Report of the Second Intersessional meeting of the North Atlantic Swordfish Management Strategy Evaluation (MSE) Technical Sub-group
(*Online, 4-5 September 2023)*

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

The meeting was held online on 4-5 September 2023. The Swordfish Species Group Rapporteur, Dr. Kyle Gillespie opened the meeting and welcomed the participants (the Group). Dr. Miguel Nives dos Santos, the ICCAT Assistant Executive Secretary, welcomed the participants and wished them success in their meeting. The Chair proceeded to review the Agenda which was adopted with minor changes (**Appendix 1**).

The List of Participants is included in **Appendix 2**. The List of Documents presented at the meeting is attached as **Appendix 3**. Document and presentation summaries are included in **Appendix 4**. The following participants served as Rapporteurs:

Item	*Rapporteur*
1.	N.G. Taylor
2.	K. Gillespie
3.	A. Hanke, K. Gillespie, T. Carruthers
4.	D. Rosa, R. Coelho
5.	S. Miller
6.	K. Gillespie, C. Brown
7.	K. Gillespie, C. Brown
8.	K. Gillespie, C. Brown
9.	N.G. Taylor

2. Review of the Swordfish Management Strategy Evaluation (MSE) framework and recent updates to Operating Model (OM) grid

SCRS/P/2023/095 provided an overview of the northern swordfish MSE framework and timelines, from inception in the mid-2010s via ICCAT Recommendations to the present MSE technical development. Operating model uncertainties were described including revisions made to the axes in 2023. The presenter described the management objective categories and subsequent development of performance metrics by the SCRS and Panel 4. CMPs were described, along with the process used to evaluate their performance relative to the reference set and robustness tests. The presenter noted that key technical elements would be described further in SCRS/P/2023/094.

The Group acknowledged the overview and noted the progress made to robustness tests and CMPs since the First Intersessional Meeting of the Swordfish Species Group (including MSE) (22-26 May 2023).

3. Candidate Management Procedure (CMP) development, results, and robustness testing

SCRS/P/2023/094 provided details on technical development of robustness tests, CMPs, and CMP performance testing since May 2023. Details on a new interactive Shiny application were provided. The App provides functionality for examining trade-offs among CMPs through a variety of figures.

Further explanation was provided for robustness test 3 (climate change impacts on recruitment) which uses the patterns found in historical Atlantic multi-decadal oscillation (AMO) trends to modulate recruitment in the projection period. The AMO patterns were used in order to draw on an example of a case from nature where an underlying trend is imposed on otherwise random variations; a relationship between AMO and recruitment deviations has not been demonstrated, nor is it being postulated.

The Group discussed the importance of clear communication of this test to Panel 4, and further noted that this is a complex issue and additional climate change testing would be required in 2024.

The Group reviewed the Shiny App and requested that the performance of the CMPs could be viewed by OM rather than across all reference OMs. It was also requested that the performance of several CMPs could be viewed in a single plot and that the data object could be downloaded in order to be able to create bespoke plots.

It was noted that there were some plotting issues for some CMPs, and a request was made to allow the user the freedom to specify the columns of the quilt plot. These changes to the App were made during the meeting.

The Group reviewed the details on the development of the R3a and R3b robustness OM's and discussed if they realistically captured variability in recruitment due to climate change processes. It was noted that the 2024 workplan would address the request of Panel 4 to develop realistic climate change OMs and that these robustness OMs could be viewed as a test on a CMP's ability to manage a population undergoing shifts in productivity. It was obvious that these particular OMs caused many CMPs to fail. Discussions on the role of the robustness OMs further clarified that they could be used to break ties between otherwise similarly performing MPs.

The developer demonstrated by comparing the performance of a constant catch MP with a constant harvest rate MP that, in fact, the responses reflected what we would expect from a properly constructed MSE framework.

The developers provided an overview of their CMPs, and it was noted that the objective for many of the CMPs was to reduce the variability in the input Catch per unit effort (CPUEs) before using them as a basis for making Total Allowable Catch (TAC) decisions. Some MPs attempted to use alternate indicators to the combined index to determine how this affected performance.

A large number of CMPs are in development, and for each, several variants. There was significant discussion on acceptable methods for culling CMPs. It was noted that Panel 4 is the ultimate decision-making body on CMP selection and that the methods employed by the technical team to cull CMPs would need to be transparent and well reasoned. Within the Group, there was support for striking a balance between selecting CMPs based on performance and selecting CMPs that represent a diversity of HCR strategies (e.g., model vs empirical; data sources; etc.).

CMPs developer provided a series of projection plot comparisons that illustrated CMP performance across reference and robustness scenarios, noting that among a set of similar CMPs, some tended to perform more poorly in some scenarios and thus should be considered for removal from the CMP list. It was noted that this "eyeballing" method, while informative, lacks an objective decision-making procedure. The technical contractor noted that functionality could be developed in the Shiny App for making pairwise comparisons among CMPs that would allow for evaluation of a CMPs performance relative to others for a given set of performance metrics. These changes were made to the app during the meeting.

