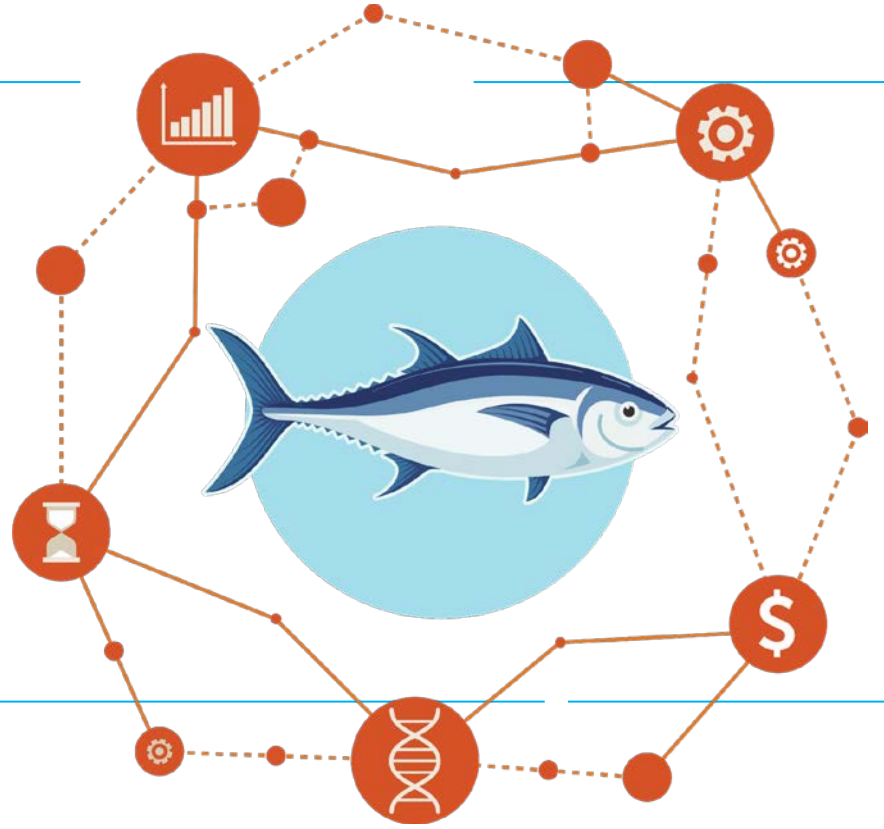
BFT Management Strategy Evaluation (MSE)



4 March 2022

References

1. BFT MSE summary: Background & Structure
2. BFT MSE summary: Preliminary Results & Next Steps
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 ID Codes	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 has been explored and may be advisable

  - Caps of 55,000t (and 45,000 t) for EBFT were explored: there was 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
  - Fishing mortality statistic is still in development
  - Key tradeoffs space

2. Overview of existing performance statistics

Performance Statistics for this MSE
(Used to evaluate achievement of management objectives)

Management Objectives (MOs)

Status: The stock should have a greater than [__]% probability of occurring in the green quadrant of the Kobe matrix

Safety: There should be a less than [__]% probability of the stock falling below B_{LIM} (to be defined)

Yield: Maximize overall catch levels

Stability: Any increase or decrease in TAC between management periods should be less than [__]%

Performance Statistics for Status MO

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

Performance Statistics for this MSE

- The stock should have a greater than [__]% probability of occurring in the green quadrant of the Kobe matrix
- *Safety*: 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 [__]%

Performance Statistic for Safety MO

- **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)
- *Yield:* Maximize overall catch levels
- Any increase or decrease in TAC between management periods should be less than [__]%

Performance Statistic for Yield MO

- **AvC10** – Mean catches (t) over first 10 years
- **AvC30** – Mean catches (t) over 30 years

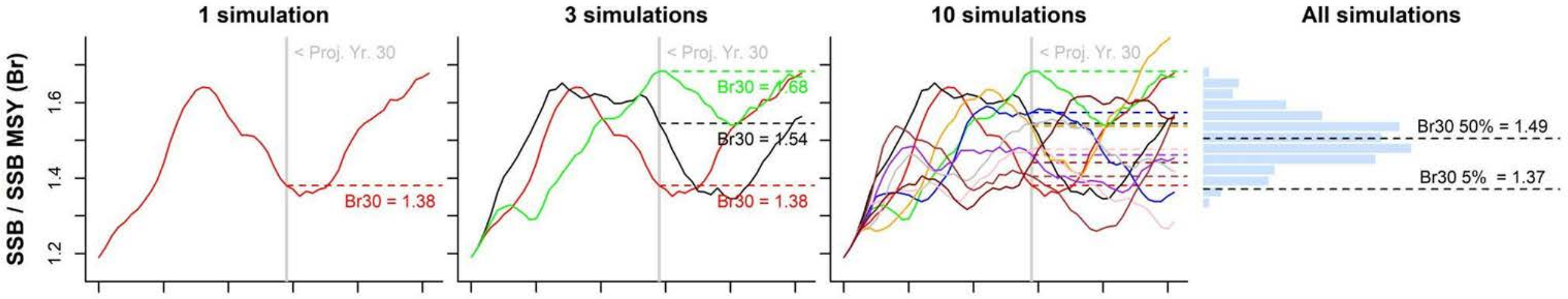
Performance Statistics for this MSE

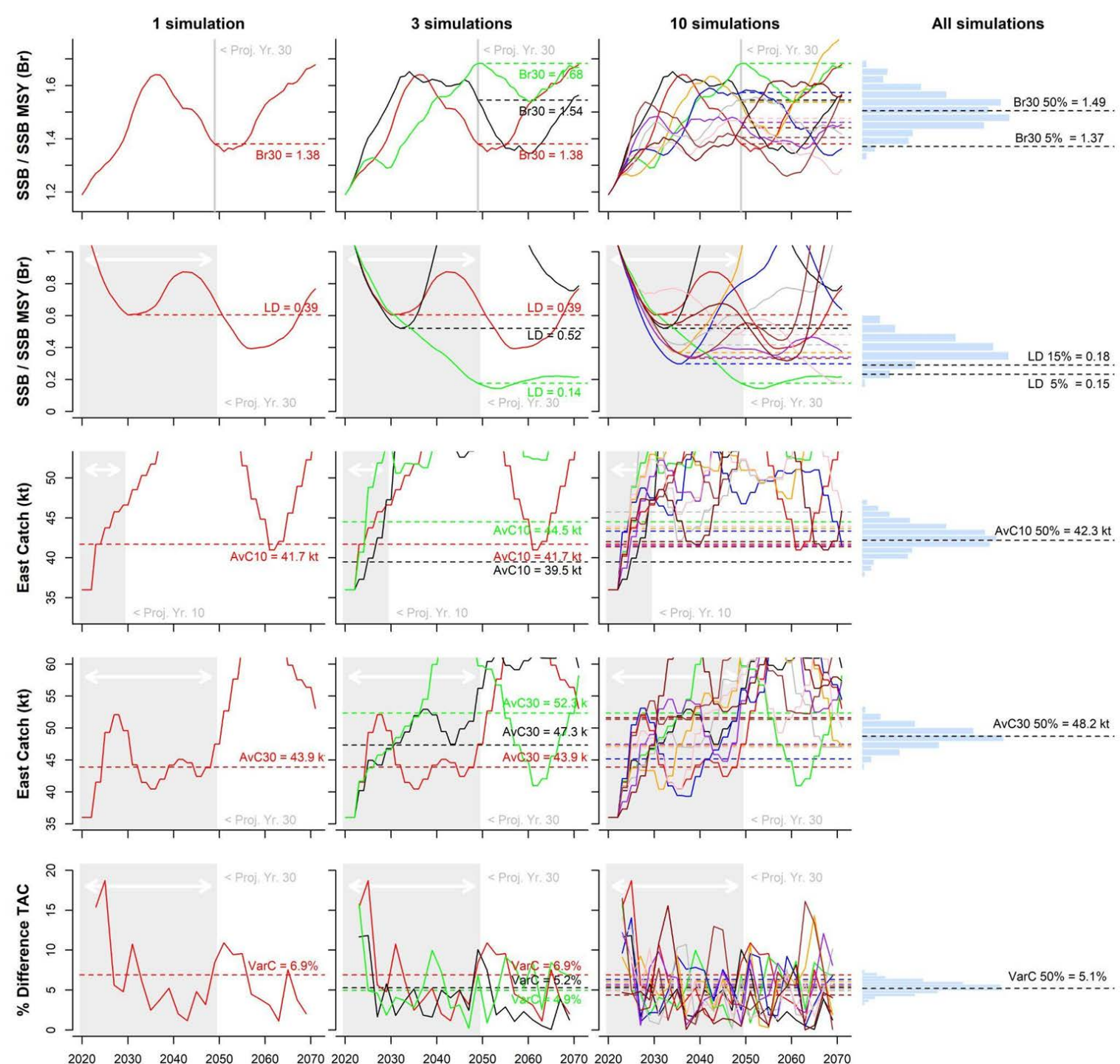
- The stock should have a greater than [__]% probability of occurring in the green quadrant of the Kobe matrix
- There should be a less than [__]% probability of the stock falling below B_{LIM} (to be defined)
- Maximize overall catch levels
- *Stability*: Any increase or decrease in TAC between management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

Performance Statistic for Stability MO

- **VarC** – % Variation in TAC between management periods

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





Br30: spawning biomass relative to dynamic SSB_{MSY} in 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 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

