

**REPORT OF THE SECOND 2020 INTERSESSIONAL MEETING OF
THE ICCAT SWORDFISH MSE TECHNICAL GROUP**

(Online, 23-24 November 2020)

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

The online Swordfish MSE Technical Group (“the Group”) meeting was held from 23 to 24 November 2020. Kyle Gillespie (Canada), the Rapporteur for the North Atlantic swordfish stock, opened the meeting and served as Chair.

On behalf of the Executive Secretary, the Assistant Executive Secretary and the Chair of the Standing Committee on Research and Statistics welcomed the participants to the meeting. The Chair proceeded to review the Agenda which was adopted after minor changes (**Appendix 1**).

The List of Participants is included in **Appendix 2**. The following served as rapporteurs:

<i>Sections</i>	<i>Rapporteur</i>
Item 1	N.G. Taylor
Item 2	R. Coelho, A. Hanke
Item 3	N.G. Taylor, M. Ortiz
Item 4	S. Miller
Item 5, 6	K. Gillespie
Item 7	N.G. Taylor

2. Update on the OM reference grid and model validation

2.1 OM fits, validation, and red face tests

Paper SCRS/2020/155 examined the marginal impact the 7 axes of uncertainty have on the predicted stock dynamics, and the performance of 5 reference management procedures. The results indicate that 6 of the 7 factors have a significant impact on either the estimated stock dynamics or the likely performance of candidate management procedures (CMPs). One axis, which has two levels in the assumed coefficient of variability in the CPUE indices used in the model conditioning, did not have a significant impact on the estimated stock status and the performance of the 5 reference management procedures. These results suggest that removing this axis from the uncertainty grid would have little impact on the evaluation of candidate management procedures for this fishery.

The Group commented that for the non-influential variables, while the central tendency looked very similar, there seemed to be a little more spread in some of the levels of those variables. As such, an indicator of variability should also be used and compared in addition to the central tendency seen in the boxplots. The author acknowledged that different performance metrics can be calculated and used, and that this paper was to start looking and determining which variables had more impact and should be considered to move forward, versus others that seem to have less impact and could be simplified.

The Group further noted that such variability could be related with interactions between variables. Such interactions could be considered and tested within the ANOVA analysis that is being used or, if needed, expanded into more general GLM. As an example, we know that natural mortality and steepness interact with each other; such interactions could be tested for the other variables, even those that at this point seem to be less influential (such as CPUE CVs).

The Group also pointed that the lack of significance in variables such as CPUE CV or ESS could be because in the OM grid all the values are changed by the same amount at the same time. In that case we could consider expanding the CPUE CVs and/or ESS values more to make sure we cover the appropriate range. And as commented previously, there could also be an interaction between CPUE CV and ESS, that would be worth testing. The Group also proposed that the CPUE CV axis remain in the grid. There is no pressure to remove it and it may prove useful for the pending conditioning of the OM grid. Moreover, testing future

CMPs may yet show which axes, including CPUE CV, are important. The Group agreed to revisit this axis of uncertainty after re-running the grid with the new minimum size limit analysis (discussed below).

The Group also commented that in addition to the performance metrics now used in this paper, it would be important to further analyze other metrics with regards, for example, to safety and stability. The Group agreed to look and explore/borrow from what is being used in the BFT MSE indicators.

The Group then discussed the way forward. After testing for those interactions and taking into account the effects on variability, if those variables are still not significant, then they could be simplified to a base case level only. One alternative is to select which level shows the widest range in variability. In that sense, the Group agreed that this paper would be a good framework to evaluate the OM, and especially with regards to which variables could eventually be simplified.

It was noted that the detailed reports (one report for each OM) have not been changed since the last meeting. However, those will be changed after running the new OM with the new base case that assumes 88% mortality at time of discard (Coelho and Muñoz-Lechuga, 2019). The Summary report will also be updated with the information now coming from this meeting.

Finally, the Chair reminded the Group about the red-face tests that were agreed at the last meeting. At this point the Group did not have any additional comments on those tests.

2.2 OM grid updates, alternative axes of uncertainty, robustness OMs

SCRS/2020/159 provided an update on migrating the existing SS population model to the latest version of SS. Furthermore, the assessment model was configured to reflect the impact of the minimum size limit and discard mortality on the MSY reference point, yield and stock status.

