INTERNATIONAL COMMISSION
for the
CONSERVATION of ATLANTIC TUNAS

R E P O R T
for biennial period, 2016-17
PART II (2017) - Vol. 2
English version SCRS

MADRID, SPAIN 2018

INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS

CONTRACTING PARTIES
(at 31 December 2017)

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, Trinidad & Tobago, Tunisia, Turkey, United Kingdom (Overseas Territories), United States, Uruguay, Vanuatu, Venezuela

COMMISSION OFFICERS

Commission Chairman	*First Vice Chair*	*Second Vice Chair*
R. DELGADO, PANAMA (since 21 November 2017)	S. DEPYPERE, EU (since 17 November 2015)	Z. DRIOUICH, MOROCCO (since 21 November 2017)

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

SUBSIDIARY BODIES OF THE COMMISSION

	Chair
STANDING COMMITTEE ON FINANCE & ADMINISTRATION (STACFAD)	H. A. ELEKON, Turkey (since 21 November 2017)
STANDING COMMITTEE ON RESEARCH & STATISTICS (SCRS) Sub-Committee on Statistics: G. DÍAZ (United States), Convener Sub-Committee on Ecosystems: K. YOKAWA (Japan), A. HANKE (Canada), Conveners	D. DIE, United States (since 3 October 2014)
CONSERVATION & MANAGEMENT MEASURES COMPLIANCE COMMITTEE (COC)	D. CAMPBELL, United States (since 25 November 2013)
PERMANENT WORKING GROUP FOR THE IMPROVEMENT OF ICCAT STATISTICS AND CONSERVATION MEASURES (PWG)	N. ANSELL, European Union (since 21 November 2017)
STANDING WORKING GROUP TO ENHANCE DIALOGUE BETWEEN FISHERIES SCIENTISTS AND MANAGERS (SWGSM)	R. DELGADO, Panama (since 21 November 2017)

ICCAT SECRETARIAT

Executive Secretary: MR. D. MESKI
Assistant Executive Secretary: DR M. NEVES DOS SANTOS
Address: C/Corazón de María 8, Madrid 28002 (Spain)
Internet: http://www.iccat.int - *E-mail:* info@iccat.int

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, 2016-2017, Part II (2017)"***, which describes the activities of the Commission during the second half of said biennial period.

This issue of the Biennial Report contains the Report of the 25th Regular Meeting of the Commission (Marrakesh, Morocco, 14-21 November 2017) 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). Volumes 3 and 4 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.

RAÚL DELGADO
Commission Chairman

REPORT OF THE STANDING COMMITTEE ON RESEARCH AND STATISTICS (SCRS)

(Madrid, 2-6 October 2017)

TABLE OF CONTENTS

REPORT OF THE
STANDING COMMITTEE ON RESEARCH AND STATISTICS (SCRS)
(Madrid, Spain – 2 to 6 October 2017)

1. Opening of the meeting

The 2017 meeting of the Standing Committee on Research and Statistics (SCRS) was opened on Monday, 2 October, at the Hotel Weare Chamartín in Madrid by Dr David Die, Chair of the Committee. Dr Die welcomed all the participants to the annual meeting.

The ICCAT Executive Secretary, Mr. Driss Meski, in his opening address underlined the role of the SCRS work, which he has been following for the past 14 consecutive years. He congratulated all the scientists for their great job. He mentioned that given that this meeting will probably be his last participation as Executive Secretary, he expressed his thanks to all scientists, the Secretariat staff and interpreters for their assistance over the years. He also informed the Committee that Drs Laurence Kell and Antonio Di Natale will soon retire, and expressed to them his gratitude for their work over the past 7 years at the Secretariat. The Opening Address of the Executive Secretary is attached as **Appendix 15**.

The Chair of the SCRS, Dr David Die, thanked the Executive Secretary and the Secretariat for their cooperation and work throughout 2017 and their permanent support for the SCRS.

2. Adoption of Agenda and arrangements for the meeting

The Tentative Agenda was revised and adopted with minor changes (**Appendix 1**). Full assessments were carried out this year on North and South Atlantic shortfin mako shark (SMA) stocks, Mediterranean albacore stock (ALB-Med), and North and South Atlantic swordfish (SWO) stock, and the western and eastern and Mediterranean bluefin tuna stocks (BFT). Also data preparatory meetings were held for bluefin tuna, shortfin mako and Atlantic swordfish this year, in preparation for the new assessments in 2017. Additionally, intersessional meetings were held for the Sub-committee on Ecosystems and the Small Tunas and Tropical Tunas Species Groups, as well as the Working Group on FADs and the Working Group to Enhance Dialogue between Fisheries Scientists and Managers. Finally, ICCAT organized the first joint t-RFMO meeting of the FAD Working Group.

The following scientists served as rapporteurs of the various species sections (Agenda Item 8) of the 2017 SCRS Report.

YFT	-	Yellowfin tuna	S. Cass-Calay
BET	-	Bigeye tuna	H. Murua
SKJ	-	Skipjack tuna	J. Amandé
ALB	-	Albacore	H. Arrizabalaga, J. Ortiz de Urbina (Med.)
BFT	-	Bluefin tuna General	C. Porch, G. Melvin (West), A. Gordoa (East)
BIL	-	Billfishes	F. Arocha
SWO	-	Swordfish	R. Coelho (North), H. Andrade (South) G. Tserpes (Med.)
SMT	-	Small tunas	N. Abid
SHK	-	Sharks	E. Cortes
SBF	-	Southern bluefin	

The Secretariat served as rapporteur for all other Agenda items.

3. Introduction of Contracting Party delegations

The Executive Secretary introduced the 23 Contracting Parties present at the 2017 meeting: Algeria, Angola, Canada, China (P.R.), Côte d'Ivoire, European Union, Japan, Korea (Rep.), Liberia, Mauritania, Mexico, Morocco, Namibia, Nigeria, Norway, Russian Federation, São Tomé and Príncipe, Senegal, South Africa, Tunisia, United Kingdom (O.T.), United States and Uruguay. The List of Participants at the Species Groups Meetings and the Plenary Sessions is attached as **Appendix 2**.

4. Introduction and admission of observers

Representatives from the following Cooperating non-Contracting Party, Entity, or Fishing Entity (Chinese Taipei), inter-governmental organizations (Food and Agricultural Organization – FAO) and non-governmental organizations (Federation of Maltese Aquaculture Producers – FMAP, Humane Society International – HIS, International Seafood Sustainability Foundation – ISSF, Pew Charitable Trusts, The Ocean Foundation, The Shark Trust and World Wildlife Fund – WWF) were admitted as observers and welcomed to the 2017 SCRS (see **Appendix 2**).

5. Admission of scientific documents

The Secretariat informed the Committee that 227 scientific papers and 47 scientific presentations had been submitted at the 2017 intersessional meetings. In 2016 a deadline of seven days before the beginning of the species groups meetings was established for submitting titles and abstracts and five days before the meeting to submit the full document. The objective of this deadline is to facilitate 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.

Besides the scientific documents, there are 15 reports of intersessional and regular Species Groups meetings, 42 Annual Reports from the Contracting Parties, and non-Contracting Cooperating Parties, Entities and Fishing Entities, as well as various documents by the Secretariat. The List of SCRS Documents and Presentations is attached as **Appendix 3**.

6. Report of Secretariat activities in research and statistics

The Secretariat presented information contained in the 2017 Secretariat Report on Research and Statistics related to fisheries and biological data submitted for 2016, including revisions to historical data. The activities and information included in this report refer to the period between 1 December 2016 and 12 September 2017 (the reporting period). 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 datasets required by each assessment) a lot of additional work to stock assessment activities, whether participating actively in the assessment or coordinating and managing external support to the SCRS work. The Secretariat reiterated to the CPCs the Commission's requirement of using the most recent standard electronic forms for data submission and complete all the information requested.

The overall reporting ratio of Task I T1FC for 2016 increased slightly to 72% (53 flag CPCs), with 6 flag CPCs having late submissions. All the T1NC datasets received from 63 flag CPCs (85% reporting ratio), including the 6 flag CPCs with late-reports, were processed and presented to the SCRS. The deficiencies/problems with the Task II Catch and effort data (T2CE) were also noted, which has serious implications for the estimation of related datasets such as CATDIS, EFFDIS, CAS and CAA. The Secretariat also presented a new Global Fisheries Scoreboard on basic data availability. This facilitates the quick review of the data available for stock assessment purposes. The scoreboard ranks the different stock on a scale of 1 – 10 based on the availability of Task I and II information for that stock. In 2014, a new form (ST08-FadsDep) was created and distributed in response to Rec. 13-01 paragraph 2. This form was designed to capture information on the number of FADs actually deployed on a quarterly basis, by FAD type, indicating the presence or absence of a beacon associated to the FAD. This form was modified in 2016 and again in 2017 to include additional information pursuant to Rec. 15-01 and subsequently, Rec. 16-01, paragraph 23. The response to this form has been very low due to uncertainty in the requirements of the recommendation. As such in 2018 the Secretariat will work with CPC scientists to modify and simplify these forms and address any uncertainties as required.

For the reporting period, the Secretariat has received by-catch and discard information, mainly from the recently adopted ST09-NatobPrg data submission forms as the vast majority of by-catch information recorded by CPCs comes from observer programmes. It was stressed that all future by-catch data submissions should be made using the observer data collection forms. It was however noted that the submission of observer data has been generally poor due to the complexity of the ST09 forms. As such the Secretariat, in cooperation with CPC scientists and the Sub-committees on Statistics and Ecosystems has provided a significant revision to this form for adoption by the SCRS in 2018.

The Committee was presented with an update of the various ICCAT publications. The deadline for documents was met with less than optimal success. Currently, the deadline is seven and five days before the meeting to submit titles and documents for the Species Groups. However, as with 2016, only around 50% of the documents have been submitted by the deadlines. The Committee was also informed of the intention of the Secretariat to only publish these documents electronically in the future to save costs and promote the rapid dissemination of the information. The ownCloud web server has now been used for three years by the SCRS and certain Commission meetings to share information, data, documents and models required to facilitate the work of the various groups and panels. The Secretariat has provided access details in advance of the meetings, to registered participants, so that they can access the necessary information prior to the commencement of the meetings.

During 2017, the Secretariat undertook an exhaustive work plan in terms of statistical related tasks, aiming to complete all the major SCRS demands and priorities for 2017. A reasonable part of the priority tasks were finalised in a timely manner, and the outcome used by the SCRS during 2017. However, several ongoing priority projects (RDBMS migration to MS-SQL server 2016, ICCAT-DB documentation framework, full revision of the tagging database system, improvements on the GIS system - shape files update, statistical databases deployment on the ICCAT cloud, etc.) have been partially implemented and in some cases postponed for 2018. It is important to note that, those postponed projects had no negative impact on the accomplishments of the SCRS requirements for 2017. The JAVA project which was initiated in 2015 (two years) was finalised and all the development made (unattended data integration software, web-form prototyping, ICCAT-DB improvements in structure and automation tools, improvement of various applications) was fully incorporated into the ICCAT-DB system.

The Secretariat has also begun work on addressing the Commission's request to provide the possibility for online reporting information. The Secretariat has already begun to develop tools to provide this possibility for the statistical data reporting forms. However, to extend this work to all the ICCAT reporting requirements is an extremely large undertaking that requires time and resources not currently available at the Secretariat. The work has been conducted internally within the Secretariat and, to a certain degree, in collaboration with the GEF-Common Oceans ABNJ Tuna Project. The Secretariat is also working with the ICCAT Online Reporting Working Group to ensure the various initiatives are coordinated and planned. The Online Reporting Working Group has primarily corresponded electronically. However, a physical meeting was also attended by members of the Secretariat staff.

The Secretariat has continued the series of periodic publications developed throughout the history of ICCAT, which includes: Volume 73 (9 issues) and 74 of the *ICCAT Collective Volume of Scientific Papers*; *Part I of the Biennial Period 2016-2017*, corresponding to Volume I (Commission meeting report), II (SCRS Plenary meeting report) and Volume 3 (Annual Reports); Volume 43 (II) of the Statistical Bulletin; and, Volume IV (Secretariat reports). The Secretariat highlighted the effort to publish until the end of 2017 all issues of volume 74 of the *ICCAT Collective Volume of Scientific Papers*. Having these papers published 3-4 month after the meeting they were presented is great improvement, but also a goal that can only be achieved if contributers strictly comply with the deadlines and guidelines for authors when submitting their papers.

In 2014 *Aquatic Living Resources* has changed its editorial line towards an ecosystem approach of fisheries management, which considerably reduced the possibilities of publishing the documents presented to the SCRS in this peer review journal. The field of interest of the journal in its new phase will continue to have an ecosystem approach, but with a broader outlook than in its last phase, which will open the publication up to a larger number of SCRS documents. In 2016 the Secretariat contacted the new ALR editorial team, and ALR expressed their willingness to publish a few more ICCAT papers (12-15) on an annual basis. However, the SCRS failed to select a minimum number of papers for submission to ALR. To revert this situation the Secretariat together with the SCRS Chair prepared an alternative option for consideration of the SCRS (additional information in section 21.5).

The Committee acknowledged the extensive workload conducted by the Secretariat and thanked them for their support of the SCRS documentation processes. The Chair noted that the CPCs scientists should continue to work with and provide feedback to the Secretariat in order to maintain the productive functioning of the SCRS. The Committee noted that there are still issues with the deadlines for submission of documents that needs to be improved further.

Ms. Mari Mishima who coordinated the ICCAT-Japan Capacity-Building Assistance Project (JCAP) during five years terminated her mandate in 2016. Since the last SCRS meeting, her duties are now a responsibility of the Secretariat. The JCAP trust fund has been dedicated to assisting developing CPCs to effectively implement ICCAT measures including those related to the monitoring, control and surveillance of tuna fishing activities as well as the improvement of data collection, analysis and reporting. Following the Secretariat presentation, the SCRS Chair and CPCs welcomed the outcome of the activities carried out this year and expressed their gratitude to the support of the JCAP toward capacity building of the developing CPCs. In response, Japan remarked that taking into account that this project is very much welcomed by the CPCs, they will make effort to keep contributing through JCAP for coming years while the budgetary situation is getting difficult year by year. Japan also expressed their wish for the project to take place in other regions and requested that CPCs help the Secretariat in finding experts that can be involved in the JCAP funded capacity building initiatives. The SCRS and the Secretariat expressed their appreciation to Japan.

7. Review of national fisheries and research programmes

In accordance with the Revised Guidelines for the preparation of Annual Reports (ICCAT Ref. 12-13), only information relative to new research programmes (Part I of the Annual Report) was presented to the Committee. The Committee considered the need to include information of interest for its work, separating it from the Annual Report which, with its current structure, is more geared to providing information to the Commission on compliance. The Committee reiterated the need to follow the Revised Guidelines for the preparation of the Annual Reports including the Summary Tables.

Algeria

Algerian catches of tuna and tuna-like species recorded for 2016 are in the order of 668.43 t of swordfish, 448.4 t of bluefin tuna and 2313.948 t of small tunas. In 2016, the statistics on two species of shark taken as by-catch were made available: the blue shark (*Prionace glauca*) and thresher shark (*Alopias vulpinus*).

Fishing for live bluefin tuna was carried out by tuna purse seine vessels flying the Algerian flag. In 2016, 11 tuna purse seine vessels satisfied the regulatory requirements to participate in the fishing campaign, with vessel lengths of between 22 and 40 m. The Algerian fleet is organised in a joint fishing group. The entire quota allocated to Algeria was fished.

A sample of 20 individuals of bluefin tuna caught dead during the fishing campaign were measured and sexed. The total weight of the individuals sampled is 1935 kg.

Swordfish (*Xiphias gladius*) were also sampled for size and sex at landing ports.

With regard to collecting statistical data on fishing activity, the mechanism that exists at national level contributes effectively to feeding and updating the database maintained by the General Directorate of Fisheries and Aquaculture. This mechanism is strengthened by the carrying out for the third consecutive year of two assessment campaigns for pelagic and demersal resources in Algerian waters.

Research is carried out by the National Centre of Research and Development of the Fisheries and Aquaculture (CNRDPA) as well as some national universities that provide scientific data and advice for decision-making on management of fisheries resources.

Canada

Bluefin tuna are harvested in Canadian waters from July through December. The adjusted Canadian quota for 2016 was 506.74 t which includes a 55.98 transfer from Mexico. A total of 700 licensed fishermen were active (i.e. licenses that had landings) in the directed bluefin fishery using rod and reel, handlines, tended lines, electric harpoon and trap nets to harvest 385.2 t. An additional 80.9 t was harvested as bycatch in the pelagic longline fleet in the swordfish and other tunas fishery. These figures include 8.7 t of mortality associated with tagging studies.

The swordfish fishery in Canadian waters takes place from April to December. Canada's adjusted swordfish quota for 2015 was 2040.2 t with landings reaching 1547.9 t. The tonnage taken by longline gear was 1462.6 t while 85.3 t were taken by harpoon. Of the 77 licensed swordfish longline fishermen, 43 were active in 2016. Only 161 of 1,157 harpoon licenses reported swordfish landings in 2016.

The other tunas (albacore, bigeye and yellowfin) are at the northern edge of their range in Canada and are harvested from May through October. In 2016, other tunas accounted for approximately 9%, by weight, of the commercial large pelagic species landed in Atlantic Canada.

The Canadian Atlantic statistical systems provide real time monitoring of catch and effort for all fishing trips targeting pelagic species. At the 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 such as; the reprocessing of acoustic data from the Gulf of St. Lawrence herring survey for bluefin tuna targets which yielded a new relative index of relative abundance, tagging of bluefin tuna that addresses questions related to mixing, migration and the distribution within the Canadian EEZ, the collection of bluefin tuna otoliths and spines which will contribute to a mixing analysis, diet analysis and lipid analysis. For sharks, recent research has been focused on a conventional tagging program for incidental captures of blue, porbeagle and shortfin mako shark caught by charter and recreational fishermen and a fixed station longline survey designed to give abundance and distribution information for porbeagle shark.

China (People's Rep.)

The number of vessels from China operated in the Atlantic Ocean increased from 24 in 2015 to 34 in 2016. Longline was the only fishing gear used to target bigeye tuna and bluefin tuna. The total catch of main species including by-catch was 7049.098 t (in round weight), 1207.6 t higher than that in 2015 (5841.5 t). The catch of bigeye tuna and bluefin tuna amounted to 5852.39 t and 53.89 t in 2016, respectively. The catch of bigeye tuna accounted for 83.02% of the total in 2016. Yellowfin tuna, swordfish and albacore tuna, etc. were taken as by-catch. The catch of yellowfin tuna was 467.746 t in 2016. The catch of swordfish was 357.277 t. The catch of albacore tuna was 197.565 t. The data compiled, including Task I and Task II as well as the number of fishing vessels, have been routinely reported to the ICCAT Secretariat by the Bureau of Fisheries (BOF), Ministry of Agriculture of PRC. PRC has carried out a national scientific observer program for the tuna fishery in ICCAT waters since 2001. Three observers in 2016 have been dispatched on board five Chinese longliners covering the fishing areas of S8°53′-N13°04′, W01°26′-W44°39′ (targeting bigeye tuna) and N52°41′-N50°28′, W32°35′-W29°57′ (targeting bluefin tuna). Data of target species and non-target species (sharks, sea turtles, especially) were collected during the observation.

Côte d'Ivoire

A total amount of 2369.59 t comprising tuna (1912.41 t), billfish (142.60 t) and sharks (314.58 t) were landed in the different docks and ports by the industrial and artisanal fishery operating in the marine environment. Tuna were dominant with 1912.41 t, followed by shark (314 t) and billfish (142 t). Skipjack tuna, blue marlin, frigate tuna and thresher were dominant in the catches. The average sizes calculated only refer to individuals taken by the artisanal fishery. In 2016, the quotas for species with an allocated quota were not exceeded and the recommendations were implemented as far as possible. In addition, given the importance of tuna and the species caught in association in the national economy and for the purpose of improving management of the existing stock, it is essential to advance knowledge on biology and strengthen the research staff.

In addition, Côte d'Ivoire needs urgently to participate henceforth in the statistical monitoring programme with the presence of observers on board vessels.

European Union

Several Member States of the European Union (EU) have fleets actively fishing in the ICCAT Convention area. These are: Croatia, Cyprus, France, Greece, Ireland, Italy, Malta, The Netherlands, Portugal, Spain and United Kingdom.

The EU fleet targets most of the species that are regulated by ICCAT i.e. eastern bluefin tuna, skipjack, yellowfin, bigeye, albacore, swordfish, marlins and sharks. Other groups of species such as small tunas (bullet tuna, Atlantic bonito, frigate tuna, little tunny and dolphinfish) are also caught by the EU fleets operating in the ICCAT Convention area. The EU fleet uses a wide range of fishing gears: purse seiners, baitboats, longliners, handlines, troll, harpoons, mid-water trawls, traps and sport fishing gear. The EU is one of the major players in the ICCAT area and its catches represent around 40% of the total catches of the ICCAT Contracting Parties.

This diversity also constitutes a concrete challenge in faithfully reporting on such variety, namely through Task I and II data, but also information on by-catches, interactions with associated species, the composition of fleets, etc. Despite the complexity of the tasks pertaining to the follow up of the reporting obligations involving the different Member States, the EU pays special attention to ensure a timely and complete submission of information by keeping them updated on the different ICCAT reporting obligations, clearly identifying data, deadlines, formats, and contact persons responsible for the compilation of reports and data submission to ICCAT.

Japan

The Fisheries Agency of Japan (FAJ) has set catch quotas for western and eastern Atlantic bluefin tuna as well as for southern albacore, northern and southern Atlantic swordfish, blue marlin, white marlin, spearfish and bigeye tuna, and has required all tuna vessels operating in the Atlantic Ocean to submit logbook and, for bluefin tuna, daily catch information. All Japanese longline vessels operating in the Convention area have been equipped with satellite tracking devices onboard. In accordance with ICCAT recommendations, FAJ has taken necessary measures to comply with its minimum size regulations, time area closures and so on by ministerial order. A statistical or electronic catch document program has been conducted for each species. Records of fishing vessels larger than 20 meters in length overall (LSFVs) have been established. One patrol vessel was dispatched to the North Atlantic to monitor and inspect Japanese tuna vessels catching bluefin tuna and also observe fishing activities of fishing vessels from other nations. FAJ also inspected landings of Japanese fishing vessels at Japanese ports to enforce the catch quotas and minimum size limits. A prior authorization from FAJ is required in the case that Japanese tuna longline vessels transship tuna or tuna products to carriers at foreign ports or at sea.

Korea (Rep. of)

In 2016, 11 Korean longline vessels engaged in fishing for tuna and tuna-like species in the Atlantic Ocean and the total catch was 2,801 t. The catches of bigeye tuna, yellowfin tuna and bluefin tuna were 562 t, 368 t and 161 t, respectively. Fishing grounds of Korean longline vessels have been formed at the tropical area of the Atlantic Ocean (20°N ~20°S, 20°E~60°W) throughout the year, and that of 2016 was almost the same as in the previous years. The observer coverage of logbook by Korean fleet in 2016 is estimated at about 13.4% of the total efforts (number of hooks) for longline fishery.

Liberia

Some management measures have been put in place to ensure the proper management of Liberia's tuna fisheries such as: tuna fisheries access agreement for foreign tuna fishing fleet, 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 catch by individual vessels to the Liberia Fisheries Monitoring Center (FMC). Liberia signed a Sustainable Fisheries Partnership Agreement (SFPA) with the European Union (EU) in June 2015 for access to its EEZ to exploit tropical tuna resources.

Mauritania

In Mauritania, high seas tunas are targeted only by foreign fleets working within the framework of bilateral agreements and operating under the open licence regime. The fleets of these Contracting Parties, which reached around 62 tuna vessels in 2016, land their products in foreign ports.

Coastal tuna species are caught as by-catch by high seas small pelagic vessels. Statistics show that by-catch of high seas tuna taken by the high seas fisheries amounted to 8,300 t in 2016 (i.e. an increase of 93% compared to 2015) and essentially comprised Atlantic bonito (*Sarda sarda*) (58%), compared to little tunny (Euthynnus sp.) (30%) and frigate tuna (*Auxis thazard*) (12%).

Catches landed by the artisanal and coastal fisheries have increased substantially in 2016, following the decline observed in 2014 by less than 500 t, essentially comprised of West African Spanish mackerel (*Scomberomorus tritor*). A monitoring programme aimed at these fisheries will be established to strengthen data collection on small tunas and tropical tunas at the times of day that are least covered by the Coastal and Artisanal Fisheries Monitoring System (SSPAC).

Finally, several research programmes focusing on the study of certain tuna species have been launched by the IMROP in 2016 and 2017 with the financial support of ICCAT. One programme in particular aims to collect available data and information on the presence of bluefin tuna in the area of Mauritania in 2016 and another programme aims to collect biological data on small tunas in order to study the size structures and growth parameters but the development of approaches to recovery of catches of these species from 2000 to 2016 is still underway.

Morocco

Fishing of tuna and tuna-like species attained a production of 9702.7 t in 2016 compared to 9120.9 t in 2015 which is a volume increase of around 7% However, the bluefin tuna quota allocated by ICCAT was fully exhausted. The main species exploited off the Moroccan coasts are bluefin tuna, swordfish, bigeye tuna, yellowfin tuna, albacore tuna, small tunas, other tunas, sharks and dogfish. Statistical data collection on production and effort is carried out virtually exhaustively, through the fisheries administrative structures (Secretariat of State for Maritime Fisheries and the National Fisheries Office), located along the Atlantic and Mediterranean coasts of the Kingdom of Morocco. A control is also conducted subsequently by the Exchange Office in relation to exports of fishing products. In terms of science, the National Institute of Fisheries Research (INRH), through its six Regional Centres which cover the entire Moroccan coastline, has strengthened the collection of biological data on the main species (bluefin tuna and swordfish). The Regional Centre of the INRH in Tangier coordinates the collection of all these data. In recent years, monitoring of other species has begun, in particular tropical tuna species (bigeye tuna among others) and small tunas, with an extension of the research work to areas located in southern Morocco. As a result, significant success has been achieved in terms of statistical and biological data collection, as evidenced by the number of scientific documents and Task II data submitted by Moroccan researchers to the different SCRS scientific meetings, for the purpose 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 by-catch, while highlighting compliance with national regulations and/or enforcement of the recommendations and resolutions adopted by the International Commission for the Conservation of Atlantic Tunas (ICCAT).

Yellowfin tuna (*Thunnus albacares*) fishing in the Gulf of Mexico is carried out by midwater longline vessels. In addition to the target species, other species are also caught incidentally such as: skipjack (*Katsuwonus pelamis*), bigeye (*Thunnus obesus*), Atlantic bluefin tuna (*Thunnus thynnus*), sharks 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 for the purpose of incorporating the regulations adopted by ICCAT.

The Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA) through the National Commission of Aquaculture and the Fisheries (CONAPESCA) is the national authority in charge of implementing policies, programmes and regulations that facilitate the competitive and sustainable development of Mexico's fisheries and aquaculture sector. For its part, the National Fisheries Institute (INAPESCA) is responsible for carrying out scientific research and collecting data on the longline tuna fishery in the Gulf of Mexico.

Namibia

Namibia, as a member of ICCAT, 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 any other RFMOs or international organisation. In addition, monitoring measures are in place to ensure that all products coming from licensed tuna fishing vessels, when entering or leaving Namibia, are accompanied by the necessary documents.

In 2016, Namibia continued to undertake research on all ICCAT species caught by boats operating in Namibian waters. Data obtained from log sheets supplied to fishing vessels, as well as data collected by Fisheries Inspectors deployed at all landing points and those data collected by Fisheries Observers onboard fishing vessels were analysed and the results were submitted to ICCAT in June 2016 (Task I and Task II). The landings for some species, namely; albacore (ALB), bigeye tuna (BET) and longfin mako (LMA) have decreased in 2016 when compared to 2015, while those of swordfish (SWO), yellowfin tuna (YFT), blue shark (BSH), shortfin mako (SMA) and blue marlin (BUM) have increased in 2016 when compared to 2015. Other species, such as skipjack tuna (SKJ), were also recorded in 2016 (0.55 t).

Fisheries observers were also tasked to observe the activities of fishing vessels at sea and report any violations for possible action to be taken against the culprits. Furthermore, Namibia had deployed Fisheries Inspectors both at sea onboard Fisheries Patrol vessels and in the harbours, to ensure strict compliance with the country's rules and regulations related to the exploitation of marine living resources, including those adopted by Namibia as part of its obligations to RFMOs and international organisations.

Norway

Norway was allocated a quota of 43.71 t of eastern bluefin tuna (*Thunnus thynnus*) for 2016. The quota was exhausted in a directed ICCAT fishery and as by-catch in non-ICCAT fisheries. Numerous observations of Atlantic bluefin tuna were made along the coast and offshore waters of Norway from 58° to 68°N during August-November 2016. Norway put a lot of effort into obtaining biological, ecological and genetic samples and data from all individuals of Atlantic bluefin tuna caught in 2016. 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 SCRS annual science meeting in 2016.

Russia

Fishery. In 2016 and 2017 a specialized (purse-seine) tuna fishery fleet flying the Russian flag did not carry out any operations. In 2016 trawl vessels caught 1428 t of 4 tuna species and 850 t of Atlantic bonito as by-catch in the Eastern-Central Atlantic. In the first half of 2017 the trawl vessels caught 173 t of 3 tuna species and 228 t of Atlantic bonito.

Scientific research and statistics. In 2016 "AtlantNIRO" observers collected biological and fishery materials on tunas onboard trawl vessels in the Eastern-Central Atlantic (area SJ71 according to the ICCAT classification). Fish length and weight were measured, and fish sex, gonads maturity stages and degree of stomach fullness were determined. Species of the group "small tunas" occurred in trawls as a by-catch from one individual specimen or up to a few dozen. Material on frigate tuna, bullet tuna, Atlantic black skipjack, oceanic skipjack and Atlantic bonito in the amount of 5405 specimens was collected for weight measurements and 1480 for biological analyses.

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

Sao Tome and Príncipe

Sao Tomé and Principe is an island country, with an EEZ of 160,000 km^2, where fish is the main source of animal protein consumed.

It is important to highlight that the country has made some improvements to its fleet but the desired standard has not yet been attained because it is still very much artisanal and semi-industrial. The country currently has 2,305 artisanal vessels operating in the artisanal fishery in the EEZ, between 12 and 15 miles off the coast.

In terms of valuable commercial species, the tuna and tuna-like fishery is of major importance to Sao Tomé and Príncipe. Fishing for tuna and tuna-like species is carried out in Sao Tomé and Príncipe by artisanal vessels. Those with the highest capacity are Cariocos, boats and some semi-industrial fishing boats, of which 75 boats use purse seine and troll and 10 semi-industrial vessels use troll.

Data have been reported since 2012, when 2049 t of tuna and tuna-like species were taken, 2105 t in 2013, 2250 t in 2014, and 3273 t in 2015.

Total catches of tuna and tuna-like species of the Sao Tomé and Príncipe fleet in 2016 were estimated at 4474 t of which 421 t were BET, 167 t BIL, 207 t BON, 91 t BUM, 536 t FRI, 122 t FTA, 11 t MAW, 212 t SAI, 380 t SKJ, 77 t SWO, 70 t WAH, 15 t WHM and 301 t YFT.

Monitoring of tuna fishing vessel activities in Sao Tomé and Príncipe was relaunched in 2015 by the Department for Research and Statistics of the Directorate for Fisheries with the JCAP support programme which continues to date. Within the framework of the Enhanced Program for Billfish Research, data collection (catches and fishing effort by number of trips) and sampling are always carried out in the main artisanal fishing ports.

Senegal

In 2016, the Senegalese industrial tuna fleet was comprised of six (6) baitboat vessels and four (4) purse seiners that mainly targeted tropical tuna, in particular yellowfin (*Thunnus albacares*), bigeye (*Thunnus obesus*) and skipjack (*Katsuwonus pelamis*), one (1) longline vessel and two (2) small cord boats targeting swordfish. However, a portion of the artisanal fisheries that use fishing gears such as handline, troll, purse seine and nets catches billfish (marlins and sailfish) and small tunas (Atlantic black skipjack, mackerel, bonito, frigate tuna, etc.) and sharks.

Total catches of tropical tunas by Senegalese baitboats are estimated at 3,874 t, of which 692 t were yellowfin tuna, 2,495 t skipjack, 575 t bigeye, 108 t frigate tuna and 3 t albacore tuna. Catches of tropical tunas by Senegalese purse seiners amount to 21,878 t. Catches are comprised of yellowfin (6017 t), skipjack (14,092 t), bigeye (895 t), frigate tuna (871 t) and Atlantic black skipjack (2 t). For Senegalese longline fisheries targeting swordfish, the 2016 catches are estimated at 375 t of which 225 t are swordfish, 101 t are yellowfin tuna, 35 t are shark, 12 t are blue marlin and 2 t dolphinfish. As regards the artisanal fisheries, the catches of small tunas and tuna-like species in 2016 were estimated at 8,677 t and 1,693 t for sharks.

Monitoring of the fishing activities of all tuna vessels operating in the Atlantic Ocean that use the port of Dakar, and data collection and in port sampling continue to be carried out by the Centre of Oceangraphic Research in Dakar - Thiaroye (CRODT). Statistics collection (catch and fishing effort by number of trips) and sampling of billfish continue to be carried out in the main artisanal fishing ports with the financial support of the Enhanced Program for Billfish Research (EPBR).

South Africa

The South African tuna and billfish resources are exploited by baitboat (tuna pole and line) and longline fisheries. The baitboat fleet consisted of 98 active vessels of an average 16 m length overall (LOA) fishing for 4,908 catch days. Despite an increase in effort by seven vessels compared to 2015, the baitboat fishery saw an almost 50% decline in albacore (*Thunnus alalunga*) catch and a more than 30% decline in yellowfin tuna (*Thunnus albacares*) catch, resulting in a total 2016 catch of 2,001 t and 599 t, respectively. In 2016, 15 longline vessels were active in the Atlantic. These were exclusively South African flagged vessels, with all three active joint-venture (Japanese) vessels having fished exclusively in the Indian Ocean since 2014. Total longline effort in the Atlantic has decreased from 1,187 thousand hooks in 2015 to 924 thousand hooks in 2016. The 2016 catches of swordfish (164 t), albacore (65 t), yellowfin tuna (107 t), bigeye tuna (111 t), shortfin mako shark (339 t) and blue sharks (356 t) have all decreased compared to 2015. Measures to reduce shark targeting to direct effort towards improved tuna and billfish catch have been included in the Large Pelagics Fishery Policy and have been fully incorporated into the fishery regulations since January 2017. The South African government (DAFF) is conducting independent research and is collaborating with universities, scientists from other CPCs and NGOs to optimise sustainable large pelagic fishing. Key research conducted in 2016 included the development and application of the Bayesian Surplus Production modelling software 'JABBA', the development and improvement of abundance indices of large pelagic species and involvement in multilateral bycatch estimation, genetics and life-history research programs. Research projects investigating the stock origin and intermixing of tuna and swordfish populations at the boundary between the Atlantic and Indian Oceans remain a high research priority in South Africa.

Tunisia

The tuna and tuna-like management and conservation plans are essentially governed by the provisions of Law No. 94-13 of 31 January 1994 and its implementing texts. In 2016, as in previous years, these plans have been supported by implementation of all the control programmes (onboard observers programme) and the at-sea and in-port inspection programmes in particular during periods of prohibition on fishing for bluefin tuna and swordfish. In preparation for the 2016 bluefin tuna fishing campaign, Tunisia adjusted its fishing capacity in accordance with the methodology adopted by ICCAT (paragraph 41 of Rec. 14-04). On the basis of this methodology, Tunisia established a fishing plan and allocated individual quotas to 27 vessels to fish for bluefin tuna in 2016.

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 by-catch and discards in the tuna and swordfish fisheries, the relevant authority, in addition to catch documentation, has achieved a scientific observer coverage of 5% of the tuna and artisanal fisheries. The allocation of quotas for bluefin tuna fishing and fine-tuning of gears targeting swordfish have greatly reduced incidental catches; in 2016, no by-catch of sea turtles or sea mammals was reported by the national observers programme. Total catches of bluefin tuna in 2016 amounted to 1,490.6 t, which equates to 99.92% of the adjusted national quota of 1,491.71 tonnes. It should be noted that 2% of these catches were taken as by-catch.

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.

United Kingdom - OTs

The level of fishing effort in the United Kingdom Overseas Territories (UKOTs) engaged in ICCAT during 2016 was similar to that of 2015 in terms of vessels registered, with a slight decrease in the Bermuda fleet, but also a slight increase, in terms of vessels registered, with St Helena registering the first vessel over 20 m in length to the UKOT fleet, as part of its efforts to expand its fishery. The total tonnage of ICCAT species caught in the UK OTs has remained modest when compared to more developed fisheries. Bermuda and St Helena continue to represent the largest contributors to the total UK OT catch, with much smaller catches in the British Virgin Islands and the Turks and Caicos Islands.

UK OT fishing activity is primarily artisanal or sports-related. There is no fishing involving larger scale methods utilising, for example, fish aggregating devices or purse seines, and only very limited deployment of longlines. However, the UKOTs continue with their interest in developing commercially viable fisheries to aid in their economic development.

The Territories recognise their responsibilities for the sustainable management of their natural environments and have been working with the UK Government to develop fisheries – including developing sustainable management plans and facilitating development of the fishing sector. The establishment of a robust management framework is, however, dependent upon long term investment, which is in turn reliant on the retention of some existing quotas and the potential for expansion in others (such as s. albacore or swordfish) which might come under pressure if fisheries were expanded.

United States

Total (preliminary) reported U.S. catch of tunas (YFT, SKJ, BET, ALB, BFT) and swordfish, including dead discards, in 2016 was 6,737 t, an increase of about 15% from 5,847 t in 2015. Swordfish catches (including estimated dead discards) decreased from 1,718 t in 2015 to 1,522 t in 2016, and provisional landings from the U.S. fishery for yellowfin tuna increased in 2016 to 3,274 t from 2,074 t in 2015. U.S. vessels fishing in the northwest Atlantic caught in 2016 an estimated 1,025 t of bluefin tuna, an increase of about 126 t compared to 2015. Provisional skipjack tuna landings increased by about 56 t to 134 t from 2015 to 2016, bigeye tuna landings decreased by 298 t compared to 2015 to an estimated 533 t in 2016, and albacore landings increased from 2015 to 2016 by 3 t to 250 t.

U.S. government (NOAA) and university scientists, working independently or in collaboration (including collaborations with scientists from other CPCs), conducted research in 2016 involving a variety of ICCAT and by-catch species. Such research included larval surveys, the development of abundance indices, electronic and conventional 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, and the development of stock assessment models.

Uruguay

In 2016, the Uruguayan tuna fleet did not carry out any activity. So far in 2017 several projects have been submitted to DINARA for inclusion of new vessels in the large pelagic resources fishery. A recovery in the sector is therefore expected from late 2017. The analysis of catch and effort statistics of the species of interest to the Commission continued. Two research campaigns were carried out onboard DINARA's B/I, aimed at large pelagic resources. During these campaigns the catch was recorded, sampling for size and sex was carried out, biological samples were taken, and the Conventional Tagging Programme and the Satelite Tagging Programme (*Thunnus albacares, Prionace glauca, Isurus oxyrinchus, Lamna nasus* and *Diomedea epomophora*) were continued. In addition, experiments were performed to evaluate by-catch mitigation measures. Uruguay participated in and provided papers for different SCRS meetings, including the inter-sessional meeting of the Conservation and Management Measures Compliance Committee, yellowfin tuna data preparatory meeting (3 documents), the inter-sessional meeting of the Sharks Species Group (4 documents), the North and South Atlantic albacore stock assessments meeting, the yellowfin tuna stock assessment meeting (2 documents) and the meeting of the Sub-Committee on Ecosystems. 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 the vessel documentation. All ICCAT Recommendations during the 2016 Commission Meeting have been implemented into Uruguayan law, and are currently in force through decree.

- Cooperating Non-Contracting Parties, Entities and Fishing Entities

Chinese Taipei

In 2016, the number of authorized fishing vessels was 101 with 70 targeting bigeye tuna and 31 targeting albacore, and the total catch of tuna and tuna-like species was about 30,517 t. Bigeye tuna was the most dominant species, which accounts for 43% of the total catch in weight, followed by albacore with catch accounting for 39% of the total catch. We have carried out a scientific observer program for the tuna fishery in ICCAT waters since 2002. In 2016, there were 19 observers deployed on fishing vessels operating in the Atlantic Ocean, and the observer coverage on albacore and bigeye vessels was 6.63% and 11.79% respectively. The research programs conducted by scientists in 2016-2017 included the research on CPUE standardizations and assessments of bigeye tuna, yellowfin tuna, albacore, swordfish and sharks; the impact of climatic change on major tuna stocks; studies of shark by-catch and abundance index; the age and growth of sharks; and the research on incidental catch of ecological related species. The research results were presented at the inter-sessional working group meetings and regular meetings of SCRS. As for the reporting obligation, the related statistical information and information required by ICCAT Recommendations was submitted to the ICCAT Secretariat within the required timeframe.

8. Executive Summaries on species

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.*

The Committee also pointed out that the texts and tables of these Summaries generally reflect the information available in ICCAT immediately prior to the SCRS plenary sessions, since they were prepared during the meetings of the Species Groups. Therefore, the catches reported to ICCAT during or after the SCRS meeting cannot be included in these Summaries.

8.1 YFT – YELLOWFIN TUNA

A stock assessment for yellowfin tuna was conducted in 2016, at which time catch and effort data through 2014 were available. The catch table presented in this Executive Summary (**YFT-Table 1**) has been updated to include reported catches through 2016, including revisions to Ghanaian catches for the period 1973-2014 that have been incorporated since the last assessment. The revisions to Ghanaian yellowfin tuna catches for 2015 and 2016 are still pending review by the SCRS. Readers interested in a more complete summary of the state of knowledge on yellowfin tuna stock status should consult the detailed Report of the 2016 Yellowfin Stock Assessment Session (Anon., 2017a). The Tropical Tunas Work Plan (**Appendix 12**) includes plans to address research and assessment needs for yellowfin tuna.

YFT-1. Biology

Yellowfin tuna is a cosmopolitan species distributed mainly in the tropical and subtropical oceanic waters of the three oceans. The exploited sizes typically range from 30 cm to 170 cm FL. Juvenile yellowfin tuna form mixed schools with skipjack and juvenile bigeye, and are mainly limited to surface waters, while larger fish form schools in surface and sub-surface waters. Spawning on the main fishing grounds, the equatorial zone of the Gulf of Guinea, occurs primarily from December to April. Spawning also takes place in the Gulf of Mexico, the southeastern Caribbean Sea and off Cabo Verde, although the peak spawning can occur in different months in these regions. The relative importance of the various spawning grounds is unknown.

Although the distinct spawning areas might imply separate stocks, or substantial heterogeneity in the distribution of yellowfin tuna, a single stock for the entire Atlantic is currently assumed. This assumption is based upon information such as observed transatlantic movements (from west to east) indicated by conventional tagging and longline catch data that indicates yellowfin are distributed continuously throughout the tropical Atlantic Ocean. However, movement rates and timing, routes, and local residence times remain highly uncertain. In addition, some electronic tagging studies in the Atlantic as well as in other oceans suggest that there may be some degree of extended local residence times and/or site fidelity.

A recent study in the eastern Atlantic Ocean further described the reproductive traits of female yellowfin tuna including, sex-ratio, size at maturity, spawning seasonality, fish condition and fecundity. Size at 50% maturity was estimated at 103.9 cm fork length when cortical alveoli were used as a maturity threshold, however a larger size of around 120 cm at 50% maturity was estimated when more advanced oocytes were used. The conclusions of this research were incorporated in the 2016 stock assessment of yellowfin tuna.

Tagging studies of yellowfin in the Pacific and Indian Oceans suggest that natural mortality is age-specific, and higher for juveniles than for adults. Nevertheless, uncertainties remain as to the exact parameterization of the age-specific natural mortality function. As was applied for the recent bigeye tuna assessment, an age-specific natural mortality function (e.g. Lorenzen) was developed and applied to the 2016 assessment of yellowfin tuna. The most recent stock assessment does not consider sex-specific natural mortality or growth, yet there are disparities in average size by gender. Males are predominant in the catches of larger sized fish (over 145 cm), which could result if large females experience a higher natural mortality rate, perhaps as a consequence of spawning. In contrast, females are predominant in the catches of intermediate sizes (120 to 135 cm), which could result from differential growth (e.g. females having a lower asymptotic size than males). Recent results from studies in the Indian Ocean suggest a combination of the two hypotheses.

It is generally agreed that growth rates are relatively slow initially, increasing at the time the fish leave the nursery grounds. This interpretation is supported by analyses of size frequency distributions as well as tagging data. Regardless, questions remain concerning the most appropriate growth model for Atlantic yellowfin tuna, as analyses of hard part growth increments support somewhat different growth patterns.

Younger age classes of yellowfin tuna (40-80 cm) exhibit a strong association with FADs (natural or artificial fish aggregating devices/floating objects). The Committee noted that this association with FADs, which increases the vulnerability of these smaller fish to surface fishing gears, may also have an impact on the biology and on the ecology of yellowfin due to changes in feeding and migratory behaviors. These uncertainties in stock structure, natural mortality, and growth could have important implications for the stock assessment. The ongoing Atlantic Ocean Tropical Tuna Tagging Programme (AOTTP), if fully successful, will help reduce these uncertainties.

YFT-2. Fishery indicators

Yellowfin tuna have been exploited by three major gears (longline, baitboat and purse seine fisheries) and by many countries throughout its range. Detailed data are available since the 1950s (**YFT-Table 1**). Overall Atlantic catches declined by nearly half from the peak in 1990 (193,600 t) to 109,000 t estimated for 2015, but have since increased to 127,800 t in 2016. The most recent catch distribution is given in **YFT-Figure 1**. However, it should be noted that official reports are not yet available from several Contracting and/or non-Contracting Parties, and that **YFT-Table 1** and **YFT-Figure 1** incorporate provisional scientific estimates of Ghanaian catches for 2006-2014.

In the eastern Atlantic, purse seine catches declined by over 60% between 1990 and 2007 (127,700 t to 48,000 t), but subsequently increased to 94,000 t in 2016 (**YFT-Table 1; YFT-Figure 2**). Baitboat catches declined by 70% between 1990 and 2015 (from 19,600 t to 5,900 t), but increased to 9,750 t in 2016. Longline catches, which were 10,300 t in 1990, declined to 4,860 t in 2016. In the western Atlantic, purse seine catches (predominantly from Venezuela) were as high as 25,700 t during the mid-1980s, but have since declined nearly 80% to 5,330 t in 2016. Baitboat catches also declined 80% since a peak in 1994 (7,100 t), and for 2016 were estimated to be about 1,150 t. Since 1990, longline catches have generally fluctuated between 10,000 t and 20,000 t.

The decline in purse seine catches during 1992-2007 was in large part due to a decline in the number of European and associated fleet purse seine vessels operating in the eastern Atlantic (e.g. from 67 vessels in 1992 to 27 vessels in 2007; **SKJ-Figure 9**). However, since that time, the number of purse seiners and overall fleet efficiency has increased as newer vessels with greater fishing power and carrying capacity have moved from the Indian Ocean to the Atlantic. The Committee notes that since 2013, six new purse seine vessels began operations in the Atlantic Ocean. By 2010, overall carrying capacity of the purse seine fleet had increased significantly, to about the same level as in the 1990s, and has increased by nearly 50% since. FAD based fishing has accelerated even more rapidly than free school fishing.

The Committee noted that surface fisheries for tropical tunas in the eastern Atlantic have expanded in recent years. Since 2011, significant catches of yellowfin tuna have been obtained by EU purse seiners south of 15°S off the coast of West Africa (in association with skipjack and bigeye on FADs). Another recent change is the implementation in 2012 of the strategy of fishing on floating objects off of Mauritania (north of 15°N). Catches on floating objects in this area tended to consist almost entirely of skipjack. Effort directed in this manner may therefore have a reduced impact on yellowfin tuna.

Catch-at-size was fully rebuilt for the assessment (1960-2014) to incorporate all new and revised size, and catch at size information available to ICCAT; note that samples from 1960-1965 were very limited. New and revised information were received from major purse seine and longline fleets, and from fisheries such as "*faux poisson*". The species composition and catch at size of tropical tunas landed by Ghanaian baitboats and purse seiners were also updated for the period 2006-2014. These changes are reflected in **YFT-Table 1**. As in previous assessments, catch at age was estimated by slicing from deterministic growth functions.

Eight longline indices were selected for use in the stock assessment based on meeting specific criteria for inclusion. Indices with similar characteristic were grouped together using a cluster analysis. The two "clusters" represent unique hypotheses regarding trends in abundance of yellowfin tuna. Cluster 1 indices showed an initial decline, with nearly constant relative abundance since 1990, while Cluster 2 indices suggest increased abundance during the 1990s, followed by a general decline through 2014 (**YFT-Figure 3**). The two trends represent a major source of scientific uncertainty regarding the abundance of yellowfin tuna. Several nominal baitboat and purse seine indices which had been used in previous assessments were eliminated from the 2016 assessment because they had not been standardized, lacked documentation, or their diagnostic characteristics could not be examined. Abundance indices from surface fleets, particularly those that capture newly recruited fish could be useful if properly adjusted for changes in fishing power. Future work to develop, document and maintain indices from these fleets is desirable.

New information was recently made available (Parker *et al*., 2017a) regarding the standardized catch rates of yellowfin tuna from the South African pole-and-line fishery during 2003-2016. The analyses indicate that the CPUE of the South African baitboat fishery for yellowfin tuna exhibits high inter-annual variability but, overall, has maintained similar levels to those from the previous decade. A decrease in CPUE from 2006-2009 was noted and could not be explained by targeting, weather or effort shifts. With additional evaluation, indices from this region could be considered for use in future stock assessments, especially if the spatial structure of the stock can be better accommodated.

The average weight trends by fleet (1970-2014) are shown in **YFT-Figure 4**. The recent average weight in European purse seine catches, which represent the majority of the landings, had declined to about half of the average weight of 1990. This decline is at least in part due to changes in selectivity associated with fishing on floating objects beginning in the 1990s, which was observed in the increased catches of small yellowfin. A declining trend in average weight and a corresponding increase in the catch of small yellowfin is also evident in eastern tropical baitboat catches. Longline mean weights and catch at size have been more variable.

YFT-3. State of the stock

A full stock assessment was conducted for yellowfin tuna in 2016, applying three age-structured models and a non-equilibrium production model to the available catch data through 2014. As has been done in previous stock assessments, stock status was evaluated using both surplus production and age-structured models. Models used to develop management advice considered two primary sources of scientific uncertainty, the use of index clusters that reflect two disparate hypotheses regarding trends in abundance of yellowfin tuna, and alternative model structures as implemented using four model platforms. Surplus production models that used Cluster 2 indices did not converge and were not considered. Management advice was developed using a joint distribution of the results of seven models (ASPIC Cluster 1; ASPM-Clusters 1 and 2, VPA Clusters 1 and 2, SS Clusters 1 and 2) which were weighted equally. Additional uncertainties in growth, age-slicing, mortality, index selection and data weighting were explored in sensitivity runs. Trends in biomass (**YFT-Figure 5**) and fishing mortality (**YFT-Figure 6**), relative to the levels that produce MSY, were generally similar for all models used to develop management advice, although small differences in current stock status were noted (**YFT-Figures 5** and **6**). Model specific Kobe status plots (**YFT-Figure 7**), with the annual trajectories of stock status, indicate that for most models the 2014 stock status was near B_{MSY} and below F_{MSY}. Annual trajectories should be interpreted with caution because they are not adjusted for known changes in selectivity.

The estimated MSY (median = 126,304 t) may be below what was achieved in past decades because overall selectivity has shifted to smaller fish. The impact of this change in selectivity on estimates of MSY is clearly seen in the results from age structured models (e.g. **YFT-Figure 8**). Bootstrapped estimates of the current status for the seven models, which reflect the variability of the point estimates given assumptions about uncertainty in the inputs, are shown in **YFT-Figure 9**. When the uncertainty around the point estimates from all models is taken into account, there was an estimated 45.5% chance that the stock was healthy (not overfished and overfishing not occurring) in 2014, a 41.2% probability that the stock was overfished, but not experiencing overfishing, and a 13.3% chance that the stock was both overfished and undergoing overfishing (**YFT-Figure 10**).

In summary, 2014 stock biomass was estimated to be about 5% below B_{MSY} (overfished) and fishing mortality rates were about 23% below F_{MSY} (no overfishing).

YFT-4. Outlook

Projections conducted in 2016 considered a number of constant catch scenarios (**YFT-Figures 11-12**). In most cases, catches less than 120,000 t led to, or maintained a healthy stock status through 2024. The results from the seven models were summarized to produce estimated probabilities of achieving the Convention objectives ($B>B_{MSY}$, $F<F_{MSY}$), for a given level of constant catch, for each year up to 2024 (**YFT-Table 2**). Maintaining catch levels at the current TAC of 110,000 t was expected to maintain healthy stock status ($B>B_{MSY}$, $F<F_{MSY}$) through 2024 with at least 68% probability, increasing to 97% by 2024. As the actual 2016 catches exceeded the values assumed for projections and the TAC, the percentages above (and in **YFT-Table 2**), are likely to be optimistic.

YFT-5. Effect of current regulations

Closures in various time-areas in the eastern tropical Atlantic have been in place during some prior years, imposing restrictions on either FAD-associated sets or all surface gears. Rec. 11-01 (later Rec. 14-01) implemented a closure of surface fishing on FADs in the area from the African coast to 10ºS, 5ºW-5ºE during January-February in the Gulf of Guinea. This closure came into effect in 2013. The efficacy of the area-time closure (moratorium) agreed in Rec. 14-01 was evaluated by examining fine-scale (1ºx1º) skipjack, yellowfin, and bigeye catch by month distributions from the European and associated purse seine fleet FAD fishery and the Ghanaian purse seine and baitboat fishery. After reviewing this information, the Committee concluded that the moratorium had not been effective at reducing the mortality of juvenile bigeye tuna, and any reduction in yellowfin tuna mortality was minimal, largely due to the redistribution of effort into areas adjacent to the moratorium area. The anticipated effect of the moratorium described in Rec. 16-01 will be evaluated when data becomes available.

Rec. 14-01 (reiterated in Rec. 16-01) also implemented a TAC of 110,000 t for 2012 and subsequent years. The overall catches in 2012 (104,500 t), 2013 (97,300 t), 2014 (97,000 t) and 2015 (108,900 t) were lower than this TAC, but the 2016 estimates exceeded the TAC (127,800 t).

YFT-6. Management recommendations

Based on the 2016 stock assessment, the Atlantic yellowfin tuna stock was estimated to be overfished, but at 95% B_{MSY} in 2014. Maintaining catch levels at the current TAC of 110,000 t was expected to maintain healthy stock status through 2024. However, 2016 catches exceeded the catch recommendation by 16%.

The Commission should also be aware that increased harvests on FADs could have negative consequences for yellowfin and bigeye tuna, as well as other by-catch species (Anon., 2017b). Should the Commission wish to increase long term sustainable yield, the Committee continues to recommend that effective measures be found to reduce FAD-related and other fishing mortality of small yellowfin tuna.

ATLANTIC YELLOWFIN TUNA SUMMARY	
Maximum Sustainable Yield (MSY)	126,304 t (119,100 - 151,255 t)[1]
2016 Yield	127,800 t
Relative Biomass B_{2014}/B_{MSY}	0.95 (0.71-1.36)[1]
Relative Fishing Mortality: $F_{current\ (2014)}/F_{MSY}$	0.77 (0.53-1.05)[1]
2014 Total Biomass	464,712 t (308,287 – 731,485 t)[1]
Stock Status (2014)	Overfished: Yes Overfishing: No

Management measures in effect:
[Rec. 14-01]:
- Time-area closure for FAD associated surface fishing
- TAC of 110,000 t
- Specific authorization to fish for tropical tunas for vessels 20 meters or greater
- Specific limits of number of longline and/or purse seine boats for a number of fleets

[Rec. 16-01]
- Revised time-area closure for FAD associated surface fishing
- TAC of 110,000 t
- Specific authorization to fish for tropical tunas for vessels 20 meters or greater
- Specific limits of number of longline and/or purse seine boats for a number of fleets
- Specific limits on FADs, non-entangling FADs required

NOTE: $F_{current(2014)}$ refers to F_{2014} in the case of ASPIC, ASPM and SS, and the geometric mean of F across 2011-2013 in the case of VPA. Relative biomass is calculated in terms of spawning stock biomass in the case of ASPM, SS and VPA and in total biomass in the case of ASPIC.

[1] Median (10^{th}-90^{th} percentiles) from joint distribution of age-structured and production model bootstrap outcomes considered.

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
TOTAL			163770	163451	173744	154588	149152	137375	144496	136325	132154	153455	134427	122448	119445	101745	104659	95963	106716	113438	108981	102783	104528	97269	96988	108934	127777
	ATE		126058	124706	125530	119314	116096	105034	113576	105615	96531	113132	104767	97467	88207	75677	76388	71795	88593	94661	88187	85105	84678	77790	82109	93858	109001
	ATW		37712	38745	48215	35274	33056	32341	30919	30710	35623	40323	29660	24982	31238	26068	28272	24167	18123	18777	20794	17678	19851	19479	14879	15076	18776
Landings	ATE	Bait boat	15095	18471	15652	13496	11365	12695	14265	16729	10022	14034	11145	9967	14639	9725	12490	7044	7253	7424	6879	9118	6297	4731	6176	5913	9751
		Longline	6518	8537	14638	13723	14236	10483	13872	13561	11369	7570	5869	9183	11537	7317	7234	13437	8562	7385	5544	6602	5510	5659	5283	4339	4863
		Other surf.	2450	2122	2030	1989	2065	2136	1674	1580	2424	2074	1624	2309	2699	2152	2988	2534	1693	3012	1890	1397	1964	2941	1450	1508	349
		Purse seine	99532	92130	90151	87597	87616	78225	82278	71964	70664	89068	85808	74702	57797	55429	52928	47944	70077	75417	72006	64966	69034	63126	67798	81961	94038
	ATW	Bait boat	6276	6383	7094	5297	4560	4275	5511	5364	6753	5315	6009	3764	4868	3867	2695	2304	886	1331	1436	2311	1108	1403	493	743	1152
		Longline	17336	12129	11790	11185	11882	11554	11671	13326	15760	14872	11921	10166	16019	14449	14249	13557	13192	12782	13038	10677	12558	12308	8384	7347	7647
		Other surf.	2741	4152	9719	12454	5830	4801	4581	5330	5241	7027	3763	6445	7134	5118	6880	5959	1973	3285	3590	2425	2885	2130	3418	4651	4640
		Purse seine	11359	16081	19612	6338	10784	11710	9157	6523	7870	13108	7966	4607	3217	2634	4442	2341	2067	1370	2722	2256	3292	3635	2581	2332	5334
Landings(FP)	ATE	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	0	
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	
		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	
	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
		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	
Landings	ATE CP	Angola	441	211	137	216	78	70	115	170	35	34	34	34	34	111	0	405	98	701	520	485	191	0	541	0	
		Belize	0	0	0	1	0	3	0	0	5	0	0	0	0	0	0	0	0	405	1794	3172	5861	5207	7036	7132	3497
		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**
		Cape Verde	1527	1612	1943	1908	1518	1783	1421	1663	1851	1684	1802	1868	3236	6019	5648	4568	7905	4638	5856	6002	4603	7513	4507	7823	4933
		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
		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
		Côte d'Ivoire	0	0	0	0	0	2	0	0	673	213	99	302	565	175	482	216	626	90	470	385	1481	2077	324	251	315
		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
		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	
		EU.France	33964	36064	35468	29567	33819	29966	30739	31246	29789	32211	32753	32429	23949	22672	18940	11330	16115	18923	20280	22037	18506	20291	21087	19443	26198
		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	
		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**
		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	
		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	
		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	
		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
		EU.United Kingdom	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**
		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	2750	8252
		Gabon	0	12	88	218	225	225	295	225	162	270	245	44	44	44	44	0	0	0	0	0	0	0	0	0	
		Ghana	9331	13283	9984	9268	8182	15080	13222	20815	12304	23392	18100	15002	14044	13019	12897	11115	11502	11037	10457	8676	9591	8786	11652	13282	18970
		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
		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	**0**
		Guinée Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	298	292	1559	1484	823	0	
		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	
		Japan	2961	2627	4194	4770	4246	2733	4092	2101	2286	1550	1534	1999	5066	3088	4206	8496	5266	3563	3041	3348	3637	3843	3358	2853	2917
		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
		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	19
		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	
		Maroc	0	0	0	0	0	0	0	0	0	0	79	108	95	1940	222	102	110	110	44	272	55	137	107	72	115
		Namibia	0	0	35	14	72	69	3	147	59	165	89	139	85	135	59	28	11	1	9	90	0	6	15	42	53
		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**
		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	
		Panama	8338	10973	12066	13442	7713	4293	2111	1315	1103	626	1112	0	1887	6170	8557	9363	6175	5982	5048	4358	5004	3899	4587	3202	4305
		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**
		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**
		S. Tomé e Príncipe	170	181	125	135	120	109	124	114	122	122	122	122	134	145	137	0	160	165	169	173	177	182	186	301	301
		Senegal	40	19	6	20	41	208	251	834	252	295	447	279	681	1301	1262	819	588	1279	1212	1050	1683	1247	612	1883	6850
		South Africa	69	266	486	183	157	116	240	320	191	342	152	298	402	1156	1187	1063	351	303	235	673	174	440	1512	925	706
		St. Vincent and Grenadines	0	0	0	0	12	129	28	255	126	75	194	56	14	0	101	209	83	74	28	0	0	0	0	0	
		U.S.A.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		U.S.S.R.	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	1	0	0	0	**0**
		UK.Sta Helena	166	171	150	181	151	109	181	116	136	72	9	0	0	0	344	177	97	104	65	163	149	53	152	178	181
		Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	0	24	145	483	450	331	23	10	124	21	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**

				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
		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	762
		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	
			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	
			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	
			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	
			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	
			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	
			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	
			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	
			Mixed flags (FR+ES)	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)	10820	9800	8327	8844	9485	6514	7193	5086	5117	9942	7436	2649	2120	0	0	0	0	0	0	0	0	0	0	0	
			NEI (Flag related)	1315	1157	2524	2975	3588	3368	5464	5679	3072	2038	43	466	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	
			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	
	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
			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
			Brazil	4228	5131	4169	4021	2767	2705	2514	4127	6145	6239	6172	3503	6985	7223	3790	5468	2749	3313	3617	3499	2836	3316	2866	4896	3693
			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
			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	
			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
			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
			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
			EU.France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	122	456	712	412	358	647	632	403
			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	
			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
			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
			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**
			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
			Japan	1591	469	589	457	1004	806	1081	1304	1775	1141	571	755	1194	1159	437	541	986	1431	1539	1106	1024	734	465	613	466
			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
			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
			Panama	2297	0	0	0	0	0	0	5	0	20	28	0	0	0	2804	227	153	119	2134	0	0	1995	902	210	25
			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**
			St. Vincent and Grenadines	22	65	16	43	37	35	48	38	1989	1365	1160	568	4251	0	2680	2989	2547	2274	854	963	551	352	505	153	434
			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
			U.S.A.	6938	6283	8298	8131	7745	7674	5621	7567	7051	6703	5710	7695	6516	5568	7091	5529	2473	2788	2510	3010	4100	2332	2630	2074	3274
			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	
			UK.British Virgin Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	3	10	5	**0**
			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**
			Uruguay	74	20	59	53	171	53	88	45	45	90	91	95	204	644	218	35	66	76	122	24	6	7	0	0	**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**
			Venezuela	13773	16663	24789	9714	13772	14671	13995	11187	11663	18651	11421	7411	5774	5097	6514	3911	3272	3198	4783	4419	4837	5050	3772	3122	4198
		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	180
			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	
			Suriname	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1943	1829	0	0	**0**
		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	
			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	
			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	
			Dominica	23	30	31	9	0	0	0	80	78	120	169	119	81	119	65	103	124	102	110	132	119	120	0	0	179
			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	
			Grenada	595	858	385	410	523	302	484	430	403	759	593	749	460	492	502	633	756	630	673	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	
			NEI (ETRO)	0	0	0	0	0	0	0	0	0	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			NEI (Flag related)	2521	1514	1880	1227	2374	2732	2875	1730	2197	773	14	112	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
			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	
			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	
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	
			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	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	
			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	
			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	0	
			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	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
			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	
			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	
			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	
			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	
		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	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	137	**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**
			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	
		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**
	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**
			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**
			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
			U.S.A.	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**
			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**
		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**

The Brazilian catches for 2016 are SCRS estimations (carry over based on a 2013-2015 average) obtained due to the absence of official statistics.

YFT-Table 2. Kobe II matrices giving the probability that $F<F_{MSY}$, $B>B_{MSY}$ and the joint probability of $F<F_{MSY}$ and $B>B_{MSY}$, in given years, for various constant catch levels based on combined model results.

a) Probability that $F<F_{MSY}$

TAC	2017	2018	2019	2020	2021	2022	2023	2024
60,000	99%	100%	100%	100%	100%	100%	100%	100%
70,000	99%	99%	100%	100%	100%	100%	100%	100%
80,000	98%	99%	99%	99%	99%	100%	100%	100%
90,000	95%	98%	99%	99%	99%	99%	99%	99%
100,000	91%	96%	98%	98%	99%	99%	99%	99%
110,000	84%	89%	93%	96%	97%	98%	98%	98%
120,000	74%	79%	83%	80%	81%	82%	83%	84%
130,000	60%	61%	62%	62%	58%	54%	51%	48%
140,000	46%	44%	39%	33%	31%	31%	31%	30%
150,000	32%	25%	21%	20%	19%	20%	20%	20%

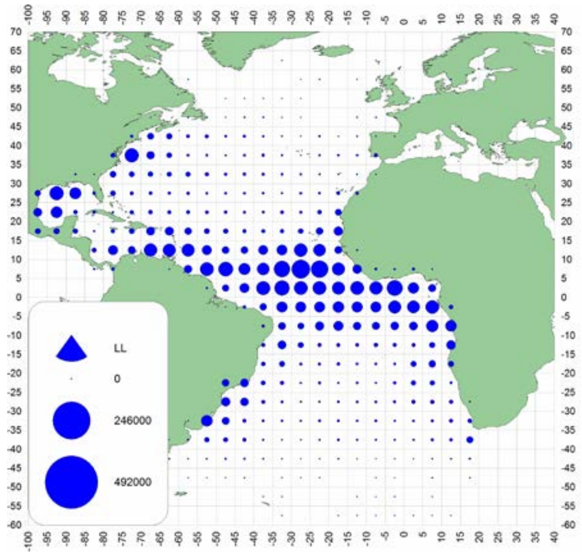
b) Probability that $B>B_{MSY}$

TAC	2017	2018	2019	2020	2021	2022	2023	2024
60,000	75%	91%	99%	99%	99%	99%	100%	100%
70,000	74%	87%	97%	99%	99%	99%	99%	99%
80,000	73%	86%	96%	99%	99%	99%	99%	99%
90,000	71%	82%	91%	97%	99%	99%	99%	99%
100,000	70%	80%	89%	92%	96%	97%	99%	99%
110,000	68%	78%	85%	90%	93%	95%	96%	97%
120,000	67%	75%	80%	80%	81%	82%	84%	84%
130,000	64%	68%	72%	70%	69%	67%	65%	62%
140,000	63%	64%	63%	59%	53%	46%	40%	38%
150,000	61%	59%	55%	47%	34%	30%	28%	27%

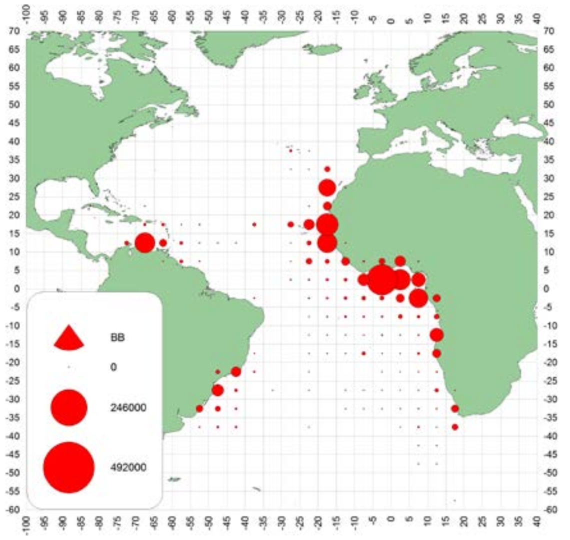
c) Probability that $F<F_{MSY}$ and $B>B_{MSY}$

TAC	2017	2018	2019	2020	2021	2022	2023	2024
60,000	75%	91%	99%	99%	99%	99%	100%	100%
70,000	74%	87%	97%	99%	99%	99%	99%	99%
80,000	73%	86%	96%	99%	99%	99%	99%	99%
90,000	71%	82%	91%	97%	99%	99%	99%	99%
100,000	70%	80%	89%	92%	96%	97%	99%	99%
110,000	68%	78%	85%	90%	92%	95%	96%	97%
120,000	65%	73%	79%	78%	79%	80%	82%	82%
130,000	57%	59%	61%	61%	57%	54%	50%	48%
140,000	45%	44%	38%	33%	31%	31%	31%	30%
150,000	31%	24%	21%	20%	19%	20%	20%	20%

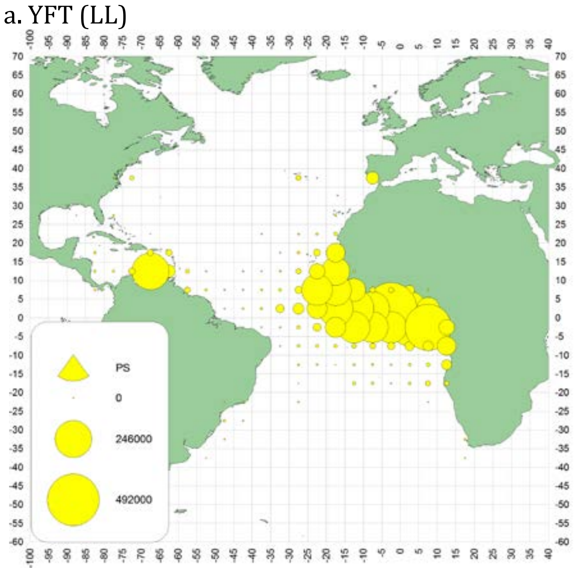
Note: SS, VPA and ASPIC projections applied an assumed catch of 110,337 (2015 estimate with carry-overs) to 2015 and 2016, prior to the application of the constant TACs of 60,000 to 150,000 t in 2017-2024. Due to a software constraint, ASPM projections applied constant TACs beginning in 2015.



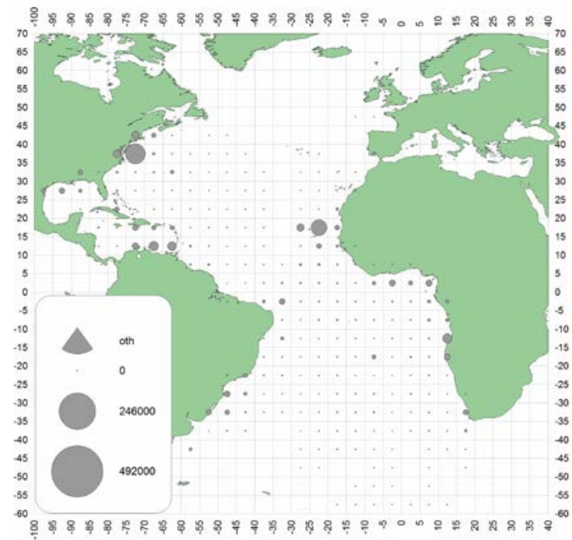
a. YFT (LL)



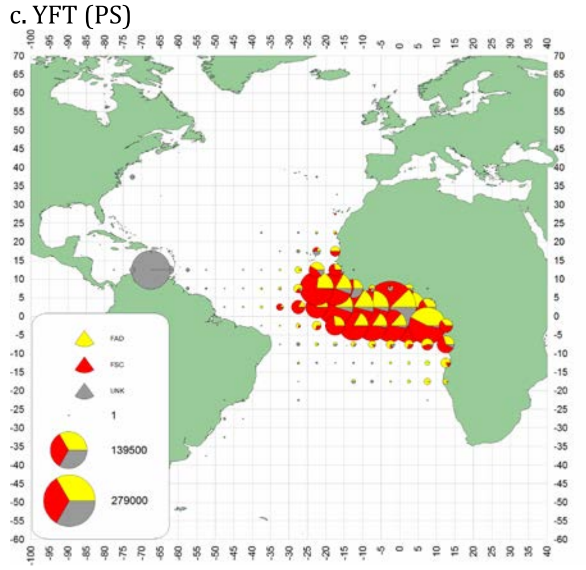
b. YFT (BB)



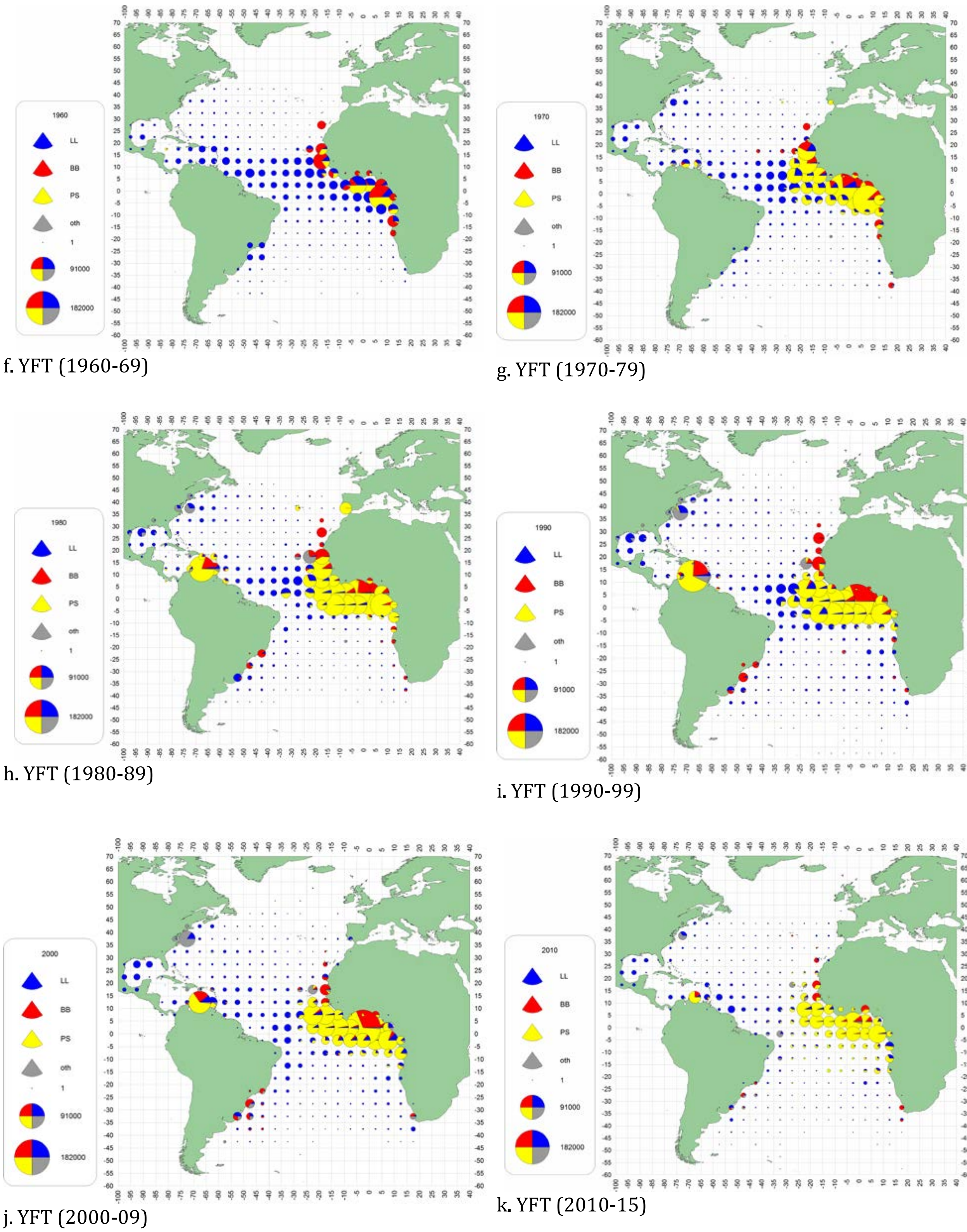
c. YFT (PS)



d. YFT (oth)



e. YFT (FAD/FREE 1991-2015)



f. YFT (1960-69)

g. YFT (1970-79)

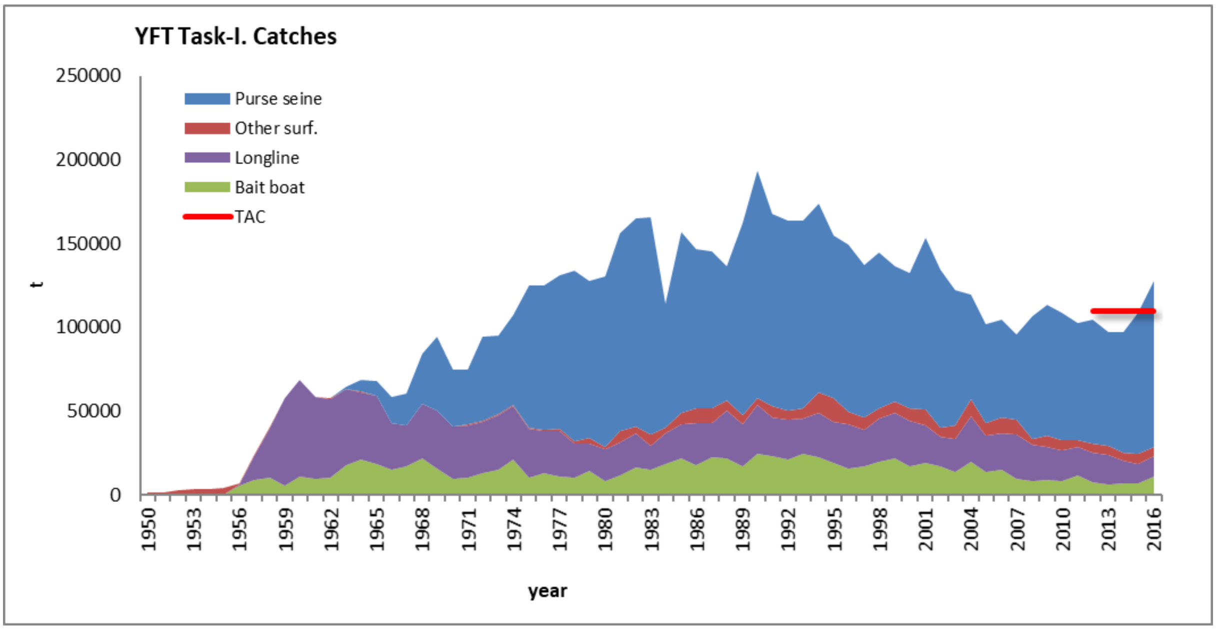
h. YFT (1980-89)

i. YFT (1990-99)

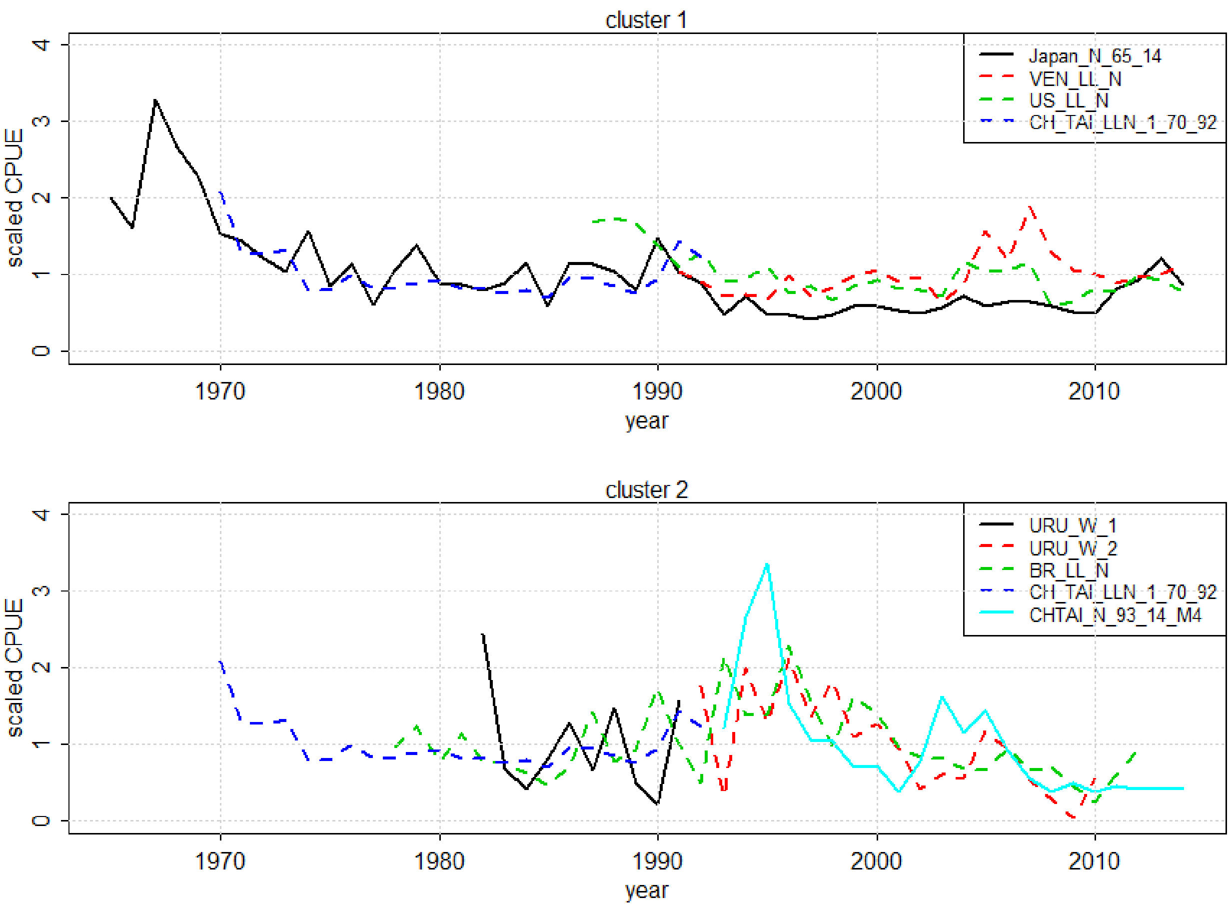
j. YFT (2000-09)

k. YFT (2010-15)

YFT-Figure 1. Geographical distribution of yellowfin tuna total catches by major gears [a-e] and by decade [f-k]. The maps are scaled to the maximum catch observed during 1960-2015. Note: the last panel (k) shows only 6 years of information. Thus, apparent changes in the size of the pie charts (in k) should not be interpreted as a reduction in catch during 2010-2015.

