REPORT OF THE 2016 MEETING OF THE
ICCAT WORKING GROUP ON STOCK ASSESSMENT METHODS (WGSAM)
(Madrid, Spain, 15-19 February 2016)

1. Opening, adoption of Agenda and meeting arrangements

The meeting was held at the ICCAT Secretariat offices in Madrid, Spain from 15-19 February 2016. Dr Miguel Neves dos Santos, on behalf of the ICCAT Executive Secretary, welcomed the participants to the meeting.

Dr Michael Schirripa, the Stock Assessment Methods Working Group Rapporteur, chaired the meeting. Dr Schirripa again welcomed meeting participants ("the group") and proceeded to review the Agenda which was adopted without changes (**Appendix 1**).

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

The List of Documents presented at the meeting is attached as **Appendix 3**.

The following participants served as Rapporteurs for various sections of the report:

Section	*Rapporteurs*
1, 13	Paul de Bruyn
2	Gorka Moreno
3	Gary Melvin
4	Ana Justel
5	Jose Ortiz de Urbina
6-8	Craig Brown
9, 10	Victoria Ortiz de Zarate
11, 12	David Die

2. Review of the original charter of WGSAM

When first formed, the primary mission statement of the WGSAM was as follows: *"To implement Quality Management for stock assessment methods, leading to the review, testing and documentation of assessment methods used by the SCRS."*

The group discussed how to better communicate with each of the species groups chairs and keep the general mandate but also address their specific questions. In an effort to encourage intersessional work, a contribution of this meeting will be the drafting of a preliminary agenda for next year's meeting[1]. The agenda will include three main components: 1) ongoing works, CPUE standardization, HCRs, MSE etc. 2) what the WGSAM decides that it will be working on throughout the year, 3) items brought up during the year by the SCRS, species groups etc. This draft agenda and associated work plan will be presented in the SCRS plenary for consideration.

With regards to the evolution of this WGSAM, it was agreed that the original mandate was broad but in practice the working group has evolved in some specific topics. More topics can be included in this overall scope than are included in the original mandate. However, the WGSAM agreed that this group should focus on methodologies to be applied to multiple species groups.

The function of the WGSAM is one for guidance and a way to review general methodology, and not to resolve the specific problems of any one individual species group. It is expected that the different WGs will apply the guidance in their own way. In addition, it was stressed that it is difficult for this group to have expertise in all fields of fisheries, i.e. acoustics, and therefore, the group should mostly focus on general guidance. In addition, in order to improve the current role of the WGSAM and its link with each species group, it was suggested that the WGSAM should clearly address recommendations from each species group and the WGSAM should also communicate the type of questions that it can address. The questions that this WGSAM will address should be applicable across multiple species groups as opposed to one individual species group.

[1] Due to time constraints at this meeting a draft agenda was not developed. However, the group did agree to develop one intersessionally and to present this draft at the SCRS meeting in September.

Should a species group decide to pose a problem for consideration to the WGSAM, it would be beneficial for the species group rapporteur (or a designee) to attend the WGSAM to help facilitate the problem solving process.

2.1 Reducing the burden on stock assessment analysts and modellers

A discussion paper (SCRS/2016/019) presented the many burdens that the modellers face when conducting the assessment of ICCAT stocks, especially when using complex models. In brief, the modelling activity is now facing data or other issues that are hampering the modelling in ICCAT. Maintenance of some basic rule such as data deadline as well as well-designed scheduling of meeting submissions was suggested to improve the situation. A variety of proposals were presented to facilitate modellers' work, which where discussed by the WGSAM.

The WGSAM agreed with the presentation and many comments highlighting the problems of the stock assessment process in ICCAT, some not mentioned in the presentation. For example, the pressure imposed on the Secretariat to meet deadlines for producing data for input into the assessment models, which is exacerbated by unstructured and heterogeneous format on which data are often submitted to the Secretariat. Another example are the decisions that must be made when confronted with abundance indices with conflicting trends, which can also be a problem for stock assessment. Furthermore, properly producing retrospective analyses, bootstraps and other appropriate diagnostics, while a necessary task, also adds burden to the modellers as well as the assessment process in general.

Many comments were dedicated to discuss the options within the presentation for improving the process and reducing some of the burdens. However, some of the proposals outlined in the presentation may prove to be difficult in terms of logistics. For example, with several ICCAT assessments every year, having two data preparation meetings for each assessment may not be realistic.

The WGSAM agreed that some guidelines could be prepared to help guide and suggest the best use of the available time and effort that goes into the stock assessment models and overall process. In this regard, the SCRS Strategic Research Plan should be used as a guideline to ensure that the workload of assessments is appropriate:

- ON SCHEDULING: Species groups rapporteurs should develop a clear schedule of the entire stock assessment process, taking into account existing rules on data submission deadlines, including a timetable in the agenda and their strict application during the year for both the data preparatory as well as the stock assessment meetings. This schedule should include enough time for analysing diagnostics and for summarizing the results of the stock assessment. The chair, modellers and data providers need to coordinate their work through the entire process including intersessional work to ensure that the schedule is adhered to. The species group rapporteurs should reiterate to CPCs the importance of submitting their data on time. The WGSAM also emphasizes that the use of multiple and complex models makes it even more necessary for CPCs to submit data on time.

- ON THE USE OF MULTIPLE MODELS: The common practice of applying multiple types of models during an assessment may be appropriate, for example, when differences between models offer scientists an opportunity to understand an underlying problem in the assessment. However, anticipation and forethought are necessary to combine their results in an effective and understandable manner. It is important for each model to clarify the purpose of each model, the assumptions of the model, and whether these assumptions are being met. This will help ensure that the proposed models are appropriate for the available data and fishery under consideration.

