

**Report of the First Intersessional Meeting of the
North Atlantic Swordfish MSE Technical Sub-group**
(Online, from 25 to 26 January 2023)

The results, conclusions, and recommendations contained in this report only reflect the view of the Swordfish Species Group. Therefore, these should be considered preliminary until the SCRS adopts them at its annual Plenary meeting and the Commission revises them at its annual meeting. Accordingly, ICCAT reserves the right to comment, object and endorse this report, until it is finally adopted by the Commission.

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

The Assistant Executive Secretary opened the meeting on behalf of the Executive Secretary. He welcomed the participants to the meeting as the first of a larger set of meetings related to swordfish scheduled for 2023. He reminded the participants that the primary objective for the meeting should be to prepare for the [First Intersessional Meeting of Panel 4 on North Atlantic Swordfish MSE](#) (Online, 6 March 2023). The SCRS Chair reviewed the Agenda. It was adopted without changes (**Appendix 1**). The List of Participants is included in **Appendix 2**. The list of SCRS documents and presentations presented at the meeting is attached as **Appendix 3**. The abstracts of all SCRS presentations or documents presented at the meeting are included in **Appendix 4**. The following served as Rapporteurs:

Section Rapporteur

1. Taylor, N.G.
2. Brown, C.
3. Brown C.
4. Taylor, N.G., Cass-Calay, S., Hanke, A.
5. Miller, S
6. Brown, C., Ortiz, M.
7. Hordyk, A.
8. Taylor, N.G.
9. Taylor, N.G.

2. Review of the Swordfish MSE framework and recent updates to OM grid

A brief overview of the history and current state of the North Atlantic Swordfish MSE process was presented to the Sub-group (SCRS/P/2023/001). The presentation described the development of the MSE framework and the construction and refinement of the operating model (OMs) uncertainty grid over the last five years. The specifications and assumptions of the reference and robustness OMs were described, as well as an outline of the outstanding decision points that will be discussed at this meeting. Finally, the presentation gave an overview of the material that will be presented to Panel 4 and described the next steps to complete the management strategy evaluation (MSE) process for recommending a candidate management procedure (CMP) to be implemented into the fishery in 2024.

The Sub-group did not identify any concerns regarding the current reference grid or robustness set of OMs and agreed that these could form the basis for the testing of CMPs. Discussion was limited, as the discussion on most of the topics that were raised was deferred to the relevant sections under items 4 and 5 of the report.

3. Review of CMP development

SCRS/P/2023/002 described how fishery data is used by the CMPs in the MSE framework. The primary sources of data are the historical catches and the combined index. The individual fleet CPUE indices are also available in the MSE framework for the CMPs to use if required. The process for generating these data in the projection period was described to the Sub-group, including a description of how the observation error is generated based on the statistical properties (standard deviation and auto-correlation) of the fit of the index to the biomass in the OM conditioning. Some general examples of model-based and model-free CMPs were shown to the Sub-group to demonstrate the types of management procedures that could be developed for this fishery. Finally, a brief overview of the November 2022 CMP Development Workshop was provided, and the next steps in CMP development were outlined to the Sub-group.

During discussions, it was noted that the procedure undertaken to produce the combined index for the [2022 Atlantic Swordfish Stock Assessment Meeting](#) (Online, 20-28 June 2022) differed from the approach undertaken for earlier assessments. The 2022 approach used aggregated catch and effort data, whereas set level data from the various fleets were used in previous assessments. Whether or not this change would make any difference in how well the combined index would track relative abundance, it was clarified during discussion that the properties of the combined index within each OM could be characterized within the MSE and reflected in projected values of the index for use in CMP testing. In other words, the combined index could be used within a CMP regardless of which methodology was used. The important point regarding the methodology used to produce the combined index was that the same methodology used should continue to be used into the future (if that index is ultimately used in the CMP that is adopted) in order to produce an index expected to have similar properties with respect to the abundance trend (i.e., variability, auto-correlation) as the index tested within the MSE.

The Sub-group reviewed progress made developing CMPs. To date empirical CMPs have been developed based on each of the available indicators (14 individual and the combined index) as well two CMPs based on clusters of the best and worst performing indices. Performances in this case related to how well a particular index reflected the underlying trend in the male and female stock components. The empirical indicators were designed to adjust the total allowable catch (TAC) in accordance with the change in the indicator. In this first step of CMP development, the primary objective was to understand which indices were the best candidates for future CMP development and to identify potential issues with the projected data. To that end, the developer updated the swordfish management strategy evaluation (SWOMSE) package to include catch-at-length data by fleet. This required developing a multi-fleet model that now supports development of CMPs that use length-based indicators.

The Sub-group was reminded that the models provide sex-specific output that might require some different approaches or metrics when assessing CMP performance. It was highlighted that the ability to track CMP performance separately by sex is unique among the ICCAT MSEs to the SWOMSE. Beyond the female spawning stock biomass, the Sub-group should consider identifying any sex-specific performance metrics that may be relevant and communicate these to Panel 4.

As was the case for the discussion for Agenda item 2, discussion was limited, with most comments or questions being deferred to the relevant sections under sections 4 and 5 of this report.

