INTERNATIONAL PACIFIC HALIBUT COMMISSION

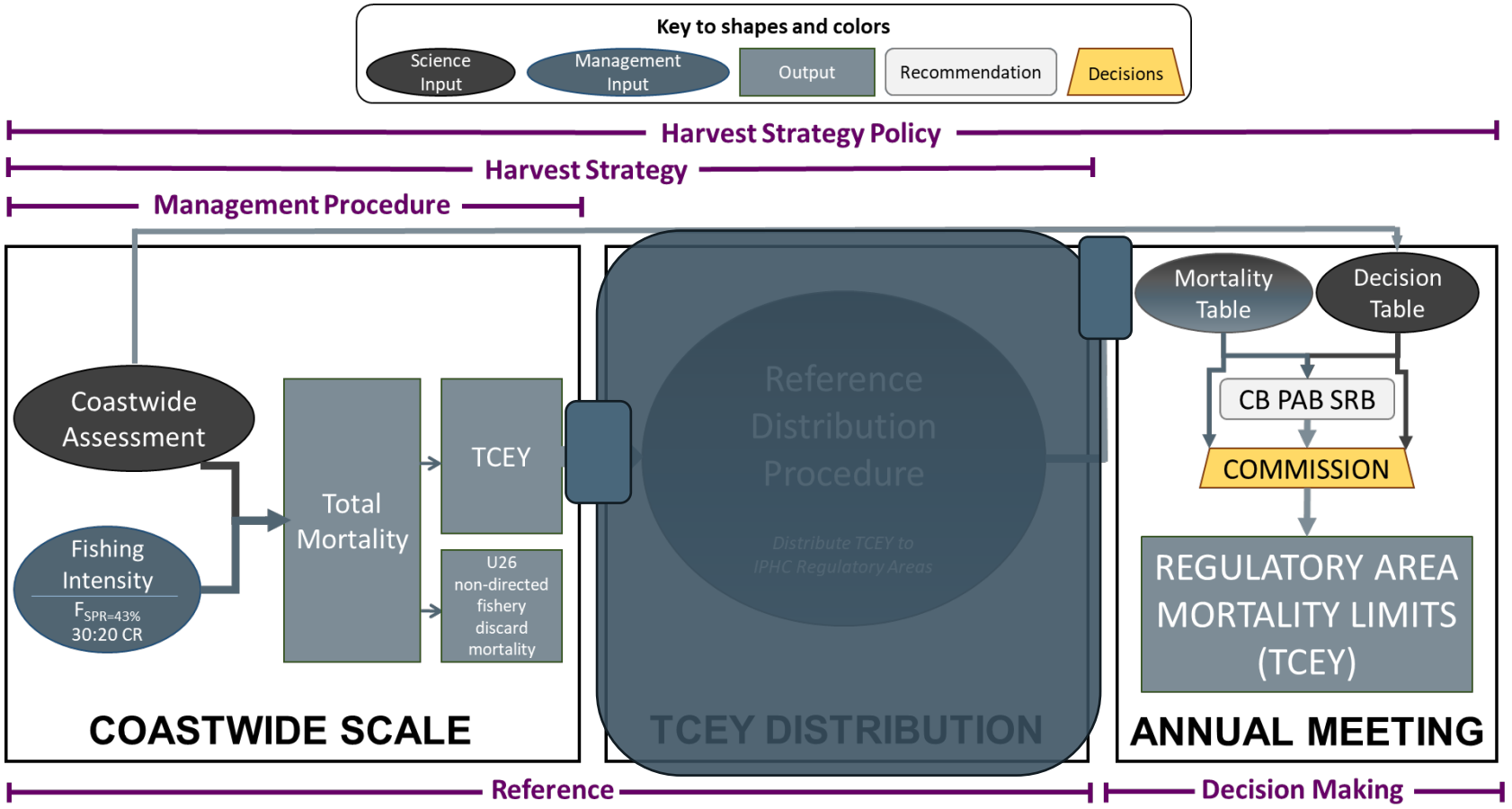
MSE Program of Work (2024)

Agenda item 4.1.2.
IPHC-2024-SRB024-07
(A. Hicks and I. Stewart)

Harvest Strategy Policy

IPHC-2023-SRB023-R, para. 30: *The SRB **RECOMMENDED** that the Commission consider revising the harvest policy to (i) determine coastwide TCEY via a formal management procedure and (ii) negotiate distribution independently (e.g. during annual meetings). Such separated processes are used in other jurisdictions (e.g. most tuna RFMOs, Mid Atlantic Fishery Management Council, AK Sablefish, etc.).*

Secretariat currently revising a draft Harvest Strategy Policy



Exceptional Circumstances

IPHC-2023-SRB023-R, para. 27: ***RECOGNIZING*** *the spatial variability of environmental factors that influence population dynamics, the SRB* ***RECOMMENDED*** *that an exceptional circumstance be defined based on regional as well as stockwide deviations from expectations. For example, an exceptional circumstance could be declared if any of the following are met:*

