Report of the ICCAT 2023 Blue Shark Data Preparatory Meeting
(hybrid, Olhão, Portugal, 17-21 April 2023)

1. Opening, adoption of the Agenda and meeting arrangements

The Shark Species Group Rapporteur and meeting Chairman, Dr Rodrigo Forselledo, opened the meeting and welcomed the participants (the Group). The Assistant Executive Secretary, Dr Miguel Neves dos Santos, greeted the participants noting his thanks to the Instituto Português do Mar e da Atmosfera for hosting the meeting. The meeting agenda was adopted and is contained in **Appendix 1**. The List of participants is included in **Appendix 2**. The list of papers and presentations is attached as **Appendix 3**. The authors´ abstracts of all SCRS documents and presentations are included in **Appendix 4**. The following participants served as rapporteurs:

Section	*Rapporteur*
Item 1	Taylor, N.G
Item 2	Carlson, J., Erauskin, M., Junge, C.
Item 3	Palma, C., Mayor, C., Garcia, J.
Item 4	Zhang, X., Cardoso, G., Baibbat, A, Rice, J.
Item 5	Courteney, D., Fernández, C., Braccini, M.
Item 6	Forselledo, R.
Item 7	Brown, C., Diaz, G., Santos, M.N.
Item 8	Brown, C., Forselledo, R., Diaz, G.
Item 9	Taylor, N.G.

2. Review of historical and new information on biology

Document SCRS/2023/038 analyzed conventional blue shark tagging-recapture records available in the ICCAT database, providing estimates about growth and sensitivity analyses testing different FL_0 values, several transformation equations between TL and FL, and different fitting models. The document also reviewed historical FL_{MAX} values. The results using several non-linear fits were very similar among them and in general had estimated higher mean von Bertalanffy K parameters than those described by other authors using reading-interpretations on vertebrae.

The Group considered the measurement error for sharks and the potential bias in estimation of length. Various suggestions were provided to attempt to correct for this and alternate ways to further analyze the data.

SCRS/2023/047 reviewed and analyzed the data obtained from conventional tagging of Atlantic blue sharks. There are some transoceanic movements but there is limited exchange among stock management units. The information on size obtained from conventional tagging data also agrees with model predicted data from Skomal and Natanson (2002).

There was some Group discussion about the over- and under-estimation of growth-curve parameters as well as measurement error (that may vary by situation and person). More work is needed on those data even though they have been standardized and filtered.

SCRS/2023/054 summarized tagging data and stock identification for Atlantic blue shark. Both conventional and satellite tagging data suggest few individuals crossed the Equator. Genetic information provides statistically significant differences between the Mediterranean and the North Atlantic individuals.

Discussion pertaining to the markers used for genetic analysis and why two groups are differentiated between the Mediterranean Sea and the Atlantic occurred. Tagging data support a small mixing between the North and the South stocks. The Group suggested to increase tagging effort in areas where few tags have been deployed, especially in the area where the stock is delineated, in order to better characterize transatlantic migration/movements. The Group concluded that there was not yet sufficient evidence to alter the current delineation of stock structure.

SCRS/2023/053 provided the age, growth, and maturity of the blue shark in the Northwest Atlantic Ocean based on vertebrae data. It was noted that life history did not vary greatly from the previous 2015 stock assessment.

Discussion regarding the relationship between maternal size and number of pups was considered, but there is not enough current information available to determine this relationship due to low sample sizes.

SCRS/P/2023/030 provided information about the reproductive biology of the blue shark in the South Atlantic Ocean. The Group suggested that the author filter the data directly in the database and construct an age ogive for the reproductive data to be included in the report. There was also discussion related to the low number of pups for some litters noting that these low numbers may be related to aborted pups due to stress of capture.

SCRS/P/2023/031 provided information about the movement and overlap of the blue shark with the longline fishing gear in the Southwest Atlantic using conventional and satellite tagging data.

The Group remarked that the analysis of the overlapping/encounter rates of the blue shark with the longline fishery was estimated by counting exposure time from when the hook reaches the operational depth, but the hooks are "fishing" even when they are not at operational depth, so the exposure time could be higher. The author considers that the change in encounter rates is not going to be significant for blue sharks although some studies for other species found this something to consider.

The Group also discussed that the length of tag deployment (majority < 2 months of information) makes some conclusions uncertain. It concluded that it would be important to further discuss tagging effort and data needs at the Workshop on the Shark Research and Data Collection Programme, to be held from 13-15 July 2023.

SCRS/P/2023/032 provided information of the hooking mortality of blue shark caught by commercial longliners in the Southwest Atlantic.

The Group further discussed the analyses of the size composition of females and males to test for differences in the mortality rate by sex and size.

SCRS/P/2023/34 provided a summary of biological characteristics of blue shark captured off Côte d'Ivoire.

Of particular note, the Group discussed the hypothesized biennial reproductive cycle described in the presentation and its implication for the productivity of the species and the overall stock assessment. The senior author agreed to provide data from the study to the Group to test for differences in maturity between the east and west Atlantic and to further examine the relationship between maternal size and litter size. The Group concluded that, while the results from SCRS/P/2023/034 were interesting and merited further examination, all previous studies in the Atlantic, Pacific, and Indian Oceans have reported annual reproduction for blue shark, and annual reproduction should continue to be used for the assessment.

3. Review of fishery statistics/indicators

The Secretariat presented to the Group the most up-to-date fishery statistics (Task 1 nominal catches, T1NC, Task 2 catch and effort, T2CE, and Task 2 size samples T2SZ) and tagging (CTAG: conventional tagging; ETAG: electronic tagging) information on blue shark areas (BSH-N: North Atlantic stock; BSH-S: South Atlantic stock; BSH-M: Mediterranean area). Detailed statistics together with SCRS catalogues and detailed catalogues as well as dynamic dashboards to explore and analyze existing information were also presented. These served to identify data weaknesses (gaps, inconsistencies, etc.) on the northern blue shark stock for further corrections.

Document SCRS/2023/52 presented the results from an analysis of the Southwest of England blue shark recreational fishery from 1953-2021, in response to the 2020 ICCAT request for information on catches, catch and effort, and size data on the species. During this period 108,731 blue shark specimens were captured in 56,650 fishing days, giving an overall nominal CPUE of 1.92 fish/trip. Nominal CPUE initially peaked during the 1950s to between 2.93-4.59 fish/trip before declining during the 1960s. The nominal CPUE reached the lowest value of 0.18 fish/trip in 2000 with an increasing trend during 2010-2014.

Nominal CPUE increased markedly from 2.58 fish/trip in 2014 to 5.33 fish/trip in 2015 and peaked at 8.85 fish/trip in 2017 before decreasing slightly during 2018-2021. Female fish dominated catches throughout, although male fish were more evident in catches during certain periods. The Secretariat committed to work with UK scientists on the provision of this information to ICCAT in the standard formats in the short term.

3.1 Task 1 (catches) data and spatial distribution of catches

The updated blue shark T1NC statistics (landings plus dead discards) by stock, flag CPC and gear, are presented in **Table 1** and **Figure 1**. The updated SCRS catalogues of BSH stocks/areas (BSH-N stock in **Table 2**; BSH-S stock in **Table 3**; BSH-M area in **Table 4**), showing both Task 1 (T1NC) and Task 2 (T2CE and T2SZ) paired series for the last 30 years (1993-2022) by order of importance (i.e. % of landings by each CPC to the total landings in the 30 years) were also presented to the Group. These catalogues allowed the Group to identify potential data inconsistencies and gaps in both stocks as well as the BSH-M area.

The Secretariat informed the Group that except for the official revision of the Spanish surface longline fleet catch series (updated from 1997 onwards on both stocks), there have been no major improvements to the historical catches before 2000 for either BSH-N and BSH-S stocks since the 2015 stock assessment. The last two decades are reasonably complete, with several CPC updates made during the interim period 2015 to 2022. However, there still are a few incomplete catch series for some longline fleets (Belize, Panama, Korea (Rep.), and China (P.R.)), and to a lesser extent, there are incomplete catch series for other surface gears (recreational handline and rod & reel, gillnets, etc. for several CPCs). These other surface gears make a minor contribution to the total catches of both stocks.

The Secretariat indicated that Brazilian longline fleet catches reported for the southern stock (BSH-S), may require a partial reassignment to BSH-N in the most recent decade, as indicated by the T2CE of Brazilian longline fishing activity (SCRS/2023/057). The Secretariat will work with the Brazilian scientists to explore the feasibility of splitting the Brazilian longline BSH-S catches into the two stocks, if possible, before the stock assessment.

The data gap analyses identified sparsely distributed and missing catches between 1993 and 2021. Some of those BSH-N missing catches were obtained during the meeting (Maroc longline 2010-2014, Venezuela gillnets 2014-2022 and longline 2022, Canada longline 2022) and adopted as preliminary SCRS T1NC statistics. The remaining data gaps were filled by using mean catches of the previous three years for each series (this is the most widely used carryover method adopted by the SCRS). All the estimates detailed in **Table 5** were registered as preliminary SCRS estimates and stored in the ICCAT database system (ICCAT-DB). ICCAT CPCs are requested to review these estimates and to provide new official reports to replace them if they do not agree that the estimates accurately represent their data. The U.S. already committed to replace the above estimates for the recreational rod and reel fishery 2002-2009 with its own estimated catches by the SCRS annual meeting. The EU-France unclassified gear catch series (mostly longline and gillnets) also has to be split by gear type with the support of the French scientists. Other catch series with unclassified gears will also require similar corrections in the future.

The BSH-N and BSH-S historical catch reconstruction (Anon., 2016a) covering the period 1971 to 2013 was used for the 2015 stock assessment, but was never included in the ICCAT official T1NC stored in the ICCAT-DB. The Group discussed the possibility of adopting these estimations as preliminary SCRS estimations (only for those fleets for which there are no official T1NC reports), which will allow their storage in the ICCAT-DB. After some debate and considering the decisions made for other species (e.g. billfish species, porbeagle, shortfin mako, etc.), the Group recommended (section 8) the preliminary adoption of these historical catch series used in the 2015 stock assessment as the best scientific estimates of total removals for BSH (T1NC) up until 2013. It further requested that the Subcommittee on Statistics discuss this recommendation during its September 2023 meeting for final SCRS adoption.

During the sharks T1NC dashboard presentation, where the Secretariat gave some examples on their filtering and exploratory capabilities, the Group asked for the definition of the various T1NC catch type components and nominal catch definitions. The Secretariat responded that catch type codes adopted by the SCRS for T1NC and other datasets (catch C, landings L, dead discards DD, discarded live DL, post-release mortality of live releases DM, etc.) keep the different catch types in the T1NC and other datasets as they were originally reported.

3.2 Task 2 catch/effort

The SCRS catalogues and detailed BSH catalogues (BSH-N stock, BSH-S stock, and BSH-M region, respectively in **Tables 2 to 4**) indicate that, over the last 30 years, T2CE datasets (character "a" when DSet = t2), are still highly incomplete. The last decade shows a satisfactory improvement in T2CE dataset provision. For years prior to 1993, the T2CE information with BSH is generally lacking across all fleets and years in both Atlantic stocks and in the Mediterranean (see T2CE detailed catalogue).

BSH-N stock

For the BSH northern stock, fourteen fisheries account for 99% of the total removals between 1992 and 2021. In descending order of total catch these fisheries are: EU-Spain, EU-Portugal, Japan, Canada, Maroc PS, Belize, Panama, Maroc LL, Chinese Taipei, USA LL, USA RR, Korea (Rep.), China (P.R.), and Venezuela. Longline fisheries account for 97% of the total catches, followed by catches from purse seine and recreational gears.

With some exceptions (EU-Portugal LL, USA LL, Chinese Taipei LL, and Venezuela LL), the shortage of T2CE is very prominent. Between 1993 and 2021, some of the most important longline fleets (EU-Spain, Japan, Canada, Belize, Panama, Chinese Taipei, Korea (Rep.), China (P.R.), and Venezuela) still lack 5 or more years of T2CE data with BSH catches in the species catch composition.

BSH-S stock

For the southern stock, twelve longline fisheries (importance in descending order: EU-Spain, EU Portugal, Brazil, Namibia, Chinese Taipei, Japan, Uruguay, South Africa, Ghana GN, China (P.R.), Belize, and Korea (Rep.)) account for 99% of the total removals, between 1993 and 2021. The majority (except Ghana gillnets) are longline fisheries.

With some exceptions (EU-Portugal LL, Chinese Taipei LL, Namibia LL, Uruguay LL, and South Africa LL), the lack of T2CE is also significant. Some of most important longline fleets (EU-Spain, Brazil, Namibia, Chinese Taipei, Japan, Uruguay, South Africa, China (P.R.), Belize, Korea (Rep.), and Panama) lack 5 or more years of T2CE data with BSH catches in the species catch composition from 1993-2021.

BSH-M region

The BSH Mediterranean information on T2CE is highly incomplete, with only a few flag CPCs reporting T2CE (EU-Spain LL, EU-Italy LL, and EU-Malta) and only for the last decade. Overall, the T2CE information with BSH catches in the catch composition is sparse and limited across all years.

Overall, no major progress has been made in recent years in the recovery of T2CE data including BSH. With the existing T2CE information it is not possible to estimate CATDIS (T1NC estimated by quarter and in 5x5 degree resolution). Therefore, it is impossible to produce geographical maps of the catch spatial distribution over time. Accordingly, the Group reiterates that additional effort should be made by ICCAT CPC scientists to recover T2CE with BSH in the species catch composition.

3.3 Task 2 size data

The SCRS catalogues and the detailed catalogues of BSH (BSH-N stock, BSH-S stock, and BSH-M region, respectively in **Table 2**, **Table 3** and **Table 4**) indicate that the T2SZ datasets in the last 30 years (character "b" when DSet = t2), are still highly incomplete. The last decade shows satisfactory improvements in T2SZ dataset provision. For years before 1993, BSH T2SZ information is generally lacking across all fleets and years in both Atlantic stocks and in the Mediterranean. For the two BSH Atlantic stocks and in the Mediterranean region, the lack of available T2SZ data is consistent with the lack of T2CE datasets.

However, in terms of historical T2SZ data recoveries some progress has been made. A Spanish long-term data recovery project, allowed to recover BSH size frequency samples from the Spanish surface longline fleet from both Atlantic stocks. This work has been presented to the Group (SCRS/2023/039) and the information was also reported to ICCAT to be used in the BSH 2023 stock assessment, with a confidentiality restriction on its public dissemination (i.e. not to be published on the ICCAT website or elsewhere until the authors lift the restriction). During the meeting, Venezuela also reported (see SCRS/2023/056) two

important recovered T2SZ datasets on its fisheries, the size frequencies from the longline commercial fishery (2013 to 2018) and the drift gillnet artisanal fishery (2009 to 2014). Both T2SZ datasets will be included in the 2023 stock assessment.

Some additional T2SZ dataset recoveries are also underway or planned (Brazil, Japan, Maroc, UK, Uruguay, and Chinese Taipei) for a possible integration in the 2023 stock assessment (SS3 matrices). Some of these datasets may also be included as official T2SZ information.

3.4 Tagging data

The Secretariat provided a presentation on available ICCAT blue shark BSH conventional tagging data. **Table 6** shows releases and recoveries per year and **Table 7** shows recovery numbers grouped by number of years at liberty. Three additional figures geographically summarize available BSH conventional tagging data. The density of releases in 5x5 squares (**Figure 2**), the density of recoveries in 5x5 squares (**Figure 3**), and the apparent BSH movement (arrows from release to recovery locations) are shown in **Figure 4**.

The ICCAT Secretariat informed the Group of CPCs' important recent contributions, with special attention to the latest update made from the data reported by the APEX predator program (U.S.) with about 10,000 new records and important updates related with sex and fleet. Tagging data are summarized in SCRS/2023/047.

Conventional tagging data improvements will continue and will run in parallel with the maintenance and improvement of the conventional tagging database (CTAG). This will be accompanied by the development of the new electronic tagging (ETAG) database. The ETAG project's main objective is to integrate all electronics-tag information (metadata and data) obtained on all ICCAT managed species into a centralized relational database. This will improve ETAG data availability and facilitate analyses. Phase 1, evolving in parallel with the GBYP, has been completed. It included ICCAT, AOTTP, and GBYP data inventories, input-files creation (special format with metadata and electronic tagging data, one for each electronic tagging), and PostgreSQL database server installation. Phase 2 will consolidate the metadata and integrate electronic tagging data into the system.

Finally, the Secretariat presented two BSH dashboards to examine tagging data dynamically and interactively. The first (**Figure 5**) is for conventional tags, showing a summary of releases and recoveries. The second (**Figure 6**) is for electronic tagging, showing a summary with data extracted from metadata. The Secretariat thanked scientists for their support producing the dashboards presented. The Group acknowledged the Secretariat's tagging dashboards' achievements and their usefulness.