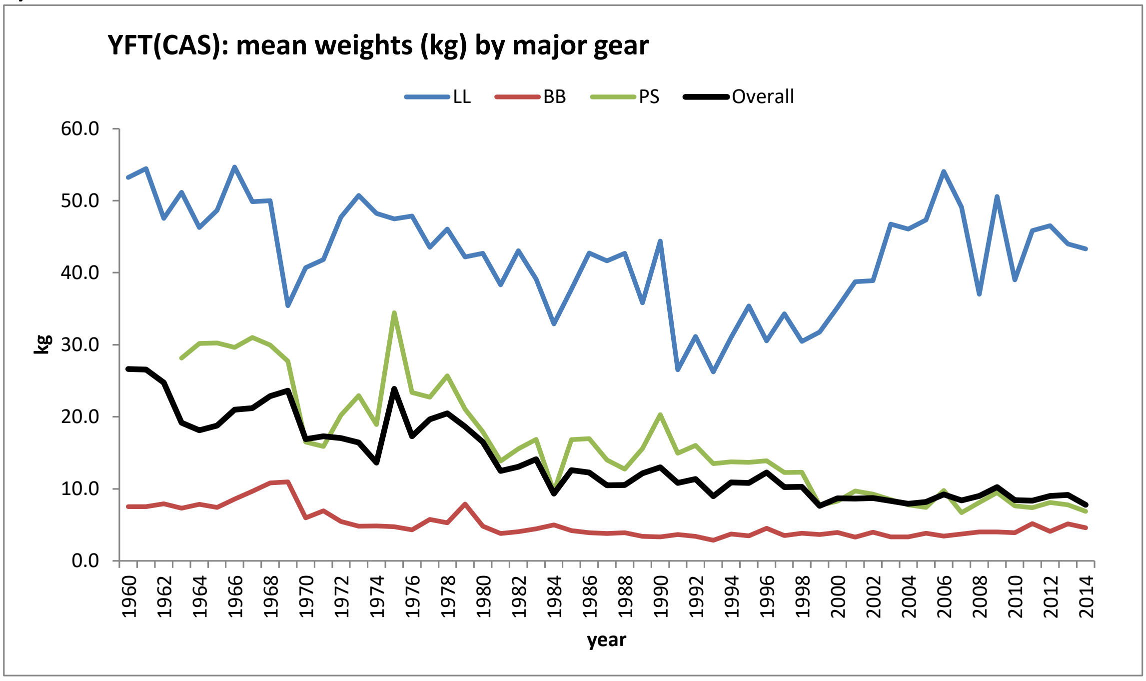


YFT-Figure 2. Estimated annual catch (t) of Atlantic yellowfin tuna by fishing gear, 1950-2016. A TAC of 110,000 t has been in place since 2012 [Rec. 14-01].

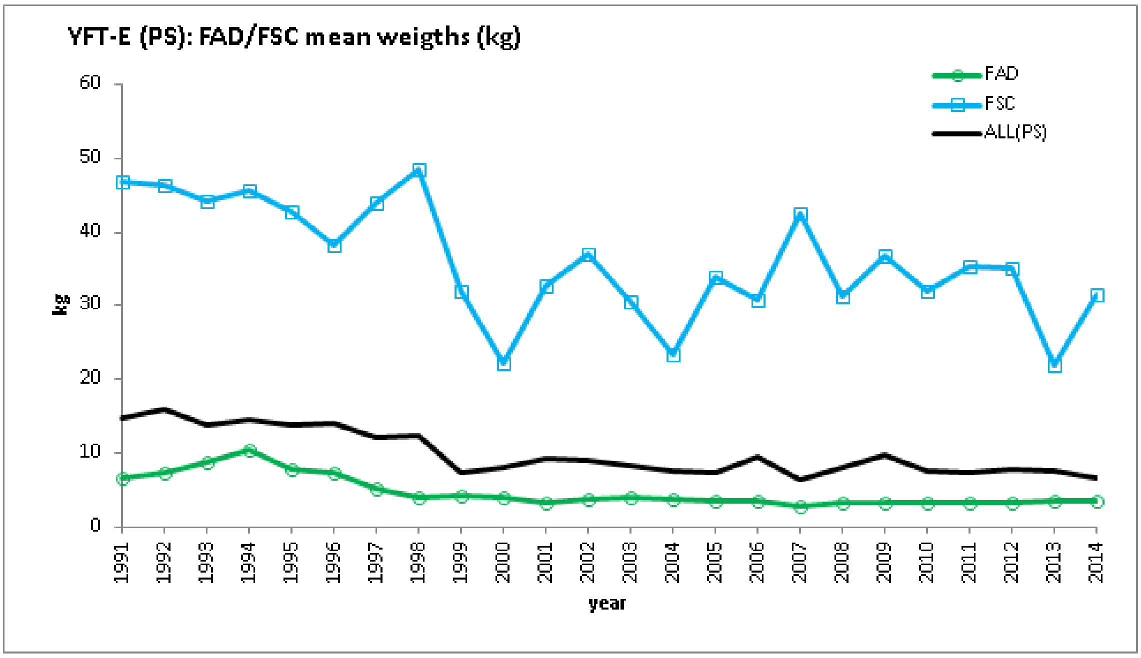


YFT-Figure 3. Yellowfin standardized catch rate trends from cluster 1 (top panel) and cluster 2 (bottom panel) indices of abundance.

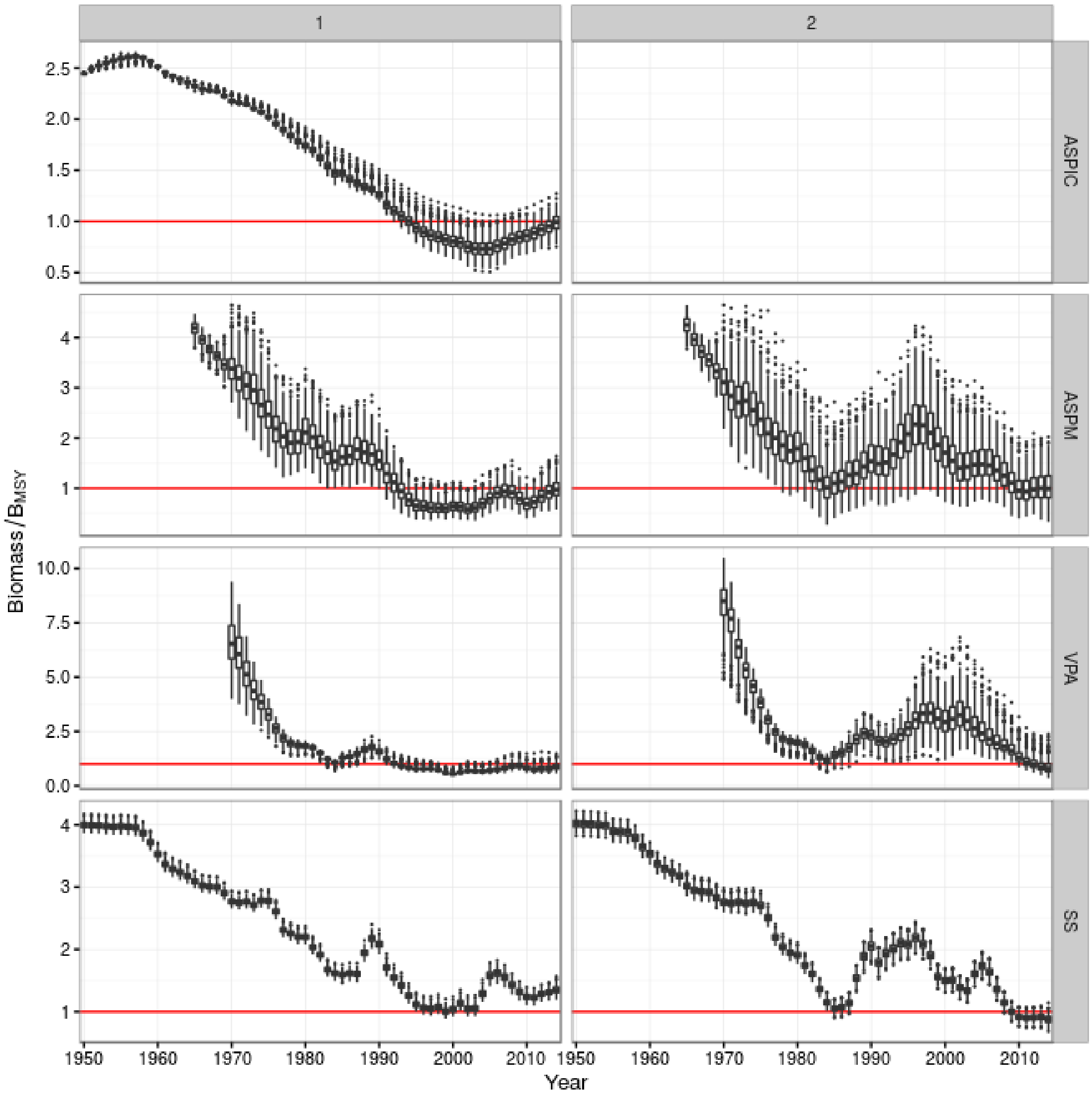
a)



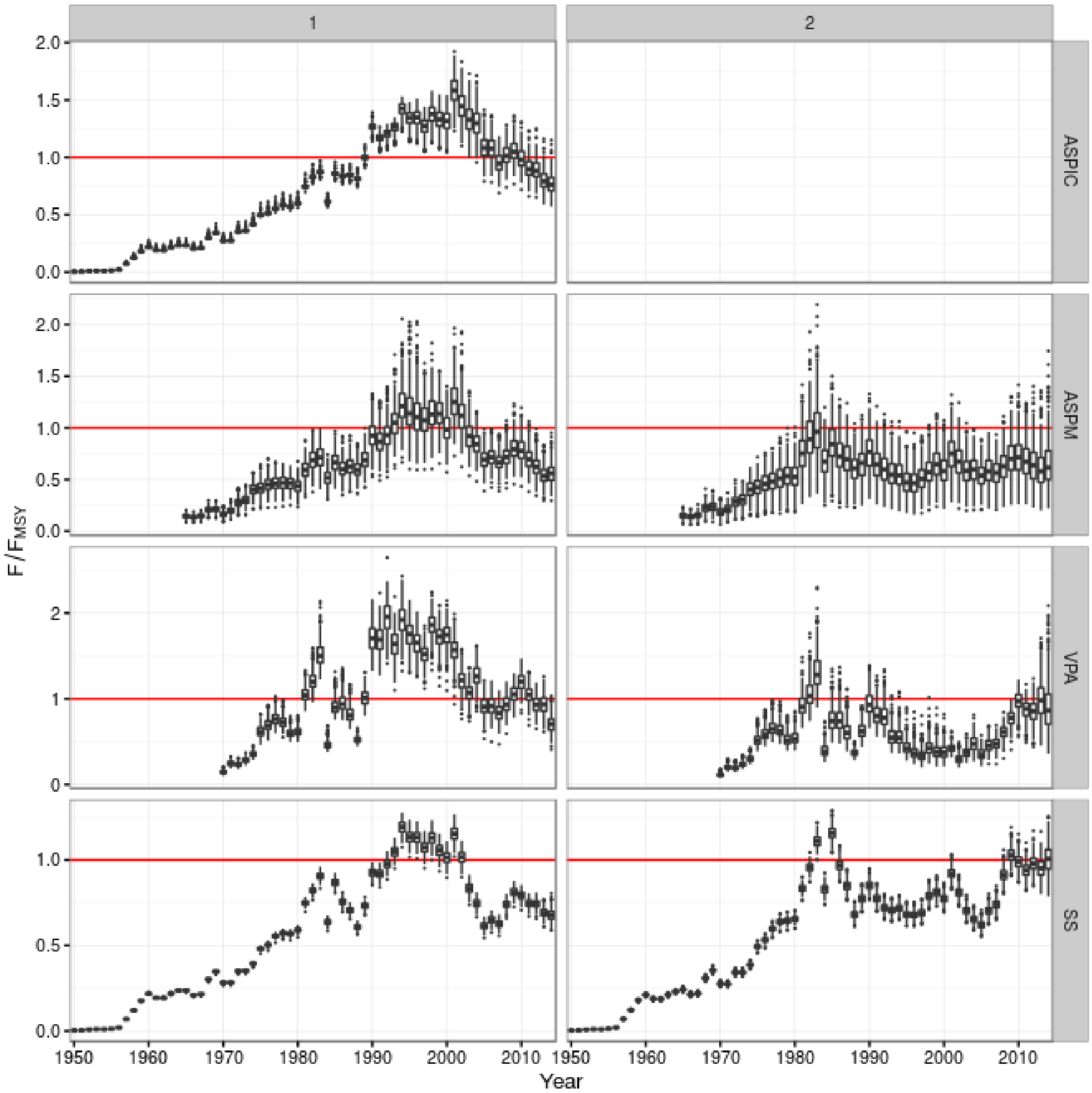
b)



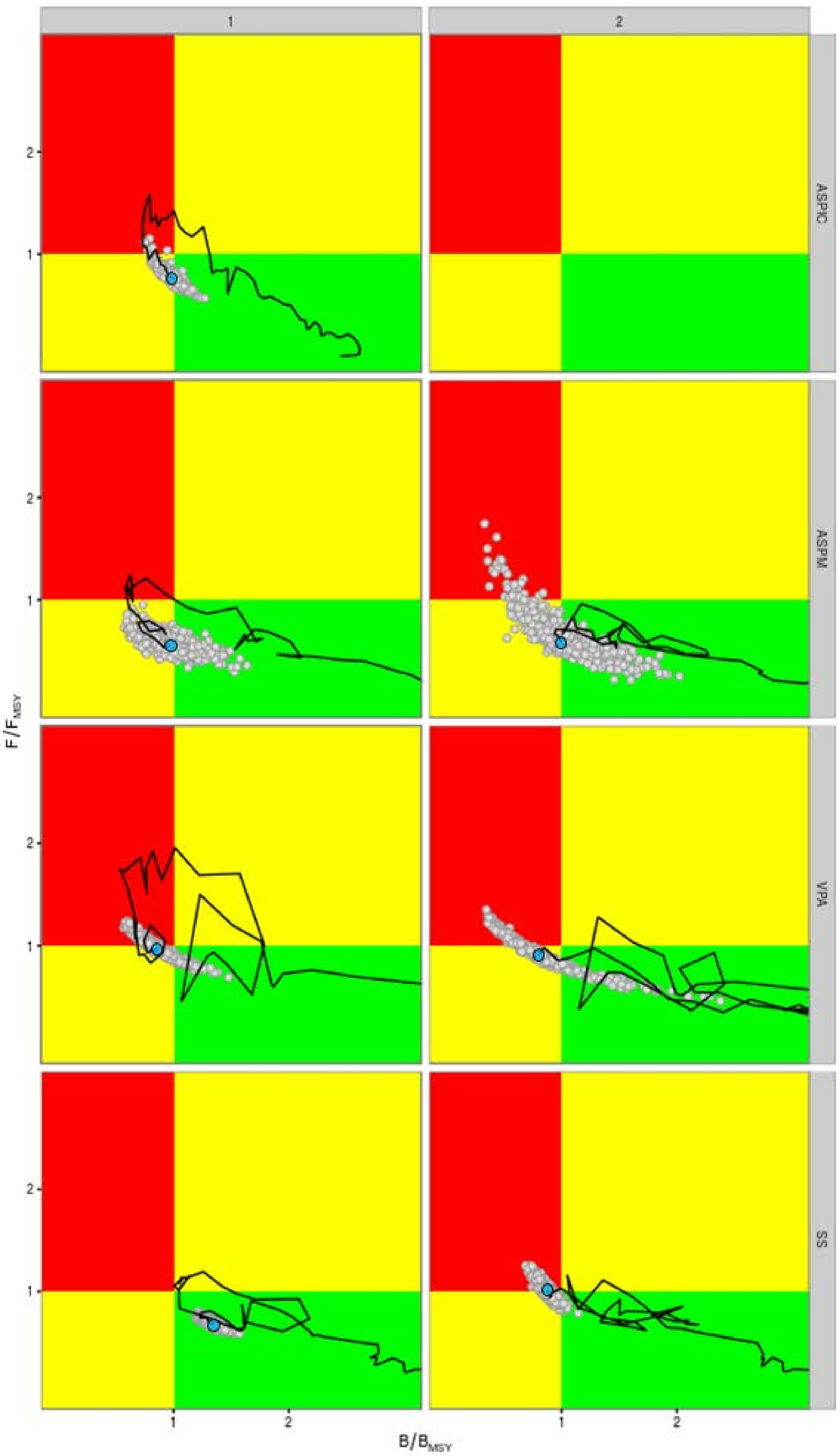
YFT-Figure 4. Trends in estimated mean weight (kg, weighted by respective catches) of yellowfin tuna: a) Overall, by major gear (1960-2014); b) Only eastern purse seine fishery (1991-2014), by operation mode (FSC: free schools; FAD: associated schools). Note: The mean weight of the baitboat fishery (panel a) reflects various baitboat fleets operating in different areas of the Atlantic Ocean.



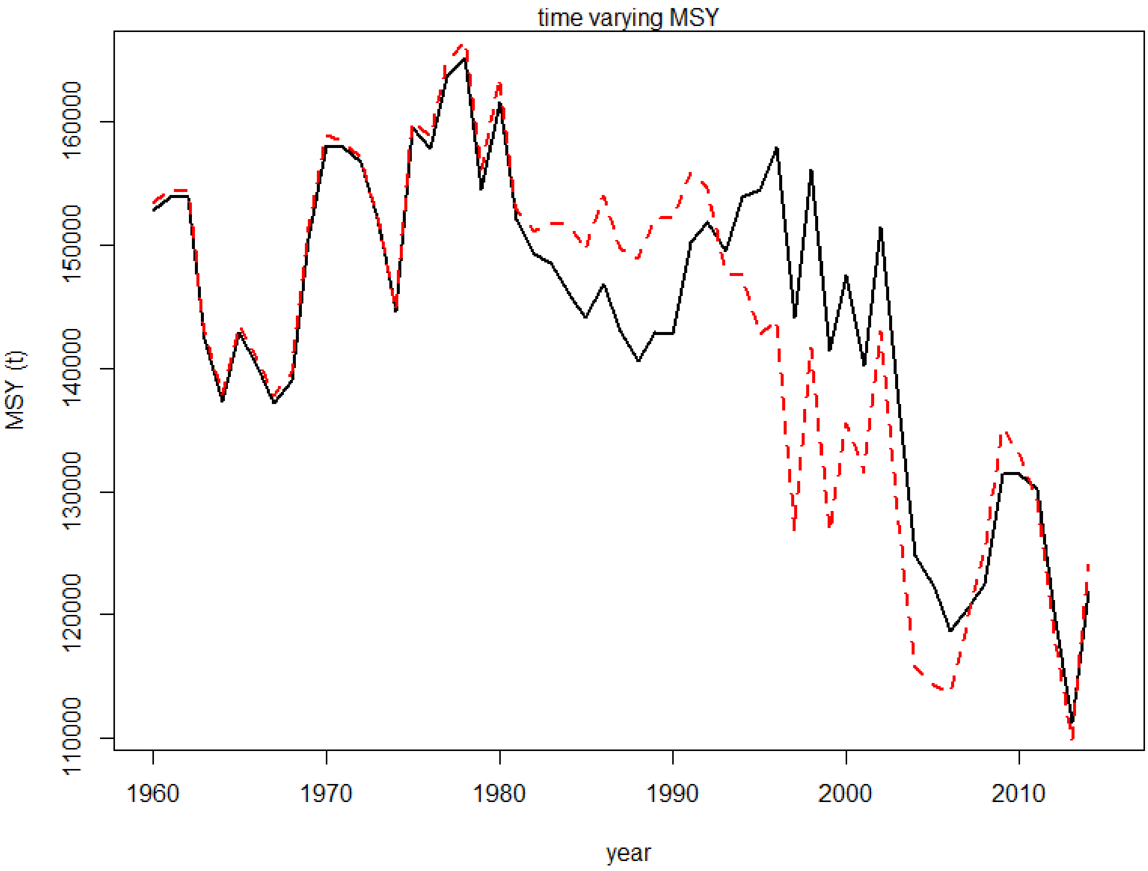
YFT-Figure 5. Trends in biomass relative to the level that produces MSY (red) for the model runs used to develop management advice. Box and whisker plots indicate the uncertainty in bootstrap estimates. (Boxes indicate the annual median estimates, 25th and 75th percentiles; whiskers and points indicate the range of more extreme outcomes).



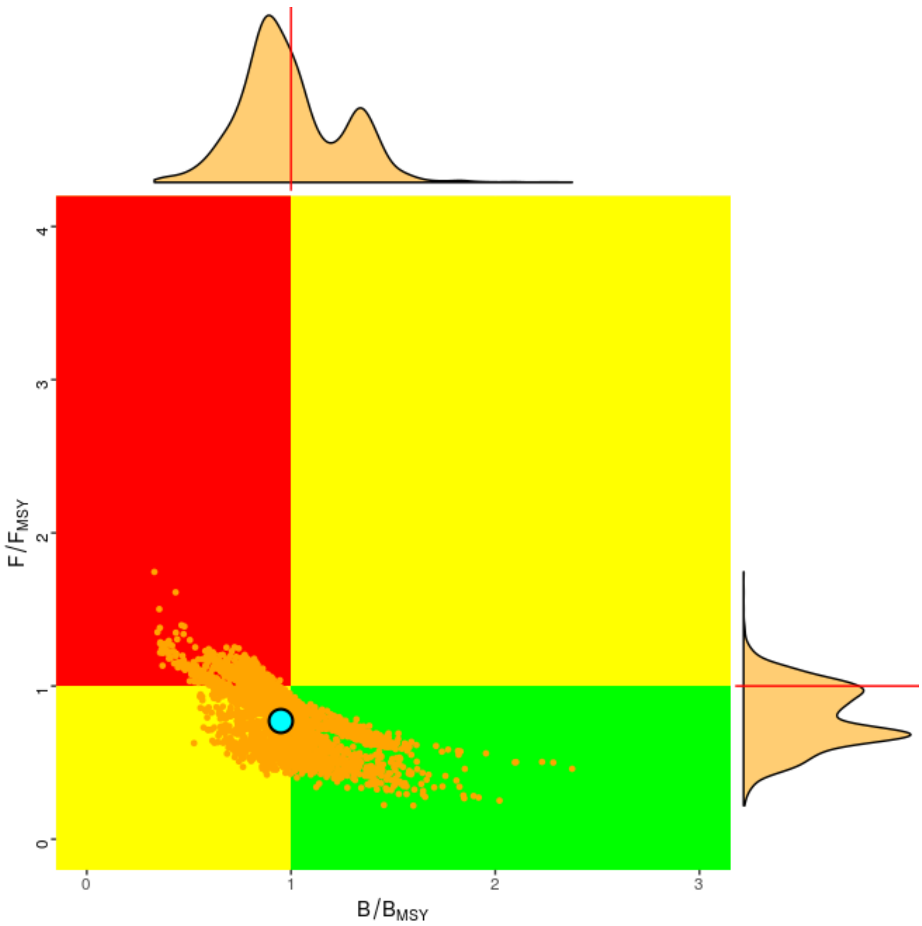
YFT-Figure 6. Trends in fishing mortality relative to the level that produces MSY (red) for the model runs used to develop management advice. Box and whisker plots indicate the uncertainty in bootstrap estimates. (Boxes indicate the annual median estimates, 25th and 75th percentiles; whiskers and points indicate the range of more extreme outcomes).



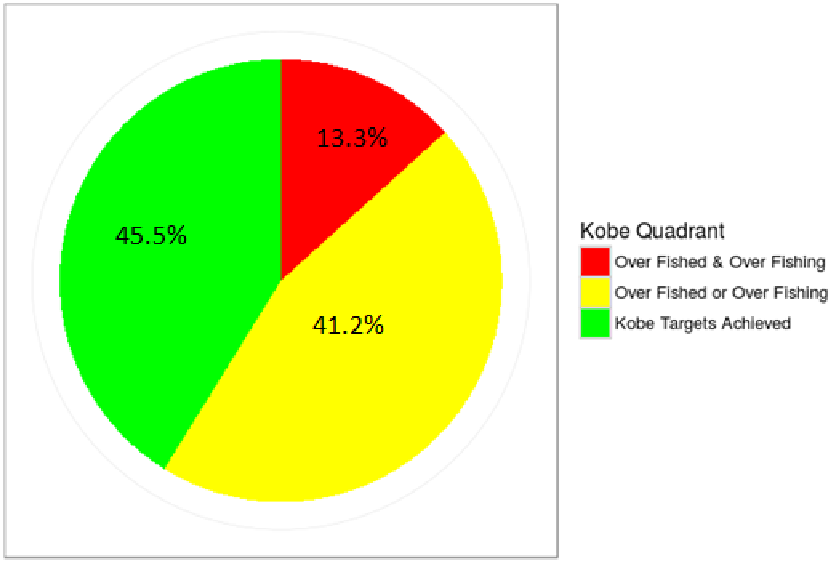
YFT-Figure 7. Kobe Status Plot for each model with 500 bootstrap estimates of the uncertainty in current stock status. The trajectories are intended to demonstrate general trends in stock status, but do not account for known changes in selectivity.



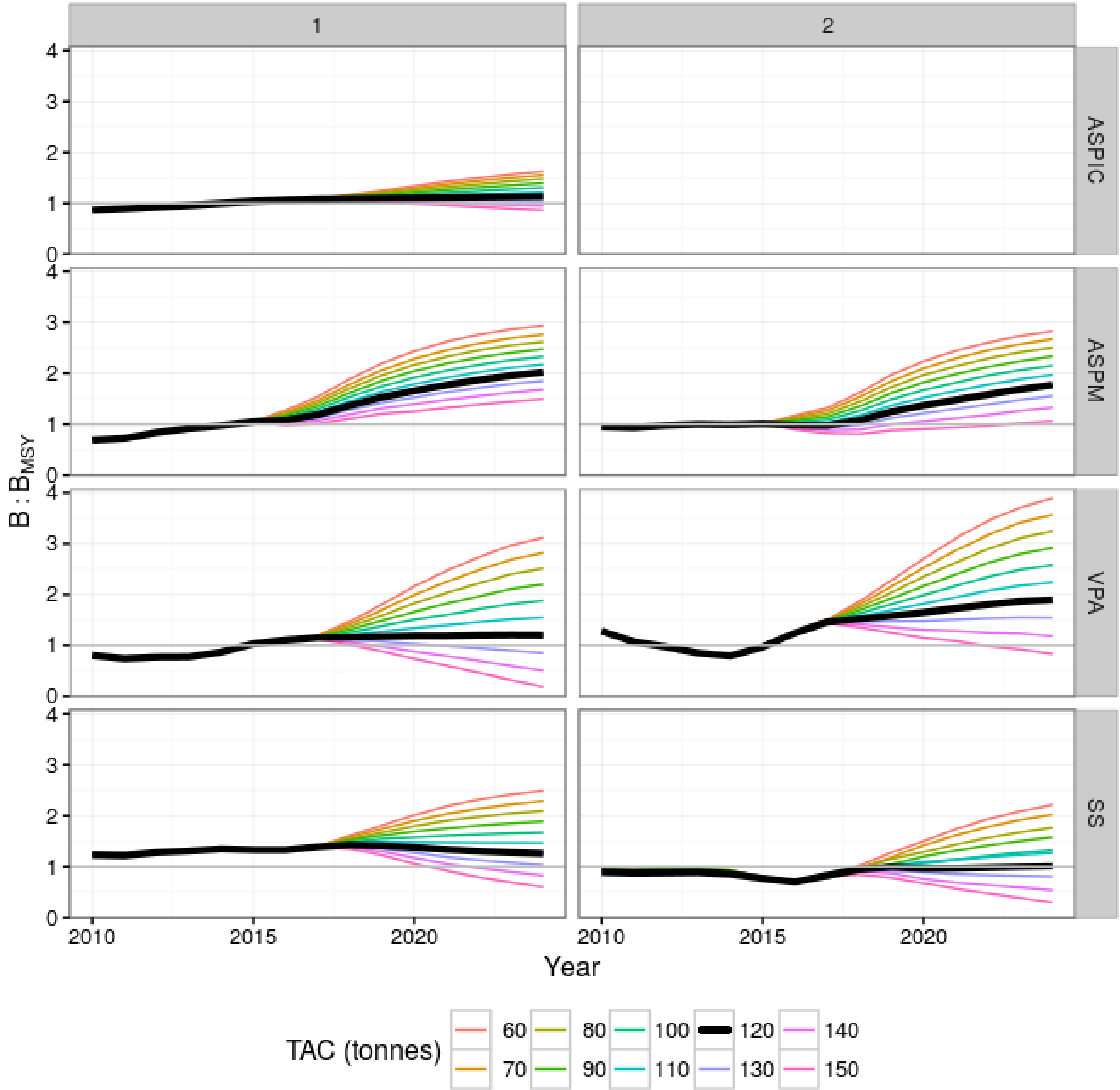
YFT-Figure 8. MSY estimated annually from an age structured stock assessment (SS) using cluster 1 and 2 indices.



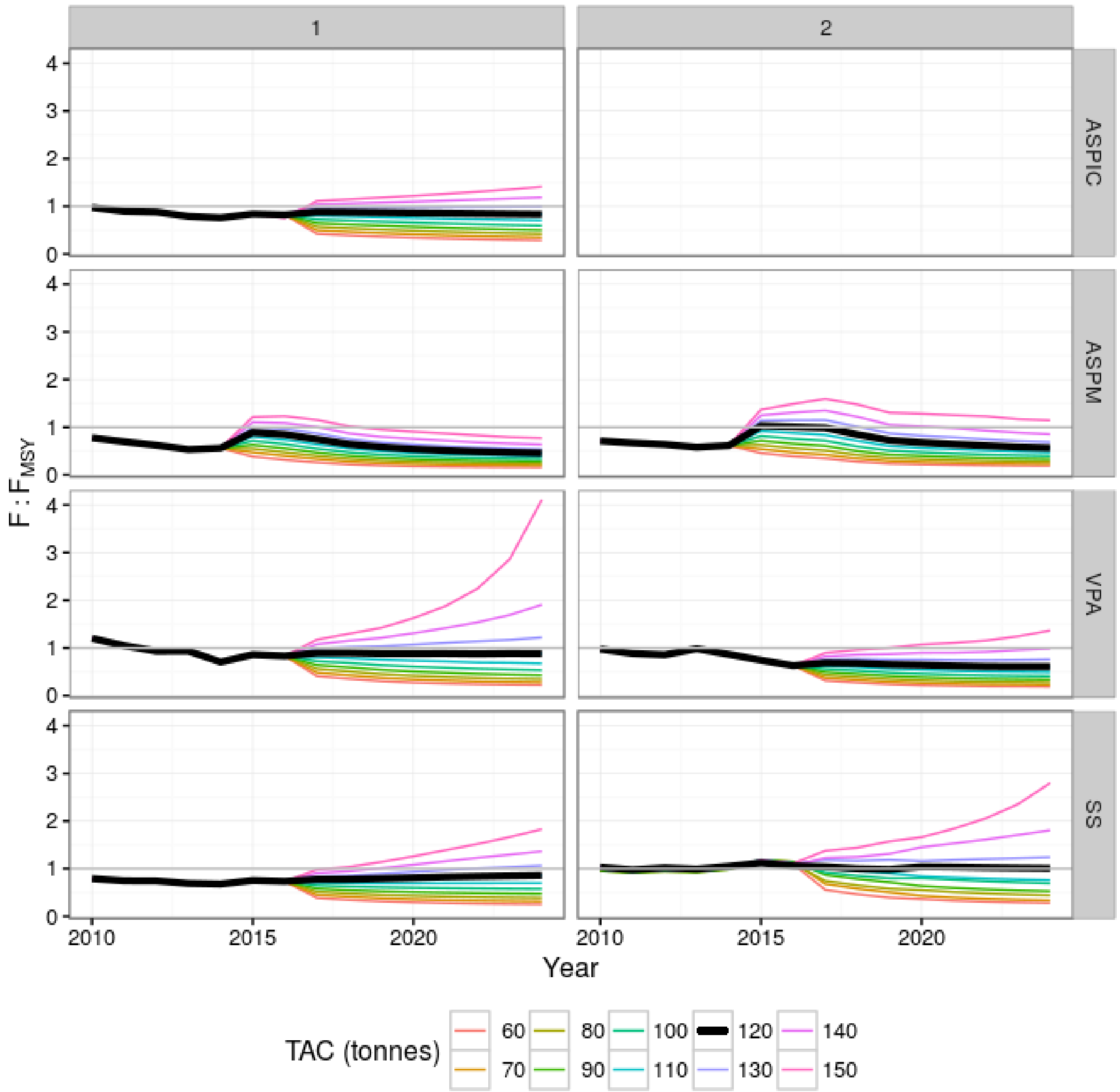
YFT-Figure 9. Kobe Phase Plot and marginal density for all models (used to develop management advice) combined.



YFT-Figure 10. Summary of current status estimates for the yellowfin tuna stock based on age structured and production models making use of the catch and effort data through 2014.



YFT-Figure 11. Median B/B_{MSY} (2010 – 2024) for projections of constant TACs of 60,000 to 150,000 t . SS, VPA and ASPIC projections applied an assumed catch of 110,337 (2015 estimate with carry-overs) to 2015 and 2016, prior to the application of the constant TACs of 60,000 to 150,000 t in 2017-2024. Due to a software constraint, ASPM projections applied constant TACs beginning in 2015.



YFT-Figure 12. Median F/F_{MSY} (2010 – 2024) for projections of constant TACs of 60,000 to 150,000 t. SS, VPA and ASPIC projections applied an assumed catch of 110,337 (2015 estimate with carry-overs) to 2015 and 2016, prior to the application of the constant TACs of 60,000 to 150,000 t in 2017-2024. Due to a software constraint, ASPM projections applied constant TACs beginning in 2015.

8.2 BET – BIGEYE TUNA

The last stock assessment for bigeye tuna was conducted in 2015 (Anon., 2016) through a process that included a data preparatory meeting in May and an assessment meeting in July. The stock assessment used fishery data from the period 1950-2014 and most indices of relative abundance used in the assessment were also constructed through 2014. This executive summary reports the most up to date fishery indicators for bigeye available in 2017 to update bigeye management advice.

BET-1. Biology

Bigeye tuna are distributed throughout the Atlantic Ocean between 50ºN and 45ºS, but not in the Mediterranean Sea. This species swims at deeper depths than other tropical tuna species and exhibits extensive vertical movements. Similar to the results obtained in other oceans, pop-up tagging and sonic tracking studies conducted on adult fish in the Atlantic have revealed that they exhibit clear diurnal patterns: they are found much deeper during the daytime than at night. In the eastern tropical Pacific, this diurnal pattern is exhibited equally by juveniles and adults. In the western Pacific these daily patterns have been associated with feeding and are synchronized with depth changes in the deep scattering layer. Spawning takes place in tropical waters when the environment is favorable. From nursery areas in tropical waters, juvenile fish tend to diffuse into temperate waters as they grow. Catch information from surface gears indicate that the Gulf of Guinea is a major nursery ground for this species. Dietary habits of bigeye tuna are varied and prey organisms like fish, mollusks, and crustaceans are found in their stomach contents. Bigeye tuna exhibit relatively fast growth: about 105 cm fork length at age three, 140 cm at age five and 163 cm at age seven. Recently, however, reports from other oceans suggest that growth rates of juvenile bigeye are lower than those estimated in the Atlantic. Bigeye tuna over 200 cm are relatively rare. The growth rates of bigeye tuna by sex are different based on Indian Ocean tagging data, males reaching around 10 cm larger L_{inf} than females. Bigeye tuna become mature around 100 cm at between 3 and 4 years old. Young fish form schools mixed with other tunas such as yellowfin tuna and skipjack. These schools are often associated with drifting objects, whale sharks and sea mounts. This association weakens as bigeye tuna grow. Indian and Pacific Oceans tagging data showed that bigeye longevity is over 10 years, which may imply lower natural mortality rates than previously being assumed for the Atlantic Ocean. Therefore, the Committee has adopted a new natural mortality vector for the last assessment done in 2015 which is considered to more appropriately reflect this. Various pieces of evidence, such as a lack of identified genetic heterogeneity, the time-area distribution of fish and movements of tagged fish, suggest an Atlantic-wide single stock for this species, which is currently accepted by the Committee. However, the possibility of other scenarios, such as north and south stocks, should not be disregarded. These uncertainties in stock structure, natural mortality, and growth could have important implications for the stock assessment. The ongoing Atlantic Ocean Tropical Tuna Tagging Programme (AOTTP), if fully successful, will help reduce these uncertainties.

BET-2. Fisheries indicators

The stock has been exploited by three major gears (longline, baitboat and purse seine fisheries) and by many countries throughout its range and ICCAT has detailed data on the fishery for this stock since the 1950s. Scientific sampling at landing ports for purse seine vessels from the EU and associated fleets has been conducted since 1980 to estimate bigeye tuna catches (**BET-Figure 1, BET-Table 1**). The size of fish caught varies among fisheries: medium to large fish for the longline fishery, small to large for the directed baitboat fishery, and small for other baitboat and for purse seine fisheries.

The major baitboat fisheries are located in Ghana, Senegal, the Canary Islands, Madeira and the Azores. The tropical purse seine fleets operate in the Gulf of Guinea in the East Atlantic. In the eastern Atlantic, these fleets are comprised of vessels flying the flags of Ghana, EU-France, EU-Spain and others which are mostly managed by EU companies. The longline fleets operated across a broader geographic range, covering tropical and temperate regions (**BET-Figure 1**). While bigeye tuna is now a primary target species for most of the longline and some baitboat fisheries, this species has always been of secondary importance for the other surface fisheries. In the purse seine fishery, unlike yellowfin tuna, bigeye tuna are mostly caught while fishing on floating objects such as logs or manmade fish aggregating devices (FADs). The estimated total numbers of FADs released yearly has increased since the beginning of the FAD fishery, especially in recent years. During 2012-2016, landings of bigeye in weight caught by longline fleets represent 47%, while purse seine fleets represent 37% and baitboat and other surface fleets represent 15% of the total (**BET-Table 1**).

In 2016, however, landing of bigeye in weight caught by longline represent 49%, while purse seiner and baitboat fleets represent 39% and 10%, respectively.

The total annual Task I catch (**BET-Table 1**, **BET-Figure 2**) increased up to the mid-1970s reaching 60,000 t and fluctuated over the next 15 years. In 1992, catch reached 100,000 t and continued to increase, reaching a historic high of about 135,000 t in 1994. Since then, reported and estimated catch continuously declined and fell to 58,875 t 2006. From 2006 catches have increased and fluctuated between around 75,000 t and 80,000 t, with the exception of 2008 (67,720 t). The preliminary catch estimated for 2016 is 72,375 t, a reduction of 9% from 2015 levels (79,861 t).

After the historic high catch in 1994, all major fisheries exhibited a decline in catch while the relative share by each fishery in total catch remained relatively constant until 2008. These reductions in catch were related to declines in fishing fleet size (longline) as well as decline in CPUE (longline and baitboat). Although the general trend of decreasing catches continued for longline and baitboat, the purse seiner catches increased, as did the relative contribution of purse seine in the total catches in the period 2010-2016. The number of active purse seiners declined by more than half from 1994 until 2006, but then increased as some vessels returned from the Indian Ocean to the Atlantic (**SKJ-Figure 9**) and since 2014, the number of purse seine vessels has remained stable. While the number of purse seiners operating in 2010-2014 was stable purse seine carrying capacity during the same period showed an increasing trend.

Species composition and catch at size from the Ghanaian fleet of baitboats and purse seiners, has been thoroughly reviewed during the past few years. This review has led to new estimates of Task I, and partially Task II catch and effort and size, for these fleets for the period 1973-2013. This revision has shown that catches of bigeye tuna by Ghanaian fleets over the period 1996-2005 were significantly lower than previously estimated by an average of 2,500 t but larger for the period 2006-2013. Although the Committee agreed to use the new estimates for 2006-2013, and carry over of 2013 estimate to 2014 for the assessment, after the stock assessment meeting, some issues with the area stratification used to estimate the species composition of recent Ghanaian catches were identified; which implies that the most recent Ghanaian catches (from 2012 to 2014) could be underestimated by 25% (2012) and 45% (2013 and 2014). Thus, estimates for 2012-2014 are considered provisional and should be reviewed in the future. No new information on Ghana statistics was presented in the Intersessional Meeting of the Tropical Tunas Species Group in 2017.

Significant catches of small bigeye tuna continue to be channeled to local West African markets, predominantly in Abidjan, and sold as "*faux poisson*" in ways that make their monitoring and official reporting challenging. Monitoring of such catches has recently progressed through a coordinated approach that allows ICCAT to properly account for these catches and thus increase the quality of the basic catch and size data available for assessments. Currently those catches are included for the main purse seine fleet in the ICCAT Task I data used for the assessment up to 2014. No update estimates of *faux poisson* are available for the 2015-2016 period.

Mean average weight of bigeye tuna decreased prior to 1993 but has remained relatively stable at around 10 kg for the last decade (**BET-Figure 3**). This mean weight, however, is quite different for the different fishing gears in recent years, around 62 kg for longliners, around an average of 18 kg for baitboats (with different mean weight for different fleet segments: 9 kg for Dakar baitboat and 3 kg for Tema baitboat), and 4 kg for purse seiners. In the last ten years, several longline fleets have shown increases in the mean weight of bigeye tuna caught, with the average longline-caught fish increasing from 40 kg to 60 kg between 1999 and 2008. During the same period, purse seine-caught bigeye tuna had average weights between 3 kg and 4 kg. Average weight of bigeye tuna caught in free schools is more than twice the average weight of those caught around FADs. Since 1991, when bigeye catches were identified separately for FADs for EU and associated purse seine fleets, the majority of bigeye tuna are caught in sets associated with FADs (75%-80%). Similarly baitboat-caught bigeye tuna weighted between 6 and 10 kg up to 2011, but with greater inter-annual variability in average weight compared to longline or purse seine caught fish, while it increased to around 18 kg since 2012.

A number of standardized indices of abundance were developed by national scientists for selected fleets for which data were available at greater spatial and/or temporal resolution for the assessment. These indices represented data from five different fleets, four longline fleets and one baitboat fleet which were used in different stock assessment methods (**BET-Figure 4**). New information was recently made available (Parker *et al*., 2017b) regarding the standardized catch rates of bigeye tuna from the South African longline fishery during 2004-2016. The analyses indicate that the CPUE of the South African longline fishery for bigeye tuna exhibits larger inter-annual variability and no clear trend. A revised standardization of bigeye for the Japanese longline fishery in the main Atlantic fishing ground for the period 1961–2016 in response to recommendations from the 2015 Bigeye Tuna Data Preparatory Meeting to solve over-parameterization, improve spatial resolution of catches and incorporate SST data was presented (Matsumoto and Satoh, 2017). With the exception of the early period (1960s), the results were similar to those derived from the previous method. It was noted that since the last assessment (2015), bigeye CPUE has remained stable.

BET-3. State of the stock

Stock status evaluations for Atlantic bigeye tuna used several modeling approaches, ranging from non-equilibrium production models to integrated statistical assessment models. The results of different model formulations considered to be plausible representations of the stock dynamics were used to characterize stock status and the uncertainties in the status evaluations. The 2015 stock assessment was conducted using similar assessment models to those used in 2010 but with updated data and relative abundance indices.

In 2010, the stock status determination and management advice was based on the results obtained with non-equilibrium production models. Virtual population analysis results were used to characterize the uncertainty in stock status as related to model structure. Integrated statistical models were also run in 2010 and those results were used to explore the gains obtained by integrating more data sources (e.g. length composition data) as well as to take into account different exploitation patterns and selectivities of different type of gears.

In 2015, results from a non-equilibrium production model and an integrated statistical assessment model, which can account for temporal changes in selectivity, were used to provide the status of the resource. Multiple runs of each model were included in the results, using alternative assumptions in order to better reflect the uncertainties in the assessment. The non-equilibrium production model results included 3 different runs, which used different individual CPUE indices. These CPUEs were based on longline indices that characterize the adult component of the stock, while the production model dynamics are based on exploitable biomass. The integrated statistical assessment model results included 12 different runs, reflecting different assumptions regarding growth, the influence of spawning biomass on recruitment, and confidence in available size data. Because the results of both non-equilibrium production model and integrated assessment model were considered to represent plausible alternative hypotheses of stock status, they were given equal weight in determining the state of the stock.

In 2015, a non-equilibrium production model was run using the composite index from 2010 and a new composite index generated in 2015 (using a similar procedure as in 2010). The objective was to compare the robustness of the assessment and projection conducted in 2010 with the assessment done in 2015. The results of 2010 assessment were projected until 2014 using the reported catches. The exercise showed that stock status for 2010, when re-estimated in 2015, was more pessimistic than originally estimated during the 2010 assessment. In general, data availability has continued to improve. There are still missing data within the ICCAT database on detailed catch statistics, catch and effort and fish size from some important fleets for which estimation of catches were available. All these issues forced the Committee to estimate the catch of some important fleets as well as assume catch-at-size for an important part of the overall catch which contribute to the overall uncertainty in the assessment results. Final modifications to these inputs were performed during the assessment meeting, such as an update of the total catch of Ghanaian fleet for the period 2006-2013, catch for 2014, and the identification of representative CPUE indices for stock assessment.

Various CPUE indices (**BET-Figure 4**) were used for non-equilibrium production model and integrated statistical assessment model. For the non-equilibrium production model, the Committee considered that it is more appropriate to use multiple indices in separate runs, as different hypotheses of stock dynamics, rather than including potentially conflicting indices in a single run or combined as a single index. This is different from the approach taken in the 2010 stock assessment. In the 2010 assessment, a single combined CPUE index, which is a combination of various CPUE indices available at that time, was used for various non-equilibrium production model runs.

The stock biomass estimated from the three non-equilibrium production model runs declines from the beginning of the time series in the 1950s (**BET-Figure 5**). The decline in biomass corresponds with increasing fishing mortality including a sharp increase of fishing mortality and catch in the 1990s and a peak of fishing mortality by the end of the 1990s. From the late 1990s, the biomass and fishing mortality trajectories of the 3 scenarios were different. While biomass increased and fishing mortality decreased in one of the runs using the Chinese Taipei CPUE; biomass continued to decrease at a lower rate in the other runs and fishing mortality showed a general increasing trend in one run (except for the last three years when F decreased) and was somewhat stable in the last run. The three runs show similar trajectories of increasing F and decreasing B towards the red area of the Kobe plot ($F > F_{MSY}$ and $B < B_{MSY}$) until the end of the 1990s, but 2 out of 3 runs estimate that on average the stock still remains in the red area since 2000; while the third estimates a recovery towards the green area since the mid-2000s (**BET-Figure 6**). The results based on the three scenarios suggest that the stocks status in recent years varied between scenarios (B_{2014}/B_{MSY} ratio is from 0.554 to 1.225 and F_{2014}/F_{MSY} ratio is from 0.576 to 1.436 (**BET-Figure 7**)).

The SS3 model results indicate that fishing mortality increased steadily since the beginning of the fishery, rapidly increased by the end of the 1990s, fluctuating around the level corresponding to F_{MSY} in the 2000s, then increased sharply at the end of the 2000s where $F > F_{MSY}$ in 2011, and decreased in the latest three years. However, it remained at levels higher than F_{MSY} in 7 out of 12 scenarios in 2014 (**BET-Figure 8**). With regards to biomass, it decreased constantly since the beginning of the time series and fell below and remained below B_{MSY} levels since 2010. It should be noted that those F_{MSY} and B_{MSY} trajectories (**BET-Figure 8**) were estimated using 2014 selectivity pattern without accounting for selectivity changes over time. The results based on the twelve cases studied suggest that the stock's status in recent years varied between cases (B_{2014}/B_{MSY} ratio is from 0.435 to 0.917 and F_{2014}/F_{MSY} ratio is from 0.776 to 1.635 (**BET-Figure 9a**). In the combined phase plot of equally weighted 12 SS3 scenarios, taking into account the uncertainty around the point estimates from all scenarios, there was an estimated 67% chance that the stock is being overfished and overfishing is occurring in 2014 (**BET-Figure 9b**).

The current MSY may be below what was achieved in past decades because overall selectivity has shifted to smaller fish; the impact of this change in selectivity on estimates of MSY is clearly seen in the results from integrated statistical assessment models (**BET-Figure 10**). While the potential MSY has decreased over time the spawning stock biomass required to produce this MSY has increased.

Most of the integrated statistical assessment model runs give a similar view compared to the non-equilibrium production model runs regarding the historical evolution of the relative patterns in biomass and fishing mortality. Both assessment models suggest that biomass decreased throughout the period investigated, with the exception of one run of the non-equilibrium production model where a recovery is observed since 2005. For fishing mortality, both assessment models show that F increased sharply by the late 1990s, then fluctuated to reach a similar level of the late 1990s in 2004/2005 and increased again in 2011 to decrease the last three years. **BET-Figure 11** shows a combined Kobe phase plot of both assessment models, which formulates the basis of the management recommendation. The combined plot was developed by giving equal weighting between non-equilibrium production model and integrated statistical assessment model results. Within each model type equal weighting was given to each run. There was an estimated 70% chance that the stock was being overfished and overfishing was occurring in 2014.

The incorporation of the revised catch estimates for Ghana, as well as additional reporting and corrections, has resulted in a somewhat different catch history from what was available for the last assessment in 2010. The projections done in 2010, which provide a characterization of the prospects of the stock achieving or being maintained at levels consistent with the Convention objective, over time, showed that the probabilities of the stock being maintained at levels capable of producing MSY by 2015 were about 60% for a future constant catch set of the TAC level of 85,000 t at that time. As stated in 2010, any changes in the exploitation pattern and selectivity due to changes in the ratios of relative mortality exerted by the different fleets – such as an increase in the relative mortality of small fish – during the projected period would have affected and changed the outcomes of those projections. Although catches from the period 2012 to 2014 were lower than the adopted TAC the status of the stock worsened. The proportion of small age 0 and 1 bigeye has shown a continuous increase since the beginning of the time series which may have affected the prospect of recovery of the population and worsened the status of the stock in 2015. The relative contribution of purse seine gear to the total catch has increased by 50% in the period 2009-2014 from the period 2000-2008.

The Committee notes, as it did in previous assessments, that there is considerable uncertainty as well as potential bias in the assessment of stock status and productivity for bigeye tuna. There are many sources of uncertainty including which method represents best the dynamics of the stock, which method is supported more by the available data, which relative abundance indices are appropriate to be used in the assessment, and what precision is associated with the measurement/calculation of each of the model inputs. In general, data availability has improved since 2010 but there is still a lack of information regarding detailed fishing effort and catch-at-size data from certain fleets.

BET-4. Outlook

It was noted in 2015 that the modeled probabilities of the stock achieving levels consistent with the Convention objective at the end of the projected time period in 2028 was 29% for a future constant catch at the TAC level of 85,000 t established in Rec. 14-01, and 41% probability at catch levels of 70,000 t. Higher probabilities of rebuilding require longer timeframes and/or larger reduction of current catches. For instance, 49% probability of rebuilding would be achieved by 2028 with a constant catch of 65,000 t and 58% of probability with catches of 60,000 t (**BET-Table 2**).

It needs to be noted that projections made by the Committee assume that future constant catches represent the total removals from the stock, and not just the reported catches and the current selectivity pattern is maintained. ICCAT established a TAC of 85,000 t for 2010 onwards (Rec. 09-01, Rec. 11-01 and Rec. 14-01) and reduced the TAC to 65,000 t for 2016 onwards (Rec. 15-01 and Rec. 16-01). Note that because this TAC does not affect all countries that can catch bigeye tuna, in theory the total catch removed from the stock could exceed the TAC which will worsen the prospect of stock rebuilding. Furthermore, any future changes in selectivity due to changes in the ratios of relative mortality exerted by the different fleets – such as an increase in the relative mortality of small fish – will change and add to the uncertainty of these projections.

BET-5. Effect of current regulations

During the period 2005-2008 an overall TAC was set at 90,000 t. The TAC was later lowered (Rec. 09-01 and later modified by Rec. 14-01) to 85,000 t. Estimates of reported catch for 2009-2015 (**BET-Table 1**) have been always lower than 85,000 t. The TAC was again reduced to 65,000 t in Recommendation 15-01 which entered into force in 2016. Projections indicated that catches at the current TAC level (65,000 t) would have 49% chances of achieving Convention objectives by 2028. This probability may be improved by the additional measures (i.e. FAD moratorium) agreed by the Commission. However, 2016 catches (72,375 t) exceeded the TAC of 65,000 t by 11%. Therefore, if future catches are maintained at the level of 2016, the probability of achieving Convention objectives by 2028 ($B>B_{MSY}$, $F<F_{MSY}$) is expected to decrease to around 38 % (**BET-Table 2**).

Concern over the catch of small bigeye tuna partially led to the establishment of spatial closures to surface fishing gear in the Gulf of Guinea (Recs. 04-01, 08-01, 11-01, 14-01, 15-01). The Committee examined trends in average bigeye tuna catches by areas as a broad indicator of the effects of such closures as well as changes in juvenile bigeye and yellowfin catches due to the moratorium. The efficacy of the area-time closure (moratorium) agreed in Rec. 14-01 was evaluated by examining fine-scale (1ºx1º) skipjack, yellowfin, and bigeye catch by month distributions from the European and associated purse seine fleet FAD fishery and the Ghanaian purse seine and baitboat fishery. After reviewing this information, the Committee concluded that the moratorium has not been effective at reducing the mortality of juvenile bigeye tuna, and any reduction in yellowfin tuna mortality was minimal, largely due to the redistribution of effort into areas adjacent to the moratorium area. The efficacy of the area-time closure agreed in Rec. 15-01 has not been evaluated; however, purse seiner catches in 2016 have not decreased from 2014-2015 levels.

BET-6. Management recommendations

The Atlantic bigeye tuna stock was estimated to be overfished and that overfishing was occurring in 2014. Projections indicated that maintaining catch levels at the current TAC of 65,000 t was expected to recover the stock status to Convention objectives with 49% probability by 2028. However, 2016 catches (72,375 t) exceeded the TAC of 65,000 t by 11%. Therefore, if future catches are maintained at the level of 2016, the probability of achieving Convention objectives by 2028 ($B>B_{MSY}$, $F<F_{MSY}$) is expected to decrease to around 38 % (**BET-Table 2**).

The Commission should be aware that increased harvests on FADs could have had negative consequences for the productivity of bigeye tuna fisheries (e.g. reduced yield at MSY and increased SSB required to produce MSY) and, therefore, should the Commission wish to increase long-term sustainable yield, the Committee continues to recommend that effective measures be found to reduce FAD-related and other fishing mortality of small bigeye tunas. However, the Commission should be aware that increased harvests on FADs could have negative consequences for yellowfin and bigeye tuna, as well as other by-catch species (Anon., 2017b).

ATLANTIC BIGEYE TUNA SUMMARY	
Maximum Sustainable Yield	78,824 t (67,725-85,009 t)[1]
Current (2016) Yield	72,375 t[2]
Relative Biomass (B_{2014}/B_{MSY})	0.67 (0.48-1.20)[1]
Relative Fishing Mortality (F_{2014}/F_{MSY})	1.28 (0.62-1.85)[1]
Stock Status (2014)	Overfished: Yes Overfishing: Yes
Conservation & management measures in effect:	[Rec. 16-01] – Total allowable catch for 2016-2018 is set at 65,000 t for Contracting Parties and Cooperating non-Contracting Parties, Entities or Fishing Entities. – Be restricted to the number of their vessels notified to ICCAT in 2005 as fishing for bigeye tuna. – Specific limits of number of longline boats; China (65), Chinese Taipei (75), Philippines (5), Korea (14), EU (269) and Japan (231). – Specific limits of number of purse seine boats; EU (34) and Ghana (17). – No fishing with natural or artificial floating objects during January and February in the area encompassed by the African coast, 20º W, 5ºN and 4ºS. – No more than 500 FADs active at any time by vessel. – Use of non-entangling FADs.

[1] Combined results of non-equilibrium production model and statistical integrated assessment models. Median and 10 and 90% percentile in brackets.
[2] Reports for 2016 reflect most recent data but should be considered provisional.

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
TOTAL	A+M		100117	113862	134936	128018	120751	110261	107804	121643	103680	91201	75726	87702	90534	67964	58875	75070	67720	80447	80521	82954	75934	73207	78039	79861	72375
Landings		Bait boat	16248	16467	20361	25576	18300	21276	18999	22301	12365	14540	8523	11450	20812	13058	10636	11833	7761	13476	9506	14267	12648	11403	9959	10007	6928
		Longline	62403	62871	78898	74852	74930	68310	71856	76527	71193	55265	46438	54466	48396	38035	34182	46232	41063	43985	42925	38204	35005	32037	37008	39792	35398
		Other surf.	607	652	980	567	357	536	434	1377	1226	1628	1134	1336	1290	717	552	448	220	257	461	977	678	1140	1971	1942	1997
		Purse seine	19223	31582	32665	25355	26624	19147	15525	20254	17533	19511	19418	19582	19016	15128	12962	15865	17904	21648	26636	28229	26766	27996	28492	28082	28051
Landings(FP)		Purse seine	1636	2290	2032	1667	540	993	989	1184	1363	257	214	867	1019	1026	542	692	772	1082	994	1277	823	632	609	0	
Discards		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
		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	
Landings	CP	Angola	0	0	0	0	0	0	0	0	0	0	0	0	476	75	0	0	0	452	410	320	394	375	372	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
		Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	60	70	234	249	1218	1242	1336	1502	1877	1764
		Brazil	790	1256	601	1935	1707	1237	644	2024	2768	2659	2582	2455	1496	1081	1479	1593	958	1189	1151	1799	1400	1433	3475	3561	2823
		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
		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	1679
		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
		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
		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
		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
		EU.France	6888	12719	12263	8363	9171	5980	5624	5529	5949	4948	4293	3940	2926	2816	2984	1629	1130	2313	3329	3507	3756	3222	3549	2548	4566
		EU.Ireland	0	0	0	0	0	0	0	0	0	10	0	0	0	33	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	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
		EU.United Kingdom	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**
		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	992	1450
		FR.St Pierre et Miquelon	0	0	0	0	0	0	0	0	0	0	21	0	28	6	0	2	3	0	2	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	
		Ghana	2866	3577	4738	5517	4751	10165	10155	10416	5269	9214	5611	8646	17744	8860	2041	8119	7727	8186	10455	9850	9477	10992	9974	11902	4813
		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
		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	**0**
		Guinée Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	328	322	1516	1429	902	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	
		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**
		Japan	34722	35053	38503	35477	33171	26490	24330	21833	24605	18087	15306	19572	18509	14026	15735	17993	16684	16395	15205	12306	15390	13397	13464	12170	10426
		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
		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
		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	
		Maroc	0	0	0	0	0	0	0	700	770	857	913	889	929	786	929	700	802	795	276	300	300	308	300	309	350
		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
		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
		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**
		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	
		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	2022
		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**
		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**
		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
		Senegal	5	9	126	237	138	258	730	1473	1131	1308	565	541	574	721	1267	805	926	1042	858	239	230	646	371	1031	1500
		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	
		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
		St. Vincent and Grenadines	1	3	0	0	75	127	198	877	1782	721	130	103	18	0	114	567	171	292	396	38	25	16	30	496	622
		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
		U.S.A.	813	1090	1402	1209	882	1138	929	1263	574	1085	601	482	416	484	991	527	508	515	571	722	867	881	859	831	533
		U.S.S.R.	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	0	0	0	0	0	0	0	
		UK.Sta Helena	10	6	6	10	10	12	17	6	8	5	5	0	0	0	25	18	28	17	11	190	51	19	17	44	77
		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**
		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**
		Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	104	109	52	132	91	34	42	39	23	9	4	0	**0**
		Venezuela	270	809	457	457	189	274	222	140	221	708	629	516	1060	243	261	318	122	229	85	264	98	94	169	132	156
	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
		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	
	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	

			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
		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	
		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	
		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	
		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	
		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
		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	
		Grenada	25	20	10	10	0	1	0	0	0	0	0	0	0	0	0	10	31	0	0	0	0	0	0	0	
		Mixed flags (FR+ES)	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)	1938	4360	4858	4932	5585	2403	1350	2539	979	1857	1790	1256	360	0	0	0	0	0	0	0	0	0	0	0	
		NEI (Flag related)	6146	4378	8964	10697	11862	16569	24896	24060	15092	7997	383	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
		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	
		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	
		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	
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	
		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	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	
		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	
		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	0	
		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	0	
		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	
		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	
		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	
		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	
	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	0	
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
		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	
		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**
		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	
	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**

The Brazilian catches for 2016 are SCRS estimations (carry over based on a 2013-2015 average) obtained due to the absence of official statistics.

BET-Table 2. Estimated probabilities of the Atlantic bigeye tuna 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 catch level ('000 t), based upon the 2015 assessment outcomes.

Probability of Overfishing not occuring (F<Fmsy)

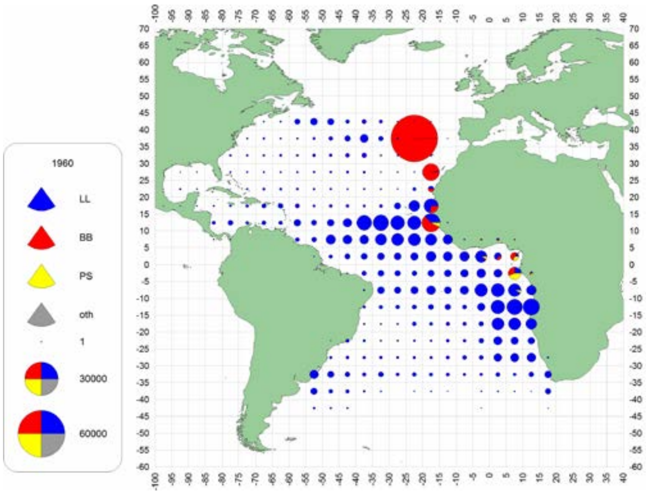
Catch (000 t)	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
0	29	100	100	100	100	100	100	100	100	100	100	100	100	100
40	29	84	89	92	93	94	95	95	96	96	97	97	97	97
45	29	72	80	84	88	89	91	92	93	94	94	94	95	95
50	29	61	70	75	79	83	85	87	89	90	91	92	92	93
55	29	52	59	65	69	73	76	79	81	82	84	85	86	88
60	29	44	51	55	59	62	65	69	70	72	74	76	77	78
65	29	38	44	48	51	54	56	58	60	62	63	65	66	68
70	29	32	38	41	44	47	49	50	52	53	53	59	60	61
75	29	27	33	36	37	40	42	43	45	50	51	52	52	55
80	29	24	29	31	33	34	36	42	42	43	46	46	47	51
85	29	22	26	28	30	31	37	37	38	41	43	45	48	48
90	29	19	23	24	26	28	31	34	40	39	42	40	43	47
95	29	17	20	20	20	24	26	31	30	31	31	35	35	38
100	29	14	15	15	15	16	19	22	24	31	35	37	37	37

Probability of nor being overfished (B>Bmsy)

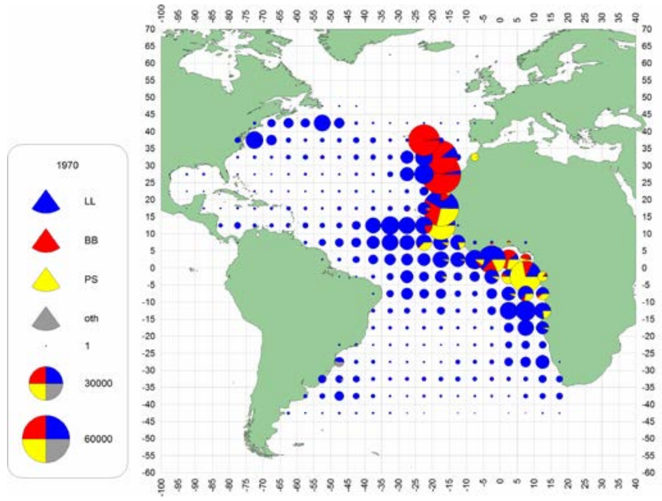
Catch (000 t)	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
0	17	17	21	33	57	74	85	92	95	97	98	98	99	99
40	17	17	18	22	31	40	51	60	67	73	78	81	84	87
45	17	17	18	21	29	37	46	53	60	66	71	76	79	81
50	17	17	18	20	27	34	41	48	53	59	65	69	72	76
55	17	17	18	20	25	31	37	42	47	52	56	61	65	68
60	17	17	17	19	24	28	34	37	41	45	49	53	56	59
65	17	17	17	18	22	26	30	33	37	40	43	45	48	51
70	17	17	17	18	21	24	27	30	33	35	38	40	41	43
75	17	17	17	18	20	23	25	27	28	31	33	34	36	37
80	17	17	17	17	19	21	23	24	26	27	29	29	31	32
85	17	17	17	17	19	20	22	23	24	25	30	28	31	35
90	17	17	17	17	18	19	21	22	22	24	23	23	23	23
95	17	17	17	16	17	17	17	19	20	19	18	17	17	14
100	17	17	16	16	16	15	14	15	14	11	13	10	8	7

Probability of being in the green zone (B>Bmsy and F<Fmsy)

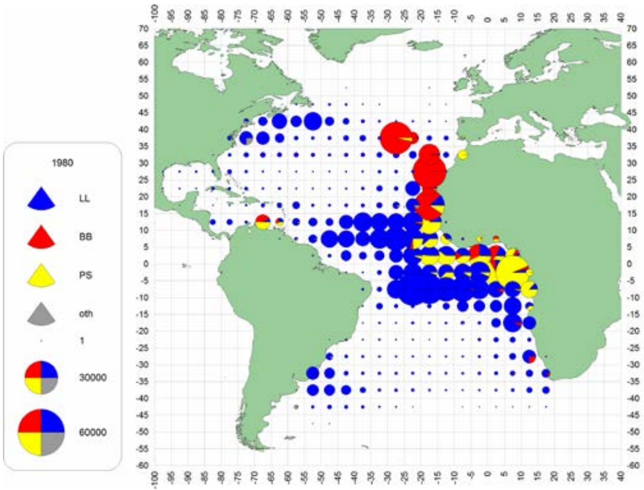
Catch (000 t)	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
0	17	17	21	33	57	74	85	92	95	97	98	98	99	99
40	17	17	18	22	31	40	51	60	67	73	78	81	84	87
45	17	17	18	21	29	37	45	53	60	66	71	76	79	81
50	17	17	18	20	27	34	41	48	53	59	64	69	72	76
55	17	17	18	20	25	31	37	42	47	51	56	60	64	68
60	17	17	17	19	23	28	33	37	40	44	48	52	55	58
65	17	17	17	18	22	26	30	33	36	39	42	44	46	49
70	17	17	17	18	21	24	26	30	31	34	36	38	39	41
75	17	17	17	18	19	22	24	26	27	29	31	32	33	35
80	17	16	16	16	18	19	21	22	23	25	26	27	28	29
85	17	16	16	16	18	18	20	21	21	22	25	24	26	29
90	17	15	15	15	16	16	17	19	19	19	19	18	18	19
95	17	14	14	13	13	12	12	12	12	11	10	10	10	8
100	17	12	11	10	8	7	6	6	5	4	6	5	4	3



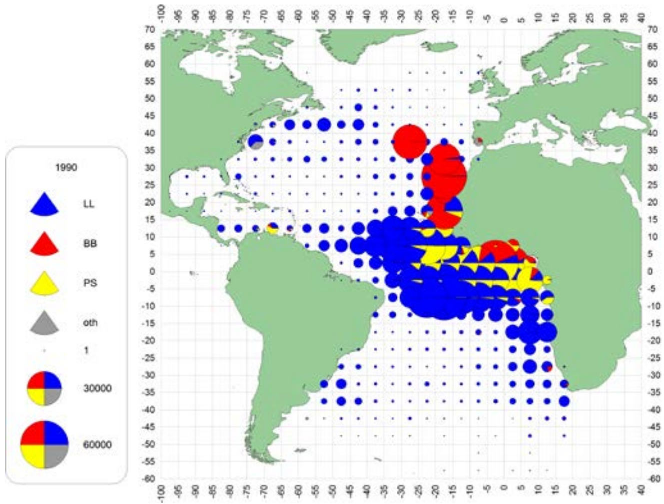
a. BET (1960-69)



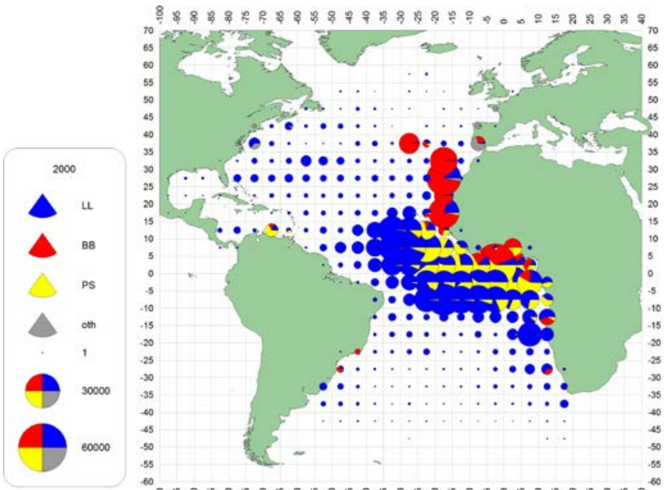
b. BET (1970-79)



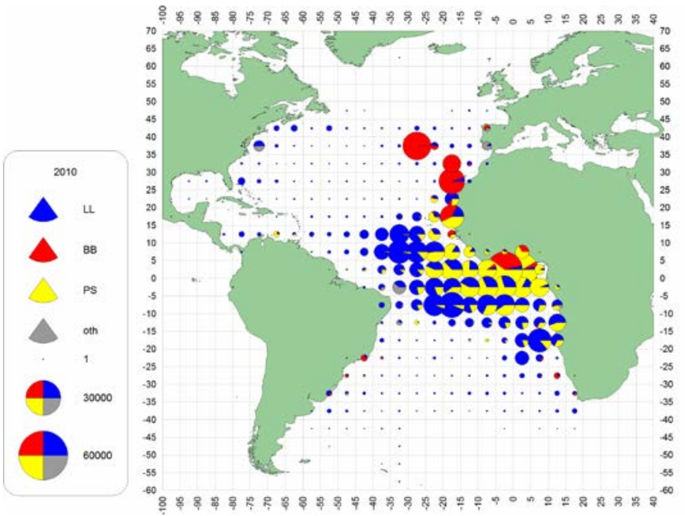
c. BET (1980-89)



d. BET (1990-99)

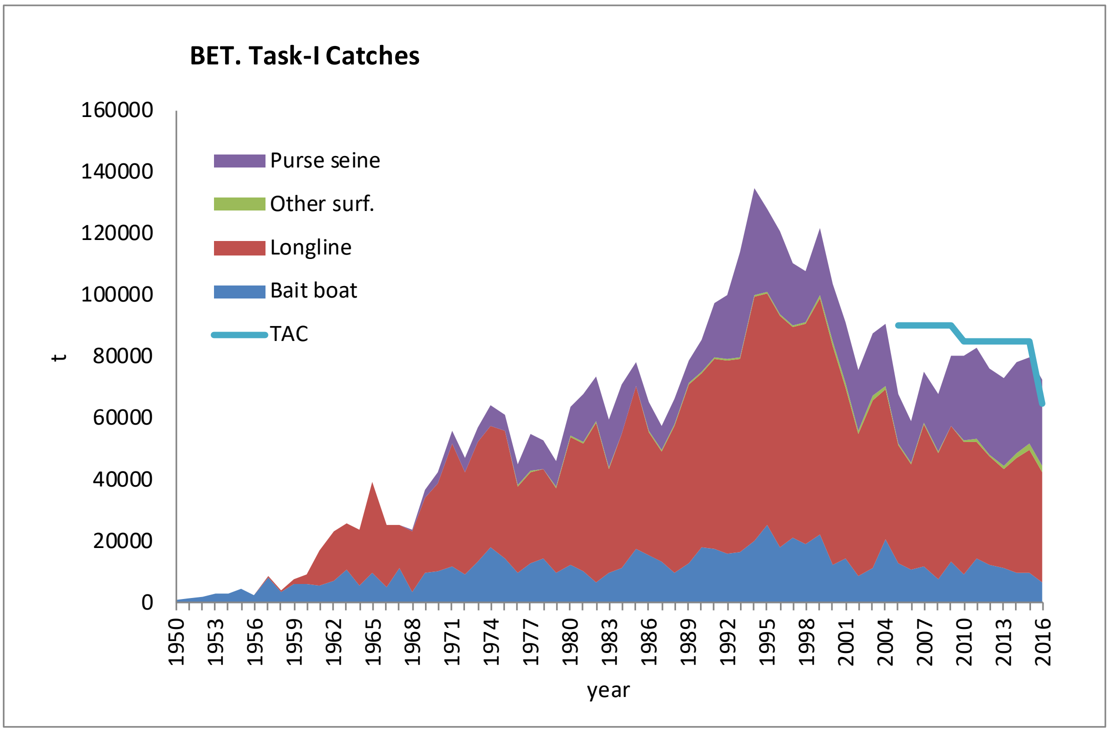


e. BET (2000-09)

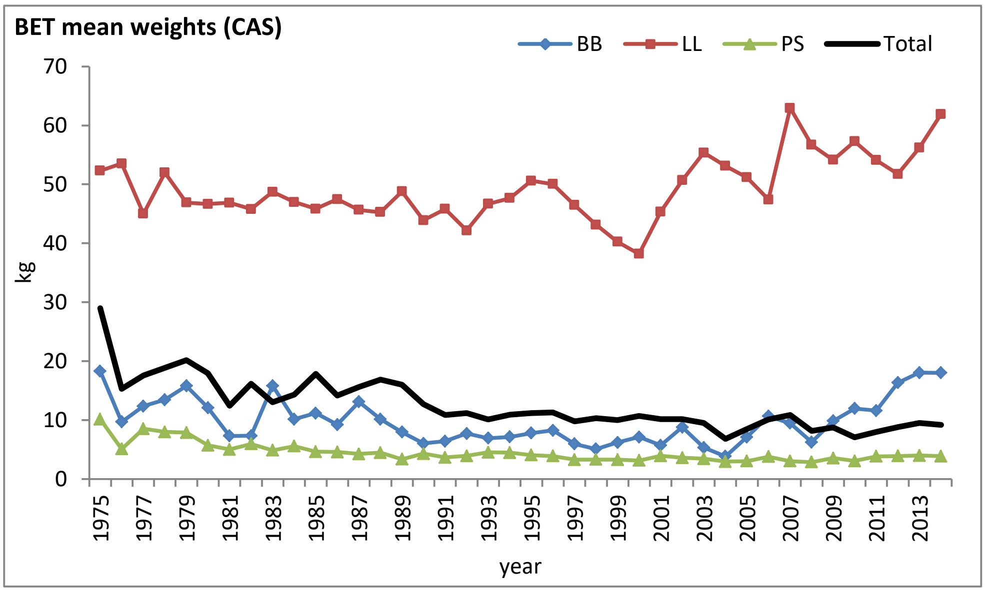


f. BET (2010-15)

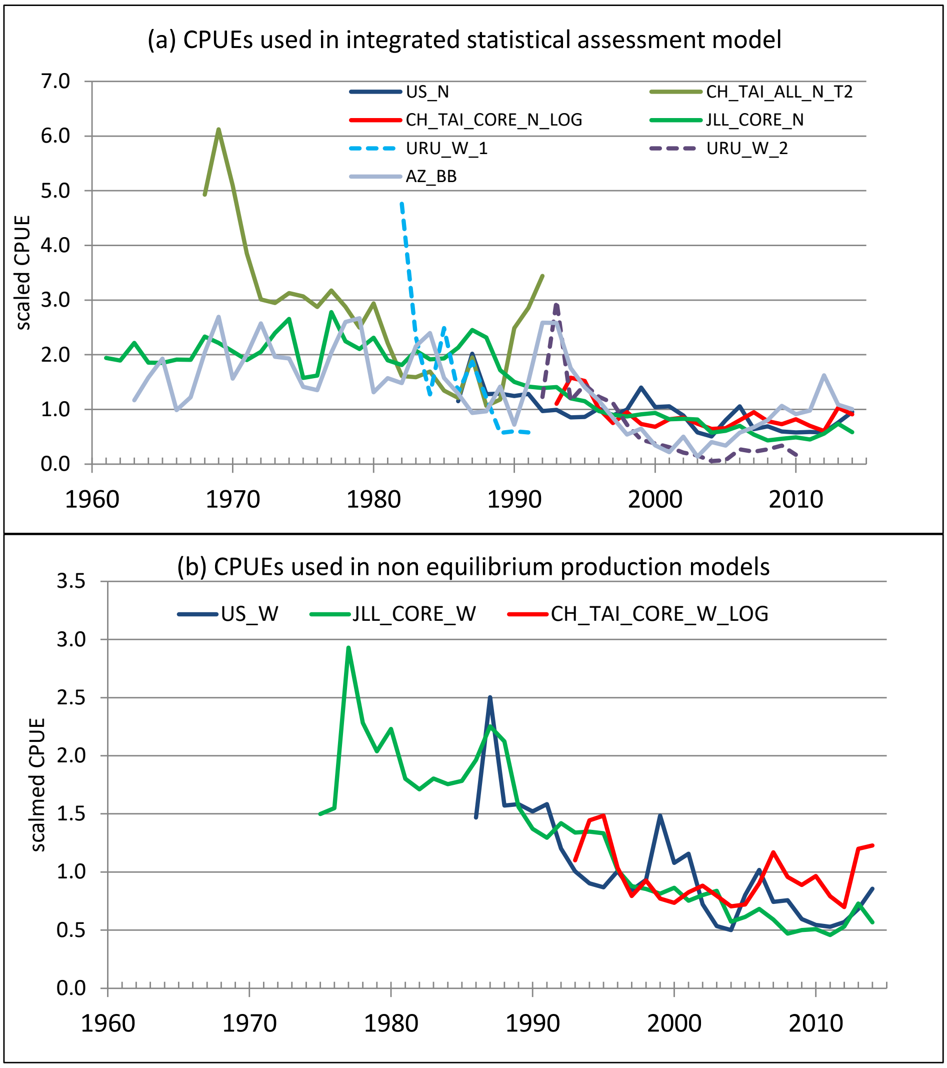
BET-Figure 1 [a-f]. Geographical distribution of the bigeye tuna catch by major gears and decade. The maps are scaled to the maximum catch observed during 1960-2015 (the last decade only covers 6 years).



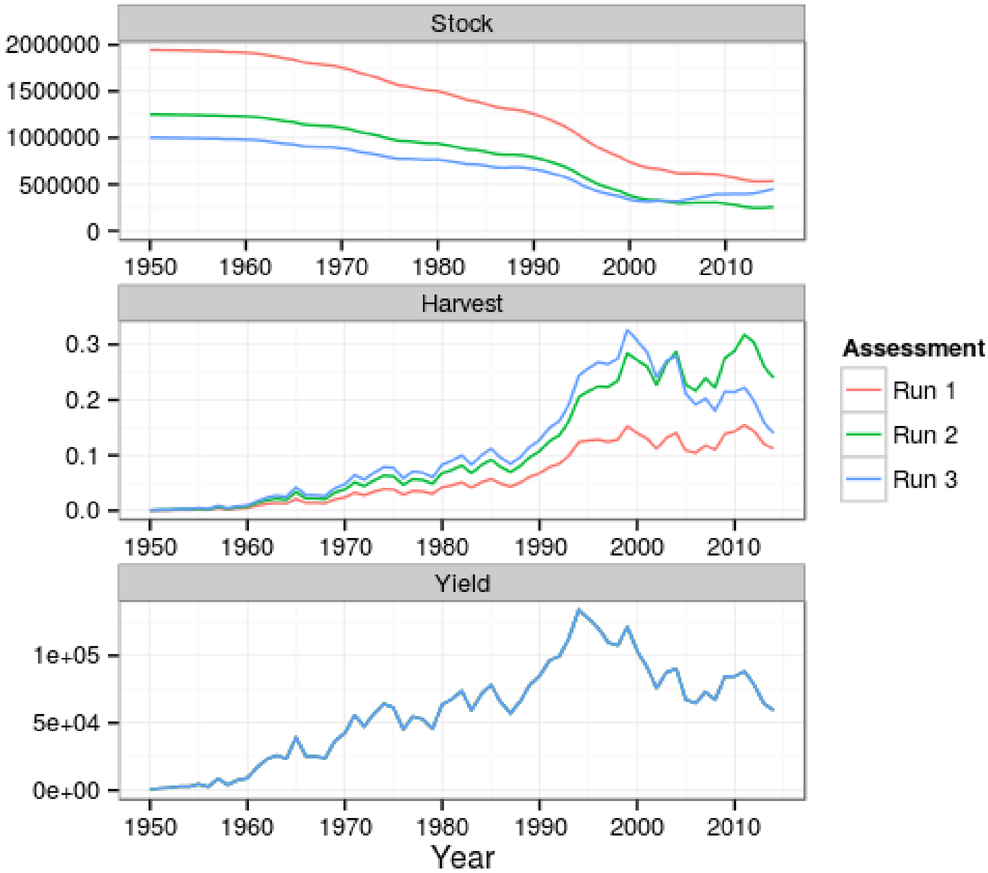
BET-Figure 2. Bigeye estimated and reported catches for all the Atlantic stock (t). The value for 2016 represents preliminary estimates because some countries have yet to provide data for this year or are under revision.



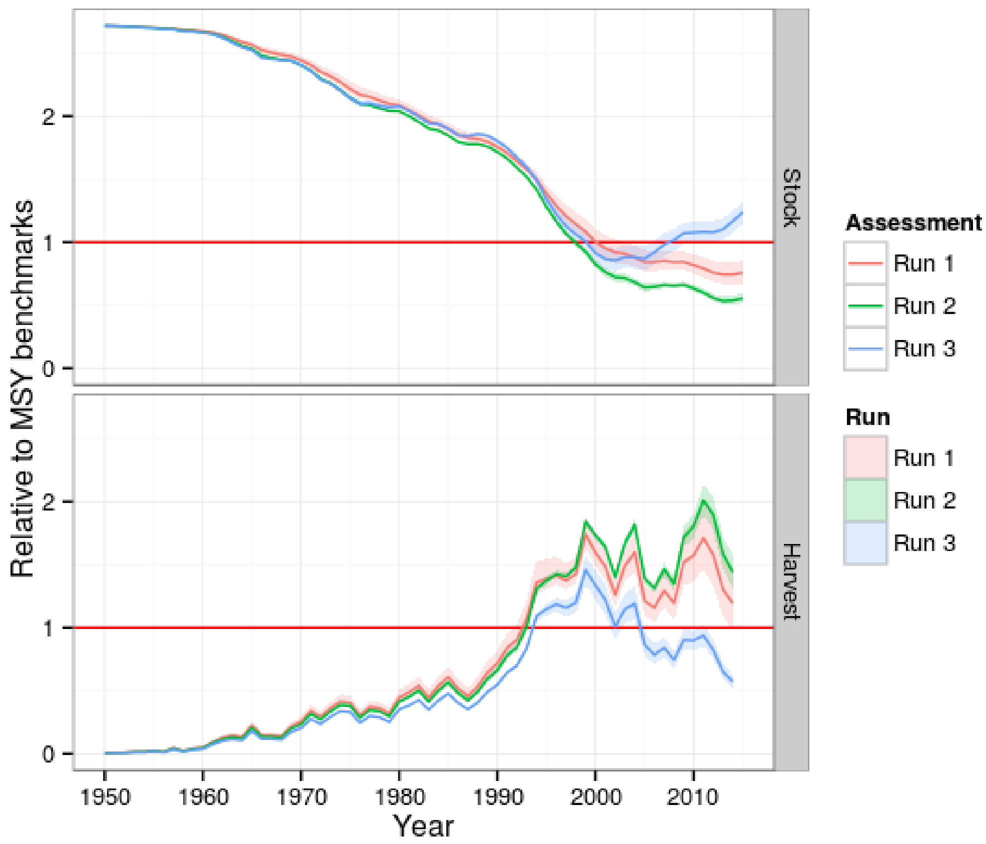
BET-Figure 3. Trend of mean weight for bigeye based on the catch-at-size data for 1975-2014 by major fisheries (BB=Baitboats, LL=Longlines, PS=Purse seine). The mean weight of the baitboat fishery (BB) reflects various baitboat fleets operating in different areas of the Atlantic Ocean.