- ON THE USE OF INFORMATION: The WGSAM notes that conflicting trends in indices assumed to track the same fishery cause difficulties in the application of stock assessment models. The WGSAM has previously provided guidance on the selection of indices for use in the appropriate assessment models, and reiterates that a strict application of this process may reduce the incidence of conflicting indices. To facilitate this process, all the available information to evaluate indices (e.g. sample size, geographic coverage, etc.) should be provided in the index documentation. If varying catchability and/or selectivity are deemed appropriate, careful consideration should be given to ensure appropriateness.

3. Limit Reference points and Management Strategy Evaluation

The WGSAM reviewed and contributed to the continuing progress on Management Strategy Evaluations (MSE), Harvest Control Rules (HCR), Limit, Threshold and Target Reference points. More specifically to:

- Review the current status of the northern albacore MSE effort and progress
- Review of the recent decision on northern albacore HCR
- Determine what work should be accomplished in 2016 to continue progress

In this section we distinguish the MSE process, which includes the dialog between scientists and commissioners and the decisions coming from it, from the MSE study which involves conducting simulations of the fishery system, and the MSE framework which includes the software used to conduct the simulations.

A key paper in this review was SCRS 2016/015 and the presentation entitled "Evaluation of Harvest Control Rules for North Atlantic albacore through MSE". The North Atlantic Albacore MSE study code, data objects and summary of the operating model conditioning is at https://github.com/iccat-mse/albn, the intention is to explore the results and the code used to generate the OM and some example runs. The work has previously been presented and reviewed at both the WGSAM and the albacore species group (Shannon L. *et al.* 2014, Kell L. *et al*. 2014a, Kell L. *et al*. 2014b, Kell L. *et al*. 2014c, Kell L. *et al*. 2014d, Kell L. *et al*. 2014e).

ICCAT's management objective is to maintain high long-term catch with a high probability of stocks not being overfished or overfishing occurring and a low probability of being outside biological limits. To achieve this, HCRs are sets of pre-agreed defined rules that can be used to determine annual management actions (i.e. annual quotas). This MSE related research has developed an MSE study for North Atlantic albacore and simulated the impact of alternative HCRs, concluding that stable high long-term catches and conservation objectives are achievable with certain levels of precaution.

The study was presented at the Standing Working Group on Dialogue between Fisheries Scientists and Managers (SWGSM), following which the Commission recommended (Rec. 15-04) that the SCRS shall identify and test candidate reference points (e.g., SSBTHRESHOLD, SSBLIM and FTARGET) and associated HCRs that would support the management objective to maintain the stock in the green zone of the Kobe plot, with at least a 60% probability, while maximizing long-term yield from the fishery. The report and presentation described the results from a range of Harvest Control Rules as follows: F_{TAR} = (0.45-1.25) F_{MSY}, B_{THRESH} = (0.6-1.4) B_{MSY}, B_{LIM} = 0.4 B_{MSY}, F_{MIN}[2] = 0.1 F_{MSY}.

A series of operating models using MultifanCL, which were conditioned with the 2013 stock assessment data were created and approved by the albacore species group and were used to evaluate the robustness of HCRs using the estimation model BioDyn (Punt and Hilborn, 1996), a non-equilibrium biomass dynamic model. A 3 year assessment cycle was incorporated. The initial discussion was focused on the approach, process, and results but there were many questions by WGSAM members related to the methodology.

The group agreed that the focus of the WGSAM would be to examine the methodology of the above mentioned MSE study in a general context, not on the outcomes. In essence the WGSAM felt that the study represents a major step forward in the move towards the MSE process and serves to illustrate how MSE studies can be used to evaluate alternative HCRs. This work illustrates how MSE studies can provide a mechanism to evaluate trade-offs between adopting alternative HCRs. Such evaluation can be useful in the delivery of robust advice in the fishery. However, there were a number of questions about the MSE process and the MSE study, including how the framework operated, and how the outputs should be interpreted. In particular it was unclear to the group how the MSE process would alter the assessment process within ICCAT. The authors of the document stressed that this simulation framework would be used to provide information to the Commission as expressed in Rec. 15-04. The group was reminded that deciding on the albacore quota would always be the responsibility of the Commission. It is also the Commission that needs to develop and approve an HCR evaluated using a MSE study. Here the MSE study showed how to evaluate which HCRs would meet the objectives defined by the Commission. It was also pointed out that MSE studies could be used to evaluate where to put research/sampling effort to improve the overall assessment (e.g. types of biological data).

[2] F_{MIN} is the mortality applied when the stock fall below B_{LIM}.

A particular concern expressed by the WGSAM was that the use of a surplus production model for HCR evaluations may give a false impression that such a simple model is all that is needed to provide advice and that the collection of detailed biological data is not necessary. The group stressed the necessity to identify the data requirements for both the operating and observation model. The surplus production model would be run to set management advice on the basis of the HCR. The operating model (e.g. Multifan) would have to be reconditioned in the future to evaluate changes to the conditions under which the MP was evaluated (e.g. changes in selection pattern, recruitment dynamics or other processes (Ortiz and Babcock, 2015)). Periodically the albacore species group would also use more realistic assessment models to confirm the perceived evolution of the stock and enhance our knowledge about its dynamics. So there would always be a need to collect additional data on the biology of the stock beyond what is just needed to run the production model.

Concern was also expressed about the fact that the production model used as observational data a truncated time series. It was reported that as part of the conditioning of the operating model an extensive evaluation of the nature of productivity, and time series of recruitment, productivity and stock dynamics has been conducted and an additional SCRS paper will be presented at the albacore species group. The group noted that careful consideration needs to be put on the length of the observational time series to ensure the robustness of the Management Plan based on biomass dynamic models.

The group noted that for the agreed upon Management Procedure to remain robust over time it is important that changes to the productivity of the stock, for example the results of regime shifts and/or selectivity changes, be identified in the future. The WGSAM requests that the albacore species group identifies what indicators should be monitored to detect regime change and selectivity so that in the future it can be determined when the operating model requires reconditioning. This may compromise any previously agreed upon schedule of reconditioning the operating model.