4. Review and discuss key decisions and proposals up for consideration at Panel 4

SCRS/P/2023/003 reviewed the key decisions that would be sought from Panel 4 and the proposals for consideration at the [First Intersessional Meeting of Panel 4 on North Atlantic Swordfish MSE](#) (6 March 2023).

4a. Key decision: Acceptance of updated OM reference and robustness sets

The Sub-group agreed to use the existing OM reference and robustness sets. It recommended that the reasons for the decisions about the OM grid be clearly articulated to Panel 4. The Sub-group also noted that Panel 4 should be made aware of important underlying assumptions in the reference set of OMs, including that the selectivity pattern was not modeled to change during the projection period i.e., that current relative catches across fleets do not change.

An additional complexity for the purpose of CMP development is how catch per unit effort (CPUE) is calculated. Of particular importance is to clarify if the CPUE has been/will be based on fish landed (i.e., after discards) or on fish caught (including discards). This is particularly important if changes to minimum size limits are to be considered or evaluated. It was noted that the current OMs include the current minimum size provisions.

The Sub-group discussed how to address evaluating the minimum size regulation in the context of the MSE. First it was noted that there are currently multiple size limits within the [Recommendation by ICCAT amending the Recommendation for the conservation of South Atlantic swordfish, Rec. 16-04 \[Rec. 17-03\]](#): one that is based on weight, and another based on three different lengths. A further complexity is that the way this Recommendation is worded, a tolerance in the minimum size is allowed that applies to "15 percent of

the number of swordfish per landing of the total swordfish catch". Minimum size limits interact with spatial biological dynamics where fishers could potentially change their behaviour to avoid encountering small fish. How to address discard mortality is an additional complexity. Precisely addressing the spatial dynamics might require that the minimum size regulation be evaluated on a fleet-by-fleet basis and some additional information about how fish are geographically distributed by size and season. However, it may be that an approach ignoring the differences between fleets may be adequate for the Commission's purposes.

Hypothesized changes in fishers encounter rate of undersized fish can be simulated in OMs. The implication of this can be addressed by modeling changes in both retention and selectivity in OMs across a continuum between full selectivity and/or retention of small fish to the fleet no longer encountering/retaining any under sized fish. The data on the lengths of discarded fish, which are needed to evaluate where within this continuum the selectivity actually is, are sparse. Therefore, although modeling selectivity changes (as a way of modeling any of several ways in that fishers might make changes to avoid catching small fish) is possible, there is little information available to specify which possible changes in selectivity are likely for a particular minimum size limit. These considerations, along with the complexities in the minimum size regulation as drafted in [Rec. 17-03](#) make it difficult to evaluate the overall effect of different minimum size limits with simulation.

To evaluate the size limit in the simplest way, the following assumptions would be needed:

- The regulation would not change the selectivity of the catch in the fishery;
- All discards are a result of the catch and release of undersized fish;
- All undersized fish are discarded (i.e., no tolerances).

The effect of a minimum size regulation and release mortality was presented at the [2022 Atlantic Swordfish Stock Assessment meeting](#) and in [Schirripa \(2022\)](#). However, this analysis assumed that the selectivity of catch (as opposed to retention) on the undersized fish was not affected by the minimum size regulation (i.e., fishers continued to encounter undersized fish at the same rate pre- and post-regulation). Data to support how to model these changes are needed. Without any discard data these choices would be largely speculative. But evaluating the size limit in the simplest way (above) would permit that the efficacy of the size limit be evaluated conceptually. More complex dynamics could be evaluated later.

If the Commission wanted the SCRS to evaluate potential alternative minimum size limit regulations, a simpler minimum size limit, for example, only permitting the retention of fish above one particular length or the equivalent in round weight would be easier to evaluate. This could be evaluated for all North Atlantic SWO fisheries.

4b. Key decision: Determine probability values for the conceptual management objectives found in Resolution by ICCAT on development of initial management objectives for North Atlantic swordfish [Res. 19-14]

The Group noted that the preliminary feedback that it had received from Panel 4 on the minimum probabilities of achieving conceptual management objectives was described in [Anon., 2021](#) and is as follows:

- The probability of being in the Green Zone of the Kobe matrix was=50-60% (that the Sub-group interprets as this applying to female spawning biomass);
- The probability that the stock is below B_{LIM} =5-10% (in terms of female spawning biomass);
- 15-25% maximum change in TAC

With Performance Metrics (PMs) being calculated at 1-10 and 11-30 years, for short and medium terms, respectively.

The Sub-group noted variability in catches should be expressed as being between management periods. The Sub-group agreed that the MSE package will be modified to reflect this change.

These PMs with their associated risk limits could be used as a *minimum* standard.

The Sub-group considered **Table 1** as a summary of metrics that would be proposed to Panel 4. This table is based on the feedback received by Panel 4 in [Anon., 2021](#).

With the aim to ensure that the performance statistics being considered for swordfish are consistent with the recent deliberations that occurred at ICCAT for adopting the bluefin tuna (BFT) management procedure, the Sub-group reviewed the Performance Metrics to identify which BFT PMs are effectively captured within the proposed SWO PMs (see BFT equivalent column in **Table 1**).

