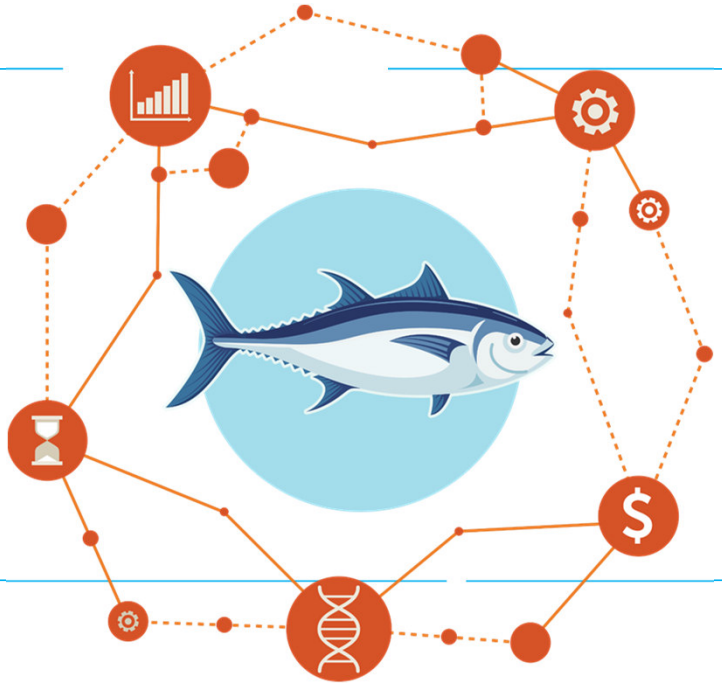
BFT Management Strategy Evaluation (MSE)



February, 2022

References

1. BFT MSE summary 4-page
2. BFT MSE summary 1-page
3. Splash Page: https://iccat.github.io/abft-mse/

Outline

1. Progress report on BFT MSE

   9 Candidate Management Procedures from multiple teams, revisions to match Panel 2 recommendations

   Discussion points for Panel 2

2. Overview of existing performance statistics

3. Review of key tradeoffs and initial CMP performance

4. Demonstration of the management framework and path forward

Candidate Management Procedures (9)

CMP	Indices used		Formulae for calculating TACs	References
	EAST	WEST		
FZ	JPN LL NEAtl2, FR AER SUV2, W-MED LAR SUV	CAN SWNS RR, US RR 66-144, US-MEX GOM PLL	TACs are product of stock-specific F0.1 estimates and estimate of US-MEX GOM PLL for the West and W-MED LAR SUV for the East.	SCRS/2020/144 SCRS/2021/122
AI	All	All	Artificial intelligence MP that fishes regional biomass at a fixed harvest rate.	SCRS/2021/028
BR	MOR POR TRAP, JPN LL NEAtl2, FR AER SUV2, W-MED LAR SUV	CAN SWNS RR, US RR 66-144, JPN LL West2, US-MEX GOM PLL, GOM LAR SUV	TACs set using a relative harvest rate for a reference year (2018) applied to the 2-year moving average of a combined master abundance index. In recent refinement, the weighting range across individual indices on the East area master index has been reduced, given that this resulted in improved resource conservation performance.	SCRS/2021/121 SCRS/2021/152
EA	MOR POR TRAP, JPN LL NEAtl2, FR AER SUV2, W-MED LAR SUV	US RR 66-144, JPN LL West2, US-MEX GOM PLL, GOM LAR SUV	Adjust TAC based on ratio of current and target abundance index.	SCRS/2021/032 SCRS/2021/P/046
LW	JPN LL NEAtl2, W-MED LAR SUV	US-MEX GOM PLL, GOM LAR SUV	TAC is adjusted based on comparing current relative harvest rate to reference period (2019) relative harvest rate.	SCRS/2021/122
NC	MOR POR TRAP	US-MEX GOM PLL	TAC is updated using an average of an index in recent years compared to an average in previous years. The scale of TAC increase/decrease is controlled based on the trend in catches and indices.	SCRS/2021/122
PW	JPN LL NEAtl2, W-MED LAR SUV	US-MEX GOM PLL, GOM LAR SUV	TAC is adjusted based on comparing current relative harvest rate to reference period (2019) relative harvest rate.	SCRS/2021/155
TC	MOR POR TRAP, JPN LL NEAtl2, GBYP AER SUV BAR, W-MED LAR SUV	US RR 66-144	TAC is adjusted based on F/F_{MSY} and B/B_{MSY} (model-based).	SCRS/2020/150 SCRS/2020/165
TN	JPN LL NEAtl2	JPN LL West2	Both area TACs calculated based on their respective JPN LL moving averages.	SCRS/2020/151 SCRS/2021/041

Discussion points for Panel 2 March

- Update on BFT-MSE framework and CMPs by SCRS
- Feedback and guidance on additional changes to the CMPs by PA2
  - Percent change in TAC at each management cycle: greater than 20% on downward change may be advisable
  - Caps of 55kt (and 45 kt): result, little performance benefit of either: retain default of no caps
- Development of initial operational management objectives
  - B_{lim} proposal needs to go through the bluefin working group and fishing mortality is statistic still in development
  - Key tradeoff space

2. Overview of existing performance statistics

Performance Statistics for this MSE

- The stock should have a greater than [__]% probability of occurring in the green quadrant of the Kobe matrix
- There should be a less than [__]% probability of the stock falling below B_{LIM} (to be defined)
- Maximize overall catch levels
- Any increase or decrease in TAC between management periods should be less than [__]%

- **AvgBr** – Average Br [i.e., biomass ratio, or spawning stock biomass (SSB) relative to dynamic SSB_{MSY}] over projection years 11-30
- **Br30** – Br after 30 years
- **OFT** – Overfished Trend, SSB trend if Br30<1.
- [F statistic – once finalized]

Performance Statistics for this MSE

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- Maximize overall catch levels
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- **LD** – Lowest depletion (i.e., SSB relative to dynamic SSB_{msy}) over the projection period

Performance Statistics for this MSE

- The stock should have a greater than [__]% probability of occurring in the green quadrant of the Kobe matrix
- There should be a less than [__]% probability of the stock falling below B_{LIM} (to be defined)
- Maximize overall catch levels
  - **AvC10** – Mean catches (t) over first 10 years
  - **AvC30** – Mean catches (t) over 30 years
- Any increase or decrease in TAC between management periods should be less than [__]%

Performance Statistics for this MSE

- The stock should have a greater than [__]% probability of occurring in the green quadrant of the Kobe matrix
- There should be a less than [__]% probability of the stock falling below B_{LIM} (to be defined)
- Maximize overall catch levels
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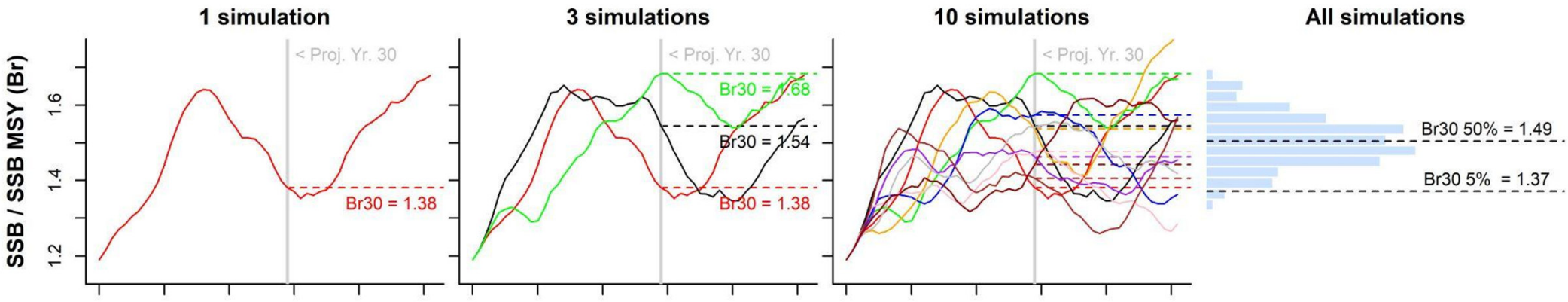
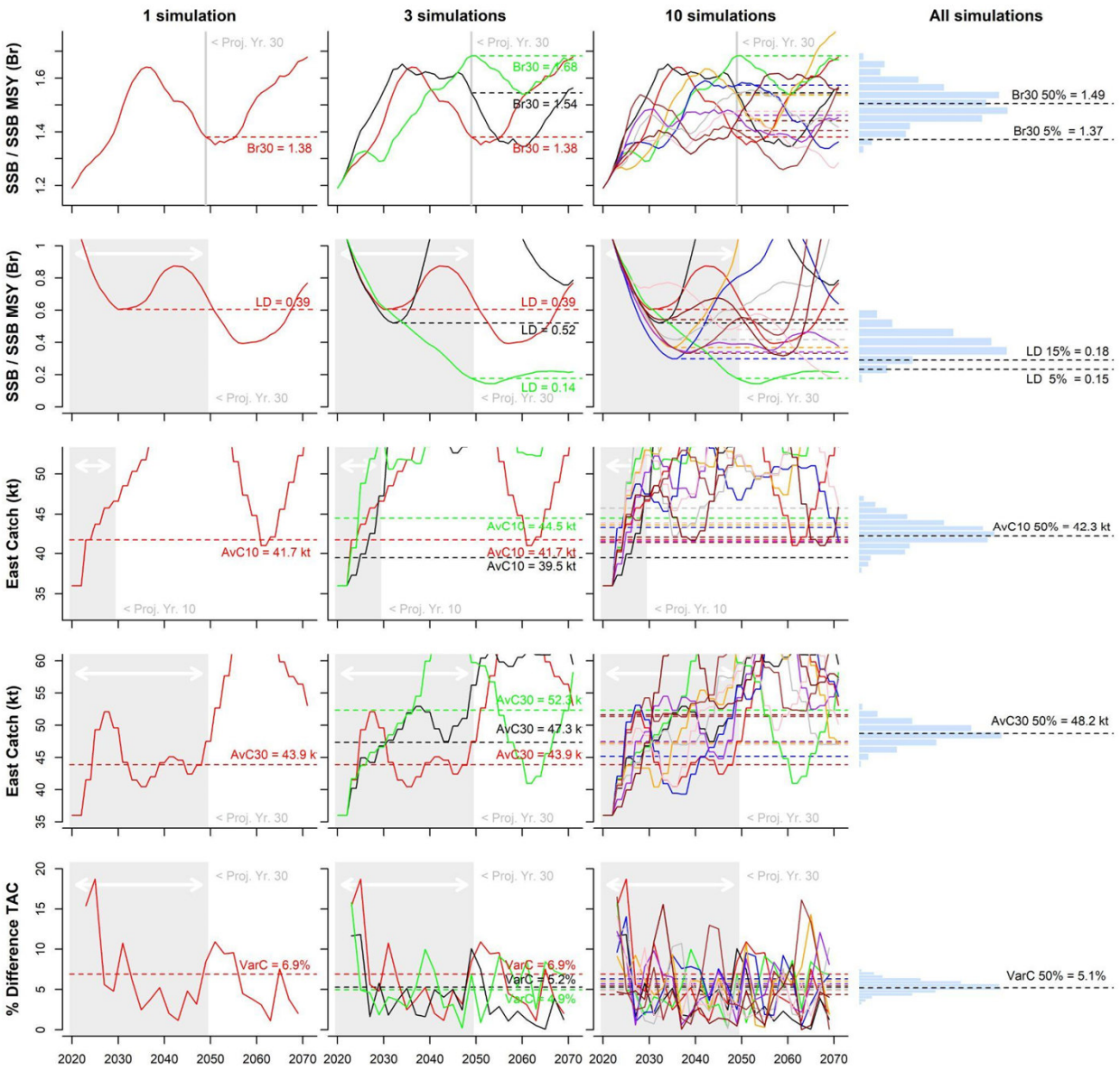
  - **VarC** – % Variation in TAC between management periods

