REPORT OF THE SECOND 2022 INTERSESSIONAL MEETING OF THE BLUEFIN TUNA TECHNICAL SUB-GROUP ON MSE

(Online 5-9 September, 2022)

Please note that the material, documents and draft report from an SCRS meeting are considered confidential and not for general circulation until the meeting report is posted. The results, conclusions and recommendations contained in this Report only reflect the view of the Bluefin Tuna Technical Sub-group on Management Strategy Evaluation (MSE). Therefore, these should be considered preliminary until the SCRS adopts them at its annual Plenary meeting and the Commission reviews them at its Annual meeting. Accordingly, ICCAT reserves the right to comment, object and endorse this Report, until it is finally adopted by the Commission.

1. Opening, adoption of agenda, meeting arrangements, and assignment of rapporteurs

The meeting was held online from 5 to 9 September 2022. Drs Enrique Rodríguez-Marín (EU-Spain) and John Walter (USA), the Rapporteurs for the eastern Atlantic and Mediterranean, and western Atlantic bluefin tuna stocks (E-BFT and W-BFT) respectively, opened the meeting and served as Co-Chairs. On behalf of the Executive Secretary, the Assistant Executive Secretary, and the SCRS Chair, Dr Gary Melvin (Canada), welcomed the participants. The Chairs proceeded to review the Agenda which was adopted with some changes (**Appendix 1**).

The List of Participants is included in **Appendix 2**. The List of Documents presented at the meeting is attached as **Appendix 3**. The abstracts of all SCRS documents and presentations provided at the meeting are included in **Appendix 4**. The following served as rapporteurs:

Sections	*Rapporteur*
Items 1 and 9	A. Kimoto
Item 2	M. Lauretta, N. Duprey, A. Kimoto
Items 3, 4 and 5	C. Peterson, T. Rouyer, J. Walter
Item 6	S. Miller, E. Andonegi
Item 7	T. Carruthers
Item 8	E. Rodriguez-Marin, J. Walter

2. 2021 index values and first year TAC calculations for each CMP

The Group reviewed updates to indices of abundance for the Japan longline (SCRS/2022/152), the Mexico-US longline (MEXUS LL, SCRS/2022/160), the Morocco-Portugal (MOR-POR) traps (SCRS/2022/141), the GBYP aerial survey and the Canada Gul of St. Lawrence (GSL) and the southwestern Nova Scotia (SWNS) handline indices (SCRS/2022/145). A correction to the Japan LL series was presented, which included a necessary modification to the data formatting, and treatment. The corrections resulted in a modified index series compared to the data presented during the 2022 Eastern Atlantic and Mediterranean Bluefin Tuna Data Preparatory Meeting (including BFT MSE) (online, 18-26 April 2022) (Anon., 2022) for the terminal two years. It was noted that the data correction did not affect the historical period for the Northeast Atlantic or the West Atlantic historical period before the terminal year (2019) used in Operating Model (OM) re-conditioning in 2021. Additionally, a modification of model formulation in R was presented to mimic the nesting structure used in SAS. This modification made the indices standardized by SAS and R consistent. The Group agreed that the indices standardized by R will be used in the MSE update and current Candidate Management Procedure (CMP) calculations. However, the Group noted that the revision will not be integrated into the 2022 eastern BFT assessment models, because that modelling is already complete and because it would be expected to make only a small difference in the results.

The updated MEXUS LL and MOR-POR traps survey indices were presented, with no change in methodology. Both indices showed consistent estimates and trends between the updated and prior series. The Canada southwestern Nova Scotia (SWNS) handline and the Atlantic-wide Research Programme for Bluefin Tuna (GBYP) aerial survey indices were updated using revised data treatment and standardization methods, and both showed deviations from the prior indices used in the last update of the MSE. The GBYP aerial survey had undergone extensive peer-review since the last MSE re-conditioning, with recommended revisions and design-based index estimates provided by contracted experts and adopted by the Group for use in the MSE. The Group discussed the modifications to the Canada SWNS handline index and determined that the deviations in index values and overall trends were considered acceptable in terms of the statistical requirements of the MSE. The indices adopted by the Group are listed in **Tables 1** and **2**, and are plotted in **Figure 1**.

The specifications for scaling the updated indices of abundance for ABFT-MSE package input were discussed in great detail. The MSE Consultant explained the appropriate methods for ensuring accuracy in the scale of the data input into the CMPs, and clarified this is important for consistency related to CMP tuning. The following procedure, to be applied only this year, outlines the methods for scaling the index time series for input into the ABFT-MSE package.

- Some of the CPUE and fishery independent indices that are available to CMPs in projection years have been updated.
- Since CMPs are tuned to the magnitude of previous index series (i.e., the ones available on which the most recent package was based, which were provided at the 2022 Eastern Atlantic and Mediterranean Bluefin Tuna Data Preparatory Meeting (including BFT MSE) (online, 18-26 April 2022) (Anon., 2022), it is important that the new indices provided at this meeting have the same scale as the previous index series (a new rescaled index is required for MSE projections).
- To achieve this, each updated index I_{new}, is rescaled to have the same geometric mean as the previous index $I_{previous}$ for those n historical years y which they have in common (starting year S, final year F, for the previous indices, where both S and F are index dependent):

$$k = \frac{exp\left(\frac{1}{n}\sum_{y=S}^{F} ln(I_{previous,y})\right)}{exp\left(\frac{1}{n}\sum_{y=S}^{F} ln(I_{new,y})\right)} \quad (1)$$

- In this way a new rescaled index $I_{rescaled}$, for all available years of the new index can be calculated:

$$I_{rescaled,y} = kI_{new,y} \quad (2)$$

The new indices are included in **Tables 1** and **2**. The rescaled new indices are shown in **Tables 3** and **4**. Plots of the previous and rescaled new indices (rescaled using scaling equation above) are presented in **Figure 1**.

