

2015 INTER-SESSIONAL MEETING OF THE SUB-COMMITTEE ON ECOSYSTEMS*(Madrid, Spain, 8-12 June 2015)***1. Opening, adoption of Agenda and meeting arrangements**

The meeting was held at the ICCAT Secretariat, Madrid, from June 8 to 12, 2015. Mr. Driss Meski, ICCAT Executive Secretary, opened the meeting and welcomed participants. The Sub-Committee on Ecosystems Co-conveners, Dr Kotaro Yokawa (Japan) and Dr Alex Hanke (Canada) reiterated the ICCAT Executive Secretary's welcome. It was noted that the ICCAT Meeting Participation Fund (MPF) had provided financial assistance for one of the delegates to attend and participate in the meeting. The Conveners then described the objectives and logistics of the meeting. The Agenda was adopted with minor changes (**Appendix 1**).

The List of Participants is included in **Appendix 2**. The List of Documents presented at the meeting is attached as **Appendix 3**. The following participants served as rapporteurs:

<i>Section</i>	<i>Rapporteurs</i>
Items 1, 6, 9, 11	P. de Bruyn
Item 2	G. Diaz
Item 3	D. Die
Item 4	M-J Juan Jorda
Item 5	M. Karnauskas
Items 7, 8	R. Coelho, A. Domingo, H. Minami
Item 10	A. Wolfaardt
Items 12, 13	A. Hanke
Item 14	P. de Bruyn

2. Continue to assess the importance of the Sargasso Sea ecosystem to ICCAT species as per Res. [12-12]

Document SCRS/2015/111 provided information on the spawning area of three species managed by ICCAT – albacore tuna (ALB), swordfish (SWO), and white marlin (WHM) – in the southern Sargasso Sea. The significance of the Subtropical Convergence Zone (STCZ), an important oceanographic feature in the southern Sargasso Sea, is highlighted. ALB are shown to spawn in March and April between 20°-23° N and 60°-70° W in proximity to the STCZ. Female SWO in spawning condition were sampled from a larger latitudinal range (18°-25° N) and further east (55°-65° W). SWO spawning occurs from December to June within the subtropical area (13°-35° N), but it appears that the southern Sargasso Sea is one of the areas of more intense reproduction. WHM spawn in essentially the same area as ALB from April to June. The overlap of the spawning areas between the three species during similar time periods and in proximity to the STCZ suggests that some management/conservation measures should be considered to protect the spawning stocks in this area. An analysis of the ICCAT catch records for these three species for the southern Sargasso Sea (20°-30° N) indicates that the catches from this zone are not generally a significant contributor to the catches from the Sargasso Sea as a whole.

The document reported a decrease in catches of ALB, SWO, and WHM in the area between 20°-25° N in the last years of the time series analyzed. The Sub-Committee inquired if the author was able to link these decreases in catch to particular ICCAT management regulations. It was pointed out that finding a link between the decrease in catches and management regulation is something that has not been attempted yet, but that was worth looking into in the future. Similarly, the Sub-Committee wondered if the reduction in catches was from a particular fleet or from all fleets operating in the area.

Questions were raised regarding the area where the spawning activity was described to occur and if this area could be considered part of the Sargasso Sea. In particular, it was observed that ALB catches tend to occur in areas of strong current which results in a lack of Sargassum, and that longline fishing vessels cannot operate in areas with heavy Sargassum coverage. It was indicated that the Sargasso Sea is a dynamic system defined by oceanographic conditions and, therefore, its boundaries are expected to change. It was also pointed out that the Sargasso Sea Commission considers a boundary that extends to 22° N latitude part of the Sargasso Sea geographical area of collaboration and as such it encompasses significant portions of the areas where spawning was identified.

The document suggested that establishing a time-area closure in the identified area of spawning could potentially result in significant conservation benefits. The Sub-Committee questioned this conclusion because the catches in the area between 20°-25° N were extremely low (for example, SWO catches varied between 3-15 t during 2008-2012) and a time-area closure would most probably result in effort displacement to adjacent areas and no significant reduction in overall catches would be achieved. However, the Sub-Committee questioned if fishing activities in the area might potentially disrupt spawning activities.

The Sub-Committee inquired if the spawning activity identified south of 25° N was associated with any particular oceanographic features. It was explained that the data used in this analysis was collected by fishing vessels and information regarding oceanographic conditions was not available. It was pointed out that available oceanographic data could be used to explore the existence of particular oceanographic conditions that could trigger spawning in the area. The Sub-Committee discussed that the subtropical convergence is an area where 2 different water masses 'collide' resulting in frontal areas, and these fronts are known to attract a variety of marine species. It was further hypothesized that, due to the currents in the area and the presence of the continental shelf, some undetected weak upwelling might occur at some time of the year which can increase the productivity in the area making it a suitable spawning habitat for some species. But, there was a general agreement that the area has been poorly studied.

The Sub-Committee acknowledged that the low level of catches in the Sargasso Sea did not necessarily indicate that this particular habitat is not ecologically important for the species in question. It was discussed that the low catches can be the result of low fishing effort in the area instead of low densities of the species in question. However, the Sub-Committee agreed that regardless of the species abundance in the Sargasso Sea, ICCAT fishing seems to have a very low impact on this area due to the low catches.

The Sub-Committee also reviewed presentations SCRS/P/2015/010 (Canadian POP-Tagging) and SCRS/P/2015/002 (Preferred habitat of the juvenile and adult Atlantic bluefin tuna: from ecology to management). Both presentations were originally introduced during the BFT Data Preparatory Meeting conducted earlier this year. Presentation SCRS/P/2015/002 showed feeding and spawning habitats based on modeling results using oceanographic data and presence-absence data from catch data. This particular modeling exercise showed that the Sargasso Sea does not play a key role in BFT life history (no spawning or feeding habitats were identified in the Sargasso Sea). However, the satellite tagging data presented in SCRS/P/2015/010 clearly showed the presence of BFT (both of western and eastern origin) in the Sargasso Sea. Although the behavior (i.e., feeding, migrating, spawning) that BFT were performing in the Sargasso Sea cannot be directly discerned from the satellite tracks, depth utilization profiles obtained from some tags showed BFT performing deep dives which is usually associated with feeding behavior (similar results have also been obtained from PSAT tags deployed on SWO). To confirm this hypothesis, stomach content analysis is a potential area of research that might be warranted pursuing. The Sub-Committee discussed that the results of these two presentations emphasizes that the lack of catches in a particular area, once again, does not necessarily imply that a particular species is not present or is not utilizing that particular habitat.

Based on all the information that has been presented to the Sub-Committee until present, the Sub-Committee agreed that the Sargasso Sea is an important and unique ecosystem for ICCAT species. At the same time, the Sub-Committee acknowledged that there are other ecosystems in the Atlantic Ocean that are also important and unique for ICCAT species. The Sub-Committee pointed out the significant progress that was made in the past few years to advance the understanding of the importance of the Sargasso Sea for ICCAT species (see Anon. 2015), and it recommends continuing collecting and reviewing information from the Sargasso Sea.

3. Review the progress that has been made in implementing ecosystem based fisheries management and enhanced stock assessments

The Sub-Committee discussed progress made in incorporating environmental variables in the assessment process and in the development of ecosystem models for areas under ICCAT responsibilities in the Atlantic Ocean.

In presentation SCRS/P/2015/022 it was noted that it has long been known that highly migratory species of fish have evolved life history traits that take advantage of the heterogeneity of their oceanic environment. While some habitats offer ideal spawning and nursery grounds, others, often several thousands of miles away, offer high densities of food sources not found anywhere else in the ocean. Equally well known is that the Atlantic Ocean experiences changes on time scales from days to decades. The combination of these factors can influence the interpretation of long term indices of abundance, conclusions drawn from tagging studies, and assumptions of population structure. The SCRS found that it would be beneficial to regularly characterize the state of the Atlantic Ocean by a group of core oceanographic and environmental indicators known, or suspected, to play a role in the global distribution of highly migratory fish and their productivity. As a result, the Working Group on Stock Assessment Methods (WGSAM) decided earlier this year to test, through simulation, how appropriate it is to incorporate environmental variables in the CPUE standardization and/or the population assessment model. A candidate list of indicators that depict a generalized view of the Atlantic Ocean and offer a means of explaining variations in observational data as well as the means of testing various biological hypotheses, the possible improvement of stock assessments and important considerations for management strategy evaluations are presented in SCRS/P/2015/20. The authors of this paper submit that this type of information will be useful to scientist and managers alike in their efforts to assess and manage the various ICCAT stocks.

The Sub-Committee discussed whether some selection criteria could be used to figure out whether particular indicators would be useful or not. For instance, some environmental indicators have been used in ICCAT assessments to explain aspects of the dynamics of some stocks such as the NAO index to explain variation in the dynamics of yellowfin tuna (Die *et al.* 2001) and the northern stock of albacore (Kell *et al.* 2005). Currently, the WGSAM is conducting a more comprehensive analysis on whether environmental indicators can explain CPUE variation for the northern stock of swordfish (SCRS/2015/010). Also, other studies have looked at how the spatial extent of the equatorial oxygen minimum zone may explain the spatial variations in the catchability of billfish (Stramma *et al.* 2012).

The two things that may be considered to make such a selection could be the relative availability and the time/spatial scale of the indicator. Although the table which related indicators to spatial scales refers to a variety of life history stages, a similar table could be developed for each stage.

In the Pacific, several papers have made use of environmental explanatory variables in the CPUE standardization process (Bigelow *et al.*, 1999; Ghosn *et al.*, 2012; Hinton and Bayliff, 2002; Kanaiwa *et al.*, 2008). Most of the time, however, there is no clear understanding of the biophysical processes that link the environmental variables to CPUE.

SCRS/2015/122 presents a framework for analyzing CPUE trends based on multivariate state-space modeling methods that have been used in fields such as finance, physics, and ecology, but have only recently been applied to fisheries. This class of methods allows for analysis of time series in a flexible manner which permits hypothesis testing regarding the nature of relationships between different time series, as well as properties regarding their observation and process variance. As such, the methods are potentially useful for gleaning information on stock dynamics from existing abundance indices. The authors of the paper showcase the potential utility of multivariate state space modeling by applying the methods to swordfish, a species suspected of being influenced by environmental drivers. Alternative models containing assumptions about process error, observation error, stock migrations, and environmental linkages, are compared via an information criterion framework. In the paper, the most parsimonious model is then used to produce a combined index of abundance for the stock. In addition to informing the issue of combining separate abundance indices, multivariate state-space methods can also be used to: estimate commonalities in species' responses to the environment, test for species interactions, identify structural breakpoints, or even to make one-step-ahead predictions in abundance. This paper highlights, however, how such state-space models can help to justify why relative abundance trends for different parts of the stock may have different trends.

