DRAFT RECOMMENDATION BY ICCAT ESTABLISHING A MANAGEMENT PROCEDURE FOR ATLANTIC BLUEFIN TUNA TO BE USED FOR BOTH THE WESTERN ATLANTIC AND EASTERN ATLANTIC AND MEDITERRANEAN MANAGEMENT AREAS

(Panel 2 Chair's Proposal)

NOTING that the objective of the Convention is to maintain populations of tuna and tuna-like species at levels that will support maximum sustainable catch (usually referred to as Maximum Sustainable Yield (MSY));

RECALLING that the Commission often had difficulties in deciding the total allowable catch (TAC) based on advice from the SCRS;

ALSO RECALLING that the SCRS had difficulties in providing robust scientific advice to the Commission due to various uncertainties such as the low quality of data;

RECOGNIZING that Harvest Control Rules (HCRs) and Management Procedures (MPs) developed using Management Strategy Evaluation (MSE) provide a more robust management framework than that based on a conventional stock assessment, ensuring a more precautionary approach and better stability of TACs;

ALSO RECOGNIZING the intent of the Commission to adopt HCRs and MPs developed using MSE, as established in *Recommendation by ICCAT on the Development of Harvest Control Rules and of Management Strategy Evaluation* (Rec. 15-07);

NOTING the *Resolution by ICCAT on Developing Initial Management Objectives for Eastern and Western Bluefin Tuna* [Res. 18-03], which outlined the conceptual objectives for the Atlantic bluefin tuna MSE;

RECALLING that the Commission requested the SCRS to continue testing various candidate MPs in 2022 and to meet with Panel 2 to review the results and support the panel in selecting one to adopt and apply for 2023 as anticipated in the 2021 Recommendations the *Recommendation by ICCAT amending Recommendation 17-06 for an interim conservation and management plan for western Atlantic bluefin tuna* (Rec. 21-07) and *Recommendation by ICCAT amending the Recommendation 19-04 amending Recommendation 18-02 establishing a multi-annual management plan for bluefin tuna in the eastern Atlantic and the Mediterranean* (Rec. 21-08) and for this purpose Panel 2 held four intersessional meetings in 2022;

STRESSING the importance that all the stakeholders are involved in the MSE process since the MP automatically calculates the TAC to be adopted by the Commission unless it encountered an exceptional circumstance that is not envisaged by the MP;

APPRECIATING the efforts of all the scientists involved in the MSE process who made tremendous contribution not only to the scientific work but also to better communication of the results to various stakeholders involved in the bluefin tuna fisheries, including through informal ambassador meetings in three languages;

RECOGNIZING that the bluefin tuna MSE framework evaluated the status of the stock over the course of a 30-year projection period ending in 2052;

FURTHER RECOGNIZING that the relative biomass statistic (lowest depletion or LD value, which is the spawning biomass relative to dynamic SSB_{MSY}) will be evaluated across years 11-30 in this projection period to provide time for the MP to rebuild stocks given that the MSE operating models have been designed to cover a wide range of plausible scenarios, including scenarios that depict the stocks in a depleted state in the first 10 years of the 30-year projection period;

NOTING the importance of establishing an exceptional circumstances protocol in 2023 that could result in suspending or modifying the application of the MP;

THE INTERNATIONAL COMMISSION FOR THE CONSERVATION
OF ATLANTIC TUNAS (ICCAT) RECOMMENDS THAT:

PART I
GENERAL PROVISIONS

1. Contracting Parties and Cooperating non-Contracting Parties, Entities or Fishing Entities (CPCs) whose vessels fish for Atlantic bluefin tuna (*Thunnus thynnus*) in the Convention area shall implement the following MP. This MP shall be used to calculate the TAC for both the western Atlantic management area (hereafter called "the western management area") and the eastern Atlantic and the Mediterranean management area (hereafter called "the eastern management area").

Management Objectives

2. The management objectives for Atlantic bluefin tuna are:

   (a) Stock Status:
   - Both the western and eastern stocks should have a 60% or greater probability of occurring in the green quadrant of the Kobe plot (no overfishing occurring and not overfished);

   (b) Safety:
   - There should be a 15% or less probability of either stock falling below B_{LIM}[1];

   (c) Yield:
   - Maximize overall catch levels in both western and eastern management areas; and,

   (d) Stability:
   - Any change in TAC between consecutive management periods in both the western and the eastern management areas should be no more than a 20% increase or a 35% decrease.