Note that, by construction, the rescaled new index values are completely independent of the scale of the new index values. For example in **Table 1,** the series values where all multiplied by 0.01, so that their average was about 1. This would mean that k from equation (1) for that series was 100 times bigger. But then when equation (2) was applied, the $I_{new,y}$ values (all 100 times smaller) would all be multiplied by a value of k that was 100 times larger, so that the $I_{rescaled,y}$ values would remain unchanged. In other words, any scaling applied to the values in the new series does not matter. The results for the new rescaled values are unaffected as that scaling cancels out in equation (2).

The Group discussed rules of index provision for CMPs and for annual indicators (**Appendix 5**). Because the Group is now moving to using indices for management procedures, an additional category of index provision was proposed for Management Procedure applications, and to clarify index provision categories. The most appropriate form of index provision for management procedure applications should be further discussed in the BFT Species Group meeting in September 2022.

3. Summary of developments on ABFT-MSE

3.1 Report on 2022 July Panel 2 meeting on BFT MSE

The Co-Chair briefly discussed the Third Intersessional Meeting of Panel 2 on Bluefin Tuna Management Strategy Evaluation (BFT MSE), (online, 14 July 2022) (Anon., in press) and referred the Group to the report of the meeting, noting that all of the requests from Panel 2 have been addressed and will be illustrated with results at this meeting.

3.2 Round-robin from CMP developers and any final changes

Each development team provided a verbal update on their progress performance tuning their CMPs to PGK (Probability of Green zone in Kobe plot after 30 projected years) targets of 60% and 70% in both 2- or 3-year management cycles (SCRS/2022/154, SCRS/2022/156). The CMPs followed the following labeling convention: XX#y (e.g., BR5a), where XX indicates the algorithm, # indicates the tuning target (2 = median Br30=1.25 in West and 1.5 in East; 5 = mean PGK = 60% in West and East, 6 = mean PGK = 70% in West and East), and y indicates the management cycle or other procedure variant (where a = 2-year management interval, b = 3-year management interval, and additional subscripts were alternate configurations, which can be found on the help page of the Shiny App: https://apps.bluematterscience.com/ABTMSE/). Some developers (BR, FO) further prepared additional CMP configurations designed to reduce VarC (average annual variation in catches), following the MSE Contractor's approach. All developers noted the additional challenge of tuning the full stochastic grid to PGK, as the tuning OM grids were developed to tune to Br30 (Depletion (spawning biomass relative to dynamic SSB_{MSY}) after projection year 30) targets. PW and AI were removed from consideration, and though TC was not tuned with sufficient accuracy to be compared with the suite of remaining CMPs in current analyses, it will remain in the running. Remaining CMPs are BR, FO, and LW, and TC will be re-included at a later stage.

Developers also examined expected yields for the first few management cycles, experimented with different phase-in options, explored the frequency with which CMP-derived management advice hit maximum or minimum allowable TAC change bounds, and reiterated preferred tuning methodologies.

3.3 Changes to CMPs based on Panel 2/Commission input

Updated results were presented in SCRS/P/2022/052. Package updates included a PGK_wt function, code to implement 3-year management cycles, presentation of worm plots, and a tab to visualize mean results in Shiny App tables. However, it was noted that, unrelated to the ABFT-MSE package, an R function that it relied upon had changed, resulting in the tunings not being on the weighted OM grid. Hence when the resulting OM-weighted PGK values were examined they did not exactly match the targets. To address this the ABFT-MSE package was updated at the meeting and developers will need to re-tune their CMPs prior to the BFT Species Group meeting in September 2022. Updated results will be due to the MSE Contractor on 16 September 2022.

CMP developers will need to retune their CMPs with the updated PGK_wt function in the updated ABFT-MSE package. The updated package will also include updated indices of abundance through the year 2021. Since the updated indices were almost indistinguishable from the previous version, their incorporation will not require OM-reconditioning, while providing a better reflection of the first few years of CMP dynamics once implemented.

Developers should retune to 5 tuning targets:

1. Tune to PGK = 60% with a 2-year management cycle, where allowable TAC adjustment is +20/-30
2. Tune to PGK = 60% with a 3-year management cycle, where allowable TAC adjustment is +20/-30
3. Tune to PGK = 70% with a 2-year management cycle, where allowable TAC adjustment is +20/-30
4. Tune to PGK = 70% with a 3-year management cycle, where allowable TAC adjustment is +20/-30
5. Tune to PGK = 60% with a 3-year management cycle, where allowable TAC adjustment is +20/-35

The rationale for tuning to PGK, as opposed to the previous performance tuning to LD* was a result of the need to satisfy both LD* and PGK. Initial tuning to $LD^*_{15\%}$ indicated PGK performance below 60%, so that PGK became the limiting factor in satisfying both of Panel 2 minimum operational management objectives for both $LD^*_{15\%}$ and PGK>=60%. Panel 2 also requested that the SCRS tests $LD^*_{10\%}$. Developers could, time permitting, conduct additional runs after the BFT Species Group meeting in September 2022 to evaluate this, the process for doing this should be spelled out in detail by the BFT Species Group and reviewed by the SCRS. Developers should retune in the context of satisficing, where if a re-tuned CMP does not meet $LD^*_{15\%} \geq 0.4$, then the PGK criterion should be relaxed such that the LD* statistic is met. Developers should note that resulting PGK should be as close to the target as possible without falling below the target (e.g., PGK=0.61 is acceptable, but PGK=0.59 should be re-tuned). Developers were encouraged to explore methods of reducing VarC at their discretion. Updated CMP results will be due 16 September 2022. The Group noted that results are desired under extreme time limitations, and the first four tuning options are accordingly prioritized.
Key deadlines:

- 13 September 2022 (Tuesday) Circulate SCRS/2022/169 (MSE results, section 4)
- 16 September 2022 (Friday) Retuned CMPs
- 16 September 2022 (Friday) Comments due on SCRS/2022/169
- 19 September 2022 (Monday) Recompiled CMPs into package
- 20 September 2022 (Tuesday) Revised SCRS/2022/169

4. Final CMP features and performance tuning of each CMP

As the CMPs will still need to undergo an additional round of performance tuning, final results are not provided in this document. The BFT Technical Sub-group on MSE reviewed preliminary results and recommended that the final results be provided as SCRS/2022/169 to the BFT Species Group meeting in September 2022.

