REPORT OF THE TROPICAL TUNAS MSE TECHNICAL GROUP MEETING
(*Online 29-31 March 2021*)

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

The online meeting of the Tropical Tuna MSE Technical Group was held the 29-31 March 2021. On behalf of the ICCAT Executive Secretary, the Assistant Executive Secretary welcomed the participants to the meeting. David Die (United States), the Coordinator for Tropical Tunas opened the meeting and served as Chair. He provided some opening remarks TT Technical MSE Sub-group ("the Group"), noting that the Group had received a clear mandate to make process on the tropical tuna MSE, albeit at a slower pace than other MSE initiatives.

The agenda for the meeting was approved with minor changes (**Appendix 1**). The List of Participants is included in **Appendix 2**, the list of documents in **Appendix 3** and the summary of the meeting abstracts in **Appendix 4**.

The following served as rapporteurs:

Section	*Rapporteur*
Item 1.	N.G. Taylor
Item 2.	B. Mourato, G. Merino
Item 3.	G. Merino, A. Urtizberea
Item 4.	G. Scott
Item 5.	D. Die, H. Murua, G. Galland
Item 6.	N.G. Taylor
Item 7.	N.G. Taylor

2. State of development of MSE Operating Models

2.1 Western Skipjack Tunas

The Group reviewed the preliminary results on western SKJ MSE, which were presented in Huynh *et al.*, 2020 in the Tropical Tuna Species Group meeting in 2020. The preliminary MSE exercise considered the Southwestern Atlantic portion as a single stock using catches from the Brazilian baitboat and handline fleets. The model was built in the MSEtool R package using a stochastic Stock Reduction Analysis, SRA, (Walters *et al*., 2006) approach for conditioning the Operating Models (OMs). In summary, a total of six OMs were explored, considering uncertainty in natural mortality, growth, maturity, selectivity, and steepness. A suite of example management procedures (MPs), including fixed TACs, index-slope MPs, and harvest control rules (HCRs), was tested in closed-loop simulation.

The Group expressed concern regarding the assumption of a separate southwestern Atlantic stock, since the current stock structure hypothesis for SKJ consider two stocks (western and eastern). The Group discussed the available data that could be used to suggest a separate stock for the southwestern Atlantic potentially. In fact, northwest fleets' participation (i.e., Venezuelan purse-seine and US longline) in the western skipjack landings is much lower than that of the Brazilian baitboat fishery, which has been representing more than 90% of landings for the western stock throughout the last decade. The Group emphasized that recent AOTTP results may improve the understanding of skipjack stock structure and movement patterns in the western Atlantic. Also, the Group agreed that this issue must be discussed in the future, before the next assessment of skipjack, especially in light of new biological information available.
For the next steps for the western skipjack MSE, the Group agreed to continue the work that has been already done and to revise the existing OMs to consider the current hypothesis of stock structure that should include data from all western fisheries, such as the Venezuelan and the US, in conformity with the stock structure used in the last western skipjack stock assessment. As naturally derived from the discussion about the possible segregation of the western skipjack stock into two stocks (northwest and southwest), the Group agreed that this possibility could be a new hypothesis for stock structure to be explored in the future by the Tropical Tuna Working Group.

Questions about the possibility of including economic variables and climate changes in the W-SKJ MSE were raised from the comparison between methods delineated from both MSE analysis presented during the first day of the meeting. The Group, however, expressed concerns about the feasibility of including economic variables, due to the present lack of such data.

2.2 Multistock Tropical Tunas

The term Multi-stock Tropical Tunas corresponds to the MSE that includes the stocks of yellowfin, bigeye and eastern skipjack tuna.

Progress on the multi-species MSE for tropical tunas was presented. The presentation was divided in two parts. The first included the general characteristics of FLBEIA, the tool that will be used for this MSE. FLBEIA is an R package (Garcia *et al*., 2017), https://github.com/flr/FLBEIA) that contains an algorithm that facilitates the development of a bio-economic model under an MSE framework to evaluate management strategies. The package has been applied in many case studies and resources are available online to facilitate the compression of the model as well as the development of case studies. In the second part of the presentation, the process of the MSE of tropical tunas that was started in 2018 was explained.