BFT had a number of additional PMs that could also be included if identified as important by Panel 4. Among these are the probability of not overfishing (PNOF) and the statistics related to spawning biomass relative SSB_{MSY} : these quantities might be germane because some delegations require that CMPs be shown not to cause overfishing (even though this is considered in the PGK statistic above). These might be considered with some modification (e.g., time frames, and dynamic SSB_{MSY}) for SWO MSE. For instance, the projection time periods over which specific performance metric should be calculated may be different for SWO compared to BFT, along with differences such as initial starting status, biological differences in growth by sex, and reproductive patterns.

Additional performance statistics such as those considered for BFT ([Recommendation by ICCAT establishing a management procedure for Atlantic bluefin tuna to be used for both the western Atlantic and eastern Atlantic and Mediterranean management areas \[Rec. 22-09\]](#)) and/or ALB ([Recommendation by ICCAT on conservation and management measures, including a management procedure and Exceptional Circumstances Protocol, for North Atlantic albacore \[Rec. 21-04\]](#)) could be calculated in addition to the minimum set presented above.

4c. Key decision: Determine key performance metrics for CMPs, their probability values, and over which years they are to be calculated

This was addressed in 4b above.

4d. Key decision: Provide feedback on an advice interval schedule for updating CMPs, and running assessments

The Sub-group considered a proposed schedule for data provision, updating CMPs and doing CMP reviews (**Table 2**). Under the proposed schedule, the CMP would first be applied in 2024, and then every third year with TAC held constant in the interim. Exceptional circumstances would be evaluated annually using specific indicators. Data required to update the management procedures would also be needed every third year. In the proposed approach, data would be lagged by 3-years (noting that the SCRS and the ICCAT Secretariat could explore reducing this lag to two years). For example, the CMP in 2024 would use data up to and including 2021. The more comprehensive data inputs required to update the assessment model would be required at six-year intervals. MSE OMs would be re-conditioned as needed.

The Sub-group also noted that future assessments are expected to occur in the same year as the CMP run. This could be undesirable if the CMP and the assessment were thought to represent conflicting management options. This could be addressed by using specific nomenclature to clarify that the assessment is a tool to evaluate the CMP and is not intended to provide catch recommendations, and/or by conducting this assessment work in years where the CMP is not updated. The Sub-group noted that there are practical issues associated with increasing the update frequency. Specifically, more frequent updates will impede other important work conducted by the SCRS.

The Sub-group further considered the nomenclature and recommended that we don't use the term "assessment" because it implies choices will be made to improve model fits and that alternative TAC would be provided. Instead, the Sub-group recommended that the term "Stock Assessment" be changed to "CMP Review" in **Table 2**. The Sub-group also requested to include an option to conduct the CMP review in Year 5 instead of Year 6 depending on the nature of the adopted CMP. This could better balance SCRS workload.

The Sub-group also considered whether to test 2- and 4-year management cycles for performance comparison, and whether there were scientific considerations for the management interval (e.g., how often do we expect to see changes in the indices and biomass of the stock). The Sub-group concluded that a three-year cycle should be minimum, especially for empirical CMPs. If Panel 4 requests a longer management cycle, we would need to reconsider the calendar of events, perhaps a period of 8 years for CMP review if we move to a 4-year management cycle.

Arguments for 3 years as minimum interval:

- Northern albacore and Atlantic bluefin both have 3-year management cycles;
- Minimum time to expect measurable changes in indices and stock status;
- Balance SCRS and Commission workload;
- Consistent with current frequency of north Atlantic swordfish assessments and management.

The Sub-group proposed that a previous analysis on porbeagle analysis be used as a reference for evaluating alternative management cycles (Taylor *et al.*, 2022, see **Figure 6**). Longer management cycle intervals (and/or shorter if Panel 4 requests) could be tested for swordfish once we have a reduced set of CMPs to see if there are any pattern result, as occurred with porbeagle. The MSE expert expects the analysis would be relatively straightforward.

4e. Key decision: Determine the types of CMPs to be developed (types of management actions; model vs empirical procedures; etc.)

The Sub-group considered the types of CMPs to be developed, including various management actions, and model vs. empirical management procedures. An example of a model-based management procedure is shown in **Figure 1**. In this example the recommended TAC is generated by applying a surplus production model to estimate the vulnerable biomass (VB) ratio (B/B_{MSY}) and fishing mortality ratio (F/F_{MSY}). The TAC is set at a fixed harvest rate equal to F_{MSY} multiplied by the VB. The TAC is adjusted as $B < B_{MSY}$ using a harvest control rule (HCR). Numerous model based CMPs are possible including those with different data inputs, model assumptions, HCRs and constraints (e.g., maximum change in TAC).

An example model-free management procedure is illustrated in **Figure 2**. In this case no model is applied. Instead, an index target is set (e.g., the mean index between 2010-2020) and the ratio between the current index value and the target is calculated. The TAC is adjusted using that ratio with the application of constraints on the minimum/maximum change. Like model-based methods, many variations are possible including the use of a different index target, changing the reference years and the inclusion of an HCR (e.g., adjustments to TAC based on index trends).

The Sub-group notes that a variety of management recommendations can be considered, including those based on TAC, total allowable effort, spatial closures and size recommendations. CMPs return a global TAC is allocated to fleets using the same fleet structure as the assessment model. However, given data availability, some are more tractable than others.

