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for the
CONSERVATION of ATLANTIC TUNAS

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INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS

CONTRACTING PARTIES
(at 31 December 2022)

Albania, Algeria, Angola, Barbados, Belize, Brazil, Cabo Verde, Canada, China (People's Rep.), Côte d'Ivoire, Curaçao, Egypt, El Salvador, Equatorial Guinea, European Union, France (St. Pierre & Miquelon), Gabon, Ghana, Grenada, Guatemala, Guinea (Rep.), Guinea Bissau, Honduras, Iceland, Japan, Korea (Rep.), Liberia, Libya, Mauritania, Mexico, Morocco, Namibia, Nicaragua, Nigeria, Norway, Panama, Philippines, Russia, Sao Tomé & Principe, Senegal, Sierra Leone, South Africa, St Vincent and the Grenadines, Syria, The Gambia, Trinidad & Tobago, Tunisia, Türkiye, United Kingdom of Great Britain and Northern Ireland, United States, Uruguay, Venezuela

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Panel No.	***PANEL MEMBERSHIP***	***Chair***
-1- Tropical tunas	Angola, Belize, Brazil, Cabo Verde, Canada, China (P.R.), Côte d'Ivoire, Curaçao, El Salvador, Equatorial Guinea, European Union, France, Gabon, Ghana, Guatemala, Guinea (Rep.), Guinea-Bissau, Honduras, Japan, Korea (Rep.), Liberia, Libya, Mauritania, Mexico, Morocco, Namibia, Nicaragua, Nigeria, Panama, Philippines, Russian Federation, Sao Tomé & Principe, Senegal, Sierra Leone, South Africa, St. Vincent and Grenadines, Trinidad & Tobago, United Kingdom of Great Britan and Northern Ireland, United States of America, Uruguay and Venezuela.	Ghana
-2- Temperate tunas, North	Albania, Algeria, Belize, Brazil, Cabo Verde, Canada, China (P.R), Egypt, European Union, France (St. Pierre and Miquelon), Iceland, Japan, Korea (Rep.), Libya, Mauritania, Mexico, Morocco, Namibia, Norway, Panama, Russian Federation, Senegal, St. Vincent and the Grenadines, Syria, Tunisia, Turkey, United Kingdom of Great Britain and Northern Ireland, United States, and Venezuela.	Japan
-3- Temperate tunas, South	Angola, Belize, Brazil, China (P.R.), Côte d'Ivoire, European Union, Japan, Korea (Rep.), Namibia, Panama, Philippines, South Africa, St Vincent and the Grenadines, United Kingdom of Great Britain and Northern Ireland, United States and Uruguay.	South Africa
-4- Other species	Algeria, Angola, Belize, Brazil, Cabo Verde, Canada, China (People's Republic), Côte d'Ivoire, Egypt, Equatorial Guinea, European Union, France (St. Pierre & Miquelon), Gabon, The Gambia Guatemala, Guinea Bissau, Guinea (Rep.), Honduras, Japan, Korea (Rep.), Liberia, Libya, Mauritania, Mexico, Morocco, Namibia, Nigeria, Norway, Panama, Sao Tomé & Principe, Senegal, Sierra Leone, South Africa, St. Vincent and the Grenadines, Trinidad and Tobago, Tunisia, Turkey, United Kingdom of Great Britain and Northern Ireland, United States of America, Uruguay, and Venezuela.	Algeria

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FOREWORD

The Chairman of the International Commission for the Conservation of Atlantic Tunas presents his compliments to the Contracting Parties of the International Convention for the Conservation of Atlantic Tunas (signed in Rio de Janeiro, May 14, 1966), as well as to the Delegates and Advisers that represent said Contracting Parties, and has the honor to transmit to them the ***"Report for the Biennial Period, 2022-2023, Part I (2022)"***, which describes the activities of the Commission during the first half of said biennial period.

This issue of the Biennial Report contains the Report of the 23rd Special Meeting of the Commission (Vale do Lobo, Portugal/Hybrid, 14-21 November 2022) and the reports of all the meetings of the Panels, Standing Committees and Sub-Committees, as well as some of the Working Groups. It also includes a summary of the activities of the Secretariat and the Annual Reports of the Contracting Parties of the Commission and Observers, relative to their activities in tuna and tuna-like fisheries in the Convention area.

The Report is published in four volumes. ***Volume 1*** includes the Proceedings of the Commission Meetings and the reports of all the associated meetings (with the exception of the Report of the Standing Committee on Research and Statistics-SCRS). ***Volume 2*** contains the Report of the Standing Committee on Research and Statistics (SCRS) and its appendices. ***Volume 3*** includes the Annual Reports of the Contracting Parties of the Commission. ***Volume 4*** includes the Secretariat's Report on Statistics and Coordination of Research, the Secretariat's Administrative and Financial Reports, and the Secretariat's Reports to the ICCAT Conservation and Management Measures Compliance Committee (COC), and to the Permanent Working Group for the Improvement of ICCAT Statistics and Conservation Measures (PWG). All Volumes of the Biennial Report are only published in electronic format.

This Report has been prepared, approved and distributed in accordance with Article III, paragraph 9, and Article IV, paragraph 2-d, of the Convention, and Rule 15 of the Rules of Procedure of the Commission. The Report is available in the three official languages of the Commission: English, French and Spanish.

ERNESTO PENAS
Commission Chairman

REPORT OF THE STANDING COMMITTEE ON RESEARCH AND STATISTICS (SCRS)
(Madrid (Spain)/Hybrid – 26-30 September 2022)

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REPORT OF THE STANDING COMMITTEE ON RESEARCH AND STATISTICS (SCRS)
(Hybrid/ Madrid (Spain) – 26-30 September 2022)

1. General remarks by the SCRS Chair and the Executive Secretary

The 2022 Meeting of the Standing Committee on Research and Statistics (SCRS), held in a hybrid format, was opened on Monday, 26 September 2022 by Dr Gary Melvin, Chair of the Committee. Dr Melvin welcomed all the participants to the annual meeting, both online and in person.

General remarks by the SCRS Chair, Dr Gary Melvin

I sincerely hope that everyone is healthy and safe during these challenging times. I would like to congratulate the SCRS members for adapting to the new way of doing business during the COVID pandemic. Fortunately, we appear to be moving into a new phase where restrictions have been reduced and in-person meetings are possible to a limited extent. Our attempts to return to previous practices since June have however been both positive and negative. Consequently, we will likely have to live with hybrid and virtual meetings for several years to come.

Last year was extremely busy for the SCRS, given the never decreasing demands of the Commission to provide advice and responses. In this context, I would like to thank all the Officers, rapporteurs, participants and the Secretariat for their efforts and cooperation in achieving our intersessional, Sub-group, and Committee goals and objectives. As in the past few years of COVID we have again established four priorities for the Plenary, the Executive Summary for those stocks assessed (skipjack (East and West), porbeagle shark, swordfish and eastern bluefin tuna) workplans, responses to the Commission and recommendations with financial implications, to provide our advice to the Commission. I am pleased to announce that most, if not all, of these meetings have met their objectives, adopted their reports, and provided revisions to the Secretariat within a reasonable period of time, allowing these to be translated, published and disseminated through the usual channels. This is only due to the dedication of all involved. This efficiency has allowed the Plenary to focus on the essential business for 2022 and 2023. While this is not ideal, it does provide an open and transparent mechanism to provide up-to-date scientific advice for specific stocks where information is available.

As many of you know I will be stepping down as the Chair of the SCRS this year. Consequently, we have scheduled an election for the end of the week. I kindly ask that anyone considering running for the position to please notify myself, and the Executive Secretary, by the end of the day on Wednesday so we can schedule the necessary time if a vote is required.

Finally, it has been an extreme pleasure to serve as the Chair of this distinguished scientific group for the last four years. Over this period, I have met many new colleagues and established new friends. I will truly miss the dedicated people of the Committee and the Secretariat. Thank you all. I only ask that the members of this Committee are as kind to the new SCRS Chair as they were to me.

General remarks by the ICCAT Executive Secretary, Mr. Camille Jean Pierre Manel

The ICCAT Executive Secretary, Mr. Camille Jean Pierre Manel, addressed the meeting, welcomed all the participants and congratulated all the scientists and the Secretariat staff who contributed to the work of the SCRS throughout 2022 with significant progress. He noted that in 2022, as in previous years, the upward trajectory in the number of meetings has persisted and has increased the work overload for both the SCRS and the Secretariat. He drew the attention of the SCRS to the unsustainability of the situation, which continues to be a growing threat, with a high risk to the contribution of the Secretariat. He also recognized the need for the SCRS to progress on several crucial and urgent issues and other requests of the Commission.

He then reiterated his previous calls for adequacy between the different tasks that are assigned to the Secretariat and its means, together with the streamlining of the SCRS meetings. Finally, he reiterated that the Secretariat is always committed to assisting the SCRS and the other subsidiary bodies of the Commission and expressed his hope that the SCRS will meet in a face-to-face format soon without any restrictions. The full Executive Secretary speech is contained in **Appendix 1**.

2. Adoption of Agenda and arrangements for the meeting

The Tentative Agenda was slightly modified and is provided in **Appendix 2.** Full assessments were carried out this year on eastern Atlantic and Mediterranean bluefin tuna (E-BFT), Atlantic swordfish (SWO), skipjack (SKJ) and North-eastern porbeagle (POR). Additionally, intersessional meetings were held for the Subcommittee on Ecosystems and Bycatch and Working Group on Stock Assessment Methods (WGSAM). Additionally, several meetings of the MSE Technical Groups of bluefin tuna, North Atlantic swordfish and tropical tunas were also held, as well as three Intersessional Meetings of Panel 2 on BFT MSE that involved a high number of SCRS delegates.

The following scientists served as rapporteurs of the various species sections (Agenda item 9) of the 2022 SCRS Report:

BFT - Bluefin tuna general - G. Melvin (Coordinator), J. Walter (West), E. Rodriguez-Marín (East)
SWO - Swordfish - K. Gillespie (North Atlantic), D. Parker (South Atlantic)
SKJ - Skipjack - R. Sant'Anna
POR - Porbeagle - R. Forselledo
Task 1 reported catch (Secretariat)

The Secretariat served as rapporteur for all other Agenda items.

3. Introduction of Contracting Party delegations

The Executive Secretary introduced the 32 Contracting Parties present at the 2022 meeting both online and in person: Algeria, Belize, Brazil, Canada, China (P.R.), Côte d'Ivoire, Egypt, El Salvador, European Union (EU), Gabon, Guatemala, Honduras, Japan, Korea (Rep.), Liberia, Mexico, Morocco, Mauritania, Namibia, Nicaragua, Norway, Panama, Russian Federation, Sao Tomé & Príncipe, Senegal, Sierra Leona, South Africa, Tunisia, Türkiye, United Kingdom, United States and Uruguay. The List of Participants at the Species Groups Meetings and the Plenary Sessions is attached as **Appendix 3**.

4. Introduction and admission of observers

Representatives from two Cooperating non-Contracting Parties, Entities, or Fishing Entities (Chinese Taipei and Costa Rica), one inter-governmental organization (Caribbean Community - CARICOM) and non-governmental organizations (Asociación de Pesca, Comercio y Consumo Responsable del Atún Rojo - APCCR, Asociación Nacional de Acuicultura de Atún Rojo - ANATUN, Associaçao de Ciencias Marinhas e Cooperaçao - SCIAENA, EUROPÊCHE, Federation of Maltese Aquaculture Producers - FMAP, International Seafood Sustainability Foundation - ISSF, Marine Stewardship Council - MSC, Pew Charitable Trusts - PEW, Pro Wildlife, Shark Guardian, Sharkproject International, The Ocean Foundation, The Shark Trust and Worldwide Fund for Nature - WWF) were admitted as observers and welcomed to the 2022 meeting of the SCRS (see **Appendix 3**).

5. Admission of scientific documents and presentations

As of 24 September 2022, a total of 162 scientific papers and 59 scientific presentations had been submitted at the different SCRS meetings. In 2015 a deadline of seven days before the beginning of the SCRS meetings was established for submitting the full documents and in 2019 it was agreed to also apply the same deadline for the submission of presentations, with the objective of facilitating the work of the rapporteurs in preparing the meeting. Taking into account the limited time that the Groups have to complete their work, adherence to deadlines greatly contributes to improving the work of the SCRS. The List of SCRS Papers and Presentations is attached as **Appendix 4**.

Besides the scientific documents and presentations, there are 14 reports of intersessional meetings and regular Species Groups meetings, 49 Annual Reports from the Contracting Parties, and non-Contracting Cooperating Parties, Entities and Fishing Entities, as well as various documents by the Secretariat.

6. Report of Secretariat activities in research and statistics

The Secretariat summarized its activities, data reported, publications, website updates, and other information contained in the 2022 Secretariat Report on Research and Statistics related to fisheries and biological data submitted for 2021, which included revisions to historical data. The activities and information included in this report refer to the period between 1 October 2021 and 8 September 2022 (the Reporting Period).

Regarding the activities conducted by the Secretariat in the most recent years, in addition to the normal activities on statistics, publications, data funds management and others, due to the impact of the pandemic on the SCRS activities, the Secretariat dedicated a lot of additional work to the preparation and attendance of SCRS meetings, as well as supporting the Commission and SCRS Officers in planning the rescheduling of the meetings and managing all related correspondence work. Moreover, it participated extensively in stock assessment activities, and conducted extensive work related to coordination and management of external support for the SCRS data collection and research programmes and activities. The Secretariat's participation in these programmes mainly consisted in both administrative and scientific support, including the coordination of research proposals, calls for tenders, database management, fund administration, and oversight of auditory and accounting responsibilities, as well as IT support for each programme. As in the past, during 2022 the Secretariat actively participated in all data collection and research programmes components. Finally, the Secretariat highlighted the effort being made in the development of the ICCAT Integrated Online Management System (IOMS), a system designed to manage online all the information associated with the ICCAT data requirements in the future. This is a long-term project intended to entirely replace the current ICCAT data management system. One new software developer was hired for a short-term period (12 months) to work full-time on the IOMS implementation, based on a grant agreement signed with the EU.

A total of 57 ICCAT CPCs [52 Contracting Parties (CP), plus 5 Cooperating non-Contracting Parties/Entities/Fishing Entities (NCC)] have reporting obligations to ICCAT. For statistical purposes, this corresponds to a total of 75 flag related CPCs (50 CP + 1 CP [15 EU Member States] + 1 CP [5 UK flag States] + 5 NCC) who have reported information to ICCAT in recent years. The term "flag CPC" was adopted here to refer to those 75 flags. The SCRS report cards (2021 data), the SCRS catalogues (1992-2021), and the overall SCRS scorecards, were some of the instruments used to provide the SCRS with the current Flag CPC fisheries data during the Reporting Period. Various weaknesses in the information submitted were also identified. The most problematic one is the use of outdated ICCAT forms to send the information. The Secretariat reiterated to the CPCs the Commission's requirement of using the most recent standard electronic forms for data submission and completing all the information requested.

Since the last provision of advice by the SCRS in September 2021, the Secretariat provided support to a total of 38 SCRS and COM/SCRS official online and in-person meetings. In addition to these, the Secretariat also provided support to 11 additional workshops and meetings of the SCRS Technical Sub-groups.

The Secretariat has continued the series of periodic publications developed throughout the history of ICCAT, which includes: completed publication of volume 78 (completed issues 1 to 10) and has already published issues 1 to 3 of Volume 79 of the ICCAT Collective Volume of Scientific Papers; Part I of the Biennial Period 2020-2021, corresponding to Volume I (Commission meeting report), Volume II (SCRS Plenary meeting report), Volume III (Annual Reports) and Volume IV (Secretariat reports) were already published throughout 2022. Volume 47 of the Statistical Bulletin was published in an electronic version in January 2022, which includes the catches and other statistics series for the period 1950 to 2020, and volume 48 will be available in early 2023.

Following the 2019, 2020 and 2021 requests regarding the update and expansion of Chapter 2 of the ICCAT Manual, in 2022 the Secretariat hired an expert to prepare a new chapter for a small tuna: for the narrow-barred Spanish mackerel (*Scomberomorus commerson*). In addition, all the chapters were revised and translated by the Secretariat, and some by SCRS experts, aiming their publication towards the end of 2022. The ICCAT website, in the three official languages of the Commission, continues to be updated and new tools are being developed on a regular basis to provide better service to users. The search engine for scientific documents requested by the SCRS has been completed. This new tool enables searches for SCRS documents published in the ICCAT Collective Volume of Scientific Papers since 1973, by using different parameters and criteria. For that purpose, a bibliographic database of published SCRS documents was developed. For the first time all documents presented to the SCRS were published within the same year of their presentation in the ICCAT Collective Volume of Scientific Papers.

In 2012, the SCRS approved a protocol to use the Data Fund and other ICCAT funds. This protocol defines a broad structure for use of the funds which includes improvement of statistics, training and support of SCRS work, including attendance to meetings. The protocol also includes the criteria to be followed for allocation of funds.

On the basis of this protocol, in 2022 the funds have been used as follows:

1. *Participation at SCRS meetings:* Due to the pandemic most SCRS meetings were held online, and therefore financial assistance was only provided to some participants attending recent meetings held in a hybrid format.

2. *Improvement of statistics:* With the support of the ICCAT/Japan Capacity-building Assistance Project (JCAP-2), two projects were funded: i) Reinforcement of data collection, monitoring for tuna fisheries, and adaptation to the new catch documentation scheme of Statistic System in Belize; and ii) Pilot study proposal for Automatic fish count and length/weight estimation system for bluefin tuna in Moroccan Atlantic Farm.

3. *Enhancement of scientific capacity building:* JCAP-2 has also approved the financial support of a young researcher from Uruguay (Federico Más) for a 2-month internship training at a European research centre (Instituto Português do Mar e da Atmosfera - IPMA, Portugal).

During its 2021 Annual Meeting, the Commission approved a total amount of €404,500 for the 2022 Science Envelope. To meet the Science budget, an additional contract related to voluntary contribution by ICCAT CPCs was signed with the: i) European Union in March 2022 (€701,385.00) to finance 64% of the scientific activities; ii) United States to cover the costs of the Enhanced Programme for Billfish Research Data Fund (€30,000.00); and iii) Chinese Taipei, which has contributed €4,000. A total of 21 short-term contracts were signed and/or extended during the reporting period.

Ms. Marisa de Andrés, a previous Spanish Translator at the Secretariat, took the new position of Publications Editor. Consequently, a new Spanish Translator (Ms. Beatriz Motos) was hired from May 2022. Finally, in June 2022, Ms. Dawn Baity took the new position of Technical Officer in the Compliance Department.

Finally, references were made to international cooperation promoted by the Secretariat with several international organization: UN Marine Biodiversity of Areas Beyond National Jurisdiction (BBNJ) process, FAO Committee of Fisheries (COFI), FAO Coordinating Working Group on Fishery Statistics (CWP), General Fisheries Commission for the Mediterranean (GFCM), International Council for the Exploration of the Sea (ICES), Western Central Atlantic Fishery Commission (WECAFC), Mediterranean Advisory Council (MEDAC), Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), EU Regional Coordination Group Large Pelagics (RCG LP) and Regional Fishery Body Secretariats' Network (RSN).

Discussion

The Committee acknowledged and thanked the Secretariat for the extensive, efficient and hard work of the Secretariat to deliver the SCRS requests and keeping the usual standards under such a heavy workload.

The EU noted that the workload increase is in part due to the Commission's request, but also from the SCRS while developing its own activities. Therefore, they suggested that the 2023 workplan should be commensurate with the Secretariat's capacity.

The United States also reiterated the EU comments. In addition, it was proposed to develop (for future inclusion in the Secretariat annual report) information similar to the SCRS catalogues oriented to look at trends in catch rates (nominal CPUEs) for the major fisheries (species/stock, flag, gear, year). These trends will allow to understand better the changes over time of both dimensions (catch, effort) and facilitate evaluation of trends. The United States also requested more detailed information on discards to be provided.

Japan conveyed the wellness of the Government of Japan's Ministry of Fisheries for the continuation and active support to the ICCAT/Japan Capacity-building Assistance Improvement Project (JCAP-2). Uruguay thanked JCAP and the EU (Instituto Português do Mar e da Atmosfera (IPMA) laboratory, Portugal), for their support, indicating that the support provided to a national scientist (F. Mass) was very beneficial for his PhD, as well as for the Committee as the document was already presented this year to the SCRS and other documents will be presented to the upcoming blue shark data preparatory meeting.

The Executive Secretary also thanked the government of Japan for its support and noted the scheduled meeting of the JCAP Steering Committee during the Plenary. The EU thanked Japan for the capacity building element and noted the importance that all CPCs contribute to the SCRS and ICCAT activities, highlighting that the EU provides very important voluntary contributions in support of ICCAT and the overall SCRS capacity building.

Morocco also thanked the government of Japan and its programme in support of research initiatives for developing CPCs, aiming to contribute to the research activities of the SCRS. Finally, the SCRS Chair thanked Japan and all other CPCs that supports research and capacity building through their voluntary contributions to ICCAT.

7. Review of national fisheries and research programmes

Algeria

The national catches of tuna and tuna-like species recorded in 2021 are around 451,478 t for swordfish from a quota of 486,910 t, 1,649.805 t for bluefin tuna including 3,152.833 kg of dead individuals recorded during the live tuna fishing campaign by tuna purse seiners and 2,481.859 t for small tunas. Shark catch data have been collected in the context of monitoring shark species, for two shark species that are taken as bycatch and accidentally: around 3,443 t of blue shark (*Prionace glauca*) and 2,183 t of thresher shark (*Alopias vulpinus*). 21 Algerian-flagged tuna purse seiners, with a length of between 21.8 m and 40 m, have participated in the live bluefin tuna fishing campaign. This campaign was divided into four (4) joint fishing groups. As a result of this fishing, 1,649.805 t of bluefin tuna have been caught from the quota of 1655 t that was allocated to Algeria, and of this amount caught, 3,152.833 kg of dead bluefin tuna have been recorded, representing 31 specimens. The national programme for sampling on landing continues in national ports, which allows for information on swordfish (*Xiphias gladius*) to be collected regularly. It has been possible to carry out sampling for size and weight. 137 individual specimens were sampled. The size interval ranges from 100 cm to 210 cm.

Belize

As a member of two major RFMOs, ICCAT and IATTC, and a new Cooperating non-Contracting Party of SPRFMO, Belize continues to maintain a compliant fleet in all the areas where our vessels operate. Belize's fishing fleet which operated in the ICCAT area during 2021 comprised purse seiners and longliners which were licensed to target tuna and tuna-like species and their support vessels. Our fleet in previous years consisted predominantly of longliners which have fluctuated over the years, followed by purse seine vessels. The total number of tuna longline vessels over the past five years averages 11 vessels while our purse seine fleet averages 8 vessels. Despite the fleet size and structure, the catches of tuna and tuna-like species and sharks have fluctuated over the past five years with catches ranging from 20,031.94 m/t in 2017, 33,208 m/t in 2018, 31,383 m/t in 2019, 31,157 m/t in 2020 to 27,772.28 m/t in 2021, inclusive of tunas, billfishes, and sharks. Skipjack has been the predominant catch for the past several years, amounting to 59% of our overall catches in the past five years. Blue shark, frigate tuna, wahoo, sailfish, dolphinfish continue to be the most common incidentally caught species in our overall fishery, inter alia. The compiled data including Task 1 and Task 2 for 2021 and the list of authorized vessels will be reported to the Secretariat on or before the deadline date.

Brazil

In 2021, the Brazilian fleet fishing for tunas and tuna-like fish consisted of 331 fishing boats, including about 255 artisanal and small-scale. The Brazilian catch of tunas and tuna-like fish, including marlins, sharks and other species (e.g. wahoo, dolphinfish, etc.) was 52,519 t (live weight), slightly higher than catches recorded in 2020, when 46,801 t were landed. Most of the catches were done by handline fishery (19,308 t i.e. 36%), in associated schools, targeting tropical tunas, mainly YFT (11,052 t). The baitboat fishery accounted for the second largest catch in 2021, representing 35% (18,319 t) of the total tuna and tuna like-fish caught this year, with SKJ responding for 85% of the fish landed, in weight (15,568 t). Longline catches reached 12,438 t, representing 24% of the total, being made mainly of BSH (4,345 t), SWO (2,240 t), BET (1,850 t), and YFT (1,316 t). About 39% of all Brazilian catches of tunas and tuna-like fish came from artisanal and small-scale boats (10 to 20 m LOA), based predominantly in the southeast and northeast region and targeting YFT, BET, SKJ, DOL, plus a variety of small tuna species, with various fishing gears, including mainly handline, trolling and other surface gears. With the support provided by the Secretary of Aquaculture and Fisheries (SAP) of the Ministry of Agriculture, Livestock and Supply (MAPA) to the Scientific Subcommittee of the Standing Committee for the Management of the Tuna Fisheries in Brazil, several scientific activities were continued in 2021, such as the collection of biological data, including size distribution of the fish caught and research on the bycatch of seabirds and sea turtles in the longline fishery, including the development of measures to avoid their catches.

Canada

Western Atlantic bluefin tuna are harvested by Canada, primarily within Canada's exclusive economic zone (EEZ), from May through December. The adjusted Canadian quota for 2021 was 679.97 t which includes a 100.4 t transfer from Mexico and a 4.78 t transfer from France (Saint Pierre and Miquelon). Canada's total Atlantic bluefin tuna landings in 2021 was 626 t, including 517 t from the directed fishery and 104 t from the mixed swordfish and tuna's pelagic longline fishery. There were 4.6 t of observed dead discards in 2021, 2 t from the longline fleet and 2.6 t from bottom trawl-fisheries (e.g. halibut). Canada's swordfish fishery takes place from April to December. Canada's adjusted quota for 2021 was 1970.2 t, which included transfers to Canada of 35 t from each of Japan and Chinese Taipei, 200 t from the European Union, and 150 t from Senegal, as well as an underage (2018) of 202.2 t. Canadian nominal landings in 2021 were 1377.26 t, resulting in an underage of 592.94 t. The Canadian tonnage taken by longline was 1359.6 t (or 99 per cent of the catch), while 17.66 t were taken by harpoon (one per cent of the catch). A total of 53 of the 77 licensed swordfish longline harvesters were active in the 2021 fishery. Tropical tunas, including bigeye and yellowfin are at the northern edge of their range in Canada and along with albacore tuna are harvested from April through November. In 2021, other tunas (albacore, bigeye, and yellowfin) accounted for approximately 16.7 per cent, by weight, of the commercial large pelagic species landed in Atlantic Canada. Canada has real time monitoring of catch and effort for all fishing trips targeting pelagic species. Upon completion of each fishing trip, independent and certified dockside monitors must be present for off-loading to weigh out the landing and verify log record data. Canada continues to actively support scientific research through real time monitoring of catch and effort for all fishing trips; updating model indices; acoustic monitoring; tagging programs; and, biological sampling. Canada's leadership role extends to ecosystem related challenges and to the Standing Committee on Research and Statistics itself with assessment support for bluefin tuna, North Atlantic swordfish, and porbeagle shark. In 2021, Canada's bluefin tuna biological sampling program sampled tissue to address questions related to mixing, age at length and supports diet, lipid, histological, and genetic analyses of the catch. The bluefin tagging research in Canada also addresses questions related to mixing, migration and the distribution of bluefin tuna within Canada's EEZ. In 2021, Canada again coordinated the international biological sampling research program for swordfish in the Atlantic Ocean aiming to improve the knowledge of the stock distribution, age and sex of the catch, growth rate, age-at-maturity, maturation rate, spawning season/location, and diet. In 2021 Canada continued to coordinate an international sampling program for albacore tuna. For sharks, recent research focused on estimating reproductive characteristics or size-at-maturity for mako and porbeagle, evaluating distributions and population structuring for thresher and shortfin mako, developing data-poor stock assessment methods to contribute to the 2020 porbeagle assessment, quantifying post-release and natural mortality rates for porbeagle and shortfin mako, evaluating covariates with survival and recovery to contribute to bycatch mitigation, as well as continuation of our white shark research program.

China (P.R.)

Bureau of Fisheries (BOF), Ministry of Agriculture and Rural Affairs of China is in charge of management of distant water fisheries including tuna fishing activities in ICCAT waters. And China Overseas Fisheries Association (COFA) assists BOF with coordination of tuna fisheries activities. China attaches great importance to the ICCAT tuna fishery and priorities were given to abide by Recommendations and Resolutions adopted by ICCAT. China had set up a series of domestic MCS to implement ICCAT Recommendations by transferring those Recommendations into domestic regulation. China established a monitoring, control and surveillance system, as well as annual review of each fishing vessel performance, a sanction scheme, a fishing license system, VMS, logbook, monthly catch report (weekly report for BFT), national observer program, bycatch regulation, CDS and market-related measures, compliance training, setting a catch limit for each vessel for target and bycatch stocks strictly in accordance with the respective ICCAT Recommendations. Severe sanctions will be imposed on fishing vessels that violate management measures, including fines, suspension or termination of fishing license, cancelation of qualification to conduct fishing activities and so on. In addition, China holds a meeting at national level each year, in which all companies involved in the tuna fisheries participate. During the meeting, we circulate the new ICCAT Recommendations that come into force, after translating them into Chinese. We also reiterate key compliance issues, such as catch limit, VMS, observer deployment, logbook, bycatch, transhipment and so on. Non-compliance behaviour for tuna fishing vessels will be punished.

Côte d'Ivoire

In the Côte d'Ivoire EEZ and in international waters, two fishing vessels regularly carry out their activities, industrial and artisanal fishing vessels. In 2021, a total amount of 12,765,878 kg of fish managed by the Commission was landed by vessels flagged to Côte Ivoire and canoes operating in the Atlantic. This quantity is significantly highly than that obtained in 2020. Catches comprise tuna (95.96%) and sharks and billfish (4.04%). Analysis of data on large tunas shows that yellowfin is predominant (2,117,156 kg), followed by skipjack (1,310,512 kg). There are low levels of albacore and bigeye in the catches and no quota overage has been observed. As regards small tunas, BON is predominant (6,244,452 kg) followed by LTA (1,917,356 kg). Production of FRI which is usually close to that of LTA has decreased considerably (104,638 kg).

Egypt

The allocated quota of BFT for Egypt for the fishing season 2022 is 330 t, and the adjusted quota is 326.7 t, as Egypt has assigned 1% of its total quota for bycatch, even though Egypt has not recorded any bycatch for this season. Egypt initiated the fishing season with two fishing vessels *SAFINAT NOOH* under ICCAT registration number AT000EGY00010 and national registration number 4274 in the port of Alexandria, and *GOLOVIK* under ICCAT registration number AT000EGY00020 and national registration number 5365 in the same port. *SAFINAT NOOH* was authorized for the caging operation during the 2022 fishing season with Turkey under Caging Authorization No. TUR-2022/AUT/151 for the allocated quota (67.08 t) at Antakya Bay, while *GOLOVIK* transferred 259.62 t to 2 authorized Moroccan tuna traps (129.810 t for each). Egypt has recorded tuna-like species in 2020, approximately 4 t of swordfish, 1071 t of little tunny, 316 t of albacore, and 595 t of Scomberomorus spp. According to the yearly statistical book for 2020 published by the General Authority for Fish Resources Development (GAFRD), tuna and tuna-like species, mainly Scomberomorus spp. and *Euthynnus alletteratus*, were caught by purse seiners, longliners and trammel fishing vessels in coastal fisheries within the territorial waters. Egyptian regulations prohibit catching and trading of sharks and sea turtles.

El Salvador

The Republic of El Salvador is a developing country located in Central America, with more than 7 million inhabitants which, due to its social and economic challenges, is dependent on the agricultural production that it produces in its scarce territory of 21,041 km^2, as well as the fishing activity that is carried out in its territorial sea and on the high seas, which is processed on land, and in particular, the tuna canning industry. This fishing activity in the area of the International Commission for the Conservation of Atlantic Tunas has been carried out since 2015. The Authority responsible for managing fishing activities and aquaculture is the Centre of Fisheries and Aquaculture Development (CENDEPESCA), which is a directorate attached to the Ministry of Agriculture and Livestock. El Salvador regulates the fisheries and aquaculture through implementation of the General Law on Management and Promotion of the Fisheries and Aquaculture. During 2021, four purse seine vessels operated, taking a total catch of 18,167 t of tropical tunas, broken down as follows: 9,374 t of SKJ, 6,337 t of YFT, 1,492 t of BET, and 964 t of frigate tuna (*Auxis thazard*). El Salvador complied with all the ICCAT management measures applicable to its fisheries, in particular, as regards the fishing possibilities authorised under Recommendation 21-01 for tropical tunas. In the case of BET, it should be noted that under Rec. 21-01, a catch limit of 1553 t was established for El Salvador, and this year's catches did not exceed that limit.

European Union

This report presents the fishing activities performed by the EU fleet in the ICCAT Convention area in 2021. The EU Member States with fleets actively fishing in the ICCAT Convention area in 2021 were the following: Croatia, Cyprus, France, Greece, Ireland, Italy, Malta, Portugal, and Spain. The EU fleet was composed of around 3,850 commercial vessels with a great diversity in terms of vessel length and fishing gears involved in the different fisheries. Fishing gears include purse seine, longline, pole-and-line, handline, mid-water trawl, troll, baitboat, trap, harpoon, and sport and recreational fishing gears. The EU fleet operates in both the Atlantic and Mediterranean Sea. The main species and stocks regulated by ICCAT that are targeted or taken as bycatch by the EU vessels are: Atlantic and Mediterranean bluefin tuna, Atlantic swordfish, Mediterranean swordfish, tropical tunas (skipjack, yellowfin and bigeye tunas), Atlantic albacore, Mediterranean albacore, blue and white marlins, sharks and small tuna species (bullet tuna, Atlantic bonito, frigate tuna, little tunny and dolphinfish). In 2021, the total reported EU catches for the main species regulated by ICCAT in the Atlantic Ocean and Mediterranean Sea amounted to 205,814 t, which represent an increase of 4% compared to 2020 (197,821 t). The EU fishing patterns remained relatively consistent compared to previous years, with 46% of the 2021 catches corresponding to tropical tunas (yellowfin, bigeye and skipjack), 20% to sharks and 14% to albacore tuna. Skipjack, blue shark, albacore tuna, yellowfin tuna, bluefin tuna, swordfish and bigeye tuna continued to be the most important resources exploited by the EU fishing fleet, in terms of volume. The EU continues to engage significant financial resources for the funding of studies and research activities in the context of the RFMOs to which it is a member, including in particular ICCAT. Research activities related to ICCAT fisheries are also carried out at national level by the EU Member States.

Gabon

Gabon does not have a tuna fleet. The existing fisheries interact incidentally with the tuna stocks. Moreover, for 2021, the fisheries administration issued licenses to foreign purse seiners for the tuna fishery. These purse seiners have mainly targeted yellowfin (*Thunnus albacores*), bigeye (*Thunnus obesus*) and skipjack (*Katsuwonus pelamis*). For its part, the national fleet has taken bycatch of small tunas the information of which has been transmitted to the ICCAT Secretariat.

Guatemala

The State of Guatemala is a member the International Commission for the Conservation of Atlantic Tunas and confirms its commitment to comply and participate in line with each of its responsibilities in the fishery. In Guatemala, the main hydrobiological resource in international trade are the tuna fisheries, which is a sophisticated, technological fishery with national and international monitoring. We have worked together with the industry, providing them with the necessary tools, which have been reviewed, reconciled and approved by the Commission. Union and work, with a regional vision, with other countries that are Contracting Parties of the Commission has meant that the efforts to which Guatemala commits are reflected through compliance with its obligations, actively participating in the meetings and providing information to the scientific committee, and therefore maintaining open communication. The management measures for tropical tunas and associated species must be implemented in the Convention area, and by the vessels flagged to Guatemala.

Honduras

The Republic of Honduras has not carried out any positive fishing activity in the Convention area in the last 7 years, and hence compliance with the obligation to provide data on zero catches and fishing inactivity. Despite the entry into force on 25 August 2017 of the new Law on Fisheries and Aquaculture, which enables fisheries management to be adapted to the requirements of modern management practices, in view of their complex implementation process which involved professionalisation of the operative and logistic frameworks, the fleet has not been active in the area of the Commission, without prejudice to resumption of activities in the near future, which will be reported to the Commission.

Japan

Longline is the only tuna-fishing gear deployed by Japan at present in the Atlantic Ocean. The coverage (provisional) of the logbook from the Japanese longline fleet in 2021 is estimated to be 84%. In 2021, the number of fishing days was 9,000, which was 84% of past ten years' average. The catch of tunas and tuna-like fishes (excluding sharks) in 2021 is estimated to be about 19,000 t, which is about 82% of past ten years' average. In 2021, the most dominant species was bigeye tuna, representing 45% of the total tuna and tuna-like fish catch in weight. The second dominant species was yellowfin tuna occupying 17% and the third one was bluefin tuna (15%). Observer trips were not conducted in 2021 due to the effect of COVID-19.

Korea (Rep.)

In 2021, Korea has only a longline fishery for tunas and tuna-like species in the Atlantic Ocean, and the coverage of data reporting was 100%. 10 Korean longline vessels engaged in fishing in the Atlantic Ocean, and the fishing effort (no. of fishing days) was 1,467 days, which is an increase of 16% compared to 2020. Total catch was 2,658 t, which is also an increase of 14% compared to 2020. The catches of Atlantic bluefin tuna, bigeye tuna and yellowfin tuna were 242 t (9%), 674 t (25%) and 373 t (14%), respectively. All Atlantic bluefin tuna were caught within 15°-30°W in the north of 54°-58°N. Except for fishing operations targeting Atlantic and southern bluefin tunas, most fishing efforts were focused on the areas of 15°-40°W of 0°-20°N and 0°-10°E of 5°-30°S. In 2021, there were problems in dispatching onboard scientific observers due to the COVID-19 pandemic.

Liberia

Nominal catches for the period under review were reported to ICCAT on 27 June 2022. Some management measures have been put in place to ensure the proper management of Liberia's tuna fisheries such as: a more comprehensive access agreement guideline for foreign tuna fishing fleets, an effective Monitoring Control and Surveillance Unit, VMS requirement for all tuna fishing vessels and a minimum of 15% observer coverage for all tuna companies and daily reporting of catches and logbook by individual vessels to NaFAA through the Research and Statistics Division.

Mauritania

In Mauritania, high seas tuna species were only targeted by foreign fleets operating under bilateral agreements and free licence arrangements. The fleets of these Contracting Parties which comprised in 2021 some 53 tuna vessels landed their products in foreign ports. Coastal tuna species were taken as bycatch by small pelagic high seas vessels. The statistics show that bycatch of high seas tuna taken by the high seas fishery in 2021 amounted to 12846 t (i.e. a -31% decrease as compared with 2020) and essentially comprised *Sarda sarda* (58%), compared to Euthynnus sp (30%) and *Auxis thazard* (12%). Catches landed by the artisanal fishery and coastal fishery have increased slightly (105%) in 2021 compared to 2020. It should be noted that landings of tuna by purse seine in Mauritania are generally taken at night, and are not covered by the current monitoring system. A monitoring programme for these fisheries should be envisaged to strengthen data collection on small tunas and tropical tunas during the times not covered by the Artisanal and Coastal Fishery Monitoring System (SSPAC).

Finally, several research programmes focussed on the study of some tuna species were launched by the IMROP in 2016 and 2017 with financial support from ICCAT; in particular, a programme to collect available data and information on the presence of bluefin tuna in the region of Mauritania in 2016 and another programme to collect biological data in order to study the size structures and growth parameters and develop approaches to recover catches of these species from 2000 to 2016. Since 2018, the delegation of Mauritania to ICCAT has submitted requests to ICCAT to strengthen monitoring of the fisheries and bycatch of these tuna species.

Morocco

The tuna and tuna-like species fishery attained a production of 19,519.96 t in 2021 compared to 18,037.4 t in 2020, which is an increase in volume of 8.2%. The major species caught off the coasts of Morocco are bluefin tuna, swordfish, bigeye, yellowfin, skipjack, small tunas, and sharks. Collection of statistical data on fishing and effort is carried out virtually exhaustively through the fisheries administrative structures (Department of Maritime Fisheries and the National Fisheries Office), located along Morocco's Atlantic and Mediterranean coasts. A subsequent control is also carried out by the Exchange Office on exports of fishing products. In terms of science, the National Institute of Fisheries Research (INRH), through its Regional Centres (6), which cover the entire Moroccan coastline, has strengthened collection of biological data on the major species (bluefin tuna and swordfish). The Regional Centre of the INRH in Tangier coordinates the collection and analysis of all these data. In recent years, monitoring has started of other species, in particular, the tropical species (bigeye tuna, among others), small tunas, and pelagic sharks especially in the areas to the south of Morocco. There has been significant progress in collection of statistical and biological data, as evidenced by the series of scientific papers, and the Task 2 data, submitted by Moroccan researchers to the different SCRS scientific meetings, for the purposes of tuna stock assessments.

Mexico

This report describes the characteristics of the longline yellowfin tuna (*Thunnus albacares*) fishery in the Gulf of Mexico as well as the species that make up the bycatch, while highlighting compliance with national regulations and/or implementation of the recommendations and resolutions adopted by the International Commission for the Conservation of Atlantic Tunas (ICCAT). It should be noted that fishing for yellowfin tuna in the Gulf of Mexico is carried out by midwater longline vessels. In addition to the target species, other species are also taken as bycatch such as: skipjack (*Katsuwonus pelamis*), bigeye tuna (*Thunnus obesus*), Atlantic bluefin tuna (*Thunnus thynnus*), shark and swordfish, among others. The legal framework that regulates this fishery in Mexico includes the General Law on Sustainable Fisheries and Aquaculture (LGPAS), and the Official Mexican Standard NOM-023-SAG/PESC-2014 which governs exploitation of tuna species by longline vessels in waters of Federal Jurisdiction of the Gulf of Mexico and Caribbean Sea, which is updated periodically to incorporate the regulations adopted by ICCAT. The Secretariat of Agriculture and Rural Development (SADER), through the National Commission of Aquaculture and the Fisheries (CONAPESCA) is the national authority in charge of implementing policies, programmes and regulations that facilitate competitive and sustainable development of Mexico's fisheries and aquaculture sector. For its part, the National Institute of Fisheries and Aquaculture (INAPESCA) is responsible for carrying out scientific research and collecting data on the longline tuna fishery in the Gulf of Mexico.

Namibia

Namibia's tuna longline (LL) fishery has been operational since the late 1960s, followed by a tuna pole-and-line fishery which started operations later in the mid-seventies. Right after Independence in 1990, a Namibian-controlled tuna pole-and-line fishery started the next year, mostly for albacore with a fleet of about 30 local and foreign-owned vessels. Exploratory fishing for swordfish taken by surface longlining was initiated in 1996, and since 1999 substantial numbers of swordfish have been taken annually. The large pelagics sector of Namibia has two commercial fishing sectors that target tuna and tuna-like species – the large pelagics longline and the tuna pole-line (baitboat) sectors. The most important large pelagic species commonly caught by this fishery are tuna (mostly albacore *Thunnus alalunga* and bigeye tuna *T. obesus*), swordfish *Xiphias gladius*, and large pelagic sharks (mostly blue *Prionace glauca* and shortfin mako *Isurus oxyrinchus*). As a member of ICCAT, Namibia strives to fully implement all ICCAT conservation and management measures. Foreign fishing vessels entering Namibian ports are thoroughly inspected to ensure that they have not contravened national laws and regulations of Namibia or those of other States, as well as conservation and management measures adopted by ICCAT and other regional fisheries management organisations (RFMOs) or international organisations. Additionally, monitoring measures are in place to ensure that all products coming from licensed LSPLVs fishing vessels, when entering or leaving Namibia, are accompanied by the necessary documentation. In 2021 Namibia continued to undertake research on all ICCAT species caught by vessels operating in Namibian waters. Data obtained from the logbooks supplied to fishing vessels, as well as data collected by Fisheries Inspectors deployed at all landing points and the biological data collected by Fisheries Observers onboard fishing vessels were analysed and the results were submitted to ICCAT on 29 July 2022. The deployment of fisheries observers onboard the large pelagic fishing fleet continued to ensure monitoring and surveillance as they are tasked to observe, monitor and report any violations at sea. A total of 37% of fisheries observers were deployed during the 2021 fishing season. Namibia continued the deployment of fisheries inspectors both at sea onboard fisheries patrol vessels and in the harbours to ensure that there is strict compliance with the country's rules and regulations related to the exploitation of marine living resources, which also include those that are adopted by Namibia as part of its obligations to RFMOs and International Organisations. Namibia also ratified the FAO Port State Measures agreements in June 2017.

Nicaragua

The Republic of Nicaragua has not carried out any positive fishing activity in the ICCAT area, since the country does not yet have national or chartered fishing fleets. Notwithstanding, Nicaragua complies with the obligation to provide data on zero catches and fishing inactivity.

Norway

Norway was allocated a quota of 300 t of eastern bluefin tuna (*Thunnus thynnus*) for 2021. In addition to this, 5% of the unused quota from 2020 was carried over to 2021. Thus, the total Norwegian quota in 2021 was 315 t. Due to bad weather conditions, the quota was not exhausted. Numerous observations of Atlantic bluefin tuna continued to be made, also in 2021, along the Norwegian coast and in offshore waters from late June to October, with the majority of observations made in August and September. Norway put a lot of effort into obtaining biological, ecological and genetic samples and data from Atlantic bluefin tuna caught in 2021. Norway continuously works on present and historical data on tuna and tuna-like species and aims to incorporate the data on these species into an ecosystem perspective. Norway participated in the Management Strategy Evaluation (MSE) related meetings on bluefin tuna and in the SCRS annual science meeting in 2021.

Panama

In the waters of the Pacific Ocean, Panama carries out 95% of its fishing activity, and 80% of the country's population is found in this geographic area. Therefore, 5% of the fishing activities carried out in the Panamanian Caribbean, Atlantic Ocean, are artisanal; but it also has an important fishery in the high seas, which has developed through its fleet of vessels with international fishing licenses; which historically has targeted tuna. The artisanal fishery that operates in the Panamanian Caribbean, is sectorised towards the provinces of Bocas del Toro, Colón and the district of Guna Yala with a short continental shelf which enables development of subsistence fishing activities associated with reefs, mainly with catching lobster (Panulirus sp), octopus and spider crab. As regards the international fisheries service, Panama maintains a register of fishing vessels that carry out their activities in the Atlantic Ocean, as well as modifications of their specifications and sizes, fishing gears, species caught and fishing areas. Currently, the fleet comprises longline and purse seine vessels fishing for yellowfin tuna (*Thunnus albacares*), bigeye tuna (*Thunnus obesus*), skipjack tuna (*Katsuwonus pelamis*) and bycatch species. Currently, there are registers and statistics on landing data of fishery products in national ports and those landed in international ports, through the Panama Maritime Authority (AMP) and the Panama Aquatic Resources Authority (ARAP). Based on the above, and given that Panama is a country committed to compliance with management measures on fishery resources, we have submitted the annual scientific report, as well as the compliance report through the Integrated Online Management System for 2021.

Russian Federation

Fishery. In 2021 and 2022, a specialized (purse-seine) tuna fishery fleet flying the Russian flag did not carry out any operations. In 2021, trawl vessels caught 525 t of 4 tuna species and 908 t of Atlantic bonito as bycatch in the Eastern-Central Atlantic.

In the first half of 2022, the trawl vessels caught 39 t of 3 tuna species and 571 t of Atlantic bonito.

Research and statistics. In 2021, observers of the Atlantic branch of VNIRO (AtlantNIRO) sampled biological and fishery materials on tuna species onboard trawl vessels in the Eastern-Central Atlantic (area BIL94B according to the ICCAT classification). Fish length, weight, sex- and maturity stages of gonads as well as stomach fullness were measured. Species from the "small tunas" group occurred in trawls as bycatch, individually or up to several tons. The material on frigate tuna, bullet tuna, Atlantic black skipjack, oceanic skipjack and Atlantic bonito was collected in the amount of 4962 specimens for measurement of length and 1672 specimens for biological analyses.

Implementation of the ICCAT conservation and management measures. In the course of the trawl fishery in the areas where tuna and tuna-like species occurred in the catches as bycatch, the ICCAT requirements and recommendations on compliance with the restrictions on the tuna fishery and a ban on fishing for quoted species were applied.

Senegal

In Senegal, tuna and tuna-like species are fished by the industrial and artisanal fleets. In 2021, the Senegalese industrial tuna fleet fishery comprised six (6) baitboat vessels and seven (7) purse seiners that exploited mainly Atlantic tropical tunas, in particular yellowfin (*Thunnus albacares*), bigeye (*Thunnus obesus*) and skipjack (*Katsuwonus pelamis*). Some gears of the artisanal fishery target or bycatch billfish (marlins and sailfish), large tunas, small tunas (Atlantic black skipjack, mackerel, bonito, Atlantic bonito, frigate tuna etc.) and shark. Total catches of tropical tunas taken by Senegalese baitboats and purse seiners amounted to around 42,467 t (36,418 t in 2020). The total catch of the six (6) Senegalese baitboats is estimated at 1,845 t in 2021 (2,169 t in 2020), with 954 t of skipjack, 663 t of yellowfin, 184 t of bigeye, and 44 t of frigate tuna. The tropical tuna catches of Senegalese purse seiners are estimated at 40,622 t (36,418 t in 2020), with 7,509 t of yellowfin, 27,021 t of skipjack, 518 t of bigeye and 5,574 t of small tunas. It should be noted that 86 % of catches are taken under floating objects (FOB). The fishing effort deployed in 2021 by the industrial tuna fleets was 1126 days at sea and 952 fishing days for baitboats, and 1700 fishing days and 1748 days at sea for Senegalese purse seiners. In 2021, the total catches of all species combined of the artisanal fishery are estimated at 17,711 t, i.e., a significant increase of 117% compared to 2020 (8,158 t).

Sierra Leone

Sierra Leone does not have tuna vessels flying her flag. Therefore, tuna catch data submitted by Sierra Leone from the licensed industrial tuna vessels have never been included in the tuna data preparation for regional analysis. However, about 40 to 45 tuna vessels, many of which are purse seiners, mostly from Spain and France, were given licenses to catch tuna and tuna-like species within the EEZ of Sierra Leone. These vessels exploited mainly the skipjack, yellowfin and bigeye tuna within the Atlantic Ocean. Other tuna and tuna-like species exploited were Atlantic black skipjack. Sierra Leone does not have observers on board these fleets to collect data. However, catch information are submitted to Sierra Leone through emails by the captains of these vessels. Pre-license inspections on these vessels are conducted in Abidjan and Dakar ports. Regarding the industrial trawl vessels, the tuna catch reported as bycatch, has not been classified into the various categories of species (YFT, BET and SKJ). Therefore, we cannot submit the data as individual bycatch species at this moment. A plan has been made to train at-sea observers on board industrial trawl vessels to start collecting data by species types. For the artisanal tuna and tuna-like species data, plans are ongoing for data collection which will start later this year if the required fund is available.

South Africa

South African large pelagic fisheries comprise a baitboat fleet (tuna pole-line) and a pelagic longline fleet (large pelagic longline). In 2021, the baitboat fleet comprised 98 active vessels of an average length of 16 m overall (LOA). The total baitboat effort of 3,915 catch days within the ICCAT Convention area represents a decrease of 1.51%, which resulted in a decrease of albacore catches to 3508 t and yellowfin tuna catches to 213 t. In 2021, 15 active longline vessels fished in the Atlantic. After having seen an increase from 924 thousand hooks in 2016 to 1537 thousand hooks in 2018, there was a notable decreased of effort from 1435 thousand hooks in 2019 and a further decrease in effort in 2020 with 1069 thousand hooks, while in 2021 the effort has increased with 1186 thousand hooks. The 2021 longline catches of swordfish increased to 179 t from 149 t, yellowfin tuna increased from 174 t to 189 t, bigeye tuna decreased from 286 t to 258 t, albacore notably increased from 247 t to 333 t, blue sharks increased from 158 t to 181 t and shortfin mako shark increased from 46 t to 70 t. Strategies to reduce shark targeting to direct effort towards improved tuna and billfish catch have been included in the Large Pelagic Longline Fishery Policy and the measures have been effective. In 2019, the number of observed trips in the ICCAT area increased from 2 to 23, while in 2021 the number of observed trips in the ICCAT area decreased to 11. South African government scientists are working independently and in collaboration with scientists from other CPCs and NGOs to carry out research related to large pelagic fisheries. Key research activities in 2020/2021 included collaborations collaborative work on additional ICCAT stock assessment applications of the Bayesian Surplus Production modelling software 'JABBA', in addition to analysing historical satellite data and collecting samples for several key large pelagic species.

Tunisia

The tuna and tuna-like species management and conservation plans are essentially governed by the provisions of Law No. 94-13 of 31 January 1994 and its implementing texts. In 2021, as for previous years, these plans were supported by implementation of all the control programmes (onboard observers programme) and the at-sea and in-port inspection programmes, in particular, during the periods of prohibition on fishing for bluefin tuna and swordfish. In preparation for the 2021 bluefin tuna fishing campaign, Tunisia adjusted its fishing capacity in accordance with the methodology adopted by ICCAT (Rec. 19-04). Based on this methodology, Tunisia established a fishing plan, allocating individual quotas to 47 vessels to fish for bluefin tuna in 2021. In this context and within the framework of improvement of collection of bluefin tuna catch statistics and monitoring of implementation of action taken to mitigate bycatch and discards in the tuna and swordfish fisheries, the competent authority, in addition to catch documentation, has attained a scientific observer coverage of more than 10% of its tuna fisheries. Allocation of quotas for bluefin tuna fishing and fine-tuning of gears targeting swordfish have greatly reduced bycatch; in 2021, there was no bycatch of sea turtles, sea birds, shark or sea mammals reported by the national and scientific observers programme. Total catches of bluefin tuna in 2021 amounted to 2,729.738 t, with 2,727.908 t taken by purse seine vessels authorised to fish for bluefin tuna. Regarding its contribution to the scientific research programme, Tunisia carries out different research activities on bluefin tuna, swordfish and small tunas. These activities are defined taking into account ICCAT recommendations and SCRS priorities.

Türkiye

Total marine fisheries production of Türkiye was 295,025 t during the year 2021. The portion of the tuna and tuna-like fishes in total catch was 6,507.9 t including Mediterranean swordfish. In 2021, catch amount of bluefin tuna, swordfish, albacore, bullet tuna, Atlantic bonito and little tunny was 2,266.2 t, 390.4 t, 58.1 t, 736.8 t, 2,595.4 t and 462.9 t, respectively. Most of bluefin tunas were caught by purse seiners, which have an overall length 35-62 meters. The fishing operations were conducted intensively off Antalya Bay in the south of Türkiye and in the Central Mediterranean region close to Malta. The bluefin tuna catch started on 15 May and finished on 1 July. Conservation and management measures regarding swordfish, bluefin tuna fisheries and farming are regulated by national legislation through notifications, considering ICCAT's related regulations.

United Kingdom

The United Kingdom 2021 annual report provides information for both Metropolitan (Met) UK and the United Kingdom Overseas Territories (UKOTs) of Bermuda, British Virgin Islands, St Helena (including Ascension Island and Tristan da Cunha) and Turks and Caicos Islands. The Met UK's only commercial/targeted ICCAT fishery is for albacore and uses midwater trawl gear. Catches from this fishery account for the majority of Met UK catches. The other gears used by Met UK vessels which catch ICCAT regulated species in the Convention Area are, predominantly, gillnets. Gillnet fishers do not actively target ICCAT species but do take them as bycatch. Vessels in the Met UK fleet which interact with ICCAT species range in LOA from 3.8m to 45m, with 79 vessels under 20m and 16 vessels over 20m. The fishing fleets of the UKOTs are small-scale and deploy limited effort which is mostly conducted in close proximity to shore. Offshore fishing is associated with seamounts within the UKOT's respective maritime zones. The typical fishing gears utilised are rod-and-reel, trolling, pole-and-line, and handline. Use of these gears minimises the incidental capture of non-target bycatch species more typically associated with some other industrial fishing techniques. In 2021, a single longline vessel (<20 m) operated in the UKOT of Bermuda. The UK landed 373 t in total (UK Met, 171 t; Bermuda, 109 t; the British Virgin Islands, 8 t; St Helena, 86 t; Turks and Caicos Islands, 0 t). The catch was greater in 2021 than in 2020, which is a result of the increase in North Atlantic albacore catches by Met UK. UKOT activity is quite diverse, ranging from no commercial activity by TCI to reasonably consistent fisheries by Bermuda and St Helena. All UKOTs have ambitions to expand capacity to fish ICCAT species within their respective maritime zones. A fish tagging programme continued in St Helena in 2021, with an additional 1,579 fish of ICCAT species tagged in 2021. This work (in previous years undertaken under the AOTTP and in 2021 continued under the Blue Belt Programme) contributes to scientific research to study the movement, growth and habitat use of pelagic species in the St Helena maritime zone.

United States

Total (preliminary) reported U.S. catch of main tunas (YFT, SKJ, BET, ALB, BFT) and swordfish, in 2021 was 7,711 MT, an increase of about 2% from 7,562 MT in 2020. This total catch includes estimates of dead discards for the tropical tunas, BFT, and SWO. Swordfish catches (including estimated dead discards) decreased from 1,476 MT in 2020 to 1,226 MT in 2021, and provisional landings from the U.S. fishery for yellowfin tuna increased in 2021 to 3,954 MT from 3,662 MT in 2020. In 2021, U.S. vessels fishing in the northwest Atlantic caught an estimated 1,200 MT of bluefin tuna, an increase of about 17 MT compared to 2020 (1,183 MT). Provisional skipjack tuna landings decreased by about 0.3 MT to 65 MT from 2020 to 2021, bigeye tuna landings increased by 150 MT compared to 2020 to an estimated 971 MT in 2021, and albacore landings decreased from 2020 to 2021 by 33 MT to 295 MT.

U.S. government (NOAA) and university scientists, working independently or in collaboration (including collaborations with scientists from other CPCs), conducted research in 2021 involving a variety of ICCAT and bycatch species. Such research included development of abundance indices, tagging to investigate movements, habitat usage and post-release mortality, and the collection and analysis of biological samples to study topics such as age, growth, stock structure, spawning areas, fecundity, and genetics (including direct estimates of stock size). Additional topics included the influence of environmental factors on distribution and catch rates, the development of stock assessment models and the evaluation of specific candidate management procedures as part of management strategy evaluations.

Uruguay

In 2021, the Uruguayan tuna fleet did not carry out any activity. This inactivity was due to several factors. Moreover, the pandemic (COVID-19) caused a decrease in fishing activity and research at national level, and many activities were suspended which was reflected in ICCAT related matters. Despite this, the analysis of historical catches and effort statistics of species of interest to the Commission was continued. Uruguay participated in and provided papers for several SCRS meetings, including the Billfish Species Group Meeting, the Bigeye Stock Assessment Meeting, the Swordfish Species Group Meeting, the Small Tunas Species Group Meeting, the Meeting of the Subcommittee on Ecosystems and Bycatch and the Albacore Species Group Meeting. The work to control third party vessels in port continued, having started in 2009. Port inspections were carried out to determine which species had been landed, their origin and to control formal aspects of vessel documentation. All ICCAT Recommendations adopted at the 2021 Commission meeting have been implemented into Uruguayan law, and are currently in force through decree.

8. Reports of intersessional SCRS meetings

Below you will find information and quick access to all Detailed Reports of the intersessional meetings held in 2022. All reports are posted in the ICCAT Past meetings webpage and all information related to the Detailed Reports is included in the table below.

Item No.	*Detailed Report*	*SCRS No.*
8.1	2021/22 ICCAT/ICES Northeastern Atlantic porbeagle data compilation workshop aiming 2022 ICCAT-ICES stock assessment (included under 8.5)	-
8.2	Report of the 2022 skipjack data preparatory meeting	SCRS/2022/001
8.3	Report of the 2022 Atlantic swordfish data preparatory meeting (including N-SWO MSE)	SCRS/2022/003
8.4	Report of the 2022 eastern Atlantic and Mediterranean bluefin tuna data preparatory meeting	SCRS/2022/004
8.5	Report of the Joint ICCAT/ICES benchmark workshop in advance of the Northeastern Atlantic porbeagle stock assessment	SCRS/2022/002
8.6	Report of the first 2022 Intersessional Meeting of the Bluefin Tuna Technical Sub-group on MSE	SCRS/2022/005
8.7	Report of the 2022 Intersessional Meeting of the Sharks Species Group	SCRS/2022/006
8.8	Report of the 2022 Intersessional Meeting of the Tropical Tunas Technical Sub-group on MSE	SCRS/2022/007
8.9	Report of the 2022 skipjack stock assessment meeting	SCRS/2022/008
8.10	Report of the 2022 Intersessional Meeting of the Working Group on Stock Assessment Methods (WGSAM)	SCRS/2022/010
8.11	Report of the 2022 ICCAT/ICES Northeastern Atlantic porbeagle stock assessment meeting	SCRS/2022/011
8.12	Report of the 2022 Atlantic swordfish stock assessment meeting	SCRS/2022/012
8.13	Report of the 2022 eastern Atlantic and Mediterranean bluefin tuna stock assessment meeting	SCRS/2022/013
8.14	Report of the second 2022 Intersessional Meeting of the Bluefin Tuna MSE Technical Sub-group on MSE	SCRS/2022/014

8.1 2021/22 ICCAT-ICES North-eastern Atlantic Porbeagle Data Compilation Workshop aiming 2022 ICCAT-ICES Stock Assessment

In December 2021, January 2022, and February 2022 members of ICES Working Group on Elasmobranchs (WKELASMO) as well as ICCAT scientists met several times to define the unit stock, and to review and decide on which data series to use for the 2022 benchmark stock assessment for North-eastern stock of porbeagle shark. While there were some preliminary data presented to suggest sub-dividing the current stock unit into smaller ones, there was not yet sufficient information to consider options other than a single stock for porbeagle in the North-East Atlantic Ocean. The current stock area was expanded with its southern limit extended southward from 36°N to 5°N, to align with ICCAT. In the course of these meetings the Working Group decided on final catch series that included updated historical series for Norway and Denmark. The Working Group also reviewed a set of indices of relative abundance that included a derived survey series, a French longline CPUE, and a Norwegian CPUE. In addition, a historical Spanish surface line time series was considered.

8.2 Skipjack Data Preparatory Meeting

The Skipjack Data Preparatory Meeting was held online from 21 to 25 February 2022 (Anon., 2022a). The Group reviewed the new data on fisheries, biology and tagging. The catch data submitted up to 2020 were reviewed and the Group agreed to use 2020 as the last year for the assessment models. "Faux poisson" tropical tuna catches from the purse-seine FAD fishing operations between 2015 and 2020 were estimated and reviewed by the Group. These were recommended to be included in the total catch removal series, after consultation with the respective CPCs engaged in these fisheries. Updates on growth, stock structure, weight-at-size, tagging (including updates to the AOTTP database), natural mortality and indices of abundance were presented. Estimates of natural mortality were reviewed, and the Group recommended that alternative hypotheses of M-at-age be considered for the assessment that covers the uncertainty of estimates. The Group also reviewed nine indices of abundance for East and West skipjack, plus historical indices available at the 2014 assessment, and provided recommendations for their use in the assessment models. The fleet structure for the assessment models was also revised, aiming to standardize it for all three species of tropical tunas for consistency in assessment approaches and Management Strategy Evaluations (MSEs) operating models (OMs).

The Group decided to use the surplus production model (JABBA) and a statistical catch model (Stock Synthesis 3) for the 2022 skipjack stock assessment. In addition, the Group agreed to hold an online intersessional meeting to detail the models' inputs, data structure, and uncertainty specifications for the modelling team to proceed with the evaluation in preparation for the assessment meeting.

The detailed report is provided here.

8.3 Atlantic Swordfish Data Preparatory Meeting (including N-SWO MSE)

The Swordfish Species Group met online from 21 March to 1 April 2022 (Anon., 2022b), aiming to review data inputs for the 2022 North and South Atlantic stock assessments and to review progress on North Atlantic swordfish management strategy evaluation (N-SWO MSE). The Group reviewed new biological information from ongoing work associated with the ICCAT Swordfish Year Programme (SWOYP). Growth modeling work and an updated length-length (curved-straight) conversion were presented. Fishery statistics were reviewed, and minor revisions were made to historical Task 1 data. Similarly, Task 2 underwent minor revisions and CPCs were reminded to continue their efforts to fill data gaps, particularly with regard to historical effort data. The Group reviewed conventional and electronic tagging data and a new online graphical tagging dashboard. Abundance indices for North and South Atlantic stocks were considered and following some minor revisions, 8 indices were recommended for use in the North and 6 in the South - all longline indices. The Group discussed creation of an updated North Atlantic combined index using data from multiple CPCs. The combined index has historically been used in surplus production models and has been proposed as an indicator in model based CMPs in N-SWO MSE. CPCs were encouraged to provide data needed for the intersessional development for the index. Candidate stock assessment modeling platforms were identified, and core teams were formed to develop Stock Synthesis, JABBA, and ASPIC models. For each of these modeling platforms, the Group discussed and agreed upon model assumptions, inputs, outputs, key parameters, and uncertainties. Following recommendations from the ICCAT Working Group on Stock Assessment Methods (WGSAM), the Group selected a core set of assessment model diagnostics to be used. MSE progress for late 2021 and early 2022 was reviewed and it was agreed that the process was still on-track for proposing a CMP for management by the end of 2023. Much of the work in late 2021 and early 2022 was related to conditioning of the operating model grid, evaluating the importance of axes within the grid, identifying robustness scenarios, evaluating weightings of CPUE and length composition data among OMs. The current version of the MSE uses data to 2015 and the Group agreed to recondition the grid using updated data and Stock Synthesis model settings decided upon at the 2022 Stock Assessment session (Anon. 2022k). The Group reviewed a candidate set of performance metrics and advice intervals and there was agreement that additional interactions with Panel 4 were needed before finalizing these items. The SWO MSE roadmap was updated to reflect timelines associated with reconditioning the OM grid, developing CMPs, and consulting with managers and stakeholders.

The detailed report is provided here.

8.4 East Atlantic and Mediterranean Bluefin Tuna Data Preparatory Meeting

The 2022 East Atlantic and Mediterranean Bluefin Tuna Data Preparatory Meeting, including the MSE for bluefin tuna, was held online from 18 to 26 April 2022 (Anon., 2022c).

In the Management Strategy Assessment (MSE) section of the meeting, the candidate management procedures (CMPs), and their response to Br30 target calibration levels and maximum and minimum TAC variations, were reviewed. Factor trade-offs cover yield, biomass and yield variability, with clear trade-offs between catch variability and stability. The Group discussed the convenience of including basic performance statistics in a main quilt plot and the creation of a second table for additional statistics requested. The Group also agreed that it would be essential to review the catch and SSB time series plots for multiple stochastic simulations of each operating model (worm plots) for each CMP as part of its review of the performance of the CMPs. Other performance statistics were proposed based on initial operational management objectives: a B_{LIM} of 40% of dynamic SSB_{MSY} was recommended for CMP testing and CMP performance tuning, an exploitation rate was also proposed as an appropriate measure of MSE performance related to fishing mortality (U/U_{MSY}). The Group reviewed the existing set of robustness tests and concluded that many CMPs developed so far largely passed them. The Group proposed a decision process for the performance tuning CMPs and their possible selection. The MSE bluefin tuna ambassador programme activity was also discussed.

The Group considered that the default approach for the eastern stock assessment for bluefin tuna should be similar to previous assessments, unless there was strong justification for changes, due to the limited time available and commitment to the MSE process. The importance of using the best available information for the stock assessment was also recognized, so an effort could be made to harmonize the input data for this stock assessment and the current operational models in the MSE for bluefin tuna. The initial biological and age data were reviewed, including the size composition from the stereoscopic cameras used in the fattening farms. The Secretariat updated the catch-at-size (CAS) and catch-at-age (CAA). The Task 1 nominal catches were also revised, adopting for 2020 and 2021 catches identical to the TAC for those years. The Group agreed to update CAS/CAA in the inter-sessional period by replacing the partial catch component "NEI (increased)" (1998-2007) with a new set of combined size samples from the Mediterranean (various gears and flags). All available abundance indices were reviewed and those to be used in the assessment were decided. It was also agreed to employ three platforms for the 2022 stock assessment: Virtual Population Analysis (VPA), the Stock Synthesis model, and the Age-Structured Assessment Program (ASAP). Problems encountered in the previous assessment were identified using the VPA model. Preliminary assays were discussed, and detailed terms of reference were established for the three platforms. The work plan included two informal online meetings prior to the July 2022 stock assessment meeting. Finally, recent GBYP activities and results were discussed, as well as future plans and a new approach to adapt to a possible future scenario of decreased funding.

The detailed report is provided here.

8.5 Joint ICCAT-ICES Benchmark Workshop in advance of the North-eastern Atlantic Porbeagle Stock Assessment

On 29 April, the ICES Working Group on elasmobranchs and ICCAT scientists met to finalize the North East Atlantic porbeagle assessment. The Working Group decided on input data (catch, CPUE) for stock assessment, priors for SPiCT/JABBA models, and did exploratory assessments with SPiCT and JABBA models. It agreed to use a Norwegian longline CPUE series from 1950 to 1972; a French longline CPUE series from 1972 to 2009; a composite survey CPUE series constructed by combining CPUEs of a French commercial vessel, from 2000 to 2009, with CPUEs of a survey carried out in 2018-2019. In addition, a Spanish bycatch surface longline CPUE series that has been available since the 2009 ICCAT-ICES was used. After examining a set of exploratory runs using SPiCT and JABBA surplus production models, the Working Group agreed on a run (#8) that would form the basis for the ICES Science Advice. This run had the lowest number of failures when testing the influence of initial values on parameter estimates, thus supporting its use as the final model.

The detailed report is provided here.

8.6 First Intersessional Meeting of the Bluefin Tuna Technical Sub-group on MSE

The First Intersessional Meeting of the Bluefin Tuna Technical Sub-group on MSE was held online from 3 to 6 May 2022 (Anon., 2022d). The Sub-group continued discussion on the CMP (candidate management procedure) results after the Eastern Atlantic and Mediterranean Bluefin Tuna Data Preparatory Meeting (including BFT MSE) (18-26 April 2022) (Anon., 2022c), and prepared the materials for the Second Intersessional Meeting of Panel 2 on Bluefin Tuna MSE (Online, 9-10 May 2022).

Since the Eastern Atlantic and Mediterranean Bluefin Tuna Data Preparatory Meeting (including BFT MSE) (Online, 18-26 April 2022) (Anon., 2022c), new performance metrics were added to the ABTMSE package (v.7.6.4) including POF (Probability of Overfishing ($U > U_{MSY}$) after 30 projected years), PNOF (Probability of not Overfishing (1- POF)), PGK (Probability of Green Kobe ($SSB > SSB_{MSY}$ & $U < U_{MSY}$) after 30 projected years), PNRK (Probability of not Red Kobe ($SSB > SSB_{MSY}$ or $U < U_{MSY}$) after 30 projected years), AvC20 (Mean catches over first 20 projected years), and Br20 (Depletion (spawning biomass relative to dynamic SSB_{MSY}) after projection year 20); the Shiny app (https://apps.bluematterscience.com/ABTMSE_Performance/) was updated accordingly.

CMP updates/revisions were provided by each CMP developer with mathematical descriptions. Four of the CMPs had been tuned to each of the four tuning levels (i.e., West 1.25 – East 1.25, West 1.25 – East 1.5, West 1.5 – East 1.25, and West 1.5 – East 1.5). Across all these tuning levels, the relative rankings of CMPs for various key performance statistics were largely preserved. Accordingly, the Sub-group continues to be of the view that the tuning level does not need to be decided upon at this point because relative CMP rankings do not change greatly for alternate tuning.

The Sub-group reviewed updated stochastic results for one of tuning levels and further noted the importance of presenting spawning biomass and especially TAC trajectory plots to managers and stakeholders as they provide more comprehensive information on the overall behaviour of each CMP. The Sub-group expressed concern that CMP performance could be unrealistically optimistic due to omniscience (i.e., a thorough understanding of the testing reference Operating Model grid). However, to date, the MSE Consultant has not found evidence for omniscience within any CMPs.

Effect of limits on allowable TAC change was discussed because Panel 2 requested CMP developers to evaluate TAC change constraint scenarios of: +20%/-30%; +20%/-20%; +20%/-10% and no limits. The Sub-group noted that across both CMPs evaluated the +20%/-30% restriction in TAC change provides a useful compromise, allowing adequate safety as well as acceptable stability in yield.

The Sub-group discussed the contents of documents and presentations for the Second 2022 Ambassadors Webinar on Bluefin Tuna MSE (Online, 4-6 October 2022) and the Second Intersessional Meeting of Panel 2 on Bluefin Tuna MSE (9-10 May 2022). The following key decision points were identified for the Second Intersessional Meeting of Panel 2 on Bluefin Tuna MSE (9-10 May 2022).

a) Panel 2 approval of operational management objectives and performance statistics;
b) Panel 2 approval of the processes for development tuning and performance tuning;
c) BFT Species Group recommendations for narrowing (culling) of CMPs to retain a reduced subset for further consideration.

The detailed report is provided here.

Discussion

The discussion is contained in section 8.14 below.

8.7 Intersessional Meeting of the Sharks Species Group

The 2022 Intersessional Meeting of the Shark Species Group was held online from 16 to 18 May 2022 (Anon., 2022e). The Committee revised the most up-to-date information available in the ICCAT database (namely the fishery statistics and the conventional tagging) for the three major shark species, and the group of other bycatch shark species. No major changes or updates were made at the meeting to the existing catches, nor to the discards component of the catches. The Committee reiterated to CPCs the requirement to report discards (both dead and alive) of BSH, SMA, and POR as part of their Task 1 data submission. The Committee also evaluated the status of the large list of other by-catch shark species available in Task 1. A reasonable amount of those shark catches may have been erroneously classified with codes of species not typically found in the ICCAT Convention area. Others may belong to species not directly associated with ICCAT fisheries. The Committee reiterated the need to revise the list of ICCAT shark species.

A review was made on the Shark Research and Data Collection Programme (SRDCP) activities and its progress. Updates presented on shortfin mako studies included those on: i) age and growth of South Atlantic; ii) post-release mortality in the Atlantic Ocean; and, iii) the analyses of genetic structure. In addition, the Committee discussed the workplan to investigate the feasibility of whole mitochondrial genome sequencing for Atlantic porbeagle, and an overview of the e-tagging activities, which to date includes tagging of 90 sharks, including shortfin mako, silky shark, oceanic whitetip, porbeagle, smooth hammerhead and scalloped hammerhead. There was consensus that it would be important to do a thorough assessment of the achieved results of SRDCP and to review its ongoing activities. For this purpose, it was suggested to schedule an intersessional meeting in 2023.

In preparation for the 2023 blue shark stock assessment the Committee proposed and discussed a draft workplan. A brief review of the results from the 2015 Blue Shark Stock Assessment Session (Lisbon, Portugal, 27-31 July 2015) were presented. The proposal for 2023 was to have scientists from the United States to lead the northern stock assessment using Stock Synthesis (SS3) and scientists from Brazil to lead the southern stock assessment using SS3. Also, to give continuity to what has been previously done in the shark stock assessments, Surplus Production Models for both the North and South should be developed. Indices used in the previous assessment should be updated and the potential for new indices may be explored, mainly from the South, such as from South Africa and from Namibia.

The advances in the process leading up to the stock assessment of NE porbeagle that has been carried out by ICES with the participation of ICCAT were presented. The Committee discussed what the process would be for generating management advice for NE-POR for the SCRS and finally for ICCAT. To clarify the ICES process, the Joint ICCAT/ICES Benchmark Workshop in advance of the North-Eastern Atlantic Porbeagle Stock Assessment (Anon., 2022f), held in June 2022, carried out an assessment using the model proposed by the WKELASMO group. ICES scheduled for 26 September 2022 the release of their formal advice. The details on management advice are similar to the usual advice provided by the SCRS where projections and reference points are normally derived from the model(s) that had been adopted. Nonetheless, it was indicated that the final assessment model adopted by the ICES WKELASMO integrated both the inputs from ICES and ICCAT throughout the meetings held in 2021 and 2022. In general, all models indicated the same status of the stock in 2020. It was agreed that the advice can be generated based on the single adopted base-case model.

The detailed report is provided here.

8.8 Intersessional Meeting of the Tropical Tunas Technical Sub-group on MSE

The Tropical Tunas (TT) Technical Sub-group on Management Strategy Evaluation (MSE) met online, 19-20 May 2022 (Anon., 2022g). The Sub-group addressed the state of development of the MSEs for tropical tunas. The Sub-group reviewed an update in the initial operating models for the W-SKJ MSE: these had been expanded to include catch time series spanning from 1952 to 2020 and were conditioned with catches, Catch Per Unit Effort (CPUE), and size data from five fleets including PS West, BB West, LL USMX, LL Others, and HL_RR. In addition, the analysts completed preliminary projected management outcomes of the 11 OMs under 12 MPs using 4 PMs including Constant Catch (CC) and index-slope Harvest Control Rules (HCRs). The trade-offs of each MP for the 11 OMs were also presented in html documents made available to the Sub-group. The Sub-group sought input on operational management objectives for western skipjack at the Intersessional Meeting of Panel 1 (Azores, São Miguel, Portugal, 28-30 June 2022) to facilitate further progress on the W-SKJ MSE. The Sub-group reviewed progress made toward a multi-stock Atlantic Tropical Tunas MSE, and considered the steps needed to complete this work. At present, yellowfin and bigeye single-stock operating models (OM) are available and preliminary conditioning is complete for such OMs. Both were configured using the Stock Synthesis (SS3) model and developed with the most recent stock assessments for such stocks. The Sub-group identified the remaining tasks needed to complete a multi-stock MSE. These included:

- Harmonization of the fleet structure
- Developing and conditioning the skipjack OM (pending successful completion of the 2022 skipjack tuna stock assessment model).
- Refining the conditioning of the yellowfin and bigeye tuna OMs, as needed.
- Developing, conditioning and evaluating the multi-stock model using the three species-specific OMs which will be linked within the MSE.

The Sub-group recommended the formation of a formal team of ambassadors with representation by native speakers of each of the three official ICCAT languages, for the purpose of developing communication materials, organizing, and engaging in stakeholder outreach efforts related to MSE. In addition, the Sub-group recommended the following: the SCRS Chair to present a succinct summary of the current state of affairs for tropical tunas at the Intersessional Meeting of Panel 1 (Azores, São Miguel, Portugal, 28-30 June 2022) emphasizing the need for focused dialogue to meet the Commission priorities identified in the MSE roadmap; and, the need to establish Terms of Reference for two new contracts (for W-SKJ and multi-stock MSE) to support the development of MSEs for tropical tunas. In addition, the Sub-group recommended that there be a 2023 technical review of the West SKJ MSE and capacity building programmes for tropical tuna scientists and stakeholders, to increase the knowledge of the MSE principles, approaches, and details related to Atlantic tropical tunas. Training workshops are recommended to be held in 2023 in different languages (English, Spanish and French at a minimum).

The detailed report is provided here.

Discussion

The Committee reviewed the progress on tropical tunas MSE (for details see item 18.4 of this report) as well as the MSE roadmap for the western and multi-stock tropical tunas MSE. They noted that the Committee was aware that the multi-stock MSE would be difficult, but it was not yet clear how difficult it would be. The Committee inquired how much the Tropical Tunas Technical Sub-group on MSE had reviewed how realistic their plans were. In response, it was noted that progress on the multi-stock MSE had to date occurred in small steps. To date this had been administered in small contracts to continue to develop the multi-stock MSE. Moreover, the Tropical Tunas Technical Sub-group on MSE had the opportunity to learn from the experience of other MSE processes where they might encounter difficulties, and where they might mitigate such difficulties.

Regarding the potential workload involved in undertaking a multi-stock MSE, the Committee noted that the sooner they started a dialogue on their objectives, the better: in this way, the Committee could ensure that the avenues they pursued in designing the MSE would ultimately lead to addressing these objectives. The Committee agreed and noted that such dialogue was included in their communication plan.

8.9 Skipjack Stock Assessment Meeting

The 2022 Skipjack Stock Assessment Meeting was held online between 23 and 27 May 2022 (Anon., 2022h). During this meeting, the Committee reviewed updates on catch statistics, fisheries and biology information, and the new relative indices of abundance provided after the 2022 Skipjack Data Preparatory Meeting. For both stocks (W-SKJ and E-SKJ), their status was preliminary assessed using two production models (JABBA and MPB) and an integrated statistical model (Stock Synthesis). The uncertainty grid proposed for both stocks considered vectors of variations in a) growth parameters (25%, 50%, and 75% quantiles) and its impacts over natural mortality at age, and; b) steepness of stock productivity (0.7, 0.8, and 0.9) (additional details can be found in documents Anon. (2022n) and in the Report of the 2022 Skipjack Stock Assessment Meeting *(Online, 23-27 May 2022)* (Anon., 2022h).

For the eastern skipjack stock, after exhaustive work, a better convergence of the models and stability of the model parameters, the Group decided that none of the preliminary or additional runs attempted during the meeting were accepted as a reference case. Thus, at that time, the Committee agreed that more work was needed to be developed during the intersessional period, to get a more robust and stable model(s), which should be presented in the informal intersessional online meeting held on 15 July 2022. An additional axis of uncertainty was included for the E-SKJ grid of uncertainty considering 2 alternative CPUEs series combinations.

For the western skipjack, all the models presented during the meeting showed more stable fits than those observed for the eastern stock. In this sense, the Committee agreed to use these results for management advice. The Committee also noted that the stock status estimates from the JABBA model agree with the stock status estimated using the Stock Synthesis model. However, it was decided not to use the results of the surplus production model to provide management advice.

Further details of the results for both, E-SKJ and W-SKJ stocks are presented in the Report of the 2022 Skipjack Stock Assessment Meeting *(Online, 23-27 May 2022)* (Anon., 2022h) and the Skipjack Executive Summary (item 9.1 of this report).

Intersessional Skipjack Stock Assessment work

As agreed by the Committee during the 2022 Skipjack Stock Assessment Meeting *(Online, 23-27 May 2022)* (Anon., 2022h), a Tropical Species Group Informal Meeting on Skipjack Stock Assessments was held online on 15 July 2022 (Anon., 2022i), aiming to evaluate the results of the new runs for the eastern skipjack stock assessment and, if possible, develop the projections and the respective management advice for this stock. Additionally, as an initiative of the W-SKJ modellers' team and based on the new recommendations of the Working Group on Stock Assessment Methods (WGSAM), a new Kobe plot, Kobe matrix and projections were presented for the western skipjack stock.

The new results for the eastern skipjack stock showed more robust and stable fits than those observed during the 2022 Skipjack Stock Assessment Meeting *(Online, 23-27 May 2022)* (Anon., 2022h). The Committee agreed that all models, including those runs fitted using JABBA and Stock Synthesis, presented during this intersessional meeting showed similar relative biomass trends and fishing mortality trends. In this sense, the Committee agreed to use both frameworks for management advice.

For the western skipjack, an update in the Kobe plot, Kobe matrix and projections was also provided based on the new recommendations of the WGSAM. Thus, these results were updated using the SSB at the end of each year.

Details of the results for the final models of E-SKJ and projections of the W-SKJ stock are detailed in Anon. (2022i), Kimoto *et al*. (2022a), and in the Skipjack Executive Summary item 9.1 of this report).

The detailed report is available here.

Discussion

The Rapporteur presented the results of the 2022 Skipjack East and West stocks assessments highlighting the main conclusions of the stock status, trends, future projections, and management advice. The Committee indicated that this assessment represents an important advance for the Atlantic tropical tuna resources in being able to provide quantitative advice for both stocks although there is still large uncertainty.

The Committee welcomed the detailed information provided on the intersessional work done by the assessment teams and the provision of SCRS documents recording the main decisions and results. The Committee noted the importance to also record the discussions during the Species Groups and SCRS Plenary meetings to have a more complete record of the Committee decisions for reaching the final management advice provided to the Commission.

The Committee inquired about the information provided within the tables of the probability of the SKJ stocks being below a given percent of the biomass at MSY (B_{MSY}) at the end of the projection period. The Committee has produced these tables in the past for BET and YFT. It was indicated that when there is relatively large uncertainty in current stock status, there is often a non-negligible probability for the stock to reach low biomass levels at some of the catch levels considered in the projections. The Committee agreed that this risk should be communicated with the management advice. It was recommended that this analysis and results be standard for all stocks.

The Committee also inquired about the estimates of “faux poissons”. The Rapporteur informed that the Group estimated catches of “faux poissons” for the SKJ assessment for the 2015 -2020 period only, thus no estimates were available for 2021.

8.10 Intersessional Meeting of the Working Group on Stock Assessment Methods

The Intersessional Meeting of the Working Group on Stock Assessment Methods (WGSAM) was held online from 31 May to 3 June 2022 (Anon., 2022j). The agenda for the meeting included general topics on management strategy evaluations (MSE), stock assessment, bycatch estimation and CPUE standardization and diagnostics.

The Rapporteurs for each of the ICCAT MSE efforts presented a brief summary of progress and challenges recently faced by their respective efforts. A key feature critical to all MSE efforts is that of communication with their respective Panels. Iterative communication with the Panels, who are the key decision makers of the MSE process, is critical, particularly since management decisions are outside the scope of the SCRS. The Group agreed that the Ambassador approach has been productive for BFT and should be continued for all MSE efforts. The Group also highlighted the value in developing unified and consistent presentation materials across all species to disseminate MSE results. Exceptional Circumstances should identify values not observed within the MSE projections, which would trigger a requisite revisiting of the MP.

The Group recognized the increased use of the “model ensemble” approach to create structural uncertainty grids to characterize the uncertainty in stock assessments and discussed the merits of alternative grid weighting determined using an expert opinion versus other methods such as equal weighting typically adopted by ICCAT. The Group discussed whether it would be possible to use the assessment results to get plausibility values and use those as weights within a structural uncertainty grid. The Group noted that the choice of which parameters, or model formulations, to include within a structural uncertainty evaluation is an important consideration that is not reflected in the alternative grid weightings and that the uniqueness of alternative model formulations may not be captured in alternative grid weightings. The Group supported highlighting the following three discussion topics: 1) coupling the Jackknife procedure (removal of one data source at the time) with standard diagnostics to evaluate data conflicts and model misspecification; 2) assessment teams should write a concise summary of the structural uncertainties that were identified during the assessment and that were not able to be considered in the uncertainty grid used for management advice; 3) in reference to trends of the recruitment deviation presentation, the Group highlighted the consistency in agreement between the recruitment deviation diagnostics and the age-structured production model (ASPM), and that both may be useful as a diagnostic of processes to be included in stock assessment runs to help diagnose model misspecification, in combination with other diagnostics.

A newly developed R library for semi-automated total bycatch estimation using model-based and design-based estimators was presented to the Group. The method was tested using simulated observer and logbook data from three simulated fleets in the Atlantic generated by LLSIM (longline simulator, Goodyear, 2021) with a decreasing trend in blue marlin abundance over time. The bycatch estimation tool performed well and produced reasonably unbiased estimates of the total blue marlin bycatch for all methods. In general, the amount of bias in the estimates was driven more by the observer allocation scheme than the specific allocation method. An important next step is to apply the method to real CPC data. There is also a need for beta testing, and training. The Group recognized the usefulness of the bycatch estimation tool presented to the Group and recommended it continue to be funded for further development as a means to address the SCRS general needs to estimate bycatch of species such as, but not limited to, billfish and shark.

The Group was presented with an investigation of the projected Atlantic Multidecadal Oscillation (AMO), an index traditionally defined using sea surface temperature, at depths inhabited by highly migratory species. When recreating the sea surface AMO index from a new climate dataset, it was discovered that the signal did not align with others previously published. The Group acknowledged the concerns of the large variations in AMO signals for fisheries inference and the lack of consistency in the AMO index dependent on the dataset, time scale and detrending methods.

The Group presented a management strategy evaluation framework called "EcoTest" to inform decision makers for Ecosystem Based Fisheries Management (EBFM). A multi-species framework that supports tactical decision making can make significant progress toward the essential goals of EBFM. The Group discussed the use of this tool and possible future developments. There is a need to develop new tools to operationalize EBFM, and this tool provides a useful step forward.

The Group was presented with a proposal for the creation of a study group tasked with developing standards and best practices for CPUE model diagnostics. Noting existing species distribution models and a longline simulator created by members of the Group, it was suggested that these data sets be used for a simulation study.

The detailed report is provided here.

Discussion

The Committee welcomed the development of the Bycatch Estimator tool and the availability for its use to CPCs for testing. It was recommended that this tool be validated using actual observer and landing data from other areas in the Atlantic, recognizing that bycatch distribution and ratios are likely to vary across different regions, including species composition. It was also commented to coordinate among Rapporteurs of other interested Species Groups (e.g., sharks, billfish, small tunas, etc.) to expand its potential use and test.

The WGSAM Rapporteur reiterated that this Group provides tools for scientists to address their statistical and modelling problems, inviting them to have more direct interaction with WGSAM to optimize tools provided. It was also indicated that the proposal workplan on CPUE diagnostics will complement the current CPUE summary tables used by the SCRS and improve and standardize the evaluation across multiple and varied catch and effort series.

8.11 ICCAT/ICES North-eastern Atlantic Porbeagle Stock Assessment Meeting

The last porbeagle joint assessment between ICES an ICCAT was held in 2009. On that occasion, the porbeagle stocks were assessed and consensus between scientists from both organizations was the basis for the proposed management recommendations. In the 2022 NE porbeagle assessment, ICCAT and ICES agreed on the data used and the assessment model to be used. Unfortunately, consensus could not be reach on other matters, namely on the advice for management.

The north-eastern Atlantic porbeagle stock assessment was discussed at the ICES Working Group on Elasmobranch Fishes (WGEF) meeting held in 15-17 June in Lisbon, Portugal. At the meeting, some additional updates to catch the last two years were provided. With these data having been updated, the SPiCT assessment model was re-run and presented. The SPiCT assessment method had been through a rigorous benchmark process and independent review so the assessment was updated during the meeting in keeping with the data and settings adopted during this process. In addition, at this meeting it was revealed that ICES had a generic harvest control rule (HCR) that it intended to apply using this assessment model. According to the results and the application of the generic HCR, the TAC for the NE porbeagle would be 432 t for 2023 and 599 t for 2024. For reference, the 2021 reported ICCAT catches for NE porbeagle were approximately 8 t.

There were several concerns raised by ICCAT scientists about the proposed HCR. The first of these was that it was a generic HCR, i.e., it had not tested specifically on porbeagle shark. Furthermore, the generic HCR had been tested to achieve objectives unknown to ICCAT. Finally, the future availability of an index of abundance that would be required to apply this HCR were in doubt. Given the problems described above in relying on this generic HCR, ICCAT and the Chair of the WGEF requested that long-term projections be made using constant catches so that future stock status (i.e., a K2SM) could be reviewed. These projections would be made by the subgroup of the WGEF. There was agreement to undertake these projections and to reconvene intersessionally to review the results.

On the 13 July 2022, these constant catch projections were presented. During the review of the projections, some problems were found. These could neither be solved nor explained during the meeting. To work out these issues, the sub-group agreed to wait until November to have an "inter-benchmark" (an ICES meeting held outside their major "benchmark" meetings that occur at specific intervals) meeting to continue with the discussion.

Recent development from ICES

While the hope had been to resolve the projection problems during an inter-benchmark meeting, the ICES Advisory Committee (ACOM) overruled the decision of the WGEF. ACOM decided instead that projections at different percentiles of F_{MSY} (10, 15, 20 and 35th) were sufficient to obtain medium-term probabilities of achieving a range of stock statuses for a set of constant F scenarios. The WGEF was allowed to comment/agree on the draft advice by correspondence. But because of time constraints and because the ACOM's decision was outside of the process agreed to at the WGEF, ICCAT provided neither comments on this draft advice nor did it agree to this advice.

Given the process problems described above, no K2SM was produced. The Secretariat described these issues to the September 2022 Shark Species Group meeting. The Committee agreed with a proposed management recommendation, which is included in the POR Executive Summary (see section 9.4 of this report).

8.12 Atlantic Swordfish Stock Assessment Meeting

The Swordfish Species Group met from 20-28 June 2022 online aiming to conduct the assessment of North and South Atlantic stocks (Anon., 2022k). It updated available catch data, biology parameters, size composition data, fleet structure, and summarized the relative abundance indices to be used. The Group expressed interest in proposing a continued programme for biological sampling, undertaken by CPCs, that extends further than the current biology programme, with specific sizes, and structures (hard parts) to be collected from different geographical areas. With respect to indices, the Group reviewed a combined index of abundance for the North Atlantic swordfish stock. The 2022 version of the index includes catch and effort information from seven ICCAT longline fleets which represent over 90% of annual swordfish catch. The index is used as an indicator in surplus production models and there was interest in its potential use as an indicator for a model-based Management Procedure in the N-SWO management strategy evaluation. For the northern stock the Group reviewed Stock Synthesis and JABBA models for stock assessments. It also entertained the ASPIC and SPiCT surplus production models. The Group agreed to a final Stock Synthesis reference case, with fits to all CPUE indices and a JABBA model run. The Group agreed to continue exploring different Stock Synthesis model configurations to improve the estimation of dead discards to better match the observed discards. Stochastic projections were conducted for the JABBA base case model with 22 constant catch scenarios. The final projections for Stock Synthesis could not be finished during the meeting so were deferred to the September 2022 Swordfish Species Group meeting.

For the southern stock, the Group reviewed the first preliminary Stock Synthesis model for the stock, as well as several JABBA models. In addition, it reviewed the preliminary closed-loop simulations on the management procedure performance of the alternative Management Procedures for the stock. Management advice was based on a selected JABBA model, and there was a notable difference in estimated productivity between the 2017 Swordfish Stock Assessment (Anon., 2017a) and the current, with the former assuming a more productive stock.

The detailed report is provided here.

8.13 Eastern Atlantic and Mediterranean Bluefin Tuna Stock Assessment Meeting

The meeting was held in hybrid form from 4 to 9 July 2022 (Anon., 2022l). Three assessment modelling platforms have been used to conduct the assessment of the eastern Atlantic and Mediterranean bluefin tuna stock in 2022. As in previous assessments, a virtual population analysis (VPA) was used, and two alternative platforms, Stock Synthesis (SS) and the age-structured assessment programme (ASAP), were applied. Input data, assumptions, interim results, diagnostics and estimates of SSB and recruitment were reviewed to select a base case for each platform.

As a synthesis of the assessment results, the three models showed similar trends in SSB, with a progressive decline in SSB from the 1970s until the implementation of a recovery plan set up in 2007. Since the late 2000s there has been a strong increase in SSB although the magnitude and rate differ in the three models, with VPA indicating a lower biomass while the ASAP model indicates the largest increase. Uncertainty in the rate and magnitude of the increase in SSB can be observed on all three platforms and in the sensitivity tests on each platform, especially in recent years. The fishing mortality of the age group 2-5 and age 10+ fish showed an increasing trend since the 1970s, although the F of the age group 2-5 shows a marked decline since the late 1990s, while the adult group (age 10 plus F) shows a drastic decline in fishing mortality since the establishment of the 2007 rebuilding plan. Recruitments estimated by the three assessment platforms show considerable variability, especially in the recent period, but in general there are two periods, one with low recruitments before 1990 and one with higher recruitments thereafter. Estimates in recent years indicate a clear increase in recruitment, although there is uncertainty as to the magnitude of this increase, reflected by the differences between the three models and the variability of each model. The different models showed a relatively wide range of stock status relative to the $F_{0.1}$ reference level. Management recommendations will be finalized at the September Bluefin Tuna Species Group meeting. To inform stock status, the Group recommended that the results of the three models be considered.

Regarding the Management Strategy Assessment (MSE), additional variants of the Candidate Management Procedures (CMPs) have been developed in response to requests made during the Second Intersessional Meeting of Panel 2 on Bluefin Tuna MSE (Online, 9-10 May 2022). The Panel intends to further adjust the performance of each CMP to directly target the thresholds that Panel 2 has identified for biomass performance (LD*15=0.40) and the probability of being in the green quadrant of the Kobe plot (PGK; current threshold of PGK=0.60). However, when calibrated only at LD*15=0.4 the PGK of 60% may not be reached and this should be considered in a subsequent performance calibration.

The three-year management cycle was slower in reacting to signals of decreasing TAC and therefore performed slightly worse than the two-year cycle, along with slightly higher variability in TAC changes. To compensate, the Group explored further reductions in allowable TAC (+20%/-35% stability). Since performance was only slightly lower and practical considerations (stability, reduction of administrative burden) could support a three-year management cycle, this decision should be taken by Panel 2. Panel 2 also requested the SCRS to assess a symmetric stability provision of +20%/-20%, as opposed to the default +20%/-30% values. The +20%/-20% option took longer to implement the required TAC decreases and therefore had lower biomass yield and performance (i.e., higher risk). The SCRS Chairman stated that ambassadors' meetings have proven to be an effective venue for the exchange of information. However, ambassadors' meetings are not an official means of obtaining stakeholder feedback and this remains a matter for each CPC. The Group will attempt to convene more ambassadors' meetings.

The detailed report is provided here.

Discussion

The Committee noted that the current structure of the SCRS meetings makes it difficult to record the discussion at the Species Group meeting preceding the SCRS, as well as discussion at the SCRS. In particular, it was noted that the detailed report of the independent external review results of the E-BFT stock assessment is not included in the current report. The E-BFT Rapporteur noted that E-BFT Executive Summary includes a brief summary of the expert reviewer’s comments in the preamble and in two sections of the report.

Two CPCs suggested projection results from assessment models for E-BFT be included in the report for the purpose of evaluating the outlook for the stock. The E-BFT Rapporteur and SCRS Chair replied that the decision to not provide projections for E-BFT was made by the BFT Species Group meeting. Initially the BFT Species Group decided to conduct preliminary short-term projections. But finally, the BFT Species Group did not have enough confidence in the models to provide the projections, because they were highly uncertain as to absolute scale in Spawning Stock Biomass and the recent recruitment. After further discussion, the Committee agree to include limited projection results from VPA in the Executive Summary for information purposes only.

8.14 Second Intersessional Meeting of the Bluefin Tuna MSE Technical Sub-Group

The Second Intersessional Meeting of the Bluefin Tuna Technical Sub-group on Management Strategy Evaluation (MSE) was held online from 5 to 9 September 2022 (Anon., 2022m).

The Group reviewed updates to indices of abundance for the Japan longline, the Mexico-US longline, the Morocco-Portugal traps, the GBYP aerial survey and the Canada Gulf of St. Lawrence and the southwestern Nova Scotia handline indices to include in the latest MSE. The specifications for scaling the updated indices of abundance for ABFT-MSE package input were also discussed. All input data was provided to update the CMP results.

The Group discussed rules of providing indices for CMPs and for annual indicators. Because the Group is now moving to using indices for management procedures, an additional category of index provision was proposed for Management Procedure applications, and to clarify index provision categories. The most appropriate form of index provision for management procedure applications should be further discussed in the BFT Species Group meeting in September 2022.

The Group discussed the changes to CMPs based on the input of the Third Intersessional Meeting of Panel 2 on Bluefin Tuna Management Strategy Evaluation (BFT MSE) (Online, 14 July 2022) and the updated CMP results. The ABFT-MSE package was updated during the meeting, therefore CMP developers will need to re-tune their CMPs with the updated PGK (Probability of Green zone in Kobe plot after 30 projected years) wt function in the updated ABFT-MSE package and the final CMP results will be prepared prior to the BFT Species Group meeting in September 2022. The updated package will also include updated indices of abundance through the year 2021. Since the updated indices were almost indistinguishable from the previous version, their incorporation will not require OM-reconditioning, while providing a better reflection of the first few years of CMP dynamics once implemented.

Based on the Panel 2 input, the list of tuning targets was developed for the developers:

1. Tune to PGK = 60% with a 2-year management cycle, where allowable TAC adjustment is +20/-30
2. Tune to PGK = 60% with a 3-year management cycle, where allowable TAC adjustment is +20/-30
3. Tune to PGK = 70% with a 2-year management cycle, where allowable TAC adjustment is +20/-30
4. Tune to PGK = 70% with a 3-year management cycle, where allowable TAC adjustment is +20/-30
5. Tune to PGK = 60% with a 3-year management cycle, where allowable TAC adjustment is +20/-35

The rationale for tuning to PGK, as opposed to the previous performance tuning to LD*, was a result of the need to satisfy both LD* and PGK. Initial tuning to $LD*_{15\%}$ indicated PGK performance below 60%, so that PGK became the limiting factor in satisfying both of Panel 2 minimum operational management objectives for both $LD*_{15\%}$ and PGK>=60%. Panel 2 also requested that the SCRS tests $LD*_{10\%}$.

The detailed report is provided here.

Discussion

The Committee welcomed the MSE work done by the BFT Species Groups and the clear presentation by the W-BFT Rapporteur. The Committee questioned if all decision points on BFT MSE need to be the same for both stocks. The W-BFT clarified that this BFT MSE provides advice for both eastern and western stocks in one "package", because the operating models already incorporated unique biological information by stocks (e.g. stock recruitment relationship) and mixing between stocks. The BFT Species Group considered the same risk for any stocks and easy path for the manager's decisions for one final management procedure. The Committee suggested to make this point clearer in the presentation to the Commission meeting.

The Committee reviewed and modified Final Results & Decision Guide Package (see section 17.14) and agreed to remove Decision point 7 for minimum TAC change initially proposed by the BFT Species Group and refer to it as an additional consideration in the text of the decision document.

9. Executive Summaries on species

The COVID-19 pandemic continued to impose a number of restrictions on the operational capability of the SCRS and its Species Groups. Therefore, to provide scientific advice to the Commission, the SCRS has concentrated on updating the Executive Summary for only those species which have undergone a stock assessment in 2022 (skipjack, Atlantic swordfish, eastern Atlantic and Mediterranean bluefin tuna and North-eastern porbeagle).

The Committee reiterated that in order to achieve a more rigorous understanding of these Executive Summaries from a scientific point of view, the previous Executive Summaries should be consulted, as well as the corresponding detailed reports which are published in the *Collective Volume of Scientific Papers.*

9.1 SKJ-Skipjack tuna

The previous assessment of both skipjack stocks was conducted in 2014 (Anon., 2015). Stock assessments for eastern and western Atlantic skipjack were conducted in 2022 through a process that included a data preparatory meeting, held online from 21-25 February 2022 (Anon., 2022a), and a stock assessment meeting, held online from 23-27 May 2022 (Anon., 2022h). Additionally, informal intersessional meetings of the Group were held in April and July to prepare and finalize the stock assessment results. This report covers the most recent information on the status of the eastern and western skipjack stocks. The 2022 assessment was able to provide quantitative estimates of management reference points and projections of stock status for both skipjack stocks, something that was never achieved before by the Committee.

These new assessments for the eastern and western Atlantic skipjack stocks used fishery data from 1950-2020 and 1952-2020, respectively, and indices of relative abundance used in the assessments were calculated through 2020. In both cases, Surplus Production models and Statistically Integrated models were used.

For a complete and detailed description of the assessment and the state of knowledge and status of the eastern and western Atlantic skipjack tuna stocks, readers should consult the Report of the 2022 Skipjack Tuna Data Preparatory Meeting (Anon. 2022a) and the Report of the 2022 Skipjack Stock Assessment Meeting (Anon., 2022h).

SKJ-1. Biology

Skipjack tuna is a cosmopolitan species found in schools distributed mainly in tropical and subtropical waters of the three oceans. This tropical tuna is the predominant species aggregated around FOBs (including FADs) where it is caught, commonly associated with juveniles of yellowfin tuna, bigeye tuna and with other species of epipelagic fauna. This species exploited sizes range from 30 cm to 62 cm FL for E-SKJ (**SKJ-Table 2**) and 30 cm to 80 cm FL for W-SKJ (**SKJ-Table 3**).

Skipjack tuna breed opportunistically throughout the year over broad areas of the Atlantic Ocean. Both stocks show synchronized spawning behavior when in a school. Moreover, the skipjack's reproductive potential is considered high because it reaches sexual maturity around one year of age and spawns in warm waters above 25º C which represents a large ocean area. More specifically, the eastern skipjack stock, spawns over a wide area on either side of the equator, from the Gulf of Guinea to 20º – 30º W. There are two known spawning areas for the western skipjack stock, one off the Brazil margin delimited by the parallel of 20º S and the southern limit of the Brazil current, and another area in the North of the Atlantic Ocean, located in the Gulf of Mexico and Caribbean.

Movement patterns based on AOTTP tagging data demonstrated some connectivity between the Azores and Gulf of Guinea areas for the eastern stock, which had not been observed in the ICCAT historical tagging data. Although in general, the AOTTP tagging data shows minimal exchange between the eastern and western skipjack stocks, the separation between the two stocks is less clear for those tags released by the AOTTP close to the boundaries of the stock (5º S; 35º W) (**SKJ-Figure 2**). This pattern sparked concerns in the current way catches are assigned to a stock when fleets are fishing near and/or across this boundary area. More studies on the potential migration across stock boundaries are needed. These include analysis of returned AOTTP SKJ tags, or potential future releases of conventional tagged fish in places where movement details remain unknown (e.g., Venezuela to the Equator and northern migrations of the western stock). Such studies could improve our understanding of these movements and of potential levels of mixing across the current stock boundaries.

Length at 50% maturity remains estimated at 42 cm, approximately 9.5 months old, and the size of full maturity at 55 cm. Both reproduction parameters remain the same as those used in the last stock assessment.

Considerable uncertainty remains around the growth parameters for the skipjack tuna. To deal with this uncertainty, a distribution of potential growth curves was developed considering available estimated growth parameters compiled from scientific literature, and the resulting growth parameters are shown in the assessment report (Anon., 2022h). Natural mortality at age was estimated assuming the Lorenzen function and maximum age of 6 years.

All these uncertainties reported on growth, natural mortality, and stock structure could have important implications for the stock assessment of the eastern and western skipjack stocks. Research should aim to continue to reduce these uncertainties.

SKJ-2. Fishery indicators

Skipjack tuna stocks have been historically exploited by two major gears (purse seine on the eastern stock and baitboat on the western stock) and by many countries throughout their range. Longline fisheries remove a comparatively small portion of the total removals (**SKJ-Figures 1, 5 and 6**).

The numerous changes that have occurred in the skipjack fisheries, mainly since the early 1990s (e.g., the progressive use of FOBs and the geographical expansion of the fishing areas by surface fleets), have brought about an increase in skipjack catchability and the proportion of biomass exploited. The nominal catches for the eastern stock had shown a generally increasing trend since the 1960s (**SKJ-Figure 4**). The total catches increase from 1,171 metric tons in 1960 to more than 280,000 metric tons in 2018. Since 2018 the total catches of the eastern stock have gradually declined to 196,987 t in 2021. This recent decline in total catches was in part due to decreasing landings of the PS eastern Atlantic since 2018. Decline trends are also observed in the catch of eastern baitboat fisheries that have decreased from 32,619 metric tons on average between 2011 - 2015 to less than 24,500 metric tons in the last six years of the time series (2016-2021) (**SKJ-Figure 5**).

The Group estimated the current fishing capacity of all large-scale purse seiners (defined as vessels with ≥ 335 m3 of fish hold-volume) targeting tropical tunas in the Atlantic, using a combination of data sources including the ICCAT authorized vessel records, ISSF records on purse seiners, and AIS data. The Group estimated that at least 67 - and possibly 72 - large-scale purse seiners were operating in the Convention area as of the first half of 2022. The 2022 capacity estimate (67-72) for large-scale purse seiner was similar to the estimate of capacity made by the SCRS in 2020 (68-72 vessels) and lower than the capacity estimate in 2021 (74-80), indicating that at least some vessels moved out of the ICCAT area during the last year. The Committee was informed by national scientists of the reductions in the operations of the baitboat fleet in recent years (since 2020), in part due to the implementation of a Marine Protected Area (Decree No. 2020-1133 on the creation of the Marine Protected Areas of Kaalolaal Blouffogny and Gorée (Senegal)) limiting access to live bait for the fishery.

The western skipjack landings have shown a slight decrease since 1982, and this has intensified in the most recent period of the time series (2013 - 2020) (**SKJ-W Figure 6**). The maximum total catch for this stock was observed in 1985 (40,272 t), and the lowest catch since 1985 was reached in 2020 (18,859 t). This trend can be explained by the reductions in the baitboat catches, which decreased from 26,941 t on average for the period 2011 – 2015 to less than 15,400 t (on average) in the most recent period of the time series (2016 – 2021). On the contrary, handline catches have increased in recent years, reaching more than an annual average of 2,960 t in the period between 2016-2021, a significant increase over the 301 t average for the period 2011– 2015 (**SKJ-Table 1**). Data provided in Task 1 Fleet showed a reduction in the number of vessels operating within the Brazilian baitboat fleet (from 54 baitboat vessels operating in 2015 to 30 vessels in 2020). This reductions in the number of baitboat vessels may be driving much of the decrease in catches of this stock observed in the recent period, as the Brazilian fleet catches the majority of SKJ in the West side of the Atlantic.

Estimates of “faux poisson” catches for the purse seine fleets targeting tropical tunas in the eastern Atlantic were provided by some CPCs. The Group estimated “faux poisson” catches based on a methodology presented and adopted by the Group at the Data Preparatory Meeting and were included under the “NEI_mixed flags” code for the Stock Assessment.

As indicated before, another important fishery indicator was the westward expansion of the eastern purse seine FOB fisheries with an increase in catches in the equatorial area. In the last decade surface fleet fisheries have reported catches on both sides of the SKJ stock boundary of the equatorial area (**SKJ-Figures 1 and 3**). Recent research has shown some similarities between the skipjack size ranges among the catches reported by the EU and Ghana PS-FOB when they are operating on either side of the boundary (40-50 cm SFL, **SKJ-Figure 7** and **SKJ-Figure 8**). Such fish caught by these two fleets tend to be smaller than those caught by purse seiners in the West stock area, mainly by Venezuela PS non-FOB fisheries (45-60 cm). It is possible that the stock boundary area is a mixed area including individuals of both stocks. Any increases in effort of purse seine vessels fishing on FOBs in this area could increase removals from the western SKJ stock.

Mean weight time-series by major fishery for both eastern and western skipjack stocks were estimated using the most recent information available on T1NC, T2SZ and T2CS (Task 2 catch-at-size estimated/reported by ICCAT CPCs). For the eastern and western skipjack stocks, the estimated mean weights have oscillated throughout the time series (1969-2020), **SKJ-Figure 9, SKJ-Figure 10**. The estimated mean weight of E-SKJ is about 2.1 kg for 1969-2020. The W-SKJ average weight is 3.4 kg, indicating that fish caught on eastern stock are smaller than the ones in the western stock.

Three relative indices of abundance were included in the stock assessment of the eastern skipjack, the Canary historical baitboat index (1980-2013), the EU PS FAD index (2010-2020), and the EU Echosounder buoy (2010-2020) index. The EU PS FAD index is new for this stock, derived from sets made by vessels fishing on FADs with operational buoys not owned by the vessel making the set. The Canary baitboat index showed a generally stable trend. For the recent period, the EU PS FAD index showed a slight decreasing trend over the time series, while the EU echosounder buoy index showed a sharp decline at the beginning of the series and a sharp increase at the end of the series (**SKJ-Figure 11**). For the western skipjack, five relative abundance indices were included in the stock assessment model: Brazilian baitboat historical (1981-1999) and recent (2000-2020), Brazilian handline (2010-2016), US-longline (1993-2020), and Venezuelan PS (1987-2020) indices. The indices for recent years showed a slight decrease trend since the mid-2010s (**SKJ-Figure 12**).

SKJ-3. State of the stocks

The 2022 Skipjack Stock Assessment Meeting was conducted using similar assessment models/methods to those used in the assessments of other tropical tuna species, including yellowfin and bigeye tuna. Stock status evaluations for both stocks of Atlantic skipjack tuna used in 2022 included several modelling approaches, ranging from non-equilibrium (MPB) and Bayesian state-space (JABBA) production models to integrated statistical assessment models (Stock Synthesis). Different model formulations considering plausible representations of the dynamics of the skipjack stocks were used to characterize the stock status and the uncertainties in stock status evaluations.

Eastern skipjack stock

A full stock assessment was conducted for the eastern skipjack tuna stock in 2022, applying production models (JABBA) and one integrated statistical assessment model (Stock Synthesis) to the available catch data through 2020. The Group decided to combine the results of JABBA and Stock Synthesis, with equal weighting, to estimate stock status and develop management advice to capture all major uncertainties in the population dynamics. The uncertainty grids were comprised of combinations of CPUE selection ((i) Canary BB index + EU PS FADs index, and; (ii) Canary BB index + Echosounder buoy index), steepness *h* (0.7, 0.8, or 0.9), and growth (25, 50, or 75th regression quantiles) for both Stock Synthesis and JABBA.

SKJ-Figure 13 shows the historic trends of the relative fishing mortality (F/F_{MSY}) and relative biomass (B/B_{MSY}) from the different assessment model runs for the E-SKJ. The combined results of the assessment, based on the median of the entire uncertainty grid, show that in 2020 the East Atlantic skipjack tuna stock was not overfished (median B_{2020}/B_{MSY} = 1.60) and was not undergoing overfishing (median F_{2020}/F_{MSY} = 0.63). The median MSY was estimated as 216,617 t from the uncertainty grid of the deterministic runs. Probabilities of the stock being in each quadrant of the Kobe plot (**SKJ-Figure 14**) are 78% in the green (not overfished, not subject to overfishing), 4% in the orange (subject to overfishing but not overfished), 1% in the yellow (overfished but not subject to overfishing) and 16% in the red (overfished and subject to overfishing). In summary, the results indicated a stock status of not overfished (83% probability), with no overfishing (80% probability).

Noteworthy, the estimated stock biomass of the combined results as shown in the Kobe plot (**SKJ-Figure 14**) and summary table, there is large uncertainty in biomass estimates reflected in the long tails of the biomass distribution relative to B_{MSY} (95% confidence interval of 0.5 to 5.79 B/B_{MSY}). This large range of uncertainty in stock status estimates has implications on the estimated probabilities for each constant catch scenario in the projections that have been used to develop management advice (**SKJ-Tables 4 and 5**).

In the projection results from the Stock Synthesis and JABBA models, some iterations of high catches were predicted with exceptionally small biomass, which results in extremely high fishing mortality. Especially Stock Synthesis and JABBA runs with the Acoustic Buoy index removed projected low biomass within 3-4 years once the stock is harvested at high constant catches. **SKJ-Table 5** and **SKJ-Figure 15** show the joint stochastic projections for both quantities (B/B_{MSY} and F/F_{MSY}). The probability of biomass being less than 10% or 20% of the biomass that supports MSY was calculated for each projection year and catch scenario (**SKJ-Table 4**). Assuming a constant catch at MSY level, the probability of the stock being below 20% of the B_{MSY} at 2028 was about 17% and the probability of being below 10% of the B_{MSY} was about 14%.

Western skipjack stock

The assessment of the western skipjack stock was conducted using a Bayesian state-space production model (JABBA) and an integrated statistical assessment model (Stock Synthesis). Given that the stock status estimated from the JABBA model agreed with the estimated stock status using Stock Synthesis, the Group decided to use the results of the surplus production model as a comparative perception of the western skipjack stock status, but not for the development of management advice. Therefore, the final stock status and management advice presented in this Executive Summary are based on the combined results from the 9 distinct Stock Synthesis runs derived from the uncertainty grid proposed for the western skipjack stock. A more detailed description of the assessment can be seen in Anon. (2022a).

SKJ-Figure 16 shows the historical trends of the relative fishing mortality (F/F_{MSY}) and relative biomass (B/B_{MSY}) from the different assessment model platforms for the W-SKJ. Based on the combined results used to the develop management advice (9 Stock Synthesis deterministic runs), the median estimate of SSB_{2020}/SSB_{MSY} is 1.60, and the median estimated for F_{2020}/F_{MSY} is 0.41. The combined results of all runs indicates that the western skipjack stock is estimated to be in healthy condition with 91% probability of being in the green quadrant, and that the stock is not overfished nor undergoing overfishing (**SKJ-Figure 17**). There was a relatively low estimated probability that the stock is either overfished (yellow quadrant; 6.2%) or both overfished and undergoing overfishing (red quadrant; 2.9%).

The catch advice is provided in the form of Kobe II Strategy Matrices including probabilities that overfishing is not occurring ($F <= F_{MSY}$), stock is not overfished ($SSB >= SSB_{MSY}$) and the joint probability of being in the green quadrant of the Kobe plot (i.e., $F <= F_{MSY}$ and $SSB >= SSB_{MSY}$) (**SKJ-Table 7**). Future constant catches of 20,000 t, close to the current catch (19,951 t in 2021) are expected to maintain the stock in the green quadrant. The median MSY across the 9 grid runs was 35,277 t. Future constant catches of this level are expected to maintain the stock in the green quadrant ($F \leq F_{MSY}$ and $SSB \geq SSB_{MSY}$) with about 70% probability by 2028. Probabilities of the stock biomass being below 20% and 10% of B_{MSY} are presented in **SKJ-Table 6**. The probability of the stock biomass being below 20% or 10% of B_{MSY} was less than 1% until 2028 assuming a future constant catch at the level of MSY. The projections for both quantities (F/F_{MSY} and SSB/SSB_{MSY}) are presented in **SKJ-Table 7** and **SKJ-Figure 18**.

SKJ-4. Effect of current regulations

The current regulations for tropical tunas, in Rec. 21-01, only entered into force in June 2022, and the impacts on the SKJ stock and fisheries are not yet evident in the available scientific data. However, the previous Recommendation, Rec. 19-02, included several measures that impacted fishing for the eastern stock, including the first Atlantic-wide, temporal closure on fishing for schools associated with FADs, limits to the number of FADs that can be actively managed by individual purse seiners, changes in FAD design, and others. In addition, taking into consideration the multi-species nature of tropical tuna fisheries, the TAC and catch limits adopted for other tropical tuna stocks, mainly bigeye tuna, may also explain the drop in skipjack catches in recent years. Before this closure, the Commission had adopted various FAD spatio-temporal closures (Rec. 98-01, Rec. 99-01, Rec. 14-01, and Rec. 16-01).

The effect of the temporal FAD closure was evaluated by examining catch of each tropical tuna species, by month and by fleet, in 2020 with comparison to a reference period in the 1990s, to account for years in which no closure was in place. There is preliminary evidence that tropical tuna catch was lower during the closure than during the same months in the reference period, and the annual 2020 catch was lower than in 2019. Preliminary catch estimates for SKJ in 2021 are also lower than the catches recorded in 2020. After reviewing this information, the Committee concluded that Atlantic-wide, temporal closures on fishing on FAD-associated schools may lead to reduced catch of eastern skipjack. This conclusion is further discussed in section 17.25 (Responses to the Commission) of this report.

Although the measures in Rec. 19-02 also applied to the western stock, no fleets were targeting western skipjack using FADs, so the impact of Rec. 19-02 on the western stock and fisheries was likely to be minimal.

SKJ-5. Management recommendations

Eastern skipjack stock

The stock status of eastern Atlantic skipjack tuna in 2020 was estimated with a high probability (78%) to be in a sustainable condition (green quadrant), with that stock not overfished or subjected to overfishing. According to the Kobe II Strategy Matrix (K2SM), a future constant catch using the median MSY of 216,617 t will have about 55% probability of maintaining the stock in the green quadrant of the Kobe plot through 2028. Assuming a constant catch at MSY[1], the probability of the stock biomass being below 20% of B_{MSY} in 2028 was about 17%, and the probability of stock biomass being below 10% in 2028 was about 14%.

The Commission should also be aware that fishing effort for skipjack also impacts other species that are caught in combination with skipjack particularly in the purse seine FOB fisheries (particularly juveniles of yellowfin and bigeye tuna).

Western skipjack stock

The status of the western Atlantic skipjack stock in 2020 was estimated with a high probability (91%) to be in healthy condition and is not overfished nor undergoing overfishing. According to the Kobe II Strategy Matrix (K2SM), a future constant catch using the median MSY of 35,277 t will have about 70% probability of maintaining the stock in the green quadrant of the Kobe plot by 2028. Assuming a constant catch at MSY[1], the probabilities of the stock biomass being below 20% or 10% of the B_{MSY} until 2028 are less than 1%.

ATLANTIC SKIPJACK SUMMARY TABLE

	Eastern Atlantic	***Western Atlantic***
Maximum Sustainable Yield (MSY)[1]	216,617 t (172,735 – 284,658 t)	35,277 t (28,444 – 46,340 t)
Yield for 2020 at the Stock Assessment	217,874 t	18,183 t
Current yield for 2021 (as of September 2022)	196,987 t	19,951 t
Relative Biomass (B_{2020}/B_{MSY})[2]	1.60 (0.50 – 5.79)	1.60 (0.90 – 2.87)
Relative Fishing Mortality (F_{2020}/F_{MSY})[2]	0.63 (0.18 – 2.35)	0.41 (0.19 – 0.89)
Stock Status (2020)		
Overfished:	No	No
Overfishing:	No	No

[1] Median and 95% confidence interval estimated from the joint uncertainty grid.
[2] Median and 95% confidence interval based on 90,000 iterations of the MVLN approximation for Stock Synthesis and 9,0000 MCMC iterations for JABBA.

[1] Projections are conducted with the MSY estimated for each model of the uncertainty grid.

SKJ-Table 1. Estimated catches (t) of skipjack (*Katsuwonus pelamis*) by area, gear and flag.

			1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
TOTAL			171198	209776	191405	174844	157152	148941	161412	182296	155487	163360	122185	154941	181467	172499	138376	145662	145104	163604	189933	219484	251498	258603	232672	242142	259762	266002	306442	278647	241090	216939
	ATE		141043	176555	161456	152984	129590	117229	132325	154940	126294	131909	100585	130192	154006	143982	111923	120223	123091	137829	164026	187096	218431	224007	205316	221076	237395	241957	283169	258526	222231	196987
	ATW		30155	33221	29949	21860	27562	31712	29087	27356	29193	31451	21600	24749	27461	28517	26453	25440	22013	25774	25907	32388	33067	34596	27356	21066	22367	24045	23273	20121	18859	19951
Landings	ATE	Bait boat	35653	31670	37767	33840	35861	36993	46506	44901	33705	56493	31167	34428	54194	48279	44700	44316	31863	35105	38607	38085	44814	30670	25682	23843	28875	25776	33437	24415	15677	16664
		Longline	3	2	10	3	7	47	85	42	48	53	59	83	67	83	204	428	199	59	46	35	58	79	54	21	540	498	113	350	366	150
		Other surf.	1424	1013	366	423	409	425	1228	301	2399	867	597	562	1324	2672	5270	3436	3803	5137	5098	5885	6769	7206	2184	2527	2623	4698	5087	5432	5774	9800
		Purse seine	91194	125997	107452	105709	89096	72015	76790	100459	79507	72492	67097	88350	90464	87660	58570	66817	81431	89059	112070	133696	159881	179759	170477	183342	190130	202265	233353	218358	189782	165466
	ATW	Bait boat	21112	19902	22855	17744	23741	27045	24727	23881	25641	25142	18737	21990	24082	26028	23766	23898	20702	23518	22803	29468	30693	32187	24817	17538	16810	14648	14926	15410	14593	15573
		Longline	37	21	16	36	21	7	21	58	22	60	334	95	206	207	286	52	49	20	854	352	62	642	464	209	806	292	322	416	193	420
		Other surf.	496	504	1367	2021	450	313	513	481	467	951	413	367	404	316	355	280	361	202	306	708	498	792	837	728	1534	5702	4797	2395	2387	2418
		Purse seine	8509	12794	5712	2059	3349	4347	3826	2936	3063	5297	2116	2296	2769	1967	2045	1209	901	2035	1943	1859	1814	975	1238	2524	3110	3347	3182	1881	1649	1537
Landings(FP)	ATE	Purse seine	12769	17873	15860	13010	4217	7749	7716	9237	10634	2004	1666	6769	7956	5288	3181	5226	5796	8471	8205	9395	6909	6293	6918	10712	15227	8626	11123	9762	10610	4868
	ATW	Purse seine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	67	107	55	45	19	35	
Discards	ATE	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
		Purse seine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	631	0	94	56	208	22	35
	ATW	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Purse seine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Landings	ATE CP	Algerie	0	0	0	0	0	0	171	43	89	77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Angola	41	13	7	3	15	52	2	32	14	14	14	14	10	0	0	0	0	50	636	44	91	514	0	1	1	1	3	3240	0	
		Belize	0	0	0	0	0	0	720	0	229	278	0	0	0	0	0	0	0	1373	2714	7429	15554	6218	10779	12599	7730	9958	20748	17063	19180	18044
		Brazil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1008
		Canada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Cape Verde	1257	1138	1176	1585	581	858	1245	1040	789	794	398	343	1097	7157	4754	5453	4682	4909	5155	7883	5535	16016	15254	17600	10925	7823	7852	5785	6068	1281
		China PR	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Curaçao	0	0	0	0	7096	8444	8553	10045	11056	15450	7246	12084	10225	101	3042	1587	6436	9143	9179	11939	12779	17792	18086	19621	22180	20660	24539	17360	10841	12398
		Côte d'Ivoire	0	0	0	0	0	0	0	0	1173	259	292	143	559	1259	1565	1817	2328	2840	2840	5968	10923	8063	2365	254	675	1534	22	3241	990	1311
		EU-España	53319	63660	50538	51594	38538	38513	36008	44520	37226	30954	25466	44837	38751	28178	22292	23723	35124	36722	41235	56908	67040	66911	51628	46085	52110	57458	52912	48378	31804	37865
		EU-Estonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		EU-France	21883	33691	32798	25239	23068	17035	18323	21800	18149	16320	16180	19336	21326	14850	7033	6196	4439	7790	14900	13067	13139	16173	17674	20960	19342	16574	23112	20438	12800	16178
		EU-Germany	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
		EU-Greece	0	0	0	0	0	0	0	0	0	0	0	102	99	99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		EU-Ireland	0	0	0	0	0	0	0	0	0	0	0	0	14	14	14	0	0	8	6	0	0	0	0	0	0	7	0	0	0	0
		EU-Italy	0	0	0	0	0	0	0	0	0	0	4	29	34	17	0	0	0	0	0	0	0	0	0	0	47	57	91	131	402	69
		EU-Latvia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		EU-Lithuania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	95	0	0	6	0	0	0	0
		EU-Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	2	0	6
		EU-Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	9	0	0	23	0	0	0	0	0	5	1	0	0	0
		EU-Portugal	7477	5651	7528	4996	8297	4399	4544	1810	1302	2167	2958	4315	8504	4735	11158	8995	6057	1084	12974	4143	2794	4049	1712	1347	708	1785	7480	2799	1033	6640
		EU-Rumania	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6970	16949	14577	17045	16729	14806	9374
		Gabon	0	1	11	51	26	0	59	76	21	101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Gambia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	
		Ghana	18967	20225	21258	18607	24205	26380	43612	54088	36517	57540	40194	34435	47746	54209	31934	35419	38648	43922	45505	44169	54032	48064	49986	61849	54723	57496	68147	62855	63223	44489
		Guatemala	0	0	0	0	0	0	0	0	0	0	0	2120	4808	6389	4959	5546	6319	4036	2951	2829	3631	4907	5811	7078	7386	9800	8648	7626	6503	5873
		Guinea Ecuatorial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1224	1224	1010	0	1	1	3	1	0	1	1	1	1
		Guinée Rep	0	0	0	975	6432	2408	0	0	0	0	0	0	0	0	0	0	0	0	1500	1473	7942	7363	5484	0	0	0	0	0	0	888
		Japan	2378	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	1	4	5	2	4	1	1	3	5	2	3
		Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	1	1
		Liberia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	61	80	49	98	21	19	29	21	6770	489
		Maroc	880	3652	3672	6886	2859	5532	4741	4176	4091	1737	1303	3403	3843	4666	4032	1592	1309	2580	2343	2151	2267	2045	1068	576	258	750	3585	1258	3171	5503
		Namibia	0	0	2	15	0	1	0	0	0	8	0	0	0	0	0	0	0	71	2	2	15	1	0	0	1	1	0	0	1	11
		Nigeria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	12	4	0	0	0	6	2	0	0	0	0
		Norway	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Panama	8719	13027	12978	14853	5855	1300	572	1308	1559	281	342	0	7126	11490	13468	18821	8253	8518	9590	12509	10927	14558	14165	8372	11510	8815	9089	10926	10626	1051
		Russian Federation	1110	540	1471	1450	381	1146	2086	1426	374	0	0	0	0	0	392	1130	313	260	0	20	0	0	2	1	1	110	178	25	6	0
		S Tomé e Príncipe	178	212	190	180	187	178	169	181	179	179	179	179	117	166	143	0	229	235	241	247	254	260	266	360	380	346	15	5	51	53
		Senegal	260	108	64	282	238	429	1983	1784	1357	1284	1178	639	1456	5033	3858	4552	3045	4566	2743	5441	4477	4659	3931	5943	17082	25431	28476	30633	23286	29537
		South Africa	7	6	4	4	1	6	2	1	7	1	1	2	2	1	0	0	4	4	2	6	8	2	5	2	2	1	2	2	1	1
		St Vincent and Grenadines	4397	5731	2184	1847	1501	1191	1441	2127	1422	1435	524	42	0	0	1	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0
		Syria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	36	0	0	0	15	17	0	0	0	0	0	0	0	0
		UK-Sta Helena	16	65	55	115	86	294	298	13	64	205	63	178	317	321	88	110	45	15	25	371	29	7	26	6	127	9	7	28	1	2
		USA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		USSR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Venezuela	0	0	0	0	0	0	0	0	0	35	2407	1197	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	NCC	Chinese Taipei	3	2	10	3	5	47	73	39	41	24	23	26	16	10	9	14	19	6	11	15	2	12	9	4	2	2	3	4	4	4
	NCO	Benin	2	2	2	2	2	7	3	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Cayman Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Congo	9	10	7	7	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Cuba	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

				1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
			NEI (ETRO)	1830	133	744	2803	0	27	0	0	0	760	148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Vanuatu	5468	10808	10896	8477	5992	1233	0	1192	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	ATW	CP	Barbados	5	6	6	6	5	5	10	3	3	0	0	0	0	0	0	0	0	0	0	1	2	0	1	1	1	2	1	1	0	0
			Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	164	0	0	0	0	0
			Brazil	18535	17771	20588	16560	22528	26564	23789	23188	25164	24146	18338	20416	23037	26388	23270	24191	20846	23307	23456	30571	30863	32438	25195	18133	18231	20068	19687	17925	17432	18788
			Canada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	94	0	88	0
			Curaçao	40	45	40	35	30	30	30	30	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	100	123	157	35	30	0
			EU-España	1120	397	0	0	0	0	0	1	1	0	0	0	0	0	0	5	11	0	0	0	0	0	0	0	641	223	109	192	124	78
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	10	0	0	0	0	25	224	282	23	2	210
			EU-Portugal	0	0	0	0	0	0	0	0	4	1	0	3	3	5	21	11	0	6	0	8	0	0	0	0	0	0	0	0	0	0
			El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	85	35	135	27	0	70	0
			Ghana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	232	67	160	265	160	411	1234	700	283	0
			Grenada	30	25	11	12	11	15	23	23	23	15	14	16	21	22	15	26	20	0	0	0	0	0	0	22	17	17	18	30	10	
			Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	86	54	44	7	91
			Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
			Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Mexico	8	1	1	0	2	3	6	51	13	54	71	75	9	7	10	7	8	9	7	9	8	5	5	7	10	6	6	4	4	3
			Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	543	410	161	185	0	0	22	40	0
			St Vincent and Grenadine	20	66	56	53	37	42	57	37	68	97	357	92	251	251	355	90	83	54	46	50	0	36	39	47	0	78	36	35	29	0
			Trinidad and Tobago	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			UK-Bermuda	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
			USA	560	367	99	82	85	84	106	152	44	70	88	79	103	30	61	66	67	119	95	107	99	326	183	94	179	199	78	46	68	65
			Venezuela	7834	11172	6697	2387	3574	3834	4114	2981	2890	6870	2554	3247	3270	1093	2008	921	757	2250	2119	1473	1742	1002	1179	2019	2317	2222	1276	927	614	694
		NCC	Chinese Taipei	26	9	7	2	10	1	2	1	0	1	16	14	27	28	29	2	8	0	2	1	11	1	2	21	17	34	32	27	19	19
		NCO	Argentina	123	50	1	0	1	0	2	0	1	0	0	0	30	0	0	0	0	3	12	0	0	0	0	0	0	0	0	0	0	
			Colombia	0	2074	789	1583	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Cuba	1638	1017	1268	886	1000	1000	651	651	651	0	0	624	545	514	536	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Dominica	41	24	43	33	33	33	33	85	86	45	55	51	30	20	28	32	45	25	0	13	0	4	41	16	27	21	11	10	4	
			Dominican Republic	135	143	257	146	146	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Jamaica	0	0	0	0	62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	0	
			Saint Kitts and Nevis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	
			Sta Lucia	39	53	86	72	38	100	263	153	216	151	106	132	137	159	120	89	168	0	153	143	109	171	139	87	138	142	122	78	0	
Landings(FP)	ATE	CP	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114	395	368	179	636	301	0	0	0	0	0	0	0
			Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	419	131	162	276	603	726	411	230	428	1362	1485	1046	327	512	355	410	0
			Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	88	171	116	105	917	415	441	545	520	351	0	0	0	0	0	0	447
			Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42	562	544	202	0	0	0	0	0	0	0
			EU-España	4455	5959	4719	2899	453	1990	2562	3802	3700	0	0	1738	1907	713	437	366	1158	1994	1394	1842	983	998	1623	3028	3658	2788	1943	2396	1809	2035
			EU-France	5355	8055	7573	5568	2447	3414	3647	4316	4740	1786	1601	3484	3096	918	346	206	287	1120	743	1480	1646	463	440	1716	1920	893	2169	1616	1681	2206
			Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	260	69	66	162	59	136	51	102	72	93	0	0	0	0	0	0	180
			Guinée Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	387	0	330	118	359	614	1778	2379	1670	2146	0	0	0	0	0	0	0
			Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	796	548	977	693	680	354	609	284	962	400	0	0	0	0	0	0	0
		NCO	Mixed flags (EU tropical)	2959	3858	3568	4543	1316	2345	1508	1119	2194	218	65	1547	2953	1708	1478	3003	2998	2624	3427	2372	0	0	0	4484	8603	4618	6499	5396	6710	
	ATW	CP	Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	9	0	9	0
			EU-España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	67	35	7	13	9	0
		NCO	Mixed flags (EU tropical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	58	37	21	29	6	17	
Discards	ATE	CP	Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	631	0	94	56	208	22	35
			Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Russian Federation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	ATW	CP	EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
			Mexico	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

SKJ-Table 2. CAS (catch-at-size) matrix estimated for E-SKJ (eastern stock) in thousands of fish caught, by year and 2 cm size classes.

