

Report of the Working Group on Stock Assessment Methods (WGSAM) Meeting (Madrid/hybrid, 10 - 13 February 2025)

The results, conclusions and recommendations contained in this Report only reflect the view of the Working Group on Stock Assessment Methods (WGSAM). 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 2025 Intersessional Meeting of the Working Group on Stock Assessment Methods (WGSAM) ("The Group") was held hybrid/Madrid from 10 to 13 February 2025. The SCRS Chair announced that the WGSAM Rapporteur, Dr Michael Schirripa (USA), has formally stepped down after his ten-year contribution to the Group. Dr Carmen Fernandez (EU-Spain) was appointed as the meeting Chair and opened the meeting. The ICCAT Executive Secretary welcomed and thanked the participants. The meeting Chair proceeded to review the Agenda, which was adopted with some changes (**Appendix 1**).

The List of participants is included in **Appendix 2**. The List of Documents and Presentations provided at the meeting is attached as **Appendix 3**. The abstracts of all SCRS documents and presentations provided are included in **Appendix 4**. The following served as rapporteurs:

| <i>Sections</i> | <i>Rapporteur</i> |
|-----------------|------------------------|
| Items 1, 7 | A. Kimoto |
| Item 2 | C. Peterson, S. Miller |
| Item 3 | S. Cass-Calay |
| Item 4 | E. Wozniak, G. Merino |
| Item 5.1 | M. Ortiz, A. Kimoto |
| Item 5.2 | C. Brown |
| Item 5.3 | C. Fernandez |
| Item 6 | D. Die |

2. Management Strategy Evaluation

To open the Management Strategy Evaluation (MSE) Section 2, the SCRS Chair highlighted the importance of carefully considering the MSE workload of the SCRS throughout the MSE discussion. MSEs require extensive work, generally greater than stock assessments in the MSE's initial stages and especially as the SCRS works to develop more efficient processes. Therefore, capacity limitation is a notable concern, particularly considering that the SCRS has eight ongoing MSE processes, five - six of which are projected to be active in 2025 and 2026.

2.1 Presentation of the MSE Review

Document SCRS/2025/019 presented the ICCAT MSE External Review, which focused on the ICCAT MSE processes rather than the coding. The purpose of the review was to cover the five MSE processes to date: North Atlantic albacore (ALB-N), Atlantic bluefin tuna (BFT), North Atlantic swordfish (SWO-N), West Atlantic skipjack (SKJ-W), and multi-stocks tropical tunas, and to design a unified and ideal approach for future MSE implementation in ICCAT. For each of the MSE processes, the review considered: fishery dynamics (e.g., number of countries contributing to the catch and magnitude of catch), number and involvement of experts engaged in the MSE process; project timeline, funding, personnel and computational resources required, stakeholder engagement and communication, management objectives and performance indicators, presentation of results, and technical review.

Overall, the reviewers highlighted areas in which the ICCAT MSE processes should be improved and recommended, due to the current limited SCRS capacity, to conduct no more than two simultaneous MSE developments or formal review processes. Additionally, MSEs processes should not occur at the same time as a stock assessment for a single stock (**Appendix 5**). The authors recommended standardizing the MSE processes, including characterization of management objectives, performance indicators, and use of a presentation template to make the efforts more efficient and understandable. Recommendations included creating a permanent MSE coordinator position at the ICCAT Secretariat and expanding the [ICCAT MSE webpage](#) to include additional information on MSE and relevant documents for each ICCAT MSE process (e.g. summary documents, presentation, Shiny Apps, etc.), as further detailed in sections 2.2 and 2.3 of this report.

2.2 Response to the MSE Review

The Group engaged in considerable detailed discussion on document SCRS/2025/019.

The Group defined “MSE processes” as initial MSE development or particularly comprehensive MSE reviews or revisions that are scheduled to occur every few management cycles (e.g., every 6 years). A key recommendation of the MSE External Review was that the SCRS should not embark on more than 2 MSEs at a time and that each MSE should be done reasonably quickly (e.g. take around 2 years from data guillotine¹ to Management Procedure (MP) adoption). This recommendation was based on expert guidance, taking note from streamlined MSE processes established by the International Whaling Commission (IWC). For example, an MSE process conducted by the IWC takes two years, so that the IWC limits their MSE processes to two at any one time. Likewise, the General Fisheries Commission for the Mediterranean (GFCM) has adopted a similar process where a single MSE process is conducted at a time, and each MSE process takes one year. Notably, limiting ICCAT activities in this way would require clear prioritization, which might consider stock assessment uncertainties, or whether there are challenges associated with providing catch advice for the stock, though this was outside the scope of the Review. There was some debate on the limit of two MSE processes and consideration of the impact of increased MSE processes efficiency and capacity should be prioritized, which may warrant a reconsideration of this number of MSE processes limit.

Related discussions focused on efficiency of the ICCAT MSE process. Importantly, the Group acknowledged that MSE processes are still relatively new for ICCAT, and that substantial progress has been made over the past 5-10 years in standardizing and streamlining the MSE process. However, the process and investment has clearly varied amongst stocks (e.g., compare the large investment of money, time, and personnel in BFT and the comparatively low investment in time for tropical tunas), and substantial room for improvement remains. Limited overlap in key personnel engaging in the technical aspects of each MSE has resulted in concurrent processes that are siloed, such that opportunities for standardization and shared expertise are lost across ICCAT MSE processes. The presence of a dedicated Secretariat MSE Coordinator and an associated Standing SCRS Working Group on MSE (or a sub-group of the WGSAM) could help rectify this shortcoming and were thoroughly discussed by the Group (see more details in section 2.3).

The Group considered the value that MSE processes conducted externally to and in isolation from the SCRS could have in maximizing capacity and resource limitations in the SCRS, and whether there should be a thorough review process for integrating these external MSEs (e.g., MSE processes conducted outside of the ICCAT framework with no Commission oversight or SCRS engagement) into ICCAT. While the value of such an approach in avoiding the limitations of SCRS capacity was admitted, the Group was concerned that external MSEs would: i) not maintain a desired level of iterative engagement and scientific rigor; ii) miss key methodological details in the ICCAT review process; iii) lack the SCRS scientist engagement from the initiation of the MSE process; and iv) lack a structured framework to facilitate Commission engagement. The Group concluded not to consider external MSEs at this time but remained open to receiving funding to help support SCRS-driven MSE processes, including contracts with MSE experts. However, it was noted that a commitment to the funding of the long-term maintenance of the MSE process is critical, which may imply support through the ICCAT regular budget rather than dependence on external funding through voluntary contributions from ICCAT CPCs.

¹ A date after which new data will not be accepted for use in operating model or management procedure development (Carruthers 2024b).

The Group also noted that ICCAT has thus far not established criteria for prioritizing MSE processes. Generic MSEs to develop generic MPs could also be considered to apply the findings, including resultant robust MPs, to a wide variety of stocks, thereby streamlining the MSE process, similar to what has been done at some other Regional Fisheries Management Organizations (RFMOs). However, these are typically desk MSEs, and stakeholders may feel left out of the process. Nevertheless, MSEs were originally designed to simplify the fisheries management process and reduce demands on scientific resources, and the Reviewers offered several viable recommendations to move ICCAT toward this more efficient MSE process.

As scientists become more comfortable and practiced with the MSE process, they will be able to more easily and effectively communicate MSE processes and results with stakeholders and managers. While stakeholders and managers may push to initiate an MSE process, the development of an MSE framework is a scientific process, such that the technical MSE development has largely been driven by scientists. It is imperative for managers to feel a sense of ownership of the process if they are to manage using MSE-defined MPs. Stakeholders are also key players in the MSE process, and were defined to be inclusive of other interest groups beyond managers, including fishers, non-governmental organizations (NGOs) and others.

2.3 Addressing recommendations of the MSE Review

The Group noted that many of the MSE External Review's recommendations have already been implemented or considered by this and other ICCAT or t-RFMO working groups. A number of helpful references related to the MSE External Review were noted and are linked throughout this Section. These resources may already address many of the MSE External Review's recommendations and should be utilized, where appropriate.

The Group discussed each MSE External Review recommendation. The Group separated the recommendations into actionable recommendations and those that should comprise 'standard' or 'good practices,' and recommendations that are geared towards the SCRS versus the Commission. As many of the original recommendations overlapped, not every recommendation was thoroughly discussed (**Appendix 5**). Furthermore, the Group merged several recommendations that overlapped and proposed a priority level (High or Medium) for the resulting "filtered" recommendations. Key details, including recommendation number, prioritization, ownership, and key notes are compiled in **Appendix 6**. Relevant clarifications and discussions for select recommendation items are described below.

Recommendation by ICCAT replacing Recommendation 22-01 on a multi-annual conservation and management programme for tropical tunas (Rec. 24-01) and Resolution by ICCAT on interim operational management objectives for Atlantic bigeye tuna, yellowfin tuna, and the eastern stock of skipjack tuna (Res. 24-02) were referenced to assure the Group that Commissioners do desire and recommend pursuing a multi-stock tropical tuna MSE.

The following includes conclusions and discussion from the Group on the main MSE External Review recommendations. The number in parentheses refers to the item number indicated in **Appendix 5**.

- (4) *Centralize important information for each MSE process to include presentations, links to relevant documents, and MSE-specific Shiny Apps*

Revision of the ICCAT MSE webpage is ongoing (as presented in SCRS/P/2025/009), and this revision will address the goals of this recommendation.

