REPORT OF THE 2020 ICCAT INTERSESSIONAL MEETING OF THE SWORDFISH SPECIES GROUP
(Online, 16-19 March 2020)

"The results, conclusions and recommendations contained in this Report only reflect the view of the Swordfish Species Group. Therefore, these should be considered preliminary until the SCRS adopts them at its annual Plenary meeting and the Commission revise them at its Annual meeting. Accordingly, ICCAT reserves the right to comment, object and endorse this Report, until it is finally adopted by the Commission."

1. Opening, adoption of agenda and meeting arrangements

The meeting was held on-line due to the outbreak of Coronavirus (COVID-19), and particularly in Madrid, which obliged the ICCAT Secretariat to close. Therefore, it was decided to set an on-line meeting, from 16-19 March 2020. Dr. Rui Coelho (EU-Portugal), the Swordfish Species Group ("the Group") coordinator and meeting Chairman, opened the meeting and welcomed participants. Dr. Miguel Neves dos Santos (ICCAT Assistance Executive Secretary) welcomed the participants thanked the efforts made by all participants to remotely attend the meeting, apologized for any inconvenience this could cause, and noted this was also an opportunity for the SCRS to test alternative ways to develop its intersessional work.

The Secretariat provided information on how to use the on-line platform for the meeting (Microsoft TEAMS). The Chair reviewed the Agenda, which was adopted with minor changes (**Appendix 1**).

The List of Participants is included in **Appendix 2**. The List of Documents and Presentations provided to the meeting is attached as **Appendix 3**. The abstracts of all SCRS documents and presentations provided at the meeting are included in **Appendix 4**. The following served as rapporteurs:

Sections	Rapporteur
Items 1, 10	M. Neves dos Santos
Item 2	C. Palma, M. Ortiz, J. Garcia
Item 3	K. Gillespie, D. Rosa
Item 4	K. Gillespie, R. Coelho, M. Neves dos Santos
Item 5, 6	A. Hordyk, N. Taylor
Item 7	F. Garibaldi, G. Tserpes, A. Kimoto
Item 8	M. Neves dos Santos
Item 9	R. Coelho, G. Tserpes, M. Neves dos Santos

2. Review of fishery statistics

The Group reviewed the most up-to-date swordfish (SWO) fishery statistics (T1NC: Task I nominal catches; T2CE: Task II catch & effort; T2SZ: Task II size frequencies; T2CS: Task II catch-at-size reported) and conventional tagging data, available in the ICCAT database system (ICCAT-DB). The three swordfish stocks (SWO-N: North Atlantic; SWO-S: South Atlantic; SWO-M: Mediterranean) were presented individually. **Tables 1 (a to c)**, are the respective SCRS catalogues on fisheries data availability for the 1989-2018 period.

2.1 Task I (nominal catches) data

For the three swordfish stocks (SWO-N, SWO-S, and SWO-M) various revisions were made when compared to the corresponding swordfish statistics adopted at the 2019 SCRS annual meeting. These revisions included the elimination of the unclassified gear group "UN" (gears UNCL and SURF, reclassified with the correct gear, in line with the work done with other species such as billfishes). Some adjustments were also made to the fleet codes within each flag CPC, to the gears with the elimination of historical LL gear codes discontinued by the SCRS (LLHB, LLFB, LLMB) by reclassifying them into the new LL codes ("LLSWO", "LL-surf", etc.), and, some minor corrections of gear codes outside complete catch series. For gap completion on incomplete catches series, temporary estimates (carry overs) were calculated as the average of three previous years of catches. As recommended by the SCRS, all the carry overs are always preliminary and should be replaced by official statistics in the shortest time possible.
All the corrections were adopted and registered in ICCAT-DB.

SWO-N (North Atlantic swordfish stock)

The unclassified gear "UNCL" catch series corrected were Liberia (GILL: 1980-98), NEI-ETRO (LL: 1986-93) afterwards reclassified as NEI-MIX (NEI catches from flag related LL catches estimated in the past using the swordfish statistical document programme of ICCAT: SWO-SD), EU-France (TRAWPP: 1996-97, 2004-05, 2007-08), EU-Portugal (LL-surf: 2016-18), and St. Vincent and the Grenadines (LL: 1990-99). The major gear corrections were made to EU-Spain (1978: TRAW to TRAP), EU-Portugal Madeira fleet (1980-85: BB to HAND; 2001-18: LL to LLALB), and, Morocco (1990: LL to LLSWO). Finally, some carry overs were estimated for EU-Spain (Canary fleet BB: 1998; GILL: 1995), Morocco (TRAP: 1985, 2005, and, 2010; LLSWO: 1998), St, Vincent and Grenadines (LL: 2007), USSR (LL: 1981, 1983, 1988-89), and UK-Bermuda (LLSWO: 2017-18).

SWO-S (South Atlantic swordfish stock)

The unclassified gear "UNCL" catch series corrected were Argentina (LL: 1990; TRAW: 1991-94), Brazil (LL-surf: 2004, 2006-11), Nigeria (GILL: 1983-84, 1992, 1996), NEI-ETRO (LL: 1986-93) also reclassified as fleet NEI-MIX, Togo (GILL: 1985-96), and USSR (PS: 1981, 1984). The major gear corrections were Brazil (1961-95: LLHB to LL; 1990-95: LLMB merged with LL-surf), South Africa (1998-03 and 2014-19: LL to LLSWO), and USSR (1964-85: LLMB to LL). Two years of catches (2006 and 2009) of EU-UK reported as being caught in SWO-S were reallocated to stock SWO-N to complete the respective LL series. Finally, the carry overs estimated for SWO-S were Argentina (LL: 1978-81 and 1983-84), and Benin (GILL: 1983).

SCRS/2020/022 also presented a full revision of the Côte d'Ivoire GILL catch series for SWO-S, covering the period 1984 to 2018. This information was already available in the Task I catches but due to some discrepancies in the late years, the Group accepted this revision. They were incorporated in ICCAT-DB as official statistics.

SWO-M (Mediterranean Sea swordfish stock)

The SWO-M catch data were subject to large revisions. A large portion of the SWO-M historical catches have no gear associated (UNCL gear for 48% of the total catches in the 60's, 44% in the 70's, and, 35% in the 80's). The gear discrimination for SWO-M was greatly improved by this Group in recent years, in particular the last three decades (UNCL gears for 7% of the total catches in the 90's, 10% in the 2000's, and, 2% in the 2010's). With the collaboration of the National scientists, the Group was able to revise the majority of the catch series without gear on the early decades, by reallocating and/or splitting in one or more gears those "UNCL" catches. The unclassified gear "UNCL" catch series corrected were Algeria (GILL: 1990-97), Italy fleet fishing in the Strait of Sicily (small catches of HARP: 1995, 2000, 2014-15), and Libya (LL: 1965-68). The major gear corrections were for Algeria (1990-09: LL/LL-B: merged as LLSWO), EU-Cyprus (1990-09: LL to LLSWO), EU-Spain (1950-18: LLHB to LLSWO), EU-France (2015: LL-deri merged with LL), EU-Greece (1981-99: LL to LLSWO), EU-Italy (1968-84: LL/LLHB merged as LLSWO), Morocco (2006-11: GILLSWO to GILL; 1961-11: LL to LLSWO), Japan (1972-89: LLHB to LL), and Turkey (2003-07: LL to LLSWO). The EU-Portugal (Mainland) LL-surf fleet catch series (2000-06) was also reallocated to the Madeira LL fleet. To complete some gaps identified in some catch series, the Group estimated carry overs for Tunisia (LL in 1980) and EU-Cyprus (LLBFT: 2015 and 2016).

With the new information obtained under an ICCAT data recovery project (SCRS/2020/020, with partial catches of HARP, GILL and LL between 1972 and 1989) the Group tried to solve the outstanding Italian UNCL catch series issue (see Anon., 2019) covering the period 1984 to 1991, and the missing or partially incomplete catch series of HARP and GILL between 1960 and 1983.

The HARP catches obtained in SCRS/2020/020 (1972 to 1989, hereafter partial catches) represent on average 2.2% of the overall HARP catches of Italy between 1972 and 1983. The overall HARP missing catches of the period 1984-89 were obtained dividing the partial catches by 0.022. For 1990 and 1991 carry overs were applied. This new HARP catch series was afterwards discounted from the UNCL catch series (1984-91).

The mode of splitting the resulting UNCL catch series (1984-91) gave rise to various discussions and possibilities. With some background provided by Italian scientists in relation to these fisheries in the early 70s, the Group was able to adopt a preliminary estimation. The licensing system in Italy in the 70s was mostly based on a multi-gear licence and this fact did not allow for a proper vessel number for a given fishery, possibly excluding only the harpoon fleet. According to the existing knowledge, there was a tradition of longline fishery for adult swordfish in ports, along the Ionian Sicilian coast, in the harbour of Marsala (W Sicily) and along the Tyrrhenian coast, with other vessels in some parts of Italy. The LLSWO fishery was implemented in some Ionian ports of Apulia in the late 70s. At that time, hundreds of small vessels were also operating with coastal LL in autumn, targeting age 0 SWO for the local markets, following old habits, and these catches were not officially recorded (except for some research programmes in the late 80's and early 90's), because they were also not respecting the minimum size rules. The LL catches of swordfish in this early decade were in weight around 30% of the total Italian catches, but higher in number of fish caught.

The majority of vessels were fishing with driftnets (GILL), mostly in the Tyrrhenian Sea, but also in the Ionian Sea with few vessels in the Ligurian and in the southern Adriatic Sea. GILL were much more economically efficient compared to LL and catches where quite abundant at that time, mostly with medium-big fish. The number of gillnet vessels increased substantially over the years, from a few hundreds to more than 500 in total, reaching a peak of 772 in 1997. Detailed information about the early evolution of both LLSWO and GILL is not existing, because detailed fishery statistics in Italy initiated only in 1982, with the PESTAT programme. Catches with GILL were substantially high, even if the fishery was concentrated in spring and summer. Therefore, missing the details of the progression by year, the proportion could be assessed around 70% for GILL fishery in these early years.

The Group agreed to estimate the missing Italian swordfish catches as follow: for the period 1972 to 1991 the GILL catch series was obtained as being 70% of the total LL and UNCL (after discounting HARP) catches, and LL catch series as the remainder 30% of the total. Between 1972 and 1983 the up to now inexistent GILL catch series, was obtained by dividing the current LL catches by 0.70 (a proxy of the unknown LL and GILL combined catches) which results in GILL estimates being about 60% of the new LL and GILL combined yearly catches. In this period, the LL catches were maintained without any change. The new estimated GILL catch series, increased the total Task I nominal catches between 1972 and 1983, by about 4,500 t on average per year. The comparison of T1NC for SWO-M before and after the new estimations is presented in **Figure 1**.

There are, however, some important catch series for which the Group could not find a proper solution:

- EU-Spain UNCL catches between 1992 and 2007 could contain GILL (a fraction only). Spanish scientists committed to study and reallocate part of those catches to GILL.
- NEI (MED) catch series for GILL (1984 to 1992) and LL (1980 to 1992) have no flag association (both series estimated at the 1992 GFCM-ICCAT joint meeting). This could lead in the future (after a full recovery of all the GILL and LL catch series) to double counting those catches.

This Group should continue to make efforts to address and solve these problems in the future.

Table 2 presents the final SWO T1NC estimations by stock/gear group and year. **Table 3** shows the level of UNCL gear reduction (before and after the revision) by decade. With the solution found for EU-Italy 1984-91 UNCL catch series, all the decades have improved substantially having now ratios below 10% of catches without gear. **Figure 2** presents the T1NC estimations by gear group and year for the three swordfish stocks.

Document SCRS/2020/022 presented a revised catch series (1984-2018) for the artisanal gillnet fishery of Côte d'Ivoire for the SWO-S stock. The biomass was obtained by converting the swordfish specimens measured at three main landing ports of Côte d'Ivoire (Abidjan, San Pedro and Sassandra). This revised series was adopted and included in T1NC updated the existing one. Further discussion on this document are included in **Appendix 4**.

2.2 Task II (catch-effort and size samples) data

As shown in the swordfish SCRS catalogues (**Tables 1, a to c**) both Atlantic stocks are reasonably well covered in the last 30 years (1989-2018), with the SWO-N (score = 7.6) in a slight better shape than SWO-S (score = 6.8). The Mediterranean stock (SWO-M) has improved with the recovery of some T2CE and T2SZ

catch series between 1972 and 1989 (score increase from of 3.9 in 2019 to 4.4). However, important gaps in both T2CE and T2SZ still exist. As for other ICCAT species, the Secretariat has in place since 2014, a long-term project aiming to (a) recover missing Task II datasets, and to, (b) improve the level of Task II resolution and harmonization (replacing year/trimester by month, replacing 20x20/10x20/10x10 grids by 1x1 and 5x5, harmonise efforts by gear, harmonise/improve size/weight classes, etc). This work supported by the SCRS (committed to a long-term improvement of ICCAT statistics) requires the participation and full commitment of the ICCAT CPC scientists. The Secretariat is using the SCRS catalogues as one of the important instruments used to request revisions to ICCAT CPCs.

Document SCRS/2020/020 presented a summary of the data recovery project of Italian swordfish fisheries (HARP, GILL and LL) for the period 1972 to 1989 in the Mediterranean Sea. Both catch and effort and size/weight frequencies were analysed and included in the ICCAT-DB system. This information was crucial to solve the Italian UNCL (and the missing GILL) catch series between 1972 and 1989. It will be also used in the input files for the stock assessment.

In relation to size information, the Secretariat presented a summary and preliminary analysis of the T2SZ and T2CS datasets available for Mediterranean swordfish in ICCAT-DB (SCRS/2020/19). This analysis also included recovery size information from Italian fisheries from 1972 to 1989 (SCRS/2020/20). Size sampling for SWO-M is relatively sufficient since 1990 for the two main fishing gears longlines and gillnets. T2CS is available since 1976, but only for one fleet (EU-Spain), and since 2000 for seven out of 20 CPCs that have reported catches of SWO-M. However, compared to T1NC the T2CS reported, does not always represent the total CAS for the main fleets and in most cases, the submitted T2CS represents a small percent of the total landings reported. In conclusion, before overall CAS or CAA can be estimated, a thorough review of the available data in collaboration with national scientists is recommended.

Size samples are primarily from the longline (88%) and gillnet (11%) fleets. Overall, twelve flag/gear fleets account for 96% of the total catch since 1980's (**Table 1c**) and it's recommended to use these fleet's size data for the characterization of the catch at size distributions. It was noted that within the longline gear for example, there are different fishing strategies among fleets for fleets targeting swordfish and those that target bluefin tuna in the Mediterranean Sea resulting in different catch size distributions. It was noted also that size data from the 1980's is sparse and shows less information for the same gear/fleet compared to 1990's when enough data were provided. Thus, the Group's recommendation is to use primarily the size data after 1990. Further, the analysis shows that a 5 cm size bin interval was used for Med-SWO size frequency samples.

Another source of size information also compiled by ICCAT is the Domestic (former National) Observer Programme data, gathered using form ST09-DomObPrg (hereafter ST09 data). Due to the changes in the form structure (four versions since 2014, including the new 2020 version of ST09) ICCAT has now four different database models. All the information reported by CPCs since 2015 was integrated into the databases during 2019. However, due to the incompatible structures and the need to validate and harmonise all the information received, including the request for resending the most recent 2017 and 2018 ST09 data (this work is expected to require an additional three months of work), the Secretariat cannot currently provide any type of dataset or catalogue of ST09 data. However, the Secretariat has committed to present to the SCRS annual meeting a report card and a catalogue (in line with the SCRS standard report cards/catalogues for Task I/II), and, a dataset structure for general dissemination purposes.

2.3 Tagging data

The Secretariat presented a summary of swordfish conventional tagging updated in terms of total number of records, valid records and records under review. **Table 4** shows releases and recoveries per year and **Table 5** shows the number of recoveries grouped by number of years at liberty.

