Indian Ocean swordfish management procedures evaluation : status report

MSE task force – 14 February 2024

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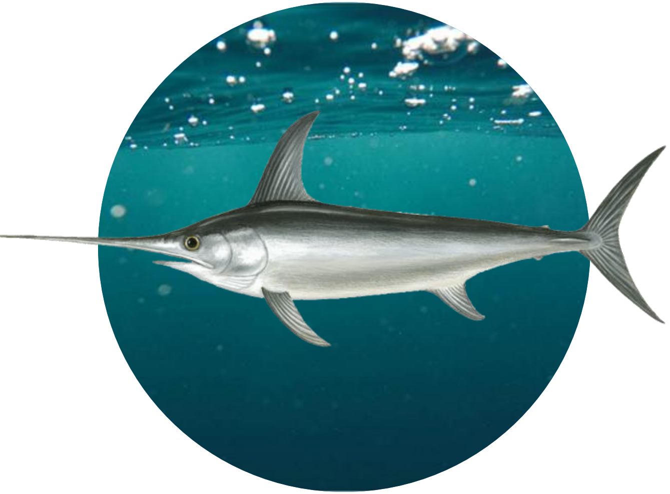

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Status of the SWO MSE work

- OM based on 2020 WPB SS3 assessment and covered the dynamics of the swordfish until the year 2018.

→updated to the 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.

- Comparison with new 2023 WPB SS3 assessment
- Candidate MPs explored
  - Model-based (surplus production model JABBA using Japanese and Taiwanese LL CPUE)
  - Data-based (CPUE rule based on Japanese LL CPUE)
- Tuning objectives set in TCMP-04 (2021)
- Robustness tests
- Work conducted at WMR (new contract for 2024) with support of WPM/ MSE taskforce

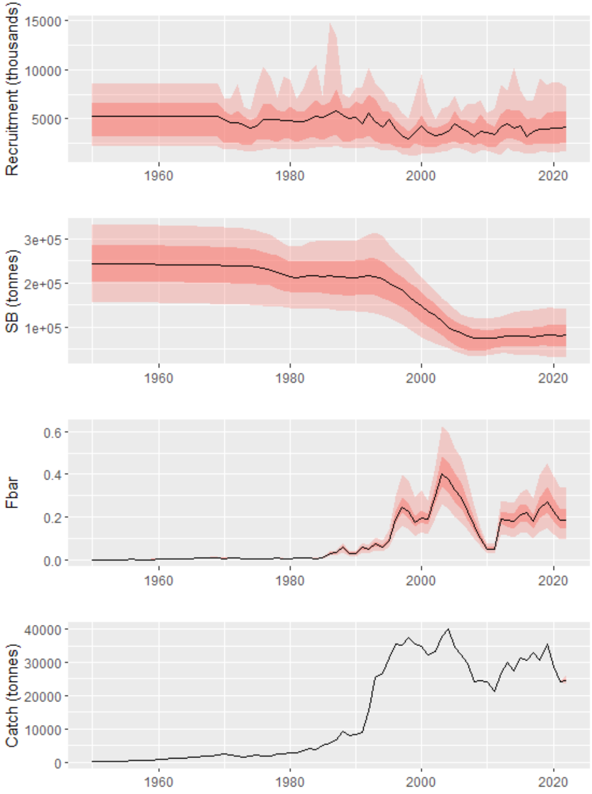
Swordfish OM : OM construction

structural uncertainty grid

- to account for uncertainty in 9 parameters used in the configuration of the stock assessment
- Resulting 130 acceptable SS3 runs

Selectivity	Double Normal		
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			Biomass
CPUEs	JPN late + EU.PRT	JPN late	TWN + EU.PRT
Catchability increase	0%	1% / year	