Br30: spawning biomass relative to dynamic SSB_{MSY} after projection year 30





Br30: spawning biomass relative to dynamic SSB_{MSY} after projection year 30

LD: Lowest depletion (spawning biomass relative to dynamic SSB_{msy})

AvC10: Average catch years 1-10, measures short term yield

AvC30: Average catch years 1-30, measures short & long term yield

VarC: Average % Variation in TAC between management periods

3. Review of key tradeoffs and initial CMP performance

Initial results: Tradeoff between stock status and yield

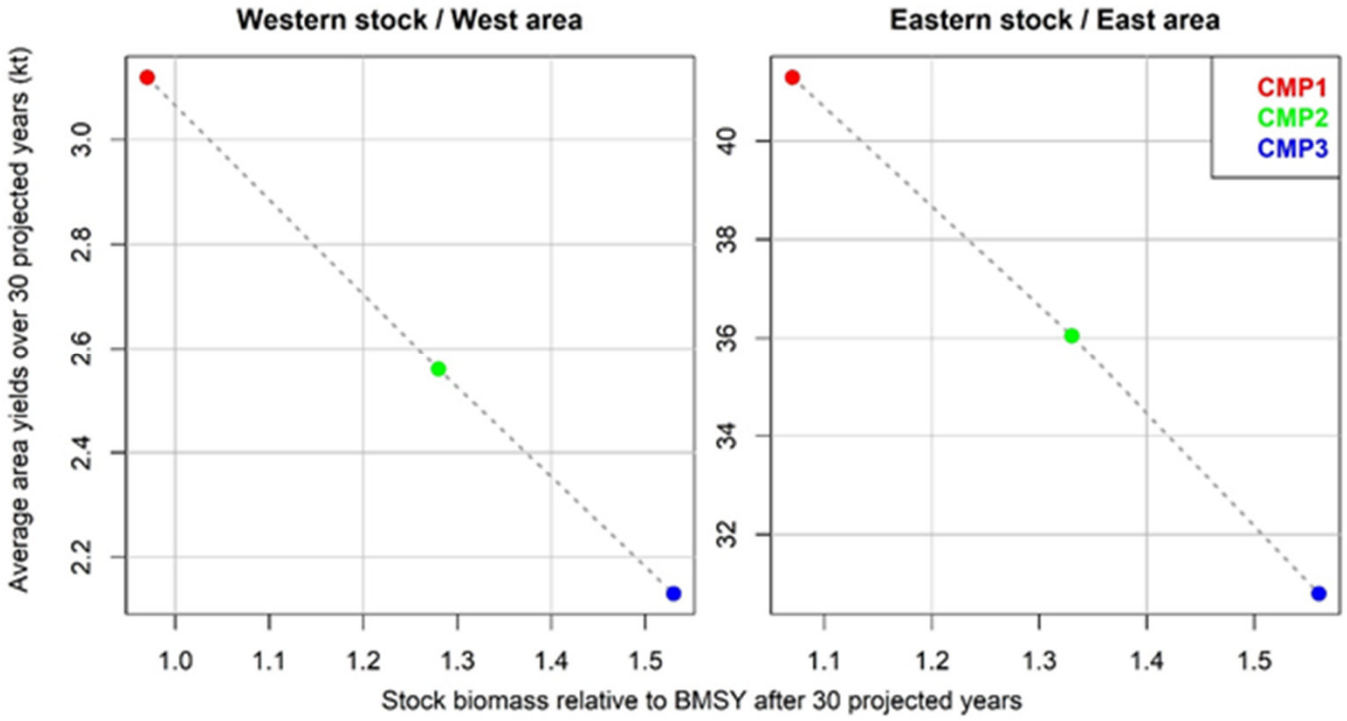
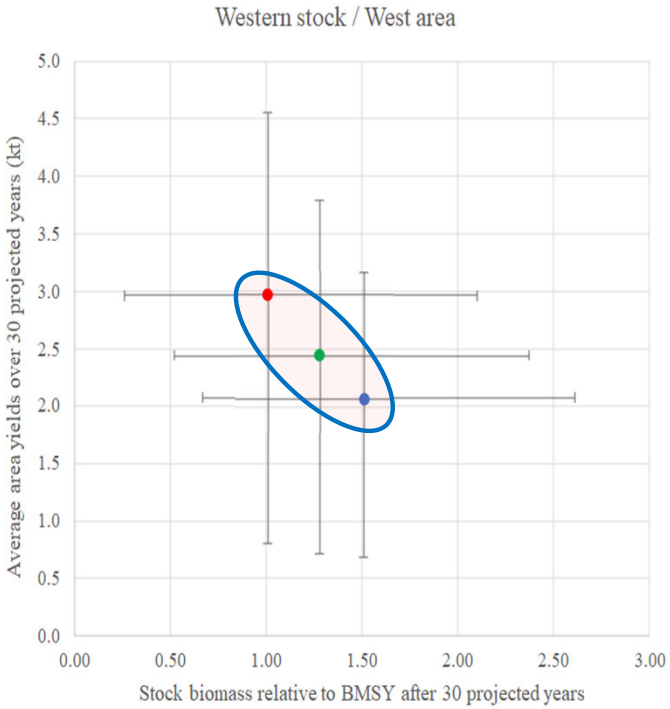
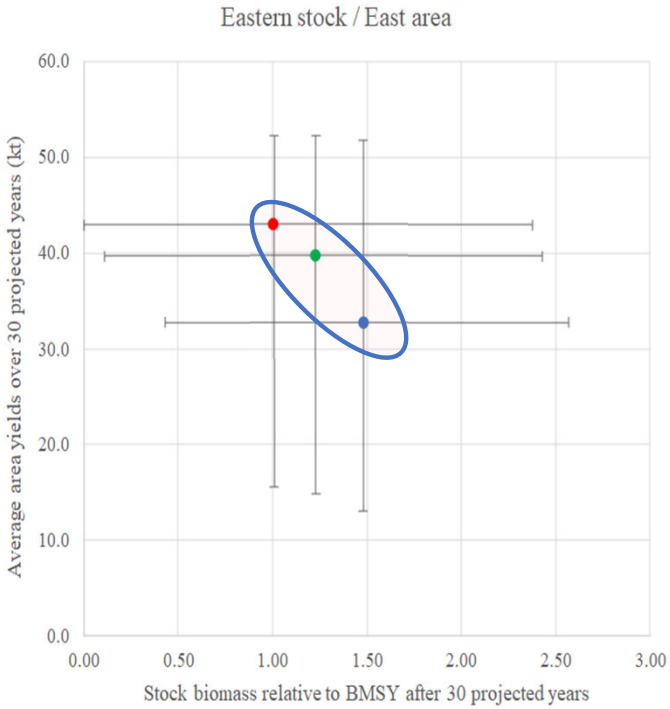


Figure 1. An example of the primary trade-off between yields (what is taken by fishing over 30 years, expressed as an annual average) and stock biomass (what remains in the resource after those 30 years) for three CMPs (CMP1 – red, CMP2 – green, CMP3 – blue). The left panel features western *stock* biomass (relative to B_{MSY}) on the horizontal axis and West *area* catch (in 1000s of tons) on the vertical axis. The right panel features eastern *stock* biomass (relative to B_{MSY}) on the horizontal axis and East *area* catch (in 1000s of tons) on the vertical axis. CMP1 has the highest catches but also the lowest eventual biomass relative to B_{MSY}. CMP3 has the lowest catches but also the highest eventual biomass relative to B_{MSY}. CMP2 has intermediate performance for both catch and biomass.

Status and yield tradeoff space





The ellipse is the primary decision space where most CMPs will fall.