The Secretariat provided demonstrations of two cartographic visualization tools (viewers). The first (**Figure 3**) displayed the apparent movements of swordfish released and recovered with animations. In this cartographic viewer the user can select the source of data (release or recovery) and the month. The second viewer (**Figure 4**) shows all GIS layers created from the tagging data: Release points, recovery points, apparent lines of motion between the release and the recovery positions, as well as the grouped data on the mesh of 5x5 degrees. The options available to this viewer are: 1) Turn layers on or off; 2) Visualize numbers of registers of the releases and recoveries in each cell; 3) Show information in a dialog.

In addition, for the meeting, a geographic database "iccat_swo.gpkg" (geopackage) was created with all related GIS layers stored. Besides a GIS project was created ("swo.qgz") with QGIS, (software for the processing of freely disseminated geographic information: https://www.qgis.org). This project (snapshot in **Figure 5**) was presented to the Group with the focus on the use of this software for viewing and querying the swordfish geospatial tagging data. The Group acknowledged the work of the Secretariat and the potential of the geographic database created and the QGIS software, which increases to a great extent the geographical analysis capacity.

3. Progress on the Atlantic and Mediterranean Swordfish Project and other work related to the workplans

Document SCRS/2020/025 reported on details of the second phase of biological sampling program and associated analysis undertaken to date. The sampling representativeness relative to spatial and temporal patterns in recent catch data was examined. Samples were obtained from a broad temporal and spatial range; however, some gaps remain in the spatial-temporal coverage.

The Group was asked to support further sampling in the following areas: in the North Atlantic, in the waters near the Canary Islands, the mid-Atlantic (BIL92C), the Caribbean and Gulf of Mexico; in the South Atlantic, along a band ocean stretching from Brazil to Namibia along the 30°S latitude; and in the Mediterranean, near a potential mixing areas close to the Strait of Gibraltar, along the coastline of North Africa, and in the eastern Mediterranean. It was noted that for most ocean areas, additional sampling is required in the fourth quarter of the year (October through December). Specific updates on the project components are presented in specific documents/presentations in the following subsections.

The Group acknowledged the progress done so far regarding the collection of samples for the biology project and reiterated the need to continue this work. The Group noted that analyses will address questions relevant to both the stock assessment and to the axes of uncertainty in the MSE.

3.1 Stock structure (based on genetics, morphology and tagging data)

SCRS/P/2020/006 presented results from their *de novo X. gladius* genome sequencing, assembly and annotation and comparative phylogenomic analysis. The genome of the swordfish *Xiphias gladius* was sequenced, assembled and annotated. The authors then discussed the results from their genetic population analysis. Double digest restriction-site associated DNA (ddRAD) sequencing technology was applied to evaluate intra and inter-population differences between 25 North Atlantic and 71 Mediterranean specimens. The authors noted that additional ddRAD analysis are in progress to evaluate genetic population differences among North and South Atlantic and Mediterranean swordfish. In particular, 200 samples chosen on the basis of the fishing areas and the gonadal maturity stage are being used to provide the first genetic data on the mixing and spawning area. These first results will help to identify potential areas for spawning and mixing which should be confirmed by the analysis of a greater number of specimens in the future.

The Group noted the observation of Mediterranean swordfish being under stress due to pollution and parasites while the Atlantic population invests energy in migration and questioned whether such conclusion was supported by the analysis. The Group asked why the comparative genomics analysis was being performed against distantly related fish species for which genomic data is available. It was clarified that this could be due to the available genetic analysis of other distantly related species, even if the ICCAT catalogue could be incomplete. The existence of a mixing zone in the Balearic area and the possibility for the Mediterranean not being a unique population was also noted. However, the Group also noted that the results are still very preliminary for drawing any conclusions and the analyses should include more samples and a better more detailed description of the methodology.

3.2 Age and growth

Document SCRS/2020/024 presented the progress of the age and growth component of the Atlantic and Mediterranean swordfish biology project. It presented an update on sample numbers available for age and growth, both spines and otoliths, as well as sample numbers so far sent for processing. Also, a preliminary analysis of otolith readings was presented.

It was clarified that a comparison between spines and otoliths is being planned, and this document presented only a preliminary analysis of what is available so far. A workshop to define ageing reference sets for both spines and otoliths is being planned so that future analysis can include readings on both otoliths and spines.

The Group questioned if the analysis of otolith length and width was a precursor to back-calculating size at age for otoliths. The authors explained that there is no plan to back calculate size at age and that this analysis was conducted to check for differences in otolith shape between the Mediterranean Sea and the Atlantic Ocean. Possibly an otolith shape analysis could also be conducted to detect stock differences.

The Group questioned how prevalent fish with type A spines are in the population and if other spine types could be used or should be discarded. It was noted that 90% of all swordfish have type A spines and it was recommended that only type A be used. Using the other types of spines could impact back-calculation of ages given the characteristics of the second spine relative to other spine configurations. It was noted that a comparative analysis of different spine configurations could be completed to check if these differences translate in different readings or back-calculated ages.

3.3 Reproduction

SCRS/P/2020/005 provided preliminary results of swordfish reproduction studies associated with the ICCAT swordfish biology project. Of the 3048 swordfish in the database in early March 2020, 1186 were classified as male, 1523 as female, and 338 as undetermined. The preliminary estimates of L_{50} for the three stocks was consistently lower than those adopted by the SCRS. However, it should be noted that a significant number of histological sections of ovaries examined showed that females microscopically classified as immature were often incorrectly evaluated as developing (stage 2, mature) when using the macroscopic criteria. It was recommended to increase sampling of swordfish across the Mediterranean Sea and Atlantic Ocean, to collect enough data for the reliable estimation of maturity and other reproductive traits, as is the validation of the macroscopic maturity data using the histological examination of gonads.

The Group acknowledged the work completed to date on these reproductive studies, particularly given the short timelines for this sub-project. It was noted that more females were present for this analysis, however this relationship can vary with sampling location and timing relative to movement of different components of the stock. The observed ratio could also be due to differences in the size range because males have different growth rates and are smaller than females. It was noted that in the available literature, namely studies using samples from the harpoon fishery, that the ratio of females to males is usually smaller during the spawning period. It was also mentioned that the analysis could take into consideration differences between gears, but it was clarified that for this project all samples so far have been collected from longline gear.

3.4 Movements

Document SCRS/2020/023 presented a brief update on the satellite tagging of swordfish. So far, 9 individuals have been tagged with MiniPAT tags in the Atlantic Ocean under this collaborative project. The remaining acquired tags are being returned to the manufacturer due to faulty battery issues. Of the nine deployed tags, four specimen showed post-release mortality, three tags pop-up prematurely, one tag reached full planned deployment and one tag pop-up has yet not occurred. Depth and temperature series were presented for the four individuals that did not suffer from post-release mortality.

The Group noted that tagging involved a small sample size of individuals. The vertical movements of a tagged individual that remained mostly at the surface during an 8-day deployment duration was noted, as it did not display the usual daily vertical migration pattern, being in the surface during night-time and at deeper waters during daytime. It was suggested that this fish could be injured and therefore not displaying the usual vertical pattern. In previous studies a period of adaptation after tagging has been observed with fish staying at relatively shallow depth (Abascal *et al.,* 2010). Furthermore, previous work has shown differences between juveniles and adults have been identified, with juveniles spending more time at shallower depths (Braun *et al*., 2019). In this case this fish was of similar size to the other fish tagged in this study and the deployment duration was short (8 days), however at tag-release, it did not show signs of mortality, and it is not possible to know the fate of this individual after the pop-up date. It was noted that the depth of the mixing layer could be considered to check for possible relationship between vertical movements and the depth of the mixing layer.

Regarding horizontal movements, it was questioned if the fish that showed different patterns, moving north or south, were of different sizes or tagged in different seasons that could explain this difference, but this was not the case, both fish were of similar sizes and tagged in the same season. It was noted that some of the horizontal movements were consistent with foraging along fronts and the importance of using the data from the tags to help standardize CPUE time series through the development of habitat models was recognized. Consequently, the Group requested that these data be included in the ICCAT held swordfish electronic tagging data repository.

SCRS/P/2020/007 provided some preliminary results from a USA (NOAA): Portugal (IPMA) collaborative project on *Pop-up Satellite Archival Tagging of Atlantic Swordfish*. Between 2015 and 2019, 11 of MiniPAT were deployed in swordfish from Portuguese longline vessels near the current swordfish boundary of the North/South Atlantic. The presentation provided five fish tracks, including the depth and temperature profiles of the diving behaviour. The overall maximum dive observed was 1,480 m, by a 115cm swordfish tagged on August 2015 (at 14.3°N and 25.3°W), which is more than 600m deeper than the second deepest dive observed for this fish.

The authors noted that these deployments have provided useful data on movement and habitat use. However, high post release mortality, and (more recently) poor battery performance in the PSATs have seriously hampered data collection.

The Group noted very deep dives of a specimen, which are also observed in other species, e.g. yellowfin tuna and bluefin tuna. Such deep dives may cause a premature pop-up of the tags, as currently the new tags are programmed to release at much shallower depths in order not to cause damage to the tag. The Group suggested to discuss with the tag manufacturer the implications of the current depth limit related to the automatic release device.

3.5 Size/sex distribution

There were no updates regarding this section.

4. Plan for the ongoing and future activities of the Atlantic and Mediterranean Swordfish Project

The Secretariat provided a brief explanation on the Commission's decision to fund 2020 workplan activities. It noted that until 31 March 2020, 2019 funds were still available for tagging and the biology project (*Short-term contract for ICCAT swordfish biological samples collection for growth, reproduction and genetics studies*). The 2020 funds were made available by the Commission and included a voluntary contribution by the EU, through a grant agreement for *Strengthening the scientific basis for decision-making in ICCAT*.

The science budget proposed for swordfish in 2020 amounts to €355,000, which represents 85% of the request made by the SCRS and an increase of almost 20% compared to the funds available in 2019. The available funds to develop the 2020 swordfish workplan are distributed as follows:

Activity	***Amount (€)***
E-tagging	30,000
Reproductive biology study	25,000
Age and growth study	40,000
Genetics study for stock differentiation	90,000
Sampling collection and shipping	35,000
Inter-lab calibration workshop for age reading and histology validation	25,000
Other fisheries related _SWO studies (including data recovery)	20,000
N-SWO MSE	90,000
Total	**€355,000**

In order to make the best use of the available funds the Secretariat also informed the Group that a contract was recently signed aiming at the continuation of the northern Atlantic swordfish MSE process, following the roadmap adopted by the Commission in the 2019 Annual meeting.

Regarding other 2020 workplan activities, the Group discussed and agreed to the following:

E-tagging

The Secretariat provided a brief explanation of the technological problems of the two batches of Wildlife Computers P-SATs that have been purchase and the uncertainty on the when the problem related to the battery issue will be solved. , it was requested for the Secretariat to proceed with the acquisition of Microwave Telemetry X-tags. Furthermore, it was suggested that new X-tags and available miniPATs be deployed in the same area and time to allow for comparison of tag performance. As X-tags have to be pre-programmed by the manufacturers, the Group agreed to request a pre-defined pop up deployment duration of 180 days, and to ask for the "emergency depth release" to be changed to at least 1500-1700m (instead of the usually programed 1250m, given that swordfish can make dives deeper than 1250m).

Biology study (reproductive, aging and genetics)

Upon the review of the results achieved (see item 3) the Secretariat highlighted the need for new Terms of Reference (ToRs) to be developed to allow a new contract to be signed as soon as possible. The Group developed these ToRs for the third year of the study, which are include in **Appendix 5**.

Fisheries related studies (data recovery for Mediterranean)

The Secretariat informed the Group that the consultant that was contracted to recover EU-Italy swordfish fisheries data for the period prior to 1990, had recently informed holding similar data for EU-Italy longline fisheries data in the Ionian Sea for period between 2012 and 2019. A small group (composed by George Tserpes and Fulvio Garibaldi) was nominated to assess the need and possibility to continue the data recovery of swordfish fisheries related data. This small group shall also develop and provide the Secretariat the respective ToRs.

Finally, the Secretariat informed the Group about the suggestion made at the 2020 SCRS Process and Protocol meeting, for the Group to develop a swordfish programme that could integrate all research activities. Such a programme, which should be integrated in the new SCRS Strategic Research Plan for the period 2021-2025, should have as major goals reducing uncertainty in swordfish stock assessments and

MSE processes and aiming to improve scientific advice provided to the Commission. The Group identified national scientists that have been coordinating the ongoing work (Rui Coelho, George Tserpes, Kyle Gillespie, Daniela Rosa and Fulvio Garibaldi) and Miguel Neves dos Santos from the Secretariat, who would be in charge of preparing a draft proposal to be presented at the 2020 September Species Group meeting. This proposal will consider a timeframe of at least three years and take into consideration the major research topics listed in the current workplan. Furthermore, it should contemplate extensive collaborative work among national scientists with the aims of enhancing capacity building and contributing information to the upcoming swordfish stock assessments.

5. Review of work done in 2019 on North Atlantic Swordfish MSE

The swordfish MSE contractor provided an update on the North Atlantic Swordfish MSE (SCRS_P/2020/004). He began with a review of the SWO MSE work done in 2019. This included: the development of the SWOMSE R package (based on the existing R packages MSETool and DLMTool), the Shiny App, MSE Trial Specifications Doc, MSE Project Progress Sheet (http://bit.ly/nswo-mse-progress).

The Group discussed whether or not the operating model grid captured a "broad enough" range of scenarios. As part of this discussion it was asked if mixing could be considered in the operating models. Mixing was acknowledged as a possibility to explore but that it would depend on hypothesis on mixing and data (including genetics and tagging). The Group noted that they had seen only a single observation of a conventionally tagged fish moving between the Mediterranean and the eastern Atlantic, and that information about a mixing area in the Atlantic West of Gibraltar is available in literature already presented at the SCRS swordfish Species Group in the past. Alternative hypotheses about mixing could only be considered once supported by more exhaustive analysis of tagging and genetics data. In addition, considering such data would require modifying current operating models to include spatial and possibly also stock structure. It is not the recommendation of the Group to entertain operating models with stock mixing at this stage.

The swordfish MSE contractor provided an overview of the 2020 workplan. This included: finalizing the OM uncertainty grid, OM Validation, Performance Metrics (including minimum performance limits and how to formulate performance measures). The MSE contractor is working with a full seven factor factorial design of operating models for a total of 288 uncertainty OMs plus the base case. As part of this progress review, he provided several additional HTML documents summarizing the MSE output including OM-4-Report.html, OM-base_case-Report.html, and OMs_Summary.html in the meeting's OwnCloud that describe the operating model fits and the key outputs from each. The intention was to get feedback from the Group on the reports and rerun the grids and generating the associated diagnostic output with the recommended changes.

The Group discussed the diagnostic plots and the contractor asked the Group for feedback on these. The MSE contractor took suggestions for what additional information would be useful for the plotting. These suggestions were as follows:

- add numbers on top of boxplots to indicate # of OMs in each group;
- combine Table 3 and Table 4 (contained in the live OMs summary report presented by the contractor during the meeting) so it is easier to see how parameters and likelihood values are related;
- add bold line to each plot showing result from the 2017 stock assessment.

The need to define criteria for use of CPUEs (whether for use in empirical MPs or in management procedures that used models) in future simulation was also discussed. There were three concerns raised by the Group:

- the feasibility of recreating/predicting CPUE data in the simulation phase with the same characteristics as the original data;
- Including CPUE time series in the list to be projected, those that may be not available in the future;
- The feasibility of reflecting CPUE variability caused by alternative model fitting approaches in the MSE.

The Group noted that the bluefin tuna Species Group has developed criteria for selecting CPUEs for projections which would be relevant to the swordfish MSE but did not decide on any details at the meeting. The need to identify the indices that would be used for future work was discussed. The MSE contractor noted that he could provide some statistical outputs (residuals, autocorrelation, etc.) and practical criteria (like if the index is likely to continue in the future) that will guide the decisions on which CPUEs to use.

Finally, the SWO MSE contractor provided a summary of the next steps in the 2020 swordfish MSE workplan. These were:

- Finalize OM Uncertainty Grid;
- Develop OM Reference Set;
- Develop OM Robustness Set;
- Determine index (indices) to use in CMPs;
- Propose example CMPs to evaluate;
- Decide probability values for preliminary performance metrics.