   Performance statistics (indicators) used to evaluate the performance of MPs for each management objective are found in **Annex 1**.

PART II
MANAGEMENT PROCEDURE AND CATCH LIMITS

3. Consistent with the management objectives specified in paragraph 2, the BR management procedure has been selected and is fully described in **Annex 2**.

Total Allowable Catch Setting

4. The first TACs derived from the MP shall apply in 2023, 2024, and 2025. The management cycle length shall be three years; therefore, the MP shall be applied every three years.

5. Notwithstanding the stability management objective in paragraph 2d, there will be a phase-in period of one management cycle where the decrease in TAC shall be no more than 10%.

6. If the TAC change as a result of the application of the MP is less than 50 t for the western management area and 1,000 t for the eastern management area, the TAC shall not be changed.

7. According to the timeline set out in **Annex 3**, the SCRS shall run the MP specified in **Annex 2** and advise the Commission of the resulting TAC for both the western management area and the eastern management area.

[1] For the purposes of this bluefin tuna MSE, the Commission has agreed to use a B_{LIM} of 40% of the dynamic spawning stock biomass at maximum sustainable yield.

8. The Commission shall then adopt the TACs based on the outcome of the MP, unless the SCRS identifies exceptional circumstances that require consideration of alternative management actions to be taken by the Commission.

9. The SCRS shall assess the occurrence of exceptional circumstances annually and the Commission shall act in accordance with the exceptional circumstances protocol based on scientific advice by the SCRS and adopted by the Commission.

TAC Implementation

10. The MP shall be applied according to the determined schedule and procedure and the resulting TACs for the eastern and western management areas shall be implemented and monitored according to the provisions set out in Rec. 22-XX and Rec. 22-YY.

PART III
FINAL PROVISIONS

11. A review of the performance of the MP, by the Commission and the SCRS, shall be completed by 2028 and every 6 years thereafter. The aim of the review is to ensure the MP is performing as expected and determine whether there are conditions that justify its continuity, or that warrant: reconditioning the MSE operating models; retuning the existing MP; including new indices into a new MP; and/or considering alternate candidate management procedures, or development of a new, MSE framework. Based on that review and subsequent SCRS advice, the Commission shall decide on future management measures, approaches, and strategies, including, *inter alia*, regarding TAC levels, for bluefin tuna stocks in both management areas.

12. Panel 2, with scientific guidance from the SCRS, shall develop the exceptional circumstances protocol for this MP, for review and adoption by the Commission at its 2023 annual meeting. The protocol will become **Annex 4** of this Recommendation once adopted.

13. This Recommendation repeals and replaces *Resolution by ICCAT on development of initial management objectives for eastern and western bluefin tuna* (Res. 18-03).

Annex 1

Table of Operational Management Objectives and Performance Statistics. Performance statistics are calculated based on 48 simulations/replicates for each of the 48 operating models of a 30-year projection under a CMP. Results reported are percentiles of the resultant distributions, e.g., median (50%-ile) or lower 5%-ile.

Management Objectives (Res. 18-03) + PA2 guidance	**Primary Performance Statistics (Quilt plot 1)**	**Secondary Performance Statistics (Quilt plot 2)**
Status The stock should have a greater than 60% probability of occurring in the green quadrant of the Kobe matrix. (To be evaluated at intermediate points between zero and 30 years, and at the end of the 30-year period.)	**PGK**: Probability of being in the Kobe green quadrant (i.e., SSB≧dynamic SSB_{MSY}[1] and U<U_{MSY}[2]) in year 30 of the management period (2052).	**Br30** – Br [i.e., biomass ratio, or spawning stock biomass (SSB) relative to dynamic SSB_{MSY}] after 30 years. **AvgBr** – Average Br over projection years 11-30. **Br20** – Br after 20 years. **POF** – Probability of overfishing (U>U_{MSY}) after 30 projected years. **PNRK** – Probability of not being in the red Kobe quadrant (SSB ≧ SSB_{MSY} and/or U < U_{MSY}) after 30 projected years. **OFT** – Overfished Trend, SSB trend if Br30<1.
Safety There should be no more than a 15% probability of the stock falling below B_{LIM} at any point during the years 11-30 of the projection period.	**LD*** – Lowest depletion (i.e., the lowest SSB relative to dynamic SSB_{MSY}) over years 11-30 in the projection period. LD* value is evaluated relative to B_{LIM} (40% of dynamic SSB_{MSY}). $LD^*_{5\%}$, $LD^*_{10\%}$ and $LD^*_{15\%}$ are all evaluated, with the latter in Quilt 1 and the former 2 in Quilt 2.	
Yield Maximize overall catch levels.	**AvC10** – Median TAC (t) over years 1-10. **AvC30** – Median TAC (t) over years 1-30.	**C1** – TAC in first 3 years of MP (i.e., 2023-25), depending on management cycle length. **AvC20** – Median TAC (t) over years 1-20.
Stability Any change in TAC between management periods should be no more than a 20% increase or a 35% decrease, except during the application of the MP in the first (for 3-year cycle), where any TAC change shall not exceed a 20% increase or a 10% decrease.	**VarC** – Variation in TAC (%) between management cycles (3 year).	

