



Management Strategy Evaluation: Small Pelagics in the Adriatic Sea

A synthesis and results

REPORTS ARE ON STECF WEBSITE

Christoph Konrad
JRC, December 2021

JRC Team:

Henning Winker, Michael Gras, Alessandro Mannini

Management Goal:

To reach F_{msy} (proxy) and SSB_{target}

Work carried out

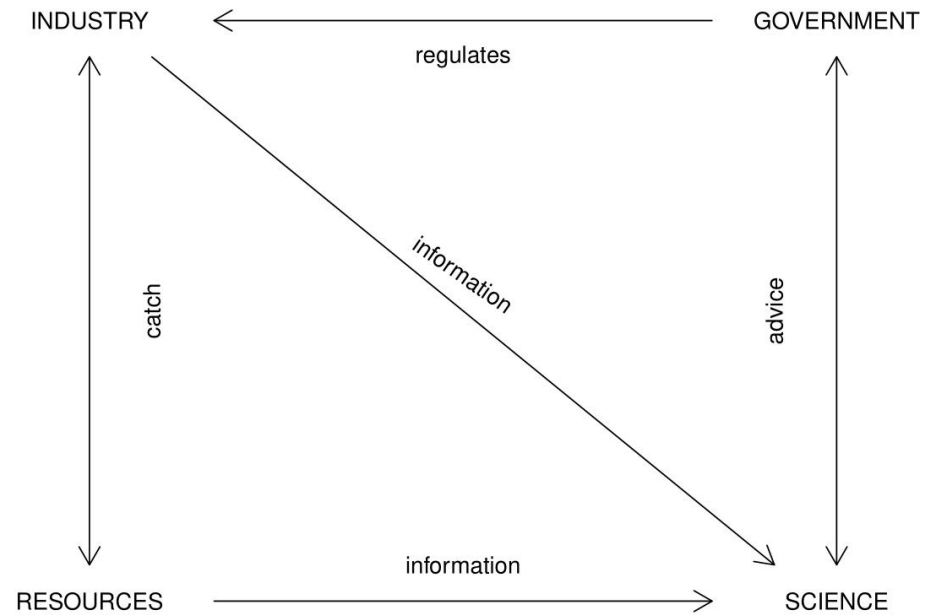
- EWG 21-adhoc-02 and EWG 21-04
- Based on benchmarks from GFCM
- No Sardine MSE – assessment model not coherent enough. Issues with reference points.
- Facilitated by scientists from JRC

What is an MSE?

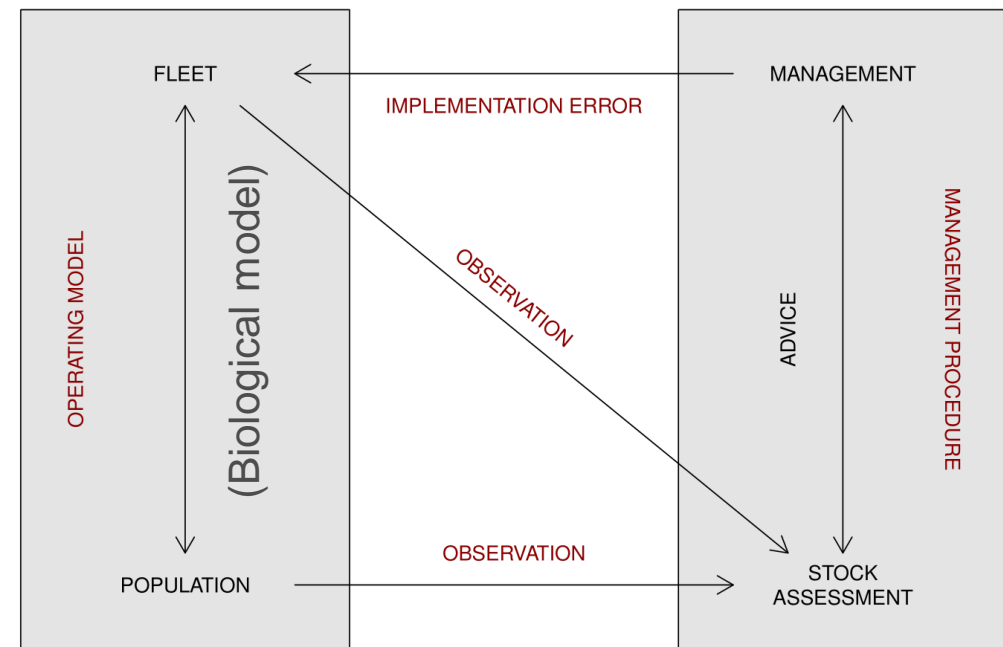
- Simulation exercise to predict the performance of the harvest control rule.
- Robustness test the HCRs under “what if conditions”:
 - what if we get uncertainty estimates wrong
 - what if we get the natural mortality wrong
 - what if there is a recruitment failure
 - what if we got any other model assumption wrong
- Check if management goals are achieved.

What is an MSE?

