

**REPORT OF THE THIRD MEETING OF THE STANDING WORKING GROUP TO ENHANCE
DIALOGUE BETWEEN FISHERIES SCIENTISTS AND MANAGERS (SWGSM)**
(Madrid, Spain, 29-30 June 2017)

1 Opening of the meeting

The Chair of the Standing Working Group to Enhance Dialogue Between Fisheries Scientists and Managers (SWGSM), Dr Martin Tsamenyi (Ghana), welcomed all participants and introduced the SCRS Chair, Dr David Die. The Chair encouraged communication between the fisheries scientists and managers and suggested the group develop recommendations to be referred back to the Commission. He stressed the importance of broad participation. The Commission has recognized this by dedicating funding to support the participation of one scientist and one manager from each developing CPC.

The Executive Secretary noted that 21 CPCs were present (Algeria, Angola, Belize, Canada, Côte d'Ivoire, European Union, Gabon, Honduras, Japan, Libya, Mauritania, Morocco, Nicaragua, Nigeria, Norway, Sao Tome and Principe, Senegal, South Africa, Tunisia, United States and Uruguay) as well as the fishing entity Chinese Taipei.

The following non-governmental organizations also attended the meeting: Ecology Action Center (EAC), International Seafood Sustainability Foundation (ISSF), Pew Charitable Trusts and the Ocean Foundation.

The List of Participants is appended as **Appendix 2**.

2 Adoption of Agenda and meeting arrangements

Dr Die proposed that point 5 on the tentative agenda, *Outcomes of the 2016 Joint Tuna RFMOs Working Group on Management Strategy Evaluation (MSE)*, be moved to follow the discussion of point 9, Consideration of other stocks for possible addition to the 5-year road map. It was agreed that this change would improve the flow of discussion. The Chair noted his intention to raise the relevant findings of the 2016 independent performance review under Other Matters.

The Agenda was adopted and is appended as **Appendix 1**.

3 Nomination of the rapporteur

Ms. Oriana Villar and Ms. Rachel O'Malley (United States) served as rapporteurs for the meeting.

4 SWGSM Terms of Reference [Rec. 14-13] and outcomes of 1st and 2nd SWGSM meetings

The development of a general framework to guide establishment, review and update of management objectives and strategies.

Dr Die reviewed the SWGSM Terms of Reference. Following the SWGSM meetings in 2014 and 2015, the Commission adopted Rec. 15-07, which calls for the Commission to provide guidance to the SCRS on the following: a) management objectives; b) acceptable quantitative level(s) of probability of achieving and/or maintaining stocks in the green zone of the Kobe plot and avoiding limit reference points; and c) timeframes for halting overfishing on a stock and/or rebuilding an overfished stock. The SCRS was requested to provide the Commission with a 5-year schedule for the establishment of species-specific harvest control rules (HCRs). Rec. 15-04 established northern albacore as the "pilot stock" for this effort. In 2016, with input from the SCRS, the Commission agreed on a 5-year road map to advance this work for priority stocks: northern albacore, North Atlantic swordfish, bluefin tuna and tropical tunas (*ICCAT Report of Biennial Period 2016-2017, Part I*, 2016 (Vol. 1), Annex 7.2).

Dr Die introduced Dr Michael Schirripa, Chair of the SCRS Working Group on Stock Assessment Methods. Dr Schirripa provided the Group with an introduction to management strategy evaluation (MSE) (**Appendix 3**), which involves using simulation to compare different combinations of data collection schemes, methods of analysis and subsequent processes leading to management actions. The outputs can help managers to weigh each alternative's relative effectiveness in achieving management objectives. Ideally a clear set of management objectives is defined in advance based on ongoing dialogue among scientists, managers, and stakeholders. Dr Schirripa led the Group through a conceptual overview of the MSE modeling process and outlined which Group is responsible for which steps (either the SCRS or the Commission) within the MSE.

Dr Schirripa recalled Rec. 11-13 and clarified some of the basic terminology, including reference points typically used in a Harvest Control Rule (HCR) (i.e., target, threshold, and limit reference points) and Management Procedures (MPs, the combination of a set of data, an assessment method and an HCR). At a future stage, when establishing the HCR for a particular stock, the Commission will determine pre-agreed management actions that would be triggered to halt or reduce fishing mortality if limit or threshold reference points are breached. This has the potential to provide for more predictable management actions in response to changes in the condition of stocks. One CPC noted that the use of different reference points varies among the regional fisheries management organizations, which can be a source of confusion.

There was general recognition that the concepts of HCR and MSE are challenging, and that the SWGSM provides an important forum for managers to ask questions and develop a deeper understanding of the process. It was suggested that future examples of MSE, for illustrative purposes, should focus on scenarios currently faced by ICCAT, in order to make the concepts more readily understandable and practical for managers. Dr Schirripa suggested that there are different levels of managers' understanding regarding the MSE process. The most important is a clear understanding of management objectives, followed by familiarity with basic terminology, and finally a deeper understanding of the simulation and modeling.

Several CPCs noted that yield is an important consideration for their fisheries. There was a question about how short-term vs. long-term benefits to the fishery are evaluated through MSE. Dr Schirripa explained that this is a clear example of trade-offs and how the performance metrics provide information that the Commission can use as a basis for making more informed decisions. He emphasized that a single HCR cannot fully achieve all management objectives simultaneously; it is up to the Commission to decide which HCR best meets the combination of identified management objectives. Dr Die reiterated that HCRs should not be determined in isolation; other aspects of the MP should be also determined, including the data and assessment models to be used as part of the MP.

There was general agreement that the spider plots are a useful way to display a complex series of MSE outputs for consideration by managers. However, when the performance of all metrics is shown on a spider plot, there are so many overlapping lines that it can become difficult for managers to interpret the outcomes. One CPC asked whether there is a danger in oversimplifying the spider plots when a more comprehensive set of performance metrics has been considered. Dr Schirripa explained that the performance metrics adopted by the Commission for northern albacore can be grouped in four categories (status, safety, stability, and yield), and a representative metric can be selected to illustrate each of these on the spider plot. Other types of graphical displays can also be used to summarize MSE outputs.

The Chair noted that the adoption of management procedures is a step-wise and iterative process in which scientists rely on input and feedback from the CPCs and their stakeholders. In response to a question about the setting of the TAC for northern albacore, Dr Die explained that HCR should be considered a tool for the Commission to use in deciding future TACs and levels of exploitation. Several CPCs noted that it is important for managers to understand and consider the implications of alternative management procedures and the range of associated potential outcomes (e.g. regarding stability and yield) before selecting an HCR.

