REPORT OF THE 2022 ICCAT INTERSESSIONAL MEETING OF THE SHARKS SPECIES GROUP

(Online, 16-18 May 2022)

1. Opening, adoption of the agenda and meeting arrangements

The Assistant Executive Secretary opened the meeting and welcomed the participants (the "Group"). The Chairman proceeded to review the agenda which was adopted without changes (**Appendix 1**). The List of participants is included in **Appendix 2**. The List of documents and presentations provided at the meeting is attached as **Appendix 3**. The abstracts of all SCRS documents and presentations presented at the meeting are included in **Appendix 4**. The following served as rapporteurs:

Item 1. Taylor N.G.
Item 2. Santos C., Semba Y. Domingo A., Santos M.N., Carlson J.
Item 3. Palma C., Mayor C., Garcia J.
Item 4. Courtney D., Bowlby H., Cardoso G.
Item 5. Taylor N.G., Ortiz M., Cortés E.
Item 6. Forselledo R., Domingo A.
Item 7. Domingo A., Santos M.N.
Item 8. Forselledo R., Melvin G., Brown C., Coelho R., Arrizabalaga H.
Item 9. Coelho R., Brown C., Díaz G., Santos M.N.
Item 10. Taylor N.G., Ellis J.
Item 11. Taylor N.G.

2. Presentation of activities under SRDCP and future activities

SCRS/P/2022/025 provided an update of the study on age and growth of South Atlantic shortfin mako, developed within the ICCAT Shark Research and Data Collection Programme (SRDCP). A sample size of 883 specimens ranging in size from 55 to 330 cm fork length (FL) and 57 to 250 cm has been made available for females and for males, respectively. Age readings will start soon.

The Group noted the lack of samples from the extremes of the size distribution, most notably from large shortfin mako, which in this study, results in convergence issues in the estimation of growth curves. The preferable solution would be to collect samples from large specimens, but to date that has been challenging likely due to the size selectivity of the gear. However, participants from Uruguay and Brazil informed the Group that they may be able to provide additional samples to overcome this issue at least partially. Difficulties related to export of shortfin mako samples as a result of the inclusion of this species in CITES Appendix II were also mentioned as an additional burden to advance this study. A possible approach suggested to overcome the latter problem was to share the processed images between the research teams providing the samples, and those doing the readings.

One of several alternative approaches to overcome the lack of samples from small and/or large size specimens that will be explored in the future is to use Bayesian growth models using informative priors from other stocks (e.g. the northern stock) on L_0 and L_∞ to improve the estimates. In addition to Bayesian growth models, it was proposed to explore models that use truncated distributions to account for limited sampling due to minimum size restrictions or gear selectivity issues.

SCRS/P/2022/024 provided an updated overview of the e-tagging activities within the SRDCP, which to date includes tagging of 90 sharks (including deployment of 80 miniPATS and 10 sPATs), including shortfin mako (61), silky shark (14), oceanic whitetip (8), porbeagle (5), smooth hammerhead (1) and scalloped hammerhead (1), as part of a collaborative effort of the ICCAT Sharks Species Group. In 2021, two scientific peer-reviewed papers were produced with information collected from ICCAT tags (Bowlby *et al*., 2021; Santos *et al.*, 2021). In addition, there are 2 ongoing studies regarding post-release mortality of shortfin mako and movements and habitat use of porbeagle. At the moment, the SRDCP has 53 miniPATs available for deployment, some already distributed by species in different CPCs, and some others waiting to be allocated.

Presentation SCRS/P/2022/028 provided an update on the study on post-release mortality of shortfin mako in the Atlantic Ocean. Thirty-five out of 43 tags analyzed rendered reliable information on individual fate, resulting in 27 survival and 8 mortality events (22.8% post-release mortality). This study will continue by analyzing the available information of tags deployed since 2019. Also, it will explore the possible contribution from other CPCs research programmes that are willing to participate, such as Canada, South Africa and the U.K.

Presentation SCRS/P/2022/027 provided an update of the tagging activities of the SRCDP for the Northwest Atlantic Ocean. To date, tags were deployed on porbeagle, oceanic whitetip shark and silky shark as part of a collaborative effort of the ICCAT Sharks Species Group with academia and non-Governmental Organizations. One scientific peer-reviewed paper has been published as part of this collaboration. The target for 2022 will include deploying the remaining four ICCAT tags on porbeagle and silky shark (two tags per species). Efforts will also continue to deploy tags on oceanic whitetip shark with NOAA-purchased tags using observers on the U.S. pelagic longline fleet and on research expeditions with collaborators in academia.

Some technical failures of a couple of tags provided by ICCAT were reported. The Secretariat clarified that this issue was discussed and reported in the past, which was related to particular batches of PSAT tags purchased in 2019 and 2020. The manufacturer has offered replacement tags and some addition goodwill tags that are available at the Secretariat for distribution.

Following the initial discussion on presentation SCRS/P/2022/024 (plus 2 other presentations on tagging), the Group further discussed future tagging activities and short-term priorities. These included providing ICCAT tags to the U.S. team for oceanic whitetip shark; to allocate some of the available tags to the more commonly captured blue shark to improve knowledge on specific topics such as stock mixture zones and parturition/nursery areas for this species; and to include the thresher sharks in the list of priority species to tag. There was consensus that it would be important to do a thorough assessment of the achieved results of SRDCP and to review its ongoing activities. For this purpose, it was suggested to schedule an intersessional meeting in 2023. However, it was also agreed that in the intersessional period prior to the September 2022 Species Group meeting, short informal online meetings should be organized by the Group to allow decisions to be made regarding the workplan to be proposed for 2023 as regards tagging activities.

The Group was informed that the Secretariat is developing a database of electronic tags. Further details are provided below under agenda item 3.3.

Document SCRS/2022/085 provided an update on the analyses of shortfin mako shark genetic structure based on 183 individuals (including individuals used in the previous analysis) from 13 sampling units. The geographic distribution of the individual's assignment to the three nuclear genome groups (Nc-group α, β, and α/β) and the two mitochondrial clades (previously detected Mt-clade I and II) have some important implications for the source of genetic types and especially contact zone between the two types, namely α+I and β+II. It was suggested that the source of the pure β+II type is outside of the Atlantic Ocean and that the Central and South Atlantic regions are promising candidates for a contact zone between the two types via the immigration of pure β+II type from the Indian Ocean side.

Samples from two locations in the Indian Ocean, off South Africa, and Australia, have already been collected and will be included in the analysis. Although there was no specific discussion on this document, the authors confirmed that 2022 will be the terminal year to this study on the shortfin mako genetic population structure within the SRDCP.

Document SCRS/2022/086 presented the workplan to investigate the feasibility of whole mitochondrial genome sequencing (mitogenomics) for Atlantic porbeagle and showed the spatial distribution of samples currently available. It is planned to conduct mitogenomics of porbeagle on 96 individuals from three localities in the Atlantic Ocean (northwest, northeast, southeast) at least.

Samples from the Southwest Atlantic had been already provided by Uruguay and will be included in the analysis. The Group also suggested that samples could possibly be obtained from Argentina and Chile. For the northeastern region, some CPCs provided information on samples available and on movement of juvenile porbeagle. As was the case for shortfin mako, difficulties related to export of samples of porbeagle were also mentioned as a result of the species listing in CITES Appendix II. The Group acknowledged that it was feasible that this study be conducted within SRDCP in 2022.

3. Review of shark fishery statistics

The Secretariat presented the most up-to-date statistical datasets (T1NC: Task 1 nominal catches; T2CE: Task 2 catch & effort; T2SZ: Task 2 size samples) and conventional tagging data on shark species available in the ICCAT database system (ICCAT-DB). This information covered the three major shark species (BSH: blue shark, SMA: shortfin mako, POR: porbeagle), and the group of other bycatch sharks (a long list of more than 60 species or groups of species) stored in ICCAT-DB.

Overall, when compared with the information adopted by the SCRS in 2021 during its annual meeting, there are only minor updates/corrections to catches reported by ICCAT CPCs afterwards (between October and December 2021) for the last three years of the series 1950-2020.

No documents on fishery statistics improvements (completion or revisions) were presented by ICCAT CPCs to the Group. Therefore, no changes were made to the shark statistics.

3.1 Task 1 (catches) data

The Group reviewed the Task 1 nominal catches (T1NC: landings and dead discards) of BSH, SMA and POR, covering the period 1950 to 2020 (only one Flag CPC reported 2021 catches on sharks). No major changes (updates or corrections) were made to the sharks catch series other than some flag CPCs minor revisions recently made for the last three years. The final T1NC statistics (landings plus dead discards) of BSH, SMA and POR by year (1950-2020) and stock are summarised in **Table 1** (graphically shown in **Figures 1 to 3,** respectively for BSH, SMA and POR). The Secretariat noted that previously identified weaknesses in the current major sharks catch series (incomplete or gaps in the catch series of some CPCs, catches without a proper gear allocation, uncertainty in the stock allocation of some catches, etc.) still exist and are more evident in years before 2000. The historical catch rebuilding process of these three species is far from being completed and additional efforts should also be made to recover data from the earlier period (1950 through 1990).

The Secretariat also informed the Group that no major improvements were made on the discards (either dead or alive) component of the catches of major sharks. Only a few CPCs reported estimates of dead discards (**Table 2**) and live releases (**Table 3**) for the three major species. The Group reiterates to the CPCs the requirement to report discards (both dead and alive) of BSH, SMA, and POR as part of their Task 1 data submission.

The Group also evaluated the status of the long list of other by-catch shark species available in Task 1 (more than 60 species/genus/families, and 4 sharks unclassified codes). **Table 4** summarises those catches in T1NC.

The Secretariat presented a brief comparison of the amount of these catches in comparison to the overall shark catches available in Task 1 (**Figures 4** and **5**). A reasonable amount of those shark catches may have been erroneously classified with codes of species not typically found in the ICCAT Convention area. Others may belong to species not directly associated with ICCAT fisheries. In addition, the unclassified shark's groups (CXX: Coastal sharks nei; PXX: Pelagic sharks nei; SKH: Selachimorpha/Pleurotremata; SHX: Squaliformes) may also contain a portion of the catches belonging to major shark species (BSH, SMA, POR), especially before 2000 when there was no obligation to report to ICCAT species-specific shark catches.
The Group reiterated the need to revise the list of ICCAT shark species considering the last meeting guideline of having three shark species categories in addition to major and other sharks, as a more efficient mode of handling the large list of shark species. The three categories proposed were:

a) Major ICCAT sharks (3 species),
b) Other ICCAT sharks (~30 species),
c) Non-ICCAT sharks (rest of the sharks).

Furthermore, as discussed during the 2017 shortfin mako data preparatory meeting (Anon., 2017), this classification should be studied in the future, considering ICCAT regulations, particularly those associated with data provision to ICCAT (e.g. include only the first two categories in the T1 and T2 forms, and all three categories in the ST09 observer data collection form). This revision work should proceed in the next couple of years, with Secretariat support, which will prepare the conditions (datasets, guidelines and methodology) to start this revision process before the annual Species Groups meetings.

In line with other ICCAT species, the Secretariat also prepared a dashboard (screenshot in **Figure 6**) for the three major shark species (for now only available to the meeting participants) using the standard T1NC dataset format adopted by the SCRS. The Group appreciated this work and recommended that CPCs use this new tool to explore their own T1NC series and report to the Secretariat any identified inconsistencies.

3.2 Task 2 (catch-effort and size samples) data

For the three major sharks, the information available for Task 2 (T2CE: catch and effort, T2SZ: size samples) is very incomplete, as shown in the SCRS standard catalogues (**Tables 5a to 5h**, by stock and for the period 1991 to 2020) for the last 30 years. The CPCs were encouraged by the Group to report to ICCAT the T2CE and T2SZ missing information on sharks, requesting whenever necessary guidance from the Secretariat. Recovering the missing T2CE and T2SZ datasets is the only way to have in the future CATDIS estimates (derived Task 1 yearly catches, by trimester and a 5x5 square grid) for BSH, SMA and POR. CATDIS estimates fully depend on the T2CE completeness level ("a" marks shown in the SCRS catalogues).

Finally using a presentation of the T2CE and T2SZ detailed catalogues on sharks (with important metadata on dataset characterisation), the Secretariat highlighted those datasets that require revision due to poor levels of resolution (highly aggregated by year and quarter, large geographical strata, large class bins, etc.). This list is slowly becoming shorter. The Group invited CPC scientists to revise those datasets with the support of the Secretariat.

3.3 Tagging data

The Secretariat presented a summary of the conventional tagging data available for the three main shark species. The number of releases and recoveries (grouped by number of years at liberty) are summarised in **Table 6** (BSH), **Table 7** (SMA), and **Table 8** (POR). The corresponding maps of the three species are presented in **Figure 7**, including the density of releases in 5°x5° squares, the density of recoveries in 5x5 squares, and the apparent movement (arrows from release to recovery location).

In summary, the conventional tagging database of ICCAT has registered a total of 143,316 releases (10,164 recoveries) of BSH, 9,685 releases (1,366 recoveries) of SMA, and 2,610 releases (352 recoveries) of POR.

Reasonable progress has been achieved on the recovery of sex and fleet information for the three major shark species. These improvements resulted from querying the existing raw data reported by the United States to ICCAT in the past, and from the collaboration of various National Scientists who revised a reasonable number of records. These improvements to the conventional tagging data will continue and will run in parallel with the maintenance and improvement of the conventional tagging database (CTAG), and the development of the new database on electronic tagging (ETAG), which has been underway with the recovery of raw information from ICCAT tags and the improvement of the associated metadata (part of it already compiled on the ICCAT electronic tagging inventory published on the web. The full integration of the raw electronic tagging information on sharks on the ETAG system is planned for the final stage of the ETAG development.

In addition, the Secretariat presented a dashboard with SMA tagging data (snapshot in **Figure 8**) to visualize and interact dynamically with these data, and a GIS map viewer to visualize and interact with the layers created. Both the dashboard and the map viewer will cover the three major shark species. The Group acknowledged the work of the Secretariat on the tagging dashboards and its usefulness.

4. Draft workplan for 2023 blue shark stock assessment

A brief review of the results from the 2015 blue shark assessment were presented. Recommendations raised at the previous meeting were to incorporate tag recapture data directly into the assessment models, and to apply an age-structured assessment model for the southern stock. The size composition and spatial structure of the fleets were captured better if the abundance indices were not combined.

The proposal for 2023 was to have the United States lead the northern stock assessment using Stock Synthesis (SS3) and Brazil lead the southern stock assessment using SS3. Multiple model structures are important to give a better characterization of uncertainty in this case, which may not be well-captured using a single model structure. Also, to give continuity to what has been previously done in the shark stock assessments, Surplus Production Models for both the North and South should be developed. Brazil offered to lead the JABBA analysis for the South stock, and if nobody else is available to run production models for the North, then Brazil would consider running JABBA there. Also, previously used methods should be explored. The Group encouraged collaboration on the assessment methods by Group members. Indices used in the previous assessment should be updated and the potential for new indices may be explored, mainly from the South, such as those from South Africa and Namibia.

A presentation (SCRS/P/2022/023) was given on model diagnostics in integrated stock assessments. These methods are applicable to multiple modeling frameworks (e.g. SS3 and JABBA). Multiple working groups have identified that objective criteria are needed to assess model plausibility during stock assessment. Generic tools for model diagnostics and validation should show uncertainties, biases and misspecifications (e.g. SS3diags package in R). Recent work has shown that model selection is an iterative process that cannot be automated, but that hindcasting and cross validation (Carvalho *et al*., 2021; Kell *et al*., 2021) are useful tools to identify the best assessment approach (Base Case) and explore alternative formulations. Examples were also provided from ongoing work (Kell *et al*., 2022) using plausibility based on Retrospective Analysis (Mohn's ρ) and Prediction Skill (MASE) to weight models from a full factorial design.

The presentation author noted that the presentation was developed in response to the recommendation in the Sharks Workplan for 2022 (*Report for Biennial Period 2020-2021, Part II (2021), Vol. 2*, section 19.1.6): "Consider, together with the Working Group on Stock Assessment Methods, alternative stock assessment methods (as per Kell, 2021, other SCRS papers, and the fisheries literature)." The presentation author also noted two recent recommendations from the Working Group on Stock Assessment Methods (WGSAM): 1) That the SCRS routinely apply objective criteria to determine model plausibility for assessments that are intended for management advice; e.g. using diagnostics such as those of Carvalho *et al*., 2021 which are available in a variety of R and FLR packages such as ss3diags; and 2) In preparation for stock assessments species groups should routinely present model diagnostics for previous assessments, identifying model uncertainties, biases and misspecifications, which should then be considered when specifying the uncertainty grid for consideration at subsequent stock assessment meetings.