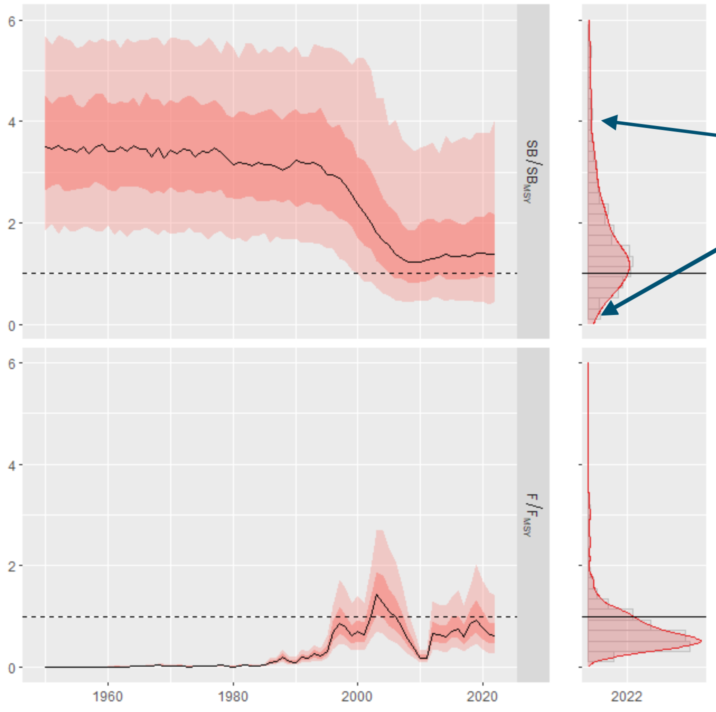
Stock metrics



Swordfish OM

Stock status

2023



Large variability in initial conditions

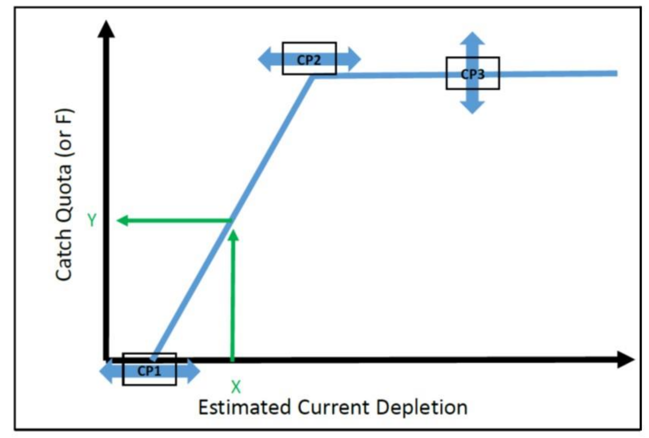
Candidate MPs

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

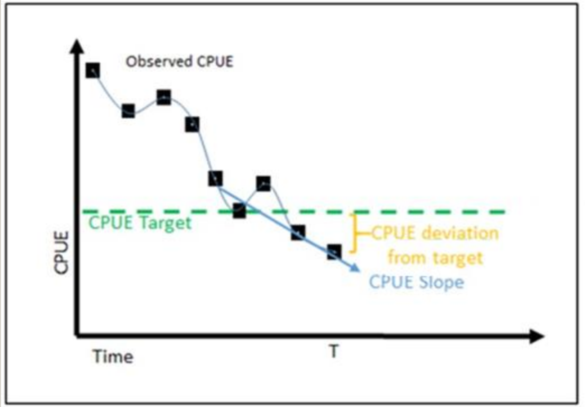
DATA BASED MP

INPUT : CPUE (UJPLL_NW)