CMP developers may develop both model based and empirical CMPS at their discretion.

Other considerations:

- Minimum/maximum TAC change
 - Would want specific numbers to analyze;
 - Minimum TAC change would be to ease administrative burden (100 t as a possible option);
 - Maximum TAC change from stability objective (ask for confirmation of 2021 percentage range); could look to step-down in TAC that was used when stock was overfished, as real-world example.
- Maximum TAC for fleet, market or conservation purposes

The Sub-group should prioritize which information is needed at this point in the process. The Sub-group's plan is to develop CMPs that would provide TAC advice, rather than management approaches that include time/area closures or size limits. If Panel 4 wishes to prioritize these other management approaches, then the Panel must consider that more time and restructuring of the MSE would be required. This would preclude having a CMP ready for adoption this year.

The efficacy of the current minimum size limit has been questioned due to high at-haulback and post-release mortality. However, the minimum size may alter fisher behaviour (e.g., to successfully avoid/reduce catch of small swordfish) to provide some conservation benefit. Unfortunately, we lack sufficient data to evaluate these changes. The Sub-group expressed concerns that a preliminary analysis of the efficacy of minimum size would require strong assumptions and be subject to high uncertainty due to data limitations (e.g., need size composition data from before and after minimum size was put in place). Given these concerns, the SCRS considers that the best approach to evaluating the minimum size limits would be to evaluate the effect on CMP performance through a robustness test. The Sub-group also noted that the minimum size robustness test would not affect the conditioning of MSE; it only impacts projections due to changed assumptions about selectivity.

4f. Key decision: Tuning criterion/criteria for CMPs

During the development of CMPs, tuning occurs in two phases. In the developmental phase, a tuning target is selected so that all CMPs have the same expected performance with respect to at least one metric. In the performance tuning phase, each CMP is evaluated against stated minimum performance criteria. For example, one may choose to optimize yield while maintaining acceptable performance with respect to other minimum performance criteria (e.g., section 4b).

Development tuning can be considered a scientific decision, while performance tuning is more relevant to managers. CMPs are tuned to a performance metric. The Sub-group considered various tuning options but agreed to tune to $BR_{30}=1.2$ (defined as the ratio of the female spawning stock biomass in year 30 to female SSB_{MSY}) for development tuning.

The longer timeframe gives CMPs a chance to do what they need to do and be evaluated on an even playing field; some CMPs are slower to respond than others.

4g. Key decision: Agreement on index/indices and other data that will be used by the CMPs (both in the MSE and application of the selected CMP in 2024 and beyond)

The Sub-group discussed whether to limit the indices used for CMP development to just the combined index. It was noted that limiting developers to one index would reduce the variety of CMPs that could be produced. It was considered important to know whether length based or CPUE based indices either singly or in some combination could outperform an index based on the combined index. The Sub-group questioned whether Panel 4 had any preferences in terms of the data used in the CMPs or would performance govern CMP selection.

4h. Key decision: Approval of process for narrowing (culling) of CMPs to retain a reduced subset for further development

The process for selecting the best CMPs for approval by Panel 4 was described as:

- requiring CMP development and tuning to a common target;
- an evaluation of the tuned CMPs relative to a suite of performance metrics;
- redevelopment of CMPs and tuning to management objectives;
- culling of CMPs that fail minimum performance metrics;
- eliminate any CMPs that were dominated by others (i.e., those for which other CMPs performed better across all criteria);
- presentation of reduced subset to Panel 4 for final selection.

The Sub-group approved the process and discussed potential tuning targets. It was suggested to limit the tuning to a single target during the development tuning process and only introduce other tunings targets once a final subset of the CMPs had been chosen. It was suggested that CMPs be tuned to a Br30 of 1.2. Future tunings might involve PGK with the value set to at least 60% and alternate Br30 values were also suggested. For the purpose of culling CMPs, it was suggested to use a biomass-based limit refer point of $.4B_{MSY}$ which must not be exceeded by more than 15% of the runs across all OMs and realizations.

It was noted that the CMP development process for swordfish differed from bluefin tuna in that the development of CMPs is not based on the effort of multiple teams working independently but will be a collaborative effort. Interested individuals were invited to participate.

4i. Key decision: Feedback on trade-off preferences and how they may be presented graphically

The developer provided an overview of the [Slick application](https://harveststrategies.org/management-strategy-evaluation/shiny-app/) (https://harveststrategies.org/management-strategy-evaluation/shiny-app/) which is designed to provide visuals that demonstrate the multivariate tradeoffs resulting from CMP design. The application was shown to provide a large variety of visuals including spider plots, zigzag and rail plots, box and violin plots, Kobe line plots and Kobe time series plots. Plots reflected performance of CMPs for various metrics both across and by OMs and offered some ability to select what is plotted. All plots could be easily copied and pasted.

The Sub-group considered the Slick application to contain much of what would be needed to reflect the tradeoffs in choosing a CMP. It was recommended that the spider plots limit the number of axes and that they allow overlays of the CMPs on a single plot, as well as it was questioned whether the axes all had the same interpretation. The developer indicated that results are standardized and are in the same units and same direction.