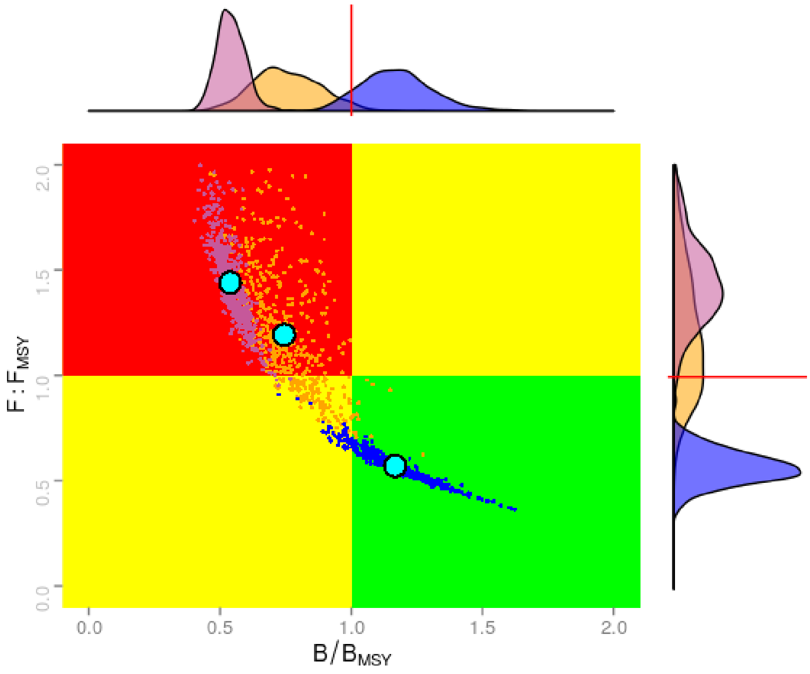
BET-Figure 4. (a) Indices used in the integrated statistical assessment model. Note that these are the annual means but the indices were calculated by area and season for input into the model. (b) Indices used in the non-equilibrium production assessment model.



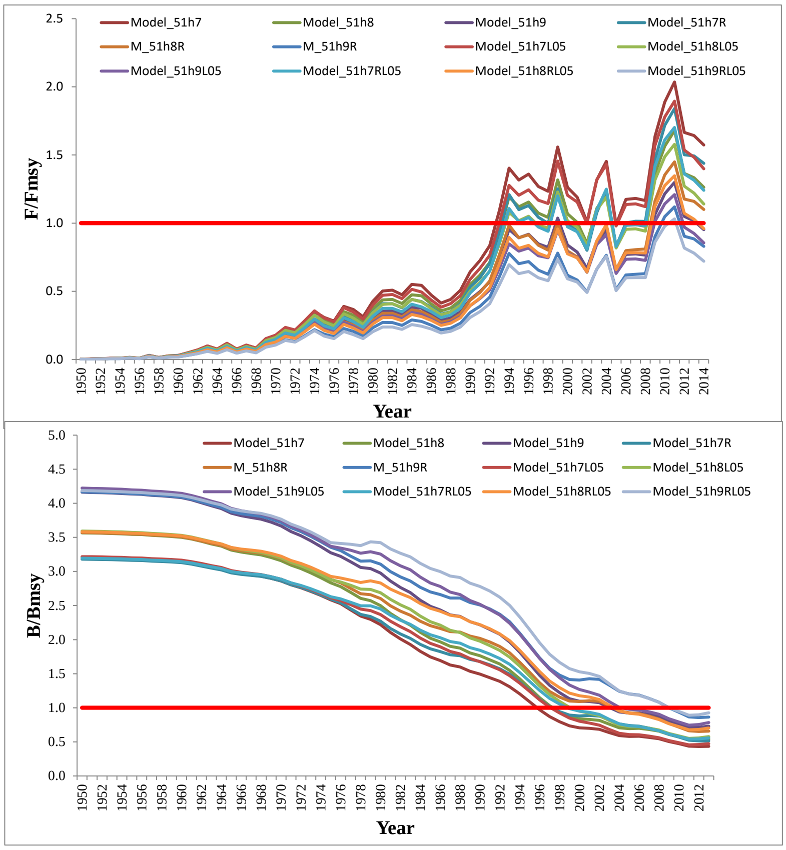
BET-Figure 5. Trajectories of biomass, fishing mortality and yield from different ASPIC scenarios. Run 1: using USA LL CPUE; Run 2: using Japanese LL CPUE; and Run 3: using Chinese Taipei LL CPUE.



BET-Figure 6. Trajectories of B/B_{MSY} and F/F_{MSY} estimated from the different runs of ASPIC. Lines represent the medians and ribbons the inter-quantiles. Run 1: using USA LL CPUE; Run 2: using Japanese LL CPUE; and Run 3: using Chinese Taipei LL CPUE.

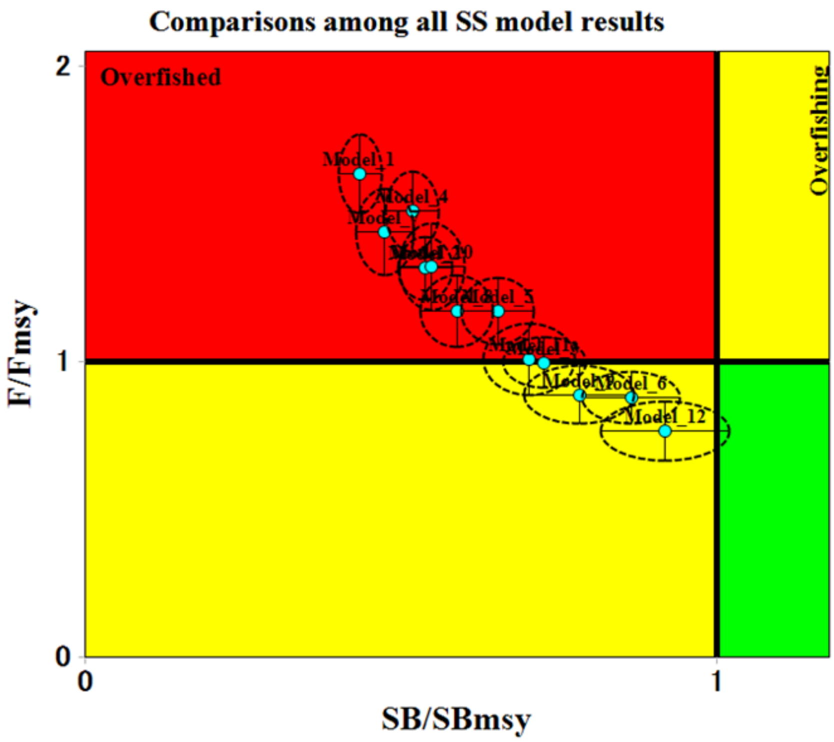


BET-Figure 7. ASPIC: Current status (2014) of bigeye tuna based on ASPIC. Graph combines results for the 3 runs considered. The clouds of points depict the bootstrap estimates of uncertainty for the most recent year (purple = Japan LL run, brown = US LL run, blue= Chinese Taipei LL run). The median point estimate for each model's results are shown in open (cyan) circles. The marginal density plots shown above and to the right of the main graph reflect the frequency distribution of the bootstrap estimates of each model with respect to relative biomass (top) and relative fishing mortality (right). The red lines represent the benchmark levels (ratios equal to 1.0).

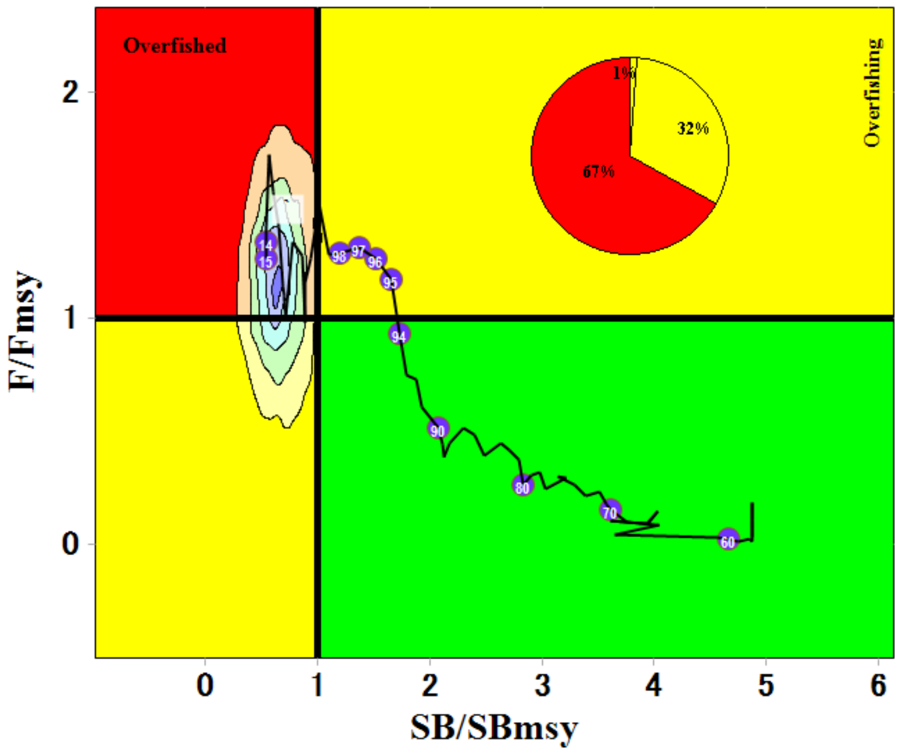


BET-Figure 8. Estimated Spawning Stock Biomass and fishing mortality relative to MSY benchmark (B/B_{MSY} and F/F_{MSY}) both based on 2014 selectivity patterns for the 12 SS3 selected runs.

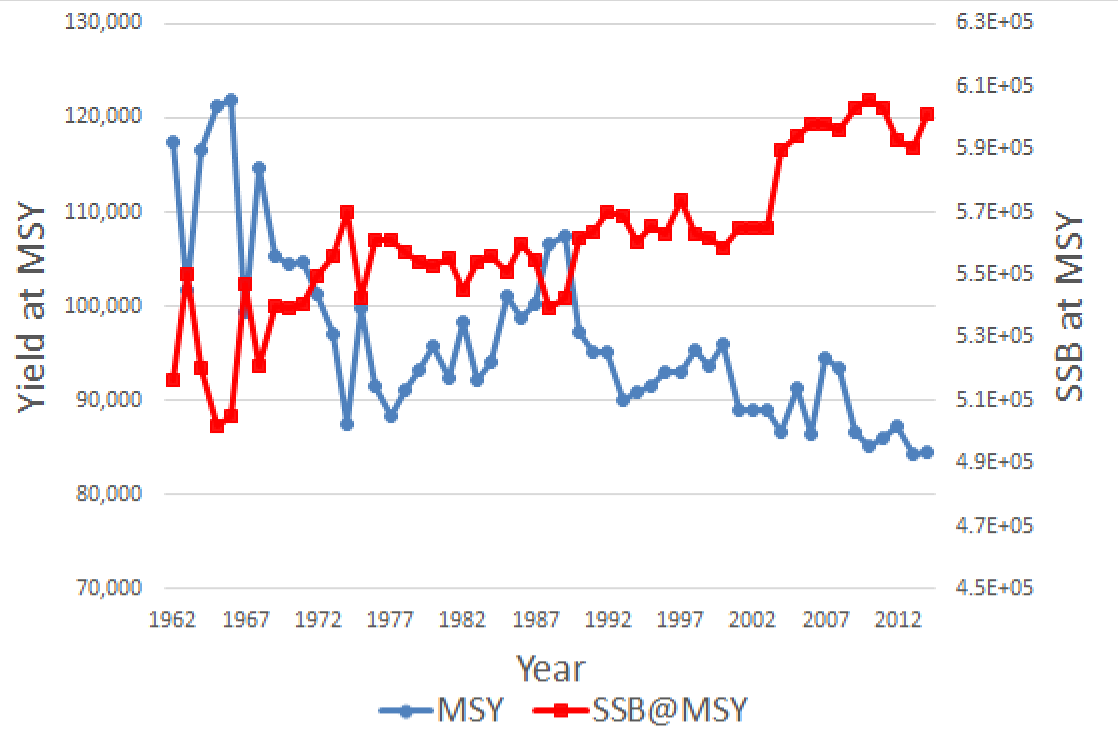
(a)



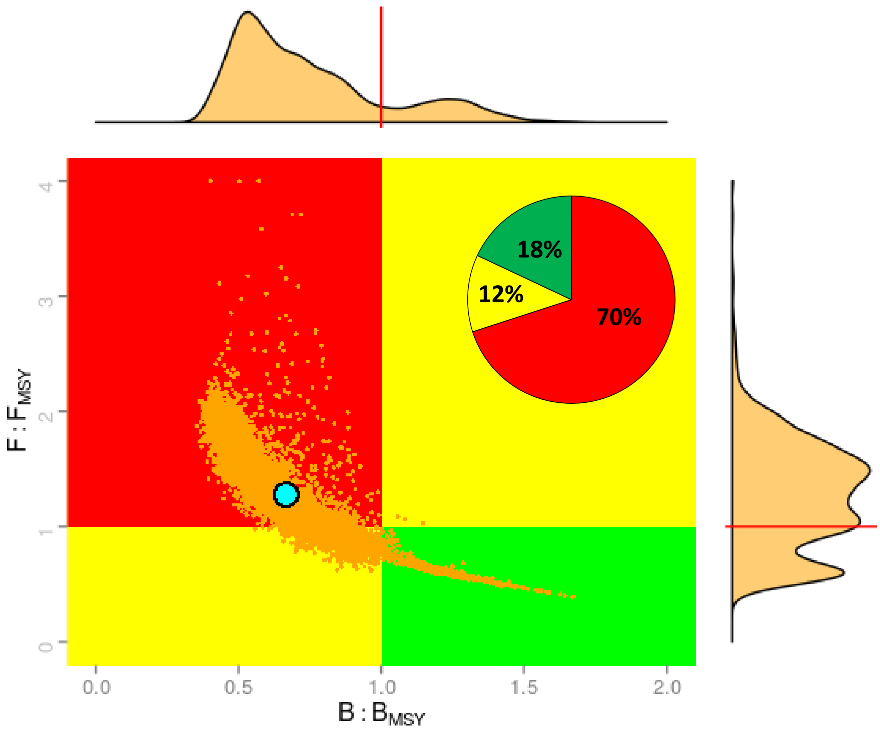
(b)



BET-Figure 9. Kobe Phase Plot for SS3: (A) for all runs separately and (b) combined 2014 status outcomes – the trajectory shown is an illustrative example which accounts for changes in selectivity over time of run. 8.



BET-Figure 10. Year/selectivity specific maximum sustainable yield (MSY) and spawning stock biomass (SSB) required to produce that maximum sustainable yield.



BET-Figure 11. Combined Kobe phase plot of non-equilibrium production model and integrated stock assessment model. The combined plot was developed by giving equal weighting between production models and integrated assessment model results. Within each model type equal weighting was given to different runs.

8.3 SKJ – SKIPJACK TUNA

Stock assessments for East and West Atlantic skipjack were conducted in 2014 using catch data available to 2013 (Anon., 2015). The previous assessment of skipjack stocks was only conducted in 2008. This report is an update of that of 2016 covering the most recent information on the state of the stocks on this species.

SKJ-1. Biology

Skipjack tuna is a gregarious species that is found in schools in the tropical and subtropical waters of the three oceans (**SKJ-Figure 1a and b**). Skipjack is the predominant species aggregated to FADs where it is caught in association with juvenile yellowfin tuna, bigeye tuna and with other species of epipelagic fauna. Skipjack reproductive potential is considered to be high because it reaches sexual maturity around one year and it spawns opportunistically in warm waters above 25ºC throughout the year and in large areas of the ocean. Moreover, the analysis of East Atlantic tagging data has confirmed that the growth of skipjack was quicker in sub-tropical waters than in equatorial waters where it produces most of its spawn. These growth differences depending on latitude must be taken into account if the assessments are carried out on separate stocks between sub-tropical and tropical areas. It is also possible that the growth does not follow the conventional Von Bertalanffy model but rather a two-stanza model. The appropriate growth model may be confirmed before the next skipjack stock assessment by using the tag data from the AOTTP. Based on the relationships between life history characteristics and natural mortality, a natural mortality vector decreasing with size has been estimated (**SKJ-Figure 2**). The natural mortality values estimated by this approach are greater than those used in the past for East Atlantic skipjack. Lower values have been obtained by another approach which has been applied for the western stock, whose catches are however composed of larger sized individuals than in the eastern stock.

The increasing use of fish aggregation devices (FADs) since the early 1990s, have changed the species composition of free schools. It is noted that, in fact, the free schools of mixed species were considerably more common prior to the introduction of FADs. Furthermore, the association with FADs may also have an impact on the biology (growth rate, plumpness of the fish) and on the ecology (distances, movement orientation) of skipjack and yellowfin ("ecological trap" concept).

SKJ-2. Fishery indicators

Following the historic record in 2013 (255,730 t), the total catches of skipjack throughout the Atlantic Ocean (including catches of "*faux poisson*" landed in Côte d'Ivoire) remain high, reaching 245,933 t in 2016 (**SKJ-Table 1, SKJ-Figure 3**). This represents a very sharp rise compared to the average catches of the five years prior to 2010 (155,157 t). It is possible, however, that the catches of a segment of the Ghanaian purse seine fleet, transshipped on carriers, have escaped the fishery statistics collection process before 2011. In addition, following the expert missions carried out in Ghana which have shown the existence of bias in the sampling protocol which aims to correct the multi-species compositions of the catches reported in the logbooks, Ghanaian Task I and II statistics have been reviewed in several stages (1973-2005). The review for the period 2006-2014 had shown that the skipjack catches reported by Ghana were underestimated by around 28%, which gives an average of 12,000 t/year. Therefore, all of these historical data have consequently been corrected.

The numerous changes that have occurred in the skipjack fishery since the early 1990s (e.g. the progressive use of FADs and the latitudinal expansion and the westward extension of the fishing area) have brought about an increase in skipjack catchability and in the proportion of biomass exploited. Currently, the major fisheries are the purse seine fisheries, particularly those of Belize, Curaçao, EU-France, EU-Spain, Ghana, Guinea, Panama, and Cabo Verde, followed by the baitboat fisheries of EU-Portugal, EU-Spain, Ghana, and Senegal. The preliminary estimates of catches made in 2016 in the East Atlantic amounted to 217,363 t, which is an increase of about 68% as compared to the average of 2005-2009 (**SKJ-Figure 4**). It should be noted that there has been a sharp increase in the skipjack catches by the European purse seiners, probably due to the high selling price of this species from 2011 to mid-2013 (**SKJ-Figure 5**). This increase in catches is accompanied by changes in fishing strategies since the proportion of skipjack catches using floating objects has continued to increase. This is the result to some extent of the sharp reduction in seasonal fishing by European purse seiners on free schools after 2006 off the coast of Senegal and of the emergence as from 2012 of atypical fishing off FADs since it involves single species schools composed of large individuals off the coast of Mauritania (**SKJ-Figure 1B**). These changes in fishing strategy can take place differently in the purse seine fleets, including in fleets that operated similarly in the past (**SKJ-Figure 6**) and are therefore difficult to integrate into stock assessment models.

The unreported catches of some purse seiners were estimated by comparing the monitored landings in West African ports and cannery data to the catches reported to ICCAT. Estimates of the unreported catches of these purse seiners have increased since 2006 and may have exceeded 20,000 t for the three main species of tropical tunas. The Committee expressed the need for the countries and the industry concerned in the region to cooperate to estimate and report these catches accurately to ICCAT. Recent progress in the transmission and review of data submitted to the ICCAT Secretariat has enabled the Committee to partially include these catches and the associated sizes in the skipjack assessment. The magnitudes of these estimates of IUU catch, however, are likely to influence the assessments and the perception of stock status.

The average rate of discards of skipjack on FADs by European purse seiners operating in the eastern Atlantic has been estimated based on onboard observer programmes to be 42 kg per t of skipjack landed. Furthermore, the amount of small skipjack (average size 37 cm FL) landed in the local market of Abidjan in Côte d'Ivoire as "*faux poisson"* has been estimated at 235 kg per t of skipjack landed (i.e. an average of 6,641 t/year between 1988 and 2007 for the European or associated purse seiners, **SKJ-Figure 7**). However, the latest estimates indicate values close to 10,000 t/year between 2005 and 2014 for all purse seiners operating in the eastern Atlantic (skipjack representing around 30% of the total "*faux poisson*": the species composition in 2014 has not been taken into account because it seems less accurate than in previous years). The Committee regularly incorporates these estimates into the reported historical catches for the EU purse seiners since 1982, as well as in the catch-at-size matrix. "*Faux poisson*" estimates for 2015 and 2016 are not yet available. The Group needs additional information on modification to the access rights to fishing grounds along the African coast to be able to assess catch trends.

In the West Atlantic the major fishery is the Brazilian baitboat fishery, followed by the Venezuelan purse seine fleet. The preliminary estimates of catches in 2016 made in the West Atlantic amounted to 28,570 t (against the historic record of 40,272 t in 1985 (**SKJ-Figure 8**)).

It is difficult to discriminate a fishing effort between free schools (composed of large yellowfin tunas) and for FAD fishing (targeting skipjack) in the East Atlantic because the fishing strategies can change from one year to the next and in addition, the sea time devoted to activities on FADs and the assistance provided by supply vessels are difficult to quantify. The Committee recognizes that the use of data series on the yearly progression of the sale prices of tropical species by commercial category enables identification of the years when skipjack is most targeted by the purse seiners (which seems to be the case in the past few years, **SKJ-Figure 6**). Nominal purse seine effort, expressed in terms of carrying capacity, has decreased regularly since the mid-1990s up to 2006. However, after this date, several European Union purse seiners have transferred their effort to the East Atlantic, due to piracy in the Indian Ocean, and a fleet of new purse seiners have started operating from Tema (Ghana), whose catches are probably underestimated. All this has contributed to the growth in carrying capacity of the purse seiners, which is gradually nearing the level observed in the early 1990s (**SKJ-Figure 9**). The number of purse seiners follows this trend but seems to have remained steady since 2010; the nominal effort of baitboats has remained stable for over 20 years. By 2010, overall carrying capacity of the purse seine fleet had increased significantly, to about the same level as in the 1990s, and has increased by nearly 50% since. FAD based fishing has accelerated even more rapidly than free school fishing.

It is recognised that the increase in fishing power linked to the introduction of technological innovation on board the vessels as well as to the development of fishing using floating objects has resulted in an increase in the efficiency of the various fleets, since the early 1980s. In order to take into account the effect of the technological changes in skipjack catchability, an annual yearly growth of 3% is generally assumed as the working hypothesis, although an analysis carried out fixing the MSY and K at the values estimated in the previous stock assessment would suggest an increase in catchability between 1 and 13% per year. Moreover, the estimates on growth in bigeye catchability, whose juveniles are also captured using FADs, would indeed indicate a value of 2.5% per year before 1991 and 6 to 8% thereafter. However, it is not known whether these estimates only reflect technological changes, or the availability of fish as well, resulting from the expansion of the surface area exploited over the years, reaching its historic high in 2013 and which corresponds to the expansion of the fishery towards the West Central Atlantic or more recently to the level of the North and South latitudes (**SKJ-Figure 10**).

The increase in total mortality (Z) between the early 1980s and the late 1990s, estimated using different methods, such as the tag-recovery model, the catch curves by size and the average size observed in the yearly catches, is consistent with an increase in catchability. The steady decrease in average weight up to 2011 (**SKJ-Figure 11**) is also consistent with the fact that the purse seine fleet has increased pressure on juvenile tunas. This trend has reversed since 2012 and at the same time a broadening of the range of sizes caught is observed (**SKJ-Figure 12**). Generally, except the East Pacific, it has been noted that the average skipjack weight observed in the East Atlantic (close to 2 kg) was much lower than the estimates provided for the other oceans (close to 3 kg).

With respect to the West Atlantic, the fishing effort of the Brazilian baitboats, which constitute the main skipjack fishery in this region, seems to have stabilised over the past 20 years. No marked trend regarding the structure of catches by size has been observed (**SKJ-Figure 13**).

SKJ-3. State of the stocks

In all the oceans, the traditional stock assessment models are difficult to apply to skipjack because of their particular biological and fishery characteristics (on the one hand, continuous spawning, spatial variation in growth and on the other, discrimination of effort for free schools and FADs, transition between these two fishing methods which are difficult to quantify). In order to overcome these difficulties, several assessment methods, conventional and non-conventional (based solely on catches, or on development of average size) have been applied to the two stocks of Atlantic skipjack. Several fishery indicators have also been analysed in order to track the development of the state of the stock over time.

Based on the large geographic distances between the fishing areas and current knowledge on small-scale migrations of skipjack in the Atlantic (**SKJ-Figure 1a and b** and **SKJ-Figure 14**), the Committee has also analysed the possibility of using smaller stock units. While recognising the validity of this approach, the Committee does not currently have evidence, such as a sufficient amount of tag-recovery data covering the entire tropical ocean, in order to validate smaller stock units. Consequently, the Committee has decided to maintain the working hypothesis which favours two different units of eastern and western stocks but on an experimental basis to assess a sub-unit in each of the two stocks. The use of smaller areas has however been recommended to monitor the development over time of fishery indicators. It is expected that the five year Atlantic Tropical Tuna Tagging Programme (AOTTP), may improve our understanding of skipjack stock structures and movement patterns.

Eastern stock

The Committee has analysed two standardized fishery indices from the EU-purse seine fishery: an index which accounts for skipjack caught in free schools off the coast of Senegal up to 2006 and the second index which characterises fish captured off FADs and in free schools in the equatorial area (**SKJ-Figure 15**). The increase in CPUE of the European purse seiners in the late 1990s is partly the consequence of the increase in the catches of positive sets under FADS, in particular for Spanish vessels since 2011 (**SKJ-Figure 16**). In addition, the introduction of the price of skipjack (price adjusted for inflation) into the standardisation of the CPUE has not improved the fit. Furthermore, the regular increase in the skipjack yields of the baitboats based in Senegal may only be the result of an increase in catchability linked to the adoption of the so-called "baitboat associated school" fishing towards the mid-1980s (**SKJ Figure 15**). No marked trend has been observed for the Canary Islands baitboats, nor for the peripheral fishery of the Azorean baitboat fishery. Although the Committee has only considered a single stock for the East Atlantic, due to the very low apparent exchange rates between the sectors (based on available information, only 0.9% of tagged fish on both sides of the latitude 10ºN have exceeded this limit), a decrease in abundance for a local segment of the stock would probably have little repercussion on abundance in other areas (refer to notion of stock viscosity).

Regardless of the model used: 2 surplus biomass production models (one non-equilibrium conventional model, and one Bayesian model), a model based only on catch and a mortality estimation model based on the average sizes of fish captured, the Committee was not in a position to provide a reliable estimate of the maximum sustainable yield and therefore nor provide advice on the state of the eastern stock. This applies in the Bayesian case, (1) after testing different working hypotheses on the a priori distribution of the input parameters of the surplus production model (i.e. the growth rate and the carrying capacity), and on the impact of the growth of the catchability coefficient on the CPUE of each fleet, and (2) after performing a retrospective analysis in the case of the catch-only based model. The absence of definition of a fishing effort associated with FADs for the purse seiners, the difficulty of taking into account changes in catchability, the lack of marked contrast in the datasets despite the historical development of the fishing pressure (**SKJ-Figure 9**) and the fact that the catches and the CPUEs have increased in parallel in recent years are constraints for effective use of the classic stock assessment methods. The Committee has also highlighted that it is difficult to estimate the MSY in conditions of continuous growth of catches without having reliable indicators on the response of the stock to these increases. These indicators may be improved CPUE series, fishing mortality estimates from tagging programmes or other indicators on the exploitation of this species.

Even if caution must be exercised when formulating a diagnosis on the state of the stock in the absence of quantification by an adequate approach, there is no evidence of a fall in yield, or in the average weight of individuals captured (**SKJ-Figure 11**). The estimated value of the MSY, according to the catch-only assessment model, has tended to increase in recent years but at a growth rate that is lower than that observed for the catches for the same period. However, according to this model, although it is unlikely that the eastern skipjack stock is overexploited, current catches could be at, even above, the MSY.

As in the past, it is difficult to know whether this hypothesis can be applied to all spatial components of this stock in the East Atlantic, due to the moderate exchange rates which seem to exist between the different sectors of this region. The Committee considers that the MSY should be higher than that estimated in the 2008 assessment in a different exploitation plot to the current one, but cannot express an opinion on the level of the new MSY and the sustainability of the current catches, nor on the repercussions of this exploitation plot on juveniles of the two other species of tropical tunas.

Taking into account the biological and fishery specificities of skipjack, the Committee has attempted to develop Harvest Control Rules based on the proportion of individuals whose sizes are larger than the reference sizes (e.g. size at sexual maturity, the size corresponding to the length which maximises the catches for a given cohort, etc.). The Committee recommends, however, that due to the multi-species nature of the tropical tuna fishery, the HCRs on skipjack take into account the consequences of targeting skipjack on the other two species of tropical tunas.

Western stock

The CPUEs in the West were those of the Brazilian baitboat which remain relatively stable, those of the Venezuelan purse seiner, the US pelagic longline and a larval index (**SKJ-Figure 17**). In addition, the average weight of skipjack caught in the West Atlantic is higher than in the East (3 to 4.5 kg compared to 2 to 2.5 kg), at least for the Brazilian baitboat fishery.

The model based on catches and the non-equilibrium surplus biomass production model have estimated respectively the MSY at 30,000 t - 32,000 t (which remains close to the previous estimates in the order of 34,000 t). The fishing mortality vector estimated by a method based on the development of average size of individuals captured over time (mainly from Brazilian catches) shows a profiles which is very close to that estimated by the non-equilibrium surplus biomass model (**SKJ-Figure 18**).

It should be emphasised that all these analyses rest on the assumption of a single western stock from the US coast to Brazil and correspond to the current geographic coverage of this fishery.

For the western Atlantic stock, in light of the information provided by the trajectory of B/B_{MSY} and F/F_{MSY} ratios (**SKJ-Figure 19**), it is unlikely that the current catch is larger than the replacement yield.

SKJ-4. Effect of current regulations

There is currently no specific regulation in place for skipjack tuna. Several time/area regulatory measures on banning fishing on FADs [Rec. 98-01, Rec. 99-01, Rec. 14-01 and Rec. 16-01] or on complete closure to surface fleets [Rec. 04-01] have however been implemented in the East Atlantic but the intended aim was to protect yellowfin and bigeye tuna juveniles.

The new Recommendation [Rec. 16-01] establishes a moratorium on FAD fishing in the area that extends from to 4ºS and 5ºN latitude and from African coast to 20ºW longitude during the months of January and February, entered into force in 2016.

SKJ-5. Management recommendations

Despite the absence of evidence that the eastern stock is overexploited, but considering (1) the lack of quantitative findings for the eastern stock assessment, and (2) pending the submission of additional data (including on FADs and on the ongoing AOTTP) which are necessary to improve the stock assessment, the Committee recommends that the catch and effort levels do not exceed the level of 2012-2013 catch or effort. In addition, the Commission should be aware that increasing harvests and fishing effort for skipjack could lead to involuntary consequences for other species that are caught in combination with skipjack in certain fisheries (particularly juveniles of yellowfin and bigeye (Anon., 2017b). For the West Atlantic, the Committee recommends that the catches should not be allowed to exceed the MSY.

Despite recent progress, the Committee has expressed its concern regarding uncertainties which the underreporting of skipjack catches may have on the perception of the state of the stocks.

ATLANTIC SKIPJACK SUMMARY TABLE

	East Atlantic	**West Atlantic**
Maximum Sustainable Yield (MSY)	Probably higher than previous estimates (143,000-170,000 t)	Around 30,000-32,000 t
Current yield (2016[1])	217,363 t	28,570 t
Current Replacement Yield	Unknown	Somewhat below 32,000 t
Relative Biomass (B_{2013}/B_{MSY})	Likely >1	Probably close to 1.3
Mortality due to fishing (F_{2013}/F_{MSY})	Likely <1	Probably close to 0.7
Stock Status		
Overfished:	Not likely	Not
Overfishing:	Not likely	Not
Management measures in force	Rec. 16-01[2]	None

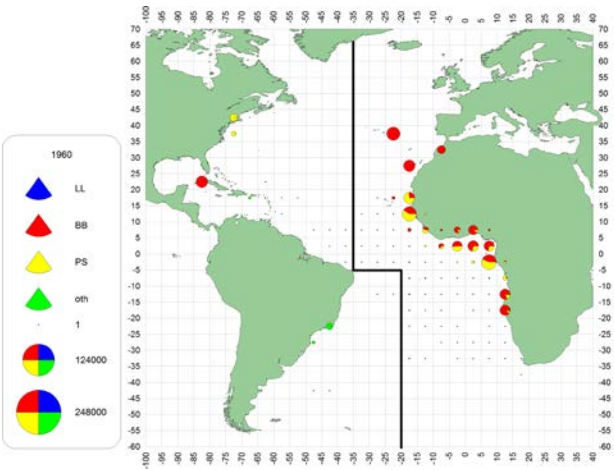
[1] Reports of catches for 2016 should be considered provisional, particularly for the West Atlantic.
[2] This moratorium on FADs entered into force in June 2016 and replaces Rec. 15-01.

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

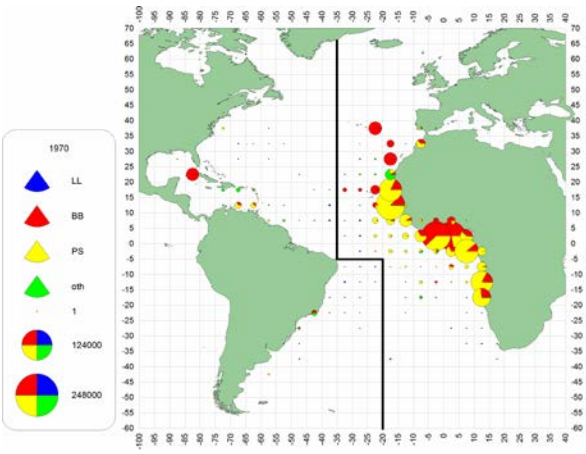
				1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
TOTAL				171204	209807	191381	174529	157116	148955	161452	180687	155671	163620	122524	155483	181705	172082	139731	152580	146633	164760	193125	223500	253191	255730	231174	229211	245933
	ATE			141050	176587	161432	152669	129554	117243	132365	153331	126477	132169	100924	130734	154243	143566	113279	127137	124611	138985	170125	191117	220334	220693	204446	209082	217363
	ATW			30155	33221	29949	21860	27562	31712	29087	27356	29193	31451	21600	24749	27461	28517	26453	25443	22022	25774	23000	32383	32857	35037	26727	20130	28570
Landings	ATE		Bait boat	35660	31656	37817	33691	35872	37314	46784	44762	33909	56689	31076	34445	54602	48185	44711	35418	33019	34549	39175	38566	44893	30294	27152	25041	28633
			Longline	3	2	10	3	7	47	85	42	48	53	59	83	67	83	204	428	199	59	46	35	58	79	66	21	540
			Other surf.	1602	1225	501	488	510	308	1099	470	2513	841	534	385	1008	2351	5270	3432	3794	6361	5098	5822	6708	7126	2109	2423	987
			Purse seine	91016	125831	107244	105478	88949	71824	76680	98821	79373	72582	67589	89053	90610	87659	59913	82633	81804	89546	117601	137298	161766	176901	168201	180966	187203
	ATW		Bait boat	20852	19697	22645	17744	23741	26797	24724	23881	25641	25142	18737	21990	24082	26028	23749	22865	20617	22770	19923	29468	30693	32397	24814	17538	25267
			Longline	37	21	16	34	21	12	21	58	22	60	349	95	206	207	286	52	49	20	30	41	107	1194	462	35	83
			Other surf.	756	709	1577	2023	450	556	516	481	467	951	398	367	404	316	372	1317	455	950	1104	1014	475	538	369	297	270
			Purse seine	8509	12794	5712	2059	3349	4347	3826	2936	3063	5297	2116	2296	2769	1967	2045	1209	901	2035	1943	1859	1582	908	1081	2259	2950
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	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	
			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	
	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	
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**
			Angola	41	13	7	3	15	52	2	32	14	14	14	14	10	0	0	0	0	50	636	44	91	514	12	1	1
			Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1373	2714	7429	15554	6218	10779	12599	7730
			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**
			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	9425
			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**
			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
			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
			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	
			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
			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	
			EU.France	21890	33735	32779	25188	23107	17023	18382	20344	18183	16593	16637	19899	21879	14850	7034	4168	4439	7789	14749	13067	13139	16242	17406	20563	19435
			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	
			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	
			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	
			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
			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**
			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	
			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	
			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
			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	
			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
			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	
			Ghana	18967	20225	21258	18607	24205	26364	41840	52024	34980	55475	37570	32977	46030	54209	33612	46638	39561	45072	52051	48871	56134	45236	49261	61061	51334
			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
			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	**0**
			Guinée Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1500	1473	7942	7363	5484	0	
			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
			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
			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	19
			Maroc	559	312	248	5024	684	4513	2486	858	1199	268	281	524	809	4666	4032	1592	1309	2580	2343	2151	2267	2045	1068	576	258
			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
			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	**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	
			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
			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
			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
			Senegal	260	95	59	18	163	455	1963	1631	1506	1271	1060	733	1395	4874	3534	2278	3661	4573	2447	4823	4339	4183	4091	5943	17082
			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
			St. Vincent and Grenadines	0	0	0	0	50	236	447	1025	835	363	524	42	0	0	1	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	38	36	0	0	0	15	17	0	0	
			U.S.A.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			U.S.S.R.	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	16	65	55	115	86	294	298	13	64	205	63	63	63	63	88	110	45	15	25	371	29	7	26	6	127
			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**
		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
		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	

				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**
			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	
			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	
			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	
			Mixed flags (FR+ES)	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)	12016	20012	17248	15964	16050	5658	5741	7675	5245	5679	6202	5533	4750	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
			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
			Brazil	18535	17771	20588	16560	22528	26564	23789	23188	25164	24146	18338	20416	23037	26388	23270	24191	20846	23307	20590	30563	30872	32602	24873	17584	25020
			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**
			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
			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
			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
			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
			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**
			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
			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
			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
			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**
			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
			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	67
			St. Vincent and Grenadines	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**
			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**
			U.S.A.	560	367	99	82	85	84	106	152	44	70	88	79	103	30	61	66	67	119	54	87	112	117	76	78	134
			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	
			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
		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
			Suriname	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	552	0	0	**0**
		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	
			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	
			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	
			Dominica	41	24	43	33	33	33	33	85	86	45	55	51	30	20	28	32	45	25	0	13	0	4	0	0	27
			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	
			Grenada	30	25	11	12	11	15	23	23	23	15	14	16	21	22	15	26	20	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	
			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
			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	
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	
			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	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	
			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	
			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	0	
			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	0	
			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	
			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	
			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	
		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	0	
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**
			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**
			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**
		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**
	ATW	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**
		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**

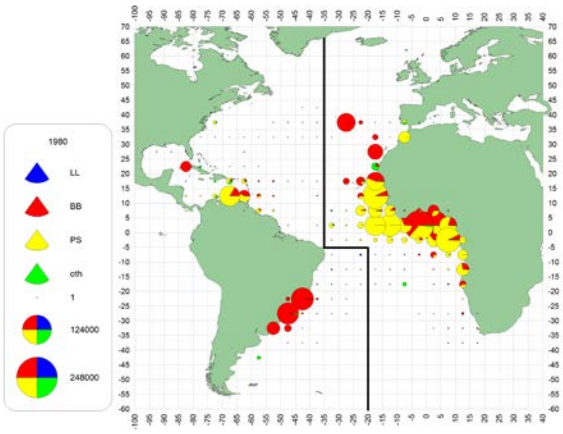
The Brazilian catches for 2016 are SCRS estimations (carry over based on a 2013-2015 average) obtained due to the absence of official statistics.



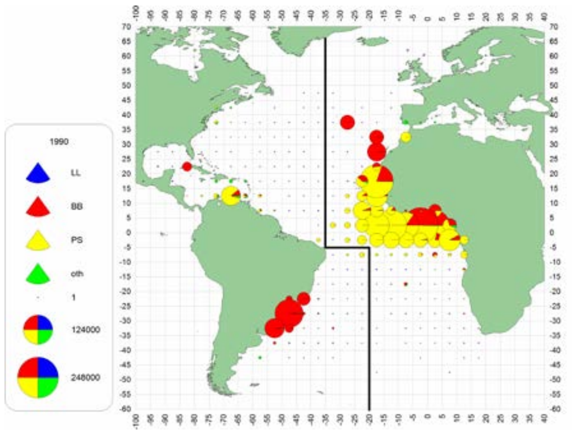
a. SKJ (1960-69)



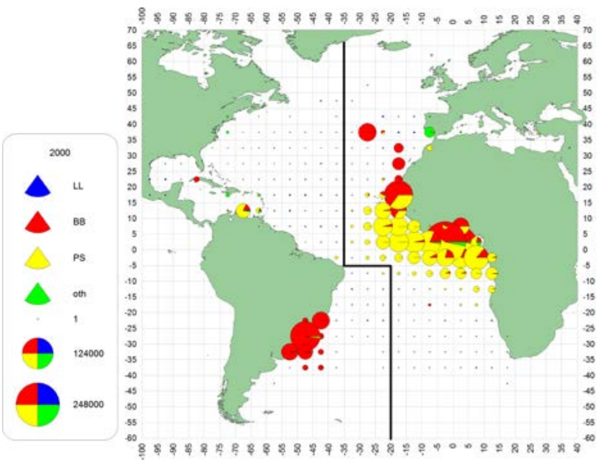
b. SKJ (1970-79)



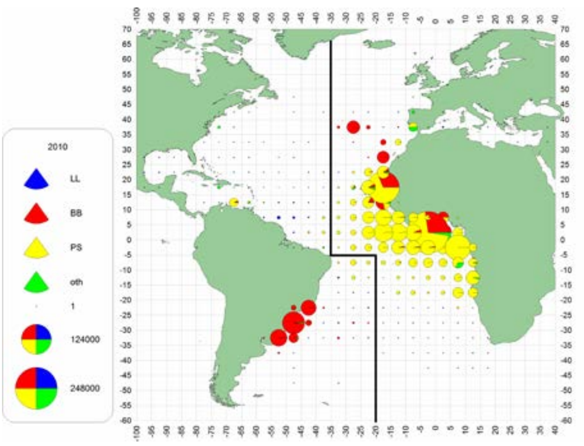
c. SKJ (1980-89)



d. SKJ (1990-99)

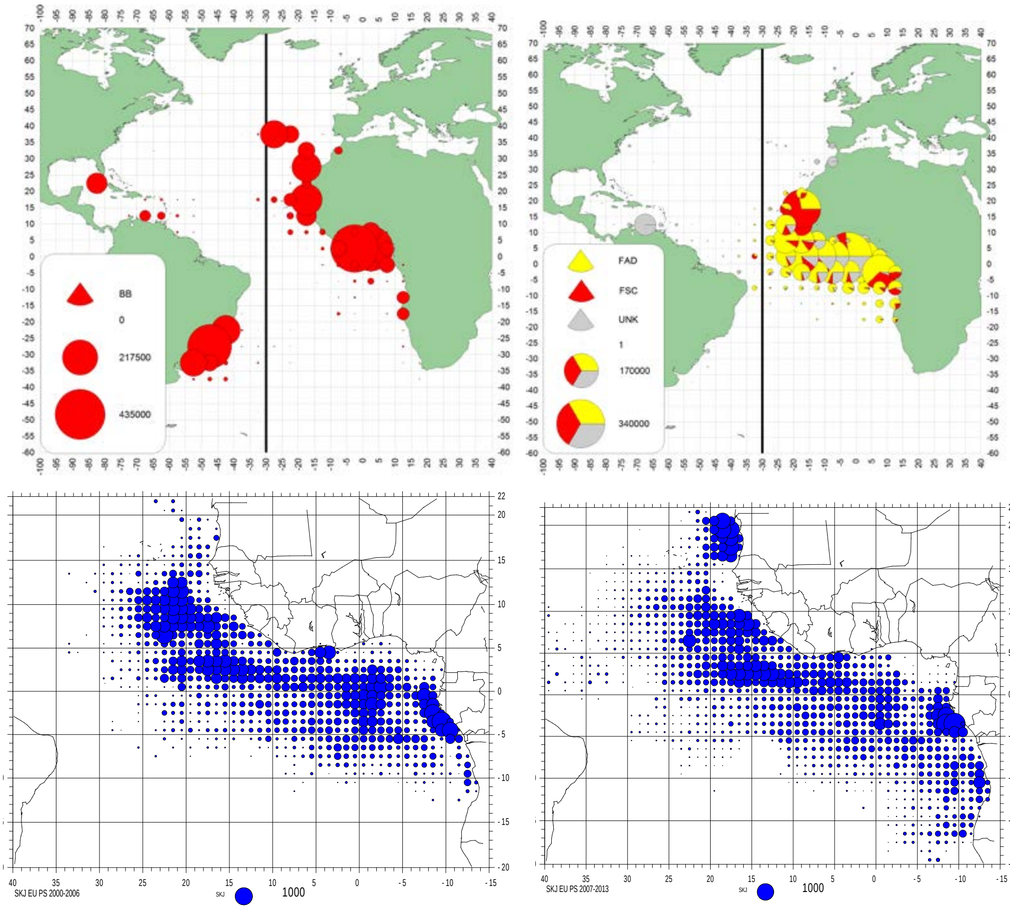


e. SKJ (2000-09)

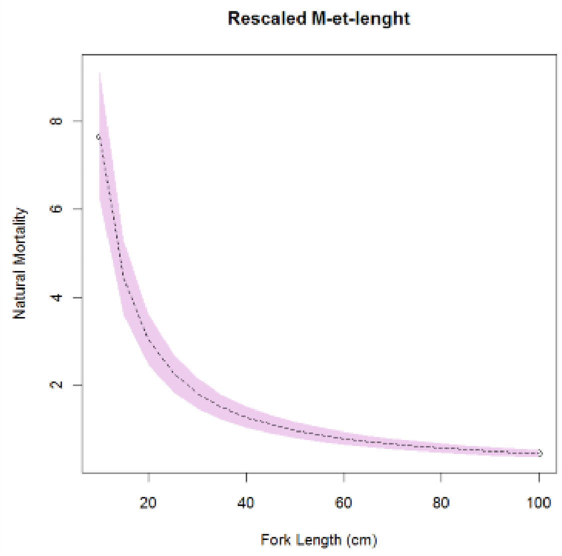


f. SKJ (2010-15)

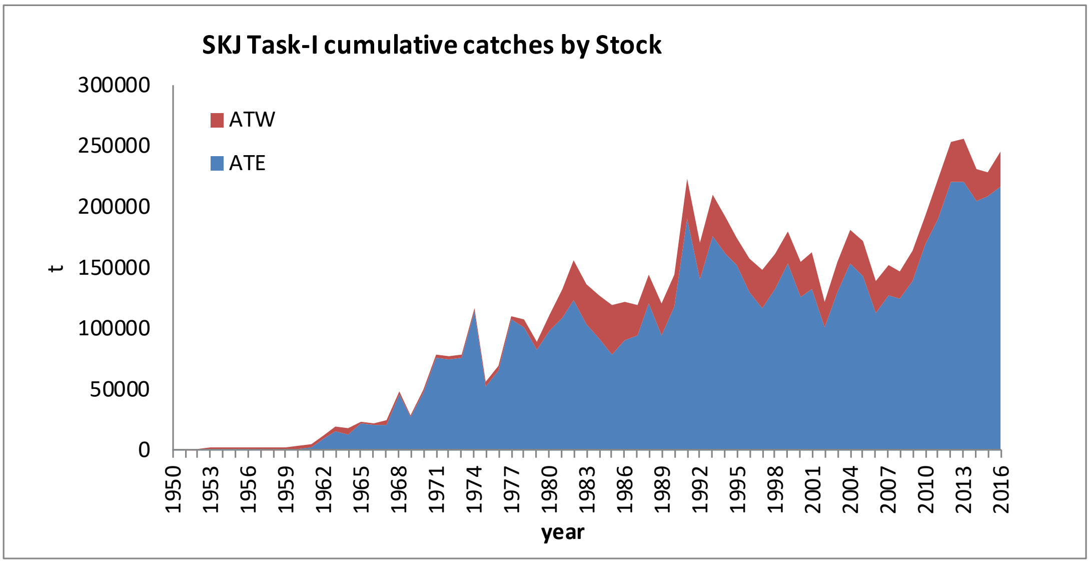
SKJ-Figure 1A [a-f]. Geographical distribution of the skipjack catch by major gears and decade. The maps are scaled to the maximum catch observed during 1960-2015 (last decade only covers 6 years).



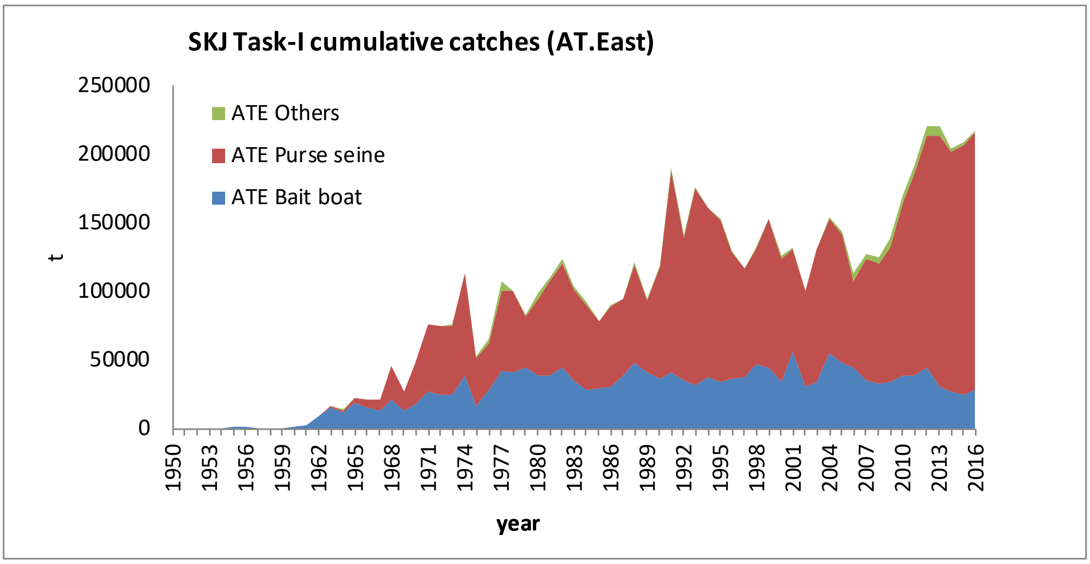
SKJ-Figure 1B. Distribution of skipjack catches in the Atlantic for baitboat (upper left panel) between 1950 and 2014 and for purse seiners (upper right panel) by fishing mode (free schools vs. FADs. UNK is considered to be mainly free schools in the Western and mainly FAD in the Eastern Atlantic) between 1991 and 2014. Skipjack catches made by European and associated purse seiners (about 75% of the total catches) between 2000 and 2006 (lower left panel) and between 2007 and 2014 (lower right panel) showing the withdrawal from the Senegal fishing zone on free schools, due to non-renewal of the fishing agreements in 2006, and the appearance of a fishing area under FADs in 2012 North of 15ºN latitude.



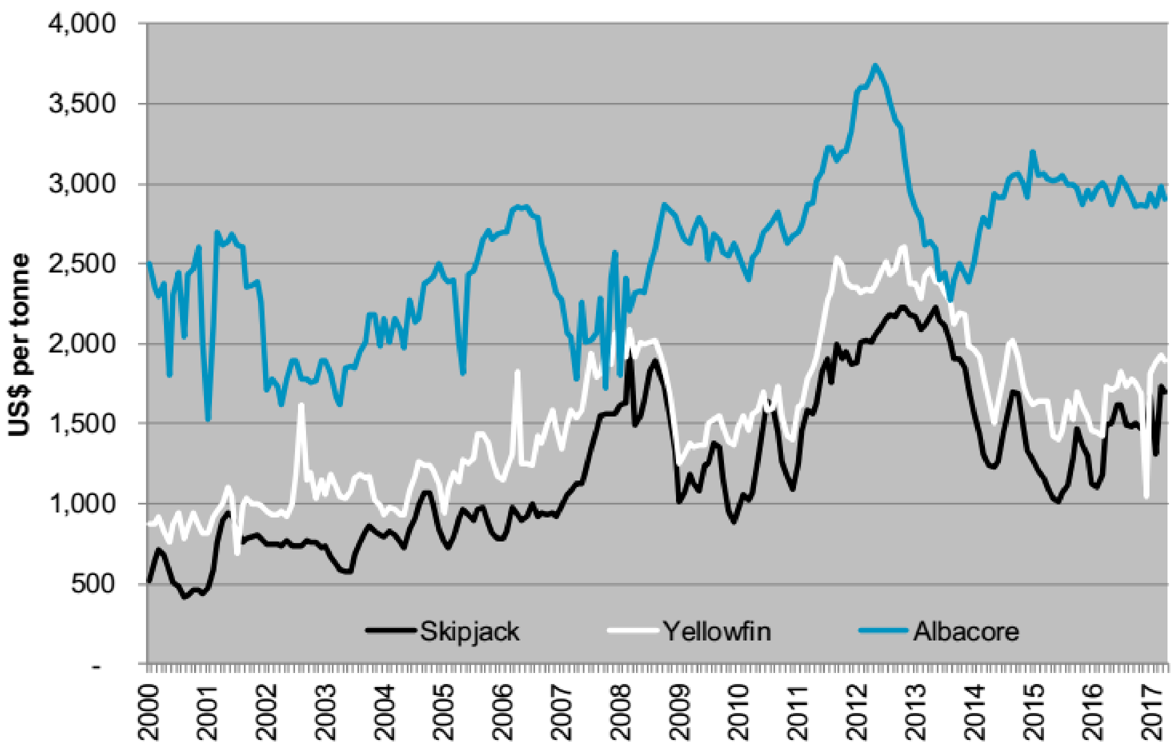
SKJ-Figure 2. Estimates of natural mortality by size of Atlantic skipjack calculated by empirical relationships between mortality and some biological parameters (which show different values from those traditionally used in the East.



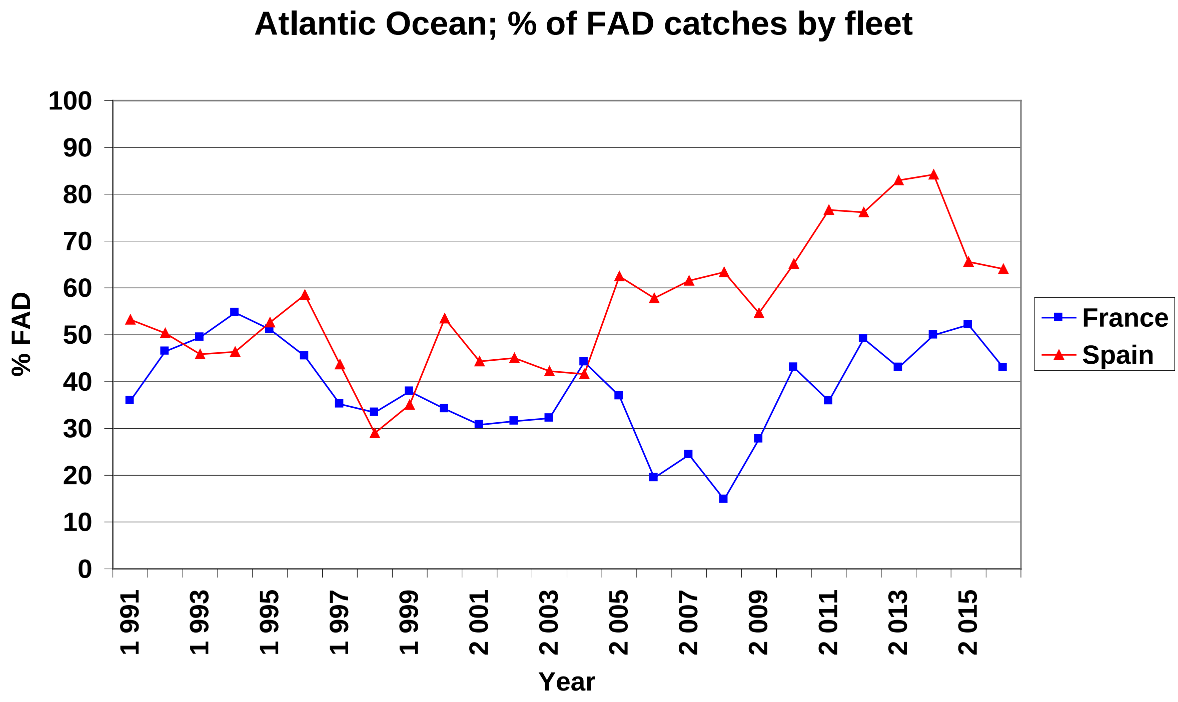
SKJ-Figure 3. Total skipjack catches (t) in the Atlantic and by stock (East and West) between 1950 and 2016. Skipjack estimates in the *faux poissons* landed in Côte d'Ivoire were included in the skipjack trade catches in the eastern Atlantic except for 2016. It is possible that skipjack catches taken 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 2016 figure is still preliminary, in particular for the East Atlantic.



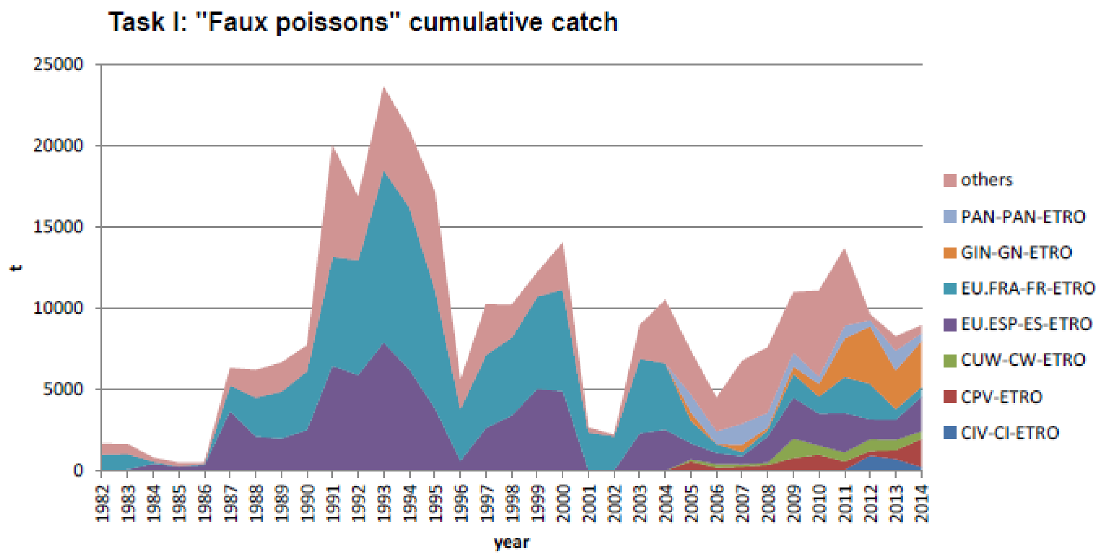
SKJ-Figure 4. Skipjack catches in the eastern Atlantic, by gear (1950-2016), after correction of Ghana's data by species (1996-2014).



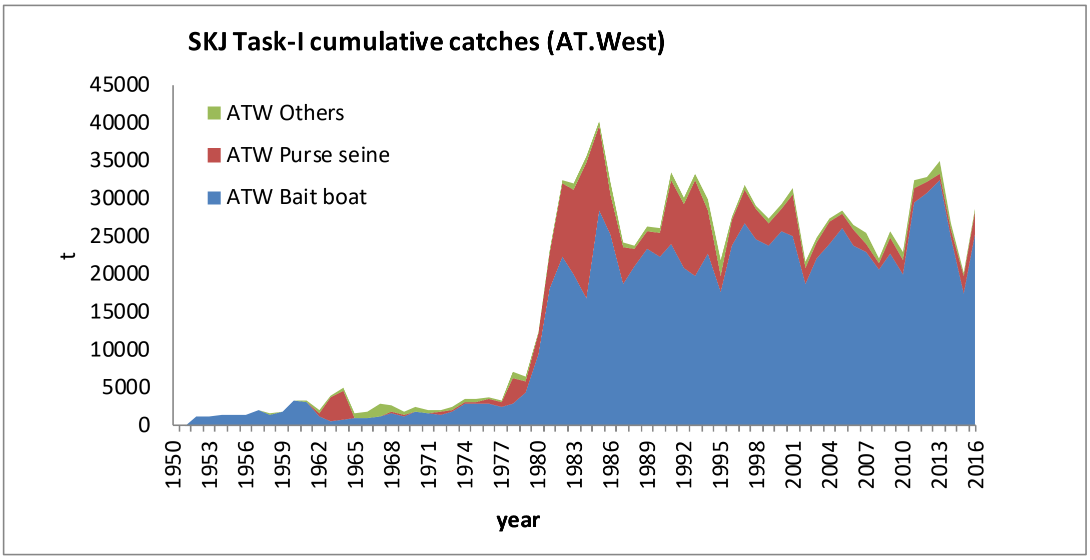
SKJ-Figure 5. Average prices of skipjack and yellowfin in U.S. dollars (adjusted for inflation and converted into the value of the 2015$US) in the Bangkok market.
(Source at 2017-09-14: https://www.ffa.int/system/files/FFA%20Trade%20and%20Industry%20News_May-Jun_2017_0.pdf)



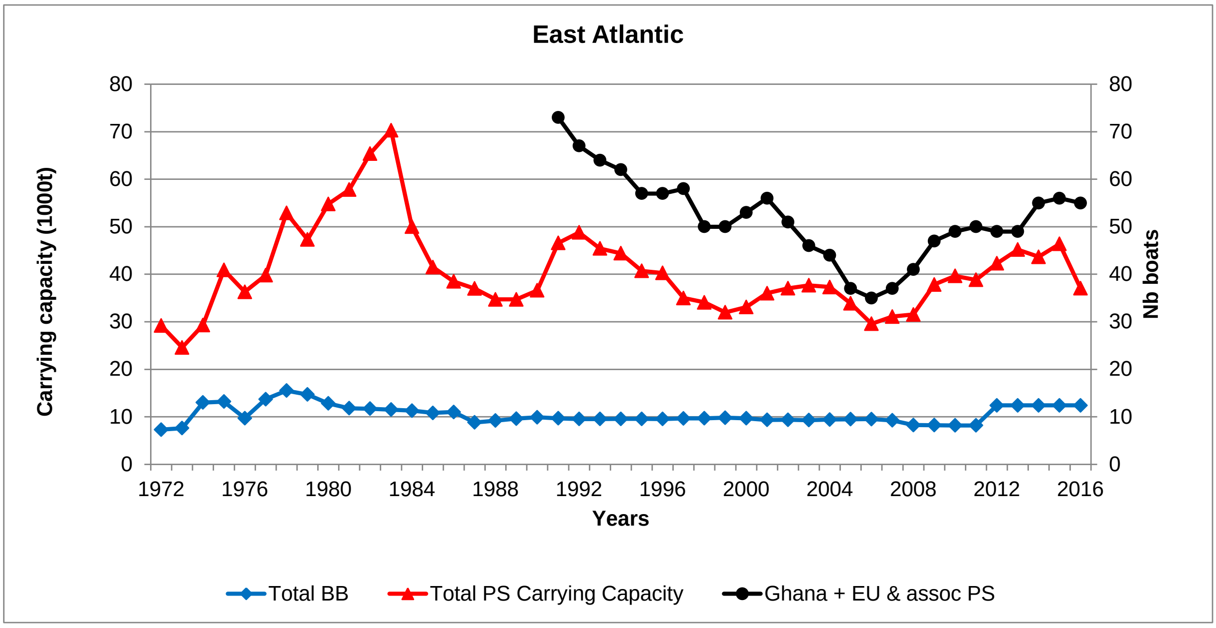
SKJ-Figure 6. Changes in the proportion of total catches under FADs made by French and Spanish purse seiners (1991-2016). The increase in the percentage of catches under FADs coincides with the shift from the Senegal area, known for its seasonal fishing on free schools (see **Figure 1**), and with the increase of skipjack prices.



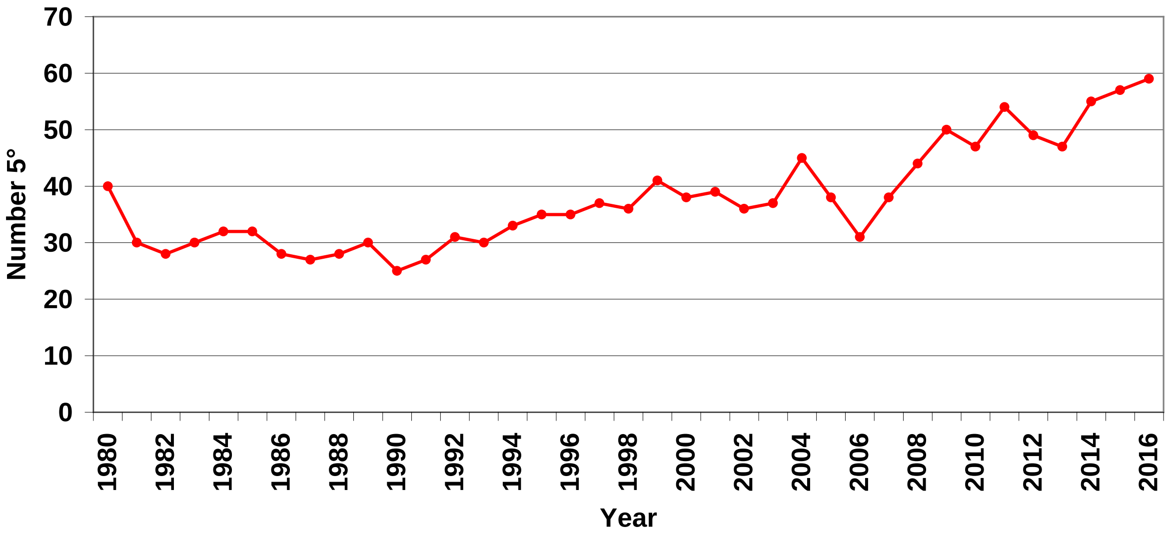
SKJ-Figure 7. Cumulative estimated landings of *faux poissons* (1981-2014) by purse seiners operating in the Eastern Atlantic for the three major species of tropical tunas in the local market of Abidjan (Côte d'Ivoire).



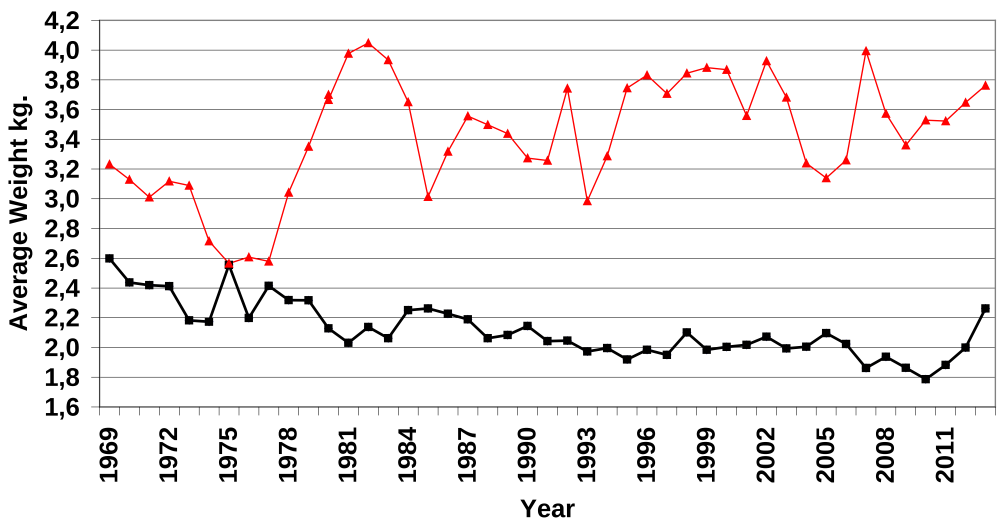
SKJ-Figure 8. Cumulative skipjack catches in the western Atlantic, by gear (1950-2016). The values for 2016 are preliminary.



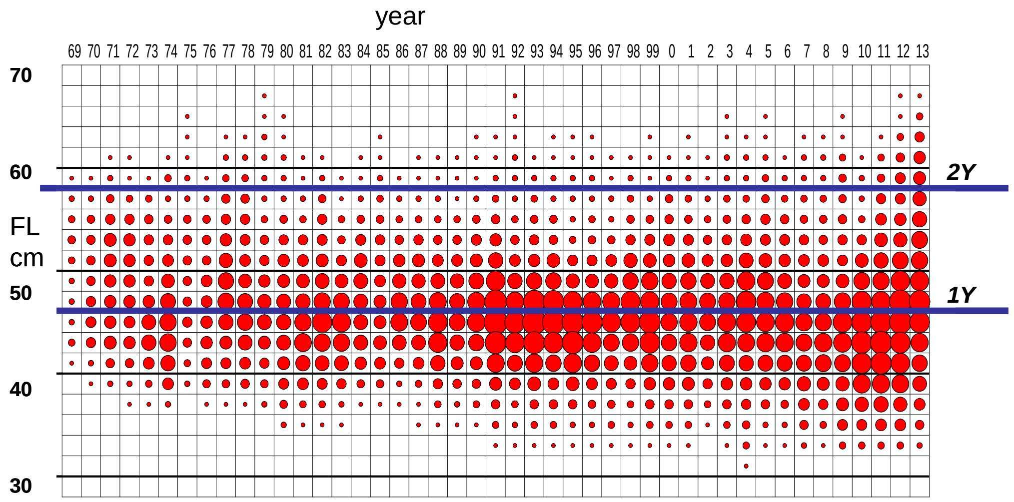
SKJ-Figure 9. Changes over time in the carrying capacity, corrected by the annual percentage of time at sea, (left axis) for the overall purse seiners (1971-2016) and baitboats (1971-2016) operating in the eastern Atlantic and in number of boats for the European purse seiners, associated and Ghanaian fleets (right axis). It is possible that the carrying capacity for some segments of the purse seine fleet was underestimated during recent years.



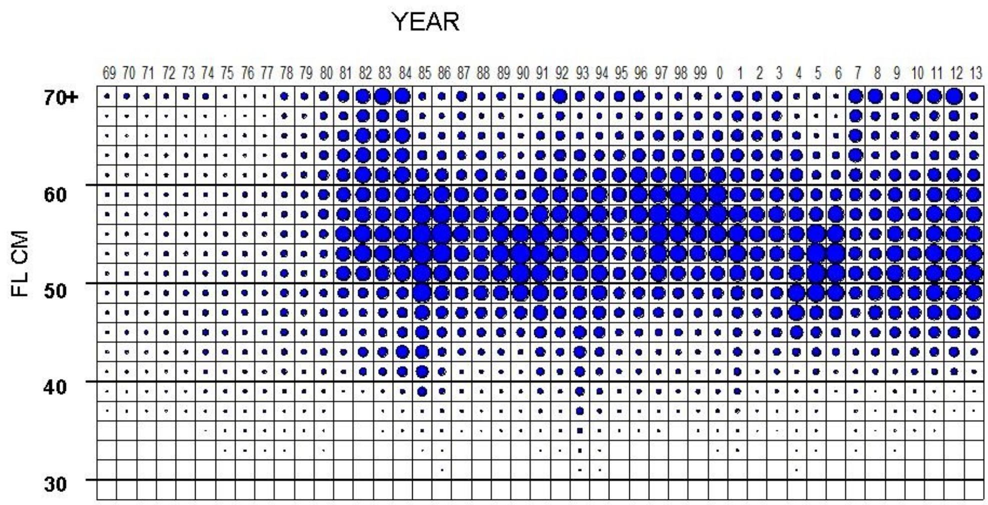
SKJ-Figure 10. Number of 5°x5° squares with annual skipjack catches above 10 t for the European and associated purse seiners operating in the eastern Atlantic (1980-2016). The increase observed in 1991 could be due to a modification of the species composition correction procedure for the catches implemented at that date (skipjack catches could have been attributed to squares that did not have any until then). On the other hand, the recent increase in the successfully exploited surface area is an extension of the fishery towards the western central Atlantic and off the coasts of Mauritania and Angola.



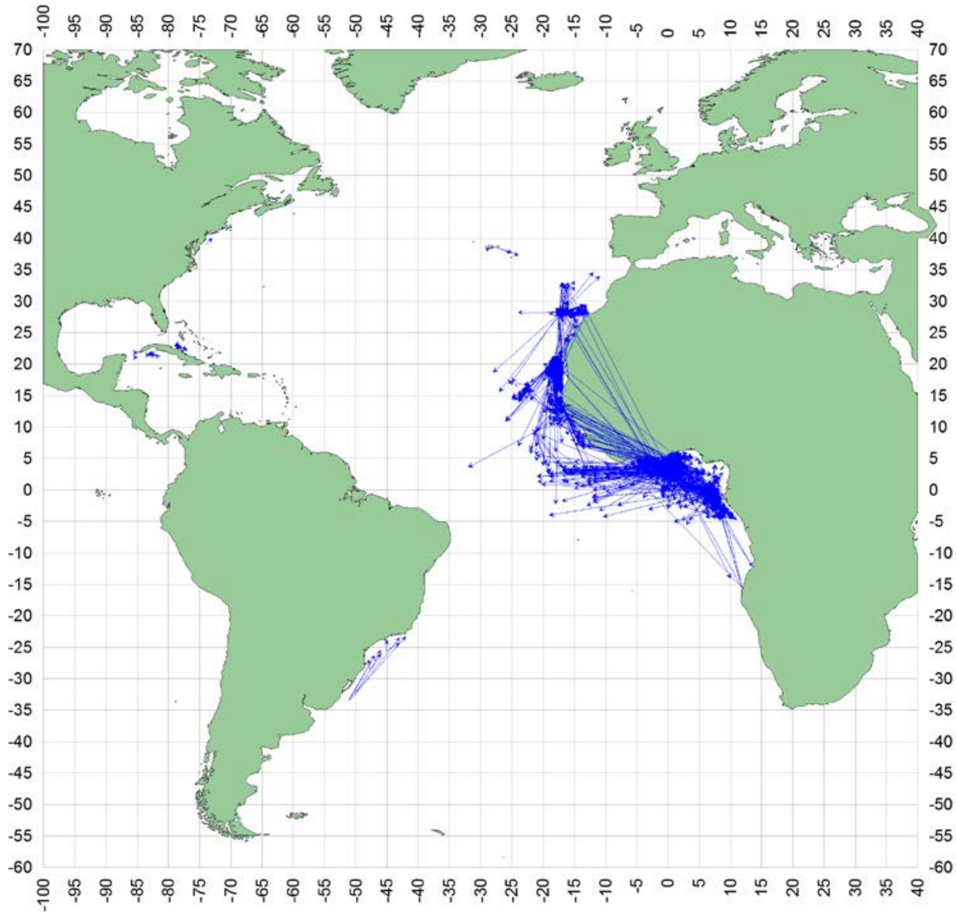
SKJ-Figure 11. Changes in the average weight of skipjack in the eastern (black) and western Atlantic (red).



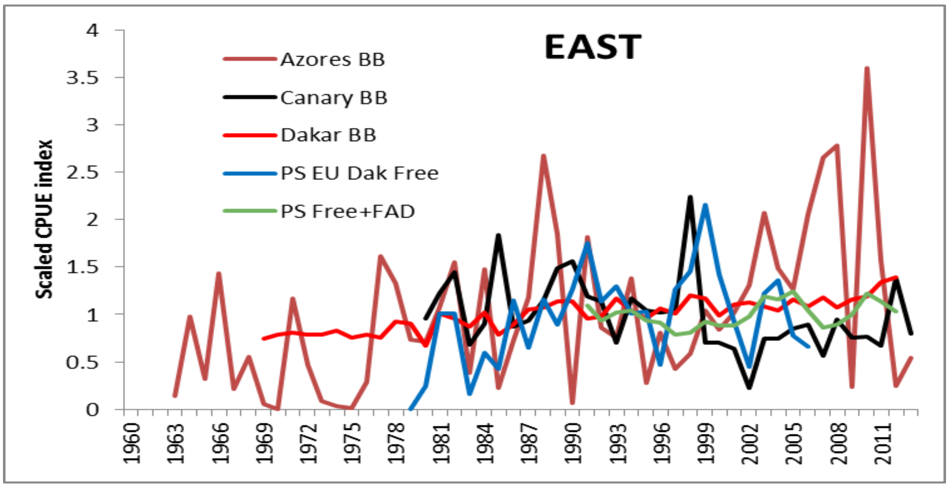
SKJ-Figure 12. Distribution of skipjack catch-at-size by size class (2 cm FL size bin) and year for the eastern Atlantic stock. Each bubble represents the proportion of catch weight stratified by size bin and year. The size limits of ages 1 and 2 are indicated by the horizontal lines (blue).



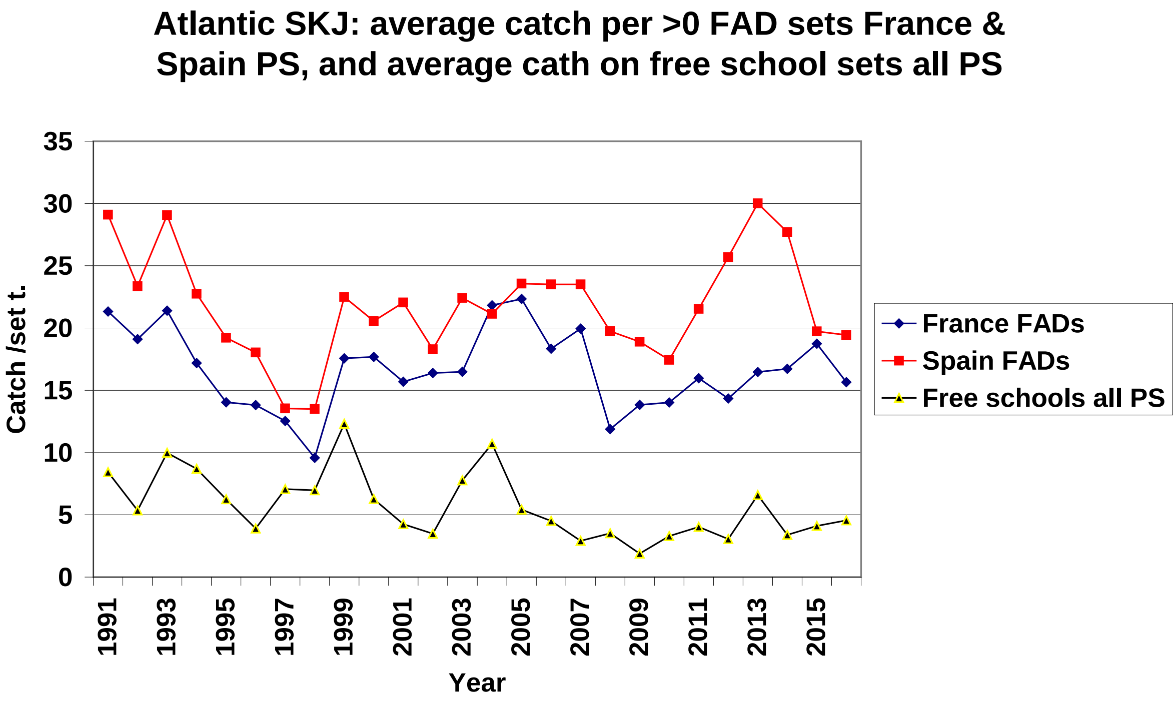
SKJ-Figure 13. Distribution of skipjack catch-at-size by size class (2 cm FL size bin) and year for the western Atlantic stock. Each bubble represents the proportion of catch weight stratified by size bin and year.



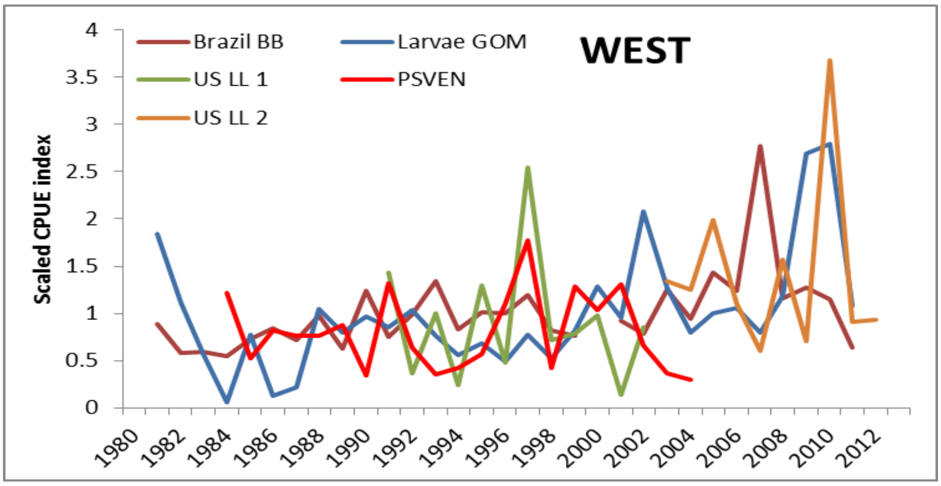
SKJ-Figure 14. Apparent movements (straight line distance between the tagging location and that of recovery) calculated from conventional tagging.



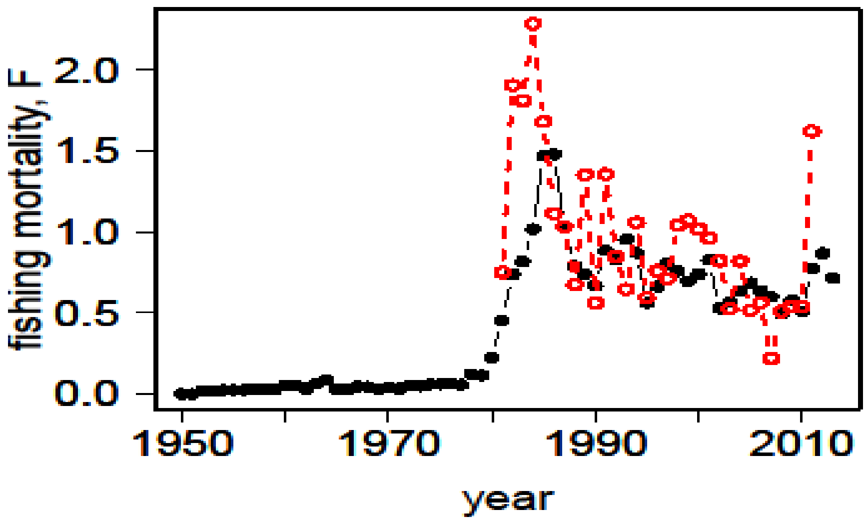
SKJ-Figure 15. Relative abundance indices for the eastern skipjack stock. Each index has been adjusted to its own average level given that to resolve problems regarding scaling, the indices for purse seine have been adjusted to the same level as the Azorean baitboat series.



