# Indian Ocean swordfish MSE
# Current status and recent developments

IOTC-2023-WPM14(MSE)-05

IOTC WPM-MSE – 28-31h March 2023

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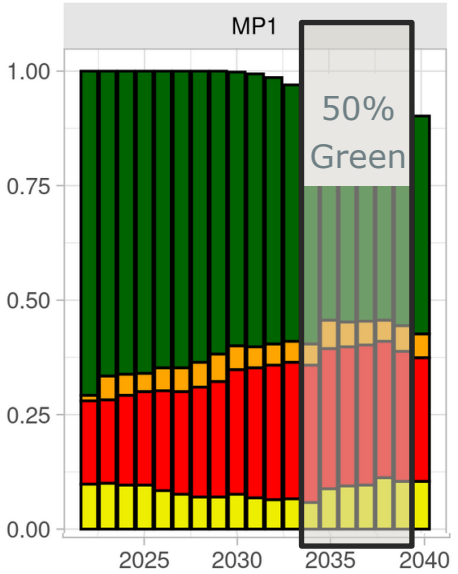
# Status of the SWO MSE work

- OM based on 2019 WPB SS3 assessment and covered the dynamics of the swordfish until the year 2018.

→updated to the current year (2023), by projecting the stock forward based on the reported catches for 2019, 2020 and 2021 and assuming constant catches in 2022 at the 2021 level.

- Modification of the uncertainty grid
- Candidate MPs explored
  - Model-based (JABBA)
  - Data-based (Japanese LL CPUE) :
    - Cpue rule
    - Relative harvest rate rule
- Tunning objectives set in TCMP-04 (2021) :

$p(\text{Kobe Green})_{2034\text{-}2039}$ = 50, 60 or 70%



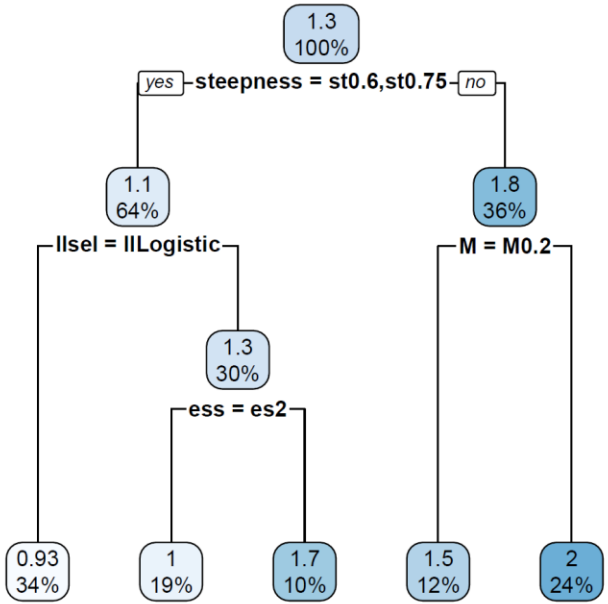
# OM construction

## structural uncertainty grid

| Variable | Values | | |
|---|---|---|---|
| **Selectivity** | Double Normal | Logistic | |
| **Steepness** | 0.6 | 0.75 | 0.9 |
| **Growth + Maturity** | Slow growth, late maturity (Wang et al.,2010) | Fast growth, early maturity (Farley et al., 2016, otoliths) | |
| **M** | Low = 0.2 | High = 0.3 | Sex-specific Lorenzen M (Farley et al. (2016), otoliths) |
| **Sigma R** | 0.2 | 0.6 | |
| **ESS** | 2 | 20 | |
| **CPUE scaling schemes** | Area effect x Surface | Catch | Biomass |
| **CPUEs** | JPN late + EU.PRT | JPN late | TWN + EU.PRT |
| **Catchability increase** | 0% | 1% / year | |

- 2592 possible combinations
- Reduced to 108 using factorial design optimisation
- Resulting 67 acceptable SS3 runs