5. Draft CMP recommendations from BFT Technical Sub-group on MSE to SCRS

The BFT Technical Sub-group on MSE is not providing recommendations on specific CMPs to the SCRS. The detailed material to be provided in SCRS/2022/169 will be available to the BFT Species Group meeting in September 2022 to facilitate the SCRS materials for Panel 2.

6. Communications material

The Group discussed the best approaches for presenting the final MSE results to Panel 2 and the Commission. It was noted that there are five major decisions that remain: choice of CMP types, minimum PGK, maximum LD*, management cycle length, and restrictions on maximum TAC increase/decrease between cycles. The Group also discussed the need to consider the time period of revision of MP. Since ranking relative CMP performance is similar across these decisions, independent of each other, the Group noted that Panel 2 could decide the order in which the decisions would be made. Further, the decisions can therefore be made one at a time, in a stepwise fashion. As such, to the extent possible, communications materials should be flexible, allowing an approach akin to a decision tree or "choose-your-own-adventure" (e.g., by using internal hyperlinks to specific results). The Group suggested that the SCRS recommend that Panel 2 select the final MP before making the other decisions, but the order of decisions be left at the discretion of Panel 2.

Several messaging nuances were noted, including that worm plots show alternative possibilities, not unique predictions. The Group also agreed that the SCRS will not recommend a single MP for adoption, since that is a decision for Panel 2. However, qualitative summaries of performance statistic results may help to inform on which MP achieves the best balance of tradeoffs among management objectives.

6.1 4-pager

The Group reviewed an updated version of the "4-pager" summary document that has been revised and presented to each Panel 2 meeting in 2022. The new version is streamlined to minimize text and to tie the final results directly to each remaining decision point in a stepwise fashion. The document will be finalized at the BFT Species Group meeting in September 2022 when final results are available and accepted. At that time, a decision will be made on whether to produce additional print documents, such as separate summaries for each of the CMPs still under consideration and/or a matrix of tables of results for each CMP variant.

6.2 BFT MSE Ambassadors programme presentations

The Group agreed to hold Ambassadors' sessions in early October 2022. A presentation will be developed for these meetings, which will also form the basis for the presentation to be made to the Fourth Intersessional Meeting of Panel 2 on Bluefin Tuna Management Strategy Evaluation (BFT MSE) (Madrid, Spain / hybrid, 14 October 2022). The presentation will include a separate slide for each CMP variant (4 CMPs x 5 variants = 20 CMP variants); these slides will not all be shown but will instead be hyperlinked, so they are available, if needed. All worm plots and trajectories will be truncated to a 35-year projection period prior to inclusion in the presentation. The presentation will be drafted for review by the BFT Species Group meeting in September 2022.

7. Update of trial specification document (TSD)

TSD was updated to reflect revised catches by fleet between 2020 and 2022 (TSD Table 6.1) (**Appendix 6**).

8. Other matters

8.1 Draft of response to commission in relation to MSE SCI-79

The Group decided to prepare intersessionally the response for the Commission, so that a draft would be ready for review at the BFT Species Group meeting in September 2022.

8.2 Contingency options for management advice

Two contingency options for management advice were discussed: one based on constant catch projections using the MSE framework and the other based on analysis of recent trends in fishery dependent and fishery independent indices.

The MSE constant catch projection approach was used last year to provide information on the range of possible TACs for the W-BFT stock advice. The Group will leave the final decision on which, if any, approach needs to be taken to the BFT Species Group meeting in September 2022.

9. Adoption of the report and closure

The Report of the Second 2022 Intersessional Meeting of the BFT Technical Sub-group on MSE was adopted. Drs Rodríguez-Marín and Walter, and the SCRS Chair thanked the participants and the Secretariat for their hard work and collaboration to finalize the report on time. The meeting was adjourned.

References

Anonymous. 2022. Report of the 2022 eastern Atlantic and Mediterranean bluefin tuna data preparatory meeting (including BFT MSE) (online, 18-26 April 2022). Collect. Vol. Sci. Pap. ICCAT, 79 (3): 1-140.

Anonymous. (in press) Third Intersessional Meeting of Panel 2 on Bluefin Tuna Management Strategy Evaluation (BFT MSE) (online, 14 July 2022). 30p.

Table 1. Fishery dependent indices in the MSE input (* shows indices updated by September 2022).