The Sub-Committee discussed whether statistically-integrated models could be modified to include the sort of environmental variables incorporated into paper SCRS/2015/122 as opposed to during the estimation of relative abundance. It was agreed that it depended on whether the environmental variable was thought to be directly affecting CPUE, population abundance or both. If it influenced CPUE it seemed appropriate not to include it in the statistically integrated-population-model and to do so during CPUE standardization. If the environmental variable was affecting abundance directly, then it may be better to incorporate it into the population model, however, the Sub-Committee agreed that this would increase the number of parameters to estimate in a model that is already quite high.

The Sub-Committee was provided with a summary relevant to the use of management strategy evaluation (MSE) to evaluate the impact of environmental variation on the performance of management strategies. Punt *et al.* (2014) observed that two alternative approaches have been used, i.e. either a “mechanistic” or an “empirical” approach. In the former, a model is used to describe the relationship between the environment and the population dynamics of the fished species and to make predictions using the outputs from climate models. In contrast, the “empirical approach” examines possible broad scenarios without explicitly identifying mechanisms. In their review of the many published studies, it was found that modifying management strategies to include environmental factors does not improve the ability to achieve management goals much, unless the manner in which these factors drive the system is well known. Schindler and Hilborn (2015) in a review of environmental models used for management observed that a great deal of research to inform environmental conservation and management takes a predict-and-prescribe strategy in which improving forecasts about future states of ecosystems is the primary goal. However, a sufficiently thorough understanding of ecosystems needed to reduce deep uncertainties is probably not achievable, seriously limiting the potential effectiveness of the predict-and-prescribe approach (Punt *et al.*, 2014). Research should identify the range of alternative plausible future states of the system and develop strategies that are robust across these scenarios and responsive to unpredictable ecosystem dynamics. MSE offers an alternative to the predict-and-prescribe approach, which is also the basis of traditional stock assessment advice, where it is assumed that the system dynamics are known and can be expressed in the form of a mathematical model. MSE allows a management control to be adjusted based on that knowledge about system processes.

The Sub-Committee recommended the following next steps to extend these research efforts:

1. Continue to test the proposed indicators for inclusion as covariates in the abundance index standardization process, in stock assessment models, or in other statistical models such as those proposed in SCRS/2015/122.
2. Work toward an annual report to describe the physical state of the Atlantic Ocean, which would serve to inform SCRS species groups, and managers of significant changes in the physical habitat used by ICCAT-managed species.
3. Expand the existing analysis in SCRS/2015/122 of environmental effects on swordfish to include area-specific or age-specific CPUEs.
4. Explore the application of the methods from SCRS/2015/122 to combine abundance indices to other ICCAT species and to understand the spatial dynamics of different stocks.

The Sub-Committee has also made progress in the development of ecosystem models to test the effects of fishing in the ecosystem. An example of such a test is the work presented in SCRS/2015/120 to estimate the effect on the ecosystem of the development of the FAD fishery. The FAD fishery in the eastern tropical Atlantic has increased in recent decades and accounts for over 60% of the tropical tuna catch from purse seine vessels. The use of FADs has raised concerns due to the wide array of species that are associated with these floating objects and are caught as bycatch along with tuna. It has been proposed that ecosystem models may be a tool for assessing ecosystem impacts of FADs. Paper SCRS/2015/120 presents an ECOPATH model for an area of the Gulf of Guinea that is five times bigger than the area of the original “piccolo” ECOPATH model (Schultz and Menard 2003) from which the new model was derived. The model is composed of 27 functional groups ranging from high trophic level pelagic predators to zooplankton and detritus groups. Bigeye and yellowfin tuna were split into multi-stanza groups to account for differences in diets and size composition of catches. The four major fisheries in the area; FAD and free school purse seine, longline and baitboat, were included in the model along with a discard group. The EU observer database was used to estimate composition and amounts of bycatch from the purse seine fisheries. Primary production required for the current levels of catch was at 6%, compared to 4% found by an earlier version of the model for the smaller South Sherbro Area. The ECOPATH model has now been balanced and will be used as a basis for an ECOSIM model that will be fitted to the tropical tuna catch and relative abundance time histories. The resulting ECOSIM model will then be used to investigate the effects of the FAD fishery on the ecosystem.

The Sub-Committee discussed whether, once developed, the ECOSIM model could be used as a diagnostic tool to look at annual changes in model variables that may be reflecting the “health” of the ecosystem. The authors of the paper believe that the quality of the data inputs and the paucity of data on many components of the model may make such use inappropriate. It was acknowledged, however, that indicators developed from the model such as estimates of *primary productivity required* could help estimate the amount of fishery production that is needed to produce current catches in a sustainable fashion (Pauly and Christensen 1995). Although the current ECOPATH model is not able to provide any advice on ecosystem dynamics, because it is an equilibrium model, it would be useful if the Sub-Committee could evaluate if the current parameterization seems realistic.

4. Develop a list of ecosystem objectives that are practical and measurable to present to the Commission so that they can guide the group as to which objectives are of highest priority. This will inform the generation of the tool/framework used to manage the system

In an exchange between the Sub-Committee on Ecosystems and the small tunas species group, invited speaker Dr Rainer Froese presented a new method (C_{MSY}) for estimating maximum sustainable yield (MSY) and related fisheries reference points (B_{MSY} , F_{MSY}) from catch data and resilience to help with preliminary stock assessment in data-limited stocks (SCRS/2015/113). CMSY was applied to 16 stocks of data-limited ICCAT species using default settings.

The Sub-Committee indicated that this method, and others like it, would facilitate the work of the SCRS as it allows data-poor species to be included in an ecosystem based fisheries management framework and provides stock assessment advice. The Sub-Committee also recognized that the approach could be improved by incorporating density dependent effects by updating the production function to test the sensitivity of the estimates to other values of the shape parameter. Also, suggestions for testing the accuracy of the approach included taking data-rich stocks and making them data-poor, which is an alternative to simulation testing on artificial data or comparisons with more sophisticated models applied to a data-rich species. The Sub-Committee observed that the strength of the approach was its simplicity, and that the diagnostics allowed you to quickly determine if the data was adequate for continuing with the analysis. The preliminary results presented were discussed by the Sub-Committee and subsequently a rerun with more realistic priors was conducted for at least some of the species for which it was possible to provide a complimentary nominal CPUE index. The results were all evaluated and used to update the original working paper.

Two documents SCRS/2015/076 and SCRS/2015/103 were presented examining the life history traits, fishery patterns and vulnerability of teleost species caught by the tuna longline fleet in south Atlantic and Indian Oceans.

The first document SCRS/2015/076 provided a summary of teleost species caught (targeted and bycatch) in the tuna longline fisheries of the South Atlantic and Indian Oceans. The study analyses the relationships between seven life history traits and three fishery attributes for 33 and 27 stocks caught in South Atlantic and Indian Oceans, respectively. In addition, each species was assigned to four fate categories: i) target species for commercial use, ii) bycaught and kept for consumption, iii) bycaught kept for commercial use and iv) discarded bycatch. Life history traits and fishery attributes did not differ between oceans. However, non-target but commercialized species were smaller in the Atlantic Ocean. Species were segregated into three main groups based on life history: (1) fast growing species (2) target tunas and most other bycatch species which were part of an intermediate group and (3) Istiophoridae and the swordfish representing large and fast growing species, characterized by life history traits vulnerable to exploitation and therefore needs an incentive to promote data collection for future assessments.

The second document SCRS/2015/103 provided a semi-quantitative level 2 ERA (productivity and susceptibility analysis) to evaluate the vulnerability of tuna, billfishes and other teleosts caught by the tuna longline fleet in the South Atlantic and Indian Oceans. The study (a) evaluated the vulnerability of the species in the study areas, (b) compared the vulnerability of target and non-target species and (c) identified the most appropriate productivity and susceptibility attributes. Istiophoridae exhibited lowest values of productivity and the highest scores of susceptibility. The “top 10” species at risk are the Atlantic *Istiophorus albicans* and *Thunnus alalunga*; Indian *Xiphias gladius*, *I. platypterus*, *Istiompax indica*; Atlantic *Xiphias gladius* and *Makaira nigricans*; *T. maccoyii*; and Atlantic *T. albacares* and *Scomberomorus cavalla*. All species considered at high risk are target or are commercialized bycatch, except the Atlantic *Gempylus serpens*, which is discarded. Most species at moderate risk are commercialized bycatch. Conversely, for the species classified at low risk, most are discarded.

The Sub-Committee valued the importance of this first attempt to characterize the vulnerability of teleost fish species to becoming overfished and to categorize them in different risk groups based on its biological productivity and susceptibility to the fisheries. The Sub-Committee noted that species categorized in the high risk category of vulnerability were mostly target and bycatch species that already have been evaluated by ICCAT with fishery stock assessments (e.g. the marlins) reflecting the SCRS was already doing a relatively good job assessing species in these risk categories. However, the status of some of these stocks at high risk is Sub-Committee highly uncertain and some were never assessed. The Sub-Committee also wondered whether the analyses were taking into account the uncertainty in the life history parameters and the author indicated some measures were already taken, but will be doing more tests in future assessments which the Sub-Committee intends to carry out an ERA level 3 analysis. Future studies also plan to extend these analyses to the North Atlantic region and include other gears including purse seiners.

The presentation SCRS/P/2015/019 entitled “Three simple rules for ecosystem-based fisheries management” presents three simple rules to assist in the implementation for ecosystem-based fisheries management. The three rules are: (1) Take less than nature, i.e. the mortality caused by fishing should be less than the natural rate of mortality; (2) Maintain population sizes above half of natural abundance, i.e. at levels where populations are still likely to be able to fulfill their ecosystem functions as prey or predator; and (3) Let fish grow and reproduce, i.e. adjust size at first capture such that the mean length in the catch equals the length L_{opt} where the biomass of an unexploited cohort is maximum. For rule 3, the basic equations describing growth in age-structured populations were reexamined and a new optimum length for first capture ($L_{c,opt}$) was established. For a given rate of mortality caused by fishing, $L_{c,opt}$ keeps catch and profit near their theoretical optima while maintaining large population sizes. Compared with current fishing, management according to these three simple rules results in higher catches, lower cost of fishing, larger stock sizes, more large fishes, and an age and size structure that is close to that of an unexploited population. The presentation is based on a paper by Froese *et al.* entitled “Minimizing the impact of fishing”, submitted to Fish and Fisheries.

