*Working document for Focus Group on Western Horse Mackerel 2020*

**Evaluation of rebuilding plans for Western horse mackerel**

Martin Pastoors, 13/08/2020

**Abstract**

*To be done*

# Introduction

A technical subgroup of the PELAC Focus Group on Western horse mackerel has developed and applied several evaluation tools to evaluate potential rebuilding plans for western horse mackerel. Although in the most recent assessment of western horse mackerel (WGWIDE 2019), the stock was assessed to be above Blim, there is a general perception that the stock is not doing well and that the development of a rebuilding plan would be appropriate.

# Data and methods

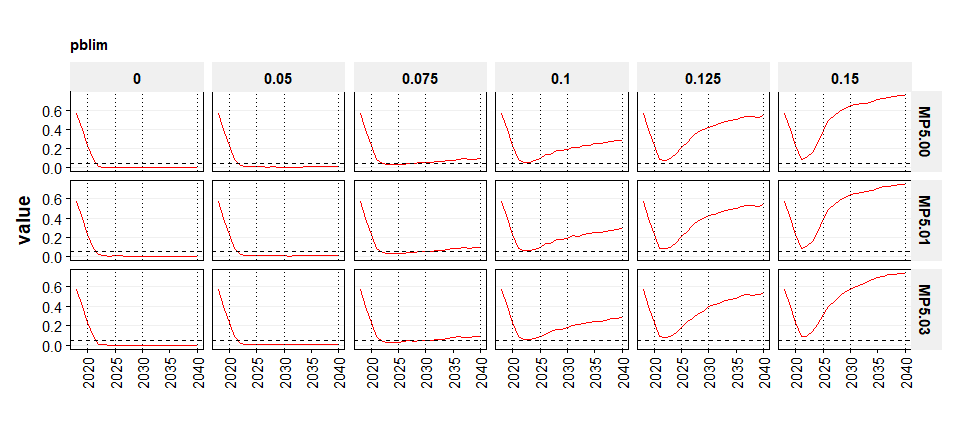
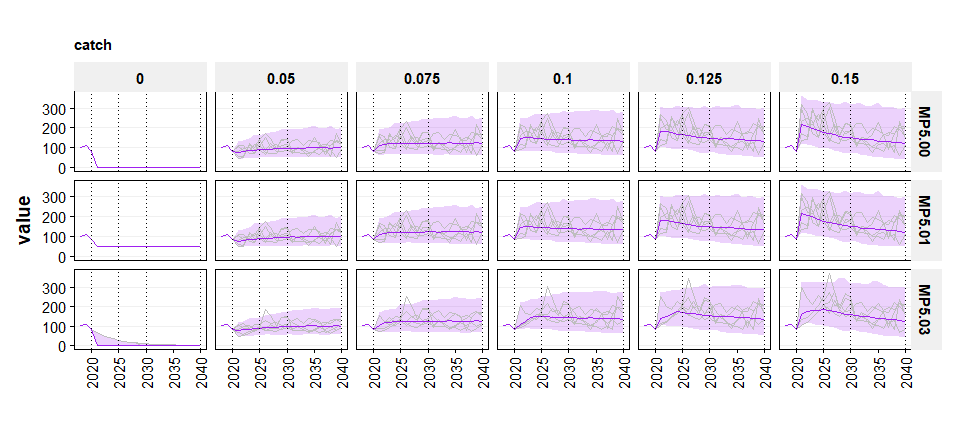
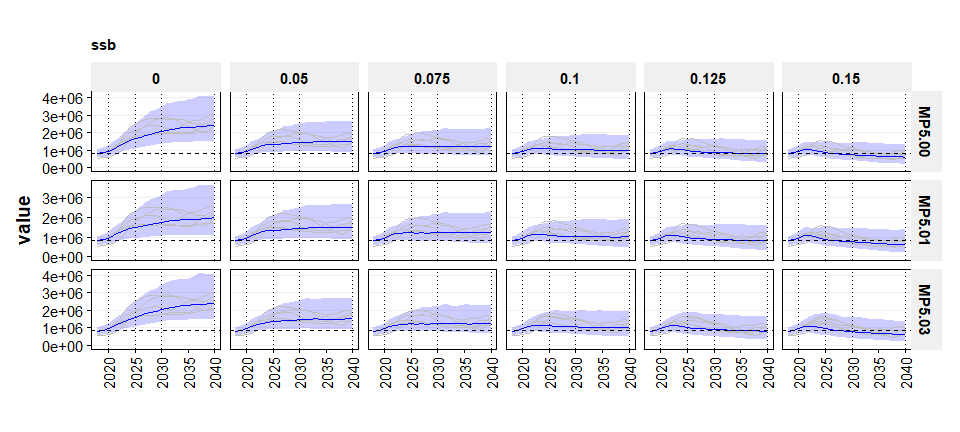
The approach to evaluate potential harvest control rules (HCR) for western horse mackerel is based on two different assessments (Stock synthesis and SAM) and two different evaluation methods (EqSim and SAM HCR forecast). Both evaluation methods are of the ‘short cut’ type to allow for a rapid evaluation process.

