

REPORT OF THE 2017 ICCAT SHORTFIN MAKO DATA PREPARATORY MEETING*(Madrid, Spain 28-31 March 2017)***1. Opening, adoption of Agenda and meeting arrangements**

The meeting was held at the ICCAT Secretariat in Madrid, 28-31 March 2017. Dr. Enric Cortes (USA), the Species Group (“the Group”) rapporteur and meeting Chairman, opened the meeting and welcomed participants. Dr. Miguel Neves dos Santos (ICCAT Scientific Coordinator) addressed the Group on behalf of the ICCAT Executive Secretary, welcomed the participants and highlighted the importance of the meeting due to the Commissions increasing interest in by-catch issues, particularly those related to shark species. The Chairmen proceeded to review the Agenda which 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 abstracts of all SCRS documents presented at the meeting are included in **Appendix 4**. The following served as rapporteurs:

<i>Sections</i>	<i>Rapporteur</i>
Items 1, 2, 12	P. de Bruyn, C. Palma
Item 3	A. Domingo, P. de Bruyn
Item 4	R. Coelho
Item 5	A. Domingo, D. Rosa
Item 6	Y. Semba, D. Courtney
Item 7, 9	E. Cortes
Item 8	D. Courtney
Item 10, 11	D. Die

2. Review of data held by the Secretariat*2.1 Task I and II catch data*

The Task I nominal catch (T1NC) statistics of SMA by stock, flag and gear, are presented in **Table 1**. The Secretariat informed the Group that several updates were made to the historical catch series, namely for:

- EU-Spain LLHB (SCRS/2017/062)
- South Africa (SCRS document to be sent)
- Japan (2014, 2015)
- and some other minor corrections

For the rest of the flags, only the most recent years of official catches were added/updated and duly incorporated into T1NC. The most recent updates significantly increase the amount of information available for the species although there is a lack of official catch statistics prior to 1997 for some of the major CPCs for both shortfin mako stocks (North and South). **Table 2** and **Figures 1a and b** show the comparison between the previously available Task I information and the set revised using the most recent data obtained prior to the meeting. It was also highlighted that as substantial historical revisions have been made to the Task I data, the current Task I catches (new) were considered by the Group to be acceptable for use in the assessment models. As such, the extensive historical calculations (for multiple fleets) carried out for the 2012 assessment (Anon., 2013) based on ratios of shortfin mako to a variety of target species were not made for the current assessment. As a result, the historical catches to be used in the current assessment are lower than those documented in the Report of the 2012 Shortfin Mako Stock Assessment (Anon., 2013).

It was also noted that in the ICCAT databases (since 2015) and reporting forms (from 2018), the code MAK (*Isurus spp*) has been discontinued (everything for this code - ~2% - was reclassified/merged as SMA in the ICCAT DB in 2016).

2.2 Task II effort and size data

The shortfin mako shark datasets of Task II catch and effort (T2CE) and Task II size information (T2SZ) were presented to the Group for the Atlantic North, South and Mediterranean. The data catalogues for this information relative to submitted Task I data are presented in **Tables 3a and b**, respectively. The Group noted that many gaps exist in these datasets and this could be problematic for stock assessment purposes. The Group noted, however, that much observer data regarding size information exist and these data are being compiled by national scientists and are described in section 4 of this report. In addition, the Task II CE data are not often used in shark stock assessments as CPCs usually provide standardised CPUE indices using more comprehensive data than are available in the Task II dataset.

2.3 Tagging data

The shortfin mako shark conventional tagging data available in the ICCAT database are presented in **Table 4**. There is a total of 9,318 SMA individuals released between 1962 and 2015. The total number of individuals recovered is 1,258, which represents on average a recovery ratio of about 13.5%. The apparent movement (straight displacements between release and recovery positions) shown in **Figure 2** (complemented by the release and recovery density maps of **Figure 3**) indicates that the largest amount of the shortfin mako tagging took place in the Western North Atlantic. The Group acknowledged the important work (national scientists and the Secretariat) behind the ICCAT tagging database on sharks, in particular the data recovery process made during the most recent years, and recommended its continuity.

Some additional analysis of the tagging data was conducted by the Secretariat in cooperation with national scientists. The tagging recovery data was filtered to remove entries that did not include information on either the release or recovery positions. The distance between the release and the recovery positions was then calculated and tabulated against a) the length of the released individual (**Table 5**) and b) the days at liberty (**Table 6**) in order to investigate any potential trends in distances covered by size bin or by days at liberty. Although it was noted that most individuals of all sizes were recaptured within 400km of release, it was also noted that the majority of recaptures occurred within a year of release. At this stage, no firm conclusions can be drawn from this work, but it was agreed that the increased use of tagging data is important and thus the continuation of this work was encouraged. In addition it was noted that work regarding the analysis of the size information (size at release and size at recapture) was also being conducted. This work aims to provide complimentary information to existing growth curves.

3. Alternative catch estimation methodologies

In 2016 the Group noted that a comprehensive estimation of historic catches for blue shark was made in 2015 for stock assessment purposes (Anon., 2016). This data was estimated to provide historic levels of catches for time periods for which official data were not available for fleets which are believed to have significant catches during that time. Initially it was proposed that a similar exercise would be conducted for shortfin mako; however the Group noted that the same methodology may not be appropriate for this species. It was noted that unlike the blue shark, shortfin mako has always had commercial value and thus discards have been less. As such reported catch is likely to be more realistic than that for the blue shark. In addition, there is likely to be better observer data for this species that can be used to make these historical estimations. As such the Group recommended that the Secretariat coordinate with CPC scientists to develop historical estimations of catch using this observer data as well as other potential techniques to provide these estimations for review by the Group during the 2017 Data Preparatory meeting (this meeting). It was further recommended that for those series where no additional information is available, catch ratios will be used to make these estimations as was done for the blue shark in 2015. The following CPCs and time periods were identified as being of highest priority for this exercise:

North Atlantic

- Morocco (before 2011)
- EU-Spain (before 1997)
- Canada (before 1995)

South Atlantic

- EU-Spain (before 1997)
- Namibia (before 2002)
- South Africa (before 2002)
- Chinese Taipei (before 1994)
- Brazil (before 1998)
- China P.R. (before 2000)

As noted in section 2, official historical revisions were received for EU-Spain (North and South) and South Africa. Chinese Taipei (North and South Atlantic Ocean) provided historical estimates (1981-2014) in an SCRS document (SCRS/2017/071) and the Group agreed to use these estimates in the assessment models. These data are not yet considered official and thus will not at this stage be used to update the Task I dataset. Canada and Namibia stated their intention to provide data prior to the assessment. This will need to be done before the deadline determined by the Group for inclusion in the assessment models. As such, catches were calculated for Morocco (North), Brazil and for 3 years of China P.R. (South).