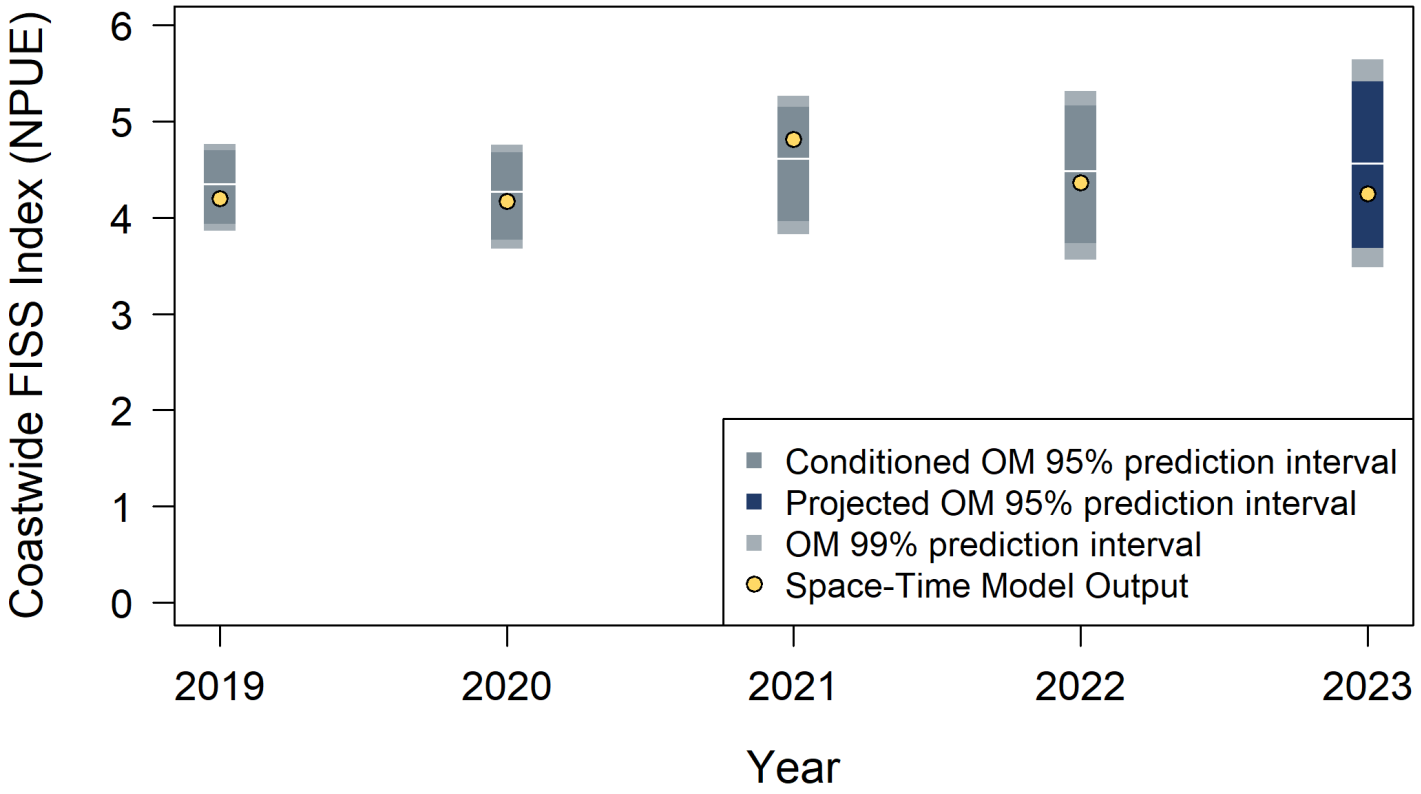
a) The coastwide all-sizes FISS WPUE or NPUE from the space-time model falls above the 97.5th percentile or below the 2.5th percentile of the simulated FISS index for two or more consecutive years.

b) The observed FISS all-sizes stock distribution for any Biological Region is above the 97.5th percentile or below the 2.5th percentile of the simulated FISS index over a period of 2 or more years.

c) Recruitment, weight-at-age, sex ratios, other biological observations, or new research indicating parameters that are outside the 2.5th and 97.5th percentiles of the range used or calculated in the MSE simulations.

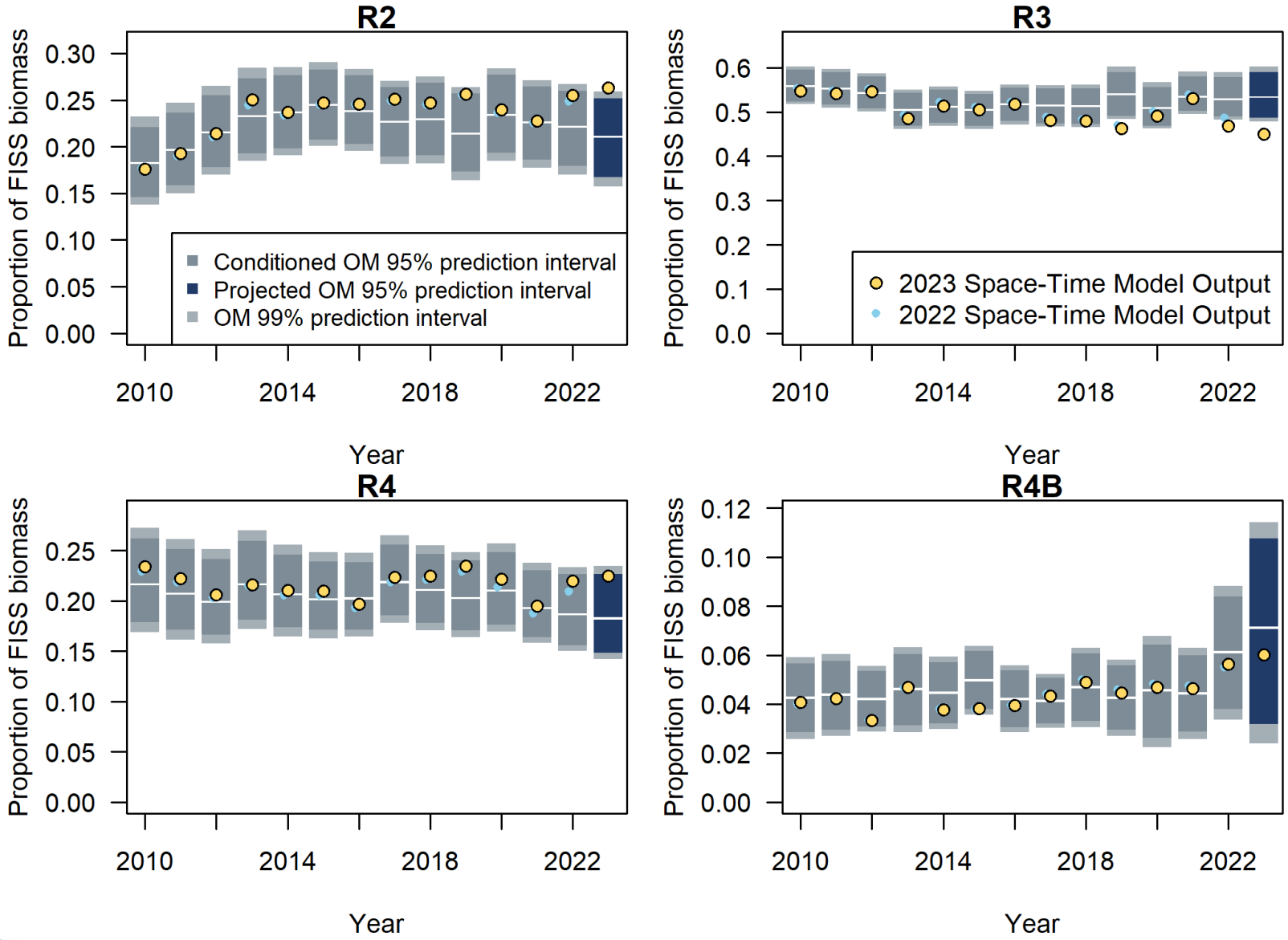
Exceptional Circumstances: Coastwide NPUE