There was general recognition that the HCR/MSE process will require new expertise and committed resources to support this work. This fall, the SCRS should advise on the technical resources that are needed for future work and these needs should be considered by STACFAD at the Commission's Annual meeting.

5 Status of the development of Harvest Control Rules (HCRs) and actions to be taken in 2017 for priority stocks identified in Rec. 15-07

Dr Die provided a detailed explanation of the development of HCRs and action to be taken in 2017 for priority stock. A summary is provided in **Appendix 4**.

5.1 *Northern albacore*

Dr Die explained how MSE is being used to test the robustness of alternative limit, target, and threshold reference points, and associated HCRs in relation to the northern albacore management objectives, probabilities, and timeframes already determined by the Commission (**Appendix 5**). Under Rec. 16-06, the Commission agreed to endeavour to adopt an HCR by 2017 and defined the management objective as maintaining the stock in the green zone with at least a 60% probability, while maximizing long term yield. Through MSE, the SCRS is conducting an evaluation of alternative management procedures through simulation. The results of these simulations will allow managers to evaluate the performance of candidate HCRs by examining trade-offs through the examination of performance indicators. The performance indicators are grouped in four categories, as follows: 1) Status of stock (5 indicators); 2) Safety (2 indicators); 3) Yield (3 indicators) and 4) Stability (5 indicators).

Dr Die described changes that have been made since the previous MSE exercise for northern albacore. These changes include efforts to better characterize uncertainty about the system using a greater number of operating models (132 total), to define stability in terms of quantitative bounds for variability in the TAC, and to use the performance indicators defined by the Commission in Rec. 16-06. The expanded grid of operating models is an attempt to represent uncertainty through a broad range of plausible states of nature. Results were calculated and averaged across the 132 operating models and projected to the year 2045.

One CPC asked whether the MSE could be run again on the basis of the 2016 stock assessment (Anon. 2017a), rather than the 2013 stock assessment (Anon. 2014). While the modelers could try to do so, Dr Die explained that stock status scenarios such as those represented in the 2016 stock assessment are already part of the broad set of operating models that were tested. The best MSE approach is to design a range of operating models that are plausible and focus on testing the candidate HCRs to be robust to all these operating model scenarios. In this way, the performance of the management procedures is robust to the possibility that the system dynamics are not necessarily represented by the results of the 2016 assessment.

Dr Die presented the proposed format for a detailed table that shows MSE results for all performance indicators and candidate HCRs. In this table, the first four columns help to define the HCR and each row corresponds to the results of that particular HCR. The resulting figures do not reflect individual results; rather, the outputs are averaged across operating models so the table provides a broad view of results.

The potential trade-offs were illustrated through spider plots with four main axes reflecting the four categories of performance indicators, with the intent that this method could be used to present outputs to the Commission. Through these performance indicators, the Commission can quantitatively examine how well its management objectives would be met. One CPC asked whether the management objectives related to status, safety, stability, and yield were equally weighted. It was explained that weighting of management objectives is not part of the input to the spider plot; the weighting of management objectives is determined later in the process as the managers consider MSE outputs and make decisions about preferred trade-offs.

The main trade-off illustrated through this MSE is between stock status and the long-term yield. All runs resulted in a probability of being in the green zone of the Kobe plot (not overfished, no overfishing) of >60%. Under some of the candidate HCRs tested, long-term yield could reach 35,000 t. There was a question about whether it was possible to evaluate candidate HCRs with probabilities of the stock biomass remaining in the green zone that are closer to 60%. One CPC suggested that the range of candidate HCRs may be too conservative, given that many have a probability of remaining in the green zone that is much higher than 60% (ranging from 66-92%). Dr Die explained that the probability associated with stock status is not applied as an initial constraint; it is an output of the model. All candidate HCRs tested had a high percentage of remaining in the green.

There were several questions for the SCRS Chair about the MSE outputs regarding short-term yield, which indicated catches less than the current TAC. Dr Die explained that this was the result of the fact that SCRS considered all of the hypotheses concerning stock status. The 2016 assessment results, based on updated indices, are more optimistic than the majority of the OMs considered in their work thus far. The SCRS has not yet calculated the TAC implications for any particular HCR. Preliminary calculations, however, suggest that the TAC for 2018-2020 will not be lower than the current TAC under any of the candidate HCRs. In terms of safety, all runs resulted in a probability > 95% of avoiding the B_{limit} ($0.4B_{MSY}$).

Stability, considered at the request of the Commission, is largely driven by the constraints on variability in the TAC, the current stock status, and the placement of target and threshold reference points. In this particular MSE, the smaller the TAC constraint (e.g., 20%), the greater the stability without significant loss in the other indicators. For this reason, it was generally agreed that constraints on the variability of TAC should be limited to 20% change (rather than 25% or 30%) in future testing of the management procedures.

There was a question about the constraints applied to ensure TAC stability, and whether this would limit the Commission's responsiveness in a case where there were concerns about rapidly declining biomass. Dr Die explained that if the stock biomass declines below the $B_{threshold}$ and begins to approach the B_{limit} , the HCR would adjust the TAC as needed to begin rebuilding the stock biomass. One CPC suggested that it would be informative to evaluate the management procedures with and without the stability clause for cases when the stock is assessed to be between $B_{threshold}$ and B_{limit} .

One CPC asked on what basis the SCRS selected the particular values assigned to each axis of the spider plot. Depending on the selected values they will give different impressions of the trade-offs. It was agreed that it would be helpful for the SCRS to include an explanation of the rationale for selecting these values in future reports of MSE work.

Discussions returned to the summary table in Dr Die's presentation, which was based on Merino *et al.* (2017). As the most recent MSE work produced 24 candidate HCRs, Dr Die suggested that the SWGSM consider choosing a smaller set of HCRs for the SCRS to analyze further. One CPC noted that the presentation provided summary information, but did not provide the full range of outputs from 132 runs. Dr Die explained that Merino *et al.* (2017) paper had been presented to the Albacore Species Group on June 5-9, 2017 (Anon. 2017b), but had not yet been presented to the SCRS Plenary, and, therefore, according to the usual SCRS process, it had not been widely distributed. Several CPCs expressed concerns about their ability to consider all of the alternatives under these circumstances. The SWGSM agreed that it would be necessary for all to have access to the Merino *et al.* (2017) paper in order to provide guidance on how to narrow the set of candidate HCRs. With the authors' permission, the paper was made available to participants on the meeting ownCloud background documents folder.

