

**REPORT OF THE 2020 ICCAT INTERSESSIONAL MEETING OF THE  
STOCK ASSESSMENT METHODS WORKING GROUP**  
(*Online, 7-8 May 2020*)

*"The results, conclusions and recommendations contained in this Report only reflect the view of the Working Group on Stock Assessment Methods. Therefore, these should be considered preliminary until the SCRS adopts them at its annual Plenary meeting and the Commission revise 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 and meeting arrangements**

Dr. Michael Schirripa (USA), the Working Group ("the Group") rapporteur and meeting Chair, opened the meeting highlighting the items outlined in the annotated agenda. In addition to reviewing the meeting's papers and presentations, one of the other priorities for the meeting is to discuss the processes that are currently undertaken for MSE. The SCRS chair addressed the group, noting the challenging circumstances under which the meeting is being held and his hope that the web-based meeting would allow the working group to move forward any priority items they have. On behalf of the Executive Secretary, the Deputy Executive Secretary welcomed the participants to the meeting. The Working Group agreed to adopt the agenda with some changes (**Appendix 1**).

The List of Participants is included in **Appendix 2**. The List of Documents and presentations 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, 5, 7	A. Kimoto and N.G. Taylor
Item 2	G. Diaz
Item 3	D. Rosa
Item 4	F. Forrestal
Item 6	A. Kimoto, N.G. Taylor, M. Ortiz

### **2. Harvest Control Rules, Limit Reference points and Management Strategy Evaluation**

The Group discussed the different venues that the SCRS and the Commission have used to communicate with each other with regards to the MSE process for different species. They include the 'Standing Working Group on Dialogue Between Fishery Scientists and Managers' (SWGSM), intersessional meetings of the Panels of the Commission, and the annual meetings of the Commission. In the case of the northern albacore (N-ALB) MSE, the dialogue with the Commission was essential to advance the MSE work as it helped focus the efforts of the SCRS by giving precise indication of the products the Commission wanted. For example, the SCRS developed an initial large number of HCRs, but the Commission requested that the work be focused on only 8 of them. In addition, the Commission helped in the process of choosing the different performance statistics and in the development of the exceptional circumstances clause. As the result of these meetings, the Commission is now more aware of how the MSE process works and the type of decisions it needs to make to help SCRS to advance it works. However, the Group also discussed that this has not been entirely the case with other of the MSE work the SCRS is trying to advance. A common denominator of the discussions was the fact that the meetings of the SWGSM were not informal enough to allow for a fluid discussion between managers and scientists. It was also discussed by the Group on ways to improve the dialogue with the Commission with regard to advancing the MSE work. While it was agreed that the SWGSM is probably the best venue to do so, there was an agreement that the meetings must have a more informal setting and that the Secretariat might be in a position to facilitate this to happen. But, because the SWGSM also discuss other issues besides MSEs, it was proposed that a smaller venue between managers and scientists that focuses solely on MSE might be helpful. In summary, the Group agreed that the SWGSM is currently the best available venue for the SCRS to communicate with managers and stakeholders. However, the efficiency of the meetings could be enhanced by creating a more informal environment, and have more focus MSE meetings and agendas for SWGSM as was done effectively at the 2016 SWGSM meeting for N-ALB.

There was a general agreement within the Group that MSE capacity building has been limited and that it has to include managers. Meetings that involve managers that are more knowledgeable on the MSE process can increase the efficiency of the meetings. The Group was informed that currently there are two global efforts one through ABNJ and the other through the University of Miami with the Ocean Foundation, to build global capacity on MSE. Given the current situation with COVID-19, it is expected that virtual workshops might be conducted in the near future which will allow for wider participation of those interested.

The Group discussed the need to standardize MSE outputs to present to the Commission. That way, managers can learn how to interpret a series of result presentations that are common to all species MSEs instead of having to learn how to interpret a wide range of MSEs results from different Species Groups. The use of, for example, R scripts to produce standardized figures and tables was presented as a potential way to advance this issue. However, the Group recognized that MSEs are being conducted using a variety of platforms and an R script might not work in all of them. It was made clear that the standardization is related to the way MSE results are presented to the Commission and not how the different Species Groups are conducting their technical work. The Group was informed that there is an external effort on ways and tools to standardize MSE outputs to inform managers. The Group also discussed the importance of making available the codes used to develop the MSEs to increase the transparency of the process and also to facilitate the error checking process. Unlike assessment tools like ASPIC and Stock Synthesis that are generalized frameworks and have already been fully vetted, MSE codes are very unique and require open source code for review. It was also suggested to have guidelines for common standards for MSE documentation, OM, MPs, grid specification and trial development, what is known commonly as the "live documentation" for each MSE process.

The Group discussed the next steps of the N-ALB MSE. The objective of the ALB WG at the upcoming assessment meeting is to rerun the mpb production model used at the 2016 Madeira stock assessment (this is the same production model that was used in the HCR in the MSE) and to apply the HCR to provide TAC advice. The Commission indicated a desire to adopt a long-term management procedure in 2020 (Rec. 17-04) and the aim of the ALB WG will be to provide the needed elements so a MP can be adopted. The N-ALB MP has 3 elements the management cycle length; a HCR; and, the specific model and data inputs to be used to calculate the reference points and current biomass needed in the HCR. Reference points and current biomass are determined with the mpb production model that includes several indices of abundance. The Group inquired what would be the impact on the MP if in the future one or more of the indices of abundance was no longer available. To assess that impact there is a need to run some simulations excluding some indices.