The Sub-Committee found this presentation very interesting and recognized the value and potential of applying the rules and analysis presented for ICCAT data-poor species. The Sub-Committee discussed what could be done in a situation where M is very uncertain or poorly known since it is a critical parameter to apply rule number one in data-poor situations and in situations where M is known to change with the size and age of the stock. It was also indicated that M is poorly known when conducting fisheries stock assessment for data-rich stocks. In these cases, expert knowledge and sensitivity analysis are used to test the sensitivity to different M values and that the same procedures could be used for data poor stocks. It was recommended to choose a static value of M since current knowledge indicates that for intermediate fish sizes, over which much of the exploitation occurs, M remains quite constant.

The Sub-Committee also discussed several examples of fisheries where these rules have been applied and discussed the difficulties encountered. It was commented that it is relatively simple to convince managers of the value to fish species above the length of maturity since this concept has already been embraced by fisheries managers. However, it remains a challenge for fisheries managers to accept the notion of the importance of catching sizes at the optimal length (L_{opt}) which corresponds to lengths of about 2/3 of L_{max} . The Sub-Committee also noted the difficulties of implementing these three rules in multi-species fisheries and single species fisheries where fleets and gears target different sizes of the stocks. The potential to develop more selective fisheries and take advantage of fish behavior that segregates spatially and temporally according to size was discussed as possible solutions. Finally, it was also suggested to use size-based ecosystem models such as OSMOSE¹ to test what would be the impact of implementing these three rules on target species and its resultant effects on the ecosystem.

The presentation SCRS-P-2015-025 summarized work using a management strategy evaluation (MSE) approach to compare 26 different new and established management procedures (MPs, i.e. combination of pre-defined data, together with an algorithm to provide advice). Their performance was evaluated with respect to fish life-history type, data quality, recruitment dynamics and current level of stock depletion. This allowed assessing the sensitivities of the management procedure to both population dynamics and observation processes. Data types considered were historical time series of catch, index of absolute stock biomass, relative abundance and recent estimates of catch, index of absolute stock biomass, catch-at-length, recruitment, catch rate, depletion. In addition, inputs to the assessment (i.e. fixed values using expert knowledge) were growth model, stock recruitment relationship, target catch rate, depletion, M , MSY , F_{MSY}/M , B_{MSY}/K . The study reveals that methods that made use of survey indices of absolute biomass or stock depletion offered the best overall performance and this was consistent across life-history types, data quality and stock depletion level. In addition, simple MPs were shown to be able to outperform conventional approaches in both data-limited and data-rich assessment cases. Management procedure performance was found to be most sensitive to biases in reported catches, the selectivity to fishing of older age classes and relatively small temporal changes in somatic growth parameters.

The Sub-Committee on Ecosystems found this presentation very interesting and recognized the value and potential of applying MSE to both ICCAT data-rich and data-poor species. The Sub-Committee noted that there is a lot of confusion about what MSE is and what it can be used for. The presenter emphasized that MSE is about designing simple rules and not complex models, and that can be applied to provide advice, given the data, the assumptions and algorithms, for decision rules and management recommendations. So, this is where simulation testing is used to test the simple rules and their effects. These methods can be applied to data rich and data poor

¹ <http://www.osmose-model.org/publications>

species, and if data are poor, the set of rules should be more precautionary. Empirical harvest control rules² based on good data can provide management performance equivalent to traditional fishery stock assessment methods.

The Sub-Committee discussed how reliable the results might be when MSE is applied to data poor stocks. The presenter emphasized the potential of using MSE to investigate the value of collecting and having different data types given a fixed budget and its effect on achieving the management objectives. For example, MSE could be used to determine whether it is better to collect new good quality for a few years or whether it is better to use the historical reported data with high uncertainty, or what the effect is of having life history information with several degrees of uncertainty.

The Sub-Committee also noted that in the example for rockfish none of the management procedures performed well. It was noted that perhaps the simulations were not run long enough given that rockfish are a long-living species. Additionally, it was discussed that of the 26 management procedures tested in the study, some performed better for the rebuilding objectives while others worked better for the testing of management objectives. These results make sense because a management procedure that performs well for one objective does not mean that it will work well for other objectives because there are trade-offs between objectives.

The presentation SCRS/P/2015/024 entitled “Characterizing uncertainty in stock assessment and management advice – ecosystem considerations” showed how ecosystem considerations could be characterized in stock assessment and management advice. It was noted that the great majority of stock assessment and management procedures are based on fisheries information and sometimes scientific surveys, but no or few environmental or ecosystemic data/considerations (except bycatch) are included. The study also finds that there are growing gaps between stock assessment procedures and very recent knowledge, in particular concerning recruitment and productivity, synergy between fishing and climate and trophic interactions. The study reveals that environment appears to more strongly influence recruitment than SSB for many stocks. Environmental fluctuations can generate substantial changes in stock productivity and then the conditions for overexploitation under an otherwise acceptable fishing effort. Several regional examples, such as the Barents Sea, show that fish stocks need to be managed at a multispecies/community level because of strong interactions (i.e. predation or competition) between species. A paradigm shift would be to maintain the structure/functioning of the ecosystem to determine the exploitation schemes and not the reverse, as currently occurs; i.e. moving from an ecosystem approach to fisheries to ecosystem-based fisheries.

The study also identifies and discusses two different approaches: (1) Development of complex models to handle trophic interactions (e.g. M_{MSY} approaches) or more (complex) processes at the population level (e.g. SS3). These can only be applied on (the minority of) data-rich stocks and do not integrate environmental forcing on biological/ecological processes. Interactions between marine species are complex and dynamics are still poorly understood. A high number of parameters are required and models are often unstable and only understood by a limited number of scientists. (2) Development of empirical rules using MSE based on robust observation system. The main need is to regularly check the representativeness of the observation system at the population/ecosystem levels.

The Sub-Committee found this presentation very interesting and had no further comments.

5. Request input from the other SCRS species groups and the Commission with regard to the implementation of EBFM

Document SCRS/2015/123 focused on a framework for defining recommended best practices for tuna RFMOs. International instruments of fisheries governance have slowly changed the expectations and roles of RFMOs in accounting for ecosystem considerations in their management decisions. The main objective of the paper is to evaluate the progress of tuna RFMOs in applying Ecosystem Based Fisheries Management (EBFM). The paper first defines a framework that was developed to describe what could be considered a “role model” tuna RFMO. Secondly, criteria were developed to evaluate the progress in applying EBFM against this idealized role model RFMO. The framework and criteria were then used to evaluate progress of ICCAT and WCPFC. Both tuna RFMOs have made considerable progress within the ecological component of target species, moderate progress in the ecological component of bycatch, and little progress in the component of trophic interactions and habitat. Both tuna RFMOs have adopted management measures to minimize the effects of fishing on ecosystems, yet no

² An empirical harvest control rule is where resource-monitoring data (such as a survey estimate of abundance) are input directly into a formula that generates a control measure such as a TAC without an intermediate (typically population-model based) estimator.

measure has been linked to pre-agreed operational objectives, indicators and thresholds, precluding them from being activated when predefined thresholds are exceeded. ICCAT and WCPFC share the same challenge of developing a formal mechanism to better integrate ecosystem considerations into management decisions. The review will be expanded to include the five tuna RFMOs, so that a baseline of progress in implementing EBFM can be established.

The Sub-Committee thought that overall, the framework was useful as a metric for the advancement of EBFM within RFMOs, but a number of potential improvements were discussed. Group discussion revolved around the challenges of implementing EBFM particularly when “ecosystem-based management” can have very different meanings to different people. It was noted that ICCAT has much advanced in the area of EBFM in the past several years, although this might not be apparent when put in comparison with an “idealized” RFMO. The Sub-Committee offered some suggestions for improvements in the way that ICCAT’s progress had been scored against the criteria. It was noted that ICCAT has a number of Recommendations regarding bycatch and other wider ecosystem aspects that were not necessarily reflected in the criteria evaluations. It was also noted that, if “habitat” considerations were to be encompassing of factors not directly under human control (e.g. climate-driven variability of pelagic ocean habitat), that this was not reflected completely in the evaluations of ICCAT’s progress in EBFM to date.

The Sub-Committee discussed changes to the methodology that might improve the utility of the tool. There were some questions in regard to how some ecosystem aspects are evaluated; for example, it can be difficult to determine target reference points for bycatch species, and thus they cannot be held to the same standard as target species where reference points such as MSY are used. Also, the concept of “habitat” can take on a very different meaning depending on the species of focus and the type of fishing gear used. A question was posed regarding whether or not habitat drivers beyond the control of ICCAT (e.g. oil spills, climate effects) should be incorporated into the tool. Another question was related to whether or not socioeconomic aspects of the ecosystem should be incorporated into the framework, and it was clarified that the present framework was intended to encompass mainly ecological aspects of EBFM. Finally, the Sub-Committee discussed the level of detail that would be necessary for practical implementation. Given the large number of target and bycatch species that could potentially be directly or indirectly managed, it would be necessary to carry out some sort of prioritization exercise such as an ecological risk assessment, and implementation would be carried out in a step-wise approach. The Sub-Committee agreed that with some revisions to the framework, it could be a useful tool for moving forward with EBFM and for communicating needs to managers.

The Sub-Committee then noted that there would be a need to readdress EBFM goals and objectives in ICCAT as part of the ongoing convention amendment process. A brief presentation was made to revisit the progress from the last meeting of the Sub-Committee on Ecosystems (SCRS/P/2015/021), and to review the materials that were produced from that meeting; these materials are to be presented at the 2015 meeting of the Standing Working Group to Enhance Dialogue between Fisheries Scientists and Managers (SWGSM). The purpose of the presentation at that meeting would be to get feedback from managers and to introduce managers to the components of an EBFM framework. The Sub-Committee reviewed the unpacking exercise from the previous year’s meeting which was intended to demonstrate how EBFM might be operationalized from an ICCAT perspective. It was agreed that the theoretical framework, along with the unpacking exercise, would be useful to present at the upcoming meeting referred to above. This presentation is to be accompanied by a scheduled presentation which will highlight steps to implement EBFM in the European Union.