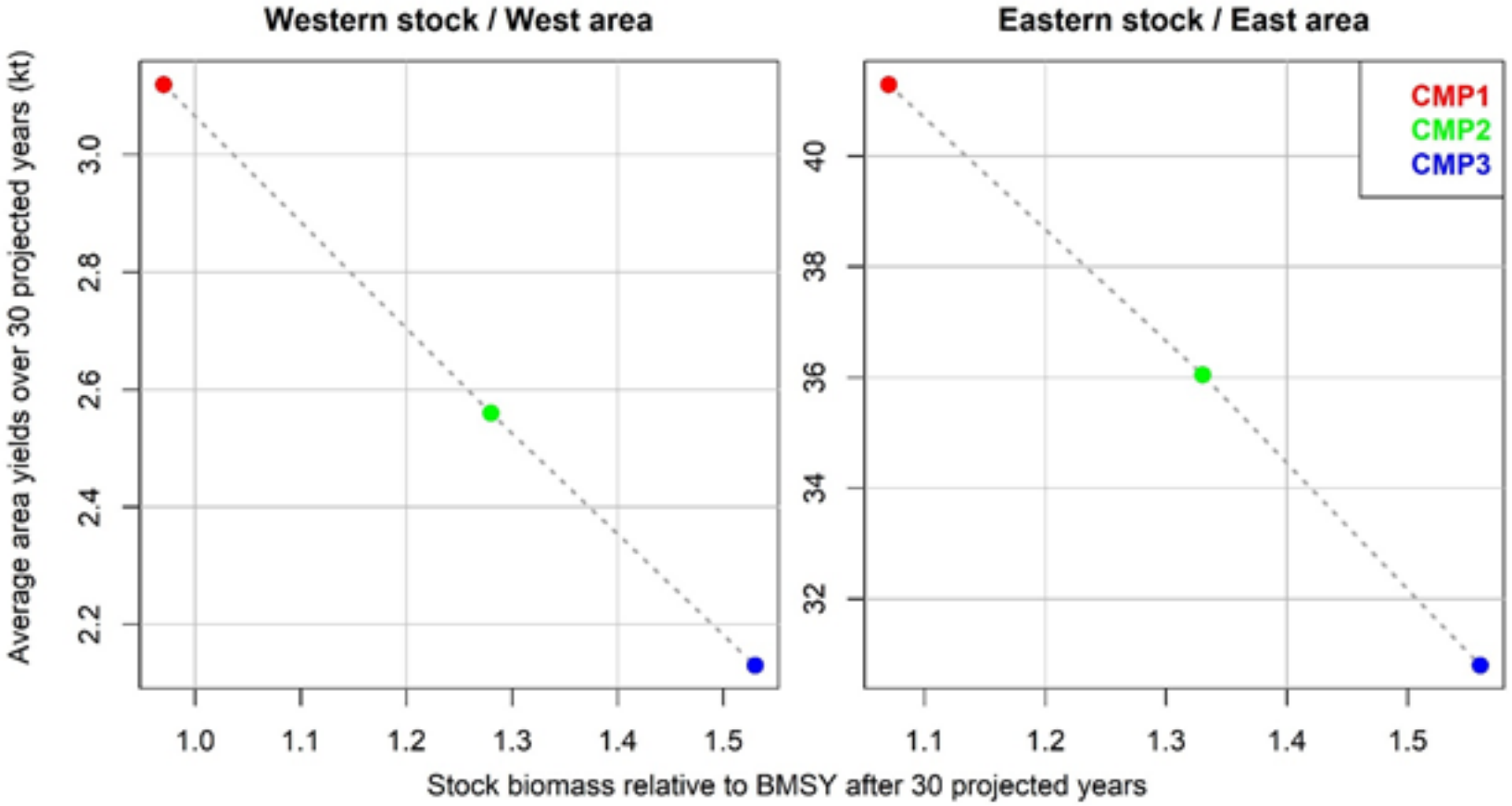
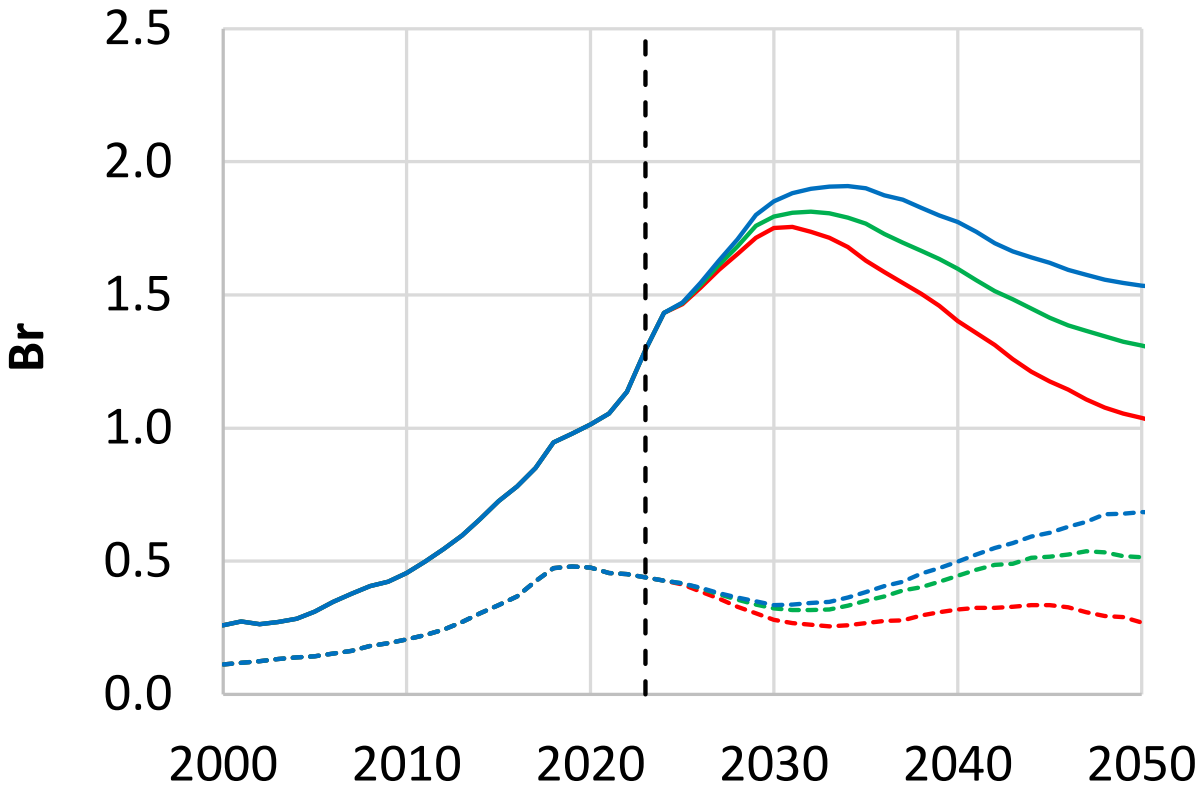


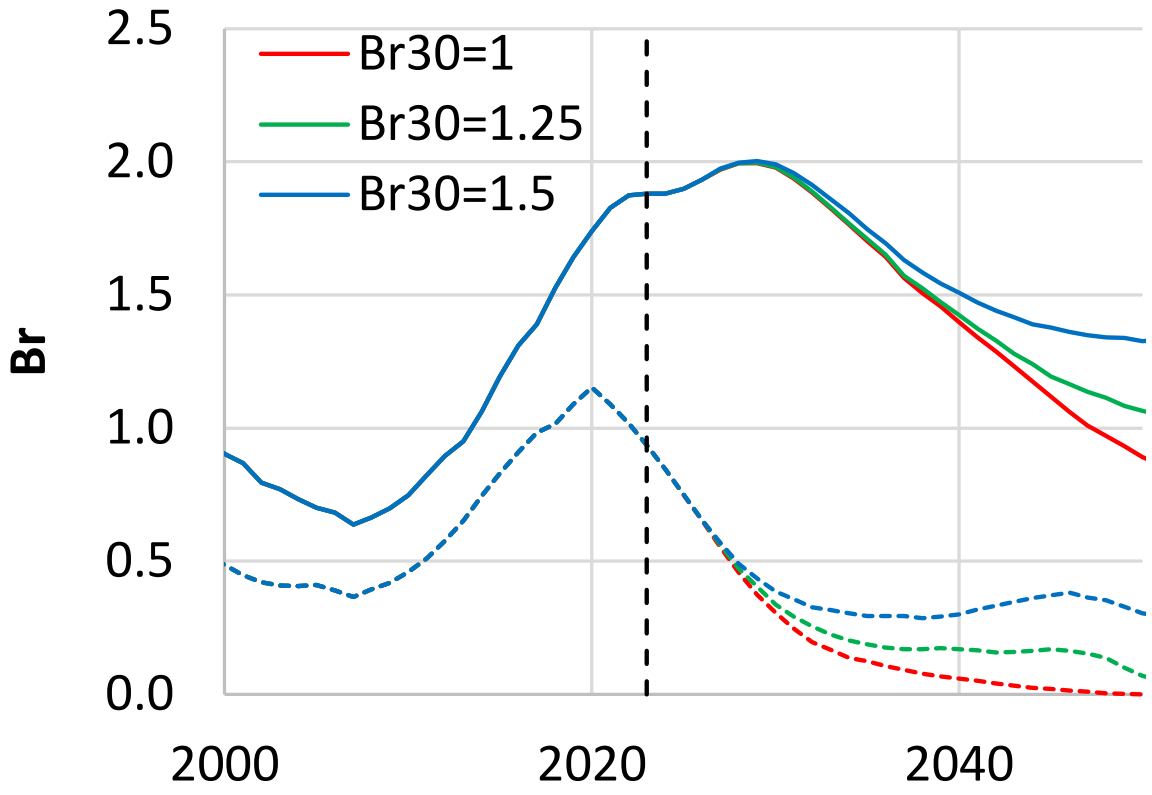
Figure 1. An example of the primary trade-off between yields (what is taken by fishing over 30 years, expressed as an annual average) and stock biomass (what remains in the resource after those 30 years) for three CMPs (CMP1 – red, CMP2 – green, CMP3 – blue). The left panel features western *stock* biomass (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.

Time series of SSB/SSBmsy (median – solid line and 5%tile – dashed line across all OMs) for three different BR30 tuning targets for the CMPs shown in previous slide.

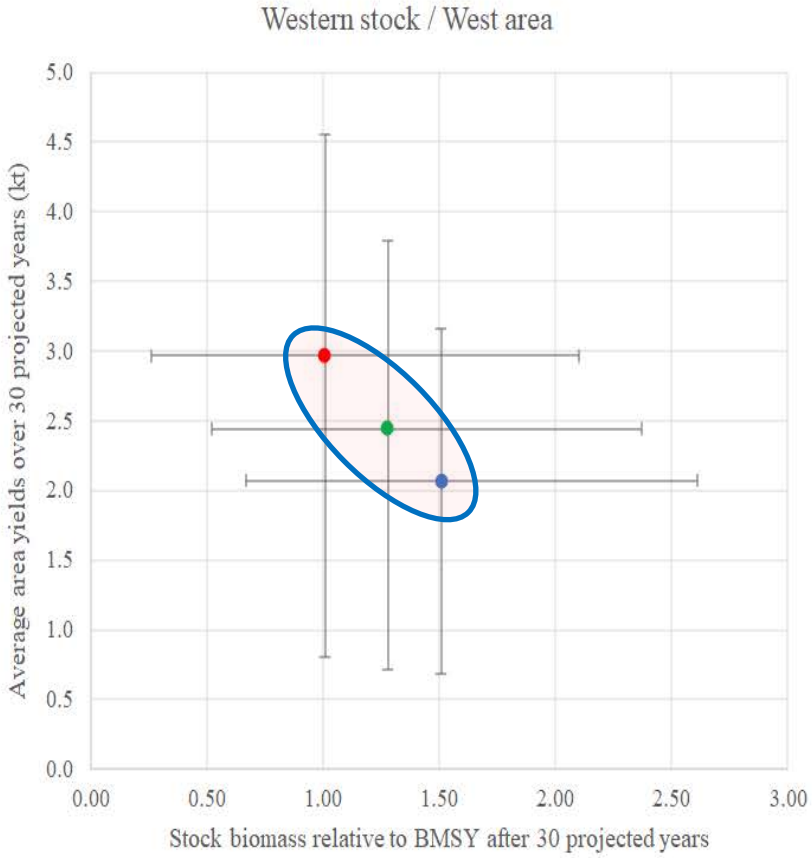
Western Stock

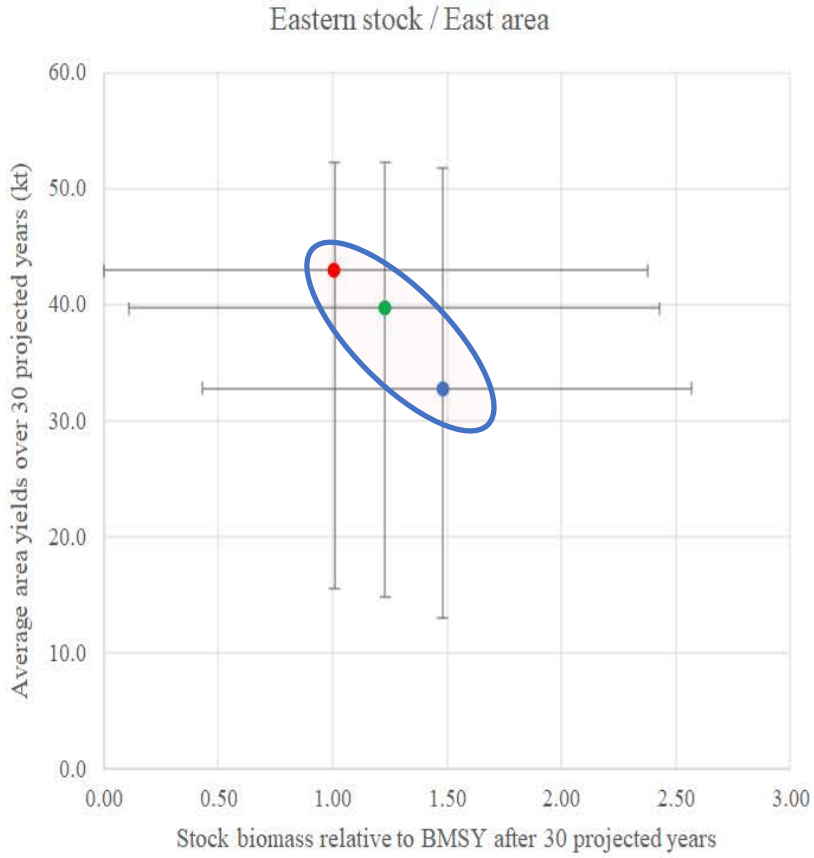


Eastern Stock



Status and yield tradeoff space





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

Br30=1 involves higher risk to the status of the stock but higher yield whereas

Br30>1.5 reduces yield substantially but has lower risk to the status of the stock at the end of the 30 year time period.