Spider plots provide an overall score for each CMP, and it was cautioned not to use this score to select or rank CMPs given that each metric is valued differently by Panel 4. It was also suggested that the performance of CMPs be compared to a target or standard value for each metric rather than to each other or an unknown value. This would facilitate making comparisons across CMPs and allow to recognize whether a CMP met or exceeded the targets.

The Kobe time series plots were recognized as a valuable way of visualizing the changing state of the stock across OMs over time. It was requested that the order of the states be reversed in the plots so that green Kobe was above yellow and red.

For the time series plots it was requested to show yield and to provide additional plots that demonstrate the trajectories of individual realizations (i.e., worm plots) rather than just the median response for individual or multiple OMs. It was indicated that the variables available for presentation in the Slick application are selected by the operator when compiling the results file in the SWOMSE package. The addition of worm plots would be possible and it was also suggested to provide this functionality directly in the SWOMSE package. It was noted that the compilation of CMP result files for presentation in the Slick application was supported by a function in the SWOMSE package and that this would facilitate the CMP development, tuning and selection process.

5. Communications/Ambassador material

The Sub-group discussed the importance of communicating the MSE process, MSE results, and performance tradeoffs among CMPs to three main audiences: the broader Swordfish Species Group, Panel 4 (including commissioners) and stakeholders. The SCRS Chair stressed that the MSE process is designed to involve a dialogue with not only managers but also stakeholders.

The Swordfish MSE Communications Team's job over the next several weeks and months is to take key decisions and make them accessible to these audiences. The Chair noted that three main types of materials will be used in these communications: SCRS papers, summary documents, and PowerPoint presentations. The default will be to mimic prior communications efforts for the Atlantic bluefin tuna MSE, but the Communications Team will have the discretion to make modifications as appropriate (e.g., to use the Kobe Time plot from Slick).

The Sub-group agreed that materials should be developed to communicate sufficient detail without being overwhelming. It is desirable to present the same information in multiple ways since there are different styles of learners (e.g., graphical vs. tabular vs. text). Typically, the SCRS Chair has the primary responsibility for communicating the science to the Panels and Commission. That said, there is a clear precedent from bluefin for the lead scientist involved with the process to be responsible for the communications to the Commission. The preferred approach is that the NSW Chair to take the lead on presenting to the Commission, with the collaboration and support of the SCRS Chair. Ultimately, that will be up to the Panel 4 Chair. The SCRS Chair will reach out to the Panel 4 Chair immediately after the close of this meeting to communicate the proposed process for this year.

5 a. Key plots and outputs

The Sub-group reviewed the swordfish Shiny App which can generate many plots and outputs for the purpose of visualizing the output of the closed-loop simulations.

5 b. Develop presentation to Panel 4

The Sub-group agreed on five main decision points for the [First Intersessional Meeting of Panel 4 on North Atlantic Swordfish MSE](#) in March 2023, stressing the need to communicate to Panel 4 why each of these items is relevant:

1. OM reference grid: Seek Panel 4 approval
2. Approach to minimum size: Seek Panel 4 approval to test minimum size options (e.g., no minimum size, 119 cm LJFL, 125 cm LJFL, 63 cm CK, status quo) as a robustness test
 - Also mention other three existing categories of robustness tests
3. Management objectives and performance metrics
 - Present a table with conceptual management objectives (*Resolution by ICCAT on development of initial management objectives for North Atlantic swordfish [Res. 19-14]*), probability ranges suggested by Panel 4 in 2021, and seek approval of proposed corresponding performance metrics. Solicit Panel 4 input on modifications to the probability ranges;
 - Reiterate the scientific basis for the B_{LIM} of 40% SSB_{MSY} (e.g., [Kell et al., 2012](#)), and accept PA4 input on the issue. The Sub-group suggested that Panel 4 might want to change it from an interim limit reference point (LRP) to an LRP until such a time where other analyses might suggest an alternative value is more appropriate. Note that the Working Group on Stock Assessment (WGSAM) is exploring reference points for ICCAT stocks, but that work is outside of the scope of the swordfish MSE and will not be completed this year. The Sub-group also noted that ICCAT uses 40% SSB_{MSY} as the LRP for northern albacore and Atlantic bluefin as well. Additionally, Indian Ocean Tuna Commission (IOTC) uses 40% SSB_{MSY} as the LRP for swordfish, yellowfin and albacore.
4. CMP specifications: Seek Panel 4 approval for the current assumptions, mentioning that CMP development is occurring in a collaborative manner within the North Atlantic Swordfish MSE Technical Sub-Group.
 - CMP output is one TAC for the North Atlantic
 - Both empirical and model based CMPs are being developed
 - 3-year management cycle is the default minimum cycle length (if Panel 4 would like, longer cycles could be explored later once there is a reduced set up CMPs)
 - All indices from the assessment are eligible for use in the MSE and CMPs, plus a composite index
 - CMPs use a maximum TAC change based on the probability range of the stability objective

- Other options that Panel 4 can consider later once preliminary CMP results are available:
 - i. Minimum TAC change
 - ii. Maximum TAC
- 5. Overall process: Seek Panel 4 approval for the proposed MSE approach and timeline, including 2-step CMP tuning process including development and performance tuning stages. The Slick application will be used to present of results. Initial MSE results based on development tuning will be presented at the [Second Intersessional Meeting of Panel 4 on North Atlantic Swordfish MSE](#) (online, 1 June 2023).