The issue of 'exceptional circumstances' was also discussed. Particularly, how severe exceptional circumstances, including environmental shifts, need to be to revoke the validity of the MPs. Currently, there is no guidance available on how to determine the severity of particular circumstances. The Group also discussed the concept of exceptional circumstances in the sense that they could have a positive or a negative effect on the stock. A discussion was also held regarding the optimum periodicity to conduct assessments and apply the N-ALB MP to set the TAC. Currently, the simulations are conducted considering a periodicity of 3 years, but simulations can be conducted to test what is the periodicity that provides best performance while reducing the frequency of conducting full stock assessment.

The Group discussed some of the differences among the different MSE works being advanced. In the case of N-ALB, a production model that includes 4 indices of abundance was used in the MSE. These 4 indices of abundance are considered to reflect local abundance in different areas and that overall, they represent total stock abundance. The N-ALB MSE is using a modeling approach while in the case of bluefin tuna (BFT), the MSE is using an index based empirical approach. Therefore, the BFT-WG assessed additional properties of the indices that the ALB-WG did not. It was discussed that it is important to be sure that the independent indices of abundance used in the BFT-MSE are continued into the future and that the Commission needs to be aware of this so sufficient support for these efforts are made available. The northern swordfish (N-SWO) MSE is considering the combined index that has been used in previous stock assessments. One advantage of this approach is that if one of the indices is discontinued, the combined index can continue to be estimated using the remaining indices. The Group agreed on the importance of building MPs that are robust to circumstance like losing an indicator and it emphasized the risks associated to building MP that are based on just one indicator.

The Group also reiterated the importance of prior recommendation (Anon. 2019) from this Group on the Independent Review panel (IPR) and reiterated its objective as a mechanism to ensure transparency, quality and consistency of standards among the different ICCAT MSE process currently in development. The Group recommends that other WG in the SCRS discuss this recommendation with a view for the plenary of the SCRS to decide whether such review is necessary.

### **3. CPUE standardization/incorporation of oceanographic and environmental changes into the assessment process**

#### ***3.1 Addition of swordfish distribution model to longline simulator study***

Document SCRS/2020/016 presented the development of a species distribution model (SDM) for swordfish, developed through habitat suitability indices and pop-up satellite tag data. This work was presented as the final deliverable for ICCAT Call for Tenders, ICCAT Circular #2907/2019. This SDM was used as input into the longline simulator (LLSIM) to obtain catch per unit effort datasets based on the US pelagic longline fishery. The swordfish catch and effort data were used to assess different methods of commonly used CPUE standardization methods.

The Group acknowledged the work undertaken for the development and inclusion in the LLSIM of the swordfish SDM. It was questioned if using all the data provided by the satellite tags when conditioning the SDM was not causing some noise in the model, it was added that although this might not have an impact on the CPUE standardizations it could be looked at the input level into the SDM.

It was noted that the Tweedie model performed worst in standardizing the swordfish CPUE data, as opposed to BUM for which this method had a good performance. The percentage of zero-catches was questioned, as Tweedie models were developed to deal with a high percentage of zeros. The authors clarified that the SWO data has only 14% zeros which might explain the worst performance of this model. The usefulness of the LLSIM to test for standardization techniques and testing for best practices when standardizing CPUEs was noted.

It was noted that using sea surface temperature (SST) when standardizing the CPUEs provided better fits to BUM than to SWO, given the biology of the two species, BUM spends more time at the surface, while swordfish has a different habitat use with a wider depth range, it was noted that other indicators could be used (e.g. oxygen). It was also noted that swordfish are found to be distributed along front systems. It was clarified that for the SDM model, temperature at depth and sea surface height gradients were used, while SST was used only for CPUE standardization as it is the most used parameter when standardizing CPUEs for assessments. One of the goals would be to obtain a habitat coefficient to be used in CPUE standardizations that can account for latitude, longitude and depth, therefore proving a coefficient for where the fish encounters the hook, taking into account the gear depth.

The expansion of these models to other species (e.g. YFT or bycatch species) and inclusion of other longline fisheries in the LLSIM were questioned. It was noted that expanding the development of SDMs is possible as long as the data and human resources are available to develop the affinity curves and model validation procedure. Regarding the inclusion of other LL fisheries, it was noted that as a first step the data that the authors could readily access was used, and as a second step the available non-confidential data information in ICCAT would be used in the simulator, however this data might not be detailed enough and the model would not be as realistic. It was suggested that efforts to develop a collaborative work where individual CPCs share detailed data could be conducted, as has been done for example with sea turtles in SC-ECO.

#### ***3.2 Incorporating environmental effects and species interactions in a bluefin tuna index standardization***

SCRS/P/2020/018 presented an overview of development of a fisheries independent index standardization for the Gulf of St. Lawrence bluefin tuna acoustic survey. The proposed index attempts to incorporate environmental (e.g. sea surface temperature, lunar phase) and a predator-prey interaction (bluefin tuna and herring) alongside typical covariates (vessel, time of year, etc.).