Dr Die noted that next steps planned for the northern Atlantic albacore MSE include conducting further diagnostic tests, documenting OM/OEM assumptions, and responding to issues raised at meetings of the Working Group on Stock Assessment Methods and the Albacore Species Group meetings earlier this year. The SCRS Plenary will review this work in October 2-6, 2017, and, taking this into account, will provide the Commission with management advice for northern albacore, including TACs for 2018-2020 resulting from the application of the selected HCRs.

The CPCs reiterated their support for the MSE process and thanked the SCRS their work. One CPC voiced its expectation that the Commission will be able to select an HCR this year, as anticipated in Rec. 16-06. Several other CPCs maintained that more robust discussions were necessary and the process should not be rushed. One CPC noted that the management objectives should be iterative and that lessons learned through this new process can inform refinement of the objectives. It was generally agreed that there should be further testing of the northern albacore MSE, and that this work should be reviewed by the SCRS Plenary before the Commission takes a decision to select an HCR. If the Commission does adopt an HCR in 2017, it should also determine when and how the HCR's performance should be reviewed by the SCRS.

It was agreed to return to this discussion under point 6 of the Agenda (item 6 of this report).

5.2 Bluefin tuna

Dr Die provided an update on MSE-related work for bluefin tuna. This is a flexible framework used to test hypotheses about system dynamics, especially those related to mixing and spatial structure. Results of the 2017 bluefin tuna stock assessment will inform the range of operating models to be used in future MSE work. The SCRS will continue developing appropriate simulation models that encompass the current understanding of system dynamics.

Dr Die informed participants that the MSE work for bluefin tuna is likely to take longer than anticipated in the original HCR/MSE road map, and asked the SWGSM whether a delay of one year (from 2018 to 2019) would cause concern for the Commission. There was general agreement that the SCRS should devote this additional year to further development and refinement of the bluefin tuna MSE. Based on this work and on additional input from the Commission, the SCRS will develop alternative management procedures, including candidate HCRs, and test them through simulation as part of the MSE.

Dr Die reiterated that the Commission should consider its management objectives and associated performance indicators for bluefin tuna, as this will guide the MSE process and facilitate the Commission's ability to evaluate trade-offs in the future. Several CPCs stated that northern albacore management objectives identified in Rec. 16-06 provide a good starting point for deliberations; some emphasized that the management objectives may need to be adapted for bluefin tuna. These management objectives will need to be considered within Panel 2 and agreed by the Commission.

One CPC asked for clarification on whether it is possible to develop management objectives and performance indicators for the eastern and western stocks, given that the stocks are currently managed separately. Dr Die responded that the Commission could determine its objectives and indicators for the separate stocks, and MSE could be used to test alternative management procedures for both stocks to see how they would perform. He noted the SCRS may be able to evaluate spatial indicators as part of this process. It was generally agreed that management objectives should be considered separately for separate stocks, although the harmonization of objectives and performance indicators may also be considered, as appropriate, in light of stock mixing. One CPC noted that it would be important to keep the deliberations on management objectives separate from allocation decisions. One CPC questioned whether it would be possible to develop management objectives for the western stock, given that the stock assessment is based on the assumption of low recruitment and high recruitment scenarios, which provide two totally different pictures.

An observer from the Ocean Foundation encouraged CPCs to consider possible management objectives in light of recommendations from the independent performance review that call for greater precaution, including higher probabilities of success, in light of uncertainty and Rec. 11-13.

5.3 North Atlantic swordfish

Dr Die noted that work has been presented at the SCRS Working Group on Stock Assessment Methods to support development of the operating model and future testing of candidate HCRs for North Atlantic swordfish, but the MSE framework is incomplete. Results of the 2017 stock assessment for North Atlantic swordfish will help to confirm the range of operating models to be tested in the MSE. There must also be a plan for financing the necessary research to support the MSE process. One of the main challenges is that unlike bluefin tuna, which has the GBYP, there is no Atlantic-wide research program for swordfish that can inform the process.

It is up to the Commission to define management objectives for the stock and select performance indicators. One CPC expressed concern with the idea of committing to a specific and quantitative management objective before the performance indicators are determined and there is some indication of outputs that will affect the fishery in the short term and long term. Another CPC agreed, noting that this is an iterative process and the probability of stock status staying in the green zone of the Kobe plot (no overfishing; not overfished) will be an output of testing the candidate HCRs. Dr Die suggested that the Commission should begin by defining the management objectives in a more focused way so that there is a more manageable range of candidate HCRs to be analyzed and considered through the MSE process.

5.4 Tropical tunas

Dr Die recalled that although one CPC had an interest in developing an MSE for western Atlantic skipjack independently of other tropical tuna stocks, this work has not yet been presented to the SCRS. When the SCRS Tropical Species Group meets in 4-8 September 2017, they will discuss the development of a multispecies MSE for bigeye tuna, yellowfin tuna and Atlantic skipjack.

Considering the early stage of MSE development in tropical tunas, the SCRS has advised that the earliest a full MSE for tropical tunas can be completed is 2020. Partial support has already been provided by ICCAT's Atlantic Ocean Tropical tunas Tagging Program (AOTTP) to support the estimation of population parameters that are required to support the development of the operating model. However, the MSE for tropical tunas will require investment in resources that are currently not available to the Tropical Tunas Species Group of the SCRS. The Tropical Tunas Species Group will develop a plan and associated budget when it meets in September 2017.

There was general support within the SWGSM for a multispecies approach to tropical tunas. In response to a question about how a multi-species HCR is structured when one stock is overfished but others are not, Dr Die said that the management objectives are developed by fishery (e.g., performance indicators are identified separately for different gear types). This will involve a challenging discussion for managers, including decisions about the preferred size selectivity in the tropical tunas fisheries. It was noted that WCPFC is considering the adoption of harvest strategies on a multispecies basis. This experience can be informative to the Commission and the SCRS. One CPC stated that it would be practical and necessary to focus on bigeye, whose stock status is low, as the first step, rather than a multispecies approach.

6 Recommendations to the Commission on management objectives, performance indicators and HCR for stocks referred to under point 5

The CPCs reviewed a Chair's paper "Recommendations relating to northern albacore (NALB)" that contained draft recommendations to guide additional work on the testing of candidate HCRs for northern albacore through MSE. There was extensive discussion of the elements in this paper and several CPCs proposed modifications that were incorporated. The resulting recommendations are designed to guide the sequence of next steps within the SCRS and the Commission.