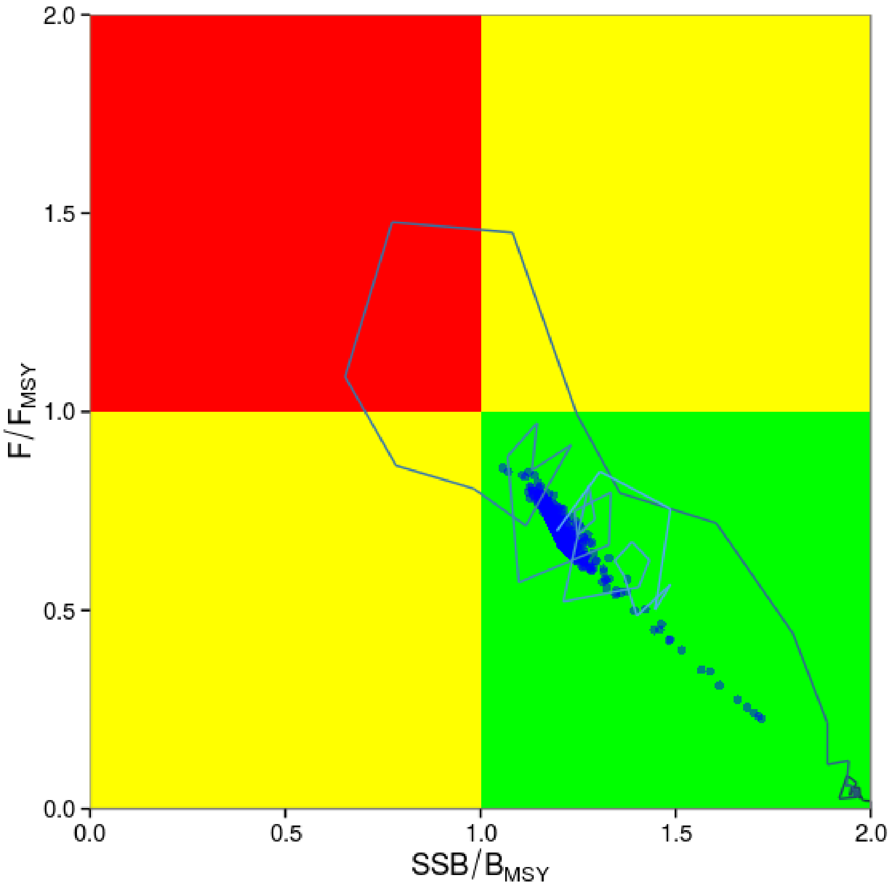
SKJ-Figure 16. Catches by set (t) of eastern Atlantic skipjack and on FADs (France and Spain + associated fleets) and on free schools (all purse seiners).



SKJ-Figure 17. Relative abundance indices for the western skipjack stock. Each index has been adjusted to its own average level given that to resolve problems regarding scaling, the indices for purse seiners and longliners have been adjusted to the level of the larvae index of the Gulf of Mexico.



SKJ-Figure 18. Comparison of coefficient mortality estimates of skipjack fishing in the western Atlantic obtained from a biomass surplus production model (ASPIC black line and solid circles) and by the model based on the average size of catches (so called *Then Hoenig-Gédamke* in red and empty circles).



SKJ-Figure 19. Western skipjack stock status: trajectories of B/B_{MSY} and F/F_{MSY} from the ASPIC surplus production model (Schaefer type).

8.4 ALB – ALBACORE

The status of the North and South Atlantic albacore stocks is based on the most recent analyses conducted in May 2016 by means of using the available data up to 2014. Complete information on the assessment can be found in the Report of the 2016 ICCAT North and South Atlantic albacore stock assessment meeting (Anon., 2017c).

The status of the Mediterranean albacore stock is based on the 2017 assessment using available data up to 2015. Complete information is found in the Report of the 2017 ICCAT albacore species group intersessional meeting (including assessment of Mediterranean albacore) (Anon., 2017d).

ALB-1. Biology

Albacore is a temperate tuna widely distributed throughout the Atlantic Ocean and Mediterranean Sea. On the basis of the biological information available for assessment purposes, the existence of three stocks is assumed: northern and southern Atlantic stocks (separated at 5ºN) and a Mediterranean stock (**ALB-Figure 1**). However, some studies support the hypothesis that various sub populations of albacore exist in the North Atlantic and Mediterranean. Likewise, there is likely intermingling of Indian Ocean and South Atlantic immature albacore which needs further research.

Scientific studies on albacore stocks, in the North Atlantic, North Pacific and the Mediterranean, suggest that environmental variability may have a serious potential impact on albacore stocks, affecting fisheries by changing the fishing grounds, as well as productivity levels and potential MSY of the stocks. Those yet sufficiently unexplored aspects might explain recently observed changes in fisheries, such as the lack of availability of the resource in the Bay of Biscay in some years, or the apparent decline in the estimated recruitment which are demanding focussed research.

The expected life-span for albacore is around 15 years. While albacore is a temperate species, spawning in the Atlantic occurs in tropical waters. Present available knowledge on habitat, distribution, spawning areas and maturity of Atlantic albacore is based on limited studies, mostly from past decades. In the Mediterranean, there is a need to integrate different available studies so as to better characterize growth of Mediterranean albacore. Besides some additional recent studies on maturity, in general, there is poor knowledge about Mediterranean albacore biology and ecology.

More information on albacore biology and ecology is published in the *ICCAT Manual*.

ALB-2. Description of fisheries or fishery indicators

North Atlantic

The northern stock is exploited by surface fisheries targeting mainly immature and sub-adult fish (50 cm to 90 cm FL) and longline fisheries targeting immature and adult albacore (60 cm to 130 cm FL). The main surface fisheries are carried out by EU fleets (Ireland, France, Portugal and Spain) in the Bay of Biscay, in the adjacent waters of the northeast Atlantic and in the vicinity of the Canary and Azores Islands in summer and autumn. The main longline fleet is the Chinese Taipei fleet which operates in the central and western North Atlantic year round. However, Chinese Taipei fishing effort decreased in the late 1980s due to a shift towards targeting on tropical tuna, and then continued at this lower level to the present. Over time, the relative contribution of different fleets to the total catch of North Atlantic albacore has changed, which resulted in differential effects on the age structure of the stock. Since the 1980s, a reduction of the area fished for albacore was observed for both longline and surface fisheries.

Total reported landings, steadily increased since 1930 to peak above 60,000 t in the early 1960s, declining afterwards, largely due to a reduction of fishing effort by the traditional surface (troll and baitboat) and longline fisheries (**ALB-Table 1**; **ALB-Figure 2a**). Some stabilization was observed in the 1990s, mainly due to increased effort and catch by new surface fisheries (driftnet and mid-water pair pelagic trawl), with a maximum catch in 2006 of 36,989 t and, since then, a generally decreasing trend of catch is observed in the North Atlantic.

The preliminary total reported catch in 2016 was 30,141 t (above the TAC of 28,000 t), and the catch in the last five years has remained about 26,000 t, above the historical minimum of around 15,000 t recorded in 2009. During the last years, the surface fisheries contributed to approximately 80% of the total catch (**ALB-Table 1**). The reported catch for 2016, when compared with the average of the last five years, was similar for EU-Ireland and EU-France, but increased significantly (around 46%) for EU-Spain.

Longline catch contributed to approximately 37% of the total catch during the last five years. During the last decades, both Chinese Taipei and Japan have reduced their fishing effort directed to albacore. In the case of Japan, albacore was taken mainly as by-catch. The catch reported in 2016 for Japan was below the last 5 year average, while for Chinese Taipei it was significantly above.

The trend in mean weight for northern albacore remained stable between 1975 and 2014, ranging between 7 and 11 kg. The mean weight for surface fleets (baitboat and troll) showed a stable trend with an average of 7 kg (range of 4 to 10 kg), and for longline fleets it showed no clear trend with an average of 19 kg, but some important fluctuations between 15 and 26 kg since the 1990 (**ALB-Figure 3a**).

South Atlantic

The recent total annual South Atlantic albacore landings were largely attributed to four fisheries, namely the surface baitboat fleets of South Africa and Namibia, and the longline fleets of Brazil and Chinese Taipei (**ALB-Table 1**; **ALB-Figure 2b**). The surface fleets are entirely albacore directed and mainly catch sub-adult fish (70 cm to 90 cm FL). These surface fisheries operate seasonally, from October to May, when albacore are available in coastal waters. Brazilian longliners target albacore during the first and fourth quarters of the year, when an important concentration of adult fish (>90 cm) is observed off the northeast coast of Brazil, between 5ºS and 20ºS, being likely related to favorable environmental conditions for spawning, particularly of sea surface temperature. The longline Chinese Taipei fleet operates over a larger area and throughout the year, and consists of vessels that target albacore and vessels that take albacore as by-catch, in bigeye directed fishing operations. On average, the longline vessels catch larger albacore (60 cm to 120 cm FL) than the surface fleets.

Albacore landings increased sharply since the mid-1950s to reach values oscillating around 25,000 t between the mid-1960s and the 1980s, 35,000 t until the last decade when they oscillated around 20,000 t. However, total reported albacore landings for 2016 decreased to 13,679 t, which is among the lowest values in the time series. The Chinese Taipei catch in the last years has decreased compared to historical catches, mainly due to a decrease in fishing effort targeting albacore. Chinese Taipei longliners (including boats flagged in Belize and St. Vincent and the Grenadines) stopped fishing for Brazil in 2003, which resulted in albacore only being caught as by-catch in tropical tuna-directed longline fisheries. Albacore is only caught as by-catch in Brazilian tropical tuna-directed longline and baitboat fisheries. The significantly higher average catch of about 4,287 t during the period 2000-2003 was obtained by the Brazilian longline fleet when albacore was a target species.

In 2016, the estimated South African and Namibian catch (mainly baitboat), below the average of the last five years. During the last decades, Japan took albacore as by-catch using longline gear, but recently Japan is again targeting albacore and increased the fishing effort in waters off South Africa and Namibia (20-40˚S). Thus, catches during the last five years double those in the last few decades.

The trend in mean weight from 1975 to 2014 is shown in **ALB-Figure 3b**. Surface fleets showed a stable trend from 1981 onwards with an average of 13 kg and a maximum and minimum average weight of 17 kg and 10 kg, respectively. Longline fleets showed a relatively stable trend for the mean weight around 17 kg until 1996 where the average weight increased to about 20 kg, oscillating between 16 and 26 kg.

Mediterranean

During the last assessment, the catch series was revisited and, after revision, some series were included in the ICCAT database. In 2016, the reported landings were 3,519 t, similar to those in the last decade (**ALB-Table 1** and **ALB-Figure 2c**). The majority of the catch came from longline fisheries. EU-Italy is the main producer of Mediterranean albacore, with around 57% of the catch during the last 10 years. In 2016 the Italian catch remained similar to the last five year average. 2015 was an unusual year in that the fishing pattern was very different as compared to previous years, possibly related to the anticipation of management measures directed to Mediterranean swordfish that modified the fishing strategy in 2015. Therefore, the relative abundance estimates for 2015 CPUE indices were not used in the assessment.

ALB-3. State of stocks

North Atlantic

In the 2013 stock assessment, several model formulations (Multifan-CL, Stock Synthesis, VPA and ASPIC) with varying degrees of complexity were used. This allowed the modeling of different scenarios that represented different hypotheses, and the characterization of the uncertainty around the stock status. The results showed that although the range of estimated management benchmarks was relatively wide, most models were in agreement that the stock was overfished, and no model indicated that the stock was undergoing overfishing. These models from all the various platforms showed a general drop in stock biomass from 1930 to about 1990 and an increasing trend in biomass starting in around 2000. Likewise, most models within all configurations showed a peak in fishing mortality in around 1990 with a decreasing trend thereafter. The analyses conducted in 2013 involved a large amount of data preparation and scrutiny, and the Committee suggested that future assessment updates could be conducted using simpler models (e.g. production models).

Thus, in 2016 a production model was used to assess the stock status. A thorough revision of North Atlantic Task I data was conducted and catch rate analyses were improved and updated with new information for the northern albacore fisheries. Decisions on the final specifications of the base case model were guided by first principles (e.g. knowledge of the fisheries) and data exploration (e.g. correlation between indices). The results of these efforts are reflected in the following summaries of stock status that analyzed data through 2014.

Four longline and one baitboat CPUE indices were selected to be used in a production model framework. The Committee lacked a basis to decide which CPUE series could best represent abundance. In fact, it was assumed that different CPUE series reflected local abundance available to different fleets operating in different areas, and that overall they represented the global population trend. On this basis, the Committee agreed to use all the 5 CPUEs jointly in the base case scenario, and to weight them equally. Despite their variable pattern, these indices showed an overall increasing trend towards the end of the time series (**ALB-Figure 4**), which could be reflecting the increasing trend of the stock during this period of relatively low catch. The Chinese Taipei longline index showed the steepest increase during the last years of the series.

The biomass dynamic model results for the base case suggest a biomass drop between 1930 and the 1990s and a recovery since then, while fishing mortality decreases. Relative to MSY benchmarks, the base case scenario estimates that the stock remained slightly overfished with B below B_{MSY} during the 1980s and 1990s, but now has recovered to levels well above B_{MSY} (**ALB-Figure 5**). Peak relative fishing mortality levels in the order of 1.4 were observed in the early 1980s but overfishing stopped in the 1990s, current F_{2014}/F_{MSY} ratio being 0.54. The uncertainty around the current stock status has a clear shape determined by the strong correlation between parameters estimated by the production model. The probability of the stock currently being in the green area of the Kobe plot (not overfished and not undergoing overfishing, $F<F_{MSY}$ and $B>B_{MSY}$) is 96.8% while the probability of being in the yellow area (overfished, $B<B_{MSY}$) is 3.2%. The probability of being in the red area (overfished and undergoing overfishing, $F>F_{MSY}$ and $B<B_{MSY}$) is 0% (**ALB-Figure 6**).

Sensitivity analyses revealed that recent stock status indicators are sensitive to different modelling assumptions as well as the choice of the CPUE series. When a logistic function was assumed in the biomass dynamic model lower values of B/B_{MSY} were predicted over the whole time series, while excluding the Chinese-Taipei longline CPUE resulted in much larger values of B/B_{MSY} in the recent period. Other sensitivity analyses did not show strong deviations from the base case. However, although the recent status varied across scenarios, all predicted the stock to be in the green quadrant. Finally, the Committee noted that the B/B_{MSY} trajectory showed a strong retrospective pattern that might imply that the current stock status is overestimated, although all the retrospective trajectories showed an improvement in stock status in the most recent period.

In summary, the available information indicates that the stock has improved and is most likely in the green area of the Kobe plot, although the exact condition of the stock is not well determined.

South Atlantic

In 2016, a stock assessment of South Atlantic albacore was conducted including catch, effort and size data up until 2014, and considering similar methods as in the previous assessment.

The southern standardized CPUE trends are mainly for longline fisheries, which harvest mostly adult albacore. The longest time series of Chinese Taipei, showed a strong declining trend in the early part of the time series, and less steep decline over the last three decades, similar to the Japanese longline index. However, the Uruguayan longline CPUE series showed significant decreases since the 1980s (**ALB-Figure 7**).

In the 2016 assessment, the same eight scenarios as in 2013 were considered, but after screening during the assessment meeting, the early Japanese CPUE series was not used to fit the models. Stock status results varied significantly among scenarios (**ALB-Figure 8a**). Two different production model forms were considered, each with four scenarios. One showed more optimistic results than the other. However, the Committee lacked enough objective information to identify the most plausible scenarios and considered them equally likely. Six of eight scenarios indicated that the stock is not overfished and not undergoing overfishing, and two other scenarios indicated that the stock is overfished but not undergoing overfishing. Six scenarios estimated a higher B/B_{MSY} than in the last stock assessment, and seven scenarios estimated a lower F/F_{MSY} than in the previous assessment. This indicated that current stock status has improved since the last assessment. Considering the whole range of scenarios, the median MSY value was 25,901 t (ranging between 15,270 t and 31,768 t), the median estimate of current B/B_{MSY} was 1.10 (ranging between 0.51 and 1.80 t) and the median estimate of current F/F_{MSY} was 0.54 (ranging between 0.31 and 0.87). The wide confidence intervals reflect the large uncertainty around the estimates of stock status. Considering all scenarios, there is 3% probability for the stock to be both overfished and experiencing overfishing, 31% probability for the stock to be either overfished or experiencing overfishing but not both, and 66% probability that biomass is above and fishing mortality is below the Convention objectives (**ALB-Figure 8b**).

Mediterranean

In 2017, the stock assessment for Mediterranean albacore was conducted using catch data up until 2015 and CPUE data up until 2014. The methods used were coherent with "limited data" category of this stock. The methods applied included a length-based catch curve analysis and a bayesian state space surplus production model (JABBA).

Two standardized CPUE series for EU-Spain and EU-Italy longline fisheries were used during this last assessment (**ALB-Figure 9**). In addition, a larval index independent of the fishery, providing information on the trends of the spawning biomass, was used. The three indices showed a decreasing trend for the period 2013-2014.

The results of the 2017 assessment, based on the limited information available, show that the status of the stock is highly uncertain with respect to both fishing mortality and biomass. Despite the high uncertainty, the results would seem to indicate that recent albacore median biomass levels are at about B_{MSY}, and median fishing mortality levels are below F_{MSY} (**ALB-Figure 10a**). The probability to be in the red, yellow and green parts of the Kobe plot is 35.7%, 15.8% and 48,5%, respectively (**ALB-Figure 10b**).

However, the Group noted the lack of CPUE estimates in 2015. Given the recent downward trends of the available series, it is very important to corroborate, in the coming years, whether this trend continues or not. However, the Committee reiterates that the ability to monitor stock trends is limited, and that the currently used fishery dependent indices might be affected by the ban imposed as part of the swordfish recovery plan.

ALB-4. Outlook

North Atlantic

In 2016, the estimated population was projected under both alternative TACs and HCRs, as combinations of target fishing mortality (F_{TAR}), threshold biomass (B_{THRESH}) and an interim biomass limit reference point

(B_{LIM}) of 0.4 B_{MSY} (**ALB-Figure 11**). The projections assuming catch levels similar to those observed during the last five years (between 25,000 t and 30,000 t) or the current TAC (28,000 t) suggest that biomass would continue to increase and are likely sustainable. The Committee noted that the new projections suggested higher sustainable catch levels compared to most of the previous assessments. However, the Committee had little trust in the absolute biomass estimate and the projections did not fully account for many other sources of uncertainty (i.e. model structure and assumptions) that need further evaluation. Thus, the Committee did not have confidence in the projections and the Kobe 2 Strategy Matrix and decided not to provide or use these analyses for advice.

During 2017, considering that Rec. 16-06 requested the SCRS to "refine the testing of candidate reference points (e.g., $SSB_{THRESHOLD}$, SSB_{LIM} and F_{TARGET}) and associated harvest control rules (HCRs) that would support the management objective", a set of alternative HCRs were tested by projecting a wide range of simulated albacore populations in a management strategy evaluation (MSE) framework. The MSE used was tailored specifically to support the process to discuss and eventually adopt an HCR for North Atlantic albacore in 2017 but not to provide TAC recommendation. As such, the simulated management procedure was consistent with the 2016 assessment approach, and thus, if the Commission selects a HCR, it would be appropriate to apply it to the outcome of the 2016 stock assessment to set the TAC for the next three years. However, as every MSE process, this framework can be further improved and expanded in the future (e.g. by exploring alternative management procedures).

Although a larger set of HCRs have been tested, following the advice of the Standing Working Group to Enhance Dialogue between Fisheries Scientists and Managers (SWGSM), a reduced number of eight HCRs is finally considered. Eight HCRs are all the combinations of the following elements: two alternative target fishing mortalities (0.8 and 1 x F_{MSY}); two threshold biomasses (0.8 and 1 x B_{MSY}); and 2 stability clauses. The 2 stability clauses were: (SC1) maximum change in TAC of 20% always applied from one 3-year management period to the next while also always imposing a 15,000-50,000 t min-max TAC; and (SC2) same as (SC1) but not restricting TAC reductions and not imposing a minimum TAC when $B<B_{THR}$.

All HCRs tested met the objective to be in the green quadrant of the Kobe plot with a probability higher than 60% (**ALB-Table 2**). 96% of the OMs showed biomass above B_{MSY} with 60% probability between 2020-2045. HCRs with higher target fishing mortalities (F_{MSY}) were associated with lower probabilities of being in the Kobe green quadrant, higher probabilities of the stock being between B_{LIM} and $B_{THRESHOLD}$, and slightly higher long term yields. The different stability clauses had important effects on long term yield and stability. In SC1 (maximum change in TAC of 20% always allowed), higher stability and higher long term yields were achieved, compared to SC2 (**ALB-Figure 12**, **ALB-Table 2**). Note that **Table 2** was prepared for the comparison of the performance of alternative HCRs, but not for actual TAC calculation. For more detail on the MSE, please refer to Responses to the Commission 20.16 and 17 as well as the Report of the 2017 ICCAT albacore species group intersessional meeting (including assessment of Mediterranean albacore) (Anon., 2017d).

Whichever HCR is selected, its application will result in a short-term TAC of 33,600 t which results from the maximum 20% increase from the current level; this conforms to the positive stock status estimated in the 2016 assessment.

South Atlantic

The projection results differ between the base case scenarios. Since there is not objective information with which to select which scenario is most plausible, the Committee considered the entire range of scenarios, thus characterizing the range of possible responses to the distinct catch levels projected, as done in 2013. The Kobe matrix indicates that, depending on the scenario, catches which enable the stock to be in the Kobe green zone in 2020 with at least a 60% probability ranged from 18,000 to 34,000 t, with an average of 25,750 t and a median of 26,000 t (**ALB-Table 3**). Averaging all scenarios, projections at a level consistent with the 2016 TAC (24,000 t) showed that probabilities of being in the green area of the Kobe plot would be higher than 60% in 2020 (**ALB-Table 3**).

Projections at F_{MSY}, without considering implementation errors, suggested that the probability of the stock to be in the green quadrant of the Kobe plot would not consistently increase over time, while it would when projected at $0.95*F_{MSY}$ or any lower fishing mortality rate.

Mediterranean

Due to the limited quantitative information available to the SCRS, the sensitivity of the stock assessment to different sources of information, and the limited prediction skill of the assessment model, the projections for this stock were not conducted. As a result, future stock status in response to constant catch levels could not be quantified.

ALB-5. Effect of current regulations

North Atlantic

In 2016, the Commission established a TAC for 2017-2018 of 28,000 t (Rec. 16-06), but included several provisions that allow the catch to exceed this level. The Committee noted that, since the establishment of the TAC in the year 2001, catch remained substantially below the TAC in all but three years, including 2016 (**ALB-Figure 2**). This might have accelerated rebuilding over the last decade, but the Committee did not test the effect of perfect implementation of the TAC.

Furthermore, [Rec. 98-08] that limits fishing capacity to the average of 1993-1995, remains in force. The effect of this recommendation has not been evaluated but a general decrease of fishing mortality is observed since its implementation.

South Atlantic

In 2016 the Commission established a new TAC of 24,000 t for 2017-2020 (Rec. 16-07). The Committee noted that, since 2004, reported catches remained below 24,000 t, except in 2006, 2011 and 2012, where reported catches were slightly above this value (**ALB-Table 1**). As in the case of the North Atlantic, the Committee did not test the effect of perfect implementation of the TAC.

Mediterranean

Although there are no ICCAT regulations directly aimed at managing the Mediterranean albacore stock, as a result of the Mediterranean swordfish rebuilding plan (Rec. 16-05), a time closure of two months (1 October - 30 November), originally aimed at protecting the Mediterranean swordfish juveniles, applies to the longline fleet targeting albacore in the Mediterranean from 2017 onwards. Furthermore, a list of vessels authorized to target Mediterranean albacore was implemented in 2017.

ALB-6. Management recommendations

North Atlantic

Recommendation 16-06 sets the objective of maintaining the stock in the green area of the Kobe plot with a 60% probability while maximizing long-term yield, and, if $B<B_{MSY}$, to recover it as soon as possible, while maximizing average catch and minimizing inter-annual fluctuations in TAC levels.

In 2016, the Committee noted that the relative abundance of north Atlantic albacore had continued to increase over the last decades and was likely somewhere in the green area of the Kobe plot. However, without additional information, the magnitude of the recovery was not well determined and remains sensitive to many different assumptions. This undermined the ability of the Committee to reliably quantify the effects of future TAC or HCR scenarios on the status of the stock, until more sources of uncertainty and the robustness of the advice were evaluated in the future through MSE and/or benchmark stock assessment after accumulating sufficient new information. The projections assuming catch levels similar to those observed during the last five years (between 25,000 t and 30,000 t) or the current TAC (28,000 t) suggested that biomass would continue to increase and are likely sustainable. Based on the analyses conducted in 2016 as well as in 2013, the Committee believed that the current TAC would maintain the long-term objectives of the Commission as specified in Rec. 16-06. Given the uncertainty around the current stock status and the projections, the Committee was unable to provide advice on risks associated with an increase in the TAC. Therefore, the Committee did not recommend an increase of the TAC based on the 2016 assessment. Further, the Committee reminded the Commission that our ability to monitor changes in stock abundance is currently limited due to incomplete fishery dependent information. Thus, it is desirable to pursue alternative fishery independent tools to provide improved bases for monitoring stock condition.

Although the SCRS will continue working in reviewing and improving the MSE for northern albacore, the MSE simulations conducted in 2017 allow the Committee to provide advice that is robust to a wide range of uncertainties, including those affecting the 2016 assessment. The performance of the HCRs is measured according to the indicators adopted by Panel 2 (Rec. 16-06, Annex 2). However, it should be noted that the Committee has identified several concerns in the evaluation of HCR performances, but has not yet been able to fully characterize the implications for the implementation of the selected HCR. As there is currently no clear indication that any of these concerns is sufficient to preclude the HCR implementation, the Committee agrees that the Commission could select a HCR based on the current results presented here and, according to Rec. 16-06, set an annual constant TAC for the following 3 years. However, the Committee cautions that any such adoption of an HCR should be done on an interim basis, contingent on future advice of the SCRS based on its ongoing review of these HCRs.

Based on the current MSE results, the implementation of any of the tested HCRs will meet the objective to be in the green quadrant of the Kobe plot (with a probability higher than 60%) (**ALB-Table 2**). In HCRs where maximum change in TAC of 20% is always applied (SC1), higher stability and higher long term yields are achieved, compared to HCRs where the 20% restriction for decrease is not used when $B<B_{THRESHOLD}$ (SC2). Not restricting TAC reductions improves safety and might allow quicker recoveries if the stock is really overexploited, but can also cause large unnecessary TAC reductions, or even fishery closures, when the stock is healthy but it is wrongly perceived to be overexploited.

Whichever HCR is selected, its application will result in a short-term 3 years TAC of 33,600 t which results from the maximum 20% increase from the current level; this conforms to the positive stock status estimated in the 2016 assessment. It should be noted that, as any interim HCR would directly apply to the result of future stock assessments, future TAC can change widely if the assessment results change with the incorporation of the most recent information. It should also be noted that there is an extensive workplan to validate and improve the MSE framework used in the evaluation of HCRs. In that case, the realized yield could also change in the short term if an updated HCR is adopted in the future based on such improvements.

South Atlantic

Results indicate that, most probably, the South Atlantic albacore stock is not overfished and that overfishing is not occurring. However, there is considerable uncertainty about the current stock status, and the effect of alternative catch limits on the rebuilding probabilities of the southern stock. The different model scenarios considered in the south Atlantic albacore stock assessment provide different views on the future effects of alternative management actions. Projections at a level consistent with the 2016 TAC (24,000 t) showed that probabilities of being in the green quadrant of the Kobe plot across all scenarios would increase to 63% by 2020. Further reductions in TAC would increase the probability of being in the green zone in those timeframes. On the other hand, catches above 26,000 t will not permit maintaining the stock in the green area with at least 60% probability by 2020 (**ALB-Table 3 and 4**).

Mediterranean

Unfortunately, limited quantitative information is available to the SCRS for use in conducting a robust quantitative characterization on biomass status relative to Convention objectives. Recent fishing mortality levels appear to be below F_{MSY}, and current biomass is approximately at B_{MSY} level. However, there is considerable uncertainty about current stock status. For this reason, the Commission should institute management measures designed to avoid increases in catch and effort directed at Mediterranean albacore. The analyses suggest that catch levels as high as those in the years 2006-2007 (beyond 5,900 t) proved to be clearly unsustainable. Moreover, recent catches for this stock are close to the estimated MSY. Considering the high uncertainty regarding the most recent abundance trends, the Committee recommends to maintain catches below MSY at least until these abundance trends are updated. The precise level of catch would depend on the level of risk the Commission is willing to take.

ATLANTIC AND MEDITERRANEAN ALBACORE SUMMARY			
	North Atlantic	**South Atlantic**	**Mediterranean**
Maximum Sustainable Yield	37,082 t (35,396-42,364)[1]	25,901 t (15,270-31,768)[2]	3,419 t (2,187-7,842)[4]
Current (2017) TAC	28,000 t	24,000 t	Not established
Current (2016) Yield	30,141 t	13,679 t	3,519 t
Yield in last year of assessment (2014)	26,651 t	13,677 t	
Yield in last year of assessment (2015)			2,774 t
B_{MSY}	407,567 t (366,309-463,685) [1]	120,465 t (71,312-208,438) [2]	29,168 t (17,939-65,861)[4]
F_{MSY}	0.097 (0.079-0.109) [1]	0.202 (0.119-0.373) [2]	0.119 (0.072-0.192)[4]
B_{2015}/B_{MSY}	1.36 (1.05-1.78)[1]	1.10 (0.51-1.80) [2]	1.002 (0.456-1.760)[4]
B_{2015}/B_{LIM}[3]	3.4		
F_{2014}/F_{MSY}	0.54 (0.35-0.72) [1]	0.54 (0.31-0.87) [2]	
F_{2015}/F_{MSY}			0.830 (0.223-2.194)
Stock Status	Overfished: NO	Overfished: NO	Overfished: NOT LIKELY
	Overfishing: NO	Overfishing: NO	Overfishing: NOT LIKELY
Management measures in effect:	[Rec. 98-08]: Limit number of vessels to 1993-1995 average. [Rec. 16-06]: TAC of 28,000 t for 2017-2018 and 30,000 t for 2019-2020 subject to SCRS advice. If the Commission adopts a harvest control rule during this period, the TAC shall be re-established according to those rules. Management objective is to keep the stock in (or rebuild it to) the green area of the Kobe plot with 60% probability, while maximizing catch and reducing variability of TAC.	[Rec. 16-07]: TAC of 24,000 t for 2017-2020	[Rec. 16-05]: Time closure of two months (1 October-30 November) for longlines, aimed at protecting the Mediterranean swordfish juveniles. A list of vessels authorized to target Mediterranean albacore implemented in 2017.

[1] Median and 80% CI for the base case.
[2] Median and 80% CI for the range of the 8 base cases.
[3] The proposed interim B_{LIM} is $0.4*B_{MSY}$.
[4] Median and 95% CI for the base case.

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
TOTAL				69615	73086	71812	67517	60379	59585	59039	67063	70088	69919	60095	61467	53378	57728	67407	48794	42320	41663	40857	48796	52788	45399	42728	43378	47339
	ATN			30851	38135	35163	38377	28803	29023	25746	34551	33124	26253	22741	25567	25960	35318	36989	21991	20483	15375	19509	20039	25680	24633	26651	25442	30141
	ATS			36562	32813	35300	27552	28426	28022	30595	27656	31387	38796	31746	28002	22543	18882	24453	20283	18867	22265	19225	24129	25061	19262	13677	15132	13679
	MED			2202	2138	1349	1587	3150	2541	2698	4856	5577	4870	5608	7898	4874	3529	5965	6520	2970	4024	2124	4628	2047	1503	2400	2804	3519
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
			Longline	3152	7093	7309	4859	4641	4051	4035	6710	7321	7372	6180	7699	6917	6911	5223	3237	2647	2619	3913	3666	3759	6514	3091	4457	5196
			Other surf.	5173	7279	7506	3555	3337	4378	6846	6817	5971	2828	420	551	697	624	625	525	274	427	324	412	352	596	162	28	95
			Purse seine	139	229	292	278	263	26	91	56	191	264	118	211	348	99	188	198	70	84	74	0	167	7	35	115	45
			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	6298
			Troll	7348	6109	5959	10226	6652	7870	5894	6845	5023	4312	4009	5419	7501	10224	10296	6105	5239	4440	7146	3578	5909	5891	6660	5596	3751
	ATS		Bait boat	6490	7379	9339	7091	6960	8110	10353	6709	6873	10355	9712	6973	7475	5084	5876	3375	4350	7926	3748	5938	6710	4411	4741	4965	2894
			Longline	27162	23947	24806	20040	21000	19547	19799	20640	24398	28039	21671	20626	14735	12977	17740	15087	13218	12113	13471	16445	17846	13863	8886	9971	10750
			Other surf.	393	39	91	10	209	127	0	73	58	377	323	82	299	288	395	1762	1219	2066	1651	1538	66	897	7	66	
			Purse seine	2517	1448	1064	412	257	117	434	183	58	25	39	309	16	534	442	58	81	160	355	208	437	91	42	129	36
			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	
	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	
			Longline	442	410	350	87	391	348	194	416	2796	2597	3704	4248	2335	1997	3026	4101	2694	2160	1719	2327	1959	1392	2343	2485	3458
			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	58	29
			Purse seine	6	559	23	0	0	0	0	0	0	0	1	3557	2452	1362	2803	2237	24	1230	0	869	68	86	14	247	7
			Trawl	0	0	0	0	0	0	0	0	0	0	0	48	0	0	0	0	5	0	0	0	0	0	5	4	9
			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
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
	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	
	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
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
			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
			Brazil	0	0	0	0	0	0	0	0	4	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
			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	
			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
			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
			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
			EU.France	6924	6293	5934	5304	4694	4618	3711	6888	5718	6006	4345	3456	2448	7266	6585	3179	3009	1122	1298	3348	3361	4592	6716	3441	4224
			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
			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	
			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
			EU.United Kingdom	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
			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**
			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**
			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**
			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	300
			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
			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
			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
			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
			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	**0**
			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**
			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	
			St. Vincent and Grenadines	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
			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
			U.S.A.	438	509	741	545	472	577	829	315	406	322	480	444	646	488	400	532	257	189	315	422	418	599	458	247	250
			U.S.S.R.	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	1	0	2	2	2	0	0	1	1	0	0	0	0	0	1	0	0	1	0	1
			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**
			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**
			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
		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
			Suriname	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	249	216	0	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	
			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
			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	
			Grenada	0	0	0	2	1	6	7	6	12	21	23	46	25	29	19	20	15	18	18	18	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	
			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

				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
			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	
	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	
			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
			Brazil	2710	3613	1227	923	819	652	3418	1872	4411	6862	3228	2647	522	556	361	535	487	202	271	1269	1857	1821	438	425	
			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	
			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
			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
			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**
			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
			EU.France	449	564	129	82	190	38	40	13	23	11	18	63	16	478	347	12	50	60	109	53	161	73	38	53	17
			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
			EU.United Kingdom	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**
			Ghana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	10	14	25	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
			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**
			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	
			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	
			Japan	583	467	651	389	435	424	418	601	554	341	231	322	509	312	316	238	1370	921	973	1194	2903	3106	1129	1750	1100
			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
			Maroc	0	0	0	0	0	0	0	0	0	0	0	0	0	7	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
			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	2
			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**
			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**
			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
			St. Vincent and Grenadines	0	0	0	0	0	0	0	0	2116	4292	44	0	0	0	65	160	71	51	31	94	92	97	110	100	107
			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
			U.S.A.	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**
			U.S.S.R.	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	0	0	0	62	46	94	81	3	120	2	2	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**
			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**
		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
		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	
			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	
			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	
			NEI (ETRO)	122	68	55	63	41	5	27	0	0	10	14	53	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	
			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	
	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
			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
			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
			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**
			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
			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
			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
			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**
			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**
			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**
			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**
			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	
			Turkey	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
		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	
		NCO	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	
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
			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	
			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
		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**
	ATS	CP	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**
			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	
		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**
	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
			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**

ALB-Table 2. Performance of 8 HCRs, according to the performance statistics defined by Panel 2 (only one performance indicator per block is shown, which represents median values across 132 operating models). The combination of the target fishing mortality (F_{TARGET}), Biomass threshold ($B_{THRESHOLD}$) and the type of stability clause defines the HCR. Two stability clauses were considered: (SC1) maximum change in TAC of 20% always applied from one 3-year management period to the next while also always imposing a 15,000-50,000 t min-max TAC; and (SC2) same as SC1 but not restricting TAC reductions and not imposing a minimum TAC when $B<B_{THRESHOLD}$. Each HCR has a unique identification number in this table and in **ALB-Figure 12**. pGR% = probability of being in the green quadrant of the Kobe plot; pBint% = probability of $B_{THRESHOLD}>B>B_{LIM}$; LongY (kt) = mean yield for the period 2030-2045 in thousands of tons; MAP = mean absolute proportional change in catch.

HCR				Stock Status	Safety	Catch	Stability
Number	Ftar	Bthresh	Stability clause	pGr%	pBint%	LongY (kt)	MAP (%)
1	0,80	0,80	SC2	85,5	9,0	26,5	8,3
2	1,00	0,80	SC2	78,9	13,0	29,0	8,8
3	0,80	1,00	SC2	88,6	8,3	26,9	8,3
4	1,00	1,00	SC2	84,5	9,2	26,9	8,9
1	0,80	0,80	SC1	85,8	9,3	32,1	5,6
2	1,00	0,80	SC1	74,7	15,8	34,1	6,2
3	0,80	1,00	SC1	86,0	10,4	32,2	6,0
4	1,00	1,00	SC1	77,9	14,3	35,0	6,3

ALB-Table 3. South Atlantic Albacore. Maximum catch which enables the stock to be in the Kobe green zone in 2020 with a probability higher than 60%, for each ASPIC and BSP run. Average and median across runs is also provided.

Model	Run	Catch
ASPIC	Run2	26,000
	Run6	24,000
	Run7	26,000
	Run8	26,000
BSPM	EQ SH	30,000
	EQ FOX	34,000
	CW SH	22,000
	CW FOX	18,000
Average		25,750
Median		26,000

ALB-Table 4. South Atlantic albacore estimated probabilities (in %) that the South Atlantic albacore stock fishing mortality is below F_{MSY} (a), biomass is above B_{MSY} (b) and both (c). Projections for constant F and constant catch levels are shown, combining all base case scenarios.

(a) Probability $F<F_{MSY}$

Catch (t)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
12,000	96%	96%	96%	96%	96%	97%	97%	97%	97%	97%	97%	97%	97%
14,000	96%	96%	96%	96%	96%	96%	96%	96%	96%	96%	96%	96%	96%
16,000	95%	95%	96%	96%	96%	96%	96%	96%	96%	96%	96%	96%	96%
18,000	90%	91%	92%	93%	93%	94%	94%	94%	94%	95%	95%	95%	95%
20,000	84%	85%	85%	86%	86%	87%	87%	88%	88%	88%	88%	89%	89%
22,000	79%	81%	81%	81%	82%	82%	82%	82%	82%	82%	83%	83%	83%
24,000	66%	72%	75%	75%	74%	74%	74%	73%	73%	72%	72%	71%	71%
26,000	56%	57%	59%	61%	62%	61%	60%	59%	58%	56%	55%	54%	53%
28,000	48%	45%	43%	41%	40%	39%	39%	39%	38%	38%	38%	37%	36%
30,000	39%	35%	33%	30%	28%	26%	24%	23%	22%	21%	20%	19%	18%
32,000	32%	29%	26%	24%	22%	19%	17%	16%	14%	13%	12%	11%	11%
34,000	28%	25%	22%	19%	15%	13%	11%	9%	8%	7%	7%	6%	6%

(b) Probability $B>B_{MSY}$

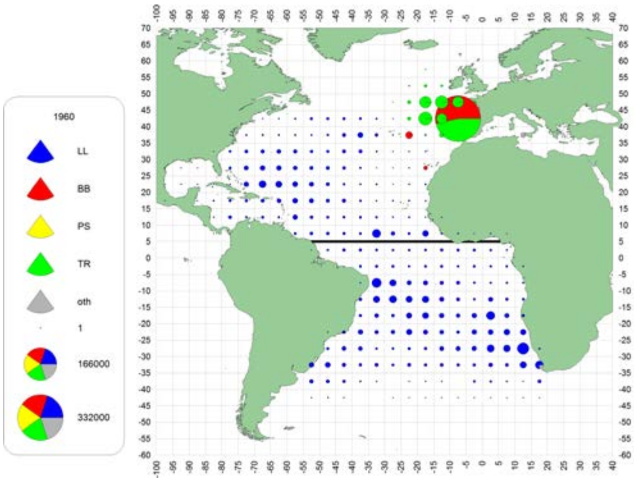
Catch (t)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
12,000	75%	80%	94%	95%	96%	96%	96%	96%	96%	96%	96%	96%	96%
14,000	75%	79%	93%	95%	95%	95%	95%	96%	96%	96%	96%	96%	96%
16,000	75%	78%	91%	94%	94%	95%	95%	95%	95%	95%	95%	95%	95%
18,000	75%	77%	87%	93%	93%	94%	94%	94%	94%	95%	95%	95%	95%
20,000	75%	76%	81%	90%	91%	92%	92%	92%	92%	92%	92%	91%	91%
22,000	75%	75%	76%	84%	87%	86%	85%	84%	84%	83%	83%	83%	82%
24,000	75%	74%	73%	72%	74%	75%	75%	74%	73%	73%	73%	72%	72%
26,000	75%	73%	67%	61%	60%	62%	65%	65%	65%	63%	62%	61%	59%
28,000	75%	71%	61%	55%	53%	51%	49%	48%	47%	46%	45%	43%	42%
30,000	75%	69%	56%	51%	47%	43%	40%	36%	32%	30%	27%	26%	25%
32,000	75%	66%	53%	47%	42%	37%	32%	28%	25%	23%	21%	19%	18%
34,000	75%	62%	50%	43%	37%	31%	26%	23%	20%	18%	16%	14%	13%

F	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
0.75*FMSY	75%	76%	89%	90%	90%	91%	91%	92%	92%	92%	92%	92%	92%
0.80*FMSY	75%	75%	86%	88%	89%	89%	89%	89%	89%	90%	90%	90%	90%
0.85*FMSY	75%	74%	82%	86%	86%	87%	87%	86%	87%	87%	87%	87%	87%
0.90*FMSY	75%	74%	77%	84%	84%	84%	84%	84%	84%	84%	83%	83%	83%
0.95*FMSY	75%	73%	72%	80%	80%	80%	81%	80%	80%	79%	79%	79%	79%
1.00*FMSY	75%	72%	68%	70%	74%	74%	73%	72%	68%	63%	60%	59%	59%

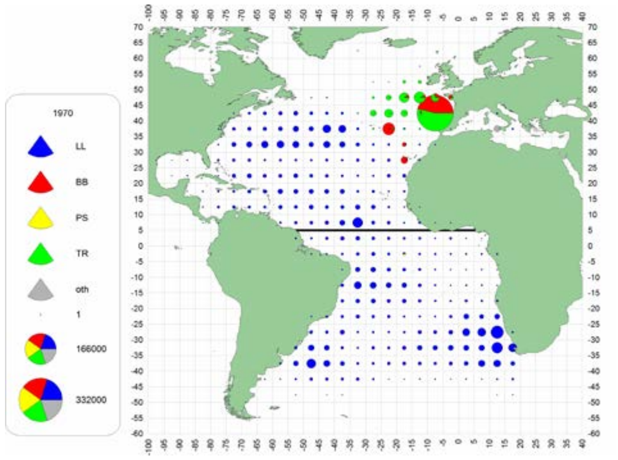
(c) Probability of green status ($B>B_{MSY}$ and $F<F_{MSY}$).

Catch (t)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
12,000	74%	80%	94%	95%	95%	96%	96%	96%	96%	96%	96%	96%	96%
14,000	74%	78%	93%	94%	95%	95%	95%	96%	96%	96%	96%	96%	96%
16,000	73%	77%	90%	93%	94%	94%	95%	95%	95%	95%	95%	95%	95%
18,000	68%	72%	83%	89%	91%	92%	92%	93%	93%	93%	93%	94%	94%
20,000	63%	65%	71%	81%	83%	84%	84%	85%	86%	86%	86%	87%	87%
22,000	62%	63%	65%	73%	78%	79%	79%	79%	80%	80%	80%	80%	80%
24,000	61%	60%	60%	63%	69%	72%	72%	72%	71%	71%	70%	70%	69%
26,000	55%	54%	53%	52%	52%	55%	56%	57%	56%	55%	54%	53%	52%
28,000	48%	45%	42%	40%	37%	35%	35%	35%	35%	35%	35%	35%	35%
30,000	39%	35%	33%	30%	28%	26%	24%	23%	21%	20%	19%	18%	18%
32,000	32%	29%	26%	24%	22%	19%	17%	16%	14%	13%	12%	11%	11%
34,000	28%	25%	22%	19%	15%	13%	11%	9%	8%	7%	7%	6%	6%

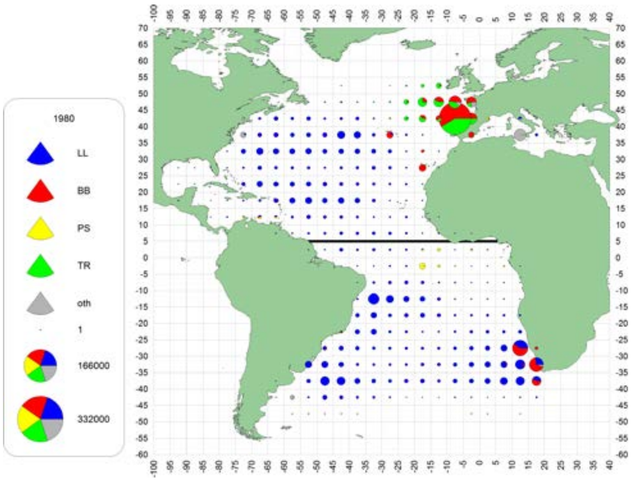
F	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
0.75*FMSY	75%	76%	89%	90%	90%	91%	91%	92%	92%	92%	92%	92%	92%
0.80*FMSY	74%	75%	86%	88%	89%	89%	89%	89%	89%	89%	90%	90%	90%
0.85*FMSY	72%	73%	81%	85%	86%	86%	86%	86%	86%	86%	86%	86%	86%
0.90*FMSY	69%	69%	74%	81%	81%	82%	82%	82%	82%	82%	82%	82%	82%
0.95*FMSY	64%	64%	65%	73%	75%	75%	77%	77%	77%	77%	77%	77%	77%
1.00*FMSY	59%	59%	57%	61%	66%	67%	67%	67%	63%	59%	57%	56%	57%



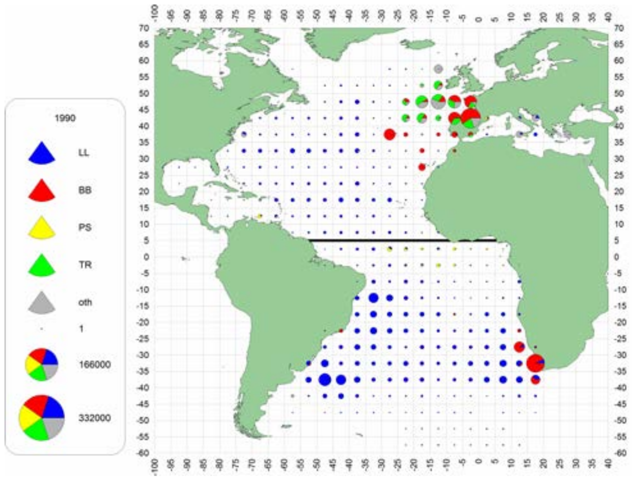
a. ALB (1960-69)



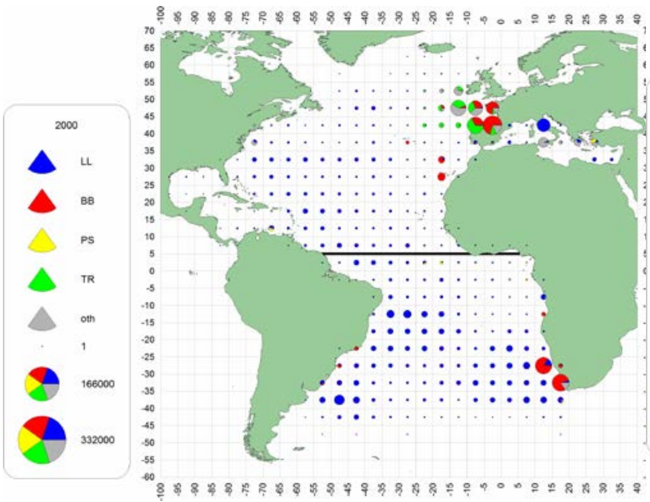
b. ALB (1970-79)



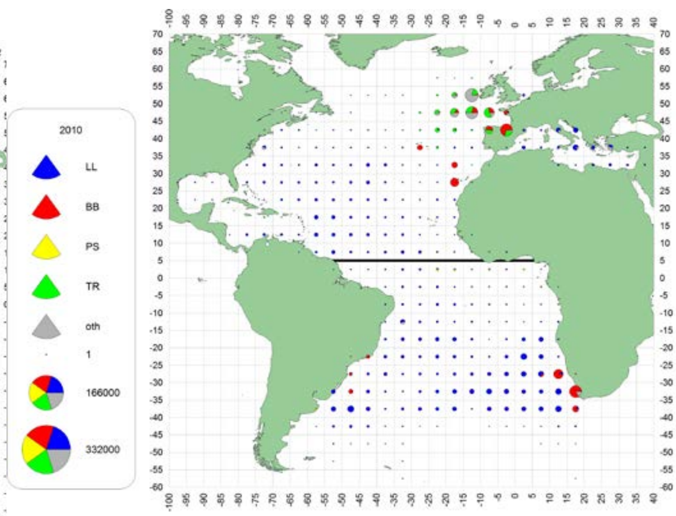
c. ALB (1980-89)



d. ALB (1990-99)

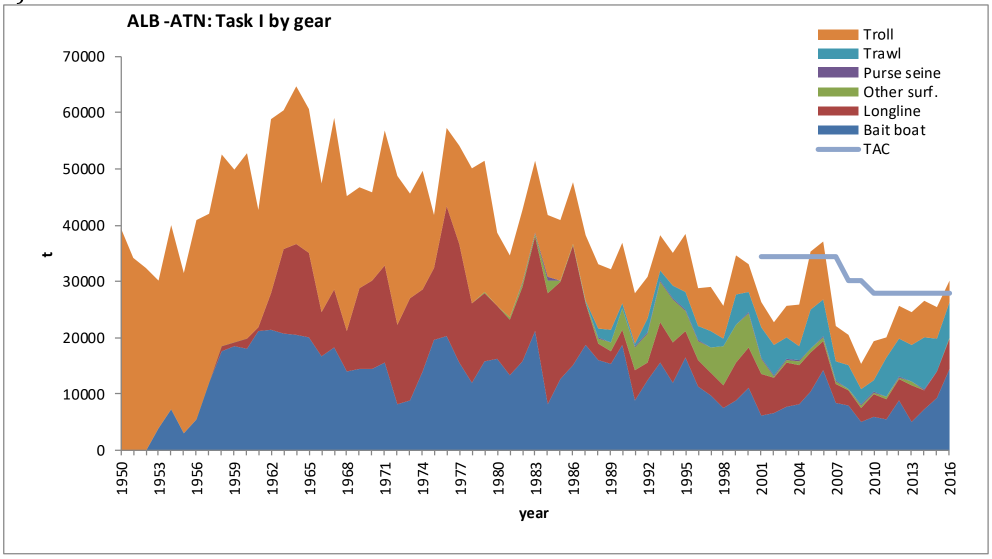


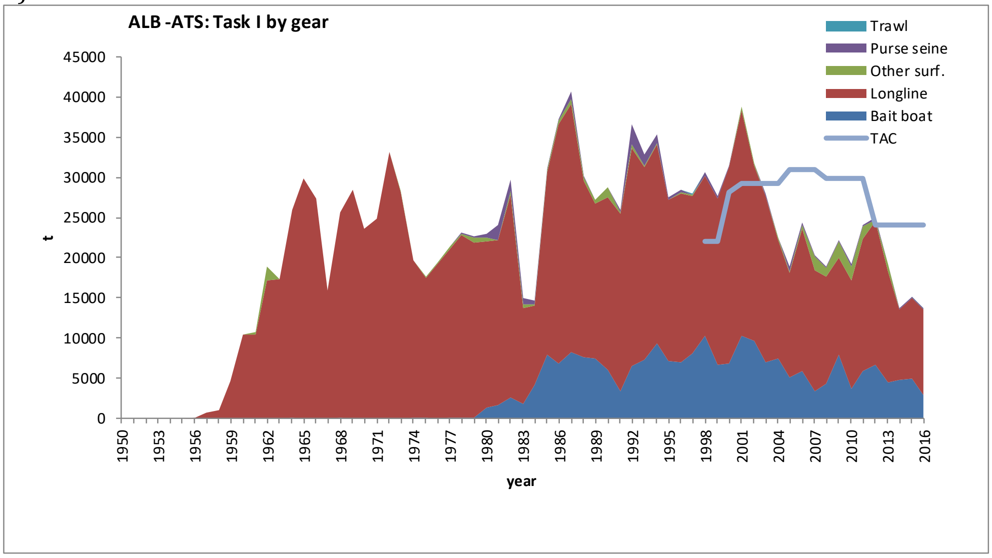
e. ALB (2000-09)

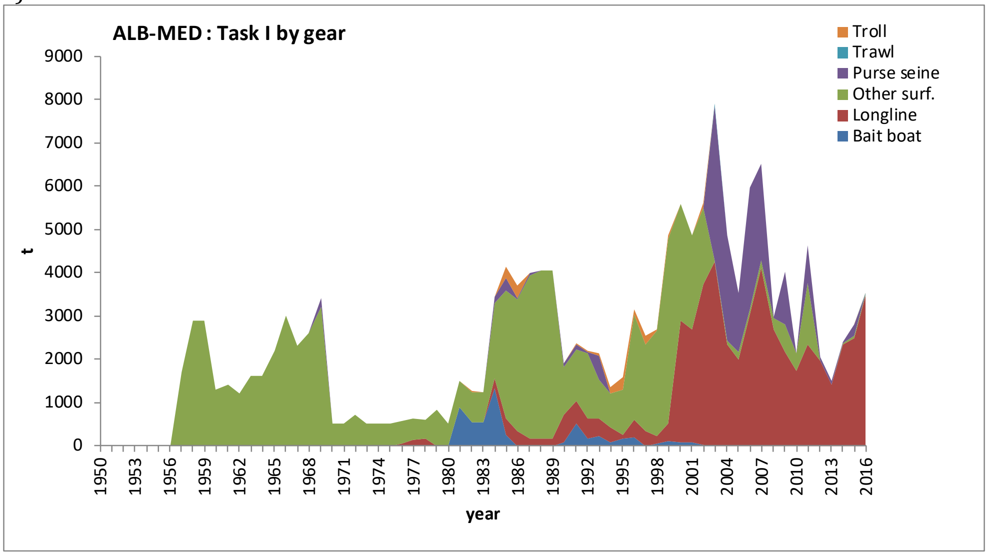


f. ALB (2010-15)

ALB-Figure 1. Geographic distribution of albacore accumulated catch by major gears and decade (1960-2015). Baitboat and troll catches prior to the 1990s, these catches were assigned to only one 5ºx5º stratum in the Bay of Biscay. Plots are scaled to the maximum catch observed from 1960 to 2015 (last decade only covers 6 years).

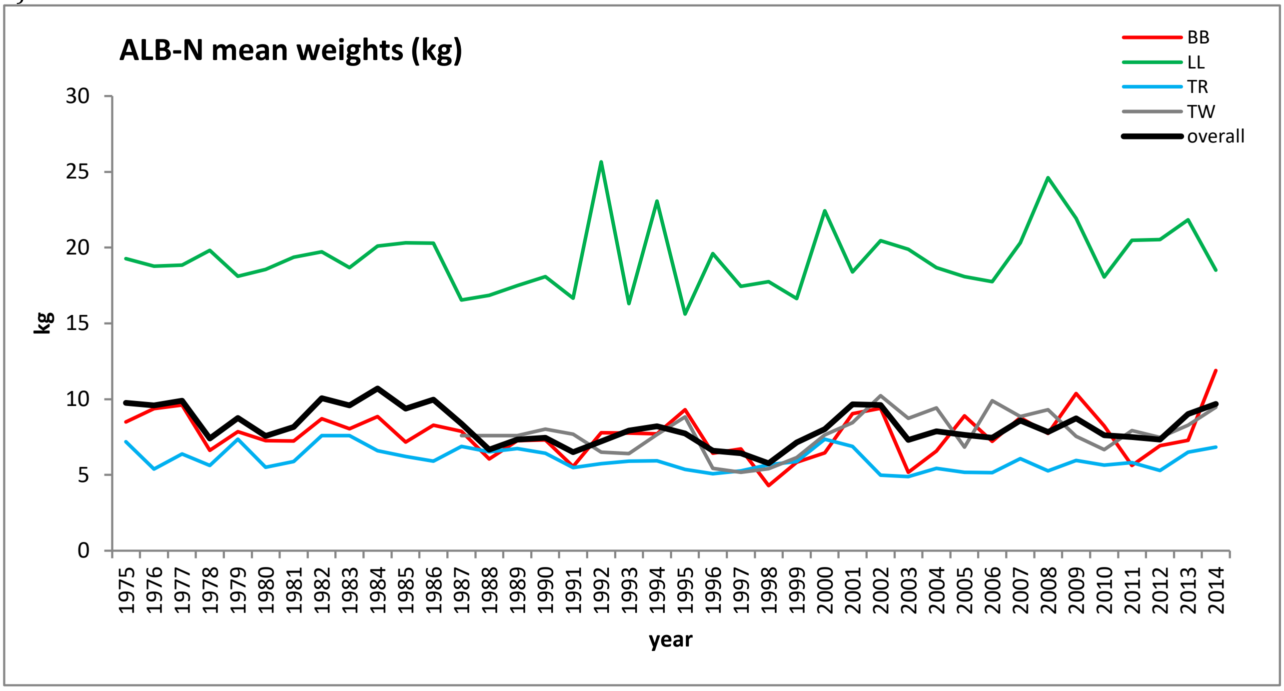
a)


b)


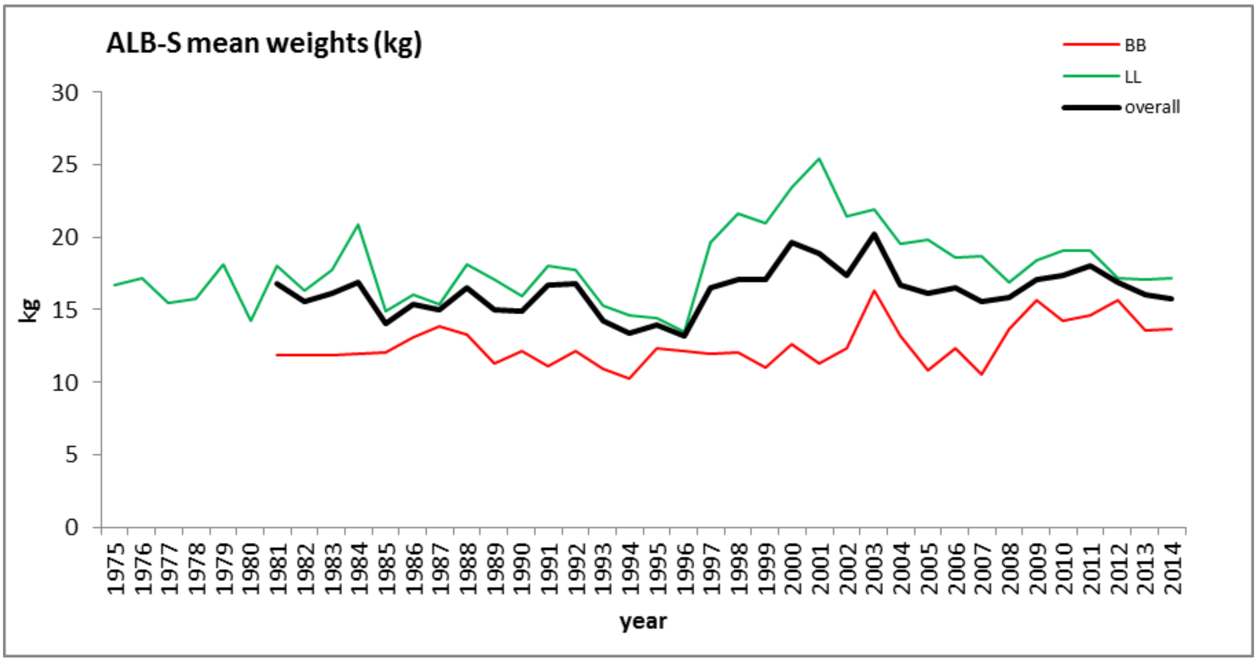
c)


ALB-Figure 2a, b, c. Total albacore catches reported to ICCAT (Task I) by gear for the northern, southern Atlantic stocks including TAC, and the Mediterranean stock.

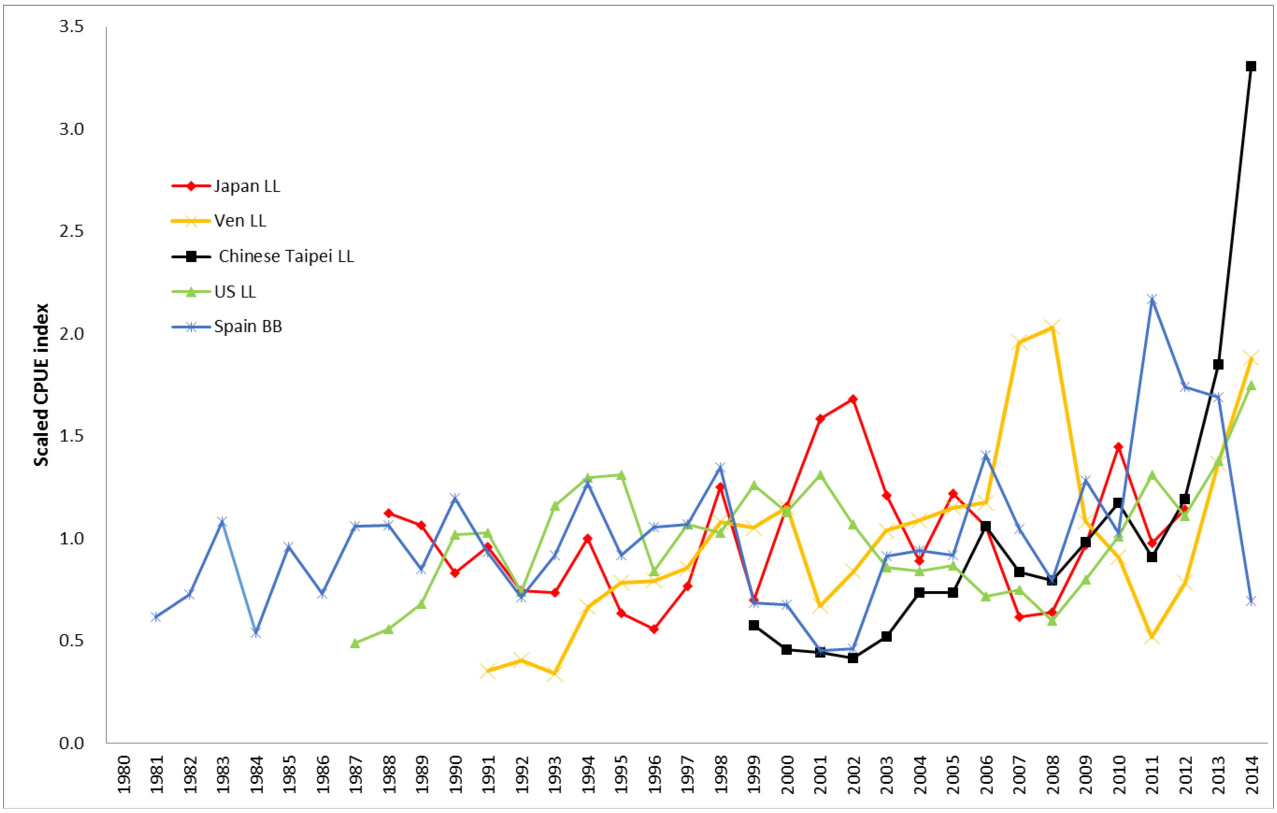
a)



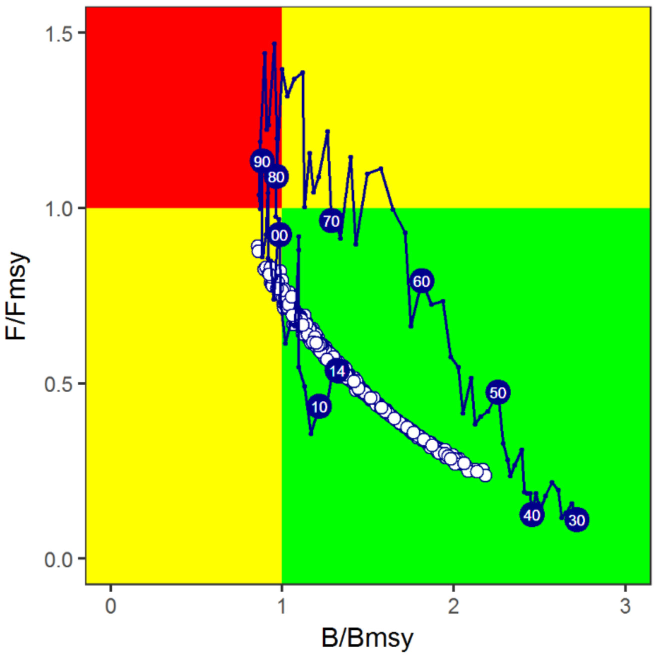
b)



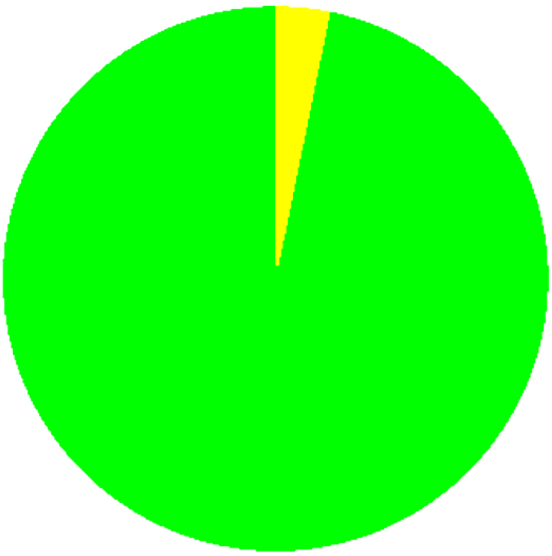
ALB-Figure 3a, b. Mean weight trend by surface and longline fisheries in North Atlantic (a) and South Atlantic (b) stocks. The baitboat fishery in the South Atlantic started in 1979 and mean weights are provided from 1980 onwards.



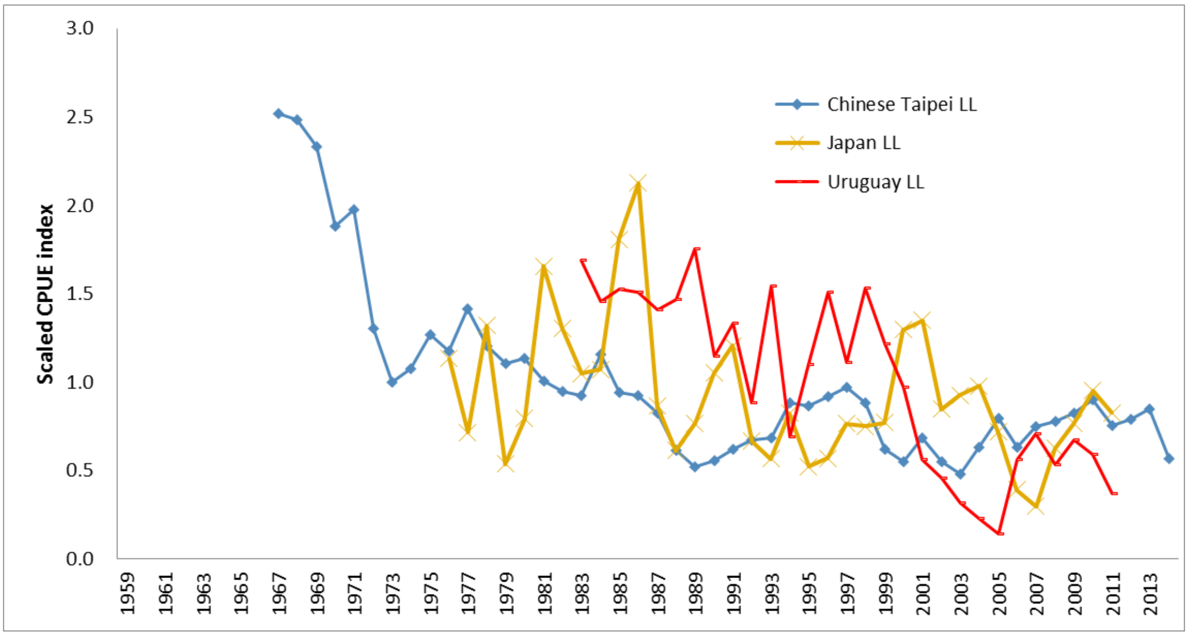
ALB-Figure 4. North Atlantic albacore. Standardized catch rate indices used in the 2016 stock assessment from the surface fisheries, which take mostly juvenile fish, and from the longline fisheries, which take mostly adult fish.



ALB-Figure 5. North Atlantic albacore. Joint trajectories of B/BMSY and F/FMSY over time (1930-2014) and current stock status according to the Base Case biomass dynamic model. Dots represent the uncertainty on the estimated 2014 stock status.

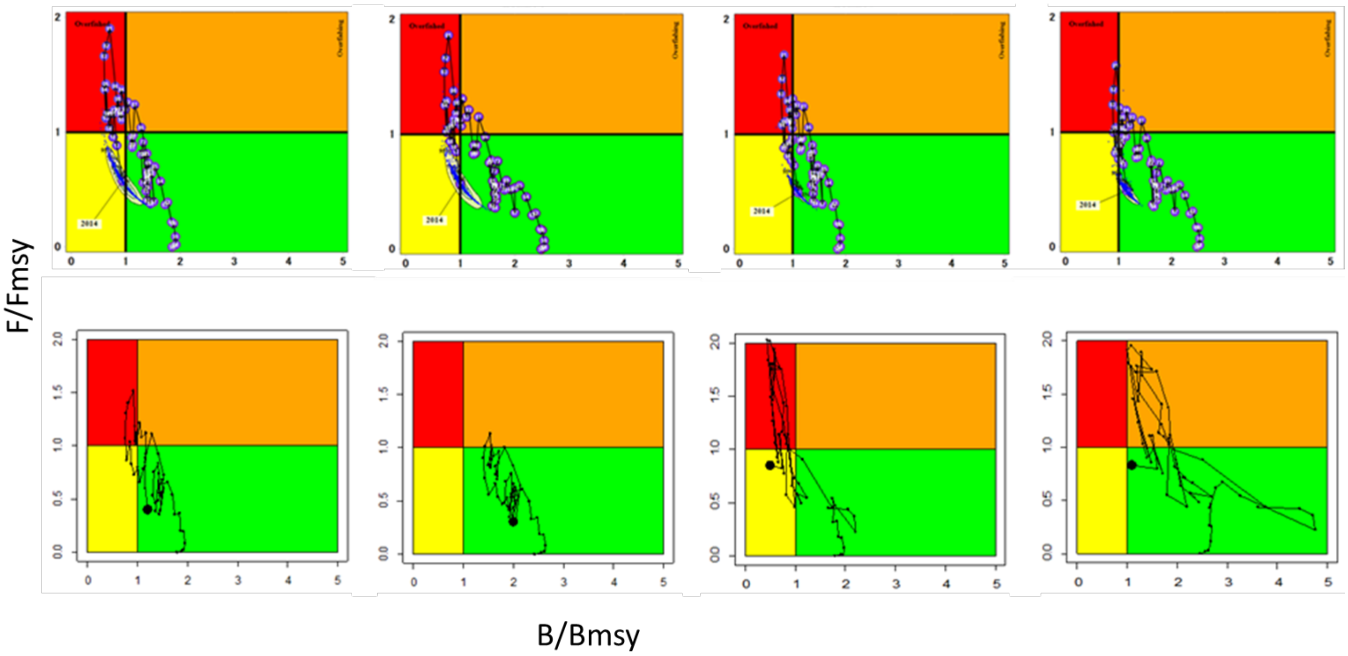


ALB-Figure 6. North Atlantic albacore probability of being overfished and overfishing (red, 0%), of being neither overfished nor overfishing (green, 96.8%), and of being overfished (yellow, 3.2%), according to the Base Case.

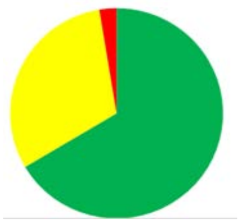


ALB-Figure 7. South Atlantic albacore. Standardized catch rates used in the 2016 stock assessment.

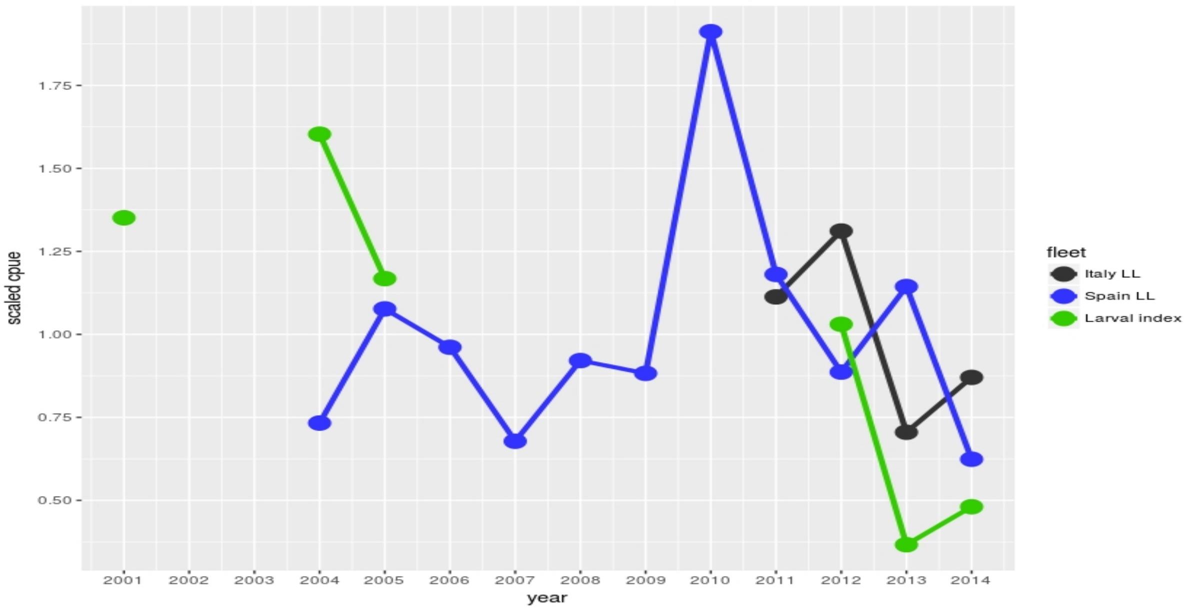
a)



b)

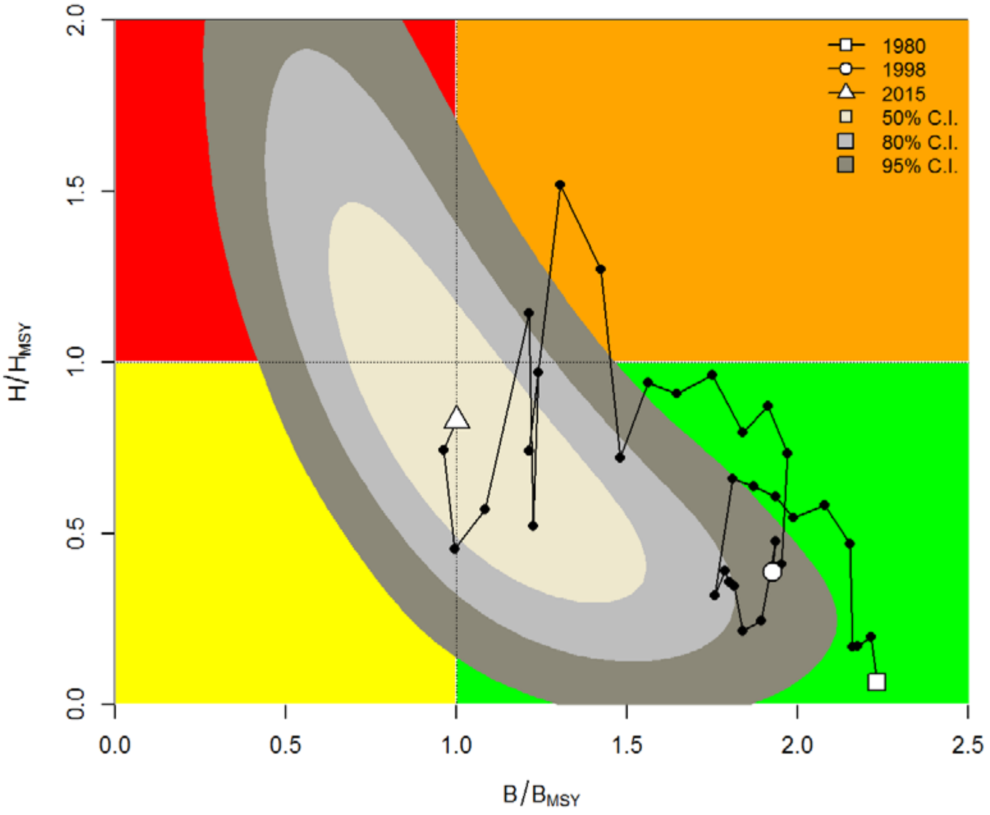


ALB-Figure 8. South Atlantic albacore. a) Stock status trajectories of B/B_{MSY} and F/F_{MSY}, as well as uncertainty around the current estimate (Kobe plots) for the base case ASPIC models (upper row) alongside those from the base case BSP runs (bottom row). From left to right, boxes indicate the following scenarios: Equal weight, Schaefer; Equal weight, Fox; Catch weight, Schaefer; Catch weight, Fox. (b) Combined probability of being overfished and overfishing (red, 3%), of being neither overfished nor overfishing (green (66%), and of being overfished or overfishing, but not both (yellow, 31%).

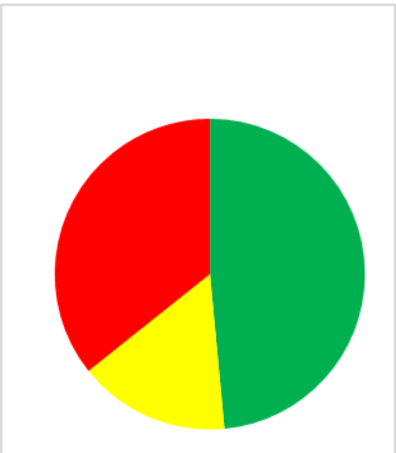


ALB-Figure 9. Set of abundance indices used in the 2017 assessment of the Mediterranean albacore stock.

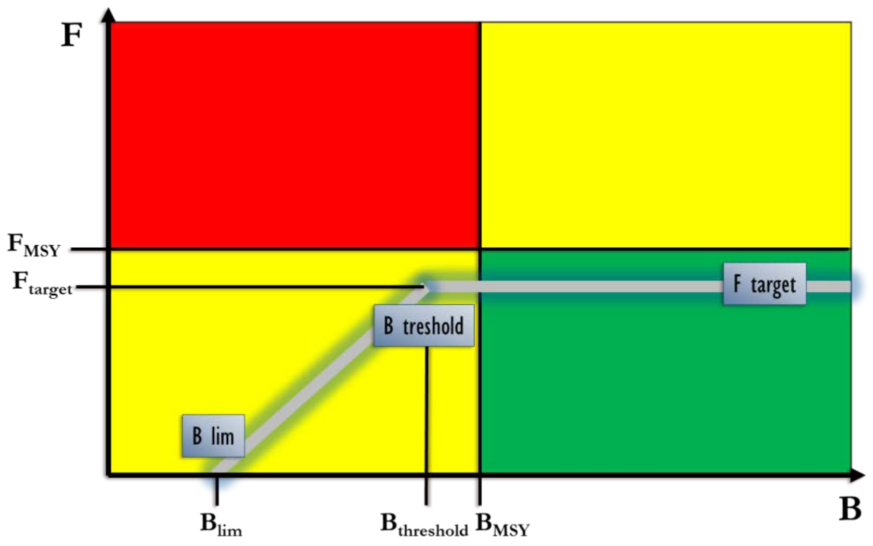
a)



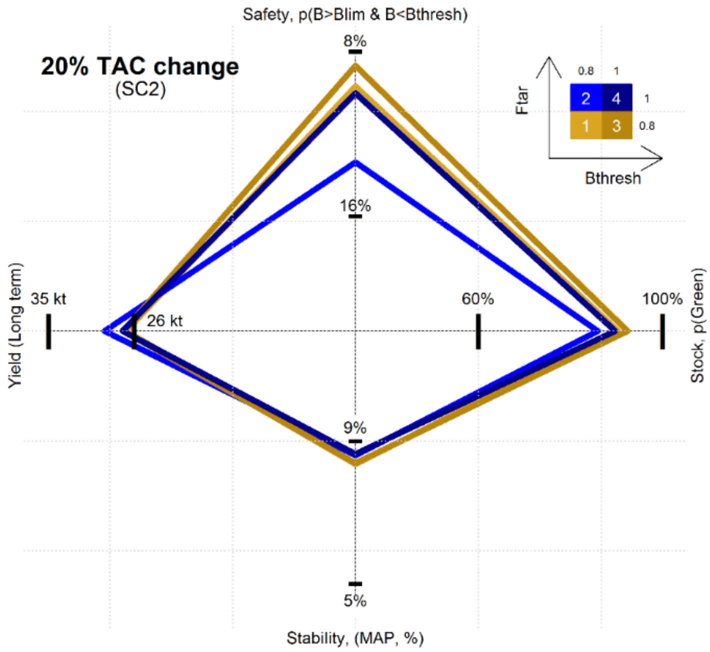
b)

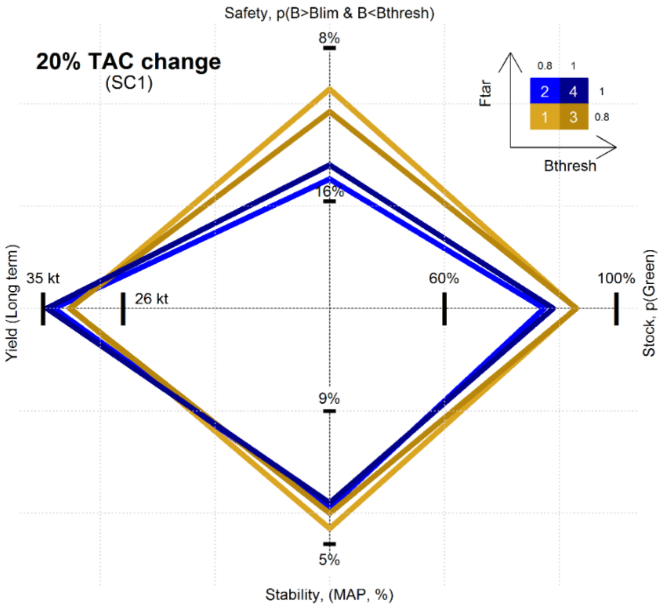


ALB-Figure 10. Mediterranean albacore. a) Stock status trajectories of B/B_{MSY} and F/F_{MSY}, as well as uncertainty around the current estimate (Kobe plots) for the base case JABBA model. (b) Probability of being overfished and overfishing (red, 36%), of being neither overfished nor overfishing (green (48%), and of being overfished or overfishing, but not both (yellow, 16%).



ALB-Figure 11. Generic form of the HCR recommended by SCRS (*Report for Biennial Period 2010-2011, Part I (2011), Vol. 2*). BLIM is the limit biomass reference point, $B_{THRESHOLD}$ is the biomass point at which increasingly strict management actions should be taken as biomass decreases and F_{TARGET}, the target fishing mortality rate to be applied to achieve the management objective (Rec. 16-06).