It was questioned if the decline in the acoustic index could be an artifact of vessel avoidance, and if the acoustic index is consistent with other available indices for herring in the same area. It was noted that this index is tracking the juvenile portion of the herring population while other data track the spawning stock, but the authors will look at other available indices from the same area to check if this decline has been observed too. The concern on whether the herring should be used in the standardization of the index has not been addressed, as the author considers that it is appropriate to use herring abundance to track the spatial-temporal abundance of bluefin tuna. The author did however note that the index may be influenced by prey availability and that this should be considered when we interpret the index.

### ***3.3 Technological and gear changes affecting the capture of billfish between 1973-2019***

Document SCRS/2020/064 presented the results of a literature review and in-person interviews to assess changes of gear and technology that have affected the catchability of billfish between 1973-2019, given the concerns that catchability might have been changing throughout the duration of the National Marine Fisheries Service Recreational Billfish Survey. The paper suggests using this qualitative report on gear and technology changes as guidelines for calculating catchability in future stock assessments. This work was made possible through a cooperative effort between the National Marine Fisheries Service and the Billfish Foundation.

The Group acknowledged the work done in obtaining this information, and noted these changes can be affecting the WHM and BUM recreational CPUEs, however the analysis so far is qualitative, and it is difficult to make it quantitative so that it can be incorporated in standardizations. It is difficult to quantify and take into consideration if a replacement in technology leads to a change in catchability, or if one equipment is just replacing another, also this information has not been recorded consistently and it will be difficult to start recording these changes. It was noted that in a previous study on BFT, skipper interviews suggested that the introduction of the sonar had a potentially important influence on catchability, but it was difficult to quantify. Additionally, when an equipment works better than a previous one, most boats will acquire that equipment making it difficult to disentangle between this factor and year effect for example. It was noted that less common solutions might have to be found to be able to incorporate these changes in the CPUE. It was considered that it is reasonable to assume that these changes in gear and technology are affecting catchability. It was suggested that periods where equipment were similar could be used to break up the index. It was also suggested that this could be done with the assessment model by letting the recreational CPUE have a time-varying catchability to account for these changes. It was noted that this work aiming to improve CPUE standardization also had the positive effect of involving and outreaching to the industry.

### ***3.4 AOTTP preliminary results***

SCRS/P/2020/015 presented data and preliminary results related to the ICCAT Atlantic Ocean Tropical tuna Tagging Programme (AOTTP) and their relevance for stock assessment. Ongoing work includes estimating growth, mortality, abundance and movement for yellowfin, bigeye and skipjack tuna, as well as little tunny.

The Group acknowledged all the work done under the AOTTP and collection of such important data. It was noted that the AOTTP Symposium was postponed but the Secretariat is working to have this Symposium in the future, even if the AOTTP will have officially ended. It is still expected that before the ending of the program, by November, there will be the opportunity to present the results to the SCRS.

The movements around South Africa, from the Atlantic Ocean into the Indian Ocean were noted, and it was questioned if there are known movements in the opposite direction. It was clarified that it is known that there are movements between the two oceans, however there is a genetics study indicating these are separate stocks, however this issue has not been resolved completely and it is expected to have more advances in this question with the availability of more tagging and genetics data and analysis.

It was asked if this program includes the provision of growth curves based on the tagging data for LTA. Although this analysis has not been contracted out, it will be conducted by AOTTP and preliminary results presented by September in the Species Groups meetings, it was noted that tagging data might not stand alone to provide growth curves, but will need to be combined with direct ageing. This could be combined with the Small Tuna group as they are working on LTA ageing too. It was noted that growth information in the Atlantic Ocean for YFT has been controversial, it was questioned if there are any expectations of

validation of growth for YFT or other tropical tuna species. Regarding YFT, the two main controversial points were the 1 vs 2 stanza growth pattern, and the maximum age obtained for YFT through counts of annual growth zones, which is in disagreement with age obtained from daily increment counts. So far, growth data from the AOTTP conventional tags are consistent with a 2 stanza growth pattern; and the validation work that was performed on fish at liberty 2 years or less indicate that annual growth zones observed in YFT and BET are indeed being deposited on an annual basis, while daily increments are unreliable for larger fish; this could be further confirmed when fish that have been at sea for 4/5 years have been recovered.

The results of satellite tagging from the equatorial areas were asked about, the author clarified that only Wildlife Computer tag results were shown in this presentation and that further tracks from the internal tags, which cover the equatorial zone, are being analyzed and will be available by September. It was also noted that there is a gap in tagging in the North West region, with less tags than expected having been deployed. AOTTP is hoping to conduct an analysis of biases for non-balanced tagging design to check if conclusions can be drawn for the whole Atlantic or only for specific areas. It was asked if the cost vs data quality of archival tags comparing to other tag types was analyzed, as these tags were applied in smaller fish and can provide multi-year data. The author noted that although a formal analysis was not performed, this would be very interesting, so far it has been successful in obtaining data for smaller fish, that could not be obtained with other tags however the overall recovery and data quality has not been accessed yet.

As the program is coming to an end, the author was questioned regarding perspectives on the commitment of scientists, technicians, fishers and other in continuing to collect and report tag data to ICCAT. It was noted that for large purse-seiners there is a lot of enthusiasm around this project and it is expected that reporting of tags will still occur. At a minimum, it is suggested that a person of contact is kept in the main ports to remind people about the recovery of tags and keep the posters up. Also, it would be important to keep the tag seeding activities going to allow for estimation of reporting rates into the future. Regarding capacity building activities that were conducted within AOTTP, it is expected that participants are now able to contribute even after the program has come to an end, as they were trained and the material and equipment made available to the laboratories.