North Atlantic

Morocco - An approach using ratios was considered based on Task I swordfish catches, as shortfin mako shark has traditionally been a by-catch of the swordfish pelagic longline fishery. Shortfin mako shark catches were estimated for the period 1961-2010, based on the ratio of 0.66 SMA to 1 SWO. This figure corresponds to the mean ratio (SMA:SWO) calculated on the basis of the reported shortfin mako shark and swordfish catches for the period 2011-2014 (Task I data). The ratio was calculated for each year and then the un-weighted mean ratio across all years was calculated.

The final catches to be made available for the assessment are provided in **Table 7** for the North Atlantic.

South Atlantic

Brazil - The same approach was used for Brazil as for Morocco. A ratio of 0.06 SMA to 1 SWO was used to calculate catches for the period 1971-1998. The ratio was based on the mean ratio (SMA:SWO) of the reported Task I catch for the period 1999-2015.

China PR - In the case of China PR, there are official data submissions from 1993-2015, but missing years in 2004-2006. The Group was not convinced that the ratio of SMA:SWO was appropriate in this instance, while the ratio of SMA:TUN (main tuna species) was very high in the available data. As such an estimation was made for 2004-2006 using the Task II CE data as well as the Effdis dataset maintained by the Secretariat. Task II CE for 2007-2015 was used to calculate an average CPUE for this time period (by dividing the total reported SMA catches by the total reported hooks for the entire period). This CPUE was then multiplied by the Effdis estimated for the years 2004-2006 to obtain annual catches for these years.

The final catches to be made available for the assessment are provided in **Table 8** for the South Atlantic.

The Group specified that any additional catch data or revisions to the data provided in **Tables 7 and 8** that CPCs may wish to see incorporated in the assessment, must be submitted by the end of April 2017, or it will not be included in the assessment input files.

Other estimations

Document SCRS/2017/062 presented estimations of landings of shortfin mako by the Spanish surface longline fleet targeting swordfish in Atlantic for the period 1950-2015 combining different sources of information. The Group welcomed the substantial additional information provided by this study and thanked the authors for this work. The Group agreed to officially adopt the estimations provided in the document and include them in the official Task I database.

During the 2013 Intersessional Meeting of the Sharks Species Group meeting (Anon., 2014), the EU presented the outputs of a research project which estimated shark catches in the Atlantic for the period 2000-2010 (Murua *et al.*, 2013). These potential shark catches by major fleets and countries were estimated based on the ratio of shark catch/by-catch over target species catch estimated through observers, literature, or personal communications. A

detailed explanation of the method is available in section 5 of the Report of the 2014 Intersessional Meeting of the Shark Species Group (Anon., 2015). At the 2014 meeting, the sharks Working Group requested EU scientists to try to improve the methodology, namely by applying this method to each year in order to have the time series of the catch.

A new EU project (EASME/EMFF/2016/008 - SC01) has recently started and one of the tasks is in part to address this issue. The method is still being refined, but a preliminary shortfin mako time series for the ICCAT area (all Atlantic) was presented. The authors are now trying to split the whole Atlantic Ocean into the North and South Atlantic stock areas. The series is particularly different in the first years, and that will have an influence in the model assumptions about catch for the years before the model starting year. The Group agreed that this series could be useful as a sensitivity run in the 2017 Shortfin mako Stock Assessment.

4. Analysis of length composition data by sex and region to aid in the definition of fleets and specification of selectivities

SCRS/2017/048 revised size data distributions and trends for shortfin mako in the Atlantic using observer data. This work was done as part of an ongoing cooperative program for fisheries and biological data collection for sharks, and currently includes information from Brazil, EU-Portugal, Japan, Uruguay, USA, Venezuela and Chinese Taipei. Currently, a total of 36,903 shortfin mako records collected between 1992 and 2015 were compiled, with the sizes ranging from 30 to 366 cm FL (fork length). Considerable variability was observed in the size distribution by region and season, with larger sizes tending to occur in equatorial and tropical regions and smaller sizes in higher latitudes. Most fleets showed unimodal distributions, but in some cases there were possible bimodal patterns that may need to be addressed for stock assessment. The distributional patterns presented in this study provide a better understanding of different aspects of the shortfin mako distribution in the Atlantic, and can be considered for use in the stock assessment (**Figure 4**).

The examination of the currently available shortfin mako length data by fleet revealed some bimodal patterns for some cases, but not the same strong bimodal distributions for some fleets that were apparent for North Atlantic blue shark. Consequently, the need to split data into sub-fleets based on this data might not be needed for this species. Still, this is an issue that needs to be further explored as the SS model is prepared, and also as more data from the other main fleets becomes available. In general, if needed, splitting the data into sub-regions/fleets to have relatively more unimodal size distributions is possible, but other needed inputs as the associated catch data from those sub-regions/fleets could be problematic. In the future, national scientists from each CPC may need to revise the catch data in order to calculate the respective catch in each of those sub-regions/fleets.

Specifically for the US data, a slight bimodal length distribution is observed in the North Atlantic, likely due to more inshore vs offshore fishing locations. It was discussed if this data could be disaggregated into those sub-regions so that the data becomes more unimodal shaped. It was noted that although the length frequencies could be stratified/disaggregated in this way, it would not be possible to obtain the corresponding catches specific to those locations. It was also noted that the observed bimodality might not be as problematic as for blue shark where there was a strong bimodality in the length frequency data.

For the Japanese fleet the question of whether there was a latitudinal difference in the length frequency was raised, likely due to the different fleets targeting bluefin tuna in northern latitudes and the fleet targeting tropical tunas in tropical and equatorial waters. However, this difference was not observed clearly for the aggregate years. Thus, it was decided to treat the Japanese data as one fleet.

It was also noted that the information presented is important and can contribute to the ICCAT statistical areas revisions that are currently being carried out by the SCRS species groups. Those areas will probably move from statistical areas that are defined for major groups to a species by species approach with statistical areas having more biological meaning. However, a general approach for identifying statistical areas by species for sharks, e.g. based on geographic areas with similar size composition data, has not been identified.

Finally, it was noted that size composition data from some of the main fleets are still missing and should be included. The priority fleets to contribute with size composition data are:

- *North Atlantic*
 - EU-Spain: Main fleet landing shortfin mako in the North Atlantic. National scientists are checking if size composition data are available; some data may be available from the ICCAT database directly (2013-2015).
 - Morocco: Recent shortfin mako landings from Morocco have been increasing, so it would be important to have the size composition data.
 - Canada: Submits detailed size composition data to ICCAT so it might be possible to use the ICCAT database directly.
 - USA: In addition to the available observer data, submits weight composition data (headed and gutted port sample weight) to ICCAT so it might be possible to use the ICCAT database directly.
- *South Atlantic*
 - South Africa: National scientists were contacted during the meeting and should be able to provide size composition data.
 - Namibia: National scientists were contacted during the meeting. The Group is awaiting confirmation of data available.

The available length frequencies are provided in **Figure 5**.

In terms of deadlines for the continuation of this work the following was agreed:

- To be included in the final analysis (as with the catch data) the remaining size data should be sent by the end of April.

