Update of the Indian Ocean Albacore Operating Model & MSE

IOTC WPM12, 18-20 October 2021

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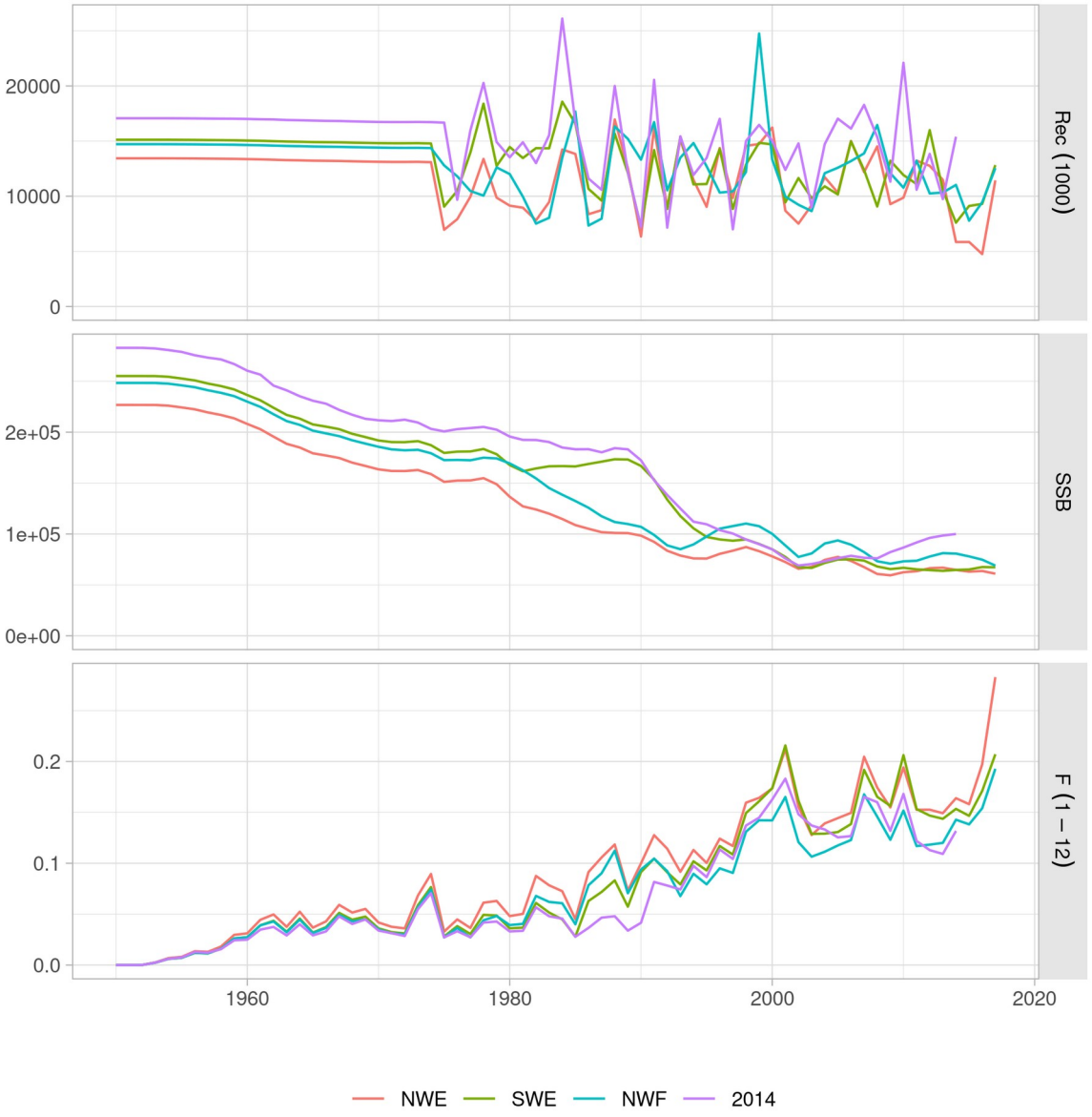
Funded by:

iotc ctoi

Food and Agriculture Organization of the United Nations

Albacore Stock Assessment 2019

- 2 sex, 1 area
- 4 LL fleets, PS (NW), DN (1982-92).
- NW CPUE + LF, SW CPUE + LF, NW CPUE down LF.
- Lower K, lower SB, higher F than 2014 model.



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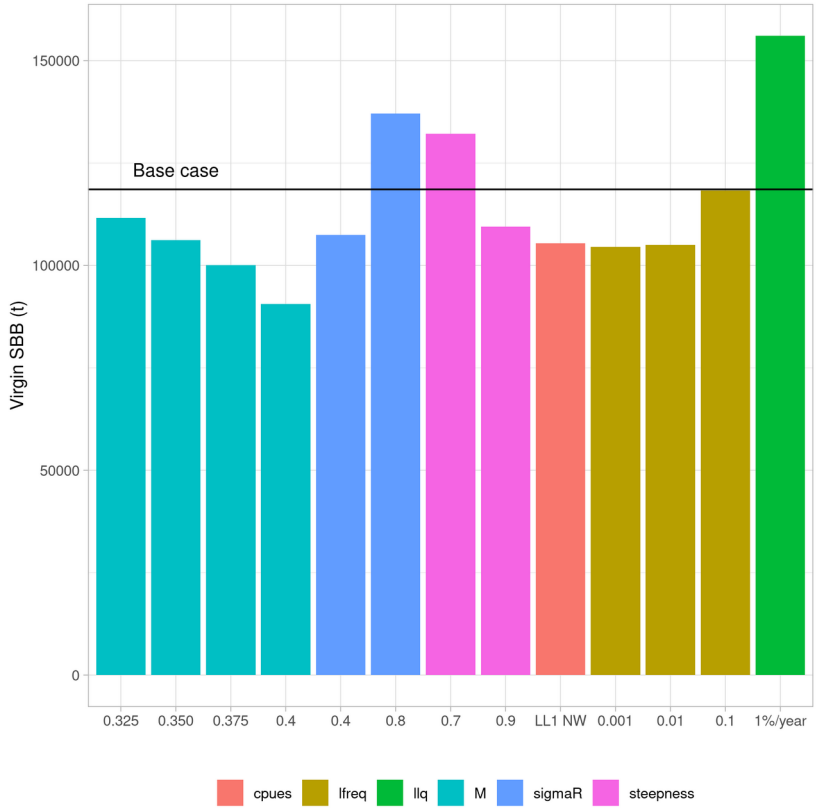
Albacore Operating Model in brief

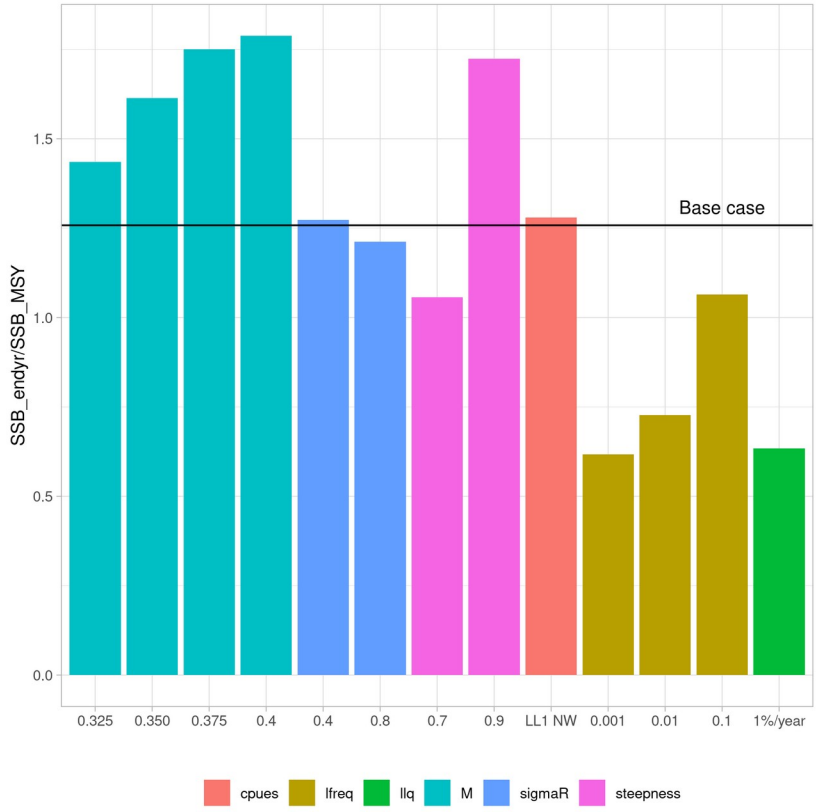
- WPTmT 2019, data 1950-2017
- Uncertainty in
  - M
  - Steepness
  - recruitment variability
  - Weight CPUE / length data
  - Yearly increase catchability LL
  - CPUE (NW, SW)
- Runs selected on CPUE MASE, B0 limit 4e5 t
- Resampled with weights based on CPUE prediction skill

SS3 model grid

- Natural mortality (M): 0.3, 0.325, 0.35, 0.375 or 0.4, for all ages.
- Standard deviation in recruitment deviates (sigmaR): 0.4, 0.6, or 0.8.
- Stock-recruitment relationship steepness: 0.7, 0.8 or 0.9.
- LL CPUE series (cpues): Northwest (12) or Southwest (14).
- Length-frequency data likelihood weighting (lfreq): 0.001, 0.01, 0.1 or 1.
- Catchability increase of the LL CPUE series (llq): 0% or 1% per year.
- 432 model runs.