Br30<1 involves high risk whereas Br30>1.5 reduces yield substantially.

Why greater than 20% on downward TAC change

	VarC (50%)	AvC10 (50%)	AvC30 (50%)	AvgBr (5%)	LD (5%)
CMP2a	11.34	35.92	31.07	0.40	0.07
CMP2c (% TAC change)	12.34	36.62	30.85	0.61	0.11
% change	9%	2%	-1%	53%	57%

1% reduction in average yield

Big improvement in safety

Why greater than 20% on downward TAC change

	VarC (50%)	AvC10 (50%)	AvC30 (50%)	AvgBr (5%)	LD (5%)
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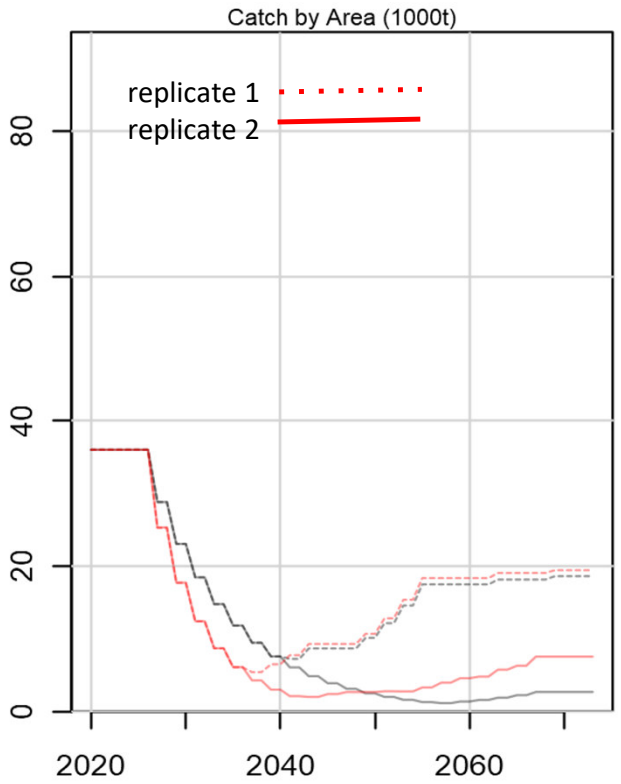
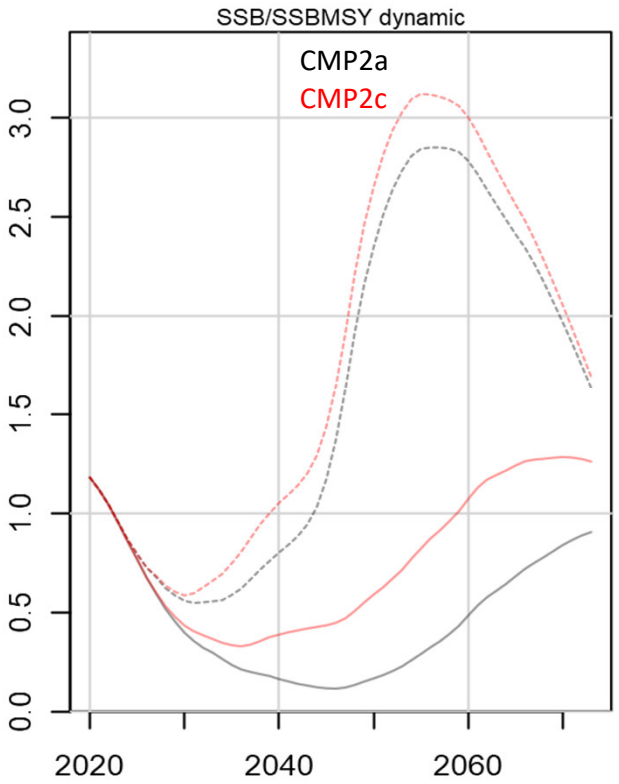
Higher percentage TAC change allows for faster recovery minimal loss in yield





General process for narrowing down CMPs

- SCRS will rank CMPs across performance statistics (yield, status, safety and stability).
- Panel 2 will see relative performance of the CMPs (see plot in next slide)
- Any candidate Management Procedure (CMP) will include at least one “control parameter” whose value determines how heavy or light the fishing pressure on stock will be.
- Ultimate decision by the Commission will likely be from very few CMPs and will involve a decision upon heavy to light fishing pressure to achieve management objectives.

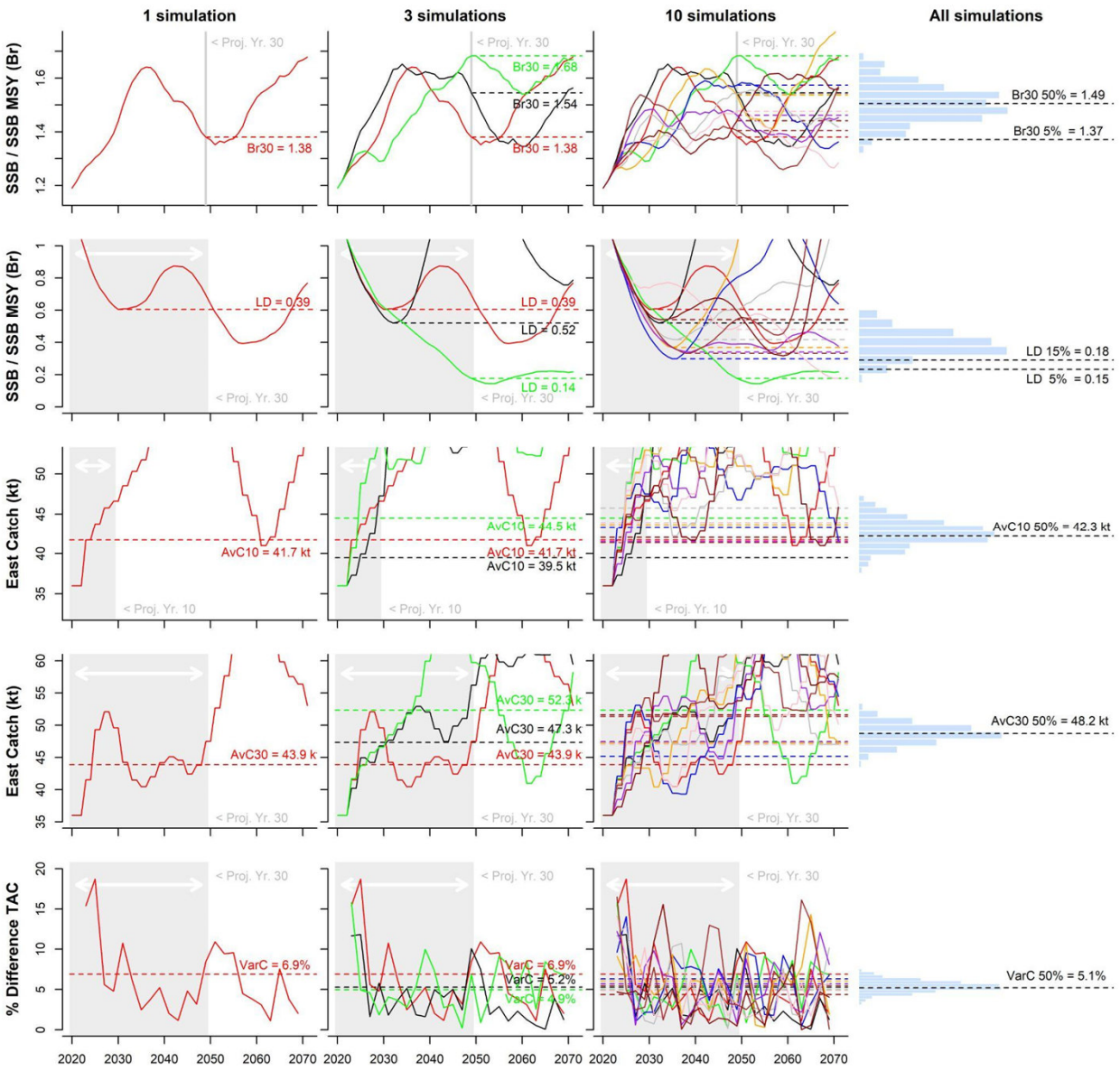
WEST	VarC (50%)	AvC10 (50%)	AvC30 (50%)	Br30 (5%)	LD (5%)	LD (15%)
CMP1	13.792	3.093	2.87	0.436	0.221	0.432
CMP2	11.364	2.046	2.209	0.527	0.26	0.476
CMP3	16.465	1.902	2.125	0.433	0.244	0.423
CMP4	15.974	2.958	2.527	0.021	0.016	0.254

EAST	VarC (50%)	AvC10 (50%)	AvC30 (50%)	Br30 (5%)	LD (5%)	LD (15%)
CMP1	16.722	39.056	37.654	0.344	0.301	0.547
CMP2	11.413	34.738	28.497	0.489	0.327	0.517
CMP3	16.283	30.848	27.433	0.448	0.284	0.48
CMP4	13.949	41.481	30.294	0.071	0.065	0.286

Relative Ranking table of CMPs
(within column, green = best, red = worst)

- CMP1-4 are for illustrative purposes, to show contrast and relative performance between good, medium and poor performing CMPs within the performance statistics

- Key take home: Not every CMP may be the top in every category
- Different statistics may be ‘weighted’ differentially
- It may be possible to obtain an overall ‘score’



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AvC10: Average catch years 1-10, measures short term yield

AvC30: Average catch years 1-30, measures short & long term yield

VarC: Average % Variation in TAC between management periods

4. Demonstration of the management framework and path forward

Atlantic Bluefin Tuna management framework

Current Framework

Separate East and West assessment models → project forward 2-3 years → generate Kobe II strategy matrix for E & W → Commission sets TAC

What does adopting a Management Procedure approach look like?