- (23) *ICCAT should have a permanent position in the ICCAT Secretariat (MSE Coordinator) to support all the MSE activities*

The Group strongly supported the recommendation, which has financial implications. The proposal is as follows: Hire an MSE Coordinator to join the ICCAT Secretariat to coordinate and oversee all ICCAT MSE processes and reviews, to provide expert feedback on MSE coding (or do some coding, as required) and Candidate Management Procedures (CMPs) development (with the aim to harmonize where possible), and to serve as a liaison among ICCAT MSE processes, advising Species Groups on MSE best practices and ensuring consistency of the approach across Groups (where appropriate).

- (3) *A document with preferred standardized tables and figures, including their interpretation and the types of data for which they should be used, and*
 (19) *ICCAT should host and maintain Shiny Apps and other applications*

This document would provide a useful starting place for subsequent MSE processes and make it easier for the Commission to digest results if they are always presented in the same format (see [IOTC example](#)). Several example presentation tools (e.g., [Slick App](#), [FAO-funded Shiny App](#), etc.) have been developed. The Group should identify a preferred template, preferably from an existing Shiny App that has been developed for this purpose. This preferred presentation tool should be recommended for use but should not be required. The Group was made aware of FAO Common Oceans funding to develop a template PowerPoint presentation for presenting MSE results, so could tap into that support this year, if desired.

- (2) *A document with a list of default management objectives and associated performance indicators*

A live, technical document should be developed that clearly defines a 'default' list of management objectives (e.g., conceptual objectives with timeframes in the categories of status, yield, stability, and safety) and associated performance indicators (PIs) for ICCAT MSE processes. Note that PIs should be subsequently modified to meet stock-specific objectives and risk tolerance. This document should list PIs that have been identified for each stock, with a complete description of how each PI was calculated and at what timescale. This complete calculation overview is required, because there are many ways to calculate PIs, which may impact the ranking of candidate MPs. This document should be developed collaboratively with managers (for more information that may assist in developing this document see Taylor *et al.*, 2024).

- (7) *Default MSE reporting*

This should be interpreted as a thorough Trials Specifications Document (TSD) that includes the technical specification of the MSE framework, including reference and robustness operating models, operational management objectives and associated PIs, MP configuration, complete mathematical descriptions, and associated data and modeling decisions with their justifications. The Group proposed using the [NSWO TSD](#) as a template for future MSE processes at ICCAT.

- (1) *Update the glossary*

To avoid confusion, the MSE glossary should be updated to be ICCAT-specific and easily understood by managers and stakeholders, for whom MSE jargon is often difficult to follow. [Harveststrategies.org](#) has prepared an [approachable glossary of MSE-related jargon](#) that may be useful here.

- (11) *More detailed roadmaps containing details on responsibilities, expected outcomes, and deadlines*

A proposal for a detailed MSE roadmap, clearly specifying the roles of each participant, delineating data guillotines, and actively tracking progress throughout the MSE process described in Carruthers (2024a and 2024b). The SCRS should decide whether this detailed MSE roadmap (Carruthers, 2024b) should be adopted and implemented for ICCAT MSE processes.

- (16) *Any external advisors should begin participation early in the process*

"External experts" are not external reviewers or contracted MSE expert analysts, but instead subject matter experts who are contracted to assist in coordinating and providing expert guidance on the project. The rationale for this recommendation follows that of implementing data guillotines: interference that invalidates previous work will slow or halt the process completely. While not all MSE processes require an MSE expert, if one is contracted, he/she should be involved early in the process.

(17) Promote interaction and communication among experts working in different MSE processes within ICCAT

The Group strongly considered the value of a Standing SCRS Working Group on MSE or a MSE sub-group of the WGSAM, which would be tasked with reducing silos and promoting information sharing among MSE developments within ICCAT. The WGSAM is well appointed to organize this Group. Though some participants noted that WGSAM is already serving this role, others highlighted the limitations of the current approach (WGSAM), including delayed and incomplete communication between the WGSAM and individual Species Groups, as well as transient or inconsistent membership over time. The Group recommended that this be discussed further during the drafting of the SCRS Science Strategic Plan.

(14) Clearly define which parts of the MSE require feedback, (15) use direct questions to guide discussions, and (18) Conduct a survey to get feedback from stakeholders and identify improvement points

These recommendations are designed to maximize the value and streamline the process of stakeholder and manager interactions with scientists, such as by adding clear feedback and decision points (with timing) in the roadmap discussed above in item 11. The draft bluefin tuna MSE process poll (Walter, 2024) and other materials developed by the bluefin tuna Communications team could serve as a blueprint to obtain Commission and stakeholder viewpoints, and these documents may be further developed if desired (e.g., separate into communications for year #1, year #2, etc., or expanded to all ICCAT MSE processes).

(12) Hard deadlines at least for Data & Operation Models (OMs) [essential component of the process], and (13) Do not update data (inputs of OMs) and assessment in the process

Data guillotines are particularly important, as continually adding and updating existing data within the MSE process is the primary cause for delay, though they may be warranted if needed to obtain buy-in from the Commission. However, exceptional circumstances protocols (ECPs) and scheduled reviews are more appropriate places to consider new data or scientific advancements. Within ECPs, updated data should be sufficiently compelling to justify revisiting the MSE. MPs should rely only on complete data that is regularly available from the stock and to maintain consistency may require a data lag (e.g., 2 years), considering the ICCAT reporting deadline of July 15.

(24) The MSE developments should not rely on "external funding" and stability for several years is required

The Group noted that MSE funding can come from ICCAT Commission through the regular budget, or in the form of voluntary contributions from Contracting Parties and Cooperating non-Contracting Parties, Entities or Fishing Entities (CPCs) and NGOs (e.g., "internal" versus "external"). Regardless of where the funding originates, it is desirable to confirm long-term support before initiating an MSE process.

The Group emphasizes that these are the perspectives and opinions expressed during the WGSAM meeting and recommends additional consideration by Species Groups engaged in MSE processes within the SCRS.

2.4 Other MSE matters

SCRS/P/2025/003 provided MSE simulations to evaluate North Atlantic Albacore harvest control rule (HCR) with a simulation model to conduct bio-economic evaluation of fisheries management strategies (FLBEIA) and consider the surplus production model SPiCT as assessment model in the MP. The North Atlantic Albacore (ALB-N) HCR was the first MP adopted by ICCAT in [Recommendation by ICCAT on conservation and management measures, including a management procedure and Exceptional Circumstances Protocol, for North Atlantic albacore \(Rec. 21-04\)](#). Now the MSE of North Atlantic Albacore is in its second stage, and as a first step, the performance of the adopted MP is being evaluated using a new grid of OMs. In this study, the new OMs were conditioned based on the most recent stock assessment model developed in 2023 with Stock Synthesis (ICCAT, 2023). The candidate MP under development includes a new biomass dynamic model (SPiCT) that is proposed to replace the previous *mpb* package (Kell, 2016). The abundance indices were introduced in two different ways with and without considering uncertainty in the historical period, and the MSE simulation was conducted using the FLBEIA framework (García *et al.*, 2017). The performance of the MP described in [Rec. 21-04](#) was estimated to be very similar for both assumptions on the abundance indices, but the results were more precautionary when the simulated indices were included in the historical period.

The Group clarified that the objectives of the revised MSE were related to a shift in the stock assessment platform from MultifanCL to Stock Synthesis (SS3), ensuring that the ALB-N MP still performed as expected, and testing whether the ALB-N MP is robust to new assumptions (new Reference set of OMs). An updated model-based MP that uses SPiCT as the Estimation Model (EM) was tested, because the previously tested ALB-N EM software (*mpb*) is no longer supported.

The Group entertained technical discussions on the observation error model, which resampled historical catch per unit effort (CPUE) indices as well as future CPUE indices; this is the same approach that was taken in the previous ALB-N MSE and discussed at the WGSAM already in the past. The methods and intentions of this approach were discussed, debated, and eventually taken offline for further consideration. Notably, to assist in future technical discussions of this nature, the Group recommended that fully characterized mathematical descriptions be provided for each paper and should accompany all presentation materials. The authors noted that this mathematical description was presented already last year (Urtizberea *et al.*, 2024) and the plan is to update the TSD with this.

During the meeting, it was noted that different approaches have been used to characterize the statistical properties of the CPUE series used in the MSE OMs for the projection of CPUE series into the future in the evaluation of CMPs. In some instances, the historical component of the CPUE series is re-estimated for each iteration, while the approach varies for other MSE processes. The Group commented that the WGSAM should consider reviewing these procedures and make recommendations on how best to characterize the statistical properties of CPUEs and to estimate future projection series, and possibly for past years, and recommended including this item in the proposed 2026 workplan of the Group.

SCRS/P/2025/004 presented HCR for multi-stock tropical tuna fisheries. The OM for the multi-stock tropical tuna fisheries was conditioned considering the uncertainty grid for the three species: Atlantic bigeye tuna (BET), Atlantic yellowfin tuna (YFT) and East Atlantic skipjack (SKJ-E). The historical recruitment deviates of East Atlantic skipjack seem to show a regime shift with positive recruitment deviates in the most recent years. Consequently, the projections assuming recent and constant effort showed that the catches of East Atlantic skipjack would decrease substantially if equilibrium conditions for the stock-recruitment relationship derived from the assessment model were assumed. Therefore, other simulations were carried out by increasing the estimated recruitment through considering the mean recruitment deviates of the last 10 (R_0 10) and 20 (R_0 20) years. Projections assumed recent effort but considering the modified stock recruitment relationship with R_0 10 result in the projection with similar catches to the catches observed recently. The International Council for the Exploration of the Sea (ICES) HCR and another HCR based on catches were tested together with the F_{cube} approach (Ulrich *et al.*, 2011), determining their performance under effort ruled by different species as a first attempt to discuss potential multi-stock MPs for tropical tunas. The results suggest that the effort applied to bigeye tuna is the most restrictive and precautionary, and therefore, catches of the three species under the effort restricted by bigeye tuna regulation help maintain the three stocks in the green quadrant of the Kobe plot with high probability.