HCR %change in the TAC,

New = Old * TACmult

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



Responsiveness to CPUE slope and deviation from target : set

CPUE target : Estimated by tuning

Candidate MPs

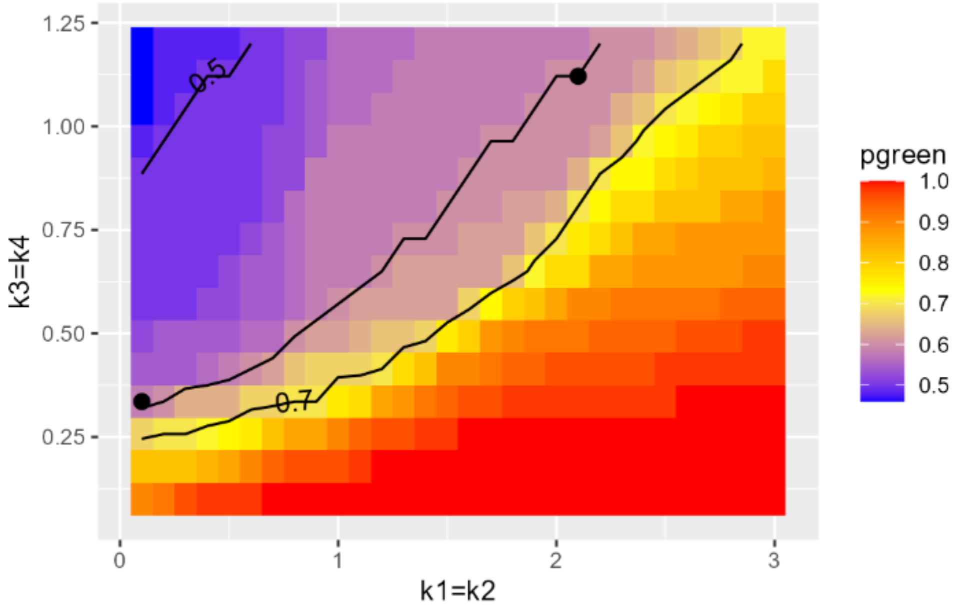
Two versions of the data-based MP : **slow** and **fast** reaction to CPUE index

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

Slow reaction data-based MP:
- k_a : k_1 & k_2 = 0.1
- k_b : k_3 & k_4 = 0.3

Fast reaction data-based MP :
- k_a : k_1 & k_2 = 2.1
- k_b : k_3 & k_4 = 1.2

For both, tuning done for $\mathbf{CPUE_{target}}$



Candidate MPs

Two versions of the CPUE data-based MP : 1) **slow** and 2) **fast** reaction to CPUE

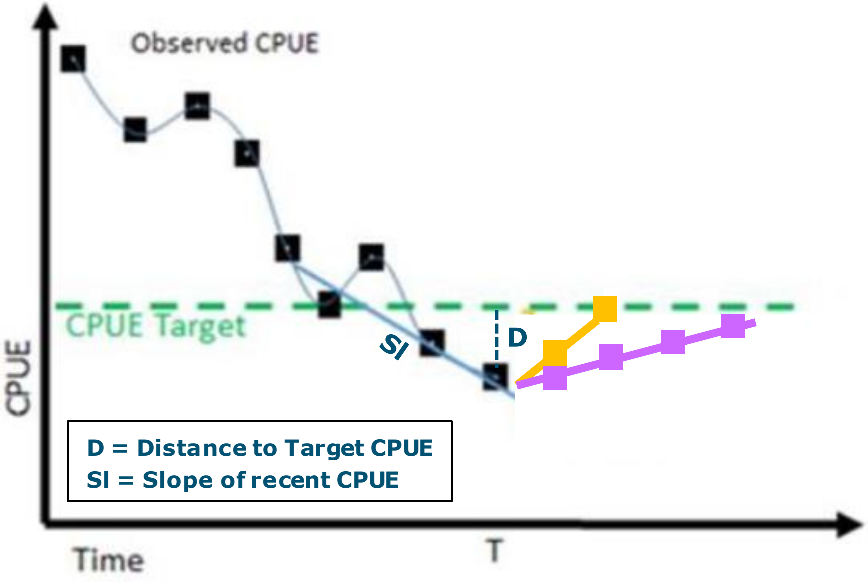
$$TAC_{mult} = 1 + \boldsymbol{k_a}\, Slope + \boldsymbol{k_b}\, DistanceToTarget$$

The values ka and kb effect how quickly the CPUE moves back to the target.

For a given CPUE *slope* and CPUE *distance to target*, larger values of K_a and K_b will result in:

a) Larger change in TAC_{mult} value
b) Larger change in TAC,
c) Faster progression of CPUE back to target (orange line).