The low recovery of tags from fish that are captured by longlines was noted as a concern, as fish grow it is expected they will be captured from LL instead of PS, and these recoveries are a missing component. Awareness activities aimed at longliners has been performed, however the recoveries from the LL fishery is still low.

The importance of keeping these international efforts in collecting important biological data was noted. The SCRS needs to keep showing the Commission the need to continue this type of research with the creation of multi-year research programs within the species groups. If research programs are integrated, it might be easier to have funders than if several individual projects are proposed. The routine collection of biological data was also discussed during the Process and Protocol meeting held early in 2020. It was also noted that it is important to ask for funding but also to direct the Commission to support the highest priorities regarding research activities. Additionally, individual CPCs should feel committed to the request of better scientific advice by keeping such research activities alive.

#### **4. Approaches to estimate the level of IUU catches for inclusion in stock assessments**

In direct response to Commission Recommendation 2019-05, a method to estimate IUU fishing of white marlin through the use of estimated catch multiplier within the stock assessment model framework was presented (SCRS/2020/065). Because the estimates of IUU landings are made within the assessment model itself the estimation is internally consistent with all other observational data used in the assessment model. As with any estimated parameters, great care must be given to how this parameter(s) is estimated and exactly which component of the observational data the estimate is responding to. The results of this work were used to produce management advice for the recent white marlin assessment.

The Group discussed comparing the presented method with other existing methods, including the Sea Around Us work on reconstructing unreported catches, and it was noted that the use of these independent methods could provide a useful comparison.

The Group discussed whether the catch multiplier work contained any time variant options to account for inconsistencies across time in reporting discards. The author noted that the CM was estimated for a single period from 1998-2017 as regulations around discards were not in force until 1998. Prior to 1998, it was assumed that minimal underreporting was occurring as all fish were retained and reported in the landings. The author noted that it would be possible to estimate a time-varying CM but that it would result in more estimates for the model, potentially confounding the results for other estimates, most importantly fishing mortality. Further, it could be detrimental to projections by masking low recruitment periods.

It was noted that trends and inconsistencies can result from several possibilities and caution is needed assigning a single cause to inconsistencies in the data, as discussed by the author in the presentation. It is also important to consider species or gear specific regulation when considering data inconsistencies, such as underreporting due size limits or retention regulations. The Group discussed the need to account for these underreported landings in stock assessments even though data is not recorded.

The Group discussed the need for methods for estimating underreported catch or discards, and it noted that this work was encouraged by the Stock Assessment Meeting on White Marlin as there are errors and inconsistencies that cannot be explained by the data.

It was noted that if reliable recruitment indices were available, the inconsistencies in the white marlin data could be explained more clearly by underreported landings. The current mismatch between decreasing landings and flat CPUE could be accounted for in the recent assessment model by either under reported catch or through negative recruitment deviations. It was discussed that if reliable recruitment indices were used, the landing and CPUE mismatch could indicate a less productive population or time-varying catchability. The benefit of using the CM is that is internally consistent within the model.

## **5. Other matters**

### ***5.1 Terms of Reference for quotation request on Swordfish Habitat Distribution Model***

Secretariat highlighted the need for new Terms of Reference (ToRs) to be made available, aiming further development of the longline simulator. The Chair briefly presented the draft ToRs, aiming to explain initial estimations of decadal changes in swordfish habitat and to significantly increase utility of the simulator in providing the means to investigate CPUE standardization and develop best practices for it. The Group agreed on some minor modifications to the proposed ToRs, that are include in **Appendix 5**.

### ***5.2 ICCAT website***

The Secretariat reported two updates of ICCAT website for the requests from the Group in 2019. A table of the stock assessment(s) used for the management recommendations by species with the year, the accepted stock assessment models and the version of the software for the latest assessment was included in the webpage for the Stock Assessments and Executive Summaries (<https://www.iccat.int/en/assess.html>). The list of software with its link was also added to the current webpage for the ICCAT software catalogue (<https://www.iccat.int/en/AssessCatalog.html>), while maintaining the GitHub site. The Group was also informed that R-package for JABBA is now available.

### ***5.3 Virtual meetings***

The Group also discussed the challenges created by the SCRS having to conduct virtual meetings to advance their work. The SCRS has made significant progress in the past several months through virtual meetings, albeit more challenging materials like making MSE decisions or stock assessment meetings have yet to occur. Although, virtual meetings allow for a wider participation, they pose challenges for formal decision making such as drafting scientific/management advice, or adopting critical MSE elements necessary to advance MSE work. However, the Group recognized that these webinars are getting more efficient as the participants become more familiar with the process and, therefore, these webinars can play a role in advancing the SCRS work.

## 6. Recommendations

### *With financial implications*

1. The Group recommended the use of the longline simulator (LLSIM) datasets as capacity building for training methods in CPUE standardization. Further addition of detailed CPC fleet information would increase the utility of the LLSIM datasets as a tool for CPUE standardization best-practice work. Therefore, the Group recommend an expert to be contracted to further develop this tool (60,000 €).
2. The Group recommends that the Secretariat develop a specific budget line in the ICCAT regular budget for the 2022/23 cycle, independent of the Science budget. This budget item shall include the funds needed for developing the entire ICCAT MSE processes, including fulfilling the Commission request for an MSE Independent Peer Review (IPR) composed of a panel of at least three independent reviewers, as well as the funds for other MSE processes activities developed by the SCRS. The products of this IPR would be a review of past and current practices, recommendations for improvements and a subsequent design of a generalized framework for the MSE process suited to the ICCAT process.