Why allowing greater than 20% reduction in TAC between management periods may be advisable:

	VarC (50%)	AvC10 (50%)	AvC30 (50%)	AvgBr (5%)	LD (5%)
CMP1 +20 / - 20% on TAC change	11.3	35.9	31.1	0.40	0.07
CMP2 +20 / -30% on TAC change	12.3	36.6	30.9	0.61	0.11
% change in performance	9%	2%	-1%	51%	51%

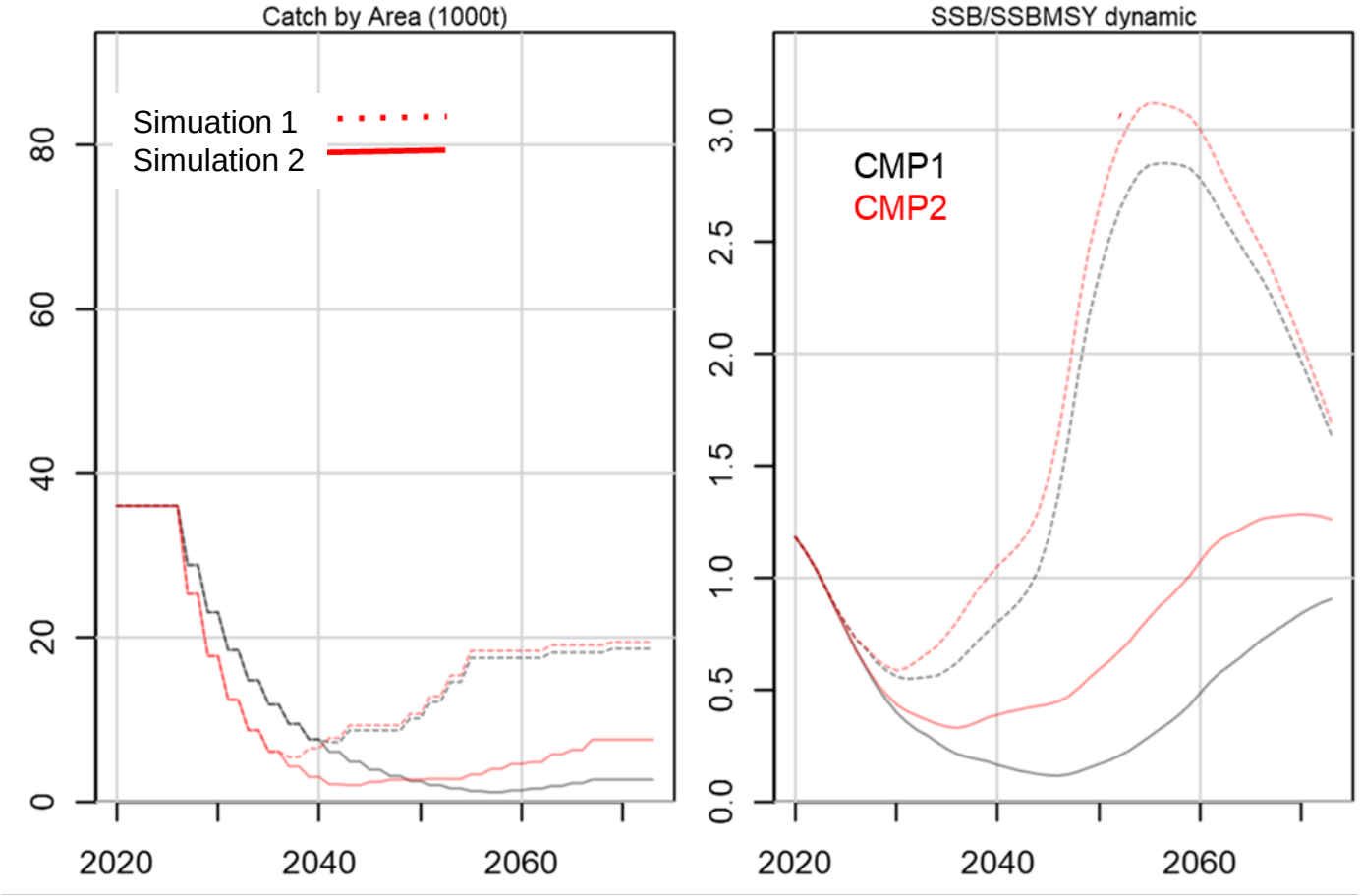
1% reduction in average yield

Big improvement in safety

Why greater than 20% on downward TAC change

	VarC (50%)	AvC10 (50%)	AvC30 (50%)	AvgBr (5%)	LD (5%)
CMP1 +20 / - 20% on TAC change	11.3	35.9	31.1	0.40	0.07
CMP2 +20 / -30% on TAC change	12.3	36.6	30.9	0.61	0.11
% change in performance	9%	2%	-1%	51%	51%

Higher percentage TAC reduction allows for faster stock recovery with little loss in yield over time



Two-step process for facilitating CMP selection.

- *Development tuning* for CMP comparison (Step 1)
  - CMPs are tested on common Br30 performance levels
  - SCRS then ranks CMPs across remaining performance statistics (yield, status, safety and stability)
  - Panel 2 will then be able to evaluate relative performance of the CMPs (see plot in next slide) to make decisions on selecting one or several top CMPs

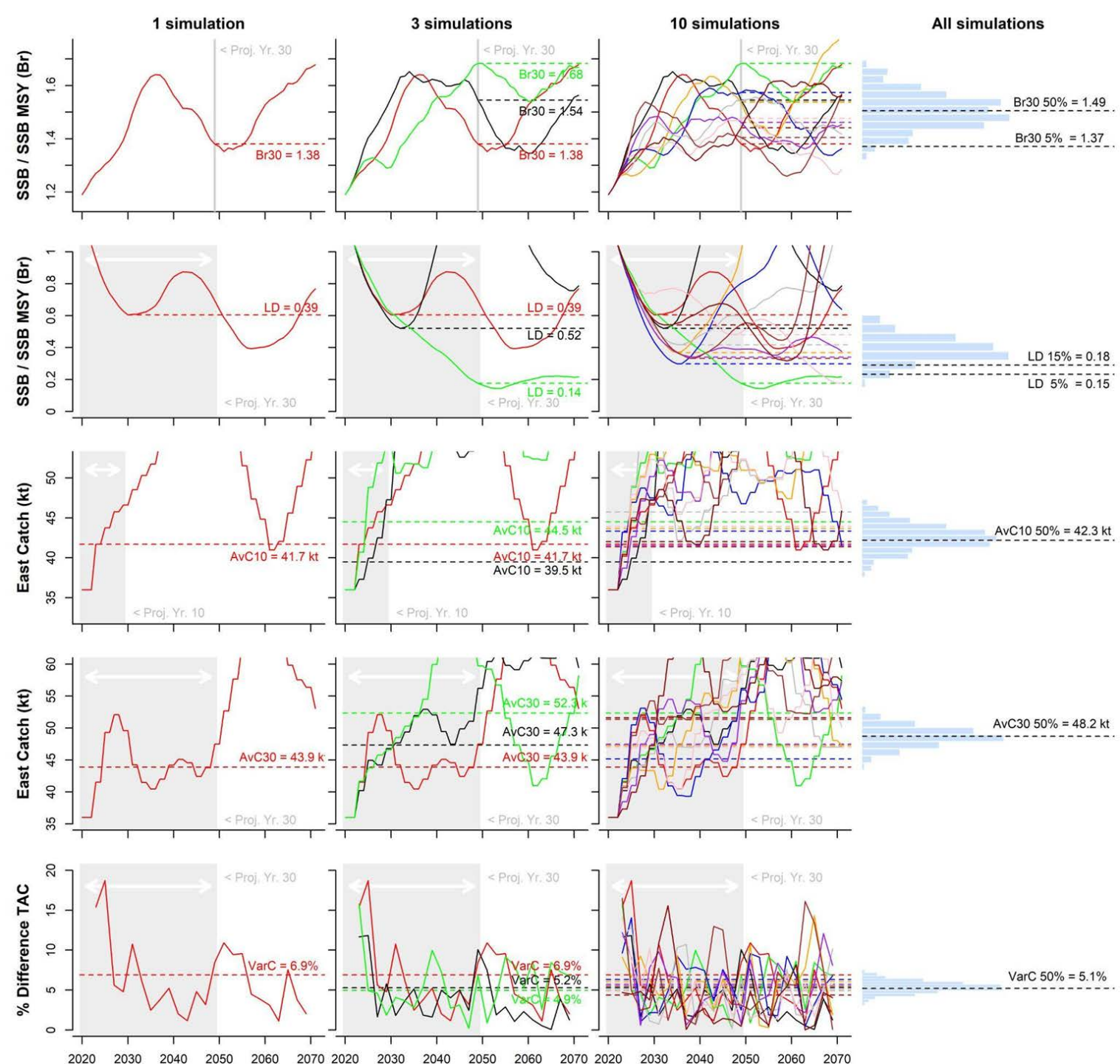
- *Performance tuning* to achieve the final CMP specifications (Step 2)
  - All Candidate Management Procedures (CMP) include at least one tuning parameter for each area that can be adjusted to determine how heavily or lightly the CMP applies fishing pressure.
  - This tuning parameter can be altered to achieve desired performance on the risk-reward tradeoff
  - Once top performing CMPs are selected in step 1 they will be *performance tuned* to best achieve Commission objectives. These dial settings will be set differently for each area and hence for each stock and will be fixed for the adopted MP.

West	Br30 target	VarC (median)	AvC10 (median)	AvC30 (median)	LD (5th percentile)	LD (15th percentile)
CMP1	1.25	13.79	3.09	2.87	0.22	0.43
CMP2	1.25	11.36	2.05	2.21	0.26	0.48
CMP3	1.25	15.97	2.96	2.53	0.02	0.25

East	Br30 target	VarC (median)	AvC10 (median)	AvC30 (median)	LD (5th percentile)	LD (15th percentile)
CMP1	1.50	16.72	39.06	37.65	0.30	0.55
CMP2	1.50	11.41	34.74	28.50	0.33	0.52
CMP3	1.50	13.95	41.48	30.29	0.07	0.29

Relative Ranking of CMPs

- Within column, green= best, yellow = intermediate, red = worst
- color scale represents relative performance; red does not necessarily indicate unacceptable performance
- CMP1-3 are for illustrative purposes, to show contrast
- Key take home: Not every CMP may be the top in every category
- Different statistics may be ‘weighted’ differentially



Br30: spawning biomass relative to dynamic SSB_{MSY} in 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 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?