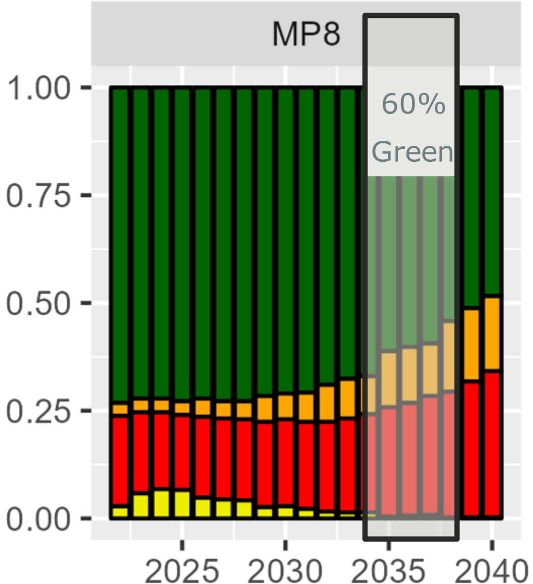
Conversely, smaller values of k_a and k_b mean smaller TAC change and slower CPUE movement back to target. (purple line)



Candidate MPs

- MP constraints and implementation
  - 3 options for the TAC stabilizer (15-15, 10-10, 15-10)
  - 3-year advice (first TAC set for 2024)
  - 2-year lag (1 data, 1 advice) : 2022 data used in 2023 assessment to set TAC for 2024-2026
- Tuning
  - For Max catch (model-based MP) and target CPUE (data-based MP)
  - Tuning separately for 2 objectives :

  p(Kobe Green) 2034-2038 = 60% or 70%



Candidate MPs

List of requested tuned MPs

MP name	descriptor	MPtype	Tuning objective P(Green)=	TAC stabilizer (max up- max down)
MP1	Modelbased_60%_15-15	Model based	60%	15-15
MP2	Modelbased_60%_10-10	Model based	60%	10-10
MP3	Modelbased_60%_15-10	Model based	60%	15-10
MP4	Modelbased_70%_15-15	Model based	70%	15-15
MP5	Modelbased_70%_10-10	Model based	70%	10-10
MP6	Modelbased_70%_15-10	Model based	70%	15-10
MP7	CPUE_Slow_60%_15-15	CPUE_Slow	60%	15-15
MP8	CPUE_Slow_60%_10-10	CPUE_Slow	60%	10-10
MP9	CPUE_Slow_60%_15-10	CPUE_Slow	60%	15-10
MP10	CPUE_Slow_70%_15-15	CPUE_Slow	70%	15-15
MP11	CPUE_Slow_70%_10-10	CPUE_Slow	70%	10-10
MP12	CPUE_Slow_70%_15-10	CPUE_Slow	70%	15-10
MP13	CPUE_Fast_60%_15-15	CPUE_Fast	60%	15-15
MP14	CPUE_Fast_60%_10-10	CPUE_Fast	60%	10-10
MP15	CPUE_Fast_60%_15-10	CPUE_Fast	60%	15-10
MP16	CPUE_Fast_70%_15-15	CPUE_Fast	70%	15-15
MP17	CPUE_Fast_70%_10-10	CPUE_Fast	70%	10-10
MP18	CPUE_Fast_70%_15-10	CPUE_Fast	70%	15-10

Robustness tests

- **Implementation error**

  robustness of the tuned MPs to different scenarios regarding a possible overshoot of the TACs delivered by the MP

  - A maximum implementation error of 15% for a single management cycle, or three years
  - An implementation error of 10% over a longer period of time