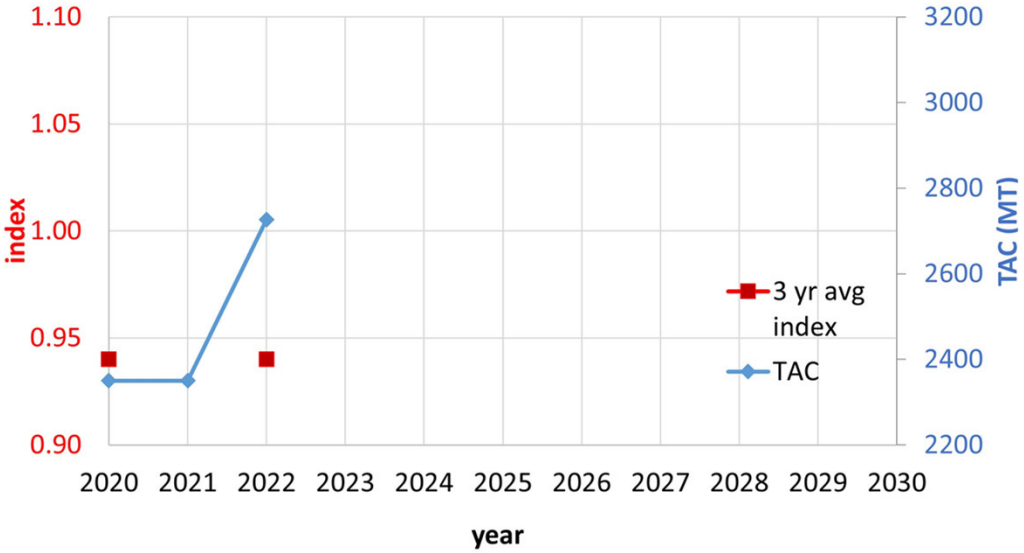
Roles in the Management Strategy Evaluation process

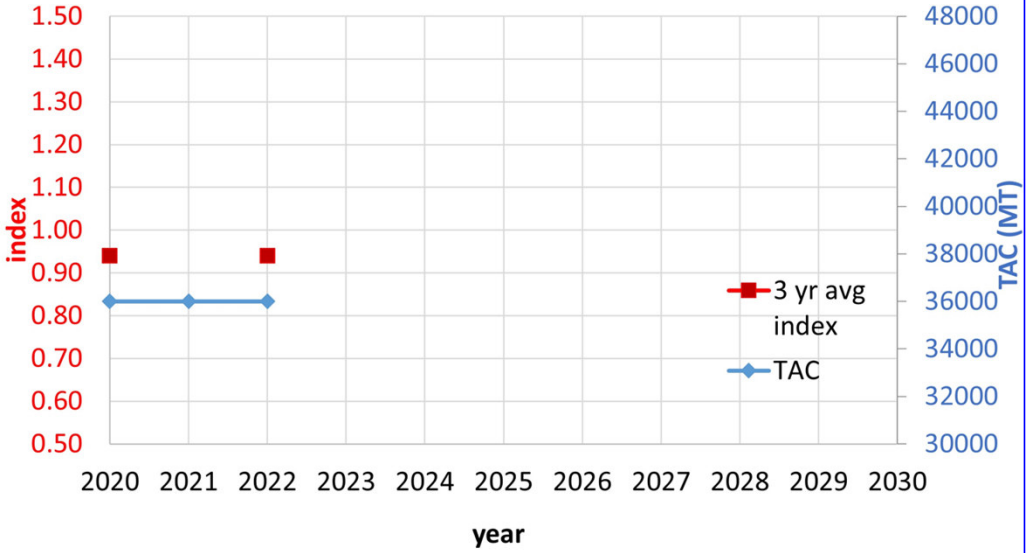
	Scientists	Managers (Stakeholders *advise*)	status
Operating models	Construct, **adopt** reference grid and robustness set	*advise*	*completed*
	Adopt plausibility weights for OMs	*advise*	*completed*
Management objectives	Propose options for initial operational MOs	**Adopt** conceptual MOs (*Res. 18-03*) Provide *advice* on Management Objectives	March 4, 1st Panel 2 meeting
	Propose options for refined MOs	**Adopt** Operational Management Objectives	May 9, 2nd Panel 2 meeting
Management Procedures	Propose Candidate MPs	Provide initial *advice* on performance preferences on Candidate MPs	April BFT meeting/ May 9, 2nd Panel 2 meeting
	Test performance of CMPs	**Adopt** MP	October 14, 3rd Panel 2 meeting/ Nov 14-21 2022 Commission
	Advise on Exceptional circumstances	**Adopt** 'rules' for Exceptional circumstances	Commission 2023

Conceptual vision for a Bluefin Management Procedure

WEST **EAST**

collect 3 years of index



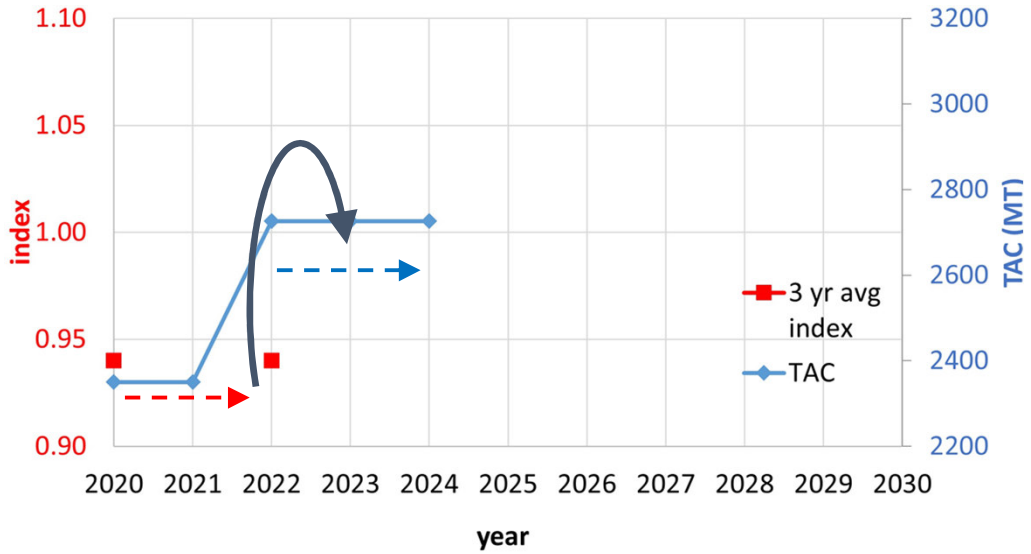


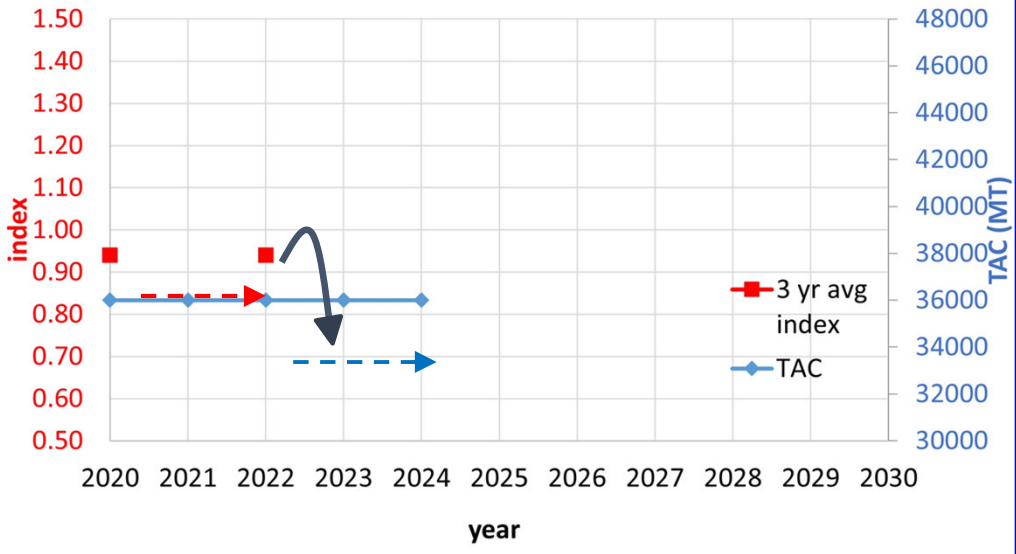
- Empirical management procedure based on index
- SCRS collects data, applies MP
- Commission sets TAC based upon MP advice
- TAC remains for *X* years