Another concern expressed by the group was that the simulated CPUE index used to “monitor” the stock was drawn using a pattern of full selectivity, a situation not found in the albacore CPUE times series used in the actual assessment. The group noted that the CPUE used to monitor the simulated stock in the MSE exercise should be the same one proposed to monitor the actual stock between full assessments. For this reason the WGSAM requests that the albacore species group identifies exactly which CPUE should be used when implementing the agreed upon HCR.

Two other concerns raised by the WGSAM related to the degree of uncertainty in the operating model. The group noted that the CPUE in operating model had a lower degree of uncertainty (0.10) than is usually associated with ICCAT CPUE time series. Similarly, the degree of standard deviation assumed for annual recruitment was quote low (0.20) when compared to that used in the MFCL albacore assessment (0.50). These lower uncertainties could lead to the conclusion that any given HCR is more robust than may be seen in the actual fishery.

The question of exactly which tasks need to be completed by the albacore species group between now (i.e. the time of this meeting) and the July 2016 Panel 2 meeting, when the MSE simulation study will be presented to the Commission, was discussed by the WGSAM. It was pointed out that the final decision on what to present to the Commission should be made shortly after the albacore assessment. The WGSAM discussed the need to identify and assign priorities to additional work that could be completed before the albacore assessment. Although the WGSAM identified a number of possible issues to be further investigated during the conditioning of the operating model, the group did not however prioritize these issues.

It was noted that there was limited capacity to address issues that required the reconditioning of Multifan because the capacity to run this software has been partially lost at the SCRS. Minor (single) adjustments to the MSE framework are still possible before July 2016. The WGSAM stressed it was important that the MSE simulation framework be properly reviewed. The WGSAM was informed that there had been already a number of reviews of components of the framework, a great number of simulations had gone into conditioning the operation model, and that the source code was available for further review.

The results of this MSE study will also be presented at the Joint Tuna RFMO MSE working group that was established as part of the Kobe process. A key component of moving the process to other species is collaboration across RFMOs and developing diagnostics. Questions such as how much effort is required for other WGs to implement the MSE approach and the time-frame required for implementation were identified by the WGSAM. For July it was suggested that the current work be presented as a case study and to identify recommendations for the future; possibly addressing or clarifying small steps forward and pointing out advantages and disadvantages.

In conclusion the WGSAM encourages the continued development of this MSE framework and that the results of the study are presented to Panel 2 in July. The operating model has been developed, tested under a variety of situations and approved by the albacore species group. The process is now available to investigate a variety of HCRs. However, any outstanding issues should be highlighted and recommendations for future work presented.

The group reviewed paper SCRS/2016/014, "Conditioning Operating Models on Data and Knowledge and Rejecting and Weighting of Hypotheses". This research highlights important steps when conducting Management Strategy Evaluation such as the selection of hypotheses for consideration in the Operating Model that represent the simulated versions of reality, the conditioning the Operating Model based on data and knowledge, and also the procedures on how to weight and reject those hypotheses depending on their plausibility. There are many alternative ways to do this, one way is to use the currently-used stock assessment model as the Operating Model. Although use of the assessment model as the operating model seems to imply that assessment models describe nature almost perfectly, if a Management Procedure cannot perform well when reality is as simple as implied by an assessment model, it is unlikely to perform adequately for more realistic representations of uncertainty. Basing an operating model on the current assessment model also has arguably the lowest demands for knowledge and data. In a stock assessment due to limitations in time often only a limited number of hypotheses are considered for developing assessment scenarios. Given the need to evaluate robustness and the longer time scale required for conducting an MSE, a broader range of hypotheses for conditioning an Operating Model is both desirable and possible. As an example this paper presents diagnostics from an Operating Model developed for Indian Ocean albacore conditioned using Stock Synthesis.

The group reviewed SCRS/2016/018, "FLife: An R Package for Modelling Life History Relationships and Dynamic Processes". FLife is an R package for modelling life history traits, biological processes, density dependence and simulation of time series. Life history traits have many uses in stock assessment. They are used to provide advice for data poor stocks and to derive priors or fixed values for difficult to estimate population parameters in data rich stock assessments. Furthermore, to ensure that advice is robust, when conducting Management Strategy Evaluation, scenarios based on life history traits can be used to condition Operating Models.

4. Incorporation of oceanographic and environmental changes into the assessment process

Previously, the ICCAT WGSAM recommended in 2003 to use simulated datasets with known values of underlying population trends to test the robustness of CPUE standardization methods. This recommendation was reiterated by the swordfish species group and the Sub-Committee on Ecosystems who both recommended that oceanographic variability be formally used in CPUE standardization. Paper SCRS/2016/020 describes the use of a habitat suitability model (HSM) to investigate the size and 3-D spatial distribution of blue marlin habitat by month using weighted habitat volume (H). H was estimated from monthly average oceanographic data partitioned by 1° of latitude and 1° of longitude in 50 layers from the surface to a depth of 1200 m. Fluctuations in habitat volume likely contribute to seasonal and longer-term fluctuations in CPUE that are independent of population abundance and add unrecognized uncertainty to abundance indices used to estimate population benchmarks. The results highlight the need to expand stock assessments to include annual climatology to account for changes in habitat volume and global warming. The HSM-based weighted- habitat-volume model offers a way to frame the problem and to validate analytical methods for using longline CPUE to monitor population health.

The group identified some aspects that should be taken into account when describing BUM abundance in relation to its habitat, such as the thermocline depth, biological traits (i.e. spawning) and other variables, such as currents, that could influence BUM and gear presence. A series of validation exercises were proposed: 1) it was recommended to contrast the habitat described by this study against BUM tagging recapture data to confirm that all recaptures fall within areas of BUM presence predicted by the model; 2) also, overlaying the habitat map with catch rate data was also proposed since this type of data is in theory more related to distribution patterns than the nominal catch distribution; and 3) another comparison would consist of analysing whether these theoretical habitat distributions are consistent with the migration paths available from PSAT tagging data to corroborate that suitable habitat areas indeed correlate with BUM presence.

