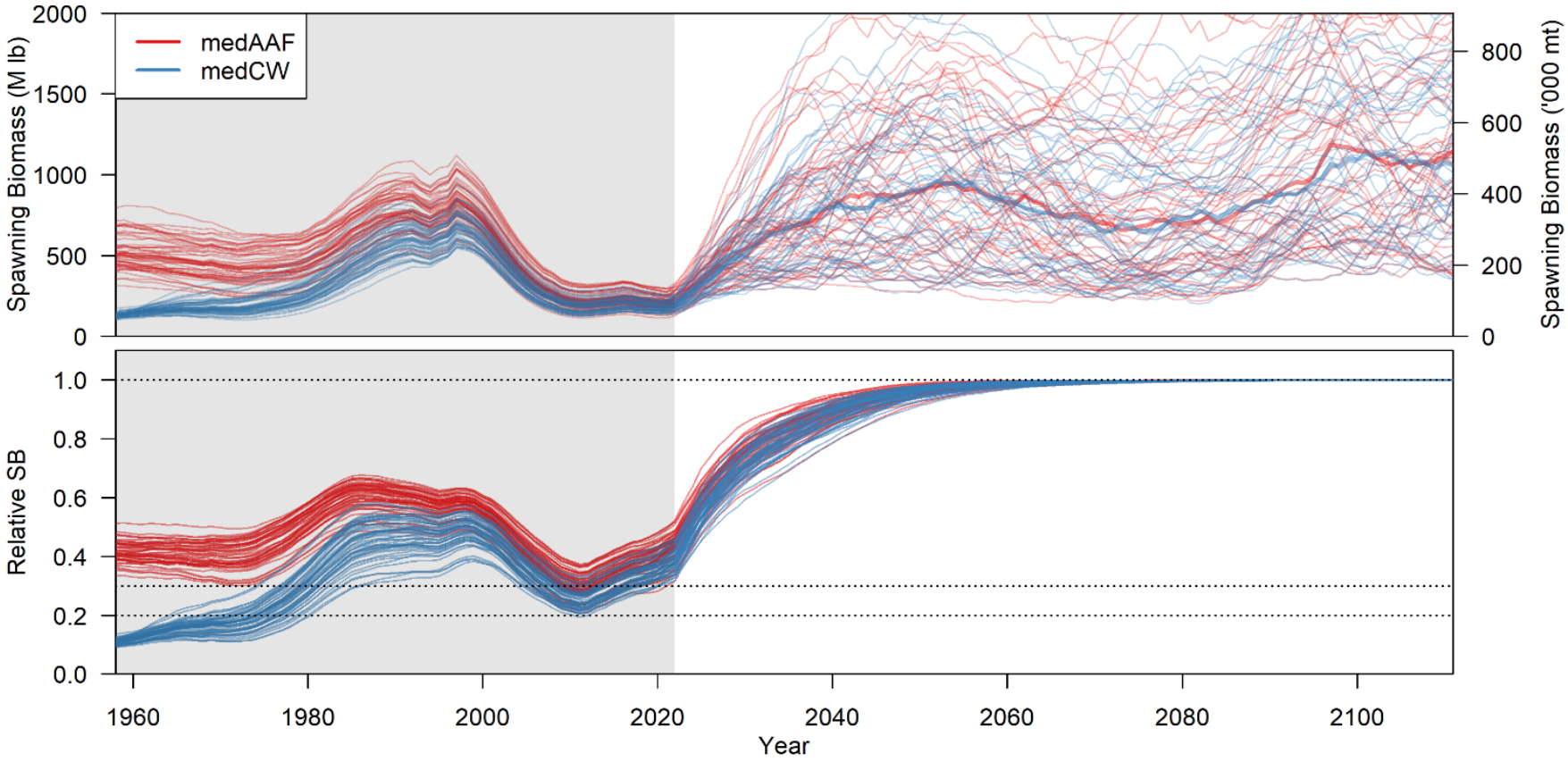




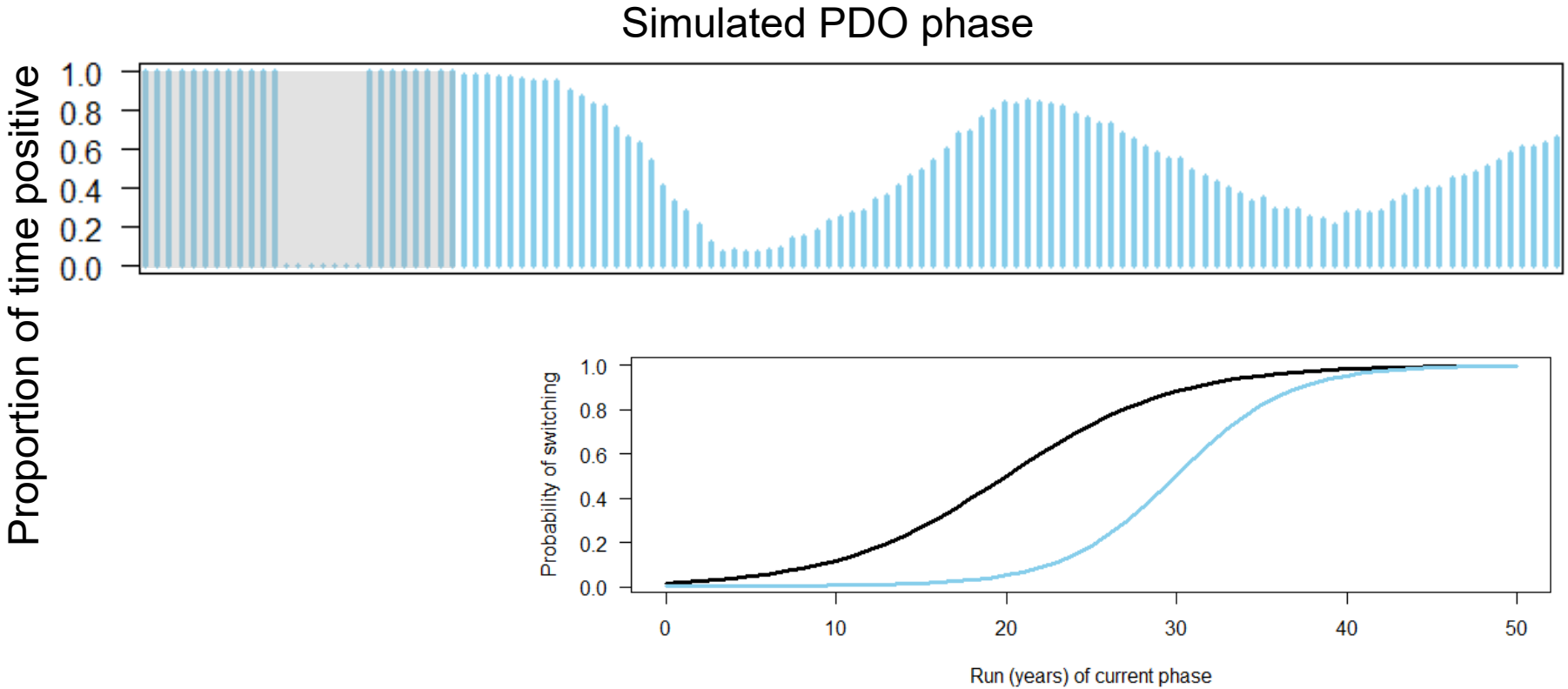




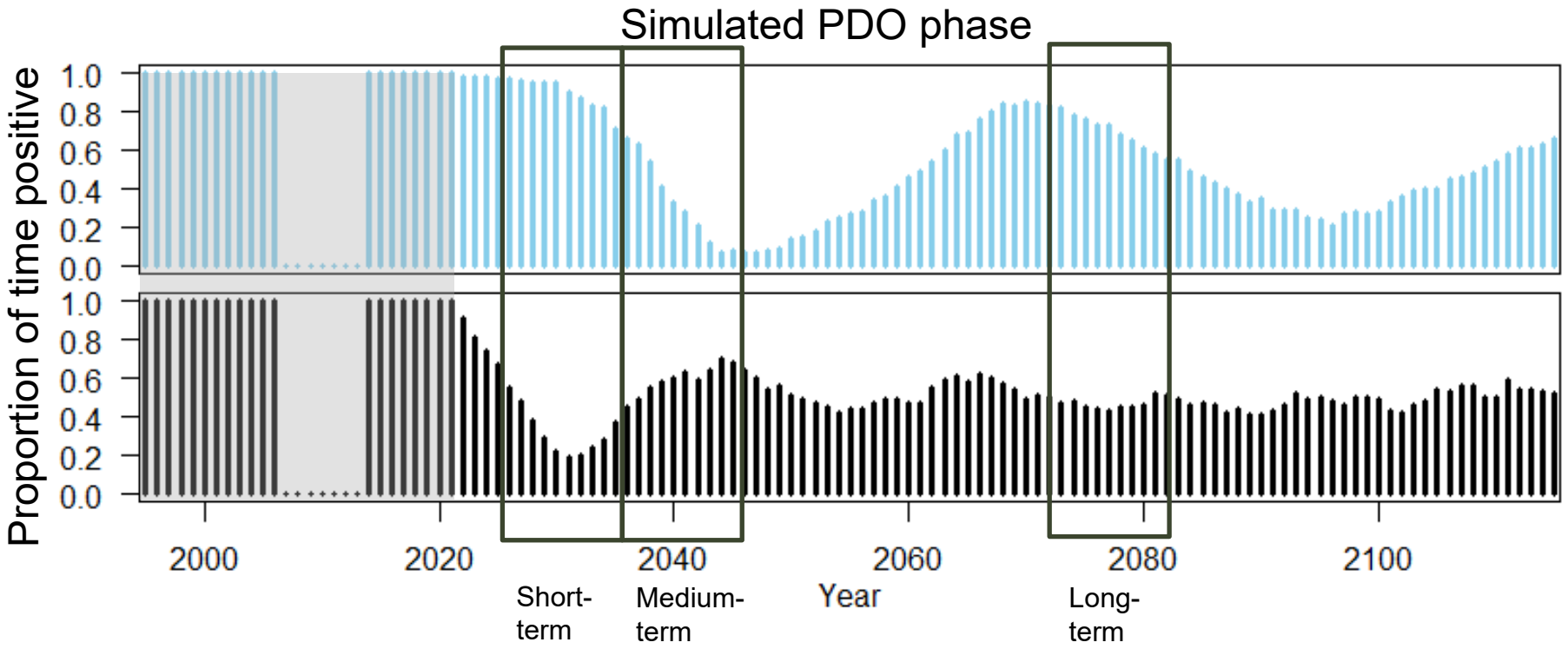
Projections with No Fishing Mortality



Sinusoidal behavior in projections

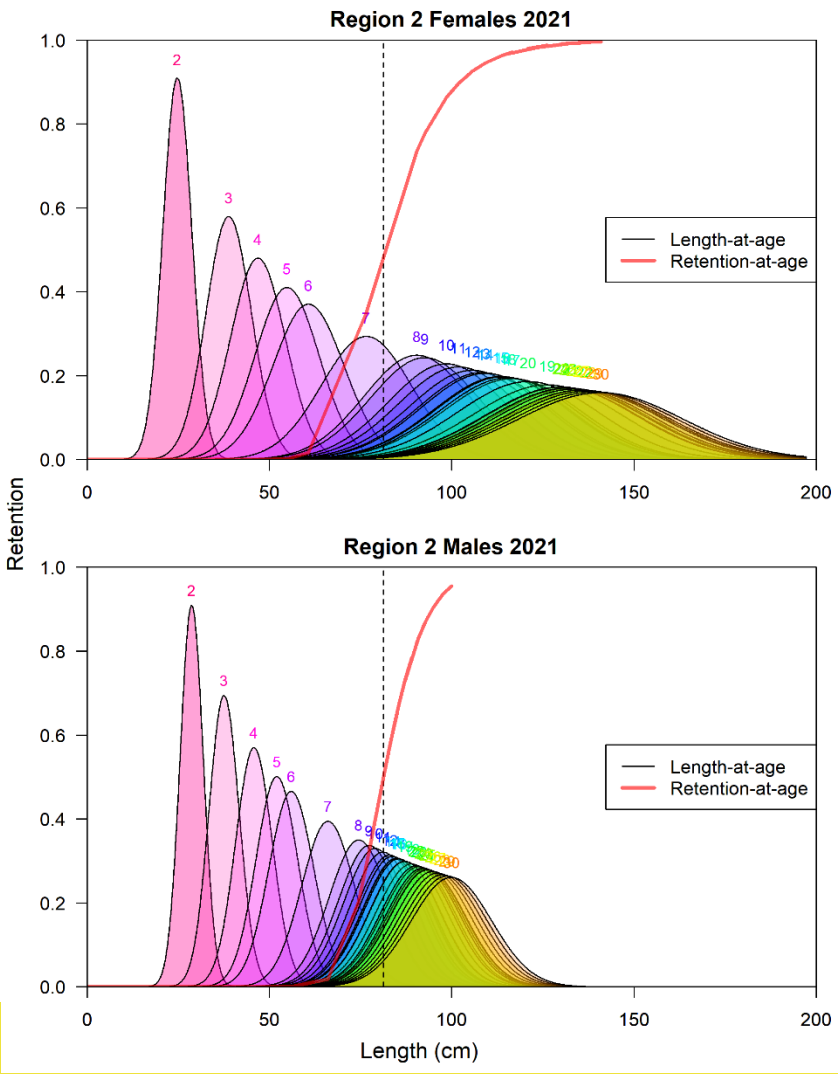


Sinusoidal behavior in projections