# Results

## EqSim and Stock Synthesis

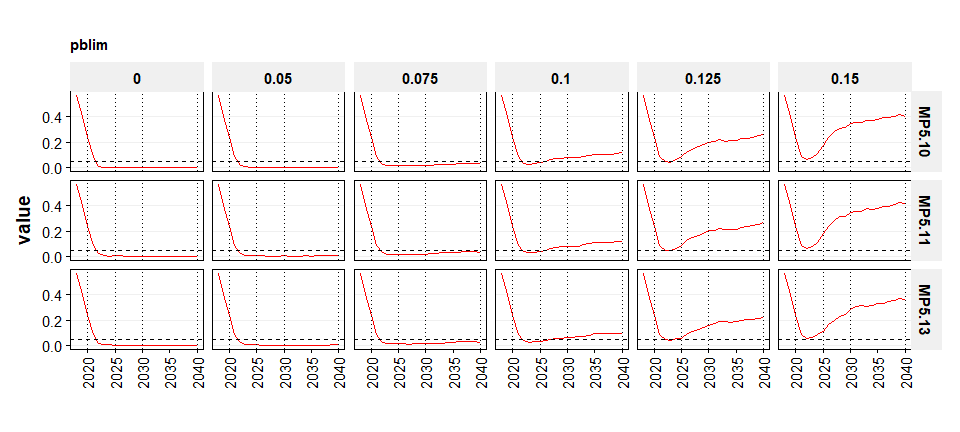
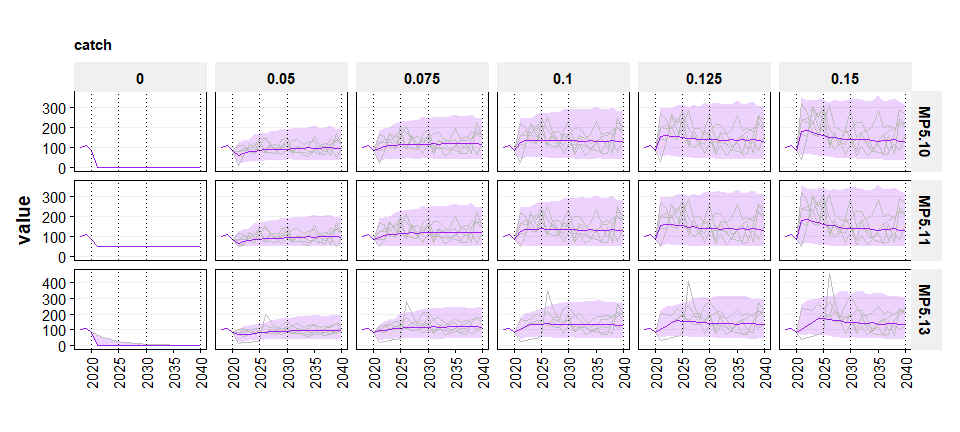
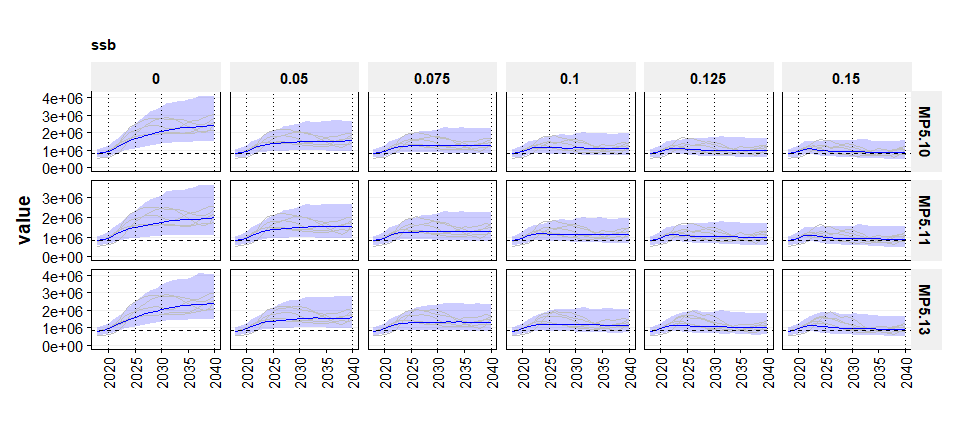
### Constant F strategy

MP5.00 constant F; MP5.01 constant F with minimum TAC of 50kT; MP5.03 constant F with 20% IAV constraint above Btrigger.



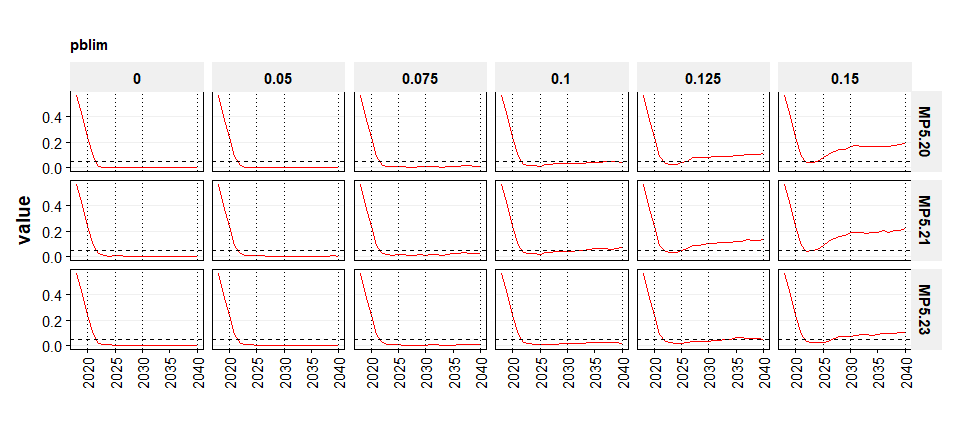
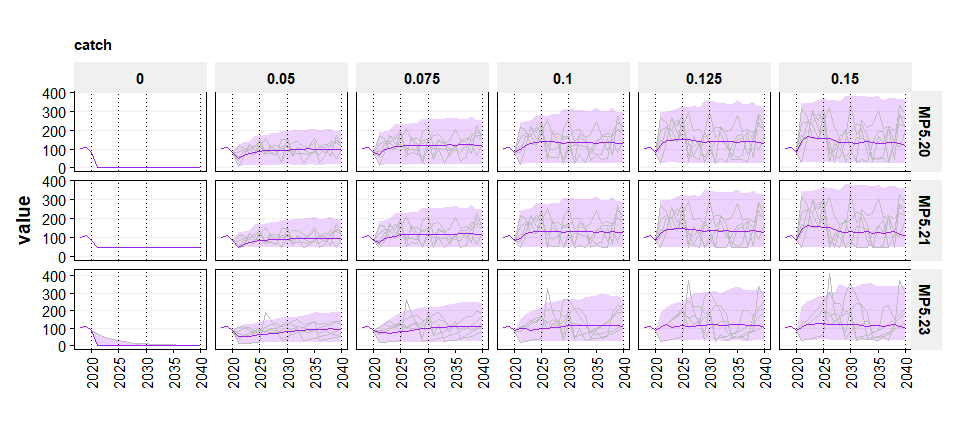
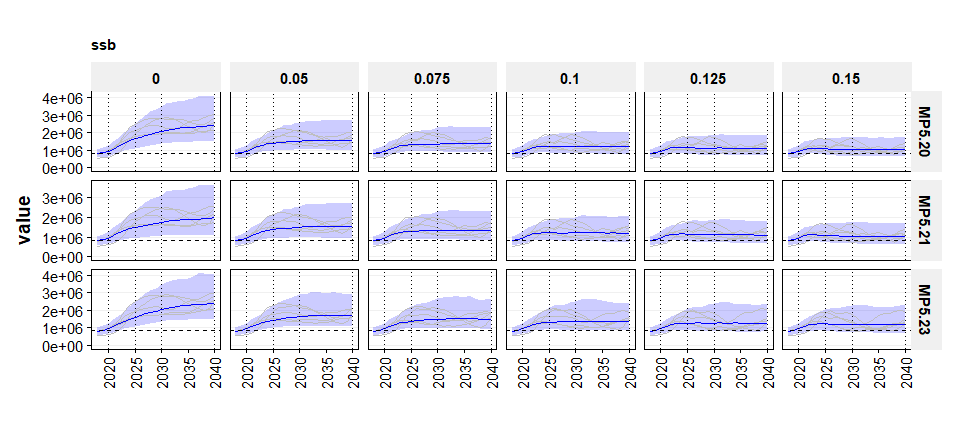
### ICES advice rule

MP5.10 ICES AR; MP5.11 ICES AR with minimum TAC of 50kT; MP5.13 ICES AR with 20% IAV constraint above Btrigger.

