

NORTH ATLANTIC SWORDFISH MSE – FINAL RESULTS AND DECISIONS

28th Regular Meeting of the Commission

13 – 20 November 2023

Resources: [Swordfish MSE website](#)

[Swordfish MSE results](#)

ICCAT

CICTA

CICAA



Goals

Communicate final results for the North Atlantic Swordfish Management Strategy Evaluation

Provide information to support Commission decision making on MP selection and MP specifications



Presentation outline

1. Review of North Atlantic Swordfish MSE
 - OMs and robustness tests
 - Management objectives & performance metrics
2. Review of Panel 4 decisions and requests in October 2023
3. Final CMPs and their results
4. Key decisions to be taken
 - Selection of a Management Procedure (MP)
 - a. Final operational management objectives
 - b. Final MP type
 - c. MP implementation schedule



Operating models

- Reference operating models
 - The most important uncertainties in the stock and the fishery
- Robustness operating models
 - Other potentially important uncertainties or scenarios
 - May be considered less plausible
 - “Stress tests”



Final reference OM grid

<i>Variable</i>	<i>Stock assessment base case model</i>	<i>Operating model grid</i>		
Steepness	0.88	0.69	0.8	0.88
Natural mortality	0.2	0.1	0.2	0.3



Robustness tests

- Plausible but less likely scenarios / stress tests for CMPs

<i>Test name</i>	<i>Category</i>	<i>Description</i>
R1	Catchability	1 percent annual increase catchability, that is not accounted for in the standardization of the indices of abundance (historical & projection)
R2	Catchability	1 percent annual increase catchability, that is not accounted for in the standardization of the indices of abundance (historical only)
R3a	Climate Change	Climate Change impacts on recruitment deviations (positive and negative)
R3b	Climate Change	Climate Change impacts on recruitment deviations (negative)
R4	Implementation error	10% overage in TAC due to IUU



Management objectives

Objectives fall into 4 categories:

19-14

RESOLUTION BY ICCAT ON DEVELOPMENT OF INITIAL MANAGEMENT OBJECTIVES FOR NORTH ATLANTIC SWORDFISH

SWO

1. Safety [15%, 10%, 5%]
 E.g. “There should be a [__]% or less probability of the stock falling below B_{LIM} at any point during the 30-year evaluation period.”


2. Stock status [51%, 60%, 70%]
 E.g. The stock should have a greater than [__]% probability of occurring in the green quadrant of the Kobe matrix

3. Stability [25% / no cap / bifurcation]
 E.g. Any increase or decrease in TAC between management periods should be less than [__]%

4. Yield
 E.g. Maximize overall catch



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Panel 4 feedback and requests in October 2023

Operationalizing management objectives

- Safety: probability of not breaching the limit reference point at any point in the projection period
 - [85%, 90%, 95%]
- Status: probability being in the green quadrant of the Kobe plot
 - [~~51%~~, 60%, 70%]
- Stability: variation in TAC between management cycles
 - [25%, no cap, **bifurcated cap**]



Panel 4 feedback and requests in October 2023

MP specifications:

- TAC for all the North Atlantic
- TAC: sum of landings + dead discards
- 3-year management cycle
- 200 t minimum TAC change threshold

CMP type

- Some CMPs and tunings eliminated



Panel 4 feedback and requests in October 2023

- MP implementation schedule

Year	Management cycle	<i>Activity</i>					<i>Data inputs</i>	
		MP run	MP advice implemented	Stock assessment	MSE Review	Exceptional circumstances evaluated	Combined index*	Exceptional circumstance indicators
2023		x					x	x
2024	1		x			x		x
2025						x		x
2026		x				x	x	x
2027	2		x	[x]		x		x
2028				[x]		x		x
2029		x			[x]	x	x	x
2030	3		x			x		x
2031						x		x
2032		x				x	x	x

*The combined index may be updated every year, depending on the requirements set out in the exceptional circumstances protocol.



Panel 4 feedback and requests in October 2023

Tuning

- Application of 60% PGK threshold for all 3 time periods:
 - short (years 1 – 10)
 - medium (years 11 – 20)
 - long (years 21 – 30)

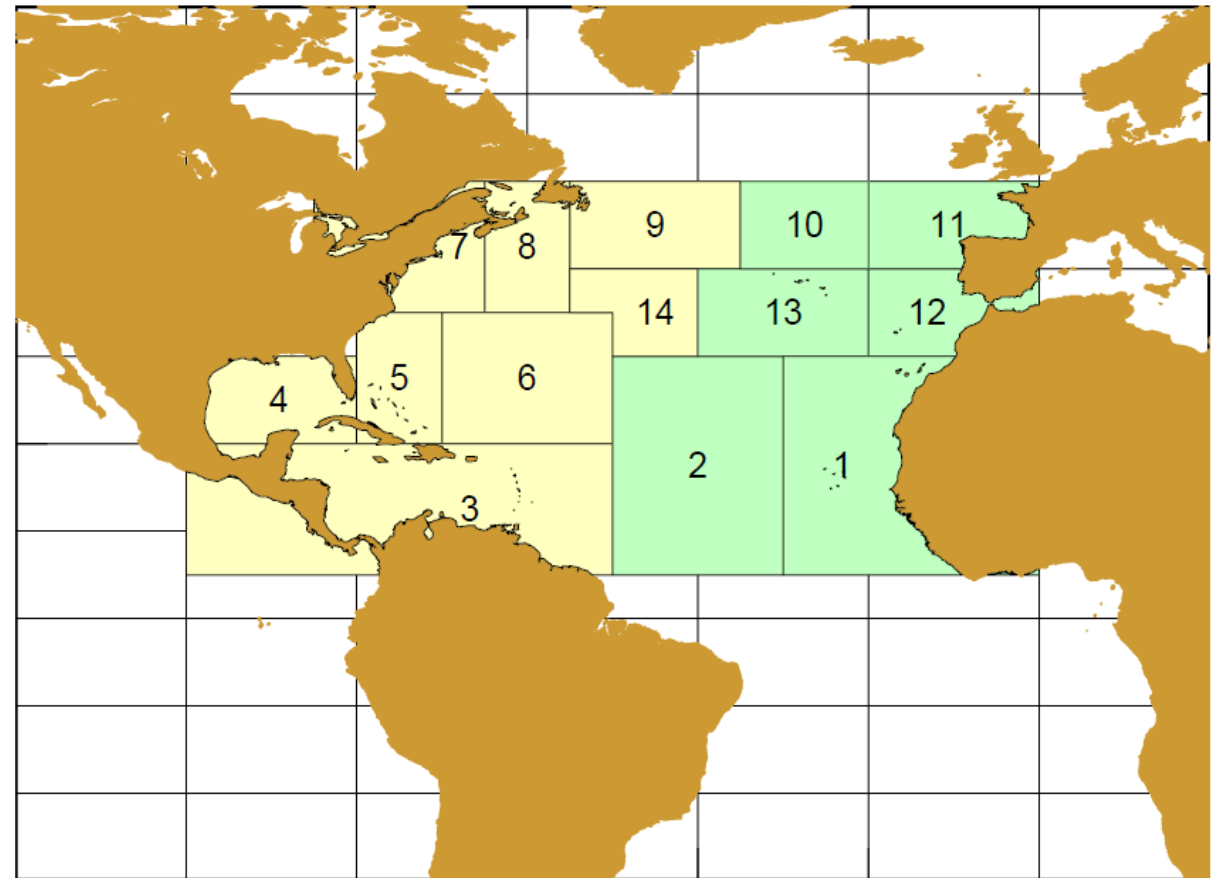
Stability

- Develop a variation of the SPSSFox CMP with a bifurcated TAC change rule
 - $\pm 25\%$ cap, with no cap on TAC decreases if the MP's estimated $B < B_{MSY}$