- Predict coastwide NPUE from MSE simulations
- Use SPR=43%
  - current reference MP
- Generate 100 indices per simulation to add prediction uncertainty



Exceptional Circumstances: Proportion of biomass

- Predict proportion of FISS all-sizes biomass (WPUE) in each Biological Region using OM
- Departure in R2 and R3 could be due to a new low regime starting in 2020 not specified in OM
  - More movement from 3 to 2 in low regime



Exceptional Circumstances: Updates in knowledge

- Outcomes of current research may suggest updating the OM
  - Stock structure
  - Maturity-at-age
  - Fecundity
  - Movement
  - Recruitment
  - Environmental drivers

Fishery-dependent data

IPHC-2024-MSAB019-R, para. 53: *The MSAB **NOTED** that the FISS is conducted to measure the population and that it may not be an accurate depiction of the fishery, and that fishery-dependent data may provide insights into fishery concerns that the FISS may not capture.*

IPHC-2024-MSAB019-R, para. 54: *The MSAB **REQUESTED** that the SRB and Secretariat work together to consider different ways to incorporate fishery-dependent data into an exceptional circumstance.*

Actions if Exceptional Circumstance Declared

IPHC-2023-SRB023-R, para. 28: *The SRB **RECOMMENDED** that if an exceptional circumstance occurred the following actions would take place:*

a) A review of the MSE simulations to determine if the OM can be improved and MPs should be reevaluated.

b) If a multi-year MP was implemented and an exceptional circumstance occurred in a year without a stock assessment, a stock assessment would be completed as soon as possible along with the re-examination of the MSE.

c) Consult with the SRB and MSAB to identify why the exceptional circumstance occurred, what can be done to resolve it, and determine a set of MPs to evaluate with an updated OM.

d) Further consult with the SRB and MSAB after simulations are complete to identify whether a new MP is appropriate.

Objectives

- Currently four primary coastwide objectives
  - **IPHC-2023-AM099-R, para. 76.** *The Commission **RECOMMENDED** that for the purpose of a comprehensive and intelligible Harvest Strategy Policy (HSP), four coastwide objectives should be documented within the HSP, in priority order:*

    a) Maintain the long-term coastwide female spawning stock biomass above a biomass limit reference point (B20%) at least 95% of the time.

    b) Maintain the long-term coastwide female spawning stock biomass at or above a biomass reference point (B36%) 50% or more of the time.

    c) Optimise average coastwide TCEY.

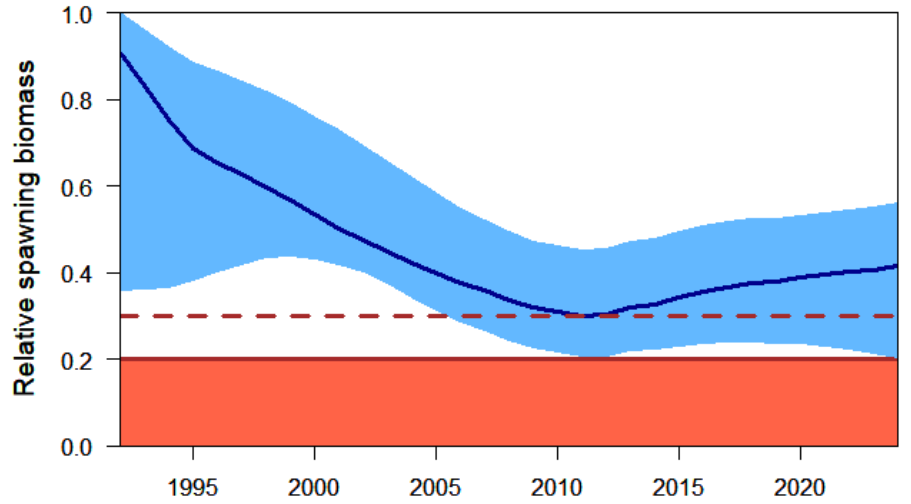
    d) Limit annual changes in the coastwide TCEY.

- More objectives shown in Appendix A of IPHC-2024-SRB024-07

Different perceptions

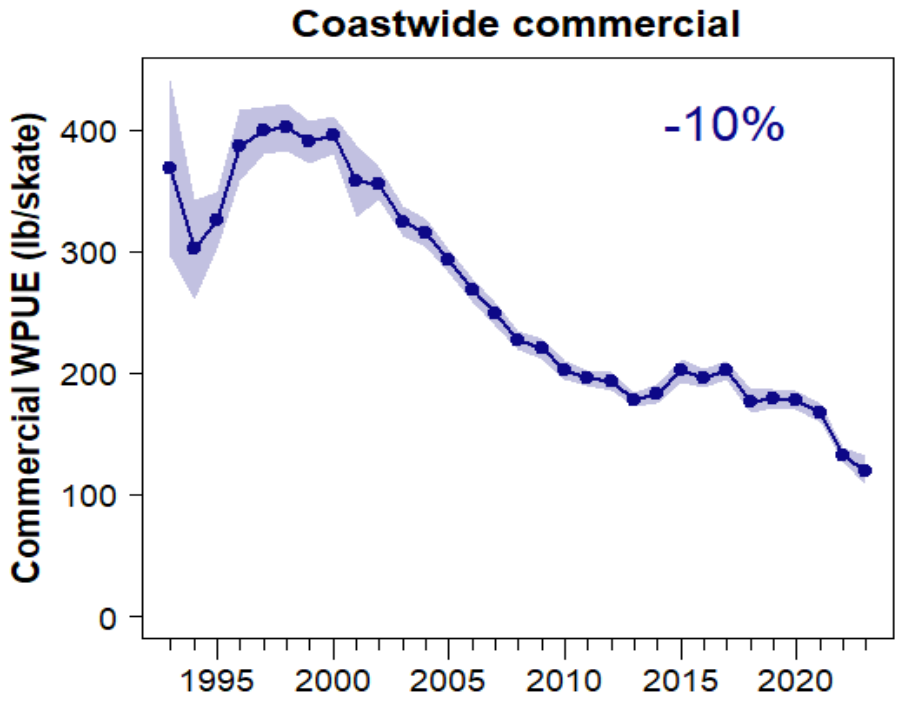
- Stock status (effect of fishing) is 42% and above proxy threshold $B_{36\%}$
- Long-term average stock status when fishing consistently at SPR=43% would be near 38%

Stock Status



- Catch-rates are at lowest level since early 1990's
- Commission decisions (2023 and 2024) set coastwide TCEYs less than the reference TCEY suggested by the stock assessment and SPR=43%

Catch Rate



Commission Notes

IPHC-2024-AM100-R

- Estimated spawning biomass at a 35-year low and likely to remain low
- Fishing at SPR=43% would have a high likelihood of stock decline
- Wide uncertainty in estimated spawning biomass and actual fishing intensity
- Adopted mortality limits for 2024 correspond to a 41% chance of stock decline
- Adopted mortality limits for 2024 correspond to a fishing intensity SPR=52%

Last two years: adopted TCEY is lower than reference TCEY

Are we missing an objective?