The author clarified that the output of the multi-stock MP will be a fishing effort level by stock, which implies that the management will be effectively limited by bigeye tuna, the least resilient stock. MP-defined effort is used to project catches by fleet within the MP, and the Group stressed the difficulty of monitoring stock effort in practice, particularly within a mixed-stock fishery. Additional thought should be given to ^{how} the multi-stock MP will translate to real-world monitoring, and these considerations should be reflected in the simulations.

The Group considered the implications of the 'base' recruitment assumptions for East Atlantic skipjack and suggested that a robustness test be added that returns recruitment level to the average of what it was over the entire time series (since 1985). This level of recruitment would be lower than what is assumed as recent recruitment (e.g., unmodified R_0). The Group suggested that this alternative, plausible recruitment assumption(s) should be added to the reference set of OMs. Since shifts in recruitment appear to also experience shifts in σ_R , analysts may consider paired shifts in R_0 and σ_R scenarios.

The Group enquired whether recruitment has increased in the recent decade because of climate change-induced increases in productivity. Robustness tests may also consider autocorrelation in recruitment and correlated recruitment among species.

The multi-stock tropical tuna MSE developers' initiative clearly stated from the beginning that biological interactions among stocks will not be considered for the purposes of these analyses; instead, it is multi-stock because it considers interactions among fleets catching all three stocks. The SCRS should be prepared to justify this decision and associate implications.

Challenges associated with modeling recruitment and productivity in FAD-based fisheries and potential associated biases were considered. Because of these implications for FAD fisheries, juvenile mortality may be explored in the MSE framework. Following the example of bluefin tuna, additional consideration should be given to unique fishing regimes, which may have implications for FAD fishery and stock productivity. Specifically, for bluefin tuna, complete characterization of the implications of these unique fishing regimes and other scenarios could only be understood through MSE. Additional consideration of these fishery dynamics is warranted.

The Group discussed [Butterworth \(2024\)](#) document that described the origins of the fishing mortality restriction in the probability of being in the green quadrant of the Kobe plot (PGK), questioning its pertinence to the MSE/ MP as distinct from the Best Assessment fisheries management paradigm. The author warned that care must be taken with probabilities in the former paradigm, as they are not comparable to values calculated under the latter. The author's key recommendations were: 1) refrain from using PGK as a performance target in MSE; especially because it imposes constraints on fishing mortality (F) which are not required biologically to safeguard the resource, and compromise attaining better total allowable catch (TAC) and industry stability; 2) rather than an F constraint, ensure that the expected trend in resource biomass at the end of the management period considered is reasonably flat; and 3) if a more conservative approach is required, increase the median biomass recovery target, or decrease the period over which that target is to be achieved, rather than adjust a probability level (such as increasing that in PGK), because medians are estimated more robustly than lower percentiles.

The Group raised several concerns about abandoning F or PGK-related performance indicators.

An important consideration raised by the Group was that ICCAT [Recommendation by ICCAT on the principles of decision making for ICCAT conservation and management measures \(Rec. 11-13\)](#) and [Recommendation by ICCAT on the development of harvest control rules and of management strategy evaluation \(Rec. 15-07\)](#), as well as some domestic CPC regulatory frameworks, require overfishing ($F > F_{MSY}$) to be avoided. In data-limited MSEs (e.g., with poor knowledge of stock-recruitment relationship), considering only the biomass trend at the end of the period could be particularly risky, particularly since biomass stability does not necessarily equate to a rebuilt stock. If MPs are tuned directly to a target PGK (e.g., 60% PGK), then any modification or reconditioning of the OM grid may invalidate the MP; if the allowable tuning is a bit more "relaxed," then this should not be a problem. Consequently, PGK may be a viable or necessary performance indicator for ICCAT stocks.

The author explained that the trend in biomass at the end of the projection period is considered in addition to the requirement that the stock be at its target level (in median terms) at this time, so that rebuilding is confirmed. Furthermore, PGK is not a robust indicator and compromises TAC size and stability without good reason as the lowest depletion (LD) performance statistic ensures that risk to the resource is adequately contained. The proposed metric of terminal biomass stability would typically be calculated in terms of spawning biomass, and the period length would depend on the longevity of the species (e.g., for 30-year projection period, median trend in spawning stock biomass (SSB) over the last five years should have a slope = 0).

The Group agreed that requiring strict adherence to the Kobe green quadrant is unnecessary for stocks that are underfished, and distinguished between short term variability in relative F and long-term median F behavior. Essentially, by allowing F to vary and considerably exceed F_{MSY} at certain times, an MP could result in overfishing over long periods of time, which may be problematic. The author responded that it might be defensibly decided to take large catches initially when the stock is well above B_{MSY} (rather than fishing at F_{MSY} for an extended time) without undue risk to the resource, and that other metrics, like the safety performance indicator of LD, are designed to ensure that resource risk is appropriately contained throughout the projected management period.

The Group agreed that one needs to be careful about choosing extreme quantiles (e.g., 5%), as highlighted in the presentation, since it is very difficult to characterize the tails of a distribution, and medians are more reliably estimated. The Group pointed out that the Commission has typically been setting PGK at 60%, which is not far off the median, so can be reasonably reliably estimated. It is also important to look at the period over which PGK is estimated; looking over a longer period or at the end of a longer period, as often done in MSEs, reflects stock status after the MP has had sufficient opportunity to affect the stock.

The Group also acknowledged that as all ICCAT MSE processes are using PGK at this time, further consideration of appropriate performance indicators should be a research priority. The author concluded the discussion, reiterating that the F restriction in PGK comes from the 1995 UN Fish Stocks Agreement, which relates to the best assessment paradigm, and is not as suitable for an MSE paradigm. The Group considered adding a long-term biomass trend at the end of the projection period as an additional performance indicator for ICCAT MSEs for SCRS scientists rather than moving away from PGK. The Group did not agree to remove PGK from the list of performance indicators at this time.

The Rapporteur of the Sharks Species Group noted their intention to conduct the MSE feasibility study for North and South Atlantic blue shark stocks as per the Commission request in [Recommendation by ICCAT to replace Recommendation 19-07 on management measures for the conservation of North Atlantic blue shark caught in association with ICCAT fisheries \(Rec. 23-10\)](#) and [Recommendation by ICCAT to replace Recommendation 19-08 on management measures for the conservation of the South Atlantic blue shark caught in association with ICCAT fisheries \(Rec. 23-11\)](#). It was noted that the Sharks Species Group is busy with the shortfin mako stock assessment this year and the Group was asked for its view on how to carry out the MSE feasibility study. The Group noted that this is why it is important to have overarching MSE guidance for ICCAT (via a Standing SCRS Working Group on MSE or a MSE sub-group of the WGSAM) and suggested that the Sharks Species Group could benefit from the expertise of other Species Groups. The Commission wants to initiate MSEs for both blue shark stocks, and the Group suggested that the feasibility studies should be addressed in light of this, considering what would be needed to develop MSE processes for each blue shark stock, including the resources required.

3. Bycatch estimation tool

3.1 Contractor Progress Report

Document SCRS/2025/018 was presented and it summarizes the progress of a contracted project to develop a bycatch estimation tool and train CPC scientists in the use of that tool. An R package, [BycatchEstimator](#), was produced which applies model-based and design-based procedures in a semiautomated process to estimate total annual bycatch by expanding the data from an observer program to the total effort from logbooks or landings records. The authors of the tool also conducted a training workshop in Madrid on 15 to 17 July 2024. The goal was to train the attendees on the use of this tool to expand observer data to the total fishery and provide discard estimates. Twelve CPC scientists were trained to use the tool, applied it to their own data, and discussed technical details and best practices for bycatch estimation.

The Group requested additional information about the implementation of the tool, including the level of stratification supported, the advantages of matching observed trips to the associated logbook reports, whether the tool could be used to estimate the catch of target species, and the appropriate use of ratio-estimators versus model-based approaches. The contractor responded that the tool could produce estimates stratified by year, season, area, etc., if those data are available. The Group also noted that for ICCAT reporting requirements, bycatch should be reported in the same spatial strata as Task 1 nominal catch.

The contractor confirmed that the tool can be used to estimate catch and discards of target species as well as bycatch. In fact, using the tool to estimate the reported catch can be useful to test for potential biases, like for example the non-representative assignation of observers to fishing vessels. With regard to matching of observed trips to logbook reports, it is strongly recommended when the observer coverage is high to produce appropriate estimates of the variance because the bycatch on observed trips is assumed to be known without error. However, the contractor noted that in most ICCAT longline fisheries, the observer coverage rate is 5-10%, and at these levels the variance would not be strongly affected. Finally, the

contractor noted that in simulation testing, ratio estimators were much faster and performed well when the species of interest was not particularly rare. Additionally, users found the ratio estimators much easier and understandable. The contractor cautioned that if bycatch estimates are needed for rare-event species, model-based approaches generally performed better in simulation studies.

