INTERNATIONAL PACIFIC HALIBUT COMMISSION

Updates to the IPHC MSE

Agenda item: 4.2
IPHC-2025-MSAB021-07
(A Hicks & I Stewart)

Outline

- MSAB020 Requests
  - Additional understanding of patterns
  - Assessment frequency performance metrics
  - Additional FISS design investigations
- Effects of weight-at-age and PDO regimes

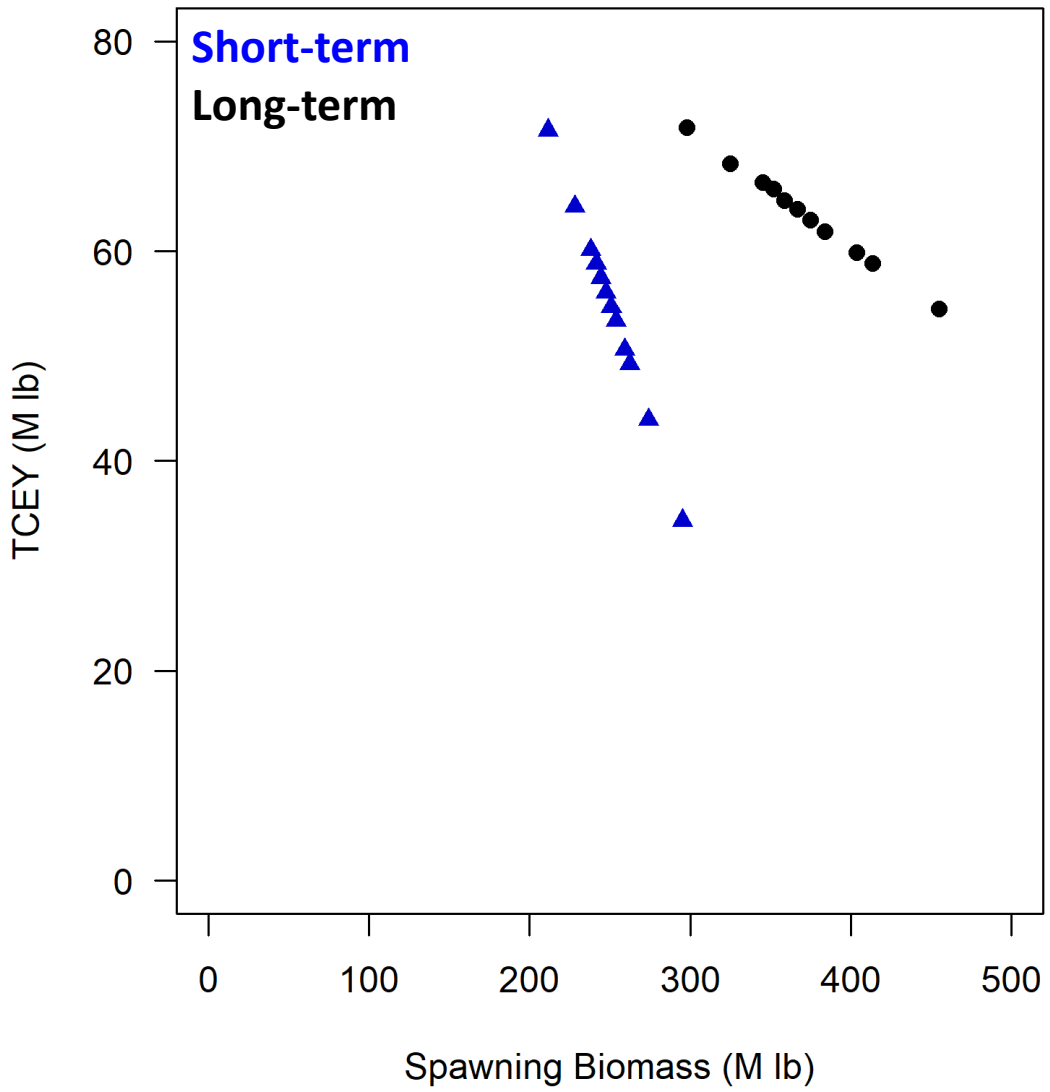
Additional understanding of patterns

IPHC-2024-MSAB020-R, para 27. *The MSAB **NOTED** that lower fishing intensities (i.e. higher SPR values) resulted in higher absolute spawning biomass but reduced the median coastwide TCEY. There is a greater than 1-in-3 chance that the short-term absolute spawning biomass will be less than the 2023 spawning biomass when fishing at a reference SPR=43%. The chance was approximately 1-in-4 for long-term spawning biomass. Fishing at an SPR=52% reduced these chances to approximately 1-in-4 and 1-in-6 for the short- and long-terms, respectively. However, lower fishing intensities did not realize high TCEYs seen at higher fishing intensities, and did result in lower TCEYs more often than seen at higher fishing intensities, over the short-term.*

IPHC-2024-MSAB020-R, para 28. *The MSAB **REQUESTED** more exploration into understanding the patterns presented in paragraph 27.*