### *Without financial implications*

3. The Group recommends that exploratory work begin on how to translate qualitative descriptions of changes in a fishery's catchability into quantitative values suitable for CPUE statistical standardization, with special attention towards recreational fishing. This could begin either with a literature review of past efforts or hypothesis testing with currently available ICCAT assessment models.
4. The Group recommends that the SCRS, through WGSAM, develop a standardized set of plots and/or tables to be used for presenting MSE results for all ICCAT stocks. This effort can draw from IOTC's MSE presentation package as well as an ongoing external effort to develop standardized plots for presentation of MSE results as well as R code to produce them. These products, as well as an associated interactive Shiny App will all be open source.
5. The Group discussed the need for better procedures for SCRS virtual meetings including having the SCRS Chair and Co-chair distribute guidance on how working groups should function virtually to achieve their workplans, including guidance on adopting stock assessment results, recommendations, and other decision points as necessary. A specific recommendation from the Group was having at least one day off between the end of the presentation/discussions and the time dedicated to report adoption. This would allow time for reflection and revisions to be sent to the Secretariat/chair(s) that might not have been otherwise possible considering the spread of time zones.
6. The Group highlights the importance of interactions among SCRS, managers, and stakeholders to exchange guidance and feedback on key pieces in ICCAT's ongoing MSE processes (e.g., Objectives, Performance Indicators, cycle length of MP, exceptional circumstances, early results, etc.). As a means of improving this necessary interface the Group recommends that the Commission incorporate more informal interactions among SCRS, managers, and stakeholders, regardless of the forum for dialogue (e.g., Commission annual meeting, Panel intersessional meetings, and the SWGSM), allowing more information exchange, capacity building, and timely integration of managers' input into the MSE development.
7. The Group recommends that ICCAT continue to dedicate time in capacity building initiatives to support MSE. Ideally, resources should be allocated to continue to offer short training workshops on MSE alongside the meetings of the SWGSM. Additionally, the Group recommends that scientists and managers of ICCAT CPCs take advantage of the MSE training opportunities organized by global MSE capacity building projects, like those organized in the past by the FAO ABNJ.

8. The Group also recommended that appropriate representatives from the Species Groups with ongoing MSE processes should be included to help facilitate the review, beginning with a drafting of the ToRs for the MSE Independent Peer Review, that should be reviewed by each of these Species Groups and finally adopted by SCRS in September, with a proposed budget.
9. The Group recommends the development of a Tropical Tuna Science Plan to define and direct strategic research needs, including support for essential activities of the AOTTP after the existing programme is completed. The group also notes that this recommendation is consistent with previous recommendations of the Tropical Tunas species group, and the ICCAT Strategic Plan (Section 1.4.3) to improve stock assessments by "incorporating improved information on life history characteristics: fecundity, age composition of catch, growth, stock structure, and spatial distribution patterns."

## **7. Adoption of the report and closure**

Due to the limited time, some Agenda items were only partially reviewed prior to the close of the meeting: 3) CPUE standardization/incorporation of oceanographic and environmental changes into the assessment process, 4) Approaches to estimate the level of IUU catches for inclusion in stock assessments, 5) Other matters, and 6) Recommendations (without financial implications). Therefore, these sections of the report were adopted electronically after the meeting. The remainder of the report was adopted during the meeting. The meeting was adjourned.

## **References**

Anon. 2019. Report of the 2019 ICCAT Working Group on Stock Assessment Methods Meeting (WGSAM) (Madrid, Spain 8-12 April 2019). ICCAT Col. Vol. Sci. Pap. Vol. 72(5): 125-165.

## **Appendix 1**

### **Agenda**

1. Opening, adoption of agenda and meeting arrangements
2. Harvest Control Rules, Limit Reference points and Management Strategy Evaluation
3. CPUE standardization/incorporation of oceanographic and environmental changes into the assessment process
  - 3.1 Addition of swordfish distribution model to longline simulator study
  - 3.2 Incorporating environmental effects and species interactions in a bluefin tuna index standardization
  - 3.3 Technological and gear changes affecting the capture of billfish between 1973-2019
  - 3.4 AOTTP preliminary results
4. Approaches to estimate the level of IUU catches for inclusion in stock assessments
5. Other matters
  - 5.1 Terms of Reference for quotation request on Swordfish Habitat Distribution Model
  - 5.2 ICCAT website
  - 5.3 Virtual meetings
6. Recommendations
7. Adoption of the report and closure

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**Appendix 3****List of Papers and Presentations**

<b>Number</b>	<b>Title</b>	<b>Authors</b>
SCRS/2020/016	Addition of swordfish distribution model to longline simulator study	Forrestal F., and Schirripa M.
SCRS/2020/064	Technological and gear changes affecting the capture of billfish 1973-2019	Gibbs B.R., Schirripa M., and Chaibongsai P.
SCRS/2020/065	A method of estimating unreported landings of white marlin ( <i>Kajikia albida</i> ) in the Atlantic Ocean	Schirripa M.