The training workshop produced a set of recommendations on the information that should be included in SCRS documents describing the use of the Bycatch Estimator tool or other methods to estimate live and dead discards. The Group agreed these recommendations are useful:

- Explanation of how observers are allocated to vessels.
- Separate or classify the estimated discards into live or dead discards.
- Data checking figures, including information on sample sizes and the amount of effort observed and unobserved by levels of variables.
- For design-based methods, an explanation of if any pooling was done.
- For model-based methods, model selection tables and residuals for the selected model.
- Figures showing the estimated total discards with confidence intervals, perhaps for multiple methods.
- A table providing the estimated bycatch, standard error, and confidence interval for the authors' preferred estimation method. This should be done by ICCAT statistical areas for the species. This would be the potential input to a stock assessment model.

The Group discussed the possibility of developing an R-Markdown script to generate a template for an SCRS document following these guidelines for results of the tool to further automate bycatch documentation and reporting. The Group agreed that developing an R-Markdown script is not a priority at this time.

3.2 2025 and possible 2026 training workshop

The 2025 WGSAM workplan and approved budget already include funding to add functionality to the tool in 2025 including the development of a prototype Shiny App to run the Bycatch Estimator tool from a web-based interface and a training workshop in 2025. To further facilitate trainees, the Group noted, and the contractor agreed, that it would be helpful to make the capacity building materials available in the GitHub repository associated with the project and to attempt to have a preliminary version of the Shiny App available for users' feedback during the 2025 workshop (if possible).

The Group also recommended that training be continued for at least the next two years so that additional CPCs can participate. In particular, when the web-based Shiny App becomes available, it will be necessary to have additional training for the new version of the tool. To evaluate the effectiveness of the Bycatch Estimator tool and the training, the Group recommended that the Secretariat produce a report on how many CPCs who have attended the Bycatch Estimator training workshops have started to report their dead discards using the tool.

The Group considered that some further development of the tool will likely still be required during 2026 (e.g. in relation to refinements in the Shiny App), although it is not clear to the Group at this stage what the priority issues will be, as they will also depend on feedback from the workshop to be held in 2025 as well as this Group's review of the Shiny App in 2026.

3.3 Other Bycatch Estimation matters

SCRS/P/2025/006 compared various modeling approaches used for the estimation of swordfish discards in the Canadian pelagic longline fishery for the period between 2002 and 2020. Preliminary results suggest that Generalized Additive Models (GAMs) and Generalized Linear Models (GLMs) may perform well for this fishery. Early results suggest that swordfish bycatch represents 1-2% of the annual removals in recent years. The authors emphasized that the modeling approach must be tailored to the data availability and quality.

The Group discussed the methods and requested clarification on several aspects in the presentation including spatial zonation assumptions and juvenile swordfish distribution. A number of future research needs were discussed including evaluation and selection of fishery and environmental covariates, improved differentiation between live and dead discards, evaluating spatial shifts in fishing activities since 2020, and using these analyses to evaluate optimal observer coverage levels. A plan to apply improved models and generate bycatch estimates for this fishery is forthcoming.

More specifically, the Group inquired about the potential to estimate both the dead discards and live releases of swordfish. While these data are available, the author cautioned that live releases may be difficult to estimate as a separate component because haulback mortality is high and observations of live releases are sparse. The Group also noted that it would be useful to further explore the authors' conclusion that model selection depends on data quality and quantity to guide future efforts for other fisheries. The author agreed but noted that data confidentiality requirements prevent broad dissemination of the dataset and that observations are very sparse for many species. Regarding model stratification, the Group noted that an alternative spatial stratification was developed in cooperation with the fishing community (Hanke 2012) and suggested that the author may wish to explore the use of this alternative stratification in future efforts.

Additionally, the Group noted that there appear to be important trends in the spatial distribution of the fishery (northward) and a smaller fraction of small fish in the most recent years. The Group suggested an additional evaluation of these trends to determine the cause (e.g. northward movement of larger fish, high-grading, avoidance of areas with a high proportion of undersized fish, reduction in recruitment). The Group also suggested that an ensemble approach could be useful to improve estimates of variability and noted that annual variability in bycatch would be useful in stock assessment models. Finally, the Group noted that the Commission has requested information regarding the appropriate level of observer coverage and proposed evaluating subsets of the Canadian pelagic longline data to respond to this request. Similar analyses have been conducted in the past and could inform that analysis (Beerkircher *et al.*, 2009 and Babcock *et al.*, 2003).

4. Climate Change

4.1 Comments on the *Climate Change Proposed Plan of Action*

The Group reviewed the Revised ICCAT Plan of Action on Climate Change (ICCAT. 2024) and highlighted the following aspects that need further investigation by the WGSAM:

- Include climate change as an agenda item, as appropriate, to provide dedicated time to discuss how the ongoing climate science can benefit the ICCAT management and scientific processes.
- As part of the meeting reports, include as appropriate, updates related to the execution of the Climate Change Plan of Action. Additionally, include where relevant a section on climate change considerations in the executive summaries for each Species Group.
- Prioritize needs for scientific research and data collection and specifying associated time frames and resource needs, where possible. This could include a draft list of proposed climate-related questions with implications for management that the SCRS can use to continue integrating, as appropriate, climate considerations into management advice to the Commission. These questions could consider the areas of interest already identified by Commission Officers in the stock-take exercise, such as productivity, recruitment, growth, and species distribution as well as how to better reconcile the different timeframes used for climate science and fisheries management.
- Advance the integration of work related to climate as indicated in the 2024 stock-take exercise. This work includes CPUE standardization and incorporation of relevant oceanographic and environmental changes into the stock assessment process, where feasible. In addition, the SCRS should continue to incorporate climate-related considerations into MSEs and Management Procedure (MP) development and continue to explore dynamic reference points.

The Group noted that presentations during the climate change section of the meeting (Section 4.2) addressed some of the issues raised in the plan of action and the Group will consider next steps, including a potential workshop. This is discussed further under the WGSAM workplan section of this report (Section 5.3).

4.2 Discussion of Dynamic Reference Points regarding Climate Change

SCRS/P/2025/007 presented dynamic reference points for climate change and discussed the implementation of integrated assessments to account for altered environmental conditions and impacts on stock productivity. Types of dynamic reference points included: (1) Time-varying parameters through random variation, linking with covariate and time blocks. An example discussed was the assessment reference points for Southern bluefin tuna with varying growth, relative fleet allocation and selectivity. (2) Dynamic B_0 where a theoretical biomass trajectory resulted if no fishing of the stock had occurred throughout its history, but other parameters had remained as estimated in the assessment. An example was discussed for 3 demersal fish species which tested 2 HCRs.

The Group discussed how to attribute directional changes in recruitment and reference points to environmental changes (e.g. Climate Change) or to changes in the fishery, using the example of the introduction of the purse seine FAD fishery leading to more juvenile catch of tropical tunas. There was agreement that identifying when a change is driven by changes in the environment or by changes in fishery selectivity is going to be a challenge moving forward because of data limitations. The Group discussed two ways of using the unfished biomass (B_0) (static and dynamic) and noted that the simulation in the work presented uses data from a model that assumes variation of the productivity changes over time instead of using a stationary process. The author noted that stock assessments are able to pick up on those changes even with the stationary assumption and clarified that they tested a generic model-based MP over a limited environmental range, but implementation would need to undertake a more tailored exercise for each species that captures potential future changes. While this process worked well for Southern bluefin tuna because it tracks biomass with the stock assessment, using external adjustment to influence TAC through time may not work well.

The Group noted that while climate change robustness tests have been included in some MSE processes at ICCAT, it is not always clear how ranges of climate driven impacts on biological processes can be defined (e.g. impact on natural mortality, growth, or recruitment). The author agreed and responded that there may be value in having ecosystem-based assessments run in parallel to define these ranges. The Group agreed that it is important to have scientists develop realistic bounds within which resource dynamic parameters may change.

The Group noted that the work in this presentation seems of more direct relevance to the case where the HCR relies on a stock assessment model to estimate reference points and set catch limits using the output from the stock assessment and from the reference points estimated from the same assessment.

The Group also received a presentation informing about previous work from a U.S. South Atlantic Fishery Management scientific and statistical Council report that reviewed recent literature on recruitment assumptions and impacts on catch level advice. The report noted that short-term catch advice has typically a less than 50% probability of overfishing, and the “buffer” is based on the degree of scientific uncertainty. Long term forecasts tend to cycle around the central tendency, hence it should consider the complete history of the stocks. The report recommends the inclusion of hindcasting as described in Kell *et al.* (2021) in order to assess and improve the forecasting ability of assessments. More research is required to explore autocorrelation, proportional variability, and correlation in age at 50% maturity across managed stocks. Research should specifically look at the factors from Van Beveren *et al.* (2021) in order to help determine the best methods of projection based on the species’ characteristics. The Group found this work to be very useful.

SCRS/P/2025/001 presented evidence of directional changes in parameters estimated by stock assessments and the need to update management benchmarks accounting for these changes. Trends in recruitment deviates are probably an indication of model misspecification but they can also indicate changing conditions (productivity, etc.) linked (or not) to climate change. These need to be addressed to develop robust management advice. A case study on the Indian Ocean yellowfin tuna showed that current catches are not sustainable, so the productivity needs to be scaled, and updates made to the benchmarks. The presentation concluded that the stock status, benchmarks, and projections need to reflect recent trends and current conditions.

The Group agreed that defining "recent" to be a reasonably long period would avoid or reduce the potential problem with poorly estimated recruitment in the most recent period. The Group noted that using recent recruitment deviates instead of recent recruitment in the projections would maintain the link between the spawning stock biomass and the expected recruitment and, for low levels of biomass there would also be an expectation of low recruitment. This would not happen if recent recruitments were used to estimate benchmarks in the recent period and in the projections.