Finally, it was noted that the FAO Common Oceans ABNJ Tuna Project, funded by the Global Environmental Facility, is promoting and supporting the preparation of long-term plans for operationalizing the ecosystem approach in fisheries in each of the tRFMOs, encouraging consideration of the impacts of fishing activities. The project could provide support for a proposed joint meeting of the tRFMOs led by ICCAT to discuss experiences and proposed approaches to implement the EBFM.

The Sub-Committee responded to a request regarding the agenda for the Second Meeting of the Standing Working Group to Enhance Dialogue between Fisheries Scientists and Managers. Agenda item 6.3 deals with ecosystem considerations, and the Sub-Committee on Ecosystems should thus weigh in on the discussion by facilitating questions to ensure that the outcomes of the meeting are aligned with the needs of the Sub-Committee. The Sub-Committee agreed on the discussion facilitation questions and intended discussion outcomes which are summarized in **Table 1**.

The next item of discussion was in regard to a proposed meeting between RFMOs on the implementation of EBFM. The Sub-Committee agreed on the content of a proposed agenda for this meeting (see below). Ideally, a series of meetings would be held and these were to be funded by the FAO Common Oceans ABNJ Tuna Project. The Sub-Committee discussed the implementation of the meetings, the ideal number of participants, and the

appropriate institutional approvals that would need to be obtained. Although the ABNJ project will only fund the participation of two to three individuals from each RFMO, the Sub-Committee thought that at least the initial meeting would benefit from a larger participant pool. The Sub-Committee discussed the advantages and disadvantages of starting a global RFMO dialogue on EBFM implementation, versus waiting until the regional science is further developed. It was agreed that in principle, it would be beneficial to begin moving forward with such an initiative, pending the necessary institutional approvals and support.

Proposed Meeting between RFMOs on EBFM Implementation

Objectives:

1. Establish dialogue between other RFMOs on the issue of EBFM and its implementation.

Tentative Agenda

1. Review of RFMO EBFM experiences
 - a. Describe the progress that has been made within your organization.
 - b. Describe the impediments to implementation.
 - c. Describe the structure of the framework that best suits your organization.
2. Discussion on strengths and weaknesses of each organizations approach
 - a. Identify opportunities to collaborate.
3. Discuss next steps

Invitation open to tRFMOs with 2 representatives from each funded to attend. Possibly include representatives from organization that have an advanced/functioning EBFM framework. Decisions are not binding.

Funding: Common Oceans ABNJ Tuna Project ~400 K euros for travel, venue and overall coordinator. 2 - 3 meetings

Where: TBD

When: 2016

Lastly, the Sub-Committee discussed the formation of a draft workplan to guide meeting progress and inter-sessional work throughout the next year. It was requested that the Sub-Committee match its workplan with the ICCAT strategic plan, and thus the discussion was initiated by a review of the five thematic elements in the strategic plan (SCRS/P/2015/020). Elements of the plan that are related to EBFM were extracted from the strategic plan and summarized in a list. Discussion was then held in regard to which items would serve as starting points in the process of EBFM implementation, where progress had already occurred, and where progress could most feasibly be made in the near-term future. In a classic EBFM implementation framework, such as that proposed by Levin *et al.* (2009), the first step is to identify the goals and objectives, as these objectives are used to identify data gaps and guide the development of indicators. However, from a practical perspective, management bodies may be slow to develop and accept specific goals, particularly in cases where they are hindered by a lack of understanding of the major ecosystem drivers and responses within the system they are managing. The Sub-Committee thus concluded that the most feasible path forward would be to continue working with the Commission on the development of goals and objectives, while at the same time continuing progress with promising lines of research that might help inform these ecosystem goals. The 2016 workplan for the ecosystem component of the Sub-Committee is attached as **Appendix 4**.

6. Review the methodology to be used to update the longline EFFDIS data and develop similar effort information for other major gears

6.1 Review the methodology to be used to update the longline EFFDIS data

Work on the short term EFFDIS contract was presented (SCRS/P/2015/026). The objectives of the contract are to develop a robust statistical modeling approach to estimate overall Atlantic fishing effort, update the current EFFDIS estimations for longline gear (1950 to 2014) using the new approach, and develop an estimation procedure for other gears. In the past, both the Sub-Committee on Ecosystems and the Working Group on Stock Assessment Methods have made a number of recommendations for updating and improving EFFDIS, which will be incorporated in the new estimates. The project has only recently started and the data are complex and the contractor has been working to understand the data and identify issues related to non-random, non-representative sampling. All the analysis will be made available on a github repository <http://iccat-stats.github.io/>.

The Sub-Committee acknowledged the importance of this dataset and expressed its support of the process to update this information. The Secretariat clarified that the initial timetable for the creation of the EFFDIS dataset has been delayed. It was hoped that a preliminary dataset would be available for use at the 2015 Sub-Committee on Ecosystems meeting, but the project will now only finish in October 2015. A preliminary dataset for longline fleets will be presented to the sharks species group during the Atlantic Blue Shark Stock Assessment Meeting in July 2015. This preliminary dataset will be revised based on feedback by the SCRS prior to finalization in October. It was also noted that the new EFFDIS dataset will be expanded to incorporate additional fisheries and not just longline as was done in the past.

It was also clarified that the EFFDIS data are reliant on Task II catch and effort information, and it is known that there are errors in this data. The Secretariat clarified that data screening will take place to eliminate problems such as effort duplication. This revision and clean up should reduce the amount of problematic data used for the EFFDIS estimation. The Secretariat and contractor are also working to harmonise the very heterogeneous catch and effort data in order to make them comparable and facilitate their use in the development of EFFDIS. Additional data revisions are also being requested from CPCs but this is a longer term issue.

It was also discussed that the EFFDIS estimations rely on species composition information (for key target species). This could be problematic when applying to bycatch species as the composition is biased towards target species and there are non-consistent historical trends in this bias. The contractor is hoping to address this issue using cross validation although non-random bias is still a complicated problem that will require several assumptions are made to fill data gaps. The Sub-Committee also requests to add southern bluefin tuna catch information into the estimation of EFFDIS.

6.2 Develop similar effort information for other major gears

Table 2 provides a summary of effort measures by gear as reported by CPCs to the ICCAT Secretariat as part of the T2CE data. This table was useful in providing guidance as to what units of effort would be most appropriate for gears other than longline for use in the EFFDIS dataset. It was discussed that due to the fact that bycatch information is usually recorded on a set by set basis for purse seine, this unit of effort would be appropriate for use as the effort metric in the EFFDIS dataset for this gear. However, it is not the most frequently reported unit of effort for purse seines, and thus the contractor will have to evaluate the efficacy of using this metric.

The Sub-Committee also discussed the proposal by the 2013 Working Group on Stock Assessment Methods (WGSAM) regarding the additional gears that should be included in the EFFDIS estimation. Previously, it was requested that additional estimations should be conducted for purse seine and baitboat fleets. It was pointed out, however, that EFFDIS is only used to assess the fishing impacts of ICCAT fleets on bycatch species, and as bycatch in baitboat fisheries is extremely limited, there is little point in conducting this exercise for that gear. It was thus agreed that the contractor should rather focus on the important longline and purse seine estimations under the current contract, with consideration given in future EFFDIS estimations (not the current contract) to gillnet fisheries which are believed to have far higher levels of bycatch. It was also discussed that in this case, the appropriate effort unit for gillnets would be “days fished”. The Sub-Committee recognised that very little Task II or bycatch data have been submitted for gillnet fisheries and thus the Sub-Committee recommended that CPCs who have gillnet fisheries should submit Task II and bycatch data.

The Sub-Committee also suggested that when conducting fleet profiles for the purse seine fleet, instead of just separating the effort into FAD or free school fishing, an additional category, namely the Ghanaian purse seine/baitboat cooperative fishery should be considered. This is due to the different catchability apparent for this fleet due to the close cooperation in fishing operations between these two gear types and the sharing of catch, which could bias effort estimates. It was suggested that Ghanaian scientists should be consulted to fully explore this unique sector.

7. Determine "best practices" for estimation of total extrapolated bycatch for sea turtles

Document SCRS/2015/110 presented a potential approach for the estimation of the number of interactions of longline fleets operating in the ICCAT Convention area with sea turtles. Information on the area of operation of 26 longline fleets fishing in the Atlantic in 2013 was obtained from the ICCAT Task II catch and effort database (T2CE). From a literature review, sea turtle bycatch rates were identified for 8 fleets. Bycatch rates were assigned to the 18 fleets without sea turtle bycatch rates based on their temporal and spatial overlap with fleets with known bycatch rates. The T2CE information was deemed not to be the best source of effort information due to errors and missing data that were identified in the database. Further advancing this work will require updating the current ICCAT EFFDIS database so it can be used as a source of effort (number of hooks) information.

The Sub-Committee commented that this is a very good project that summarizes what is available now and what is still missing in terms of CPUEs. This is important as it provides ideas for future directions and work such as estimating total sea turtle interactions, which is an objective of the Sub-Committee and the SCRS.

The Sub-Committee commented that sea turtle CPUEs are available only for some fleet / area combinations and that assigning CPUEs from one fleet to another or across areas may be a problem. This is a limitation of the method but it can be refined with more contributions from other CPCs with specific fleet/area information.

The Sub-Committee also suggested that some fleets may be aggregated into larger groupings so that it is possible to define which substitutions between fleets can be made. Fleets that have the same species compositions or target species may indicate that they likely operated in a similar way and this may be a good indication of fleets for which interpolations can be made. The Sub-Committee commented that there is a strong relation between depth of gear and hook type for sea turtle bycatches. Also, there was a comment on the problematic issue to use CPUEs that are obtained during scientific cruises as those cruises may not operate in the same way as the actual fishery operations.

The authors informed the Sub-Committee that the approach used so far is similar to what was used in the ICCAT seabird impact assessment.

Document SCRS/2015/107 presented a preliminary work using statistical models to estimate the species composition and fate of sea turtles captured in the Portuguese pelagic longline fishery operating in the equatorial and tropical north Atlantic. Specifically, multinomial models were used to predict the species composition and binomial models to predict the fate of the captured specimens. Both models showed good goodness-of-fit. In the multinomial models, the estimated R^2 was 0.562 and the 10-fold cross-validation procedure resulted in a classification error rate of 46.8 %. In the binomial models the estimated R^2 was 0.293, the Area Under the Curve (AUC) was estimated to be 0.805 with a sensitivity of 74.5% and a specificity of 75.5%, and the 10-fold cross validation procedure resulted in a prediction error rate of 21.1%. The models produced are still preliminary, but can now be used to better estimate the species composition and fate of sea turtles that interact with the Portuguese pelagic longline fishery operating in the equatorial and tropical north Atlantic.