SCRS/P/2020/015	The Atlantic Ocean Tropical tuna Tagging Programme: data, preliminary results and their use in stock assessment	AOTTP Coordination
SCRS/P/2020/016	Summary on North Atlantic Albacore MSE	Arrizabalaga H., and Merino G.
SCRS/P/2020/017	Status of the North Atlantic Swordfish MSE Project	Adrian Hordyk
SCRS/P/2020/018	Incorporating environmental effects and species interactions in a bluefin tuna index standardization	Gillespie K., Minch T., Turcotte F., and Hanke A.
SCRS/P/2020/019	Atlantic Bluefin tuna MSE Progress and lessons learned to date	Walter J.F.
SCRS/P/2020/021	Summary of tropical tuna MSE	Die D.

## Appendix 4

### **SCRS Document and Presentations Abstracts as provided by the authors**

*SCRS/2020/016* - A species distribution model (SDM) for swordfish was developed through habitat suitability indices and pop-up satellite tag data. The model used detailed biological and oceanographic data to define the spatial distribution of swordfish. This SDM was compared to a similar model developed previously for blue marlin. The two species SDMs were used as input into the longline simulator (LLSIM) to obtain catch per unit effort datasets based on the US pelagic longline fishery. These datasets were used to identify methods to reduce blue marlin bycatch through the use of time-area closures. The swordfish catch and effort data were also used to assess different methods of CPUE standardization. The datasets produced by LLISM have a known, underlying population abundance and can be used to test the accuracy of standardization methods that are commonly used in assessments of swordfish. Model approaches used in this report include a Tweedie generalized linear model, a negative binomial generalized linear model, a lognormal generalized linear model and Delta lognormal generalized linear model. Standardized indices obtained from these models were compared to the known population abundance entered into LLISM.

*SCRS/2020/064* - ICCAT stock assessments on blue and white marlin have assumed constant catchability for marlin species throughout the duration of the National Marine Fisheries Service Recreational Billfish Survey (RBS, 1973-2019). However, scientists and anglers have both expressed concerns that there has been an increase in catchability throughout the 46-year dataset. Tournament fishers are highly motivated to adopt measures that increase the probability of successful trips. Literature review and in-person interviews revealed numerous changes in gear and technology utilized by the recreational fishery which have likely contributed to an increase in billfish catchability since 1973.

*SCRS/2020/065* - Landings of mostly bycatch species such as white marlin and blue marlin have long been suspected of being under reported in the ICCAT Task I database. However, most assessments assume that landings are known with certainty. An under reporting of landings can appear as conflicts between observational data sources that could be explained by modifications in the observed catch. A new feature of the latest version of Stock Synthesis, a catch multiplier, was used to estimate the degree of illegal, unreported and unregulated (IUU) landings of white marlin that was in agreement with the remaining observational data. Of the three pre-decisional models considered, Model\_3 (estimated catch multiplier and variance reweighting used on CPUEs) performed the best with regard to diagnostics and estimated IUU landings of 13%, while the postdecisional model estimated 27% IUU landings. The methods described here offer one means to estimate IUU landings internal to the assessment model, and thus uses the entire suite of observational data available.

*SCRS/P/2020/015* - Data and preliminary results related to the ICCAT Atlantic Ocean Tropical tuna Tagging Programme (AOTTP) and their relevance for stock assessment were presented. Ongoing work includes estimating growth, mortality, abundance and movement for yellowfin, bigeye and skipjack tuna, as well as little tunny.

*SCRS/P/2020/016* - Since the interim HCR was adopted in 2017 (Rec 17-04), a peer review of the northern albacore MSE, including the operating models (OMs), management procedures, performance indicators and the code was conducted in 2018. The peer review (Sculley, 2019) concluded that the Northern Albacore MSE is scientifically sound and robust to major sources of uncertainty. The review also made some recommendations that were addressed during 2019 (SCRS/2019/167Rev), when a single consolidated report was also produced (SCRS/2019/170Rev), which includes the indicators to be used to detect exceptional circumstances. As requested in Rec 17-04, the WG ALB has also tested some variants of the interim HCR that would allow for additional stability for the fisheries while meeting management objectives. In 2020, the WGALB will evaluate whether exceptional circumstances occur, will evaluate current stock status and provide TAC advice based on the interim HCR. The Commission might adopt a long term MP as well as a protocol on what to do if exceptional circumstances are detected by the SCRS.

*SCRS/P/2020/017* - The framework being used is based on the R packages MSETool and DLMTool, with the development of a specific R package for this work (SWOMSE R package). The current work has an ongoing Trial Specifications Doc and an MSE Project Progress Sheet, this last one for interaction and requests from the SWO Species Group to the Contractor. All code and documents are available online and access is granted to SCRS scientists upon request to the Secretariat. Most of the work done in 2020 so far has focused on

finalizing the OM uncertainty grid, re-running the OM models, and OM Validation. The current OM is a seven variable factorial design of models based on the SS3 stock assessment base case from 2017, with the structural uncertainty being captured by a total of 288 models. All the validation work and summaries are available as HTML documents summarizing model fits and the key outputs from each. The workplan for the rest of 2020 includes continuing the work on the development Candidate Management Procedures, determine (preliminary) Performance Metrics, evaluate the impact of uncertainties in OM grid on MP performance, and an initial evaluation of impact of uncertainty scenarios asked by the SWO species group in future projections. The SWO Species Group has requested a small technical meeting to continue this work with the contractor and modelers, and that has been tentatively scheduled for the 4 and 5 of June.