Area	East&Med	East&Med	East&Med	East&Med*	East&Med	East&Med*	East&Med*
series	SPN BB	SPN-FR BB	MOR-SPN TRAP	MOR-POR TRAP	JPN LL Eatl&Med	JPN LL NEAtl1	JPN LL NEAtl2
age	2-3	3-6	6+	10+	6 - 10	4 - 10	4 - 10
indexing	Weight	Weight	Number	Number	Number	Number	Number
source	SCRS/2014/054	SCRS/2015/169	SCRS/2014/060	SCRS/2022/141	SCRS/2012/131	SCRS/2022/152	SCRS/2022/152
1952	179.22						
1953	184.74						
1954	226.46						
1955	187.01						
1956	470.53						
1957	315.05						
1958	252.25						
1959	506.79						
1960	485.16						
1961	327.29						
1962	180.12						
1963	312.09						
1964	457.40						
1965	228.91						
1966	349.10						
1967	345.89						
1968	447.00						
1969	610.62						
1970	594.66						
1971	744.71						
1972	525.63						
1973	535.63						
1974	245.39						
1975	484.22				1.90		
1976	483.96				2.15		
1977	547.56				3.53		
1978	705.26				1.50		
1979	623.01				2.70		
1980	634.81				1.69		
1981	510.66		768.36		1.63		
1982	503.78		1038.12		3.32		
1983	625.14		1092.05		2.12		
1984	331.71		1200.27		1.62		
1985	1125.74		814.46		1.75		
1986	751.21		394.33		1.32		
1987	1008.43		433.53		2.16		
1988	1394.68		1014.56		1.35		
1989	1285.60		531.45		1.05		
1990	986.51		614.37		1.41	0.43	
1991	901.20		727.86		1.21	0.46	
1992	695.16		313.95		1.03	0.85	
1993	2093.55		325.36		1.04	0.68	
1994	1007.03		341.90		1.12	0.95	
1995	1235.91		223.43		1.42	0.98	
1996	1739.29		375.22		0.50	2.29	
1997	2246.41		992.41		0.53	1.49	
1998	879.51		925.14		0.71	0.76	
1999	339.77		1137.45		0.64	1.01	
2000	960.44		739.23		0.74	1.04	
2001	704.49		1284.62		0.96	1.30	
2002	687.42		1130.42		2.05	0.88	
2003	444.91		662.66		1.70	0.94	
2004	1210.46		332.36		0.82	0.87	
2005	2383.57		677.39		0.88	0.68	
2006	850.09		633.94		1.91	0.79	
2007		2179.98	1000.60		0.94	0.88	
2008		2154.01	634.18		1.22	0.93	
2009		955.38	876.71		1.04	1.51	
2010		2126.20	1042.24				2.17
2011		2785.47	674.97				3.80
2012		2306.99		101.49			8.30
2013		1569.13		139.56			6.87
2014		678.29		68.76			7.93
2015				106.15			6.29
2016				104.21			5.69
2017				118.70			7.14
2018				78.63			8.57
2019				108.33			8.18
2020				112.93			5.98
2021				171.82			5.85

Table 1. Continued.

Area	West	West	West	West	West*	West*	West	West	West*	West*	West*	West	West*	West*
series	US RR<145cm	US RR>195cm	US RR 66-114cm	US RR 115-144cm	US RR 66-144cm	US RR >177cm	US GOM PLL1	US GOM PLL2	MEXUS GOM LL	JPN LL1	JPN LL2	JPN LL GOM	CAN GSL HL	CAN SWNS HL
age	<145cm	>195cm	66-114cm	115-144cm	66-144cm	>177cm	8-16	8-16	8-35	4 - 10	5 - 16	9-16	8-16	5-16
indexing	Number	Number	Number	Number	Number	Number				Number	Number	Number		
source	SCRS/1993/067	SCRS/1993/067	SCRS/2021/034	SCRS/2021/034	SCRS/2021/034	SCRS/2022/	SCRS/2021/026	SCRS/2021/026	SCRS/2022/160	SCRS/2022/152	SCRS/2022/152	SCRS/1991/071	SCRS/2021/025	SCRS/2022/145
1970												0.97		
1971												0.53		
1972										0.36		0.67		
1973										0.91		0.91		
1974										0.74		0.88		
1975										0.76		1.29		
1976										1.37		1.16		
1977										1.10		0.55		
1978										0.77				
1979										0.46				
1980	0.80									0.67				
1981	0.40									0.83				
1982	2.10									0.01				
1983	1.11	2.81								0.38				
1984		1.25					1.32			0.34			0.03	
1985	0.63	0.86					0.64			0.69			0.10	
1986	0.78	0.50					0.99			0.48			0.08	
1987	1.22	0.53					0.77			0.59			0.05	
1988	0.99	0.94					1.29			1.03			0.16	
1989	0.99	0.76				0.49		0.64		0.97			0.14	
1990	0.90	0.63				0.70		0.47	0.89	0.89			0.06	
1991	1.26	0.82												
1992	0.82	0.91												
1993						0.49		0.64		0.97			0.14	
1994						0.70		0.47	0.89	0.89			0.06	
1995			1.33	0.86	1.26	1.49		0.44	0.44	0.63			0.15	
1996			1.34	1.18	1.33	2.67		0.25	0.78	2.16			0.02	0.32
1997			2.69	0.30	2.00	1.17		0.47	0.21	1.57			0.03	0.28
1998			0.97	0.79	0.94	1.56		0.50	0.75	0.74			0.04	0.36
1999			0.79	1.26	0.90	1.55		0.84	0.45	1.07			0.07	0.68
2000			1.16	0.84	1.15	0.95		1.25	2.24	1.05			0.06	0.30
2001			0.47	1.70	0.77	1.99		0.71	0.97	0.87			0.05	0.57
2002			0.97	1.56	1.07	1.90		0.66	1.45	0.79				0.58
2003			0.58	0.81	0.68	0.56		1.20	1.19	1.20			0.14	0.47
2004			1.77	0.90	1.64	0.39		1.09	0.60	1.12			0.31	0.60
2005			1.68	0.86	1.55	0.45		0.82	0.55	1.01			0.21	0.69
2006			0.64	1.01	0.71	0.30		0.58	0.79	1.50			0.17	0.91
2007			0.54	1.19	0.69	0.32		0.77	0.49	0.93			0.36	0.67
2008			0.34	1.81	0.68	0.34		1.79	0.80	1.44			0.24	0.79
2009			0.54	0.68	0.56	0.40		1.47	0.68	2.38			0.60	1.20
2010			0.63	1.74	0.87	0.76		1.23	0.51		0.54		0.94	1.35
2011			0.81	0.59	0.76	0.71		1.10	0.94		1.84		0.63	1.11
2012			0.96	0.52	0.83	0.61		3.42	1.49		2.37		0.66	1.06
2013			0.99	2.36	1.31	0.39		1.24	0.72		1.88		0.63	0.69
2014			0.82	0.81	0.80	0.52		0.96	1.31		2.02		0.69	0.88
2015			0.43	0.26	0.38	0.83		1.03	1.90		1.28		0.52	0.98
2016			0.46	1.03	0.58	1.03		1.10	1.58		3.07		0.64	1.10
2017			0.96	0.87	0.93	1.60		0.82	1.16		3.34		0.56	1.03
2018			0.82	0.11	0.68	1.55		1.04	1.45		6.33		0.56	0.97
2019			1.23	1.72	1.23	1.77		0.62	1.66		5.51		0.56	1.08
2020			2.07	0.24	1.70	1.50		1.21	1.25		4.16		0.62	1.36
2021					2.13	1.32			1.79		3.63		0.50	1.45