The presentation author noted that the presentation was based on one given to the Center for the Advancement of Population Assessment Methodology (CAPAM) workshop on model diagnostics in integrated stock assessments, following which the authors were asked to develop guidelines for the use of the hindcast as part of selection, rejection, weighting and extension of models in ensembles. The Group noted that the presentation will also be given at the meeting of the WGSAM where a more detailed review may be possible.

A brief presentation (SCRS/P/2022/026) was made to assess interest in using a recent publication on blue shark habitat (Druon *et al.*, 2022) for potential use to develop maps that could inform spatiotemporal management of blue shark. The work would categorize areas of highest overlap, areas with less risk and areas with little overlap in interactive map products, by month. To protect reproductive output and the most vulnerable size classes, the proposal was to focus on small juveniles (FL < 125 cm) and adult females (FL > 180 cm).

The Group supported the proposal in principle, and identified several important considerations as work progresses, including ensuring data completeness, clearly identifying goals, consideration of how targeting versus bycatch records would impact both model development and resulting conclusions, and developing any recommendations within a stock assessment context to make sure the interpretation of inferred habitat is useful and appropriate for management. There was some interest in collaboration to provide additional data and perspective for future work on this topic.

5. ICES-ICCAT joint stock assessment for the northeastern Atlantic porbeagle

The Chair, in conjunction with the lead ICES scientist, reviewed the process leading up to the ICES stock assessment of NE porbeagle in April 2022 and the additional ICES meeting that will follow in June. The Assistant Executive Secretary noted that once ICES has finished its assessment document, then ICCAT would post on the ICCAT webpage the section of the assessment meeting report dealing with the results of the assessment.

SCRS/2022/084 showed that while different parts of the population may undertake different seasonal migrations, the wide-ranging movements and mixing in the Northeast Atlantic support the single-stock hypothesis within the NE porbeagle stock assessment area, extending southwards to 5°N in FAO area 34, as is used by ICCAT. The paper hypothesized that porbeagle sharks found in the Mediterranean Sea were the product of occasional incursions there from the north of the Atlantic Ocean and while it could be included as part of the stock area, the effect of including it is likely to be negligible.

The Group discussed the paper. It was noted that while there had been a discussion at the ICES Working Group on Elasmobranchs (WKELASMO) meeting, regarding data evaluation arguing that there could be some evidence for a second NE stock, the ICES Working Group had decided to use a single NE stock. In addition, there was discussion about the frequency of porbeagle migrations to the Norwegian Sea and it was noted that in the 1950s there were high landings that have never been repeated since. The Group further discussed possible reasons why the northern fisheries have never returned to their previous catch levels: one hypothesis was that it was a unique stock that had been depleted during those early fisheries; an opposing explanation was that it was a seasonal shift in migration. In either case, additional evidence needs to be collected to support either hypothesis.

In a matter related to migration, the Group asked if there was the possibility that there was a resident stock in the Mediterranean Sea. In response it was noted that with the current evidence and limited samples, this was thought to be unlikely.

SCRS/2022/022 reviewed total catches of Northeast porbeagle shark. Following the review of the ICES catch series, the analysis showed that a significant amount of catch had been missing from the ICCAT databases from Denmark and Norway prior to 1960. There were also revisions of the catch series from France. These catch series were revised, adopted and harmonized for the joint ICCAT-ICES stock assessment.

The Group noted the need for a process by which joint working groups would agree which are the best scientific estimates of total removals, as in the case of the Northeast porbeagle stock assessment. It was suggested that the Group approve the harmonized ICES/ICCAT POR NE catch series 1926–2020 for inclusion in the ICCAT databases.

SCRS/2022/042 presented JABBA model diagnostics and stock status estimates for two main Northeast porbeagle stock assessment scenarios: 1) a reference model that was fitted to three biomass indices reviewed by the ICES WKELASMO in 2022 (a Norwegian CPUE based on logbooks of longline vessels targeting porbeagle (1950-1972), a French CPUE also based on longline vessels targeting porbeagle (1972-2009), and a French CPUE based on the personal logbook of a commercial longliner targeting porbeagle (2000-2009) complemented with a survey biomass index conducted in the Bay of Biscay and the Celtic Sea in 2018-2019 [referred to as composite index]); and 2) a full model that also included fits to a historical bycatch CPUE index from the Spanish pelagic longline fleet (1986-2007) presented in the 2009 stock assessment. The results of this analysis suggested that the full model represents the most plausible candidate model.

The Group inquired whether the data inputs had been updated with changes made during the WKELASMO assessment meeting and the author responded affirmatively. The Group also noted that a revised version of the final ICES working document would be needed. An additional comment was made regarding some potential useful additions: 1) set up a base case of JABBA and SPICT parameterized equivalently because this would allow to check if differences were artifacts of model choice; 2) use the package of model diagnostics presented in SCRS/P/2022/023 for both models; and 3) it was noted that JABBA has evolved the capacity to be run as a catch-only model and to incorporate length data. In response to this comment, the authors noted that they had attempted to the extent possible for one model to mimic the other.

Regarding the application of diagnostics, all diagnostics recommended by the ICCAT WGSAM had been run. But the ability to do hindcasting in this case was limited because there were only two data points for the composite survey index series in the last decade, in 2018 and 2019.

SCRS/2022/053 used the SPiCT model with the three biomass indices and the model to present additional analyses using as a base the SPiCT model presented to the WKELASMO assessment meeting. The additional runs included the historical Spanish index described above that was also used in the 2009 joint stock assessment. A comparison of results from the two proposed modeling approaches, SPiCT and JABBA run by ICCAT as well as the SPiCT final accepted model run from ICES, showed that results were quite similar. The stock status of the Northeast porbeagle stock is still overfished but is experiencing very low fishing mortality at present. The paper recommended monitoring programs to confirm the recovery trends of the stock.

It was also noted that while very similar, JABBA and SPiCT are not configured identically and thus some differences in results are inevitable. The Group also discussed the different assumptions about the position of the inflection point of the production curve in JABBA and SPiCT: for the ICES assessment with SPiCT and the ICCAT assessment with SPiCT, the prior for the shape parameter n (which is obtained based on the assumption of where the inflection point of the production curve occurs) was set equal to 2 (or $B_{MSY}/K=0.5$), implying a Schaefer production model to make it more consistent with the life-history of this species, whereas for the ICCAT JABBA assessment the position of the inflection point was fixed at 0.37, implying a Fox production model, which is representative of a more productive species than porbeagle.

SCRS/2022/090 did a preliminary series of closed-loop simulations for NE porbeagle shark to determine the yield, conservation, and variability in effort performance of different Management Procedures (MPs) with different data inputs. While there are model-free MPs that can meet minimum satisficing criteria across a range of risk thresholds, the general pattern was they do so at the expense of yield compared to model-based MPs. Whether MPs be model based or not, an index of abundance would be very useful to support future stock assessment and management.

The Group noted that they had been exploring the effect of assessment frequency in another project with a large coastal shark off the U.S. East coast that showed similar results to those presented for porbeagle, and that some of these results seem somewhat paradoxical.

SCRS/2022/092. To address concerns about hyperstability/hyperdepletion in indices of abundance for the Northeast porbeagle stock, this paper presented a set of simulations across a range of non-linear relationships between CPUE and abundance. These simulations spanned a range of values from hyperstable to hyperdeplete. The paper showed that for model-free MPs, the effect of hyperstability on MP performance is minimal, but that for the model-based MPs, performance is adequate provided that there is not excessive hyperstability or excessive hyperdepletion. A key research area is to analyze the index to determine if there is evidence for hyperstability of hyperdepletion, and to see if such effects can be removed through the standardization.

The Group sought some clarification on why the index-based MPs appeared to be relatively insensitive to the degree of hyperstability. The answer was that the three index-based MPs tested against hyperstability do not change their catch recommendations in direct proportion to the index but rather vary the TAC by adjusting it as the catch in a previous year multiplied by some factor that depends on if the index falls outside its historical confidence intervals, or to the ratio of the mean index in the most recent two years of the time series and the mean index in years from t-3 to t-5. In this way, the index-based MPs tested in the paper are buffered but not totally immune to non-linear relationships between the index and abundance.

Recognizing the need for data for the assessment of the POR-NE assessment, the Group encourages CPCs to develop monitoring programmes (e.g. dedicated surveys or improved use of observer data) or improve existing ones for this stock so that any changes in the trajectory of the stock may be detected and assessment models validated.

The Group discussed what the process would be for generating management advice for POR-NE for the SCRS and finally for ICCAT. Clarifications on the ICES process were provided; the next meeting in June will do an assessment using the model proposed by the WKELASMO. On 26 September 2022, ICES is scheduled to release their formal advice. It was also indicated that ICCAT scientists that are part of ICES member countries can participate in the June meeting. The details on management advice are similar to the usual advice provided by the SCRS where projections and reference points are normally derived from the model(s) that had been adopted by the Group.

Nonetheless, it was indicated that the final assessment model adopted by the WKELASMO integrated both the inputs from ICES and ICCAT throughout the meetings held in 2021 and 2022. In general, all models indicated the same status of the stock in 2020 with biomass still below B_{MSY}, while fishing mortality has been very low since 2010, and in 2020 it was estimated to be about 2% of F_{MSY}. The Group agreed that the advice can be generated based on the single adopted base-case model.

6. Revision of shark bycatch species (as requested by the SC-ECO)

The Subcommittee on Ecosystems and Bycatch (SC-ECO) is in the process of revising the ICCAT list of bycatch species, and to do so, has requested the collaboration of the Group regarding the shark species included on that list. One of the objectives of the SC-ECO is to confirm or correct reporting of rare species as bycatch in tuna fisheries. This action can be done by reviewing the data in the ICCAT database, identifying those records, and contacting the reporting CPC in order to ask for confirmation or correction.

This discussion was linked to point 3.1 of the agenda (Task 1 catch data) related to the long list of other bycatch shark species available in Task 1, and the need to revise this list. Further comments on this issue can be found above in Section 3.1 of the report.

7. Adoption of the updated Shark chapters in the ICCAT Manual

The Secretariat provided an overview of the process related to the update and expansion of Chapter 2 of the ICCAT Manual. In 2021, the Secretariat hired experts to revise the current chapters for the following shark species: blue shark (*Prionace glauca*), shortfin mako (*Isurus oxyrinchus*), porbeagle (*Lamna nasus*), common thresher (*Alopias vulpinus*), bigeye thresher (*Alopias superciliosus*), oceanic whitetip (*Carcharhinus longimanus*), scalloped hammerhead (*Sphyrna lewini*), smooth hammerhead (*S. zygaena*) and great hammerhead (*S. mokarran*). In addition, new species chapters were prepared for the following species: silky shark (*C. falciformis*), longfin mako (*I. paucus*), crocodile shark (*Pseudocarcharias kamoharai*) and pelagic stingray (*Pteroplatytrygon violacea*). These chapters have been translated by the Secretariat and have been made available for revision by the Group, noting that a few formatting issues are still to be addressed, particularly regarding distribution charts. The Secretariat requested that the Group revise these documents and provide feedback on any additional changes and/or information to be included, aiming for the final adoption during the 2022 SCRS Plenary.

The Group acknowledged the updated and new shark sub-chapters to be included in Chapter 2 of the ICCAT Manual and agreed to provide feedback on these, if needed, to the Secretariat by 31 May 2022.

8. Reponses to the Commission

During the meeting, the *Recommendation by ICCAT on the conservation of the North Atlantic stock of shortfin mako caught in association with ICCAT fisheries* (Rec. 21-09) was presented, and paragraphs that need a response to the Commission were discussed. As a first general overview, the Group noted that several of those responses can only be provided in the September meeting of the SCRS Species Groups, after the 2021 catch data have been submitted by CPCs. The Group noted that given the 31 July deadline for reporting the 2021 catches, it may be challenging even to address some of the Commission requests during the 2022 Species Groups Meeting in September.

It was also mentioned that the request of determining if described methods "are not scientifically sound" and that data reported or estimated are "inappropriate for inclusion" is a difficult task, that needs a careful review of the methodologies.

The Group recommended establishing a small working group, to work on these responses between now and the September Species Group meeting, in order to have a first draft ready for revision at that time. Nonetheless, some preliminary notes reflective of the group discussion at this meeting are provided here.

8.1 SCRS and Panel 4 shall work together to test and confirm the appropriateness of the process to determine possible retention. Rec. 21-09, para 5a

Background: *During 2022 and 2023 the SCRS and Panel 4 shall work together to test and confirm the appropriateness of the approach in Annex 1, or alternative approaches, for determining the amount of permissible retention of North Atlantic shortfin mako in the future. Any alternative approaches shall take into consideration, among other factors, the relative contributions made by CPCs to conserve, manage, and rebuild the stock (including a CPC's performance in reducing its mortality in line with the objectives of previous ICCAT Recommendations 17-08 and 19-06) and other criteria as set out in Resolution 15-13, as well as the need to continue to incentivize individual CPC accountability to achieve fishing mortality reductions in line with the objectives of this rebuilding program. To assist with this work, the SCRS shall, as appropriate, provide to the Commission estimates of post release mortality and, where needed, estimates of dead discards, taking into account data submitted by CPCs and other relevant information and analyses.*

It was discussed that in order to test the appropriateness of the approach of Annex 1 of Rec 21-09, the Group has to work with the 2021 data required under Rec. 21-09, and that cannot be done until those data are reported in July 2022. It is important that CPCs provide complete Task 1 data of shortfin mako retained catch, dead discards, and live releases. Furthermore, as requested in paragraph 13 of the Recommendation, it is also important that a document describing the statistical methodology used by CPCs to estimate dead discards and live releases be provided. If a CPC's reporting of retained catch, dead discards, and/or live releases is incomplete or estimates are not considered to be scientifically sound, then the default approach by the SCRS for filling in the data gaps will be to assume that interaction levels (i.e. retained catch + dead discards + live releases) are the same as in recent levels (e.g. average of prior 3 years). Under a retention ban, it would be assumed that the discards would be at the same level as the total interactions from those previous years. At-haulback mortality rates would be applied to estimate discarded dead and live releases, with a post-release mortality rate applied to the live releases in order to calculate total mortalities.

If a CPC considers that it has altered fishing practices in a way that reduces interactions with shortfin mako or reduces mortality, then it should provide documentation describing those changes as well as data that would permit quantifying their effect.

For post-release mortality and at-haulback mortality, the Group agreed to explore and propose a set of values to be used for this exercise and to present these to the Species Group meeting in September 2022.

8.2 SCRS to calculate possible retention allowed in 2023 and provide the results to the Commission. Rec. 21-09, para 5b

Background: *Notwithstanding paragraph 3, in 2022, the SCRS will use Annex 1 to calculate possible retention allowed in 2023 and provide the results to the Commission, which shall then validate the amount of any permissible retention in 2023.*

As mentioned above, in the general review of the Recommendation, this paragraph cannot be responded to before the 31 July 2022 deadline for CPCs to submit information to ICCAT. CPCs will have to produce by 31 July their reported catches, as well as estimates of dead discards and live releases, with the respective methodology. If that is not done, then an approach as drafted in the previous response (see item 8.1 above) can be used by the SCRS for estimating discards.

8.3 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. 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 programs. 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.*

A presentation was given on the reporting methods used by Canada for shortfin mako catches (SCRS/2022/094). Reporting from 1995-2014 was landings exclusively, from all national and international fleets. Shark condition at landing began to be evaluated in 2010, but for pelagic longline exclusively. Discards from at-sea observer (ASO) data were first included in 2015, and 100% reporting in a bycatch logbook for pelagic longline (PLL) was introduced in 2018. Nine analytical approaches to estimate fleetwide bycatch from ASO data are in development, encompassing simple mean estimators, to complex spatiotemporal models. Preliminary results suggest that overall predictive ability is low for the suite of models. Moreover, a single analytical approach is not optimal for all years. Nearest-neighbor interpolation has the best predictive ability in cross-validation. While Canada intends to use model estimates in future years, reporting of the 2021 data will represent a sum of at-sea observer records (all fleets) and bycatch logbook records (for pelagic longline only).

The Group noted that some CPCs have already submitted documents describing how they estimate their discards. For example, the United States submitted a document (Brown *et al*., 2001) describing these methods. The Secretariat agreed that it would compile documents that CPCs have submitted historically and those documents that were submitted by 31 July 2022 and make these available to the Group. CPCs were encouraged to update discard estimate procedures where relevant to take into consideration, where applicable, changes in management regimes.

The Group acknowledged that the work 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. In addition to those methodologies that have already been assessed by the SCRS, in the event that other methodologies are presented by other CPCs between now and 31 July, the Sharks Species Group will work intersessionally to do an initial review of such methods.

Additionally, the Group recommended that the WGSAM start to analyze methodologies in general for estimating dead and live discards, including those that apply to this shortfin mako recommendation, but also to other species groups like billfishes (see recommendations section). Species Groups would remain responsible for reviewing specific method to be applied in specific situations.