6. Further development of the MSE workplan and roadmap for ICCAT North Atlantic Swordfish MSE process

6.1 Implications of the new MSE roadmap adopted by the Commission

The Chair presented the MSE roadmap that had been adopted by the Commission. The MSE for N-SWO appears to be on track and the plan for 2021 appears to be feasible.

It is important for the SCRS to provide additional feedback to the Commission on the updated 2019 roadmap based on feedback from the Group. The Group agreed to review the roadmap in light of the intersessional meeting and provide the SCRS suggestions/comments to incorporate into the SCRS' annual report to the Commission.

The Secretariat informed the Group that in the agenda for the upcoming 2020 Panel 4 intersessional meeting there is an item for the N-SWO MSE that will provide an opportunity to present the MSE progress to date and the next steps in the workplan. It was noted that by the end of 2020, the Group would need to have some additional information from the Commission on management objectives and associated performance metrics to move forward with the swordfish MSE.

The formulation and presentation of Performance Metrics was discussed. The Group noted that more work was needed to be done in order to define any criteria for choosing management procedures. The Group concluded that there were some high priority items for the Panel 4 meeting discussion and decisions by the Commission in 2020. These are referred to in the recommendations section. There is a need for a Panel 4 meeting early in the 2021 in order to have additional dialogue to practically make progress with the MSE in 2021. The Commission would have to approve the approach for conditions for exceptional circumstances. This means that these conditions would have to be determined soon.

The Group stressed the importance that the swordfish Species Group identify what specific responses it needed from the Commission and when. The timing of the Commission's responses will be key for both work-planning such as selecting MPs and the management of the fishery. With respect to work-planning, it would be important to consider timing of decisions required from the Commission so that meetings are scheduled appropriately. The SCRS Chair responded that requests to the Commission would need to be finalized by the September 2020 SCRS meeting, so that they can be presented to the Commission.

The Group discussed what would be the reference grid for swordfish. It was noted that until the initial grid was finalized with updates to the SS model runs (discussed below), it was premature to discuss this.

The Group recognized that the Working Group on Stock Assessment Methods (WGSAM) has demonstrated how different methods of CPUE standardization (all of which were acceptable) can result in different trends in indices of abundance given the same data set (Forrestal *et al.* 2019, Forrestal and Schirripa 2019). These different methods can have critical implications whether an empirical or model-based Management

Procedure is used and that this finding should not be overlooked. There was discussion on the importance of maintaining consistency with the CPUE standardizations used in the stock assessment, the OM's as well as the projections of these CPUE for use in the MSE process. In this regard, the Group noted that complete descriptions and records of methods (software, type of standardization, data groupings, etc.) should be maintained to keep all pertinent MSE processes consistent, allow for the correct implementation of a MP, and to allow exceptional circumstances to be properly monitored.

The Group agreed that it still needed to look at the properties of the indices. It was noted that initially the objective would be to identify indices that had poor fit diagnostics across all OMs and secondly to evaluate whether there was a pattern in the fit diagnostics that related to OM features such as the use of an environmental covariate. The MSE contractor agreed to provide a summary table of the index fits across OMs that would assist in this decision making.

Robustness tests for MSE scenarios were discussed. The Group discussed that there was an opportunity to do this but because the OMs were based on Stock Synthesis, it had to be technically possible using Stock Synthesis. The Group discussed the biological sampling project and if results from it could be included in the MSE. It was noted that any results from this project would have to fit into future OM development. As it pertained to growth it was noted that alternative scenarios could be considered such as marginal changes from the existing growth curve. OMs could also consider discard mortality of undersized swordfish. It was noted that while the effect of undersize fish release mortality is considered explicitly in the existing OMs, this could be improved by including both selectivity and retention curves for each fleet. The Group agreed that a list of robustness tests and their relative prioritization should be defined for the swordfish MSE. In this way, limited time and resources could be dedicated to higher priority items.

The Group agreed that after the OM runs were complete, the MSE contractor could re-run the package and generate the set of reports discussed above with the OM diagnostics. The results of the OM fitting and corresponding diagnostic package could be discussed in the September Species Group meetings. It was noted that a lot of important decisions had to be made in the Species Group week. So, it would be very important to ensure that swordfish had a Species Group meeting. Moreover, because there will also be a stock assessment for Mediterranean swordfish, a better alternative might be to have interim meetings (webinars, etc.) to discuss any outstanding issues. The Group agreed to have a webinar mid to late summer, depending on progress with OM development.

6.2 Discussion on finalizing the reference set of OMs

The modeling platform used for the 2017 northern swordfish stock assessment (Stock Synthesis, SS3, version 3.24P) (Anon. 2018) is being used as the basis for the N-SWO MSE Operating Model. The first model fits were completed on all 288 possible states of nature that were initially identified by the Group. Examination of the results of these trials revealed that several model configurations either resulted in hitting parameters bounds or in non-convergence. Thus, the next task was to diagnose the underlying causes of these issues and attempt to solve them in the most parsimonious manner.

One standard technique to employ when conducting a stock assessment with SS3 is, after stable values for some parameters are found, is to reduce the range of the space the model searches for those values in future runs. This is done by tightening the bounds of some parameters so as to make the search more efficient as the fitting process evolves. However, in the case of MSE, the task is to fit a wide range of possible states of nature, not only the one suggested to be most likely by the data. In the case of the 288 OMs, some states of nature explored pushed parameter estimates to their previously tightened minimums and maximums (e.g. virgin recruitment). This issue was remedied by simply widening the bounds on a few keys parameters so that bounds were not hit. One parameter in particular (the parameter of peak selectivity of the "Japanese Early" fishery) could not be increased far enough to prevent it from ever hitting the upper bound. Noting, however, that this did not occur with all OMs, in the case of the peak selectivity it was deemed not to be a serious concern as it did not prevent model convergence.

Further examination of the results of the OM revealed that the parameters estimating added variance associated with each of the CPUE's was causing the greatest number of undesirable issues. It was suspected that the reduced variance was creating a flattened fitting surface making the model less stable than it would be without them. Test runs with the added variance turned off showed indeed that this was the case and that the model proved to be much more stable without the estimation of these parameters. Consequently, the CV of the indices has been fixed at two alternative levels for the purpose of characterizing this aspect of uncertainty in the MSE framework.

An option introduced into the SS3 control file was the "extended options" in the stock-recruitment function so as to better define recruitment estimated bias correction. This is a standard practice when using SS3. Using these expanded options more finely tuned the stock-recruitment relationship but could not be re-tuned for each of the 288 configurations. This was not a critical handicap and it was deemed more appropriate to keep the bias correct within the model, tuned to the base case. A warning comes up when using sigma_r = 0.6 is "Main recdev biasadj is >2 times ratio of rmse to sigmaR". This is due to the combination of the signal in the data, which suggests a sigma_r of around 0.2 but having the value fixed at 0.6 (per the MSE uncertainly selection). This too is not a major concern for the MSE. The bias adjustment was "tuned" to the base case model and then used through the 288 OMs. This is a minor issue and one that cannot be fine-tuned for all 288 OM's. Once all the above issues were addressed a random selection of the 288 OM's (including the most extreme configurations) were fit, none of which had any issues besides the two mentioned above (bounded HI peak selectivity for "Japanese Early" and the sigma_*r* issue). In order to reduce run time of the model three trials were run with the identical model. The first trial run was run with the "normal" settings of SS3, this model took 9:28 min to complete inversion of the hessian or approximately 48 hours for all 288 models. When the model was run in "optimal" mode it took 5:58 min to run (approximately 29 hours for all 288 models). Furthermore, when the model was run in optimal mode and started with the ss.par file, which starts the model with the estimated parameter values, the run time was reduced to 3:10 min, for a total of 14 hours for all 288 models.

Use of the SS3_opt.exe program needs to be done with care as this executable program uses a reduced number of error checks to reduce run time. As the set of 288 models will only need to run one time (in theory), the saving in time may not outweigh the reduced error checking. Starting with the ss.par file also needs to be done with care to ensure that the ss.par file being used is paired with the intended control file (*.ctl) being used.

The Group decided that the plan to finalize the OM reference set is as follows:

- Michael Schirripa will send Daniela Rosa the new "base case" input files (with the new ctr file modified);
  Daniela Rosa will build the new OM grid, i.e. create the 288 folders with SS3 input files;
- Those input files will be shared to swordfish Species Group members with high-performance computing power to run those 288 SS3 models (Adrian Hordyk, Kyle Gillespie);
- The output will be re-examined to see if errors/hitting constraint/convergence problems still exist;
- If there is no need for another round of fixing, the 288 new files (with SS3 inputs + outputs) will be used by Adrian Hordyk to continue the MSE work.

6.3 Discussion on starting to test candidate management procedures

The Group discussed what the process would be for developing Candidate Management Procedures (CMPs). The contractor expressed his intention to document how to develop MPs in the MSE package so that individuals could develop their own MPs. The Group also considered whether it was the intention of the Group to allow national scientists to develop their own CMPs or have a smaller subgroup or the contractor do it. The Chair responded that he would prefer to keep all options open. The Group agreed to consider both model-based and empirical CMPs.

7. Data preparation for the next stock assessment of the Mediterranean swordfish

7.1 Review of biology

The Group reviewed new information from the literature on the maturity of swordfish in the Mediterranean (Marisaldi *et al*., 2019). The estimated L50, based on histological analysis, was 131.5 cm, a rate that is lower than the currently adopted value by SCRS (142 cm). The lower estimate coincides with relevant preliminary results provided by the ICCAT swordfish biology program (SCRS/P/2020/005). Some concerns were raised that the number of actual samples and the sampling location were not clearly defined in the paper. The Group generally agreed that the maturity at age is younger than the currently used age 3, and the new information about maturity will be considered in the forthcoming stock assessment. The actual values for length and/or age at maturity that will be used in the 2020 assessment will be discussed intersessionally.

During the presentation of the statistics (see section 2) the Group was reminded that a series of length-weight relationships for Mediterranean swordfish were revised, based on integrated data from different areas (Tserpes *et al.*, 2017):

GG=0.00000843xLJFL^3.059,

GW=0.00000645xLJFL^3.129, and

RW=1.14xGG

The Group agreed to use these length-weight relationships for the 2020 stock assessment, as these have been adopted by the SCRS in 2017.

7.2 Review of fisheries indicators

The Group reviewed three new documents that were presented with CPUE data from the EU-Greece, Morocco and EU-Italy (Ligurian) swordfish targeting longline fisheries.

Document SCRS/2020/021 provided biomass and density indexes for the Greek surface longline fisheries for the period between 1987 and 2018. A biomass index from the same fisheries was used in the previous assessment. During the discussion it was noted that index decreases in the last decade coincide with the perception of the fishers on stock status. The authors were requested to provide further details on the data used, as well as on the model outputs, in an updated version of the document.

Document SCRS/2020/026 provided the Moroccan longline index between 2012 and 2019. This index was used in the 2016 stock assessment for the period between 2001 and 2015 (Anon. 2017). The author stressed that the gillnet fishery was the main gear for swordfish before 2011, and a longline index, based on good quality data from relatively large vessels was investigated after 2012. The Group questioned if there are many zero-catch operations. It was answered that there were many for small scale longline fishery in the former study, but the data used in the current study contain mostly positive-catch data, because the data for large longline vessels is trip-based that aggregate about five operations. It was also clarified that the fishing area referring to the dataset covers only the Strait of Gibraltar and the Alboran sea. The author was requested to provide information on the approach that was followed for computing the annual standardized indexes. A point was raised by the Group regarding the significant Year*Month interaction shown in the analysis, and how to best estimate then a Year index. It was indicated that an approach used in many SCRS Groups has been to convert the interaction of Year*Month into a random effects interaction so that the resulting Year index factor will include the variance associated with the interaction. The Group agreed that this approach would be plausible and suggested to go ahead.

Document SCRS/2020/027 presented information on the Ligurian (Italy) swordfish fisheries, including preliminary analysis of CPUE indexes. CPUE data included observations from both the surface and mesopelagic longline gears for the period 1990-2018. The authors emphasized that the work is in progress and final results including appropriate model diagnostics will be provided on time for potential use in the assessment. While the Group highlighted the importance of longer time series in stock assessments, it was commented that careful consideration is needed when combining data from gears with different selection patterns. The authors were requested to provide indices based on the standardization of the combined data and by gear type.

The Group noted that the Spanish longline index used in the 2016 stock assessment (Anon. 2017) was not updated at this meeting, and it was agreed to contact intersessionally with the Spanish scientists exploring the possibility of providing updated indexes before 3 April 2020.

The Group also discussed the potential development of indices from other Mediterranean fisheries, e.g. Algerian. The Group felt that it would be difficult to consider and review indices for the use in the stock assessment if they are not submitted well before the stock assessment session, mainly due to time limitations. The Group has discussed this in the workplan, and repeatedly encouraged CPC scientists to explore the possibility of developing new, as well as updating existing CPUE indexes.

In general, the Group noted that changes in discard rates over the time series may have affected the estimates of the overall trends for all indices.

7.3 Identification of data inputs, appropriate stock assessment approaches, and their specifications

The Group reviewed the biological parameters which were used in the previous assessments since 2010 (Anon. 2011, 2015, and 2017) and identified the changes needed. The table below contains the adopted parameters.

Parameter	*Mean*	*CV*	*Distribution*	*Description*	*Source*
M	0.206	0.25	lognormal	Natural mortality (1/year)	McAllister (2014)
L_{inf}	238.58	0.1	lognormal	Von Bertalanffy asymptotic length	Mean: ICCAT Manual CV: Working Group
K	0.185	0.1	normal	Von Bertalanffy growth parameter	Mean: ICCAT Manual CV: Working Group
t_0	-1.404	0.2	normal	Von Bertalanffy age at zero length	Mean: ICCAT Manual CV: Working Group
a	9.61E-06	-	exponential	Weight at length parameter (GG-LJFL)	Tserpes *et al.* (2017)
b	3.059	-	non lognormal	Weight at length parameter (GG-LJFL)	Tserpes *et al.* (2017)
L_{50}*	142	0.2	lognormal	Length at 50% maturity	Mean: ICCAT Manual CV: McAllister (2014)
d	0.2	0.2	lognormal	Parameter of the logistic maturity ogive	Working Group
h	0.83	0.14	beta	Steepness h=0.2 + 0.8 Beta (5.86. 1.59)	McAllister (2014)

*L_{50} will be revised interessionally.

The Group reviewed the available indexes and compiled a list of those that could be potentially utilized for assessment purposes (**Tables 6 and 7**). The list will be finalized by 10 April 2020 after clarifying pending issues on certain existing indexes and receiving additional indexes from CPUE data series that are still under analysis (Moroccan, Spanish and Ligurian longline fisheries).

The Group agreed that the use of the longest CPUE series and those covering the most recent period are preferable for the assessment of the stock.

Regarding assessment methods, the Group discussed possible models and their challenges considering the model assumptions and the available dataset. For the age structured models, concern was raised due to the fact that the currently available size data are rather insufficient (see Table 1 in SCRS/2020/019). For the production models, prior information will need to be studied well, since the available CPUEs show mostly flat trends and the results will largely depend on them.

Given those challenges, the Group agreed to follow different approaches:

1. Age structured models

- For the purpose of continuity, XSA runs with similar settings with those used in the 2016 assessment (Anon. 2017). The Group decided to maintain CAS (catch at size) and CAA (catch at age) before 2015 used in the 2016 assessment and to create them newly for the years 2016-2018. The EU-Spain, EU-Greece, and Morocco longline CPUEs will be used;
- A statistical catch at age method (a4a) using the same data with XSA.

2. Production models

- ASPIC;
- Bayesian approaches (e.g. JABBA).

3. Data-poor methods (optional, mostly depending on the availability of an external expert)

CPC scientists and the ICCAT Secretariat staff will facilitate model runs. The possibility of inviting an external expert, mainly for contributing to data poor assessments will be also explored.