Modelling discards

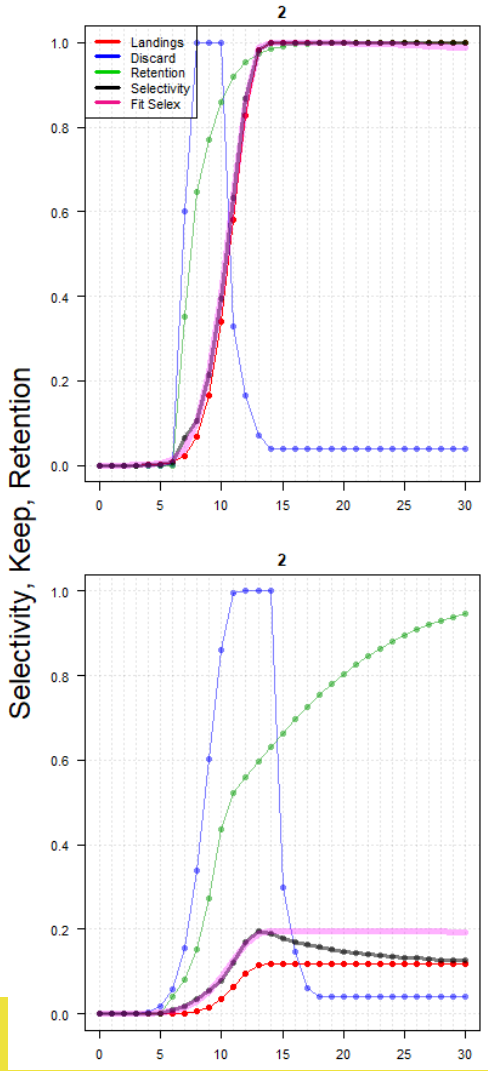
- To investigate size limits, it is helpful to model retention/discarding
- Length is not modelled in assessment or MSE
- Determine retention-at-age for a size limit based on weight-at-age and length-at-weight
- Variability included based on past observations