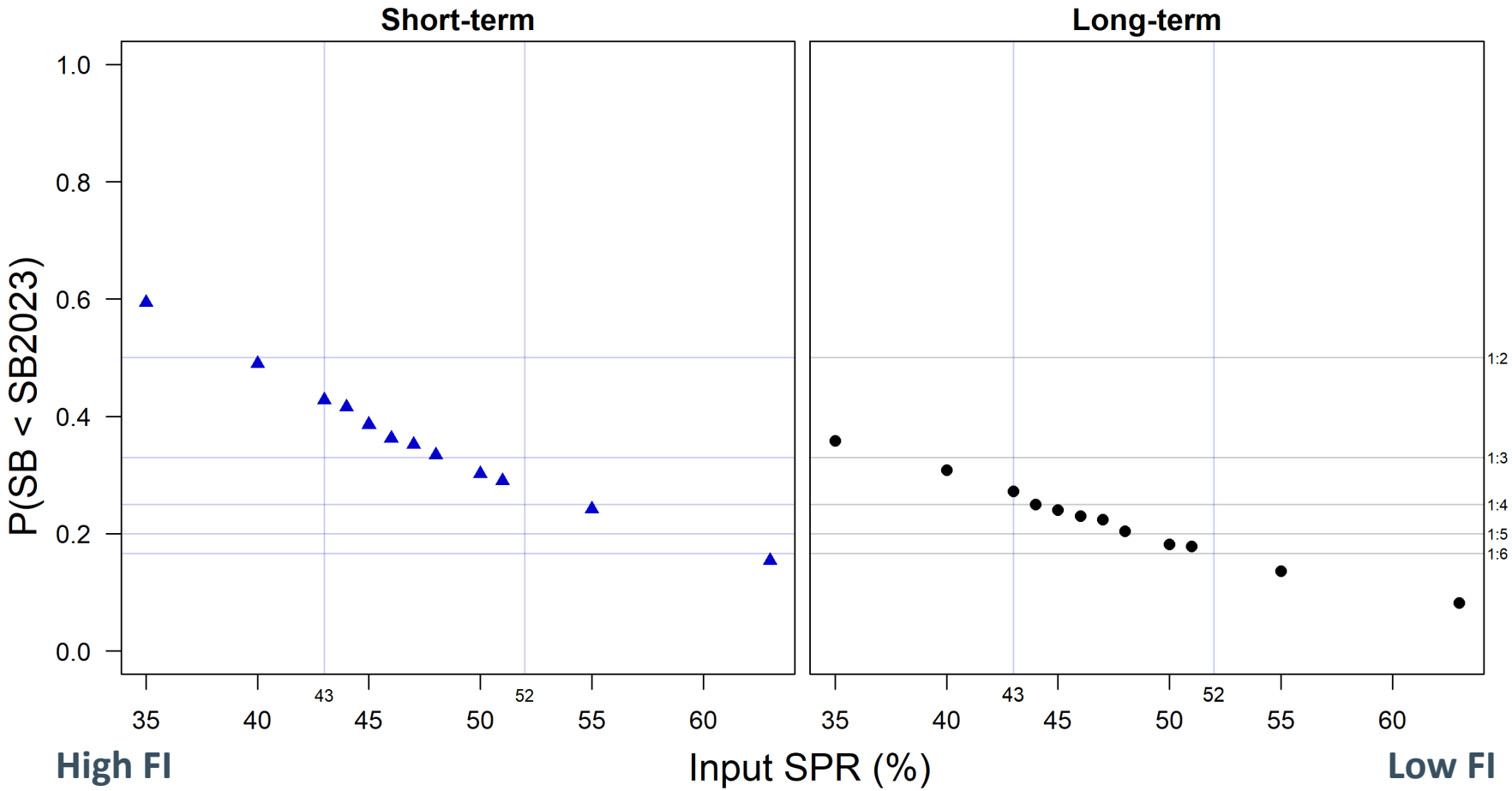
Spawning Biomass and TCEY

- Lower Fishing Intensity leads to
  - Higher Spawning Biomass
  - Lower TCEY



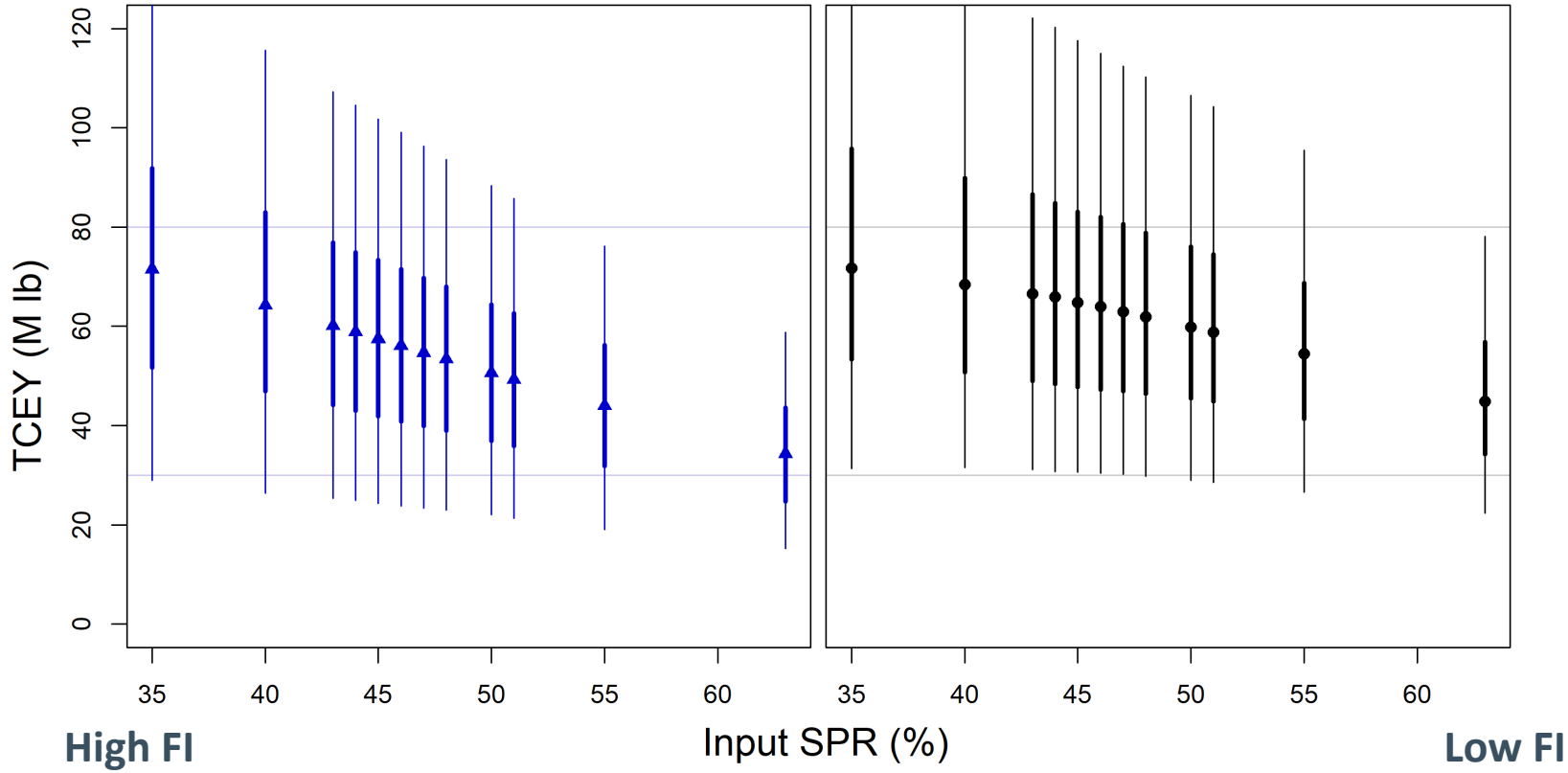
SB less than SB in 2023

- Higher in short-term due to starting conditions



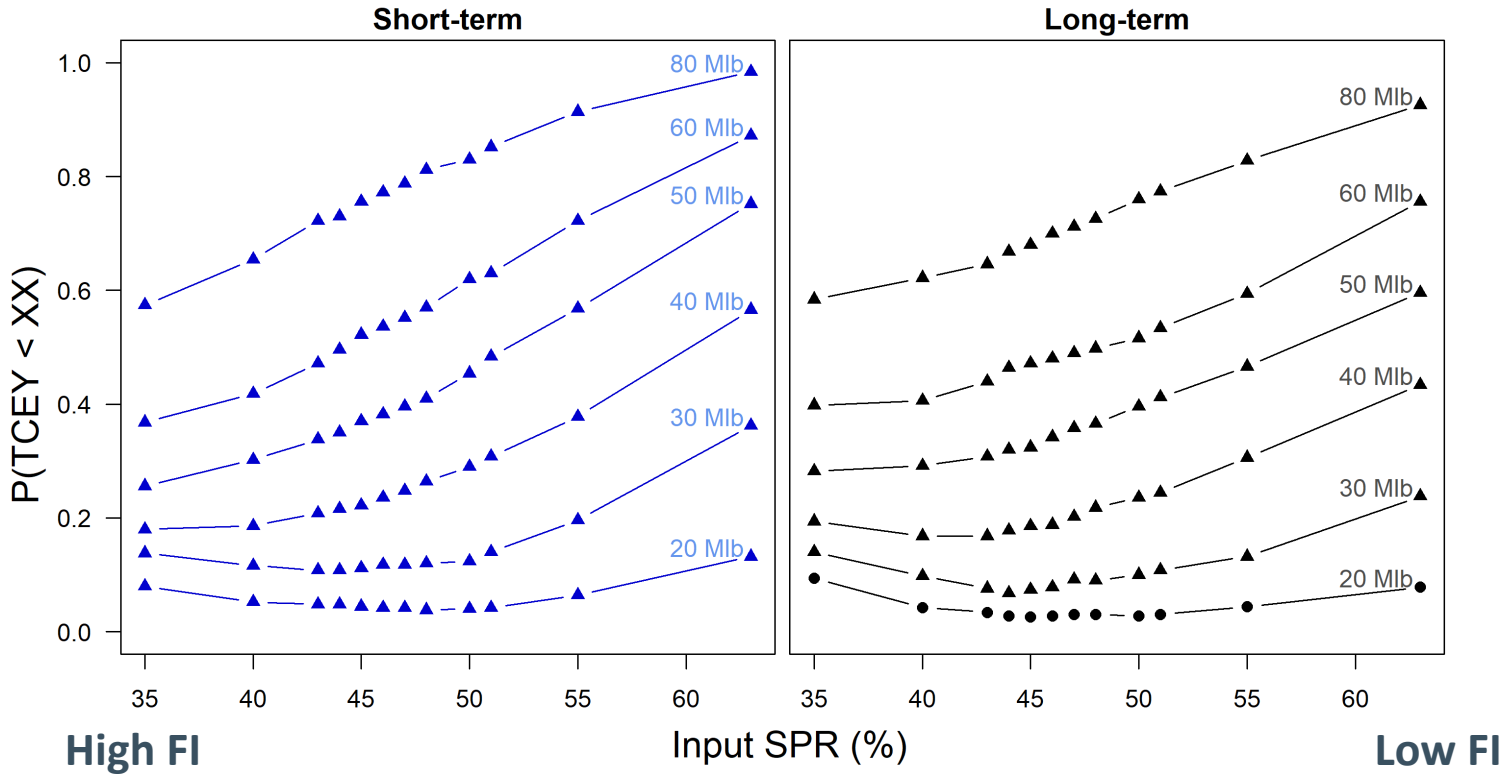
Range of TCEYs

- *However, lower fishing intensities did not realize high TCEYs seen at higher fishing intensities, and did result in lower TCEYs more often than seen at higher fishing intensities, over the short-term*
  - Range was large
  - The 95% quantile declined quicker than the 5% quantile