8.4 SCRS shall evaluate the completeness of Task 1 and 2 data submissions, including estimates of total dead discards and live releases. Whenever appropriate the SCRS shall inform the Commission on CPCs providing inappropriate data for inclusion in the calculation of the retention allowance and shall estimate dead discards and live releases for those CPCs for use in the retention allowance calculation. Rec. 21-09, para 15

Background: *The SCRS shall evaluate the completeness of Task 1 and 2 data submissions, including estimates of total dead discards and live releases. If, after conducting this evaluation, the SCRS determines that significant gaps in data reporting exist, or, following the review in paragraph 13, that the methodology used by one or more CPCs to estimate dead discards and live releases is not scientifically sound, the SCRS shall inform the Commission that the data for those CPCs are inappropriate for inclusion in the calculation of the retention allowance. In this case, the SCRS shall estimate dead discards and live releases for those CPCs for use in the retention allowance calculation.*

This is related to the answers provided above with regards to paragraph 5a (see item 8.1). A possible method for such CPCs that do not provide discards data is drafted under section 8.1 of this report.

8.5 The SCRS shall continue to prioritize research, together with the benefits and disadvantages for the objectives of the rebuilding programme, and identify other areas deemed helpful both to improving stock assessments and reducing shortfin mako mortality. Rec. 21-09, para 19

Background: *The SCRS shall continue to prioritize research into: identifying mating, pupping and nursery grounds, and other high concentration areas of North Atlantic shortfin mako; options for spatial-temporal measures; mitigation measures (inter alia, gear configuration and modification, deployment options), together with the benefits and disadvantages for the objectives of the rebuilding programme, aimed at further improving stock status; and other areas the SCRS deems helpful both to improving stock assessments and reducing shortfin mako mortality. In addition, CPCs are encouraged to investigate at-vessel and post-release* *mortality of shortfin mako including, but not exclusively through, the incorporation of hook-timers and of satellite tagging programs.*

The basis for this response could be the outputs that have been produced from the SRDCP. The Group will work intersessionally and will draft a response taking that into account. The Group has recommended an SRDCP workshop take place in early 2023 (see recommendations section). Additionally, it was also noted that some information might be provided by the SC-ECO Sub-group on Technical Gear Changes, that will report later in May to the Subcommittee.

8.6 The SCRS shall launch a pilot project to explore the benefits of installing mini data loggers on the mainline and on the branch lines of longline fishing vessels targeting ICCAT species that have potential interactions with shortfin mako sharks, and shall provide guidance on the basic characteristics, minimum number and positions to install the mini data loggers. Rec. 21-09, para 20

Background: *Taking into account that hotspots of incidental catches may occur in areas and periods with specific oceanographic conditions, the SCRS shall launch a pilot project to explore the benefits of installing mini data loggers on the mainline and on the branch lines of longline fishing vessels which participate in the project on a voluntary basis targeting ICCAT species that have potential interactions with shortfin mako sharks. The SCRS shall provide guidance on the basic characteristics, minimum number and positions to install the mini data loggers with a view to have a better understanding of the effects of the soaking time, fishing depths and environmental characteristics underpinning higher incidental catches of shortfin mako.*

No information was presented to the Group on this issue. A study such as this could be long-term and take several years to complete, so the Commission should not expect such a project to be undertaken quickly. The Group agreed that a small group would explore the process for how it would address this request. As a possible starting point the small working group could review studies that have already used mini data loggers and present the results of that review to the Group. The Chair agreed to contact the Group members to solicit their interest in being part of this small group.

8.7 The SCRS shall review the reported landings and discards of longfin mako shark to identify inconsistencies from misidentification between the two mako species, for the purpose of formulating management advice. Rec. 21-09, para 22

Background: *The SCRS shall review the reported landings and discards of longfin mako shark to identify any unexpected inconsistencies that could be the result of misidentification between the two mako species, for the purpose of formulating management advice.*

The Group agreed to address this matter during the September 2022 Sharks Species Group meeting.

9. Recommendations

The Group recommends an in-person workshop in early 2023 to review the SRDCP status and establish the objectives for the next phases. Dates and budget (if need be) will be determined at the September 2022 Sharks Species Group meeting.

As a result of changes in the shark data reporting requirements over time, significant gaps in historical shark data still remain in the ICCAT-DB. Therefore, the Group once again reiterates its previous recommendations that National Scientists review the SCRS reports cards to identify shark data gaps and submit missing data to the Secretariat to comply with ICCAT's shark data submission requirements.

The Group recommends that National Scientists from those CPCs that in the past have reported shark data as part of a species complex (e.g. coastal sharks) explore the possibility of re-submitting the data at the species level.

The Group recommends that the Secretariat undertake an analysis of catch data for longfin mako shark as per Rec. 21-09 as it has for other species.

The Group recommends that the Subcommittee on Statistics identify the best procedure to report missing T2-CE shark data, so as to avoid duplications of fishing effort with the T2-CE data for other species that have already been submitted and included in the ICCAT-DB.

The Group recommends that WGSAM review the various methodologies that have been presented by various CPCs on how they estimate dead discards and live releases. This applies to the new SMA recommendation and also to the BIL requests for discards estimates. The Group will continue to evaluate if the estimates that have been produced are scientifically sound.

Over the past years the cooperation between ICCAT and ICES has been recommended by both organizations, particularly regarding sharks/elasmobranchs Working Groups. Recently there has been scope to improve collaboration between the two organizations, namely regarding the joint assessment of porbeagle shark stocks. The Group agreed that improving coordination between ICES and ICCAT would be desirable and recommended the Secretariat to work with the ICES Secretariat in drafting a Memorandum of Understanding between the two organizations in the near future.

The Group recommends working with the WGSAM to investigate methods for model validation, diagnostics for identifying model uncertainties, biases, and misspecification that can be applied within and across model structures, and guidelines for developing model ensembles. The Group in collaboration with the WGSAM will consider using the blue shark assessment, to be conducted in 2023, as a test case.

10. Other matters

SCRS/2022/083 highlighted that longfin mako (*Isurus paucus*) is a rarely encountered data-limited species, for which suspected declines have resulted in the International Union for the Conservation of Nature (IUCN) considering this species to be classified as Endangered. Available biological data and ICCAT Task 1 catch data show that despite the apparent rarity of longfin mako, mean annual reported catches have increased from 11.7 t y^{-1} (1990–1999) to 44.1 t y^{-1} (2000–2009) and 134.9 t y^{-1} (2010–2019). Some of these apparent increases could be due to errors in the data like coding errors. The paper recommended that there be a more focused effort on checking the reported data against observer data as well as comparing CPC data and RFMO data to ensure that these data are correctly reported in Task 1 data at ICCAT (as per paragraph 22 of Rec. 21-09). The utility of more coordinated and collaborative studies to better understand the status of rarer pelagic sharks was also highlighted.

The Group noted that the kinds of anomalies observed in the longfin mako catch data were common across CPCs and especially in the case of rare species that can often suffer from misidentification, as well as the potential for input errors in relation to, for example, species-codes.

SCRS/2022/096 studied the reproductive biology of *Isurus oxyrinchus* in the Southwest Atlantic through the description of primary and secondary sexual characteristics and by determining the mean length at maturity calculated with a Bayesian approach to the logistic model. Individuals were sampled onboard commercial pelagic longline vessels operating off southern Brazil between November 2020 and July 2021. The lengths of the specimens ranged from 115 to 295 cm, and from 141 to 239 cm for females and males, respectively. Quantified parameters (e.g. gonad weight) were used to corroborate maturity staging. The preliminary estimates of the lengths at maturity were about 286 cm total length (cf. 273-297 cm in some previous studies) for females, and at about 197 cm (cf. 180-194 cm in some previous studies) for males. These reproductive parameters were slightly different from some estimates from other oceanic regions, although this could be an artefact of low sample sizes. Given the low sample sizes, especially for mature females, the authors suggested the need for more collaborative work.

The authors invited all of those who have information of this species, mainly from the South Atlantic, to participate in this study. Uruguay will review their available information and will contact the authors.

11. Adoption of the report and closure

The report was adopted during the meeting and the meeting was adjourned.

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Table 1. Task 1 nominal catches (in *t*, landings + dead discards) of the main shark species (BSH, POR, and SMA) by stock (BSH and SMA: AN - North Atlantic; AS - South Atlantic; POR: NE - Northeast Atlantic; NW - Northwest Atlantic; SE - Southeast Atlantic; SW - Southwest Atlantic) and year. The Mediterranean Sea region (MD) is also presented for the three species.

	BSH (*Prionace glauca*)			POR (*Lamna nasus*)					SMA (*Isurus oxyrinchus*)		
Year	AN	AS	MD	NE	NW	SE	SW	MD	AN	AS	MD
1950				3262					106		
1951				2381					71		
1952				2209					71		
1953				1916					88		
1954			6	1595				6	22		
1955			9	1599				7	45		
1956			11	1272			1	6	27		
1957			13	1800			1	6	73		
1958			9	2290			8	3	61		
1959			5	2395			42	3	80		
1960			3	2841			52	1	53		
1961			11	1667	1924		53	2	124		
1962			8	871	3017		82	2	168		
1963			5	341	6593		154	1	73		
1964			17	400	9302		162	5	132		
1965			13	416	5208		146	8	105		
1966			10	433	2150		37	3	219		
1967			10	520	646		28	2	197		
1968			7	730	1084		64	2	260		
1969			5	1023	1097		392	2	256		
1970			6	484	926		463	0	231		
1971			9	1175	563		104	0	359	97	
1972			16	1652	393		171	2	350	60	
1973			13	965	361		107	4	341	212	
1974			10	735	88		116	2	518	67	
1975			11	1116	143		82	3	618	76	
1976			11	1188	473		91	2	290	30	
1977			7	833	475		129	3	478	252	
1978	4		8	1033	250		146	3	417	168	
1979	12		9	1280	469		163	2	234	299	
1980			11	1180	579		153	1	525	324	
1981	204		11	1039	514		247	1	1097	375	
1982	9		7	338	339		267	1	1332	974	
1983	613		6	905	366		289	1	1248	512	
1984	121		5	564	281		304	1	1591	745	
1985	380		8	452	355		320	1	3781	786	
1986	1494		6	439	462		420	0	3689	609	
1987	1629		26	403	580		348	1	3243	386	12
1988	1843		3	569	554		383	0	2926	1032	
1989	1818		2	461	627		341	1	2170	1546	
1990	3038		1	679	696		328	0	2389	1255	
1991	4306	8	3	467	1586		256	1	2296	1062	
1992	3561	107	1	637	2021		385	0	3233	1183	
1993	9591	10	0	777	1475		213	0	4114	1743	
1994	8592	2704	6	1045	1726		284	0	3659	2182	
1995	8468	3108	8	749	1424		170	0	5306	3100	
1996	7396	4252	2	428	1212	3	327	1	5306	2395	0
1997	29285	10145	150	444	1432	19	159	0	3534	2187	6
1998	26764	8797	63	371	1144	1	261	1	3845	2008	8
1999	26172	10829	22	424	1047	6	172	0	2858	1606	5
2000	28170	12448	45	567	988		214	1	2587	2588	4
2001	21128	14044	47	506	574	1	141	1	2677	2107	7
2002	20066	12682	17	610	282	1	181	0	3426	2103	2
2003	23006	14966	11	527	164	9	187	0	3987	3235	2
2004	21741	14440	125	578	264	3	105	3	4000	2526	2
2005	22359	20642	72	367	237	1	133	2	3695	3259	17
2006	23218	20493	178	302	217		122	1	3574	3036	10
2007	26927	23487	50	421	101	5	143	0	4158	2786	2
2008	30725	23097	81	391	141	30	55	2	3800	1881	1
2009	35199	23459	185	349	84	37	26	1	4541	2063	1
2010	37239	27799	216	21	114	6	10	1	4782	2486	2
2011	38092	35069	40	14	85	7	14	0	3720	3258	2
2012	36602	26421	42	25	162	26	12	1	4437	2905	2
2013	36806	20672	100	10	284	29	0	0	3603	2183	0
2014	36579	26148	235	5	35	38	0	0	3467	3274	0
2015	39627	22498	665	8	93	3	0	0	3281	2774	0
2016	44068	25417	729	9	30	1	0	1	3356	2765	0
2017	39664	28373	105	8	39	0	0	1	3119	2786	0
2018	33964	34309	58	4	19	4	0	0	2373	3158	1
2019	27198	34743	64	0	16	0	0	0	1882	2309	0
2020	20997	33652	73	3	11	0	0	0	1718	2855	0

Table 2. Task 1 reported dead discards (DD, in t) of BSH, POR and SMA by flag and year.

Species	FlagName	1987	1988	1989	1990	1991	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
BSH	Brazil																					60	14												
	Canada																												0	5	16	32	71	4	193
	Chinese Taipei																									4	146	142	118	141	166	235	127	176	195
	Curaçao																															2			
	El Salvador																															1			
	EU-España																													0		1			
	EU-France																													6		1	0	0	
	Guatemala																															1			
	Japan																																	284	464
	Korea Rep																										0		0	18	2	46	2	44	2
	Panama																															1			
	Russian Federation																															0	0		
	South Africa																												1						
	UK-Bermuda									3	1			8										0	0	0			0		0				0
	USA	526	421	480	741	772	184	1136	572	618	711	185	195	101	137	106	68	55	65	66	45	54	130	103	167	206	106	99	122	82	43	42	11	20	24
BSH Total		**526**	**421**	**480**	**741**	**772**	**184**	**1136**	**572**	**621**	**712**	**185**	**195**	**109**	**137**	**106**	**68**	**55**	**65**	**66**	**45**	**114**	**144**	**103**	**167**	**210**	**252**	**241**	**242**	**252**	**227**	**362**	**212**	**528**	**878**
POR	Barbados																						0	0	0	0	0	0	1	4	1	1	1		
	Canada																												1	2	3	2	3	3	5
	Chinese Taipei																						0	0	2	0	1	1	1	11	4	0		0	
	Curaçao																															0			
	El Salvador																															0			
	EU-España																															0			
	EU-Germany																																		0
	Guatemala																															0			
	Japan																						0	1	4	0	1	1	1	5	1	1			
	Korea Rep																						0	0	0	0	1	0	0						
	Panama																															0			
	UK-Bermuda																																		0
	Uruguay												1	1																					
	USA						2		1														0	2	3	1	1	2	7	34	1	9	1	0	
	Venezuela																						0	1	2	0	1	1	3	14	4	7	4		
POR Total							**2**		**1**				**1**	**1**									**1**	**4**	**11**	**2**	**5**	**6**	**14**	**69**	**15**	**21**	**9**	**3**	**6**
SMA	Brazil																					12	0												
	Canada																													0	1	0	2	1	20
	China PR																																	20	3
	Chinese Taipei																									0	9	0	3	3	4	4	5	3	2
	Curaçao																															0			
	El Salvador																															0			
	EU-España																													0		1			
	EU-France																													0	1	0	1	1	0
	EU-Portugal																																		1
	Guatemala																															0			
	Japan																																	31	32
	Korea Rep																													1	0	0		5	
	Mexico									1												0					0			0	0	0	0		
	Panama																															0			
	Russian Federation																															0	0		
	UK-Bermuda													2																					
	USA	9	5	9	10	11	38	24	21	28	1											7	10	20	2	9	18	5	11	8	6	4	2	1	3
SMA Total		**9**	**5**	**9**	**10**	**11**	**38**	**24**	**21**	**29**	**1**			**2**								**18**	**10**	**20**	**2**	**9**	**28**	**5**	**14**	**13**	**11**	**10**	**9**	**63**	**60**

Table 3. Task 1 reported live releases (DL discarded live, in t) of BSH, POR and SMA by flag and year.

Species	FlagName	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
BSH	Brazil		327	13												
	Canada										113	132	239	591	446	865
	Curaçao												4			
	El Salvador												4			
	EU-España										4	2	2			
	EU-France										6		1	1	1	0
	Guatemala												3			
	Korea Rep											50	44	107	12	1
	Mexico									0		0				0
	Panama												3			
	Russian Federation															0
	South Africa								0	2						
	UK-Bermuda				2	1	2	0	0	0	1	1		0	1	4
BSH Total			**327**	**13**	**2**	**1**	**2**	**0**	**0**	**2**	**123**	**185**	**301**	**699**	**459**	**870**
POR	Canada										11	24	25	56	47	24
	Curaçao												0			
	El Salvador												0			
	EU-Denmark															0
	EU-España												0			
	EU-France										0					
	Guatemala												0			
	Korea Rep											0			0	
	UK-Bermuda															0
POR Total											**11**	**24**	**26**	**56**	**48**	**24**
SMA	Brazil		16	0												
	Canada										1	2	2	28	12	81
	China PR														7	4
	Curaçao												1			
	El Salvador												1			
	EU-España												2			
	EU-France										0	1	0	1	1	0
	Guatemala												1			
	Japan															18
	Korea Rep											1	1			
	Mexico	0	0	0	0	0	0	0		0	0	1	2	0	1	1
	Panama												1			
	UK-Bermuda														0	0
	USA														24	31
SMA Total		**0**	**16**	**0**	**0**	**0**	**0**	**0**		**0**	**2**	**6**	**10**	**29**	**45**	**135**

Table 4. Task 1 nominal catches (landings plus dead discards, in t) of the (a) major shark species (3 species), and (b) other bycatch species (60+ species, genus, families, or groups of species). Lines shaded in orange represent records that are coarser levels of taxonomic classification as identified in the Group type column (see section 3.1 for further details).