Workplan:

- Share necessary updates of CPUE series by 3 April 2020 with the Group. *Responsibility:* CPC scientists;
- Decision on the use of Moroccan, Spanish and Ligurian longline indices by 10 April 2020. *Responsibility*: CPC scientists;
- Task I, and size data by 15 April 2020 *Responsibility*: ICCAT Secretariat;
- Catch-at-size/age matrix for the continuity runs by 3 May 2020. *Responsibility*: ICCAT Secretariat;
- Provide tentative stock assessment results one week before the stock assessment meeting, including the appropriate diagnostics recommended by SCRS (Kell and Merino, 2016). *Responsibility*: CPC scientists and ICCAT Secretariat;
- Tentative **Tables 6 and 7** will be updated by 10 April 2020.

8. Other matters

Recognizing the inherent limitations of a webinar format, the Group noted the effort of all participants to make the webinar generally successful at addressing the material that the meeting intended to cover.

The Group noted that the Mediterranean swordfish stock assessment meeting is scheduled for the 25-28 May in Crete, Greece, but given the current uncertainties in terms of travelling a plan-B was discussed in case an in-person meeting is not possible. In such case, the Group agreed that the meeting should be carried out by Webinar and requested for a longer meeting duration period (weekdays, between 25 May and 2 June 2020). The Group also requested for flexibility (e.g. shorter meeting times, flexible timing) to better accommodate the participation of colleagues from the different time zones, and perhaps to allow time to conduct analyses during the meeting period.

9. Recommendations

Recommendations with financial implications

Since the financial mean has been approved by the Commission, it is requested the Secretariat to proceed with the administrative procedures to:

- sign, as early as possible, a new short-term contract to ensure the continuation of the *ICCAT swordfish biological samples collection for growth, reproduction and genetics studies*. The ToRs related to this contract are provided in **Appendix 5;**

- purchase six x-tags from Microwave Telemetry. Specifications on these tags will be provided by the Group coordinator (Dr. Rui Coelho);

- invite a stock assessment expert to help run data poor stock assessment models during the Mediterranean stock assessment session;

- hire an external expert to proceed with the recovery of fisheries data related to the EU-Italy swordfish fishery, namely longline fishery targeting swordfish in the Ionian Sean during the 2010's. However, the Secretariat will check with the EU-Italy statistical correspondents that this data set is not included in the data provided to ICCAT.

Recommendations related to statistics

The Group recommends and reminds CPCs to submit their 2019 domestic (formerly National) Observer Program data on the 2020 ST09 form and to resubmit both the 2017-2018 data on the 2020 ST09 form, as well as any other un-submitted data to the Secretariat.

The Group also recommends that the Secretariat provide the SCRS with an overview observers' data submitted to ICCAT by the CPCs after *Recommendation by ICCAT replacing the Recommendation [13-04] and Establishing a Multi-annual Recovery Plan for Mediterranean Swordfish* [Rec. 16-05], independently from the format used to submit the data.

The Group reminds CPCs that the reporting of discards is required and is essential to assessing the stock status of all swordfish stocks. This is particularly important for Mediterranean swordfish because dead discarded undersized swordfish could be a large component of the fishing mortality.

The latest Chinese Taipei full revision to their swordfish Task II size frequencies (reported on March 2017) did not contain individuals below 120 cm in size (LJFL). The Group recommends that Chinese Taipei once again report the Task II size frequencies (since 1980) to ICCAT, with the inclusion this time of the swordfish samples with LJFL below 120 cm (landed and/or discarded).

Recommendations related to Northern Atlantic Swordfish MSE

- The Group recognized the progress that has been made by Panel 4 through *Resolution by ICCAT on development of initial management objectives for North Atlantic swordfish* [Res. 19-14]. The Group, however, also noted that the Resolution now needs further development before it is complete enough to be used within the NSWO MSE effort. Specifically, the SCRS needs the following to be able to continue making progress on the MSE and development of candidate management procedures (MP):

    1. Management interval length, this is the number of years between re-running the MP (previously northern swordfish TAC Recommendations have ranged in length from 1-year to 4-year periods);

    2. Provide values of probabilities that are currently blank in Resolution 19-14;

3. Define the desired timeframes when each of the objectives are to be met (this could be stated as a particular year, a set number of years, or as "short, medium, long term" – however if using descriptive terms such as "short-term" please also indicate how many years Panel 4 considers "short-term" to be).

- When providing this information to SCRS, Panel 4 should ensure the use of terminology consistent with the Joint RFMO MSE glossary and the current MSE scientific literature (e.g. conceptual vs. operational objectives, performance metrics, etc.) and other concurrent ICCAT MSE efforts.

- The Group recognize that Res. 19-14 indicates Panel 4 will submit its finalized objectives to the Commission for the 2021 meeting, however the answers to items 1 to 3 above are needed sooner in order to facilitate the continued work on the North Atlantic Swordfish MSE (especially #1: management interval length) and should be addressed at the 2020 Panel 4 intersessional meeting or at the Commission meeting should the intersessional meeting be postponed.

10. Adoption of the report and closure

The report was adopted during the meeting. The Chair and the Secretariat thanked all the participants for their efforts to work effectively and efficiently within a new framework of SCRS meetings. The meeting was adjourned.

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Table 1 [A/B/C]. Standard SCRS catalogues on statistics (Task 1 and Task 2) of SWO by stock, major fishery (flag/gear combinations ranked by order of importance) and year (1990 to 2019, being 2019 preliminary). 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 visualised against its equivalent Task 2 availability (DSet= "t2") scheme. The Task 2 colour scheme, has a concatenation of characters ("a"= T2CE exists; "b"= T2SZ exists; "c"= T2CS exists) that represents the Task 2 data availability in the ICCAT-DB system.

Table A. SWO-N stock (1990-19)

						T1 Total	15672	14934	15394	16738	15501	17105	15222	13025	12329	11622	11453	10011	9654	11442	12068	12377	11478	12302	11050	12081	11558	12523	13868	12069	10678	10673	10376	10171	8895	0			
Species	**Stock**	**Status**	**FlagName**	**GearGrp**	**DSet**		**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**	Rank	%	%cum
SWO	ATN	CP	EU.España	LL	t1		5736	6506	6351	6392	6027	6948	5519	5133	4079	3993	4581	3967	3954	4585	5373	5511	5446	5564	4366	4949	4147	4885	5620	4082	3750	4013	3915	3586	3186		1	39.2%	39%
SWO	ATN	CP	EU.España	LL	t2		abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	ac	ac	abc		1		
SWO	ATN	CP	U.S.A.	LL	t1		4967	4399	4124	4044	3960	4452	4015	3399	3433	3364	3316	2498	2598	2757	2591	2273	1961	2474	2405	2691	2204	2572	3347	2812	1816	1593	1389	1301	1105		2	23.1%	62%
SWO	ATN	CP	U.S.A.	LL	t2		ab	ab	ab	ab	ab	ab	ab	ab	ab	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc		2		
SWO	ATN	CP	Canada	LL	t1		819	953	1487	2206	1654	1421	646	1005	927	1136	923	984	954	1216	1161	1470	1238	1142	1115	1061	1182	1351	1502	1290	1383	1489	1473	1034	753		3	9.7%	72%
SWO	ATN	CP	Canada	LL	t2		ab	ab	ab	ab	ab	ab	ab	ab	ab	abc	abc	bc	abc	abc	abc	abc	bc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc		3		
SWO	ATN	CP	EU.Portugal	LL	t1		463	757	497	1950	1579	1593	1702	902	772	776	731	731	765	1032	1319	900	949	778	747	898	1054	1202	882	1438	1241	1420	1459	1871	1670		4	8.9%	81%
SWO	ATN	CP	EU.Portugal	LL	t2		ab	abc	ac	ab	ab	ab	ab	ab	ab	ab	abc	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab		4		
SWO	ATN	CP	Japan	LL	t1		1051	992	1064	1126	933	1043	1494	1218	1391	1089	759	567	319	263	575	705	656	889	935	778	1062	523	639	300	545	430	379	456	325		5	6.2%	87%
SWO	ATN	CP	Japan	LL	t2		abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	bc	bc	bc	abc	abc	abc	abc	abc	abc	abc	abc	ab	ab	ab	ab	ab	ab			5		
SWO	ATN	CP	Maroc	LL	t1		24	92	41	27	7	28	35	239	101	35	38	264	154	223	255	325	333	229	428	720	963	700	700	1000	1000	800	800	750	950		6	3.1%	90%
SWO	ATN	CP	Maroc	LL	t2		-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	bc	abc	abc	abc	abc	abc	bc	abc	a	a	abc	bc	abc	ab	abc	abc		6		
SWO	ATN	NCC	Chinese Taipei	LL	t1		269	577	441	127	507	489	521	509	286	285	347	299	310	257	30	140	172	103	82	89	88	192	193	115	85	133	152	96	169		7	1.9%	92%
SWO	ATN	NCC	Chinese Taipei	LL	t2		abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	ab	ab	ab	ab	ab	ab	ab	ab	ab	abc	abc	abc	abc			7		
SWO	ATN	CP	Canada	HP	t1		92	73	60	28	22	189	93	89	240	18	95	121	38	147	87	193	203	267	258	248	176	208	97	275	233	98	85	175	34		8	1.1%	93%
SWO	ATN	CP	Canada	HP	t2		ab	ab	ab	ab	ab	ab	ab	ab	ab	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc			8		
SWO	ATN	CP	China PR	LL	t1					73	86	104	132	40	337	304	22	102	90	316	56	108	72	85	92	92	73	75	59	96	60	141	135	81	86		9	0.8%	94%
SWO	ATN	CP	China PR	LL	t2					-1	-1	-1	-1	-1	a	a	a	a	a	a	a	a	ab	a	ab	ab	ab	ab	ab	ab	a	ab	abc	abc	abc		9		
SWO	ATN	CP	EU.España	GN	t1		646	124	316	202	150	223	20																								10	0.5%	95%
SWO	ATN	CP	EU.España	GN	t2		ac	ab		-1	-1	-1	-1	-1																								10		
SWO	ATN	CP	Trinidad and Tobago	LL	t1		66	71	562	11	180	150	158	110	130	138	41	75	92	78	83	91	19	29	48	30	21	16	14	16	26	17	13	36	3		11	0.6%	95%
SWO	ATN	CP	Trinidad and Tobago	LL	t2		-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	ab	ab	ab	a		11		
SWO	ATN	CP	U.S.A.	GN	t1		535	82	86	92	88	74	78	0	36		0		0		0			0		0			0				0		0		12	0.3%	95%
SWO	ATN	CP	U.S.A.	GN	t2		ab	ab	ab	ab	ab	ab	ab	ab	ab		-1		-1		-1			-1		bc			c				c		c		12		
SWO	ATN	CP	U.S.A.	HL	t1					38			0	1		5	9	9	12	21	23	35	33	125	94	125	129	121	155	105	88	77	76	62	132		13	0.4%	96%
SWO	ATN	CP	U.S.A.	HL	t2					-1			-1	b	b	c	bc	bc	c	bc	bc	bc	bc	bc	bc	bc	bc	bc	bc	bc	bc	bc	bc	bc	bc	bc		13		

Table B. SWO-S stock (1990-19)

						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	Rank	%	%cum
			T1 Total			17305	13893	13813	16130	18958	21931	18289	18542	14027	15502	15728	15128	14104	12634	13082	13163	14245	15629	12411	12727	12698	11368	10686	9191	9970	10345	10663	10559	10405	251			
SWO	ATS	CP	EU.España	LL	t1	6166	5760	5651	6974	7937	11290	9622	8461	5832	5758	6388	5789	5741	4527	5483	5402	5300	5283	4073	5183	5801	4700	4852	4184	4113	5059	4992	4654	4404		1	42.0%	42%
SWO	ATS	CP	EU.España	LL	t2	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	ac	ac	ac		1		
SWO	ATS	CP	Brazil	LL	t1	1696	1312	2609	2013	1571	1970	1892	4100	3844	4721	4579	4075	2903	2917	2984	3780	4430	4243	3413	3386	2926	2984	2831	2381	2892	2594	2935	2406	2792		2	21.6%	64%
SWO	ATS	CP	Brazil	LL	t2	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	a	a	a	a	a	ab		2		
SWO	ATS	CP	Japan	LL	t1	6708	4459	2870	5256	4699	3619	2197	1494	1186	775	790	685	833	924	686	480	1090	2155	1600	1340	1314	1233	1162	684	976	659	637	915	640		3	12.9%	77%
SWO	ATS	CP	Japan	LL	t2	ab	ab	ab	ab	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	ab	ab	ab	ab	ab	ab		3		
SWO	ATS	NCC	Chinese Taipei	LL	t1	896	1453	1686	846	2829	2876	2873	2562	1147	1168	1303	1149	1164	1254	745	744	377	671	727	612	410	428	496	582	451	554	480	527	472		4	7.8%	84%
SWO	ATS	NCC	Chinese Taipei	LL	t2	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	abc	abc	abc	abc	4		
SWO	ATS	CP	Uruguay	LL	t1	302	156	210	260	165	499	644	760	889	650	713	789	768	850	1105	843	620	464	370	501	222	179	40	103							5	3.0%	87%
SWO	ATS	CP	Uruguay	LL	t2	a	a	a	a	a	a	a	a	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab							5		
SWO	ATS	CP	Namibia	LL	t1					22					374	452	607	504	187	549	832	1118	1038	518	25	408	366	22	129	395	225	466	600	881		6	2.4%	90%
SWO	ATS	CP	Namibia	LL	t2					a					a	-1	ab	a	-1	a	ab	ab	ab	ab	ab	ab	a	ab	a	a	a	abc	abc			6		
SWO	ATS	CP	EU.Portugal	LL	t1						380	389	441	384	381	392	393	380	354	345	493	440	428	271	367	232	263	184	125	252	236	250	466	369		7	2.0%	92%
SWO	ATS	CP	EU.Portugal	LL	t2						a	a	ab	ab	ab	ab	ab	ab	a	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	7		
SWO	ATS	CP	China PR	LL	t1									29	534	344	200	423	353	278	91	300	473	470	291	296	248	316	196	206	328	222	302	355		8	1.6%	93%
SWO	ATS	CP	China PR	LL	t2									a	a	a	a	a	a	a	a	a	a	ab	ab	ab	ab	ab	ab	abc	ab	abc	abc	abc		8		
SWO	ATS	CP	South Africa	LL	t1						1			240	143	327	547	649	293	295	199	186	207	142	170	145	97	50	171	152	218	164	189	189	251	9	1.2%	95%
SWO	ATS	CP	South Africa	LL	t2						-1			ab	ab	ab	ac	abc	ab	ab	ab	ab	ab	ab	ab	ab	a	ab	ab	ab	ab	ab	ab	ab	ab	9		
SWO	ATS	CP	Ghana	GN	t1	146	73	69	121	51	103	140	44	106	121	117	531	372	734	343	55	32	65	177	132	116	60	54	37	26	56	36	55	6		10	1.0%	96%
SWO	ATS	CP	Ghana	GN	t2	-1	-1	-1	-1	-1	-1	ab	b	ab	b	ab	ab	ab	ab	ab	ab	ab	ab	a	ab	a	a	a	a	a	a	a	a	a		10		
SWO	ATS	CP	S. Tomé e Príncipe	TR	t1	181	179	177	202	190	178	166	148	135	129	120	120	120	120	126	147	138	138	172	188	193	60	84	60	94	145	77	65			11	1.0%	96%
SWO	ATS	CP	S. Tomé e Príncipe	TR	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1		11		

Table C. SWO-M stock (1990-19)