5. Review of life history information

SCRS/2017/058 presented information on male size-at-maturity and a length-HG (eviscerated weight) relationship for both sexes combined. Male size-at-maturity based on maturity ogives and clasper-fork length relationships yielded consistent results, with a median size at maturity (LMat50%) of 166 cm FL and a full size at maturity (LMat100%) of 180 cm FL. Median size at maturity estimates were smaller than those reported for the North Atlantic, as has also been reported to be the case for females.

The method of fitting a segmented linear regression to the CLI-FL relationship does not provide an *L*50% estimate but rather identifies different maturity transition points between maturity stages (Segura *et al.* 2013). Assuming a three-stage maturity form (i.e. two transition points) this method can identify the size range at the onset of maturity (after the first transition point) and the average size at which all individuals in the population are mature (after the second transition point).

It was noted that the presented eviscerated weight (HG) to fork length relationship is of great use, as this relationship was not available for the southeast Atlantic and it had been recommended in the 2016 Intersessional Meeting of the Sharks Species Group as mentioned in Anon. (in press) for countries to provide these relationships.

Document SCRS/2017/051 presented an update on the SRDCP study on age and growth of shortfin mako in the Atlantic. Preliminary growth models were presented for the North Atlantic. It was suggested that fitting a model to the 3 readers band pair count jointly, could be an alternative to fitting to an agreed age (when at least 2 out of the 3 readers agreed) which represented only 73% of the sample (the remaining sample was discarded). This method would allow the introduction of process error into the growth model.

Additionally, an integrated growth analysis using both tag-recapture data and age readings was discussed. For this analysis the ICCAT conventional tag data would be used. This data, which is derived from several sources, is being investigated to determine the observed growth from direct observations. It was agreed that the full dataset should be used, as even very high growth rates could be real, as observed in other species, and the negative growth will introduce observation error, avoiding bias in the estimations.

An updated table was presented to the Group containing life history parameters for shortfin mako (SMA) in the Atlantic Ocean. The Group discussed and agreed on the parameters to be used for the next assessment. Note that the *a* and *b* parameters of the recommended female maturity ogive for females in the North Atlantic were not reported in the original paper (Mollet *et al.* 2000) and so the authors will be contacted for elucidation (**Table 9**).

6. Review of indices of abundance, including identification of conflicting time series for potential grouping

SCRS/2017/049 provided standardized CPUEs for the shortfin mako shark in the North Atlantic (>5° N) captured by the Portuguese pelagic longline fishery during the years 1995-2015. The analysis was based on data collected from fishery observers, port sampling and skippers logbooks (self sampling). CPUEs were modeled with Tweedie and Delta GLM approaches for the CPUE standardization procedure. In general, there was a large variability in the nominal CPUE trends for the North Atlantic with the standardized series flatter than the nominal. For the size distribution there were no major trends in the time series, but the sizes tended to be larger in the South Atlantic and showed larger variability. The data presented in this working document can be considered for use in the upcoming 2017 shortfin mako stock assessment in the Atlantic Ocean, specifically the standardized CPUE for the North Atlantic and the size distribution for both hemispheres.

Diagnostic plots for Tweedie and Delta models were discussed and the rationale for using these distributions was explained citing the high ratio of zero catch in the logbook data.

The spike in 2007 from the nominal CPUE was noted and it was suggested that this spike was only apparent for shortfin mako and not other species. It was questioned whether this spike was recorded for a specific vessel or several vessels and it was noted that this data was recoded for a specific area.

SCRS/2017/054 revised previous estimates of standardized CPUE for shortfin mako caught by the Japanese tuna longline fishery in the Atlantic Ocean (Semba and Yokawa 2016) with consideration for the temporal changes in the operational pattern for the Japanese fleet in the North Atlantic between 1994 and 2015. Investigation of the spatiotemporal distribution of fishing effort suggested that displacement of fishing effort for Atlantic bluefin tuna (*Thunnus thynnus*), especially in the area north of 20° N, caused an unrealistic decline in CPUE for the North Atlantic shortfin mako in the past five years in the previous analysis.

Based on the investigation of numbers of sets and nominal CPUE of shortfin mako, the area stratification was revised and explanatory variables included in the GLM analysis were modified. Following the data filtering described in Semba *et al.* (2012), CPUE of North Atlantic shortfin mako was standardized using a zero inflated negative binomial model. The revised abundance index showed a declining trend in the earliest few years and stable trend around 0.1 (fish/1000 hooks) between 1995 and 2005, followed by high fluctuations between 2005 and 2013. Although uncertainty remains in the estimates for several years, the current analysis has reduced the uncertainty apparent since the late 2000s in the past analysis and suggests that the annual trend of the abundance index does not show a continuous increasing/decreasing trend between 1994 and 2015.

The ratio of 0 catch was questioned, which was 46% in logbook data before filtering. The method of estimating fleet-specific catch was discussed and one possible approach was the application of effort data in 5 by 5 grid which is available from the ICCAT database. Based on a discussion of the spatial pattern of operation and nominal CPUE of shortfin mako, the definition of fleets was discussed.

It was noted that based on a discussion of observed differences (SCRS/2017/054, Appendix 1, lower left panel) in the number of sets by gear type within area, that it may be important to treat the Japanese CPUE in the North Atlantic as two separate fleets: one fleet in area-1, and a second fleet in area-2 and area-3 combined.

Although the operation pattern is likely to differ depending on areas in Japanese fisheries, a spatial investigation of size frequency does not support differentiation into several fleets, as discussed in section 4, where it was reiterated that the Japanese fleet be treated as one fleet in the Stock Synthesis analysis. The size frequency is identified in the the working document Appendix 2.

It was noted that the filtering method was designed to reduce over and under estimation from the CPUE standardization, and that the filtering method is described in detail in previous SCRS documents cited in the report.

SCRS/2017/056 revised two stock status indicators for mako sharks (*Isurus* spp.) encountered by the US pelagic longline fleet. First, standardized indices of relative abundance were developed from data in the US pelagic longline logbook program (1986-2015) and the US pelagic longline observer program (1992-2015). Indices were calculated using a two-step delta-lognormal approach that treats the proportion of positive sets and the CPUE of positive catches separately. Observations that were affected by fishing regulations (time-area closures or bait restrictions) were subsequently excluded in a restricted analysis. The logbook time series showed a concave shape from the beginning of the series in the mid-1980s to 2009-2010, followed by a downward trend thereafter. The observer time series also showed a concave shape from the beginning of the series in the early 1990s to 2011, followed by a declining trend thereafter. Overall, the logbook index did not show a substantial change in relative abundance since the late 1990s and the observer index showed a generally increasing tendency since the mid-1990s. The lack of strong trends in all series suggests that the status of the stock is stable, yet the declining trend since 2009-2011 should continue to be closely monitored. No discernible trends in size were detected, suggesting that no specific segment of the population is being disproportionately affected.