Updating the combined index

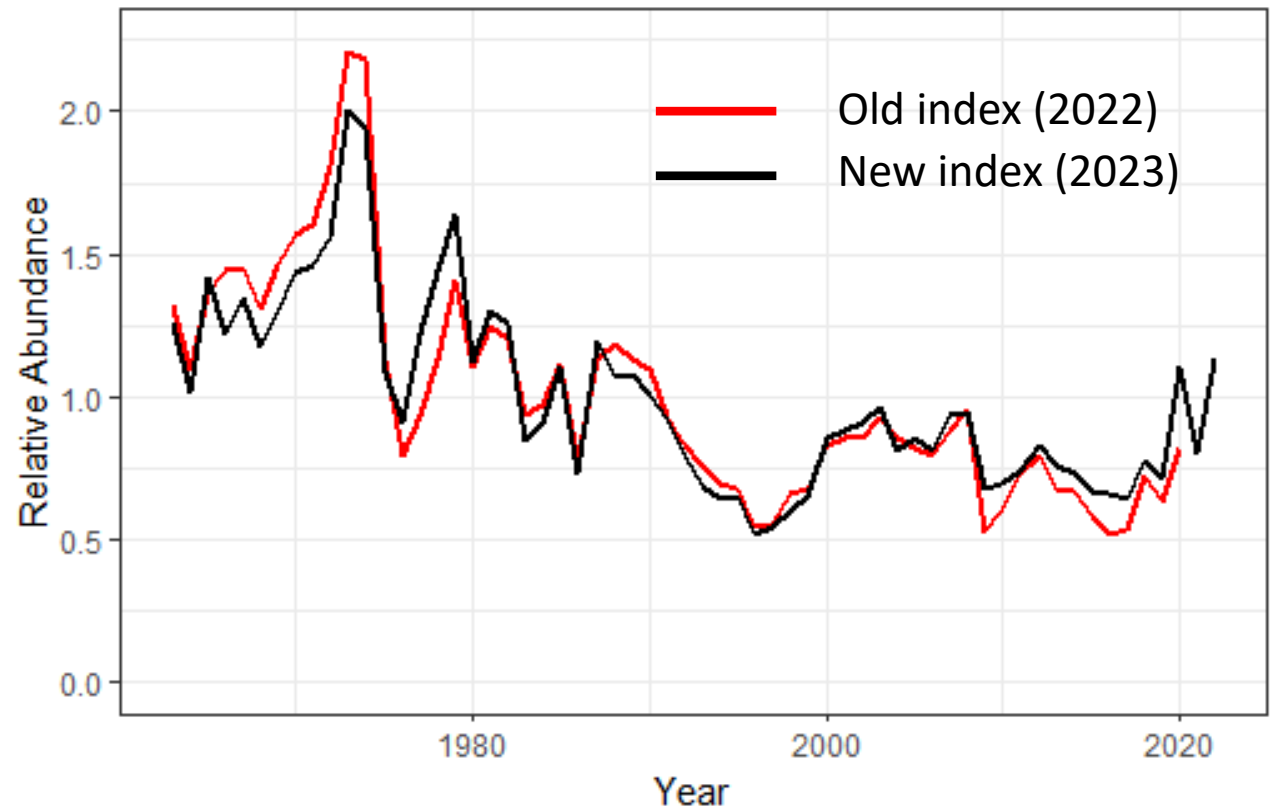
- Data from 7 CPCs accounting for ~95% of catch in the North Atlantic
- Model-based standardization
- Abundance indicator for all CMPs
- Data update for 2021 & 2022






Updating the combined index

- Data submissions (some data received November 2023)
- Problematic model diagnostics
- Model updated
 - Identical model factors
 - Change in distribution type (delta-gamma)





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CMP types

	CE	MCC5	MCC7	SPSSFox	SPSSFox2
Type	Empirical	Empirical	Empirical	Model	Model
Index	Combined	Combined	Combined	Combined	Combined
Steps	N/A	4	7	N/A	N/A
Minimum TAC	10% of reference historical exploitation	4000 t	50% of base TAC (~5000-5500t)	10%*E _{MSY}	10%*E _{MSY}
PGK Tuning	60%	60%, 70%	60%, 70%	60%	60%
Stability Limit	±25% cap	None	None	±25% cap	±25% cap, with no cap on TAC decreases if B<B _{MSY}
Reference Period	2016-2020	2017-2019	2017-2019	N/A	N/A
Detailed Description	Attempts to maintain a constant exploitation rate in the projection period, based on the mean exploitation rate in the recent historical years.	Provides relative stability in TAC by using a base TAC that can increase by 1 step or decrease by up to 2 steps. Steps occur once thresholds in the abundance indicator are breached. Steps are selected depending on the value of the current 3-year average of the Combined Index compared to a 3-year historical average (2017-2019). The minimum TAC is used when the 3-year average of the Combined Index is less than half of the 3-year historical average.	Like MCC5 but the base TAC can increase by 4 small steps or decrease by 2 steps. A smoother is applied to the 3-year average of the Combined Index to buffer effects of interannual variability in the index.	A Fox surplus production model with a hockey-stick HCR where fishing mortality decreases linearly from 100*BMSY to 40*BMSY.	Like SPSSFox but with a bifurcated stability restriction as described above in "Stability Limit"



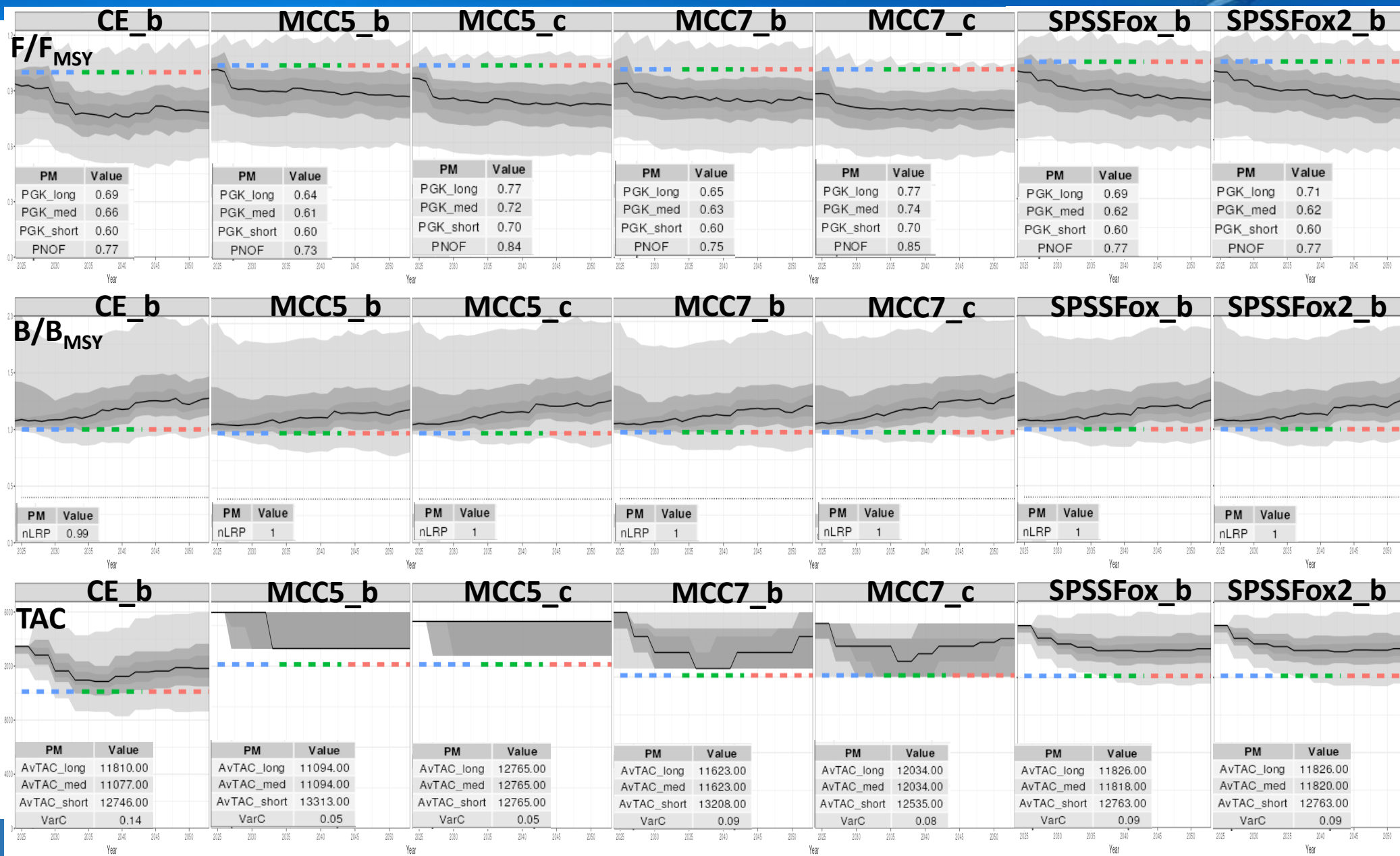
CMP performance results

- All CMPs meet minimum standards for Safety and Status management objectives
- The CMP short-list contains a variety of TAC setting strategies and rules and span the trade-off space
 - Type: empirical and model-based
 - Interpretation of abundance and exploitation information
 - Frequency and scale of response to signals in the abundance indicator