Determining selectivity

$keep_a = retention_a \times selex_a$

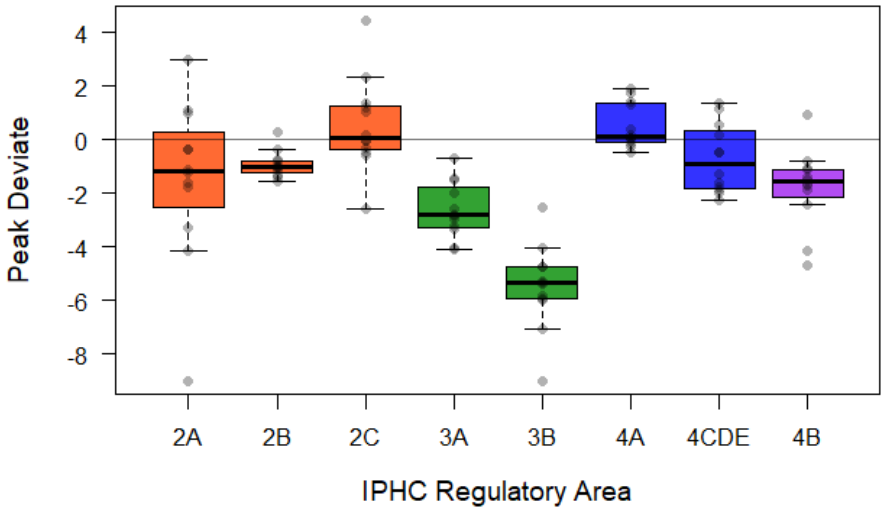
- $retention_a$ calculated using length-age distributions (green)
- $keep_a$ is from assessment (red)
- $selex_a$ calculated with assumptions (black) and parameterized (pink)