*SCRS/P/2020/018* - An overview of development of a fisheries independent index standardization for the Gulf of St. Lawrence bluefin tuna acoustic survey was presented. The proposed index attempts to incorporate environmental (e.g. sea surface temperature, lunar phase) and a predator-prey interaction (bluefin tuna and herring) alongside typical covariates (vessel, time of year, etc.)

*SCRS/P/2020/019* - A brief overview of the status of the ABFT MSE process and several lessons learned so far were presented. The complexity of the ABT population dynamics has required the development of custom operating models, incorporating a vast array of novel data on mixing, movement and stock composition. This has challenged the development of the operating models at a time when the state of knowledge on BFT has also vastly increased from what was known at the outset of the MSE process. Notwithstanding these challenges, the MSE process has made substantial progress of late in developing an interim reference grid that addresses several axes of uncertainty previously not addressed regarding fit to the composition data, Western mixing percentage and absolute biomass scale of the stocks. The objective remains to provide a candidate management procedure to the Commission in 2021 for potential adoption. This remains a possibility but it may require remote meeting participation and a more condensed in-person meeting schedule to achieve the necessary steps towards adoption. The presentation also addressed lessons learned from the process. These were solely the views of the presentation author and not necessarily views of any particular group. Several of the lessons learned were to clearly specify: the objective of the MSE, who will conduct the work and how it will be funded, the scope of the MSE (whether it is to fully specify a management procedure or simply a harvest control rule), the necessary complexity of the operating models and how or if they will be weighted and how to facilitate dialogue between participants.

*SCRS/P/2020/021* - The tropical tuna MSE started in earnest in 2018 and developed an initial workplan and an set of potential operating models based on SS3 (SCRS/2019/033), but progress was slowed down considerably as the Commission revised the MSE road map lowering the priority of Tropical tunas MSE. The modeling framework was designed to allow for either stock-specific or a multispecies MSE. At the 2019 meeting the Commission allocated Euros 50,000 to progress the research which will support continuation of model developments but also changed the TT workplan by adding BET to the list of stocks to be in the 2020 agenda of the working group. The MSE process for tropical tunas has been challenged by:

- the continued pressures of the stock assessment process (4 stocks, with almost yearly stock assessments),
- the lack of capacity for involvement in the MSE at the scientist and management level,
- the overfished status of BET and difficulties of reaching agreement on new management measures and operational management objectives for the tropical tuna stock complex.

**Appendix 5**

**Quotation request - Terms of reference  
Investigation into decadal changes in swordfish habitat distribution  
and the furthering of a longline simulator**

**1. Background and Objectives**

It is now a generally accepted fact that variation in the planet's climate and its effects on the world's oceans is increasing. For marine fish, specifically those of the highly migratory nature, this increased climate variation has led to changes in distribution, migratory patterns, and susceptibility to various fishing gears. These changes become especially problematic when they manifest themselves through the fishery dependent indices of abundance (such as catch-per-unit-effort, or CPUE) used to assess the status of the stocks, such as is done routinely by the International Commission for the Conservation of Atlantic Tuna (ICCAT). Knowledge of habitat use, and seasonal migrations of pelagic fish stocks are necessary for the proper management of these species, but this information is often lacking. Quantitative species distribution models (SDM) can provide this information by pairing detailed environmental data with satellite tag information using a habitat suitability framework. A species distribution model has been successfully developed for blue marlin and has been used to examine different methods of CPUE standardization when paired with a longline simulator (LLSIM).

At the 2019 meeting of the Working Group on Stock Assessment methods (WGSAM) the Group recognized that a swordfish species distribution model would provide a useful tool for gaining information on stock structure and movement in the Atlantic. In 2019 a contract was awarded to work together with other CPCs and combined PSAT data to develop a swordfish distribution model and to use it to carry out a factorial study of CPUE standardization via the LLSIM. The results of this contract were presented at the WGSAM 2020 meeting. One related observation of the 2019 study, but not investigated, was what appeared to be a decadal change in the size of location of the habitat of swordfish. Habitat appeared to be moving poleward and either condensing and or shrinking. Another question with regard to the changing of habit that has not been examined is the role that depth of the habitat may be playing (e.g. habitat compression towards the surface layers has been shown to influence the depth distribution of several highly migratory species). This third dimension of the swordfish SDM has yet to be examined.

In addition, these SDMs provide the necessary base model for ongoing work with the longline simulator tool (LLSIM). At the WGSAM meeting in 2019 WGSAM recommended that funding be made available to continue this work by a cooperative effort between the WGSAM and an independent expert. The products of this work should support the ongoing development of the Longline Simulator which will significantly increase the utility of the simulator in providing the means to investigate CPUE standardization and develop best practices for it. The LLSIM model is capable of modeling several longline fisheries simultaneously. However, to date only one fishery (one similar to the US longline) has been included in the LLSIM. While this fishery was able to be simulated in relative detail due to the access of logbook data, the fishery itself only covers a relatively small geographical area, generally only the northwest corner of the ICCAT Convention area. Simulating a second, generalized longline fleet, one that fishes a greater portion of the ICCAT Convention area, would greatly increase the usefulness of the LLSIM. This second simulated fleet, representative of a typical ICCAT CPC fishing fleet, can be developed using the ICCAT statistical databases freely available from the ICCAT website.