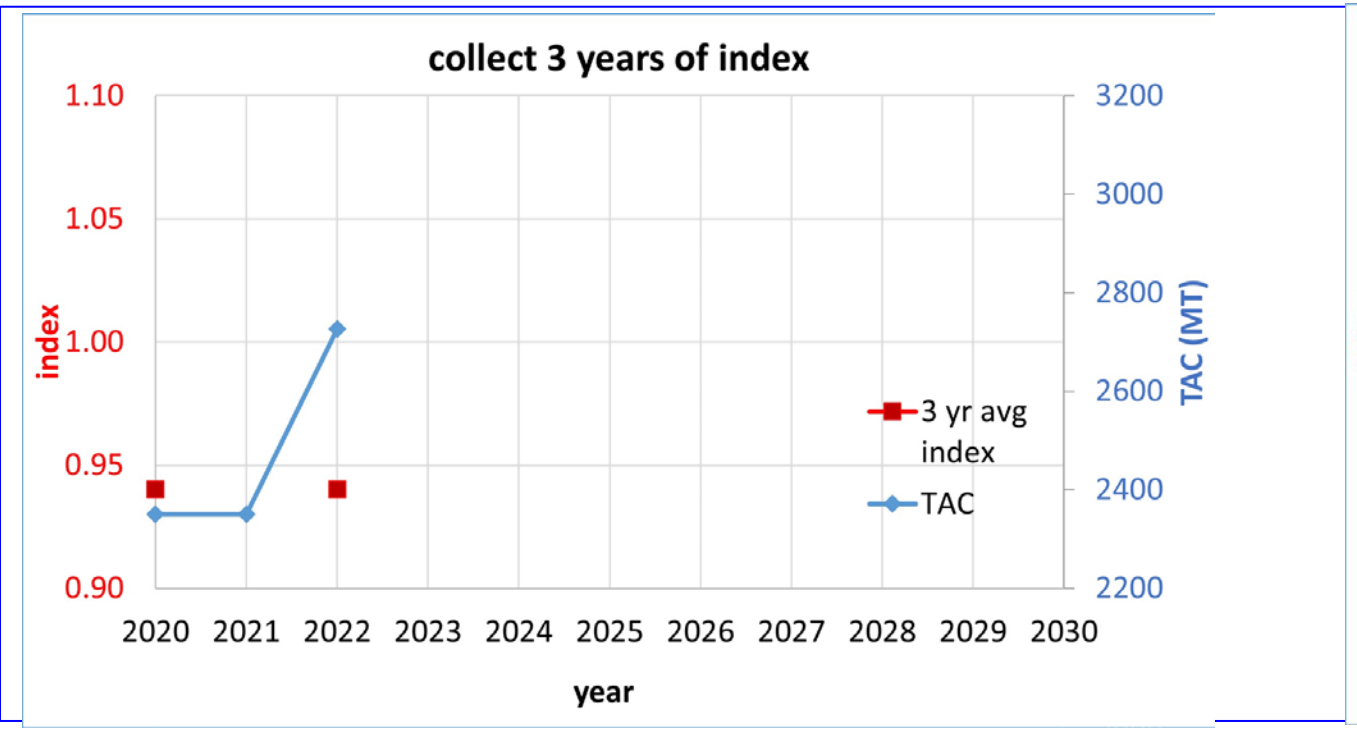
Roles in and Steps of the Management Strategy Evaluation process

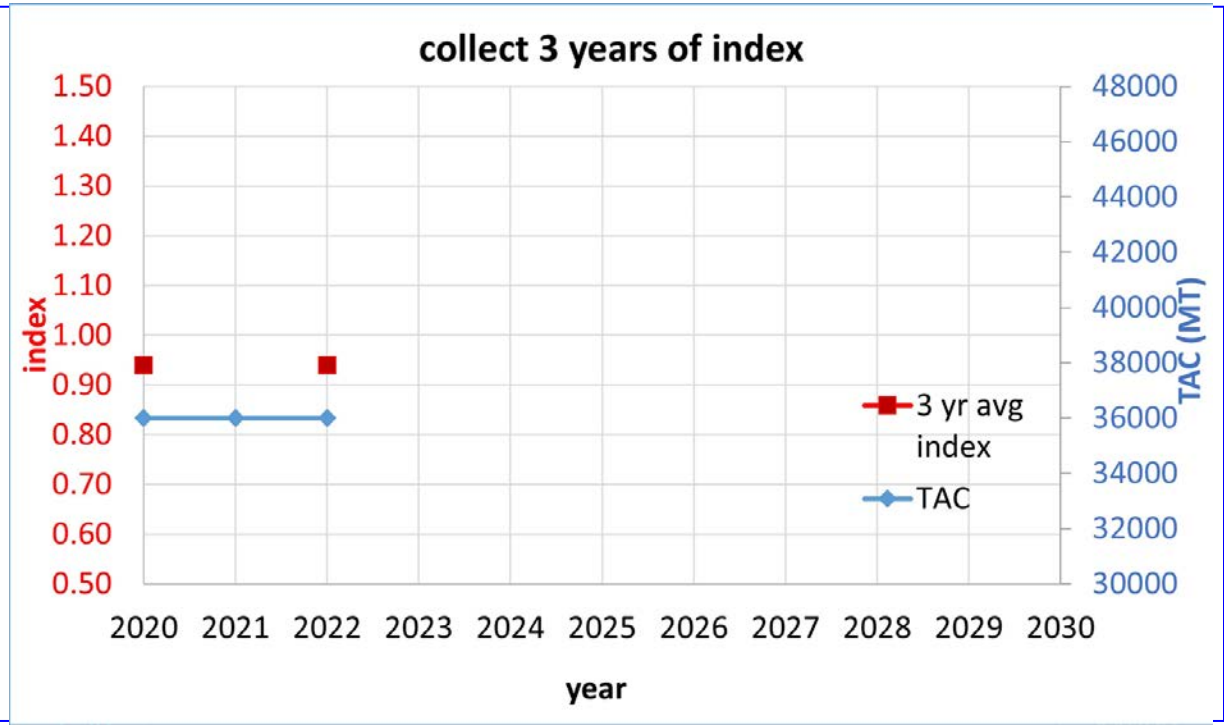
	Scientists	Managers (Stakeholders *advise*)	status
Operating models	Construct, **adopt** reference grid and robustness set	*advise*	*completed*
	Adopt plausibility weights for OMs	*advise*	*completed*
Management objectives	Provide input on initial operational MOs	**Adopt** conceptual MOs (*Res. 18-03*) **Refine** interim operational Management Objectives	March 4, 1st Panel 2 meeting
	Provide input for refined MOs	**Agree** final Operational Management Objectives	May 9, 2nd Panel 2 meeting
Management Procedures	Propose Candidate MPs	Provide initial *advice* on performance preferences of Candidate MPs in line with MOs.	April BFT meeting/ May 9, 2nd Panel 2 meeting
	Test performance of CMPs	**Identify** preferred CMP; **Adopt** MP	October 14, 3rd Panel 2 meeting/ Nov 14-21, 2022 Commission
	Advise on Exceptional circumstances	**Adopt** 'rules' for Exceptional circumstances	Commission 2023 (addressed in 2023 because the EC will be specific to the MP adopted in 2022)

Conceptual vision for a Bluefin Management Procedure

WEST **EAST**

collect 3 years of index



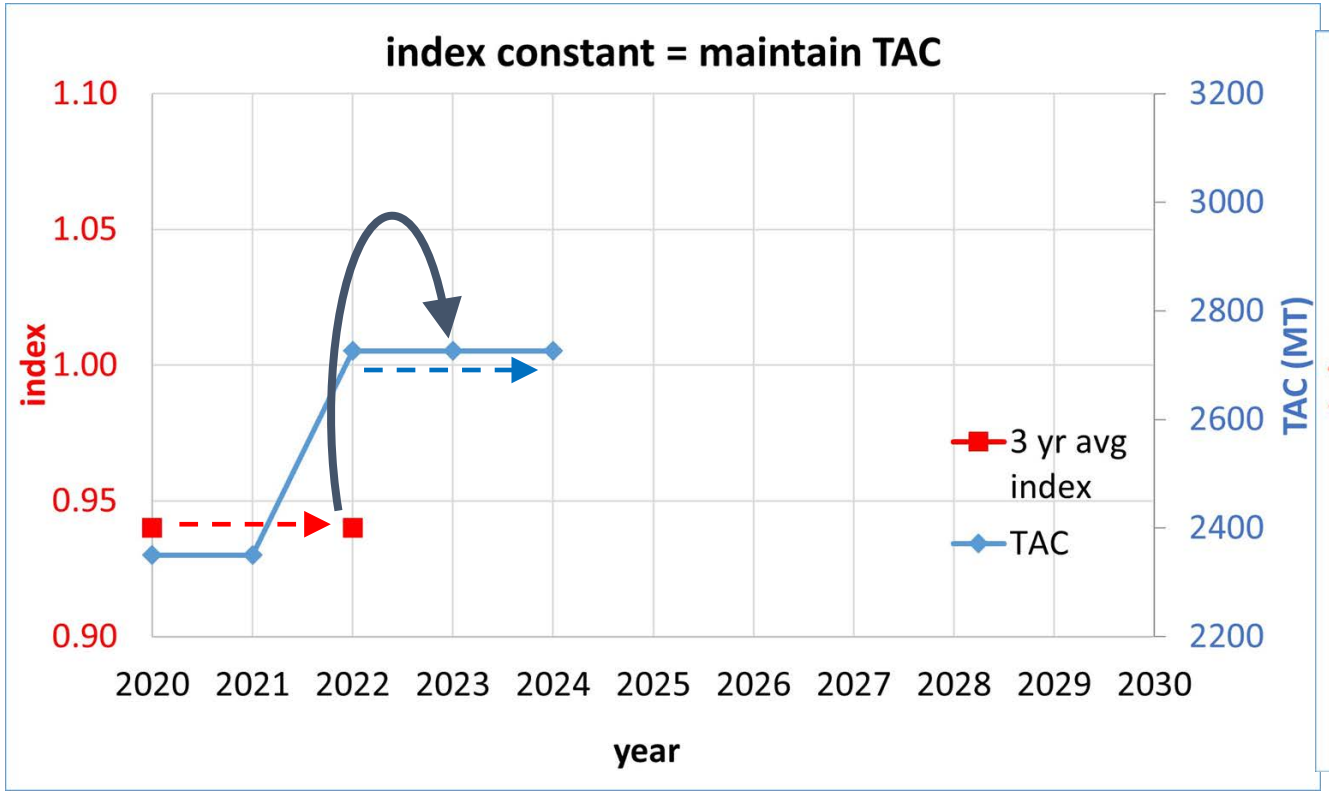


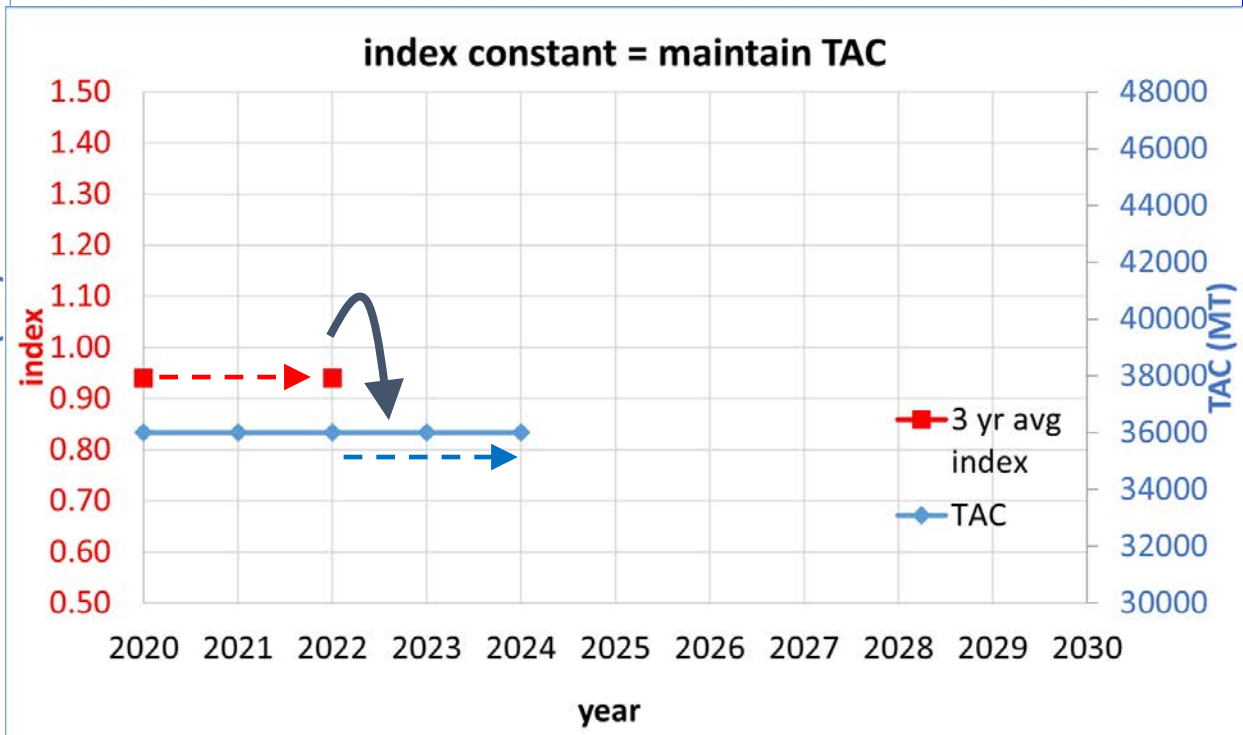
- Empirical management procedure based on index
- SCRS collects data, applies MP
- Commission sets TACs (East and West) based upon MP advice
- TACs remain unchanged for *X* years