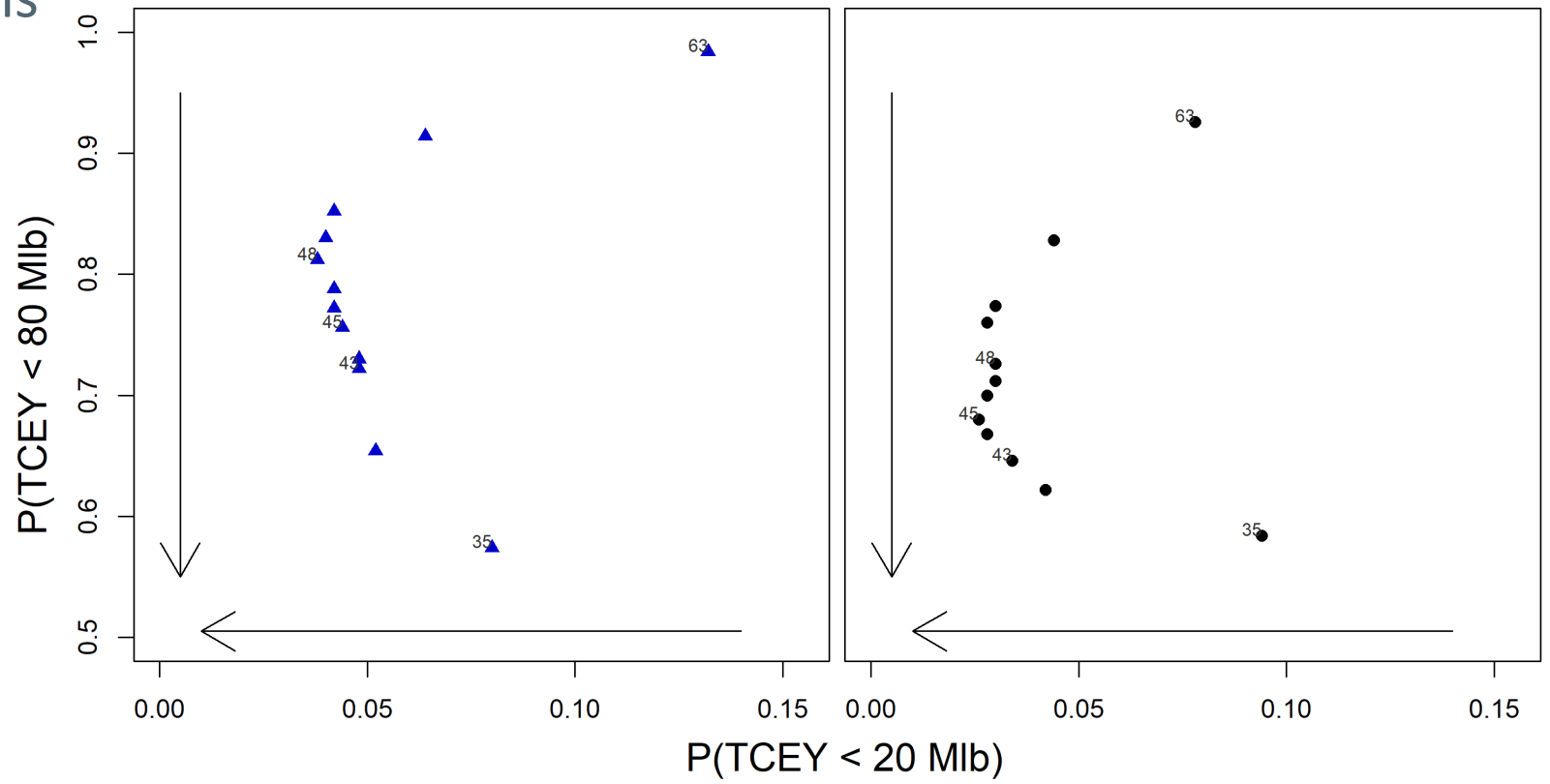
Probability TCEY is less than a value

- The probability that the TCEY is less than a high value declines consistently with increasing fishing intensity
- The probability that the TCEY is less than a low value is less at intermediate fishing intensity



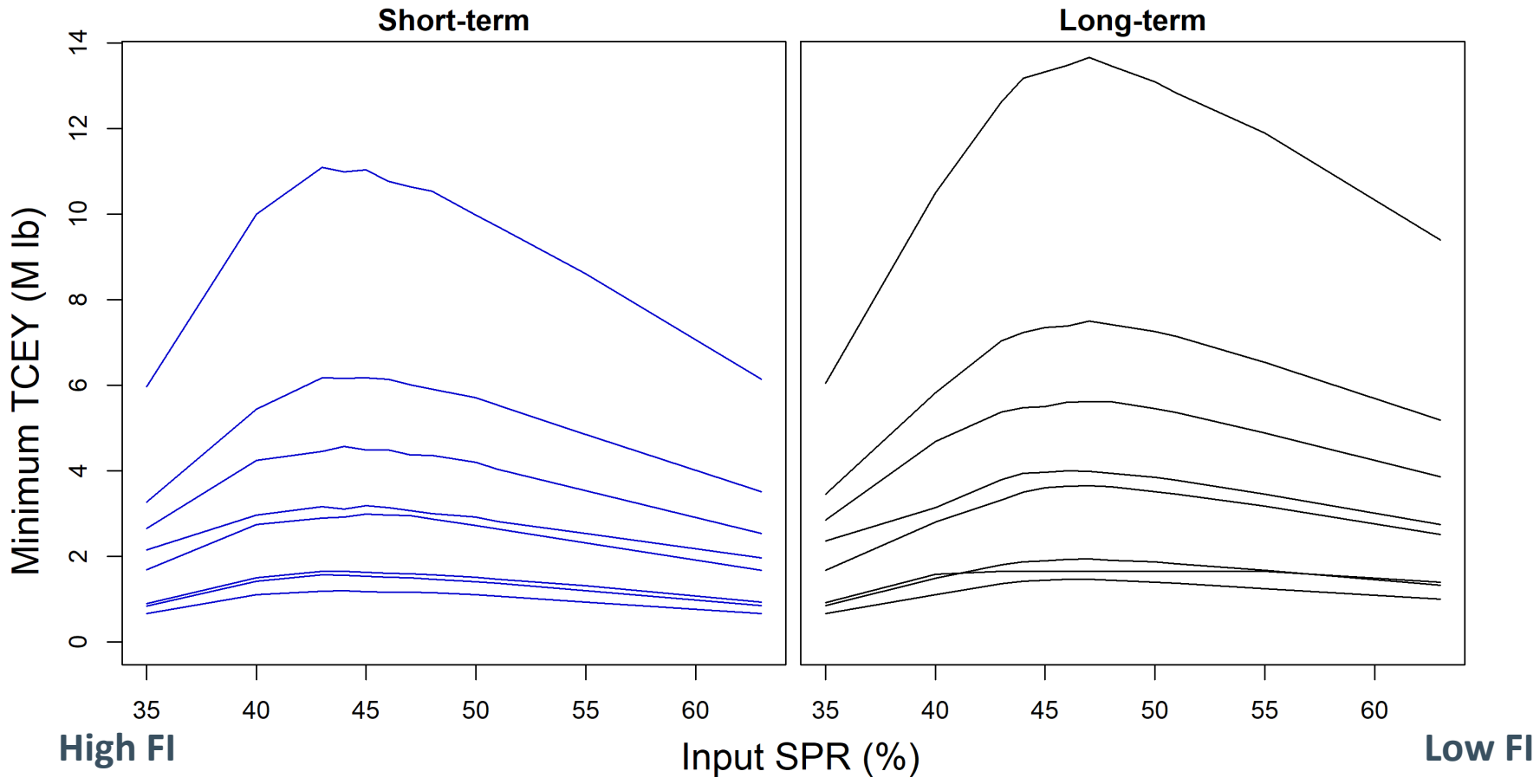
Tradeoffs between low and high TCEYs

- Look jointly at the TCEY is less than 80Mlb and the TCEY is less than 20Mlb
- High fishing intensities take advantage of high biomass
- High fishing intensities can result in a negative feedback at low biomass levels
  - Stay more often at low levels



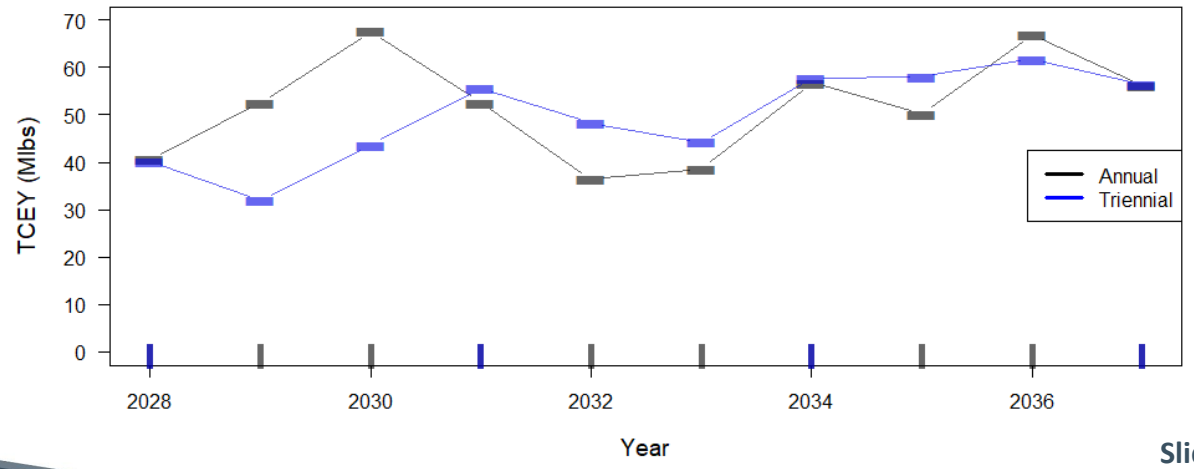
Minimum TCEY

- Want to avoid a small TCEY
  - Occurs at intermediate fishing intensities



Assessment frequency performance metrics

- Stock assessment is useful to determine mortality limits, estimate status, and provide an understanding of the population
- Estimation (assessment) error can result in variable mortality limits over time due to different data sources telling different information
- Using a simpler approach may reduce variability in mortality limits
  - Empirical approach using the change in the O32 WPUE
  - An assessment every third year “groundtruths” the mortality limit
  - This may mean a large change in the mortality limit when an assessment is done