**2. Contractor Tasks**

- Examination of the full four dimensions of swordfish habitat (latitude, longitude and depth over time) to further investigate and describe the possible past decadal changes swordfish habitat.
- Analyze in more detail which environmental factors, or combinations thereof, within the swordfish SDM have the most influence on the observed shifting of habitat.

- Create a generalized yet representative ICCAT CPC longline fishery suitable for inclusion in the existing longline simulator LLSIM. The simulated fishery should cover a large portion of the ICCAT Conventional area. Ideally, this simulated fishery would consist of several sub-groups of longline sets that are similar within a given sub-group (e.g. hooks between floats, depth fished, length of set, etc.), but dissimilarly between the sub-groups.

### **3. Deliverables**

- The successful bidder shall provide a **SCRS document** to be presented during the 2021 Working Group on Stock Assessment Methods meeting and possibly the 2021 Swordfish Working Group meeting (should one be held). Such document shall describe, in detail, the methodology and preliminary results obtained during the study.
- Comments on the above mentioned SCRS document that might be provided by the Working Group on Stock Assessment Methods, the SCRS and/or the Secretariat, shall be taken into consideration by the contractor, and included in a **draft final report**, to be submitted to the Secretariat no later than **15 November 2020**. The draft report shall include a:
  - a) Executive summary;
  - b) Full description of the work carried out;
  - c) Detailed description of final results achieved.
  - d) List of references and literature cited.

The **final report** shall be updated taking into account the comments provided by the ICCAT Secretariat and the rapporteur of the WGSAM and be submitted by **15 December 2020** at the latest.

### **4. Contractor Minimum Qualifications**

- Documented multi-year experience in species distribution models (e.g. Goodyear 2017) and a commercial logbook and/or observer data analysis, and PSAT tag data and preferably multi-year experience with a longline simulator
- University degree in one of the following: fisheries science, marine biology, statistics, natural sciences, biological sciences, environmental sciences or closely related fields (in case of individual scientists).
- Excellent working knowledge of at least one of the three official languages of ICCAT (English, French or Spanish). A high level of knowledge of English is desirable.

### **5. Submission of proposals**

Scientists and public or private Scientific Institutes or entities interested shall submit detailed offer(s) only to the attention of Mr. Camille Jean Pierre Manel, the Executive Secretary of ICCAT, at the following address: [camille.manel@iccat.int](mailto:camille.manel@iccat.int) and Ms. Ana Martinez ([ana.martinez@iccat.int](mailto:ana.martinez@iccat.int)) by **1 June 2020 at the latest**, including:

- a) A description of methodology to be used;
- b) Declaration of commitment of the provision of access to pop-up satellite data;
- c) The budget proposal;
- d) A short Curriculum vitae of the tender (in case of individual scientists, i.e. the 5 most relevant papers and involvement in recent CPUE standardization, fishing gear simulation, or stock assessment projects);
- e) The name, address, and telephone number of the tendering body;
- f) The institutional and administrative background of the tendering body (e.g., statutes, type of institution, annual budget, budget control procedures, etc.), if applicable;

- g) Acknowledgement of this Call for Tenders; and h) A statement specifying the extent of agreement with all terms, conditions, and provisions herein included.

If the tender is submitted by an institute/University, it must indicate the expert(s) who will be dedicated to the design and programming tasks and that he/she be available to attend the 2021 Working Group on Stock Assessment Methods meeting. Offers sent after the deadline or that fail to furnish the required documentation or information, or reject the terms and conditions of the Call for Tenders will not be considered.

Interested scientists and public or private Scientific Institutes or entities interested to apply shall provide a detailed budget and clearly identify costs related to main activities of the work (e.g. labor, including estimated number of days of work; travelling and subsistence).

For additional information or clarifications please contact the Secretariat at: [miguel.santos@iccat.int](mailto:miguel.santos@iccat.int).

## **6. Selection of proposals**

The ICCAT Secretariat will make a selection of the offer(s). Following the selection process, the ICCAT Executive Secretary will notify the entity selected for the contract as soon as the selection process is completed. Contract will be awarded on the basis of competitive tendering and the evaluation of proposals will be undertaken objectively, consistently and without bias towards particular suppliers. Proposal(s) will be evaluated against a pre-determined set of criteria, which include: (i) cost; (ii) proven track record; (iii) technical merit based on work plan; and, (iv) flexibility to future changes to requirements.

## **7. Duration of the contract**

The work under this contract shall be concluded by **31 December 2020**. If required and strictly necessary, the contract may be opened for extension, depending on funding availability and on the priorities of the ICCAT Working Group on Stock Assessment Methods.

## **8. Payment details**

Disbursements will be made according to the following schedule:

1. 40% of the total amount of the contract upon signing of the contract;
2. 40% of the total amount of the contract upon submission of the SCRS document and its approval by the WGSAM;
3. 20% after the approval of the final report by ICCAT upon incorporation of comments made by ICCAT.

## **9. Logistics**

The text report shall be in MS Word or compatible software. All other documents provided by the Contractor must be in Open Office, Latex or compatible software. All documents submitted must be in English, French or Spanish.

## **10. Copyright**

All the material produced by the Contractor will remain the property of ICCAT. All software written by the Contractor will be licensed under GLP or similar open source license.

For additional information concerning this Call for Tenders, please contact ICCAT Secretariat at the following address: [info@iccat.int](mailto:info@iccat.int).