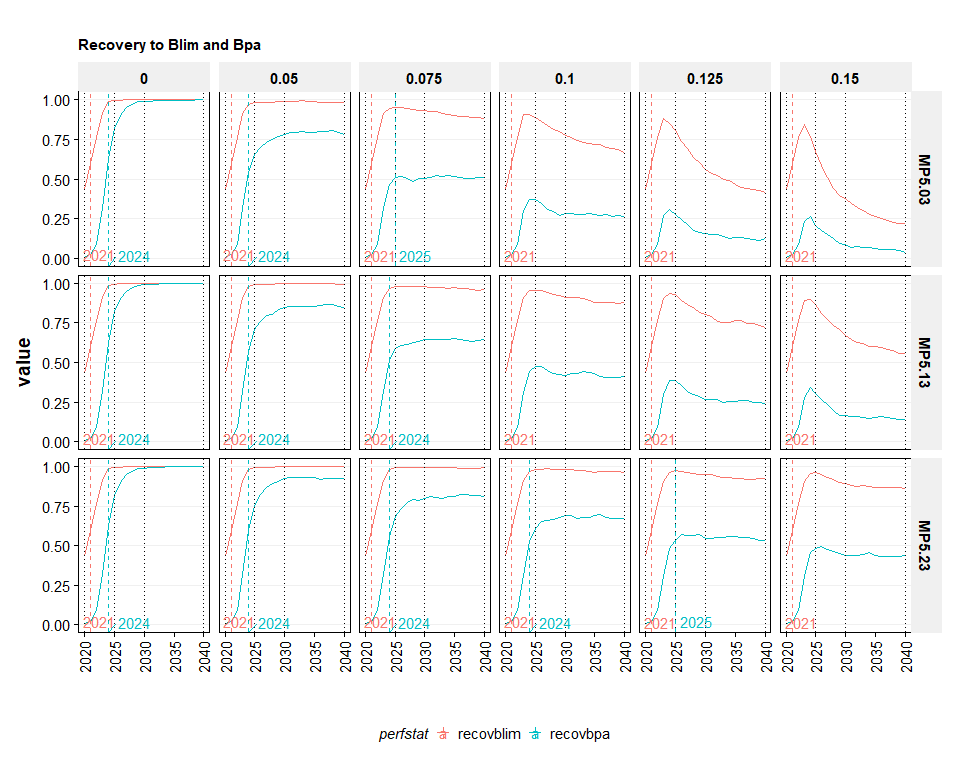


### Double breakpoint rule

MP5.20 Double BP; MP5.11 Double BP with minimum TAC of 50kT; MP5.13 Doubl BP with 20% IAV constraint above Btrigger. Minimum F in Double BP is 20% of Fmsy.



### Probability of achieving rebuilding with 20% IAV constraint above Btrigger



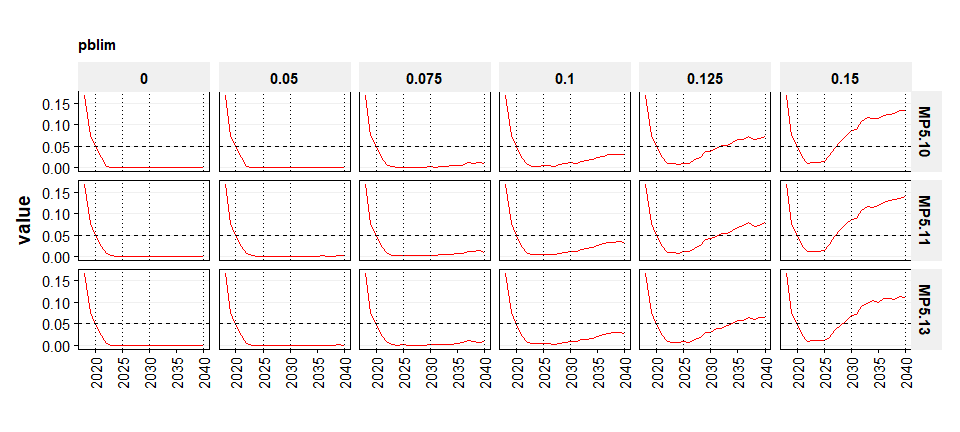
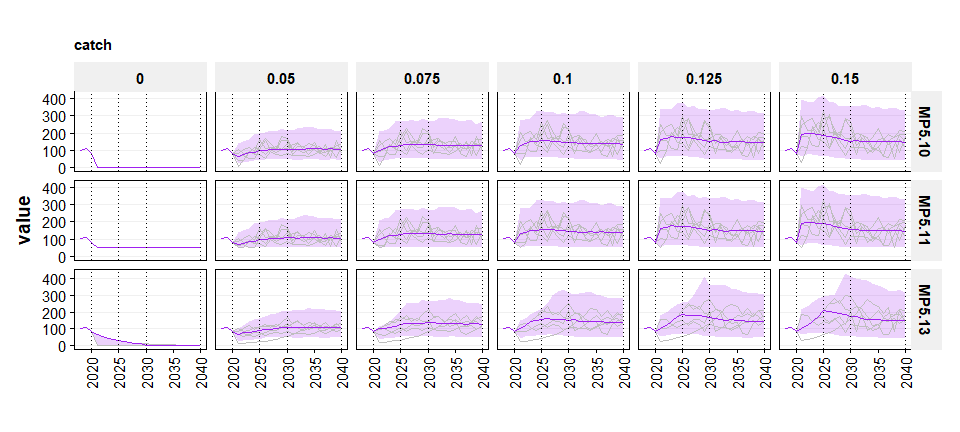
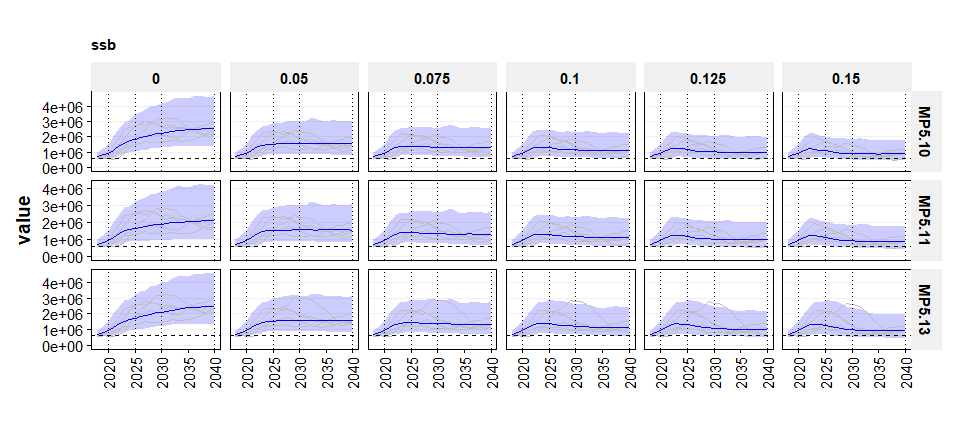
## EqSim and SAM