Main effects





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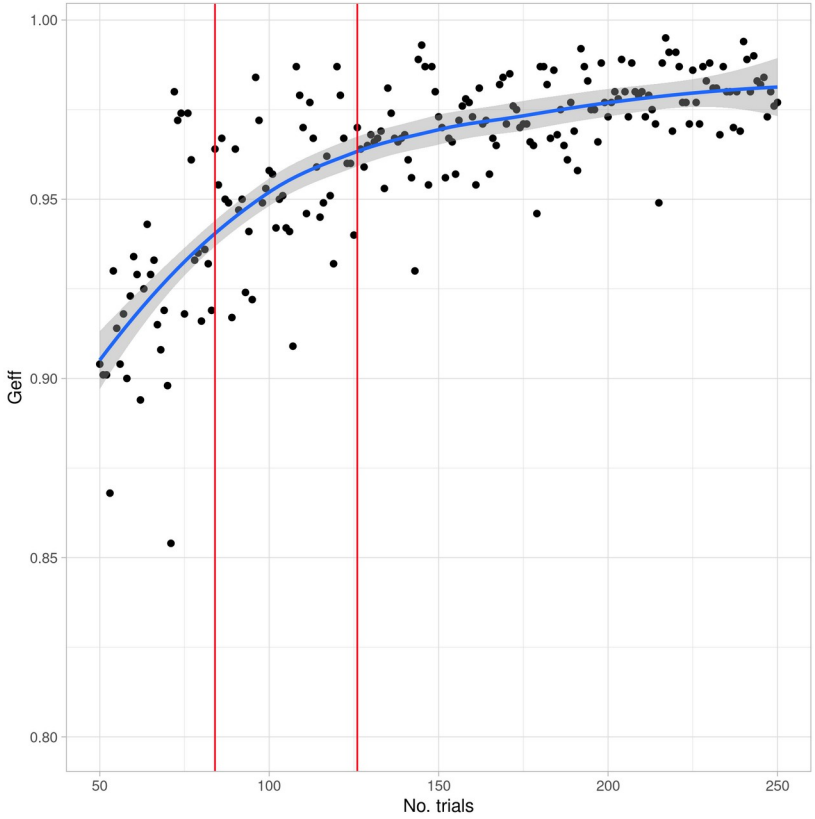
Partial factorial design

- 84 / 125 model runs
- 40% rejection rate: 52 runs
- Full grid would lead to 260 runs



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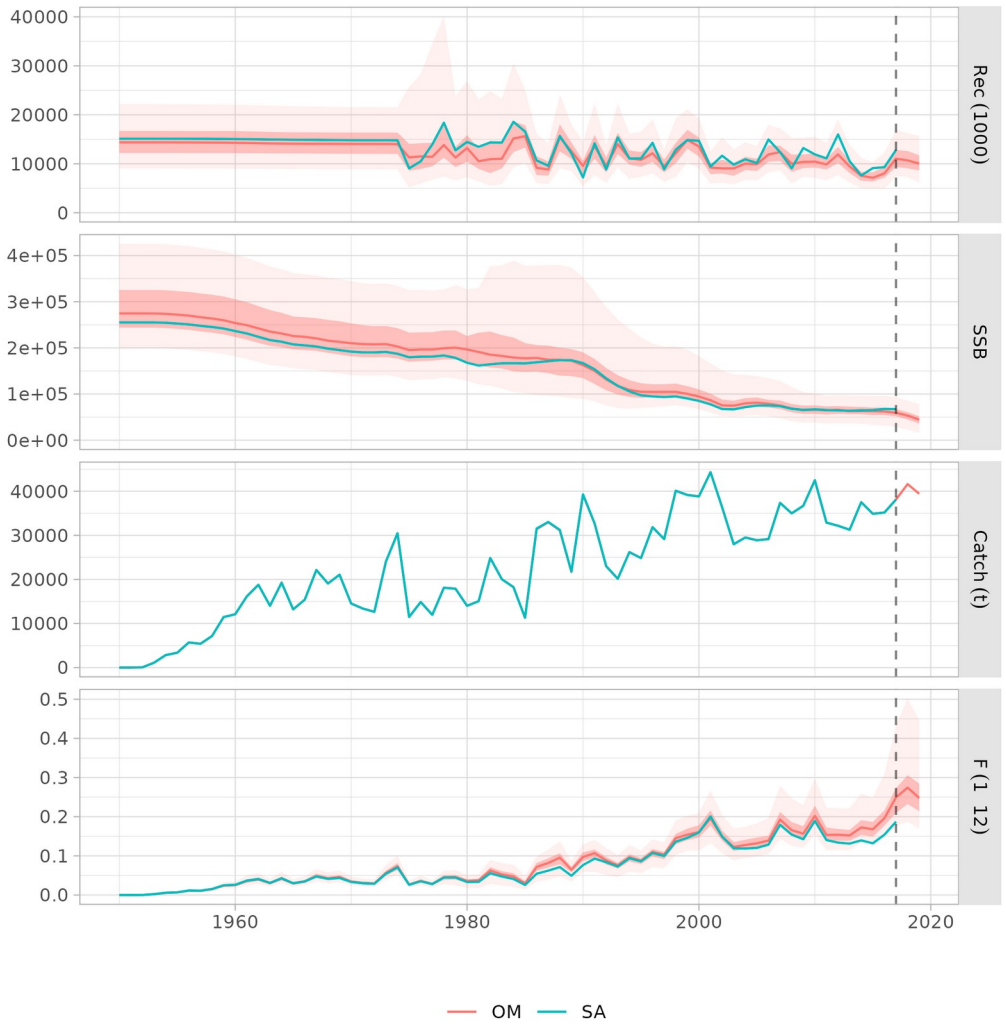
Full factorial grid

- 432 models
- Model selection criteria
  - If SB0 > 1e7 or SB 2017 / SBMSY > 3 (10)
  - Convergence, if final gradient > 1e-4 (26)
  - MASE of LLCPUE1 NW and LLCPUE3, SW (Q1 & 4) > 1 (120)
  - Explain catch 2018-19 (41,615, 39,246 t), with F limited to 200% 2017 (132)
  - 263 / 432 models selected

Full factorial OM



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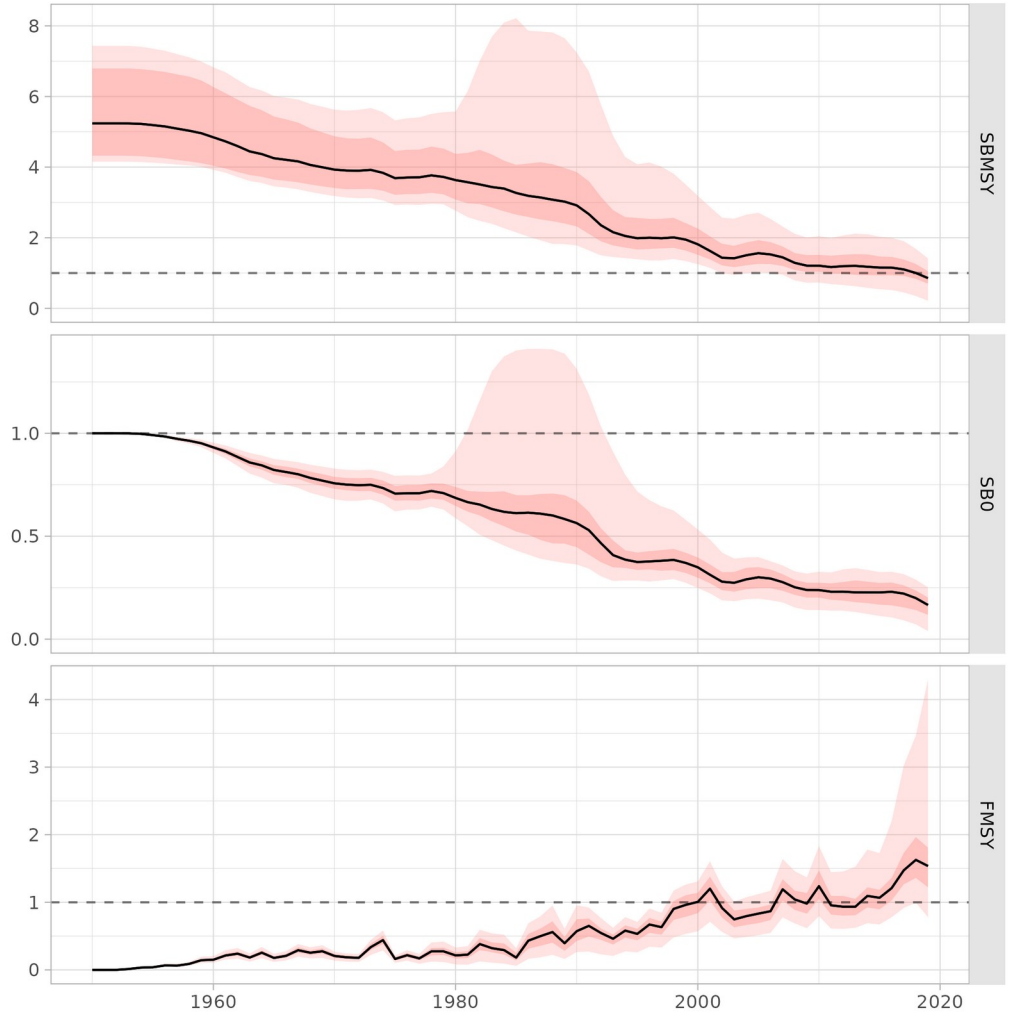
Full factorial OM