The Group reviewed the progress of migrating the 2017 SWO assessment model from SS version 3.24 to version 3.30. It was noted that the translate function migrated the model specifications and data without issue and the resulting outputs of trends in SSB, recruitment, B/B_{MSY} and F/F_{MSY} were identical to those provided by the 2017 assessment model.

The SWO population model was configured to mimic 3 alternative states of the fishery: a) full retention of all undersized fish (no discarding); b) fleet-specific observance of a minimum size threshold (119 or 125 cm but without a 15% allowance) with no mortality of the discards; and c) similar to b) but with 88% mortality on the discards. The Group noted these scenarios may not reflect the full effect of the management measure and that CPCs may have imposed time-area closures on their fleets in order to limit impact on undersized SWO and/or that the selectivity of the gear may have been changed by, for example, using circle hooks, changing the depth of the hooks or changing the leader material. Consequently, it was requested to characterize the fishing behaviour and management by CPCs before and after the minimum size measure was implemented.

SCRS/2020/156 evaluated 4 alternative minimum-size-mortality scenarios in conjunction with the axes of uncertainty considered in the SWO MSE.

The Group discussed other alternative minimum size scenarios that could be characterized, the work involved, and whether to include these in the current OM grid.

The Group discussed the effect of management measures given the current size limit. It was indicated that changes in fishing practices resulting from the implementation of the size measure could be modeled provided that the estimate change in selectivity could be defined. There was interest in contrasting different selectivity curves in an MSE context since it has implications with respect to the productivity of the stock but this should be reviewed in a robustness OM prior to committing them to the OM grid. It was indicated that while selectivity scenarios can be created and tested that they need to be evaluated against our status quo assumptions about selectivity.

It was also discussed if consideration should be given to size-class-specific discard mortality rates and whether the 88% discard mortality rate was sufficient to cover both the mortality occurring at haulback and the post release mortality of discards. It was concluded that the Group will need to define all the relevant minimum size hypotheses and the appropriate characterization of the fishery for review. The Group was reminded of the alternative hypotheses that were defined at a previous meeting of the SWO MSE Technical

Group along with other scenarios that could be implemented as robustness OMs. The developer indicated that all the scenarios that have been proposed, including those related to the minimum size measure would be possible to implement, however, it was cautioned to consider the value of each in light of the other MSE work that needs to be done. It was noted that characterizing other hypotheses relevant to the current minimum size, i.e. modeling how it affects the dynamics assumed in operating models, is a longer term process that is outside the scope of the current workplan.

It was recommended that the minimum size model developed (with 88% mortality on undersized fish) should become the new base case model for future assessments as well as the base model for the OM grid. The Group will initiate work on adapting the OM grid to include minimum size dynamics. It was considered that the lack of a proper characterization of fishing practices would not affect this proposal but it was deemed necessary that the SWO Species Group make the final decision.

3. Updates on the development of preliminary CMP

3.1 CMP development

There have been very few changes on the development of Candidate Management Procedures since the last meeting. It was noted that some examples of CMPs were presented by the Contractor (SCRS/2020/155) for testing and preliminary evaluation of the axis of uncertainty grid of OMs and could be used as the basis for further development. While the MSE Contractor had provided some example CMPs, the primary responsibility for developing CMPs lays with national scientists. The Chair requested that volunteers contact the SWO MSE Technical Group Chair and the MSE Contractor if they wished to develop CMPs and help implement their testing. Canada expressed interest developing a CMP.

3.2 Scoping of robustness OMs and interactions with CMPs

SCRS/2020/157 showed an initial evaluation of a set of four uncertainty scenarios that evaluated the same set of management procedures for each. The analysis showed that that spatial structure and movement patterns had only a small impact on the expected performance compared to the base case OM. However, cyclic recruitment patterns, increasing catchability had the biggest impact on the performance of simple index-targeting MPs; directional changes in implementation error are likely to have a bigger impact on performance. The Group discussed the presentation and inquired if CMPs could be developed that combined some of the features of a model-based and index-based MP. It was noted that if the Group maps out the full range of uncertainties that it considered to be important then CMPs could be developed and their performance evaluated accordingly.