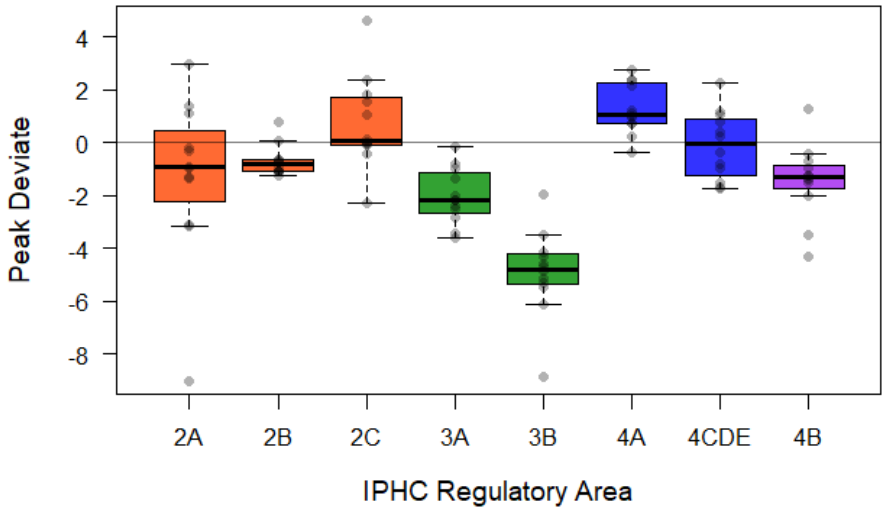
Groundtruth selectivity

- Predict U32 discards in OM (2010-2021)
- Further adjust Peak selex param until match