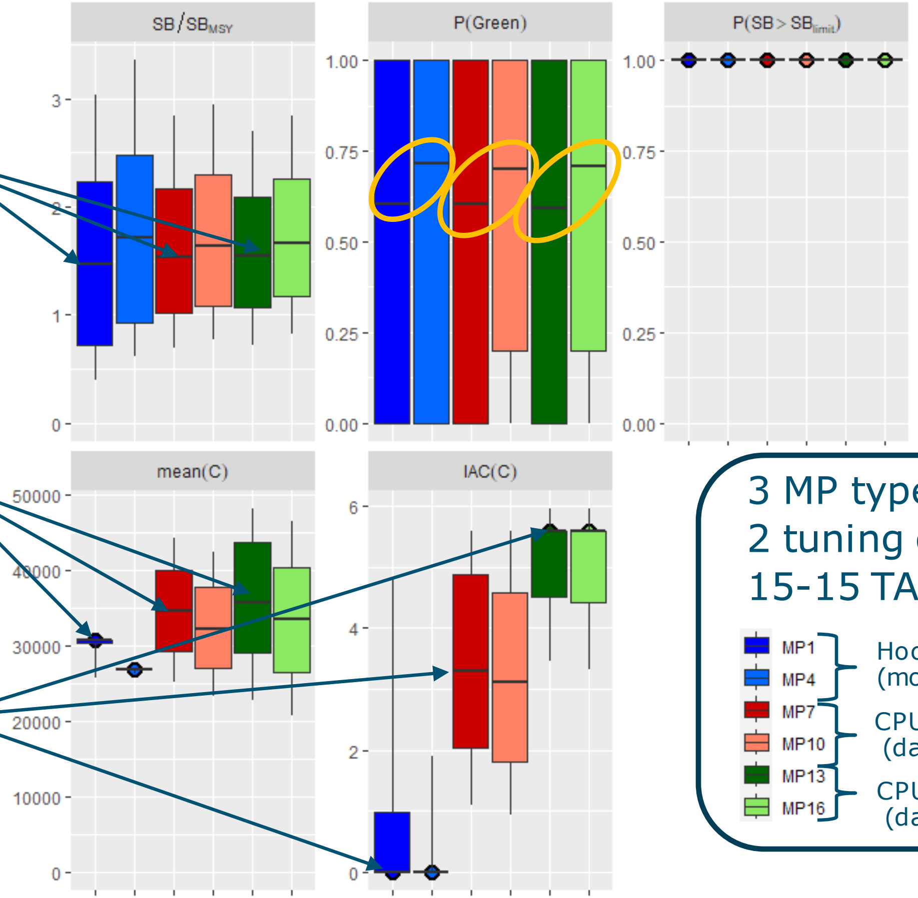
Runs not yet carried out

MP performance (15-15 TAC stabilizer)

Similar SB but wider distribution for model-based MP

Higher catches for data-based MP (FAST>SLOW), with wider distribution

Stable catches for model-based MP, more variable for data-based MP



Low risk

3 MP types
2 tuning objectives
15-15 TAC stabilizer

MP1, MP4 – Hockey stick HCR (model based)
MP7, MP10 – CPUE rule SLOW (data based)
MP13, MP16 – CPUE rule FAST (data based)