Table 2. Fishery independent indices in the MSE input (* shows indices updated by September 2022).

Area	East&Med*	East&Med*	East&Med*	East&Med*	West*	West	West
series	French Aerial survey 1	French Aerial survey 2	WMed Larval Survey	WMed GBYP Aerial Survey	GOM Larval Survey	CAN Acoustic survey1	CAN Acoustic survey2
age	2-4	2-4	Spawners	Spawners	8-16	5-16	5-16
indexing	Number of schools	Number of schools		Total weight (t)			
source	SCRS/2022/068	SCRS/2022/068	SCRS/2022/071	SCRS/P/2022/018	SCRS/P/2018/055	SCRS/2021/036	SCRS/2021/036
1970							
1971							
1972							
1973							
1974							
1975							
1976							
1977					3.04		
1978					5.51		
1979							
1980							
1981					1.07		
1982					1.55		
1983					1.43		
1984					0.41		
1985							
1986					0.44		
1987					0.39		
1988					1.50		
1989					0.99		
1990					0.42		
1991					0.38		
1992					0.56		
1993					0.58		
1994					0.72	0.03	
1995					0.31	0.03	
1996					1.03	0.07	
1997					0.44	0.04	
1998					0.16	0.04	
1999					0.63	0.04	
2000	0.02				0.30	0.02	
2001	0.01		4.58		0.54	0.04	
2002	0.01		9.58		0.34	0.02	
2003	0.01		2.67		0.93	0.04	
2004			10.86		0.69	0.04	
2005			2.27		0.23	0.05	
2006					0.70	0.06	
2007					0.58	0.04	
2008			1.96		0.43	0.03	
2009		0.02			0.76	0.06	
2010		0.01		1659	0.40	0.07	
2011		0.03	9.92	1392	1.35	0.05	
2012		0.02	26.57		0.36	0.10	
2013			40.32	2393	1.23	0.06	
2014		0.06	20.10		0.34	0.08	
2015		0.03	36.61	4766	0.51	0.08	
2016		0.11	32.41		3.04	0.09	
2017		0.07	73.03	8072	1.24	0.05	
2018		0.03		13471	2.53		0.01
2019		0.06	46.16	11649	1.92		0.02
2020		0.14	107.15				
2021		0.10		4717	2.16		

Table 3. Rescaled fishery dependent indices for use in current MSE projections in September 2022.