Species group	Scientific name	Species code	Group type	In ICCAT list (y/n)	1950 ...	1960 ...	1970 ...	1980 ...	1990	1991	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
4-Sharks (major)	Isurus oxyrinchus	SMA	majorSP	yes	644	1586	5099	28902	3645	3358	4416	5856	5841	8406	7701	5727	5861	4469	5179	4792	5531	7225	6528	6970	6620	6946	5682	6605	7269	6980	7344	5786	6741	6055	6121	5905	5532	4190	4573
	Lamna nasus	POR	majorSP	yes	20803	41462	16197	14087	1702	2311	3043	2465	3054	2343	1971	2055	1779	1649	1769	1223	1075	887	954	740	642	671	619	496	152	121	225	323	78	104	41	48	27	16	14
	Prionace glauca	BSH	majorSP	yes	53	89	118	8196	3039	4318	3669	9602	11301	11585	11651	39580	35624	37023	40664	35220	32765	37983	36306	43072	43889	50464	53903	58843	65254	73200	63064	57578	62961	62791	70214	68142	68331	62005	54722
5-Sharks (other)	Alopias pelagicus	PTH	Species	no																						0	7	3	0	0		1	1	0	0	0	0	0	2
	Alopias spp	THR	genusGrp	yes				435	62	42	60	38	65	60	98	140	102	112	172	90	32	70	47	90	36	58	109	26	69	117	213	140	210	172	286	127	103	96	89
	Alopias superciliosus	BTH	Species	yes								20	18	39	14	185	114		43	108	114	133	121	74	83	131	108	135	50	20	81	35	32	27	24	30	13	15	19
	Alopias vulpinus	ALV	Species	yes				30				2	7	9	0	30	46	1	15	25	136	30	65	104	109	158	70	148	51	42	15	69	75	167	409	347	139	145	157
	Apristurus spp	API	genusGrp	no																							0	1	0	0	0	1	0						
	Carcharhinidae	RSK	familyGrp	yes					389	375	1034	1016	1720	998	1586	425	1084	1133	1714	2103	1546	4021	2106	5998	1581	3156	2348	1779	1442	1970	3814	23	1137	1932	710	216	124	79	140
	Carcharhinus acronotus	CCN	Species	no																			49										0						
	Carcharhinus albimarginatus	ALS	Species	no																									0	0									
	Carcharhinus altimus	CCA	Species	no							5						1					0	43			0	0	0	0				0	0			0	0	0
	Carcharhinus brachyurus	BRO	Species	no																1				1	2	3	8	1	51				0	0			0	0	0
	Carcharhinus brevipinna	CCB	Species	no							1		1		22	7	5	6	3	1	0	0	19					0			0	3	0				0	0	
	Carcharhinus falciformis	FAL	Species	yes				0		13	341	139	92	127	531	343	33	140	118	42	358	476	316	74	7	232	31	70	1	104	63	123	37	170	149	421	554	288	336
	Carcharhinus galapagensis	CCG	Species	yes										10	5	4	6		10							0		1	0				0	0			0	2	1
	Carcharhinus isodon	CCO	Species	no																			0																
	Carcharhinus leucas	CCE	Species	no				0		0	19	3	8	7	1	0	0		7	0	123	375	138	1	0	0	11	0	0	9	2	0	0	0	0	0	0		0
	Carcharhinus limbatus	CCL	Species	no				32	7	13	40	20	120	44	50	206	21	24	101	34	107	53	219	565	42	58	62	48	12	6	5	24	9	0			0	0	0
	Carcharhinus longimanus	OCS	Species	yes				2	0	0	8	11	10	14	8	12	15	2	642	543	205	179	189	82	78	36	246	54	132	6	4	4	6	1	3	10	2	2	2
	Carcharhinus melanopterus	BLR	Species	no																						0			0						0	0			
	Carcharhinus obscurus	DUS	Species	no				1	2	1	64	36	270	80	52	48	54	38	48	1	2	0	0			19	2	15	0	15	8	5	4	0			0	0	0
	Carcharhinus plumbeus	CCP	Species	no				0	0	1	111	61	146	327	468	343	154	149	174	181	121	120	49	60	40	12	2	22	5	8	4	6	0	0			0	0	0
	Carcharhinus porosus	CCR	Species	no												23			192	114	306			130	10		0	0					0						
	Carcharhinus signatus	CCS	Species	no								0	3	1	0	21	23	27	91	30	9	24	0			13	42	35	47	13	34	6605	1	0	0	0	0	0	0
	Carcharias taurus	CCT	Species	no								0										2	0	5	0	1	52	4	3	7	5	0	0						
	Carcharodon carcharias	WSH	Species	yes				5	2	3													0	8		177			18	92	13	25	7				0		
	Centrophorus granulosus	GUP	Species	no	2	17	31	47	49	13	10	17	12	18	5	5	4	4	4	95	9	0	65	143	266	312	176	27	7	2	1	1	1		1	1			
	Centrophorus lusitanicus	CPL	Species	no																				0	0	218	274	438	271	434	531	488	0						
	Centrophorus spp	CWO	genusGrp	no																																	1	1	
	Centrophorus squamosus	GUQ	Species	no																1			801	538	758	333	208	256	149	3	0	0	0						
	Centroscyllium fabricii	CFB	Species	no																			56	4		6	133	90	81	0	0		0						
	Centroscymnus coelolepis	CYO	Species	no																13			708	752	754	704	549	155	118	1		0	0						
	Centroscymnus crepidater	CYP	Species	no																			7	9	418	144	39	33	2										
	Cetorhinus maximus	BSK	Species	yes													0		1	200	135	319		224	16	11	2	0	0	2	24	0	0		5	1	7	2	3
	Coastal Sharks nei	CXX	unkn	no				981	218	204	199	112	483	289	177	98	154	22	32																				
	Dalatias licha	SCK	Species	no									1	0										354	42	5	17	2	7	10	0		15	0					
	Dasyatidae	STT	familyGrp	yes																													8		4	3	5	3	9
	Deania calcea	DCA	Species	no																				153	97	46	74	27	4	1		0	0						
	Echinorhinus brucus	SHB	Species	no																				0	1	1		2	1	0	1	0							
	Etmopterus princeps	ETR	Species	no																							20	0	0	0	0		0						
	Etmopterus spinax	ETX	Species	no																						8		1	0	1	0	19	0						
	Etmopterus spp	SHL	genusGrp	no																				0	0					0	0								
	Galeocerdo cuvier	TIG	Species	no				12	4	7	13	11	10	20	5	5	9	1	13	10	4	4	22	1	8	65	65	69	23	92	58	20	23	3	3	2	1	1	1
	Galeorhinus galeus	GAG	Species	no											93	100	90	89	110	66	38	141	862	1172	768	822	745	843	371	336	187	337	21				43	4	2
	Galeus melastomus	SHO	Species	no									1	0	1	1	0	2	2	2	1	0	0	52	31	42	16	22	13	4	1	22	0						
	Galeus spp	GAU	genusGrp	no																								0		0	0		0						
	Ginglymostoma cirratum	GNC	Species	no																0		2	30	2	3	4	1	3	3	4	5	3	7	3	5	10	1	2	
	Heptranchias perlo	HXT	Species	no																										0	0						1		
	Hexanchus griseus	SBL	Species	no				17	5	3	2	6	8	3	3	4	5	4	5	7	10	6	5	17	21	60	5	10	21	21	25	62	0				32	36	35
	Isurus paucus	LMA	Species	yes				8	1	1	29	8	18	17	3	29	10	2	20	51	67	63	52	0	1	65	15	109	79	91	154	130	94	316	114	98	163	109	14
	Lamna ditropis	LMD	Species	no																						0		0	0	0	0	0	0	0			0	0	0
	Lamnidae	MSK	familyGrp	yes															254								69	8									0	0	
	Manta birostris	RMB	Species	yes																													0	0	1	2	2	2	1
	Mitsukurina owstoni	LMO	Species	yes																																	0		
	Mobula japanica	RMJ	Species	yes																														0		4			
	Mobula mobular	RMM	Species	yes																														0		8	2	4	0
	Mobula tarapacana	RMT	Species	yes																																		0	3
	Mobula thurstoni	RMO	Species	yes																																			0
	Mobulidae	MAN	familyGrp	yes																																6		0	
	Mustelus asterias	SDS	Species	no																				10	23	31	9	16	7	22	29	42	8						
	Mustelus henlei	CTK	Species	no																1908										2									
	Mustelus mustelus	SMD	Species	no					398	462	386	437	690	379	596	158	100	155	255	4019	78	143	109	107	277	258	275	387	352	1185	412	441	370						
	Mustelus schmitti	SDP	Species	no											0	0	0	0	0	0	0	0	0	0					0				0						
	Mustelus spp	SDV	genusGrp	no																76		71	2477	2588	432	3180	3382	220	3605	3753	821	2859	172		172	172	172	172	172
	Negaprion brevirostris	NGB	Species	no																		0	53		0	0	0	0	0	0		0	0		0				
	Notorynchus cepedianus	NTC	Species	no																									0										
	Oxynotus centrina	OXY	Species	no																				38	244	100	63	76	50	15	3	4	0						
	Oxynotus paradoxus	OXN	Species	no																						1					1								
	Pelagic Sharks nei	PXX	unkn	no									661	633	275	1011	85	440	79																				
	Pseudocarcharias kamoharai	PSK	Species	yes																						0	0			0	0	0	0	1					
	Pseudotriakis microdon	PTM	Species	no																								17					0						
	Pteroplatytrygon violacea	PLS	Species	yes																												1	3	2	4	12	33	21	19
	Rhincodon typus	RHN	Species	yes																									0	0				0		0	0	0	0
	Rhizoprionodon acutus	RHA	Species	no					52	9	7	12	5	5	12	0	5	10	20	138	11	23	1	11	16	5	0	68	0	6	3		0						
	Rhizoprionodon terraenovae	RHT	Species	no							2								22		0		144		1681	988		370	384				0		0				
	Scyliorhinidae	SYX	familyGrp	no																			133		4	13	5	24	12	28	129	56	56						
	Scyliorhinus canicula	SYC	Species	no									1	1	1	1	2	1	1	1	0	0	5648	5792	141	5937	5422	3052	6152	5568	1847	6167	524						
	Scyliorhinus spp	SCL	genusGrp	no				17	4	2	1	2	1	1	1	1	2	2	3	2	2	0	42	526	336	370	139	1929	645	411	273	463	0						
	Scyliorhinus stellaris	SYT	Species	no																			181	405	425	171	596	652	707	689	313	705	0						
	Scymnodon obscurus	SYO	Species	no																										0									
	Scymnodon ringens	SYR	Species	no																						178	117	94	121	4	1	0	0						
	Selachimorpha(Pleurotremata)	SKH	unkn	yes				427	36	23	295	310	2780	4620	3255	2880	4634	1279	687	113	13	64	31	34	59	503	1237	137	2250	550	1513	607	867	570	282	1013	310	5751	285
	Somniosus microcephalus	GSK	Species	no								41	42	43	61	73	87	51	45	57	56	55	58	54	33	2	45	26	52				0						
	Somniosus rostratus	SOR	Species	no																								0	0	1									
	Sphyrna lewini	SPL	Species	yes							363	14	33	93	50	185	16	23	272	319	16	22	20	0		0	56	63	0	21	1	3	35	34	40	344	15	15	54
	Sphyrna mokarran	SPK	Species	yes							19	2	4	1			1						0		0	1	1	1	7	0	14	2	5	5	2	9	2	0	3
	Sphyrna spp	SPN	genusGrp	yes				483	303	292	238	257	318	254	230	1009	889	166	690	2018	583	1003	917	599	474	657	337	435	219	609	528	48	1304	485	519	346	355	346	354
	Sphyrna tiburo	SPJ	Species	no																			77										0						
	Sphyrna zygaena	SPZ	Species	yes				3	0	0	4	0	3	1	42	83	48	38	40	38	44	58	40	56	360	57	6	17	9	190	168	459	4	25	5	13	2	13	4
	Sphyrnidae	SPY	familyGrp	yes																			0				198		2	13	403	0	4		244	38	43	244	
	Squalidae	DGX	familyGrp	no					3	2	0	0	0	0	0	0	1	1	0	8	519	0	19	849	27	764	122	213	269	425	308	151	316						
	Squalidae / Scyliorhinidae	DGH	familyGrp	no															13	40	10			5	309	300	222	2714	372	578	119	87	78						
	Squaliformes	SHX	unkn	no				605	346	273	319	289	326	755	3138	1286	6743	6422	6616	8974	8083	7164	9594	8492	3503	3681	4554	2869	195	26	16	15	8	1	0	1	1	0	
	Squaliolus laticaudus	QUL	Species	yes																														133	83	50	10	17	48
	Squalus acanthias	DGS	Species	no								109	97	166	157	106	78	57	97	1826	1519	1321	1962	3253	2081	1372	749	1035	548	231	39	41	0						
	Squalus blainville	QUB	Species	no	99	203	306	418	36	15	26	33	29	24	28	28	23	18	19	17	24	17	20	19	15	20	19	13	21			21							
	Squalus megalops	DOP	Species	no																	379			0						0			0						
	Squalus spp	DGZ	genusGrp	no																564	14	58	108	0				0	45	17	62	56	0						
	Squatina squatina	AGN	Species	no	26	16	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	0	1	0	1	2	1	0	0	0						
	Squatinidae	ASK	familyGrp	no																				10	8	8	10	3	6	375	0		0						
	Triakidae	TRK	familyGrp	no																				0			0	1	0			0	0						
	Triakis semifasciata	LES	Species	no																										0									
TOTAL					21626	43374	21750	54712	10304	11743	14722	20932	28177	31369	32289	56214	57907	53558	60242	63164	55951	62113	71392	84248	66769	83577	83277	84813	91743	98434	82885	84063	75222	72998	79442	77380	76027	73579	61062

Table 5 [a - h]. Standard SCRS catalogues on statistics (Task 1 and Task 2) of the 3 major ICCAT shark species by stock, major fishery (flag/gear combinations ranked by order of importance) and year (1991 to 2020). Only the most important fisheries (representing ±97.5% of Task 1 total catches) are shown. For each data series, Task 1 (DSet= t1, in t) is visualized against its equivalent Task 2 availability (DSet= t2) scheme. The Task 2 color scheme has a concatenation of characters ("a"= T2CE exists; b= T2SZ exists; c= CAS exists) that represents the Task 2 data availability in the ICCAT-DB system. See the legend for the color scheme pattern definitions.