The Group noted that FLBEIA features an economic component, but the initial plan is not to include economic variables in this MSE. It was also noted that FLBEIA can be configured to evaluate the impact of effort limits.

The Group asked about how selectivity dynamics can be modelled with FLBEIA and it was clarified that selectivity is defined for each fleet, metier and age. The selectivity can be defined *a priori*, or it can be forced using covariates.

Another important question was related to the common definition of fisheries in the stock assessments of the three tropical tuna stocks. There was concern on the purse seine fishery operating on free schools of yellowfin and skipjack and the Group discussed the fisheries that would need to be defined for the MSE to accommodate all fisheries. It was clarified that in recent times there is seldom skipjack catch from the purse seine fleet operating on free schools. However, it was noted that the fleet structure that will be defined in the next skipjack stock assessment (probably in 2022) will consider the fleets defined in the bigeye (2021) and yellowfin (2019) assessments (Anon. 2019a).

The Group requested further clarifications on the FCube approach of the FLBEIA model. It was clarified that it is a function that estimates the effort that corresponds to the extraction of the total allowable catch (TAC) share of each stock caught be the fleet. FCube has not been applied to tropical tunas. FCube is described in (Ulrich *et al.,* 2011).

The Group discussed the inclusion of the growing Brazilian handline fishery for bigeye and yellowfin in the MSE. In this regard the group noted that in the recent bigeye and yellowfin assessments this fishery was grouped in different categories (*Others* for the yellowfin assessment and *North baitboat* for the bigeye assessment). The size composition of the Brazilian handline fishery was used to assign those catches to fleets in the assessment model. It is important to ensure that the fleet's definitions are consistent in the two assessments.

It was clarified that FLBEIA does not include trophic interactions.

2.3 Discussion on the two approaches (Multistock and West)

In order to facilitate communication of MSE results to the Commission, it is important to be coherent on the assumptions and simulations that can be run for both the western and multistock MSEs. The definition of fisheries should also be consistent in the two MSEs. It was noted that the communication between the scientists developing both MSEs is important to have a consistent approach and to simulate similar scenarios.

It was also noted that the development of an age-structured population model such us Stock Synthesis is very challenging for skipjack due in part to the difficulties on defining biological characteristics such us

growth. In this regard, it was noted that the recently developed JABBA-Select model (Winker *et al.,* 2020) or alternative stock synthesis configurations could be valid options to explore.

3. Major axes of uncertainty for operating models

The MSE for the Atlantic tropical tuna stocks started in 2018 by developing a proposal on how to conduct this MSE in a series of phases. Forrestal *et al.,* 2021 aims at starting the second phase of the tropical tuna MSE by reviewing the main sources of uncertainty in the dynamics of tropical tuna fish and fisheries, including the uncertainty in the biological parameters of fish stocks, fishery exploitation patterns and information content of the data used in stock assessments. In this document, the axes of uncertainty considered in the recent stock assessments of tropical tunas in ICCAT and other tuna RFMOs are reviewed. The Group discussed the differences between stock assessments' structural uncertainty grids and the axes of uncertainty used to condition Operating Models (OM). In this regard, it was noted that the uncertainty on OM is generally wider than in the stock assessments and that it can sometimes include interactions between factors that are not plausible. In order to reduce the number of models and consider mainly the uncertainty that matters, different methodologies can be applied such as: factorial fraction method or to evaluate the prediction skill of the OMs using hindcasting of the historical data (Kell *et al.,* 2016) .

The Group also discussed that options different from tropical tunas should be explored in the review of MSE processes. For example, the MSEs for North Atlantic albacore, Atlantic bluefin, Pacific Northern albacore, Southern bluefin, Atlantic swordfish, Indian Ocean albacore and swordfish should be included in the review.

The Group agreed to examine diagnostics from stock assessment models in order to define/improve the uncertainty factors that were most important for the MSE.

The Group discussed options that should be included in the tropical tuna MSE, which included an agreed-to set of axes for biological parameters (Steepness, sigmaR, natural mortality, growth, selection of the largest fish of the population (longline), maturity) and additional options for data.