[1] Dynamic SSB_{MSY} is a set fraction of dynamic SSB_0, which is the spawning stock biomass that would occur in the absence of fishing, historically and in the future. Dynamic SSB_{MSY} can change over time since it is based on current recruitment levels, which fluctuate due to time-varying dynamics in the models.

[2] The exploitation rate (U) is annual catch (in tonnes) divided by the total annual biomass in tonnes. U_{MSY} is the fixed harvest rate (U) corresponding with SSB/SSB_{MSY}=1 at year 50.

Annex 2

Description and formulae for calculating TACs for western Atlantic and eastern Atlantic and Mediterranean bluefin tuna management areas using the BR Management Procedure

The BR CMP is empirical, based on inputs related to abundance indices which are first standardised for magnitude, then aggregated by way of a weighted average of all indices available for the East or for the West areas as appropriate (**Table A1**, 5 indices in each management area), and finally smoothed over years to reduce observation error variability effects. TACs are then set based on the concept of taking a fixed proportion of the abundance present, as indicated by these aggregated and smoothed abundance indices.

Aggregate abundance indices

An aggregate abundance index is developed for each of the East and the West areas by first standardising each index available for that area to an average value of 1 over the past years for which the index appeared reasonably stable, and then taking a weighted average of the results for each index, where the weight is inversely proportional to the variance[2] of the residuals used to generate future values of that index in the future modified to take into account the loss of information content as a result of autocorrelation. The mathematical details are as follows.

The indices, I_y^i, are first standardised to an average value of 1 over the past years for which the index appeared reasonably stable:

$$I_y^{i*} = \frac{I_y^i}{\sum_{y_1^i}^{y_2^i} I_y^i / (y_2^i - y_1^i + 1)} \quad \text{(A1)}$$

where y_1^i and y_2^i specify the period to which each index (i) is standardised (**Table A1**).

$J_y^{E/W}$ is an average index over n series (n=5 for the East area and n=5 for the West area):

$$J_y^{E/W} = \frac{\sum_i^n w_i \times I_y^{i*}}{\sum_i^n w_i} \quad \text{(A2)}$$

where $w_i = \frac{1}{\sqrt{\sigma^i}}$ (i.e., effective inverse variance to the power ¼ weighting). σ^i is computed as $\sigma^i = \frac{SD^i}{1-AC^i}$, where SD^i is the standard deviation of the residuals in log space and AC^i is their autocorrelation, averaged over the OMs, as used for generating future pseudo-data. **Table A1** lists these values for w_i.

For the West, the weights computed above for US_RR_66_144, JPN_LL_West2 and CAN_SWNS have been multiplied by 3 (i.e., $w_i \rightarrow 3w_i$). This change has been implemented to avoid a steep drop in the median TAC for the West area during the 2030s.

In case of a missing index value in year y, $J_y^{E/W}$, is computed by setting w_i to zero, i.e., that index is disregarded when averaging over indices for that year only.

The actual index used in the CMPs, $J_{av,y-2}^{E/W}$, is the average over the last three years for which data would be available at the time the MP would be applied, hence:

$$J_{av,y-2}^{E/W} = \frac{1}{3}\left(J_{y-2}^{E/W} + J_{y-3}^{E/W} + J_{y-4}^{E/W}\right) \quad \text{(A3)}$$

where the $J_{av,y-2}^{E/W}$ applies either to the East or to the West area.