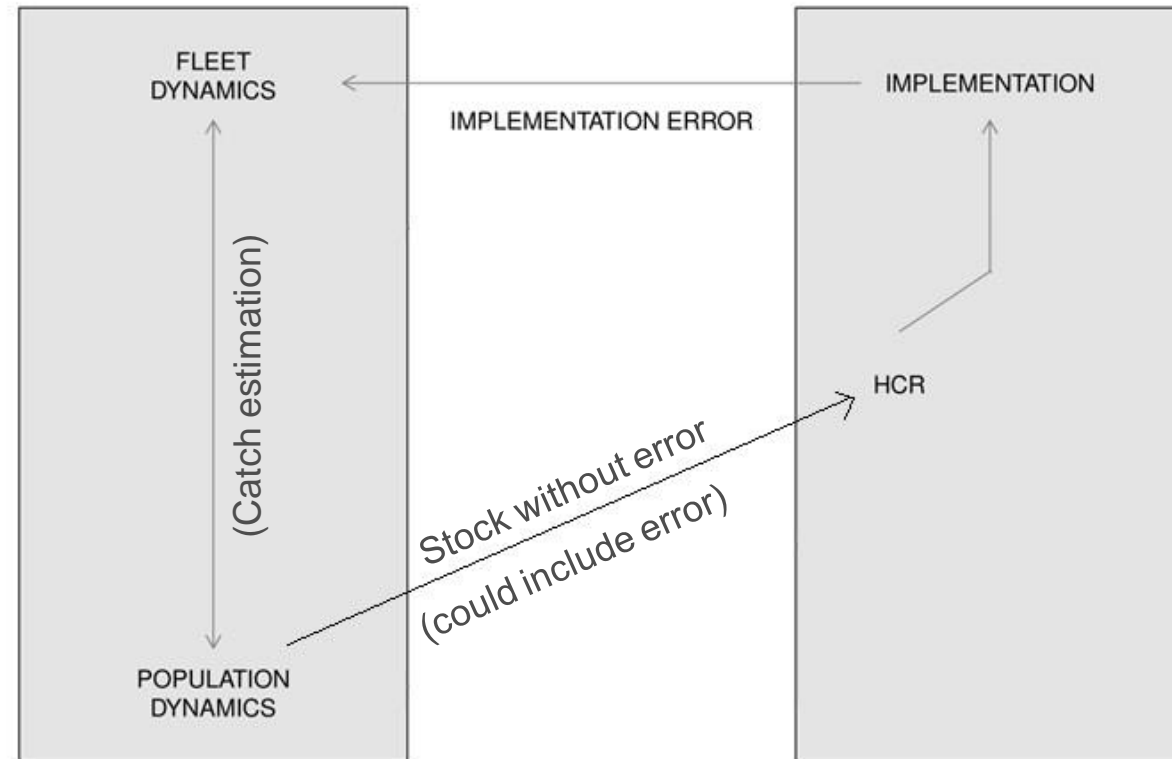
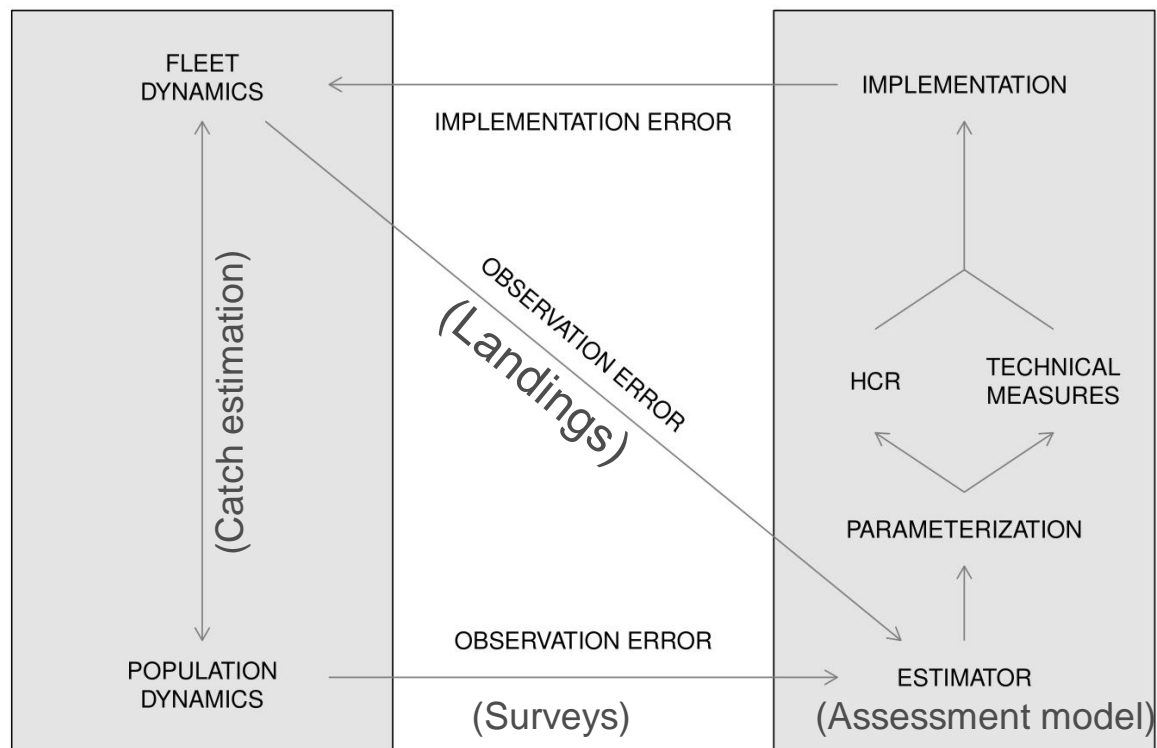
Reality