### Constant F rule with SAM assessment

Results for the constant F rule are not presented because it was clear that this option would not be selected by the PELAC for the potential rebuilding plan.

### ICES Advice Rule with SAM assessment

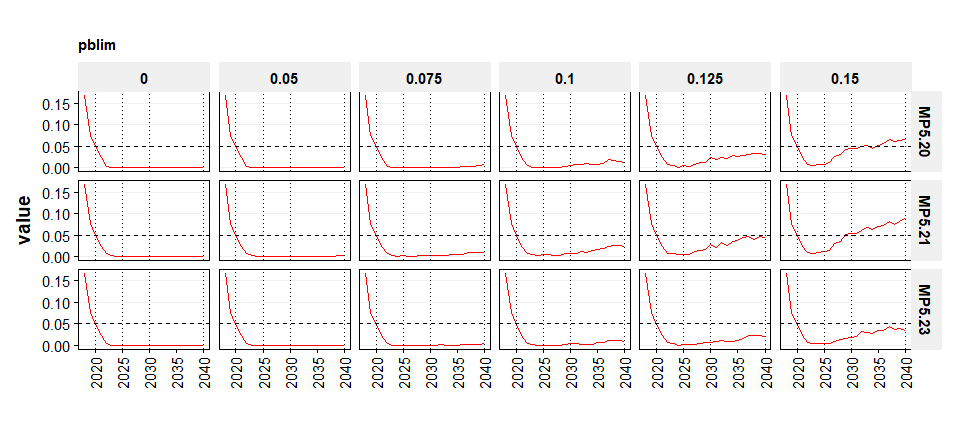
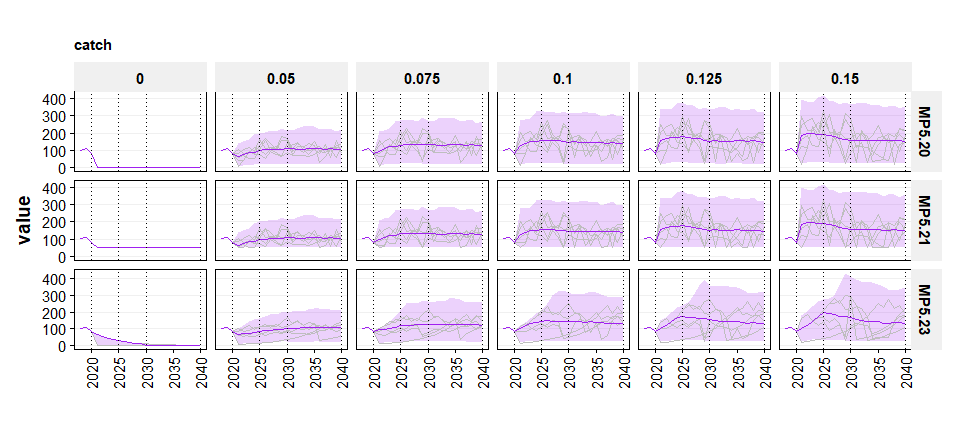
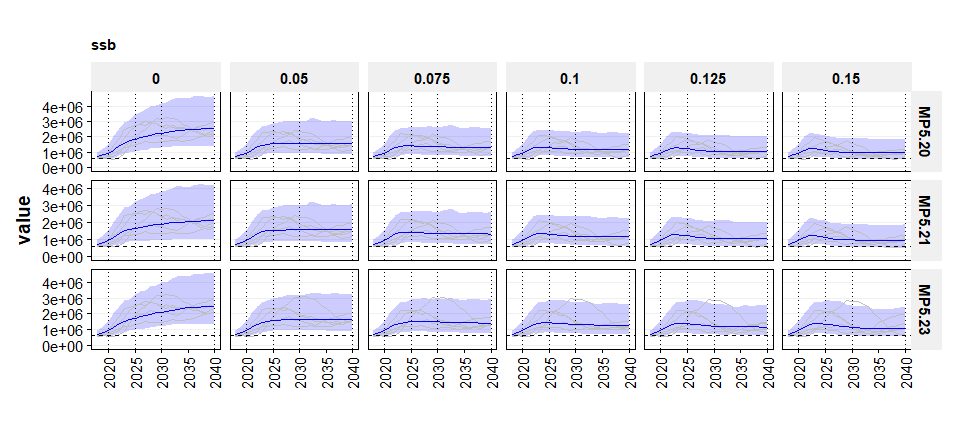
MP5.10 ICES AR; MP5.11 ICES AR with minimum TAC of 50kT; MP5.13 ICES AR with 20% IAV constraint above Btrigger.