The Group raised some questions related to the tagging database system content and ownership. The Secretariat responded that both CTAG and ETAG systems can potentially contain ICCAT information (i.e. tagging financed by ICCAT and/or ICCAT CPCs that must report this information to ICCAT) and additional information owned by other entities (organizations, scientists, etc.) that is reported on a voluntary basis. The ICCAT confidentiality policy will apply to these datasets. Ownership of raw electronic tag data by the original provider will be maintained. CTAG information will always be publicly available on the ICCAT website but ETAG information will have some restrictions in that only inventories with summarized information will be published.

In relation to the current ICCAT data dissemination policy, some questions were also raised in relation to the fact that while observer data are considered confidential, tagging data that are recovered in observer programs have been released publicly. The Secretariat informed the Group that CTAG follows the same data dissemination rules of the Task 2 size information (T2SZ: size frequencies were always collected and published by sex in ICCAT). For sharks in particular, this Group requested about five years ago that the sex be recovered in the conventional tagging (releases and recoveries) and that this information be integrated in the CTAG system. This work is still in progress. Based on the above considerations, the Group recommended that the ICCAT confidentiality policy be revisited by the Subcommittee on Statistics in order to try to eliminate potential inconsistencies recalling that CTAG has no dissemination restrictions (no risk) but that biological information may have some restriction (moderate risk) (see Recommendations section).

Based on a study from Uruguay on steel darts efficiency on sharks (Mas *et al*. 2022), the Group also recommended that ICCAT provide Stainless-Steel Dart Tags for sharks. The Secretariat suggested including this as a recommendation with financial implications in the Group's annual work plan.

4. Indices of abundance

Document SCRS/2023/052 presented an analysis of the recreational blue shark fishery from the Southwest of England, from 1953-2021. During this period 108,731 blue sharks were captured for 56,650 fishing days, giving an overall nominal CPUE of 1.92 fish/trip. The nominal CPUE initially peaked during the 1950s between 2.93-4.59 before declining during the 1960s. The nominal CPUE reached a nadir of 0.18 in 2000 then showed an increasing, but highly variable trend since 2010. Immature female fish dominated catches throughout, although both mature male and female were present during certain periods.

The Group discussed that while these data cover a very long time period, they cover only a very small geographic area. The Group noted that nominal CPUE showed huge fluctuations around 2015 which are inconsistent with shark biology. The Group discussed that these fluctuations likely reflect the availability to the local fishery, perhaps driven by environmental factors, rather than the overall stock abundance trend. The Group noted that these data are collected through citizen science initiatives, so that data collection and CPUE standardization procedures need to be fully evaluated and documented. The author noted willingness to develop the work and potentially develop a data sharing agreement with ICCAT, and the possibility of a collaborative tagging effort with the Commission or a CPC. The Group discussed the possible use of these data to characterize the recreational fleet selectivity in this area.

Documents SCRS/2023/040 and SCRS/2023/041 presented updated standardized CPUE indices of blue shark caught in the Spanish surface longline fleet targeting swordfish, between 1997-2021 in the North Atlantic and South Atlantic, respectively. Most of the model variability was explained by the ratio of SWO /(SWO+BSH), a proxy of the targeting criteria, followed by gear factor. In the North, the standardized CPUE showed an increasing trend until 2008 and remains stable since then to 2021. In the South, the standardized index of relative abundance showed an increasing trend reaching a peak in 2017, then a slight decrease until 2020 followed by an increasing trend in most recent years.

The Group discussed whether the ratio of swordfish to blue shark and swordfish catches used in these two analyses are an effective proxy for blue shark targeting. That blue shark catch is used both as a dependent variable and as a factor in the predictor variable, may lead to index hyperstability. The author noted that this is used as the best proxy indicator to determine targeting criteria of the skippers, and that this might also apply for some other EU fleets. The methodology used explains most of the model variability. The author also noted that this methodology has been previously used. The Group discussed the model's relatively low coefficient of variation (CV), which was likely due to the aggregation of data by trips, rather than analyzing the data at the set level. The author confirmed that the analysis was done by trip which covers nearly 95% of the catch. If the analysis were made by sets, then the coverage would be lower.

It was noted that this issue of using catch ratios as a proxy for targeting was previously assessed by the Working Group on Stock Assessment Methods (WGSAM) (Anon., 2001) via simulation for some specific cases and scenarios. The results of the evaluation performed by the WGSAM suggested that clearly there is no best method that could be generally applied and that any proxy, even if it performs best relative to others, can still produce biased results. Of the proxy methods evaluated by the WGSAM, the use of the catch ratio of the target species in relation to the total catch performed best on average and remains the preferred proxy, even though this method may not provide the best performance in all cases.

Document SCRS/2023/045 updated the catch, effort, and standardized CPUE for the North Atlantic blue shark captured by the Portuguese pelagic longline fleet. Nominal annual CPUE was calculated and standardized with Generalized Linear Models (GLM) and Generalized Linear Mixed Models (GLMM). Sensitivity analyzes were carried out along with goodness-of-fit analysis that was carried out with AIC and the pseudo R2, along with model validation with residual analysis.

The Group discussed possible changes in how fleets operated after the COVID pandemic; the authors stated that the fleet seems not to have changed their mode of operation. The Group raised another question about the area and total catch coverage, and the authors showed that the area coverage might be more in

temperate zones for recent years. Regarding total catches, the authors agreed to check if the full coverage included the Madeira and Azores catch. Similarities between EU-Portugal and EU-Spain fleets were mentioned. As was addressed in previous documents, different methodologies on how to incorporate targeting criteria as a model variable were discussed.

SCRS/2023/046 showed an updated index of abundance developed for blue shark (*Prionace glauca*) from the U.S. Pelagic Observer Program (longline, 1992-2022). The index was calculated using a delta-lognormal approach that treats the proportion of positive sets and the CPUE of positive catches separately. The standardized index showed an initial increasing trend from 1992 to 1998, followed by a decrease to 2003, an increase to 2011, and a subsequent decrease to 2022.

The Group discussed the areas used as factors in the model and whether they could underrepresent the spatial coverage of the fishing fleet or shark catches. The authors clarified that most catches come from only 3 areas used as model factors and, once they are treated as factors, their effects have been extracted from the general temporal trend. It was indicated that the standardization model also used catch ratios between target species (e.g. sharks and tunas) to categorize fishing operation targets. The Group noted that the CPUE index tended to be more variable than nominal CPUE, which could be related to explanatory variables that were not available for standardization. The Group also raised questions about the low numbers of sets used in the analysis compared to the number of sets reported in logbooks or landings data. The authors explained that there is a trade-off between data quality and quantity, and the use of observer data brings accuracy and information on additional potentially influential factors that should be valued. The authors confirmed that a previous study with the same data set showed that observer coverage on pelagic longline vessels averaged 7% of the deployed longline sets annually.

The Group inquired about the fleet´s gear configuration changes and specifically, the introduction of circle hooks. The authors indicated that this factor was not considered in the standardization due in part to the low level of overlap in the use of the different hook types (J-hook vs circle hook), due to the implementation of the mandatory use of circle hook. It was noted that changes in catchability from J-hook to circle hook remains equivocal. It was also noted that U.S. longline fishing effort has been decreasing over time, which resulted in fishing effort shifting to more coastal areas in the past recent years (SCRS/P/2023/036).

Documents SCRS 2023/049 and 2023/050 detailed the estimation of abundance indices of blue shark by Japanese longline fishery from 1994 to 2021 in the South Atlantic and in the North Atlantic, respectively. Shark catches by the commercial tuna longline fishery are usually underreported due to the lack of reporting of discards. The author filtered the logbook data using similar filtering methods to those applied in the previous analysis. The logbook data were filtered (as in previous assessments) and the nominal CPUE standardized with a spatio-temporal generalized linear mixed model (GLMM).

The Group asked how the filtering method had been done and if, for example, vessels could be excluded in one year and included in another. The author clarified that the exclusions were conducted based on the shark reporting ratio per trip; if the reporting ratio is larger than 80%, those trip data were included. The Group also questioned if the clustering analysis included the BSH ratios. The authors confirmed that species composition data of tunas and swordfishes were included, but BSH catches were not.

Document SCRS/2023/057 presented a joint standardized catch-per-unit-of-effort time series for ICCAT sampling area BIL96 from Brazilian and Uruguayan longline fishery data. The series spanned 30 years, from 1992 to 2022. The document presented the data cleaning process and satisfactory model fit. The estimated delta-lognormal index showed three distinct periods: the first from 1992 and 2005, when the index was marked by low and stable values; the second from 2006 to 2012, in which a sharp increase was observed; and the third from 2013 to 2022 presented higher values than the beginning of the series, but without any apparent increase or decreasing trend.

The Group discussed if the standardization accounted for target species. The authors clarified that while vessels do target different species, this has changed over the study period as the mix of fleets included was very variable. While data storage and formatting precluded analysis regarding target species for a large portion of the fleets used, the authors noted that the number of hooks between floats (HBF) was used as a proxy of targeting. Regarding the Brazilian fleet's catch and effort, the Group noted that some data may correspond to the northern stock area, and therefore there might be a need to redistribute some of the Brazilian BSH catches currently classified in the South to the northern stock (see section 3 of this report).

Document SCRS/2023/058 presented standardized CPUE for BSH caught by Moroccan longliners targeting swordfish in the southern Atlantic part of the Moroccan EEZ. The analysis showed an increasing trend in the first two years, followed by a slight decline in 2013 and significant increase for three years after and a flat trend subsequently in the last six years of the time series.

The Group asked how longliner operations were standardized, given that the unit of effort was a fishing day. The author indicated that all 13 fishing vessels follow the same fishing strategies.

Document SCRS/2023/059 presented updated and revised standardized blue shark CPUEs in the North and South Atlantic caught by Chinese Taipei using delta-lognormal models based on observers' records data from 2007 to 2022.

The Group asked the authors to explain data anomalies, especially in 2020 for the South Atlantic, and suggested that the author could explore the estimation of CPUE using weight instead of numbers of sharks via the length-weight relationship. The author clarified that during 2020, the fleet fished in different areas and had lower observer coverage due to the COVID pandemic, which may explain the anomalies in that one year of the length and CPUE data. Further size data revisions by year and fishing effort distribution confirmed that the year 2020 showed a different pattern compared to other years, including significant catches of smaller size sharks with a relatively higher proportion of sets catching blue shark. It was noted that the reason for this might be that in 2020 the fleet operated in an area of the Southwest Atlantic where it does not usually operate, off the coast of Uruguay and Argentina. In this area other fleets have previously reported large CPUE values of small blue shark individuals. For the North Atlantic, the authors noted that the index years for 2015 and 2016 were limited by a low number of sets and therefore restricted area representation compared to other years.

5. Discussion on assessment models to be developed, their assumptions and input data

5.1 Catch data

Catch (i.e. landings and dead discards) and other data inputs (CPUE, size composition, etc.) will be updated up to 2021 (last complete records), therefore spanning the period 1971 - 2021. This entails the addition of new data after 2013 (the last complete year used in the 2015 stock assessment) and revision of catch data prior to 2013 by some CPCs with a recommendation to display the previously used and updated catches and an explanation of why updated series should be used. Finally, a request was made that the Secretariat informally requests that statistical correspondents provide preliminary total BSH catches for 2022 for model projections to the ICCAT Secretariat by 7 July 2023 for each stock.

5.2 CPUE indices

The Group discussed the representativeness of the available CPUE series for each stock considering the spatial extent of the data used in the standardization, the percentage of fishing effort covered, the data resolution, the modeling diagnostics, etc.

For the U.S. series, the reduction in the proportion of positives may be due to domestic management measures introduced in 2014. The Group agreed to split the index into two time series 1992-2014 and 2015-2021, which requires refitting of the U.S. CPUE data.

No index was identified as flawed, so the Group decided not to exclude any index. The suggestion was made to use a cluster analysis approach to formulate alternative states of nature and evaluate CPUE series using the resulting groups. The results of the cluster analysis (SCRS/2023/061) for the North Atlantic would group Morocco and EU-Portugal together, and Japan, EU-Spain, and Chinese Taipei as another group, while waiting for the results of the new U.S. standardization. For Venezuela, it was noted that it was positively correlated with the Moroccan index but the two indices only overlapped in a limited number of years. The Group agreed that it would explore using this index from Venezuela along with the updated U.S. index. It further recommended further exploring the influence of this index on the assessment.
Alternative groups of indices based on targeting (EU-Portugal, EU-Spain, and Morocco) versus non-targeting (the rest of indices) should also be examined. For the South Atlantic, the groups resulting from the cluster analysis are Brazil-Uruguay, Japan, and EU-Spain, as one group, and Chinese Taipei and Japan, as another

group (see SCRS/2023/060). It might be worthwhile to run Brazil-Uruguay on its own because it seems to have unique trend. Targeting (Brazil-Uruguay, and EU-Spain) versus non-targeting (Chinese Taipei and Japan) groups should also be examined.

The Group was reminded that the WGSAM has recommended to apply a minimum CV (i.e. 0.2) in stock assessments when actual estimates of CV are lower than that threshold value because not all CPUE standardization models provide comparable estimates of variance, and this approach has been applied to the other species stock assessments.

The available CPUE indices tables for North and South Atlantic blue shark are in **Table 7** and **Table 8**, respectively. Evaluation tables for northern and southern blue shark stocks are in **Table 9** and **Table 10**, respectively.

5.3 Size composition data and fleet structure

The Group was provided with summaries of the size distribution patterns, based on data from observer programs, used in the last blue shark stock assessment, with a discussion on options for updating in the new stock assessment (SCRS/P/2023/033; SCRS/P/2023/035).

Document SCRS/2023/039 summarizes the length data mining of the blue shark (*Prionace glauca*) carried out in the Spanish longline fleet between years 1997-2021 for the North and South Atlantic stocks. The results obtained from 626,671 length observations showed a stable mean length trend, albeit with a slightly upward trend in the most recent period for both stocks.

SCRS/2023/056 included updated 2013-2022 catch and effort data recorded from the Venezuelan artisanal drift-gillnet fishery and updated catch for 2022 from the pelagic longline fishery. It also included updated size and sex of blue shark data from the longline fishery from 2013 through the termination of the National Observer Programme in 2018; as well as size information from the artisanal drift-gillnet fishery for the period 2009-2014.

SCRS/P/2023/033 presented the 2015 stock assessment size distributions (SCRS/2015/039 in Anon., 2016b). In addition, summaries of new available size-composition data were presented by EU-Spain and Venezuela. The size spatial segregation was noted for both stocks and it was reflected in the bimodal size distribution in the catches of EU-Portugal, EU-Spain and to a lesser degree Japan, for the North stock. Splitting the data at 30ºN latitude eliminated the size distributions bimodality. To address the bimodality issue, the possible effects on the SS3 model fits were considered, as well as the feasibility of splitting the catch data from the Portuguese and Spanish fleet for the North stock. Further efforts to parse out final spatial strata for the size-composition data were not taken forward. This was in part due to the fact that the bimodal size distribution seen in the 2015 northern stock was not evident in blue shark length revision from EU-Spain.

For fleets for which size composition data were not available, assumptions on selectivity must be made. The importance of maintaining modelling continuity and consistent size composition data (i.e., records from measured individuals only without the inclusion of back-calculated lengths from weights) was emphasized. The Group agreed to use the size composition data as it did in the 2015 SS3 assessment, adding the data for the period 2014-2021, and including revisions that may now be available for the earlier period. 5 May 2023 was the agreed deadline for providing any revised information.

A recommendation was made to split some of the fleets used in the 2015 stock assessment based on differences in their spatial distribution and sharks´ size segregation and to allow modelers flexibility by providing them with data at the highest fleet resolution. In principle, it was decided to maintain similar fleet structure of the 2015 model, except for splitting the combined EU-fleet into EU-Spain and EU-Portugal fleets. For the South stock, the Uruguay and Brazil fleets will likely be kept separated. Finally, as 98% of the total blue shark catch is taken by longline fishing gear, other fishing methods can be combined as a single fleet ('other fleet') in the SS3 model. It was agreed that the modelers should have some freedom to modify the fleet structure if they found it appropriate when developing the stock assessment models.

It was discussed and decided that separate length-frequency data for each fleet for females, male, and unknown categories, as was done in the 2015 SS3 assessment, will be used. Prior to use in SS3, length

information presented in total length (TL) or precaudal length (PCL) will be converted to fork length (FL), based on conversion factors presented in **Tables 11** and **12**. It was agreed not to use size data converted from weight.

5.4 Biological parameters

The Group reviewed life-history information for northern and southern stocks (**Tables 11** and **12**, respectively). Those tables include a column with the parameter values used in the 2015 stock assessment, a column with information updated in 2023, and a column with the information decided to be used in the 2023 assessment. If no new information was available, the decision was to maintain the values from 2015. **Table 13** summarizes the discussions on life-history parameters with the corresponding justification. It was noted that some flexibility should be given to assessment teams to make changes if needed.

It was also noted that due to the updated life- history information, new estimates of the intrinsic rate of growth r and steepness h (Mace and Doonan, 1988) will be required for the 2023 assessment and that sensitivity analysis and alternative states of nature should be considered (e.g. the tagging growth model vs. the vertebral growth model). It was noted that work will be undertaken to generate distributions of steepness and r for the 2023 assessment consistent with the method used in the 2020 porbeagle stock assessment.