Area	East&Med	East&Med	West	West	West	West	West	West	West	West	West
series	MOR-POR TRAP	JPN LL NEAtl2	US RR 66-114cm	US RR 115-144cm	US RR 66-144cm	US RR >177cm	US GOM PLL2	MEXUS GOM LL	JPN LL2	CAN GSL HL	CAN SWNS HL
1988										0.01491	
1989										0.04847	
1990										0.03775	
1991										0.02191	
1992							1.14000			0.07411	
1993						0.46094	0.64000			0.06711	
1994						0.65717	0.47000	0.88985		0.02843	
1995			1.33000	0.86000	1.26394	1.40998	0.44000	0.43993		0.07038	
1996			1.34000	1.18000	1.32904	2.51820	0.25000	0.77987		0.00979	0.58261
1997			2.69000	0.30000	2.00384	1.10252	0.47000	0.20996		0.01305	0.50749
1998			0.97000	0.79000	0.94141	1.47074	0.50000	0.74987		0.02051	0.65406
1999			0.79000	1.26000	0.90296	1.46576	0.84000	0.44992		0.03029	1.25132
2000			1.16000	0.84000	1.15460	0.89662	1.25000	2.23962		0.02936	0.54963
2001			0.47000	1.70000	0.76638	1.87664	0.71000	0.96984		0.02237	1.04246
2002			0.97000	1.56000	1.06639	1.79324	0.66000	1.44976			1.05895
2003			0.58000	0.81000	0.67795	0.52980	1.20000	1.18980		0.06478	0.85925
2004			1.77000	0.90000	1.64142	0.36681	1.09000	0.59990		0.14308	1.10475
2005			1.68000	0.86000	1.55373	0.42344	0.82000	0.54991		0.09648	1.27148
2006			0.64000	1.01000	0.70733	0.27899	0.58000	0.78987		0.07830	1.66354
2007			0.54000	1.19000	0.69359	0.30623	0.77000	0.48992		0.16965	1.22934
2008			0.34000	1.81000	0.68050	0.31966	1.79000	0.79987		0.11139	1.44003
2009			0.54000	0.68000	0.55664	0.37585	1.47000	0.67989		0.27871	2.18936
2010		2.25447	0.63000	1.74000	0.87127	0.71592	1.23000	0.50991	0.18322	0.43718	2.46600
2011		3.94200	0.81000	0.59000	0.75705	0.66889	1.10000	0.93984	0.62628	0.29502	2.02447
2012	93.37093	8.60915	0.96000	0.52000	0.83465	0.58033	3.42000	1.48975	0.80890	0.30668	1.94569
2013	128.39538	7.12326	0.99000	2.36000	1.30839	0.37208	1.24000	0.71988	0.63979	0.29363	1.26781
2014	63.25929	8.21920	0.82000	0.81000	0.80477	0.48911	0.96000	1.30978	0.69060	0.32019	1.61225
2015	97.65814	6.52556	0.43000	0.26000	0.37588	0.78616	1.03000	1.89968	0.43830	0.24376	1.79729
2016	95.87334	5.89756	0.46000	1.03000	0.57555	0.97650	1.10000	1.57973	1.04578	0.29642	2.00981
2017	109.20415	7.40097	0.96000	0.87000	0.93000	1.50929	0.82000	1.15980	1.13799	0.26007	1.88340
2018	72.33970	8.88247	0.82000	0.11000	0.67684	1.46328	1.04000	1.44976	2.16019	0.26054	1.77347
2019	99.66374	8.47695	1.23000	1.72000	1.23082	1.66644	0.62000	1.65972	1.87953	0.26240	1.98599
2020	103.89575	6.20493	2.07000	0.24000	1.69506	1.41266	1.21000	1.24979	1.41905	0.28990	2.48616
2021	158.07462	6.06671			2.12813	1.24877		1.78970	1.23667	0.23071	2.65837

Table 4. Rescaled fishery independent indices for use in current MSE projections in September 2022.

Area	East&Med	East&Med	East&Med	West	West
series	French Aerial survey 2	WMed Larval Survey	WMed GBYP Aerial Survey	GOM Larval Survey	CAN Acoustic survey2
1977				3.0448	
1978				5.5123	
1979					
1980					
1981				1.0711	
1982				1.5476	
1983				1.4336	
1984				0.4089	
1985					
1986				0.4393	
1987				0.3901	
1988				1.5041	
1989				0.9882	
1990				0.4174	
1991				0.3834	
1992				0.5576	
1993				0.5836	
1994				0.7215	
1995				0.3124	
1996				1.0260	
1997				0.4408	
1998				0.1582	
1999				0.6341	
2000				0.3020	
2001		4.2656		0.5438	
2002		8.9273		0.3394	
2003		2.4912		0.9294	
2004		10.1268		0.6881	
2005		2.1188		0.2334	
2006				0.7027	
2007				0.5799	
2008		1.8252		0.4260	
2009	0.0181			0.7641	
2010	0.0142		1652.6084	0.4017	
2011	0.0265	9.2519	1386.6370	1.3528	
2012	0.0180	24.7751		0.3617	
2013		37.5874	2383.7805	1.2268	
2014	0.0634	18.7387		0.3437	
2015	0.0274	34.1292	4747.6380	0.5058	
2016	0.1074	30.2137		3.0367	
2017	0.0686	68.0857	8041.1101	1.2426	
2018	0.0309		13418.8411	2.5282	0.0070
2019	0.0625	43.0380	11604.1098	1.9163	0.0150
2020	0.1357	99.8994			
2021	0.0975		4698.4183	2.1629	