Table #	Fishery
5a	BSH-N stock
5b	BSH-S stock
5c	POR-NE stock
5d	POR-NW stock
5e	POR-SE stock
5f	POR-SW stock
5g	SMA-N stock
5h	SMA-S stock
not shown	BSH-M region
	POR-M region
	SMA-M region

LEGEND and color schemes used to show Task 2 (t2) availability

character	represents
a	T2CE
b	T2SZ
c	T2CS (*)

(*) Only 6 species require T2CS data: ALB, BFT, BET, YFT, SKJ, SWO

color scheme	
Concatenated string	represents
-1	no T2* data
a	T2CE only
b	T2SZ only
c	T2CS only
bc	T2SZ + T2CS
ab	T2CE + T2SZ
ac	T2CE + T2CS
abc	all

All catalogues: possible gap in T1NC

Table 5a. BSH-N stock

Species	Stock	Status	FlagName	GearGrp	DSet	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
				T1 Total		4306	3561	9591	8592	8468	7396	29285	26764	26172	28170	21128	20066	23006	21741	22359
BSH	ATN	CP	EU-España	LL	t1							24497	22504	21811	24112	17362	15666	15975	17314	15006
BSH	ATN	CP	EU-España	LL	t2							-1	-1	-1	-1	-1	-1	-1	-1	-1
BSH	ATN	CP	EU-Portugal	LL	t1	2257	1583	5726	4669	4722	4843	2630	2440	2227	2081	2110	2265	5642	1751	4026
BSH	ATN	CP	EU-Portugal	LL	t2	-1	-1	-1	-1	a	a	a	a	a	a	a	a	ab	ab	ab
BSH	ATN	CP	Japan	LL	t1				1203	1145	618	489	340	357	273	350	386	558	1035	1729
BSH	ATN	CP	Japan	LL	t2				-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
BSH	ATN	CP	Canada	LL	t1	774	1277	1702	1260	1494	528	831	612	547	624	581	836	346	965	1134
BSH	ATN	CP	Canada	LL	t2	-1	-1	-1	-1	-1	a	a	a	a	a	-1	a	a	a	a
BSH	ATN	CP	USA	LL	t1	772	186	1146	582	623	608	181	173	96	138	106	68	56	70	68
BSH	ATN	CP	USA	LL	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	b	c	-1	b	b
BSH	ATN	CP	Belize	LL	t1															
BSH	ATN	CP	Belize	LL	t2															
BSH	ATN	CP	Maroc	PS	t1															
BSH	ATN	CP	Maroc	PS	t2															
BSH	ATN	NCC	Chinese Taipei	LL	t1				487	167	132	203	246	384	165	59		171	206	240
BSH	ATN	NCC	Chinese Taipei	LL	t2				-1	-1	-1	-1	-1	-1	-1	-1		ab	ab	ab
BSH	ATN	CP	Panama	LL	t1									9						
BSH	ATN	CP	Panama	LL	t2									-1						

Species	Stock	Status	FlagName	GearGrp	DSet	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Rank	%	%cum
				T1 Total		23218	26927	30725	35199	37239	38092	36602	36806	36579	39627	44068	39664	33964	27198	20997			
BSH	ATN	CP	EU-España	LL	t1	15464	17038	20788	24465	26094	27988	28666	28562	29041	30078	29019	27316	21685	16314	12325	1	68.9%	69%
BSH	ATN	CP	EU-España	LL	t2	-1	-1	-1	b	b	b	b	b	b	b	b	b	b	b	b	1		
BSH	ATN	CP	EU-Portugal	LL	t1	4337	5283	6164	6248	8256	6508	3725	3694	2994	3808	7679	5610	5162	4475	3806	2	16.5%	85%
BSH	ATN	CP	EU-Portugal	LL	t2	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	2		
BSH	ATN	CP	Japan	LL	t1	1434	1921	2531	2007	1763	1227	2437	1808	3287	4011	4217	4444	4111	3855	2328	3	6.5%	92%
BSH	ATN	CP	Japan	LL	t2	-1	-1	-1	ab	ab	ab	a	a	a	a	a	a	a	a	a	3		
BSH	ATN	CP	Canada	LL	t1	977	843	0	0	0	0	1	0	1	5	16	32	71	4	193	4	2.0%	94%
BSH	ATN	CP	Canada	LL	t2	-1	a	a	a	a	a	a	a	a	a	a	a	a	a	a	4		
BSH	ATN	CP	USA	LL	t1	47	54	138	107	178	238	127	117	147	82	43	42	11	20	24	5	0.8%	95%
BSH	ATN	CP	USA	LL	t2	b	b	b	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	5		
BSH	ATN	CP	Belize	LL	t1				114	461	1039	903	1216	392	4	6	201	317	369	301	6	0.7%	95%
BSH	ATN	CP	Belize	LL	t2				ab	ab	ab	ab	a	a	a	a	ab	ab	ab	ab	6		
BSH	ATN	CP	Maroc	PS	t1										573	863	875	975	915	899	7	0.7%	96%
BSH	ATN	CP	Maroc	PS	t2										-1	-1	-1	-1	-1	-1	7		
BSH	ATN	NCC	Chinese Taipei	LL	t1	588	292	110	73	99	148	107	123	83	238	287	76	153	38	74	8	0.6%	97%
BSH	ATN	NCC	Chinese Taipei	LL	t2	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	8		
BSH	ATN	CP	Panama	LL	t1	254	892	613	1575				289	153		262		437	242	170	9	0.6%	97%
BSH	ATN	CP	Panama	LL	t2	a	a	a	a				a	a		-1		-1	a	a	9		

Table 5b. BSH-S stock

Species	Stock	Status	FlagName	GearGrp	DSet	1991	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	Rank	%	%cum
				T1 Total		8	107	10	2704	3108	4252	10145	8797	10829	12448	14044	12682	14966	14440	20642	20493	23487	23097	23459	27799	35069	26421	20672	26148	22498	25417	28373	34309	34743	33652			
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	1	45.7%	46%
BSH	ATS	CP	EU-España	LL	t2							-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	b	-1	b	b	b	b	b	-1	b	b	-1	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	2	17.4%	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	2		
BSH	ATS	CP	Brazil	LL	t1						743	1103		179	1687	2173	1966	2160	1568	2520	2533	2309	1625	1268	1500	1913	1607	2013	2551	2420	1334	2177	3010	3784	3435	3	8.9%	72%
BSH	ATS	CP	Brazil	LL	t2						-1	a		-1	ab	a	a	a	a	ab	a	ab	a	ab	ab	ab	ab	a	a	a	a	a	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		3950	4	8.5%	80%
BSH	ATS	CP	Namibia	LL	t2									-1			a	-1	ab	ab	ab	ab	ab	ab	ab	ab	a	ab	a	a	a	ab	ab	ab	ab	4		
BSH	ATS	NCC	Chinese Taipei	LL	t1				1232	1767	1952	1737	1559	1496	1353	665		521	800	866	1805	2177	1843	1356	1625	2142	2074	2257	2240	1854	1992	2053	1372	861	1338	5	7.7%	88%
BSH	ATS	NCC	Chinese Taipei	LL	t2				-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	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	2508	2102	6	6.8%	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	6		
BSH	ATS	CP	Uruguay	LL	t1	8	107	10	84	57	259	180	248	118	81	66	85	480	462	376	232	337	359	942	208	725	433	130								7	1.1%	96%
BSH	ATS	CP	Uruguay	LL	t2	-1	-1	-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	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	8		

Table 5c. POR-NE stock

Species	Stock	Status	FlagName	GearGrp	DSet	1991	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	Rank	%	%cum
				T1 Total		467	637	777	1045	749	428	444	371	424	567	506	610	527	578	367	302	421	391	349	21	14	25	10	5	8	9	8	4	0	3			
POR	ANE	CP	EU-France	UN	t1	300	496	633	820	565	267	315	219	240	410	361	461	303	194	276	194	83	83	153								0				1	63.3%	63%
POR	ANE	CP	EU-France	UN	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1								ab				1		
POR	ANE	CP	EU-Denmark	UN	t1	85	80	91	93	86	72	69	85	107	73	76	42	21	20	4	3	2	1		0		2									2	10.1%	73%
POR	ANE	CP	EU-Denmark	UN	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1		a		a									2		
POR	ANE	CP	EU-France	LL	t1														185			271	184	46		1	0			0		1			0	3	6.8%	80%
POR	ANE	CP	EU-France	LL	t2														-1			-1	-1	-1		-1	-1			-1		a		a	-1	3		
POR	ANE	CP	EU-España	LL	t1	47	15	21	52	19	41	25	25	18	13	24	54	27	11	14	34	8	41	77		0										4	5.6%	86%
POR	ANE	CP	EU-España	LL	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1		-1										4		
POR	ANE	CP	Norway	UN	t1	32	41	24	24	26	28	17	27	32	22			19			1	8	9	6	12	11	17									5	3.5%	89%
POR	ANE	CP	Norway	UN	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1			-1			-1	-1	-1	-1	-1	-1	-1									5		
POR	ANE	CP	EU-Portugal	LL	t1	1	0	1	1	1	1	1	1	0	7	4	10	101	50	14	6	0	3	17	7	0	0						0			6	2.3%	92%
POR	ANE	CP	EU-Portugal	LL	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	a	a	a	a	a	a	a	a	a	a	a			b	b	b	b	b	b	6		
POR	ANE	NCO	Faroe Islands	LL	t1				48	44	8	9	7	10	13	8	10	14	5	19	21															7	2.1%	94%
POR	ANE	NCO	Faroe Islands	LL	t2				-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1															7		
POR	ANE	CP	Great Britain	UN	t1					0			1	6	8	12	10	25	24																	8	0.8%	95%
POR	ANE	CP	Great Britain	UN	t2					-1			-1	-1	-1	-1	-1	-1	-1									b								8		
POR	ANE	CP	Norway	GN	t1											6	3			8	26	1	2	2				8			5	6	3		2	9	0.7%	95%
POR	ANE	CP	Norway	GN	t2											-1	-1			-1	-1	-1	-1	-1				-1			-1	-1	-1		-1	9		
POR	ANE	CP	EU-Ireland	UN	t1									8	2	6	3	11	18	3	4	8	7	0	0											10	0.7%	96%
POR	ANE	CP	EU-Ireland	UN	t2									-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1											10		
POR	ANE	CP	EU-France	TW	t1														24				22	14		1	3			3		0			0	11	0.7%	97%
POR	ANE	CP	EU-France	TW	t2														-1				-1	-1		-1	-1			-1		ab		a	-1	11		

Table 5d. POR-NW stock

Species	Stock	Status	FlagName	GearGrp	DSet	1991	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	Rank	%	%cum
				T1 Total		1586	2021	1475	1726	1424	1212	1432	1144	1047	988	574	282	164	264	237	217	101	141	84	114	85	162	284	35	93	30	39	19	16	11			
POR	ANW	CP	Canada	LL	t1	329	813	919	1575	1351	1045	1322	1055	956	899	491	223	130	220	191	184	83	115	50	65	22	29	16	8	3	2	2	1	0	1	1	71.2%	71%
POR	ANW	CP	Canada	LL	t2	-1	-1	-1	-1	-1	a	a	a	a	a	-1	a	a	a	a	-1	a	a	a	abc	ab	ab	ab	ab	ab	a	ab	ab	a	a	1		
POR	ANW	NCO	Faroe Islands	LL	t1	1189	1149	465																												2	16.5%	88%
POR	ANW	NCO	Faroe Islands	LL	t2	-1	-1	-1																												2		
POR	ANW	CP	Japan	LL	t1	62	54	35	29	15	10	9	19	41	47	52	21	7	20	27	18	5	11	11	15	13	49	99	1	5	1	1				3	4.0%	92%
POR	ANW	CP	Japan	LL	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	ab	ab	ab	a	a	-1	-1	-1	-1				3		
POR	ANW	CP	USA	LL	t1	4	4	50	108	35	78	56	9	0	1	0	1	0	1	0	0	0	0	2	3	2	1	2	7	34	1	9	1	0	0	4	2.4%	94%
POR	ANW	CP	USA	LL	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	b	b	b	b	b	b	b	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	a	ab	4		
POR	ANW	NCC	Chinese Taipei	LL	t1			4	10	12	27	18	13	27	19	18	22	12	8	7	5	3	2	2	5	8	15	51	2	15	8					5	1.8%	96%
POR	ANW	NCC	Chinese Taipei	LL	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					5		
POR	ANW	CP	Venezuela	LL	t1	1	2	2	4	1	7	2	8	9	6	2	0	0					1	4	4	10	20	70	7	20	8	15	9			6	1.3%	97%
POR	ANW	CP	Venezuela	LL	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			6		
POR	ANW	CP	Canada	GN	t1					2	4	8	11	6	2	7	12	11	10	10	6	10	8	11	18	7	2	0	1	1	0	0	0	0		7	0.9%	98%
POR	ANW	CP	Canada	GN	t2					a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	ac	a	a	a	a	a	a	a	a	a		7		

Table 5e. POR-SE stock

Species	Stock	Status	FlagName	GearGrp	DSet	1991	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	Rank	%	%cum
				T1 Total		0	0	0	0	0	3	19	1	6	0	1	1	9	3	1	0	5	30	37	6	7	26	29	38	3	1	0	4	0	0			
POR	ASE	CP	Japan	LL	t1						3	13										5	29	25	6	7	25	15	13	3	1	0				1	63.3%	63%
POR	ASE	CP	Japan	LL	t2						-1	-1										-1	-1	a	a	a	a	a	a	a	a	a				1		
POR	ASE	CP	EU-España	LL	t1							2	1	2		1	1	9	3			0	1	11												2	13.6%	77%
POR	ASE	CP	EU-España	LL	t2							-1	-1	-1		-1	-1	-1	-1			-1	-1	-1												2		
POR	ASE	CP	Ghana	PS	t1																								25							3	10.8%	88%
POR	ASE	CP	Ghana	PS	t2																								-1							3		
POR	ASE	CP	Korea Rep	LL	t1																							14					4			4	7.7%	95%
POR	ASE	CP	Korea Rep	LL	t2																							abc			b		ab	a		4		
POR	ASE	NCO	Benin	UN	t1							4	0	4																						5	3.4%	99%
POR	ASE	NCO	Benin	UN	t2							-1	-1	-1																						5		
POR	ASE	NCC	Chinese Taipei	LL	t1																					0	0	1	0	0		0				6	0.6%	99%
POR	ASE	NCC	Chinese Taipei	LL	t2																					-1	a	a	-1	-1		-1				6		
POR	ASE	CP	EU-Portugal	LL	t1															1																7	0.4%	100%
POR	ASE	CP	EU-Portugal	LL	t2													a		a														b		7		

Table 5f. POR-SW stock

Species	Stock	Status	FlagName	GearGrp	DSet	1991	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	Rank	%	%cum
				T1 Total		256	385	213	284	170	327	159	261	172	214	141	181	187	105	133	122	143	55	26	10	14	12	0	0	0	0	0	0	0	0			
POR	ASW	NCC	Chinese Taipei	LL	t1	73	192	85	146	57	168	65	170	73	84	29	93	95	39	43	47	99			2									0		1	43.6%	44%
POR	ASW	NCC	Chinese Taipei	LL	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1			a									-1		1		
POR	ASW	CP	Brazil	LL	t1	81	128	60	32	49	33	36	38	58	60	67	74	49	37	52	32	23				2										2	25.5%	69%
POR	ASW	CP	Brazil	LL	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	a	-1	-1	-1	-1	a			-1										2		
POR	ASW	CP	Uruguay	LL	t1	18	24	7	5	3	19	5	14	3	4	20	8	34	8	28	34	3	40	14	6	12	12									3	9.0%	78%
POR	ASW	CP	Uruguay	LL	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	a	a	b	a	-1	ab	ab	b								3		
POR	ASW	CP	EU-España	LL	t1	13	12	32	35	43	28	25	1	12	7	13	1	0	0	0	3	5	3	2												4	6.6%	85%
POR	ASW	CP	EU-España	LL	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1												4		
POR	ASW	NCO	NEI (Flag related)	LL	t1	8	14	10	22	8	46	23	37	11	15	3	1																			5	5.5%	90%
POR	ASW	NCO	NEI (Flag related)	LL	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1																			5		
POR	ASW	CP	Japan	LL	t1	48	12	13	14	6	6	1	1	1	7	4	3	2	11	3	3	4	12	10	2					0						6	4.5%	95%
POR	ASW	CP	Japan	LL	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	a	a					a						6		
POR	ASW	CP	Panama	LL	t1	14	2	6	24	4	21	3		0	1																					7	2.1%	97%
POR	ASW	CP	Panama	LL	t2	-1	-1	-1	-1	-1	-1	-1		-1	-1																					7		
POR	ASW	CP	China PR	LL	t1			0	1	0				13	36	4		5	4	2	2	6														8	2.0%	99%
POR	ASW	CP	China PR	LL	t2			-1	-1	-1				-1	-1	-1		-1	-1	-1	-1	-1														8		
POR	ASW	CP	Korea Rep	LL	t1	3	1	1	2	1	6	1										3														9	0.5%	99%
POR	ASW	CP	Korea Rep	LL	t2	-1	-1	-1	-1	-1	-1	-1										-1														9		