With regards to the CPUE data generated by the operating model, the Group agreed to add autocorrelation and lognormal random errors which reflects the properties of available indices of abundance. The Group also discussed the possibility of generating error in the species assignments of the purse seine catch.

Different possibilities for the projection of the selectivity were discussed: time varying selectivity or not. However, this can have implications on the CPUE, where the index is an indicator of the exploitable biomass. If the selectivity can change, the index would not be an indicator of the same part of the population. In addition, the Group noted that time-varying selectivity in future scenarios will result in different benchmarks, including MSY, that would have to accounted for in the projection period and in calculating the performance statistics.

The options for implementation error were also considered based on other tropical tuna species' MSE. However, in these cases there is already an estimate of the implementation error that can be evaluated in the uncertainty grid. In the case of the Atlantic tropical tuna stocks, there is not an OM with implementation error, so it would be only considered in the projection. This would not be a problem if it is included as a robustness test.

4. Performance Metrics

Performance metrics (*aka* performance statistics) are quantitative expressions of management objectives. They compare the value of an indicator or variable (e.g., biomass, depletion) at a given point in time (or over a period, *e.g.,* average catch over the next 20 years) to the stated objective for this indicator, so as to evaluate how well the objective is expected to be achieved under the Harvest Strategy/Management Procedure being evaluated (Miller *et al.,* 2019).

As noted, performance metrics should reflect the objectives of management. The overriding management objective in the ICCAT Convention text is provided in Article VIII, para.1: "to maintain the populations of tuna and tuna-like fishes that may be taken in the Convention area at levels which will permit the maximum

sustainable catch."(BasicTexts.pdf). There are numerous additional management objectives that are also considered, reflecting social, economic, biological, ecosystem, and political (or other) goals for a given stock or group of stocks. These typically conflict and imply trade-offs to evaluate, which include concepts such as maximizing catches over time, minimizing the chance of unintended stock depletion, and enhancing industry stability through low inter-annual variability in catches (MSEGlossary). Within ICCAT, a decision framework for implementing management measures has been agreed [Rec. 11-13], taking into account the overriding management objective, and designed to rebuild and/or maintain stocks within the Kobe 'green' zone, with high probability and in as short a time as possible, taking into account the biology of the stock and SCRS advice. ICCAT has conducted several science-management dialogues to address which management objectives are most desirable regarding stock management, which can be stock/fishery/flag specific. In general, these management objectives can be classified as ones which address Sustainability (high probability of maintaining stock in the Kobe green zone), Safety (high probability of the stock remaining above a biomass limit), Yield (maximize catch across regions and gears), Abundance (high catch rates to enhance fishery profitability), Stability (stability in catches to reduce commercial uncertainty), and others, including but not limited to Ecosystem Considerations, maximizing Profit, maximizing Employment, *etc*. (see, *e.g.* Anon. 2015). Similar outcomes related to management objectives (and hence performance metrics used in MSE of candidate Harvest Strategies designed to achieve objectives), have resulted from other tRFMO dialogues (IOTC, and IATTC, ISC NPALB MSE Workshops, WCPFC Harvest Strategies).

In general, there is a large range of performance metrics that may be used to address various types of management objectives (see **Table 1**). In the Atlantic tropical tuna MSE studies under development, a few performance metrics have been identified by the authors involved and supplemented by members of the Group (**Table 2**), although others will have to be designed to quantify objectives as they are more fully identified using feedback from managers and stakeholders. The Group identified addition performance statistics that might be relevant in **Table 3**. It is notable that the ICCAT SWGSM process has remained dormant over the past several years, which seems to limit opportunity for seeking feedback if limited to Commission Meetings and Panel 1 discussions for tropical tunas. To address this issue, ICCAT should consider formalizing the feedback process, similar in structure used by the IOTC which established TCMP as a subsidiary body to the Commission.

Selected performance metrics listed in **Table 1** were presented to Anon. 2016a and subsequently applied on Northern Atlantic Albacore. They are expected to be starting points for the tropical tunas. The Group noted that new performance metrics may need to be included subsequently to capture the multi-species nature of the fishery.