A question was raised about the distribution of pregnant females and it was indicated that there is little information on this even from the analysis based on size data from the main CPCs. The question was raised about the very small sample size in the logbook data in 1986. It was suggested that the reason was uncertain but it may partly result from this year being the first year for the data collection scheme for logbook data of US longline fishery. An additional question was raised about the decline indicated in 1986 in the restricted analysis, which was not observed in the full analysis. Time area closures were not the cause because they were implemented later in the time series. The trend after 1986 was quite similar among estimates and thus the effect of that year was suggested to be small; nevertheless the standardized CPUE for the full analysis was recommended for use in the assessment.

SCRS/2017/057 provided preliminary results from an analysis of environmental conditions on CPUE of shortfin mako from the US pelagic longline observer program (1992-2016). CPUE was calculated using a generalized linear mixed model (GLMM) with a delta-lognormal approach. The GLMM analysis included consideration of the following environmental variables as predictor variables: sea surface height, sea surface temperature, and bathymetry. The addition of environmental predictor variables resulted in an index that spans 2003-2012. The final index was used to predict average CPUE based on environmental conditions. The two portions of the delta-lognormal approach retained different suites of variables with sea surface temperature and bathymetry retained to predict proportion of positive sets while bathymetry was retained to predict the CPUE of positive catches. Quantile regression was also performed to evaluate whether environmental variables can predict spatial areas with high CPUE. As with the delta approach, environmental data were used to predict conditions that favor high CPUE. Maps generated from both the approaches will later be used for determining mako shark habitat for a spatial management strategy evaluation.

The Group discussed the detail of environmental data and its resolution. It was clarified that the data were downloaded from satellite databases and the resolution for SST and SSH was weekly and daily, respectively. The degree which the model explained the data was questioned. It was noted that GLMM suggested that environmental variables explained < 3 % deviance and that for gear effect explained a bit more. It was noted that diagnostic methods for the quantile regression as well as final model selection methods were still under development and that there was an increasing residual pattern of the GLMM relative to the predicted values

It was also noted that gear was selected for inclusion in the GLMM but not in the quantile regression, and that this is consistent with the idea that gear type would be relatively more important in lower CPUE areas. The mechanism in which SSH affects the distribution was suggested to be related to the front.

SCRS/2017/058 summarized preliminary results of a Uruguayan analysis comparing shortfin mako CPUE and mean shortfin mako size between longline fishing vessels with different gear configurations, namely: deep vs. shallow sets, and fishing sets using reinforced stainless steel branch lines vs. simple monofilament branch lines.

All data analyzed was gathered by the Uruguayan National Observer Program and onboard the R/V Aldebarán form DINARA. Comparisons of CPUE and mean fork length between deep and shallow fishing sets was assessed by analyzing Japanese and Uruguayan longline fishing vessels operating within the Uruguayan Exclusive Economic Zone. Within the Uruguayan longline fleet, the use of reinforced branch lines in some vessels and the use of simple nylon monofilament branch lines in others also allowed the comparison of both CPUE and mean fork length of captures between these different configurations of shallow longline fishing sets.

Results suggests that shortfin mako CPUE is considerably lower in deep fishing sets compared to shallow fishing sets, whereas both types of shallow fishing sets render similar CPUE values. Mean fork length of sharks caught was higher in shallow fishing sets using reinforced branch lines, but was not significantly different between shallow simple branch line sets and deep sets. Although these results should be considered preliminary and further analysis are needed, this document highlights the potential effects of deep vs. shallow longline sets, as well as different branch line configurations, over the catchability and selectivity of the shortfin mako. It is suggested that these aspects should be taken into consideration when standardizing CPUE time series and in the assessment models as they could potentially bias the results if not considered.

Based on catch data from the Uruguayan longline fleet using reinforced branch lines, smaller size classes of the shortfin mako seem to occur at intermediate latitudes

The Group noted that selecting datasets where there is overlap for a particular factor is effective because more information is available than when using the whole data set. The Working Group noted that the shallow and deep sets should be treated as different fleets because the catchability is different.

SCRS/2017/059 provided standardized CPUEs for the shortfin mako shark in the Southwestern Atlantic caught by the Uruguayan longline fleet using information from national onboard observed program between 2001 and 2012. Because of the large proportion of zeros catches (23%) the CPUE (catch per unit of effort in numbers of individuals) was standardized by Generalized Linear Mixed Models (GLMMs) using a Delta Lognormal approach. The independent variables included in the models as main factors and first-order interactions in some cases were: Year, Quarter, Area, Sea Surface Temperature and Gear. A total of 1,706 sets were analyzed. Standardized CPUE showed an apparent increasing trend during the last six years of the study period.

The Group discussed that observer coverage in the Uruguayan fleet is 52-60% and much higher compared to other countries. It was also noted that the trend of the standardized CPUE was quite similar to that of the Brazilian CPUE. Regarding the difference between observer and logbook data, the difference in Uruguay is much smaller than that in USA where observer coverage is lower. The reason for criteria of cutting data with SST <15°C was questioned and it was noted that it is based on swordfish operation strategy rather than biological reasons.

SCRS/2017/061 provided a summary of shark catches from two Mauritanian long line vessels fished during 2016 (latitude ~19-20, mean 500 m depth). Results were presented in number by species. 99% of catches consisted of sharks. Mean length of shortfin mako was 2 m (compliments other data sets).

It was discussed that the species identification was at the group level for some species (e.g., thresher) and this was identified as an area of concern for prohibited species. It was noted that sharks were landed head off, which could also make it hard to identify to species as well as convert to original length.

SCRS/2017/071 provided estimates of standardized CPUE for shortfin mako based on catch and effort data from observers' records of Taiwanese large longline fishing vessels operating in the Atlantic Ocean from 2007-2015. Based on the shark by-catch rate, four areas, namely, I (north of 20°N), II (5°N-20°N), III (5°N-15°S), and IV (south of 15°S), were categorized. To cope with the large percentage of zero shark catch, the catch per unit effort (CPUE) of shortfin mako shark, as the number of fish caught per 1,000 hooks, was standardized using a two-step delta-lognormal approach that treats the proportion of positive sets and the CPUE of positive catches separately. Standardized indices with 95% bootstrapping confidence intervals were reported separately for the North and South Atlantic (separated at 5°N). The standardized CPUE of shortfin mako sharks in the South Atlantic was relatively stable from 2007-2013 but peaked in 2014 and decreased in 2015. The standardized CPUE in the North Atlantic peaked in 2009, decreased in 2010 and fluctuated thereafter. The shortfin mako shark by-catch in weight of the Chinese Taipei large-scale longline fishery, updated as described in this document, ranged from 2 tons (1989) to 89 tons (2009) in the North Atlantic Ocean and ranged from 29 tons (1989) to 280 tons (2011) in the South Atlantic Ocean.