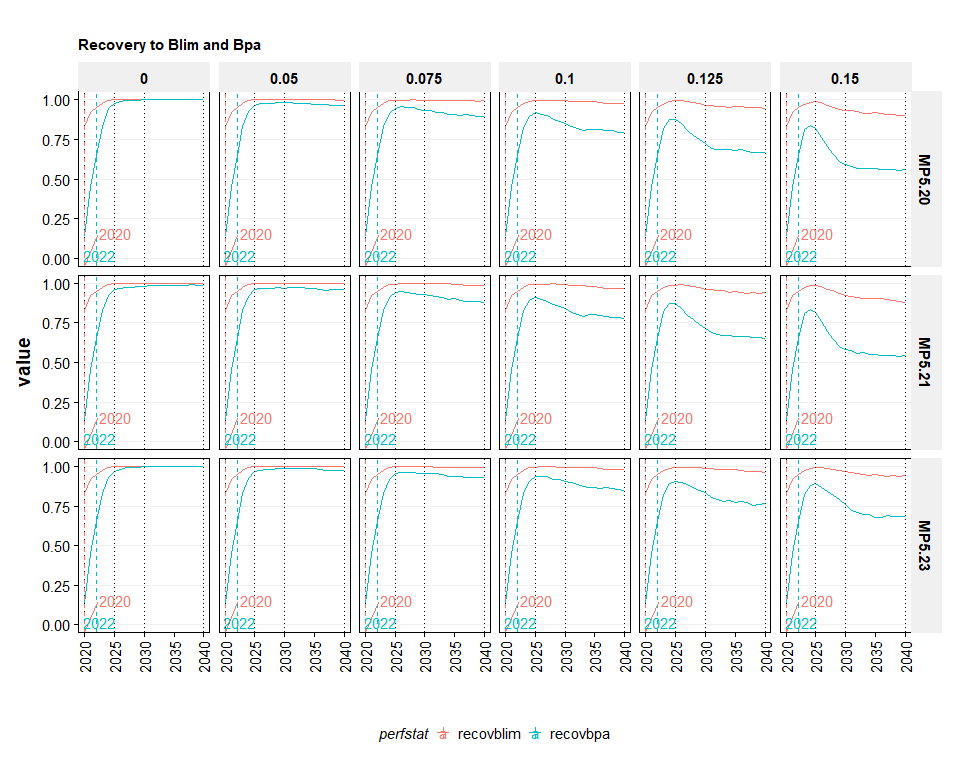
### Double breakpoint rule with SAM assessment

SAM Assessment.

MP5.20 Double BP; MP5.11 Double BP with minimum TAC of 50kT; MP5.13 Doubl BP with 20% IAV constraint above Btrigger. Minimum F in Double BP is 20% of Fmsy.



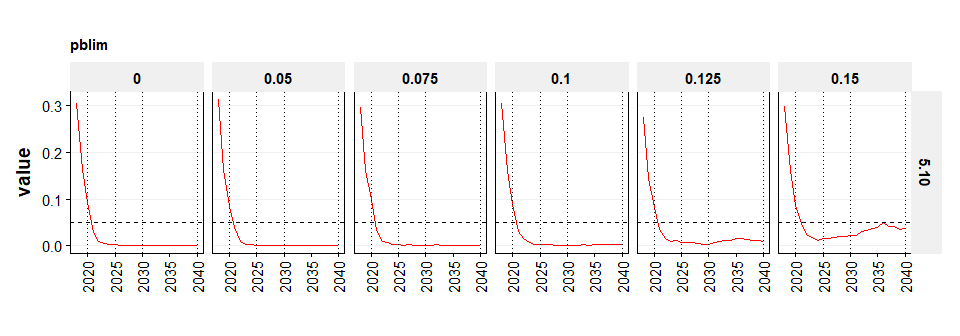
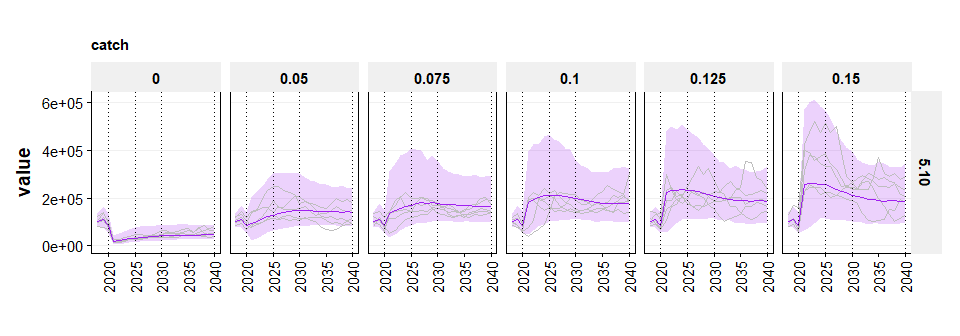
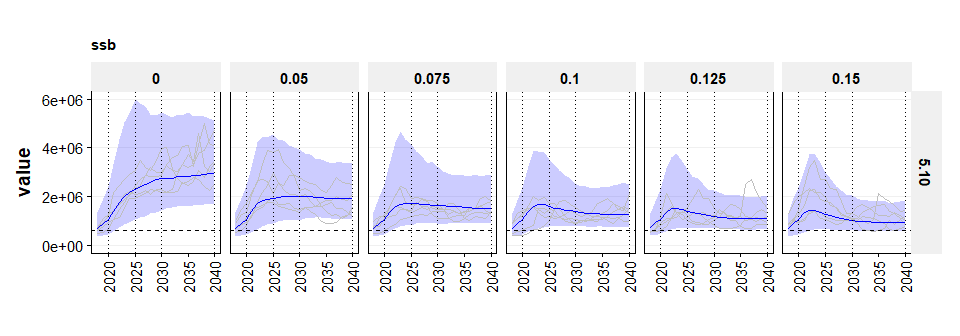
### EqSim SAM: probability of achieving rebuilding with 20% IAV constraint above Btrigger