Li (2cm)	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
20	0	0	1	0	0	0	0	66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	1	6	0	0	0	0	2	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	6	34	4	0	0	0	0	0	1	0	14	0	0	0	0	0	0	1	1	1	1	2	1	2	2	1
26	1	13	45	4	0	0	0	0	0	3	0	7	37	1	1	1	1	0	5	5	5	6	16	13	19	17	17
28	2	20	98	40	1	14	1	2	0	4	3	10	207	28	8	4	4	2	29	28	31	35	92	78	109	97	81
30	3	18	25	4	6	40	11	59	7	49	30	69	195	82	63	30	22	13	139	145	154	186	462	379	549	471	390
32	3	16	28	18	10	63	15	73	67	58	211	221	315	180	175	90	53	40	436	463	492	587	1430	1189	1645	1521	1261
34	31	57	88	93	131	279	54	169	200	197	314	543	664	489	460	262	206	145	935	975	1064	1188	2765	2283	3192	3004	2456
36	73	112	161	167	358	744	246	386	493	632	895	1950	1008	1194	1037	652	603	573	1475	1638	1634	1860	4149	3373	4643	4385	3768
38	240	377	707	904	1013	2078	644	1318	1345	1514	1718	3110	2914	2512	2115	1264	1301	1183	1788	2595	2452	2874	5454	4087	5796	5489	5337
40	466	834	1771	1850	2584	5500	1396	3105	2984	3467	2818	4613	5792	5083	4161	2828	3003	1923	2873	4772	3890	4250	7835	6102	8632	6798	8127
42	870	1685	3268	3123	4836	8551	2181	4038	4286	5124	3817	6139	8555	7530	7647	5279	5163	3688	5155	8087	5912	6321	12267	9322	12041	10183	12771
44	1555	3301	5077	4843	7418	9364	2744	4676	5359	6572	5133	6514	9817	9390	9033	6635	5633	6784	6801	11022	7190	8355	15072	11687	14621	13058	14890
46	1299	3188	4128	3953	5969	8204	2764	3994	6284	7182	6053	6165	8229	11027	9690	6104	4738	8674	7537	10436	7591	9682	15780	12262	16248	14204	13457
48	1070	2590	3555	3821	3685	6076	2129	3357	6648	5961	4708	5337	5538	7235	6943	5245	3954	7097	5951	7628	5988	8055	12395	8430	11789	11042	9206
50	981	1776	3289	3385	2159	4020	1977	2823	5797	4095	3339	3774	3842	4527	3898	4579	3110	4439	4213	4525	4220	5286	8042	4824	5781	5622	4329
52	1150	1783	3229	3129	1952	2564	1798	1836	3838	2692	2055	2821	2725	3131	2459	3467	2431	2847	3113	2746	2605	3173	4461	2687	2954	3549	2251
54	1138	1627	2775	2693	1915	1760	1470	1529	2528	2046	1420	1875	1767	2110	1420	2119	1756	1617	1648	1592	1396	1965	2516	1507	1815	1647	1053
56	797	1122	1681	1702	1343	1086	1168	1073	1697	1616	967	1110	1005	1648	771	1056	1145	898	943	976	777	1081	1388	887	1132	1009	681
58	498	606	927	853	770	651	579	635	1130	1169	632	639	595	942	445	469	740	468	521	600	411	569	868	595	700	626	583
60	275	317	458	354	294	611	535	385	760	613	565	532	375	516	319	232	494	219	394	401	271	404	469	472	501	441	474
62	115	135	198	194	165	303	236	177	393	445	491	370	315	217	192	199	347	137	248	269	205	288	308	388	336	267	359
64	29	63	111	89	80	105	205	93	238	203	343	223	144	114	135	160	203	74	149	144	117	223	189	330	157	194	220
66	8	24	37	42	52	127	222	45	122	149	201	153	111	91	61	122	104	37	91	51	41	142	137	251	96	129	133
68	8	8	24	19	36	41	106	21	93	107	177	121	66	35	32	75	56	10	30	16	19	78	81	166	95	98	78
70	1	0	0	6	8	27	71	22	37	75	61	69	35	21	7	35	22	2	8	4	32	25	35	99	38	39	37
72	1	0	0	1	1	3	34	6	5	34	29	34	28	9	12	8	7	1	3	4	27	10	13	26	9	25	23
74	4	7	10	12	8	3	23	3	2	9	12	4	8	5	1	6	3	0	1	6	10	1	1	13	7	8	7
76	0	0	0	0	0	2	7	0	6	2	1	2	2	1	0	1	0	0	1	7	1	0	0	4	3	1	1
78	0	0	0	0	0	5	2	1	11	5	0	0	1	1	1	1	0	0	1	9	1	0	0	3	0	0	0
80	0	0	0	0	0	0	7	1	5	0	0	1	0	1	0	1	0	0	1	3	0	0	0	0	0	0	0
82	0	0	0	0	0	0	0	0	9	0	0	0	0	2	0	0	0	0	1	1	0	0	0	0	0	0	0
84	0	0	0	0	0	0	0	0	3	4	13	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0
86	0	0	0	0	0	0	0	0	6	9	26	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
88	0	1	0	0	0	0	0	0	9	9	26	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
90	0	1	0	0	0	232	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
TOTAL	10619	19687	31734	31305	34796	52451	20627	29895	44370	44045	36061	46425	54290	58121	51087	40924	35098	40871	44495	59151	46536	56644	96228	71456	92910	83925	81992

Li (2cm)	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
20	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	1	0	0	0	0	4145	0	0	1	0
22	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	3	0	1	15	3	0	5
24	0	1	1	1	2	0	0	1	6	1	3	1	7	10	21	1	0	0	8	6	13	24	11	5	4
26	4	8	8	11	11	7	2	7	10	11	6	8	41	25	55	5	5	4	20	20	30	27	57	30	28
28	27	61	63	60	70	33	26	41	67	35	34	48	95	67	118	22	55	29	80	60	117	134	123	89	116
30	145	330	311	342	366	138	142	293	523	230	183	288	382	269	324	252	383	246	349	455	811	779	719	516	515
32	520	1028	920	1118	1168	483	378	1005	1791	706	584	1081	1045	1054	1046	1108	1326	843	1009	1451	2568	2318	2392	1796	1976
34	1316	2085	1716	2414	2336	953	811	2030	3453	1973	1172	2523	2423	2818	3055	3499	4131	2045	2472	3529	5516	5277	5913	4051	4521
36	2731	3422	2592	3665	3723	2160	1633	3284	4677	3304	1866	4639	3792	5386	5557	7082	7362	3363	4997	5964	7583	9332	10659	7674	7431
38	3556	4249	3244	4565	4638	3721	2716	4526	5178	4478	2954	6275	4740	6189	7031	9873	9477	4466	6209	5823	9489	14112	15679	10985	10105
40	5582	5415	4409	7059	6654	6391	4148	6205	6422	6544	4683	8124	5773	6455	9679	11951	11654	6108	8236	8495	14280	19006	22065	17171	15242
42	9548	7912	6743	10726	8182	9074	5832	8788	8143	9041	6848	8711	7685	7242	10924	13469	12299	7297	9701	13151	16993	20404	25817	19362	16646
44	11521	8926	9530	13306	8473	10222	7138	10306	9769	10159	8166	8429	8521	8344	11115	13559	12459	9324	11775	16208	16143	19485	24687	19420	15613
46	12145	10178	11360	12818	8123	9029	7592	9235	10458	9695	7986	7391	7671	8264	10545	11421	13222	10319	12328	13482	12622	16231	20569	17256	13770
48	8467	7895	9350	8939	6779	7583	6667	7057	9988	7959	6498	5397	6207	6472	9279	8567	10897	9866	10236	9728	10546	11076	13409	12417	9867
50	3815	4210	5722	6353	4950	5544	4486	4954	6982	6023	4470	3551	4249	4631	6480	5888	7511	7909	6708	6814	7857	6535	7502	7507	5843
52	2247	2642	3894	3452	2971	3504	2709	2865	4050	3681	2958	2531	3143	3226	4293	4268	5302	6903	5023	5597	5315	3923	4229	4857	4062
54	1365	1129	1829	2042	2243	2052	1574	1675	2209	2202	2008	1774	2117	2476	2347	2925	3574	6114	3868	3969	3880	2328	2500	3042	2598
56	948	691	1014	1060	1304	1104	938	1091	1433	1552	1408	1148	1388	1750	1525	1942	2645	4544	2919	2828	2601	1664	1534	2528	1996
58	645	489	701	652	900	797	609	776	826	955	800	779	908	1393	918	1373	1866	3474	2147	2038	1943	1070	1154	1785	1547
60	468	345	441	403	563	552	398	576	580	642	435	637	696	924	556	780	1583	2560	1681	1398	1291	866	926	1559	1253
62	305	246	239	220	335	346	227	364	405	460	267	418	412	644	373	504	1144	1969	1233	956	826	621	565	946	811
64	176	129	150	171	152	216	116	224	280	297	137	187	335	472	181	262	637	1322	875	571	584	400	275	614	542
66	111	47	75	107	79	112	54	184	134	155	79	103	126	145	68	134	300	706	584	474	348	169	96	334	362
68	75	38	24	40	38	77	31	91	68	99	61	33	46	75	47	53	139	239	329	378	220	99	48	158	154
70	30	12	20	19	52	20	16	46	28	24	28	17	17	35	9	29	18	85	170	337	104	39	22	44	38
72	5	5	8	11	20	7	12	27	14	15	11	18	11	37	9	9	19	31	50	161	84	33	2	11	7
74	1	0	2	1	3	2	10	12	7	7	5	20	16	11	0	4	4	10	5	88	33	13	1	4	1
76	0	3	2	3	3	2	4	2	3	5	9	12	8	1	1	3	1	2	1	4	8	4	0	0	0
78	0	0	0	0	1	3	3	4	1	3	4	3	1	1	1	3	0	0	1	1	0	2	0	1	0
80	0	0	1	1	0	0	1	2	0	1	3	2	2	0	1	1	0	0	0	0	1	1	0	1	0
82	0	3	1	0	0	0	1	1	18	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
84	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
86	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
88	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
90	0	4	2	0	0	1	0	1	1	2	5	0	0	0	1	2	1	0	2	0	1	0	0	0	0
TOTAL	65756	61508	64371	79561	64138	64134	48273	65674	77527	70263	53671	64151	61860	68417	85562	98989	108017	89778	93021	103985	125952	135986	160957	134165	115056

SKJ-Table 3. CAS (catch-at-size) matrix estimated for W-SKJ (western stock) in thousands of fish caught, by year and 2 cm size classes.

	Year																								
Li (2cm)	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0
24	0	1	1	1	1	1	0	0	0	1	0	2	0	0	0	0	0	0	0	0	1	1	0	0	2
26	1	1	1	1	1	1	1	1	1	1	0	1	0	0	1	0	0	0	1	0	1	0	1	0	0
28	1	2	2	2	2	2	1	1	1	1	0	1	0	0	1	0	0	0	2	1	2	1	3	0	1
30	2	3	2	2	2	3	2	2	1	4	1	8	1	2	1	1	12	15	3	1	2	1	4	0	17
32	5	7	6	6	6	7	7	8	7	10	5	14	1	1	1	2	15	33	4	4	4	2	13	1	56
34	5	7	6	6	6	7	26	30	27	16	11	18	2	1	3	10	14	24	5	5	6	3	30	22	127
36	7	10	9	8	9	13	39	45	40	23	22	23	4	3	17	29	74	62	16	15	35	33	49	77	305
38	23	34	30	30	30	46	66	70	64	44	49	44	8	6	27	57	59	121	75	36	76	48	129	68	512
40	25	38	34	36	35	78	107	117	106	83	84	91	30	34	56	166	694	305	105	63	86	67	202	121	586
42	33	50	45	49	47	116	110	110	104	113	95	186	119	342	385	706	1047	383	93	108	121	101	393	221	687
44	50	75	67	75	73	161	161	147	140	160	127	273	211	556	600	1016	1100	407	311	229	235	147	518	357	894
46	59	87	78	81	89	175	159	149	140	210	153	266	231	253	373	547	945	551	385	389	419	357	764	530	855
48	55	82	72	72	89	166	152	154	148	219	154	274	300	289	380	475	1041	710	648	647	583	756	1070	707	793
50	54	79	69	68	93	129	127	130	123	198	188	241	461	436	588	582	1637	922	729	919	958	1258	1204	741	833
52	43	56	48	52	63	84	107	120	95	165	131	192	792	847	877	986	1448	1111	701	929	1183	1473	1291	821	885
54	30	39	32	34	43	61	83	87	69	139	106	197	710	1025	933	1122	1437	1288	795	778	1129	1437	1214	863	1213
56	29	36	27	27	31	41	64	72	58	116	119	215	684	932	811	824	1300	1323	854	743	952	1067	1093	851	991
58	31	34	22	25	27	30	41	56	49	98	123	278	467	676	643	638	1054	1003	792	682	830	565	855	790	898
60	37	41	27	31	37	33	43	62	52	76	113	289	496	550	529	527	681	691	528	509	424	287	588	595	553
62	21	25	16	16	27	19	19	26	25	55	85	241	400	580	491	592	390	369	251	326	265	187	373	399	362
64	21	24	17	18	25	21	16	23	20	51	73	187	313	461	359	422	184	168	155	189	121	68	182	282	271
66	11	10	6	9	10	7	12	22	18	49	46	136	253	420	354	419	95	86	103	97	83	49	119	159	97
68	8	11	7	7	10	9	5	6	7	38	34	89	121	280	269	255	54	42	90	40	51	19	49	127	41
70	16	23	21	19	24	27	8	5	5	26	21	64	83	211	229	238	33	34	51	19	56	9	19	81	66
72	10	15	14	12	17	17	5	3	3	13	12	25	50	79	102	79	30	21	53	16	14	5	31	85	18
74	2	4	4	3	6	6	4	2	2	7	7	16	36	26	48	22	11	10	29	19	14	13	15	39	21
76	0	1	1	1	2	1	1	0	0	4	4	12	24	18	41	12	2	4	10	7	5	5	15	34	30
78	0	0	0	0	1	1	0	0	0	6	7	3	10	6	16	7	2	2	3	15	11	11	13	38	8
80	0	0	0	0	1	0	0	0	0	4	8	0	0	1	4	5	1	1	1	1	0	0	5	3	4
82	0	0	0	0	0	0	0	0	0	9	4	0	0	1	2	11	0	1	1	0	11	7	16	11	2
84	0	0	0	0	1	0	0	0	0	6	4	0	0	0	0	2	1	0	0	0	0	0	1	6	2
86	0	0	0	0	0	0	0	0	0	1	4	0	0	0	0	1	0	0	1	1	0	0	0	0	0
88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	28	1
TOTAL	578	796	665	693	808	1263	1369	1449	1303	1944	1792	3385	5808	8036	8141	9750	13363	9691	6797	6786	7677	7979	10258	8057	11131

	Year																										
Li (2cm)	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	18	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	7	0	0	0	0	0	1	0	0	0	0
26	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	6	0	0	0	0	0	1	0	3	0	0
28	5	1	0	0	0	0	0	0	0	0	1	3	0	1	0	1	0	0	0	14	33	0	4	2	2	1	2
30	10	2	1	2	0	2	0	4	0	2	10	6	3	2	1	2	1	1	1	36	0	1	16	10	8	4	4
32	31	4	2	3	1	3	8	11	2	4	16	9	0	9	1	10	5	2	0	12	1	4	39	24	59	30	11
34	35	11	8	11	5	11	29	52	8	10	34	16	0	23	3	23	13	6	0	15	33	29	109	87	62	48	48
36	58	32	27	34	10	27	32	86	16	12	24	34	2	39	12	40	28	21	11	8	1	14	300	271	242	214	207
38	148	79	65	75	48	75	92	144	29	30	47	45	9	78	13	69	47	30	12	10	136	74	453	435	398	378	350
40	281	114	152	174	119	147	144	294	45	84	67	102	30	94	25	76	70	35	26	187	75	141	244	335	248	160	149
42	326	146	173	167	140	125	150	350	74	175	128	247	105	133	190	160	278	242	309	93	150	185	265	571	295	226	165
44	512	204	208	187	177	132	201	425	103	319	382	458	338	223	362	288	479	475	596	295	61	512	396	843	439	350	277
46	716	283	320	302	296	185	187	413	188	473	901	634	477	316	442	615	634	735	742	524	994	571	636	988	769	592	489
48	837	434	510	466	400	344	312	577	329	567	1228	909	899	411	908	847	850	1035	996	507	1622	842	894	1096	1097	894	694
50	981	531	579	732	522	517	519	801	526	614	1316	1337	1207	696	979	963	900	1163	995	2050	2410	486	1004	1061	1140	975	816
52	1020	621	690	1000	826	697	735	935	689	675	904	1486	1306	775	704	1053	807	1154	981	3063	1783	494	972	980	1025	918	783
54	914	607	739	1180	963	821	895	1013	725	740	809	1426	1327	587	501	898	686	1026	919	1536	807	439	616	632	834	711	486
56	899	566	775	1206	935	898	959	952	714	745	726	1091	955	478	391	758	570	841	784	667	420	429	758	689	599	616	562
58	798	626	850	1063	1004	985	1066	817	620	684	568	543	723	418	388	611	484	692	701	843	341	550	663	661	603	601	562
60	647	538	743	782	880	861	916	551	407	457	471	334	356	404	302	493	396	547	584	526	107	389	218	205	200	184	256
62	420	436	584	509	569	556	602	449	321	371	372	175	188	368	217	322	277	375	416	287	203	446	116	100	79	70	108
64	219	256	340	292	297	291	321	327	230	256	265	107	102	405	113	147	123	170	190	20	68	215	64	46	67	37	48
66	86	114	157	193	194	190	208	268	196	214	109	39	49	322	123	113	129	145	168	2	69	156	35	11	9	5	35
68	43	64	85	99	103	104	104	197	136	149	37	19	11	270	136	78	150	151	186	1	38	96	19	9	9	3	12
70	35	57	73	41	47	46	41	57	48	47	17	21	0	146	117	47	128	121	157	0	2	22	14	5	5	1	27
72	28	49	54	13	10	12	10	50	40	41	14	19	0	75	56	27	72	61	76	1	0	22	12	3	3	3	24
74	27	26	26	11	9	9	7	31	25	26	7	8	6	50	70	10	76	65	91	19	5	24	4	3	3	1	0
76	13	12	8	4	5	2	3	25	16	16	8	4	9	31	41	10	46	38	52	1	1	3	4	2	5	1	22
78	10	16	13	8	5	5	5	2	2	2	6	5	7	5	27	1	29	24	34	20	0	12	1	1	54	28	0
80	1	3	5	0	0	0	0	4	3	6	5	3	6	6	22	5	24	19	26	0	0	0	0	1	10	13	21
82	1	1	2	0	1	0	0	2	2	2	0	0	0	3	7	1	7	6	9	2	0	6	0	1	6	5	21
84	7	0	0	0	0	0	0	0	0	0	0	3	0	0	0	1	0	0	0	0	6	0	0	1	1	0	0
86	2	3	4	0	0	0	0	0	0	0	0	0	0	0	7	1	7	6	9	0	6	3	0	4	0	0	21
88	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	7	1	0	0	0
90	1	1	0	0	1	0	0	0	8	1	3	0	0	1	0	0	1	0	0	24	11	0	14	6	0	1	0
TOTAL	9116	5838	7193	8555	7567	7046	7548	8837	5500	6722	8478	9085	8116	6369	6161	7670	7332	9187	9072	10781	9382	6165	7881	9085	8272	7072	6201

SKJ-Table 4. E-SKJ The probability of stock biomass being below 10% or 20% of B_{MSY} during the projection period for a given catch level and is based on 180,000 iterations of the MVLN and MCMC statistical analyses developed from the Stock Synthesis and JABBA model runs (2 model platforms x 3 steepness options x 3 growth/M options x 2 index combinations).

Probability of B<10%*B_{MSY}

TAC (kt)	2023	2024	2025	2026	2027	2028
100	5%	6%	6%	6%	6%	6%
110	5%	6%	6%	6%	6%	7%
120	5%	6%	6%	7%	7%	7%
130	5%	6%	7%	7%	7%	7%
140	5%	6%	7%	7%	7%	7%
150	5%	6%	7%	7%	8%	8%
160	5%	7%	7%	8%	8%	8%
170	5%	7%	7%	8%	8%	9%
180	5%	7%	8%	8%	9%	9%
190	5%	7%	8%	9%	9%	10%
200	5%	7%	8%	9%	10%	10%
210	5%	7%	9%	10%	11%	12%
220	5%	7%	9%	10%	12%	14%
230	5%	7%	9%	11%	14%	15%
240	5%	8%	10%	13%	15%	17%
250	5%	8%	10%	14%	17%	20%
260	5%	8%	11%	15%	19%	23%
270	5%	8%	13%	17%	21%	31%
280	5%	9%	14%	18%	27%	48%
290	5%	9%	15%	21%	41%	51%
300	5%	10%	16%	27%	49%	54%

Probability of B<20%*B_{MSY}

TAC (kt)	2023	2024	2025	2026	2027	2028
100	6%	6%	6%	6%	6%	6%
110	6%	6%	6%	7%	7%	7%
120	6%	6%	7%	7%	7%	7%
130	6%	7%	7%	7%	7%	7%
140	6%	7%	7%	7%	7%	7%
150	6%	7%	7%	8%	8%	8%
160	6%	7%	7%	8%	8%	8%
170	6%	7%	8%	8%	8%	9%
180	6%	7%	8%	9%	9%	9%
190	6%	7%	8%	9%	10%	10%
200	6%	7%	9%	9%	10%	11%
210	6%	8%	9%	10%	11%	14%
220	6%	8%	9%	11%	14%	17%
230	6%	8%	10%	13%	17%	20%
240	6%	8%	11%	16%	19%	22%
250	6%	9%	13%	18%	22%	26%
260	6%	9%	15%	20%	25%	32%
270	6%	10%	17%	22%	29%	43%
280	6%	11%	18%	25%	38%	61%
290	6%	12%	20%	30%	54%	64%
300	6%	13%	22%	38%	61%	67%

SKJ-Table 5. E-SKJ - Joint probabilities of the eastern Atlantic skipjack stock being below F_{MSY} (overfishing not occurring), above B_{MSY} (not overfished) and above B_{MSY} and below F_{MSY} (green zone) in a given year for a given catch level (thousand t), based on 90,000 iterations of the MVLN approximation for Stock Synthesis and 90,000 MCMC iterations for JABBA.

Probaility $F<=F_{MSY}$

TAC (kt)	2023	2024	2025	2026	2027	2028
100	91%	92%	93%	93%	93%	94%
110	90%	92%	92%	93%	93%	93%
120	89%	91%	92%	92%	93%	93%
130	88%	90%	91%	92%	92%	92%
140	87%	89%	90%	91%	91%	92%
150	85%	87%	88%	89%	90%	90%
160	84%	85%	86%	87%	88%	88%
170	82%	84%	84%	85%	85%	86%
180	81%	81%	82%	82%	82%	82%
190	79%	79%	79%	78%	77%	76%
200	77%	76%	75%	73%	71%	70%
210	75%	73%	71%	68%	65%	63%
220	73%	70%	67%	63%	59%	57%
230	71%	67%	62%	57%	53%	50%
240	69%	63%	57%	51%	46%	42%
250	67%	60%	52%	45%	39%	35%
260	65%	56%	47%	38%	32%	27%
270	63%	52%	42%	33%	26%	20%
280	60%	48%	36%	27%	20%	14%
290	58%	44%	31%	21%	14%	10%
300	56%	40%	26%	16%	10%	7%

Probability $SSB>=SSB_{MSY}$ or $B>=B_{MSY}$

TAC (kt)	2023	2024	2025	2026	2027	2028
100	82%	88%	91%	92%	93%	93%
110	82%	88%	90%	92%	92%	93%
120	82%	87%	90%	91%	92%	92%
130	82%	87%	89%	91%	92%	92%
140	81%	86%	88%	90%	91%	91%
150	81%	85%	87%	89%	90%	90%
160	81%	84%	86%	87%	88%	89%
170	80%	83%	84%	85%	86%	87%
180	80%	81%	82%	82%	82%	83%
190	79%	80%	80%	79%	78%	77%
200	79%	78%	77%	74%	72%	70%
210	78%	76%	73%	70%	66%	63%
220	77%	74%	69%	64%	60%	58%
230	77%	72%	65%	59%	55%	52%
240	76%	69%	61%	54%	49%	45%
250	75%	66%	57%	49%	43%	37%
260	74%	63%	53%	44%	36%	29%
270	73%	61%	48%	38%	29%	19%
280	72%	57%	44%	32%	20%	12%
290	71%	54%	39%	24%	12%	9%
300	70%	51%	34%	17%	9%	7%

Probability $F<=F_{MSY}$ and $SSB>=SSB_{MSY}$ or $B>=B_{MSY}$

TAC (kt)	2023	2024	2025	2026	2027	2028
100	82%	88%	91%	92%	93%	93%
110	82%	88%	90%	92%	92%	93%
120	81%	87%	90%	91%	92%	92%
130	81%	86%	89%	90%	91%	92%
140	81%	85%	88%	89%	90%	91%
150	80%	84%	86%	88%	89%	90%
160	79%	83%	84%	86%	87%	88%
170	79%	81%	83%	84%	84%	85%
180	78%	79%	80%	80%	81%	81%
190	77%	77%	77%	77%	76%	75%
200	76%	75%	74%	72%	70%	68%
210	75%	72%	70%	67%	63%	61%
220	73%	70%	65%	61%	57%	55%
230	71%	66%	60%	55%	51%	48%
240	69%	63%	55%	49%	45%	41%
250	67%	59%	50%	43%	38%	33%
260	65%	54%	45%	37%	31%	25%
270	62%	50%	40%	32%	24%	17%
280	60%	46%	34%	26%	17%	10%
290	58%	41%	30%	19%	10%	8%
300	55%	38%	25%	13%	7%	6%

SKJ-Table 6. W-SKJ - The probability of stock biomass being below 10% or 20% of B_{MSY} during the projection period for a given catch level and is based on 200,000 iterations of the MVLN approximation for the Stock Synthesis.

Probability of B<10%*B_{MSY}

TAC (1000s mt)	2023	2024	2025	2026	2027	2028
16	0%	0%	0%	0%	0%	0%
18	0%	0%	0%	0%	0%	0%
20	0%	0%	0%	0%	0%	0%
22	0%	0%	0%	0%	0%	0%
24	0%	0%	0%	0%	0%	0%
26	0%	0%	0%	0%	0%	0%
28	0%	0%	0%	0%	0%	0%
30	0%	0%	0%	0%	0%	0%
32	0%	0%	0%	0%	0%	0%
33	0%	0%	0%	0%	0%	0%
34	0%	0%	0%	0%	0%	0%
35	0%	0%	0%	0%	0%	0%
36	0%	0%	0%	0%	0%	0%
38	0%	0%	0%	0%	0%	0%
40	0%	0%	0%	0%	0%	0%

Probability of B<20%*B_{MSY}

TAC (1000s mt)	2023	2024	2025	2026	2027	2028
16	0%	0%	0%	0%	0%	0%
18	0%	0%	0%	0%	0%	0%
20	0%	0%	0%	0%	0%	0%
22	0%	0%	0%	0%	0%	0%
24	0%	0%	0%	0%	0%	0%
26	0%	0%	0%	0%	0%	0%
28	0%	0%	0%	0%	0%	0%
30	0%	0%	0%	0%	0%	0%
32	0%	0%	0%	0%	0%	0%
33	0%	0%	0%	0%	0%	0%
34	0%	0%	0%	0%	0%	0%
35	0%	0%	0%	0%	0%	0%
36	0%	0%	0%	0%	0%	0%
38	0%	0%	0%	0%	0%	1%
40	0%	0%	0%	0%	1%	3%

SKJ-Table 7. W-SKJ - Estimated probabilities of the western Atlantic skipjack stock being below F_{MSY} (overfishing not occurring), above B_{MSY} (not overfished) and above B_{MSY} and below F_{MSY} (green zone) in a given year for a given catch level (thousand t), based on 200,000 iterations of the MVLN approximation.

Probaility F<=F_{MSY}

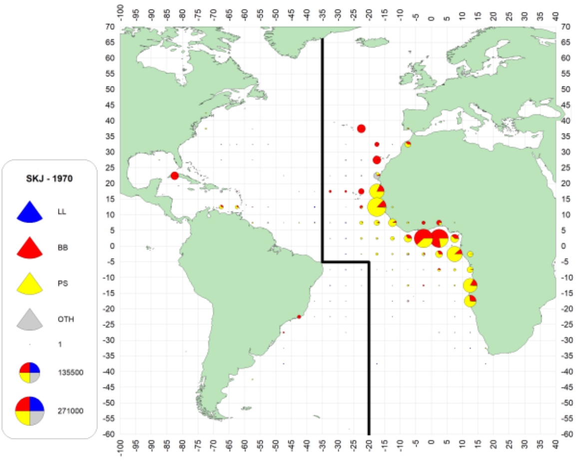
TAC (1000s mt)	2023	2024	2025	2026	2027	2028
16	100%	100%	100%	100%	100%	100%
18	100%	100%	100%	100%	100%	100%
20	100%	100%	100%	100%	100%	100%
22	99%	100%	100%	100%	100%	100%
24	99%	99%	99%	100%	100%	100%
26	98%	98%	98%	99%	99%	99%
28	97%	97%	97%	97%	97%	97%
30	96%	95%	94%	93%	93%	92%
32	94%	92%	91%	89%	87%	85%
33	93%	91%	88%	86%	83%	80%
34	92%	89%	86%	82%	79%	75%
35	91%	87%	83%	78%	74%	70%
36	90%	85%	80%	75%	70%	65%
38	88%	81%	74%	67%	61%	56%
40	85%	76%	67%	59%	53%	48%

Probability SSB>=SSB_{MSY}

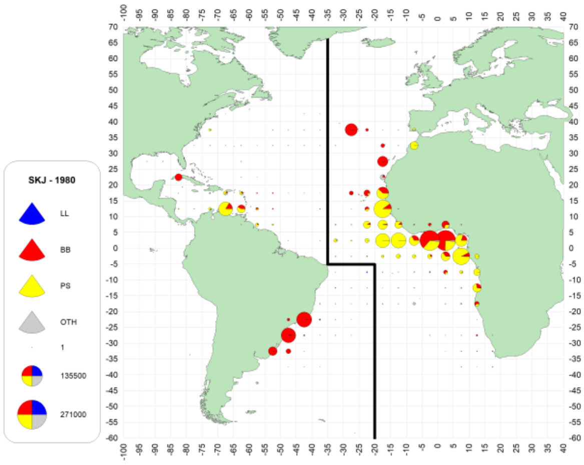
TAC (1000s mt)	2023	2024	2025	2026	2027	2028
16	99%	100%	100%	100%	100%	100%
18	99%	100%	100%	100%	100%	100%
20	99%	100%	100%	100%	100%	100%
22	99%	99%	100%	100%	100%	100%
24	99%	99%	99%	100%	100%	100%
26	98%	99%	99%	99%	99%	99%
28	98%	98%	98%	98%	98%	98%
30	98%	97%	96%	96%	95%	94%
32	97%	96%	94%	92%	90%	88%
33	97%	95%	93%	90%	87%	84%
34	96%	94%	91%	87%	83%	79%
35	96%	93%	89%	84%	79%	74%
36	96%	92%	87%	81%	75%	69%
38	95%	89%	82%	73%	66%	60%
40	94%	86%	76%	66%	59%	53%

Probability F<=F_{MSY} and SSB>=SSB_{MSY}

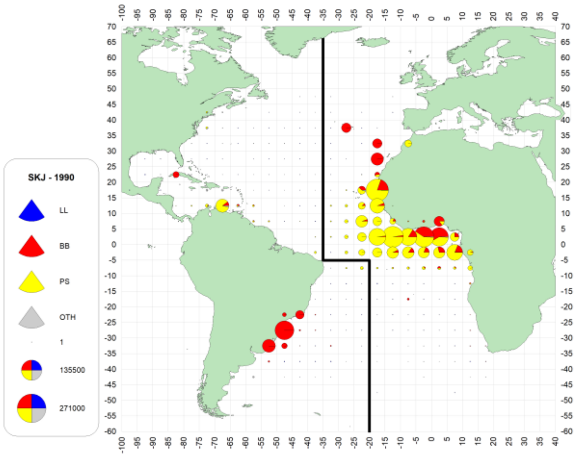
TAC (1000s mt)	2023	2024	2025	2026	2027	2028
16	99%	100%	100%	100%	100%	100%
18	99%	100%	100%	100%	100%	100%
20	99%	100%	100%	100%	100%	100%
22	99%	99%	100%	100%	100%	100%
24	99%	99%	99%	99%	100%	100%
26	98%	98%	98%	99%	99%	99%
28	97%	97%	97%	97%	97%	97%
30	96%	95%	94%	93%	93%	92%
32	94%	92%	91%	89%	87%	85%
33	93%	91%	88%	86%	83%	80%
34	92%	89%	86%	82%	79%	75%
35	91%	87%	83%	78%	74%	70%
36	90%	85%	80%	75%	70%	65%
38	88%	81%	74%	67%	61%	56%
40	85%	76%	67%	59%	53%	48%



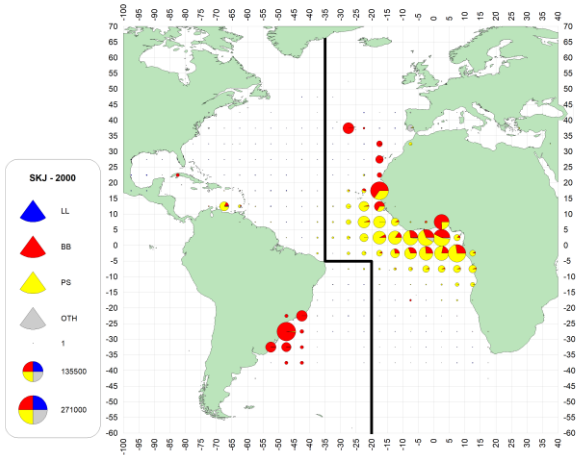
a. SKJ (1970-79)



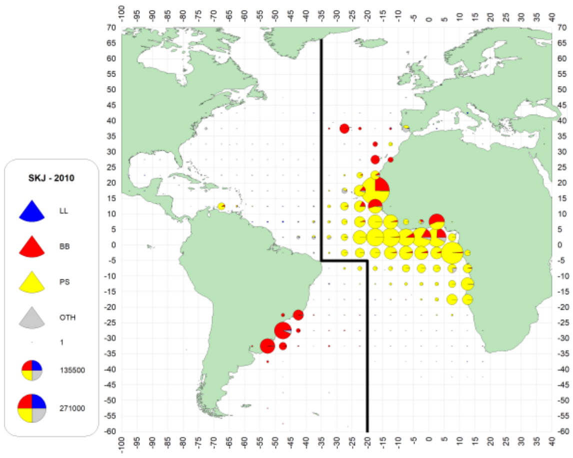
b. SKJ (1980-89)



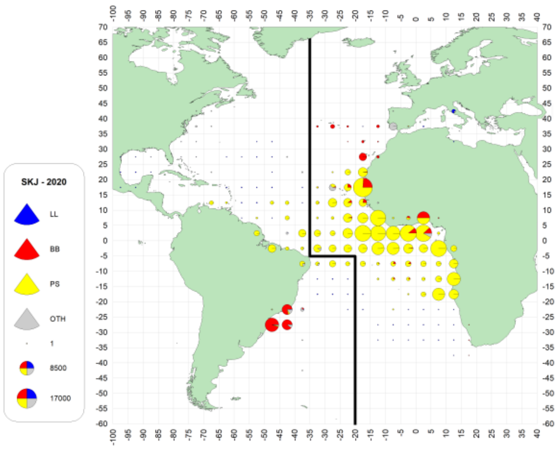
c. SKJ (1990-99)



d. SKJ (2000-09)

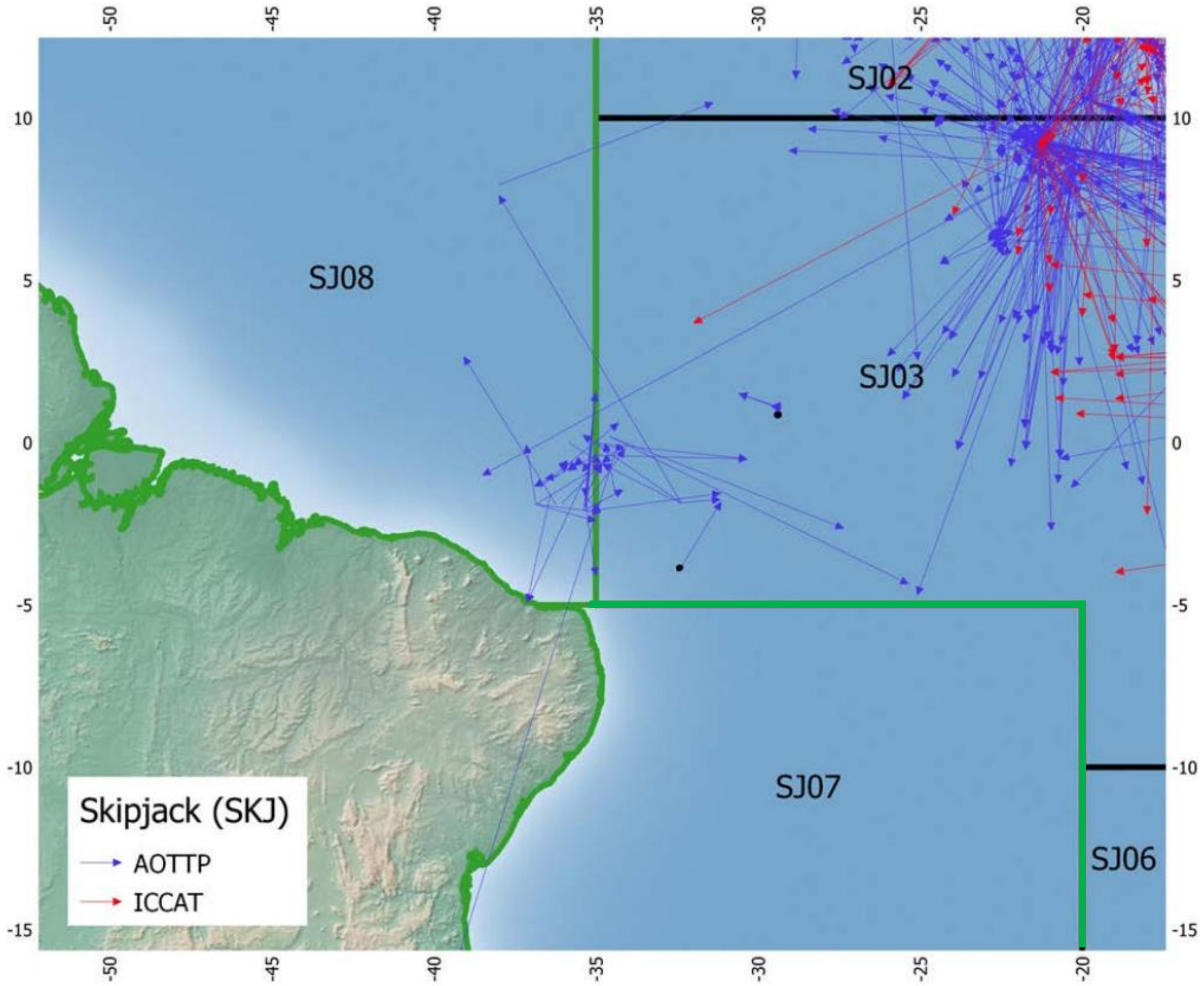


e. SKJ (2010-19)

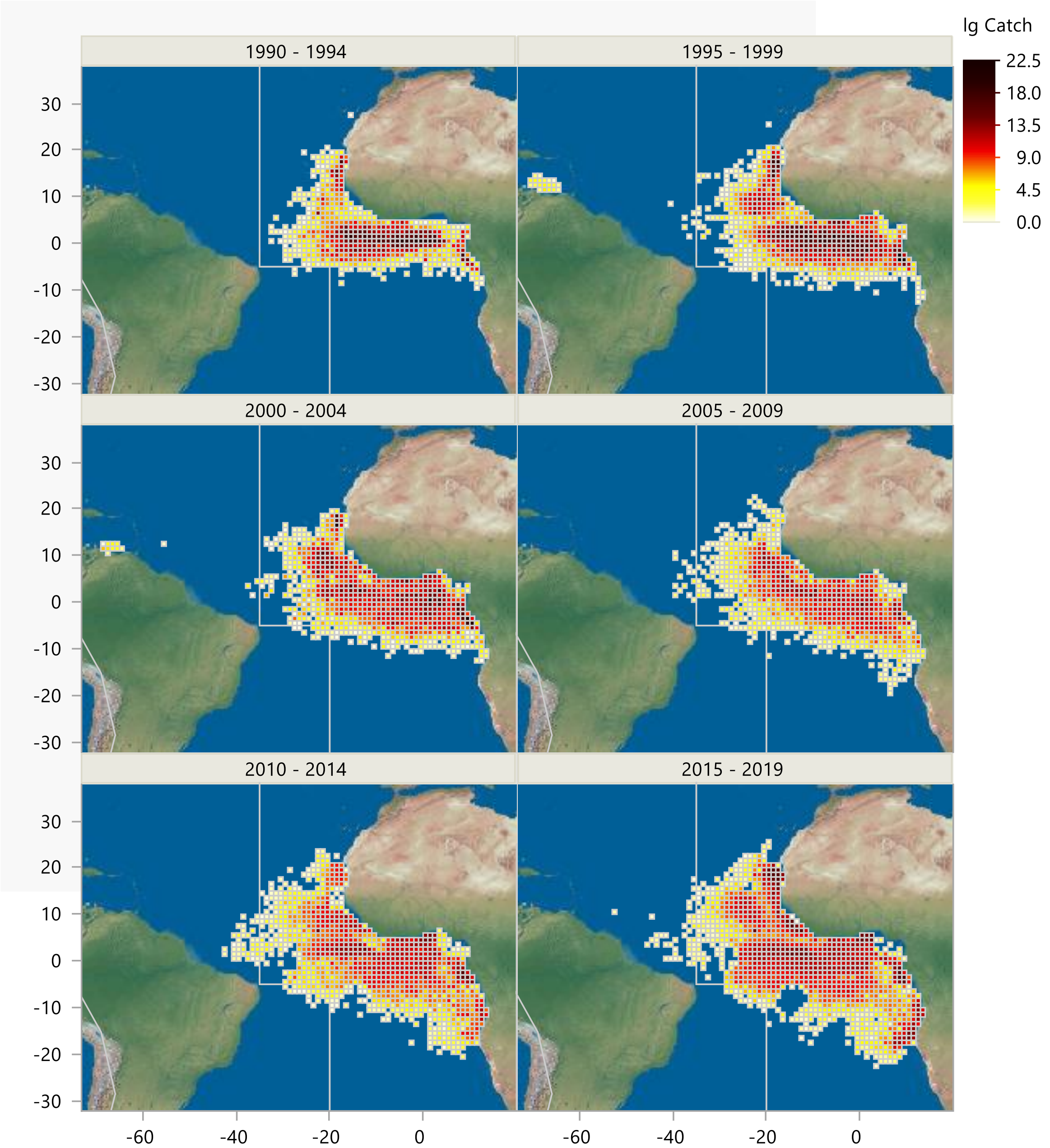


f. SKJ (2020-21)

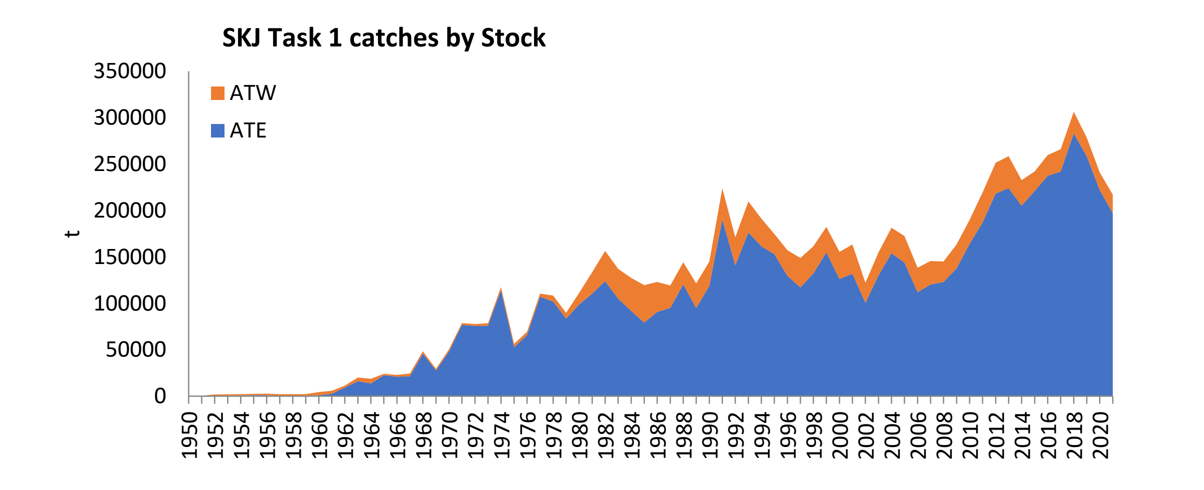
SKJ-Figure 1. [a-f]. Geographical distribution of the skipjack catch by major gears and decade. The maps are scaled to the maximum catch observed during 1970-2021 (last decade only covers 2 years).



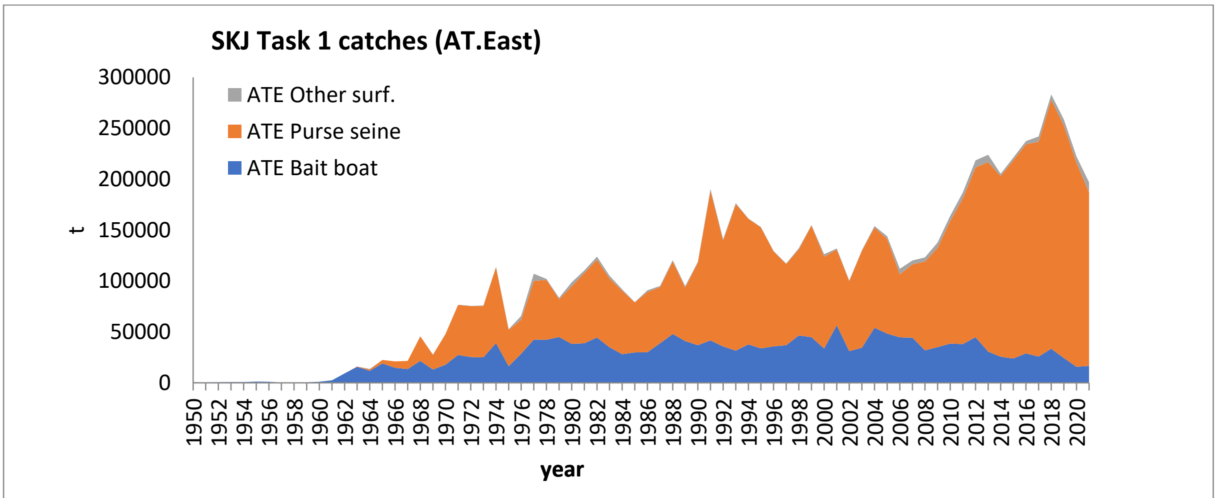
SKJ-Figure 2. A map of the AOTTP (blue lines) and ICCAT (red lines) tagged returns demonstrating the movement of fish in proximity to the eastern-western stock boundary. Area codes correspond to SKJ sample areas. Green line represents the East-West stock boundary.



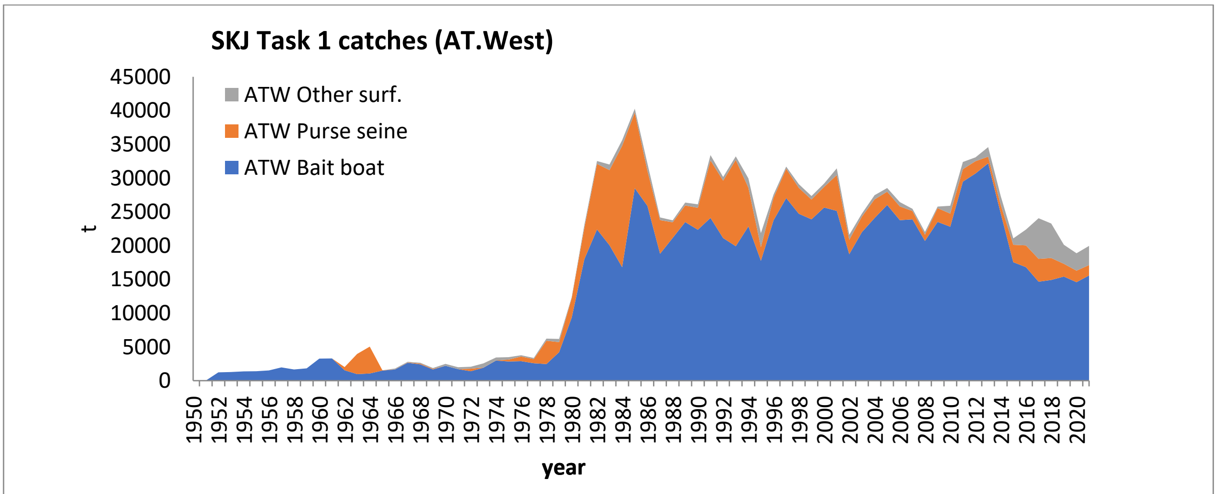
SKJ-Figure 3. Spatial distribution of the total SKJ catch (lg scale) from all PS-FAD fisheries by 1º x 1º of latitude - longitude and by lustrum (each box) 1990 – 2019. Line denotes the SKJ stocks boundary.



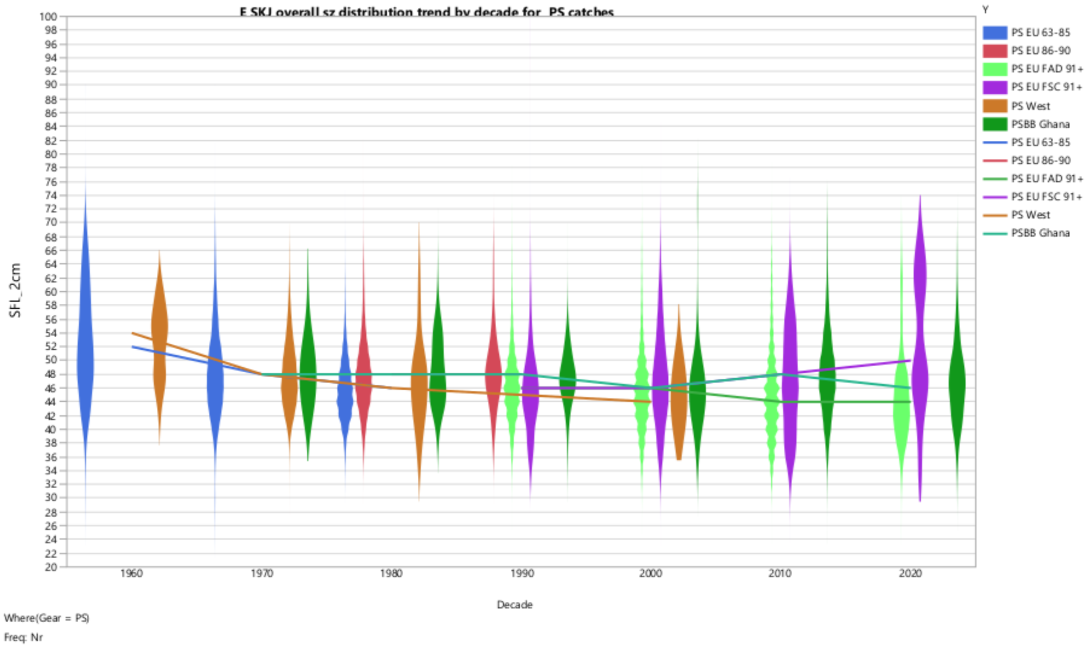
SKJ-Figure 4. Total skipjack catches (t) in the Atlantic and by stock (East and West) between 1950 and 2021. It is possible that skipjack catches taken in the eastern Atlantic in recent years were not reported or were under-estimated in the logbook correction of species composition based on multi-species sampling carried out at the ports. The 2021 figure is still preliminary.



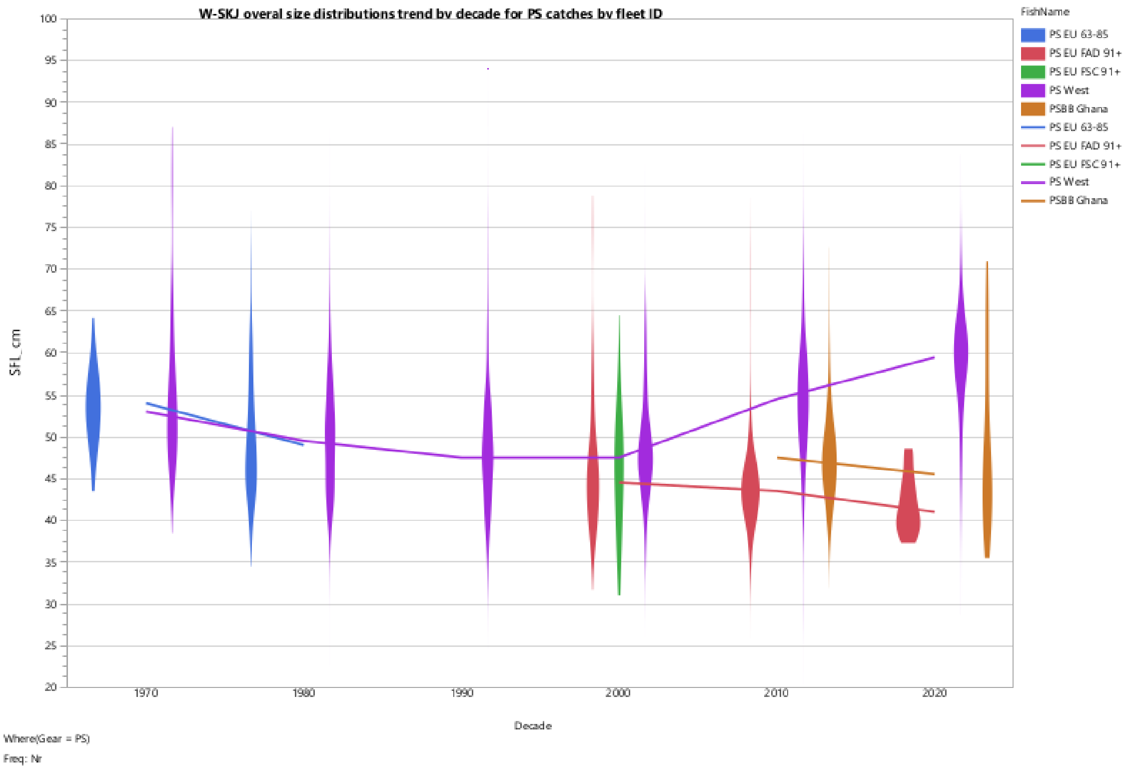
SKJ-Figure 5. Skipjack catches in the eastern Atlantic, by gear (1950-2021). The values for 2021 are preliminary.



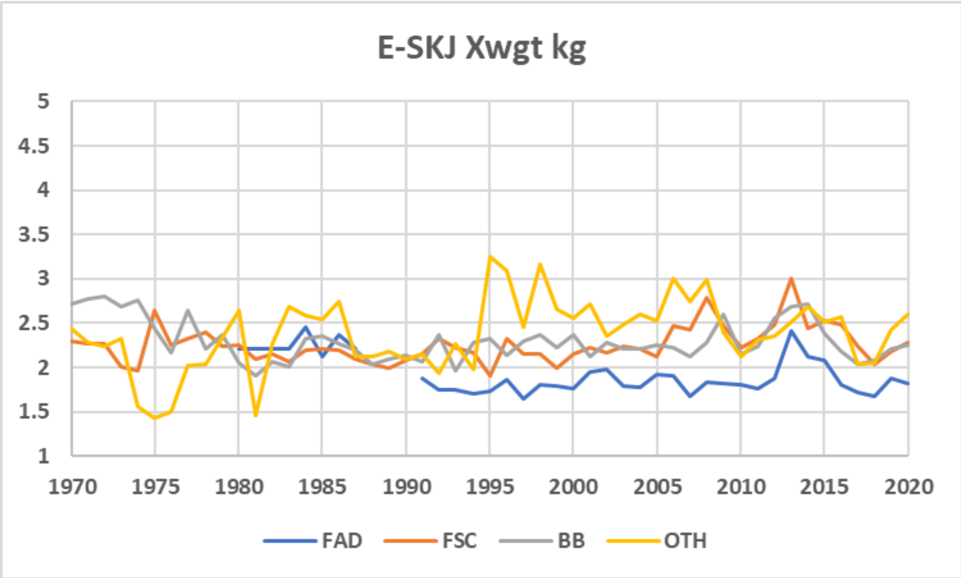
SKJ-Figure 6. Skipjack catches in the western Atlantic, by gear (1950-2021). The values for 2021 are preliminary.



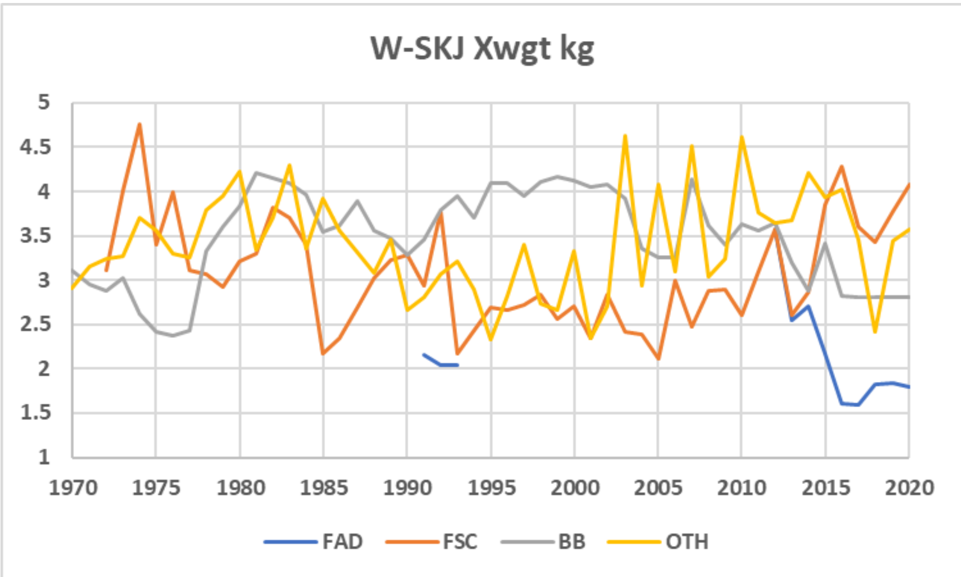
SKJ-Figure 7. E-SKJ - Overall size distribution of catch by decade for the PS fisheries by fleet ID, lines indicate the median of the distribution.



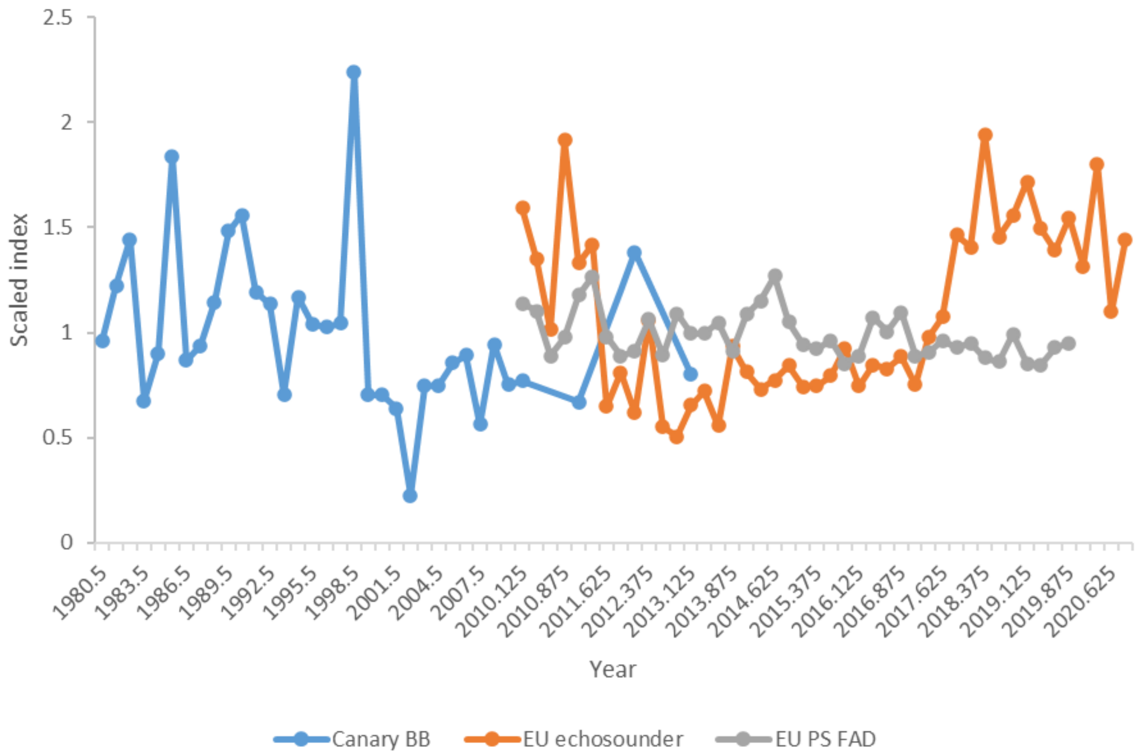
SKJ-Figure 8. W-SKJ - Size distributions by fleet ID from the PS fisheries, lines indicate the median of the distributions.



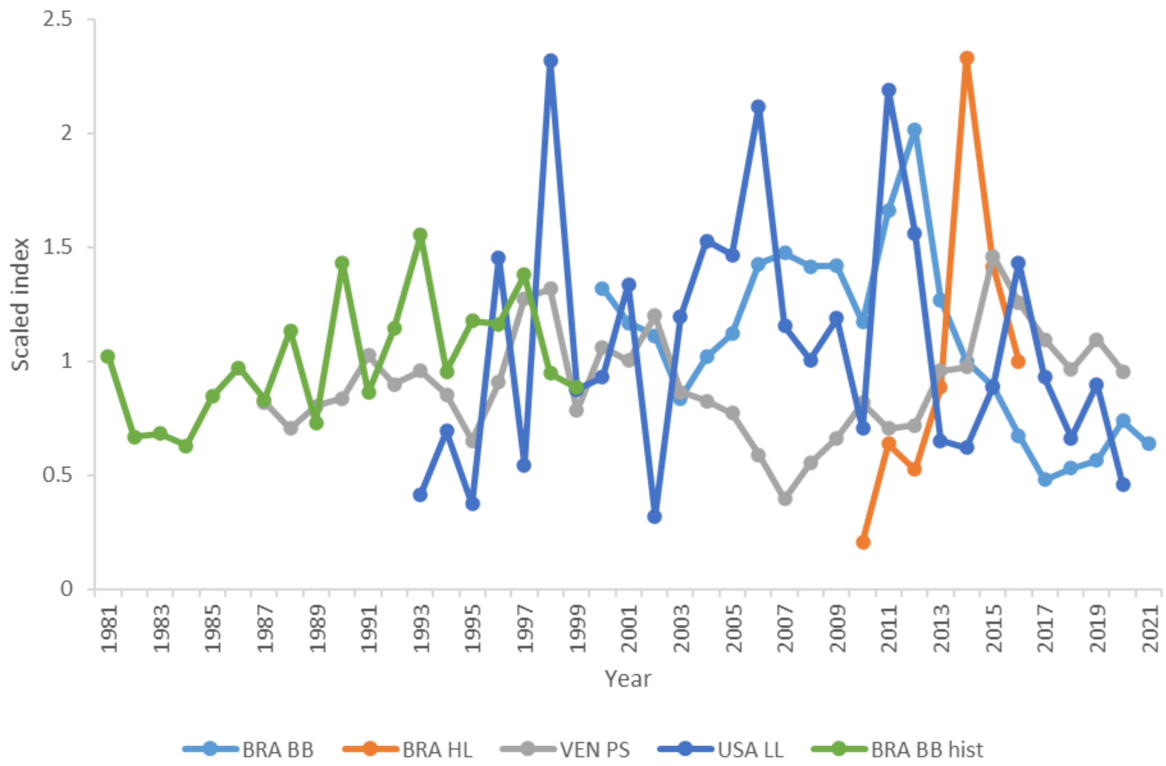
SKJ-Figure 9. E-SKJ - Mean weights (kg) estimated from the overall CAS estimations updated by Secretariat including Fishing mode free-schools (FSC), FOB (FAD), baitboat (BB), and other gears (OTH).



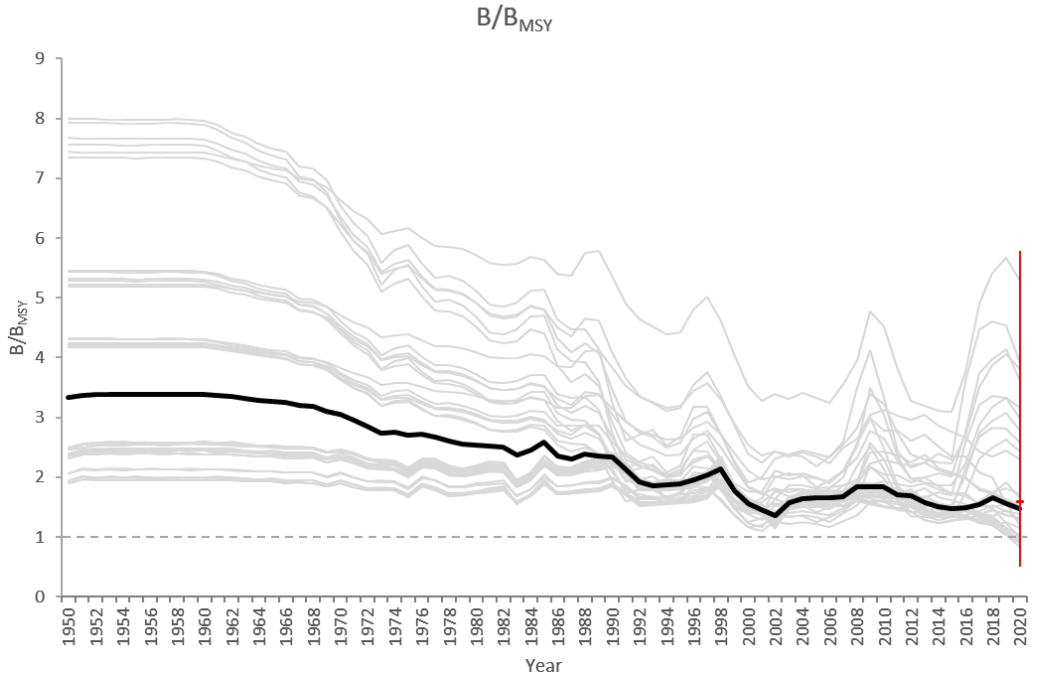
SKJ-Figure 10. W-SKJ - Mean weights (kg) estimated from the overall CAS estimations updated by Secretariat including Fishing mode free-schools (FSC), FOB (FAD), baitboat (BB), and other gears (OTH).

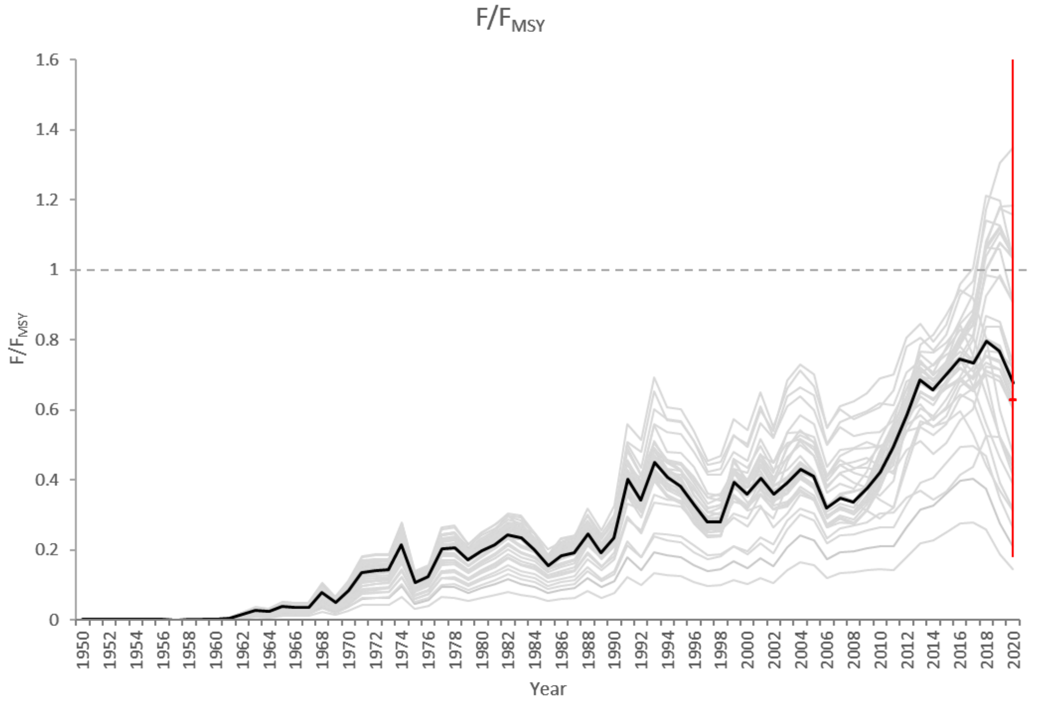


SKJ-Figure 11. E-SKJ Relative abundance indices included in the final stock assessment models, Stock Synthesis and JABBA, for the eastern skipjack stock. Years in the x axis are non-integers because the model runs at quarterly time steps.

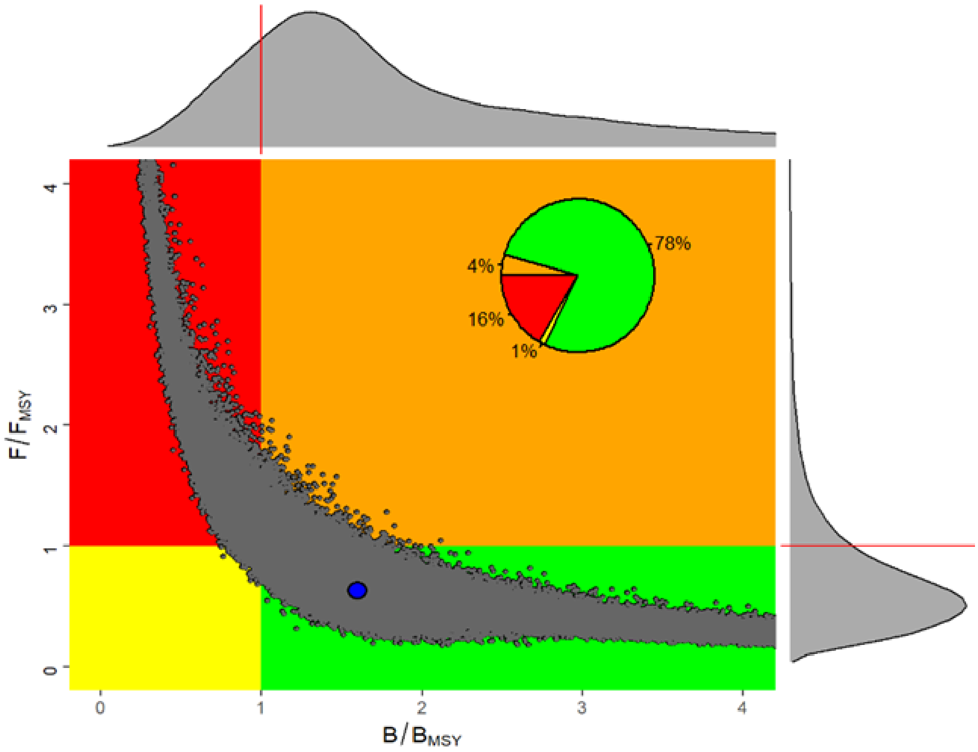


SKJ-Figure 12. W-SKJ - Relative abundance indices included in the final stock assessment model, Stock Synthesis, for the western skipjack stock.

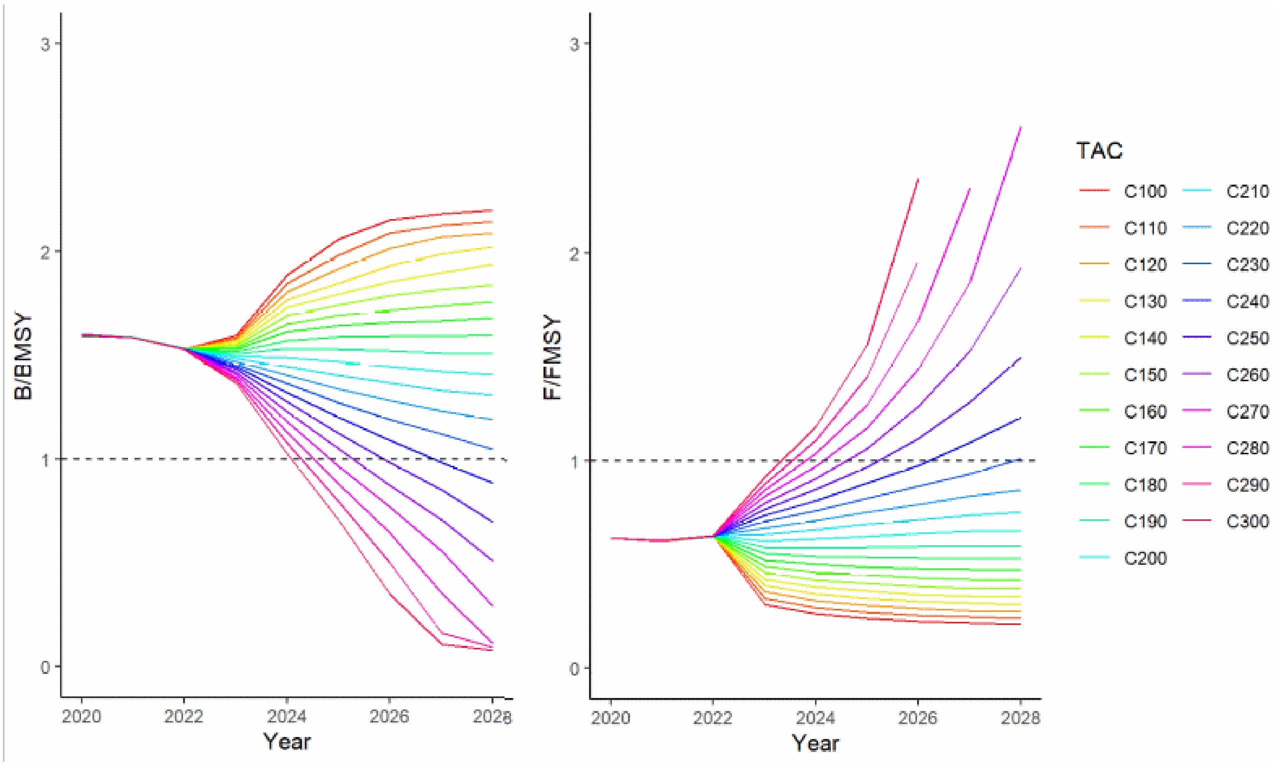




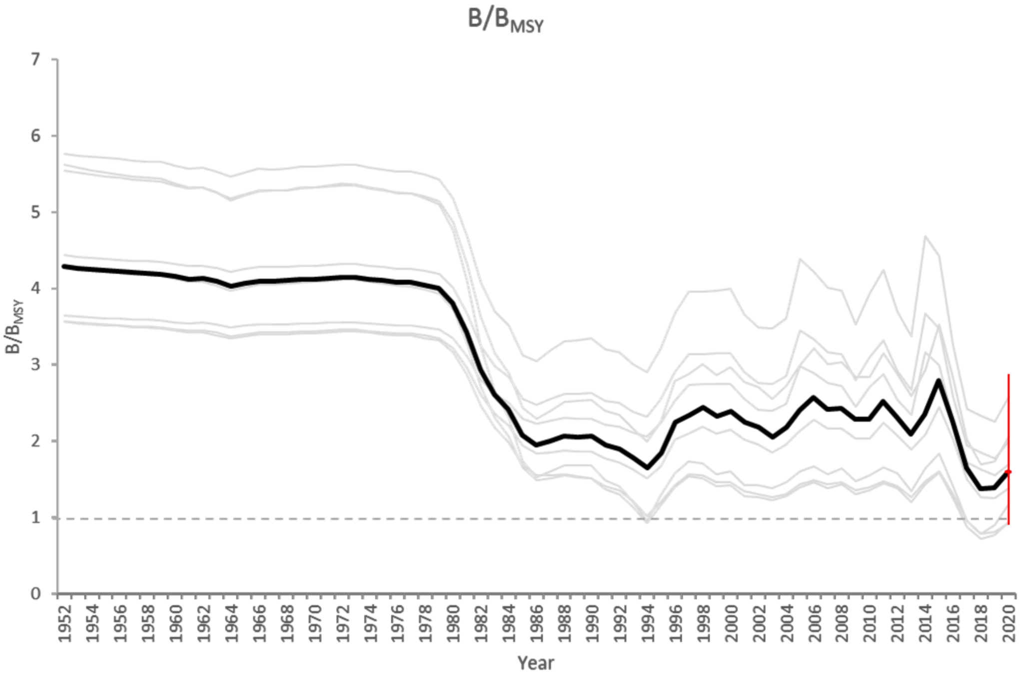
SKJ-Figure 13. E-SKJ Relative abundance (B/B_{MSY}) (top) and fishing mortality (F/F_{MSY}) (bottom) historic median trends for the eastern skipjack stock estimated by each model from the uncertainty grid, solid line represent the median of the trends plotted, and the vertical red line in 2020, the 95% confidence bound of the stochastic combined results.

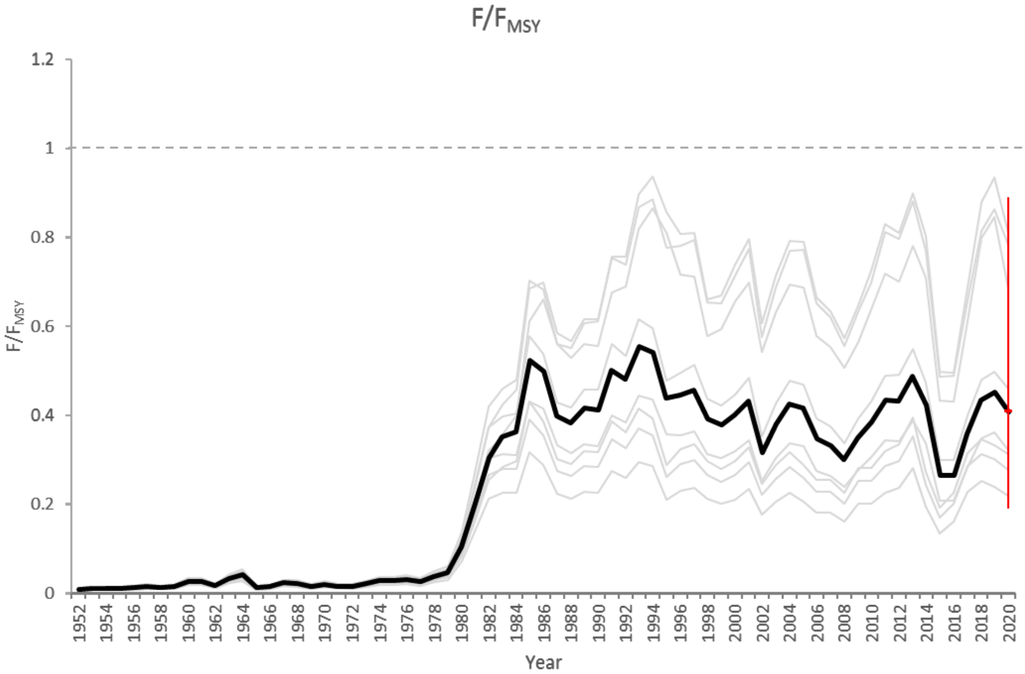


SKJ-Figure 14. E-SKJ Joint Kobe phase plot for the 18 Stock Synthesis uncertainty grid runs and 18 JABBA uncertainty grid runs for the eastern Atlantic skipjack stock. For each run the benchmarks are calculated from the year-specific selectivity and fleet allocations, and based on 90,000 MVLN iterations for Stock Synthesis and 90,000 MCMC iterations for JABBA. The blue point shows the median of 180,000 iterations for SSB_{2020}/SSB_{MSY} or B_{2020}/B_{MSY} and F_{2020}/F_{MSY} for the entire set of runs in the grid. Grey points represent the 2020 estimates of relative fishing mortality and relative spawning stock biomass for 2020 for each of the 180,000 iterations. The upper graph represents the smoothed frequency distribution of SSB_{2020}/SSB_{MSY} or B_{2020}/B_{MSY} estimates for 2020. The right graph represents the smoothed frequency distribution of F_{2020}/F_{MSY} estimates for 2020. The inserted pie graph represents the percentage of each 2020 estimate that fall in each quadrant of the Kobe plot. All SSB for Stock Synthesis showed the values at the end of years.

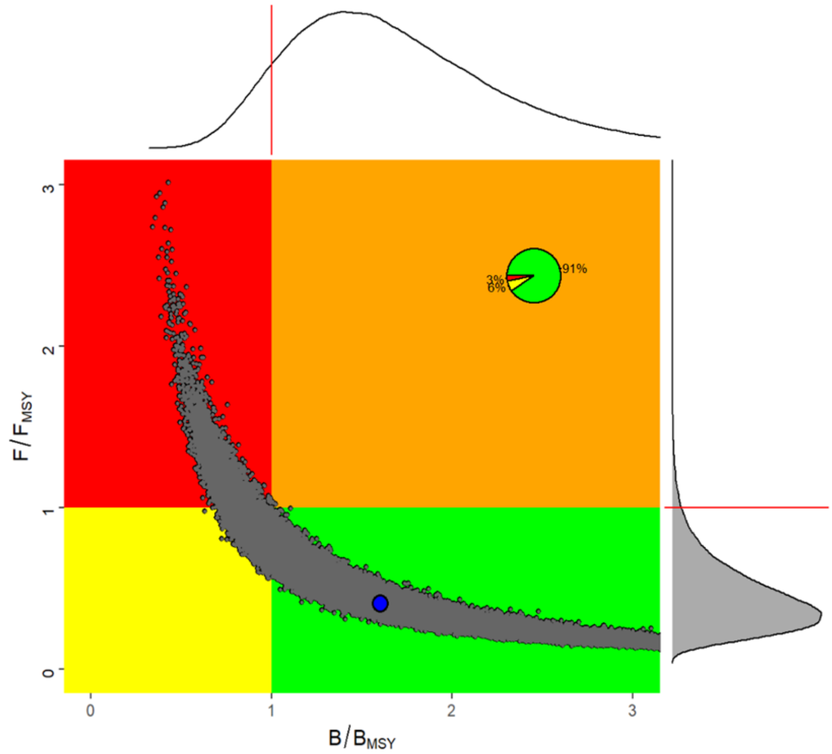


SKJ-Figure 15. E-SKJ - Joint stochastic projections of B/B_{MSY} and F/F_{MSY} for the 18 Stock Synthesis and the 18 JABBA uncertainty grid runs at 100-300 thousand t constant TACs for the eastern Atlantic skipjack stocks. The lines are the median of 180,000 iterations.

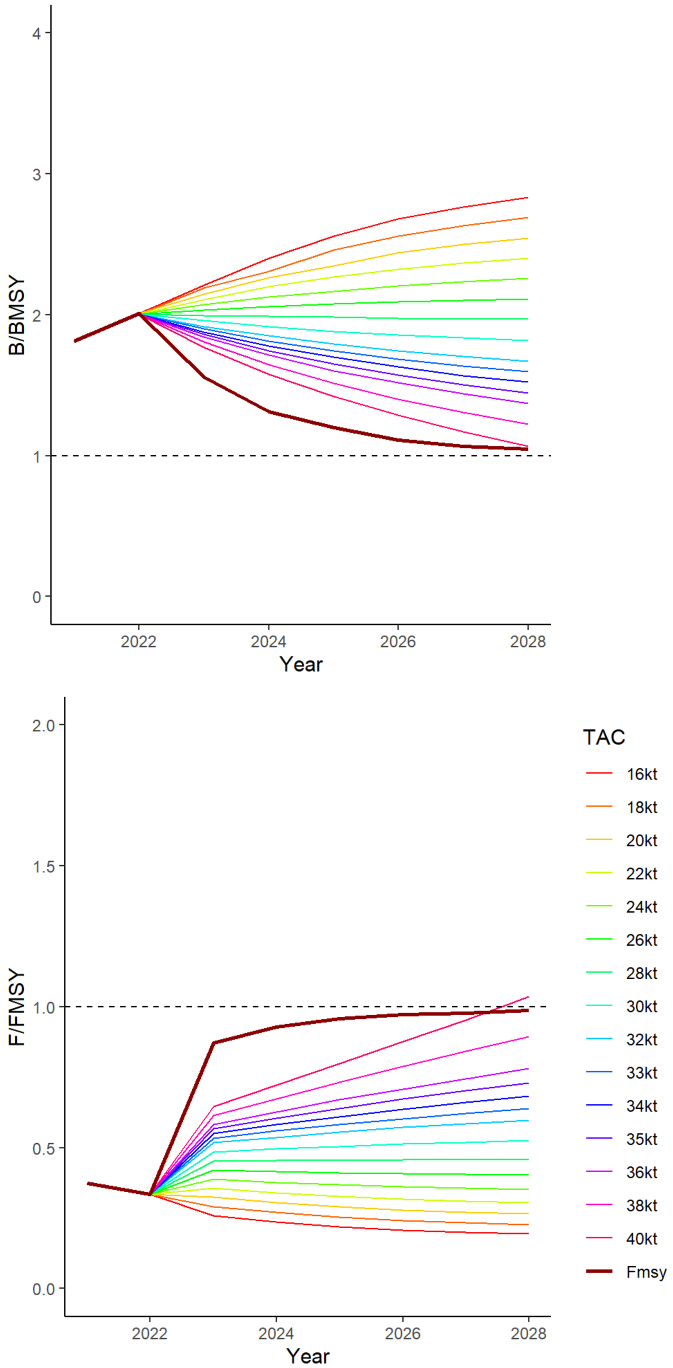




SKJ-Figure 16. W-SKJ - Relative abundance (B/B_{MSY}) (top) and fishing mortality (F/F_{MSY}) (bottom) historical median trends for the western skipjack stock estimated by each model from the uncertainty grid, solid line represents the median of the trends plotted, and the vertical red line in 2020, the 95% confidence bound of the stochastic combined results.



SKJ-Figure 17. W-SKJ - Kobe phase plot for the 9 Stock Synthesis uncertainty grid runs for the western Atlantic skipjack stock. For each run the benchmarks are calculated from the year-specific selectivity and fleet allocations and based on 200,000 MVLN iterations. The blue point shows the median of 200,000 iterations for SSB_{2020}/SSB_{MSY} and F_{2020}/F_{MSY} for the entire set of runs in the grid. Black line with black symbols represents the historical evolution of the median of all runs. Grey points represent the 2020 estimates of relative fishing mortality and relative spawning stock biomass for 2020 for each of the 200,000 iterations. The upper graph represents the smoothed frequency distribution of SSB/SSB_{MSY} estimates for 2020. The right graph represents the smoothed frequency distribution of F/F_{MSY} estimates for 2020. The inserted pie graph represents the percentage of each 2020 estimate that fall in each quadrant of the Kobe plot. All SSB showed the values at the end of years.



SKJ-Figure 18. W-SKJ - Stochastic MVLN projections of SSB/SSB_{MSY} and F/F_{MSY} for the 9 Stock Synthesis uncertainty grid runs at 16-40 thousand t constant TACs and constant F_{MSY} for the western Atlantic skipjack stocks. The lines are the median of 200,000 iterations.

9.2 SWO-ATL - ATLANTIC SWORDFISH

The status of the North and South Atlantic swordfish stocks was assessed in 2022, by means of applying statistical modelling to the available data up to 2020. Complete information on the data availability and assessment can be found in the Report of the 2022 ICCAT Atlantic Swordfish Data Preparatory Session *(Online, March 21 to 1 April 2022*) (Anon., 2022b) and Report of the 2022 ICCAT Atlantic Swordfish Stock Assessment *(Online, 20-28 June 2022)* (Anon., 2022k). Statistics relevant to Atlantic swordfish is presented in the Report of the Subcommittee on Statistics, included as **Appendix 13** to this SCRS Report, and recommendations pertinent to Atlantic swordfish are presented in Item 16.

SWO-ATL-1. Biology

Swordfish (*Xiphias gladius*) are members of the family Xiphiidae and are in the suborder Scombroidei. They can reach a maximum weight in excess of 500 kg. They are distributed widely in the Atlantic Ocean and Mediterranean Sea. In the ICCAT Convention area, the management units of swordfish for assessment purposes are a separate Mediterranean group, and North and South Atlantic groups separated at 5°N.

Swordfish feed on a wide variety of prey including groundfish, pelagic fish, deep-water fish, and invertebrates. They are believed to feed throughout the water column, and from electronic tagging studies, undertake extensive diel vertical migrations.

Swordfish mostly spawn in the western warm tropical and subtropical waters throughout the year, although seasonality has been reported in some of these areas. They are found in the colder temperate waters during summer and fall months. Young swordfish grow very rapidly, reaching about 140 cm LJFL (lower-jaw fork length) by age three, but grow slowly thereafter. Females grow faster than males and reach a larger maximum size. Tagging studies have shown that some swordfish can live up to 15 years. Swordfish are difficult to age, but about 50% of females were considered to be mature by age five, at a length of about 180 cm. However, the most recent information indicates a smaller length and age at maturity.

The analysis of the horizontal movements shows seasonal patterns, with fish generally moving towards the equator by winter and returning to the temperate foraging grounds in spring and summer. Broader areas of mixing between some eastern and western areas were also suggested. Results obtained by up satellite tags also fully confirm the previous knowledge that was available from fishery data: deep longline settings catch swordfish during the daytime as a by-catch, while shallow setting longliners target swordfish at night closer to the surface.

Beginning in 2018, an ICCAT swordfish biology programme, encompassing all three ICCAT stocks, has been conducting studies on swordfish growth, reproductive biology, and genetic analysis for identification of stock boundaries and mixing. Since programme inception, 4,159 fish have been sampled for otolith, fin spines, gonads and other tissues. The three research areas address key uncertainties important for improving the scientific advice for management of the stocks. Within each of the project areas, important scientific advances have been made:

- Ageing and growth: standards for ageing spines and otoliths; preliminary work on new growth models.

- Reproductive biology: standards for classifying reproductive status of swordfish and preliminary updates to maturity schedules.

- Genetics: identified genetic markers important for stock differentiation; identified key stock mixing areas in the North-East Atlantic; identified sub-populations within the Mediterranean.

These biological studies are ongoing, and the collective work contributes to the next major advance in the assessment of swordfish status.

SWO-ATL-2. Fishery indicators

Due to the broad geographical distribution of Atlantic swordfish (**SWO-ATL-Figure 1**) in coastal and off-shore areas (mostly ranging from 50ºN to 45ºS), this species is available to a large number of fishing countries. **SWO-ATL-Figure 2** shows total estimated catches for North and South Atlantic swordfish. Directed longline fisheries from Canada, EU-Spain, and the United States have operated since the late 1950s or early 1960s, and harpoon fisheries have existed at least since the late 1800s. Other directed swordfish fisheries include fleets from Brazil, Morocco, Namibia, EU-Portugal, South Africa, and Venezuela. The primary bycatch or opportunistic fisheries that take swordfish are tuna fleets from Chinese Taipei, Japan, Korea and EU-France. The tuna longline fishery started in 1956 and has operated throughout the Atlantic since then, with substantial catches of swordfish that are produced as a bycatch of tuna fisheries. The largest proportion of the Atlantic catches is made using surface-drifting longline. However, many additional gears are used, including traditional gillnets off the coast of western Africa.

Trends by area (NE vs. NW Atlantic) in the CPUE indexes were consistent with the seasonal movement patterns observed in the electronic tagging data, as well as in the catches and sex-ratio distributions. Relationships observed for the eastern Atlantic were opposite to those in the western Atlantic. This pattern was correlated with the decadal cycling of the AMO as well as that of the North Atlantic Oscillation (NAO). Including the AMO as a covariate to area specific catchability within the assessment model helped reduce the conflicting directions of the various CPUE trends. Further analysis and hypothesis testing was recommended to determine if the relationship was due to a swordfish temperature preference, a change in prey distribution, or perhaps both. To support this hypothesis testing the Committee encouraged a group of swordfish scientists to work towards uniting the available North Atlantic swordfish CPUE data into a single dataset so that a more refined, area specific CPUE analyses could be conducted.

For both the North and South Atlantic some of the indices of abundance were affected by changes in gear technology and management that could not be accounted for in the CPUE standardization, and therefore some indices had to be split into consistent time periods.

Total Atlantic

The total Atlantic estimated catch (landings plus dead discards) of swordfish (North and South, including reported dead discards) in 2021 (19,214 t) was 8.9% lower than the reported catch of 2015 (21,097 t), the terminal data year in the previous assessment. Catch reports are considered to be nearly complete for 2021, however, few countries, which typically represent a small portion of the catch, have not yet reported their 2021 catches and because of unknown unreported catches, this value should be considered provisional and subject to further revision.

North Atlantic

For the past decade, the North Atlantic estimated catch (landings plus dead discards) has averaged about 11,000 t per year (**SWO-ATL-Table 1**). The catch in 2021 (9,729 t) represents a 51.9% decrease since the 1987 peak in North Atlantic landings (20,238 t). These reduced landings have been attributed to ICCAT management measures, a reduction in total longline effort (Taylor *et al.,* 2020), and shifts in fleet distributions, including the movement of some vessels in certain years to the South Atlantic or out of the Atlantic. In addition, some fleets, including at least the United States, EU-Spain and EU-Portugal have changed operating procedures to opportunistically target tuna and/or sharks, taking advantage of market conditions and higher relative catch rates of these species previously considered as bycatch in some fleets. Recently, socio-economic factors, and oceanography patterns may have also contributed to the decline in catch. Task 1 and 2 data coverage is generally good, however the Committee noted the sparse discarding data for most CPCs as well as gaps in the catch and effort data for some CPCs.

Available longline CPUE series were evaluated by the Committee and certain indices were identified as suitable for use in the assessment models (Canada, Chinese Taipei, EU-Portugal, EU-Spain, Japan, Morocco, and USA). Trends in standardized CPUE series by fleets contributing to the stock assessment models are shown in **SWO-ATL-Figure 3**. Most of the series have an increasing trend since the late 1990s but show a decrease or plateau in the more recent years. There have been some recent changes in United States regulations (such as time-area closures for other species like Atlantic bluefin tuna) that may have impacted catch rates. The combined index used in the biomass models is shown in **SWO-ATL-Figure 4**.

South Atlantic

The historical trend of catch (landings plus dead discards) can be divided in two periods: before and after 1980. The first one is characterized by relatively low catches, generally less than 5,000 t (with an average value of 1,824 t). After 1980, landings increased continuously up to a peak of 21,931 t in 1995, levels that are comparable to the peak of North Atlantic harvest (20,238 t in 1987). This increase of landings was, in part, due to progressive shifts of fishing effort to the South Atlantic, primarily from the North Atlantic, as well as other waters. Expansion of fishing activities by southern coastal countries, such as Brazil and Uruguay, also contributed to this increase in catches. The reduction in catch following the peak in 1995 resulted from regulations and was partly due to a shift to other oceans and target species. In 2021, the reported catch (9,486 t) is 57% lower than the 1995 reported catch (**SWO-ATL-Table 1**).

Available longline CPUE series for South Atlantic swordfish were evaluated by the Committee and certain indices were identified as suitable for use in assessment models (Brazil, Chinese Taipei, EU-Spain, Japan, South Africa, Uruguay). The available indices are illustrated in **SWO-ATL-Figure 5**.

Discards

Since 1991, very few fleets have reported dead discards (see **SWO-ATL-Table 1**). The volume of North Atlantic reported dead discards reached a maximum of 1,138 t in 2000. Recent reported dead discards for the North Atlantic are low (113 t in 2020; 99 t in 2021). For the South Atlantic, the reported discards peaked at 147 t in 2010. In 2021, 128 t of dead discards were reported for the South Atlantic. The Committee continued to express concerns due to the low percentage of fleets that have reported annual dead discards (in t) and that what has been reported is not necessarily scaled to the entire fishery.

SWO-ATL-3. State of the stocks

North Atlantic

Two stock assessment platforms were used to provide estimates of stock status for the North Atlantic swordfish stock as a basis for management advice. There were: a Bayesian surplus production model (JABBA - Just Another Bayesian Biomass Assessment) and the integrated assessment model Stock Synthesis (SS).

The Committee noted that the 2022 assessment represents a significant improvement in the characterization of uncertainty of current stock status for North Atlantic swordfish using updated information and integration of JABBA. The Committee agreed that management advice for North Atlantic swordfish, including stock status and projections, should be based on JABBA and SS models.

There were important developments to the modelling this year. In particular, the SS model provided estimates of the full number of dead discards due to the size limit (i.e., reported and unreported) in the estimation of stock status. This analysis is consistent with the request of the Commission that the SCRS monitor and analyse the effects of the minimum size limit (Rec. 17-02, paragraph 10). This capacity will also be useful in future MSE simulations.

Based on the combined results from the two stock assessment model platforms (Stock Synthesis and JABBA), the North Atlantic swordfish stock biomass was above B_{MSY} (median B_{2020}/B_{MSY} = 1.08 and 95% CI of 0.71 and 1.33) and fishing mortality was below F_{MSY} (median F_{2020}/F_{MSY} = 0.80 and 95% CI of 0.64 and 1.24) in 2020 (**SWO-ATL-Figure 6**). The median MSY was estimated as 12,819 t with 95% CI of (10,864 t and 15,289 t).

The joint Kobe phase plot shows that JABBA model results provide wider range of uncertainty than the Stock Synthesis results. Probabilities of the stock being in each quadrant of the Kobe plot (**SWO-ATL-Figure 9**) are 63% in the green (not overfished not subject to overfishing), 22% in the yellow (overfished but not subject to overfishing) and 15% in the red (overfished and subject to overfishing). The results point to a stock status of not overfished (37% probability of overfished status), with no overfishing (15% probability of overfishing taking place). The estimate of stock status in 2020 is very similar to the estimated status from the previous assessment in the terminal year (2015).

South Atlantic

Two stock assessment platforms were used to assess the South Atlantic swordfish stock. These were a Bayesian surplus production model (JABBA) and Stock Synthesis. While Stock Synthesis was explored in 2022, only the JABBA model was used for providing advice.

The Committee acknowledged the progress made to implement a Stock Synthesis model for the South stock for the first time, but revision of size data and further model development are still required before it can be fully used for management advice. As such, the Stock Synthesis model was considered preliminary, and the Committee agreed that stock status estimates and projections for management advice should be done using only the JABBA model. For the purpose of comparison of model results across platforms only, results from Stock Synthesis are presented in **SWO-ATL-Figure 7** to illustrate the overall consistency among models.

Both models were consistent and suggested a decline in stock biomass as the fishing mortality increased in the 1990s. The final JABBA results estimated that B_{2020} was also below B_{MSY} (median = 0.77, 95% CIs = 0.53-1.13) while F_{2020} was marginally above F_{MSY} (median = 1.03, 95% CIs = 0.67-1.51) (**SWO-ATL-Figure 8**). The JABBA's MSY_{2020} was estimated to be 11,481 t.

The southern swordfish stock biomass is overfished, and overfishing is occurring. The JABBA base case assessment indicates a 56% probability that the stock is within the red quadrant of the Kobe plot (**SWO-ATL-Figure 10**).

SWO-ATL-4. Outlook

North Atlantic

Based on the currently available information to the Committee, both the JABBA and Stock Synthesis base models were projected to the year 2033 under constant TAC scenarios of 9,000 to 16,000 t, as well as a zero-catch scenario.

For the projections, catches for 2021 and 2022 are assumed to be constant at 10,476 t (the catch value for 2020 at the time of the assessment). Different levels of constant catch are projected for the period 2023-2033 (**SWO-ATL-Table 2**). The combined Stock Synthesis and JABBA projections show that a 13,200 t constant catch, which is the current TAC level (Rec. 21-02), will have a 60% probability of being in green quadrant in 2033. However, given that the estimated MSY (that is inclusive of dead discards) is 12,819 t and B_{2020}/B_{MSY}=1.08, catches above MSY will results in biomass declines over the projection period (**SWO-ATL-Figure 11**). Under 2021 catch (9,729 t), there is an 84-87% probability of the stock being in green quadrant by 2033 (**SWO-ATL-Table 2**).

South Atlantic

The 2022 assessment stock status results are similar to the 2017 assessment, but updated information used in the 2022 assessment resulted in estimates of a less productive stock (MSY_{2020} = 11,481 t; MSY_{2015} = 14,570 t). Specifically, a new surplus production function was objectively derived using biological information, and updated CPUE indices.

Results of projections from the 2017 assessment indicated that if catches remained below 11,000 t, there was a 60% chance of the stock falling within the green quadrant by 2020. The average catch for the period 2016-2020 was 10,125 t, yet the assessment still indicates a 56% probability that the stock is within the red quadrant in 2020 (**SWO-ATL-Figure 10**). The Committee notes that this apparent inconsistency can be explained by the lower productivity (see above) of the stock determined in the 2022 assessment.

Projections were conducted for the base case JABBA model under constant TAC scenarios of 6 to 15 thousand tons, as well as a zero-catch scenario (**SWO-ATL-Figure 12**). Projections were implemented in 2023 and catches for 2021 and 2022 were assumed to remain constant (9,826 t) at the average from the previous three years. Under current catch levels (9,826 t), the South Atlantic swordfish stock has a 55% probability of being in the green quadrant of the Kobe plot by 2033 (**SWO-ATL-Table 3**).

SWO-ATL-5. Effect of current regulations

For the North and South Atlantic, the most germane recommendations can be found in Recs. 21-02 and 21-03, modifying Recs 17-02 and 16-04, respectively.

Catch limits

The total allowable catch in the North Atlantic during the 2007 to 2009 period was 14,000 t per year. The reported catch during that period averaged 11,811 t and did not exceed the TAC in any year. In 2010, the TAC was reduced to 13,700 t. The reported mean catch from 2010-2017 was 11,576 t and exceeded the TAC in 2012 (13,868 t). In 2018, the TAC was reduced to 13,200 t. The reported catch from 2018-2021 has averaged 9,862 t and has not exceeded the TAC in any year.

The TAC in the South Atlantic for the years 2007 through 2009 was 17,000 t. The reported catch during that period averaged 13,674 t and did not exceed the TAC in any year. In 2010, the TAC was reduced to 15,000 t. The reported catch from 2010-2017 averaged 10,644 t and did not exceed the TAC in any year. In 2018, the TAC was reduced to 14,000 t. The reported catch from 2018-2021 averaged 9,719 t and did not exceed the TAC in any year.

Minimum size limits (Rec. 17-02)

There are three minimum size options that are applied to the entire Atlantic: 125 cm LJFL/25 kg with a 15% tolerance (of the number of swordfish *per landing*); or 119 cm LJFL/15 kg with zero tolerance and evaluation of the discards; and for dressed fish, cleithrum to keel length of 63 cm.

Since the implementation of the minimum landing sizes in 2000, the estimated proportion of swordfish less than 125 cm LJFL reported in the landings (in numbers) has been generally decreasing in the North Atlantic and stable in the South. In the North Atlantic, the estimate was 33% in 2000 and decreased to 23% in 2015. In the South Atlantic the estimate was 18% in 2000, had a maximum of 19% in 2006 and decreased to 13% in 2015. The Committee notes that these estimates are based on low sample sizes, are uncertain and may be biased. They will remain uncertain until CPCs fully report size samples from the entire catch. A figure of the estimated absolute biomass and numbers of fish as well as estimated proportions of undersized fish in the catch that are discarded in the North Atlantic is shown in **SWO-ATL-Figure 13**. The decreasing trend can be due to a decrease in encounter rate of undersized fish due to changes in fleet behaviour, or a decrease in recruitment over time, or a combination of both.

The Committee also noted high values of hooking mortality (ranging between 78-88%) on small swordfish (<125 cm LJFL) by surface longline fisheries targeting swordfish (**SWO-ATL-Figure 14**). The post-release mortality of specimens discarded alive from commercial fishing gear is unknown. Evaluating other strategies to reduce fishing mortality on juvenile swordfish will need complete datasets on fishing effort and size data over the entire Atlantic and should take into account the effects of these strategies on other species. In view of the Commission objective to reduce fishing mortality on small swordfish, the Committee therefore recommends that future work should be carried out to determine more precisely the spatial distribution and magnitude of fishing effort, the size and sex distribution of undersized swordfish in the Atlantic, using high resolution observer data.

SWO-ATL-6. Management Recommendations

North Atlantic

SWO-ATL-Table 2 shows the probabilities of maintaining B>B_{MSY}, maintaining F<F_{MSY}, and maintaining the stock in the green quadrant of the Kobe plot over a range of TAC options for North Atlantic swordfish over a period of 10 years. The combined Stock Synthesis and JABBA projections show that a 13,200 t constant catch, which is the current TAC level (Rec. 21-02), will result in a 60% probability of being in the green quadrant in 2033 (**SWO-ATL-Table 2**). However, given that the estimated MSY (that is inclusive of dead discards) is 12,819 t, catches above MSY will results in biomass declines over the projection period (**SWO-ATL-Figure 11**).

The Committee also recognizes that the above advice does not fully account for removals associated with the actual mortality of unreported dead and live discards, quota carryovers (15% in the North Atlantic), quota transfers across the North, and South stock management boundaries nor the total cumulative quota, which includes catch allocated to "other CPCs" and would fall above the TAC if achieved. The Committee emphasizes that the importance of this uncertainty be taken into consideration by the Commission when adopting a TAC.

South Atlantic

SWO-ATL-Table 3 shows the probabilities of maintaining B>B_{MSY}, maintaining F<F_{MSY}, and maintaining the stock in the green quadrant of the Kobe plot over a range of TAC options for South Atlantic swordfish over a period through 2033. The current TAC of 14,000 t (Rec. 21-03) is unlikely (3% probability) to result in the stock being in the green quadrant of the Kobe plot by 2033. The reported catch for 2021 was 9,454 t. Catch levels less than 10,000 t will accelerate rebuilding.

The Committee also recognizes that as was the case for the northern stock, the above advice does not fully account for removals associated with the actual mortality of unreported dead and live discards, quota carryovers (30% in the South Atlantic) nor quota transfers across the North and South stock management boundaries. The Committee emphasizes the importance of these uncertainties and recommends that the stock be closely monitored in the upcoming years to confirm rebuilding.

ATLANTIC SWORDFISH SUMMARY TABLE		
	North Atlantic	***South Atlantic***
Maximum Sustainable Yield	12,819 t (10,864 t-15,289 t)[1]	11,481 t (9,793 t-13,265 t)[2]
Current (2022) TAC	13,200 t	14,000 t
Current (2021) Yield[3]	9,729 t	9,454 t
Yield in last year used in assessment (2020)[4]	10,668 t	9,020 t
B_{MSY} (CI)	57,919 t (23,666 t-153,156 t)[5]	74,641 t (60,179 t-92,946 t)[2]
F_{MSY}	0.15 (0.08-0.23) [5]	0.15 (0.12-0.19) [2]
Relative Biomass (B_{2020}/B_{MSY})	1.08 (0.71-1.33) [5]	0.77 (0.53-1.11)[2]
Relative Fishing Mortality (F_{2020}/F_{MSY})	0.80 (0.64-1.24)[5]	1.03 (0.67-1.51)[2]
Stock Status (2020)	Overfished: NO	Overfished: YES
	Overfishing: NO	Overfishing: YES
Management Measures in Effect	Country-specific TACs [Rec. 21-02]; Minimum size 125/119 cm LJFL[6]	Country-specific TACs [Rec. 21-03]; Minimum size 125/119 cm LJFL[7]

[1] Median from base case JABBA and Stock Synthesis models; range corresponding to the lowest and highest 95% CIs from the two models.
[2] Median and 95% CIs from base case JABBA model.
[3] Provisional and subject to revision.
[4] Based on catch data available in July 2021 for the stock assessment session.
[5] Median and 95% quantiles from base case Stock Synthesis and JABBA models.
[6] Associated alternatives listed in Rec. 17-02.
[7] Associated alternatives listed in Rec. 17-03.

SWO-ATL-Table 1. Estimated catches (t) of Atlantic swordfish (*Xiphias gladius*) by area, gear and flag.

			1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
TOTAL			29207	32868	34460	39036	33511	31567	26356	27124	27181	25139	23758	24078	25153	25544	25724	27935	23472	24814	24267	23914	24576	21282	20678	21097	21112	20833	19403	20325	19415	19214
	ATN		15394	16738	15501	17105	15222	13025	12329	11622	11453	10011	9654	11444	12071	12380	11528	12306	11102	12146	11672	12709	13890	12078	10708	10752	10501	10295	9025	10244	10451	9729
	ATS		13813	16130	18958	21931	18289	18542	14027	15502	15728	15128	14104	12634	13082	13163	14196	15629	12370	12668	12596	11205	10686	9204	9970	10345	10611	10537	10378	10081	8964	9486
Landings	ATN	Longline	14356	15804	14365	15864	13822	12204	11062	10717	9922	8678	8799	10334	11410	11531	10896	11478	10394	11504	11077	11796	12976	11366	10089	10194	9913	9462	8401	9340	9752	9118
		Other surf.	655	526	428	715	812	370	782	376	393	432	240	486	341	516	409	546	465	485	441	511	512	513	463	391	483	684	472	600	587	512
	ATS	Longline	13422	15739	17839	21584	17859	18299	13748	14823	15448	14302	13576	11714	12558	12915	13984	15318	11980	12301	12087	10854	10255	8958	9736	10047	10461	10281	10323	9975	8814	9325
		Other surf.	391	391	1119	347	429	222	269	672	278	826	527	920	523	248	212	221	384	368	361	277	291	246	189	254	148	145	27	57	93	33
Discards	ATN	Longline	383	408	708	526	562	439	476	525	1137	896	607	618	313	323	215	273	235	151	148	392	391	199	156	167	105	149	152	304	113	97
		Other surf.	0	0	0	0	26	12	9	4	1	6	8	5	7	10	8	8	9	7	5	9	10	0	0	0	0	0	0	0	0	1
	ATS	Longline	0	0	0	0	1	21	10	6	1	0	0	0	1	0	0	91	6	0	147	74	140	0	46	43	2	111	26	50	57	128
		Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	
Landings	ATN CP	Barbados	0	0	0	0	33	16	16	12	13	19	10	21	25	44	39	27	39	20	13	23	21	16	21	29	20	21	18	10	12	13
		Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	1	112	106	184	141	142	76	1	3	59	145	117	111	121
		Brazil	0	0	0	0	0	0	0	0	117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Canada	1547	2234	1676	1610	739	1089	1115	1119	968	1079	959	1285	1203	1558	1404	1348	1334	1300	1346	1551	1489	1505	1604	1579	1548	1188	782	995	1334	1377
		China PR	0	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	92	96	44
		Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	30	0	0	0	0	0	0	0	0	0	26	**0**
		EU-Denmark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		EU-España	6672	6598	6185	7176	5547	5140	4084	3996	4595	3968	3957	4586	5376	5521	5448	5564	4366	4949	4147	4889	5622	4084	3750	4013	3916	3586	3186	3112	3587	3235
		EU-France	75	95	46	84	97	164	110	104	122	0	74	169	102	178	92	46	14	15	35	16	94	44	28	66	90	79	80	82	90	103
		EU-Germany	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		EU-Ireland	0	7	0	0	15	15	132	81	35	17	5	12	1	1	3	2	2	1	1	2	5	2	3	15	15	10	13	3	24	9
		EU-Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	**0**
		EU-Poland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	**0**
		EU-Portugal	542	1961	1599	1617	1703	903	773	777	732	735	766	1032	1320	900	949	778	747	898	1054	1203	882	1438	1241	1420	1460	1871	1691	2392	2070	2165
		EU-Rumania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		FR-St Pierre et Miquelon	0	0	0	0	0	0	0	0	0	0	10	3	36	48	0	82	48	17	90	1	0	18	3	0	0	0	0	0	0	**0**
		Great Britain	0	2	3	1	5	11	0	2	1	0	0	0	0	0	49	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
		Grenada	3	13	0	1	4	15	15	42	84	0	54	88	73	56	30	26	43	0	0	0	0	0	0	39	29	36	36	22	15	
		Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Iceland	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Japan	1064	1126	933	1043	1494	1218	1391	1089	161	0	0	0	575	705	656	889	935	778	1062	523	639	300	545	430	379	456	325	355	412	274
		Korea Rep	3	19	16	16	19	15	0	0	0	0	0	0	0	51	65	175	157	3	0	0	0	64	35	0	9	19	9	9	14	13
		Liberia	7	14	26	28	28	28	28	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	95	5	7	3	8
		Maroc	69	39	36	79	462	267	292	119	114	523	223	329	335	339	341	237	430	724	968	782	770	1062	1062	850	900	900	950	950	936	955
		Mexico	0	6	14	10	22	14	28	24	37	27	34	32	44	41	31	35	34	32	35	38	40	33	32	31	36	64	44	30	21	25
		Norway	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Panama	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Philippines	0	0	0	0	0	0	0	0	0	1	4	44	5	0	8	0	22	28	0	17	36	9	14	0	0	0	0	0	0	**0**
		Russian Federation	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Senegal	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	41	87	113	148	44	43	49	78	146	112	89	121	33	6
		Sierra Leone	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	
		St Vincent and Grenadines	3	23	0	4	3	1	0	1	0	22	22	7	7	7	7	51	7	34	13	11	8	4	40	102	33	46	26	12	7	**0**
		Trinidad and Tobago	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	6	8	6
		UK-Bermuda	0	0	0	1	1	5	5	3	3	2	0	0	1	1	0	3	4	3	3	3	1	1	1	1	2	1	2	2	6	5
		UK-British Virgin Islands	0	0	0	0	0	0	0	0	0	0	0	0	4	4	7	0	3	0	0	4	0	0	0	0	0	0	0	0	0	0
		UK-Turks and Caicos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	17	0	0	0	0	0	0	**0**
		USA	3852	3783	3366	4026	3559	2987	3058	2908	2863	2217	2384	2513	2380	2160	1873	2463	2387	2730	2274	2551	3393	2824	1809	1581	1408	1294	1135	1449	1351	1137
		USSR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Venezuela	103	73	69	54	85	20	37	30	44	21	34	45	53	55	22	30	11	13	24	18	25	24	24	34	56	58	36	35	16	13
	NCC	Chinese Taipei	441	127	507	489	521	509	286	285	347	299	310	257	30	140	172	103	82	89	88	192	166	115	78	115	148	78	162	115	144	66
		Costa Rica	0	0	0	0	0	0	0	1	1	0	0	1	4	3	2	4	11	6	11	23	21	22	30	34	26	44	43	23	19	51
		Guyana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	10	5	2	5	3
	NCO	Cuba	27	16	50	86	7	7	7	7	0	0	10	3	3	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Dominica	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	
		Faroe Islands	0	0	0	0	0	0	0	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		NEI (Flag related)	35	111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Saint Kitts and Nevis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	
		Seychelles	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Sta Lucia	0	0	1	0	0	0	0	0	0	0	0	0	2	3	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	
		Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	35	29	14	0	0	0	10	23	15	2	4	7	0	0	0	0	0	
	ATS CP	Angola	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	18	0	0	13	0	0	0	
		Belize	0	0	0	1	0	0	0	17	8	0	0	0	0	0	0	120	32	111	121	207	197	136	45	111	176	166	115	55	2	2
		Brazil	2609	2013	1571	1975	1892	4100	3847	4721	4579	4082	2910	2920	2998	3785	4430	4153	3407	3386	2926	3033	2833	2384	2892	2599	2938	2410	2798	2863	2110	2823
		China PR	0	0	0	0	0	0	29	534	344	200	423	353	278	91	300	473	470	291	296	248	316	196	206	328	222	302	355	211	89	37
		Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Côte d'Ivoire	13	14	20	19	26	18	25	26	20	19	19	43	29	31	39	17	24	145	156	58	89	133	68	48	58	41	57	123	19	22
		EU-Bulgaria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		EU-España	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	4656	4404	4224	4442	4470
		EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	**0**
		EU-Lithuania	0	0	794	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		EU-Portugal	1	0	0	380	389	441	384	381	392	393	380	354	345	493	440	428	271	367	232	263	184	125	252	236	250	466	369	323	335	224
		El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Gabon	0	0	0	0	0	0	0	0	0	0	0	9	2	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	**0**
		Ghana	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	32	31	19
		Great Britain	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	**0**
		Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Guinea Ecuatorial	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	**0**
		Honduras	3	0	0	6	4	5	2	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Japan	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	647	552	484

				1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
			Korea Rep	147	198	164	164	7	18	7	5	10	0	2	24	70	36	94	176	223	10	0	0	42	47	53	5	19	11	18	9	15	6
			Namibia	0	0	22	0	0	0	0	730	469	751	504	191	549	832	1118	1038	518	25	417	414	85	129	395	225	466	600	881	811	789	623
			Nigeria	3	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Panama	0	0	0	0	0	0	29	105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Philippines	0	0	0	0	0	0	0	0	0	6	1	8	1	1	4	58	41	49	14	35	15	35	58	0	0	0	0	0	0	**0**
			S Tomé e Príncipe	177	202	190	178	166	148	135	129	120	120	120	120	126	147	138	138	183	188	193	60	84	60	94	145	77	65	1	3	30	32
			Senegal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	77	97	137	78	117	162	178	143	97	90	112	65	116	38	**0**
			South Africa	9	4	1	4	1	1	240	143	328	547	649	293	295	199	186	207	142	170	145	97	50	171	152	218	164	189	189	251	149	179
			St Vincent and Grenadines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	7	16	4	3	2	2	19	0	5	9	4	15	9	32
			UK-Sta Helena	0	0	0	0	0	0	0	0	0	20	4	2	2	0	0	0	0	0	0	0	0	5	6	2	0	0	0	0	0	**0**
			USA	0	0	0	0	171	396	160	179	142	43	200	21	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			USSR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Uruguay	210	260	165	499	644	760	889	650	713	789	768	850	1105	843	620	464	370	501	222	179	40	103	0	0	0	0	0	0	0	**0**
		NCC	Chinese Taipei	1686	846	2829	2876	2873	2562	1147	1168	1303	1149	1164	1254	745	744	377	671	727	612	410	424	379	582	406	511	478	416	446	346	296	406
		NCO	Argentina	88	14	24	0	0	0	0	38	0	5	10	8	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	
			Benin	26	28	25	24	24	10	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Cambodia	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Cuba	246	192	452	778	60	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Mixed flags (FR+ES)	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			NEI (Flag related)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Seychelles	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Togo	5	8	14	14	64	0	0	0	0	0	0	0	9	10	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	0	11	26	6	3	0	3	1	3	0	1	1	0	0	0	0	0	
Discards	ATN	CP	Canada	0	0	0	0	0	5	52	35	50	26	33	79	45	106	38	61	39	9	15	8	111	59	12	8	11	21	5	2	2	3
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
			Japan	0	0	0	0	0	0	0	0	598	567	319	263	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	6	3
			Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	170	46	19	0	2	0	0	0	0	0	**0**
			Mexico	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
			UK-Bermuda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			USA	383	408	708	526	588	446	433	494	490	308	263	282	275	227	185	220	205	148	138	223	217	120	137	137	90	111	140	287	91	89
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	0	7	18	4	18	7	7	14	2
	ATS	CP	Brazil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	91	6	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	**0**
			Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
			Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	147	70	23	0	0	0	0	0	0	0	0	**0**
			South Africa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			USA	0	0	0	0	1	21	10	6	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	117	0	45	43	2	111	26	49	57	126

SWO-ATL-Table 2. Joint probabilities of the North Atlantic swordfish stock being below F_{MSY} (top, overfishing not occurring), above B_{MSY} (middle, not overfished) as well as the joint probability of being above B_{MSY} and below F_{MSY} (bottom, green zone) in a given year for a given catch level based on 30,000 iterations of the MVLN approximation for Stock Synthesis and JABBA MCMC iterations.

Probaility $F<F_{MSY}$

TAC (t)	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
0t	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
9000t	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%
10000t	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
11000t	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
12000t	79%	79%	79%	79%	79%	80%	80%	80%	79%	79%	79%
12500t	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%
12600t	75%	75%	75%	75%	75%	75%	75%	76%	75%	75%	75%
12700t	74%	74%	74%	74%	74%	74%	74%	74%	74%	74%	74%
12800t	74%	73%	73%	73%	73%	73%	73%	73%	73%	73%	73%
12900t	73%	72%	72%	72%	72%	72%	72%	72%	71%	71%	71%
13000t	72%	71%	71%	71%	71%	70%	70%	70%	69%	69%	68%
13100t	71%	70%	70%	69%	69%	68%	68%	67%	66%	66%	65%
13200t	70%	69%	69%	68%	67%	66%	65%	64%	63%	62%	61%
13300t	69%	68%	67%	66%	65%	63%	62%	61%	59%	58%	56%
13400t	68%	66%	65%	64%	62%	60%	59%	57%	55%	53%	51%
13500t	66%	65%	63%	61%	59%	57%	55%	53%	51%	48%	46%
13600t	65%	63%	61%	59%	56%	54%	51%	49%	46%	43%	41%
13700t	63%	61%	59%	56%	53%	50%	47%	44%	41%	38%	36%
13800t	62%	59%	56%	53%	50%	46%	43%	40%	37%	34%	32%
14000t	58%	55%	51%	47%	43%	39%	35%	32%	29%	27%	25%
15000t	38%	31%	25%	21%	25%	32%	32%	31%	31%	30%	29%
16000t	20%	15%	12%	11%	10%	10%	10%	9%	9%	9%	9%

Probability $B>B_{MSY}$

TAC (t)	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
0t	75%	84%	90%	94%	96%	97%	98%	98%	99%	99%	99%
9000t	75%	78%	80%	82%	83%	84%	85%	86%	86%	87%	87%
10000t	75%	77%	79%	80%	81%	82%	83%	83%	83%	84%	84%
11000t	75%	76%	77%	78%	79%	79%	80%	80%	81%	81%	81%
12000t	75%	75%	76%	76%	77%	77%	77%	77%	77%	77%	77%
12500t	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%
12600t	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%
12700t	75%	75%	74%	74%	74%	74%	74%	74%	74%	74%	74%
12800t	75%	74%	74%	74%	74%	74%	74%	74%	74%	73%	73%
12900t	75%	74%	74%	74%	73%	73%	73%	73%	73%	72%	72%
13000t	75%	74%	74%	73%	73%	73%	72%	72%	72%	71%	71%
13100t	75%	74%	73%	73%	72%	72%	72%	71%	70%	70%	69%
13200t	75%	74%	73%	72%	72%	71%	71%	70%	69%	68%	67%
13300t	75%	74%	73%	72%	71%	70%	69%	68%	67%	66%	65%
13400t	75%	74%	73%	72%	70%	70%	68%	67%	65%	64%	62%
13500t	75%	74%	72%	71%	70%	68%	67%	65%	63%	61%	59%
13600t	74%	74%	72%	71%	69%	67%	65%	63%	61%	58%	55%
13700t	74%	73%	72%	70%	68%	66%	64%	61%	58%	55%	52%
13800t	74%	73%	71%	70%	67%	65%	62%	59%	55%	52%	48%
14000t	74%	73%	71%	68%	65%	62%	58%	54%	50%	45%	41%
15000t	74%	71%	66%	59%	47%	44%	42%	41%	39%	38%	36%
16000t	74%	69%	59%	48%	36%	27%	21%	18%	16%	15%	14%

Probability $F<F_{MSY}$ and $B>B_{MSY}$

TAC (t)	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
0t	75%	84%	90%	94%	96%	97%	98%	98%	99%	99%	99%
9000t	75%	78%	80%	82%	83%	84%	85%	86%	86%	87%	87%
10000t	75%	77%	79%	80%	81%	82%	83%	83%	83%	84%	84%
11000t	75%	76%	77%	78%	79%	79%	80%	80%	80%	81%	81%
12000t	74%	75%	75%	76%	76%	76%	77%	77%	77%	77%	77%
12500t	73%	73%	74%	74%	74%	74%	74%	75%	75%	75%	75%
12600t	73%	73%	73%	73%	74%	74%	74%	74%	74%	74%	74%
12700t	72%	72%	73%	73%	73%	73%	73%	73%	73%	73%	73%
12800t	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%
12900t	71%	71%	71%	71%	71%	71%	71%	71%	70%	70%	70%
13000t	70%	70%	70%	70%	70%	69%	69%	69%	68%	68%	67%
13100t	70%	69%	69%	69%	68%	67%	67%	66%	66%	65%	64%
13200t	69%	68%	68%	67%	66%	65%	64%	63%	62%	61%	60%
13300t	68%	67%	66%	65%	64%	63%	61%	60%	59%	57%	56%
13400t	67%	66%	64%	63%	61%	60%	58%	56%	54%	53%	51%
13500t	66%	64%	62%	61%	59%	57%	55%	53%	50%	48%	46%
13600t	64%	62%	60%	58%	56%	53%	51%	48%	46%	43%	40%
13700t	63%	61%	58%	55%	53%	50%	47%	44%	41%	38%	36%
13800t	61%	59%	56%	53%	49%	46%	43%	40%	37%	34%	32%
14000t	58%	55%	51%	47%	43%	39%	35%	32%	29%	27%	25%
15000t	38%	31%	25%	21%	22%	32%	30%	29%	27%	26%	25%
16000t	20%	15%	12%	11%	10%	10%	10%	9%	9%	9%	9%

SWO-ATL-Table 3. Estimated projection probabilities (%) for the reference case model for South Atlantic swordfish. Projection probabilities are provided for $F<=F_{MSY}$ (top); $B>=B_{MSY}$ (middle); $F<=F_{MSY}$ and $B>=B_{MSY}$ (bottom). Stochastic projections were conducted over the period 2023-2033 with a range of fixed TACs (6,000 – 15,000 t), including a zero catch-scenario. The 2021 and 2022 catches are assumed to be 9,826 t, which is the mean of the 2018-2020 reported catch.