The definition of North Atlantic was questioned and the Group accepted that Area I and Area II in the present study were regarded as North Atlantic. It was noted that the ratio of zero catch in this data was very high compared to other fleets. The method of estimation for catch for the period between 2007 and 2015 and before 2007 (no observer data was available) was checked and the Working Group agreed that their method for estimation was sound.

The CPUE indices available for use are shown in **Figure 6** and **Table 10** (North Atlantic) and **Table 11** (South Atlantic). For the North Atlantic, the Group recommended using the US (logbook), EU-Portugal, Japan, and Chinese Taipei CPUE indices. The EU-Spain CPUE index was requested and it is hoped it will be made available by the data deadline to be included in the assessment; the US observer index was recommended for a sensitivity

analysis if appropriate. For the South Atlantic, the Group recommended using the Brazil, Japan, Chinese Taipei and both Uruguayan indices (logbook and observer). In the case of Uruguay, the observer series covers an additional two years (2011 and 2012) not covered by the logbook series. An index from Spain for the South Atlantic is also expected to be made available in time for inclusion in the assessment.

Hierarchical cluster analysis and cross-correlation of selected CPUE indices

A hierarchical cluster analysis and cross-correlation of selected CPUE indices for shortfin mako in the North and South Atlantic was conducted by the ICCAT Secretariat during the Shortfin Mako Data Preparatory meeting.

It is not uncommon for CPUE indices to contain conflicting information. However, when CPUE indices are conflicting, including them in a single assessment (either explicitly or after combining them into a single index) tends to result in parameter estimates intermediate to what would be obtained from the data sets individually. Schnute and Hilborn (1993) showed the most likely parameter values are usually not intermediate but occur at one of the apparent extremes. Including conflicting indices in a stock assessment scenario may also result in residuals not being identically and independently distributed (IID) and so procedures such as the bootstrap cannot be used to estimate parameter uncertainty. Consequently, when CPUEs with conflicting information are identified, an alternative is to assume that indices reflect hypotheses about states of nature and to run scenarios for single or sets of indices that represent a common hypothesis.

CPUE indices were evaluated for conflicting information separately for the North and South Atlantic. The agreed CPUE indices in the North and South Atlantic were evaluated for consistency with the average trend by area from a lowess smoother (fitted to year for each area with series as a factor—separately for North and South Atlantic). Time series of residuals from the lowess fit to agreed indices were evaluated separately for the North and South Atlantic. Pairwise scatter plots for agreed indices were evaluated separately the North and South Atlantic to identify correlations and high leverage points among indices. A hierarchical cluster analysis (Murtagh and Legendre, 2014) was used to group the agreed indices based on their correlations separately for the North and South Atlantic. Cross-correlations between agreed indices were evaluated to identify lagged correlations (e.g., due to year-class effects).

Results are provided in **Appendix 5**. There was generally strong agreement among selected indices in both the North and South Atlantic.

7. Other data relevant for stock assessment and remaining issues in preparation for the June stock assessment meeting

Two background documents (Vaudo *et al.* 2016 and Vaudo *et al.* 2017) were briefly presented. Vaudo *et al.* (2016) presents information on the vertical distribution of shortfin makos obtained by tagging eight individuals with pop-up satellite archival tags off the northeastern United States and the Yucatan Peninsula, Mexico. Depth and temperature records across 587 days showed vertical movements strongly associated with ocean temperature. The sharks showed diel diving behavior, with deeper dives occurring primarily during the daytime (maximum depth: 866 m). Overall, sharks experienced temperatures between 5.2 and 31.1°C. When the opportunity was available, sharks spent considerable time in waters ranging from 22 to 27°C, indicating underestimation of the previously reported upper limit of the mako sharks' preferred temperature.

Vaudo *et al.* (2017) was a study on long-term satellite tracking that revealed region-specific movements of shortfin mako in the western North Atlantic Ocean. Among other results, the study found that sharks moved across the jurisdictional management boundaries of 17 nations and the proportion of tracked sharks harvested (22%) was twice that obtained from previous fisheries-dependent, conventional tagging studies.

It was subsequently brought to the attention of the Group that a study that had just been submitted for publication that augmented the sample size from Vaudo *et al.* (2017) had found that the proportion of harvested sharks was *ca.* 30%. In discussions about this new paper (Byrne *et al.* in review), it was asked whether the sharks harvested by fishermen had been caught near the tagging locations and shortly after being tagged. After asking clarification from the senior author, it was clarified that the 12 animals caught by fishers had been at liberty an average of *ca.* 5 months and only 4 of the 12 animals had been fished in areas near the original tagging locations (three off the Yucatan Peninsula in Mexico and one off Cape Hatteras in the USA). The significance of this paper is that the fishing mortality rate found is almost an order of magnitude larger than found in the 2012 Shortfin Mako Stock Assessment (Anon., 2013). The limitations of the study, e.g. that it was not designed to estimate mortality, covered only an area in the western North Atlantic and may not be representative of the whole stock, were noted, but

nevertheless the study was considered interesting enough for the Group to discuss that it could be worthwhile to investigate through modeling the implications on stock status of considering such large fishing mortality rate once the paper is published.

8. Discussion on models to be used during the assessment and their assumptions

8.1 Production models

Document SCRS/2017/055 presented results on the application of the Bayesian Surplus Production (BSP) software, which uses the Sampling-Importance-Resampling (SIR) method to integrate posterior distributions, to the shortfin mako data used in the 2012 assessment. The paper noted that the 2014 blue shark assessment (Anon., 2015) used both the BSP software and the Markov Chain Monte Carlo (MCMC) algorithm, implemented in the JAGS software, and found that the JAGS and BSP model results were not always consistent. In this document, both the BSP1 software (without process error) and the BSP2 software (with process error), and two independent MCMC software packages, JAGS and Stan, were applied to the data from the 2012 mako shark assessment (Anon., 2013) to determine whether the same problem existed. Although all modeling packages gave similar results for other species, they are not consistent for mako sharks. This may be because there is a long period of catches with no CPUE data, or because the catch and CPUE data are not consistent with each other.

It was noted that the issue will be further addressed intersessionally with the data derived at this meeting that extend to 2015.

Bayesian production models specify priors, among other things, for r_{max} , the intrinsic or maximum rate of population increase, which will be computed based on the life history parameters derived at this meeting, and further require a single catch series and indices of relative abundance, which will be derived at this meeting. For the North Atlantic, production models using the SIR algorithm with and without process error and MCMC algorithms incorporating process error will be used. For the South Atlantic, it is envisaged that production models incorporating process error will be used.

Vectors of natural mortality, M , and estimates of productivity and steepness will be developed intersessionally, presented in a document, and made available to the stock assessment analysts for inclusion in the models. It was discussed that M will be calculated based on a suite of life history invariant methods, and it was noted that r_{max} is obtained by definition after the stock has been fully exploited and exploitation has ceased and the stock is at low population levels growing under ideal conditions.