There was a request for clarification of the term "exceptional circumstances," which has been associated with different meanings in different RFMOs such as CCSBT and NAFO. It was confirmed that in the Chair's paper this term is used as in CCSBT, where it is not an opt-out clause but rather an integral part of the agreed management procedure for bluefin tuna. ICCAT would need to define what it considers "exceptional circumstances" that would result in suspending the application of the HCR, and also establish guidance on the alternative management response in those circumstances. There was a question about the role of the SCRS in defining "exceptional circumstances", for example, whether the disappearance of critical data streams would be considered an exceptional circumstance. Dr Die suggested that the SCRS could provide some advice on the technical aspects of this issue for the Commission's consideration.

It was noted that the external review of stock assessments has become standard practice within the SCRS, and considering that the use of management procedures is a newly emerging tool for ICCAT, an external review of this work would also be appropriate in the case of the northern albacore MSE. It was also noted that when the Commission selects an HCR for northern albacore, it will need to establish the terms- especially the timeframe- of the SCRS review process.

It was also noted that paragraph 4 in first block of the Chair's paper should be revisited at the annual meeting, which requires more consideration to reach consensus.

The SWGSM did not reach agreement on specific recommendations for stocks other than northern albacore. It was decided to focus on next steps for northern albacore so that all CPCs can more fully understand the MSE and have confidence in the process. There was general acknowledgement that ICCAT's commitment to MSE and the eventual adoption of management procedures for priority stocks is a resource-intensive undertaking. The SCRS should advise on specific needs in terms of expert participation and financial resources, including needs within the Secretariat, from participation by CPC scientists to engagement of external experts as the SCRS deems appropriate. Financial implications should be considered by the Commission's Standing Committee on Finance and Administration (STACFAD) at the upcoming annual meeting so that priority work can be supported.

The agreed recommendations are attached in **Appendix 6**.

7 Review of the 5-year road map for the development of MSE/HCR for priority stocks

Dr Die presented the schedule for stock assessment and MSE work as planned for 2017-2021, confirming that this schedule reflects the earliest possible time an MSE could be completed for various stocks. This schedule is subject to change based on priorities expressed by the Commission and SCRS workload. Dr Die emphasized the resource challenges faced by the SCRS in coming years. Further development of MSE for ICCAT stocks requires specialized scientific expertise and takes substantial time; these resource needs must be considered and supported by the Commission if the work is to continue as planned.

It was generally agreed that the Commission should aim to maintain momentum while at the same time be realistic about the amount of work involved, particularly on the part of the SCRS. Dr Die emphasized that future consideration of candidate HCRs for ICCAT stocks will depend on a structured process that is best accomplished through MSE. It will also depend on the Commission providing specific input to the SCRS to guide their work (e.g. on management objectives and performance indicators). This will require hard work, engagement, communication, trust and proper planning by the SCRS and the Commission.

8 Consideration of other stocks for possible addition to the 5-year road map

Dr Die reminded participants that the SCRS Strategic Plan for 2015-2020 calls for the application of MSE to evaluate candidate HCRs and the information value of different data sources. One CPC had expressed interest in developing an independent MSE for western Atlantic skipjack. Rec. 16-12 requests the SCRS to provide, if possible, candidate HCRs with associated reference points for blue shark by the next assessment in 2021. One CPC expressed the desire to begin work on an MSE for Mediterranean swordfish due to the overfished status of the stock. Dr Die informed the Group that the next stock assessment for Mediterranean swordfish will be in 2019, which would be an appropriate point to begin the MSE process.

No changes were made to the road map. It is anticipated that the road map will be reviewed at the 2017 Annual meeting, in light of SWGSM discussions and taking into account additional information about necessary tasks and workload provided by the 2017 SCRS this fall.

9 Outcomes of the 2016 Joint Tuna RFMOs Working Group on Management Strategy Evaluation (MSE)

Dr Paul de Bruyn of the ICCAT Secretariat provided a summary of the first meeting of the Tuna Regional Fisheries Management Organizations (t-RFMOs) Joint Working Group on MSE (**Appendix 7**), held at the offices of the ICCAT Secretariat on 1-3 November 2016. Prior to this meeting, the ICCAT Secretariat had created a wiki for the Group to engage virtually and share their efforts online: <http://groupspaces.com/tRFMO-MSE/wiki/>.

There was general agreement on the importance of collaboration among the tRFMOs on this issue. The importance of disseminating results among scientific colleagues and communicating with managers was emphasized. The technical expertise of this Group and its potential ability to inform or review further work on ICCAT's northern albacore MSE was also noted. Eventually the development of "shiny apps" will facilitate better visualization of the MSE process. The 2016 meeting was supported by GEF/ABNJ funding, and a second meeting of this Group is anticipated in the GEF/ABNJ work plan for 2017-2018.

10 Outcomes of the 2016 Joint Tuna RFMO Working Group on Ecosystem Based Fisheries Management (EBFM)

There was a report of outcomes from the Joint Meeting of t-RFMOs on EBFM, initiated by ICCAT and supported by the Common Oceans ABNJ Tuna Project implemented by FAO and funded by the GEF, which brought together scientists from the five t-RFMOs and national experts in December 2016 (**Appendix 8**). During that meeting, participants from each of the t-RFMOs presented a summary of progress towards implementation of EAF/EBFM. Many of the elements necessary for an operational EAF or EBFM are already present in most t-RFMOs but challenges remain in determining how to operationalize this in a holistic and integrated way.

The tRFMO Group concluded that implementation of EAF and EBFM will not require a substantial amount of additional data. However, as with MSE, the design and implementation of an EAF and EBFM plan is a participatory process that must involve managers, science and stakeholders. EAF and EBFM are management tools that can only be initiated at a Commission level, not by the Scientific Committee or dedicated technical subcommittees or Working Groups.

The SWGSM recognized that there was much to be gained from ongoing discussions with other tRFMOs on the subject, particularly for issues relating to data availability and communication with managers. Another joint t-RFMO working group on EAF /EBFM issue could be an effective way to formalize collaboration and establish an understanding of common challenges and solutions. A second meeting of this Group is anticipated in the ABNJ work plan for 2017-2018, this time with the participation of CPCs.