Probability $F<=F_{MSY}$

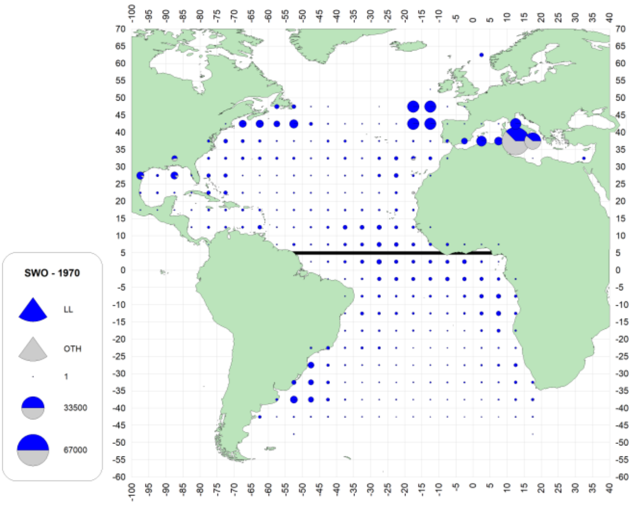
TAC (t)	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
0	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
6000	95%	97%	98%	98%	99%	99%	99%	99%	100%	100%	100%
6500	92%	94%	96%	97%	98%	98%	99%	99%	99%	99%	99%
7000	88%	91%	93%	95%	96%	97%	97%	98%	98%	98%	98%
7500	82%	86%	89%	91%	93%	94%	95%	96%	96%	97%	97%
8000	75%	80%	83%	86%	88%	90%	91%	92%	93%	94%	95%
8500	68%	72%	76%	79%	82%	84%	85%	87%	88%	89%	90%
9000	59%	64%	68%	71%	74%	76%	78%	80%	81%	83%	84%
9500	51%	55%	59%	62%	65%	67%	69%	71%	72%	74%	75%
9826	46%	50%	53%	56%	58%	60%	62%	64%	65%	67%	68%
10000	43%	47%	49%	52%	54%	57%	59%	60%	62%	64%	65%
10500	35%	38%	40%	42%	44%	46%	48%	49%	50%	52%	53%
11000	29%	31%	32%	33%	35%	36%	37%	38%	39%	40%	40%
11500	23%	24%	25%	25%	26%	27%	27%	28%	28%	29%	29%
12000	18%	18%	19%	19%	19%	19%	19%	20%	20%	20%	20%
12500	13%	14%	14%	14%	14%	14%	14%	13%	13%	13%	13%
13000	11%	10%	10%	10%	10%	10%	9%	9%	9%	9%	9%
13500	8%	8%	7%	7%	7%	6%	6%	6%	6%	6%	5%
14000	6%	6%	5%	5%	5%	4%	4%	4%	4%	3%	3%
14500	5%	4%	4%	3%	3%	3%	3%	2%	2%	2%	2%
15000	4%	3%	3%	2%	2%	2%	2%	2%	1%	1%	1%

Probability $B>=B_{MSY}$

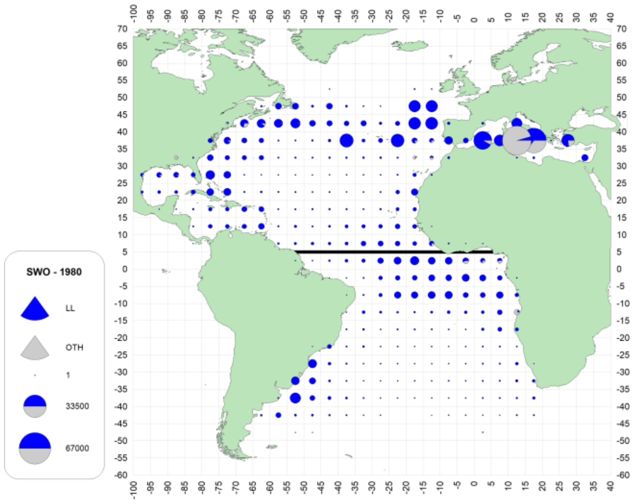
TAC (t)	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
0	21%	48%	74%	90%	96%	99%	99%	100%	100%	100%	100%
6000	21%	33%	46%	59%	70%	77%	83%	88%	92%	94%	95%
6500	21%	32%	44%	56%	66%	74%	80%	85%	88%	91%	93%
7000	21%	31%	41%	52%	62%	70%	75%	80%	85%	88%	90%
7500	21%	30%	39%	48%	57%	65%	70%	76%	80%	83%	86%
8000	21%	29%	37%	45%	53%	60%	65%	70%	74%	78%	81%
8500	21%	28%	34%	41%	48%	54%	59%	64%	68%	72%	75%
9000	21%	27%	32%	38%	44%	49%	53%	58%	61%	65%	68%
9500	21%	26%	31%	35%	39%	44%	48%	51%	55%	58%	60%
9826	21%	25%	29%	33%	36%	40%	43%	47%	50%	52%	55%
10000	21%	25%	29%	32%	35%	39%	41%	45%	47%	49%	52%
10500	21%	24%	27%	29%	31%	34%	36%	38%	40%	41%	43%
11000	21%	23%	25%	26%	28%	29%	30%	32%	33%	34%	35%
11500	21%	22%	23%	24%	24%	25%	25%	26%	26%	27%	27%
12000	21%	21%	21%	21%	21%	21%	21%	21%	21%	21%	21%
12500	21%	20%	19%	19%	18%	18%	17%	17%	16%	16%	16%
13000	21%	19%	18%	17%	16%	15%	14%	13%	13%	12%	12%
13500	21%	18%	17%	15%	14%	12%	11%	10%	10%	9%	9%
14000	21%	18%	15%	13%	12%	10%	9%	8%	7%	7%	6%
14500	21%	17%	14%	12%	10%	8%	7%	6%	6%	5%	4%
15000	21%	16%	13%	10%	8%	7%	6%	5%	4%	3%	3%

Probability $F<=F_{MSY}$ and $B>=B_{MSY}$

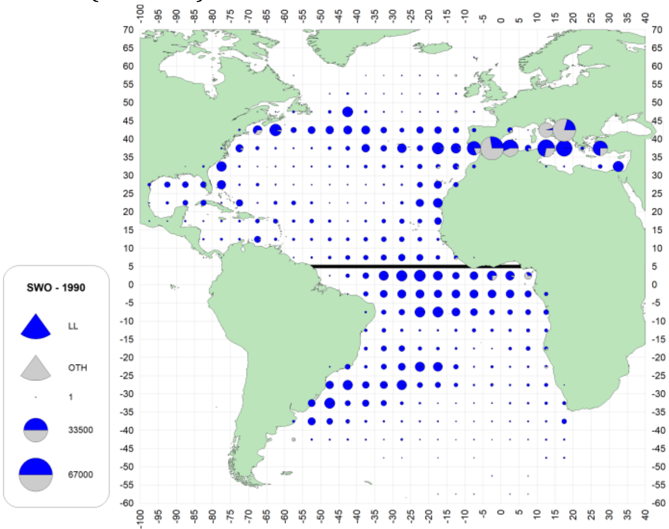
TAC (t)	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
0	21%	48%	74%	90%	96%	99%	99%	100%	100%	100%	100%
6000	21%	33%	46%	59%	70%	77%	83%	88%	92%	94%	95%
6500	21%	32%	44%	56%	66%	74%	80%	85%	88%	91%	93%
7000	21%	31%	41%	52%	62%	70%	75%	80%	85%	88%	90%
7500	21%	30%	39%	48%	57%	65%	70%	76%	80%	83%	86%
8000	21%	29%	37%	45%	53%	60%	65%	70%	74%	78%	81%
8500	21%	28%	34%	41%	48%	54%	59%	64%	68%	72%	75%
9000	21%	27%	32%	38%	44%	49%	53%	58%	61%	65%	68%
9500	21%	26%	31%	35%	39%	44%	48%	51%	55%	58%	60%
9826	21%	25%	29%	33%	36%	40%	43%	47%	50%	52%	55%
10000	20%	25%	28%	32%	35%	39%	41%	45%	47%	49%	52%
10500	20%	23%	26%	29%	31%	33%	35%	38%	40%	41%	43%
11000	20%	22%	24%	25%	27%	28%	30%	31%	32%	33%	35%
11500	18%	19%	21%	22%	23%	23%	24%	24%	25%	26%	26%
12000	16%	16%	17%	18%	18%	18%	18%	18%	19%	19%	19%
12500	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%
13000	10%	10%	10%	10%	9%	9%	9%	9%	9%	9%	8%
13500	8%	8%	7%	7%	7%	6%	6%	6%	6%	5%	5%
14000	6%	6%	5%	5%	5%	4%	4%	4%	4%	3%	3%
14500	5%	4%	4%	3%	3%	3%	3%	2%	2%	2%	2%
15000	4%	3%	3%	2%	2%	2%	2%	2%	1%	1%	1%



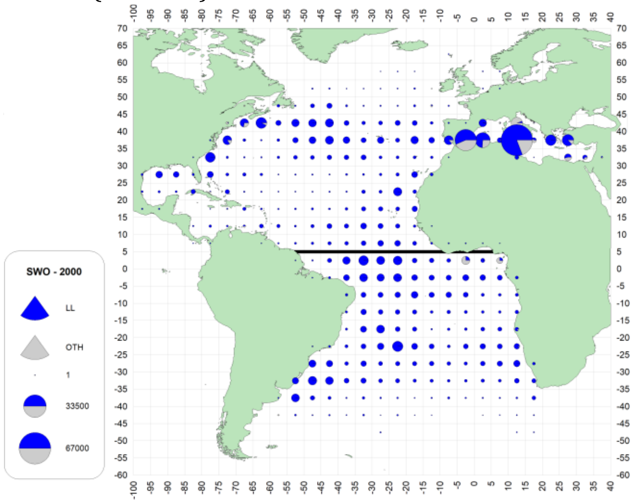
a. SWO (1970-79)



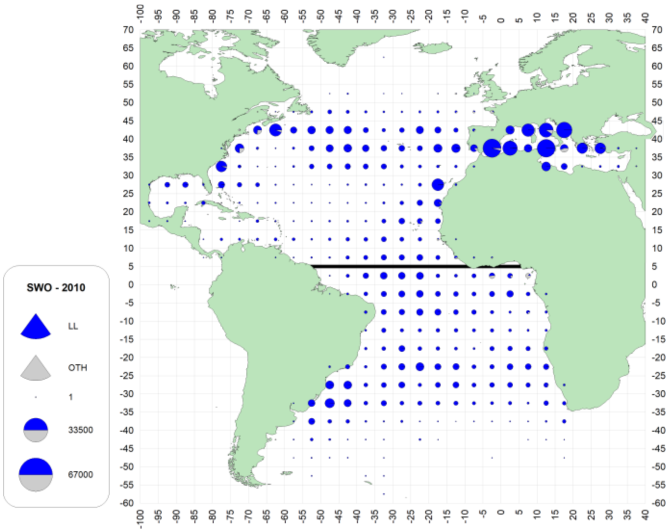
b. SWO (1980-89)



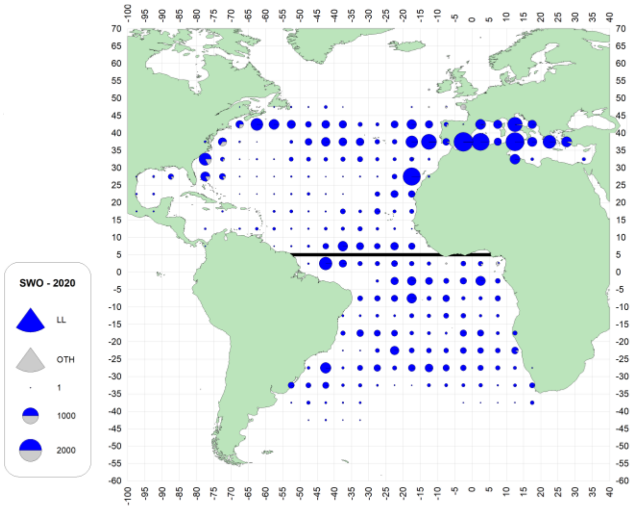
c. SWO (1990-99)



d. SWO (2000-09)

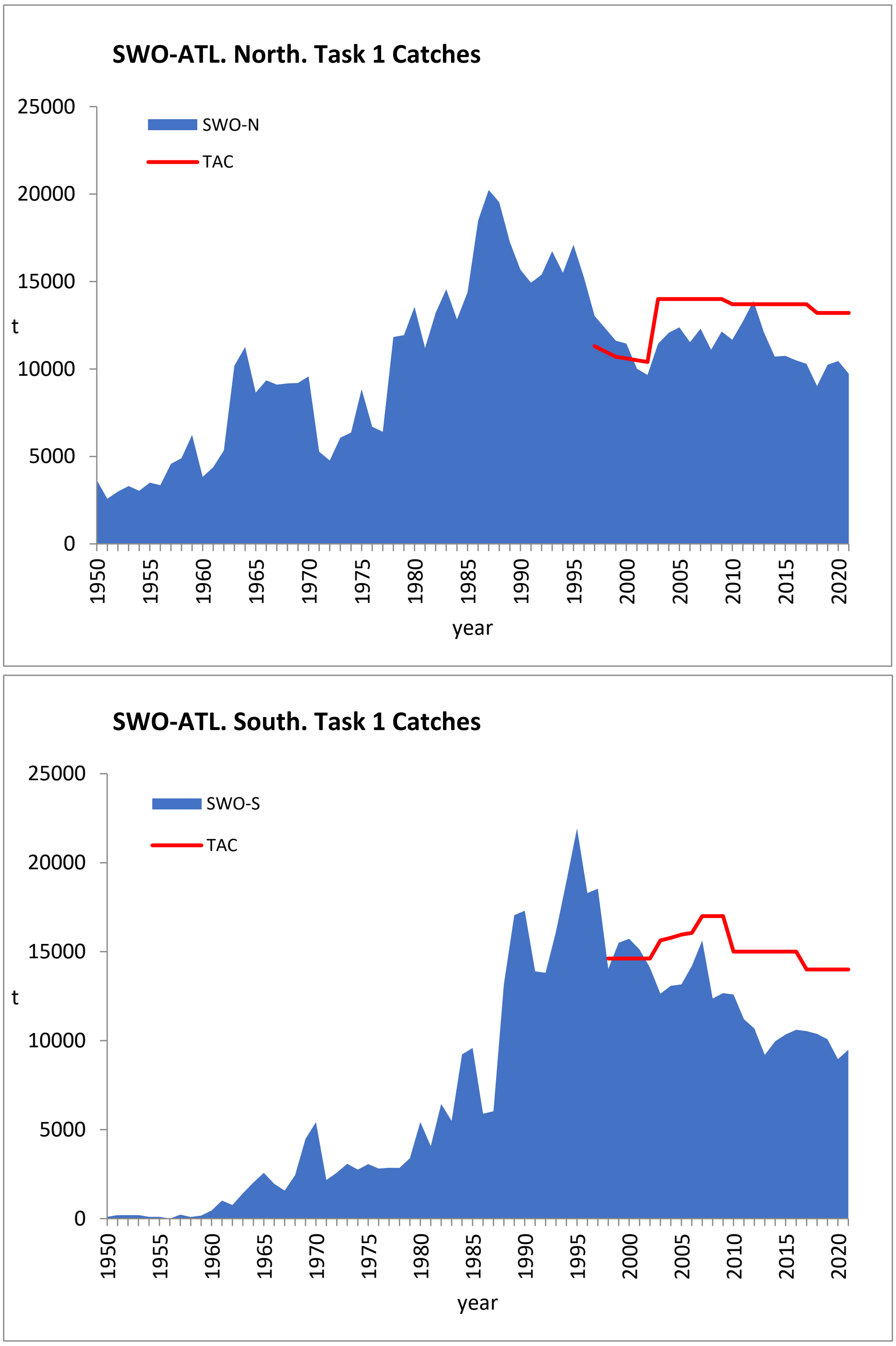


e. SWO (2010-19)

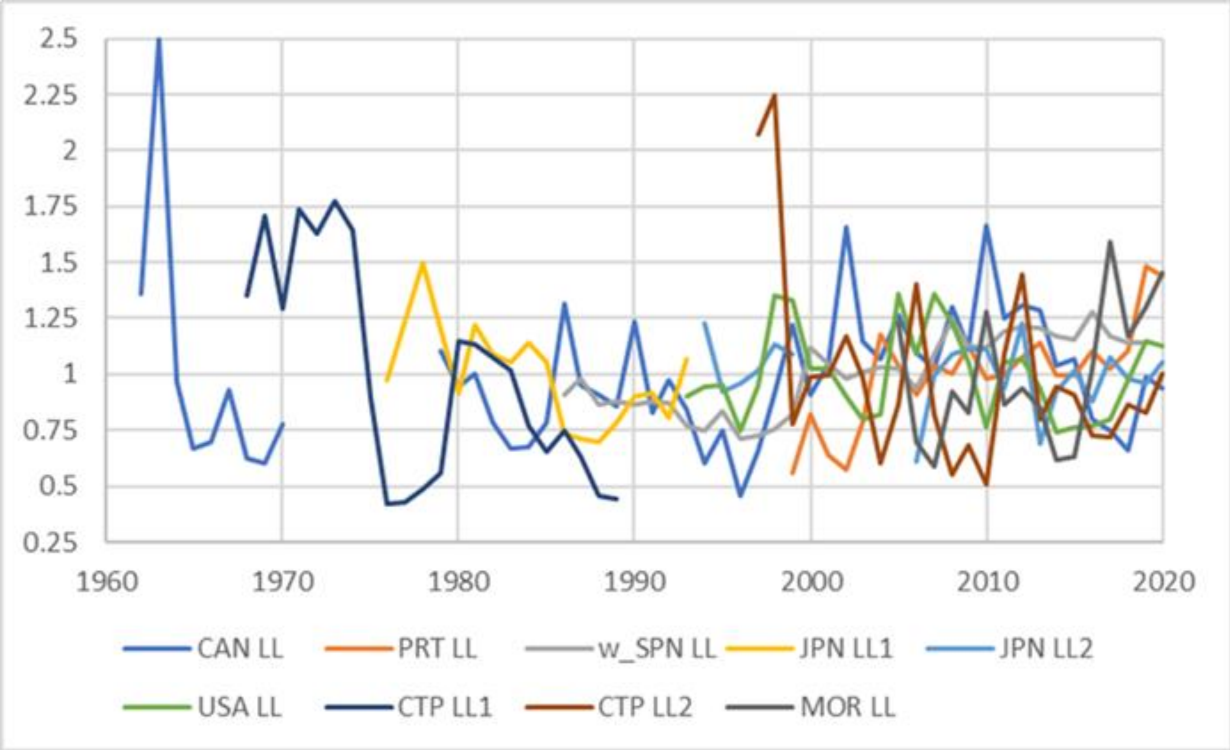


f. SWO (2020-21)

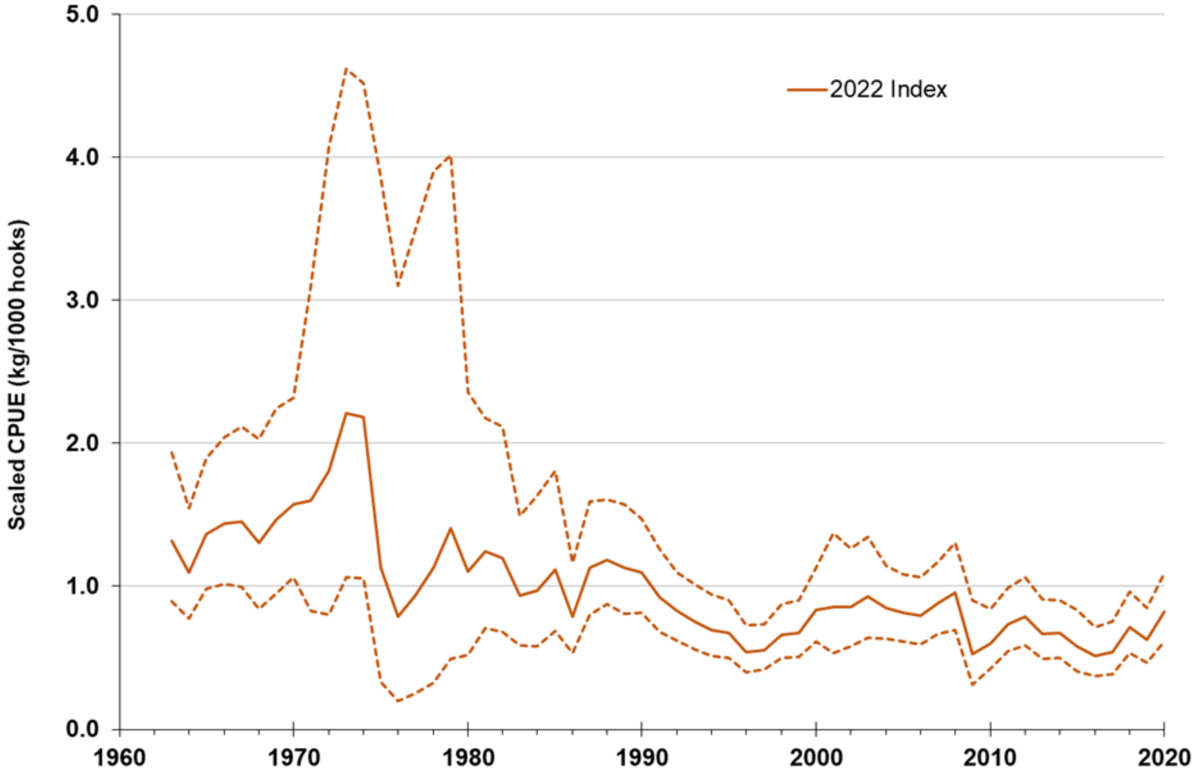
SWO-ATL-Figure 1. Geographic distribution of swordfish cumulative catch (t) by gear, in the Convention area, shown on a decadal scale. The maps are scaled to the maximum catch observed during 1970-2021 (the last decade only covers 2 years).



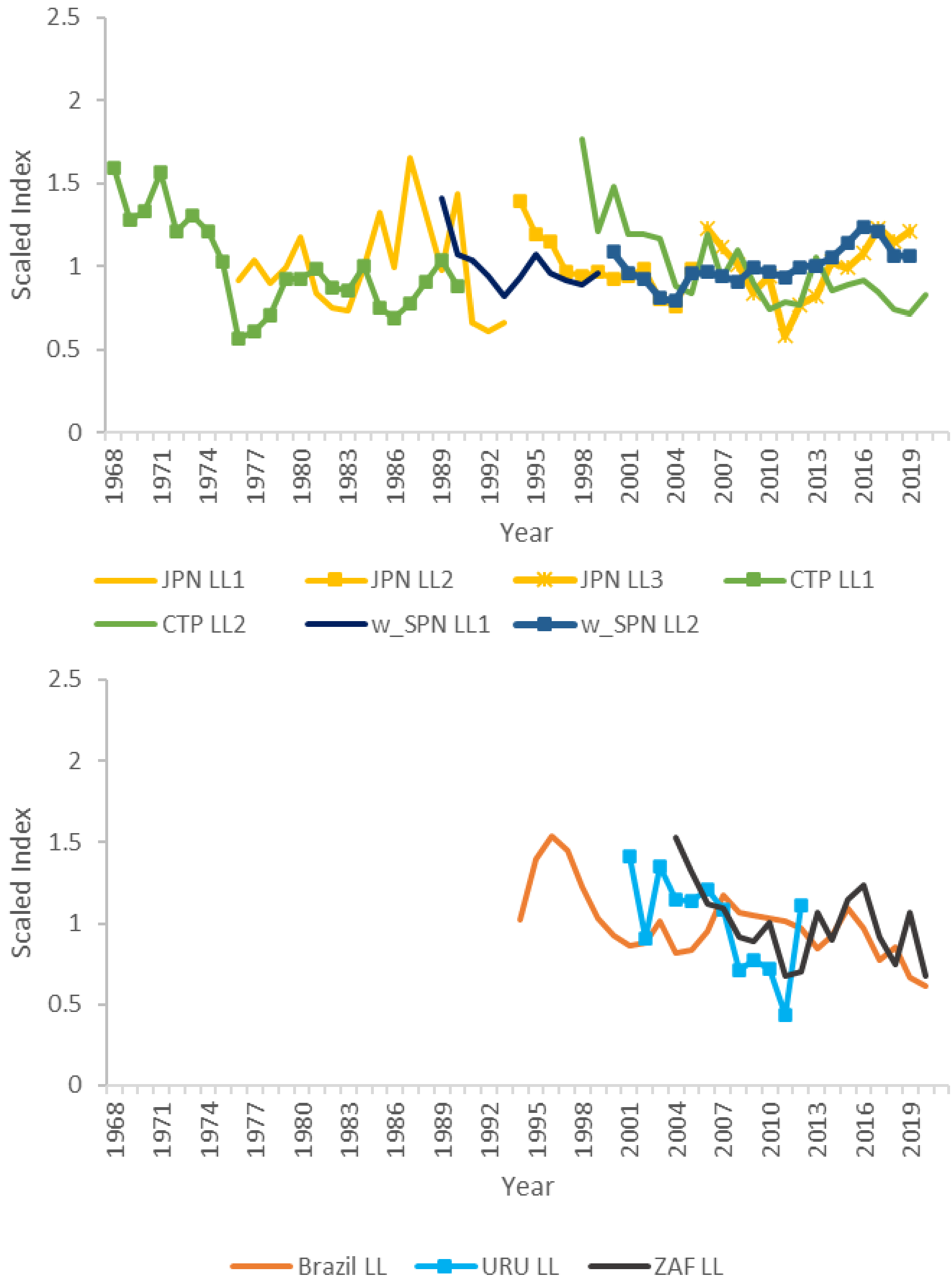
SWO-ATL-Figure 2. North (top) and South (bottom) Atlantic swordfish catches (t, landings and dead discards) and TAC (t), for the period 1950-2021.



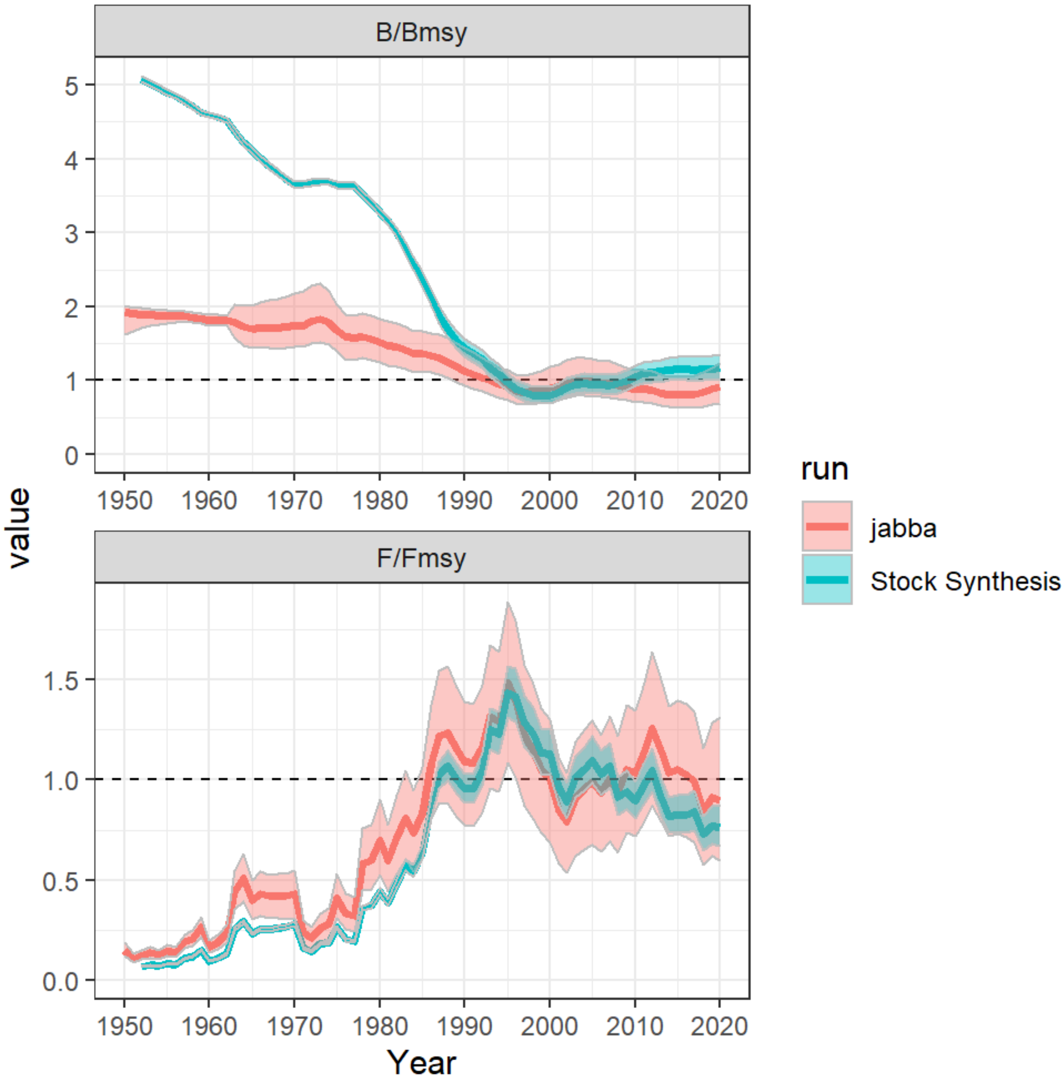
SWO-ATL-Figure 3. Standardized CPUEs series provided by CPCs for the North Atlantic swordfish and the combined index for the base continuity production model. The CPUE series were scaled to their mean for comparison purposes.



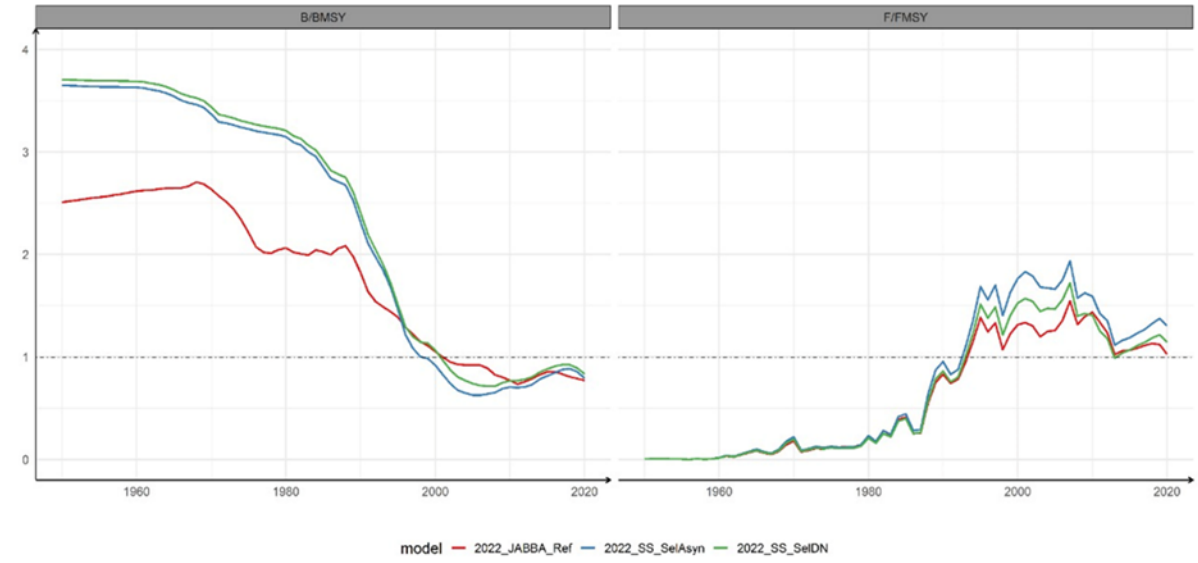
SWO-ATL-Figure 4. Standardized combined biomass CPUE index for North Atlantic and 95% confidence intervals, used as the continuity run for the production models.



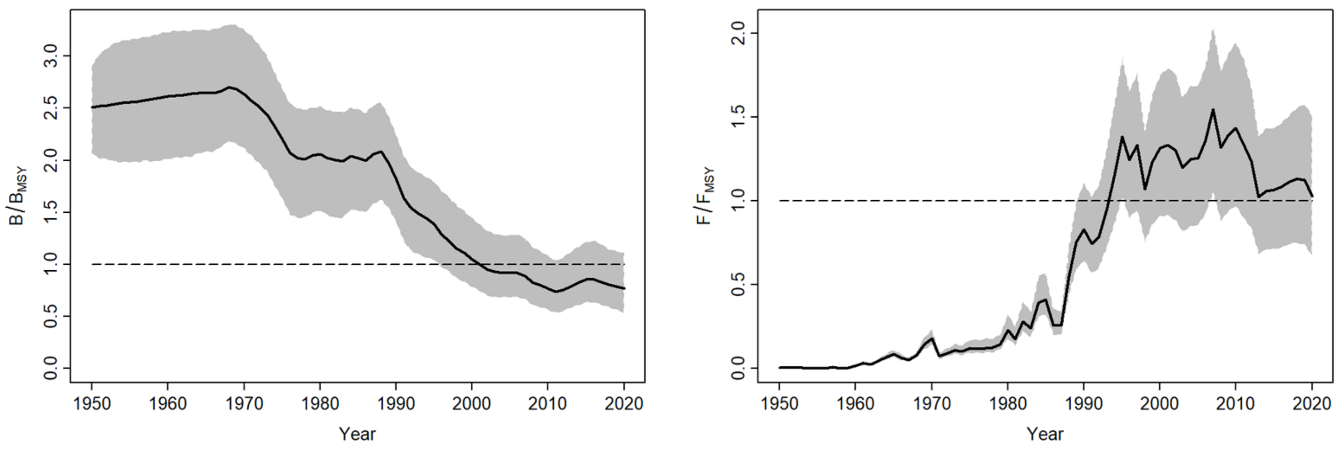
SWO-ATL-Figure 5. Standardized CPUEs series for that were used in the assessment of the South Atlantic swordfish, Indices that were split (JPN, EU-SPN and CTP) are shown on the top, and the rest (BRA, URU and ZAF) are shown at the bottom. The CPUE series were scaled to their mean for comparison purposes.



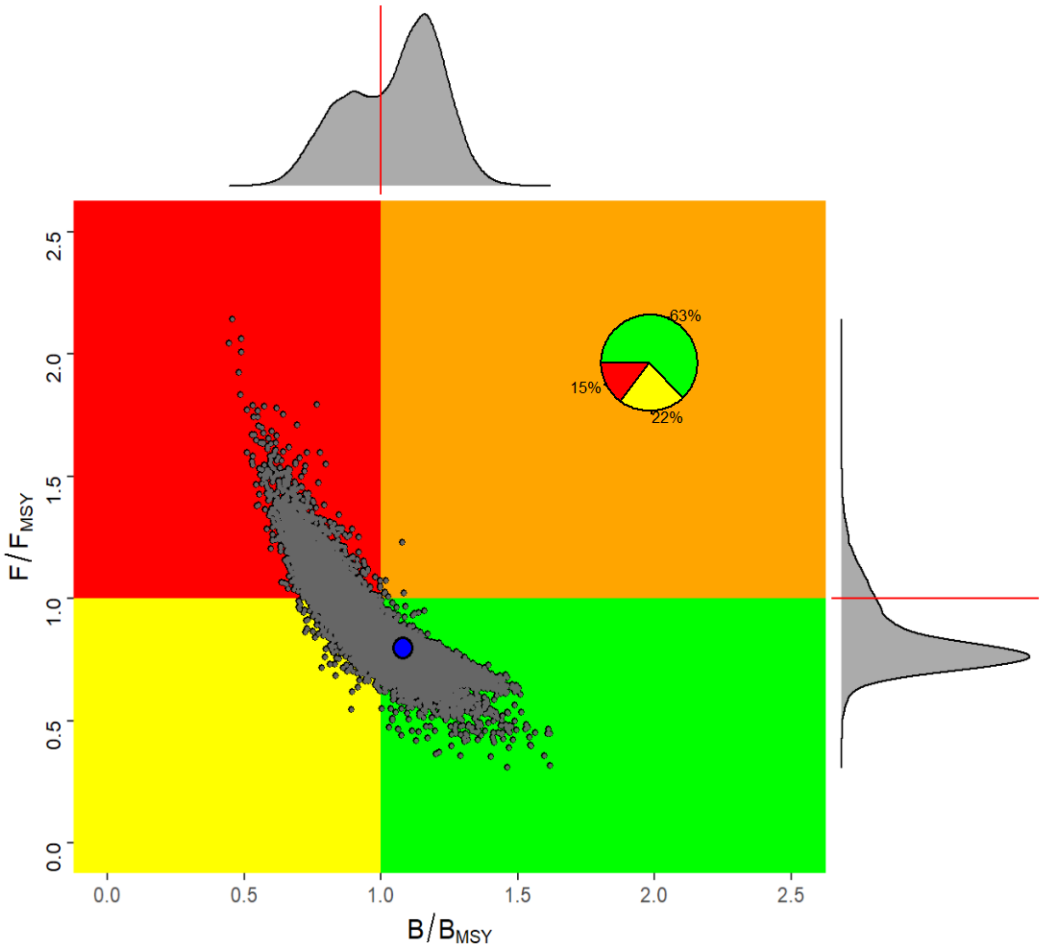
SWO-ATL-Figure 6. Results from the two models used for management advice in the North Atlantic swordfish assessment: JABBA and Stock Synthesis. Trends in relative biomass (top) and fishing mortality (bottom). Uncertainty intervals are approximations of 95% credibility intervals.



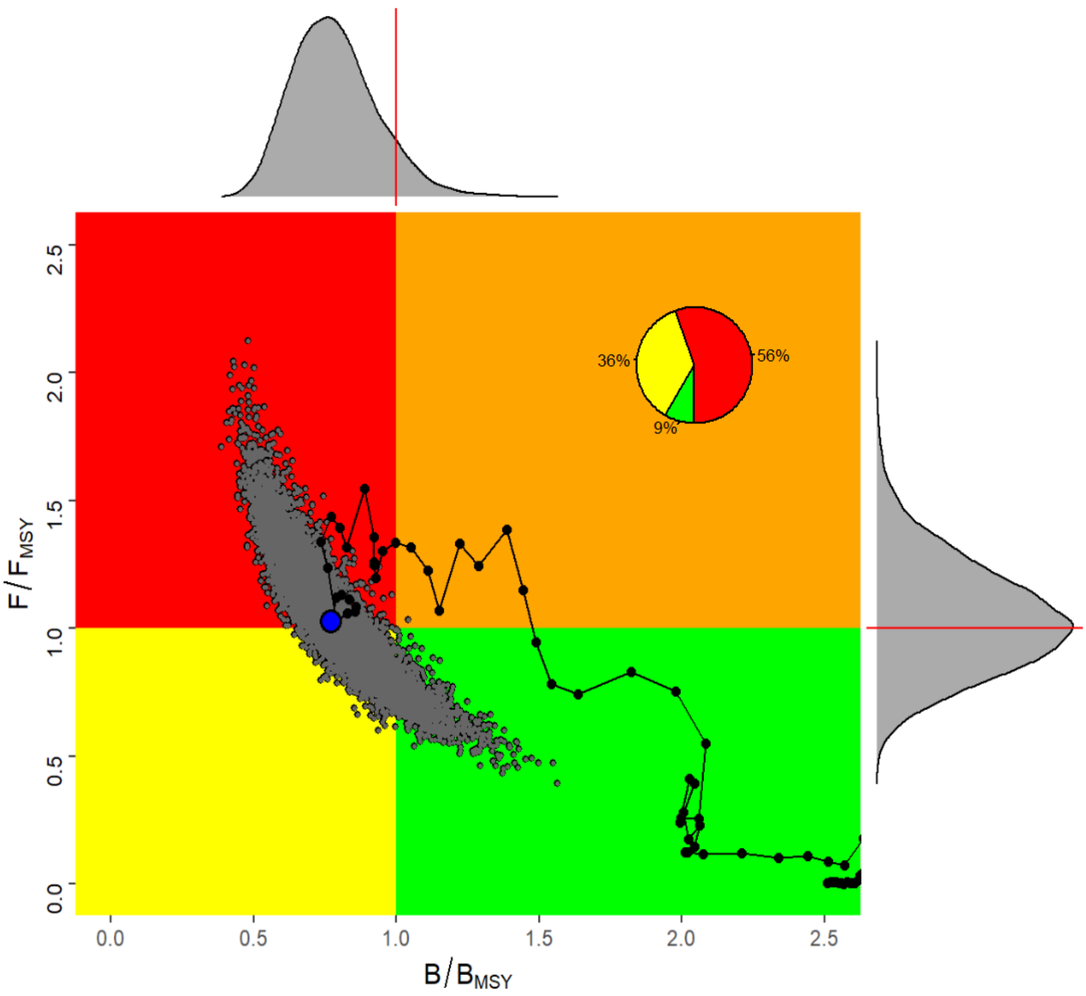
SWO-ATL-Figure 7. Comparisons of B/B$_{MSY}$ and F/F$_{MSY}$ between JABBA base case and two SS runs for the South Atlantic swordfish stock.



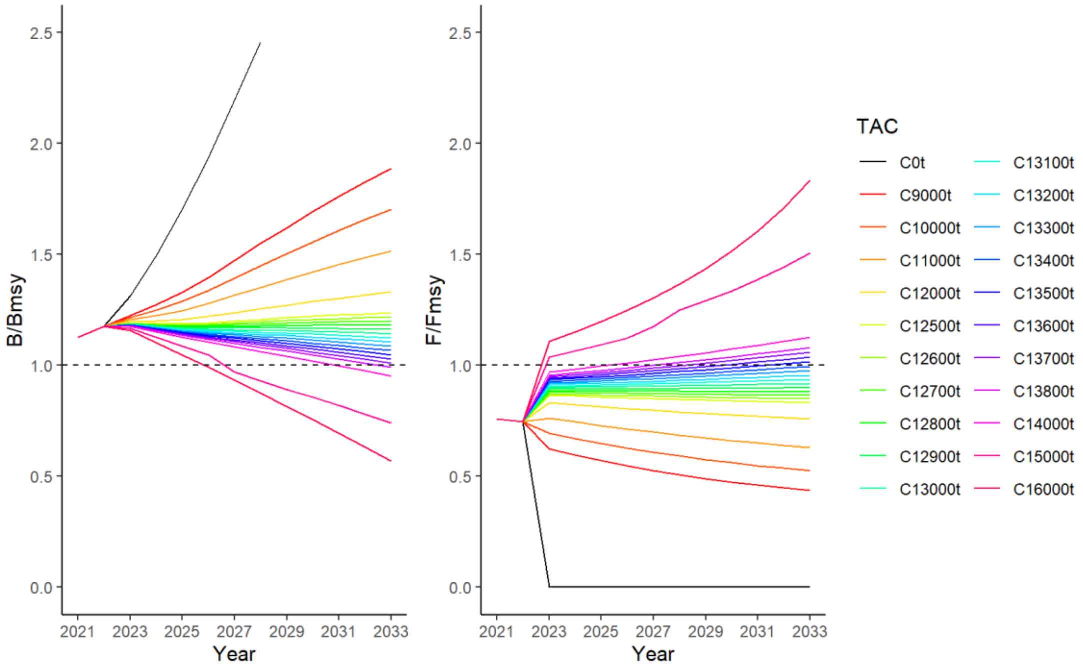
SWO-ATL-Figure 8. South Atlantic swordfish biomass and fishing mortality rates relative to MSY levels, from the JABBA base case model. Grey areas represent 95% credibility intervals.



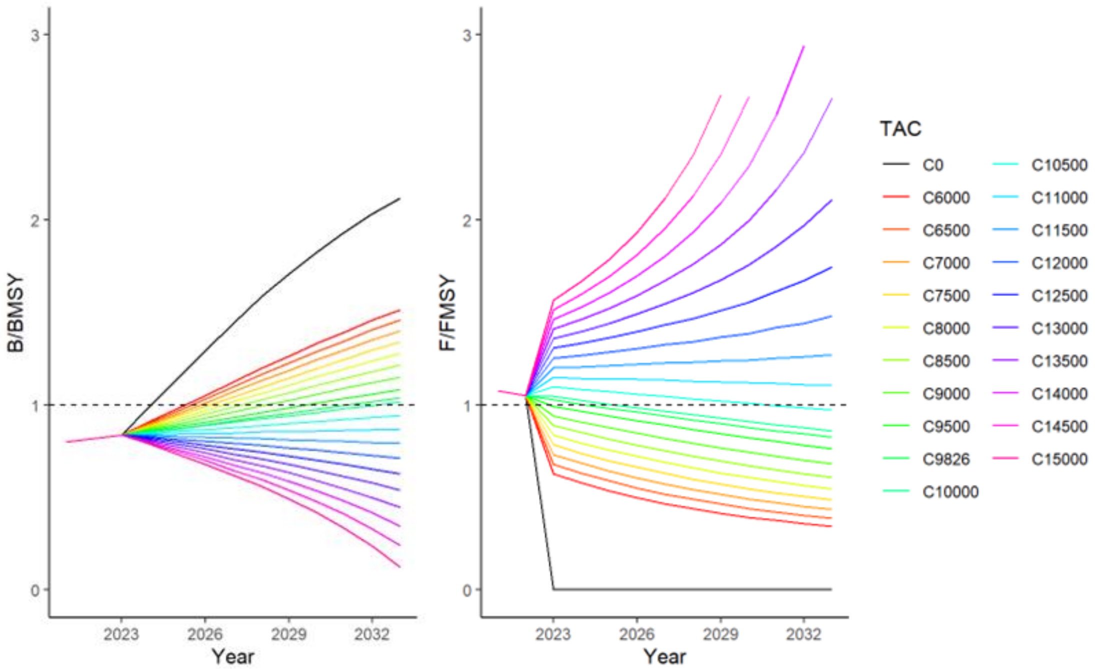
SWO-ATL-Figure 9. Joint Kobe plot for the Stock Synthesis and the JABBA reference case models for the North Atlantic swordfish stock. For the Stock Synthesis run, the benchmark is calculated from the year-specific selectivity and fleet allocations and based on 15000 MVLN iterations for Stock Synthesis and 15000 MCMC iterations for JABBA. The blue point shows the median of 30,000 iterations for SSB_{2020}/SSB_{MSY} or B_{2020}/B_{MSY} and F_{2020}/F_{MSY} for the entire iterations from Stock Synthesis and JABBA. Grey points represent the 2020 estimates of relative fishing mortality and relative spawning stock biomass for 2020 for each of the 30,000 iterations. The upper graph represents the smoothed frequency distribution of SSB_{2020}/SSB_{MSY} or B_{2020}/B_{MSY} estimates. The right graph represents the smoothed frequency distribution of F_{2020}/F_{MSY} estimates. The inserted pie graph represents the percentage of each 2020 estimate that fall in each quadrant of the Kobe plot. All SSB for Stock Synthesis showed the values at the end of years. The blue dot is the median of the 2020 stock status.



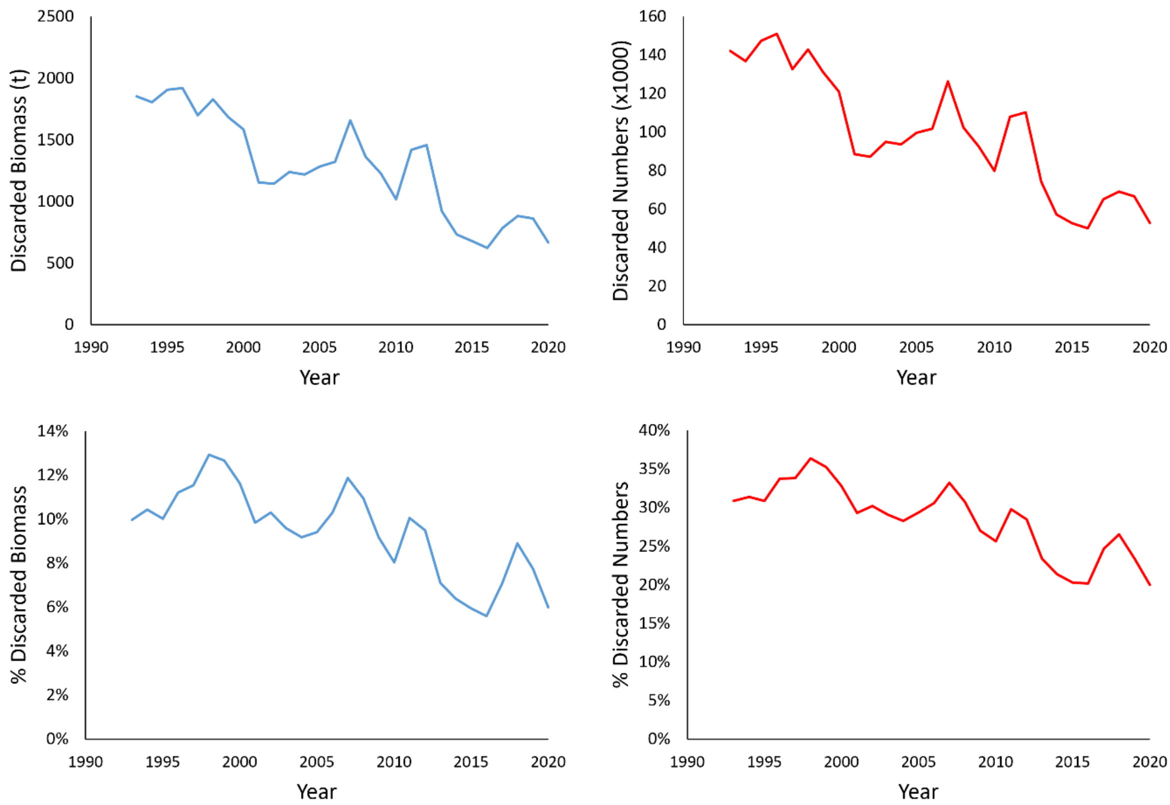
SWO-ATL-Figure 10. Kobe plot for the JABBA reference base case model for southern Atlantic swordfish. The solid blue circle is the estimated median point with the respective uncertainties in the terminal year (2020). The pie chart represents the probabilities of stock being in the different colour quadrants (red 56%, yellow 36%, green 9%). The blue dot represents the 2020 stock status.



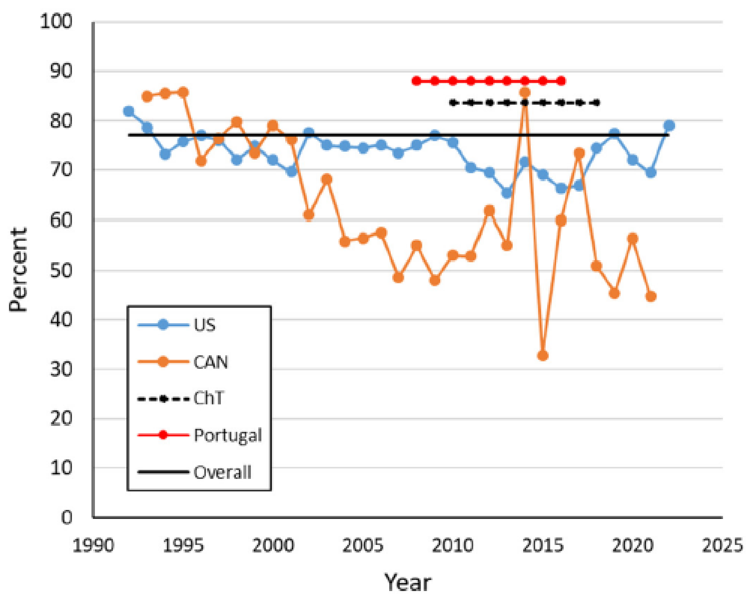
SWO-ATL-Figure 11. Joint projections from Stock Synthesis and JABBA of biomass (or spawning stock biomass) at 0, 9-16 thousand t constant TACs for the North Atlantic swordfish stock.



SWO-ATL-Figure 12. Median trends of relative biomass (B/B_{MSY}) for the projected South Atlantic swordfish stock derived from the JABBA base case model at 0, 6-15 thousand t constant TACs for the period 2023-2033.



SWO-ATL-Figure 13. Estimated total discards due to the minimum size regulation in absolute biomass and numbers (top row) and in biomass and numbers as a proportion of the catch (bottom row) for years 1992 to 2020, as estimated by Stock Synthesis.



SWO-ATL-Figure 14. Direct observations of at-haulback mortality of fish below the minimum size limit in four longline fleets operating in the North Atlantic.

9.3 BFT-ATLANTIC BLUEFIN TUNA

The Committee notes that Atlantic bluefin tuna management is embarking upon a transition to a management procedure approach, pending adoption by the Commission at its November 2022 meeting. Such an approach will link eastern and western area TACs under one management framework, providing joint management advice. This approach will also require a restructuring of the traditional separate management advice sections East and West BFT (E-BFT and W-BFT) Executive Summaries. The Committee takes this opportunity in the bluefin tuna 'preamble' to comment on recommendations for both East and West BFT in this regard.

The primary efforts of the Committee have been directed at the ongoing development of the Management Strategy Evaluation (MSE) and, as the MSE has simulation tested multiple management procedures to check that they are robust to multiple uncertainties, the Committee recommends that the Commission adopt a management procedure which will set TAC advice for both the East and the West areas for 2023 and beyond. Should the Commission not be able to adopt a management procedure in 2022, the Committee sees no undue risk to either eastern or western stocks for a rollover of the present TACs to apply for 2023, based on an evaluation of the updated abundance indices.

The Commission requested the previously scheduled stock assessment of E-BFT in 2022 to be pursued for the purposes of evaluating stock status. In that regard, the Committee has been successful, exceeding previous attempts in that three assessment models were determined to be useful for evaluating stock status relative to fishing mortality. While this is a substantial accomplishment, the assessment models for bluefin tuna are nevertheless believed to be better at providing relative stock status (e.g., status relative to $F_{0.1}$) than in providing absolute TAC advice. This challenge plays out in the substantial variability in the absolute scale of the total population size estimates coming from the assessment models. Given this uncertainty as well as a number of remaining issues related to the reliability of basic catch data, the Committee is not providing TAC recommendations based on the assessment models. For the W-BFT, the Committee conducted an assessment in 2021 which was also used only for stock status relative to overfishing and not for TAC advice. As an assessment has not been conducted for W-BFT this year, the Committee will not provide an updated Executive Summary. Instead, management advice for W-BFT will be provided specifically in response to the Commission's request (item 17.11).

In past situations where the Committee has not developed TAC advice directly from assessments, it has employed alternative options, e.g., explorations based on index trends. However, such options could not be considered the best available scientific information for informing TAC decisions in light of the extensive, robust and simulation tested advice that comes from any of the remaining available candidate management procedures. Hence the Committee reiterates its recommendation that TAC advice for 2023 (and beyond) for both East and West areas be obtained from an MSE tested management procedure (see item 17.14, Response to the Commission's request).

BFT-1. Biology

Atlantic bluefin tuna (BFT) have a wide geographical distribution but live mainly in the temperate pelagic ecosystem of the entire North Atlantic and its adjacent waters, for example the Gulf of Mexico, Gulf of St. Lawrence and the Mediterranean Sea. Historical catch information documents the presence in the South Atlantic (**BFT-Figure 1**). Electronic archival tagging information has confirmed that bluefin tuna can tolerate cold as well as warm water temperatures while maintaining a stable internal body temperature. Bluefin tuna preferentially occupy the surface and subsurface waters of the coastal and open-sea areas, but archival electronic tagging and ultrasonic telemetry data indicate that they frequently dive to depths of more than 1,000 m. Bluefin tuna are a highly migratory species that seems to display a homing behavior and spawning site fidelity to primary spawning areas in both the Mediterranean Sea and the Gulf of Mexico. Evidence indicates spawning in other areas, for example the vicinity of the Slope Sea off the Northeast USA and more recently the Cantabrian Sea, though the persistence and importance of these other areas as spawning grounds remain to be determined. Electronic tagging is also resolving the movements to the foraging areas within the Mediterranean and the North Atlantic and indicates that bluefin tuna movement patterns vary by tagging site, by month of tagging and according to the age of the fish. The reappearance of bluefin tuna in historical fishing areas (e.g., Norway and, more recently, the Black Sea) suggest that important changes in the spatial dynamics of bluefin tuna may also have resulted from interactions between biological factors, environmental variations and a reduction in fishing effort.

The fisheries for Atlantic bluefin tuna are managed as two management units, conventionally separated by the 45°W meridian. However, efforts to understand the population structure through tagging, genetic and microchemistry studies indicate that mixing is occurring at variable rates between the two management areas.

The ICCAT GBYP, as well as national research programmes, have provided the basis for improved biological studies. Substantial progress has been made in estimating regional, time varying mixing rates for Atlantic bluefin tuna, using otolith stable isotope and genetic analyses. Research on the larval ecology of Atlantic bluefin tuna has advanced in recent years through oceanographic habitat suitability models. Direct age estimation, using otoliths and dorsal fin spines from both stock areas, have been calibrated between readers from several institutions resulting in stock specific age length keys and a new growth model for the western population. Otolith preparation and reading protocols have been updated to minimize bias in age estimation. Following Rec. 18-02 para 28, a research study of growth in farms was launched in 2019 at five locations, and a new database will be created to integrate all the data from stereo-camera measurements and harvesting operations. Additionally, a Sub-group on growth of BFT in farms was established in 2020 within the BFT Species Group. This Sub-group was created to ensure that the best scientific data would be provided to the Commission.

Currently, the Committee assumes for assessment purposes that eastern Atlantic and Mediterranean bluefin tuna contributes fully to spawning at age 5. There are also indications that some young individuals (of age 5) of unknown origin caught in the West Atlantic are mature, but there is considerable uncertainty with regards to their contribution to the western stock spawning. Therefore, the Committee has considered two spawning schedules for the western stock; one identical to that used for the East and one with peak spawning at age 15. However, the latest review of reproductive biology has shown that both the current vectors for spawning fraction at-age might be biased, and that the magnitude of that bias is unknown. Juvenile growth is rapid for a teleost fish, but slower than for other tuna and billfish species. Fish born in June attain a length of about 30-40 cm and a weight of about 1 kg by October. After one year, fish reach about 4 kg and 60 cm in length. At 10 years of age, a bluefin tuna is about 200 cm and 170 kg and reaches about 270 cm and 400 kg at 20 years of age. Bluefin tuna is a long-living species, with a lifespan of about 40 years as indicated by radiocarbon deposition and can reach 330 cm (SFL) and weigh up to 725 kg. In 2017, the Committee revised the natural mortality assumptions, and adopted a single new age specific natural mortality vector for both stocks.

Important electronic and conventional tagging activity has been conducted for both juvenile and adult fish for several years in the Atlantic and Mediterranean by the ICCAT GBYP, National Programmes and NGOs. Contributions from e-tag data from all groups are supporting ongoing efforts to provide important insights into bluefin tuna stock structure, distribution, mixing and migrations, and are helping to estimate fishing mortality rates and to condition the MSE operating models.

EAST BLUEFIN TUNA

BFTE-2. Fishery trends and indicators –East Atlantic and Mediterranean

Reported catches in the East Atlantic and Mediterranean reached a peak of over 50,000 t in 1996 and then decreased substantially, stabilizing at around the TAC levels established by ICCAT for the most recent period (**BFTE-Figure 1**). Catches between 2017 and 2021 (as of September 2022) were respectively 23,665 t, 27,782 t, 31,134 t, 35,038 t and 35,075 t for the East Atlantic and Mediterranean, of which 16,450 t, 19,624 t, 22,041 t, 24,164 t and 24,729 t were reported for the Mediterranean for those same years (**BFT-Table 1**). The Committee is aware of ongoing, unquantified, IUU catches that represents a serious impediment to being able to determine the productivity of the stock and to provide reliable TAC advice. In response, the Committee urges identification and quantification of IUU catches so that it can provide more accurate biomass-based catch advice and obtain more accurate scientific understanding of stock productivity.

Available information has demonstrated that catches of bluefin tuna from the East Atlantic and Mediterranean were seriously under-reported between the mid-1990s through 2007. The Committee estimated that the realized total catch during this period was likely of the order of 50,000 t to 61,000 t per year, based on the number of vessels operating in the Mediterranean Sea and their respective catch rates.

Since the 2017 Stock Assessment (Anon., 2018a), these estimates (1998-2007) have been treated as the actual catches.

During the 2022 Stock Assessment meeting, the decision was made to use ten abundance indices up to 2020 (seven CPUE series and three fisheries independent indices) (**BFTE-Figure 2**).

CPUE indices (**BFTE-Figure 2**) have been affected appreciably by regulatory measures through changes to operational patterns, length of the fishing season and target sizes; thus, it is difficult to distinguish the effect of these changes on CPUE index values from the effects of changes in abundance.

BFTE-3. State of the stock

There have been considerable improvements in data quality and quantity over the past few years; nevertheless, important gaps remain in the temporal and spatial coverage for detailed size and catch-effort statistics for several fisheries, especially in the Mediterranean before the implementation of stereo video cameras in 2014. The catch at size (CAS) and catch-at-age (CAA) of the NEI catch (1998-2007) were revised.

Three modelling platforms were used to conduct the assessment of the E-BFT in 2022. As in previous assessments, a virtual population analysis (VPA) was conducted, and two additional platforms, Stock Synthesis (SS) and the age-structured assessment programme (ASAP), were applied.

The three models showed similar trends in spawning stock biomass (SSB), with a progressive decline in SSB from the 1970s until the implementation of a Recovery Plan developed in 2006 (Rec. 06-05). Since the late 2000s there has been a strong increase in SSB, although the magnitude and rate of increase differ among the three models, with VPA indicating a lowest biomass while ASAP indicates the largest increase. Uncertainty in the rate and magnitude of the increase in SSB is evident for all three platforms and in the sensitivity tests conducted for each platform, especially in recent years (**BFT-E Figure 3**). The fishing mortality of the age group 2-5 and age 10+ fish showed an increasing trend since the 1970s, whereas the F for both the age group 2-5 and age 10 plus shows a drastic decline in fishing mortality since the establishment of the 2006 Recovery Plan (**BFT-E Figure 3**). Recently, fishing mortality has been increasing, however, when average over all three models, fishing mortality is still below fishing mortality target.

Recruitments estimated by the three assessment platforms show considerable variability, especially over the recent period. In general, however, there are two distinct periods, one with low recruitments before 1990 and the other with higher recruitments thereafter (**BFT-E Figure 3**).

An independent review concluded that the results of the three models are sufficient to provide general management advice that abundance has increased and is likely to continue to increase given recent patterns of fishing mortality (effort). However, the review also recommended against using the results from these models for TAC advice.

The current perception of the stock status depends on recruitment estimates which are highly uncertain. The different models showed a relatively wide range of stock status estimates relative to the $F_{0.1}$ reference level, ranging from overfishing to not overfishing ($F_{CURRENT}/F_{0.1}$): VPA = 1.16; SS = 0.72 and ASAP = 0.54. To inform stock status, the Committee recommended that the results of the three models be considered equally, by integrating the results. The resultant point estimate of F_{CUR} is below $F_{0.1}$ ($F_{CURRENT}/F_{0.1}$= 0.81; 95% CI 0.48-1.62), indicating a stock status determination of not overfishing. Furthermore, fishing mortality rates are much lower than those during the 1998-2007 period.

BFTE- 4. Outlook

The Committee considers that the three assessment platforms (VPA, SS and ASAP) have disparate and highly uncertain estimates of recent recruitment and absolute biomass, which would make short-term catch advice based on $F_{0.1}$ not robust in terms of both the consequences of taking a particular TAC and the accuracy of absolute $F_{0.1}$ estimate. Considering the uncertainties and shortcomings noted above, as well as the advice of the independent peer review, the Committee only provides VPA short-term projections and only for informative purposes. The VPA projections were conducted at both $F_{0.1}$ and at the current TAC of 36,000 t, using a long term (1968-2016) average and a recent (2007-2016) average of recruitment. Projections at $F_{0.1}$ correspond to median yields of 35,000 t and 38,500 t for 2023 and 2024, respectively. These projections, as well as those with the current TAC, indicate that the spawning biomass increases for the next two years under both scenarios and under both recruitment assumptions (**BFTE-Figure 4**).

As requested in Rec. 21-08, the Committee evaluated whether the stock size indicators supported the TAC advice for 2023 and the following years. Evaluation of recent changes in these indicators in 2022 indicate positive signs in almost all of these, because although there have been decreases in some of these indices in recent years (French Aerial survey and JPN LL NEast), their values are still high compared to historical levels (**BFTE-Figure 2**).

BFTE-5. Effect of current regulations

The Committee noted that reported catches are in line with recent TACs. However, the Committee has been informed of the existence of unquantified illegal catches.

The TAC of 36,000 t originally implemented in 2020 through Rec. 19-04 and retained in Rec. 21-08 has been in place for 3 years. The combination of size limits and the reduction of catch has certainly contributed to a rapid increase in the abundance of the stock.

BFTE-6. Management recommendations

The Committee recommends that the Commission adopt one of the MSE-tested management procedures (see item 17.14, Response to the Commission's request), and that the TAC be set based on that MP for 2023 and beyond.

Should the Commission not adopt a management procedure in 2022, the Committee sees no undue risk to the stock for a rollover of the present TAC for 2023 (36,000 t). The Committee bases this on a review of the stock indicators and from the trends in the VPA projections that indicate increases in the stock under the current management.

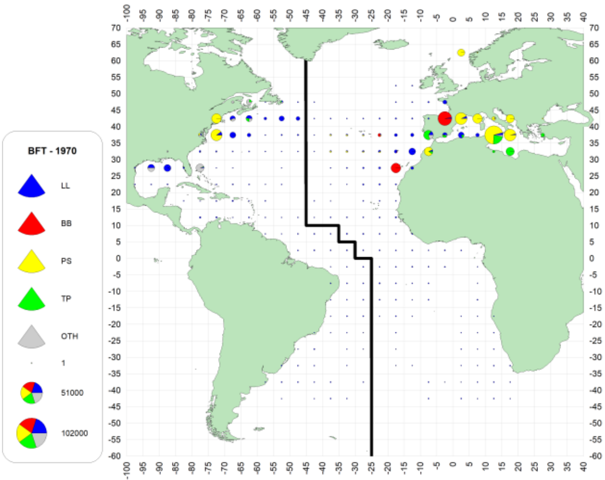
EAST ATLANTIC AND MEDITERRANEAN BLUEFIN TUNA SUMMARY	
Current reported catch (2021)	35,075 t*
$F_{CURRENT}/F_{0.1}$[2]	0.81 (0.48-1.62)[1]
Stock Status [3]	Overfishing: No
TAC 2022	36,000 t

[1] Mean and approximate 95% confidence interval from integrating across the uncertainty for each model.
[2] $F_{CURRENT}$ refers to the geometric mean of the estimates (a proxy for recent F levels) for 2017-2020 for VPA, and for 2018-2020 for ASAP and Stock Synthesis. For the VPA and ASAP, F is measured as apical F, for Stock Synthesis F is exploitation rate in biomass.
[3] Biomass reference points to determine stock status were not estimated since the 2017 assessment due to uncertainty in recruitment potential.
* As of September 2022.

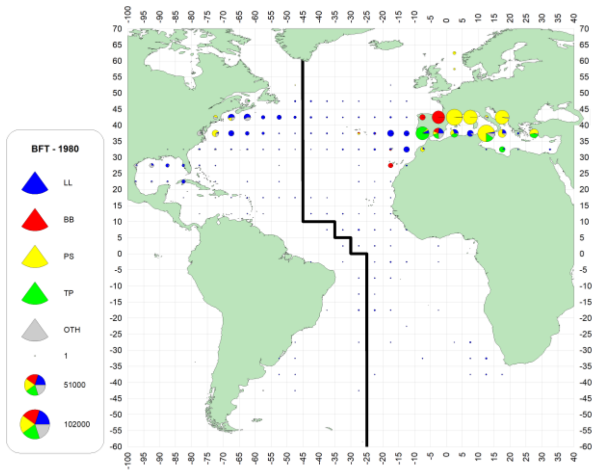
BFT-Table 1. Estimated catches (t) of northern bluefin tuna (*Thunnus thynnus*) by area, gear and flag.

				1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
TOTAL				34128	36642	48881	49751	54009	53545	52657	52772	52775	52784	53319	52305	52125	51756	51812	62638	26460	21798	13195	11781	12688	14725	14887	18055	21076	25515	29809	33440	37308	37378
BFT-E				31831	34258	46769	47303	51497	51211	50000	50000	50000	50000	50000	50000	50000	50000	50000	61000	24460	19818	11338	9774	10934	13243	13261	16214	19175	23665	27782	31134	35038	35075
	ATE			7396	9317	7054	9780	12098	16379	11630	10247	10061	10086	10347	7394	7402	9023	7529	8441	8243	6684	4379	3984	3834	4163	3918	4841	5968	7216	8157	9093	10874	10346
	MED			24435	24941	39715	37523	39399	34831	38370	39753	39939	39914	39653	42606	42598	40977	42471	52559	16217	13133	6959	5790	7100	9080	9343	11372	13206	16450	19624	22041	24164	24729
BFT-W	ATW			2296	2384	2113	2448	2512	2334	2657	2772	2775	2784	3319	2305	2125	1756	1811	1638	2000	1980	1857	2007	1754	1482	1627	1842	1901	1850	2027	2306	2269	2303
Landings	ATE		Bait boat	1422	3884	2284	3093	5369	7215	3139	1554	2032	2426	2635	1409	1902	2282	1263	2436	2393	1260	725	636	283	243	95	172	1085	1195	692	845	936	1031
			Longline	3618	2802	2311	4522	4212	4057	3789	3570	3736	3303	2896	2748	2064	2700	2033	1705	2491	1951	1194	1125	1139	1167	1194	1467	1829	2208	2730	3177	3313	3286
			Other surf.	523	976	590	555	273	60	387	404	509	558	631	521	290	424	831	502	181	297	124	35	49	141	210	193	261	295	340	320	381	359
			Purse seine	462	24	213	458	323	828	700	726	661	153	887	490	1078	1197	408	0	0	2	1	0	0	2	0	0	42	49	11	56	190	147
			Sport (HL+RR)	7	0	25	0	0	237	28	33	126	61	63	109	89	11	99	11	12	11	44	51	53	46	43	104	35	101	118	92	156	267
			Traps	1365	1631	1630	1152	1921	3982	3586	3960	2996	3585	3235	2116	1978	2408	2895	3788	3166	3164	2292	2137	2311	2564	2376	2905	2716	3362	4258	4594	5889	5255
	MED		Bait boat	158	48	0	206	5	4	11	4	38	28	1	9	17	5	0	0	0	38	1	0	2	2	9	25	0	50	56	72	103	81
			Longline	3145	2470	6993	8469	9856	7313	4117	3338	3424	4144	3234	3484	3036	3427	3408	3269	2376	1344	1242	962	587	605	588	776	1523	1184	1518	1436	1824	1619
			Other surf.	447	371	776	545	417	282	284	228	728	354	340	198	197	175	81	85	0	0	1	1	1	20	29	3	37	90	34	51	282	65
			Purse seine	18580	20065	27948	23799	26021	24279	31792	33798	33237	33043	34044	37291	37869	36639	38363	48994	13540	11448	4986	4293	6172	7982	8184	9993	11340	14493	17128	19515	20872	21989
			Sport (HL+RR)	952	1238	2307	3562	2149	2340	1092	1533	1773	1167	1520	1404	1325	619	494	117	149	160	448	356	202	240	289	373	297	351	582	611	713	718
			Traps	1152	749	1691	942	951	613	1074	852	739	1177	515	221	154	112	125	93	152	144	281	165	125	222	232	192	0	272	300	353	366	252
	ATW		Longline	689	712	539	491	545	382	764	915	858	610	729	186	644	425	565	420	606	366	529	743	478	470	498	553	562	559	664	675	576	651
			Other surf.	509	406	307	384	429	293	342	279	283	201	107	139	97	89	85	63	78	121	107	147	117	121	119	138	93	123	77	168	134	175
			Purse seine	300	295	301	249	245	250	249	248	275	196	208	265	32	178	4	28	0	11	0	0	2	29	38	34	0	0	0	0	0	
			Sport (HL+RR)	586	854	804	1114	1032	1181	1108	1125	1121	1650	2036	1399	1139	924	1005	1023	1134	1251	1009	888	917	692	810	1085	1204	1144	1263	1450	1543	1444
			Traps	1	29	79	72	90	59	68	44	16	16	28	84	32	8	3	4	23	23	39	26	17	11	20	6	10	13	3	4	4	4
Discards	ATE		Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	7	9	8	1
	MED		Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	
			Purse seine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	12	9	11	2	9	10	6	4	5	4
	ATW		Longline	211	88	83	138	167	155	123	160	222	105	211	232	181	131	149	100	159	207	174	202	224	145	139	19	29	10	17	7	8	25
			Other surf.	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	1	2	2	4	3
			Purse seine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	4	5	0	0	0	0	0	
			Sport (HL+RR)	0	0	0	0	0	14	3	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Landings	ATE	CP	Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			China PR	0	0	0	0	0	0	85	103	80	68	39	19	41	24	42	72	119	42	38	36	36	38	37	45	54	64	79	89	101	101
			EU-Denmark	0	37	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	3
			EU-España	2318	4962	3137	3819	6186	9519	4565	4429	3493	3633	4089	2172	2801	3102	2339	3680	3536	2409	1550	1483	1329	1553	1282	1655	1986	2509	2489	2729	3289	2953
			EU-France	894	1099	336	725	563	269	613	588	542	629	755	648	561	818	1218	629	253	366	228	135	148	223	212	254	343	350	461	462	557	559
			EU-Germany	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			EU-Ireland	0	0	0	0	0	14	21	52	22	8	15	3	1	1	2	1	1	1	2	4	10	13	19	14	32	16	17	6	16	16
			EU-Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	
			EU-Poland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			EU-Portugal	128	91	363	169	199	712	323	411	441	404	186	61	27	82	104	29	36	53	58	180	223	235	243	263	327	429	450	475	592	614
			EU-Sweden	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Great Britain	0	0	0	1	0	1	1	12	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3	0	0	0	0	2
			Guinea Ecuatorial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	7	0	0	
			Guinée Rep	0	0	330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Iceland	0	0	0	0	0	0	2	27	0	0	1	0	0	0	0	0	0	0	0	2	5	4	30	37	6	0	0	0	1	1
			Japan	3350	2484	2075	3971	3341	2905	3195	2690	2895	2425	2536	2695	2015	2598	1896	1612	2351	1904	1155	1089	1093	1129	1134	1386	1578	1905	2262	2514	2773	2779
			Korea Rep	0	0	4	205	92	203	0	0	6	1	0	0	3	0	1	0	0	0	0	0	0	0	0	0	161	181	208	232	247	242
			Maroc	562	415	720	678	1035	2068	2341	1591	2228	2497	2565	1795	1953	2389	1923	2418	1947	1909	1348	1055	990	960	959	1176	1433	1703	2164	2525	3089	2922
			Norway	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	44	51	12	49	194	152
			Panama	0	0	1	19	550	255	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Senegal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	
			Sierra Leone	0	0	0	0	0	0	0	0	93	118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		NCC	Chinese Taipei	0	6	20	4	61	226	350	222	144	304	158	0	0	10	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		NCO	Faroe Islands	0	0	0	0	0	0	67	104	118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			ICCAT (RMA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	6	2
			NEI (ETRO)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			NEI (Flag related)	144	223	68	189	71	208	66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Seychelles	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	MED	CP	Albania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	0	0	0	9	34	40	47	56	100	156	168	148
			Algerie	1104	1097	1560	156	638	829	1674	1760	2083	2098	2056	1504	1440	1500	1673	1489	1311	0	0	0	69	244	244	370	448	1038	1300	1437	1649	1650
			China PR	0	0	97	137	93	49	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			EU-Bulgaria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			EU-Croatia	1076	1058	1410	1220	1360	1105	906	970	930	903	977	1139	828	1017	1022	825	834	619	389	371	369	384	385	456	515	630	738	827	903	903

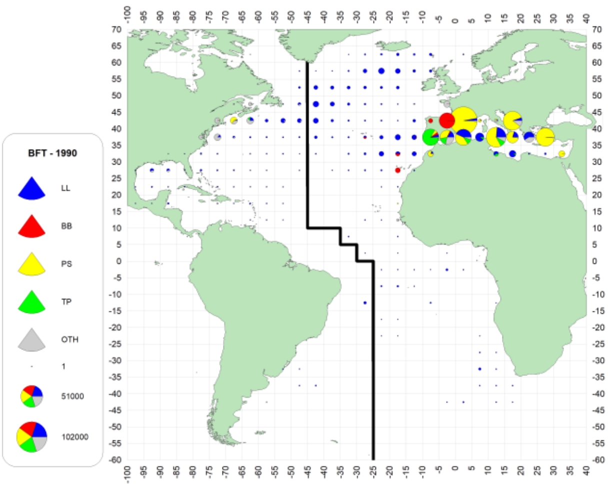
			EU-Cyprus	10	14	10	10	10	10	21	31	61	85	91	79	105	149	110	1	132	2	3	10	18	17	18	22	59	110	133	151	153	169
			EU-España	2165	2018	2741	4607	2588	2209	2000	2003	2772	2234	2215	2512	2353	2758	2689	2414	2465	1769	1056	942	1064	948	1164	1238	1467	1688	2706	2660	2774	3228
			EU-France	7376	6995	11843	9604	9171	8235	7122	6156	6794	6167	5832	5859	6471	8638	7663	10200	2670	3087	1755	805	791	2191	2216	2565	3054	3661	4360	4919	5316	5289
			EU-Greece	447	439	886	1004	874	1217	286	248	622	361	438	422	389	318	255	285	350	373	224	172	176	178	161	195	218	235	267	313	354	327
			EU-Italy	5006	5379	6901	7076	10200	9619	4441	3283	3847	4383	4628	4981	4697	4853	4708	4638	2247	2749	1061	1783	1788	1938	1946	2273	2488	3196	3860	4286	4731	4699
			EU-Malta	81	259	580	590	402	396	409	449	378	224	244	258	264	350	270	334	296	316	136	142	137	155	160	182	212	261	308	338	387	382
			EU-Portugal	211	164	306	313	274	37	54	76	61	64	0	2	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Egypt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	64	77	77	155	99	124	181	263	122	327
			Iceland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	
			Japan	123	793	536	813	765	185	361	381	136	152	390	316	638	378	556	466	80	18	0	0	0	0	0	0	0	0	0	0	0	
			Korea Rep	0	0	684	458	591	410	66	0	0	0	0	0	700	1145	26	276	335	102	0	0	77	80	81	0	0	0	0	0	0	
			Libya	737	635	1422	1540	1388	1029	1331	1195	1549	1941	638	752	1300	1091	1327	1358	1318	1082	645	0	756	929	933	1153	1368	1631	1792	2052	2228	2234
			Maroc	205	79	1092	1035	586	535	687	636	695	511	421	762	827	108	463	641	531	369	205	182	223	309	310	322	350	439	407	395	365	372
			Panama	484	467	1499	1498	2850	236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Syria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	41	0	34	0	0	0	0	40	47	57	66	72	79	
			Tunisie	1195	2132	2773	1897	2393	2200	1745	2352	2184	2493	2528	791	2376	3249	2545	431	2679	1932	1042	852	1017	1057	1047	1248	1486	1783	2102	2380	2653	2730
			Türkiye	2817	3084	3466	4219	4616	5093	5899	1200	1070	2100	2300	3300	1075	990	806	918	879	665	409	519	536	551	555	1091	1324	1515	1284	1771	2258	2266
		NCC	Chinese Taipei	0	328	709	494	411	278	106	27	169	329	508	445	51	267	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		NCO	Gibraltar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	14	16	15	17	20	
			ICCAT (RMA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	3	1	0	1	1	0	0	0	0
			Israel	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			NEI (Flag related)	0	0	427	639	171	1058	761	78	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			NEI (combined)	1398	0	773	211	0	101	1030	1995	109	571	508	610	709	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			NEI (inflated)	0	0	0	0	0	0	9471	16893	16458	15298	15880	18873	18376	14164	18343	28234	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Serbia & Montenegro	0	0	0	2	4	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Yugoslavia Fed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	ATW	CP	Brazil	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
			Canada	443	459	392	576	597	503	595	576	549	524	604	557	537	600	733	491	575	530	505	474	477	480	463	531	466	472	508	666	642	626
			EU-España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			FR-St Pierre et Miquelon	0	0	0	0	0	0	0	1	0	0	3	1	10	5	0	4	3	2	8	0	0	0	0	9	0	0	0	0	0	
			Japan	512	581	427	387	436	322	691	365	492	506	575	57	470	265	376	277	492	162	353	578	289	317	302	347	345	346	406	406	407	408
			Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	1	52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Mexico	15	17	4	23	19	2	8	14	29	10	12	22	9	10	14	7	7	10	14	14	51	23	51	53	55	34	80	39	28	63
			Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Trinidad and Tobago	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			UK-Bermuda	0	0	0	0	1	2	2	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1
			UK-British Virgin Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			UK-Turks and Caicos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			USA	1085	1237	1163	1311	1285	1334	1235	1213	1212	1583	1840	1426	899	717	468	758	764	1068	803	738	713	502	667	877	1002	986	1013	1185	1178	1177
		NCC	Chinese Taipei	0	0	0	4	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		NCO	Argentina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Cuba	0	0	0	0	0	0	0	0	0	0	74	11	19	27	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Dominica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			ICCAT (RMA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			NEI (Flag related)	17	0	0	0	0	0	0	429	270	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Sta Lucia	14	2	43	9	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Discards	ATE	CP	Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	7	9	8	1
	MED		Albania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			EU-Croatia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	5	5	2	2	4	5	6	4	5	4
			EU-España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	
			Libya	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	4	0	0	0	0	0	0	0	
			Tunisie	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	5	5	0	0	0	
			Türkiye	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	
	ATW		Canada	0	0	0	0	0	6	16	11	46	13	37	14	15	0	2	0	1	3	25	36	17	0	0	3	8	1	3	3	5	5
			Japan	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	
			Mexico	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
			USA	211	88	83	138	171	155	110	149	176	98	174	218	167	131	147	100	158	204	150	166	206	159	143	22	24	10	15	6	8	23



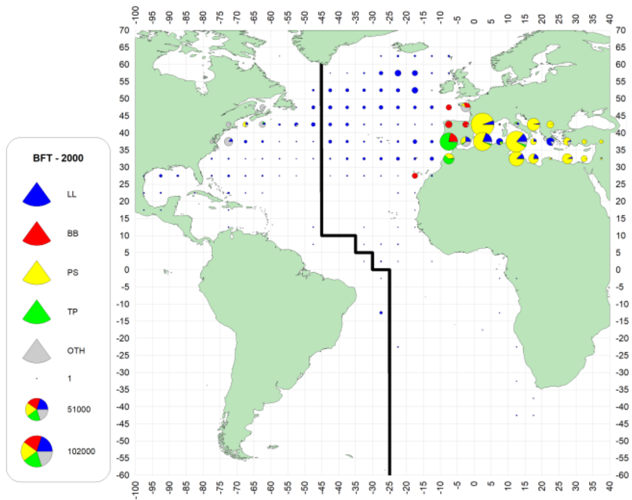
a. BFT (1970-79)



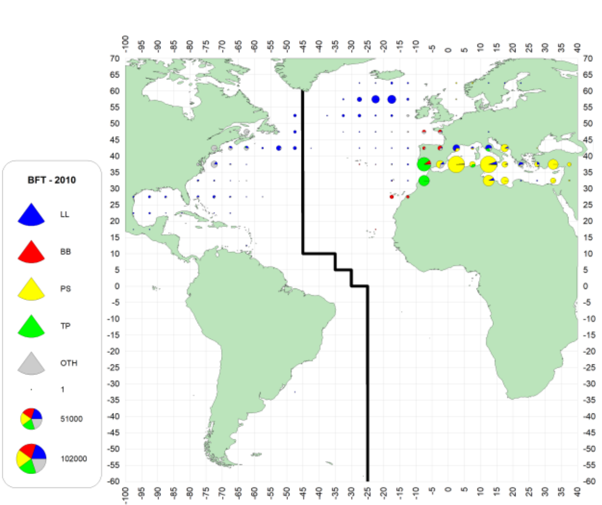
b. BFT (1980-89)



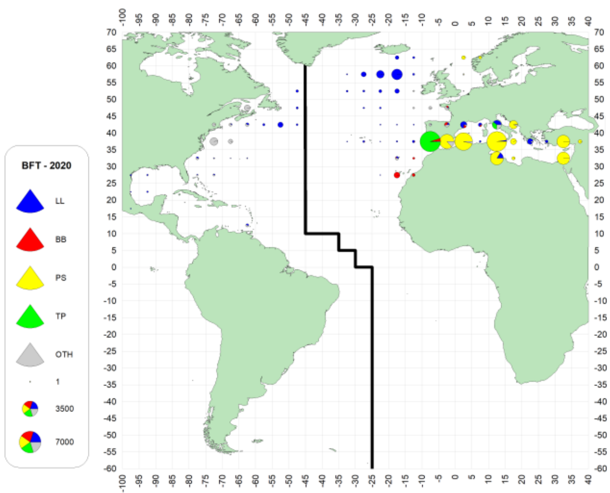
c. BFT (1990-99)



d. BFT (2000-09)

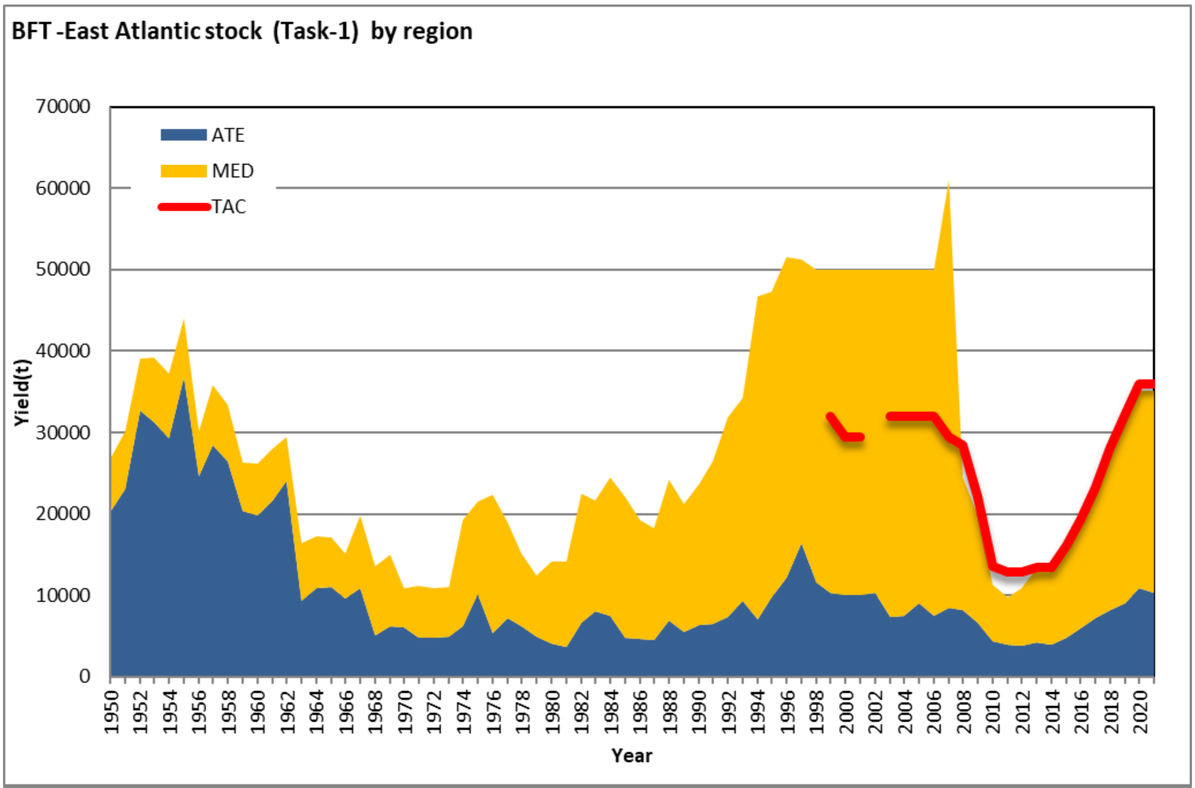


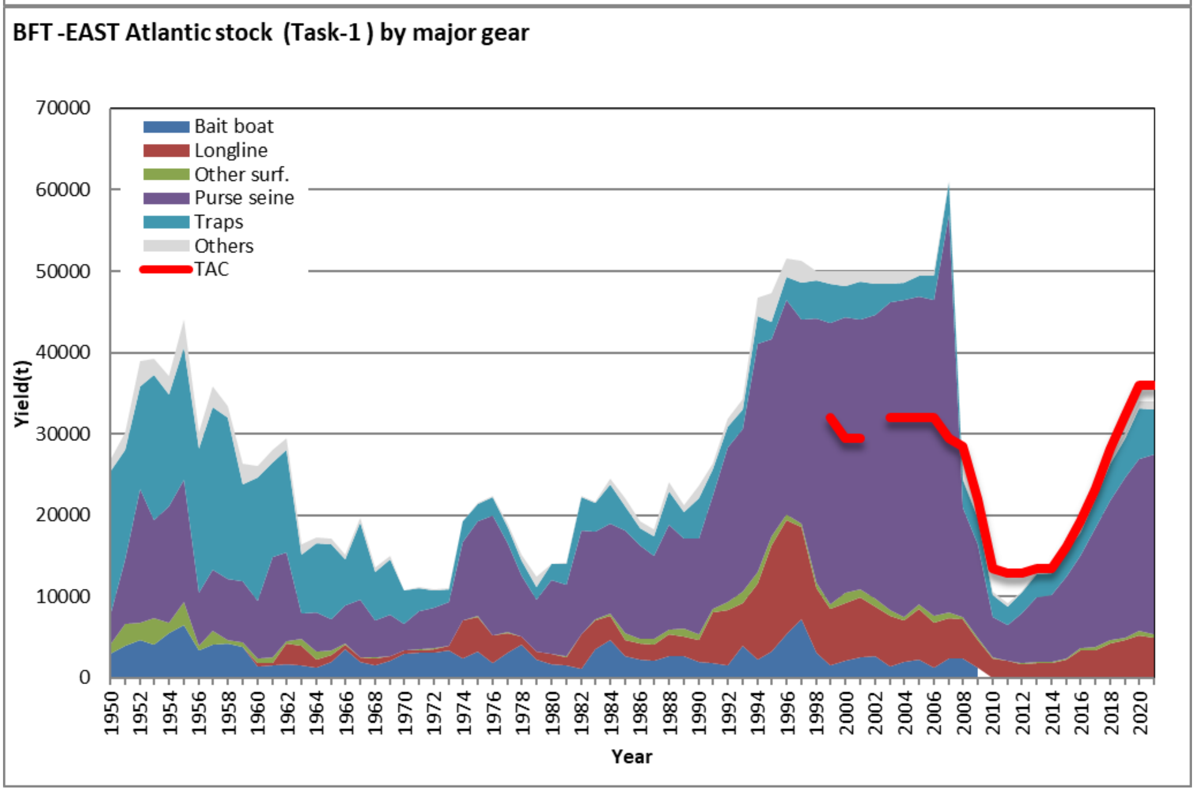
e. BFT (2010-19)



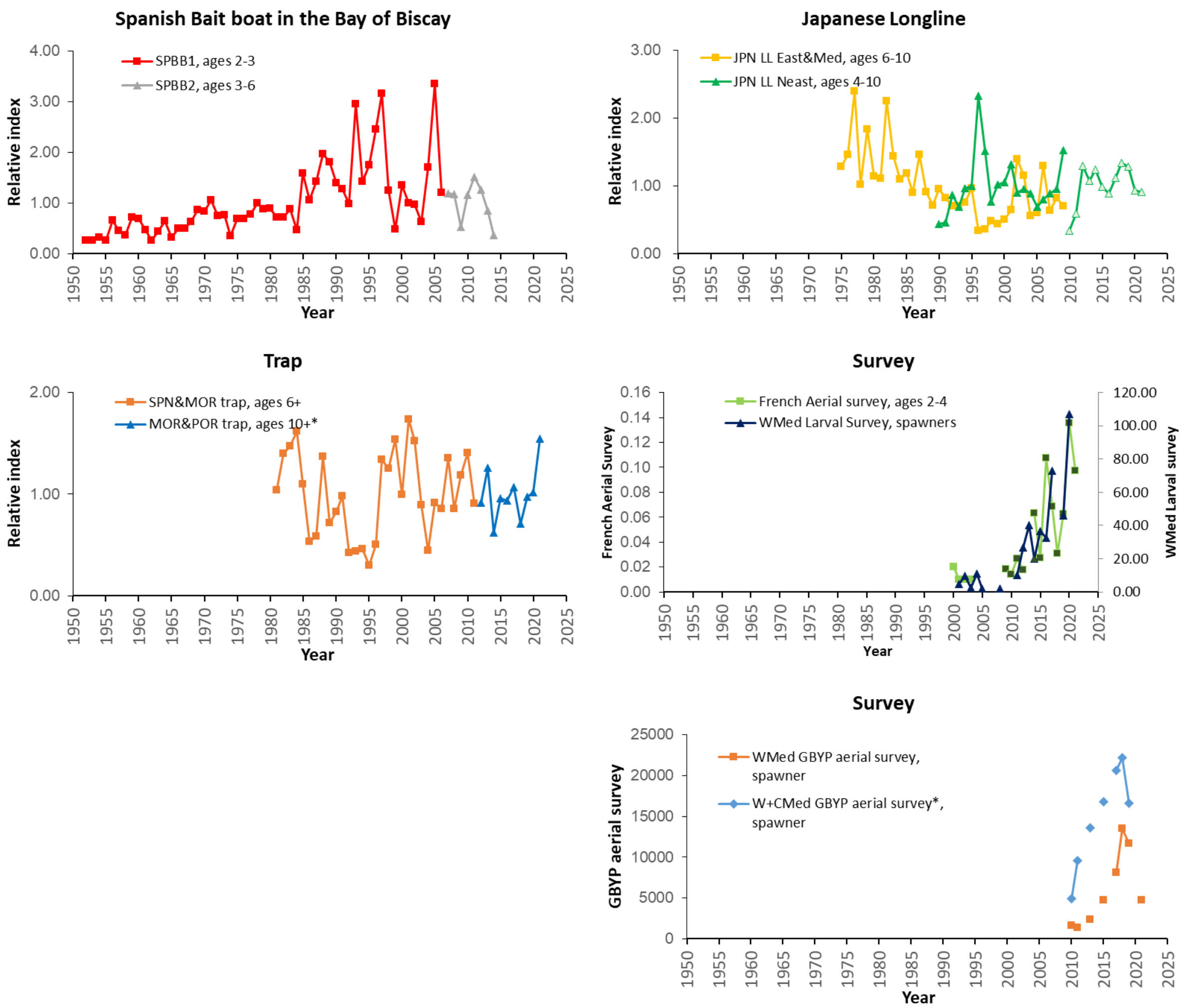
f. BFT (2020-21)

BFT-Figure 1. Geographic distribution of bluefin tuna catches per 5x5 degrees and per main gears from 1970 to 2021 (last decade only covers 2 years).



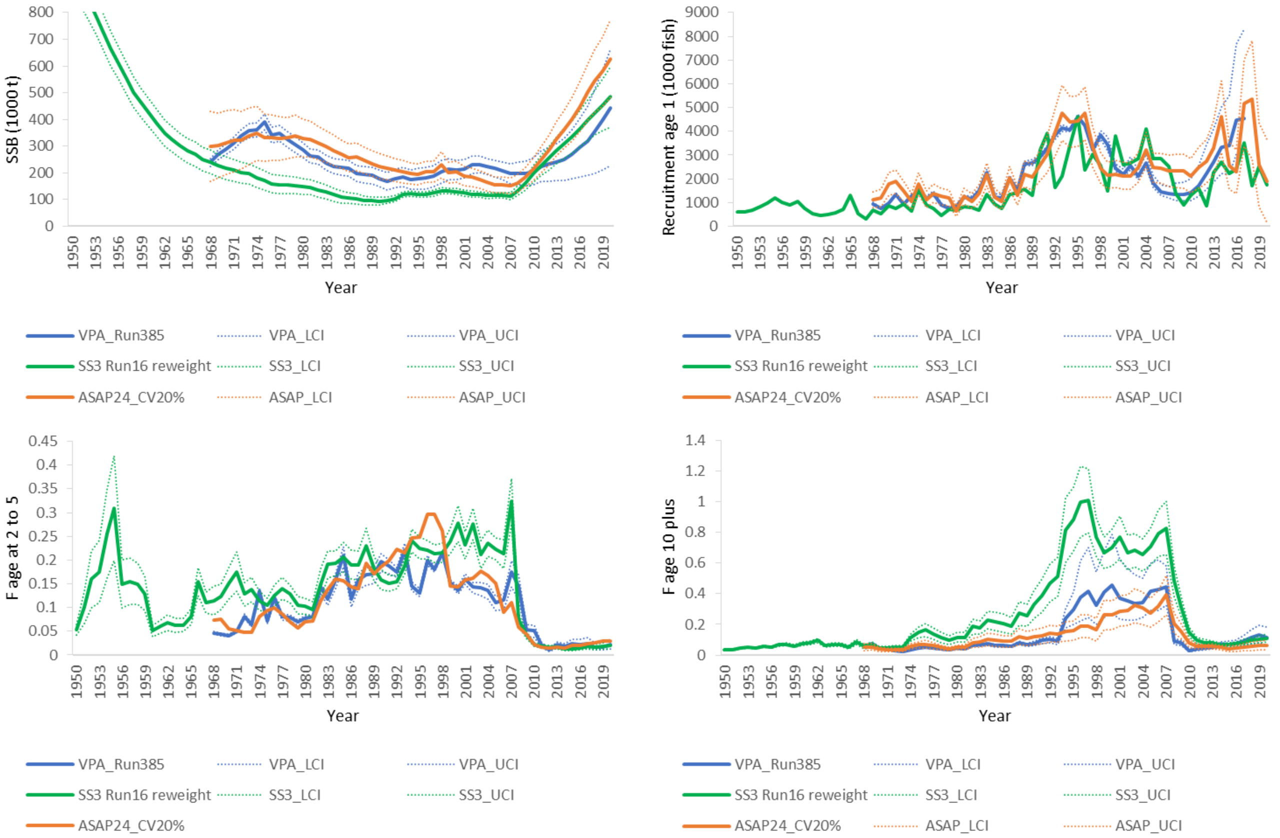


BFTE-Figure 1. Reported catch for the East Atlantic and Mediterranean from Task 1 data from 1950 to 2021 split by main geographic areas (top panel) and by gears (bottom panel) together with unreported catch estimated by the Committee from 1998 to 2007 and TAC levels since 1998.

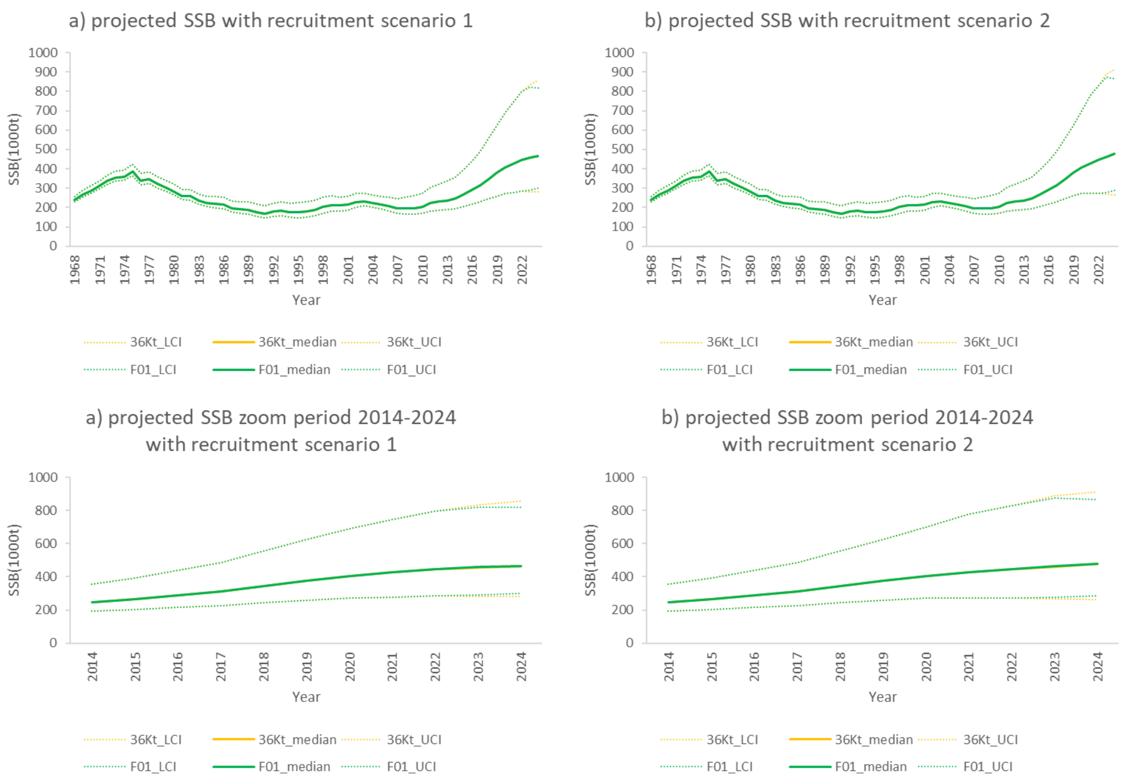


* GBYP aerial survey for the West and Central Mediterranean will be used as auxiliary information.

BFTE-Figure 2. Plots of the updated fishery dependent and independent indicators used for the East Atlantic and Mediterranean bluefin tuna stock. All indicators are standardized series and scaled to their averages. The Spanish BB series was split in two series to account for changes in selectivity patterns, and the latest series was calculated using French BB data due to the sale of the quota by the Spanish fleet. The Japanese longlines CPUE for the northeast Atlantic (split in 2009/2010), the Morocco-Portugal trap combined CPUE, the French aerial survey index (split in 2008/2009) and the GBYP aerial survey for the western Mediterranean (WMed) have been updated until 2021. The larval survey in the western Mediterranean was updated until 2020.



BFTE-Figure 3. Comparisons of the trends in estimated spawning stock biomass (SSB), recruitment (age 1), F at age 2 to 5, and F at age 10 plus group between base cases by model platform: VPA (blue lines), Stock Synthesis (green lines), and ASAP (orange lines). The time series of recruitments for the VPA have the terminal three years removed as it is standard practice not to consider these due to their estimates being unreliable.



BFTE-Figure 4. Projected spawning stock biomass (SSB) with 95% confidence intervals in VPA Run 385 projection with 2 recruitment scenarios (a: the average between 1986 and 2016 and b: the average between 2007 and 2016) assuming constant catch at $F_{0.1}$ or 36,000 t. The top panels show the entire assessment period and the projection until 2024, and the bottom panels only show since 2014.

9.4 POR-PORBEAGLE

Text referring to species other than porbeagle is not included in this Executive Summary. As is the case with other SHK Executive Summaries, this document contains the information on stock assessments conducted in different years. Three of the porbeagle stocks (northwest, southwest and southeast) were assessed by the ICCAT SCRS in 2020. The northeast stock was assessed in 2022 in a joint process with ICES. The Porbeagle Executive Summary updated catch information from all stocks. However, stock status elements for the southern and western stocks use the information from the 2020 assessment. The Northeast stock information has been updated with both new information from the catch and new information from the 2022 assessment. The decision was to keep results for all porbeagle stock together because the information from the northwest and southern stocks was not updated in the 2022 assessment.

The latest information on the status of the porbeagle (*Lamna nasus*) stock is available in the Report of the 2020 ICCAT Porbeagle Stock Assessment Meeting (Anon., 2020a). In 2022 a joint ICES/ICCAT stock assessment was conducted for the northeast stock of porbeagle, for which results are included herein.

POR-1. Biology

A great variety of shark species are found within the ICCAT Convention area, from coastal to oceanic species. Biological strategies of these sharks are very diverse and are adapted to the needs within their respective ecosystems where they occupy a very high position in the trophic chain as active predators. Therefore, generalization as regards to the biology of these very diverse species results in inevitable inaccuracies, as would occur for teleosts. To date, ICCAT has prioritized the biological study and assessment of the major sharks of the epipelagic system as these species are more susceptible to being caught as by-catch by oceanic fleets targeting tuna and tuna-like species. Among these shark species there are some of special prevalence and with an extensive geographical distribution within the oceanic-epipelagic ecosystem, such as the blue shark and shortfin mako shark, and others with less or even limited prevalence, such as porbeagle, hammerhead sharks, thresher sharks, and white sharks.

Porbeagle is a large pelagic shark that shows a wide geographic distribution associated with cold-temperate waters. Porbeagle has aplacental viviparity with an oophagous reproductive system, which limits their fecundity but increases the probability of survival of their young. The porbeagle has a litter size of usually just four individuals and a gestation period of 8-9 months. Median size at maturity is about 174 cm FL (fork length) or 8 years for males and 218 cm FL or 13 years for females, with mating taking place between September and November. Breeding frequency was determined to be annual, but a recent study found that at least a portion of the Northwest Atlantic population is biennial or possibly even triennial based on the finding of a resting stage. Although uncertainty regarding their biology remains, available life history traits (slow growth, late maturity and small litter size) indicate that it is vulnerable to overfishing. A behavioral characteristic of this species is its tendency to segregate temporally and spatially by size and/or sex during feeding, mating-reproduction, gestation and birth processes. Tagging studies have suggested that the species exhibits large-scale migratory behaviour and periodic vertical movement, but the lack of information on some components of the populations precludes a complete understanding of their distribution/migration patterns by ontogenetic stage and in some cases identifying their pupping/mating grounds. Numerous aspects of the biology of this species are still poorly understood or completely unknown, particularly for some regions, which contributes to increased uncertainty in quantitative and qualitative assessments.

The stock structure for porbeagle shark was first addressed in 2009 at the joint ICCAT/ICES stock assessment (Anon. 2010). Data at that time supported the view of restricted movements between the NE and NW Atlantic individuals. Therefore, it was concluded that in the North Atlantic there were two stocks. Regarding the South Atlantic, it was understood that there were two stocks, SW and SE, although the possibility was raised that both southern stocks would extend to the bordering oceans (Pacific and Indian). Since 2009, a number of mark-recapture, pop-up archival satellite tag (PSAT) studies have further examined the movements of porbeagle particularly in the North Atlantic Ocean. Nearly all of the long-term satellite tagging, conventional tagging, and survival tagging supports that porbeagle stocks in the Northeast Atlantic are separate from the Northwest. There is little tagging information from the South Atlantic. In addition to tagging studies, a study of genomic DNA suggests there is strong genetic subdivision between the North Atlantic and Southern Hemisphere populations, but found no differentiation within these hemispheres. New information derived from fishery and research data from the South Atlantic, Pacific and

Indian Oceans indicates that there is a continuous distribution of the species in the three oceans and that it ranges from 20° to 60° South latitude. Overall, there is insufficient data to define the appropriate number of stocks in the Southern Hemisphere.

POR-2. Fishery indicators

The Committee considered that, based on the most recent and best available information, there are two stocks in the North Atlantic (NW, NE) and likely a single stock in the South Atlantic. However, two areas (SW and SE) are considered for catch data reporting purposes in the South Atlantic (**POR-Table 1** and **POR Figure 1**).

Few CPUE series were presented during the 2020 porbeagle assessment as management measures led to changes in the fishery that resulted in lack of sufficient data on porbeagle catch rates or changes in management that could not be accounted for in the CPUE standardization procedure.

Two standardized CPUE series were presented for the NW Atlantic stock: a Canadian fishery-independent survey and a Japanese pelagic longline fishery series based on observer data. The Canadian survey showed a decline from 2007 to 2017 but was deemed not to reflect abundance; the Japanese series showed a stable trend during 2000-2014 and an increase from 2014 to 2018, which could be attributable to an increase in juvenile sharks. A standardized CPUE series was presented for the SW stock based on data from Uruguayan longliners from 1982 to 2012. The Uruguayan tuna fleet can be divided into two well-defined periods: 1982-1992 Japanese-Style longline (deep sets), and 1993-2012 American-Style longline (shallow sets). The first period had higher standardized CPUE values, suggesting that fishing method factors such as set depth or bait type may have an effect on porbeagle catch rates.

For the 2022 NE Atlantic porbeagle assessment 3 standardized CPUE indices were considered: a Norwegian longline CPUE series from 1950 to 1972, that shows a downward trend in the second half of the 1950s, but this trend seems to have stabilized in the early 1960s, followed by a slight increase in the late 1960s and early 1970s; a French longline CPUE series from 1972 to 2009, that shows that the relative abundance index obtained decreases in the 1970s, but thereafter varies without trend; a Spanish longline CPUE series from 1986 to 2007, that presents higher values in the 2000s, with large interannual variations. This index was previously used in the 2009 ICCAT-ICES assessment. Also, it was considered in the assessment a composite survey CPUE series constructed by combining CPUEs of a French commercial vessel, from 2000 to 2009, with CPUEs of a survey carried out in 2018-2019.

POR-3. State of the stocks

Due to changes in management practices that would have affected the development of CPUE series and potentially length composition data, in 2020 the Committee was constrained to use non-traditional stock assessment methods. Overfished stock status could only be determined for the NW stock and overfishing stock status, for the combined stocks in the North Atlantic and the South Atlantic. The Committee formally assessed the NE stock together with the ICES Working Group of Elasmobranch Fishes (WGEF) in 2021-2022.

Two modelling approaches were used to assess the status of porbeagle shark in the Atlantic and two additional methods were also explored. The Sustainability Assessment for Fishing Effects (SAFE) was used to evaluate whether the combined North and combined South Atlantic stocks were experiencing overfishing. The Incidental Catch Model (ICM) was used to evaluate whether the NW Atlantic stock was currently overfished and to determine the stock's capacity for future removals. Exploratory analyses that were not used to derive advice for the current assessment included the ICM fit to the South Atlantic stock, length-based approaches fit to the NW, SW, and SE stocks, and input control management options explored in a preliminary MSE approach for the NW stock. All of the exploratory approaches showed promise and could be further explored in future assessments.

Results of the SAFE approach indicated that neither the North Atlantic nor the South Atlantic stocks are undergoing overfishing. It was noted that while this is a data-limited approach, the overfishing status results were robust to the selectivity curve assumed and the post-release mortality value used in the computation of post-capture mortality. The Committee noted that for the South Atlantic results are in line with those found in the 2017 Southern Hemisphere (SH) porbeagle Areas Beyond National Jurisdiction

(ABNJ) stock status assessment, with F/F_{MSY} values from both studies being of relatively similar magnitude (annual mean=0.063, range: 0.046 to 0.083 for 2006-2014 in the SH assessment vs. annual mean=0.113, range: 0.107-0.119 for 2010-2018 in the SAFE analysis).

An equal mix of annual and biennial reproduction was considered the most likely scenario for the porbeagle population in the NW Atlantic, so these productivity assumptions were used for the base case formulation of the ICM. Two alternate parameterizations of the ICM were evaluated to determine the model's sensitivity to life history assumptions as well as to the assumed population size in 2018. The first sensitivity analysis assumed a reproductive periodicity of only one year (annual reproduction), consistent with productivity assumptions in the 2009 assessment. The second assumed larger population size in 2018, so that predicted abundance in 2009 matched the value of 200,000 animals from the Canadian Statistical-Catch-at-Age model presented at the 2009 assessment. In all formulations, the stock was predicted to be overfished in 2018 with > 70% probability, even though abundance has been increasing since 2001. The scenarios differed in how far 2018 abundance was below the MSY proxy for biomass, with both sensitivity analyses suggesting that the population was closer to the reference point. The base case formulation of the ICM estimated biomass in 2018 to be 57% of the MSY proxy reference point (353,000 animals), giving a 98% probability of the stock being overfished.

Due to a lack of reporting, the magnitude of dead discards remains uncertain and post-release mortalities are not incorporated in this assessment, so there remains considerable uncertainty in the assessment of status. If actual total removals (unreported landings, dead discards, and post-release mortalities) do not largely exceed what has been estimated, then with the large reduction in recent reported removals, the Committee considers it unlikely that the stock is undergoing overfishing, but it considers that the stock remains overfished.

The northeast Atlantic porbeagle stock has the longest recorded history of commercial exploitation for ICCAT sharks. During the 2009 assessment, a lack of CPUE data for the peak of the fishery was considered to add uncertainty in identifying the status relative to virgin biomass. This issue has been resolved in the 2022 assessment with the availability of the Norwegian longline CPUE series which begins in 1950, thus when catches were still above 3,000 t. The 2022 stock assessment was carried out using the SPiCT model with priors agreed for the final benchmark assessment. The exploited biomass decreases below B_{MSY} in the early 1950s. Despite an increase in the 2010s due to the fishing restriction in place since 2010, B/B_{MSY} = 0.5 in 2022. The stock remains overfished, but overfishing is not occurring, consistent with the low values of current F.

POR-4. Outlook

Projections conducted with the ICM for the NW stock indicated that removals of less than 7,000 sharks (214 t) would allow rebuilding with a 60% probability by 2070 (a projection interval of 2.5 generations) and removals of less than 8,000 sharks (245 t) would allow rebuilding with a 50% probability by 2060 (**POR-Table 2** and **POR-Figure 3**). If removals remained similar to 2014-2018 (mean = 47 t), the stock was predicted to rebuild with at least a 50% probability between 2030 and 2035). However, the Committee emphasized that recent removals are very likely underestimated because few CPCs report dead discards, and post-release mortality of live discards was not taken into account.

During the 2022 porbeagle northeast stock assessment, long-term projections using constant catch were not presented because technical issues prevented projections from being carried out during the assessment. So, Kobe Strategy matrix was not created. Projections will be produced during the next porbeagle stock assessment.

POR-5. Effect of current regulations

In 2013 Uruguay prohibited retention of porbeagle sharks and Canadian directed fisheries for porbeagle have also been closed since 2013. From 2010–2014, successive EC Regulations had established a zero TAC for the northeast porbeagle in EU waters of the ICES area and prohibited EU vessels to fish for, to retain on board, to transship and to land porbeagle in international waters. Since 2015 it has been prohibited for EU vessels to fish for, to retain on board, to transship or to land porbeagle, with this applying to all waters. Since 2021 porbeagle is also included on the list of prohibited species in UK waters. It has been forbidden to catch and land porbeagle in Sweden since 2004; and in 2007, Norway banned all direct fisheries for porbeagle. In 2017, a regulation was issued to ban all targeted fishing in Icelandic waters for spurdog, porbeagle and basking shark and stipulating that all viable catch in other fisheries must be released.

Estimated catches (based primarily on landings data) for the NE stock have steadily decreased since the species became prohibited in 2010 (34.3 t) to 7.1 t in 2021; for the NW stock catches of 284 t were estimated for 2013 but have decreased to 10 t in 2021; catches for the SE and SW stocks are insignificant, less than 4 t annually since 2015 for the SE and 0 t for the SW since 2013. Captures in the Mediterranean have historically been very low, less than 1 t since 1980 (**POR-Table 1** and **POR Figure 1**). However, the Committee noted that these catches likely underestimate total removals because they do not include dead discards in many cases and reporting of post-release mortality of live releases is not required. Furthermore, the magnitude of porbeagle removals in non-ICCAT coastal fisheries is unknown but likely high.

The proportion of catches released alive has increased since 2015 following the implementation of Rec. 15-06, which obligates that CPCs require their vessels to promptly release unharmed, to the extent practicable, porbeagle sharks caught in association with ICCAT fisheries when brought alive alongside for taking on board the vessel.

Porbeagle was listed under Appendix II of the Convention on International Trade in Endangered Species (CITES) in 2013. Among other things, CITES Appendix II carries a requirement that Parties issue export and import, as well as introduction from the sea, permits based on findings that the take is legal and sustainable. Development of these “non-detriment findings” and related permitting processes is underway.

Parties to the Convention on Migratory Species (CMS) have listed 29 elasmobranch species under its Appendices. Appendix II, which includes porbeagle, signals a commitment to international cooperation toward conservation.

Under current regulations, 2020 NW assessment and 2022 NE assessment indicates that both stocks have increased in the last 10 years, showing in the case of the NW a rebuilding trend since 2001.

POR-6. Management recommendations

The following management recommendations were agreed upon and included in the Executive Summary based on the 2020 ICCAT porbeagle stock assessment. During the 2022 SCRS meeting, section 1a was updated with the information reported by CPCs, and section 7 was discussed and agreed based on the results of the NE porbeagle stock assessment conducted during 2022 in a joint process between ICCAT and ICES.

The Committee recommends that the Commission work with countries catching porbeagle and relevant RFMOs to ensure recovery of North Atlantic porbeagle stocks (e.g., ICES, NAFO). In particular, porbeagle fishing mortality should be kept at levels in line with scientific advice and with removals not exceeding the current level. New targeted porbeagle fisheries should be prevented, porbeagles retrieved alive should be released following best handling practices to increase survivorship, and all catches should be reported. Management measures and data collection should be harmonized as much as possible among all relevant RFMOs dealing with these stocks, and ICCAT should facilitate appropriate communication.

1. The SCRS needs cooperation from all CPCs to improve catch statistics, which is critical to advancing the assessments of all porbeagle stocks.

a) Three CPCs have reported live discards of porbeagle for 2021. The Committee underlines that the reporting and quantification of live discards is critical, especially for a stock where all live animals must be released (Rec. 15-06); the Commission should find ways to encourage improved reporting of live discards.
b) There is a need for CPCs to strengthen their monitoring and data collection efforts, including but not limited to improved estimates of dead discards and the estimation of CPUEs using observer data.
c) The Committee requests CPCs revise their porbeagle catch series (landings, live discards, and dead discards) including incidental captures from their other non-ICCAT fisheries (gillnet, trawling, purse seiner, etc.) to allow the SCRS to incorporate all mortality sources into future assessments and reduce the uncertainty in stock status and projections.
d) In addition, the Committee recommends that the ICCAT liaise with parties (e.g., other RFMOs) and engage in data mining to determine the total capture from non-ICCAT parties.

2. The Committee notes that management recommendations for porbeagle stocks under ICCAT responsibility are drafted for ICCAT fisheries. However, porbeagle stocks are subject to mortality from CPCs' coastal fisheries and countries that are not ICCAT Parties. Therefore, the Committee recommends that CPCs implement a live release requirement for all porbeagle caught in their waters and that ICCAT develop integrated management approaches (with other countries, other Regional Fisheries Bodies, FAO) to assure the sustainability of Atlantic porbeagle stocks.

3. The Committee notes that some landings and the majority of discards go unreported, meaning that total mortality of porbeagle from all sources (i.e., landings, dead discards and live releases that subsequently die as a result of gear interactions) is underestimated. For the purposes of this assessment, the Committee estimated unreported landings and dead discards preliminarily that were 89% higher than reported but did not estimate mortality following live release. The Commission should be aware that actual removals are higher than what is being reported and Kobe matrices will be optimistic to the extent that removals are underreported.

4. Considering the underreporting of removals, and the current low stock status of the NW Atlantic stock (B_{2018}/B_{MSY}=0.57), the Committee recommends that total removals (i.e., the sum of landings, dead discards, and post-release mortality of live releases) do not exceed current levels (including unreported removals) to allow for stock recovery. Although the Kobe matrix might suggest that some increases in total removals could allow for potential recovery in the long term, the assessment suggests that the stock is productive enough to recover in a much shorter time frame if total removals are maintained at a lower level. This is consistent with Rec. 11-13 that overfished stocks be recovered in as short a period as possible. However, the Commission should be aware that actual removals (particularly dead discards and post-release mortalities of live releases) are higher than what is being reported and the Kobe matrix is overly optimistic to the extent that removals are underreported.

5. While there is large uncertainty in southern stock structure, new information suggests a single stock of porbeagle in the South Atlantic; the Committee had, until now, considered two stock units, SW and SE. Indeed, there may be a southern stock that extends across Indian and Pacific Ocean basins. More research on stock structure needs to be undertaken to determine an appropriate unit stock. Until this research is done, the Committee recommends leaving the management units as currently defined.

6. The Committee was not able to draw any conclusions on the overfished status of the southern stock(s). It noted that indeed, conventional data (e.g., landings, representative length compositions) cannot be collected for any northern or southern porbeagle stocks, so the Committee concluded that alternative (e.g., fishery independent) data collection methods that allow CPUE or length-frequency data (or other altogether different forms of data) to be collected are required to provide more reliable estimates of stock status in the North and in the South Atlantic.

7. Considering the underreporting of removals, the current stock status of the NE Atlantic stock B_{2022}/B_{MSY}=0.464 (0.15-1.43), and the lack of reliable projections to build Kobe II Strategy Matrix (K2SM), the Committee recommends that total removals (i.e., the sum of landings and estimated dead discards) at the very least shall not exceed the average reported ICCAT catch since the implementation of the zero TAC recommendation (i.e., 2010-2021 which current estimates would be 9.3 tons) to allow for stock recovery. Lower levels of removals will accelerate such recovery.

NORTHWEST ATLANTIC PORBEAGLE SUMMARY		
Yield (2019)		28 t[1]
Relative Biomass	B_{2018}/B_{MSY}	0.57[2]
Fishing Mortality at MSY	F_{MSY}	0.049[3]
Relative fishing mortality	$F_{2010\text{-}2018}/F_{MSY}$	0.413[3]
Stock Status (2018)	Overfished Overfishing	Yes Not likely
Management Measures in Effect		Rec. 15-06

[1] Estimated catch for the Northwest stock as of 3 September 2020. Catch does not include all dead discards and includes no mortalities resulting from live releases.
[2] Value obtained with the ICM model. The reference point used (SPR_{MER}) is a proxy for B_{MSY}.
[3] Value obtained with the SAFE approach for the North Atlantic.

NORTHEAST ATLANTIC PORBEAGLE SUMMARY TABLE		
ICES-ICCAT Yield in 2021[1]		7.95 t[2]
Relative Biomass	B_{2021}/B_{MSY}	0.464 (0.15-1.43)[2]
Fishing mortality at MSY	F_{MSY}	0.051 (0.0217-0.120)[2]
Relative fishing mortality	F_{2021}/F_{MSY}	0.013 (0.0024-0.073)[2]
Stock Status (2021)	Overfished Overfishing	Yes No
Management Measures in Effect		Rec. 15-06

[1] The value reported represents the total catches determined at the ICES-ICCAT Working Group on Elasmobranch Fishes (WGEF). While the Task 1 reported catch for the Northeast stock was 5.25 t, the catch shown does not include all dead discards and includes no mortalities resulting from live releases.
[2] Range obtained from reference case SPiCT with 95% Bayesian credibility intervals.

SOUTH ATLANTIC PORBEAGLE SUMMARY		
Yield (2019)		0 t[1]
Relative Biomass	B_{2018}/B_{MSY}	Unknown
Fishing mortality at MSY	F_{MSY}	0.062[2]
Relative fishing mortality	$F_{2010\text{-}2018}/F_{MSY}$	0.113[2]
Stock Status (2018)	Overfished Overfishing	Undetermined Not likely
Management Measures in Effect		Rec. 15-06

[1] Sum of the estimated catch for the Southwest and Southeast Atlantic stock areas as of 3 September 2020. Catch does not include all dead discards and includes no mortalities resulting from live releases.
[2] Value obtained with the SAFE approach for the South Atlantic.

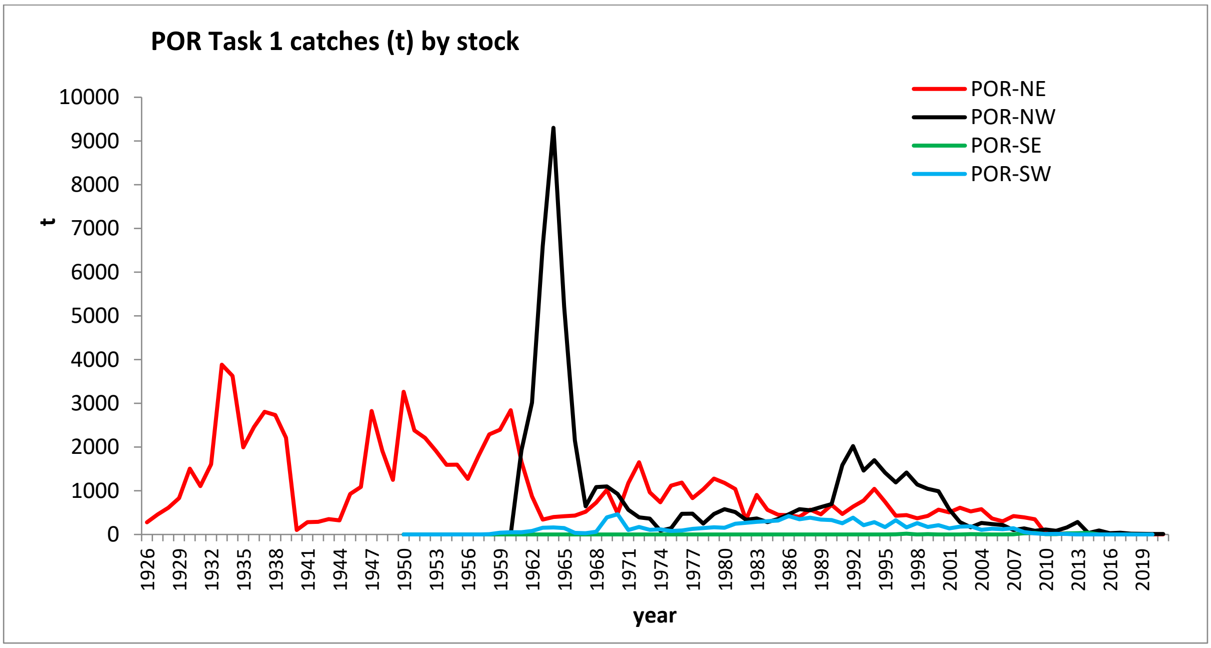
POR-Table 1. Estimated catches (t) of porbeagle (*Lamna nasus*) by area, gear and flag.

				1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
TOTAL				3043	2453	3027	2334	1951	2041	1776	1648	1769	1223	1074	887	954	740	642	671	619	495	152	120	225	323	78	104	41	48	27	16	14	15
	ANE			637	777	1045	749	428	444	371	424	567	506	610	527	578	367	302	421	391	349	21	14	25	10	5	8	9	8	4	0	3	5
	ANW			2021	1462	1698	1415	1192	1418	1141	1046	988	574	282	164	264	237	217	101	141	84	114	85	162	284	35	93	30	39	19	16	11	10
	ASE			0	0	0	0	3	19	1	6	0	1	1	9	3	1	0	5	30	37	6	7	26	29	38	3	1	0	4	0	0	
	ASW			385	213	284	170	327	159	261	172	214	141	181	187	105	133	122	143	55	26	10	14	12	0	0	0	0	0	0	0	0	
	MED			0	0	0	0	1	0	1	0	1	1	0	0	3	2	1	0	2	1	1	0	1	0	0	0	1	1	0	0	0	0
Landings	ANE		Longline	15	23	101	64	55	39	33	28	33	41	83	142	275	63	62	301	229	143	9	2	1	1	0	5	3	1	0	0	0	0
			Other surf.	622	754	943	685	373	405	338	396	533	465	527	385	303	305	240	120	162	206	13	12	24	9	5	3	6	7	4	0	3	5
	ANW		Longline	2019	1462	1697	1413	1186	1406	1124	1034	985	566	269	151	252	226	208	91	131	67	83	68	134	248	14	15	10	10	6	0	0	0
			Other surf.	0	0	0	2	6	12	18	12	3	8	13	13	12	12	8	11	9	12	20	15	23	30	7	9	5	8	3	12	5	1
	ASE		Longline	0	0	0	0	3	15	1	2	0	1	1	9	3	1	0	5	30	36	6	7	25	29	13	3	1	0	4	0	0	
			Other surf.	0	0	0	0	0	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	
	ASW		Longline	384	213	282	170	326	159	259	170	213	141	181	187	105	133	122	143	55	26	10	14	12	0	0	0	0	0	0	0	0	
			Other surf.	0	1	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	MED		Longline	0	0	0	0	1	0	1	0	1	1	0	0	2	2	0	0	2	1	0	0	1	0	0	0	0	0	0	0	0	
			Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
Discards	ANE		Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	ANW		Longline	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	11	2	5	6	14	67	13	19	7	0	1	2
			Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	3	4	6
	ASE		Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	ASW		Longline	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Landings	ANE	CP	EU-Denmark	80	91	93	86	72	69	85	107	73	76	42	21	20	4	3	2	1	0	0	0	2	0	0	0	0	0	0	0	0	**0**
			EU-España	15	21	52	19	41	25	25	18	13	24	54	27	11	14	34	8	41	77	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-France	496	633	820	565	267	315	219	240	410	361	461	303	413	276	194	354	311	228	0	2	4	0	0	3	0	1	0	0	0	0
			EU-Germany	0	1	0	0	0	0	2	0	17	1	3	5	7	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-Ireland	0	0	0	0	0	0	0	8	2	6	3	11	18	3	4	8	7	3	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-Portugal	0	1	1	1	1	1	1	0	7	4	10	101	50	14	6	0	3	17	7	0	0	0	0	0	0	0	0	0	0	**0**
			EU-Sweden	4	3	2	2	1	1	1	1	1	1	0	0	5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Great Britain	0	0	0	0	0	0	1	6	8	12	10	25	24	24	11	26	15	11	0	0	0	0	0	0	0	0	0	0	0	**0**
			Iceland	1	3	4	6	5	3	4	2	2	3	2	1	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	**0**
			Japan	0	0	0	0	5	4	0	0	0	0	0	0	0	0	0	12	0	3	2	1	1	0	0	0	2	0	0	0	0	**0**
			Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Liberia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	**0**
			Maroc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	**0**
			Norway	41	24	24	26	28	17	27	32	22	11	14	19	24	8	27	10	12	10	12	11	17	9	5	4	6	6	3	0	3	5
			Russian Federation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		NCO	Faroe Islands	0	0	48	44	8	9	7	10	13	8	10	14	5	19	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	ANW	CP	Barbados	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	3	13	1	2	1	1	1	0	0	**0**
			Canada	813	919	1575	1353	1051	1334	1070	965	902	499	237	142	232	202	192	93	124	62	83	30	33	19	9	4	2	2	1	0	0	0
			FR-St Pierre et Miquelon	0	0	0	7	40	13	20	0	13	2	1	2	4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Japan	54	35	29	15	10	9	19	41	47	52	21	7	20	27	18	5	10	10	11	13	48	98	0	0	0	0	0	0	0	**0**
			Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	13	20	3	0	0	0	0	0	0	0	**0**
			Norway	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			USA	1	38	79	26	58	41	9	2	1	1	1	0	0	0	0	0	0	0	2	9	19	27	6	8	4	8	3	12	5	1
			Venezuela	2	2	4	1	7	2	8	9	6	2	0	0	0	0	0	0	1	3	3	9	19	69	4	6	4	8	4	0	0	**0**
		NCC	Chinese Taipei	0	4	10	12	27	18	13	27	19	18	22	12	8	7	5	3	2	2	3	7	15	50	1	5	4	0	0	0	0	**0**
		NCO	Cuba	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Faroe Islands	1149	465	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	ASE	CP	EU-España	0	0	0	0	0	2	1	2	0	1	1	9	3	0	0	0	1	11	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Ghana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	**0**
			Guinea Ecuatorial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**

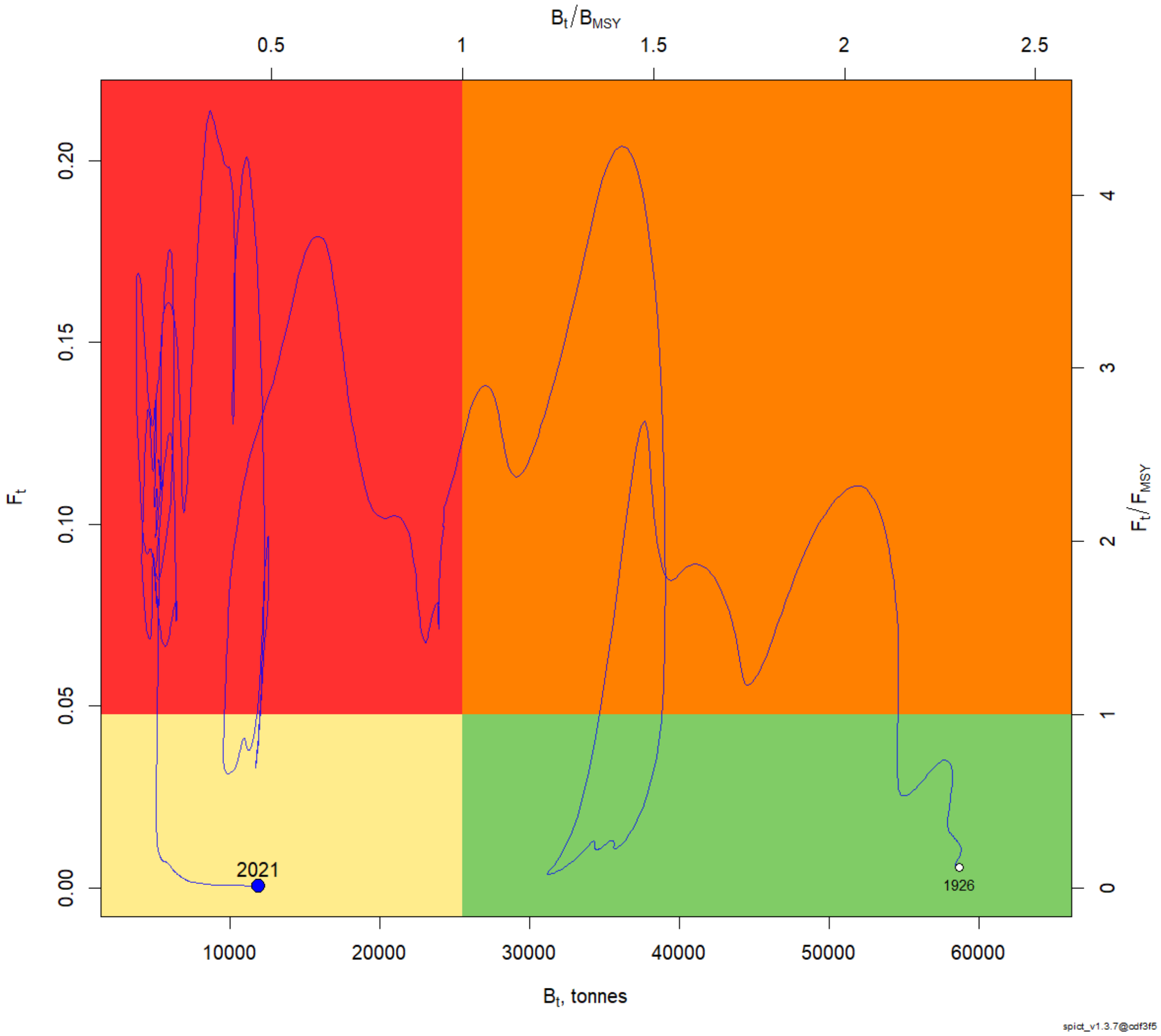
				1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
			Japan	0	0	0	0	3	13	0	0	0	0	0	0	0	0	0	5	29	25	6	7	25	15	13	3	1	0	0	0	0	**0**
			Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	4	0	0	**0**
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	**0**
		NCO	Benin	0	0	0	0	0	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Landings	ASW	CP	Brazil	128	60	32	49	33	36	38	58	60	67	74	49	37	52	32	23	0	0	0	2	0	0	0	0	0	0	0	0	0	**0**
			China PR	0	0	1	0	0	0	0	13	36	4	0	5	4	2	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-España	12	32	35	43	28	25	1	12	7	13	1	0	0	0	3	5	3	2	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-Poland	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-Portugal	0	0	0	0	0	1	0	0	0	1	1	1	4	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Japan	12	13	14	6	6	1	1	2	7	4	3	2	11	3	3	4	12	10	2	0	0	0	0	0	0	0	0	0	0	**0**
			Korea Rep	1	1	2	1	6	1	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Panama	2	6	24	4	21	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Philippines	0	0	0	0	0	0	0	0	0	0	0	0	1	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Uruguay	24	7	5	3	19	5	13	2	4	20	8	34	8	28	34	3	40	14	6	12	12	0	0	0	0	0	0	0	0	**0**
			Venezuela	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		NCC	Chinese Taipei	192	85	146	57	168	65	170	73	84	29	93	95	39	43	47	99	0	0	2	0	0	0	0	0	0	0	0	0	0	**0**
		NCO	Argentina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Chile	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Cuba	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Falklands	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			NEI (Flag related)	14	10	22	8	46	23	37	11	15	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Seychelles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	MED	CP	EU-Bulgaria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			EU-Italy	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	0	2	0	0	0	0	0	0	0	1	1	0	0	0	**0**
			EU-Malta	0	0	0	0	1	0	1	0	1	1	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	**0**
Discards	ANE	CP	EU-Denmark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			EU-Germany	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	ANW	CP	Barbados	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	1	1	1	0	0	**0**
			Canada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	2	3	3	5	8
			Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0	1	1	1	5	1	1	0	0	0	**0**
			Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	**0**
			UK-Bermuda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			USA	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	1	1	2	7	34	1	9	1	0	0	**0**
			Venezuela	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	1	1	3	14	4	7	4	0	0	**0**
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	1	1	11	4	0	0	0	0	**0**
	ASE	CP	Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	ASW	CP	El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Uruguay	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**

POR-Table 2. Kobe II strategy matrix showing the probability of being above the overfished reference point (a proxy for B_{MSY}) by 5-year time period for removals scenarios ranging from 0 to 24,000 individuals (0-734 t) for porbeagle in the Northwest Atlantic.

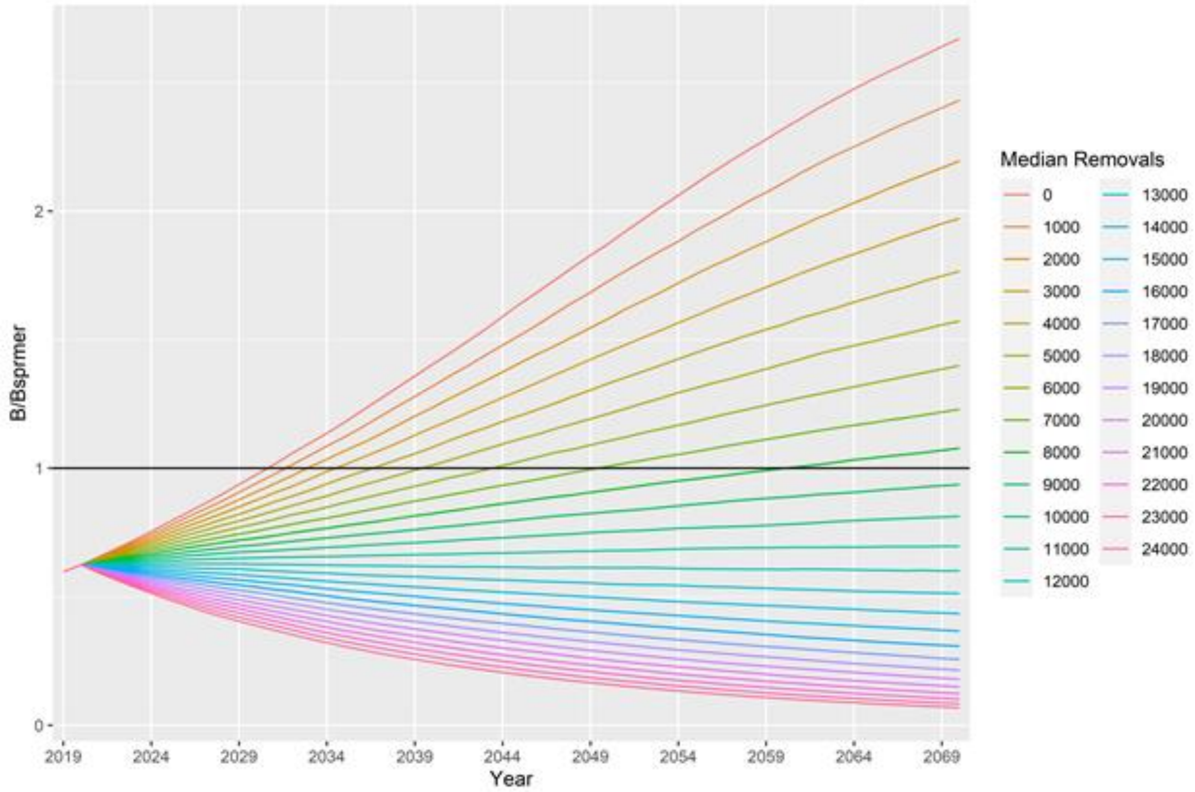
Animals (#)	Ton (mt)	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2070
0	**0**	2%	21%	47%	68%	83%	92%	96%	98%	99%	99%	100%
1000	**31**	3%	21%	44%	63%	77%	87%	92%	95%	97%	98%	99%
2000	**61**	2%	19%	40%	57%	71%	81%	87%	91%	94%	95%	96%
3000	**92**	1%	16%	35%	50%	62%	72%	79%	85%	88%	90%	92%
4000	**122**	2%	15%	32%	47%	58%	66%	73%	78%	82%	84%	87%
5000	**153**	2%	13%	27%	41%	50%	58%	64%	68%	72%	76%	78%
6000	**183**	1%	12%	25%	37%	45%	52%	57%	62%	65%	67%	70%
7000	**214**	2%	10%	22%	32%	39%	46%	50%	54%	57%	60%	62%
8000	**245**	2%	10%	19%	27%	34%	39%	44%	47%	50%	53%	55%
9000	**275**	2%	8%	17%	23%	30%	34%	38%	41%	43%	45%	47%
10000	**306**	2%	8%	14%	20%	25%	29%	31%	34%	36%	38%	39%
11000	**336**	1%	6%	13%	17%	21%	25%	27%	29%	31%	32%	33%
12000	**367**	2%	7%	11%	15%	18%	21%	23%	24%	26%	27%	28%
13000	**398**	2%	5%	9%	12%	14%	16%	18%	19%	20%	21%	22%
14000	**428**	2%	5%	7%	9%	12%	13%	14%	15%	16%	17%	18%
15000	**459**	1%	3%	5%	6%	8%	9%	10%	11%	11%	12%	12%
16000	**489**	2%	3%	4%	5%	6%	7%	8%	9%	9%	10%	10%
17000	**520**	2%	2%	3%	4%	5%	5%	6%	6%	6%	7%	7%
18000	**550**	2%	2%	2%	3%	3%	4%	4%	4%	5%	5%	5%
19000	**581**	2%	1%	2%	2%	3%	3%	3%	3%	3%	3%	4%
20000	**612**	2%	1%	1%	2%	2%	2%	2%	2%	2%	3%	3%
21000	**642**	2%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%
22000	**673**	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
23000	**703**	2%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
24000	**734**	2%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%



POR-Figure 1. Porbeagle estimated catches by management unit.