8.2 Stock Synthesis

Stock Synthesis will be implemented for the North Atlantic stock (as a length-based age-structured statistical model; Methot and Wetzel 2013; Methot 2013). Stock Synthesis is an integrated modeling approach (Maunder and Punt, 2013) and was proposed to take advantage of the length composition data sources available for the North Atlantic stock. An advantage of the integrated modeling approach is that the development of statistical methods that combine several sources of information into a single analysis allows for consistency in assumptions and permits the uncertainty associated with multiple data sources to be propagated to final model outputs (Maunder and Punt, 2013). A disadvantage of the integrated modeling approach is the increased model complexity. Because of the model complexity, its application will be limited to the North Atlantic stock, and will follow closely upon that previously developed by the Group for blue sharks in the North Atlantic.

It was discussed that information needed for the model includes time series of catch, abundance, and length composition data starting in 1971 (based on available time series of reliable catch history), with separate sex (based on observed differences in growth among sexes). Catch in metric tons will be grouped into separate fleets with similar gear characteristics and size frequency. If a fishery is known to have occurred before 1971 and catch is available (Spain, Morocco) then the average catch during the period prior to 1971 will be input as the equilibrium catch prior to 1971 in Stock Synthesis. If a fishery is known to have occurred before 1971 and catch is not available (Japan) then the average catch during the first 10 years (1971-1980) will be input as the equilibrium catch prior to 1971 in Stock Synthesis, as done in the previous blue shark assessment.

The indices of abundance to be used in SS3 are detailed in Section 6. Catches and length compositions were assigned to fleets in the model based on similar observed size frequency.

It was discussed that, as done in the previous blue shark assessment, life history data will be utilized based on recommendations provided by the Group at the Data Preparatory meeting. A table of recommended life history values can be found in Section 5.

8.2.1 Sensitivity Analysis Proposals for SS3

Several sensitivity analyses were proposed during the course of the Data Preparatory meeting and are summarized here:

Catch

It was discussed that an alternative catch stream based on estimates developed under an EU project could be appropriate for a sensitivity analysis (see Section 3) to reflect a high catch scenario.

CPUE

It was noted that it might be appropriate to consider splitting CPUEs of some fleets based on gear characteristics. If this were done and if new CPUEs were produced by 30 April, then the CPUEs could be included as sensitivities.

Compositional data

Additional size composition data may be available from the ICCAT Task II sz database.

Growth and stock productivity

It was noted that alternative growth models from the SRDCP may be available before 30 April, which include the results of vertebral ageing and tagging data.

It was noted that these alternative growth models could be included as sensitivities, but that it would be important to insure the stock productivity and other associated derived parameters – e.g. natural mortality, are consistent with the alternative growth parameters.

Other sensitivity runs proposed include: weighting method for the CVs of CPUEs, weighting method for sample size of length compositions, and several combinations of parameters in the low fecundity stock recruitment function in SS3, and recruitment deviations. Sometime after 30 April, assessment analysts will plan to send the very preliminary SS model to the Group as soon as available so that the assessment model development work can be conducted collaboratively to develop a reasonable base model and a reasonable range of sensitivity analyses before presenting the model and sensitivity analyses to the Group at the June meeting.

The assessment sensitivity runs should try to incorporate a narrow range for parameter sensitivities developed collaboratively with the Group based on reasonable parameters from a scientific viewpoint and not grid all possible parameter values because this could lead to unreasonable parameter value combinations.

9. Shark Research and Data Collection Plan (SRDCP)

The ICCAT Shark Research and Data Collection Program (SRDCP) aims to develop and coordinate science and science-related activities needed to support provision of sound scientific advice for the conservation and management of pelagic sharks in the Atlantic. This Program was developed in 2013-2014 by the Sharks Species Group, and framed within the 2015-2020 SCRS Strategic Plan. Within this Program, specific studies have been developed for 1) age and growth, 2) satellite tagging for habitat use, 3) satellite tagging for post-release survival, 4) population genetics and 5) isotope analysis.

Updates on the execution state of those projects were discussed and presented in some preliminary SCRS documents. Plans for the future of SRDCP were also discussed.

Age and growth

Document SCRS/2017/051 presented an update on the SRDCP study on age and growth of shortfin mako in the Atlantic. There are currently 721 sampled sharks (384 males, 332 females, five specimens with undetermined sex)

collected and processed from both the Northern (379 samples) and Southern (342 samples) hemispheres. The size range of the samples varies from 52-366 cm FL in the North and 81-330 cm FL in the South. A workshop was carried out at the Northeast Fisheries Science Center (Narragansett Laboratory, NOAA Fisheries, USA) on 2-3 June 2016 to prepare a reference set of vertebrae that is being used as a guideline for the age readings. Preliminary growth models for the North Atlantic were presented. This project is ongoing and final results for the North Atlantic will be submitted in the intersessional period before the stock assessment meeting, in order to contribute to the 2017 shortfin mako stock assessment.

The Group discussed issues related with age validation and band deposition periodicity. The method being used is following Natanson work on age validation with tetracycline and bomb-radiocarbon. The Group also discussed the possibility to have a growth model incorporating tag-recapture data, following recommendations from the Group. Several hypotheses on the filtering method for the tag-recapture data can be considered. More details on the discussion of the paper are presented in section 5 (life history) of this report.

Tagging studies

Document SCRS/2017/050 presented an update of the shortfin mako tagging projects within SRDCP for both habitat use and post-release mortality. Currently, all phase 1 (2015-2016) tags (23 tags: 9 miniPATs and 14 sPAT) have been deployed by observers on Portuguese, Uruguayan and US vessels in the temperate NE, temperate NW and SW Atlantic. A total of 668 tracking days have been recorded so far. In terms of post-release survivorship, data from 19 tags/specimens has been used. From those, six specimens died (31.6%) while the remaining 13 (68.4%) survived, at least the first 30 days after tagging. All planned project milestones and deliverables have been achieved and delivered in due time, including additional deliverables that were not originally planned. For the second phase of the project (2016-2017) 12 miniPATs were acquired and will be deployed during 2017 in various regions of the Atlantic, including temperate, tropical and equatorial waters.

The Group commented that the post-release mortality estimates are very useful, especially when considering possible mitigation measures. The post-release survival estimates will also be useful for future Ecological Risk Assessments. The Group also commented that the current evidence from tagging is consistent with other information from conventional tagging, genetics and life history.

The Group suggested that the tagging data can in the future be used for building habitat models, especially as more funds are made available to continue this work and more information is compiled. While this can be possible, it is also important to note that the funds that have been available for this work are very limited and as such the number of tags used is also limited. One important point to note is that the participants in the SRDCP have committed and are contributing with data from other projects and as such there is now also information from additional projects that can be used.

Genetics

Current results on the genetic study (Taguchi *et al.* in press) were introduced. Mitochondrial analyses indicated that the Atlantic shortfin mako was significantly differentiated at least among the northern, southwestern, and southcentral and southeastern areas, while the microsatellite analyses did not show any genetic structuring of the Atlantic shortfin mako. Ongoing project is under processing which aims to investigate the population structure in the North Atlantic in finer scale based on the specimens collected from waters off Florida, the Mediterranean, and tropical Atlantic Ocean.