Conceptual vision for a Bluefin Management Procedure

WEST **EAST**

index constant = maintain TAC

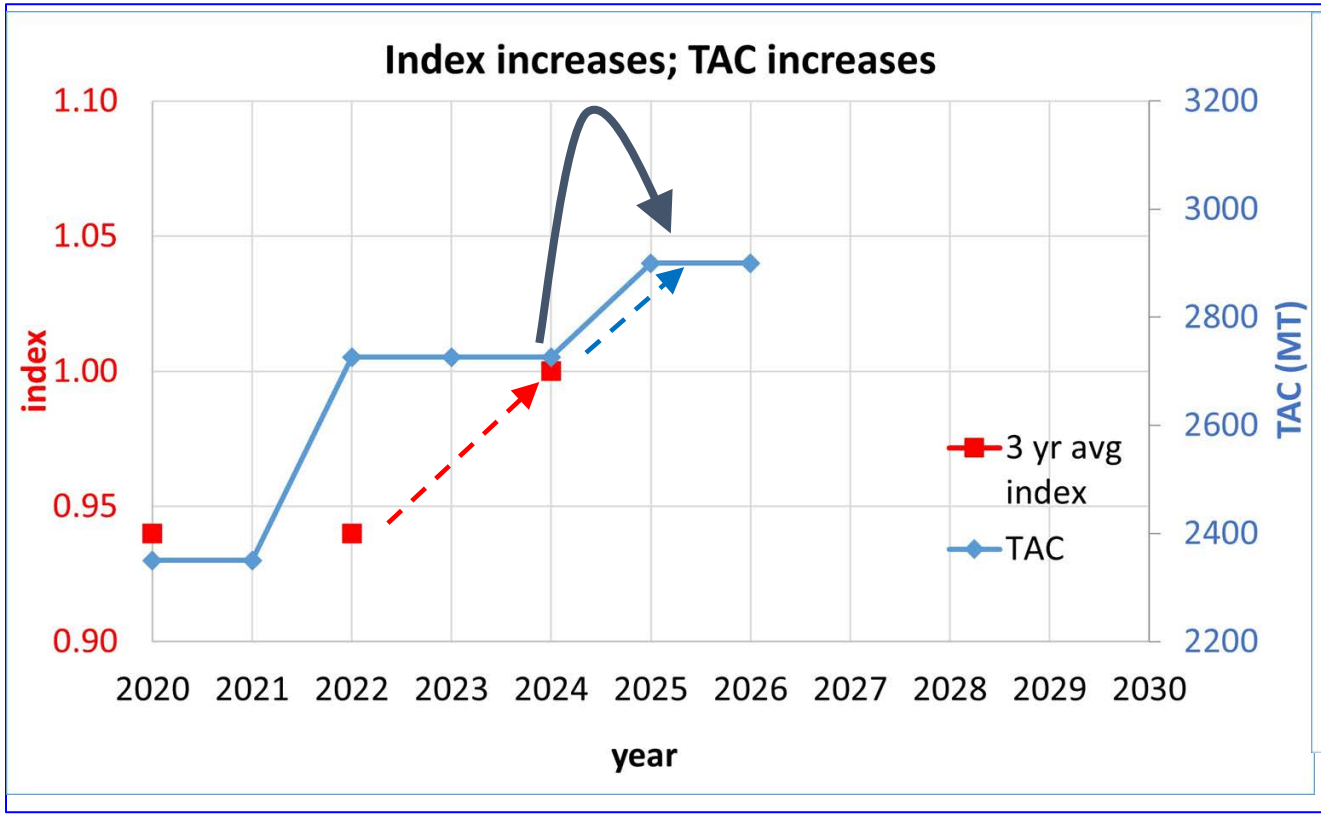




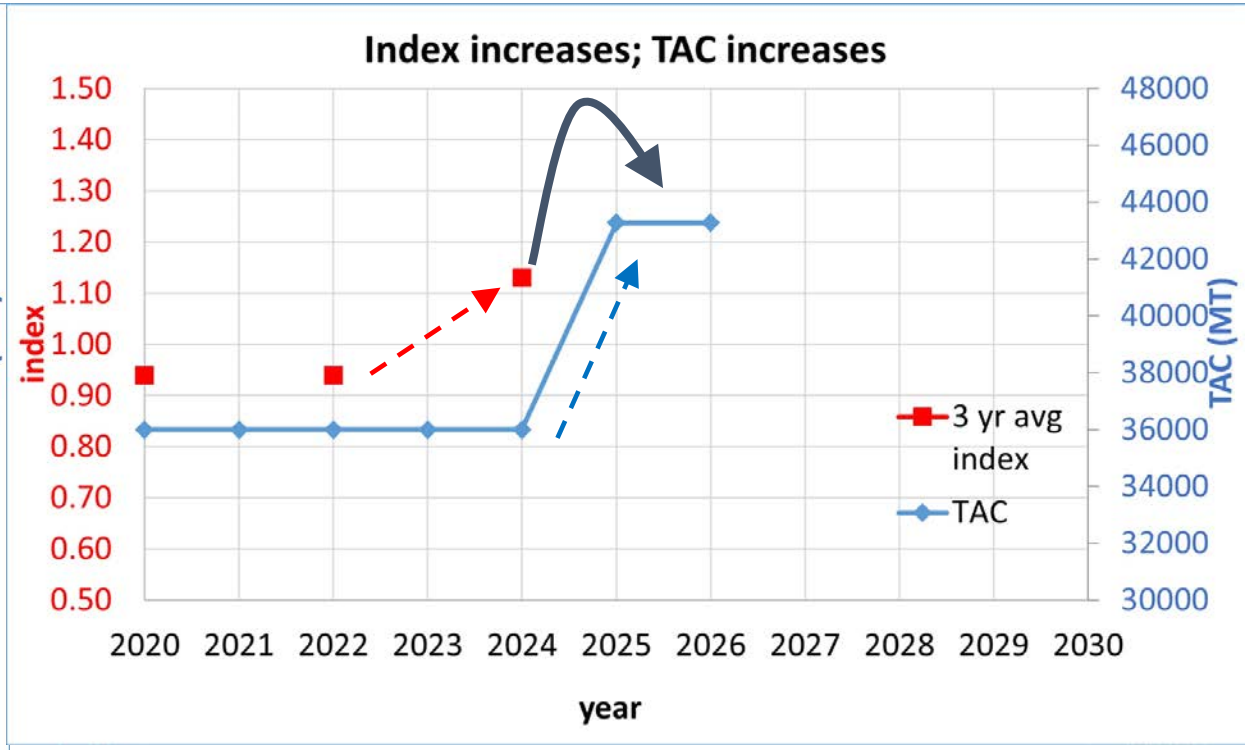
* Note that this is simply for illustration purposes and does not imply what would actually happen in the future; different CMPs may have differential responses to indices.