Assessment frequency performance metrics (2)

- Triennial assessment possibly has a smaller average amount of variability over a ten year period, but with larger jumps every third year

IPHC-2025-MSAB020-R, para 31. The MSAB **REQUESTED** more research into performance metrics that may be informative of changes in the TCEY for non-assessment years and changes in the TCEY for assessment years when using a triennial assessment frequency

- Document IPHC-2024-MSAB020-06 compared some performance metrics for annual, biennial, and triennial assessment frequencies

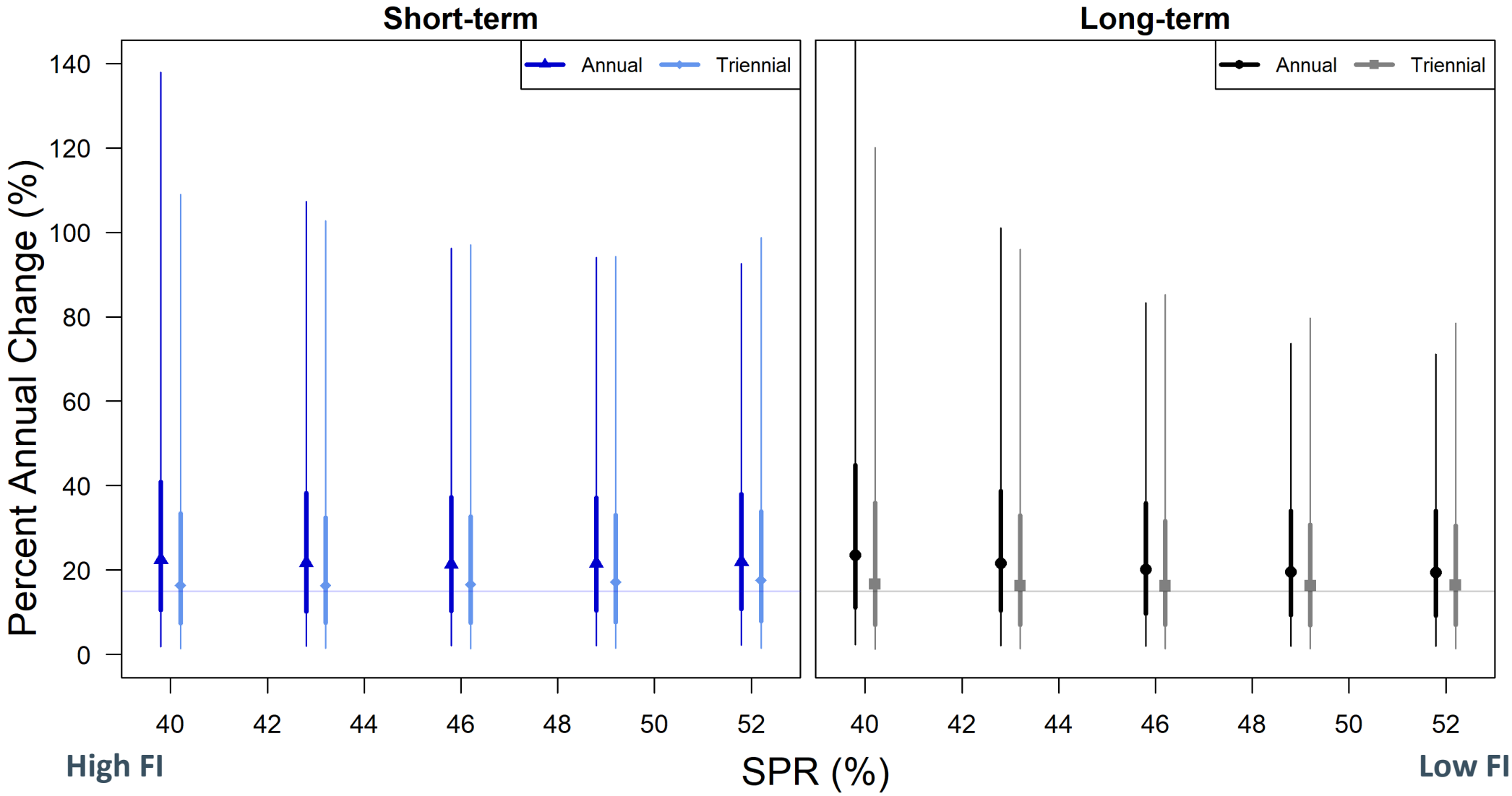
Annual and Triennial assessment frequencies

- Focus only on annual and triennial can compare assessment years and non-assessment years
- Can compare 4 assessment years and 6 non-assessment years

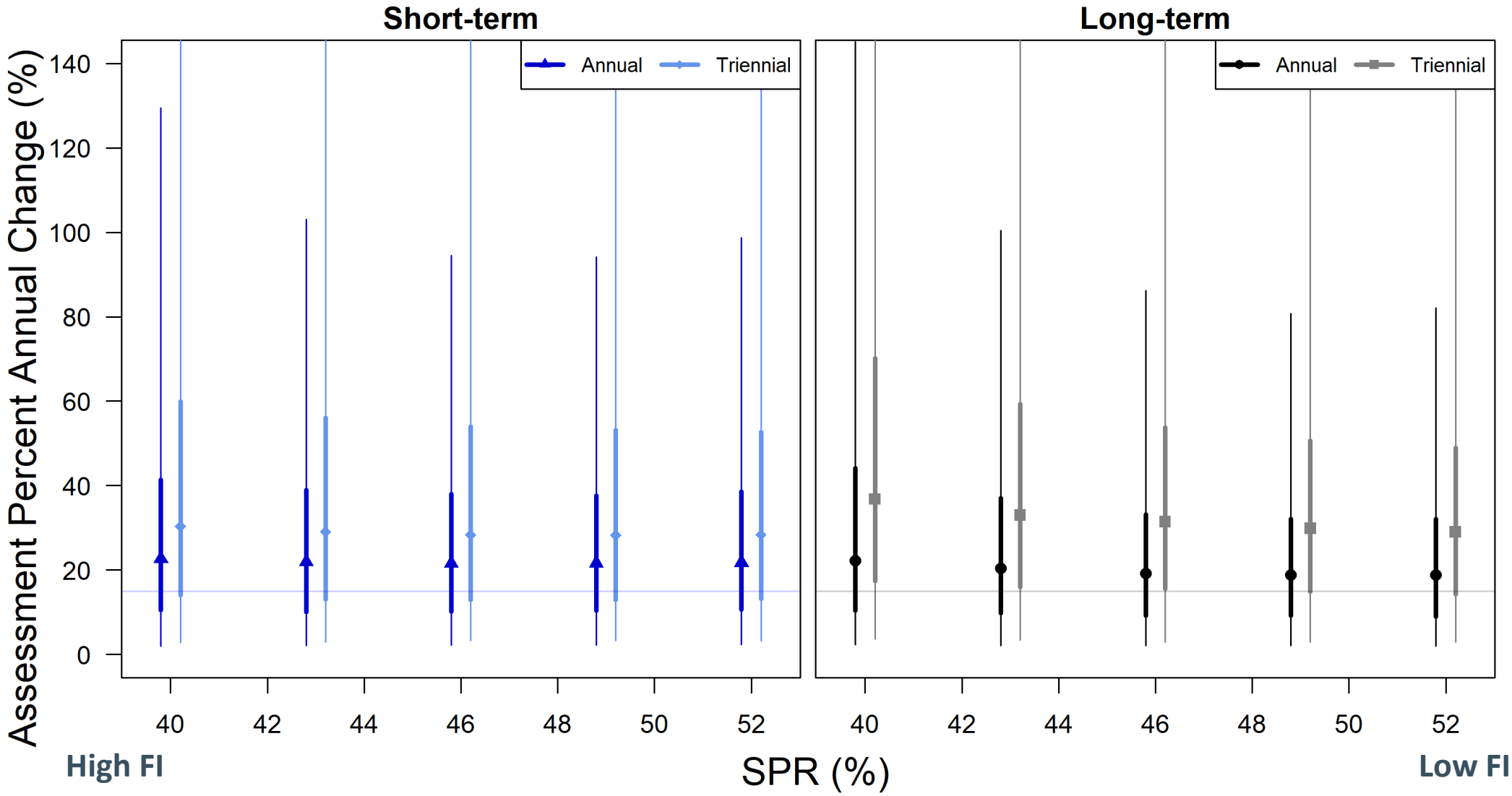
Year	1	2	3	4	5	6	7	8	9	10
Annual	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Triennial	Y	X	X	Y	X	X	Y	X	X	Y