## $SB/SB_{MSY}$ (2018) (regression tree)



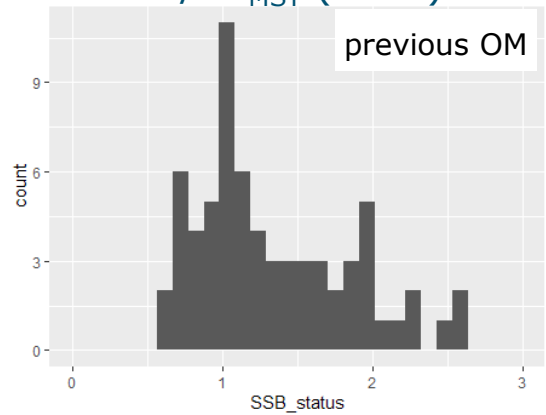
# Simplification of the OM

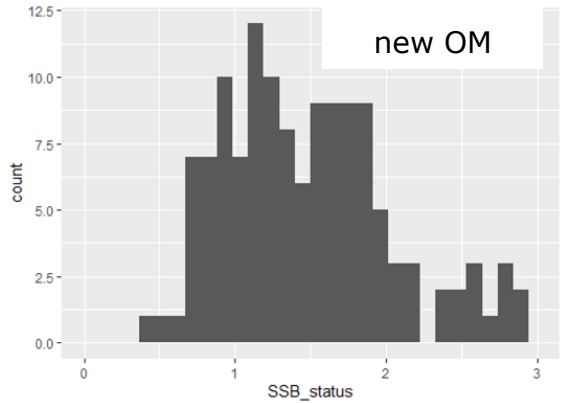
## structural uncertainty grid

| Variable | Values | | |
|---|---|---|---|
| **Selectivity** | Double Normal | ~~Logistic~~ | |
| **Steepness** | 0.6 | 0.75 | 0.9 |
| **Growth + Maturity** | Slow growth, late maturity (Wang et al.,2010) | Fast growth, early maturity (Farley et al., 2016, otoliths) | |
| **M** | Low = 0.2 | High = 0.3 | Sex-specific Lorenzen M (Farley et al. (2016), otoliths) |
| **Sigma R** | 0.2 | 0.4 | 0.6 |
| **ESS** | 2 | 20 | |
| **CPUE scaling schemes** | ~~Area effect x Surface~~ | ~~Catch~~ | Biomass |
| **CPUEs** | JPN late + EU.PRT | JPN late | TWN + EU.PRT |
| **Catchability increase** | 0% | 1% / year | |

- ~~2592~~ 648 possible combinations
- Reduced to ~~108~~ 175 using factorial design optimisation
- Resulting ~~67~~ 130 acceptable SS3 runs

$SB/SB_{MSY}$ (2018)

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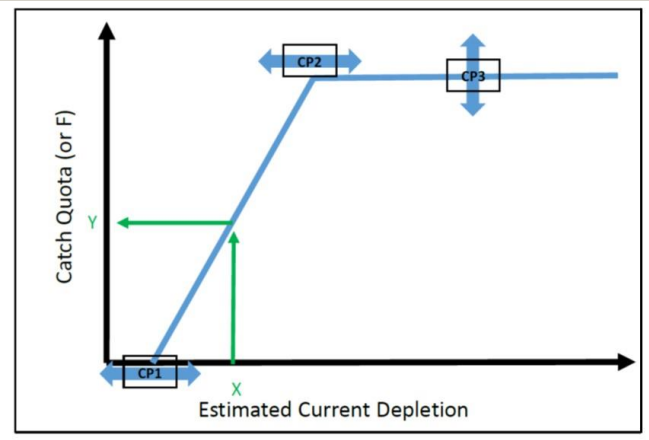
# Candidate MPs