Another element that could potentially be integrated in the study is the newly calculated EFFDIS database that will soon be made available. However, it was noted that this dataset does not incorporate depth information, which may hamper its integration in the simulator.

It was suggested to apply the simulator to other pelagic species by changing the parameters of the distribution of fish with respect to depth and temperature. In particular, there is a study on several shark species in the North Atlantic that could be used in this type of exercise. The group discussed the potential application of this simulator on other species such as SWO, ALB and BFT and agreed to continue developing this work, but to apply it preferentially to species for which the majority of catches depend on longline gear, as is the case for BUM and SWO. However, future applications on BFT and other species are also envisaged, where the existence of other gears will increase the complexity of the analyses.

The group identified datasets that would be necessary for the continuation of the work in progress. These data would include catch, effort and electronic archival tagging information from several areas in the Atlantic Ocean. Ideally, cooperation among scientists from several CPCs and WGs will result in the development and standardization of single CPUEs by Area and not by Flag, which are believed to describe abundance more realistically. It was noted that this group has previously identified methodologies for incorporating environmental data with individual set data.

It was noted that the shark species group had utilized a consolidated shark catch dataset from LL effort targeting SWO which could be of use in providing more detailed effort information for this project in order to better describe BUM distribution across the Atlantic Ocean.

The results of this simulation project may lead to improved standardization of CPUEs by incorporating habitat predictions, and thereby may improve the interpretation of contradicting CPUE indices and changes in catchability.

The group noted that this is a very useful project and recommends cooperation between the WGSAM and other WGs in order to assure the successful progress of this study. Particularly, there should be coordination with the Sub-committee on Ecosystems in the assessment of what specific variables have been used for habitat description for pelagic species to date that could be introduced in this study. On this aspect, the group noted that there is some available bibliography from recent years, such as the work by Arrizabalaga *et al*., 2015 on habitats of main tuna species across all oceans.

5. Maximum Sustainable Yield

A presentation was given describing the variability of fishing mortality by age and the consequences for maximum sustainable yield in the case of bigeye tuna. As a result of increasing amounts of catch from purse seine and a decreasing proportion from the longline fishery, the overall selectivity of the fishery is moving from older (age 4+) to younger fish (ages 0 and 1). As a consequence, the estimated MSY time series for the aforementioned stock shows a decreasing trend. The presentation included the results of a study on the issue of the effect of changing selectivity patterns on maximum sustainable yield by Goodyear, 1996.

Following the presentation, the group discussed the implications of the changes in the selectivity pattern on the estimation of MSY, total yield at MSY, and corresponding reference points (SSB at MSY and F at MSY). It was noted that the common SCRS practice is to calculate MSY estimates assuming the most recent selectivity patterns and F apex (e.g. BFT). However, a changing selectivity pattern over time can pose problems with the interpretation of the assessments as the MSY estimated will correspondingly vary. As a consequence, the management benchmarks of biomass and fishing mortality required to produce MSY are dependent upon the selectivity pattern as well as other biological parameters which may change the productivity of the stock.

Given the implications for management, there was an agreement on the need to inform the Commission about the implications of changes in selectivity patterns. The group discussed how to better communicate this information to the Commission. It was agreed that for stocks with fisheries that are known to have time varying selectivity the SCRS should provide a time series of year specific MSY estimates and the corresponding B/B_{MSY} and F/F_{MSY} time series based on the year specific B_{MSY} and F_{MSY}. In addition, for reference purposes, a global MSY estimate (based on yield per recruit analysis, spawning potential ratio, L_{OPT}, etc.) should be included.

Furthermore, the group agreed that in the process of setting projections with alternative selection pattern scenarios, the SCRS would need guidance from the Commission. It was stressed that any advice including projections under alternative selection pattern scenarios should be accompanied by specific approaches for achieving the alternative selectivity pattern.

The suitability for communicating the results of the assessments to the Commission in the form of decision tables (in essence, an arrangement of factors by which to multiply one or several reference points in order to ensure that a given value of probability is below those reference points, depending on the assumed state of nature) was discussed.

The group agreed that decision tables are handy tools to both interpret sources of uncertainty and summarising the results of the assessment: a valuable tool for the SCRS that may be worth to include in the detailed Report.

The group concluded that since the interpretation of these decision tables involves choosing highly technical information regarding the stock, they do not seem a good choice for reporting purposes to the Commission.

The group agreed to continue to review the summary figures and tables used for providing information to the Commission, such as the Kobe plot and the Kobe strategy matrix.

6. Review progress towards unifying the North Atlantic swordfish and other species CPUE data

The abundance indices utilized in SCRS stock assessments are typically developed by a CPC scientist from the CPUE data collected from that CPC's fisheries (generally from logbook, observer or creel survey data). As a result, the index trends may be affected by changes in local (within the spatio-temporal coverage of the available data from that fishery) availability. This may at least partially explain why available indices may show conflicting trends (e.g. USA and CAN BFT RR indices), and may undermine the utility of the indices for tracking stock abundance trends.

One approach to address this concern would be to create a single index, incorporating data from the relevant fisheries of multiple CPCs, with a spatio-temporal coverage that more closely corresponds to the stock distribution. This could also permit the evaluation of the effects of time, area, environmental and ecological factors that may influence shifts in distribution, so that these may be taken into account in the estimation of the yearly changes in relative abundance. Combining higher resolution data from multiple CPCs can also be useful for other purposes; for example, following a proposal by Japanese scientists the shark species group examined combined high resolution size data from multiple CPCs.

For some past stock assessments (e.g. North Atlantic SWO), combined data abundance indices have been calculated from available Task II data on catch and effort, or through separate data requests. However, these analyses have been conducted using aggregated data, often at a resolution of 5^{o} X 5^{o} by quarter. In these circumstances, it is not possible to test the influence of factors other than area, time period, and flag, and loss of information on the observational (e.g. set) level variability poses difficulties in hypothesis testing.