IPHC-2023-SRB023-R, para. 25. *The SRB **RECOMMENDED** that the Commission re-evaluate the target objective for long-term coastwide female spawning stock biomass given that estimated 2023 female spawning biomass (and associated WPUE), which was well-above the current target B36%, in part triggered harvest rate reductions from the interim harvest policy. Such ad-hoc adjustments limited the value of projections and performance measures from MSE.*

- Catch-rates and absolute biomass seem to be important
  - Especially when they are low
- Threshold objective ($B_{36\%}$) does not seem to be important
  - See **IPHC-2023-SRB023-R, para. 25**
- Thompson (1937)
  - "… obtaining a catch from a larger accumulated stock … less effort, but also less time at sea"
- Clark & Hare (2006)
  - Commission's objective is to maintain a healthy level of spawning biomass

Objective related to absolute biomass or catch-rate

- Spawning biomass highly correlated with commercial fishery catch-rates
- Current conservation objectives use dynamic RSB which may result in a low spawning biomass but a satisfactory stock status
- A minimum absolute coastwide spawning biomass may be necessary to ensure successful reproduction (not currently known)
- An observed absolute spawning biomass or catch-rate reference may have concrete meaning to stakeholders

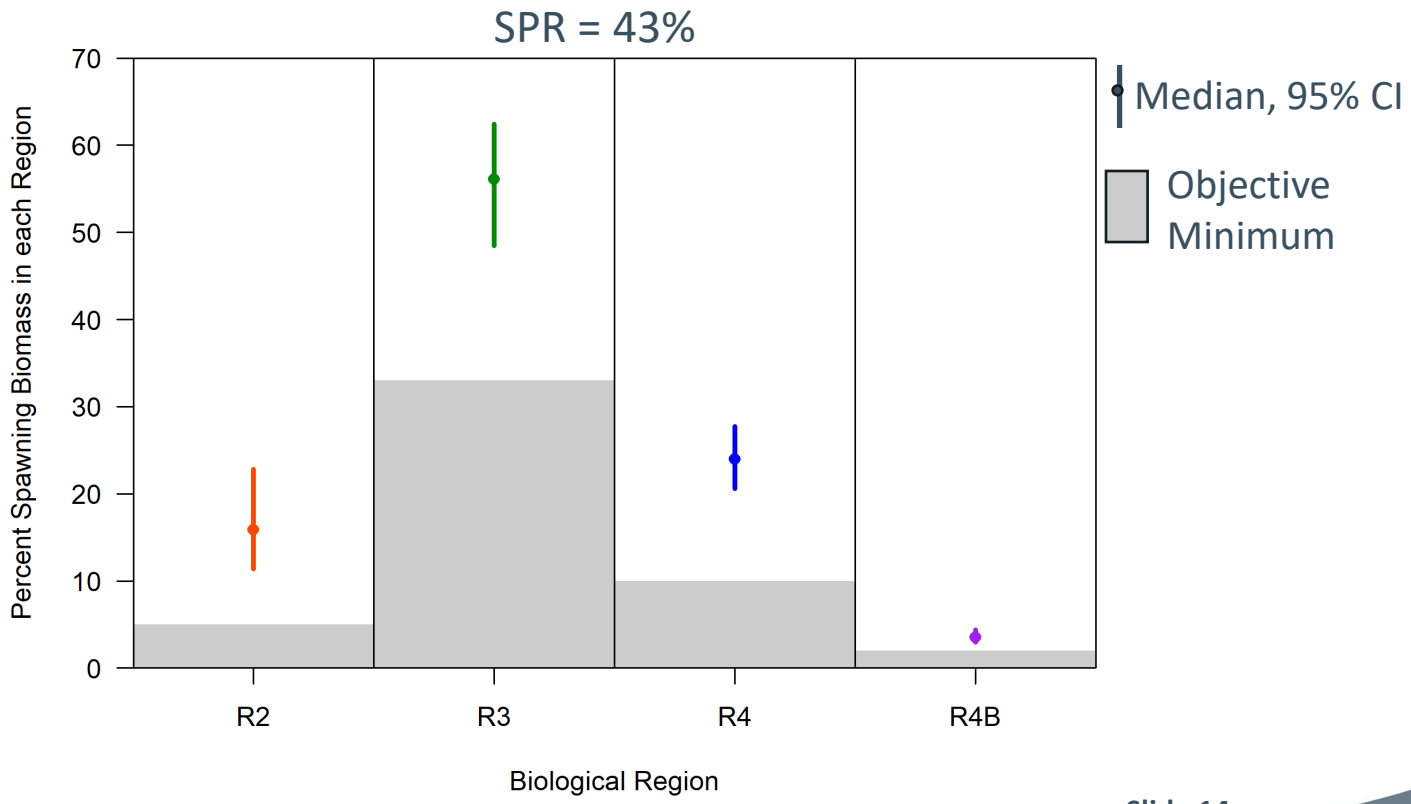
- Possibly replace $B_{36\%}$ with an absolute reference point for which dropping below would result in serious hardships to the fishery
  - B in 2023?