						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	Rank	%	%cum
			T1 Total			16018	15746	14709	13265	16082	13015	12053	14693	14369	13699	15569	15006	12814	15694	14405	14622	14915	14227	12164	11840	13265	11450	9913	9096	9801	10760	10931	8402	7079	2434			
SWO	MED	CP	EU.Italy	LL	t1	2617	2442	3518	3260	3844	3035	2617	2458	2458	2680	2639	2236	1841	5844	5452	5560	5253	4564	4521	4687	5101	4579	3856	2848	3384	4213	3917	2974	1754		1	27.6%	28%
SWO	MED	CP	EU.Italy	LL	t2	b	ab	ab	b	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	b	ab	ab	b	bc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	bc		1		
SWO	MED	CP	EU.Italy	GN	t1	6105	5698	4077	3070	3921	4264	2657	3632	3632	3632	4863	4152	1698	2540	1483	1891	2373	1948								0					2	16.3%	44%
SWO	MED	CP	EU.Italy	GN	t2	ab	ab	ab	ab	ab	b	b	b	b	b	ab	b	-1	b	b	b	b	-1								-1					2		
SWO	MED	CP	EU.España	LL	t1	1438	1132	790	1293	1402	1351	1040	1184	1409	867	1396	1402	1421	1165	930	860	1405	1648	2063	1994	1785	1730	1580	1605	2019	2289	1732	1487	1470		3	11.1%	55%
SWO	MED	CP	EU.España	LL	t2	ac	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	3		
SWO	MED	CP	EU.Greece	LL	t1	1344	1904	1456	1568	2520	974	1237	750	1650	1520	1960	1730	1680	1230	1129	1424	1374	1907	989	1132	1494	1306	877	1731	1344	761	761	392	350		4	10.2%	65%
SWO	MED	CP	EU.Greece	LL	t2	ab	ab	ab	ab	ab	ab	-1	-1	ab	ab	ab	ab	b	a	a	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	-1	ab	ab			4		
SWO	MED	CP	Maroc	GN	t1	866	1186	1883	2068	2109	1518	2461	4653	2905	2979	2503	2266	2230	1629	1299	722	603	615	587	477	410	387										5	9.6%	75%
SWO	MED	CP	Maroc	GN	t2	-1	-1	-1	-1	b	-1	-1	-1	c	bc	abc	abc	b	b	b	b	b	b	abc	-1	abc	abc										5		
SWO	MED	CP	Maroc	LL	t1	371	508	807	517	527	169	273	245	323	259	205	754	1149	1670	1954	1801	1455	1107	1370	1110	1200	640	802	770	770	480	1110	1000	1013	982		6	6.7%	81%
SWO	MED	CP	Maroc	LL	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	bc	abc	abc	abc	abc	abc	abc	abc		6		
SWO	MED	CP	Tunisie	LL	t1	176	181	178	354	298	378	352	346	414	468	483	567	1138	285	791	791	949	1024	1011	1012	1016	1040	1038	1036	1030	1034	1007	1003	974	934		7	5.6%	87%
SWO	MED	CP	Tunisie	LL	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	a	a	a	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1		7		
SWO	MED	CP	Algerie	LL	t1	173	173	6	173	185	247	247	247	178	126	166	439	347	238	174	93	496	492	802	468	459	192	356	384	549	558	666	550	528	517		8	2.7%	90%
SWO	MED	CP	Algerie	LL	t2	b	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	a	a	-1	-1	ab	ab	ab	ab	ab	-1	-1	-1	ab		8		
SWO	MED	CP	Algerie	GN	t1	539	389	389	389	415	560	560	560	590	531	599	642	467	427	233	311	87	108													9	2.1%	92%
SWO	MED	CP	Algerie	GN	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1													9		
SWO	MED	CP	EU.Malta	LL	t1	135	129	85	91	47	72	72	100	153	187	175	102	257	163	195	362	239	213	260	266	423	532	503	460	376	489	410	330	308		10	1.9%	94%
SWO	MED	CP	EU.Malta	LL	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	ac	ac	ac	-1	-1	-1	abc	bc	ab	abc	ab	ab	ab	abc	ab	abc	abc	abc	abc	abc			10		
SWO	MED	CP	Turkey	GN	t1	243	100	136	292	533	306	320	350	450	230	370	360	300	274	317	341	337	352													11	1.5%	95%
SWO	MED	CP	Turkey	GN	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	ab	ab	ab	ac	c								11		
SWO	MED	CP	Turkey	LL	t1													70	76	69	84	73	71	386	301	334	190	66	97	56	35	70	405	397		12	0.7%	96%
SWO	MED	CP	Turkey	LL	t2													-1	-1	-1	-1	-1	-1	a	a	a	ab	a	ab	abc	abc	bc	ab	abc		12		
SWO	MED	CP	EU.Italy	UN	t1																				329	921	694	718		0				0		13	0.7%	97%
SWO	MED	CP	EU.Italy	UN	t2														b		b	b			-1	-1	-1	-1		bc				-1		13		

Table 2. Swordfish final Task 1 nominal catches (t, landings and dead discards) by stock, major gear and year.

	SWO-N													SWO-S													SWO-M												
Year	BB	GN	HL	HP	LL	PS	RR	TN	TP	TR	TW	UN	Total	BB	GN	HL	HS	LL	PS	RR	TR	TW	UN	Total	BB	GN	HL	HP	LL	PS	RR	TN	TP	TR	TW	UN	Total
1950				2201	1445								3646										100	100					586								586
1951				1615	966								2581										200	200					580								580
1952				2027	966								2993										200	200					337								337
1953				2100	1203								3303										200	200					501								501
1954				2729	305								3034										100	100					452								452
1955				2883	619								3502										100	100					340								340
1956				2984	374								3358					1						1					393								393
1957				3467	1010						1	100	4578					124					100	224		250			395								645
1958				3929	875							100	4904					92						92		500			414								914
1959				4704	1428							100	6232					71					100	171		200			401								601
1960				2786	1042								3828					359					100	459		112			403								515
1961				2321	2060								4381					816					200	1016		112			500								612
1962				2140	3202								5342					769						769		112			591								703
1963				997	9193								10190					1418						1418		224			498								722
1964	9			316	10833				100				11258					2030						2030		112			686								798
1965	6		179	622	7759				86				8652					2578						2578		112			1423				1		224		1760
1966	15			782	8503				49				9349					1952						1952		336			1192						224		1752
1967	11			394	8679				23				9107					1577						1577		111			869				1		336		1317
1968	12			145	8985				30				9172		100			2348						2448		115		194	2570				1		560		3440
1969	11			185	9003				4				9203		200			4281						4481		133		277	3313								3723
1970	8			83	9484				3				9578					5426						5426		99		249	2993								3341
1971	11				5243				12				5266	2				2164						2166		76		402	4496				1				4975
1972	21				4717				28				4766					2580						2580		5247		513	5399				1				11160
1973	37				5929				8			100	6074					3078						3078		3985		388	4362								8735
1974	92				6267				3				6362					2753						2753		4684		462	4564				3				9713
1975	58	3			8778								8839					3062						3062		4219		416	3888								8522
1976	32	1			6663								6696					2812						2812		4914		312	4318								9544
1977	38				6370				1				6409		12			2840					3	2855		4791		417	4838								10046
1978	17	8		656	11125	2			11		2	6	11827		5			2829	12					2846		5377		756	5186						8		11327
1979		16	29	715	11177								11937		1			3374				28		3403		4980		475	5200								10655
1980		30	15	676	12831							6	13558		113			5287				31		5431		5216		501	6230								11947
1981		50	8	551	10583				1			4	11197		24			4039	4			9		4076		4873		461	6450								11784
1982		37	7	148	13023								13215		80			6364				3		6447		3730		356	6112								10198
1983		70	6	421	14062				4				14563		102			5383				7		5492		4016		366	6313				1				10696
1984		65	7	94	12664				2			1	12833		180		1	8986	12			23	26	9227		6658		294	6709				5				13666
1985	1	50	7	76	14240				5			4	14383		131			9224				3	228	9586		7816	1	298	7169				5		1	3	15294
1986	0	68	7	104	18283	15			5			4	18486		95			4982				2	815	5894		8130		469	8166								16765
1987	1	85	10	107	20029				6				20238		147			5797				2	84	6030		9219		325	8776								18320
1988	4	333	5	55	19126	0			2				19525		266			12602			216	4	84	13172		9645		468	10250				2				20365
1989	1	1510	8	182	15554	1			5			0	17261		191			16573			207	0	84	17055		9542		345	7875								17762
1990	0	1209	10	100	14215	16			38		9	75	15672		189			16705			181	230		17305		8280		379	7346				12				16018
1991	0	217	21	75	14491	5			8		42	75	14934		124			13496			179	93		13893		7971		397	7365				12				15746
1992	2	415	51	61	14739	3			24		24	75	15394	1	116			13422			177	97		13813		7076			7631				2				14709
1993	3	324	49	28	16212	8			3		16	95	16738		172			15739		2	202	16		16130		5819			7377				4		65		13265
1994	5	322	21	24	15073	5			14		37		15501	0	110			17839		1	190	24	794	18958		6978			8985				18		101		16082
1995	4	400	23	190	16390	8	1		13		38	38	17105		165			21584		1	178	2		21931		6648		11	6319	0			11		26		13015
1996	7	479	0	94	14384	99	7		8	1	117	26	15222		263			17860			166	1		18289		5998		10	5884				4		157		12053
1997	4	67	1	90	12643	11	16		8	0	172	12	13025		73			18320			148	1		18542		9195		12	5389				5		92		14693
1998	5	472		241	11538	41	10		2	1	10	9	12329		131	3		13758			135			14027		7577		12	6674				4	57	45		14369
1999	3	248	5	18	11241	40	21		13	2	26	4	11622	356	150			14829			129	38		15502		7372			6223				3	52	49		13699
2000	13	158	9	95	11058	23	16		6	2	72	1	11453	18	137			15450	4		120	0		15728		8335		11	7129				3	51	39		15569
2001	1	266	9	129	9573	17	2		7		6	2	10011	144	550	7		14302			120	5	0	15128		7420			7498	4			6		78		15006
2002	3	73	12	41	9406	1	22		4		83	8	9654	7	391			13577			120	10		14104		4695			8042				2		75		12814
2003	1	114	23	147	10951	1	6		7	0	156	37	11442	4	777	3		11714			120	16		12634		4870		7	10748	2	2		6	0	58		15694
2004	3	83	24	88	11719	1	25		3	2	112	7	12068		395			12558			126	2		13082		3332	112	5	10886	45	2		2		20		14405
2005	10	16	40	193	11851		62		5	3	187	11	12377		96	5		12915			147	1		13163		3265	175	6	11067	56	2		5		46		14622
2006	2	7	38	204	11061		53		8	0	97	8	11478		73	1		14033			138			14245		3400	72		11339	47			1		56		14915
2007	0	11	129	267	11748	0	68		8	7	54	9	12302		82	1		15408			138			15629		3023	1		11132	22			1		48		14227
2008	0	6	97	258	10576		76	0	2	2	24	9	11050		201	11		12027			172			12411		587	0	27	11506	12			2		30		12164
2009	1	34	128	248	11590	0	32	0	4	1	36	9	12081		178			12359			188	2		12727		477	0		11020	2		0	3		4	333	11840
2010	0	19	129	177	11112	1	52		5	0	55	8	11558	9	158			12337			193	1		12698		411	1		11918	3		1	2		3	926	13265
2011	1	86	121	208	12003		54		5	0	36	9	12523	49	164	4		11092			60	0	0	11368		388	1		10288	3		0	3	0	24	744	11450
2012	0	63	231	98	13346		71		2	1	45	12	13868	63	120	1		10395	23		84		0	10686		0	2		9131	34		0	3		15	727	9913
2013	1	4	181	275	11543	0	22	0	1	0	40	2	12069		168	3		8958	1		60			9191		2	4		9047	13			1	1	24	5	9096
2014	0	9	151	233	10215	0	35			0	33	0	10678		94			9781	0		94	0		9970	0	3	3	2	9718	7	0	3	1	0	10	53	9801
2015	0	31	128	98	10288	0	46			1	81		10673		104	5		10090			145			10345		1	5	32	10682	19			1		20	0	10760
2016	0	19	228	85	9907		27		1	0	108	0	10376		67			10519			77			10663		0	4	7	10878	17		3	1	2	17	1	10931
2017		95	266	175	9504	3	34	0		1	93	0	10171		74	1		10419	1		65			10559			4	35	8345	11		2	0		4	0	8402
2018		6	178	34	8530	0	36	0	0	2	107	1	8895		17	6		10377	5			1	0	10405		0	2	29	7017	17		1	0		12	0	7079

Table 3. SWO-M Task I catches (t) by decade and major gear, showing the rate (%) of unclassified gears (UN) before and after the revision adopted by the Group (respectively 1st and last day of the meeting).

			Catch (t)												UN rate (%)
T1NC data	**Stock**	**Decade**	**BB**	**GN**	**HL**	**HP**	**LL**	**PS**	**RR**	**TN**	**TP**	**TR**	**TW**	**UN**	
	SWO-M	**1950**		950			4399								0%
		1960		1479		471	12046				3			1344	9%
		1970		424		4390	45243				5		8		0%
before the revision		**1980**		14661	1	1684	70396				11		1	42541	33%
		1990		66453		34	69059	0			75		109	7919	6%
		2000		39404	360	48	100368	190	6	0	31		55	792	1%
		2010	0	805	27	991	89438	123		11	12	10	121	1571	2%
	TOTAL		0	124177	388	7618	390949	313	6	11	137	10	294	54167	9%
	SWO-M	**1950**		950			4399								0%
		1960		1479		471	12046				3			1344	9%
		1970		38372		4390	45243				5		8		0%
after the revision		**1980**		68846	1	3882	74051				13		1	3	0%
		1990		72915		822	69194	0			75		109	535	0%
		2000		39404	360	56	100368	190	6	0	31		55	784	1%
		2010	0	805	27	104	89457	123	0	11	12	2	129	2458	3%
	TOTAL		0	222771	388	9725	394758	313	6	11	139	2	302	5124	1%

Table 4. Summary of SWO conventional tagging data available in ICCAT. Number of SWO releases by year and associated recoveries by year. Also shown, the number of releases in unknown state (pending), recoveries without release information (?), and recoveries without recovery dates (?).

Releases			Recoveries (year)																																																
Year	Total	Pending	?	1966	1968	1969	1970	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2012	2013	2014	2016	2018
1940	2	2																																																	
1961	2	2																																																	
1962	1	1																																																	
1963	2	2																																																	
1964	58	56		2																																															
1965	49	48				1																																													
1966	34	33				1																																													
1967	25	24																1																																	
1968	28	20			1	2	2	1	1						1																																				
1969	30	28					1				1																																								
1970	91	80					6	1		1	1	1		1																																					
1971	12	12																																																	
1972	7	7																																																	
1973	1	1																																																	
1974	32	30									1		1																																						
1975	25	23												1			1																																		
1976	10	10																																																	
1977	55	53													1	1																																			
1978	178	165													2	2	4	3	2																																
1979	118	113														3				1		1																													
1980	490	464														4	3	4	7		2	4	1				1																								
1981	267	240															2	8	8	6	1				1	1																									
1982	166	162																2		2																															
1983	162	156																	1	2	1	1			1																										
1984	168	163																			1	1				1		1	1																						
1985	204	194																				3	1	1	1	4																									
1986	404	387																					3	4	5	1						4																			
1987	411	393																					2	3	7	4			1	1																					
1988	475	460																						1	6	2	1	1	1		1	1	1																		
1989	217	214																								1			1	1																					
1990	531	520																								1	4		2	4																					
1991	1604	1551																									4	9	15	12	7	1		2	1			1				1									
1992	1697	1641																										5	21	17	6	4		2			1														
1993	1542	1481																											6	23	6	7	6	3	2	2	2		1	1		1	1								
1994	1919	1866	1																											5	15	5	9	8	2	4	1	2	1												
1995	1174	1137	1																												4	8	8	5	3	8															
1996	680	655																														6	5	5	4	4			1												
1997	769	741																															5	10	3	2	2	2		2		1					1				
1998	397	376	1																															2	6	4	4		2	2											
1999	258	250																																		1	3		2		2										
2000	193	181																																		1	7	3						1							
2001	159	157	1																																			1													
2002	282	271	4																																			2	3	2											
2003	253	244	2																																				2	1	2	1	1								
2004	284	265	6																																						6	3	2		1	1					
2005	344	333	4																																							4	1	2							
2006	779	759	10																																							1	4	3		1				1	
2007	352	339	2																																								2	2	4	2					1
2008	96	90	2																																									1	2		1				
2009	38	36																																												1	1				
2010	12	11																																														1			
2011	38	35																																													1	2			
2012	56	55																																															1		
2013	64	64																																																	
2014	16	16																																																	
2015	6	6																																																	
2016	19	18																																																	1
2017	3	3																																																	
?	14	3																													2	1	3				1	1			1				1		1				
Total	17303	16647	34	2	1	4	9	2	1	1	3	1	1	2	4	10	10	18	18	11	5	10	7	9	21	15	10	16	48	63	41	37	37	37	21	26	21	12	12	8	11	12	11	9	8	5	5	3	1	1	2

Table 5. Summary of SWO conventional tagging data: number of recoveries grouped by number of years at liberty in each release year. The last column shows the recovery rate (%) in each release year.