11 Development of a draft road map to implement EBFM, including roles and responsibilities

Dr María José Juan-Jordá, on behalf of AZTI and its consortium members, gave a presentation on “Selecting Ecosystem Indicators for Fisheries Targeting Highly Migratory Species” (**Appendix 9**). The objectives of this work are to provide: 1) a list of ecosystem indicators and guidance for associated reference points to monitor the impacts of fisheries targeting tuna and tuna-like species on ecosystems; 2) criteria and guidelines to choose regions with meaningful ecological boundaries for highly migratory species; and, 3) guidelines for an EAFM plan using two ecoregions as case studies (one in ICCAT and one in IOTC). Dr Juan-Jordá described the tasks associated with this project. Currently it is a scientific exercise, but the work can later be adapted in light of management needs.

Dr Die presented a flowchart to illustrate information flow that could lead to a draft road map for EBFM within ICCAT. Each species group of the SCRS would provide indicators and the SCRS would develop ecosystem report cards to inform the Commission. He noted that the SCRS may engage experts in this particular field, which is the usual process when the SCRS does not have the necessary information or expertise. The SCRS intends to develop a draft road map from the scientific perspective, which will be informed by its review of the SCRS Strategic Plan for 2015-2020, and present this for the Commission's consideration.

There was a discussion about the benefits of EBFM versus the traditional focus on management of target species within ICCAT. It is important for CPCs to engage their stakeholder groups in this issue. Several CPCs mentioned the need to acknowledge the human component including by taking socioeconomic impacts into account. In the HCR/MSE process, socio-economic considerations are taken into account when management objectives and related performance indicators are established as well as when an HCR is selected based on MSE evaluation of management trade-offs. Once an HCR is selected, determination of TACs becomes more automatic. One CPC stated that if the Commission decides to adopt an EBFM road map, it should be comprehensive and incorporate all related activities. Dr Die invited participants to consider this and provide suggestions on how this topic should be handled in future SWGSM meetings.

12 Other matters

The Chair noted that [the Ad hoc Working Group on follow up of the Second ICCAT Performance Review](#) (Anon. 2017c), which met in Madrid, 27-28 June 2017 had identified the following recommendations of the 2016 Independent Performance Review for the SWGSM's consideration:

12 The Panel recommends that bigeye, which is fished in association with juvenile yellowfin and skipjack on FADs, should form part of the long term management strategy for the tropical tuna stocks. (short/medium timeframe)

18. The Panel recommends that yellowfin, which is fished in association with juvenile bigeye and skipjack on FADs, should form part of the long term management strategy. (short/medium timeframe)

21. The Panel recommends that skipjack, which is fished in association with juvenile yellowfin and bigeye on FADs, should form part of the long term management strategy. (short/medium timeframe)

47. The Panel recommends that ICCAT move away from the current re-active management to re-redress the status of stocks through re-building plans, to a more pro-active policy of developing comprehensive long term management strategies for the main stocks. Such management strategies would encompass management objectives, harvest control rules, the stock assessment method, fishery indicators and the monitoring programme. (short/medium timeframe)

48. The Panel recommends that ICCAT should prioritise the development of a long term management strategy for the tropical tuna stocks. (short/medium timeframe)

114. The Panel recommends that the Commission adopts specific management objectives and reference points for all the stocks. This would guide the SCRS in its work and increase the consistency of the SCRS advice. (short timeframe)

115. The Panel recommends that the development of harvest control rules through Management Strategy Evaluation should be strongly supported. (short timeframe)

It was recognized that the SWGSM, the SCRS and the Commission have already begun work on many of these recommendations and that they would be taken into account in future meetings of the SWGSM, consistent with the process that is determined when the Performance Review Working Group presents its report to the Commission at the 2017 Annual meeting.

13 Adoption of Report and adjournment

The Chair thanked the participants and asked the CPCs to consider their views on a future work plan for the SWGSM, consistent with its mandate as outlined in the terms of reference. The Chair noted that he would welcome any proposals in this regard in advance of the 2017 Annual meeting.

Dr Die encouraged greater input and participation from the managers during future presentations. This suggestion was welcomed, and there was general agreement that an informal dialogue between scientists and managers tends to be the most productive approach. It was agreed to adopt the report by correspondence.

The third meeting of the SWGSM was adjourned.

References

- Anon. 2014. Report of the 2013 ICCAT North and South Atlantic albacore stock assessment meeting (*Sukarrieta, Spain, 17-24 June 2013*). Col. Vol. Sci. Pap. 70(3): 830-995.
- Anon. 2017a. Report of the 2016 ICCAT North and South Atlantic albacore stock assessment meeting (*Madeira, Portugal - April 28 to May 6, 2016*). Col. Vol. Sci. Pap. 73(4): 1147-1295.
- Anon. 2017b. Report of the 2017 ICCAT albacore species group intersessional meeting (including assessment of Mediterranean albacore) (*Madrid, Spain, 5-9 June 2017*). Col. Vol. Sci. Pap. 74(2): 331-378.
- Anon. 2017c. Report of the meeting of the Ad hoc Working Group on follow up of the Second ICCAT Performance Review (*Madrid 27-28 June 2017*) (http://www.iccat.int/Documents/Meetings/Docs/2017_PERF_REP_ENG.pdf)
- Merino G., Kell L.T., Arrizabalaga H., Santiago J., Sharma R., Ortiz de Zarate V., de Bruyn P. 2017. Updated evaluation of Harvest Control Rules for North Atlantic albacore through Management Strategy Evaluation. Col. Vol. Sci. Pap. 74(2): 457-478.

Agenda

Introduction

This Tentative Agenda has been prepared in accordance with the Terms of Reference of the Standing Working Group to Enhance Dialogue Between Fisheries Scientists and Managers (SWGSM) (ICCAT Recommendation 14-13), taking into account the detailed program for its third meeting contained in ICCAT Resolution 16-21.