The Group reviewed various methods for filtering and culling CMPs to create a shortlist that is to be considered by Panel 4. It was noted that there is some uncertainty in exactly how the variability metrics were being calculated and it was suggested it may be more appropriate to calculate variability as a mean rather than as a median. The Group agreed that the core technical team would formalize a decision tree after closure of this meeting that would be used for selecting a CMP shortlist.

4. Updates to the Combined Index

Presentation SCRS/P/2023/096 provided an overview of the combined CPUE index that has been developed over time for the North Atlantic swordfish stock, as well as the ongoing work to update the index with the most recent data, until 2022. The current work uses detailed raw data from several CPCs, that is complemented with ICCAT Task 2 data in cases where such raw data is not available or cannot be provided. The presenter noted

that for this CPUE update, there is the desire to maintain all previously estimated year parameters fixed, so that the index updates only the most recent years of data, in this case 2021 and 2022. For that, a Bayesian GLM approach is being explored.

The Group requested that besides the Bayesian model, to also run a model without fixed parameters and allow a complete re-estimation of all parameters, for comparison purposes. The presenter confirmed that such comparative work is being done and will be provided.

The Group noted that such an approach of fixing previous year parameters is something relatively new in the ICCAT Species Groups, that will likely have to be analyzed in further detail. From a statistical point of view, fixing those previous years parameters can be problematic, regardless of being done in a frequentist or Bayesian approach. The main advantage of the method is that the new model is consistent with the previous years, as only the new year parameters are allowed to be freely calculated. However, one important caveat is that by maintaining most model parameters fixed, the new model can only account for the new year parameters to explain the variability in the new data. This means that the new model is not necessarily the best fitted model. The Group recommended that WGSAM discusses this issue of updating CPUE standardized series maintaining the previous years fixed, that will be similar across the various ICCAT Species Groups that are developing MSEs that need updated CPUE indices.

5. Communications/Ambassador material

The Group discussed the summary document that will be produced as a key input for the October Ambassador and Panel 4 meetings. The summary will then be updated in advance of the 28th Regular Meeting of the Commission (November 2023), if necessary. There are two options for the structure of the document: 1) update the summary from the Second Intersessional Meeting of Panel 4 on North Atlantic Swordfish MSE (30 June 2023) ('North Atlantic Swordfish MSE: Background, Structure, Preliminary Results and Key Decisions' PA4_JUN_02_ENG.pdf) with the draft final results and current key decisions; or 2) reconfigure the document to be a decision guide, removing the background information and presenting the key decisions in a stepwise fashion, paired with the results relevant to each specific decision.

The aim is to finalize the summary by 19 September 2023, the final day of the Swordfish Species Working Group, once the CMP list has been narrowed. This will enable timely translation in advance of the Second Ambassadors webinar on Northern Atlantic Swordfish MSE (N-SWO MSE) (5 October 2023).

6. Identification of matters to discuss with Panel 4

The Chair reminded the Group of the interactions and collaboration between the SCRS and Panel 4 in 2023 with regard to SWO MSE development. In two previous Panel 4 meetings, the SCRS worked with the Panel 4 Chair to develop meeting agendas that reflected important decision items and feedback needed from the Panel. The meeting Chair presented an early draft of candidate items for inclusion in the agenda for the upcoming Third Intersessional Meeting of Panel 4 on North Atlantic Swordfish MSE (10-11 October 2023), reminding the Group that consultation with the Panel 4 Chair on these items was still ongoing. The tentative set of materials included a review of decision items and work requested by Panel 4 at the June 2023 meeting, an update on progress for that work, CMP results and robustness testing, key decisions to be taken by Panel 4, and development of a management measure. The proposed agenda outlined additional details on decisions needed from Panel 4 on MP selection, including: operational management objectives, management cycle length, minimum TAC change thresholds, and an MP implementation schedule. The Group noted that time limitations may constrain the ability to conduct a significant amount of further work while maintaining the workplan deadlines.

7. Workplan (short and long term)

The meeting Chair presented a workplan for the technical team for the remainder of 2023 and for 2024. The short term workplan contained tasks needed for the development of analyses and materials that would support Commission decision making on final MP selection at the 2023 Annual meeting. These tasks include selecting a shortlist of CMPs for consideration by Panel 4; finalizing an SCRS paper that describes the CMP shortlist including CMP formulas, harvest control rules (HCRs), and data sources; development of additional robustness scenarios; refinement of the Shiny App; and advancement of communications materials needed for the remaining Second Ambassadors webinar on Northern Atlantic Swordfish MSE (N-SWO MSE) and the Third Intersessional Meeting of Panel 4 on North Atlantic Swordfish MSE in October. Noting the complexity of some of the robustness scenarios, the Chair suggested that analysis supporting these tests continue into 2024, particularly with regard to testing for climate change, minimum size limit, steepness and length composition scenarios. Additional work is also needed in 2024 on an exceptional circumstance (EC) protocol, noting that EC materials have already been developed for northern albacore and bluefin tuna, and that these protocols may serve as a template for a protocol for northern swordfish MSE. The SCRS Chair reminded the Group of the need for interactions with Panel 4 on these materials and indicated that the Group should plan accordingly with their meeting requests for 2024.