MSE simulation

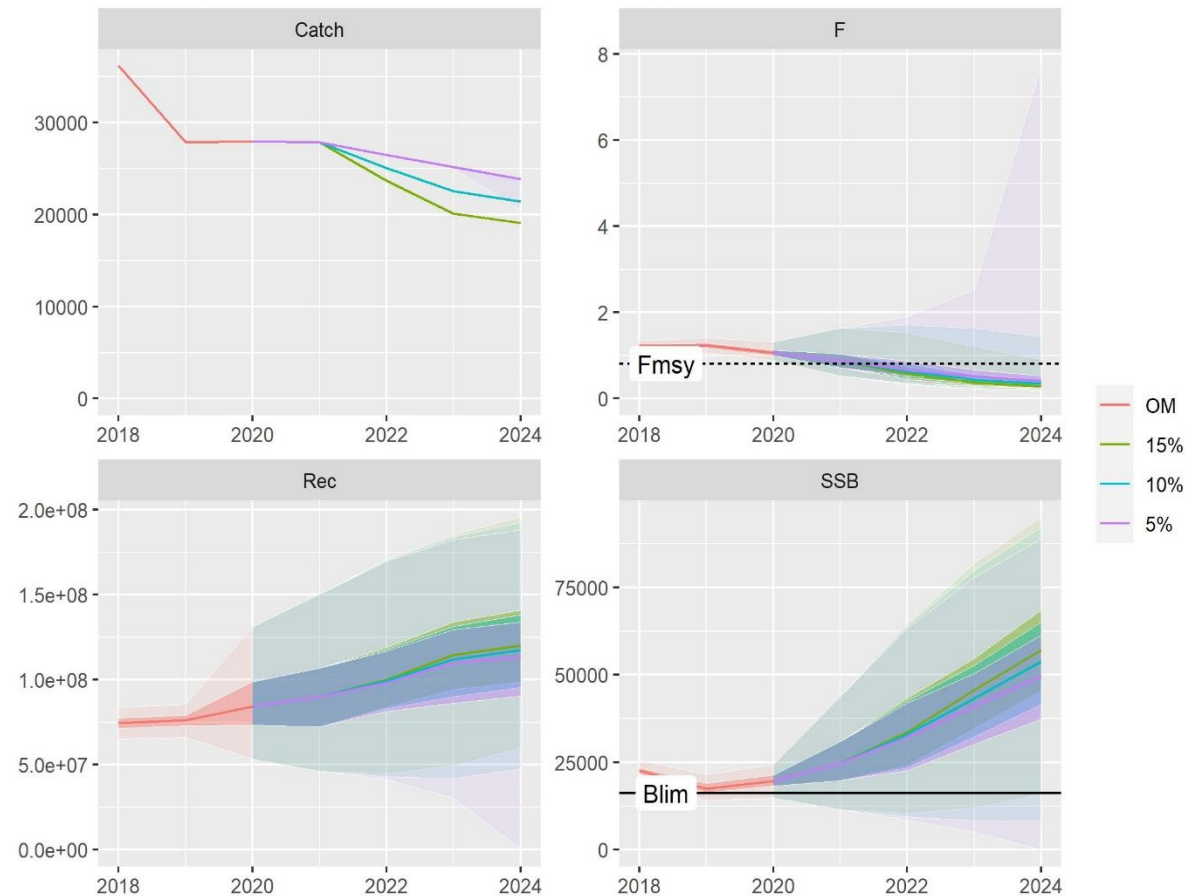


MSE: shortcut vs full-feedback



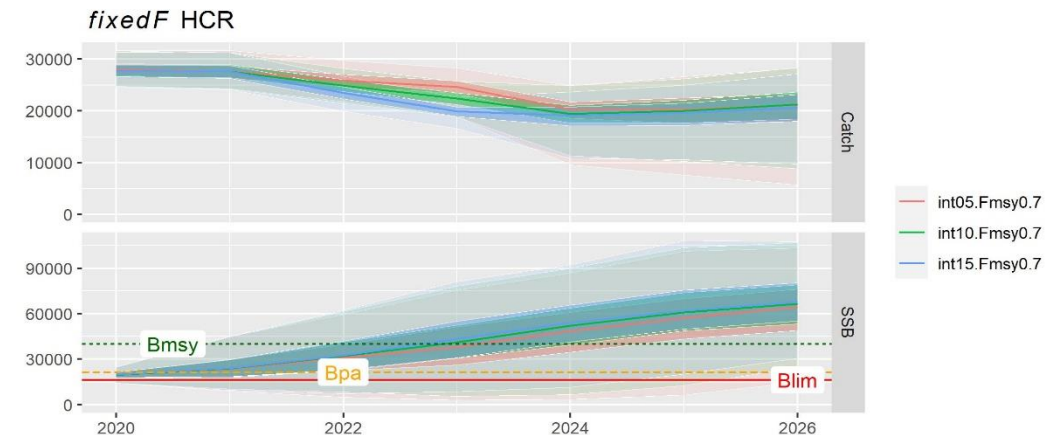
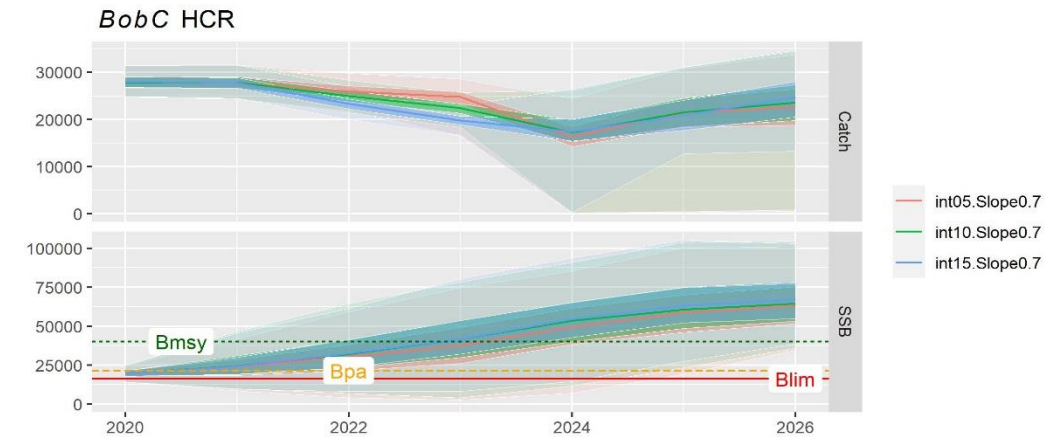
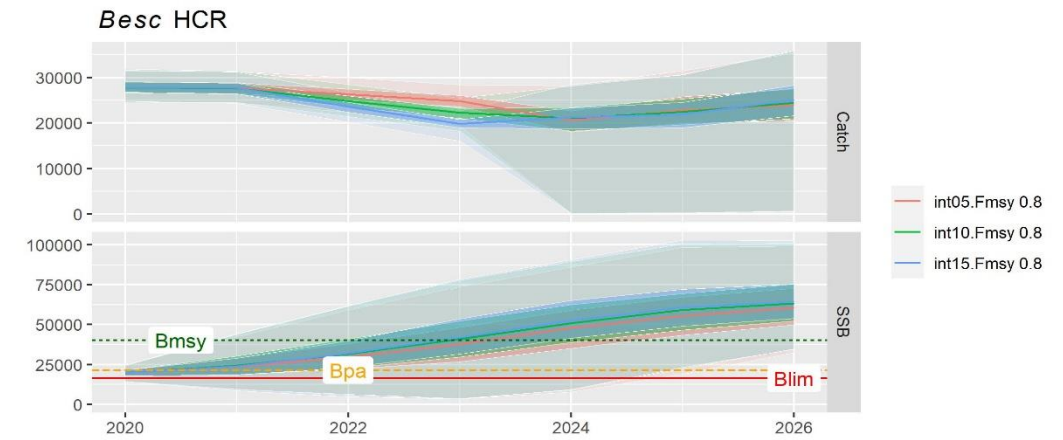
Intermediate years – what are the effects?

- Implementation of HCR in 2024.
- Until then gradual reduction in catches:
 - 2020 – same catch as 2019
 - 2021 – same catch as 2020
 - 2022 – 85%/90%/95% of catch in 2021
 - 2023 – 85%/90%/95% of catch in 2022



Intermediate years

- Little effect in long term
- Short term can result in closures (SSB < Blim) if recruitment is not sufficient
- Requires direct management action, as reductions are deterministic.



What is an HCR?

“A pre-agreed and well-defined rule or action(s) that describes how management should adjust management measures in response to the state of specified indicator(s) of stock status. This is described by a mathematical formula.” - Joint tuna RFMO Management Strategy Evaluation Working Group⁽¹⁾

The rule is pre-agreed and the resultant management measures should not to be altered.

(1) https://tuna-org.org/Documents/MSEGlossary_tRFMO_MSEWG2018.pdf

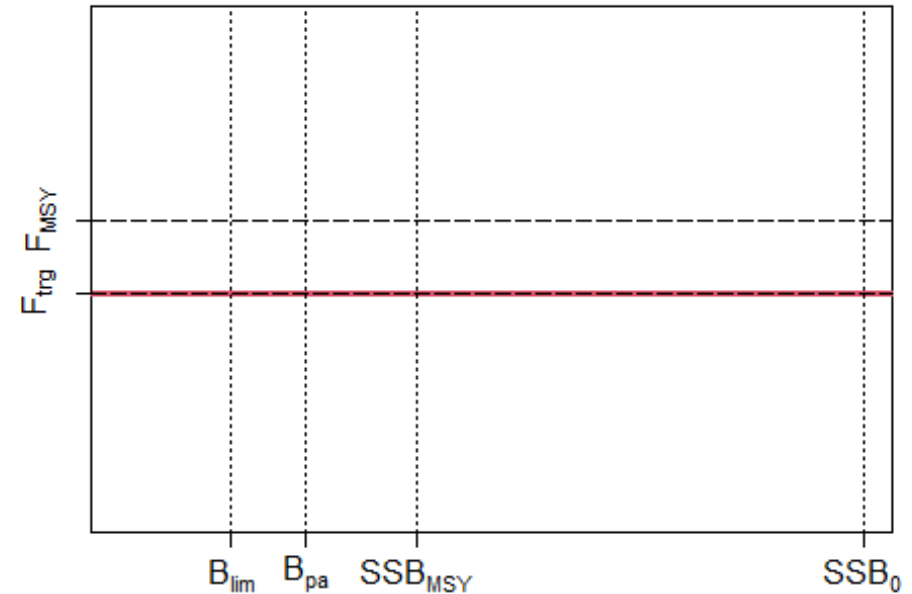
What does that mean for us?

- Rule(s):
 - Fixed F
 - Bay of Biscay Style
 - Biomass escapment
- Management measure:
 - TAC
- Stock status indicator:
 - SSB

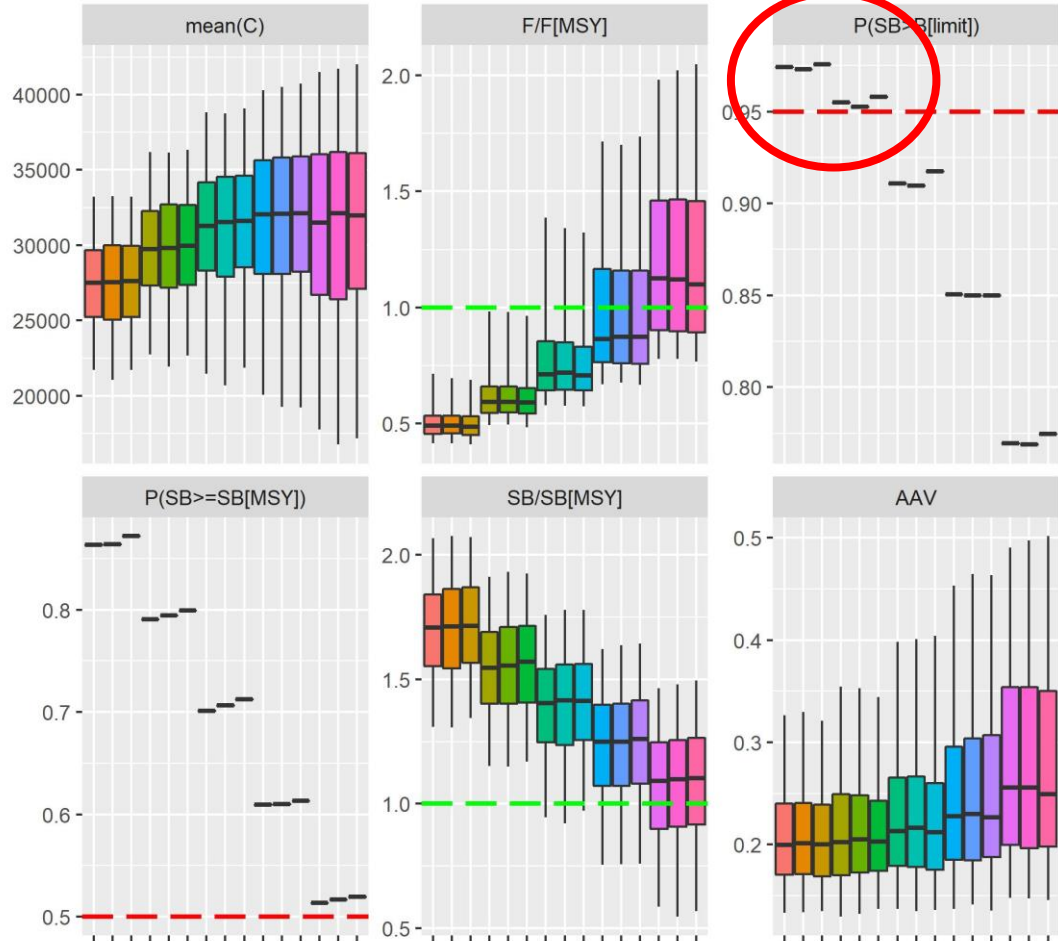
Our Harvest Control Rules (1)