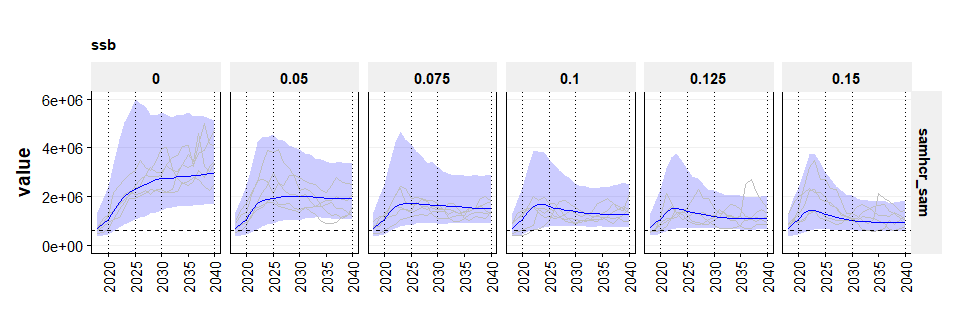
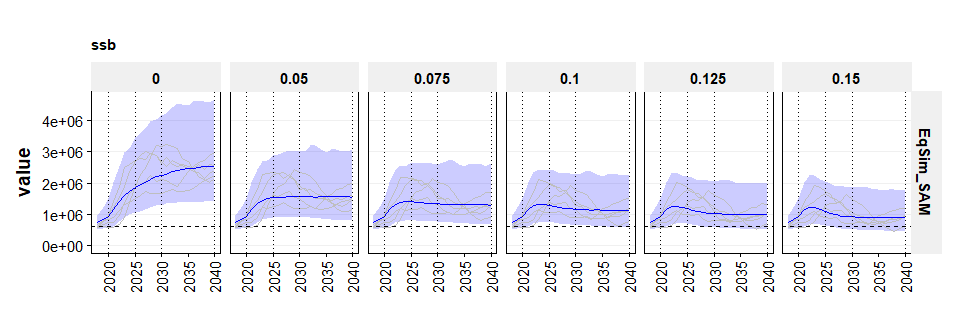
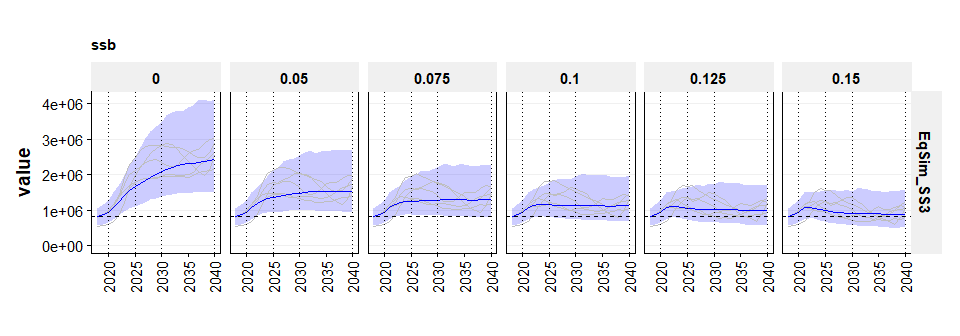
## SAM and SAM HCR forecast

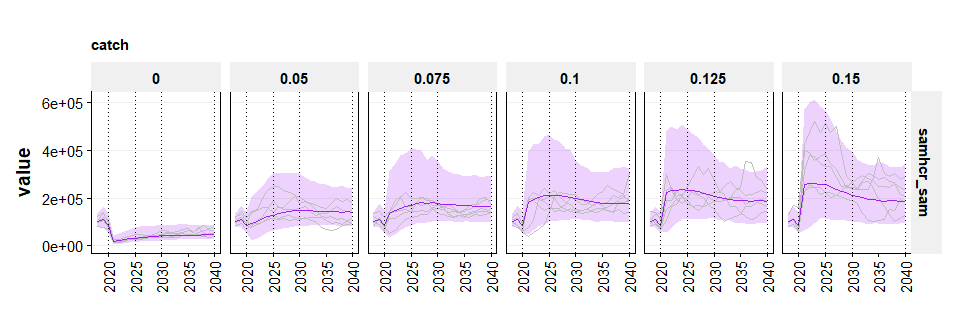
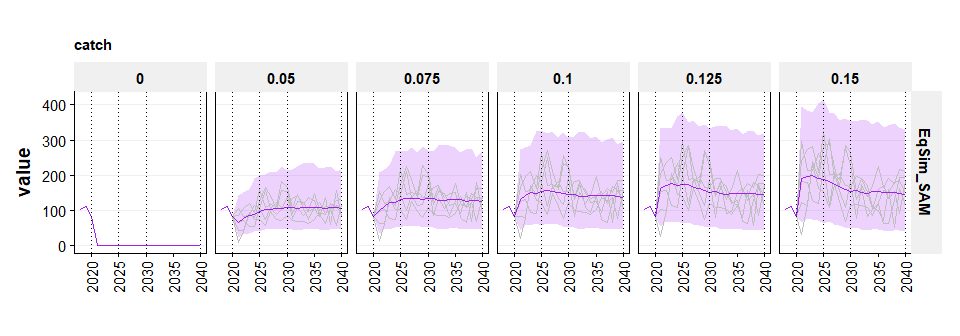
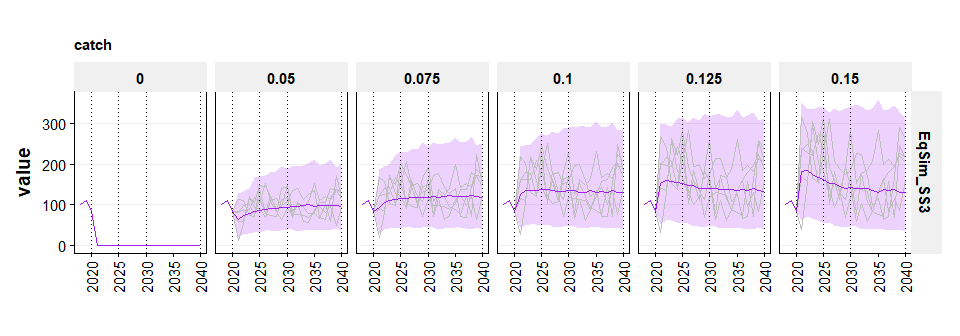
SAM Assessment.