POR-Figure 2. NE Atlantic porbeagle - Plot showing current status of northeast Atlantic porbeagle for the base case Surplus Production model in Continuous Time (SPiCT) model. Note that the step for the model is 1/16th of a year (0.0625).



POR-Figure 3. **NW Atlantic porbeagle -** Predicted relative abundance for annual removals ranging from 0 to 24,000 animals for the northwest stock, expressed as the biomass/biomass at SPR_{MER} ratio (a proxy for B_t/B_{MSY}) for the base case of the ICM. The horizontal line shows the reference point, and the projections extend for 50 years. Average removals from 2016-2018 were assumed for 2019 and 2020 and the projection starts in 2021.

9.5 Task 1 catches for all major ICCAT species (excluding those contained in items 9.1 to 9.4 of this report

The Task 1 catches for all major ICCAT species excluding those contained in the Executive Summaries provided in item 9.1 to 9.4 of this report, are provided as **Appendix 6**.

9.6 Other relevant information on stocks not assessed in 2022

Several concerns were expressed by the Committee as regards the reported Task 1 reported catch levels for following species:

Tropical tunas

The Committee reviewed the Task 1 table and noted that total reported catches in 2021 were lower than in recent years for all three tropical species (Ref. to Task 1 Table). The reduced catches occurred primarily in the eastern Atlantic, catches in the western Atlantic varied without trend (**Figure 9.6.1**). Bigeye tuna catches have recently declined for all major gears, with the largest reductions attributed to the purse seine and longline (**Figure 9.6.2**). Catches of eastern Atlantic skipjack tuna have also decreased, with the largest reduction attributed to the purse seine (**Figure 9.6.3**). Catches of eastern Atlantic yellowfin tuna increased from 2018-2020, and then sharply declined in 2021. This reduction was largely due to decreased purse seine landings (**Figure 9.6.4**).

The Committee emphasized that the 2021 landings are provisional and subject to change. Official Task 1 catch statistics for 2021 are still pending from about 12 ICCAT CPCs (see SC-STAT report). These catches are expected to represent a small fraction of the total based on historical reported catches. Additionally, some late submissions, minor updates, and the addition of by-catch of tropical species caught in other targeted ICCAT fisheries (e.g. "faux poisson" landings of the majority of the purse seiners, Sao Tomé e Príncipe catches, Spanish bycatch of bigeye tuna in the Cantabrian Sea fishing for albacore tuna and bluefin tuna, etc.) were only recently included. These changes are not expected to significantly alter the catch trends observed over the last three years.

Reduced catches can occur as stock biomass declines. It was not possible to evaluate potential changes in biomass in 2020 or 2021 for yellowfin or bigeye tunas because indices have not been updated since the most recent stock assessments. There was no consistent evidence of a decline in biomass across the suite of models used to develop management advice for eastern Atlantic skipjack tuna (reference SKJ Stock Assessment that included catch data until 2020). To better evaluate changes in stock biomass, the Committee recommends that indices of abundance for the three tropical species be updated using the most current data available and presented to the 2023 Intersessional Meeting of the Tropical Tunas Species Group.

It was evident that there were changes in fishing effort and behavior in 2021 for one major eastern Atlantic fleet, the French purse seine (Floch *et al*., 2022). This fleet recently represents 10-15% of the purse seine landings of tropical tunas. This study reported that there was no reduction in the number or carrying capacity of vessels, although there was a modest decrease in fishing and search time in 2020 and 2021, relative to other recent years. More importantly, there were large decreases in the number of sets in 2020 and 2021, and a substantial increase in the proportion of sets on FOBs during the same years. Furthermore, there was a large shift in the spatial distribution of fishing effort due to a new agreement to fish off Gabon. These changes had a strong effect on the species composition of the French purse seine catch, shifting the composition of the catch from 51.8% yellowfin and 40.2% skipjack in 2020 to 40.1% yellowfin and 51.6% skipjack in 2021 (Floch *et al*., 2022). The change in the proportion of bigeye was small. Pending analysis of the catch data for other purse seine fleets, these changes certainly suggest that the reduced landings of yellowfin tuna in 2021 could be due, at least in part, to changes in fishing behavior. It is important to note that the various purse seine fleets may have different fishing behaviors and may have dissimilar species composition. The Committee was not able to perform a comprehensive evaluation of fishing behavior across all major fleets.

With regard to eastern skipjack tuna, there was a notable change in fishing effort for the Spanish Dakar baitboat fleet that could contribute to the general decrease in skipjack catches. In 2021, a total of 3 Spanish baitboats operated in the eastern Atlantic Ocean based in Dakar. Until 2020, there had been 7 vessels operating, but due to a series of problems, including the prohibition of bait fishing in the usual area, 4 of them left fishing activity. In 2019 BB_Dakar (7 vessels) caught 8.237 t. In 2021 only 3 vessels caught 1.983 t of skipjack.

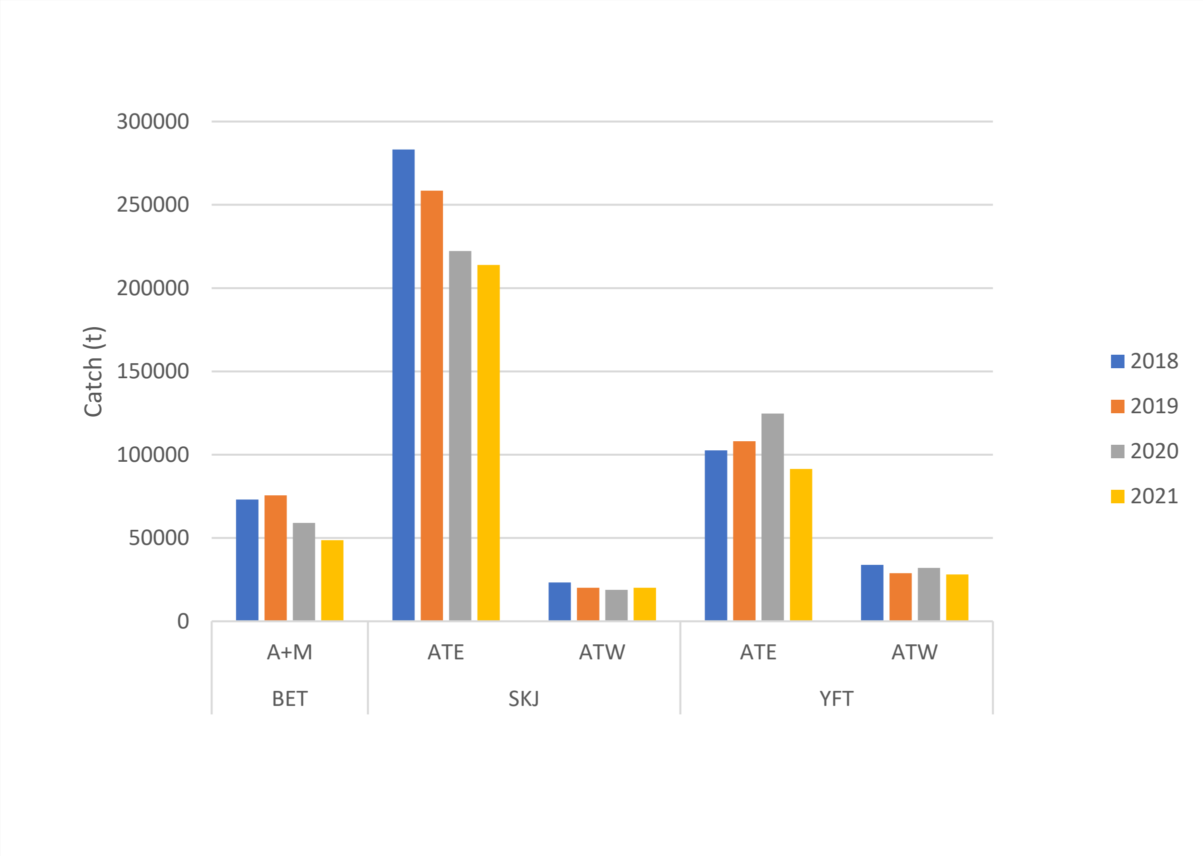


Figure 9.6.1. Total reported catches (t) of tropical tuna during 2018-2021.

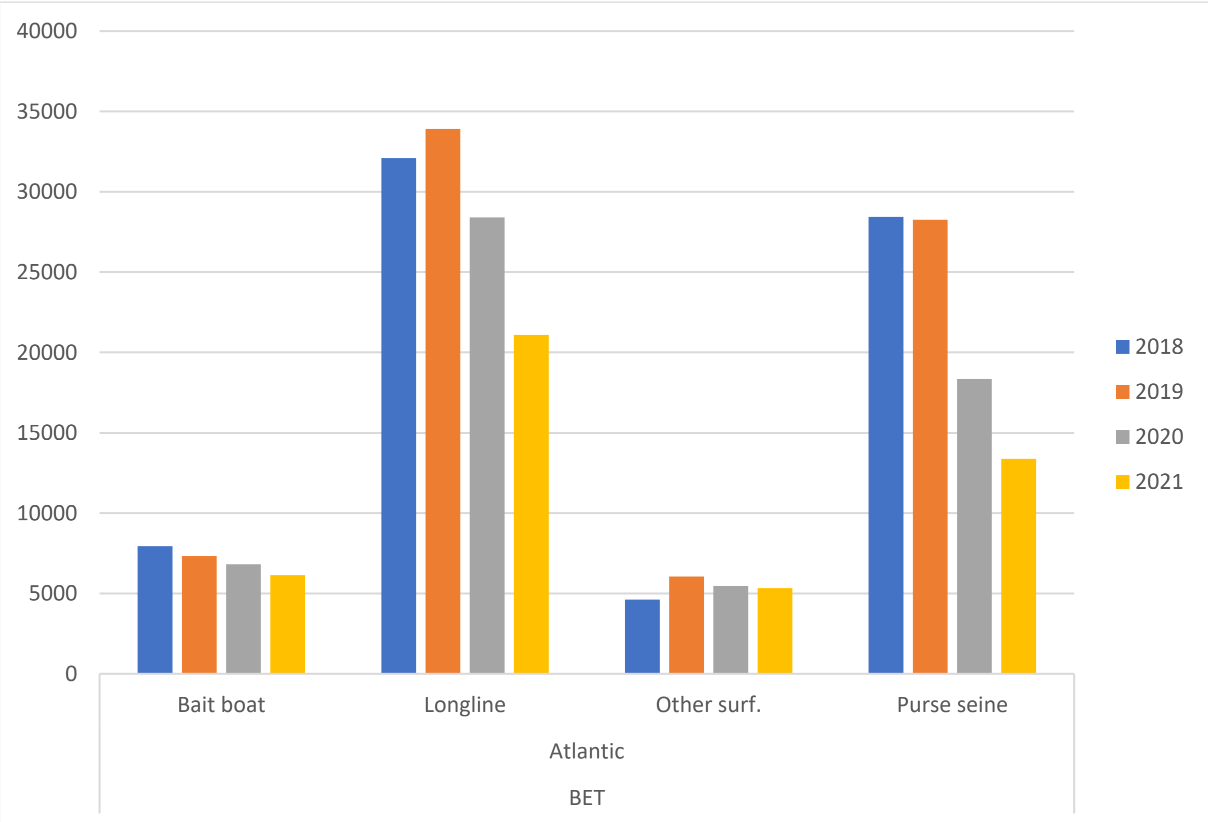


Figure 9.6.2. Total reported catches (t) of bigeye tuna during 2018-2021, by major gear.

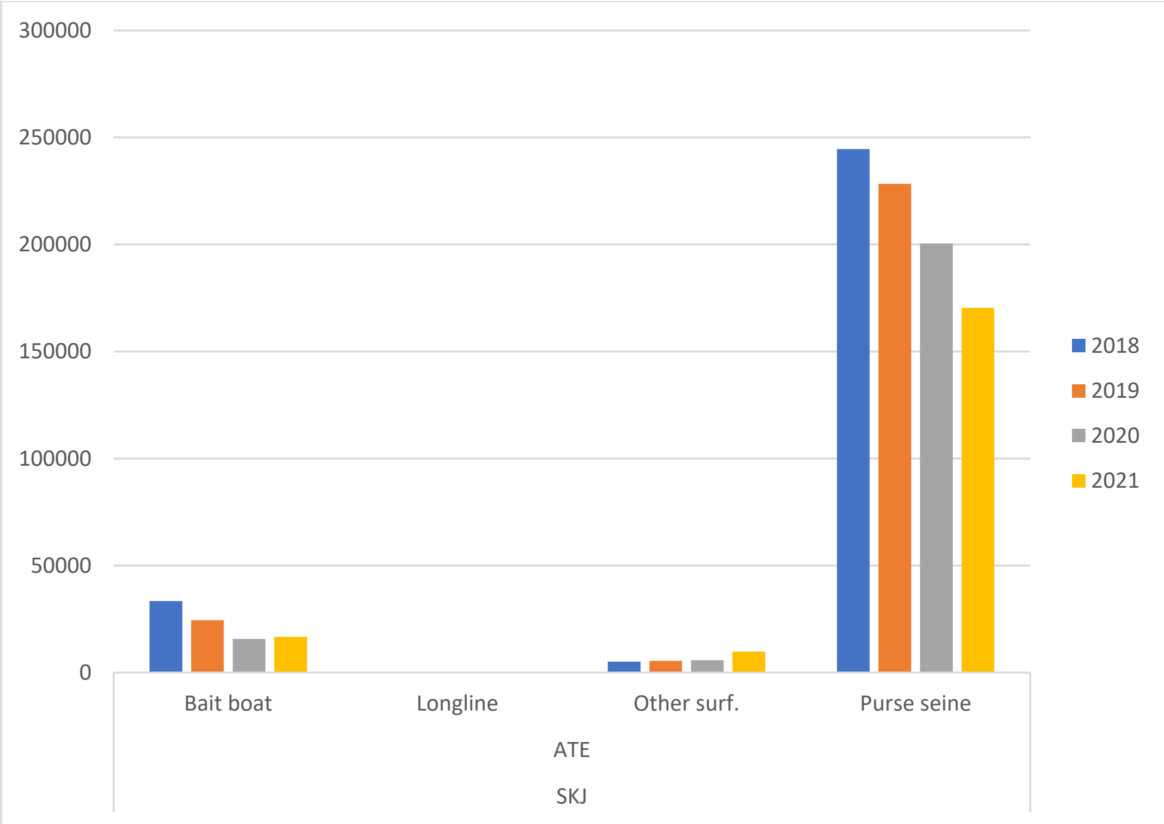


Figure 9.6.3. Total reported catches (t) of eastern Atlantic skipjack tuna during 2018-2021, by major gear.

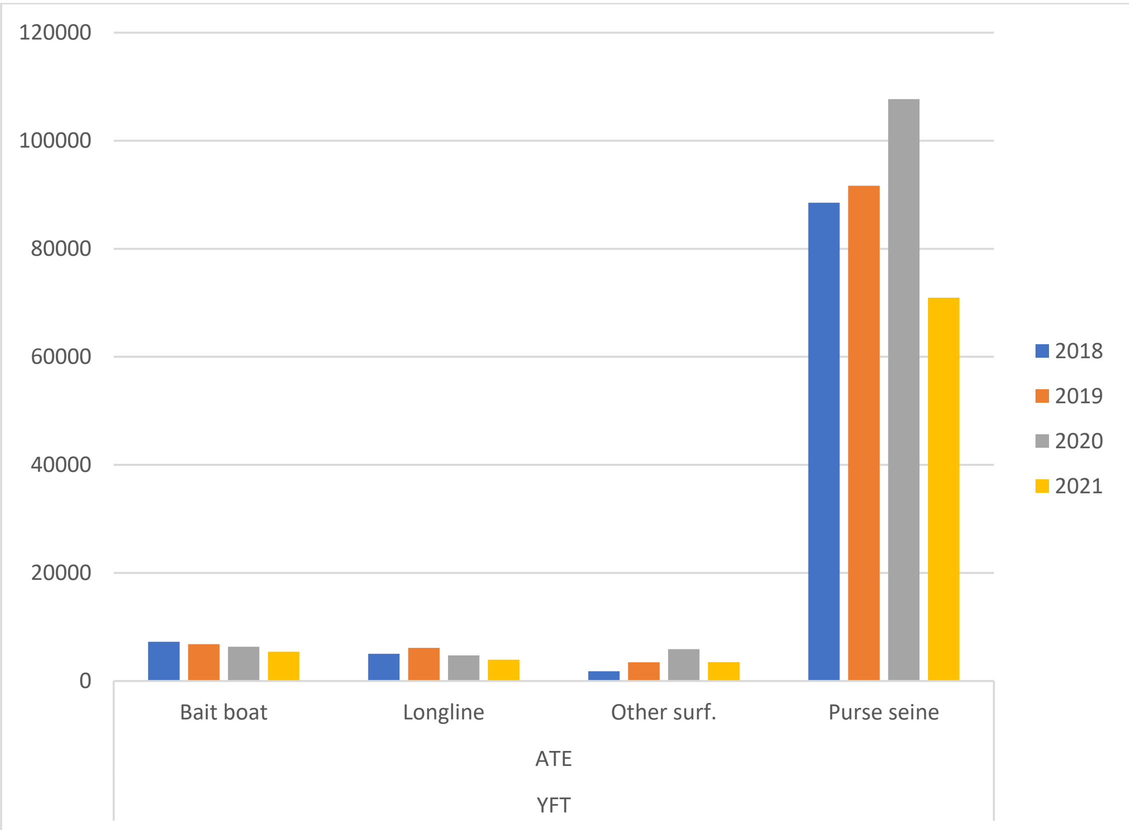


Figure 9.6.4. Total reported catches (t) of eastern Atlantic yellowfin tuna during 2018-2021, by major gear.

10. Reports of Research Programmes

10.1 Atlantic-Wide Research Programme for Bluefin Tuna (ICCAT/GBYP)

GBYP Phase 11 started on 1 January 2021, with an initial duration of 12 months, which was later extended for 8 months (until 31 July 2022) to allow to complete some studies that were delayed due to COVID-19 pandemic related restrictions, and carry out the 2022 aerial surveys in Western and Central Mediterranean, therefore making a better use of available funds. Phase 12 started on 24 March 2022 with an initial duration of 12 months.

The most relevant research activities carried out during this reporting period (October 2021-September 2022) have been:

a) Data recovery and management – During Phase 11 there has been one data recovery activity, which has allowed to incorporate into the ICCAT e-tagging data DB 138 new relevant BFT tracks. However, the activities in this line consisted of in-house desk work focused on development of relational databases to enable proper storage and analysis of raw data relevant for BFT management generated by GBYP or submitted by the CPCs, i.e. data related to BFT farming and the GBYP growth in farms studies, biological data, aerial survey data, and electronic tagging data. This in-housework is continuing through Phase 12 and encompasses collection and evaluation of relevant data not previously available to the SCRS.

b) Aerial survey on bluefin tuna spawning aggregations – Due to numerous uncertainties related to the aerial survey index, a thorough review of the GBYP aerial survey program was carried out by external experts in 2020, who identified several issues with work done so far. Following external expert advice, a pilot survey to explore the feasibility of incorporating automated digital systems to complement human observers based systems and to evaluate the influence of the extension of the surveyed areas was carried out in June 2021. In addition, it was also recommended to develop model-based approaches for data analyses, instead of the classic design-based approach, aiming at considering the potential changes in index values driven by environmental variability and not only by stock abundance changes. Along the last year, the data from this pilot survey have been analysed, producing an updated aerial survey time series, using both design based and model-based approaches. In summer 2022 the standard GBYP aerial surveys have been resumed, surveying successfully the Western and Central Mediterranean spawning core areas. It was decided that the Levantine Sea sub-area (Area G) would not be surveyed because the results obtained in previous campaigns suggest that one of the basic assumptions to apply this methodology, which is that the BFT spawners be fully available for aerial observations, is not met. The results from these surveys will be analyzed within GBYP Phase 12.

c) Tagging – Conventional tagging continued as a complementary activity, providing support to national teams. Although conventional tag reporting has improved since implementation of the GBYP tag awareness and rewards programme, the recovery rate remains low. Deployment of electronic tags has further enhanced the knowledge on bluefin tuna behaviour and helped address several previous hypotheses. These data have been used within the framework of MSE development. The new strategic approach for implementing the GBYP e-tagging program based on close collaboration with CPCs tagging programs initiated in Phase 10 has continued in Phase 11, which allowed to deploy a total of 70 pop-up satellite tags by experienced tagging teams in the Western and Eastern Mediterranean and/or North Atlantic Ocean, targeting eastern stock individuals, within the framework of 9 MoU signed with the awarded institutions. A new Call for Expressions of Interest to collaborate with GBYP e-tagging program was launched in April 2022, under GBYP Phase 12. As a result, 8 new proposals were received and awarded, and consequently 7 MoUs have been signed and one is still under preparation. These MoUs will allow to deploy 55 additional GBYP owned tags and incorporate in a future the dataset from both GBYP tags and from the CPCs teams owned e-tags deployed within the campaigns covered by these MoUs.

d) Biological studies – Biological sampling focused on the collection of tissue and otoliths/spines samples (1046 otoliths, 995 fin spines and 1157 tissue samples, from 1189 individuals), for the purpose of better determining the population structure and mixing and improving the accuracy of the age length key, used for the stock assessment and MSE. Throughout last year, within GBYP Phase 11, the analyses of Sr, Ba, Mg and Mn concentrations along the life cycle have allowed to develop an effective neural network application which successfully predicted the origin of bluefin tuna with a classification accuracy of 98%. The reference genetic data have been improved by replacing the least informative markers of the 96 SNP traceability panel by 10 newly selected ones (including 3 genetic markers for sex identification, with a success rate over 80%), and enlarged with 564 new genotypes. Comparison between stock of origin assignations based on microchemistry and genetics have shown some discrepancies between both approaches.

It has been also evaluated, through an in-depth review of available bibliography, the potential of epigenetic approaches for ageing Atlantic bluefin tuna samples to be applied for the Close-Kin Mark Recapture studies, concluding that the development of an epigenetic clock in Atlantic bluefin tuna requires a sampling scheme that ensures good representation of the species population in terms of environment, genetic component, sex and age classes. Finally, in Phase 11 a determination of annual periodicity in *annuli* formation in Atlantic bluefin tuna otoliths has been carried out applying the Marginal Increment Analysis (MIA) method, since controversies remain regarding the periodicity, or seasonality, of otolith growth band formation which directly influences a correct age determination of Atlantic bluefin tuna using otoliths. Results indicated that the opaque bands begin to form in July and continue to form up until October and that the *annulus* in the Atlantic Bluefin tuna otolith start to be formed in November and peaks in May and June. Consequently, ageing results based on otolith counts have been updated accordingly in the ICCAT catalogue.

e) Modelling – Throughout the last year there has been a major consolidation of the modelling foundations of the BFT MSE, including reconditioning of all operating models, integration of OM weighting, the refinement of seven CMPs authored by five independent developer groups. An external MSE code review has also been carried out, concluding that the M3 model and BFT MSE code base were correctly implemented at every level, with generally accurate description in the TSD. A few minor errors were found and described, and several minor improvements to the code were suggested mainly for readability and maintainability. Summing up, nothing was found in the review to suggest any reservations for the use of this package in ICCAT management. In addition to MSE development, GBYP has also contracted an independent external expert (Dr James Ianelli) for the 2022 eastern Atlantic and Mediterranean bluefin tuna stock assessment. The reviewer has participated actively in the full process, from data preparation to the projections and in the discussions on the results, providing expert advice. The external reviewer final report has been provided to the September 2022 Bluefin Tuna Species Group meeting. Finally, GBYP has continued providing financial support to various experts for their attendance to the meetings of the BFT Technical Sub-group on MSE.

The detailed report is attached as **Appendix 7**.

Discussion

The GBYP Coordinator presented to the Committee a summary of results and work carried out in the previous year within each line of activity (i.e., data recovery, independent indices, biological studies, tagging and MSE). The summary of GBYP contributions to the scientific advice was also provided, highlighting the inputs to the Bluefin tuna Stock Assessment and the MSE process. The ongoing activities within Phase 12, namely the workshops to be held in early 2023, were also presented. Finally, the activities proposal for the 2023-2024 activities for 2023-2024 period (Phase 13) were presented, together with the related budget and other Bluefin tuna Species Group recommendations. In addition, a reference was made to mid-term planned activities.

The Committee acknowledged the important contribution of GBYP in providing the important scientific information needed to develop the advice for bluefin tuna management and thanked the Secretariat for its effort. It was noted that major accomplishments have been achieved this year, namely in the field of electronic tagging, which showed a clear improvement in retention times and recovery rates. The importance of continuing with the development of fishery independent index was also highlighted, as well as the development of the methodology for close kin genetic tagging. The overall contribution from GBYP supporting the Bluefin tuna Species Group and SCRS achievements was reiterated and therefore a specific request was made for maintaining the budgetary support for the programme.

It was noted that GBYP programme entered into a new phase of development, which implies merging it with other ICCAT scientific projects. Accordingly, the European Union, the major GBYP funder, requested to keep reference to GBYP phases, setting clear annual objectives to easer monitoring of target achievements and avoid overlapping of GBYP phases. Also, it was request that SCRS to set clear priorities for scientific research.

The Committee also noted that to the level of biological sampling is unbalanced between the two sides of the Atlantic, and therefore there is a need to quantify the differences and identify the gaps. It was explained that this subject will be addressed in detail during the GBYP workshop on biological sampling and CKMR, to design and implement an Atlantic and Mediterranean wide coordinated sampling plan, aiming to fill MSE and other research line needs. It was stressed that improving coordination between national sampling programs is a key factor to reduce sampling costs and minimize the needed funds to coordinate efforts and ensure sampling conducted by national teams serves the best SCRS needs.

10.2 Small Tunas Year Programme (SMTYP)

Between 2018 and 2022, SMTYP continued collecting biological samples aimed at growth, maturity and stock structure studies on small tunas species (little tunny, LTA, *Euthynnus alletteratus*; Atlantic bonito, BON, *Sarda sarda*; and wahoo, WAH, *Acanthocybium solandri*). In that regard, a single contract was issued to a consortium of 12 institutions (11 CPCs) by the ICCAT Secretariat in 2018 that ended on 31 March 2019. In July 2019 a new contract was signed with the same consortium, whereas in 2020 a new consortium was set up involving 11 entities from 9 CPCs, and a new contract was signed. The objective of the latter contract was to collect biological samples to: i) fill specific size gaps for estimating the growth and maturity parameters for BON, LTA and WAH; ii) expand stock structure studies for FRI and BLT in the Atlantic Ocean and the Mediterranean Sea; iii) determine the growth and reproduction parameters for BON, LTA, and WAH; iv) refine the stock structure analysis for WAH, BON, and LTA and determinate the stock structure analysis for FRI and BLT; and, v) investigate genetic species differentiation between FRI and BLT.

A number of documents and presentations were provided during 2022 meeting of the Small Tunas Species Group, which presented results of the research conducted in the previous years within SMTYP. In addition, the Group identified the priorities that should be taken into account in terms of the species and areas to be sampled and revised the biological data to be collected under the SMTYP biological collection contract in 2022-2023. These priorities are presented in the small tunas workplan for 2023 (item 15.1.8), which also contains details on other relevant research activities to be developed throughout 2022-2024 including: updating the biological meta-database, estimation of length-weight relationships representative at the stocks/regional level, calibration and adopting internationally agreed maturity scales and, further investigating and applying of data limited methods to be used for the provision of management advice to these stocks.

The SMTYP report is attached as **Appendix 8**.

10.3 Shark Research and Data Collection Programme (ICCAT/SRDCP)

The Shark Species Group (SSG) continued the work on the age and growth of the South Atlantic shortfin mako study with the incorporation of samples from Japan, Namibia, and Brazil. Sample processing was completed by the end of 2021, and age readings will start in the last quarter of 2022. The lack of samples from the extremes of the size distribution, most notably from large shortfin mako, may result in convergence issues in the estimation of growth curves or biologically unreasonable estimated parameters. Approaches to overcome the lack of samples from small and/or large size specimens will be explored through growth modelling once the age readings are complete.

The population genetics study to estimate stock structure and phylogeography of shortfin mako continued, as previous results showed some inconsistency between genetic population structures predicted from mitochondrial and nuclear DNA analyses. To answer these questions two genome-wide analysis approaches were used: whole mitochondrial genome analysis and nuclear-genome-wide single-nucleotide polymorphism. The results obtained may support a scenario that consists of the establishment of geographically isolated populations, subsequently generating genetic divergence, followed by secondary contact between the divergent populations. During 2022, a total of 96 additional individuals collected from three localities, from the SE Atlantic, the SE Pacific, and the SW Pacific, were analysed in order to clarify effective measures for proper management units of the Atlantic shortfin mako populations. In the Atlantic Ocean, four regional and temporal groups were identified, North Atlantic, Central Atlantic I, Central Atlantic II, and South Atlantic. These units seem to be genetically reasonable management units for the purposes of conservation and management of the shortfin mako resource.

In 2022 the study on genetic analysis of porbeagle in the Atlantic Ocean started. A workplan to investigate the feasibility of whole mitochondrial genome sequencing (mitogenomics) for Atlantic porbeagle was presented in early 2022. As a start, mitogenomics of porbeagle on 96 individuals from three localities in the Atlantic Ocean (Northeast, Northwest, and Southeast) were conducted, succeeding in reconstructing 92 mitogenomes. The result of phylogenetic tree reconstruction clearly showed the existence of two distinct mitogenome clades in the Atlantic Ocean (North and South Atlantic clades). No genetic differentiation between East and West regions in the North Atlantic Ocean was observed.

Studies on movements, stock boundaries, habitat use and post-release mortality of shortfin mako caught on pelagic longline fisheries continued. A total of 43 tags deployed in the Northwest, Northeast, tropical Northeast and equatorial region, and Southwest Atlantic have been used in the post-release mortality assessment. Data available from 35 of the 43 tagged specimens revealed a 22.9% rate of post-release mortality. Data acquired from the most recent tag deployments is being updated and analysed and should be presented during 2023. With regards to shortfin mako movements, stock boundaries and habitat use, the results of this project up to the end of 2019 were published in Santos *et al*. (2021). Overall, a total of 53 tags (31 miniPATs and 14 sPATs ICCAT tags, and 8 additional miniPATs from other projects) have been deployed by observers from EU-Portugal, Uruguay, Brazil, EU-Spain and US in the temperate NE and NW, Equatorial and SW Atlantic. The movement analysis showed that sharks tagged in the Northwest and Central Atlantic moved away from tagging sites showing low to no apparent residency patterns, whereas sharks tagged in the Northeast and Southwest Atlantic showed evidence of site fidelity and were identified as possible key areas for shortfin mako. For the next phase of the project, 7 tags have already been deployed in the SW Indian Ocean, and it is proposed to deploy remaining tags in the SE Atlantic, to determine possible movements between the SE Atlantic and SW Indian Ocean and the analysis will be updated with the most recent data.

The porbeagle electronic tagging continued by teams from EU-France, EU-Portugal and Norway in the North Atlantic to better understand the movement patterns, stock boundary, and habitat use of this species in the Atlantic, to potentially contribute to their assessment and management. A total of five tags have been deployed by EU-Portugal and EU-France in the Northeast Atlantic, Bay of Biscay/Celtic Sea area, and central North Atlantic. Deployment of remaining tags are planned by scientists from EU-Portugal and Norway in the North Atlantic, and Uruguay in the South Atlantic to be conducted during the rest of 2022 and 2023, depending on the tagging opportunities.

The movements, stock boundaries and habitat use of silky, oceanic whitetip, longfin mako, and hammerhead sharks in the Atlantic Ocean are also part of the SRDCP. A total of 27 miniPATs were deployed by EU-Portugal, the United States and Uruguay on silky (17), oceanic whitetip (8), smooth hammerhead (1) and scalloped hammerhead (1) sharks, which were deemed by the SCRS to be priority species. Multiple tags acquired during 2019 and 2020 had to be returned to the manufacturer due to battery failures and could not be deployed as originally planned in 2020. It has been discussed that the species selected for this tagging activities are not always commonly caught, and this represents a bigger challenge to achieve the proposed goal. The available tags are planned to be deployed throughout 2022 and 2023.

The report is attached as **Appendix 9**.

10.4 Enhanced Programme for Billfish Research Programme (EPBR)

The EPBR continued its activities in 2022, although with restrictions due to the COVID-19 pandemic situation. The Secretariat coordinates the transfer of funds, information, and data. The overall programme coordinator and eastern Atlantic coordinator during 2022 was Dr. Fambaye Ngom Sow (Senegal) and Ms. Karina Ramírez López (Mexico) remaining as coordinator for the western Atlantic. The original plan (1986) for EPBR included the following objectives: (1) to provide more detailed catch and effort statistics, particularly for size frequency data; (2) to initiate the ICCAT tagging programme for billfish; and (3) to assist in collecting data for age and growth studies. These objectives have been expanded to evaluate adult billfish habitat use, study billfish spawning patterns and billfish population genetics, as these are essential aspects to improve billfish assessments. The original plan was revised by the Group, to overcome the data gap issues, in particular artisanal fisheries of developing CPCs, taking into account the findings of these regional reviews. The previously available specific funding for EPBR has now been combined with the general research fund (ICCAT Science Envelope). Project funding is now being allotted on a more competitive basis with other Species Groups. The United States Data Fund has been supporting the EPBR activities.

In July 2022 a new contract was awarded to Centre de Recherches Océanographiques de Dakar/Thiaroye (ISRA/CRODT, Senegal) to continue the activities of the previous contract for a 12-month period (until December 2022). Over this period, EPBR engaged research teams from Senegal, Côte d'Ivoire and Gabon sampling for billfishes from artisanal fleet and a EU research team from Portugal, which have significantly enhanced the collection of samples onboard industrial vessels operating in the same area and support the analysis of data on length and age for estimating the growth parameters of the main billfish species that occur in the eastern Atlantic (*Makaira nigricans*, BUM; *Kajikia albida*, WHM; and *Istiophorus albicans*, SAI).

In 2022, 57 additional samples have been collected: 25 samples from industrial fisheries by the Instituto Português do Mar e da Atmosfera (IPMA) and 32 samples from artisanal fisheries by CRO. A total of 509 samples have now been collected from those species. All otoliths collected and sent to the Fish Ageing Services in Australia for age reading in 2021 were analysed. The report of preliminary result of a study to evaluate the use of otoliths to estimate the annual age and provide some preliminary otolith-based estimates of potential longevity of Atlantic blue marlin (*Makaira nigricans*), Atlantic white marlin (*Kajikia albida*) and Atlantic sailfish (*Istiophorus albicans*) is provided and presented during the Billfish Species Group meeting.

A workshop on Age Reading was held online from the 25-28 October 2021, that was intended to review the existing sampling and processing protocols, for consistency between laboratories, and initiate discussions on age reading protocols.

Following the SCRS request, in autumn 2019 through the ICCAT Science Envelope, a contract was proposed to the Dirección General Adjunta de Investigación Pesquera en el Atlántico, Centro Regional de Investigación Acuícola y Pesquera en Veracruz (Mexico) to develop a Reproductive biology study on Atlantic blue marlin in the Gulf of Mexico. During September 2022, the Secretariat received a draft proposal for review, aiming to sign a contract to initiate the study on blue marlin reproduction in the Gulf of Mexico in the near future.

The report is attached as **Appendix 10**.

Discussion

The Rapporteur presented the research work on billfish species in 2022 highlighting the advance in the biological sampling and ageing of blue and white marlin, and sailfish, particularly from the East Atlantic areas, despite the limitations associated with the COVID-19 pandemic.

The Committee welcomed the proposals for workshops aiming at the improvement of data collection and report of small-scale and artisanal fisheries data, highlighting the importance of these fisheries as local food providers and the social content for ICCAT. The Committee strongly recommended that these workshops cover other ICCAT species, such as small tunas and sharks, inviting other working groups to participate. It was also raised the need of some CPCs for the scientific support that the SCRS can provide to improve the monitoring, data collection and management of these fisheries.

Finally, it was noted the importance of improving the identification of catches between white marlin and round scale spearfish by CPCs to provide better advice to the Commission.

10.5 Albacore Year Programme (ALBYP)

The Albacore Species Group (ALB SG) continued the work on albacore reproduction in both the North and South stocks. In the North Atlantic, a consortium with scientists from EU-Spain, Canada, Venezuela and Chinese Taipei collected and processed 272 gonads from Venezuelan and Chinese Taipei longliners. First dorsal fin spines (n=163 from albacore collected in Venezuelan longliners) were also collected and analyzed to assign age and interpret maturity data. All the female albacore collected in the tropical area by Venezuela longliners were mature but had no sign of spawning. Fecundity parameters were estimated on a reduced number of gonads (n=21) collected in May and June of 2021 in the Central North Atlantic area by Chinese Taipei longline vessels. Collection of albacore gonads continues in this area and a comprehensive summary of compiled results will be presented in 2023.

In the South Atlantic, the reproductive study is in its initial stage, being conducted by a consortium of scientists from Brazil, Uruguay, South Africa and Chinese Taipei. Biological sampling is being carried out in the three main areas of abundance/fishing in the South Atlantic (oceanic areas off Brazil, Uruguay and South Africa). To date, 104 gonads have been collected in the Brazilian fleet at two different latitudes, which have been analyzed. Most mature individuals came from the northernmost sample, and the data support the hypothesis that the reproduction site of albacore is up to 20°S along the Brazilian coast. This information will be completed with gonads from other sampling areas.

Another component of the research programme relates to movements and habitat use of Atlantic albacore, which is being conducted by scientists from EU, Brazil, Uruguay, South Africa, Chinese Taipei and Japan. In the North Atlantic, several tagging surveys have been conducted off the Canary Islands targeting large individuals, where 29 MiniPATs have been implanted. In addition, in the Bay of Biscay tagging has targeted small and medium size albacore, with 2 MiniPATs and 83 internal archival tags being already deployed. Posters announcing €1000 rewards were produced in Spanish, French, English, Portuguese, Chinese and Japanese, and distributed through collaborating Albacore Species Group participants from different CPCs. To date data from 29 tracks have been gathered, which includes 1953 tracking days. It is worth noting that for the first time a full year track of a juvenile albacore has been recorded. This specimen visited shallow waters of the Bay of Biscay in subsequent summers, while inhabiting deeper waters in the central and western Atlantic during the winter. In the South Atlantic, first attempts to deploy MiniPATs were not successful, and no tags were deployed yet. The teams will continue to deploy tags and an update of the results will be presented in 2023.

Finally, a short-term contract was issued to accomplish the technical tasks required to follow the Albacore MSE schedule adopted by the Commission. According to this schedule, after adoption of the first ICCAT Management Procedure (MP) in 2021 (following adoption of a harvest control rule in 2017), it is needed to check for the existence of exceptional circumstances on a yearly basis. In addition, in 2023 a new benchmark stock assessment using SS3 is scheduled, which should serve as a basis for conditioning new operating models for the second round of the MSE framework, expected to be delivered in 2026. Moreover, *Recommendation by ICCAT on conservation and management measures, including a management procedure and exceptional circumstances protocol, for North Atlantic albacore* (Rec. 21-04) requires testing alternatives to the adopted Management Procedure (MP). The contractors developed initial SS3 models according to the model and fleet structure previously agreed by the SCRS and presented results to the Albacore Species Group. In addition, they presented the performance of MP variants requested in Rec. 21-04, namely with varying levels of target fishing mortality and biomass thresholds, as well as varying number of CPUE series, levels of underreporting, effect of carry over, TAC implementation error and alternative stability clauses. They also produced the necessary plots for the ALB SG to discuss the detection of exceptional circumstances, as requested by the Exceptional Circumstances protocol contained in Rec. 21-04.

The report is attached as **Appendix 11**.

Discussion

The Rapporteur presented an update of the ALBYP research activities on albacore stocks developed in 2022. He highlighted the advances in the electronic tagging and reproduction studies for northern and southern albacore, and the work related to North Atlantic albacore MSE.

The Committee inquired on the proposal for the Mediterranean albacore assessment in 2023. The rapporteur indicated that this is a specific request from the Commission (Rec. 21-06).

10.6 Swordfish Year Programme (SWOYP)

The Swordfish Year Programme was established in 2018 to address key uncertainties important for improving the scientific advice for management of the stocks. The three main research areas - ageing and growth, reproductive biology, and genetics - are each led by study coordinators who oversee work involving 20 institutions from 14 ICCAT CPCs/Cooperating Non-Contracting Parties. The work to date has been organized through a series of short-term contracts and in 2022 is being formalized as an ICCAT research programme. Since project inception, 4,159 swordfish representing all three ICCAT managed stocks have been sampled for some combination of fin spines, otoliths, muscle tissue, gonads, and additional information has been collected on fish size, sex, maturity stage, and catch date, location and method. The SWOYP aims to improve knowledge of the stock distribution, age and sex of the catch, growth rates, age at maturation, maturation rate, spawning season and location, stock boundaries and mixing, thereby contributing to the next major advance in the assessment of swordfish status. In addition, tagging work supports studies on distribution, movement, and habitat use which are important for the development of a species distribution model. In 2018, the North Atlantic swordfish management strategy evaluation was initiated and in subsequent years a modeling framework has been developed and the core modeling team is on track to provide CMPs to the Commission by the end of 2023.

In 2018 and 2019, emphasis was placed on sample collection and standardization of sampling methods and processing among member institutions. Samples were collected in the major fishing areas in the North and South Atlantic and Mediterranean. Since 2018, 4,159 samples have been collected from longline fisheries, covering all three stocks. The majority of samples collected consist of an anal fin spine for aging, a piece of tissue for genetic analysis, and include data on fish size, sex, location and catch date. Within this sample set are 3,497 fin spines, 985 otoliths, and 322 gonads. Subsequent processing and analysis of samples since 2019, has led to ageing and maturity reading efforts and calibration exercises. The resulting data have contributed to preliminary work on revised growth models, and maturity ogives. The genetic analyses have resulted in sequencing of the swordfish genome, identification of SNPs important for stock differentiation, and preliminary estimates of stock boundaries and mixing areas. Work within each of the project areas will continue in 2023 with continued processing of samples, readings of otoliths/spines and gonads, genetic analysis of tissues and collection of samples in areas where there are sampling gaps.

Tagging studies aim to analyse the vertical habitat-use and migration patterns of swordfish, and help to delimit the stock boundaries and mixing rate of swordfish between the Mediterranean Sea and the North and South Atlantic. Forty-four ICCAT funded tags have been acquired since 2018, when the tagging programme was implemented. To date, a total of 26 miniPAT tags have been deployed in the North (13) and South Atlantic (9) and the Mediterranean Sea (4). These studies indicate considerable horizontal movements and patterns of vertical movement through depth and temperature layers. These findings are important for improvements to the swordfish species distribution model which the Swordfish Species Group uses to better understand SWO catch rates.

The N-SWO MSE is now at a critical stage. The Species Group identified key uncertainties early in the process and subsequently developed a factorial operating model grid. The grid was recently re-conditioned using the 2022 Stock Synthesis III assessment model as a base case, creating a 216-model grid. The core N-SWO MSE technical team has identified a reference set of 9 OMs, candidate robustness OMs, and has begun work on CMPs. In 2023, the Species Group will continue CMP development, as defined in the ICCAT MSE roadmap, and engage with Panel 4 and stakeholders on the refinement of performance metrics and development and selection of a MP. Results will be presented to the Commission at intersessional meetings of Panel 4 and at the Commission meeting in later 2023.

The detailed report is attached as **Appendix 12**.

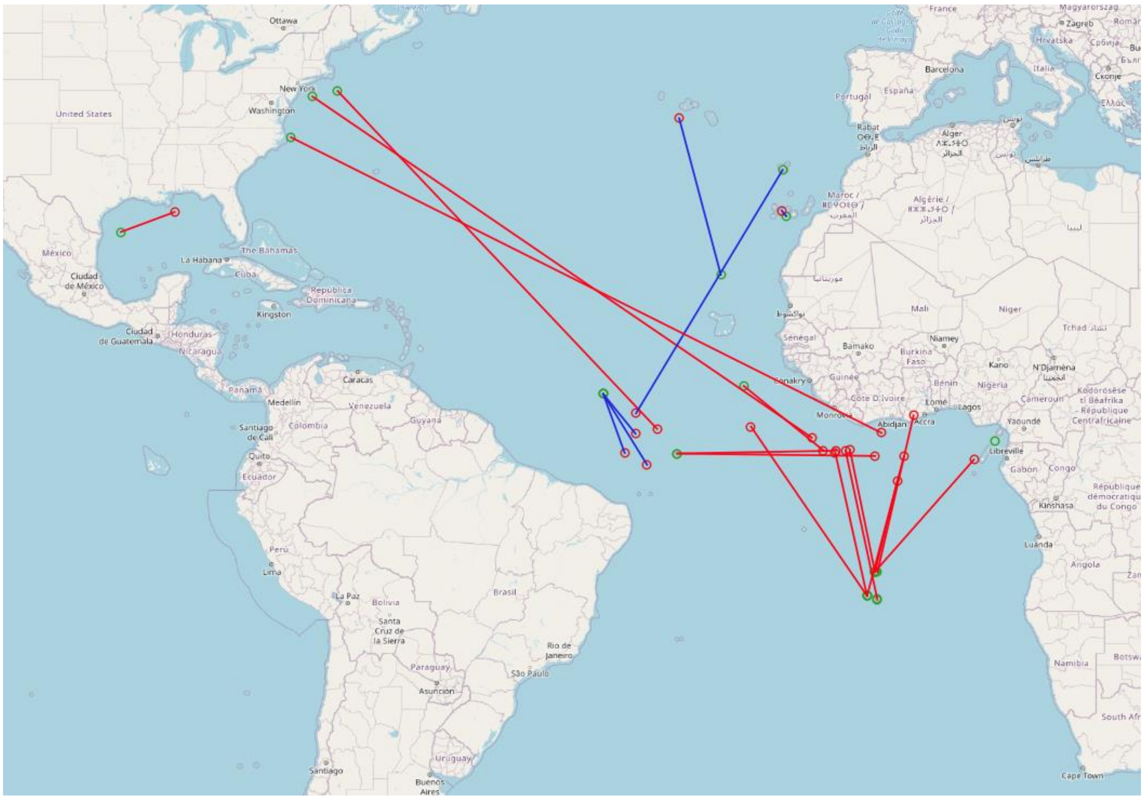
10.7 Other research activities (on tropical tunas)

After the closure of the ICCAT-AOTTP the activities have focused into four main tasks: i) tag recovery and rewarding; ii) tag seeding experiments; iii) ageing study; and iv) tagging in the north-western Atlantic, an area which was short on the number of fish targets during AOTTP.

Two short-term contracts were issued to Senegal and Côte d'Ivoire teams in the field, to continue tag recovery and awareness campaigns, tag seeding experiments, and sample processing to age hard parts from recaptures. In addition to these, other ex-AOTTP teams have kept tag recovery activities at no or little cost. During the past 12 month a total of 25 recoveries were made, namely 5 of BET, 20 of YFT. The table and figure below show additional details on these recoveries.

Species	*BET*	*YFT*	*SKJ*	*Total*
Conventional tags	5	20	-	25
Days at liberty (min-max)	666-1376	576-1810	-	

The figure below shows the tagging (green circles) and recovery (red circles) locations of the conventional tags recovered between October 2021 and September 2022. Blue lines correspond to BET and red lines to YFT.



As regards tag seeding experiments aiming the estimation of the reporting rate, during the reporting period a total of 87 experiments were made by the teams in Senegal, Côte d'Ivoire and Ghana, as detailed below. Recovery rates are provided between parentheses as a percentage.

Location	*BET*	*YFT*	*SKJ*
Senegal	8 (87%)	17 (82%)	38 (68%)
Côte d'Ivoire	2 (100%)	2 (100%)	5 (100%)
Ghana	5 (*)	8 (*)	2 (*)
Total	**15 (90%)**	**27 (84%)**	**45 (72%)**

* Data not yet available.

In addition, within the short-term contract issued to the University of Main targeting the deployment of 1400 tags of the eastern coast of the United States, as of 5 August 2022 a total of 215 were deployed (15.4% of the target), as detailed in the table below.

Species	*Tagging area*	*Tagging target by area*	*Tagged until 05/08/2022*
Yellow fin tuna (YFT)	YF12 (North 30°N)	-	180
	YF30 and YF40	419	
Bigeye tuna (BET)	BE10	-	21
	BE9	110	
	BE30 and BE 40	233	
Skipjack (SKJ)	SJ08 (North 30°N)	58	7
	SJ09, SJ30 and SJ40	580	3
Unknown (UNK)		-	4
Total		**1400**	**215**

Discussion

The Secretariat presented the activities related to the continuation of activities in support of the objectives of the AOTTP. The Committee was informed that the contractor in charge of tagging tropical tunas in the Northwest Atlantic has requested to add the tagging of little tunny to its contract. This request stems from the challenges encountered by the contractor in reaching the target of numbers of tropical tuna tagged and released. There was no proposal to the Tropical Tunas Species Group. Therefore, the proposal was not discussed by the Group. Therefore, the Committee agreed that it was unable to provide an answer to this request from the contractor. The Committee suggested that the Rapporteurs of the Tropical Tunas and Small Tunas Species Groups review such request, consult with their members, and report the opinion of both species groups to the Secretariat and the Committee, for a decision to be taken in 2023.

11. Report of the Subcommittee on Statistics

The 2022 Meeting of the Subcommittee on Statistics (SC-STAT) was held in Madrid on 19 September 2022, under a hybrid format. The Convener of the SC-STAT, Dr Pedro Lino (EU), welcomed all the participants and acknowledged the work of the Secretariat in the support provided to this Subcommittee and to the SCRS in general. In the report, the Convener referenced the 2022 Secretariat Report on Statistics and Coordination of Research (**Appendix 5**) which has detailed explanations of the work done during 2022 by the Secretariat including the current CPCs reporting status (SCRS Report Cards which used the filtering criteria to validate 2021 Task 1 Task 2 data submissions), improvements made in statistics (historical revisions and recoveries) and the associated data management tools (databases, infrastructure, applications, etc.), and progress made on various Secretariat ongoing projects (historical data recoveries, IOMS, improved and new databases, etc.). The SCRS "scorecard on Task 1 and Task 2 data availability", with the format approved by the SCRS in 2019, was also presented (for the fourth year) covering the period 1992 to 2021.

Special emphasis was given once again to the failure of most CPCs to comply with the mandatory reporting of both dead and live discards in Task 1, as required by the Commission, and the important need to improve this aspect in the short term.

The Convener also summarised the status of addressing the 2021 Subcommittee's recommendations, reiterating the need to continue advancing on those that have not been fully addressed, and the need for active participation of Species Group Rapporteurs and CPC Statistical Correspondents in the Subcommittee. It was recalled that many decisions made by this Subcommittee usually affect all the ICCAT CPCs, such as the set of proposals aiming to improve and normalise the ICCAT coding system, as well as important changes made to statistical and tagging forms. These forms, revised every year, always contain important updates (e.g. since 2016, all the Task 2 information must be reported by month, Task 1 and Task 2 forms allow submissions of data from multiple years at once, etc.). Since 2020, the Task 1 nominal catches form (ST02-T1NC) has included two additional columns aimed to inform the raising factors used to obtain the live/round weight catches equivalent of the landings and the discards. The outcome of this inclusion was not yet fully addressed during the meeting but plans to revise the conversion factors reported by the ICCAT CPCs should be properly addressed in near the future.

The Subcommittee acknowledged the progress made on the ICCAT Online Management System (IOMS). A Meeting of the Online Reporting Technology Working Group (WG-ORT) was held in 2022 (see meeting report) where it was revised the existing workplan and planned the next few phases. The WG-ORT considered the outcome of the release into production of the IOMS on 1 August 2021 (experimental year) working with the 2020 Annual Reports was very satisfactory. The Secretariat informed the Subcommittee that the 2022 Annual Reports are now being reported by the ICCAT CPCs using the IOMS (Part I/Annex 1 and Part II/Section 3) with a great adherence of the ICCAT CPCs in the last couple of months. Two IOMS workshops (training sessions) were held by the Secretariat in 2022 to support IOMS users. Currently the IOMS only allows to work with Annual Reports (Part 1/Annex 1 and Part 2/Section 3) for compliance purposes. The testing phase of the IOMS to submit Task 1 statistical form (ST02-T1NC) will start in 2024. The Subcommittee acknowledged the importance of the IOMS project on the future of ICCAT and reiterates its full support for the IOMS project, its development and support from the Commission and the CPCs.

Finally, the Subcommittee presented to the SCRS its 2022/2023 workplan (see details in section 15.1.2 of the report).

The Report was adopted and is attached as **Appendix 13**.

Discussion

The Committee congratulated the Convener of the Subcommittee on Statistics, Dr Pedro Lino, for the excellent work done in its first year chairing the Subcommittee. The Convener congratulated the Secretariat for greatly facilitating his work.

Several points were raised in relation to the ICCAT IOMS system, in terms of guaranties in security aspects (user rights and roles, permissions, etc.) and automation tools related to Annual Report completion. The Secretariat informed that, the WG-ORT governs all the IOMS implementation process (short, middle, and long-term planification) including those aspects related to security and automation improvements (pre-emptive completion based on CPC profiles, etc.). All these details can be followed in the Report of the Meeting of the Online Reporting Technology Working Group (WG-ORT) *(Virtual, 7-8 February 2022)*. The Committee recognised the importance of the IOMS in the future work of ICCAT, with particular emphasis on the impact of this system on the management of statistical and biological information required by the SCRS where the first module to manage Task 1 information within the IOMS is planned to be operational in 2024.

The Committee also made two important recommendations: 1) to facilitate the work of the Subcommittee, the Committee recommends that the SC-STAT meeting report be posted on Owncloud prior to being sent for translation, to give the participants of the meeting an opportunity to review and comment on the draft text of the report; and, 2) to improve the executive summary tables on Task 1 nominal catches published in the report of the Committee, it was recommended that the Task 1 summary tables (legends, structure, normalisation, etc.), that for more than 20 years have had the same format and are not totally adapted to the current needs of the SCRS, be fully studied and revised intersessionally by the Convener of the Subcommittee, interested national scientists, and the Secretariat in order to present a proposal at 2023 meeting of the Subcommittee of Statistics.

12. Report of the Subcommittee on Ecosystems and Bycatch

The Intersessional Meeting of the Subcommittee on Ecosystems and Bycatch met online from 31 May to 3 June 2022. Pertaining to ecosystems, the Subcommittee reviewed the work of the sub-group tasked with assessing the applicability and functionality of the Ecosystem Report Card as a tool for monitoring the impacts of ICCAT fisheries and the results of a workshop which developed ecoregions within the ICCAT Convention area. Both processes support the implementation of an Ecosystem Approach to Fisheries Management (EAFM) framework and reporting system for ICCAT. Methods for validating bycatch indicators and assessing and prioritizing risk to ICCAT species were reviewed and updates on cases studies supporting EAFM implementation and new projects supporting indicator development were provided.

Pertaining to bycatch, the Subcommittee reviewed the progress made on collaborative work on sea turtle bycatch in ICCAT fisheries and agreed on the next steps, which will include gathering and the analysis of data for the Mediterranean Sea. In addition, the Subcommittee discussed the factors affecting bycatch and interactions, and reviewed the progress made within the course of five online meetings held by the Sub-group on Technical Gear Changes which is examining how potential technical changes to the terminal gear could affect catch rates, retention rates, at-haulback mortality and post-release mortality. The mechanisms for the Subcommittee to work across all Species Groups of the SCRS on the issues related with multi-stocks was also discussed, whereas part of the list of bycatch species was revised.

Finally, the Subcommittee developed its recommendations and workplan for 2023.

The detailed report is provided in **Appendix 15**.

Discussion

The co-convenors of the Subcommittee on Ecosystems and Bycatch presented a summary of their progress to date. The Committee congratulated the Subcommittee on their progress to date. However, they inquired about how the results of their work might be operationalized (i.e., how they might appear in the Executive

Summary) in the future and noted that they might consider forming a small group that could work on this issue brainstorm how that might happen. On this point it was noted that most ICCAT stocks occupied more than on Ecoregion with the exception of the Mediterranean. So, it was asked how they might provide information about species that spanned more than one Ecoregion and if they could provide some feedback on these fisheries. In response it was noted that the issue of Ecoregions was a matter that was still under development and that the Subcommittee had yet to resolve finally. The Committee further noted that they had a number on inquiries about how tuna interaction with other fisheries that are of specific interest to coastal CPCs (for example, the interaction between tuna and small pelagics).

With respect to the presentation on Bycatch, the Subcommittee had a number of comments. They were complimentary of the work on sea turtles noting that it was an enormous advance in terms of its use of data sources and the geographic extent of the work, but also as an example of a potential model for how collaborative work on this nature could be conducted by other subsidiary bodies of the SCRS. The Committee highlighted that the project had employed new approaches for protecting data confidentiality so that for example the environmental data can be associated with each set, while other data types were aggregated at spatial temporal resolution that their data confidentiality rules permitted. Finally, the Committee thanked the co-convenor for his efforts to get the Subcommittee to come to an agreement on recommendations.

13. Progress related to work developed on MSE

Since the September 2021, the SCRS has further developed substantial work on the ongoing ICCAT MSE processes. Additional details are provided below (items 13.1 to 13.5).

13.1 Work conducted for northern albacore

In 2017, the ICCAT Commission adopted an interim Harvest Control Rule (HCR) for North Atlantic albacore (Rec. 17-04), which represents the first HCR adopted in the history of ICCAT. In 2021, the Commission adopted the first full management procedure (Rec. 21-04), including the harvest control rule, the specifications about how to determine stock status in the future, and an exceptional circumstances protocol. The adopted HCR imposed an F_{TARGET}=0.8*F_{MSY}, a $B_{THRESHOLD}$=B_{MSY}, a B_{LIM}=0.4B_{MSY} and an F_{MIN}=0.1F_{MSY}, with a maximum TAC of 50,000 t and a maximum TAC change of 25% in case of increase or 20% in case of decrease when B_{CURR}>$B_{THRESHOLD}$.

Since 2015, the SCRS has provided scientific advice and interacted with the Commission, to allow the Commission to adopt the recommendations mentioned above. This included testing several HCR variants, stability clauses, the effect of the carryover and additional scenarios about TAC implementation error. In addition, an independent peer review was conducted during 2018, criteria for the identification of exceptional circumstances were developed, and a single consolidated report was produced (Merino *et al.*, 2020).

In 2022, a short-term contract was issued to accomplish the technical tasks required to follow the Albacore MSE schedule and Rec. 21-04 adopted by the Commission. The exceptional circumstances protocol in Rec. 21-04 requires determining, on a yearly basis, if exceptional circumstances exist. In this regard, the contractors produced the necessary plots for the Albacore Species Group to discuss the detection of exceptional circumstances according to the Exceptional Circumstances protocol contained in Rec. 21-04.

Rec. 21-04 also required testing alternatives to the adopted Management Procedure (MP), as well as determining the number of CPUE series and the level of underreporting that would trigger the occurrence of exceptional circumstances. The contractors evaluated the performance of MP variants requested in Rec. 21-04, namely with varying levels of target fishing mortality and biomass thresholds and evaluated the performance of the MP when only some of the CPUE series were available. They also performed initial tests with varying levels of underreporting, though this analysis needs to be continued in 2023.

In 2023 a new benchmark stock assessment using SS3 is scheduled, which should serve as a basis for conditioning new operating models for the second round of the MSE framework. During 2021 and 2022, the Albacore Species Group decided the model and fleet structure for the SS3 model, and the contractors developed initial SS3 models and presented results to the Species Group.

13.2 Work conducted for bluefin tuna

The ICCAT Bluefin Tuna Species Group has made substantial progress on MSE throughout 8 intersessional meetings, including the Panel 2 meetings. The MSE Consultant contracted by ICCAT GBYP under the supervision of the BFT Technical Sub-group on MSE (partially funded by ICCAT GBYP) has worked extensively on the updates of the Operating Models (OMs) and comparisons of Candidate Management Procedures (CMPs), following the recommendations made at the various meetings.

The Committee has been discussing Candidate Management Procedures (CMPs) results, performance measures, and the process to condense CMPs into a reduced subset. The Committee interacted with Panel 2 twice and reflected their views on CMPs, performance measures, and management objectives to the MSE work. After reviewing the performance and results of the initial proposed CMPs, the Committee is providing four candidate types of CMPs to the Commission. The latest CMP results incorporated the abundance indices up to 2021.

The Trial Specification Document (TSD) for BFT OMs is now complete, and the Shiny App to review the OMs has been developed and improved following recommendations from users.

13.3 Work conducted for northern swordfish

Work on North Atlantic swordfish MSE started in 2018. ICCAT awarded a contract for operating model and management procedure development to an expert team. In 2019 a new contract was awarded to a different contractor and most of the work in 2019 was devoted to conditioning the Operating Model (OM). The Committee agreed to use the Base Case stock synthesis assessment from 2017 to set up the initial OM design based on a factorial design (i.e., grid) to develop scenarios that represent the main uncertainties identified. This grid was constructed and provided following the MSE workshops/courses organized by ICCAT in 2018, which resulted in a paper presented to the SCRS (Rosa *et al.*, 2018a). The current OMs are composed of an uncertainty grid of 216 Stock Synthesis III (SS3) models with alternative assumptions including a range of assumed values for natural mortality, variance in recruitment deviations, and steepness of the stock-recruitment relationship, and other assumptions such as degree of observation error in the indices of abundance. For 2022, the ICCAT MSE roadmap requested completing the work on conditioning the OM grid and starting the development of candidate management procedures (CMPs). The same contractor from 2019 - 2021 was awarded the 2022 contract to continue this work. Much of the work conducted in 2022 has been related to reconditioning the OM grid with the 2022 northern swordfish stock assessment model (and associated indices and data) as a base case. In addition, the contractor and technical team explored and worked to validate the OM grid of models, evaluated the relative importance of the 6 axes of uncertainty; developed and tested initial CMPs; and developed a communications plan for engaging with Panel 4 and stakeholders. In 2022, time was dedicated to MSE issues at the SWO intersessional (data preparatory) meeting, and during the stock assessment meeting (June 20-28) with regard to implications of the new assessment model for N-SWO MSE and associated timelines. Subsequently, the core technical team met regularly to further discuss in more detail issues related to conditioning the OM grid based on the 2022 assessment model and start the development of CMPs. There was additional discussion on robustness OMs, advice and assessment intervals, red-face tests, and development of criteria for identifying exceptional circumstances.

In 2022, the contractor continued the work in collaboration with the Committee and most of the discussions and developments were regarding development of the performance metrics, finalizing the OM grid, and evaluating the relative importance of the uncertainties to the selection of the CMPs. Results from the evaluation of axes of uncertainty in the reconditioned OM grid reveal that the three levels of natural mortality and steepness have the largest impact on the estimated stock dynamics and stock status. The evaluation of the preliminary surplus production CMPs was focused on the 9 operating models that spanned these key uncertainties.

For 2023, the workplan is to continue the work, mostly to continue CMP development, as defined in the ICCAT MSE roadmap, and to engage with Panel 4 and stakeholders on the refinement of performance metrics and development and selection of an MP. Results would be presented to the Commission at intersessional meetings of Panel 4 and at the Commission meeting in later 2023.

Discussion

The Swordfish Species Group Coordinator presented the work developed since the last SCRS Plenary meeting on the northern Atlantic MSE.

The Committee noted that it would be beneficial for the Swordfish Species Group to consider a reasonable number of Candidate Management Procedures for tuning and for consideration of Panel 4. In response to this, the Swordfish Species Group responded that they would make a judicious effort to consider a manageable number of CMPs.

13.4 Work conducted for tropical tunas (W-SKJ and multi-species)

Progress on MSE simulations

Following the recommendations of the Committee, the Tropical Tunas MSE is made of two MSE programs, developing in parallel: the multi-stock MSE for the BET, YFT and E-SKJ tuna and the Western-SKJ MSE. The Committee have made progress on MSE by supporting the work of MSE Consultants contracted by ICCAT and throughout its intersessional meetings (Anon., 2022d). Mourato *et al.* (2022a) presents an update of the initial operating models for the W-SKJ MSE and is an improvement of the preliminary model (Huynh *et al.*, 2020). The new model was developed following the recommendations of the Tropical Tuna Species Group and conditioned with data for 1952 to 2020, provided during the 2022 Skipjack Data Preparatory Meeting (Anon. 2022a). The model was reconditioned following the 2022 Skipjack Stock Assessment (Anon. 2022h) and used performance metrics, diagnostics, and graphical display of results following SCRS recommendations (Mourato *et al.,* 2022b). OMs were reconditioned based on the Stock Synthesis SKJ-W 2022 outputs. The new update includes simulations for the evaluation of the relative performance of pre-selected MPs across a specific set of performance metrics (PMs). Robustness tests were conducted for the amount of recruitment variability and different levels of catch overages (errors in TAC implementation). Some technical aspects, however, are still under development and such aspects need to be reflected in the terms of reference of the contracts to be issued to continue the WSKJ development in 2023.

Development of the Multi-stock MSE, in 2022. At present, yellowfin and bigeye single-species operating models (OM) are available and preliminary conditioning is complete for such OMs. Both were configured using the Stock Synthesis (SS3) model configurations developed in the most recent stock assessments for such stocks. The next tasks to be completed include: 1) Harmonization of the fleet structure, 2) conditioning the skipjack OM following the results of the 2022 E-SKJ stock assessment model, 3) linking the conditioned OMs of the three stocks, including considering whether some of the uncertainties considered for individual stocks are somewhat linked, 4) remapping the current PMS to explicit multi-stock operational objectives agreed upon with the Commission. These tasks should define the Terms of references of 2023 contracts for the Multi-species MSE.

Communication of MSE results

The Committee continues to recommend that the SCRS and the Commission develop a set of standard guidelines to present MSE results to facilitate interpretation of the results by the Commission. The IOTC MSE document templates can be used as an example as many CPCs are familiar with those as they are members of both Commissions.

The Committee further stressed that the dialog between scientists and the Commission needs to be reinvigorated to develop a set of operational objectives for tropical tuna stocks and fisheries, an essential part of the development of MPs for the MSE. The Committee requests that Panel 1 include an agenda item on MSE to a meeting of Panel 1 in 2023 so as to present an update of the MSE development and focus on development of operational management objectives for tropical tunas.

MSE Roadmap

The modified MSE tropical tuna roadmap is included along with the roadmaps of other stocks in section 13.5 of this Report and contains modifications to the 2021 roadmap agreed by this Committee. An essential item in this roadmap is to include an agenda item on a meeting of Panel 1 that focuses on MSE.

Discussion

The Western Skipjack Rapporteur presented the work developed since the last SCRS Plenary meeting on the tropical tunas MSE.

The Committee reviewed the progress on tropical tunas MSE (for details see section 13.5 of this report) as well as the MSE roadmap for the western skipjack and multi-stock tropical tunas MSE. The Committee noted that the Subcommittee was aware of the multi-stock MSE complexity and the difficulty of its development. The Committee recommended to start early the dialogue with the Panel 1 asking for clear guidelines and operational objectives for the MSE development, in this way, it could ensure that the avenues they pursued in designing the MSE by the Committee would ultimately lead to addressing the objectives of the Commission. The Committee agreed and noted that such early dialogue has been included in their work and communication plan for next year.

13.5 Review the Roadmap for the ICCAT MSE processes adopted by the Commission in 2021

In 2021 during the Annual Meeting of the Commission, a new roadmap for ICCAT MSE processes was adopted and a request was made to the SCRS to review it. In 2022 the Bluefin Tuna, Albacore, Swordfish and Tropical Tunas Species Groups discussed and reviewed the roadmap intersessionally.

However, only the northern albacore and tropical tunas MSE roadmap was revised by the Committee. Due to the lack of time, the changes proposed by the Bluefin Tuna and northern Swordfish Species Groups were not revised and therefore they remain as adopted by the Commission in 2021. The updated version of the MSE roadmap is available in **Appendix 16.**

14. Update of the stock assessment software catalogue

The Secretariat has been maintaining the ICCAT software catalogue and the GitHub site. Following the recommendation by the Committee this year, the SPiCT model will be considered for inclusion in the ICCAT software catalogue in 2023.

15. Consideration of plans for future activities

15.1 Annual workplans and research programmes

15.1.1 Subcommittee on Ecosystems and Bycatch Workplan for 2023

Consistent with the ongoing exercise of developing an Ecosystem report card and implementing an EAFM framework for ICCAT, the Subcommittee drafted the following workplan. The plan indicates specific tasks to be completed and organizes them by priority (from highest to lowest) for the coming year.

Pertaining to the work of the Sub-group on the Ecosystem Report Card

The Subcommittee recommended that the Sub-group on the Ecosystem Report Card continue to do intersessional work related to the ToRs provided in Appendix 5 of the Report of the 2021 Intersessional Meeting of the Subcommittee of Ecosystems (Anon., 2021) and the Report of the First Meeting of the Sub-group on the Ecosystem Report Card (Semba *et al.,* 2022).

Date	*Component*	*Proposed tasks*	*Who*
December 2022, 3 days, online	Sub-group	1. Review progress on the regular production and communication of the EcoCard to the SCRS (i.e., assessments updating pilot EcoCard); 2. Plan specific activities to obtain feedback from the Commission, including creating a questionnaire targeting the ICCAT community to support a scoping exercise;	Convenor: Participants: national scientists and observers

		3. Discuss how the ongoing case studies (e.g. Sargasso Sea, Tropical Atlantic, Mediterranean Sea) contribute to EcoCard development; 4. Review a draft of the "guideline document" shared prior to the next Subgroup meeting; 5. Identify and discuss potential synergies and collaborations with outside international projects and initiatives to support indicator and EcoCard development; 6. Undertake a scoping exercise to: – Review the objectives of each ecosystem component, – Review objectives of EcoCard and each of the ecosystem components relative to the conceptual DPSIR model, – Identify the attributes each component monitors, – Identify synergies and overlapping among the ecosystem components.	

Pertaining to the workshop on ecoregion development:

The Subcommittee proposes:

- To develop pilot products to test their utility and be presented at the next meeting of the Subcommittee on Ecosystems and Bycatch;

- To conduct a second ICCAT ecoregion workshop to refine the ecoregions following the delineation process. This includes every step of the process from objectives to methods used to derive them, to refining of boundaries, to testing their usefulness. The pilot projects finished by the time of the second workshop can be presented there to facilitate discussion with concrete examples.

Date	*Component*	*Task*	*Who*
Intersessional work starting June 2022 and ends December 2023	Pilot Product development	Test the relevance of the ecoregions	Sub-group participants
December 2023, 3 days	Second Ecoregion Workshop	Review and update ecoregions	Sub-group participants

Pertaining to the development of a Risk Screening and Management Prioritization Tool

The steps required for development of the tool include:

- Establish supporting database containing ecological and habitat characteristics of species, and characteristics of fishing operations of individual gears, in particular, including a list of species used as baits, list of species observed to interact with ICCAT fisheries, depth of gears, and any attracting devices (e.g. FADs, bait, light sticks).

- Develop a risk screening tool with machine learning, based on susceptibility determined by the ecological and habitat characteristics of species. Observed occurrences of interactions will be used as the cases showing positive susceptibility when training the machine learning process.

The results of the risk screening tool will be tabled at the 2023 meeting of the Subcommittee.

- Develop a management prioritization tool as a further extension of machine learning model, once a range of risk species identified and judgment criteria to determine management priority are given.

Date	*Component*	*Task*	*Who*
June 2022 to June 2023	Further development of supporting database	Operational characteristics of fleets; interaction observed between any species with ICCAT fisheries; habitat characteristics for non-fish species, including seabirds, sea turtles, sea mammals; data mining of habitat characteristics information for crustaceans, cephalopods, and ctenophores to be done with automated data acquisition.	Sachiko Tsuji/Contractor Contract must complete prior to the end of December 2022
June 2022 to June 2023	Develop AI modeling for risk screening	Explore and choose proper model structure for risk screening, test model, provide screening results at the 2023 meeting of the Subcommittee.	Laurie Kell, Sachiko Tsuji
2023 to June 2024	Develop AI modeling for management prioritization	Develop model to identify additional species of concern, depending on an assessment of their conservation priority. First trial to be tabled for review of 2023 meeting of the Subcommittee and final model to be presented at the 2024 meeting of the Subcommittee.	Modeling team/Contractor?

Pertaining to the progress on Case Studies

While the Subcommittee endorses objectives of the various case studies, it is not currently engaged in ensuring their completion.

Date	*Component*	*Task*	*Who*
June 2022 to June 2023	Sargasso Sea Case Study	Extend DPSIR approach to more components in the NW Atlantic Ocean (i.e., Habitat, Environmental Pressures, Fishing Pressure)	Laurence Kell
	Tropical Ecoregion Case Study	Advance existing knowledge on the biological interactions between different ecosystem components in the Atlantic tropical ecosystem as follows: 1. Undertaking trophic analysis using stomach contents, stable isotope analysis, fatty acid analysis, and genetics 2. Developing ecosystem models (Ecopath with Ecosim (EwE)) 3. Developing model-derived indicators to inform several components of the ICCAT EcoCard	Eider Andonegi
	Western Mediterranean Sea Case Study	1. Develop tools (e.g., web based) for monitoring marine extreme events with an impact on tuna ecology in key areas of the Mediterranean	Diego Alvarez

		2. Explore the integration of environmental recruitment spatial models into assessments to provide new fisheries and conservation perspectives 3. Provide updates for the environmental component of the ecosystem report card 4. Explore outreach activities through the tuna dedicated education platform planettuna.com 5. Conduct workshops at Mediterranean scale to find ways to align general objectives of ICCAT in this ecoregion with institutions in charge of i) ocean observation (e.g., The Mediterranean Ocean Network, MONGOOS) and ii) the implementation of the new objectives of the Barcelona Convention and the 2030 biodiversity strategy of the European Union (e.g., The United Nations Environmental Program)	

Pertaining to Ecosystems Report Card Development

The tasks outlined here are somewhat contingent on the outcomes of an elicitation process and a review by the Sub-group on the Ecosystem Report Card. No updates are expected before the 2023 meeting of the Subcommittee. There is no obligation, but teams are welcome to continue their work.

Component	*Task*
	Update prototype report card components with new indicators
Retained species: Assessed	Update B_{RATIO} and/or F_{RATIO} values from recent assessments and deal with $F_{0.1}$ issue
Retained species: Not assessed	Perform Productivity-susceptibility Assessments (PSA) to select retained unassessed species
Non retained sharks	Increase the scope of the data used in the analysis. Include other gear types
Turtles	Perform risk assessment for loggerhead and leatherback turtles and indicator development
Seabirds	Create indicator based on the total interactions, total mortality or alternatives
Mammals	Discuss collaborations with International Whaling Commission (IWC) and International Council on the Exploration of the Sea (ICES)
Trophic structure, community and diversity indicators	Continue work developing indicators to monitor the biomass structure, size structure and trophodynamics of the ecological communities in response to fishing pressure and environment (detail workplan in Andonegi *et al.*, 2020)
Habitat	Create indicators to monitor climate-induced and fishing-induced habitat changes in ICCAT species
Socio economic	Develop a process to extract the socio-economic data
Fishing pressure	Develop an indicator based on fishing effort or capacity Develop indicator based on marine debris
Environmental pressure	Develop indicators that are generic
Marine debris, food webs and trophic relationship	Informal discussion of the elements of the plans and potential indicators

Pertaining to other ecosystem items

It was recommended that the Subcommittee Co-convenors, in cooperation with the SCRS Chair and Vice Chair, continue their revisions to the EAFM components of the SCRS strategic workplan.

Date	*Component*	*Task*	*Who*
May 2022 – June 2023	SCRS Strategic workplan	Review and propose updates to the components of the plan that relate to EAFM and Bycatch	Bycatch and ecosystem convenors
June 2023, 5 days	2023 meeting of the Subcommittee on Ecosystems and Bycatch		

Pertaining to bycatch

- ECOTEST development will continue through 2022, expanding it to include other species
- Continue the collaborative work on sea turtles
- Conduct a 5-day workshop focussed on sea turtle (including leatherback) bycatch in the Mediterranean Sea
- Continue the collaborative work with the Sharks Species Group on bycatch
- Continue work on Sub-group on Technical Gear Changes
- Continue to review and clean the list of bycatch species
- Discuss and continue to make progress on seabird bycatch issues
- Explore the use of reference points for the management of bycatch species

15.1.2 Subcommittee on Statistics Workplan and Research Plan for 2023

The following tasks represent continuous database improvements and maintenance that will continue during 2022 and beyond. The priority tasks (including the ones postponed in prior years) for 2022/2023 include:

- Upgrade all the ICCAT-DB system from MS-SQL server 2016 to MS-SQL server 2019
- Replace the stand-alone MS-ACCESS Task 2 databases on the web by SQLite equivalent ones
- Improve the "client applications" that manage the databases of the ICCAT-DB system
- Continue the development of the statistical/tagging dashboards (dynamic querying)
- Continue the tagging database development for both conventional and electronic tagging
- Continue the Biological Sampling database development (includes data recovery/integration)
- Continue the standardization of the electronic forms (TG: tagging forms, CP: compliance forms)
- Extend the automatic data integration tools for the standardized electronic forms
- Continue the development of the GIS project (create a PostGIS server and geo-reference all the ICCAT data available in ICCAT-DB)
- The adaptation/migration of all the databases of the ICCAT-DB system to the new ICCAT IOMS system

15.1.3 Working Group on Stock Assessment Methods (WGSAM) Workplan for 2023

1. Evaluation of the products provided by the bycatch estimation methodology contract

2. Development of advice and/or guidelines on bycatch estimation

3. Initiation of the Study Group on CPUE Standardization Diagnostics

4. Initiation of the Study Group on Reference Points

5. Addressing within year issues referred to WGSAM by other Species Groups

15.1.4 Albacore Workplan for 2023

The Mediterranean, South Atlantic and North Atlantic albacore stocks were assessed in 2021, 2020 and 2020, respectively. Between 2018 and 2021 advice was provided for adoption of a long-term Management Procedure for North Atlantic albacore.

The main objectives for 2023 are to conduct stock assessments for the North and Mediterranean stocks (as required by Rec. 21-04 and Rec. 21-06), iterate the management procedure, start developing a new MSE for the northern stock, and continue with the research as defined in the Albacore Year Programme (ALBYP).

Two intersessional meetings are envisaged, a data preparatory meeting (5-day, March) and a stock assessment meeting (5-days, June-July).

North Atlantic stock proposed workplan

a) Stock Assessment and MSE:

- Update (using data up to 2021) the following standardized CPUEs, both in yearly (for MP iteration) and quarterly scale (for SS3 model). *Deadline:* 1 week before the data preparatory meeting. *Deliverable:* SCRS documents, following the standards provided by the Working Group on Stock Assessment Methods (WGSAM). Responsibility: CPCs.

  - Japanese longline:
    - 3 periods, 2 areas (North and South of 30ºN), quarterly
    - 3 periods, single area, yearly
  - Chinese Taipei longline:
    - 3 periods, 2 areas (North and South of 30ºN), quarterly
    - 3 periods, single area, yearly
  - US longline:
    - 2 areas (North and South of 30ºN), quarterly
    - single area, yearly
  - Spanish baitboat:
    - Quarterly
    - Yearly

- The biomass dynamic model (MPB) will be fit to the updated catch and CPUE data, in order to iterate the Management Procedure according to Rec. 21-04. *Deadline:* 1 week before the assessment meeting. *Deliverable:* SCRS Document. *Responsibility:* MSE contractor.

- According to the fleet structure agreed in 2022, the Secretariat will update Stock Synthesis inputs with data up until 2021. *Deadline:* 1 week before the data preparatory meeting. *Deliverable:* SS inputs. *Responsibility:* Secretariat.

- SS3 models will be fit to the data, and models evaluated using diagnostics proposed by WGSAM. Key sensitivities will be identified in order to inform the decision by the Species Group to select a reference case as well as main sensitivities. The main axes of uncertainty in the MSE will be rediscussed and reference grid and robustness tests defined. *Deadline:* 1 week before the assessment meeting. *Deliverable:* SCRS Document. *Responsibility:* MSE contractor and Albacore Species Group.

- Initial conditioning of reference grid of OMS for the next round of MSE. *Deadline:* 1 week before the species groups meetings. *Deliverable:* SCRS Document. *Responsibility:* MSE contractor.

b) Exceptional circumstances:

- Prepare T1 dataset up to and including 2021. *Responsibility:* Secretariat. *Deadline:* 1 month before the assessment meeting.

- Determine whether exceptional circumstances occur, according to the indicators in the exceptional circumstances protocol (Rec. 21-04). *Deadline:* 1 week before the assessment meeting (to be updated during the meeting). *Deliverable:* SCRS Document. *Responsibility:* MSE contractor.

c) Research:

- The Committee reiterated the need to continue research activities within the ALBYP. For 2023, the priority is to continue the reproductive biology and electronic tagging studies. *Deadline:* 1 week before the Species Group meeting. *Deliverable:* SCRS documents. *Responsibility:* EU-Spain and Albacore Species Group.

South Atlantic stock proposed workplan

a) Research:

- The Committee reiterated the need to continue research activities within the ALBYP. Consistent with the North Atlantic Albacore Workplan, the priority for 2023 is to continue the reproductive biology and electronic tagging studies. *Deadline:* 1 week before the Species Group meeting. *Deliverable:* SCRS documents. *Responsibility:* Brazil, South Africa, Uruguay and Chinese Taipei.

Mediterranean albacore stock proposed workplan

a) Stock Assessment:

The intention is to strictly update the JABBA model with data up until 2021, following the procedures of the last stock assessment. Following is a list of actions, responsibilities, and deadlines:

- Update T1 for Mediterranean albacore. *Responsibility*: Secretariat. *Deadline*: 1 week before the data preparatory meeting.

- Update (till 2021) the following yearly indices of abundance. *Deadline*: 1 week before the data preparatory meeting. *Deliverable*: SCRS documents, following the standards provided by the WGSAM. *Responsibility*: CPCs.

    - Italian longline CPUE
    - Spanish longline CPUE
    - Larval index

- Update the JABBA model up until 2021. *Responsibility*: EU-Secretariat. *Deadline*: 1 week before the stock assessment meeting. *Deliverable*: SCRS document.

- In addition, available size, maturity and selectivity information submitted by CPCs will be compiled and revised to consider providing advice on minimum size, closure periods and appropriate characteristics of the fishing gear for this stock. *Responsibility*: Secretariat, Albacore Species Group. *Deadline*: 1 week before the stock assessment meeting.

b) Research:

Research on Mediterranean albacore will focus on setting up an information network to promote collaboration among scientists working on this species in the Mediterranean. The main objective will be the development of a detailed research plan.

A more detailed study on the influence of the different abundance indices available on the results of the 2021 assessment will also be addressed.

Larval habitat modelling studies will continue in order to improve the larval indices independent of the fisheries. The objectives for 2023 are, first to investigate the links between the environmental variability in Mediterranean spawning grounds (W-Med, Central Med, E-Med) and the spatio-temporal distribution of albacore during early life stages, developing larval habitat models and identifying main sources of environmental variability affecting catchability, and second, to assess how uncertainty on catchability affects the assessment model of Mediterranean albacore. The specific activities to conduct are associated to:

1. Homogenization of databases from different countries (including biological from ichthyoplankton surveys and environmental from hydrographical in-situ sampling in different spawning grounds);

2. Generation of remote sensing and oceanographic model data repositories and link with the larvae data from surveys;

3. Design seascape indicators for key oceanographic processes with relevance to early life stages;

4. Test different modelling approaches for abundance standardization;

5. Run sensitivity analyses on the current assessment model for Mediterranean albacore considering the new information obtained.

Finally, analyses will continue to develop a growth model for the Mediterranean stock that integrates the different studies on the matter available to date.

15.1.5 Billfish Workplan for 2023

Sailfish stock assessment

Noting that the last stock assessment for East and West sailfish (Anon., 2017b) was conducted in 2016 with catch data until 2014 and given that catches of both sailfish stocks have increased since the implementation of Rec. 16-11 para 1(a) (that limits catch levels of E-SAI to 1,271 t and W-SAI to 1,030 t), the Committee recommends that the next sailfish stock assessment be scheduled for 2023. The Committee noted that catches of sailfish stocks in 2017 (1,631 t E-SAI and 1,279 t W-SAI), 2018 (936 t E-SAI and 1,535 t W-SAI), 2019 (2,017 t E-SAI and 1,368 t W-SAI) had surpassed in most cases the catch limits of Rec. 16-11. In 2021 available catches, albeit still incomplete are estimated to be 1,523 t for E-SAI and 821 t for W-SAI, thereby exceeding the catch limit for the E-SAI.

To complete the planned stock assessment of sailfish, the Committee will need to conduct two meetings:

a) An intersessional hybrid data preparatory meeting in March 2023 (5 days) to collect and analyze all the existing information required for stock assessment, using data through 2021.
b) A stock assessment hybrid meeting in about July 2023 (5 days), using data through 2021.

Work related to the stock assessment:

a) Review sailfish stock structure
b) Identify and select CPUE indices through 2021(2022 when possible)
c) Advance in the use of a combined CPUE index
d) Review and update sex-specific length data through 2021
e) Review and update fleet composition
f) Update biological parameters for use in the stock assessment
g) Review models to be used for stock status
h) Diagnostics and validation of stock assessment model(s)

Catch (Task 1), catch and effort, and size data (Task 2)

Important white marlin catches occur in the tropical and subtropical central Atlantic by both CPC and non-CPC fisheries, mainly in the Caribbean Sea and off West Africa. Catch and effort statistics for billfish species remain incomplete for many of the coastal and industrial fishing countries. Therefore, all countries catching billfishes (directed or bycatch) should report species-specific catches, catch and effort, and size information by as small an area as possible, and by month.

- The Committee suggested the Secretariat work with the experts hired to review the billfishes artisanal fisheries in the eastern Atlantic and Caribbean regions to develop the Terms of Reference, Agenda and List of participants to be invited in person to workshops for developing CPCs to improve the collection, analysis and the transmission of data in order to improve data collection and statistics of billfish. The first of these workshops shall be organized in 2023 in the West Africa region and in the Caribbean for 2024. In addition, it was recommended to engage the Western Central Atlantic Fishery Commission (WECAFC) in this process, particularly to address the issues raised in Rec. 19-05, para 16.

- Efforts should be made by all CPCs fishing in the Mediterranean Sea to improve the collection of catch data of billfishes in this region.

Discards

The Committee noted that to date only a few countries have ever reported billfish discards. For example, in 2021, of 27 number of CPCs with reports of marlin catches, 3 number CPCs have reported estimates of dead discards. Having the total catches, including dead and live discards, and estimates of post-release mortality for all fleets is important for stock assessment purposes. As such, the Committee emphasized the need for all CPCs to comply with the mandatory requirements to report discards (both dead and alive) for billfishes. Rec. 19-05 requires all CPCs to submit to the SCRS the methods for estimations of live and dead discards, as of today the Secretariat has only received 3 responses on the methods used for discard estimations. The Committee supports the recommendation made in 2020 by the Subcommittee on Ecosystems on estimation of discards workshop and endorses the participation of the Billfish Species Group.

The WGSAM has been funding the development of a generalized tool for the estimation of bycatch. The Bycatch Estimator (BE) uses observer data combined with either total effort data from logbooks or with landings to estimate total bycatch. Results of simulation testing of the BE using the longline simulator (LLSIM) were presented at the 2022 meeting of the WGSAM and proved the efficacy of the BE. The WGSAM believes the bycatch estimator tool could be an effective candidate for general use by CPCs for the estimation of bycatch of billfish but other bycatch species. The Billfish Species Group recommends that the use of the BE be investigated as a standardized means to generate estimates of bycatch.

CPUE

- *Sports fisheries CPUEs*: Conduct the work to collect and incorporate any data which informs on the historical evolution of fishing practices which could affect catchability. There may still be issues related with increasing catchability in sports fisheries over time that are not fully taken into account in the CPUE standardization.

- *Joint CPUE*: Noting that the joint CPUEs for longline fleets which use fine scale operational data have improved the assessment models for other species, investigate the possibility for doing these analyses for billfishes together with other SCRS species and SCRS Species Groups.

- *Compare observer and logbook data CPUEs indices*: National scientists are encouraged to develop both observed data and logbook CPUEs indices within their fleets.

Life history parameters

Continue the sampling of hard parts for the growth studies on billfish caught off West Africa:

- Organize an in-person workshop in 2023 on age reading of billfish to enhance current expertise in the eastern Atlantic and to standardize processing and reading protocols between laboratories.

- Continue the research and biological sampling of blue marlin from the Gulf of Mexico Mexican longline fisheries.

Tagging

Satellite tagging blue and white marlin in the South Portugal coast in the recreational fishery

Little or no satellite tags have been deployed in blue and white marlin in its North-east distribution limit so far (see maps provided in Braun *et al*. (2015) and IGFA, 2020). A satellite tagging study on billfish in the Northeast Atlantic, would allow for a better understanding of the impact of fisheries in the northern limit. These data will expand the coverage of the existing data on billfish habitat preferences, informing the models that have been developed to simulate the interactions with longline gear. SCRS research has led to the incorporation of such habitat preferences in standardized CPUE abundance indices used in stock assessments. Vertical distribution analysis provides for a better understating of the use of the water column by these species, that can be compared to fishing sets depth and/or the target species vertical distribution.

As a trial, national scientist from Portugal plan to tag 3 white marlins and 3 blue marlins (pending tagging opportunities), in the South Portugal coast in the recreational fishery. Tagging these fish in recreational fisheries allows for a better condition at tagging (compared to longlines, where fish can be hooked for a long time before hauling and tagging), increasing the post-release survivorship and data acquisition success.

15.1.6 Bluefin Tuna Workplan for 2023

The Bluefin Tuna Species Group (BFT SG) anticipates the Commission adopting a management procedure in 2022. The remaining tasks for the MSE will then be to draft the exceptional circumstances provisions. The Bluefin Species Group will thereafter be able to focus on a number of strategic initiatives, as outlined below. The focus of the BFT SG for 2023 and beyond is to develop four strategic initiative directions and to be able to engage more fully with ongoing scientific work. The four strategic initiative directions are as follows and need to be linked as each supports key elements of the other:

- Coordination of BFT tagging
- Coordination of larval surveys
- Coordination of BFT biological sampling
- Advanced genomic approaches to population size estimation (CKMR/Gene tagging)

The workplan for 2023 is as follows:

1. Hold one intersessional meeting and one MSE Technical team meeting

   a) MSE Technical team (January/February) to draft initial exceptional circumstances provisions (3 days, online)

   b) BFT intersessional meeting (5 days hybrid meeting, June/July):
      a. Further develop exceptional circumstances proposals for Panel 2
      b. Convene four technical sub-groups at the BFT intersessional. Each sub-group will be expected to meet remotely to develop a plan to bring to the BFT intersessional for overall consideration.
         i. Coordination of BFT electronic tagging, focused on the development and joint use of a global ICCAT e-tagging database
         ii. Coordination and standardization of BFT larval surveys and potential development of larval basin scale indices
         iii. Coordination of BFT biological sampling at international level to support implementation of the genomic (CKMR/gene tagging) approach to the Atlantic BFT and feasibility planning for genomic approaches
         iv. BFT Technical Sub-group on Farm Operations
      c. Presentation of scientific papers
      d. Develop methodology for update of indices to be input to Management Procedures ideally in coordination with WGSAM

2. Dialogue with Panel 2

a) Dialogue with Panel 2:

1) Panel 2 March 2023 (initial discussions with Panel on Exceptional Circumstances Provisions)

2) Panel 2 October/November 2023 (Finalize Exceptional Circumstances provisions)

3. Task four technical sub-groups. The purpose of the technical sub-groups is to create focused research teams to address specific issues. The teams can operate under their own timing and meeting schedule but will need to report back to the meetings of the BFT SG with their findings and are free to report electronically at any time deemed appropriate. Each technical sub-group will be tasked with the following topics:

1. BFT Technical Sub-group on Farm Operations. The BFT Technical Sub-group on Growth in Farms will transition into a broader BFT Technical Sub-group on Farm Operations to address methodological improvements in the monitoring of transfers and in the estimation of the size and biomass of the tuna fattened in the farms.

2. CKMR for ABFT and BFT biological sampling coordination in relation to close-kin mark recapture

3. BFT electronic tagging

4. BFT larval surveys

4. Work on Responses to the Commission

a) Continue the analysis to estimate catch rates, defined as nominal CPUE per vessel size category and main gear type (national scientists and Secretariat staff)
b) Develop response to the Commission on observer coverage (national scientists and Secretariat staff)

5. Hold 3 technical workshops (number and terms of reference to be determined by the GBYP Steering Committee)

a) CKMR/genomics for ABFT and BFT biological sampling coordination to support genomics approaches
b) BFT electronic tagging (not for SCRS official schedule)
c) BFT larval surveys (not for SCRS official schedule)

15.1.7 Sharks Workplan for 2023

Given that the last stock assessment for blue shark (BSH) (Anon., 2016) was held in 2015, in preparation for the planned stock assessment of blue shark in 2023, the Group will conduct the following activities:

- Hold a 5-day long data preparatory meeting (in April) to collate and analyze all the existing information required for stock assessment, using data through 2021.

- Hold a 5-day stock assessment meeting (in July), using data through 2021.

The following tasks will be required for the blue shark assessment:

Data preparatory meeting

- CPCs provide sex-specific length-composition information going through 2021 for the assessment. CPCs should use SCRS data catalogue to identify size-data gaps

- Secretariat to provide a summary of available tag mark-recapture data for BSH

- If possible, present the relevant diagnostics from previous assessment models

- CPCs provide CPUE series going through 2021; (at least 1 week before the data preparatory meeting)

- Identify appropriate CPUE indices for use in blue shark stock assessment models

- National scientists and the ICCAT Secretariat to use observer data and other potential techniques to estimate historical catches of fleets with significant catches where that information is missing

- Define fleets based on spatial/selectivity considerations

- Review any new life history information for BSH in the Atlantic

- Consider, together with the Working Group on Stock Assessment Methods, alternative stock assessment methods (as per Kell (2021), other SCRS papers, and the fisheries literature) as well as alternative stock assessment scenarios

- Consider weighting schemes for stock assessment model scenarios

Hold a 3-day long meeting to do a thorough assessment of the achieved results of SRDCP (in person or hybrid, if possible) and to review its ongoing activities. The meeting might be scheduled before the data preparatory meeting.

Continue and/or expand participation in the SCRS Sub-group on Technical Gear Changes in order to participate in the tasks assigned to it (see Anon. 2022o).

Continue and/or expand participation in the SCRS Sub-group on Electronic Monitoring in order to participate in the tasks assigned to it (see Anon. 2022p and the 2022 Report of the Subcommittee on Statistics, **Appendix 13**).

15.1.8 Small Tunas Workplan for 2023

This workplan foresees both short and long-term objectives (see specific timeframes below).

- Have an intersessional meeting of the Small Tuna Species Group in 2023 for 4 days. The objectives of the meeting are: organize all the data and information that have been obtained to date, to organize the length and catch position information, to present new life-history information and to review data-limited assessments that might be applied to small tunas. There would be the workshop on ageing, growth, and reproduction before the intersessional meeting.

Progress on the biological studies of small tunas:

- *Background/objectives:* The Small Tuna Year Programme (SMTYP) started in 2016-2017 with the initial aim of recovering small tunas historical data (statistical and biological data) from the main ICCAT fishing areas including a specific component of biological studies. A consortium led by the University of Girona (Spain) was established in 2018 for the collection of samples aiming at biological studies (reproduction and aging LTA, BON WAH) as well as stock (LTA, BON, WAH, FRI, BLT) and species (LTA, FRI, BLT) differentiation studies. In 2020, a new consortium led by Brazil (Fundação Apolônio Salles de Desenvolvimento Educacional - FADURPE) was established to continue these studies. The programme is ongoing and currently covers different activities related to biological studies.
- *Priority:* High (1st priority with financial implication).
- *Leader/Participation*: In 2023, the consortium led by Brazil (FADURPE) will continue the biological studies (reproduction and aging) as well as stock and species differentiation studies.
- *Timeframe*: Ongoing work with annual updates scheduled to be provided to the Small Tunas (SMT) Species Group.

Revision of small tunas L/W relationships at stock level:

- *Background/objectives*: There are several L/W equations available for small tunas at local level, and several more are currently being developed by various CPCs/national scientists. The Committee recommends that joint analyses are carried out using detailed data collected by observer, so that L/W relations that are representative of the stocks at regional level can be presented and adopted by ICCAT. Both older data and novel data collections of length and weight data for missing size ranges are needed.
- *Priority*: High.
- *Leader/Participation*: EU-Spain, with collaboration of CPCs willing to participate/share L/W data from observer and sampling programmes. EU-Spain and Portugal, Morocco and Brazil have already committed to participate. Other CPCs are expected to join this collaborative effort.
- *Timeframe*: The Subcommittee will again request that any outstanding or new data be submitted. The leader (Dr Pedro Pascual, EU-Spain) will compile individual observations of length (cm, SFL) and weight (g, total weight).
    - He will provide by November of 2022 a summary of the data (by species and size ranges) that are currently available.
    - CPCs will provide Dr Pascual with any new data by June or July 2023.
    - A paper with an analysis of all of the data will be provided by September of 2023).

Updating the biological meta-database:

- *Background/objectives*: In 2016, the SMT Species Group started a biological meta-database. The Committee recognized the importance of continuously updating this database as new biological information becomes available, also developing criteria for replacing existing parameters when available. Such information is then provided to update the SMT Executive Summaries and will eventually be used for both qualitative and quantitative assessments for the different species and stocks.
- *Priority*: High.
- *Leader/Participation*: EU-Portugal, with collaboration of CPCs willing to participate, will continue to update the meta-database and provide updated information (in the form of SCRS papers or presentation) to the Species Group. The next update is planned for the next meeting of the Group in 2023. Scientists that have access to recent literature on SMT biology that can inform this database are encouraged to send that information to the SMTYP Coordinator and the SMT Species Group Rapporteur. Leaders: Dr Pedro G. Lino and Dr Rubén Muñoz-Lechuga (EU-Portugal).
- *Timeframe*: A SCRS paper will be presented annually to the 2023 Species Groups or intersessional meeting.

Updating and/or applying the Data-Limited Models:

- *Background/objectives*: The Committee started applying data-limited methods in 2016 and, although the Committee has improved in applying a range of models, the robustness still needs to be evaluated before they can be used to provide management advice. In 2023 the Group will develop the specific ToRs and an agenda for a proposed workshop on data-limited models before the 2024 species groups.
- *Priority:* Medium (2nd highest priority with financial implication).
- *Leader/Participation*: Brazil and Morocco will continue to update the application of Data-Limited methods to SMT, with collaboration of CPCs willing to participate.
- *Timeframe:* A workshop in Data-Limited models could be held immediately after (back-to-back) the 2023 Intersessional Meeting of the Small Tunas Species Group, which would allow for reduction of travel related costs. This workshop should be updated in 2024, also in the format back-to-back with the 2024 Intersessional Meeting of the Small Tunas Species Group. SCRS papers are to be presented annually to Species Group meetings or intersessional meeting.

Calibration and adopting internationally agreed maturity scales:

- *Background/objectives*: During 2020 ICCAT Workshop on Small Tunas Biology Studies for Growth and Reproduction, studies on small tunas on growth and reproduction, including drafting protocols and training of sample processing and analysis of maturity stage, were carried out.

However, the Committee feels that further work is still needed as regards the calibration and adopting internationally agreed maturity scales for *Acanthocybium solandri, Auxis rochei, A. thazard*.

- *Priority:* High (3rd highest priority with financial implications).
- *Leader/participation*: Spain will continue to lead the reproduction studies, collaborating with CPCs willing to participate.
- *Timeframe:* A new workshop on maturity would be held in 2023. Also, SCRS papers are to be presented annually to Species Group meetings or at intersessional meetings.

15.1.9 Swordfish Workplan for 2023

North and South Atlantic

Assessments for North and South Atlantic swordfish were conducted in 2022 (Anon., 2022k). The Committee requests a Species Group meeting in 2023 that will include a MSE component (6 days in-person) in addition to two MSE-specific meetings: the first in early 2023 (2 days, online webinar) to review and finalize the OM grid and robustness OMs, and review CMPs; the second, later in 2023 (2 days, online webinar) to review final versions of CMPs. The MSE technical team will continue to work intersessionally online to advance the technical work. The Committee requires direction from Panel 4 on items related to MSE and requests two, one day meetings (online or in-person) in 2023: the first, early in the year to discuss performance metrics, advice intervals and CMPs. The second meeting, later in the year (but well before the Commission meeting) to review a smaller set of CMPs and evaluate their performance relative to performance indicators selected by Panel 4 earlier in the year. In addition, the conceptual management objectives (Res. 19-14) should be operationalized by Panel 4 at the Commission meeting in 2022 or at the first Panel 4 meeting in 2023. The main Species Group meeting will be dedicated mainly to updating information for the Mediterranean assessment and improving North and South CPUEs but an agenda item on MSE will be included to advance the MSE work. The Committee also requests a technical workshop (5 days, in-person) for an ageing, growth, and reproductive biology workshop associated with the SWOYP in early 2023.

The Committee noted that having in-person meetings would be more productive, but that, if needed, online meetings are also possible to advance the more technical work. A significant additional number of days would be needed if online meetings are required.

A list of recommended work for the Swordfish Species Group was identified as high priority areas where continued efforts are required for North and South Atlantic swordfish. The list is organized in such a way that priorities for 2023 work are listed first, followed by other tasks that are part of other ongoing work.

Priorities for completion in 2023

Improving CPUEs:

- *Background/objectives:* Noting conflicting patterns in the CPUE indices developed by CPC scientists, it is recommended that a CPUE Working Group that will work intersessionally to review the CPUE data inputs, treatments, and model assumptions and methods be formed. The objective of this Group will be to diagnose conflicting trends in the CPUEs and improve the quality of indicators used in SWO assessment and N-SWO MSE. This Group will also be tasked with developing code for reproducing the N-SWO combined index using ICCAT Task 2 Catch and Effort Data. Develop methodology for estimating new index values without re-estimating historical values.
- *Priority:* High priority.
- *Leader/Participation:* Collaborative work of CPCs scientists.
- *Timeframe:* Started in 2023 and ongoing.

Exploring a closed loop simulation study for South Atlantic swordfish stock:

- *Background/objectives:* In the 2022 Swordfish Stock Assessment meeting (Anon., 2022k), Taylor *et al.* (2022) was presented which documented preliminary closed-loop simulations for southern Atlantic swordfish. The preliminary results showed that most of the Candidate Management

Procedures (CMP) met minimal satisficing criteria. However, further work is required. To be informative for management, this preliminary exercise would have to be expanded to include stock specific priors, a broader set of operating models, and finalized quantitative objectives.
- *Priority:* High priority.
- *Leader/Participation:* Secretariat/Rapporteur/Consultant.
- *Timeframe:* Started in 2023 and ongoing.

Life history Project:

- *Background/objectives:* An understanding of the species biology, including age, growth and reproductive parameters is crucial for the application of biologically realistic stock assessment models and, ultimately, for effective conservation and management. Given the current uncertainties that still exist in those biological parameters, the Committee recommends that more studies on swordfish life history are carried out. Those should be integrated with an ICCAT swordfish research plan that is provided in the recommendations with financial implications.
- *Priority:* High priority.
- *Leader/Participation:* A consortium led by Canada started this work in 2018. The work has progressed to date and is scheduled to continue in 2023.
- *Timeframe:* Started in 2018 and is currently ongoing; request for funds to continue throughout 2023.

Size/Sex distribution study:

- *Background/objectives:* The Committee recommends that a detailed size and sex distribution study is started in order to better understand the spatial and seasonal dynamics of swordfish in the Atlantic. This study should be carried out in a cooperative manner among scientists, involving as many fleets as possible and preferably using detailed fishery observer data. This is particularly important if future alternative management measures are considered, for example when considering spatial/seasonal protection areas for juveniles. The results could also inform on fleet specific discarding estimations. An informal data call was circulated in late 2021 to CPC scientists interested in participating in this collaborative work.
- *Priority:* High priority.
- *Leader/Participation:* Collaborative work of CPCs willing to participate/share data on size/sex/location from observer programmes.
- *Timeframe:* Started in 2018. An ICCAT paper is planned to be presented with the results at the 2023 swordfish meeting.

Priorities related with northern MSE work:

- *Background/objectives:* The initial focus specific for North Atlantic swordfish, which began in 2018 and involved some development of the framework to use in the OM development, was further developed in subsequent years. Consistent with the MSE implementation roadmap adopted by the Commission, various components of the MSE framework are ongoing and are outlined below and in the ICCAT MSE roadmap.
- *Priority:* High priority.
- *Leader/Participation:* MSE contractor; core MSE technical team.
- *Timeframe:* Ongoing (see ICCAT MSE roadmap in **Appendix 16**).

Work to be completed until the end of 2022:

- Continue work on analyses related to minimum size limits and discarding estimation.
- Propose candidate performance metrics to PA4.
- Continue development of an exceptional circumstances protocol.
- Discuss the process for CMP tuning.
- Continue development of CMPs including via a CMP workshop.

Work to be completed during 2023:

- Participate in the general ICCAT MSE process review.
- Continue developing and refining CMPs and propose to Panel 4.
- Evaluate the CMPs against the performance metrics, and CMP tuning.
- Robustness tests against additional uncertainties.
- Prepare and present N-SWO MSE communications materials for consultation with Panel 4 and stakeholders.
- Continue work on performance metrics and an exceptional circumstances protocol in collaboration with PA4.
- Finalize a MP for TAC advice in 2024, in consultation with PA4.

Priorities for ongoing work (ongoing past 2023)

Pop-up Satellite Archival Tag (PSAT) tag data request for joint analysis:

- *Background/objectives:* The Committee continues to encourage all CPCs to provide their swordfish PSAT tag data to an ad hoc study group. As a minimum the data should include the temperature and depth by hour, date and one-degree latitude*longitude square. This will contribute to support the improvement of CPUE standardization through the removal of environmental effects as well as the better definition of stock boundaries. This activity is linked with another from the WGSAM workplan.
- *Priority:* High priority.
- *Leader/Participation:* Led by the United States, with the participation of CPCs with PSAT data.
- *Timeframe:* Started in 2018, ongoing to date; to continue in 2023.

Continuing work on environmental effects:

- *Background/objectives:* Given the possibility of spatial and environmental effects being partially responsible for the conflicting trends of some of the influential indices of abundance, the Committee should further study this hypothesis during the coming years, use existing PSAT data to compliment this work, and determine how best to formally include these environmental covariates into the overall assessment process. The United States has taken a lead role in this investigation and likely collaborators would include scientists from Canada, Japan, and the EU (Spain and Portugal) as their indices of abundance are the most appropriate for this work. Expected deliverables would include quantified reduction in the conflicting indices of abundance from the temperate and tropic regions, which in turn should lead to a more stable stock assessment. Other products could include an increased understanding of the distribution of swordfish and perhaps a revisiting of the geographic structure of the data and the assessment. Ideally, this work should be done in collaboration with the Subcommittee on Ecosystems. This work should be expanded to include the Mediterranean.
- *Priority:* High priority.
- *Leader/Participation:* Lead by United States, with participation of other CPCs.
- *Timeframe:* Ongoing, to be considered at the next stock assessment.

Development of sex-specific relationships between straight and curved Lower/Upper Jaw Fork Length:

- *Background/objectives:* The Committee noted that some CPCs are collecting straight LJFL/UJFL while others collect curved LJFL/UJFL. However, there is currently no adopted relationship between those 2 measurements in the ICCAT Manual. A LJFL/UJFL conversion was presented for the North Atlantic stock in 2022 and is expected to be adopted for inclusion in the ICCAT Manual but conversions are still not available for the Mediterranean and South Atlantic. As such, the Committee recommended that national scientists collect data and work on the estimation of those relationships. The measurement data should include stock of origin, sex and condition factor data.
- *Priority:* High priority.
- *Leader/Participation:* Dr Antonio Di Natale and Dr Fulvio Garibaldi will coordinate, with participation of national scientists willing to collect and collaborate with these data.
- *Timeframe:* The final paper in 2023.

Mediterranean

For the Mediterranean stock, the last assessment was conducted in 2020 (Anon., 2020b). The next assessment should take place not before 2024 but, in order to monitor stock trends, essential fisheries indicators (e.g. catch, indices of abundance), should be reviewed in 2023.

Given the above needs and taking into account the questions raised during the latest assessment the workplan will include:

- Review relevant fisheries and biological data.
- Update estimates of standardized CPUE indexes for the most important fisheries.
- Obtain estimates of discard misreporting.
- Estimates of undersized catch.

Additionally, the Committee should develop a workplan aiming to better identify the effects of the environment on swordfish biology, ecology and fisheries. Future CPUE analyses should evaluate the benefits of taking into account important climate and oceanographic changes that have occurred recently in the Mediterranean Sea (e.g. eastern Mediterranean transient) and may have impacted the availability of the stock to some fisheries, and/or the recruitment success of the population.

- *Time frame:* by the next stock assessment (2024).
- *Priority:* Medium.
- *Participation*: all CPs.

15.1.10 Tropical Tunas Workplan for 2023

The last assessments of yellowfin tuna, bigeye tuna and the two skipjack stocks were conducted respectively in 2019, 2020 and 2021. The heavy assessment schedule has stretched the capacity of the Committee to put enough resources into other important research activities. The Committee recommends that the next stock assessment for yellowfin tuna be conducted in 2024 so that significant progress can be made in the multi-stock MSE and in the improvement of basic data to support stock assessments.

The Committee recommends that CPUE indices of all tropical tuna stocks are updated during 2023. The Committee intends to use these indices as fishery indicators to help interpret changes in recent catches (section 9.6 of this report).

Improvement of basic fishery data

The Committee recommends the creation of an ad-hoc group within the Tropical Tunas Species Group that will be charged with reviewing the quality of the basic data used in stock assessment (catch, effort and size data) contained in the ICCAT databases with the aim of:

- Reviewing the most important data gaps and sources of uncertainty in data reports provided to the SCRS
- Provide guidance to CPCs on potential strategies for improving the quality of the data

Similar efforts conducted by this Committee in the past, suggest that such a review needs to be done with full cooperation, collaboration and involvement of scientists from the CPC data providers. These scientists have the best knowledge about the challenges facing each country regarding data collection and reporting. They are also in the best position to implement guidance provided by the Committee.

The Tropical Tunas Coordinator will invite members of the SCRS and the ICCAT Secretariat to join this group and will coordinate the development of the terms of reference and process used by the group to reach the desired improvement in data quality. Terms of reference should clearly define the scope of the review and make sure that it focuses on data that are most important for the stock assessment and MSE processes as well as for providing responses to the Commission.

Improvement of biological parameters

The Committee will continue to support efforts to be involved in activities related to the AOTTP programme and the continuation of the analysis of the AOTTP data. These activities will provide data on recaptured tagged fish, and reporting rates of tagged fish through seeding experiments. The work will be focused on supporting tagging in the NW Atlantic, and the monitoring of recaptured fish and tag seeding in West Africa. Both of these activities are currently ongoing, and it is proposed that they continue in 2023.

Biological parameters of all tropical stocks continue to have large associated uncertainty, and in particularly those related to growth models and ageing. Although tagging is providing valuable information on growth, it tends to be restricted to a narrow range of lengths and ages. The range is defined by the smallest fish that can be tagged, by the survival rate of those fish and reporting behaviour of different fleets. Growth of small fish and of large fish is therefore not well informed by tagging. The Committee has therefore been engaged in the collection of samples for ageing. This collection has been particularly fruitful in West Africa with the support initially of the AOTTP and currently of ICCAT. During 2022 the West African scientists have been focusing data collection and analysis on age samples of skipjack and this focus will remain for 2023.

Unfortunately, sample collections in West Africa are not generating sufficient information on small and large bigeye and small yellowfin. It is therefore proposed that the group make an effort to collect and age samples of such fish by developing a network of sample providers within the SCRS. The network will be developed by identifying the fisheries where such fish are more likely to be collected. Successful collection of such fish will improve growth models for both species and estimates of maximum age for bigeye tuna.

MSE

The Committee will support the implementation of an independent technical review of W-SKJ MSE. Terms of reference for this review can be adapted from those developed in the past for the North albacore MSE.

The Committee will support the organization and implementation of training workshops on MSE. These workshops will follow a modified format following the experience of the workshops conducted in Brazil and funded by ICCAT in 2021. Workshops will be conducted in French, Spanish and English depending on the countries invited to attend. Priority will be placed on CPCs that did not attend the 2021 workshops, and ideally will be organized at the regional level (West Africa, Central American/Caribbean, etc.). Workshops will use the experience from the Brazilian 2021 workshops and other previous experiences from other organizations to improve training outcomes. Six online workshops for scientists (4 in 2023 and 2 in 2024) and 6 for stakeholders (2 in 2023 and 4 in 2024) will be conducted.

The Committee will prepare documents and presentations describing progress on MSE for Panel 1. The Committee requests that the Commission adopt an agenda item on MSE for one of their 2023 meetings so that the Committee can start a dialogue with the Commission on operational management objectives for tropical tunas. Such objectives are essential for a successful MSE process as they need to be linked to specific performance indicators used in selecting a management procedure.

More details on the work to be conducted on E-SKJ MSE and the multi-stock MSE is included in the MSE section of this report.

15.2 Intersessional meetings proposed for 2023

As a preamble to the presentation of the SCRS calendar for 2023, the Committee believes it is necessary to highlight the context in which the work has been developed.

During the last three years, the Committee has suffered the impact derived from the pandemic situation, which has introduced challenges conducting its activities and providing deliverables. In addition to this already difficult situation, there has been a substantial increase in the number of meetings and requests from the Commission. These additional demands have been generating a level of activity that strongly affects the work, particularly bearing in mind the effective number of hours during online meetings as compared to in-person meetings, the current expertise assigned by the CPCs, and the current human resources available at the Secretariat. Accordingly, the Committee is facing increasing challenges and difficulties to provide the scientific advice requested by the Commission in due time and in keeping with the high standard that has been the practice in ICCAT.

In 2022 the Committee discussed and adopted the workplans of its subsidiary bodies which were developed in consideration of the overall requests from the Commission and the needs of the different subsidiary bodies to fully address those requests. In this context, the workplans contained in item 15 of this report, are an attempt to address those scientific priorities identified individually by the SCRS subsidiary bodies while aiming to provide the scientific advice set by the Commission.

Year after year the Committee has a busy schedule of critical assessments. Based on decisions taken in recent years by the Commission and the limitations faced by the Committee, the 2023 calendar of the intersessional meetings should include the stock assessments for North Atlantic albacore, Mediterranean albacore, North and South blue shark and eastern and western sailfish. The workplans also include further development of five ongoing MSE processes (for northern Atlantic albacore and swordfish, for bluefin tuna, for western skipjack and a multi-stock for tropical tunas) that imply a number of meetings of the MSE technical sub-groups, a number of workshops related to the ongoing research programmes and several challenging responses to the Commission that would require substantial analytical effort by the Committee.

According to these workplans, the meetings that would be necessary to address the different issues accounted for a total of 112 days based on both in-person (hybrid format) and online meetings.

Since the original meetings and respective duration proposed in the SCRS subsidiary bodies workplans was considered unsustainable by the Committee, after long discussions it was agreed that the tentative 2023 SCRS calendar will include a total of 77 days of meetings, as provided in **Table 15.2.1** and the chart below.

Table 15.2.1. List of official ICCAT meetings requested by working groups in their workplans.

Requested meetings	Duration (No. days)	Secretariat participation
Subcommittee on Ecosytems and Bycatch		
1. Intersessional meeting of SC-ECO	5	Yes
Subcommittee on Statistics		
2. SC-STATS meeting (during Species Groups' week)*	1.5	Yes
Albacore Species Group		
3. Data preparatory meeting for N-ALB and M-ALB	5	Yes
4. Stock assessment meeting for N-ALB and M-ALB	5	Yes
5. Meeting during Species Groups' week*		Yes
Shark Species Group		
6. Data preparatory meeting for Atlantic blue shark	5	Yes
7. Stock assessment meeting for Atlantic blue shark	5	Yes
8. Meeting during Species Groups' week*		Yes
Billfish Species Group		
9. Data preparatory and stock assessment meeting for sailfish	6	Yes
10. Workshop of statistical correspondents	5	Yes
11. Meeting during Species Groups' week*		Yes
Small Tunas Species Group		
12. Intersessional Meeting of Small Tunas Species Group	4	Yes
13. Workshop on data limited methods	4	Yes
14. Meeting during Species Groups' week*		Yes
Swordfish Species Group		
15. Intersessional Meeting of Swordfish Species Group (inc. MSE)	5	Yes
16. Two Swordfish MSE Technical Group (online) meeting (2 days each)	4	No
17. Two Swordfish MSE (SCRS:Commission) (online) meeting (1 day each)	2	No
18. Meeting during Species Groups' week*		Yes
Tropical Tunas Species Group		
19. Intersessional Meeting of Tropical Tunas Species Group (inc. MSE)	5	Yes
20. Two workshops on MSE for scientists (online) (2 days each)	4	No
21. One workshop on MSE for managers (online) (2 days)	2	No
22. Meeting during Species Groups' week*		Yes
Bluefin Tuna Species Group		
23. Workshop on Close-kin mark-recapture	3	Yes
24. Meeting during Species Groups' week*		Yes
Working Group on Stock Assessment Methods		
25. Intersessional Meeting of WGSAM	4	Yes
Standing Committee of Research and Statistics		
26. Species Groups meetings*	4.5	Yes
27. SCRS Annual meeting	5	Yes
Total	**78**	**23**

* Species Group meetings will be held during the week prior to the SCRS plenary meeting and last 4.5 days.

The Subcommittee on Statistics will meet for 1.5 days after the Species Group meetings and immediately before the SCRS plenary.

15.2 Intersessional meetings proposed for 2023

	MON	TUE	WED	THU	FRI	SAT	SUN	MON	TUE	WED	THU	FRI	SAT	SUN	MON	TUE	WED	THU	FRI	SAT	SUN	MON	TUE	WED	THU	FRI	SAT	SUN	MON	TUE	WED	THU	FRI	SAT	SUN	MON	TUE
January							1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
																															SWO MSE T. Group						
February			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28							
																						Tropical tuna SG + MSE							PA4 SWO MSE								
March			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31				
																	CKMR BFT						N-ALB + M-ALB Data preparatory + MSE														
April						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
																						BSH Data Preparatory								TT MSE WkP (Sc)							
May	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31						
									SMT Data Limited Workshop						Small Tunas																						
								SC-ECO							WGSAM							SWO Species Group + MSE															
June				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30				
																TT MSE WkP (Sc)																					
								SAI Data preparatory + Stock Assessment							BIL Workshop Statistic correspondants														N-ALB + M-ALB Stock Assessment								
July						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
																		Workshop SRDCP				BSH Stock Assessment															
August		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31					
September					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30			
																						BFT															
																						ALB		TT													
																						SWO		SHK		SC-STAT											
								SWO MSE T. Group														SMT	BIL						SCRS								
October						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
																PA4 SWO MSE		TT MSE WkP (Mg)																			
November			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30					
															Commission meeting																						
December					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31		

Free day in ICCAT | Meeting of technical nature | Secretariat meeting preparation/holidays | Workshop

15.3 Date and place of the next meeting of the SCRS

The next meeting of the Standing Committee on Research and Statistics (SCRS) will possibly be held in-person, from 25 to 29 September 2023 and the Species Groups meeting from 18 to 23 September 2023. These meeting will be held in Madrid (Spain).

Should the pandemic situation improve all SCRS meetings will be held in-person, with the exception of those already identified as online. Furthermore, in order to ensure a wider participation of all ICCAT CPCs, the in-person meeting will have a hybrid format.

16. General recommendations to the Commission

16.1 General recommendations to the Commission that have financial implications

The Committee requests the Commission to provide the Secretariat with the necessary financial means to support and organize the SCRS meetings with simultaneous interpretation (i.e., interpreters, larger rooms to accommodate the associated logistics and concurrent meetings), as currently occurs in all Commission intersessional meetings. The Committee considers such funding is essential to ensure all CPCs can have equal conditions and effective engagement to the SCRS meetings. The estimated cost for online meetings amounts to €6,450 per day. Following the Commission request in 2021, the Committee provide in **Appendix 18** a proposal (based on the number of participants) on priorities for the provision of interpretation during intersessional meetings, which would amount to a maximum of €290,250 for the 5 categories considered. In addition, the Committee also request the Commission to consider an alternative scenario, based on an analysis on the number of CPCs attending the SCRS meetings, which would amount to a maximum of €141,900 for the 5 categories considered.

In addition, the Committee recommended that all SCRS meetings scheduled in-person shall have a hybrid format to allow for a wide number of participants to attend the meetings, namely from those delegation which have budgetary constraints and therefore have limitations on the number of scientists that can attend the meetings. According to the SCRS tentative calendar for 2023, using the ZOOM platform for the hybrid meetings will have an estimated cost of €140,000.

16.1.1 Subcommittee on Ecosystems and Bycatch

Regarding the Ecosystem component

- The Committee endorses the proposed preliminary candidate ecoregions derived from the first ICCAT ecoregion workshop to develop pilot products to test their usefulness and utility as a tool to progress on EAFM implementation in ICCAT. The pilot products will provide some concrete examples of the use of ecoregions to operationalize EAFM in ICCAT. They will also show their potential uses and benefits to the SCRS/Commission. The Subcommittee requests financial assistance to support the work to develop a case study project (integrated bycatch assessment for two selected ecoregions) to test usefulness and utility of the ecoregions as a tool to progress on EAFM implementation in ICCAT (**€15,000**).

- The Committee recommends that the SCRS support further refinements of the ecoregion process and proposed candidate ecoregions based on the suggestions described in the Report of the 2022 Intersessional Meeting of the Subcommittee on Ecosystems and Bycatch (**Appendix 15**) as well any suggestion received from the SCRS. The Committee recommends a second ICCAT ecoregion workshop in 2023 to refine the ecoregion delineation process based on the expert advice and feedback received in the first ICCAT ecoregion workshop as well as feedback received by the SCRS. For this, the Committee requests financial assistance to organize this second ecoregion workshop (online). Financial assistance will be used to support the preparatory work (**€15,000**).

- The Committee recommends that financial support be given to assist with development of the risk screening and management prioritization tool (**€15,000**).

Regarding the Bycatch component

- The Committee requests financial assistance to support the attendance of five to eight CPC scientists at a collaborative workshop to continue the evaluation of ICCAT fisheries impact on marine turtles in the Mediterranean Sea, with the use of detailed fishery observer data. This is in support of an ongoing process that will continue over the coming years (**€20,000**).

The table below contains the overall funding requests made by the Committee:

Subcommittee on Ecosystems and Bycatch	**2023**
Workshops/meetings	
Support the work on Ecoregions by designing a case study testing these regions	**€15,000**
Collaborative workshop to discuss the relevance and the methodology used to delineate candidate ecoregions	**€15,000**
Workshop on evaluation of impact of ICCAT fisheries on marine turtles in the Mediterranean Sea	**€20,000**
Support for development of risk screening and management prioritization tool	**€15,000**
TOTAL	**€65,000**

16.1.2 Subcommittee on Statistics

- The Subcommittee recommended continued development of front-end applications for making and publishing graphically dashboards of ICCAT statistical datasets and provide the necessary financial resources for its full implementation (**€6,000**).

16.1.3 Albacore

The Committee recommends continued funding of the Albacore Research Programme for North and South Atlantic stocks, as well as to start funding the research for the Mediterranean stock. For the next two-years, research on the North and South Albacore stocks will be focused on three main research areas (biology and ecology, monitoring of stock status, and management strategy evaluation).

- For 2023 the Committee recommends continuing electronic tagging and reproductive biology studies (with associated aging of samples) in the North and South Atlantic, and to progress on the North Atlantic albacore MSE. These are all considered to be high priority tasks, with an estimated cost of:

  i. €40,000 for tagging (€20,000 for each stock);
  ii. €20,000 for reproductive biology and related ageing (€10,000 for each stock);
  iii. Following the ICCAT MSE roadmap adopted by the Commission, the Committee recommends that the Commission provides the necessary financial means for the continuity of N-ALB MSE work. This high priority task requires €30,000 funding for 2023.

More details of the proposed research and economic plan are provided in the detailed report of the Albacore Year Program (ALBYP) (**Appendix 11**).

- The Committee supports the continuation of larval data collection in the Balearic Sea and other spawning areas (e.g. central and eastern Mediterranean), and recommends further research related to the use of larval indices to complement fisheries dependent data in stock assessments, including development of larval habitat models, corrected abundance indices and their impact in the assessment. This is considered a secondary priority task, with an estimated cost of €33,000 for 2023.

Albacore	2023	2024
Tagging, rewards and awareness	€40,000*	€20,000**
Biological studies:		
Reproduction	€10,000*	
Age and growth	€10,000*	
Sample collection and shipping	€5,000*	
Other fisheries related studies (including data recovery, etc.)		
Mediterranean ALB larval index related studies	€33,000	€33,000
Workshops/meetings		
Equipment		
MSE	€30,000	€30,000
TOTAL	**€128,000**	**€83,000**

* Funds to be evenly split between North/South stocks. In case of budget reduction, the southern stock has priority.
**Funds only for the southern Atlantic stock.

16.1.4 Billfish

The highest priorities for 2023 are to support the objectives established by the billfish workplan and those of the Enhanced Programme for Billfish Research (EPBR), that have been delayed or kept on hold due to the COVID-19 issue:

- Continue the growth study of the three priority billfish species in the eastern Atlantic;

- Initiate/continue reproduction study of blue marlin in the Gulf of Mexico;

- To fund a Workshop on small-scale fisheries (artisanal) in the West Africa region, with the objective of collecting detailed information describing their fishery(ies) and sampling programmes, aiming to improve the collection and submission of billfish fisheries data in these regions (funding already available from 2022 science budget);

- To fund a technical workshop on age reading in 2023 to standardize protocols, start the aging reference set and reading guidelines, and a second workshop in 2024 that should focus on building a reference set for both spines and otoliths.

- Conduct electronic tagging of marlins (BUM/WHM) in the North-east Atlantic area.

Breakdown of the requested billfishes estimated budget for the period 2023 and 2024.

Billfishes	***2023***	***2024***
Tagging, rewards and awareness		
Tags, satellite, rewarding	€30,000	
Recreational sea campaigns (5 days)	€6,000	
Biological studies:		
Reproduction		
Age and growth	€5,000	€15,000
Genetic		€5,000
Other fisheries related studies (including data recovery and collection of fisheries statistics in the field in West Africa)	€5,000	€10,000
Sample collection and shipping	€2,500	€10,000
Consumables	€2,500	€5,000
Workshops/meetings		
Workshop on data collection and reporting on artisanal fisheries in the western Atlantic in 2024		€25,000
Technical workshop for age reading	€25,000	
Stock assessment 2023 reviewer	€10,000	
TOTAL	**€86,000**	**€70,000**

16.1.5 Bluefin tuna

For 2023/early 2024 the Committee recommends the Commission:

- Continued funding to support the essential work of GBYP including funding of tagging and tag recovery reward programs, biological studies, sample collection, maintenance and shipping, fishery independent indices (aerial surveys), MSE process development (details in table below) and the coordination:

  - Hold 3 Technical workshops late 2022 and early 2023, for which funding has already been secured by GBYP Phase 12:

    - CKMR/genomics for ABFT and BFT biological sampling coordination to support genomics approaches;
    - BFT electronic tagging;
    - BFT larval surveys

  - Hold one intersessional meeting of the Bluefin Tuna Species Group;[*]

  - Hold one intersessional meeting of the BFT Technical Sub-group on MSE;[*]

  - Support the Ambassador meetings (to be held in 2022) and potential continuation into 2023;*

  - Contract an expert to develop methodology for update of indices to be input to Management Procedures (included in Phase 12);

  - Contract for epigenetic aging (included in Phase 12).

[*] Activities require non GBYP funds.

The table below contains the overall funding requests for bluefin tuna (GBYP) for 2023 new Phase (13):

Bluefin tuna [GBYP Phase 13]	***2023***
Tagging, rewards and awareness	
Electronic and conventional tagging, rewarding and awareness	€160,000
Biological studies:	€110,000
Other (if any, i.e., fisheries independent indices)	
Aerial surveys	€365,000
Sample collection and shipping	€80,000
Workshops/meetings	
GBYP workshops (TBD, probably further WS for BFT sampling coordination and Close Kin)	€20,000
Experts' attendance to intersessional meetings	€10,000
MSE	
Progress of the BFT MSE	€25,000
Process review and communication	€5,000
Sub-TOTAL	**€775,000**
Programme coordination (include staff salaries, SC external member contract, SC members and GBYP coordination team travels, overheads and ICCAT staff participation)	€475,000
TOTAL	**€1,250,000**

16.1.6 Sharks

- Provide funding for the SRDCP for Year 9 (€94,000) to:

  i) Finalize analytical results on South Atlantic shortfin mako age and growth (€2,000).
  ii) Continue with stock differentiation analysis for porbeagle (Next Generation Sequencing (NGS)) (€25,000).
  iii) Continue on prioritized study on movement, habitat characterization and post-release mortality for shortfin mako (*Isurus oxyrinchus*), porbeagle (*Lamna nasus*), silky (*Carcharhinus falciformis*), oceanic whitetip (*C. longimanus*), longfin mako (*I. paucus*), and hammerhead sharks (*Sphyrna* sp.) through satellite tagging, including tag-return rewards (€10,000).
  iv) Studies of hormones analysis to determine maturity and reproductive state of shortfin mako (€10,000).
  v) Workshop to update the BSH age and growth information that will be used in the 2023 stock assessment. The workshop will be held in Narragansett, Rhode Island, United States and 5 experts will attend (€15,000).

- Provide funds for a 3-day meeting to do a thorough assessment of the achieved results of SRDCP and to review its ongoing activities. The costs include inviting 7 relevant experts to the meeting, which might be scheduled immediately before or after the Data Preparatory meeting for the blue shark stock assessment (€20,000).
- Consider hiring an external expert on stock assessment and validation to participate in carrying out the 2023 stock assessment of Atlantic North and South blue shark stocks (€10,000).

The table below contains the overall funding requests for sharks (including SRDCP) for 2023:

Sharks	**2023**
Tagging, rewards and awareness	
SMA, POR, FAL, OCS, SPL, SPZ and LMA	€10,000
Biological studies:	
Age and growth (S. Atl. SMA)	€2,000
Genetic (POR)	€25,000
Reproductive study (N. Atl. SMA)	€10,000
Other (samples shipping)	€2,000
Other fisheries related studies	
External expert for stock assessment	€10,000
Workshops/meetings	
SRDCP meeting	€20,000
Ageing and growth workshop (Narragansett, RI)	€15,000
TOTAL	**€94,000**

16.1.7 Small tunas

The Committee recommended the following activities which will have financial implications during the period of 2023 in order of priority from highest to lowest:

- *Continuing support to the SMTYP:* The Committee recommended continuing with the ICCAT SMTYP research programme activities in 2023 to further improve the biological information (improving geographical coverage for growth, maturity and stock identification) to fill the remaining gaps of the three species (WAH, LTA, BON) and continue the sampling for *Auxis thazard* (FRI) and *A. rochei* (BLT). Costs for 2023 are partly covered by the 2022 budget estimated at (€22,500).

- *Conduct a regional workshop (in person, 4 days) on the application of data-limited methods to assess small tuna stocks*. Data-limited models include integrated, length, and catch based models. With such tools, it is possible to estimate the status of the population and, depending on the method used, provide reference point for the fishery. Such approaches require inputs from biologists and fisheries experts. As such, the Committee recommended that an in-person workshop be held to advance data-limited models applied to some small tuna species. This workshop could be held back-to-back with the 2023 intersessional meeting of the Small Tunas Species Group, which would reduce traveling costs (costs to be covered by 2022 budget).