- Percent Annual Change (AC) is the percentage change from previous year
  - Sign ignored (made positive)
- P(AC>15%) is the probability that the AC is less than 15% in a 10-year period

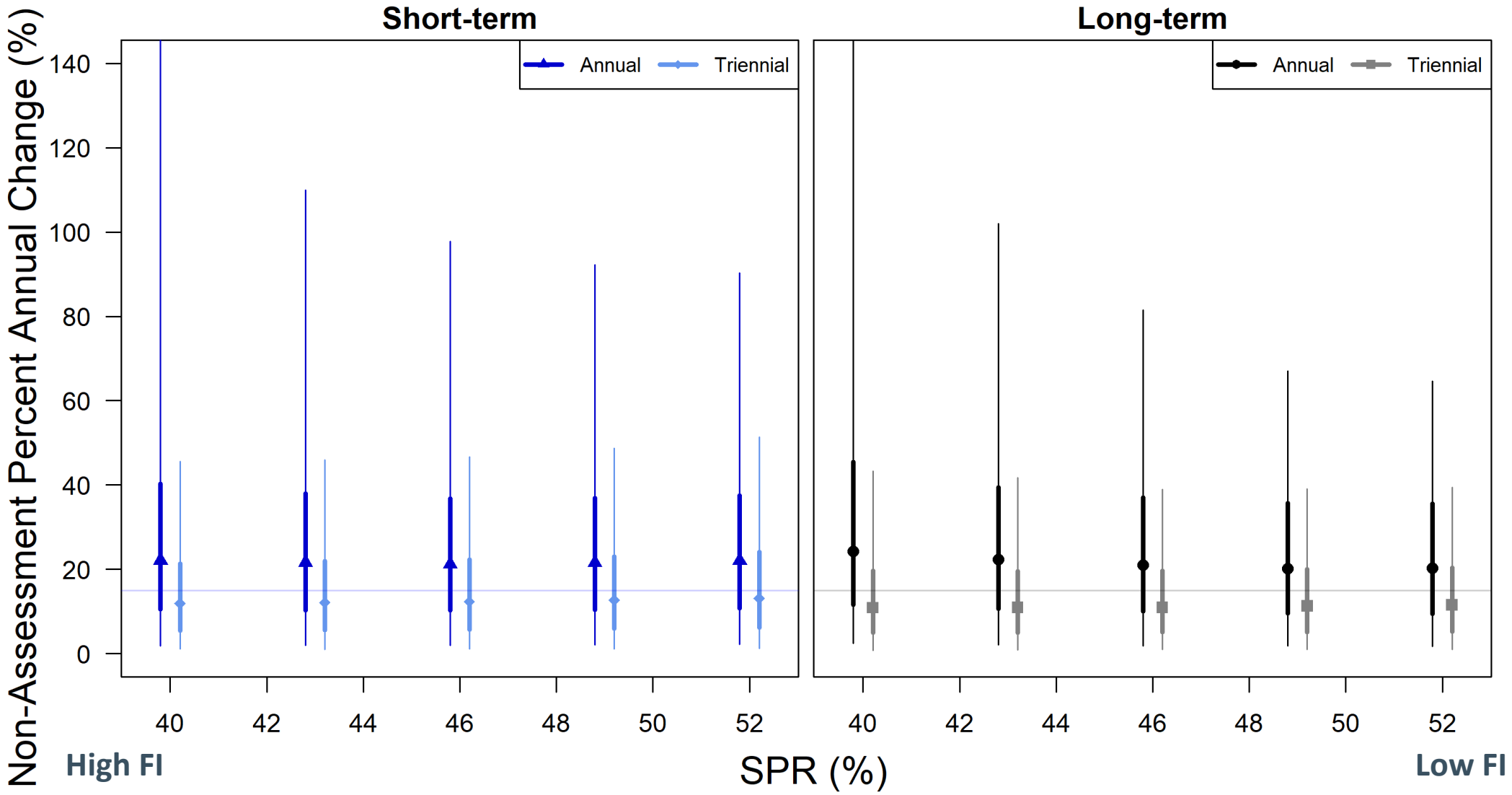
Percent Annual Change over all years



Percent Annual Change: assessment years



Percent Annual Change over all years



P(AC>15%)

Assessment Frequency	Annual				
SPR	40	43	46	49	52
P(AC>15%) assessment years (triennial)	0.649	0.636	0.634	0.640	0.644
P(AC>15%) non-assessment years (triennial)	0.653	0.648	0.640	0.645	0.648

Assessment Frequency	Triennial				
SPR	40	43	46	49	52
P(AC>15%) assessment years	0.728	0.713	0.703	0.710	0.715
P(AC>15%) non-assessment years	0.402	0.410	0.418	0.428	0.448

- Same for any combination of years with Annual frequency
- Lower in non-assessment years with Triennial frequency

Summary of assessment frequency metrics

- Given assumptions of estimation error and FISS uncertainty

- Assessment years with triennial frequency have a higher percent AC than assessment years with annual frequency
- Non-assessment years with triennial frequency have a lower percent AC than non-assessment years with annual frequency
- Over all years, triennial frequency has lower percent AC

- If objective is to lower average change over a time-period, triennial frequency has lower variability
- If the objective is to reduce variability in any year, the annual frequency has lower variability

FISS design investigations

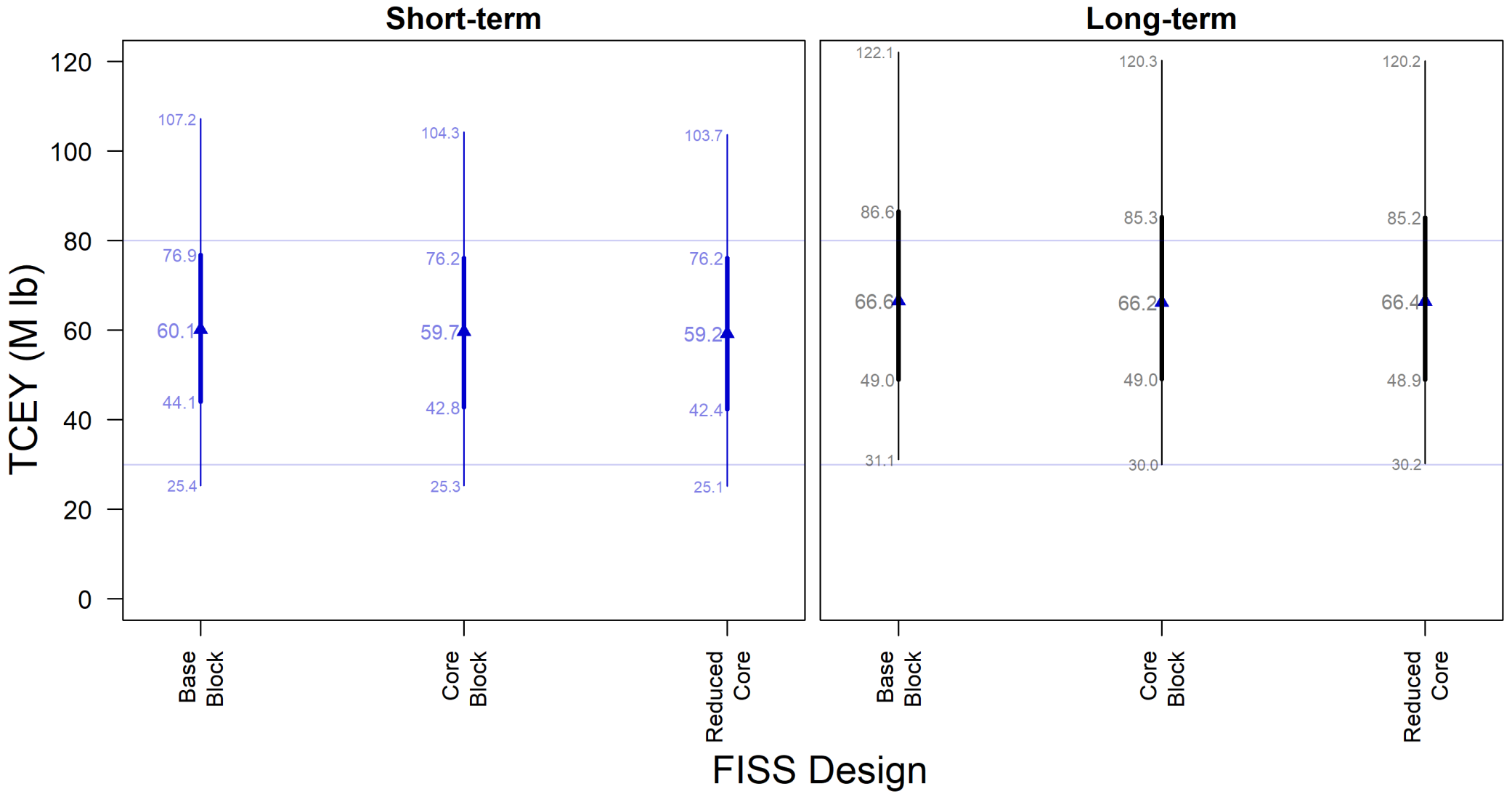
- Three survey designs were investigated at MSAB020
  - Base Block, Core Block, Reduced Core
  - Reduction in short-term TCEY, on average
  - Increase in short-term AAV