Conceptual vision for a Bluefin Management Procedure

WEST



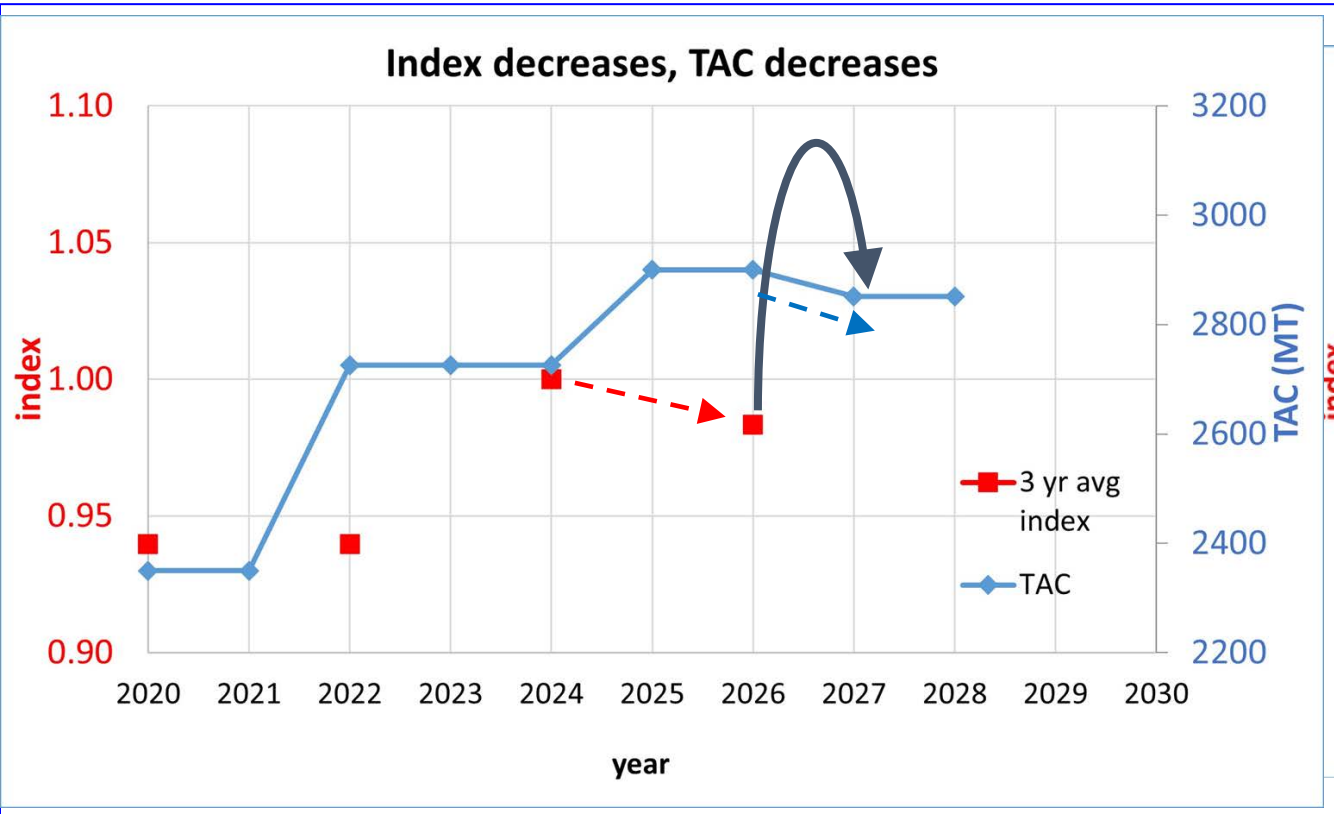
EAST

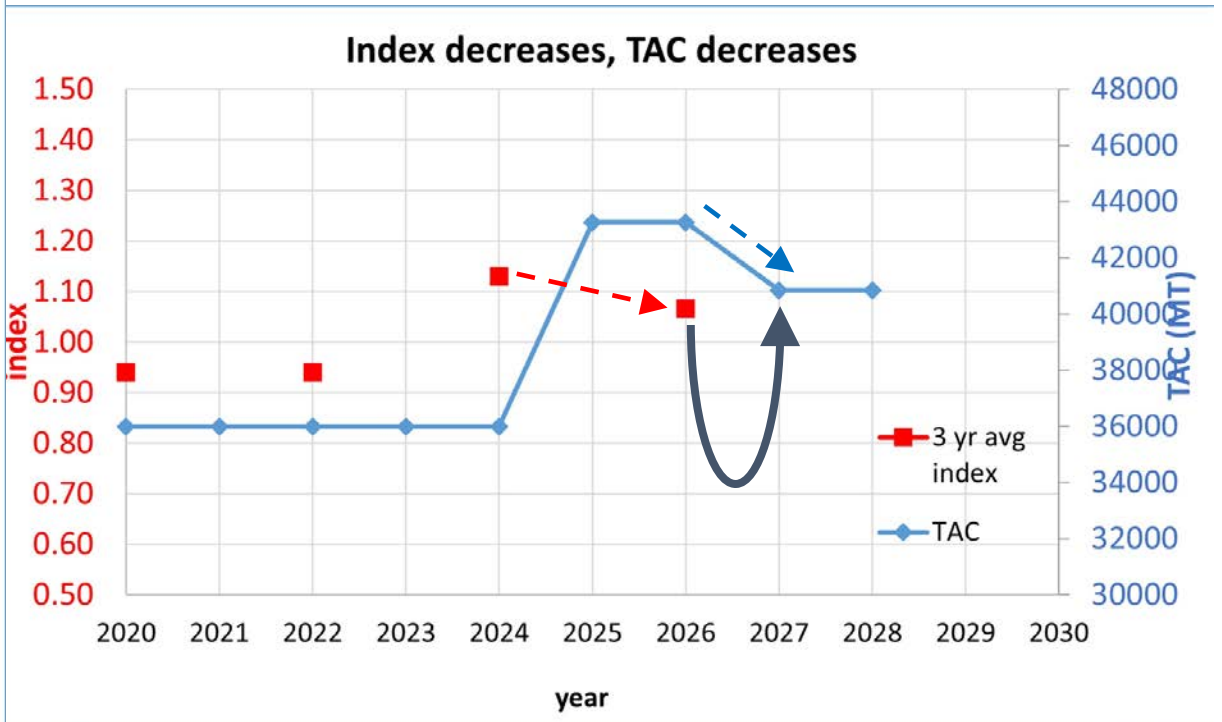


Conceptual vision for a Bluefin Management Procedure

WEST **EAST**

index decreases, TAC decreases

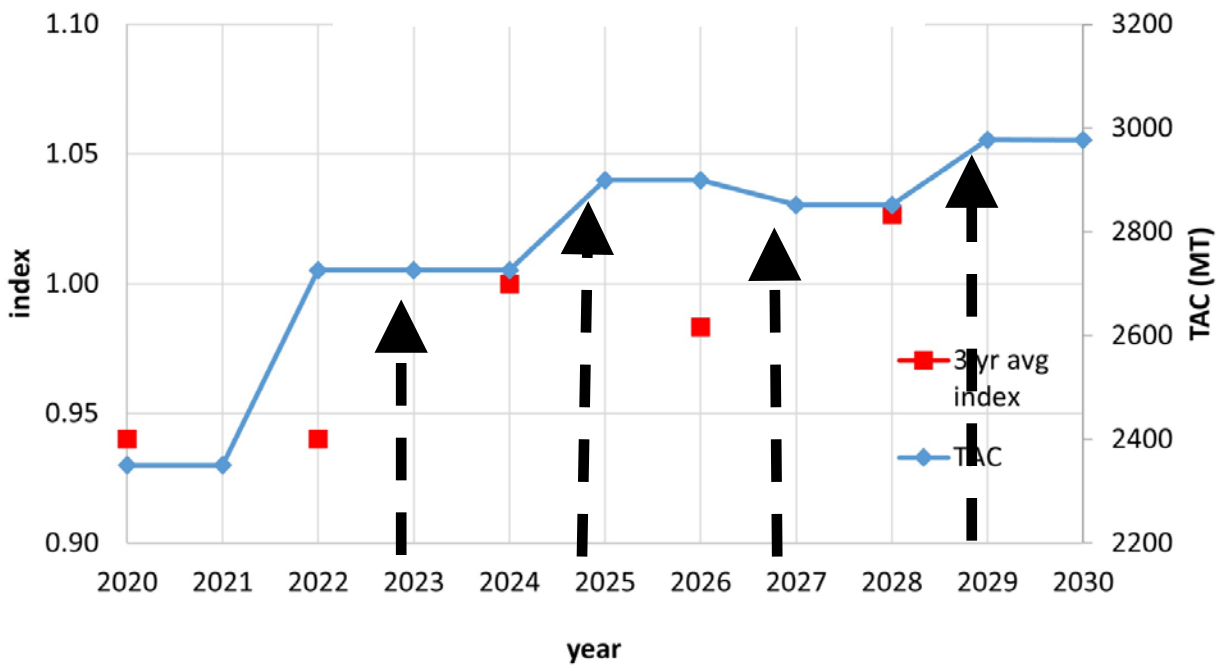


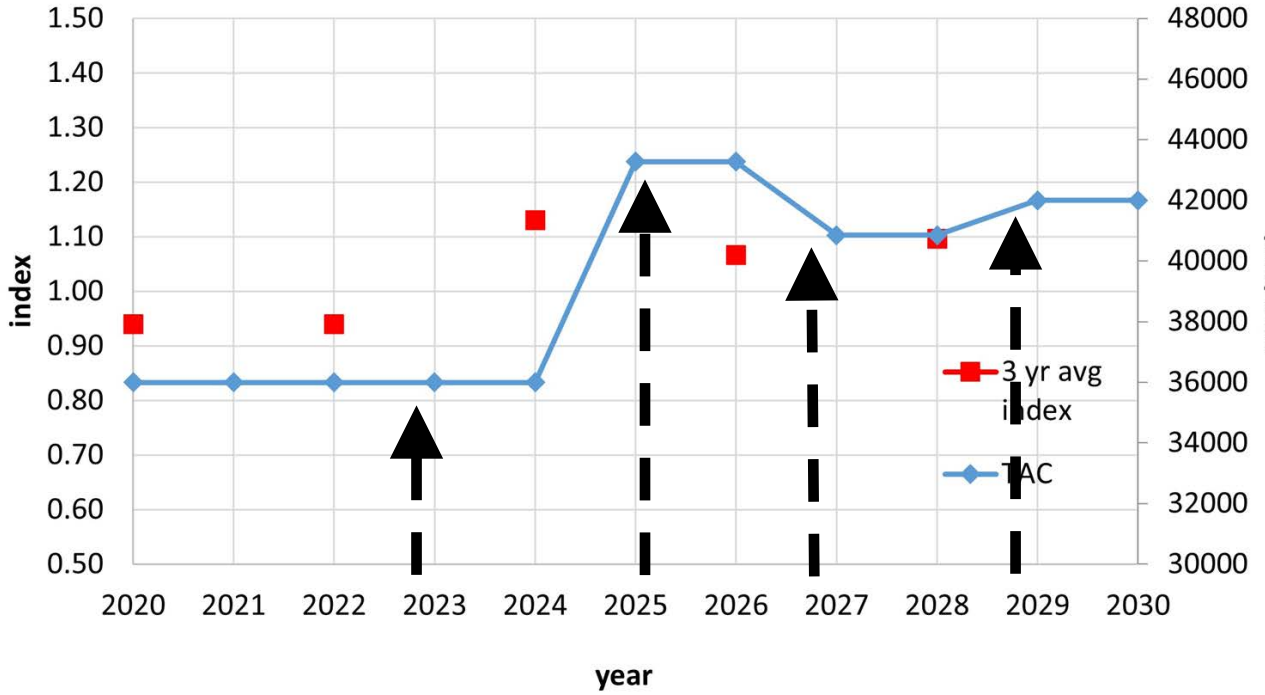


Conceptual vision for a Bluefin Management Procedure

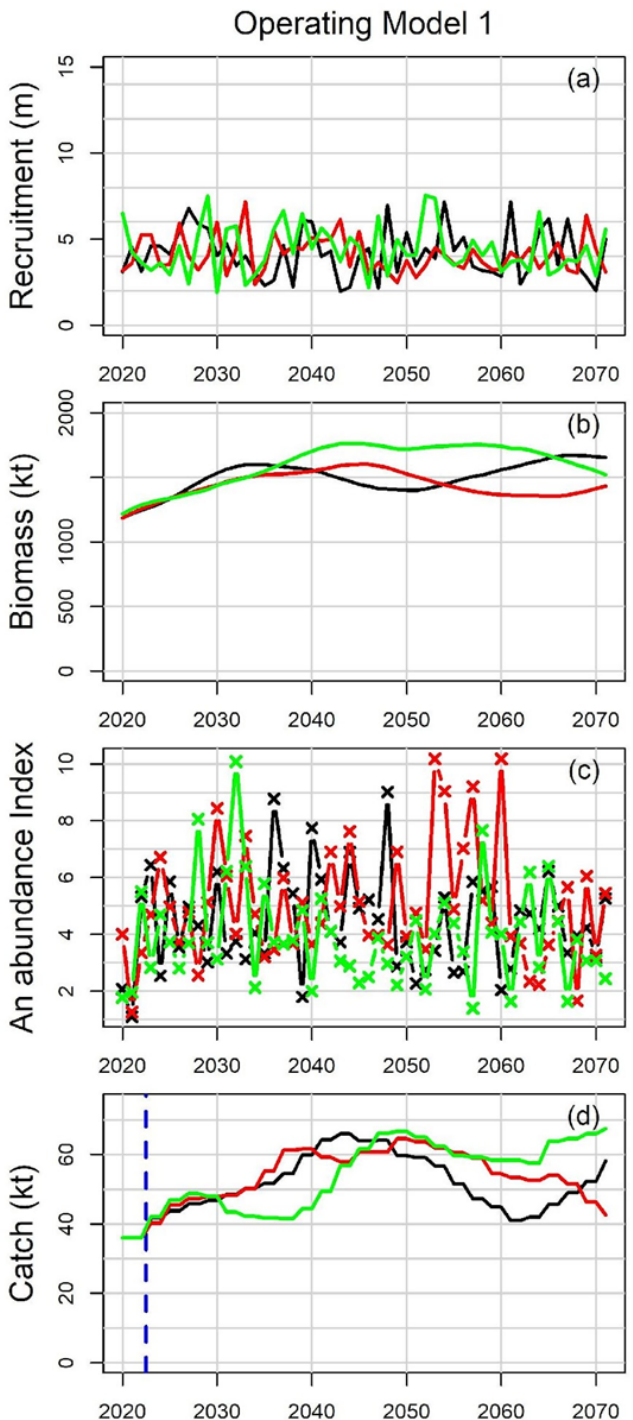
WEST **EAST**

TAC set every two years





At pre-specified intervals, Commission adopts new TACs (both East and West), based on pre-agreed **Management Procedure.**