In order to avoid these limitations, USA and Canadian scientists collaborated to explore options for working with combined, non-aggregated data prior to the last North Atlantic SWO stock assessment, and were able to produce initial abundance index results (Walter *et al.*, 2014). Similar work for western Atlantic BFT was subsequently facilitated through the fishery managers and scientist dialogue process for western Atlantic BFT, with agreement among Japan, Canada and the USA to make available non-aggregated CPUE data so long as appropriate confidentiality constraints are observed.

At the 2015 meeting of the WGSAM, an approach was presented that would permit the development of a combined non-aggregated dataset from multiple CPCs, incorporating external data (e.g. environment variables) and maintaining data confidentiality (Lauretta *et al*., 2015 (*in press*)) – CPC scientists would assign key environmental (or other) covariates to each observation, and then assign the observations to a coarser resolution spatial (e.g. 5 by 5 degree cell, or larger areas) and temporal (e.g. month) categories that maintain requisite levels of confidentiality. Subsequently, during 2015 USA and Canadian scientists again collaborated to develop BFT CPUE indices using data combined from the LL and RR fisheries of both CPCs (Lauretta and Hanke, 2015 (*in press*), Hanke *et al*., 2015 (*in press*).

In preparation for the 2017 western BFT stock assessment, scientists from the USA, Canada, Japan and Mexico will collaborate in the analyses of combined LL datasets with a goal of producing an abundance index. USA and Mexican scientists plan to have a working meeting in the second quarter of 2016, and scientists from all four CPCs will meet later in the year to conduct joint analyses (currently planned for the week prior to the 2016 BFT Data Preparatory Meeting). Work is also planned to further develop abundance indices for the next North Atlantic SWO stock assessment using combined LL data, involving at least scientists from the USA and Canada (participation of scientists from other CPCs with relevant CPUE data would be encouraged).

In addition to various data handling and treatment methodologies that are being considered, the Group discussed some options for providing greater assurance to CPCs that confidentiality of data will be maintained. One suggestion was that this concept might be incorporated in the SCRS Code of Conduct being developed.

7. Finalize review of new ICCAT method for estimating EFFDIS

A presentation was made to the group on the new methodology that has been developed for the estimation of EFFDIS (Beare *et al*., 2015 (*in press*)). The steps involved in the process were described, including assumptions. It was noted that there is not clear consensus regarding some of the assumptions/decisions necessitated by the characteristics of the current data. For example, some CPCs report Task II catch only in numbers, some report only in weight, and some report both numbers and weight. In order to work with catch values in consistent units, as part of the calculations to estimate missing effort, a decision was made to calculate average weights from the records where both weight and number were reported, then apply this to the records reporting only numbers. Concern was expressed that this may not be appropriate if the size distributions of the catches are different between the various gear types.

In addition to providing a dataset that would include estimates for cells for which data were unreported or incomplete, a benefit of the effort is that R code has been provided that will allow individual scientists to work with the data. This could include processing it using alternative assumptions/decisions. This flexibility could allow, for instance, an evaluation of the implications of alternative calculations of average weight for those records which included catch only in numbers.

It was noted that this new methodology for the estimation of EFFDIS represents a fundamental change from the previous approach. It differs in a number of ways, including the modelling of the spatio-temporal catch distribution in order to provide estimates for missing cells. Therefore, the results can change as data is added or revised.

8. Comment on and/or make recommendations on the CPUE course to be undertaken to create SAI CPUEs

The SAI species group has identified a clear need for abundance indices from the eastern Atlantic. It was agreed to provide support to African scientists for the development of CPUE indices. There is the intent to hold a workshop in Madrid to prepare SAI CPUEs involving West African scientists and their data. Dr Monin Justin Amandè and Dr Mauricio Ortiz will provide instruction on standardization methodology. The date of this meeting has not yet been finalized.

It was noted that data from the artisanal fisheries should be available, but that information will be summarized across multiple boats. It was suggested that information on other species caught may be useful in the development of the indices. For instance, this may provide some information regarding changes in targeting. The group reminds the workshop participants to consider the guidance on the development of abundance indices, as well as the template for the review of indices, that have previously been recommended by the WGSAM.

9. ICCAT software catalog: review of the progress to incorporate new methods in both the stock assessment and the software catalog

As agreed under the strategic plan, the needs of the SCRS have been reviewed with respect to the cataloging of software used by assessment groups, https://github.com/ICCAT/software/wiki. This work has been done in coordination with the rapporteur of each SCRS species group. The catalogue was received and the next step in the process will be to solicit volunteers to add other software to the catalogue.

Species groups should preferentially use software in the catalog. If they use software included in the catalog it should be the version in the catalog or a newer one. Groups are reminded that software not included in the catalog, but to be regularly used by the SCRS to produce stock assessment advice, should be included in the catalog.

As mentioned before in other WGSAM reports all data used in stock assessment should be fully described and the software used by the species group included in the ICCAT repository in case a replication of analyses is required.

10. Collaboration with other Stock Assessment Methods WGs (ICES, RFMOs, etc.)

An ICES-ICCAT Global Assessment Methods Working Group (GAME) would work on Terms of Reference (ToR) and would define the deliverables to be generated over a three year period. The first year would be 2016, which is when a meeting would be held in Woods Hole (USA). The ToR would be addressed in three consecutive annual meetings. Those ToR would be:

- Development of new Assessment models
- Improving existing assessment models
- Organize a collection of datasets
- Tests performance of existing and new models
- Develop, improve and test assessment-related techniques

Timing and logistics of how to run a joint ICES and ICCAT meeting need to be decided before the end of February to comply with ICES planning needs.

At the Third Joint Tuna RFMOs meeting it was recognized that Management Strategy Evaluation (MSE) needs to be widely implemented in the tRFMOs in order to implement a Precautionary Approach for tuna fisheries management. Therefore a Joint MSE Technical Working Group was created to work electronically. The Group is chaired by the ICCAT Secretariat. Various activities have been conducted, e.g. a review of the Kobe Framework in relations to MSE. The next stage is a physical meeting that will take place before the Kobe meeting in the first semester of 2016.