Conceptual vision for a Bluefin Management Procedure

WEST **EAST**

index constant = maintain TAC



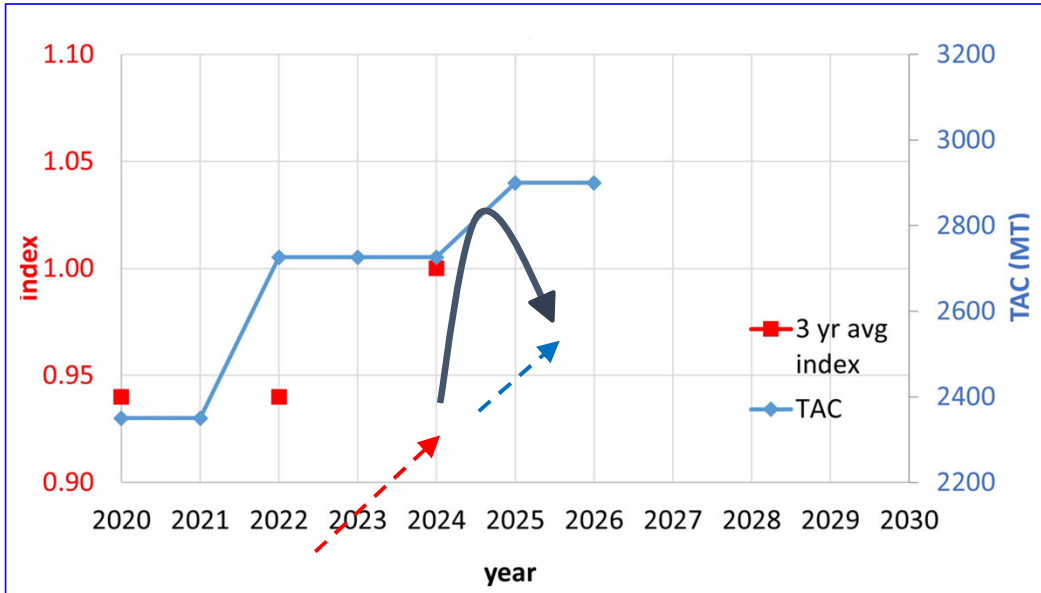


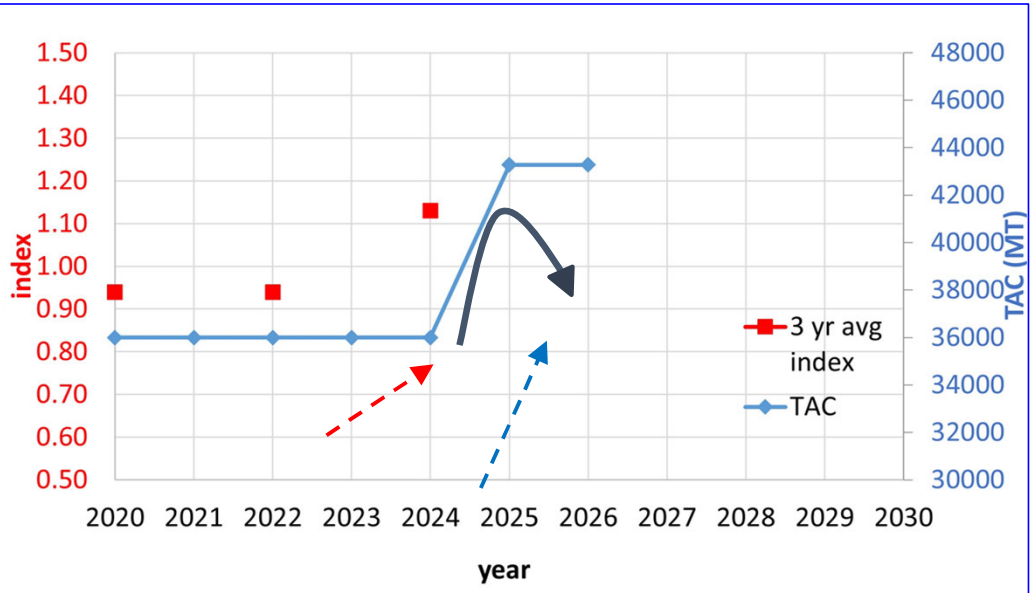
* Note that this is simply for illustration purposes and does not imply what would actually happen in the future.