5.5 Other relevant data

SCRS/2023/051 examined the use of structural uncertainty in shark assessments in other RMFOs, including the use of intersessional work done in those RMFOs to reduce the uncertainty in future analyses, following stock assessments focused on improving aspects of the model based on intersessional work.

The Group found the work interesting and looked forward to applying similar methodologies in ICCAT assessments in the future.

Following decisions made in the 2015 stock assessment, the Group agreed to run SS3 and JABBA for both North and South Atlantic blue shark stocks. Assessment leads and teams were identified. For continuity with the previous assessment, the Bayesian Surplus Production (BSP) software was also recommended to be used, as it was used for the 2004, 2008, and 2015 stock assessments.

6. Shark Research and Data Collection Programme (SRDCP)

There was only one presentation regarding the Shark Research and Data Collection Programme (SRDCP). The Group was reminded that a workshop of the SRDCP will be held in July 2023 before the BSH assessment meeting. The objective of the workshop will be to review the outcomes of the programme and plan future activities.

SCRS/P/2023/036 referred to the ongoing porbeagle satellite tagging activities carried out in Norway and to the first results obtained from one shark tracked in 2022 with one of the tags provided by the SRDCP. Future steps and proposals for continuing the collaborative work with the SRDCP were discussed.

The Group welcomed the presentation of results of this collaboration between Norway and the ICCAT SRDCP. Even though there was some initial discussion on potential future collaboration, it was decided to leave the main discussion for the SRDCP workshop. However, comments related to the data sharing between ICCAT and Norway were made. The Group stated that to continue collaboration, it will be necessary that the information on Norwegian tags deployed be shared and be included (only metadata at first) in the ICCAT tagging database to be publicly available. It was also indicated that raw data obtained from the tags deployed and shared with Norway would be considered confidential and would not be used without owners' authorization. Also, as a common practice in the Sharks Species Group, the invitation to participate in any publication that might result from this collaboration in tagging activities was well received.

7. Other matters

7.1 Summary of the meeting

The SCRS Chair informed the Group about ongoing efforts to explore options for improving the SCRS processes and communication/coordination both within the SCRS and between the SCRS and the Commission. The SCRS Chair noted that he has so far met twice this year with the SCRS Officers and relevant Secretariat staff to discuss these topics among others, but that this is intended to be an inclusive process, so other SCRS scientists should bring any concerns or suggestions to the attention of an SCRS officer so that this input can be considered in those discussions.

The SCRS Chair explained the new procedure for the preparation and adoption of the meeting summary report to be included in the SCRS Annual Report, which should not be confused with the Executive Summaries that appear by species or species group during the meeting. Previously, these summaries have been developed by the Rapporteurs in collaboration with Secretariat staff and presented to the SCRS at Plenary for review and comments. With this new procedure, the draft summary of the meeting will be developed during or soon after the intersessional meeting by the Rapporteur (with assistance as requested) and circulated (by correspondence, if after the conclusion of the meeting) to the meeting participants for review and adoption. This will improve efficiency at the SCRS Plenary. Since there was no time during the meeting to adopt the meeting summary that will be included in the SCRS Plenary report, it was agreed to adopt the text by correspondence.

7.2 Sharks Executive Summaries

The Group supported the decision of splitting the current Executive Summary for the three ICCAT main shark species (i.e. blue shark, porbeagle, and shortfin mako) into three separate Executive Summaries. For that purpose, the Chair of the Group will work with the Secretariat and the SCRS Chair to prepare initial drafts of the three Executive Summaries. These drafts will be shared with interested national scientists who will provide their input intersessionally to improve the drafts. Initial versions of the Executive Summaries will then be presented to the Group at the BSH stock assessment meeting scheduled for July 2023. Blue shark stock assessment results and management recommendations will be incorporated into the new Executive Summary prior to the 2023 SCRS Plenary meeting.

As has been the past practice, the North Atlantic stock assessment only considers North Atlantic data. Research (SCRS/2023/054) raises the question as to whether there is a separate blue shark stock in the Mediterranean. The Group recognized that this question warranted further research, as well as an evaluation of the available data from the Mediterranean, and that this should be considered in the development of the shark working plan as well as being addressed in the new SCRS Strategic Plan.

7.3 Overview of the Responses to the Commission

Document SCRS/2023/044 presented a methodology to estimate dead discards and live releases of shortfin mako by the Portuguese longline fleet in the North Atlantic using scientific observer data.

The Group noted that the methodology estimates total discards and that hooking mortality (determined from the proportion of fish dead at haul back) is used to split the estimated discards into dead discards and live releases. The Group inquired why this approach was used instead of estimating dead discards and live releases separately. It was pointed out that the available size samples were too small to allow for the modeling of dead discards and live releases separately. It was expected that in the future, when more information is available, it might be possible to use this modeling approach. The Group questioned if this methodology could also be applied to the South Atlantic. The authors indicated that the observer coverage of the Portuguese fleet in the South Atlantic is limited to the Equatorial region. Therefore, there is no available observer data covering the entire area of operation of the Portuguese fleet in the South Atlantic. Given that the proportion of live vs. dead discards is assigned based on at-haulback mortality, the presenter was asked if it was possible that there could be additional handling mortality not accounted for. The response, supported by other knowledgeable experts, was that by regulation and for practical crew safety reasons, the fishers follow safe handling and release practices, and any additional handling mortality is expected to be minimal.

The Group acknowledged that some of the current modeling approaches used by CPCs can have limitations due to small sample sizes from observers, limited spatial coverage, and the fact that at this time all shortfin mako are required to be released. It agreed that, despite the limitation of some of these modeling approaches, the estimated discards should be reported as part of the CPCs' Task 1 Nominal Catches official reports. If in the future CPCs adopt different or improved methodologies to estimate discards, CPCs can revise and change their reported discards.

The Group was reminded that the WGSAM developed a bycatch estimator tool (Babcock *et al.*, 2022). A workshop to train scientists in the use of this bycatch estimator is planned for late July - early August 2023. While noting that the in-person participation in this workshop will likely need to be limited to allow for the necessary level of one-on-one instruction, the Group encouraged national scientists to participate in the workshop since the bycatch estimator tool might help to overcome the limitation of some of the current modeling approaches used to estimate discards.

7.4 Overview of Other responses to the Commission

The SCRS was asked to "review and approve the methods and, if it determines that the methods are not scientifically sound, the SCRS shall provide relevant feedback to the CPCs in question. Rec. 21-09, para 13"

Background: No later than 31 July 2022, CPCs that reported annual average catches (landings and dead discards) of North Atlantic shortfin mako over 1 t between 2018-2020 shall present to the SCRS the statistical methodology used to estimate dead discards and live releases. CPCs with artisanal and small-scale fisheries shall also provide information about their data collection programmes. The SCRS shall review and approve the methods and, if it determines that the methods are not scientifically sound, the SCRS shall provide relevant feedback to the CPCs in question to improve them.

The Group noted that few CPCs have submitted documents describing how they estimate their discards. CPCs that have submitted new documents since the adoption of Rec. 21-09 include Canada, Japan, China (P.R.), Chinese Taipei, and EU-Portugal.

The United States had already submitted and published a document with the methodology for estimating BFT discards (Brown, 2001), and after the adoption of Rec. 21-09 presented this document to the SCRS again. Even though this method was initially developed to update a time series of BFT dead discards, it continues to be used by the United States to estimate dead discards and live releases for a variety of species, including sharks.

EU-Spain submitted a document on 21 September 2022, during the Species Group meeting, but it was not presented. In addition, it was not submitted as an SCRS document. Accordingly, the Group did not review the document and was unable to evaluate or approve the method. The document was kept on record as a background document.

Canada presented its document on the reporting methods used to estimate shortfin mako discards (Bowlby *et al*. 2022) during the Shark Species Group meeting in May 2022. The Group acknowledged that the work presented by Canada was promising and that it raised several questions related to how conditions in Rec. 21-09 will be addressed. The potential for the landings prohibition to influence the validity of statistical models developed with historical data was discussed.

The estimation of dead discards and live releases by the Japanese longline fleet were described in Semba *et al*., 2023. It was noted that the estimation of dead discards and live releases were based on self-reported discards by fishers through logbooks and at-haulback-mortality estimated from observer data. The Group discussed that the use of self-reported dead discards is not an ideal source of discard data and it also commented on the fact that the annual estimated at-haulback-mortality rate was applied to the entire fleet without any consideration of factors that can affect such mortality rate. The Group also indicated that it would be helpful if future documents on this issue include information on the observer percentage coverage and the number of hooks observed. The authors agreed with the Group's comments and will endeavour to improve the methodology in the future.

Feng *et al*. (2022) described the methodology used to estimate dead discards and live releases for the Chinese longline fleet. The method used a simple ratio estimation. The authors acknowledged that the use of ratio estimators is not ideal for this type of calculations and indicated that they are exploring the use of more statistically sound techniques to apply in the future.

The Group reviewed Liu and Su (2022) that detailed the statistical methodology used to estimate dead discards and live releases by the Chinese Taipei longline fleet. The Group found that the use of Delta Lognormal model to obtain the estimates was an appropriate methodology. However, it was pointed out that the document did not include any model diagnostics which precluded the Group from fully assessing model behavior and the results. In addition, the observer data available to conduct the estimation was limited (e.g. only 3 sharks observed in 2019). This data limitation required the use of a unique mortality-at-haulback ratio for the entire fleet even though this type of mortality is known to be affected by factors such as season, sea surface temperature (SST), fish size, etc. The Group also indicated that it would be helpful if future documents on this issue include information on the observer percentage coverage and the number of hooks observed.

The Group reviewed the document presented by EU-Portugal (SCRS/2023/044). It was noted that the modeling approach estimated total discards which were then split into dead discards and live releases using a 'hooking mortality' estimate. This approach was used because the available observer data was limited. It was expected that in the future when the amount of observer data increases, different approaches to estimate dead discards and live releases of shortfin mako for the Portuguese fleet might be applied.

8. Recommendations

- The Group recalled that during the 2015 blue shark stock assessment, times series of removals of this species were estimated for several CPCs. The Group recommends that the SC-STAT discusses the inclusion of these estimates in Task 1 time series in the ICCAT-DB.
- The Group recommends that those CPCs for which these Task 1 time series were estimated review these estimates and provide the Secretariat with their updated Task 1 time series. In case CPCs do not disagree with the estimated time series or do not provide the Secretariat with an updated Task 1 data to replace the estimated time series, then the Task 1 removals estimated by the Group will be considered the official CPCs' Task 1 data.
- The Group recommended that ICCAT CPCs provide the most updated current estimate of BSH 2022 total catches in tons by stock (North and South) by 7 July 2023, to be used for projection purposes during the upcoming 2023 stock assessment meeting.
- The Group discussed the importance of data provision and revision to be used in the models. In order to give time to modelers to work before the stock assessment meeting, 5 May 2023, was established as the deadline for receiving information on catches, CPUEs, as well as size and sex frequencies distribution.
- The Group discussed that while data collected by scientific observers and reported with the ST-09 DomObProg ICCAT electronic form are not publicly available, the conventional tagging data also collected by observer programmes are. These publicly available tagging data include locations, sex and size of tagged individuals, and dates. It was unclear for the Group if this situation constituted a lack of consistency on the current policies regarding the dissemination of data collected by scientific observers. Therefore, the Group recommended that the Subcommittee on Statistics review the current policies regarding the dissemination of scientific data collected by domestic observer programmes and conventional tagging data and, if necessary, make recommendations to solve any potential lack of consistency.
- In relation to different standardization documents presented during the meeting, the Group expressed concern about how to model changes in targeting in fleets that may have different target species over years, or even within the same year, and that may affect the standardized blue shark CPUEs representativeness. The Group discussed that accurate target species identification for the fishery as a variable is a very good input in the models that improves the results. Different methodologies have been presented and discussed over the years to identify this variable. The Group recommends that the use of available observer programmes data that can include specific

information on fishing techniques changes, is a very good approximation to identify target species, and that CPCs scientist should explore.

- Regarding this same issue, it was noted that the WGSAM has previously assessed different methodologies via simulation for some specific cases and scenarios. However, as it is a common issue of discussion and no solution nor agreement has been found, the Group recommends the WGSAM review again the proxy for targeting as it is germane to several fleets that catch blue shark and other species.

- The Group recommends for the ICCAT conventional tagging programme the use of Stainless-Steel Dart Tags for sharks. The recommendation is based on new information available and presented to the Group that proves that the recapture rate of this type of tag is higher than the obtained with the conventional single dart plastic tags used by ICCAT.

9. Adoption of the report and closure

The report sections 1 to 3 and part section 5 were adopted during the meeting. Due to lack of time during the meeting, it was agreed that sections 4, part of section 5, and sections 6 to 9 would be adopted by correspondence. The Chair of the Group thanked all the participants for their efforts. The meeting was adjourned.

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Table 1. Blue shark (BSH) Task 1 nominal catch (t, landings plus dead discards) official statistics (T1NC), by stock, major gear and year. Year 2022 still incomplete.

	BSH-N													BSH-S									BSH-M										
	Longline	Other surf.												Longline	Other surf.								Longline	Other surf.									
Year	LL	BB	GN	HL	HP	PS	RR	TN	TP	TR	TW	UN	Total	LL	BB	GN	HL	PS	RR	TW	UN	Total	LL	GN	HL	HP	PS	SP	TN	TP	TW	UN	Total
1954																																6	6
1955																																9	9
1956																																11	11
1957																																13	13
1958																																9	9
1959																																5	5
1960																																3	3
1961																																11	11
1962																																8	8
1963																																5	5
1964																																17	17
1965																																13	13
1966																																10	10
1967																																10	10
1968																																7	7
1969																																5	5
1970																																6	6
1971																																9	9
1972																																16	16
1973																																13	13
1974																																10	10
1975																																11	11
1976																																11	11
1977																																7	7
1978												4	4																			8	8
1979												12	12																			9	9
1980																							11										11
1981							204						204										11										11
1982												9	9										7										7
1983							605					8	613										6										6
1984							107					14	121										5										5
1985							341					39	380										8										8
1986	332						1112					50	1494										6										6
1987	688						874					67	1629										26										26
1988	1398						355					91	1843										3										3
1989	1467						271					81	1818										2										2
1990	2818						87					133	3038										1										1
1991	3810		1				308					188	4306	8								8	3										3
1992	3069		1				214					277	3561	107								107	1										1
1993	8597		0				672				0	322	9591	10								10	0										0
1994	8232		1				21					351	8605	2704								2704	6										6
1995	8173		12				19					268	8472	3108								3108	8										8
1996	6181		1		0		277					281	6740	4246								4246	2										2
1997	28982		33	2			210	21			11	12	29271	10139							6	10145	150										150
1998	26354		26				252	16	0		8	10	26668	9410							4	9414	63										63
1999	25699		120	0			217	40			25	20	26122	10802							27	10828	22										22
2000	27685		87				291	40			24	34	28161	12448								12448	45										45
2001	20962		85				39	21			24	21	21151	14043	1						0	14044	47										47
2002	19712		490				182	22			22	30	20458	13849	4							13854	17										17
2003	22980		12			1	171	6			3	12	23184	14960			6					14966	11										11
2004	21843		16			2	131	49			5	9	22054	15320	0			0	0		0	15320	77	32	0	2			13				125
2005	22452		21	0		1	161	12	0		6	6	22660	21043							3	21046	72	0	0	0						0	72
2006	23323		17	0		1	154	10	1		6	5	23517	21762	0		6				0	21768	142	28						19			189
2007	26864		16	0		0	149	5	2		2	32	27070	23477						1	9	23487	48	2									50
2008	30647		16	0		2	155	5	8		3	47	30882	23517	0		0				0	23518	81							0			81
2009	35137		18	0		4	153	5	2	0	4	32	35354	23601			0				6	23607	18	166					0	1			185
2010	38811		29	0		5	58	11	4	0	6	4	38929	27785	1		13					27799	176	50				0	0	33			258
2011	40188		21	3		2	40	13	3	0	14	8	40292	35430	324	0	1	143	0		0	35898	40	0									40
2012	38844		14	0		0	40	3	1	0	6	3	38912	26010	263		0	147	0		0	26421	41	0					0	0			42
2013	37713	0	25	1		1	43	13	4	1	12	1	37813	20520	0			152	0			20672	68	0	0			0	0	29	3		100
2014	38014		26	1		1	19	4	0	1	3	64	38133	24422	0	1675		156				26253	341	13	0		0	0	0	9	44		408
2015	39460		47	2		575	32	7		0	20	49	40191	21858		401	16	223			0	22498	664	1	0		0			0	0			665
2016	42963		32	4		865	31	21	0		18	152	44085	24782		438	6	190				25417	735	1				1		1			737
2017	38969		24	9		877	22	16			20	68	40004	27880		475		200				28555	90	0				6		7			103
2018	32892		42	7		977	15	8			13	25	33979	33660	0	654	0	199			0	34514	54	1		0				3			58
2019	26187	5	46	2		917	17	6	1		19	13	27212	36759	0	436	0	213				37408	51	4	0	0		0	0	9	0		64
2020	20161		27	2		900	8	13	3		18	14	21147	33097	170	391	0	217				33873	71	1	0	0		1	0	1			73
2021	20761		26	3		983	9	15	1	0	16	33	21848	33128	0	408	0	225				33761	53	2	0	1			1	2			59
2022	3043		5			617		1			0		3665	1547								1547	0										0

Table 2. SCRS standard catalogue for BSH-N. Year 2022 still incomplete.