## MODEL BASED MP

**INPUT** : Total annual catches
CPUE (UJPLL_NW, UTWLL_NW)
**Model (JABBA)** ➔ Current depletion SB/SB0
**HCR** ➔ TAC

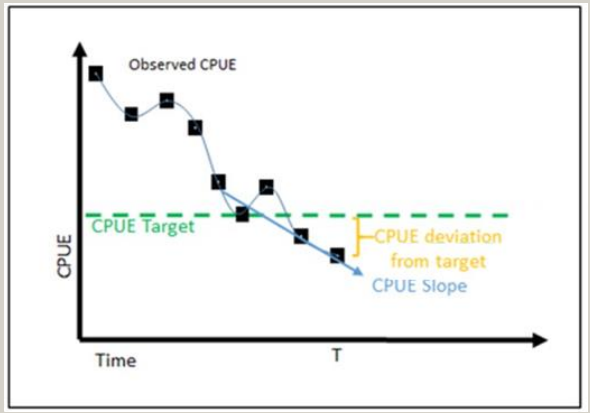



**CP1** : Set at SB/SB0 = 0.1
**CP2** : Set at SB/SB0 = 0.4
**CP3** : Estimated by tuning

## DATA BASED MP

**INPUT** : CPUE (UJPLL_NW)
**MP** ➔ % change in the TAC

$$TAC_{mult} = 1 + k_a\, Sl + k_b\, D$$




**Responsiveness to CPUE slope and deviation from target :** set
**CPUE targe** : Estimated by tuning

# Candidate MPs

## DATA BASED MP : relative harvest rate MP (Fischer et al., 2022)

**INPUT** : CPUE index(UJPLL_NW)

**MP** ➔ TAC as a function of *relative harvest rate* (catch/CPUE index)

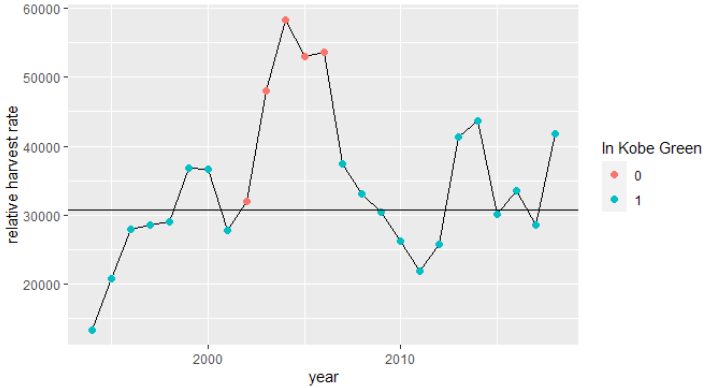
$$TAC_{y+1} = I_y \times H_{target} \times BSG \times \gamma$$

with

$$BSG = min\left(1\,;\, {I_y}/{I_{trigger}}\right)$$

**Itrigger :** set

**Htarget** : based on historical HR value,
or estimated by tuning

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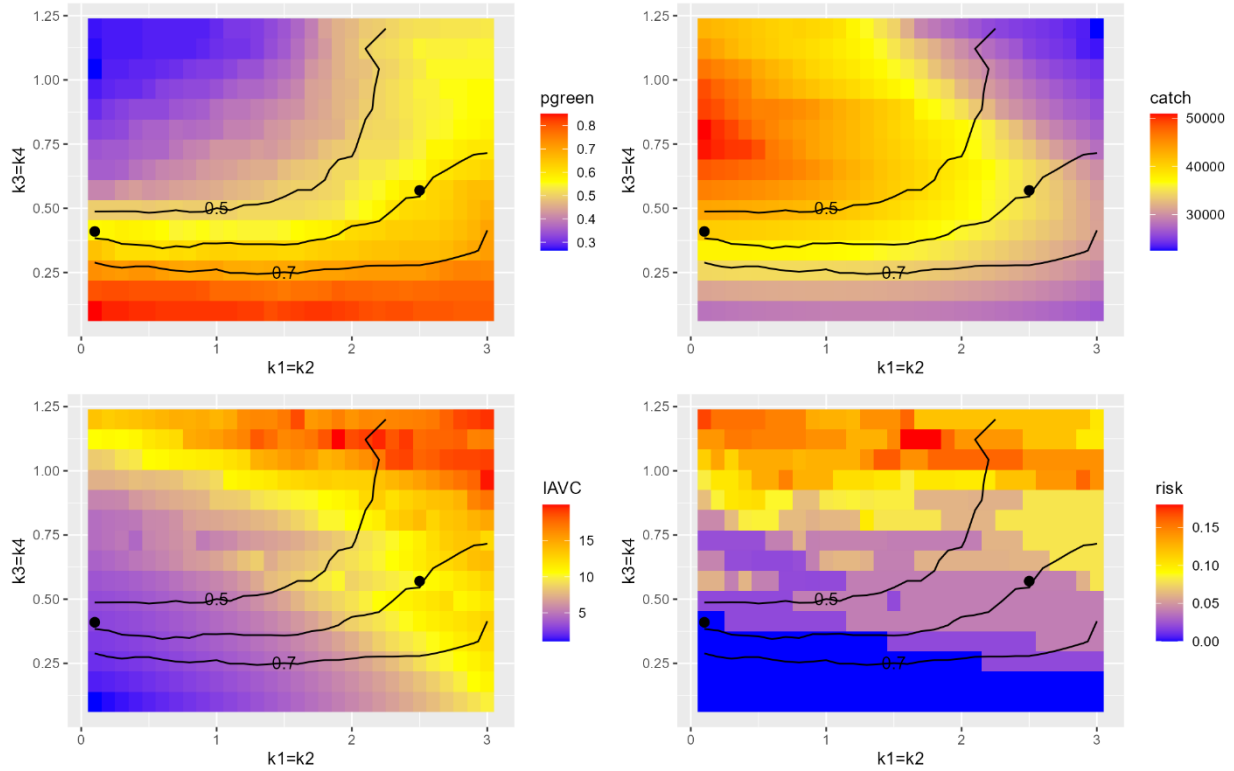
# Parameterisation of the CPUE MP