The Sub-Committee emphasized that, as mentioned in the paper, the predictions made for those species compositions and mortality rates are exclusive for this fleet and region, and should not be extrapolated to other areas and fleets. It is possible to expand these models to other areas and fleets to take this into account. This is something that can be explored in the future.

The Sub-Committee made some suggestions for future work and ideas, including: 1) show the predictions as maps instead of the probability plots; 2) add tables with the effort by quarter; 3) try to include a year effect, possibly as a random variable to allow the incorporation of yearly variability without the need to calculate coefficients for each year; and 4) explore the use of locations as categorical variables (e.g. 5*5 degrees) instead of continuous variables, although as it is now, the model contains interactions between locations which allow flexibility in spatial effects.

The Sub-Committee also commented that it would be interesting to compare species compositions from shallow sets to species compositions from deep sets to see if they could reflect different distribution and behavioral aspects of the sea turtle species. It was noted that in deeper sets there are likely to be relatively less catches of leatherbacks and loggerheads and more catches of olive ridleys.

Document SCRS/P/2015/027 presented an introduction to an ongoing analysis of existing United States shallow set longline fisheries observer data to assess the efficacy of sea turtle bycatch regulations implemented in U.S. Atlantic and Pacific longline fisheries. Since 2004, vessels targeting swordfish (shallow-set) in Hawaii and some regions in the North Atlantic (the Northeast Distant) have had the following regulations aimed to protect sea turtles: Use of maximum 10 degree offset 18/0 circle hooks and fish bait. Vessels had previously used narrower 9/0 J hooks with squid bait. In addition, vessels in Hawaii operate with limits on turtle captures, 100% onboard observer coverage, and reduced fishing effort. This analysis will explore shallow-set longline observer data from Hawaii and the Atlantic Ocean's pelagic observer program from the time periods prior to regulations (~ 1994-2000) to post regulation (~ 2004-2014). Analyses to investigate relationships between the number and type of turtle interactions (live/dead, hooking/entangled) and operational components such as, depth, proximity to light sticks, bait type, hook shape, and hook size. The outcomes will assist in evaluating the effectiveness of regulatory measures to improve the likelihood of recovery for protected sea turtle species, such as loggerhead (*Caretta caretta*), leatherback (*Dermochelys coriacea*), olive ridley (*Lepidochelys olivacea*), and green sea

turtles (*Chelonia mydas*) within U.S. fisheries. Results may also play a role in influencing international efforts to mitigate sea turtle bycatch in global fisheries. Results will be shared with tRFMOs, such as the ICCAT Sub-Committee on Ecosystems and the Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC, Scientific Committee). Results may also be valuable to the WCPFC, ISSF, and FAO that aim to promote sustainable fishing worldwide.

The authors explained that this project is just starting and is now at the stage of data compilation and harmonization. The Sub-Committee commented that this appears to be a very interesting project and encouraged the authors to present future results to the Sub-Committee. The Sub-Committee commented that in terms of analysis, any changes in abundance in the sea turtle populations through time may confound the results of the mitigation measures implemented. This may be addressed by including the year effect as a random variable (amongst other possibilities). There was a suggestion to possibly expand the analysis for other fleets such as the Canadian fleet, and this may be possible in the future.

8. Map sea turtle bycatch rates against EFFDIS effort estimates

The Sub-Committee discussed that the EFFDIS database that is being completed in late 2015 could be used to improve the ERA that has been prepared in the past for sea turtles (2013). However, the Sub-Committee also acknowledged that an ERA for sea turtles may be of limited use for assessing impact of ICCAT fleets as an ERA is a relative analysis. Unlike sharks and seabirds where there was a clear need to compare vulnerabilities among species or stocks to establish priorities; all sea turtle populations are a priority and are likely to benefit from implemented mitigation measures.

The Sub-Committee noted that the priority now should be to determine rates of interactions from the various gears/métiers on sea turtle species. The first step of the work would be to compile or estimate available species-specific catch rates of sea turtles with the different gears/métiers taking into account spatial and temporal effects, and then extrapolate the total number of interactions using the EFFDIS database.

In the case of sea turtles, most impacts may be coming from non-ICCAT fisheries, or ICCAT fisheries where little data is available, i.e. gears other than purse seines and industrial longlines, and there is a need to make estimations and comparisons across different gears. The estimation of total sea turtle interactions with longline and purse seine fleets can be made by the Sub-Committee in cooperation with the Secretariat once the EFFDIS database is finished. The major problems will be with the estimations from gillnets and artisanal longlines.

9. Review and compile direct bycatch mortality estimates for sea turtles and the estimation methodologies

SCRS/P/2015/023 presents a proposal for an analysis of mitigation options for longline bycatch of sea turtles to be conducted as a series of two workshops – a data preparatory workshop and a findings workshop. These workshops will quantitatively assess the potential for a variety of mitigation measures (e.g. changes in gear designs and fishing methods) to reduce mortality and injury, either singly or in combination. ICCAT CPCs were invited to contribute data in a common format which will be loaded onto a confidentially-held platform that can be queried using coded scripts during the workshops. Findings will inform ICCAT bycatch management discussions as well as demonstrate methods and indicative results for other tRFMOs.

The author of the proposal clarified the timetable required for this initiative. A first workshop is planned to be held in the first quarter of 2016 although this could be flexible. The second workshop would need to be held within a year thereafter with an absolute limit of 2018. It was discussed that this timetable needs to be carefully discussed as it is reliant on whether it is feasible within the SCRS plan for the next few years. The workshops need to be incorporated into the SCRS agenda of meetings planned for 2016 and beyond. As the agenda is normally extremely full, it may be difficult to facilitate these additional workshops. It was also stressed that the Sub-Committee must also consider issues other than sea turtles, and thus these workshops cannot supplant or replace the Sub-Committee meeting in 2016. The SCRS would need to be informed for approval of these additional workshops. As the meeting agenda is discussed by the SCRS in October and approved by Commission in November this would leave little time to prepare for a meeting in the first quarter of 2016.

Another major issue that needs to be solved with regard to the proposed workshop is the provision of data. Confidentiality issues prevent certain CPCs from providing operational data and thus discussions should take place to clarify exactly what data and at what level of aggregation are required for this study. It was suggested that the data required would be discussed and clarified between the external consultant, the Secretariat and participating CPCs. The Sub-Committee also discussed whether the available national observer programme data are sufficient to address this question as they are not collected using a sampling design that facilitates this kind of investigation. It was mentioned that in the Pacific, this has been investigated and the data available when supplemented by questionnaires were sufficient. The Sub-Committee questioned whether the sources of the data required for this study are the same as the sources that usually provide information to ICCAT or whether additional institutes/scientists need to be specifically contacted in order to obtain data that may be of use for the study. This could be time consuming, and again affect the plausibility of conducting a workshop in the first quarter of 2016.

Regarding the actual studies to be conducted, it was noted that the impact of mitigation measures on target species (and other bycatch species) will also need to be addressed and incorporated into the process. It was also stressed that work has already been conducted on bycatch mitigation and this should be consulted and utilised to avoid “reinventing the wheel”. It was also discussed that the work suggested in Phase 3 of the proposal of the planned activities has been attempted by the Sub-Committee (previous ERA) and has thus far been unsuccessful for a number of reasons and as such may not be feasible within the framework of this proposal. The author clarified that the proposal can be restructured to suit the needs of the Sub-Committee and it is not a fixed plan. It was also clarified that the work must address mitigation, but that it is flexible with regards to what gear can be addressed. The Sub-Committee suggested that issues such as FAD entanglements could also be reviewed, although it was pointed out that ICCAT already has recommendations to prohibit entangling FADs and so this may not be suitable for the aims of the Common Oceans ABNJ Tuna Project.

Regarding the actual workshops themselves, two concerns were raised by the Sub-Committee. The first was related to the funding provided by the Common Oceans ABNJ Tuna Project. It was clarified that support for travel would only be provided to scientists from GEF eligible nations. It was raised that due to the already high number of meetings that scientists from developed countries have to attend, additional workshops may not fall within existing budgets and this would affect the participation of scientists from these countries, many of whom have significant data regarding sea turtle interactions with ICCAT gears and data on sea turtle mitigation measures. The exact role of the external consultant was also queried and it was suggested that this expert could assist in the analysis of the data, act as an interface to request data from CPCs, and reduce the burden of the ICCAT Secretariat regarding data management. Some scientists expressed their opinion that this is not necessary and the analysis and data storage should be the responsibility of CPC scientists along with the ICCAT Secretariat. The involvement of an external consultant from another region who will be intimately involved in dealing with confidential data and its potential publication was compared with past problematic experiences where this arrangement was not optimal for all parties. It was clarified that this may not be necessary outside of the actual workshops and the consultant could assist with any tasks deemed necessary by the Sub-Committee, and his/her role can be reduced or expanded as required.

The Sub-Committee agreed to review the proposed workplan for sea turtles developed in 2014 (Page 9, Anon. 2014) to determine the overlap in tasks with the proposal by Common Oceans ABNJ Tuna Project and to determine whether it should be accomplished using the resources provided by the project, or whether it should continue independently within the Sub-Committee according to its own schedule.

The Sub-Committee thus recommended that the focus of future efforts should be to ensure that all CPCs with information on sea turtle bycatch collaborate to estimate bycatch numbers for sea turtles. The Sub-Committee noted that the catch number cannot be directly related to the impact of fisheries on the sea turtle population as many turtles caught by ICCAT fisheries are released alive. The Sub-Committee noticed existing data gaps for the estimation of catch number by ICCAT fishery. It was thus stressed that CPC participation is crucial and data for this purpose must be provided. The Sub-Committee thus decided that the Secretariat will contact CPCs for which no data are available in order to request submission of necessary data and attendance of national scientists of these CPCs.