						T1 Total	9591	8605	8472	6740	29271	26668	26122	28161	21151	20458	23184	22054	22660	23517	27070	30882	35354	38929	40292	38912	37813	38133	40191	44085	40004	33979	27212	21147	21848	3665			
Score:	4.34921																																						
Species	**Stock**	**Status**	**FlagName**	**GearGrp**	**DSet**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	Rank	%	%cum
BSH	ATN	CP	EU-España	LL	t1					24497	22504	21811	24112	17362	15666	15975	17314	15006	15464	17038	20788	24465	26094	27988	28666	28562	29041	30078	29019	27316	21685	16314	12325	13125		1	68.1%	68%
BSH	ATN	CP	EU-España	LL	t2					b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b		1		
BSH	ATN	CP	EU-Portugal	LL	t1	5726	4669	4722	4843	2630	2440	2227	2081	2110	2265	5642	2023	4026	4337	5283	6164	6248	8256	6508	3768	3694	2994	3808	7679	5610	5162	4475	3806	4248		2	16.0%	84%
BSH	ATN	CP	EU-Portugal	LL	t2	-1	-1	a	a	a	a	a	a	a	a	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab		2		
BSH	ATN	CP	Japan	LL	t1		1203	1145	618	489	340	357	273	350	386	558	1035	1729	1434	1921	2531	2007	1763	1227	2437	1808	3287	4011	4217	4444	4111	3855	2290	1985	1974	3	6.8%	91%
BSH	ATN	CP	Japan	LL	t2		-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	ab	ab	ab	a	a	a	a	a	a	a	a	a	a	-1	3		
BSH	ATN	CP	Canada	LL	t1	1702	1260	1494	528	831	612	547	624	581	836	346	965	1134	977	843	0	0	0	0	1	0	1	5	16	32	71	4	193	173	119	4	1.7%	93%
BSH	ATN	CP	Canada	LL	t2	-1	-1	-1	a	a	a	a	a	-1	a	a	a	a	-1	a	a	a	a	a	a	a	a	a	a	a	a	a	a	ab	-1	4		
BSH	ATN	CP	Maroc	LL	t1																		661	975	1072	999	1389	300	760	600	669	609	599	654	915	5	1.3%	94%
BSH	ATN	CP	Maroc	LL	t2																		-1	-1	-1	-1	-1	-1	-1	ab	ab	a	a	ab	ab	5		
BSH	ATN	CP	Panama	LL	t1							9							254	892	613	1575	1026	1071	1224	289	153	555	262	324	437	242	344	84		6	1.2%	95%
BSH	ATN	CP	Panama	LL	t2							-1							a	a	a	a	-1	-1	-1	a	a	-1	-1	-1	-1	a	a	a		6		
BSH	ATN	CP	Maroc	PS	t1																							573	863	875	975	915	899	982	617	7	0.8%	96%
BSH	ATN	CP	Maroc	PS	t2																							-1	-1	-1	-1	-1	-1	-1	-1	7		
BSH	ATN	CP	Belize	LL	t1																	114	461	1039	903	1216	392	4	6	201	317	369	301	349		8	0.7%	97%
BSH	ATN	CP	Belize	LL	t2																	ab	ab	ab	ab	a	a	a	a	ab	ab	ab	ab	ab		8		
BSH	ATN	NCC	Chinese Taipei	LL	t1		487	167	132	203	246	384	165	59	203	171	206	240	588	292	110	73	99	148	107	123	83	238	287	76	153	38	74	53	27	9	0.7%	97%
BSH	ATN	NCC	Chinese Taipei	LL	t2		-1	-1	-1	-1	-1	-1	-1	-1	-1	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	9		
BSH	ATN	CP	USA	LL	t1	1146	582	623	50	162	92	41	113	106	68	56	70	68	47	54	138	107	178	238	127	117	147	82	43	42	11	20	24	25		10	0.6%	98%
BSH	ATN	CP	USA	LL	t2	ab	ab	ab	ab	ab	ab	ab	ab	ab	abc	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab		10		
BSH	ATN	CP	USA	RR	t1	672	21	19	277	210	252	217	291	39	182	171	131	161	154	149	155	153	58	40	40	43	19	32	31	22	15	17	8	9		11	0.5%	98%
BSH	ATN	CP	USA	RR	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	b	b	b		11		
BSH	ATN	CP	EU-France	LL	t1					138	106	259	257	135	144	37	65	78	65	111	47	30	77	66	18	173	92	203	286	62	51	33	17	18		12	0.3%	99%
BSH	ATN	CP	EU-France	LL	t2					-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	b	-1	-1	ab	-1	-1	ab	-1	ab	-1	ab		12		
BSH	ATN	CP	China PR	LL	t1									185	104	148	146	132	142	367	109	88	53	109	98	327	178	1	27	2	6	18	65	2		13	0.3%	99%
BSH	ATN	CP	China PR	LL	t2									-1	-1	-1	-1	-1	-1	a	a	a	a	a	a	a	-1	ab	a	ab	ab	ab	ab	ab	b	13		
BSH	ATN	CP	Korea Rep	LL	t1																			537	299	327	113	18	11	132	92	138	48	17		14	0.2%	99%
BSH	ATN	CP	Korea Rep	LL	t2																		ab	abc	abc	a	b	a	ab	ab	ab	a	a			14		
BSH	ATN	CP	Venezuela	LL	t1	23	17	15	4	26	6	47	42	46	28	38	9	26	10	18	7	71	74	116	96	51	111	129	116	105	111	55	59	11	9	15	0.2%	99%
BSH	ATN	CP	Venezuela	LL	t2	-1	b	b	b	b	b	b	b	b	b	b	ab	ab	ab	ab	ab	ab	ab	ab	ab	a	a	a	a	a	a	a	a	a	-1	15		
BSH	ATN	CP	EU-France	UN	t1	322	350	266	278	11	8	20	20	10	11	3		6	5	31	46	30	3	6	0	0			14	16	9	2	0			16	0.2%	100%
BSH	ATN	CP	EU-France	UN	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1		-1	-1	-1	-1	-1	-1	-1	-1	-1	a		-1	ab	-1	-1	-1	a		16		
BSH	ATN	CP	Senegal	LL	t1															43	134	255	56	148	5	12	17	13	14	14	14	14	14	14		17	0.1%	100%
BSH	ATN	CP	Senegal	LL	t2															-1	-1	-1	a	a	a	a	a	a	a	-1	-1	-1	-1	-1		17		
BSH	ATN	CP	EU-France	GN	t1					32	24	60	59	31	33	9	14	18	15	12	12	14	24	14	5	17	16	36	17	13	15	20	17	9		18	0.1%	100%
BSH	ATN	CP	EU-France	GN	t2					-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	ab	-1	ab	-1	ab		18		

Table 3. SCRS standard catalogue for BSH-S. Year 2022 still incomplete.

						T1 Total	10	2704	3108	4246	10145	9414	10828	12448	14044	13854	14966	15320	21046	21768	23487	23518	23607	27799	35898	26421	20672	26253	22498	25417	28555	34514	37408	33873	33761	1547			
Score:		5.39683																																					
Species	Stock	Status	FlagName	GearGrp	DSet		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Rank	%	%cum
BSH	ATS	CP	EU-España	LL	t1						5272	5574	7173	6951	7743	5368	6626	7366	6410	8724	8942	9615	13099	13953	16978	14348	10473	11447	10133	10107	11486	13515	18497	14717	16778		1	45.6%	46%
BSH	ATS	CP	EU-España	LL	t2					b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	-1	b	b		1		
BSH	ATS	CP	EU-Portugal	LL	t1				847	867	1336	876	1110	2134	2562	2324	1841	1863	3184	2751	4493	4866	5358	6338	7642	2424	1646	1622	2420	5609	6663	8015	6753	7350	5524		2	17.0%	63%
BSH	ATS	CP	EU-Portugal	LL	t2				-1	-1	a	a	a	a	a	a	a	a	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	a	ab		2		
BSH	ATS	CP	Brazil	LL	t1					743	1103	616	179	1687	2173	1966	2160	2103	2520	3328	2309	2421	1268	1500	2808	1607	2013	2551	2420	1334	2177	3010	3784	3435	4629		3	9.7%	72%
BSH	ATS	CP	Brazil	LL	t2					-1	a	-1	-1	ab	a	a	a	a	ab	a	ab	a	ab	ab	ab	ab	a	a	a	a	a	ab	ab	ab	ab		3		
BSH	ATS	CP	Namibia	LL	t1								0			2213	2316	1906	6616	3536	3419	1829	207	2351	2633	1176	1147	2471	2137	2775	1357	3290	2474	3950	3237		4	8.9%	81%
BSH	ATS	CP	Namibia	LL	t2								-1		a		-1	ab	ab	ab	ab	ab	ab	ab	ab	ab	a	ab	a	a	a	ab	ab	ab	ab	ab		4		
BSH	ATS	NCC	Chinese Taipei	LL	t1			1232	1767	1952	1737	1559	1496	1353	665	1172	521	800	866	1805	2177	1843	1356	1625	2142	2074	2257	2240	1854	1992	2053	1372	861	1338	1052	1031	5	7.2%	88%
BSH	ATS	NCC	Chinese Taipei	LL	t2			-1	-1	-1	-1	-1	-1	-1	-1	-1	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	5		
BSH	ATS	CP	Japan	LL	t1			1388	437	425	506	510	536	221	182	343	331	209	236	525	896	1789	981	1161	1483	3060	2255	3232	2277	2127	3112	3495	2513	2116	1639	453	6	6.4%	95%
BSH	ATS	CP	Japan	LL	t2			-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	ab	ab	ab	a	a	a	a	a	a	a	a	a	a	-1	6		
BSH	ATS	CP	Uruguay	LL	t1		10	84	57	259	180	248	118	81	66	85	480	462	376	232	337	359	942	208	725	433	130										7	1.0%	96%
BSH	ATS	CP	Uruguay	LL	t2		-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	ab	ab	ab	ab	b	ab	ab	ab										7		
BSH	ATS	CP	South Africa	LL	t1							23	21		82	63	232	128	154	90	82	126	119	112	317	158	179	525	402	356	418	403	292	52	181		8	0.8%	97%
BSH	ATS	CP	South Africa	LL	t2							-1	-1	ab	a	ab	ab	ab	ab	ab	ab	ab	ab	ab	a	ab	ab	ab	ab	ab	ab	ab	a	ab	ab			8		
BSH	ATS	CP	Ghana	GN	t1																							1583	385	429	467	407	387	382	408		9	0.8%	97%
BSH	ATS	CP	Ghana	GN	t2																							a	a	a	a	a	-1	-1	-1		9		
BSH	ATS	CP	China PR	LL	t1										565	316	452	444	404	434	585	40	109	41	131	84	64	48	20	30	283	127	52	45	15		10	0.7%	98%
BSH	ATS	CP	China PR	LL	t2										-1	-1	-1	-1	-1	-1	a	a	a	a	a	a	a	ab	a	ab	ab	ab	ab	ab	a	b		10		
BSH	ATS	CP	Belize	LL	t1													37	259	99	236	109	148	273	243	483	234	171	105	167	200	222	165	15	21		11	0.6%	99%
BSH	ATS	CP	Belize	LL	t2													a	a	a	a	a	-1	a	ab	a	a	a	a	a	ab	ab	ab	ab	ab		11		
BSH	ATS	CP	S Tomé e Príncipe	PS	t1																				143	147	152	156	206	183	182	190	185	186	187		12	0.3%	99%
BSH	ATS	CP	S Tomé e Príncipe	PS	t2																				-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1		12		
BSH	ATS	CP	Korea Rep	LL	t1																			222	125	112	61	10	71	252	104	194	175	57	8		13	0.2%	99%
BSH	ATS	CP	Korea Rep	LL	t2																			b	ab	abc	abc	a	a	ab	ab	ab	ab	a	a		13		
BSH	ATS	CP	Côte d'Ivoire	LL	t1																										0		1153				14	0.2%	99%
BSH	ATS	CP	Côte d'Ivoire	LL	t2																									b		a					14		
BSH	ATS	CP	Namibia	BB	t1																			1	324	263	0							170			15	0.1%	100%
BSH	ATS	CP	Namibia	BB	t2																			-1	-1	-1	-1							-1			15		
BSH	ATS	CP	Panama	LL	t1								168	22								521															16	0.1%	100%
BSH	ATS	CP	Panama	LL	t2								-1	-1						a	a	a	a				a	a					a	a	a		16		
BSH	ATS	CP	Senegal	LL	t1																				203	51	60	105	18	15	11	15	39	22	25		17	0.1%	100%
BSH	ATS	CP	Senegal	LL	t2																	a		a	a	a	a	a	a	a	-1	-1	-1	-1	-1		17		

Table 4. SCRS standard catalogue for BSH-M. Year 2022 still incomplete.

						T1 Total	1	0	6	8	2	150	63	22	45	47	17	11	125	72	189	50	81	185	258	40	42	100	408	665	737	103	58	64	73	59			
Score:		1.28571																																					
Species	**Stock**	**Status**	**FlagName**	**GearGrp**	**DSet**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	Rank	%	%cum
BSH	MED	CP	Libya	LL	t1																								580	650		10	6	6	5	1	34.2%	34%
BSH	MED	CP	Libya	LL	t2																								-1	-1		-1	-1	-1	-1	1		
BSH	MED	CP	EU-Italy	LL	t1													65	1	58	44	75	9	125			25	280		16	46	15	20	25	30	2	22.7%	57%
BSH	MED	CP	EU-Italy	LL	t2				a			a	a	a	a		a	-1	a	a	-1	-1	-1	-1			-1	-1	-1	b	b	ab	ab		-1	2		
BSH	MED	CP	EU-España	LL	t1						146	59	20	31	6	3	3	4	8	61	3	2	7	48	38	39	37	53	65	58	40	19	18	34	14	3	22.2%	79%
BSH	MED	CP	EU-España	LL	t2						-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	a	-1	a	ab	ab	ab	ab	ab	ab	ab	ab	ab	3		
BSH	MED	CP	EU-Italy	GN	t1													32		28	2		166	50				13		1		0	4	1	1	4	8.0%	87%
BSH	MED	CP	EU-Italy	GN	t2													-1		-1	-1		-1	-1				-1		-1		-1	-1	-1	-1	4		
BSH	MED	CP	EU-Portugal	LL	t1							2		5	41	14	3		56	22				2												5	3.9%	91%
BSH	MED	CP	EU-Portugal	LL	t2							-1		-1	-1	a	a	a	a	a				a												5		
BSH	MED	CP	EU-Italy	TW	t1													13		19		0	1	33			29	9		1	7	2	9	1	2	6	3.4%	94%
BSH	MED	CP	EU-Italy	TW	t2													-1		-1		-1	-1	-1			-1	-1		-1	-1	-1	-1	-1	-1	6		
BSH	MED	CP	EU-Malta	LL	t1	1	0	1	1	1	2	2	2	1	1	1	0		0	0	1	1	2	1	1	2	2	4	5	3	4	2	2	2	1	7	1.3%	96%
BSH	MED	CP	EU-Malta	LL	t2	-1	-1	-1	-1	-1	-1	-1	a	a	-1	-1	-1		a	-1	a	ab	ab	ab	ab	abc	ab	abc	a	ab	ab	a	ab	a	a	7		
BSH	MED	CP	EU-Italy	UN	t1																							3	44							8	1.3%	97%
BSH	MED	CP	EU-Italy	UN	t2																						-1	-1								8		
BSH	MED	CP	EU-France	LL	t1																0	0	0	0	0	0	3	4	14	7		1	2	1	0	9	0.9%	98%
BSH	MED	CP	EU-France	LL	t2																-1	-1	-1	-1	-1	-1	-1	b	-1	-1		-1	-1	-1	-1	9		
BSH	MED	CP	EU-Cyprus	LL	t1									9			3	6	5																	10	0.6%	99%
BSH	MED	CP	EU-Cyprus	LL	t2									a			a	a	a																	10		
BSH	MED	CP	Japan	LL	t1			5	7	1	1						1	1	2			2	0													11	0.6%	99%
BSH	MED	CP	Japan	LL	t2			-1	-1	-1	-1						-1	-1	-1			-1	a													11		
BSH	MED	CP	Algerie	LL	t1																								1			7	4	2	3	12	0.4%	99%
BSH	MED	CP	Algerie	LL	t2																								a			-1	a	a	a	12		
BSH	MED	CP	EU-Italy	TN	t1																									1	6					13	0.2%	100%
BSH	MED	CP	EU-Italy	TN	t2																									-1	-1					13		
BSH	MED	CP	EU-France	GN	t1																		0	0	0	0	0	0	1	0	0	1	0	0	1	14	0.1%	100%
BSH	MED	CP	EU-France	GN	t2																		-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	14		

Table 5. Updates made to T1NC (CPC recoveries, gap completion, corrections, etc.) and adopted by the Group as preliminary T1NC estimates. All these estimates must be revised and confirmed by each CPC. When available (for a given fleet, year, gear and stock) the BSH catches were discounted from the unclassified sharks (codes: SKH, SKX, PXX, CXX) officially reported.