11. Other matters

11.1 Update of the ICCAT-SCRS technical glossary

SCRS paper 2016/021 presents a preliminary list of technical terms that could be used to update the current ICCAT glossary that is part of the ICCAT manual. This list was developed by scanning a selected set of ICCAT scientific documents (Executive Summaries and reports of the Sub-committee on Ecosystems from 2000-2015) and recent ICCAT resolutions and recommendations containing technical definitions (on quality of science, ecosystem-based management, harvest control rules…). Definitions for the new terms or proposed changes of definitions of existing terms were obtained from other fisheries glossaries, or literature. This document will serve as the basis for the update of the glossary that has been requested by the SCRS and the Commission. Such update needs to be presented to the Commission in November 2016. SCRS scientists are encouraged to provide comments to the SCRS Chair to help improve the list, including proposing new terms and modifying proposed definitions. The group discussed the glossary update and recommends that this document be shared with leading scientists from other tuna RFMOs to identify whether definitions of important terms are consistent across such organizations or not. It was also recommended that the update of the glossary should be a continuous process. This could be facilitated by the creation of a small ad-hoc committee that would consider every year proposals for updates. Any SCRS scientist could propose updates through the appropriate working group or sub-committee and such proposals would be collated by rapporteurs and provided to the ad-hoc committee. These proposed updates would then be presented to the SCRS plenary for review and approval. The committee should have members from the SCRS, the Secretariat and the Commission. The SCRS Chair will propose ToR for this committee. The working group also recommended the authors of the paper to look at terms included in the Marine Stewardship Council (MSC) glossary and check the ICCAT basic texts to determine if any terms contained there are not in conflict with the glossary. Some fisheries within the ICCAT Convention area are seeking certification and use ICCAT analyses to justify their applications for MSC certification. Finally the group suggested that the update should also endeavor to update the list of acronyms included in the current glossary.

11.2 Atlantic Ocean Tuna Tagging Program

The Atlantic Ocean Tuna Tagging Program (AOTTP) coordinator made a short presentation on the objectives of the program and its progress to date. This included a summary of the plans for tagging this year, the hires that have been made and those that are in progress and a description of the process used to make decisions regarding the design of the tagging experiments.

The working group agreed that it was essential that SCRS scientists involved in tropical tuna research had a chance to provide advice to the AOTTP about major decisions of the program. These decisions included the design of the conventional tagging and electronic tagging program and the specific types of tags used in the experiments. The working group also discussed whether it was essential or not to release tagged fish with conventional tags and electronic tags at the same time. It was agreed that the program should wait at least until the YFT data preparatory meeting to decide on the types of electronic tags and the design of electronic tag experiments. The group recommended that the program coordinator makes further contacts with experts that have used electronic tag technology in the past. Maintaining the tropical tuna species group involved in this manner would improve the chances that the program would be successful.

The intention of the program is to generate data that, after the quality control process has been completed, is accessible to all SCRS scientists. The working group discussed, however, how to incentivize scientists to become involved in the analysis of the data that will be generated by the program. The question of how the data would be made available to SCRS scientists was discussed, and the working group agreed that the program should develop a protocol on how and when such data would become available to the SCRS. It was mentioned that scientists involved in the tagging experiments may expect to have a period of time during which they would be the ones exclusively accessing the data. This may be especially relevant to data such as that obtained from electronic tags.

11.3 ICCAT-SCRS Competitive Research Program

The SCRS Chair provided a summary of this proposal as it was presented to the SCRS plenary and the Commission in 2015. If implemented this program would provide a more stable source of funds for ICCAT funded research, as funds would be part of the regular budget. Additionally, the competitive nature of the process would ensure more efficient use of the limited funds to support the SCRS research and encourage research that is better aligned to the ICCAT strategic research plan. The Chair proposed that the research priorities would be developed from the appropriate sections of the ICCAT strategic research plan.

The working group agreed that, in addition to the criteria included in the original proposal for the document, priority be given to proposals that involve young scientists and students. It was mentioned that the research call may be used to fund development and testing of software used in ICCAT to perform stock assessments and provide management advice.

12. Recommendations

1. In order to improve the current role of the WGSAM and its link with each species group, it was suggested that the WGSAM should clearly address recommendations from each species group and the WGSAM should also communicate the type of questions that it can address. The questions that this WGSAM will address should be applicable across multiple species groups as opposed to one individual species group.

   Should a species group decide to pose a problem for consideration to the WGSAM, it would be beneficial for the species group rapporteur (or a designee) to attend the WGSAM to help facilitate the problem solving process.

2. It was agreed that for stocks with fisheries that are known to have time varying selectivity, or changes in the proportion of catch between gears with different selectivity, the SCRS should provide a time series of year specific MSY estimates and the corresponding B/B_{MSY} and F/F_{MSY} time series based on the year specific B_{MSY} and F_{MSY}. In addition, for reference purposes, a global MSY estimate (based on yield per recruit analysis, spawning potential ratio, Lopt, ...) should be included.

3. It was recommended that the update of the glossary should be a continuous process. This could be facilitated by the creation of a small ad-hoc committee that would consider every year proposals for updates. Any SCRS scientist could propose updates through the appropriate working group or sub-committee and such proposals would be collated by rapporteurs and provided to the ad-hoc committee. These proposed updates would then be presented to the SCRS plenary for review and approval. The committee should have members from the SCRS, the Secretariat and the Commission. The SCRS Chair will propose ToR for this committee.

4. The working group also recommended the authors of the paper to look at terms included in the Marine Stewardship Council (MSC) glossary and check the ICCAT basic texts to determine if any terms contained there are not in conflict with the glossary. Some fisheries within the ICCAT Convention area are seeking certification and use ICCAT analyses to justify their applications for MSC certification. Finally the group suggested that the update should also endeavor to update the list of acronyms included in the current glossary.