ALB-Figure 12. Spider plots representing the relative performance of HCRs with alternative stability clauses: SC1 (panel below), maximum change in TAC of 20% always applied from one 3-year management period to the next while also always imposing a 15,000-50,000 t min-max TAC; and (SC2) same as SC1 but not restricting TAC reductions and not imposing a minimum TAC when B<B$_{THRESHOLD}$. Among the 15 performance statistics identified by Panel 2, a single performance statistic per main group (namely stock status, stability, yield and safety) is represented in each of the axes. Each HCR has a unique identification number in this figure and **ALB-Table 2**. Different tickmarks in the axes are included to inform about absolute values. The exact values for all the HCRs can be seen in **ALB-Table 2.**

8.5 BFT – ATLANTIC BLUEFIN TUNA

Recent assessments of both the eastern and western stocks have attempted to develop Kobe plots and matrices depicting the status of the stock relative to certain reference points, despite a general consensus that they did not adequately reflect the true range of uncertainties. The long-term recruitment potential in particular is unknown and probably changes over time. Mindful of the Commission's request for Kobe matrices, the WBFT Group has in the past, attempted to bracket the long-term recruitment potential with "high" and "low" scenarios based on two different spawner-recruit relationships fit to recruitment estimates from different periods of years. Similarly, the EBFT Group has attempted to bracket the range of possibilities with three different constant recruitment scenarios corresponding to the averages taken over three different periods. This bracketing approach has not proven especially helpful in either case because the range of possibilities is so large.

Despite considerable efforts to improve the historical data for both stocks, the 2017 Committee has not gained any further insights into future recruitment potential. As any additional improvements to the historical data are likely to be rather modest in scope, the Group expects such insights to remain elusive. Moreover, the Convention objective of stabilizing the stock near the level that will produce the maximum sustainable catch by its very nature tends to prevent the stock from reaching the high and low levels needed to provide adequate contrast for estimating the spawner-recruit relationship. Accordingly, the Group has elected to focus on fishing-mortality based reference points that do not require knowledge of long-term recruitment potential, but nevertheless can be implemented in a manner that will eventually approach and maintain the stock near the corresponding biomass reference point.

It is not possible to calculate biomass-based reference points (e.g., MSY and F_{MSY}) apart from the knowledge (or assumptions) about how future recruitment potential relates to spawning stock biomass. In the absence of such knowledge, several F reference points have been recommended in the literature as proxies for F_{MSY}. The reference point of choice for the eastern stock has been $F_{0.1}$ since 2008. The 2017 Committee considers $F_{0.1}$ to be a reasonable proxy for the western stock as well. Accordingly, the Committee has provided Kobe matrices for both stocks that reflect the probability of not overfishing ($F<F_{0.1}$). Yields associated with $F_{0.1}$ can be higher or lower than MSY-based yields, depending on the spawner-recruit relationship. Further, the status of the stock relative to the corresponding long-term biomass, $B_{0.1}$, is considered unknown because the spawner-recruit relationship is unknown. Nevertheless, fishing consistently at $F_{0.1}$ will, over the long-term cause the stock to fluctuate around $B_{0.1}$, whatever the future recruitment potential.

Although the Committee was unable to provide reliable biomass reference points, the new information available through GBYP and other programmes improved the assessment in many ways, which are documented in the reports of the data preparatory and stock assessment meetings. Therefore the Committee considers the following advice to be more reliable than previously provided to the Commission.

BFT-1. Biology

Atlantic bluefin tuna (BFT) have a wide geographical distribution but mainly live 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. Recent information for their presence in the South Atlantic is incomplete (**BFT-Figure 1**). Archival tagging information confirmed that bluefin tuna can sustain cold as well as warm 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 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 Gulf of Mexico. Recent evidence indicates that spawning also occurs in the vicinity of the Slope Sea, though its persistence and its importance remains to be determined. Electronic tagging is also resolving the movements to the foraging areas within the Mediterranean and the North Atlantic and indicate 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 and north temperate waters suggest that important changes in the spatial dynamics of bluefin tuna may also have resulted from interactions between biological factors, environmental variations and the reduction in fishing effort. The Atlantic bluefin tuna population is managed as two stocks, 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 various rates in the eastern, western and northwestern Atlantic.

The ICCAT GBYP biological sample database provided the basis for improved biological studies. Substantial progress has been made in estimating regional, time varying mixing levels for Atlantic bluefin tuna throughout the Atlantic, using otolith stable isotope and genetic analyses. Research on larval ecology of Atlantic bluefin tuna has advanced in recent years through oceanographic habitat suitability models. Direct age estimations, using otoliths and dorsal fin spine, have been calibrated between readers from several institutions resulting in stock specific age length keys and a new growth model for the western population.

Currently, the SCRS assumes for assessment purpose that eastern Atlantic and Mediterranean bluefin tuna contribute fully to spawning at age 5. Recent information received by the SCRS indicates that some young individuals (age 5) of unknown origin caught in the West Atlantic were mature, but there was considerable uncertainty with regards to their contribution to the western stock spawning. Therefore, for the western stock the SCRS considered two spawning schedules; one identical to that used for the East and one with peak spawning at age 15. Juvenile and adult bluefin tuna are opportunistic feeders (as are most predators). However, in general, juveniles feed on crustaceans, fish and cephalopods, while adults primarily feed on fish such as herring, anchovy, sand lance, sardine, sprat, bluefish and mackerel. Juvenile growth is rapid for a teleost fish, but slower than other tuna and billfish species. Fish born in June attain a length of about 30-40 cm long and a weight of about 1 kg by October. After one year, fish reach about 4 kg and 60 cm long. At 10 years old, a bluefin tuna is about 200 cm and 170 kg and reaches about 270 cm and 400 kg at 20 years. Bluefin tuna is a long-lived 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.

Important electronic and conventional tagging activity on both juveniles and adult fish has been performed in recent years in the Atlantic and Mediterranean by ICCAT GBYP, national programmes and NGOs. Contribution of PSAT data from all groups are supporting ongoing efforts to provide significant insight into bluefin tuna stock structure, mixing and migrations and would possibly help in estimating fishing mortality rates and condition the MSE operating model.

The Committee believes that, the two stocks share many biological characteristics and the natural mortality rate have to be similar in magnitude and decline with age. Thus, the Committee revised the natural mortality assumptions and adopted a single new age specific natural mortality curve for both stocks.

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

It is very well known that introduction of fattening and farming activities into the Mediterranean in 1997 and good market conditions resulted in rapid changes in the Mediterranean fisheries for bluefin tuna mainly due to increasing purse seine catches. In the last few years, a high percentage of the Mediterranean bluefin fishery production was exported. Declared catches in the East Atlantic and Mediterranean reached a peak of over 50,000 t in 1996 and then decreased substantially, stabilizing around TAC levels established by ICCAT for the most recent period (**BFTE-Figure 2**). Both the increase and the subsequent decrease in declared production occurred mainly for the Mediterranean (**BFTE-Figure 2**). Since 2008, there was a significant decrease in the reported catch following more restrictive TACs and a substantial increase in monitoring, control and surveillance. Catches between 2012 and 2016 was 10,934 t, 13,244 t, 13,261 t, 16,201 t and 20,098 t for the East Atlantic and Mediterranean, of which 7,100 t, 9,081 t, 9,343 t, 11,360 t and 13,162 t was reported for the Mediterranean for those same years (**BFT-Table 1**).

Information available 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 has estimated that realized catch during this period likely was on 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. The current assessment uses these estimates (1996-2007) rather than the declared catches.

CPUE indices (**BFTE-Figure 3**) have been affected significantly by regulatory measures through the change of operational patterns, length of the fishing season and target sizes; thus it is difficult to distinguish the effect of these changes on CPUEs from the effects of changes in abundance. Some indices showed very rapid increases in the most recent years and the Committee questioned if these rates of increase were biologically plausible indicators of the stock biomass as a whole, and noted that many factors may have contributed to the increase in the index.

Nonetheless, recent tendencies in the indicators are partly a reflection of positive outcomes from recent management measures.

During the stock assessment meeting, held in July 2017, it was decided to use ten indices for the 2017 stock assessment (7 CPUE series and 3 fisheries independent index, **BFTE-Figure 3**). Two new fishery-independent indices were introduced that displayed an increasing trend in the recent years. The French aerial survey for juvenile bluefin tuna in the northwest Mediterranean Sea was split into two series (2000-2003 and 2009-2015). The larval survey in the western Mediterranean (Balearic Islands) covered the periods 2001-2005 and 2012-2015. A new combined Morocco and Portuguese trap index was used for 2012 to 2015. The Japanese longline index in the Northeast Atlantic was split in 2010. Both indices remained steady in the most recent years.

Three indices were updated after the assessment period: the French aerial survey (updated to 2016), the Japanese longline index in the Northeast Atlantic (updated to 2017) and the combined Moroccan and Portuguese traps (updated to 2016). The values of the updated indices remained steady or increased since 2015.

BFTE-3. State of the stock

There have been considerable improvements in the data quality and quantity over the past few years, nevertheless there remain important gaps in the temporal and spatial coverage for detailed size and catch-effort statistics for several fisheries prior to 2014, especially in the Mediterranean. The Committee does not expect that there can be further improvement in historical statistics.

Five stock assessment platforms were used and explored for the current assessment but only the VPA results were considered sufficiently advanced at the conclusion of the meeting to be considered as the primary basis for management advice for the eastern stock. Nevertheless, there was still concern over the performance of the VPA, notably the unstable estimation of total biomass (i.e. the estimating of a substantial overall increase in biomass with the addition of only the last year of data) and that the size composition of many eastern Atlantic and Mediterranean fleets is poorly characterized for a number of years before the implementation of stereo video camera in 2014.

The original base case VPA selected during the stock assessment meeting was revised to reduce the uncertainties of its estimates in recruitment levels (2004-2007) as assessment-model-independent analyses of size composition data indicated that the original assessment was overestimating the sizes of these year classes relative to the 2003 year class as was also evident from the retrospective analysis. A slight modification of the original base case with more plausible recruitment estimates was adopted as the new base case (see BFT Species Group, 2017).

The 2017 assessment results from the VPA base case, indicated that the spawning stock biomass (SSB) peaked in the mid-1970s after increasing initially and then declined until 1991 and remained steady up to the mid-2000s. From the late 2000s, SSB exhibited a substantial increase through 2015 (**BFTE Figure 4**). The extent of that increase depends on the choices of model configuration and the indices of abundance and terminal year (2014 vs 2015). The 2014 assessment estimated extraordinarily large year classes in 2004-2007 while in the current assessment recruitment estimates declined from 2002 to 2009 followed by an increase in 2011.

The estimated fishing mortality rates on the younger ages (i.e., average F for ages 2 to 5) displayed a continuous increase until the late 1990s and then showed a sharp decline to reach very low levels after the late 2000s (**BFTE-Figure 4**). This result is consequence of the dramatic reduction in the catches at ages 2 to 3 in the recent years in response to the new minimum size regulations implemented in 2007. The trend of F in young ages was similar to that in the 2014 assessment. For oldest fish (F at plus group for ages 10 and older) showed (**BFTE-Figure 4**) an initial decline from 1968 to 1973, and slightly fluctuated around 0.03 afterwards. It increased in 1994 and continued increasing up to 2007 (F_{10+}=0.2). This period (from the mid-1990s to the mid-2000s) observed the highest level on fishing mortality of larger fish. Since 2008, there has been a rapid decrease in F_{10+}, as already noted in the previous assessments, which related to the regulation, i.e. the drastic reduction of TAC.

F0.1 was considered a reasonable proxy for F_{MSY}, although it can be higher or lower than F_{MSY} depending on the stock recruitment relationship, which in this case is poorly determined. However given the uncertainties about future recruitment, estimates of biomass base reference points were unreliable. In addition to those uncertainties, the current perception of the stock status was also closely related to the assumptions made about stock structure and migratory behaviour, which remain poorly known. Nonetheless, compared to 2014 the extra data now available do better confirm recent stock increase though the level of increase remains difficult to quantify. F_{cur} appears to be clearly below $F_{0.1}$ $F_{cur}/F_{0.1}$= 0.34. The current status of the stock, and status in 2022 under a F0.1 strategy, relative to B0.1 depends on assumptions made for longer term future recruitment. For medium[1] and low recruitment levels, the stock is already above $B_{0.1}$, whereas for the high level it is below.

If an $F_{0.1}$ strategy were to continue to be applied, over the longer term the resource would fluctuate around the true, but unknown value of $B_{0.1}$ whatever the future recruitment level.

BFTE- 4. Outlook

In 2017, the Committee presented short-term projections (2017-2022, **BFTE-Figure 5**) using the average recruitment over a six year period (2006-2011) and replacing the last four years (2012-2015) recruitments, which are considered poorly estimated, with that average. According to the base model annual constant catches up to 36,000 t have higher than 60% probability of maintaining F below $F_{0.1}$ throughout 2022 (**BFTE-Table 1**).

Projections are known to be impaired by various sources of uncertainties that have not yet been fully quantified. Due to the limited possibility of improving the quality of the data the Committee does not expect to provide further clarity regarding future recruitment therefore the Kobe matrix is presented only in terms of the probability that F is less than $F_{0.1}$ (**BFTE-Table 1**). If the Committee were to continue the past practice of assuming three different constant recruitment levels, under the medium and low scenarios the stock is already above $B_{0.1}$, whereas for the high level it is below.

The updated indices of abundance were consistent with the projections for 2016.

BFTE-5. Effect of current regulations

The 2011, 2012, and 2013 TACs were set at 12,900 t, 12,900 t, and 13,400 t respectively by Rec. 10-04 and Rec. 12-03, at 13,400 t in 2014 (Rec. 13-07), 16,142 t in 2015 (Rec. 14-04), 19,296 t in 2016 (Rec. 14-04) and 23, 655 t in 2017 (Rec. 14-04 and Rec. 16-09). Nevertheless, the reported catch in 2016 exceeded the TAC.

The Committee agreed that a substantial decrease in the catch occurred in the eastern Atlantic and Mediterranean Sea through implementation of the rebuilding plan and through monitoring and enforcement controls.

2017 analyses from the reported catch-at-size and catch-at-age displayed substantial changes in selectivity patterns towards larger fish over the last years for several fleets operating in the Mediterranean Sea or the East Atlantic, partly resulting from the enforcement of minimum size regulations under Rec. 06-05. This also resulted in improved yield-per-recruit levels due to higher survival of juvenile fish in comparison to the early 2000s, meaning that the stock can produce larger yield at any given level of SSB.

An important source of uncertainty originated from the reduction in TAC and size limits which may have caused changes in the fishing strategy that has strongly affected all the index calculations. It is also worth noting that the transfer of quotas from one fisheries to another may also affect stock assessment outcomes, as such transfers have implications for the repartition of the fishing effort and thus for selectivity patterns, which are known to impact the references points. Therefore, the Committee reiterates the importance to continue effort, through national programmes and GBYP, to improve the quality of currently used abundance indices and obtain robust fisheries-independent indicators. It notes however that necessary decisions regarding management of the stock have often the side effect of adding uncertainties to stock assessment, e.g., by changing fleet behaviour and fisheries selection pattern.

[1] Averages taken over the years 1968-1980/ 1968-2012/1990-2005, for the low medium and high scenarios respectively.

The combination of size limits and the reduction of catch has certainly contributed to a rapid increase of the abundance of the stock.

BFTE-6. Management recommendations

The projections generated from the base VPA suggest that catches up to 38,000 t or 36,000 t have a greater than a 60% probability of maintaining F below $F_{0.1}$ in 2020 or 2022 respectively (**BFTE-Table 1**). They also indicate that catches of 28,000 t or less have a higher than 50% probability of allowing a continue increase in the stock (**BFTE-Figure 5**). It should be kept in mind, however, that the Kobe matrix cannot integrate some important sources of uncertainties that currently remain unquantified as mentioned in section BFTE-4 and in the Report of the 2017 ICCAT Atlantic bluefin tuna stock assessment session (Anon., 2017e). Several sensitivity runs of the VPA and preliminary results of other assessment models suggest catches at $F_{0.1}$ that are notably lower than given by the base VPA. This points to the need to be cautious.

A case could be made to base TAC advice on the Kobe matrix results for either 2020 or 2022. However, if the TAC is set at 38,000 t through 2020, then it may have to be reduced below 36,000 t in 2021 and 2022 to maintain at least a 60% probability of not overfishing. Given the uncertainties discussed above, use of the catch figure of 36 000 t is advised due to the rebuilding time frame set to 2022. For these same reasons the Committee advises that the catches be increased using a gradual stepwise approach to 36,000 t in 2020. The continuation of the stepped increases should be reviewed annually by the Commission on the advice of the SCRS (which would be based on updates of the fishery indicators as has been done in the past three years, i.e., the SCRS could, on any of those occasions, recommend that the next increase not occur given sufficiently negative indicator signals). The Committee recommends a full assessment in 2020.

Given the abundance increase evident for the stock, the Committee advises that the Commission should consider moving from the current rebuilding plan to a management plan.

EAST ATLANTIC AND MEDITERRANEAN BLUEFIN TUNA SUMMARY	
Current reported yield (2016)	20,098 t*
$F_{0.1}$	0.107(0.103-0.120)[1]
$F_{2012-2014}/F_{0.1}$[2]	0.339 (0.254-0.438)[1]
Stock Status	Overfishing: No
Projected Yield[3] at $F_{0.1}$ in 2018 Projected Yield[3] at $F_{0.1}$ in 2019 Projected Yield[3] at $F_{0.1}$ in 2020	41,205 (31,190 – 57,770) t 40,455 (31,330 – 56,600) t 39,655 (30,420 – 55,280) t
[Rec. 12-03] TAC in 2013-2014 [Rec. 14-04] TAC in 2015-2017 [Rec. 16-09] TAC in 2017	13,400 t – 13,400 t 16,142 t – 19,296 t – 23,155 t +500 t

1 Median and approximate 80% confidence interval from bootstrapping from the assessment.
2 $F_{2012-2014}$ refers to the geometric mean of the estimates for 2012-2014 (a proxy for recent F levels).
3 Projected yield at $F_{0.1}$ was calculated with the recent 6 years (2006-2011) recruitment level.
* As of 29 September 2017.

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

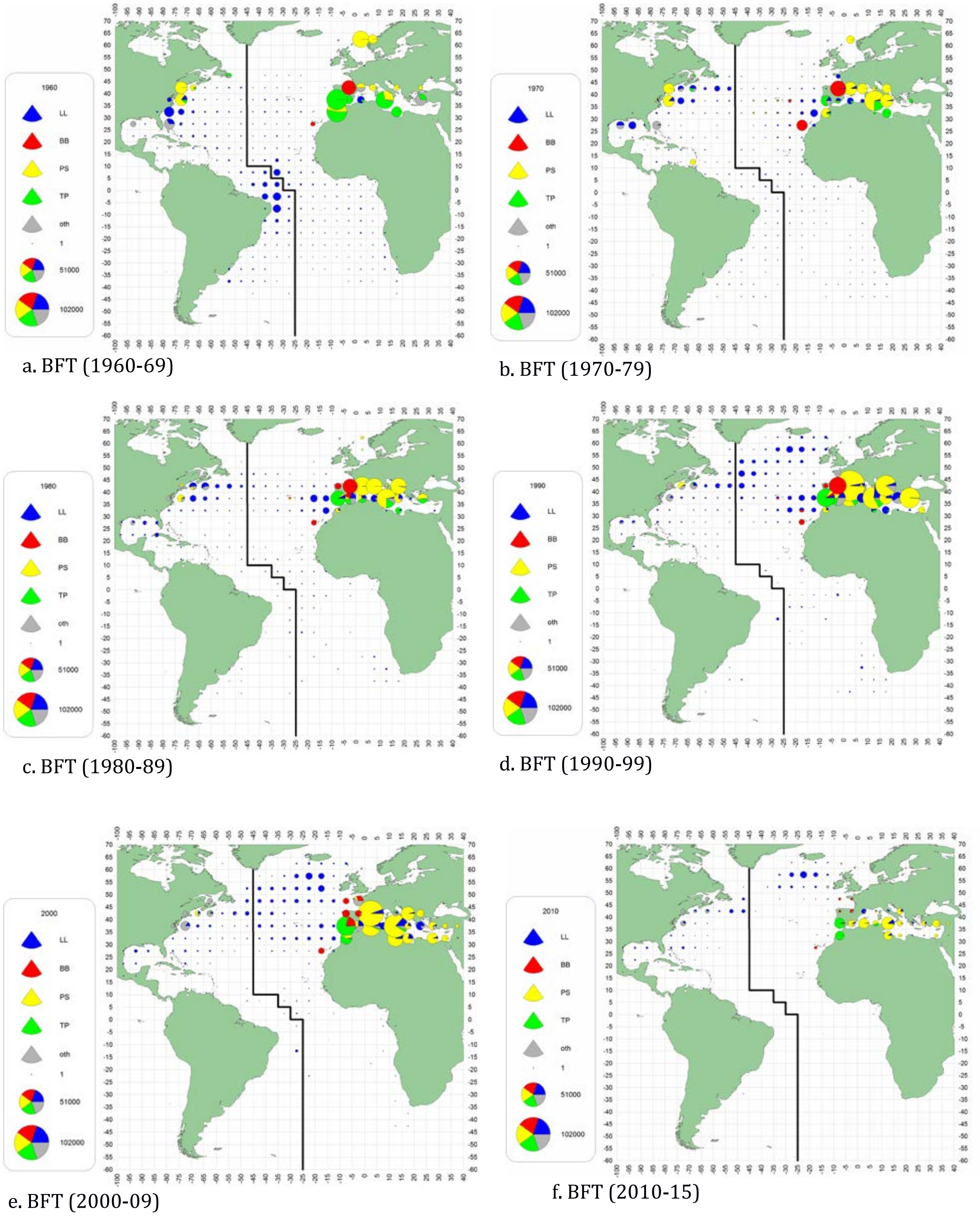
				1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
TOTAL				34128	36642	48881	49751	54009	53545	52657	52772	52775	52784	53319	52305	52125	51756	51811	62638	26460	21798	13195	11781	12688	14726	14887	18042	21997
BFT-E				31831	34258	46769	47303	51497	51211	50000	50000	50000	50000	50000	50000	50000	50000	50000	61000	24460	19818	11338	9774	10934	13244	13261	16201	20098
	ATE			7396	9317	7054	9780	12098	16379	11630	10247	10061	10086	10347	7396	7410	9039	7802	8441	8243	6684	4379	3984	3834	4163	3918	4841	6936
	MED			24435	24941	39715	37523	39399	34831	38370	39753	39939	39914	39653	42604	42590	40961	42198	52559	16217	13133	6959	5790	7100	9081	9343	11360	13162
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	1626	1842	1899
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
			Longline	3618	2802	2311	4522	4212	4057	3789	3570	3736	3303	2896	2750	2072	2717	2306	1705	2491	1951	1194	1125	1139	1167	1194	1467	1829
			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
			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
			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
			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	3684
	MED		Bait boat	158	48	0	206	5	4	11	4	38	28	1	9	17	5	0	0	0	38	1	0	2	11	9	25	
			Longline	3145	2470	6993	8469	9856	7313	4117	3338	3424	4144	3234	3482	3028	3411	3135	3269	2376	1344	1242	962	587	605	588	776	1523
			Other surf.	447	371	776	545	417	282	284	228	728	354	340	198	197	175	81	85	0	0	1	1	1	21	29	3	37
			Purse seine	18580	20065	27948	23799	26021	24279	31792	33798	33237	33043	34044	37291	37869	36639	38363	48994	13540	11448	4986	4293	6172	7974	8184	9993	11315
			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	361	283
			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	
	ATW		Longline	689	712	539	491	545	382	764	915	858	610	729	186	644	425	565	420	606	366	529	743	478	470	497	553	562
			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
			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	
			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
			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
Discards	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	
			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	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	27
			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
			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	
			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	
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	
			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
			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	
			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	2954
			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
			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	
			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
			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
			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	
			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
			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	
			EU.United Kingdom	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
			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**
			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	
			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
			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
			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
			Maroc	562	415	720	678	1035	2068	2341	1591	2228	2497	2565	1797	1961	2405	2196	2418	1947	1909	1348	1055	990	960	959	1176	1433
			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
			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**
			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**
			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	
		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**
		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	
			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	
			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	
			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	
			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	
	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
			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
			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**
			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	
			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
			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

				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
			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
			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
			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
			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
			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
			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**
			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
			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**
			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**
			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**
			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
			Maroc	205	79	1092	1035	586	535	687	636	695	511	421	760	819	92	190	641	531	369	205	182	223	309	310	322	350
			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**
			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
			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	1461
			Turkey	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
		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**
		NCO	ICCAT (RMA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	1	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	
			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	
			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	
			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	
			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	
			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	
	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	
			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
			EU.United Kingdom	0	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**
			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
			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**
			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
			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**
			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**
			U.S.A.	1085	1237	1163	1311	1285	1334	1235	1213	1212	1583	1840	1426	899	717	468	758	764	1068	803	738	713	502	667	877	1003
			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	
			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**
			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**
		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**
		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	
			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	
			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
			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	
			NEI (ETRO)	17	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	0	0	0	0	0	429	270	49	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	
Discards	MED	CP	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	
			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
			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**
			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	
			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	**0**
			Turkey	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**
	ATW	CP	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
			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	
			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
			U.S.A.	211	88	83	138	171	155	110	149	176	98	174	218	167	131	147	100	158	204	150	166	206	159	143	22	23

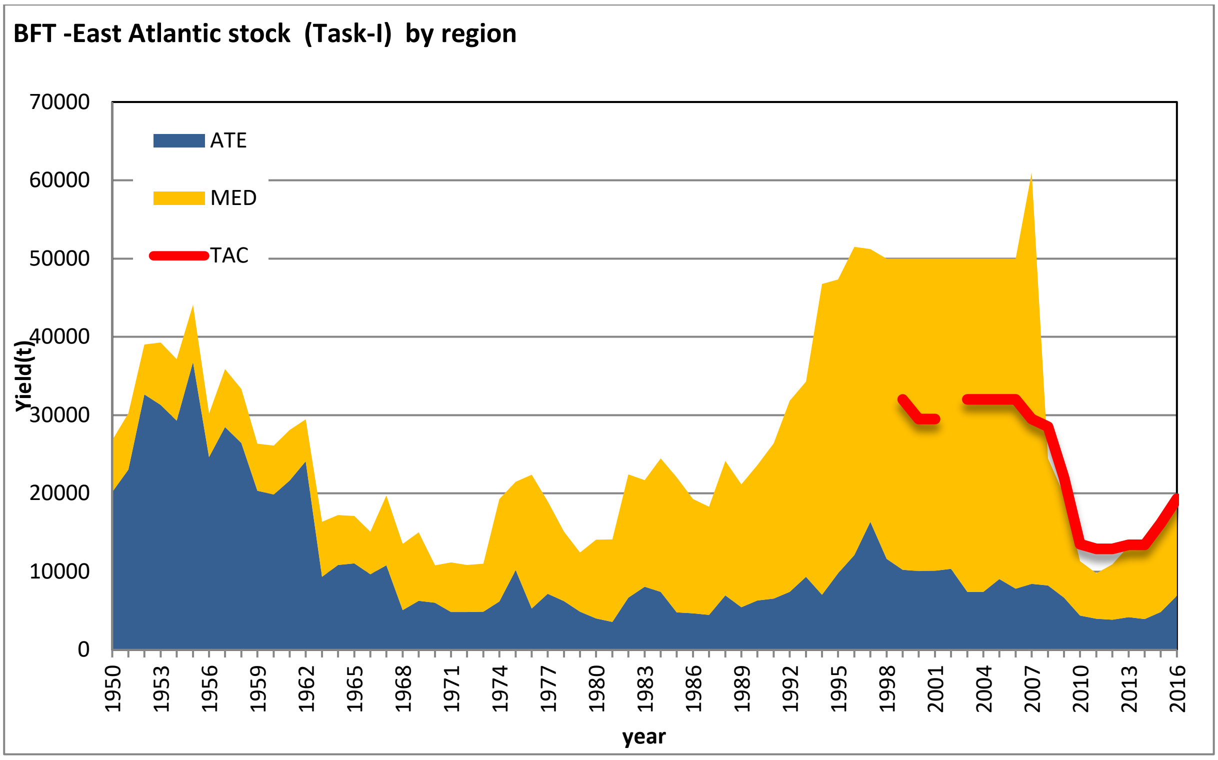
BFTE-Table 1. The probabilities of $F<F_{0.1}$ for quotas from 0 to 50,000 t for 2018 through 2022 under the recent 6 years (2006-2011) recruitment scenario. Shading corresponds to the probabilities of being in the ranges of 50-59%, 60-69%, 70-79%, 80-89% and greater or equal to 90%. Catches for 2016 and 2017 are assumed to be equal to the 2016 and 2017 TAC in all scenarios.

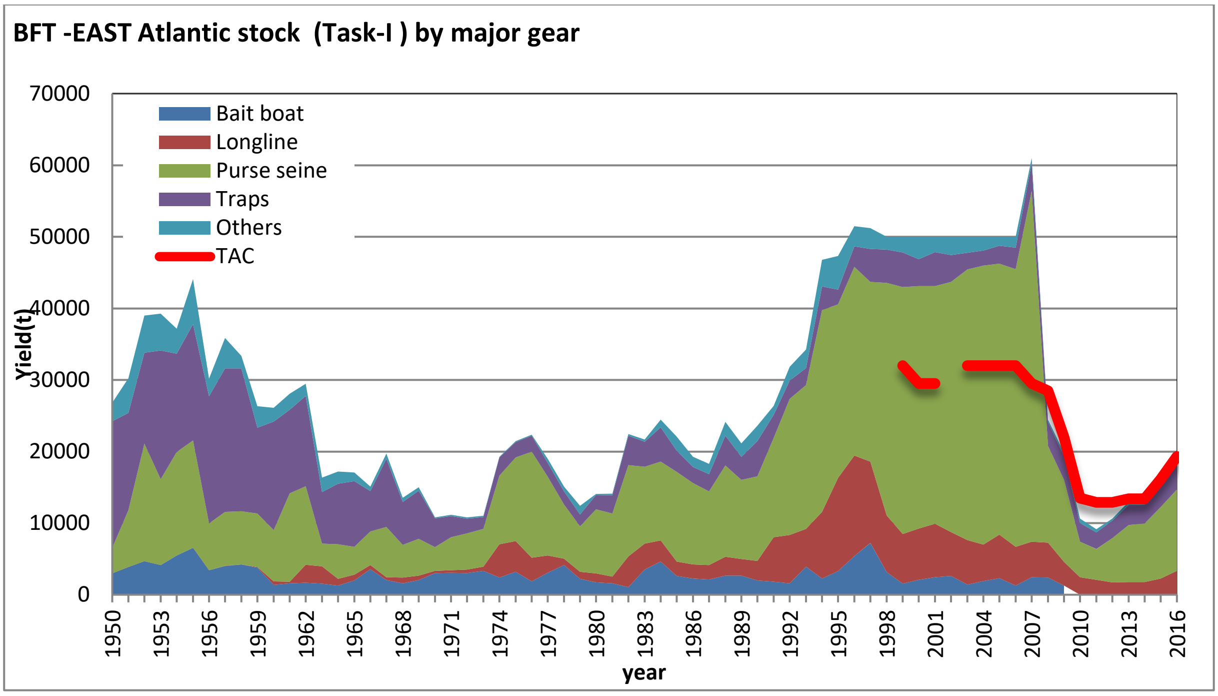
TAC (mt)	2018	2019	2020	2021	2022
18000	100	100	100	100	100
20000	99	99	99	99	99
22000	99	99	98	98	98
23655	98	98	98	98	98
24000	98	98	97	98	97
26000	97	96	96	96	96
28000	95	94	94	94	94
30000	93	92	92	90	89
31000	90	90	89	89	88
32000	89	88	87	86	83
33000	86	85	83	81	80
34000	82	81	79	78	75
35000	79	77	76	72	70
36000	75	73	70	68	64
37000	70	68	65	62	59
38000	65	63	60	57	54
39000	59	57	54	52	49
40000	56	52	49	46	44
45000	36	35	34	30	28
50000	24	22	20	18	18

$P(F < F_{0.1})$ 25 50 75

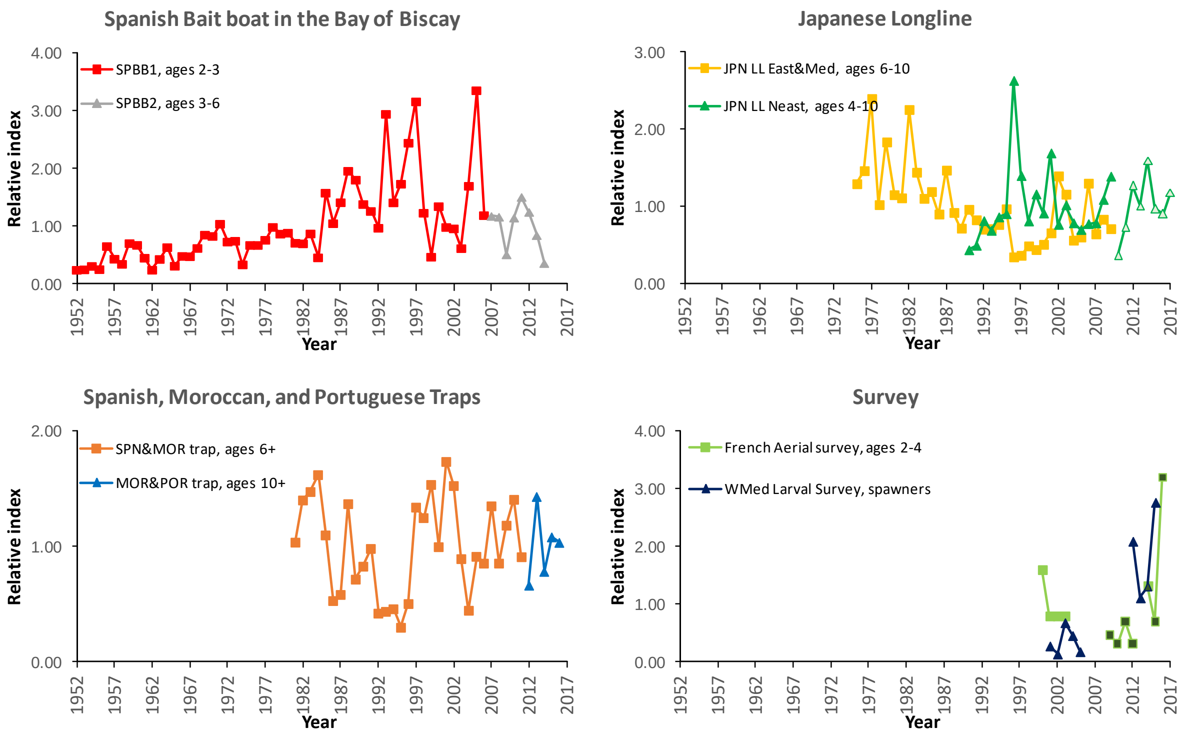


BFT-Figure 1. Geographic distribution of bluefin tuna catches per 5x5 degrees and per main gears from 1960 to 2015 (last decade only covers 6 years).

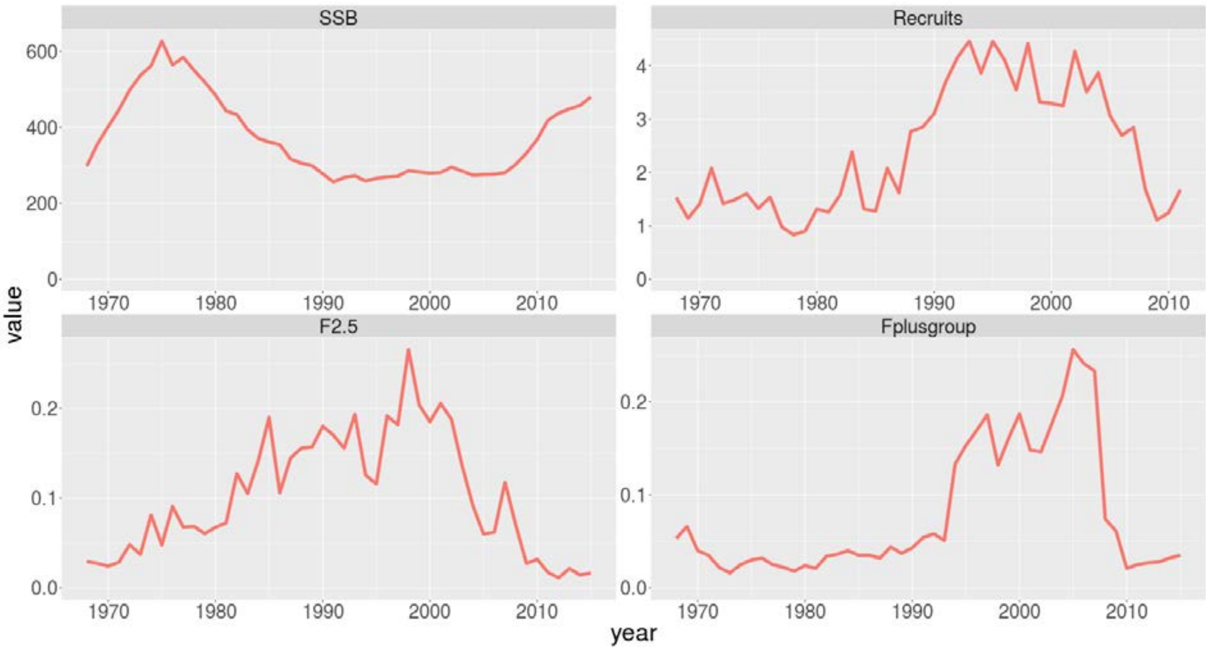




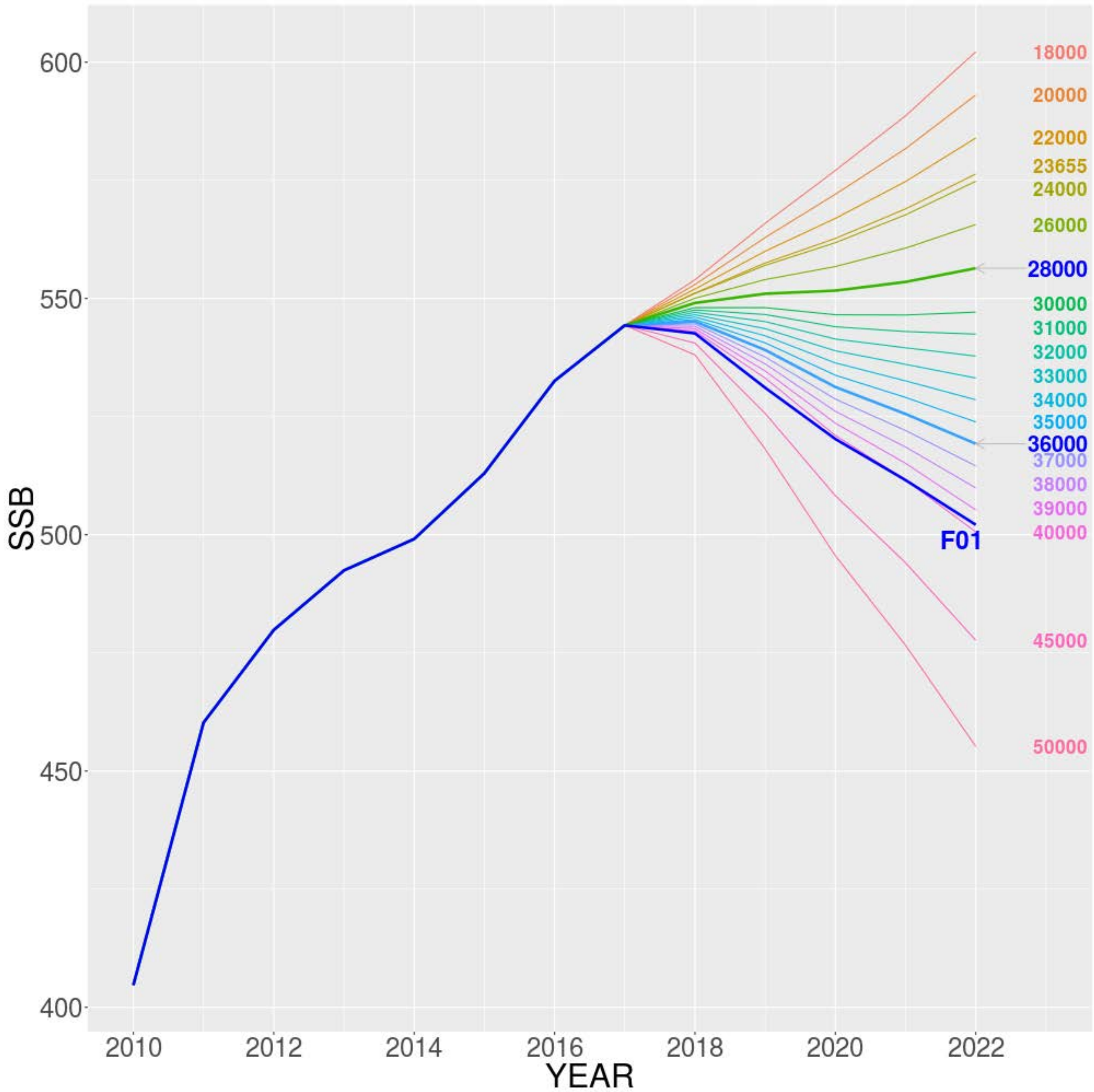
BFTE-Figure 2. Reported catch for the East Atlantic and Mediterranean from Task I data from 1950 to 2016 split by main geographic areas (top panel) and by gears (bottom panel) together with unreported catch estimated by the SCRS (grey shading, using fishing capacity information and mean catch rates over the last decade) from 1998 to 2007 (the SCRS did not detect unreported catch using fishing capacity information since 2008) and TAC levels since 1998.



BFTE-Figure 3. Plots of the updated fishery dependent and independent indicators which used for the 2017 stock assessment 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 has been updated until 2017, and it was split in 2009/2010. Because the Moroccan-Spanish traps CPUE was not be able to be updated, the Moroccan-Portuguese traps CPUE was developed and used for the first time. Two fishery independent indicators were also used for the first time: French aerial and Western Mediterranean larval survey.



BFTE-Figure 4. Spawning stock biomass (in thousand metric ton), recruitment (in million), and fishing mortality (average over ages 2 to 5, and 10+) estimates from VPA base run from the 2017 stock assessment for the period between 1968 and 2015. The last four years recruitments (2012-2015) are not shown because they are poorly estimated.



BFTE-Figure 5. Median trends in the 2017 projections of spawning stock biomass (in 1000 metric t) up to 2022 under the recent 6 years (2006-2011) recruitment scenario with various levels of constant catch starting in 2018, assuming TAC is caught in 2016 and 2017. The TAC values for 2016 (19,296 t) and 2017 (23,655 t) were also used for the projection.

BLUEFIN TUNA - WEST

BFTW-2. Fishery indicators

The total catch for the West Atlantic peaked at 18,608 t in 1964, mostly due to the Japanese longline fishery for large fish off Brazil (that started in 1962) and the U.S. purse seine fishery for juvenile fish (**BFT-Table 1**, **BFTW-Figure 1**). Catches dropped sharply thereafter to slightly above 3,000 t in 1969 with the collapse of the bluefin tuna by-catch longline fishery off Brazil in 1967 and declines in purse seine catches. Catches increased again to average over 5,000 t in the 1970s due to the expansion of the Japanese longline fleet into the northwest Atlantic and Gulf of Mexico and an increase in purse seine effort targeting larger fish for the sashimi market. Catches declined abruptly in 1982 from close to 6,000 t in the late 1970s early 1980s with the imposition of a quota. The total catch for the West Atlantic, including discards, fluctuated without trend after 1982 reaching 3,319 t in 2002 (the highest since 1981, with all three major fishing nations indicating higher catches). Total catch in the West Atlantic subsequently declined steadily to 1,638 t in 2007 and then fluctuated without pronounced trend. The catch in 2014 was 1,626 t, 1,842 t in 2015 and 1,899 t in 2016 (**BFTW-Figure 1**). The decline through 2007 was primarily due to considerable reductions in the catch in U.S. fisheries.

The data preparatory meeting, held in March 2017, decided to use 10 CPUE and two survey indices including a new Gulf of St. Lawrence acoustic survey. The two traditional Canadian CPUE indices for the Gulf of St Lawrence and Southwest Nova Scotia were replaced with a combined index for the two areas. Indices were updated to 2016 (**BFTW-Figure 2**) (and 2017 for the Japanese longline). All updated indices increased in 2016 compared to 2015, some modestly (US RR 66-114cm, US RR >177 and GOM US LL) and others with more pronounced increases (US RR 115-144, JLL, the larval index and the Canadian RR combined). The 2017 index for JLL is slightly lower than 2016.

BFTW-3. State of the stock

The SCRS continues to caution that the conclusions from the latest assessment (2017), using data through 2015, do not capture the full degree of uncertainty in the assessments and projections. The various major contributing factors to these uncertainties include mixing between the stocks, recruitment, age composition, age at maturity, and indices of abundance.

Four stock assessment models were explored for the 2017 western bluefin tuna stock assessment: virtual population analysis (VPA), Stock Synthesis (SS), Age Structured Assessment Programme (ASAP), and Statistical Catch-at-length (SCAL). However, only the results of the former two were considered sufficiently developed to provide advice on stock status. Major revisions to the input data were incorporated into the 2017 stock assessment as agreed at the 2017 data preparatory meeting (Anon., 2017f). Revisions/decisions used across all assessment models include revised natural mortality, growth, two spawning-at-age scenarios, revised total and fleet specific catch-at age (based on new Task I and Task II data and growth), Canadian CPUE indices combined into a single index, Canadian acoustic survey included in the assessment inputs, and the Japanese longline index split into two time series.

All models demonstrated a generally consistent trend in relative abundance during overlapping time periods, however the absolute biomass varied depending upon the model.

Previous stock assessments determined stock status based on MSY-related reference points using two alternative recruitment potential scenarios: a 'low recruitment' scenario and a 'high recruitment' scenario. The 2017 assessments do not provide management advice based on MSY reference points. Instead, the focus is on giving short-term advice based on F reference point ($F_{0.1}$), a proxy for F_{MSY}, using recent recruitment assuming that near term recruitment will be similar to the recent past recruitment.

In addition to the revisions identified above that are common to all models, the starting year for the VPA input was advanced from 1970 in the 2014 assessment to 1974 in the 2017 assessment, due to limited size composition data before 1974. This has had major implications on fitting the stock recruitment relationship because there is no longer sufficient contrast in stock biomass. The Canadian combined RR and the US RR>177 indices were removed from the VPA model because they indicated opposing trends and were believed to be most sensitive to the hypothesis of shifting spatial distribution of fish. The conflicting signals in these and other indicators could be a function of changing oceanographic conditions, as considered in the Stock Synthesis models. VPA runs were made for two spawning fraction scenarios (a young age at spawning, consistent with the eastern stock and older age of spawning with 100% spawning contribution at age 15). Rather than presenting two series of spawning stock biomass (SSB) based on these two spawning fraction scenarios, total biomass is presented here instead.

The total stock biomass estimated by VPA decreased sharply between 1974 and 1981, followed by more than two decades of stability (at about 50% of the 1974 biomass) across the turn of the century, and then by a gradual increase since 2004 to 69% of the 1974 biomass in 2015. Recruitment was high in the early 1970s, but subsequently fluctuated around a lower average until 2003 when there was a strong year class. Recruitment has shown a downward trend since.

Using $F_{0.1}$ as a proxy for F_{MSY}, current F estimated from the VPA relative to the $F_{0.1}$ reference point was 0.72, indicating that overfishing is not occurring.

The base Stock Synthesis (SS) model was fit to the agreed eleven indices and for the young age and older age spawning scenarios. Differences from the VPA included the extended time series going back to 1950, incorporation of length and age composition information and estimation of growth parameters. The SS model also considered a hypothesis that the divergent patterns between the Canadian GSL-SWNS and GSL-Acoustic indices and the US RR>177 index were due to changes in availability of fish due to variable oceanographic conditions. This was done by directly incorporating the Atlantic Multidecadal Oscillation (AMO), an index of cyclical sea surface temperature, into the model to reconcile the conflicting signals from these indices.

SS gives a longer time series view of the population, capturing the higher recruitments estimated in the 1960s. In the recent time period, mean recruitment is similar to the VPA but the magnitude of the 1994 and 2003 year classes are estimated to be larger, resulting in lower fishing mortality and higher total biomass than in the VPA (**Figures-BFTW 3** and **BFTW 4**). Total biomass in 2015 was 18% of biomass in 1950 and 45% of biomass in 1974.

Under an $F_{0.1}$ strategy for the younger and older spawning fraction scenarios $F_{current}/F_{0.1}$ was 0.56 for both scenarios indicating that overfishing is not occurring for this stock.

In 2017, the Committee explored the implications of stock mixing using two approaches. The first approach revised the catches and stock size indices of eastern and western fisheries to eastern and western populations-of-origin based on time varying stock composition estimates. VPA models were then applied to the revised data for western-origin fish and eastern-origin fish separately. Trends in stock size and fishing mortality from the population-of-origin VPAs were generally similar to those of the original VPAs of mixed stocks, but the western VPA was more sensitive to stock mixing than the eastern VPA.

The second approach used a mixed VPA that assumed that the proportion of the stocks that move from one area to the other is constant in time and space. The trends for the western stock were similar in the stock of origin VPA to the runs without mixing; however, the mixed VPA indicated that some of the recent increase in biomass in the West Atlantic may be attributed to immigration of eastern origin fish.

Biomass estimates were more sensitive to stock composition data than to conventional tagging data. However, both data sets have limited spatial and temporal coverage and do not represent random samples of the overall population. The Committee noted that further work is needed to validate the methods and collect more representative data before these approaches can be used for quantitative scientific advice.

Summary

Two stock assessment platforms (VPA and SS) were considered sufficiently advanced at the conclusion of the assessment meeting to be considered as the basis for management advice for the western stock. Two other models (ASAP and SCAL), as well as the mixing analyses provided useful insights. Both VPA and SS showed good fits to the data and stable model performance. Those results were equally weighted to formulate advice. Both models estimated with a high probability that overfishing is not occurring. The SS biomass estimates suggest that historical biomasses were considerably higher than current ones (**BFTW-Figure 4**).

As indicated above, management advice is not based on MSY reference points because of continued uncertainty about spawning biomass and recruitment potential. Instead it is based on fishing mortality reference points to project short term yield based on recent recruitment as opposed to a stock recruitment assumption. $F_{0.1}$ was considered a reasonable proxy for F_{MSY}, although it can be higher or lower than F_{MSY} depending on the stock recruitment relationship, which in this case is poorly determined.

BFTW-4. Outlook

The current fishing mortality (F=0.05) is below the $F_{0.1}$ reference point ($F_{0.1}$= 0.09). $F_{current}/F_{0.1}$ for the combined VPA and SS results is 0.59.

The 2017 short term-projections (2018-2020) were based on the average recruitment during 2007-2012 for both the VPA and the SS models. Fishing at $F_{0.1}$ in 2018 to 2020 implies increased catches in 2018 (2,691 t) followed by decreases in 2019 (2,568 t) and 2020 (2,446 t). The decreases in biomass are predicted due to the 2003 year-class having passed its peak biomass and below average recruitment in recent years. The expected changes in biomass under constant catch scenarios and one constant $F_{0.1}$ scenario are shown in **BFTW-Table 3** and **BFTW-Figure 5**. It should be noted that biomass is expected to decline for catches greater than 1,000 t.

The Committee reiterates that the effects of mixing and management measures on the eastern stock remains a considerable source of uncertainty for the outlook of the western stock.

BFTW-5. Effect of current regulations

The Committee noted that Recommendations 08-04, 10-03, 12-02 and 14-05 were expected to result in a rebuilding of the stock towards the Convention objective. The 2017 assessment estimated that the biomass has increased during 2004 to 2015. As biomass based reference points are not used in formulating 2017 advice, the Committee did not evaluate if the rebuilding objectives were met.

BFTW-6. Management recommendations

In 1998, the Commission initiated a 20-year rebuilding plan designed to achieve SSB_{MSY} with at least 50% probability. In response to recent assessments, the Commission recommended a total allowable catch (TAC) of 1,900 t in 2009, 1,800 t in 2010 (Rec. 08-04), 1,750 t in 2011, 2012, 2013 and 2014 (Rec. 10-03, Rec. 12-02, Rec. 13-09) and 2,000 t in 2015 to 2017 (Rec. 14-05, Rec 16-08). As indicated above, the Committee is not using biomass based reference points in formulating 2017 advice. Instead, $F_{0.1}$ is used as a proxy for F_{MSY} to provide the TAC recommendations.

The 2017 assessment indicated similar historical trends in abundance as in previous assessments, with a general increase in recent years (since 2004). The strong 2003 year class and recent reduction in fishing mortality have contributed to this increase in recent years. However, the 2003 year-class is past its peak biomass, recruitment has been declining for a number of years and there are no signs of a strong year class coming into the fishery.

The Committee is not evaluating if the stock is rebuilt because it has been unable to resolve the long term recruitment potential. If an $F_{0.1}$ strategy were to continue to be applied, over the longer term the resource would fluctuate around the true, but unknown value of $B_{0.1}$ whatever the future recruitment level. The $F_{0.1}$ strategy compensates for the effect of recruitment changes on biomass by allowing higher catches when recent recruitment is higher, and reducing catches when recent recruitments are lower. Under this strategy, biomass may decrease at times because the stock is above $B_{0.1}$ or following lower recruitments.

The Committee advises that constant catches over 2018-2020 should not be greater than 2500 t as that would exceed the median yield associated with $F_{0.1}$. The probability of avoiding overfishing ($F<F_{0.1}$) associated with various constant catch strategies are shown in **BFTW-Table 2**. The Committee notes that nearly all constant catch options shown (i.e., greater than 1,000 t) will result in an estimated decrease in biomass between 2018 and 2020; the percentage decrease being larger for the larger catches (**BFTW-Table 3**).

SUMMARY TABLE

Estimated recent fishing mortality rate (geometric mean of apical F for the period 2012 to 2014) relative to the F reference point, $F_{0.1}$ (a proxy for F_{MSY} based on recent recruitment estimates for the period 2007 to 2012). An 80% confidence interval of estimated Fs and projected catches are shown in parentheses.

SUMMARY TABLE	
Current Catch including discards (2016)	1,899*
$F_{current}$ (2012-2014)	0.05 (0.04-0.10)
$F_{0.1}$	0.09 (0.08-0.12)
Ratio of recent F to $F_{0.1}$	0.59 (0.44-0.79)
Estimated probability of overfishing	0.002
Stock status	Overfishing : No Overfished : 1
Projected Catch in 2018 at $F_{0.1}$	2,691 t (2,098-3,183)
Projected Catch in 2019 at $F_{0.1}$	2,568 t (2,010-3,020)
Projected Catch in 2020 at $F_{0.1}$	2,446 t (1,922-2,872)
Management Measures:	[Rec. 10-03, 12-02, 13-09] TAC of 1,750 t in 2011-2014, including dead discards.
	[Rec. 14-05] TAC of 2,000 t in 2015-2016, including dead discards.
	[Rec. 16-08] TAC of 2,000 t in 2017, including dead discards.

* As of 29 September 2017.

1Biomass reference points were not estimated due to uncertainty in recruitment potential.

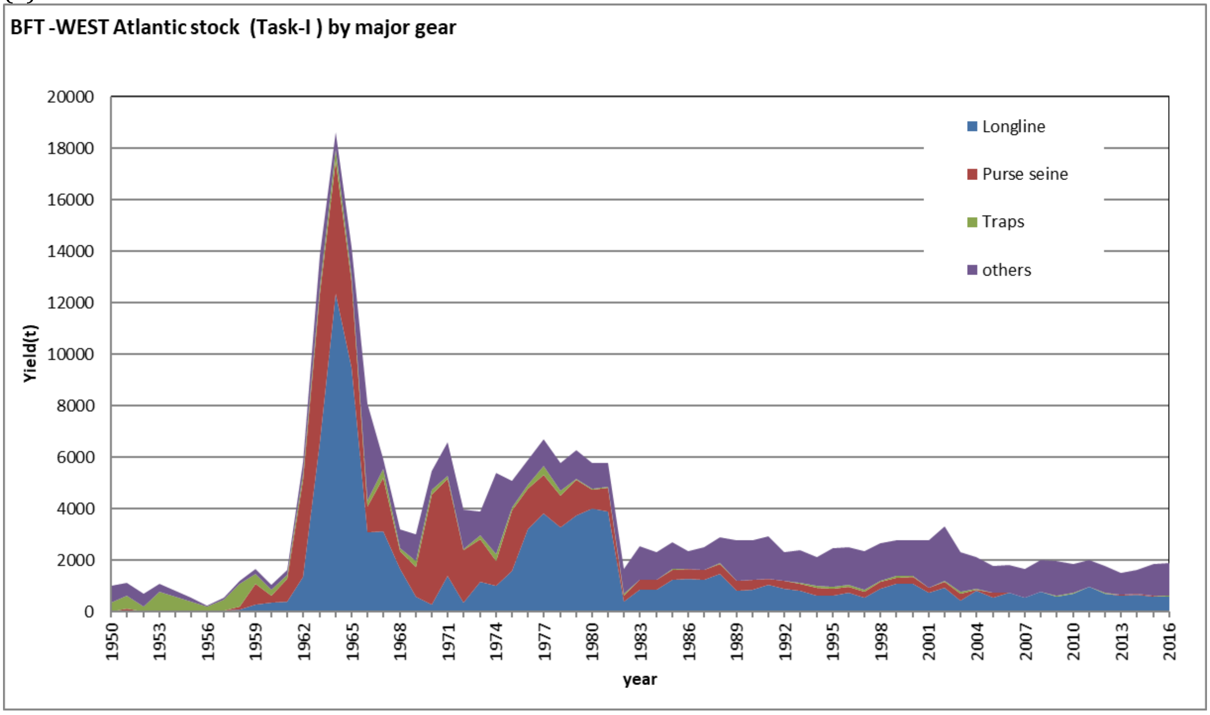
BFTW-Table 2. Kobe II matrix giving the probability that the fishing mortality rate (F) will be less than the F reference point ($F \leq F_{0.1}$, overfishing not occurring) over the next 3 years for alternative constant catches, based on results from VPA and SS combined.

Catch	2018	2019	2020
1000	100%	100%	100%
1250	100%	100%	100%
1500	100%	100%	100%
1750	99%	98%	96%
2000	94%	90%	87%
2250	83%	80%	76%
2500	72%	69%	65%
2750	62%	54%	46%
3000	46%	33%	21%
3250	26%	15%	7%

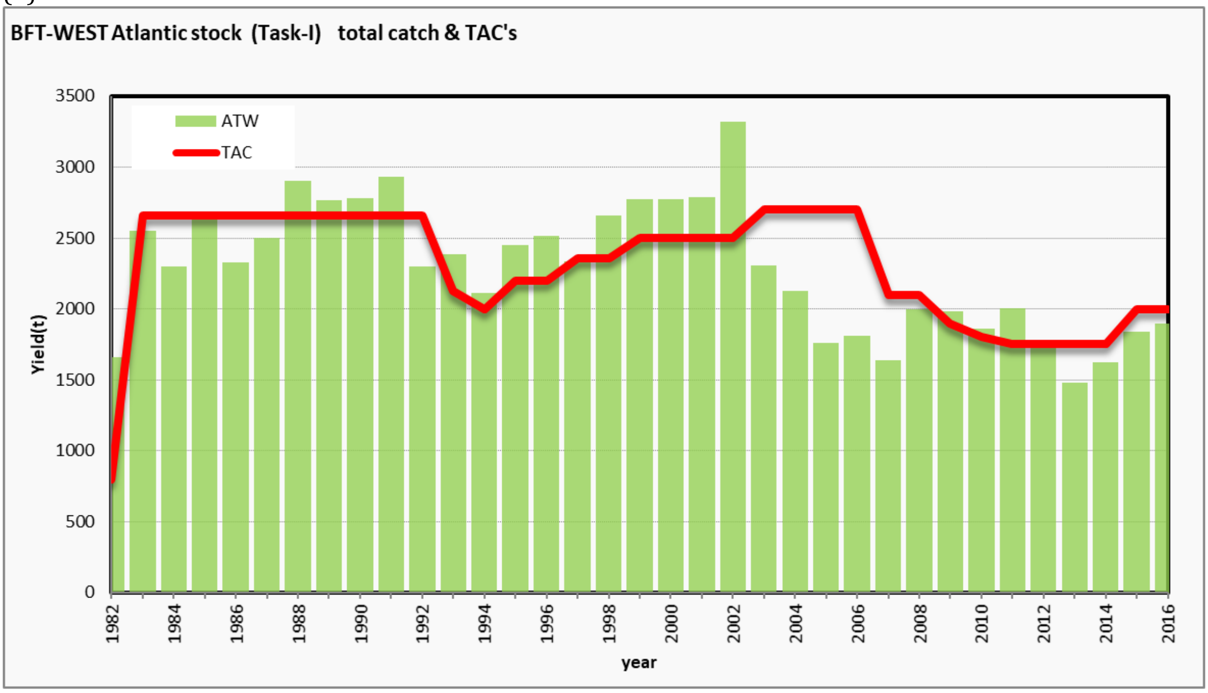
BFTW-Table 3. Relative change in total stock biomass relative to 2017 under alternative constant catch scenarios.

Catch	2018	2019	2020
1000	-0.7%	-0.3%	0.4%
1250	-0.8%	-1.0%	-1.1%
1500	-0.9%	-1.8%	-2.6%
1750	-1.2%	-2.5%	-4.1%
2000	-1.5%	-3.3%	-5.6%
2250	-1.7%	-4.0%	-7.2%
2500	-1.7%	-4.8%	-8.7%
2750	-1.7%	-5.5%	-10.1%
3000	-1.7%	-6.2%	-11.5%
3250	-1.8%	-7.0%	-13.0%
F0.1	-1.7%	-5.0%	-9.0%

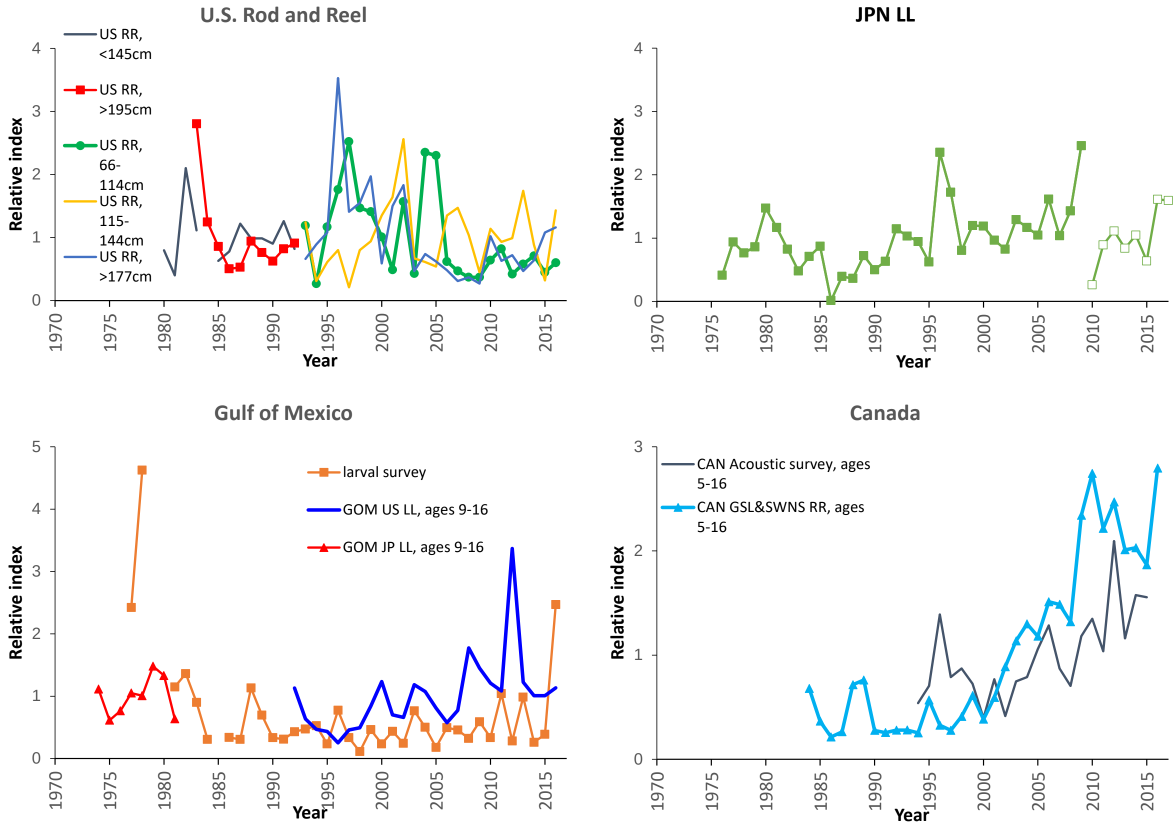
(a)



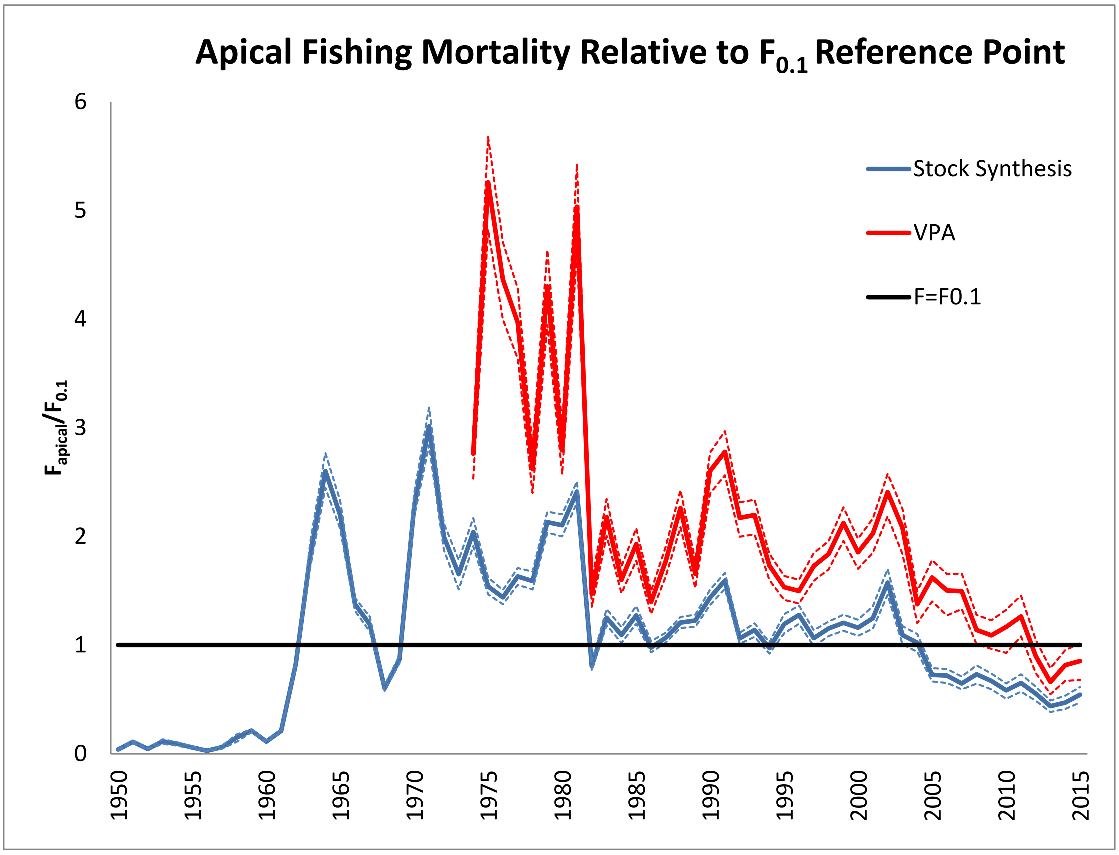
(b)



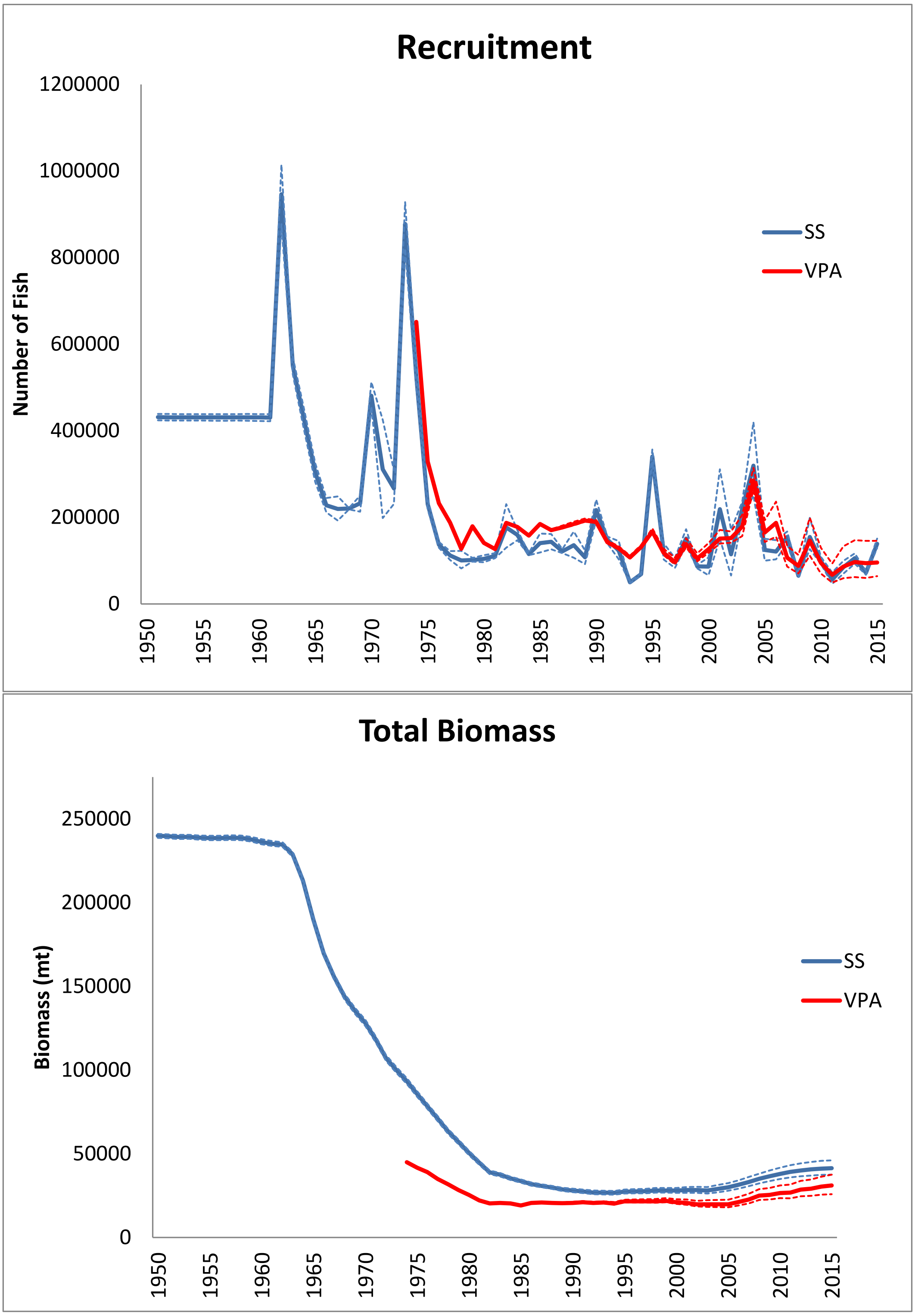
BFTW-Figure 1. Historical catches of western bluefin tuna: (a) by gear type and (b) in comparison to TAC levels agreed by the Commission.



BFTW-Figure 2. Indices of relative abundance for western bluefin tuna.

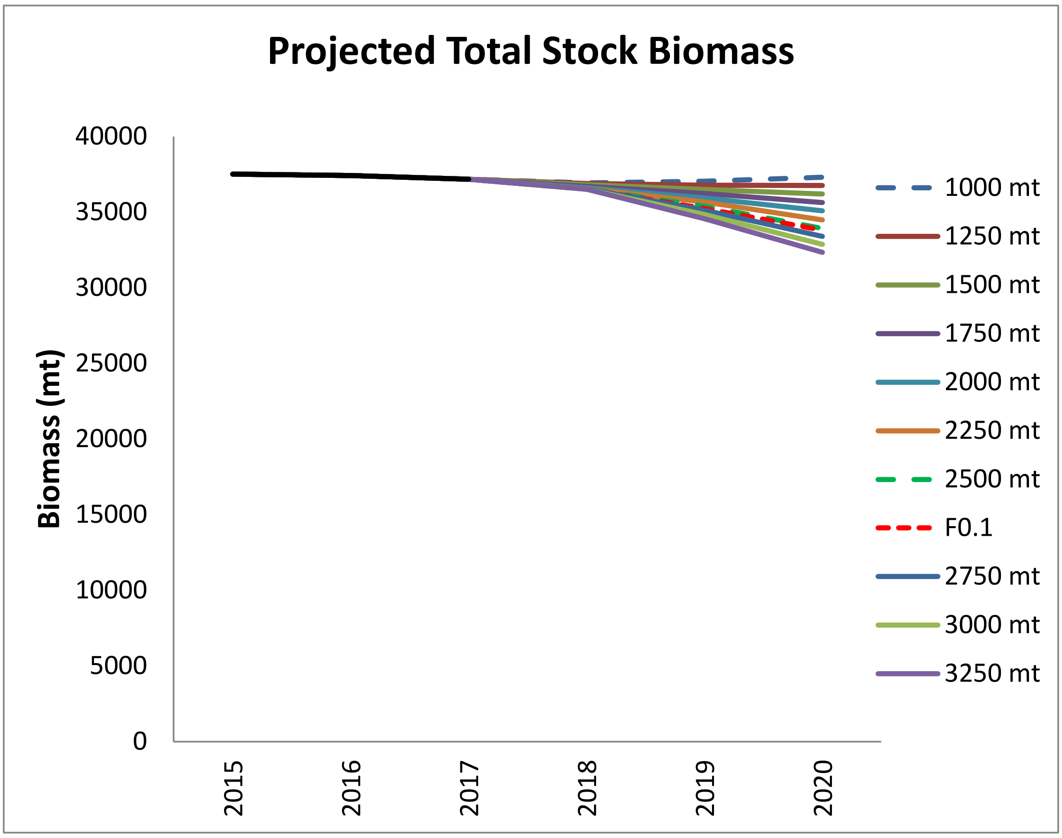


BFTW-Figure 3. Estimated fishing mortality relative to the $F_{0.1}$ reference point estimated by VPA (red) and SS (blue). The 80% confidence intervals are indicated with dashed lines.

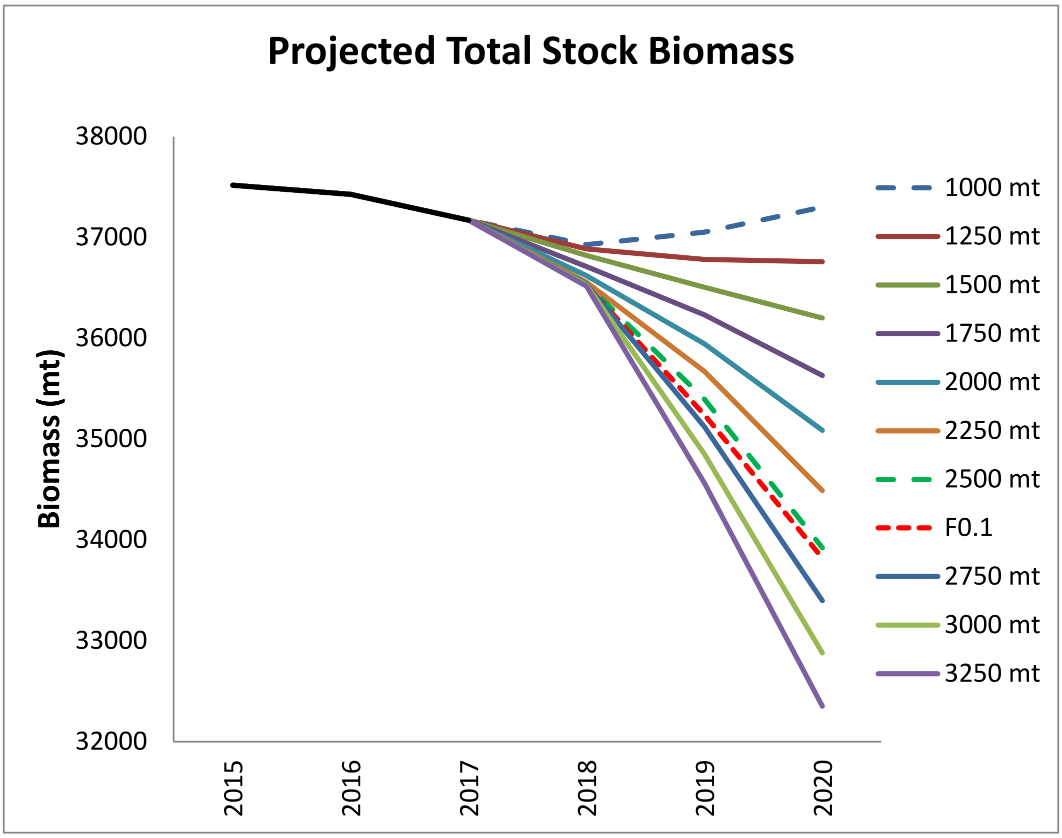


BFTW-Figure 4. Median estimates of recruitment and total stock biomass for the base VPA (red) and SS (blue) models. The 80% confidence intervals are indicated with dashed lines. The recruitment estimates for the last three years of the VPA are considered unreliable and have been replaced by the average estimates from 2007 to 2012.

a)



b)



BFTW-Figure 5. Projected total stock biomass under alternative constant catch scenarios and a constant F scenario (F=$F_{0.1}$) for the base VPA and SS model results combined; a) showing full range on y-axis, and b) y-axis shown from 32,000 to 38,000 t.

8.6 BUM – BLUE MARLIN

The most recent assessment for blue marlin was conducted in 2011 through a process that included a data preparatory meeting in May 2010 (Anon., 2011) and an assessment meeting in April 2011 (Anon., 2012). The last year of fishery data used in the assessment was 2009.

BUM-1. Biology

The central and northern Caribbean Sea and northern Bahamas have historically been known as the primary spawning area for blue marlin in the western North Atlantic. Recent reports show that blue marlin spawning can also occur north of the Bahamas in an offshore area near Bermuda at about 32º-34º N. Ovaries of female blue marlin caught by artisanal vessel in Côte d'Ivoire show evidence of pre-spawning and post-spawning, but not of spawning. In this area females are more abundant than males (4:1 female/male ratio). Coastal areas off West Africa have strong seasonal upwelling, and may be feeding areas for blue marlin.

Atlantic blue marlin inhabit the upper parts of the open ocean. Blue marlin spend the majority of their time in the mixed surface layer (58% of daylight and 84% of nighttime hours), however, they regularly make short-duration dives to maximum depths of around 300 m, with some vertical excursions down to 800 m. They do not confine themselves to a narrow range of temperatures but most tend to be found in waters warmer than 17°C. The distribution of time at depth is significantly different between day and night. At night, the fish spent most of their time at or very close to the surface. During daylight hours, they are typically below the surface, often at 40 to 100+ m. These patterns, however, can be highly variable between individuals and also vary depending on the temperature and dissolved oxygen of the surface mixed layer. This variability in the use of habitat by blue marlin indicates that simplistic assumptions about habitat usage made during the standardization of CPUE data may be inappropriate.

BUM-2. Fishery indicators

The decadal geographic distribution of the catches is given in **BUM-Figure 1**. The Committee used Task I catches as the basis for the estimation of total removals (**BUM-Figure 2**). Total removals for the period 1990-2009 were obtained during the 2011 Blue Marlin Stock Assessment and the White Marlin Data Preparatory Meeting by modifying Task I values with the addition of blue marlin that the Committee estimated from catches reported as billfish unclassified. Additionally the reporting gaps were filled with estimated values for some fleets.

During the 2011 blue marlin assessment it was noted that catches continued to decline through 2009. Over the last 20 years, Antillean artisanal fleets have increased the use of Moored Fish Aggregating Devices (MFADs) to capture pelagic fish. Catches of blue marlin caught around MFADs are known to be significant and increasing in some areas, however reports to ICCAT on these catches are incomplete. Although historical catches from some Antillean artisanal fleets have been recently included in Task I there still an unknown number of Antillean artisanal fleets that may have unreported catches of blue marlin caught around MFADs. It is important that the amount of these catches be documented. Recent reports from purse seine fleets in West Africa suggest that blue marlin is more commonly caught with tuna schools associated with FADs than with free tuna schools. Preliminary Task I catches of blue marlin (**BUM-Table 1**) in 2016 were 1,295 t, compared to 1,569 t reported for 2015. Due to the work conducted by the Committee and improved reporting by CPCs the amount of unclassified billfish in the Task I table has been reduced.

A number of relative abundance indices were estimated during the blue marlin 2011 assessment. However, given the apparent shift in landings from industrial to non-industrial fleets in recent times, it is imperative that CPUE indices are developed for all fleets that have substantial landings.

During the 2011 assessment, an estimated standardized combined CPUE index for blue marlin showed a sharp decline during the period 1960-1975, followed by a period of stabilization from about 1976 to 1995, and further decline thereafter to the lowest value in the series (**BUM-Figure 3**).

BUM-3. State of the stocks

Unlike the partial assessment of 2006, the Committee conducted a full assessment in 2011, which included estimations of management benchmarks. The results of the 2011 assessment indicated that the stock remains overfished and undergoing overfishing (**BUM-Figure 4**). In contrast to the results of the 2006 assessment, which indicate that, the declining trend in biomass had partially stabilized, current results indicated a continued decline trend. Current status of the blue marlin stock is presented in **BUM Figure 5.** However, the Committee recognizes the high uncertainty with regard to data and the productivity of the stock.

BUM-4. Outlook

Although uncertain, the results of the 2011 stock assessment indicated that if the recent catch levels of blue marlin (3,358 t in 2010, as in the time of the stock assessment) are not substantially reduced, the stock will continue to decline further (**BUM-Figure 6; BUM-Table 2**). The current management plan has the potential of recovering the blue marlin stock to the B_{MSY} level if properly conducted.

BUM-5. Effect of current regulations

A 2006 recommendation (Rec. 06-09) established that the annual amount harvested by pelagic longline and purse seine vessels and retained for landing must be no more than 33% for white marlin and 50% for blue marlin of the 1996 or 1999 landing levels, whichever is greater. Furthermore, in 2012, the Commission established a TAC for 2013, 2014, and 2015 of 2,000 t (Rec. 12-04), placed additional catch and commerce restrictions in recreational fisheries for blue marlin and white marlin, and requested methods for estimating live and dead discards of blue marlin and white marlin/spearfish. In 2015, the Commission further strengthened the plan to rebuild blue marlin stock by extending for 2016, 2017, and 2018 the annual limit of 2,000 t for blue marlin (Rec. 15-05).

The Committee is concerned with the significant increase in the contribution from non-industrial fisheries to the total blue marlin harvest and that these fisheries are not fully accounted for in the current ICCAT database. The Committee expressed its serious concern over this limitation on data for future assessments. Such data limitation precludes any analysis of the current regulations.

Currently, four ICCAT Contracting Parties (Brazil, Canada, Mexico, and the United States) mandate or encourage the use of circle hooks on their pelagic longline fleets. Recent research has demonstrated that in some longline fisheries the use of non-offset circle hooks resulted in a reduction of billfish mortality, while the catch rates of several of the target species remained the same or were greater than the catch rates observed with the use of conventional J hooks or offset circle hooks.