The Group emphasized the need to complete a number of items in order to be able to implement CMPs. First, the combined index needs to be completed for 2022. In addition, come CPCs may need to update their CPUE series in order to be able to apply a subset of CMPs. Any CMPs requiring updated CPUE series that cannot be updated in the short term, cannot proceed forward. CMP developers need to verify that strict updates of CPUE series needed for the application of their CMP can be made available before the SCRS plenary.

8. Other matters

The Group discussed that a script needs to be developed to run the selected CMP once adopted. The associated description of the CMP (summarizing how it computes the TAC, etc.) will need to be written in a format suitable to be appended to the Northern Atlantic Swordfish Recommendation that is going to prescribe the TAC once the CMP is implemented.

9. Adoption of the report and closure

The Chair thanked the Group for their contributions to the meeting, making special reference to the SWO MSE core technical team and technical contractor for their hard work in 2023. Further thanks were given to the meeting rapporteurs and the ICCAT Secretariat for their meeting support.

References

Gillespie, K., Ortiz, M., Su, N. J., Coelho, R., & Ikkiss, A. (2022). Updated combined biomass index of abundance of the North Atlantic swordfish stock 1963-2020. Collect. Vol. Sci. Pap. ICCAT, 79(2), 565-587.

Appendix 1

Agenda

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

2. Review of the Swordfish Management Strategy Evaluation (MSE) framework and recent updates to Operating Model (OM) grid

3. Candidate Management Procedure (CMP) development, results, and robustness testing

4. Updates to the Combined Index

5. Communications/Ambassador material

6. Identification of matters to discuss with Panel 4

7. Workplan (short and long term)

8. Other matters

9. Adoption of the report and closure

Appendix 2

List of participants[1] *

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Appendix 3

List of Presentations

Doc Ref	*Title*	*Authors*
SCRS/P/2023/094	Evaluation of Performance of Candidate Management Procedures for the North Atlantic Swordfish MSE	Hordyk A.
SCRS/P/2023/095	Review of the NSWO MSE framework and recent interactions with Panel 4	Anonymous
SCRS/P/2023/096	Method for updating the North Atlantic swordfish combined index	Anonymous
SCRS/P/2023/097	SP, EA, WA, AT, FX MPs	Hanke A.

Appendix 4

SCRS Presentation Abstracts as provided by the authors

SCRS/P/2023/094 provided a summary of the initial results of the candidate management procedures (CMPs) that have been developed and tested in the North Atlantic swordfish management strategy evaluation. The CMPs were tuned to three levels (0.51, 0.60, and 0.70) for the PGK_short performance metric (probability of being in the green area of the Kobe space over the first 10-years of the projections) across the nine Reference operating models. The central operating model from the Reference set was chosen to be used for the Robustness tests. Five robustness tests were considered. The first two robustness tests looked at the consequences of hyperstability in the indices of abundance, both for the historical and projection periods (R1) and only for the historical period (R2). The next two robustness tests evaluated the consequences of a cyclic recruitment pattern (R3a) and an extended period of negative recruitment deviations (R3b). The final robustness tests considered illegal, unreported, and unregulated catches, where the actual landings were consistently 10% higher than the specified TAC. The results from these analyses were presented in an online app that allowed the Group to interactively explore the performance of the CMPs across the Reference and Robustness operating models.

SCRS/P/2023/095 provided an overview of northern swordfish MSE development. Technical work began in 2018 and in subsequent years the operating model grid has been revised, now including steepness and natural mortality as the axes of uncertainty. Five additional robustness OMs/tests are included that span uncertainty in retention and discarding mortality, climate change impacts on recruitment, TAC implementation, and management cycle length. Performance metrics have been developed in collaboration with Panel 4. Final CMP results are to be presented to the SCRS and Panel 4 later in 2023.

SCRS/P/2023/096 provided an overview of the northern swordfish combined index which serves as an important data source for several CMPs in development for the MSE. A method for updating the index with data to 2022 is presented. The updated model will use informative priors for parameters used to standardize the index, including year factors up to 2020.

SCRS/P/2023/097 used 4 trade-off scenarios to identify CMPs meeting or exceeding threshold values for PGK, TAC_short, TAC_medium, nLRP, MaxVarC and VarC. These values were 0.6, 10,770 MT, 10,770 MT, 0.85, 0.25 and 0.06.