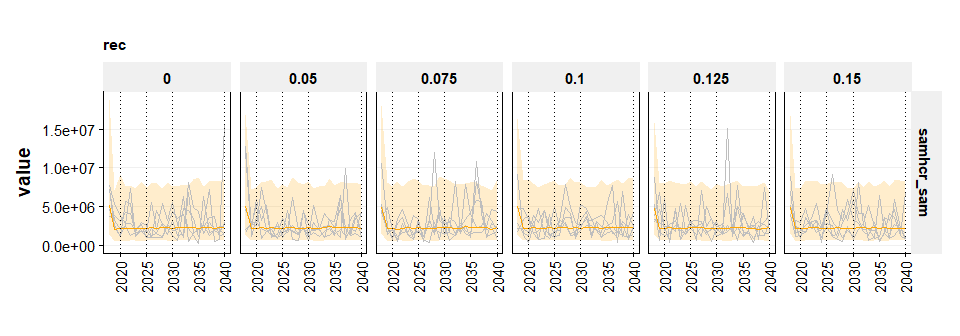
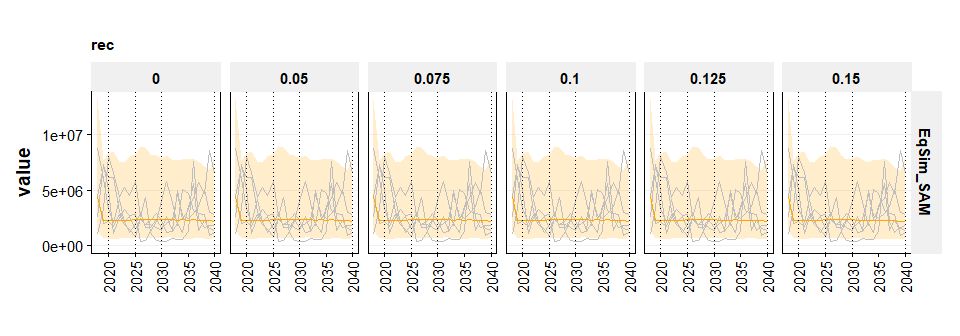
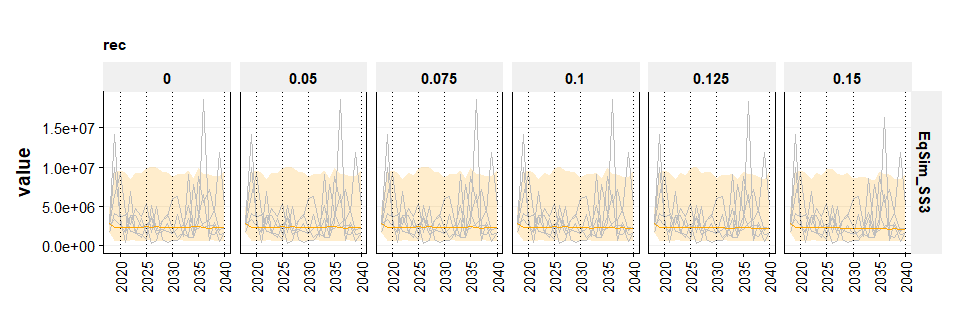
MP5.10 ICES AR.

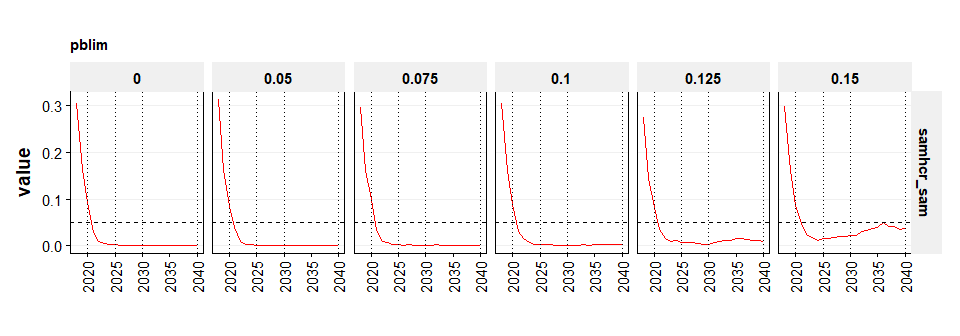
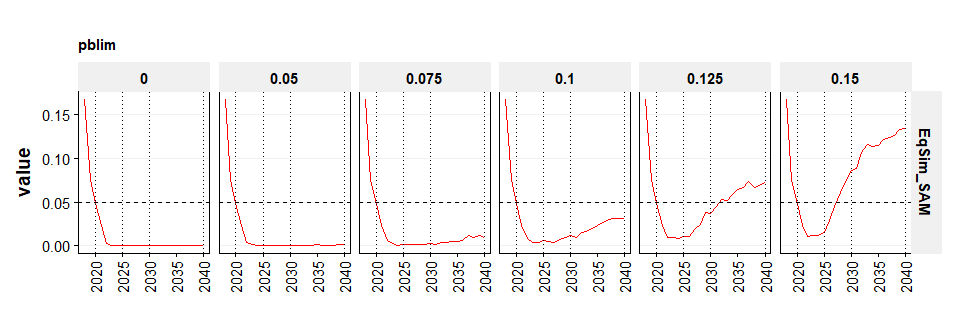
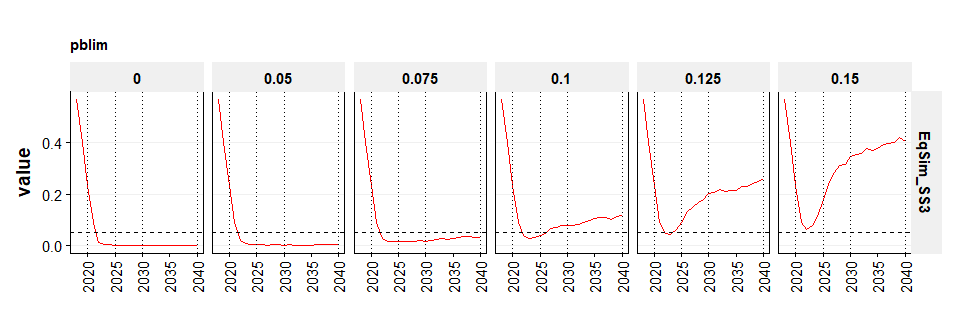