The Sub-group agreed that the most important is to get approval of this proposed way forward in March 2023 rather than asking for specific decisions (e.g., on operational management objectives).

5 c. SWO-MSE Ambassadors program

Ambassador sessions will be scheduled to align with the First and Second Intersessional Meetings of Panel 4 in 2023. Dr. Kyle Gillespie will serve as the English-speaking ambassador. French and Spanish ambassadors will be identified within the next week. Ambassador sessions will be open to anyone, including managers, industry representatives, NGOs and other stakeholders. The sessions will guide participants through the MSE material in an accessible way. The goal will be for participants to better understand key decisions, model behavior, and CMP function, so they can provide feedback to their delegations in preparation for the Panel 4 meetings. The SCRS Chair noted that better communications will allow Panel 4 to reach decisions more smoothly.

6. Timelines and workplan for 2023

The Sub-group reviewed the meeting schedule (**Table 3**) and proposed a workplan for the N-SWO MSE development and dialog with Panel 4. It was noted that between the Intersessional Meeting of the Swordfish Species Group (including MSE) (22-26 May 2023) and the Second Intersessional meeting of Panel 4 on North Atlantic Swordfish (1 June 2023) there is very limited time to prepare material and results for an effective presentation to Panel 4. It was proposed that SCRS consult with Panel 4 to possibly move the Second meeting with Panel 4 to later in June or early July. It was also encouraged fluid communication with the Panel 4 Chair throughout the process to advance main decisions and discussions ahead of the dialog meetings between SCRS and Panel 4. The short-term workplan includes efforts to continue development and tuning of CMPs, and production of N-SWO summary documents (e.g., 1-pager, 4 pager), ambassador session materials, and a key-decisions SCRS paper for consideration at Panel 4.

7. Updates to the Trial Specification Document (TSD)

The Sub-group was provided with a brief walk through of the Trial Specification Document (TSD), available on the North Atlantic Swordfish MSE homepage (<https://iccat.github.io/nsw-mse>). The TSD is a living document that is frequently updated as the MSE work progresses. The document describes the structure and assumptions of the OMs, and the process used to generate the simulated data in the forward projections. A description of the CMP will be added to the document once the first round of CMP development is complete. The TSD describes the current performance metrics that have been proposed to evaluate the performance of the CMPs. These will be revised or extended based on further information from Panel 4.

There was some discussion with the Sub-group to determine if the TSD was updated recently. It was confirmed that the TSD is up-to-date and reflects the current state of the MSE process. The Sub-group was encouraged to request additional information or details where they determined it was necessary. When the MSE process is complete, the TSD will describe all the specifications and assumptions used in the analyses to evaluate CMPs and identify those best suited to managing this fishery.

8. Other matters

No other matters were discussed.

9. Adoption of the report and closure

The report was adopted during the session and the meeting was closed.

References

- Anonymous 2021. [2021 Report of the Intersessional Meeting of Panel 4](#) (Virtual Zoom meeting, 6-8 July 2021). 62 pp
- Anonymous 2022. [2022 Report of the Atlantic Swordfish Stock Assessment Meeting](#) (Online, 20-28 June 2022). Collect. Vol. Sci. Pap. ICCAT, 79(2): 392-564
- Kell L., Mosqueira, I., De Bruyn P., and Magnusson A. 2012. An evaluation of limit and target reference points as part of a harvest control rule: An Atlantic swordfish example. Collect. Vol. Sci. Pap. ICCAT, 68(4): 1630-1644
- Schirripa, M. 2022. Current Status of the Northern Swordfish (*Xiphias gladius*) Stock in the Atlantic Ocean 2022: post-decisional stock assessment model. Collect. Vol. Sci. Pap. ICCAT, 79(2): 715-748
- Taylor N.G., Ortiz M., Kimoto A. and Coelho R. 2022. Preliminary closed-loop simulations for northeast porbeagle: Illustrating the efficacy of alternative management procedures and assessment frequency. Collect. Vol. Sci. Pap. ICCAT, 79(4): 216-230

Table 1. Summary of proposed performance metrics, including years and minimum performance probabilities. For illustrative purposes the equivalent bluefin tuna (BFT) performance statistics are included. Probabilities are calculated across all simulations in a given time block specified by the Year column.

Name	Description (from Res. 19-14)	Quantity calculated	BFT equivalent	Years	Minimum Probability (as per Panel 4 2021)	Notes
Safety - Short	Maintain low probability of stock declining to unacceptably low level	Prob. SB < SB _{LIM}	Lowest depletion (LD)	1 - 10	5 - 10%	SB _{LIM} defined as 0.4 SB _{MSY}
Safety Medium	As above	As above	As above	11 - 30	5 - 10%	
Status - Short	Maintain stock in green quadrant of the Kobe matrix	Prob SB > SB _{MSY} & F < F _{MSY}	PGK	1 - 10	50 - 60%	
Status Medium	As above	As above	PGK	11 - 30	50 - 60%	
Stability	Minimize large in TAC between management intervals	Variation in TAC (%) between management cycles	VarC	1 - 30	Maximum AAVY of 15 - 25%	
Short-term Yield	Maximize yield while meeting other objectives	Average catch	C _x	1 - 10	-	
Medium-term Yield	As above	As above	C _{x=20}	11 - 30	-	

Table 2. Proposed schedule for data provision, updating CMPs and doing CMP reviews.