Table 5g. SMA-N stock

Species	Stock	Status	FlagName	GearGrp	DSet	1991	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	Rank	%	%cum
				T1 Total		2296	3233	4114	3659	5306	5306	3534	3845	2858	2587	2677	3426	3987	4000	3695	3574	4158	3800	4541	4782	3720	4437	3603	3467	3281	3356	3119	2373	1882	1708			
SMA	ATN	CP	EU-España	LL	t1	1390	2145	1964	2164	2209	3294	2416	2223	2051	1561	1684	2047	2068	2088	1751	1918	1814	1895	2216	2091	1667	2308	1509	1481	1362	1574	1784	1165	866	870	1	52.3%	52%
SMA	ATN	CP	EU-España	LL	t2	-1	-1	b	-1	-1	-1	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		
SMA	ATN	CP	EU-Portugal	LL	t1	314	220	796	649	657	691	354	307	327	318	378	415	1249	399	1109	951	1540	1033	1169	1432	1045	1023	817	209	213	257	270	268	284	339	2	17.9%	70%
SMA	ATN	CP	EU-Portugal	LL	t2	-1	-1	-1	-1	a	a	a	a	a	a	a	a	a	a	a	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	2		
SMA	ATN	CP	USA	RR	t1	210	250	667	317	1422	232	164	148	69	290	214	248	0	336	282	257	158	156	163	183	180	236	227	816	480	168	192	125	25	24	3	7.7%	78%
SMA	ATN	CP	USA	RR	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	b	b	b	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	b	b	b	b	ab	3		
SMA	ATN	CP	Maroc	LL	t1													147	169	215	220	151	283	476	636	390	380	616	580	807	1000	320	423	357	382	4	7.1%	85%
SMA	ATN	CP	Maroc	LL	t2													-1	-1	-1	-1	-1	-1	-1	-1	-1	a	a	-1	a	ab	ab	ab	ab	ab	4		
SMA	ATN	CP	Japan	LL	t1	157	318	425	214	592	790	258	892	120	138	105	438	267	572			82	131	98	116	53	56	33	69	45	74	89	20	33	29	5	5.8%	91%
SMA	ATN	CP	Japan	LL	t2	-1	-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	-1	5		
SMA	ATN	CP	USA	LL	t1	176	273	249	269	259	166	179	146	124	123	135	123	105	140	138	95	167	149	171	168	160	152	140	155	100	108	112	41	32	26	6	4.1%	95%
SMA	ATN	CP	USA	LL	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	b	b	b	b	b	b	b	b	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	6		
SMA	ATN	CP	Canada	LL	t1					93	56	99	55	54	59	60	61	63	69	74	64	64	39	50	39	37	28	35	53	84	82	109	54	62	18	7	1.5%	96%
SMA	ATN	CP	Canada	LL	t2					-1	a	a	a	a	a	-1	a	a	a	a	-1	a	a	a	abc	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	7		
SMA	ATN	NCC	Chinese Taipei	LL	t1	39	16	9	29	32	45	42	47	75	56	47	53	37	70	68	40	6	23	11	14	13	15	8	4	15	8	1	3	1	0	8	0.8%	97%
SMA	ATN	NCC	Chinese Taipei	LL	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	ab	ab	ab	ab	ab	ab	a	ab	ab	ab	ab	ab	ab	ab	a	-1	-1	-1	8		
SMA	ATN	CP	Maroc	PS	t1																					30	26	51	44	140	50	130	172	144		9	0.7%	98%
SMA	ATN	CP	Maroc	PS	t2																					-1	-1	-1	-1	-1	-1	-1	-1	-1		9		
SMA	ATN	CP	Belize	LL	t1																			23	28	69	114	99	1	1	1	9	12	2		10	0.3%	98%
SMA	ATN	CP	Belize	LL	t2																			ab	ab	ab	ab	a	a	-1	a	a	a	ab		10		

Table 5h. SMA-S stock

Species	Stock	Status	FlagName	GearGrp	DSet	1991	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	Rank	%	%cum
				T1 Total		1062	1183	1743	2182	3100	2395	2187	2008	1606	2588	2107	2103	3235	2526	3259	3036	2786	1881	2063	2486	3258	2905	2183	3274	2774	2765	2786	3158	2309	2855			
SMA	ATS	CP	EU-España	LL	t1	327	421	772	552	1084	1482	1356	984	861	1090	1235	811	1158	703	584	664	654	628	922	1192	1535	1207	1083	1077	862	882	1049	1044	1090	799	1	38.1%	38%
SMA	ATS	CP	EU-España	LL	t2	-1	-1	b	b	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	b	1		
SMA	ATS	CP	Namibia	LL	t1									1			459	375	509	1415	1243	1002	295	23	306	328	554	9	950	661	799	194	980		929	2	14.9%	53%
SMA	ATS	CP	Namibia	LL	t2									-1			a	-1	ab	ab	ab	ab	ab	ab	ab	ab	a	ab	a	a	a	ab	ab	ab	ab	2		
SMA	ATS	CP	Japan	LL	t1	506	460	701	1369	1617	514	244	267	151	264	56	133	118	398			72	115	108	103	132	291	114	182	109	77	96	93	55	3	3	11.3%	64%
SMA	ATS	CP	Japan	LL	t2	-1	-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	3		
SMA	ATS	CP	EU-Portugal	LL	t1					92	94	165	116	119	388	140	56	625	13	242	493	375	321	502	336	409	176	132	127	158	393	503	300	243	449	4	9.4%	74%
SMA	ATS	CP	EU-Portugal	LL	t2					-1	-1	a	a	a	a	a	a	a	a	a	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	a	4		
SMA	ATS	CP	Brazil	LL	t1	79	158	122	95	119	83	190	233	27	219	409	226	283	177	426	183	152	121	92	128	179	193	276	256	172	124	275	396	739	542	5	9.0%	83%
SMA	ATS	CP	Brazil	LL	t2	-1	-1	-1	-1	-1	-1	a	-1	-1	ab	a	a	a	a	ab	a	ab	a	ab	ab	ab	a	a	a	a	a	a	a	a	a	5		
SMA	ATS	CP	South Africa	LL	t1		64	43	23	46	36	29	168	66	103	68	12	115	101	111	86	224	137	146	152	218	108	250	476	613	339	305	244	110	46	6	6.0%	89%
SMA	ATS	CP	South Africa	LL	t2		-1	-1	-1	-1	-1	-1	-1	-1	ab	a	ab	ab	ab	ab	ab	ab	ab	ab	ab	a	ab	ab	ab	ab	ab	ab	ab	ab	ab	6		
SMA	ATS	NCC	Chinese Taipei	LL	t1	80	44	31	65	87	117	139	130	198	162	120	146	83	180	226	166	147	124	117	144	204	158	157	161	154	95	88	66	44	54	7	5.0%	94%
SMA	ATS	NCC	Chinese Taipei	LL	t2	-1	-1	-1	-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	7		
SMA	ATS	CP	China PR	LL	t1			34	45	23	27	19	74	126	305	22	208	260	68	45	70	77	6	24	32	29	8	9	9	5	3	1			1	8	2.1%	96%
SMA	ATS	CP	China PR	LL	t2			-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	a	a	a	a	a	a	a	a	a	a	a		a	a	8		
SMA	ATS	CP	Uruguay	LL	t1	13	20	28	12	17	26	20	23	21	35	40	38	188	249	146	68	36	41	106	23	76	36	1								9	1.7%	98%
SMA	ATS	CP	Uruguay	LL	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	ab	ab	ab	a	-1	ab	ab	ab								9		
SMA	ATS	CP	Côte d'Ivoire	GN	t1	9	13	10	20	13	15	23	10	10	9	15	15	30	15	14	16	25					19	33	19	11	13	161	4	8	7	10	0.7%	98%
SMA	ATS	CP	Côte d'Ivoire	GN	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	b	b	-1	-1	-1	a					a	a	ab	a	a	b	-1	a	-1	10		
SMA	ATS	CP	Belize	LL	t1															38		17	2		32	59	78	88	1	15	14	34	15	7	2	11	0.5%	99%
SMA	ATS	CP	Belize	LL	t2															a	a	a	a		a	ab	ab	a	a	a	a	a	a	ab	a	11		

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 (%). The color is a gradient that represents from lowest (green) to highest (red) number of records recovered.

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	1468	53	46	6	1								3.6%
1970	505	15	7	4	2		1	1					3.0%
1971	546	16	11	5									2.9%
1972	923	25	18	5	1	1							2.7%
1973	361	12	8	3	1								3.3%
1974	630	16	13	2	1								2.5%
1975	809	40	30	5	2	1	1				1		4.9%
1976	1113	56	47	4	2		2				1		5.0%
1977	2843	111	92	12	4	2		1					3.9%
1978	3212	164	153	5	3	2					1		5.1%
1979	3807	138	107	20	7			1			2	1	3.6%
1980	3328	88	70	13	2	2	1						2.6%
1981	3121	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	2780	81	48	22	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	3404	170	116	29	9	7		5			4		5.0%
1991	4661	230	162	39	11	2	5	5			6		4.9%
1992	6162	385	249	67	30	9	11	9			9	1	6.2%
1993	5494	374	249	65	19	15	6	7			12	1	6.8%
1994	5572	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	7619	754	386	193	83	36	13	13			30		9.9%
1997	7290	713	383	159	91	34	11	5			30		9.8%
1998	4352	419	219	110	33	20	11	6			19	1	9.6%
1999	3762	343	196	87	23	17	3	8			9		9.1%
2000	3056	315	192	71	26	8	4	4	1		8	1	10.3%
2001	2635	283	151	60	33	14	2	3			19	1	10.7%
2002	2392	241	140	48	24	8	7	3	3		7	1	10.1%
2003	2670	242	121	66	26	12		2			15		9.1%
2004	2392	225	119	60	16	10	3	7			10		9.4%
2005	2198	215	116	48	18	13	5	5			10		9.8%
2006	1601	178	94	46	14	9	2	3			9	1	11.1%
2007	3054	298	150	71	41	17	6	2			11		9.8%
2008	3197	254	106	65	36	32	6	2			7		7.9%
2009	3195	235	113	68	34	9	3	2	1		5		7.4%
2010	3274	198	105	48	23	12	2	1	1		6		6.0%
2011	2157	106	61	12	16	7	4				6		4.9%
2012	904	58	30	20	7	1							6.4%
2013	1034	73	40	21	8	1	2	1					7.1%
2014	305	18	11	5	2								5.9%
2015	17	8	6	2									47.1%
2016	303	18	10	4	1		2	1					5.9%
2017	396	9	3	3		3							2.3%
2018	134	6	4	1							1		4.5%
2019	27	4	2	2									14.8%
Unk	2303	1019									1019		44.2%
Grand To	143418	10167	5373	1909	865	382	145	137	10	3	315	9	7.1%

Table 7. Summary of SMA 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 (%). The color is a gradient that represents from lowest (green) to highest (red) number of records recovered.

Number of tag Shortfin Mako (*Isurus oxyrinchus*)											
			Years at liberty								
Year	Releases	Recaptures	< 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10+	Unk	% recapt*
1962	5	0									
1963	8	0									
1964	5	1	1								20.0%
1965	11	2	2								18.2%
1966	20	2	2								10.0%
1967	12	1			1						8.3%
1968	59	1	1								1.7%
1969	29	2	1			1					6.9%
1970	11	1	1								9.1%
1971	18	4	3			1					22.2%
1972	15	1					1				6.7%
1973	16	0									
1974	15	0									
1975	13	1		1							7.7%
1976	18	5	3	1	1						27.8%
1977	111	17	7	5	1	2	1	1			15.3%
1978	118	12	5	5			2				10.2%
1979	157	13	6	6		1					8.3%
1980	171	11	4	3	2	2					6.4%
1981	185	13	7	1	3		2				7.0%
1982	241	21	14	3		2	2				8.7%
1983	228	25	15	4	2	1	1	2			11.0%
1984	196	31	16	10	1	1	1	1	1		15.8%
1985	249	24	15	4		3	1	1			9.6%
1986	176	13	6	3	4						7.4%
1987	264	25	14	6	1	1	1			2	9.5%
1988	119	17	6	6	1	1	2		1		14.3%
1989	145	19	10	6	3						13.1%
1990	172	22	13	7	2						12.8%
1991	296	35	18	10	4	1	1			1	11.8%
1992	537	53	28	15	2	3	2	2	1		9.9%
1993	505	65	32	22	3	4	1	1		2	12.9%
1994	425	74	42	19	2	3		2		6	17.4%
1995	295	47	29	8	5	2				3	15.9%
1996	143	20	13	5	1			1			14.0%
1997	233	36	20	10	4	1	1				15.5%
1998	267	36	22	9	3	2					13.5%
1999	298	48	22	19	2		1	2		2	16.1%
2000	375	49	29	8	3			4		5	13.1%
2001	375	64	38	13	5	1	3	2	1	1	17.1%
2002	360	44	28	10	1	1	1	1		2	12.2%
2003	257	41	19	7	10	3				2	16.0%
2004	389	65	42	18	1			1		3	16.7%
2005	244	36	22	7	2	1	1	1		2	14.8%
2006	255	42	26	13	1			1		1	16.5%
2007	368	83	53	19	5		4			2	22.6%
2008	279	52	23	21	3	2	1			2	18.6%
2009	237	39	24	8	4	3					16.5%
2010	182	21	13	8							11.5%
2011	161	9	8	1							5.6%
2012	25	10	7	2	1						40.0%
2013	20	5	5								25.0%
2014	7	2		1	1						28.6%
2016	10	0									
2017	16	0									
2018	1	1				1					
2019	15	2		2							13.3%
2020	37	1	1								2.7%
Unk	288	84								84	29.2%
Grand Total	9687	1348	716	326	85	44	30	23	4	120	13.9%

Table 8. Summary of POR 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 (%). The color is a gradient that represents from lowest (green) to highest (red) number of records recovered.

Number of tag Porbeagle (*Lamna nasus*)			Years at liberty										
Year	Releases	Recaptures	< 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10+	15+	Unk	ERROR	% recapt*
1961	1	1			1								100.0%
1962	12	12	5	5	2							1	100.0%
1963	2	2	2										100.0%
1965	1	0											
1967	2	0											
1968	1	0											
1978	1	0											
1979	1	0											
1980	4	0											
1981	18	0											
1982	9	2			2								22.2%
1983	31	8	2		2		2	2					25.8%
1984	21	6			2			4					28.6%
1985	20	4				2	2						20.0%
1986	38	6	2		2			2					15.8%
1987	99	30	2	4	6		2	15			1		30.3%
1988	69	22	2	2	2	2	4	10					31.9%
1989	7	2				1					1		28.6%
1990	1	0											
1991	47	7	3	2		1		1					14.9%
1992	41	7		2	3			2					17.1%
1993	134	34	6	4	4	10	3	5		1	1		25.4%
1994	173	72	14	19	18	9	4	7			1		41.6%
1995	154	44	10	12	5	12	3		1		1	1	28.6%
1996	70	16	5	4	4	1		2					22.9%
1997	147	23	8	6	2	3	1				3		15.6%
1998	94	9	6	2		1							9.6%
1999	180	20	6	3	4			4	1		2		11.1%
2000	91	6	1			1		1	3				6.6%
2001	8	0											
2002	43	3			3								7.0%
2003	47	3	1		2								6.4%
2004	30	1			1								3.3%
2005	26	1						1					3.8%
2006	72	1			1								1.4%
2007	32	0											
2008	23	1		1									4.3%
2009	80	0										1	
2010	233	1	1										0.4%
2011	101	1	1										1.0%
2012	49	0											
2013	46	0											
2014	6	0											
2015	42	1	1										2.4%
2016	56	0											
2017	186	0											
2018	28	0											
2019	19	0											
2020	7	0											
Unk	7										5		
Grand Total	2610	346	78	66	66	43	21	56	5	1	10	3	

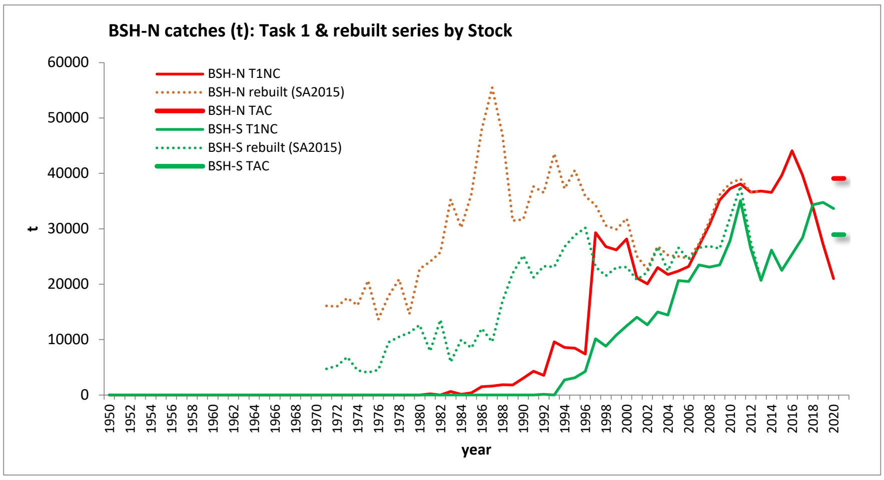

Figure 1. Total BSH catches (t) by stock and year, with the respective TAC. Both the T1NC and the rebuilt series (Anon., 2016) are presented.

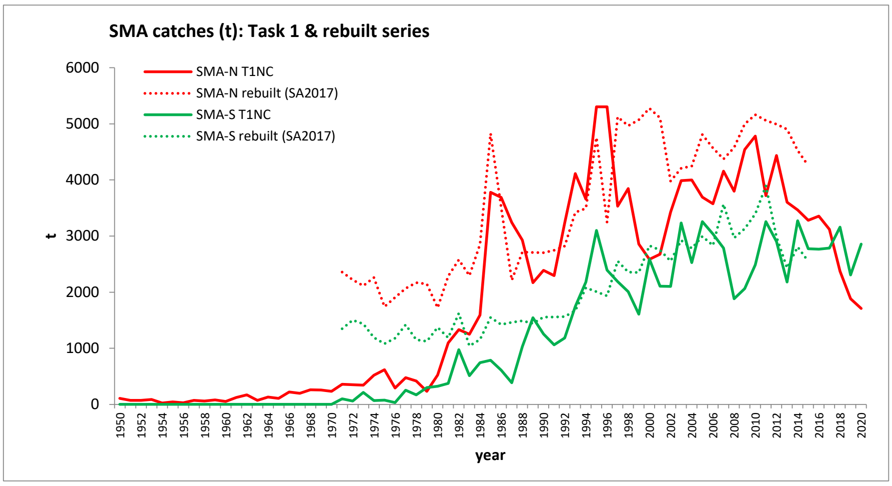

Figure 2. Total SMA catches (t) by stock and year. Both the T1NC and the rebuilt series (Anon., 2017) are presented.