4. Updates on points of discussion for future interactions with the Commission

4.1 Timelines for interactions with PA4/Commission

The Group discussed the input needed from Panel 4 on the MSE, noting that there is a Panel 4 meeting tentatively scheduled for July 2021, with one swordfish MSE intersessional meeting planned in the interim (tentatively June 2021). The Chair initiated the conversation by presenting the draft list of required feedback topics developed at the June 2020 intersessional meeting, namely: a) guidance on developing an exceptional circumstances protocol (ECP), including the range of appropriate management responses should exceptional circumstances be identified; b) whether the Group should assume continuation of the 0.4 B_{MSY} interim limit reference point (Rec. 13-02) when evaluating candidate management procedures; c) whether the Commission has a preference for empirical or model-based MPs; and d) which operational management objective and performance measures/associated indicators the Group will develop.

On exceptional circumstances, the Group had decided in June to start with the ECP developed for northern albacore and modify it to incorporate knowledge about swordfish biology and population dynamics. Since the albacore group has not worked on its ECP in recent months, the Group decided to proceed with its own analyses, forming a small group to explore the issue between now and the next intersessional meeting in June 2021 to develop content to present to the Panel 4 intersessional meeting.

On the issue of limit reference points, the Group agreed that the typical definition of a limit reference point is the point of recruitment impairment. However, it was noted that ICCAT might not operationally view it as such and may not have set the interim reference point based on that understanding. Some argued that setting the limit should be based entirely on biology and thus was under the jurisdiction of the SCRS, while others argued that the point of biological vulnerability was heavily dependent on assumptions of e.g., steepness and natural mortality, and thus a limit reference point should only be set within the context of a specific OM as part of MSE testing. The Group agreed that the issue of limit reference points, including their definition and application in an operational sense required additional exploration and clarification. This should be an agenda item for the June intersessional meeting.

Regarding the question of a preference for empirical versus model-based MPs, the Group agreed to strike this request for 2021 feedback in order to prioritize the other issues. It was pointed out that the Panel 4 intersessional meeting is likely to have a heavy focus on shortfin mako, so swordfish inquiries should be limited to the most critical issues. Furthermore, the Group is likely to evaluate both empirical and model-based options, so the Commission can provide feedback at a later date.

Following the discussion about the limit reference point, the Group agreed to add a third question on how the Commission defines risk tolerance (e.g., in the case of breaching a limit reference point).

To conclude the agenda topic, the Chair recalled the matters for Panel 4 completion in 2021, either intersessionally or at the annual meeting, as set out in the MSE workplan. These include a) recommending operational management objectives, with associated performance metrics; b) reviewing MSE progress and example CMP results and providing feedback to the SCRS; and c) providing guidance on exceptional circumstances, including the range of appropriate management responses should exceptional circumstances be identified. The Group agreed that these workplan tasks remain valid for 2021. The Group also recalled a small group was formed at the June 2020 intersessional to explore operational management objectives and corresponding performance metrics beyond those default metrics already included in the model. The small group has not yet met so was tasked with carrying out their work and reporting to the tentatively scheduled June 2021 intersessional meeting. That will allow the Group to review the findings and prepare potential content for the July 2021 Panel 4 meeting.

4.2 MSE & assessment advice intervals

The current MSE framework assumes that MPs get applied annually, so the Group discussed the need for Commission feedback on this issue. Assessment/advice frequency and advice intervals have both scientific and management components, so will require Commission input, ideally based on scientific analyses.

The Chair noted that North Atlantic swordfish assessments are currently conducted once every three to four years and then outlined a potential schedule for MP implementation. The proposal was for a 3-year MP cycle in which an initial total allowable catch (TAC) would be set, and then the TAC would be increased or decreased for the next two years of the cycle in accordance with the index values. Assessments would occur every 5 or 6 years to confirm MP performance. Some noted that this annual TAC change would add flexibility to the process, potentially improving MP performance (as indicated by Huynh *et al.* 2020), but that the Commission might prefer 3-year static TACs. It was noted that lags in data and indices could impact this approach (e.g., current assessments often operate with a 2-year lag). Further, this approach would assume annual updates to the indices, which has not been the practice for swordfish.

The SCRS Chair reminded the Group that the 2021 SCRS workplan is under revision by the Commission and still uncertain. It is not necessary to make a decision on advice intervals at this time. Recognizing that advice intervals and data lags can be evaluated within the MSE, the Group agreed to produce some preliminary results on the effects of MP intervals before seeking input from Panel 4.