Stock	Fleet code	Gear	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Remarks
BSH-N	MAR	LL																	661	975	1072	999	1389									CPC new (meeting)
	CAN	LL																													414	CPC new (meeting)
	CHN	LL											146	132	142								178									carry-over (averagre 3yrs)
	EU.FRA-FR	GILL				32	24	60	59	31	33	9	14	18	15	12							16									Split BSH UN (GN/LL/TN/TW)
		HAND																					1									Split BSH UN (GN/LL/TN/TW)
		LL				138	106	259	257	135	144	37	65	78	65								92									Split BSH UN (GN/LL/TN/TW)
		TN				21	16	40	40	21	22	6	49	12	10	5								5						6	Split BSH UN (GN/LL/TN/TW)
		TRAW				11	8	20	20	10	11	3	5	6	5																Split BSH UN (GN/LL/TN/TW)
		UN				11	8	20	20	10	11	3	0	6	5	31							0									Split BSH UN (remainder BSH UN also to split TP)
	EU.IRL	GILL							27	53																						SKH ratios (SKH adjusted)
		TRAW							4	13																						SKH ratios (SKH adjusted)
		UN							0	0																						Split BSH UN (GN/LL/TN/TW, remainder BSH UN = 0)
	EU.PRT-PT-MAINLD	LL-surf											450								2535											BSH SURF merged with LL
		UN											0								0											gear reclass (-> 0 t)
	MEX	LL									2	3	4	3	3		2	2														carry-over (averagre 3yrs)
	PAN	LL																	1026	1071	1224			555		324						carry-over (averagre 3yrs)
	SEN	GILL									456																					to remove ? (later Fambaye)
		LL																		148					14	14	14	14	14	14	carry-over (averagre 3yrs)
	TAI	LL									203																					carry-over (averagre 3yrs)
	TTO-TT-TRINID	LL	13	4	5	4	7	8	12	19																						SKH split ratios (BSH/SMA/SKH)
	UK-BMU	LL							3	4	5	4	5	5																		carry-over (averagre 3yrs)
	USA	RR									182	171	131	161	154	149	155	153														carry-over (averagre 3yrs)
	VEN	GILL																					2.3	1.7	1.9	2.2	1.0	0.8	0.3	0.0	0.2	CPC new (meeting)
		LL																													9	CPC new (meeting)
	Sub total		13	4	5	217	170	407	441	296	1069	235	869	422	399	197	157	154	1688	2194	4831	999	1678	562	16	340	15	15	14	20	423	
BSH-S	BLZ	LL													99			148														carry-over (averagre 3yrs)
	BRA	LL											1667		2585		2000			1979												BSH UN merge (LL)
							616																									carry-over (averagre 3yrs)
		UN											0		0		0			0												gear reclass (-> 0 t)
	CHN	LL											444	404	434																	carry-over (averagre 3yrs)
	NAM	LL																										2474				carry-over (averagre 3yrs)
	SEN	LL																					105				15		22	25		carry-over (averagre 3yrs)
	STP	PS																								182	190	185	186	187		carry-over (averagre 3yrs)
	TAI	LL									1172																					carry-over (averagre 3yrs)
	Sub total						616				1172		2112	404	3117		2000	148		1979			105			182	205	2659	207	212		
BSH-M	EU.FRA-FR-MEDI	GILL																							0	0						carry-over (averagre 3yrs)
		LL																							7							carry-over (averagre 3yrs)
	EU.ITA	GILL											32		28				50				13									split gear (UN->GN+LL+TW)
		LL											65		58				125				151									split gear (UN->GN+LL+TW)
		TRAW											13		19				33				9									split gear (UN->GN+LL+TW)
	Sub total												111		106				208				173		7	0						

Table 6. Summary of BSH conventional tagging data: number of recoveries grouped by number of years at liberty in each year of release. The last column shows the recovery rate (%).

Number of tag Blue shark (*Prionace glauca*)													
			Years at liberty										
Year	Releases	Recaptures	< 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10+	15+	Unk	ERROR	% recapt*
1959	14												
1962	43												
1963	134	2	2										1.5%
1964	134	3	2		1								2.2%
1965	255	9	5	4									3.5%
1966	407	6	4		1		1						1.5%
1967	836	17	15		2								2.0%
1968	794	11	7	2	1			1					1.4%
1969	1469	54	46	6	1						1		3.7%
1970	497	15	7	4	2		1	1					3.0%
1971	544	16	11	5									2.9%
1972	921	25	18	5	1	1							2.7%
1973	355	12	8	3	1								3.4%
1974	629	16	13	2	1								2.5%
1975	803	40	30	5	2	1	1				1		5.0%
1976	1086	56	47	4	2		2				1		5.2%
1977	2813	111	92	12	4	2		1					3.9%
1978	3210	164	153	5	3	2					1		5.1%
1979	3807	138	107	20	7			1			2	1	3.6%
1980	3327	88	70	13	2	2	1						2.6%
1981	3118	109	87	9	8	1	2	2					3.5%
1982	2695	69	41	16	9	1				1	1		2.6%
1983	4274	117	59	32	14	5	1	3		1	2		2.7%
1984	2405	57	31	17	5	3					1		2.4%
1985	4471	167	128	20	12	3	2	2					3.7%
1986	2976	106	72	11	9	4	5	3			2		3.6%
1987	2781	82	48	23	8			3					2.9%
1988	3255	140	99	19	8	2	5	1			6		4.3%
1989	2779	143	98	16	11	9	1	4			4		5.1%
1990	3401	170	116	29	9	7		5			4		5.0%
1991	4661	230	162	39	11	2	5	5			6		4.9%
1992	6161	385	249	67	30	9	11	9			9	1	6.2%
1993	5493	373	249	65	19	15	6	7			12		6.8%
1994	5573	438	290	50	37	17	3	9	2		30		7.9%
1995	6940	567	249	137	89	33	12	12	2	1	31	1	8.2%
1996	7622	754	386	193	83	36	13	13			30		9.9%
1997	7307	714	384	159	91	34	11	5			30		9.8%
1998	4359	418	219	110	33	20	11	6			19		9.6%
1999	3762	343	196	87	23	17	3	8			9		9.1%
2000	3057	316	192	71	26	8	4	4	1		9	1	10.3%
2001	2635	283	151	60	33	14	2	3			19	1	10.7%
2002	2394	241	141	48	24	8	7	3	3		7		10.1%
2003	2675	242	121	66	26	12		2			15		9.0%
2004	2392	225	119	60	16	10	3	7			10		9.4%
2005	2199	215	116	48	18	13	5	5			10		9.8%
2006	1601	178	94	46	14	9	2	3			9	1	11.1%
2007	3065	299	150	71	41	17	6	3			11		9.8%
2008	3198	255	106	65	36	32	7	2			7		8.0%
2009	3195	235	113	68	34	9	3	2	1		5		7.4%
2010	3284	200	105	48	24	13	2	1	1		6		6.1%
2011	2442	132	68	17	21	9	7	3			7		5.4%
2012	2405	159	71	46	23	7	4	7			1		6.6%
2013	2813	180	87	46	25	7	7	2			6		6.4%
2014	1812	85	46	25	11	1					2		4.7%
2015	1106	55	38	8	7						2		5.0%
2016	1270	67	41	16	2	1	5	1			1		5.3%
2017	739	26	14	4	3	5							3.5%
2018	155	10	9	1									6.5%
2019	413	9	6	3									2.2%
2020	275	3	2	1									1.1%
2021	159	0											
Unk	2348	1067									1067		45.4%
Grand T	151743	10647	5590	2007	924	401	161	149	10	3	1396	6	7.0%

Table 7. Available Catch Per Unit Effort indices for the northern blue shark stock.

	Venezuela LL		Spain LL		Portugal LL		US pelagic LL		Japan LL		Chinese-Taipei LL		Morocco LL	
	VEN-LL		SPN-LL		POR-LL		US-LL		JPN-LL		CTP-LL		MOR-LL	
SCRS Do	SCRS/2015/022		SCRS/2023/040		SCRS/2023/045		SCRS/2023/046		SCRS/2023/050		SCRS/2023/059		SCRS/2023/058	
Age rang														
Catch Ur	Number													
Effort Ur	1000 hooks													
Std. Met	Delta log-normal													
Year	'enLL.CPUI	VenLL.CV	SPLL.CPUE	SPLL.CV	POR.CPUE	POR.CV	US.CPUE	US.CV	JPN.CPUE	JPN.CV	CTP.CPUE	CTP.CV	MOR.CPUE	MOR.CV
1990														
1991														
1992							6.109	0.27						
1993							9.362	0.248						
1994	0.05	1.08					8.27	0.247	1.03	0.12				
1995	0.07	0.87					8.215	0.252	1.17	0.11				
1996	0.02	1.90					6.03	0.446	1.01	0.11				
1997	0.15	0.69	186.37	0.0226	160.89	0.08	12.443	0.284	1.06	0.12				
1998	0.22	0.67	180.36	0.0227	163.87	0.07	14.726	0.293	0.93	0.11				
1999	0.12	0.84	212.08	0.0248	141.54	0.07	6.711	0.278	0.64	0.12				
2000	0.15	0.74	285.83	0.0240	189.44	0.08	9.441	0.267	0.71	0.14				
2001	0.13	0.77	259.30	0.0236	215.57	0.08	4.877	0.324	0.74	0.11				
2002	0.07	1.03	222.91	0.0240	191.07	0.08	5.813	0.318	0.53	0.11				
2003	0.04	1.26	258.79	0.0273	229.91	0.08	3.897	0.293	0.77	0.10				
2004	0.03	1.53	233.39	0.0278	262.03	0.08	8.941	0.285	0.53	0.09				
2005	0.01	3.88	223.52	0.0293	217.76	0.08	3.584	0.293	0.69	0.07				
2006	0.01	2.24	221.88	0.0324	213.06	0.08	3.914	0.292	0.87	0.08				
2007	0.06	1.35	250.51	0.0335	235.13	0.08	6.665	0.312	1.02	0.09	0.55	0.07		
2008	0.09	1.16	289.60	0.0336	223.60	0.08	6.844	0.294	1.49	0.08	0.46	0.07		
2009	0.05	1.56	274.86	0.0320	233.14	0.08	6.383	0.294	1.24	0.11	0.52	0.07		
2010	0.04	1.54	269.23	0.0313	274.04	0.08	7.451	0.286	1.44	0.16	0.89	0.04	94	0.11
2011	0.04	1.51	279.63	0.0315	244.96	0.07	13.683	0.271	1.15	0.18	0.77	0.06	233	0.08
2012	0.11	1.00	275.01	0.0309	310.08	0.08	7.184	0.279	1.63	0.20	0.68	0.06	248	0.04
2013	0.04	1.84	288.31	0.0319	309.59	0.08	6.864	0.278	1.26	0.23	0.95	0.06	165	0.04
2014			272.34	0.0300	288.26	0.07	6.487	0.275	1.36	0.22	0.88	0.08	261	0.08
2015			281.97	0.0283	383.11	0.08	6.467	0.298	1.37	0.18	0.07	0.18	304	0.06
2016			257.40	0.0279	373.44	0.08	8.442	0.274	1.17	0.20	1.66	0.03	385	0.05
2017			244.98	0.0289	344.19	0.08	6.909	0.276	1.13	0.21	0.93	0.06	333	0.03
2018			241.42	0.0315	330.21	0.08	4.027	0.342	0.74	0.21	0.81	0.06	267	0.09
2019			239.11	0.0312	340.89	0.08	3.664	0.306	0.91	0.21	0.71	0.06	383	0.05
2020			260.78	0.0202	373.14	0.07	3.505	0.307	0.64	0.21	0.67	0.06	262	0.06
2021			263.46	0.0282	345.71	0.08	3.616	0.317	0.77	0.21	0.24	0.09	340	0.05
2022							4.25	0.33					270	0.07

Table 8. Available Catch Per Unit Effort indices for the southern blue shark stock.

Year	SP.CPUE	SP.CV	JPN.CPUE	JPN.CV	CTP.CPUE	CTP.CV	BRZ.CPUE	BRZ.CV
1990								
1991								
1992							1.13	0.147
1993							0.75	0.147
1994			1.11	0.14			0.48	0.101
1995			0.46	0.16			0.94	0.093
1996			0.72	0.19			0.55	0.072
1997	310.498	0.0254	0.75	0.17			0.57	0.051
1998	324.441	0.0282	0.63	0.16			0.8	0.041
1999	339.351	0.0283	0.71	0.16			0.61	0.044
2000	438.835	0.0301	0.48	0.19			0.67	0.042
2001	403.786	0.0254	0.46	0.21			0.7	0.041
2002	379.787	0.0263	0.53	0.23			0.63	0.035
2003	346.252	0.0286	0.7	0.18			0.66	0.041
2004	358.338	0.0313	0.6	0.18			0.58	0.035
2005	408.236	0.0361	0.59	0.19			0.67	0.036
2006	402.998	0.0352	0.94	0.17			0.48	0.038
2007	401.32	0.0372	0.91	0.16	0.85	0.06	0.68	0.039
2008	391.849	0.0319	1.34	0.13	1.13	0.06	0.86	0.039
2009	440.309	0.0306	1.21	0.11	0.88	0.06	0.91	0.033
2010	429.144	0.032	1.66	0.11	1.36	0.05	0.82	0.049
2011	412.368	0.0311	1.7	0.12	0.87	0.06	1.14	0.042
2012	443.843	0.0348	1.32	0.12	1.38	0.06	1.58	0.036
2013	445.452	0.0364	1.42	0.14	1.43	0.06	1.14	0.051
2014	471.983	0.0372	1.52	0.16	1.67	0.06	0.93	0.042
2015	481.62	0.0382	1.17	0.14	1.10	0.07	1.19	0.044
2016	562.566	0.042	1.22	0.16	1.70	0.05	0.88	0.049
2017	533.862	0.0403	1.22	0.16	0.93	0.06	1.02	0.102
2018	477.055	0.0363	1.23	0.14	1.16	0.05	1.24	0.042
2019	506.571	0.0309	1.23	0.17	0.72	0.06	1.28	0.055
2020	424.626	0.0206	1.08	0.17	2.35	0.05	0.72	0.072
2021	483.047	0.028	1.08	0.2	0.60	0.06	1.49	0.044
2022					0.96	0.04	1	0.046

Table 9. Catch Per Unit Effort evaluation table for the northern blue shark stock.

Use in stock assessment?	Adequate	Adequate	Adequate	Incomplete	Adequate	Adequate	Adequate
SCRS Doc No.	SCRS/2015/022	SCRS/2023/040	SCRS/2023/045	SCRS/2023/046	SCRS/2023/050	SCRS/2023/059	SCRS/2023/058
Index Name:	Venezuela LL	Spain LL	Portugal LL	US pelagic LL	Japan LL	Chinese-Taipei LL	Morocco LL
Data Source (state if based on logbooks, observer data etc)	Observer data	voluntary scientific reporting fleet, observer data	Observers, self-sampling and port-sampling	Observer data	logbook	observer data	National fishery office (ONP), fishery department and natioanal institute for fishery research
Do the authors indicate the percentage of total effort of the fleet the CPUE data represents?	Yes	Yes	Yes	Yes	Yes	No	No
If the answer to 1 is yes, what is the percentage?	0-10%	91-100%	11-20%	0-10%	21-30%	0-10%	91-100%
Are sufficient diagnostics provided to assess model performance??	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient
How does the model perform relative to the diagnostics ?	Well	Well	Well	Well	Well	Well	Well
Documented data exclusions and classifications?	Yes	NA	Yes	Yes	Yes	Yes	Yes
Data exclusions appropriate?	NA	NA	NA	Yes	Yes	NA	NA
Data classifications appropriate?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographical Area	Atl NW	Atl N	Atl NE	Atl NW	Atl N	Atl N	Atl N
Data resolution level	OTH	trip	trip	Set	Set	Set	Set
Ranking of Catch of fleet in TINC database (use data catalogue)	11 or more	1-5	1-5	6-10	1-5	6-10	6-10
Length of Time Series	11-20 years	longer than 20 years	longer than 20 years	longer than 20 years	longer than 20 years	11-20 years	11-20 years
Are other indices available for the same time period?	Many	Many	Many	Few	Few	Many	
Are other indices available for the same geographic range?	Few	Few	Few	Few	Few	Many	None
Does the index standardization account for Known factors that influence catchability/selectivity? (eg. Type of hook, bait type, depth etc.)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimated annual CV of the CPUE series	Variable	Low	Medium	Medium	Variable	Medium	Medium
Annual variation in the estimated CPUE exceeds biological plausibility	Unlikely	Unlikely	Unlikely	Likely	Unlikely	Possible	Unlikely
Is data adequate for standardization purposes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Is this standardised CPUE time series continuous?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
For fisheries independent surveys: what is the survey type?							
For 19: Is the survey design clearly described?							
Other Comments							

Table 10. Catch Per Unit Effort evaluation table for the southern blue shark stock.

sessment?	Adequate	Adequate	Adequate	Adequate
	SCRS/2023/041	SCRS/2023/049	SCRS/2023/059	SCRS/2023/057
	Spain LL	Japan LL	Chinese-Taipei LL	Brazil-Uruguay LL
Data Source (state if based on logbooks, observer data etc)	voluntary scientific reporting fleet, observer data	Logbook	observer data	logbooks
Do the authors indicate the percentage of total effort of the fleet the CPUE data represents?	Yes	Yes	No	Yes
If the answer to 1 is yes, what is the percentage?	91-100%	21-30%	0-10%	51-60%
Are sufficient diagnostics provided to assess model performance??	Sufficient	Sufficient	Sufficient	Sufficient
How does the model perform relative to the diagnostics ?	Well	Well	Well	Well
Documented data exclusions and classifications?	NA	Yes	NA	Yes
ropriate?	NA	Yes	Yes	Yes
appropriate?	Yes	Yes	Yes	Yes
	Atl S	Atl S	Atl S	Atl SW
l	trip	Set	Set	Set
Ranking of Catch of fleet in TINC database (use data catalogue)	1-5	1-5	1-5	1-5
es	longer than 20 years	longer than 20 years	11-20 years	longer than 20 years
Are other indices available for the same time period?	Many	Few	Many	Few
Are other indices available for the same geographic range?	Few	Few	Many	Few
Does the index standardization account for Known factors that influence catchability/selectivity? (eg. Type of hook, bait type, depth etc.)	Yes	Yes	Yes	Yes
Estimated annual CV of the CPUE series	Low	Variable	Low	Low
Annual variation in the estimated CPUE exceeds biological plausibility	Unlikely	Unlikely	Unlikely	Unlikely
Is data adequate for standardization purposes	Yes	Yes	Yes	Yes
Is this standardised CPUE time series continuous?	Yes	Yes	Yes	Yes
For fisheries independent surveys: what is the survey type?				
For 19: Is the survey design clearly described?				
		For 18&19, observer data is available but not standardized due to coverage.		