$$TAC_{mult} = 1 + k_a\, Sl + k_b\, D$$



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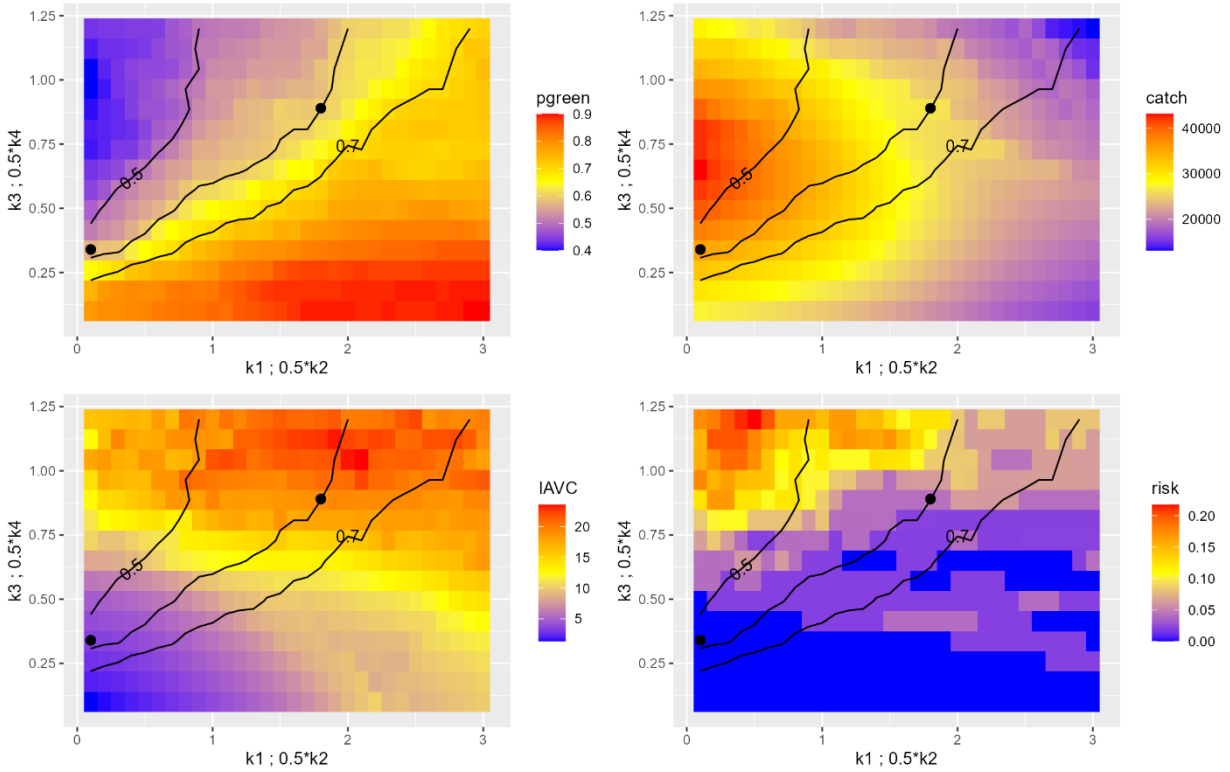