Year	Stock assessment	Recondition OMs*	MP run	MP advice implemented	Exceptional circumstances evaluated	Combined index (or other dependent indices)			EC indicators
						Other CPUEs	Use/review catch		
0	?		X		X	X	X		X
1				X					X
2					X				X
3			X		X		X		X
4				X	X				X
5					X				X
6	X		X		X		X	X	X

Table 3. N-SWO MSE meeting timing and descriptions for 2023. Note the core modeling, CMP, and communications teams will be meeting intersessionally, outside of this schedule.

<i>Timing</i>	<i>Event</i>	<i>Description/objectives</i>	<i>Responsibility</i>
November 2023 [online]	SWO CMP development workshop 1	<u>Informal</u> 3–4-hour CMP development session. Guide participants through CMP creation and tuning process	SWO MSE TT / National scientists
25-26 January 2023 [online]	SWO MSE TT meeting	Review progress on SWO MSE; develop proposals for PA4 to consider	SWO MSE TT / National scientists
February/March 2023 [online]	SWO CMP development workshop 2 (if needed)	<u>Informal</u> 3–4-hour CMP development session. Review CMPs developed by CPC scientists and review tuning procedures	SWO MSE TT / National scientists
6 March 2023 [online/ in-person]	Panel 4 meeting	PA4 to consider MSE overview and proposals from SWO SG and provide feedback on performance metrics, advice intervals, CMPs	PA4 / SWO MSE TT
March/April 2023 [online]	SWO MSE ambassador session	A communications session open to managers and stakeholders on SWO MSE progress.	SWO MSE communications and MSE TTs
22-26 May 2023 [in-person]	SWO intersessional and MSE	Full species group to review MSE progress, particularly regarding CMP development.	SWO Species Group / MSE TT
1 June 2023*	Panel 4 meeting	PA4 to review progress on CMP development and consider trade-offs among CMPs	PA4 / SWO MSE TT
May/June 2023 [online]	SWO MSE ambassador session	A communications session open to managers and stakeholders on SWO MSE progress.	SWO MSE communications and MSE TTs
4-5 September 2023 [online]	SWO MSE TT meeting	Two-day meeting to review progress on SWO MSE and narrow down list of CMPs	SWO MSE TT / National scientists
September 2023 [in-person]	Species Groups and SCRS Plenary	Full Species Group to consider smaller set of CMPs and review tuning and performance	SWO MSE TT, SWO SG
October 2023 [online]	SWO MSE ambassador session	A communications session open to managers and stakeholders on SWO MSE progress.	SWO MSE communications and MSE TTs
10-11 October 2023 [online]	Panel 4 meeting	Two days. PA4 to provide feedback on small set of CMPs and tunings	PA4 / SWO MSE TT
November 2023 [in-person]	Commission meeting	COMM to adopt a CMP for implementation in 2024	COMM
2024	Develop exceptional circumstances protocol		SWO MSE TT / PA4

*Assuming that this meeting actually occurs on 1 June 2023.

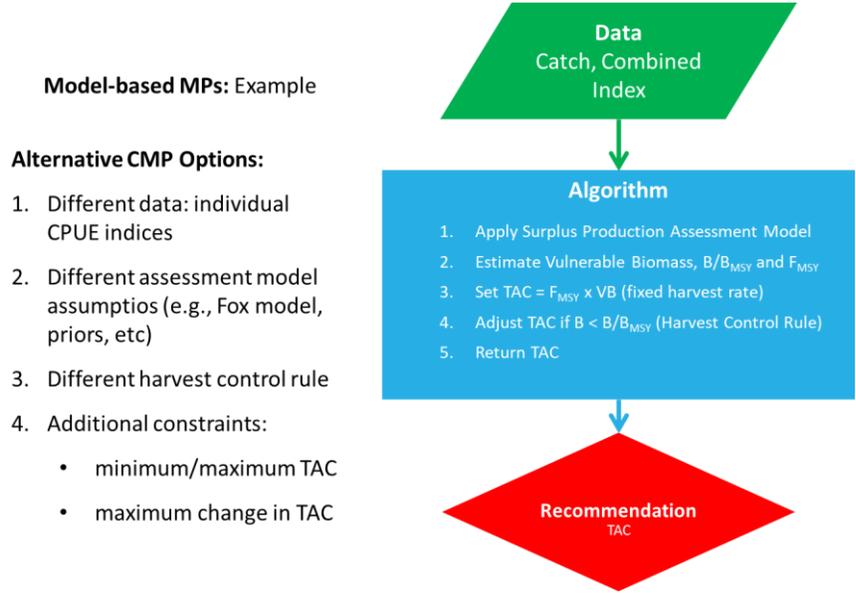


Figure 1. An example of a model-based management procedure.