IPHC-2025-MSAB020-R, para 37. ***NOTING*** *that increased uncertainty due to reductions in the FISS design resulted in only declines in the median coastwide TCEY, the MSAB* ***REQUESTED*** *further exploration into the causes of this, especially since there is a monetary value being attributed to the FISS design*

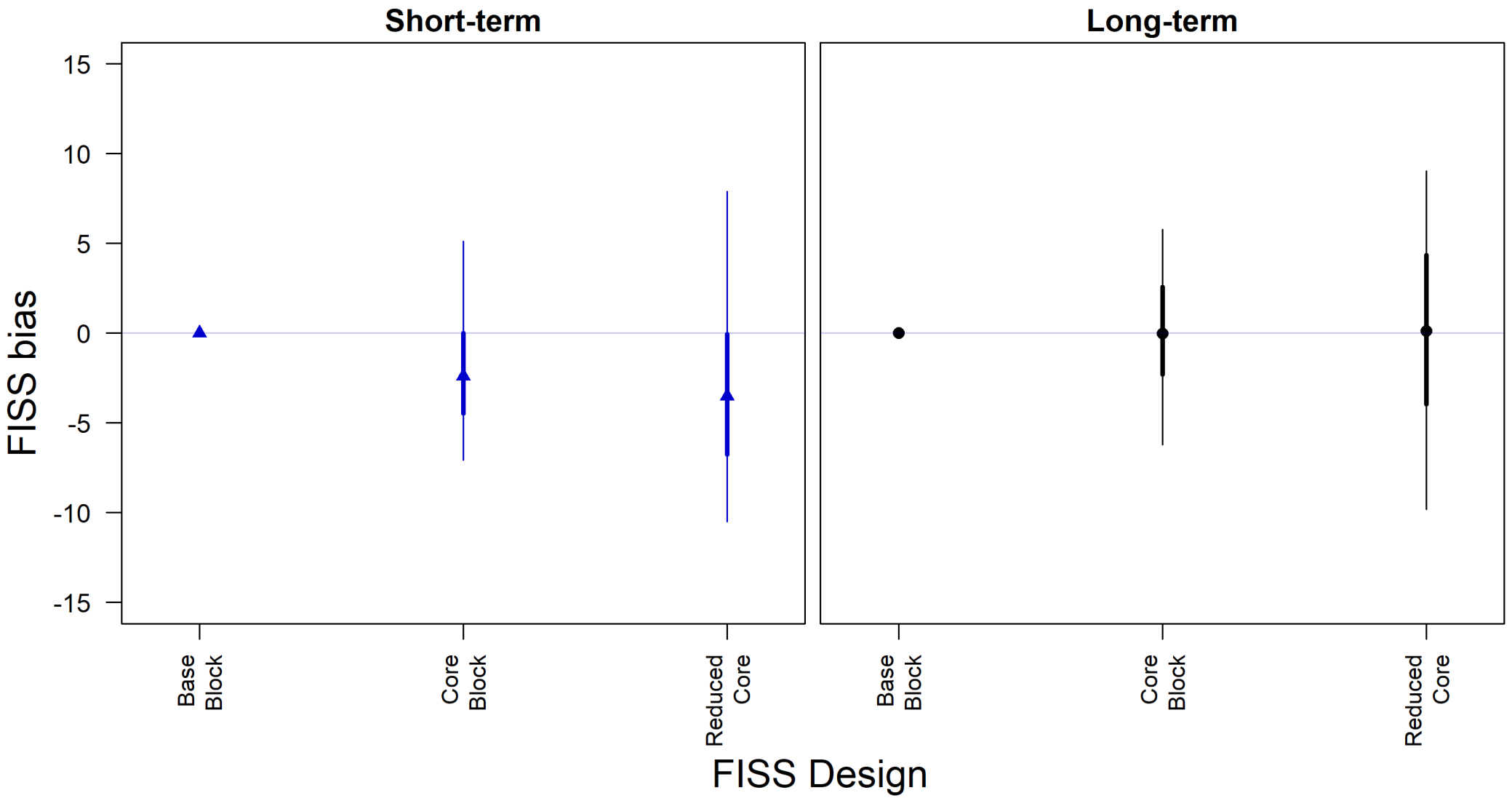
- A base block design occurs every 3-5 years in the simulations

FISS Design	Frequency	Coastwide WPUE CV	Coastwide WPUE Bias	Assessment Uncertainty	Assessment Bias
Base Block	Every year	4%	None	18%	None
Core	2-4 years	6%	Increases annually up to 3%	19%	Increases annually up to 2%
Reduced Core	2-4 years	8%	Increases annually up to 4%	20%	Increases annually up to 2.5%

TCEY


Short-term
Long-term
TCEY (M lb)
120
100
80
60
40
20
0
107.2
76.9
60.1
44.1
25.4
104.3
76.2
59.7
42.8
25.3
103.7
76.2
59.2
42.4
25.1
122.1
86.6
66.6
49.0
31.1
120.3
85.3
66.2
49.0
30.0
120.2
85.2
66.4
48.9
30.2
Base Block
Core Block
Reduced Core
Base Block
Core Block
Reduced Core
FISS Design

Simulated FISS bias

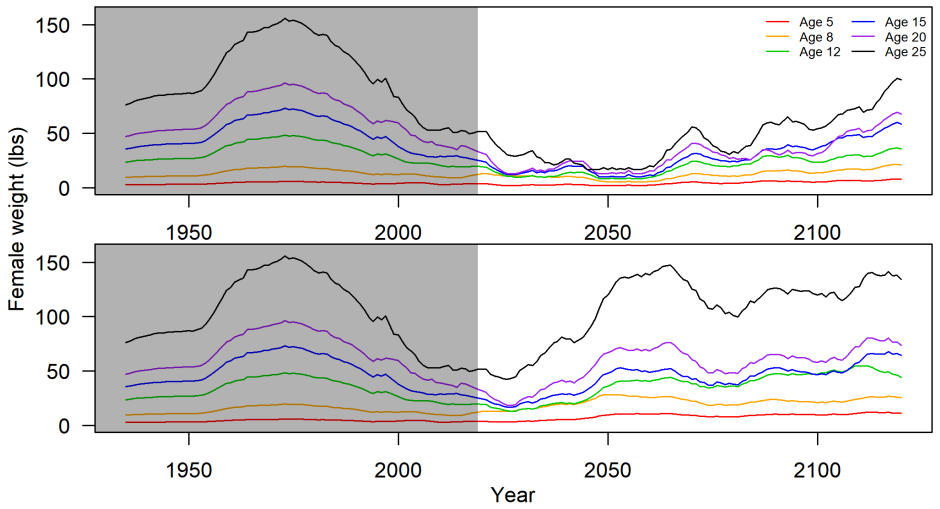


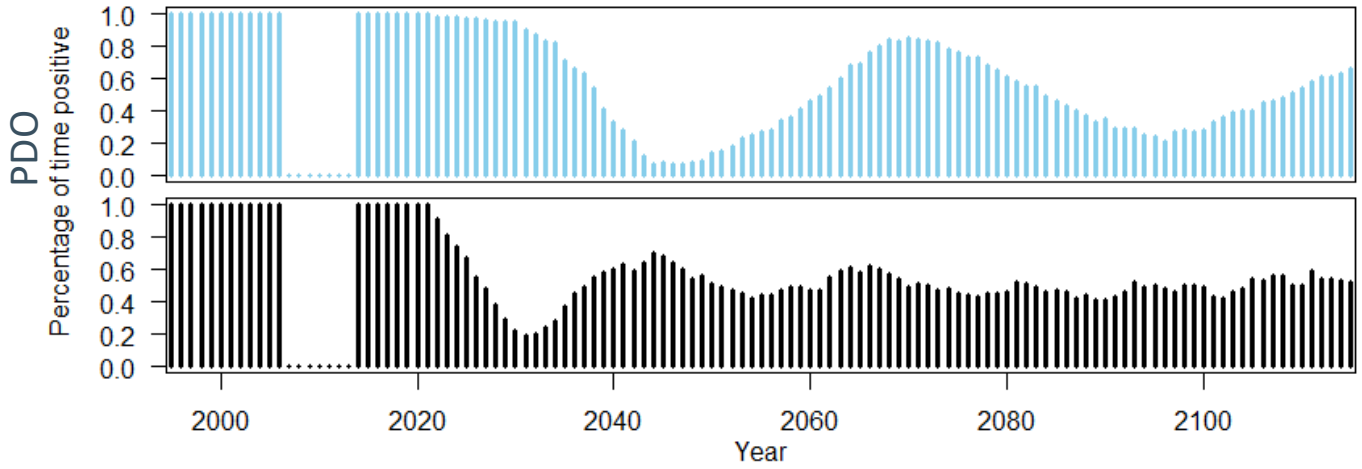
FISS designs

- Long-term bias is near zero on average, but can be present in reduced designs
  - Bias is opposite of trend
- The effect of the FISS design is situation dependent
  - Population increasing
    - FISS likely underestimate increase and result in lower TCEY
  - Population decreasing
    - FISS may overestimate biomass and result in higher TCEYs