CMP performance

Projection time series

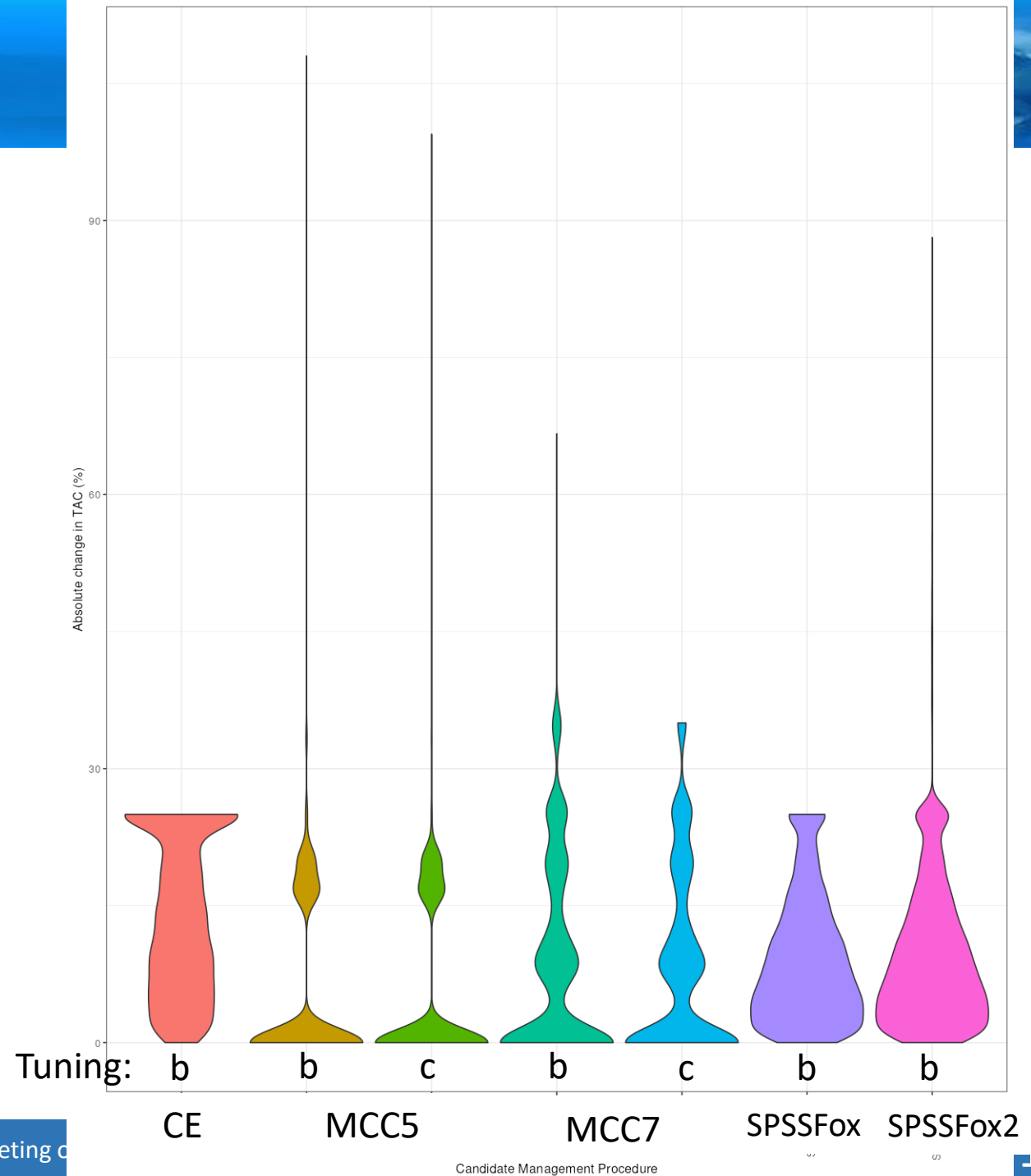




CMP performance

Stability

Reference OMs





CMP performance – Quilt plot

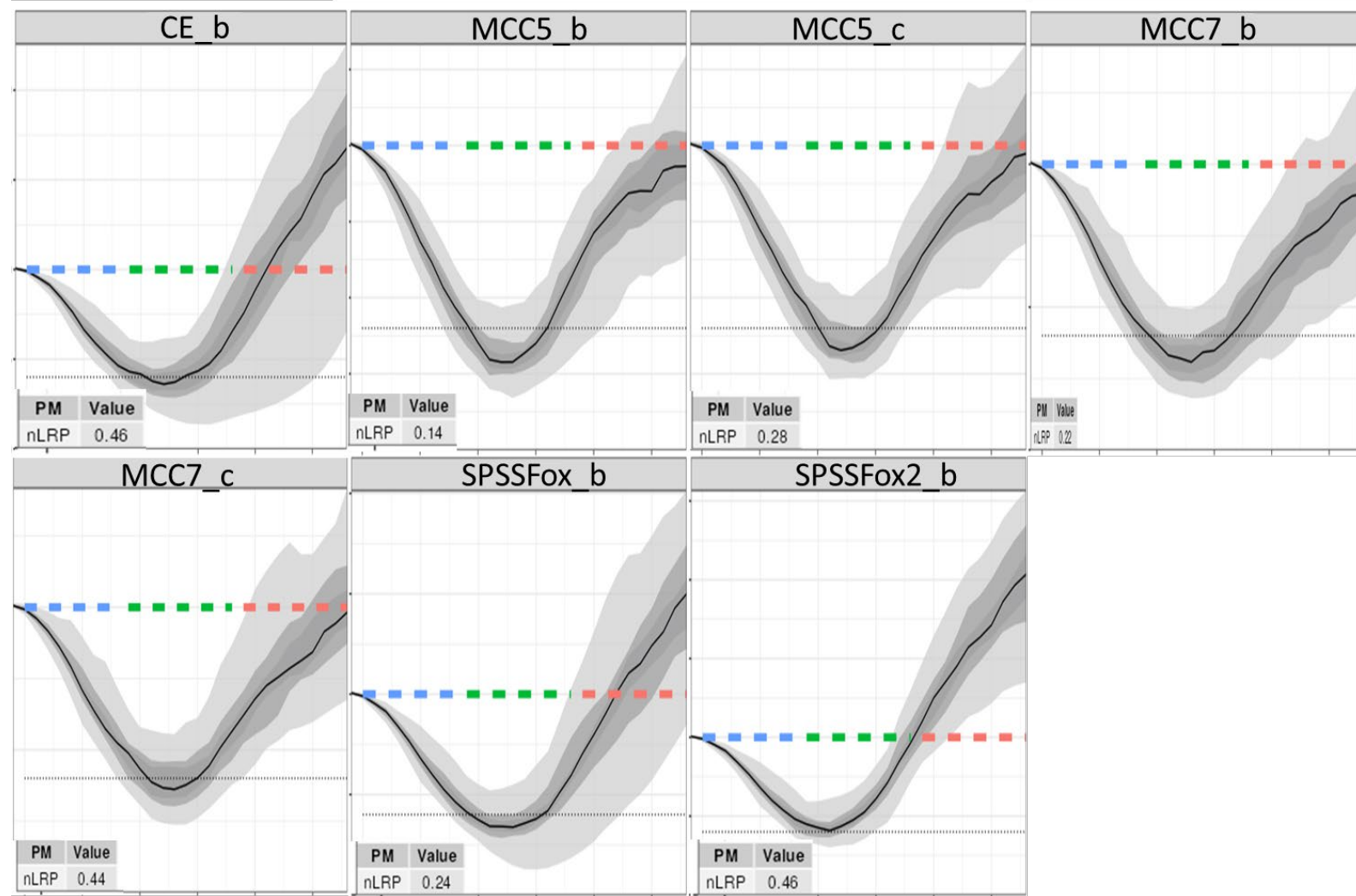
MP	AvTAC_long	AvTAC_med	AvTAC_short	nLRP	PGK	PGK_long	PGK_med	PGK_short	PNOF	VarC
1 CE_b	11810.26	11076.62	12746.1	0.99	0.65	0.69	0.66	0.6	0.77	0.14
2 MCC5_b	11094.44	11094.44	13313.33	1	0.62	0.64	0.61	0.6	0.73	0.05
3 MCC5_c	12765.19	12765.19	12765.19	1	0.73	0.77	0.72	0.7	0.84	0.05
4 MCC7_b	11623.25	11623.25	13208.24	1	0.63	0.65	0.63	0.6	0.75	0.09
5 MCC7_c	12034.01	12034.01	12535.43	1	0.74	0.77	0.74	0.7	0.85	0.08
6 SPSSFox_b	11826.06	11817.93	12762.8	1	0.64	0.69	0.62	0.6	0.77	0.09
7 SPSSFox2_b	11826.36	11819.67	12762.91	1	0.64	0.71	0.62	0.6	0.77	0.09