- *Workshop (in person, 4 days) on maturity staging (reproduction) in 2023 for small tuna stocks:* This workshop would allow for calibration and adopting internationally agreed macroscopic and microscopic maturity scales for the new studied small tuna species. Costs are estimated at €25,000, which would allow for participation of 1 expert and 8-10 national scientists.

The table below contains the overall funding requests made by the Subcommittee for 2023:

Small tunas	**2023**
Biological studies:	
Reproduction	€7,500
Age and growth	€7,500
Genetic	€7,500
Sample collection and shipping	€10,000
Workshops/meetings	
Maturity and staging	€25,000
TOTAL	**€57,500**

16.1.8 Swordfish

Biology and stock structure study - Swordfish Year Programme (SWOYP) (this recommendation applies to both the North and South Atlantic and Mediterranean stocks): An understanding of the species biology, including age, growth and reproductive parameters, as well as stock structure and mixing is crucial for the application of biologically realistic stock assessment models and, ultimately, for effective conservation and management. Given the current uncertainties that still exist, the Committee recommends as high priority to continue biological studies on swordfish. An ICCAT project on swordfish biology, genetics and satellite tagging started in 2018 and the Committee recommends that the project continues for 2023 and is provided with financial support.

Considering the prioritization of satellite tagging in the SWOYP, the Committee recommends that a hand-held Argos electronic satellite tag receiver be purchased for use among ICCAT Species Groups. The receiver is an important tool in the retrieval of electronic tags and the subsequent recovery of electronic tagging data (€10,000).

Several of the following activities will be funded through the 2022 ICCAT science budget, however, there are cases where additional budget will be needed, detailed in the table below.

- *Satellite tagging work:* to cover expenses with deployments of previously acquired tags and some tagging equipment (tagging poles, etc.).

- *Reproduction:* ongoing work processing and analysing of gonads.

- *Age and growth*: finish processing spines and otoliths collected under previous phases; continuation of a bomb-radiocarbon age validation study.

- *Genetics:* continued population analysis of tissues samples for stock differentiation; continuation of a study on epigenetic ageing, to be completed in conjunction with the bomb radiocarbon study. a study on the viability study of close-kin mark recapture project to develop a fishery independent index of abundance.

- *Age and growth reference set workshop:* 7-8 participants plus 2 experts (workshop should be scheduled as 5 in-person days).

- *Sampling and shipping* (priority on missing areas/sizes as defined in the project summary).

- *MSE for N-SWO*: €90,000 for 2023 (priority: High). The Species Group is scheduled to provide a final set of CMPs to the Commission in 2023. Delivering MSE results for northern swordfish according to the schedule agreed upon by the Commission will be very challenging and require time and resources. Funding to start this work was provided in 2018, and a contractor was hired to start the work. The Committee recommended funding for continuing the swordfish MSE work for 2023.

- *Closed-loop simulation study for S-SWO:* The Committee recommends that preliminary closed-loop analyses done in 2022 for the South Atlantic stock be continued. Thus, an expanded set of closed-loop simulations be conducted for the southern swordfish stock using Operating Models tailored to that stock. While the work will be predominantly done by CPC scientists and the Secretariat, a contractor will review the simulation setup and code.

The Table below contains the overall funding requests made for the Swordfish Year Programme (SWOYP) for 2023:

Swordfish	2023
Tagging, rewards and awareness	
Electronic tagging, rewarding and awareness	€10,000
Tag locator device	€10,000
Biological studies:	
Reproduction	€5,000
Age and growth	€25,000
Genetic	€80,000
Other (if any, identify)	
Sample collection and shipping	€5,000
Workshops/meetings	
Age and growth reference sets workshop	€20,000
MSE	
Progress of the N-SWO MSE	€90,000
Simulation study for S-SWO MSE	€10,000
TOTAL	**€255,000**

16.1.9 Tropical tunas

The highest priority is to advance the development of the multi-stock MSE and the western skipjack MSE, including training workshops and the independent technical review of W-SKJ MSE.

The next highest priority is to continue to invest in the recovery of AOTTP tagged fish, tag seeding and maintenance of the tagging database.

Finally, the last research priority is to continue progressing on the estimation of growth, maximum age and natural mortality for the three species of tropical tuna. This should be done by continued collecting and ageing of specimens of the three species and by taking advantage of the AOTTP data to provide estimates of survival. The work should focus on improving the overall database of age/length samples for skipjack, increasing age/length samples of small and large bigeye tuna and of small yellowfin tuna.

The Table below contains the overall funding requests for tropical tunas for 2023 and 2024:

Tropical tunas	2023	2024
Tag recovery and maintenance of AOTTP database	€50,000	€25,000
Biological studies:		
Age and growth of BET and YFT	€15,000	€15,000
MSE		
Western SKJ	€25,000	€25,000
Multi-stocks MSE	€75,000	€75,000
Independent external reviewer	€10,000	€10,000
Training workshops for scientists (4 in 2023 and 2 in 2024) and stakeholders (2 in 2023 and 4 in 2024), with translation in all official languages	€50,000	€50,000
TOTAL	**€225,000**	**€200,000**

16.1.10 Working Group on Stock Assessment Methods (WGSAM)

- The Committee recognized the usefulness of the bycatch estimation tool presented to the Group and recommended it continue to be funded for further development as a means to address the SCRS general needs to estimate bycatch of species such as, but not limited to, billfish and sharks. The Group further recommends that this work be carried out using the 2022 WGSAM funds.

- The Committee continued to recommend an overall review of ICCAT MSE activities by an external expert. This overall review would serve to identify potential improvements, highlight any missing components or shortcomings of the current process, achieve efficiencies across species and promote standardization of the MSE process across species, refine and standardize MSE communication and stakeholder engagement, and provide guidance on what the future of MSE looks like within ICCAT. This could include the way MSEs are supported and how resources are divided, and how the MSE process should be structured and supported after MP adoption.

The table below contains the overall funding requests made by the WGSAM for 2023:

Working Group on Stock Assessment Methods	**2023**
Other fisheries related studies (including data recovery, experts, etc.)	
Tool to estimate bycatch of species	€35,000
Overall review of ICCAT MSE process	€30,000
TOTAL	**€65,000**

16.2 Other general recommendations

The Committee recommends that CPCs make available biological samples from their fisheries to the SCRS. The SCRS relies on representative biological samples (e.g. fin spines/otoliths for determining age structure; tissue for close kin and stock mixing analysis, gonads for estimating maturity and fecundity) to estimate the status of ICCAT stocks and make science and management recommendations. The Committee stresses that it has been difficult obtaining these samples from CPCs and that they are vital to producing scientifically robust stock assessments.

16.2.1 Subcommittee on Ecosystems and Bycatch

Regarding the Ecosystem component

- The Subcommittee recommends that the SCRS review and comment on the ecoregion delineation process as well as on the proposed candidate ecoregions within the ICCAT Convention area. It further invites the SCRS to provide future directions and report back to the Subcommittee.

Regarding the Bycatch component

- The Committee noted the relevant advances made by the collaborative research regarding interactions between ICCAT fisheries and marine turtles. To increase the value of this work to the SCRS and the Commission, the Committee recommends more national scientists holding relevant data on these interactions within ICCAT fisheries to join this collaborative research and make their data available.

16.2.2 Subcommittee on Statistics

- The Subcommittee recommends that the Secretariat requests that CPCs identified as having reported T2CE datasets with incomplete information on effort (catches without effort), report revisions to ICCAT with the missing effort included and whenever possible the catches of the three major shark species (POR, BSH, SMA). The Secretariat should estimate the fractions of the total longline catches that do not have sufficient effort information in T2CE and estimate the impact of those datasets on the estimations of EFFDIS. These analyses completed with the gaps identified on the SCRS species catalogues should be presented at next meeting of the Subcommittee on Ecosystems.

- The Subcommittee recommends that the Commission continues to support the development of the IOMS system.

16.2.3 Albacore

- Due to the current limitations of the Mediterranean albacore stock assessment, the Committee recommends a network of researchers be established to work intersessionally on the development of a comprehensive and coherent research plan for this stock to be integrated within the Albacore Year Programme (ALBYP), together with the North and South Atlantic stocks research plans.

- The Committee recommends an increase in effort to complete the Task 1 data for Mediterranean albacore, this being one of the main uncertainties not quantified in the assessment. The Committee recommends that CPCs and the Secretariat work together to complete the Task 1 data in the ICCAT database before the next assessment, and to consider methods developed by the WGSAM to estimate unreported catches.

16.2.4 Billfish

- Given the misidentification of roundscale spearfish and white marlin in the reported fisheries statistics, the Committee reiterated its concern regarding uncertainty in white marlin stock assessment results. Therefore, the Committee continues to recommend that research to address this problem should continue to be supported by the Commission. The Committee recommends that the morphological characteristics as described in the ICCAT Guide for the Identification of Atlantic *Istiophorids* (as well as any other characteristics approved by the Billfish Species Group), be used by onboard observers to identify the species.

- The Committee emphasized the need for all CPCs to comply with the mandatory requirements to report discards (both dead and live) for billfishes. In 2021, of the 27 CPCs with reports of marlin catches, 7 CPCs have reported estimates of dead discards. Having the total catches, including dead and live discards, and estimates of post-release mortality is important for stock assessment purposes.

16.2.5 Bluefin tuna

- The Committee recommends increasing the coordination of biological sampling and processing among the different CPCs teams and GBYP, in order to provide age hard parts, genetic, reproductive and other biological samples. Knowing the samples currently available and planning future sampling will allow optimizing sampling and adequately covering the wide distribution area of this species. This coordination is also important in order to use standardized sampling and processing methodologies.

- The Committee recommends that continuation of the feasibility analysis and planning for close-kin mark recapture for eastern Atlantic and Mediterranean bluefin tuna and that a review for operational implementation of close-kin mark recapture be prioritized as soon as it becomes technically and logistically feasible.

16.2.6 Sharks

- Considering the need to improve stock assessments of pelagic shark species impacted by ICCAT fisheries and bearing in mind *Recommendation by ICCAT to replace Recommendation 16-13 on improvement of compliance review of conservation and management measures regarding sharks caught in association with ICCAT fisheries* (Rec. 18-06) as well as the various previous recommendations which made the submission of shark data mandatory, the Committee strongly urges the CPCs to provide the corresponding statistics, including discards (dead and alive), of all ICCAT fisheries, including recreational and artisanal fisheries, and to the extent possible non-ICCAT fisheries capturing these species. The Committee considers that a basic premise for correctly evaluating the status of any stock is to have a solid basis to estimate total removals.

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

16.2.7 Small tunas

- The Committee recommends that any CPCs with small tuna data on length and weight be made available so that they can integrated into a general database for studies defined in the Small Tuna Year Programme (SMTYP).

- The Committee recommends that CPCs provide indices of abundance and size-frequency sample data, preferably from fishery independent surveys and/or other national programmes, which would substantially improve stock assessments.

16.2.8 Swordfish

- The Committee continues to note that there is a general lack of reported discard data by most CPCs, which is important to inform the stock assessment and ongoing MSE work. As such, the Committee recommends national scientists to use their domestic observer programmes information to estimate dead discards and live releases. The estimates should go back in time as far as possible. Furthermore, the Committee recommends that the submission of size samples to the ICCAT Secretariat, as part of the CPCs Task 1 and 2 data submission obligations, be completed using the ST04-T2SZ statistical form. Size samples reported with the ST04-T2SZ form shall include all samples collected by the CPC from all fisheries and size samples of dead and live discards (when applicable) collected by its National Observer Programme. This recommendation does not preclude CPCs from the optional reporting of size samples collected by their National Observer Programme using the ST09-DomObPrg form.

- The Committee recommends that CPCs make available biological samples from their fisheries to the SCRS. The SCRS relies on biological samples (e.g. fin spines/otoliths for determining age structure; tissue for close kin and stock mixing analysis, gonads for estimating maturity and fecundity) to estimate the status of ICCAT stocks and make science and management recommendations. The Committee stresses that it has been difficult obtaining these samples from CPCs and that they are vital to producing scientifically robust stock assessments. Within this sampling requirement should be an allowance for sampling by onboard observers on undersized swordfish in the Mediterranean that are dead at haulback.

16.2.9 Tropical tunas

- The SCRS should continue to conduct research on the impacts of spatial and total fishing closures of surface fisheries, including the effects of limitations on FAD operations, as these impacts are of great interest to the Commission. The Commission, however, should help the SCRS by ensuring that all CPCs provide the necessary detailed information on fishing operations required to conduct these analyses. Of highest importance is improvements in the provision of detailed spatial information on the location of catches by species and fishing effort for all major gears (at the 1x1 degree resolution for surface fisheries, including number of purse seine sets by fishing mode), and estimation of “faux poisson” for all fleets.

- The amount of mixing between the eastern stock and western stock of skipjack and the connectivity between the southern hemisphere and northern hemisphere areas of the western stock remain unclear, especially in light of the expansion of surface fisheries in the equatorial area. The SCRS should investigate the changes in the spatial extend of the surface fisheries in the equatorial area and develop a sampling program to collect biological information (genetics, tagging) to improve understanding of the dynamics of skipjack stocks in this area.

16.2.10 Working Group on Stock Assessment Methods (WGSAM)

- The Committee recognized the need for further attention to the manner in which CPUE diagnostics are formulated and presented for use in ICCAT stock assessments. In response, the WGSAM recommended the formation of a study group on CPUE diagnostics. The study group would work closely with the bycatch estimation tool contractor to develop a path forward to improve CPUE diagnostic interpretation, creation of guidelines and best practices. The study group should make a concerted effort to ensure involvement of scientists from several CPCs via direct invitation and outreach.

- The Committee recommended that a dedicated Limit Reference Point study group be formed to investigate how Reference Points should be identified in general as well as for each species. The Committee should consider how Limit Reference Points should be calculated across life history strategies, and if they feel so inclined, could expand their investigation beyond Limit Reference Points to more broadly consider also Target Reference Points (e.g. MSY), including dynamic, time-varying Reference Points.

17. Responses to the Commission's requests

17.1 Explore potential technical changes to the terminal gear and fishing practices that could reduce bycatch and bycatch mortality (at-vessel and post-release). Design and implement a study(ies) to compare the effects of hook shape and size on catch rates. Rec. 19-05, para 21

Background: *The SCRS shall, in collaboration with CPCs, explore potential technical changes to the terminal gear (such as hook shape, hook size, leader type, etc.) and fishing practices (e.g. timing, soaking time, bait, depths, areas) that could reduce bycatch and bycatch mortality (at-vessel and post-release). As part of this process, the SCRS in collaboration with CPCs shall design and implement a study(ies) to compare the effects of hook shape and size on catch rates (considering both hooking and retention rates), at-haulback mortality, and post-release mortality. The experimental design should account for the influence of leader material types and consider potential operational differences among regions and fleets.*

As indicated in the 2021 response to the Commission, a Sub-group was created to explore potential technical changes to the terminal gear changes. The Sub-group continued to work intersessionally during 2022 and it made significant progress in completing the following tasks:

- Compiling a preliminary list of operational longline fleet characteristics in the ICCAT Convention area.
- Making a preliminary review of available scientific literature regarding catch rates and retention rates, at-haulback mortality and post-release mortality in ICCAT longline fisheries.
- Conducting a power analysis for some ICCAT longline fleets to establish the required fishing effort to be able to detect the effects of the technical gear changes.

While the Committee acknowledges that important work has been conducted to address the Commission's request, it also indicated that more work is still needed in order to provide advice to the Commission. Therefore, the Sub-group will continue to meet intersessionally in 2023 and report its findings to the Subcommittee on Ecosystems and Bycatch.

17.2 Develop recommendations for Electronic Monitoring Systems, Rec. 19-05, para 20

Background: *The Permanent Working Group for the Improvement of ICCAT Statistics and Conservation Measures (PWG), in cooperation with the SCRS, shall work to develop recommendations on the following issues for consideration at the 2021 annual meeting of the Commission:*

a) Minimum standard for an electronic monitoring system such as:

i) the minimum specification of the recording equipment (e.g. resolution. recording time capacity, data storage type, data protection) *ii) the number of cameras to be installed at which points on board*

b) What shall be recorded

c) Data to be analyzed, e.g. species, length, estimated weight, fishing operation details

d) Reporting format to the Secretariat

In 2020 CPCs are encouraged to conduct trials on electronic monitoring and report the results back to the PWG and the SCRS in 2021 for their review.

Following the Commission's request, the Committee created a Sub-group created in 2021 to address this issue. The Sub-group noted that there were already minimum standards recommended by the SCRS for EMS on purse seine fisheries (Ruiz *et al.,* 2017), which were endorsed by the Commission. The Sub-group then focused most of its work on pelagic longline fisheries, noting that other fisheries (e.g. gillnets) also need to be addressed in the future. The Committee reviewed the EMS information available from other fisheries and no results from trials were provided by CPCs.

The Sub-group worked intersessionally during 2021 and 2022, focusing on the following items: revision of previous literature comparing human observers with EMS, comparison of what data can be collected by human observers versus EMS specifically for ICCAT pelagic longline fisheries (using ICCAT observer data form ST-09), and creating a draft proposal for ICCAT EMS minimum standards for pelagic longlines.

The summary of the main work and conclusions from this Sub-group was presented to SC-STATS in 2022 in the document Report of the Sub-group on Electronic Monitoring Systems: Proposal of draft ICCAT minimum technical standards for EMS in pelagic longliners (Anon., 2022p). The Committee's proposal for ICCAT EMS minimum standards for pelagic longlines are provided in **Appendix 17** for Commission consideration.

17.3 Minimum standards for Electronic Monitoring Systems in tropical tuna fisheries, Rec. 21-01, para 55

Background: *For longline vessels flying their flag 20 meters length overall (LOA) or greater targeting bigeye, yellowfin and/or skipjack in the Convention area, CPCs shall ensure a minimum of 10% observer coverage of fishing effort by 2022, through the presence of a human observer on board in accordance with Annex 7 and/or an electronic monitoring system. For this purpose, the Working Group on Integrated Monitoring Measures (IMM WG), in cooperation with the SCRS, shall make a recommendation to the Commission for endorsement at its 2021 Annual meeting on the following:*

a) Minimum standards for an electronic monitoring system such as:

iii) the minimum specifications of the recording equipment (e.g. resolution, recording time capacity), data storage type, data protection
iv) the number of cameras to be installed at which points on board

b) What shall be recorded

c) Data analysis standards, e.g., converting video footage into actionable data by the use of artificial intelligence

d) Data to be analyzed, e.g., species, length, estimated weight, fishing operation details

e) Reporting format to the ICCAT Secretariat

In 2020 CPCs are encouraged to conduct trials on electronic monitoring and report the results back to the IMM and the SCRS in 2021 for their review.

CPCs shall report the information collected by the observers or the electronic monitoring system from the previous year by 30 April to the ICCAT Secretariat and to SCRS taking into account CPC confidentiality requirements.

The Subcommittee recognized that several minimum standards for Electronic Monitoring Systems proposed for longliners can be applied in tropical tuna fisheries. However, the Subcommittee did not have the time to review those in detail and requested the Tropical Tunas Species Group to include this task in their workplan for 2023.

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

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

To determine the appropriateness of the approach described in Annex 1, it is important that CPCs provide complete Task 1 data of shortfin mako retained catch, dead discards, and live releases. Furthermore, as requested in paragraph 13 of the Recommendation, it is also important that a document describing the statistical methodology used by CPCs to estimate dead discards and live releases be provided. If a CPC's reporting of retained catch, dead discards, and/or live releases is incomplete or estimates are not considered to be scientifically sound, then the default approach used by the Committee for filling in the 2021 data gaps is described in the response to paragraph 5b (see item 17.5 of this report). At this time reporting appears to be incomplete and hampers the evaluation of this approach.

Two post-release mortality rate estimates were applied for estimating total fishing mortality. These are referred to in the response to paragraph 5b of this Recommendation.

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

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

The Committee reviewed all data submissions for northern shortfin mako for 2021. For those CPCs that had not submitted information on landings for 2021, the Committee estimated the landings for these nations based on the average of the preceding two years with data. The Committee assumed that all fish that were dead at haul back were landed, and there were no dead discards. With the information available, it was not possible to estimate missing data for DL. The reported data and estimated missing landings are presented in the table below **Table 17.5.1**.

Table 17.5.1. Reported and SCRS estimated (shaded figures) landings, dead discards and live discards.

	Landings				Dead Discards				Live Discards			
	2018	**2019**	**2020**	**2021**	**2018**	**2019**	**2020**	**2021**	**2018**	**2019**	**2020**	**2021**
Belize	11.92	2.35		2.62								
Canada	52.87	62.82	0.52	0.32	1.84	0.93	19.69	21.95	28.29	12.05	81.19	63.01
China PR				0.00		20.30	1.97	1.17		7.34	2.96	1.76
Chinese Taipei	0.00	0.00	0.00	0.00	22.00	5.00	12.00	4.00	10.00	2.00	6.00	2.00
EU-España	1165.29	866.22	869.55	867.88				0.00				
EU-France	0.44	1.47	0.10	1.49	0.23	0.26		0.00		0.76		0.10
EU-Portugal	271.66	288.85	341.88	202.11			0.53	0.00				1.66
FR-St Pierre et Miquelon	0.00			**No Activity**								
Great Britain		0.03	0.02	0.00			0.00	0.00				
Japan	20.21	3.59	0.00	0.00		29.70	28.17	13.59			17.27	9.44
Korea Rep	4.71	3.72		4.21	0.00	0.00		0.00				
Liberia			9.85	9.85				0.00				
Maroc	594.10	501.10	382.40	298.70	0.00		0.00	0.00				0.00
Mexico	2.45	2.06	2.19	2.18	0.04	0.00	0.00	0.00	0.43	0.72	1.10	1.25
Russian Federation	0.00	0.20		0.00	0.01	0.00		0.00				0.28
Senegal	68.02	26.40		47.21				0.00				
St Vincent and Grenadines		3.30		3.30				0.00				
Trinidad and Tobago	2.31	1.16	1.23	0.91	0.00	0.00	0.00	0.00				
UK-Bermuda	0.00	0.20	0.00	0.12	0.00	0.00	0.00	0.19		0.05	0.11	0.07
UK-British Virgin Islands			0.00	0.00			0.00	0.00				
UK-Turks and Caicos			0.00	**No Activity**								
USA	164.79	56.80	47.94	38.80	1.55	1.03	3.27	3.17		24.11	31.03	67.50
Venezuela	7.49	8.26	7.67	2.94				0.00				
Total	2366.25	1828.54	1663.34	1482.64	25.66	57.22	65.63	44.07	38.73	47.03	139.66	147.06

Considering all CPCs, the preliminary Committee estimates were as follows:

- Retained catch (landings): 1,483 t
- Dead discards: 44 t
- Live Discards: 147 t

Using a post-release mortality rate of 23% (Miller *et al.*, 2020) the "total fishing mortality from all sources" (the value needed for Rec. 21-09 Annex 1 paragraph 1a) for 2021 was estimated as 1,561 t. Applying a 34% post-release mortality rate (Bowlby *et al.,* 2021), the total fishing mortality from all sources was estimated as 1,577 t.

According to Annex 1 of Rec. 21-09, these values are then subtracted from the amount established in Rec. 21-09 paragraph 4a, 250 t, to estimate the "dead bycatch retention allowance" in 2023 (see equation 1 below).

"limit from Rec. 21-09" – "fishing mortality 2021" = "dead bycatch retention allowance in 2023" (1)

If the "dead bycatch retention allowance" amount is negative, no retention is to be allowed in 2023.

The dead bycatch retention allowance was calculated to be -1,311 t or -1,327 t (depending on the post-release mortality rate used, see above). Therefore, the possible retention allowance for 2023 (calculated with Annex 1) is 0 t. In accordance with paragraph 1c of Annex 1, CPCs shall prohibit retaining onboard, transshipping, and landing, whole or in part, North Atlantic shortfin mako caught in association with ICCAT fisheries in year Y+1 (in this case 2023).

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

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

The Committee noted that few CPCs have submitted documents describing how they estimate their discards. In compliance with this paragraph of Rec. 21-09, CPCs that have submitted documents in 2022 were Canada, Japan, China (P.R.), Chinese Taipei. The United States had already submitted and published a document with the methodology for BFT (Brown, 2001). Even though this method was initially developed to update a time series of BFT dead discards, it has been used by the United States to estimate dead discards and live releases for a variety of species, including sharks.

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

Canada presented its document on the reporting methods used for shortfin mako catches (Bowlby, 2021) during the Shark Species Group meeting in May 2022. The Committee acknowledged that the work presented by Canada was promising and that it raised several questions related to how conditions in Rec. 21-09 will be addressed. The potential for the landings prohibition to influence the validity of statistical models developed with historical data was discussed.

The estimation of dead discards and live releases by the Japanese longline fleet were described in Semba *et al*. (2022). It was noted that the estimation of dead discards and live releases were based on self-reported discards by fishers through logbooks and at-haulback-mortality estimated from observer data. The Committee discussed that the use of self-reported dead discards is not an ideal source of discard data and it also commented on the fact that the annual estimated at-haulback-mortality rate was applied to the entire fleet without any consideration of factors that can affect such mortality rate. The Committee also indicated that it would be helpful if future documents on this issue include information on the observer percent coverage and the number of hooks observed. The authors agreed with the Committee's comments and will endeavour to improve the methodology in the future.

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

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

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

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

For this response refer to the response to Rec. 21-09, paragraph 5b (see item 17.5 of this report).

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

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

The Shark Research and Data Collection Programme (SRDCP) started in 2014 with its focus on different aspects of the life history, stock structure, and fisheries of the shortfin mako. Since then, a large amount of work has been done, producing very valuable information regarding the age and growth of the species, stock structure, movements, habitat use, and post release mortality. The Committee has recommended a SRDCP workshop take place in early 2023 (see recommendations section of 2022 Report of the Intersessional Meeting of the Sharks Species Group, Anon. 2022e) in order to review the progress of the Programme and to identify the information gaps that need to be prioritized as mentioned in paragraph 19 of Rec. 21-09. Additionally, the Committee is working on Technical Gear Changes to tackle mitigation measures and mortality reductions.

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

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

No information was presented to the Committee on this issue during 2022. A study such as this will be long-term and take several years to complete, so the Commission should not expect such a project to be undertaken quickly. This issue could be explored and proposed to be included as a long-term line of research in the SRDCP, for which the Committee has recommended to have a workshop in early 2023 (see recommendations section of 2022 ICCAT Intersessional Meeting of the Shark Species Group (Anon. 2022e). Importantly, this study will require a significant amount of funding that would need to be added to the ICCAT Shark Research and Data Collection Programme (SRDCP). Other methodologies could be explored to determine hotspots of incidental catches, such as those based on modelling the effect of environmental conditions on the shortfin mako CPUE.

17.10 The SCRS shall review the reported landings and discards of longfin mako shark to identify any unexpected inconsistencies that could be the result of misidentification between the two mako species. Rec. 21-09, para 22

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

The Committee reviewed the reported nominal catches of longfin mako shark in the last years. Insofar as the possible reporting of shortfin mako as longfin mako, no unexpected inconsistencies related to possible misidentification of the species were found.

17.11 The SCRS to provide new TAC advice in 2022 if the MP is not available yet. Rec. 21-07, para C

Background: *Should the MSE process not be completed in order to allow adoption of a management procedure (MP) in 2022, the Commission shall establish a TAC for 2023 taking into account additional SCRS advice in 2022, which would include consideration of updates of the fishery indicators. In support of the development of this advice, CPCs shall make special efforts, inter alia, to update abundance indices and other fishery indicators in 2022 and provide them to the SCRS.*

The SCRS has updated all indices used for the western area up to year 2021. With the completion of the MSE, the full suite of CMPs is now available (see section 17.14). With regards to western TAC advice, should the Commission not adopt a management procedure in November, the SCRS sees no undue risk to the stock for a rollover of the existing TAC for the West (2726 t) for 2023 based on the updated indices.

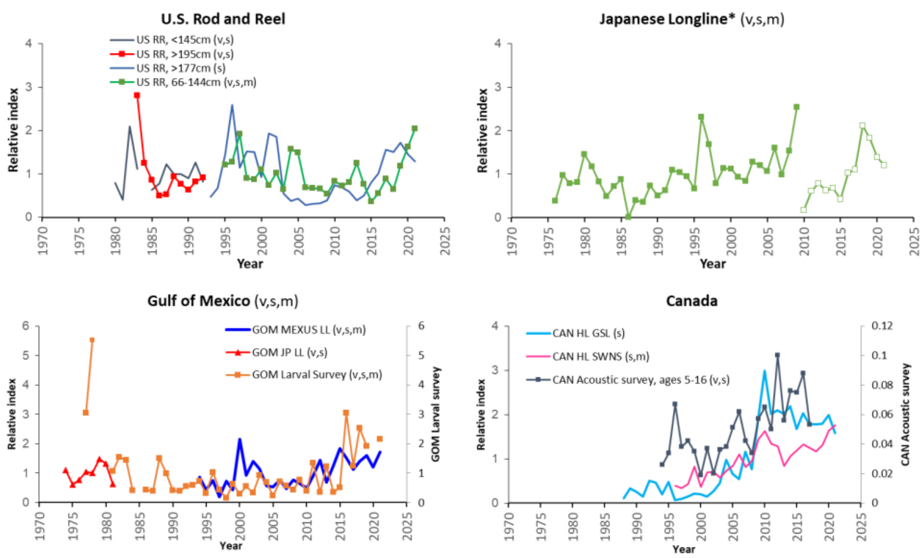


Figure 1. Indices of relative abundance for western bluefin tuna. Indices denoted with "*" represent revised indices rather than strict updates of indices used in the 2021 stock assessment. Indices denoted with an "s" were used in Stock Synthesis and indices with a "v" were used in VPA and indices denoted with "m" are used in the management procedures. The Canadian Acoustic index data point for 2018 was not used in the assessment models. U.S. Rod and reel 66-114 and 115-144 indices are shown for illustrative purposes but were superseded by the combined 66-144 index.

17.12 The SCRS to provide advice on any potential impacts due to uncertainties of implementing an $F_{0.1}$ strategy. Rec. 21-07, para F

Background: *By 2022, the SCRS shall provide the Commission with advice on any potential impacts due to uncertainties (including regarding the spawner-recruit relationship) of implementing an $F_{0.1}$ strategy, and, for any identified risks, advise how they could be addressed in future management decisions.*

Given the focus of the SCRS to develop management procedures through the MSE that are robust to uncertainties in the spawner-recruitment relationship and taking into account a number of technical challenges with exactly replicating the existing stock assessment modeling process within the MSE, the SCRS has not evaluated the risks of the current $F_{0.1}$ strategy. The Committee notes that many of the concerns about the risks of an $F_{0.1}$ strategy, either with respect to danger to the stock or loss of yield arise out of the concern that we might make the incorrect assumption about the spawner-recruitment relationship. For instance, $F_{0.1}$ could be higher or lower than F_{MSY}, depending on the nature of the spawner recruit relationship. In contrast, all of the CMPs tested in the MSE achieve operational management objectives regardless of the assumed underlying stock recruitment relationship indicating inherent robustness to this fundamental source of uncertainty.

17.13 The SCRS to provide new TAC advice in 2022 if the MP is not available yet. Rec. 21-08, para 5

Background: *The total allowable catches (TACs), inclusive of dead discards, for 2022 shall be set at 36,000 t, in accordance with the SCRS advice. The TACs for 2023 and thereafter shall be decided at the 2022 Commission annual meeting in accordance with an MP or based on new SCRS advice in 2022 if the MP is not available yet.*

The full suite of CMPs is available in the response contained in section 17.14.

Should the Commission not adopt a management procedure in 2022, the Committee sees no undue risk to the stock for a rollover of the present TAC for 2023 (36,000 t).

17.14 The SCRS shall continue its MSE work, testing candidate management procedures, including HCRs, which would support management objectives to be agreed by the Commission. Rec. 21-08, para 11

Background: *In line with the MSE Roadmap, the SCRS shall continue its MSE work, testing candidate management procedures, including HCRs, which would support management objectives to be agreed by the Commission. Based on the SCRS inputs and advice, and a dialogue process between scientists and managers, the Commission shall select in 2022 a management procedure for Atlantic bluefin, including pre-agreed management actions to be taken under various stock conditions for the provision of the TAC advice starting for 2023.*

The SCRS is nearing the completion of a multi-year process of development of MPs in partnership with Panel 2 and anticipates Panel 2 being able to recommend one or a short-list of MPs for adoption by the Commission at its November meeting for TAC setting for 2023 and beyond. The Committee provides the Specifications for MSE Trials For Atlantic Bluefin Tuna and the Final Results and Decision Guide Package documents here. The latter document outlines the key decision points before Panel 2. The Committee also provides Peterson *et al.* (2022) for further details on results and performance of CMPs. Lastly the Committee also refers interested parties to the full suite of information related to the MSE located here.

The Committee provides some further considerations regarding the MSE review and exceptional circumstances below. The additional outstanding task for 2023 is to define an exceptional circumstances protocol.

Management Procedure review considerations

A key element of the process of management procedure implementation is the process of its review. Such a review can occur at regularly, prescheduled intervals or following the declaration of exceptional circumstances. In most cases such review would not constitute a wholesale revision to the operating model structure, full reconditioning of the OMs and substantial changes to the CMPs, though it offers that opportunity should the need arise. In most cases such reviews could implement index revisions or relatively minor improvements to the operating models or MPs; indeed the outcome may leave the MP unchanged. The purpose and need of such review follow:

- The purpose of the regularly scheduled review is to ensure that the Management Procedure in force at the time is consistent with the state of knowledge of the stock.
- In most cases this review would not result in a substantial revision to the MP unless such revision was critical for the function of the MP.

- However, though typically tested over a lengthy future period of implementation (e.g. 30 years for tuna species), it is expected that any MP for a tuna resource will be modified during that period.
- An autopilot in an airplane is updated as the aircraft is upgraded, and further science enables a better understanding of how it reacts to its controls.
- Similarly, the understanding of the dynamics of a tuna population will improve over time, necessitating revisions over time of the Operating Models used for testing, and hence of the MP based on those OMs.
- Thus, it is standard practice to agree to a process of regular reviews of an MP, possibly leading to its revision, over time.
- The period between these reviews varies across resources, ranging from 4 to 10 years. For southern bluefin tuna, the period agreed was originally 9 years, but this has subsequently been shortened to 6 years.

Exceptional Circumstances considerations

It is also essential to adopt an exceptional circumstances protocol in 2023 that cover situations where the advice from the MP could potentially not be followed, requiring some alternative TAC advice.

- Exceptional Circumstances protocols are intended to cover the situation where a resource (or fishery) turns out to behave outside the range anticipated when OMs were developed to test the MP before its adoption.
- These provisions specify the basis on which such determinations are to be made by a scientific body; generally, compelling reasons are required.
- If Exceptional Circumstances are determined to apply, alternative management actions to those indicated by the MP may or may not be recommended by that scientific body.
- These actions may include bringing forward the regular MP review, thereby effectively shortening the review period at the end of which the MP may be modified.

The possible occurrence of exceptional circumstances will be checked annually by the SCRS, similar to their annual review of the fishery indicators, and consequent advice will be provided to the Commission for consideration.

17.15 The SCRS should review fishing capacity parameters of the different CPCs no later than 2022, including specific rates for gear type and fishing area. Rec. 21-08, para 16

Background: *Each CPC shall adjust its fishing capacity to ensure that it is commensurate with its allocated quota by using relevant yearly catch rates by fleet segment and gear proposed by the SCRS and adopted by the Commission in 2009. Those parameters should be reviewed by the SCRS no later than 2022 and each time that a stock assessment for eastern Atlantic and Mediterranean bluefin tuna is performed, including specific rates for gear type and fishing area.*

The SCRS responded last year to this question on the review and update of catch rates of fleets targeting eastern bluefin tuna by main fishing gear and vessel size category. The analysis conducted by the Secretariat (Ortiz *et al.,* 2021) was based on a wealth of information consisting of weekly/monthly BFT catch reports, Bluefin Catch Documentation (BCD), the Regional Observer Program (ROP) and the eastern bluefin VMS database. Of the 3,000 registered vessels, a small fraction (~12%) accounts for approximately 86% of the catch. This "core" fleet is composed of vessels with a minimum annual catch and at least 4 years of reported bluefin tuna catch and represents a constant and active fleet which allows providing reliable estimates of nominal catch rates (CPUE, tons per day fished) by vessel and gear category and whether participating in a joint fishing operation or not (in the case of purse seine gear).

If the Commission intends to use the new CPUE to calculate fishing capacity, it will be necessary to also have an estimate of "potential fishing activity" in addition to the number of registered vessels, since CPUE rates represent an average catch (t) of bluefin tuna by fishing activity (hours, days fished, trip, etc.) and not by year. Given current regulations, including seasonal closure/opening, quota allocation by CPC/vessel and the type of fishing operation (JFO) that catches the majority of bluefin tuna each year, an analysis of fishing effort should be conducted to estimate some equivalent unit of "possible number of days (trips)" by gear and vessel category that may operate during a calendar year. Therefore, multiplying this possible number of days by the average CPUE per day would provide a more consistent and robust "annual probable yield" estimate.

Due to the workload this year, the Bluefin Tuna Species Group has not been able to define an estimate of "potential fishing activity". In addition, it would be important for this definition to have the analysis of the catch rates of the fleets of each CPC. Unfortunately, only the analysis of one CPC (Nøttestad *et al.,* 2020) and one type of fleet has been provided to the Secretariat and the SCRS in the last two years. The SCRS invites CPCs to conduct catch rate analyses of their fleets to contrast the results with the ongoing research study.

17.16 Based on the result of the trials and other scientific information available, the SCRS shall review and update the growth table published in 2009. Rec. 21-08, para 27

Background: *The SCRS, on the basis of a standardized protocol to be established by the SCRS for the monitoring of recognizable individual fish, shall undertake trials to identify growth rates including in weight and size gains during the fattening period. Based on the result of the trials and other scientific information available, the SCRS shall review and update the growth table published in 2009, and the growth rates utilized for farming the fish referred to under paragraph 34 (c), and present those results to the 2022 annual meeting of the Commission. In updating the growth table, the SCRS should invite independent scientists who have appropriate expertise to review the analysis. The SCRS shall also consider the difference among geographic areas (including Atlantic and Mediterranean) in updating the table. Farm CPCs shall ensure that the scientists tasked by the SCRS for the trials can have access to and, as required by the protocol, assistance to carry out the trials. Farm CPCs shall endeavor to ensure that the growth rates derived from the eBCDs are coherent with the growth rates published by the SCRS. If significant discrepancies are found between the SCRS tables and growth rates observed, that information should be sent to the SCRS for analysis.*

The farm growth rates were estimated based on the in-situ tagging experiments performed in commercial farms and ROP cage harvest data, and cross-checked with data from modal progression analysis (Alemany *et al.,* 2021a). These growth rates, which differ from wild growth rates, were used to develop a farm growth model through modifications from the accepted wild growth von Bertalanffy model (Cort*.,* 1991) of E-BFT and to estimate size at caging. The model assumed a 45-day transition period from initial caging to adjust from the wild growth to the farm growth rates, associated with stress of transfer and adjusting to farm conditions.

Then, weight at harvest from the farm cages was modeled as a function of the time spent in farm, the initial size at caging, and other factors that may account for the differences among farms that are likely associated with local husbandry, biotic and environmental conditions. The only statistical difference found was for small fish (< 100 SFL cm) in the farms of the Adriatic Sea (Ortiz *et al.,* 2022). Days at farm was initially included as a continuous variable; however, analyses indicated that there are seasonal effects on growth, and it is not linear all year around, with higher rates in the spring-summer months, and lower growth rate in the winter.

Although the area, month of harvest, year and month of catch were statistically significant, their influence on the predictions were minor, and for the purpose of producing a table of expected weight at harvest, it was decided to use only size at catch and days at farm, including the flag/farm as a random factor, which will likely incorporate some of the area, and local biotic and husbandry effects.

The model considered for the 1st year at farm monthly time steps, for the 2nd and 3rd year time steps were 3-month time step, due to low number of observations.

Table 17.16.1 shows the updated growth matrix table of the expected mean weight at harvest of farmed bluefin tuna as a function of size at caging (rows) and time in farms (months after caging) with the values in parenthesis corresponding to the estimated upper 95% confidence interval. Empty cells imply insufficient data for the model to compute expected mean weight.

This is the best available estimate at this time and the SCRS suggests using this table to estimate farm growth. This table may be updated in the future as new information becomes available and as the methodology for estimating growth (e.g. using AI, acoustic methods) advances.

Table 17.16.1. Updated matrix table of the expected mean weight at harvest (kg) of farmed bluefin tuna as a function of size at caging (rows) and time in farms (columns, month after caging). The 1st year estimates are for each month, for the 2nd and 3rd year the estimates are for 3-month period, where the value indicated correspond to the mid-month. The values in parenthesis correspond to the estimated upper 95% confidence interval (CI).

				Predicted wgt (kg) at harvest (95% upp CI) by month at farm																			
			Month at farm																				
Grp size	Start age	Size 10 bin	Wgt at cag	1	2	3	4	5	6	7	8	9	10	11	12	14	17	20	23	26	29	32	35
small	1.9	70	7			12 (32)	23 (44)	28 (50)	29 (52)	34 (56)	36 (58)	38 (60)	29 (50)	29 (50)	44 (66)	43 (65)	49 (72)	50 (73)	51 (73)	56 (79)		72 (95)	
small	2.4	80	10			19 (39)	29 (51)	35 (57)	36 (58)	40 (63)	42 (65)	44 (67)	35 (57)	36 (56)	51 (73)	50 (71)	55 (78)	57 (79)	58 (80)	63 (85)	76 (98)	79 (101)	79 (101)
small	2.8	90	14		11 (31)	29 (49)	39 (61)	45 (67)	46 (68)	50 (73)	52 (75)	54 (77)	45 (67)	46 (67)	61 (83)	60 (82)	66 (88)	67 (89)	68 (90)	73 (95)	86 (109)	89 (111)	89 (111)
medium	3.3	100	19		13 (60)	30 (79)	43 (92)	50 (99)	52 (101)	53 (102)	54 (103)	60 (110)	62 (111)	73 (122)	86 (135)	68 (117)	80 (130)	90 (139)	92 (140)	114 (162)	122 (171)		132 (180)
medium	3.8	110	25		24 (71)	41 (90)	54 (104)	61 (110)	63 (112)	64 (113)	65 (114)	71 (121)	73 (122)	84 (133)	97 (146)	79 (128)	91 (141)	101 (150)	103 (151)		133 (182)	140 (189)	143 (191)
medium	4.4	120	32	25 (69)	36 (83)	53 (102)	67 (116)	73 (123)	75 (124)	76 (126)	77 (127)	84 (133)	85 (135)	96 (145)	109 (158)	91 (141)	104 (153)	113 (162)	115 (163)	138 (185)	146 (194)	153 (202)	
medium	5.0	130	40	41 (85)	52 (99)	69 (118)	82 (132)	89 (138)	91 (140)	92 (141)	93 (143)	100 (149)	101 (150)	112 (161)	125 (174)	107 (157)	119 (169)		131 (179)	153 (201)	162 (210)	169 (217)	171 (219)
medium	5.6	140	50	59 (103)	70 (117)	87 (136)	100 (150)	107 (156)	109 (158)	110 (159)	111 (161)	118 (167)	119 (168)	130 (179)	143 (192)	125 (175)	137 (187)	147 (196)	149 (197)	171 (219)		187 (235)	189 (237)
medium	6.2	150	61	81 (124)	92 (139)	109 (158)	122 (172)	129 (178)	131 (180)	132 (181)	133 (182)	139 (189)	141 (190)	152 (201)		147 (197)	159 (209)	169 (218)	171 (219)	193 (241)	201 (250)		211 (259)
medium	6.9	160	74	106 (150)	117 (164)	134 (183)	147 (197)	154 (203)	156 (205)	157 (206)	158 (208)	165 (214)	166 (215)	177 (226)	190 (239)		185 (234)	194 (243)		218 (266)	227 (275)	234 (282)	236 (284)
medium	7.6	170	88	131 (175)	142 (189)	159 (208)		179 (229)	181 (231)	182 (232)	184 (233)	190 (239)	191 (241)	202 (252)	215 (264)	198 (247)	210 (259)	219 (268)	221 (269)	244 (292)	252 (301)	259 (308)	
large	8.4	180	104	118 (198)	142 (224)	175 (257)	196 (277)	205 (286)	207 (289)	206 (288)	206 (288)	216 (297)	216 (298)	238 (319)	239 (320)	225 (306)	239 (321)	249 (331)	267 (346)		274 (354)	279 (359)	299 (378)
large	9.2	190	121	145 (225)	170 (251)	203 (284)	223 (305)	232 (314)	234 (316)	234 (315)	234 (315)	243 (325)	244 (325)	265 (346)	266 (348)	252 (334)		277 (358)	294 (374)	282 (361)		306 (387)	326 (405)
large	10.1	200	141	175 (255)	200 (281)	233 (314)	253 (334)		264 (346)	264 (345)	263 (345)	273 (355)	273 (355)	295 (376)	296 (377)	282 (364)	296 (378)		324 (404)	312 (391)	331 (411)		
large	11.1	210	162	207 (287)	231 (313)	265 (346)	285 (366)	294 (376)		295 (377)	295 (377)	305 (386)	305 (387)	327 (408)	328 (409)	314 (395)	328 (410)	338 (420)		344 (423)	363 (443)	368 (448)	388 (467)
large	12.2	220	186	240 (320)	264 (345)	297 (379)	317 (399)	326 (408)	329 (411)			337 (419)	338 (419)	359 (441)	361 (442)	346 (428)	361 (442)	371 (452)	389 (468)		395 (475)	401 (481)	420 (499)
large	13.4	230	211	272 (352)	296 (377)	330 (411)	350 (431)	359 (440)	361 (443)	360 (442)	360 (442)				393 (474)	379 (460)	393 (475)	403 (485)	421 (500)	409 (488)			453 (532)
large	14.8	240	239	304 (384)		362 (443)	382 (464)	391 (473)	394 (475)	393 (474)	393 (474)	402 (484)	403 (484)	424 (505)				436 (517)	453 (533)	441 (520)	460 (540)	465 (546)	
large	16.3	250	269	330 (409)	355 (434)	388 (468)	408 (488)	417 (497)	420 (500)	419 (499)	419 (499)	428 (508)	429 (509)	450 (530)	451 (531)	437 (517)	451 (531)			467 (545)	486 (565)	491 (570)	511 (589)

17.17 The SCRS to advise to what extent the fishing seasons for different gear types and/or fishing areas might be extended and/or modified. Rec. 21-08, para 32

Background: *Not later than 2022, the Commission shall decide to what extent the fishing seasons for different gear types and/or fishing areas might be extended and/or modified based on the SCRS advice without negatively influencing the stock development and by ensuring the stock is managed sustainably.*

As indicated in the response to this request in 2021, the Committee has not received new information. The Committee has no scientific basis for recommending any particular fishing season configuration at this time. In addition, the Committee has never provided advice on the appropriate length or timing of fishing seasons in relation to stock development, and the length of the current fishing seasons was determined without input from the Committee.

As indicated in 2020 and 2021, this request is broad in scope, considering fleet diversity, spatial coverage and seasonality. The Committee requests more detail on the issues to be addressed in order to conduct proper data compilation and analysis. Assuming the Commission provides clarification to the SCRS in 2022, a response could be available by 2023.

17.18 The SCRS shall report on the coverage level achieved by each CPC and provide any recommendations to improve the effectiveness of CPCs' observer programmes. Rec. 21-08, para 99

Background: *For the scientific aspects of the programme, the SCRS shall report on the coverage level achieved by each CPC and provide a summary of the data collected and any relevant findings associated with those data. The SCRS shall also provide any recommendations to improve the effectiveness of CPCs' observer programmes.*

The Committee cannot respond to the observer coverage request this year due the lack of available/appropriate data. The SCRS reminds the Commission that Rec. 21-08 paragraph 98 states that the requirements and procedures required to undertake this analysis are to be developed by the Commission by 2023 taking into account CPC confidentiality requirements. In addition, paragraph 95 specifies a set of observer coverage rates that apply to implementing this Recommendation, thus it would be beneficial to define how these coverage levels are to be calculated so that potential problems with inconsistencies in defining coverage levels for different CPCs can be avoided. The SCRS looks forward to understanding what these requirements and procedures are so that it may design a data collection form and to subsequently provide recommendations on how to improve the effectiveness of CPC's observer programmes (specified in paragraph 99).

17.19 The SCRS should evaluate procedures and results related to the stereoscopic camera programme (or alternative methods) provided by CPCs and report to the Commission at the next annual meeting. Rec. 21-08, para 173

Background: *Each farm CPC competent authority shall submit the procedures and results related to the stereoscopic camera programme (or alternative methods) to the SCRS by 31 October annually. The SCRS should evaluate such procedures and results and report to the Commission at the next annual meeting.*

The procedure for the use of stereoscopic camera systems is well detailed in ICCAT Rec. 21-08, Annex 9, para 1. This procedure has not changed since the first application of this methodology as presented in ICCAT Rec. 14-04, Annex 9. Since the initiation of the use of the stereo camera, the Recommendations have required that the reports should be submitted with a specified list of information, but there is no requirement for stereo camera footage to be sent.

The SCRS has concerns whether the 20% minimum requirement (Rec. 21-08) for SFL sampling intensity is sufficient or even necessary to have a representative sample of the fish in the cage population in certain situations, such as low/high size homogeneity of the fish being caged. Since the stereo camera footage available to the SCRS is limited and rarely corresponds to the full footage made by transfer operation, the Committee has not been able to assess this issue. Therefore, the SCRS recommends that CPCs provide the entire stereo camera footage done by each transfer operation to the Secretariat, so that the SCRS can take a random sample to be analysed to study this issue at different regions.

The SCRS will continue to investigate the use of AI technology as a means of making the counting and size/weight determination of caged fish more accurately and less labour intensive and costly, namely through the use of recently developed high-tech automatic systems (e.g. Abid *et al.,* 2022).

17.20 The SCRS should develop an algorithm to convert length into weight for fattened and/or farmed fish. Rec. 21-08, para 217

Background: *The caging of the bluefin tuna at the farm of destination shall be subject to the requirements for caging operations laid down in paragraphs 156 to 171, including a video record to confirm the number and weight of the bluefin tuna caged and the verification of the operation by an ICCAT Regional Observer. The determination of the weight for caged fish from another farm, shall not apply until the SCRS has developed an algorithm to convert length into weight for fattened and/or farmed fish.*

This request refers to a requirement following an inter-farm transfer which could happen prior to or after harvesting of fish from the cage has taken place. The solution cannot be found by estimating a generic L-W relationship from fish harvested on the farms, as doing so would ignore the gain in weight and size as a function of time at the particular farm and depending on the initial size of the fish at caging.

This request is addressed with the updated growth table for E-BFT as a function of the initial size of the fish at caging and the time spent on the farm (see item 17.16). In addition, we note that the analyses of the eastern Atlantic and Mediterranean bluefin tuna farm growth using the extensive ROP harvest database have shown no statistically significant differences between farms in the Mediterranean or East Atlantic, except for the operations in the Adriatic Sea with small bluefin (< 100 cm SFL at caging) and this difference has been incorporated in the expected variance of weight-at-size of harvest of the updated farm growth table (Ortiz *et al.,* 2022).

17.21 The SCRS shall review the stereoscopic cameras systems specifications, and if necessary, provide recommendations to modify them. Rec. 21-08, Ann. 9, item vii

Background: *The report on the results of the stereoscopic program should include details on all the technical specifications above, including the sampling intensity, the way of sampling methodology, the distance from the camera, the dimensions of the transfer gate, and the algorithms (length-weight relationship). The SCRS shall review these specifications, and if necessary, provide recommendations to modify them.*

While the issue of sampling intensity is addressed in item 17.19 of the 2022 SCRS Report, due to the workload of the Bluefin Tuna Species Group, the Committee was not able to review the technological detail of the stereoscopic camera system in 2022.

17.22 Assess the occurrence of exceptional circumstances, Rec. 21-04, para 4

Background: *The SCRS shall assess the occurrence of exceptional circumstances (ECs) and the Commission shall act in accordance with the Exceptional Circumstances Protocol sets out in Annex 2.*

According to the North Atlantic albacore exceptional circumstances protocol in Rec. 21-04, two indicators are to be revised annually, one related to catch, and another one related to CPUEs.

Catch

The criteria to determine if there are exceptional circumstances is when "Total catch is above by more than 20% the TAC set using the MP". According to Task 1, North Atlantic albacore catch in 2021 was 31.374 t, and the TAC was 37,801 t (ignoring carryovers). Thus, there are no exceptional circumstances according to this indicator.

CPUE

In this indicator, exceptional circumstances would occur when the CPUEs "fall outside the 2.5% and 97.5% percentile range of values in any given year from the OMs used in the MSE when the accepted MP was tested".

The Chinese Taipei longline index was updated to 2020, the Japanese longline and the U.S. longline indices were updated to 2021, and the EU-Spain baitboat index was also updated to 2021, though lacking the 2020 data point. The normalized standardized values for these indices in 2020 and 2021, when available, are within the 2.5%-97.5% percentile of the normalized CPUE values used to run the closed-loop simulations (**Figure 17.22.1**). Thus, no exceptional circumstances were detected using this indicator.

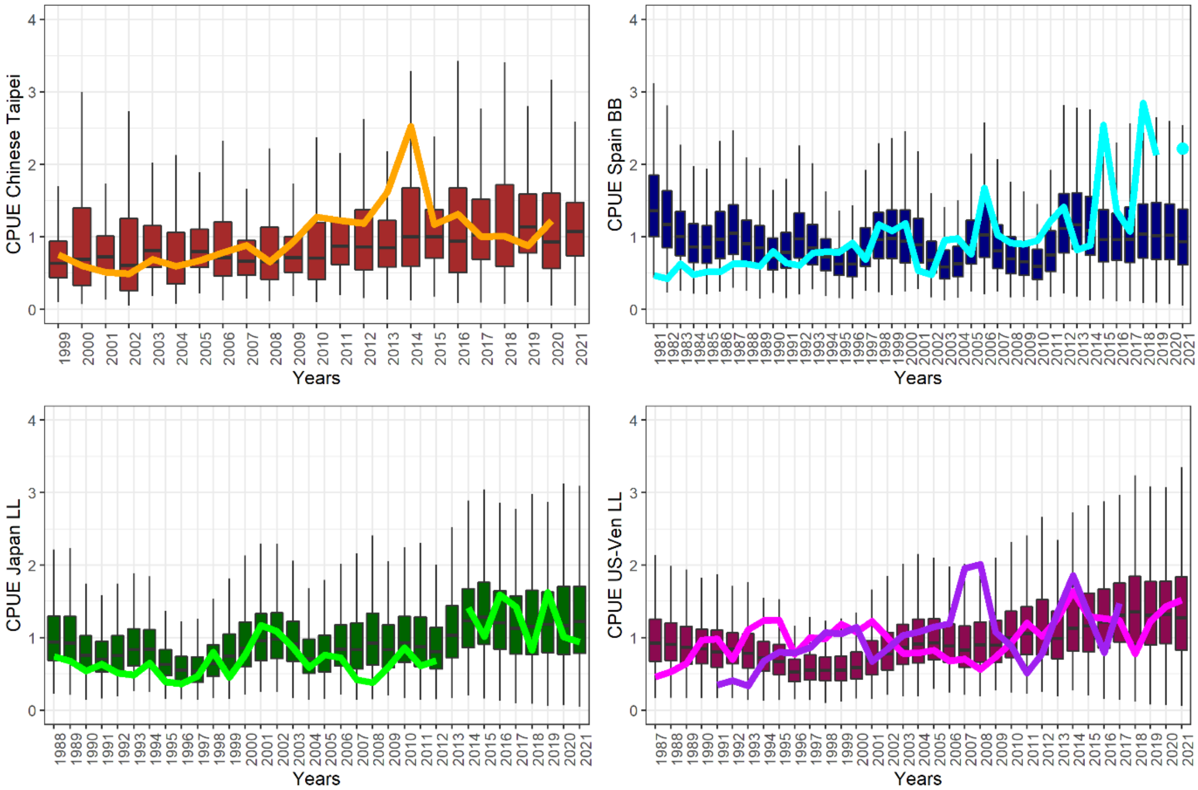


Figure 17.22.1. Updated standardized CPUE series (lines) and normalized CPUE values used in the closed-loop simulations (boxplots). Boxplots contain the 25-75% percentile range and whisks contain the 2.5-97.5% percentile range.

17.23 The SCRS should undertake the following analyses, Rec. 21-04, para 14

Background: *During 2022-2023, the SCRS should undertake the following analyses to:*

(a) test further HCRs supporting the management objectives expressed in paragraph 2 above and associated with a range of control parameters wider than those explored for this Management Procedure and namely:

$$F_{TAR} = (0.8; 0.9; 1.0) * F_{MSY}$$
$$B_{THRESH} = (0.8; 0.9; 1.0; 1.1; 1.2) * B_{MSY}$$

The remaining control parameters shall remain as indicated by this Recommendation.

The Committee evaluated the performance of the Management Procedure (MP) for North Atlantic albacore as well as the variants requested in Rec. 21-04. The management objective (to keep the stock in the green quadrant of the Kobe plot with at least 60% probability) was met for any B_{THRESH} value as long as F_{TAR} was kept at 0.8. When F_{TAR} increased to 0.9, only B_{THRESH} values at or above 1 would meet the management objective. For F_{TAR} equal to 1, none of the scenarios met the management objective (see **Table 17.23.1**).

In general, higher B_{THRESH} values are associated to better stock status and less risk, at the expense of less yield and mostly a larger variability in catch. Larger F_{TAR} values were also associated with higher yield. However, this was not always the case, and in general, percentual decreases in stock status, risk and stability were much larger than increases (if any) in yield (see **Table 17.23.1**).

b) evaluate the number of Catch per Unit of Effort (CPUE) series that need to be available and the percentage by which catch data are underreported, that would trigger an occurrence of exceptional circumstance.

Using the currently adopted MP, a test was conducted to understand the impact of using a reduced number of CPUEs. Both the pGreen (probability of being in the green quadrant of the Kobe plot) and the long-term yield statistics showed lower values compared to when the whole set of CPUE indices was used. However, results suggest that the management objective would still be achieved in the absence of one or several series of catch per unit of effort, except when the Japanese longline index was used alone (in which case pGreen=59.36%).

As for estimating the effects of underreporting, the Committee was unable to fully accomplish this task in 2022 and will provide a more complete response in 2023.

Finally, the Committee updated (with the adopted MP) the analyses on the effects of the carryover, the systematic over/under catch (banking and borrowing scenario) and the effect of applying the 25%up-20%down stability clause when $B>B_{LIM}$ (instead of when $B>B_{MSY}$ as in the adopted MP). Management objectives (pGreen>60%) were met in all cases, and scores for other performance statistics are provided in **Table 17.23.1**.

Table. 17.23.1. Estimated performance metrics for a series of alternatives to the MP adopted in Recommendation 21-04 for North Atlantic albacore. In red, scenarios that are estimated to fall short in achieving the management objective of pGreen>60%. The adopted MP is indicated with an asterisk (*). pGr(%): Probability of being in the Kobe green quadrant; PB_{INT}(%): Probability of B_{LIM}<B <B_{THRESH}; LongY(kt): Mean catch – Long term; MAP%: Mean absolute proportional change in catch.

Coordinates of HCR		Status	Safety	Catch	Stability
Bthreshold	**Ftarget**	**pGr(%)**	**pBint(%)**	**LongY(kt)**	**MAP%**
0.8	0.8	**64.68**	18.41	30.86	9.54
0.9	0.8	**67.21**	18.06	30.53	10.47
1*	**0.8***	**70.94**	**14.68**	**30.76**	**12.14**
1.1	0.8	**74.38**	11.74	31.37	15.49
1.2	0.8	**73.53**	10.65	31.2	16.47
0.8	0.9	**55.03**	22.29	31.65	10.16
0.9	0.9	**59.68**	20.35	31.53	12.51
1	0.9	**61.65**	18.03	31.2	14.2
1.1	0.9	**64.24**	16.5	31.21	20.53
1.2	0.9	**65.71**	13.53	31.37	17.07
0.8	1	**47.09**	28.35	31.79	10.75
0.9	1	**49.38**	24.65	31.54	13.39
1	1	**55.47**	22.35	31.09	16.09
1.1	1	**59.38**	18.21	31.33	18.77
1.2	1	**58.38**	18.12	30.92	24.15
Absence of CPUE					**Stability**
		pGr(%)	**pBint(%)**	**LongY(kt)**	**MAP%**
Miss 1 CPUE	Spain BB	**60.14**	22.43	30.00	15.35
	Japan LL	**62.79**	17.93	29.69	18.33
	Chinese Taipei	**67.50**	15.79	29.29	18.37
	US/Ven	**66.50**	14.36	29.69	20.03
Miss 2 CPUE	Sp/Jap	**64.29**	18.14	28.24	29.92
	Sp/ChT	**65.93**	15.79	28.47	27.94
	Sp/Ven/US	**61.14**	18.50	27.53	30.92
	Jap/ChT	**60.86**	21.29	28.07	29.66
	Jap/US/Ven	**65.86**	15.43	28.03	29.52
	ChT/US/Ven	**66.86**	17.57	27.37	41.58
Miss 3 CPUE	Spain Only	**66.93**	19.07	26.11	85.77
	Japan Only	**59.36**	18.93	25.56	128.47
	Chinese Taipei Only	**61.71**	20.64	27.20	38.50
	Ven/US Only	**68.29**	15.21	25.96	98.83
Carry Over					**Stability**
		pGr(%)	**pBint(%)**	**LongY(kt)**	**MAP%**
Carry Over	Historic	**84.62**	3.79	26.51	21.09
Bank and Borrow					**Stability**
		pGr(%)	**pBint(%)**	**LongY(kt)**	**MAP%**
Bank and Borrow	20%-20% TAC	**71.41**	13.53	29.81	37.13
Beyond Blim Stability					**Stability**
		pGr(%)	**pBint(%)**	**LongY(kt)**	**MAP%**
Beyond Blim Stability	20-25%	**65.44**	18.62	29.99	6.81

17.24 Discards in purse seine fisheries, Rec. 17-01, para 4

Background: *In 2020, the SCRS shall assess the effectiveness of this Recommendation and submit recommendations to the Commission regarding potential improvements.*

The Secretariat provided the Committee with a summary of the available information on discards of tropical tuna contained in the ICCAT databases. Two sources exist, Task 1 reports of dead discards and data on discards collected by on-board observers and reported in ST09. Discard reports are always going to be more uncertain than landing reports, as fish that are discarded are not as easily observed and recorded as fish that are kept on board and landed. There are many discrepancies between data on discards reported in Task 1 and observer data reported in ST09 (form to report the Domestic Observer Programs data by CPCs) and many possible explanations for them. Comparison of these two sources is complicated by the fact that reports in Task 1 are on weight and those on ST09 are on numbers and there is commonly no information on the size of fish discarded. Observers may only be able to record an incomplete estimate of the total discards, even in cases where there is 100% observer coverage for a given fleet. Some CPC may be using ST09 to provide data on "faux poisson". ST09 should not contain data on "faux poisson" as these fish are landed and should only contain data on discarded fish.

In theory, Task 1 reports should represent the same weight of discards than observer reports or higher, but never lower. The committee recommends that each CPC should make sure the two sources of data are consistent. Data in ST09 should provide observations of discards as recorded by the observer and Task 1 discard data should raise such observations to the total operations of each fleet. The Committee notes that observer data and Task 1 report on discards are likely to be reliable only for the most recent period. Discard reports from purse seine are likely to be more reliable since 100% coverage for the PS began.

17.25 Fishing prohibited with FADs, Rec. 21-01, para 28

Background: *1 January to 13 March 2022, throughout the Convention area. This should be reviewed and, if necessary, revised based on advice by the SCRS taking into account monthly trends in free school and FAD-associated catches and the monthly variability in the proportion of juvenile tuna in catches. The SCRS should provide this advice to the Commission in 2022.*

In 2021 the Committee noted that reporting of historical FOB/FAD set data is mandatory as per Rec. 21-01. The historical data on the number of sets conducted on FOB remains incomplete.

The Committee investigated the monthly pattern of purse seine catch based on the data available at the Secretariat for the period 1991-2020. Data considered were the monthly catches by fishing mode from the ICCAT Task 2 database and the catch at size estimated for the most recent assessment of each of the three tropical tuna species. The analysis separated the data into six periods, a reference period from 1991-1999, and five different FAD closure periods. The first four closure period represents different partial spatial closures and the last period a full closure (**Table 17.25.1**). Juveniles of YFT and BET were defined as fish of a size smaller than the size of a 3-year-old (the age when 50% of fish are mature).

Table 17.25.1. FAD closure periods and reference years used in the analysis.

Period	*Reference*	*Closure B*	*Closure C*	*Closure D*	*Closure E*	*Closure F*
Recommendation	N/A	Rec. 99-01	Rec. 04-01 Rec. 08-01	Rec. 11-01 Rec. 14-01	Rec. 15-01 Rec. 16-01	Rec. 19-02
Years implemented	N/A	2000-2004	2005-2011	2012-2015	2016-2019	2020-2021

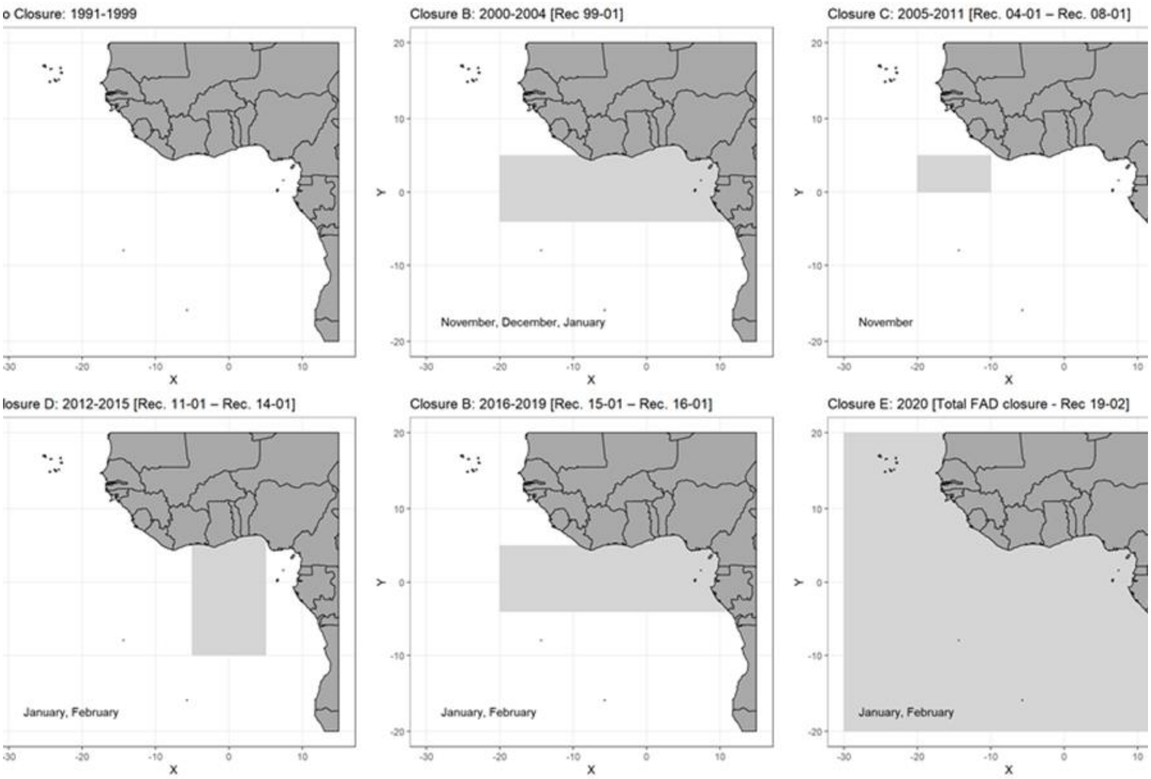


Figure 17.25.1. Summary of the FAD closures implemented in the tropical tuna fisheries. Each box represents the years and the geographical area (shade marine areas) of implementation[1].

The proportion of juvenile tuna caught in purse seine sets for the period of 2010-2020 shows quarterly variation for yellowfin in all types of sets and bigeye caught in free school sets but not for bigeye tuna caught in FOB sets (**Table 17.25.2**). Furthermore, the proportion of juvenile yellowfin caught in free school sets is always low (<5.0 %).

Table 17.25.2. Proportion of the species catch in weight that were juveniles, by quarter for bigeye and yellowfin tuna caught in free school (FSC) and FOB sets for the period 2010-2020. Values represent the percent of the catch (in weight) for each species catch and, in each quarter, (e.g. in quarter 1 the catch of juvenile BET comprise 83.5% of the total BET catch on FOB). Percentages were calculated from the catch at size data used in the latest assessment by considering that juveniles were fish of a size smaller than the size of a 3-year-old (the age when 50% of fish are mature).

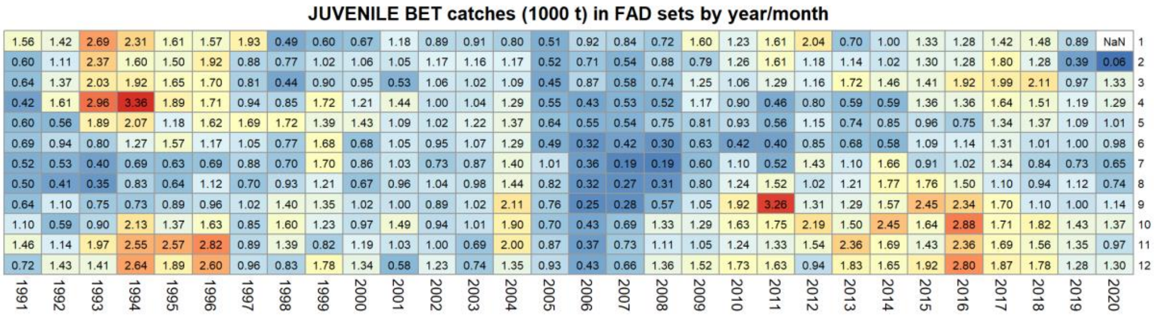
Fishing mode/ species	*Quarter 1*	*Quarter 2*	*Quarter 3*	*Quarter 4*
BET FOB	83.5	82.9	82.1	84.4
YFT FOB	62.7	65.6	67.5	71.0
BET FSC	15.2	16.4	18.2	22.0
YFT FSC	1.6	2.3	3.2	4.9

The monthly catch of juveniles on FOB sets estimated from the catch at size shows variation across years and months for both bigeye tuna and yellowfin tuna. Catches of bigeye tuna juveniles are greater in the first and fourth quarter and the annual pattern shows high variability between years. Catches of juvenile yellowfin are greater in the fourth quarter (**Figure 17.25.2**).

[1] For the sake of simplicity, the reference period (upper-left figure) does not show the voluntary moratorium implemented only by the European purse seiners in the 1997-1998 period (same strata as the first ICCAT moratorium).

The relative importance of the catch of juveniles of BET and YFT in the fishery that targets SKJ was estimated with an index developed as the ratios of the catch of juveniles YFT or BET divided by the catch of SKJ. This index shows a decreasing trend for bigeye tuna from 1990-2020 but not for yellowfin tuna (**Figure 17.25.3**). The lowest index for bigeye juveniles were reported for 2020, the year where there was a full closure of the FAD fishery during January and February. The index of juvenile yellowfin tuna in 2020, however, was within the range seen in previous periods.

It should be noted that the reference period 1991-1999 was defined to have sufficient number of years for comparison with later closure periods. This reference period, however, includes a few years when some fleets voluntarily ceased FAD operations during a short period in a designated area. The dynamics of the fleets and status of stocks during the reference period, however, are not necessarily comparable with the most current situation. Therefore, these results should be taken with caution.



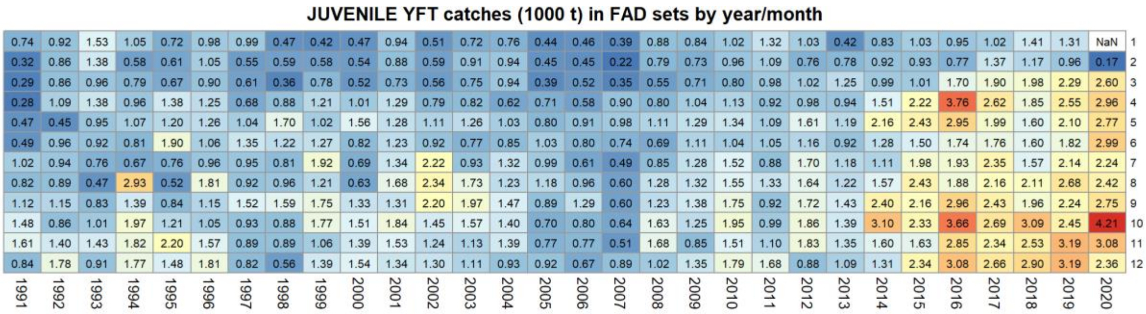


Figure 17.25.2. Catch (tons) of juvenile bigeye and yellowfin tuna caught in FOB sets by year and month for the period 1991-2020. Juvenile BET and YFT were considered to be fish of a size smaller than the size of a 3-year-old (the age when 50% of fish are mature).

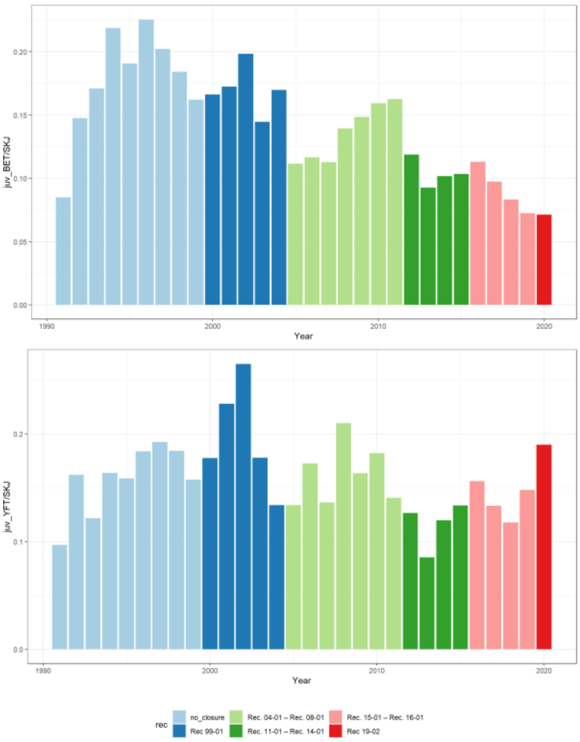


Figure 17.25.3. Index of relative importance of juvenile catch of yellowfin tuna and bigeye tuna (catch of juveniles YFT or BET /catch SKJ) during the different FAD closure periods. Juvenile BET and YFT were considered to be fish of a size smaller than the size of a 3-year-old (the age when 50% of fish are mature).

17.26 The SCRS to inform on CPCs that have provided by 31 July 2022 the required historical FAD set data. Rec. 21-01, para 31

Background: *With a view to establishing FAD set limits to keep the catches of juvenile tropical tunas at sustainable levels, in 2022 the SCRS should inform the Commission about the maximum number of FAD sets which should be established per vessel or per CPC. To support this analysis, CPCs with purse seine vessels shall urgently undertake to report to the SCRS by 31 July 2022 the required historical FAD set data. CPCs that do not report these data in accordance with this paragraph shall be prohibited from setting on FADs until such data have been received by the SCRS.*

In 2021 the Committee provided a summary of the challenges faced by the Committee to provide an answer to this request. The Committee was unable to resolve these challenges this year. In summary, there has not been any improvements in the information available to the Committee to provide advice on the maximum number of FAD sets per vessel as requested by the Commission.

17.27 The SCRS to inform on CPCs that have provided by 31 July 2022 the required historical FAD set data. Rec. 21-01, para 33

Background: *Further analysis shall be conducted by the SCRS on the impact of support vessels on the catches of juvenile yellowfin and bigeye tuna to be considered in 2022.*

The Committee provided a partial response to this request in 2021. The Committee provides some additional information on support vessels in Restrepo *et al.* (2022), by comparing the list of support vessels in the ISSF ProActive Vessel Register and the ICCAT record but was unable to determine which support vessels were active. The Committee is unable to provide a more final response to this request from the Commission.

17.28 The SCRS shall refine the MSE process in line with the SCRS roadmap and continue testing the candidate management procedures. Rec. 21-01, para 62

Background: *The SCRS shall refine the MSE process in line with the SCRS roadmap and continue testing the candidate management procedures. On this basis, the Commission shall review the candidate management procedures, including pre-agreed management actions to be taken under various stock conditions. These shall take into account the differential impacts of fishing operations (e.g. purse seine, longline and baitboat) on juvenile mortality and the yield at MSY.*

The Committee proposed a few changes to Tropical Tunas MSE roadmap, that are included under section 13.4 on this report.

17.29 Efficacy that full fishery closures along the lines of those proposed in "Draft recommendation by ICCAT to replace Recommendation 16-01 by ICCAT on a multi-annual conservation and management programme for tropical tunas" (PA1_505A/2019), Rec. 21-01, para 66a

Background: *Actions required from the SCRS and the Secretariat:*

a) The SCRS shall explore the efficacy that full fishery closures along the lines of those proposed in PA1-505A/2019 might have to reduce the catches of tropical tunas to the agreed levels; and the potential of such scheme to reduce the catches of juvenile bigeye and yellowfin tunas, in line with recommendations from the SCRS.

The Committee reviewed the work previously done on the evaluation of full fishery closures by Sharma and Herrera (2019) and Herrera *et al*. (2020). Such work proposed a method to evaluate full fishery closures as an alternative management tool for managing tropical tuna stocks rather than the current method based on individual stock TACs.

At present, the tool of Sharma and Herrera (2019) that estimates the length of the closure uses estimates of biomass for the species that is the focus of management, from the latest assessment (the one in the poorest condition), and a target catch level for that stock allowing, at the same time, to set caps in the catch of other stocks.

At the time the work was completed the authors made appropriate assumptions about dynamics of the tropical tuna stocks. The calculations made by these authors, however, did not have the benefit of the results of the 2022 E-SKJ and 2021 bigeye assessments which provides reference points, stock status and biomass estimates for such stocks. The authors acknowledged such limitation and recognised that their tool can be adapted as required when new estimates of biomass based on the latest assessment are updated.

The Group examined the assumptions made by the authors and concluded the following:

- We currently have data for a longer period than that used in the analysis. Catch and effort information is now available for 2003-2021 rather than 2003-2017;

- Biomass estimates for bigeye tuna are now available up to 2019 rather than up to 2017. Trends in biomass for the decade of 2010-2019 is more optimistic than the trend available after the 2018 bigeye assessment;

- The most recent assessments of skipjack and yellowfin have slightly changed the assumptions about the size of 50% maturity that were used by Sharma and Herrera (2019).

	SKJ	*BET*	*YFT*
Sharma & Herrera 2019	45 cm	100 cm	108.6 cm
Latest assessment (year)	42 cm (2022)	100 cm (2021)	115 cm (2020)

- Recent analysis have continued to highlight the influence of spatial closures and access agreements to the EEZ of coastal countries on the relationship between the catch of tropical tunas and the effort of the purse seine fishery. This suggests that the predictions of the catch of tropical tunas obtained from total purse seine effort will be associated with considerable uncertainty as long as operations of the fishery respond to changes in access rights and or to changes in the spatial distribution of the stocks. It is therefore essential that any evaluation of total effort closures is accompanied by estimates of the uncertainty of the prediction that account for such potential changes in fleet distribution.

The Committee also recommends that the tropical tuna multi-stock MSE considers Candidate Management Procedures that include effort controls for the purse fishery.

17.30 Estimate of capacity in the Convention area, to include at least all the fishing units that are large-scale or operate outside the EEZ of the CPC they are registered in, Rec. 19-02, para 66b

Background: *Actions required from the SCRS and the Secretariat:*

b) The ICCAT Secretariat shall work with the SCRS in preparing an estimate of capacity in the Convention area, to include at least all the fishing units that are large-scale or operate outside the EEZ of the CPC they are registered in. All CPCs shall cooperate with this work, providing estimates of the number of fishing units fishing for tuna and tuna-like species under their flag, and the species or species groups each fishing unit targets (e.g. tropical tunas, temperate tunas, swordfish, other billfish, small tunas, sharks, etc.); this work shall be presented to the next meeting of the SCRS in 2020 and forwarded to the Commission for consideration;

In 2022, the Committee considered two documents that included capacity estimates for large-scale purse seine fisheries. These vessels should be considered as potential capacity although they may not have been actively targeting tropical tunas. Floch *et al.* (2022) described the statistics of the French purse seine fleets targeting tropical tunas in the Atlantic Ocean and Restrepo *et al.* (2022) included estimates of the current fishing capacity of all large-scale purse seiners (defined as vessels with ≥335 m3 of fish hold-volume) targeting tropical tunas in the Atlantic, using a combination of data sources including the ICCAT authorized vessel records, ISSF records on purse seiners, AIS data and direct enquiries with some vessel owners. Based on Restrepo *et al.* (2022), the Committee estimates that at least 67 - and possibly 72 - large-scale purse seiners were operating in the Convention area as of the first half of 2022 (**Table 17.30.1**). The combined Fish Hold Volume (FHV) of the 72 vessels was 99,326 m^3, which is equivalent to about 77,363 t of fish carrying capacity. In 2021, purse seiners caught 317,426 t of tropical tunas in the Atlantic (Task1NC data distributed at the 2022 SCRS). Therefore, if the 72 vessels made fishing trips that completely filled their wells, they would need to make an average of 4.1 trips per vessel in a year. Given that large-scale purse seiners may make 5-8 trips a year, this suggests that the current capacity is higher than necessary to meet current catch recommendations. The 2022 capacity estimate (67-72 PSs) is similar to the estimate of capacity made by the Committee in in 2020 (68-72 vessels) and lower than the capacity estimate in 2021 (74-80), indicating that at least some vessels moved out of the ICCAT area during the last year. The Committee notes that these estimates are intended to measure active capacity, not potential capacity. In 2022, there were 99 large-scale purse seiners authorized to fish for tropical tunas in the ICCAT Convention area, these vessels should be considered as potential capacity.

ICCAT Secretariat informed that CPCs shall submit the number and name of vessels operating in a particular year, including information of the fishery and target species, as part of Task 1 Fleet characteristics information (i.e., ST01-T1FC form). This information is available at the Secretariat database since 2015, however, the Secretariat informed that this information might be incomplete. Thus, the Group requested to compare the information available at the Secretariat for large-scale purse seiners with the estimate from Restrepo *et al.* (2022), which could inform the completeness of the active fleet statistics available at the Secretariat to answer this question in relation to PS but also other gears.

When the Committee made this comparison for 2020 and 2021, and only for large scale purse seine vessels, it showed that the number of purse seiners reported as active in the ICCAT database is higher (4 more vessels in both years 2020 and 2021) than the higher range in Restrepo *et al.* (2022). This is mostly explained by double-counting of vessels reflagged that year, including vessels recently sunk/scrapped or that are inactive, and/or including smaller vessels (**Table 17.30.2**). Few vessels identified by Restrepo *et al.* (2022) operating in the ICCAT region are not included in the ICCAT active fleet database. To cross-check both databases, the name of the vessels or ICCAT serial number was used. This makes the comparison challenging. It is therefore recommended that ICCAT adds the requirement to provide the vessel IMO # in the ST01-T1FC form. Although the comparison should be considered preliminary and taken with caution, it shows that the number of large-scale purse seiner vessels operating in ICCAT estimated from both databases are comparable and, therefore, the ICCAT database of active fleets operating in a particular year could be used also to estimate active capacity of other gears such as longline and pole and line. The Group recommends that the ICCAT Secretariat prepares this information to respond to this Commission request in 2023.

The Committee wants to highlight to the Commission that there is a need to agree on a set of definitions and indicators of fishing capacity for the tropical tuna fleets which are useful to both the Commission and the Committee. The Committee favours indicators based on fish-hold volume metrics to minimize the influence of different crew operations. In developing indicators of active capacity, it will also be necessary to consider the effects of spatial-temporal changes in fishing activity due to fishing access agreements between ICCAT CPCs, as well as ICCAT Recommendations, given that both can influence and constrain fishing activity. Additionally, movement of fishing vessels from one RFMO Convention area to another complicates regional and global estimates of active fishing capacity. It would therefore be useful if tRFMOs joined forces towards the common challenge of managing global fishing capacity.

The Committee can only presently report on capacity estimates of large-scale purse-seine vessels (defined as vessels with ≥335 m^3 of fish hold-volume). The Committee intends to evaluate the capacity and number of other fleet components (e.g. support vessels, BB, LL) in the future.

Table 17.30.1. Estimated number of large-scale purse seiners operating in the Atlantic Ocean from 2014 to 2018 (left; Table 2 of the 2019 SKJ Executive Summary in the *Report for Biennial Period 2018-2019, Part II (2019), Vol. 2*) and minimum and maximum numbers estimated for 2020 (Restrepo *et al.*, 2020), 2021 (Restrepo *et al.*, 2021), and 2022 (Restrepo *et al.*, 2022).

	SCRS 2019					***SCRS 2020***		***SCRS 2021***		***SCRS 2022***	
FLAG	***2014***	***2015***	***2016***	***2017***	***2018***	***2020 (Min)***	***2020 (Max)***	***2021 (Min)***	***2021 (Max)***	***2022 (Min)***	***2022 (Max)***
Neth. Antilles	2										
Belize	3	2	2	3	2	8	8	8	8	8	8
Brazil						0	1	0	1	0	0
Cabo Verde	3	4	2	1	1	1	1	1	1	0	0
Curaçao		4	5	5	5	4	4	4	4	2	2
Côte d' Ivoire	1	0	0	0	0	0	0	0	0	0	0
El Salvador	0	2	4	4	4	4	4	3	3	3	3
Morocco						1	1	3	4	3	4
EU Spain	15	12	10	10	10	10	10	11	11	10	10
EU France	9	9	11	10	10	9	9	10	10	10	10
Ghana	12	12	13	13	15	16	16	16	17	16	17
Guatemala	2	2	2	2	2	2	2	2	2	2	2
Liberia						2	2	2	2	0	0
Panama	2	3	2	2	2	3	6	5	6	4	6
Senegal	0	3	4	5	7	7	7	7	7	7	7
Venezuela						1	1	2	4	2	3
TOTAL	**49**	**53**	**55**	**55**	**58**	**68**	**72**	**74**	**80**	**67**	**72**

Table 17.30.2 Comparison between the estimates of the number of purse seine vessels (SCRS columns, indicating the minimum and maximum estimate) versus the reported list of registered Tropical Tuna Authorized vessel list (Task 1 FC) in the ICCAT database (ICCAT columns) by CPC for 2020 and 2021. The question mark (?) indicates registered authorized vessels but for which no information was available to determine if they were fishing actively for tropical tunas in that year.

FLAG	Restrepo *et al.* (2020)	***ICCAT 2020***	***Notes***	Restrepo *et al.* (2021)	***ICCAT 2021***	***Notes***
BLZ	8-8	8		8-8	8	includes 3 small-scale
BRA	0-1	3		0-1	3	
CPV	1-1	0		1-1	1	double-counted in CUW
CUW	4-4	5	includes 1 sunk in 2020	4-4	5	
EU.ESP	10-10	10		11-11	11	
EU.FRA	9-9	9		10-10	10	
GHA	16-16	17	includes 1 inactive (?)	16-17	16	
GTM	2-2	2		2-2	2	
LBR	2-2	2		2-2	2	
MAR	1-1	0		3-4	5	
PAN	3-6	6		5-6	6	includes 1 scrapped in 2019
SEN	7-7	7		7-7	7	
SLV	4-4	4		3-3	4	includes 1 moved to IATTC that year
VEN	1-1	3	includes 2 inactive (?)	2-4	3	includes 1 inactive (?)
Total	**68-72**	**76**	**Does not include 1 vessel identified in** Restrepo *et al.* (2020)	**74-80**	**84**	**Does not include 3-4 vessels identified in** Restrepo *et al.* (2021)

17.31 The SCRS and the Secretariat shall prepare TORs to carry out an evaluation of the monitoring, control and surveillance mechanisms in place in ICCAT CPCs. Rec. 21-01, para 66c

Background: *Actions required from the SCRS and the Secretariat:*

c) The ICCAT Secretariat shall identify a Consultant to carry out an evaluation of the monitoring, control and surveillance mechanisms in place in ICCAT CPCs. This work shall primarily focus on the evaluation of data collection and processing systems in each CPC, and the ability to produce estimates of catch and effort, and length frequency for all stocks under ICCAT management, with a focus on stocks for which input and/or output measures are in place; in preparing this work the Consultant shall evaluate how efficient the catch monitoring systems that each CPC has implemented are to achieve robust estimates of catches for the stocks subject to a TAC; the ICCAT Secretariat shall work with SCRS scientists to prepare a TOR for this work as soon as possible.

The Committee agreed that a Sub-group of experts on tropical tuna fisheries work together through online correspondence with the Secretariat to develop the specific TORs for a consultant to carry out a technical evaluation to respond to this request.

17.32 The SCRS shall review these data (catch, catch at size, location and month of capture) annually. Rec. 17-02, para 8

Background: *All CPCs catching swordfish in the North Atlantic shall endeavor to provide annually the best available data to the SCRS, including catch, catch at size, location and month of capture on the smallest scale possible, as determined by the SCRS. The data submitted shall be for broadest range of age classes possible, consistent with minimum size restrictions, and by sex when possible. The data shall also include discards (both dead and alive) and effort statistics, even when no analytical stock assessment is scheduled. The SCRS shall review these data annually.*

A detailed review of the available N-SWO data for inclusion in the 2022 stock assessment was conducted by the Committee during the 2022 Atlantic Swordfish Data Preparatory Meeting (Anon. 2022b). The results of this review are summarized in the SCRS data catalogue (**Tables 17.32.1-5**). Overall, the available catch, size, and effort data for the main fleets (the fleets that catch approximately 95% of the total catch) are quite complete, while the data for the minor fleets continue to be sparse. With respect to the reporting of dead and live discards, the Committee observed that only a few CPCs have been providing these data and only one CPC extrapolates observations to the total effort (**Tables 17.32.2-3**).

Table 17.32.1. SWO total catches (t) by stock, fleet, gear and year, changed in Task 1 nominal catches. The source indicates the type of change made (preliminary estimates of non-reported catch, CPC preliminary estimates adopted by the Committee, stock corrections based on T2CE evidence) while preparing data for use in the 2022 Atlantic Swordfish Stock Assessment Meeting (Anon. 2022k).

					Year																					
Source (T1NC)	**Stock**	**FleetCode**	**GearCode**	**SAreaCode**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Preliminary estimates of non-reported catch	ATN	SEN	GILL	BIL94B																		10.3	13.6	18.0	14.0	16.0
			HAND	BIL94B																						10.1
	ATS	BRA	HAND	BIL96																		3.6	3.7		4.3	4.6
		GHA	GILL	BIL97																					32.4	31.2
		VCT	LL	BIL96																						9.3
SCRS/2022/047	ATN	CRI	LL	BIL93	0.7	0.7	0.3	0.0	1.1	3.5	2.9	1.7	3.6	11.2	6.2	11.1	22.9	21.3	22.0	29.9	34.2	26.4	43.8	43.5	23.0	18.8
Split LL (avg 2012-17) into LL (91%) and HAND (9%)	ATN	MAR	HAND	BIL94B																				84.7	84.7	83.4
			LL	BIL94B																				865.4	865.4	852.4
Stock corrections/split (basis T2CE)	ATN	CIV	LL	BIL97																			21.2			
		GBR	LL	BIL94B								49.0														
		SEN	LL	BIL94B										41.4	58.5	102.3	147.2					83.7	48.0	27.7	49.8	
		SLE	LL	BIL94B													15.9									
	ATS	CIV	LL	BIL97																		27.4				
		CIV-CI-ABIDJAN	GILL	BIL97																			18.7			
			HAND	BIL97																			0.7			
		GNQ	HAND	BIL97															13.1							
		SEN	LL	BIL97										96.7	136.5	78.1	116.9					89.6	112.0	64.6	116.3	
Preliminary estimates provided by CPCs:	ATN	SEN	LL	BIL94B																						16.1
- Senegal (split by stock using T2CE: 30% N/70%S)	ATS	SEN	LL	BIL97																						37.7
- Venezuela (Artisanal, Playa Verde)	ATN	VEN	GILL	BIL93																	5.4	3.8	5.3	5.3	3.6	1.8

Table 17.32.2. SWO Task 1 nominal catches (landings and dead discards) in tons by stock, major gear and year, between 1950 and 2020 (as of 28 March 2022).

	SWO Atlantic stocks																									
	SWO-N														SWO-S											TOTAL
	Longline	Other surf.													Longline	Other surf.										
Year	LL	BB	GN	HL	HP	HS	PS	RR	TN	TP	TR	TW	UN	Total	LL	BB	GN	HL	HS	PS	RR	TR	TW	UN	Total	
1950	1445				2201					0			0	3646			0							100	100	3746
1951	966				1615					0			0	2581			0							200	200	2781
1952	966			0	2027					0		0	0	2993			0							200	200	3193
1953	1203				2100					0		0	0	3303			0							200	200	3503
1954	305				2729					0			0	3034			0							100	100	3134
1955	619				2883					0			0	3502			0							100	100	3602
1956	374				2984					0			0	3358	1	0	0								1	3359
1957	1010				3467					0		1	100	4578	124		0							100	224	4802
1958	875				3929					0			100	4904	92	0	0								92	4996
1959	1428				4704					0		0	100	6232	71		0							100	171	6403
1960	1042				2786					0		0	0	3828	359		0							100	459	4287
1961	2060				2321							0	0	4381	816		0							200	1016	5397
1962	3202				2140								0	5342	769	0	0								769	6111
1963	9193				997							0	0	10190	1418	0	0								1418	11608
1964	10833	9			316					100		0	0	11258	2030		0								2030	13288
1965	7759	6		179	622					86		0	0	8652	2578		0								2578	11230
1966	8503	15			782					49			0	9349	1952		0								1952	11301
1967	8679	11			394					23			0	9107	1577		0								1577	10684
1968	8985	12		0	145					30			0	9172	2348		100								2448	11620
1969	9003	11		0	185					4		0	0	9203	4281		200								4481	13684
1970	9484	8		0	83					3				9578	5426										5426	15004
1971	5243	11		0	0					12			0	5266	2164	2									2166	7432
1972	4717	21		0	0					28				4766	2580										2580	7346
1973	5929	37		0	0					8			100	6074	3078										3078	9152
1974	6267	92		0	0					3				6362	2753										2753	9115
1975	8778	58	3	0	0									8839	3062										3062	11901
1976	6663	32	1	0	0									6696	2812										2812	9508
1977	6370	38		0	0					1				6409	2840		12							3	2855	9264
1978	11125	17	8	0	656		2			11		2	6	11827	2829		5			12					2846	14673
1979	11177		16	29	715									11937	3374		1						28		3403	15340
1980	12831		30	15	676								6	13558	5287		113						31		5431	18989
1981	10583		50	8	551					1			4	11197	4039		24			4			9		4076	15273
1982	13023		37	7	148									13215	6364		80						3		6447	19662
1983	14062		70	6	421					4				14563	5383		102						7		5492	20055
1984	12664		65	7	94					2			1	12833	8986		180		1	12			23	26	9227	22060
1985	14240	1	50	7	76					5			4	14383	9224		131						3	228	9586	23969
1986	18283	0	68	7	104		15			5		0	4	18486	4982	0	95						2	815	5894	24381
1987	20029	1	85	10	107					6		0		20238	5797		147						2	84	6030	26269
1988	19126	4	333	5	55		0	0		2		0		19525	12602		266					216	4	84	13172	32697
1989	15554	1	1510	8	182		1			5			0	17261	16573		191					207	0	84	17055	34316
1990	14215	0	1209	10	100		16			38		9	75	15672	16705		189					181	230	0	17305	32977
1991	14491	0	217	21	75		5			8		42	75	14934	13496		124					179	93	0	13893	28826
1992	14739	2	415	51	61		3			24		24	75	15394	13422	1	116					177	97		13813	29207
1993	16212	3	324	49	28		8			3		16	95	16738	15739		172				2	202	16		16130	32868
1994	15073	5	322	21	24		5			14		37		15501	17839	0	110				1	190	24	794	18958	34460
1995	16390	4	400	23	190		8	1		13		38	38	17105	21584		165				1	178	2		21931	39036
1996	14384	7	479	0	94		99	7		8	1	117	26	15222	17860	0	263					166	1		18289	33511
1997	12643	4	67	1	90		11	16		8	0	172	12	13025	18320		73					148	1		18542	31567
1998	11538	5	472		241		41	10		2	1	10	9	12329	13758		131	3				135			14027	26356
1999	11242	3	248	5	18		40	21		13	2	26	4	11622	14829	356	150					129	38		15502	27124
2000	11058	13	158	9	95		23	16		6	2	72	1	11453	15450	18	137			4		120	0		15728	27181
2001	9574	1	266	9	129		17	2		7		6	2	10011	14302	144	550	7				120	5	0	15128	25139
2002	9406	3	73	12	41		1	22		4		83	8	9654	13577	7	391					120	10		14104	23758
2003	10952	1	114	23	147		1	6		7	0	156	37	11444	11714	4	777	3				120	16		12634	24078
2004	11723	3	83	24	88		1	25		3	2	112	7	12071	12558	0	395					126	2	0	13082	25153
2005	11854	10	16	40	193			62		5	3	187	11	12380	12915		96	5				147	1		13163	25544
2006	11111	2	7	38	204			53		8	0	97	8	11528	13984		73	1				138			14196	25724
2007	11751	0	11	129	267		0	68		8	7	54	9	12306	15408		82	1		0		138			15629	27935
2008	10587	0	6	97	258		0	76	0	2	2	24	9	11061	12027		201	11		0		172			12411	23472
2009	11596	1	34	128	248		0	32	0	4	1	36	9	12088	12359		178			0		188	2		12727	24814
2010	11123	0	19	129	177		1	52		5	0	55	8	11569	12337	9	158					193	1		12698	24267
2011	12189	1	86	121	208		0	54		5	0	36	9	12709	10928	49	164	4		0		60	0	0	11205	23914
2012	13367	0	63	231	98		0	71		2	1	45	12	13890	10395	63	120	1		23		84		0	10686	24576
2013	11565	1	4	168	275	0	0	22	0	1	0	40	2	12078	8958		168	16		1		60			9204	21282
2014	10245	0	9	151	233		0	35		0	0	33	0	10708	9781		94			0		94	0		9970	20678
2015	10361	0	37	128	98		0	46		0	1	81		10752	10090		104	5		0		145			10345	21097
2016	10045	0	33	228	85			27		1	0	108	0	10529	10463		67	4				77			10611	21139
2017	9765		133	266	175		3	34	0		1	93	1	10471	10259		55	4		1		65			10383	20854
2018	8656	0	30	277	34		0	36	0	0	2	107	1	9144	10377		17	6		5			1	0	10405	19549
2019	9749	34	28	380	33		0	64		0	0	90	3	10381	10074		49	4					3		10131	20512
2020	10025	1	25	355	50		1	53	2	0	2	144	3	10659	8936	15	42	5		0			30		9029	19688

Table 17.32.2a. SWO-ATL reported catches and dead discards of swordfish (*Xiphias gladius*) by area, gear and flag.

				1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total ATL				32977	28826	29207	32868	34460	39036	33511	31567	26356	27124	27181	25139	23758	24078	25153	25544	25724	27935	23472	24814	24267	23914	24576	21282	20678	21097	21139	20854	19549	20512	19688
	ATN			15672	14934	15394	16738	15501	17105	15222	13025	12329	11622	11453	10011	9654	11444	12071	12380	11528	12306	11061	12088	11569	12709	13890	12078	10708	10752	10529	10471	9144	10381	10659
	ATS			17305	13893	13813	16130	18958	21931	18289	18542	14027	15502	15728	15128	14104	12634	13082	13163	14196	15629	12411	12727	12698	11205	10686	9204	9970	10345	10611	10383	10405	10131	9029
Landings	ATN		Longline	14215	14276	14356	15804	14365	15864	13822	12204	11062	10717	9922	8678	8799	10334	11410	11531	10896	11478	10352	11445	10975	11796	12976	11366	10089	10194	9941	9616	8504	9445	9912
			Other surf.	1457	443	655	526	428	715	812	370	782	376	393	432	240	486	341	516	409	546	465	485	441	511	512	513	463	391	483	705	488	632	635
	ATS		Longline	16705	13496	13422	15739	17839	21584	17859	18299	13748	14823	15448	14302	13576	11714	12558	12915	13984	15318	12022	12359	12189	10854	10255	8958	9736	10047	10461	10148	10351	10025	8879
			Other surf.	600	397	391	391	1119	347	429	222	269	672	278	826	527	920	523	248	212	221	384	368	361	277	291	246	189	254	148	124	27	57	93
Discards	ATN		Longline	0	215	383	408	708	526	562	439	476	525	1137	896	607	618	313	323	215	273	235	151	148	392	391	199	156	167	105	149	152	304	113
			Other surf.	0	0	0	0	0	0	26	12	9	4	1	6	8	5	7	10	8	8	9	7	5	9	10	0	0	0	0	0	0	0	
	ATS		Longline	0	0	0	0	0	0	1	21	10	6	1	0	0	0	1	0	0	91	6	0	147	74	140	0	46	43	2	111	26	50	57
			Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	
Landings	ATN	CP	Barbados	0	0	0	0	0	0	33	16	16	12	13	19	10	21	25	44	39	27	39	20	13	23	21	16	21	29	20	21	18	10	12
			Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	1	112	106	184	141	142	76	1	3	59	145	117	111
			Brazil	0	0	0	0	0	0	0	0	0	0	117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Canada	911	1026	1547	2234	1676	1610	739	1089	1115	1119	968	1079	959	1285	1203	1558	1404	1348	1334	1300	1346	1551	1489	1505	1604	1579	1548	1188	782	995	1334
			China PR	0	0	0	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	92	96
			Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	30	0	0	0	0	0	27	62	0	0	26
			EU-Denmark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			EU-España	6386	6633	6672	6598	6185	7176	5547	5140	4084	3996	4595	3968	3957	4586	5376	5521	5448	5564	4366	4949	4147	4889	5622	4084	3750	4013	3916	3588	3186	3112	3587
			EU-France	75	75	75	95	46	84	97	164	110	104	122	0	74	169	102	178	92	46	14	15	35	16	94	44	28	66	90	79	80	82	90
			EU-Germany	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			EU-Ireland	0	0	0	7	0	0	15	15	132	81	35	17	5	12	1	1	3	2	2	1	1	2	5	2	3	15	15	10	13	3	24
			EU-Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
			EU-Poland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			EU-Portugal	475	773	542	1961	1599	1617	1703	903	773	777	732	735	766	1032	1320	900	949	778	747	898	1054	1203	882	1438	1241	1420	1460	1871	1691	2392	2070
			EU-Rumania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			FR-St Pierre et Miquelon	0	0	0	0	0	0	0	0	0	0	0	0	10	3	36	48	0	82	48	17	90	1	0	18	3	0	0	0	0	0	
			Great Britain	0	0	0	2	3	1	5	11	0	2	1	0	0	0	0	0	49	0	0	2	0	0	0	0	0	0	0	0	0	0	0
			Grenada	1	2	3	13	0	1	4	15	15	42	84	0	54	88	73	56	30	26	43	0	0	0	0	0	0	39	29	36	36	22	15
			Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Iceland	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Japan	1051	992	1064	1126	933	1043	1494	1218	1391	1089	161	0	0	0	575	705	656	889	935	778	1062	523	639	300	545	430	379	456	325	355	413
			Korea Rep	51	3	3	19	16	16	19	15	0	0	0	0	0	0	0	51	65	175	157	3	0	0	0	64	35	0	9	19	9	9	14
			Liberia	3	0	7	14	26	28	28	28	28	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	95	5	7	3
			Maroc	91	110	69	39	36	79	462	267	292	119	114	523	223	329	335	339	341	237	430	724	968	782	770	1062	1062	850	900	900	1050	1067	1058
			Mexico	0	0	0	6	14	10	22	14	28	24	37	27	34	32	44	41	31	35	34	32	35	38	40	33	32	31	36	64	44	30	21
			Norway	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Panama	0	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Philippines	0	0	0	0	0	0	0	0	0	0	0	1	4	44	5	0	8	0	22	28	0	17	36	9	14	0	0	0	0	0	
			Russian Federation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Senegal	0	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	0	28	11	148	44	43	49	78	146	224	108	117	80
			Sierra Leone	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	
			St Vincent and Grenadines	3	0	3	23	0	4	3	1	0	1	0	22	22	7	7	7	7	51	7	34	13	11	8	4	40	102	33	46	26	12	7
			Trinidad and Tobago	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	6	8
			UK-Bermuda	0	0	0	0	0	1	1	5	5	3	3	2	0	0	1	1	0	3	4	3	3	3	1	1	1	1	2	1	2	2	6
			UK-British Virgin Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	7	0	3	0	0	4	0	0	0	0	0	0	0	0	
			UK-Turks and Caicos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	17	0	0	0	0	0	
			USA	5519	4310	3852	3783	3366	4026	3559	2987	3058	2908	2863	2217	2384	2513	2380	2160	1873	2463	2387	2730	2274	2551	3393	2824	1809	1581	1408	1294	1135	1449	1351
			USSR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Venezuela	9	75	103	73	69	54	85	20	37	30	44	21	34	45	53	55	22	30	11	13	24	18	25	24	24	34	56	58	36	35	16
		NCC	Chinese Taipei	270	577	441	127	507	489	521	509	286	285	347	299	310	257	30	140	172	103	82	89	88	192	166	115	78	115	148	78	162	115	158
			Costa Rica	0	0	0	0	0	0	0	0	0	1	1	0	0	1	4	3	2	4	11	6	11	23	21	22	30	34	26	44	43	47	42
			Guyana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	10	5	2	5
		NCO	Cuba	47	23	27	16	50	86	7	7	7	7	0	0	10	3	3	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Dominica	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
			Faroe Islands	0	0	0	0	0	0	0	0	0	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			NEI (Flag related)	714	43	35	111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Saint Kitts and Nevis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1
			Seychelles	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Sta Lucia	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	3	0	0	2	0	0	0	0	0	0	0	0	1	0	0	
			Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	29	14	0	0	0	10	23	15	2	4	7	0	0	0	0	
	ATS	CP	Angola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	18	0	0	13	0	0	
			Belize	0	0	0	0	0	1	0	0	0	17	8	0	0	0	0	0	0	120	32	111	121	207	197	136	45	111	176	166	115	55	2
			Brazil	1696	1312	2609	2013	1571	1975	1892	4100	3847	4721	4579	4082	2910	2920	2998	3785	4430	4153	3407	3386	2926	3033	2833	2384	2892	2599	2938	2410	2798	2863	2110
			China PR	0	0	0	0	0	0	0	0	29	534	344	200	423	353	278	91	300	473	470	291	296	248	316	196	206	328	222	302	355	211	89
			Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Côte d'Ivoire	8	18	13	14	20	19	26	18	25	26	20	19	19	43	29	31	39	17	24	145	156	58	89	133	68	48	58	0	57	123	19
			EU-Bulgaria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			EU-España	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	4224	4442
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
			EU-Lithuania	0	0	0	0	794	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			EU-Portugal	0	0	1	0	0	380	389	441	384	381	392	393	380	354	345	493	440	428	271	367	232	263	184	125	252	236	250	466	369	323	335
			El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Gabon	0	0	0	0	0	0	0	0	0	0	0	0	0	9	2	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	
			Ghana	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	32	31
			Great Britain	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	
			Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Guinea Ecuatorial	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	
			Honduras	0	0	3	0	0	6	4	5	2	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Japan	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	647	551
			Korea Rep	50	147	147	198	164	164	7	18	7	5	10	0	2	24	70	36	94	176	223	10	0	0	42	47	53	5	19	11	18	9	15
			Namibia	0	0	0	0	22	0	0	0	0	730	469	751	504	191	549	832	1118	1038	518	25	417	414	85	129	395	225	466	600	881	811	789
			Nigeria	0	0	3	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Panama	0	0	0	0	0	0	0	0	29	105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Philippines	0	0	0	0	0	0	0	0	0	0	0	6	1	8	1	1	4	58	41	49	14	35	15	35	58	0	0	0	0	0	
			S Tomé e Príncipe	181	179	177	202	190	178	166	148	135	129	120	120	120	120	126	147	138	138	183	188	193	60	84	60	94	145	77	65	1	3	30
			Senegal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	77	138	195	180	117	162	178	143	97	90	0	92	166	46
			South Africa	0	5	9	4	1	4	1	1	240	143	328	547	649	293	295	199	186	207	142	170	145	97	50	171	152	218	164	189	189	251	149
			St Vincent and Grenadines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	7	16	4	3	2	2	19	0	5	9	4	15	9
			UK-Sta Helena	0	0	0	0	0	0	0	0	0	0	0	20	4	2	2	0	0	0	0	0	0	0	0	5	6	2	0	0	0	0	
			USA	0	0	0	0	0	0	171	396	160	179	142	43	200	21	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			USSR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Uruguay	302	156	210	260	165	499	644	760	889	650	713	789	768	850	1105	843	620	464	370	501	222	179	40	103	0	0	0	0	0	0	
		NCC	Chinese Taipei	900	1453	1686	846	2829	2876	2873	2562	1147	1168	1303	1149	1164	1254	745	744	377	671	727	612	410	424	379	582	406	511	478	416	446	346	353
		NCO	Argentina	230	88	88	14	24	0	0	0	0	38	0	5	10	8	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	
			Benin	28	28	26	28	25	24	24	10	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Cambodia	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Cuba	448	209	246	192	452	778	60	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Mixed flags (FR+ES)	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			NEI (Flag related)	439	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Seychelles	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Togo	3	5	5	8	14	14	64	0	0	0	0	0	0	0	9	10	2	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	26	6	3	0	3	1	3	0	1	1	0	0	0	0	
Discards	ATN	CP	Canada	0	0	0	0	0	0	0	5	52	35	50	26	33	79	45	106	38	61	39	9	15	8	111	59	12	8	11	21	5	2	2
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Japan	0	0	0	0	0	0	0	0	0	0	598	567	319	263	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	6
			Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	170	46	19	0	2	0	0	0	0	
			Mexico	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
			UK-Bermuda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			USA	0	215	383	408	708	526	588	446	433	494	490	308	263	282	275	227	185	220	205	148	138	223	217	120	137	137	90	111	140	287	91
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	0	7	18	4	18	7	7	14
	ATS	CP	Brazil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	91	6	0	0	0	0	0	0	0	0	0	0	0	
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	
			Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	147	70	23	0	0	0	0	0	0	0	
			South Africa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			USA	0	0	0	0	0	0	1	21	10	6	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	117	0	45	43	2	111	26	49	57

Table 17.32.3. Reported SWO dead discards (DD) and live releases (DL) by stock, major gears, and year.

	DD (discarded dead)						DL (discarded live)					
	SWO-N			SWO-S			SWO-N			SWO-S		
Year	Longline	Other surf.	Total	Longline	Other surf.	Total	Longline	Other surf.	Total	Longline	Other surf.	Total
1991	215		215									
1992	383		383									
1993	408		408									
1994	708		708									
1995	526		526									
1996	562	26	588	1		1						
1997	439	12	451	21		21						
1998	476	9	485	10		10						
1999	525	4	529	6		6						
2000	1137	1	1138	1		1	331		331			
2001	896	6	902	0	0	0	329		329			
2002	607	8	615	0		0	224		224			
2003	618	5	623	0		0	133		133			
2004	313	7	320	1		1	339		339			
2005	323	10	333				123		123			
2006	215	8	223				1		1			
2007	273	8	281	91		91	0		0	54		54
2008	235	9	244	6		6	0		0	3		3
2009	151	7	157				0		0			
2010	148	5	153	147		147	1		1	10		10
2011	392	9	402	74		74	0		0			
2012	391	10	402	140		140	0		0			
2013	199	0	199	0		0	0	0	0	0		0
2014	156	0	156	46		46	0	0	0	0		0
2015	167	0	167	43	0	43	29	0	29			
2016	105	0	105	2		2	47	0	47	0		0
2017	149	0	150	111	0	111	64	0	64	0	0	0
2018	152	0	152	26	1	27	84	0	84			
2019	304	0	304	50		50	31		31			
2020	113	0	113	57	0	57	45	0	45			

Table 17.32.4. N-SWO standard SCRS catalogue on statistics (Task 1 and Task 2) by stock, major fishery (flag/gear combinations ranked by order of importance) and year (1991 to 2020). Only the most important fisheries (representing ±97.5% of Task 1 total catch) 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.

Species	Stock	Status	FlagName	GearGrp	DSet	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Rank	%	%cum
				T1 Total		14934	15394	16738	15501	17105	15222	13025	12329	11622	11453	10011	9654	11444	12071	12380	11528	12306	11061	12088	11569	12709	13890	12078	10708	10752	10529	10471	9144	10381	10659			
SWO	ATN	CP	EU-España	LL	t1	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	3112	3587	1	38.8%	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	abc	abc	abc	abc	1		
SWO	ATN	CP	USA	LL	t1	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	1106	1456	1150	2	22.1%	61%
SWO	ATN	CP	USA	LL	t2	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	abc	abc	2		
SWO	ATN	CP	Canada	LL	t1	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	965	1286	3	9.9%	71%
SWO	ATN	CP	Canada	LL	t2	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	abc	abc	3		
SWO	ATN	CP	EU-Portugal	LL	t1	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	2346	2044	4	9.8%	81%
SWO	ATN	CP	EU-Portugal	LL	t2	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	ab	ab	4		
SWO	ATN	CP	Japan	LL	t1	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	362	419	5	6.0%	87%
SWO	ATN	CP	Japan	LL	t2	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	bc	bc	bc	abc	abc	abc	abc	abc	abc	abc	abc	abc	ab	ab	ab	ab	ab	ab	ab	ab	5		
SWO	ATN	CP	Maroc	LL	t1	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	950	936	6	3.6%	90%
SWO	ATN	CP	Maroc	LL	t2	-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	abc	abc	6		
SWO	ATN	NCC	Chinese Taipei	LL	t1	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	122	172	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	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	abc	abc	abc	abc	abc	abc	7		
SWO	ATN	CP	Canada	HP	t1	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	33	50	8	1.1%	93%
SWO	ATN	CP	Canada	HP	t2	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	abc	ab	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	92	96	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	ab	abc	9		
SWO	ATN	CP	Trinidad and Tobago	LL	t1	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	6	8	10	0.6%	95%
SWO	ATN	CP	Trinidad and Tobago	LL	t2	-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	ab	b	10		
SWO	ATN	CP	USA	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	205	219	11	0.5%	95%
SWO	ATN	CP	USA	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	bc	11		
SWO	ATN	CP	EU-France	TW	t1				13	13	97	164			60		74	138	102	178	91	46	14	12	32	15	13	35	25	63	87	76	74	70	86	12	0.4%	96%
SWO	ATN	CP	EU-France	TW	t2				a	-1	-1	-1			-1		-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	ab	-1	-1	ab	-1	abc	-1	12		
SWO	ATN	CP	Maroc	GN	t1	9	4	2	13	32	322	13	179	60	51	243	64	98	76	9						80										13	0.3%	96%
SWO	ATN	CP	Maroc	GN	t2	-1	-1	-1	-1	-1	-1	-1	c	ac	ac	ac	-1	b	b	b						-1										13		
SWO	ATN	CP	Belize	LL	t1																	9	1	112	106	184	141	142	76	1	3	59	145	117	111	14	0.3%	96%
SWO	ATN	CP	Belize	LL	t2																	a	a	ab	ab	ab	ab	a	a	ab	a	ab	abc	ab	abc	14		
SWO	ATN	CP	EU-España	GN	t1	124	316	202	150	223	20																									15	0.3%	96%
SWO	ATN	CP	EU-España	GN	t2	ab	b	-1	-1	-1	-1																									15		
SWO	ATN	CP	Venezuela	LL	t1	73	101	68	60	45	74	11	7	9	30	12	25	29	46	48	15	19	5	8	16	13	18	20	18	29	53	52	31	31	14	16	0.3%	97%
SWO	ATN	CP	Venezuela	LL	t2	b	b	b	b	b	b	b	b	ab	ab	b	b	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	a	a	a	a	16		

Table 17.32.5. S-SWO standard SCRS catalogue on statistics (Task 1 and Task 2) by stock, major fishery (flag/gear combinations ranked by order of importance) and year (1991 to 2020). Only the most important fisheries (representing ±97.5% of Task 1 total catch) 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.

Speci	Sto	Stat	FlagName	GearG	DS	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Rank	%	%cum
				T1 Total		13893	13813	16130	18958	21931	18289	18542	14027	15502	15728	15128	14104	12634	13082	13163	14196	15629	12411	12727	12698	11205	10686	9204	9970	10345	10611	10383	10405	10131	9029			
SWO	ATS	CP	EU-España	LL	t1	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	4224	4442	1	42.5%	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	abc	abc	abc	abc	1		
SWO	ATS	CP	Brazil	LL	t1	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	2859	2105	2	22.4%	65%
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	a	a	a	a	a	ab	ab	ab	2		
SWO	ATS	CP	Japan	LL	t1	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	648	551	3	11.5%	76%
SWO	ATS	CP	Japan	LL	t2	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	ab	ab	3		
SWO	ATS	NCC	Chinese Taipei	LL	t1	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	395	410	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	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	abc	abc	abc	abc	abc	abc	4		
SWO	ATS	CP	Uruguay	LL	t1	156	210	260	165	499	644	760	889	650	713	789	768	850	1105	843	620	464	370	501	222	179	40	103								5	2.9%	87%
SWO	ATS	CP	Uruguay	LL	t2	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	811	774	6	2.8%	90%
SWO	ATS	CP	Namibia	LL	t2				a					a	-1	ab	a	-1	a	ab	ab	ab	ab	ab	ab	ab	a	ab	a	a	a	abc	abc	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	323	335	7	2.2%	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	a	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	211	89	8	1.6%	94%
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	ab	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	149	9	1.3%	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	ab	9		
SWO	ATS	CP	Ghana	GN	t1	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	32	31	10	1.0%	96%
SWO	ATS	CP	Ghana	GN	t2	-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	-1	-1	10		
SWO	ATS	CP	S Tomé e Príncipe	TR	t1	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	0.9%	97%
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				11		
SWO	ATS	NCO	Cuba	LL	t1	209	246	192	452	778	60	60																								12	0.5%	97%
SWO	ATS	NCO	Cuba	LL	t2	-1	-1	-1	-1	-1	-1	-1																								12		
SWO	ATS	CP	Korea Rep	LL	t1	147	147	198	164	164	7	18	7	5	10	0	2	24	70	36	94	176	223	10	147	70	65	47	53	5	19	11	18	9	15	13	0.5%	98%
SWO	ATS	CP	Korea Rep	LL	t2	ab	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	-1	a	-1	abc	abc	a	abc	ab	abc	ab	abc	13		

17.33 The SCRS should continue to monitor and analyze the effects of this measure (minimum size) on the mortality of immature swordfish. Rec. 17-02, para 10

Background: *Notwithstanding the provisions of paragraph 9, any CPC may choose, as an alternative to the minimum size of 25 kg/ 125 cm LJFL, to take the necessary measures to prohibit the taking by its vessels in the Atlantic Ocean, as well as the landing and sale in its jurisdiction, of swordfish (and swordfish parts), less than 119 cm LJFL, or in the alternative 15 kg, provided that, if this alternative is chosen, no tolerance of swordfish smaller than 119 LJFL, or in the alternative 15 kg, shall be allowed. For swordfish that have been dressed, a cleithrum to keel (CK) measurement of 63 cm can also be applied. A Party that chooses this alternative minimum size shall require appropriate record keeping of discards. The SCRS should continue to monitor and analyze the effects of this measure on the mortality of immature swordfish.*

An answer to these requests was provided by the Committee in 2017, referring to Recommendations 16-03 paragraph 10, current 17-02, and 16-04, paragraph 7, current 17-03. To reiterate what was provided in 2017, the estimated mortality at-haulback for undersized swordfish differed between fleets and varied annually but is on average 78%. However, it is not clear how much the regulation may have reduced the encounter rate with small fish as a redistribution of fishing effort to avoid undersized swordfish could also have resulted in reduced total mortality. The Committee reiterates that reporting of dead discards and the corresponding lengths of the discarded fish are essential to address the efficacy of this recommendation. Currently, the Committee is reviewing new studies and conducting further analysis to determine population level impacts of this at-haulback mortality and intends to provide advice to the Commission tentatively in 2023. In addition, the ongoing N-SWO MSE work might provide further insight on this issue.

17.34 The SCRS to provide advice on conservation and management measures for North Atlantic swordfish, Rec. 21-02, para 5

Background: *The Commission shall establish at its 2022 meeting conservation and management measures for North Atlantic swordfish on the basis of the SCRS advice resulting from a stock assessment that will be carried out by the SCRS in 2022 as well as the Resolution by ICCAT on Criteria for the Allocation of Fishing Possibilities (Res. 15-13).*

The SCRS conducted the 2022 Atlantic Swordfish Data Preparatory meeting (Anon. 2022b) and the 2022 Atlantic Swordfish Stock Assessment meeting (Anon. 2022k) for both the northern and southern swordfish stocks. Both meetings were held online. Details of the stock assessment methods, results, and management advice related to TAC and minimum size limits are provided in Anon. 2022k. Further details on the management advice can be found in Swordfish Executive Summary (item 9.2 above).

17.35 Interim limit reference (LRP) of 0.4*B_{MSY} or any more robust LRP established through further analysis, Rec. 17-03, para 12 (Rec. 21-03)

Background: *When assessing stock status and providing management recommendations to the Commission in 2021, the SCRS shall consider the interim limit reference (LRP) of 0.4*B_{MSY} or any more robust LRP established through further analysis.*

There was no analysis conducted for southern swordfish on this issue in 2022. Until such an analysis is conducted, the Committee will consider the interim limit reference point of 0.4*B_{MSY}.

17.36 The SCRS shall report to the Commission the results of the 2022 South Atlantic swordfish stock assessment, Rec. 21-03, para 2

Background: *The SCRS will carry out a stock assessment of South Atlantic swordfish in 2022 and report the results to the Commission.*

The SCRS conducted the 2022 Atlantic Swordfish Data Preparatory Meeting (Anon. 2022b) and the 2022 Atlantic Swordfish Stock Assessment meeting (Anon. 2022k) for both the northern and southern swordfish stocks. Both meetings were held online. Details of the stock assessment methods, results, and management advice is provided in Anon. (2022k). Further details on the management advice can be found in Swordfish Executive Summary (item 9.2 above).

17.37 The SCRS shall review these data and determine the feasibility of estimating fishing mortality by commercial fisheries, Rec. 16-11, para 2

Background: *CPCs shall enhance their efforts to collect data on catches of sailfish, including live and dead discards, and report these data annually as part of their Task 1 and 2 data submission to support the stock assessment process. The SCRS shall review these data and determine the feasibility of estimating fishing mortality by commercial fisheries (including longline, gillnets and purse seine), recreational fisheries and artisanal fisheries.*

The Committee will conduct a stock assessment of sailfish stocks in 2023. As part of the assessment the Committee will determine the feasibility of estimating fishing mortality by commercial fisheries (including longline, gillnets and purse seine), recreational fisheries and artisanal fisheries.

17.38 Revise the statistical methodology used to estimate dead and live discards and provide feedback to CPCs, Rec. 19-05, para 16

Background: *No later than 2020, CPCs shall present to the SCRS the statistical methodology used to estimate dead and live discards. CPCs with artisanal and small-scale fisheries shall also provide information about their data collection programmes.*

The SCRS shall review these methodologies and if it determines that a methodology is not scientifically sound, the SCRS shall provide relevant feedback to the CPCs in question to improve the methodologies.

The SCRS shall also determine if one or more capacity building workshops are warranted to help CPCs to comply with the requirement to report total live and dead discards. If so, the Secretariat in coordination with the SCRS should begin organizing the SCRS-recommended workshop(s) in 2021 with a view to convening them as soon as practicable.

In 2022 the SCRS has not received new information on the methods for estimating discards from ICCAT fisheries of bycatch of billfish species.

In general, there are very few papers and information provided from CPCs on the methods for estimating discards. One paper was submitted in 2020 by Canada (Gillespie, 2021). The United States also provided an SCRS document (Santos *et al*., 2020) and additional information describing the methodology was provided in 2020. During the 2019 assessment of white marlin Brazil presented the methodology used by the CPC and plans to provide an SCRS document by 2023.

It is important for the Committee to understand the methodology that has been put in place by the CPCs to estimate live and dead discards of marlins. The Committee reminds CPCs that have not yet presented documentation on the bycatch estimation methodologies used of the obligation to do so. Until the Committee can review the methodologies currently being used by other CPCs, the Committee is not in a position to provide suggestions for any necessary improvements on those methods, and it hampers the ability to provide general recommendations on methodology for those CPCs that still do not have implemented methodology.

With regards to the artisanal and small-scale fisheries, the Committee was informed that generally there are no discards as all billfish specimens are retained and landed. As such in those cases the landings represent the total catch.

The Committee recognizes that the lack of reporting of dead discards is not limited to billfish, and it also occurs for other species. Therefore, the Committee and the Secretariat will organize a capacity building workshop on statistical techniques to estimate dead discards and live releases.

17.39 The SCRS will advise the Commission on the suitability of the alternative approach proposed by CPCs, Rec. 16-14, para 4b

Background: *b) Notwithstanding paragraph a), for vessels less than 15 meters, where an extraordinary safety concern may exist that precludes deployment of an onboard observer, a CPC may employ an alternative scientific monitoring approach that will collect data equivalent to that specified in this Recommendation in a manner that ensures comparable coverage. In any such cases, the CPC wishing to avail itself of an alternative approach must present the details of the approach to the SCRS for evaluation. The SCRS will advise the Commission on the suitability of the alternative approach for carrying out the data collection obligations set forth in this Recommendation. Alternative approaches implemented pursuant to this provision shall be subject to the approval of the Commission at the annual meeting prior to implementation.*

Morocco presented an alternative scientific monitoring approach to collect data from small scale/artisanal fisheries of bluefin tuna (Abid *et al.,* 2022), small tuna (Abid and Bensbai, 2022a) and swordfish (Abid and Bensbai, 2022b).

The Committee discussed the alternative monitoring approach being implemented by Morocco, which addresses a long-standing issue on how to collect fisheries and biological data from small scale fleets without observer coverage. The port sampling program collects information on fishing areas, fishing effort (duration of the trip, number and size of fishing gear, number of hooks, number of operations, duration of the fishing operation, etc.), and bycatch data for multiple species, including live and dead discards by species. This information is supplemented by their biological sampling program (size and individual weights) of fish caught by the artisanal fleet. The data collected are also adaptable to the ICCAT standard Task 1, Task 2 and ST09 forms, thus providing valuable information on artisanal fisheries that is not captured in the ICCAT database system.

The Committee acknowledged the potential of the approach proposed by Morocco to fill this challenging data gap and encouraged them to continue to develop the methodology, given its application to multiple species harvested in artisanal fisheries where observer coverage is not possible. However, while the Committee acknowledges the effort to monitor small scale/artisanal fleets by Morocco and requested to provide further information for the Committee to properly evaluate the proposed methodology.

18. Other matters

18.1 Update of Chapter 2 of the ICCAT Manual

The Secretariat informed the Committee that one contract was issued by the Secretariat in 2022 to develop a new subchapter for the narrow-barred Spanish mackerel (*Scomberomorus commerson*).

Overall, during the past two years 16 subchapters were updated, as follows:

1. Small tunas (bonito, *Sarda sarda*; bullet tuna, *Auxis rochei*; frigate tuna, *Auxis thazard*; king mackerel, *Scomberomorus cavalla*; little tunny, *Euthynnus alletteratus*; Spanish mackerel, *Scomberomorus maculatus*; and blackfin tuna, *Thunnus atlanticus*);

2. Pelagic sharks (blue shark, *Prionace glauca*; shortfin mako, *Isurus oxyrinchus*; porbeagle, *Lamna nasus*; common thresher, *Alopias vulpinus*; bigeye thresher, *Alopias superciliosus*; oceanic whitetip, *Carcharhinus longimanus*; scalloped hammerhead, *Sphyrna lewini*; smooth hammerhead, *Sphyrna zygaena*; and great hammerhead, *Sphyrna mokarran*).

In addition, nine new chapters were produced for the ICCAT Manual Chapter 2:

1. Small tunas (plain bonito, *Orcynopsis unicolor*; wahoo, *Acanthocybium solandri*; serra Spanish mackerel, *Scomberomorus brasiliensis*; cero, *Scomberomorus regalis*, and narrow-barred Spanish mackerel, *Scomberomorus commerson*);

2. Shark species (silky shark, *Carcharhinus falciformis*; longfin mako, *Isurus paucus*; crocodile shark, *Pseudocarcharias kamoharai*; and pelagic stingray, *Pteroplatytrygon violacea*).

These 25 subchapters have been made available in the three official ICCAT languages to the SCRS and will be published in the ICCAT Manual over the coming months.

18.2 Election of the SCRS Chair

Dr Gary Melvin who will remain as SCRS Chair until the end of 2022, requested the Committee to make nominations to this position. Two nominations were made, Dr Craig Brown and Dr Carmen Fernández. Voting took place by the Heads of Delegations present in the meeting room, as well as on-line. The SCRS Chair announced that Dr Craig Brown was elected to this position for a two-year mandate. The elected Chair announced that his choice to the Vice Chair position will be communicated to the Committee in the near future.

19. Adoption of report and closure

The Chair thanked the SCRS for its hard work this year. Dr Melvin thanked the Secretariat staff for their excellent work, as well as appreciating their professional attitude, particularly noted within a difficult framework. Dr Melvin then expressed his appreciation towards the interpreters and to all participants.

The Report of the 2022 SCRS meeting was adopted and the 2022 Meeting of the SCRS was adjourned.

APPENDICES

Appendix 1

Opening Address by Mr. Camille Jean Pierre Manel, ICCAT Executive Secretary

SCRS Chair and Vice-Chair,

Species Groups Rapporteurs,

Scientific delegates,

Partners,

Interpreters,

Dear colleagues,

Present here in Madrid or participating online,

Good morning, good evening,

Once again, I wish you a warm welcome, and it is my enormous pleasure to meet with you in this hybrid meeting format, after the imposed time apart due to the pandemic which cannot unfortunately yet be forgotten, since it still continues to dictate its law, but we will face up to it over and over!

Chair and Vice-Chair, having sincerely thanked and congratulated you on your remarkable coordination, allow me to extend these thanks and congratulation to all the SCRS for all its results, which are the fruit of a synergy of sustained efforts as we have all been able to see throughout the year through the numerous meetings which have enabled important conclusions to be reached. This is also the occasion to highlight the unreserved commitment of the entire Secretariat staff for continued improvement of our contribution to the different Commission bodies. I thank you and congratulate you, dear colleagues.

Chair, the record number of meetings that are being held, are taking place at such a pace that the Secretariat no longer has time to organise them properly, with their preparation, development and follow-up through the reports, and this continues to pose an increasing threat, with a high risk of their quality being affected.

Also, solely with a view to further strengthening this commitment with a well-rounded staff, and to respond effectively to the ever-growing complex requests received by the Secretariat, I formally reiterate the call that has been made every year recently for balance between the different tasks assigned to the Secretariat and its resources. For this purpose, the role of each Commission body is crucial. As such, I would like to focus more SCRS attention on the unsustainability of the situation, while recognising its need to advance on several crucial and urgent issues and other Commission requests. I am still convinced that the SCRS can contribute very significantly to improving the situation that has just been described.

Finally, more than usual, I renew the commitment of the entire Secretariat to continue to make every effort to always accompany the SCRS in its pursuit of the Commission’s objectives.

In the hope that we will very soon get fully back to normal with the possibility of organising meetings without any restriction, I wish you every success in your work.

Thank you for your very kind attention!