medAAF

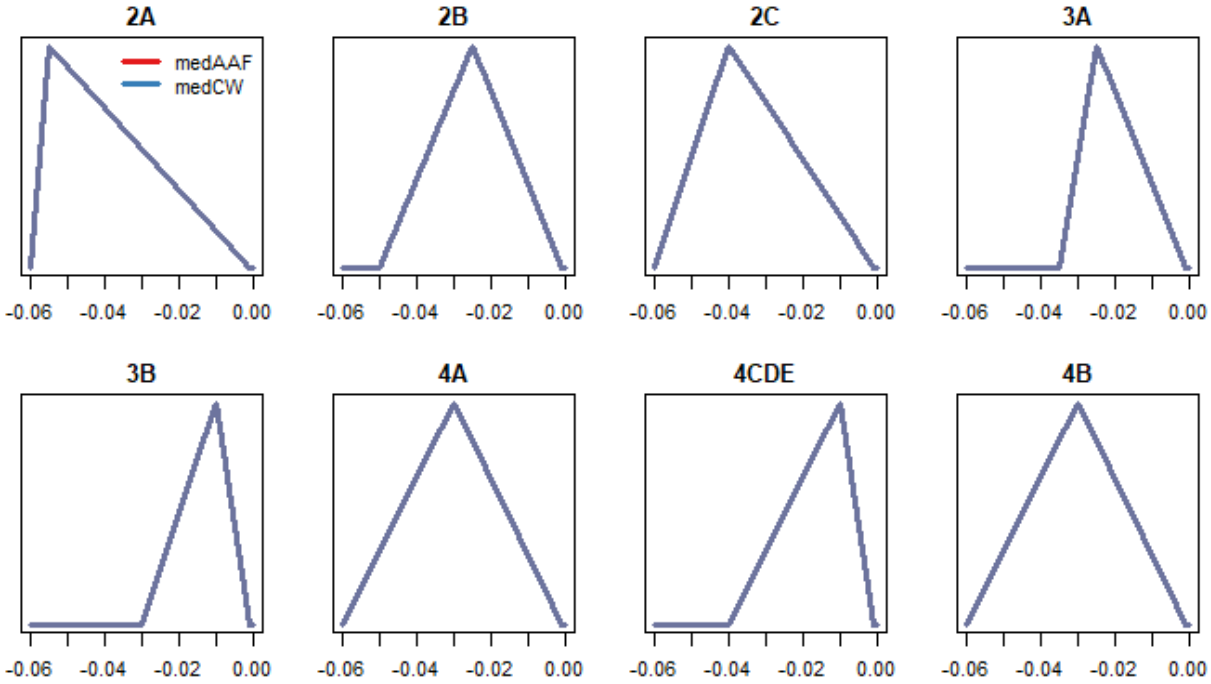


medCW



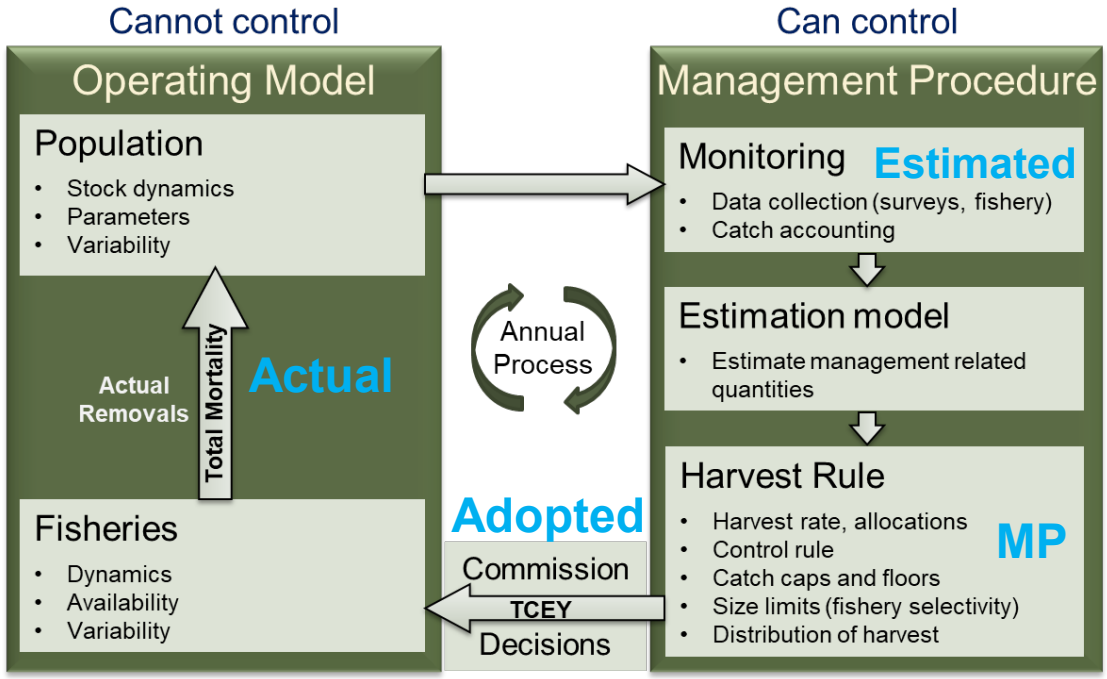
Groundtruth retention asymptote

- Predict O32 discards (2010-2021)
- Adjust retention asymptote down from 1.0
- Draw deviate from triangle distribution



F.2: Implementation variability & uncertainty

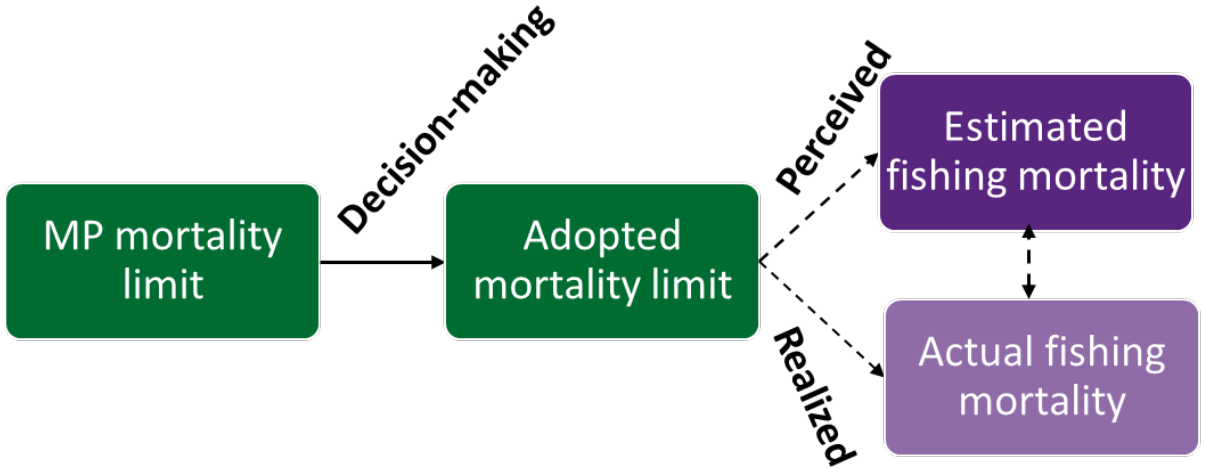
- The deviation of the fishing mortality from the mortality limit determined from an MP
- **Variability**: inherent heterogeneity observed in the past
- **Uncertainty**: incomplete understanding what may happen in the future