5. Workplan for the 2021 MSE contract

A tentative MSE workplan for 2021 (**Appendix 3**) was presented to the Group. It was noted that the scope and timing of workplan items is contingent on guidance from the Commission on, for example, whether a SWO stock assessment takes place in 2021. There was discussion on prioritization of workplan items and the Group adjusted timelines to reflect provision of guidance to Panel 4. It was noted that the Commission

MSE roadmap indicates that the SCRS initiate an independent peer review of the MSE code in 2021. The Contractor indicated that the MSE code is ready for review. The Chair and the SWO Species Group coordinator will consult with the Secretariat on funding for the review and will develop ToRs.

6. Other matters

The Contractor noted that updating the combined index (Ortiz *et al.* 2017) (that is not used in the conditioning but is used in MP application) would not require re-conditioning the OMs. The Group recommended that updated catch data be included along with an update to the Combined Index using data until 2019. The Group proposed deferring a decision on updates to fleet-specific indices and new size data to the June SWO intersessional meeting, noting that these indices were not required for MSE forecasting, however regional indices might be used to verify whether the 2017 Kobe matrix TACs could be supported.

In addition, the Group agreed to review the schedule of other MSE processes under way to evaluate how synchronous MSE updates are likely to be at the Commission and provide advice on how this issue should be taken into consideration by the Commission.

7. Closure

The Chair thanked the Group for their engagement and the excellent discussion during this meeting, despite the added difficulties of teleconferencing. The Chair noted the efforts and contributions from both the ICCAT Secretariat and the SWO MSE Contractor. It was noted that the small groups (**Appendix 4**) formed during this meeting will continue their work intersessionally and will update the SWO Species Group at the 2021 intersessional meeting.

References

- Coelho, R., Muñoz-Lechuga, R. 2019. Hooking mortality of swordfish in pelagic longlines: Comments on the efficiency of the minimum retention sizes. *Reviews in Fish Biology and Fisheries*, 29(2), 453-463. <https://doi.org/10.1007/s11160-018-9543-0>.
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- Ortiz, M., Mejuto, J., Hanke, A., Ijima, H., Walter, J., Coelho, R., Ikkiss, A.I. 2017. Updated Combined Biomass Index of Abundance of North Atlantic Swordfish Stock 1963-2015, *Collect. Vol. Sci. Pap. ICCAT*, 74(3): 1275-1294.

Appendix 1

Agenda

1. Opening, adoption of agenda and meeting arrangements
2. Update on the OM reference grid and model validation
 - 2.1. OM fits, validation, and red face tests
 - 2.2. OM grid updates, alternative axes of uncertainty, robustness OMs
3. Updates on the development of preliminary CMPs
 - 3.1. CMP development
 - 3.2. Scoping of robustness OMs and interactions with CMPs
4. Updates on points of discussion for future interactions with the Commission
 - 4.1. Timelines for interactions with PA4/COMM
 - 4.2. MSE & assessment advice intervals
5. Workplan until the end of the 2020 MSE contract
6. Other matters
7. Closure

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Appendix 3

MSE workplan for 2021

Task	Completion timeframe	Responsibility
Update OM Reference grid to SS3.30 & conditioning	February 2021	Schirripa, Rosa, Contractor, Gillespie
Finalize OM Reference grid with improvements identified in previous phase	Ongoing (Updated grid: early 2021)	Contractor
Identification and implementation of Robustness OMs	June 2021	Contractor with collaboration from TT
Formalize red-face tests for OMs and evaluate grid	March 2021	Small group: Chair <i>et al.</i>
Development of CMPs & selection of index	Ongoing	National Scientists, Contractor
Tuning of proposed CMPs	Late 2021 (after feedback from PA4)	National Scientists, Contractor
Determine how CMP performance will be evaluated (reference & robustness OMs)	June 2021	Small group to finish development of additional PMs & performance indicators
Test the robustness of the projections and cMPs to data lags and gaps	June 2021	Contractor with collaboration from TT
Evaluation of CMPs against performance metrics	Late 2021	Contractor with collaboration from TT
Develop proposal for exceptional circumstances	June 2021	SMO MSE TT led by small group
*Prepare updates/inputs for the Dialogue with Commission Panel 4 on management objectives	July 2021 (to coincide with SWO MSE intersessional)	Contractor with collaboration from TT
Contractor to attend and provide updates at both the Dialogue, Intersessional and Species meetings	As needed	Contractor
Contractor prepares reporting and SCRS drafting/submissions	Ongoing	Contractor with collaboration from TT
Independent peer review of MSE code (as per SCRS MSE roadmap)	September 2021	Chair, SWG Coordinator, Secretariat
Misc: Webinars, contingencies, individual calls/support with MSE package	As needed	Contractor