			Years at liberty									
Year	Releases	Recaptures	< 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10+	15+	Unk	% recapt*
1940	2	0										
1961	2	0										
1962	1	0										
1963	2	0										
1964	58	2		2								3.4%
1965	49	1				1						2.0%
1966	34	1				1						2.9%
1967	25	1								1		4.0%
1968	28	8	1	2	2	1		1	1			28.6%
1969	30	2		1				1				6.7%
1970	91	11	6		1		1	3				12.1%
1971	12	0										
1972	7	0										
1973	1	0										
1974	32	2		1		1						6.3%
1975	25	2			1			1				8.0%
1976	10	0										
1977	55	2		1	1							3.6%
1978	178	13	1	3	3	2	4					7.3%
1979	118	5	2	1			1	1				4.2%
1980	490	26	4	6	7	1		7	1			5.3%
1981	267	27	8	10	5	2		2				10.1%
1982	166	4	2	2								2.4%
1983	162	6	2	2	1			1				3.7%
1984	168	5		2				3				3.0%
1985	204	10	2	2	1	1	3	1				4.9%
1986	404	17	3	3	5	2		4				4.2%
1987	411	18	5	6	4	1		2				4.4%
1988	475	15	5	4	1		2	3				3.2%
1989	217	3		1			1	1				1.4%
1990	531	11	3	2	2	4						2.1%
1991	1604	53	12	8	14	12	2	3	2			3.3%
1992	1697	56	12	24	11	3	3	3				3.3%
1993	1542	61	21	11	7	7	4	8	3			4.0%
1994	1919	53	15	7	10	5	6	9			1	2.8%
1995	1174	37	9	5	9	3	8	2			1	3.2%
1996	680	25	10	3	7	2	2	1				3.7%
1997	769	28	11	6	1	3	3	3	1			3.6%
1998	397	21	6	4	5	1	2	2			1	5.3%
1999	258	8	1	2	1	1	1	2				3.1%
2000	193	12	5	5	1			1				6.2%
2001	159	2		1							1	1.3%
2002	282	11	4	3							4	3.9%
2003	253	9	3	1	2		1				2	3.6%
2004	284	19	5	2	3	1		2			6	6.7%
2005	344	11	2	3	1	1					4	3.2%
2006	779	20	4	3	1	1		1			10	2.6%
2007	352	13	4	2	4				1		2	3.7%
2008	96	6	2	1		1					2	6.3%
2009	38	2		1	1							5.3%
2010	12	1			1							8.3%
2011	38	3	1	2								7.9%
2012	56	1			1							1.8%
2013	64	0										
2014	16	0										
2015	6	0										
2016	19	1			1							5.3%
2017	3	0										
Total	17289	645	171	145	115	58	44	68	9	1	34	3.7%

Table 6. Available indices for the 2020 stock assessment of swordfish Mediterranean. Some indices will be updated intersessionally.

Period	1987-2018	NA	2012-2018	1988-2017	1999-2011	1991-2009	1990-2009
SCRS paper	SCRS/2020/021	SCRS/2020/027	SCRS/2020/026	SCRS/2019/019	SCRS/2010/083	SCRS/2014/105	SCRS/2010/085
Country/Location	Greece	Liguria	Morocco	Spain	Morocco	Sicily	Sicily
Gear	Longline	Longline	Longline	Longline	Gillnet	Longline	Gillnet
Unit	weight	weight	weight	number	weight	weight	weight
Used in 2016 XSA	Yes	No	Yes	Yes	No	No	No
Potential Use in 2020	Use	Possibly, consider by April 3	Most likely, reconsider by April 3	Most likely, reconsider by April 3	Potentially use	Potentially use	Potentially use
Year	GRC_LL	LIG_LL	MOR_LL	SPN_LL	MOR_GN	SIC_LL	SIC_GN
1987	214.7						
1988	238.2			2.46			
1989				1.40			
1990	234.5			1.53			8.3
1991	316.8			1.99		100.3	9.8
1992	127.4			2.11		98.5	16.9
1993	211.4			2.11			13.0
1994	298.4			2.34		99.5	9.5
1995	181.4			2.18		124.2	14.7
1996				1.79			9.3
1997				1.75		75.9	14.0
1998	250.2			1.96		127.6	10.1
1999	172.7			1.73	58.3	151.5	12.7
2000	125.9			1.54	66.7	93.3	14.9
2001	130.6			1.82	43.1	144.0	13.1
2002	107.3			2.43	56.0	204.8	
2003	128.6			1.97	48.2	82.2	
2004	125.6			1.63	58.4	111.2	15.2
2005	131.5			1.85	70.7	123.2	12.1
2006	136.5			1.96	66.2	140.6	30.7
2007	140.6			2.24	63.2	81.1	
2008	134.0			2.16	69.2	87.0	3.3
2009	121.9			1.60	55.6	99.1	2.0
2010	141.4			1.71	51.9		
2011	116.3			1.83	46.5		
2012	106.5		276.9	2.13			
2013	167.9		164.0	1.89			
2014	128.4		190.5	1.92			
2015	115.7		156.8	1.92			
2016	125.5		59.0	1.93			
2017	70.7		67.9	1.86			
2018	84.3		91.4				

Table 7. CPUE evaluation table for abundance indices presented during the meeting.

SCRS Doc No.	**SCRS/2020/021**	**SCRS/2020/027**	**SCRS/2020/026**		**SCRS/2010/083**	**SCRS/2014/105**	**SCRS/2010/085**
Index Name:	Greece longline	Liguria longline	Morocco longline	Spain longline	Morocco gillnet	Sicily longline	Sicily gillnet
Data Source (state if based on logbooks, observer data etc)	Observations		Fish market statistics		Fish market statistics	Observations	Observations
Do the authors indicate the percentage of total effort of the fleet the CPUE data represents?	No		No		No	No	No
If the answer to 1 is yes, what is the percentage?							
Are sufficient diagnostics provided to assess model performance??	Sufficient		Sufficient		Sufficient	Sufficient	Sufficient
How does the model perform relative to the diagnostics ?	Well		Well		Well	Well	Well
Documented data exclusions and classifications?	NA		NA		NA	NA	NA
Data exclusions appropriate?	NA		NA		NA	NA	NA
Data classifications appropriate?	NA		NA		NA	NA	NA
Geographical Area	East Med		St. Gibrartar, West Med		St. Gibrartar, West Med	Central Med	Central Med
Data resolution level	trip		trip		trip	trip	trip
Ranking of Catch of fleet in TINC database (use data catalogue)	1-5	NA	6-10	1-5	1-5	NA	NA
Length of Time Series	longer than 20 years		6-10 years		11-20 years	11-20 years	11-20 years
Are other indices available for the same time period?	Few		Few		Few	Few	Few
Are other indices available for the same geographic range?	None		Few		Few	None	None
Does the index standardization account for Known factors that influence catchability/selectivity? (eg. Type of hook, bait type, depth etc.)	Yes		Yes		Yes	Yes	Yes
Estimated annual CV of the CPUE series	Medium		Low		Low	Medium	Medium
Annual variation in the estimated CPUE exceeds biological plausibility	Unlikely		Unlikely		Unlikely	Unlikely	Unlikely
Is data adequate for standardization purposes	Yes		Yes		Yes	Yes	Yes
Is this standardised CPUE time series continuous?	No		Yes		No	No	No
For fisheries independent surveys: what is the survey type?							
For 19: Is the survey design clearly described?							
Other Comments	Localised (< 10 x 10 degrees)		Localised (< 10 x 10 degrees)		Localised (< 10 x 10 degrees)	Localised (< 10 x 10 degrees)	Localised (< 10 x 10 degrees)

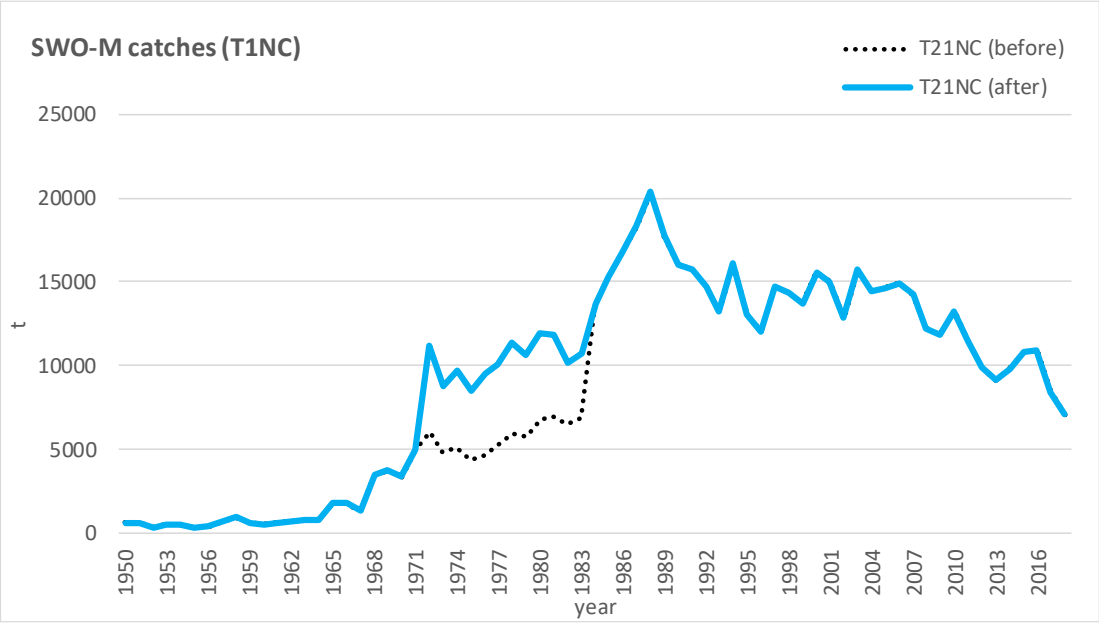

Figure 1. Task 1 nominal catches (T1NC, t) of SWO-N before the revision (day 1 of the meeting) and after the revisions (day 5). Increase mostly due to the inclusion of the (up to now inexistent) Italian GILL catches between 1972 and 1983.

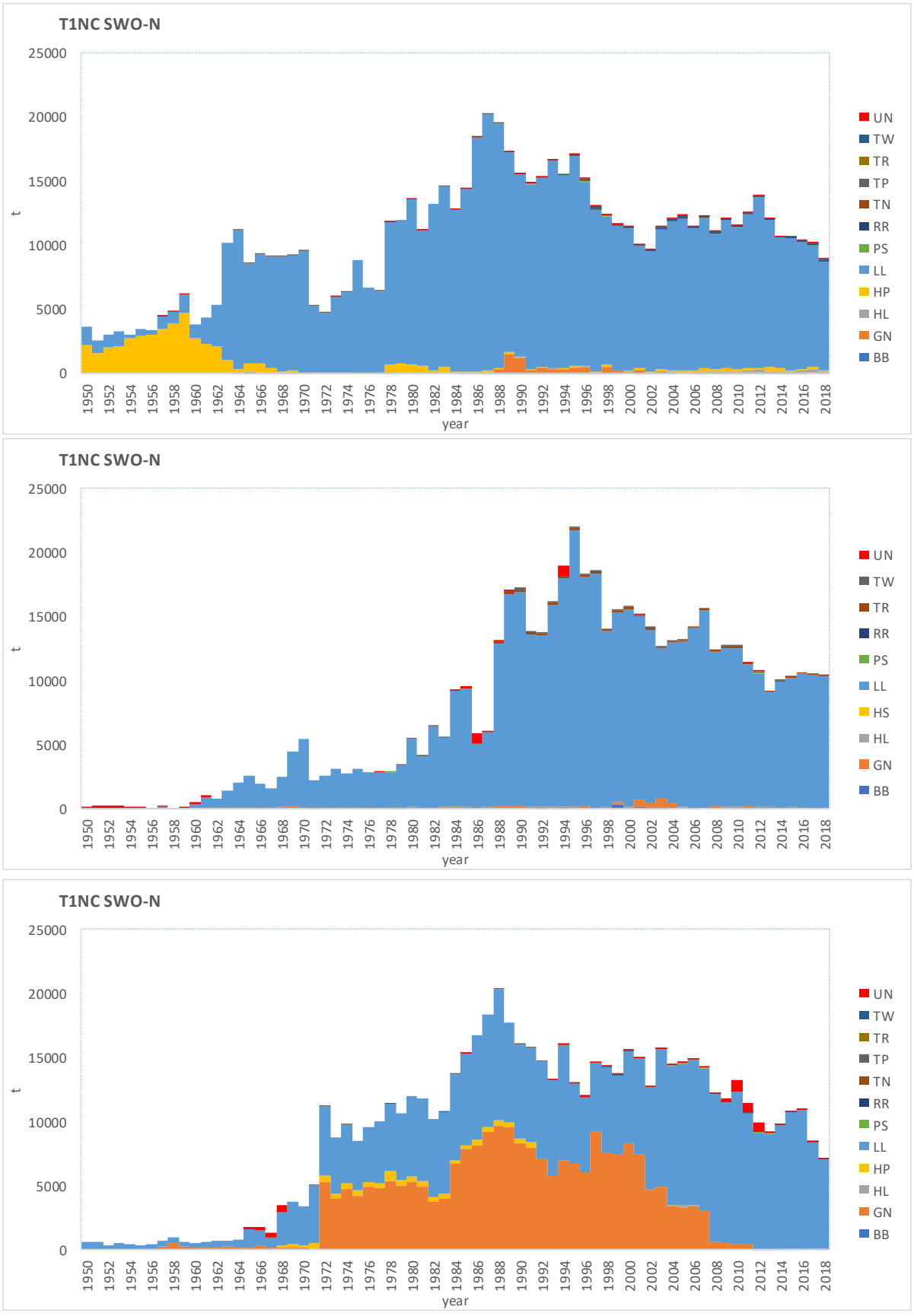

Figure 2. Swordfish Task 1 nominal catches (T1NC, t) of each stock (SWO-N top, SWO-S centre, SWO-M bottom) by gear group and year. Unclassified gear series (UN, containing gears UNCL and SURF) are shown in "red".