Appendix 2

SCRS Agenda

1. General remarks by the SCRS Chair and the Executive Secretary

2. Adoption of Agenda and arrangements for the meeting

3. Introduction of Contracting Party delegations

4. Introduction and admission of observers

5. Admission of scientific documents and presentations

6. Report of Secretariat activities on statistics and science

7. Review of national fisheries and research programmes

8. Reports of intersessional SCRS meetings

    8.1 2021/22 ICCAT-ICES Northeastern Atlantic Porbeagle Data Compilation Workshop aiming 2022 ICCAT-ICES Stock Assessment

    8.2. Skipjack Data Preparatory Meeting

    8.3 Atlantic Swordfish Data Preparatory Meeting (including N-SWO MSE)

    8.4 Eastern Atlantic and Mediterranean Bluefin Tuna Data Preparatory Meeting

    8.5 ICCAT-ICES Northeastern Atlantic Porbeagle Benchmark Meeting

    8.6 First Intersessional Meeting of the Bluefin Tuna MSE Technical Sub-Group

    8.7 Intersessional Meeting of the Sharks Species Group

    8.8 Tropical Tunas MSE Technical Sub-Group Meeting

    8.9 Skipjack Stock Assessment Meeting

    8.10 Meeting of the Working Group on Stock Assessment Methods

    8.11 ICCAT-ICES Northeastern Atlantic Porbeagle Stock Assessment Meeting

    8.12 Atlantic Swordfish Stock Assessment Meeting

    8.13 Eastern Atlantic and Mediterranean Bluefin Tuna Stock Assessment Meeting

    8.14 Second Intersessional Meeting of the Bluefin Tuna MSE Technical Sub-Group

9. Executive Summaries on species:

    9.1 SKJ-Skipjack tuna

    9.2 SWO-Atlantic swordfish

    9.3 E-BFT-Eastern Atlantic and Mediterranean bluefin tuna

    9.4 POR-Porbeagle

9.5 Task 1 catches for all major ICCAT species (excluding those contained in items 9.1 to 9.3 of this report

9.6 Other relevant information on stocks not assessed in 2022

10. Reports of Research Programmes

10.1 Atlantic-Wide Research Programme for Bluefin Tuna (GBYP)

10.2 Small Tunas Year Programme (SMTYP)

10.3 Shark Research and Data Collection Programme (SRDCP)

10.4 Enhanced Programme for Billfish Research Programme (EPBR)

10.5 Albacore Year Programme (ALBYP)

10.6 Swordfish Year Programme (SWOYP)

10.7 Other research activities (on tropical tunas)

11. Report of the Subcommittee on Statistics

12. Report of the Subcommittee on Ecosystems and Bycatch

13. Progress related to work developed on MSE

13.1 Work conducted for northern albacore

13.2 Work conducted for bluefin tuna

13.3 Work conducted for northern swordfish

13.4 Work conducted for tropical tunas (W-SKJ and multi-species)

13.5 Review the Roadmap for the ICCAT MSE processes adopted by the Commission in 2021

14. Update of the stock assessment software catalogue

15. Consideration of plans for future activities

15.1 Annual workplans and research programmes

15.1.1 Subcommittee on Ecosystems and Bycatch Workplan

15.1.2 Subcommittee on Statistics Workplan

15.1.3 Working Group on Stock Assessment Methods (WGSAM) Workplan

15.1.4 Albacore Workplan

15.1.5 Billfish Workplan

15.1.6 Bluefin Tuna Workplan

15.1.7 Sharks Workplan

15.1.8 Small Tunas Workplan

15.1.9 Swordfish Workplan

15.1.10 Tropical Tunas Workplan

15.2 Intersessional meetings proposed for 2023

15.3 Date and place of the next meeting of the SCRS

16. General recommendations to the Commission

16.1 General recommendations to the Commission that have financial implications

16.1.1 Subcommittee on Ecosystems and Bycatch

16.1.2 Subcommittee on Statistics

16.1.3 Albacore

16.1.4 Billfish

16.1.5 Bluefin tuna

16.1.6 Sharks

16.1.7 Small tunas

16.1.8 Swordfish

16.1.9 Tropical tunas

16.1.10 Working Group on Stock Assessment Methods

16.2 Other general recommendations

16.2.1 Subcommittee on Ecosystems and Bycatch

16.2.2 Subcommittee on Statistics

16.2.3 Albacore

16.2.4 Billfish tuna

16.2.5 Bluefin tuna

16.2.6 Sharks

16.2.7 Small tunas

16.2.8 Swordfish

16.2.9 Tropical tunas

16.2.10 Working Group on Stock Assessment Methods (WGSAM)

17. Responses to the Commission's requests

18. Other matters

18.1 Update of Chapter 2 of the ICCAT Manual

18.2 Election of the SCRS Chair

19. Adoption of the report

Appendix 3

List of participants [1]

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Appendix 4

List of SCRS Papers and Presentations

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SCRS/2022/001	Report of the Skipjack Data Preparatory Meeting	Anon.
SCRS/2022/002	Report of the Joint ICCAT/ICES Benchmark Workshop in advance of the North-eastern Atlantic Porbeagle Stock Assessment	Anon.
SCRS/2022/003	Report of the Atlantic Swordfish Data Preparatory Meeting (including N-SWO MSE)	Anon.
SCRS/2022/004	Report of the Eastern Atlantic and Mediterranean Bluefin Tuna Data Preparatory Meeting	Anon.
SCRS/2022/005	Report of the First 2022 Intersessional Meeting of the Bluefin Tuna Technical Sub-group on MSE	Anon.
SCRS/2022/006	Report of the Intersessional Meeting of the Sharks Species Group	Anon.
SCRS/2022/007	Report of the Intersessional Meeting of the Tropical Tunas Technical Sub-group on MSE	Anon.
SCRS/2022/008	Report of the Skipjack Stock Assessment Meeting	Anon.
SCRS/2022/009	Report of the Intersessional Meeting of the Subcommittee on Ecosystems and Bycatch	Anon.
SCRS/2022/010	Report of the Intersessional Meeting of the Working Group on Stock Assessment Methods	Anon.
SCRS/2022/011	Report of the ICCAT/ICES North-eastern Atlantic Porbeagle Stock Assessing Meeting	Anon.
SCRS/2022/012	Report of the Atlantic Swordfish Stock Assessment Meeting	Anon.
SCRS/2022/013	Report of the Eastern Atlantic and Mediterranean Bluefin Tuna Stock Assessment Meeting	Anon.
SCRS/2022/014	Report of the Second 2022 Intersessional Meeting of the Bluefin Tuna Technical Sub-group on MSE	Anon.
SCRS/2022/021	Life History of Skipjack caught around the UK Overseas Territory of St Helena, South Atlantic: Report for the 2022 ICCAT Skipjack Tuna Data Preparatory Meeting	Bell J. B., Wright S.R., Naulaerts J., Henry L.
SCRS/2022/022	Review of the Catch Series for Northeast Porbeagle (*Lamnus nasus*) as Input for Stock Assessment	Ortiz M., Mayor C., Palma C., Taylor N.G.

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SCRS/2022/024	Growth and mortality rates of skipjack tuna, *Katsuwonus pelamis* in the Southwest Atlantic Ocean	Benevenuti Soares J., Marcel de Souza G., Monteiro-Neto C., Almeida R., Rodrigues da Costa M.
SCRS/2022/025	Life history trades of the skipjack tune in the Southwest Atlantic	Rodrigues da Costa M., Almeida Tubino R., Castello J.P., Mello V.S., Benevenuti Soares J., Camponez de Almeida P.R., Coletto J.L., Pastous Madureira L.S., Monteiro-Neto C.
SCRS/2022/026	Index of abundance of skipjack tuna in the Atlantic Ocean derived from echosounder buoys (2010-2020).	Santiago J., Uranga J., Quinconces I., Grande M., Murua H., Merino G., Zudaire I., Urtizberea A., Boyra G.
SCRS/2022/027	Review and preliminary analyses of size samples of East and West Atlantic skipjack tuna stocks (*Katsuwonus pelamis*)	Ortiz M., Kimoto A.
SCRS/2022/028	European purse seiners CPUE standardization of Eastern Atlantic skipjack caught under non-owned dFADs using the VAST methodology	Akia S., Guery L., Grande M., Kaplan D., Pascual P., Ramos M.L., Uranga J., Abascal F., Santiago J., Merino G., Gaertner D.
SCRS/2022/029	CPUE standardization of skipjack tuna (*Katsuwonus pelamis*) caught by Brazilian baitboat fleet in the southwestern Atlantic Ocean	Sant'Ana R., Mourato B.L., Cardoso L.G., Travassos P.
SCRS/2022/030	What can the size data tell us about the western Atlantic skipjack tuna stock?	Cardoso L.G., Mourato B., Sant'Ana R., Silva G., Castello J.P., Monteiro-Neto C., Rodrigues M.R., Tubino R.
SCRS/2022/031	An alternative index of abundance for Atlantic skipjack tuna (*Katsuwonus pelamis*) based on catch ratio and abundance of a reference species	Abascal F.J., Gaertner D., Báez J.C., Kaplan D., Pascual P., Ortiz de Urbina J.
SCRS/2022/032	What does genetics reveal about the population connectivity and exploitation of the skipjack tuna (*Katsuwonus pelamis*)?	Queiroz-Brito M.C.G, Silva D.L., Mendonça F.F, Robalo J., Travassos P., Adam M.L., Torres R.A.
SCRS/2022/034	A systematic review of tropical tuna preferences for tropical tuna movement models	Norelli A.P., Die D.J., Moffat B.T.
SCRS/2022/035	The skipjack fishery in the Canary Islands for the period 1926 to 2020.	Pascual-Alayón P.J., Déniz S., Abascal F.J.
SCRS/2022/036	Bayesian generalized linear models for standardization of skipjack catch rates based on Brazilian handline associated school fishing (2010-2020) in the western equatorial Atlantic.	Mourato B., Sant'Ana R., Silva G., Cardoso L.G., Travassos P.
SCRS/2022/037	Standardized catch indices of skipjack tuna, K*atsuwonus pelamis*, from the United States pelagic longline observer program	Lauretta M.
SCRS/2022/038	The faux poisson estimates for the EU-FR and EU-SP purse seine fleet over the period 2015 - 2020	Duparc A., Pascual-Alayon P.J., Rojo-Mendez V.

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SCRS/2022/039	Standardized catch rates for skipjack tuna (*Katsuwonus pelamis*) from the Venezuelan purse seine fishery in the Caribbean Sea and adjacent waters of the Western Central Atlantic for the period of 1987 - 2020.	Narvaez M., Evaristo E., Marcano J.H., Gutierrez X., Arocha F.
SCRS/2022/040	Annual indices of skipjack tuna (*Katsuwonus pelamis*) larvae in the Gulf of Mexico (1982-2019)	Ingram G.W.
SCRS/2022/041	Review of the fleet structure for the Stock Synthesis assessment models for the North and South Atlantic swordfish stocks	Kimoto A., Ortiz M., Taylor N.G.
SCRS/2022/042	Preliminary Stock Assessment of Northeastern Atlantic porbeagle (*Lamna Nasus*) using the Bayesian State-Space Surplus Production Model JABBA	Ortiz M., Taylor N.G., Kimoto, A, Forselledo, R.
SCRS/2022/044	Datos estadísticos de la pesquería de túnidos de las islas Canarias durante el periodo 2000 a 2021	Delgado R.
SCRS/2022/045	Actualización de algunos parámetros biológicos del listado de la pesquería de las islas Canarias	Delgado R.
SCRS/2022/046	CPUE standardization for Atlantic swordfish caught by Japanese longline fishery: The Glmm analisis Using R software package R-INLA	Iijima H.
SCRS/2022/047	Revisión de las estadísticas históricas de desembarque de pez espada (*Xiphias Gladius*) por parte de la flota de mediana escala en el caribe costarricense	Quesada N., Pacheco Chaves, B., Miguel Carvajal J.
SCRS/2022/048	A relative index of Atlantic swordfish abundance based on Canadian pelagic longline data (1962 to 2021)	Hanke A., Gillespie K.
SCRS/2022/049	Standardised catch rates of swordfish (*Xiphias gladius*) for the South African pelagic longline fishery (2004-2020)	Parker D.
SCRS/2022/050	Developing the abundance index of swordfish (*Xiphias gladius*) with consideration of targeting shift for the Chinese Taipei Tuna longline fishery in the North Atlantic Ocean	Su N-J., Cheng C-Y.
SCRS/2022/051	Catch Per Unit Effort standardization of swordfish (*Xiphias gladius*) for the Chinese Taipei tuna longline fishery in the South Atlantic Ocean	Su N-J., Cheng C-Y.
SCRS/2022/052	Update on the satellite tagging of Atlantic and Mediterranean swordfish	Rosa D., Garibaldi F., Snodgrass D., Orbesen E., Santos C., Macias D., Ortiz de Urbina J., Forselledo R., Miller P., Domingo A., Brown C., Coelho R.

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SCRS/2022/053	Additional analyses on the stock assessment of North-eastern Atlantic porbeagle (*Lamna nasus*) using the Spict Surplus Production Model	Ortiz M., Taylor N.G., Kimoto A., Forselledo R., Coelho R., Arrizabalaga H.,
SCRS/2022/054	Standardized CPUE for swordfish captured by the Portuguese pelagic longline fishery in the North Atlantic Ocean	Coelho R., Rosa, D., Barbosa, C., Goes S., Lino P.
SCRS/2022/055	Standardized catch indices of atlantic swordfish, *Xiphias gladius*, from the United States Pelagic Longline Observer Program	Lauretta M.
SCRS/2022/056	Updated standardized catch rate of swordfish (*Xiphias gladius*) from the Moroccan longline fishery operating South of the Moroccan Atlantic waters	Ikkiss A., Baibbat S.A., Noureddine A., Jilali B.
SCRS/2022/057	Catch rates of swordfish from Brazilian longline fisheries in the South Atlantic (1994-2020)	Mourato B., Sant'Ana R., Gustavo Cardoso L., Travassos P.
SCRS/2022/058	Proposal to develop an ICCAT seabird work plan	Wolfaardt A., Prince S., Yates O., Jimenez S., Gianuca D.
SCRS/2022/059	Annual indices of swordfish (*Xiphius gladius*) Spawning biomass in the Gulf of Mexico (1982-2019)	Ingram W.
SCRS/2022/060	Review and preliminary analyses of size samples of North and South Atlantic swordfish stocks (*Xiphias gladius*)	Ortiz M., Kimoto A.
SCRS/2022/061	Preliminary relationship between straight and curved lower jaw fork length for swordfish (*Xiphias gladius*) in the North Atlantic	Coelho R., Barbosa C., Rosa D., Lino P., Gillespie K.
SCRS/2022/062	Pre-workshop analysis in preparation for the 2022 ICCAT Ecoregion Workshop: Identification of regions in the ICCAT Convention area for supporting the implementation of ecosystem based fisheries management	Nieblas A.E., Murua H., Juan Jordá M.J.
SCRS/2022/065	Summary of preliminary input data (catch and size) for the North Atlantic albacore stock synthesis in 2022	Kimoto A., Arrizabalaga H., Ortiz M., Merino G., Urtizberea A., Ortiz de Zárate V., Palma C., Mayor C., Lauretta M.
SCRS/2022/066	Acoustic-based fishery-independent abundance index of bluefin tuna in the Bay of Biscay: results from the first seven surveys	Onandia I., Goñi N., Uranga J., Arregui I., Martinez U., Boyra G., Melvin G.D., Godard I., Arrizabalaga H.
SCRS/2022/067	Data and initial model set-up for the 2022 VPA stock assessment of the eastern Atlantic and Mediterranean bluefin tuna	Rouyer T., Kimoto A., Zarrad R., Ortiz M., Palma C., Mayor C., Lauretta M., Rodriguez-Marin E., Walter J.
SCRS/2022/068	Update of the French Aerial Abundance Index for 2021	Rouyer T., Derridj O., Fromentin J.M.

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SCRS/2022/069	Update of electronic tagging data and methodologies for Atlantic bluefin tuna in order to plan future tagging activities	Aarestrup K., Alemany F., Arregui I., Arrizabalaga H., Cabanellas-Reboredo M., Carruthers T., Hanke A., Lauretta M., Pagá A., Rouyer T., Tensek S., Walter J., Rodriguez-Marin E.
SCRS/2022/070	Data and initial model set-up for the 2022 ASAP stock assessment of the eastern Atlantic and Mediterranean bluefin tuna	Cadrin S.X., Carrano C., Maguire J.J., Kerr L., Walter J., Rouyer T.
SCRS/2022/071	Retrocalculated larval abundance index of Atlantic bluefin tuna in the western Mediterranean Sea, 2001-2020	Alvarez-Berastegui D., Tugores M.P., Martín M., Calcina N.L., Torres, A.P., Balbín R., Reglero P.
SCRS/2022/072	A review of available information for the eastern Atlantic bluefin tuna using Chinese longliner observer data for the period 2013-2019	Feng J., Zhang F., Zhu J., Wu F.
SCRS/2022/073	The standardized CPUE for Japanese longline fishery in the Atlantic up to 2021	Tsukahara Y., Fukuda H., Nakatsuka S.
SCRS/2022/074	A simple candidate management procedure using Japanese longline indices	Tsukahara Y., Nakatsuka S.
SCRS/2022/075	Description of the ICCAT length at age data base for bluefin tuna from the eastern Atlantic, including the Mediterranean Sea	Rodriguez-Marin E., Quelle P., Busawon D.
SCRS/2022/076	Report of the Management Strategy Evaluation Technical Sub-group February 14-16, 2022	Walter J., Peterson C.
SCRS/2022/077	A proposal for a Biomass Limit Reference Point (B_{LIM}) for the MSE for Atlantic bluefin tuna	Walter J., Butterworth D., Rodriguez-Marin E.
SCRS/2022/078	Effects of tuning to alternative recruitment scenarios in the Atlantic bluefin tuna MSE on performance of the PW candidate management procure	Peterson C., Lauretta M., Walter J.
SCRS/2022/079	Data and initial model set-up for the 2022 stock synthesis stock assessment of the eastern Atlantic and Mediterranean bluefin tuna	Sampedro P., Kimoto A., Ortiz M., Sharma R., Fukuda H., Gordoa A., Lauretta M., Rouyer T., Sunderlöf, A., Tsukahara Y., Walter J., Rodríguez-Marín E.
SCRS/2022/080	BFT MSE operating model index projections and questions of plausibility: are these futures possible?	Duprey N.M.T., Hanke A.R.
SCRS/2022/081	Putting Candidate Management Procedures into practice	Duprey N.M.T., Hanke A.R., Butterworth D. S., Rademeyer R.A., Peterson C., Lauretta M., Walter J.
SCRS/2022/082	Refinements of the BR CMP as of April 2022	Butterworth D.S., Rademeyer R.A.
SCRS/2022/083	Longfin mako *Isurus paucus*: the forgotten cousin	Ellis J., Reeves S., McCully-Phillips S.R.
SCRS/2022/084	Stock delineation of North-east Atlantic porbeagle *Lamna nasus*	Ellis J, Johnston G., Coelho R.

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SCRS/2022/086	Workplan for the investigation of the genetic population structure of porbeagle (*Lamna nasus*) in the Atlantic Ocean	Semba Y., Tahara D., Takeshima H.
SCRS/2022/087	Refinements of the BR CMP as of May 2022	Butterworth D., Rademeyer R.A.
SCRS/2022/089	Standardized catch rates for skipjack tuna (*Katsuwonus pelamis*) from the Venezuelan baitboat fishery in the Caribbean Sea and adjacent waters of the western central Atlantic for the period of 1987-2020	Narvaez M., Evaristo E., Marcano J.H., Gutiérrez X., Arocha F.
SCRS/2022/088	Update of BR CMP to include intended indices weights	Butterworth D., Rademeyer R.A.
SCRS/2022/090	Preliminary closed-loop simulations for Northeast porbeagle: illustrating the efficacy of alternative management procedures and assessment frequency	Taylor N.G., Ortiz M., Kimoto A., Coelho R.
SCRS/2022/092	The effect of non-linear relationships between CPUE and abundance on the management procedure performance for Northeast Porbeagle	Taylor N.G., Ortiz M., Kimoto A., Coelho R., Cortés E., Forselledo R.
SCRS/2022/093	Data input and assessment models settings for the evaluation of east and west Atlantic skipjack tuna stocks.	Anon.
SCRS/2022/094	Methods description for reporting shortfin mako landings, live releases and dead discards from Canadian fisheries	Bowlby H., Minch T., Yin Y., Duprey N.
SCRS/2022/095	Preliminary East Atlantic skipjack tuna Stock Synthesis analyses	Urtizberea A., Merino G., Ortiz M., Kimoto A., Lauretta M., Ailloud L., Mourato B., SantAna R., Akia S., Santiago J., Gaertner D., Palma C., Mayor C., Taylor N., Díaz G., Calay S., Die D.
SCRS/2022/096	Updating reproductive parameters of the shortfin mako in the Southwestern Atlantic Ocean	Cabanillas-Torpoco M., Oddone M.C., Cardoso L.G.
SCRS/2022/097	Western Atlantic skipjack tuna MSE: updates to the operating models and initial evaluation of the relative performance of preliminary management procedures	Mourato B., Gustavo-Cardoso L., Arocha F., Narvaez M., Sant'Ana R.
SCRS/2022/098	Preliminary western Atlantic skipjack tuna stock assessment 1952-2020 using Stock Synthesis	Cardoso L.G., Kikuchi E., Sant'Ana R., Lauretta M., Kimoto A., Mourato B.L.

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SCRS/2022/099	Bayesian surplus production models (JABBA) applied to the western Atlantic skipjack tuna stock assessment	Sant'Ana R., Kikuchi E., Mourato B.L., Kimoto A., Ortiz M., Cardoso L.G.
SCRS/2022/100	Bayesian surplus production models (JABBA) applied to the eastern Atlantic skipjack tuna stock assessment	Sant'Ana R., Kikuchi E., Mourato B.L., Kimoto A., Ortiz M., Cardoso L.G.
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SCRS/2022/102	Stock assessment for east Atlantic skipjack using a biomass production model	Merino G., Urtizberea A., Santiago J., Laborda A., Sant'Ana R.
SCRS/2022/103	Determination of annual periodicity in annuli formation in Atlantic bluefin tuna otoliths	Rodriguez-Marin E., Busawon D., Luque P.L., Castillo I., Stewart N., Krusic-Golub K., Parejo A., Hanke A.
SCRS/2022/104	Report of the First Meeting of the Sub-Group on the Ecosystem Report Card	Juan-Jorda M., Murua H., Diaz G., Obregon P., Kell L., Alvarez-Berastegui D., Eider A., Coelho R., Sachiko T., Ochi D., Domingo A., Die D., Yates O., Tai I., Bell J., Tugores P., Hanke A.
SCRS/2022/105	Efficacy of a bycatch estimation tool	Babcock E.A., Harford W.J., Gedamke T., Soto D., Goodyear C. P.
SCRS/2022/106	ECOTEST, a proof of concept for evaluating ecological indicators in multispecies fisheries, with the Atlantic longline fishery case study	Huynh Q., Carruthers T., Taylor N.G.
SCRS/2022/107	Report of the ICCAT workshop on identification of regions in the ICCAT Convention area for supporting the implementation of ecosystem-based fisheries management	Juan-Jorda M., Nieblas A., Hanke A., Tsuji S., Andonegi E., Di Natale A., Kell L., Diaz G., Alvarez Berastegui D., Brown C., Die D., Arrizabalaga H., Yates O., Gianuca D., Niemeyer Fiedler F., Luckhurst B., Coelho R., Zador S., Dickey-Collas M., Pepin P., Murua H.
SCRS/2022/108	Developing bycatch reduction devices in tropical tuna purse seine fisheries to improve elasmobranch release	Murua J., Ferarios J.M., Grande M., Onandia I., Moreno G., Murua H., Santiago, J.
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SCRS/2022/110	Second Report of the Sub-group on Technical Gear Changes	Anon.
SCRS/2022/111	The effect of terminal gear modifications on the total mortality of the shortfin mako, *Isurus oxyrinchus*	Keller B., Reinhardt J., Swimmer Y., Brown C.
SCRS/2022/113	Tagging programs of mobulids in the Atlantic Ocean	Grande M., Onandia I., Murua J., Ferarios J.M., Ruiz J., Lezama-Ochoa N., Santiago J.

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SCRS/2022/115	Updated combined biomass index of abundance of the North Atlantic swordfish stock 1963-2020	Gillespie K.
SCRS/2022/116	Preliminary stock assessment of South Atlantic swordfish (*Xiphias gladius*) using Stock Synthesis model	Mourato B., Kikuchi E., Gustavo Cardoso L., Sant'Ana R., Parker D.
SCRS/2022/117	Assessment of the South Atlantic swordfish (*Xiphias gladius*) stock using JABBA	Parker D., Kikuchi E., Mourato B.
SCRS/2022/118	Update of the age and growth component of the Swordfish Biology Project with preliminary age reading results	Rosa D., Busawon D., Quelle P., Krusic-Golub K., Garibaldi F., Mariani A. Di Natale A., Schirripa M., Alves Bezerra N., Su Gustavo Cardoso L., Arocha F., Lombardo S., Campello T., Travassos P., Brown C., Hanke A., Gillespie K., Coelho R.
SCRS/2022/119	Preliminary evaluation of the North Atlantic swordfish (*Xiphias gladius*) stock using the surplus production model ASPIC	Ortiz M., Kimoto A.
SCRS/2022/120	A stochastic prior on steepness for Atlantic swordfish derived from life-history information	Taylor N.G., Sharma R., Arocha F.
SCRS/2022/121	Preliminary closed-loop simulation of management procedure performance for southern swordfish	Taylor N.G.
SCRS/2022/122	Standardized catch per unit of effort of albacore (*Thunnus alalunga*) from the Spanish bait boat fleet for period; 1981-2021 in the North-East Atlantic	Ortiz de Zárate V., Ortiz M.
SCRS/2022/123	Albacore (*Thunnus alalunga*) reproductive biology study for the North Atlantic stock: years 2020 and 2021	Ortiz de Zárate V., Macias D., Arocha F., Su NJ., Dheeraj, B., Hanke A., Puerto MA, Gomez MJ., Parejo A., and Castillo I.
SCRS/2022/124	Current status of the northern swordfish (*Xiphias gladius*) stock in the Atlantic Ocean 2022: post-decisional stock assessment model	Schirripa M.
SCRS/2022/125	2022 ASAP stock assessment of the eastern Atlantic and Mediterranean bluefin tuna	Carrano C., Maguire J-J., Kerr L., Walter J., Lauretta M., Rouyer T., Cadrin S. X.
SCRS/2022/126	BR CMP as at June 2022	Butterworth D., Rademeyer R.A.
SCRS/2022/127	A brief review of natural mortality for the eastern Atlantic and Mediterranean bluefin tuna, Pacific bluefin tuna and southern bluefin tuna	Feng J., Zhang F., Zhu J.
SCRS/2022/128	2022 proposed base case model for eastern Atlantic and Mediterranean bluefin tuna assessment using stock synthesis	Sampedro P., Tsukahara Y., Lauretta M., Fukuda H., Sharma R., Gordoa A., Rouyer T., Kimoto A., Walter J. and Rodríguez-Marín E.

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SCRS/2022/129	Final data, explorations, model set-up and diagnostics for the 2022 VPA stock assessment of the eastern Atlantic and Mediterranean bluefin tuna stock	Rouyer T., Kimoto A., Zarrad R., Ortiz M., Palma C., Mayor C., Lauretta M., Gordoa A., Rodriguez Marín E., Walter J.
SCRS/2022/130	Western skipjack stock status and projections with the Stock Synthesis assessment model	Kimoto A., Cardoso L.G., Kikuchi E., Lauretta M., Sant'Ana R., Mourato B.L., Ortiz M.
SCRS/2022/131	Characteristics of the Balfegó purse seine fleet, CPUE approaches contextualize with the eastern stock indicators	Gordoa A., Bahamón N., Ortiz M., Santiago J.
SCRS/2022/132	Eastern Atlantic bluefin tuna assessment review Report from the data preparation meeting held in April	Ianelli J.
SCRS/2022/133	Some features of the Spanish surface albacore (*Thunnus alalunga*) fishery in 2021	Ortiz de Zárate V., Parejo A.
SCRS/2022/134	Summary of data from the Southwest of England blue shark fishery from 1953-2021	Thomas S., Alsop A., Chapman R.S., Collings M., Davis P., Evans L., Faisey K.A., Hawkins D., Hodder L., Howell A., Malia O., Margetts D., Forester M., McKie K.A., McMaster J.D.,Murphy S., Narbett S., Newell S., Rogers J., Rudd H.S., Somerfield P.J., West D., Whittaker P., Wright S., Wyatt K., Uren D., Jones G.
SCRS/2022/136	Report of the 2021 ICCAT Billfish Workshop on Age Reading	Anon.
SCRS/2022/137	Protocol for sampling and processing billfish anal fin spines and otoliths	Rosa D., Sow F.N., Krusic-Golub K., Sutrovic A., Barbosa C., Bento T., Goes S., Coelho R.
SCRS/2022/138	Intersessional work on the eastern Atlantic skipjack stock: Bayesian surplus production model JABBA	Sant'Ana R., Kikuchi E., Mourato B.L., Kimoto A., Ortiz M., Cardoso L.G.
SCRS/2022/139	Report of the Tropical Species Group Informal Meeting on Skipjack Projections	Anon.
SCRS/2022/140	Description of current estimation method of dead discard and live release of North Atlantic shortfin mako caught by Japanese longline fleet between 2019 and 2021	Semba Y., Inoue Y., Satoh K., Uosaki K.
SCRS/2022/141	Standardized joint CPUE index for bluefin tuna (*Thunnus thynnus*) caught by Moroccan and Portuguese traps for the period 2008-2021	Lino P.G., Abid N., Malouli M.I., Bensbai J., Coelho R.
SCRS/2022/142	Description for estimating shortfin mako (*Isurus oxyrinchus*) live releases and dead discards from China fisheries	Feng J., Zhang F., Zhu J., Wu F.
SCRS/2022/143	Revision of U.S. shark dead discards estimates for the pelagic longline fishery 1987-2000	Diaz G.

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SCRS/2022/145	Updated indicators of relative abundance for bluefin tuna based on 1996 to 2021 Canadian fisheries data	Hanke A.
SCRS/2022/146	Updated size conversion factors for Mediterranean swordfish (*Xiphias gladius L.*) caught by the Italian longline fleet in the Mediterranean Sea	Pappalardo L., Pignalosa P.
SCRS/2022/147	On the major concentration of large bigeye tuna and yellowfin tuna exploited in the Atlantic Ocean by purse seiners in February and March 2019: analysis of the fishery data	Fonteneau A., Gaertner D.
SCRS/2022/148	Area specific standardized CPUE for north Atlantic albacore by the Japanese longline fishery	Matsumoto T., Matsubara N., Tsuda Y.
SCRS/2022/149	standardised catch rates of swordfish (*Xiphias gladius*) for the South African pelagic longline fishery (2004-2020)	Parker D.
SCRS/2022/151	Estimate of the capacity of large-scale purse seiners fishing for tropical tunas in the Atlantic Ocean in 2022	Restrepo V.R., Murua H., Justel-Rubio A.
SCRS/2022/152	The standardized CPUE for Japanese longline fishery in the Atlantic up to 2021 fishing year: revision and porting to R	Tsukahara Y., Fukuda H., Nakatsuka S.
SCRS/2022/153	Eastern skipjack stock status and projections with the Stock Synthesis and JABBA assessment models	Kimoto A., Lauretta M., Urtizberea A., Ortiz M., Sant'Ana R.
SCRS/2022/154	Addendum to BR CMP as at end August 2022	Butterworth D., Rademeyer R.A.
SCRS/2022/155	The Potential of conventional genetic mark-recapture for informing management procedures and stock assessments for Atlantic bluefin tuna	Carruthers T.
SCRS/2022/156	Update to the F_{01} based Candidate Management Procedure and final performance tuning results	Duprey N.M.T., Hanke A.R.
SCRS/2022/157	North Atlantic swordfish stock status and projections with the Stock Synthesis and JABBA assessment models	Kimoto A., Schirripa M., Gillespie K., Parker D., Ortiz M.
SCRS/2022/158	The preliminary results of the pilot study for automatic fish length estimation system for bluefin tuna in Moroccan Atlantic farm	Abid N., Bensbai J., Faraj A.
SCRS/2022/159	Update on shortfin mako (*Isurus oxyrinchus*) fishery in the Moroccan Atlantic waters	Baibbat S., Abid N., Bensbai J.

Doc Ref	*Title*	*Authors*
SCRS/2022/160	Multinational pelagic longline index of bluefin tuna relative abundance in the Gulf of Mexico	Lauretta M., Ramirez K.
SCRS/2022/161	Reconstrucción histórica de las capturas de especies pelágicas incluidas en ICCAT realizadas por flota palangrera en la zona económica exclusiva del Caribe de Costa Rica entre 1999 y 2020	Quesada N., Sánchez L.A., Chaves B.P., Carvajal J.M.
SCRS/2022/162	Catches of carcharhinidae sharks in ICCAT fisheries	Taylor N.G., Ortiz M., Palma C.
SCRS/2022/163	Lessons learned and recommendations from the Atlantic Ocean Tropical Tuna Tagging Programme (AOTTP) - evidence based approach for sustainable management of tuna resources in the Atlantic	Beare D., Garcia J., Naulaerts J., Wright S., Ngom F., Diaha C., Goñi N., Chifflet M., Onandia I., Norman S., Parker D., Pascual P., Ailloud L.
SCRS/2022/164	Statistics of the French purse seine fishing fleet targeting tropical tunas in the Atlantic Ocean (1991-2021)	Floch L., Cauquil P., Depetris M., Duparc A., Sabarros P., Lebranchu J.
SCRS/2022/165	Report of the Sub-group on Electronic Monitoring Systems: Proposal of Draft ICCAT Minimum Technical Standards for EMS in Pelagic Longliners	Anon.
SCRS/2022/166	Quarterly standardized CPUE of albacore tuna in the North and South of the North Atlantic Ocean for the Chinese Taipei longline fishery	Su N-J., Cheng C.Y., Shiu Y.W.
SCRS/2022/167	Updating size composition information for bigeye tuna caught in the Chinese Taipei longline fishery in the Atlantic Ocean	Su N-J., Huang W.H.
SCRS/2022/168	ICCAT Atlantic-Wide Research Programme for Bluefin tuna (GBYP) Activity Report for Phase 11 and the First Part of Phase 12 (2021-2022)	Alemany F., Tensek S., Pagá García A.
SCRS/2022/169	Results, features and interpretations of the four remaining BFT MSE candidate management procedures	Peterson C., Walter J., Butterworth D., and Rouyer T.
SCRS/2022/170	Final report on the genetic population structure on shortfin mako shark in the Atlantic Ocean.	Takeshima H., Nanba R., Ooka S., Ando D.,Hayakawa A., Kokubun S., Noda S.,Takano Y., Yanada R., Coelho R., Santos M.N., Cortés E., Domingo A., de Urbina J.O., Sakuma K., Nohara K., Tahara D., Y. Semba
SCRS/2022/171	Progress report of genetic population structure of porbeagle in the Atlantic Ocean	Semba Y.
SCRS/2022/172	An overview of bigeye tuna (*Thunnus obesus*) stock productivity parameters in the Atlantic Ocean	Artetxe-Arrate I., Zudaire I., Merino G., Urtizberea A., Fraile I., Luque P., Grande M., Arrizabalaga H., Santiago J.

Doc Ref	*Title*	*Authors*
SCRS/2022/173	Summary of the 2021 Pilot Year Catch and Release Tagging (CHART) Programme in Southwest England	Phillips S., Ford J., Murphy S., McMaster J., Thomas S., Duffy M., Davis S., Arris M., Righton D.
SCRS/2022/174	A review of SCRS comments on reporting of catch for eastern Atlantic and Mediterranean bluefin tuna	Maguire J.-J., Cadrin S., Carrano C.
SCRS/2022/175	Eastern Atlantic bluefin tuna assessment review	Ianelli J.
SCRS/2022/176	Technical report on the preliminary age estimation of Atlantic blue marlin, white marlin and sailfish using sagittal otoliths	Krusic-Golub K., Sutrovic A., Rosa D., Ngom F.
SCRS/2022/177	Evaluation of alternative management procedures for North Atlantic albacore after Recommendation 21-04	Merino G., Urtizberea A., Santiago J., Arrizabalaga H.
SCRS/2022/178	Analysis and results of weight gain of bluefin tuna (*Thunnus thynnus*) in farms	Ortiz M., Mayor C., Alemany F., Pagá A.
SCRS/2022/179	Preliminary Stock Synthesis model using updated data for North Atlantic albacore	Urtizberea A., Merino G.
SCRS/2022/180	Management Strategy Evaluation for the western Atlantic skipjack tuna with operating model conditioning based on the Stock Synthesis model	Mourato B., Cardoso L.G., Sant'Ana R.
SCRS/2022/181	Revision of gear classification and fishing effort location in the South Atlantic (St Helena)	Benjamin G., Wright S., Bradley K.
SCRS/2022/182	South Atlantic albacore tuna reproductive biology	Travassos P., Araújo M.L., Rêgo M., Evêncio J., Cardoso L.G., Parker D., Domingo A., Su N.J., Santana F.
SCRS/2022/183	The BR CMP as submitted to the September 2022 Bluefin Species Group Meeting	Butterworth D., Rademeyer R.A.
SCRS/2022/185	Estimate of live release and dead discards of the shortfin mako shark caught by the Taiwanese longline fishery in the North Atlantic Ocean	Liu K-M, Su K-Y.
SCRS/2022/186	Alternative approach for scientific monitoring of small scale bluefin tuna fisheries in the Mediterranean Sea	Abid N., Bensbai J.
SCRS/2022/187	Alternative approach for scientific monitoring of small-scale fishery targeting swordfish in the Mediterranean Sea	Abid N., Bensbai J.
SCRS/2022/188	Seasonal indices of albacore relative abundance in the U.S. Atlantic longline fishery	Lauretta M.
SCRS/2022/189	Specifications for MSE trials for Atlantic bluefin tuna	Anon.

List of Presentations

DocRef	*Title*	*Authors*
SCRS/P/2022/001	A brief overview of AOTTP results for skipjack tuna	Ailloud L.
SCRS/P/2022/002	Tuna catch estimate in faux poisson for the purse seine fishery	Duparc A.
SCRS/P/2022/005	Update of the ageing sample collection, processing, reading and modelling: spines and otoliths	Anon.
SCRS/P/2022/006	Review of outstanding decision points for the North Atlantic swordfish MSE process	Hordyk A.
SCRS/P/2022/007	Development of Candidate Management Procedures for the North Atlantic swordfish MSE	Hordyk A.
SCRS/P/2022/009	Update on development of the North Atlantic swordfish MSE	Gilespie K, Hordyk A.
SCRS/P/2022/011	Applying mixed-effects growth models to back-calculated size-at-age data for Atlantic bluefin tuna	Stewart N.D., Busawon D.S., Rodriguez-Marin E., Siskey M., Hanke A.
SCRS/P/2022/012	Estimating age-at-maturity from biphasic growth models for Atlantic bluefin tuna	Stewart N.D., Busawon D.S., Rodriguez-Marin E., Siskey M., Wilson K., Hanke A.
SCRS/P/2022/013	Preliminary CMP results April 2022	Carruthers T.
SCRS/P/2022/014	An exploitation rate proposal for an appropriate MSE performance metric relating to fishing mortality	Carruthers T.
SCRS/P/2022/015	The 2022 VPA stock assessment preliminary results of the eastern Atlantic and Mediterranean bluefin tuna	Rouyer T., Kimoto A., Zarrad R., Ortiz M., Palma C., Mayor C., Lauretta M., Rodriguez-Marin E., Walter J.
SCRS/P/2022/016	The 2022 Stock Synthesis stock assessment preliminary results of the eastern Atlantic and Mediterranean bluefin tuna	Sampedro P., Kimoto A., Ortiz M., Sharma R., Fukuda H., Gordoa, A., Lauretta M., Rouyer T., Sunderlöf A., Tsukahara Y., Walter J., Rodríguez-Marín E.
SCRS/P/2022/017	The 2022 ASAP stock assessment preliminary results of the eastern Atlantic and Mediterranean bluefin tuna	Cadrin S.X., Carrano C., Maguire J.-J.
SCRS/P/2022/018	GBYP Aerial survey: overview and latest results	Alemany F., Tensek S., Pagá A.
SCRS/P/2022/019	Updating on GBYP matters	Alemany F., Tensek S., Pagá A.
SCRS/P/2022/020	Atlantic tropical tuna Management Strategy Evaluation (MSE)	Laborda A., Merino G., Urtizberea A., Santiago J.
SCRS/P/2022/021	Updated CMP results	Carruthers T.
SCRS/P/2022/022	Analysis of recruitment deviates of tropical tuna stock assessments	Merino G., Urtizberea A., Fu D., Winker H., Cardinale M., Lauretta M.V., Murua H., Kitakado T., Arrizabalaga H., Scott R., Pilling G., Minte-Vera C., Xui H., Laborda A., Erauskin-Extraminiana M., Santiago J.

DocRef	*Title*	*Authors*
SCRS/P/2022/023	Model diagnostics in integrated stock assessments	Kell L.T., Winker H., Cardinale M., Sharma R., Mosqueira M., Kitakado T.
SCRS/P/2022/024	SRDCP Tagging activities: update	Santos C.C., Domingo A., Carlson J., Natanson L., Travassos P., Macías D., Cortés E., Miller P., Hazin F., Mas F., Ortiz de Urbina J., Parker D., Romanov E., Sabarros P., Bach P., Bowlby H., Biais G., Coelho R.
SCRS/P/2022/025	Age and growth of shortfin mako in the South Atlantic: update	Santos C.C., Cardoso L.G., Semba Y., Domingo A., Jagger C., Rosa D., Mas F., Mathers A., Natanson L.J., Carlson J., Coelho R.
SCRS/P/2022/026	Bycatch mitigation of BSH using a global habitat model by sex and size	Druon N., Bowlby H.
SCRS/P/2022/027	Update on NW Atlantic pelagic shark tagging	Carlson J., Cortés E., Kroetz A., Talwar B., Cardenosa D., Heithaus M., Santos C., Coelho R., Domingo A., Grubbs R.D., Chapman D., Anderson B.N., Sulikowski J.
SCRS/P/2022/029	Updated summary on North Atlantic ALB MSE	Arrizabalaga H., Merino G.
SCRS/P/2022/030	Improving EFFDIS: cross-validation of catch and effort data to identify weaknesses	Palma C., Taylor N.G., Major C.
SCRS/P/2022/031	Preliminary stock status and projection results of the western skipjack stock using Stock Synthesis	Cardoso L.G., Kikuchi E., Lauretta M., Kimoto A., Sant'Ana R., Mourato B. L.
SCRS/P/2022/032	Update of the meta-analysis on the effects of hook, bait, and leader type on retention and at-haulback mortality rates of target and bycatch species	Santos C., Rosa D., Coelho R.
SCRS/P/2022/033	Advances on the collaborative work to assess sea turtle bycatch in pelagic longline and purse seine fleets (Atlantic and Indian oceans and Mediterranean Sea)	Domingo A.
SCRS/P/2022/034	Examples of the use of structural uncertainty in RFMO shark assessments	Rice J.
SCRS/P/2022/035	Study case for Ecosystem Based Management (EBM) in the Mediterranean EcoRegion: an initiative for monitoring the environmental variability of tuna related marine ecosystems and transference for effective EBM	Alvarez-Berastegui D., Reglero P., Carlos-Baez J., Macias D., Ortiz-de Urbina J., Cabanellas M., Juza M., Mourre B., Hernandez I., Diaz-Barroso L., Tintoré J., Amengual-Ramis J., Cardin V., Gloria-Lazaro, A.
SCRS/P/2022/036	Updated summary on North Atlantic SWO MSE	Gillespie K.
SCRS/P/2022/037	Risk assessment framework for targeted, bycaught, endangered, threatened, protected, predator and prey species	Kell L.T.
SCRS/P/2022/038	BFT Management Strategy Evaluation (MSE)	Walter J.
SCRS/P/2022/039	Atlantic multidecadal oscillation: a clarification and projection at depths	Moffat B.T.

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SCRS/P/2022/040	EAFM or EBFM in ICCAT: terminology and definitions	Juan-Jordá M.
SCRS/P/2022/041	Trophic ecology in the ICCAT tropical ecoregion	Andonegi E.
SCRS/P/2022/042	Stock status and projections from the reference case model for South Atlantic swordfish (*Xiphias gladius*) stock using JABBA	Parker D., Kikuchi E., Mourato B.L., Kimoto A.
SCRS/P/2022/043	Model results and initial projections for the 2022 VPA stock assessment of the eastern and Mediterranean Atlantic bluefin tuna stock	Rouyer T., Kimoto A., Zarrad R., Ortiz M., Palma C., Mayor C., Lauretta M., Gordoa A., Rodriguez Marín E., Walter J.
SCRS/P/2022/044	The use of AR1 in Projecting with JABBA	Parker D., Winker H.
SCRS/P/2022/045	North Atlantic swordfish projection	Kimoto A., Winker H., Shrippa M., Parker D., Gillespie K., Ortiz M.
SCRS/P/2022/046	Some considerations for modeling growth of east Atlantic bluefin tuna in Stock Synthesis	Lauretta M., Sampedro P.
SCRS/P/2022/047	Updated CMP results	Carruthers T.
SCRS/P/2022/048	An update on the analysis of weight gain of farm E- BFT	Ortiz M., Mayor C., Pagá A., Alemany F.
SCRS/P/2022/049	Updating on GBYP matters	Alemany F., Tensek S., Pagá A.
SCRS/P/2022/050	Evaluation of exceptional circumstances for North Atlantic albacore in 2022	Merino G., Arrizabalaga H., Santiago J.
SCRS/P/2022/051	Development and evaluation of some Candidate Management Procedures based on surplus production assessment models for the North Atlantic swordfish	Hordyk A.
SCRS/P/2022/052	Updated CMP results	Carruthers T.
SCRS/P/2022/053	Shedding rates and retention performance of conventional dart tags in large pelagic sharks: Insights from a double-tagging experiment on blue shark (*Prionace glauca*)	Mas F., Cortés E., Coelho R., Defeo O., Forselledo R., Jiménez S., Miller P., Domingo A.
SCRS/P/2022/054	Bycatch mitigation trials in pelagic longlines Southern Adriatic (Central Mediterranean)	Carbonara P., Prato G., Zupa W., Niedermüller S., Buzzi A., Spedicato M.
SCRS/P/2022/055	Updated North Atlantic albacore e-tagging research 2019 - 2022	Cabello de los Cobos M., Arregui I., Onandia I., Uranga J., Lezema-Ochoa N., Ortiz de Zarate V., Delgado R., Santiago J., Abascal F., Arrizabalaga H.
SCRS/P/2022/056	Fisheries & biological data submitted during 2022 (includes historical revisions)	Secretariat
SCRS/P/2022/057	A preliminary stock assessment of the king mackerel in Southwest Atlantic	Silva M., Barreto T., Soares A., Cope J., Lucena-Frédou F.
SCRS/P/2022/058	NEA Porbeagle stock: long term projections with SPICT at the 2022 ICES Elasmobranch Working Group (WGEF)	Biais G.
SCRS/P/2022/059	CMP results	Carruthers T.

DocRef	*Title*	*Authors*
SCRS/P/2022/061	On the major concentration of large BET and YFT exploited in the Atlantic by purse seiners in February & March 2019, analysis of the Spanish fishery data	Pascual P., Déniz S.
SCRS/P/2022/062	Growth studies of little tunny (*Euthynnus alletteratus*) and Atlantic bonito (*Sarda sarda*) for the Small Tunas Year Programme	Muñoz-Lechuga R., Silva G., Lino P.G., Macias D., Saber S., Sow F.N., Diaha C.N., Angueko D., Hajjej G., Baibbat S., Massa-Gallucci A., Deguara S., Sant'Ana R.
SCRS/P/2022/063	On the impact of the moratoria on FADs	Santiago J., Grande M., Merino G.
SCRS/P/2022/064	Summary the observer data for tropical tunas caught in PS gear submitted through the ST09	Taylor N.G.
SCRS/P/2022/065	SMT	

Appendix 5

2022 Secretariat Report on Statistics and Coordination of Research

The final 2022 Secretariat Report on Statistics and Coordination of Research will be published in the *Report for Biennial Period 2022-2023, Part I (2022), Vol. 4.*

Appendix 6

Task 1 catches for all major ICCAT species (excluding those contained in items 9.1 to 9.4 of this report)

Task 1 catches for all major ICCAT species (excluding those contained in items 9.1 to 9.4 of this report). In some tables, shaded grey cells indicate SCRS temporary estimates (mostly carry overs).

#	Table	Source	Species	Scie. Name	Spc. Group
1	YFT-Table 1	T1NC catches (t) - (L + DD)	YFT	*Thunnus albacares*	Tropical tunas
2	BET-Table 1	T1NC catches (t) - (L + DD)	BET	*Thunnus obesus*	Tropical tunas
3	ALB-Table 1	T1NC catches (t) - (L + DD)	ALB	*Thunnus alalunga*	Temperate
4	SWO-MED-Table 1	T1NC catches (t) - (L + DD)	SWO-MD	*Xiphias gladius*	SWO & billfish
5	WHM+RSP -Table 1	T1NC catches (t) - (L + DD)	WHM	*Kajikia albida*	SWO & billfish
6	BUM-Table 1	T1NC catches (t) - (L + DD)	BUM	*Makaira nigricans*	SWO & billfish
7	SAI-Table 1	T1NC catches (t) - (L + DD)	SAI	*Istiophorus albicans*	SWO & billfish
8	SPF-Table 1	T1NC catches (t) - (L + DD)	SPF	*Tetrapturus pfluegeri*	SWO & billfish
9	SMTuna-Table 1	T1NC catches (t) - (L + DD)	SMT sp.	*(13 species)*	Small tuna species
10	BSH-Table 1	T1NC catches (t) - (L + DD)	BSH	*Prionace glauca*	Major sharks
11	SMA-Table 1	T1NC catches (t) - (L + DD)	SMA	*Isurus oxyrinchus*	Major sharks

YFT-Table 1. Estimated catches (t) of yellowfin (*Thunnus albacares*) by area, gear and flag.

				1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
TOTAL				163687	163561	173185	154725	149206	137304	144561	134817	132453	153101	136461	123192	119573	105075	105892	102843	111874	117915	118280	113918	113686	106333	115024	130699	151385	137519	136530	137016	156692	110602
	ATE			125398	124725	124849	119431	116151	104363	113615	103601	96825	112772	106797	98205	88267	75559	77614	78667	93744	99135	97251	94678	91176	82445	89880	102473	114124	98841	102632	108093	124675	83820
	ATW			38289	38836	48336	35294	33056	32941	30946	31217	35628	40329	29665	24987	31305	29516	28278	24176	18130	18780	21029	19239	22510	23888	25144	28226	37262	38678	33898	28922	32017	26783
Landings	ATE		Bait boat	15095	18297	15496	13390	11250	12529	14080	16444	9830	13950	11398	9956	14511	9540	12492	12795	9457	8750	9305	12219	9029	6748	9352	9173	9862	7785	7274	6814	6354	5435
			Longline	7171	9079	14876	13935	14493	10740	13872	13063	11588	7576	5864	9183	11537	7206	7234	13437	8562	7443	5161	6298	5337	5657	4742	4343	4860	4583	5025	6132	4735	3940
			Other surf.	1519	1570	1817	1839	1839	1879	1752	1581	2437	2021	1714	2467	2886	2350	2988	2129	1595	1844	1752	1264	2040	3032	1702	1774	2651	2550	1803	3469	5885	3490
			Purse seine	99149	92332	89601	87759	87755	77720	82423	70730	70920	88838	87499	75294	57798	55409	54153	49471	73122	79675	79164	71875	72897	65676	72682	85146	94245	82477	86950	90060	105951	70186
	ATW		Bait boat	6276	6383	7094	5297	4560	4275	5511	5364	6753	5572	6009	3764	4868	3867	2695	2304	886	1331	1436	2311	1299	1602	520	810	1238	925	742	862	826	1028
			Longline	18442	13675	12626	11560	12605	11896	12426	14259	16168	15699	11926	10167	18166	18171	15469	16106	13780	14654	14888	11977	13005	10067	9059	10027	13129	11710	11236	11512	13666	9644
			Other surf.	1635	2606	5465	4907	5107	4459	3826	4900	4838	5107	3763	6445	5004	4826	5667	3418	1392	1417	1975	2686	4432	8181	12431	14293	16881	20493	17550	13288	14425	15082
			Purse seine	11937	16172	23151	13530	10784	12310	9184	6527	7870	13951	7966	4611	3266	2652	4442	2341	2067	1370	2722	2256	3768	4035	3131	3037	5948	5499	4331	3224	3053	1011
Landings(FP)	ATE	CP	Purse seine	2463	3447	3059	2509	813	1495	1488	1781	2051	387	321	1305	1534	1054	747	836	1008	1423	1869	3021	1872	1332	1401	1901	2506	1384	1533	1596	1725	741
	ATW		Purse seine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	54	63	49	35	32	28	
Discards	ATE		Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	6	5	7	10
			Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Purse seine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	137	0	63	40	17	20	19
	ATW		Longline	0	0	0	0	0	0	0	167	0	0	0	0	0	0	5	6	5	9	8	9	7	3	3	3	3	3	5	4	18	18
			Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Purse seine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Landings	ATE	CP	Angola	441	211	137	216	78	70	115	170	35	34	34	34	34	0	0	23	98	0	0	0	0	0	0	0	0	2	3	150	0	
			Belize	0	0	0	1	0	3	963	0	326	406	0	0	0	0	0	0	0	405	1794	3172	5861	5207	7036	7132	3497	5811	8121	9152	8688	7571
			Canada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Cape Verde	1527	1612	1943	1908	1518	1783	1421	1663	1851	1684	1953	1868	3236	6019	5648	4568	7905	4638	5856	6002	4603	7513	4507	7823	6990	2756	5498	3699	6239	2043
			China PR	0	139	156	200	124	84	71	1535	1652	586	262	1033	1030	1112	1056	1000	365	214	169	220	170	130	20	78	286	346	188	163	81	32
			Curaçao	0	0	0	0	3183	6082	6110	4039	5646	4945	4619	6667	4747	24	1939	1368	7351	6293	5302	4413	6792	3727	5152	6140	7905	6535	7543	7751	8986	7700
			Côte d'Ivoire	0	0	0	0	0	2	0	0	673	213	99	302	565	175	482	216	626	573	470	385	1481	2077	324	251	315	952	116	2649	4460	2117
			EU-Denmark	0	0	0	0	0	0	0	0	0	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-España	49902	40403	40612	38278	34879	24550	31337	19947	24681	31105	31469	24884	21414	11795	11606	13584	24409	32793	25560	21026	18854	11878	14225	21094	19266	12308	10669	14457	19418	9885
			EU-Estonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-France	33304	36087	34793	29594	33838	29351	30760	29900	29923	31861	34444	33035	23913	22662	18940	13733	16115	18927	20342	22037	18506	20258	22533	20451	26085	25831	24581	17745	15867	12454
			EU-Ireland	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-Italy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-Latvia	54	16	0	55	151	223	97	25	36	72	334	334	334	334	334	0	0	0	200	143	15	0	0	23	0	0	0	0	0	**0**
			EU-Lithuania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	**0**
			EU-Poland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-Portugal	195	128	126	231	288	176	267	177	194	4	6	4	5	16	274	865	300	990	537	452	355	335	69	76	112	67	133	125	127	19
			El Salvador	0	0	0	0	0	0	0	0	0	933	0	0	0	0	0	0	0	0	0	0	0	0	0	2750	8252	6227	5553	3959	8694	6337

	Gabon	0	12	88	218	225	225	295	225	162	270	245	44	6	2	44	0	1	0	0	0	0	0	0	0	1	3	0	0	0	0
	Gambia	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
	Ghana	9331	13283	9984	9268	8182	15087	13850	21450	12673	23845	18546	15839	15444	13019	14037	15570	16521	15858	20252	18501	15994	13552	18426	18896	19582	18969	21970	24099	24599	20111
	Great Britain	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	21	22	1	0	0	0	0	0	0	0	0
	Guatemala	0	0	0	0	0	0	0	0	0	0	0	2207	1588	2906	5265	3461	3736	2603	3124	2803	2949	4023	3754	5200	2703	3647	2499	2944	2581	1841
	Guinea Ecuatorial	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	892	892	199	0	2	11	9	6	0	8	10	8	7
	Guinée Rep	0	0	0	208	1956	820	0	0	0	0	0	0	0	0	0	0	0	0	298	292	1559	1484	823	0	0	0	0	0	0	322
	Honduras	2	0	0	4	3	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Japan	2961	2627	4194	4770	4246	2733	4092	2101	2286	1550	1534	1999	5066	3088	4206	8496	5266	3563	3041	3348	3637	3843	3358	2857	2914	2708	2946	3395	2565	2652
	Korea Rep	174	169	436	453	297	101	23	94	142	3	8	209	984	95	4	303	983	381	324	20	26	97	77	36	356	408	449	507	563	249
	Liberia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	49	71	89	100	88	76	88	1	6	1731	10
	Libya	0	0	0	0	0	0	0	0	0	208	73	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Maroc	2653	2396	3017	2290	3430	1947	2276	2307	2441	3000	2111	1675	814	1940	222	102	110	110	44	272	55	137	107	72	115	113	108	228	344	493
	Mauritania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Namibia	0	0	35	14	72	69	3	147	59	165	89	139	85	135	59	28	11	1	9	90	24	6	15	42	53	53	424	82	327	256
	Nigeria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	3	1	0	0	0	0	0	0	0	0	0
	Norway	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Panama	8338	10973	12066	13442	7713	4293	2111	1315	1322	626	1112	0	1887	6170	8557	9363	6175	5982	5048	4358	5004	3899	4587	3202	4305	5073	4071	5863	8187	5
	Philippines	0	0	0	0	0	0	126	173	86	0	50	9	68	13	30	88	53	152	89	134	5	56	0	0	0	0	0	0	0	0
	Russian Federation	1862	2160	1503	2936	2696	4275	4931	4359	737	0	0	0	0	4	42	211	42	33	0	0	0	0	0	0	0	0	0	0	0	0
	S Tomé e Príncipe	170	181	125	135	120	109	124	114	122	122	122	122	134	145	137	144	160	165	169	173	177	182	186	301	301	266	3	8	58	60
	Senegal	40	15	1	94	77	152	248	663	194	279	558	253	589	1106	1347	1071	720	1146	939	1235	1875	1081	603	1883	6850	3988	5029	8161	8177	8228
	South Africa	69	266	486	199	157	116	261	320	191	342	152	298	402	1156	1187	1063	351	303	235	673	174	440	1512	925	706	387	389	551	700	398
	St Vincent and Grenadines	4936	5391	2476	2142	2981	3146	3355	2170	2113	3715	189	56	14	0	101	209	83	74	28	0	0	0	0	0	0	71	0	0	0	0
	UK-Sta Helena	166	171	150	181	151	109	181	116	136	72	90	158	226	240	344	177	97	104	65	163	149	53	152	178	181	221	199	310	87	79
	USA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	USSR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Uruguay	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Venezuela	0	0	0	0	0	0	0	0	0	0	3612	245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCC	Chinese Taipei	1554	1301	3851	2681	3985	2993	3643	3389	4014	2787	3363	4946	4145	2327	860	1707	807	1180	537	1463	818	1023	902	927	761	563	550	464	437	180
NCO	Benin	1	1	1	1	1	3	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Cambodia	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Cayman Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Congo	18	17	14	13	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Cuba	653	541	238	212	257	269	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Faroe Islands	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Georgia	22	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	NEI (ETRO)	2359	388	477	1847	0	148	0	0	0	1510	1345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	NEI (Flag related)	1315	1157	2524	2975	3588	3368	5464	5182	3072	2019	43	466	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

	Seychelles	0	0	0	0	0	0	0	0	6	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Ukraine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Vanuatu	872	1624	2357	2357	1130	576	0	228	0	0	0	0	0	24	145	483	450	331	23	10	124	21	0	0	0	0	0	0	0	
ATW CP	Barbados	179	161	156	255	160	149	150	155	155	142	115	178	211	292	197	154	156	79	129	131	195	188	218	262	324	270	248	121	173	212
	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	143	1164	1160	940	264	42	41	38	33	0	2163	359	623	955	653	625
	Brazil	4228	5131	4169	4021	2767	2705	2514	4127	6145	6239	6172	3503	6985	7223	3790	5468	2749	3313	3677	3615	4639	7277	11645	13643	16682	18362	16381	12907	13183	13664
	Canada	25	71	52	174	155	100	57	22	105	125	70	73	304	240	293	276	168	53	166	50	93	74	34	59	19	193	15	108	75	110
	Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43	0	81	86	0	21	**0**
	China PR	0	0	0	0	0	0	628	655	22	470	435	17	275	74	29	124	284	248	258	126	94	81	73	91	182	232	172	158	380	108
	Curaçao	160	170	155	140	130	130	130	130	130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	127	107	126	72	22	96	28
	EU-España	1314	989	7	4	36	34	46	30	171	0	0	0	0	0	1	84	81	69	27	33	32	138	155	105	360	357	239	299	200	317
	EU-France	578	91	121	20	0	600	27	4	0	9	0	4	49	18	0	0	0	122	456	712	412	389	690	641	403	346	488	864	1222	808
	EU-Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**0**
	EU-Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	151	60	88	179	260	115	127	92	4	2	0	15	70	505	131	3	3
	El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31	381	91	21	18	119	**0**
	FR-St Pierre et Miquelon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Ghana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	476	369	513	763	636	1429	2376	2144	1836	**0**
	Grenada	595	858	385	410	523	302	484	430	403	759	593	749	460	492	502	633	756	630	673	0	0	0	0	1167	1607	1257	1391	818	784	
	Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	71	40	13	14	15
	Japan	1591	469	589	457	1004	806	1081	1304	1775	1141	571	755	1194	1159	437	541	986	1431	1539	1106	1024	734	465	612	462	415	147	655	349	722
	Korea Rep	45	11	0	0	84	156	0	0	0	0	0	0	0	580	279	270	10	52	56	470	472	115	39	11	12	3	6	0	16	123
	Mexico	742	855	1093	1126	771	826	788	1283	1390	1084	1133	1313	1208	1050	938	890	956	1211	916	1174	1414	1004	1045	968	1279	1241	1028	760	817	881
	Panama	2297	0	0	0	0	0	0	5	0	20	28	0	0	0	2804	227	153	119	2134	1126	1630	1995	902	1580	1863	1620	2104	2382	4222	1304
	Philippines	0	0	0	0	0	0	36	106	78	12	79	145	299	230	234	151	167	0	0	0	30	72	76	0	0	0	0	0	0	**0**
	St Vincent and Grenadines	22	65	16	43	37	35	48	687	1989	1365	1165	568	4251	3430	2680	2989	2547	2274	854	963	551	352	505	153	434	701	373	105	226	3
	Trinidad and Tobago	4	4	120	79	183	223	213	163	112	122	125	186	224	295	459	615	520	629	788	799	931	1128	1141	1179	1057	890	1214	982	973	1244
	UK-Bermuda	42	58	44	44	67	55	53	59	31	37	48	47	82	61	31	30	15	41	37	100	66	36	12	10	9	25	32	50	52	74
	UK-British Virgin Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	3	10	5	0	0	0	0	0	6
	UK-Turks and Caicos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	6	2	0	0	0	0	0	0	**0**
	USA	6938	6283	8298	8131	7745	7674	5621	7567	7051	6703	5710	7695	6516	5568	7091	5529	2473	2788	2679	3315	4777	4177	3184	2798	4104	4444	2720	2625	3648	3942
	Uruguay	74	20	59	53	171	53	88	45	45	91	91	95	204	644	218	35	66	76	122	24	6	7	0	0	0	0	0	0	0	**0**
	Venezuela	13773	16663	24789	9714	13772	14671	13995	11187	11663	18687	11421	7411	5792	5097	6514	3911	3272	3198	4783	4419	4837	5050	3772	3127	4204	5059	2743	2029	1931	1973
NCC	Chinese Taipei	2974	2895	2809	2017	2668	1473	1685	1022	1647	2018	1296	1540	1679	1269	400	240	315	211	287	305	252	236	139	293	181	213	395	272	433	288
	Costa Rica	0	0	0	0	0	0	0	6	5	4	0	1	1	0	7	9	7	4	6	14	15	32	120	117	139	183	114	74	117	150
	Guyana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	183	181	3	43	116	164
NCO	Argentina	1	0	0	0	0	0	0	0	0	0	0	0	327	327	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	
	Colombia	95	2404	3418	7172	238	46	46	46	46	46	46	46	46	46	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Cuba	11	1	14	54	40	40	15	15	0	0	65	65	65	65	65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

			Dominica	23	30	31	9	0	0	0	80	78	120	169	119	81	119	65	103	124	102	110	132	119	120	256	194	179	145	110	179	307	
			Dominican Republic	0	0	0	0	0	0	89	220	226	226	226	226	226	226	226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Jamaica	0	0	0	0	21	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			NEI (Flag related)	2521	1514	1880	1227	2374	2732	2875	1578	2197	765	14	112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Saint Kitts and Nevis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	29	13	0	6	
			Seychelles	0	0	0	0	0	0	0	0	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Sta Lucia	58	92	130	144	110	110	276	123	134	145	94	139	147	172	103	82	106	97	223	114	98	136	93	175	191	232	199	172	0	
			Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	681	689	661	555	873	816	720	330	207	124	17	0	0	0	0	0	0	
Landings(FP)	ATE	CP	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	50	71	27	109	35	0	0	0	0	0	0	**0**
			Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	77	28	39	40	103	152	58	35	82	256	267	174	50	66	60	67	**0**
			Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	15	25	22	16	176	95	89	114	86	78	0	0	0	0	0	0	67
			Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	267	116	24	0	0	0	0	0	0	**0**
			EU-España	859	1149	910	559	87	384	494	733	714	0	0	335	368	142	154	67	270	279	352	358	140	146	353	511	547	418	276	342	269	260
			EU-France	1033	1554	1461	1074	472	658	703	832	914	344	309	672	597	244	128	33	52	203	181	344	347	129	115	332	349	158	293	290	291	388
			Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	57	35	17	32	9	34	8	12	13	19	0	0	0	0	0	0	27
			Guinée Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	72	0	66	20	67	95	389	876	487	461	0	0	0	0	0	0	**0**
			Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	155	125	177	114	99	54	101	54	163	59	0	0	0	0	0	0	**0**
			St Vincent and Grenadines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**0**
		NCO	Mixed flags (EU tropical)	571	744	688	876	254	452	291	216	423	42	13	298	570	292	251	416	464	467	857	1601	0	0	0	791	1436	757	898	903	1098	
	ATW	CP	Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	5	7	0	3	**0**
			EU-España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	24	21	9	24	7	**0**
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	3	3	0	**0**
		NCO	Mixed flags (EU tropical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42	32	19	15	6	18	
Discards	ATE	CP	EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	137	0	63	40	17	20	19
			Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	5	7	10
			Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			South Africa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			UK-Sta Helena	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	**0**
	ATW	CP	Canada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Mexico	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	6	5	9	8	9	7	3	3	3	3	3	5	3	4	5
			UK-Bermuda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			UK-British Virgin Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			USA	0	0	0	0	0	0	0	167	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	12
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**

BET-Table 1. Estimated catches (t) of bigeye tuna (*Thunnus obesus*) by area, gear and flag.

			1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
TOTAL	A+M		100106	113790	134932	128047	120767	110255	107954	121425	103434	91636	75802	87596	90043	67954	59192	69895	63172	76427	76074	76749	71317	66977	75308	80000	79897	78665	73077	75563	59033	45959
Landings		Bait boat	16248	16466	20352	25687	18342	21277	19173	22197	12141	14383	8460	11233	20238	13104	10605	10561	6307	11548	7842	12659	10459	9195	8715	7970	6710	8366	7932	7341	6811	6141
		Longline	62484	62891	78908	74872	74930	68312	71857	77227	72011	56123	47351	55356	49400	37961	34182	46231	41063	43533	42516	37899	34930	32245	36770	40379	36345	35190	32065	33890	28376	21073
		Other surf.	523	628	973	561	363	546	445	678	459	770	226	451	293	733	552	449	220	258	487	1146	1012	2783	4960	6002	6472	7217	4616	6054	5470	5336
		Purse seine	19216	31515	32667	25260	26592	19127	15490	20139	17460	20103	19552	19689	19094	15129	13310	11962	14810	20007	24235	23767	24080	22122	24253	24418	28624	26838	27284	27108	16991	12790
Landings(FP)		Purse seine	1636	2290	2032	1667	540	993	989	1184	1363	257	214	867	1019	1026	542	692	772	1081	994	1277	823	632	609	1193	1744	1015	1151	1145	1355	593
Discards		Bait boat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	2	0	0	26	15	27	24
		Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Purse seine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	0	38	2	10	3	1
Landings	CP	Angola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	253	0	
		Barbados	0	0	0	0	0	24	17	18	18	6	11	16	19	27	18	14	14	7	12	7	15	11	26	30	19	16	29	14	20	25
		Belize	0	0	0	10	0	5	195	0	134	96	0	0	0	0	4	60	70	234	249	1218	1242	1336	1502	1877	1764	1961	2135	2307	991	600
		Brazil	790	1256	601	1935	1707	1237	776	2024	2768	2659	2582	2455	1496	1081	1479	1593	958	1189	1173	1841	2120	3623	6456	7750	7660	7258	5096	6249	6284	6499
		Canada	67	124	111	148	144	166	120	263	327	241	279	182	143	187	196	144	130	111	103	137	166	197	218	257	171	214	237	193	104	253
		Cape Verde	305	319	385	271	299	228	140	9	2	0	1	1	1	1077	1406	1247	444	545	554	1037	713	1333	2271	2764	1680	1107	1418	880	576	171
		China PR	0	70	428	476	520	427	1503	7347	6564	7210	5840	7890	6555	6200	7200	7399	5686	4973	5489	3720	3231	2371	2232	4942	5852	5514	4823	5718	3614	1638
		Curaçao	0	0	0	0	1893	2890	2919	4016	3098	3757	2221	3203	3526	27	416	252	1721	2348	2688	3441	2890	1964	2315	2573	3598	2844	3530	2787	1519	1701
		Côte d'Ivoire	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	790	576	47	507	635	441	12	544	1239	384	2334	141	59
		EU-España	14656	16782	22096	17849	15393	12513	7110	13739	11250	10133	10572	11120	8365	7618	7454	6675	7494	11966	11272	13100	10914	10082	10736	10058	11469	11544	8400	9117	5997	6598
		EU-France	6877	12648	12262	8262	9135	5955	5583	5413	5873	5533	4437	4048	2989	2814	2984	1525	1130	2313	3355	3507	3756	3222	3837	2801	4772	4039	4055	5118	2104	1809
		EU-Ireland	0	0	0	0	0	4	0	0	0	10	0	0	0	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		EU-Italy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	7	**0**
		EU-Poland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		EU-Portugal	5796	5616	3099	9662	5810	5437	6334	3314	1498	1605	2590	1655	3204	4146	5071	5505	3422	5605	3682	6920	6128	5345	3869	3135	2187	3146	4405	3146	3069	3106
		El Salvador	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	992	1450	1826	2634	2464	1518	1492
		FR-St Pierre et Miquelon	0	0	0	0	0	0	0	0	0	90	21	0	28	6	0	2	3	0	2	0	0	0	0	0	0	0	0	0	0	**0**
		Gabon	0	1	87	10	0	0	0	184	150	121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Gambia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Ghana	2866	3577	4738	5517	4751	10174	10647	11704	5632	9864	6480	9061	17888	8860	2307	2559	3372	4515	6253	3541	4468	2963	4175	5918	5194	3838	3636	2917	3160	1925
		Great Britain	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	32	0	0	0	0	0	0	0	0	0	0	0	**0**
		Grenada	25	20	10	10	0	1	0	0	0	0	0	0	0	0	0	10	31	0	0	0	0	0	0	18	23	33	27	19	11	
		Guatemala	0	0	0	0	0	0	0	0	0	0	0	736	831	998	949	836	998	913	1011	282	262	163	993	340	1103	1602	1488	1623	906	768
		Guinea Ecuatorial	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	50	0	58	0	3	10	17	4	11	7	8	6	6
		Guinée Rep	0	0	0	334	2394	885	0	0	0	0	0	0	0	0	0	0	0	0	328	322	1516	1429	902	0	0	0	0	0	0	**0**
		Honduras	44	0	0	61	28	59	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Iceland	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Japan	34722	35053	38503	35477	33171	26490	24330	21833	24605	18087	15306	19572	18509	14026	15735	17993	16684	16395	15205	12306	15390	13397	13603	12390	10365	10994	9854	9327	9635	8747
		Korea Rep	866	377	386	423	1250	796	163	124	43	1	87	143	629	770	2067	2136	2599	2134	2646	2762	1908	1151	1039	675	562	432	623	540	587	674
		Liberia	42	65	53	57	57	57	57	57	57	57	57	57	0	0	0	0	0	0	0	0	0	0	0	0	27	98	1	3	222	29
		Libya	508	1085	500	400	400	400	400	400	400	31	593	593	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Maroc	81	774	977	553	654	255	336	1444	1160	1181	1154	1399	1145	786	929	700	802	795	276	300	300	308	300	309	350	410	500	850	1033	1239
		Mauritania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**0**
		Mexico	0	1	4	0	2	6	8	6	2	2	7	4	5	4	3	3	1	1	3	1	1	2	1	2	2	3	3	3	3	3
		Namibia	0	0	715	29	7	46	16	423	589	640	274	215	177	307	283	41	146	108	181	289	376	135	240	465	359	141	109	79	568	1185
		Nigeria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	**0**
		Norway	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Panama	9991	10138	13234	9927	4777	2098	1252	580	952	562	211	0	1521	2310	2415	2922	2263	2405	3047	3462	1694	2774	2315	1289	2337	1664	2067	3052	2074	224

		Philippines	0	0	0	0	0	0	1154	2113	975	377	837	855	1854	1743	1816	2368	1874	1880	1399	1267	532	1323	1964	0	0	0	0	0	0	**0**
		Russian Federation	5	0	0	0	13	38	4	8	91	0	0	0	0	1	1	26	73	43	0	0	0	0	0	0	0	0	0	0	0	**0**
		S Tomé e Príncipe	4	4	3	6	4	5	6	5	4	4	4	4	11	6	4	0	92	94	97	100	103	107	110	633	421	393	2	6	11	12
		Senegal	5	8	123	357	190	272	789	1372	915	1159	497	322	490	770	1318	1293	734	1144	969	479	436	606	369	1031	1500	2978	2870	2272	2772	856
		Sierra Leone	0	0	0	0	0	0	0	0	6	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		South Africa	43	88	79	27	7	10	53	55	249	239	341	113	270	221	84	171	226	159	145	153	47	435	332	193	121	257	282	432	357	380
		St Vincent and Grenadines	818	1740	812	519	596	545	1937	2940	1921	1143	130	103	18	0	114	567	171	293	396	38	25	16	30	496	622	889	428	504	220	136
		Trinidad and Tobago	0	3	29	27	37	36	24	19	5	11	30	6	5	9	12	27	69	56	40	33	33	37	59	77	37	25	17	13	10	9
		UK-Bermuda	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
		UK-Sta Helena	10	6	6	10	10	12	17	6	8	5	5	4	6	18	25	18	28	17	11	190	51	19	17	44	77	70	45	4	0	0
		UK-Turks and Caicos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	0	0	0	0	0	0	**0**
		USA	813	1090	1402	1209	882	1138	929	1263	574	1085	601	482	416	484	991	527	508	515	578	866	727	903	892	1082	568	836	921	829	801	965
		USSR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Uruguay	56	48	37	80	124	69	59	28	25	51	67	59	40	62	83	22	27	201	23	15	2	30	0	0	0	0	0	0	0	**0**
		Venezuela	270	809	457	457	189	274	222	140	221	708	1241	847	1060	243	261	318	122	229	85	264	98	94	169	132	156	318	165	28	79	129
	NCC	Chinese Taipei	11546	13426	19680	18023	21850	19242	16314	16837	16795	16429	18483	21563	17717	11984	2965	12116	10418	13252	13189	13732	10805	10316	13272	16453	13115	11845	11630	11288	9226	4093
		Costa Rica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	4	4	1	0	6
		Guyana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	25	34	53	2	4	1
	NCO	Argentina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Benin	7	8	9	9	9	30	13	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Cambodia	0	0	0	0	0	0	0	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Congo	12	14	9	9	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Cuba	56	36	7	7	5	0	0	0	0	0	16	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Dominica	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Faroe Islands	0	0	0	0	0	0	0	11	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		NEI (ETRO)	364	42	356	915	0	7	0	0	0	362	68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		NEI (Flag related)	6146	4378	8964	10697	11862	16565	23484	22190	15092	7907	383	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Saint Kitts and Nevis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	0	0	1	
		Seychelles	0	0	0	0	0	0	0	0	58	0	162	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Sta Lucia	1	0	0	0	0	0	0	0	0	1	2	2	0	2	0	0	0	0	0	0	0	0	0	6	10	24	13	13	17	
		Togo	2	86	23	6	33	33	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Vanuatu	676	1807	2713	2610	2016	828	0	314	0	0	0	0	104	109	52	132	91	34	42	39	23	9	4	0	0	0	0	0	0	
Landings(FP)	CP	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	46	42	16	41	23	0	0	0	0	0	0	**0**
		Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	75	28	37	38	61	102	40	22	45	97	165	121	38	53	42	54	**0**
		Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	13	25	20	13	117	59	46	60	34	42	0	0	0	0	0	0	57
		Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	95	45	0	0	0	0	0	0	0	**0**
		EU-España	571	764	605	371	58	255	328	487	474	0	0	223	244	143	88	49	190	250	211	216	98	80	143	334	398	323	216	265	200	224
		EU-France	686	1032	970	713	314	437	467	553	607	229	205	446	397	222	79	26	51	150	122	394	192	56	54	191	233	108	213	201	233	289
		Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	56	28	15	26	9	18	6	11	5	15	0	0	0	0	0	0	23
		Guinée Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	72	0	60	20	22	74	203	288	245	209	0	0	0	0	0	0	**0**
		Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	151	106	135	97	85	38	70	41	80	27	0	0	0	0	0	0	**0**
	NCO	Mixed flags (EU tropical)	379	494	457	582	169	301	193	143	281	28	8	198	378	294	189	348	337	375	324	257	0	0	0	503	993	546	669	637	868	
Discards	CP	Canada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
		EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	0	38	2	10	3	1
		EU-Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26	15	18	15
		Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**0**
		Mexico	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		South Africa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		UK-Bermuda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		USA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	6
	NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0	**0**

ALB-Table 1. Estimated catches (t) of albacore (*Thunnus alalunga*) by area, gear and flag.

			1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
ALB TOTAL			69616	73087	71813	67518	60379	59586	59039	67062	70088	69918	60070	61470	53375	57728	67381	48794	42320	41663	40759	48743	52751	45598	42761	44635	49179	45476	49694	53163	52253	59281
	ATN		30851	38135	35163	38377	28803	29023	25746	34549	33123	26252	22716	25567	25957	35318	36963	21991	20483	15391	19411	19989	25432	24671	26656	25635	30400	28475	29733	34787	31408	31374
	ATS		36564	32814	35301	27554	28426	28022	30595	27656	31388	38795	31746	28005	22545	18882	24453	20283	18867	22248	19225	24126	25272	19424	13705	15201	14383	13825	17098	15614	18171	25006
	MED		2202	2138	1349	1587	3150	2541	2698	4856	5577	4870	5608	7898	4874	3529	5965	6520	2970	4024	2124	4628	2047	1503	2400	3800	4396	3176	2863	2762	2675	2901
Landings	ATN	Bait boat	12436	15646	11967	16411	11338	9821	7562	8780	11072	6103	6638	7840	8128	10458	14273	8496	7931	4994	6026	5530	8816	4975	7341	9265	14455	12196	11330	12662	11855	11696
		Longline	3152	7093	7309	4859	4641	4051	4035	6710	7320	7372	6235	7826	7037	6911	5223	3237	2647	2619	3913	3666	3510	6298	3094	4541	5448	5025	4515	4643	5847	4854
		Other surf.	5173	7279	7506	3555	3337	4378	6846	6817	5971	2828	365	470	577	624	625	525	274	427	231	359	344	816	163	136	95	139	62	157	116	115
		Purse seine	139	229	292	278	263	26	91	55	191	263	93	211	344	99	162	198	70	101	70	3	176	40	35	116	50	38	39	65	21	30
		Trawl	2603	1779	2131	3049	2571	2877	1318	5343	3547	5374	5376	3846	2369	7001	6385	3429	4321	2811	2026	6852	6678	6558	9184	5771	6299	6611	8820	10816	7577	8309
		Troll	7348	6109	5959	10226	6652	7870	5894	6845	5023	4312	4009	5373	7501	10224	10296	6105	5239	4440	7146	3578	5909	5891	6660	5597	3753	4165	4807	6292	5938	6249
	ATS	Bait boat	6490	7341	9334	7009	6913	8092	10352	6708	6815	10343	9710	6973	7475	5084	5876	3375	4350	7926	3748	5938	6931	5211	4765	4965	2949	1846	3228	2852	4297	4434
		Longline	27167	23950	24806	20040	21000	19547	19799	20640	24399	28039	21671	20626	14735	12977	17740	15087	13218	12113	13471	16445	17846	13888	8888	10104	11243	11674	13767	12587	13834	20546
		Other surf.	388	74	96	92	256	145	1	74	116	389	325	85	300	323	395	1762	1219	2066	1651	1538	66	266	7	0	108	114	84	134	17	0
		Purse seine	2518	1450	1065	413	258	118	434	183	58	25	39	308	16	499	442	58	81	144	355	205	428	58	44	131	83	190	19	3	11	21
		Trawl	0	0	0	0	0	120	9	52	0	0	0	12	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	MED	Bait boat	171	231	81	163	205	0	33	96	88	77	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Longline	442	410	350	87	391	348	194	416	2796	2597	3704	4248	2335	1997	3026	4101	2694	2160	1719	2327	1959	1392	2343	3235	4333	3087	2378	2656	2497	2804
		Other surf.	1533	879	766	1031	2435	1991	2426	4271	2693	2196	1757	46	87	169	134	182	246	634	404	1408	8	18	27	5	4	2	2	8	29	1
		Purse seine	6	559	23	0	0	0	0	0	0	0	1	3557	2452	1362	2803	2237	24	1230	0	869	68	86	15	543	34	82	481	30	66	72
		Trawl	0	0	0	0	0	0	0	0	0	0	0	48	0	0	0	0	5	0	0	0	0	0	5	7	9	3	2	2	5	13
		Troll	50	59	129	306	119	202	45	73	0	0	117	0	0	0	1	0	1	0	1	0	6	0	3	0	0	2	1	67	62	5
Discards	ATN	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	93	179	209	300	302	160	151	53	121
	ATS	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	37	11	5
		Purse seine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	MED	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	6	7	8	10	16	0	0	0	16	5
Landings	ATN	CP Barbados	0	0	0	0	0	1	1	1	0	2	5	8	10	13	9	7	7	4	6	4	20	22	13	16	38	32	15	7	10	12
		Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	26	39	416	351	155	230	79	1	399	448	385	216	326	201
		Brazil	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Canada	1	9	32	12	24	31	23	38	122	51	113	56	27	52	27	25	33	11	14	28	34	32	47	32	20	17	26	31	12	40
		Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	**0**
		China PR	0	0	14	8	20	0	0	21	16	57	196	155	32	112	202	59	24	27	142	101	21	81	35	21	103	124	124	129	208	291
		Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	**0**
		Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	53	39	146	0	0	0	151	549	0	76	14	30
		EU-España	18175	18380	16998	20197	16324	17295	13285	15363	16000	9177	8952	12530	15379	20447	24538	14582	12725	9617	12961	8357	13719	10502	11607	14126	17077	13964	15691	16536	16205	17408
		EU-France	6924	6293	5934	5304	4694	4618	3711	6887	5718	6005	4320	3456	2444	7266	6559	3179	3009	1139	1293	3352	3370	4625	6716	3441	4229	4191	5824	7881	4753	5397
		EU-Ireland	451	1946	2534	918	874	1913	3750	4858	3464	2093	1100	755	175	306	521	596	1517	1997	788	3597	3575	2231	2485	2390	2337	2492	3102	3213	2938	2879
		EU-Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	**0**
		EU-Portugal	1638	3385	974	6470	1634	395	91	324	278	1175	1953	553	513	556	119	184	614	108	202	1046	1231	567	2609	929	1111	2527	498	2493	1596	501
		FR-St Pierre et Miquelon	0	0	0	0	0	0	0	0	0	0	4	0	7	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Great Britain	59	499	613	196	49	33	117	343	15	0	0	0	0	6	19	30	50	67	118	57	50	133	136	31	0	0	0	0	77	165
		Grenada	0	0	0	2	1	6	7	6	12	21	23	46	25	29	19	20	15	18	18	18	0	0	0	79	50	62	37	23	22	27
		Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	**0**
		Iceland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Japan	466	485	505	386	466	414	446	425	688	1126	711	680	893	1336	781	288	402	288	525	336	400	1745	267	276	297	366	196	334	269	238
		Korea Rep	0	8	0	2	2	1	0	0	0	0	0	0	0	59	45	12	59	82	110	60	200	184	64	5	13	8	27	48	116	115
		Liberia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	90	3	0	0	**0**
		Maroc	0	0	0	0	0	0	0	0	0	0	55	81	120	178	98	96	99	130	0	0	0	0	0	0	20	20	20	25	29	40

		Mexico	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	2	0	7	0	1	1
		Panama	29	60	117	73	11	5	0	0	0	0	0	0	0	0	96	298	113	45	154	103	0	246	126	103	200	0	196	198	383	183
		Philippines	0	0	0	0	0	0	151	4	0	0	0	0	0	9	0	8	19	54	0	0	83	0	0	0	0	0	0	0	0	**0**
		Senegal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	**0**
		Sierra Leone	0	0	0	0	0	0	0	0	0	91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		St Vincent and Grenadine	0	2	0	0	0	0	0	1	704	1370	300	1555	89	802	76	263	130	135	177	329	305	286	328	305	291	297	173	180	252	202
		Trinidad and Tobago	247	0	0	0	0	2	1	1	2	11	9	12	12	9	12	18	32	17	17	23	47	67	71	95	71	48	33	22	16	27
		UK-Bermuda	0	0	0	0	0	1	0	2	2	2	0	0	1	1	0	0	0	0	0	1	0	0	1	0	1	0	0	1	2	4
		UK-Turks and Caicos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	**0**
		USA	438	509	741	545	472	577	829	315	406	322	480	444	646	488	400	532	257	189	221	369	409	819	458	354	250	238	103	221	328	295
		USSR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Venezuela	193	246	282	279	315	75	107	91	299	348	162	346	457	175	321	375	222	398	288	247	312	181	285	351	287	301	165	221	246	299
	NCC	Chinese Taipei	2209	6300	6409	3977	3905	3330	3098	5785	5299	4399	4330	4557	4278	2540	2357	1297	1107	863	1587	1367	1180	2394	947	2857	3134	2385	2926	2770	3549	2896
		Costa Rica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	5	11	5	1	1	2
		Guyana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	**0**
	NCO	Cuba	0	0	0	0	0	0	0	0	0	0	1	322	435	424	527	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Dominica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	1	1	0	2	0	
		Dominican Republic	0	0	0	0	0	323	121	73	95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		NEI (Flag related)	19	13	10	8	11	3	8	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Saint Kitts and Nevis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Sta Lucia	1	1	0	1	1	0	0	0	1	3	2	10	0	2	2	2	2	0	130	2	3	2	0	0	2	1	0	1	0	
		Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	414	507	235	95	20	140	187	196	172	228	195	0	0	0	0	0	0	
ATS	CP	Angola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	168	0	5	0	0	0	0	0	0	
		Belize	0	0	0	2	0	0	0	8	2	0	0	0	0	0	54	32	31	213	303	365	171	87	98	0	123	219	311	158	162	31
		Brazil	2710	3613	1227	923	819	652	3418	1872	4412	6862	3228	2647	522	556	361	535	487	202	271	1269	2077	2016	462	490	658	497	396	1003	617	516
		Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	8	46	24	0	5	0	5	0	0	0	0	0	0	0	0	0	**0**
		China PR	0	0	0	0	0	0	0	39	89	26	30	26	112	95	100	35	25	89	97	80	61	65	34	120	94	185	116	132	184	10
		Curaçao	0	0	0	0	0	9	192	0	2	0	0	0	0	0	0	0	0	21	4	4	24	0	0	1	14	10	0	0	0	**0**
		Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47	43	45	50	0	0	0	0	0	6	19	45	47
		EU-España	1943	783	831	457	184	256	193	1027	288	573	836	376	81	285	367	758	933	1061	294	314	351	369	259	418	195	347	303	186	30	37
		EU-France	451	565	130	83	191	39	40	13	23	11	18	63	16	443	347	12	50	43	109	50	151	40	41	54	64	78	16	3	10	21
		EU-Portugal	184	483	1185	655	494	256	124	232	486	41	433	415	9	43	8	13	49	254	84	44	11	1	3	1	9	9	11	3	2	3
		Ghana	0	0	0	0	0	0	0	0	0	0	0	53	0	0	0	5	10	14	25	0	0	0	0	0	0	0	0	0	0	**0**
		Great Britain	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**0**
		Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	0	0	0	56	0	0	15	0	1	3	1	0	0	0	**0**
		Guinea Ecuatorial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	1	0	0	**0**
		Guinée Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	7	74	0	0	0	0	0	0	0	0	**0**
		Honduras	29	0	0	2	0	7	1	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Japan	583	467	651	389	435	424	418	601	554	341	231	322	509	312	316	238	1370	921	973	1194	2903	3106	1131	1752	1096	1189	2985	1506	904	1668
		Korea Rep	5	20	3	3	18	4	7	14	18	1	0	5	37	42	66	56	88	374	130	70	89	33	2	4	48	86	167	170	131	131
		Maroc	92	68	24	24	0	5	4	0	0	0	14	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Namibia	0	0	1111	950	982	1199	1429	1162	2418	3419	2962	3152	3328	2344	5100	1196	1958	4936	1320	3791	2420	848	1057	1062	994	214	888	260	2166	8165
		Panama	482	318	458	228	380	53	60	14	0	0	0	0	0	17	0	87	5	6	1	0	12	3	0	6	5	13	1	0	31	17
		Philippines	0	0	0	0	0	0	5	4	0	0	0	0	0	52	0	13	79	45	95	96	203	415	18	0	0	0	0	0	0	**0**
		Senegal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	24	0	**0**
		South Africa	6360	6881	6931	5214	5634	6708	8412	5101	3610	7236	6507	3469	4502	3198	3735	3797	3468	5043	4147	3380	3553	3510	3719	4030	2065	1785	2572	2455	4026	3823
		St Vincent and Grenadine	2	0	29	30	41	0	23	0	2116	4303	44	0	0	0	65	160	71	51	31	94	92	97	110	100	107	101	98	31	0	14
		Trinidad and Tobago	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		UK-Sta Helena	28	38	5	82	47	18	1	1	58	12	2	3	1	35	62	46	94	81	3	120	2	2	0	0	0	0	0	0	0	**0**

		USA	0	0	0	0	1	5	1	1	1	2	8	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		USSR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Uruguay	31	28	16	49	75	56	110	90	90	135	111	108	120	32	93	34	53	97	24	37	12	209	0	0	0	0	0	0	0	**0**
	NCC	Chinese Taipei	23063	19400	22573	18351	18956	18165	16106	17377	17221	15833	17321	17351	13288	10730	12293	13146	9966	8678	10975	13032	12812	8519	6675	7157	8907	9090	9227	9626	9851	10519
	NCO	Argentina	306	0	2	0	0	120	9	52	0	0	0	12	18	0	0	0	0	0	130	43	0	0	0	0	0	0	0	0	0	
		Cambodia	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Cuba	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		NEI (ETRO)	28	0	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		NEI (Flag related)	262	146	123	102	169	47	42	38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Seychelles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	0	684	1400	96	131	64	104	85	35	83	91	0	0	0	0	0	0	
	MED CP	EU-Croatia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	7	12	20	30	11	7	2	2	1	1	0
		EU-Cyprus	0	0	0	0	0	0	0	0	6	0	12	30	255	425	507	712	209	223	206	222	315	350	377	495	542	568	624	714	632	513
		EU-España	227	298	218	475	429	380	126	284	152	200	209	1	138	189	382	516	238	204	277	343	389	244	283	53	51	206	71	68	67	133
		EU-France	11	64	23	3	0	5	5	0	0	0	1	0	0	0	0	2	1	0	1	2	0	0	1	1	0	0	0	15	15	24
		EU-Greece	500	1	1	0	952	741	1152	2005	1786	1840	1352	950	773	623	402	448	191	116	125	126	126	165	287	541	1332	608	522	297	158	182
		EU-Italy	1464	1275	1107	1109	1769	1414	1414	2561	3630	2826	4032	6913	3671	2248	4584	3970	2104	2727	1109	2501	1117	615	1353	1602	1490	1348	1044	1287	1423	1192
		EU-Malta	0	0	0	0	0	1	1	6	4	4	2	5	10	15	18	1	5	1	2	5	19	29	62	37	56	4	104	77	13	137
		EU-Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Egypt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	246	77	396	429	278	316	622
		Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	**0**
		Libya	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	750	800	0	30	21	19	23
		Maroc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	120	0	0	0	0	0	0	0	0	0	0	0	10
		Syria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	14	0	0	0	1	1	0	0	0	0	0	0	0	**0**
		Türkiye	0	0	0	0	0	0	0	0	0	0	0	0	27	30	73	852	208	631	402	1396	62	71	0	53	25	44	38	4	16	58
	NCO	NEI (MED)	0	500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Yugoslavia Fed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Discards	ATN CP	Canada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
		Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		UK-Bermuda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Venezuela	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	93	179	209	300	302	160	151	52	121
	NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	ATS CP	Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	11	5
		Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		South Africa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	**0**
	MED CP	EU-Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	6	7	8	10	16	0	0	0	16	5
		EU-España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**

SWO-MED-Table 1. Estimated catches (t) of swordfish (*Xiphias gladius*) in the Mediterranean by gear and flag.

			1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
TOTAL	MED		14709	13265	16082	13015	12053	14693	14369	####	####	15006	12814	15694	14405	14622	14915	14227	13683	13235	14754	####	11046	10070	10969	11983	12300	10390	8681	8176	7664	7493
Landings	MED	Longline	7631	7377	8985	6319	5884	5389	6674	6223	7129	7498	8042	10748	10877	10954	11323	11113	11479	11020	11918	####	9131	9047	9718	10675	10878	8345	6938	8041	7603	7239
		Other surf.	7078	5888	7097	6696	6169	9304	7695	7476	8440	7508	4772	4945	3519	3555	3576	3094	658	819	1347	1162	782	49	83	78	53	57	61	45	60	66
Discards	MED	Longline	0	0	0	0	0	0	0	0	0	0	0	0	9	113	16	19	1546	1396	1488	1191	1133	973	1168	1230	1369	1988	1682	89	0	188
Landings	MED CP	Albania	0	0	0	0	13	13	13	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Algerie	395	562	600	807	807	807	825	709	816	1081	814	665	564	635	702	601	802	468	459	216	387	403	557	568	671	550	528	517	501	447
		EU-Croatia	0	0	0	0	0	0	10	20	0	0	0	0	0	0	0	0	4	3	6	6	4	10	16	10	25	20	28	33	23	25
		EU-Cyprus	56	116	159	89	40	51	61	92	82	135	104	47	49	53	43	67	67	38	31	35	35	51	59	54	53	50	45	24	30	56
		EU-España	822	1358	1503	1379	1186	1264	1443	906	1436	1484	1498	1226	951	910	1462	1697	2095	2000	1792	1744	1591	1607	2073	2283	1733	1487	1387	1460	1434	1372
		EU-France	0	0	0	0	0	0	0	0	0	12	27	20	19	22	20	14	14	16	78	81	12	66	127	182	179	113	86	71	110	96
		EU-Greece	1456	1568	2520	974	1237	750	1650	1520	1960	1730	1680	1230	1120	1311	1358	1887	962	1132	1494	1306	877	1731	1344	761	761	392	350	745	657	686
		EU-Italy	7595	6330	7765	7310	5286	6104	6104	6312	7515	6388	3539	8395	6942	7460	7626	6518	4549	5016	6022	5274	4574	2862	3393	4272	3946	2987	1779	2473	2250	2016
		EU-Malta	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	407	361	391
		EU-Portugal	0	0	0	0	0	0	0	0	13	115	8	1	120	14	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Egypt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	4	0	4	12
		Japan	2	4	2	4	5	5	7	4	2	1	1	0	2	4	0	3	1	1	0	0	0	0	0	0	0	0	0	0	0	**0**
		Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**0**
		Libya	0	0	0	0	0	0	11	0	8	6	0	10	2	0	16	0	0	0	0	0	0	0	0	585	960	30	70	26	22	
		Maroc	2692	2589	2654	1696	2734	4900	3228	3238	2708	3026	3379	3300	3253	2523	2058	1722	1957	1587	1610	1027	802	770	770	480	1110	1000	1013	982	951	924
		Syria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	28	0	0	0	9	4	0	0	0	0	0	0	0	**0**
		Tunisie	178	354	298	378	352	346	414	468	483	567	1138	288	791	791	949	1024	1011	1012	1016	1040	1038	1036	1030	1034	1007	1003	974	934	918	891
		Türkiye	136	292	533	306	320	350	450	230	370	360	370	350	386	425	410	423	386	301	334	190	80	97	56	35	77	441	427	414	402	390
	NCC	Chinese Taipei	0	1	1	1	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	NCO	NEI (MED)	1292	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Discards	MED CP	Algerie	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	175	102	100	42	78	84	145	147	176	205	197	0	0	**0**
		EU-Croatia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		EU-Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		EU-España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	84	89	0	188
		EU-Greece	0	0	0	0	0	0	0	0	0	0	0	0	9	113	16	19	27	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		EU-Italy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	724	751	817	734	618	456	538	670	623	907	535	0	0	**0**
		Maroc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	343	278	301	160	201	193	198	123	285	350	355	0	0	**0**
		Tunisie	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	221	221	222	227	227	226	272	273	266	374	364	0	0	**0**
		Türkiye	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	55	43	48	27	10	14	16	10	20	151	148	0	0	**0**

WHM+RSP -Table 1. Estimated catches (t) of Atlantic white marlin (*Kajikia albida*) and Roundscale spearfish (*Tetrapturus georgii*) by area, gear and flag.

				1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
WHM+RSP	TOTAL	A+M		1557	1681	2202	1880	1679	1513	1945	1786	1535	1078	1012	845	841	768	612	748	714	755	506	530	465	647	452	528	480	468	268	282	182	121
	Landings	A+M	Longline	1389	1528	2065	1720	1535	1367	1717	1638	1403	970	834	756	757	689	532	629	607	632	419	414	372	464	373	481	434	408	198	195	133	96
			Other surf.	59	56	64	36	56	62	189	85	89	86	139	71	55	60	65	81	84	95	68	85	62	56	61	34	33	42	26	24	32	14
			Sport (HL+RR)	22	30	30	22	24	14	6	6	2	4	6	1	1	1	2	1	2	2	6	4	6	116	7	3	4	5	10	3	7	3
	Discards	A+M	Longline	88	67	43	101	65	70	32	57	41	17	29	17	27	17	12	36	21	24	12	27	24	11	11	10	9	12	34	60	10	8
			Other surf.	0	0	0	0	0	0	1	0	0	1	4	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	
	Landings	A+M CP	Barbados	24	29	26	43	15	41	33	25	25	24	15	15	18	16	33	22	24	26	6	3	5	6	6	10	14	17	22	11	14	10
			Belize	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Brazil	211	301	91	105	75	105	217	158	106	172	407	266	80	244	90	52	55	53	35	75	71	352	102	121	67	47	62	76	46	0
			Canada	0	0	4	4	8	8	8	5	5	3	2	1	2	5	3	2	2	1	2	1	2	3	5	3	1	2	1	1	1	2
			China PR	0	0	9	11	9	11	15	30	2	20	23	8	6	9	6	10	5	9	8	3	4	2	0	0	0	3	2	3	2	2
			Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	**0**
			Côte d'Ivoire	0	0	0	0	1	2	1	5	1	2	2	3	1	1	1	1	3	2	1	1	0	1	1	1	1	1	1	0	0	**0**
			EU-España	23	26	26	36	151	93	101	119	186	61	6	22	64	58	51	46	35	16	113	4	35	42	99	125	96	118	9	9	1	4
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	**0**
			EU-Portugal	0	0	0	0	0	0	1	1	0	0	1	5	19	30	22	2	35	40	11	18	25	10	9	7	11	13	0	0	1	9
			El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Gabon	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Ghana	14	22	1	2	1	3	7	6	8	21	2	1	1	1	0	1	4	4	3	1	1	1	1	1	1	0	0	0	0	0
			Grenada	0	0	0	0	0	0	0	0	1	15	8	14	33	10	12	11	17	14	0	0	0	0	0	37	15	9	11	19	14	14
			Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Honduras	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Japan	248	82	92	57	112	58	56	40	83	56	16	33	36	34	39	21	34	43	41	31	42	24	6	8	9	10	6	11	7	7
			Korea Rep	10	8	43	23	59	23	35	39	0	0	0	11	40	7	0	113	96	78	43	43	0	0	0	0	0	0	0	0	0	**0**
			Liberia	0	0	0	0	1	1	3	8	4	3	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	**0**
			Maroc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	**0**
			Mexico	0	1	7	11	3	1	3	6	11	13	16	15	28	25	16	14	14	19	20	28	36	30	20	26	20	12	16	9	10	12
			Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Philippines	0	0	0	0	0	0	1	12	0	0	0	0	0	0	0	0	1	1	2	2	1	2	2	0	0	0	0	0	0	**0**
			S Tomé e Príncipe	24	17	21	21	30	45	40	36	37	37	37	37	21	33	29	35	36	37	38	39	40	41	42	17	15	13	1	3	6	**0**
			Senegal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	**0**
			South Africa	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	**0**
			St Vincent and Grenadine	0	1	0	0	0	0	0	0	0	1	0	44	0	0	0	0	0	0	0	0	0	0	0	0	0	8	8	5	9	**0**

			Trinidad and Tobago	6	1	11	18	8	32	10	13	4	2	5	12	6	6	5	12	10	11	15	14	39	33	38	32	20	0	0	0	0	0
			UK-Bermuda	1	1	1	1	1	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			UK-British Virgin Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			USA	11	19	13	7	12	8	5	5	1	3	6	1	1	1	1	0	2	2	2	2	1	4	2	3	1	2	3	2	6	2
			USSR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Uruguay	3	2	3	0	1	24	22	16	21	20	1	9	2	5	9	3	6	5	5	0	0	0	0	0	0	0	0	0	0	**0**
			Venezuela	276	362	236	286	270	177	310	228	178	182	215	168	136	156	190	131	63	128	116	160	121	77	99	119	187	192	84	67	50	46
		NCC	Chinese Taipei	598	616	1350	907	566	441	506	465	437	152	178	104	172	56	44	54	38	28	20	28	15	7	7	10	10	5	6	2	2	4
			Costa Rica	0	0	0	0	0	0	0	3	14	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		NCO	Argentina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Cambodia	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Cuba	10	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Mixed flags (FR+ES)	10	12	11	9	7	7	9	8	12	13	12	13	13	11	10	9	10	12	12	37	0	0	0	0	0	0	0	0	0	
			NEI (BIL)	0	0	0	0	0	0	0	0	34	77	4	30	134	42	37	170	204	199	0	11	0	0	0	0	0	0	0	0	0	
			NEI (ETRO)	0	114	214	237	285	359	526	498	322	180	11	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Sta Lucia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	1	0	1	1	0	1	
			Togo	0	0	0	0	0	0	0	1	1	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Discards	A+M	CP	Brazil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	19	1	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Canada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	0
			Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	**0**
			Mexico	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			UK-Bermuda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			USA	88	66	42	100	65	70	33	58	41	18	33	17	27	17	10	8	10	14	8	23	21	10	11	8	3	5	2	2	1	1
			Venezuela	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26	54	1	**0**
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	2	2	1	3	3	1
		NCO	NEI (BIL)	0	1	1	1	0	0	0	0	1	0	0	0	0	0	1	10	11	11	2	2	2	1	0	0	4	6	3	0	3	2

BUM-Table 1. Estimated catches (t) of Atlantic blue marlin (*Makaira nigricans*) by area, gear and flag.

			1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
BUM	TOTAL A+M		3077	3135	4216	4187	5366	5670	5637	5326	5395	4376	3807	4316	3106	3470	3070	4263	3602	3121	3001	2744	2740	2131	2749	2087	2133	2454	1633	1817	1888	1711
	Landings A+M	Longline	2407	2306	3115	3088	3983	4450	4422	3933	3965	2829	2083	2342	2013	2267	2102	2643	2555	2125	2023	1571	1432	1169	1593	1309	1334	1539	1148	1398	1051	782
		Other surf.	433	588	870	869	1119	950	1033	1238	1302	1400	1459	1650	884	1126	826	1399	739	782	781	880	944	761	899	554	514	722	360	314	690	726
		Sport (HL+RR)	90	114	120	77	68	132	130	72	69	123	216	305	174	51	103	179	269	152	177	237	289	142	200	112	220	93	64	42	78	151
	Discards A+M	Longline	146	127	111	153	197	139	51	83	60	22	37	19	34	24	38	42	37	40	19	56	70	55	54	106	52	73	44	55	58	47
		Other surf.	0	0	0	0	0	0	1	0	0	2	11	0	1	1	0	0	1	21	1	0	5	4	3	5	13	27	17	9	11	5
	Landings A+M CP	Angola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	
		Barbados	18	21	19	31	25	30	25	19	19	18	11	11	0	0	25	0	0	0	9	13	14	11	12	34	11	24	21	13	22	12
		Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	3	3	7	47	19	8	5	13	1	6	0	2	**0**
		Brazil	125	147	81	180	331	193	486	509	467	780	387	577	195	612	298	262	182	150	130	63	48	114	105	89	79	64	37	20	13	2
		Canada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
		China PR	0	0	62	73	62	78	120	201	23	92	88	89	58	96	99	65	13	77	100	99	61	45	40	44	50	40	42	46	37	4
		Curaçao	40	40	40	40	40	40	40	40	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	44	2	0	15	2
		Côte d'Ivoire	56	104	151	134	113	157	66	189	288	208	111	171	115	21	8	132	66	72	54	17	48	48	87	15	72	44	32	163	41	148
		EU-España	47	44	55	40	158	122	195	125	140	94	28	12	51	24	91	38	55	160	257	131	190	147	209	287	225	321	0	0	0	4
		EU-France	88	139	149	154	197	232	257	285	305	329	340	340	345	360	361	358	395	265	281	284	263	162	303	196	167	209	279	386	282	131
		EU-Portugal	2	15	11	10	7	3	61	20	22	18	8	32	27	48	105	135	158	106	140	54	55	25	23	46	50	57	74	18	28	37
		El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		FR-St Pierre et Miquelon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Gabon	0	1	2	0	304	5	0	0	0	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Ghana	123	236	441	471	422	491	447	624	639	795	999	415	470	759	405	683	191	140	116	332	234	163	236	88	44	162	60	44	53	278
		Great Britain	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Grenada	30	33	52	50	26	47	60	100	87	104	69	72	45	42	33	49	54	32	69	53	32	63	63	56	53	54	62	69	49	60
		Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	23	0	15	**0**
		Japan	1017	926	1523	1409	1679	1349	1185	790	883	335	267	442	540	442	490	920	1028	822	731	402	430	189	280	293	296	430	287	357	301	277
		Korea Rep	24	13	56	56	144	56	2	3	1	1	0	0	1	6	33	64	91	36	85	57	34	24	10	3	26	25	25	13	20	12
		Liberia	0	0	0	87	148	148	701	420	712	235	158	115	188	304	162	274	76	56	46	133	94	178	293	35	127	10	1	2	2	9
		Maroc	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	4	7	82	0	0	27	**0**
		Mexico	0	3	13	13	13	13	27	35	68	37	50	70	90	86	64	91	81	93	89	68	106	86	67	72	66	60	68	51	39	43
		Namibia	0	0	0	0	0	0	0	0	0	0	3	0	5	9	57	0	50	2	23	10	0	8	36	8	32	57	84	53	51	70
		Panama	0	0	0	0	0	0	0	0	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	21	0	14	12
		Philippines	0	0	0	0	0	0	7	71	38	0	0	0	0	0	0	0	8	0	3	4	1	2	2	0	0	0	0	0	0	**0**
		Russian Federation	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		S Tomé e Príncipe	21	25	28	33	36	35	33	30	32	32	32	32	9	21	26	66	68	70	72	74	76	78	81	11	10	13	5	7	10	11
		Senegal	8	0	9	0	2	5	0	0	0	11	24	32	11	1	5	91	114	61	41	64	164	45	72	10	82	39	25	21	358	73
		South Africa	0	0	0	0	0	0	0	0	0	1	4	0	0	0	0	2	0	0	1	0	0	0	1	1	0	0	0	0	0	0
		St Vincent and Grenadines	1	2	2	2	1	1	0	1	0	0	20	0	0	0	0	1	3	2	1	0	0	2	0	0	0	2	2	1	2	2

		Trinidad and Tobago	1	2	16	28	14	50	16	20	51	17	16	9	11	7	14	16	34	26	22	25	46	48	48	35	19	0	0	0	0	1
		UK-Bermuda	19	11	15	15	15	3	5	1	2	2	2	2	2	2	2	2	2	0	1	2	2	3	3	3	2	1	2	1	1	1
		UK-British Virgin Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		UK-Sta Helena	0	0	0	2	2	1	2	4	4	3	4	1	1	2	2	3	4	2	2	2	12	2	1	1	0	0	0	0	0	**0**
		UK-Turks and Caicos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		USA	51	80	88	43	43	46	50	37	24	16	17	19	26	16	17	9	13	6	4	6	14	9	1	9	19	13	20	17	17	22
		USSR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Uruguay	0	0	3	1	1	26	23	0	0	0	1	5	3	2	8	5	0	6	1	0	0	0	0	0	0	0	0	0	0	**0**
		Venezuela	67	86	122	117	148	142	226	240	125	84	88	120	101	160	172	222	130	120	151	116	143	111	139	150	185	194	125	148	125	121
	NCC	Chinese Taipei	824	685	663	467	660	1478	578	486	485	240	294	319	315	151	99	233	148	195	153	199	133	78	62	61	75	73	74	40	70	76
		Costa Rica	0	0	0	0	0	0	0	3	2	2	0	0	2	1	3	2	11	9	12	19	14	19	34	53	48	74	35	27	15	24
		Guyana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	128	39	75
	NCO	Benin	6	6	5	5	5	5	5	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Cuba	204	69	39	85	43	53	12	38	55	56	34	3	4	7	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Dominica	0	0	0	0	0	0	0	0	0	64	69	75	36	44	55	58	106	76	76	60	0	0	85	62	49	74	52	45	64	54
		Dominican Republic	0	0	0	0	0	41	71	29	23	23	115	207	142	30	38	47	67	60	65	100	98	99	96	73	170	0	0	0	0	
		Jamaica	0	0	0	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Mixed flags (FR+ES)	116	146	133	126	96	82	80	83	147	151	131	148	171	150	136	135	139	164	178	186	181	191	173	176	0	0	0	0	0	
		NEI (BIL)	38	0	0	0	0	0	0	0	0	53	184	258	167	89	7	160	209	205	177	0	34	0	0	0	0	0	0	0	0	
		NEI (ETRO)	0	174	326	362	435	548	803	761	492	274	17	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Saint Kitts and Nevis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	8	12	0	2	5
		Sta Lucia	0	0	0	0	0	4	1	0	10	5	9	18	17	21	53	46	70	72	58	64	119	99	111	53	91	134	93	82	103	93
		Togo	0	0	0	0	0	23	0	73	53	141	103	775	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Ukraine	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	7	8	6	3	2	0	0	0	0	0	0	
Discards	A+M CP	Brazil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Canada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
		Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	1	**0**
		EU-España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	0	1	4	3	5	7	6	0	0	2	**0**
		EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	1	0	0	6	11	12	9	5	5
		Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	2	**0**
		Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	8	16	10
		Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	1	1	0	0	0	0	0	**0**
		Mexico	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	2	**0**
		UK-Bermuda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		USA	146	127	111	153	197	139	52	83	60	25	49	19	35	25	36	42	38	42	19	50	39	55	53	81	25	47	22	24	20	10
	NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	0	0	24	27	26	16	22	21	20

SAI-Table 1. Estimated catches (t) of Atlantic sailfish (*Istiophorus albicans*) by area, gear and flag.

				1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
SAI	TOTAL			3239	3228	2292	2445	3023	2604	2978	2922	3976	4603	4411	4137	4339	4059	3855	4138	3963	3755	3083	2890	2869	2325	2027	2177	2782	2911	2472	3385	2900	2344
		ATE		1776	1814	1171	1231	1880	1347	1363	1342	1980	2805	2351	2639	2612	2220	1916	2577	2229	2129	1853	1553	1591	1339	1163	1246	1422	1631	936	2017	1186	1523
		ATW		1463	1414	1121	1214	1143	1257	1615	1580	1996	1798	2060	1498	1727	1839	1939	1562	1734	1626	1230	1337	1278	986	864	931	1360	1279	1535	1368	1714	821
	Landings	ATE	Longline	300	332	234	261	729	216	275	273	198	568	756	497	335	319	580	590	628	622	514	546	543	457	423	436	338	356	497	962	343	234
			Other surf.	783	1034	871	836	970	644	859	883	1231	1470	1496	1860	2057	1758	1289	1798	1493	932	900	870	985	754	730	749	1082	1175	435	1047	791	755
			Sport (HL+RR)	692	448	67	135	182	488	228	186	551	767	98	282	219	143	46	189	108	575	439	136	58	128	10	56	0	94	1	0	47	532
		ATW	Longline	919	958	651	581	453	641	1033	1102	1711	1661	1636	1161	1271	1704	1738	1300	1407	1154	1132	1215	1084	882	735	917	1330	1248	1513	1351	1697	809
			Other surf.	175	160	225	256	390	209	287	244	163	66	311	331	449	131	194	248	310	457	92	102	154	86	107	2	9	12	10	7	11	1
			Sport (HL+RR)	333	233	217	348	230	350	267	163	76	60	106	0	0	0	2	6	7	4	2	10	19	7	12	5	15	13	6	5	2	8
	Discards	ATE	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	0	0	6	1	4	2	6	5	2
			Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	2	1	
		ATW	Longline	36	63	28	29	69	57	27	72	45	11	7	5	7	3	5	8	9	10	4	10	20	12	11	7	7	7	7	5	3	2
			Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	
	Landings	ATE CP	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	0	0	0	0	0	0	0	0	0	0	**0**
			Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
			China PR	0	0	3	3	3	3	5	9	4	5	11	4	4	8	16	8	1	4	5	2	4	1	1	2	2	4	2	11	25	1
			Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
			Côte d'Ivoire	69	40	54	66	91	65	35	80	45	47	65	121	73	93	78	52	448	74	24	108	192	80	99	55	38	405	35	959	404	336
			EU-España	3	42	8	13	42	48	15	20	8	195	245	197	169	202	214	227	239	318	206	197	257	229	302	333	225	236	277	324	86	84
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	11	8	31	8	2
			EU-Portugal	1	2	1	2	1	2	27	53	13	4	10	13	19	31	137	43	49	131	170	121	72	109	33	41	30	27	123	65	51	13
			El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	**0**
			Gabon	0	3	3	110	218	2	0	0	0	0	0	4	4	1	0	0	0	0	0	0	0	0	4	0	0	5	0	0	2	1
			Ghana	297	693	450	353	303	196	351	305	275	568	592	566	521	542	282	420	342	358	417	299	201	220	191	99	238	267	82	78	68	**0**
			Great Britain	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Guinea Ecuatorial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	1	3	0	0	0	2	3	5
			Honduras	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Japan	15	27	45	52	47	19	58	16	26	6	20	22	70	50	62	144	199	94	115	143	157	71	59	36	52	45	47	62	73	44
			Korea Rep	2	2	5	5	11	4	0	0	0	0	0	0	0	0	0	0	0	1	0	10	1	6	10	2	6	15	9	8	10	5
			Liberia	0	0	0	33	85	43	136	122	154	56	133	127	106	122	118	115	0	0	0	0	0	0	0	0	0	59	11	50	47	3
			Maroc	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Namibia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	22
			Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	**0**
			Russian Federation	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			S Tomé e Príncipe	78	81	88	92	96	139	141	141	136	136	136	136	515	346	292	384	114	119	121	124	127	131	134	312	212	219	2	7	24	26
			Senegal	860	462	162	167	240	560	260	238	786	953	240	673	567	463	256	737	446	630	484	174	247	165	37	60	586	301	313	397	350	972
			Sierra Leone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	
			South Africa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			St Vincent and Grenadine	0	0	0	0	0	0	0	0	0	0	4	0	0	0	1	5	0	0	0	0	0	0	0	0	0	2	0	0	0	**0**
			USSR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		NCC	Chinese Taipei	80	157	38	58	24	56	44	66	45	50	62	49	15	25	36	109	121	80	21	52	54	42	17	21	23	26	21	16	17	6
		NCO	Benin	21	20	20	20	19	6	4	5	5	12	2	2	5	3	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Cuba	200	77	83	72	533	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Mixed flags (FR+ES)	150	182	160	128	97	110	138	131	353	400	365	413	336	264	274	205	251	308	265	275	275	275	275	275	0	0	0	0	0	
			NEI (BIL)	0	0	0	0	0	0	0	0	28	269	408	213	55	1	105	43	20	11	0	44	0	0	0	0	0	0	0	0	0	
			NEI (ETRO)	0	27	51	57	69	86	127	120	77	43	3	2	16	7	8	10	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Togo	0	0	0	0	0	9	22	36	23	62	55	95	135	47	31	71	0	0	0	0	0	0	0	0	0	0	0	0	0	

	ATW	CP	Barbados	42	50	46	74	25	71	58	44	44	42	26	27	26	42	58	42	0	0	18	36	36	39	44	54	56	42	20	15	15	20
			Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	12	0	0	52	8	7	4	3	0	11	19	62	104	42	**0**
			Brazil	351	243	129	245	310	137	184	356	598	412	547	585	534	416	139	123	268	433	71	138	108	76	57	72	59	39	43	17	28	24
			China PR	0	0	3	3	3	3	3	9	4	3	1	0	1	0	0	0	1	2	1	1	1	0	1	1	3	6	2	9	160	8
			Curaçao	10	15	15	15	15	15	15	15	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-España	13	13	19	36	5	20	42	7	14	309	414	183	160	89	134	214	361	412	275	190	184	203	244	311	207	454	256	228	57	67
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	4
			EU-Portugal	0	0	0	0	0	0	0	0	4	0	0	12	12	110	18	53	101	20	19	9	2	0	0	0	0	1	37	9	3	0
			El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Grenada	310	246	151	119	56	83	151	148	164	187	151	171	112	147	159	174	216	183	191	191	191	191	191	210	137	165	150	111	97	119
			Japan	0	1	8	2	4	17	3	10	12	3	3	10	5	22	4	1	33	43	36	12	16	7	11	12	13	7	3	18	5	13
			Korea Rep	2	3	4	4	12	4	0	0	0	0	0	0	0	0	0	0	0	1	0	40	3	1	1	0	0	0	0	0	0	**0**
			Mexico	0	2	19	19	10	9	65	40	118	36	34	45	51	55	41	46	45	48	34	32	51	63	42	35	47	51	24	27	20	24
			Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	415	0	461	378	839	198
			St Vincent and Grenadine	4	4	4	2	1	3	2	1	0	2	164	3	86	73	59	18	13	8	7	4	4	3	4	1	85	8	10	5	19	0
			Trinidad and Tobago	3	1	2	1	4	10	25	37	3	7	6	8	10	9	17	13	32	16	16	38	72	34	29	51	53	63	51	56	47	43
			UK-British Virgin Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			USA	298	203	180	348	232	349	267	163	76	58	103	0	0	0	0	0	3	3	0	0	7	3	2	2	3	3	3	3	1	1
			Venezuela	205	341	223	180	255	279	515	367	261	249	277	327	509	607	1042	549	382	416	498	590	543	341	210	152	246	387	381	373	363	290
		NCC	Chinese Taipei	17	112	117	19	19	2	65	17	11	33	31	13	8	21	5	14	10	11	6	8	26	6	3	6	5	5	5	4	7	2
			Costa Rica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	2	3	1	5	14	9	13	14	6	2	4
		NCO	Aruba	5	10	10	10	10	10	10	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Cuba	70	42	46	37	37	40	28	196	208	68	32	18	50	72	47	56	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Dominica	0	0	0	0	0	0	0	0	0	5	3	0	1	0	3	3	4	2	0	2	0	0	5	3	3	3	2	1	2	2
			Dominican Republic	98	50	90	40	40	101	89	27	67	81	260	91	144	165	133	147	0	0	0	0	0	0	0	0	0	0	0	0	0	
			NEI (BIL)	0	0	0	0	0	0	0	0	297	268	0	0	0	0	68	81	252	17	0	21	0	0	0	0	0	0	0	0	0	
			NEI (ETRO)	0	15	27	30	36	46	67	64	41	23	1	1	9	4	4	6	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Saint Kitts and Nevis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	
			Seychelles	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Sta Lucia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	2	2	3	2	3	1	1	4	2	0	2	
Discards	ATE	CP	Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	2	1	**0**
			El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0
			Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	6	1	4	2	4	2	2
	ATW	CP	Brazil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Mexico	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			USA	36	63	28	29	69	57	27	72	45	11	7	5	7	4	5	7	10	10	4	10	19	11	11	6	7	6	6	5	3	2
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0

SPF-Table 1. Estimated catches (t) of longbill spearfish (*Tetrapturus pfluegeri*) by area, gear and flag.

			1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
SPF TOTAL			273	540	320	240	165	201	266	306	278	188	179	133	188	169	340	167	166	140	245	153	229	447	52	80	76	350	173	118	272	462
	ATE		255	419	198	207	128	194	192	257	181	81	84	54	51	68	84	66	60	78	128	73	170	95	16	18	15	29	36	60	202	179
	ATW		19	120	122	33	37	7	74	50	97	107	95	79	137	101	256	102	106	62	117	80	58	352	36	62	62	322	138	58	69	283
Landings	ATE	Longline	163	307	100	129	69	126	106	176	121	81	84	54	51	68	84	66	60	78	128	73	170	95	16	18	14	29	23	48	192	174
		Other surf.	92	112	98	78	59	68	86	81	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	ATW	Longline	19	120	122	26	34	7	74	50	97	107	95	79	137	101	256	102	106	62	117	80	58	337	30	59	61	321	137	53	65	281
		Other surf.	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Sport (HL+RR)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	6	0	0	0	0	0	0	
Discards	ATE	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	11	10	6
		Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	ATW	Longline	0	0	0	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	1	5	4	2
4-SPF Landings	ATE CP	China PR	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	**0**
		EU-España	0	12	0	5	1	1	9	31	17	9	6	5	0	3	3	0	2	7	32	12	10	9	13	17	10	13	13	19	164	100
		EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		EU-Italy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		EU-Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	8	2	6	25	9	20	0	0	0	0	1	4	26	22	73
		Japan	27	31	36	26	25	30	22	33	29	20	16	25	36	40	21	36	53	59	49	39	134	85	3	0	4	2	4	2	3	0
		Korea Rep	1	1	1	1	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Senegal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	**0**
		South Africa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		St Vincent and Grenadine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	**0**
	NCC	Chinese Taipei	135	263	63	97	41	94	73	112	75	52	62	25	15	25	37	22	2	6	16	9	6	0	0	1	0	1	2	0	2	0
	NCO	Mixed flags (FR+ES)	92	112	98	78	59	68	86	81	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		NEI (BIL)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	**0**
	ATW CP	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	3	0	0	0	0	0	0	0	0	0	**0**
		Brazil	0	0	0	0	0	0	0	0	27	56	39	3	0	0	5	4	0	0	0	24	4	325	6	6	0	0	0	0	0	**0**
		China PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	**0**
		EU-España	0	5	0	1	0	0	0	22	47	20	5	21	0	5	14	0	2	5	0	10	10	9	11	19	14	259	19	17	52	276
		EU-Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26	15	44	10	10	0	1	0	0	0	0	0	19	18	0	**0**
		Japan	1	1	2	3	4	1	8	11	11	3	12	40	41	58	54	25	45	26	57	12	13	3	1	0	0	0	0	0	0	0
		Korea Rep	1	2	4	4	10	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Mexico	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	2	1	1	2
		St Vincent and Grenadine	0	0	0	0	0	0	0	0	0	0	0	0	82	0	135	23	13	7	8	5	4	3	3	1	7	52	84	12	9	1
		Trinidad and Tobago	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		UK-Bermuda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		USA	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Venezuela	0	1	0	0	1	0	1	0	0	4	0	3	3	17	5	15	3	14	24	12	24	11	13	32	35	6	10	4	3	2

		NCC	Chinese Taipei	16	111	116	19	18	2	64	16	11	24	39	12	11	20	17	20	0	0	5	12	3	1	3	1	1	1	1	1	0	1
		NCO	Dominica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	
			NEI (BIL)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	
Discards	ATE	CP	EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	8	7	4
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	3	1
	ATW	CP	Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			UK-Bermuda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			USA	0	0	0	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	1	5	4	1

SMT-Table 1. Reported landings (t) of small tuna species, by area and flag.