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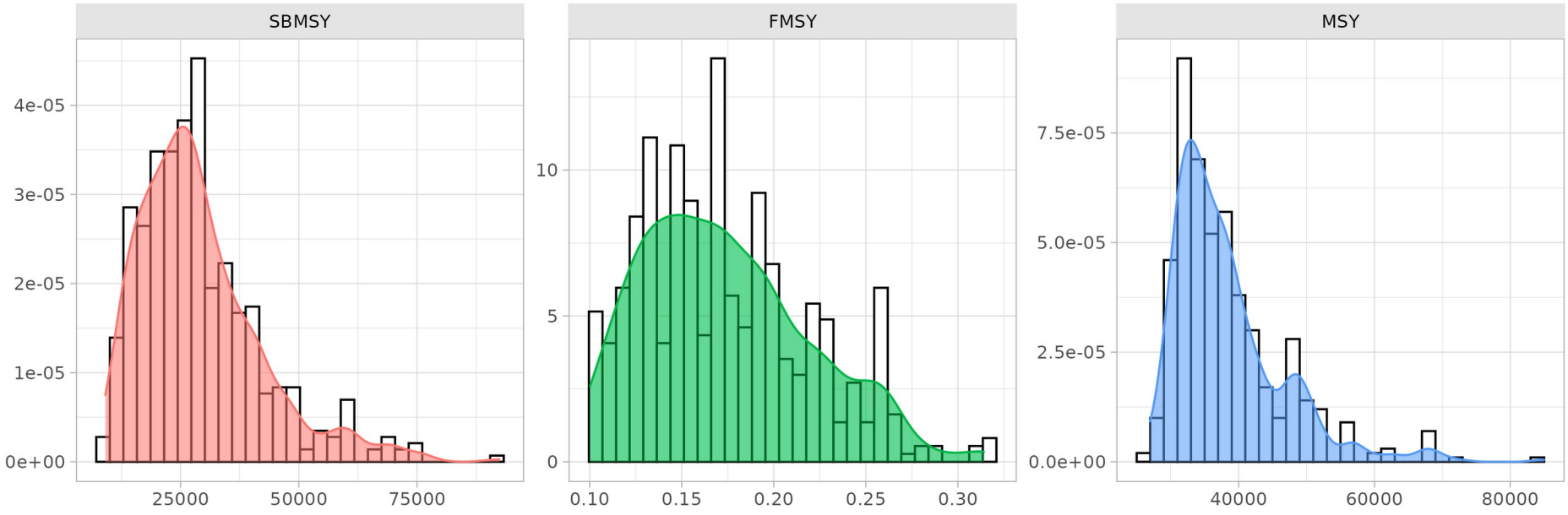
Full factorial OM



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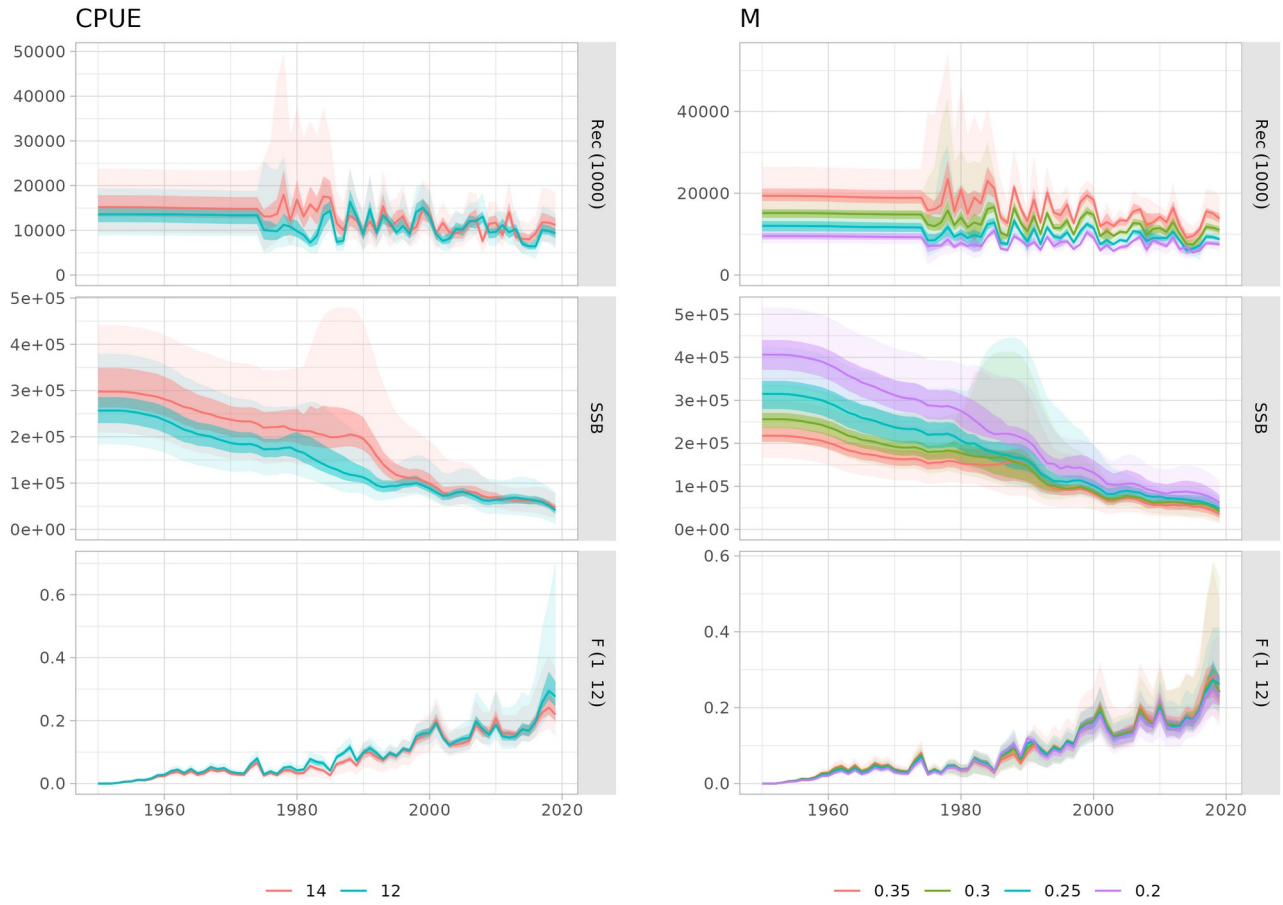
Factors in OM