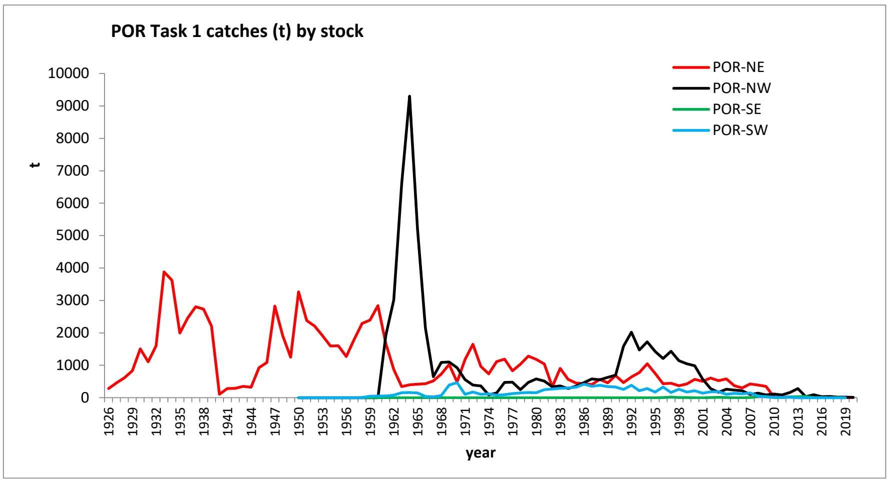

Figure 3. Total POR catches (t) by stock and year.

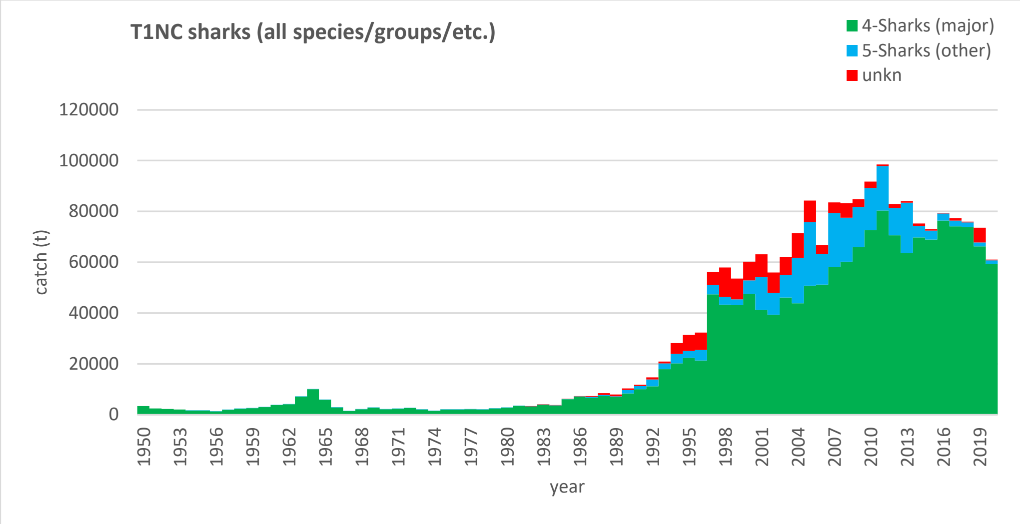

Figure 4. Total accumulated catches (landings and dead discards, t) by groups of sharks (major, others, unknown) and year. Both the light blue (other bycatch sharks: species/genus/families) and the red (mix of large groups of sharks) series are under a full revision process.

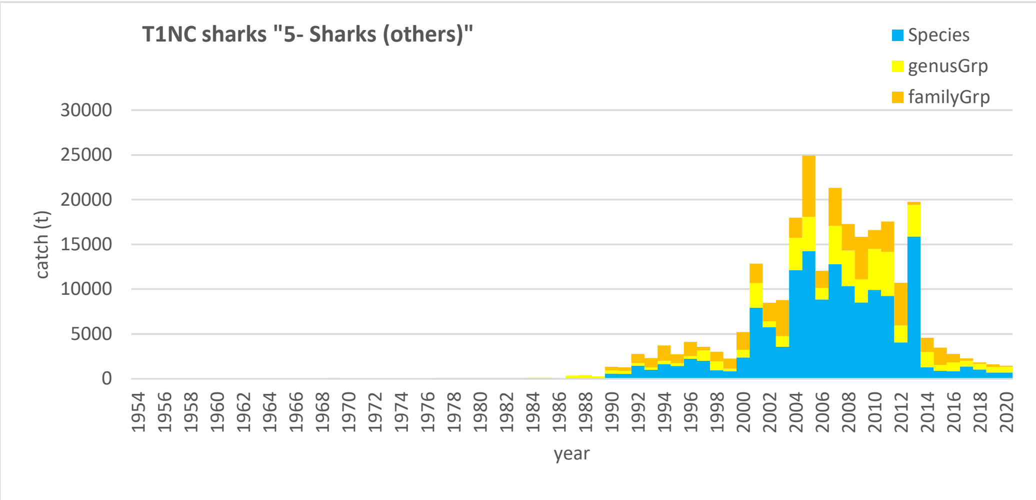

Figure 5. Total accumulated catches (landings and dead discards, t) by type of species code (species, genus or family) and year only for the group “5-Sharks (other)”. The dead discards (DD) component of the catches in group “5-Sharks (other)” shall be left apart when the species code refers to a genus or family.

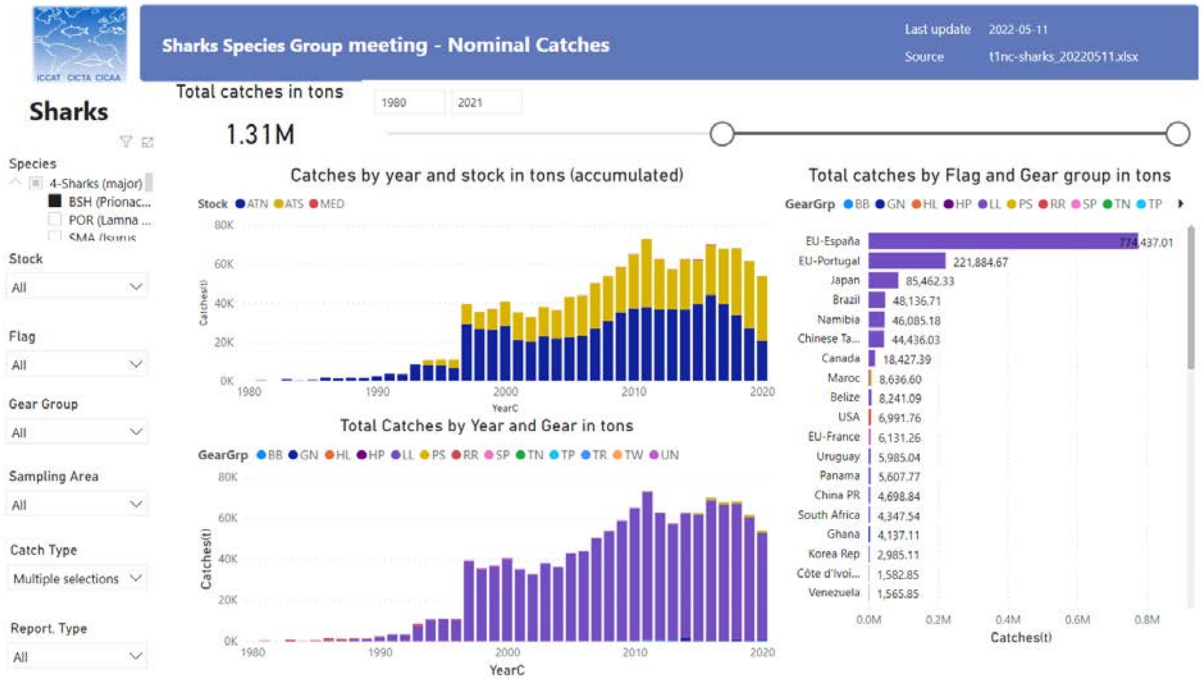

Figure 6. Screenshot of the T1NC dashboard developed for all the shark species.

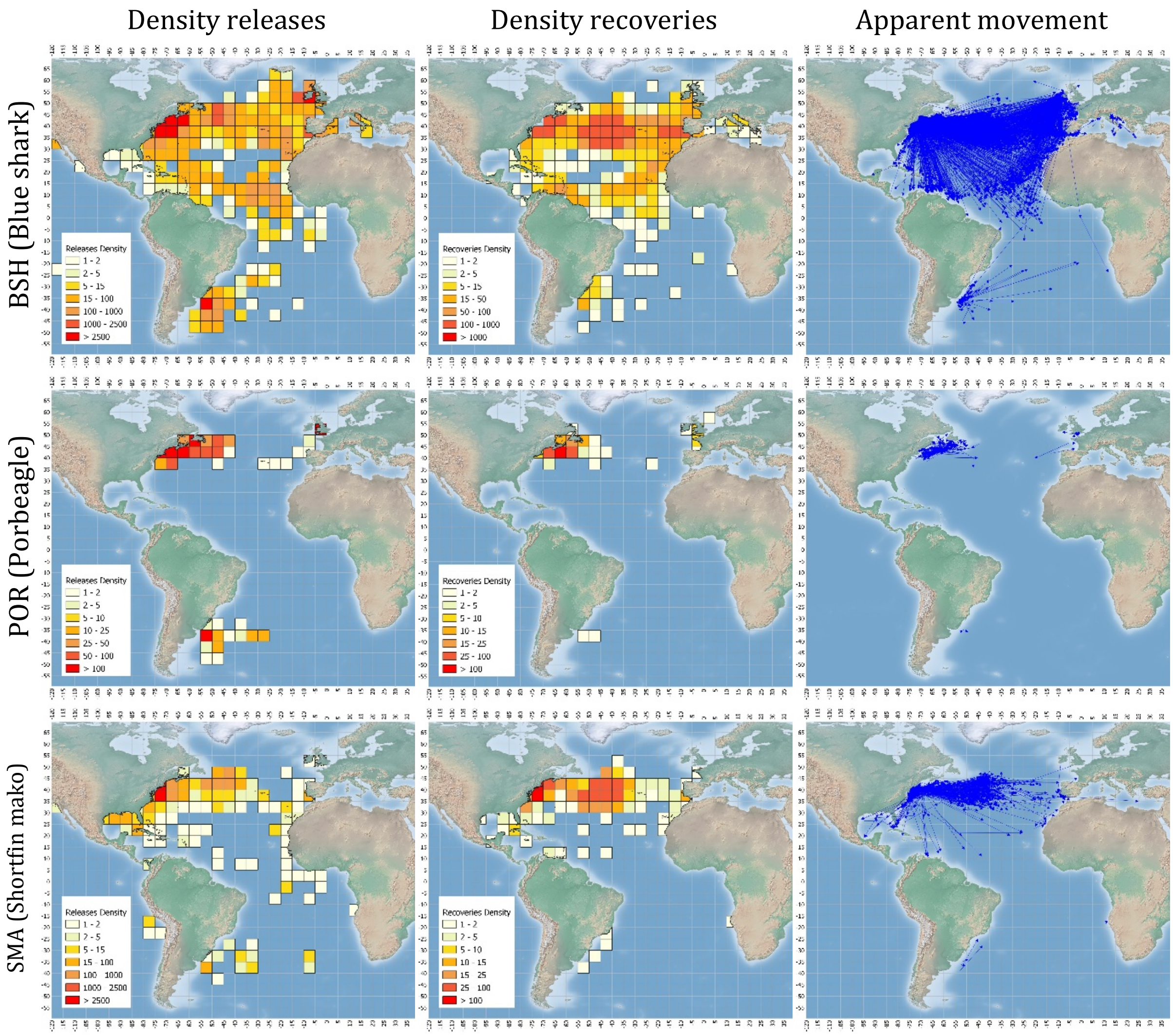

Figure 7. Nine maps with conventional tagging of the three major shark species (rows) showing: the density of releases in a 5x5 grid (left); the density of recoveries in a 5x5 grid (center); the apparent movement (straight line from the release to the recovery position).

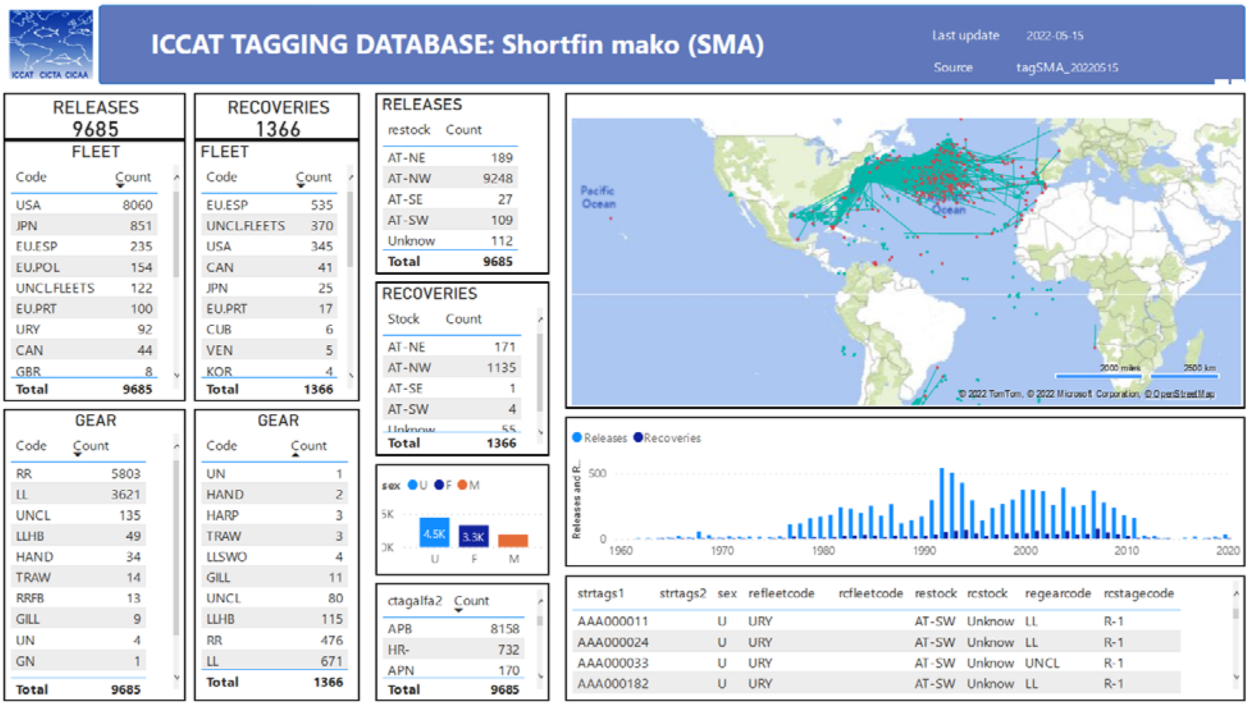

Figure 8. Screenshot of the conventional tagging dashboard on sharks (SMA example).

Appendix 1

Agenda

Objectives

In 2021, the SCRS planned an intersessional meeting of the Shark Species Group in 2022. The meeting will give priority to activities being developed within the Shark Research and Data Collection Program (SRDCP) and to define a workplan for the blue shark stock assessment that is scheduled for 2023. Among other relevant aspects to be discussed, special attention will be dedicated to responses to the Commission namely those related to the *Recommendation by ICCAT on the conservation of the North Atlantic stock of shortfin mako caught in association with ICCAT fisheries* (Rec. 21-09) and the ongoing joint ICES-ICCAT stock assessment for northeastern Atlantic porbeagle.