CMP performance

Projections biomass trend

Robustness test 3b

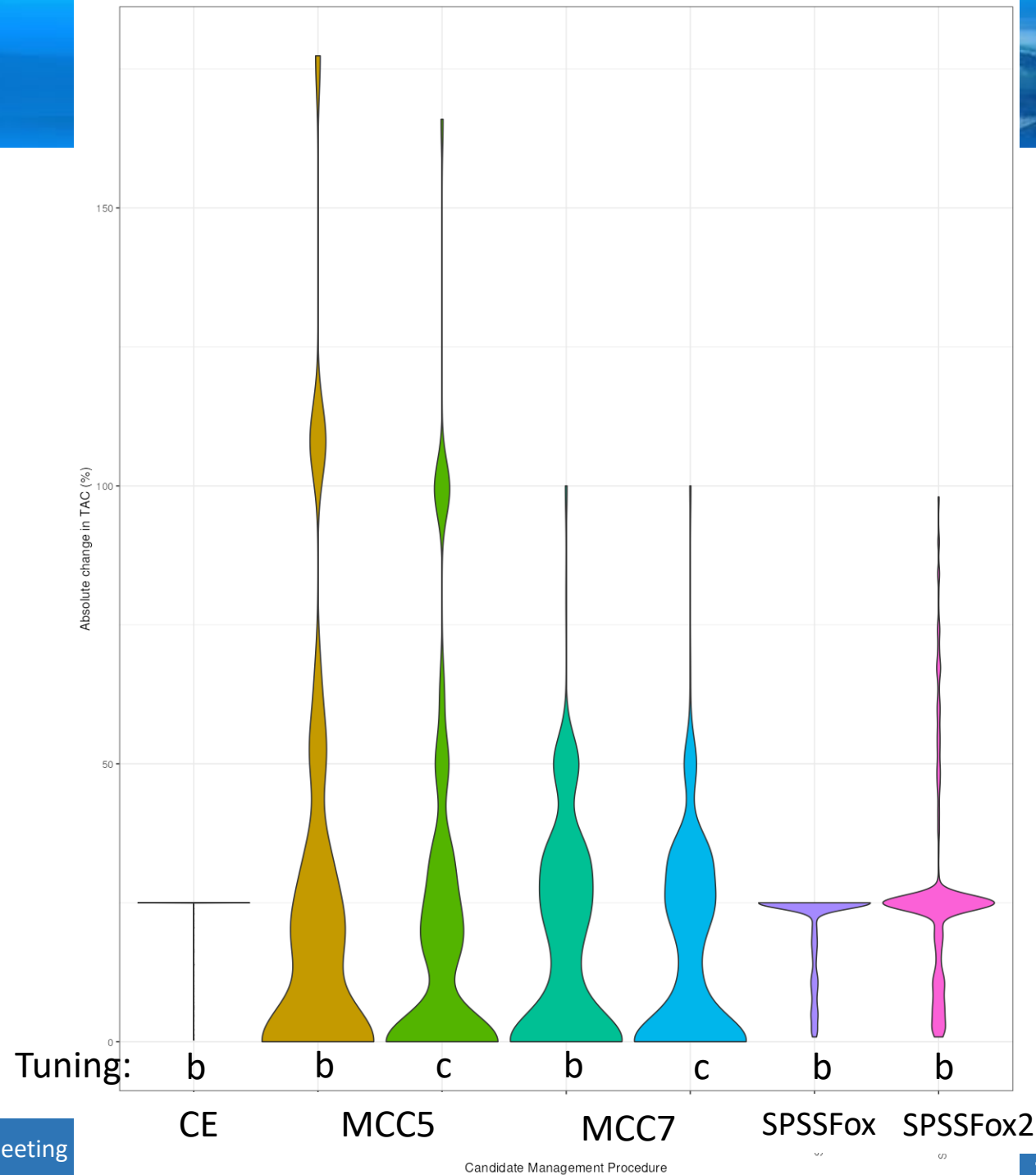




CMP performance

Stability

Robustness test 3b





CMP performance R3b – Quilt plot

	MP	AvTAC_long	AvTAC_med	AvTAC_short	nLRP	PGK	PGK_long	PGK_med	PGK_short	PNOF	VarC
1	CE_b	4680.78	5307.38	12111.75	0.46	0.23	0.65	0.03	0.02	0.51	0.22
2	MCC5_b	11094.44	4000	13313.33	0.14	0.06	0.17	0	0	0.42	0.24
3	MCC5_c	10637.66	7978.25	12765.19	0.28	0.08	0.23	0	0.01	0.44	0.21
4	MCC7_b	10566.59	7924.94	11623.25	0.22	0.06	0.16	0	0.03	0.38	0.17
5	MCC7_c	10028.34	7521.26	11031.17	0.44	0.1	0.24	0	0.05	0.46	0.15
6	SPSSFox_b	5578.91	5863.67	12191.76	0.24	0.19	0.55	0.01	0.01	0.49	0.21
7	SPSSFox2_b	5435.55	3561.52	12192.76	0.46	0.33	0.9	0.08	0.01	0.64	0.26




TAC 1 values

CMP	TAC1 (t)
CE_b	12,936
MCC5_b	13,313
MCC5_c	12,765
MCC7_b	14,265
MCC7_c	13,538
SPSSFox_b	12,936
SPSSFox2_b	12,936



Agenda

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Selection of a Management Procedure (MP)

- a. Final operational management objectives
 - Safety, status, yield, stability

- b. Final MP type
 - Seven short-listed CMPs

- c. MP implementation schedule
 - Overall schedule: MP implementation, stock assessment, MP review, etc.



Summary

- The Commission is scheduled to select a MP to generate TAC in 2024+
- Final CMP performance results are available
- A variety of CMP types are available for selection, all meeting minimum standards for the Safety and Status management objectives
- Detailed resulted and CMP tradeoffs are contained in an [interactive website](#)



Acknowledgements

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The Swordfish Species Group Coordinator would like to acknowledge the work of the SWO-MSE technical team. This dedicated team has worked exceptionally hard to produce this analysis, the content in this presentation, and the supporting materials



CMP results



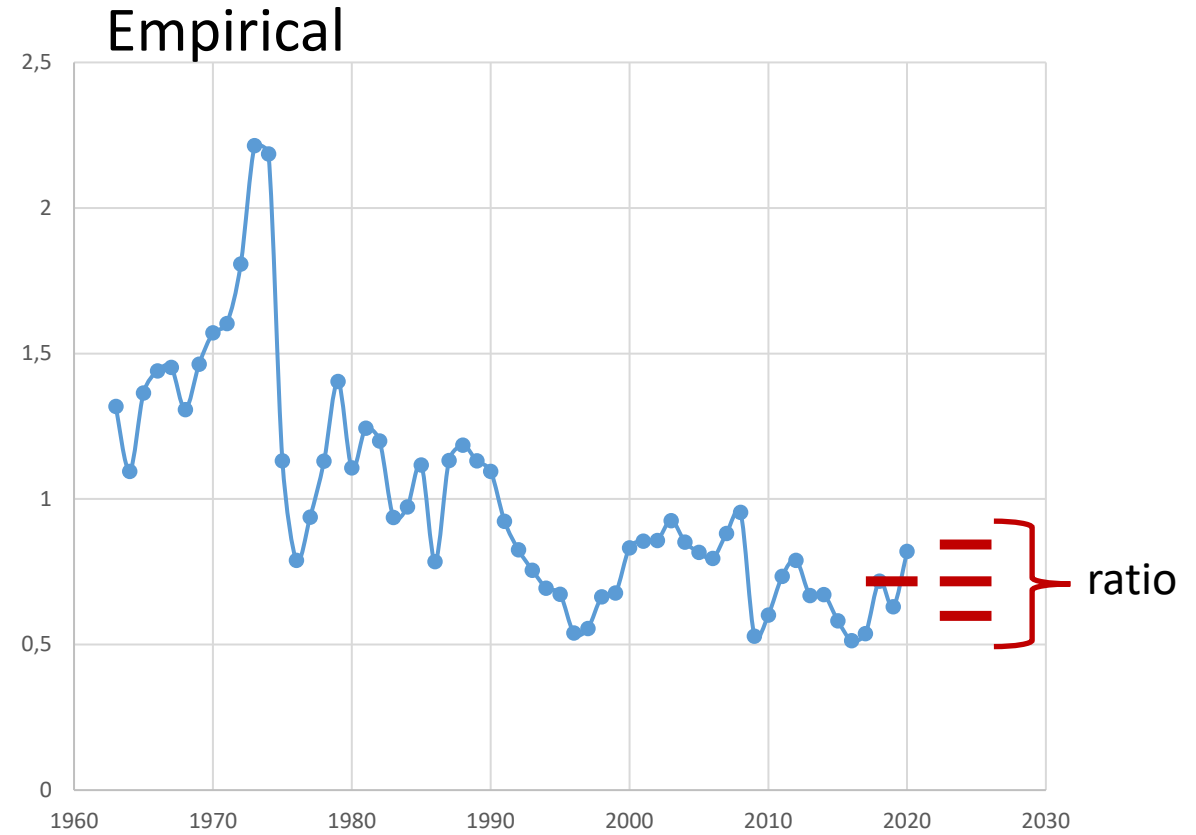
Other supporting information

The following slides are not planned for presentation, but they contain useful additional information