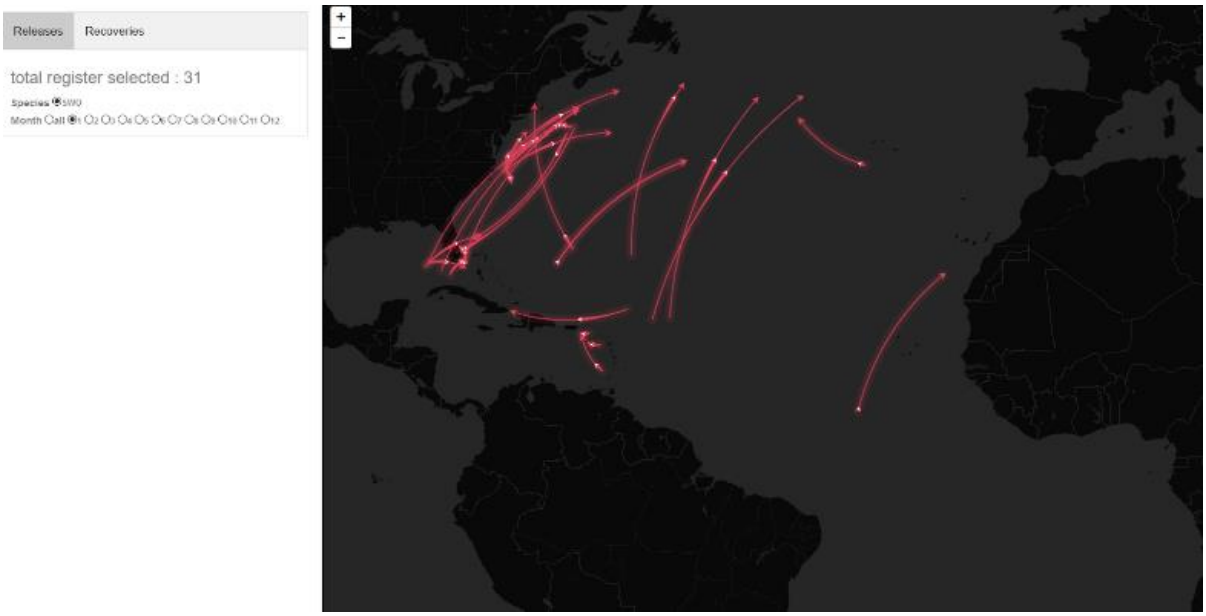

Figure 3. Snapshot of the 1st tagging data visualization tool showing the (animated) apparent movements of a subset of SWO released and recovered.

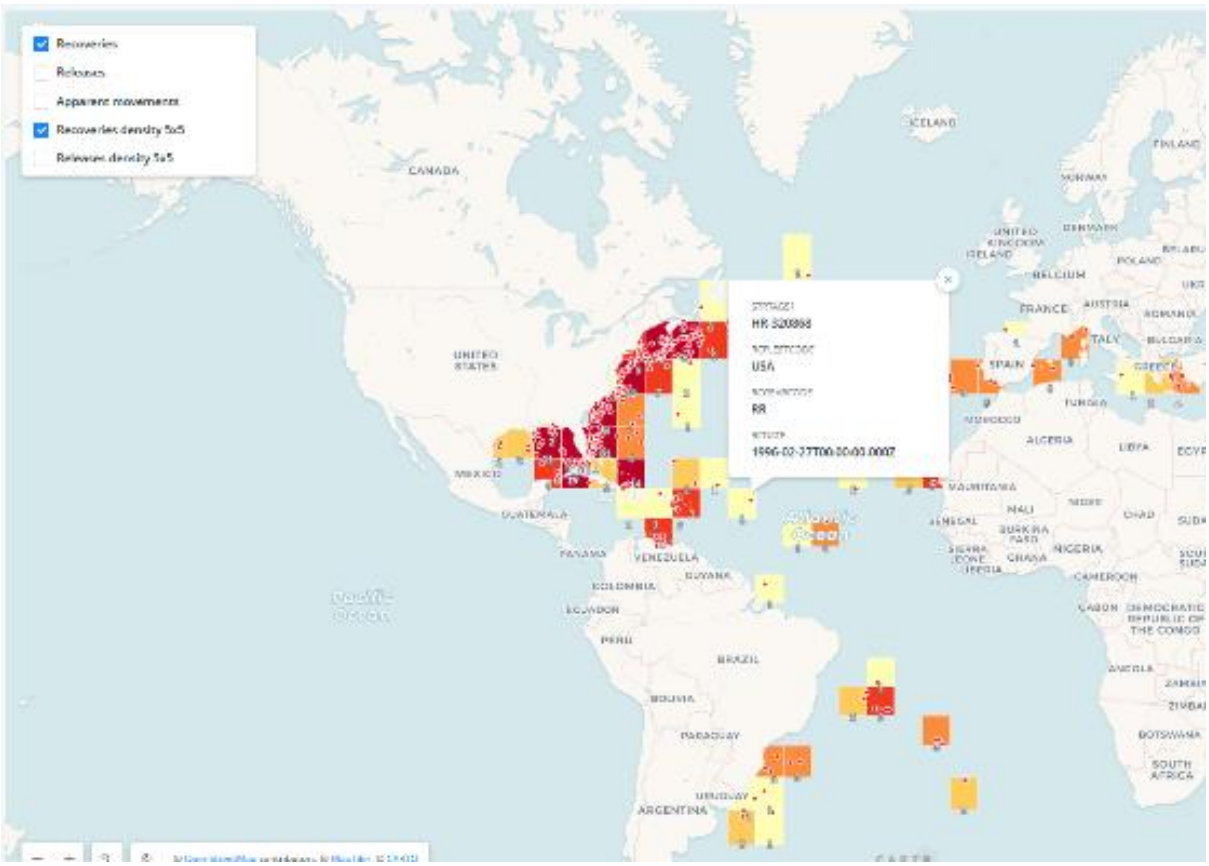

Figure 4. Snapshot of the 1st tagging data visualization tool showing all GIS layers created from SWO conventional tagging data (release & recovery points, apparent movement with lines connecting release/recovery positions, release density in a 5x5 degree grid).

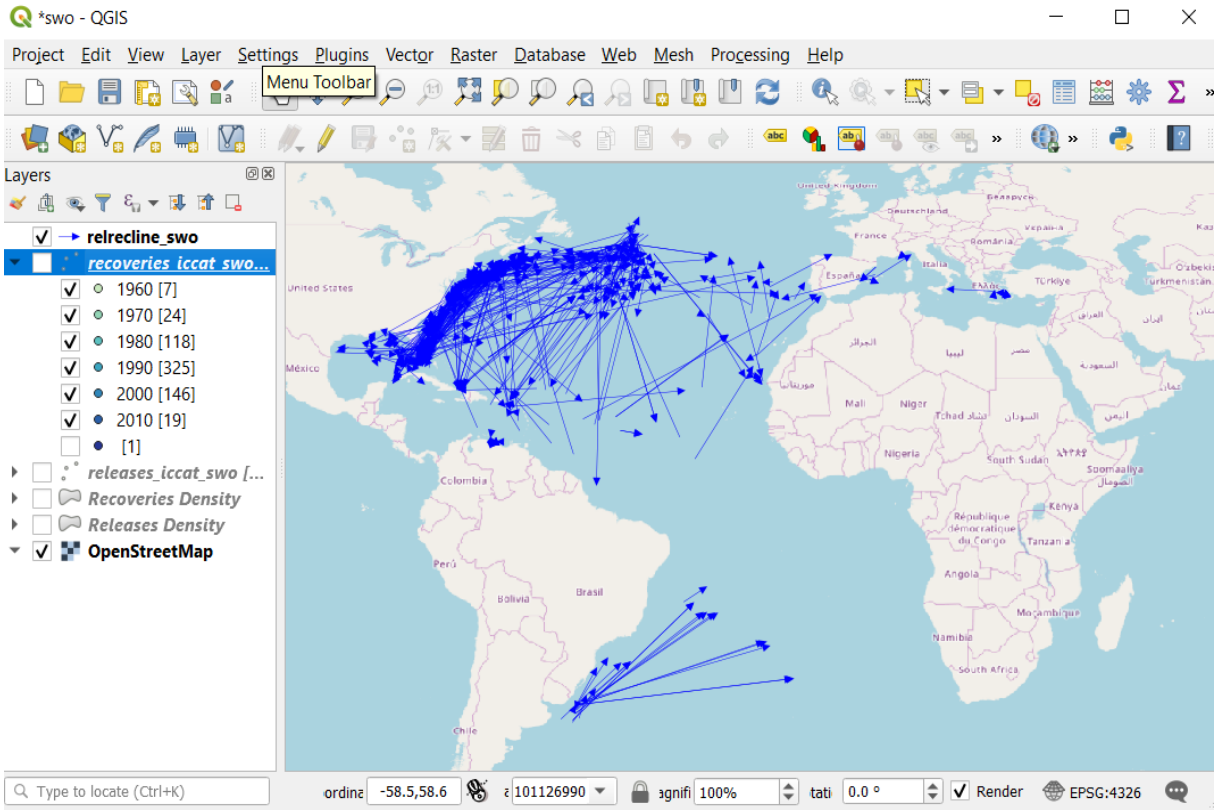

Figure 5. The QGIS software (https://www.qgis.org) running the geographical database created for the SWO conventional tagging data. Additional information is available in the ICCAT Statistical Bulletin Volume 45, Figures 72 a-c.

Appendix 1

Agenda

1. Opening, adoption of agenda and meeting arrangements
2. Review of fishery statistics
   - 2.1. Task I (catches) data
   - 2.2. Task II (catch-effort and size samples) data
   - 2.3. Tagging data
3. Progress on the Atlantic and Mediterranean Swordfish Project and other work related to the workplans
   - 3.1 Stock structure (based on genetics, morphology and tagging data)
   - 3.2 Age and growth
   - 3.3 Reproduction
   - 3.4 Movements
   - 3.5 Size/Sex distribution
4. Plan for the ongoing and future activities of the Atlantic and Mediterranean Swordfish Project
5. Review of work done in 2019 on North Atlantic Swordfish MSE
6. Further development of the MSE workplan and roadmap for ICCAT North Atlantic Swordfish MSE process
   - 6.1 Implications of the new MSE roadmap adopted by the Commission
   - 6.2 Discussion on finalizing the reference set of OMs
   - 6.3 Discussion on start testing of candidate management procedures
7. Data preparation for the next stock assessment of the swordfish Mediterranean
   - 7.1 Review of biology
   - 7.2 Review of fisheries indicators
   - 7.3 Identification of data inputs, appropriate stock assessment approaches, and their specifications
8. Other matters
9. Recommendations
10. Adoption of the report and closure

Appendix 2

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Appendix 3

List of Papers and Presentations

Number	Title	Authors
SCRS/2020/019	Review and preliminary analysis of size samples of Mediterranean swordfish (*Xiphias gladius*)	Ortiz M., and Palma C.
SCRS/2020/020	Historical recovery of Italian swordfish Task II data between 1972 and 1989 in the Mediterranean Sea (Tyrrhenian/Ionian seas, and Strait of Messina)	Celona A., Palma C., Santos M.N., and Ortiz M.
SCRS/2020/021	Updated standardized swordfish catch rates from the Greek surface longline fisheries operating in the E. Mediterranean	Tserpes G., and Peristeraki P.
SCRS/2020/022	Swordfish (*Xiphias gladius*) fishery statistics collected from artisanal fisheries in Côte d'Ivoire, from 1984 to 2018: a review	Bahou L., Amandé A.J., Konan K.J., and Diaha N'G.C.
SCRS/2020/023	Brief update on the satellite tagging of Atlantic swordfish	Rosa D., Santos C.C., Macias D., Ortiz de Urbina J., Forselledo R., Miller P., Domingo A., and Coelho R.
SCRS/2020/024	Progress of the age and growth component of the swordfish biology project	Rosa D., Gillespie K., Garibaldi F., Cardoso L.G., Schirripa M., Bezerra N.A., Campello T., Travassos P., Hazin F., Hanke A., and Coelho R.
SCRS/2020/025	Draft final report for phase two of the ICCAT short-term contract: swordfish biological samples collection for growth, reproduction and genetics studies	Gillespie K., and Hanke A.
SCRS/2020/026	Updated catch rates of swordfish (*Xiphias gladius*) caught by Moroccan longline fleet in the Mediterranean Sea, 2012-2019	Abid N., and Idrissi M.M.
SCRS/2020/027	An update of the swordfish fishery in the Ligurian Sea (western Mediterranean) with a preliminary attempt to standardize the mesopelagic longline CPUEs	Garibaldi F., and Tserpes G.

SCRS/P/2020/004	Update on the North Atlantic Swordfish MSE	Hordyk A., and Carruthers T.
SCRS/P/2020/005	Preliminary analysis of the reproductive study for the three swordfish stocks	Anonymous
SCRS/P/2020/006	A swordfish de novo genome assembly to support population genetic analysis: searching the genetic clustering between and within Atlantic and Mediterranean populations	Gioacchini G., Filippi S., Marisaldi L., Candelma M., Righi T., Gillespie K. Hanke A., Caputo L., and Carnevali O.
SCRS/P/2020/007	Update on USA (NOAA) and Portugal (IPMA) Collaborative Pop-up Satellite Archival Tagging of Atlantic Swordfish	Brow C., Orbesen E., Snodgrass D., and Coelho R.

Appendix 4

SCRS Document and Presentations Abstracts as provided by the authors

SCRS/2020/019 - Size sampling data of Mediterranean swordfish was reviewed, and preliminary analyses performed for its use within the stock evaluation models. The size sampling data is a mandatory data provision submitted to the Secretariat by CPCs under the Task II requirements. For the major flag fisheries, CPCs have also to report Catch at Size estimations. The size samples data was revise and standardized. For the Mediterranean stock, the size sampling is sufficient and in proportion with the catch since 1990 for major fleet/gears; in general, longline fisheries are better sampled compared to other fisheries. The number of fish measured has increased in the last decades for the Mediterranean fisheries; however, precision of measurements reported has been low which may substantially impair the estimation of CAS and CAA.

SCRS/2020/020 – This document presents an evaluation of the historical data recovered for the Italian fisheries on the Mediterranean swordfish (*Xiphias gladius*), obtained through the "Short-Term contract for Mediterranean swordfish data recovery (ICCAT S19-2563 on April 26, 2019)". A total of 3694 individual fishing operations of 15 fishing vessels (gillnets: 46%, harpoon: 50%, longline: 4%) were recovered for the period 1972 to 1989, which included 15158 associated individual fish weight measurements. In terms of overall coverage in weight within that period, this information represents about to 5% of the gillnet and harpoon catches, and less than 2% of the longline catches. None of this detailed Task 2 information exists in ICCAT.

SCRS/2020/021 – Indices of swordfish (*Xiphias gladius*) abundance, expressed both in terms of number and biomass, are estimated from the Greek drifting surface longline fisheries targeting swordfish in the eastern Mediterranean in the period 1987-2018. Annual standardized indices were estimated by means of Generalized Linear Modeling techniques and the predictor variables included the Year, Month, Gear type and Area of fishing. In addition catchability changes occurred in the fisheries were also taken into account. Catch per Unit Effort (CPUE) differences among years were found to be statistically significant and the standardized indices, both in terms of number and biomass, from 2000 onwards are generally lower than those estimated for the previous years. Estimated indexes for the most recent years are among the lowest ones.

SCRS/2020/022 – The multispecies artisanal fishery operating with canoes in continental shelf waters of Côte d'Ivoire has been fishing for years for various fishes. Here, information about the data on swordfish specimens that have been caught from 1984 to 2018 is reviewed. The data are about specimens that were counted and measured at three main landing sites in Côte d'Ivoire. These sites are located in Abidjan, San Pédro and Sassandra. The statistics from these sites have been combined to meet accuracy and the ICCAT's Task-I and Task-II requirements. The yield and size data for those years are addressed in the review, as are the CPUE and effort data that were lacking in former reports. The results indicated that from 1984 to 1995, swordfish less than 145 cm slightly dominated the catches. In contrast, from 1996 to 2007, specimens ranging in size from 165 to 204 made up the majority of swordfish caught. Yet, from 2008 to 2018, almost all swordfish captured either measured less than 145 cm or were over. Although no clear trends are observed, evidence is given of the year-to-year variation in yield, fishing effort and CPUE.

SCRS/2020/023 – This paper provides a brief update of the study on habitat use for swordfish, developed within the working plan of the Swordfish Species Group of ICCAT. A total of 9 miniPAT tags have been deployed by observers on Portuguese and Spanish vessels and the Uruguayan research cruise in the North and South Atlantic. Data from eight tags/specimens are available, four specimens suffered from post-release mortality and one individual tag pop-up date has not occurred yet. These preliminary results showed swordfish moved in several directions, travelling considerable distances. Swordfish spent most of the daytime in deeper waters, being closer to the surface during night-time. The main plan for the next phase of the project is to continue the tag deployment during 2020 in several regions of the Atlantic Ocean and Mediterranean Sea.