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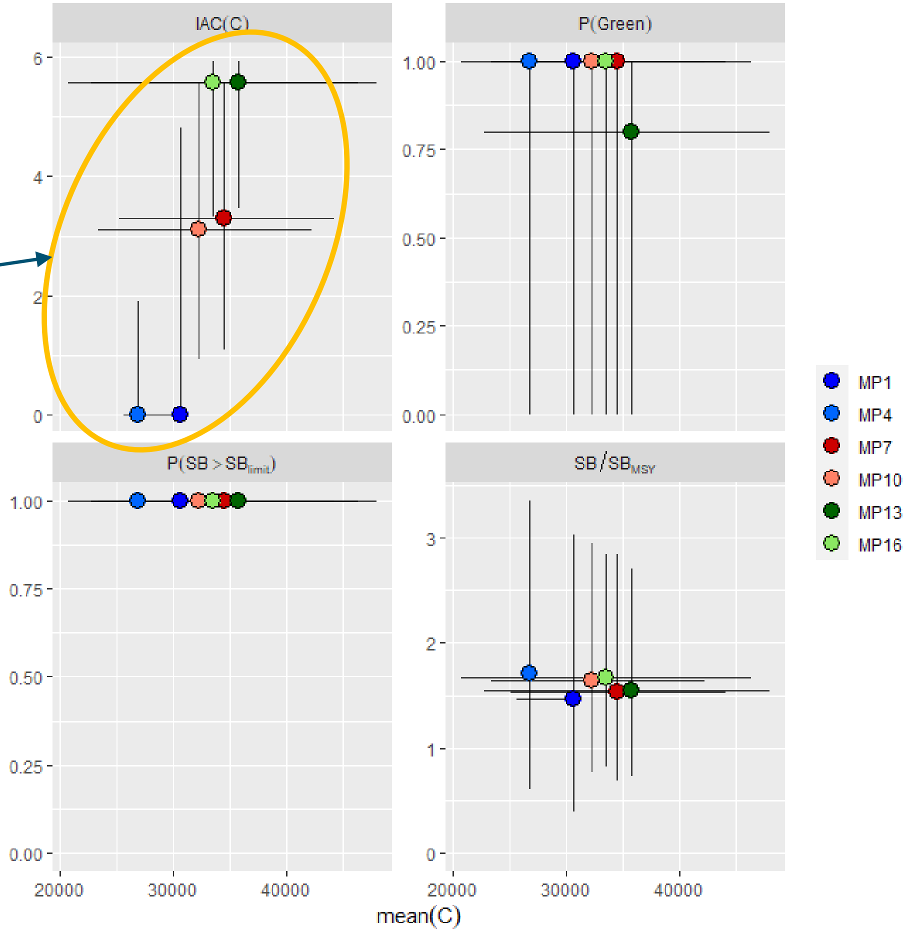
MP performance

	MP	p(SB>SBlim)	Catch Variability	prob(Green)	Mean Catch	SB/SB_{MSY}
MP1	Modelbased_60%_15-15	1.0 (1.0-1)	3.4	0.6	30652 (25633-30652)	**1.6**
MP4	Modelbased_70%_15-15	1.0 (1.0-1)	2.3	0.71	26820. (26249-26821)	**1.8**
MP7	CPUE_Slow_60%_15-15	1.0 (1.0-1)	4.6	0.6	34514. (25185-44188)	**1.7**
MP10	CPUE_Slow_70%_15-15	1.0 (1.0-1)	4.3	0.7	32212 (23338-42297)	**1.7**
MP13	CPUE_Fast_60%_15-15	1.0 (1.0-1)	5.4	0.59	35709 (22703-47996)	**1.6**
MP16	CPUE_Fast_70%_15-15	1.0 (1.0-1)	5.4	0.71	33528 (20718-46394)	1.8

Trade-offs (2034-2038)

higher catches but larger interannual variation and overall uncertainty for the data-based MP