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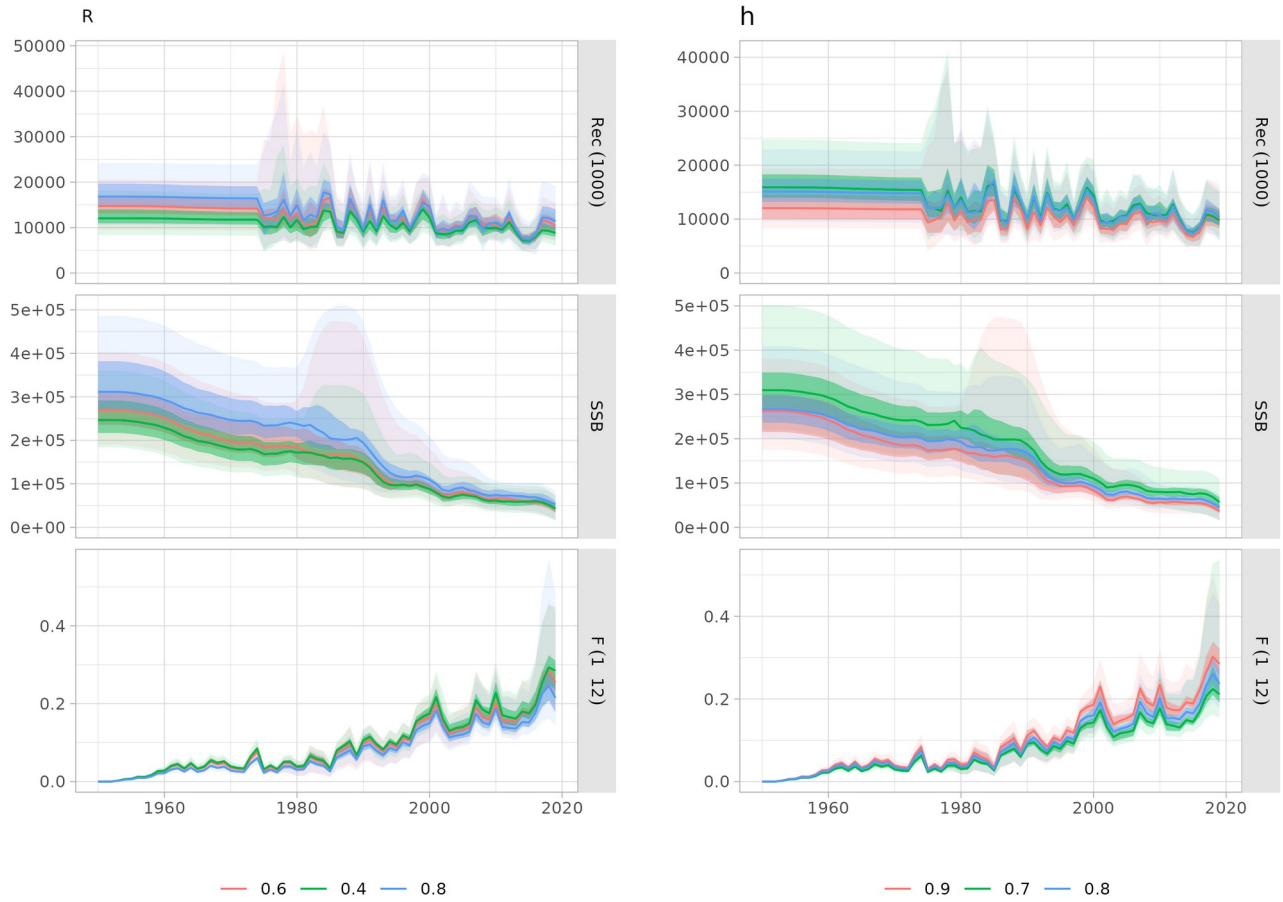
Factors in OM



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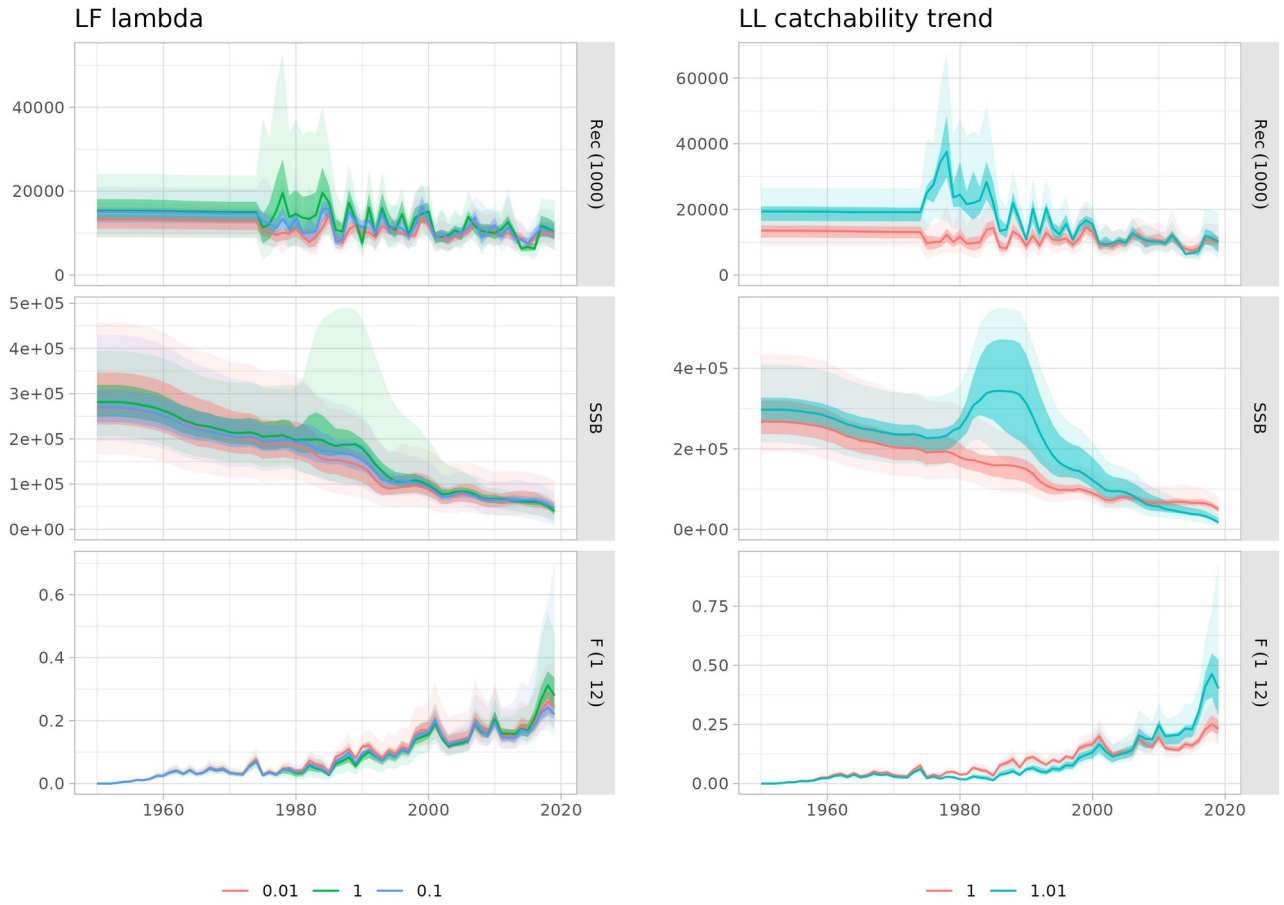
Factors in OM



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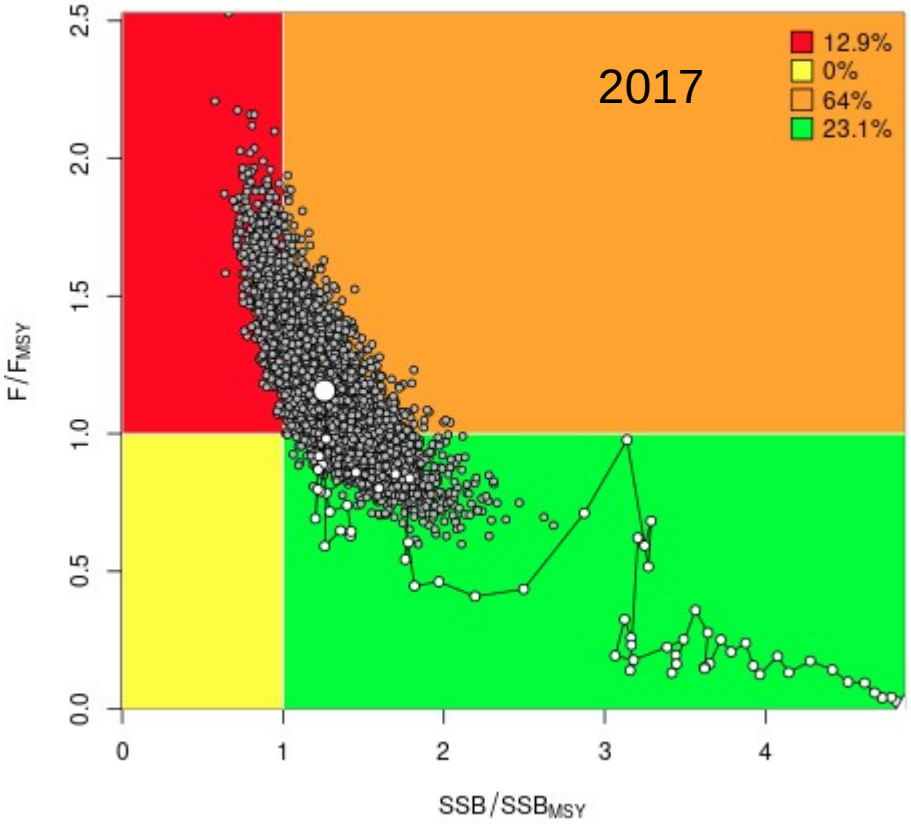
Tuning Objectives

- **TA2**: P(Kobe = green) = 50%
- **TA3**: P(Kobe = green) = 60%
- **TA4**: P(Kobe = green) = 70%
- Computed over the 2030-2034 period

Constraints:

- 3-year TAC setting
- 15% TAC constraint
- Two year data lag, effect of one year.