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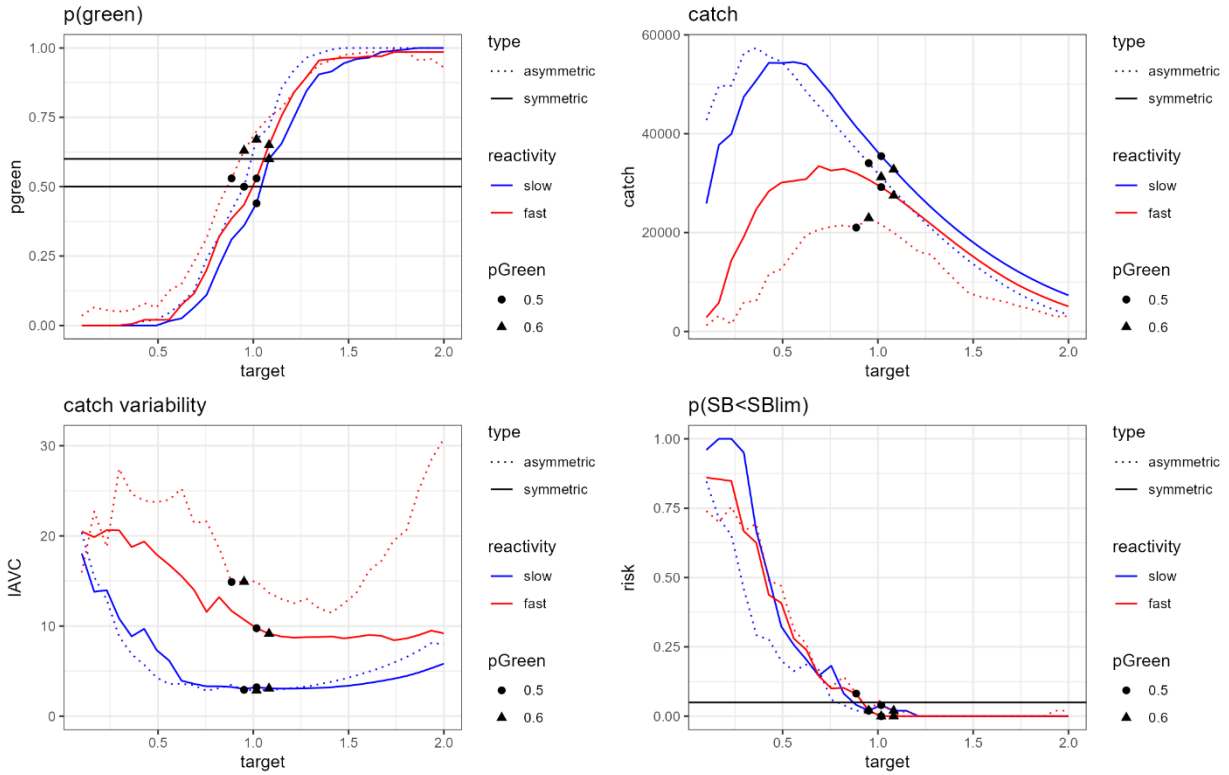