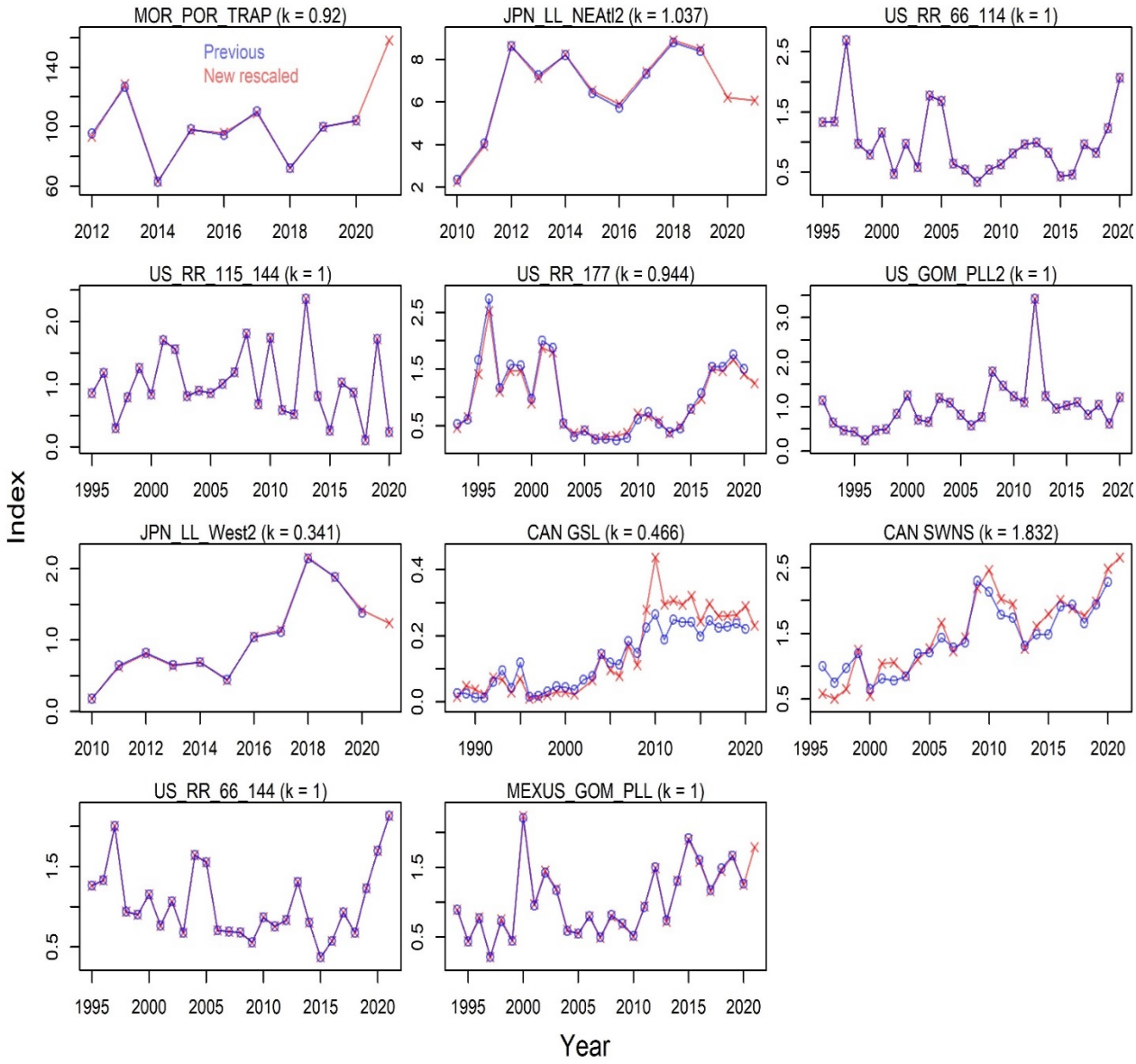

Figure 1. Comparisons between previous (April 2022) and new (September 2022) rescaled fisheries dependent indices for use in current MSE projections.

Appendix 1

Agenda

1. Opening, adoption of agenda and meeting arrangements and assignment of rapporteurs

2. 2021 index values and first year TAC calculations for each CMP

3. Summary of developments on ABFT-MSE

    3.1 Report on 2022 July Panel 2 meeting on BFT MSE
    3.2 Round-robin from CMP developers and any final changes
    3.3 Changes to CMPs based on Panel 2/Commission input

4. Final CMP features and performance tuning of each CMP

5. Draft CMP recommendations from BFT Technical Sub-group on MSE to SCRS

6. Communications material

    6.1 4-pager
    6.2 BFT MSE Ambassadors programme presentations

7. Update of trial specification document (TSD)

8. Other matters

    8.1 Draft of response to commission in relation to MSE SCI-79
    8.2 Contingency options for management advice

9. Adoption of the report and closure

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Appendix 3

List of documents and presentations

Reference	Title	Authors
SCRS/2022/141	Standardized joint CPUE index for bluefin tuna (*Thunnus thynnus*) caught by Moroccan and Portuguese traps for the period 2008-2021	Lino P.G., Abid N., Malouli M.I., Bensbai J., Coelho R.
SCRS/2022/145	Updated Indicators of relative abundance for Bluefin tuna based on 1996 to 2021 Canadian fisheries data	Hanke A.
SCRS/2022/152	The standardized CPUE for Japanese longline fishery in the Atlantic up to 2021 fishing year: revision and porting to R	Tsukahara Y., Fukuda H., Nakatsuka S.
SCRS/2022/154	BR CMP as at end August 2022	Butterworth D., Rademeyer R.A.
SCRS/2022/156	Update to the F01 based Candidate Management Procedure and final performance tuning results	Duprey N.M.T., Hanke A.R.
SCRS/2022/160	Multinational pelagic longline index of bluefin tuna relative abundance in the Gulf of Mexico	Lauretta M., Ramirez K.
SCRS/P/2022/052	Updated CMP results	Carruthers T.

Appendix 4

SCRS document abstracts as provided by the authors

SCRS/2022/141 – Relative abundance indices of bluefin tuna (*Thunnus thynnus*) caught by the Moroccan and Portuguese traps in the Atlantic area close to the Strait of Gibraltar were estimated for the period 2008-2021. Data from four Moroccan and one Portuguese tuna traps were compiled and used in the analysis. The trend of the nominal CPUE series shows a relatively low and flat period until 2013, followed by a steep increase, and a fluctuation in the more recent years. It is noted, however, that those trends are different between Portugal and Morocco, with the CPUEs in Moroccan traps increasing much more in recent years while in Portugal there has been some decreases. Standardized CPUEs were estimated with Generalized Linear Models (GLMs) with Negative Binomial distribution, and using the factors year, month and trapID/location. Due to possible changes in the fishery operation patterns since the year when the quotas started to be reached, two separate periods are analyzed and presented as: 1) a single time series period (2008-2021) and 2) split in 2 periods (2008-2011 and 2012-2021). The nominal combined CPUE shows a clear increase since 2013 with a higher dispersal in the past 2 years. The standardized split series are more similar to the nominal data, while the single series for all years diverges more compared to the nominal. Both standardized series, in general, show a fluctuation around a stable trend.

SCRS/2022/145 – Updates of the SWNS and sGSL indicators of relative Bluefin tuna abundance are provided. These updates follow the new data treatments implemented in 2020 (Hanke 2021).