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

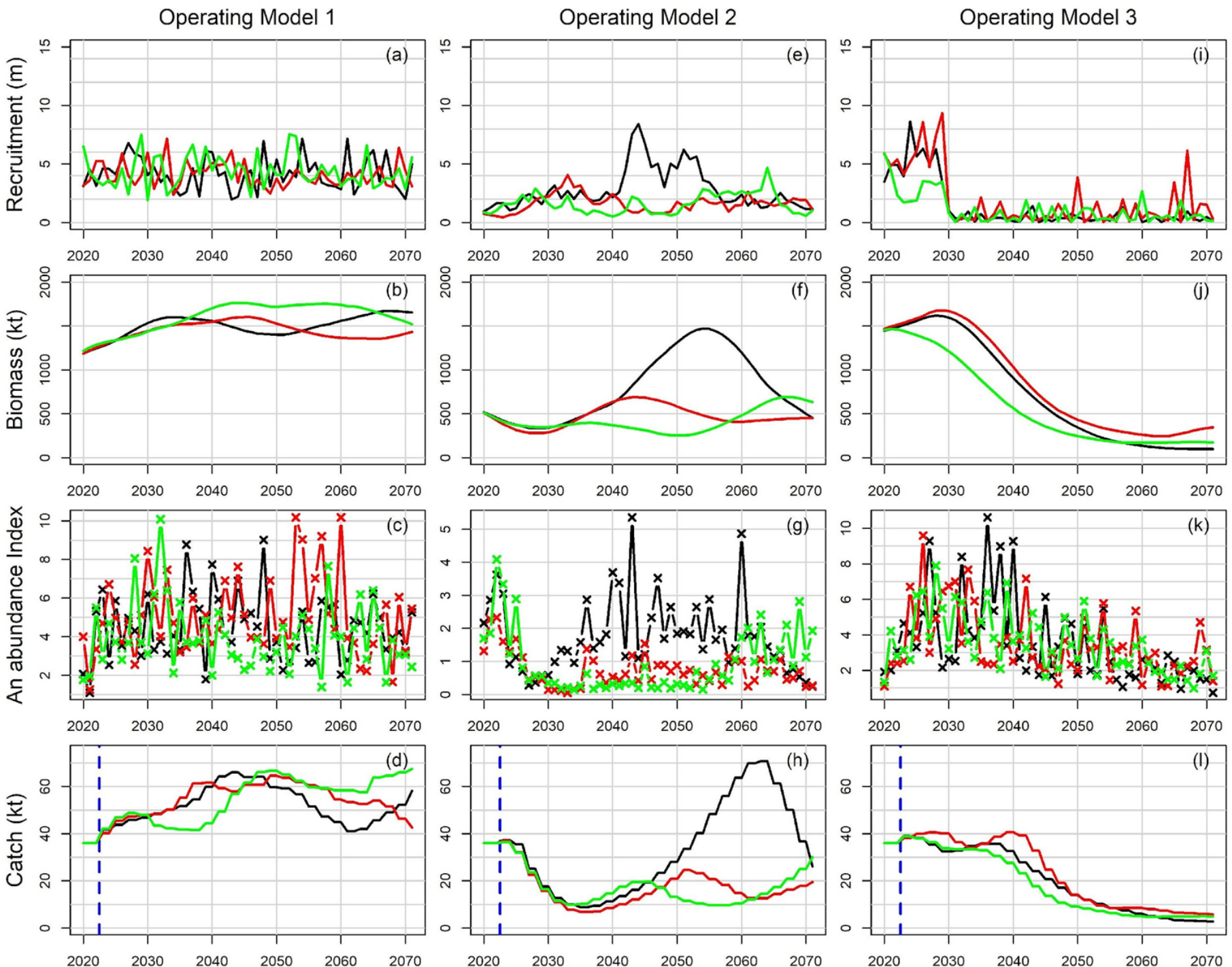
Trend in biomass
(East Stock)

Corresponding index (Eastern Area)

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

Red, green and black lines are 3 different simulations

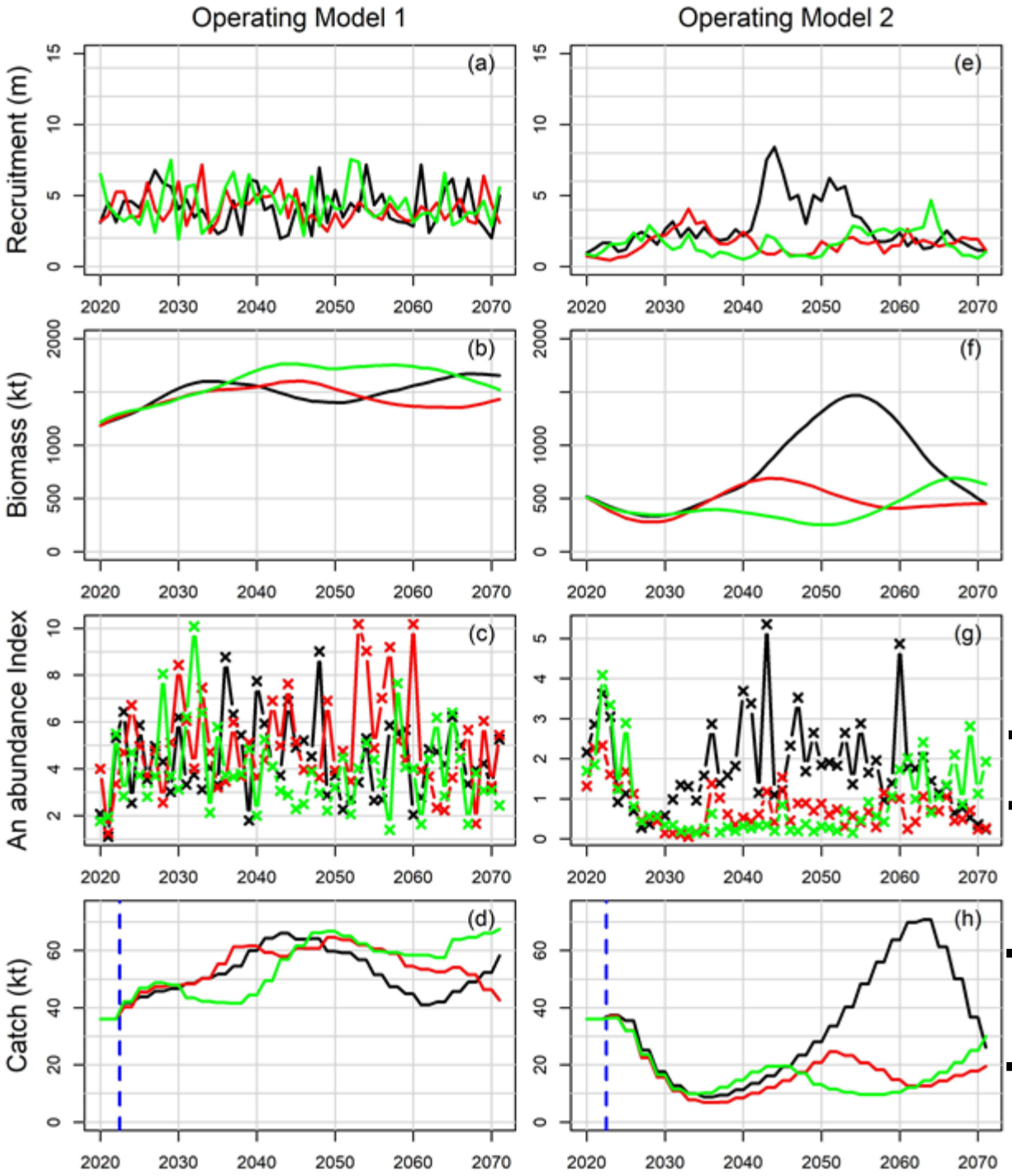


OM1 is Recruitment level 1 western stock – "low" scenario (i.e., switch from high to low 70s); eastern stock – switch from low to high in 80s

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

Red, green and black lines are 3 different simulations

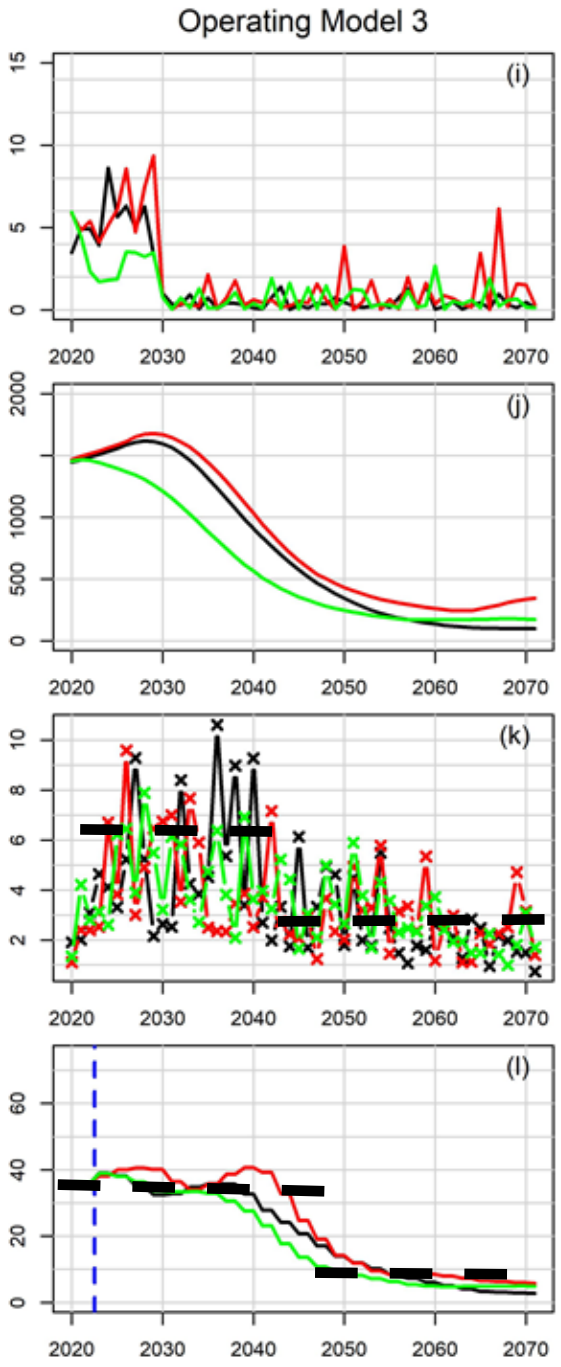


Let's talk about Recruitment Level 1 (OM1: high Eastern) versus Recruitment Level 2 (OM2: low Eastern)

Future expected index would be very different under the 2 scenarios

Future expected TAC would be very different under two scenarios

TAC would be a function of future indices



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

Recent index is high

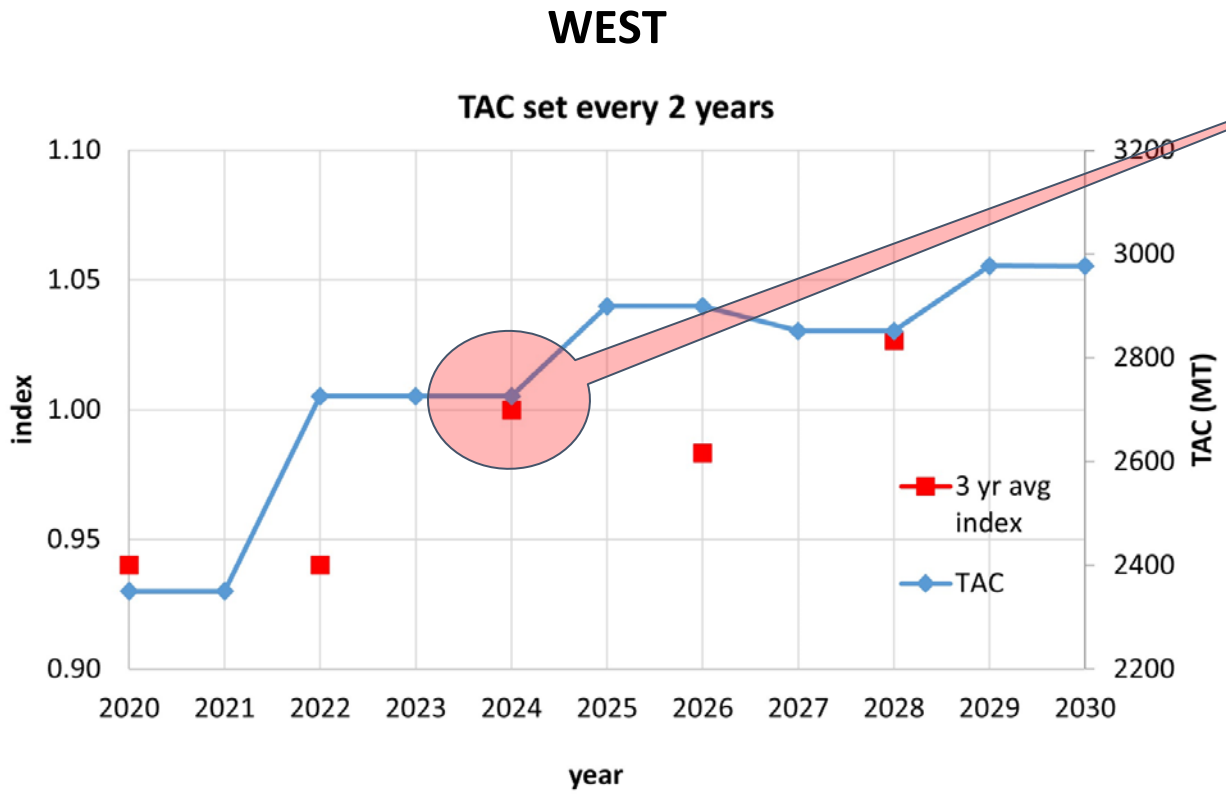
If regime shift of this magnitude happens, index will trend down noticeably