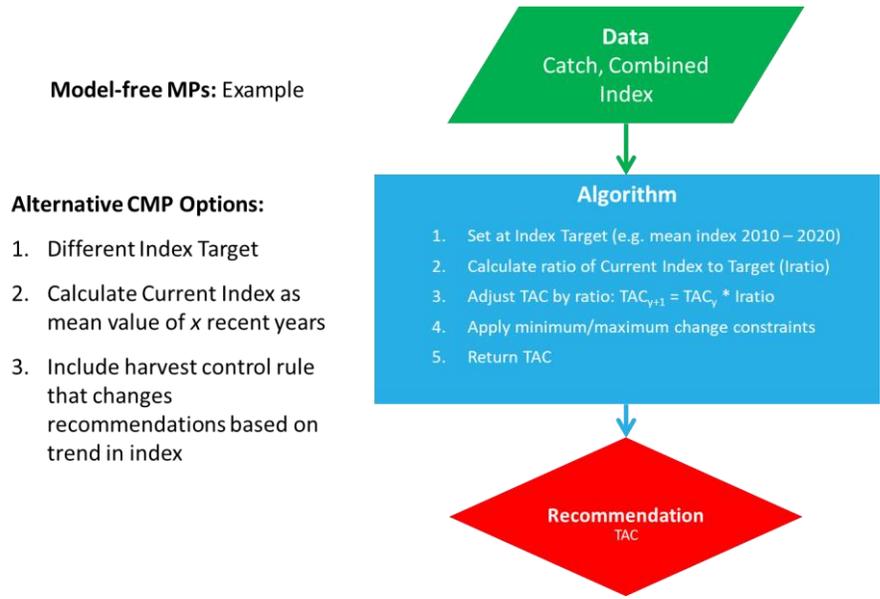


Figure 2. An example of a model-free (or empirical) management procedure.

Agenda

1. Opening, adoption of agenda and meeting arrangements and assignment of rapporteurs
2. Review of the Swordfish MSE framework and recent updates to OM grid
3. Review of CMP development
4. Review and discuss key decisions and proposals up for consideration at Panel 4
 - a. Key decision: Acceptance of updated Operating Model (OM) reference and robustness sets
 - b. Key decision: Determine probability values for the conceptual management objectives found in Res. 19-14.
 - c. Key decision: Determine key performance metrics for Candidate Management Procedures (CMPs), their probability values, and over which years they are to be calculated.
 - d. Key decision: Provide feedback on an advice interval schedule for updating MPs and running assessments.
 - e. Key decision: Determine the types of CMPs to be developed (types of management actions; model vs empirical procedures; etc.)
 - f. Key decision: Tuning criterion/criteria for CMPs
 - g. Key decision: Agreement on index/indices and other data that will be used by the CMPs (both in the MSE and application of the selected CMP in 2024 and beyond)
 - h. Key decision: Approval of process for narrowing (culling) of CMPs to retain a reduced subset for further development.
 - i. Key decision: Feedback on trade-off preferences and how they may be presented graphically.
5. Communications/Ambassador material
 - a. Key plots and outputs
 - b. Develop presentation to Panel 4
 - c. SWO-MSE Ambassadors program
6. Timelines and workplan for 2023
7. Updates to the Trial Specification Document (TSD)
8. Other matters
9. Adoption of the report and closure

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List of Papers and Presentations

DocRef	Title	Authors
SCRS/P/2023/001	Update on ICCAT North Atlantic Swordfish MSE	Gillespie K. and Hordyk A.
SCRS/P/2023/002	Overview of Development of Candidate Management Procedures	Hordyk A.
SCRS/P/2023/003	Review and Discussion of Key Decisions and Proposals for Consideration at Panel 4	Hordyk A.

SCRS document abstracts as provided by the authors

SCRS/P/2023/001 - This presentation provides a brief overview of the history and current state of the North Atlantic Swordfish MSE process. The MSE framework was developed in 2019, and the operating model uncertainty grid has been constructed and refined over the last five years. The operating models were re-conditioned in 2022, based on the recent stock assessment also conducted in 2022. The conditioned operating models have been classified into Reference and Robustness sets and are being used to evaluate the performance of candidate management procedures that are currently being developed. The presentation also provides an overview of the material that will be presented to Panel 4 and described the next steps to completing the MSE process for recommending a candidate management procedure to be implemented into the fishery in 2024.

SCRS/P/2023/002 -This presentation describes how fishery data are used by the candidate management procedures (CMPs) in the MSE framework. The primary sources of data are the historical catches and the Combined Index. The individual fleet CPUE indices are also available in the MSE framework for the CMPs to use if required. The process for generating these data in the projection period is described, including a description of how the observation error is generated based on the statistical properties (standard deviation and auto-correlation) of the fit of the index to the biomass in the operating model conditioning. Some general examples of model-based and model-free CMPs are shown to demonstrate the types of management procedures that could be developed for this fishery. Finally, a brief overview of the November 2022 CMP Development Workshop is provided, and the next steps in CMP development are outlined.

SCRS/P/2023/003 - This presentation provides a brief overview of background information to provide context for the review and discussion of the key decision points and proposals for consideration at the upcoming meeting of Panel 4. This information was used to guide the Group discussion of each of these decision points.