SCRS/2022/152 – Catch-per-unit-effort based abundance indices of bluefin tuna from the Japanese longline fishery in the West and Northeast Atlantic were provided up to 2021 fishing year in 2022 intersessional BFT WG, April. The authors had applied the alternative software, i.e., R, into standardization, instead of SAS. While the West Atlantic indices standardized by each software showed similar trajectory except for value in 2020 fishing year, those in Northeast Atlantic had clear discrepancy each other. The authors reviewed the model and method to seek the cause of those discrepancies and found that there was an inconsistency in a method of data curation from the logbook between those in 2019 and thereafter. This paper describes the revision of input data for the updated indices and an alternative approach for standardization with "lme4" package in R, which enables to mimic the nested model structure used the previous SAS model. As a result of the revision in input data, the updated values for West Atlantic was almost identical to that in index used in the 2020 assessment. Additionally, the new standardization approach using "lme4" in R enables to create similar index to that standardized by SAS in Northeast Atlantic.

SCRS/2022/154 –The BR CMP is tuned to meet the specifications arising from the July Panel 2 meeting. Of particular note is that the application of the Carruthers TAC variation reduction adjustment reduces the median values for the associated VarC performance statistic by about 25%, with scarcely any deterioration in the values of the other performance statistics.

SCRS/2022/156 – An updated description of the $F_{0.1}$ management procedure is provided. The performance tuned results indicate that a phase-in period where TAC is consistent with current levels can be implemented with little effect on performance. Tuning to a PGK value of 0.7 rather than 0.6 resulted in a loss of yield regardless of the length of the management cycle (2 versus 3 year). However, when comparing performance for 2 versus 3 year cycles with the same PGK target, it was observed that a 3 year cycle introduces more variability in yield. Implementing a strong "phase-in" approach on TAC changes (in the form of a log space modifier) effectively reduced the TAC variability with minor reductions in yield or safety.

SCRS/2022/160 – This document summarizes the update of the MEXUS LL index for bluefin tuna in the Gulf of Mexico for the period 1994 to 2021. We conducted a strict update of the standardization model with the addition of data from 2020 and 2021.

SCRS/P/2022/052 – The MSE Consultant updated CMP results before the second BFT MSE meeting. The updated results found that the CMPs perform much more similarly than previous rounds. Tuning 60% vs 70% does not affect the performance pattern among CMPs. Moving from 2 to 3 year update interval only somewhat affects lower tail biomass outcomes but does increase variability in catch among updates. In the East Area, the CMP types appear to define a relatively tight trade-off between catches (Br30) and yields (AvC30).

Appendix 5

Rules of index provision for CMPs and for annual indicators

Categories of indices

1. **Management Procedure (MP) index update** adds additional years of data but with unchanged historical data. Model parameters remain fixed except for the additional year factors. This locks in the model parameters, model factors, factor levels and structural assumptions of previous indices – specifically those used to condition the Operating Models used for the testing used that led to the adoption of that MP.

   This will involve modification of the statistical code for most CPUE standardization packages. For consideration as MPs, index specifications for *MP Updates* need to be clearly identified similar to the degree of detail that is provided for the CCSBT MP (https://www.ccsbt.org/sites/ccsbt.org/files/userfiles/file/docs_english/general/MP_Specifications.pdf) and both mathematical specification of the standardization and computing code should be provided in a technical document**.** MP update indices would only need to be provided on the MP cycle, e.g. every 2 or 3 years. *Such indices should be plotted to ensure that they are identical to indices used in conditioning over the comparable period.*

2. **Strict update (traditionally)** of indices entails use of the same data, but updated years, model parameters are re-estimated, but model factors, factor levels and structural assumptions must remain the same. The historical time series should be similar to previous indices*. This method was allowed for calculation for the first MP application as updates were very similar to historical time series, however method 1 will be required for future MP applications.*

3. **Index revision** could involve changes to data, model structure, error assumptions or factors for the same index. Index revisions constitute new indices and though they can be reviewed by the Group at any time, they will only be in included in a population model during an assessment following review and acceptance. It is recommended that all authors conduct **strict updates** to compare with **revisions** until the new revision is accepted by the group for use in assessment. *Index revisions will not be used in MPs. They may only be used, once accepted, in the reconditioning of the OMs for the MSE when this is reviewed after the specified period of a few years.*

Usage of indices

Either MP updates, strict index updates or **index revisions** can be used for updating the indicators that is reported annually in the Executive Summary. They should be provided annually and in time for submission to the Species Group. The Species Group requires that SCRS documents are provided for **index revisions** but are not necessary for **strict updates**. In Executive Summary figures, the indices will be denoted according to whether they are MP updates, strict updates or revisions but priority is given to including only **MP updates** or **strict updates** in the Executive Summary figures. Any index that is included in an MP should have an **MP index update** conducted annually regardless of whether other forms of updates are being provided (**strict update** or **index revision**), this will allow the indices to be assessed for exceptional circumstances as part of the MSE process.

Recommendations

ICCAT SCRS Working Group on Stock Assessment Methods reviews code for developing MP index updates as this issue is general across all MSE applications, though individual bluefin tuna index providers will likely need to develop and implement the code revision themselves. It may require external expert assistance to modify code and to evaluate how to handle random effects, interactions and other features of the existing standardization programs.

Index retrospective diagnostic

This is a new index diagnostic that should be conducted for every index, particularly for indices considered for management procedures. This is to conduct a -N (usually 5-10 years) retrospective peel on the index and calculate Mohn's rho on the retrospective pattern. Indices with high retrospective variability may be problematic for management procedures or may warrant consideration under Exceptional Circumstances if they may change substantially at each update as model parameter estimates change.

Appendix 6

Specifications for MSE Trials for Bluefin Tuna in the North Atlantic
Version 22-2: 9 September 2022

Specifications for the MSE trials are contained in a living document that is under constant modification. The most recent version of the document (Version 22-2: 9 September 2022) can be found here.