[2] This is modified somewhat in a few cases to provide the smoother TAC trend over time., as explained further below.

CMP specifications

The BR Fixed Proportion CMP variants set the TAC (in mt) every management cycle simply as a multiple of the J_{av} value for the area at the time (**Figure A1**), but subject to the change in the TAC for each area being restricted to a maximum of 20% up and 35% down (10% down for the phase-in period).

For the East area:

$$TAC_{E,y} = \begin{cases} \left(\frac{35032.31}{J^E_{2017}}\right) \cdot \alpha_y \cdot J^E_{av,y-2} & \text{for } J^E_{av,y-2} \geq T^E \\ \left(\frac{35032.31}{J^E_{2017}}\right) \cdot \alpha_y \cdot \frac{\left(J^E_{av,y-2}\right)^2}{T^E} & \text{for } J^E_{av,y-2} < T^E \end{cases} \quad \text{(A4a)}$$

$$\alpha_y = \begin{cases} \alpha_0 + \Delta\alpha(y - 2021) & \text{for } 2021 \leq y \leq 2025 \\ \alpha_0 + 4\Delta\alpha & \text{for } y > 2025 \end{cases}$$

For the West area:

$$TAC_{W,y} = \begin{cases} \left(\frac{2269.362}{J^W_{2017}}\right) \cdot \beta_y \cdot J^W_{av,y-2} & \text{for } J^W_{av,y-2} \geq T^W \\ \left(\frac{2269.362}{J^W_{2017}}\right) \cdot \beta_y \cdot \frac{\left(J^W_{av,y-2}\right)^2}{T^W} & \text{for } J^W_{av,y-2} < T^W \end{cases} \quad \text{(A4b)}$$

$$\beta_y = \begin{cases} \beta_0 + \Delta\beta(y - 2021) & \text{for } 2021 \leq y \leq 2028 \\ \beta_0 + 7\Delta\beta & \text{for } y > 2028 \end{cases}$$

The values 35032.314 mt and 2269.362 mt used in equations A4a and b respectively are the ICCAT Task 1 catch by management area in 2020 as at April 2022.

Note that in equation (A4a), setting $\alpha_y = 1$ would amount to keeping the East area TAC the same as the corresponding catch in 2020 (as explained above) if the abundance indices stayed at their 2017 level. If α_y or $\beta_y > 1$ harvesting would be more intensive than at that time, and for α_y or $\beta_y < 1$ it would be less intensive.

Below *T*, the law is parabolic rather than linear at low abundance (i.e., below some threshold, so as to reduce the proportion taken by the fishery as abundance drops); this is to better enable resource recovery in the event of unintended depletion of the stock. For the BR CMP, the choices of $T^E = 1$ and $T^W = 1$ have been made.

Constraints on the extent of TAC increase and decrease

$$\Delta TAC^{E/W} = \frac{TAC^{E/W}_y}{TAC^{E/W}_{y-1}} \quad \text{(A5)}$$

with $TAC^{E/W}_y$ from equation A4. $\Delta TAC^{E/W}$ is then modified as follows:

$$\Delta TAC^{E/W\prime} = \exp\left(\ln(\Delta TAC^{E/W}) VarCadj\right) \quad \text{(A6)}$$

with a control parameter, *VarCadj*, taken for the BR CMP to be 0.5. This parameter is introduced to reduce the magnitude of the TAC changes; the smaller the value of this parameter the smaller the TAC change.

$\Delta TAC^{E/W\prime}$ is then constrained to a maximum of 20% up and 35% down and 10% down for the phase-in period,

if $\Delta TAC^{E/W\prime} > (1 + maxUp^{E/W})$ then $\Delta TAC^{E/W\prime} = (1 + maxUp^{E/W})$, or
if $\Delta TAC^{E/W\prime} < (1 - maxDown^{E/W})$ then $\Delta TAC^{E/W\prime} = (1 - maxDown^{E/W})$

The TAC is then computed as:

$$TAC_y^{E/W\prime} = TAC_{y-1}^{E/W} \cdot \Delta TAC^{E/W\prime} \quad \text{(A7)}$$

If minimum TAC change constraints are accepted, the following revisions to these TACs apply:

$$\begin{aligned} &\text{if} \quad \left|TAC_{y-1}^{E/W} - TAC_y^{E/W\prime}\right| < min\Delta TAC^{E/W} \\ &\text{then} \quad TAC^{E/W\prime\prime} = TAC_{y-1}^{E/W} \end{aligned} \quad \text{(A8)}$$

where values suggested for $min\Delta TAC^{E/W}$ have been 50 mt for the West and 1000 mt for the East.