The Group expect the final set of PMs to be considered for selecting MPs to be modified following dialogue with the Commission.

5. Update of Roadmap

5.1 Process

In 2015, ICCAT directed the SCRS to develop Harvest Control Rules and implement MSE for several stocks, including tropical tunas (Rec. [15-07]). Progress on MSE for tropical tunas, however, has been conditioned by the challenges faced by the status of tropical tuna stocks and the Commission resolutions (Res. [15-12], Rec. [16-01], Rec. [19-02], Rec. [20-01]), and by the limited capacity of the SCRS to progress on MSE at the same time for all ICCAT stocks mentioned in Rec. [15-07]. The Commission has requested ([Rec. 19-02], paragraph 62) the SCRS to modify the MSE roadmap for tropical tuna MSE to help cope with these challenges.

The SCRS and the Commission agreed that the MSE for tropical tunas would have two components, the western SKJ MSE and the multi-stock tropical tuna MSE (YFT, BET and eastern SKJ). It was also agreed that progress on the two MSE components could be somewhat independent although, mindful of issues of timing regarding assessments. The SCRS has made some progress on both MSE components. Both components rely on operating models conditioned on stock assessment results for each stock and Commission decisions about agreed management objectives and performance indicators.

In its most recent advice (Anon., 2020) the SCRS already identified some of the challenges for the development of this roadmap:

- "Revision to the calendar of stock assessments for tropical tuna, which include postponing the Atlantic skipjack assessment until 2022 and conducting a bigeye assessment in 2021, as requested by the Commission.
- The limited technical capacity within the Committee to engage in MSE development during the year when assessments are conducted.
- The relative lower priority placed by the Commission on progress on the tropical tuna MSE.
- The ongoing challenges of working during the COVID-19 pandemic."

This same advice also provided a list of MSE related activities for 2021 by Group shaping the agenda of the current meeting and the roadmap (Anon., 2020).

Satisfactory project on the western SKJ MSE (see section 2.1 of this report) suggests that it should be possible for the western SKJ development team to re-condition the SKJ operating model in 2022, after the western stock of SKJ has been re-assessed. This would allow faster progress and an early delivery of simulation results to the Commission on the western SKJ MSE than the Multi-stock tropical tuna MSE. The Group agreed that this faster process for the simpler MSE would help the dialog on Tropical tuna MSE between the Commission and the SCRS, thus benefitting the acceptance and support of the more complex Multi-stock tropical tuna MSE.

The most recent SKJ assessments conducted in 2014 did not provide acceptable status determination for the eastern stock, the MSE development team for the multi-stock MSE has always recommended waiting until a new SKJ assessment, to condition the SKJ operating model. The Group noted that it is yet not clear what type of assessment model the SCRS will successfully use to assess the eastern stock of SKJ. The two most likely candidate will be an SS3 model to be consistent with the SS3 models developed for the YFT and BET or a JABBA-SELECT model (Winker *et al.* 2020). It was noted that a fully age-structured SS3 model similar to the BET and YFT models may be challenging for the Eastern SKJ, however, the SS3 platform can be run analogous to an age-structured production model as it has been done for some of the ICCAT billfish stocks (Anon., 2019a and 2019b).

The Group discussed whether the delay in the SKJ would delay again progress on the multi-stock tropical tuna MSE. Assuming a successful determination of SKJ east stock status, the operating model for the eastern stock of SKJ should be conditioned after the 2022 SKJ assessment.

By next year, the most recent assessment for YFT would be from 2019 (using data up until 2018). Moreover, the SCRS's capacity to work on MSE development during 2021 and 2022 will be limited, as the SCRS focuses its efforts on the stock assessments of BET and SKJ. The Group decided it would be better to recommend an assessment of YFT in 2023. Such proposal would provide a best-case scenario for the conditioning of the operating model for all three stocks in the multi-stock tropical tuna MSE (with stock assessments of BET in 2021, SKJ in 2022 and YFT in 2023). The Group agreed the earliest delivery of the multi-stock MSE, with candidate management procedures, to the Commission would be at the November 2024 meeting of the Commission.