More countries have started reporting data on live releases since 2006. Additional information has come about, for some fleets, regarding the potential for modifying gears to reduce the by-catch and increase the survival of marlins. Such studies have also provided information on the rates of live releases for those fleets. However there is not enough information on the proportion of fish being released alive for all fleets, to evaluate the effectiveness of the ICCAT recommendation relating to the live release of marlins.

BUM-6. Management recommendations

In 2012, the Commission implemented Rec. 12-04, intended to reduce the total harvest to 2,000 t in 2013, 2014, and 2015 to allow the rebuilding of the blue marlin stock from the overfished condition. In 2015, the Commission extended the 2,000 t annual catch limit to 2016, 2017, and 2018 (Rec. 15-05). The Committee expressed its concern on the effectiveness of such measure in light of severe under reporting currently occurring in some fisheries. Therefore, the Committee alerts the Commission that unless such non-compliance issues are properly addressed the adoption of additional measures might be rendered ineffective.

ATLANTIC BLUE MARLIN SUMMARY

Maximum Sustainable Yield	2,837 t (2,343 – 3,331 t)[1]
Current (2016) Yield	1,295 t[2]
Relative Biomass (SSB_{2009}/SSB_{MSY})	0.67 (0.53 – 0.81)[1]
Relative Fishing Mortality (F_{2009}/F_{MSY})	1.63 (1.11 – 2.16)[1]
Stock Status (2009)	Overfished: Yes Overfishing: Yes
Conservation and Management Measures in Effect:	Recommendation [Rec. 15-05]. Reduce the total harvest to 2,000 t in 2016, 2017, and 2018.

[1] Stock Synthesis version 3.2.0.b model results. Values correspond to median estimates, 95% confidence interval values are provided in parenthesis.
[2] 2016 yield should be considered provisional.

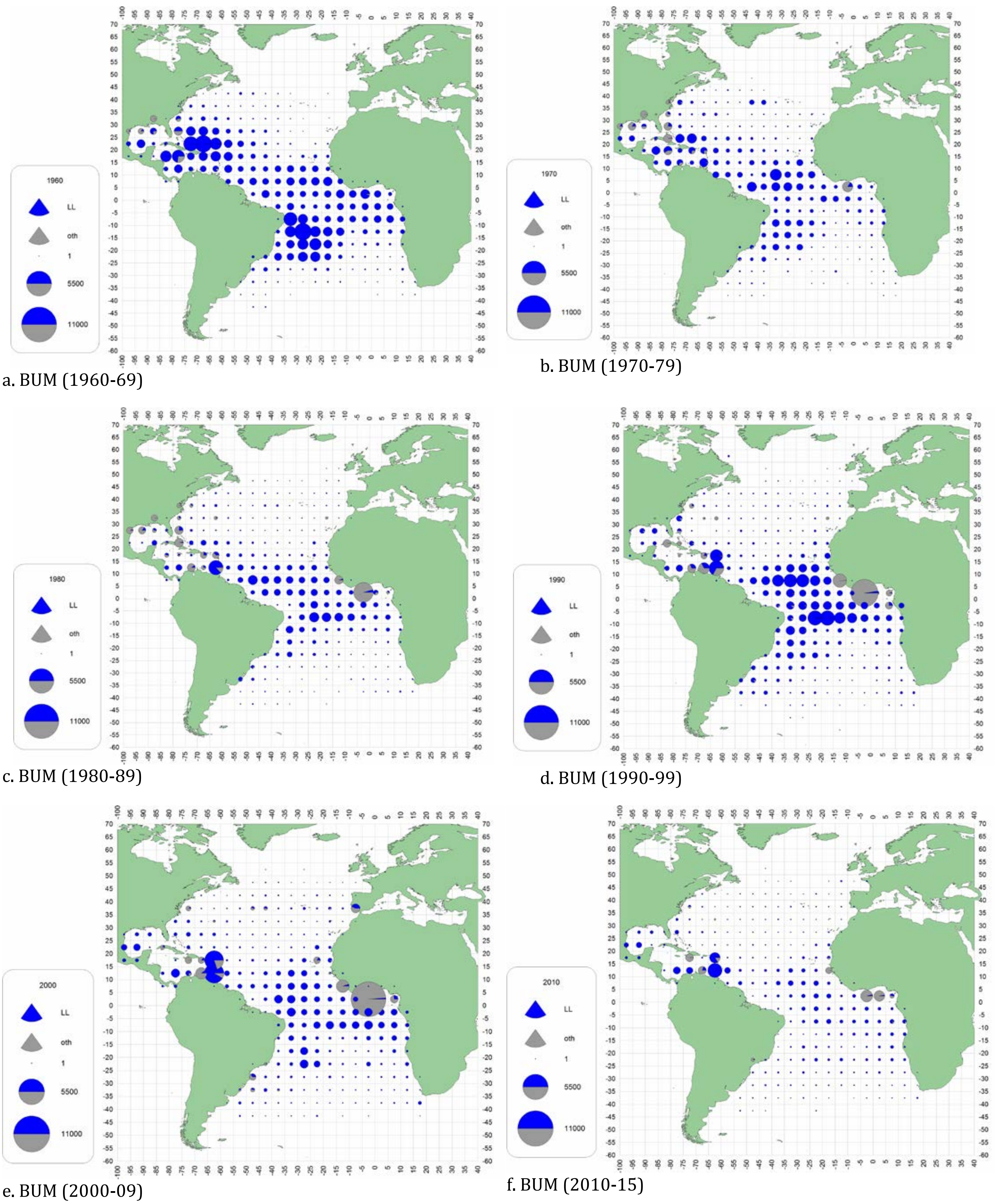
BUM-Table 1. Estimated catches (t) of Atlantic blue marlin (Makaira nigricans) by area, gear and flag.

			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
TOTAL	A+M		3144	3235	4319	4270	5462	5800	5812	5476	5395	4458	3745	4356	2872	3319	2989	3994	4508	3510	3223	2324	2190	1325	1807	1569	1295
Landings		Longline	2232	2223	3047	2877	3796	4269	3723	3445	3161	2398	1832	2245	1894	2063	1829	2477	2557	2309	2050	1579	1466	879	1195	1288	895
		Other surf.	675	770	1041	1165	1403	1303	1981	1910	2138	1939	1774	2069	912	1212	1057	1346	1712	1063	1038	554	465	350	491	187	336
		Sport (HL+RR)	90	114	120	75	66	88	56	38	36	97	90	22	31	20	63	129	200	95	116	135	187	41	67	13	39
Discards		Longline	146	127	111	153	197	139	51	83	60	22	37	19	34	24	38	42	37	40	19	56	70	55	54	82	24
		Other surf.	0	0	0	0	0	0	1	0	0	2	11	0	1	1	0	0	1	2	0	0	1	0	0	0	
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	11	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
		Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	3	6	47	19	8	5	13
		Brazil	125	147	81	180	331	193	486	509	467	780	387	577	195	612	298	262	182	150	133	63	48	17	20	1	
		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
		China PR	0	0	62	73	62	78	120	201	23	92	88	89	58	96	0	65	13	77	100	99	61	45	40	44	50
		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**
		Côte d'Ivoire	79	139	212	177	157	222	182	275	206	196	78	109	115	107	178	150	991	463	450	42	23	26	44	30	51
		EU.España	47	44	55	40	158	122	195	125	140	94	28	12	51	24	91	38	55	60	165	16	34	44	137	212	140
		EU.France	115	179	191	197	252	299	333	370	397	428	443	443	450	470	470	461	585	498	344	461	395	212	393	406	165
		EU.Portugal	2	15	11	10	7	3	47	8	22	18	8	32	27	48	105	135	158	106	140	54	53	25	23	46	50
		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**
		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	
		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
		Japan	1017	926	1523	1409	1679	1349	1185	790	883	335	267	442	540	442	490	920	1028	822	731	402	430	189	279	288	297
		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
		Liberia	0	0	0	87	148	148	701	420	712	235	158	115	0	0	0	0	0	0	0	0	0	0	0	0	19
		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
		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
		Namibia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	10	0	8	36	8	32
		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**
		Philippines	0	0	0	0	0	0	7	71	38	0	0	0	0	0	0	0	8	0	3	4	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**
		S. Tomé e Príncipe	21	25	28	33	36	35	33	30	32	32	32	32	9	21	26	0	68	70	72	0	0	0	0	11	9
		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
		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
		St. Vincent and Grenadines	1	2	2	2	0	1	0	0	0	0	20	0	0	0	0	1	3	2	1	0	0	2	0	0	
		Trinidad and Tobago	1	2	16	28	14	49	15	20	51	17	16	9	11	7	14	16	34	26	22	25	46	48	48	35	19
		U.S.A.	51	80	88	43	43	46	50	37	24	16	17	19	26	16	17	9	13	6	4	6	14	9	1	9	30
		U.S.S.R.	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	19	11	15	15	15	3	5	1	2	2	2	2	2	2	2	2	2	0	1	2	2	3	3	3	
		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**
		UK.Sta Helena	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	12	2	1	1	0
		UK.Turks and Caicos	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**
		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**
		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**
		Venezuela	67	86	122	117	148	142	226	240	125	84	88	120	101	160	172	222	130	120	151	116	143	111	139	60	83
	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
	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	
		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	

			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
		Dominica	0	0	0	0	0	0	0	0	0	64	69	75	36	44	55	58	106	76	76	60	0	0	0	0	
		Dominican Republic	0	0	0	0	0	41	71	29	19	23	0	207	0	0	0	0	0	0	0	0	0	0	0	0	
		Grenada	52	58	52	50	26	47	60	100	87	104	69	72	45	42	33	49	54	45	45	45	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	
		Mixed flags (FR+ES)	116	146	133	126	96	82	80	83	147	151	131	148	171	150	136	135	139	164	178	49	0	0	0	0	
		NEI (BIL)	38	0	0	0	0	0	0	0	53	184	258	167	89	7	160	209	205	177	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	
		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
		Sta. Lucia	0	0	0	0	0	4	1	0	10	5	0	18	17	21	53	46	70	72	58	64	119	99	111	53	
		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	
		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	
Discards	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	
		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**
		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	
		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
		U.S.A.	146	127	111	153	197	139	52	83	60	25	49	19	35	25	36	42	38	42	19	50	39	55	53	81	24
	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	0	**0**

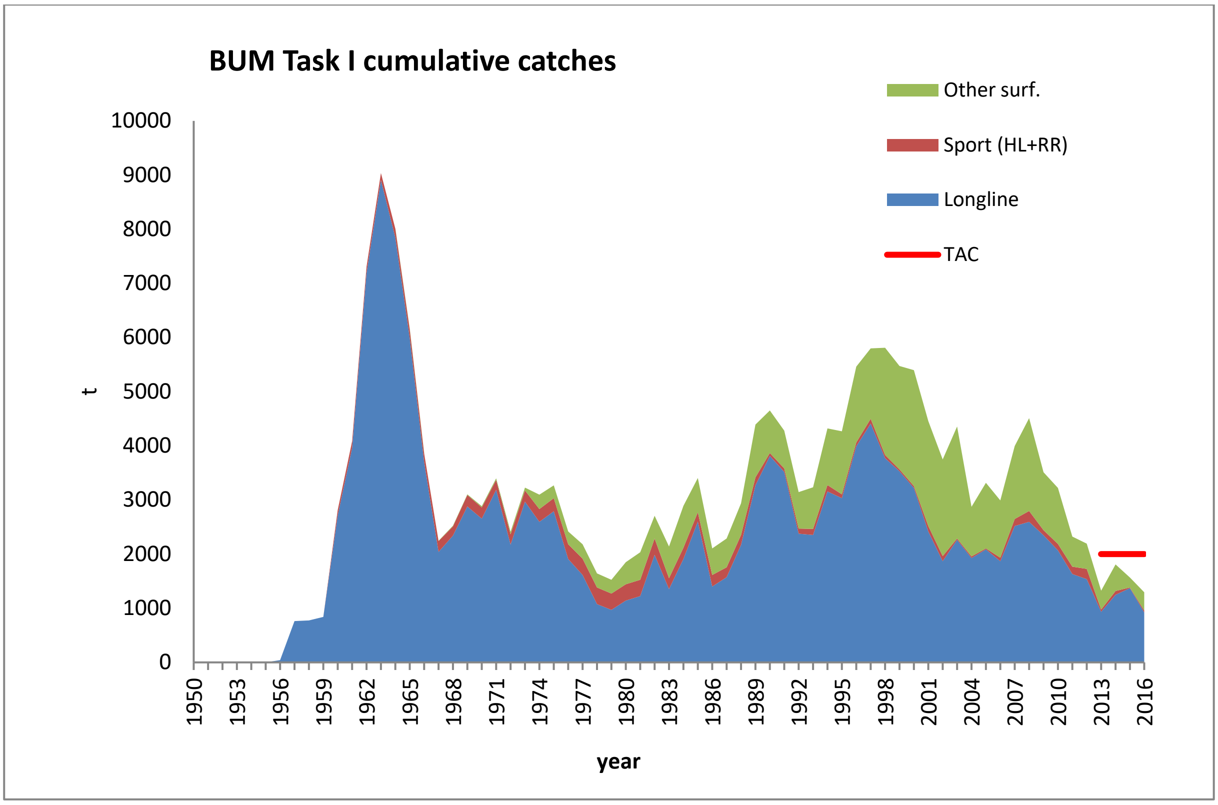
BUM Table 2. Kobe II Strategy Matrix (K2SM). Percent values indicate the probability of achieving the goal of $SSB_{yr} > SSB_{MSY}$ and $F_{yr} < F_{MSY}$ for each year (yr) under different constant catch scenarios (TAC t).

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
0	0	2	9	19	33	49	63	74	81	87	92	94	96	97	98
500	0	2	6	13	23	35	47	58	67	74	80	84	88	91	93
1000	0	1	4	9	15	22	31	40	49	56	63	68	73	77	81
1500	0	1	3	6	9	13	18	24	30	36	41	46	57	55	59
2000	0	1	2	3	5	7	10	12	16	18	21	24	20	29	32
2500	0	1	1	2	3	3	4	5	6	7	8	9	10	11	12
3000	0	0	1	1	1	2	2	2	2	2	3	3	3	3	3
3500	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
4000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

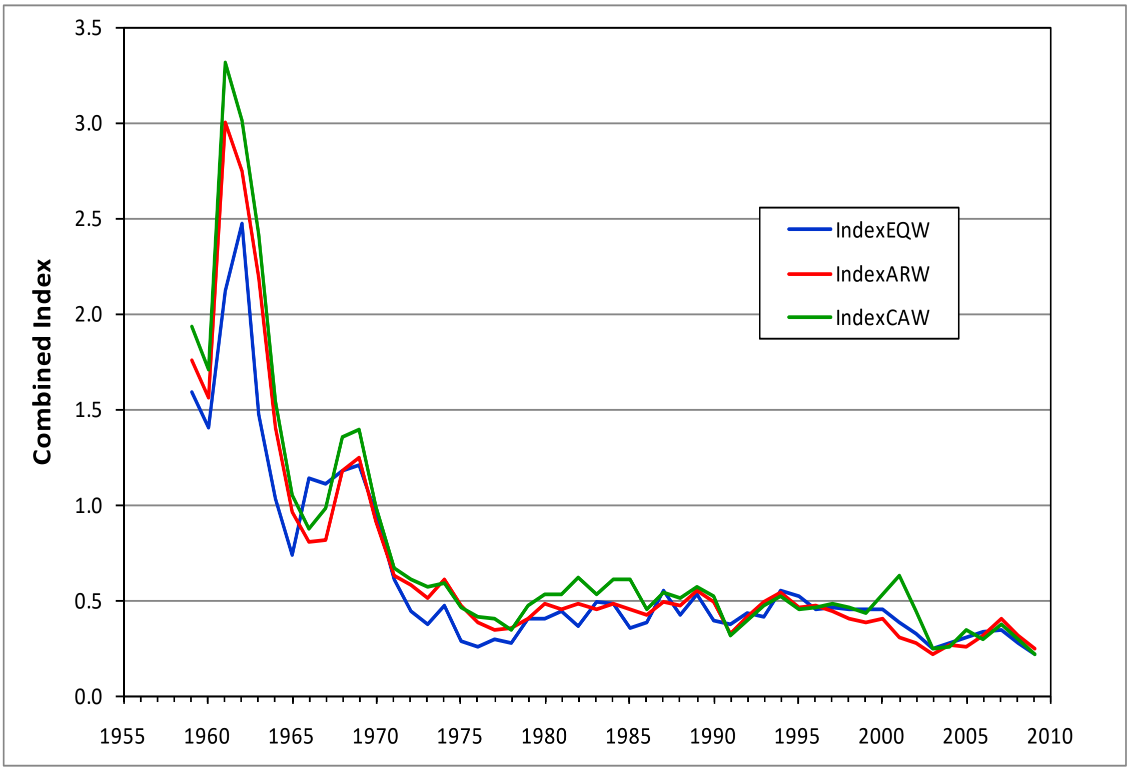


a. BUM (1960-69)
b. BUM (1970-79)
c. BUM (1980-89)
d. BUM (1990-99)
e. BUM (2000-09)
f. BUM (2010-15)

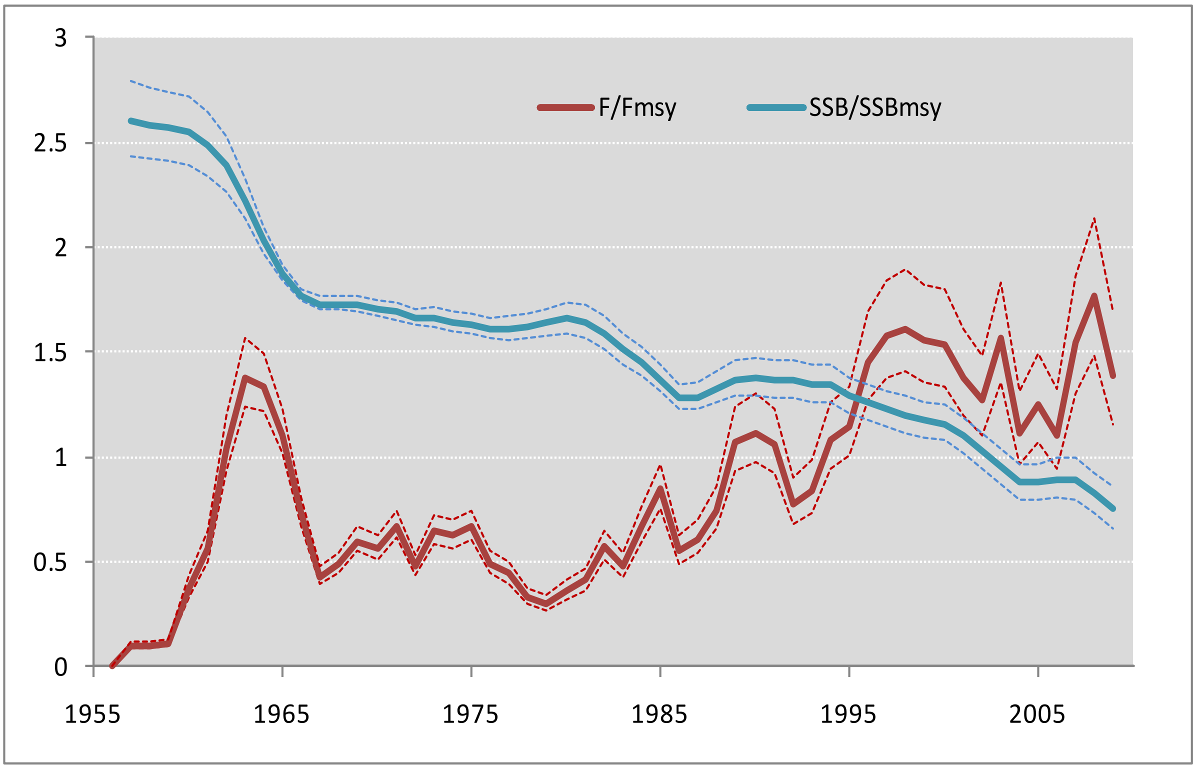
BUM-Figure 1. Geographic distribution of blue marlin total catches by decade (last decade only covers 6 years).



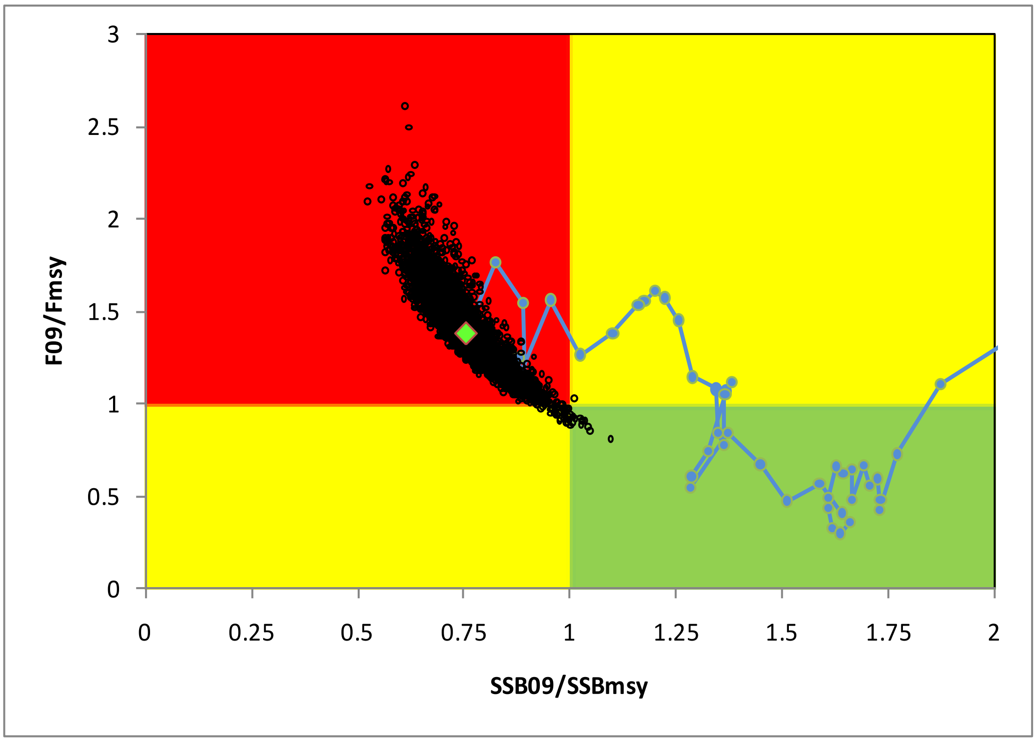
BUM-Figure 2. Total catch of blue marlin reported in Task I for the period 1956-2016.



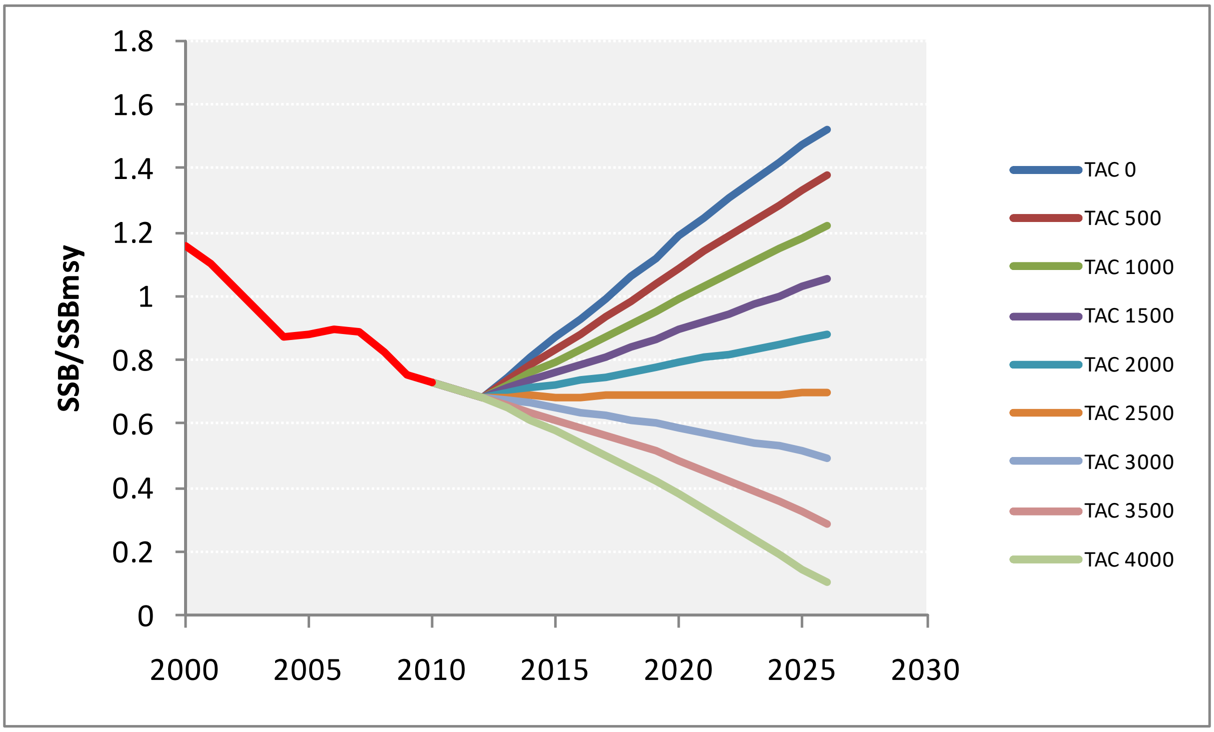
BUM-Figure 3. Blue marlin standardized combined CPUE indices estimated using equal weighting for all CPUE series (EQW), weighting the CPUE series by area (ARW) and by catch (CAW).



BUM-Figure 4. Trends of F/F$_{MSY}$ and SSB/SSB$_{MSY}$ ratios for blue marlin from the base model (SS3). Solid lines represent median from MCMC runs, and broken lines the 10% and 90% percentiles, respectively.



BUM-Figure 5. Phase plot for blue marlin from the base model in final year model assessment (2009). Individual points represent MCMC iterations, large diamond the median of the series. Blue circles with line represent the historic trend of the median F/F$_{MSY}$ vs. SSB/SSB$_{MSY}$ 1965-2008.



BUM-Figure 6. Trends of SSB/SSB_{MSY} ratios under different scenarios of constant catch projections (TAC tons) for blue marlin from the base model. Projections start in 2010; for 2010/11 a catch of 3,341 t was assumed.

8.7 WHM – WHITE MARLIN

The most recent assessment for white marlin was conducted in 2012 through a process that included a data preparatory meeting in April 2011 (Anon., 2012) and an assessment meeting held in May 2012 (Anon., 2013). The last year of fishery data used in the assessment was 2010.

WHM-1. Biology

White marlin spawning areas occur mainly in the tropical western North and South Atlantic, predominantly in the same offshore locations in their normal range. In the North Atlantic, spawning activity has been reported off eastern Florida (USA), the Windward Passage (between La Hispaniola and Cuba), and north of Puerto Rico. Seasonal spawning concentrations have been noted northeast of Hispaniola and Puerto Rico, and off the east coast of Hispaniola. Spawning activity has also been reported for the equatorial Atlantic (5°N-5°S) off northeastern Brazil, and in the South Atlantic off southern Brazil.

Previous reports have mentioned that spawning takes place during austral and boreal spring-summer. In the North Atlantic, reproduction events occur from April to July, with spawning activity peaking around April-May. In the equatorial Atlantic (5°N-5°S), spawning occurs during May to June, and in the South Atlantic, reproduction events take place from December to March.

White marlin inhabits the surface mixed layer of the open ocean. Although they spend about 50% of daylight hours and 81% of nighttime hours in the warmer waters of the mixed surface layer, they do explore temperatures ranging 7.8-29.6°C. However, a negligible amount of time is spent at temperatures less than 7 °C below the mixed surface layer. Information from pop-up satellite archival tag (PSAT) data indicated frequent short-duration dives extending to >300 m depths, although most dives ranged from 100 to 200 m. Two types of diving behavior have been identified for white marlin, (1) a shorter duration V-shaped dive, and (2) a U-shaped dive characterized as those confined to a specific depth range for a prolonged period. These patterns, however, can be highly variable between individuals and also vary depending on the temperature and dissolved oxygen of the surface mixed layer. Therefore, it is important to consider vertical habitat use and the environmental factors that influence it during the standardization of CPUE data.

All white marlin biological material sampled prior to the confirmation of the presence of roundscale spearfish (*T. georgii*) in 2006, are now presumed to contain an unknown proportion of roundscale spearfish. Therefore reproductive parameters, growth curves and other biological studies previously thought to describe white marlin may not accurately represent this species.

WHM-2. Fishery indicators

It has now been confirmed that white marlin landings reported to ICCAT include roundscale spearfish in significant numbers, so that historical statistics of white marlin most likely comprise a mixture of the two species. Studies of white marlin/roundscale spearfish ratios in the western Atlantic have been conducted, with overall estimated ratios between 23-27%, although they varied in time and space. Previously, these were thought to represent only white marlin. However, there is little information on these species ratios in the eastern Atlantic.

The decadal geographic distribution of the catches is given in **WHM-Figure 1**. The Committee used Task I catches as the basis for the estimation of total removals (**WHM-Figure 2**). Total removals for the period 1990-2010 were obtained during the 2012 White Marlin Stock Assessment Session by modifying Task I values with the addition of white marlin that the Committee estimated from catches reported as billfish unclassified.

Additionally the reporting gaps for some fleets were completed using estimates based on catch values reported for years before and/or after the gap(s) years.

Preliminary Task I catches of white marlin (**WHM-Table 1**) in 2016 were 452 t, compared to 457 t reported for 2015. Landings for 2016 do not include the reports. Due to the work conducted by the Committee and improved reporting by CPCs the amount of unclassified billfish in the Task I table has been minimized.

A series of indices of abundance for white marlin were presented and discussed during the 2011 and 2012 meetings. Following the guidelines developed by the SCRS Working Group on Stock Assessment Methods (WGSAM), seven CPUE series were selected for their inclusion in the assessment models. In general, the indices showed no discerning trend during the latter part of the time series examined (**WHM-Figure 3**). During the 2012 assessment, an estimated standardized combined CPUE index for white marlin showed a sharp decline during the period 1960-1991, and a relatively stable trend thereafter (**WHM-Figure 3**).

WHM-3. State of the stock

Unlike the partial assessment conducted in 2006, the Committee conducted a full assessment in 2012, which included estimations of management benchmarks. Two models were used to estimate the status of the stock, a surplus production model (ASPIC), and a fully integrated model (SS3). The methods used for the fully integrated model followed very closely those used in the 2011 blue marlin assessment. As recommended by the working group in 2010, the model configuration was an effort to use all available data on white marlin, including lengths, dimorphic growth patterns and other biological data. Although it is believed that the modeling methods employed were relatively robust, the input data for the models were very likely less so. Perhaps the most important uncertainty was that associated with the landings data. There remains uncertainty not only in the species composition but also the magnitude of the catch. This is especially a problem with the landings data starting in 2002 when CPCs were mandated to release billfish that were alive at haulback. This led to a decrease in reported landings but not necessarily a decrease in fishing and/or release mortality. This apparent drop in landings led to a marked decrease in the estimates of F/F_{MSY} from 2002-present, however the Committee considers that this trend is likely overly optimistic due to unreported catch and unaccounted release mortality.

The results of the 2012 assessment indicated that the stock remains overfished but most likely not undergoing overfishing (**WHM-Figure 4, Figure 5**). Relative fishing mortality has been declining over the last ten years and is now most likely to be below F_{MSY} (**WHM-Figure 6**). Relative biomass has probably stopped declining over the last ten years, but still remains well below B_{MSY} (**WHM-Figure 6**). There is considerable uncertainty in these results. The two assessment models provide different estimates about the productivity of the stock, with the integrated model suggesting that white marlin is a stock that can rebuild relatively fast whereas the surplus production model suggests the stock will rebuild very slowly. The results from both approaches are considered to be equally plausible. These results are conditional on the reported catch being a true reflection of the fishing mortality experienced by white marlin. Sensitivity analyses suggest that if recent fishing mortality has been greater than reported, because discards are not reported by many fleets, estimates of stock status would be more pessimistic and current relative biomass would be lower and overfishing would continue. The presence of unknown quantities of roundscale spearfish in the reported catches and data used to estimate relative abundance of white marlin increases the uncertainty for the stock status and outlook for this species.

WHM-4. Outlook

The outlook for this stock remains uncertain because of the possibility that reported catches underestimate fishing mortality and the lack of certainty in the productivity of the stock. As a result, forecasts of how the stock will respond to different levels of catch are uncertain (**WHM-Table 2**). At current catch levels of about 400 t the stock will likely increase in size, but is very unlikely to rebuild to B_{MSY} in the next ten year period (**WHM-Table 2**). Fishing mortality is highly likely to remain below F_{MSY}. The speed at which the stock biomass may increase and the time necessary to rebuild the stock to B_{MSY} remains highly uncertain. This will depend on whether current reported catches are true estimates of fishing mortality, and on the true productivity of the white marlin stock.

WHM-5. Effect of current regulations

A 2006 recommendation (Rec. 06-09) established that the annual amount harvested by pelagic longline and purse seine vessels and retained for landing must be no more than 33% for white marlin and 50% for blue marlin of the 1996 or 1999 landing levels, whichever is greater. Furthermore, in 2012, the Commission established a TAC for 2013, 2014, and 2015 of 400 t (Rec. 12-04), placed additional catch and commerce restrictions in recreational fisheries for blue marlin and white marlin, and requested methods for estimating live and dead discards of blue marlin and white marlin/spearfish. In 2015, the Commission further strengthened the plan to rebuild white marlin stock by extending for 2016, 2017, and 2018 the annual limit of 400 t for white marlin/spearfish (Rec. 15-05).

The Committee is concerned with the significant increase in the contribution from non-industrial fisheries to the total white marlin harvest and that these fisheries are not fully accounted for in the current ICCAT database. The Committee expressed its serious concern over this limitation on data for future assessments. Such data limitation precludes any analysis of the current regulations. In addition the Committee expressed concern of the status of white marlin due to the misidentification of spearfishes in the white marlin catches. This situation adds uncertainty to the stock assessment results.

Currently, four ICCAT Contracting Parties (Brazil, Canada, Mexico, and the United States) mandate or encourage the use of circle hooks on their pelagic longline fleets. Recent research has demonstrated that in some longline fisheries the use of non-offset circle hooks resulted in a reduction of billfish mortality, while the catch rates of several of the target species remained the same or were greater than the catch rates observed with the use of conventional J hooks or offset circle hooks.

The Committee noted that more countries have started reporting data on live releases in 2006. However, there is not enough information on the proportion of fish being released alive to evaluate the effectiveness of the ICCAT recommendation, relating to the live release of white marlin.

WHM-6. Management recommendations

In 2012, the Commission implemented Rec. 12-04, intended to reduce the total harvest to 400 t in 2013, 2014, and 2015 to allow the rebuilding of the white marlin stock from the overfished condition. In 2015, the Commission extended the 400 t annual catch limit to 2016, 2017, and 2018 (Rec. 15-05). The Committee expressed its concern on the effectiveness of such measure in light of the misidentification of spearfishes in the white marlin catches, which causes uncertainty in stock assessment results and enforcement related problems. The Committee notes that if catches exceed the TAC, as was the case for 2015 and 2016, the rebuilding of the stock will proceed more slowly.

ATLANTIC WHITE MARLIN SUMMARY

MSY	874 t[1] - 1604 t[2]
Current (2016) Yield	452 t [3]
Relative Biomass:	
B_{2010}/B_{MSY}	0.50 (0.42-0.60)[4]
SSB_{2010}/SSB_{MSY}	0.322 (0.23-0.41)[5]
Relative Fishing Mortality:	
F_{2010}/F_{MSY}	0.99 (0.75-1.27)[4]
	0.72 (0.51-0.93)[5]
Stock Status (2010)	Overfished: Yes Overfishing: Not likely[6]
Conservation and Management Measure in Effect:	Recommendation [Rec. 15-05] Reduce the total harvest to 400 t in 2016, 2017, and 2018

[1] ASPIC estimates.
[2] SS3 estimates.
[3] 2016 yield should be considered provisional.
[4] ASPIC estimates with 10 and 90 percentiles.
[5] SS3 estimates with approximate 95% confidence intervals.
[6] Overfishing could be occurring if catches are under reported.

WHM-Table 1. Estimated catches (t) of Atlantic white marlin (Tetrapturus albidus) 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
TOTAL	A+M		1552	1679	2202	1876	1679	1517	1912	1736	1521	1088	1010	844	823	751	610	680	670	714	495	537	460	372	380	457	452
Landings		Longline	1360	1499	2039	1674	1520	1371	1684	1588	1389	966	832	742	739	672	526	606	559	602	414	411	369	252	303	345	329
		Other surf.	83	85	90	79	71	62	189	85	90	101	140	85	55	60	71	46	99	95	65	85	62	103	60	101	115
		Sport (HL+RR)	22	30	30	22	24	14	6	6	2	4	6	1	1	1	2	1	2	2	6	4	6	7	7	3	4
Discards		Longline	88	66	42	100	65	70	32	57	41	17	29	17	27	17	11	26	10	13	10	38	22	10	11	8	3
		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	
Landings	CP	Barbados	24	29	26	43	15	41	33	25	25	24	15	15	0	0	33	0	0	0	6	3	5	6	6	10	14
		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**
		Brazil	211	301	91	105	75	105	217	158	106	172	407	266	80	244	90	52	55	53	36	60	71	87	49	115	
		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
		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
		Côte d'Ivoire	0	0	0	0	1	2	1	5	1	2	2	3	1	1	1	1	3	2	0	1	0	1	1	1	1
		EU.España	23	26	26	36	151	93	101	119	186	61	6	22	64	58	51	46	32	16	111	4	34	37	93	113	89
		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
		EU.Portugal	0	0	0	0	0	0	0	0	0	0	1	5	19	30	22	2	35	40	11	18	25	10	9	7	11
		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	
		Ghana	14	22	1	2	1	3	7	6	8	21	2	1	1	1	0	0	4	4	0	1	1	1	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	
		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
		Korea Rep.	10	8	43	23	59	23	0	0	0	0	0	11	40	7	0	113	96	78	43	43	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	98
		Mexico	0	2	8	8	3	5	6	11	18	44	15	15	28	25	16	13	14	19	20	28	36	30	20	26	20
		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**
		Philippines	0	0	0	0	0	0	1	12	0	0	0	0	0	0	0	0	1	0	2	2	0	0	0	0	**0**
		S. Tomé e Príncipe	24	17	21	21	30	45	40	36	37	37	37	37	21	33	29	0	36	37	38	39	40	41	42	17	15
		South Africa	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**
		St. Vincent and Grenadines	0	1	0	0	0	0	0	0	0	0	0	44	0	0	0	0	0	0	0	0	0	0	0	0	
		Trinidad and Tobago	0	1	11	18	8	32	10	13	4	2	5	12	6	6	5	12	10	11	15	14	39	33	38	32	20
		U.S.A.	11	19	13	7	12	8	5	5	1	3	6	1	1	1	1	0	2	2	2	26	1	4	2	2	1
		U.S.S.R.	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	1	1	1	1	1	1	1	1	0	0	0	0	1	1	1	1	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**
		Uruguay	3	0	3	0	1	24	22	0	0	0	1	9	2	5	9	3	0	5	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**
		Venezuela	276	362	236	286	270	177	310	228	178	182	215	168	136	156	190	131	63	128	116	160	121	75	89	104	158
	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
		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**
	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	
		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	
		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	
		Grenada	0	0	0	0	0	0	0	0	1	15	8	14	33	10	12	11	17	14	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	
		NEI (BIL)	0	0	0	0	0	0	0	0	34	77	4	30	134	42	37	170	204	199	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	
		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	
		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	

			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
Discards	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	
		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
		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**
		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
		U.S.A.	88	66	42	100	65	70	33	58	41	18	33	17	27	17	10	8	10	14	8	36	21	10	11	8	3
		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	
	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	0	**0**

WHM-Table 2. Kobe II Strategy Matrix (K2SM) of the combined models (ASPIC and SS3). Percent values indicate the probability of achieving the goal of $F<F_{MSY}$, $B>B_{MSY}$, and $SSB_{yr} > SSB_{MSY}$ and $F_{yr} < F_{MSY}$ for each year (yr) under different constant catch scenarios (TAC tons).

$F<F_{MSY}$

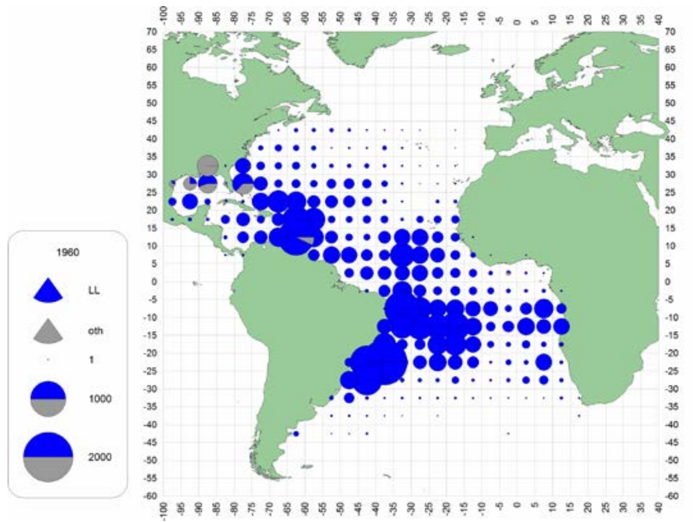
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
0	100	100	100	100	100	100	100	100	100	100
200	100	100	100	100	100	100	100	100	100	100
400	73	74	75	77	79	79	81	82	84	85
600	9	11	12	12	13	14	16	16	17	19
800	0	0	0	0	1	1	1	1	1	1
1000	0	0	0	0	0	0	0	0	0	0
1200	0	0	0	0	0	0	0	0	0	0
1400	0	0	0	0	0	0	0	0	0	0
1600	0	0	0	0	0	0	0	0	0	0

$B>B_{MSY}$

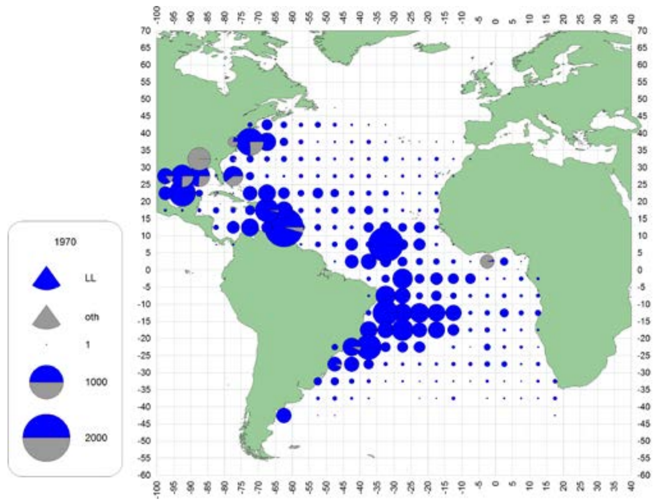
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
0	0	0	0	0	0	0	0	1	1	2
200	0	0	0	0	0	0	0	0	1	1
400	0	0	0	0	0	0	0	0	0	0
600	0	0	0	0	0	0	0	0	0	0
800	0	0	0	0	0	0	0	0	0	0
1000	0	0	0	0	0	0	0	0	0	0
1200	0	0	0	0	0	0	0	0	0	0
1400	0	0	0	0	0	0	0	0	0	0
1600	0	0	0	0	0	0	0	0	0	0

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

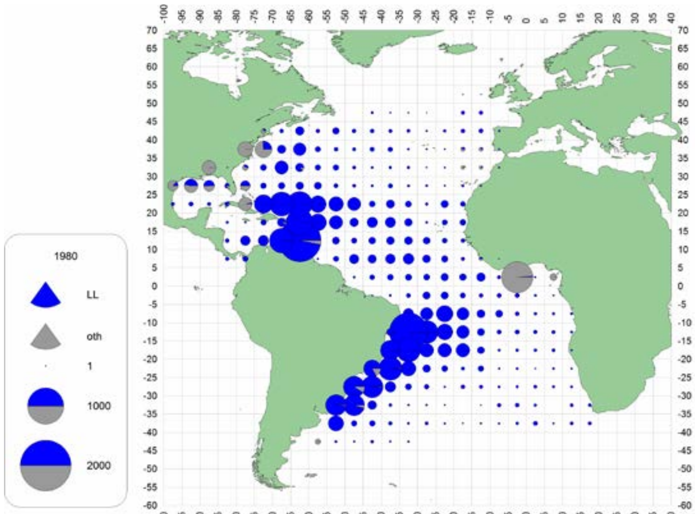
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
0	0	0	0	0	0	0	0	1	1	2
200	0	0	0	0	0	0	0	0	1	1
400	0	0	0	0	0	0	0	0	0	0
600	0	0	0	0	0	0	0	0	0	0
800	0	0	0	0	0	0	0	0	0	0
1000	0	0	0	0	0	0	0	0	0	0
1200	0	0	0	0	0	0	0	0	0	0
1400	0	0	0	0	0	0	0	0	0	0
1600	0	0	0	0	0	0	0	0	0	0



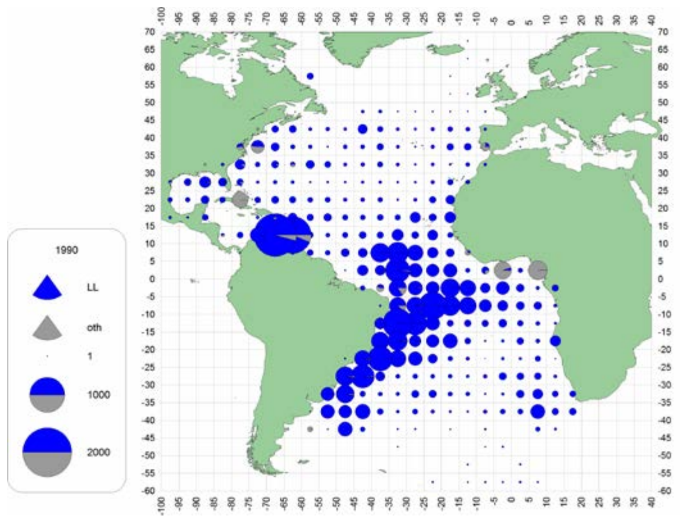
a. WHM (1960-69)



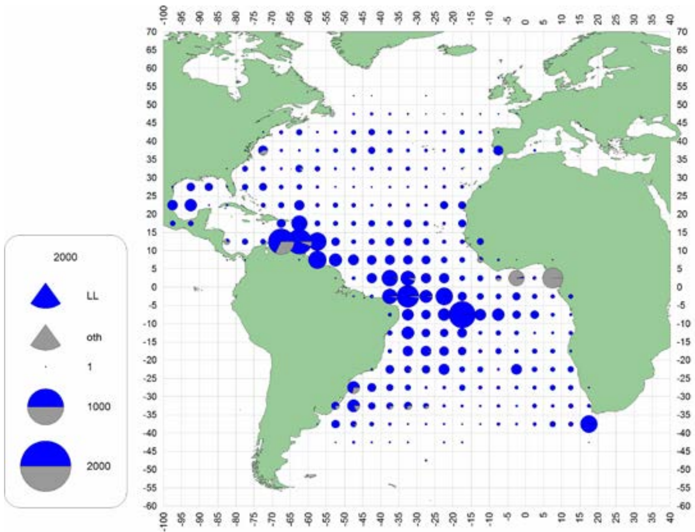
b. WHM (1970-79)



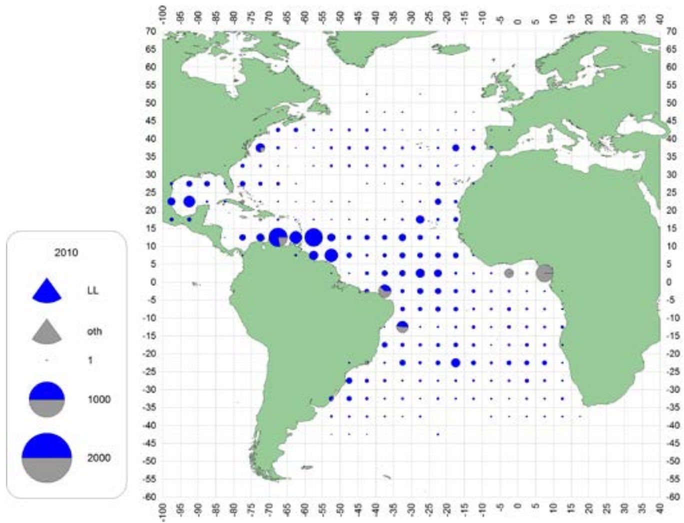
c. WHM (1980-89)



d. WHM (1990-99)

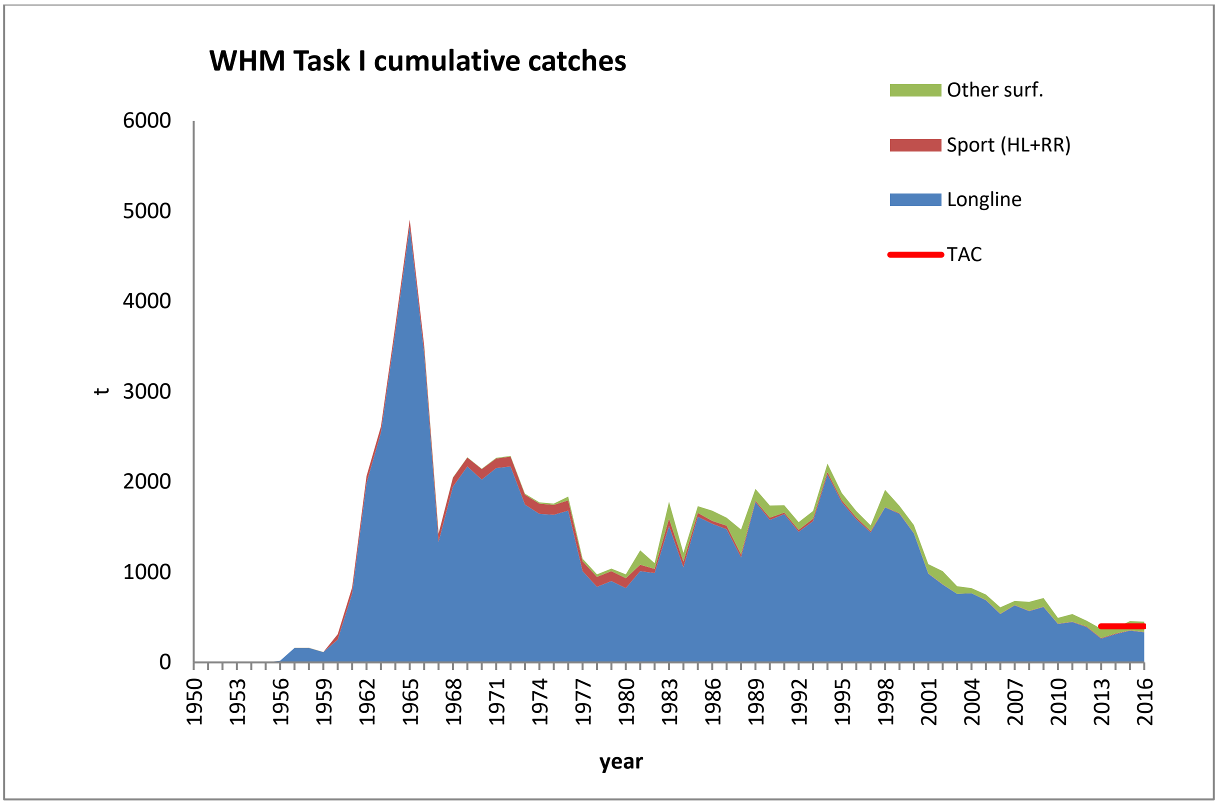


e. WHM (2000-09)

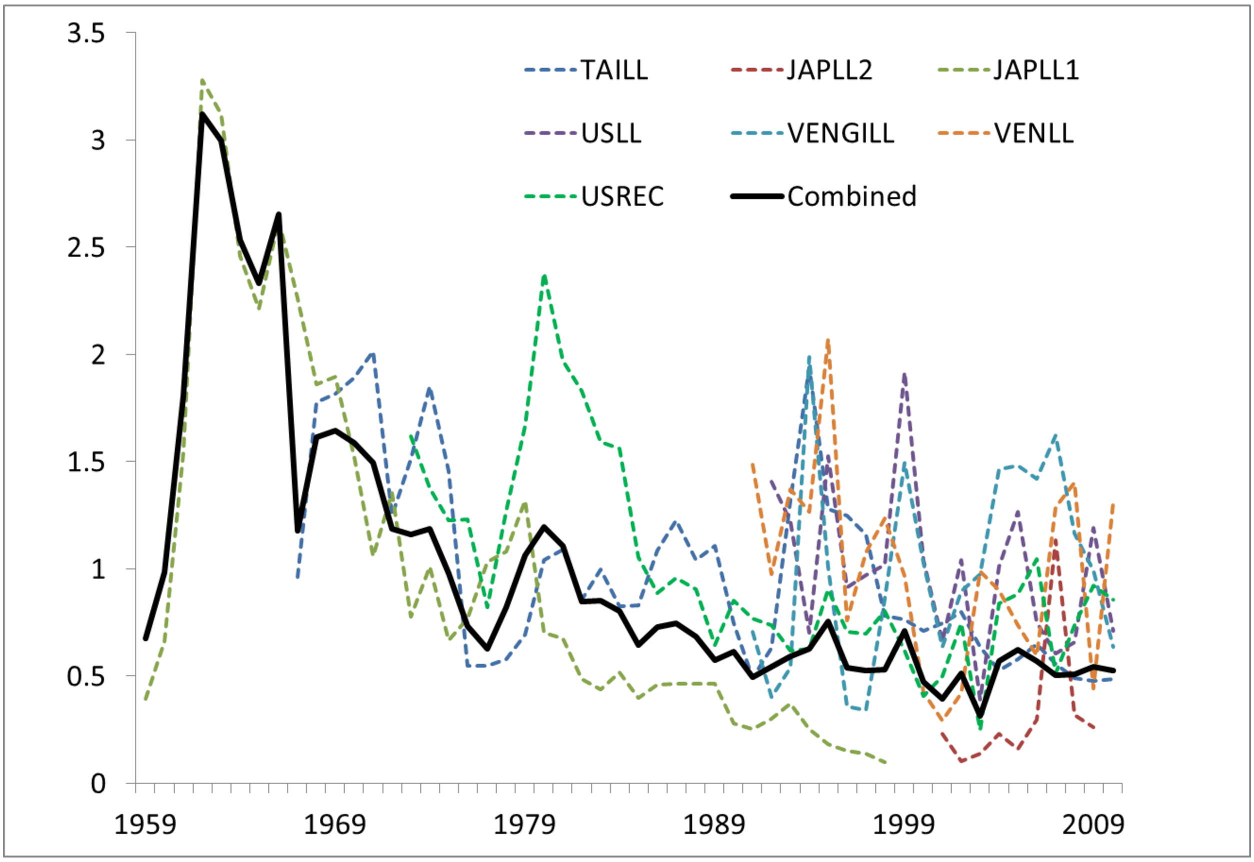


f. WHM (2010-15)

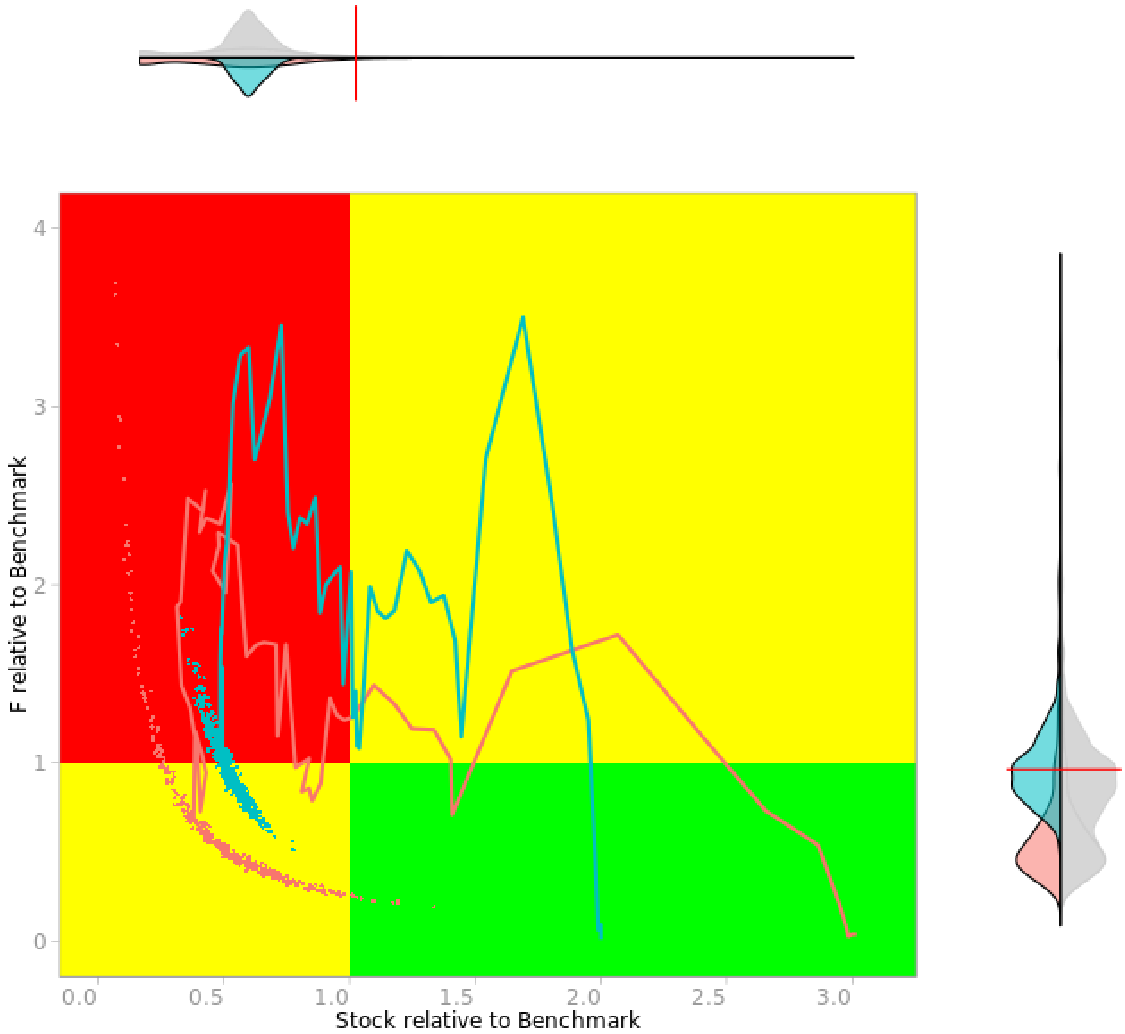
WHM-Figure 1. Geographic distribution of white marlin total catches by decade (last decade only covers 6 years).



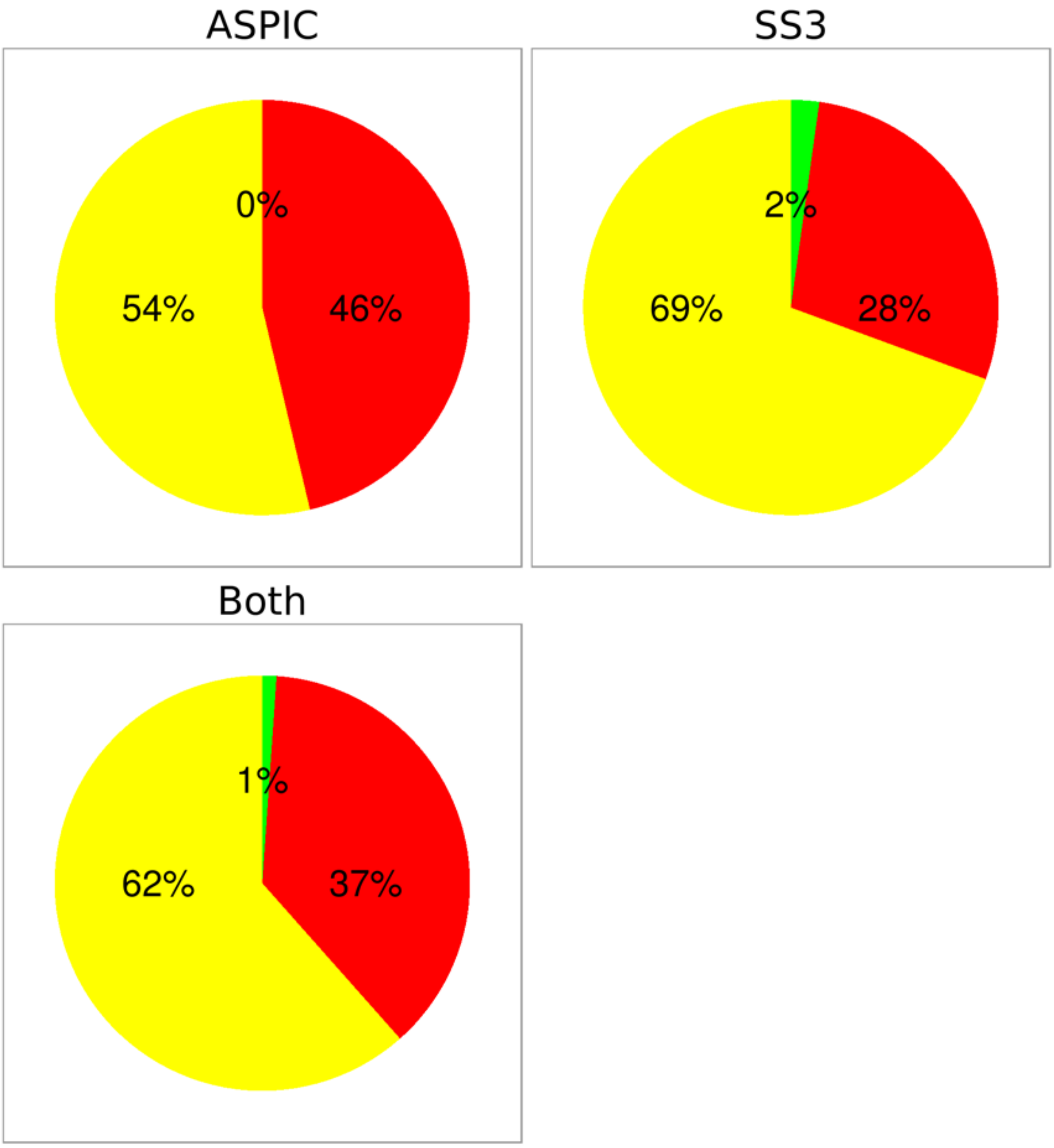
WHM-Figure 2. Total catch of white marlin reported in Task I for the period 1956-2016.



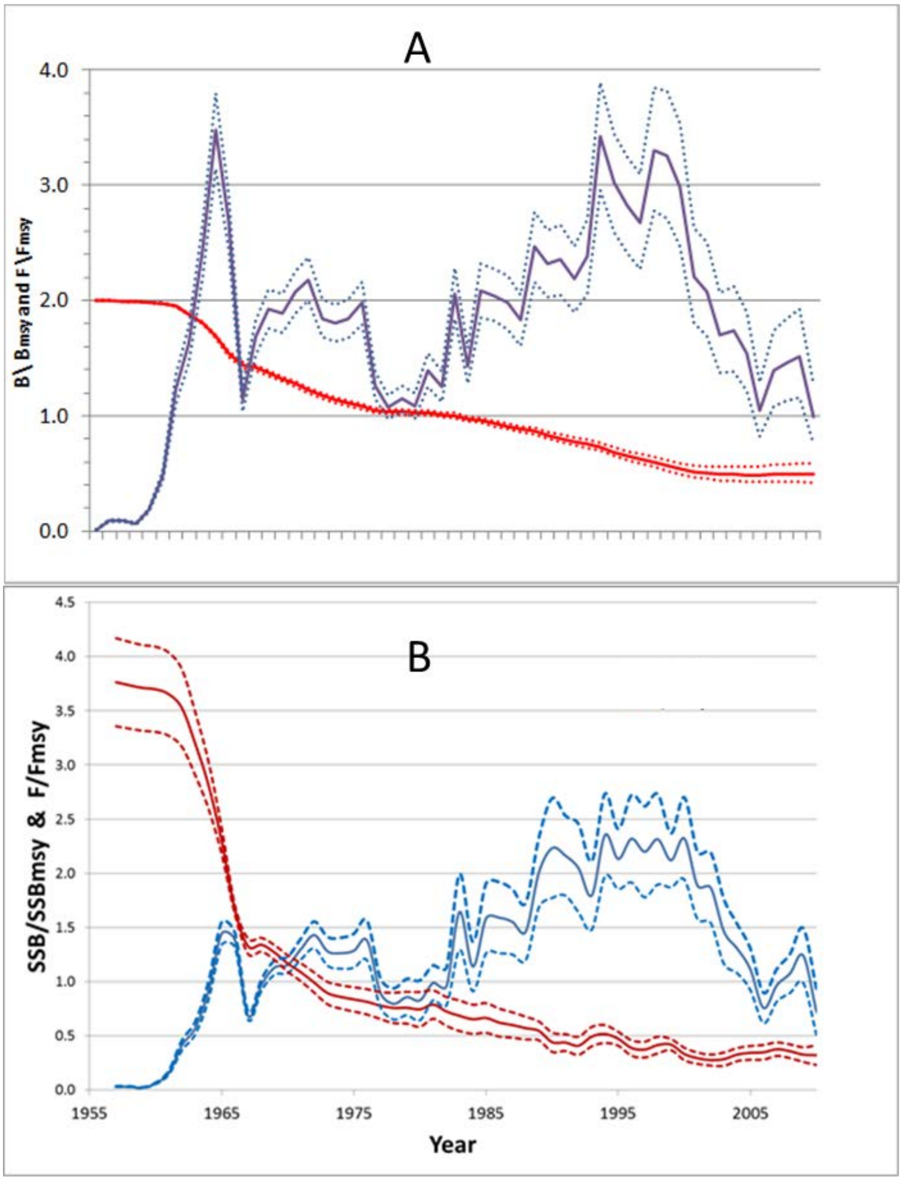
WHM-Figure 3. White marlin indices of abundance presented and selected during the meeting. For graphing purposes the indices were scaled to their respective mean value for the period 1990-2010.



WHM-Figure 4. Kobe phase plot panel showing the estimated trajectories for stock (B) relative to B_{MSY} and harvest rate (F) relative to F_{MSY} (line) along with the bootstrap estimates for 2012. The green quadrant corresponds to the stock not being overfished and no overfishing occurring and the red quadrant to the stock being overfished and overfishing occurring. The red line represents the SS3 model, and the blue line represents the ASPIC model (large panel). The marginal densities plots for stock relative to B_{MSY} and harvest rate relative to F_{MSY} are also shown (top and right of large panel); the upper part (grey) are combined probabilities for both ASPIC and SS3, and the lower part (blue and pink) are individual probabilities of ASPIC and SS3 overlaid. The red lines represent the benchmark levels (ratios equal to 1.0).



WHM-Figure 5. Pie chart showing the proportion of assessment results for 2012 that are within the green quadrant of the Kobe plot chart (not overfished, no overfishing), the yellow quadrant (overfishing), and the red quadrant (overfished and overfishing).



WHM-Figure 6. Historical ASPIC (A) and SS3 (B) estimates of biomass over biomass at MSY ratio (red) and fishing mortality over fishing mortality at MSY ratios (blue) for white marlin.

8.8 SAI – SAILFISH

The most recent stock assessments for East and West sailfish were conducted in 2016 (Anon., 2017g) using catch data available to 2014, through a process that included meetings for data preparatory, and a catch rate standardization workshop in May. The previous sailfish stock assessments were conducted in 2009.

SAI-1. Biology

Sailfish have a mainly pan-tropical distribution in the Atlantic Ocean, with occasional catches reported from temperate waters. Based on life history information, migration rates and geographic distribution of catch, ICCAT has established two management units for sailfish, eastern and western Atlantic stocks (**SAI-Figure 1**). However, a recent preliminary study investigating genetic differentiation among groups of Atlantic sailfish suggests genetic stock structure between both the eastern and western Atlantic, and northern and southern hemispheres, suggesting the need for further investigations to elucidate and confirm the presence of additional stock structure that may influence future assessments.

Sailfish is more coastally oriented than other billfish species. Conventional tagging data suggests they move shorter distances than the other billfish (**SAI-Figure 2**). Temperature preferences for adult sailfish appear to be in the range of 25-28°C. Sailfish generally seek out the warmest water available, and electronic tagging studies indicate that about 96% of darkness, 86% of twilight, and 82% of daylight hours are spent near the surface (Hoolihan *et al*., 2011). Vertical habitat use is more complex however, with frequent short duration excursions to deeper depths in excess of 100 m, with some dives as deep as 350 m.

Sailfish grow rapidly and reach a maximum size of 160 cm for males and 220 cm for females, with a mean maximum age of at least 12 years. A new length at 50% maturity (L50) has been estimated for West Atlantic female sailfish (146.12 cm LJFL); while the previous L50 value used for western sailfish males remains at 135.7 cm LJFL. No values are currently available for eastern Atlantic sailfish.

Sailfish spawn over a wide area and year around. For the western stock, evidence of spawning has been detected in the Straits of Florida, and off the Venezuelan, Guyanese and Surinamese coasts. In the southwestern Atlantic, spawning has been confirmed off the southern coast of Brazil between 20° and 27°S. Additional spawning areas occur in the eastern Atlantic off Senegal and Côte d'Ivoire. Timing of spawning can differ between regions; from the Florida Straits to the areas off Guyana western Atlantic sailfish spawn in the second and third quarter of the year, while in the southwestern Atlantic they spawn during the austral summer.

SAI-2. Fisheries indicators

Sailfish are targeted by coastal artisanal and recreational fleets and are captured to a lesser extent as by-catch in longline and purse seine fisheries (**SAI-Figure 3**). Historically, catches of sailfish were reported together with spearfish by many longline fleets. In 2009 these catches were separated by the Committee (**SAI-Table 1**).

East Atlantic

The eastern stock is exploited by surface fisheries, mainly artisanal gillnet and troll, and to a lesser degree by purse seine, as well as longline and recreational fisheries. The main surface fisheries are carried out by the artisanal fleets of Côte d'Ivoire, Ghana and Senegal followed by the EU mixed flags fleets (France and Spain) in the Gulf of Guinea and in the waters of the tropical eastern Atlantic. The main longline fleets are EU-Spain, Japan and Chinese Taipei fleets which operate in the central, eastern and western Atlantic. Total reported landings, increased abruptly after 1973, to peak above 5,000 t in 1975-1976, remaining relatively high (>2000 t), largely due to the incorporation of artisanal fishing effort by the traditional surface (gillnet and troll) fisheries (**SAI-Table 1**; **SAI-Figure 3a**). A generally decreasing trend in catch is apparent since 2008, mainly due to a decreased catch by the surface fisheries (gillnet and purse seine) (**SAI-Figure 3a**). Preliminary Task I catches of sailfish_east in 2016 were 1,421 t, compared to 1,240 t reported for 2015 (**SAI-Table 1**).

West Atlantic

The western stock is exploited by longline, recreational fisheries, and by surface fisheries, mainly artisanal drift-gillnet. The main longline fleets include Brazil, EU-Spain, Venezuela and Grenada, which operate in the western and central Atlantic. The main surface fisheries are carried out by the artisanal fleets of Grenada and Venezuela in the Caribbean Sea and waters of the tropical western Atlantic.

Total reported landings steadily increased since 1960 to peak 2,060 t in 2002 (**SAI-Figure 3b**). A steep decreasing trend of catch is observed from 2005, mainly due to a decreased catch by the surface (artisanal drift-gillnet) fisheries. Preliminary Task I catches of sailfish west in 2016 were 739 t, compared to 874 t reported for 2015 (**SAI-Table 1**).

Although there has been some progress, historical catches of unclassified billfish continue to be reported to the Committee, confounding sailfish catch estimates. Catch reports from countries that have historically been known to land sailfish continue to suffer from gaps and there is increasing *ad hoc* evidence of unreported landings in some other countries. These considerations provide support to the idea that the historical catch of sailfish has been under-reported, especially in recent times where more and more fleets encounter sailfish as by-catch or direct targeting.

Several standardized CPUE data series were used in 2016 for the Atlantic sailfish stock assessment. For the eastern Atlantic stock, the eight indices of abundance used were: Côte d'Ivoire, Ghana, and Senegal artisanal, Chinese Taipei longline, Japan longline (early and late), EU-Portugal longline, and EU-Spain longline; for the western Atlantic stock, the eleven indices used were: Brazilian longline, Brazilian rod & reel, Chinese Taipei longline, Japanese longline (early and late), EU-Spain longline, US longline observer, US rod & reel, Venezuelan longline, Venezuelan rod & reel, and Venezuelan artisanal (**SAI-Figure 4**). For both stocks, the available CPUE time series showed a mixture of both decreasing and increasing trends, which demonstrated a potential conflict in the indicators of stock abundance. For this reason, CPUE time series were put into two groups, each based on the similarity of their indication of stock abundance (i.e., increasing or decreasing). In the assessment, these CPUE groups were considered as alternatives for the surplus production and Stock Synthesis models.

SAI-3. State of the stocks

Important progress was made on the integration of new data sources, in particular standardized catch rate data, size data, and modeling approaches, in the 2016 assessment of the status of the stocks of Atlantic sailfish. For both stocks (East and West), uncertainty in data inputs and model configuration was explored through sensitivity analysis. They revealed that results were sensitive to structural assumptions of the models. The production model formulations and the Stock Synthesis model (applied for the western stock) had varying degrees of difficulty fitting the decreasing or increasing trends in the CPUE series. Overall, assessment results were uncertain and should be interpreted with caution.

East Atlantic

The Bayesian surplus production model, the ASPIC and the Stock Reduction Analysis models showed similar trends in biomass trajectories and fishing mortality levels; trends in abundance suggest that the stock suffered their greatest declines in abundance prior to 1990. Different model runs indicate a declining/increasing trend in recent years depending on the CPUE series selected. All the scenarios considered for advice using the surplus production models indicated that the stock is overfished (0.27-0.71 B_{MSY}), but overfishing status is uncertain (0.33-2.85 F_{MSY}) (**SAI-Figure 5**).

West Atlantic

The ASPIC and the Bayesian surplus production models examined were heavily influenced by the priors used in the models. Neither model could provide stock status due to the large uncertainty in benchmark estimates, and generally poor model convergence. The point estimates of both Stock Synthesis models indicated that the stock is neither overfished nor experiencing overfishing (**SAI-Figure 6**). In contrast, the Stock Reduction Analysis model indicated that the stock was overfished with overfishing occurring (0.23-0.61 B_{MSY}; 0.69-2.45 F_{MSY}). However, due to the large degree of uncertainty in the Stock Reduction Analysis results, the Stock Synthesis models were used for management recommendations.

SAI-4. Outlook

Both the eastern and western sailfish stocks may have been reduced to stock sizes below B_{MSY}. There is considerable uncertainty on the level of reduction. The results for the eastern stock were more pessimistic than those for the western stock in that more of the results indicated recent stock biomass below B_{MSY}. Therefore, there is particular concern over the outlook for the eastern stock.

Due to the difficulty of determining current status for both the eastern and western Atlantic stocks, the Committee considered that it was not appropriate to conduct quantitative projections of future stock condition based on the range of scenarios considered at the stock assessment meeting.

SAI-5. Effect of current regulations

In 2016, the Commission established catch limits for both sailfish stocks [Rec. 16-11], and included several provisions that would allow the Committee enhance data collection initiatives to reduce fishing mortality estimates and overcome data gap issues in all fisheries.

East Atlantic

It was established that the total catch harvested must be no more than 67% of the average estimate of the Maximum Sustainable Yield (i.e., 1,271 t).

West Atlantic

It was established that the total catch harvested must be no more than 67% of the average estimate of the Maximum Sustainable Yield (i.e., 1,030 t).

If the catch limit is exceeded in any stock, the Commission shall review the implementation and effectiveness of the current regulation.

In line with other ICCAT conservation measures, some countries have established domestic regulations to limit the catch of sailfish. Among these regulations are: the requirement of releasing all billfish from longline vessels, minimum size restrictions, use of circle hooks and catch and release strategies in sport fisheries.

Currently, four ICCAT Contracting Parties (Brazil, Canada, Mexico, and the United States) mandate or encourage the use of circle hooks on their pelagic longline fleets. Recent research has demonstrated that in some longline fisheries the use of non-offset circle hooks resulted in a reduction of billfish mortality, while the catch rates of several of the target species remained the same or were greater than the catch rates observed with the use of conventional J hooks or offset circle hooks.

SAI-6. Management recommendations

Considerable uncertainty still remains in the assessments of both the eastern and western stocks. Available abundance indices demonstrate conflicting trends for both stocks, and there are concerns that reported catches, including dead discards, may be incomplete. Nevertheless, it should be noted that there have been significant improvements since the last assessment. There were more abundance indices available, and the standardizations have seen general improvement, fostered in part by the CPUE workshop held in advance of this meeting. As was the case during the 2009 Sailfish Stock Assessment Session (Anon., 2010), the results for the eastern stock were more pessimistic than the western stock in that more of the results indicated recent stock biomass below B_{MSY}.

East Atlantic

The eastern Atlantic sailfish stock appears to have declined markedly since the 1970s, reaching a low in the early 1990s. There is broad agreement across model results that the stock is currently overfished. Since 2010, catches appear to have declined substantially. However, models disagree whether overfishing is occurring and whether the stock is recovering.

Based on the assessment results, and considering the associated uncertainties, the Commission recommended at a minimum that catches should not exceed 67% of 1,271 t [Rec. 16-11]. Considering the increase in catch levels during 2016, the Commission may consider alternative management measures to prevent further increases in catch levels.

West Atlantic

The Stock Synthesis models for the western Atlantic sailfish stock estimates MSY between 1,438-1,636 t. Although current catches are well below this level, the results of the assessment were highly uncertain, and therefore the Committee recommends that the western Atlantic sailfish catches should not exceed current levels.

ATLANTIC SAILFISH SUMMARY

	West Atlantic	**East Atlantic**
Maximum Sustainable Yield (MSY)	1,438-1,636 t [1,2]	1,635-2,157 t [3]
Current (2016)	739 t	1,421 t
SSB_{2014}/SSB_{MSY}	1.81 (0.51-2.57)[1] 1.16 (0.18-1.69)[2]	
B_{2014}/B_{MSY}		0.22-0.70 [3]
F_{2014}/F_{MSY}	0.33 (0.25 – 0.57)[1] 0.63 (0.42 – 2.02)[2]	0.33-2.85 [3]
Overfished	Not likely	YES
Overfishing	Not likely	Possibly
Management Measures in Effect:	Recommendation [Rec. 16-11]. Limit Atlantic sailfish catches of either stock to the level of 67% of MSY.	

[1] Stock Synthesis estimate utilizing increasing CPUE trends, with approximate 95% confidence intervals.
[2] Stock Synthesis estimate utilizing decreasing CPUE trends, estimate with approximate 95% confidence intervals.
[3] Range obtained of plausible estimates from bootstrapped ASPIC, BSP-JAGS, and SRA models.

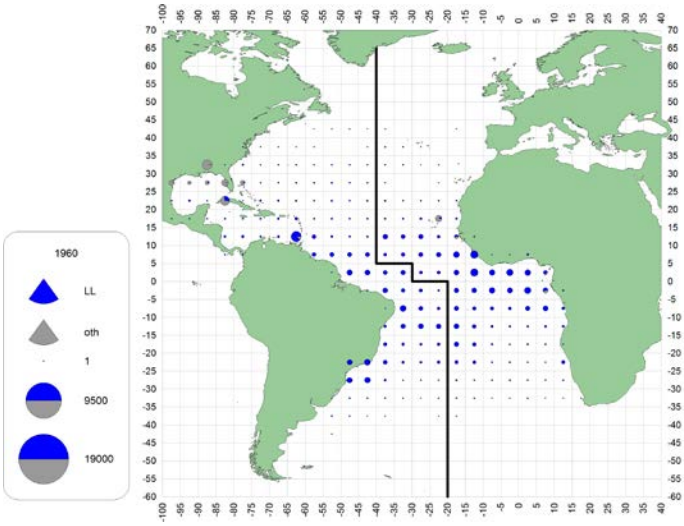
SAI-Table 1. Estimated catches (t) of Atlantic sailfish (Istiophorus albicans) by area, gear and flag.

				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
TOTAL				3239	3228	2292	2445	3023	2604	2975	2922	3976	4603	4411	4137	4335	4058	3854	4137	3962	3753	3088	2821	2859	2285	2011	2114	2159
	ATE			1780	1815	1172	1234	1881	1347	1362	1342	1980	2806	2351	2639	2608	2218	1916	2577	2229	2129	1853	1508	1591	1338	1159	1240	1421
	ATW			1459	1413	1120	1211	1142	1257	1613	1580	1996	1797	2060	1498	1727	1839	1939	1561	1733	1624	1235	1313	1267	947	852	874	739
Landings	ATE		Longline	104	256	151	189	196	216	275	273	198	314	391	335	282	319	580	590	628	622	514	502	543	457	423	435	338
			Other surf.	983	1111	954	910	1504	644	859	883	1231	1725	1862	2022	2106	1756	1289	1798	1488	927	895	870	985	764	727	749	1082
			Sport (HL+RR)	692	448	67	135	182	488	228	186	551	767	98	282	219	143	46	189	113	580	443	136	58	117	9	56	
	ATW		Longline	491	619	407	425	360	417	765	731	1272	1323	1344	1053	1077	1467	1490	1096	1213	1153	1137	1192	1074	829	726	842	710
			Other surf.	599	498	468	410	482	433	553	615	602	402	603	440	642	368	442	452	502	457	92	101	154	86	106	22	6
			Sport (HL+RR)	333	233	217	348	230	350	267	163	76	60	106	0	0	0	2	6	7	4	2	10	19	20	9	3	15
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	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	
	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	6	7
			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	
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**
			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	
			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
			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
			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
			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
			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
			EU.United Kingdom	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**
			Gabon	0	3	3	110	218	2	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	
			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
			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**
			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	
			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
			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
			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**
			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	
			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**
			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**
			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
			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
			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	
			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**
			St. Vincent and Grenadines	0	0	0	0	0	0	0	0	0	0	4	0	0	0	1	5	0	0	0	0	0	0	0	0	
			U.S.A.	4	1	1	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			U.S.S.R.	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
		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	
			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	
			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	
			NEI (BIL)	0	0	0	0	0	0	0	0	28	269	408	213	55	1	105	43	20	11	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	
			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	
	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
			Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	12	0	0	52	8	0	4	0	0	11
			Brazil	351	243	129	245	310	137	184	356	598	412	547	585	534	416	139	123	268	433	78	137	108	38	57	51	

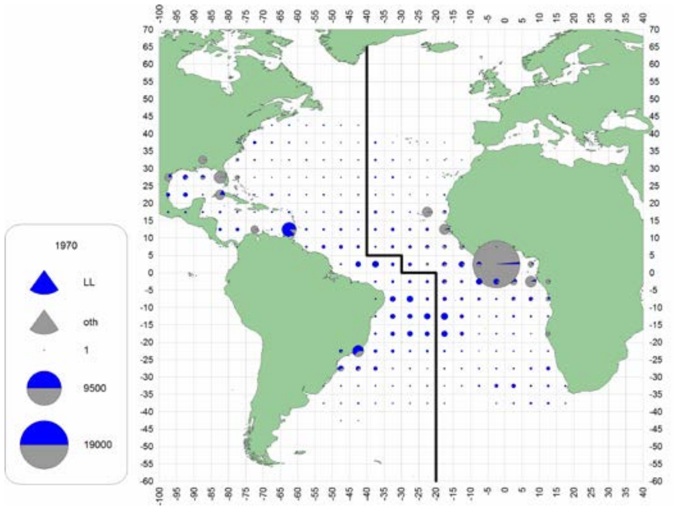
				1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
			China PR	0	0	3	3	3	3	3	9	4	3	1	0	1	0	0	0	1	2	1	1	1	0	1	1	3
			Curaçao	10	15	15	15	15	15	15	15	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			EU.España	13	13	19	36	5	20	42	7	14	309	414	183	160	89	134	214	361	412	275	190	184	203	244	311	207
			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**
			Japan	0	1	8	2	4	17	3	10	12	3	3	10	5	22	4	1	33	43	36	12	16	7	12	12	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**
			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
			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**
			St. Vincent and Grenadines	4	4	4	2	1	3	0	1	0	2	164	3	86	73	59	18	13	8	7	4	4	3	4	1	85
			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
			U.S.A.	294	202	179	345	231	349	267	163	76	58	103	0	0	0	0	0	3	3	0	0	7	3	2	2	3
			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**
			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
		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
		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	
			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	
			Dominica	0	0	0	0	0	0	0	0	0	5	3	0	1	0	3	3	4	2	0	2	0	0	0	0	3
			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	
			Grenada	310	246	151	119	56	83	151	148	164	187	151	171	112	147	159	174	216	183	191	191	191	191	191	191	
			NEI (BIL)	0	0	0	0	0	0	0	0	297	268	0	0	0	0	68	81	252	17	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	
			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
			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	
			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	
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	
			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**
		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	0	
	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	
			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**
			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
			U.S.A.	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
		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**

SPF-Table 1. Estimated catches (t) of longbill spearfish (Tetrapturus pfluegeri) by area, gear and flag.