Table A1. The index periods y_1^i and y_2^i (equation A1).and w^i weights used when averaging over the indices to provide composite indices for the East and the West areas (equation A2).

	East				West			
i	Index	y_1^i	y_2^i	w^i	Index	y_1^i	y_2^i	w^i
1	FR_AER_SUV2	2014	2017	1.33	GOM_LAR_SUV	2006	2017	1.33
2	MED_LAR_SUV	2012	2016	1.66	US_RR_66_144	2006	2018	2.55
3	GBYP_AER_SUV_BAR[3]	2015	2018	1.06	MEXUS_GOM_PLL2	2006	2018	1.39
4	MOR_POR_TRAP	2012	2018	1.43	JPN_LL_West2	2010	2019	3.96
5	JPN_LL_NEAtl2	2012	2019	1.33	CAN_SWNS	2006	2017	2.88

Table A2. Control parameter values for each of the CMPs (equation A4). A TAC variation reduction adjustment factor with VarCadj=0.5 has been applied.

CMP name	PGK	Cycle	stability	α_0	$\Delta\alpha$	β_0	$\Delta\beta$
[…]	[…]	[…]	[…]	[…]	[…]	[…]	[…]
B360	60	3	+20/-35	1.235	0.204	0.81	-0.0320
[…]	[…]	[…]	[…]	[…]	[…]	[…]	[…]
[…]	[…]	[…]	[…]	[…]	[…]	[…]	[…]
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[…]	[…]	[…]	[…]	[…]	[…]	[…]	[…]

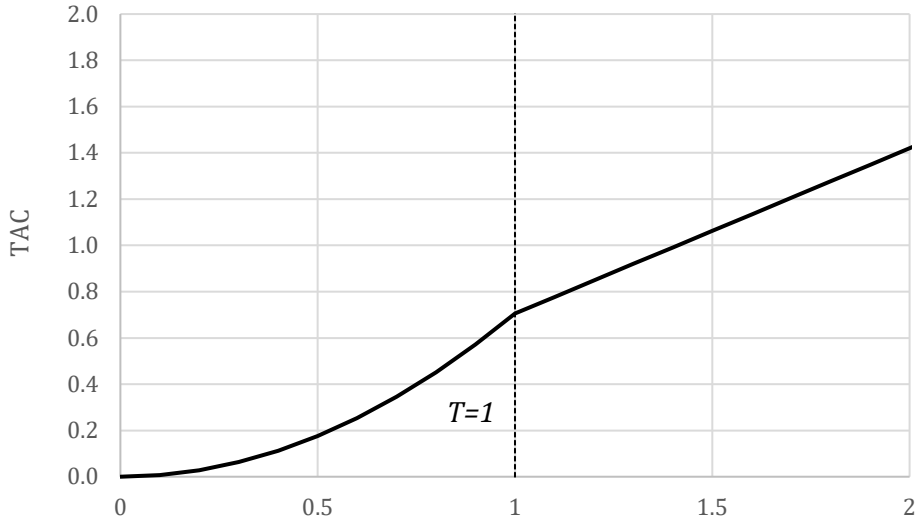

Figure A1. Illustrative relationship (the "catch control law") of *TAC* against $J_{av,y}$ for the BR CMPs, which includes the parabolic decrease below *T*.

[3] For the GBYP aerial survey, there is no value for 2016 and that year was therefore omitted from this averaging.

Annex 3

Schedule for Management Procedure implementation

3 Year Cycle

	2022	*2023*	*2024*	*2025*	*2026*	*2027*	*2028*
SCRS check ECs		X	X	X	X	X	X
SCRS runs MP	X			X			X
Commission endorses and implements TAC based on MP	X			X			X
TAC in effect		X	X	X	X	X	X
SCRS MP review						X	X
Status Check/Assessment					X*	X*	
Commission assesses SCRS review and next steps							X

*The Commission shall decide the timing of the next stock assessment in consultation with the SCRS.