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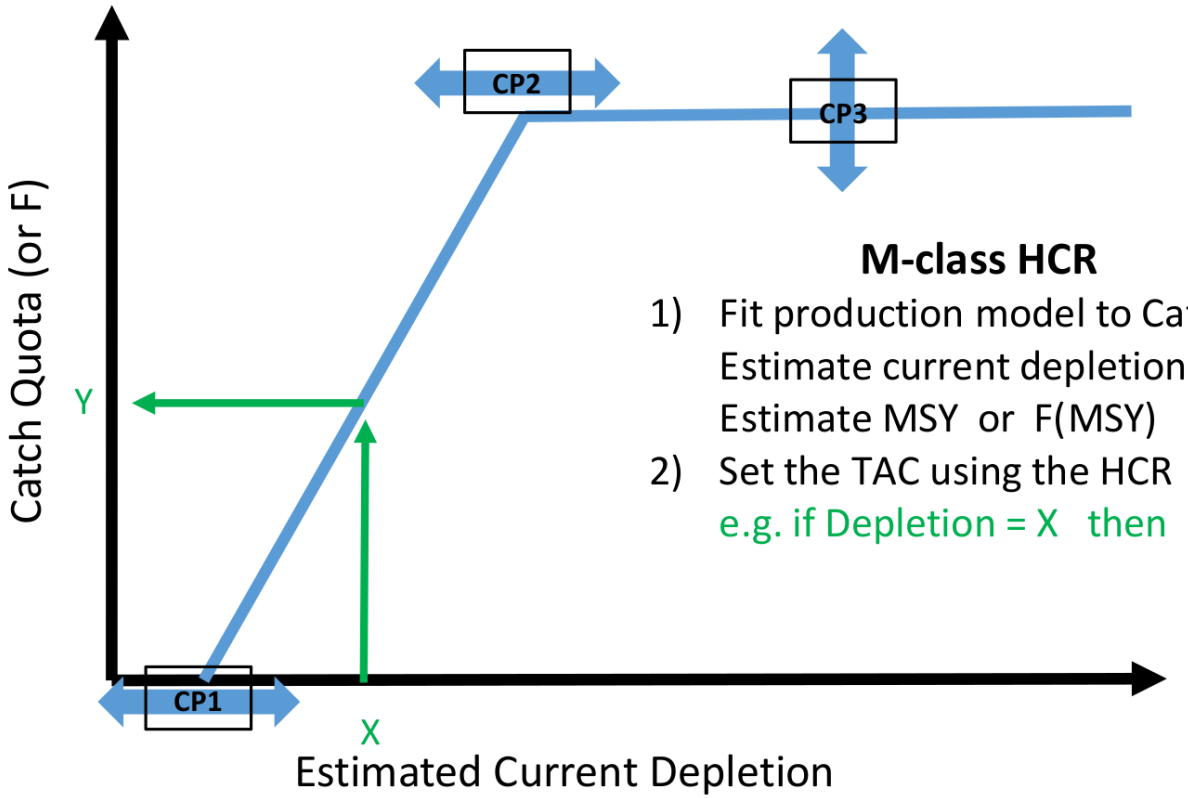
Candidate Management Procedures

M class (model-based) MPs

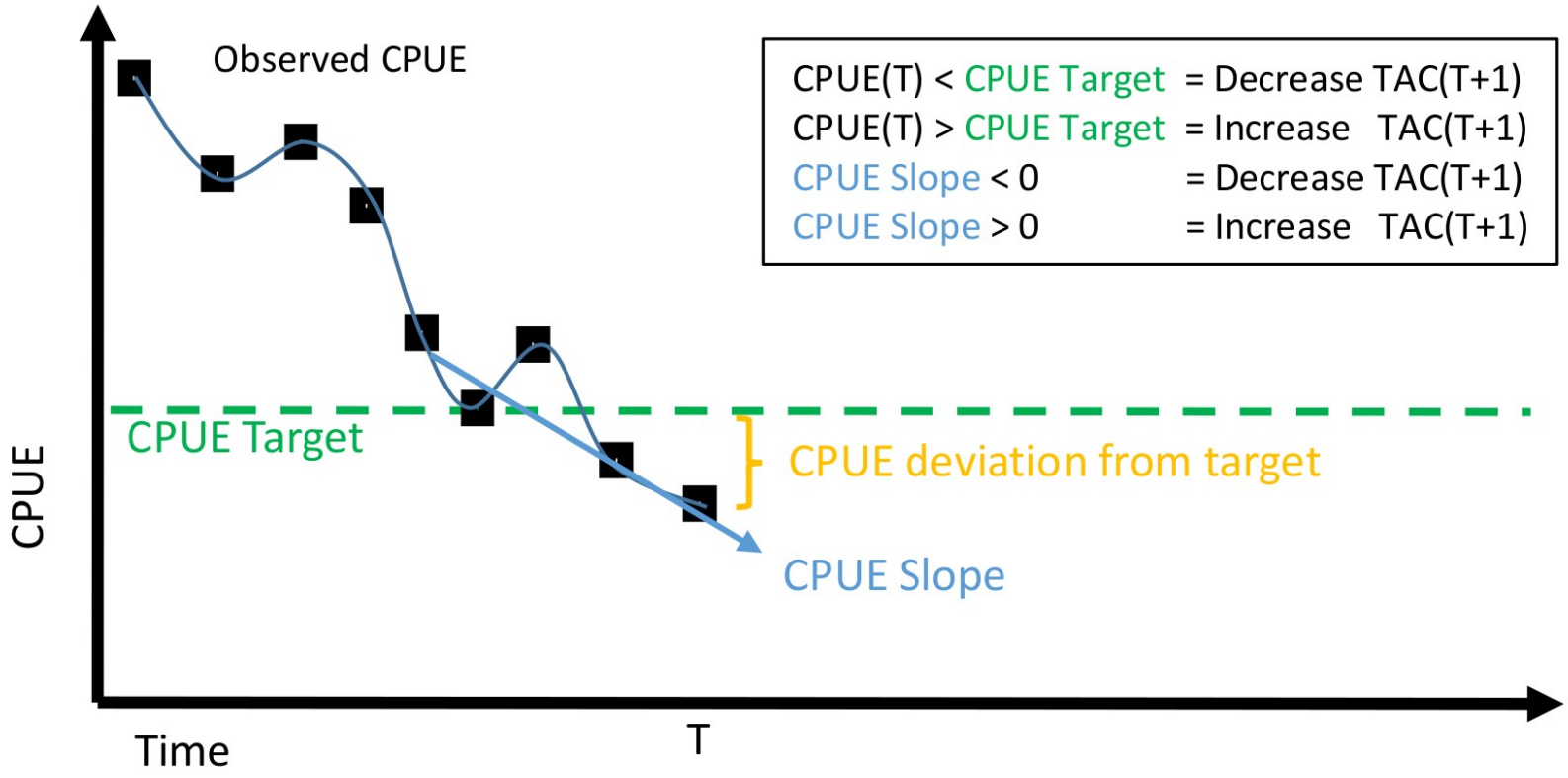


M-class HCR

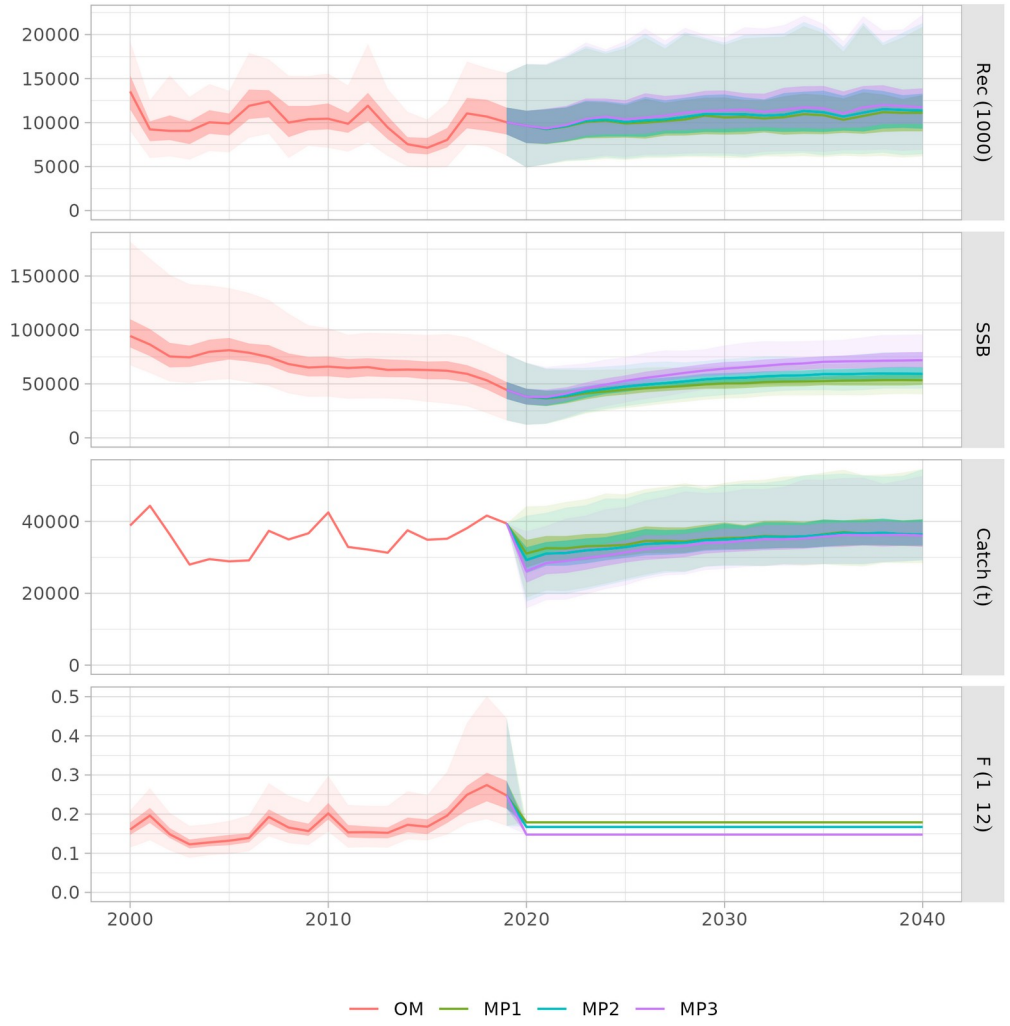
1) Fit production model to Catch and CPUE data
   Estimate current depletion
   Estimate MSY or F(MSY)
2) Set the TAC using the HCR
   e.g. if Depletion = X then Quota(T+1) = Y