- Commission supports working with SRB and MSAB to develop an objective to possibly replace the $B_{36\%}$ objective and an ad hoc MSAB meeting to discuss this further

An objective related to spatial spawning biomass

IPHC-2023-SRB023-R, para. 24: *The SRB **RECOMMENDED** that an objective to maintain spatial population structure be added or redefined to maintain the spawning biomass in a Biological Region above a defined threshold relative to the dynamic unfished equilibrium spawning biomass in that Biological Region with a pre-defined tolerance. The percentage and tolerance may be defined based on historical patterns and appropriate risk levels recognizing the limited fishery control of biomass distribution.*

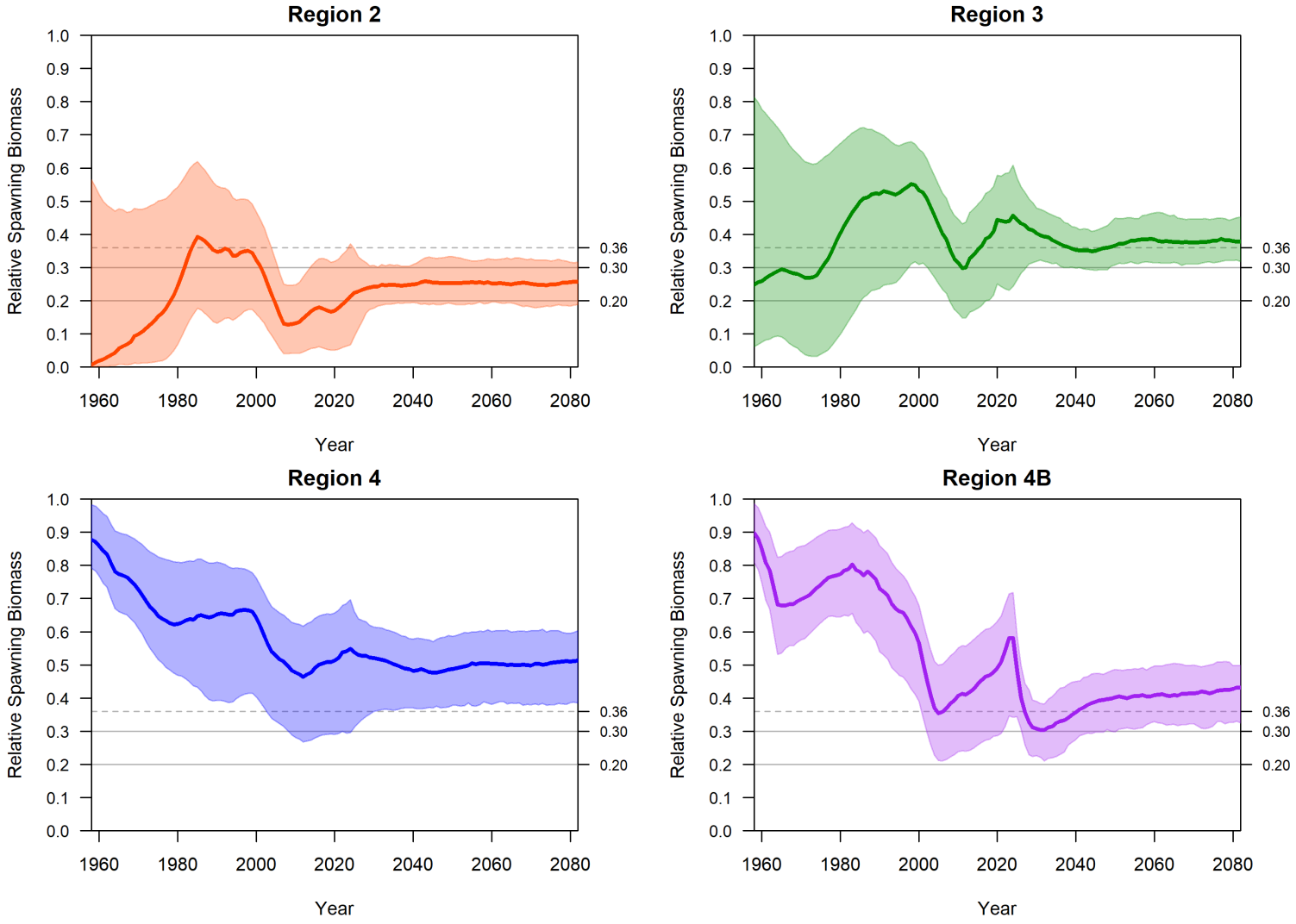
- Not currently a priority objective
- *Maintain a defined minimum proportion of female spawning biomass in each Biological Region*
  - Is subject to biomass within a region and biomass in other regions



Regional relative spawning biomass

- Relative to SB within each Biological Region
  - Important to be dynamic
    - Movement depends on environment and age
    - Recruits depend on environment
- Need to define thresholds and tolerances

SPR=43%



Management Procedures

IPHC-2023-SRB023-R, para. 29. *The SRB **RECOMMENDED** evaluating fishing intensity and frequency of the stock assessment elements of management procedures and FISS uncertainty scenarios using the MSE framework. MP elements related to constraints on the interannual change in the TCEY and calculation of stock distribution may be evaluated for a subset of the priority management procedures as time allows.*

- Assessment frequency and an empirical rule
- Constraints on interannual change in the TCEY
- Range of fishing intensities
- FISS designs

- Characterizing uncertainty in distribution of the TCEY

Assessment frequency and an empirical rule

- Annual, Biennial, Triennial assessments
- Empirical rules
  1. Constant TCEY
  2. Change in TCEY proportional to coastwide FISS O32 WPUE
  - Change in TCEY proportional to coastwide FISS all-sizes WPUE
  - Use projected TCEY's from stock assessment using reference points
  - Incorporate commercial fishery catch-rates in an empirical rule
- MSAB request

  IPHC-2024-MSAB019-R, para 40: ***RECALLING*** *paragraph 39 item a) the MSAB* ***REQUESTED*** *the Secretariat and SRB develop empirical rule options using the following possible sources of data:*

  a) A static coastwide TCEY determined from the stock assessment;

  b) FISS O32 WPUE;

  c) Incorporation of commercial and FISS age data with FISS O32 WPUE.