Conceptual vision for a Bluefin Management Procedure

WEST **EAST**

Index increases; TAC increases

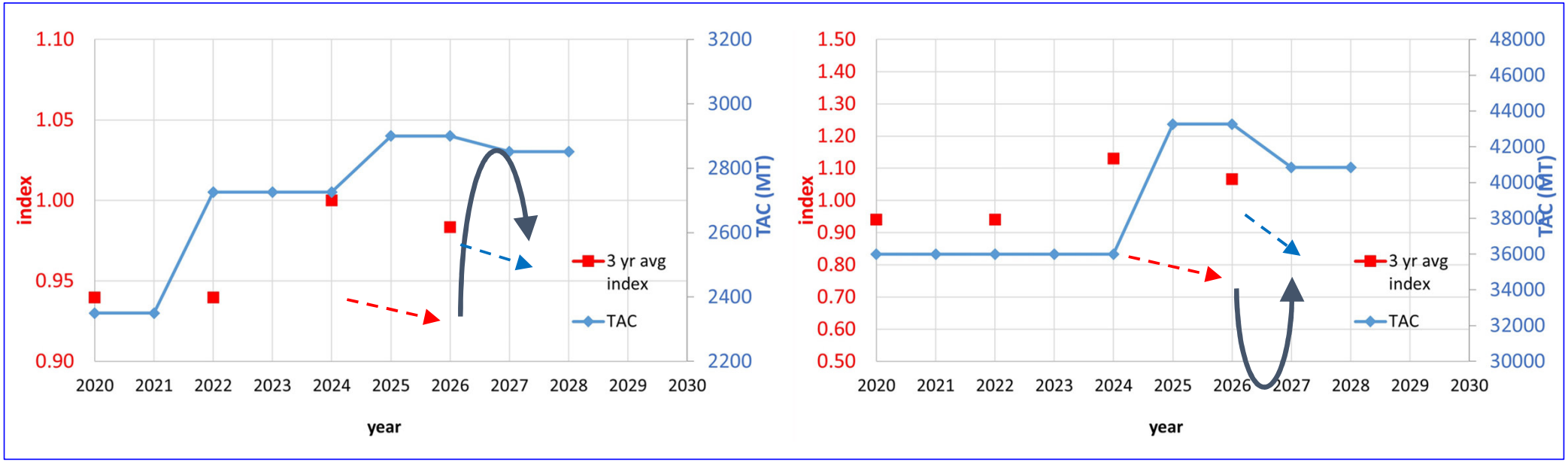




Conceptual vision for a Bluefin Management Procedure

WEST **EAST**

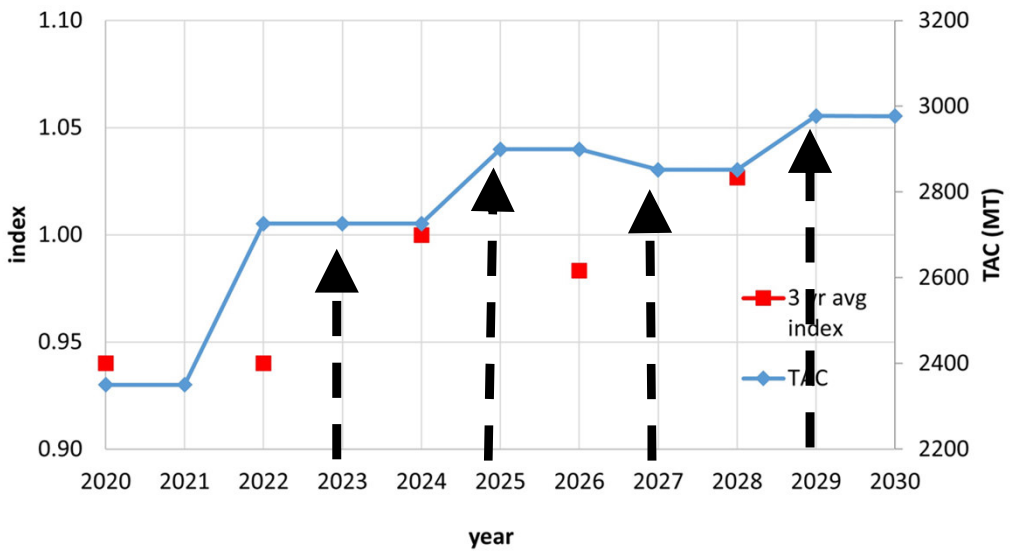
Index decreases; TAC decreases

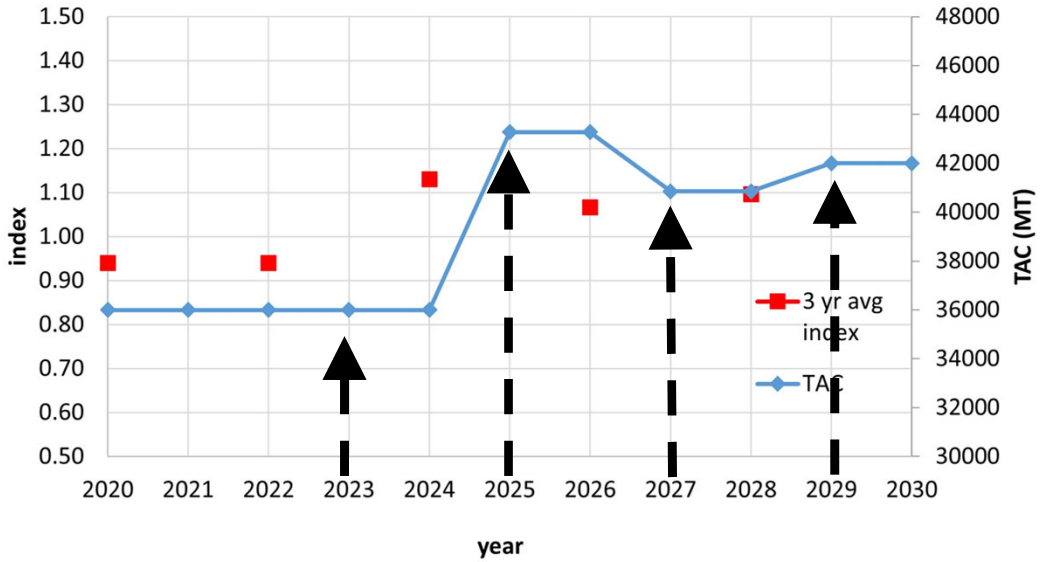


Conceptual vision for a Bluefin Management Procedure

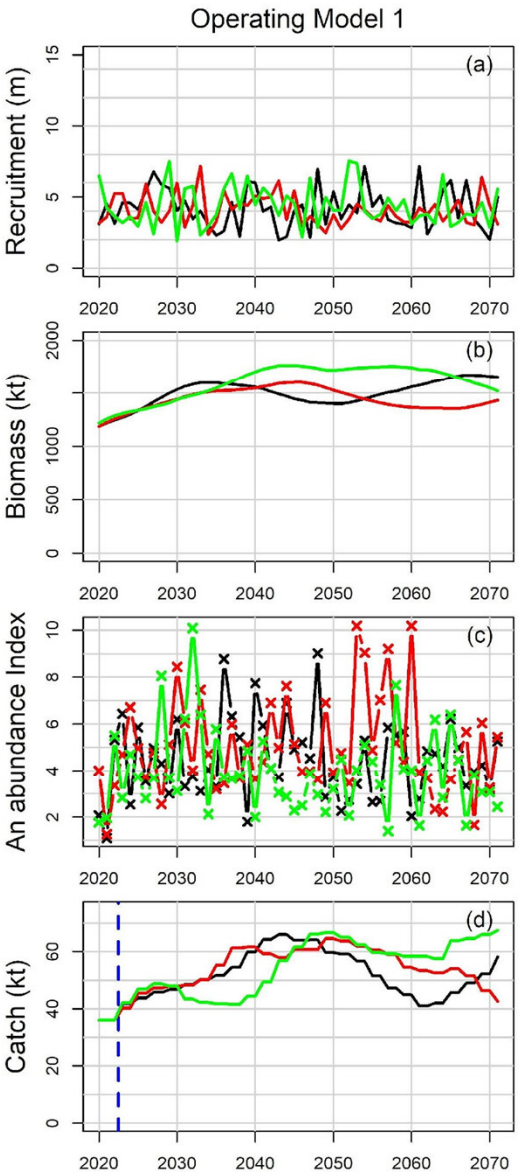
WEST **EAST**

TAC set every two years





At pre-specified intervals, Commission adopts a new TAC, based on pre-agreed **Management Procedure.**



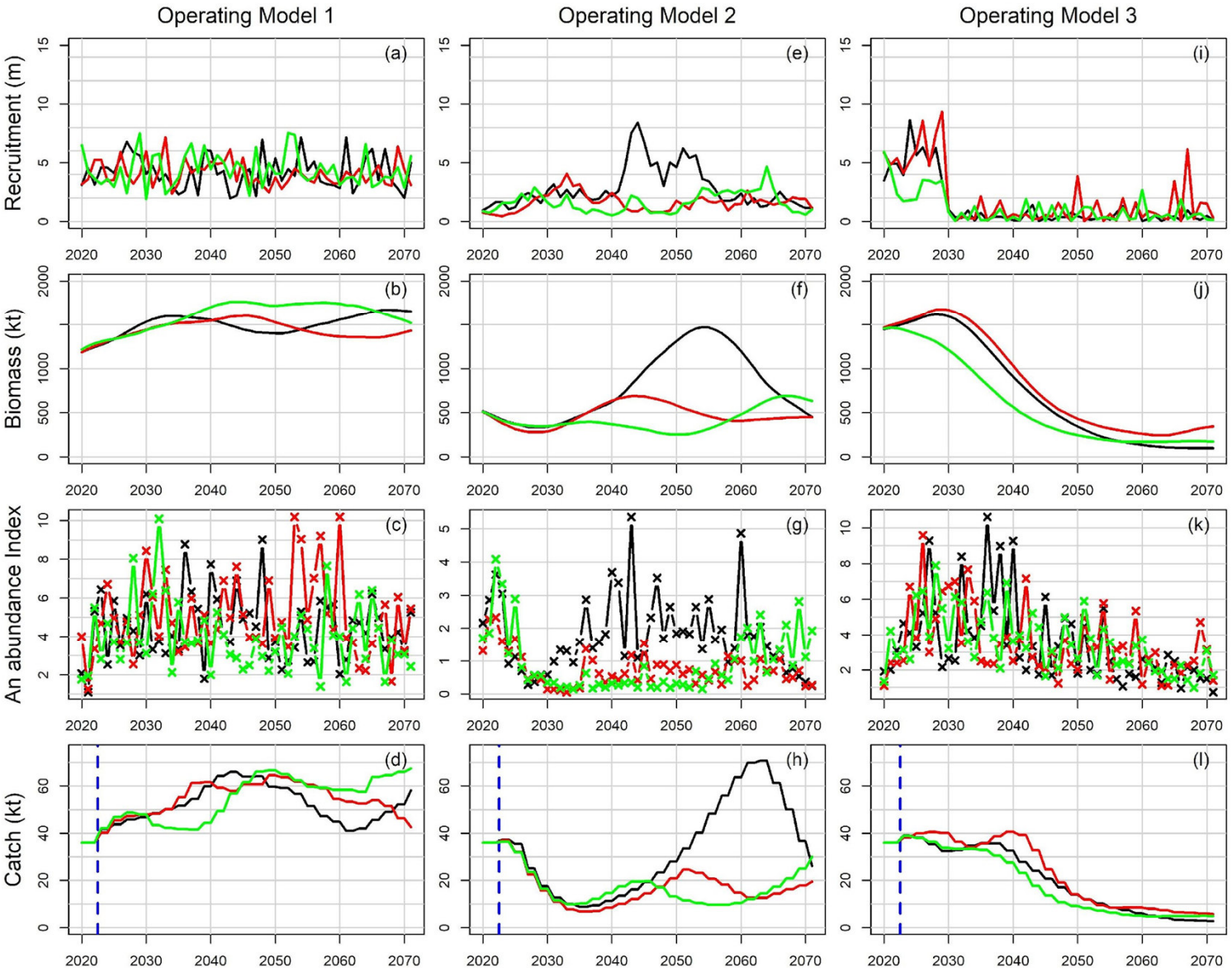
Recruitment (East Stock)
red, green and black lines are replicates from one operating model

trend in biomass
(East Stock)

Corresponding CPUE
(Eastern Area)

Resulting TAC (Eastern Area)
from one management procedure that uses previous 3 year's CPUE to modify previous TAC

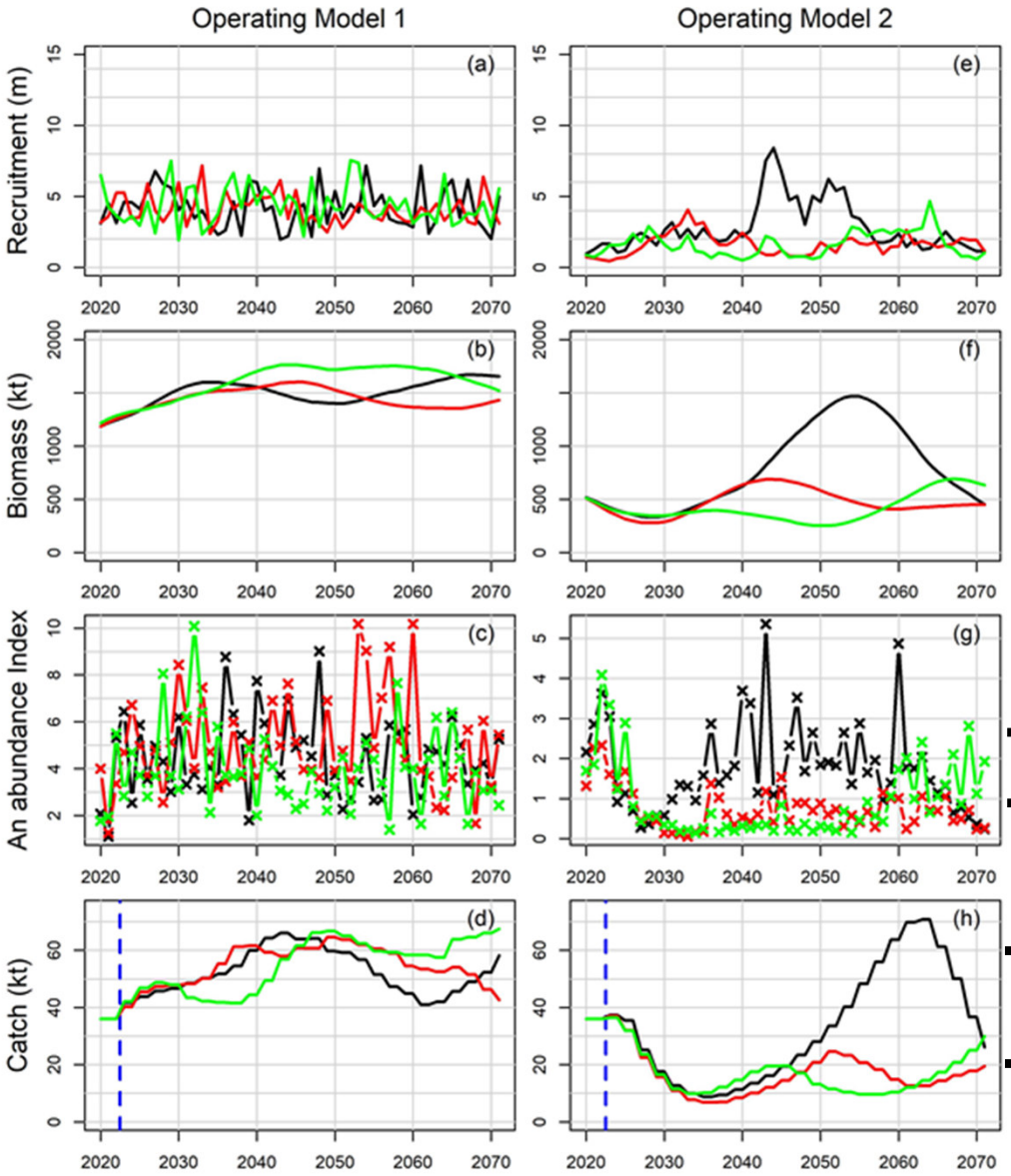
OM1 is Recruitment level 1
western stock – "low" scenario (i.e., switch from high to low 70s);
eastern stock – switch from low to high in 80s