The Group agreed that 4-5 years of recruitment deviations may not be enough to determine productivity changes and that longer periods would be more suitable. However, it was noted that the decision on the period used to update the stock-recruitment relationship and the benchmarks may be arbitrary and a matter of discussion for each stock. Retrospective analyses could help determine this period and to evaluate the predictive capacity of the models by checking if recent recruitments are consistent with updated data.

The Group noted that more work is needed to understand the residual patterns related to process error in the models. The case study showed that 9 models of the last Atlantic yellowfin stock assessment have trends in recruitment deviations and different estimates of productivity.

The Group considered that short-term projections need to take into account recruitment deviations and benchmark changes should be delayed since they have consequences for a long-term framework. The author noted that using recent recruitments for future recruitments can unlink spawners and recruits and can assume a large number of recruits in the prediction period leading to high catch recommendations even when a stock is estimated to be at low levels of biomass. There was an agreement that more work is needed to ensure that recommendations from the WGSAM form best practices taken up by the Species Groups.

A recorded presentation (SCRS/P/2025/008) was given to the Group focused on Harley (2024) relating to two aspects of stock projections: (1) what do we do if recent recruitment is significantly different from the long-term average; and (2) how the length of projections can be matched to the management needs. The presentation gave some examples, based on the outputs from the [2024 ICCAT Yellowfin Tuna Stock Assessment Meeting](#) and indicated that the plan was to continue this research work in 2025. This would include working with the bigeye tuna assessment team and any other interested Species Groups conducting assessments. The presentation also welcomed any available information on standards for projections and aimed to bring some recommendations back to the next meeting of the WGSAM.

The Group discussed shifting benchmarks and the long-term transient effects that can be above the long-term average. The Group noted that creating 2 or more Kobe matrices in the SCRS report will hinder its advice to the Commission without differentiating which is better. It may be more useful to determine which years are better for recruitment predictions to provide indices for the model (retrospective hindcasting). Counter to this, it was discussed that directional changes in the model estimates should be considered in the management advice. Multiple years of recruitment should be used to forecast empirical long-term performance.

In general terms, it was noted that there is no agreement on how to proceed when directional changes in recruitment are estimated by stock assessment models, the options being (i) to use recent recruitment for short term projections, (ii) using the stock-recruitment relationship to estimate future recruits and (iii) to scale the stock-recruitment relationship and management benchmarks from the recent recruitment deviates. However, the Group concluded that trends in recruitment deviates need to be discussed case by case by each Species Group.

The Group noted that given the use of retrospective hindcasting (Kell *et al.*, 2021) as a routine part of model diagnostics (Carvalho *et al.*, 2021) there is the potential to use this method to evaluate projection settings for recruitment. Essentially this evaluates what model specifications provide the best predictors of survey or CPUE data. In situations where recruitment deviations exhibit significant trend (Merino *et al.*, 2022) it is unclear how to best characterize future recruitment and retrospective hindcasting could be used to evaluate options, such as what years one might use to average over in case of using recent averages, or whether to use a stock recruitment relationship. Species Groups are encouraged to employ retrospective hindcasting as an empirical means for evaluating the forecasting skill of recruitment specifications early in the model development phase.

In order to advance on a common methodology for setting-up projections in general, and recruitment and management benchmarks in particular, the Group noted that it would be beneficial to learn from the experience in the stock assessments in the Eastern Pacific Tuna (Inter-American Tropical Tuna Commission IATTC) and Western Central Pacific (Western & Central Pacific Fisheries Commission, WCPFC), as they do account for recent conditions for their management advice. It was proposed that scientists from these RFMOs be encouraged to participate in the next WGSAM to discuss this topic.

It was noted that one WGSAM meeting is generally not sufficient to make big changes in the methods used by ICCAT Species Groups but can provide guidance that can be useful to the individual Species Groups. The SCRS Chair agreed that this matter should be considered in the development of the new Strategic Plan for the SCRS.

SCRS/P/2025/005 provided an overview of the application of risk equivalence approach for investigating management implications of not properly accounting for the effects of environmental variability in an assessment or MSE. In this research using the North Atlantic swordfish case study, declines in stock status occurred when environmental conditioning was not a component of the harvest control rule (HCR), or when the environmental conditioning did not match the scale of the projected declines in years class strength.

The Group questioned whether a single environmental covariate adequately accounts for fluctuations in large pelagic species productivity in a similar way as it seems to occur in this case for a demersal species (halibut). The presenter acknowledged that halibut does not have the same environmental parameters as swordfish, but this tool may still be added to future work to account for Climate Change effects where other tests are not available.

The Group concluded and agreed:

- It is important to have scientists develop realistic bounds within which dynamic parameters of the resource may change.
- Scientists should carefully consider the settings and options for recruitment in projections, such as: i) whether deterministic or stochastic, ii) based on a stock-recruitment relationship or not, iii) with a stock-recruitment relationship, whether recent trends are considered or not. Species Groups also need to reflect on whether productivity is changing B_0 or R_0 in a non-random way and whether we have hypotheses about environmental effects on productivity.
- Species Groups should also reflect on whether those choices have implications for short term or long-term advice. Make informed choices about the method used for recruitment projections and document why it was chosen. If Species Groups decide to change the method used in previous assessment(s), they should at a minimum project a continuity option using the previous method. For the advice (short term or long term) they should pick one method, and not give a choice to managers.

5. Other matters

5.1 Software catalogue

Document SCRS/2025/020 presented a summary of a new software “SSfutureC++” developed by Japanese scientists to carry out stock projections from the results of Stock Synthesis 3 (SS3) assessment models. The software was developed for and has been used by the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC). The author noted that the software has been tested and validated against the SS3 projection program, and the new software includes similar functionality as SS3 for including uncertainty applying Markov chain Monte Carlo methods (MCMC), bootstrapping, or structural grids, and maintaining the fleet and gear structure of the SS3 model in the stock projections while providing higher flexibility of future management scenarios and faster speed of computation.

The Group welcomed the availability of alternative stock projection software, indicating that the SCRS has a protocol implemented for including new software within the [ICCAT Software Catalog](#) and invited author(s) to submit it for evaluation. The author noted that currently, the source code of “SSfutureC++” software is not open access. The Group indicated that software in the ICCAT catalog passes through a series of performance tests and independent evaluations before being included in the list and invited SCRS scientists willing to test the new software during the stock evaluations in 2025 including the Bigeye Tuna Stock Assessment (hybrid, Madrid, Spain, 14-18 July 2025).

The Group reviewed SCRS/P/2025/002 on an open and reproducible stock assessment protocol for improving transparency and credibility of all ICCAT assessment processes. The authors suggested that implementing this process will improve assessment review and science collaborations among SCRS scientists, improve the efficiency of SCRS work, better manage and track changes during the assessment process, and facilitate the transition of knowledge and processes among scientists within the SCRS organization. The proposed process will directly link analysis and results into the overall workflow having a reproducible approach by using R scripts and automatic document creation (qmd/ quarto) for all assessments while keeping all these elements in a GitHub site location where different interactive tools like Shiny Apps and dashboards (flexdashboard, shinydashboard) can be also used.

The Group welcomed the presentation and thanked the authors for their efforts and proposal. However, the Group noted that in ICCAT multiple assessment platforms are frequently used for stock evaluations that are not necessarily compatible with the single R script or a single-model assessment. The authors indicated that in the proposed process, it should be possible to use single or multiple assessment models, like SS3 and JABBA (Winker *et al.*, 2018), *mpb*, SPiCT, etc.

The Group further commented that some SCRS stock evaluations have been a combination of different approaches and software responding more to the characteristics of the data, where the model(s) should adapt to the data, suggesting the need to allow different approaches and avoid imposing restrictions on stock evaluation models or platforms. However, the Group recommended that ICCAT moves towards the concept of an open and reproducible approach proposed but should avoid restrictions. The Group also noted that the initial setting of a model assessment requires the “expertise” of modelers to evaluate the process of model fitting, data weighting, and likelihood optimization considerations that are not usually part of a single script style approach.

The authors responded that the suggested process does not imply full restriction, particularly for the initial development and the creation of a start or base model. However, it will facilitate the work once the Group has adopted a base model for running and evaluating stock status and projections.

The Group further noted that the SCRS has been moving into the general approach of open and reproducible assessments by implementing and using tools that facilitate the streamlining of stock assessments, using R tools, and creating reproducible code for most of the recent evaluations. In the case of stocks managed under an MSE process the SCRS, based on recommendations from the WGSAM, is implementing an open and more accessible approach for the ICCAT community to have access to the code, runs, evaluations of MPs, results, and other products from MSE processes. It may be possible to consider applying this process to regular stock assessments. It was also reminded that the open public access level for the model may not be applicable to the current SCRS process, at least within a given year until the Commission approves the SCRS advice at the end of the year meeting.

Overall, the Group concluded that the objectives of the proposal for open and reproducible assessments are beneficial for the SCRS and ICCAT, but the actual protocol needs to be flexible and allow different assessment models and platforms for stock evaluations, multiple model combinations, and avoid restrictive code scripts. Moving towards this model of approach is good and the Group endorsed it, however, the implementation should have flexibility and the features to comply with current standards for data compliance and adoption of assessment, e.g. data preparatory and assessment meetings within the SCRS Species Groups, review by the SCRS and final adoption of the results by the Commission.

SCRS/P/2025/009 showed the proposed update for the ICCAT MSE webpage, following the 2024 WGSAM recommendations. The work presented has been the product of collaboration and input from the ad-hoc sub-group on MSE communication composed of SCRS Chair, WGSAM and Species Groups rapporteurs, and the Secretariat. The Secretariat showed a proposal for HTML web pages that include more topics and links to each ICCAT MSE process including those recently requested by the Commission. It was also noted that the Shiny Apps for bluefin tuna and Northern swordfish MSEs are now hosted by the Secretariat.