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

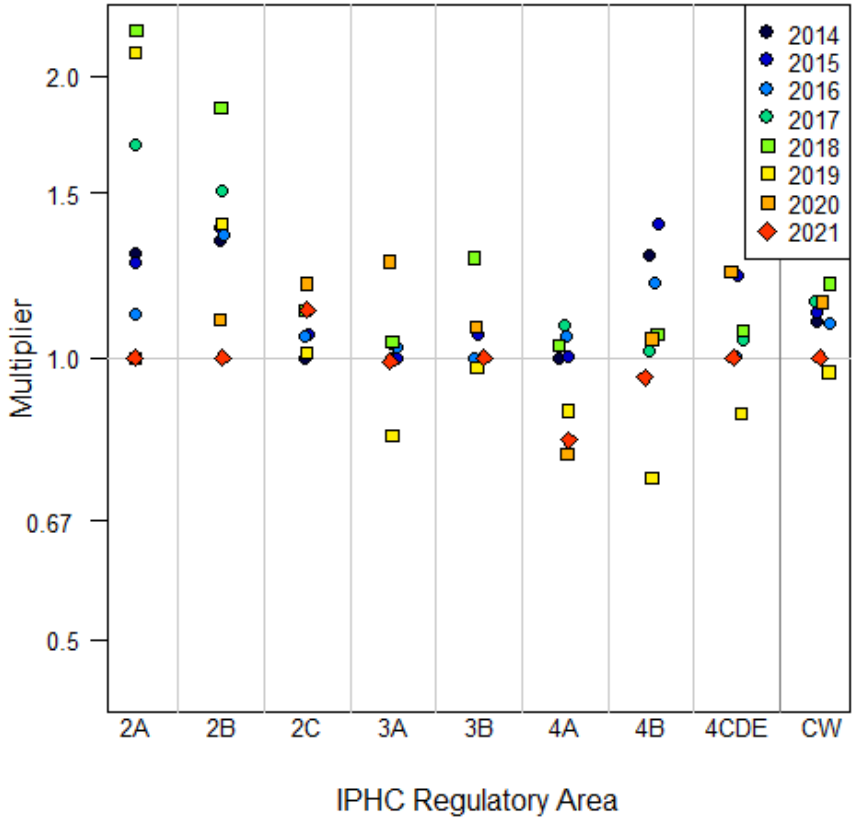


Decision-making variability

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

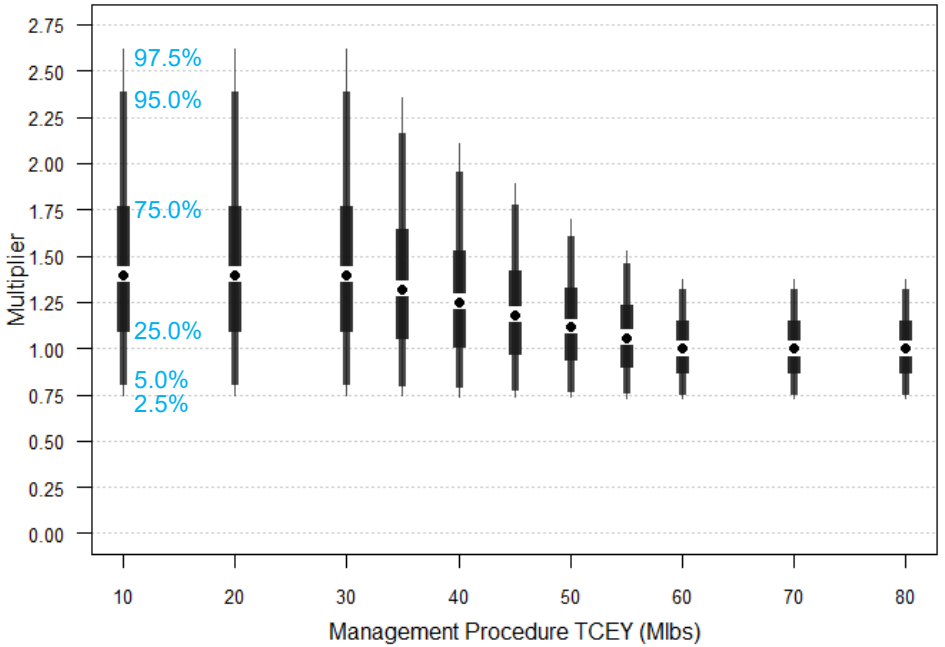
$$\widetilde{TCEY}_t = TCEY_t \times \varepsilon_I$$

Adopted MP Multiplier



Decision-making uncertainty

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



SRB requests

SRB016-R, para. 29. *… the SRB REQUESTED further investigation of decision-making variability, including empirical analysis of the relationship between recommended and implemented harvest levels*

SRB019-R, para. 35. *… the SRB RECOMMENDED that the IPHC Secretariat develop, for presentation at SRB020, alternative scenarios that represent implementation bias, i.e. the potential for quota reductions called for by the management procedure to be less likely implemented than quota increases*

- This method captures this somewhat
- Could have different relationships depending on mortality limit increasing or decreasing

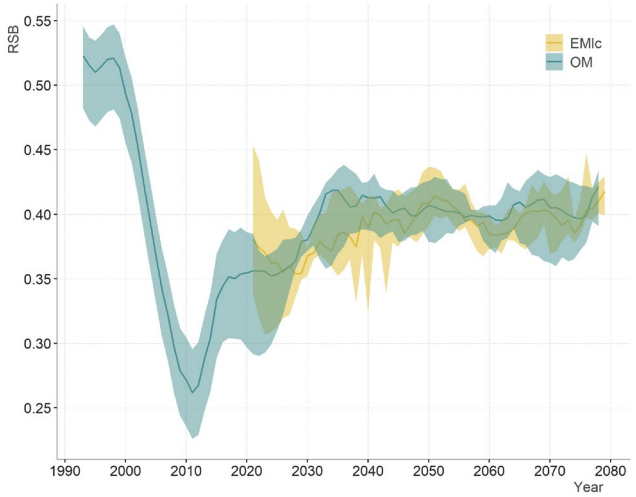
F.3: Estimation Error

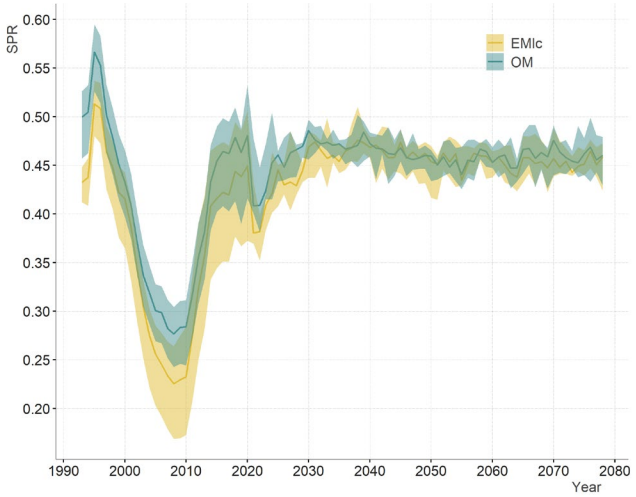
- Three methods implemented
  1. No estimation error
  2. Simulated estimation error
     - TM and stock status (correlated and autocorrelated)
  3. Use stock assessment model(s)
     - Stock synthesis