fixedF

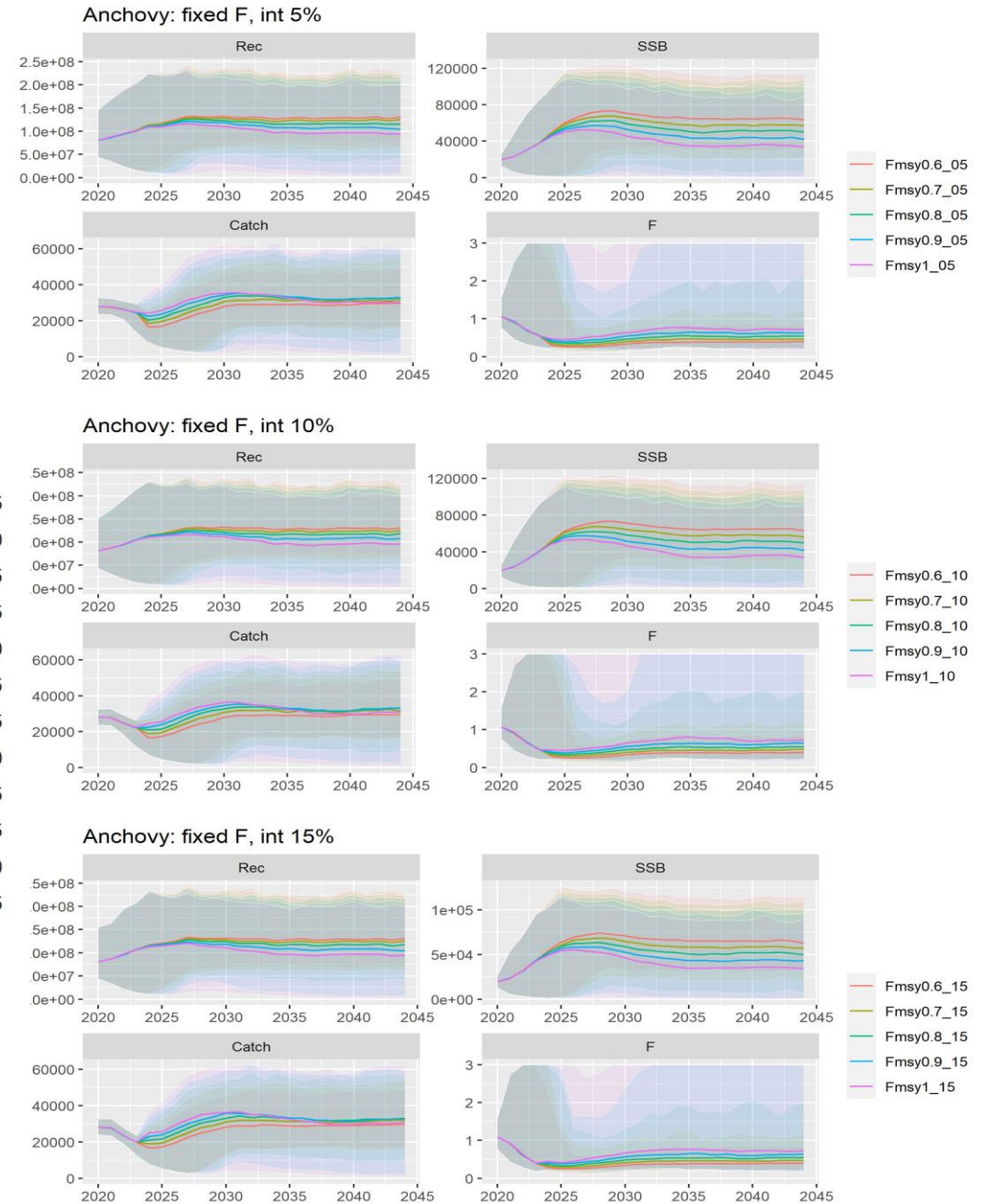
- the fishing mortality is kept constant
- The value of F:
 - Fractions of F_{msy}



Tuning runs



- Fmsy0.6_05
- Fmsy0.6_10
- Fmsy0.6_15
- Fmsy0.7_05
- Fmsy0.7_10
- Fmsy0.7_15
- Fmsy0.8_05
- Fmsy0.8_10
- Fmsy0.8_15
- Fmsy0.9_05
- Fmsy0.9_10
- Fmsy0.9_15
- Fmsy1_05
- Fmsy1_10
- Fmsy1_15



Our Harvest Control Rules (2)