Candidate Management Procedures

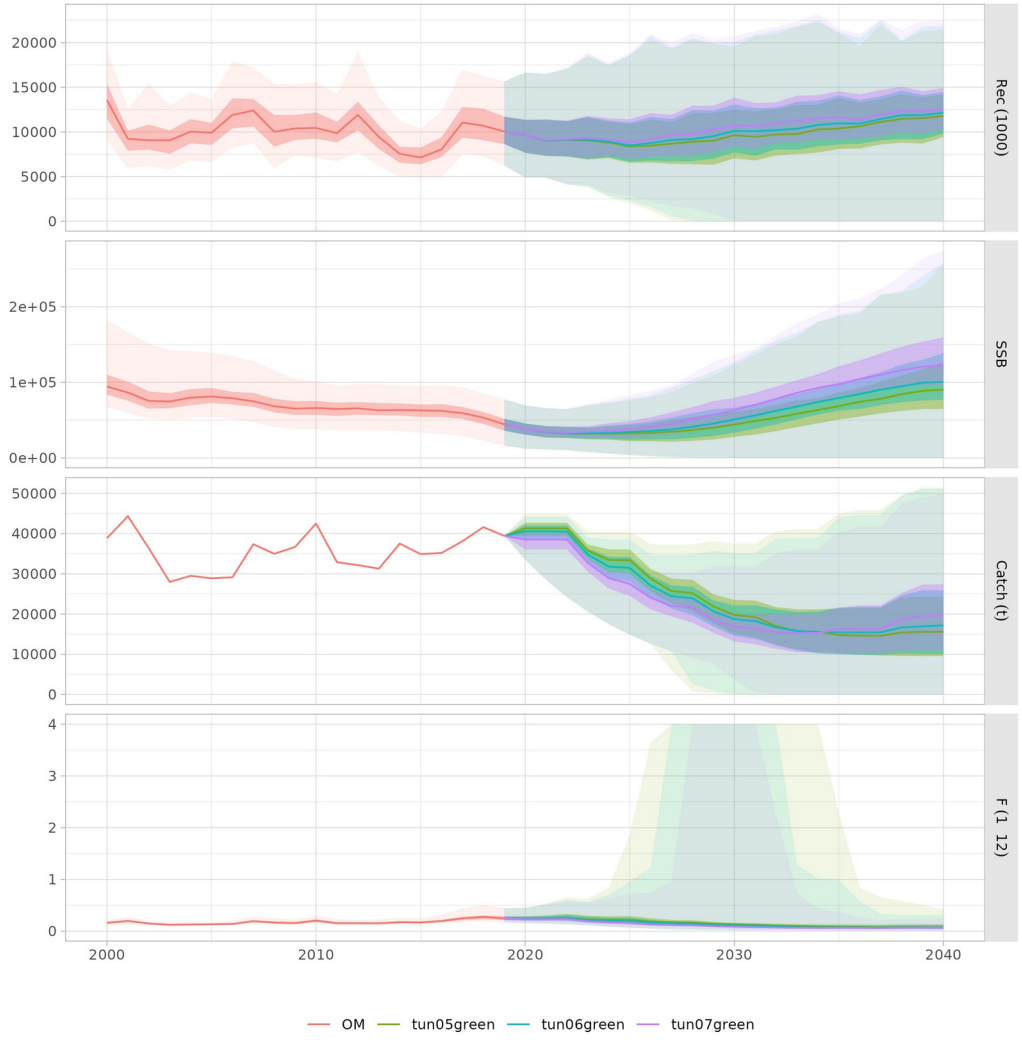
D class (data-based) MPs



Tests with perfect assessment: fixed F



Tuning CPUE MP



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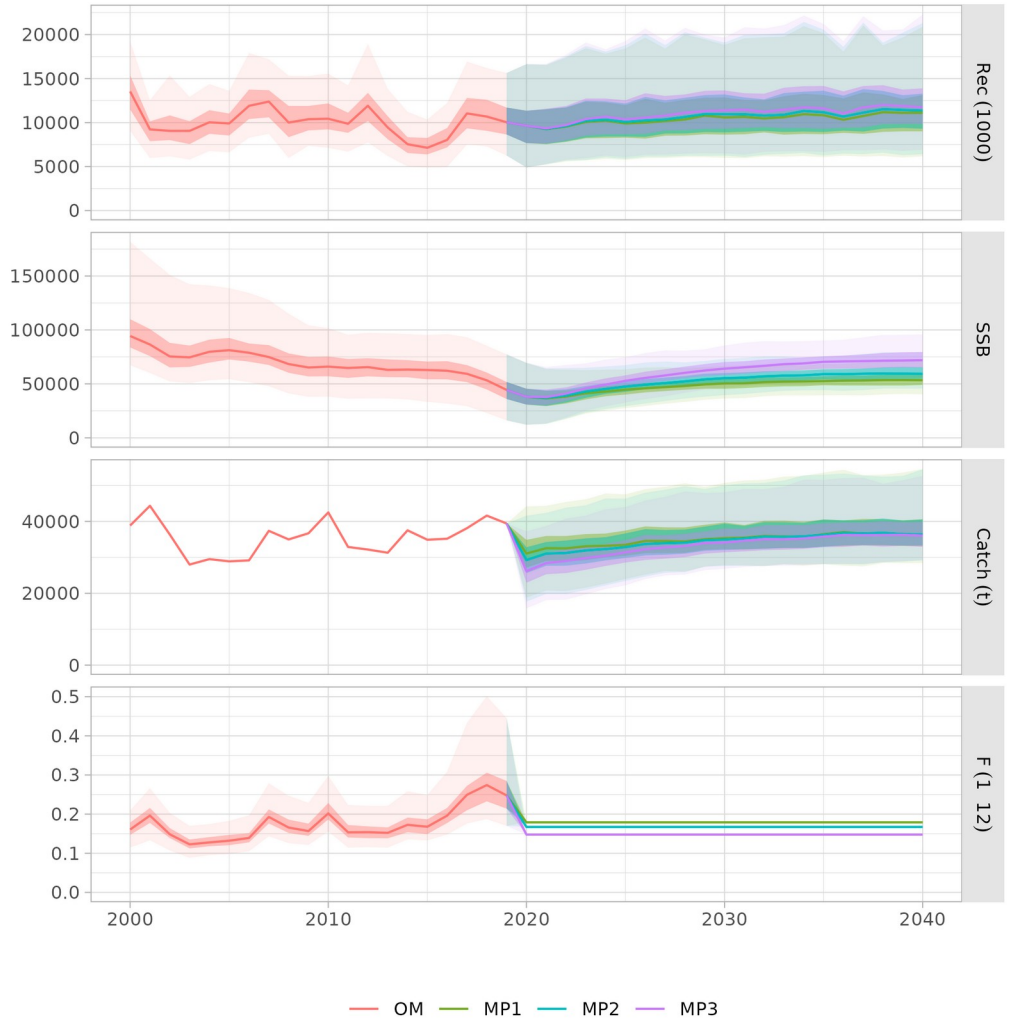
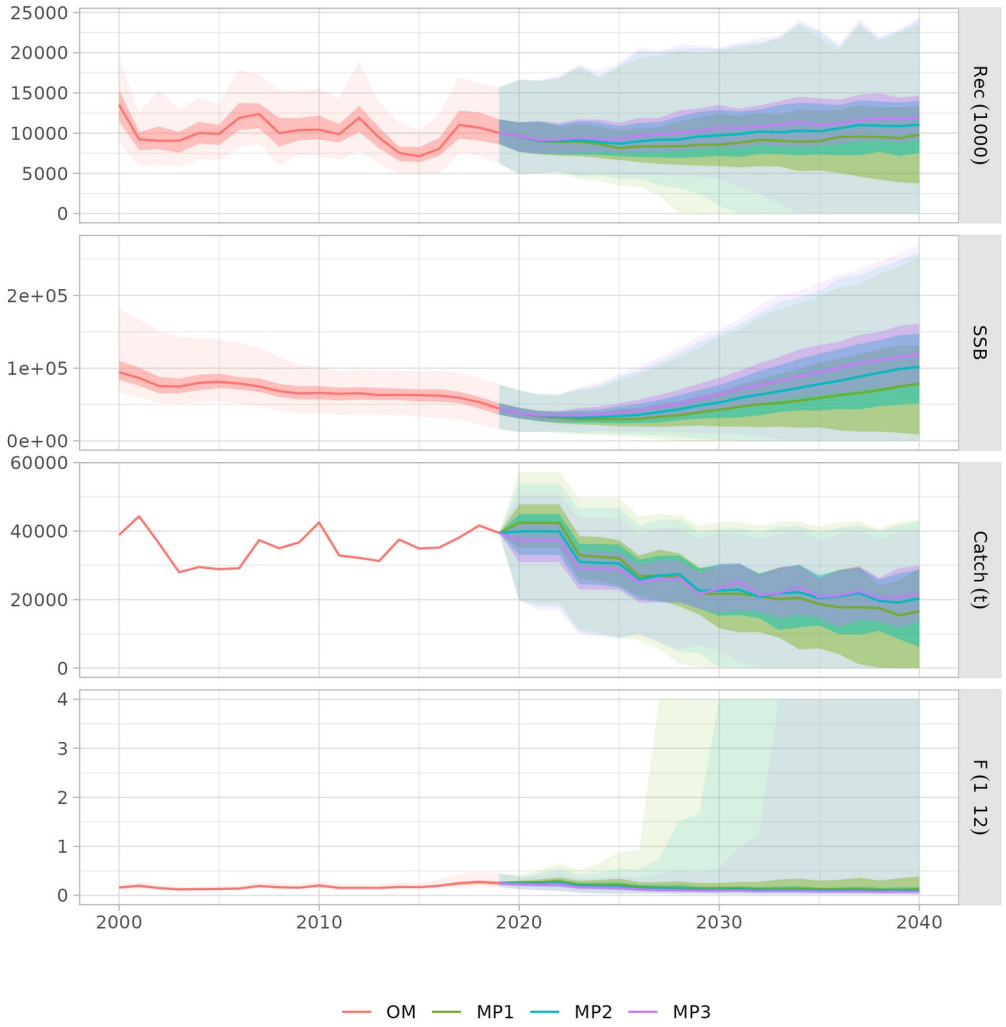