It was proposed that the Sub-Committee hold two meetings in parallel in 2016. The first would be to address commercial longline and purse seine sea turtle bycatch, and would be conducted by CPC scientists, coordinated by the Secretariat and independent of the Common Oceans ABNJ Tuna Project proposal. A parallel workshop could be held to address gillnet and artisanal longline fisheries, inviting participants that may have data regarding these fishing sectors. The Sub-Committee suggested that funding for the second workshop could be sought from the Common Oceans ABNJ Tuna Project, providing the criteria for obtaining funding from this project are met (such as ensuring the workshop will have global application and addresses mitigation). It was thus decided that the Sub-Committee Bycatch Chair in collaboration with the Secretariat will provide a new proposal for consideration by the project coordinators.

10. Review the efficacy of seabird bycatch mitigation measures [Rec. 11-09]

A number of activities were identified at the 2014 meeting of the Sub-Committee regarding key elements of the review of Rec. 11-09 that should be initiated and progressed in 2015. These include:

- Review the extent to which the bycatch mitigation requirements in Rec. 11-09 reflect current best practice for pelagic longline fisheries
- Request and review new data on seabird bycatch rates
- Develop indicators for monitoring Rec. 11-09 over time
- Update the EFFDIS database

10.1 Review the extent that ICCAT mitigation measures reflect best practices

Document SCRS/2015/114 provided the current advice from the Agreement on the Conservation of Albatrosses and Petrels (ACAP) on best practice for mitigating seabird bycatch in pelagic longline fisheries. The combined use of weighted branch lines, bird scaring lines and night setting represents best practice to mitigate seabird bycatch in pelagic longline fisheries. These measures should be applied in areas where fishing effort overlaps with seabirds vulnerable to bycatch to reduce the incidental mortality to the lowest possible levels. Other factors such as safety, practicality and the characteristics of the fishery should also be recognised. Currently, no single mitigation measure can reliably prevent the incidental mortality of seabirds in most pelagic longline fisheries. The most effective approach is to use the above measures in combination.

The Sub-Committee noted that the three mitigation measures listed in Rec. 11-09 are consistent with ACAP's current best practice advice. It was noted that new technologies that set or release baited hooks at depth or disarm hooks to specific depths, are currently being assessed, and that work to assess the relative efficacy of different line weighting options and specifications, and safety issues relating to their use, is ongoing. The outcome of these, and other initiatives, will form part of the ACAP review process at its next meeting, which is due to take place in April-May 2016. The Sub-Committee noted that it would be useful to have the updated advice and other relevant information presented at its 2016 meeting.

Document SCRS/2015/117 provided an update on the seabird bycatch mitigation fact sheets produced by BirdLife and ACAP. A series of 14 Seabird Bycatch Mitigation Fact Sheets are available that describe a range of potential seabird bycatch mitigation measures, including several with relevance to pelagic longline fisheries. The sheets are available in English, Spanish, Mandarin, Taiwanese, Portuguese, Korean, Japanese and French and are updated at each meeting of ACAP's Seabird Bycatch Working Group (every 12-18 months). The fact sheets assess the effectiveness of each mitigation measure, identifying weaknesses, strengths and recommending best practices for their use. They provide a useful tool for the fishing industry and fishery managers. Included in SCRS/2015/117 are current fact sheets on night setting, bird scaring lines and line weighting, the three seabird bycatch mitigation measures listed in Rec. 11-09. It was noted that the fact sheets are linked to the ACAP reviews and best practice advice for mitigating seabird bycatch and are reviewed and updated if necessary, as part of the same process (see above).

The Sub-Committee agreed that the fact sheets provide a useful resource, but suggested that simplified versions (to accompany the full versions), with a greater focus on illustrations, may be more appropriate for fishers. It was acknowledged that if shorter versions are prepared, it would be useful to do this in conjunction with the other tuna RFMOs.

The Sub-Committee was informed that the Seabird Bycatch Identification guide prepared by ACAP together with the Japanese Fisheries Research Agency is due to be completed by the end of July 2015. The Sub-Committee requested that once available the Seabird Bycatch ID guide and the current versions of the fact sheets for the three mitigation measures listed in Rec. 11-09 be circulated to CPCs for their use and consideration be given to making these resources available on the ICCAT web site.

SCRS/2015/130 reported on preliminary analyses relating to the effects of the newly employed seabird bycatch regulation for longline fisheries in the ICCAT Convention area using current Japanese observer data. Recently, new seabird mitigation requirements were introduced in ICCAT, IOTC and WCPFC Convention areas, and the effectiveness of these regulations needs to be tested. In this document, Japanese seabird bycatch data in the south Atlantic (south of 25° S latitude) collected by observers before and after the introduction of the new regulation were reviewed, and the effects of newly introduced measures such as the tori line, weighted branch lines and night setting were investigated. It seems that the distribution of the observer data covered the main distribution of the fishing effort. Before the introduction of the regulation in 2013, some of the Japanese tuna longline vessels employed weighted branch lines or/and the night setting. The combinations of weighted branch lines with tori lines and night setting with tori lines were used at a similar frequency. When the seabird abundance astern of the vessel during line setting increased, the bycatch rate increased. The bycatch rate decreased with the use of weighted branch lines or use of night setting. Number of tori lines (single or double) did not affect the bycatch rate. We showed the good efficiency of the regulation using fisheries data, but this is preliminary result and further model development is needed, such as considering the effect of the interaction of each mitigation measure with target species. Also, the details of the situation in which the mitigation measures were used would need to be investigated in the future.

The Sub-Committee noted that the preliminary results suggest that Rec. 11-09 has contributed to reducing seabird bycatch in the Japanese longline fleet. It was noted that seabird abundance at the stern of the vessel during setting was an important factor contributing to bycatch levels. The importance of this factor likely confounded the assessment of the relative efficacy of using one versus two tori lines because Japanese fishers often increase the number of tori lines from one to two when seabird abundance increases. The Sub-Committee encouraged other CPCs to conduct similar analyses and report on the results.

10.2 Propose candidate indicators to evaluate the efficacy of mitigation measures

Document SCRS/2015/116 outlined briefly intersessional work being progressed by ACAP to develop guidelines for methodologies to estimate seabird bycatch from observer programme data. There is a range of methods that have been used to assess and monitor levels of seabird bycatch in fisheries. Inevitably, the assessment methods are dependent on the quantity and quality of data available, as well as the specific objectives of the review. Where there is 100% observer coverage, bycatch should be completely observed, and there is no need for extrapolation. However, in most situations, observer coverage is substantially lower, and extrapolation from observed bycatch to total bycatch is required. Within ICCAT and the other tuna RFMOs, analysis and monitoring of seabird bycatch levels over time will most likely include a) bycatch rates per unit fishing effort (e.g. birds per 1000 hooks) and the total number of birds killed. The Seabird Bycatch Working Group of ACAP is currently undertaking work to identify appropriate methodologies for estimating bycatch in both data-rich and data-poor scenarios. The paper provided a brief outline of the inter-sessional work being undertaken by ACAP so as to encourage linkages between the ACAP process and work being undertaken within ICCAT and other RFMOs.

The Sub-Committee agreed that this work is of relevance to ICCAT's review of the seabird conservation measure, Rec. 11-09. It was noted that the ACAP process would focus initially on ACAP countries, but that it is intended that the guidelines would be more broadly applicable and hopefully help facilitate a wider-scale assessment of seabird bycatch. The Sub-Committee agreed that the bycatch indicators proposed (bycatch rates, and total number of birds killed) would be useful candidate indicators for the review of Rec. 11-09.

Document SCRS/2015/119 assesses the current means by which ICCAT CPCs are required to report on their data and activities on bycatch through the ICCAT annual reporting process, and makes a number of proposals. Currently, ICCAT annual reporting on bycatch, both by CPCs to the Secretariat and by the Secretariat in the public domain to the Commission, is disaggregated and distributed across sections of multiple reports, making a full assessment of reporting relevant to assessment of bycatch difficult. In relation to seabird bycatch, the upshot of the current approach is that few data are readily available through the national reporting process on seabird bycatch rates, mitigation measures used, and total seabird bycatch numbers by fleet/year, etc. Overall, for ICCAT's objectives and mandates relating to seabirds to be achieved, and to aid ICCAT's intention of monitoring the effectiveness of Rec. 11-09, the authors proposed that it would be of great benefit if CPCs were required to report on fishing effort, observer coverage, and seabird bycatch south of 25°S in their national reports. The authors suggested that adopting the approach currently required by the CCSBT, modified to meet ICCAT requirements, would represent a harmonised and useful improvement.

The Sub-Committee agreed that it is difficult to extract data and information from CPC Annual Reports for the purposes of analyses and reviews. It was noted that the ICCAT observer forms were designed and adopted (in 2014) partly for this reason, and they will facilitate the reporting of bycatch data and other information. The Sub-Committee discussed the merits of developing a simple reporting form in which summarised bycatch information could be provided, similar to that used by the CCSBT, which could be used in conjunction with the observer forms. The proposed summary reports would aim to reduce redundancies in the current reporting requirements with respect to bycatch, and complement the more detailed information that is required to be reported in the observer forms. It was agreed that while this approach had merit, given the recent adoption of the observer forms, these should be trialed for a period before considering further the need for an additional reporting mechanism. The Sub-Committee acknowledged the importance of working towards harmonised reporting of bycatch information across tuna RFMOs.

Document SCRS/2015/118 reported that BirdLife International, through its local partner BirdLife South Africa, is implementing the seabird bycatch component of the FAO's GEF-funded Common Oceans Programme for tuna fisheries. Through this project, BirdLife proposes to hold a joint tuna RFMO meeting, under the banner of the Kobe Process, which would use a collaborative approach to undertake a global assessment of the impact of tuna RFMO conservation measures on seabird bycatch. In addition, through the Common Oceans Programme, BirdLife intends to support a collaborative approach to building capacity and expertise among national scientists in terms of analysis and/or reporting on bycatch matters to RFMOs, and to create a forum for these scientists to help develop analytical tools and implement these. Both processes are aimed at strengthening national capacity to manage and assess bycatch within national fleets, and to either harmonise approaches or identify new approaches to analysing and reporting on seabird bycatch across RFMOs.