The proposed updated MSE webpage will:

- Maintain the top [ICCAT MSE page](#) and add the link to a new page for “general MSE material page” in the three official languages.
- Create a new page for “[general MSE material](#)” in the three official languages.
- Create new pages for “each species MSE materials”, using a common format ([example](#)).

Overall, the Group was very pleased with the update and proposed format and encouraged its implementation as soon as possible. The Group also agreed to use links to general information on MSE topics within the page rather than try to develop similar information in-house. It was suggested making materials (e.g. MSE training materials and Ambassador presentations that currently are not available publicly) shareable directly from the web page, eliminating the formal request to the Secretariat. It was also proposed to include a summary table of the status of each MSE process in the general material page as quick information. The Secretariat clarified that the ICCAT web page, including the MSE main sections, will be available in the three official languages once approved by the SCRS. However, it was noted that MSE links included in the page will be only in the language provided by the source page.

Finally, it was noted that some of the material and text reflect the status at the date of creation, which may have changed or been updated, therefore it was suggested to post it with the date of creation and a general note that cautions the reader to review the latest information available, something like “Please review the latest resolutions or recommendations adopted by the Commission on this topic”.

The Secretariat reported that [FLBEIA](#) and [openMSE](#) software programs have been incorporated into the ICCAT software catalogue as agreed by the SCRS in 2024.

5.2 Topics to bring to SCRS Strategic Plan meeting

The Group was informed that the SCRS Science Strategic Plan Ad Hoc Drafting Group will be working intersessionally to advance the drafting of the 2026-2031 SCRS Science Strategic Plan for review at the SCRS Science Strategic Plan meeting (9-11 July 2025). The Group discussed objectives and strategies that they wished to highlight for the consideration of the Ad Hoc Drafting Group.

One of the topics of discussion was related to a potential change in the structure of the SCRS. The Group considered whether the WGSAM should continue to be the Working Group responsible for discussing best practices for MSE within the SCRS or if there should be a new MSE Working Group formed. If the WGSAM continues to be responsible, it may be necessary to add additional meeting time during each year (for a minimum of a 5-day meeting, or potentially a separate session focused on MSE on an annual or biennial basis). If a new MSE Working Group is created, it could not only address questions related to best practices, but could potentially also carry out the MSE work to support the different Species Groups. This could be a solution to the shortage of MSE expertise within Species Groups, but it requires additional commitments from SCRS scientists with MSE experience and would likely limit the overall throughput of MSE processes within the SCRS when compared to MSE processes potentially carried out by each Species Group (if there were sufficient expertise developed within each Species Group).

5.3 Workplan for 2025 and 2026

The Group reflected on the workplan for 2025, as approved by the SCRS in 2024. This workplan included the following:

1. Conduct a debriefing of the 2024 ICCAT Workshop on the Use of the Bycatch Estimation Tool (BYET) with the BYET contractor to identify further development and potential future upgrades to the BYET.

2. Develop Terms of Reference for a contract to develop further the BYET in 2025.
3. Conduct a BYET workshop in 2025 that furthers capacity building and use of the BYET with the possibility of language interpretation.
4. Create a study group and determine how MSE results and Shiny Apps are maintained and published.
5. Address Species Groups requests to the extent possible.

The Group noted that items 1-4 are all already addressed (i.e. either the work has already been done or in progress), whereas item 5 is a long-standing item for the WGSAM.

The following discussions and tentative workplan for 2026 have been done assuming that the WGSAM remains as the main SCRS Working Group dealing with MSE outside of the Species Groups. If a separate SCRS Working Group on MSE was newly created, the WGSAM workplan would be adapted taking that into account.

Based on the discussions during this meeting, the Group identified the following additional work needed to be conducted intersessionally during 2025:

- Develop the position description for the proposed MSE coordinator within the Secretariat, as recommended by the MSE External Review and strongly supported by the Group.
- Create an MSE sub-group of the WGSAM. The sub-group should work intersessionally during 2025 to advance development of the MSE recommendations considered as high priority by the Group (**Appendix 6**). This sub-group should report progress to the WGSAM at its 2026 meeting (although with earlier interaction with the WGSAM and the SCRS in 2025 if possible). The Group requested that the SCRS Chair contact the SCRS officers to identify scientists interested in participating in this sub-group. The Group also proposed that interested scientists contact directly the SCRS Chair.

Tentative workplan for 2026

The following items were identified for the 2026 workplan. The Group anticipates that work on these topics will extend beyond 2026.

On the Bycatch Estimation Tool (BYET) tool:

- Conduct a debriefing of the 2025 ICCAT Workshop on the Use of the Bycatch Estimation Tool (BYET) with the BYET contractor to identify further development that may be required.
- Conduct a new training workshop on the Use of the BYET in 2026.

On MSE:

- Review the progress of the MSE sub-group's work and consider the work needed for 2026.

It is anticipated that support on MSE will be needed in some ICCAT MSE processes (e.g. for sharks, if or when the MSE process goes ahead). Furthermore, capacity building on MSE, both technical as well as for managers and stakeholders, is also required. The MSE sub-group should have an oversight role over these activities.

- Review procedures and make recommendations on how best to characterize the statistical properties of CPUEs used in MPs, to estimate future CPUE values in projection years, and possibly for past years, within the MSE simulations.

On addressing the provision of management advice under non-stationary conditions:

- A dedicated session in the 2026 WGSAM meeting first focusing on recruitment assumptions on projections and ways to characterize stock status under non-stationarity, with appropriate invited speakers. Preparatory work by the Group should be done reviewing different alternatives for presentation at the meeting.

This item was identified by the Group as a priority following the discussions on the session on Climate Change (see Section 4), on how best to provide advice when using projections under non-stationary conditions.

On issues related to best practices in stock assessment:

- To the extent possible, the Group will review aspects of stock assessment brought to its attention by SCRS Species Groups in advance of the next meeting.

Review and advise on best practices for assessments where the data have little contrast to estimate stock status reliably and where priors may have undue influence on results was proposed as a topic requiring attention.

6. Recommendations

Recommendation with financial implications

- Creation of an MSE coordinator position at the ICCAT Secretariat. A draft position description should be developed intersessionally in collaboration with the Secretariat for consideration at the SCRS meeting in September 2025. The appointee would coordinate, oversee, and review all ICCAT MSE processes and:
 - provide expert feedback on MSE coding (or code, as required) and CMP development (to harmonize it where possible),
 - serve as a liaison among ICCAT MSE processes,
 - advise SCRS on MSE best practices and
 - ensure consistency of MSE approaches across the SCRS Species Groups where appropriate.
- Training workshops (3-days) for the BYET in 2026 and 2027.
- Training workshops (5-days) for advanced technical MSE in 2026 and 2027.

Table 6.1. Summary of the budget requests for the period 2026-2029.

| WGSAM | 2026 | 2027 | 2028 | 2029 | Explanations |
|---|----------------|----------------|----------------|----------------|--|
| Workshops/Meetings | | | | | |
| Training workshops for the BYET* | 30,000 | 30,000 | | | It is estimated new training workshops needed to further develop CPCs capacity building to use BYET to comply with report requirements on bycatch |
| Training workshops for advanced technical MSE* | 40,000** | 40,000** | | | It is estimated new advanced technical workshops are needed to further develop SCRS capacity building on MSE development |
| Modelling | | | | | |
| Further development of the BYET | 20,000 | 20,000 | | | To incorporate possible feedback from the training workshops held the previous year |
| Science coordination | | | | | |
| Hire an MSE coordinator (permanent position at the Secretariat) | 170,000 | 175,000 | 180,000 | 185,000 | A permanent position is being requested. Until it can be funded through the regular budget, it is requested to be funded through the Science budget. |
| TOTAL | 260,000 | 265,000 | 180,000 | 185,000 | |

* Includes the labor costs of the instructors (2) and financial assistance for the instructors and selected participants in attendance at the workshop.

** Estimates to be confirmed during the SCRS Plenary meeting, based on the Terms of Reference to be developed intersessionally.

Recommendation without financial implications

The workplan (section 5.3) includes recommendations for the intersessional work of the WGSAM in 2025 and subsequent years. Comments on the recommendations provided by the MSE External Review (SCRS/2025/019) can be found in **Appendix 6**. SCRS Species Groups engaged or planning to become engaged in MSE should review the recommendations of the MSE External review.

It was agreed that the Chair will contact participants during the inter-sessional period to select two of the following recommendations, to be included in the SCRS report.

Additional recommendations on MSE:

- During the development of the SCRS Science Strategic Plan it should be decided whether MSE responsibilities should remain in the WGSAM or a new Working Group on MSE should be created. If the WGSAM continues to be in charge of MSE, the WGSAM meetings should last five days.
- MSE development teams should provide fully characterized mathematical descriptions of all components of simulation models associated with each SCRS paper or presentation on MSE.
- Multi-stock candidate MPs should in particular describe the specific monitoring requirements part of the MP.
- The feasibility study for blue shark MSEs should include a plan for increasing the capacity of the Sharks Species Group to support the development of this MSE.

Recommendations related to the bycatch estimation tool (BYET):

- To evaluate the effectiveness of the training on bycatch estimation the Secretariat should produce a report on how many of the CPCs that attended the training have recently started to report their dead discards.
- Scientists who have used this tool for bycatch estimation reports should present to the Subcommittee on Statistics an SCRS document providing the detail information included in section 3 of this report.
- The WGSAM in 2026 will review the Shiny App being developed in 2025.