5. The working group agreed that it was essential that SCRS scientists involved in tropical tuna research had a chance to provide advice to the AOTTP about major decisions of the program. These decisions included the design of the conventional tagging and electronic tagging program and the specific types of tags used in the experiments.

13. Adoption of the Report and closure

The Report was adopted during the meeting. The Chair of the SCRS on behalf of the Rapporteur, thanked the participants and the Secretariat for their work during the week. The meeting was then adjourned.

References

Arrizabalaga H., Dufour F., Kell L., Merino G., Ibaibarriaga L., Chust G., Irigoien X., Santiago J., Murua H., Fraile I. and Chifflet M. 2015. Global habitat preferences of commercially valuable tuna. Deep Sea Research Part II: Topical Studies in Oceanography, 113, pp.102-112.

Beare D.J., Palma C., de Bruyn P., Kell L. *In press*. SCRS/2015/206. A modeling approach to Estimate Overall Atlantic Fishing Effort by time-area Strata (EFFDIS). 22 p.

Goodyear C.P. 1996. Variability of Fishing Mortality by Age: Consequences for Maximum Sustainable Yield North American Journal of Fisheries Management 16:8-13, 1996.

Hanke A., Lauretta M., Andrushchenko I. *In press*. SCRS/2015/178. A preliminary western bluefin tuna index of abundance based on Canadian and USA rod and reel fisheries data. 25 p.

Lauretta M. and Hanke A. *In press*. SCRS/2015/171. An index of abundance of bluefin tuna in the northwest Atlantic Ocean from combined Canada-U.S. pelagic longline data. 5 p.

Lauretta M., Walter J.F., Hanke A., Brown C., Andrushchenko I., Kimoto A. *In press*. SCRS/2015/032. A method for combining indices of abundance across fleets that allow for precision in the assignment of environmental covariates while maintaining confidentiality of spatial and temporal information provided by CPCs: 10 p.

Kell L., *et al*. 2014a. An example of conditioning: An operating model using MULTIFAN-CL. Collect Vol. Sci. Pap. ICCAT 70(5): 2088-2095.

Kell L., *et al.* 2014b. An example management strategy evaluation of a harvest control rule. Collect Vol. Sci. Pap. ICCAT 70(5): 2096-2110.

Kell L., Ortiz de Urbina J., De Bruyn P., Mosqueira I., Magnusson A. 2014c. An evaluation of different approaches for modelling uncertainty in ASPIC and Biomass Dynamic Models. Collect Vol. Sci. Pap. ICCAT 70(5): 2111-2119.

Kell L., Ortiz de Urbina J.M., De Bruyn P. 2014d. Likelihood profiles by data components to evaluate information content of indices of abundance for North Atlantic swordfish. Collect Vol. Sci. Pap. ICCAT 70(5): 2120-2128.

Kell L., de Bruyn P., Merino G., Ortiz de Urbina J. 2014e. Implementation of a harvest control rule for northern Atlantic albacore. Collect Vol. Sci. Pap. ICCAT 70(3): 1355-1364.

Ortiz de Zárate V. and Babcock E.A. 2015. Estimating individual growth variability in albacore (*Thunnus alalunga*) from the North Atlantic stock: Aging for assessment purposes. Fisheries Research. 10.1016/j.fishres.2015.07.030.

Punt A.E., and Hilborn R. 1996. BIODYN. Biomass dynamic models. User's manual. FAO-Computerized Information Series, Rome.

Shannon L. *et al.* 2014. Model diagnostics for stock synthesis 3: examples from the 2012 assessment of cobia in the U.S. Gulf of Mexico. Collect Vol. Sci. Pap. ICCAT 70(5): 2069-2081.

Walter J., Lauretta M., Hanke A., Andrushenko I. and Brown C. 2014. Standardized catch rates of swordfish from the U.S. dealer landing system with a preliminary consideration of a combined U.S.-CANADA pelagic longline fleet dataset. Collect Vol. Sci. Pap. ICCAT 70(4): 1885-1911.

Appendix 1

Agenda

1. Opening, adoption of Agenda and meeting arrangements

2. Review of the original charter for the WGSAM

3. Limit Reference points and Management Strategy Evaluation (MSE)

   – Current situation and progress
   – Review of the recent decision on ALB Harvest Control Rule
   – Determination of what work should be accomplished in 2016 to continue progress

4. Incorporation of oceanographic and environmental changes into the assessment process

   – Blue marlin test case
   – Update the work plan for a simulation study based on progress to date
   – Identify data that the group is aware of for building habitat model for SWO and other species (i.e. PSAT)

5. Maximum Sustainable Yield

   – Implications for fisheries with time varying selectivity
   – Global vs. local MSY
   – Calculating and reporting the various values

6. Review progress towards unifying the North Atlantic swordfish and other species CPUE data

7. Finalize review of new ICCAT method for estimating EFFDIS

8. Comment on and/or make recommendations on the CPUE course to be undertaken to create SAI CPUEs

9. ICCAT software catalog: review of the progress to incorporate new methods in both the stock assessment and the software catalog.

10. Collaboration with other Stock Assessment Methods WGs (ICES, RFMOs, etc.)

11. Other matters

12. Recommendations

13. Adoption of the Report and closure

Appendix 2

List of Participants

CONTRACTING PARTIES

CANADA
Melvin, Gary
Biological Station - Fisheries and Oceans Canada, Department of Fisheries and Oceans, 531 Brandy Cove Road, St. Andrews, New Brunswick E5B 2L9
Tel: +1 506 529 5874, Fax: +1 506 529 5862, E-Mail: gary.melvin@dfo-mpo.gc.ca

CÔTE D'IVOIRE
Amandè, Monin Justin
Chercheur Halieute, Centre de Recherches Océanologiques de Côte d'Ivoire, Département Ressources Aquatiques Vivantes - DRAV29 Rue des Pêcheurs, BP V 18, Abidjan 01
Tel: +225 05 927 927, Fax: +225 21 351 155, E-Mail: monin.amande@yahoo.fr; monin.amande@cro-ci.org