1. Opening of the meeting (Working Group Chair)
2. Adoption of agenda and meeting arrangements
3. Nomination of Rapporteur
4. SWGSM Terms of Reference (Rec. 14-13) and outcomes of 1st and 2nd SWGSM meetings, with emphasis on:
 - a. the development of a general framework to guide establishment, review and update of management objectives and strategies, which
 - i. is consistent with the Convention objectives, the ecosystem-based and precautionary approaches;
 - ii. defines the role and the responsibilities of both fisheries managers and scientists (SCRS) and possible interactions and feedbacks; and
 - iii. allows for reflecting both conservation and socio-economic considerations.
 - b. ways to improve managers and scientists' mutual understanding of concepts related to management strategies, including:
 - i. the adoption of Limit and Target Reference Points (LRPs and TRPs);
 - ii. the development of Harvest Control Rules (HCRs);
 - iii. the application of Management Strategies Evaluation (MSE).
 - c. the analysis of case studies, exchanges and feedbacks on ongoing experiences.
 - d. the identification of opportunities / approaches that would enhance the available data.
 - e. the identification of research needs and priorities, in the light of discussions on SCRS annual work programmes and on the Strategic Plan on Science and including possible social and economic research topics.
 - f. the promotion of an efficient use of scientific resources and information.
5. Status of the development of Harvest Control Rules (HCRs) and actions to be taken in 2017 for priority stocks identified in Rec. 15-07:

N-ALB:

- Status update on the testing of candidate HCRs through MSE

BFT:

- Status update on MSE-related work by the SCRS
- Consideration of management objectives
- Identification of performance indicators

N-SWO:

- Identification of the acceptable quantitative probability of achieving and/or maintaining the stock in the green zone of the Kobe plot and avoiding the limit reference point
- Identification of performance indicators

Tropical tunas:

- Identification of the acceptable quantitative probability of achieving and/or maintaining the stocks in the green zone of the Kobe plot and avoiding the limit reference point
 - Review of indicative performance indicators adopted in Rec. 16-01, Annex 8
6. Recommendations to the Commission on management objectives, performance indicators and HCR for stocks referred to under point 5.
 7. Review of the 5-year road map for the development of MSE/HCR for priority stocks
 8. Consideration of other stocks for possible addition to the 5-year road map
 9. Outcomes of the 2016 Joint Tuna RFMOs Working Group on Management Strategy Evaluation (MSE): SCRS Chair
 10. Outcomes of the 2016 Joint Tuna RFMO Working Group on Ecosystem Based Fisheries Management (EBFM)
 11. Development of a draft road map to implement EBFM, including roles and responsibilities
 12. Other matters
 13. Adoption of Report and adjournment

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Title: Introduction To Management Strategy Evaluation (MSE)

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Summary

Management Strategy Evaluation (MSE) involves using simulation to compare the relative effectiveness for achieving management objectives of different combinations of data collection schemes, methods of analysis and subsequent processes leading to management actions. MSE can be used to identify a 'best' management strategy among a set of candidate strategies, or to determine how well an existing strategy performs (Punt *et al.* 2014). Effective understanding and participation of the various ICCAT resolutions and dialogues depends on a working understanding of the basic terminology that is used within the resolutions and discussions.

At the very foundation of the MSE process lies an agreed upon and clear set of management objectives. For the MSE process to be most effective, these management objectives need to be established at the very beginning of the MSE process. The agreement upon the management objectives emerges from the development and maintenance of ongoing dialogue between scientists, managers, and stakeholders. This dialogue is critical to the communication and agreement upon a set of clear management objectives in that these objectives will be used to evaluate the performance of various management procedures under consideration. In the case of the ICCAT these management procedures are generally in the form of candidate harvest control rules (HCR). Meetings such as the Standing Working Group on Dialogue between Fisheries Scientists and Managers (SWGSM) create a unique opportunity for the development of the dialogue necessary to identify the set of management objectives that benefit the fishery as a whole.

It needs to be recognized that there is no one HCR that can fully achieve all stated management objectives simultaneously. Rather, the MSE process is designed to make obvious and clear the trade-offs associated with the various management objectives that results from the potential adoption of each of the candidate management procedures. The ability of MSE to facilitate fisheries management achieving its aims depends on how well uncertainty is represented, and how effectively the results of simulations are summarized and presented to the decision-makers. Key challenges for effective use of MSE therefore include characterizing objectives and uncertainty, assigning plausibility ranks to the trials considered, and working with decision makers to interpret and implement the results of the MSE.

**Update on progress and Work Plan for MSE conducted by
the SCRS on bluefin tuna, northern swordfish and tropical tunas**

David J. Die

Summary

The Commission adopted Rec. 15-07 to develop MSE processes for northern swordfish, bluefin and tropical tunas to evaluate the possibility of adopting HCR for such stocks. In 2016 the Commission adopted a more detailed work schedule to conduct such processes. The schedule calls for the SCRS to provide the earliest results of these evaluations by 2018 (bluefin tuna, western skipjack), 2019 (northern swordfish) and 2020 (bigeye, yellowfin, eastern skipjack).

Work on bluefin tuna has been proceeding on MSE since 2015, supported by the ICCAT GBYP. This work has progressed so that the basic components of the simulation framework are ready to implement the evaluation of HCRs. Further progress depends on the Commission providing guidance on management objectives, performance indicators and potential management procedures for bluefin tuna.

Work on northern swordfish only started in 2016 and is in the very basic stages of development. The SCRS has not yet defined the range of OMs that would have to be considered and the type of candidate assessment models that could be used in the management procedure. Further progress also depends on the Commission providing guidance on management objectives, performance indicators and potential management procedures for northern swordfish.

Work on tropical tunas is still in the planning stages. The tropical tuna Working Group will have the first focused discussions on MSE at its early September intersessional meeting. There is an expectation, however, that an initial MSE framework for western skipjack will be presented at that meeting. Further progress also depends on the Commission providing guidance on management objectives, performance indicators and potential management procedures for tropical tunas. A particularly important guidance required from the Commission regards whether the management procedure should be developed and tested for each tropical tuna stock, or whether a single management procedure that integrates management for the complex of bigeye, yellowfin and eastern skipjack should be developed and tested through MSE.

Up until a time the Commission provides the feedback required on management objectives, performance indicators and potential management procedures for these stocks, the SCRS will use performance indicators and type of HCR evaluated for northern albacore to guide the development of the MSE framework for the other species. To the extent possible, however, the SCRS is developing the MSE framework in such a way that other performance indicators and types of HCR can be accommodated in future analyses.