SRB017-R, **para. 57**. *The SRB … RECOMMENDED continuing work to incorporate actual estimation models, as in the third option, because that method would best mimic the current assessment process.*

Estimation Error from Assessment Model

- Using stock assessment models is the most realistic
- Currently have one model (long CW) implemented





Potential OM scenarios to consider

- Selectivity changes with size limits
- Alternative migration
- Lower natural mortality
- Alternative implementation uncertainty

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

Size limits

IPHC-2022-AM098-R, para 61: *The Commission RECALLED SS011-Rec.01 and REQUESTED that the current size limit (32 inches), a 26 inch size limit, and no size limit be investigated. to understand the long-term effects of a change in the size limit*

- Investigate various size limits
  - MSE framework updated to accommodate any size limit
  - **32 inch (current) size limit (81.3 cm)**
  - **26 inch size limit (66.0 cm)**
    - May not be much different than no size limit
      - Directed commercial catch is less than 2% U26
  - **No size limit**

Useful objectives for size limits

- Useful objectives
  - Primary objectives
  - Fishery objectives related to efficiency
  - Consider value of the fishery and how markets may react (AM097-09)
  - There was a goal to minimize directed commercial discard mortality that was placed in the parking lot (from IPHC-2018-MSAB011-07)

Table 1: Measurable objectives and associated performance metrics, as reported in the MSAB09 Report (IPHC-2017-MSAB09-R). Discard mortality is used to describe what was formerly known as wastage. Continued from above.

Minimize discard mortality				
Measurable Objective	**Outcome**	**Time-frame**	**Probability**	**Performance Metrics**
Discard mortality in the longline fishery	<10% of annual catch limit	10 year period, Long-term	0.25	$P(discardMortality > 10\%FCEY)$
Absolute	Discard Mortality	10 year period, Long-term		Median $\overline{discardMortality}$

Multi-year stock assessment

IPHC-2022-AM098-R, para 64: *The Commission REQUESTED that multi-year management procedures include the following concepts:*

a) The stock assessment occurs biennially (and possibly triennial if time in 2022 allows) and no changes would occur to the FISS (i.e. remains annual);

b) The TCEY within IPHC Regulatory Areas for non-assessment years:

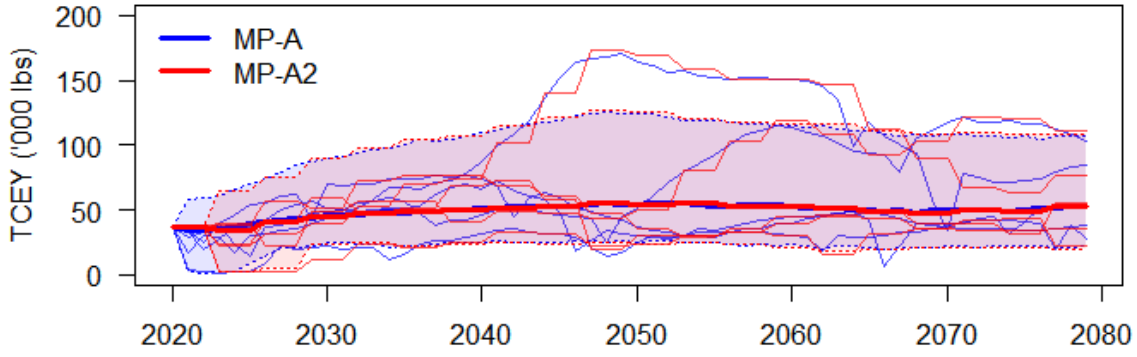
i. remains the same as defined in the previous assessment year, or

ii. changes within IPHC Regulatory Areas using simple empirical rules, to be developed by the IPHC Secretariat, that incorporate FISS data

- MPs
  - Biennial stock assessment with constant TCEY
  - Biennial stock assessment with an empirical rule
  - FISS remains an annual survey

Multi-year stock assessment objectives

- Primary objectives
- What fishery stability means
- Importance of transparency
- Costs and benefits to stock assessment, research, and management



Request to SRB

AM098-R, para 63. The Commission REQUESTED that the IPHC Secretariat work with the SRB and others as necessary to identify potential costs and benefits of not conducting an annual stock assessment. This will include a prioritized list of work items that could be accomplished in its place.