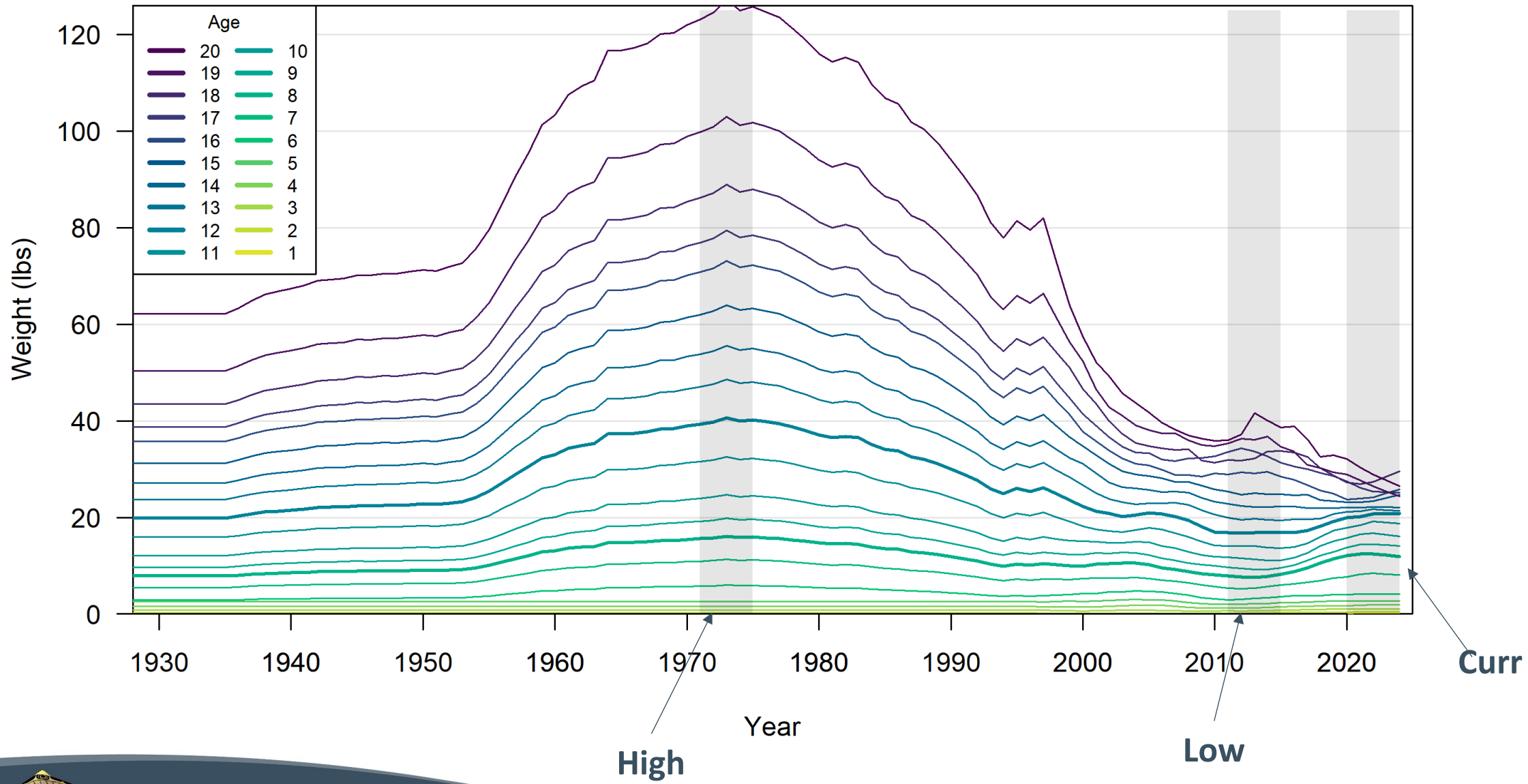
Weight-at-age and Recruitment regimes

- We cannot control the size-at-age or environmental effects
  - Modelled as variability in the OM
- However, we can investigate the effects of different **SCENARIOS**
  - Helpful to understand effects and patterns
  - Useful to understand the importance of the modelling assumptions
  - Not useful to determine the performance of an MP
    - Can be insightful to the behavior of an MP given that Scenario