The roadmap was therefore modified on the basis of the above recommendations regarding stock assessment schedules, considering also the need to continue the involvement of the Commission in the process of establishing management objectives, performance indicators, harvest control rules and management procedures (**Table 4**). The Group also proposes a technical review of the western SKJ MSE and the overall tropical tuna MSE process in 2022, to help ensure a smooth implementation of the roadmap. This proposed roadmap will need to be approved by the SCRS in Oct 2021 and the Commission in November 2021. More detail on more specific activities, will be added by the Group once the general schedule of the roadmap is approved.

ICCAT will have to provide a sufficient budget to support all activities of the roadmap. Such support should be clearly reflected in the 2022-2024 ICCAT Commission budget. The recent success of online meetings, however, gives some hope that certain activities of the roadmap may not require in person meetings, thus somewhat reducing costs. Additional cost savings could be accomplished by starting the data preparatory meetings of tropical tuna assessments in 2022 and 2023 two days early and dedicating those days to make progress on MSE.

The Group discussed the best way to conduct interactions on MSE with the ICCAT Commission. It was pointed out that such discussions have been challenging at meetings of the full Commission, panel one and SWGSM. The Group proposed to ask the Commission for specialized/focused Panel one meetings to help progress the tropical tuna MSEs. For example, a meeting of a subset of Panel 1 CPCs interested in discussing the western SKJ MSE.

The Group also notes that this roadmap will not be successfully implemented unless the ICCAT Commission supports a comprehensive capacity building strategy for MSE for all ICCAT stocks but in particular for tropical tuna (see section 5.3 below).

5.2 MSE Communication

The Group was informed about various technical documents describing harmonized graphics and best practices for communication MSE results such as the Joint tRFMO MSE Tech Group Report (2018) and Miller *et al*. (2019).

The Group noted that it would be important that, like the Kobe process that agreed on the Kobe plot to communicate stock status, a set of harmonized figures/graphics are agreed in ICCAT and/or at the tuna RFMOs level. Such figures are under development now in an initiative led by the Ocean Foundation. In addition, the Group was informed that the IOTC Scientific Committee agreed on a harmonized set of figures to present MSE results across species to the IOTC Technical Committee on Management Procedures, which is the science and manager dialogue formal subcommittee for that Commission that is somewhat equivalent to the SWGSM (Standing Working Group to enhance dialogue between fisheries Scientists and Managers).

The Group requested that tropical tuna developers consider using IOTC agreed figures to communicate MSE results along with other possible material coming from Albacore and/or bluefin tuna ICCAT MSEs until more guidance on the figures to be presented is given by SCRS and/or Commission. The Group also recommended that, for tropical tunas, harmonized figures of MSE results are presented to the next Working Group on Stock Assessment Methods.

The Group also considered that it is important to re-invigorate or replace the ICCAT science-managers dialogue process previously carried out by SWGSM so as tropical tuna species MSE can be presented and discussed. The Group considered that it would be necessary to previously agree at WGSAM/SCRS the harmonized set of figures for MSE results presentation. The recommendation section of the Species Working Group will need to capture this sentiment for the recommendation.

5.3 Capacity Building

The Group recognized that capacity building for MSE should be an SCRS priority, particularly given the number of simultaneous activities ongoing in this field. Concerns were expressed regarding the level of participation by CPCs at this meeting. The number of participants was high, but the number of CPCs represented was quite low, and this does not reflect the importance that the Commission places on development of MSE for the tropical tunas. There was recognition, however, that the lack of interpretation (simultaneous translation) at SCRS meetings continues to be a problem for many CPCs compounded by the online nature of this and similar meetings. While avoiding travel may allow for greater participation, the lack of face-to-face communication can be particularly difficult for those working in their second or third language.

Regarding an effort to develop more capacity for MSE participation, the Group agreed that the focus should be on scientists in addition to managers.