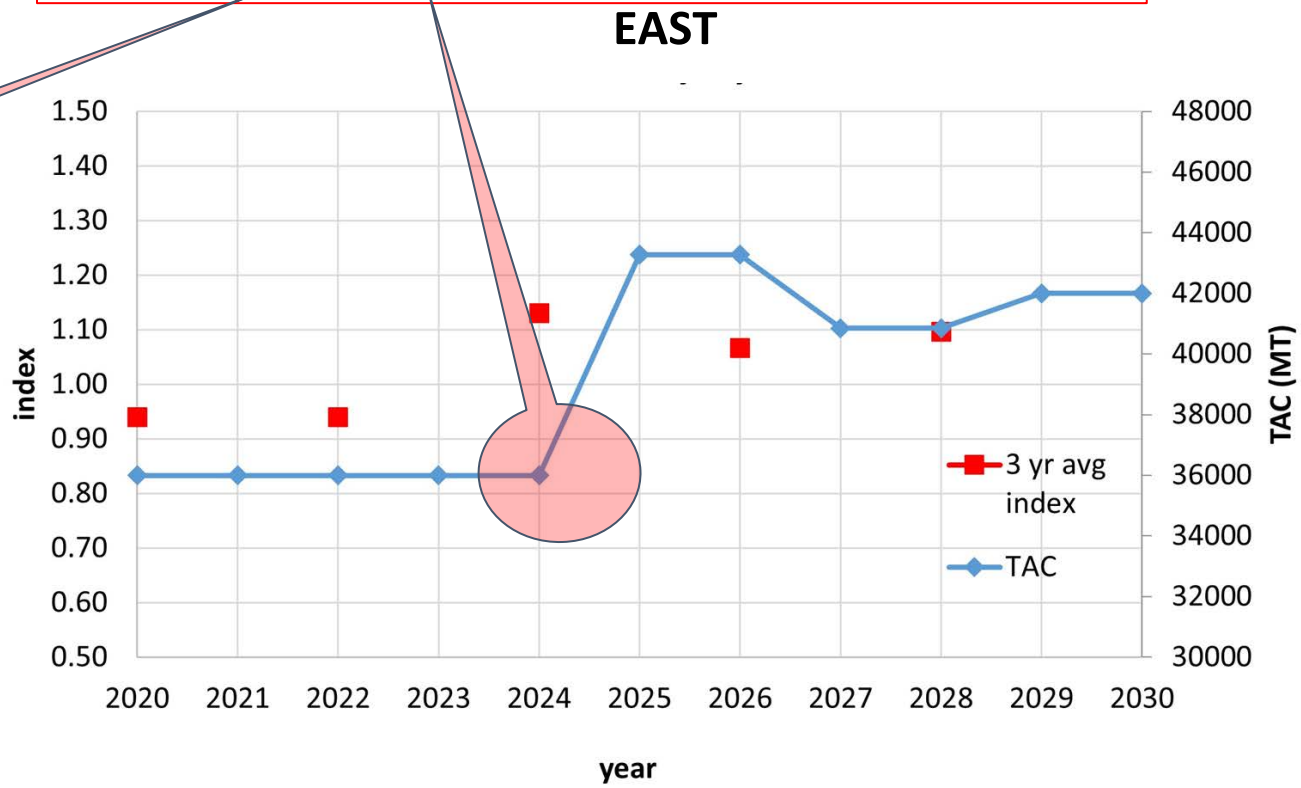
Near-term TAC would be high, reflecting high index

A well-performing Management Procedure would reduce TAC commensurate with a decrease in the index

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

All of the above are specified (for Northern Albacore) in ICCAT Rec 21-04

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

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

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

MP review/revision and MSE 'reconditioning' which includes refitting to new data, incorporation of new information or new methodology would be considered (groundbreaking science, exceptional circumstances, etc) <u>at predetermined intervals.</u>

Summary of 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 refine 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) to include MSE topics	1. BFTSG to update performance statistics based on initial operational management objectives, if necessary. 2. BFTSG to provide feedback and approval of final MSE robustness trials. 3. BFTSG to do initial cull of CMPs. 4. BFTSG to develop presentation to Panel 2 on progress
	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.
	May 9	2nd Panel 2 meeting on BFT MSE (virtual)	1. SCRS to present final MSE framework and draft suggestions for culled list of CMPs. 2. Panel 2 to provide feedback on MSE and guidance on additional changes to the CMPs. 3. Panel 2 to agree on 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 a CMP 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.

Key decisions for May Panel 2

- Decisions on final operational management objectives (e.g., B_{lim}) and associated performance statistics

- Decisions on the process for final CMP selection- taking the 9 down to 3 or fewer
  - Development tuning
  - Performance tuning

- Decisions on certain CMP specifications
  - Final agreement on TAC change interval
  - Final agreement regarding limitations on % TAC change up and down

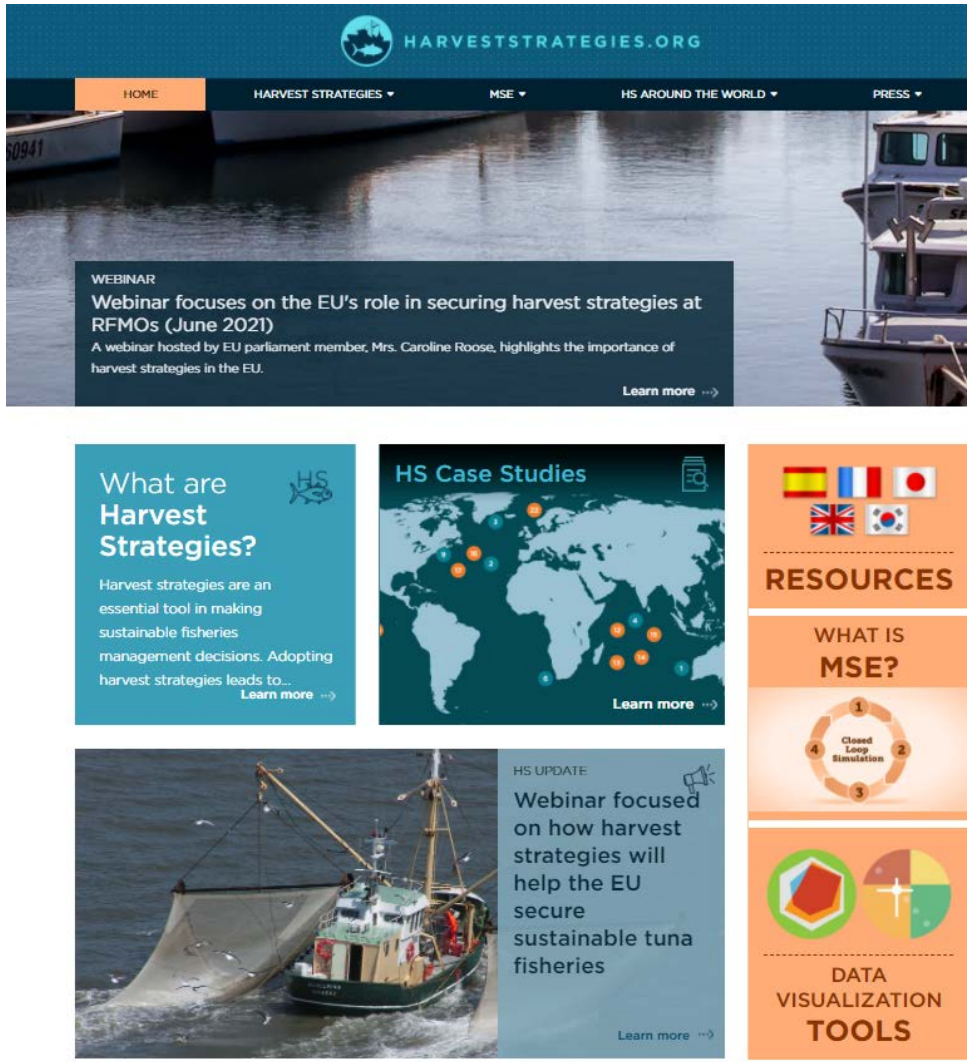
- Feedback on the list of CMPs – which will likely be from many of the 9 existing CMPs

- Feedback on Performance Tuning specifications for CMPs

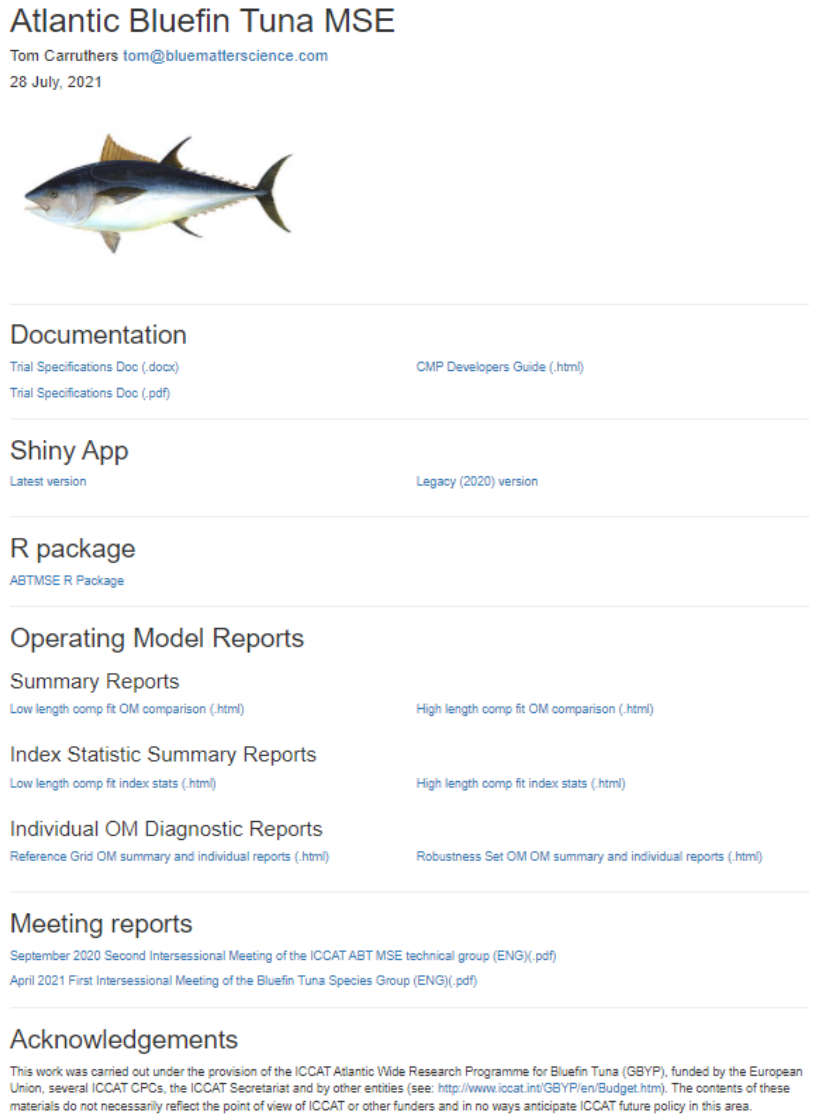
Extra material

Other Resources

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



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



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.