FISS Designs

- Many paragraphs related to FISS designs from SRB023
- SRB023-R, para 60
  - Simulation test using assessment
  - Mitigation options via MSE simulations
  - Results from assessment simulations will inform MSE simulations

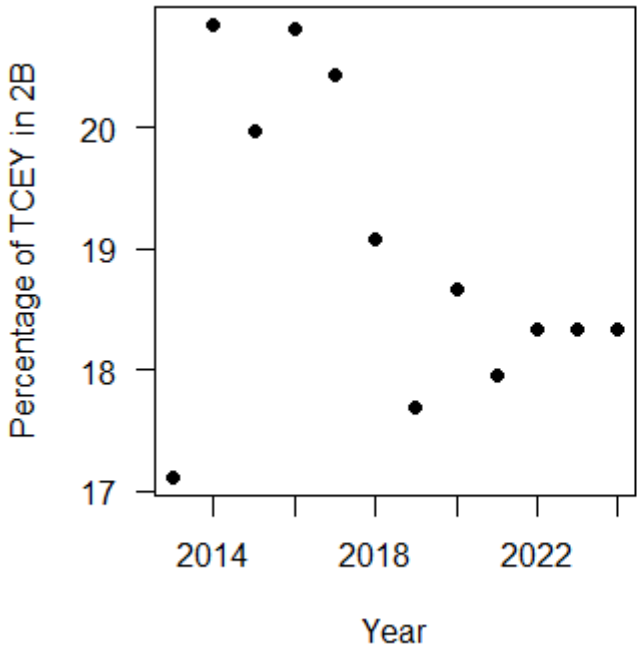
- In development and awaiting assessment simulation results

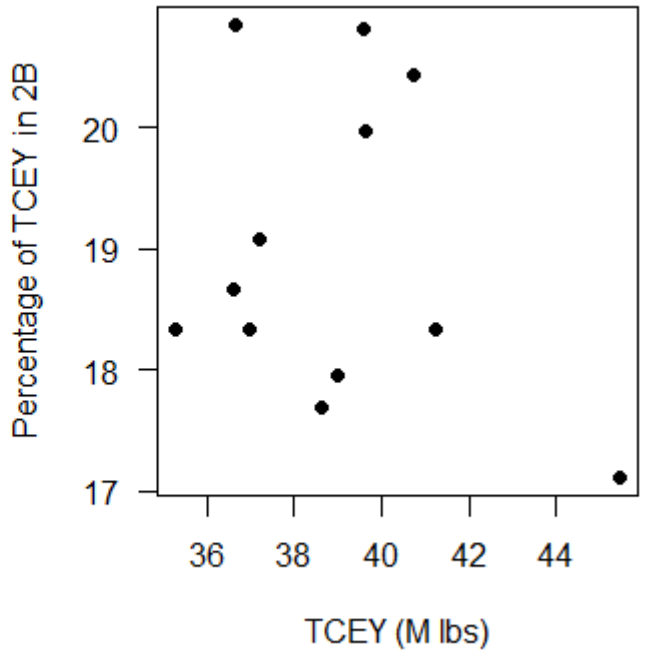
Distribution of the TCEY

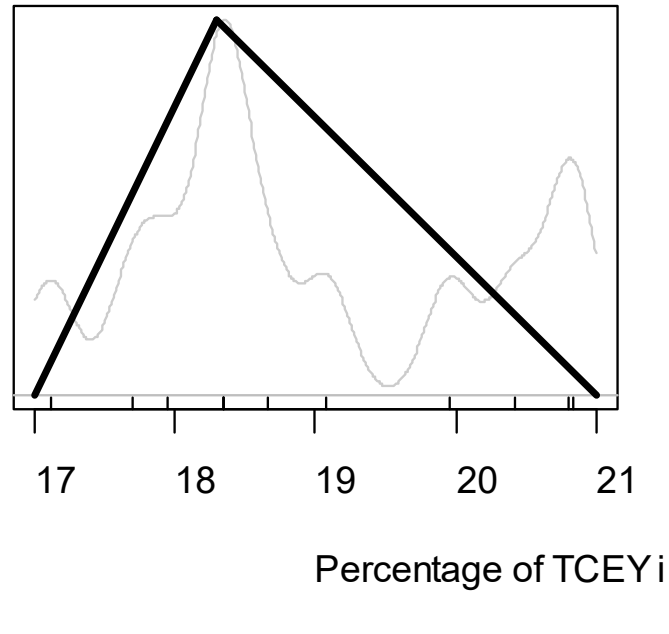
- The OM has four regions and multiple sectors within each region
- Distribution of the TCEY to each sector is necessary in the simulations
- Distribution of the TCEY is uncertain
  - Have used reference distributions and applied decision-making uncertainty
  - An alternative is to use observed distribution from past decade and then maybe apply additional decision-making uncertainty

Distribution of the TCEY to 2A and 2B

- TCEY in 2A has been 1.65 for last 6 years
  - Could be less if there is a conservation concern
- Proportion of TCEY in 2B has ranged from 17.1% to 20.8% in last 12 years