Table 11. Summary of life-history parameters to be included in the 2023 assessment for the northern stock.

		North Atlantic stock			
		Previous assessment	**New proposal**	**Decision**	**Source**
Reproduction	**L_{mat} (♂)**	192-208 FL	a=-72.94 (+/-41.46) b=0.37 (+/-0.21)	a=-72.94 (+/-41.46) b=0.37 (+/-0.21)	SCRS/2023/053
	L_{50} (♂)	200 FL	197 cm FL	197 cm FL	
	T_{mat} (♂)	5	a=-7.58 (+/-1.96) b=1.53 (+/-0.42)	a=-7.58 (+/-1.96) b=1.53 (+/-0.42)	
	T_{50} (♂)		4.9	4.9	
	L_{mat} (♀)	185 FL	a=-21.36 (+/-7.42) b=0.11 (+/-0.38)	a=-21.36 (+/-7.42) b=0.11 (+/-0.38)	
	L_{50} (♀)		190.7 cm FL (west)	190.7 cm FL (west)	
	T_{mat} (♀)	5	a=-10.81 (+/-3.45) b=2.02 (+/-0.65)	a=-10.81 (+/-3.45) b=2.02 (+/-0.65)	
	T_{50} (♀)	6	5.3	5.3	
	Cycle	1		1	
	GP (months)	9-12		9-12	Pratt, 1979
	L_0	47 cm FL		40 cm FL	Mejuto & García-Cortés, 2005
	Mean LS	39		39	
	Min LS	1		1	
	Max LS	96		96	
	Litter size vs Maternal size		LS = -23.65501 + 0.27966*FL (N = 423, R2 = 0.129)	LS = -23.65501 + 0.27966*FL (N = 423, R2 = 0.129)	Mas *et al.*, 2023
Age & Growth	**L_{inf} (♀)**	310 FL	337.3 cm FL	337.3 cm FL	Carlson *et al.*, 2023
	k (♀)	0.13	0.107	0.107	
	T_o / L_o (♀)	-1.77	-2.43	-2.43	
	T_{max} (♀)	15	15	15	
	L_{inf} (♂)	282 FL	282.4	282.4	
	k (♂)	0.18	0.179	0.179	
	T_o / L_o (♂)	-1.35	-1.59	-1.59	
	T_{max} (♂)	16	16	16	
Reproduction	**L_{mat} (sex combined)**		a=-30.03 (+/-8.36) b=0.15 (+/-0.04)	a=-30.03 (+/-8.36) b=0.15 (+/-0.04)	Carlson *et al.*, 2023
	L_{50} (sex combined)		197 FL	197 FL	

	T_{mat} (sex combined) **T_{50} (sex combined)**		a=-8.57 (+/-1.67) b=1.66 (+/-0.33) 5.1	a=-8.57 (+/-1.67) b=1.66 (+/-0.33) 5.1	
Age & Growth	**L_{inf} (sex combined)** **k (sex combined)** **T_o / L_o (sex combined)** **T_{max} (sex combined)**		292.4 FL 0.157 -1.8 16	292.4 FL 0.157 -1.8 16	Carlson *et al.*, 2023
Conversion Factors	**Length-length [cm]** **Length-weight (b) [cm,kg]** **Length-weight (♀) [cm,kg]** **Length-weight (♂) [cm,kg]**	FL=0.8313TL+ 1.3908 W=3.18E-06FL^3.1313 W=1.30E-06TL^3.2 W=3.90E-07TL^3.41		FL=0.8313TL+1.3908 W=3.18E-06FL^3.1313 W=1.30E-06TL^3.2 W=3.90E-07TL^3.41	Kolher *et al.*, 1995 Stevens, 1975

Table 12. Summary of decisions about life-history parameters to be included in the 2023 assessment for the southern stock.

	South Atlantic stock			
	Previous assessment	**New proposal**	**Decision**	**Source**
Reproduction	168-188 cm FL	a=-28.24 (+/-0.905) b=0.153 (+/-0.005)	a=-28.24 (+/-0.905) b=0.153 (+/-0.005)	Mas *et al.*, 2023
		184.4 cm FL	184.4 cm FL	Mas *et al.*, 2023
		a=-14.07 (+/-0.44) b=2.17(+/-0.07)	a=-14.07 (+/-0.44) b=2.17(+/-0.07)	Joung *et al.*, 2017; Mas *et al.*, 2023
	6.5-7	6.5	6.5	Joung *et al.*, 2017; Mas *et al.*, 2023
		a=-24.99 (+/-6.502) b=0.136 (+/-0.035)	a=-24.99 (+/-6.502) b=0.136 (+/-0.035)	Mas *et al.*, 2023
	163-190 cm FL	183.8 cm FL	183.8 cm FL	Mas *et al.*, 2023
		a=-11.93 (+/-3.18) b=1.85(+/-0.49)	a=-11.93 (+/-3.18) b=1.85(+/-0.49)	Joung *et al.*, 2017; Mas *et al.*, 2023
	6-7	6.5	6.5	Joung *et al.*, 2017; Mas *et al.*, 2023
	1		1	Montealegre-Quijano *et al.*, 2014; Mas *et al.*, 2023
	9-12		9-12	Legat & Vooren, 2004; Montealegre-Quijano *et al.*, 2014; Mas *et al.*, 2023
	48 FL	47 TL	47 TL	Amorim *et al.*, 2020; Mas *et al.*, 2023
	34	37	37	Mas *et al.*, 2023
	1		1	Mejuto & García-Cortés, 2005
	94		94	Mejuto & García-Cortés, 2005
		LS = -23.65501 + 0.27966*FL (N = 423, R2 = 0.129)	LS = -23.65501 + 0.27966*FL (N = 423, R2 = 0.129)	Mas *et al.*, 2023
Age & Growth	244-279 FL		352.1	Joung *et al.*, 2017
	0.11-0.183		0.13	
	-2.19		–1.31	
	12-16		15	
	246-259 FL		352.1	
	0.14-0.149		0.13	
	-1.3		–1.31	
	13-14		15	
Repr	168-188 FL	a=-28.19 (+/-0.896) b=0.15 (+/-0.004)	a=-28.19 (+/-0.896) b=0.15 (+/-0.004)	Mas *et al.*, 2023

		184.3 FL	184.3 FL	Mas *et al.*, 2023
		a=-14.04 (+/-0.43) b=2.17(+/-0.07)	a=-14.04 (+/-0.43) b=2.17(+/-0.07)	Joung *et al.*, 2017; Mas *et al.*, 2023
	6.5-7	6.5	6.5	Joung *et al.*, 2017; Mas *et al.*, 2023
Age & Growth	244-279 FL	352.1	352.1	Joung *et al.*, 2017
	0.11-0.183	0.13	0.13	
	-2.19	–1.31	–1.31	
	12-16	15	15	
Conversion Factors	TL=1.201FL+1.613		TL=1.201FL+1.613	Mas *et al.*, 2014
			FL=0.5732+1.0985PCL	Mas *et al.*, 2023
	W=1.1E-06FL^3.35		W=1.1E-06FL^3.35	Montealegre-Quijano & Vooren, 2010
	W=2.2E-06FL^3.189		W=2.2E-06FL^3.189	Montealegre-Quijano & Vooren, 2010

Table 13. Summary of the discussions about the parameters and sources of information presented for BSH to be included in the 2023 assessment.

Parameter	North	South
Length @ maturity (L_{mat})	A range was used in 2015. A maturity ogive was recently published so the ogive is proposed as a more accurate representation of maturity for the 2023 assessment.	A range was used in 2015. A maturity ogive was recently published so the ogive is proposed as a more accurate representation of maturity for the 2023 assessment.
L_{50}	A point estimate was used in 2015. Two new estimates (east and west North Atlantic) are recently available. It was decided to adopt the west North Atlantic estimate as it was considered to be more representative of the North stock.	No estimate available for the 2015 assessment. Recently, one study has been published on maturity at length and will be used for the 2023 assessment.
Age @ maturity (T_{mat})	A range was used in 2015. A maturity at age ogive was recently published available so this was accepted as the most appropriate representation of the maturity at age proportions.	No estimate available for the 2015 assessment. Size-based maturity estimates from a recent publication were back-calculated to age using growth parameters representative of the southern stock. An age-based maturity ogive was fitted and proposed to be used in the assessment.
T_{50}	No estimate available for the 2015 assessment. A new estimate is available from the recently published maturity at age ogive so this was adopted.	No estimate available for the 2015 assessment. Size-based maturity estimates from a recent publication were back-calculated to age using growth parameters representative of the southern stock. An age-based maturity ogive was fitted and proposed to be used in the assessment.
Reproductive cycle	No changes from 2015 assessment. An annual cycle is accepted as the most parsimonious hypothesis considering other life history traits.	No changes from 2015 assessment. An annual cycle is accepted as the most parsimonious hypothesis considering other life history traits.
L_0	Information was updated based on a range of sizes, accepting the L_0 as the midpoint of the range.	Information updated based on new size estimates based on largest embryos and smallest free-swimming individuals.
Mean litter size	No new information to update the one used in the 2015 assessment.	Information updated based on a recently published study with a larger sample size than the previous available information.

Parameter	North	South
Litter size range	No new information to update the one used in the 2015 assessment.	New proposed range from recently published study falls within the previous existing range. Proposal for the 2023 assessment, to use the same as in the 2015.
Maternal size – litter size relationship	No estimates available for the 2015 assessment. It was agreed to use for the North stock the recently published relationship for the South as the best information available.	No estimates available for the 2015 assessment. A recently published relationship was adopted.
Growth parameters	Growth parameter estimates used in the 2015 assessment were based on vertebral analysis. Recent growth parameter estimates were derived from mark recapture. The mark recapture model has bigger sample size, so it was proposed to be considered as an alternative estate of nature for the 2023 stock assessment. A faster growth rate in North Atlantic was noted.	The Group discussed that a study published in 2017 would be used to update the information available in 2015, as it presents the best information available. This study states that sex-specific growth curves should not be used as there is no statistically significant differences in growth among sexes. Growth curves estimated using both male and female samples will be used.
Sex combined parameters: reproduction	No previous information for combined sexes so recently published estimates were proposed for the 2023 assessment.	Information used in the 2015 assessment was updated based on two recently published studies. Age-based reproduction parameters were estimated based on the growth parameter estimates available for combined sexes.
Sex combined parameters: growth	No previous information for combined sexes so recently published estimates were proposed for the 2023 assessment.	Growth parameter estimates were available for the 2015 assessment. Two new studies have been recently published, one of which was selected for the assessment. The selection of this model was based on the growth parameter estimates being more biologically sound compared to the other model.

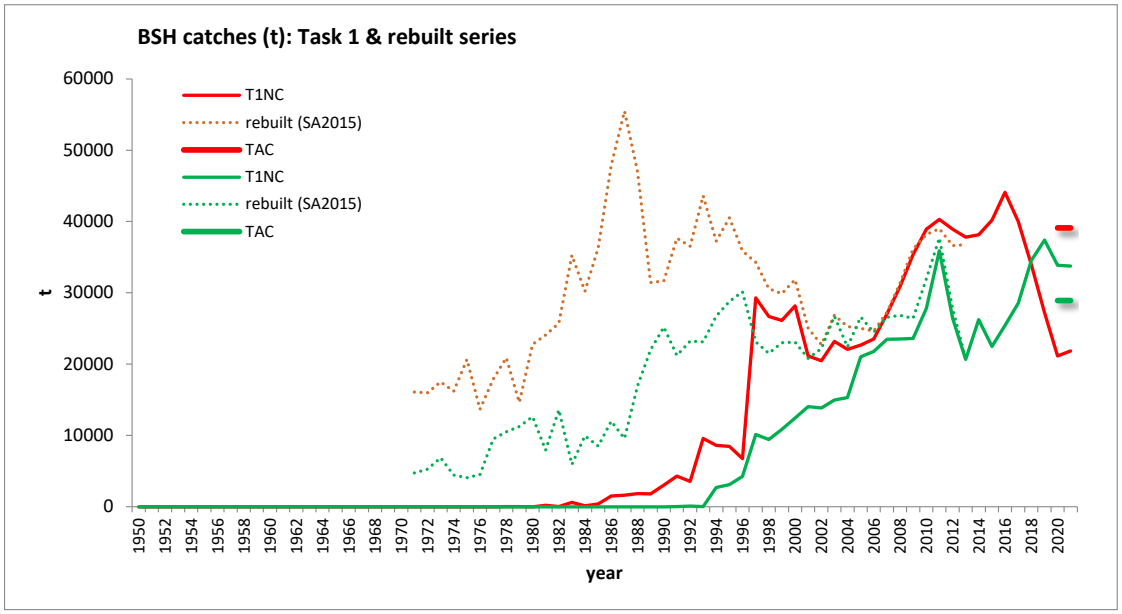

Figure 1. T1NC BSH catches (t, landings + dead discards) by stock (BSH catches in the Mediterranean not included). Dotted lines show the BSH historical rebuilt of both stocks made during the 2015 BSH stock assessment. Red and green denote northern and southern stocks.

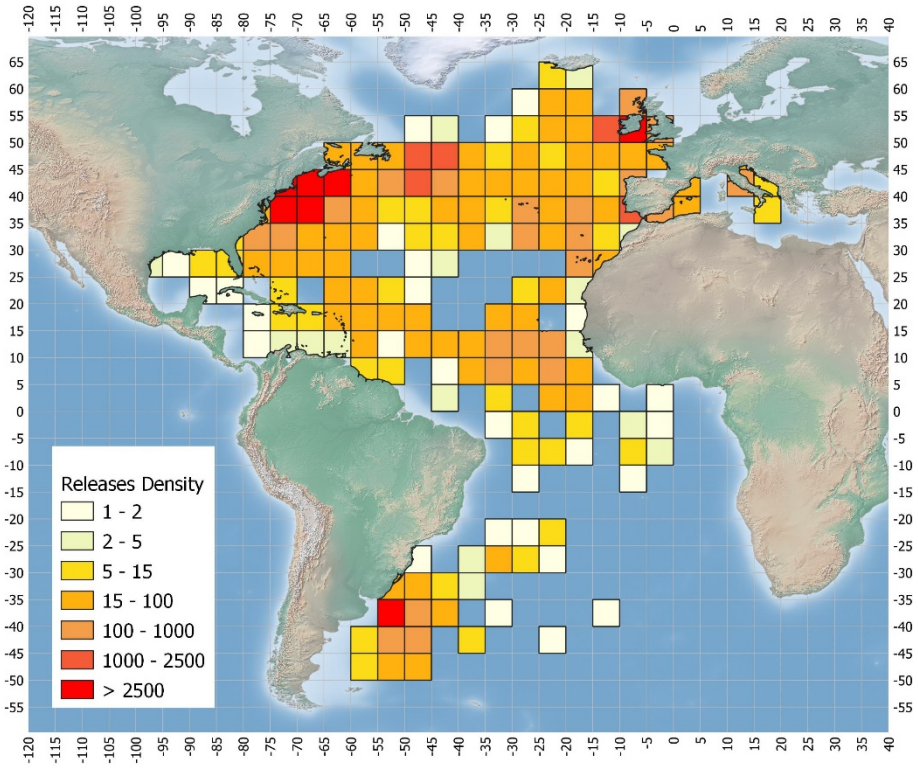

Figure 2. Density of the release positions at 5x5 lat lon grids in ICCAT conventional tagging on BSH.