EUROPEAN UNION
Gaertner, Daniel
I.R.D. UR nº 109 Centre de Recherche Halieutique Méditerranéenne et Tropicale, Avenue Jean Monnet - B.P. 171, 34203 Sète Cédex, France
Tel: +33 4 99 57 32 31, Fax: +33 4 99 57 32 95, E-Mail: daniel.gaertner@ird.fr

Merino, Gorka
AZTI - Tecnalia /Itsas Ikerketa Saila, Herrera Kaia Portualde z/g, 20110 Pasaia - Gipuzkoa, Spain
Tel: +34 94 657 4000; +34 664 793 401, Fax: +34 94 300 4801, E-Mail: gmerino@azti.es

Ortiz de Urbina, Jose María
Ministerio de Economía y Competitividad, Instituto Español de Oceanografía, C.O. de Málaga, Puerto Pesquero s/n, 29640 Fuengirola Málaga, Spain
Tel: +34 952 197 124, Fax: +34 952 463 808, E-Mail: urbina@ma.ieo.es

Ortiz de Zárate Vidal, Victoria
Ministerio de Economía y Competitividad, Instituto Español de Oceanografía, C.O. de Santander, Promontorio de San Martín s/n, 39012 Santander Cantabria, Spain
Tel: +34 942 291 716, Fax: +34 942 27 50 72, E-Mail: victoria.zarate@st.ieo.es

Soto Ruiz, María
Ministerio de Economía y Competitividad, Instituto Español de Oceanografía, C/Corazón de María, 8, 28002 Madrid, Spain
Tel: +34 91 347 3620, Fax: +34 91 413 5597, E-Mail: maria.soto@md.ieo.es

GABON
Bibang Bi Nguema, Jean Noël
Chef de service des évaluations et des aménagements, Agence nationale des pêches et de l'aquaculture (ANPA), BP. 20484, 9498 Libreville
Tel: +241 06 52 2691, E-Mail: jnbibangbinguema@anpagabon.org; jeannoel_b@yahoo.com

JAPAN
Yokawa, Kotaro
Research Coordinator, National Research Institute of Far Seas Fisheries, Fisheries Research Agency, 5-7-1 Orido, Shimizu-ku, Shizuoka 424-8633
Tel: + 81 54 336 5834, Fax: +81 543 359642, E-Mail: yokawa@affrc.go.jp

MOROCCO
Ben Mhamed, Abdelouahed
Institut national de recherche halieutique, 2, Rue Tiznit, 20000 Casablanca
Tel: +212 614 592 144, E-Mail: a.benmhamed@mail.com

Bensbai, Jilali
INRH/Laboratoires Centraux, sidi Abderrhman / Ain Diab, 20000 Casablanca
Tel: +212 661 598 386, E-Mail: jbensbai@gmail.com

TUNISIA
Zarrad, Rafik
Institut National des Sciences et Technologies de la Mer, BP 138 Mahdia 5199
Tel: +216 972 92 111, Fax: +216 73688602, E-Mail: rafik.zarrad@instm.rnrt.tn

UNITED STATES
Brown, Craig A.
Chief, Highly Migratory Species Branch, Sustainable Fisheries Division, NOAA Fisheries Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami Florida 33149
Tel: +1 305 586 6589, Fax: +1 305 361 4562, E-Mail: craig.brown@noaa.gov

Schirripa, Michael
NOAA Fisheries, Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami Florida 33149
Tel: +1 305 361 4568, Fax: +1 305 361 4562, E-Mail: michael.schirripa@noaa.gov

OBSERVERS FROM NON-GOVERNMENTAL ORGANIZATIONS

INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION – ISSF
Justel, Ana
ISSF-Spain, C/ Francisco Giralte, 2, 28002 Madrid, Spain
Tel: +34 91 745 3075, E-Mail: ajustel@iss-foundation.org

PEW CHARITABLE TRUSTS - PEW
Galland, Grantly
Pew Charitable Trusts, 901 E Street, NW, Washington, DC 20009, United States
Tel: +1 202 494 7741, Fax: +1 202 552 2299, E-Mail: ggalland@pewtrusts.org

SCRS CHAIRMAN

Die, David
SCRS Chairman, Cooperative Institute of Marine and Atmospheric Studies, University of Miami, 4600 Rickenbacker Causeway, Miami Florida 33149, United States
Tel: +1 305 421 4607, Fax: +1 305 421 4221, E-Mail: ddie@rsmas.miami.edu

****

ICCAT Secretariat
C/ Corazón de María 8 – 6th floor, 28002 Madrid – Spain
Tel: +34 91 416 56 00; Fax: +34 91 415 26 12; E-mail: info@iccat.int

Neves dos Santos, Miguel
De Bruyn, Paul
Kell, Laurence
Ortiz, Mauricio
Palma, Carlos

Appendix 3

List of Documents

SCRS/2016/014	Conditioning operating models on data and knowledge and rejecting and weighting of hypotheses	Kell L.T. and Mosqueira I.
SCRS/2016/015	Evaluation of harvest control rules for North Atlantic albacore through management strategy evaluation	Merino G., Arrizabalaga H., Murua H., Santiago J., Ortiz de Urbina J., Scott G.P. and Kell L.T.
SCRS/2016/018	FLife: An R Package for modelling life history relationships and dynamic processes	Kell L.T., Mosqueira I. and Fromentin J-M.
SCRS/2016/019	Proposals for smooth conduction of stock analysis using sophisticated but complicating stock assessment models	Yokawa K.
SCRS/2016/020	Longline data simulation: integrating 3 D species habitat with oceanographic data and depth distributions of pelagic longline hooks	Schirripa M.J., Goodyear C.P. and Foresttal F.
SCRS/2016/021	Preliminary list of updated terms for the Glossary of the International Commission for the Conservation of Atlantic Tuna	Fujimoto R., Die D.J., Restrepo V.R. and Kell L.T.