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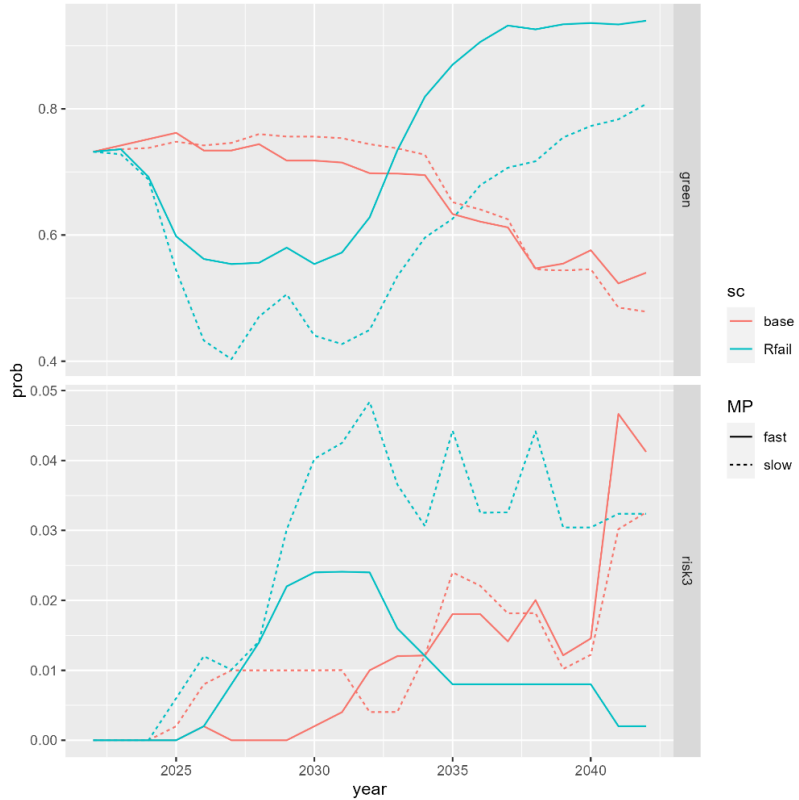
# Parameterisation of the CPUE MP

Robustness test : how would a *fast* vs. *slow* reacting CPUE MP perform in the even of a recruitment failure

<u>Scenario :</u>
recruitment falling at 10%
of SR model prediction over
2022-2025

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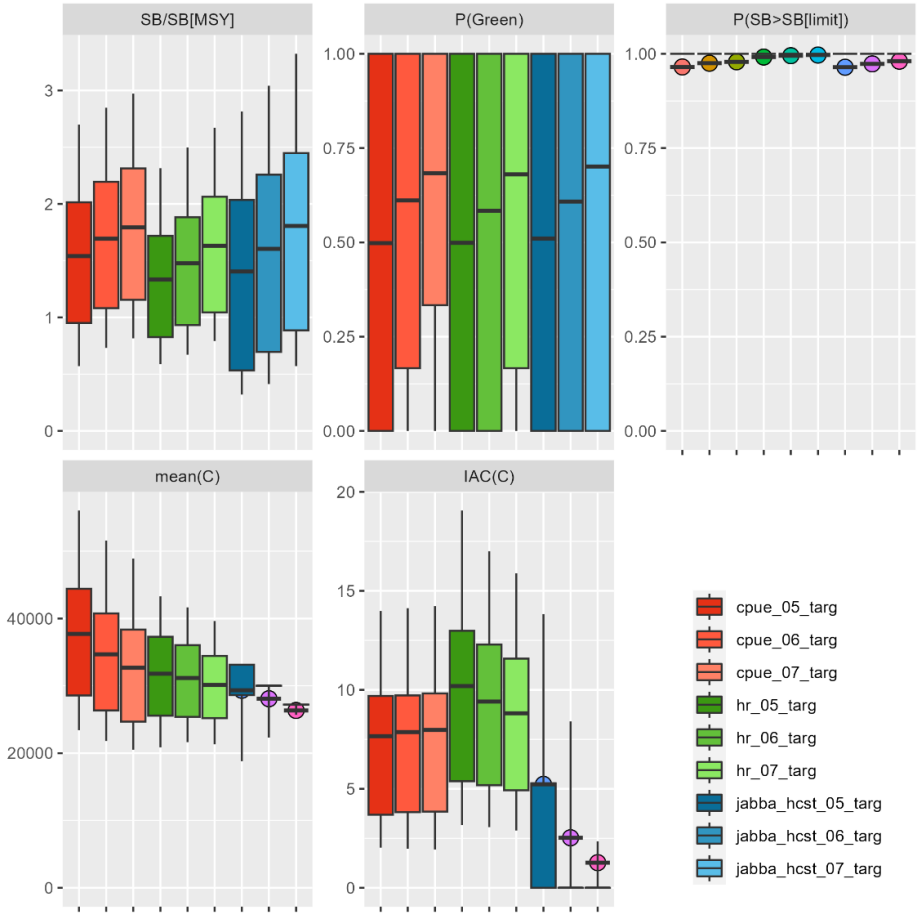
# Preliminary runs tunned MPs