Progress on the evaluation of Harvest Control Rules for North Atlantic albacore through Management Strategy Evaluation

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Summary

ICCAT's management objective is to maintain high long-term catch with a high probability of stocks not being overfished nor overfishing occurring and a high probability of not being outside biological limits. To achieve this, Harvest Control Rules (HCRs) can be used to determine annual catch limits. HCRs need to be agreed by policymakers and understood and accepted by stakeholders, which is often difficult due to the many uncertainties inherent to fisheries. HCRs cannot be evaluated in isolation, and need to be linked to the data and assessment that will be needed to implement them. The combination of data, assessment method and HCR is known as Management Procedure (MP). MPs can then be tested by simulation through Management Strategy Evaluation (MSE) to estimate different levels of probability of achieving management objectives. Based on the feedback from ICCAT's WGSAM, Panel 2, albacore WG and SCRS, improvements have been made to the MSE framework presented in 2016 to provide updated evaluations of MPs that differed only on the HCRs (**Figure 1**). Improvements on the MSE included (i) extended grid of Operating Models, (ii) a modified Observation Error Model to generate CPUE series, and (iii) bounds to the TAC changes through HCRs. Results indicate that all the HCRs evaluated would allow achieving the management objective of $p(\text{Green}) > 60\%$ but would perform differently for other indicators. Detailed results for performance statistics requested by the Commission are provided in SCRS/2017/093. These results were reviewed in early 2017 by the SCRS WGSAM and albacore WG which provided feedback for the improvement of the presentations of results to the Commission and additional requests for diagnostics. Results suggest that the main trade-offs is between the probability of being in the green zone and the long term yield (**Figure 1**). Additional work on diagnostics of the MSE continues and these results are still to be reviewed by the plenary of the SCRS in early October. In spite of these limitations the research completed is a significant improvement on the work presented in the past to the Commission and are presented to the SWGSM meeting where the potential adoption of an HCR for the northern albacore stock will be discussed.

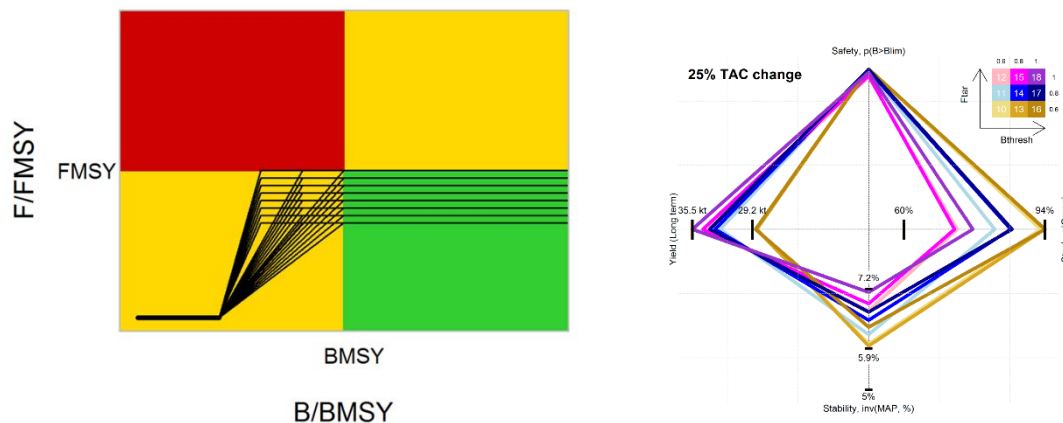


Figure 1. Type of harvest control rules evaluated for northern albacore (left panel) and example of graphical representation of trade-offs in performance indicators for a subset of the harvest control rules evaluated (right panel). Trade-offs are displayed in the main four axes of performance agreed by the Commission by using one indicator for each axis. Each line in the two panels correspond to a different HC

Recommendations relating to northern albacore (NALB)*Document presented by the Chair*

The SWGSM considered the progress to-date by SCRS on analyzing a range of HCRs using MSE. SCRS developed a total of 45 potential HCRs in line with the management objectives identified by Panel 2. The SWGSM recognized that analyzing the trade-offs between all 45 HCRs would be a difficult undertaking and, after further considering potential management priorities, agreed to reduce the number of HCRs to be further analyzed by SCRS and referred to Panel 2 for consideration in 2017 (i.e., candidate HCRs), as follows:

1. TAC between management periods should be set according to F in the candidate HCR or be modified by a condition stating that the maximum change in TAC between management periods should be 20% to prioritize stability (eliminate 25, 30%);
2. F targets of $[.8F_{MSY}]$, $[F_{MSY}]$; and
3. B thresholds of $[.8B_{MSY}]$, $[B_{MSY}]$.
4. When SSB is assessed to be below Bthreshold, F should be reduced linearly towards zero at SSB equal to Blim. To take account of the need for rapid management measures when the stock is assessed to be below Bthreshold, the stability clause should not be applied.

Given the above, the SWGSM agreed that:

1. SCRS should refine the MSE according to the recommendations from the WGSAM and the albacore Working Group and provide advice at the 2017 annual Commission meeting on short term (2018-2020) and long term TACs. In addition, the SCRS should advise on short and long term consequences in terms of status, safety, stability and yield for each of the candidate HCRs identified above using the 2016 assessment methods;
2. Subject to that advice, the Commission should select an HCR in 2017 to be applied on an interim basis pending further review of the MSE process;
3. The SCRS should consider the issue of exceptional circumstances and provide advice to the Commission on what might constitute “exceptional circumstances” that would result in suspending the application of the HCR, and establish some guidance on the alternative management response in those circumstances;
4. The HCR should be reevaluated after a period determined by the Commission.

In addition, the SWGSM recommended that:

1. An external review of the northern albacore MSE should be considered by the Commission, taking into account the advice of the SCRS on this subject. If such a review is conducted, this would ideally be completed in time for presentation to the SCRS in 2018 as this is both a best practice and recognizes that 2017 is the first time ICCAT has attempted to base management on such a tool;
2. The SCRS provide updated advice to the Commission in 2018, and the Commission consider any necessary adjustments to the HCR in line with SCRS advice.

Update on the work of the joint tuna RFMO Management Strategy Evaluation (MSE) technical Working Group

ICCAT Secretariat

Summary

The Joint Management Strategy Evaluation (MSE) Technical Working Group (TWG) was created during the Third Joint Meeting of Tuna RFMOs (the "Kobe process") in 2011 to support the implementation of the Precautionary Approach for tuna fisheries management. The TWG has previously reviewed the Kobe Advice Framework and how the adoption of MSE would change the way that risk and uncertainty is communicated. The WG had its first official meeting in Madrid from 1-3 November 2016. The objectives of the meeting were to: i) review current MSE practice, successes, failures and potential areas for collaboration; ii) discuss progress on MSE; and iii) identify future actions focusing on areas for collaboration. The workshop was organised around five themes, namely: 1) The MSE process and stakeholder dialogue, 2) Conditioning operating models, 3) Albacore case study currently underway across t-RFMOs, 4) Computational aspects and 5) Dissemination of results.