				1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
BLF	**TOTAL**			4353	3535	2719	4051	4488	3258	3395	3203	2483	4034	4756	1303	1926	1031	1937	1927	1669	1442	1837	2083	2849	2134	1152	1306	1920	1368	1557	1472	2569	2786
	Landings	ATL	All gears	4353	3535	2719	4051	4488	3258	3395	3203	2483	4034	4756	1303	1926	1031	1937	1927	1669	1442	1837	2083	2849	2134	1152	1306	1920	1368	1557	1472	2569	2786
	Discards	ATL	All gears	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Landings	ATL CP	Angola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Brazil	49	22	38	153	649	418	55	55	38	149	1669	1	118	91	242	233	266	10	9	46	124	110	299	325	228	192	392	410	820	1691
			Curaçao	60	65	60	50	45	45	45	45	45	45	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-España	307	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-France	1170	1140	1330	1370	1040	1040	1040	1040	1040	1040	1040	0	0	0	0	0	0	0	32	19	26	0	14	12	14	14	6	28	15	17
			Grenada	146	253	189	123	164	126	233	94	164	223	255	335	268	306	371	291	290	291	291	291	291	291	0	0	0	0	0	94	73	
			Mexico	0	0	0	0	0	0	0	0	0	12	0	10	9	10	10	12	6	7	6	9	5	4	4	4	5	4	4	3	3	2
			St Vincent and Grenadine	7	53	19	20	18	22	17	15	23	24	24	0	0	0	0	0	0	0	0	0	0	11	0	0	0	5	0	9	6	**0**
			Trinidad and Tobago	0	0	0	0	0	0	0	0	0	0	0	5	5	5	5	5	5	5	5	5	5	5	5	0	5	5	5	5	5	5
			UK-Bermuda	6	5	7	4	5	4	6	6	5	4	5	9	4	5	8	7	6	7	9	8	11	11	15	20	17	17	16	10	7	12
			UK-British Virgin Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
			UK-Turks and Caicos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			USA	127	508	492	582	447	547	707	617	326	474	334	414	675	225	831	422	649	619	911	967	1919	1326	585	761	1265	946	1074	756	1628	1054
			Venezuela	2148	1224	21	624	758	498	1034	1192	696	1902	1211	319	732	225	237	777	231	293	331	473	237	191	88	81	197	33	42	4	2	5
		NCO	Cuba	196	54	223	156	287	287	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Dominica	14	15	19	30	0	0	0	79	83	54	78	42	20	38	47	29	37	45	41	37	39	37	39	24	34	34	17	24	8	
			Dominican Republic	110	133	239	892	892	231	158	18	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Jamaica	0	0	0	0	148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Saint Kitts and Nevis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Sta Lucia	13	16	82	47	35	40	100	41	45	108	96	169	96	126	182	151	179	165	203	229	192	147	104	80	156	119	0	127	0	
	Discards	ATL CP	Mexico	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BLT	**TOTAL**			5714	3420	5300	4301	5909	3070	2309	2646	3912	5796	6041	3794	6223	4231	4090	5459	6825	5557	7952	9484	6234	7653	3916	5571	4003	3348	4055	3303	3449	3662
	Landings	A+M	All gears	5714	3420	5300	4301	5909	3070	2309	2646	3912	5796	6041	3794	6223	4231	4090	5459	6825	5557	7952	9484	6234	7653	3916	5566	4003	3339	4043	3303	3449	3660
	Discards	A+M	All gears	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	9	12	0	0	1
	Landings	A+M CP	Algerie	270	348	306	230	237	179	299	173	225	230	481	0	391	547	586	477	1134	806	970	1119	1236	577	1025	1984	1592	231	799	905	732	1802
			Angola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Brazil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	94	406	0	133	131	34	72	0	0	**0**
			Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	222	0	1	0	0	20	**0**
			EU-Croatia	21	52	22	28	26	26	26	26	0	0	0	0	0	0	0	0	0	0	8	13	9	10	12	15	15	25	37	27	15	17
			EU-España	1210	648	1124	1472	2296	604	487	669	1024	861	493	495	1009	845	1101	3083	3389	726	3812	3227	1620	2654	749	1241	1081	2175	778	1026	987	511
			EU-France	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
			EU-Germany	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	121	14	0	0	**0**
			EU-Greece	1400	1400	1400	1400	1426	1426	0	0	196	125	120	246	226	180	274	157	620	506	169	129	118	155	108	311	207	181	294	513	262	139
			EU-Italy	305	379	531	531	229	229	229	462	462	462	2452	1463	1819	866	0	0	342	732	574	653	613	892	0	0	0	0	966	25	6	16
			EU-Lithuania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	76	0	6
			EU-Malta	10	9	1	2	3	6	1	3	1	1	0	2	8	4	11	14	12	7	11	23	3	85	14	14	11	9	12	12	7	1
			EU-Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
			EU-Portugal	0	0	0	0	0	0	28	263	494	208	166	231	299	580	867	602	311	436	654	387	55	38	0	0	0	0	0	64	29	130
			Liberia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
			Maroc	1644	170	1726	621	1673	562	1140	682	763	256	621	246	326	50	199	35	83	336	525	237	194	237	171	811	200	0	442	50	96	91
			Mauritania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Russian Federation	814	70	100	0	0	0	0	0	408	1028	460	122	102	139	22	0	23	48	67	119	366	703	352	345	336	62	125	75	134	64
			Syria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	99	75	87	81	84	83	83	0	0	0	0	0	0	0	**0**
			Tunisie	35	20	13	14	13	32	93	45	15	2300	932	989	1760	0	0	0	0	0	0	940	935	938	920	13	23	26	136	67	91	139
			Türkiye	0	324	77	0	0	0	0	316	316	316	316	0	284	1020	1031	993	836	1873	1081	2552	907	863	562	476	407	474	367	462	1070	737
			USSR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Venezuela	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	**0**
		NCO	Serbia & Montenegro	1	0	0	2	6	6	6	7	8	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Sta Lucia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Yugoslavia Fed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Discards	A+M CP	EU-Croatia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	9	12	0	0	0

BON	TOTAL			21992	30528	21719	21219	25134	24417	45253	37312	27151	27637	23925	14424	15832	78767	41398	15018	16814	23710	28921	36783	48280	24847	27993	15706	54868	22757	46584	29676	44613	28495
		ATL		6881	4531	6037	6030	7939	10340	15523	9143	5179	5400	8208	3307	4584	4391	9648	6381	6772	13691	16338	22341	8959	6482	4640	6712	10930	10959	11093	23931	17453	21812
		MED		15111	25997	15682	15189	17195	14078	29730	28170	21972	22237	15717	11117	11248	74376	31751	8637	10042	10019	12584	14442	39321	18365	23352	8993	43938	11798	35491	5745	27160	6683
	Landings	ATL	All gears	6881	4531	6037	6030	7939	10340	15523	9143	5179	5400	8208	3307	4584	4391	9648	6381	6772	13691	16338	22341	8959	6482	4640	6712	10930	10959	11093	23929	17453	21811
		MED	All gears	15111	25997	15682	15189	17195	14078	29730	28170	21972	22237	15717	11117	11248	74376	31751	8637	10042	10019	12584	14442	39321	18365	23352	8993	43938	11798	35491	5745	27160	6683
	Discards	ATL	All gears	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
		MED	All gears	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Landings	ATL CP	Angola	4	49	20	9	39	32	0	2	118	118	118	0	0	138	0	931	0	1962	1997	131	267	1134	2	3	3	2	0	0	0	
			Barbados	0	0	0	0	0	0	0	0	0	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	10	0	0	**0**
			Brazil	86	142	142	137	0	0	0	0	0	0	0	0	0	90	0	0	0	0	0	171	0	38	0	1	2	1	23	15	0	**0**
			Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	539	539	539	539	0	0	0	0	0	0	0	**0**
			Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3	0	3	13	755	3	0	26	3	16	6	3510	42	2725	1757	6244
			EU-Bulgaria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-Denmark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			EU-España	39	5	3	2	2	1	0	12	12	10	5	23	9	2	15	14	13	36	45	57	7	44	28	10	31	18	16	20	3	8
			EU-Estonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-France	770	1052	990	990	610	610	610	24	32	0	18	0	0	0	0	122	59	25	208	241	102	245	288	333	422	290	195	115	62	60
			EU-Germany	0	0	0	0	714	0	0	0	0	0	38	0	0	0	0	0	0	0	0	0	0	0	6	0	4	89	14	0	13	1
			EU-Greece	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-Ireland	0	0	0	0	0	0	0	0	0	0	0	0	48	0	0	0	0	56	125	91	108	100	0	0	0	0	0	0	0	**0**
			EU-Latvia	4	0	3	19	301	887	318	0	416	396	639	0	0	0	0	0	0	0	1019	2231	34	48	29	0	0	0	0	6604	518	522
			EU-Lithuania	10	0	0	0	0	0	0	0	0	0	793	0	0	0	0	0	0	0	0	0	0	0	0	0	0	78	686	385	596	138
			EU-Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	344	539	539	0	2047	104	1075	54	11	124	79	39	91	71	82
			EU-Poland	0	0	0	0	225	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-Portugal	133	145	56	78	83	49	98	98	162	47	61	40	50	38	318	439	212	124	476	461	321	184	22	25	570	368	257	382	168	248
			EU-Rumania	84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Gabon	0	0	0	0	0	0	0	0	0	0	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Ghana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Great Britain	0	0	0	0	287	0	0	0	0	0	0	0	0	0	35	0	0	30	71	113	4	0	0	0	0	0	0	0	0	0
			Grenada	0	0	0	0	24	6	14	16	7	10	10	0	0	0	0	0	0	0	0	0	0	0	0	1	2	2	1	0	1	
			Guinea Ecuatorial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	59	32	0	3	4	5	6
			Maroc	1068	1246	584	699	894	1259	1557	1390	2163	1700	2019	928	989	1411	1655	1053	1419	2523	109	145	235	89	90	174	850	1417	4081	5679	5470	4516
			Mauritania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1303	839	1850	2384	6890	9463	3193	514	1052	2543	4951	1546	1801	1927	5008	5386
			Mexico	657	779	674	1144	1312	1312	1632	1861	1293	1113	1032	1238	1066	654	1303	1188	1113	1063	1046	1080	1447	1534	1115	1110	1188	1361	1440	1258	954	693
			Norway	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
			Panama	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Russian Federation	29	0	0	0	0	0	4960	0	0	574	1441	461	16	79	316	259	52	368	1042	2293	848	125	416	308	850	666	573	617	1281	908
			S Tomé e Príncipe	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	145	147	149	153	158	162	267	207	211	2	0	0	**0**
			Senegal	345	171	814	732	1012	1289	2213	2558	286	545	621	195	183	484	2304	1020	1380	4029	1677	2876	1453	514	1217	1711	1581	1226	1696	3982	1380	2915
			Sierra Leone	6	0	0	0	0	0	0	0	11	245	44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			South Africa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			St Vincent and Grenadine	0	0	0	0	0	0	0	0	0	0	0	15	18	0	16	23	27	15	6	20	0	0	0	0	0	0	0	0	0	**0**
			Trinidad and Tobago	0	17	703	169	266	220	30	117	117	56	452	188	280	81	7	16	38	68	68	14	9	16	16	0	16	16	16	16	16	16
			UK-British Virgin Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
			UK-Turks and Caicos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			USA	498	171	128	116	156	182	76	83	142	120	139	44	70	68	40	97	47	50	47	189	94	73	101	96	61	62	197	107	140	66
			USSR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Uruguay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Venezuela	1454	5	1661	1651	1359	1379	1659	1602	2	0	61	13	0	16	18	19	12	38	10	21	7	4	9	0	0	0	0	0	0	**0**
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	29	40	20	12	0	0	0	0
		NCO	Argentina	1559	434	4	138	108	130	12	68	19	235	1	129	269	110	0	0	0	220	59	6	33	0	0	0	0	0	0	0	0	
			Benin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Cuba	0	0	0	0	0	0	230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Dominica	0	0	0	0	0	0	0	0	0	0	0	0	0	6	16	16	9	4	0	0	0	0	1	2	7	1	0	2	6	
			Georgia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Germany Democratic Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Jamaica	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

			Saint Kitts and Nevis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	0	1	
			Sta Lucia	3	4	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Togo	107	311	254	145	197	197	197	197	0	0	0	0	1583	1215	2298	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Ukraine	25	0	0	0	342	2786	1918	1114	399	231	656	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		MED CP	Albania	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Algerie	315	471	418	506	277	357	511	475	405	350	597	0	609	575	684	910	1042	976	1009	355	353	614	504	716	452	593	811	302	369	485
			EU-Bulgaria	20	8	0	25	33	16	51	20	35	35	35	0	0	0	0	0	0	0	16	8	96	6	5	8	68	13	23	4	32	1
			EU-Croatia	128	6	70	0	0	0	25	120	0	0	0	0	0	0	0	0	0	0	59	41	31	56	56	34	20	22	28	42	31	24
			EU-Cyprus	0	0	0	0	0	0	0	0	14	0	10	10	6	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-España	228	200	344	632	690	628	333	433	342	349	461	544	272	215	429	531	458	247	518	574	442	881	585	519	358	314	321	483	330	253
			EU-France	5	6	0	0	0	0	0	0	0	0	27	0	0	0	0	15	34	20	23	13	12	30	25	103	60	217	52	86	57	45
			EU-Greece	2690	2690	1581	2116	1752	1559	945	2135	1914	1550	1420	1538	1321	1390	845	1123	587	476	531	798	733	960	678	691	700	399	641	422	342	269
			EU-Italy	1288	1238	1828	1512	2233	2233	2233	4159	4159	4159	4579	2091	2009	1356	0	0	1323	1131	964	1197	472	1245	1053	750	697	540	605	616	570	499
			EU-Malta	0	0	0	0	2	7	2	2	1	0	1	0	1	1	11	7	7	3	6	1	3	2	0	2	3	0	2	1	1	0
			EU-Rumania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Egypt	518	640	648	697	985	725	724	1442	1442	1128	1128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Libya	71	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	705	780	82	75	71	65	
			Maroc	31	25	93	37	67	45	39	120	115	5	61	85	78	38	89	87	142	131	57	12	1	0	8	26	50	46	28	60	8	13
			Tunisie	643	792	305	413	560	611	855	1350	1528	1183	1112	848	1251	0	0	0	0	0	0	1425	1415	1413	1407	867	1290	1993	1986	2079	2612	2498
			Türkiye	8863	19548	10093	8944	10284	7810	24000	17900	12000	13460	6286	6000	5701	70797	29690	5965	6448	7036	9401	10019	35764	13158	19032	4573	39460	7578	30920	1578	22743	2595
			USSR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		NCO	NEI (MED)	311	300	300	300	300	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Serbia & Montenegro	0	3	2	6	10	12	12	14	17	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Yugoslavia Fed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Discards	ATL CP	EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Gabon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	**0**
			UK-British Virgin Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		MED CP	EU-Croatia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			EU-España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
BOP	**TOTAL**			641	630	791	703	2196	481	177	868	1207	1012	923	736	581	217	32	1047	533	449	287	377	681	662	952	2239	805	560	126	171	105	220
	Landings	ATL	All gears	465	378	615	588	2064	254	47	651	1062	858	786	713	573	215	32	875	426	442	273	335	657	641	939	1161	743	522	104	119	63	193
		MED	All gears	176	252	176	115	132	227	130	217	145	154	137	23	8	2	0	172	107	6	14	42	24	21	13	1078	62	38	22	52	43	27
	Landings	ATL CP	EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	5	3	1	2	11	21	7	1	2	0	0	0	0	0	1	1	1
			Maroc	423	348	598	524	2003	246	28	626	1048	830	780	706	503	132	0	634	391	273	199	213	642	555	867	1113	665	450	38	53	62	169
			Mauritania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Senegal	41	29	16	63	60	5	18	24	14	28	6	7	70	78	29	240	33	158	53	115	14	84	72	48	78	72	66	66	0	23
		NCO	Benin	1	1	1	1	1	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		MED CP	Algerie	135	198	153	92	119	224	128	216	135	145	128	0	0	0	0	0	0	0	0	9	7	3	3	2	2	1	0	1	0	**0**
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Libya	40	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Maroc	1	14	23	23	13	3	2	1	10	9	9	20	7	1	0	172	107	6	14	30	15	16	8	8	33	3	8	6	35	11
			Tunisie	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0	2	2	2	2	1068	27	33	14	45	7	17
BRS	**TOTAL**			6051	8049	7161	7006	8435	8004	7923	5754	4785	4553	7750	5137	3410	3712	3587	2253	3305	2681	1590	1055	613	853	698	389	1124	1032	1010	1118	773	707
	Landings	A+M	All gears	6051	8049	7161	7006	8435	8004	7923	5754	4785	4553	7750	5137	3410	3712	3587	2253	3305	2681	1590	1055	613	853	698	389	1124	1032	1010	1118	773	707
	Landings	A+M CP	Angola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	
			Brazil	1149	842	1149	1308	3047	2125	1516	1516	988	251	3071	2881	814	471	1432	563	1521	1042	0	3	0	6	2	1	1	1	1	135	0	**0**
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Grenada	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Trinidad and Tobago	2130	2130	2130	1816	1568	1699	2130	1328	1722	2207	2472	1867	2103	2720	1778	1414	1472	1498	1498	936	489	695	695	0	695	695	695	695	695	695
			Venezuela	2772	5077	3882	3882	3609	3609	3651	1766	1766	1766	1766	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	29	29	0	0	0	**0**
			Guyana	0	0	0	0	211	571	625	1143	308	329	441	389	494	521	377	277	312	141	92	116	124	151	0	387	399	308	313	0	0	**0**
			Suriname	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	288	78	12

CER	TOTAL				390	450	490	429	280	251	251	1	4	6	1	2	1	1	1	0	0	0	0	2	0	0	1	1	0	1	1	1	0	0
	Landings	A+M		All gears	390	450	490	429	280	251	251	1	4	6	1	2	1	1	1	0	0	0	0	2	0	0	1	1	0	1	1	1	0	0
	Landings	A+M	CP	EU-France	310	400	400	400	250	250	250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
				Grenada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				St Vincent and Grenadine	1	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	**0**
			NCO	Dominica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	
				Dominican Republic	79	50	90	29	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				Jamaica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				Sta Lucia	0	0	0	0	0	0	0	0	3	5	1	2	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	
COM	TOTAL				463	770	688	1036	1348	951	1087	1037	953	1128	1898	1742	1595	1001	1087	1564	1810	1778	1625	978	628	520	709	790	1007	1113	1128	797	0	
	Landings	MED		All gears	463	770	688	1036	1348	951	1087	1037	953	1128	1898	1742	1595	1001	1087	1564	1810	1778	1625	978	628	520	709	790	1007	1113	1128	797	0	
	Landings	MED	CP	Algerie	315	471	418	506	277	357	511	475	405	350	597	839	609	575	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				Egypt	112	299	270	530	1071	594	576	562	548	778	1301	903	986	426	1087	1564	1810	1689	1578	939	494	478	658	699	895	1019	1017	696	0	
			NCO	Israel	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	89	47	39	134	42	42	42	45	42	42	42	0	
				Lebanon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	49	67	52	69	59	0	
				NEI (MED)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
FRI	TOTAL				11425	16797	13332	11816	13871	13980	14332	10589	8680	10151	5742	6096	8832	6154	8429	9789	7861	12384	14215	15471	18287	17597	17149	17074	21814	15703	17755	17939	17605	18979
	Landings	ATL		All gears	2351	3004	5300	5617	6631	9004	9531	4992	3054	4506	3893	3095	5086	2933	5918	6019	5296	8237	8633	10515	9735	11829	10941	11523	14056	11325	12523	12879	12721	16059
	Landings(FP)	ATL		All gears	9074	13793	8031	6200	7240	4976	4801	5597	5627	5646	1849	3001	3746	3221	2511	3770	2565	4147	5582	4956	8552	5768	6208	5410	7758	4299	5172	5032	4881	2912
	Discards	ATL		All gears	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	141	0	78	60	27	3	9
	Landings	ATL	CP	Angola	0	4	6	21	29	12	31	2	38	38	38	0	0	0	0	95	0	63	19	59	39	22	47	2	1	0	0	0	0	
				Belize	0	0	0	0	0	0	33	0	115	87	0	0	0	0	0	0	0	0	0	0	0	0	36	266	824	586	552	655	585	144
				Brazil	291	608	906	558	527	215	162	166	106	98	1117	860	414	532	603	202	149	313	204	347	259	227	293	308	271	445	282	109	272	100
				Cape Verde	82	115	86	13	6	22	191	154	81	171	278	264	344	300	318	378	574	1312	711	853	1811	2461	5418	3556	2324	1795	4988	2236	2282	3649
				Curaçao	0	0	0	0	590	1157	1030	1159	1134	1006	713	507	497	0	150	106	485	364	0	235	238	481	1456	1151	1124	1576	1414	750	1071	1263
				Côte d'Ivoire	0	0	0	0	0	0	3	0	1	821	2	31	1356	4	354	541	14	813	161	297	38	2837	261	141	311	81	2	89	178	105
				EU-Bulgaria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
				EU-España	228	362	297	386	947	581	570	23	17	722	438	635	34	166	73	278	631	1094	950	877	1708	1234	1200	1682	2537	1608	1033	1129	926	1274
				EU-Estonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
				EU-France	121	63	105	126	161	159	146	0	91	128	95	160	168	47	6	98	24	24	91	147	249	233	147	247	410	773	715	637	296	319
				EU-Germany	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
				EU-Latvia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	169	528	0	0	3529	272	253
				EU-Lithuania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
				EU-Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	150	90	0	164	5	85	119	6	90	45	233	13	6	0
				EU-Portugal	0	0	0	0	0	1	31	5	9	28	5	4	7	212	3	250	13	0	0	0	0	0	0	1	2	3	1	3	0	1
				EU-Rumania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
				El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	435	793	895	1157	1071	960	964
				Gabon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	**0**
				Ghana	0	0	0	0	0	0	33	221	118	39	31	0	3	0	2577	2134	1496	2786	3604	2295	2469	2382	0	0	0	0	0	0	0	**0**
				Great Britain	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	26	0	0	0	0	0	0	0	0	0	**0**
				Grenada	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	98	74	81	78	48	63	0	26	0	71	63	311	249	155	178
				Guinea Ecuatorial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	1	3	2	2
				Guinée Rep	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	96	94	332	503	236	0	0	0	0	0	0	**0**
				Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
				Liberia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	1
				Maroc	332	306	190	707	716	2717	2315	764	629	486	591	236	696	227	52	135	179	9	19	862	554	55	21	90	125	200	3	93	492	209
				Mauritania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	269	169	377	492	1420	1953	661	101	211	806	996	311	362	394	1025	1005
				Panama	57	118	341	328	240	91	0	0	0	0	0	0	394	975	970	1349	411	439	425	339	463	504	905	292	1356	1572	707	743	941	**0**
				Russian Federation	627	150	405	456	46	500	2433	477	12	25	308	56	56	63	6	6	12	113	270	912	113	217	139	249	545	389	430	305	753	153
				S Tomé e Príncipe	39	33	37	48	79	223	197	209	200	200	200	200	234	215	290	0	275	149	153	298	307	315	324	636	536	467	14	24	6	8
				Senegal	201	342	319	309	0	101	0	7	0	4	0	13	288	151	83	119	383	15	217	201	341	16	22	1407	1133	391	249	807	2498	6337
				St Vincent and Grenadine	4	0	0	0	0	17	65	0	0	208	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
				Trinidad and Tobago	0	17	0	56	199	368	127	138	245	0	0	0	414	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
				UK-Bermuda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
				USA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
				USSR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
				Venezuela	368	886	2609	2601	3083	2839	2164	1631	210	444	34	113	182	42	165	52	48	54	215	508	85	150	71	64	70	115	67	26	0	92
			NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	7	14	8	11	0	0	0	**0**
			NCO	Argentina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				Benin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				Germany Democratic Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				NEI (ETRO)	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				Sta Lucia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				Ukraine	0	0	0	0	0	0	0	36	48	0	43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

	Landings(FP)	ATL	CP	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	154	71	86	78	107	0	0	0	0	0	0	**0**
				Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	144	84	200	189	188	428	130	271	256	268	745	537	163	238	183	191	**0**
				Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	29	55	29	36	225	233	139	214	149	224	0	0	0	0	0	0	326
				Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	177	81	236	0	0	0	0	0	0	**0**
				EU-España	6131	8426	3990	3903	4495	3449	3154	3762	3385	3580	1074	1942	2450	1327	1423	2585	1685	2636	3117	3023	5770	2792	3289	1533	1753	1351	1069	1192	900	1154
				EU-France	2943	5367	4041	2297	2745	1527	1648	1836	2242	2066	775	1059	1296	1138	644	612	222	684	1214	815	1183	1466	1486	855	1046	468	886	864	731	1301
				Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	142	75	69	99	53	105	25	150	42	65	0	0	0	0	0	0	131
				Guinée Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	168	0	24	37	0	174	518	542	672	441	0	0	0	0	0	0	**0**
				Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	274	230	251	297	261	157	230	158	234	92	0	0	0	0	0	0	**0**
			NCO	Mixed flags (EU tropical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2277	4422	2317	2979	2793	3060	
	Discards	ATL	CP	EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	141	0	78	60	26	3	9
				Gabon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	**0**
KGM	**TOTAL**				14691	16331	14777	14930	17782	19815	16394	17717	16342	15408	17258	15863	12830	11766	8252	17936	7344	7826	11697	10452	10151	9712	11039	9913	10838	11257	11844	10058	14660	8786
	Landings	A+M		All gears	14691	16331	14777	14930	17782	19815	16394	17717	16342	15408	17258	15863	12830	11766	8252	17936	7344	7826	11697	10452	10151	9712	11039	9913	10838	11257	11844	10058	14660	8786
	Discards	A+M		All gears	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Landings	A+M	CP	Angola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	139	914	0	0	0	0	0	0	
				Brazil	979	1380	1365	1328	2890	2398	3595	3595	2344	1251	2316	3311	247	202	316	33	0	0	1	1	0	0	0	0	0	0	0	190	305	550
				Grenada	0	0	0	0	2	4	28	14	9	4	5	0	0	0	0	0	0	0	0	0	0	0	0	13	4	5	4	18	11	
				Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	8	0	0	**0**
				Mexico	3014	3289	3097	3214	4661	4661	3583	4121	3688	4200	4453	4369	4564	3447	4201	3526	3113	3186	3040	3130	3090	3335	3019	3281	3130	3233	3825	3231	2505	1821
				St Vincent and Grenadines	0	0	0	0	0	0	0	0	137	0	0	0	0	0	67	0	0	7	9	0	0	0	0	0	0	0	0	0	0	**0**
				Trinidad and Tobago	0	1192	0	471	1029	875	746	447	432	410	1457	802	578	747	661	567	1043	1001	1001	720	393	495	496	1	494	494	494	494	494	494
				UK-Bermuda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
				UK-British Virgin Islands	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1
				USA	9344	9616	7831	7360	7058	8720	7373	6453	6780	6603	6061	6991	7129	7123	2837	13482	3013	3541	7584	6523	6573	5641	6607	6257	6891	7325	7368	5910	10809	5618
				Venezuela	1308	801	2484	2558	2140	2139	340	2424	2424	2424	2424	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	2	2	4	5	0	1	0	1
				Guyana	0	0	0	0	0	270	440	398	214	239	267	390	312	245	168	326	174	91	59	75	90	99	0	358	314	192	143	1	0	**0**
				Suriname	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	212	534	301
			NCO	Antigua and Barbuda	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				Argentina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				Dominica	0	0	0	0	0	0	0	36	35	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				Dominican Republic	47	52	0	0	0	589	288	230	226	226	226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				Jamaica	0	0	0	0	0	155	0	0	44	48	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	
				Saint Kitts and Nevis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
				Sta Lucia	0	0	0	0	1	4	0	0	9	1	1	0	1	1	1	2	0	1	3	4	1	1	0	0	0	0	0	0	0	
	Discards		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
KGX	**TOTAL**				266	301	368	367	744	0	0	0	48	0	0	0	0	0	0	0	0	0	0	3	0	0	0	13	8	12	33	0	28	0
	Landings	A+M		All gears	266	301	368	367	744	0	0	0	48	0	0	0	0	0	0	0	0	0	0	3	0	0	0	13	8	12	33	0	28	0
	Landings	A+M	CP	Barbados	51	55	36	42	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
				EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	13	8	12	33	0	28	**0**
			NCO	Colombia	12	21	148	111	539	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				Puerto Rico	53	84	86	134	106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				Sta Lucia	150	141	98	80	50	0	0	0	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
LTA	**TOTAL**				22362	13130	14399	12276	11569	14405	15719	12283	15319	16943	16723	17010	16357	11915	9925	18159	14213	16270	23080	25347	20865	21643	14224	24030	28885	29485	27020	25453	23098	18941
		ATL			20607	11872	13202	10381	9453	12804	12804	9407	11830	13955	14080	16327	14918	10873	8320	16472	11954	14170	20910	21679	16679	17010	10619	17456	19097	14338	19134	15710	15753	13678
		MED			1755	1258	1197	1894	2116	1601	2914	2876	3489	2988	2643	684	1439	1042	1605	1687	2259	2100	2170	3668	4186	4633	3605	6574	9788	15147	7886	9743	7346	5263
	Landings	ATL		All gears	20006	10321	10906	9655	8779	11910	11732	8672	10258	11566	13476	14961	13352	10172	7417	13962	10137	12137	17433	17511	13060	13260	7968	10965	12248	10753	15848	11901	12784	12207
		MED		All gears	1755	1258	1197	1894	2116	1601	2914	2876	3489	2988	2643	684	1439	1042	1605	1687	2259	2100	2170	3668	4186	4633	3605	6574	9788	15147	7886	9743	7346	5263
	Landings(FP)	ATL		All gears	601	1551	2296	726	675	894	1073	735	1571	2389	604	1366	1566	702	903	2510	1817	2033	3477	4168	3619	3751	2651	6287	6849	3478	3221	3740	2967	1437
	Discards	ATL		All gears	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	204	0	107	64	69	1	35
		MED		All gears	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Landings	ATL	CP	Angola	14	175	121	117	235	75	406	118	132	132	132	0	0	2	0	4365	0	128	1759	3455	1905	1085	10	6	1	4	3	0	0	
				Brazil	935	985	1225	1059	834	507	920	930	615	615	615	0	320	280	0	0	0	0	0	22	581	0	0	0	0	0	34	0	113	38
				Canada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
				Cape Verde	148	17	23	72	63	86	110	776	491	178	262	143	137	81	123	292	250	357	185	102	131	131	131	131	218	113	105	59	82	135
				Curaçao	0	0	0	0	0	0	0	0	0	0	5	9	0	0	0	0	0	0	38	38	76	57	0	0	0	0	0	3	2	105
				Côte d'Ivoire	142	339	251	253	250	155	136	9	123	1	0	0	153	287	427	2159	1791	1446	1631	50	1062	1433	152	102	111	1881	7583	2441	1815	1917
				EU-España	1	0	0	10	55	27	110	6	2	22	8	1	489	50	16	0	38	35	136	168	71	52	112	381	477	185	148	89	10	11

	EU-Estonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	EU-France	13	8	54	59	22	215	21	698	631	610	613	14	10	27	12	0	1	50	35	5	30	27	6	36	73	359	268	263	156	492
	EU-Germany	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	EU-Italy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	EU-Latvia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	EU-Lithuania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	EU-Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	69	8	0	18	1	9	0	0	0	0	0	0	0	**0**
	EU-Poland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	EU-Portugal	73	45	72	72	218	320	171	14	50	0	2	16	19	21	24	43	10	6	5	14	4	18	0	0	7	31	35	43	3	6
	EU-Rumania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46	0	0	15
	Gabon	0	0	0	0	182	0	18	159	301	213	57	173	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Ghana	11608	359	994	513	113	2025	359	306	707	730	4768	8541	7060	5738	783	1335	745	1692	1465	1001	1274	1138	0	0	0	0	0	0	0	**0**
	Great Britain	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	15	23	38	0	0	0	0	0	0	0	0	**0**
	Grenada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	
	Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	120	15	45	88	38	50
	Guinea Ecuatorial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	10	11	10	11
	Liberia	237	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	673	256	176	101	78	151	212	2	70	1	19
	Maroc	370	52	43	230	588	195	189	67	101	87	308	76	91	33	0	40	2	63	5	57	10	11	3	0	11	12	0	0	0	**0**
	Mauritania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	670	423	943	1222	3549	4878	1634	252	529	1287	2478	774	901	984	2558	2462
	Panama	0	64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	**0**
	Russian Federation	306	265	189	96	49	0	88	0	0	0	74	13	0	0	0	0	0	0	268	11	208	399	255	136	547	433	698	478	1742	304
	S Tomé e Príncipe	48	41	40	43	40	50	39	37	33	33	33	33	178	182	179	0	183	188	193	198	203	209	214	182	122	249	11	3	770	772
	Senegal	4011	4724	4536	3613	1972	4174	4715	1607	3546	5176	2866	4394	3508	2699	3826	3885	5108	5683	6371	4910	2769	5912	3774	5065	4855	3841	3672	4757	3100	3718
	South Africa	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	St Vincent and Grenadine	0	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	27	33	**0**
	Trinidad and Tobago	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	UK-Bermuda	11	5	6	6	7	6	5	4	2	1	5	4	5	7	5	5	4	3	4	5	6	3	3	4	2	1	1	2	3	5
	UK-Sta Helena	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	USA	597	1286	1142	1312	2230	2015	1546	1623	1209	1451	1366	1492	1382	765	1351	1401	963	1244	1772	1875	2797	2333	2661	3537	3019	2577	2286	2580	2346	2146
	USSR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Venezuela	1409	1889	2115	2115	1840	1840	2815	2247	2247	2247	2254	50	0	0	0	0	30	4	2	8	4	1	4	0	0	0	0	0	0	**0**
NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	12	16	54	48	0	0	0	**0**
NCO	Argentina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Benin	49	53	60	58	58	196	83	69	69	69	69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Cuba	33	13	15	27	23	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Dominica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	
	Germany Democratic Re	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Israel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	NEI (ETRO)	0	0	20	0	0	0	0	0	0	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Sta Lucia	0	0	0	0	0	2	2	2	0	1	10	1	0	0	1	0	0	0	0	0	0	1	0	2	0	1	0	1	0	
MED CP	Algerie	585	495	459	552	554	448	384	562	494	407	148	0	158	116	187	96	142	119	131	98	6	157	341	204	268	444	298	242	233	195
	EU-Bulgaria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	EU-Croatia	3	2	15	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	28	25	44	37	43	31	19	42	34	31	31
	EU-Cyprus	21	11	23	10	19	19	19	16	19	19	19	0	0	0	0	6	5	4	0	0	0	0	0	0	0	0	0	0	0	**0**
	EU-España	0	0	0	15	18	9	15	0	8	82	32	0	41	262	116	202	212	86	299	488	441	235	300	456	384	486	289	640	493	413
	EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	42	0	0	0	1	0	0	0	4	7	9
	EU-Greece	0	0	0	0	0	0	0	0	195	125	132	0	0	112	69	72	183	148	165	301	276	363	289	271	501	299	489	635	955	408
	EU-Italy	0	0	0	0	0	0	0	0	0	0	16	24	38	34	0	0	486	243	365	304	669	557	442	0	992	930	1032	1513	1204	803
	EU-Malta	0	0	0	0	0	0	0	0	0	0	1	1	1	1	3	2	5	3	7	5	21	9	4	7	1	6	6	7	3	2
	Egypt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	849	712	0	0	0	1003	0	0	**0**
	Libya	0	0	0	0	0	45	52	0	5	4	4	0	0	0	0	0	0	0	0	0	0	0	0	102	1100	48	80	65	55	
	Maroc	0	0	0	1	0	1	14	8	0	0	3	1	0	9	0	331	19	24	1	0	0	0	0	0	3	0	0	0	0	**0**
	Syria	156	161	156	155	270	350	417	390	370	370	330	0	0	0	0	193	133	163	148	155	304	229	0	0	0	0	0	0	0	**0**
	Tunisie	664	242	204	696	824	333	1113	752	1453	1036	960	657	633	0	0	0	0	0	0	810	800	803	798	5165	6323	12434	4032	6152	4024	2940
	Türkiye	0	0	0	0	0	0	500	750	750	750	750	0	568	507	1230	785	1074	1309	1046	1437	1645	1386	682	326	184	480	617	450	341	

			NCO	Israel	126	119	119	215	119	119	119	119	119	119	119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				NEI (MED)	200	200	200	200	200	200	200	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				Palestine	0	0	0	0	90	59	61	60	60	60	129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				Serbia & Montenegro	0	28	21	35	22	18	20	18	16	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				Yugoslavia Fed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Landings(FP)	ATL	CP	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	223	51	238	144	133	0	0	0	0	0	0	**0**
				Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	45	76	265	214	189	262	266	179	438	178	850	458	128	146	132	109	**0**
				Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39	42	50	160	185	167	209	284	284	0	0	0	0	0	0	426
				Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	162	56	12	0	0	0	0	0	0	**0**
				EU-España	188	707	1127	454	284	353	295	194	751	1197	209	656	508	206	213	1253	944	1181	1320	2067	1105	732	1182	1968	1885	1244	781	1102	831	329
				EU-France	413	844	1169	272	391	540	777	541	821	1192	396	710	1058	367	205	262	122	241	901	1061	675	693	565	870	732	296	470	493	273	510
				Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	35	178	92	118	17	121	43	126	145	64	0	0	0	0	0	0	171
				Guinée Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	21	2	0	358	260	666	1186	202	0	0	0	0	0	0	**0**
				Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	35	191	577	368	228	106	250	259	72	30	0	0	0	0	0	0	**0**
			NCO	Mixed flags (EU tropical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2598	3774	1810	1825	2013	1753	
	Discards	ATL	CP	EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	204	0	107	64	69	1	35
				EU-Germany	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		MED	CP	EU-Croatia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
				EU-España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
MAW	**TOTAL**				2423	1723	1278	1953	2910	1475	1496	971	1321	881	1393	646	352	480	571	847	616	684	2384	1333	1128	3016	1460	1242	3206	1286	7066	1784	731	2783
		A+M			2423	1723	1278	1953	2910	1475	1496	971	1321	881	1393	646	352	480	571	847	616	684	2384	1333	1128	3016	1460	1242	3206	1286	7066	1784	731	2783
	Landings	A+M		All gears	2423	1723	1278	1953	2910	1475	1496	971	1321	881	1393	646	352	480	571	847	616	684	2384	1333	1128	3016	1460	1242	3206	1286	7066	1778	731	2783
	Discards	A+M		All gears	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0
	Landings	A+M	CP	Angola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	86	1650	249	221	1247	0	3	1	2	1	0	0	
				Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	2	0	66	0	0	1	0	0	0	90	35	47	76	122	5827	601	305	392
				EU-Estonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
				EU-Ireland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	**0**
				EU-Italy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1717	0	0	0	0	**0**
				EU-Latvia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
				EU-Lithuania	4	0	0	0	0	0	0	0	0	0	298	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
				EU-Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	10	0	0	0	0	0	0	0	0	0	**0**
				Gabon	0	0	140	145	79	60	85	61	102	53	48	82	67	37	87	93	17	22	30	34	46	42	13	37	21	56	87	137	42	195
				Ghana	899	466	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
				Mauritania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	207	319	176	203	275	193	152	110	434	493	524	164	191	79	206	2042
				Russian Federation	0	19	0	0	0	0	14	0	0	0	0	15	0	0	1	0	0	0	0	0	0	0	4	0	0	0	0	0	0	**0**
				S Tomé e Príncipe	3	5	6	6	8	7	8	5	6	6	6	6	21	12	13	0	91	93	96	98	100	102	105	13	11	72	0	0	0	**0**
				Senegal	1225	1019	938	1614	2635	1046	878	700	987	617	794	532	262	431	196	435	329	278	331	749	610	1426	870	649	856	870	961	961	178	154
				USSR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			NCO	Benin	202	214	194	188	188	362	511	205	205	205	205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				Germany Democratic Re	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				Ukraine	90	0	0	0	0	0	0	0	21	0	42	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Discards	A+M	CP	Gabon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	**0**
SSM	**TOTAL**				16285	16317	14490	13697	16571	15403	8877	9837	8220	8383	9414	9793	8119	10472	6308	6118	5900	6199	11788	10916	10156	12684	7798	7741	8669	8332	4332	12651	16691	11762
	Landings	A+M		All gears	16285	16317	14490	13697	16571	15403	8877	9837	8220	8383	9414	9793	8119	10472	6308	6118	5900	6199	11788	10916	10156	12684	7798	7741	8669	8332	4332	12651	16691	11762
	Landings	A+M	CP	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	**0**
				EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	3	14	18	11	16	6	4	0	0	**0**
				EU-Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	1	26	16	0	2	20	7	2	0	0	0	1	0	0	0	0	**0**
				Gabon	0	0	0	0	0	0	0	0	0	0	265	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
				Grenada	0	1	2	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	
				Mexico	9181	10066	8300	7673	11050	11050	5483	6431	4168	3701	4350	5242	3641	5723	3856	3955	4155	4251	4128	4026	3321	3581	3857	4077	3820	3701	4321	3870	2968	2157
				Trinidad and Tobago	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
				USA	5663	5143	4380	3363	2866	3509	2968	3282	3893	4524	4613	4552	4477	4747	2425	2147	1746	1946	7639	6871	6829	9089	3922	3652	4825	4611	6	8778	13722	9605
			NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	5	11	0	0	0	**0**
			NCO	Colombia	95	58	69	69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				Cuba	611	310	409	548	613	613	236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				Dominica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				Dominican Republic	735	739	1330	2042	2042	231	191	125	158	158	158	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				Jamaica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	
				Saint Kitts and Nevis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				Sta Lucia	0	0	0	0	0	0	0	0	0	1	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
WAH	**TOTAL**				1835	2671	2143	2408	2516	3104	2497	2972	2035	2318	2226	2067	2613	2467	1829	2581	2176	2354	2381	2844	3729	5235	3526	2554	17320	6881	6482	4741	8579	3035
	Landings	A+M		All gears	1835	2671	2143	2408	2516	3104	2497	2972	2035	2318	2226	2067	2613	2110	1650	2296	1604	1883	2111	2367	3541	5128	3440	2548	17320	6866	6467	4735	8577	3034
	Landings(FP)	A+M		All gears	0	0	0	0	0	0	0	0	0	0	0	0	0	357	179	285	572	471	269	477	85	0	0	0	0	0	0	0	0	0
	Discards	A+M		All gears	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	104	108	86	6	0	14	15	6	2	1

Landings	A+M CP	Barbados	51	91	82	42	35	52	52	41	41	0	0	34	45	26	41	36	27	17	30	29	22	21	17	10	11	10	7	9	7	5
		Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	29	27	34	23
		Brazil	71	33	26	1	16	58	41	0	0	0	0	405	519	449	111	75	76	70	19	357	213	477	153	312	404	322	150	23	57	21
		Canada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Cape Verde	350	326	361	408	503	603	429	587	487	578	500	343	458	449	555	524	351	472	470	470	445	445	445	445	490	228	298	293	196	151
		Curaçao	260	270	250	230	230	230	230	230	230	230	230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Côte d'Ivoire	1	0	0	0	0	0	0	0	0	0	0	0	16	3	1	11	0	5	5	12	9	95	1	25	1	1	1	61	62	19
		EU-España	32	22	20	15	25	25	29	28	32	38	46	48	305	237	110	66	38	73	53	87	35	50	41	50	59	51	79	61	53	45
		EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	4	0	0	46	45	38	159	61	79	58	61
		EU-Portugal	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3	0	4	3	9	8	10	2	0	0	0	0	0	0	3	0
		El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Great Britain	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Grenada	104	96	46	49	56	56	59	82	51	71	59	44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	18	
		Guinea Ecuatorial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	14	21	9	0	11	13	9	8
		Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	6	14	12
		Liberia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
		Maroc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	76	0	0	0	0	0	0	0	0	0	0	0
		Mauritania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	54	263	48	1591	46	122	13678	4271	4975	2707	7035	2026
		Mexico	0	0	0	0	0	0	0	0	0	0	0	0	35	0	0	0	0	0	0	0	0	0	16	12	18	15	12	14	15	11
		Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	91	240	120	86	111	99	210	373	228	0	109	0	77	123	216	50
		S Tomé e Príncipe	27	36	39	46	80	52	56	62	52	52	52	52	94	88	76	0	131	235	241	247	254	260	266	100	70	172	1	5	9	11
		Senegal	0	64	0	0	1	0	0	5	0	0	0	5	0	1	1	0	0	2	6	0	11	24	0	3	7	0	0	0	0	23
		South Africa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		St Vincent and Grenadine	33	41	28	16	23	10	65	52	46	311	17	40	60	0	241	29	24	31	40	31	5	32	24	9	11	126	82	27	30	0
		Trinidad and Tobago	1	0	0	0	0	1	1	1	2	1	9	7	6	6	7	6	6	5	5	7	9	9	9	9	10	8	7	6	6	5
		UK-Bermuda	80	58	50	93	99	105	108	104	61	56	91	87	88	83	86	124	117	101	81	100	88	75	76	86	95	92	68	82	60	67
		UK-British Virgin Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	1	0	4	1	1	0	0	0	0	0	1
		UK-Sta Helena	17	35	26	25	23	19	10	15	15	22	25	18	17	11	20	13	18	29	19	31	12	16	16	10	15	16	9	5	5	6
		UK-Turks and Caicos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		USA	203	827	391	764	608	750	614	858	640	633	846	789	712	558	89	1123	495	522	653	584	999	460	1027	1153	2060	1204	530	974	633	455
		Venezuela	333	514	542	540	487	488	360	467	4	17	13	9	7	16	13	33	9	25	28	23	38	32	27	30	64	51	45	46	40	31
	NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1132	1012	810	0	0	0	0	0	0	0
		Costa Rica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2	5	4	2	3	1	1
		Guyana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	NCO	Antigua and Barbuda	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	NCO	Aruba	50	50	125	40	50	50	50	50	50	50	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Benin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Dominica	59	59	59	58	58	58	58	50	46	11	37	10	6	8	15	14	16	10	13	13	0	0	20	10	10	6	3	10	5	
		Dominican Republic	13	7	0	0	0	325	112	31	35	35	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Jamaica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Saint Kitts and Nevis	0	0	0	0	0	0	0	0	0	0	0	7	6	7	0	0	0	0	0	0	0	0	0	6	9	14	13	0	9	
		Sta Lucia	150	141	98	80	221	223	223	310	243	213	217	169	238	169	187	0	171	195	199	0	0	148	155	87	147	110	0	127	0	
Landings(FP)	A+M CP	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	40	0	0	0	0	0	0	0	0	0	0
		Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	92	9	55	60	22	29	25	4	0	0	0	0	0	0	0	0	0
		Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	7	31	57	23	78	9	0	0	0	0	0	0	0	0	0
		Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
		EU-España	0	0	0	0	0	0	0	0	0	0	0	0	0	92	63	44	224	262	136	240	56	0	0	0	0	0	0	0	0	0
		EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	28	10	3	16	26	26	17	0	0	0	0	0	0	0	0	0	0
		Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	68	11	21	28	7	0	8	0	0	0	0	0	0	0	0	0	0
		Guinée Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	8	15	7	0	0	0	0	0	0	0	0	0	0	0	0
		Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	39	44	104	102	65	13	66	15	0	0	0	0	0	0	0	0	0
	NCO	Mixed flags (EU tropical)	0	0	0	0	0	0	0	0	0	0	0	0	0	28	30	44	97	26	39	0	0	0	0	0	0	0	0	0	0	
Discards	A+M CP	EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	14	15	6	2	1
		Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
		Mexico	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		South Africa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		UK-British Virgin Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	104	108	86	0	0	0	0	0	0	0

BSH-Table 1. Estimated catches (t) of blue shark (Prionace glauca) by area, gear and flag.

				1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
TOTAL				3669	9602	11301	11585	10983	39562	35522	36964	40639	35220	32765	37983	36306	43072	43889	50464	53903	58844	65256	73206	63079	57586	62967	62794	70216	68142	68331	62010	54949	54888
	ATN			3561	9591	8592	8468	6735	29267	26661	26114	28146	21128	20066	23006	21741	22359	23218	26927	30725	35200	37241	38097	36616	36815	36584	39630	44070	39664	33964	27198	21196	21507
	ATS			107	10	2704	3108	4246	10145	8799	10828	12448	14044	12682	14966	14440	20642	20493	23487	23097	23459	27799	35069	26421	20672	26148	22498	25417	28373	34309	34749	33680	33327
	MED			1	0	6	8	2	150	63	22	45	47	17	11	125	72	178	50	81	185	216	40	42	100	235	665	729	105	58	64	73	54
Landings	ATN		Longline	2884	7460	7646	7548	6131	28678	26153	25382	27301	20699	19290	22881	21297	22167	23068	26811	30516	35033	36957	37789	36386	36606	36251	38780	42861	38493	32765	25980	19797	20065
			Other surf.	492	994	373	300	560	428	419	682	732	324	708	70	380	126	104	63	80	63	117	102	110	100	205	726	1121	1033	1086	1024	986	1081
	ATS		Longline	107	10	2704	3108	4246	10135	8790	10801	12448	14043	12678	14960	14341	20638	20434	23417	22708	23453	27785	34532	25878	20387	24203	21736	24643	27662	33546	33945	32608	32655
			Other surf.	0	0	0	0	0	6	4	27	0	1	4	6	99	3	59	10	375	6	14	534	411	152	1831	635	634	487	664	464	591	446
	MED		Longline	0	0	5	8	2	150	63	22	45	47	17	11	43	72	83	48	81	18	50	40	41	68	190	664	728	92	54	51	71	48
			Other surf.	1	0	1	0	0	0	0	0	0	0	0	0	81	0	95	2	1	167	165	0	0	32	45	1	2	13	4	13	3	6
Discards	ATN		Longline	184	1136	572	621	45	161	88	49	113	105	68	55	63	66	45	53	129	102	167	205	119	109	128	124	88	138	112	193	413	361
			Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	2	1	0	0	0	0	0	0	0	0	**0**
	ATS		Longline	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0	60	14	0	0	4	132	132	114	122	139	218	99	340	481	226
			Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	7	0	0	0	0
	MED		Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Landings	ATN	CP	Barbados	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	6	7	4	2	2	2
			Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114	461	1039	903	1216	392	4	6	201	317	369	301	349
			Brazil	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Canada	1277	1702	1260	1494	528	831	612	547	624	581	836	346	965	1134	977	843	0	0	0	0	1	0	0	0	0	0	0	0	0	0
			Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			China PR	0	0	0	0	0	0	0	0	0	185	104	148	0	0	0	367	109	88	53	109	98	327	0	1	27	2	6	18	65	2
			EU-Denmark	1	0	1	2	3	1	1	0	2	1	13	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-España	0	0	0	0	0	24497	22504	21811	24112	17362	15666	15975	17314	15006	15464	17038	20788	24465	26094	27988	28666	28562	29041	30078	29019	27316	21685	16314	12325	13125
			EU-France	276	322	350	266	278	213	163	399	395	207	221	57	106	120	99	167	119	84	122	115	31	216	132	259	352	124	94	80	57	43
			EU-Ireland	0	0	0	0	0	0	0	66	31	66	11	2	0	0	0	0	0	0	0	1	3	2	1	0	0	0	0	0	0	**0**
			EU-Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-Portugal	1583	5726	4669	4722	4843	2630	2440	2227	2081	2110	2265	5643	2025	4027	4338	5283	6167	6252	8261	6509	3768	3694	3060	3859	7819	5664	5195	4507	3836	4300
			FR-St Pierre et Miquelon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**0**
			Great Britain	0	0	0	12	0	0	1	0	12	9	6	4	6	5	3	6	6	96	8	10	8	10	10	12	17	11	6	3	3	4
			Iceland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Japan	0	0	1203	1145	618	489	340	357	273	350	386	558	1035	1729	1434	1921	2531	2007	1763	1227	2437	1808	3287	4011	4217	4444	4111	3740	2193	1506
			Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	537	299	327	113	0	10	103	92	113	48	16
			Liberia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	10	3	8
			Maroc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	873	1623	1475	1644	1524	1498	1636
			Mauritania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	93	0	0	0	0	**0**
			Mexico	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	**0**
			Panama	0	0	0	0	0	0	0	9	0	0	0	0	0	0	254	892	613	1575	0	0	0	289	153	0	262	0	437	242	344	84
			Russian Federation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Senegal	0	0	0	0	0	0	0	0	0	0	456	0	0	0	0	43	134	255	56	0	5	12	17	13	3	4	1	0	0	**0**
			St Vincent and Grenadines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	119	0	0	0	2	**0**
			Trinidad and Tobago	0	0	0	0	0	0	0	0	0	0	6	3	2	1	1	0	2	8	9	11	11	8	10	4	2	2	0	0	0	0
			UK-Bermuda	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			USA	215	682	31	24	284	214	256	217	291	40	0	1	7	2	2	1	9	5	69	73	61	61	44	32	31	24	19	17	8	10
			Venezuela	24	23	18	16	6	27	7	47	43	47	29	40	10	28	12	19	8	73	75	117	98	52	113	129	116	105	111	55	59	11
		NCC	Chinese Taipei	0	0	487	167	132	203	246	384	165	59	0	171	206	240	588	292	110	73	99	148	94	113	77	220	259	42	122	8	38	49
			Costa Rica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	6	14	8	5	3	2	0	0	0	0	0
	ATS	CP	Angola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	0	0	0	
			Belize	0	0	0	0	0	0	0	0	0	0	0	0	37	259	0	236	109	0	273	243	483	234	171	105	167	200	222	165	15	21
			Brazil	0	0	0	0	743	1103	0	179	1687	2173	1971	2166	1667	2523	2591	2258	1986	1274	1500	1980	1607	2013	2551	2420	1334	2177	3011	3784	3435	4629
			China PR	0	0	0	0	0	0	0	0	0	565	316	452	0	0	0	585	40	109	41	131	84	64	48	20	30	283	127	52	45	15
			Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	92	16	9	8	247	1202	8	**0**
			EU-España	0	0	0	0	0	5272	5574	7173	6951	7743	5368	6626	7366	6410	8724	8942	9615	13099	13953	16978	14348	10473	11447	10133	10107	11486	13515	18497	14717	16778

			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-Portugal	0	0	0	847	867	1336	876	1110	2134	2562	2324	1841	1863	3184	2751	4493	4866	5358	6338	7642	2424	1646	1622	2420	5609	6663	8015	6753	7350	5524
			El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Ghana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1583	396	436	479	416	414	413	446
			Great Britain	0	0	0	0	0	0	0	0	0	0	0	0	0	0	239	0	0	14	0	0	0	0	0	0	0	0	0	0	0	**0**
			Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Guinea Ecuatorial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	6	0	0	0	0	0
			Japan	0	0	1388	437	425	506	510	536	221	182	343	331	209	236	525	896	1789	981	1161	1483	3060	2255	3232	2277	2127	3112	3495	2338	1810	1341
			Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	222	125	112	61	10	71	252	87	192	156	55	6
			Namibia	0	0	0	0	0	0	0	0	0	0	2213	2316	1906	6616	3536	3419	1829	207	2352	2957	1439	1147	2471	2137	2775	1357	3290	0	4120	3237
			Panama	0	0	0	0	0	0	0	168	22	0	0	0	0	0	0	0	521	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Russian Federation	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			S Tomé e Príncipe	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	143	147	152	156	206	183	0	0	0	0	**0**
			Senegal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	203	51	60	0	18	15	11	0	39	0	**0**
			South Africa	0	0	0	0	0	0	23	21	0	83	63	232	128	154	90	82	126	119	125	318	158	179	524	402	356	418	403	292	52	181
			St Vincent and Grenadines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	0	0	0	0	**0**
			USA	0	0	0	0	0	0	0	0	0	4	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Uruguay	107	10	84	57	259	180	248	118	81	66	85	480	462	376	232	337	359	942	208	725	433	130	0	0	0	0	0	0	0	**0**
		NCC	Chinese Taipei	0	0	1232	1767	1952	1737	1559	1496	1353	665	0	521	800	866	1805	2177	1843	1356	1625	2138	1941	2125	2128	1731	1853	1852	1276	716	1179	922
		NCO	Benin	0	0	0	0	0	6	4	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	MED	CP	Algerie	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	7	4	2	3
			EU-Cyprus	0	0	0	0	0	0	0	0	9	0	0	3	6	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-España	0	0	0	0	0	146	59	20	31	6	3	3	4	8	61	3	2	7	48	38	39	37	53	65	58	40	19	18	34	14
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	4	5	15	0	2	2	2	2	2
			EU-Italy	0	0	0	0	0	0	0	0	0	0	0	0	113	1	95	46	75	175	165	0	0	57	173	0	18	59	17	33	26	33
			EU-Malta	1	0	1	1	1	2	2	2	1	1	1	0	0	0	0	1	1	2	1	1	2	2	4	5	3	4	2	2	2	1
			EU-Portugal	0	0	0	0	0	0	2	0	5	41	14	3	0	56	22	0	0	0	2	0	0	0	0	0	0	0	0	0	0	**0**
			Japan	0	0	5	7	1	1	0	0	0	0	0	1	1	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Libya	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	580	650	0	10	6	6	**0**
Discards	ATN	CP	Canada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	16	32	71	4	193	173
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	115	159	158
			Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	1	29	0	25	1	0
			Russian Federation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			UK-Bermuda	0	0	0	3	1	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			USA	184	1136	572	618	44	161	88	41	113	106	68	55	65	66	45	54	130	103	167	206	106	99	122	82	43	42	11	20	24	24
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	10	6	19	27	34	31	30	36	4
	ATS	CP	Brazil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	14	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	**0**
			EU-España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	**0**
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	1	0	0	0	0
			El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	**0**
			Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	**0**
			Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	175	321	94
			Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	2	19	2	2
			Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	**0**
			South Africa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	**0**
			USA	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	132	132	112	122	139	201	97	146	159	130
	MED	CP	EU-España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**

SMA-Table 1. Estimated catches (t) of Shortfin mako (*Isurus oxyrinchus*) by area, gear and flag.

			1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
TOTAL			4416	5856	5841	8406	7700	5729	5861	4470	5187	4792	5531	7225	6528	6970	6620	6946	5684	6606	7270	6982	7347	5787	6743	6056	6122	5906	5552	4195	4586	3681
	ATN		3233	4114	3659	5306	5305	3536	3845	2859	2595	2677	3426	3987	4000	3695	3574	4158	3802	4542	4783	3722	4440	3604	3469	3282	3357	3119	2392	1886	1729	1431
	ATS		1183	1743	2182	3100	2395	2187	2008	1606	2588	2107	2103	3235	2526	3259	3036	2786	1881	2063	2486	3258	2905	2183	3274	2774	2765	2786	3158	2309	2857	2249
	MED		0	0	0	0	0	6	8	5	4	7	2	2	2	17	10	2	1	1	2	2	2	0	0	0	0	0	1	0	0	1
Landings	ATN	Longline	2935	3420	3306	3828	5053	3351	3670	2756	2267	2446	3155	3970	3572	3387	3302	3976	3623	4345	4588	3499	4147	3313	2577	2639	3119	2714	1998	1622	1625	521
		Other surf.	260	670	331	1448	252	183	175	99	320	231	271	17	429	308	273	175	169	177	193	215	273	286	880	632	230	401	369	207	39	30
	ATS	Longline	1168	1732	2161	3085	2379	2163	1996	1596	2566	2090	2088	3204	2450	3245	2992	2745	1799	2057	2485	3196	2842	2149	3241	2760	2748	2620	3149	2291	2820	2227
		Other surf.	15	11	21	15	16	25	12	10	22	18	15	31	76	14	43	30	82	7	1	62	55	34	31	12	13	162	7	8	29	9
	MED	Longline	0	0	0	0	0	6	8	5	4	7	2	2	2	17	10	2	1	1	2	2	2	0	0	0	0	0	0	0	0	
		Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Discards	ATN	Longline	38	24	21	29	0	2	0	1	8	0	0	0	0	0	0	7	9	20	2	9	19	5	12	10	8	4	24	56	63	881
		Other surf.	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	2	0
	ATS	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	8	0	2	2	3	3	2	9	7	13
		Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	
	MED	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Landings	ATN CP	Barbados	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	3	3	0	0	0	**0**
		Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	28	69	114	99	1	1	1	9	12	2	0	3
		Canada	0	0	0	111	67	110	69	70	78	69	78	73	80	91	71	72	43	53	41	37	29	35	55	85	82	109	53	63	1	0
		China PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	81	16	19	29	18	24	11	5	2	4	2	0	0	0	**0**
		Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		EU-España	2145	1964	2164	2209	3294	2416	2223	2051	1561	1684	2047	2068	2088	1751	1918	1814	1895	2216	2091	1667	2308	1509	1481	1362	1574	1784	1165	866	870	**0**
		EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	2	0	0	0	1	1	2	1	0	1	0	1
		EU-Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		EU-Portugal	220	796	649	657	691	354	307	327	318	378	415	1249	473	1109	951	1540	1033	1169	1432	1045	1023	820	219	222	264	276	272	289	342	202
		FR-St Pierre et Miquelon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	4	0	0	4	0	0	0	0	0	0	0	**0**
		Great Britain	0	0	0	0	0	0	0	2	3	2	1	1	1	0	0	0	1	15	0	0	0	0	0	0	0	0	0	0	0	0
		Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Japan	318	425	214	592	790	258	892	120	138	105	438	267	572	0	0	82	131	98	116	53	56	33	69	45	74	89	20	4	0	**0**
		Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	27	15	8	2	1	3	5	4	0	**0**
		Liberia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	**0**
		Maroc	0	0	0	0	0	0	0	0	0	0	0	147	169	215	220	151	283	476	636	420	406	667	624	947	1050	450	594	501	382	299
		Mauritania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	**0**
		Mexico	0	0	0	10	0	0	0	0	10	16	0	10	6	9	5	8	6	7	8	8	8	4	4	4	3	5	2	2	2	2
		Panama	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	49	33	39	0	0	0	19	7	0	0	0	0	0	0	**0**
		Philippines	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Russian Federation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**

		Senegal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	17	21	0	0	2	0	2	2	2	68	68	26	0	**0**
		St Vincent and Grenadines	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	3	0	**0**
		Trinidad and Tobago	0	0	0	0	0	0	0	1	0	1	2	3	1	2	1	1	1	1	1	0	2	1	1	1	1	2	2	1	1	1
		UK-Bermuda	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		USA	490	894	574	1658	400	345	296	198	414	350	372	106	477	422	353	319	296	314	350	332	371	363	961	572	271	302	165	57	48	39
		Venezuela	5	1	7	7	17	9	8	6	9	24	21	28	64	27	14	19	8	41	27	20	33	9	13	7	7	9	7	8	8	3
	NCC	Chinese Taipei	16	9	29	32	45	42	47	75	56	47	53	37	70	68	40	6	23	11	14	13	14	8	4	13	7	1	0	0	0	**0**
		Costa Rica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	2	2	1	2	1	1	0	1	0	0	**0**
	NCO	Sta Lucia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	
ATS	CP	Angola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31	0	0	0	
		Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	38	0	17	2	0	32	59	78	88	1	15	14	34	15	7	2	1
		Brazil	158	122	95	119	83	190	233	27	219	409	226	283	238	426	210	145	203	99	128	192	196	276	268	173	124	275	399	739	542	477
		China PR	0	34	45	23	27	19	74	126	305	22	208	260	68	45	70	77	6	24	32	29	8	9	9	5	3	1	0	0	0	**0**
		Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Côte d'Ivoire	13	10	20	13	15	23	10	10	9	15	15	30	15	14	16	25	0	5	7	0	20	34	19	11	13	161	4	8	14	9
		EU-España	421	772	552	1084	1482	1356	984	861	1090	1235	811	1158	703	584	664	654	628	922	1192	1535	1207	1083	1077	862	882	1049	1044	1090	799	650
		EU-Portugal	0	0	0	92	94	165	116	119	388	140	56	625	13	242	493	375	321	502	336	409	176	132	127	158	393	503	300	243	449	357
		El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Great Britain	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	11	0	0	0	0	0	0	0	0	0	0	0	**0**
		Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Japan	460	701	1369	1617	514	244	267	151	264	56	133	118	398	0	0	72	115	108	103	132	291	114	182	109	77	96	93	53	1	**0**
		Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	13	7	7	4	4	18	8	9	1	0	**0**
		Namibia	0	0	0	0	0	0	0	1	0	0	459	375	509	1415	1243	1002	295	23	307	377	586	9	950	661	799	194	980	0	945	637
		Panama	0	0	0	0	0	0	0	24	1	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Philippines	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Russian Federation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Senegal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	34	23	0	11	6	39	4	7	0	**0**
		South Africa	66	45	24	49	37	31	171	67	116	70	12	116	101	111	86	224	137	146	152	218	108	250	476	613	339	305	244	110	46	70
		UK-Sta Helena	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Uruguay	20	28	12	17	26	20	23	21	35	40	38	188	249	146	68	36	41	106	23	76	36	1	0	0	0	0	0	0	0	**0**
	NCC	Chinese Taipei	44	31	65	87	117	139	130	198	162	120	146	83	180	226	166	147	124	117	144	203	150	157	158	152	92	85	64	42	52	35
	NCO	Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	52	12	13	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
MED	CP	EU-Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	**0**
		EU-España	0	0	0	0	0	6	7	5	3	2	2	2	2	2	4	1	0	0	1	2	2	0	0	0	0	0	0	0	0	**0**
		EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		EU-Italy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	**0**
		EU-Portugal	0	0	0	0	0	0	1	0	1	5	0	0	0	15	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Maroc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Discards	ATN	CP	Canada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	1	20	22
			China PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	2	1
			Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	837
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**0**
			El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	28	14
			Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**0**
			Mexico	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Russian Federation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			UK-Bermuda	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			USA	38	24	21	28	0	2	0	1	8	0	0	0	0	0	0	7	10	20	2	9	18	5	11	8	6	4	2	1	3	3
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	22	5	12	4
	ATS	CP	Brazil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			China PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
			Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU-France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	**0**
			El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Japan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	11
			Korea Rep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	**0**
			Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	2	2	3	3	2	2	2	2
	MED	CP	EU-España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Appendix 7

Report of the Atlantic-wide Research Programme for Bluefin Tuna (ICCAT/GBYP)

(Activity report for the last part of Phase 11 and the first part of Phase 12 (2021-2022))

1. Introduction

The ICCAT Atlantic-wide Research Programme for Bluefin Tuna (GBYP) started officially at the end of 2009, with the objectives of improving a) basic data collection, including fishery independent data; b) understanding of key biological and ecological processes and c) assessment models and provision of scientific advice on stock status. The general information about GBYP activities and its results, as well as on budgetary and other administrative issues of the GBYP programme, from the very beginning of the programme until today, are available on the GBYP webpage. All the relevant documents related to programme development, including final reports of every activity and the derived scientific papers, Annual Reports to the SCRS and European Union, GBYP workshops or Steering Committee meetings reports, are also readily available on the GBYP webpage.

The eleventh phase of the GBYP officially started on 1 January 2021 following the signature of the Grant Agreement for the co-financing of GBYP Phase 11 (SI2.839201) by the European Commission. The initial duration of the Phase was one year, but in order to better adjust to the period of bluefin tuna fishing and harvesting operations, and to overcome the delays in some activities caused by mobility constraints derived from the COVID-19 pandemic, it was extended for eight months until 31 August 2022. The activities carried out during the first nine months of Phase 11 and their preliminary results were presented to the SCRS and the Commission in 2021 (Alemany *et al*., 2021b) and approved. Following the timing imposed by the new funding agency - European Climate, Infrastructure and Environment Executive Agency (CINEA) – the 12th phase of the GBYP officially started on 24 March 2022, after the signature of the Grant Agreement (Project 101091166) by the European Commission, with a planned duration of one year. Although these two GBYP phases have been partially developed in parallel (as occurred in previous phases), this has not caused any major problems since each phase had specific work plans and budgets, and so costs can be assigned unequivocally to the activities detailed in the respective Grant Agreements.

In general, although several tasks over the last year have continued to be affected by the COVID-19 pandemic, most of the activities planned within Phases 11 and 12 have been or are being implemented successfully. The specific activities in both phases have been structured considering the same main lines of research i.e. data recovery and management; biological studies; tagging; aerial surveys; and modelling. These have been adapted to the SCRS research needs and Commission requests. Furthermore, the methodologies have been continuously improved and the working procedures optimized, to increase the efficiency and quality of the advice. The strategic shifts initiated in Phase 10 to several of these lines have been consolidated. Accordingly, data recovery activities have shifted to data management, focusing on the development of new relational databases, integrating all the information produced and gathered by the programme from the beginning. Aerial surveys have been thoroughly revised and new methodological approaches for data analyses explored (i.e. development of Model-based approaches instead of the classic design-based approach), in order to account for the potential changes in spatial distribution of spawners derived from environmental interannual variability, and hence improving the accuracy of the index time series. Tagging activities have also deepened in the new strategic approach based on close cooperation with national tagging programmes, which has greatly increased the overall efficiency and significantly reduced operational costs. Moreover, in Phase 12 a further strategic shift in biological studies has been implemented, which will progressively focus on reviewing studies based on all the data and results gathered in previous Phases, to get sound scientific conclusions, instead of the continuous generation of new data sets (unless specific requests are needed).

All activities carried out throughout GBYP Phase 11 and those launched during the first part of Phase 12, as well their final or preliminary results and the related coordination activities, are described and summarised in this report.

As mentioned above, the COVID-19 pandemic has continued to affect the development of Phase 11 and the launching of Phase 12 activities, but the experience gained over the 2020-2021 period has allowed GBYP to face successfully the challenges derived from the global scenario. The specific impacts on each line of research are detailed below. Since the temporary closure of the ICCAT Secretariat headquarters in March 2020 has been maintained throughout last year, the GBYP Coordination Team has continued to use telecommuting facilities to manage the programme without any significant impact on the coordination activities.

2. Coordination activities and general issues of GBYP programme management

The GBYP Steering Committee (SC) in Phase 11 and 12 comprises the SCRS Chair, the Western Bluefin Tuna Rapporteur, the Eastern Bluefin Tuna Rapporteur, the ICCAT Executive Secretary and/or his deputy and one contracted external expert. In order to define the workplan and refine the ongoing activities, during Phase 11, the Steering Committee held three online meetings in October, November and December 2021. In addition, its members have been constantly informed by the GBYP Coordination Team about the status of the activities through detailed reports provided on a bimonthly basis, and they have been regularly consulted by email on many issues.

The GBYP Coordination Team comprises the GBYP Coordinator, the Assistant Coordinator and the Database Specialist. The ICCAT Secretariat has provided technical and administrative support for all GBYP activities on a daily basis. In Phase 11, a total of 6 Calls for tenders and 6 official invitations were released, which resulted in 13 contracts awarded to various entities. In addition, one Call of expression of interest was published which resulted in 10 memorandums of understanding.

2.1 Financial aspects

In Phase 11 the total budget was €1,600,000.00, thanks to contributions from the following donors: European Union (Grant Agreement) €1,280,000.00, Morocco €61,981.13, Tunisia €59,028.97, Japan €53,204.87, Türkiye €50,506.30, Libya €23,164.16, Norway €19,000.00, Canada €18,843.04, Korea (Rep.) €8,717.90, United States of America €8,420.00, Albania €3,208.52, Chinese Taipei €2,000.00 and China (P.R.) €1,925.11.

In Phase 12 the total budget is €1,500,000.00, thanks to contributions from the following donors: European Union (Grant Agreement) €1,200,000.00, Morocco €57,882.26, Tunisia €50,109.54, Japan €49,686.39, Türkiye €46,716.69, Algeria €29,170.26, Norway €24,287.66, Canada €21,327.38, Korea (Rep.) €3,525.11, Albania €2,996.34, Chinese Taipei €2,000.00, China (P.R.) €1,797.80 and United Kingdom €500.57.

The residual amounts of previous GBYP Phases were used to better balance the EU contribution and to compensate costs that were not covered by EU funding in various Phases. Additional eventual residuals from the amounts provided in Phase 11 will be used for the following Phases of GBYP. It should be noted that contributions for the current and previous GBYP Phases are still pending from some ICCAT CPCs.

The approved budget for Phase 11 and Phase 12 is summarised in **Table 1**.

Table 1. Approved budget of GBYP Phases 11 and 12.

Item	*Phase 11*	*Phase 12*
Coordination	€379,000.00	€523,000.00
Data management	€55,000.00	€55,000.00
Independent indices	€370,000.00	€80,000.00
Biological studies	€380,000.00	€348,000.00
Tagging	€221,000.00	€262,000.00
Modelling	€195,000.00	€232,000.00
Total	**€1,600,000.00**	**€1,500,000.00**

3. Summary of Phase 11 and Phase 12 GBYP scientific activities and results by main line of research

3.1 Data recovery and management

The data recovery activity, which was cancelled in Phase 10, has been resumed in Phase 11 to allow the incorporation into the ICCAT DB of a new relevant set of data from 138 pop-up satellite tags deployed on western stock juveniles. However, most of efforts in this line have been devoted to the continuity of the strategic approach initiated in Phase 9, mainly based on in-house work developed within the ICCAT Secretariat through close collaboration between the Departments of Statistics and Science, SCRS scientists and the GBYP Coordination Team, focused on the development of relational databases to allow proper storage and analysis of all raw data collected within GBYP or other relevant data sources for BFT management not included yet in the current ICCAT DBs.

Specifically, the activities carried out under GBYP Phase 11, some of which were initiated in Phase 10, included:

- Update of the database integrating the data related to BFT farming, including those from stereo camera measurements and harvesting operations, and complementing them with data from eBCD and VMS systems. Within this Phase, more than 200 files and 28,000 individual BFT stereo cameras measurements have been incorporated and analysed.

- Update of the database recording the information obtained from the GBYP studies on growth in farms. As a result, a database including more than 25,000 BFT measurements, as well as data on daily feeding and environmental conditions are now available to use.

- The tasks aiming at the implementation of the work plan for the creation of a broad biological data information system have continued, in close coordination with the ICCAT Secretariat Department of Statistics. Thus, a detailed template to get relevant information about the biological sampling activities and storage procedures of biological samples was designed and already filled by some of the contractors involved in GBYP Biological Studies in previous phases. Beside this, the data on biological information and biological sampling of species under the ICCAT Convention carried out by EU countries under the EU Data Collection Framework, have been downloaded from EU portal https://datacollection.jrc.ec.europa.eu/ars, and is being processed for its inclusion in the new ICCAT biological data and information system.

- Design and build up of a data repository to store the information from the aerial survey activity.

- A new project for developing an integrated electronic tagging management system capable of managing the data from all the electronic tags released by ICCAT, or provided by CPCs' scientific teams, has been initiated in close collaboration with the Secretariat Department of Statistics. This system, called ETAGS, will be used to manage both the metadata on electronic tagging operations and the raw data generated by these electronic tags, will allow storage of data from all other ICCAT tagging programs in the future. For this purpose, a contract was signed with Dr Chi Hin Lam (Big Fish Intelligence Company Limited), to adapt a system previously developed by this company to ICCAT needs.

3.2 Stock indices: Aerial Survey on Bluefin Tuna Spawning Aggregations

ICCAT GBYP Aerial Survey on bluefin spawning aggregations (AS) was initially identified by the Commission as one of the three main research objectives of the programme, in order to provide fishery-independent trends on the minimum SSB. However, due to budget and logistic limitations and different opinions about the best sampling strategies between successive SC members, this activity has not been developed regularly and has not followed homogenous methodologies and sampling strategies from the very beginning. Moreover, the AS has faced numerous logistical challenges, which have resulted in changes in survey design and data processing to standardize methodologies and improve the accuracy of the index.

Considering the results from the aforementioned pilot survey and those from the global revision and reanalysis of the time series carried out in 2021, as well logistic constraints, in 2019, all historical GBYP aerial survey data were re-analysed for all the areas and years in a homogeneous way, producing a new fully standardised index time series. However, the new index time series exhibited substantial differences in relation to prior time series, and still showed a high interannual variability between and within areas, which raised new concerns about the estimation procedures and the overall efficacy of the survey. Therefore, in 2020 an in-depth revision of the whole GBYP AS programme was carried out by two external experts, who provided several recommendations for its improvement, such as exploring the feasibility of incorporating automated digital observing systems, to extend, if possible, the surveyed areas, and to move from the classic design-based approach to a model-based approach aiming at overcoming the potential impact of interannual environmental variability on BFT spawners distribution and hence on index accuracy. Consequently, in 2021, under GBYP Phase 10, a pilot survey incorporating, in addition to the standard human observers-based methodology, digital systems for automatic recording of images along the transects, and covering not only the usual core area but also an extended area around it, was performed in the Balearic Sea area. In addition, a global reanalysis of the whole time series, applying both the design-based approach used from the beginning of the GBYP aerial surveys, but also exploring a new model-based approach aiming at overcoming the potential impact of interannual environmental variability on BFT spawners distribution and hence on index accuracy, was carried out by CREEMs team of the University of Saint Andrew, which is the original developer of the DISTANCE methodology applied for the design and analysis of GBYP aerial surveys from the beginning of the programme. With the available budget, the GBYP Steering Committee decided to resume, within GBYP Phase 11, the aerial survey for bluefin tuna spawning aggregations in the core areas of the Western and Central Mediterranean Sea in 2022, following the standard human observers-based methodology. It was decided that the Levantine Sea sub-area (Area G) would not be surveyed because the results obtained in previous campaigns suggest that one of the basic assumptions to apply this methodology i.e. that the BFT spawners are fully available for aerial observations, is not accomplished.

So, the three core spawning areas in the Western and Central Mediterranean are the Balearic Sea (Area A), the Southern Tyrrhenian Sea (Area C) and the Central-southern Mediterranean Sea (Area E), which have been successfully surveyed in June 2022, by ActionAir (Western Med) and Unimar/Aerial Banners (Central Med). The results from these surveys will be analyzed within GBYP Phase 12.

In parallel, in 2022 it has been signed a new contract with the Centre for Research into Ecological Environmental Modelling (CREEM) team, identified as a leading institution in the design and analysis of distance sampling surveys, for the analysis of the data from the pilot aerial survey in 2021 in the Balearic Sea area (Area A), as the complete re-analyses of GBYP aerial survey data up to 2021, providing the updated index time series following both design-based and model based approaches.

3.3 Tagging activity

The initial objectives of GBYP tagging activities were the estimation of the natural mortality rates of bluefin tuna populations by age or age-groups, the evaluation of habitat utilization and large-scale movement patterns (spatio-temporal), including estimates of mixing rates between stock units by area and time strata, of both juveniles and spawners. However, this line of research faced two important problems which limited the full achievement of these objectives: i) the very low recovery rate of conventional tags, which impeded the use of these data to estimate reliable mortality rates; and, the relatively short time that most of the electronic pop-up tags remained on the fish. Therefore, some new actions to overcome the problems were initiated in Phase 9, such as improving the deployment methodology and provision of specific training to the e-tagging teams, and developing specific actions focused on increasing the involvement of ICCAT observers and farms' staff in tag detection and reporting. The results of these activities have become evident from 2019, with the average time that the tags remain attached to the fish (programmed for 1 year) increasing from 48 days in Phases 2 to 8, to an average of 245 days in Phases 9 and 10. The first results from e-tagging surveys performed within Phase 11 showed the consolidation of this trend, since many tags have remained on fish the whole programmed one-year period. Regarding actions to improve the recovery rates, these have resulted in an increase of recoveries in the Mediterranean area. In total, from March 2021 to March 2022 a total of 154 conventional and 29 e-tags have been recovered.

As in the previous season, the specific objectives of the 2021 electronic tagging campaigns were to improve the estimations of the degree of mixing of western and eastern Atlantic bluefin tuna stocks in the different statistical areas over the year cycle, specifically considering the current needs of the MSE modelling process, with the immediate objective to improve knowledge of the bluefin spatial patterns, focusing on filling the current knowledge gaps in the spatial patterns of juvenile and young adult fish of the western stock and those of the BFT populations inhabiting the eastern Mediterranean. Therefore, considering the good results of the new strategic approach for implementing the GBYP e-tagging programmes initiated in Phase 10, a new Call for expressions of interest was published within Phase 11 (ICCAT Circular #G-0471-2021), for deployment of a total of 70 pop-up satellite tags by experienced tagging teams in the Mediterranean and/or North Atlantic Ocean, targeting eastern stock individuals. As a result, 9 proposals were awarded, and MoUs were signed with:

- Technical University of Denmark (DTU) - 9 PSAT tags for deployment in Northeastern Atlantic waters (eastern North Sea, Skagerrak, Kattegat and Øresund);
- Instituto Español de Oceanografía (IEO) in collaboration with Large Pelagics Research Center of the University of Massachusetts - 14 PSAT tags for deployment in the western Mediterranean and off Atlantic USA coasts;
- Institute of Marine Research (IMR) of Norway - 5 PSAT tags for deployment in Norwegian waters;
- The Marine Institute in collaboration with Dr Barbara Block team (Stanford University) - 9 PSAT tags for deployment in the coastal waters off Ireland;
- Swedish University of Agricultural Sciences (SLU) - 9 PSAT tags for deployment in Skagerrak, Kattegat or the Sound Strait;
- Stanford University Hopkins Marine Station in collaboration with DFO (Fisheries and Ocean Canada) and Acadia University - 11 PSAT tags for deployment in Canadian Atlantic waters;
- Stanford University Hopkins Marine Station in collaboration with "Asociación Catalana de Pesca Responsible" (ACPR), Tag a Giant (TAG) and Barcelona Zoo - 9 PSAT tags and 5 internal archival tags for deployment off Canary Islands;
- University of Genova - 5 PSAT tags for deployment in Ligurian Sea;
- Cefas Laboratory in collaboration with Exeter University - 9 PSAT tags for deployment in the western English Channel, the Celtic Sea, within waters of Jersey and Guernsey (a UK Crown dependency) and off the West coast of Scotland.

Most of these campaigns were finished between August 2021 and March 2022 (reports available at GBYP web page), but 2 are still ongoing (MoU with IEO and Genoa University).

Moreover, in 2021 GBYP had agreed with Mediterranean Fisheries Research, Production and Training Institute (MEDFRI) from Türkiye, for deployment of 20 electronic tags in the Levantine Sea, since tagging in the Levantine Sea has been identified as one of the priorities by the Steering Committee since 2019. Unfortunately, it was not possible finally to sign the MoU and carry out the campaign due to mobility restrictions derived from the COVID-19 pandemic. Finally, in June 2022, it was possible to carry out the campaign, within the framework of a MoU signed to this end, in close collaboration with local scientists (MEDFRI), and 13 tags were successfully deployed.

A new Call for expressions of interest to collaborate with GBYP e-tagging programme was launched in April 2022, under GBYP Phase 12. As a result, 8 new proposals were received, which were awarded, and consequently 8 MoUs have been signed. These MoUs will allow to deploy 55 additional GBYP owned tags and incorporate the data in the ETAGS database in the future.

Besides these activities, GBYP has supported exceptionally e-tagging activities whose results were considered as a priority research need for the SCRS, which were carried out independently by other institutions. Such support implied sharing the relevant results with ICCAT and the permission of use of GBYP Research Mortality Allowance (RMA) in the case of BFT casualties during tagging operations. In other cases, such as that of the Italian branch of WWF Mediterranean Marine Initiative, the support consisted in the use of GBYP Argos system accounts for data transmission so that the resulting data were integrated directly in the GBYP database.

As regards conventional tagging, the GBYP programme has been maintained as a complementary activity, providing logistical support to several institutions. From March 2021 to March 2022, a total of 3,725 conventional tags have been delivered to 5 institutions.

3.4 Biological studies

One of the core activities of ICCAT GBYP are the so-called Biological Studies, including biological sampling and a series of studies based on the analysis of these samples, such as microchemical and genetics analyses to investigate mixing and population structure, with a particular focus on identifying the age structure and the probable sub-populations. Population structure is a key uncertainty for bluefin tuna, given the possibility that more than two populations or contingents coexist in the Atlantic Ocean, while ICCAT managers so far assume two separate populations with no mixing, in contrast with the fact that the stock structure assumed for the stock assessment and management purposes must be in line with the real population structure. If not, overfishing of less productive populations and under exploitation of the most productive ones can occur. Therefore, in Phase 11 several activities initiated in previous phases aiming to allow a deeper understanding of the implications of the new spawning grounds in the Atlantic Ocean (Slope Sea and Bay of Biscay) and to mixing analyses to provide accurate information and more clear alternative hypotheses to the MSE process have been maintained. In addition, GBYP has continued to support the broad study to determine BFT growth in farms, in connection with ICCAT Rec. 20-07, paragraph 8.

3.4.1 Biological sampling and analyses

- Biological sampling

During Phase 11, a total of 3198 biological samples were collected (1046 otolith samples, 995 fin spines and 1157 genetic samples) from 1189 individuals, aiming at providing data to fill the remaining knowledge gaps on BFT biology, ecology and population structure, or to update such information. All these samples have been catalogued and stored together in the GBYP biological tissue bank hosted by AZTI. In addition, the tissue bank and related information system have undergone a restructuring process to revise and standardize all the information gathered over the last 10 years of the project, with the ultimate goal of creating a database with an interface that is easily manageable for any user who requires it.

- Biological analyses: Microchemistry

Within Phase 11, the baseline for Mediterranean vs. Gulf of Mexico origin was improved, by combining stable isotope and trace element analyses and the area of otolith transverse sections best discriminating between two stocks was identified. The analyses of Sr, Ba Mg and Mn concentrations over the life cycle have allowed to develop, an effective neural network application which successfully predicted the origin of bluefin tuna with a classification accuracy of 98%. Therefore, it has been concluded that a two-dimensional mapping of trace elements allows a refined identification of individual bluefin tuna origin, which can serve to answer ecological questions, such as controversies between genetic and otolith stable isotope data. Moreover, two-dimensional mapping of trace elements allows also to identify fluctuations in specific tracers, such as Sr, Ba and Mn which provide a better understanding about stock dynamics, migration patterns or connectivity between habitats of bluefin tuna.

To further assess the spatial and temporal variability of mixing proportions, new carbon and oxygen stable isotope ($\delta 13C$ and $\delta 18O$) analyses were carried out in 119 otoliths of Atlantic bluefin tuna captured in the Central North Atlantic, Norwegian Sea and western Moroccan coast. Results from these and previous analyses have allowed to conclude that the Mediterranean population is the main component of Japanese fisheries operating East of the 45ºW management boundary. Regarding the samples from the Norwegian Sea, the results showed that the Mediterranean population may be the only contributor to the Norwegian fisheries. As for the Northwest African coast (Moroccan traps), it has been identified as a putative mixing area of eastern and western populations. The contribution of western individuals to the East Atlantic fisheries is of particular interest to resource managers because of the strong asymmetrical production between the two populations.

Finally, good progress has been made during this phase to conduct a tagging experiment on Atlantic bluefin tuna held within a farm. This experiment could provide information about the relationship between otolith $\delta 18O$ and environmental conditions and the influence of internal physiology on that relationship and could be used to validate the periodicity of annual growth bands in the otolith. Ten archival tags were purchased and planning for future deployment in a tuna farm in Malta commenced. Otolith $\delta 18O$ profiles from tagged fish for the period of captivity can be related to internal and external temperature profiles from the tags to parameterize the relationship between $\delta 18O$ and water chemistry, and to examine the influence of internal physiology.

- Biological analyses: Genetics

Previous research had shown that population structure of Atlantic bluefin tuna (A-BFT) is more complex than the previous assumption of two reproductively isolated populations (Gulf of Mexico and Mediterranean Sea) that mix for feeding in the Atlantic, and that, contrastingly, individuals from the Gulf of Mexico and Mediterranean Sea interbreed. Yet, the frequency in which this interbreeding occurs in still unknown. Understanding the phenomena driving existing genetic differentiation between the Gulf of Mexico and Mediterranean populations despite this interbreeding is paramount for developing appropriate management and conservation measures. To further understand the phenomena driving genetic differentiation despite gene flow, the mixing and interbreeding dynamics of A-BFT, and to evaluate the potential epigenetic approaches for ageing in A-BFT samples, five main tasks have been carried out within Phase 11:

Task 1 - The reference dataset, which reflects better the genetic variability of Atlantic bluefin tuna, has been improved by replacing the least informative markers of the 96 single nucleotide polymorphism (SNP) traceability panel by 10 newly selected ones (including 3 genetic markers for sex identification), and has been enlarged incorporating the data from the genotyping of 564 individuals using the improved 96 SNP traceability panel.

Task 2 - Consisted in the analysis of A-BFT population structure using three different datasets: a Copy Number Variants (CNVs) dataset obtained from the re-analysis of the available RAD-seq data, the analysis of Whole Genome Sequencing data produced for 25 and 2 A-BFT and *Thunnus alalunga* individuals, respectively, and the analysis of > 700 samples genotyped using the SNP array. Regarding the population structure, the results confirm the presence of two ancestry genetic profiles. Samples from the eastern side of the Atlantic (including feeding aggregates) are predominantly Mediterranean-like, whereas samples from the western side are mostly Gulf of Mexico like (those from the Gulf of Mexico) or cover a wide range of profiles (Western and Central Atlantic). However, additional conclusions on the population structure should be derived from an integrated view when results from whole genome sequencing are available.

Task 3 - Consisted of the analysis of genetic variability at different feeding aggregates by combining genetic information based on different types of markers with otolith microchemistry data. The results showed that some samples were assigned to different origin based on otolith microchemistry and genetic markers, where the most common mismatch is Mediterranean genetic profile and Gulf of Mexico otolith origin. These individuals could correspond to individuals of Mediterranean origin performing early (yearling individuals) departures from the Mediterranean Sea, or to individuals of different origin, such as alternative spawning areas used by eastern individuals, such as the Bay of Biscay.

Task 4 - Consisted of the evaluation of the performance of the genetic sex markers included in the SNP array and the 96 SNP traceability panel for sex identification using genetic tools. Genetic markers for sex identification were successfully included in the origin traceability panel and genetic profile array, with a success rate of 80.55% with the SNP array and 89% with the 96 SNP panel. Comparison of the most frequent genotype combination in visually identified female and male individuals obtained with both methods show some differences with the expected outcomes.

Task 5 - Consisted of an evaluation of the potential of epigenetic approaches for ageing of Atlantic bluefin tuna samples to be applied for the Close-Kin Mark Recapture studies, based on an in-depth review of available bibliography. It was concluded that the development of an epigenetic clock in Atlantic bluefin tuna requires a sampling scheme that ensure good representation of the species population in terms of environment, genetic component, sex and age classes. It should be further evaluated if the expected error rates (based on previous studies on long lived species) are compatible with the application of the CKMR and if the reduced cost and logistics implied in epigenetic clock ageing compensate the implicit error rates.

- Biological analyses: Ageing

The description of the life cycle and effective management requires comprehensive age and growth studies. One of the most widely used methods for estimating the age of A-BFT has been based on the examination of calcified structures. Direct age assignment depends not only on the number of *annuli* found in the calcified structure, but also on the periodicity of *annuli* formation. In order to transform the band count into ages it is necessary to consider the marginal edge type related to the catch date and the birth date.

In Phase 11 a determination of annual periodicity in *annuli* formation in Atlantic bluefin tuna otoliths has been carried out applying the Marginal Increment Analysis (MIA) method, since controversies remain regarding the periodicity, or seasonality, of otolith growth band formation which directly influences a correct age determination of Atlantic bluefin tuna using otoliths. Results indicated that the opaque bands begin to form in July and continue to form up until October and that the *annulus* in the Atlantic bluefin tuna otolith start to form in November and peaks in May and June, with the highest percentage of wide translucent bands. This would mean to delay the date of the current 1 July adjustment criterion to 30 November. The change in the date of the otolith fitting criterion allows for a better outline of the strong 2003-year class. Consequently, ageing results based on otolith counts have been updated accordingly in the ICCAT catalogue, which also allowed to obtain a new growth curve.

- Larvae relates studies

Aiming to assess the role of the Bay of Biscay as an alternative spawning area for BFT East stock, in summer 2021, taking advantage of the BFT index acoustic survey some plankton samples were collected and analyzed under the microscope in search of BFT larvae, but there was no evidence of bluefin larvae. However, the low number of samples prevent to get any sound conclusion about the importance of this spawning site.

On the other hand, BFT larvae from surveys conducted in the Balearic spawning ground were sorted and identified for genetics to be applied in understanding population structure in the eastern stock and specially for potential close-kin analyses.

3.4.2 Study on BFT growth in farms

Pursuant to a special request by the Commission to the SCRS to provide an update on the potential growth rates of bluefin tuna in farming/fattening facilities, with the aim of improving the coherence within the growth rates derived from eBCD (initially requested under Rec. 18-02, paragraph 28, amended by Rec. 19-04, paragraph 28, and more recently by Rec. 20-07, paragraph 8), the GBYP launched in Phase 9, following the preparatory work finished in Phase 8, several lines of research on this topic, involving ad hoc experiments in selected farms along the eastern Atlantic and Mediterranean, which included individual tagging experiments in two areas (Atlantic Portuguese southern coastal waters and Adriatic Sea) and intensive monitoring of farmed fish growth by means of stereoscopic cameras in four Mediterranean BFT farming areas (Spanish Western Mediterranean, Central Mediterranean - Malta, Adriatic - Croatia, and Levantine Sea - Türkiye), besides desk work for database generation. Final results from these studies were carried out and reported within Phase 10. Over the last year these results have been provided to and discussed within the BFT Sub-group on Growth in Farms, in order to integrate them with those from other research lines for a single and coherent answer to the Commission.

In parallel, throughout Phase 11, the GBYP team continued to support the in-house work developed at the ICCAT Secretariat oriented to the consolidation of data from stereo-cameras reported to ICCAT which has allowed to build up an operative relational data base, linking data on estimated initial lengths and weights from stereo-cameras at caging with measures of real final weights and lengths at harvesting from the e-BCD system, as well VMS data, which at the same time provide crucial information for stock assessment (length distributions of the captures of purse seine fisheries). Based on such DB, the ICCAT Secretariat Department of Research has performed a broad study on the growth of caged fish in all the areas where BFT farming takes place, based on modelling the differences between weights at harvesting and at caging, as a function of fish size and duration of farming. The final and integrated results from GBYP and ICCAT Secretariat studies will be presented at the September 2022 BFT SCRS Species Group meeting, and based on them the SCRS Technical Sub-group on Growth in Farms will elaborate the proposal of answer to the Commission.

3.5 Modelling approaches

The modelling programme addresses the GBYP general objective 3, which is "Improving assessment models and providing scientific advice on stock status through improved modelling of key biological processes (including growth and stock-recruitment), further developing stock assessment models including mixing between various areas, and development and use of biologically realistic operating models for more rigorous management option testing". The modelling activities started in Phase 2, and very soon it became evident that this line of study had greater importance than perceived at the time when the GBYP was conceived and that the amount of effort for this activity should be much larger than initially considered. In addition, the MSE process embarked upon by ICCAT has been an important initiative which has represented a significant investment of time and resources by the Commission, CPCs and the scientists involved.

In Phases 11 and 12 the GBYP support to stock assessment and MSE process has been provided through several actions, such as the contract of the expert in charge of MSE, the contract of external reviewers of the MSE code and the 2022 BFT East Atlantic and Mediterranean stock assessment, and the support to the BFT Technical Sub-group on MSE, funding the travel of MSE process coordinator (Dr Doug Butterworth) whenever required.

In Phase 11 the contract for modelling approaches for providing support to bluefin tuna stock assessment was again awarded to Dr Tom Carruthers (Blue Matter Science, Canada), who initiated the work on MSE and modelling in 2014. Given the extension of Phase 11, the contract for modelling approaches was extended up to June 2022.

Over the last year there has been a major consolidation of the modelling foundations of the MSE including reconditioning of all operating models, integration of OM weighting, the refinement of seven CMPs authored by five independent developer groups. The most recent bluefin data were provided by the Secretariat and all operating models were reconditioned to 2019 and a full set of before/after comparisons were presented to the group. Following the Delphi approach, the operating model weightings were incorporated in both the code to conduct CMP tuning and the presentation of CMP results. Materials and documentation were prepared to support a comprehensive, independent code review that found no notable coding errors. Presentation of MSE results and documentation was improved by additions to the ABTMSE Shiny app and the production of an MSE splash page, serving as a hub for all relevant ABT MSE documentation and links. Further refining of CMPs to follow Panel 2 guidance on area-based caps, production of tables and figures for characterising CMP performance and selecting CMPs, and addition of robustness OMs are key priorities for 2022. All tasks and deliverables listed in the contract were completed on time with the exception of the conditioning of a single requested robustness test that was not feasible for technical reasons.

Consistent with the MSE implementation Roadmap adopted by the Commission, in Phase 11 GBYP has funded an external review of MSE code. The contracted expert was Dr Emil Aalto (The Ocean Foundation), who reviewed the code and checked it for mathematical correctness (i.e. all formulae matched the equations specified in the TSD) and programming correctness (i.e. no coding errors). He also analyzed the ABTMSE package for improvements in computational efficiency, with particular focus on speeding up the MSE process which will be used by third parties to develop and test candidate management proposals (CMPs).

The reviewer found that the M3 model and ABTMSE code base were correctly implemented at every level, with generally accurate (if occasionally insufficient) description in the TSD. A few minor errors were found and described, including typos in the TSD. Many minor improvements to the code were suggested, mainly for readability and maintainability. Although major gains in speed would require reimplementation of core code in a faster language such as C, widespread replacement of the apply function with a faster alternative promise to substantially improve runtime. Nothing was found in the review to suggest any reservations for the use of this package in ICCAT management.

In addition to MSE development, the SCRS in 2022 was committed to conduct a full stock assessment for the Eastern Atlantic and Mediterranean bluefin tuna. In order to provide the most robust scientific advice, it was decided to contract an independent external expert who would assist the SCRS in the process and provide constructive advice. For that purpose, GBYP issued a contract with the expert Dr James Ianelli. The reviewer participated actively in the full process, from data preparation to the projections and in the discussions on the results, providing advice and expert opinion where he considered that to be warranted in time to support the process. As such, he attended several online meetings and provided a brief report or presentation during each meeting. The final report showing the conclusion of this external review was presented to September 2022 BFT Species Group meeting.

Appendix 8

Report of the Small Tunas Year Programme (ICCAT/SMTYP)

Programme objectives

The status of small tuna stocks in the ICCAT Convention area is generally unknown. Nevertheless, these species have a high socio-economic relevance for a considerable number of local communities at the regional level, which depend on landings of these species for their livelihoods.

Fisheries statistics and biological data, which can provide a basis for assessing these resources and thus providing the Commission with appropriate scientific advice for their sustainable exploitation, are generally incomplete and not updated for these species.

The ICCAT Year Research Programme for Small Tunas (SMTYP) was adopted by the SCRS in 2011 and approved by ICCAT during its 2012 annual meeting in Agadir (Morocco). The main objectives of the programme are recovery of historical series of Task 1 and Task 2 data, collecting the available biological data, and conducting biological studies, mainly on growth, maturity and stock structure for the main species of small tunas.

This programme has a wide geographical sampling coverage:

1. Mediterranean and Black Sea: bullet tuna, Atlantic bonito, little tunny and plain bonito;
2. West Africa: Atlantic bonito, little tunny tuna, West African Spanish mackerel, frigate tuna, wahoo;
3. Caribbean Sea and Southwest Atlantic: blackfin tuna, wahoo, king mackerel and Spanish mackerel and dolphinfish.

The SMTYP collected biological samples aiming at describing the growth, maturity and stock structure on these three small tunas species in 2018 and 2019. In 2019, results on stock structure of two of the three species (BON and LTA) were provided and samples for growth and maturity were considered mostly satisfactory for the areas and species. In 2020, sampling priority was given to fill specific gaps necessary to obtain the growth and maturity parameters for LTA and BON from geographical areas that the Small Tunas Species Group identified as of high priority. This activity was heavily impacted due to the COVID-19, which has precluded most of the field and laboratory work to be carried out. However, considering the three proposed objectives, promising results were obtained.

Objective I - A total of 374 individuals were collected: 145 of BON, 139 of LTA and 90 WAH (**Table 1**). Initial target size classes were only accomplished for BON in the Mediterranean. Small individuals are still needed from the Northeast Atlantic, as well as from the Southeast Atlantic as no samples were obtained (**Figure 1**). For LTA there was also a shortage for all target sizes.

Objective II - A preliminary analysis of the relationship between section spine diameter (mm) and fish size (FL, cm), showed that the area effects (Northeast Atlantic, Mediterranean and Southeast Atlantic) for LTA were significant. No differences were observed between areas for BON. At this stage, no preliminary growth models were fit by area due to the low number of processed samples, particularly considering that the models have to be investigated at stock level. For WAH, for which preliminary results were required within the current contract for the Southwest Atlantic, from the 277 otoliths sampled for annual growth analysis, 157 slides were prepared (56%), 35 were already cut (13%), and 87 were embedded to be cut (31%). For the daily growth analysis, we have prepared 5 samples from an expected number of 75 otoliths, which corresponds to 6% of the overall available sampled specimens. Concerning the reproductive parameters, a total of 420 BON were used for the preliminary analysis of L_{50} using microscopic staging, and 876 fish were used for the preliminary analysis of L_{50} and spawning season combining macroscopic and microscopic data, considering the ICCAT area and the stocks units proposed within the frame of the project. L_{50} were estimated with confidence for only for the Mediterranean area. For the other areas, no estimates could be developed giving the narrow range of the size classes available. Concerning LTA, the analysis has been completed and readings of more than 250 LTA for all ICCAT areas being carried out.

Objective III - For BON, the new samples from the Morocco area showed no genetic differentiation, suggesting a genetic temporal stability for this area, and the hypothesis provided in the previous contract of a Northeast Atlantic boundary is maintained. The population genetic analysis of WAH presents a scenario of homogeneous distribution of genetic variation, which is expected in a species with high migratory potential and large effective population size.

Table 1. Summary of the number of samples collected within the SMTYP by region and species in 2020/21, within the Short-term contract for ICCAT SMTYP for the biological samples collection for growth, maturity and genetics studies. LTA - (*Euthynnus alletteratus*), BON (*Sarda sarda*) and WAH (*Acanthocybium solandri*).

Area	*Country*	*BON*	*LTA*	*WAH*	*Total overall*
ATL-NE	Mauritania	12			12
	Morocco	20			20
	Senegal	66			66
	Spain	2	2		4
ATL-NE Total		**100**	**2**		**102**
ATL-SE	Côte d'Ivoire		30		30
	Gabon		76		76
ATL-SE Total			**106**		**106**
ATL-SW	Brazil			90	90
ATL-SW Total				**90**	**90**
MED	Malta		7		7
	Spain	19	4		23
	Tunisie	26	20		46
MED Total		**45**	**31**		**76**
Total overall		**145**	**139**	**90**	**374**

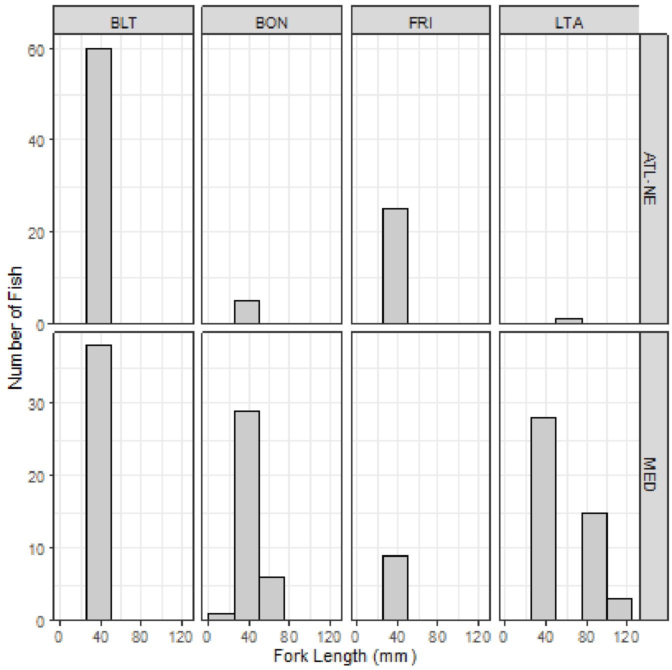

Figure 1. Histogram by size classes (fork length) for BLT, BON, FRI, and LTA by sampled regions.

Activities planned for 2021-2022

In 2020, the main gaps of sampling for BON and LTA were covered, and the results related to the growth and maturity parameters were preliminary provided for all areas. Preliminary growth parameters for WAH were also provided. However, given the problems with the pandemic, there are still ongoing analysis and size gaps for the three species to be filled, hence the parameters were not yet fully estimated. Therefore, the SMTYP shall fill the size gaps and conclude the analysis of growth and reproduction for LTA, BON and WAH and, to prioritize similar studies for other species given their socio-economic importance, for the new cycle of the program. Among the small tunas species, frigate (FRI) *Auxis thazard* and bullet tuna (BLT) *Auxis rochei*, were identified of special interest, namely on what concerns the stock structure.

Hence, during the period 2021-2022, the Group plans included: i) conducting additional sampling aiming to fill the specific gaps of the biological samples for estimating the growth and maturity parameters of BON, LTA, and WAH (**Table 2**); ii) collecting samples for FRI and BLT in the Atlantic Ocean and the Mediterranean Sea for stock structure studies; iii) determining the growth and reproduction parameters for BON, LTA, and WAH; iv) refining the stock structure analysis for WAH, BON, and LTA and determinate the stock structure analysis for FRI and BLT; and, v) investigating genetic species differentiation between FRI and BLT.

Activities developed in 2021/2022

The ICCAT Secretariat launched in May 2021 a Call for tenders with the aim of implementing the main activities scheduled within SMTYP in 2021. The main objective of this Call was to: a) conduct additional sampling aiming to fill the specific gaps of the biological samples for estimating the growth and maturity parameters for Atlantic bonito *Sarda sarda* (BON), little tunny *Euthynnus alletteratus* (LTA) and wahoo *Acanthocybium solandri* (WAH); b) collect samples for Frigate tuna *Auxis thazard* (FRI) and Bullet tuna *A. rochei* (BLT) in the Atlantic and the Mediterranean Sea for stock structure studies; c) determine the growth and reproduction parameters for BON, LTA and WAH; c) refine the stock structure analysis for WAH, BON and LTA and determinate the stock structure analysis for FRI and BLT; and d) investigate genetic species differentiation between FRI and BLT. As a result, in 2021 the Secretariat awarded a new contract to a consortium with a number of institutions, including 9 CPCs to carry out the tasks aforementioned. Due to the difficulties to samples some of the size classes as planned, the contract was extended until 30 September 2022.

Table 2. Detailed information on sampling targets by species, size classes and regions to be carried out by species for 2021-2022 under the ICCAT SMTYP.

Species	*Research line*	*Area*	*CPCs involved*	*Target size classes and desirable number of samples (in brackets)*
Frigate (FRI)	Stock Structure	NE Atlantic	Senegal, EU-Spain, EU-Portugal, Morocco	All (100)
		SE Atlantic	Côte d'Ivoire, Gabon, EU-Spain	All (100)
		SW Atlantic	Brazil	All (100)
Bullet tuna (BLT)	Stock Structure	NE Atlantic	Senegal, EU-Spain, EU-Portugal, Morocco	All (100)
		SE Atlantic	Côte d'Ivoire, Gabon, EU-Spain	All (100)
		SW Atlantic	Brazil	All (100)
		Med	Tunisia, EU-Spain, EU-Malta, Algeria	All (100)
Wahoo (WAH)	Aging and growth, reproduction	NE Atlantic	Senegal, EU-Spain, EU-Portugal, Morocco	< 70 cm (10) and > 140 cm (10)
		SE Atlantic	Côte d'Ivoire, Gabon, EU-Spain	< 70 cm (20) and > 140 cm (15)
		SW	Brazil	< 70 cm (15) and > 140 cm (15)
Little tunny (LTA)	Aging and growth and reproduction	NE Atlantic	Senegal, EU-Spain, EU-Portugal, Morocco	> 60 cm (15)
		SE Atlantic	Côte d'Ivoire, Gabon, EU-Spain	> 60 cm (20)
		Med	Tunisia, EU-Spain, EU-Malta, Algeria	≥ 60 cm (20)
Atlantic Bonito (BON)	Aging and growth and reproduction	NE Atlantic	Senegal, EU-Spain, EU-Portugal, Morocco	≤ 40 cm (5) and > 60 cm (20)
		SE Atlantic	Côte d'Ivoire, Gabon, EU-Spain	≤ 35 cm (20) and > 60 cm (10)
		Med	Tunisia, EU-Spain, EU-Malta, Algeria	≥ 60 cm (15)

Nevertheless, as in previous years, these objectives cannot be achieved with the single financial support of ICCAT and will only be possible through additional external funding that hopefully will be made available by the significant voluntary contribution provided by ICCAT CPCs, as it has been specifically the case of the European Union.

Table 3 lists those responsible for coordinating the analysis and Institutions where samples will be stored are identified.

Table 3. Scientist responsible for coordinating the analysis and Institutions where samples will be stored.

Analysis	**Institution**	**Country**	**Coordinator**
Growth	Instituto Português do Mar e da Atmosfera (IPMA)	EU-Portugal	P. Lino and Rubén Muñoz Lechuga
Reproduction	Instituto Español de Oceanografía (IEO), Málaga	EU-Spain	D. Macias, S. Saber and J.M. Ortiz
Stock structure	University of Girona	EU-Spain	J. Viñas

Expenditures in 2021 and 2022

The total expenditures within SMTYP in 2018, 2019, 2020 and 2021 amounted to €52,917, €60,000 and €97,694, respectively. The effective expenditures for that period were of €37,183, €44,531 and €91,167, respectively.

In 2021 and 2022 to implement the main activities planned in the framework of SMTYP, the total budget of provided by ICCAT amounted to €50,000 and €70,000, respectively.

The detailed fund available for SMTYP during 2021 and 2022 and respective expenditures as off 16 September 2022 are detailed in the table below.

	2021		*2022*	
Component	*Budget (€)*	*Exp. (€)*	*Budget (€)*	*Exp. (€)*
Biological studies	10,963	6,572	12,500	-
Genetics	16,312	9,882	10,000	-
Age and growth	5,963	3,479	12,500	-
Sample collection and shipping	11,762	7,088	10,000	-
Other studies (new chapter of ICCAT Manual)	5,000	2,703	-	-
Workshops/meetings	-	-	25,000	-
TOTAL	**50,000**	**29,724**	**70,000**	**-**

Appendix 9

Report of the Shark Research and Data Collection Programme (ICCAT/SRDCP)

(Activity report for the period October 2021 - September 2022)

Background and programme objectives

During the 2014 Commission meeting it was decided that an overall budget of €135,000 would be allocated to the Shark Research and Data Collection Programme (SRDCP). During the 2015 Blue Shark Data Preparatory Meeting *(Tenerife, Spain, 23-27 March 2015)* (Anon., 2016a), the Sharks Species Group (SSG) reviewed the proposal for implementation of the SRDCP that had been prepared in 2014 and identified national scientists who would be in charge of preparing proposals for receiving funds to carry out each of the research topics listed in the original proposal. During the 2015 Blue Shark Stock Assessment Meeting *(Lisbon, Portugal, 27-31 July 2015)* (Anon., 2016b) and shortly thereafter, four project proposals covering different aspects of the life history, population structure, and fisheries of the shortfin mako were presented: a pan-Atlantic age and growth study; a population genetics study to investigate the population structure and phylogeography; a post-release mortality study focusing on pelagic longline fisheries; and a satellite tagging study for determining movements and habitat use. For the first three years the programme focused on these proposals and contemplated extensive collaborative work among national scientists with the aim of contributing information to the 2017 Shortfin Mako Stock Assessment (Anon., 2018b). Activities under the SRDCP have continued since the beginning of it and extended to include other shark species such as porbeagle, silky shark, oceanic whitetip shark, longfin mako and hammerheads.

2022 activities

The following are the cumulative SRDCP activities conducted up to 2022.

Age and growth of shortfin mako in the Atlantic Ocean

The project leaders for this study are Dr Rui Coelho, Daniela Rosa and Catarina Santos, national scientists from EU-Portugal, with participation of scientists and samples from EU-Portugal, United States, Uruguay Japan, Namibia, and Brazil. There are still uncertainties about the age and growth parameters of shortfin mako and this project aims to update the available estimates by ageing specimens from both stocks in the Atlantic. To that end, an inventory of existing vertebral samples available at each national laboratory was compiled, and additional sampling was carried out. Samples were processed, and digital images were uploaded to an ICCAT online repository. Following a two-day age and growth workshop organized by NOAA-NEFSC (Narragansett Laboratory) with the participation of the involved scientists in June 2016 in which an initial reference set for ageing samples was established (Coelho *et al*., 2017). One biologist from each age-reading institution (EU-Portugal, USA and Uruguay) read and estimated the ages from all the samples, based on the agreed ages from the reference set, and growth models were developed based on those readings. For the North Atlantic, data from 375 specimens ranging in size from 57 to 366 cm fork length (FL) for females and 52 to 279 cm FL for males have been analysed, with the work completed in 2017 and presented in several SCRS papers (Rosa *et al*., 2017). The growth models presented in Rosa *et al.* (2017) for the North Atlantic were used in the 2017 Shortfin Mako Stock Assessment (Anon. 2018b). For the South Atlantic, data from 332 specimens, ranging in size from 90 to 330 cm FL for females and 81 to 250 cm FL for males, have been analysed (Rosa *et al*., 2018a). Given the poorly estimated parameters, the Group did not recommend the use of the growth curves for the South Atlantic stock at that time, and it was noted that more samples were still required to develop more credible growth curves, particularly specimens from the southeast region. A few samples from Japan and Namibia have been made available to this project since then. Additionally, in late 2019, a few hundred samples more from southern Brazil were also made available to the SRDCP, totalizing 883 samples, that were processed by the IPMA, Portugal laboratory. Due to the COVID-19 pandemic, laboratory work was much delayed during 2020, but resumed with some restrictions in 2021. Sample processing was completed by the end of 2021, and age readings will start in the last quarter of 2022. The lack of samples from the extremes of the size distribution, most notably from large shortfin mako, may result in convergence issues in the estimation of growth curves or biologically unreasonable estimated parameters. Approaches to overcome the lack of samples from small and/or large size specimens will be explored through growth modeling once the age readings are complete.

Genetic analysis of shortfin mako in the Atlantic Ocean

Dr Yasuko Semba, a national scientist from Japan took over as project leader for this study from Mr. Kotaro Yokawa, who launched this project with participation of scientists and samples from EU-Portugal, EU-Spain, Japan, United States, and Uruguay. With funding from the SRDCP (2015-2022), two questions arising from previous studies on Atlantic shortfin mako were addressed: (1) the true picture of the spatiotemporal genetic heterogeneities of mitochondrial DNA in the equatorial and South Atlantic populations (Nohara *et al*., 2017), and (2) the reason for the inconsistency between genetic population structures predicted from mitochondrial and nuclear DNA analyses (Taguchi *et al*., 2016; Nohara *et al*., 2017). To answer these questions two genome-wide analysis approaches were used: whole mitochondrial genome analysis (mitogenomics) and nuclear-genome-wide single-nucleotide polymorphism (SNP) genotyping (genotyping-by-sequencing - GBS). For the mitogenomics, the research group performed whole mitochondrial genome sequencing based on the low-cost protocol developed past year for 190 individuals. For the GBS of nuclear-genome, genotyping from 180 individuals was conducted. The results of a phylogenetic reconstruction based on mitogenome data sets clearly showed the existence of two distinct clades in the Atlantic Ocean, with a weak geographic pattern. Notably, the results of the analysis of GBS data sets clearly demonstrated the existence of two genetically differentiated groups (namely the α and β groups) as well as a putative F1 hybrid group between them for the first time. These new findings suggest the North and South Atlantic regions as operationally different management units, however, these conclusions, should be viewed with caution, because bidirectional gene flow has occurred between the northern and southern Atlantic regions and there is a possibility that gene flow occurs between the Central and South Atlantic and adjacent Oceans.

During 2022, mitogenomics and nuclear genome genotyping-by-sequencing (GBS) were performed, based on 96 additional individuals collected from the Atlantic Ocean and from the Pacific Ocean. The final results of the genetic population structure of the Atlantic shortfin mako were reported during the Intersessional Meeting of the Sharks Species Group *(Online, 16-18 May 2022)* (Anon., 2022e). The results of phylogenetic tree reconstruction based on mitogenome data sets (264 individuals from 14 sampling units) detected the existence of six new mitochondrial sub-clades, and the plots of PCA scores based on nuclear genome GBS analysis further confirmed previous findings on the existence of two nuclear genome groups and their putative F1 hybrids. The geographic distribution of the individual's assignment to the six mitochondrial sub-clades and the three nuclear genome groups (the plots of principal coordinates analysis (PCoA) scores) have important implications for population structure in the Atlantic shortfin mako. In the Atlantic Ocean, the four regional and temporal groups (the North Atlantic Ocean, the Central Atlantic Ocean I and the Central Atlantic Ocean II, and the South Atlantic Ocean) seem to be genetically reasonable management units for the purposes of conservation and management of the shortfin mako resource. Future studies using conventional/electronic tags will confirm the appropriateness of this suggestion.

The results also indicates that the relative dominance of the putative F1 hybrids in the Central and South Atlantic regions and the South Pacific region indicate that those regions are candidates for a contact zone between the two types (namely the α+I and β+II types). From the present results of geographic distribution of the genetic types, the source of the Nc-group β individuals, especially the pure β+II type individuals, is still unclear, but appearance of the β+II type individuals in the South Pacific Ocean and the Indian Ocean indicates that those regions and unanalysed regions such as the North Pacific regions are promising candidates for the source of the immigration of β+II type individuals.

Genetic analysis of porbeagle in the Atlantic Ocean

The project leader for this study is Dr Yasuko Semba, a national scientist from Japan. During the Intersessional Meeting of the Sharks Species Group *(Online, 16-18 May 2022)* (Anon., 2022e) a workplan to investigate the feasibility of mitogenomics for the Atlantic porbeagle was presented. As a start, mitogenomics of porbeagle on 96 individuals will be conducted throughout 2022, and it is planned to obtain more samples. During the remaining period 2022, mitogenomics on 96 individuals from three localities in the Atlantic Ocean (northeast, northwest, and southeast regions) was performed. A total of 92 individuals analyzed mitogenomics were successfully reconstructed. The result of the phylogenetic tree reconstruction clearly showed the existence of two distinct mitogenome clades with a fairly large divergence, the North Atlantic clade, and the South Atlantic clade. Two sub-clades were also recognized within each clade. Individuals from northeast and from northwest did not show monophyletic clade each other, and those individuals were found to be nested in both sub-clades of the North Atlantic clade. Regarding this result, following evolutionary plausible scenario may be postulated; the establishment of geographic isolated two populations for a long time, with the subsequent generation of a clade with genetic divergence, followed by a historically secondary contact between the divergent clades. Effort is still insufficient in order to draw conclusion on this inference. Next steps will include the incorporation of samples with a larger spatial coverage, including the southwestern Atlantic, and an individual-based large-scale data set from nuclear genome GBS will make it possible to test reproductive isolation between the North and South Atlantic porbeagle and also to clarify ongoing migration between East and West regions in the North Atlantic Ocean with systematic sampling procedure and advanced approach such as kinship relationship tracking.

Post-release mortality of shortfin mako in the Atlantic Ocean

The project leader for this study is Dr Andrés Domingo, a national scientist from Uruguay. The main purpose of this project is to quantify the post-release mortality of Atlantic shortfin makos on pelagic longlines, which was non-existent when the project started, to potentially contribute to their assessment and management. To that end, Survivorship Popup Satellite Archival Transmitting Tags (sPATs) were acquired and distributed to the participating laboratories for deployment in three main areas of the Atlantic: the northwest Atlantic, the tropical northeast Atlantic and equatorial region, and the southwest Atlantic. A total of 14 sPATs have been deployed thus far by scientific observers from IPMA (EU-Portugal), DINARA (Uruguay), NOAA (USA), Brazil and EU-Spain, and additional information from 29 miniPATs was also available to estimate post-release mortality. Of the 35 specimens with available information, eight died (22.9%), whereas the remaining 27 survived (77.1%), at least the first 30 days after tagging. The updated results from this project were reported and published in Miller *et al.* (2020). Tag deployment has continued and deployment of remaining miniPATs will be done during the second semester of 2022 and throughout 2023, depending on the opportunities, considering the current difficulties with onboard missions due to the pandemic. The results of this project with regards to the post-release mortality of the shortfin mako are being updated and analysed and are planned to be presented during 2023.

Movements, stock boundaries and habitat use of shortfin mako in the Atlantic Ocean

The project leaders for this study are Dr Rui Coelho and Catarina C. Santos, national scientists from EU-Portugal. The main purpose of this study is to use satellite telemetry to gather and provide information on stock boundaries, movement patterns and habitat use of shortfin mako in the Atlantic Ocean, to potentially contribute to their assessment and management. All Phase 1 (2015-2016) and Phase 2 (2016-2017) tags have been deployed (36 tags: 22 miniPATs and 14 sPATs). Regarding Phase 3 (2017-2018), of the 13 tags assigned to shortfin mako (out of 21 acquired tags, see **Table 1** below), 5 were deployed in the Atlantic Ocean and 8 were planned to be deployed in the Indian Ocean (7 tags were already deployed) in order to assess inter-ocean movements of shortfin mako. Of the 20 tags acquired during Phase 4 (2018-2019), five were assigned and have been deployed on shortfin mako. The results of this project up to the end of 2019 with regards to shortfin mako were recently published in Santos *et al.* (2021). Overall, a total of 53 tags (31 miniPATs,14 sPATs, and 8 additional miniPATs from other projects) were deployed by observers on EU-Portugal, Uruguay, Brazil, EU-Spain and US vessels in the temperate NE and NW, Equatorial and SW Atlantic. Data from 34 of the 53 tags/specimens were available for a total of 1,877 tracking days recorded. The movement analysis showed that sharks tagged in the Northwest and Central Atlantic moved away from tagging sites showing low to no apparent residency patterns, whereas sharks tagged in the Northeast and Southwest Atlantic spent large periods of time near the Canary Archipelago and Northwest Africa, and over shelf and oceanic waters off southern Brazil and Uruguay, respectively. These areas showed evidence of site fidelity and were identified as possible key areas for shortfin mako. Shortfin makos spent most of their time in temperate waters (18–22°C) above 90 m; however, data indicated the depth range extended from the surface down to 979 m, in water temperatures ranging between 7.4 and 29.9°C. Vertical behaviour of sharks seemed to be influenced by oceanographic features, and ranged from marked diel vertical movements, characterized by shallower mean depths during the night, to yo-yo diving behaviour with no clear diel pattern observed. In the next phase of the project the remaining tags will be deployed in La Reunion (SW Indian Ocean) to determine possible movements between the SE Atlantic and SW Indian Ocean and the analysis will be updated with the most recent data.

Reproduction of shortfin mako and porbeagle in the Atlantic Ocean

The point of contact for this study is Dr Enric Cortés, a national scientist from the United States. In 2017, a two-day hands-on training session on determination of reproductive maturity of porbeagle sharks was held at the Narragansett Rhode Island, NOAA Fisheries NEFSC Laboratory, led by Dr Lisa Natanson. The training was aimed at establishing standardized dissecting and sampling practices among researchers for more consistent collection of life history data. In 2020, a workshop on reproductive and other life history aspects of porbeagle and other pelagic sharks in the Atlantic Ocean was held at the Instituto Português do Mar e da Atmosfera (IPMA), in Olhão, Portugal. An overview of shark reproduction studies of porbeagle in the Northwest Atlantic Ocean was provided. Median size at maturity for males and females using data from all years was updated to 173.1 and 216.3 cm FL, respectively. There is no new information on the timing of mating, gestation period or average number of pups. The reproductive cycle of at least some portion of the population is biennial or triennial based on the finding of a resting stage. Workshop recommendations included an increase in hormone analysis to determine maturity and pregnancy of pelagic sharks, and to combine size data from various fleets to obtain more robust estimates of size at maturity and the overall reproductive cycle of porbeagle. Funds were destinated for these reproduction studies, but due to different reasons some associated with the Covid-19 pandemic, it was not possible to conduct sampling. Although some of the 2020 funds destinated for reproduction studies were extended for a 6-month period, there were no planned activities for 2021, and it was not possible to conduct in 2021 the postponed activities of 2020. This line of research needs to be revised before planning new activities.

Movements, stock boundaries and habitat use of porbeagle in the Atlantic Ocean

The project leaders for this study are Dr Andrés Domingo and Dr Rui Coelho, national scientists from Uruguay and EU-Portugal. The main purpose of this study is to use satellite telemetry to gather and provide information on stock boundaries, movement patterns and habitat use of porbeagle in the Atlantic Ocean, to potentially contribute to their assessment and management. Since the beginning of the programme, a total of 16 miniPATs acquired for this project were distributed to scientists from EU-France, EU-Portugal, and Norway, to be deployed in the North Atlantic, and Uruguay to be deployed in the South Atlantic. Relevant to this activity and that related to shortfin mako, the Shark Species Group was informed of other ongoing national programmes that can contribute data, such as Canada's, which deployed 30 sPATs on shortfin mako and 30 sPATs on porbeagle during 2018-2019; and 12 new sPATs for porbeagle from a US/NOAA project that will be deployed in EU-Portugal, Uruguay, and United States vessels. To date, a total of five POR tags have been deployed by EU-Portugal and EU-France. Four sharks were tagged in the Northeast Atlantic, in the Bay of Biscay/Celtic Sea area. Three of these specimens tended to stay in the same general area and one appeared to travel west after a 3-month residency period in the Bay of Biscay. The one shark tagged in the central North Atlantic appeared to have died shortly after tagging. The remaining 11 tags available for porbeagle had battery issues and had to be returned to Wildlife Computers for tag replacement. There are 8 tags available for this species and are planned to be deployed during the rest of 2022 and 2023, depending on the tagging opportunities and considering the still ongoing restrictions for onboard observers due to the Covid-19. The deployments are planned by scientists from EU-Portugal and Norway in the North Atlantic, and Uruguay and Brazil in the South Atlantic.

Movements, stock boundaries and habitat use of silky, oceanic whitetip, longfin mako, and hammerhead sharks in the Atlantic Ocean

The project leaders for this study are Dr Andrés Domingo, Dr Rui Coelho, Catarina C. Santos, and Dr John Carlson, national scientists from Uruguay, EU-Portugal, and the United States. A 2018 review of satellite tags previously deployed on these species in the Atlantic revealed that only three silky sharks had been tagged off Cuba, and oceanic whitetip sharks were tagged only in the NW Atlantic, but almost nowhere else in the Atlantic. These sharks, are considered priority species, as have been ranked with high vulnerability in the ICCAT shark ERAs (Cortés *et al.*, 2010 and Cortés *et al.*, 2015), and some are currently prohibited to be retained in ICCAT fisheries (i.e. Rec. 10-07, Rec. 10-08, Rec. 11-08). The SCRS decided that of 17 satellite tags that were acquired in 2019 for the SRDCP, 9 should be deployed on oceanic whitetip and hammerhead sharks and 8 on silky sharks. A total of 5 silky sharks, 3 oceanic whitetips and 1 scalloped hammerhead were tagged with miniPATs in 2018 and 2019, by EU-Portugal, Uruguayan and USA scientists/ scientific observers (in collaboration with the Cape Eleuthera Institute, and Florida State University) in the U.S. Gulf of Mexico, Caribbean Sea, and Atlantic Ocean. These tags were acquired in previous years (2017-2018) but were only deployed during late 2018 and 2019. With respect to tags acquired in 2019, a total 2 silky sharks and 3 oceanic whitetips were tagged by EU-Portugal scientific observers in the Equatorial region of the Atlantic Ocean. In addition, 1 smooth hammerhead was tagged by the Uruguayan team in the Southwest Atlantic Ocean. Due to battery issues with Wildlife Computer tags, in early 2020 a total of 11 tags had to be returned for replacement. During 2021 and 2022, 6 of these tags were deployed on silky shark in the U.S. Gulf of Mexico and 2 on oceanic whitetip in the equatorial region of the Atlantic Ocean. It has been discussed that the species selected for this tagging activities are not always commonly caught, and this represents a bigger challenge to achieve the proposed goal. The remaining tags are planned to be deployed throughout 2022 and 2023, depending on the tagging opportunities.

Other activities

The prospects of Close-Kin Mark-Recapture (CKMR) for shortfin mako sharks has been discussed as a robust way to assess abundance and productivity. There is already a strong sampling program in Brazil, and the capacity to do the necessary sampling in Namibia and South Africa from observer programs, without the complications of high-seas CITES permits that seem to be an impediment to sampling in the North Atlantic. Based on the 2019 study design, those three programs could within a few years provide enough samples from a wide geographic area, to assess the sustainability of current combined catches from the South Atlantic shortfin mako population. External funding has been set back by Covid-19, but opportunities are being investigated. External funding through NOAA Fisheries-Office of Protected Resources has been sought to determine genetic connectivity and absolute abundance through close-Kin Mark Recapture for oceanic whitetip shark. Initially the project will focus on sequencing the genome of the oceanic whitetip using archived samples but will expand as more samples potentially become available through observer programs. A CITES-Introduction from the Sea Permit application has been submitted. Since that early discussion in 2019, there has not been recent advances in the SRDCP regarding the CKMR studies, which could probably be assessed in the next revision of the program. The Shark Species Group in accordance with the SCRS recommendation and the decision taken by the Commission in 2020 decided that it was necessary to review and update the Chapter 2 of the ICCAT Manual as regards the pelagic shark species of the Atlantic Ocean and complete the chapter through the incorporation of new subchapters for silky shark (*Carcharhinus falciformis*), longfin mako (*Isurus paucus*), crocodile shark (*Pseudocarcharias kamoharai*) and pelagic stingray (*Pteroplatytrygon violacea*). The first draft of these revised and new chapter was made available to the Shark Species Group for review. The review and update of Chapter 2 was finalized in 2022. A tagging training workshop was held in the Universidad Federal de Río Grande, in conjunction with NEMA Foundation, Brazil. The objective of the workshop was to exchange tagging experiences and support conventional and satellite tagging activities that are beginning to be carried out in southern Brazil. The workshop was conducted by scientists from Uruguay, Dr Andrés Domingo, and Dr Philip Miller.

Table 1. List of ICCAT tags deployed and to be deployed by species.

Species	*Deployed (n)*	*To be deployed (n)*
SMA	53	1
POR	5	8
SPL	1	
SPZ	1	
OCS	8	
FAL	17	2
LMA/FAL/OCS/Hammerheads		39
Total	**85**	**50**
Grand total	**135**	

Expenditures in 2021 and 2022

The total budgets within SRDCP in 2018, 2019 and 2020 amounted to €100,000€, 130,000 and €163,400, respectively. The effective expenditures for that period were of €97,568, €75,746 and €128,952, respectively.

In 2021 and 2022 to implement the main activities planned in the framework of SRDCP, the total budget of provided by ICCAT amounted to €43,500 and €70,000, respectively.

The detailed fund available for SRDCP during 2021 and 2022 and respective expenditures as of 16 September 2022 are detailed in the table below.

Year	*2021*		*2022*	
Component	*Budget (€)*	*Expeditures (€)*	*Budget (€)*	*Expeditures (€)*
Tagging	13,500	1,719	35,000	277
Age and growth	5,000	-	5,000	-
Genetics	25,000	25,000	25,000	20,051
Sampling	-	-	5,000	0
TOTAL	**43,500**	**26,719**	**70,000**	**20,328**

2023 Plan and activities

Age and growth of shortfin mako in the Atlantic Ocean

In view of the need for additional vertebrae to develop reliable growth curves for the South Atlantic stock, the Shark Species Group will endeavour to analyse samples collected by Brazil, Japan, Namibia, Portugal and Uruguay, and in the South Atlantic and conduct final analyses. Samples have been processed by IPMA (EU-Portugal) laboratory, readings will be conducted through the last quarter of 2022 and 2023 with plans of presentation of an updated growth curve for South Atlantic shortfin mako in 2023.

Genetic analysis of porbeagle in the Atlantic Ocean

During 2023, further analysis of an individual-based large-scale data set from nuclear genome for at least 96 will be conducted. Additional analysis from other locality in terms of both mitogenomics and nuclear genome is planned.

Post-release mortality of shortfin mako in the Atlantic Ocean/movements, stock boundaries and habitat use of shortfin mako in the Atlantic Ocean

In late 2022 and 2023 we plan to finish the deployment of the remaining tag acquired since late 2018, including 1 tag by scientists from EU-France in the Indian Ocean. The final analyses of these projects are expected to be conducted during 2023 and will include additional tags deployed by South Africa and in the South-west Indian Ocean (La Reunion, France).

Movements and habitat use of porbeagle in the Atlantic Ocean

In late 2022 and 2023 we plan to finish the deployment of the available miniPATs acquired in recent years, which have not yet have been deployed. The deployments are planned by scientists from Brazil, EU-Portugal and Norway in the North Atlantic, and Uruguay in the South Atlantic.

Movements, stock boundaries and habitat use, and post-release survivorship of silky, oceanic whitetip, longfin mako, and hammerhead sharks in the Atlantic Ocean

The Shark Species Group decided that the 17 satellite tags acquired in late 2018 and 2019 for the SRDCP should be deployed on silky, oceanic whitetip, and hammerhead sharks, with priority given to silky sharks as this was ranked as the most vulnerable species in the 2010 Ecological Risk Assessment (ERA) (Cortés *et al*., 2010). In 2020 we acquired additional tags to be deployed on silky, oceanic whitetip, longfin mako and hammerhead sharks to continue the project. In 2021 we acquired an additional 38 tags to be deployed by the various partners in different regions of the Atlantic. These will be deployed during the last quarter of 2022 and throughout 2023 on several species (i.e. FAL, OCS, LMA and SPN) and in various regions of the Atlantic.

Reproduction of shortfin mako in the Atlantic Ocean

During the Intersessional Meeting of the Sharks Species Group *(Online, 16-18 May 2022)* (Anon., 2022e) the opportunity to resume studies related to reproductive biology of the shortfin mako in the North Atlantic were discussed. The studies will be focused on hormones analysis to determine maturity and reproductive state of the species. The SRDCP has already some experience with this analysis, that have been done for porbeagle in the North Atlantic. Unfortunately, this study had to be paused due to the Covid-19 pandemic, and the impossibility to conduct sampling. Blood and tissue sampling, and preliminary analysis of hormones for the North Atlantic shortfin mako will be conducted during 2023.

Age and growth of blue shark in the Atlantic Ocean

The purpose of this project is to conduct an Atlantic wide age and growth study for blue shark that can contribute to the 2023 ICCAT stock assessment. Available age and growth curves for the species are outdated, so the stock assessment would be improved if new information is presented. The study will start in late 2022 and will include a workshop in early 2023.

Appendix 10

Report of the Enhanced Programme for Billfish Research (ICCAT/EPBR)

(Expenditures/Contributions 2022 and Programme Plan for 2023)

Summary and Programme objectives

The ICCAT Enhanced Programme for Billfish Research (EPBR) continued its activities in 2022, although with restrictions due to the COVID-19 pandemic situation. The Secretariat coordinates the transfer of funds and distribution of tags, information, and data. The overall programme coordinator and eastern Atlantic coordinator during 2022 was Dr Fambaye Ngom Sow (Senegal) and Ms. Karina Ramírez López (Mexico) remaining as coordinator for the western Atlantic.

The original plan (1986) for EPBR included the following objectives: (1) to provide more detailed catch and effort statistics, particularly for size frequency data; (2) to initiate the ICCAT tagging programme for billfish; and (3) to assist in collecting data for age and growth studies. During past Billfish Species Group meetings, the Billfish Species Group requested that the objectives of EPBR expand to evaluate adult billfish habitat use, study billfish spawning patterns and billfish population genetics. The Billfish Species Group considers that these studies are essential to improve billfish assessments. Efforts to meet these goals since 2019 are highlighted below.

The specific funding for EPBR previously available has now been combined with the general research fund (ICCAT Science Envelope). Project funding will now be allotted on a competitive basis with other species working groups.

2022 activities

In July 2022 a new contract was awarded to Centre de Recherches Océanographiques de Dakar/Thiaroye (ISRA/CRODT, Senegal) to continue the activities of the previous contract for a 12 months period (until December 2022). This new contract engages only the EU research team (from Portugal), which have significantly enhanced the collection of samples onboard industrial vessels operating in the same area and supported the analysis of data on length and age for estimating the growth parameters based on spines of the main billfish species that occur in the eastern Atlantic (*Makaira nigricans*, BUM; *Kajikia albida*, WHM; and *Istiophorus albicans*, SAI).

Following the SCRS request, in autumn 2019 through the ICCAT Science Envelope, a contract was proposed to the Dirección General Adjunta de Investigación Pesquera en el Atlántico, Centro Regional de Investigación Acuícola y Pesquera en Veracruz (Mexico) to develop a Reproductive biology study on Atlantic blue marlin in the Gulf of Mexico. During September 2022, the Secretariat received a draft proposal for review, aiming signing a contract to initiate the study on blue marlin reproduction in the Gulf of Mexico in the near future.

In 2022 funds have been made available for sampling of artisanal and small-scale fisheries in the eastern Atlantic (Côte d'Ivoire, and Senegal). These funds were allocated to support the estimation of catch and effort statistics of fleets contributing the largest parts of the catch and/or those having traditionally provided the higher quality data in the past, to ensure the preservation of an uninterrupted time series of catch and relative abundance indices. However, no reimbursement has been requested.

In 2022, it should be noted that the COVID-19 pandemic restrictions imposed by local authorities still affecting the activity related to the age and growth study. Since the last reporting period, additional samples have been collected: 25 samples from industrial fisheries by the Instituto Português do Mar e da Atmosfera (IPMA) and 32 samples from artisanal fisheries by CRO. Specifically, a total of 509 samples have been collected to date both by artisanal and industrial fleets within the age and growth component of the project, and laboratory sample processing is ongoing.

It is noted the difficulty collecting samples from small and large specimens from the industrial through observers in industrial and artisanal fleets.

All otoliths collected and sent to the Fish Ageing Services in Australia for age reading in 2021 were analysed. The report of preliminary result of a study to evaluate the use of otoliths to estimate the annual age and provide some preliminary otolith-based estimates of potential longevity of Atlantic blue marlin (*Makaira nigricans*), Atlantic white marlin (*Kajikia albida*) and Atlantic sailfish (*Istiophorus albicans*) is provided and presented during the species group meeting. All other activities of the billfish work plan for EPBR 2022 could only be partially performed, namely those involving mainly field work research, due to the COVID-19 restrictions imposed by local authorities, the difficulty of deploying observers in longline fleets and of adding additional tasks to the observer deployed in purse seiners.

A workshop on age reading was held online from the 25-28 October 2021, that was intended to review the existing sampling and processing protocols, for consistency between laboratories, and initiate discussions on age reading protocols.

2023 plan and activities

The highest priorities for 2023 are to support the objectives established by the billfish work plan and those of the EPBR, with specific emphasis on the collection of biological samples for growth and reproductive studies that are on hold due to the COVID-19 issue, enhance the collection of fisheries data in developing countries and resume the field and laboratory research activities as much as possible:

1. support the collection of billfish biological samples off West Africa;

2. support the blue marlin biological and photographic sampling in Gulf of Mexico;

3. fund a workshop on growth and aging techniques involving researchers from both eastern and western Atlantic;

4. support the monitoring of billfish catches from West African artisanal fishing fleets (i.e. Côte d'Ivoire, Ghana, São Tomé e Príncipe and Senegal);

5. fund a regional workshop for CPC statistical correspondents on artisanal fisheries data collection in eastern Atlantic;

6. fund the development of an App for mobile phones for the collection and report of fisheries data from artisanal fisheries in collaboration with local scientific institutions.

7. Fund the satellite tagging of blue and white marlin in the south coast of Portugal.

All these activities depend on successful coordination, sufficient financial resources and adequate in-kind support by the CPCs involved. Details of EPBR funded activities for 2023 are provided below.

Shore-based sampling

Sampling of artisanal and small-scale fisheries to support the estimation of catch and effort statistics will be focused on fleets contributing the largest parts of the catch and/or those having traditionally provided the higher quality data in the past, to ensure the preservation of an uninterrupted time series of catch and relative abundance indices. In the eastern Atlantic, monitoring and sample collection will be supported for the artisanal fisheries of Côte d'Ivoire, Ghana, São Tomé e Príncipe and Senegal.

Biological studies

The collection of biological samples for genetic study to differentiate white marlin and spearfish, will continue in 2023.

Continue efforts to finalize the collection of biological samples for age and growth studies for marlins and sailfish caught off West Africa, either from directed or bycatch billfish fisheries of both artisanal and industrial fleets. In 2023 increasing effort will be made for processing and analysing the available samples, which is expected to continue also in the following years. Such activities require the continuation of financial support from ICCAT and additional voluntary contributions from CPCs.

To start a satellite tagging study on blue and white marlin in the North-eastern Atlantic (off the southern coast of Portugal).

Coordination

Training and sample collection

Programme coordinators need to travel to locations not directly accessible to promote EPBR activities and ICCAT data requirements regarding billfish. This includes travel to West African countries, as well as the Caribbean and South America by the general coordinator and the coordinator for the West. Coordinated activities between EPBR, JCAP-2 and ICCAT data funds will continue to be required.

Programme management

The EPBR budget is now part of the ICCAT Science Envelope and management is assumed by the programme coordinators, with the support of the Secretariat. Reporting to the SCRS is a responsibility of the coordinators. Countries that are allocated budget lines for programme activities need to contact the respective programme coordinators for approval of expenditures before the work is carried out. Invoices and brief reports on activities conducted need to be sent to the programme coordinators and ICCAT to obtain reimbursement. Funding requests need to follow ICCAT protocols for the use of funds (see Addendum 2 to Appendix 7 of *Report for Biennial Period 2010-2011, Part II (2011), Vol. 2*).

Expenditures in 2021 and 2022

The total budgets within EPBR in 2018, 2019 and 2020 amounted to €19,865, €0 and €28,000, respectively. The effective expenditures for that period were of €19,865, €0 and €24,984, respectively.

In 2021 and 2022 to implement the main activities planned in the framework of SRDCP, the total budget of provided by ICCAT amounted to €75,000 and €70,000, respectively.

The detailed fund available for SRDCP during 2021 and 2022 and respective expenditures as off 16 September 2022 are detailed in the table below.

	2021		*2022*	
Component	*Budget (€)*	*Expediture (€)*	*Budget (€)*	*Expediture (€)*
Biological studies	25,000	-	15,000	-
Age and growth	-	-	15,000	-
Sample collection and shipping	10,000	-	10,000	-
Consumables	5,000	-	5,000	-
Monitoring Eastern_Atlantic fisheries	10,000	-	10,000	-
Workshops	25.000	-	30,000	-
TOTAL	**75,000**	**-**	**70,000**	**-**

Conclusion

The EPBR is an important mechanism towards completing the goal of having the highest quality information to assess billfish stocks. The EPBR has been credited for major improvements in the data supporting the last ICCAT billfish assessments and the SCRS advice to the Commission. The EPBR is the only programme that focuses exclusively on billfish, and now has the added benefit of including sampling and data collection from both artisanal and industrial fleets. Therefore, programme continuation is paramount to facilitate the collection of biological and fishery information on billfish species. The EPBR will continue to require support from ICCAT and other sources to operate and address the needs of the Commission.

Appendix 11

Report of the Albacore Year Programme (ALBYP)

Background and programme objectives

Since 2010, the Albacore Species Group (ALB SG) has designed a research programme to address key uncertainties that would allow to improve the scientific advice for management of the species. The research programme is now developed for both the northern and the southern stocks of Atlantic albacore and has been revised on several occasions according to new knowledge, priorities and cost estimates. The research plan is focused on three main research areas: biology and ecology, monitoring stock status and management strategy evaluation (in the case of northern albacore). Funds for this research programme became available in 2021 which were used to develop some of the key research topics as described below.

2022 activities

Since 2021, the Albacore Species Group has prioritized the following research topics: a reproductive biology study to improve knowledge on maturity and fecundity, an electronic tagging study to better understand the life cycle and habitat use, and Management Strategy Evaluation to follow the MSE schedule agreed by the Commission. The first two research items are pursued for both the North and the South Atlantic stocks, while the thirds one is, for now, specific for the northern stock. The following are the cumulative ALBYP activities conducted up to 2022.

Reproductive biology of North Atlantic albacore

ICCAT funds were used to issue a contract to a consortium to address this project in order to improve knowledge on: (a) the reproduction and maturity for the northern Atlantic albacore stock, (b) sex-specific maturity ogives, (c) spatial and temporal spawning grounds and (d) L_{50} and size/age related fecundity.