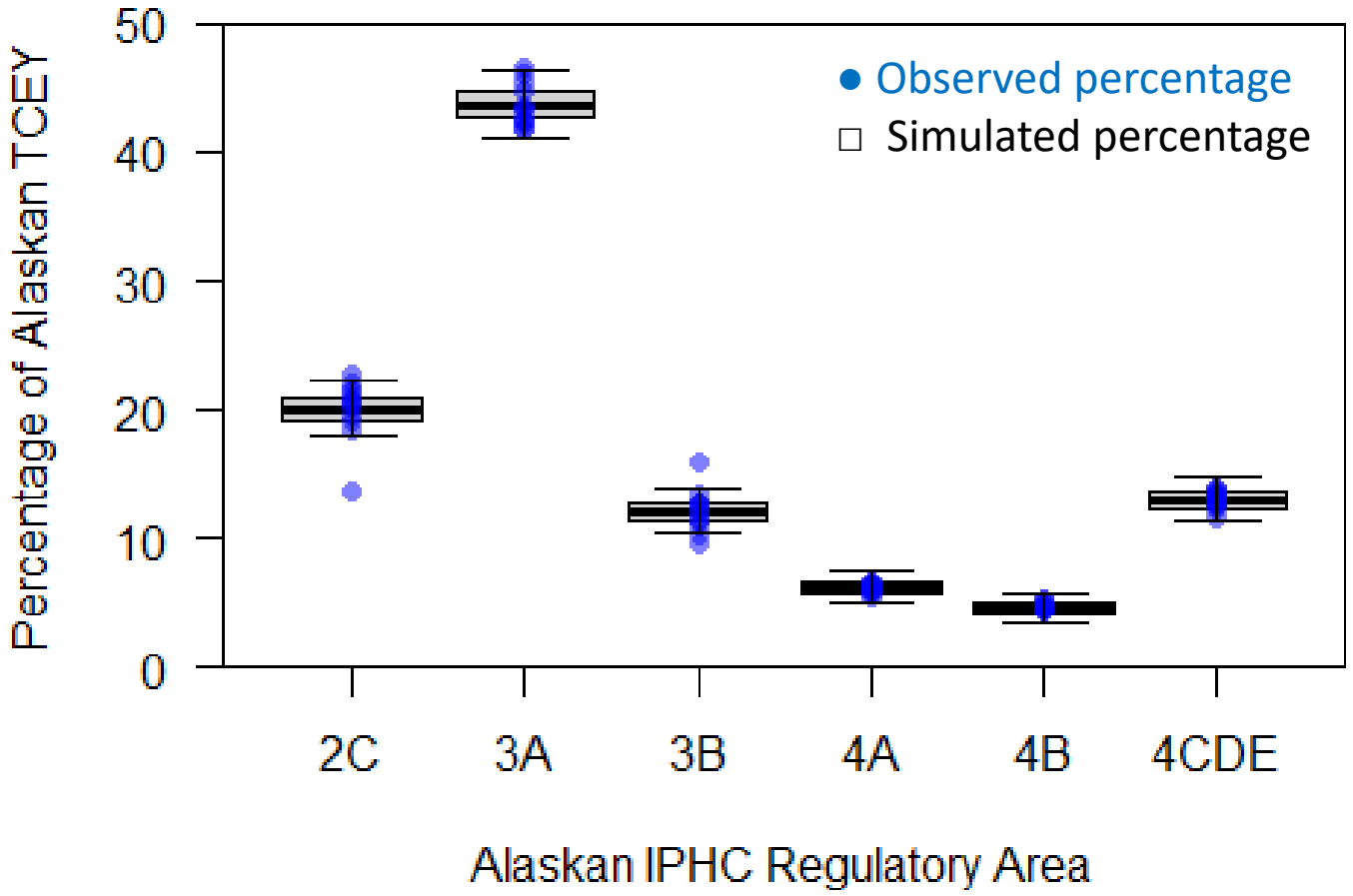






Distribution of the TCEY to AK areas

- After determining TCEY in 2A and 2B
- Use observed percentages for distribution among AK areas
- Simulate using multinomial distribution

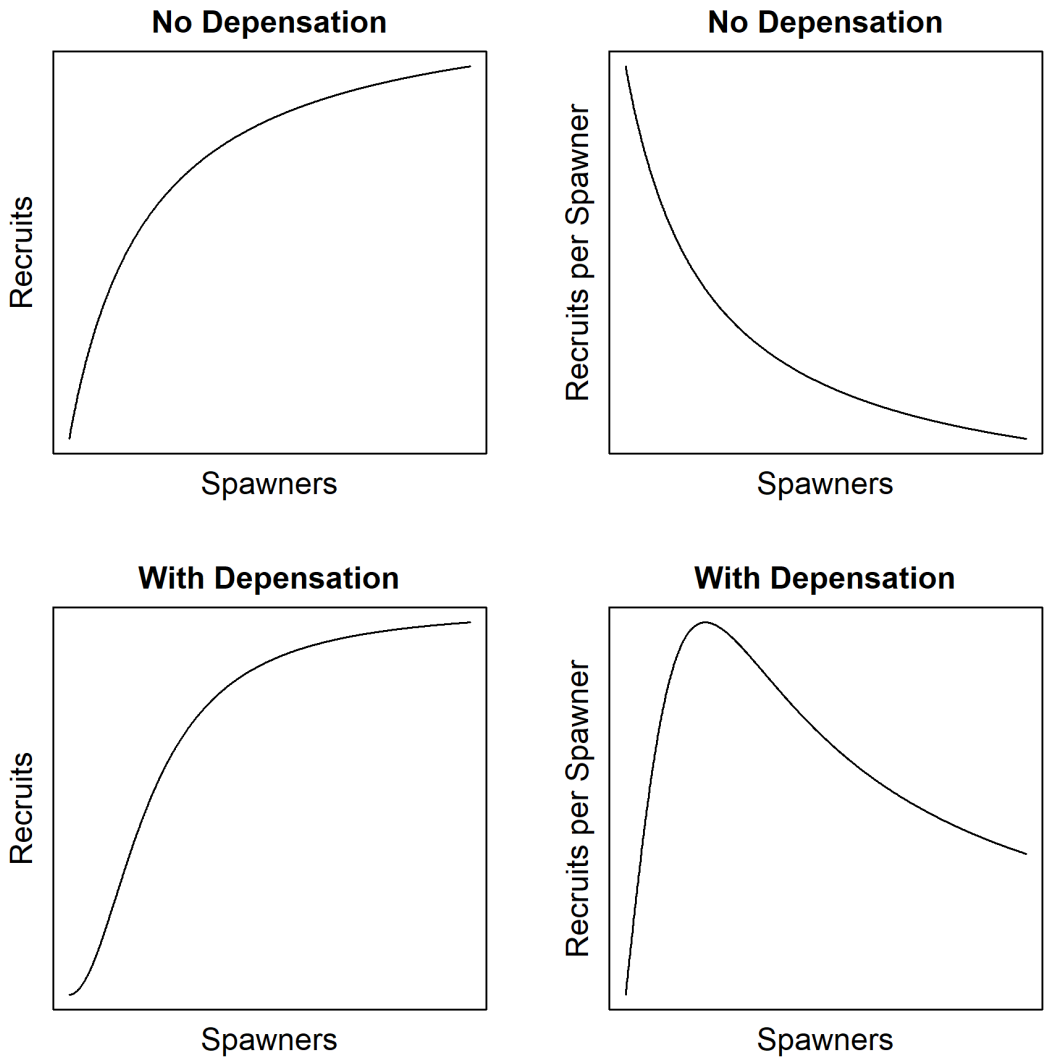


Depensation

- Per capita rate of growth decreases as abundance decreases to low levels
- Beverton-Holt formulation

$$R = \frac{\alpha S^{\delta}}{\beta^{\delta} + S^{\delta}}$$

S: Spawning biomass
α: asymptote
β: S that produces $\alpha/2$ recruits
δ: depensation parameter
$\delta < 1$: $hypercompensation$
$\delta > 1$: $depensation$