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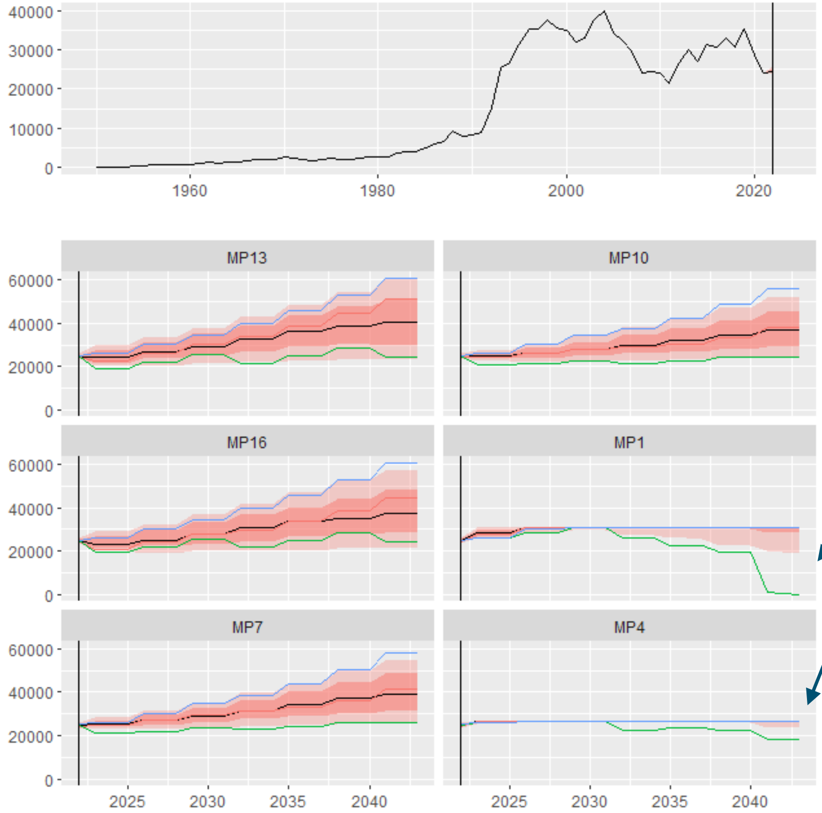
Catch trajectories (OM and simulated)



<u>Data-Based :</u>
Gradual increase in TAC to bring stock down, to tuning objective

<u>Model-based:</u>
TAC at max catch (or going to max catch at the 2nd MP iteration, due to the max 15% increase)

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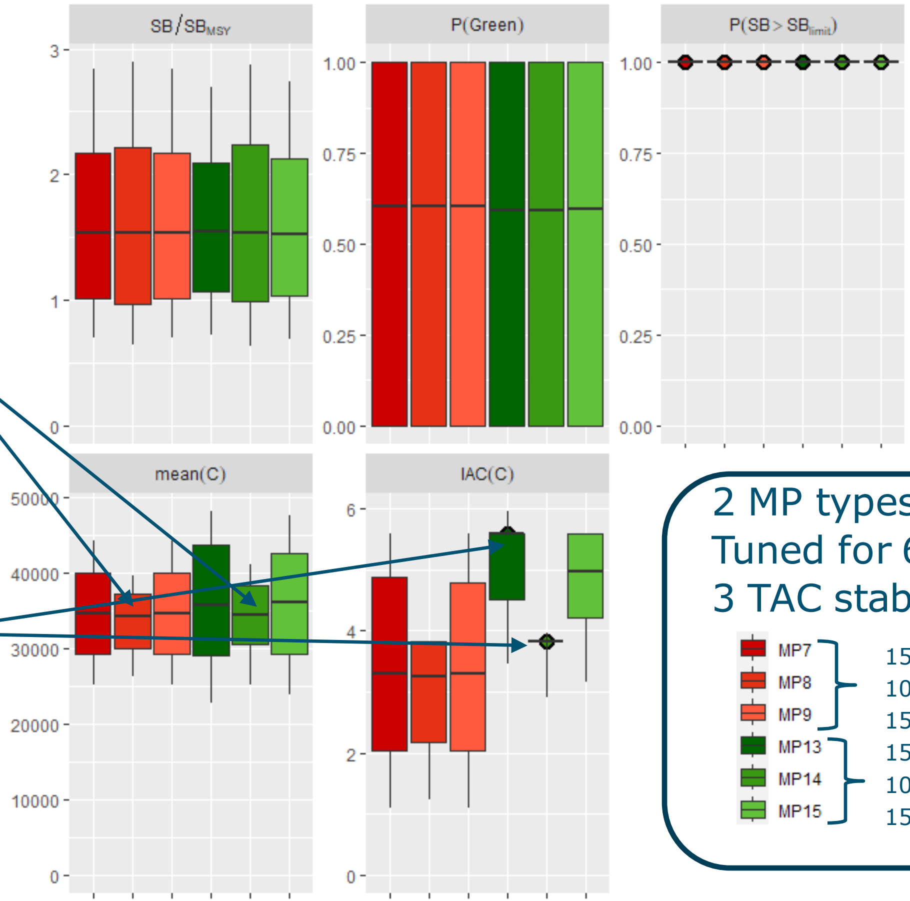
MP performance : TAC stabilizer options (data based only)