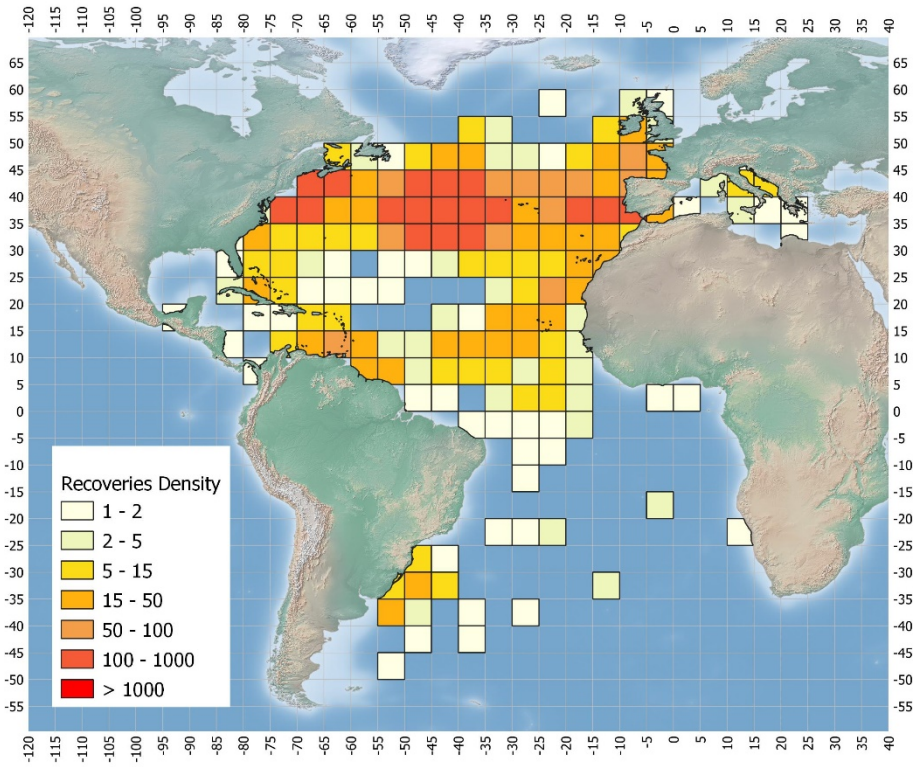

Figure 3. Density of the recovery positions at 5x5 lat lon grids in ICCAT conventional tagging on BSH.

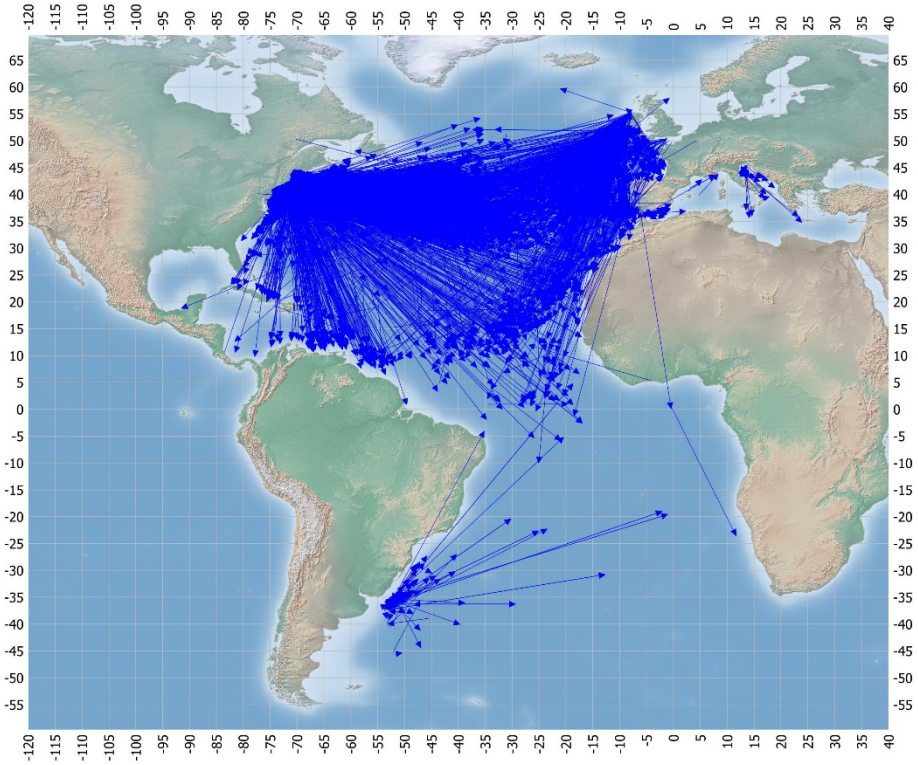

Figure 4. Straight displacement from the release to the recovery position of the recaptured specimens in ICCAT conventional tagging on BSH.

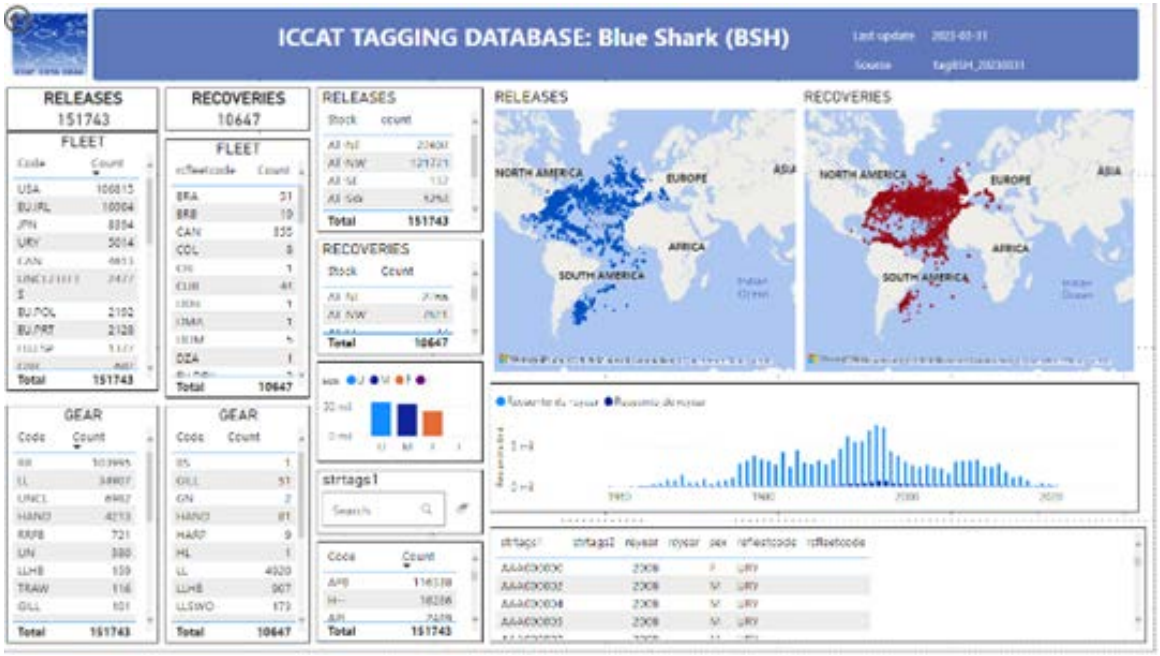

Figure 5. Screenshot of the conventional tagging dashboard.

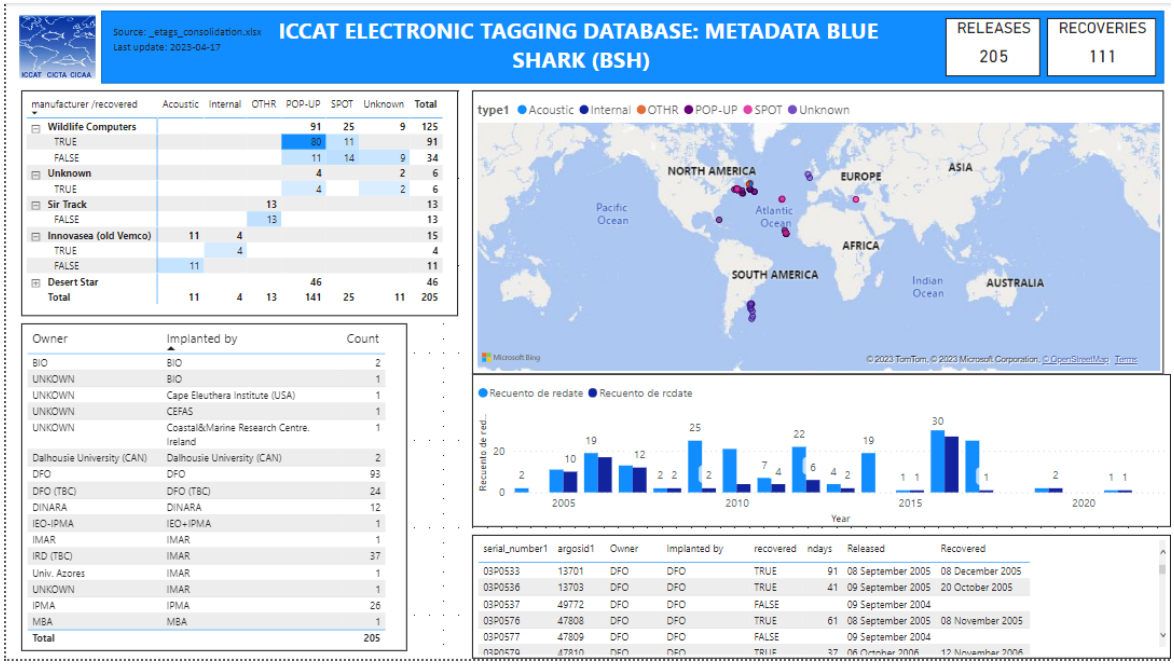

Figure 6. Screenshot of the electronic tagging dashboard.

Appendix 1

Agenda

1. Opening, adoption of Agenda and meeting arrangements

2. Review of historical and new information on biology

3. Review of fishery statistics/indicators

    3.1 Task 1 (catches) data and spatial distribution of catches
    3.2 Task 2 catch/effort
    3.3 Task 2 size data
    3.4 Tagging data

4. Indices of abundance

5. Discussion on assessment models to be developed, their assumptions and input data

    5.1 Catches
    5.2 CPUE Indices
    5.3 Biological parameters
    5.4 Size data by sex and region
    5.5 Fleet structure
    5.6 Other relevant data

6. Shark Research and Data Collection Programme (SRDCP)

7. Other matters

    7.1 Summary of the meeting
    7.2 Sharks' Executive Summaries
    7.3 Overview of the Responses to the Commission (including those related to para 25 of Recs. 21-09 and 22-11 on shortfin mako shark)

8. Recommendations

9. Adoption of the report and closure

Appendix 2

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Appendix 3

List of papers and presentations

Doc Ref	*Title*	*Authors*
SCRS/2023/004	Blue Shark Data Preparatory Meeting	Anonymous
SCRS/2023/011	Blue Shark Stock Assessment Meeting	Anonymous
SCRS/2023/038	Blue Shark: Age and growth from ICCAT conventional tag data	Ramos-Cartelle A., Carroceda A., García-Cortés B., Fernández-Costa J., Mejuto J.
SCRS/2023/039	Data-mining of blue shark length of North and South Atlantic stocks from the Spanish surface longline 1997-2021	García-Cortés B., Ramos-Cartelle A., Fernández-Costa J., Mejuto J.
SCRS/2023/040	Updated standardized catch rates in biomass for the North Atlantic stock of blue shark (*Prionace glauca*) from the Spanish surface longline fleet for the period 1997-2001	Mejuto J., Ramos-Cartelle B., García-Cortés B., Fernández-Costa J.
SCRS/2023/041	Updated standardized catch rates in biomass for the South Atlantic stock of blue shark (*Prionace glauca*) from the Spanish surface longline fleet for the period 1997-2001	Fernández-Costa J., Ramos-Cartelle A., García-Cortés B., Mejuto J.
SCRS/2023/044	Methods for estimating discards of shortfin mako (*Isurus oxyrinchus*) by the Portuguese longline fleet in the North Atlantic	Coelho R., Rosa D.,Lino P.G.
SCRS/2023/045	Updated standardized CPUEs of blue shark in the Portuguese pelagic longline fleet operating in the North Atlantic (1997-2021)	Coelho R., Rosa D., Lino P.G.
SCRS/2023/046	Standardized catch rates of blue sharks in the western North Atlantic Ocean from the U.S. pelagic longline observer program	Zhang X., Cortes E.
SCRS/2023/047	Review and preliminary analyses of conventional tagging data on Atlantic blue shark stocks (*Prionace glauca*)	Ortiz M., Garcia J., Taylor N.
SCRS/2023/049	Spatio-temporal model for CPUE standardization: application to blue shark caught by Japanese tuna longline fishery in the South Atlantic from 1994 to 2021	Kai M.
SCRS/2023/050	Spatio-temporal model for CPUE standardization: application to blue shark caught by Japanese tuna longline fishery in the North Atlantic from 1994 to 2021	Kai M.
SCRS/2023/051	Structural uncertainty in RFMO pelagic shark stock assessments: examples and recommendations resulting from two recent applications	Rice J., Courtney, D.

SCRS/2023/052	Summary of data from the Southwest of England blue shark fishery from 1953-2021	Thomas S., Alsop A., Chapman R.S., Collings M., Davis P., Faisey K.F., Forester M., Hodder L., Howell A., Malia O., Margetts D., McKie K.A., McMaster J.D., Murphy S., Narbett S., Newell S., Rogers J., Somerfield P.J., West D., Whittaker P., Wright S., Wyatt K., Uren D., Rudd H.S., Vas P., Jones G.
SCRS/2023/053	Age, growth and maturity of blue shark (*Prionace glauca*) in the Northwest Atlantic Ocean	Carlson J., Passerotti M., McCandless C.
SCRS/2023/054	Stock identification of Atlantic blue shark (P*rionace glauca*)	Carlson J., McCandless C., Passerotti M.
SCRS/2023/055	A preliminary study on standardized indices of blue shark from the Chinese longline fishery in the Atlantic Ocean during 2012 - 2021	Feng J., Zhang F., Li Y., Zhu J., Wu F.
SCRS/2023/056	Brief update on size distribution of blue shark (*Prionace glauca*) in the Caribbean Sea and adjacent waters of the North Atlantic Ocean caught by Venezuelan fisheries	Arocha F., Evaristo E., Marcano J.H., Narvaez M.
SCRS/2023/057	Catch-Per-Unit-Effort Standardization for the southern Atlantic Blue Shark (*Prionace glauca*) based on Brazilian and Uruguayan longline fishery data	Cardoso L.G., Sant'Ana R., Forselledo R., Cardoso G., Mourato B., Domingo A., Kikuchi E., Travassos P.
SCRS/2023/058	Standardized Catch Per Unit Effort (CPUE) of blue shark (*Prionace glauca*) caught by the Moroccan longline fishery in the Atlantic	Serghini M., Ahmed B., Abid N., Najd A., Bensbai J.
SCRS/2023/059	Updated standardized CPUE, size and spatial distribution of the blue shark (*Prionace glauca*) caught by the Taiwanese longline fishery in the Atlantic Ocean	Liu K., Su K.U.
SCRS/2023/060	Comparison and analysis of South Atlantic CPUE ICCAT BSH assessment	Rice J.
SCRS/2023/061	Comparison and analysis of North Atlantic CPUE 2023 ICCAT BSH assessment	Rice J.
SCRS/P/2023/030	Reproductive biology of the blue shark (*Prionace glauca*) in the South Atlantic Ocean	Mas F., Cortés E., Coelho R., Defeo O., Forselledo R., Domingo A.
SCRS/P/2023/031	Blue shark (*Prionace glauca*) movements and vertical overlap with longline fishing gears in the southwestern Atlantic Ocean	Mas F., Cortés E., Coelho R., Defeo O., Miller P., Carlson J., Gulak S., Domingo A.
SCRS/P/2023/032	Hooking mortality of blue sharks (*Prionace glauca*) caught by commercial longliners in the southwestern Atlantic Ocean	Max F., Cortés E., Coelho R, Defeo O., Jiménez S., Domingo A.

SCRS/P/2023/033	Summary of the distribution patterns and size data from observer programs used in the last blue shark stock assessment, with a discussion on options for updating in the new stock assessment	Coelho R.
SCRS/P/2023/034	Capture data and biological characteristics of the blue shark *Prionace glauca* in the Exclusive Economic Zone of Côte d'Ivoire	Konan K.J.
SCRS/P/2023/035	Continuity of Stock Synthesis data inputs and structural assumptions from 2015 to 2023 for North Atlantic BSH	Courtney D.
SCRS/P/2023/036	Porbeagle on the move	Junge C.