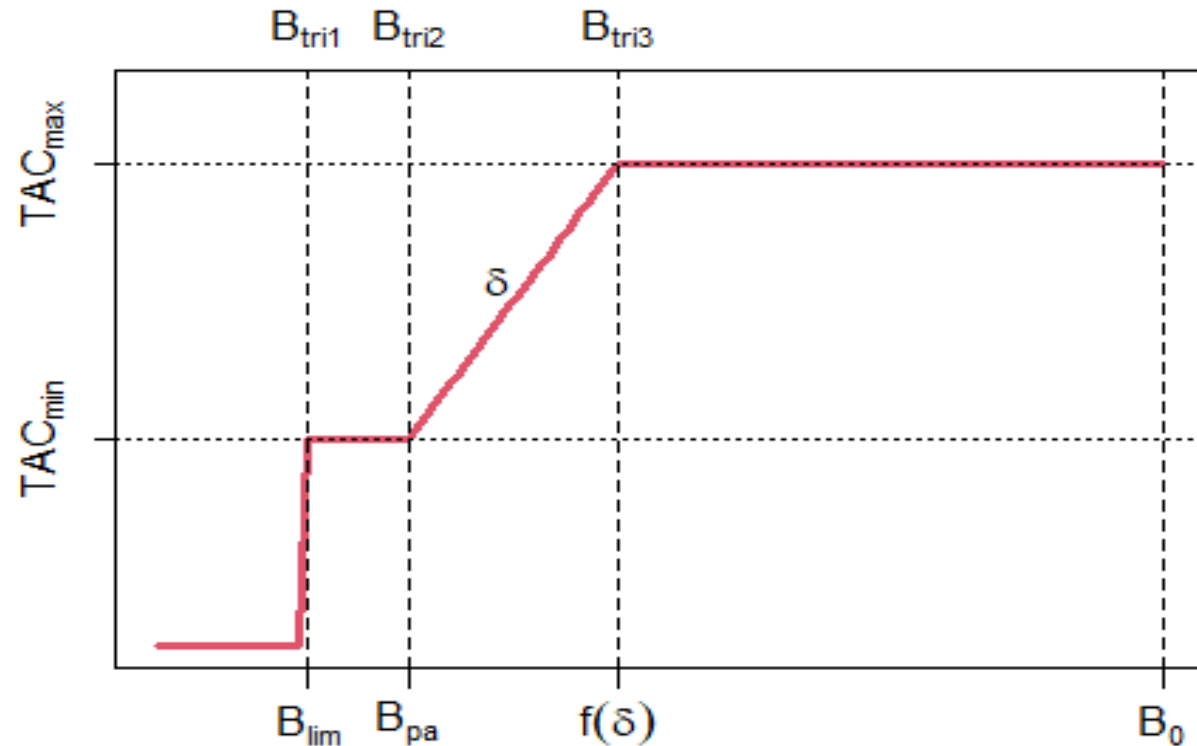
BoB HCR

$B_{lim} = 16200t$

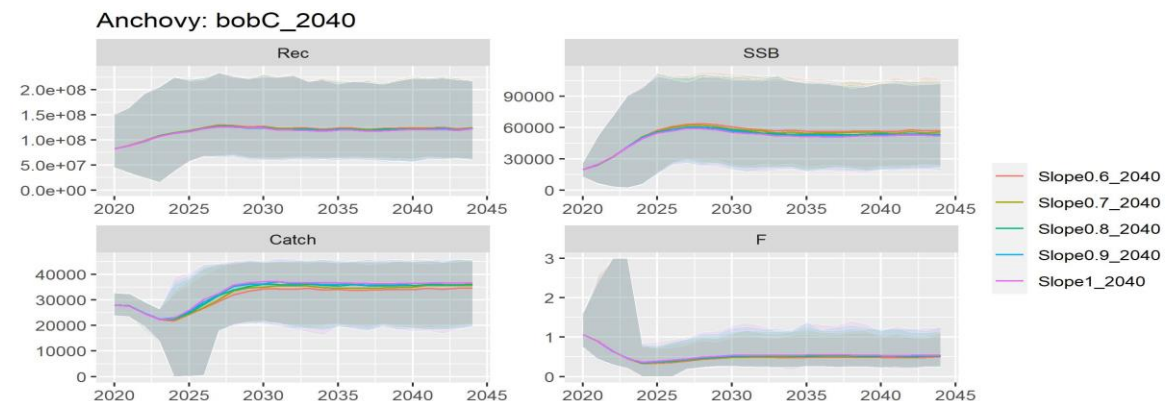
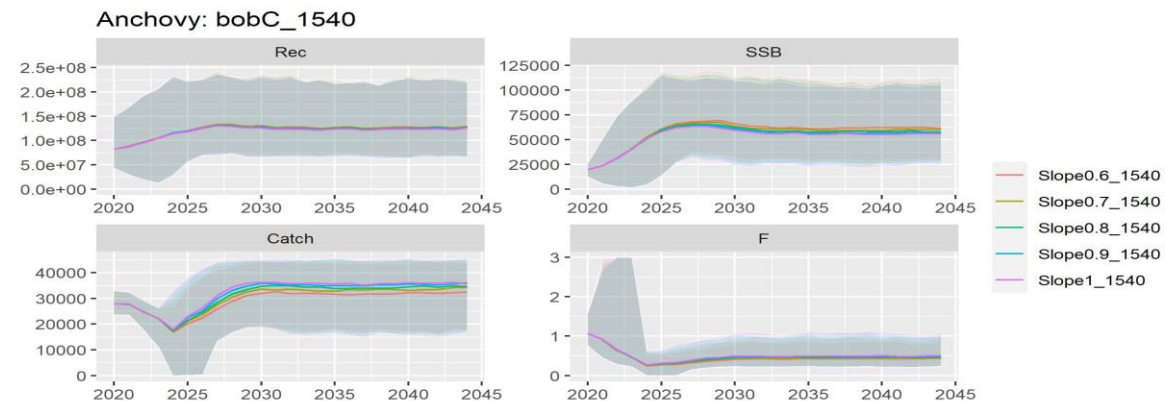
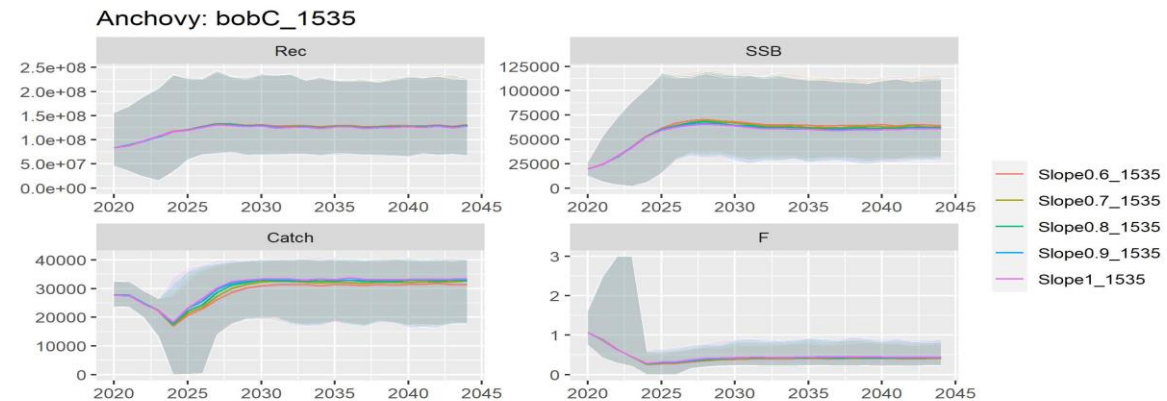
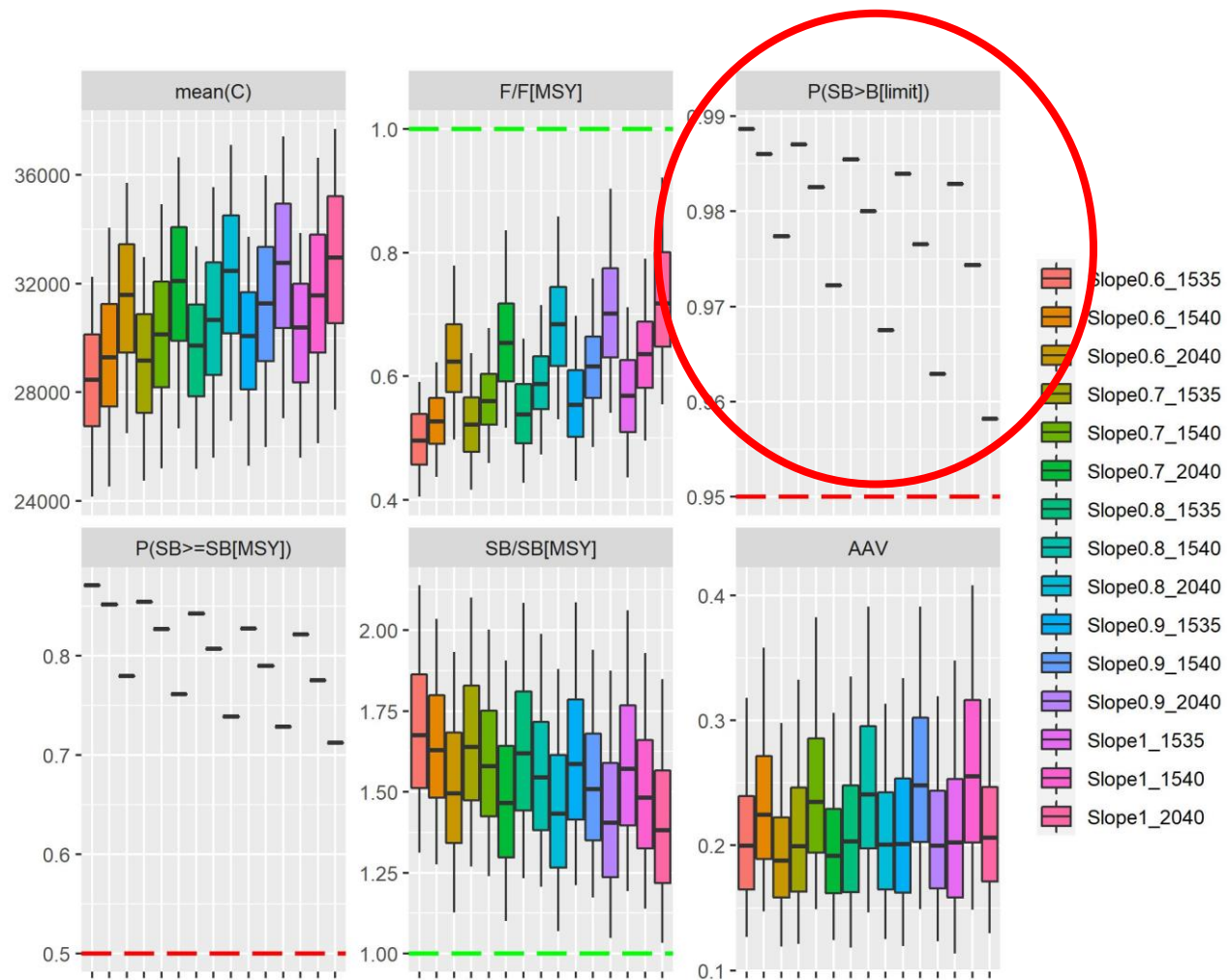
$B_{pa} = 21400t$