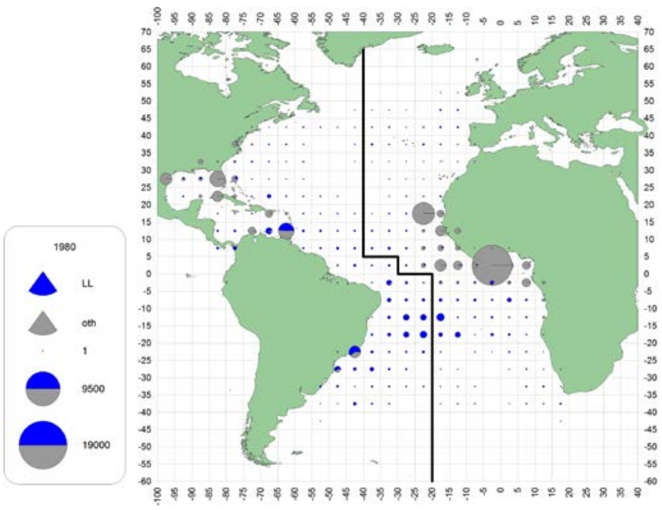
				1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
TOTAL				273	540	320	240	165	201	266	306	278	188	179	133	188	169	340	167	166	140	245	147	229	133	52	77	77
	ATE			255	419	198	207	128	194	192	257	181	81	84	54	51	68	84	66	60	78	128	69	170	95	16	18	15
	ATW			19	120	122	33	37	7	74	50	97	107	95	79	137	101	256	102	106	62	117	78	58	38	36	59	63
Landings	ATE		Longline	163	307	100	129	69	126	106	176	121	81	84	54	51	68	84	66	60	78	128	69	170	95	16	18	15
			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
	ATW		Longline	19	120	122	26	34	7	74	50	97	107	95	79	137	101	256	102	106	62	117	78	58	38	30	58	63
			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	1	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	0	6	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	
			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	
	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	0	
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
			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
			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
			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**
			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
			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**
			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**
			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
			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	
		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	1
		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	
	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**
			Brazil	0	0	0	0	0	0	0	0	27	56	39	3	0	0	5	4	0	0	0	24	4	11	6	5	
			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
			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
			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**
			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	
			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**
			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
			St. Vincent and Grenadines	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
			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**
			U.S.A.	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**
			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	
			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
		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	2
		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
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	
		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**
	ATW	CP	U.S.A.	0	0	0	6	1	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**



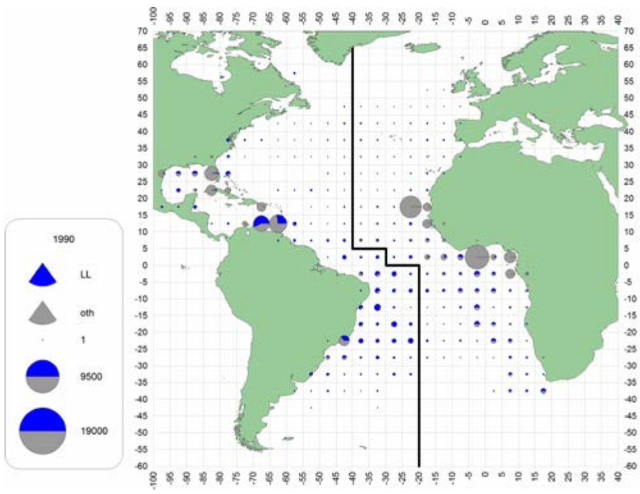
a. SAI (1960-69)



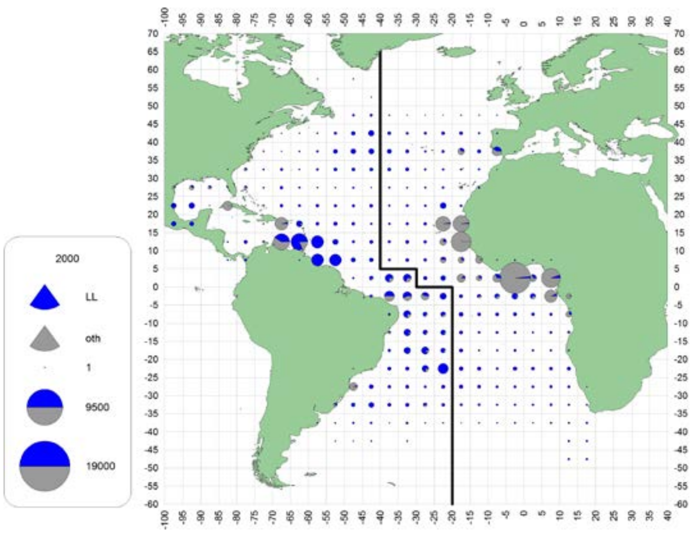
b. SAI (1970-79)



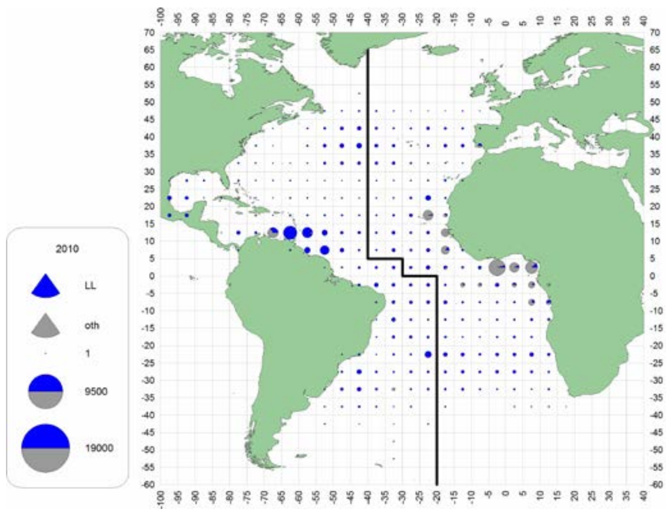
c. SAI (1980-89)



d. SAI (1990-99)

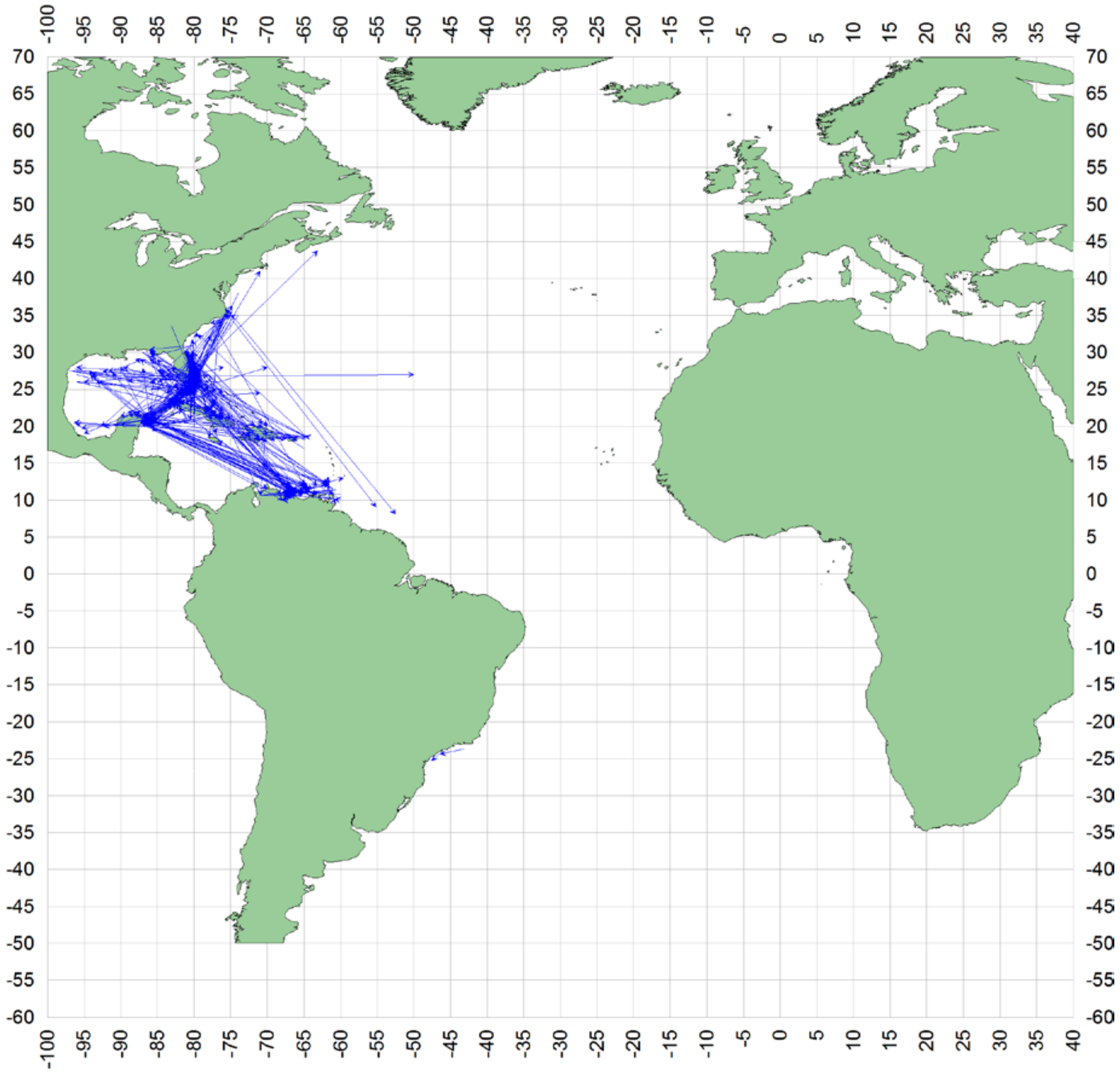


e. SAI (2000-09)

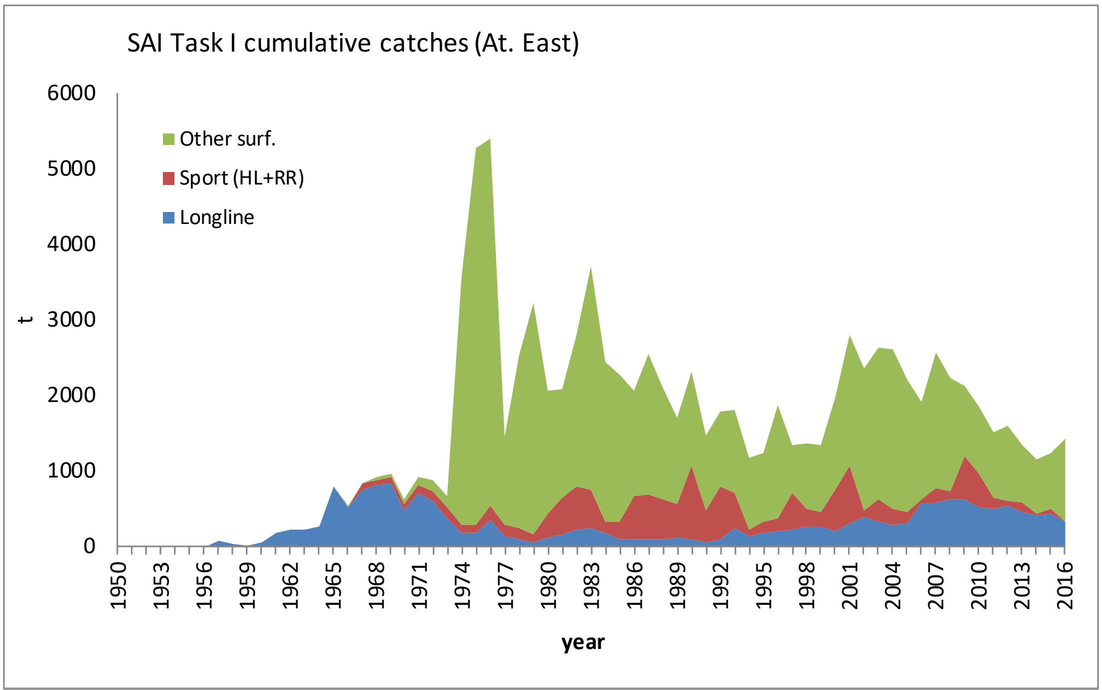


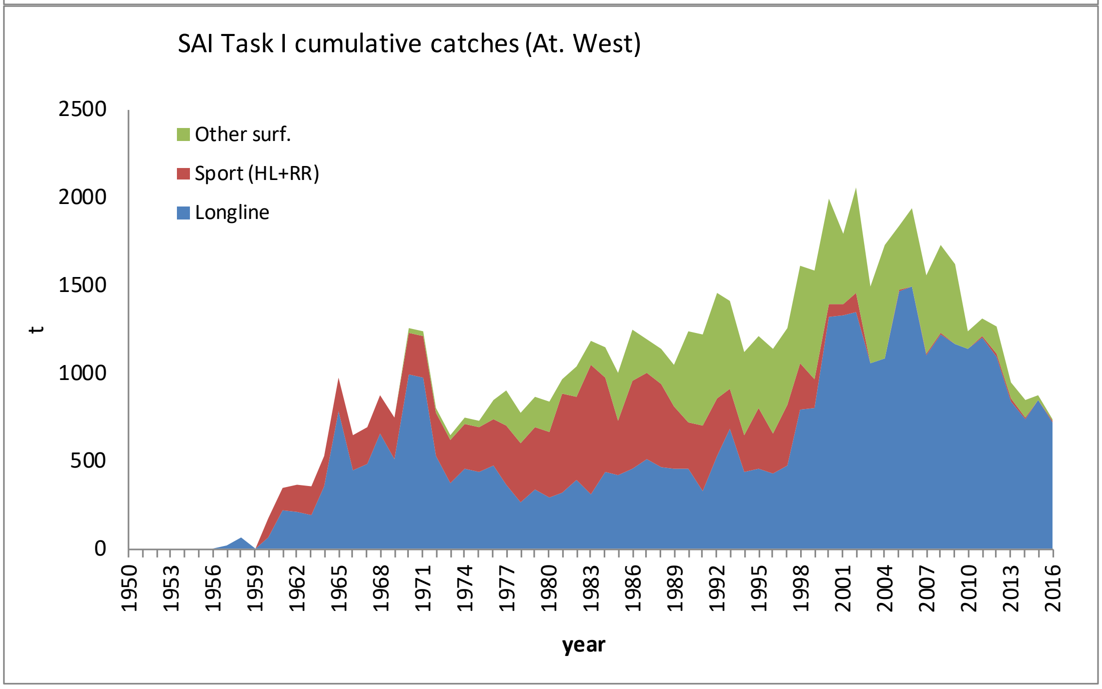
f. SAI (2010-15)

SAI-Figure 1. Geographic distribution of sailfish total catches by decade (last decade only covers 6 years). The dark line denotes the separation between stocks.

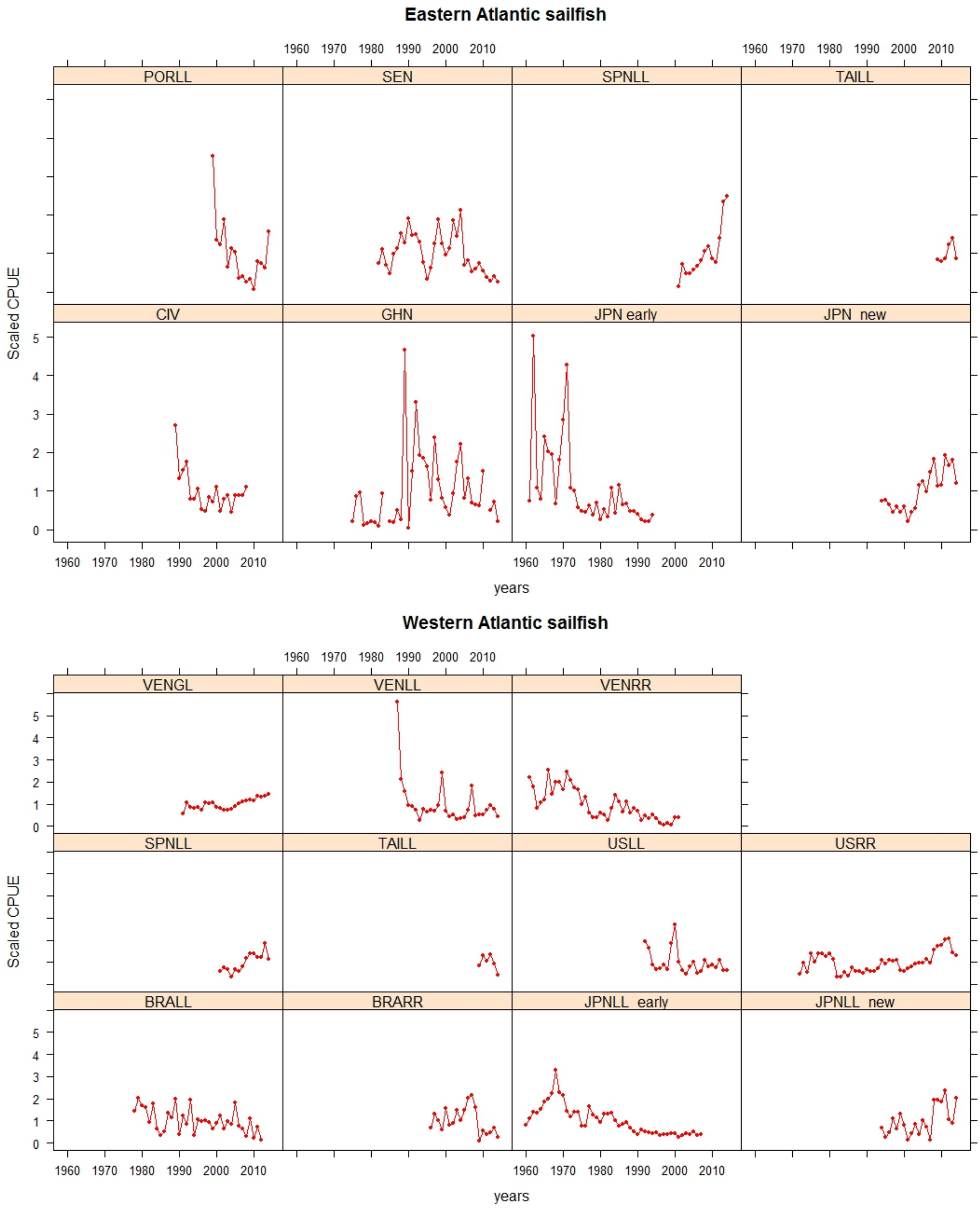


SAI-Figure 2. Conventional tag returns for Atlantic sailfish. Lines join the locations of release and recapture.

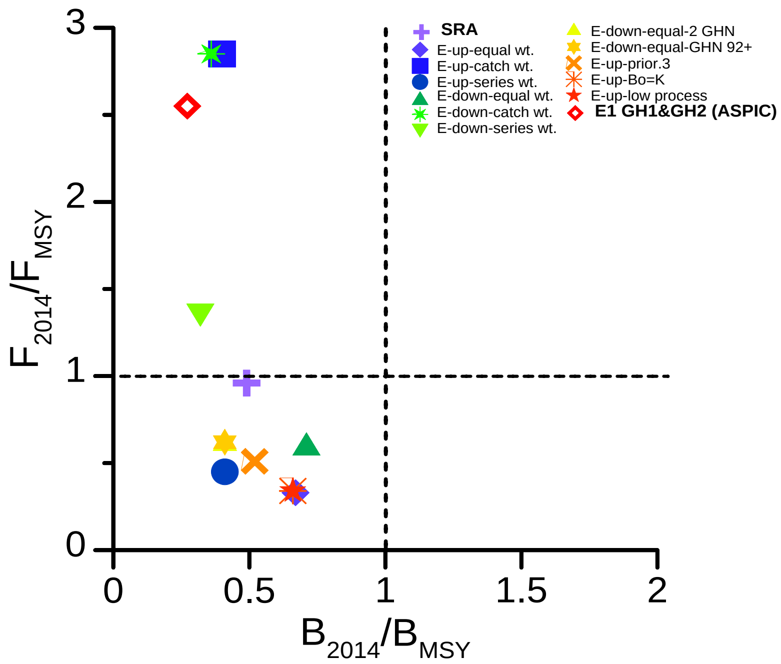




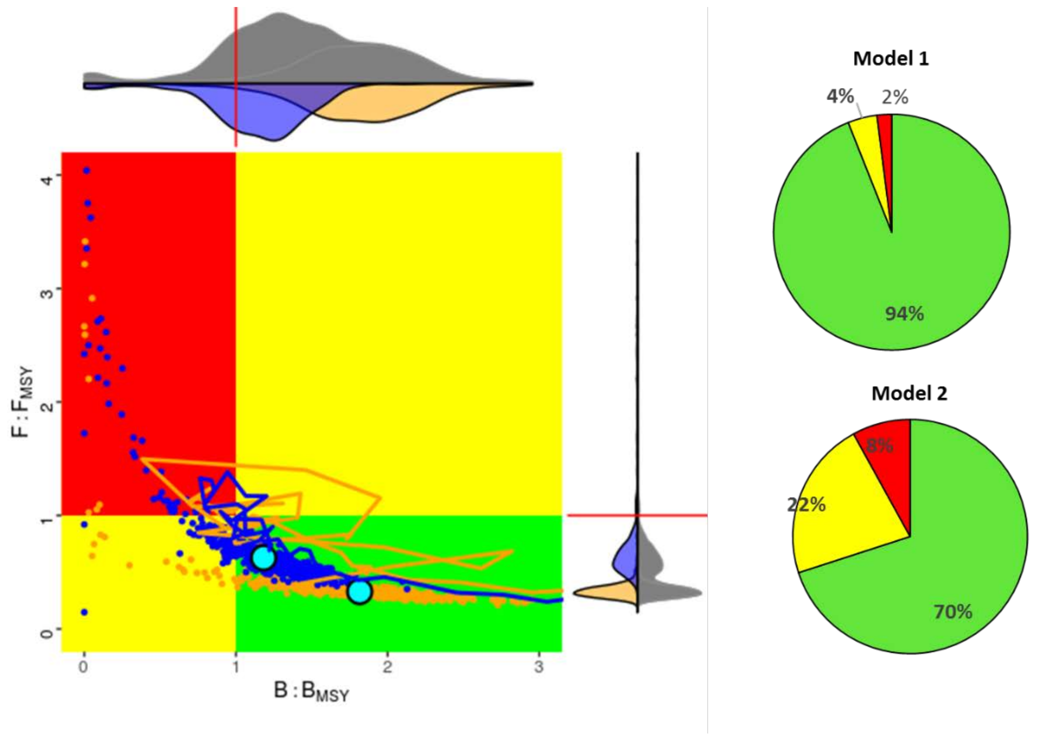
SAI-Figure 3. Task I catches of sailfish for each of the two Atlantic stocks, East and West.



SAI-Figure 4. Relative abundance indices used in the assessments of eastern and western Atlantic sailfish stocks. All indices were scaled to the mean of each series prior to graphing.



SAI-Figure 5. Phase plot summarizing scenario outputs for the current (2014) stock status of Sailfish east (SAI_east). SRA is Stock Reduction Analysis; E-up-equal wt to E-up-low process are BSMP-JAGS model runs, E1 GH1&GH2 is ASPIC base case model run.



SAI-Figure 6. Kobe plot (left) summarizing stock status of Sailfish_west based on Stock Synthesis models with increasing CPUE trends (Model 1) and with decreasing CPUE trends (Model 2). The estimated trajectories and uncertainty points for Model 1 are shown in golden yellow, and in blue for Model 2. The marginal densities plots for stock relative to B_{MSY} and harvest rate relative to F_{MSY} are also shown (top and right of large panel); the upper part (grey) are combined probabilities for both Stock Synthesis models, and the lower part (colored) are individual probabilities of Model 1 and Model 2. The red lines represent the benchmark levels (ratios equal to 1.0). Pie charts showing summary of current stock status estimates for the Sailfish_west stock based on Stock Synthesis models.

8.9 SWO-ATL – ATLANTIC SWORDFISH

The status of the North and South Atlantic swordfish stocks was assessed in 2017, by means of applying statistical modelling to the available data up to 2015. Complete information on the data availability and assessment can be found in the Reports of the 2017 ICCAT Swordfish Data Preparatory and Stock Assessment Meetings (Anon, 2017h and i). Other information relevant to Atlantic swordfish is presented in the Report of the Sub-committee on Statistics, included as **Appendix 9** to this SCRS Report, and recommendations pertinent to Atlantic swordfish are presented in Item 19.

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. New genetic information was reviewed that indicated that the existing stock boundaries should be refined for the Atlantic and Mediterranean stocks. While recognizing the importance of the work, the Committee noted that the stock boundaries are approximations, and the possible impacts of seasonal changes and oceanographic processes in resource distribution need to be fully understood.

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 evidences seasonal patterns, with fish generally moving south by winter and returning to the temperate foraging grounds in spring. Broader areas of mixing between some eastern and western areas were also suggested. These new results obtained by pop-up satellite tags also fully confirm the previous knowledge that was available from fishery data: deep longline settings catch swordfish during the day-time as a by-catch, while shallow setting longliners target swordfish at night closer to the surface.

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, Uruguay, and Venezuela. The primary by-catch 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 by-catch 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 Group 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 had to be split.

Total Atlantic

The total Atlantic estimated catch (landings plus dead discards) of swordfish (North and South, including reported dead discards) in 2016 (18,129 t) was 13.7% lower than the reported catch of 2015 (20,998 t). As a small number of countries have not yet reported their 2016 catches and because of unknown unreported catches, this value should be considered provisional and subject to further revision.

The trends in mean fish weight taken in the North and South Atlantic fisheries are shown in **SWO-ATL-Figure 3**.

North Atlantic

For the past decade, the North Atlantic estimated catch (landings plus dead discards) has averaged about 12,000 t per year (**SWO-ATL-Table 1**). The catch in 2016 (10,404 t) represents a 48.6% decrease since the 1987 peak in North Atlantic landings (20,238 t). These reduced landings have been attributed to ICCAT regulatory recommendations 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 by-catch in some fleets. Recently, socio-economic factors may have also contributed to the decline in catch.

Available catch per unit effort (CPUE) series were evaluated by the Committee and certain indices were identified as suitable for use in the assessment models (Canada, 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 4**. Most of the series have an increasing trend since the late 1990s, but show a decrease in the more recent years. There have been some recent changes in United States regulations that may have impacted catch rates. The combined index used as the continuity model from the previous assessment is shown in **SWO-ATL-Figure 5**.

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 2,300 t). After 1980, landings increased continuously up to a peak of 21,930 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 2016, the 7,725 t of reported catch was about 65% lower than the 1995 reported level (**SWO-ATL-Table 1**). The SCRS received reports from Brazil and Uruguay over the last years that they have reduced their fishing effort directed towards swordfish in recent years. Uruguay recently received increased albacore quotas that may allow increased effort for swordfish in the near future.

Available catch per unit effort (CPUE) series for the south Atlantic swordfish were evaluated by the Committee and certain indices were identified as suitable for use in assessment models (Brazil, EU-Spain, Japan, South Africa, Uruguay). The available indices are illustrated in **SWO-ATL-Figure 6**.

Discards

Since 1991, very few fleets have reported dead discards (see **SWO-ATL-Table 1**). The volume of Atlantic-wide reported discards by these fleets has ranged from a minimum of 157 t in 2009 to a maximum of 1,139 t in 2000, with 105 t reported for 2016. The Committee continued to express concerns due to the low percentage of fleets that have reported annual dead discards (in t) in recent years and that what has been reported is not necessarily scaled to the entire fishery.

SWO-ATL-3. State of the stocks

North Atlantic

Three stock assessment platforms were used to provide estimates of stock status for the North Atlantic swordfish stock, a surplus production model (ASPIC - *A Stock Production Model Incorporating Covariates*), a Bayesian surplus production model with process error (BSP2 - *Bayesian Surplus Production 2*) and an integrated assessment model (SS - *Stock Synthesis*). Stock status was determined from SS and BSP2 models, while ASPIC was used mainly to provide continuity with the previous assessments.

The final base case SS model estimated that B_{2015} was above B_{MSY} (median = 1.13, 95% CIs = 0.81-1.45) and F_{2015} was lower than F_{MSY} (median = 0.75, 95% CIs = 0.57-0.92) (**SWO-ATL-Figure 7**). The final base case BSP2 model estimated that current biomass (B_{2015}) was near B_{MSY} (median = 0.99, 95% CIs = 0.77-1.24) and current F_{2015} was lower than F_{MSY} (median = 0.81, 95% CIs = 0.61-1.10) (**SWO-ATL-Figure 8**). Both models agreed that overfishing is not occurring and that biomass is either higher or very close to B_{MSY} (**SWO-ATL-Figure 9**). The estimate of stock status in 2017 is slightly more pessimistic than the estimated status in the previous 2009 and 2013 assessments, and suggests that in 2015 there was a 61% probability that the stock is at or above MSY reference levels. The results obtained in this evaluation are not strictly comparable with those obtained in the last assessments due to the incorporation of more data sources, and using joint probabilities from two base case models, and updated catch and CPUE information.

The most recent estimates of stock productivity are lower than the previous estimates. Compared with the previous 2009 and 2013 ASPIC base case models, the trajectory of biomass are similar until the late 1990s, thereafter the current model predicted considerable lower relative biomass (**SWO-ATL-Figure 10**). It is particularly noteworthy that the CPUE series have been decreasing since 2012, causing biomass trends to adjust to a lower minimum compared to the previous assessments.

The Committee noted that the 2017 assessment represents a significant improvement in the understanding of current stock status for North Atlantic swordfish using updated information and integration of the new data sources. The Committee therefore recommends that management advice for North Atlantic swordfish, including stock status and projections, should be based on BSP2 and SS models.

South Atlantic

In 2017, evaluation of the status of the South Atlantic swordfish stock was assessed using two Bayesian biomass dynamics production models with process error (BSP2 and JABBA - *Just Another Bayesian Biomass Assessment*). Stock status and projections were determined from JABBA, while BSP2 was used mainly to provide several sensitivity analyses.

The results from both models for the South Atlantic swordfish were consistent. The final base case BSP2 model estimated that current biomass (B_{2015}) was lower than B_{MSY} (median = 0.64, 95% CIs = 0.43-1.00) and current F_{2015} was higher than F_{MSY} (median = 1.15; 95% CIs = 0.61-1.82) (**SWO-ATL-Figure 11**). The final base case JABBA model estimated that B_{2015} was also below B_{MSY} (median = 0.72, 95% CIs = 0.53-1.01) while F_{2015} was very close to F_{MSY} (median = 0.98, 95% CIs = 0.70-1.36) (**SWO-ATL-Figure 12**).

Both models agreed that the southern swordfish stock biomass is overfished, and that overfishing is either occurring or current F is very close to F_{MSY}. The Committee agreed that either one of the models (BSP2 or JABBA) could be used for management advice, but given that both are very similar in structure and use of information only one should be used. Given that JABBA is written in open-source software with more capabilities for future evolutions, the Committee agreed that the management advice, including stock status and projections, should be based on JABBA model (**SWO-ATL-Figure 13**).

The results obtained in this assessment are not comparable with those obtained in the last assessment (2013) due to the use of individual CPUEs compared to the use of a single CPUE combined across indices in the previous assessment. There was also an informative prior for K based on values from the North Atlantic in the 2013 assessment, but not in the current assessment. In 2013, the Committee noted that it was unknown whether it was possible to obtain higher yields from the stock as BSP2 suggested, or whether the stock was already fully exploited as ASPIC suggested. In 2017, with the possibility of incorporating individual CPUEs series and without the need to establish strong assumptions in productivity based in the North Atlantic stock, it was possible to provide specific quantitative advice for this stock.

SWO-ATL-4. Outlook

North Atlantic

Results from the previous 2013 assessment indicated that there was a greater than 90% probability that the northern swordfish stock had rebuilt to or above B_{MSY}. However, given the new estimates of biomass and lower productivity, the stock status now shows a 61% probability of being above B_{MSY}.

Based on the currently available information to the Committee, both the BSP2 and SS base models were projected to the year 2028 under constant TAC scenarios of 8 to 19 thousand tons. Projections used reported catch as of July, 2017 for 2016. For those CPCs whose reported catch was not available, their catch was assumed to be the average of the last three years (2013-2015), giving a total catch of 11,296 t.

For the final base case BSP2 model, projections incorporated process error and the predicted trajectories are therefore more realistic of the future uncertainty in the stock status. MSY is estimated to be around 13,400 t, and taking into account current stock status and process error catches around 13,000 t are expected to allow the population to remain at or above B_{MSY} throughout the projected time period (**SWO-ATL-Figure 14**).

For the final base case SS model, projections of stock status at various levels of future catch are shown in **SWO-ATL-Figure 14**. Given the current status of the stock being quite close to the MSY benchmarks, values of catches around 13,000 t are also projected to maintain biomass above B_{MSY} during the projected time frame.

South Atlantic

Projections were conducted for the final base case JABBA model under constant TAC scenarios of 4 to 16 thousand tons. Projections used reported catch as of July 2017 for 2016. For those CPCs whose reported catch was not yet available, it was assumed that their catch was the average of the last three years (2013-2015), giving a total catch of 10,002 t.

Although the median MSY was around 14,600 t, the 2015 biomass depletion level at B/B_{MSY} = 0.72 would require catches be reduced to a level at or below 14,000 tons to rebuild the population to biomass levels that can produce MSY by the end of the projection period in 2028 (**SWO-ATL-Figure 15**).

SWO-ATL-5. Effect of current regulations

In 2006, the Committee provided information on the effectiveness of existing minimum size regulations. New catch regulations were implemented on the basis of Rec. 06-02, which entered into effect in 2007 (Rec. 08-02 extended the provisions of Rec. 06-02 to include 2009). Rec. 09-02 came into effect in 2010 and extended most of the provisions of Rec. 06-02 for one year only. Rec. 10-02 came into effect in 2011, and again extended those provisions for one year only, but with a slight reduction in total allowable catch (TAC). For the North and South Atlantic, the most recent recommendations can be found in Recs. 16-03 and 16-04.

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 catch since then averaged 11,682 t and exceeded the TAC in one year (2012, 13,868 t).

The total allowable catch 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 since then averaged 10,150 t and did not exceed the TAC in any year.

Minimum size limits

There are two minimum size options that are applied to the entire Atlantic: 125 cm LJFL with a 15% tolerance, or 119 cm LJFL with zero tolerance and evaluation of the discards.

Since the implementation of the minimum landing sizes in 2000, the estimate of percentage of swordfish less than 125 cm LJFL reported landed (in number) 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 estimations have high levels of substitutions for a significant portion of the total catch and are highly unreliable and biased unless CPCs fully report size samples from the entire catch.

The Committee also noted high values of hooking mortality (ranging between 78-88%) on small swordfish (<125 cm LJFL) on some surface longline fisheries targeting swordfish, with the post-release mortality of specimens discarded alive unknown. Recommend and evaluating other strategies to protect juvenile swordfish will need completeness of datasets on fishing effort and size data over the entire Atlantic and should take into account the effects on other species. In view of the Commission objective to protect 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, size and sex distribution of undersized swordfish in the Atlantic, using high resolution observer data.

SWO-ATL-6. Management recommendations

North Atlantic

SWO-ATL-Tables 2, 3 and 4 show, respectively, the probabilities of maintaining the stock in the green quadrant of the Kobe plot, maintaining $B>B_{MSY}$ and maintaining $F<F_{MSY}$, over a range of TAC options for North Atlantic swordfish over a period of 10 years. The current TAC of 13,700 t has a 36% probability of maintaining the North Atlantic swordfish stock in the green quadrant of the Kobe plot by 2028, whereas a TAC of 13,200 t would have a 50% probability, and would also result in the biomass being above B_{MSY} with a probability greater than 50%, consistent with Rec. 16-03 (**SWO-ATL-Table 3**).

The Committee also recognizes that the above advice does not 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 that allocated to "other CPCs" and would fall above the TAC if achieved. The Committee emphasizes the importance of this uncertainty particularly given that the current estimated biomass is close to B_{MSY}.

South Atlantic

SWO-ATL-Tables 5, 6 and 7 show, respectively, the probabilities of maintaining the stock in the green quadrant of the Kobe plot, maintaining $B>B_{MSY}$ and maintaining $F<F_{MSY}$, over a range of TAC options for South Atlantic swordfish over a period of 10 years. The current TAC of 15,000 t has a 26% probability of rebuilding the South Atlantic swordfish stock to within MSY reference levels by 2028, whereas a TAC of 14,000 t would have a 50% probability of rebuilding the stock.

The Committee also recognizes that the above advice does not 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 this uncertainty particularly given that the current estimated biomass is lower than B_{MSY}.

ATLANTIC SWORDFISH SUMMARY

	North Atlantic	***South Atlantic***
Maximum Sustainable Yield	13,059 (11,840-14,970)[1]	14,570 (12,962-16,123)[2]
Current (2016) TAC	13,700 t	15,000 t
Current (2016) Yield[3]	10,404 t	7,725 t
Yield in last year used in assessment (2015)[4]	10,668 t	10,227 t
B_{MSY}	82,640 t (51,580-132,010)[5]	52,465 t (35,119-80,951) [2]
SSB_{MSY}	21,262 t (14,797-27,728)[6]	Unknown
F_{MSY}	0.17 (0.10-0.27) [1]	0.28 (0.17-0.44) [2]
Relative Biomass (B_{2015}/B_{MSY})	1.04 (0.82 - 1.39) [7]	0.72 (0.53 - 1.01) [8]
Relative Fishing Mortality (F_{2015}/F_{MSY})	0.78 (0.62-1.01)[7]	0.98 (0.70 - 1.36) [8]
Stock Status (2015)	Overfished: NO	Overfished: YES
	Overfishing: NO	Overfishing: NO
Management Measures in Effect	Country-specific TACs [Recs. 16-03, 06-02];	Country-specific TACs [Rec. 16-04];
	125/119 cm LJFL minimum size	125/119 cm LJFL minimum size

[1] Average from base case BSP2 and SS models; range corresponding to the lowest and highest 95% CIs from the two models.
[2] From base case JABBA model with 95% CIs.
[3] Provisional and subject to revision.
[4] Based on catch data available in July 2017 for the stock assessment session.
[5] From base case BSP2 model, with 95% CIs.
[6] From base case SS model, with 95% CIs.
[7] Median and 95% quantiles from base case SS and BSP2 models.
[8] Median and 95% quantiles from base case JABBA model.

SWO-ATL-Table 1. Estimated catches (t) of Atlantic swordfish (Xiphias gladius) 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
TOTAL				29207	32868	34459	38803	33511	31567	26251	27123	27180	25139	23758	24075	25144	25535	25715	27932	23596	24928	24251	23978	24554	20281	20633	20998	18129
	ATN			15394	16738	15501	16872	15222	13025	12223	11622	11453	10011	9654	11442	12068	12373	11470	12302	11050	12081	11553	12523	13868	12069	10677	10681	10404
	ATS			13813	16130	18958	21930	18289	18542	14027	15502	15728	15128	14104	12633	13077	13162	14245	15630	12546	12846	12697	11455	10686	8212	9956	10317	7725
Landings	ATN		Longline	14318	15670	14365	15850	13819	12203	10961	10715	9921	8676	8799	10333	11407	11528	10838	11475	10341	11439	10964	11610	12955	11344	10059	10129	9523
			Other surf.	693	660	428	496	815	371	778	377	394	433	240	486	341	512	409	546	465	485	437	511	512	526	462	386	778
	ATS		Longline	13422	15739	17839	21584	17859	18299	13748	14823	15448	14302	13576	11712	12485	12915	13723	14967	11761	12106	11920	10833	10255	7889	9733	10011	7585
			Other surf.	391	391	1119	346	429	222	269	672	278	825	527	920	591	248	522	572	779	741	629	547	291	322	177	263	139
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	103
			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	
	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
			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	
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
			Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	1	112	106	184	141	142	76	8	3
			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	
			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
			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
			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	27
			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	
			EU.España	6672	6598	6185	6953	5547	5140	4079	3996	4595	3968	3957	4586	5376	5521	5448	5564	4366	4949	4147	4889	5622	4084	3750	4013	3917
			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
			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
			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	
			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	
			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
			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	
			EU.United Kingdom	0	2	3	1	5	11	0	2	1	0	0	0	0	0	0	0	0	2	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**
			Guinea Ecuatorial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	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**
			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	383
			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
			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
			Maroc	69	39	36	79	462	267	191	119	114	523	223	329	335	334	341	237	430	724	963	782	770	1062	1062	850	900
			Mexico	0	6	14	0	22	14	28	24	37	27	34	32	44	41	31	35	34	32	35	38	40	33	32	31	36
			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
			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**
			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**
			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**
			Senegal	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	0	28	11	1	44	43	49	78	52
			Sierra Leone	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	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	0	51	7	34	13	11	8	4	40	102	33
			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
			U.S.A.	3852	3783	3366	4026	3559	2987	3058	2908	2863	2217	2384	2513	2380	2160	1873	2463	2387	2730	2274	2551	3393	2824	1809	1581	1433
			U.S.S.R.	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	1	1	5	5	3	3	2	0	0	1	1	0	3	4	3	3	3	1	1	1	1	
			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**
			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**
			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**
			Venezuela	103	73	69	54	85	20	37	30	44	21	34	45	53	55	22	30	11	13	24	18	25	24	24	29	53
		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
			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
		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	
			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
			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	
			Grenada	3	13	0	1	4	15	15	42	84	0	54	88	73	56	30	26	43	0	0	0	0	0	0	0	
			NEI (ETRO)	35	111	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
			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**
			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	
			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	
	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	
			Belize	0	0	0	1	0	0	0	17	8	0	0	0	0	0	0	120	32	111	121	207	197	136	45	104	176
			Brazil	2609	2013	1571	1975	1892	4100	3847	4721	4579	4082	2910	2920	2998	3785	4430	4153	3407	3386	2926	3033	2833	1427	2892	2588	
			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
			Côte d'Ivoire	13	14	20	19	26	18	25	26	20	19	19	43	29	31	39	17	159	267	156	145	88	110	55	42	25
			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	
			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
			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	
			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
			EU.United Kingdom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	49	0	0	3	0	0	0	0	0	0	**0**
			Gabon	0	0	0	0	0	0	0	0	0	0	0	9	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
			Guinea Ecuatorial	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**
			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	
			Japan	2870	5256	4699	3619	2197	1494	1186	775	790	685	833	924	686	480	1090	2155	1600	1340	1314	1233	1162	684	975	657	639
			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
			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
			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**
			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**
			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**
			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
			Senegal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	77	138	195	180	264	162	178	143	97	173
			Sierra Leone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	0	0	0	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
			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
			U.S.A.	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**
			U.S.S.R.	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	20	4	0	0	0	0	0	0	0	0	0	0	5	6	2	**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**
			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**
		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
		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	
			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	
			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	
			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	
			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	
			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	
			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	
			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	
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
			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	
			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	
			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
			U.S.A.	383	408	708	526	588	446	433	494	490	308	263	282	275	227	185	220	205	148	138	223	217	120	137	137	89
			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	
		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
	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	
			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	
			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	
			U.S.A.	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**
		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

SWO-ATL-Table 2. Estimated probabilities (%) that both the fishing mortality is below F_{MSY} and biomass is above B_{MSY} for North Atlantic swordfish from BSP2 and SS final base models.

TAC	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
12000	73	73	75	74	76	76	77	77	77	78	77
12200	72	72	72	73	74	74	74	74	74	74	74
12400	71	71	71	71	71	72	72	71	71	71	70
12500	71	70	70	70	70	70	70	70	69	69	68
12600	70	69	69	69	69	68	68	68	67	67	66
12700	69	68	68	68	67	66	66	66	65	64	64
12800	68	67	67	67	66	65	64	64	63	62	61
12900	67	66	65	65	64	63	62	62	60	59	59
13000	66	65	64	63	62	61	60	59	58	57	56
13100	66	64	62	62	60	59	57	57	56	55	53
13200	64	63	61	60	58	57	55	54	53	52	50
13300	64	62	60	58	56	54	53	51	50	49	48
13400	62	61	58	57	55	52	50	49	47	46	45
13500	61	59	57	55	53	50	48	46	45	43	42
13600	60	57	55	53	51	48	46	44	43	41	39
13700	59	56	54	51	49	46	44	42	40	38	36
13800	57	54	52	49	47	44	42	40	37	36	34
14000	54	51	48	46	43	40	37	35	33	31	29

SWO-ATL-Table 3. Estimated probabilities (%) that biomass is above B_{MSY} for North Atlantic swordfish from BSP2 and SS final base models.

TAC	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
12000	74	74	75	75	76	77	77	78	77	78	78
12200	74	74	74	74	75	75	75	76	76	75	75
12400	74	73	73	73	73	73	73	73	73	73	72
12500	74	73	73	73	73	72	72	72	71	71	70
12600	74	73	72	72	72	71	71	71	70	70	69
12700	74	73	71	71	71	70	70	69	69	68	67
12800	74	73	71	71	70	69	69	68	67	66	65
12900	74	73	71	70	69	68	68	66	65	64	63
13000	73	72	70	70	68	67	66	65	64	63	61
13100	73	72	70	69	67	66	65	64	62	61	59
13200	73	71	69	68	66	65	64	62	60	59	57
13300	73	71	69	67	65	64	62	61	59	58	55
13400	73	71	69	67	65	63	61	59	57	55	53
13500	73	71	68	66	64	62	60	57	55	53	51
13600	73	71	68	66	63	60	58	56	53	51	49
13700	73	71	68	65	62	59	57	55	51	48	47
13800	73	70	67	64	61	58	55	53	49	47	44
14000	73	69	66	63	60	56	53	49	46	43	40

SWO-ATL-Table 4. Estimated probabilities (%) that fishing mortality is below F_{MSY} for North Atlantic swordfish from BSP2 and SS final base models.

TAC	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
12000	83	83	83	83	83	83	83	83	83	83	83
12200	81	81	80	80	80	80	80	80	80	79	79
12400	78	77	78	77	77	76	77	76	75	75	75
12500	77	75	76	75	75	75	74	74	73	73	73
12600	76	74	74	74	74	73	72	72	71	71	70
12700	74	72	72	72	72	70	71	69	69	69	67
12800	72	71	71	70	70	69	68	67	67	65	64
12900	71	70	68	68	68	66	65	65	63	63	61
13000	70	68	67	66	65	64	62	62	61	60	58
13100	68	66	65	64	63	61	60	58	58	56	56
13200	67	65	63	62	60	59	58	56	55	54	52
13300	65	64	61	61	58	56	55	53	52	50	50
13400	64	63	60	58	56	53	52	51	49	48	46
13500	62	61	58	57	54	51	49	47	46	44	43
13600	61	59	56	54	52	49	47	45	43	42	41
13700	60	57	55	52	50	47	45	43	41	38	37
13800	58	55	52	50	47	45	42	40	38	36	35
14000	54	51	48	46	43	41	38	35	33	32	30

SWO-ATL-Table 5. Estimated probabilities (%) that both the fishing mortality is below F_{MSY} and biomass is above B_{MSY} for South Atlantic swordfish from JABBA final base model.

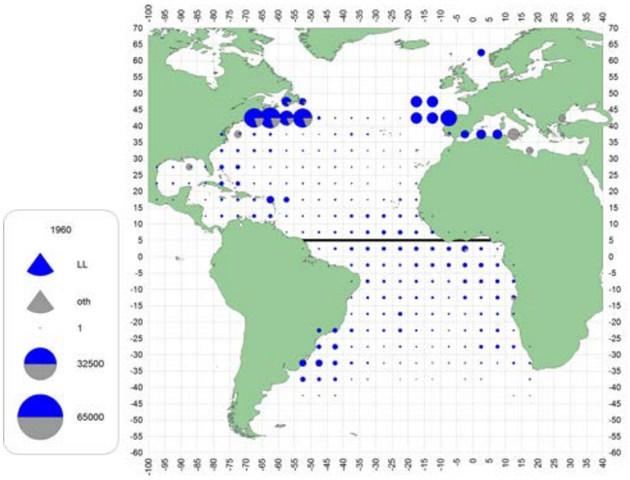
TAC	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
10000	35	51	65	75	81	85	88	90	92	93	95
10500	35	51	63	72	78	82	86	88	90	91	92
11000	35	49	59	67	74	79	82	85	87	88	90
11500	36	47	57	64	70	75	78	81	83	85	86
12000	36	46	54	60	66	70	74	77	79	81	83
12500	36	44	51	56	60	65	68	71	73	75	76
13000	36	42	47	52	56	59	62	65	66	68	70
13200	36	41	45	50	53	57	59	61	63	65	65
13400	35	40	45	49	51	54	56	58	59	61	62
13600	35	39	43	46	49	51	52	55	56	57	58
13700	35	39	42	45	47	50	52	53	54	56	57
13800	35	38	41	44	46	48	50	51	53	53	54
13900	34	37	40	43	45	46	48	49	50	52	52
14000	35	37	40	42	44	46	47	48	48	49	50
14500	33	34	35	36	36	37	38	38	38	38	39
15000	30	30	30	29	29	28	28	28	27	27	26
15500	26	25	23	22	20	19	18	17	16	16	15
16000	22	19	17	15	13	12	11	9	8	8	7

SWO-ATL-Table 6. Estimated probabilities (%) that biomass is above B_{MSY} for South Atlantic swordfish from JABBA final base model.

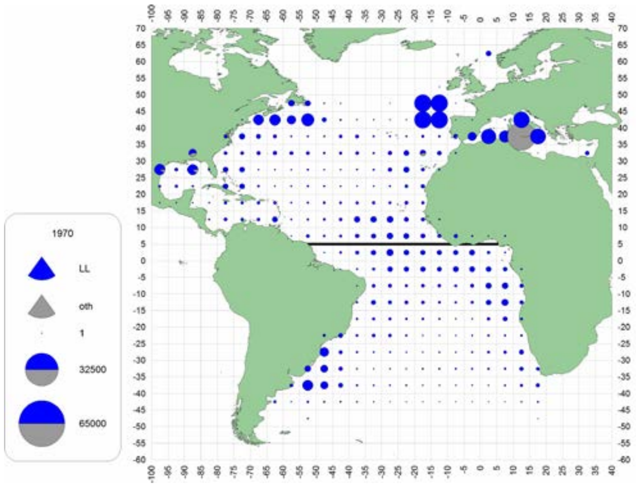
TAC	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
10000	35	51	65	75	81	85	88	90	92	93	95
10500	35	51	63	72	78	82	86	88	90	91	92
11000	35	49	59	67	74	79	82	85	87	88	90
11500	36	47	57	64	70	75	78	81	83	85	86
12000	36	46	54	60	66	70	74	77	79	81	83
12500	36	44	51	56	60	65	68	71	73	75	76
13000	36	42	47	52	56	59	62	65	66	68	70
13200	36	41	46	50	54	57	59	61	63	65	66
13400	36	41	45	49	52	54	56	58	60	61	62
13600	35	39	43	46	49	51	53	55	56	58	59
13700	35	39	43	45	48	50	52	53	54	56	57
13800	35	38	41	44	46	49	50	51	53	54	55
13900	35	38	41	43	45	47	48	50	51	52	52
14000	36	38	41	43	44	46	47	48	49	50	51
14500	36	36	37	38	38	39	39	39	40	39	40
15000	36	35	34	33	32	32	31	31	30	29	29
15500	35	33	31	28	26	24	23	21	20	19	18
16000	35	31	27	24	21	18	16	14	12	11	10

SWO-ATL-Table 7. Estimated probabilities (%) that fishing mortality is below F_{MSY} for South Atlantic swordfish from JABBA final base model.

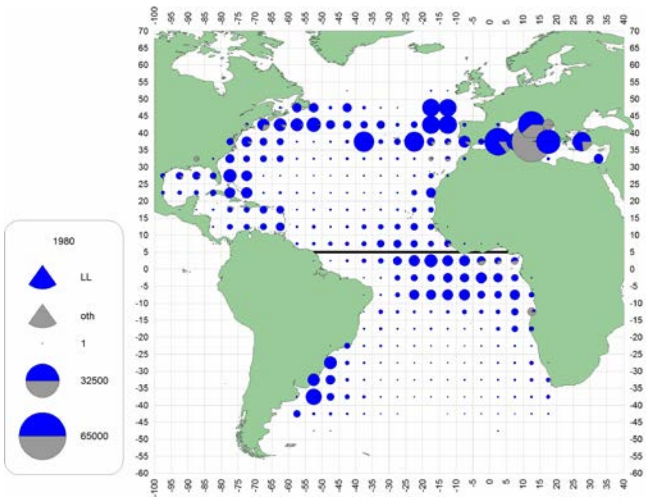
TAC	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
10000	86	90	92	94	95	96	96	97	97	97	97
10500	83	87	90	91	93	94	94	95	95	96	96
11000	78	83	86	88	90	91	92	93	93	93	94
11500	73	78	81	84	86	87	88	89	90	91	92
12000	68	73	76	79	81	83	84	86	86	87	88
12500	62	66	70	73	75	77	78	79	80	81	82
13000	56	60	63	66	68	70	71	72	73	74	75
13200	53	56	59	62	64	66	67	68	69	70	71
13400	51	54	57	60	61	63	64	65	66	66	67
13600	48	51	53	56	57	59	60	61	62	63	63
13700	47	50	52	54	55	57	58	59	60	60	61
13800	46	48	50	52	53	55	56	57	57	58	58
13900	44	46	49	50	52	53	53	54	55	56	56
14000	44	45	47	49	50	51	52	52	53	53	54
14500	38	38	39	39	40	40	40	41	41	41	41
15000	32	32	31	30	30	30	29	29	28	28	27
15500	26	25	24	22	20	20	18	17	17	16	16
16000	22	19	17	15	13	12	11	10	9	8	7



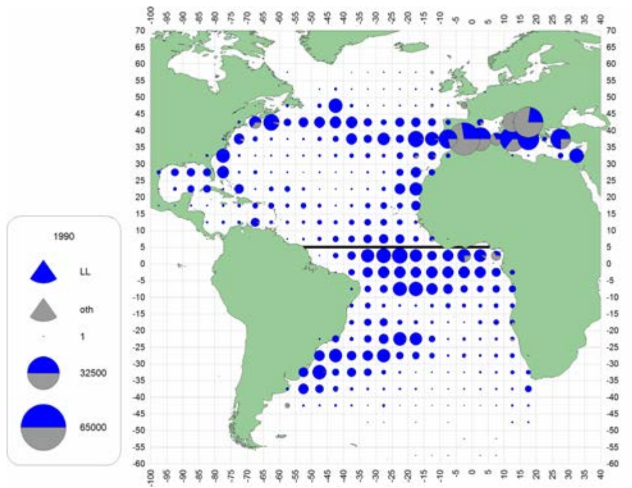
a. SWO (1960-69)



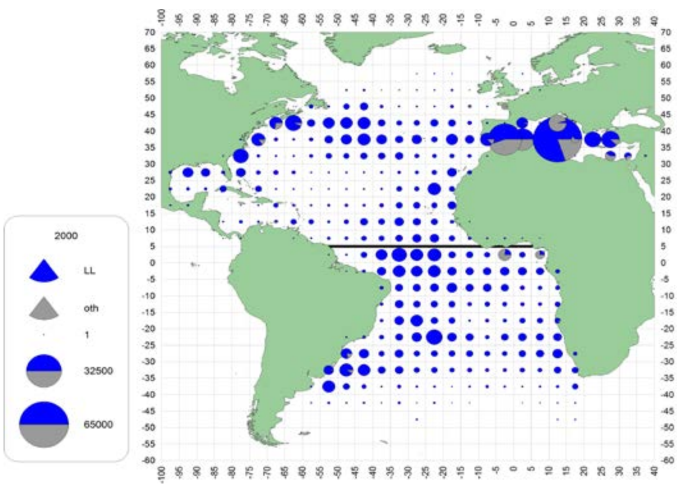
b. SWO (1970-79)



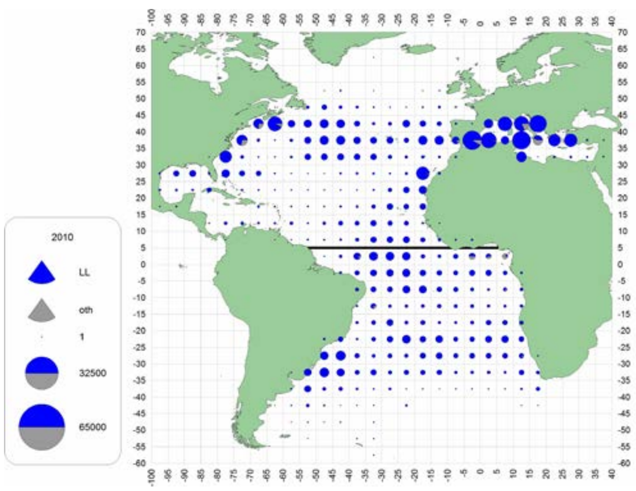
c. SWO (1980-89)



d. SWO (1990-99)

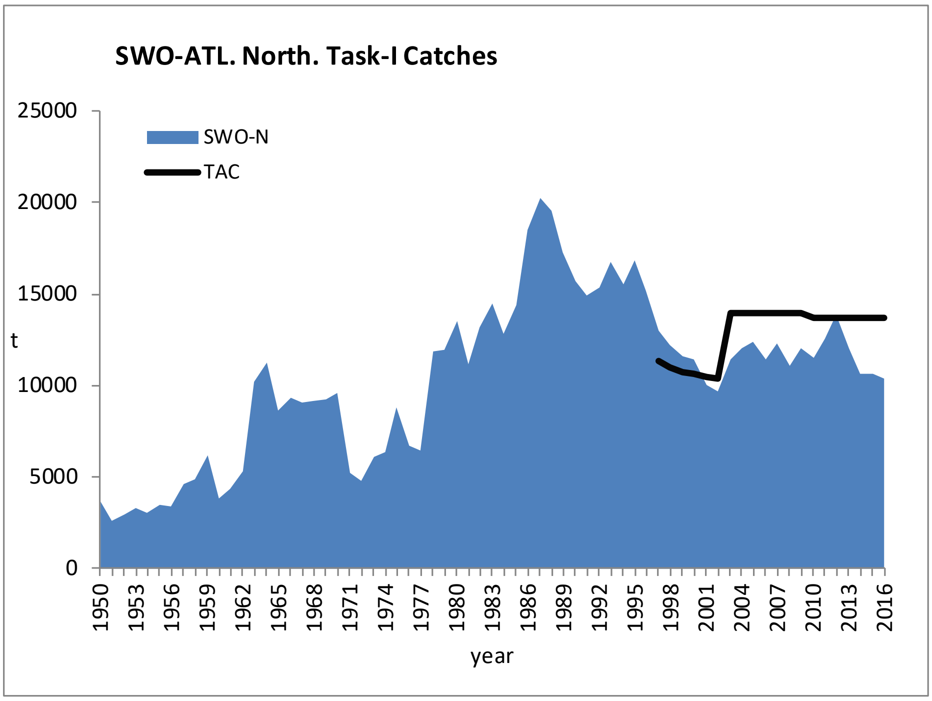


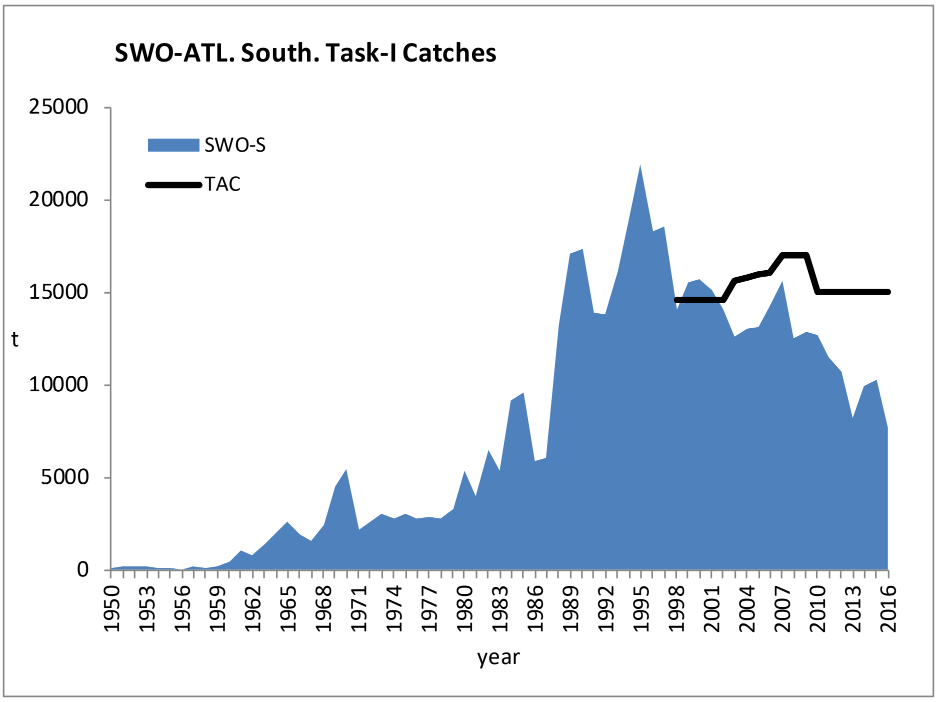
e. SWO (2000-09)



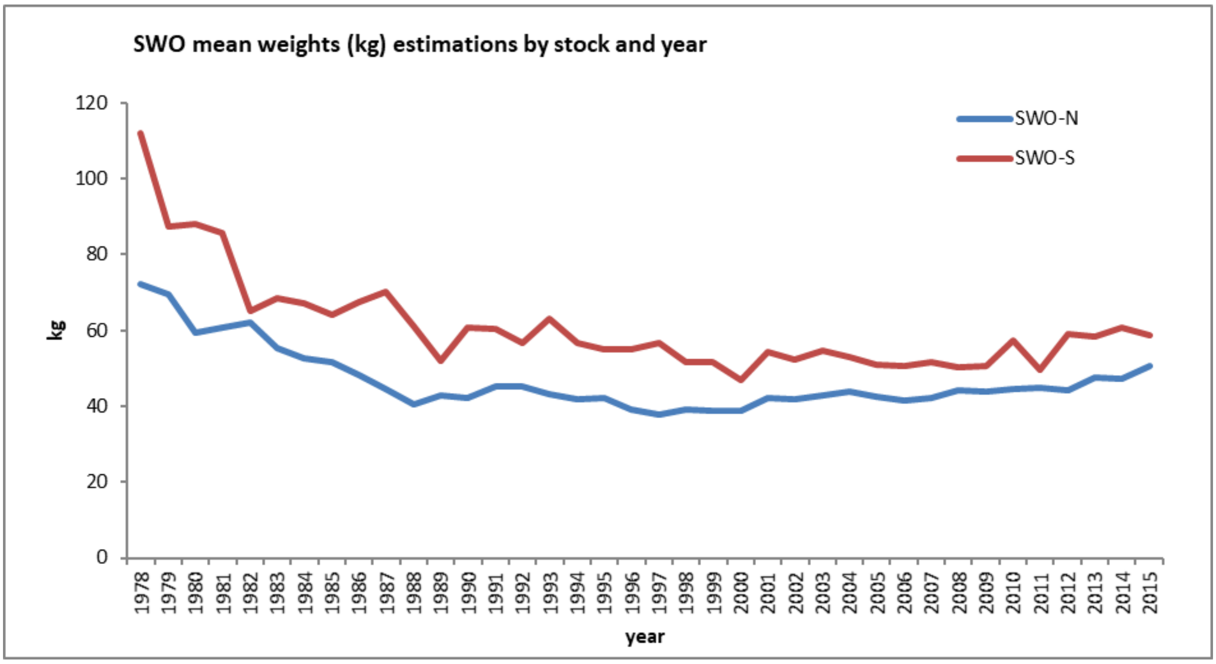
f. SWO (2010-15)

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 1960-2015 (the last decade only covers 6 years).

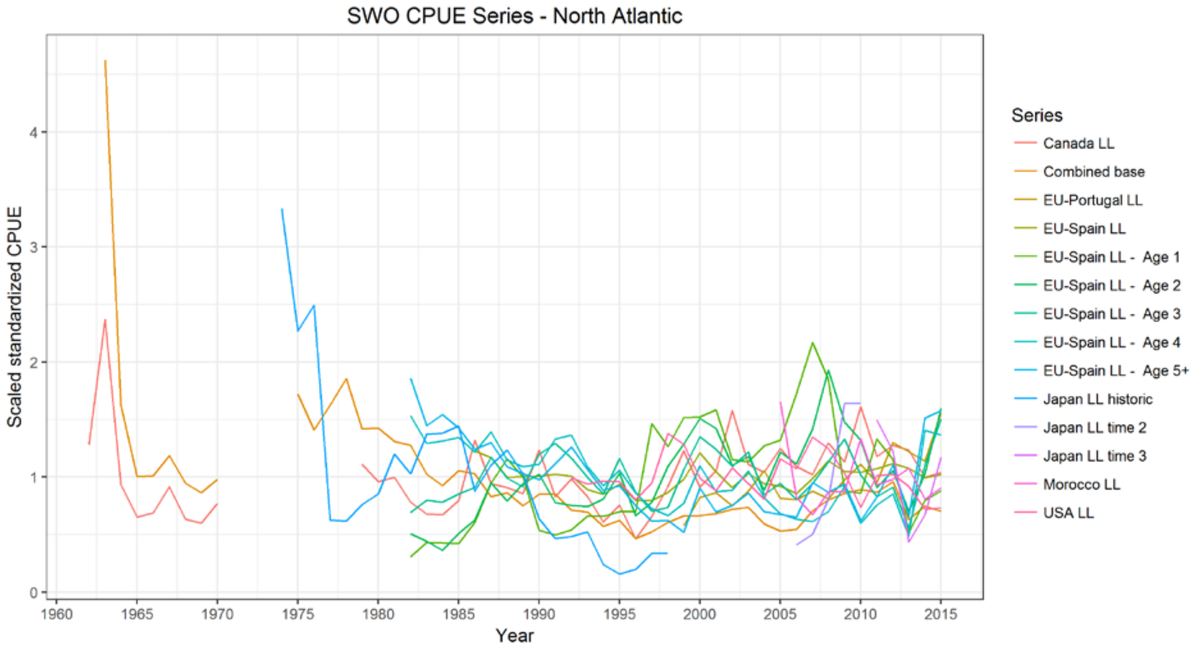




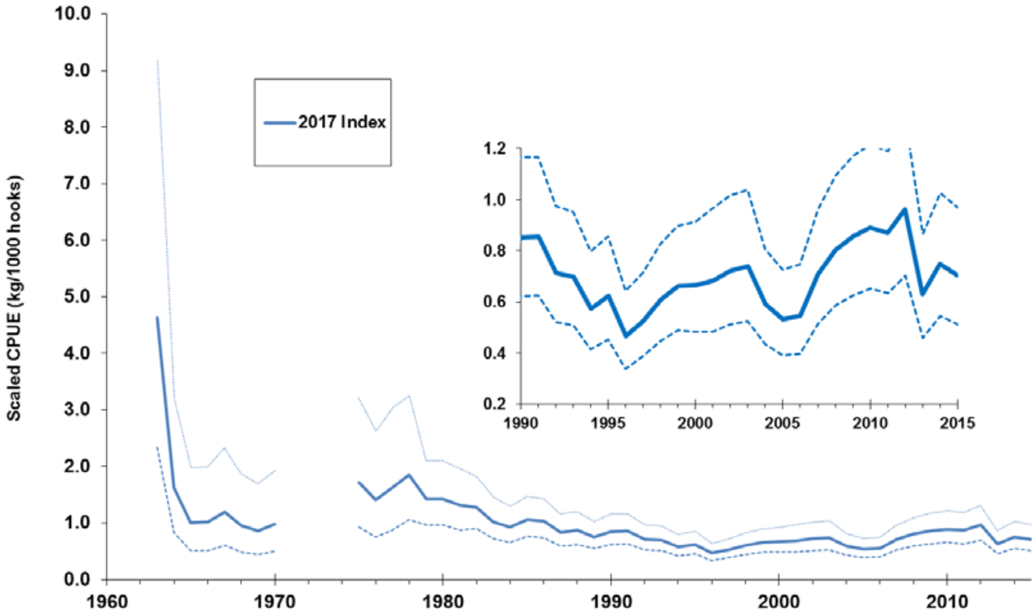
SWO-ATL-Figure 2. North and South Atlantic swordfish catches and TAC (t), for the period 1950-2016.



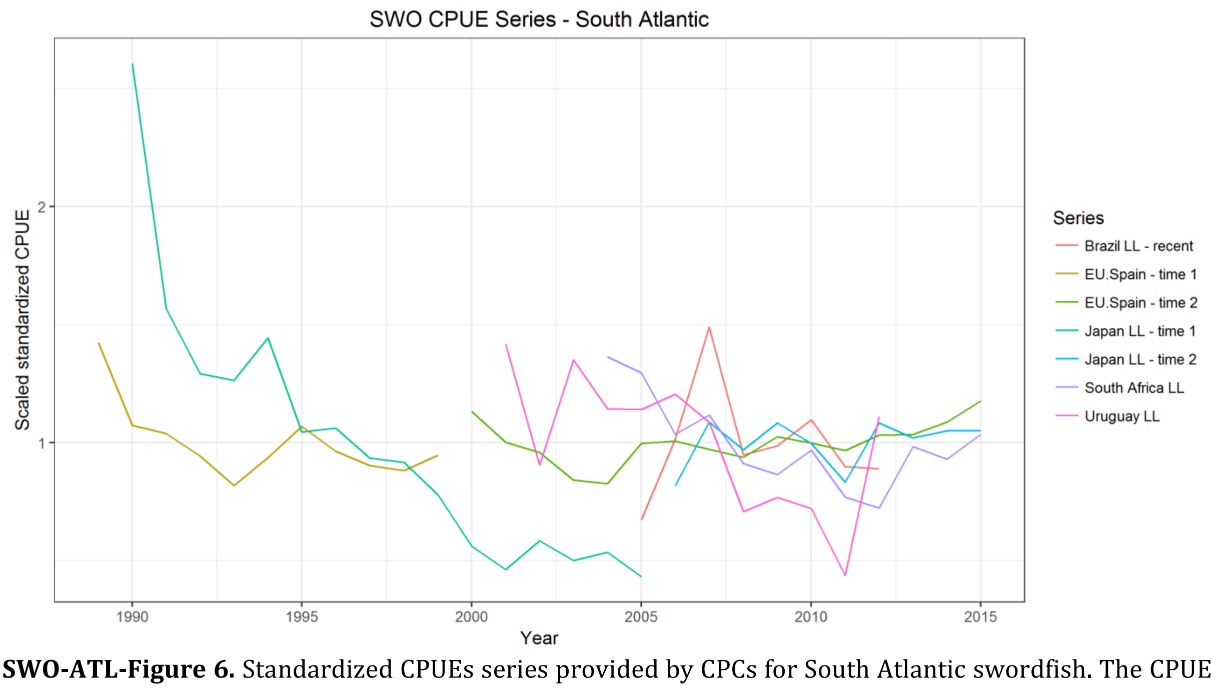
SWO-ATL-Figure 3. Trends in mean weight (kg) for the North and South Atlantic swordfish stocks.



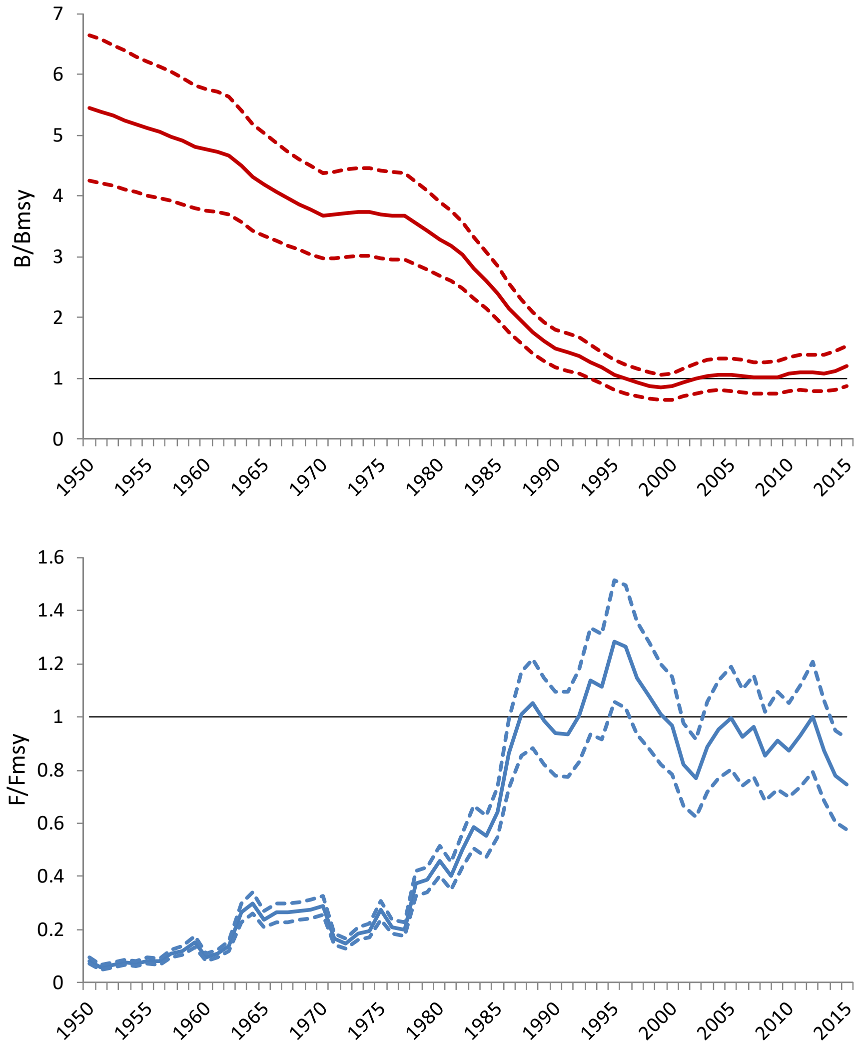
SWO-ATL-Figure 4. Standardized CPUEs series provided by CPCs for the North Atlantic swordfish and the combined index for the base continuity production model. The CPUE series were scaled to their mean for comparison purposes.



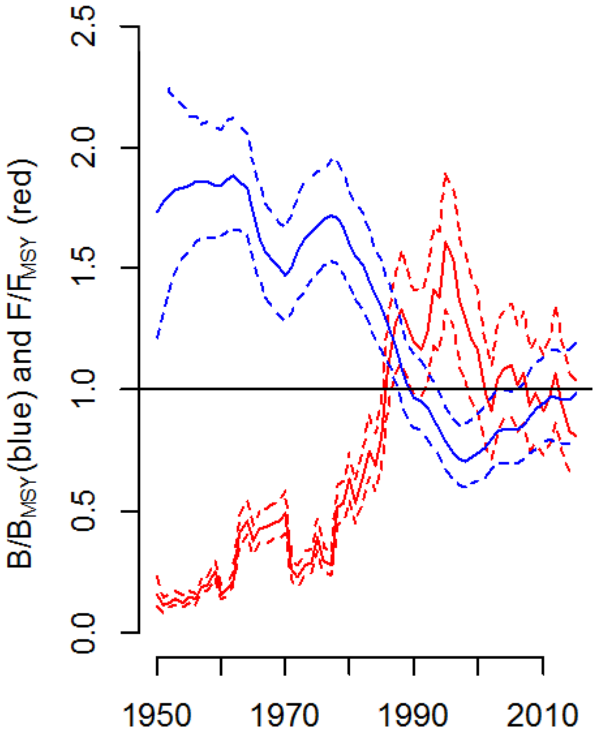
SWO-ATL-Figure 5. Standardized combined biomass CPUE index for North Atlantic and 95% confidence intervals, used as the continuity run for the production models. The inset plot shows the detail of the index trend since 1990.



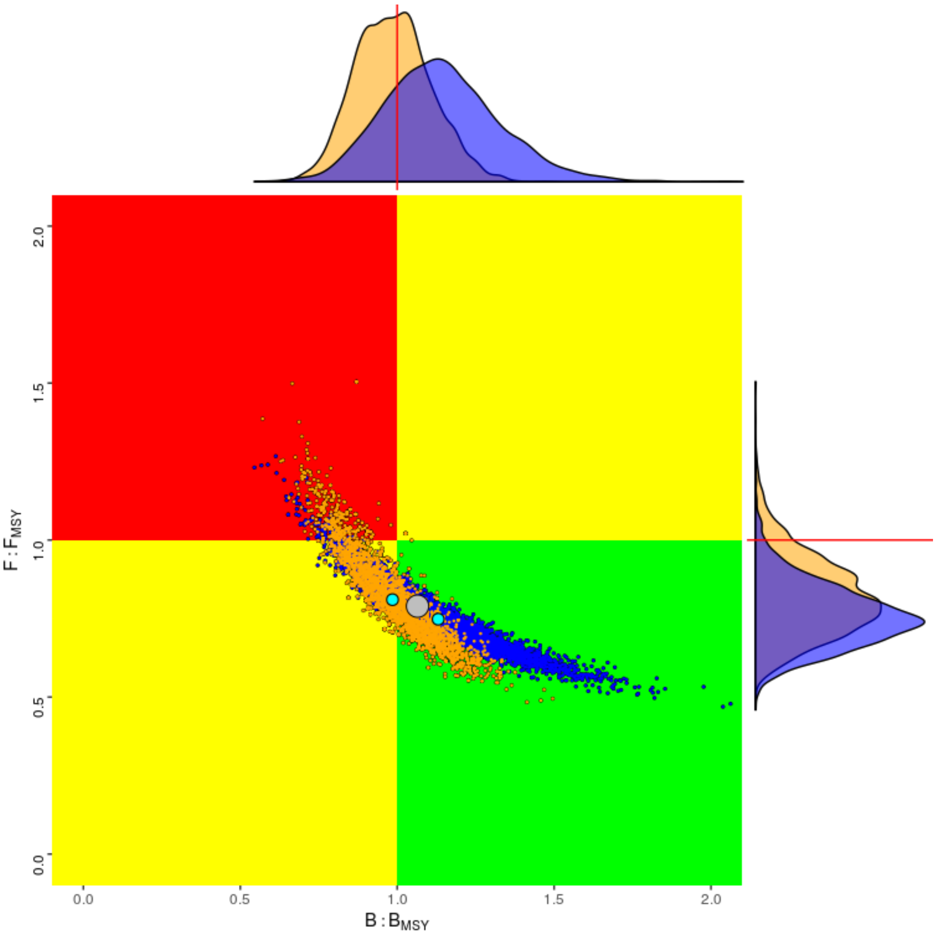
SWO-ATL-Figure 6. Standardized CPUEs series provided by CPCs for South Atlantic swordfish. The CPUE series were scaled to their mean for comparison purposes.

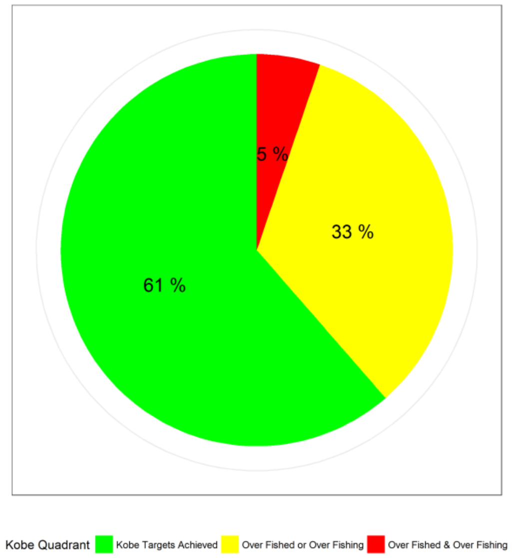


SWO-ATL-Figure 7. Results from the North Atlantic swordfish base case SS model: trends in relative biomass (top) and fishing mortality (bottom). Dashed lines represent lower and upper 95% CIs.

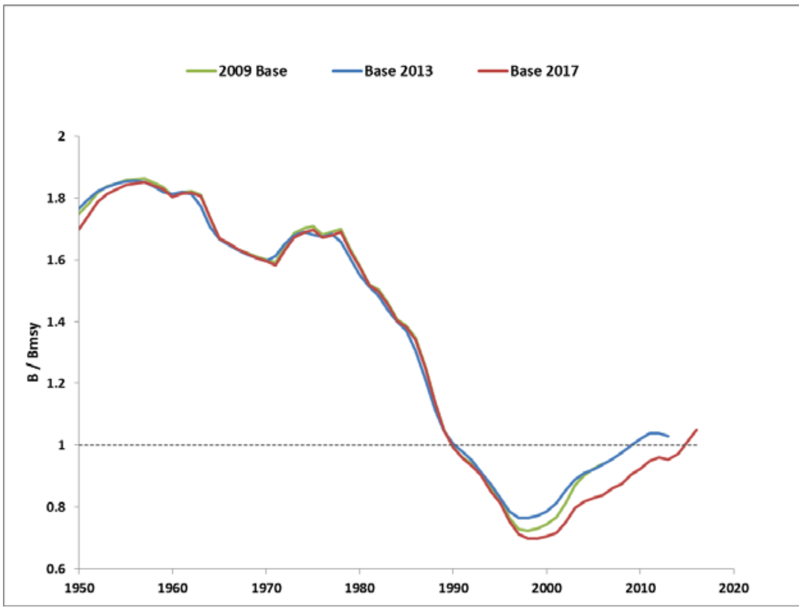


SWO-ATL-Figure 8. Results from the North Atlantic swordfish base case BSP2 model: trends in relative biomass and fishing mortality. Dashed lines represent lower and upper 90% CIs.