Appendix 4

SCRS Documents and Presentation Abstracts as provided by the authors

SCRS/2023/038 - El documento analizan registros de marcado-recaptura convencional de tintorera disponibles en la base de datos de ICCAT seleccionando distintos sets de datos, varias ecuaciones de transformación entre TL y FL. Valores históricos de FL_{max} fueron también revisados. Los resultados se comparan con los descritos por otros autores.

SCRS/2023/039 - The paper summarizes the length data-mining carried out in recent years in order to obtain a broad overview of the average length over time of the blue shark (*Prionace glauca*) between years 1997-2021 for the North and South Atlantic stocks. The data-mining was carried out through an intense compilation of records from samples on board commercial trips, experimental and tagging surveys, personal notes from skippers that were voluntarily provided for this scientific contribution through a collaborative science action, as well as through sampling during landings. The length data series was analyzed using GLM models to obtain relative and standardized trend of the mean length over time. The results showed a stable trend of the mean length and a slightly upward in the most recent period for both stocks.

SCRS/2023/040 - Standardized catch rates per unit of effort (CPUE) were updated for the North Atlantic stock of blue shark (*Prionace glauca*) using Generalized Linear Models (GLM). A total of 15,795 trips of the Spanish surface longline fleet targeting swordfish, between 1997-2021 period were analyzed. The main factors considered were year, quarter, area, gear and targeting strategy. The base case model explained the 83% of CPUE variability in gutted weight. Most of the variability was explained by the proxy of the targeting criteria followed by gear factor. Other factors were also significant, but less important. The standardized CPUE show an increasing trend until 2008 and remains stable since then to 2021.

SCRS/2023/041 - This paper provides an update of standardized catch rates in weight of blue shark using a Generalized Linear Model (GLM) from a total of 7,139 trips carried out by the Spanish surface longline fleet targeting swordfish in the South Atlantic stock for the period 1997-2021. The criteria used to define explanatory variables were similar to those used in previous papers. The main factors considered in the analysis were year, quarter, area, targeting criteria of skippers, gear and the interaction quarter-area. The results indicate that the target criteria of the skippers was the most important factor which explained the CPUE variability followed by gear and in less extent the other factors analyzed. The GLM results explained 84% of CPUE variability in gutted weight. The results showed an increasing trend reaching a peak in 2017 then a slight decrease until 2020 followed by an increased trend in most recent years.

SCRS/2023/044 - This document presents preliminary information to start addressing the ICCAT Commission request for estimation of discards of shortfin mako (*Isurus oxyrinchus*) (ICCAT Rec. 21-09), with a view to eventually allow for a possible future retention allowance in the North Atlantic. The intent of this paper is to provide an example of a possible approach for estimation of discards of shortfin mako in the Portuguese pelagic longline fleet, with known effort data, including date and location. The estimation is based on GAM models that modelled both total catches and discards of shortfin mako from fishery observer data between 2019 and 2022. With those models, and as an example, we then provide predictions for the dead discards and live releases in years 2020 and 2021.

SCRS/2023/045 - This document updates the catch, effort and standardized CPUE for the North Atlantic blue shark captured by the Portuguese pelagic longline fleet. Nominal annual CPUE were calculated in biomass (kg/1000 hooks) and were standardized with Generalized Linear Models (GLM) and Generalized Linear Mixed Models (GLMM) using year, quarter, area, gear type, targeting effects and area:quarter interactions as fixed factors, and year:area as random effects. Sensitivity analyzes were carried out for the model type (lognormal, tweedie, gamma or delta lognormal), targeting effects (ratios or cluster analysis), and definition of areas. Model goodness-of-fit was carried out with AIC and the pseudo R2, and model validation with residual analysis. This paper updates the previous index from the Portuguese fleet and can be considered for the blue shark stock assessment being carried out by ICCAT in 2023. The final standardized CPUE trend shows an overall increasing trend from the start of the time series in 1997 until 2015, and then a relatively stable period between 2015 and 2021 with yearly oscillations.

SCRS/2023/046 - An updated index of abundance was developed for blue shark (*Prionace glauca*) from the U.S. pelagic longline fishery observer program (1992-2022). The index was calculated using a two-step delta-lognormal approach that treats the proportion of positive sets and the CPUE of positive catches separately. Observations affected by fishing regulations (time-area closures or bait restrictions) were excluded in this analysis. The standardized index with 95% confidence intervals is reported. The standardized index showed an initial increasing trend from 1992 to 1998, followed by a decrease to 2003, an increase to 2011, and a subsequent decrease to 2022.

SCRS/2023/047 - Conventional tagging data of North and South Atlantic blue shark stocks were reviewed, and preliminary analyses were performed for its use within the stock evaluation. The tag releases and recapture records were revised, updated, and standardized, to summarize size distributions, time at large and distance displacement between release and recapture locations. Most of the tag releases are in the North Atlantic area, recaptures suggested a low exchange of individuals between current stock management units in the Atlantic and Mediterranean. Size distribution of tag releases and recaptures show unimodal normal distributions with a mean size of 156 and 189 SFL cm, respectively. Time at large showed recaptures up to 15 years at liberty, with a mean of 407 days at large. Stainless steel tag's reporting rates were higher than plastic double-barb streamers. And inferred movement patterns suggest a clockwise migration in the North Atlantic from the easter coast of North America to Europe following the Gulf Stream current and returning southwest to the equatorial region and the Caribbean Sea.

SCRS/2023/049 - Abundance indices of blue shark caught by Japanese longline fishery from 1994 to 2021 in the South Atlantic were estimated. Since the catch data of sharks caught by commercial tuna longline fishery is usually underreported due to discard of sharks, the author filtered the logbook data using the similar filtering methods applied in the previous analysis. The nominal CPUE of filtered data was then standardized using the spatio-temporal generalized linear mixed model (GLMM) to provide the annual changes in the abundance of blue sharks in the South Atlantic. The author focused on interannual variations of the density in the model to account for spatially and annually changes in the fishing location due to the target changes of tuna and tuna-like species. The estimated CPUE revealed an upward trend from 2005 to 2011, and then a downward trend until 2015. Thereafter the CPUE slightly decreased in recent years. The estimated CPUE using the spatio-temporal model with a large amount of data collected in the wide waters in the South Atlantic is a very useful information about the abundance of blue sharks.

SCRS/2023/050 - Abundance indices of blue shark caught by Japanese longline fishery from 1994 to 2021 in the North Atlantic were estimated. Since the catch data of sharks caught by commercial tuna longline fishery is usually underreported due to discard of sharks, the author filtered the logbook data using the similar filtering methods applied in the previous analysis. The nominal CPUE of filtered data was then standardized using the spatio-temporal generalized linear mixed model (GLMM) to provide the annual changes in the abundance. The author focused on interannual variations of the density in the model to account for spatially and annually changes in the fishing location due to the target changes of tuna and tuna-like species. The estimated CPUE revealed downward trend from 1994 to 2004, and then sharply increased until 2008. Thereafter the CPUE was stable until 2015 with annual fluctuations and then decreased in recent years. The estimated CPUE using the spatio-temporal model with a large amount of data collected in the wide waters in the North Atlantic is a very useful information about the abundance of blue sharks.

SCRS/2023/051 - This study provides two examples of the use of structural uncertainty grids in RFMO pelagic shark stock assessments. The examples are provided based on recent assessments of blue shark (*Prionace glauca*) conducted for the Indian Ocean Tuna Commission (IOTC) and of oceanic whitetip (*Carcharhinus longimanus*) conducted for the Western and Central Pacific Fisheries Commission (WCPFC). Details cover the use of multiple axes of uncertainty within a structural uncertainty grid, the use of structural uncertainty grid results to identify key assessment uncertainties, and how inter-assessment research led to a reduction in the axes of uncertainty within the grid structure over time and, consequently, to reduced assessment uncertainty. The use of weights on individual model runs and how to interpret results of a weighted group of runs within ensemble modeling are also discussed. The examples provided here demonstrate the use of a structural uncertainty grid to evaluate the effects of potential management actions and reduce, over time, assessment uncertainty.

SCRS/2023/052 - Results from analysis of the Southwest of England recreational Blue Shark fishery from 1953-2019 are presented for the purpose of the 2020 ICCAT request for data on the species. During this period 108731 Blue Sharks were captured for 56650 days fished, giving an overall CPUE of 1.02 fish/trip. CPUE initially peaked during the 1950s between 2.93-4.59 before declining during the 1960s. CPUE reached a nadir of 0.18 in 2000 then showed an increasing trend for 2010-2014. CPUE increased markedly from 2.58 in 2014 to 5.33 in 2015 and peaked at 8.85 fish/trip in 2017 before decreasing slightly during 2018-2021. Immature female fish dominated catches throughout, although both male and female mature fish were present during certain periods.

SCRS/2023/053 - Age, growth, and maturity estimates for the northwest Atlantic population of blue shark (*Prionace glauca*) were updated from previous studies with samples collected from 2002-2019. Growth rates from three models were developed from aged vertebrae and from tag-recaptured individuals and maturity estimated from aged sharks rather than back-transforming length into age from growth equations. The best fitting model was von Bertalanffy growth equation, and the estimates were similar to those previously derived. Von Bertalanffy growth parameters (sexes combined) derived from vertebral length-at-age data are L8= 292 cm FL, K= 0.157 yr-1, and t0=-1.80 yr-1whereas those developed from the tag-recapture model were L8 = 249 cm FL, K= 0.29 yr-1. The median size and age at maturity estimates were 197 cm FL and 4.9 years for males and 191 cm FL and 5.3 years for females. Overall, growth and maturity estimates for blue shark suggest the species is fast growing and matures earlier then many other species of sharks

SCRS/2023/054 - We conducted a review of all available information on genetics, tagging, and movement of blue shark (Prionace glauca) in the Atlantic Ocean since 2015 to evaluate stock structure and inform the upcoming stock assessment. There is evidence of a north-south movement across the equator by larger, older individuals particularly in the eastern Atlantic. However, the observed movement rates between the north and south Atlantic appear to be low enough to consider separate spatial units for stock assessment. When considering genetics, several studies found complete genetic homogeneity across the Atlantic Ocean (and globally in some cases). However, small sample size combined with the pace of drift of genetic traits and population size may impact results. Additional studies have found genetic differentiation within the Atlantic Ocean, and between the Atlantic Ocean and the Mediterranean Sea which further confounds splitting stocks based on genetics. Outside of the Mediterranean Sea, there is no new evidence to suggest further splitting of the Atlantic Ocean beyond a northern and southern stock is required at this time.

SCRS/2023/055 - A preliminary study is presented on the standardization of index of Blue shark from the Chinese longline fishery in the Atlantic Ocean during 2012-2021. The results of the spatial and temporal distributions of catch and nominal CPUE show the geographical range of Blue shark caught by the Chinese longline fleets is expanding. Compared to nominal CPUE, the variation of different fishing years is smoother in standardized CPUE. In general, the standardized CPUE of Blue shark from the Chinese longline fishery in the Atlantic Ocean slightly increase in 2013, and then decreased to a stable level from 2014 to recent year in 2021.

SCRS/2023/056 - In this document, statistical data from past ICCAT sponsored monitoring programs for data improvement in Venezuela and available information from the National Observer Program were used to update specific blue shark information for the period of 2013-2018 caught by the industrial longline fishery and from the artisanal drift-gillnet fishery for the period 2013-2022. Information on size and sex of blue shark from the Venezuelan pelagic longline fishery and catch & effort, and size information from the artisanal drift-gillnet fishery is updated for the period 2013-2018 (LL) and through 2022 (artisanal, GN). The document reviews the size distribution of 625 blue sharks from both fisheries.

SCRS/P/2023/030 - Reproductive data for the blue shark in the southwest Atlantic Ocean based on scientific observer data collected between 1998 and 2019 were presented. The document provided new estimates of median size at maturity for both sexes, data on female fecundity and the relationship between litter size and maternal size, embryo size and development, probable gestation time, estimates of most likely size at birth, and potential parturition areas. Some aspects related to the reproductive cycle of the species in the South Atlantic were presented, including evidence that suggests that a portion of the reproductively active female population could be completing the entire reproductive cycle within the southwestern area of the Atlantic.

SCRS/P/2023/031 - Information on blue sharks' movements in the southwestern Atlantic Ocean based on conventional and satellite tagging, and estimates of vertical overlap between the species and commercial longliners based on data loggers was presented. Information was provided in terms of short- and large-sale horizontal movements, vertical distribution and behavior, and encounterability estimates with shallow and deep-set commercial longliners.

SCRS/P/2023/032 - We present at-vessel or hooking mortality estimates of blue sharks caught by commercial longliners in the southwestern Atlantic Ocean based on scientific observer data. A general additive model was fitted to the data considering biological, environmental, and operative aspects of the fishery as candidate variables. Data on blue sharks caught on branchlines equipped with data loggers were also presented to provide insight into the timing of catches and post-capture behavior.

SCRS/2023/057 - Catch and effort data from Brazilian and Uruguayan tuna longline fishery in the South Atlantic Ocean from 1978 to 2022 were analyzed. The effort was distributed in a wide area of the western Atlantic Ocean. The CPUE of the southern blue shark was standardized by a GLM using a Delta Lognormal approach. The factors used in the models were: year, quarter, flag, vessel, hooks per floats, hooks, and the lat-long reference for each five by 5 degrees square. After the data cleaning, an index was estimated for the period between 1992 to 2022. The estimated delta-lognormal index showed three distinct periods. Between 1992 and 2005, the index was marked by stable smooth and low values. The second one, from 2006 to 2012, presented a slight increase in relative abundance attaining its peak in 2012. The third period, from 2013 to 2022, showed a dynamic pattern with higher values than the beginning of the series but without any apparent increase or decreasing trend.

SCRS/2023/058 - Blue shark Prionace glauca is harvested as bycatch by the Moroccan longliners targeting swordfish *Xiphias gladius* in the South of Moroccan Atlantic waters. We generated a time series of standardized catch per unit effort (CPUE) for blue shark by initially analyzing the identification of fishing tactics using a multi-table method, and then estimating the duration of individual fishing trips using commercial fishing, and scientific survey data. After completing all the necessary information, we use two statistical models, including Boosted Regression Trees model (BRT) with main effects and two-way interactions. BRT with two-way interactions was selected as the best model to estimate CPUE with less RMSE and high PDE. The analysis of standardized CPUE reveals an increase trend since the early two years, followed by a slight decline in 2013 and significant increase for three years after and subsequent stability in the last six years of the time series.

SCRS/P/2023/033 - This presentation provided a summary of the distribution patterns and size data from observer programs used in the last blue shark stock assessment, with a discussion on options for updating in the new stock assessment.

SCRS/P/2023/034 - This presentation provided a summary of capture data and biological characteristics of the blue shark *Prionace glauca* in the Exclusive Economic Zone of Côte d'Ivoire.

SCRS/2023/059 - The blue shark *Prionace glauca* catch and effort data from observers' records of Taiwanese large longline fishing vessels operating in the Atlantic Ocean from 2007-2022 were analyzed. Based on the shark by-catch rate, five areas, namely, A (North of 20ºN), B (5ºN-20ºN), C (5ºN-15ºS), D (15ºS-50ºS, West to 20ºW) and E (15ºS-50ºS, 20ºW-20ºE), were categorized. To cope with the large percentage of zero shark catch, the catch per unit effort (CPUE) of blue sharks, 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 are reported. The standardized CPUE of blue sharks in the North Atlantic had a lowest value in 2015, peaked in 2016, and decreased thereafter. The standardized CPUE of blue sharks in the South Atlantic was relatively stable from 2007-2019 but peaked in 2020 and decreased thereafter. The mean sizes of females were significantly smaller than those of males (P 0.05) in the North and South Atlantic Ocean. The mean size of males in Area B was larger than that in Area A (P 0.05) but no significant difference was found for females (P>0.05). In the South Atlantic, the mean size of blue sharks Area C was larger than those in Areas D and E (P 0.05), but no significant difference in mean size was found between Areas D and E (P > 0.05).

SCRS/P/2023/035 - This presentation provided a summary of Stock Synthesis Data Inputs and Structural Assumptions from the 2015 assessment and discussed some candidate parameterizations and data inputs for the 2023 assessment in the North Atlantic.

SCRS/P/2023/036 - This presentation included an overview of the ongoing satellite tagging work on porbeagle by researchers from the IMR in Norway as part of the NRC funded "Sharks on the Move" project, as well as the first results from a female shark tagged with a miniPAT provided by the ICCAT SRDCP. The specimen was tracked for 4 months in 2022. Further tagging plans were elaborated on and discussions on further collaboration with the SRDCP were initiated involving people working within the porbeagle tagging program.

SCRS/2023/060 - This document provided a cluster analysis of southern blue shark CPUE data to group CPUE indices into sets of CPUEs with similar properties.

SCRS/2023/061 This document did a cluster analysis of northern blue shark CPUE data to group CPUE indices into sets of CPUEs with similar properties to each other.