$TAC_{min} = 15/20kt$

$TAC_{max} = 35/40kt$



Tuning runs

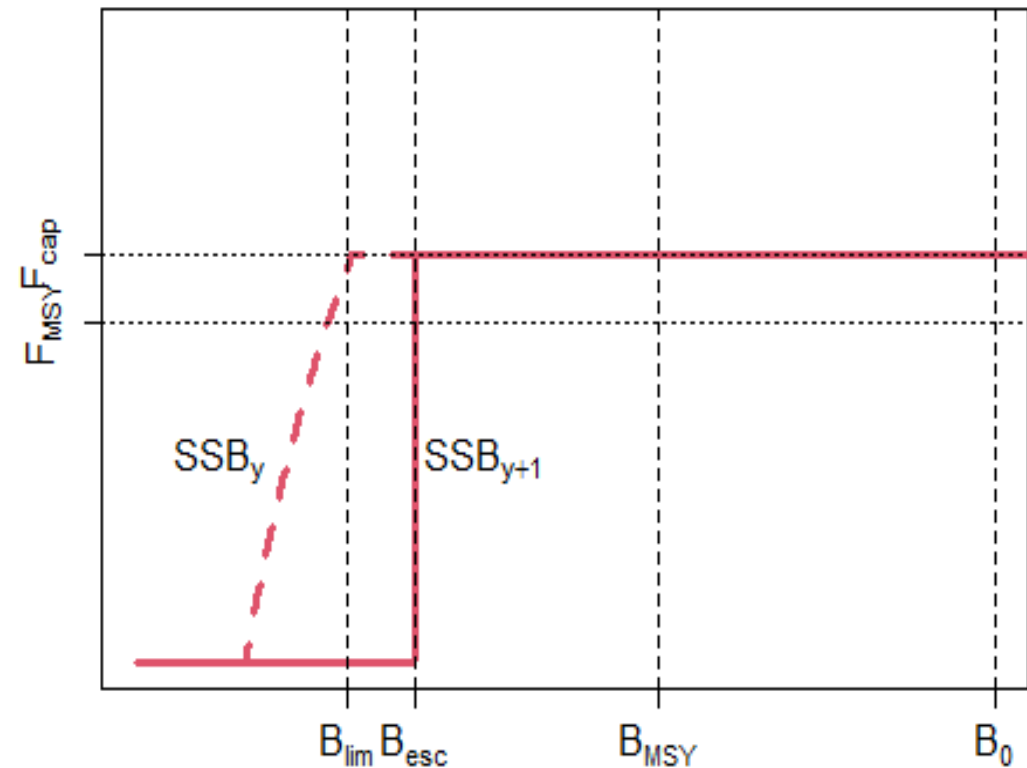


Our Harvest Control Rules (3)

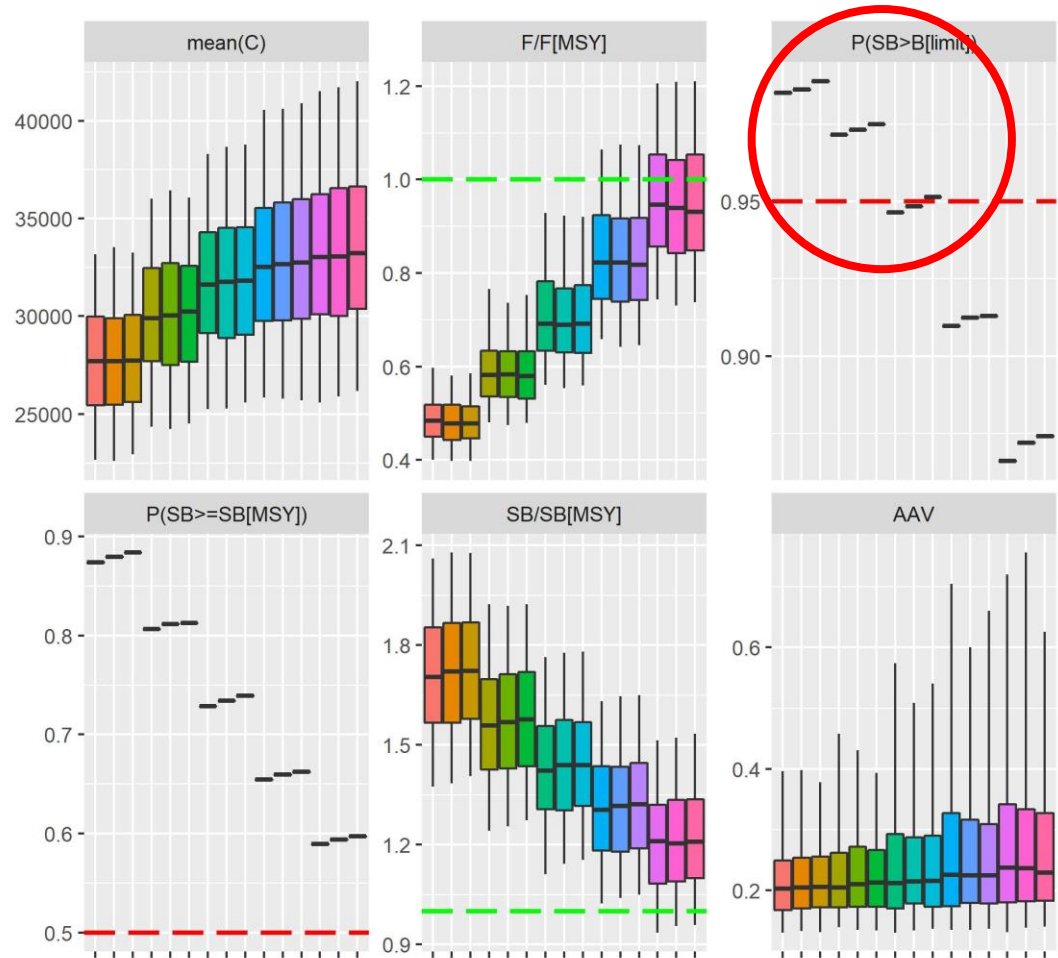
B_{esc} (Biomass escapement)