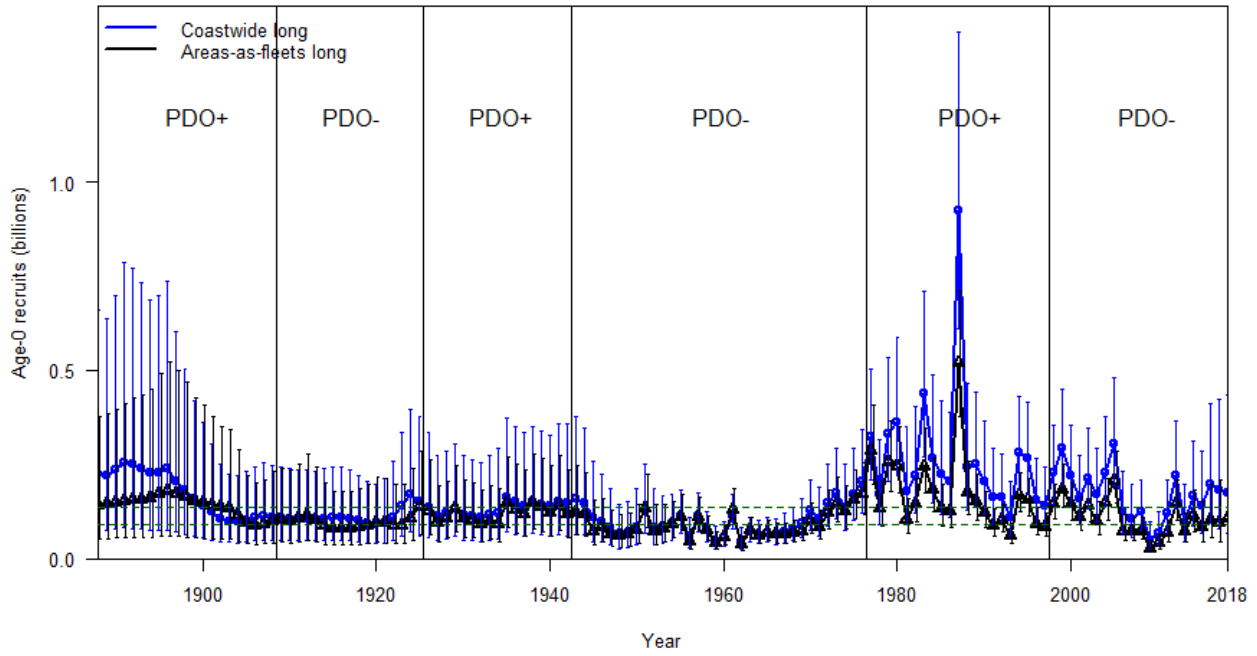


Historical weight-at-age



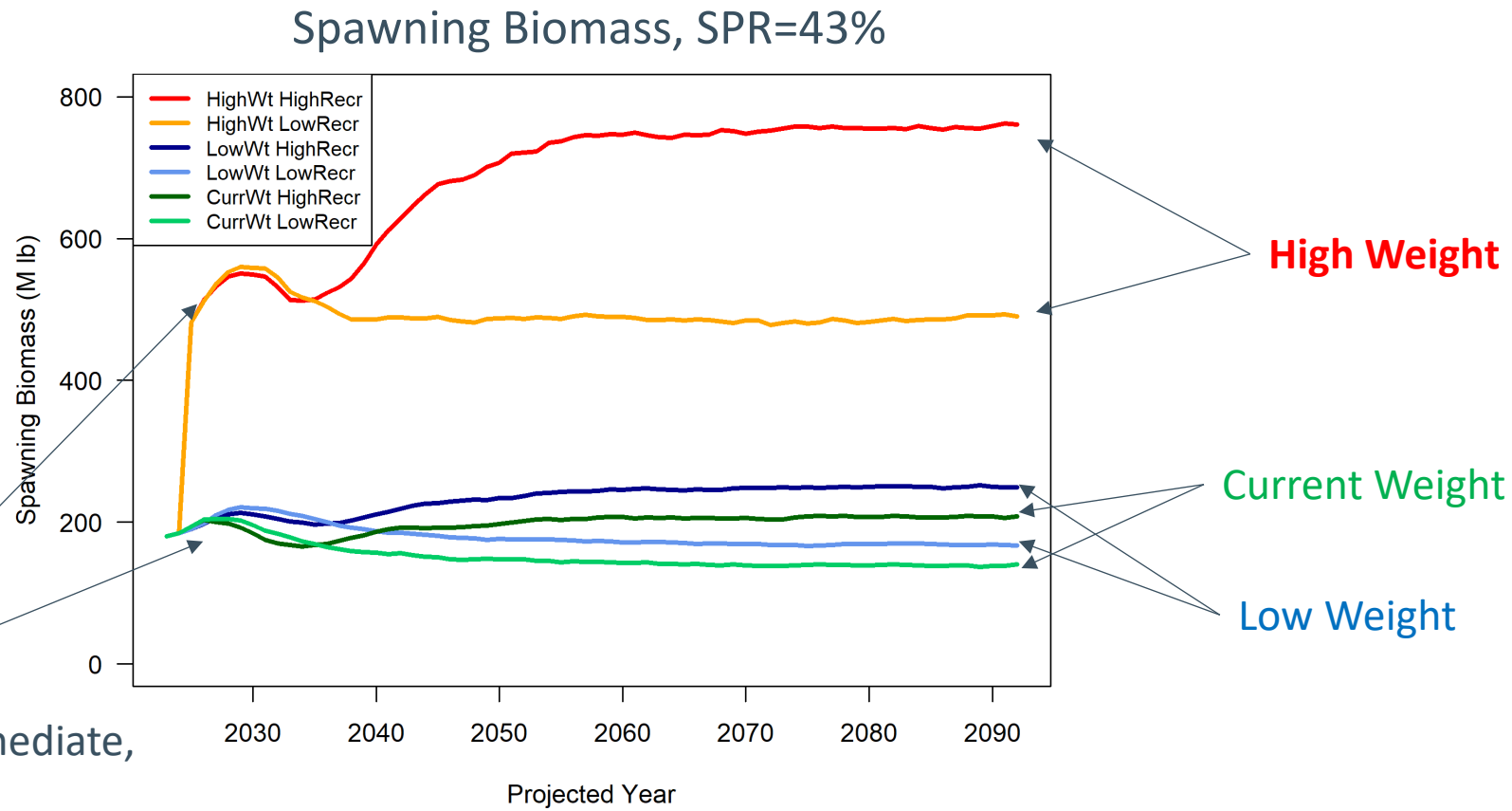
Pacific Decadal Oscillation

- Can fix the PDO to low or high throughout the projections
- Average recruitment is about 1.4 times greater during high PDO
- More age-0 Pacific halibut typically recruit to Region 4 during high PDO
- Fewer Pacific halibut move to Region 2 during high PDO



Spawning Biomass from Simulated Regimes

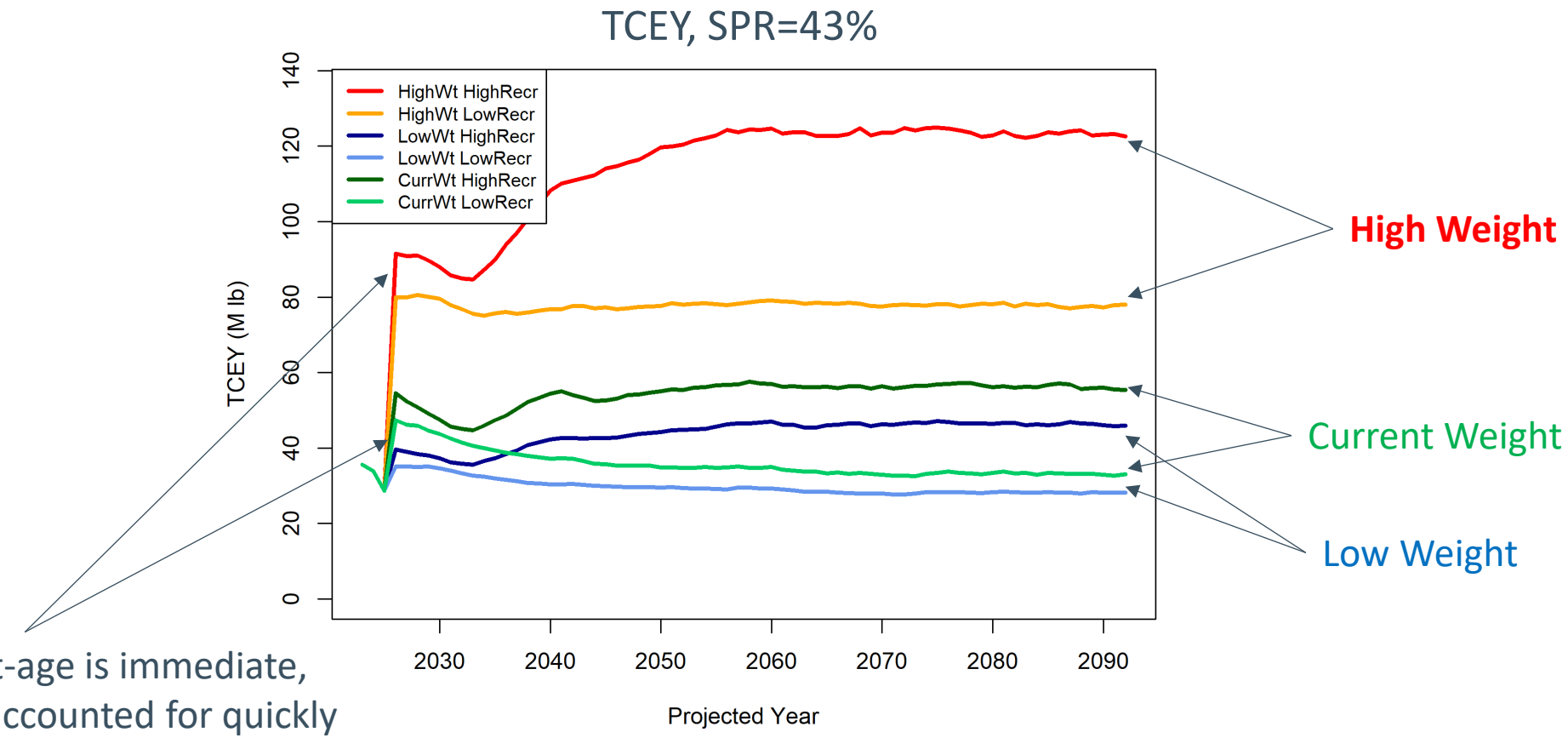
- Spawning Biomass is greatly affected by weight-at-age and recruitment
- Would not likely see these effects immediately



Effect of weight-at-age is immediate, but recruitment has a lag

TCEY from Simulated Regimes

- TCEY is greatly affected by weight-at-age and recruitment
- Slightly different order than Spawning Biomass (low and current)



Effect of weight-at-age is immediate,
And recruitment accounted for quickly

Recommendations

- That the MSAB **NOTE** paper IPHC-2025-MSAB021-07 which details responses to requests of the MSAB and other work done using the management strategy evaluation framework

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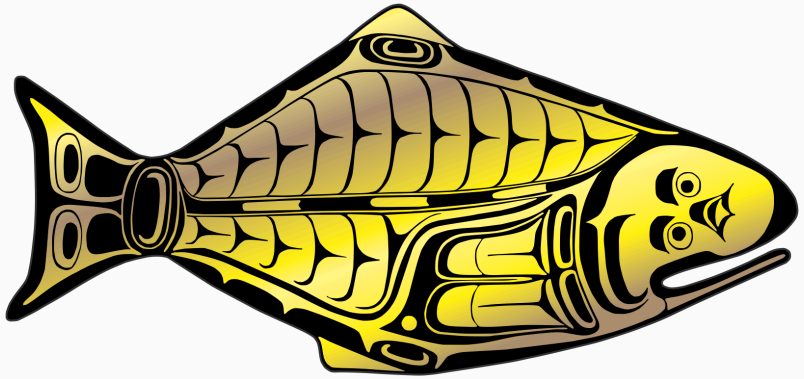

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