1. Opening, adoption of the Agenda and meeting arrangements

2. Presentation of activities under SRDCP and future activities

3. Review of shark fishery statistics

   3.1 Task 1 (catches) data

   3.2 Task 2 (catch-effort and size samples) data

   3.3 Tagging data

4. Draft workplan for 2023 blue shark stock assessment

5. ICES-ICCAT joint stock assessment for northeastern Atlantic porbeagle

6. Revision of shark bycatch species (as requested by the SC-ECO)

7. Adoption of the updated Shark chapters on the ICCAT Manual

8. Responses to the Commission

9. Recommendations

10. Other matters

11. Adoption of the report and closure

Appendix 2

List of participants*

CONTRACTING PARTIES

ALGERIA

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Appendix 3

List of papers and presentations

Doc Ref	*Title*	*Authors*
SCRS/2022/022	Review of the Catch Series for Northeast Porbeagle (*Lamnus nasus*) as Input for Stock Assessment	Ortiz M., Mayor C., Palma C., Taylor N.G.
SCRS/2022/042	Preliminary Stock Assessment of Northeastern Atlantic Porbeagle (*Lamna nasus*) Using the Bayesian State-Space Surplus Production Model JABBA	Ortiz M., Taylor N.G., Kimoto A., Forselledo R.
SCRS/2022/053	Additional Analyses on the Stock Assessment of Northeastern Atlantic Porbeagle (*Lamna nasus*) Using the SPICT Surplus Production Model	Ortiz M., Taylor N.G., Kimoto A., Forselledo R., Coelho R., Arrizabalaga H.,
SCRS/2022/083	Longfin Mako *Isurus paucus*: the forgotten cousin	Ellis J., Reeves S., McCully-Phillips S.R.
SCRS/2022/084	Stock delineation of Northeast Atlantic porbeagle *Lamna nasus*	Ellis J., Johnston G., Coelho R.
SCRS/2022/085	Preliminary results of the genetic population structure of the Atlantic shortfin mako (*Isurus oxyrinchus*) using mitogenomics and nuclear-genome-wide single-nucleotide polymorphism genotyping based on additional samples comprehensively collected from in and around the Atlantic Ocean	Semba Y., Takeshima H., Nanba R., Ooka S., Ando D., Hayakawa A., Kokubun S., Noda S., Takano Y., Yanada R., Coelho R., Santos M.N., Cortés E., Domingo A., de Urbina J.O., Sakuma K., Nohara K., Tahara D.
SCRS/2022/086	Workplan for the investigation of the genetic population structure of porbeagle (*Lamna nasus*) in the Atlantic Ocean	Semba Y., Tahara D., Takeshima H.
SCRS/2022/090	Preliminary Closed-Loop Simulations for Northeast Porbeagle: Illustrating the Efficacy of Alternative Management Procedures and Assessment Frequency	Taylor N.G., Ortiz M., Kimoto A.
SCRS/2022/091	Notes on Possible Methods for the Estimation of Shortfin Mako (*Isurus oxyrinchus*) Discards by the Portuguese Longline Fleet in the North Atlantic	Coelho R., Rosa D., Santos C.C., Lino P.G.
SCRS/2022/092	The Effect of Non-Linear Relationships Between CPUE and Abundance on the Management Procedure Performance for Northeast Porbeagle	Taylor N.G., Ortiz M., Kimoto A.
SCRS/2022/094	Methods Description for Reporting Shortfin Mako Landings, Live Releases and Dead Discards from Canadian Fisheries	Bowlby H., Minch T., Yin Y., Duprey N.
SCRS/2022/096	Updating Reproductive Parameters of the Shortfin Mako in the Southwestern Atlantic Ocean	Cabanillas-Torpoco M., Oddone M.C., Cardoso L.G.
SCRS/P/2022/023	Model Diagnostics in Integrated Stock Assessments	Kell L.T., Winker H., Cardinale M., Sharma R., Mosqueira M., Kitakado T.
SCRS/P/2022/024	SRDCP Tagging Activities: Update	Santos C.C., Domingo A., Carlson J., Natanson L., Travassos P., Macías D., Cortés E., Miller P., Hazin F., Mas F., Ortiz de Urbina J., Parker D., Romanov E., Sabarros P., Bach P., Bowlby H., Biais G., Coelho R.
SCRS/P/2022/025	Age and Growth of Shortfin Mako in the South Atlantic: Update	Santos C.C., Cardoso L.G., Semba Y., Domingo A., Jagger C., Rosa D., Mas F., Mathers A., Natanson L.J., Carlson J., Coelho R.

SCRS/P/2022/026	Bycatch Mitigation of BSH Using a Global Habitat Model by Sex and Size	Druon N., Bowlby H.
SCRS/P/2022/027	Update on NW Atlantic Pelagic Shark Tagging	Carlson J., Cortés E., Kroetz A., Talwar B., Cardenosa D., Heithaus M., Santos C., Coelho R., Domingo A., Grubbs R. D., Chapman D., Anderson B.N., Sulikowski J.
SCRS/P/2022/028	SRDCP Shortfin Mako Post-Release Mortality: Update	Forselledo R.

Appendix 4

SCRS Document summaries as provided by the authors

SCRS/2022/022 - Size sampling data of north and south Atlantic swordfish stocks were reviewed, and preliminary analyses were performed for its use within the stock evaluation models. Size data submitted to the Secretariat by CPCs under the Task II requirements include Catch at Size and or size samples for the major fisheries. The size samples data was revised, standardized, and aggregated to size frequencies samples by main fleet/gear type, year, and quarter. For the North and South Atlantic stock, the size sampling proportion among the major fishing gears is consistent with the proportion of the catch since 1990, most of the size samples come from the longline fisheries. The number of fish measured has decreased substantially in the last decades from both the North and South Atlantic fisheries. A review of the size frequency data by fleets indicated no shift of size data around 1993, for the main longline fleets. Size frequency data was consolidated by year, quarter, and fleetID for 5 cm bin size.

SCRS/2022/042 - Bayesian State-Space Surplus Production Models were fitted to Northeastern Atlantic porbeagle shark (*Lamna nasus*) catch and relative abundance indices using the 'JABBA' R package. This document presents details on the model diagnostics and stock status estimates for preliminary scenarios. S1 was fitted to three indices reviewed by the ICES WKELASMO in 2022 and S2 also included fits to a fourth historical index presented in 2009 stock assessment. The prior assumptions in the surplus production function were kept consistent with the ICES WKELASMO assessment presented in 2022. We evaluated model plausibility using four objective model diagnostics: (1) model convergence, (2) fits to the data, (3) consistency (e.g., retrospective patterns) and (4) prediction skill. Our results suggest that S1 represents the most plausible candidate model. The most notable improvement compared to the alternative scenarios is a substantially reduced retrospective bias and reduced uncertainty about the absolute biomass estimates. Additional sensitivity runs indicated that the S1 model was robust to alternative productivity and variance assumptions, while a Jackknife analysis revealed that either removing the French longline index or the Norway longline index had strong effects on the stock status estimates.

SCRS/2022/053 - In 2022, ICES and ICCAT aimed to jointly assess the northeast Atlantic porbeagle stock, which was last assessed in 2009. The SPiCT runs used the 3 indices reviewed by the Working Group on Elasmobranch Fishes (WKELASMO) and included the historical Spanish longline index that was used in the 2009 assessment. The proposed SPiCT run uses all available indices of abundance. Comparisons were made between the proposed SPiCT run and JABBA run applying similar model settings. Both models indicated that the northeast porbeagle stock is still overfished but experiencing very low fishing mortality at present. However, those results differ in the level of depletion, SPiCT results being slightly more pessimistic compared to the JABBA results, likely due to the assumptions of process error, the variance of indices, and structural model estimation, among others. It is suggested, that integrating both model results will provide a more comprehensive evaluation of the stock assessment uncertainty for providing management advice. It is recommended to reactive monitoring programs to confirm the recovery trends of the stock.

SCRS/2022/083 - Longfin mako *Isurus paucus* is a pelagic shark that is found circumglobally in tropical and subtropical waters and interacts with pelagic longline fisheries. It is encountered rarely in most areas, although it appears to be more frequent around Cuba - from where the species was described originally. Longfin mako is a data-limited species, though suspected declines have resulted in the IUCN considering this species to be Endangered. Available biological data are collated, and initial analyses of ICCAT Task 1 catch data presented. Despite the apparent rarity of longfin mako, mean annual reported catches have increased from 11.7 t y–1(1990–1999) to 44.1 t y–1(2000–2009) and 134.9 t y–1(2010–2019). The potential reasons for this marked increase in reported catches are discussed.

SCRS/2022/084 - The recent benchmark assessment for North-east Atlantic porbeagle Lamna nasus necessitated further consideration of stock identification. The published information reviewed suggests seasonal, ontogenetic and sexual differences in movements and distribution, including (i) northward movements of larger porbeagle (including large females) along the shelf to overwinter north of Scotland, (ii) southward movements of smaller porbeagle (including males) to overwinter in Iberian waters and northern parts of FAO Area 34, and (iii) westward movements of some porbeagle into oceanic waters. Whilst different parts of the population may undertake different seasonal migrations, the wide-ranging movements and mixing in the North-east Atlantic support the single-stock hypothesis within this area. The stock extends to the northern parts of FAO Area 34, and the southern boundary of the stock unit considered by ICES should extend southwards to 5°N, as used by ICCAT. It is hypothesized that porbeagle in the Mediterranean relate to occasional incursions from the Atlantic, given their wintertime presence in adjacent Atlantic waters, and that their presence in the Mediterranean is temporally sporadic and generally restricted to the cooler parts of the Mediterranean.

SCRS/2022/085 - During the remaining period for 2021 ICCAT Shark Research and Data Collection Programme, we additionally performed nuclear-genome-wide single-nucleotide polymorphism (SNP) genotyping on 93 individuals of the Atlantic shortfin mako, comprehensively collected from three localities, the Central Atlantic Ocean, the Southwest Pacific Ocean, and the North Indian Ocean in order to clarify effective measures for proper management units of this species. By using the mapping approach for data processing on nuclear genome genotyping-by-sequencing, we successfully increased the number of SNPs from 4,490 to 8,680. Our updated analyses based on 183 individuals (including individuals used in the previous analysis) from 13 sampling units confirmed previous findings of two nuclear genome groups and their putative F1 hybrids exist in the Atlantic shortfin mako. The geographic distribution of the individual's assignment to the three nuclear genome groups (Nc-group a, ß, and a/ß) and the two mitochondrial clades (previously detected Mt-clade I and II) have some important implications for the source of genetic types and especially contact zone between the two types, namely a+I and ß+II. Our present results suggested that the source of the pure ß+II type is outside of the Atlantic Ocean and that the central and south Atlantic regions are promising candidates for a contact zone between the two types via the immigration of pure ß+II type from the Indian Ocean side. Thus, our study approach—increasing the number of individuals from many localities and of SNPs—provided further insight into the geographic pattern and variability of the "genetic type" of shortfin mako in the Atlantic Ocean. Further analysis of an individual-based large-scale data set from both genomes by using additional samples collected from within and contiguous area to the Atlantic Ocean such as off South Africa may clarify both the historical process of genetic differentiation and the present genetic status of the shortfin mako populations.

SCRS/2022/086 - For the 2022 ICCAT Shark Research and Data Collection Programme, we planned to investigate the feasibility of whole mitochondrial genome sequencing (mitogenomics) for the study of genetic population structure of the Atlantic porbeagle. Considering the goal of this work, we preliminary checked the spatial distribution of samples currently available. We plan to conduct mitogenomics of porbeagle on 96 individuals from three localities in the Atlantic Ocean (Northwest, Northeast, Southeast) at least. We attempt to analyze 32 individuals from one locality, but sample size in the northeastern Atlantic was very small. Therefore, analysis of sample from the surrounding area such as southwestern Indian Ocean (near south Africa) was suggested to be alternative. The results of the analysis will be presented in the species meeting in September 2022.

SCRS/2022/090 - Porbeagle shark populations are listed on CITES appendix 2. As a result of this listing, it may be challenging to obtain indices of abundance to conduct stock assessments and do stock assessment and see if the status of a stock has improved or deteriorated since it was listed. We conduct a preliminary series of closed-loop simulations for NE porbeagle shark to determine the yield, conservation, and variability in effort performance of different Management Procedures with different data input requirements. These include model-free Management Procedure using catch, length, and index data as well as model-based MPs that require estimates of depletion and/or abundance. We define operating models by conditioning them on the catch and CPUE time series from the ICES assessment with two operating model defined by different choices about which CPUE series to include in the statistical fitting process. For life history and other parameters, we use values from the 2020 ICCAT assessment for the western porbeagle stock. Finally, we conduct a set of simulations that examine the effect of the assessment interval on MP performance. The analysis shows that there are many MPs, both model free and model-based that could be shown to meet status reference points equivalent to the CITES listing criteria, B_{MSY} and F_{MSY} criteria. Within those MPs however, there is a large variability in catch performance. While there are model-free MPs that can meet these criteria across a range of risk thresholds, the general pattern was they do so at the expense of yield. Future refinements of Operating Models are needed to match the properties of the eastern porbeagle stock and fishery closely.

SCRS/2022/092 - One potential problem with applying any Management Procedures that requires and index of abundance is that there is only one potential CPUE series, a Spanish longline series that is available for management of the eastern porbeagle stock. In this fishery, Porbeagle shark are a bycatch species so that there are concerns about the index not being representative of the non-target species. To address this concern, we run a set of simulations across a range of non-linear relationships between CPUE and abundance from hyperstable to hyperdeplete. We test a set of MPs that have previously demonstrated to meet minimum satisficing standards of having a least a 50% change that stock of above the CITES Appendix 2 threshold of 20% SSB0, at least a 50% chance that the stock is above the level that supports maximum sustained yield, and at least a 50% of chance that fishing mortality is below the fishing mortality that produces maximum sustained yield. We show that for model-free MPs, the effect of hyper stability on MP performance is minimal. For the model-based MPs, performance is adequate provided that there is not excessive hyperstability or excessive hyperdepletion. A key research recommendation for northeast porbeagle is to analyze the index to determine if there is evidence for hyperstability of hyperdepletion, and to see if such effects can be removed through the standardization process.

SCRS/2022/094 - ICCAT Recommendation 21-09 details the measures implemented to support the conservation of the North Atlantic stock of Shortfin Mako caught in association with ICCAT fisheries. Under point 13, there is a requirement to present the statistical methodology used to estimate dead discards and live releases for CPCs with reported average catches over 1 t between 2018-2020. This document describes reporting of nominal catches by Canada in Task 1 (1995-2021), details the methodology used in previous years to estimate dead discards and live releases, and outlines on-going work to improve discard estimates of sharks.

SCRS/2022/096 - *Isurus oxyrinchus* is an important pelagic species in the Southwest Atlantic Ocean, as well as in other oceans. Still being commonly captured, due to difficulties in biological sampling, some reproductive parameters are poorly known. We studied the reproductive biology of *I. oxyrinchus* in the Southwest Atlantic through the description of primary and secondary sexual characteristics and by determining the mean length at maturation calculated with a Bayesian approach to the logistic model. Individuals were sampled onboard from commercial pelagic longline fisheries between November 2020 and July 2021 in southern Brazil. The size of the specimens ranged from 115 to 295 cm, and from 141 to 239 cm to females and males, respectively. The size at maturity for females was estimated at about 286 cm, and at about 197cm for males. These reproductive parameters were different from some estimated for other oceanic regions.

SCRS/2022/P/023 presented methods based on Carvalho *et al.*, 2021 and Kell *et al.*, 2021 and applied for small fin mako shark assessment in Kell, 2021. The authors have been asked by the CAPAM workshop on stock assessment diagnostics for developing model ensembles, e.g., model uncertainty grids. Draft guidelines were presented, which have been developed in collaborate with other scientists working in ICES, GFCM, IOTC and IATTC will be presented at reviewed by WGSAM.

SCRS/P/2022/024 provided an updated overview of the e-tagging activities of the ICCAT Shark Research and Data Collection Program (SRDCP). To date, 90 tags (including 80 miniPATS and 10 PATs) were deployed in shortfin mako (61), silky shark (14), oceanic whitetip (8), porbeagle (5), smooth hammerhead (1) and scalloped hammerhead (1), as part of a collaborative effort of the ICCAT Shark Species Group. At the moment, the SRDCP has 53 miniPATs available for deployment. In addition, two scientific peer-reviewed papers were produced in 2021 with information collected from ICCAT tags. There are also 2 ongoing studies regarding post-release mortality of shortfin mako and movements and habitat use of porbeagle.

SCRS/P/2022/025 provided an update of the study on age and growth of south Atlantic shortfin mako, developed within the ICCAT Shark Research and Data Collection Program (SRDCP). A sample size of 883 specimens ranging in size from 55 to 330 cm fork length (FL) and 57 to 250 cm has been made available for females and for males, respectively. In the future, Bayesian growth models with informative priors from other stocks (e.g., the Northern stock) on L0 and L_β will be explored to overcome the lack of samples from large size specimens.

SCRS/P/2022/026 *Not provided by the authors.*

SCRS/P/2022/027 *Not provided by the authors.*

SCRS/P/2022/028 provided an update on the study on post-release mortality of shortfin mako in the Atlantic Ocean. Thirty-five out of 43 tags analyses rendered reliable information on individual fate, resulting in 27 survival and 8 mortality events (22.8% post-release mortality). This study will continue by analyzing the available information of tags deployed since 2019. It will also explore the possible contribution from other CPCs research programs that are willing to participate, such as Canada, South Africa, and U.K.