OM1 is Recruitment level 1 western stock – "low" scenario (i.e., switch from high to low 70s); eastern stock – switch from low to high in 80s

OM2 is Recruitment level 2 western stock – "high" recruitment scenario; eastern stock – no regime shift, high recruitment

OM3 is Recruitment level 3 same as Level 1, with regime shift back to early period 10 years into the projections

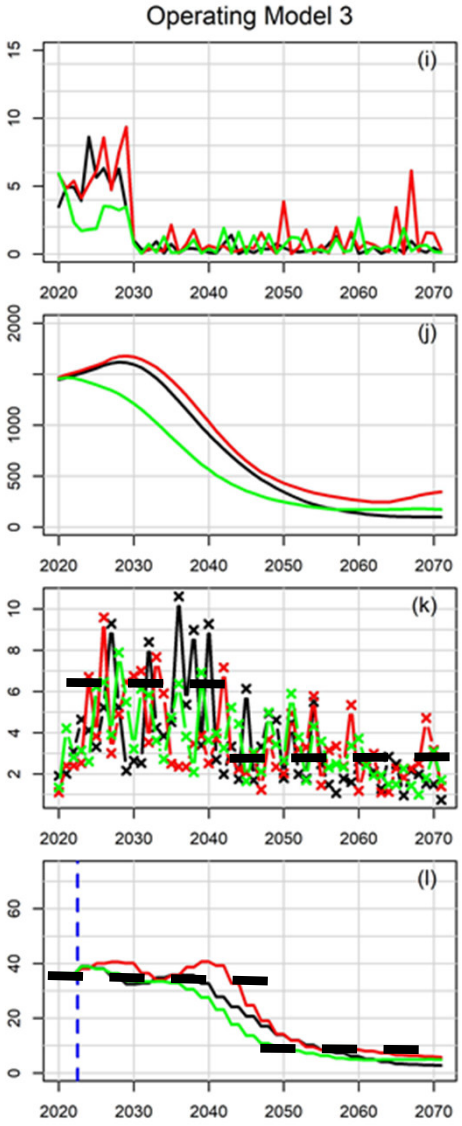


Let's talk about Recruitment Level 1 (OM1: high Eastern) versus Recruitment Level 2 (OM2: low Eastern)

Future expected CPUE would be very different under the 2 scenarios

Future expected Catch would be very different under two scenarios

Catch would be a function of future indices



Let's talk about the future regime shift (Operating model 3, in this example)

Recent CPUE is high

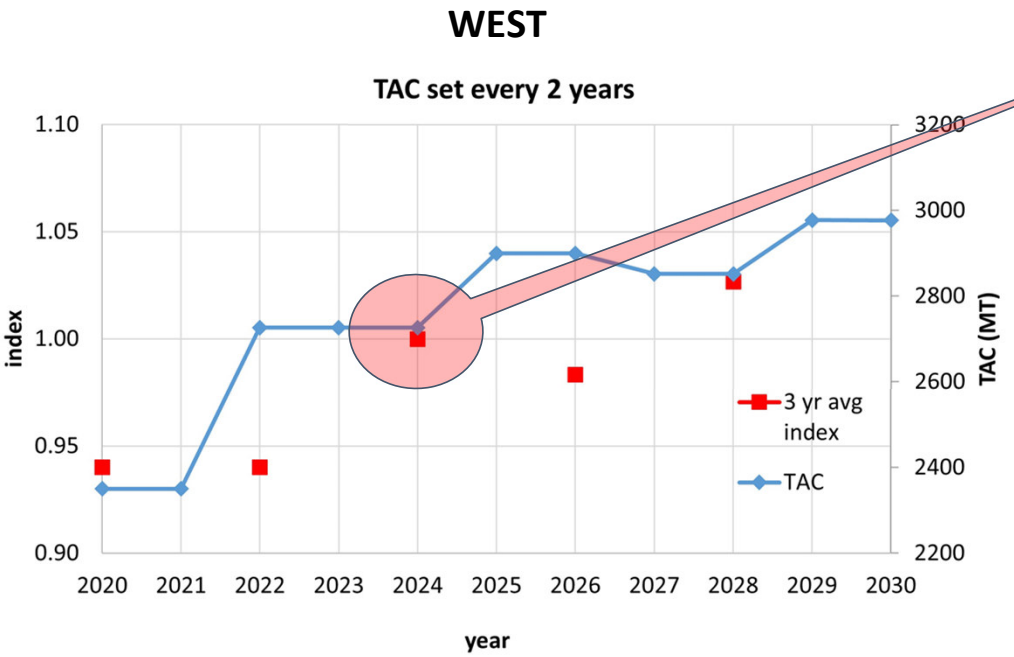
If regime shift happens, CPUE will drop noticeably

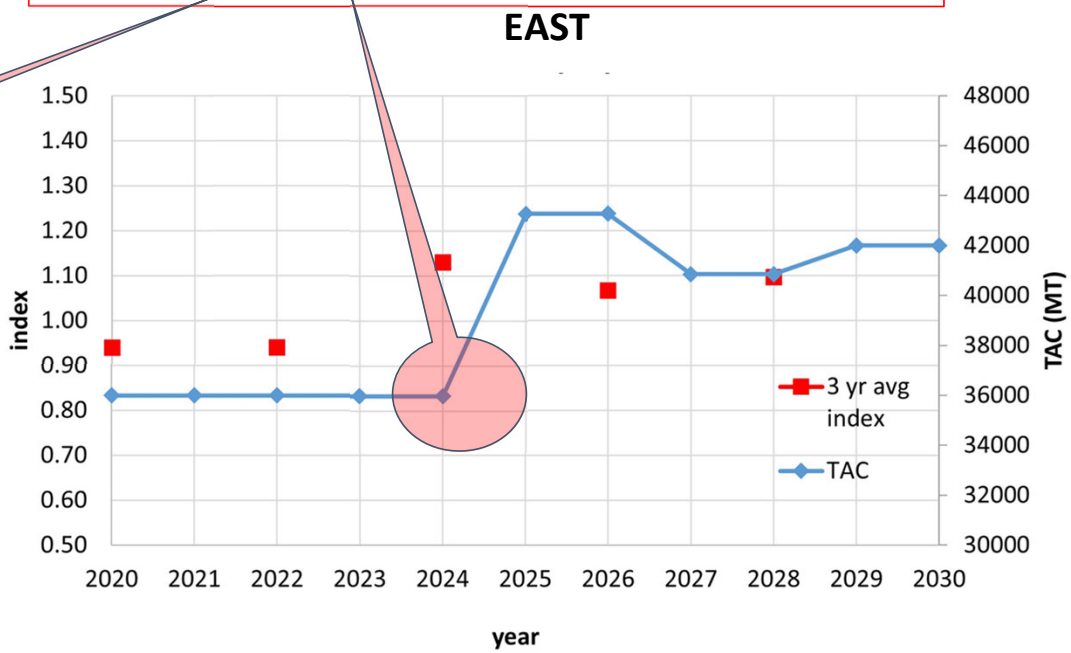
Near-term catch would be high, reflecting high CPUE

A well-performing Management Procedure would reduce TAC commensurate with decrease in CPUE

Let us consider factors that affect future TAC

1.Previous TAC
2.Indices
3.Responsiveness of MP to indices





Management Advice Framework (first sketch)

year	event
2022	Management Procedure Sets 2 year East and West TAC
2023	Define Exceptional Circumstances Provisions
2024	Management Procedure Sets 2 year East and West TAC
2025	Stock Assessment- health check (exact timing TBD)
2026	Management Procedure Sets 2 year East and West TAC
2027	MSE reconditioning, possible start in 2026 (TBD)
2028	Management Procedure Sets 2 year East and West TAC
2029	TACs as set in 2028

Management Procedure sets TAC for 2 (or possibly 3) years for both East and West by modifying previous TAC based on recent indices

Less frequent stock assessments will occur on a predetermined interval as 'health or status' checks and to inform possible reconditioning

Exceptional circumstance provisions specify situations when MP can be overridden, e.g. CPUE outside range tested, inability to update an index for multiple years, natural disasters, etc

MP revisions and MSE 'reconditioning' e.g. refitting to new data, incorporation of new information or new methodology would be considered (groundbreaking science, exceptional circumstances, etc) on a predetermined interval.

Next Steps, 2022 ICCAT official and unofficial meetings (yellow are Panel 2/Commission meetings)

Date		Meeting (virtual or TBD)	Objectives
2022	March 4	1st Panel 2 meeting on BFT MSE(virtual)	1. SCRS to present updated MSE framework and CMPs. 2. Panel 2 to provide feedback and guidance on additional changes to the CMPs. 3. Panel 2 to develop initial operational management objectives.
	March/April	informal SCRS BFT MSE Tech Group meeting (virtual)	1. Address Panel 2 feedback 2. Prepare material for BFT Species group
	April 18-26	EBFT Data Prep (virtual)	
	May 3-6	SCRS BFT MSE Technical Group meeting (virtual)	1. MSE Technical Group to present changes to CMPs based on Panel 2/Commission input. 2. BFTSG to update performance statistics based on initial operational management objectives, if necessary. 3. BFTSG to provide feedback and approval of final MSE robustness trials. 4. BFTSG to do initial cull of CMPs. 5. BFTSG to develop presentation to Panel 2 on progress.
	May 9	2nd Panel 2 meeting on BFT MSE (virtual)	1. SCRS to present final MSE framework and draft final results of culled list of CMPs. 2. Panel 2 to provide feedback and guidance on additional changes to the CMPs. 3. Panel 2 to agree to draft final operational management objectives.
	July 4-12	EBFT Assessment (virtual)	
	July (TBD)	Informal SCRS BFT MSE Tech Group meeting (virtual)	1. MSE Technical Group to collate and address Panel 2 feedback. 2. CMP developers to present revised results, incorporating feedback.