Tests with perfect assessment: catchSSB

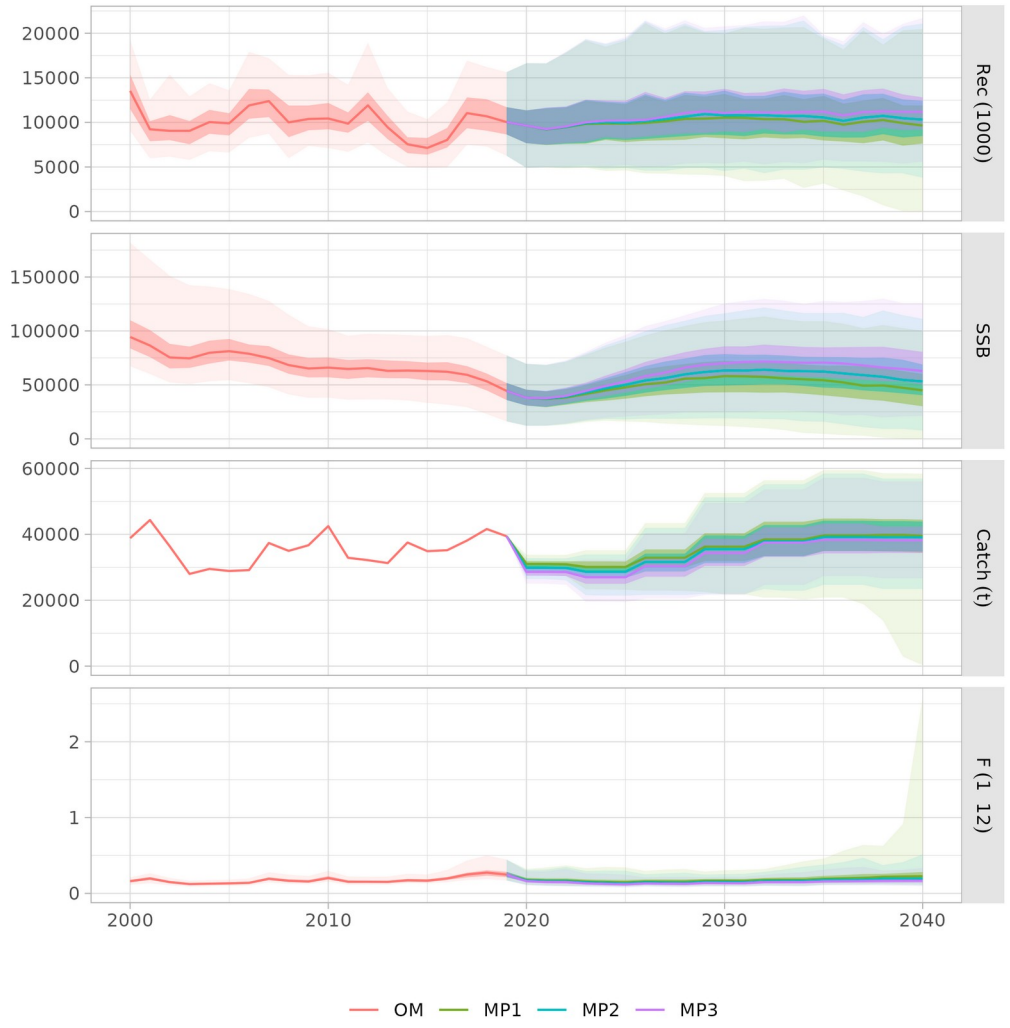


Trend HCR (CCSBT)

$$\mathrm{TAC}^{1}_{y+1} = \mathrm{TAC}_{y} \times \left\{ \begin{array}{ll} 1 - k_1|\lambda|^{\gamma} & \lambda < 0 \\ 1 + k_2\lambda & \lambda \geq 0 \end{array} \right\} \qquad (2)$$

where λ is the slope in the regression of $\ln B_y$ for τ_B years (from years $y - \tau_B + 1$ to year y), k_1 and k_2 are gain parameters, and γ is an asymmetry parameter that permits stronger or weaker action for negative biomass trends depending on the value.