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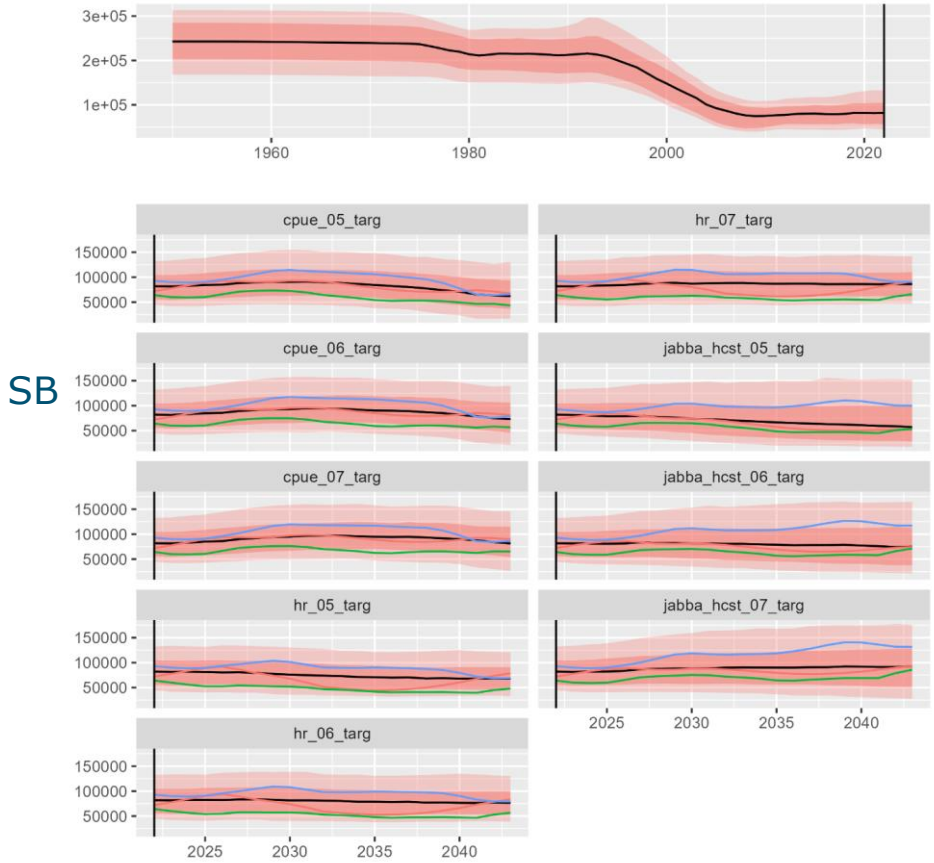
# Preliminary runs tunned MPs

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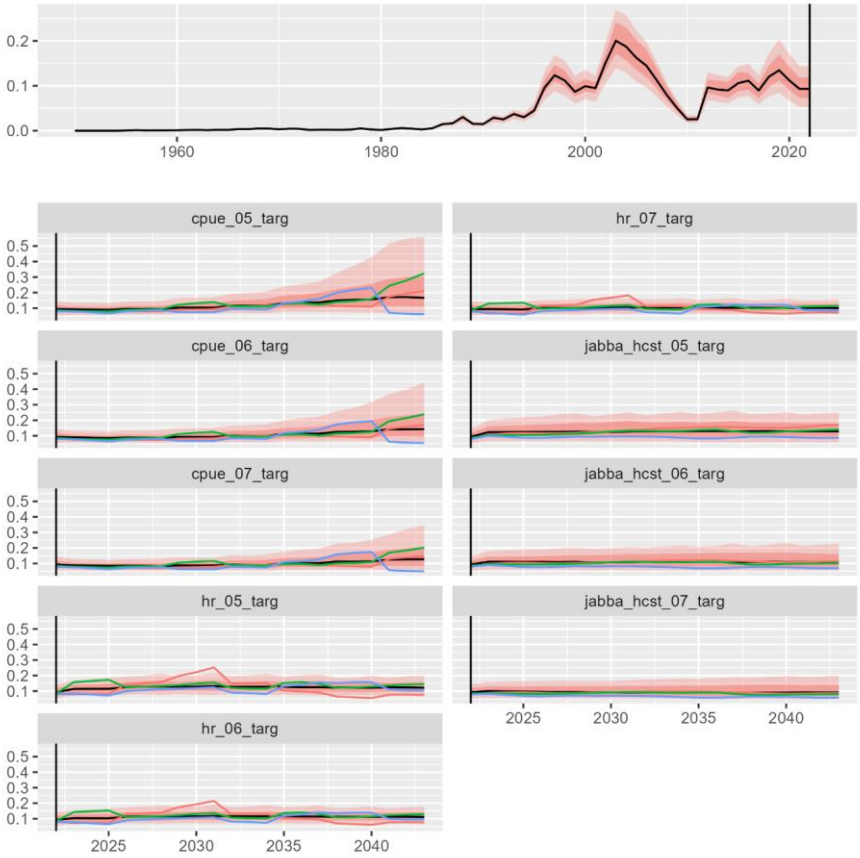
# Preliminary runs tunned MPs