## Comparison of SS & SAM / EqSim & SAM HCR

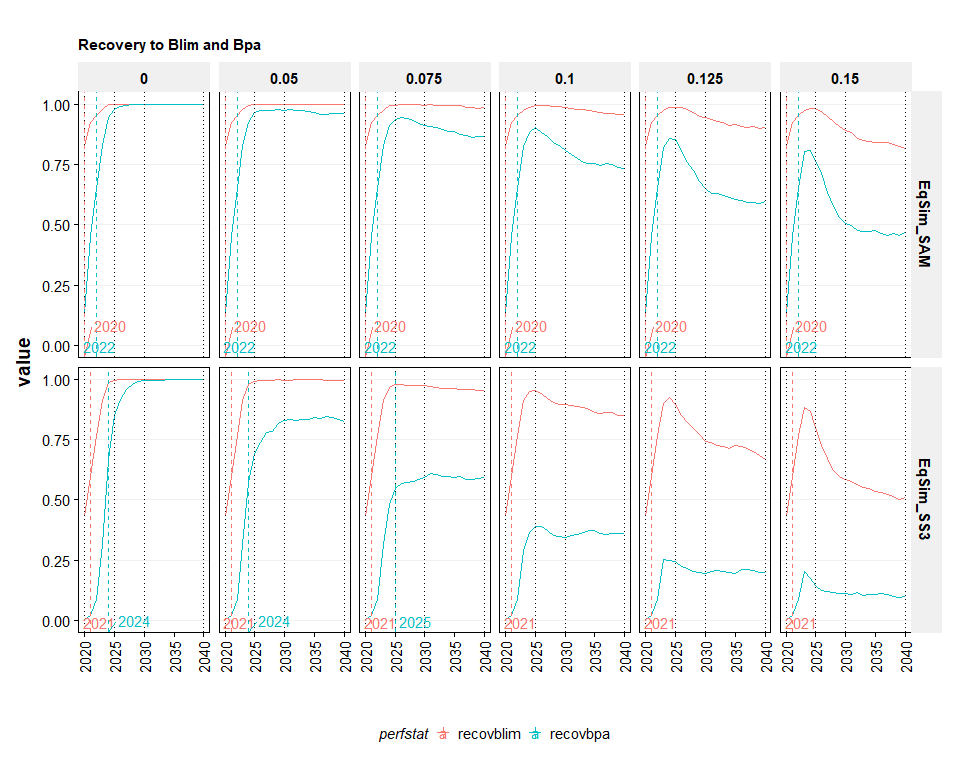








[ Recovery to Blim and Bpa not available for SAM HCR? ]



# Discussion

Two different assessment methods (SS, SAM); two different MSE methods (EqSim, SAM HCR)

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# Preferred rebuilding plan option by PELAC

The PELAC selected the following preferred option for the Western horse mackerel rebuilding plan:

* Evaluation method: EqSim
* Assessment: Stock Synthesis (WGWIDE 2019)
* Target fishing mortality at Fmsy = 0.074 (approximated by 0.075 in the simulations)
* Blim at ICES Blim (834 480 t)
* Btrigger at MSY Btrigger (1 168 272 t)
* Double breakpoint rule with 20% constraint on IAV above Btrigger
* Minimum F when stock is below Blim at 20% of Fmsy = 0.015
* 50% probability of rebuilding to Blim by 2021 (simular to zero catch option)
* 50% probability of rebuilding to Bpa by 2024 (similar to zero catch option)

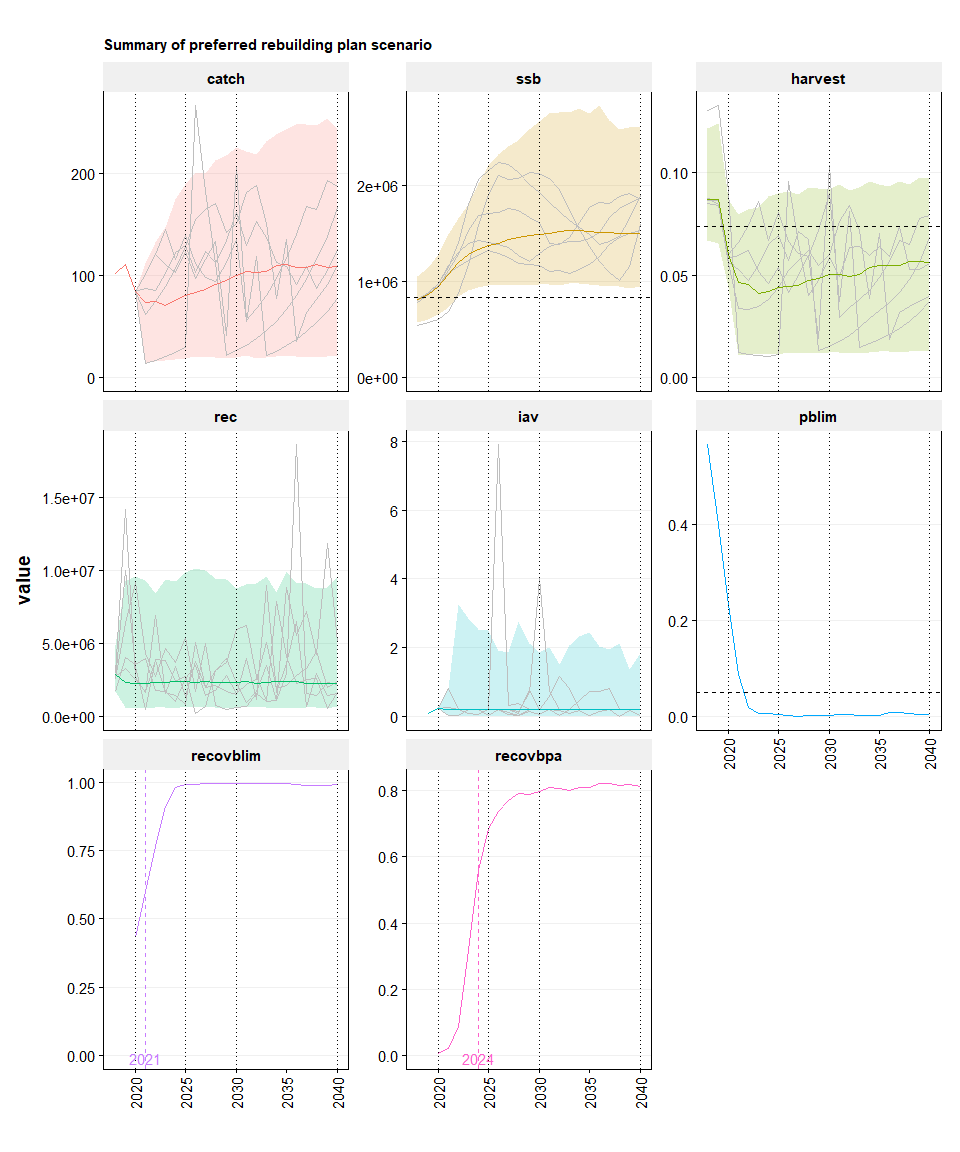
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catch 2031-2040 LT 107 21 - 242   
   
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ssb 2031-2040 LT 1,514,418 958,213 - 2,740,040   
   
harvest 2018-2020 CU 0.080 0.048 - 0.118   
harvest 2021-2025 ST 0.044 0.011 - 0.085   
harvest 2026-2030 MT 0.047 0.012 - 0.092   
harvest 2031-2040 LT 0.054 0.012 - 0.095   
   
rec 2018-2020 CU 2,599,180 696,645 - 7,944,499   
rec 2021-2025 ST 2,363,631 606,888 - 9,317,602   
rec 2026-2030 MT 2,361,298 599,077 - 9,438,791   
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iav 2026-2030 MT 0.200 0.018 - 2.083   
iav 2031-2040 LT 0.200 0.017 - 2.032   
   
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