Tests with perfect assessment: trend



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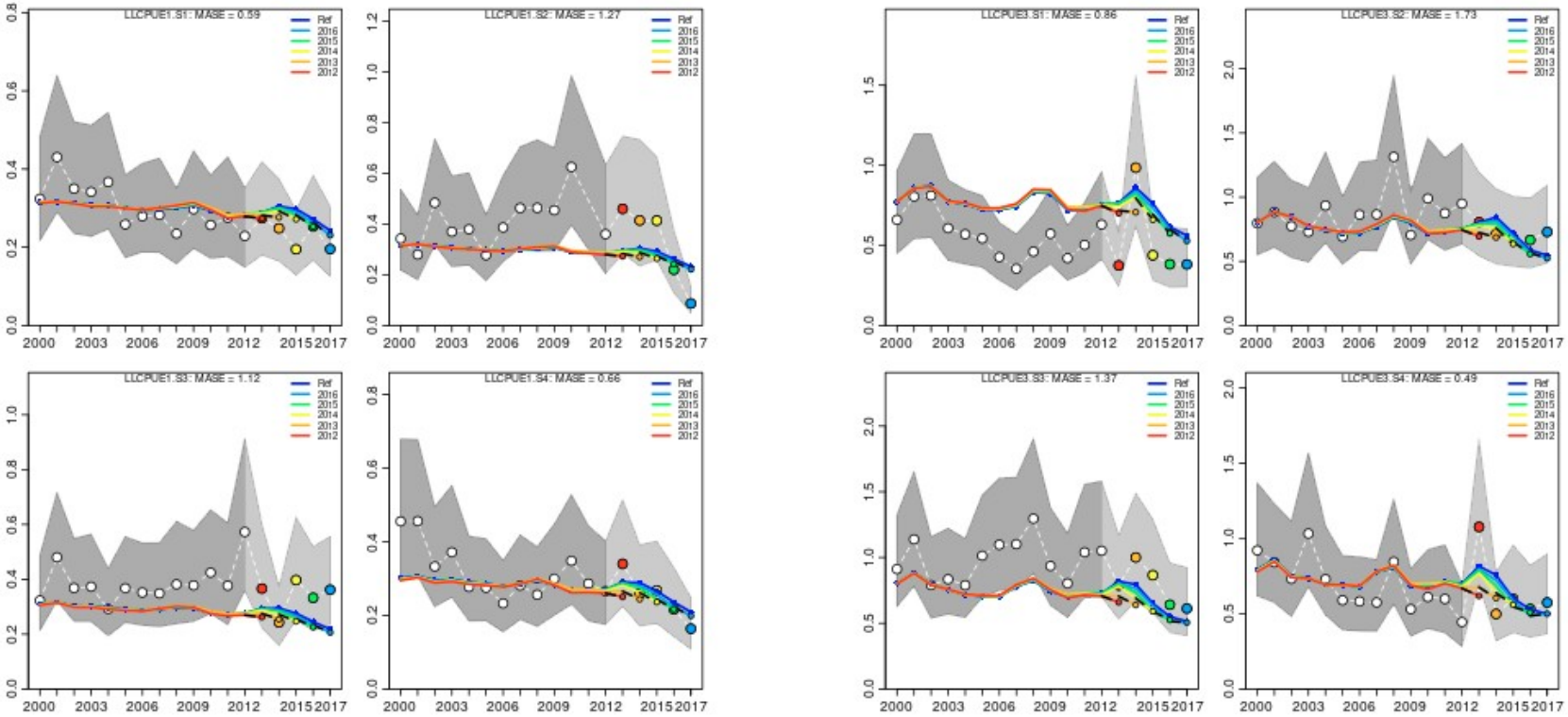
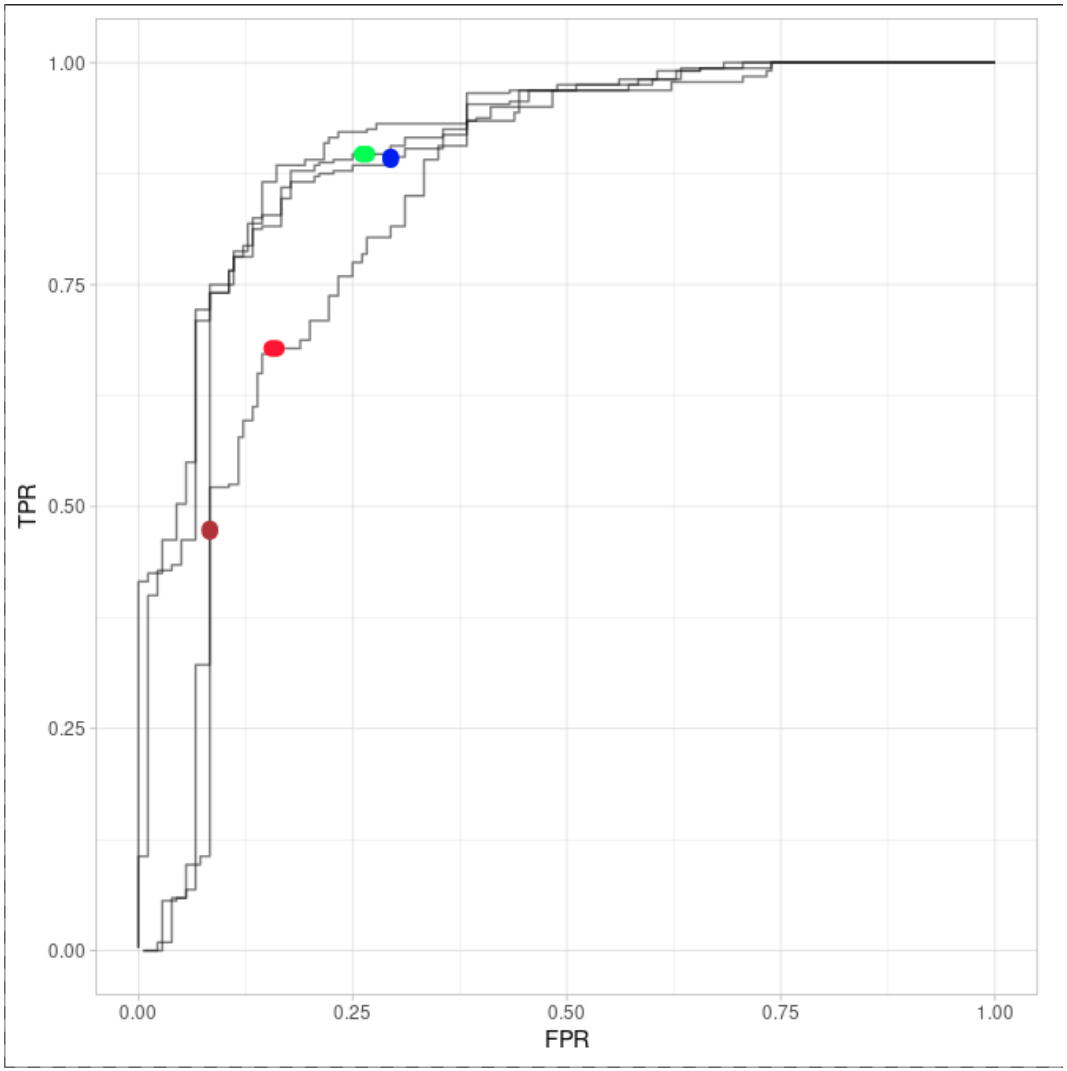
Surplus production MP: CPUEs



Surplus production MP: CPUEs



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Surplus production MP: spict

FISH and FISHERIES, 2017, **18**, 226–243

A stochastic surplus production model in continuous time

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Abstract

Surplus production modelling has a long history as a method for managing data-limited fish stocks. Recent advancements have cast surplus production models as state-space models that separate random variability of stock dynamics from error in observed indices of biomass. We present a stochastic surplus production model in continuous time (SPiCT), which in addition to stock dynamics also models the

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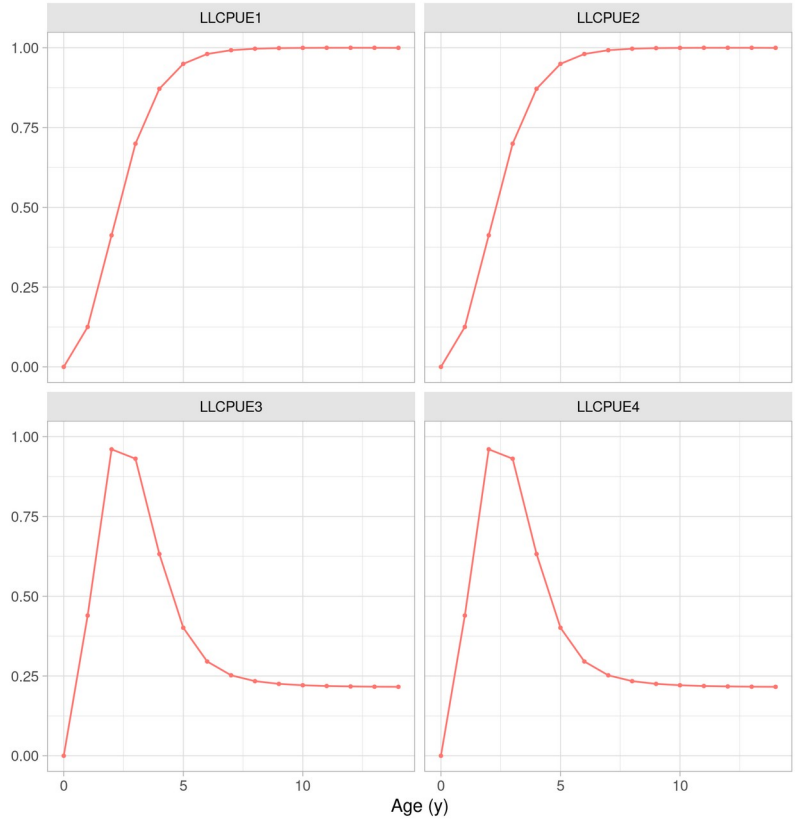
Surplus production MP: CPUEs



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Summary

- OM based on 263 runs, large uncertainty.
- MPs based on LLCPUE 1 and LLCPUE3
- Initial runs of MPs indicate need of recovery phase.
- TCMP requests
    - OM review, BUT WPTmT 2022
    - data lag, not run yet but already doable.
    - 15% TAC constraint

- Work delayed due to technical & staff issues.

Questions

- Single OM from such diverse views?
- WPTmT 2022 SA and OM reconditioning.
- Develop alternative OM (ABC), but not by TCMP 2022.
- Expected changes to ALB CPUEs and SA.
- Agreement on tunable HCR arguments.

Next steps

- Run all simulations for
    - spict + catchSSB
    - spict + trend
    - spict + (catchSSB + trend)

- Alternative TAC limits, unequal up and down.
- Submit proposal for 2022-23 contract, ALB & SWO (October 2021)
- Delivery of simulations and platform (December 2021)
- End of contract (December 2021)

To explore the potential of nature to improve the quality of life

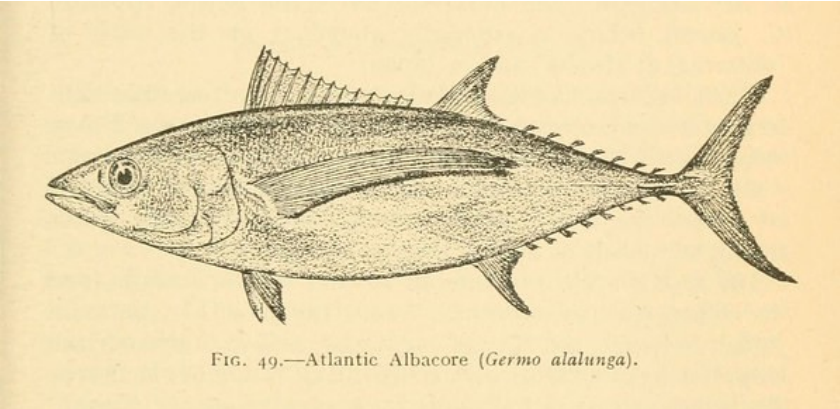

Fig. 49.—Atlantic Albacore (*Germo alalunga*).

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