- First step is to determine if multi-year assessments meet objectives

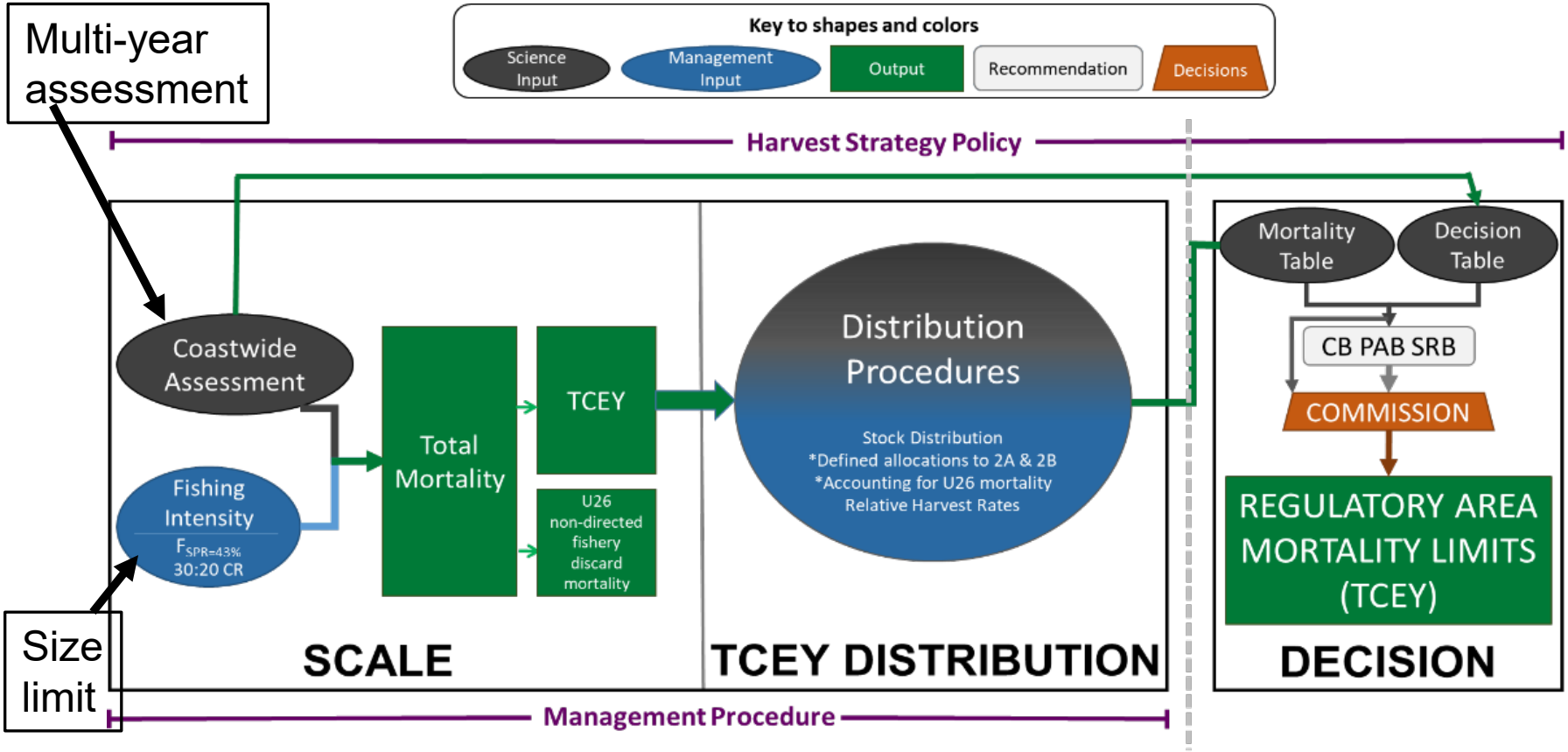
Costs

- Detailed harvest advice not available every year
- Possible delayed action (MSE will help identify this)

Benefits

- Some multi-year stability/transparency for stakeholders
- Staff resources could be directed to other topics

The entire management procedure



Distribution procedures: Reg Area

	Stock distribution	Relative harvest rates	Years in stock distribution	2A & 2B Agreements	Elements from
a	Baseline O32	0.75 for 3B-4	Recent year	None	MP-G
b	Baseline O32	0.75 for 3B-4	Recent year	Interim	MP-A
c	Baseline O32 for AK	*0.75 for 3B-4**	Recent year	2A 1.65, 2B 20%	MP-A, MP-F
d	Baseline O32	0.75 for 4B	Recent year	None	MP-G, MP-H
e	Baseline O32	0.75 for 4B	Recent year	Interim	MP-A, MP-H

*implied

IPHC-2022-SS012-R, para 11

Summary of MPs

Size Limits

- Current (32 inches)
- 26 inches
- None

Multi-year assessments

- Biennial
  - Constant
  - Empirical rule

Distribution

- Integrate over multiple procedures

Management Procedures

MP ID	Multi-year	Size Limit
MP-A32	Annual	32
MP-Bc32	Biennial, constant	32
MP-Be32	Biennial, empirical rule	32
MP-A26a	Annual	26
MP-A0a	Annual	0

Recommendations

That the SRB

a) **NOTE** paper IPHC-2022-SRB020-06 Rev_1

b) **NOTE** two new population models conditioned using assumptions and outputs from the two long models from the recent stock assessment will be integrated and used as an OM.

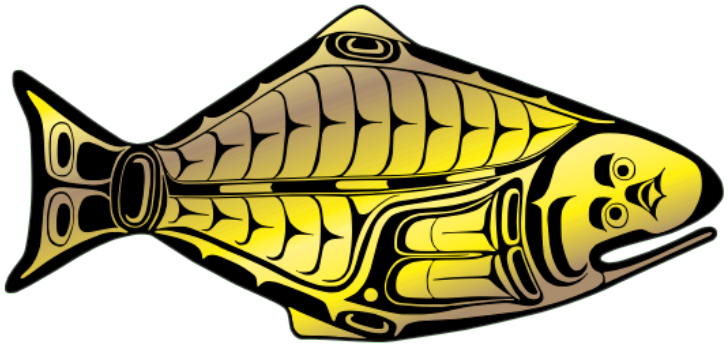
c) **NOTE** that improvements to the closed-loop simulation framework allow for a more direct method of evaluating size limits without specifically modelling a growth curve.

d) **NOTE** the methods for simulating implementation error based on past management outcomes.

e) **NOTE** that there are costs and benefits to not conducting annual stock assessments, which may affect research opportunities.

f) **NOTE** that five primary MPs investigating three size-limits, and annual and biennial assessments will be evaluated in 2022, with five distribution procedures treated as uncertainty. Sensitivities will be performed using the best performing MPs.

INTERNATIONAL PACIFIC



HALIBUT COMMISSION