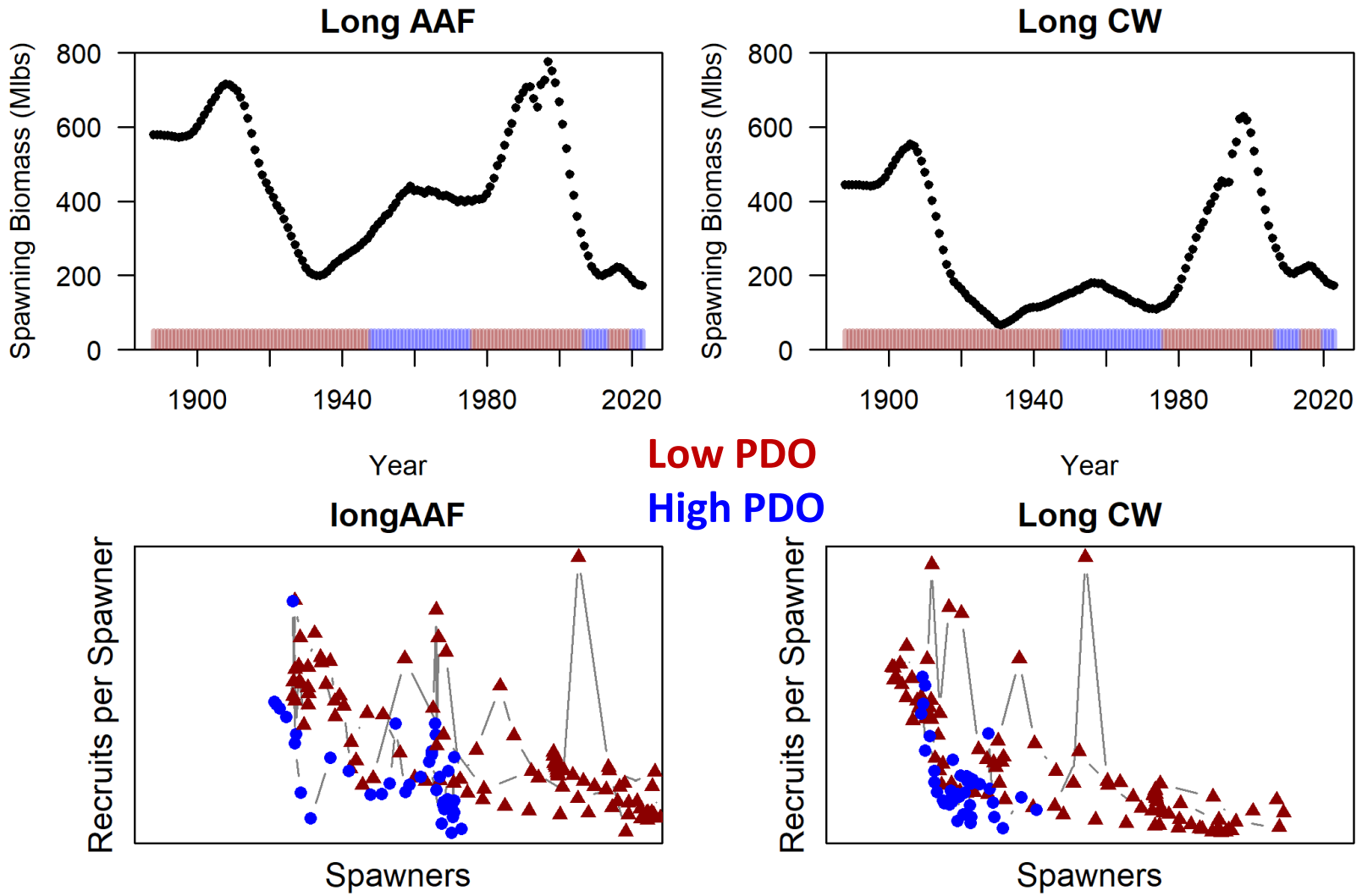


Mechanisms for depensation

Mechanism	For Pacific halibut
Environmental effects (poor/good recruitment regimes)	Possible given the effect of the environment on life-history characteristics.
Predator/prey interactions and increase in M	Probably not likely given that Pacific halibut are a generalist and have a wide range. Similar predators (e.g. arrowtooth flounder) may have some effect if the Pacific halibut population is low.
Reduced probability of fertilization	Probably not likely until very low population size given that the life-history of Pacific halibut is to migrate to spawning areas.
Impaired group dynamics	Probably not likely given that Pacific halibut are capable of making long feeding and spawning migrations.

Investigating depensation

- Two long time-series assessment models
- Two environmental (PDO) regimes



Depensation Stress Test

- At least six simulations
- Will need to convert steepness parameterization to alpha/beta parameterization

- High fishing intensities that would result in depensation are unlikely to be realized

How much?
May increase until see significant outcomes

Depensation	Fishing Intensity
None	Low (52%)
None	Reference (43%)
None	High (35%)
Yes	Low (52%)
Yes	Reference (43%)
Yes	High (35%)

Recommendations

1) **REQUEST** any additional exceptional circumstances using fishery-dependent data.
2) **REQUEST** adding a measurable objective related to absolute spawning biomass under the general objective 2.1 “maintain spawning biomass at or above a level that optimizes fishing activities” to be included in the priority Commission objectives in place of the current biomass threshold objective.
3) **REQUEST** empirical rules to simulate with biennial and triennial assessment frequencies.
4) **REQUEST** that the Secretariat simulate the uncertainty in the distribution of the TCEY using historical observations with variability.
5) **REQUEST** modifications to the proposed FISS design simulations and guidance on conducting them with the MSE framework.
6) **REQUEST** modifications to the proposed simulations investigating depensation.
7) **REQUEST** any further analyses to be provided at SRB025.

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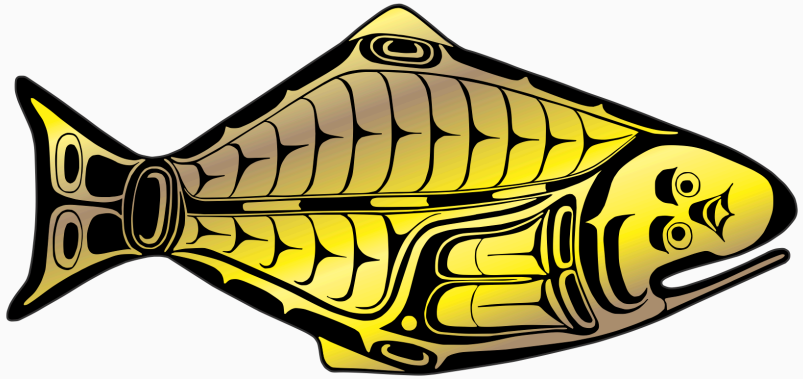

HALIBUT COMMISSION

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