SCRS/2020/024 – Since 2018, ICCAT has been developing a biology program for swordfish, through a partnership of 19 institutes of 12 CPCs. This programme aims to improve knowledge of the stock distribution, age and sex of the catch, growth rate, age at maturation, maturation rate, spawning season and location and diet. This should thereby contribute to the next major advance in the assessment of swordfish status, by permitting the development of more spatially and biologically realistic population models used

in both Atlantic and Mediterranean populations, as well as within the ICCAT Management Strategy Evaluation (MSE) for North Atlantic swordfish. Within the swordfish biology program, a specific component on the age and growth of the species in the Atlantic (including the Mediterranean Sea) was developed. In this paper, we provide an update of this component.

SCRS/2020/025 – This report details the second phase of biological sampling and associated analysis undertaken as part of an international swordfish biology program. The program was established in 2018 and sampling was conducted for swordfish in the North and South Atlantic and Mediterranean. Fish were sampled for size, sex, and maturity. Anal fin spine samples and tissues were obtained for ageing and growth and genetic analyses. These data will be used to inform ICCAT assessment and the ongoing management strategy evaluation process. In this report we examine sampling representativeness relative to spatial and temporal patterns in recent catch data. Samples were obtained from a broad temporal and spatial range, however, some improvements are required in spatial-temporal coverage.

SCRS/2020/026 – The catch rates from the Moroccan longline fleet targeting swordfish in the Mediterranean Sea, from 2012 to 2019, were analyzed using the General Linear Modelling approach (GLM), under lognormal error assumption in order to compute standardized abundance indices. The relative abundance index decreased between 2012 and 2016, but remained relatively stable since then.

SCRS/2020/027 - Nominal indices of relative abundance for swordfish caught by the Ligurian longline fishery are updated with data collected in the period 2016-2019. The trend in nominal CPUE for the mesopelagic longline indicates that relative abundance for 2016 and 2017 has strongly increased from 2015 levels, but dropped during the following season 2018, with a slight recovery in 2019. Average weight of fish, after the decrease showed up to 2012, remains quite constant between 25kg and 30kg. Starting from 2012, mainly during the winter months fishing activity is mainly carried out using the American Type longline. A first preliminary attempt to standardize mesopelagic longline CPUE values was carried out introducing soaking time as a new predictor.

SCRS/P/2020/004 – reviewed SWO MSE work done in 2019 and solicited feedback on the plan for 2020 work. Progress in 2019 included: the development of the SWOMSE R package (built as an extension of the existing R packages MSEtool and DLMtool), the Shiny App, MSE Trial Specifications Doc (http://bit.ly/nswo-mse-trialspecs), MSE Project Progress Sheet (http://bit.ly/nswo-mse-progress). The SWO MSE contractor provided a summary of the next steps in the 2020 SWO MSE workplan. These were: to finalize OM Uncertainty Grid; run preliminary MSE to identify sensitivity of MP selection to OM Uncertainties; Generate OM summary and individual OM diagnostic reports to develop OM Reference Set; to develop OM Robustness Set; to determine index (indices) to use in CMPs; and to propose CMPs to evaluate, decide probability values for preliminary performance metrics.

SCRS/P/2020/005 – The presentation provides preliminary results of swordfish reproduction studies associated with the ICCAT swordfish biology project. Of the 3048 swordfish in the database in early March 2020, 1186 were classified as male, 1523 as female, and 338 as undetermined. The sex ratio was calculated as the ratio of females to males. Six macroscopic maturity stages of gonads were assigned (ICCAT, 2016). Fish were classified as either undetermined (stage 0), immature (stage 1) or mature (stages 2 - 5). The L_{50} was estimated using the macroscopic maturity data. Gonad samples and histological imagery were sent to the coordinator of the reproductive studies at IEO-Málaga (Spain). Microscopic maturity determination of gonads was based on a modification of the criteria from Schaefer (2001) and Farley et al. (2013). The analysis of the sex-ratio showed that females were more abundant than males, but that some samples require further verification for sex assignment. The estimated L_{50} for the three stocks was consistently lower than those adopted by the SCRS. However, it should be noted that a significant number of histological sections of ovaries examined showed that females microscopically classified as immature were often incorrectly evaluated as developing (stage 2, mature) when using the macroscopic criteria. It was recommended to increase sampling of swordfish across the Mediterranean Sea and Atlantic Ocean, to collect enough data for the reliable estimation of maturity and other reproductive traits, as is the validation of the macroscopic maturity data using the histological examination of gonads.

SCRS/P/2020/006 - presented results from their de novo *Xiphias gladius* genome sequencing, assembly and annotation and comparative phylogenomic analysis. For the first time, the genome of the swordfish was sequenced, assembled and annotated. This initial step allowed for comprehensive phylogenomic and evolutionary analysis through comparison of the swordfish genome to available high-quality genomes of 19

other fish species. Such analysis allowed the authors to evaluate the conservation of swordfish protein coding genes as well as the expansion/contraction of gene families. Among genes clustered in swordfish-specific groups, representing a unique evolutionary fingerprint of this species, a relevant fraction was composed of transposons-related elements, which make the swordfish genome highly dynamic and likely subject to intense remodelling. Most of the genes belonging to expanding gene families were found to be related to the immune response, suggesting that some swordfish populations may be facing parasite/microbial infections and, generally, marine pollution at higher levels than observed in other fish species. The authors then discussed the results from their genetic population analysis. Double digest restriction-site associated DNA (ddRAD) sequencing technology was applied to evaluate intra and inter-population differences between 25 North Atlantic and 71 Mediterranean specimens. The availability of the assembled and annotated swordfish genome allowed the authors to show not only number of the differences between populations, but also the genes and the gene families the two population are investing in. Preliminary results suggested that the Mediterranean swordfish is investing its energy in modulating the molecular machinery involved in the response to several stimuli such as those related to the "closed" and comparitively polluted environment of the Mediterranean Sea, if compared to those of the Atlantic Ocean. On the contrary, swordfish belonging to Atlantic population seems to invest energy in processes related to migration and feeding. North Atlantic and Mediterranean specimens were clustered as two different populations. However, a few specimens from the Balearic area showed an intermediate genotype between the two populations, suggesting the existence of a mixing zone between the North Atlantic Ocean and the Mediterranean Sea. North Atlantic specimens were classified as a unique population, while Mediterranean specimens may constitute multiple populations. Analysis of additional specimens is requested to determine the number of populations present in this area. Additional ddRAD analysis are in progress to evaluate genetic population differences among North and South Atlantic and Mediterranean swordfish. In particular, 200 samples chosen on the basis of the fishing areas and the gonadal maturity stage are being used to provide the first genetic data on the mixing and spawning area. These first results will help to identify potential areas for spawning and mixing which should be confirmed by the analysis of a greater number of specimens in the future.

SCRS/P/2020/007 - provides some preliminary results from a USA-Portugal collaborative project of MiniPAT deployment throughout the Atlantic Ocean. Between 2015 and 2019, 11 swordfish were tagged from Portuguese longline vessels near the current swordfish boundary of the North/South Atlantic. Useful data on movement and habitat utilization have been obtained. However, high post release mortality, and (more recently) poor battery performance in the PSATs have seriously hampered data collection. The presentation provides the tracks that five fish followed, including the depth and temperature profiles of the diving behavior. The overall maximum dive observed was 1480 m, by a 115cm swordfish tagged on August 2015 (at 14.30N and 25.30W), which is more than 600m deeper than the second deepest dive observed for this fish. In 2015, four swordfish were tagged from Portuguese longline vessels. Two tags were apparent mortalities occurring shortly after tagging. A 115 cm swordfish was tagged on August 3, 2015 at 4.3°N and 26.4°W. This tag detached on December 1, 2015 at 0.3°S and 28.3°W, approximately 567 km from the tagging point. The deepest recorded dive was 800m. The deep descent 1840 m at the time of detachment could reflect either a mortality or an attachment failure. Another 115cm swordfish was tagged on August 19, 2015 at 14.3°N and 25.3°W. This tag detached on April 15, 2016 at 5.8°N and 23.8°W, approximately 957 km from the tagging location. This fish had a maximum dive of 1480m which is more than 600m deeper than the second deepest dive observed for this fish. Two fish were tagged in 2016, however one fish died shortly after tagging, and the second fish apparently died 10 days after tagging. In 2018, two swordfish were tagged. Unfortunately, one tag failed to transmit any data, and the second tag only transmitted for a short period of time – resulting in a considerable loss in data transmissions. Wildlife Computers has agreed to replace this tag free of charge. Results shown on the next slide are based on the reduced data set that was transmitted from this second tag. A 115 cm swordfish was tagged on October 25, 2018 at 38.9°N and 11.9°W. The tag detached on March 27, 2019 at 20.7°N and 18.8°W, approximately 2,135 km from the point of tagging. The deepest observed dive was 704 m. Three swordfish were tagged in 2019. One tag failed to transmit. A 120 cm swordfish was tagged on April 14, 2019 and was only at large for 6 days before an apparent attachment failure occurred. This fish had a maximum dive of 208 m. A 140 cm swordfish was tagged on June 4, 2019 at 0.77°S and 13.5°W. The deepest dive observed was 960 m. This tag detached on January 5, 2020, approximately 806 km from the tagging location.

Appendix 5

Terms of Reference
Swordfish growth, reproduction and genetics studies:
Biological samples collection and preliminary analysis – Year #3

Background and objectives

As approved by the SCRS in 2017, the Swordfish Species Group initiated in 2018 a biological sample collection programme to collect biological data for swordfish (SWO), which aims to improve knowledge of the stock distribution, age and sex of the catch, growth rate, age at maturation, maturation rate, spawning season and location and diet, and thereby contribute to the next major advance in the assessment of swordfish status, by permitting the development of more spatially and biologically realistic population models used in both Atlantic and Mediterranean populations assessments and within the ICCAT Management Strategy Evaluation (MSE) for North Atlantic swordfish. This should translate into more reliable advice on stock status for an internationally and collectively managed resource. The Swordfish Species Group has identified this work to be of a very high priority which will address critical deficiencies in our understanding of the population dynamics and ecology of swordfish.

The objectives of this Swordfish Species Group project are to:

1. Resolve the spatial-temporal distribution of the three known swordfish stocks found within the Atlantic Ocean and Mediterranean Sea using a genetic analysis of tissue sampled from the catch of participating CPCs.
2. Resolve the age and size at maturity of the three known swordfish stocks found within the Atlantic Ocean and Mediterranean Sea using samples/measurements provided by participating CPCs.
3. Characterize the age composition of the catch and validate the growth curves for each swordfish stock.
4. Determine the spawning period and areas of each stock.
5. Develop a protocol/template based on genetic analysis that will allow for the assignment of tissue samples to a particular stock.
6. Develop a biological database that links the sample information to the age, stock origin, sex, size, diet and maturity data of each fish.
7. Update the ICCAT Manual with new pertinent information.

This work will be closely linked to the sampling programmes of CPCs that support the goals and objectives of ICCAT and the Swordfish Species Group. The points of contact for participants of this programme are the Swordfish Species Group rapporteurs for the Atlantic and Mediterranean stocks, with contributions from the Group members, the SCRS Chair and Vice-Chair, as well as the ICCAT Secretariat.

As part of this biological study, scientific institutes and public or private entities are asked to submit tenders to continue the work started in 2018. In particular the work to be developed includes provision of biological data, collection of samples and performance of samples processing and data analysis, as described below. Submission of a single offer by a consortium of Scientific Institutes/Universities covering all areas would be highly preferable. All the data collected under the research programme will be used for scientific purposes only and in accordance with ICCAT rules. Any other use of these data should be specifically authorized by ICCAT. Samples will be collected and appropriately balanced from the geographical areas/fleets with the highest swordfish catches. For reference, see **Figures 1** and **Table 1**.

Contractor tasks

The principle objective of the project is to determine the spatial-temporal distribution including stock boundaries and mixing, age composition, maturity schedule and age at maturity of Atlantic and Mediterranean swordfish. Swordfish are landed in a broad range of ports bordering the Atlantic Ocean and Mediterranean Sea, and over a fishing season that spans the entire year. A further complication is that the species is sexually dimorphic based on size and potentially exhibit sex based spatial segregation.

The Contractor will ensure that biological samples from this heterogeneous population will be made available according to the sampling design established by the Swordfish Species Group which will ensure that the fishery is covered on a proportionate basis by sex, age, size, season and area.

It must be noted that for biological sampling and analysis, small-scale and short-term sampling is considered of little use for meeting the project objectives. As such tenders should be made on a **regional and collaborative basis**.

It is expected that the Contractor will use trained field technicians to obtain the necessary biological samples (fish length, weight, assess maturity (and optionally, collect gonads), assess sex, collect fin or muscle tissue, anal fin spine (and optionally, otolith), record sample meta data) on every fish sampled if possible. In recognition of the difficulty in collecting stomach samples, the sample will be considered complete if that component is missing. In addition, for samples collected in ports not all sample components may be available; as will be considered to be partially complete.

The Contractor must ensure that all sample information is properly cross referenced, Quality Assured and Quality Controlled (QA/QC) and stored in a relational database. Uniquely identified tissue samples and anal fin spines must be sent to an entity to be determined by the Swordfish Species Group. Otoliths will also be collected and processed, mostly for comparative purposes and calibration with ages estimated from spines. Protocols used during the sampling must be developed based on current best practices and, in the case of tissue and anal fin spines, not interfere with further processing or cause degradation of the samples. Replicate tissue samples are required. These protocols must be approved by the Swordfish Species Group Rapporteur before any collection starts. In addition, the Contractor(s) will ensure participation in a workshop to: 1) update the sampling protocols as needed; 2) establish reference sets related to aging and calibration of sexual maturity stages; and, 3) enable training of the teams to be involved in the processing and data analysis.

Deliverables

1. **Ensure participation in a technical workshop** on setting reference sets for spine and otoliths aging and calibration of reproduction, as well as to allow training of the Swordfish Species Group team members to be involved in the processing and data analysis of the samples collected. The workshop is tentatively scheduled to take place in Italy (October or November 2020).

2. **SCRS documents and/or power point presentations** at 2020 Swordfish Species Group meeting (September 2020) regarding the:
   a) Distribution of the collected samples by area, season, and sex will be made to the SCRS;
   b) Any updates on the protocols for sampling, aging and assignment of maturity stage;
   c) Report on the level of completion of sample collection and processing;

3. Labelled anal spines, otoliths and tissue **samples to be shipped** according to the updated protocols established during the technical workshop.

4. A **relational database** containing the sample data that **has undergone thorough QA/QC is to be provided. This database will reside at the ICCAT Secretariat** and will be made available for distribution upon request.

5. **Shipping and processing of samples** determined to be analyzed by the selected laboratories.

6. **Analysis of the samples and reporting** of final findings.

7. A **draft final report** to be submitted by **11 December 2020 at the latest**, which will include:

   a) Executive Summary;
   b) Full description of the work carried out;
   c) Description of final results;
   d) Proposals of further activities to be developed for achieving the objectives of the project.

8. The **final report** shall be updated taking into account the comments provided by the ICCAT Secretariat, the Swordfish Species Group rapporteurs and the SCRS Chair and Vice-Chair, be submitted **by 24 December 2020 at the latest**.

Payment details

Disbursement will be made according to the following schedule:

- 30% of the total amount of the contract upon signing the contract;
- 30% after the provision of documents and/or presentations to the Swordfish Species Group meeting in September 2020;
- 20% after receipt by the ICCAT Secretariat of the draft final report;
- 20% after the approval of the final report by the ICCAT Secretariat, following incorporation of comments made by the ICCAT Secretariat.

Logistics

All documents provided by the Contractor must be in open format ODF 1.2 (click here) such as MS word, or LibreOffice, figures must be in Excel format or compatible, figures and pictures must be in JPEG or TIFF format or compatible. All documents submitted must be in English, French or Spanish.

Data must be provided in the format agreed with the ICCAT Secretariat for statistics and biological data.

Copyright

All the material produced by the Contractor will remain the property of ICCAT, will be kept confidential, and cannot, in any case, be circulated by the Contractor selected. Use of the data for scientific purposes by the Contractor must always be notified to ICCAT in advance for clearance.

For information concerning this Call for tenders, please contact the ICCAT Secretariat at the following address: info@iccat.int