The project consortium is led by Dr Alex Hanke and Dr Dheeraj Busawon (Department of Fisheries and Oceans, DFO, Canada), assisted on coordination activities by Dr Victoria Ortiz de Zárate (EU-Spain, IEO-CSIC). Other scientists involved include: Dr Freddy Arocha (Instituto Oceanográfico de Venezuela (IOV), Universidad de Oriente (UDO), Venzuela), Dr Nan-Jay Su (National Taiwan Ocean University, Chinese Taipei), Dr David Macías (EU-Spain, IEO-CSIC) and Dr Kadra Benhalima (DFO, Canada).

During December 2020 and 2021 the sampling plan was focused on pelagic longline fisheries either targeting albacore (Chinese Taipei fleet) or bycatching it (Venezuela and Canada fleets). The female and male fish gonads sampled, and a subsample of dorsal fin ray were analysed to completion in the first semester of 2022.

All the male and female albacore collected were analysed to determine maturity stage. A total number of 284 gonads were collected, of which 272 were processed (199 from Venezuela and 73 from Chinese Taipei). First dorsal fin rays collected by Venezuela (n=111) were processed and read applying the methodology described in Ortiz de Zárate and Babcock (2016). Two readers made independent estimations of age of the total number of samples and final age was determined by agreement.

According to their different developmental stages, oocytes were classified into one of 6 classes using similar terminology of Brown-Peterson *et al*. (2011). To determine the maturity stage of each female and its ovarian phase, a microscopic maturity scale was applied to identify: Most Advanced Group of Oocytes (MAGO) in the ovary, the Post Ovulatory Follicles (POF) and Vitellogenic Oocytes development (Farley *et al*., 2013 and 2016; and Schaefer, 2001). To estimate fecundity parameters two approaches were used, fecundity estimates described by Weibel method (Weibel and Gómez, 1962; Weibel, *et al*., 1966; Weibel, 1969) and a new dissector method (Sterio, 1984). Fecundity parameters were estimated on a reduced number of gonads (n=20) collected in May and June of 2021 in the Central North Atlantic area by Chinese Taipei longline vessels.

All the female albacore collected in the tropical area by Venezuela longliners were mature but had no sign of spawning in 2021. These female albacores were classified in resting stage, therefore were not eligible to estimate fecundity parameters.

The new findings on the reproductive biology of North Atlantic albacore obtained from 2020-2021 samples analysis were presented at the Albacore Species Group that met in September 2022. Collection of albacore gonads continues in 2022 in the Central area of North Atlantic. New results will be compiled with previous ones and a comprehensive summary with all the available data from the Reproductive albacore biology study in North Atlantic (2020-2022) will be presented in 2023 to the ALB SG.

Reproductive biology of South Atlantic albacore

Dr Paulo Travassos, a national scientist from Brazil, is the project leader for this short-term contract, with research activities being conducted with the participation and support of scientists from Brazil (Dr Mariana Rego, Dr Maria Lúcia Araújo and Dr Luis Gustavo Cardoso), Uruguay (Dr Andrés Domingo and Dr Rodrigo Forselledo), South Africa (Dr Denham Parker) and Chinese Taipei (Dr Nan-Jay Su).

Regarding this topic, there is still an important gap in scientific knowledge for the albacore in the South Atlantic Ocean that needs to be filled. Thus, the objective of this research is to determine the spawning areas and season, as well as estimate the age-size at maturity and fecundity of the species, using samples/measurements provided by participating CPCs. Therefore, with the development of this work, it is expected to generate important and necessary information for the conservation of the species and the management of fisheries in the South Atlantic.

To achieve these objectives, biological sampling is being carried out in the three main areas of abundance/fishing in the South Atlantic (oceanic areas off Brazil, Uruguay and South Africa). However, only samples collected by the Brazilian tuna fleet (104 gonads) have been analyzed so far. These samples were obtained from two areas: one to the North (around 8ºS; fleet based in Recife), with samples collected in Sep-Oct-Nov/2021 and February 2022, and the other to the South (around 32ºS; fleet based in Rio Grande), with samples collected in February and July 2021. In addition, information obtained from samples collected years ago as part of independent studies on the reproduction of the species by Brazil (2005-2010), Uruguay (2013-2016), and South Africa (2012-2018), have also been analyzed. For fish caught by the longline Recife fleet, the range of fork length was 97.0 to 115.0 cm. The size of the fish caught by the longline Rio Grande fleet ranged from 81.0 to 111.0 cm fork length.

The histological criteria used to assess the maturity status indicate that female and male reproductive activity occurred in 56% of the samples of the mature individuals analyzed, and 44% of the adult individuals were in regressing phase. Most mature individuals were caught by the Recife based fleet, and the following maturation stages were present in the samples: immature 4.2%, developing 25%, spawning capable 2.0%, active 37.5%, and regressing 31.3%. Notwithstanding, the maturation stages of individuals caught by the Rio Grande fleet were: immature 36%, developing 57%, and regressing 7%. The data support the hypothesis that the reproduction site of this species is up to 20°S along the Brazilian coast. The maturation stages identified in samples from the Rio Grande fleet are similar to preterit data of individuals sampled in South Africa (immature 42.9, developing 51.2%, spawning capable 5.0%, active 0.7 %, and regressing 0.3%). The sampling limitation is expected to be corrected with material which will be sent for analysis soon from the partner from Chinese Taipei.

The spines of the first dorsal fin have been collected and are being processed for analysis, with no results yet to present.

Movements and habitat use of North Atlantic albacore

This project is led by Dr Haritz Arrizabalaga (AZTI, EU-Spain), in collaboration with scientists mainly from EU-Spain (AZTI and IEO), and the support from scientists from different CPCs involved in communication of tagging recoveries and rewarding (EU-France, EU-Ireland, EU-Portugal, Chinese Taipei and Japan).

ICCAT funds are used mainly to purchase tags and to cover some of the deployment and satellite transmission costs, while other costs (additional tags, personnel, travel, etc.) are provided by participating institutions involved in tagging and analyses.

Since 2019, several tagging surveys have been conducted off the Canary Islands and the Bay of Biscay. The surveys off the Canary Islands were conducted onboard baitboats and charter vessels targeting large individuals during winter-spring. So far 29 MiniPATs have been implanted (5 in 2019, 10 in 2020 and 14 in

2022). In the Bay of Biscay surveys were conducted onboard baitboats used for the bluefin tuna acoustic survey, as well as recreational and charter vessels using trolling gear, targeting small to medium size individuals during summer and autumn. So far, 82 internal archival tags (Lotek LAT 2810L) and 2 PSATS have been implanted in 2020-2022.

In order to increase the chances of recovering internal archival tags, posters announcing €1,000 rewards were produced in Spanish, French, English, Portuguese, Japanese and Mandarin Chinese and distributed through collaborating ALB SG participants from different CPCs. To date we have collected data from 25 of the PSATs deployed, which account for an accumulated 1448 tracking days. As for the internal archival tags, 4 tags were recovered after 10, 17, 37 and 439 days at liberty. Unfortunately, the first one was recovered with the antenna broken, but the third recovery is, to our best knowledge, the longest recovery for an albacore tuna in the Atlantic Ocean. This track covers, for the first time, more than a year in the life of a juvenile albacore that visited shallow waters of the Bay of Biscay in subsequent summers, while inhabiting deeper waters in the central and western Atlantic during the winter. An update of the results obtained so far was presented to the Albacore Species Group during the 2022 Species Group meetings held in September (Cabello de los Cobos, 2022). In the near future we will continue deploying purchased tags that remain to be deployed.

Movements and habitat use of South Atlantic albacore

The project leaders for this study are Dr Paulo Travassos and Dr Andrés Domingo, national scientists from Brazil and Uruguay, respectively. The main purpose of this study is to provide information about movement patterns and habitat use of albacore in the South Atlantic Ocean, to contribute to the assessment and management the southern stock of the species.

To achieve this goal, a total of 6 miniPAT (Wild-Life Computers) tags have been made available so far by ICCAT as of the end of 2021. These tags arrived in Brazil in February 2022 and since then attempts have been made to tag some specimens of the species off the Northeast coast of Brazil. Taking the opportunity of an expedition to tag yellowfin tuna around the Fernando de Noronha archipelago (Protuna Project, national research supported by the Brazilian government; CNPq Process No. 445810/2015-7), an attempt to tag albacore in this area was conducted from 23-27 May 2022. However, no albacore was caught during this cruise and thus no fish was tagged. This region of the Fernando de Noronha archipelago does not have a high abundance of albacore and, furthermore, the time of year was not the most suitable for the presence of the species on the Northeast coast of Brazil. The greatest abundance occurs during the austral spring-summer periods, when the species seeks the warm tropical waters for its reproductive activity.

Management strategy evaluation of North Atlantic albacore

ICCAT funds are used for a short-term contract to AZTI, coordinated by Dr Gorka Merino and Dr Agurtzane Urtizberea, to accomplish the technical tasks required to follow the MSE schedule adopted by the Commission in 2021. According to this schedule, after adoption of the first ICCAT Management Procedure (MP) in 2021 (following adoption of a harvest control rule in 2017), the existence of exceptional circumstances is needed to be checked on a yearly basis (indicators depending on the year). In addition, in 2023 a new benchmark stock assessment using SS3 is scheduled, which should serve as a basis for conditioning new operating models for the second round of the MSE framework, expected to be delivered in 2026, to allow the Commission to revise the MP if they wish to do so. Moreover, the *Recommendation by ICCAT on conservation and management measures, including a management procedure and Exceptional Circumstances Protocol, for North Atlantic albacore* (Rec. 21-04) requires testing alternatives to the MP adopted.

Following up a webinar held in 2021 to decide on basic SS3 model structure, in 2022 interested members of the ALB SG worked with the ICCAT Secretariat on the definition of the fleet structure and the production of input catch, CPUE and size data for the SS3 model (Kimoto *et al*., 2022b). The contractors made initial SS3 runs with the agreed model and fleet structure and presented results to the September 2022 ALB SG meeting (Urtizberea and Merino, 2022). They also evaluated the performance of MP variants requested in Rec. 21-04, namely with varying levels of target fishing mortality and biomass thresholds, as well as the effect of using only some of the CPUE series on MP performance. They also performed initial tests with varying levels of underreporting and updated the analyses regarding the effect of the carry over provision, implementation error, and alternative stability clauses. Finally, they produced the necessary plots for the

ALB SG to discuss the detection of exceptional circumstances, as requested by the Exceptional Circumstances protocol contained in Rec. 21-04.

Expenditures in 2022

The total budget within ALBYP in 2018, 2019 and 2020 amounted to €94,375, €85,000 and €130,000, respectively. The effective expenditures for that period were of €41,832, €42,788 and €163,644, respectively.

In 2021 and 2022 to implement the main activities planned in the framework of ALBYP, the total budget of provided by ICCAT amounted to €142,500 and €110,000, respectively. The total amount of the expenditures as of 16 September 2022 are shown in the Table below.

The detailed fund available for ALBYP during 2021 and 2022 and respective expenditures as off 16 September 2022 are detailed in the table below.

Year	*2021*		*2022*	
Component	*Budget (€)*	*Expediture (€)*	*Budget (€)*	*Expediture (€)*
Tagging	46,500	19,487	40,000	1,394
Biological studies	27,000	16,764	35,000	-
Age and growth	-	-	10,000	-
Sample collection and shipping	31,000	21,347	5,000	-
MSE	38,000	24,000	-	-
TOTAL	**142,500**	**81,598**	**90,000**	**1,394**

2023 Plan and activities

Reproductive biology of North Atlantic albacore

In view of the inherent difficulties to collect mature albacore fish and the need for additional gonads samples to better cover the spatio/temporal strata of maturity and fecundity estimates in the North Atlantic sampling, additional sampling is planned to continue until the end of the Summer 2022 onboard Chinese Taipei and Canada longliners. The sampling that was re-scheduled for spring and summer seasons of 2022 to continue collecting gonads and the first dorsal fin rays on board Chinese Taipei longline vessels catching albacore in Central North Atlantic. When new samples are provided to the laboratories involved the analyses will be done with same methods to estimate maturity stage and fecundity. In 2023, it is expected to continue sampling gonads and spines of albacore onboard longliners from Chinese Taipei, to allow drawing conclusions from a larger collection of samples.

Reproduction of albacore in the South Atlantic Ocean

Given that so far only samples collected by Brazilian have been analyzed, priority will be given to collecting and especially shipping samples from the other partner countries to Brazil. Once that task is accomplished, it will be possible to obtain information from the samples collected in the different space and time strata, as outlined in the research plan. This sampling effort should continue until the end of this year and early 2023.

Movements and habitat use of North Atlantic albacore

During the rest of 2022 and 2023 we plan to continue deploying tags that have remained to be deployed on albacore using different tagging opportunities (commercial, research, charter and recreational vessels). Following the experience in recent years, deployments are planned by AZTI scientists in the Bay of Biscay and the Canary Islands, but open to other areas if opportunities arise.

Movements and habitat use of albacore in the South Atlantic Ocean

Tagging activities will continue in the second semester of 2022 and throughout 2023, including other areas off the Southeast and South coasts of Brazil, depending on the opportunities. In this case, it is intended to tag fish caught by baitboats that target skipjack tuna. Even in small proportion, albacore is caught in this fishery, with the advantage of tagging fish in good condition by the characteristics of this fishing method. Thus, it is expected to successfully accomplish this task. New attempts to tag the species will also be made in the Northeast region of Brazil from September to October, when the spawning season begins, promoting an increase in abundance, especially of adult fish.

Management strategy evaluation of North Atlantic albacore

In 2023 a benchmark stock assessment for North Atlantic will take place. For this stock assessment, SS3 model will need to be prepared, aiming to identify a base case and a set of main sensitivity runs, which will be used as a basis to condition future Operating Models. In 2023 the Management Procedure will also be iterated to set the TAC for 2024-2026. Accordingly, the mpb model will need to be run according to the specifications set in Rec. 21-04, and the exceptional circumstances assessed according to the Exceptional Circumstances protocol contained in Rec. 21-04.

Appendix 12

Report of the Swordfish Year Programme (SWOYP)

Background and program objectives

Since 2018, the Swordfish Species Group has conducted a research program to address key uncertainties important for improving the scientific advice for management of the species. The research program encompasses all three ICCAT swordfish stocks and has been modified each year to respond to new knowledge, priorities and cost estimates. This program aims to improve knowledge of the stock distribution, age and sex of the catch, growth rates, age at maturation, maturation rate, spawning season and location, stock boundaries and mixing, thereby contributing to the next major advance in the assessment of swordfish status. The SWOYP also encompasses an electronic tagging study to better understand swordfish life cycle and habitat use, and Management Strategy Evaluation for the North Atlantic Stock to follow the MSE schedule agreed by the Commission Collectively. These projects should translate into more reliable advice on stock status for this internationally and collectively managed resource. The Swordfish Species Group has identified this work to be of high priority and will address critical deficiencies in our understanding of the population dynamics and ecology of the stocks. The program, which has been running on a short-term contractual basis since 2018, is now being formalized as a ICCAT research program in 2023. As this is the first detailed report, below we describe overall progress since program inception in 2018.

Overview of activities

The Swordfish Species Group (SWO SG) prioritized the following research topics: an ageing and growth study to improve knowledge of growth patterns among the stocks; a reproductive biology study to improve knowledge on maturity and fecundity; a genetics study to better define stock boundaries and estimate rates of mixing among the stocks; an electronic tagging study to better understand the life cycle and habitat use, and Management Strategy Evaluation to follow the MSE schedule agreed by the Commission. These projects are overseen by a Consortium led by Canada (Dr Kyle Gillespie and Dr Alex Hanke, Fisheries and Oceans Canada) and administered by The Nova Scotia Swordfishermen's Association. Each of the three research areas are overseen by project leaders: ageing and growth (Dr Rui Coelho and Mrs. Daniela Rosa, IPMA); reproduction (Dr David Macias, IEO); and genetics (Dr Oliana Carnevali and Dr Giorgia Gioacchini, UNIVPM). A total of 20 institutions from 14 ICCAT CPCs/Cooperating Non-Contracting Parties are involved in collection and analysis of samples. Two SWOYP biology workshops have been held: the first, in 2019, to refine and standardize sampling methods and sample processing, and the second, in 2021 to review study results, and create ageing and histology reference sets and review results from a first calibration exercise. Electronic tags have been used to support movement and habitat use studies in data-limited regions. N-ATL MSE, initiated in 2018 is being conducted by a core technical team and an outside contractor. The SWO SG is scheduled to deliver a final set of CMPs to the Commission in 2023.

Sample collection and coverage

Through all phases of this program, 4,159 samples have been collected from longline fisheries, covering all three stocks. The majority of samples collected consist of an anal fin spine for aging, a piece of tissue for genetic analysis, and include data on fish size, sex, location and catch date. A subset of samples includes otoliths for aging or a piece of gonad for reproductive analysis.

Samples were collected in several of the major fishing areas in the North and South Atlantic and Mediterranean. Sampling in early project phases in the North Atlantic was concentrated in three areas: the Scotian Shelf, in the Western Atlantic; along the 39°N parallel, in the Eastern Atlantic; and off the Western coast of Morocco in the Eastern Atlantic. All three of these are major areas for swordfish catch. Samples obtained near the Strait of Gibraltar are of particular relevance to understand mixing between Atlantic and Mediterranean stocks. In later program phases, a significant number of samples were obtained from the US east coast (billfish sampling area 92), however gaps remain in the Gulf of Mexico (BIL91) and the Caribbean (BIL93). Samples were also added from the coastal waters of Venezuela. In the cases of the Gulf of Mexico and Caribbean, there is relatively little swordfish catch, however, we anticipate that future sampling efforts will include data from these areas.

Sampling in the South Atlantic occurred between 5°N and 6°S, stretching from the coast of Brazil to the Gulf of Guinea. More than half the samples were obtained in this zone which spans two billfish sampling areas (BIL96 and 97). This is an area of significant swordfish catch in distant water fishing fleets. This is also as an assumed mixing area for North Atlantic and South Atlantic stocks. In addition, samples were collected in the waters of Brazil and off the coast of South Africa and Namibia. The south coast of Brazil and Uruguay and stretching east along the 30°S parallel is a major area for swordfish catch but so far have had limited sampling in this program.

Mediterranean sampling occurred in three regions: the Balearic Sea, in the western Mediterranean; the Tyrrhenian and Adriatic Seas, in the central Mediterranean; and the Greek Islands. Sampling coverage of these seas appears somewhat representative of spatial-temporal patterns in the catch. More samples are required in the very western region of the Mediterranean, in the Alboran Sea and approaching the Strait of Gibraltar where there is suspected mixing between North Atlantic and Mediterranean stocks. Additional sampling is also required in the eastern Mediterranean in the Ionian and Aegean Seas.

Reproductive biology of swordfish in the Atlantic and Mediterranean

The reproductive biology study has the following objectives: (a) improve knowledge on the reproduction and maturity for Atlantic and Mediterranean swordfish, (b) obtain sex-specific maturity ogives, (c) identify spatial and temporal spawning grounds and (d) estimate of L_{50} and size/age related fecundity.

The sex of fish was determined via macroscopic observation and through histological analysis. 86.5% of samples were assessed for sex, while in the remaining 13.5% of samples, gonads were not available for assessment or were in a state where sex was ambiguous. Sex data are not typically collected in national sampling programs, nor are these data required in ICCAT reporting, making it difficult to assess the representativeness of these data. In all regions, females outnumber males in the sample. The most extreme difference in sex ratio was observed in the Mediterranean, where only 30% of fish were assessed as male. This region also had the greatest level of uncertainty, where sex was unknown in approximately 30% of fish. Imbalance in sex ratios may be a result of inherent spatial zonation between sexes or it may be a result of males being classified as “unknown” at higher rates than females. For example, a large proportion of the sampled fish come from more northerly water where female swordfish are known to be at higher abundances.

Maturity was assessed on a six-point scale. Nearly a third of fish sampled had maturity states that were labelled as “undetermined”, and these data require further verification. In some cases, histological data are available for samples and in these cases, macroscopic assessments of gonads will be compared to histological data.

A preliminary analysis of L_{50} comparing macroscopic and microscopic data was conducted in 2020 (Saber *et al*., 2020). Altogether, 2,434 data on sex and macroscopic maturity for swordfish from the North and South Atlantic, and the Mediterranean Sea have been collected covering an ample size range (58 to 261 cm LJFL). About 498 gonad samples have been collected from the North Atlantic and the Mediterranean Sea. A total of 322 samples of gonads, 262 from the North Atlantic and 62 from the Mediterranean Sea have been processed for microscopic maturity. Further analysis will be conducted after increasing the sample size. See Saber *et al*. (2020) for a preliminary analysis of the samples collected to date, and recommendations on next steps for data and sample collections. The descriptions of length frequencies by month/season and by stock of the swordfish sampled for maturity data are also provided.

Fish were classified as either immature (stage 1) or mature (stages 2 - 5). The L_{50} was estimated using the macroscopic maturity data. Sample gonads were sent to the coordinator of the reproductive studies in IEO-Málaga (Spain). Microscopic maturity stating of gonads was based on a modification of the criteria of Schaefer (2001) and Farley *et al.* (2013).

As expected, the analysis of the sex-ratio showed that females were more abundant than males, but further work is needed to verify if the sampling scheme is taking into account both sexes. The estimated L_{50} in the preliminary analysis for the three stocks was consistently lower than those adopted by the SCRS. However, it should be remark that the significant number of histological sections of ovaries examined showed that females microscopically classified as immature were often incorrectly staged as developing (stage 2, mature) when using the macroscopic criteria. Increasing the sampling of swordfish across the

Mediterranean Sea and Atlantic Ocean is necessary 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.

Ageing and Growth in Atlantic and Mediterranean swordfish

The objectives of the ageing and growth study are to a) develop a standardized methodology for ageing spines and otoliths, b) validate ages through procedures such as bomb radiocarbon, and c) update the sex-specific growth formulas using new sample data and modeling techniques.

A total of 3,497 spine samples (1414 males, 1,832 females, 251 specimens with undetermined sex) have been collected for this study from the North, South Atlantic and Mediterranean Sea. A total of 985 otolith samples (558 males, 414 females, 13 specimens with undetermined sex) were collected for this study from the North, South Atlantic and Mediterranean Sea.

From the collected spine and otolith samples, 1015 spines, 385 otoliths for annual readings and 1 for daily readings from the Atlantic and 99 spines, 44 otoliths for annual readings and 6 for daily reading from the Mediterranean have been processed. In total, 1114 spines and 429 otoliths for annual readings and 7 for daily readings have been processed or are under processing from the North, South and Mediterranean stock.

Sectioning of spines and otoliths is performed at Fish Ageing Services (FAS; Australia). Preparation of spines follows Quelle *et al.* (2014). The second anal fin spine is embedded individually in resin for sectioning, two sections of approximately 0.5 mm were made at one distance of the condyle width (1D) and at half distance of the condyle width (0.5D). Smaller spines were sectioned with a modified gem cutting machine high speed saw, using a single pro slicer diamond blade, while larger spines were sectioned using an Isomet with a diamond wafering blade. Spine sections were preserved in a polyplex clear ortho casting resin and photographed under a dissecting microscope with a digital camera.

Before processing, whole otoliths were measured for length and width and photographed using a Leica M80 with transmitted light and 5x magnification. Otoliths were prepared for annual and daily age readings in thin transverse sections by grinding down the otolith in a 3-step process. Firstly, the otolith was fixed on the edge (end) of a slide using thermoplastic mounting media (Crystalbond 509) with the anterior side of the otolith hanging over the edge. Care was taken to ensure that the primordium was just on the inside of the glass edge. The otolith was then ground down to the edge using 400 and 800 grit wet and dry paper. The slide was then reheated, and the otolith was removed and placed (ground side down) on another slide and Crystalbond was allowed to cool. Once cooled the otolith section was ground horizontally to the grinding surface using varying grades (400, 800 & 1500 grit) of wet and dry sandpaper and finally 5um lapping film. During this process, the otolith preparation was continuously checked for the appropriate thickness (220μm – 250μm for annual readings or 50-80μm for daily readings). Otolith sections were preserved in a polyplex clear ortho casting resin and photographed at a 40x magnification using a Leica M80 dissecting microscope illuminated with transmitted light.

In 2022, a preliminary analysis of an age reading for the North Atlantic stock was completed. Multiple readers read both spines and otoliths and biases were found between readers for both structures. The maximum modal age in spines was 7 years and in otoliths 5 years. The mean length at age from spines was similar to the mean lengths at age from the Arocha *et al.* (2003) study. Sampling, processing, and age readings will continue under the program which will contribute to development of new sex-specific growth models for the three stocks.

Genetics, stock delineation, and mixing in Atlantic and Mediterranean swordfish

The objectives of the genetics study are to a) sequence the swordfish genome and identify genetic markers for differentiating between the three stocks, b) evaluate stock boundaries, and c) identify stock mixing areas.

The swordfish genome assembly was completed using a sequencing strategy that combined Oxford Nanopore (MinION) and Illumina (NovaSeq 6000) technologies following standard analysis in a well-established bioinformatics workflow.

By comparing the swordfish genome with that of other 19 fish species, the percentage of swordfish-specific genes and the percentage genes shared was identified. A Gene Ontology Enrichment Analysis (GOEA) was performed on several swordfish-specific orthologous groups to highlight their involvement on Biological Process, Molecular Function and Cellular component. Finally, the new assembled genome was used as a reference genome to guide the double digest restriction-site associated DNA (ddRAD) analysis. Accordingly, the rationale behind this strategy was based on: 1) the better performances (i.e. precision) of the genotyping when guided with a reference genome, and 2) the finer scale of resolution and the expanded set of biological questions that can be addressed when a reference genome is available.

Double digest restriction-site associated DNA (ddRAD) sequencing technology was applied to obtain more than 40,000 SNPs for the analysis of genetic differences among 672 samples collected from the North Atlantic, South Atlantic and Mediterranean stocks. In particular, from the North Atlantic, 322 samples were analyzed, of which 54 samples from BIL92, 12 samples from BIL93, 44 samples from BIL94A, 182 samples from BIL94B and 30 samples from BIL94C. From the South Atlantic a total of 105 samples were analysed of which 11 were from BIL96 and 94 from BIL97. Finally, from the Mediterranean, 243 samples were analysed of which more than 100 were from Balearic Islands. Samples were selected homogeneously not only on the basis of the catch area but also on the basis of gender, gonad maturity, length/weight, and period of catch.

To analyze genetic differentiation among samples, several statistical analyses including Principal Component Analysis (PCA), Discriminant Analysis of Principal Component (DAPC), pairwise genetic distances (heatmap matrix), NEIGHBOR-JOINING Cladogram were applied. Regarding genetic differentiation index such as, Fixation index (FST), Heterozygosity (both observed and expected), Observed heterozigosity related to single codifying genes, Inbreeding coefficient (FIS) and Allelic richness (both mean and total) were also calculated. Genetic structure was evaluated quantifying allelic frequencies clusters and their distribution among samples. Two populations were clearly identified among the whole samples analyzed and considerable evidence on the presence of subpopulations within the two populations emerged from the first 288 samples analyzed, and in 2022 an additional 672 samples were analysed.

Also in 2022, Whole Genome Sequencing (WGS) analysis has been completed on 30 samples from each stock in order to identify a set of SNPs that can be used to assign an unknown sample to one of the stocks and to identify sex-specific regions to assign sex to an unknown sample.

The coupling of SNPs and WGS analyses with a genome assembly showed that: 1) The Mediterranean stock is strongly genetically differentiated from the two Atlantic stocks. 2) the North Atlantic and the South Atlantic stocks are weakly differentiated, and their differentiation is detectable only with few statistical tests, 3) The coupling of genome-wide SNPs analysis with a genome assembly of the allelic richness is the optimal genetic diversity index to monitor these stocks. 4) the Mediterranean stock is losing allelic richness of important genes associated with detoxification, immune response, vitamin up-take and metabolism and serotonin signaling. 5) In the East-North Atlantic a mixing area for all three stocks was found and the presence of these animals should be considered when genetic variability is monitored in this area. 6) no animals belonging to the North Atlantic stock have been found in the Mediterranean Sea.

Tagging

The objective of the swordfish tagging study is to analyse the vertical habitat-use and migration patterns of swordfish and help to delimit the stock boundaries and mixing rate of swordfish between the Mediterranean Sea and the North and South Atlantic. Forty-four ICCAT funded tags have been acquired since 2018, when the tagging program was implemented. To date, a total of 26 miniPAT tags (10 tags have been provided by NOAA) have been deployed in the North (n = 13) and South Atlantic (n = 9) and the Mediterranean Sea (n = 4). Data from 10 tags, with deployment days between 67 and 240 days, show that swordfish moved in several directions, travelling considerable distances in both the North and South Atlantic Ocean, while having shorter displacements in the Mediterranean Sea. Regarding vertical habitat use, swordfish spent most of the daytime in deeper/colder waters, and were closer to the surface during the night-time, mostly between the surface and 50 meters in depth. Updates of this work are regularly provided to the SCRS/SWO-SG with the latest one presented in Rosa *et al*. (2022).

Management Strategy Evaluation in the North Atlantic

Initiated in 2018, ICCAT awarded a contract for MSE operating model and management procedure development to an expert team. In 2019 a new contract was awarded to a different contractor and most of the work in 2019 was devoted to conditioning the Operating Model (OM). The Committee agreed to use the Base Case stock synthesis assessment from 2017 to set up the initial OM design based on a factorial design (i.e. grid) to develop scenarios that represent the main uncertainties identified. This grid was constructed and provided following the MSE workshops/courses organized by ICCAT in 2018, which resulted in a paper presented to the SCRS (Rosa *et al.*, 2018b). The current OMs are composed of an uncertainty grid of 216 Stock Synthesis III (SS3) models with alternative assumptions including a range of assumed values for natural mortality, variance in recruitment deviations, and steepness of the stock-recruitment relationship, and other assumptions such as degree of observation error in the indices of abundance. For 2022, the ICCAT MSE roadmap requested completing the work on conditioning the OM grid and starting the development of candidate management procedures (CMPs). The same contractor from 2019 - 2021 was awarded the 2022 contract to continue this work. Much of the work conducted in 2022 has been related to reconditioning the OM grid with the 2022 northern swordfish stock assessment model (and associated indices and data) as a base case. In addition, the contractor and technical team explored and worked to validate the OM grid of models, evaluated the relative importance of the 6 axes of uncertainty; developed and tested initial CMPs; and developed a communications plan for engaging with Panel 4 and stakeholders. In 2022, time was dedicated to MSE issues at the 2022 ICCAT Atlantic Swordfish Data Preparatory Meeting *(March 21 to 1 April 2022)* (Anon., 2022b) and during the 2022 ICCAT Atlantic Swordfish Stock Assessment Meeting *(20-28 June 2022)* (Anon., 2022k) with regard to implications of the new assessment model for NSWO MSE and associated timelines. Subsequently, the core technical team met regularly to further discuss in more detail issues related to conditioning the OM grid based on the 2022 assessment model and start the development of CMPs. There was additional discussion on robustness OMs, advice and assessment intervals, red-face tests, and development of criteria for identifying exceptional circumstances.

In 2022, the contractor continued the work in collaboration with the Committee and most of the discussions and developments were regarding development of the performance metrics, finalizing the OM grid, and evaluating the relative importance of the uncertainties to the selection of the CMPs. Results from the evaluation of axes of uncertainty in the reconditioned OM grid reveal that the three levels of natural mortality and steepness have the largest impact on the estimated stock dynamics and stock status. The evaluation of the preliminary surplus production CMPs was focused on the 9 operating models that spanned these key uncertainties.

Expenditures in 2021 and 2022

The total budgets within SWOYP in 2018, 2019 and 2020 amounted to €199,000, €373,700 and €280,614, respectively. The effective expenditures for that period were of €149,895, €312,434 and €194,734, respectively.

In 2021 and 2022 to implement the main activities planned in the framework of SWOYP, the total budget of provided by ICCAT amounted to €343,480 and €150,000, respectively.

The detailed fund available for SWOYP during 2021 and 2022 and respective expenditures as off 16 September 2022 are detailed in the table below.

Year	*2021*		*2022*	
Component	*Budget (€)*	*Expenditure (€)*	*Budget (€)*	*Expenditure (€)*
Tagging	16,500	5,147	10,000	191
Biological studies	15,750	4,500	15,000	-
Genetics	69,630	20,640	70,000	-
Age and growth	50,750	15,000	45,000	-
Sample collection and shipping	12,750	4,500	10,000	-
MSE	178,100	132,967	-	-
TOTAL	**343,480**	**182,754**	**150,000**	**191**

2023 Plan and activities

Sampling

The focus of SWOYP has largely shifted to analysis of samples already collected by the program, however, sampling will continue in 2023, targeting spatial sampling gaps: the Gulf of Mexico, Caribbean, Strait of Gibraltar, the far Eastern Mediterranean, the mid-North Atlantic, Southern Brazil and the area stretching east along the 30°S parallel. Additional effort will be invested in collecting gonads and otoliths as these materials have been more challenging to acquire. In addition, otolith-spine pairs in larger fish, will be collected to support the growth curve modelling. Additional CPCs and institutes are welcomed and encouraged to support sample collection and analysis.

Reproductive biology

The reproductive biology component of the SWOYP will continue in 2023 with processing and imaging of gonads. A reproduction, ageing and growth workshop in 2023 will focus on creating a reference set of histological images and CPC scientists involved in the study will work to standardize their methods for determining maturity stage. Anticipating increased capacity in the group to evaluate maturity stage, we expect that the preliminary maturity ogives developed in previous project phases will be updated for the North Atlantic and Mediterranean stocks in 2023. Additional samples are required before this work can be initiated for the South Atlantic. Preliminary work will begin in 2023 to estimate fecundity by stock.

Ageing and growth

The ageing and growth component of the SWOYP will have three main directions in 2023: continued age readings from spines and otoliths, grow modeling, and age validation through bomb radiocarbon analysis. A core team of age readers has prepared a reference set of fin spines and otoliths and have conducted an initial calibration exercise. This Group will continue their readings to increase the number of samples included in the growth modeling. New in 2023 is the inclusion of bomb radiocarbon analysis. This analysis will allow for validation of age readings.

Genetics

Genetics work in 2023 will continue the population analysis of tissues samples coming from new areas (South Africa, Brazil, North Central Atlantic Ocean, Strait of Gibraltar, North African coast) for stock differentiation analysis. In 2023, the genetics team will conduct a pilot study on epigenetic ageing, to correlate with otoliths, spines and the bomb radiocarbon study.

Tagging

Tagging work will continue in 2023 with deployment of tags already on-hand. This work will continue to support studies on swordfish distribution, movement, and habitat use. These data will also support ongoing work on the swordfish species distribution model.

Management Strategy Evaluation

The Swordfish Species Group is scheduled to provide the Commission with a final set of CMPs by the end of 2023 for use in management advice for 2024. In 2023, the work will continue, mostly related to CMP development, as defined in the ICCAT MSE roadmap, and to engage with Panel 4 and stakeholders on the refinement of performance metrics and development and selection of a MP. Results would be presented to the Commission at intersessional meetings of Panel 4 and at the Commission meeting in later 2023. The Species Group will also initiate a preliminary simulation study to explore the suitability of MSE in the South Atlantic Stock.

Appendix 13

Report of the 2022 Meeting of the Subcommittee on Statistics

(Hybrid meeting, 19 September 2022)

1. Opening, adoption of Agenda and meeting arrangements

The Subcommittee on Statistics (SC-STAT) annual meeting was held in Madrid on 19 September 2022, under a hybrid format. The Chair of the SC-STAT, Dr Pedro Lino (EU), opened the meeting. The ICCAT Executive Secretary, Mr. Camille Manel, welcomed the Subcommittee and highlighted the importance of its work and the commitment of the Secretariat to support the work of SCRS and the Commission. The Chair of the Subcommittee, highlighting the complexity associated to hybrid meetings, reinforced the need to work efficiently focusing on the main aspects.

The Agenda was discussed and adopted (**Appendix 1**) without modifications. Mr. Carlos Palma and Mr. Carlos Mayor (ICCAT Secretariat) served as rapporteurs to the meeting. The List of Participants is attached as **Appendix 2.** The List the Documents presented during the meeting is summarised in **Appendix 3,** with the respective summaries provided in **Appendix 4.**

2. Summary of fisheries and biological data submitted during 2022 (Tasks 1, 2 and 3), including historical revisions

The Secretariat provided a summary of the data reported to date (an overview of the 2022 detailed Secretariat Report on Research and Statistics) covering the activities and the information on fisheries statistics and biological data received (including revision to historical data) between 1 October 2021 and 8 September 2022 (the Reporting Period). Furthermore, all the basic fisheries statistics and biological information have been presented by the Secretariat to the SCRS Working Groups during the SCRS intersessional meetings.

After five years of continuous improvements, the Secretariat observed in the last three years (2019, 2020 and 2021, even noting that 2021 was somehow better than 2020) a slight regression in data completion quality. More datasets have only passed the SCRS filtering criteria after the corrections had been made by the Secretariat (errors mostly linked to incomplete forms and invalid use of ICCAT codes). In addition, the information submitted using old electronic forms (versions prior to version 2022) increased, with 14 ICCAT CPCs submitting information in old form versions during the Reporting Period compared to 11 CPCs of 2021. The Subcommittee reminds the CPCs that, only the latest version of the electronic forms is valid to submit new and historical data as they incorporate the latest changes approved by the SCRS.

Regarding the activities conducted by the Secretariat, in the most recent years, in addition to the normal activities developed on statistics, publications, data funds management and others, the Secretariat is dedicating (apart from the usual preparation of the majority of the data sets required for each data preparatory meeting and each stock assessment) substantial additional work to stock assessment activities, whether participating actively in the assessment or coordinating and managing external support to the SCRS work. In addition, the statistical work requested to the Secretariat, together with some lack of adherence to deadlines established for data submission, continues to constitute significant additional work for the Secretariat. However, to partially mitigate the consequences of the already excessive workload, the Secretariat has been able to expand whenever possible the automation of data integration and validation procedures.

The Secretariat applied to the 2021 datasets reported the SCRS filtering criteria to accept/reject statistical forms (2013 Report of the Subcommittee on Statistics, Addendum 2 to the 2022 Secretariat Report on Research and Statistics, Filters 1 & 2) adopted in 2013. The results are based on total of 75 flags related to CPCs (50 CP + 1 CP [15 EU Member States] + 1 CP [5 UK flag States] + 5 NCC) with reporting obligations. The forms submitted with errors that the Secretariat was unable to correct until the end of the SCRS annual meeting were considered unreported data and shall require CPC revisions.

2.1 Basic Task 1 (T1FC and T1NC) and Task 2 (T2CE and T2SZ) statistics

The Secretariat presented a summary of the 2021 data reporting status of the two datasets of Task 1 statistics: 1) the Fleet Characteristics (T1FC), and 2) the Nominal Catches (T1NC), using the standard SCRS Report Cards (Tables 1 and 2 of the 2022 Secretariat Report on Research and Statistics, respectively).

The T1FC electronic form (ST01) is used to collect information on individual vessels (sub-form ST01A) and summarized information for vessels less than 20 m LOA (sub-form ST01B). The overall reporting of T1FC for 2021 was 81% (61 flags) higher than the 79% (59 flags) observed for 2020. Eight flags reported ST01 after the deadline, and the Secretariat made corrections to the information reported by 12 flags CPCs.

The T1NC electronic form (ST02) has 2 sub-forms: 1) ST02A used to report positive catches (landings, dead discards, and live releases), and 2) ST02B used to report "zero" catches. The overall reporting of T1NC data for 2021 was 87% (65 flags) slightly higher than for 2020 data (63 flags corresponding to 84%). Eight flags reported late, and the Secretariat made corrections to the datasets of 8 flags. Ten CPCs (13%) have yet to report their 2021 T1NC. The Secretariat reminded the Subcommittee that the new version of the ST02 form (2022) incorporated two new fields since 2020 aimed to report the conversion factors used to transform the landings and discards of each species, from product weight (head off, gutted, gilled and gutted, etc.) into round/live weight equivalent.

The T2CE electronic form (ST03) has not had any major change in recent years. The T2CE report card is presented in Table 3 of the 2022 Secretariat Report on Research and Statistics. A total of 53 flags (71%), including 7 late reporting flags, reported T2CE. Similar indicators to the ones when compared to the 2020 data (52 flags corresponding to 69%). Nineteen flag CPCs (29%) have yet to report T2CE data for 2021.

The T2SZ report card (containing data from both ST04 and ST05 electronic forms) is presented in Table 4 of the 2022 Secretariat Report on Research and Statistics. A total of 43 flag CPCs (57%), including 2 late reporting flag CPCs, submitted 2021 size data. A total of 32 flag CPCs (43%) have yet to submit 2021 size data (reporting ratios slightly worse than 2019 and 2020 T2SZ data submission).

The Secretariat informed that 6 flags CPCs reported no fishing activity on ICCAT species ("0" catches in all species) for the 2021 calendar year. The list of flags with "0" catch reports is published in the Table 5 of the 2022 Secretariat Report on Research and Statistics, which presents a summarised view of all the Task 1 and Task 2 reporting status. The Secretariat also informed the Subcommittee that it continues to receive ST type forms using wrong ICCAT codes.

The Subcommittee requested that a figure showing the overall evolution of the Task 1 and Task 2 data provision over the last five SCRS meetings be prepared (similar to Figure 1 of the 2022 Secretariat Report on Research and Statistics) aimed to have a broader perspective of the ICCAT flag CPCs reporting status at the beginning of each SCRS annual meeting. **Figure 1** was prepared for that purpose.

The Subcommittee acknowledged that for the third year the ST02 form required CPCs to report the Conversion Factors used to transform product weight into round weight, and that this new requirement might have contributed to the reduction in data quality reporting (not providing it, does not allow to pass the filtering criteria). The Subcommittee hopes that once all CPCs become familiar with this new field in the ST02 form, the data quality will once again improve.

The Secretariat informed that, globally across all the Task 1 and 2 datasets, the most common deficiencies continue to be the forms incompleteness on the header and detailed sections, empty sub-forms (e.g. ST01B for small scale vessels; ST02B for "0" catches), use of non-ICCAT codes, and the use of old form versions which increased in 2022 to nearly 80 forms (7% of the total) reported by 14 flag CPCs. The Subcommittee discussed at length the reasons why some CPCs have cells appearing in "orange" (corrections made by the Secretariat that could require a CPC confirmation and/or revision) in the SCRS report cards (Tables 1 to 5 of the 2022 Secretariat Report on Research and Statistics). After some clarifications, the Subcommittee encouraged the CPCs needing clarifications on their reporting status to contact the Secretariat individually to resolve these issues.

The Secretariat provided a demonstration of an improved version of the T1NC dashboard with the most recent Task 1 nominal catches. This dashboard allows to visualise and query Task 1 catch series in multi dimensions online (web dissemination possibilities). The Secretariat recalled that, improved versions of the T1NC dashboard were also prepared for the 2022 Species Groups intersessional meetings. The Subcommittee commended the Secretariat and considered that the T1NC dashboard is now prepared for dissemination.

2.2 Tagging

The Secretariat provided a summary of the tagging data received by the Secretariat during the Reporting Period. The different laboratories and scientific institutions conducting electronic tagging in the ICCAT Convention area reported a total of 379 releases and 38 recoveries. With respect to the conventional tagging (summary in Table 7 of the 2022 Secretariat Report on Research and Statistics), a total of 9,023 tags were deployed and 554 were recovered. On the same period, the Secretariat distributed about 3,255 conventional tags, primarily under the tagging projects of the Atlantic-Wide Research Programme for Bluefin Tuna (GBYP). Several ongoing projects on the conventional tagging such as, the database merge process (ICCAT, AOTTP, and GBYP), the integration of pending datasets received by ICCAT (e.g. some USA past submissions mostly with revisions), the recovery of the shark species sex information, and the overall quality control checks on all tagging datasets, all aiming to increase the quality of the conventional tagging information managed by ICCAT.

The Secretariat also presented an improved version of the dashboard with porbeagle (based on the AOTTP dashboard used during the AOTTP symposium) and a Map Viewer (interactive GIS system) with skipjack conventional tagging. The Subcommittee welcomed the Secretariat's work on these dynamic conventional tagging tools, and also considered that these tools are ready for public dissemination.

2.3 Complementary data obtained within ICCAT data collection and research programmes (GBYP, AOTTP, EPBR, SMTYP and SRDCP)

The data recovery activities conducted within ICCAT research programmes (GBYP, AOTTP, EPBR, SMTYP and SRDCP) have contributed historically with great improvements to the ICCAT fisheries statistics by recovering missing or incomplete catch series and biological samples. However, no major fisheries statistics datasets were recovered under these programmes during 2022.

All historical revisions made during the reporting period are presented in Table 13 (T1NC), Table 16 (T2CE), and Table 17 (T2SZ) of the 2022 Secretariat Report on Research and Statistics, which also contains the supported SCRS documents and the adoption status of the respective Species Group.

2.4 Other relevant statistics (observer data, VMS, BCDs, ISSF, etc.)

Domestic Observer data is submitted using the 2022 version of the form ST09 (adopted in 2019). The Secretariat indicated that the number of flag CPCs submitting observer data using the ST09 has shown a slight increase from 21 in 2021 (2020 data) to 24 in 2022 (2021 data) under the reporting periods (Annex 4 of the 2022 Secretariat Report on Research and Statistics). Table 9 of that Report provides a summary of ST09-DomObPrg data reported for 2021 by discard fate and Species Group including sharks, sea turtles, and seabirds. Table 10 of the 2022 Secretariat Report on Research and Statistics contains T1NC data for by-catch species for 2021. A summary of the information submitted on ST09 forms for sea turtles and seabirds is provided in Table12 and 13 of the 2022 Secretariat Report on Research and Statistics, respectively.

The Secretariat provided an overview with the statistical information available on tropical support vessels activity (form ST07) and FAD data (form ST08). Appendix 2 of the 2022 Secretariat Report on Research and Statistics provides a summary of FAD information received in FAD Management Plans and ST08 forms for 2021 (some datasets could require revisions). A short presentation was also given by the Secretariat summarising the work done during the 2022 Second intersessional meeting of Panel 1, where these matters discussed in depth.

2.5 Historical revisions

An update to Task 1 occurred within the Small Tunas Species Group in 2021 with the decision to include in the small tuna official list of species, the species *Scomberomorus commerson* (Lacepède, 1800) known as "narrow-barred Spanish mackerel" (FAO code: COM). Several COM catches series were included in Task 1, based on the historical recovery of COM catches in the Mediterranean Sea (Di Natale *et al.,* 2020) combined with the FAO catches series (National statistics reported to FAO) explicitly requested to FAO for that meeting. The Secretariat informed that, no COM Task 1 nominal catches were reported to ICCAT since 2021 and none of the planned CPC full revisions of their COM catches series were made.

All the other T1NC, T2CE and T2SZ dataset revisions (details in Tables 13, 16 and 17 of the 2022 Secretariat Report on Research and Statistics, respectively) were presented and approved by the respective Species Groups during the 2021 intersessional meetings.

2.6 Relevant documents to statistics

Four documents were presented to the Subcommittee.

Diaz *et al.* (2022) provides a U.S. revision of shark dead discards reported to ICCAT between 1987 and 2000. During that period, three different statistical approaches were used to estimate dead discards. For the period 1987-1995, dead discards of unclassified sharks were reported as 'coastal' shark dead discards. From 1996-2000, dead discards reported as 'coastal' and 'pelagic' sharks corresponded to species with low representation in the data and they were re-estimated to the species level using the latest methodology used by the U.S. to estimate dead and live discards of a variety of species.

The Subcommittee acknowledged this important U.S. revision on the species discrimination of pelagic (PXX) and coastal (CXX) unclassified sharks, which greatly benefits the quality and consistency of Task 1 statistics. The Secretariat also informed that, with this revision, PXX and CXX species codes almost disappeared from Task 1.

Quesada *et al*. (2022a) provides a historical reconstruction of the historical medium scale (length overall below 20 meters) surface longline (LL-surf) catches of Costa Rica in their EEZ between 1999 and 2020. The rebuild of the catch series estimated for the major ICCAT species (including sharks), was based on the LL-surf fleet structure (number of active vessels per year) recovered by Costa Rica since 1999 and the official landing statistics (INCOPESCA) and auction sales receipts over time. Quesada *et al.* (2022b) complements it containing the recovery of swordfish catches of Costa Rica already adopted by the Swordfish Species Group.

The Subcommittee, after being informed by the Secretariat that these catch series between 1999 and 2019 did not exist in the Task 1, welcomed the new information to the ICCAT fisheries statistics. A doubt was raised about if the existing ICCAT restrictions on silky shark catches, would apply to Costa Rica. The representative of Costa Rica noted that, as a developing coastal state, potential exemptions could apply to Costa Rica.

The Report of the Sub-group on Electronic Monitoring Systems: Proposal of draft ICCAT minimum technical standards for EMS in pelagic longliners (Anon., 2022p) summarizes the work that has been carried out to date by the Sub-group on Electronic Monitoring Systems, (EMS) since it was originally created in 2021. It includes a summary of the main conclusions of the work that was carried out, and also a proposal with the draft minimum technical standards for implementation of EMS in pelagic longliners in ICCAT fisheries. A draft response to the Commission following the request contained in ICCAT Rec. 19-05 (paragraph 20) is also provided.

This Subcommittee acknowledged the work of the Sub-group on Electronic Monitoring Systems. After a deep discussion of the technical aspects of the proposed minimum technical standards for implementing the EMS on pelagic longliners fishing for ICCAT species, where important question were raised such has the potential to extend this proposal to other fleet types operating other gears such as gillnets were debated, the Subcommittee supported the proposal and the draft responses to the Commission behind Rec. 19-05 and 21-01, presented in section 6 of this report.

Benjamin *et al.* (2022) provides a review of St Helena small scale fisheries targeting several ICCAT species, including tropical tunas and wahoo. This fishery started in 1977 and the commercial fishing fleet is composed of small-scale vessels with variable fishing effort depending on the export market. A review of fishing gear codes and geographical locations of both Task 1 catches and Task 2 catch and effort datasets reported to ICCAT across the entire Sta. Helena series (1977-2020) permitted to identify several inconsistencies. Corrections to gears, sampling areas and geographical locations are here presented aiming to improve the historical catch statistics of St Helena available in the ICCAT databases.

The Subcommittee acknowledged the statistical revision presented by St Helena, and, suggested that more revisions of this kind from ICCAT CPCs would greatly improve the ICCAT statistics. The Secretariat informed that this correction was already included in the ICCAT databases.

3. Summary of Secretariat's standard (yearly based) data sets estimations

3.1 CATDIS and EFFDIS

The CATDIS (catch distribution: estimation of T1NC for the nine major tuna and tuna-like species of ICCAT, stratified by year, flag, fleet, gear, fishing mode, catch type, trimester, and 5×5 degree squares) is one of the most used ICCAT catch estimations, with a particular focus on the latest stock assessments of ICCAT using integrated stock synthesis models (SS3, Maunder and Punt, 2013). As approved by the SCRS in 2021 (see Appendix 11 of *Report for Biennial Period 2020-21, Part II (2021), Vol. 2*), the Secretariat has updated the CATDIS from 1950 to 2020 according to the plan established:

1. Update the CATDIS (1950-2020) in December/2021 using the most recent statistics approved by the SCRS/Commission and publish the Statistical Bulletin Vol. 47 in January 2022. Extraordinarily, the Statistical Bulletin Vol. 47 published in January/2022 will have merges two CATDIS estimations (1st: 1950-2019; 2nd: 1950-2020).

2. The following volumes will return to the normal publication schedule in January each year (Jan/2023: Vol 48 with 1950-2021 series; Jan/2024: Vol 49 with 1950-2022 series, etc.).

At the end of 2022, the Secretariat will update the CATDIS for 1950-2021 with the latest Task 1 and Task 2 datasets adopted by the SCRS and publish it in January 2023 (WEB and Statistical Bulletin Vol. 48). As expected, this approach had greatly benefited the 2022 intersessional work of the Species Groups and the SCRS, where no intermediate updates were made to CATDIS.

Once again, the CATDIS has not included the estimations of four additional species: spearfish (SPF), blue shark (BSH), shortfin mako (SMA) and porbeagle (POR), due to the lack of sufficient information in T2CE for these four species (**Appendix 1**). However, some progress has been made on some data recoveries (e.g. the T2CE LL series of USA complemented now with sharks in the species catch composition), and new attempts should be made in the near future.

The Subcommittee acknowledge the Secretariat additional efforts to synchronize the CATDIS estimations with the adopted SCRS statistics in relation to the times series coverage, which will greatly benefit the future work of the SCRS and reduce the number of partial CATDIS updates required intersessionally.

The Subcommittee requested a status update of the EFFDIS estimations (new methodology and preliminary estimations, presented at the Subcommittee on Ecosystems (SC-ECO) in 2020, 2021 and 2022). The SC-ECO reviewed intersessionally in 2022 the data recovery proposal of this Subcommittee made in 2021, with the gap analyses of the catch-and-effort data (T2CE) in the ICCAT-DB". In addition, the Secretariat provided a study aiming to improve EFFDIS (Palma *et al*., 2022) using a cross validation of T1NC and T2CE datasets to identify completion weaknesses. Each T2CE dataset was classified into 3 categories of effort availability and type: a) number of hooks; b) other effort measure; c) no effort reported.

This study showed that, T2CE longline information for the Atlantic is reasonably complete and consistent from 2000 onwards. Therefore, the SC-ECO recommended to publish EFFDIS estimations of Atlantic longline from 2000 onwards on a regular basis on the ICCAT website.

The Subcommittee acknowledged and endorsed the SC-ECO recommendation (see recommendations section) but also commended the Secretariat to continue with the recovery and improvement of T2CE datasets according to the plan established in 2021 by the SC-STAT, that is:

- Identify CPCs with T2CE datasets of type (b) and (c),
- Request those identified datasets to ICCAT CPCs as, revisions (a), and new data (b), both with effort measures in number of hooks, including the catches of the 3 major shark species (blue shark, shortfin mako, and porbeagle) whenever possible.

The Subcommittee noted that when CPCs provide updates to their T2CE datasets, they must follow the standard SCRS rules for revising historical data which includes the provision of a SCRS paper with the update of the methods used on the data recovery or associated estimations.

3.2 CAS (catch-at-size) and CAA (catch-at-age)

The catch-at-size (CAS) database is complete and functional, with an active connection between the size data and the substitution tables used for the CAS estimations. This year, the Secretariat has made a full update to the CAS estimations of skipjack tuna (1969 to 2020) and a partial update to the eastern bluefin tuna stock (1950-2020). The catch-at-age matrices (CAA) were obtained by the Species Groups using various slicing methods on the CAS final matrices. The CAS of SKJ was only used to obtain the overall mean weights trends for both stocks.

4. Brief overview of data deficiencies pursuant to *Recommendation by ICCAT on compliance with statistical reporting obligations* (Rec. 05-09)

4.1 2019 Report cards with SCRS validation criteria (Filters 1 and 2)

The Secretariat applied, for the ninth consecutive year, the SCRS filtering criteria (Filter 1 and 2, described in Addendum 2 to the 2022 Secretariat Report on Research and Statistics of 2013 SCRS report, updated by the SCRS in 2016) to validate and accept Task 1 (form ST01 and ST02) and Task 2 (forms ST03, ST04 and ST05) statistics received under those official forms. The filtering criteria are also embedded in each one of these forms.

For 2021 data, Filter 1 was effectively applied, and the results are presented in the SCRS Report Cards (Tables 1, 2, 3, 4, and 5, with a summary in Figure 1 of the 2022 Secretariat Report on Research and Statistics). The “orange” cells indicate the datasets that have not passed Filter 1. However, most of the Task 1 forms rejected were corrected by the Secretariat and provisionally (marked for revision) integrated into the ICCAT database system (ICCAT-DB). As in the last four years, due to the lack of time, the Task 2 forms with 2021 data submitted during 2022 that did not pass Filter 1 were not yet corrected (left for future revisions with the respective CPCs). Filter 2 criteria was applied, and the results were made available to the Subcommittee for testing purposes (no available time to do demonstrations). Both filters were used on every Task 1 and Task 2 dataset received (scenario 2, methodology described in Palma and Gallego, 2015).

Although during the last 2 years the overall level of reporting has remained relatively constant (Figure 2 of the 2022 Secretariat Report on Research and Statistics), during the last eight years the Subcommittee and the Secretariat observed steady improvements in aspects such as the level of reporting (CPCs reporting ratios), slightly less “late-reporting”, slight improvements in the level of completeness of the forms (less incomplete) and the level of resolution of some information (in particular Task 2). This tool has proven to be very effective in imposing strict reporting obligations and minimum data quality standards that will benefit the work of ICCAT in the future.

4.2 SCRS Score cards and catalogues of major ICCAT species (last 30 years)

Recommendation by ICCAT on compliance with statistical reporting obligations (Rec. 05-09) recognized the need to establish clear process and procedures to identify data gaps, particularly those that limit the ability of SCRS to conduct robust stock assessments and to find appropriate means to address those gaps and evaluate the effectiveness of the ICCAT conservation and management measures. Particularly to evaluate how reducing uncertainty can help reduce the risk of failing to meet management objectives.

The SCRS catalogues, contribute to comply with Paragraph 1 of Rec. 05-09. The Secretariat presented in Annex 1 of the 2022 Secretariat Report on Research and Statistics, the SCRS catalogues on Task 1 and 2 data availability for the major ICCAT species, by stock, for the last 30 years (1992 to 2021). The small tuna species SCRS catalogues were also prepared and made available to the SCRS annual meeting. In addition, the Secretariat informed that, as recommended by the SCRS in 2020, the Secretariat continues to publish the two SCRS catalogues on the ICCAT website (www.iccat.int/en/accesingdb.html), the latest ones published in January 2022 with the information approved by the SCRS and the Commission in 2021.

The Subcommittee acknowledged that data submissions have greatly improved during the last decade. However, major deficiencies still exist for some ICCAT stocks particularly for the historical data. Once again, the Subcommittee agreed that the SCRS catalogues should be reviewed by the Species Groups, in particular by those ones that are scheduled to conduct stock assessments in 2023.

The SCRS scorecard, in the format adopted by the SCRS in 2019, is presented in Table 6 of the 2022 Secretariat Report on Research and Statistics with all the major ICCAT fisheries and covering the period 1992 to 2021.

Despite the multiple recommendations made by the Subcommittee and different Species Groups the reporting of total dead discards and live releases (see Section 2.4) continues to be very poor which impact the estimates of total biomass removals and total mortality needed to conduct robust stock assessments.

5. Brief overview of ICCAT Online Management System (IOMS) work

The ICCAT Online Reporting Technology Working Group (WG-ORT), whose mandate was established under Recommendation 16-19, and extended through Recommendation 19-12, will govern all the IOMS implementation process. A Meeting of the 2022 Online Reporting Technology Working Group (WG-ORT) was held in 2022 (see meeting report) where it was revised the existing workplan and planned the next few phases. The outcome of the release into production of the IOMS on 1 August 2012 (experimental year) was very satisfactory. The Secretariat informed the Subcommittee that, the 2022 annuals reports are now being reported by the ICCAT CPCs using the IOMS (Part I/Annex 1 and Part II/Section 3) with a great adherence of the ICCAT CPCs in the last couple of months. Two IOMS workshops (training sessions) were made by the Secretariat in 2022 to support the IOMS users.

For the 2022/2023 IOMS development period, the European Union (EU) has also granted (Project ref: 101058273 – EU-ICCAT-IOMS2021) a complementary contribution with an extraordinary budget for 1 year aiming to support the development of the IOMS vessel record module with the integration of the FLUX-TL system (details in the Report of the Meeting of the Online Reporting Technology Working Group (WG-ORT) *(Virtual, 7-8 February 2022)*) for managing EU vessels (and potentially other ICCAT CPC vessels) in a more efficient way. Due to the lack of time, no demonstration was made this time.

This Subcommittee maintains a strong collaboration with the WG-ORT since the beginning. At the 2021 WG-ORT intersessional meeting, the proposal by the Chair of this Subcommittee to develop the Task 1 module manager on the next development phase (Phase 3) was adopted, and lately confirmed by the WG-ORT in 2022. This Subcommittee recognises the crucial importance of the IOMS in the future of ICCAT and reiterates the full support to continue with the IOMS implementation.

6. Review of responses to the Commission (Recs. 19-05 and 21-01)

6.1 Develop recommendations for Electronic Monitoring Systems, Rec. 19-05, para 20

Background: *The Permanent Working Group for the Improvement of ICCAT Statistics and Conservation Measures (PWG), in cooperation with the SCRS, shall work to develop recommendations on the following issues for consideration at the 2021 annual meeting of the Commission:*

a) Minimum standard for an electronic monitoring system such as:

(i) the minimum specification of the recording equipment (e.g. resolution. recording time capacity, data storage type, data protection)

(ii) *the number of cameras to be installed at which points on board*

b) *What shall be recorded*
c) *Data to be analyzed, e.g. species, length, estimated weight, fishing operation details*
d) *Reporting format to the Secretariat*

In 2020 CPCs are encouraged to conduct trials on electronic monitoring and report the results back to the PWG and the SCRS in 2021 for their review.

Following the Commission request a Subgroup within the Billfish Species Group was created in 2021 to address this issue. The Subgroup noted that there were already minimum standards recommended by the SCRS for EMS on purse seine fisheries (Ruiz *et al*., 2017), which were endorsed by the Commission. The Subgroup then focused most of its work on pelagic longline fisheries, noting that other fisheries (e.g. gillnets) also need to be addressed in the future.

The Subgroup worked intersessionally during 2021 and 2022, focusing on the following items: revision of previous literature comparing human observers with EMS, comparison of what data can be collected by human observers versus EMS specifically for ICCAT pelagic longline fisheries (using ICCAT observer data form ST-09), and creating a draft proposal for ICCAT EMS minimum standards for pelagic longlines.

The summary of the main work and conclusions from this Subgroup was presented to SC-STATS in 2022 in the Report of the Sub-group on Electronic Monitoring Systems: Proposal of draft ICCAT minimum technical standards for EMS in pelagic longliners (Anon., 2022p). The Committee's proposal for ICCAT EMS minimum standards for pelagic longlines are provided below.

Draft ICCAT Minimum Technical Standards for EMS in pelagic longliners

Objectives

For the SCRS, the priority for electronic monitoring systems (EMS) is to implement them in a way that will allow the collection of fisheries data that are usable for scientific purposes. They should be designed in a way that complements, and to the extent possible, is consistent with what is currently collected by human scientific observers. The SCRS also recognizes that EMS may also be used for compliance and other purposes. As such, EMS should be implemented in a way that can address both scientific data collection and compliance objectives. EMS intended to address both objectives should be designed to at least meet the requirements of the more demanding objective. For instance, scientific data often must be collected at a finer (e.g., spatial, temporal) resolution than would be required for compliance purposes. In such a situation, meeting the minimum requirements needed for science, would allow use in both scenarios.

Structure (who is responsible)

While there are several possibilities for the EMS program structure, the SCRS will discuss two: decentralized and centralized programs. A "decentralized system," is where each CPC is responsible for EMS implementation in its own fleets, including the recordings, processing, data extraction and summarization, and submission of data to ICCAT (based on minimum standards to be adopted by the Commission). This is similar to what currently exists at the level of national observer programs for scientific purposes in ICCAT, where each CPC is responsible for their own programs and for reporting the required data to ICCAT. Since the cost of implementing this approach would be borne by the CPCs, there would be little financial costs for the Commission to develop or implement the program and a lower administrative burden for the ICCAT Secretariat. A potential issue, however, is inconsistent implementation of the EMS requirements across the ICCAT members – as has been the case with regard to the implementation of ICCAT's minimum standards for scientific observer programs (*Recommendation by ICCAT to Establish Minimum Standards for Fishing Vessel Scientific Observer Program* (Rec. 16-14)).

Another approach to EMS is to establish a "centralized system" that would be coordinated at the ICCAT Secretariat level. The benefits of this approach include a more consistent implementation of EMS requirements across the ICCAT members. It might also benefit CPCs who lack the resources to set up their own local EMS databases and auditing infrastructure. There are, however, significant challenges that would be associated with this approach, particularly related to the financial costs to the Commission and the administrative burden for the ICCAT Secretariat. Among others, issues regarding data sharing and confidentiality would also need to be addressed.

It is clear that there are important trade-offs associated with the approach selected. In addition, as has been done in the case of human observer programs in ICCAT fisheries, it may also be feasible to develop a combination of the two approaches depending on data and compliance needs of the fishery. These questions and trade-offs should be further considered by scientists and managers. Taking into consideration data needs and given the significant financial costs and other challenges associated with the implementation of centralized EMS however, the sub-group focused its work on the development of input related to a decentralized system. That said, a centralized program or combination of approaches could be considered in the future. The sub-group acknowledges, however, that such a structure or combination of approaches would require substantial additional work, as well as financial and administrative resources.

Periodic reviews

Electronic Monitoring systems should undergo regular evaluations to ensure they reach the outlined objectives. These periodic reviews also give the opportunity to incorporate new technologies (i.e. improved cameras, artificial intelligence) as they become available, as well as to update and incorporate new objectives. A review framework should also allow a faster implementation of the updated minimum standards, that can be reviewed and adapted as needed in the future.

Standards described in this document

1. Standards for onboard EMS technology, including equipment and camera system requirements, installation, and maintenance;
2. Standards for data storage requirements and what data are subject to those provisions;
3. Standards for data collection, review, and reporting to ICCAT;
4. Standards for data protection and potential privacy issues.

1. Standards for onboard EMS technology, including equipment and camera system requirements, installation and maintenance

Electronic Monitoring systems have to be capable to resist rough conditions at-sea with minimum human intervention. In many cases, proper maintenance and inspection can only be achieved at port, in-between long fishing trips.

The vessel owner/operator is responsible for notifying the national authority and/or the EMS service provider if their EM system is not functioning properly.

The EMS must be linked to a receiver (e.g. GPS, GNSS) which records vessel location, speed, and heading information, and is directly and continuously logged by the control box. The receiver must be installed and remain in a location where it continuously receives a strong signal.

The EMS should have a battery backup system with capacity to provide power if the main power source from the vessel fails, to allow proper shutdown of the system and not corrupt the data.

Access to administrative configuration tools and data must be password protected. The EMS must be proof against any manual data input or external data manipulation and record any attempt to tamper with the equipment or the archived data.

The specifications for selecting, installing, operating, and maintaining EMS and their equipment (cameras, sensors, data storage devices, etc.) onboard vessels should be based on performance standards rather than being prescriptive in terms of pure technical requirements.

The video cameras must be mounted and placed so as to provide clear and unobstructed views of the areas that are being covered (see example table below). There must be sufficient lighting to clearly illuminate the area and the individual specimens captured. If vessels fish at night and use artificial lights to illuminate the deck, the quality of images under these circumstances should be checked to ensure there isn’t excessive glare.

Longline vessels should be equipped with a sufficient number of cameras to allow data collection to the required standards (see table below for example of a 4-camera system), with sufficient resolution to determine the number, species, sizes and other details of the capture, and processing operations.

Crew should aim to ensure that all specimens that are caught, even those that are released, are handled in a manner that enables the video system to record each specimen brought onboard and each release, taking into consideration any adopted safe release guidelines.

In most cases video will be the primary data collection method, but it may be possible for some CPCs to collect the data needed for ICCAT submission using still images. Whichever the chosen method, the quality of the data must be sufficient to allow species identification and detailed measurements of specimens. To allow this, it is suggested that cameras recording video must have a resolution of no less than 720p, with a minimum frame rate of 5-10 FPS. Where still images are captured, it is suggested they are captured with a resolution of no less than 2MP, with a rate of image capture determined by the characteristics of each fishery. For both data collection methods, there will be different implications for data storage which will need to be considered by the CPCs at the point of implementation.

The EMS should be independent from the crew during the trip, with the exception of some basic maintenance such as periodically cleaning the camera lenses.

It is in general not necessary for the videos to record 24h/day, but only when relevant operations are taking place. For longline vessels, the EMS should be capable of initiating video recording, and record only during the period of gear deployment (aft camera) and gear retrieval operations (work deck, processing area, surrounding water cameras) (see **Table** below for an example of camera locations/specifications). Electronic monitoring systems must continue to record for at least 30 minutes after the end of the haulback operation to ensure that there are recordings of the processing or discarding of all the specimens captured. The capability of initiating and ending the recording can be controlled by sensors that continuously monitor the hydraulic pressure signal and drum rotation sensors; these hydraulic pressures from the sensors should be recorded and stored by the control box.

The system must include a control box that receives and stores the raw data provided by the sensors and cameras.

A wheelhouse monitor must include a user interface to provide information about the functioning of the system and for the vessel operator to monitor the control box, and cameras. This can include details such as current date and time (synchronized via GPS/GNSS), vessel location, current hydraulic pressure reading, presence of a data disk, percentage used of the data disk, and video recording status.

The EMS should have a self-diagnostic test for functionality of the system components and record the outcome of the tests.

Table. Example of a four-camera system EMS deployment for pelagic longlines.

Camera location	*Action covered*	*Possible data collected*
Aft of the boat	Setting operation	Set position, date, time
		Total number of hooks, hook types, hooks between floats
		Bait type/species
		Bait ratio (%)
		Mitigation measures used (painted bait, tori lines, line weight)
Work deck	Catch at hauling	Species ID/composition
		Specimen sizes
		Condition (dead/alive)
		Fate (retained/discarded)
		Predators observed
	Discarding (if hauled before discarded)	Discards by set
		Discards ID/composition
Processing area	Catch while processing	Species ID/composition
		Total catch by set
		Specimen sizes
		Sex
		Weights?
		Product type (fresh/processed)
Surrounding water area	Discarding (if discarded in the water)	Discards by set
		Discards ID/composition
		Condition of discards?

2. Standards for data storage requirements and what data are subject to those provisions

The control box must contain data storage systems adequate for the trip duration that each national program is designed to cover. Each vessel must have sufficient storage space for the specific trip duration.

Regulations relating to data storage and transmission should be flexible as new technology may allow for different ways of storing or transmitting data that are less logistically challenging or more efficient.

The system must be verified to be functioning properly before the start of each trip, remain powered on and positioned correctly for the duration of each trip.

3. *Standards for data collection, review and reporting to ICCAT*

Raw data (i.e. video recordings) will be managed by each CPC, which can designate a contracted EM service provider for its national program.

The review of the video footage for extraction of the data to be submitted to ICCAT should be done by the CPCs authorities directly, and/or by a contracted EM service provider assuring that EM records are analysed by a qualified and experienced EM analysts.

Each CPC must assure that the EMS should be able to collect, to the extent possible, the observer data that is required to be submitted to ICCAT (ST-09) or any subsequent update of the form.

Electronic Monitoring systems cannot fully replace all the functions of human scientific observer programs, such as biological sampling. Given that, EM should be used as a complement or supplement to such programs, and a minimum human observer coverage should still be maintained for scientific purposes. This is currently 5-10% for most ICCAT fisheries, although the SCRS has indicated in the past that higher coverages would be more appropriate.

The EMS analyses and data extraction require trained EMS analysts. One potential source are trained observers with at-sea experience, who are familiar with the fisheries and species identification. There may be the need for CPCs to train EMS analysts for their programs. The ICCAT Secretariat might be involved in providing standardized training for EMS analysts or signoff/approve training programmes implemented by each CPC, to improve and harmonize the data processing and extraction from the various national programs.

The analysis software should make entering the EMS records and generating the EM data as automatic as possible. This should include, among others, location, date, and time stamps on any activity identified by the cameras, as well as user-friendly tools to directly include information regarding the processed EMS data or reports, and generally expedite the EMS data analyses.

For measurements to be taken, catch will need to be positioned by the crew on one or more calibrated areas. A calibrated area is an area of known size, such as a hatch or area of the deck, that can be defined in the EMS analysis software (see example in **Figure** below).

Figure. Example of a calibrated hatch onboard a commercial fishing vessel. These areas will vary from vessel to vessel, depending on available surfaces and the species being measured. This image is provided as an example from a non-tuna fishery. For tuna and tuna-like fisheries, the defined areas will have to be larger to accommodate larger species.

Once data is collected, it should be subject to a quality control (QC) procedure, as is standard with most observer programmes, to ensure data quality. This procedure should be defined by each CPC and be repeatable. It may be necessary for minimum standards/requirements to be set for this procedure by the Commission.

Any conversion factors (e.g. length-length or length-weight) used by the CPCs must be reported to ICCAT and they should be the conversion factors adopted by the SCRS, when available.

CPCs are responsible for reporting the data to the ICCAT Secretariat using the ICCAT ST-09 electronic form, or any other forms that in the future might be developed and approved by the SCRS for EMS data reporting. Submission of EMS data should comply with the Task 1, 2, and 3 data submission deadlines established by the SCRS and adopted by the Commission.

4. Standards for data protection and potential privacy issues

With a decentralized program, in which each CPC is responsible for the implementation, recordings, extraction of data, and submission of data to ICCAT, the aspects relative to potential issues related to the privacy or confidentiality of the data will depend on national regulations and legislation. In a decentralized system, only the CPC that is responsible for the collection of the data has access to the original recordings. Those original data are therefore managed directly by each CPC national authority.

Data submitted to the Secretariat should follow the ICCAT Rules and Procedures for the Protection, Access to, and Dissemination of Data.

6.2. Minimum standards for Electronic Monitoring Systems in tropical tuna fisheries, Rec. 21-01, para 55

Background: *For longline vessels flying their flag 20 meters length overall (LOA) or greater targeting bigeye, yellowfin and/or skipjack in the Convention area, CPCs shall ensure a minimum of 10% observer coverage of fishing effort by 2022, through the presence of a human observer on board in accordance with* ***Annex 7*** *and/or an electronic monitoring system. For this purpose, the Working Group on Integrated Monitoring Measures (IMM WG), in cooperation with the SCRS, shall make a recommendation to the Commission for endorsement at its 2021 Annual meeting on the following:*

a) *Minimum standards for an electronic monitoring system such as:*

   i) the minimum specifications of the recording equipment (e.g. resolution, recording time capacity), data storage type, data protection
   ii) the number of cameras to be installed at which points on board

b) *What shall be recorded*

c) *Data analysis standards, e.g. converting video footage into actionable data by the use of artificial intelligence*

d) *Data to be analyzed, e.g. species, length, estimated weight, fishing operation details*

e) *Reporting format to the ICCAT Secretariat*

In 2020 CPCs are encouraged to conduct trials on electronic monitoring and report the results back to the IMM and the SCRS in 2021 for their review.

CPCs shall report the information collected by the observers or the electronic monitoring system from the previous year by 30 April to the ICCAT Secretariat and to SCRS taking into account CPC confidentiality requirements.

The Subcommittee recognized that several minimum standards for Electronic Monitoring Systems proposed for longliners can be applied in tropical tuna fisheries. However, the Subcommittee did not have the time to review those in detail and requested the Tropical tunas Species Group to include this task in their workplan for 2023.

7. Workplan for 2023

The following tasks represent continuous database improvements and maintenance that will continue during 2022 and beyond. The priority tasks (including the ones postponed in prior years) for 2022/2023 include:

- Upgrade all the ICCAT-DB system from MS-SQL server 2016 to MS-SQL server 2019
- Replace the stand-alone MS-ACCESS Task 2 databases on the web by SQLite equivalent ones
- Improve the "client applications" that manage the databases of the ICCAT-DB system
- Continue the development of the statistical/tagging dashboards (dynamic querying)
- Continue the tagging database development for both conventional and electronic tagging;
- Continue the Biological Sampling database development (includes data recovery/integration)
- Continue the standardization of the electronic forms (TG: tagging forms, CP: compliance forms)
- Extend the automatic data integration tools for the standardized electronic forms
- Continue the development of the GIS project (create a PostGIS server and geo-reference for all the ICCAT data available in ICCAT-DB)
- The adaptation/migration of all the databases of the ICCAT-DB system to the new ICCAT IOMS system

8. Recommendations

8.1 Progress with prior year Recommendations endorsed by the Subcommittee

Ongoing Tasks

- The Subcommittee recommends that the Secretariat continues the development of EFFDIS and present any updates at the next meeting of the SC-ECO.

- The Subcommittee recommends that the Secretariat in coordination with the SGs prepare a draft proposal for a workplan to guide the development of the Task 3 Biological database that will be presented at the next meeting of the Subcommittee.

- The Subcommittee recommends the continuation of the development of the ICCAT Integrated Online Management System (IOMS) and the work of the Online Reporting Technology Working Group (WG-ORT). As such, the Subcommittee recommends that the Commission fully supports this effort.

- The Subcommittee recommends initiating a Sub-group to address the Commission request (Rec. 19-05, para 20) to develop recommendations on the Electronic Monitoring Systems (EMS), particularly on longline fisheries from the scientific perspective. The Sub-group will incorporate expertise from other Species Groups and Subcommittees. The Subcommittee agreed that tasks of the Sub-group will include collection and analysis of past studies (e.g. reports and documents) regarding results from comparisons between observers and EMS, in order to start describing current knowledge, possible knowledge gaps and needs for additional experimental trials, and review the draft EM guidelines produced by the IMM. The Sub-group should report back to the Subcommittee, before considering submitting its findings to the SC-STATS in September this year.

- The Subcommittee also noted that according to ICCAT data catalogue, several CPCs have not reported statistical data for Atlantic recreational fisheries, despite the allocated financial resources made by the Commission to African western CPCs. The Subcommittee recommend investigating the difficulties and needs encountered by CPCs involved, aiming to improve the data collection and reporting.

- The Subcommittee recommended that the Secretariat work with those CPCs that are reporting Task 1 and 2 data using FAO gear codes instead of ICCAT gear codes to standardize their data submissions using the correct gear codes.

- The Secretariat should continue its work on the data recovery and the inventory process of tagging data for small tuna species. This process will require active participation of the national scientists that hold such data.

- The Subcommittee recommends that it is important for CPCs to also report data on discards-at-size for swordfish, in T2 data. This information is needed to address ICCAT Rec. 19-04, para 3: "In the development of the operating models, the Commission would like the SCRS to allow for the evaluation of minimum size limits as strategies to achieve management objectives".

- Considering the implications for stock assessment and the MSE process, the Subcommittee recommends that CPCs statistical correspondents should inform the Secretariat and SWO SG about the methodology used for collecting swordfish length and if it changed over time (curved or strait LJFL). The Secretariat will confirm with the statistical correspondents on the types of measurements submitted for swordfish.

- The Subcommittee recommends that the specification of the type of measurement (curved or strait LJFL) shall be included in any ICCAT Recommendation concerning size limits in swordfish.

- The Subcommittee on Ecosystems recommends that the Subcommittee on Statistics review the gaps in the catch-and-effort data in the ICCAT-DB (information to be provided by the Secretariat). Based on this review, the Subcommittee on Statistics should decide if it recommends uploading the current version of the EFFDIS to the ICCAT website or if the data gaps are significant enough to preclude the use of EFFDIS.

- The Subcommittee recommends that CPCs abide by the reporting obligation to report size samples collected by scientific observers using the ST04 form.

- The Subcommittee recommends that the Secretariat, in collaboration with the SCRS and national scientists, review and update the list of by-catch species in the ICCAT database.

Pending tasks

- The Subcommittee recommends that the Secretariat prepare and make readily available the list of head of scientific delegations including their contact information and maintain it as a living document.

- The Subcommittee recommends that CPCs recover historical catch and effort data and apply the proper units of effort (i.e. number of hooks) and provide information on the type of longline gear deployed (i.e. American style or mesopelagic).

- The Subcommittee once again recommends that the Species Groups provide the Secretariat with the range of lengths and weights that are considered biologically acceptable for each species.

- Noting that the catches of billfish species are scarce and largely under-reported in the Mediterranean Sea and taking into account that several CPCs had already implemented domestic observer programmes in BFT and SWO fisheries, the Subcommittee recommends the ICCAT CPCs with ICCAT fisheries in that area to duly provide their billfish catches (landings, dead discards and alive releases) for all species, including target, co-target and by-catch species.

- Statistical Correspondent and/or national scientists should revise, update, complete and submit their small tuna T1NC series to the Secretariat. This revision should take into account Appendix 5 (SCRS catalogues), the split of "unclassified" gear catches to specific gear codes, and the completeness of Task 1 gaps identified. The Statistical Correspondent and/or National scientists of CPCs should correct inconsistencies identified in Task 2 datasets (T2CE: catch & effort; T2SZ: size samples). In addition, for the 13 species of small tuna, the T2SZ revision should follow the

SCRS recommendation on the T2SZ stratification (month, gear, 1°x1° geographical squares for surface gears/up to 5°x5° squares for longlines, SFL size classes of 1 cm in lower limits). CPCs should further improve their estimates of total catches, as there are still important gaps in the basic data available. These data are required inputs for most of the data-limited stock assessment methods.

- The Subcommittee continues to note that there is a general lack of discard data reported by most CPCs, including dead discards and live releases. The Subcommittee reminds CPCs that the reporting of discards is required and is essential for assessing the stocks status. Such information is required to be provided by CPCs well in advance of the next stock assessment. The Subcommittee also strongly recommends that both dead and live discards be estimated by each CPC and reported to ICCAT, backwards in time as much as possible.

8.2 Review of Recommendations from 2022 inter-sessional meetings

The Subcommittee reviewed the recommendations for statistics from the 2022 intersessional meetings.

The following recommendations were endorsed by the Subcommittee:

8.2.1 Skipjack

- The Group notes the lack of 1°x1°by month for surface fisheries Task 2 CE data from several CPCs, or inconsistencies between Task 1 and Task 2. To obtain a better definition of stocks boundaries, the Group reiterates that CPCs should fully comply with the ICCAT data submission requirements.

- With regards to the “faux-poisson” estimations obtained from the method proposed by the Group (details in section 3.1), it is recommended that each CPC with PS FAD fishing activities use a similar approach (taking into account their own specificities on how “faux-poisson” is defined) to estimate the “faux-poisson” component of Task 1 catches for the 5 main species (BET, SKJ, YFT, LTA, and FRI). An alternative method to obtain those catches may also be accepted if properly justified (e.g. better approach, inappropriate method, others).

- The Group recommends a review of all the data on length-weight relationships with a view to estimate regional and or seasonal relationships to be used in the estimation of catch at size and potentially for the establishment of stock specific relationships. The Group recommends that SKJ length-weight relationships should be sampled and analysed more regularly ideally from scientific observer programs, to provide more data to support length-weight parameters required for stock assessment.

8.2.2 Swordfish

- The Group recommends that the straight-curved lower jaw fork length relationships presented in Coelho *et al*. (2022), be adopted for use for lengths conversions in the 2022 Stock Assessment. Pending further data collection and analysis the Group recommends that the conversion be considered for the ICCAT list of approved conversions.

- Noting conflicting patterns in the CPUE indices developed by CPC scientists, the Group recommends that CPUE analysts from a Working Group that will work intersessionally to review the CPUE data inputs, treatments, and model assumptions and methods. The objective of this Group will be to diagnose conflicting trends in the CPUEs and improve the quality of indicators used in SWO assessment and N-SWO MSE.

8.2.3 Sharks

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

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

8.2.4 Subcommittee on Ecosystems

- The Subcommittee recommends that the Secretariat, in collaboration with the SCRS and national scientists, continue to review and update the list of by-catch species in the ICCAT database.

- The Subcommittee recommends that the EFFDIS estimates for the Atlantic region for 2000 onwards be posted for use on the ICCAT website.

8.3 Future recommendations

8.3.1 Recommendations without financial implications

1. The Subcommittee recommends that, where needed, the Secretariat updates the "read me" files associated with the different ICCAT Statistics Databases posted on the ICCAT Website.

2. The Subcommittee recommends that the Secretariat requests that CPCs identified as having reported T2CE datasets with incomplete information on effort (catches without effort), report revisions to ICCAT with the missing effort included and whenever possible the catches of the three major shark species (POR, BSH, SMA). The Secretariat should estimate the fractions of the total longline catches that do not have sufficient effort information in T2CE and estimate the impact of those datasets on the estimations of EFFDIS. These analyses completed with the gaps identified on the SCRS species catalogues should be presented at next meeting of the Subcommittee on Ecosystems.

3. The Subcommittee recommended that the Commission continue to support the development of the IOMS system.

4. To complete catch data series, the Subcommittee recommends that ICCAT develop a process to obtain catch statistics information from countries that are not currently part of ICCAT. It recommends that the acquisition of these data (through collaboration with FAO, other regional fisheries bodies, and CPCs) be elevated and addressed by the Commission itself.

5. The Subcommittee recommended that the T1NC dashboard should be published on the ICCAT website for general access to the public, simultaneously with the Task 1 statistics (January each year). In addition, independent T1NC dashboards should also be prepared for the Species Groups intersessional meetings.

6. The Subcommittee recommended that the conventional tagging (CTAG) dashboard and Map viewer should be published on the ICCAT website for general access to the public, simultaneously with the conventional tagging datasets (January each year). In addition, independent CTAG dashboards should also be prepared for the Species Groups intersessional meetings.

8.3.2 Recommendations with financial implications

- The Subcommittee recommended continued development of front-end applications for making and publishing graphically dashboards of ICCAT statistical datasets and provide the necessary financial resources for its full implementation (€6,000).

Billfishes

- The Group recommended that the necessary funds for the implementation of Billfish Species Group Regional workshops in West Africa and Caribbean for the improvement of statistical data collection and reporting, to be estimated intersessionally aiming for the endorsement of these funds by the 2021 SCRS Plenary for the 2022-2023 budget.

9. Other matters

Changes proposed to statistical (ST type) and tagging (TG type) electronic forms

The Subcommittee adopted two minor functional updates (no structural changes) to ST forms, for flexibility reasons:

a) ST01-T1FC: sub-form ST01B (individual vessel information) should allow, per year, more than one record per vessel. This allows to accommodate information of vessels fishing within a year with more than one gear type licenced to fish in one or more ICCAT fishery.
b) ST02-T1NC: Specifically used by the tropical PS catches (PortZone= "ETRO"). To differentiate the "faux poisson" estimated landings of a given species, from the normal landings of that species in the same strata, the field PortZone should use "ETRO-FP" (not "ETRO"). Both landing types (normal and "faux poisson") should use the field "qtyLkg" (Quantities landed- kg) for quantities.

The SCRS cannot respond to the observer coverage request this year due the lack of available/appropriate data. The SCRS reminds the Commission that Rec. 21-08 paragraph 98 states that the requirements and procedures required to undertake this analysis are to be developed by the Commission by 2023 taking into account CPC confidentiality requirements. In addition, paragraph 95 specifies a set of observer coverage rates that apply to implementing this recommendation, thus it would be beneficial to define how these coverage levels are to be calculated so that potential problems with inconsistencies in defined coverage levels for different CPCs can be avoided. The SCRS looks forward to understanding what these requirements and procedures are so that it may design a data collection form and to subsequently provide recommendations on how to improve the effectiveness of CPC's observer Programmes (specified in paragraph 99).

The Subcommittee acknowledged that, despite its already very heavy workload, the Secretariat continues to excel at its job. Therefore, the Subcommittee commended the Secretariat's staff for the excellent support they continue to provide to all the SCRS Species Groups and Subcommittees. This is particularly notable, taking into consideration the additional difficulties associated with conducting online and hybrid meetings due to the ongoing COVID limitations.

10. Adoption of the report and closure

The report of the meeting will be adopted during the SCRS Plenary meeting.

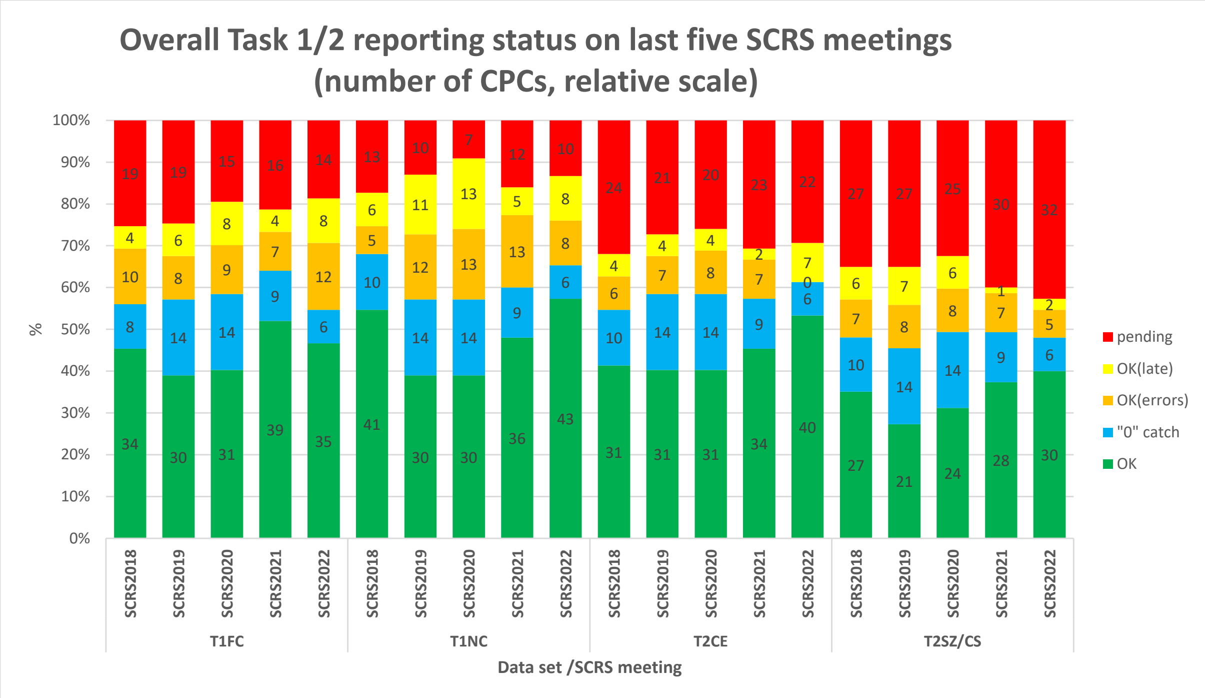

Figure 1. Overall evolution of the Task 1 (T1FC, T1NC) and Task 2 (T2CE, T2SZ/CS) reporting status (5 categories, see the 2022 Secretariat Report on Research and Statistics) over the last five SCRS annual meetings.

Appendix 14

List of Statistical and Tagging Correspondents by Country

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Appendix 15

Report of the 2022 Intersessional Meeting of the Subcommittee on Ecosystems and Bycatch

The detailed report of the 2022 Intersessional Meeting of the Subcommittee on Ecosystems and Bycatch is provided here.

Appendix 16

Revised roadmap for the ICCAT MSE processes adopted by the Commission in 2021

Document adopted at the 2021 Commission meeting and revised during the 2020 SCRS meeting as regards northern albacore and tropical tunas

(changes underlined with respect to the version adopted in 2021)

This schedule is intended to guide the development of harvest strategies for priority stocks identified in Rec. 15-07 (North Atlantic albacore, North Atlantic swordfish, eastern and western Atlantic bluefin tuna, and tropical tunas). It builds on the initial roadmap that was appended to the 2016 Annual Meeting report. It provides an aspirational timeline that is subject to revision and should be considered in conjunction with the stock assessment schedule that is revised annually by the SCRS.* Due to the amount of cross-disciplinary dialogue that may be needed, intersessional Panel meetings and/or meetings of the Standing Working Group to Enhance Dialogue between Fisheries Scientists and Managers (SWGSM) will be necessary. The aspirational nature of this timeline assumes adoption of a final management procedure for northern albacore in 2021 and interim management procedures for bluefin tuna in 2022, and northern swordfish and tropical tunas as soon as 2023. However, the exact timeline for delivery is contingent on funding, prioritization, and other work of the Commission and SCRS.

* For 2015 through <u>2021</u>, the roadmap reflects progress to-date in some detail. For <u>2022</u> onward, more general steps for the SCRS and Commission are anticipated pending outcomes of the <u>2022</u> Annual Meeting.

	Northern Albacore	*Bluefin Tuna*	*Northern Swordfish*	*Tropical Tunas*
2015	- Commission established management objectives in Rec. 15-04			- Commission provided initial guidance for the development of harvest strategies for priority stocks, including tropical tunas (Rec. 15-07)
2016	- SCRS conducted stock assessment - SCRS evaluated a range of candidate HCRs through MSE - PA2 identified performance indicators			- Commission identified performance indicators (Rec. 16-01). Commission adopted MSE roadmap, including plan for activities for tropical tunas for 2016-2021
2017	- SCRS evaluated the performance of candidate HCRs through MSE, using the performance indicators developed by PA2 - SWGSM narrowed the candidate HCRs and referred to Commission - Commission selected and adopted an HCR with associated TAC at the Annual Meeting (Rec. 17-04)	- SCRS conducted stock assessment - Core modelling group completed development of modelling framework	- SCRS conducted stock assessment	- SCRS reviewed performance indicators for YFT, SKJ, and BET - SWGSM recommended a multi-stock approach for development of MSE framework

	Northern Albacore	*Bluefin Tuna*	*Northern Swordfish*	*Tropical Tunas*
2018	- SCRS contracted independent expert to complete peer review of MSE code - Call for Tenders issued for peer review - SCRS tested the performance of the adopted HCR, as well as variations of the HCR, as requested in Rec. 17-04 - SCRS developed criteria for the identification of exceptional circumstances	- SCRS conducted joint MSE meeting on BFT/SWO - SCRS reviewed but could not adopt reference set of Oms - SCRS began testing candidate management procedures (MPs) - SWGSM considered qualitative management objectives - BFT WG reviewed progress and developed detailed road map - Commission adopted conceptual management objectives (Res. 18-03)	- SCRS conducted joint meeting on BFT/SWO MSE - SCRS contracted MSE technical expert to develop OM framework, define initial set of OMs, and conduct initial conditioning of OMs - SWGSM considered qualitative management objectives	- SCRS contracted with technical experts: start development of MSE framework (phase I) - SCRS conducted bigeye tuna stock assessment
2019	- SCRS addressed recommendations of the peer reviewer - SCRS updated performance of the interim HCR and variants - SCRS produced consolidated report on MSE 1. COMM: PA2 considered possible approaches that could be useful in developing guidance on a range of appropriate management responses if exceptional circumstances occur, including those implemented by other	- SCRS held three BFT MSE Technical Group meetings with significant progress but advised at least one additional year of work needed - SCRS continued to evaluate candidate MPs - At intersessional meeting, PA2 reviewed and developed initial operational management objectives and identified performance indicators - SCRS held December webinar to review OM progress	- SWO Species Group meeting - SCRS contracted with technical expert to develop initial MSE framework - Commission adopted conceptual management objectives at the Annual Meeting (Res. 19-14)	- SCRS conducted yellowfin tuna stock assessment - SCRS agreed on developing a western skipjack (W-SKJ) MSE and a multi-stock MSE (eastern skipjack, bigeye and yellowfin tuna) Commission updated MSE roadmap for the period 2019-2024[2] and requests that the SCRS "*refines the MSE process in line with the SCRS roadmap and continue testing the candidate*

[2] https://iccat.int/mse/en/COM_ROADMAP_ICCAT_MSE_PROCESS_ENG.pdf

	Northern Albacore	*Bluefin Tuna*	*Northern Swordfish*	*Tropical Tunas*
2019	RFMOs	COMM: PA2 reviewed MSE progress and advised the Commission on next steps, including the need for an update of the stock assessment to provide TAC advice for at least 2021		*management procedures. On this basis, the Commission shall review the candidate management procedures, including pre-agreed management actions to be taken under various stock conditions. These shall take into account the differential impacts of fishing operations (e.g. purse seine, longline and baitboat) on juvenile mortality and the yield at MSY."* (Rec. 19-02)
2020	1. COMM (PA2) developed guidance intersessionally on a range of appropriate management responses should exceptional circumstances be found to occur (5-6 March, PA2 intersessional)	1. SCRS conducted stock assessment update and developed TAC advice for 2021 and 2022	1. SCRS continued development of MSE framework, including the operating model conditioning and refinement of the uncertainty grid	COVID slowed progress on multi-stock MSE but SCRS developed a preliminary OM for W-SKJ MSE.
	2. SCRS conducted NALB stock assessment (in June)	2. COMM set TACs for at least 2021, based on stock assessment update, at the Annual Meeting (Rec. 20-06, Rec. 20-07).	2. SCRS developed example candidate MPs	
	3. SCRS evaluated existence of exceptional circumstances	3. SCRS continued development of MSE framework including the operating model conditioning and the uncertainty grid		
	4. COMM set new TAC for 2021 based on the HCR and 2020 assessment (Rec. 20-04)			

	Northern Albacore	*Bluefin Tuna*	*Northern Swordfish*	*Tropical Tunas*
2021	1. SCRS prepared inputs for a new MSE framework using the Stock Synthesis (SS) model	1. SCRS adopted reference (OM) grid and decided plausibility weighting	1. SCRS continued development and testing of candidate MPs. SCRS continued work on the reference (OM) grid, including diagnostics	1. COMM reviewed and proposed update of tropical tuna MSE roadmap
	2. SCRS evaluated existence of exceptional circumstances	2. SCRS initiated independent peer review of MSE code	2. SCRS continued work on criteria for determining exceptional circumstances, taking into account the exceptional circumstances protocol for NALB	2. SCRS agreed on major sources of uncertainty to be considered in the MSE and candidate performance indicators for tropical tuna MSEs
	3. COMM: a) reviewed and endorsed guidance developed intersessionally on management responses in the case of exceptional circumstances b) reviewed the interim HCR and adopt a long-term MP, including the TAC, at the Annual Meeting	3. SCRS continued development and testing of candidate MPs	3. SCRS initiated independent peer review of MSE code	3. SCRS conducted bigeye stock assessment
		4. SCRS/BFT SG initiated two additional subgroups on Indices and Modeling to address key issues. Subgroup on Growth in Farms continued its work	4. COMM (PA4) reviewed MSE progress, and began considering performance indicators and a limit reference point at the 1st Intersessional PA4 meeting. Additional dialogue in 2022 was proposed.	4. SCRS recommended modifying OM for W-SKJ to include the whole of the western Atlantic

	Northern Albacore	*Bluefin Tuna*	*Northern Swordfish*	*Tropical Tunas*
2021		5. COMM (PA2) – Intersessional Meetings held and updates on MSE progress provided by SCRS (March, September). Ambassadors workshops held in October.	5. The Group provided an update on the progress of the MSE to COMM/PA4 at the Annual Meeting	5. JCAP/ICCAT Training workshops on MSE and HCR held for Portuguese and Spanish speaking Scientists and Managers
		6. The SCRS presented an overview on the progress of the BFT MSE to the COMM (PA2) at the Annual Meeting (1-day prior), including conceptual illustrations on how candidate MPs would work and on the trade-offs in achieving different objectives. The workplan to complete the MSE was discussed, including the plan for future dialogue meetings. PA2 provided feedback to support next steps.		

	Northern Albacore	*Bluefin Tuna*	*Northern Swordfish*	*Tropical Tunas*
2022	1. SCRS to initiate independent peer review of MSE process			
	2. SCRS worked on a new SS model for NALB that will be used for future development of a new MSE reference grid	2. COMM (PA2) to meet intersessionally to: - recommend final operational management objectives and identify performance indicators - develop guidance on range of appropriate management responses should exceptional circumstances be found to occur	2. COMM (PA4) to recommend initial operational management objectives and identify performance indicators either intersessionally or during the Annual Meeting	2. SCRS to conduct SKJ stock assessments
	3. SCRS evaluated existence of exceptional circumstances	3. SCRS to conduct data preparatory meeting for EBFT (based on work conducted by subgroups on models and indices)	3. SCRS to conduct stock assessment (North and South Atlantic)	3. SCRS to agree on major sources of uncertainty to be considered in the MSE and candidate performance indicators for tropical tuna MSEs
		4. SCRS to complete MSE, incorporating feedback from COMM to be provided at dialogue meetings with PA2	4. SCRS to recondition OMs considering new information from the stock assessment and finalize OM grid	4. SCRS dialogue with PA1 on management objectives and performance indicators to be used for tropical tunas MSE
		5. COMM (PA2) and SCRS to meet intersessionally to consider final CMPs	5. SCRS to continue work on criteria for determining exceptional circumstances taking into account the exceptional circumstances protocol for NALB	5. SCRS to recondition OMs for SKJ in W-SKJ MSE model and ESKJ in mixed species MSE model in light of new SKJ assessments
		6. COMM to: a. consider SCRS guidance developed intersessionally on management responses in the case of exceptional circumstances, and b. adopt an MP at the Annual Meeting, including TAC	6. SCRS dialogue with PA4 on CMPs, operational management objectives and performance indicators	6. SCRS to initiate development and testing of candidate Management procedures (CMP) for W-SKJ

	Northern Albacore	*Bluefin Tuna*	*Northern Swordfish*	*Tropical Tunas*
2022		7. SCRS to continue work on criteria for determining exceptional circumstances for inclusion in the exceptional circumstances protocol for BFT to be developed by Panel 2, based on the exceptional circumstances protocol adopted for NALB	7. COMM (PA4) and the SCRS to: - refine CMP(s) - recommend final operational management objectives and identify performance indicators (2022 COMM meeting)	7. COMM (at Annual meeting or Panel 1 intersessional) to provide feedback on evaluation criteria and W-SKJ CMPs to be evaluated further
				8. SCRS to contract independent review of tropical tuna MSE process and technical review of W-SKJ MSE
2023*	1. SCRS will continue to conduct assessments periodically to ensure that the conditions considered in MP testing are still applicable to the stock. The first such assessment is scheduled for 2023	1. Once an MP is adopted, SCRS to conduct assessments to ensure that the conditions considered in MP testing are still applicable to the stock	1. SCRS to continue MSE, incorporating feedback from COMM through PA4/SWGSM	1. COMM to consider final evaluation of W-SKJ MPs and adopt an interim W-SKJ MP at the Annual Meeting
	2. SCRS will finalize a grid of reference and robustness OMs based on Stock Synthesis as part of a new MSE, after reconsidering the main axes of uncertainty.	2. SCRS to provide final advice to COMM on criteria for determining exceptional circumstances	2. COMM to: a) review candidate MPs intersessionally. Dialogue with PA4 on CMPs, operational management objectives and performance indicators. At this point the SCRS should have 2-3 candidate MPs and tangible performance statistics values to show trade-offs. b) adopt an interim MP at the Annual Meeting, including the TAC	2. SCRS to initiate independent technical review of multi-stock MSE

	Northern Albacore	*Bluefin Tuna*	*Northern Swordfish*	*Tropical Tunas*
	3. SCRS to evaluate existence of exceptional circumstances	3. On the predetermined timescale for MP setting, SCRS to evaluate existence of exceptional circumstances	3. COMM to review and finalize an exceptional circumstances protocol	
2023*	4. COMM to continue use of the MP to set TAC at the Annual Meeting, on the predetermined timescale for MP setting	4. COMM to continue use of the MP to set TAC based on the MP at the Annual Meeting, on the predetermined timescale for MP setting		
2024*	1. SCRS to improve Observation Error Model by incorporating statistical properties of CPUE residuals		1. COMM to review and finalize, as needed, guidance on a range of appropriate management responses should exceptional circumstances be found to occur.	<u>1. SCRS to conduct yellowfin assessment</u>
	2. SCRS to test the available (i.e. production model) and alternative candidate MPs (e.g. based on Jabba, or empirical)			2. SCRS to test final set of MP candidates for multi-stock MSE
	3. SCRS to evaluate existence of exceptional circumstances			3. SCRS to provide advice on exceptional circumstances for the implementation of the MP
				4. COMM to consider final evaluation of MPs for multi-stock MSE
				5. SCRS to deliver multi- stock MSE, including fully conditioned operating models and candidate management procedures to COMM

	Northern Albacore	*Bluefin Tuna*	*Northern Swordfish*	*Tropical Tunas*
				6. COMM to: a) review and endorse guidance on management responses in the case of exceptional circumstances, and b) considers adopting interim MP(s) for BET, YFT and eastern SKJ
2025 and beyond*	1. According to the frequency outlined in the exceptional circumstances protocol, SCRS to evaluate existence of exceptional circumstances	1. According to the frequency outlined in the exceptional circumstances protocol, SCRS to evaluate existence of exceptional circumstances	1. SCRS to conduct assessments as per the agreed-to assessment interval to ensure that the conditions considered in MP testing are still applicable to the stock	1. Once an MP is adopted, SCRS to conduct periodic assessments to ensure that the conditions considered in MP testing are still applicable to the stock
	2. COMM to continue use of the MP to set management measures on the predetermined timescale defined in the MP setting	2. COMM to continue use of the MP to set TAC based on the MP at the Annual Meeting, on the predetermined timescale for MP setting	2. On the predetermined timescale, SCRS to evaluate existence of exceptional circumstances	2. On the predetermined timescale for MP setting, SCRS to evaluate existence of exceptional circumstances
	3. SCRS to conduct periodic assessments to ensure that the conditions considered in MP testing are still applicable to the stock	3. Once an MP is adopted, SCRS to conduct assessments to ensure that the conditions considered in MP testing are still applicable to the stock	3. COMM to continue setting TAC based on the MP at the Annual Meeting, on the predetermined timescale for MP setting	3. COMM to continue use of the MP to set management measures on the predetermined timescale defined in the MP setting

*Assumes that the workplan is accomplished as described.

LIST OF ACRONYMS:

BET = Bigeye tuna
BFT = Bluefin tuna
BFT SG = SCRS Bluefin Tuna Species Group
COMM=Commission
HCR = Harvest Control Rule
MP = Management Procedure
MSE = Management Strategy Evaluation
OM = Operating Model
SCRS = Standing Committee on Research and Statistics
SWGSM = Standing Working Group to Enhance Dialogue between Fisheries Scientists and Managers
TAC = Total Allowable Catch
TRO = Tropical tunas

Appendix 17

Draft ICCAT Minimum Technical Standards for EMS in pelagic longliners

Objectives

The SCRS recognizes that the ultimate decision on the objectives (e.g. compliance, scientific data collection) for the use of EMS in ICCAT fisheries will be up to the Commission. For the purposes of the work of the SCRS, the priority for electronic monitoring systems (EMS) would be to implement them in a way that will allow the collection of fisheries data that are usable for scientific purposes. They should be designed in a way that complements, and to the extent possible, is consistent with what is currently collected by human scientific observers. As such, EMS could be implemented in a way that can address both scientific data collection and compliance objectives. EMS intended to address both objectives should be designed to at least meet the requirements of the more demanding objective. For instance, scientific data often must be collected at a finer (e.g. spatial, temporal) resolution than would be required for compliance purposes. In such a situation, meeting the minimum requirements needed for science, would allow use in both scenarios.

Structure (who is responsible)

While there are several possibilities for the EMS program structure, the SCRS will discuss two: decentralized and centralized programs. A "decentralized system," is where each CPC is responsible for EMS implementation in its own fleets, including the recordings, processing, data extraction and summarization, and submission of data to ICCAT (based on minimum standards to be adopted by the Commission). This is similar to what currently exists at the level of national observer programs for scientific purposes in ICCAT, where each CPC is responsible for their own programs and for reporting the required data to ICCAT. Since the cost of implementing this approach would be borne by the CPCs, there would be little financial costs for the Commission to develop or implement the program and a lower administrative burden for the ICCAT Secretariat. A potential issue, however, is inconsistent implementation of the EMS requirements across the ICCAT members – as has been the case with regard to the implementation of ICCAT's minimum standards for scientific observer programs (*Recommendation by ICCAT to Establish Minimum Standards for Fishing Vessel Scientific Observer Program* (Rec. 16-14)).

Another approach to EMS is to establish a "centralized system" that would be coordinated at the ICCAT Secretariat level. The benefits of this approach include a more consistent implementation of EMS requirements across the ICCAT members. It might also benefit CPCs who lack the resources to set up their own local EMS databases and auditing infrastructure. There are, however, significant challenges that would be associated with this approach, particularly related to the financial costs to the Commission and the administrative burden for the ICCAT Secretariat. Among others, issues regarding data sharing and confidentiality would also need to be addressed.

It is clear that there are important trade-offs associated with the approach selected. In addition, as has been done in the case of human observer programs in ICCAT fisheries, it may also be feasible to develop a combination of the two approaches depending on data and compliance needs of the fishery. These questions and tradeoffs should be further considered by scientists and managers. Taking into consideration data needs and given the significant financial costs and other challenges associated with the implementation of centralized EMS however, the sub-group focused its work on the development of input related to a decentralized system. That said, a centralized program or combination of approaches could be considered in the future. The sub-group acknowledges, however, that such a structure or combination of approaches would require substantial additional work, as well as financial and administrative resources.

Periodic reviews

Electronic Monitoring systems should undergo regular evaluations to ensure they reach the outlined objectives. These periodic reviews also give the opportunity to incorporate new technologies (i.e. improved cameras, artificial intelligence) as they become available, as well as to update and incorporate new objectives. A review framework should also allow a faster implementation of the updated minimum standards, that can be reviewed and adapted as needed in the future.

Standards described in this document

1. Standards for onboard EMS technology, including equipment and camera system requirements, installation, and maintenance;

2. Standards for data storage requirements and what data are subject to those provisions;

3. Standards for data collection, review, and reporting to ICCAT;

4. Standards for data protection and potential privacy issues.

1. Standards for onboard EMS technology, including equipment and camera system requirements, installation and maintenance

Electronic Monitoring systems have to be capable to resist rough conditions at-sea with minimum human intervention. In many cases, proper maintenance and inspection can only be achieved at port, in-between long fishing trips.

The vessel owner/operator is responsible for notifying the national authority and/or the EMS service provider if their EM system is not functioning properly.

The EMS must be linked to a receiver (e.g. GPS, GNSS) which records vessel location, speed, and heading information, and is directly and continuously logged by the control box. The receiver must be installed and remain in a location where it continuously receives a strong signal.

The EMS should have a battery backup system with capacity to provide power if the main power source from the vessel fails, to allow proper shutdown of the system and not corrupt the data.

Access to administrative configuration tools and data must be password protected. The EMS must be proof against any manual data input or external data manipulation and record any attempt to tamper with the equipment or the archived data.

The specifications for selecting, installing, operating, and maintaining EMS and their equipment (cameras, sensors, data storage devices, etc.) onboard vessels should be based on performance standards rather than being prescriptive in terms of pure technical requirements.

The video cameras must be mounted and placed so as to provide clear and unobstructed views of the areas that are being covered (see example table below). There must be sufficient lighting to clearly illuminate the area and the individual specimens captured. If vessels fish at night and use artificial lights to illuminate the deck, the quality of images under these circumstances should be checked to ensure there isn't excessive glare.

Longline vessels should be equipped with a sufficient number of cameras to allow data collection to the required standards (see table below for example of a 4-camera system), with sufficient resolution to determine the number, species, sizes and other details of the capture, and processing operations.

Crew should aim to ensure that all specimens that are caught, even those that are released, are handled in a manner that enables the video system to record each specimen brought onboard and each release, taking into consideration any adopted safe release guidelines.

In most cases video will be the primary data collection method, but it may be possible for some CPCs to collect the data needed for ICCAT submission using still images. Whichever the chosen method, the quality of the data must be sufficient to allow species identification and detailed measurements of specimens. To allow this, it is suggested that cameras recording video must have a resolution of no less than 720p, with a minimum frame rate of 5-10 FPS. Where still images are captured, it is suggested they are captured with a resolution of no less than 2MP, with a rate of image capture determined by the characteristics of each fishery. For both data collection methods, there will be different implications for data storage which will need to be considered by the CPCs at the point of implementation.

The EMS should be independent from the crew during the trip, with the exception of some basic maintenance such as periodically cleaning the camera lenses.

It is in general not necessary for the videos to record 24h/day, but only when relevant operations are taking place. For longline vessels, the EMS should be capable of initiating video recording, and record only during the period of gear deployment (aft camera) and gear retrieval operations (work deck, processing area, surrounding water cameras) (see **Table 1** below for an example of camera locations/specifications). Electronic monitoring systems must continue to record for at least 30 minutes after the end of the haulback operation to ensure that there are recordings of the processing or discarding of all the specimens captured. The capability of initiating and ending the recording can be controlled by sensors that continuously monitor the hydraulic pressure signal and drum rotation sensors; these hydraulic pressures from the sensors should be recorded and stored by the control box.

The system must include a control box that receives and stores the raw data provided by the sensors and cameras.

A wheelhouse monitor must include a user interface to provide information about the functioning of the system and for the vessel operator to monitor the control box, and cameras. This can include details such as current date and time (synchronized via GPS/GNSS), vessel location, current hydraulic pressure reading, presence of a data disk, percentage used of the data disk, and video recording status.

The EMS should have a self-diagnostic test for functionality of the system components and record the outcome of the tests.

Table 1. Example of a four-camera system EMS deployment for pelagic longlines.

Camera location	***Action covered***	***Possible data collected***
Aft of the boat	Setting operation	Set position, date, time
		Total number of hooks, hook types, hooks between floats
		Bait type/species
		Bait ratio (%)
		Mitigation measures used (painted bait, tori lines, line weight)
Work deck	Catch at hauling	Species ID/composition
		Specimen sizes
		Condition (dead/alive)
		Fate (retained/discarded)
		Predators observed
	Discarding (if hauled before discarded)	Discards by set
		Discards ID/composition
Processing area	Catch while processing	Species ID/composition
		Total catch by set
		Specimen sizes
		Sex
		Weights?
		Product type (fresh/processed)
Surrounding water area	Discarding (if discarded in the water)	Discards by set
		Discards ID/composition
		Condition of discards?

2. Standards for data storage requirements and what data are subject to those provisions

The control box must contain data storage systems adequate for the trip duration that each national program is designed to cover. Each vessel must have sufficient storage space for the specific trip duration.

Regulations relating to data storage and transmission should be flexible as new technology may allow for different ways of storing or transmitting data that are less logistically challenging or more efficient.

The system must be verified to be functioning properly before the start of each trip, remain powered on and positioned correctly for the duration of each trip.

3. Standards for data collection, review and reporting to ICCAT

Raw data (i.e. video recordings) will be managed by each CPC, which can designate a contracted EM service provider for its national program.

The review of the video footage for extraction of the data to be submitted to ICCAT should be done by the CPCs authorities directly, and/or by a contracted EM service provider assuring that EM records are analysed by a qualified and experienced EM analysts.

Each CPC must assure that the EMS should be able to collect, to the extent possible, the observer data that is required to be submitted to ICCAT (ST-09) or any subsequent update of the form.

Electronic Monitoring systems cannot fully replace all the functions of human scientific observer programs, such as biological sampling. Given that, EM should be used as a complement or supplement to such programs, and a minimum human observer coverage should still be maintained for scientific purposes. This is currently 5-10% for most ICCAT fisheries, although the SCRS has indicated in the past that higher coverages would be more appropriate.

The EMS analyses and data extraction require trained EMS analysts. One potential source are trained observers with at-sea experience, who are familiar with the fisheries and species identification. There may be the need for CPCs to train EMS analysts for their programs. The ICCAT Secretariat might be involved in providing standardized training for EMS analysts or signoff/approve training programmes implemented by each CPC, to improve and harmonize the data processing and extraction from the various national programs.

The analysis software should make entering the EMS records and generating the EM data as automatic as possible. This should include, among others, location, date, and time stamps on any activity identified by the cameras, as well as user-friendly tools to directly include information regarding the processed EMS data or reports, and generally expedite the EMS data analyses.

For measurements to be taken, catch will need to be positioned by the crew on one or more calibrated areas. A calibrated area is an area of known size, such as a hatch or area of the deck, that can be defined in the EMS analysis software (see example in **Figure 1** below).

Figure 1. Example of a calibrated hatch onboard a commercial fishing vessel. These areas will vary from vessel to vessel, depending on available surfaces and the species being measured. This image is provided as an example from a non-tuna fishery. For tuna and tuna-like fisheries, the defined areas will have to be larger to accommodate larger species.

Once data is collected, it should be subject to a quality control (QC) procedure, as is standard with most observer programmes, to ensure data quality. This procedure should be defined by each CPC and be repeatable. It may be necessary for minimum standards/requirements to be set for this procedure by the Commission.

Any conversion factors (e.g. length-length or length-weight) used by the CPCs must be reported to ICCAT and they should be the conversion factors adopted by the SCRS, when available.

CPCs are responsible for reporting the data to the ICCAT Secretariat using the ICCAT ST-09 electronic form, or any other forms that in the future might be developed and approved by the SCRS for EMS data reporting. Submission of EMS data should comply with the Task 1, 2, and 3 data submission deadlines established by the SCRS and adopted by the Commission.

4. *Standards for data protection and potential privacy issues*

With a decentralized program, in which each CPC is responsible for the implementation, recordings, extraction of data, and submission of data to ICCAT, the aspects relative to potential issues related to the privacy or confidentiality of the data will depend on national regulations and legislation. In a decentralized system, only the CPC that is responsible for the collection of the data has access to the original recordings. Those original data are therefore managed directly by each CPC national authority.

Data submitted to the Secretariat should follow the ICCAT Rules and Procedures for the Protection, Access to, and Dissemination of Data.

Appendix 18

Priorities and cost to incorporate in the budget the interpreting costs of the SCRS intersessional meetings

Following the 2021 request by the SCRS to the Commission for the provision of interpretation services during all the SCRS intersessional meetings, the Commission requested the SCRS to discuss the prioritization of the meetings based on the level of participation of non-English native speakers.

Accordingly, the Secretariat has produced a table (**Table 1**) containing the number of participants that attended the SCRS intersessional meetings between 2020 and 2022, based on their preference in terms of one of the official ICCAT languages. It is worth noting the selected period corresponds to the COVID-19 pandemic, when most meetings were held online. For comparison purposes the attendance during SCRS Plenary meetings during which interpretation is provided is also provided.

Table 1. Preference in terms of the number of participants, for English (ENG) and French (FRA) and Spanish (SPA) at SCRS intersessional meetings between 2020 and 2022. The last row of the column refers to the Plenary meeting for which interpretation is provided. DP + SA – Data Preparatory and Stock Assessment meetings. * In 2020 there was no SCRS plenary meeting during the COVID-19.

Meeting	***2020***		***2021***		***2022***		***Average (2020-2022)***	
	ENG	***FRA+SPA***	***ENG***	***FRA+SPA***	***ENG***	***FRA+SPA***	***ENG***	***FRA+SPA***
BFT	232	59	233	51	121	47	195.3	52.3
TROP	100	55	57	36	102	53	86.3	48.0
DP + SA	25	11	52	25	167	90	81.3	42.0
SHK	61	22	52	20	156	76	89.7	39.3
SC-STATS	47	23	49	27	111	59	69.0	36.3
SWO	66	24	139	41	107	42	104.0	35.7
MSE	88	23	76	15	170	65	111.3	34.3
SMT	17	14	39	30	88	45	48.0	29.7
ALB	78	16	65	22	149	50	97.3	29.3
BIL	23	9	60	24	89	39	57.3	24.0
SC-ECO	59	13	50	23	50	28	53.0	21.3
WGSAM	41	9	36	10	48	18	41.7	12.3
Plenary	*	*	98	48	128	59	113*	53.5*

Based on the ranking above, these are the five highest categories in terms of prioritization regarding the provision of interpretation during SCRS intersessional meeting following the criteria set by the Commission:

Rank of priority	***Meeting***
Category 1	Data preparatory + Stock assessment meetings
Category 2	MSE meetings
Category 3	Tropical Tunas Species Group meetings
Category 4	Bluefin Tuna Species Group meetings
Category 5	Sharks Species Group meetings

Accordingly, based on the ranking above and a tentative list of meetings scheduled for 2023, that would include 3 stock assessment meetings, the estimated costs to provide interpretation to the highest category SCRS intersessional meetings would be as follows:

Requested meetings	***Duration (No. days)***	***Category 1***	***Category 2***	***Category 3***	***Category 4***	***Category 5***
Data preparatory + Stock assessment meetings		-	-	-	-	-
· Blue shark	10	€ 64,500	-			-
· Albacore	10	€ 64,500	-			-
· Sailfish	6	€ 38,700	-	-	-	-
MSE	-	-	-	-		-
· N-SWO	6	-	€ 38,700	-		-
Tropical Tunas Species Group	8	-	-	€ 51,600		-
Bluefin Tuna Species Group	3	-	-		€ 19,350	-
Shark Species Group	2	-	-			€ 12,900
Accumulative cost		**€ 167,700**	**€ 206,400**	**€ 258,000**	**€ 277,350**	**€ 290,250**

However, the Committee considered that it would be important for the Commission to bear in mind other factors such as the number of CPCs attending the different meetings. Accordingly, the Secretariat prepared a new table (**Table 2**) similar to **Table 1**, which shows the the average number of CPCs that attended the SCRS intersessional meetings between 2020 and 2022 (most held online), based on their preference in terms of one of the official ICCAT languages.

Table 2. Preference in terms of the CPCs, for English (ENG) and French (FRA) plus Spanish (SPA) at SCRS intersessional meetings between 2020 and 2022. The last row of the columns refers to the Plenary meeting for which interpretation is provided. DP + SA – Data preparatory and stock assessment meetings. * In 2020 there was no SCRS plenary meeting during the COVID-19.

Meeting	***2020***		***2021***		***2022***		***Average (2020-2022)***	
	ENG	***FRA+SPA***	***ENG***	***FRA+SPA***	***ENG***	***FRA+SPA***	***ENG***	***FRA+SPA***
TROP	51	26	48	20	22	18	40.3	21.3
SHK	5	4	18	17	53	43	25.3	21.3
SC-STATS	20	14	26	14	45	29	30.3	19.0
SMT	25	13	16	9	42	28	27.7	16.7
SC-ECO	26	24	16	11	25	15	22.3	16.7
BIL	19	14	33	19	25	16	25.7	16.3
ALB	4	9	14	17	21	17	13.0	14.3
SWO	9	12	15	9	21	17	15.0	12.7
DP + SA	19	10	19	10	32	17	23.3	12.3
BFT	7	6	19	13	21	15	15.7	11.3
MSE			18	11	30	16	16.0	9.0
SC-ECO	19	4	14	9	15	8	16.0	7.0
Plenary	*	*	17	14	18	17	17.5*	15.5*

Based on the ranking from **Table 2**, the five highest categories in terms of prioritization regarding the provision of interpretation during SCRS intersessional meeting following the alternative criteria set by the SCRS is as follows:

Rank of priority	***Meeting***
Category 1	Tropical Tunas Species Group meetings
Category 2	Sharks Species Group meetings
Category 3	Subcommittee on Statistics meetings

Rank of priority	***Meeting***
Category 4	Small Tunas Species Group meetings
Category 5	Subcommittee on Ecosystems meetings

Accordingly, based on the alternative ranking proposed by the Committee and the tentative SCRS calendar for 2023, the alternative estimated costs to provide interpretation to the highest category SCRS intersessional meetings would be as follows:

Requested meetings	***Duration (No. days)***	***Category 1***	***Category 2***	***Category 3***	***Category 4***	***Category 5***
Tropical tunas Species Group	8	€51,600	-	-	-	-
Shark Species Group	2	-	€12,900	-	-	-
Subcommittee on Statistics	2	-	-	€12,900	-	-
Small Tunas Species Group	5	-	-	-	€32,250	-
Subcommittee on Ecosystems and Bycatch	2	-	-	-	-	€32,250
Accumulative cost		**€51,600**	**€64,500**	**€77,400**	**€109,650**	**€141,900**

Appendix 19

List of Acronyms

A-BFT	Atlantic bluefin tuna
ABNJ	UN Areas beyond National Jurisdiction
ACOM	ICES Advisory Committee
ACPR	Associación Catalana per a una Pesca Responsible (Spain)
AIS	Artificial Intelligence Systems
ALB	Albacore (*Thunnus alalunga*)
ALB SG	Albacore Species Group
ALBYP	Albacore Year Programme
AMO	Atlantic Multidecadal Oscillation
ANATUN	Associaçao de Ciencias Marinhas e Cooperaçao (Portugal)
AOTTP	Atlantic Ocean Tropical tuna Tagging Programme
APCCR	Asociación de Pesca, Comercio y Consumo Responsible del Atún Rojo (Spain)
AS	Aerial survey
ASAP	Age-structured Assessment Program
ASFA	Aquatic Sciences and Fisheries Abstracts
ASPIC	A Stock Production Model Incorporating Covariates
ASPM	Age-structured production model
AZTI	Centro Tecnológico Experto en Innovación Marina y Alimentaria (Spain)
B	Biomass
BB	Baitboat
BBNJ	UN Biodiversity Beyond National Jurisdiction
BCD	Bluefin Catch Documentation
BE	Bycatch Estimator
BET	Bigeye (*Thunnus obesus*)
BFT	Bluefin tuna (*Thunnus thynnus*)
BFT SG	Bluefin Tuna Species Group
BLT	Bullet tuna (*Auxis rochei*)
BON	Atlantic bonito (*Sarda sarda*)
BSH	Blue shark (*Prionace glauca*)
BUM	Blue marlin (*Makaira nigricans*)
CAA	Catch-at-age
CARICOM	Caribbean Community
CAS	Catch-at-size
CATDIS	Catch 5x5 distribution
CC	Constant Catch
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
CEFAS	Centre for Environment Fisheries and Aquaculture Science (UK)
CI	Confidence Interval
CINEA	European Climate, Infrastructure and Environment Executive Agency
CITES	Convention on International Trade of Endangered Species of Wild Fauna and Flora
CKMR	Close-Kin Mark-Recapture
CLAV	Consolidated List of Authorised Vessels
CMP	Candidate Management Procedure
CNV	Copy number variant
COFI	FAO Committee of Fisheries
COM	Commission
COVID-19	Coronavirus disease
CP	Contracting Party
CPCs	Contracting Parties and Cooperating Contracting Parties, Entities or Fishing Entities
CPUE	Catch per unit effort
CREEM	Centre for Research into Ecological and Environmental Modelling (University of St Andrews)
CRODT	Centre de Recherche Océanographique de Dakar-Thiaroye (Senegal)
CSIC	Consejo Superior de Investigaciones Científicas (Spain)

CWP	FAO Coordinating Working Group on Fishery Statistics
DAPC	Discriminant Analysis of Principal Component
DB	Database
ddRAD	Double digest restriction-site associated DNA
DFO	Fisheries and Oceans (Canada)
DG-MARE	Directorate-General for Maritime Affairs and Fisheries
DINARA	Dirección Nacional de Recursos Acuáticos (Uruguay)
DNA	Deoxyribonucleic acid
DOL	Common dolphinfish (*Coryphaena hippurus*)
DR	Disaster Recovery
DTU	National Institute of Aquatic Resources is an institute at the Technical University of Denmark
EAFM	Ecosystem Approach to Fisheries Management
EBCD	Electronic Bluefin tuna Catch Document
EBFM	Ecosystem Based Fisheries Management
ECOTEST	Management Strategy Evaluation Framework
EEZ	Exclusive Economic Zone
EFFDIS	Fishing effort 5x5 distribution
EM	Electronic Monitoring
EMS	Electronic Monitoring System
EPBR	Enhanced Programme for Billfish Research
ERA	Ecological Risk Assessment
ETAGS	Electronic tagging management system
EwE	Ecopath with Ecosim
F	Fishing mortality
FAD	Fish Aggregating Devices
FADURPE	Fundação Apolônio Salles de Desenvolvimento Educacional (Brazil)
FAL	Silky shark (*Carcharhinus falciformis*)
FAO	UN Food and Agriculture Organization
FC	Fleet Characteristics
FHV	Fish Hold Volume
FIRMS	FAO Fisheries and Resources Monitoring System
FIS	Inbreeding coefficient
FL	Fork length
FMAP	Federation of Maltese Aquaculture Producers (Malta)
FPS	Frames per second
FOB	Floating object
FRI	Frigate tuna (*Auxis thazard*)
FSC	Free school
FST	Fixation index
GBS	Genotyping-by-sequencing
GBYP	ICCAT Atlantic-Wide Bluefin Tuna Research Programme
GEF	UN Global Environment Facility
GFCM	General Fisheries Commission for the Mediterranean
GNSS	Global Navigation Satellite System
GOEA	Gene Ontology Enrichment Analysis
GPS	Global Positioning System
GTA	Global Tuna Atlas
HCRs	Harvest Control Rules
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
ICES	International Council on the Exploration of the Sea
ICM	Incidental Catch Model
IEO	Instituto Español de Oceanografía
IMM	Working Group on Integrated Monitoring Measures
IMR	Institute of Marine Research (Norway)
IOMS	Integrated Online Management System
IOTC	Indian Ocean Tuna Commission
IPMA	Instituto Português do Mar e da Atmosfera (Portugal)

ISRA	Institut sénégalais de recherches agricoles (Senegal)
ISSF	International Seafood Sustainability Foundation
IT	Information Technology
IUU	Illegal, Unreported and Unregulated fishing
IWC	International Whaling Commission
JABBA	Just Another Bayesian Biomass Assessment
JCAP-2	ICCAT-Japan Capacity-Building Assistance Project, phase 2
JFO	Joint Fishing Operation
K2SM	Kobe II Strategy Matrix
LD	Lowest depletion
LJFL	Lower Jaw Fork Length
LL	Longline
LLSIM	Longline simulator
LMA	Longfin mako shark (*Isurus paucus*)
LOA	Length Overall
LTA	Little tunny (*Euthynnus alletteratus*)
M	Natural mortality
MAGO	Most Advanced Group of Oocytes
MCMC	Markov chain Monte Carlo
MEDAC	Mediterranean Advisory Council
MEDFRI	Mediterranean Fisheries Research, Production and Training Institute (Türkiye)
Met UK	Metropolitan UK
MIA	Marginal Increment Analysis
MiniPAT	Pop-up archival transmitting tag
MoU	Memorandum of Understanding
MP	Management Procedure
MSC	Marine Stewardship Council
MSE	Management Strategy Evaluation
MSY	Maximum Sustainable Yield
MVLM	Monte-Carlo multivariate lognormal
NAFO	Northwest Atlantic Fisheries Organisation
NAO	North Atlantic Oscillation
NC	Nominal Catches
NCC	Cooperating Non-Contracting Party, Entity or Fishing Entity
NEI	Not elsewhere included
NGO	Non-governmental Organization
NGS	Next generation sequencing
NOAA	National Oceanic and Atmospheric Administration (United States)
NOAA-NEFSC	National Oceanic and Atmospheric Administration Northeast Fisheries Science Center (United States)
OCS	Oceanic whitetip shark (*Carcharhinus longimanus*)
OMs	Operating Models
PCA	Principal Component Analysis
PCoA	Principal Coordinates Analysis
PEW	Pew Charitable Trusts
PGK	Probability of Green Kobe
PNOF	Probability of not Red Kobe
PMs	Performance Metrics
POF	Post Ovulatory Follicles
POR	Porbeagle (*Lamna nasus*)
PS	Purse seine
PSA	Productivity-susceptibility Assessments
PSAT	Pop-up Satellite Archival Tag
PWG	Permanent Working Group for the Improvement of ICCAT Statistics and Conservation Measures
RCG LP	EU Regional Coordination Group Large Pelagics
RFB	Regional Fishery Body
RMA	Research Mortality Allowance
RMFO	Regional Management Fisheries Organization

ROP	Regional Observer Programme
RSN	Regional Fishery Body Secretariats' Network
SAFE	Sustainability Assessment for Fishing Effects
SAI	Sailfish (*Istiophorus albicans*)
SC	Steering Committee
SCBF	Special Capacity Building Fund
SC-ECO	Subcommittee on Ecosystems and Bycatch
SCIAENA	Associaçao de Ciencias Marinhas e Cooperaçao
SCRS	Standing Committee on Research and Statistics
SC-STAT	Subcommittee on Statistics
SFL	Straight fork length
SH	Southern Hemisphere
SHK SG	Sharks Species Group
SIMERPE	Simposio Ibérico de Modelado y Evaluación de Recursos Pesqueros (Portugal/Spain)
SKJ	Skipjack (*Katsuwonus pelamis*)
SLU	Swedish University of Agricultural Sciences (Sweden)
SMA	Shortfin mako
SMTYP	Small Tuna Year Programme
SNP	Single Nucleotide Polymorphism
sPAT	Survivorship Popup Satellite Archival Transmitting Tag
SPF	Spearfish (*Tetrapturus pfluegeri*)
SPiCT	Surplus Production Model in Continuous Time
SPL	Scalloped hammerhead shark (*Sphyrna lewini*)
SPN	Hammerhead sharks nei (Sphyrna spp)
SPZ	Hammerhead shark (*Sphyrna zygaena)*
SRDCP	Shark Research and Data Collection Programme
SS	Stock Synthesis
SS3	Stock Synthesis III
SSB	Spawning stock biomass
SSG	Sharks Species Group
SST	Sea Surface Temperature
SWGSM	Standing Working Group to Enhance Dialogue between Fisheries Scientists and Managers
SWO	Swordfish (*Xiphias gladius*)
SWO SG	Swordfish Species Group
SWOYP	Swordfish Year Programme
TAC	Total Allowable Catch
TCI	Turks and Caicos Islands
ToRs	Terms of Reference
TSD	Trial Specification Document
T1	Task 1
T1FC	Task 1 fleet characteristics
T1NC	Task 1 nominal catches
T2CE	Task 2 catch and effort data
U	Exploitation rate
UKOT	United Kingdom Overseas Territory
UJFL	Upper Jaw Fork Length
UNCLOS	United Nations Convention on the Law of the Sea
UNFSA	United Nations Fish Stocks Agreement
UNIVPM	Università Politecnica delle Marche (Ancona, Italy)
VMS	Vessel Monitoring System
VPA	Virtual Population Analysis
VPN	Virtual Private Network
WAH	Wahoo (*Acanthocybium solandri*)
WCPFC	Western Central Pacific Fisheries Commission
WECAFC	Western Central Atlantic Fishery Commission
WGEF	ICES Working Group on Elasmobranch Fishes
WGS	Whole Genome Sequencing

WGSAM	Working Group on Stock Assessment Methods
WHM	White marlin (*Kajikia albida*)
WKELASMO	ICES Working Group on Elasmobranchs
WT	Weight
WWF	World Wildlife Fund
YFT	Yellowfin (*Thunnus albacares*)

Appendix 20

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