The TWG has not conducted a comprehensive review of the approaches and processes used when developing MPs across but agreed these should be developed. However, an initiative is needed to identify additional key issues required to further facilitate adoption of Management Procedures in the t-RFMOs. The Group reviewed the operating models (OMs) currently being developed across the t-RFMOs and found that the range of OMs examined were primarily based on assessment models. In some cases these OMs were developed to contain peculiarities of the stock/species not considered in the current assessment models runs, e.g. including spatial structure, as in the case of Indian Ocean skipjack and Atlantic Ocean bluefin tuna. The current approach using an assessment model as the basis for OM design is a good starting point, though further processes (observation error and ecological processes with time dependence) should be accounted for in OM designs to ensure robustness.

The albacore case study takes advantage of the relative advancement of MSE for several of the albacore stocks across t-RFMOs, and of the relative simplicity of the operating models required. The case study will provide an opportunity to collaborate across RFMOs by conducting comparative studies on worldwide albacore stocks. The study will allow experiences to be shared, and provide a test bed for method development allowing rigorous, transparent, and replicable testing of methods and software. Expected outcomes are improved collaboration on developing a common dialogue, new models and software, and promoting interdisciplinary work.

The TWG has agreed that software validation is important, and should include tests across platforms, open code, and complete traceability. The user interface <http://www.stockassessment.org> and the use of "Makefiles" was highlighted as an example of such an open and transparent framework, which could be used for both stock assessments and development of MSE. The need for communication and visualisation tools, such as standardised "shiny apps", was highlighted. Support for the development of those tools may be available from partner institutions and/or other organizations. The TWG agreed to continue to work intersessionally on methods development and on case studies; in addition the TWG will investigate holding an MSE/CAPAM workshop followed by a special issue in Fisheries Research in 2019.

Joint meeting of tuna RFMOs on the implementation of the ecosystem approach to fisheries management

ICCAT Secretariat

Summary

The Ecosystem Approach is a widely accepted concept for the management of living resources and its principles can be traced back to several international instruments. T-RFMOs are increasingly examining their governance systems to adopt EAF and EBFM related measures that enhance the management of their fisheries to be more compliant to mitigating impacts on target and bycatch species, their trophic relationships and habitat requirements. The Joint Meeting of tuna RFMOs on the Implementation of the Ecosystem Approach to Fisheries Management, initiated by ICCAT and supported by the Common Oceans ABNJ Tuna Project implemented by FAO and funded by the GEF, brought together scientists from the five t-RFMOs and national experts. The goals of the meeting were to (1) establish a sustained dialogue across t-RFMOs on the issues of EAF and its implementation, (2) understand common challenges in its implementation and (3) identify case specific solutions.

During the meeting, participants from each of the t-RFMOs presented a summary of the progress towards implementation of the EAF and EBFM and FAO presented the work of the organization on EAF. A comparative assessment of progress across the five t-RFMOs in implementing the ecological component of EBFM was also presented. In addition, Australian and US experiences in implementing the EAF and EBFM within their national jurisdictions were presented. It was noted that many of the elements necessary for an operational EAF or EBFM are already present in most t-RFMOs but challenges remain in implementing a holistic and integrative view of EAF and EBFM.

Key points discussed included (i) the common definition and understanding of how to operationalize EAF and EBFM in the context of tuna fisheries management and conservation, (ii) EAF and EBFM are management tools and can only be initiated at a Commission level not by the Scientific Committee or dedicated technical subcommittees or Working Groups, (iii) elements required for EAF and EBFM implementation are already in place, but may not be in line with a long-term vision of what needs to be achieved, (iv) implementation of EAF and EBFM will not involve a substantial amount of additional work and/or data, (v) the design and implementation of an EAF and EBFM plan is a participatory process involving managers, science and stakeholders and (vi) t-RFMOs will face some particular challenges due to their current structures, mandates and complexities.

Particular challenges relating to data, science and communications were also addressed by the Group which discussed some mechanisms and processes to move the implementation of ecosystem approaches in tuna-RFMOs forward. Of particular importance was the observation that bringing EAF and EBFM to the attention of decision makers in the respective Commissions and getting their commitment is considered crucial in moving forward towards EAF and EBFM implementation. Managers will need to be the drivers of the process. EAF and EBFM is first and foremost a management process. It was highlighted that science-management dialogues which are already established in t-RFMOs to convey scientific findings to managers could be used as a forum to discuss EAF and EBFM matters as is already happening in ICCAT.

Several thematic areas would benefit from collaboration among t-RFMOs. EAF and EBFM could be part of the agenda of a future Kobe meeting. A joint working group to deal with EAF and EBFM issues (similar to the ones on MSE, FADs, by-catch) could be a way to formalize collaboration between RFMOs to work on common elements.

Selecting ecosystem indicators for fisheries targeting highly migratory species

Maria José Juan-Jordá¹ on behalf of Consortium members^{2, 3, 4, 5, 6, 7}

Summary

Several international instruments have set the minimum standards and key principles to guide the implementation of an ecosystem approach for the management and conservation of marine living resources. The ICCAT resolution 15-11 and the 2015-2020 SCRS Science Strategic Plan have also established the main objective of advancing ecosystem based fisheries management to provide advice to the Commission. Yet these aspirations have not provided practical guidance on how to make operational an EAFM within ICCAT. The Specific Contract No. 2 under the Framework Contract EASME/EMFF/2016/008 provisions of Scientific Advice for Fisheries Beyond EU Waters addresses the current impediments and provides solutions that shall support the implementation of an Ecosystem Approach to Fisheries Management (EAFM) through collaboration and consultation with the key tuna RFMOs. This Specific Contract has three main objectives: (1) Provide a list of ecosystem indicators (and guidance for associated reference points) to monitor impacts of fisheries targeting Highly Migratory Species (HMS); (2) Provide criteria and guidelines to choose ecological regions with meaningful ecological boundaries for HMS and its fisheries in order to facilitate the operationalization an EAFM in marine pelagic ecosystems; and (3) Provide guidelines for an EAFM plan using two ecoregions as case studies within ICCAT and IOTC Convention areas. The results of this contract will be imbedded in the EAFM process that ICCAT is carrying out through a close collaboration and communication with ICCAT SCRS. Ultimately, the products created throughout this contract will aim to facilitate the linkage between ecosystem science and fisheries management to foster the operationalization of an EAFM.

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