Recommendations related to the Climate Change Proposed Plan of Action.

- When considering recruitment settings for stock assessment projections or MSE simulations, Species Groups should:
 - consider the alternative options available for how to model recruitment in the future,
 - justify the choice of a particular option. If the option is different to the one used in previous assessments or MSEs, a continuity analysis should be provided,
 - avoid providing advice based on multiple options for recruitment forecasting and
 - employ retrospective hindcasting as an empirical means of evaluating the forecasting skill of recruitment specifications.

Recommendations on other matters:

- The SCRS should actively pursue the goal of adopting an open and reproducible approach for stock assessments. However, whilst pursuing this goal, the SCRS should not be prescriptive about how this goal can be achieved (e.g. particular software platforms). The SCRS should be mindful that it may not be possible to provide full public access to all components of the assessment process (e.g. fine-scale CPUE data).
- The current additions to the MSE webpage presented to the Group should be made public on the ICCAT website after the SCRS has adopted the update.

Recommendations for the SCRS Science Strategic Plan. The Group recommended that in the development of the new Strategic Plan the following objectives and strategies should be highlighted:

- The process of updating and reviewing, Terms of Reference and workplans for the different SCRS Species Groups.
- Whether the WGSAM's role should be limited to advise other SCRS Groups on methodologies or should the WGSAM have the authority to define which methods can be used by SCRS scientists.
- Improving the integration of the WGSAM recommendations within the work of other Species Groups.
- Include within the ICCAT Manual WGSAM recommendations on best practices.
- The process to identify stocks which, on a scientific basis, warrant inclusion on the ICCAT MSE Roadmap for the development of an MSE.
- The process for development and evaluation of CMPs.
- The process for development and presentation of budgets for the short and long term.

7. Adoption of the report and closure

The Report of the 2025 Intersessional Meeting of the Working Group on Stock Assessment Methods was adopted. Dr. Carmen Fernandez thanked the participants and the Secretariat for their hard work and collaboration to finalize the report on time. The SCRS Chair thanked Dr. Carmen Fernandez for her excellent work despite the short notice, and Dr. Michael Schirripa for his long-term leadership. The meeting was adjourned.

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Agenda

1. Opening, adoption of agenda and meeting arrangements and assignment of rapporteurs
2. Management Strategy Evaluation
 - 2.1 Presentation of the MSE Review
 - 2.2 Response to the MSE Review
 - 2.3 Addressing recommendations of the MSE Review
 - 2.4 Other MSE matters
3. Bycatch estimation tool (BYET)
 - 3.1 Contractor progress report
 - 3.2 2025 and possible 2026 training workshop
 - 3.3 Other bycatch estimation matters
4. Climate Change
 - 4.1 Comments on the [Climate Change Proposed Plan of Action](#)
 - 4.2 Discussion of Dynamic Reference Points with regard to Climate Change
5. Other matters
 - 5.1 Software catalogue
 - 5.2 Topics to bring to SCRS Strategic Plan meeting
 - 5.3 Workplan for 2025 and 2026
6. Recommendations
7. Adoption of the report and closure

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Appendix 3

List of documents and presentations

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|-----------------|--|--|
| SCRS/2025/018 | Training Workshop on the Bycatch Estimator Toolkit | Babcock E.A., Hartford W., and Adao A. |
| SCRS/2025/019 | Report of the Project “External Review of the Overall ICCAT MSE Process | Garcia D., Altuna-Etxabe M., Citores L., Ibaibarriaga L., and Sánchez-Marono Sonia |
| SCRS/2025/020 | Report on the development of SSfuture C++ (version 2.0.1): Future projection software seamlessly connecting to SS3. | Ijima H. |
| SCRS/P/2025/001 | Climate change or something else, the need to update management benchmarks | Merino G., Urtizberea A. and Correa G. |
| SCRS/P/2025/002 | Open and reproducible science in stock assessments | Correa G.M., Urtizberea A., and Merino G. |
| SCRS/P/2025/003 | MSE Simulations to evaluate North Atlantic Albacore HCR with FLBEIA and considering SPiCT as assessment model in the MP. | Urtizberea A., Merino G., Correa G.M., Laborda A., and Arrizabalaga H. |
| SCRS/P/2025/004 | Harvest Control Rules for multi-stock tropical tuna fisheries. | Laborda A., Urtizberea A., Correa G.M., Arrizabalaga H., and Merino G. |
| SCRS/P/2025/005 | Investigating potential North Atlantic swordfish climate-conditioned management approaches | Mormede S, Hanke A., and Gillespie K. |
| SCRS/P/2025/006 | Comparing modeling approaches for estimating swordfish discards in the Canadian pelagic longline fishery | Yin Y., Akia S., Gillespie K., and Bowlby H. |
| SCRS/P/2025/007 | Dynamic reference points with a changing climate | Bessell-Browne P. |
| SCRS/P/2025/008 | Some thoughts on stock projections | Harley S. |
| SCRS/P/2025/009 | Proposal on the ICCAT MSE website by Ad-hoc Sub-group on MSE Communication | Kimoto A., Taylor N., and Ortiz M. |

SCRS document and presentations abstracts as provided by the authors

SCRS/2025/018 - presented the results of the training in July, 2024, on the use of the Bycatch Estimator R library, in which twelve CPC scientists learned to use the tool, applied it to their own data, and discussed technical details and best practices for bycatch estimation. The WGSAM workplan includes continuing to add functionality to the tool and holding another training in 2025. The group agreed that the trainings should be continued at least for several more years so that more CPCs can attend the training. In particular, if a web-based Shiny App is developed for bycatch estimation, it will be necessary to have at least one more training for the new version of the tool. To evaluate the effectiveness of the training, the group discussed producing a report on how many CPCs who have attended the Bycatch Estimator training have started to report their dead discards.

SCRS/2025/019 - This report summarizes the review of the five MSE activities that ICCAT has been involved in since 2015. The review was based on the available working group reports, SCRS documents, and dialogue with relevant ICCAT experts. For each case study, individual meetings were held including species working group chairs, technical working group chairs, contractors and current and former SCRS Chairs (not all of them participated in all the meetings). Additionally, a general meeting was held that included all these participants plus the WGSAM Rapporteur and relevant ICCAT Secretariat members. In the species-specific meetings, processes were discussed in detail to complement the knowledge gained from existing reports and documents. Furthermore, the perception of the process by the chairs and the contractors was obtained. Conclusions and recommendations were presented and discussed in the joint meeting with all case studies. This report reflects what was presented and discussed at the joint meeting. Some recommendations resulted from assessing consistency across case studies and reviewing materials, while many arose from dialogue with relevant experts.

SCRS/2025/020 - SSfuture C++ is an Rcpp-based program designed for seamless integration with Stock Synthesis 3 (SS3). The software enables fast and flexible projections of future fish stocks. This study introduces SSfuture C++ by outlining its features, highlighting recent updates, and showcasing practical applications. Version 2.0.1 introduces new functionality allowing users to specify spawning and recruitment quarters. These enhancements improve support for complex population dynamics models, such as seasonal cohort and two-sex models. Updates to the Rcpp implementation have also improved code readability and maintainability. Analyses using SS3 files from the 2021 Atlantic Bigeye tuna stock assessment confirm that deterministic projection results from SSfuture C++ align closely with SS3 outputs. Future developments will incorporate Total Allowable Catch (TAC) scenarios and Harvest Control Rules (HCRs) simulators. Preparations are also underway for a presentation at the ICCAT Bigeye tuna data preparatory meeting in 2025.

SCRS/P/2025/001 - The document emphasizes the necessity of updating management benchmarks in response to climate change or any other factor that may be causing trends in recruitment deviates. The document discusses the assessment of tropical tunas and their recruitment deviations, highlighting how these can compensate for biomass during periods of large catches. The presentation outlines the implications for management, noting that process errors are not random but part of the response to fishing. The 2024 Atlantic yellowfin stock assessment estimated that recent recruitment is different from the average or the values calculated using the stock-recruitment relationship, suggesting that the models may underestimate productivity. The presentation also examines recruitment deviates' trends in the Indian Ocean yellowfin stock assessment and proposes a method to update benchmarks and set projections for management advice taking into account recent conditions.

SCRS/P/2025/002 - Open science promotes the sharing of data, analyses, and ideas to promote reliability, reproducibility, transparency, and collaboration during the scientific process. Reproducibility is a key tenet of the scientific process that dictates the reliability and generality of results and methods. In the stock assessment field, open science practices have received more attention in recent years. In this presentation, we list a set of open-source tools and practices that may improve the efficiency and reproducibility of stock assessment processes. The main practices are using R for handling assessment input files, running models, and analyzing results, using Quarto for making reports and presentations, using Shiny Apps to communicate results, and using GitHub to share the code. In addition, we recommend constructing workflows for improved efficiency. These same concepts can be applied to any analysis fishery scientists perform (e.g., MSE, CPUE standardizations, etc.).

SCRS/P/2025/003 - The North Atlantic Albacore HCR was the first MP adopted by ICCAT (Recommendation 21-04). Now the MSE of North Atlantic Albacore is in a second stage, and as a first step, the performance of the adopted MP is being evaluated using a new grid of OMs. In this study, the new OMs were conditioned based on the most recent stock assessments model developed until 2023 with Stock Synthesis. The candidate MP under development includes a new biomass dynamic model (SPiCT) that is proposed to replace the previous *mpb* package (Kell, 2016). The abundance indices were introduced in two different ways: with and without considering uncertainty in the historical period, and the MSE simulation was carried out using the FLBEIA framework (García *et al.*, 2019). The performance of the MP described in Rec 21-04 was estimated to be very similar with both assumptions on the abundance indices, but the results were more precautionary when the simulated indices included the historical period.