CMP types

- Collaborative process among core technical team
- Empirical and model-based approaches

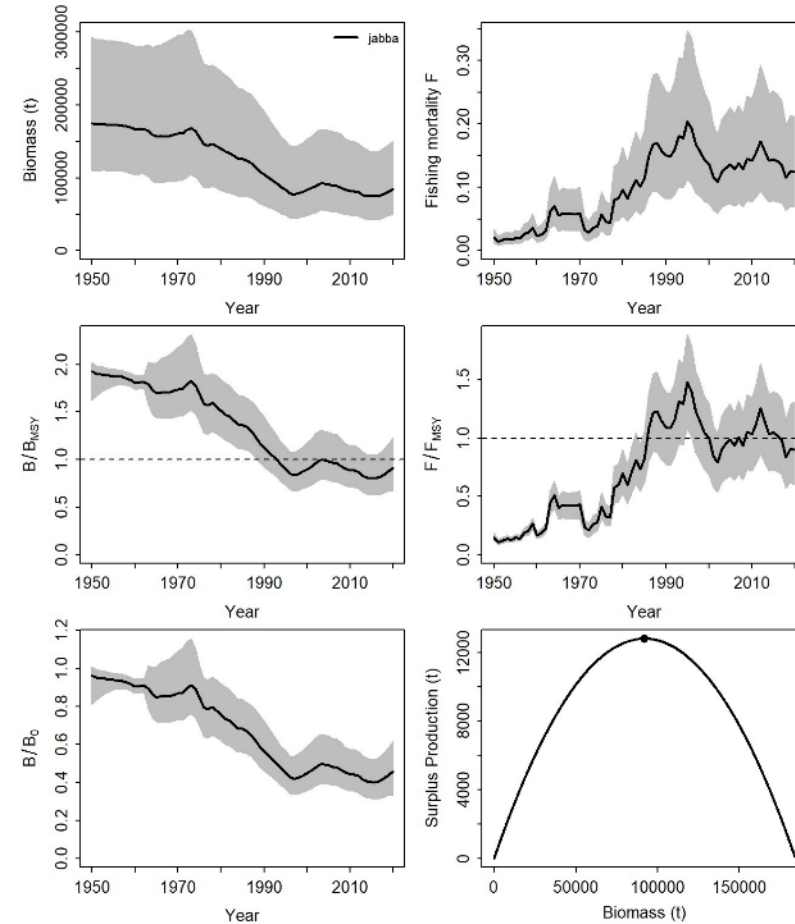




CMP types

- Collaborative process among core technical team
- Empirical and model-based approaches

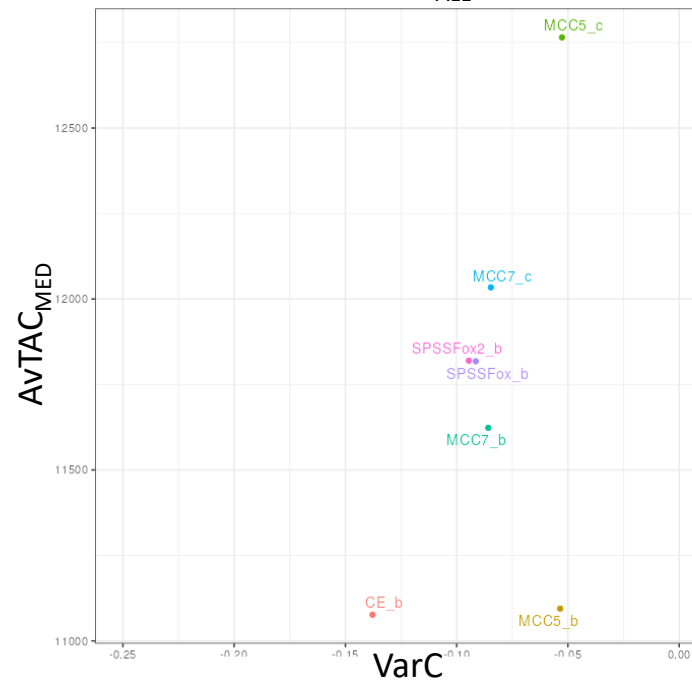
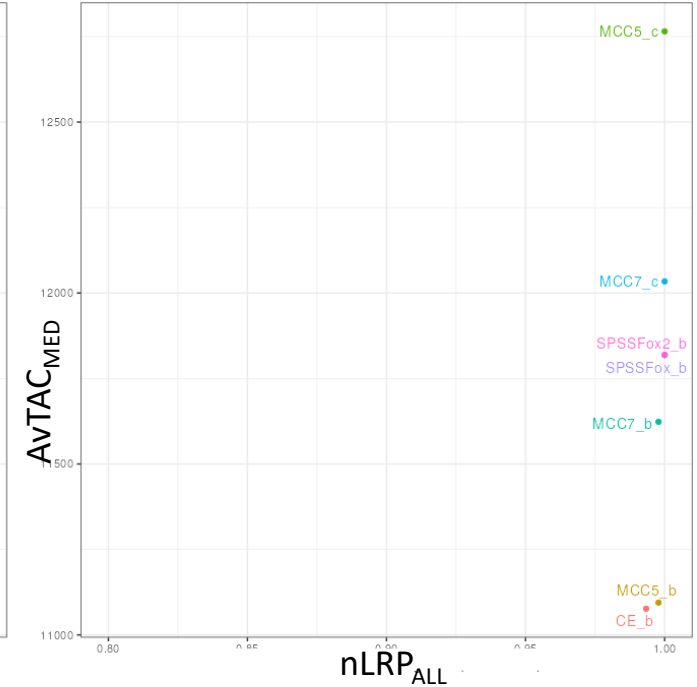
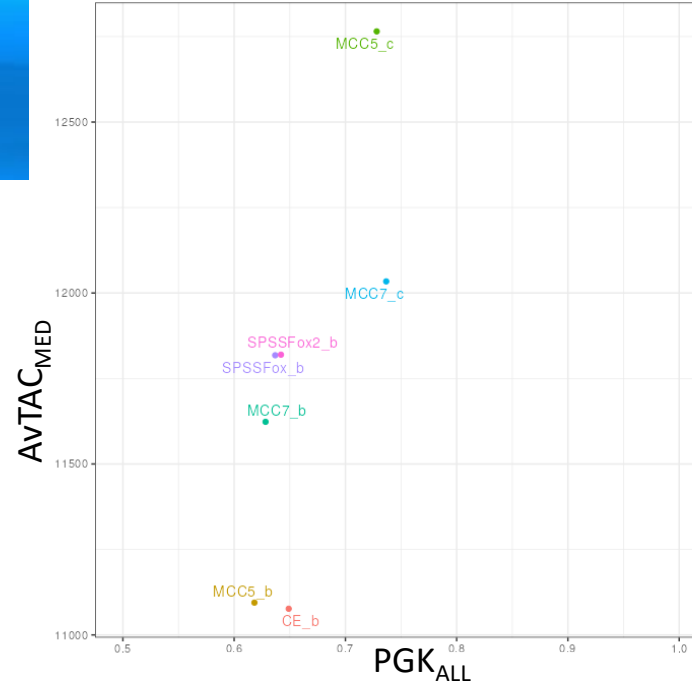
Model-based