- A given amount of the SSB is left
 - we set $B_{esc} = B_{pa}$ (21.4kt)
- Inclusion of max fishery mortality
 - necessary to stop over-exploitation

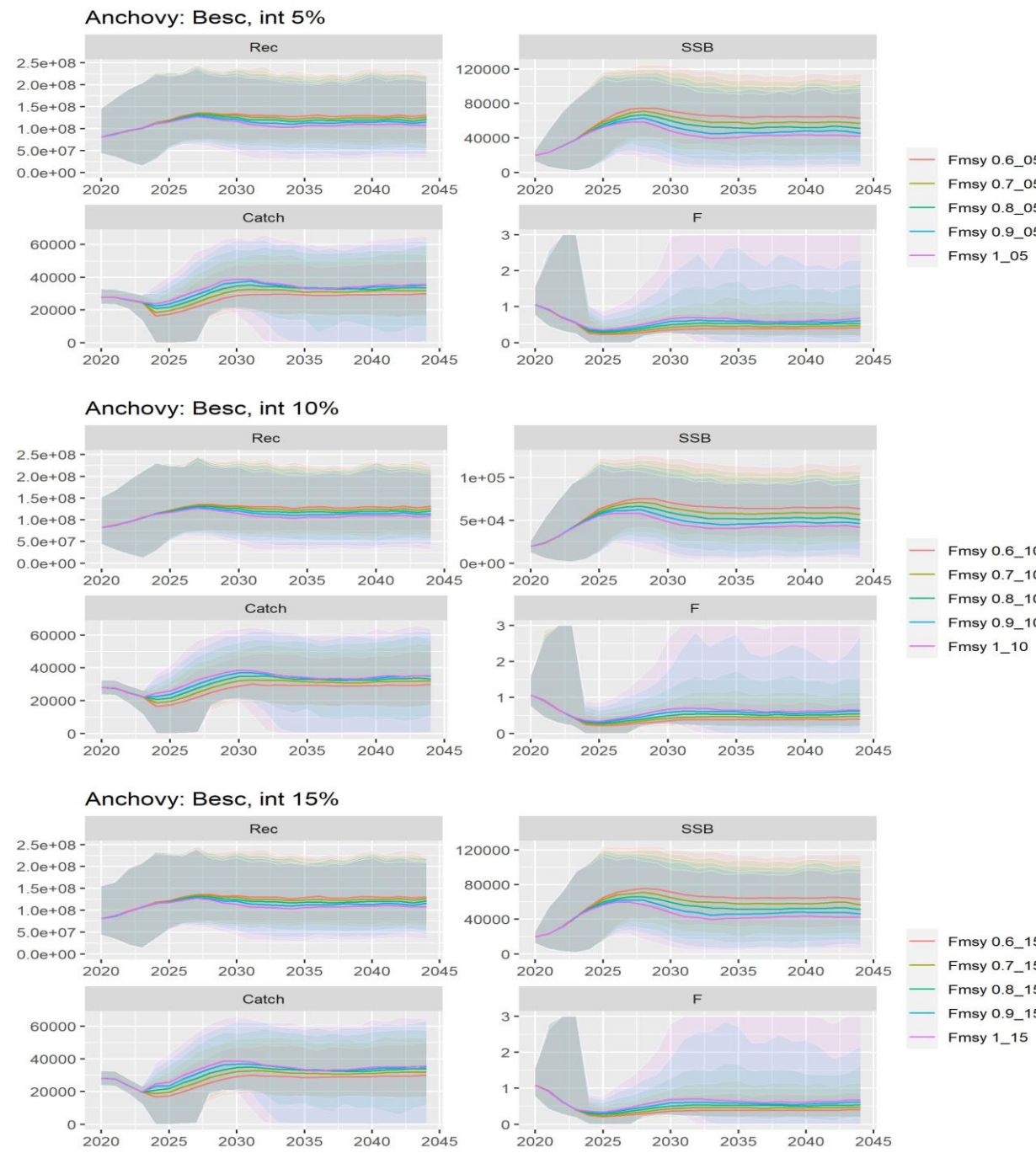
$$TAC_{y+1} = \begin{cases} 0 & \text{if } \widehat{SSB}_{y+1} < B_{esc} \\ g(\widehat{F}_{y+1}) & \text{if } \widehat{F}_{y+1} < F_{cap} \\ g(F_{cap}) & \text{if } \widehat{F}_{y+1} \geq F_{cap} \end{cases}$$



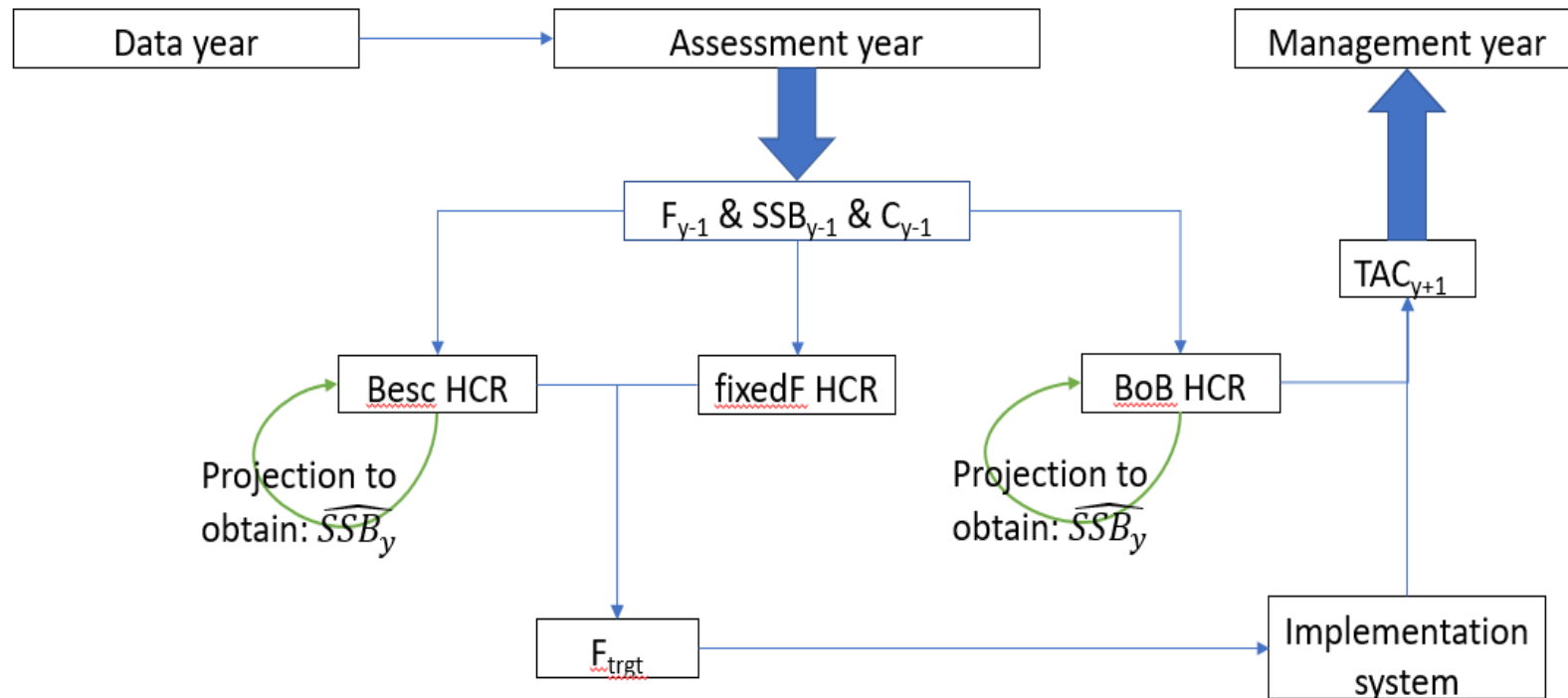
Tuning runs



- Fmsy 0.6_05
- Fmsy 0.6_10
- Fmsy 0.6_15
- Fmsy 0.7_05
- Fmsy 0.7_10
- Fmsy 0.7_15
- Fmsy 0.8_05
- Fmsy 0.8_10
- Fmsy 0.8_15
- Fmsy 0.9_05
- Fmsy 0.9_10
- Fmsy 0.9_15
- Fmsy 1_05
- Fmsy 1_10
- Fmsy 1_15