SCRS/P/2025/004 - The presentation described a range of ways dynamic reference points can be used to account for climate change impacts within stock assessments and harvest strategies. It outlined that there are various means by which climate change can be incorporated within the fishery management process, and within assessment options are only represent a small proportion of the total options. Dynamic reference points within stock assessments through the introduction of time varying parameters were introduced, including time varying natural mortality, unfished recruitment, growth, maturity etc., where example applications were discussed. The use of dynamic B0 as a method of changing reference points through time was also discussed. The performance of dynamic B0 under reduced productivity scenarios that was tested using management strategy evaluation was presented, highlighting the limitations of this approach. The presentation highlighted the range of options for including dynamic reference points within the fishery management process, that directional change in assessment parameters with climate change impacts will require further consideration, and that many assessments already include dynamic reference points.

SCRS/P/2025/005 - This presented management implications of not properly accounting for the effects of environmental variability in an assessment or management strategy evaluation (MSE) in the north Atlantic Swordfish stock. A functional relationship between trends in the North Atlantic sea-surface temperature (SST) and Swordfish year class strength (YCS) was quantified. This relationship was used as a proxy for projecting the future productivity of the stock and assessing the performance of a harvest control rule under a suite of climate change scenarios. Declines in stock status occurred when environmental conditioning was not a component of the harvest control rule or when the environmental conditioning did not match the scale of the projected declines in YCS. This work also highlights the trade-offs that providing risk equivalent, climate conditioned advice imposes in terms of yield and stability.

SCRS/P/2025/006 - This compares various modeling approaches used for the estimation of swordfish discards in the Canadian pelagic longline fishery. Discards are an important source of unaccounted mortality in this fishery due to high rates of haulback mortality and unreported discards. Estimating discards of swordfish inside the stock assessment model was previously attempted, but total discard mortality remains highly uncertain. Methodologies largely follow Yin, *et al.* (2024) which have been applied to other species. Additional models using the Bycatch Estimator tool are also undergoing testing. Model performance were evaluated using a variety of diagnostics, including cross validation. Preliminary results suggest that GAMs and GLMs may perform well for this fishery. Early results suggest that swordfish bycatch represents 1-2% of the annual removals in recent years. The authors cautioned that the modeling approach must be tailored to the data availability and quality. It is unlikely that there is any “one-size-fits-all” approach and it is important to consider the trade-offs between model complexity and practicality. The authors also described future research needs, including the evaluation and selection of fishery and environmental covariates, improved differentiation between live and dead discards and evaluating spatial shifts in fishing activities since 2020. A plan to apply improved models and generate bycatch estimates for this fishery is forthcoming.

SCRS/P/2025/007 - The OM for the multi-stock tropical tuna fisheries was conditioned considering the uncertainty grid for the three species: BET, YFT and SKJ. The historical recruitment deviates of SKJ seem to show a regime shift with positive recruitment deviates in the most recent years. Consequently, the projections assuming recent and constant effort showed that the catches of SKJ would decrease substantially if equilibrium conditions for the stock-recruitment relationship derived from the assessment model were assumed. Therefore, other simulations were carried out by increasing the estimated recruitment through considering the mean recruitment deviates of the last 10 (R0 10) and 20 (R0 20) years. The ICES HCR and another HCR based on catches were tested together with the Fcube approach (Ulrich *et*

al., 2011), determining their performance under effort ruled by different species. The results suggest that the effort applied to bigeye tuna is the most restrictive and precautionary, and therefore, catches of the three species under the effort restricted by bigeye tunas' regulation help maintain the three stocks in the green quadrant of the Kobe plot with high probability.

SCRS/P/2025/008 - This presented part of paper SCRS/2024/147 relating to two aspects of stock projections: (1) what do we do if recent recruitment is significantly different from the low-term average; and (2) how the length of projections can be matched to the management needs. Harley gave some examples, based on the outputs from the 2024 YFT assessment and indicated that he proposed to continue this work in 2025. This would include working with the BET assessment team and any other interested working groups conducting assessments. Harley also welcomed any available information on standards for projections and aimed to bring some recommendations back to the next meeting of the Methods WG.

SCRS/P/2025/009 - Following the recommendation by the 2024 SCRS, ad-hoc sub-group on MSE communication composed of SCRS Chair, WGSAM Chair, Species Group Chairs, and the Secretariat proposed update for the ICCAT MSE Web page. The proposed updated MSE web page will 1) Maintain the top page of <https://www.iccat.int/mse/en/index.asp>, and add the link to a new page for "general MSE material page" in the three official languages, 2) Create a new page for "general MSE material page" (<https://iccat.github.io/iccat-mse/>) in the three official languages, and 3) Create new pages for "each species MSE materials" ONLY in English, using a common format (example: <https://iccat.github.io/test-mse/>).

Appendix 5

Original recommendations from the MSE External Review as presented in SCRS/2025/019

For the SCRS:

1. Update the glossary.
2. A document with a standardized list of performance indicators
3. A document with standard figures, their interpretation and the type of data for which they are used
4. Centralize important information: presentations, links to relevant documents, Shiny Apps...
5. Homogenize operational management objectives.
6. Standardize: performance statistics, plots and tables.
7. Standardize how MSE settings are described
8. Standard presentation template.
9. Use the same performance indicators, figures and tables all along the process.
10. There is quite good material already, it is a question of putting it together.
11. More detailed roadmaps containing details on responsibilities, expected outcomes and deadlines.
12. Hard deadlines at least for Data & OMs
13. Do not update data and assessment in the process.
14. Clearly define in which specific parts of the MSE a feedback is needed.
15. Use very directed questions to guide discussions.
16. Incorporate external advisors early in the process
17. Promote interaction and communication among experts
18. Conduct a survey to get feedback from stakeholders and identify improvement points.
19. ICCAT should host and maintain Shiny Apps and other applications
20. Promote transparent and reproducible coding to facilitate code review and interchangeability.
21. Concise trial specifications document describing the OM settings.

For the Commission:

22. ICCAT should not develop more than two MSE processes simultaneously.
23. ICCAT should have a permanent position in ICCAT Secretariat to support all the MSE activities.
24. MSE developments should not rely on external funding and stability for several years is required.
25. Agreed management objectives early in the process.

Appendix 6

MSE Review recommendations as prioritized (High/Medium priority) and modified by the WGSAM

| Priority | <i>WGSAM Recommendations (corresponding Appendix 5)</i> | <i>Task for Group(s) in the SCRS</i> |
|---------------------|---|---|
| <i>For the SCRS</i> | | |
| High | Centralize important MSE information on the ICCAT MSE webpage, including presentations, links to relevant documents, and Shiny Apps. (4, 19) | Secretariat (MSE Coordinator) / Ad-hoc Sub-group on MSE Communication to finish and publish new webpages and keep up-to-date. |
| High | Hire an MSE Coordinator at the ICCAT Secretariat. (23) | TBD to provide ToRs for this position for Commission approval at 2025 annual meeting. |
| High | Develop a standardized package of plots and a template presentation for providing MSE results to the Commission. (3, 6, 8, 9) | WGSAM or SCRS MSE specific Group to present a draft proposal to SCRS Plenary or WGSAM. |
| High | Develop a document with a default list of conceptual management objectives (with timelines) and associated standardized performance indicators (with calculation methods) to be used as a starting point for ICCAT stocks. (2, 5, 6, 9, 25) | WGSAM or SCRS MSE specific Group to present a draft proposal to SCRS Plenary or WGSAM. |
| High | Develop a thorough trial specifications document (TSD) for all MSEs (7, 21) | Lead MSE analysts for all MSE processes. |
| Medium | Update the glossary, using ICCAT-specific technical and non-technical terms. (1) | WGSAM or SCRS MSE specific Group to present a draft proposal to SCRS Plenary or WGSAM. |
| Medium | Decide whether a detailed MSE roadmap (Carruthers 2024b, modified to include clear deadlines and responsibilities) should be adopted and implemented for ICCAT MSEs (11, 14) | All Species Groups with MSEs to review Carruthers 2024b, and SCRS Plenary to make final recommendation. |
| Medium | Any external advisors should begin participation early in the process. (16) | All Species Groups with MSEs. |
| Medium | Promote interaction and communication among experts from different MSE processes within ICCAT via WGSAM or by establishing a single SCRS-specific MSE Expert Group. The MSE Coordinator requested will also serve in this role. (17) | WGSAM or SCRS MSE specific Group, with MSE Coordinator. |
| Medium | Since the MSE External Review included input from SCRS scientists only, revisit the draft poll from Bluefin Species Group (Walter 2024) to get feedback from the Commission on ICCAT's MSE processes. (18) | BFT Species Group to present poll to SCRS Plenary for review and endorsement for presentation to annual Commission meeting. |
| Medium | Promote transparent and reproducible coding to facilitate code review and interchangeability. (20) | WGSAM or SCRS MSE specific Group. |

| <i>For the Commission</i> | | |
|---------------------------|---|--|
| | ICCAT should limit its number of new, full MSE development processes (Carruthers 2024b) to no more than two MSE processes operating concurrently, ideally accomplished within 2 years between the foundation and full adoption. (22) | SCRS Plenary to consider making a recommendation on this point. |
| | Regardless of funding source (ICCAT or external), it is desirable to first confirm stable funding for the full MSE duration. Promote MSE Capacity Building within ICCAT/ both for COM/SCRS, so more MSE development can be done within the SCRS. (24) | SCRS Plenary to consider making recommendations on these points. |