The preliminary results seem to indicate that there may be 3 stocks of shortfin mako in the Atlantic (N, SW and SE). The stock boundary areas are still uncertain, but with the new samples from the Caribbean, Gulf of Mexico and Mediterranean this will be further refined.

The porbeagle genetics study was briefly discussed, preliminary results seem to indicate that the North Atlantic porbeagle is a separate stock, but for the South Oceans (Atlantic, Indian and Pacific) the separations are not clear.

Plan for the 2017 funds

For 2017 the SRDCP had its funds reduced. The revised table with the new funds allocated for 2017 is shown below:

<i>Project</i>	<i>Participating CPCs</i>	<i>Project leader</i>	<i>Initial Budget (€) 2017</i>	<i>New Proposal (€) 2017</i>
Shortfin Mako				
Stock boundaries (Genetics)	Japan, EU, Uruguay, US, etc.	Yokawa	15,000	15,000
Fatty acids/Isotopes (Trophic relations)	Uruguay, EU, Japan, US, etc.	Domingo	15,000	15,000
Movements, habitat use, and post-release mortality (PSATs)	EU, Uruguay, US, etc.	Coelho	40,000	
Life history (Reproduction)	US, Uruguay, Japan, EU, etc.	Cortés	5,000	5,000
Porbeagle				
Life history (Reproduction)	US, Uruguay, Japan, EU, etc.	Cortés	15,000	5,000
Movements and habitat use (PSATs)	Uruguay, EU, US, etc.	Domingo	45,000	60,000
Total			150,000	100,000

Plan for the next funding cycle (2018-2019)

As agreed before in the 2016 Sharks Working Group meeting (Anon., in press) the priorities for the new funding should prioritize the following:

1. Porbeagle: The next species to be assessed will be porbeagle in 2019. ICCAT Recommendation 15-06 on porbeagle caught in association with ICCAT fisheries supports this in saying that: "Paragraph 4: *CPCs are encouraged to implement the research recommendations of the joint 2009 ICCAT-ICES inter-sessional meeting. In particular, CPCs are encouraged to implement research and monitoring projects at regional (stock) level, in the Convention area, in order to close gaps on key biological data for porbeagle and identify areas of high abundance of important life-history stages (e.g. mating, pupping and nursery grounds). SCRS should continue joint work with ICES Working Group on Elasmobranch Fishes*". The Group therefore agreed that part of the next funds should be allocated to POR with high priority.
2. Shortfin mako: The two phases of the SRDCP were devoted to shortfin mako shark, as the species to be assessed in 2017. While considerable work has been produced, there are still uncertainties on some important biological parameters and it is important to continue the work that has been started on this species. Additionally, ICCAT Recommendation 14-06 on shortfin mako caught in association with ICCAT fisheries supports this in saying that: "Paragraph 3: *CPCs are encouraged to undertake research that would provide information on key biological/ecological parameters, life-history and behavioural traits, as well as on the identification of potential mating, pupping and nursery grounds of shortfin mako sharks. Such information shall be made available to the SCRS*". As such, the Group recommends that it is important to continue the shortfin mako shark work and allocate part of the new funds for this species to continue this work.
3. Other shark species: Even though the main ICCAT shark species are blue shark, shortfin mako and porbeagle, the Sharks Working Group is also responsible for providing scientific advice on other pelagic, oceanic and highly migratory shark species that are caught in association with ICCAT fisheries. Most of those other species are data-limited species, and as such it is a priority to start biological projects and data collection on those species, in order to provide better advice in the future. Several ICCAT Recommendations also support and ask

that research should be implemented on those other shark species, specifically in the cases of the Recommendations for hammerheads and threshers: ICCAT Recommendation 10-08 on hammerhead sharks caught in association with ICCAT fisheries: Para 5: "*CPCs shall, where possible, implement research on hammerhead sharks in the Convention area in order to identify potential nursery areas. Based on this research, CPCs shall consider time and area closures and other measures, as appropriate*"; ICCAT Recommendation 09-07 on thresher sharks: Para 5: "*CPCs shall, where possible, implement research on thresher sharks of the species *Alopias spp* in the Convention area in order to identify potential nursery areas. Based on this research, CPCs shall consider time and area closures and other measures, as appropriate*". Other species under ICCAT management such as blue, silky and oceanic whitetip sharks should also be addressed. As such, the Group recommends allocating part of the future funds for research to those species.

In terms of priority areas for projects, those should focus on biological parameters (age and growth, reproduction), tagging and population genetics. The Group agreed to work inter-seasonally on the plan for the next 2-year funding cycle and present at the Species Groups meetings (September) a finalized plan for the consideration of the SCRS.

10. Other Matters

Collaboration between CITES and tuna RFMOs

During COP17 CITES urged member countries that are also members of fishery RFMOs to help CITES in their efforts to conserve shark and ray resources.

CITES Decision 17.214 Sharks and rays (*Elasmobranchii spp.*).

Decision directed to: Parties

Parties that are also members of regional fisheries management organizations or bodies (rfmos/rfbs) are urged to:

- a) Work through the respective mechanisms of these RFMOs/RFBs to develop and improve methods to avoid by-catch of sharks and rays, where retention, landing, and sale of these species is prohibited under RFMO requirements, and reduce their mortality, including by exploring gear selectivity and improved techniques for live release;*
- b) Encourage the RFMOs/RFBs to consider making CITES-listed species a priority for data collection, data collation and stock assessments among non-target species, and provide these data to their members; and*
- c) Cooperate regionally on research, stock assessments, data sharing and analysis to help Parties making legal acquisition findings and ndfs for shared stocks, and on training initiatives for CITES authorities, fisheries staff and customs officers, in cooperation with the cites and FAO Secretariats.*

In March 2017 CITES organized a workshop to improve collaborations between CITES, FAO and RFMOs in matters related to sustainable use of ocean resources, particularly sharks. This activity was a continuation of the collaborative work conducted in 2016 between these organizations, which included the CITES/ICCAT West Africa shark capacity building workshop that was held in Madrid in September 2016. The March meeting, held at CITES HQ in Geneva, was attended by scientists from FAO, CITES, WECAFC and SEAFDEC and national scientists involved in ICCAT*, IOTC and IATTC. The meeting gave RFMOs the opportunity to provide feedback on the successes and challenges faced during the prior collaborative project as well as input into the possible new project. Continuation of the project depends on funding provided by the EU and is likely to focus on activities on a selected group of countries as opposed to regional initiatives as was done during 2016. ICCAT representatives provided input to FAO and CITES on the relative scientific capacity of ICCAT CPCs in relation to sharks as indicated by their participation on the work of the ICCAT Working Group on sharks.