Fbar

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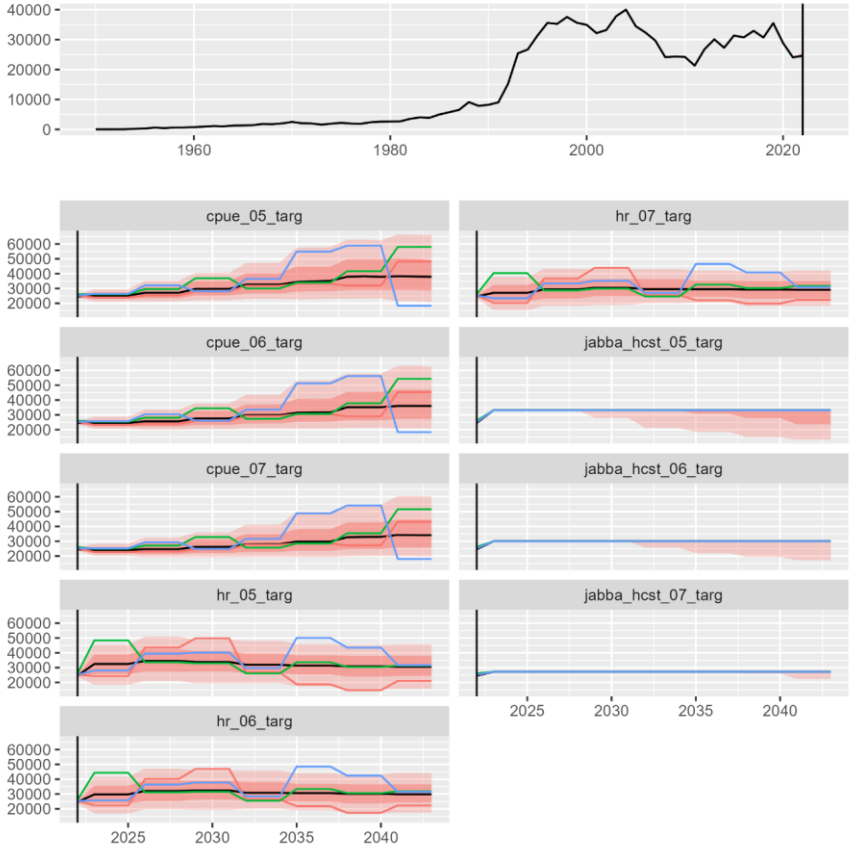
# Preliminary runs tunned MPs

Catch

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# Conclusions and perspectives

- OM : new proposed grid leads to higher number of runs for the OM, not affecting much stock history and dynamics
- Exploration of CPUE MP : *k* parameters are key for the performance of the MP. For SWO, low *k* values seem best (higher and more stable catch, while still robust to recruitment failure)
- Preliminary runs :
    - 3 MPs tunned for 50% Kobe green have low risk to $B_{lim}$
    - CPUE MP leads to highest catches
    - Hockey-Stick + JABBA leads to lower but very stable catches
    - Harvest-rate MP : no very interesting in this particular case

# Feed back from WPM-MSE

- OM : need to decide if update is needed after new assessment at WPB 2023
- Advice on approach for *k* parameters in CPUE MP
- Choice of candidates MPs : interest in the harvest rate MP?
- Configuration of JABBA
    - Fixed Process error and estimated observation error
    - Priors : can we set them (*K*) based on the SWO assessment?
- Mid-term objectives used for tunning : should we also look at consequences for longer term?

# Thank you for your attention

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