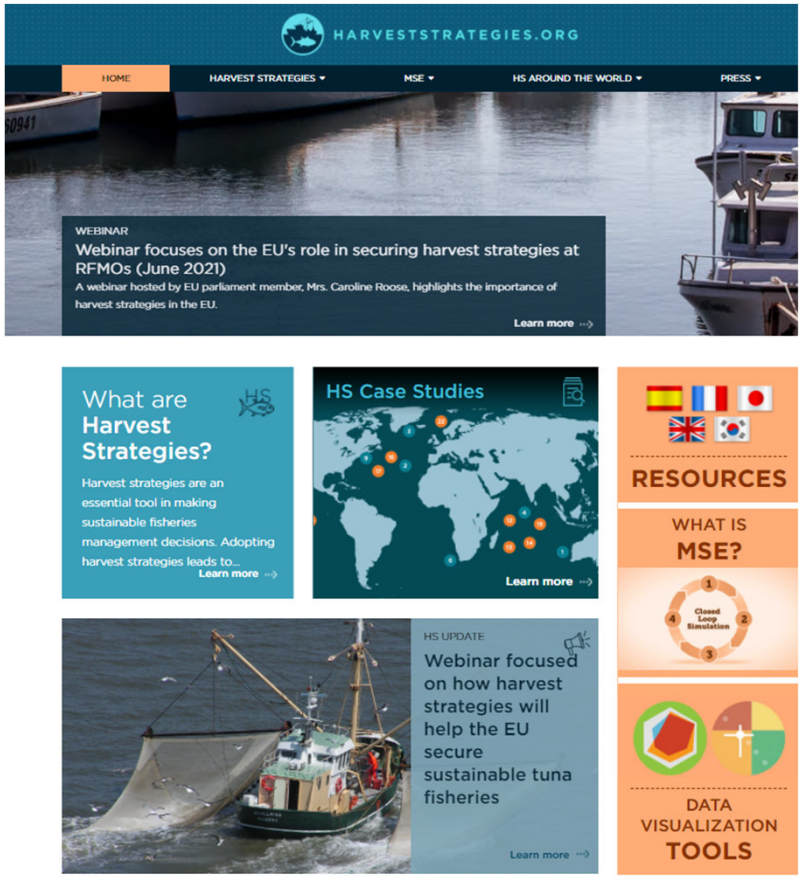
2022 ICCAT official and unofficial meetings (yellow are Panel 2/Commission meetings)

Date		Meeting (virtual or TBD)	Objectives
2022	September 5-9	SCRS BFT MSE Technical Group meeting (virtual)	1. MSE Technical Group to present updated CMP results. 2. BFTSG to provide feedback. 3. CMP developers to present revised results, incorporating feedback. 4. BFTSG to cull the CMPs to a maximum of three.
	September 19-24	SCRS BFT Species Group (TBD)	1. BFTSG & SCRS to review and endorse final CMPs results. 2. BFTSG & SCRS to select one to three final CMPs for presentation to Panel 2.
	September 26-3 Oct	SCRS Plenary (TBD)	1. SCRS to select one to three final CMPs for presentation to the Panel 2.
	October 14	3rd Panel 2 meeting BFT MSE (virtual)	1. SCRS to present final CMPs, with all final specifications, for review. 2. Panel 2 to select 1-3 CMPs to recommend for Commission adoption.
	November 14-21	Annual Commission meeting (TBD)	1. Commission to adopt a fully specified MP, including final operational management objectives.

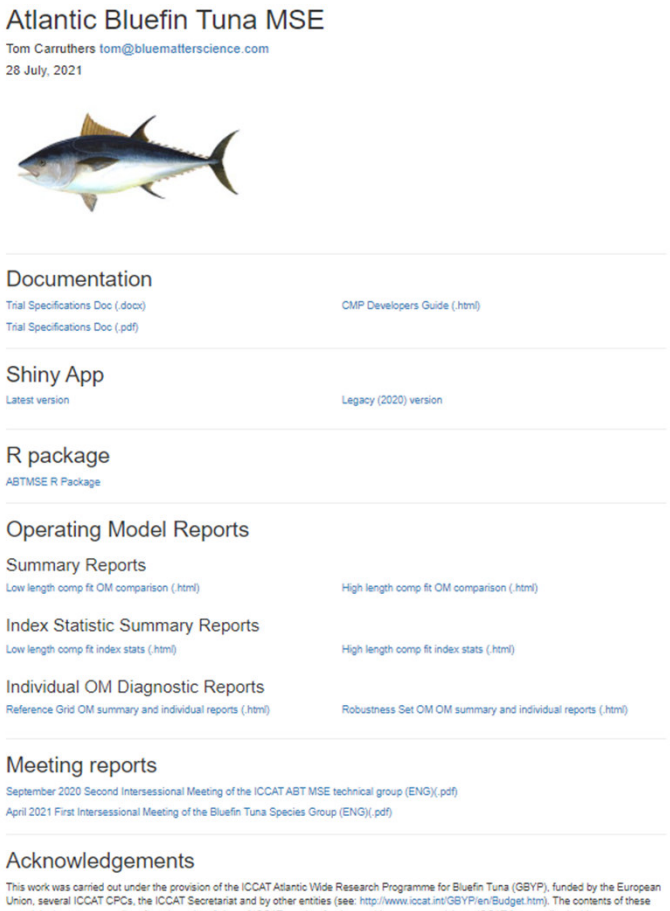
Extra material

Other Resources

[Harveststrategies.org MSE outreach materials](#)
(multiple languages)



[Splash Page: https://iccat.github.io/abft-mse/](#) (Eng only)



Atlantic Bluefin Tuna MSE

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Documentation

Trial Specifications Doc (.docx)
Trial Specifications Doc (.pdf)
CMP Developers Guide (.html)

Shiny App

Latest version
Legacy (2020) version

R package

ABTMSE R Package

Operating Model Reports

Summary Reports

Low length comp fit OM comparison (.html)
High length comp fit OM comparison (.html)

Index Statistic Summary Reports

Low length comp fit index stats (.html)
High length comp fit index stats (.html)

Individual OM Diagnostic Reports

Reference Grid OM summary and individual reports (.html)
Robustness Set OM OM summary and individual reports (.html)

Meeting reports

September 2020 Second Intersessional Meeting of the ICCAT ABT MSE technical group (ENG)(.pdf)
April 2021 First Intersessional Meeting of the Bluefin Tuna Species Group (ENG)(.pdf)

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Appendix D. Key terminology used in this document

Limit reference point (LRP): A benchmark for an indicator that defines an undesirable biological state of the stock such as the B_{lim} or the biomass limit which is undesirable to be below. To keep the stock safe, the probability of violating an LRP should be very low.

Management objectives: Formally adopted social, economic, biological, ecosystem, and political (or other) goals for a stock and fishery. They include high-level or conceptual objectives often expressed in legislation, conventions or similar documents. They must also include operational objectives that are specific and measurable, with associated timelines. When management objectives are referenced in the context of management procedures, the latter, more specific definition applies, but sometimes conceptual objectives are adopted first (e.g., Rec. 18-03 for ABFT).

Management procedure (MP): Some combination of monitoring, assessment, harvest control rule and management action designed to meet the stated objectives of a fishery, and which has been simulation tested for performance and adequate robustness to uncertainties. Also known as a harvest strategy.

Management strategy evaluation (MSE): A simulation-based, analytical framework used to evaluate the performance of multiple management procedures relative to the pre-specified management objectives.

Operating model (OM): A model representing a plausible scenario for stock and fishery dynamics that is used to simulation test the management performance of CMPs. Multiple models will usually be considered to reflect the uncertainties about the dynamics of the resource and fishery, thereby testing the robustness of management procedures.

Performance statistic: A quantitative expression of a management objective used to evaluate how well an objective is being achieved by determining the proximity of the current value of the statistic to the objective. Also known as a performance metric or performance indicator.

Reference Grid: The operating models that represent the most important uncertainties in stock and fishing dynamics, which are used as the principal basis for evaluating CMP performance. The reference operating models are specified according to factors (e.g., natural mortality rate) that have multiple levels (possible scenarios for each factor, e.g., high / low natural mortality rate). Reference operating models are organized in a usually fully crossed orthogonal 'grid' of all factors and levels.

Robustness Set: Other potentially important uncertainties in stock and fishing dynamics may be included in a Robustness Set of operating models that provide additional tests of CMP performance robustness. They can be used to further discriminate between CMPs. Compared to the Reference Grid operating models, the Robustness Set models will be typically less plausible and/or influential on performance.

Eastern Biomass %		Year					
Area	Percentile	1970	1980	1990	2000	2010	2019
WATL	5%	29.3%	24.7%	28.8%	33.8%	32.6%	46.5%
	Median	**40.8%**	**55.3%**	**68.6%**	**80.0%**	**75.6%**	**79.8%**
	95%	58.4%	63.3%	82.4%	87.7%	84.1%	84.7%
GSL	5%	7.3%	15.8%	20.5%	17.5%	15.5%	24.5%
	Median	**22.0%**	**36.4%**	**47.2%**	**60.1%**	**56.8%**	**59.7%**
	95%	45.3%	49.7%	78.4%	81.1%	86.4%	79.3%
SATL	5%	99.9%	99.9%	99.9%	99.9%	99.9%	99.9%
	Median	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
	95%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
NATL	5%	96.6%	96.9%	98.9%	99.0%	98.7%	98.4%
	Median	**98.6%**	**99.3%**	**99.7%**	**99.8%**	**99.8%**	**99.8%**
	95%	99.7%	99.8%	99.9%	99.9%	99.9%	99.9%
EATL	5%	99.7%	99.8%	99.9%	99.9%	99.8%	99.9%
	Median	**99.9%**	**99.9%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
	95%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Percentage of biomass in each area that is of Eastern Stock by decade.