Trade-offs

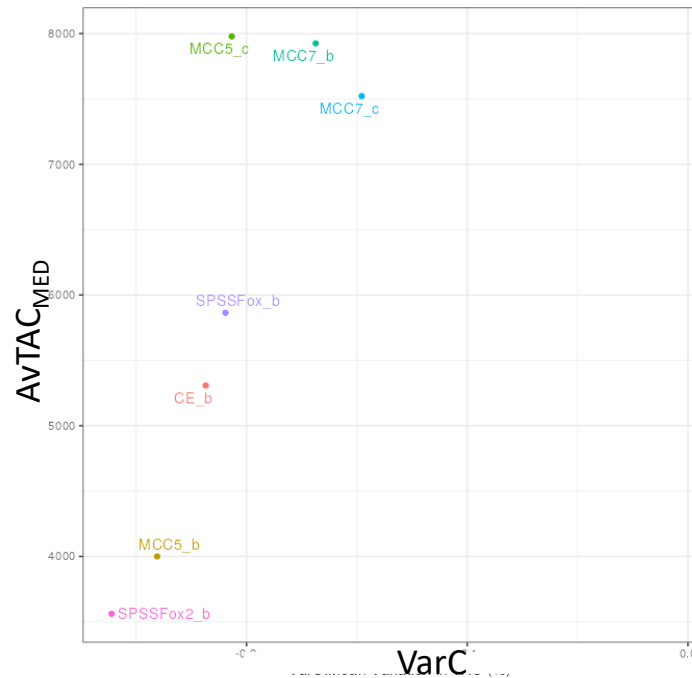
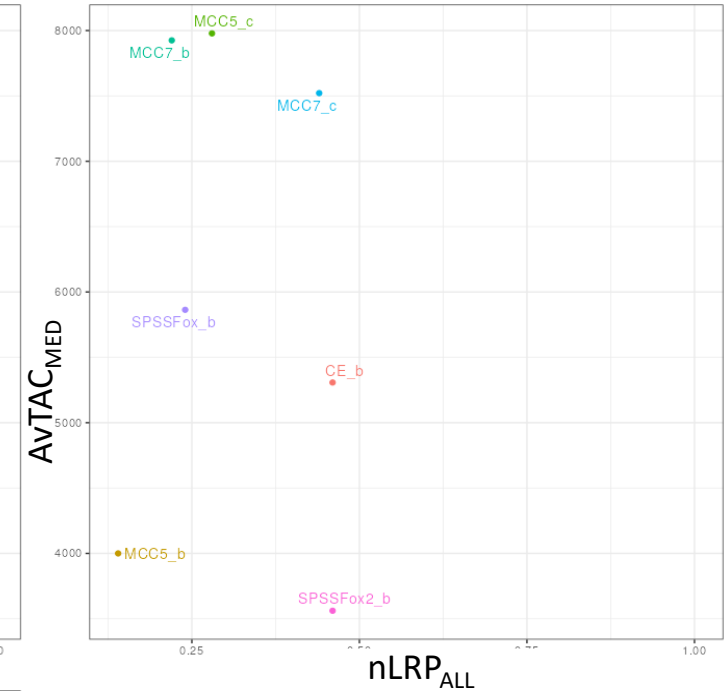
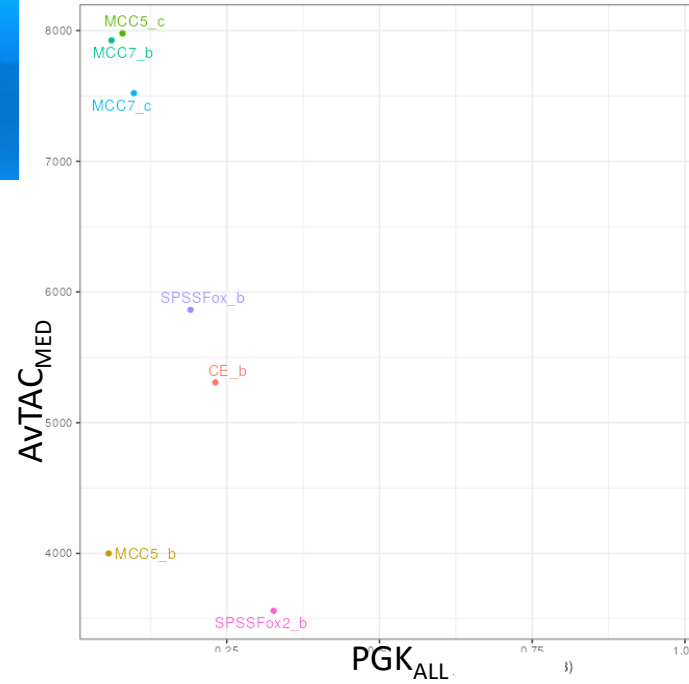
- Tradeoffs among status, safety, stability, yield
- Reference OMs