*Note: PA4 tentatively scheduled for July 2021. As per MSE roadmap: *Commission will adopt operational management objectives, building upon the conceptual objectives agreed in Res. 19-14, and associated performance indicators in 2021.*

Appendix 4

Study groups

Subgroup	Description	Membership
Performance metrics	Develop candidate performance metrics	Nathan Taylor (lead); Nicholas Duprey; Alex Hanke; Craig Brown; Michael Schirripa; Kyle Gillespie; Rui Coelho; Daniela Rosa; Adrian Hordyk
CMP development	Develop candidate	Alex Hanke; Kyle Gillespie; Adrian Hordyk; additional participants to be determined
Panel 4 preparation	Develop items for discussion at PA4 (e.g. exceptional circumstances)	Kyle Gillespie; Rui Coelho
OM red face evaluation	Formalize red-face tests for OMs and evaluate grid	Kyle Gillespie; additional participants to be determined

SCRS Paper Abstracts

SCRS/2020/155 - An MSE framework is being used to evaluate the performance of candidate management procedures (cMPs) for the North Atlantic Swordfish fishery. A base case operating model (OM) has been developed based on the most recent (2017) stock assessment. An uncertainty grid with systematic variations in seven key assumptions in the base case OM has been developed, resulting in an uncertainty grid with 288 OMs. This analysis examines the marginal impact the 7 axes of uncertainty have on the predicted stock dynamics, and the performance of 5 reference management procedures. The results indicate that 6 of the 7 factors have a significant impact on either the estimated stock dynamics or the likely performance of cMPs. One axis, which has two levels in the assumed coefficient of variability in the CPUE indices used in the model conditioning, did not have a significant impact on the estimated stock status and the performance of the 5 reference management procedures. These results suggest that removing this axis from the uncertainty grid would have little impact on the evaluation of candidate management procedures for this fishery.

SCRS/2020/156 - No summary provided by author.

SCRS/2020/157 - A broad range of hypothetical scenarios are developed for four key uncertainties related to the conditions of the swordfish fishery in the future: 1) spatial structure and movement patterns, 2) environmentally-driven cyclic patterns in recruitment deviations, 3) persistent increases in catchability, and 4) implementation error in the catch advice. Operating models (OMs) are constructed by modifying the North Atlantic swordfish base case OM with assumptions spanning a broad range of uncertainties for each scenario. A management strategy evaluation (MSE) framework is used to evaluate the performance of a set of reference management procedures (MPs) spanning the typical range of MP types against a set of performance criteria. The results are compared to those from the base case OM. The study found that spatial structure and movement patterns were least consequential compared to the base case. Cyclic recruitment patterns and increasing catchability had the biggest impact on the performance of simple index-targeting MPs. The results can be used to identify the key uncertainties for this fishery and prioritize future research on areas that are most consequential for MP performance and selection.

SCRS/2020/159 - Updates to the modeling platform used to assess the North Atlantic swordfish stock (Stock Synthesis) have been made. In order to take advantage of this update and to be fully aware of any changes to the assessment the update might have, a comparison between the older version of Stock Synthesis (version 3.24) and the updated version (version 3.30) was made. The updated version of the software gave essentially identical results than did the previous version. This updated model was used to assess the outcomes of having a full retention fishery, the current minimum size regulation with 0% discard mortality, and with a, 88% discard mortality. The model using full retention resulted in a lower retained maximum sustainable yield than the 0% discard mortality, but higher than the model assuming 88% discard mortality. Furthermore, the model using full retention required a larger stock size to account for the observed landings, but lower than the model assuming 88% discard mortality. These results are only valid under the assumption that selectivity of undersized fish does not change because of the size regulation.