The March meeting also provided the opportunity to exchange information about the scientific process which supports the objectives of CITES and RFMOs. This exchange highlighted the benefits of this collaboration, especially regarding the indicators of sustainable use which are derived by both types of organizations. It was pointed out that tuna RFMOs have, for many species of oceanic sharks, the best information on the levels of harvest that may be sustainable for each stock. Such information is very useful to countries in need of providing "Non Detriment Finding" (NDF) determinations for trade transactions related to CITES-listed species. Additionally, CITES has expertise on trade statistics, traceability and trade regulations that is relevant to RFMOs. Understanding trade can help RFMOs to better interpret the trade statistics sometimes used in the assessment process. Fin-trade

* Enric Cortés (ICCAT Shark Working Group Rapporteur), Rui Coelho (ICCAT Atlantic Swordfish Rapporteur) and David Die (SCRS Chair).

statistics, for example, have been used in the assessment process for blue sharks, and could be used in the future for other sharks. As of now, however, the CITES database holds very limited data on shark trades, partially because CITES has only listed shark species in the recent years.

During the meeting it was also noted that CITES procedures under “Introduction From The Sea” (IFTS) have recently disrupted scientific work conducted by tuna RFMO scientists. It is presently unclear whether biological samples of tissues of CITES-listed species require NDFs under IFTS procedures. As a result, European scientists that were conducting biological collections of CITES-listed shark tissues in the high seas of the Atlantic and Indian Oceans, or in the EEZs of coastal countries, stopped these collections. This situation hampers the ability of RFMO scientists to conduct their research. During the meeting it was requested that CITES and RFMOs examine their regulations with the view of not hampering the process of scientific research.

The Group supported the continued collaboration between ICCAT and CITES and pointed out the need of continuing this collaboration given the need to:

- evaluate the effectiveness of ICCAT regulations to mitigate impacts of ICCAT fisheries on CITES-listed shark species
- provide clarity on the IFTS process in regards to scientific sampling of CITES-listed species
- improve the input of ICCAT science into the CITES processes of consideration of species listing/de-listing proposals and NDFs

Commission recommendations from 2016 Annual meeting

In 2016 ICCAT passed two new Recommendations on sharks: *Recommendation by ICCAT on management measures for the conservation of Atlantic blue shark caught in association with ICCAT fisheries* [Rec. 16-12] and *Recommendation by ICCAT on improvement of compliance review of conservation and management measures regarding sharks caught in association with ICCAT fisheries* [Rec. 16-13]. The Group noted that [Rec. 16-12] requests that during the next assessment of blue sharks (planned for 2021):

“...shall provide, if possible, options of HCR with the associated limit, target and threshold reference points for the management of this species in the ICCAT Convention area.”

The Group therefore agreed of the need to plan to adjust future shark work plans and research proposed for the shark research plan to support the estimation of such reference points and development of blue shark HCR options prior to 2021.

In [Rec. 16-13] regarding submission of data by CPCs on the implementation of shark conservation measures, the Commission requests that:

“CPCs may be exempt from the submission of the check sheet when vessels flying their flag are not likely to catch any sharks species covered by the abovementioned Recommendations in paragraph 1, on the condition that the concerned CPCs obtained a confirmation by the Shark Species Group through necessary data submitted by CPCs for this purpose.”

The Group agreed that it would be best to provide guidance to CPCs on the kind of information they should provide so that the Group can confirm the exemption request. A draft describing such information was developed and is included as a recommendation in section 11 of this report.

11. Recommendations

- The ICCAT Shark Research Program has had great success in advancing the knowledge on blue shark, shortfin mako and porbeagle biology and life history, and has significantly contributed to the information available to the assessment of these species completed or to be completed in 2015, 2017 and 2019, respectively. The Group recommends the continuation of this program into 2018 and requests the Commission continued support of these activities. Considering [Rec. 16-13], future research should expand from the current focus on these three species to species of sharks for which ICCAT has already implemented by-catch conservation measures: silky, oceanic whitetip, hammerheads and thresher sharks.

The Group will provide a budget for 2018-2019 activities of the Shark Research and Data Collection Program prior to the 2017 Meeting of the Standing Committee on Research and Statistics (SCRS) annual meeting.

- Since the addition of some shark species to the CITES Appendix 2 list, ICCAT researchers have faced difficulties in conducting their ocean-wide research on those sharks, which requires the shipment of biological samples collected in the high seas or in foreign country EEZs to the laboratories that are processing the samples. These difficulties have, for example, led to scientists being forced to stop the collection of porbeagle samples from both the Indian and Atlantic Ocean. This issue was raised by tuna RFMO scientists at the March 2017 meeting between CITES and RFMOs that was held at the CITES headquarters. The Group recommends that the ICCAT Secretariat make an official request to CITES to facilitate the sampling of CITES listed species for the purposes of scientific research conducted under the auspices of ICCAT research programs. Ideally, the ICCAT Secretariat would make this request in collaboration with the IOTC Secretariat to both strengthen the request and to facilitate the collection of samples from both Oceans. Furthermore, the Group recommends that CITES and ICCAT continue their collaboration with the view of strengthening the knowledge about the status of shark populations and the effectiveness of fishery management measures in the conservation of these resources.
- The Group recommends that the SCRS ad-hoc Working Group on tagging considers:
 - Doing an ICCAT-wide review of experiences regarding the effectiveness of different designs of conventional tags with the purpose of making recommendations on the preferred design to be used in future ICCAT tagging efforts.
 - Collaborating with IOTC scientists to conduct a review of information on movements of ICCAT and IOTC species around the southern boundary of the Indian and Atlantic Oceans with the view to inform both Commissions on stock structure and movement of fish across such boundary.
- The Group recommends that CPCs requesting an exception of the requirement to submit information to the Commission regarding the implementation of shark conservation measures (pursuing Rec. 16-13), should submit the following information to the Group so that it can make a determination that the exception is justified:
 - List of species of sharks recorded to be present in the area of tuna fishing activities of the CPC;
 - Evidence (scientific surveys, scientific observer data, landing surveys) that clearly indicate the lack of interactions between CPCs tuna fleets and shark species considered by ICCAT conservation measures;
 - Information on the spatial extent of fishing effort by CPC tuna fleets;
 - A plan for periodic review of the scientific information that justifies the exemption request.

This information has to be provided to the ICCAT Secretariat at least two weeks prior to the meeting of the Group in September. The Group will then make a recommendation on whether the request for exemption is justified and will transmit this recommendation to the plenary of the SCRS for review.

- The Group recommends identifying regional fishery bodies that can be candidates for collaboration on research on shark species of common interest.
- The Group recommends the 2019 assessment of the northern stock of porbeagle should be conducted in collaboration with ICES.
- The Group recommends starting a collaboration with CCSBT, in order to support the stock assessment of the southern stock(s) of porbeagle.
- The Group recommends that CPCs continue the recovery of Task II CE and SZ data.
- The Group recommends that CPCs continue to revise their historical shark catches with the aim of classifying “unclassified” catch reports into the appropriate species.

12. Adoption of the report and closure

The report was adopted by the Group and the meeting was adjourned.

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