The Sub-Committee agreed that a two-tiered approach to seabird bycatch monitoring, in which each tuna RFMOs conducts basic monitoring on a regular basis, complemented by more detailed assessments conducted collaboratively by all the tuna RFMOs less frequently (every three to five years), is sensible. The exact frequency and approach of the basic monitoring tier should be determined by each tuna RFMO. The Sub-Committee recognised the importance of conducting a wider-scale (than the ICCAT Convention area) assessment of the impacts of fisheries on seabirds, and supported the proposal to work towards a collaborative assessment across tuna RFMOs. The Sub-Committee recommended that this be progressed in a step-wise manner. It was noted that funding available through the GEF Common Oceans Programme could be used to support national scientists and experts for a series of capacity building workshops regarding bycatch estimation methods, and thereafter the implementation of a cross-tuna RFMO seabird bycatch assessment. Although the GEF funds are limited to developing country participants and experts, careful planning of the timing and location of workshops should help facilitate the attendance of all key stakeholders. The Sub-Committee thanked BirdLife and ACAP for their inputs and contributions, and encouraged further collaboration with the ICCAT Sub-Committee.

10.3 Identify data insufficiencies

Document SCRS/2015/115 considered the data collection requirements for observer programmes to improve knowledge of fishery impacts on seabirds. The incidental catch of seabirds associated with pelagic longline fishing operations is considered one of the greatest threats to seabirds, especially albatrosses and large petrels. The five tuna Regional Fisheries Management Organisations have established requirements for their pelagic longline vessels to use seabird bycatch mitigation measures in most areas overlapping with albatrosses, petrels and other seabirds impacted by bycatch, and have plans to monitor and review the effectiveness of these measures. Such a review relies on the effective collection, analyses and reporting of seabird bycatch and associated data and results. At the 2014 inter-sessional meeting of ICCAT's Sub-Committee on Ecosystems, it was noted that the process to review ICCAT's seabird bycatch mitigation Recommendation (Rec. 11-09) should be initiated in 2015. One of the major constraints to an effective review is the availability and quality of bycatch and associated data.

It was noted that the minimum data fields identified in SCRS/2015/115 are mostly included in the current ICCAT observer forms, with some minor modifications needed. For example, the number of hooks observed should be recorded at the level of the set (fishing operation), rather than for the entire trip. The Sub-Committee recognised that data confidentiality rules might limit certain CPCs ability to report data for some specific strata.

The Sub-Committee discussed briefly the issue of observer coverage levels. It was recognised that this issue has been considered at previous meetings, and that it was difficult to recommend a single optimal level. The Sub-Committee acknowledged that the 5% observer coverage level required in Rec. 10-10 will often result in high uncertainty in bycatch estimates and assessments. Consequently, efforts should be directed towards increasing levels of observer coverage. One potential approach is the use of Electronic Monitoring to supplement traditional scientific observer programmes. The Sub-Committee highlighted that Electronic Monitoring should not be seen as a replacement for onboard observers. It was recognised that Electronic Monitoring is still in its infancy, and there are a number of Electronic Monitoring trials and initiatives currently underway. It was noted that the compliance and scientific aspects of Electronic Monitoring need to be distinguished. Some members expressed concern about the proprietary nature of Electronic Monitoring technology that was generally held by a few companies. The Sub-Committee recommended that CPCs involved in any Electronic Monitoring initiatives are encouraged to provide feedback at future meetings.

The Sub-Committee was updated on the process underway to harmonise observer data collection between tRFMOs, initially under the Kobe process, and subsequently through an expert workshop held in January 2015. The aim of the workshop was to identify minimum data fields and develop guidelines for the harmonisation of longline bycatch data collected by the five tuna RFMOs. The workshop report was made available at the end of the 2015 Inter-sessional Meeting of the Sub-Committee on Ecosystems. It is anticipated by those who attended the workshop that there may be a need for a follow up workshop. ISSF, who funded the January workshop, indicated their willingness to consider funding a follow-up workshop should it be considered useful. The Common Oceans ABNJ Tuna Project Technical Coordinator Sharks and Bycatch reported that as a follow up to the January workshop, funds have been provided through the ABNJ project for a short-term contract to prioritise the data fields across all bycatch taxa. The Sub-Committee recommended that Document SCRS/2015/115 be submitted to the consultant for inclusion in the process. The draft outputs of the prioritisation exercise will be presented in the first instance at the Scientific Committee meeting of the Western and Central Pacific Fisheries Commission in August 2015, with wider circulation thereafter. The Sub-Committee was also made aware of another initiative arising from the January workshop, which is a proposal to broaden the CCSBT data exchange protocol to include bycatch information from all five tRFMOs.

The Secretariat presented a brief summary of information that has been provided by CPCs on how they are implementing Rec. 11-09. The Sub-Committee noted with concern the paucity of information that has been submitted to the Secretariat, both in relation to seabird bycatch rates and numbers, and the combinations of bycatch mitigation measures used by the fleets. On the basis of the data that have been submitted to the Secretariat, it will not be possible to conduct an assessment of the effectiveness of seabird bycatch mitigation measures. The Sub-Committee noted that this information is crucial to enable an effective review of Rec. 11-09. Consequently, CPCs fishing longline gear south of 25° S should submit to the Secretariat seabird bycatch and associated fisheries data for years 2010-2014 using the revised electronic observer forms. **Appendix 5** outlines the envisaged workplan for 2016 in respect of the Sub-Committee's evaluation of the effectiveness of ICCAT's seabird bycatch mitigation measures (Rec. 11-09).

11. Review data received by CPCs reporting bycatch. Make recommendations to revise the data collection forms as needed

The Secretariat provided a brief summary of the state of the new ST09 observer data collection forms. It was clarified that the use of these forms had been approved by the Commission in 2014 and that they are now being used in 2015. The deadline for data submission using these forms is the 31 July and as such the Secretariat has, at this stage, no data to present with regard to these forms. It was acknowledged that these forms will require revision based on feedback by the Sub-Committee, but as no data has been submitted to date using these forms, it was impossible to do so at the 2015 Inter-sessional Meeting of the Sub-Committee on Ecosystems. It was again clarified that all observer data including bycatch information should be submitted using these forms.

12. Other matters

12.1 Comments on the format of the meeting

The 2015 Intersessional Meeting of the Sub-Committee on Ecosystems was held in conjunction with the small tunas species group in order to address issues that both groups had in common. Issues relevant to both groups were addressed in a plenary setting and experts from the Sub-Committee on Ecosystems sat in on relevant parts of the small tunas agenda. This exchange between groups was very valuable and it is recommended that other working groups look for similar joint meeting opportunities to achieve specific common objectives and to enhance participation in the groups. It was also recommended that the timing of the meetings should be such that there is ample time to allow information exchange and more flexibility in scheduling.

During the meeting, an invited speaker, Dr Rainer Froese (Helmoltz Center for Ocean Research), provided expertise on assessing and managing data-poor and data-rich species. The Sub-Committee benefited from the additional perspectives offered and will continue to seek this type of external support.

12.2 Minimum standard for data collection

The authors of SCRS/2015/115 were asked to clarify if the minimum standards for data collection reported in their document (section 10) are already required by ICCAT and if not, why should these be collected. It was noted that Rec. 10-10 is vague regarding minimum standards for data collection by CPC national observer programmes and thus it is difficult to exactly determine what the current minimum standards are. The newly adopted ST09 data collection forms contain fields which address most of the suggested minimum standards, however, the Secretariat clarified that these forms provide a mechanism for CPCs to submit their observer programme data as required by Rec. 10-10, but do not prescribe minimum standards or compulsory fields for submission. Several CPCs noted that although they collect the detailed information that could be submitted in these forms, they are legally prevented from doing so for reasons of confidentiality and thus would utilize the more aggregated options contained within the ST09 data forms to submit their data. It was noted that according to Rec. 10-10, the SCRS has been tasked with providing recommendations to the Commission regarding minimum standards for data collection. It was generally agreed that at the current stage it is not possible to make that evaluation due to the fact that the ST09 forms have not been in use long enough to determine what fields can be provided by all CPCs. The Sub-Committee would thus like to return to this issue in 2016 once some feedback and summary from these forms can be provided, but discussions in the future should use the ST09 forms as a basis for discussions.

13. Recommendations

Pertaining to ecosystems:

1. It was recommended that the SCRS should lead a joint meeting of tRFMOs on the implementation of ecosystem based fisheries management in 2016 with support from the Common Oceans ABNJ Tuna Project.
2. Given that the WGSAM is testing approaches for combining CPUE indices and how to best incorporate environmental drivers into the stock assessment process, the Sub-Committee recommended that they should test the state space modelling method described in SCRS/2015/122.
3. The Sub-Committee recognized that significant progress has been made in evaluating the ecological importance of the Sargasso Sea to ICCAT species and ecologically associated species and recommends that in accordance with the response to the Commission, work continue in order to further our understanding of this ecosystem.
4. The Sub-Committee recommended that consideration be given to using the Sargasso Sea ecosystem as a model for demonstrating the implementation of an ecosystem based fisheries management framework.
5. The Sub-Committee has noted that over the last few years the number of ecosystem-related research activities have increased in several ICCAT working groups. The Sub-Committee recommends finding mechanisms to improve the communication among groups in order to share and transfer new knowledge and tools emerging from all the working groups.

Pertaining to bycatch:

6. The Sub-Committee recommended that CPC scientists should, where possible, validate the EFFDIS estimations by analysing and comparing the outputs from that study with their own data.
7. The Sub-Committee recognised that very little Task II or bycatch data have been submitted for gillnet fisheries and thus the Sub-Committee recommended that CPCs who have gillnet fisheries should submit Task II and bycatch data.
8. The Sub-Committee recommended that the next priority for EFFDIS estimations include the gillnet fisheries.
9. It was recommended that the ACAP seabird bycatch ID guide be circulated to the CPCs once completed, by the Secretariat, for approval for possible inclusion in the ICCAT web site.
10. It was also recommended the SCRS review the Birdlife/ACAP mitigation fact sheets for inclusion in the ICCAT website.
11. The ICCAT Bycatch Coordinator, in coordination with the Sub-Committee Bycatch Co-chair, should keep in contact with other organisations conducting research or providing advice on bycatch data collection and analysis and inform the Sub-Committee on any developments.
12. CPCs should collaborate on work and data exchange in 2016 on bycatch rates of sea turtles and seabirds between fleets for use in impact assessments.
13. The Sub-Committee recommended that ICCAT engage in periodic seabird bycatch impact assessments across the tuna RFMOs.
14. The Sub-Committee recommended that the current observer templates be modified to include the number of hooks observed in Form C (at the set level), and to use drop down menus for the 3 seabird bycatch mitigation measures listed in Rec. 11-09.
15. The Sub-Committee recommended that the Secretariat make a special data request to CPCs with current and historic fishing effort south of 25°S to submit seabird bycatch and associated fisheries data using a revised observer form for the years 2010-2014 in time for the 2016 Sub-Committee meeting at which Rec. 11-09 will be reviewed
16. The Sub-Committee recommended that the Chair of the Sub-Committee (bycatch) attend the 2016 meeting of ACAP's Seabird Bycatch Working Group in April/May 2016 to facilitate further collaboration between ICCAT and ACAP.
17. The Sub-Committee recommended that the Secretariat contact CPCs to fill and verify data gaps in sea turtle bycatch rates for their longline fleets to further advance the sea turtle impact assessment.