Marginal differences on catches with 10-10 delivering lower catches

Difference in catch variability only for the fast-reacting MP

2 MP types
Tuned for 60% pgreen
3 TAC stabilizer

MP7	15-15	CPUE rule SLOW (data based)
MP8	10-10	
MP9	15-10	
MP13	15-15	CPUE rule FAST (data based)
MP14	10-10	
MP15	15-10	

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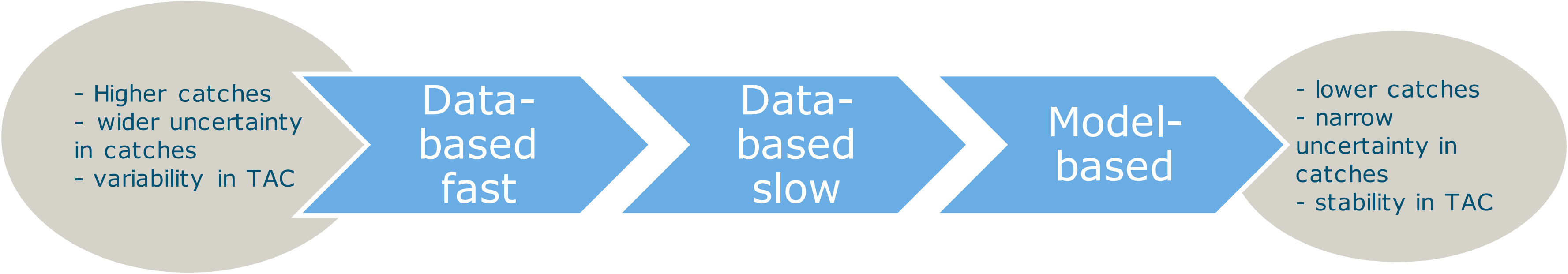
MP performance : TAC stabilizer options

MP		p(SB>SBlim)	Catch Variability	prob(Green)	Mean Catch (95% CI)	SB/SB_{MSY}
MP7	CPUE_Slow_60%_15-15	1.0 (1.0-1)	4.6	0.6	34514 (25185.-44188)	1.7
MP8	CPUE_Slow_60%_10-10	1.0 (1.0-1)	4.3	0.6	34159 (26171-39626)	1.7
MP9	CPUE_Slow_60%_15-10	1.0 (1.0-1)	4.6	0.6	34514 (25185-44188)	1.7
MP13	CPUE_Fast_60%_15-15	1.0 (1.0-1)	5.4	0.59	35709 (22703.-47996)	1.6
MP14	CPUE_Fast_60%_10-10	1.0 (1.0-1)	4.8	0.59	34343 (25087-41100)	1.7
MP15	**CPUE_Fast_60%_15-10**	1.0 (1.0-1)	5.7	0.6	36129 (23835-47534)	1.6

Summary

- Higher p(Kobe green) leads to larger stock and lower catches. All tuning objectives lead to high probability of SB>SBlim
- MP type leads to little difference in SB
- MP types offer two alternatives in terms of catches :



- Impact of TAC stabilizer depends on MP type

Further work

1) OM update

- project current OM to the start of 2024 (using latest available catch estimates)

2) Tuning MPs

- tune potentially all 18 MPs, however :
    - interest in a slow and fast version of the data-based OM, or should we present only one (which one)?
    - can we present the comparison of the 3 TAC stabiliser options only for one tuning objective (60% p(green)), as done here?
- performance indicators : also show indicators for the short-term (e.g. short-term catches)?

3) Robustness Tests (implementation error) : can it be done for 3 MPs out of the 18 possible ones :

3 MP types, one TAC stabilizer (15-15), 1 tuning objective (p(Green) = 60%).

Further progress will be discussed at WPM-MSE task force 10-13 April

Full set of results presented at TCMP 10-11 May

Thank you for your attention

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