The Group agreed that there was a broad need to develop capacity on MSE at the Commission and its subsidiary bodies. Specifically, this capacity building needed to be tailored differently in term of process and delivery of content to scientists and managers. Scientists' appointments at universities and science agencies offers them generally more stability than colleagues appointed to management agencies, where turnover can be high. Particular attention has to be paid to getting the engagement of key managers and commissioners in this capacity building. There was also agreement that these efforts should be carried out in the most relevant ICCAT language, not only English, particularly when the topic is so technical. As such,

Brazilian scientists announced their successful effort to apply for a JCAP grant to offer an MSE capacity building workshop to Spanish- and Portuguese-speaking CPCs. Many organizations in the fisheries community have discussed developing capacity building for MSE using e-learning. The Group agreed that this is a worthwhile initiative.

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Table 1. Performance indicators from Annex 2 in Anon. 2016a and Anon. 2016b with changes agreed by Panel 2.

Performance measured and associated statistics	Unit of measurement	Type of measurement
Status		
1.1 Minimum spawner biomass relative to B_{MSY}[1]	B/B_{MSY}	Minimum over [x] years
1.2 Mean spawner biomass relative to B_{MSY}	B/B_{MSY}	Geometric mean over [x] years
1.3 Mean fishing mortality relative to F_{MSY}	F/F_{MSY}	Geometric mean over [x] years
1.4 Probability of being in the Kobe green quadrant	B, F	Proportion of years that $B \geq B_{MSY}$ & $F \leq FMSY$
1.5 Probability of being in the Kobe red quadrant[2]	B, F	Proportion of years that $B \leq BMSY$ & $F \geq_{MSY}$
2 Safety		
2.1 Probability that spawner biomass is above B_{lim} ($0.4B_{MSY}$)[3]	B/B_{MSY}	Proportion of years that $B > B_{lim}$
2.2 Probability of $B_{lim} < B < B_{thresh}$	B/B_{MSY}	Proportion of years that $B_{lim} < B < B_{thresh}$
3 Yield		
3.1 Mean catch – short term	Catch	Mean over 1-3 years
3.2 Mean catch – medium term	Catch	Mean over 5-10 years
3.3 Mean catch – long term	Catch	Mean in 15 and 30 years
4 Stability		
4.1 Mean absolute proportional change in catch	Catch (C)	Mean over [x] years of |(Cn-Cn-1/ Cn-1|
4.2 Variance in catch	Catch (C)	Variance over [x] years
4.3 Probability of shutdown	TAC	Proportion of years that TAC=0
4.4 Probability of TAC change over a certain level[4]	TAC	Proportion of management cycles when the ratio of change[5] (TACn-TACn-1)/TACn-1>X%
4.5 Maximum amount of TAC change between management periods	TAC	Maximum ratio of change[6]

1 This indicator provides an indication of the expected CPUE of adult fish because CPUE is assumed to track biomass.
2 This indicator is only useful to distinguish the performance of strategies which fulfil the objective represented by 1.4.
3 This differs slightly from being equal to 1- Probability of a shutdown (4.3), because of the choice of having a management cycle of 3 years. In the next management cycle after B has been determined to be less than B_{lim} the TAC is fixed during three years to the level corresponding to F*lim*, and the catch will stay at such minimum level for three years. The biomass, however, may react quickly to the lowering of F and increase rapidly so that one or more of the three years of the cycle will have B>B*lim*.
4 Useful in the absence of TAC-related constraints in the harvest control rule.
5 Positive and negative changes to be reported separately.
6 Positive and negative changes to be reported separately.

Table 2. Preliminary performance metrics under consideration for Western skipjack and multi-species tropical tuna MSEs under consideration.

40% B_0	Probability that the biomass is greater than 40%B_0
STC30	Probability that catch >30 kt (years 1-10)
LTC30	Probability that catch >30kt (years 11-20)
AAVC (annual variability in catch)	Probability that AAVC<20% (years 1-4)
STC=x	Additional STC metrics relative to x=20, 25,..40 kt

Table 3. Additional performance metrics identified by the Tropical Tunas MSE Technical Group.