14. Adoption of the report and closure

The report was adopted during the meeting. The Conveners thanked all the participants and the Secretariat for their hard work.

The meeting was adjourned.

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Table 1. Proposed change to the agenda for the Second Meeting of the Standing Working Group to Enhance Dialogue between Fisheries Scientists and Managers (SWGSM).

<i>Agenda Item</i>	<i>Facilitator</i>	<i>Questions to Facilitate Discussion</i>	<i>Intended Discussion Outcomes</i>
6.3 Ecosystem considerations	Guillermo Diaz	<ul style="list-style-type: none"> • What role can ecosystem indicators play in the assessment and management of tuna fisheries? • [use presentation to facilitate discussion] 	<ul style="list-style-type: none"> • What are the management objectives of EBFM

Table 2. Summary of effort measures by gear. Numbers represent occurrences in Task 2 datasets. Data are for all years combined: 1950 – 2014. Colours indicate relative number of occurrences (e.g. Green = few, red = many).

nr_t2ce_Dsets	GearGrpCode																
EffortTypeCode	BB	GN	HL	HP	HS	LL	PS	RR	SP	SU	TL	TN	TP	TR	TW	UN	tot
D.AT SEA	186	5	20	2		39	70	23	12	3	1	2	2	32	34	9	440
D.FISH	361	31	41	1		173	305	12	9	11	1	11	16	68	28	26	1094
D.FISH.G		1	9			1	1							20	1		33
FISH.HOUR	106	12	9	12		12	199	49	8		7		1	6	36	8	465
Hours.FAD	6						179										185
Hours.FSC	6						179										185
HOURS.SEA	103						180										283
Hours.STD	97						179										276
KM.SETS		2															2
LINE.DAYS	3							12									15
N.POLE-D	23		1						3	1							28
NO.BOATS	3	10	1		2	13	53	18	5	1						2	108
NO.FADS.VIS							10										10
NO.HOOKS			1			1097				1						7	1106
NO.LINES	4	3	14			2		9									32
NO.MTZAS													1				1
NO.NETS		2															2
NO.POLES	7																7
NO.SETS	33	25	17			43	51	1						36	39	23	268
NO.TRAPS													54				54
NO.TRIPS	13	93	27			25	10		22	11			1	13		27	242
-none-	176	65	85	40	8	270	188	31	18	105	21		54	39	97	59	1256
SUC.D.FI	25	23	13	2		19	14				6		4	12	4		122
SUC.SETS					1	1	17									1	20
TRAP D													94				94
tot	1152	272	238	57	11	1695	1635	155	77	133	30	19	223	218	249	164	6328

Agenda

1. Opening, adoption of Agenda and meeting arrangements

Part I: Ecosystem

2. Continue to assess the importance of the Sargasso Sea ecosystem to ICCAT species as per Resolution 12-12
3. Review the progress that has been made in implementing ecosystem based fisheries management and enhanced stock assessments
4. Develop a list of ecosystem objectives that are practical and measurable to present to the Commission so that they can guide the group as to which objectives are of highest priority. This will inform the generation of the tool/framework used to manage the system
5. Request input from the other SCRS species groups and the Commission with regard to the implementation of EBFM

Part II: Bycatch

6. Review the methodology to be used to update the longline EFFDIS data and develop similar effort information for other major gears
 - 6.1. Review the methodology to be used to update the longline EFFDIS data
 - 6.2. Develop similar effort information for other major gears
7. Determine “best practices” for estimation of total extrapolated bycatch
8. Map sea turtle bycatch rates against EFFDIS effort estimates
9. Review and compile direct bycatch mortality estimates for sea turtles, and the estimation methodologies
10. Review the efficacy of seabird bycatch mitigation measures (Rec. 11-09)
 - 10.1 Review the extent that ICCAT mitigation measures reflect best practices
 - 10.2 Propose candidate indicators to evaluate the efficacy of mitigation measures
 - 10.3 Identify data insufficiencies
11. Review data received by CPCs reporting bycatch. Make recommendations to revise the data collection forms as needed
12. Other matters
13. Recommendations
14. Adoption of the report and closure

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Appendix 3

List of documents

SCRS/2015/076	Life history traits and fishery patterns of teleost caught by the tuna longline fishery in the south Atlantic and Indian Oceans
SCRS/2015/103	Estimating vulnerability of teleost caught by the tuna longline fleet in south Atlantic and Indian Oceans
SCRS/2015/107	Modelling sea turtle bycatch and mortality rates in the Portuguese pelagic longline fishery targeting swordfish: preliminary results using statistical models
SCRS/2015/110	A general approach to estimate the number of sea turtle interactions with pelagic longline gear in the ICCAT Convention area
SCRS/2015/111	Evidence of spawning in the southern Sargasso Sea of fish species managed by ICCAT - albacore tuna, swordfish and white marlin
SCRS/2015/113	Results of preliminary runs of the CMSY-method against data limited ICCAT stocks
SCRS/2015/114	ACAP summary advice for reducing impact of pelagic longlines on seabirds
SCRS/2015/115	Data collection requirements for observer programmes to improve knowledge of fishery impacts on seabirds
SCRS/2015/116	Estimation of seabird bycatch rates and numbers
SCRS/2015/117	Seabird bycatch mitigation factsheets
SCRS/2015/118	New opportunities to improve reporting and develop approaches for better understanding seabird bycatch in tuna longline fisheries
SCRS/2015/119	ICCAT process for national reporting on bycatch: an assessment of need from a seabird bycatch perspective
SCRS/2015/120	Preliminary model examining the effects of the tuna purse-seine fishery on the ecosystem of the Gulf of Guinea
SCRS/2015/122	The use of multivariate state-space modelling for understanding the influences of environmental factors on stock dynamics
SCRS/2015/123	Preliminary review of ICCAT and WCPFC progress in applying Ecosystem Based Fisheries Management
SCRS/2015/130	Preliminary analyses; evaluation of the effects of the newly employed seabird bycatch regulation for longline fisheries in ICCAT Conventional area with using current observer data
SCRS/P/2015/019	Three simple rules for EBFM
SCRS/P/2015/020	Ecosystem Considerations in the 2015-2020 SCRS Science Strategic Plan
SCRS/P/2015/021	Proposed ICCAT Objectives for Managing Fisheries within an EBFM Framework

SCRS/P/2015/022	Possible environmental indicators for the state of the Atlantic Ocean as it relates to highly migratory species
SCRS/P/2015/023	Proposal for Workshops to analyze mitigation options for sea turtles interacting with Atlantic longline fisheries
SCRS/P/2015/024	Characterizing uncertainty in stock assessment and management advice - Ecosystem considerations
SCRS/P/2015/025	Performance review of simple management procedures –ICCAT: small tuna working group
SCRS/P/2015/026	EFFDIS Effort Estimation
SCRS/P/2015/027	Analysis of U.S. Longline Fishing Regulations and Effects on Protected Species

Appendix 4

Workplan pertaining to ecosystems

The Sub-Committee determined that the following ecosystem related activities would be important to complete in 2016:

Specific objectives:

1. Review the progress that has been made in implementing ecosystem based fisheries management and enhanced stock assessments.
2. Assess our research needs and prioritize our research plans.
3. Explore possibilities for obtaining funding support by the Common Oceans ABNJ Tuna Project.
4. Through dialogue with the Commission, establish clear EBFM goals and objectives.
5. Review ecosystem indicators for use in stock assessments.
 - a. Explore adequacy of indicators and review new ones.
 - b. Review ecosystem drivers of abundance and mode of action.

Workplan pertaining to seabirds in 2016

The Sub-Committee agreed to examine the trend of annual bycatch number and bycatch rate of seabirds as a first step in the evaluation of the effect of new mitigation measures. For this purpose, the Sub-Committee recommended that all CPCs submit the following information to the 2016 meeting relative to their longline effort in the area south of 25°S latitude after July 2013.

Requested data/analyses for ICCAT SC-ECO 2016	Lead
As required by Rec. 11-09: CPCs will continue to report “ <i>on how they are implementing these measures, and on the status of their National Plans of Action</i> ” (Rec. 11-09)	CPCs – data to be collated by Secretariat
Seabird bycatch indicator 1 (bycatch rate) CPCs with current and historic longline fishing effort south of 25°S to report the following to the SC-ECO meeting 2016: 1) Using a revised version of the ST09 forms; number of seabirds observed caught, number of hooks observed hauled, amount of effort by logbook in the area south of 25°S for the period 2010-2014, to compare pre and post implementation of Rec. 11-09. 2) Distribution map for (1). 3) General description of longline operation in the area south of 25°S (target species, shallow night/deep day sets, etc.). 4) Description of mitigation measures adopted by fishers pre and post implementation of Rec. 11-09 (2010-2015) in the area south of 25°S.	CPCs
Seabird bycatch indicator 2 (total number of birds caught) CPCs to report the following to the SC-ECO meeting 2016: As far as possible, estimations of total number of seabirds caught by species (or lowest taxonomic group possible) per fishery per year in area south of 25°S, for years in which observer data is available (period 2010-2014), with explanation of methods used for calculation (form discussion on methodologies for most effectively making these estimations).	CPCs
Use EFFDIS data to: 1) Identify CPCs fishing in area of Rec. 11-09, Rec. 07-07. 2) Summarise longline fishing effort by 5x5 grid by year, including an interpretation of how longline fishing effort has changed in area relevant to Rec. 11-09 and Rec. 07-07.	Secretariat
Updated analysis of seabird distribution tracking data within ICCAT area (species vulnerable to bycatch in pelagic longline fisheries) and overlap with ICCAT fishing effort (from EFFDIS) by year and quarter. If possible, consider overlap between albatross and petrel groups.	BirdLife
ACAP paper on guidelines for seabird bycatch rate estimation and extrapolation to total number of birds killed (can be circulated after ACAP SBWG meeting April/May 2016).	ACAP
Birdlife to report the activities of seabird mitigations in the Mediterranean in relation to GFCM.	BirdLife