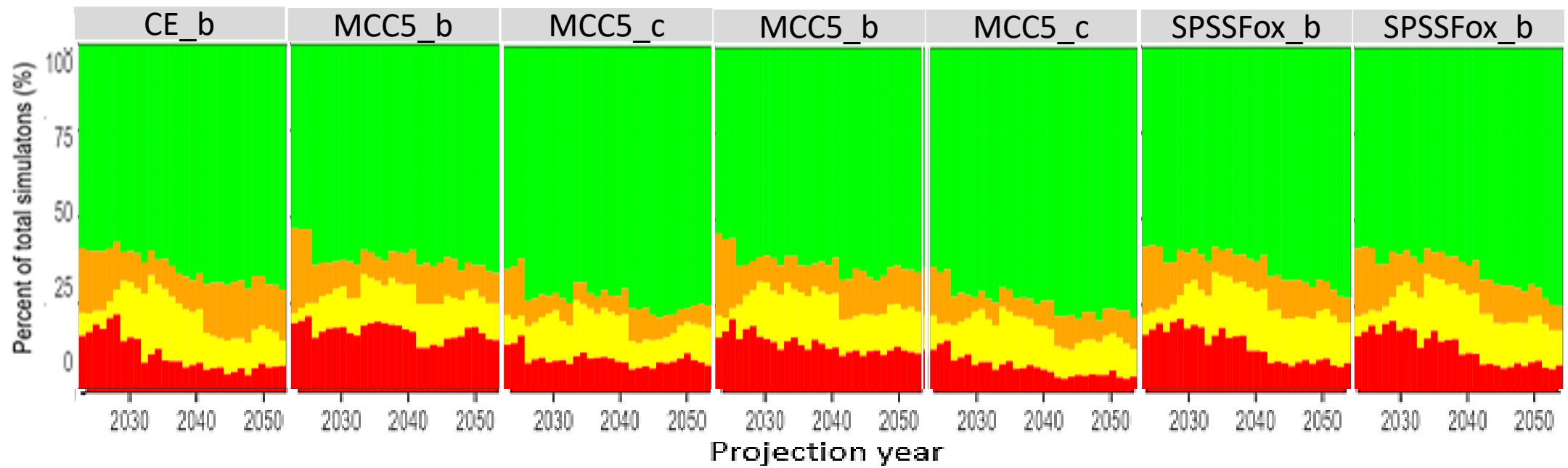
Trade-offs

- Tradeoffs among status, safety, stability, yield
- Robustness OMs





Kobe time plots





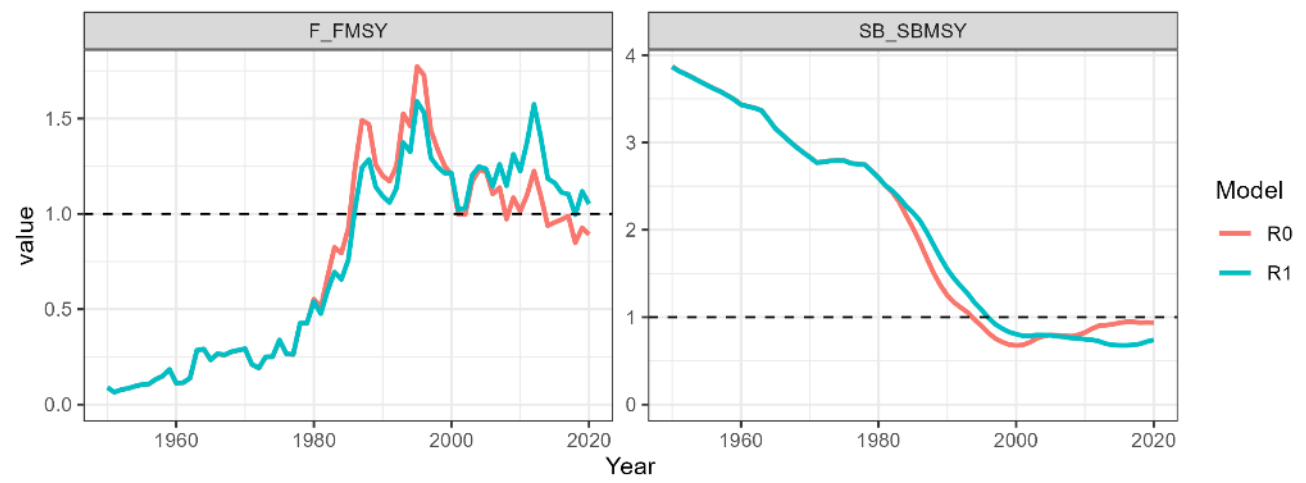
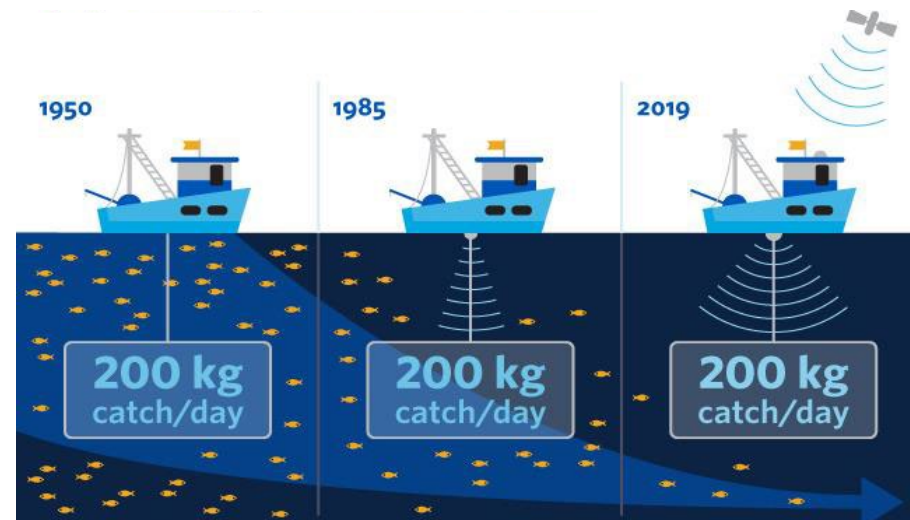
Robustness tests

Test name	Category	Description
R1	Catchability	1 percent annual increase catchability, that is not accounted for in the standardization of the indices of abundance (historical & projection)
R2	Catchability	1 percent annual increase catchability, that is not accounted for in the standardization of the indices of abundance (historical only)
R3a	Climate Change	Climate Change impacts on recruitment deviations (positive and negative)
R3b	Climate Change	Climate Change impacts on recruitment deviations (negative)
R4	Implementation error	10% overage in TAC due to IUU
R5	Size limit	Test effect of removal of minimum size limit
Additional tests	TAC change minimum threshold	Test performance of CMPs when no TAC change if TAC update is <200 t difference
	Management cycle	Compare effect of 3 year vs 4 year MP implementation length



Catchability

- Assuming ‘effort creep’ and hyperstability in indices
- R1: 1% increase in catchability in historical and projection periods
- R2: 1% increase in catchability in historical period





R3 – Climate change

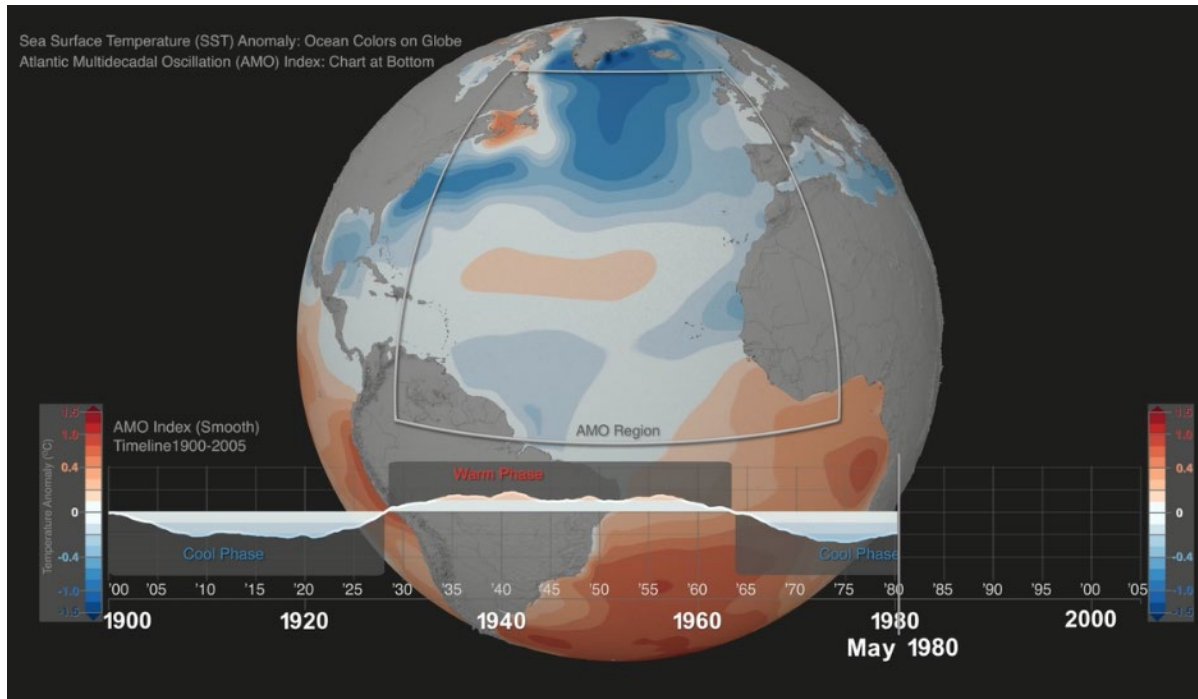
- Climate change may have varying effects on different features of the stock, such as
 - Distribution
 - Reproduction
 - Growth
- Complex scenarios require long term work plan
- Tests CMP ability to react to periods of low (50%) recruitment



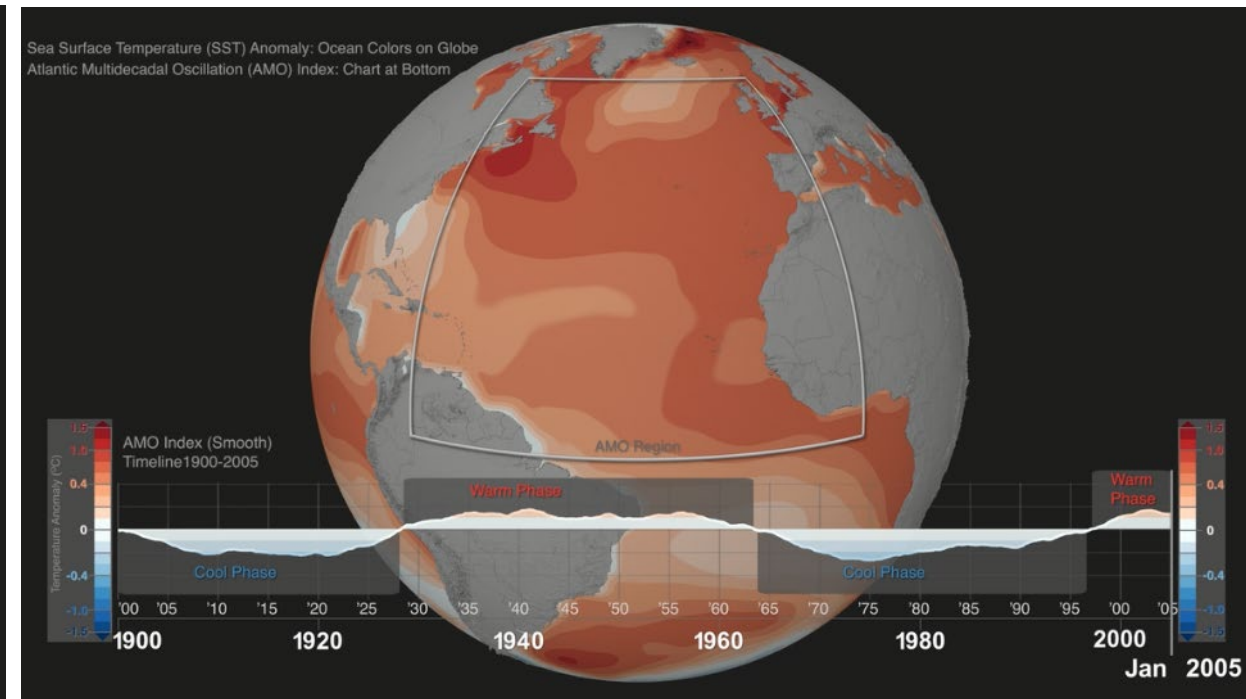
Atlantic Multidecadal Oscillation (AMO)