Yield	probability that CPUE of fisheries targeting skipjack is lower than in 202X
Maintain SSB>SSB_{MSY}	for the less productive stock and, hence, the rest will be above MSY levels as well
Status/Productivity	probability that SSB for all three stocks is greater than $SSB_{MSY199X}$
Productivity	probability that yield at MSY is greater than MSY_{199X}
Safety	probability that B for any of the three stocks drops below the limit reference point
Yield per recruit	
Foregone yield associated with gear type	
Improvement in status of limiting or "bottleneck" stock in terms of multispecies analysis	

Table 4 - Roadmap for the tropical tuna MSEs (Western stock of SKJ and Multi-Stock). Columns corresponding to each stock include activities related to stock assessments and operating models. Multi-stock column includes activities related to the Multi-stock MSE and common activities related to both tropical tuna MSEs.

		BET	YFT	E-SKJ	W-SKJ	Multi-stock
2020		Preliminary conditioned operating model	Preliminary conditioned operating model		Preliminary conditioned operating model	Simulation framework developed and agreed
2021	**Jan-Mar**	Prepare BET assessment				Discussions on uncertainty axis, update roadmap
	Apr-July	BET Stock assessment				
	July-Sept	Recondition Operating Models with assessment results			Update Simulations to include data for whole W-SKJ stock	
	Oct-Dec					Obtain feedback from the Commission on performance indicators and objectives for all tropical tunas, get updated roadmap approved including proposal of resources required to implement it
2022	**Jan-Mar**			Prepare SKJ assessment	Meeting with Panel 1 to agree on types of management procedures to be tested, definition of objectives and performance indicators	
	Apr-June			SKJ assessment		
	July-Sept			Recondition Operating Models with assessment results		Independent review of tropical tuna MSE process and technical review of Western SKJ MSE

	Oct-Dec		Present Commission with Fully specified W SKJ MSE simulations including conditioned operating model and candidate management procedures develop by SCRS
2023	**Jan-Mar**	Prepare YFT assessment	Develop alternative proposals for types of harvest strategies for all stocks
	Apr-June	YFT Stock assessment	Meeting with panel 1 to agree on types of harvest strategies to be tested, definition of objectives and performance indicators
	July-Sept	Recondition Operating Models with assessment results	Development of final set of candidate harvest strategies
	Oct-Dec		Report to Commission on final evaluation of harvest strategies for WSKJ
2024	**Jan-Mar**		Update set of harvest strategies to be tested for multi-stock MSE
	Apr-June		Final simulations evaluating candidate harvest strategies for Multi-stock MSE
	July-Sept		
	Oct-Dec		Final delivery of multi-stock MSE, including fully conditioned operating models and candidate management procedures to Commission

Appendix 1

Agenda

1. Opening, adoption of Agenda and meeting arrangements
2. State of development of MSE operating models
    2.1. Western SKJ
    2.2. East
        2.2.1. Stock specific YFT, BET, SKJ
        2.2.2. Multi-stock
3. Major axis of uncertainty for operating models
4. Performance metrics
5. Update of roadmap
    5.1. Process (including single-stock vs. multi-stock)
    5.2. Communication
    5.3. Capacity building
6. Other matters
7. Adoption of the report and closure

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Appendix 3

List of Papers and Presentations

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SCRS/2021/016	Characterization of Structural Uncertainty in Tropical Tuna Stock Dynamics	Merino, G., Die, D., Urtizberea, A., Laborda, A.

Appendix 4

SCRS Documents and Presentation Abstracts Provided by the Authors

SCRS/2021/016 - The MSE for the Atlantic tropical tuna stocks started in 2018 by developing a proposal on how to conduct this MSE in a series of phases. The present document aims at starting the second phase of the tropical tuna MSE by reviewing the main sources of uncertainty in the dynamics of tropical tuna fish and fisheries, including the uncertainty in the biological parameters of fish stocks, fishery exploitation patterns and information content of the data used in stock assessments. We will summarize the axes of uncertainty considered in the recent stock assessments of tropical tunas in ICCAT and other tuna RFMOs. It is expected that this document will facilitate discussions in the next dedicated Tropical Tuna MSE Technical Group meeting.