The entire cycle (full feedback): mind the lag



Robustness tests

The HCRs taken forward

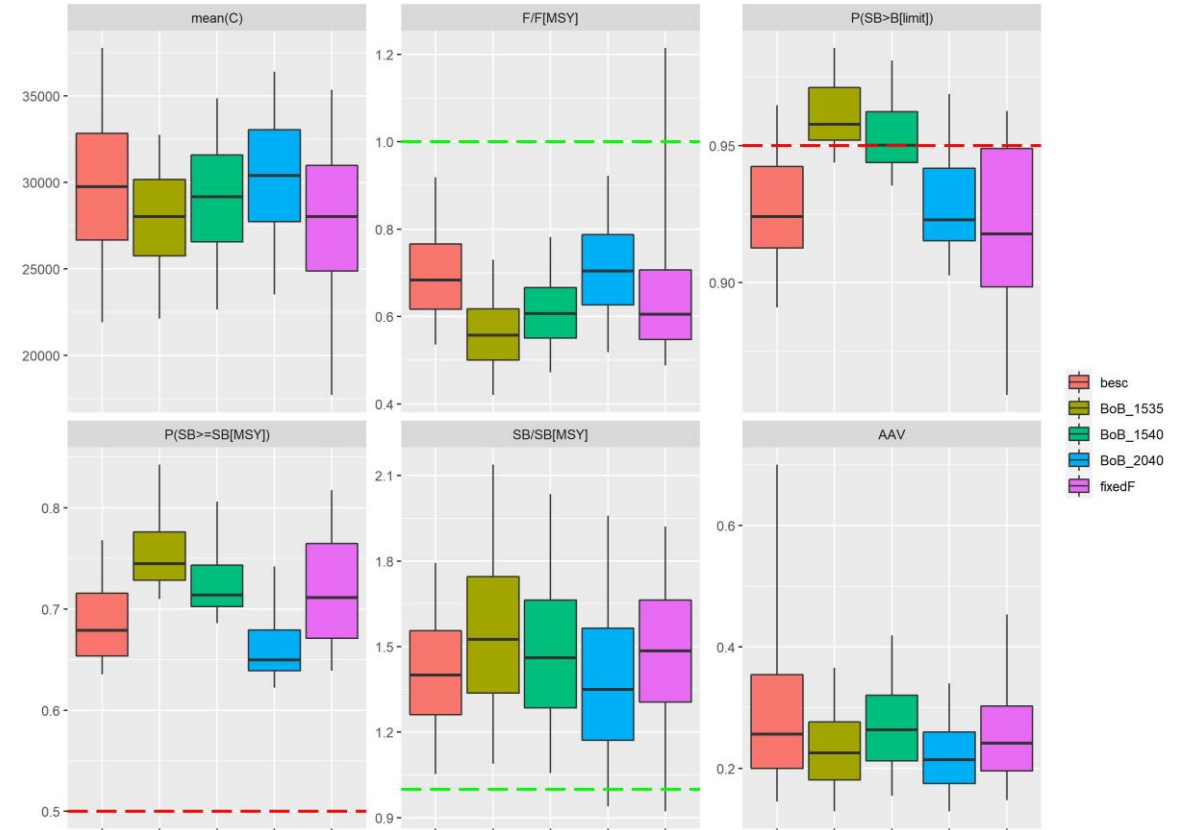
- fixedF with $F_{tar} = 0.7F_{msy}$
- Besc relative to Bpa with $F_{cap} = 0.8F_{msy}$
- BoB_1535 with slope = 0.8
- BoB_1540 with slope = 0.8
- BoB_2040 with slope = 0.8

Robustness tests

- Natural mortality:
 - Base case
 - Alternative: fixed at 0.9
- recruitment failure (LowRec) corresponds to a forcing for three consecutive years (from 2028 to 2030) of a 35% reduction of the expected recruitment from the BH-SR relationship (by a application of 0.65 multiplier).
- Increased recruitment variation (hiVar), passing from the modal to the mean variability of recruitment (σ_R) around expectations according to the BH-SRR, i.e. adopting the mean $\sigma_R = 0.49$ – value arising from the hierarchical multivariate model FishLife (Thorson, 2020).
- autocorrelation within recruitment (ar1Rec); such value was set to 0.456 based on the estimate of $\rho = 0.456$ by Thorson et al. (2014).

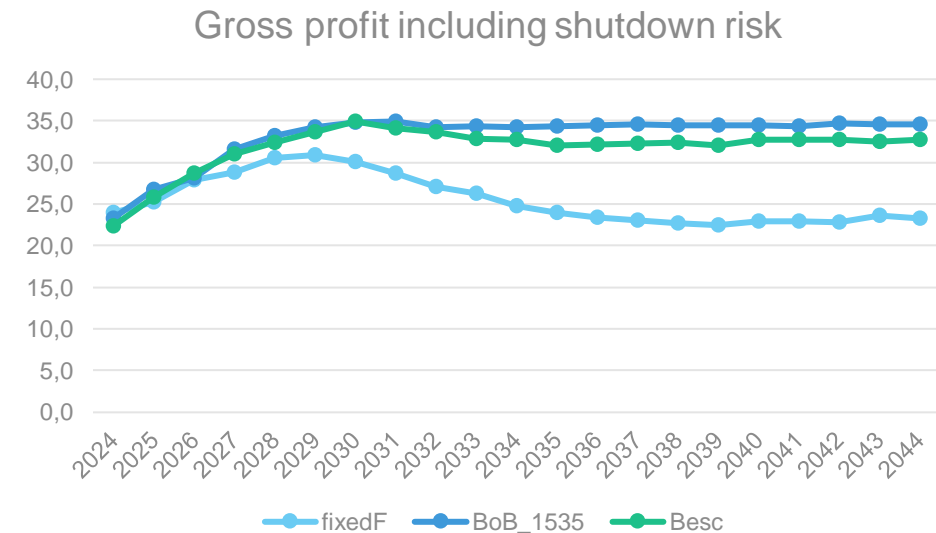
Combined results

- Only 2 HCRs pass
 - BoB1535
 - BoB1540



Economic assessment

- If Sardine is fished at F_{msy}
- Gross profit multiplied by shutdown risk
- Very crude and only to be taken as a qualitative statement



Thank you



© European Union 2020

Unless otherwise noted the reuse of this presentation is authorised under the [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/) license. For any use or reproduction of elements that are not owned by the EU, permission may need to be sought directly from the respective right holders.

Slide xx: **element concerned**, source: e.g. [Fotolia.com](https://www.fotolia.com/); Slide xx: **element concerned**, source: e.g. [iStock.com](https://www.istock.com/)

SIGN UP FOR THE EWG 21-04

Contact me or go directly to the STECF website to sign up for the Expert working group.

<https://stecf.jrc.ec.europa.eu/ewg2104>