- The Atlantic Multidecadal Oscillation (AMO) is an indicator of long-duration changes in the sea surface temperature of the North Atlantic Ocean

1980



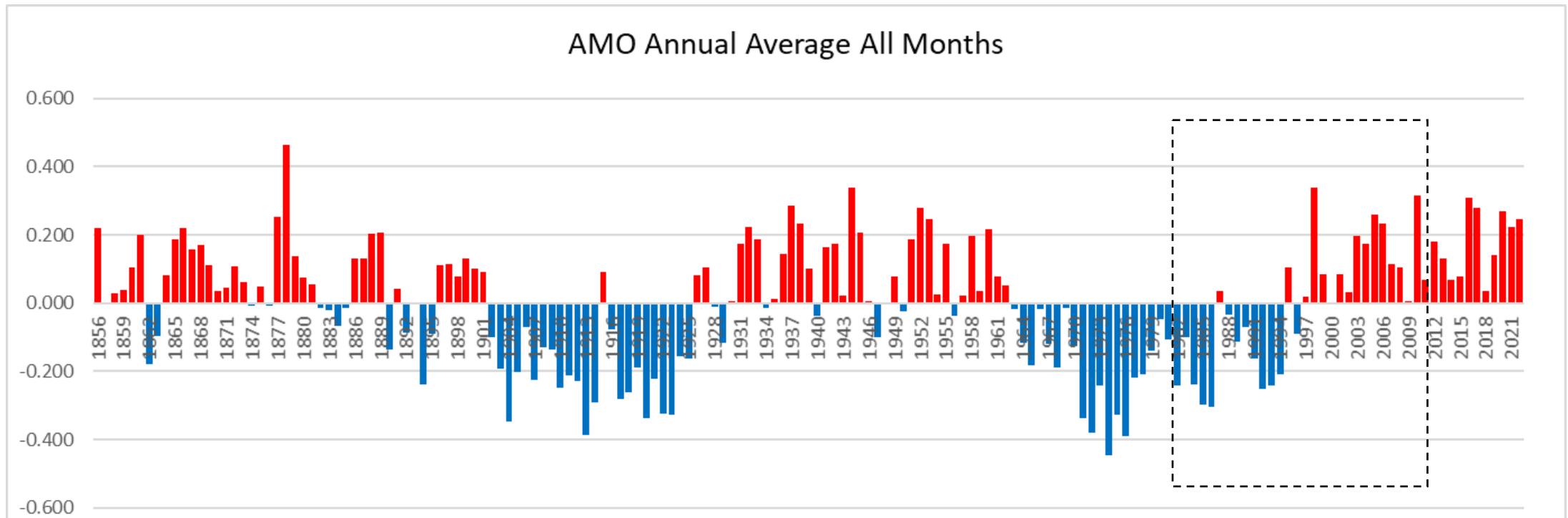
2005





Atlantic Multidecadal Oscillation (AMO)

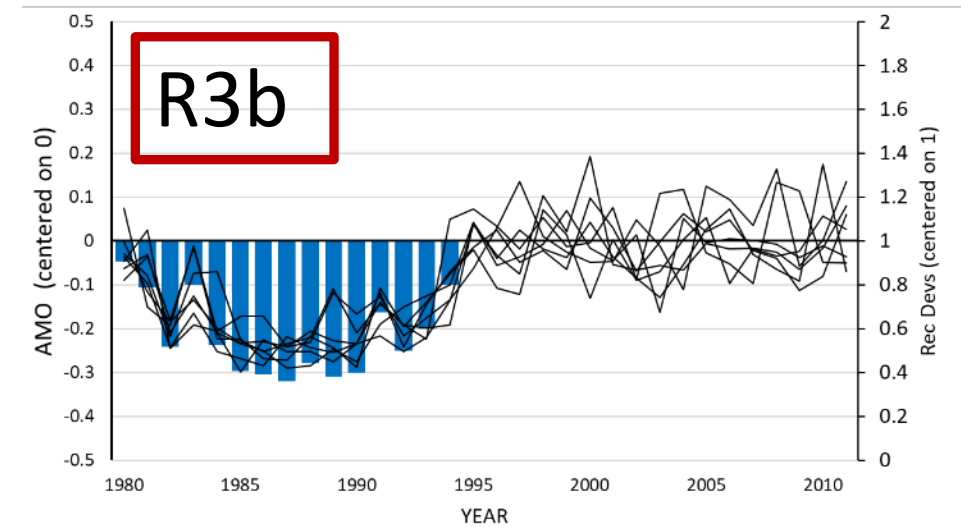
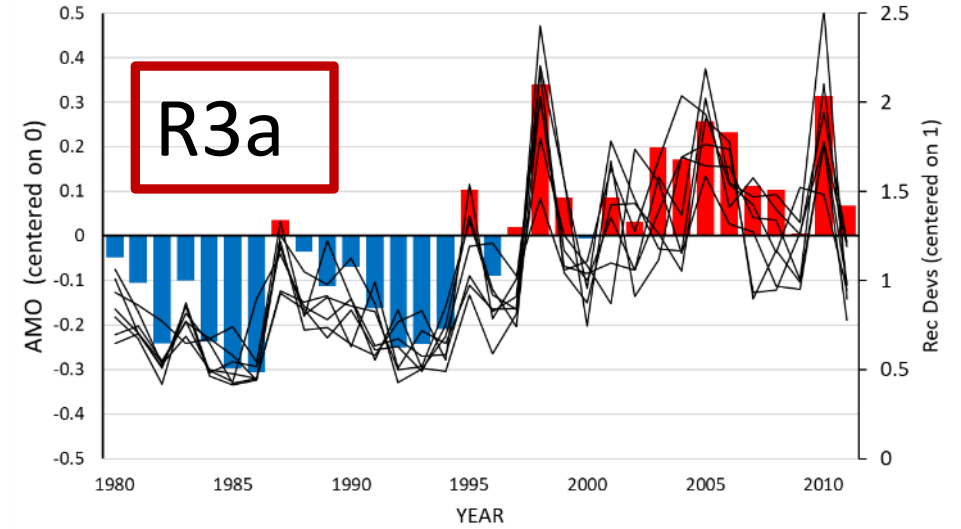
- We considered a 32 year time period that started and continued with 16 years of negative deviations and continued for 16 years of positive deviations. We are not postulating that the AMO is driving recruitment deviations, only that the trend is something we have actually observed in nature





Two Scenarios Considered

- We considered two climate change scenarios
- The first was a cyclical trend represented by the AMO trend
- The second was a period of negative deviations followed by a period of neutral deviations.
- Deviations were inflated by a factor of 2x to simulate climate change possibly increasing the magnitude of recruitment deviations.





R4 – Implementation error / IUU

- Catches assumed to be 10% higher than the TAC
- Catches are assumed to be unreported (i.e., the observed catch provided to the CMPs is equal to the TAC, which is ~90% of the actual removals).



R5 – Minimum size limit

- **Rec. 90-02:** minimum size limit requiring that swordfish less than 25 kg (or 125 cm lower jaw fork length, LJFL) not be retained in ICCAT fisheries in the Atlantic (with a 15% tolerance in the landed catch).
- Supplemented by **Rec. 95-10:** alternative minimum size limit of 119 cm LJFL (or 15 kg) with no tolerance in the landed catch.
- **Res. 19-14**
 “In the development of the operating models, the Commission would like the SCRS to allow for the evaluation of minimum size limits as strategies to achieve management objectives”
- Robustness test allows for feedback to the Commission on effects of retaining minimum size limit (120 cm) versus removal of the minimum size limit in the projection period





SCRS/PA4 work to continue in 2024

- Exceptional circumstances protocol (see examples from ALB and BFT)
- Additional robustness tests
 - Climate Change (additional tests e.g., distribution, productivity, fleet dynamics)
 - Minimum size limit testing (selectivity changes)



CMP details



TAC change steps

- MCC5
 - 1 step up: 120% of base TAC
 - 2 steps down: 50% and 75% of base TAC
 - Includes minimum TAC: 4000 t
- Depending on the tuning the range of TAC values is:
 - 51%: 4,000 t to 14,054 t
 - 60%: 4,000 t to 13,426 t
 - 70%: 4,000 t to 12,854 t



TAC change steps

- MCC7
 - 4 steps up: 110%, 120%, 125%, 135% of base TAC
 - 2 steps down: 75%, 50% of base TAC
- Depending on the tuning the range of TAC values is:
 - 51%: 5,513 t to 14,886 t
 - 60%: 5,256 t to 13,192 t
 - 70%: 5,002 t to 13,505 t
- Uses a smoother on the combined index to buffer against sudden large changes