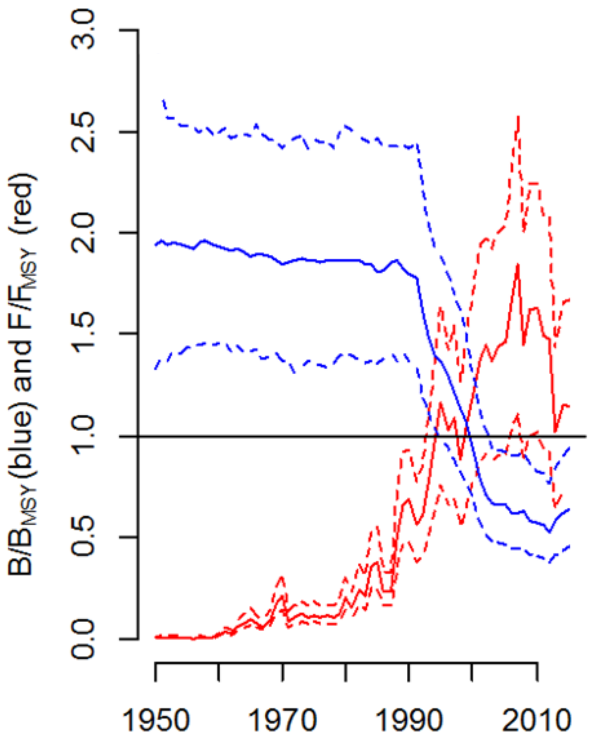




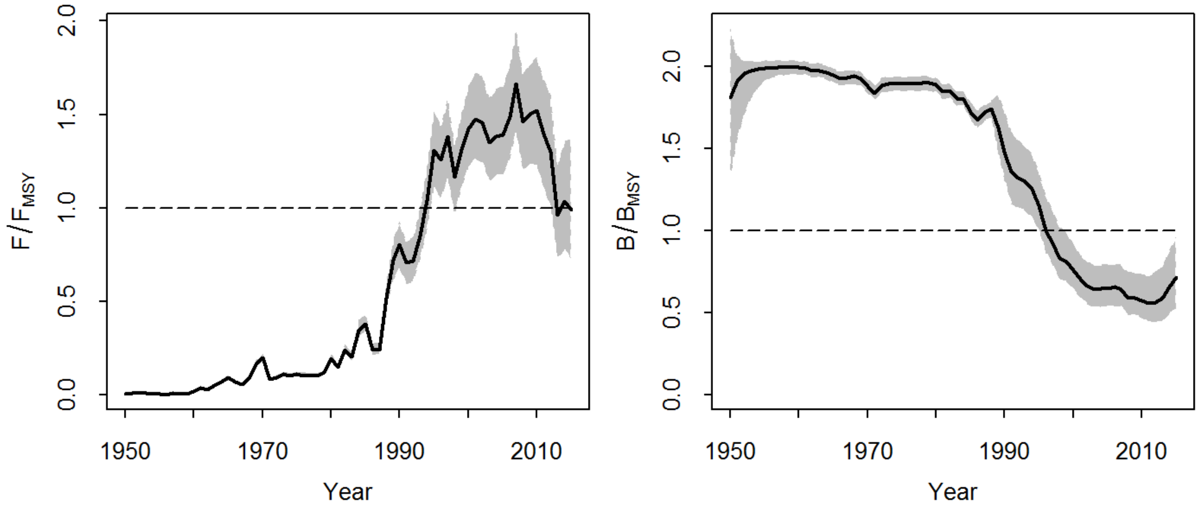
SWO-ATL-Figure 9. North Atlantic swordfish stock status terminal points (2015) from the base SS and BSP2 models. The solid light blue circle is the estimated median point with the respective uncertainties from each model (BSP2 in orange and SS in dark blue). The larger light grey circle is the estimated overall median from both models. The pie chart below represents the probabilities of stock being in the different color quadrants combined form both models (red 5%, yellow 33%, green 61%).



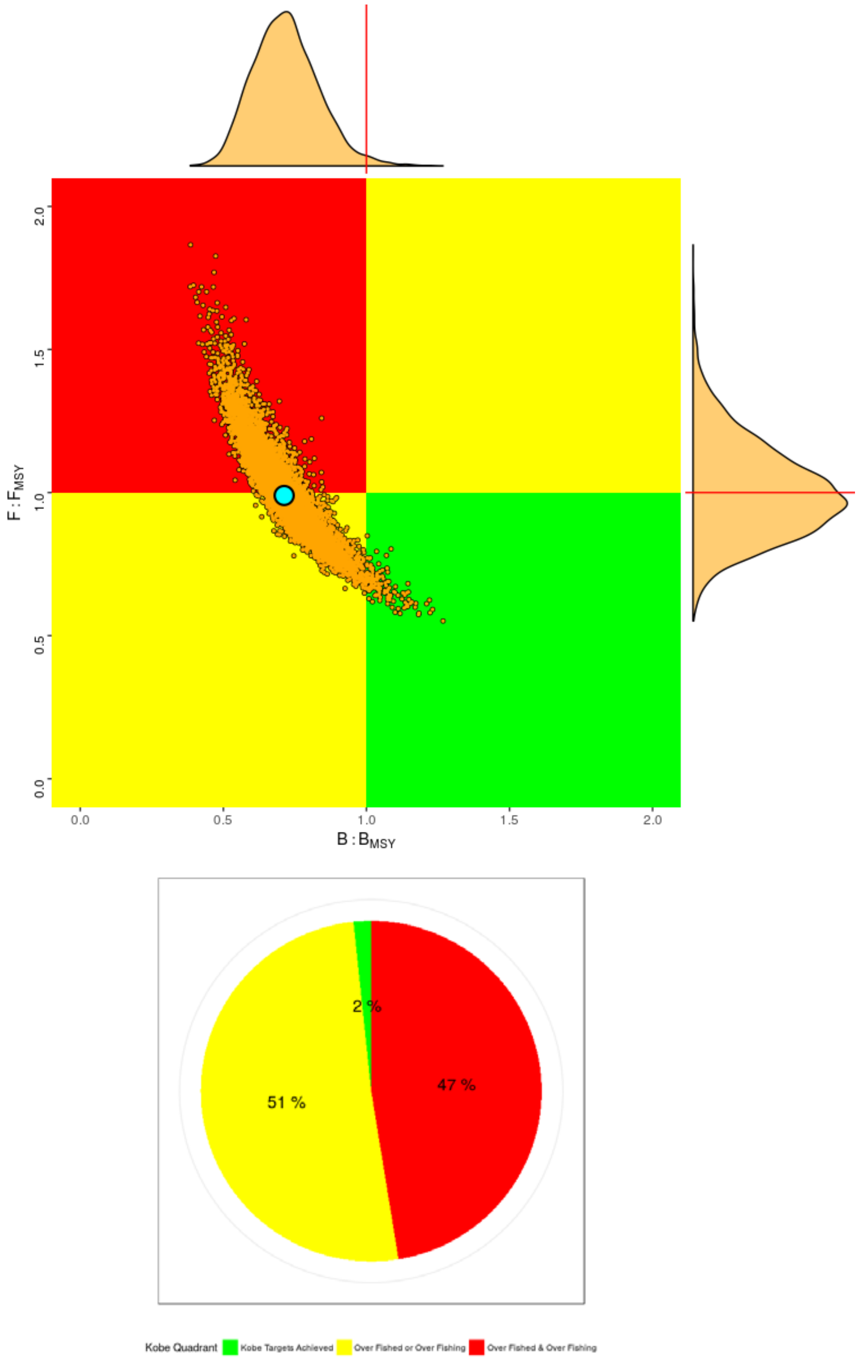
SWO-ATL-Figure 10. Comparison of relative biomass trends estimated by the ASPIC base case model for the 2009, 2013 and 2017 North Atlantic swordfish stock assessments.



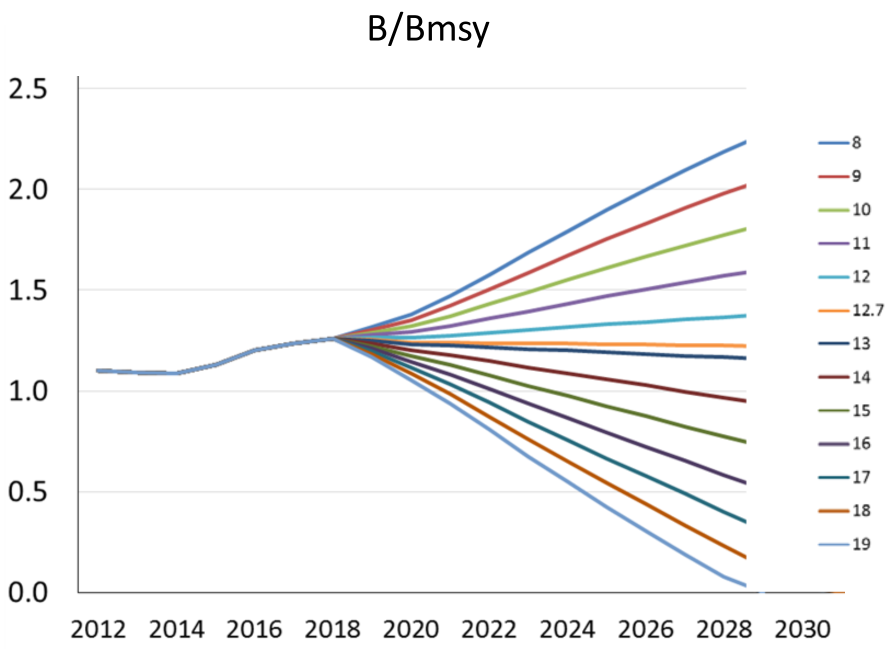
SWO-ATL-Figure 11. South Atlantic swordfish biomass and fishing mortality rates relative to MSY levels, from the BSP2 base case model. Dashed lines represent lower and upper 90% CIs.

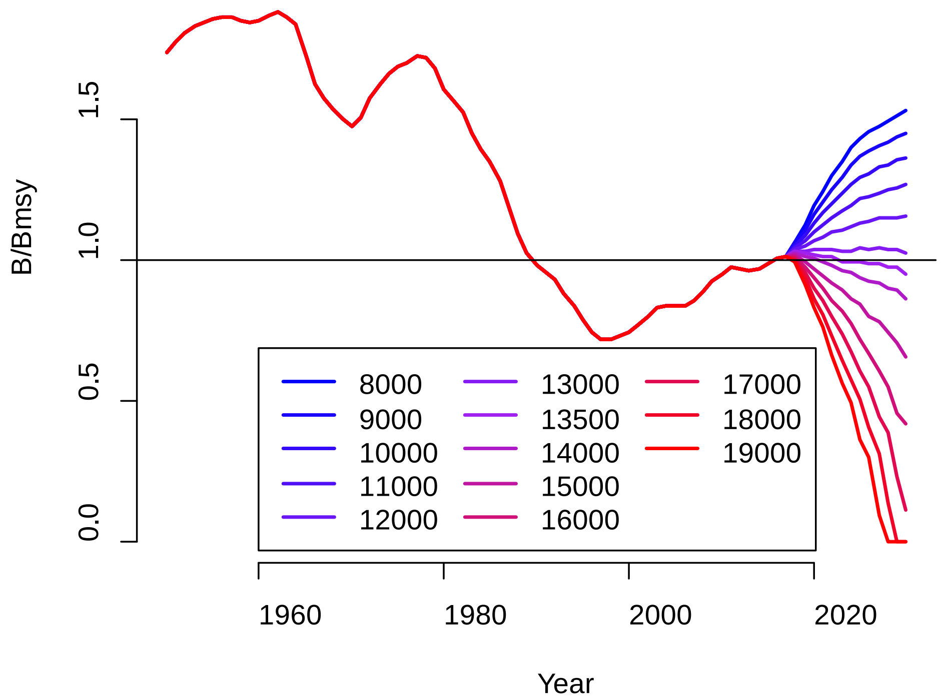


SWO-ATL-Figure 12. South Atlantic swordfish biomass and fishing mortality rates relative to MSY levels, from the JABBA base case model. Grey areas represent lower and upper 95% CIs.

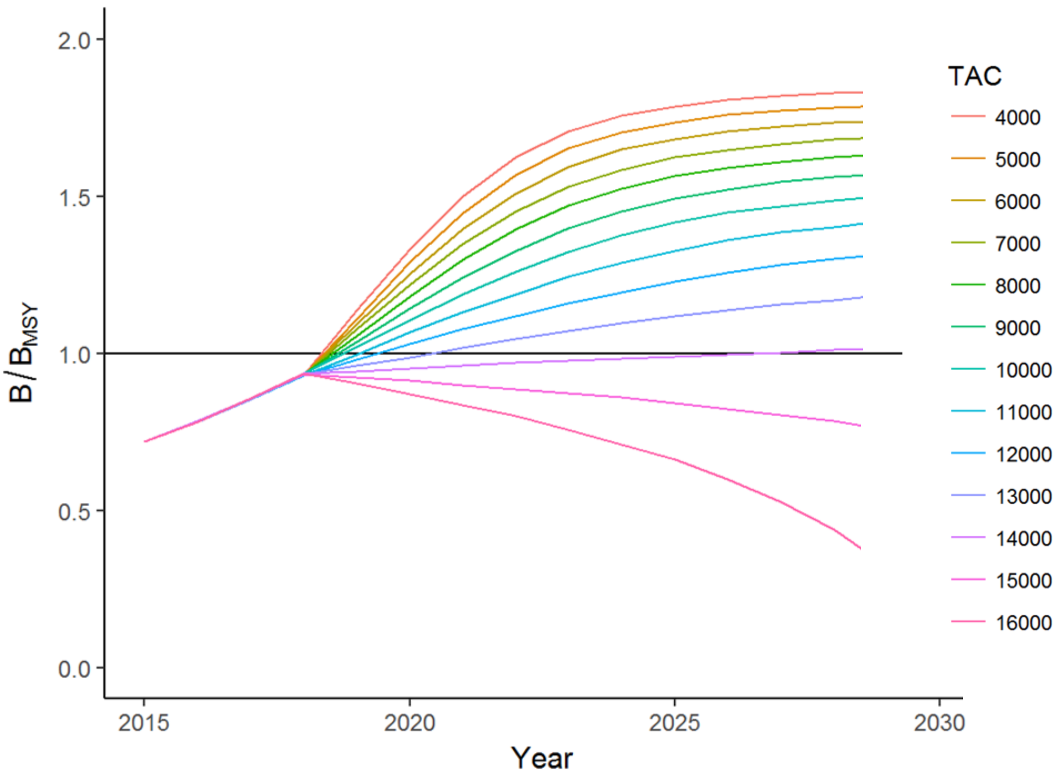


SWO-ATL-Figure 13. Kobe plots for the JABBA reference base case model for southern Atlantic swordfish. The solid blue circle is the estimated median point with the respective uncertainties in the terminal year (2015). The pie chart below represents the probabilities of stock being in the different color quadrants (red 47%, yellow 51%, green 2%).





SWO-ATL-Figure 14. Median trends of relative biomass (B/B_{MSY}) for the projected North Atlantic swordfish stock based on the SS (top) and BSP2 (bottom) base case models under different constant catch scenarios (thousand tons).



SWO-ATL-Figure 15. Median trends of relative biomass (B/B_{MSY}) for the projected South Atlantic swordfish stock based on the JABBA base case models under different constant catch scenarios (thousand tons).

8.10 SWO-MED – MEDITERRANEAN SWORDFISH

In the last 4 years the Mediterranean swordfish production is stable at around 10,000 t and it is comparable to that observed for much larger areas such as the North and South Atlantic. This may suggest that the biological and oceanographic conditions prevailing in the Mediterranean favour the high productivity of large pelagic fish. The most recent assessment was conducted in 2016, making use of the available catch, effort and size information through 2015. The present report summarizes assessment results and readers interested in more detailed information on the state of the stock should consult the report of the latest stock assessment session (Anon., 2017j).

SWO-MED-1. Biology

Research results based on genetic studies have demonstrated that Mediterranean swordfish compose a unique stock separated from the Atlantic ones, although there is incomplete information on stock mixing and boundaries. Although mixing between stocks is believed to be low and generally limited to the region around the Strait of Gibraltar, past biological and genetic studies have suggested the possible occurrence of mixing between the Mediterranean and North Atlantic stocks west of the 05°W boundary separating the two stocks. It is very likely that an important fraction of fish caught in this area belongs to the Mediterranean stock but further studies are needed to identify the degree of mixing among stocks. A brief review of past tagging experiments indicated that the existing results cannot provide robust information about mixing patterns and confirmed that further work is needed on this aspect.

According to previous knowledge, the Mediterranean swordfish have different biological characteristics compared to the Atlantic stock. The growth parameters are different, and the sexual maturity is reached at younger ages than in the Atlantic.

In the western Mediterranean, mature females as small as 110 cm LJFL have been observed and the estimated size at which 50% of the female population is mature occurs at about 140 cm. According to the growth curves used by the SCRS, these two sizes correspond to 2 and 3.5 year-old fish, respectively. Males reach sexual maturity at smaller sizes and mature specimens have been found at about 90 cm LJFL. Based on the fish growth pattern and the assumed natural mortality rate of 0.2, the maximum yield would be obtained through instantaneous fishing at age 6, while current catches are dominated, in terms of number, by fish less than 4 years old.

Based on the analysis of large data sets, integrating information from different areas, and on information from past studies, the Committee has suggested new Mediterranean-wide equations for different length-weight relationships and weight conversions. It was, however, noted that fisheries and time dependent relationships may perform better at given conditions and should be preferred, if available.

SWO-MED-2. Fishery indicators

Mediterranean swordfish landings showed an upward trend from 1965-1972, stabilized between 1973-1977, and then resumed an upward trend reaching a peak in 1988 (20,365 t; **SWO-MED-Table 1**, **SWO-MED-Figure 1**). The sharp increase between 1983 and 1988 may be partially attributed to improvement in the national systems for collecting catch statistics; thus earlier catches may be higher than those appearing in Task I tables. Since 1988 and up to 2011, the reported landings of swordfish in the Mediterranean Sea have declined fluctuating mostly between 12,000 to 16,000 t. In the last five years (2012-2016), following the implementation of the three-month fishery closure and the establishment of the list of authorized vessels, overall fishing effort has been decreased and catches are around 9-10,000 t. In general, these catch levels are relatively high and similar to those of bigger areas such as the North Atlantic. This could be related to higher recruitment levels in the Mediterranean than in the North Atlantic, different reproduction strategies (larger spawning areas in relation to the area of distribution of the stock) and the lower abundance of large pelagic predators (e.g. sharks) in the Mediterranean. Updated information on Mediterranean swordfish catch by gear type is provided in **SWO-MED-Table 1** and **SWO-MED-Figure 1**.

The provisional Task I catch for 2015 that was used in the assessment was 9,966 t, which is among the lowest annual catches since 1983. The biggest producers in the recent years (2003-2015) are EU-Italy (45%), EU-Spain (13%), EU-Greece (10%), Morocco (14%), and Tunisia (7%). Also, Algeria, EU-Cyprus, EU-Malta and Turkey have fisheries targeting swordfish in the Mediterranean. Minor catches of swordfish have also been reported by Albania, EU-Croatia, EU-France, Japan, and Libya.

In the recent years (2003-2016), the main fishing gears used are longlines (on average, representing around 85% of the annual catch) and gillnets. Since 2012, gillnets have been officially eliminated following ICCAT recommendations for a general ban of driftnets in the Mediterranean. Minor catches are also reported from harpoon, trap and fisheries targeting other large pelagic species (e.g. albacore). From 2007-2010 a mesopelagic longline gear has been gradually introduced and nowadays has partially replaced the surface longline gear in several Italian and Spanish swordfish fleets. This is particularly noteworthy, as these fisheries are among the largest within the stock area, and the changes have implications for the use of catch rates as indices of abundance in the stock assessments.

Standardised CPUE series from different longline fisheries targeting swordfish that were used in the 2016 stock assessment session, did not reveal any overall trend over time (**SWO-MED-Figure 2**). It should be noted that CPUE series did not cover the earlier years of the reported landings. No trend over the past 30 years was identified regarding the mean fish weight in the catches (**SWO-MED-Figure 3**).

SWO-MED-3. State of the stocks

It should be noted that the assessment results and projections presented here are based on the results of the 2016 assessment, including data up to 2015 that were available at the time of the assessment (July 2016).

Under different assumptions about natural mortality rates and reporting levels of undersized fish in the catch, age-structured analysis (XSA) indicated that current SSB levels are much lower than those in the 80s, although no trend appears since then.

XSA results indicate that recruitment shows a declining trend in the last decade, while stock biomass remains stable at low levels that are about 1/3 of that in the mid 1980s (**SWO-MED-Figure 4**). There appears to have been a recent decline in F in the last decade.

Results of equilibrium yield analyses based on the XSA assessment indicated that the stock is both overfished and subject to overfishing, with a 100% probability. Current (2015) SSB is less than 15% of B_{MSY} and F is almost twice the estimated F_{MSY} (**SWO-MED-Figure 5**). Results indicate that the stock is overfished throughout the whole period considered in the XSA assessment (1985-2015).

The Committee again noted the large catches of small size swordfish, i.e. less than 3 years old (many of which have probably never spawned) and the relatively low number of large individuals in the catches. Fish less than three years old usually represent 50-70% of the total yearly catches in terms of numbers (**SWO-MED-Figure 6**). A reduction of the volume of juvenile catches would improve yield per recruit and spawning biomass per recruit levels.

SWO-MED-4. Outlook

The assessment of Mediterranean swordfish indicates that the stock is overfished and suffering overfishing. The stock has been in this state since the late 1980s because of the large catches in the 1980s and the selection pattern which captures many immature fish. Catches of immature fish remain high and the greatest mortality is suffered by fish of age 3. Recruitment has been declining for the last 10 years, and recent recruitments have been lower than the level expected to be available given recent levels of SSB.

Based on the stock status estimates, once the stock is rebuilt, a reduction of current F to the F_{MSY} level would result in a substantial (about five times) long term increase in SSB. The above findings, however, should be faced with caution as there is considerable uncertainty in regards to the possible levels of future recruitment given the assumed high steepness of the S/R relationship. It is unclear whether the most recent low levels are associated with a change in stock productivity, if they are an artefact of the estimation process, or if they are due to a temporary reduction in recruitment that could be reverted naturally by a series of positive recruitment anomalies. It is worth mentioning that the estimated SSB_{MSY} levels are twice as much higher than the SSB values estimated before the full expansion of the fishery. Correspondingly, the estimated F_{MSY} is lower than all historical F values. Given the uncertainties on optimum SSB level estimates and the rapid fishery expansion in the 1980s, which resulted in severe stock biomass declines, the SSB levels before the expansion of the fisheries may be also considered as a B_{MSY} proxy for the stock. These levels are around 30,000 t, more than 50% lower than the currently estimated B_{MSY} value. (~63,000 t).

Projections of 20% fishing mortality reductions based on highly-aggregated data derived from the age-structured assessment assuming the current exploitation pattern and the assumption of reverting recruitment to the 1980s levels, according to estimated S/R relationship, are forecast to be beneficial in moving the stock condition closer to the Convention objective, resulting in substantial SSB increases in the medium-long term (8-12 years) and bringing SSB to the late 80s' levels. Projection results are summarized in **SWO-MED-Figure 7.**

SWO-MED-5. Effect of current regulations

ICCAT imposed a Mediterranean-wide one month fishery closure for all gears targeting swordfish in 2008, followed by a two-month closure since 2009. Through Recommendations 11-03 and 13-04 the Commission has adopted additional management measures intended to bring the stock back to levels that are consistent with the ICCAT Convention objective. Those measures include an additional one month closure accompanied by minimum catching size regulations, a list of authorized vessels, and specifications on the technical characteristics of the longline gear. Recently, through Rec. 16-05, which replaced Rec. 13-04, a 15-year recovery plan has been adopted. In addition, increased catching size, and fishing capacity limitations were established, accompanied by TACs and a seasonal closure of the albacore fishery to reduce juvenile swordfish by-catches. The European Union introduced a driftnet ban for highly migratory species in 2002 and in 2003 ICCAT adopted a recommendation for a general ban of this gear in the Mediterranean [Rec. 03-04]. Rec. 04-12 forbids the use of various types of nets and longlines for sport and recreational fishing for tuna and tuna-like species in the Mediterranean.

After the adoption of the aforementioned recommendations, reported catches have decreased significantly from the 2000s' level, being the catches of the period 2012-2016 among the lower of the last three decades. In addition, reported catches of juvenile swordfish of less than 90 cm have also decreased more than 50%, compared with the levels of the decade of 2000s. As the additional measures foreseen under Rec. 16-05 have only recently been adopted, their effects cannot be evaluated.

SWO-MED-6. Management recommendations

Over the last 25 years biomass levels appear to be rather stable at low levels. This situation has remained the same since the previous assessment of 2014. However, fishing mortality levels have shown a declining trend since 2010. Assessment of stock status and reference points were done under the assumption that recruitment levels can come back up to the levels seen in the past (1980s and 1990s). Under such assumption the stock is currently overfished and suffering overfishing. According to the Commission objectives the stock requires rebuilding and fishing mortality has to be reduced in accordance with Rec. 11-13. The level of the stock to be rebuilt, is contingent on the assumption on future recruitment which is highly uncertain. In order for rebuilding to start taking place there will be a need for substantial reductions in harvest (**SWO-MED-Tables 2-3**). Additionally, for the SCRS to be able to reduce uncertainty in regards to future recruitment, there will be a need to increase monitoring of landings and discards, also taking into account that since the establishment of minimum catching sizes, the discard levels of undersized swordfish may have increased.

MEDITERRANEAN SWORDFISH SUMMARY

Maximum Sustainable Yield	19,683 t[1]
Current (2016) Yield	8,954 t[2]
SSB_{MSY}	63,426 t[1]
F_{MSY}	0.25 [1]
Relative Spawning Biomass (SSB_{2015}/SSB_{MSY})	0.12[1]
Relative Fishing Mortality	
F_{2015}/F_{MSY}	1.85[1]
$F_{2015}/F_{0.1}$	2.64[1]
Stock Status (2015)	Overfished: Yes[1]
	Overfishing: Yes[1]
Management Measures in Effect:	Driftnet ban [Rec. 03-04]
	Three month fishery closure, gear specifications (number and size of hooks and length of gear), minimum catching size, regulations, list of authorized vessels, fishing capacity restrictions, TACs [Rec. 16-05].

[1] Estimates based on the XSA and equilibrium analyses (see text for details).
[2] Estimates for 2016 are considered preliminary.

SWO-MED-Table 1. Estimated catches (t) of swordfish (Xiphias gladius) in the Mediterranean by gear and flag.

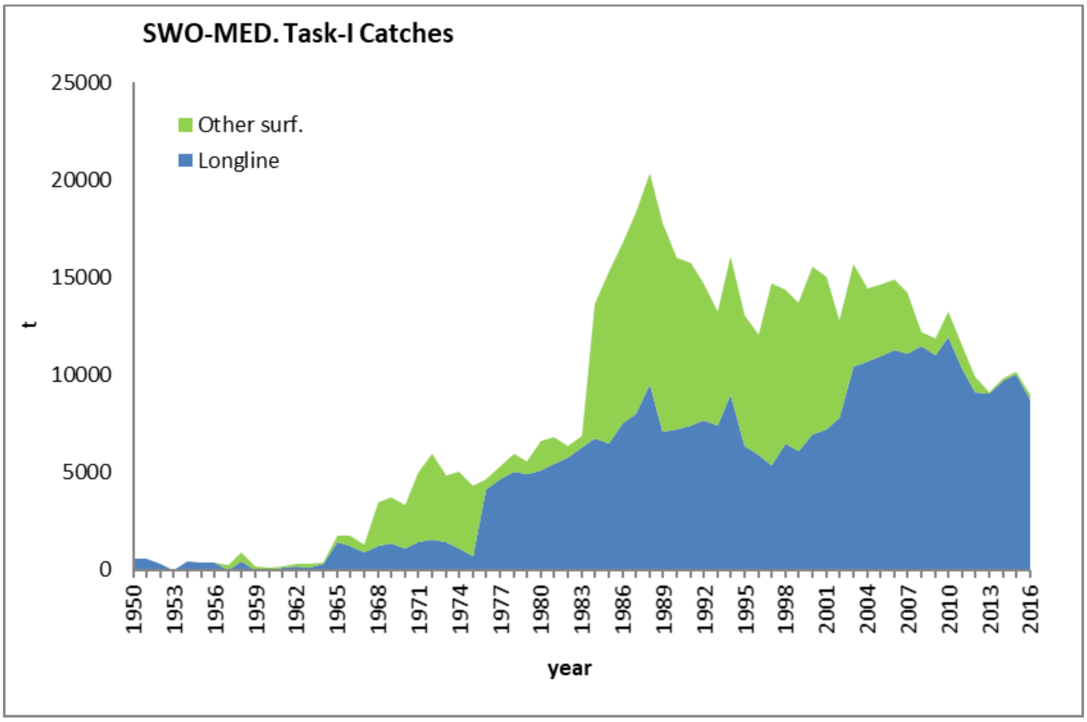
			1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
TOTAL	MED		14709	13265	16082	13015	12053	14693	14369	13699	15569	15006	12814	15674	14405	14600	14895	14227	12164	11840	13265	11450	9913	9096	9801	10166	8954
Landings		Longline	7631	7377	8985	6319	5884	5389	6496	6097	6963	7180	7767	10415	10667	10848	11230	11028	11465	11020	11918	10288	9131	9047	9718	10046	8691
		Other surf.	7078	5888	7097	6696	6169	9304	7873	7602	8606	7826	5047	5259	3729	3639	3649	3179	672	819	1347	1162	782	49	83	113	263
Discards		Longline	0	0	0	0	0	0	0	0	0	0	0	0	9	113	16	19	27	0	0	0	0	0	0	7	
Landings	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	
		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
		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
		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	45	43
		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
		EU.France	0	0	0	0	0	0	0	0	0	12	27	0	19	0	0	14	14	16	78	81	12	66	127	182	179
		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
		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
		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
		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**
		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	
		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**
		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**
		Libya	0	0	0	0	0	0	11	0	8	6	0	10	2	0	16	0	0	0	0	0	0	0	0	0	
		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
		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	
		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	
		Turkey	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
	NCC	Chinese Taipei	0	1	1	0	1	3	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	
Discards	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	7	**0**
		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	

SWO-MED-Table 2. Kobe II Strategy matrix showing probabilities (%) of being in the green quadrant by year for each level of fishing mortality. Fsq refers to the current F (2015).

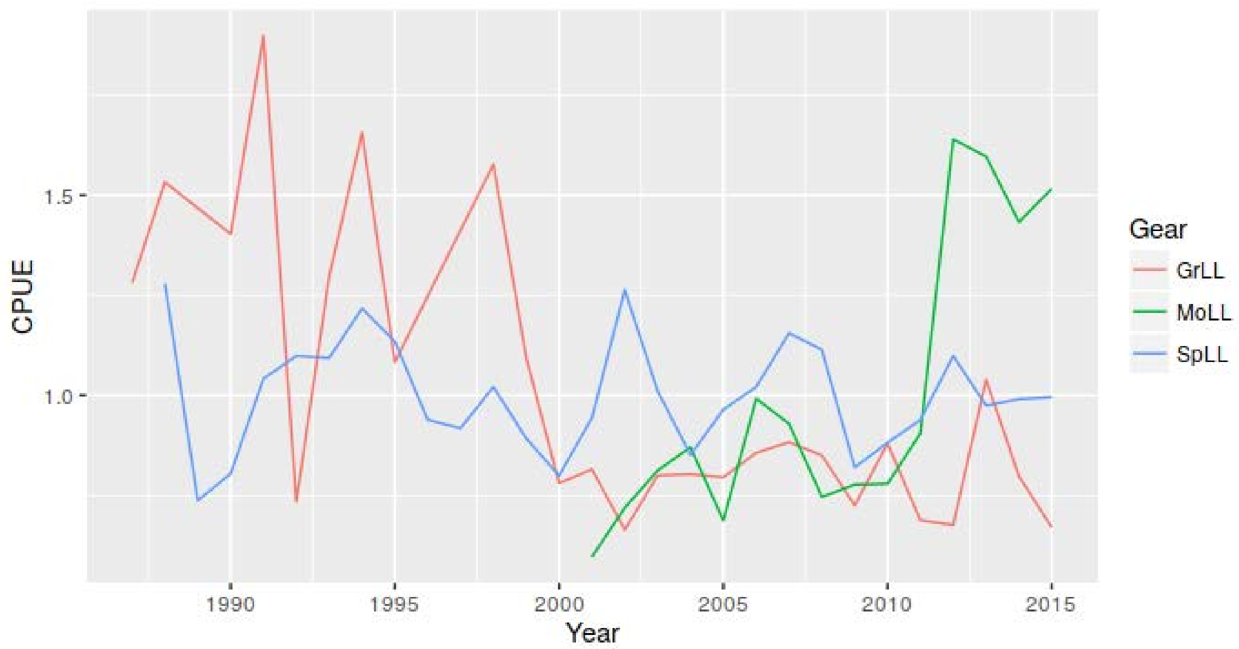
F multiplier		*F/Fsq*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*
0	F_{MSY}	0	0	0	0	0	100	100	100	100	100	100
0.25	F_{MSY}	0.14	0	0	0	0	7	100	100	100	100	100
0.5	F_{MSY}	0.29	0	0	0	0	0	10	69	96	98	100
0.75	F_{MSY}	0.43	0	0	0	0	0	1	3	20	53	72
1	F_{MSY}	0.57	0	0	0	0	0	0	0	2	4	8
1	F_{sq}	1	0	0	0	0	0	0	0	0	0	0
0.8	F_{sq}	0.8	0	0	0	0	0	0	0	0	0	0

SWO-MED Table 3. Catches correspond to F levels in **SWO-MED-Table 2.** Fsq refers to current F (2015). Note that catch levels in this table need to be examined in conjunction with **SWO-MED-Table 2**, which expresses the probability of meeting the Convention objectives.

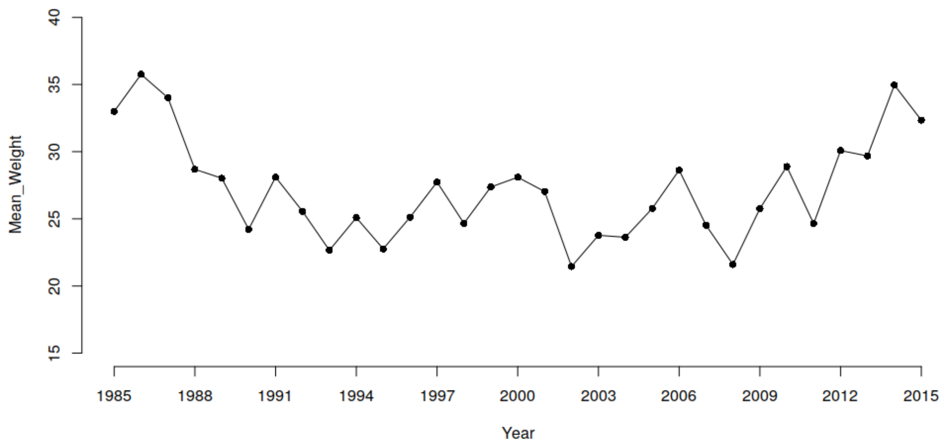
F multiplier		*F/Fsq*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*
0	F_{MSY}	0	0	0	0	0	0	0	0	0	0	0
0.25	F_{MSY}	0.14	1684	2306	3011	3843	4723	5666	6550	7409	8217	8865
0.5	F_{MSY}	0.29	3278	4275	5374	6640	7937	9299	10597	11752	12860	13771
0.75	F_{MSY}	0.43	4786	5949	7203	8639	10028	11505	12962	14164	15353	16151
1	F_{MSY}	0.57	6214	7363	8594	10006	11300	12734	14198	15309	16406	17106
1	F_{sq}	1	10624	11198	12670	13577	14439	14924	15801	16242	16468	16352
0.8	F_{sq}	0.8	8826	9939	11786	13204	14464	15287	16465	17206	17746	17711



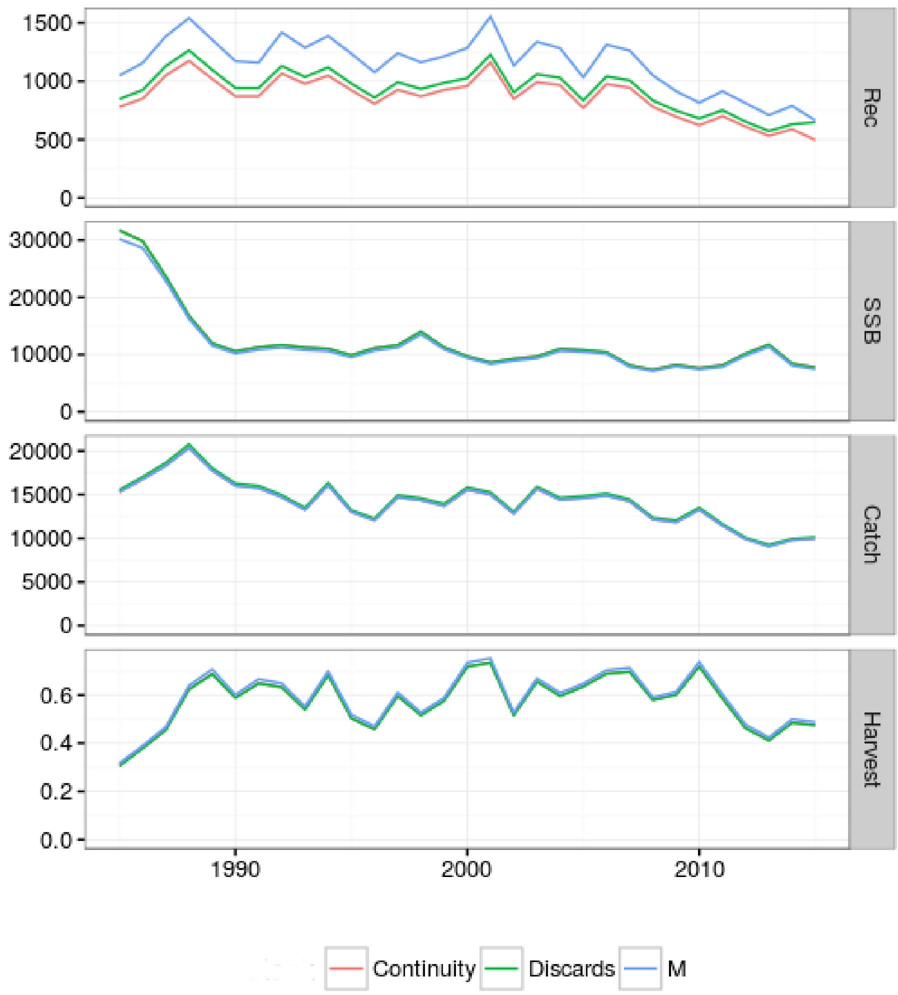
SWO-MED-Figure 1. Cumulative estimates of Task I swordfish catches (t) in the Mediterranean by major gear types, for the period 1950-2016. Misreporting may occur in the earlier period (up to the middle 1980s).



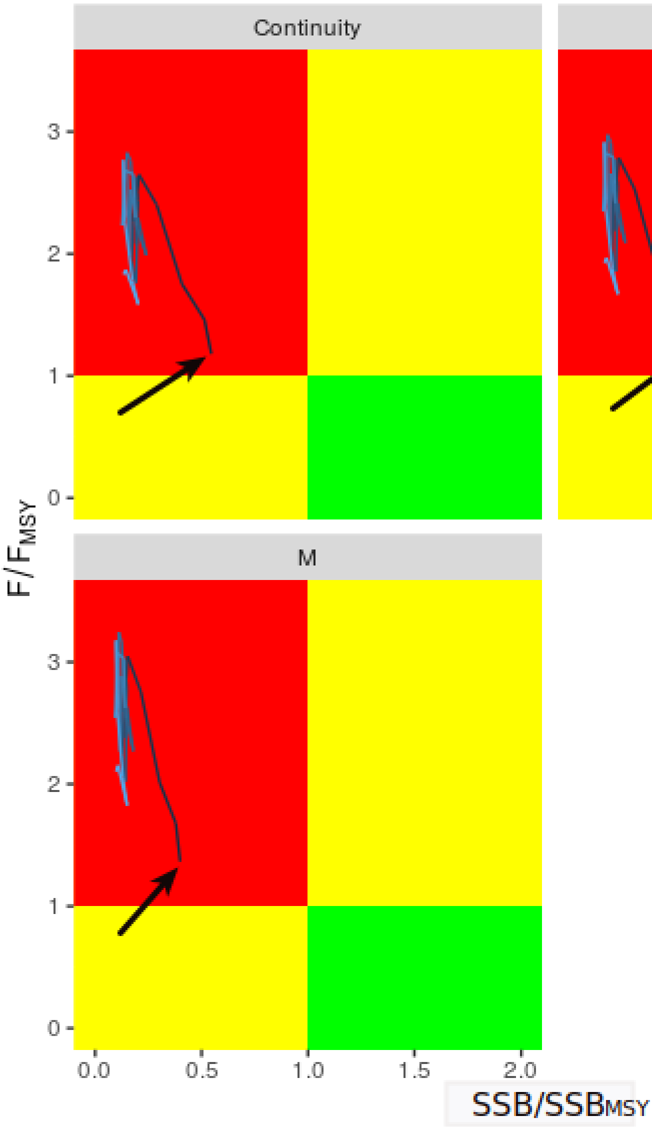
SWO-MED-Figure 2. Relative abundance indices used in the assessment of the Mediterranean swordfish. All indices are scaled to their individual means to facilitate comparison of trends and relative degree of variability. GrLL=Greek longlines, SpLL=Spanish longlines, MoLL=Moroccan longlines.



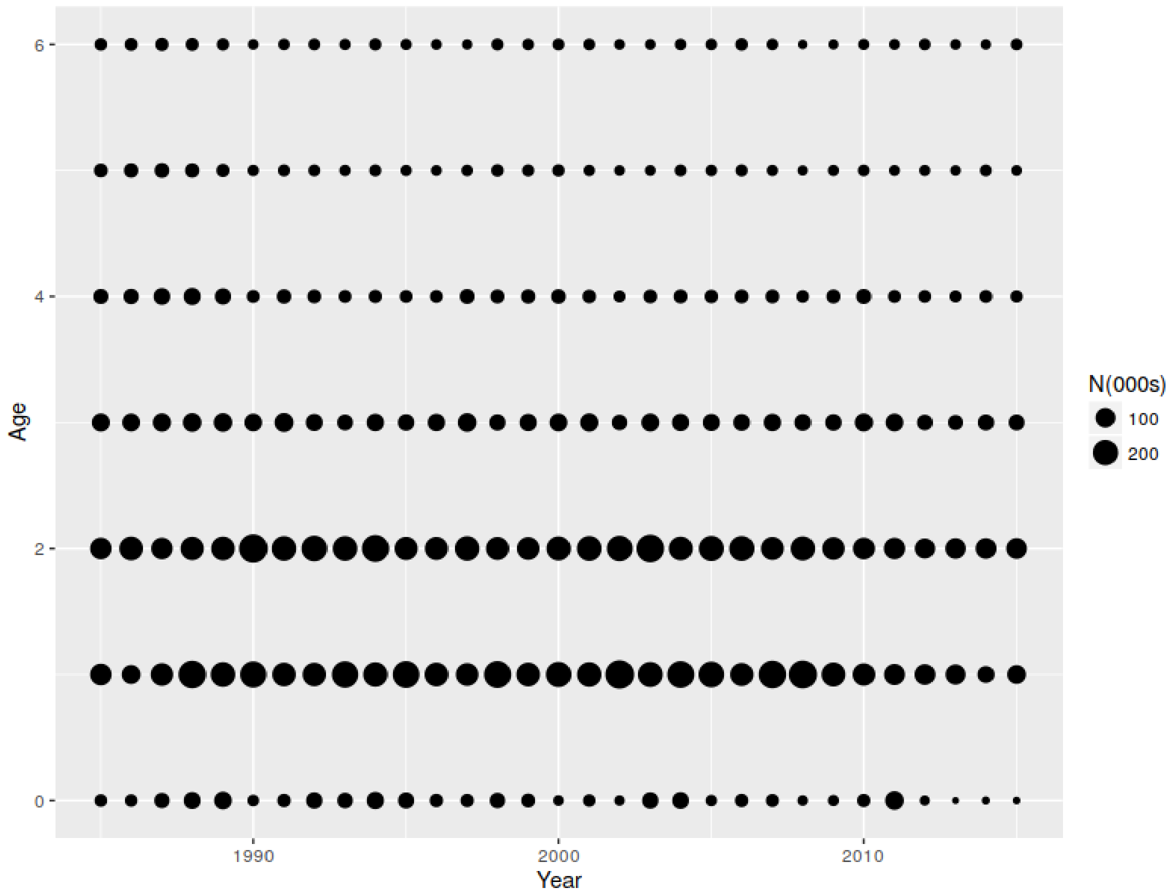
SWO-MED-Figure 3. Time series of mean fish weight (kg) in the catches.



SWO-MED-Figure 4. Estimates of historic time series of recruitment (thousands of fish), SSB (t), catch (t) and average fishing mortality (harvest) of ages 2-4 from the three XSA runs (Continuity=constant natural mortality, Discards=assuming discard rate of 4 zero-age fish/t, M=natural mortality varies with age) .

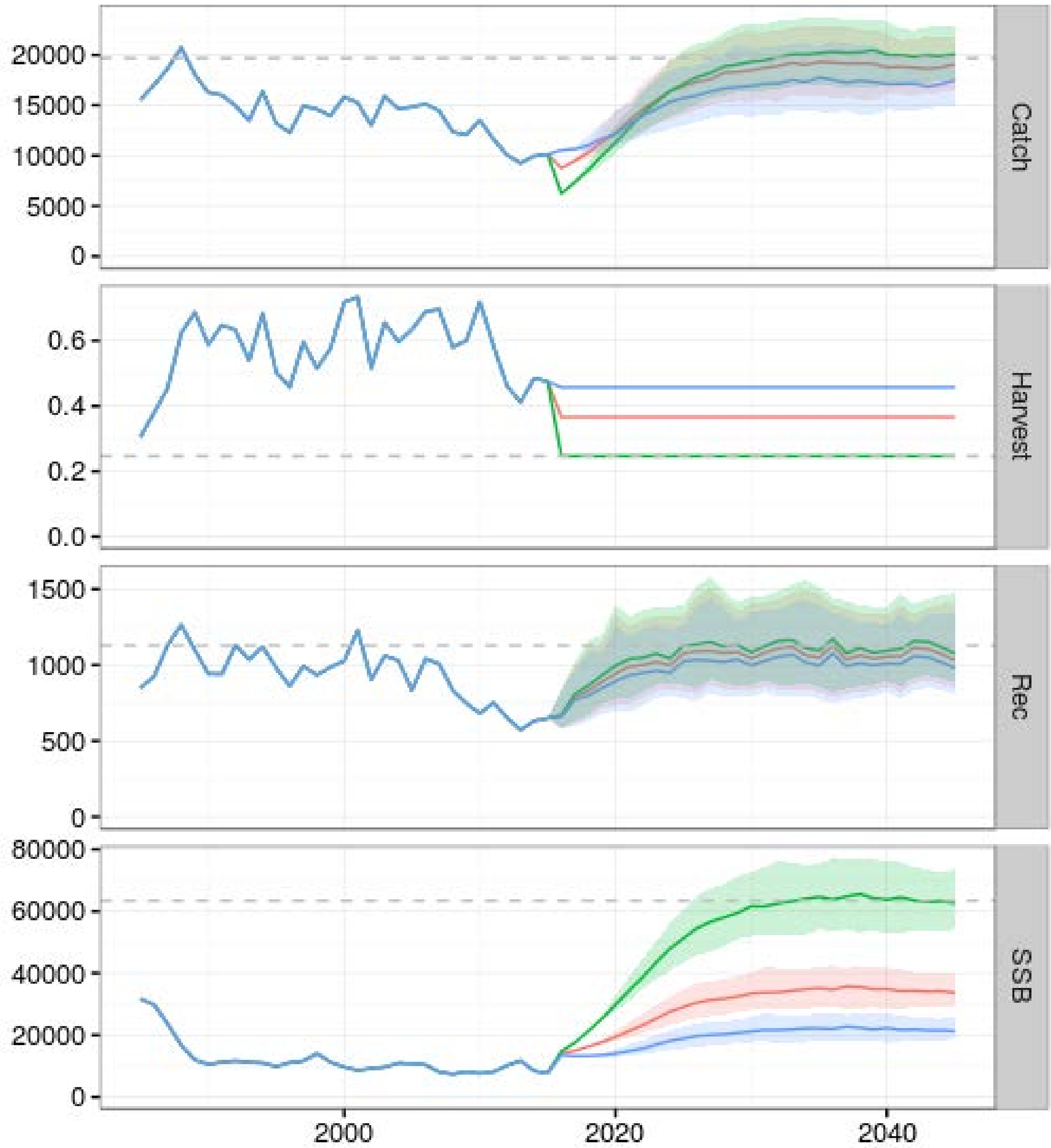


SWO-MED-Figure 5. Time trends for stock status (SSB/SSB_{MSY} and F/F_{MSY}) derived from the three XSA runs. (Continuity=constant natural mortality, Discards=assuming discard rate of 4 zero-age fish/t, M=natural mortality varies with age). Arrows indicate the ratio estimates at the beginning of the studied period.



SWO-MED-Figure 6. Catch numbers at age by year.

.



SWO-MED-Figure 7. Projections based on the current selection pattern and three different F (harvest) levels: status quo (blue), 80% of current F (red) and F_{MSY} (green). Estimates are based on the XSA assessment assuming a discard rate of 4 zero-age fish/t. Lines correspond to median estimates and ribbons to inter-quartiles.

8.11 SBF – SOUTHERN BLUEFIN TUNA

The Commission for the Conservation of Southern Bluefin Tuna (CCSBT) is charged with assessing the status of southern bluefin tuna. Each year the SCRS reviews the CCSBT report in order to know the research on southern bluefin tuna and the stock assessments carried out. The reports are available from the CCSBT.

8.12 SMT – SMALL TUNAS

SMT-1. Generalities

The species under the Small Tunas Species Group include the following tuna and tuna-like species:

- BLF Blackfin tuna (*Thunnus atlanticus*)
- BLT Bullet tuna (*Auxis rochei*)
- BON Atlantic bonito (*Sarda sarda*)
- BOP Plain bonito (*Orcynopsis unicolor*)
- BRS Serra Spanish mackerel (*Scomberomorus brasiliensis*)
- CER Cero (*Scomberomorus regalis*)
- FRI Frigate tuna (*Auxis thazard*)
- KGM King mackerel (*Scomberomorus cavalla*)
- KGX Scomberomorus unclassified (*Scomberomorus* spp.)
- LTA Little tunny (*Euthynnus alletteratus*)
- MAW West African Spanish mackerel (*Scomberomorus tritor*)
- SSM Atlantic Spanish mackerel (*Scomberomorus maculatus*)
- WAH Wahoo (*Acanthocybium solandri*)
- DOL Dolphinfish (*Coryphaena hippurus*)

Knowledge on the biology and fishery of small tunas is very fragmented. Furthermore, the quality of the knowledge varies according to the species concerned. This is due in large part to the fact that these species are often perceived to have little economic importance compared to other tunas and tuna-like species, and owing to the difficulties in conducting sampling of the landings from artisanal fisheries, which constitute a high proportion of the fisheries exploiting small tuna resources. The large industrial fleets often discard small tuna catches at sea or sell them on local markets mixed with other by-catches, especially in Africa. The amount caught is rarely reported in logbooks; however observer programs from purse seine fleets have recently provided estimates of catches of small tunas.

Small tuna species can reach high levels of catches and values in some years and have a very high relevance from a social and economic point of view, because they are important for many coastal communities in all areas and a main source of food. Their social and economic value is often not evident because of the underestimation of the total landing figures, due to the difficulties in data collection mentioned above. Several statistical problems are also caused by misidentification.

Scientific collaboration between ICCAT, Regional Fisheries Organizations (RFOs) and countries in the various regions is imperative to advance understanding of the distribution, biology and fisheries of these species.

SMT-2. Biology

Small tuna species are widely distributed in the tropical and subtropical waters of the Atlantic Ocean and several are also distributed in the Mediterranean Sea and the Black Sea. Some species extend their range even into colder waters, like the North and South Atlantic Ocean. They often form large schools with other small sized tunas or related species in coastal and high seas waters.

Generally, the small tuna species have a varied diet with a preference for small pelagics (e.g. clupeids, mullets, carangids, etc.). Small tunas are the prey of large tunas, marlins, sharks and marine mammals which at the same time are predators of small pelagics. A recent document on the feeding habit of dolphin fish off the Brazilian coast showed that these species also feed on crustaceans, mollusks and cephalopods. The reproduction period varies according to species and areas and spawning generally takes place near the coast in oceanic areas, where the waters are warmer. A study conducted on the eastern coast of Tunisia has shown that the spawning area of the bullet tuna is offshore at the limit of the continental shelf and related to the high abundance of the zooplankton. A more recent study based on the histological analysis and the gonado-somatic index of female gonads found that the spawning season of the West African Spanish mackerel extends from April to July in the Gulf of Guinea. The results from preliminary studies conducted on Atlantic bonito in the northwestern coasts of Africa showed that this species reaches its first sexual maturity between 38 and 49 cm FL and the spawning period extends from May to July. For blackfin tuna, a new study revealed that the first size of maturity of this species was estimated at 45 cm FL and that this species spawns from March to August.

The growth rate currently estimated for these species is very rapid for the first two or three years, and then slows as they reach size-at-first maturity. Information on the migration patterns of small tuna species is very limited, due to low tagging levels of these species. However, a new genetic study showed that there is a clear genetic heterogeneity for the bullet tuna among different geographical locations in the Mediterranean, suggesting that the population structure of this species in the Mediterranean is more complex than initially expected. This study revealed also the presence of few individuals caught in Strait of Gibraltar genetically identified as *Auxis thazard*. A recent preliminary genetic study of blackfin tuna in the western Atlantic Ocean using microsatellite markers, concluded that there were very weak levels of divergence among different geographic areas sampled.

The bullet tuna caught in the Spanish Mediterranean coast showed a positive allometric growth with no effect of sex on growth. Another recent study showed that the bullet tuna (age class 3+) caught in the same area had a better physical condition during years with positive NAO phase. These results could be explained by the environmental conditions during positive NAO phase that would enhance the migration process.

A study conducted recently along the Gulf of Gabes (Ionian Sea-Mediterranean) indicated that the Larvae of the bullet tuna were mainly concentrated between the isobaths 50 and 200 m, and the spawning grounds of this species were mainly offshore.

In general, biological information remains incomplete or need to be updated for the majority of species in the major fishing areas (**SMT-Table 2**).

SMT-3. Fisheries indicators

Small tunas are exploited mainly by coastal fisheries and artisanal fisheries, although substantial catches are also made as target species and as by-catch by purse seine, mid-water trawl (i.e. pelagic fisheries of West Africa-Mauritania), handline and small scale gillnets. Unknown quantities of small tuna also comprise the incidental catches of some longline fisheries. The increasing importance of FAD fisheries in the eastern Caribbean and in other areas has improved the efficiency of artisanal fisheries in catching small tunas. Various species are also caught by the sport and recreational fisheries.

Despite the scarce monitoring of various fishing activities in some areas, all the small tuna fisheries have high social and economic relevance for most of the coastal countries concerned and for many local communities, particularly in the Mediterranean Sea, in the Caribbean region and in West Africa.

SMT-Table 1 shows historical landings of small tunas for the 1989 to 2016 period although the data for the last years are preliminary. This table does not include species reported as "mixed" or "unidentified", as was the case in the previous years, since these categories include large tuna species. Seven (7) of 13 species represent more than 90% of small tuna Task I catches between 1950 and 2016: BON (34%), LTA (14%), FRI (12%), KGM (11%), SSM (11%), BRS (5%) and BLT (5%). In 1980, there was a marked increase in reported landings compared to previous years, reaching a peak of about 145,560 t in 1988 (**SMT-Figure 1**). The annual trend in the total catches by species are shown in **SMT-Figure 2**. Reported landings for the 1989-1995 period decreased to approximately 91,764 t, and then an oscillation in the values in the following years, with a minimum of 64,450 t in 2008 and a maximum of 132,275 t in 2005. Overall trends in the small tuna catch may mask declining trends for individual species because annual landings are often dominated by the landings of single species. These fluctuations seem to be related to unreported catches, as these species generally comprise part of the by-catch and are often discarded, and therefore do not reflect the real catch.

A preliminary estimate of the total nominal landings of small tunas in 2016 is 98,879 t. The Committee pointed out the relative importance of small tuna fisheries in the Mediterranean and the Black Sea, which account for about 20% of the total reported catches (1950 to 2016) in the ICCAT area.

Despite the recent improvements in the statistical information provided to ICCAT by several countries, the Committee noted that uncertainties remain regarding the accuracy and completeness of reported landings in all areas. There is a general lack of information on the mortality of these species as by-catch.

However, after the adoption of the ICCAT Small Tunas Research Programme (SMTYP) in 2012, significant historical catch, effort and size data from the artisanal fisheries in the west of Africa (Senegal, Côte d'Ivoire and Morocco) and from the Mediterranean Sea (EU-Spain and EU-Italy) were recovered and made available to the Secretariat.

The results from a new larval survey in the Gulf of Mexico showed that the values of spawning biomass indices for little tunny, and *Auxis* genus were variable throughout the time series (1982-2015), and did not show any clear trend. The highest index values occurred in 1995 and 2002, while the lowest was observed in 2015. For dolphinfish, index values were also variable throughout the time series, with lowest values occurring in 1987, 1988 and 2001, while the highest were registered in 2013 and 2015.

SMT-4. State of the stocks

There is little information available to determine the stock structure of many small tuna species. The Committee suggests that countries be requested to submit all available data to ICCAT as soon as possible, in order to be used in future meetings of the Committee.

Generally, current information does not allow the Committee to carry out quantitative assessments of stock status of the majority of the species. Nevertheless, few regional assessments have been carried out. Assessments of stocks of small tunas are also important because of their position in the trophic chain. It may therefore be best to approach assessments of small tunas from the ecosystem and regional perspective since these species have limited movements as compared to the major tuna species.

The lengths distributions and the reference points obtained from length frequencies for the small tuna species in the Task II database, pooled by species, year and Atlantic region are plotted in **SMT-Figures 3a, b**. To avoid growth overfishing, catch length compositions should consist of fish at a size at which the highest yield from a cohort occurs (Lopt). While to avoid recruitment overfishing, catches should comprise almost exclusively mature individuals (i.e. fish be >L50, the length at which 50% of fish are mature). Two reference points based on Task II data were used, i.e. Popt and P50, the proportion of individuals in the catch size data that are greater than Lopt and L50, respectively. However, Lopt is based on a per recruit analysis which ignores recruitment dynamics, for example the age/size structure and the distribution of a population which all determine productivity and hence sustainability and the formulation of robust management advice.

These data are replotted in **SMT-Figures 4a and b** as an example of how they could be used as indicators of growth and recruitment overfishing. For example if Lopt is used as a target with a probability of 0.5 and a tolerance of ±0.25 to allow limited fluctuations around the target; then in **SMT-Figure 4a** green indicated that length compositions meet this target and red when exceeded. For recruitment overfishing, if 0.6 is used as a limit for P50, then any catches where less than 40% are mature fish are coloured red (**SMT-Figure 4b**). The plots show that in most cases poor yield optimization is occurring, but that recruitment overfishing is not. Although in two cases (WAH in the southern Atlantic and LTA in the North Atlantic) recruitment overfishing has increased in the recent period.

The reliability of such indicators could be examined using management strategy evaluation (MSE), a benefit of this is that MSE can also account for sampling error, which can be substantial for many data limited fisheries.

In 2017, the Ecological Risk Analysis (ERA) was updated for the small tuna caught by longline and purse seine fisheries in the Atlantic. The study found that the top 3 stocks at risk in the Atlantic Ocean that should deserve most of the managers' attention were *E. alleteratus*, *A. solandri* and *S. cavalla* (**SMT-Table 3**). The update indicated that BRS was no longer designated at high risk and has been listed as at moderate risk.

Given the social and economic importance of the Atlantic bonito, the Committee also recommends this species as a priority for assessment.

SMT-5. Outlook

In the absence of any quantitative assessment, there is no projection made by the Committee.

Additional work is being carried out under the SMTYP to address knowledge gaps as regards size data and biological parameters, which are necessary for their assessment.

The Committee notes that the tropical tunas tagging programme adopted by ICCAT continued successfully tagging LTA and WAH.

As part of its 2018 workplan, the Committee will identify potential management procedures and management performance measures for high-priority small tuna stocks in preparation for the start of the development of management strategy evaluation for these species.

SMT-6. Effect of current regulations

There are no ICCAT regulations in effect for small tunas. Several regional and national regulations are in place.

SMT-7. Management recommendations

The provision of robust management advice by the SCRS relies on accurate reporting of Task I and II data. However, due to the nature of small tuna fisheries (i.e. multi-gear, multi-species, artisanal fisheries, etc.), information on fisheries data is difficult to collect. Therefore, the Committee has not been able to conduct any quantitative stock assessment for any of the small tunas stocks. The Committee has developed indicators, however, their robustness still need to be evaluated before they can be used to provide management advice to the Commission.

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
BLF	TOTAL	A+M			4353	3535	2719	4051	4488	3258	3395	3203	2483	4034	4756	1303	1926	1031	1937	1927	1669	1442	1548	1533	1529	1243	874	954	1181
	Landings			All gears	4353	3535	2719	4051	4488	3258	3395	3203	2483	4034	4756	1303	1926	1031	1937	1927	1669	1442	1548	1533	1529	1243	874	954	1181
	Discards				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		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	
				Brazil	49	22	38	153	649	418	55	55	38	149	1669	1	118	91	242	233	266	10	9	46	124	127	299	131	
				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**
				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**
				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
				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**
				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
				St. Vincent and Grenadines	7	53	19	20	18	22	17	15	23	24	24	0	0	0	0	0	0	0	0	0	0	11	0	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
				U.S.A.	127	508	492	582	447	547	707	617	326	474	334	414	675	225	831	422	649	619	622	417	599	418	346	627	925
				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	
				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**
				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**
				Venezuela	2148	1224	21	624	758	498	1034	1192	696	1902	1210	319	732	225	237	777	231	293	331	473	237	191	88	81	197
			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	
				Dominica	14	15	19	30	0	0	0	79	83	54	78	42	20	38	47	29	37	45	41	37	39	37	0	0	34
				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	
				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	
				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	
				NEI (ETRO)	0	0	0	0	0	0	0	0	0	0	1	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
				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	
	Discards		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**
BLT	TOTAL	A+M			5714	3420	5300	4301	5909	3070	2309	2646	3912	5796	6041	3794	6223	4231	4090	5459	6825	5557	7952	9483	6188	7247	3916	8707	3872
	Landings			All gears	5714	3420	5300	4301	5909	3070	2309	2646	3912	5796	6041	3794	6223	4231	4090	5459	6825	5557	7952	9483	6188	7247	3916	8702	3872
	Discards				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	
	Landings		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
				Brazil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47	0	0	74	
				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	3195	
				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
				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
				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
				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**
				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
				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	
				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	
				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
				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**
				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
				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
				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	
				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
				Turkey	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
				U.S.S.R.	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**
			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	
				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	
	Discards		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	5	**0**
BON	TOTAL				21992	30528	21719	21219	25134	24417	45253	37313	27151	27637	24581	14424	15832	78767	40095	14179	14964	21182	21884	27197	45038	24274	26920	12407	49108
		ATL			6881	4531	6037	6030	7939	10340	15523	9143	5179	5400	8864	3307	4584	4391	8345	5542	4922	11162	9300	12755	5718	5909	3567	4119	5949
		MED			15111	25997	15682	15189	17195	14078	29730	28170	21972	22237	15717	11117	11248	74376	31751	8637	10042	10019	12584	14442	39321	18365	23352	8288	43158
	Landings	ATL		All gears	6881	4531	6037	6030	7939	10340	15523	9143	5179	5400	8864	3307	4584	4391	8345	5542	4922	11162	9300	12755	5718	5909	3567	4119	5949
		MED			15111	25997	15682	15189	17195	14078	29730	28170	21972	22237	15717	11117	11248	74376	31751	8637	10042	10019	12584	14442	39321	18365	23352	8288	43158

				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
Discards	ATL			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			0	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
			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**
			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
			Brazil	86	142	142	137	0	0	0	0	0	0	0	0	0	90	0	0	0	0	0	171	0	3	0	1	
			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**
			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
			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	
			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	43
			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	
			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
			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
			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	
			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	
			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**
			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	
			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
			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	
			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
			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	
			EU.United Kingdom	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
			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	
			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	
			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	**0**
			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
			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
			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	
			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**
			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
			S. Tomé e Príncipe	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	149	153	158	162	267	207
			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
			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	
			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**
			St. Vincent and Grenadines	0	0	0	0	0	0	0	0	0	0	0	15	18	0	16	23	27	15	6	20	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
			U.S.A.	498	171	128	116	156	182	76	83	142	120	139	44	70	68	40	97	47	50	46	66	46	50	80	50	55
			U.S.S.R.	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	2	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**
			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**
			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**
		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
		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	
			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	
			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	
			Dominica	0	0	0	0	0	0	0	0	0	0	0	0	0	6	16	16	9	4	0	0	0	0	0	0	7
			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	
			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	
			Grenada	0	0	0	0	24	6	14	16	7	10	10	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	
			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	
			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	
			Ukraine	25	0	0	0	342	2786	1918	1114	399	231	1312	30	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	
			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
			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
			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

					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
				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**
				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
				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
				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
				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
				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
				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	
				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	
				Libya	71	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				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
				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
				Turkey	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
				U.S.S.R.	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	
				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	
				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	
	Discards	ATL	CP	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**
		MED		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
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
	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
		MED			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
		ATL	CP	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**
				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
				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	
				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
			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	
		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
				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**
				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**
				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	
				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
				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
BRS	TOTAL	A+M		All gears	6051	8049	7161	7006	8435	8004	7923	5754	4785	4553	7750	5137	3410	3712	3587	2253	3305	2681	2871	2214	613	847	698	389	1123
	Landings		CP	Brazil	1149	842	1149	1308	3047	2125	1516	1516	988	251	3071	2881	814	471	1432	563	1521	1042	1281	1162	0	0	2	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**
				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
				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**
			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
				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
			NCO	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	
CER	TOTAL	A+M		All gears	390	450	490	429	279	250	250	0	3	5	1	2	1	1	1	0	0	0	0	1	0	0	0	1	0
	Landings		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**
				St. Vincent and Grenadines	1	0	0	0	0	0	0	0	0	0	0	0	0	0	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	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	
				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	
FRI	TOTAL	ATL			6367	12678	8407	7535	13809	15055	15872	13004	12918	12788	11635	4527	6446	4905	6606	6786	6773	10465	10809	11134	11897	14570	12850	7580	11549
	Landings			All gears	6367	12678	8407	7535	13809	15055	15872	13004	12918	12788	11635	4527	6446	2933	5649	5850	4918	7878	7350	8562	9117	11985	10610	7439	11549
	Landings(FP)				0	0	0	0	0	0	0	0	0	0	0	0	0	1972	958	936	1855	2587	3459	2571	2780	2585	2240	0	
	Discards				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	141	
	Landings		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
				Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	266	824
				Brazil	291	608	906	558	527	215	162	166	106	98	1117	860	414	532	603	202	149	313	204	347	306	485	293	214	
				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	362	293
				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
				Côte d'Ivoire	0	0	0	0	0	0	3	0	1	1	0	0	994	4	354	541	14	813	161	297	38	2837	261	141	311
				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	
				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

					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
				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	
				EU.France	121	63	105	126	161	147	146	0	91	127	91	0	168	47	6	98	24	24	91	147	246	233	147	258	1201
				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
				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	
				EU.Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	150	90	0	164	5	85	0	6	90
				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
				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	
				EU.United Kingdom	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**
				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
				Ghana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2577	2134	1496	2786	3604	2295	2469	2382	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
				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**
				Guinée Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	96	94	332	503	236	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**
				Maroc	332	274	122	645	543	2614	2137	494	582	418	441	184	542	227	52	135	179	9	19	862	554	55	21	90	125
				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
				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
				S. Tomé e Príncipe	39	33	37	48	79	223	197	209	200	200	200	200	234	215	290	0	275	282	290	298	307	315	324	636	536
				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
				St. Vincent and Grenadines	0	0	0	0	0	0	0	0	0	0	0	17	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**
				U.S.A.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
				U.S.S.R.	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	32	113	182	42	165	52	48	54	215	508	85	150	71	64	70
			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
			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	
				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	
				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	
				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	
				Mixed flags (FR+ES)	4017	9674	3107	1919	7177	6063	6342	8012	9864	9104	7748	1623	1722	0	0	0	0	0	0	0	0	0	0	0	
				NEI (ETRO)	4	32	68	70	180	120	309	491	279	403	183	52	157	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	
				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	
	Landings(FP)		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	
				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	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	
				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	
				EU.España	0	0	0	0	0	0	0	0	0	0	0	0	0	265	191	108	663	866	889	708	576	555	586	0	
				EU.France	0	0	0	0	0	0	0	0	0	0	0	0	0	444	217	94	151	264	555	500	605	520	221	0	
				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	
				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	
				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	
			NCO	Mixed flags (EU tropical)	0	0	0	0	0	0	0	0	0	0	0	0	0	507	105	161	383	631	764	247	0	0	0	0	
	Discards		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**
DOL	TOTAL	A+M			188	174	334	334	307	295	363	349	234	303	347	564	2632	2772	1295	4753	1042	5381	9889	7187	3647	5162	5103	5026	2519
	Landings			All gears	188	174	334	334	307	295	363	349	234	303	347	564	2632	2772	1295	4753	1042	5381	9889	7187	3394	4936	4922	5019	2519
	Discards				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	253	226	181	7	0
	Landings		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	9
				Brazil	0	0	0	0	0	0	0	0	0	0	0	2	2159	2311	761	4270	472	4400	7990	4379	641	932	762	623	
				Canada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	7
				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	199	34	24
				EU.España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	54	73	73	0	85	166	113	102	161	64
				EU.France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	372	819	1737	1360	1474	1473	1566	2
				EU.Italy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	700	525	1133	971
				EU.Malta	188	174	334	334	307	295	363	349	234	303	347	507	473	447	517	274	399	395	530	349	181	385	208	334	238
				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	1
				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
				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**

				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
			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
			Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42	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	250	0	2
			St. Vincent and Grenadines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	155	56	118	72	96	84	86	48	0	6
			Trinidad and Tobago	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	1	24	21
			Tunisie	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	426
			U.S.A.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	479	503	578	366	668	551	450
			UK.Bermuda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4	4	
			Venezuela	0	0	0	0	0	0	0	0	0	0	0	55	0	14	16	0	0	24	0	38	40	42	29	39	41
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	343	307	245	0	
			Suriname	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	515	0	0	**0**
		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	194
			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	27	63
			Sta. Lucia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	407	505	
	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
			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
			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	7	**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**
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	253	226	181	0	
KGM	TOTAL		All gears	14691	16331	14777	14930	17782	19660	16394	17717	16161	15360	17258	15863	12830	11766	8185	17936	7344	12533	9742	10868	12762	12248	4432	3642	3942
	Landings	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	
			Brazil	979	1380	1365	1328	2890	2398	3595	3595	2344	1251	2316	3311	247	202	316	33	0	0	1	1	0	115	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
			St. Vincent and Grenadines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	9	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
			U.S.A.	9344	9616	7831	7360	7058	8720	7373	6453	6780	6603	6061	6991	7129	7123	2837	13482	3013	8247	5630	6939	9187	8062	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	
			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**
			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**
		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	2	2	4
			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
		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	
			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	
			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
			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	
			Grenada	0	0	0	0	2	4	28	14	9	4	5	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Jamaica	0	0	0	0	0	0	0	0	0	0	48	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
			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	
KGX	TOTAL		All gears	266	301	508	512	824	156	251	1	229	48	0	15	0	1	93	16	0	2	20	114	110	117	127	68	57
	Landings	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**
			Brazil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	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	5	4	14	19	23	24
			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
			Gabon	0	0	140	145	79	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**
			Russian Federation	0	0	0	0	0	0	14	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	4	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	98	100	102	105	45	32
			St. Vincent and Grenadines	0	0	0	0	1	1	1	1	138	0	0	0	0	0	67	0	0	0	0	1	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**
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	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	
			Cuba	0	0	0	0	0	0	236	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	
			Jamaica	0	0	0	0	0	155	0	0	44	48	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	
			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	
			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	

					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
LTA	TOTAL				24202	16554	14175	12829	14254	16348	17583	15391	18298	18668	19453	16713	15939	11503	9247	16878	13514	15060	18898	18613	17836	20251	11676	14068	16710
		ATL			22447	15296	12978	10934	12138	14746	14668	12515	15003	15804	16810	16029	14500	10461	7642	15191	11256	12961	16728	14945	13650	15619	8071	7596	8022
		MED			1755	1258	1197	1894	2116	1601	2914	2876	3294	2863	2643	684	1439	1042	1605	1687	2259	2100	2170	3668	4186	4633	3605	6472	8688
	Landings	ATL		All gears	22447	15296	12978	10934	12138	14746	14668	12515	15003	15804	16810	16029	14500	10172	6747	13539	9194	10911	13232	11286	9880	11990	5930	7392	8022
		MED			1755	1258	1197	1894	2116	1601	2914	2876	3294	2863	2643	684	1439	1042	1605	1687	2259	2100	2170	3668	4186	4633	3605	6472	8688
	Landings(FP)	ATL			0	0	0	0	0	0	0	0	0	0	0	0	0	290	894	1652	2062	2050	3496	3660	3770	3629	2141	0	
	Discards	ATL			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	204	
		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	
	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
				Brazil	935	985	1225	1059	834	507	920	930	615	615	615	0	320	280	0	0	0	0	0	22	581	301	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**
				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	163
				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**
				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
				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	
				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
				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	
				EU.France	13	8	54	59	22	215	21	696	631	610	613	0	10	27	12	0	1	50	35	5	30	27	6	29	217
				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	
				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	
				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**
				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	
				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**
				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	
				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
				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	
				EU.United Kingdom	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**
				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	
				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	
				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
				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	**0**
				Maroc	370	44	43	230	588	195	189	67	101	87	308	76	91	33	0	40	2	63	5	57	10	11	3	0	11
				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	
				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**
				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
				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
				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
				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**
				St. Vincent and Grenadines	0	1	0	0	0	0	0	0	0	0	0	2	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**
				U.S.A.	597	1286	1142	1312	2230	2015	1546	1623	1209	1451	1366	1492	1382	765	1351	1401	963	1244	1120	1201	1507	1191	1253	1337	1336
				U.S.S.R.	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	
				Venezuela	1409	1889	2115	2115	1840	1840	2815	2247	2247	2247	2254	50	0	0	0	0	30	0	2	8	4	1	4	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
			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	
				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	
				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	
				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
				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	
				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	
				Mixed flags (FR+ES)	2678	4975	2071	1279	3359	2836	2936	3846	4745	4238	3334	1082	1148	0	0	0	0	0	0	0	0	0	0	0	
				NEI (ETRO)	0	8	20	0	0	0	0	0	0	0	28	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	
		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
				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
				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**
				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

					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
				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**
				EU.Greece	0	0	0	0	0	0	0	0	0	0	132	0	0	112	69	72	183	148	165	301	276	363	289	271	501
				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
				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
				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	
				Libya	0	0	0	0	0	45	52	0	5	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	
				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
				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	
				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
				Turkey	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
			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	
				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	
				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	
				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	
				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	
	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	
				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	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	
				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	
				EU.España	0	0	0	0	0	0	0	0	0	0	0	0	0	41	126	208	844	970	1030	1096	577	583	873	0	
				EU.France	0	0	0	0	0	0	0	0	0	0	0	0	0	102	145	141	103	207	695	994	1354	720	365	0	
				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	
				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	
				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	
			NCO	Mixed flags (EU tropical)	0	0	0	0	0	0	0	0	0	0	0	0	0	18	139	306	364	262	516	530	0	0	0	0	
	Discards	MED	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**
				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**
MAW	TOTAL	A+M		All gears	2423	1723	1138	1808	2831	1415	1482	909	1219	828	1345	550	285	443	276	435	422	460	2079	1106	930	2865	1009	712	2661
	Landings		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
				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
				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	
				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	
				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
				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**
				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	
				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**
				Gabon	0	0	0	0	0	0	85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				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	
				Russian Federation	0	19	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	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	94	96	98	100	102	105	13	11
				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
				U.S.S.R.	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	
				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	
				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	
SSM	TOTAL	A+M		All gears	16285	16317	14490	13697	16571	15403	8641	9837	8220	8383	9414	9793	8119	10470	6282	6102	5900	6197	5974	5931	5185	5459	3857	4078	3826
	Landings		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
				EU.France	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**
				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**
				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	
				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
				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**
				U.S.A.	5663	5143	4380	3363	2866	3509	2968	3282	3893	4524	4613	4552	4477	4747	2425	2147	1746	1946	1846	1896	1864	1877	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	1	1	5
			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	
				Cuba	611	310	409	548	613	613	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
				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	

				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
			Grenada	0	1	2	2	0	0	0	0	0	0	1	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	
WAH	TOTAL	A+M	All gears	1835	2671	2143	2408	2515	3085	2488	2957	2020	2296	2202	2049	2596	2456	1809	2568	2158	2354	2032	2237	3667	3530	2912	1844	1527
	Landings			1835	2671	2143	2408	2515	3085	2488	2957	2020	2296	2202	2049	2596	2099	1630	2283	1586	1883	1763	1760	3479	3423	2826	1838	1527
	Landings(FP)			0	0	0	0	0	0	0	0	0	0	0	0	0	357	179	285	572	471	269	477	85	0	0	0	
	Discards			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	104	108	86	6	
	Landings	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
			Brazil	71	33	26	1	16	58	41	0	0	0	0	405	519	449	111	75	76	70	19	357	213	202	153	131	
			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	
			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**
			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
			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
			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
			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
			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
			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	**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
			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	
			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
			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	**0**
			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
			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
			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**
			St. Vincent and Grenadines	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
			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
			U.S.A.	203	827	391	764	608	750	614	858	640	633	846	789	712	558	89	1123	495	522	358	240	399	207	480	757	1202
			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	
			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**
			UK.Sta Helena	17	35	26	25	23	0	0	0	0	0	0	0	0	0	0	0	0	29	19	31	12	16	16	10	15
			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**
			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
		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**
			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
			Suriname	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	588	415	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	
			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	
			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	
			Dominica	59	59	59	58	58	58	58	50	46	11	37	10	6	8	15	14	16	10	13	13	0	0	0	0	10
			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	
			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	
			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
			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	
	Landings(FP)	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	
			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	
			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	
			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	
			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	
			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	
			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	
			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	
			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	
		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	
	Discards	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**
			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**
			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**
			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**
			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**
		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**

SMT-Table 2. Summary of the life-history parameters currently available for small tunas species in the 5 stock/statistical areas: North and South Atlantic Ocean (both Eastern and Western) and the Mediterranean Sea.

ZONES	NORTHEAST ATLANTIC		SOUTHEAST ATLANTIC		NORTHWEST ATLANTIC		SOUTHWEST ATLANTIC		MEDITERRANEAN	
Species	Growth Parameters	Reproduction parameter	Growth Parameters	Reproduction parameter	Growth Parameters	Reproduction parameter	Growth Parameters	Reproduction parameter	Growth Parameters	Reproduction parameter
LTA	Yellow	Yellow	Yellow	Yellow	Yellow	Red	Red	Red	Green	Yellow
FRI	Yellow	Red	Yellow	Red	Red	Red	Red	Red	Red	Red
BLT	Yellow	Red	Red	Red	Red	Red	Red	Red	Green	Yellow
SSM	Red	Red	Red	Red	Yellow	Yellow	Red	Red	Red	Red
MAW	Yellow	Yellow	Yellow	Red	Red	Red	Red	Red	Red	Yellow
BON	Yellow	Red	Yellow	Red	Yellow	Red	Yellow	Red	Green	Yellow
WAH	Yellow	Red	Red	Red	Green	Yellow	Red	Yellow	Red	Yellow
BRS	Red	Red	Red	Red	Yellow	Yellow	Green	Yellow	Red	Red
BLF	Red	Red	Red	Red	Yellow	Yellow	Yellow	Yellow	Red	Red
KGM	Red	Red	Red	Red	Green	Yellow	Green	Yellow	Red	Red
BOP	Red	Red	Red	Red	Red	Red	Red	Red	Yellow	Yellow
CER	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
DOL	Not yet reviewed by the WG-SMT									

Green: Data available, several studies and at least one of them was published in the last 10 years
Yellow: Data available, single study or several older than 10 years
Red: No existing data

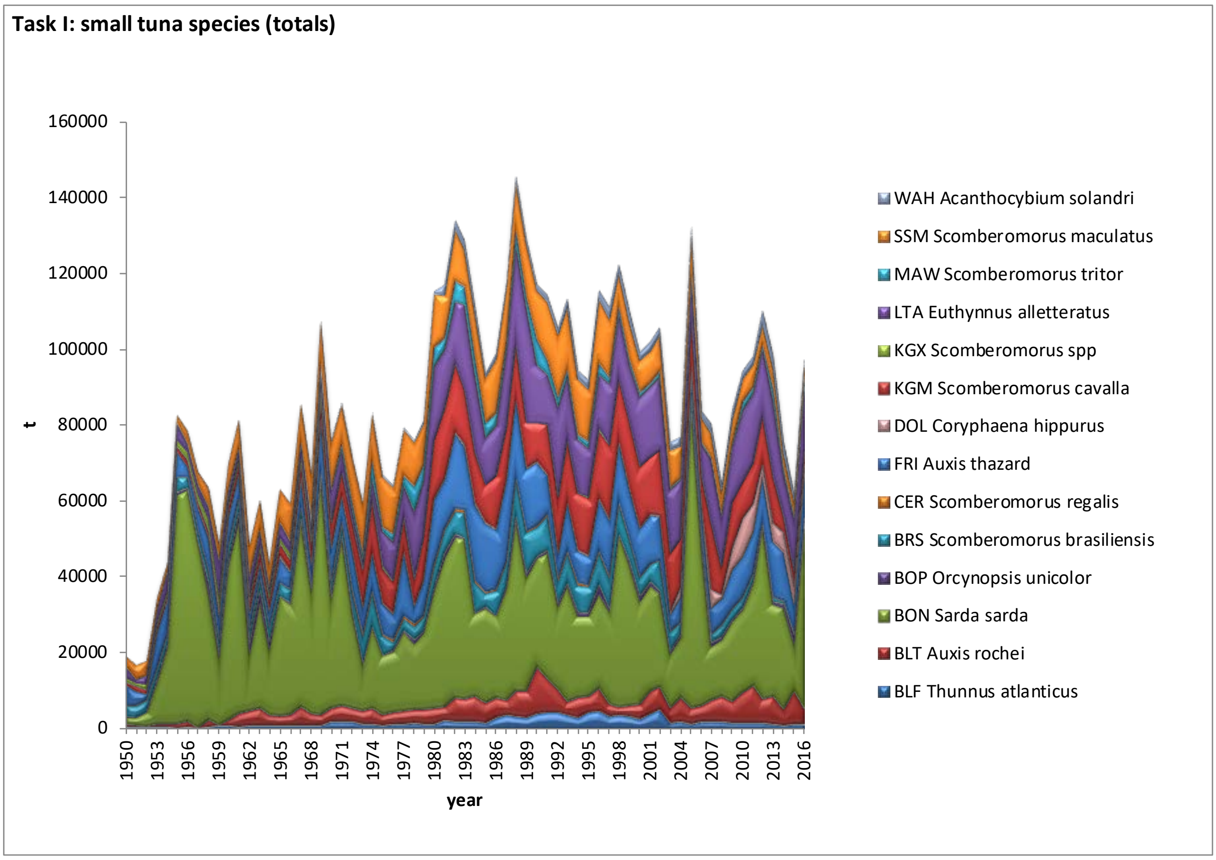
SMT-Table 3. Risk of the small tunas species caught by tuna purse-seine (a) and longline (b) fisheries in the Atlantic Ocean.

(a) Purse seine Fishery

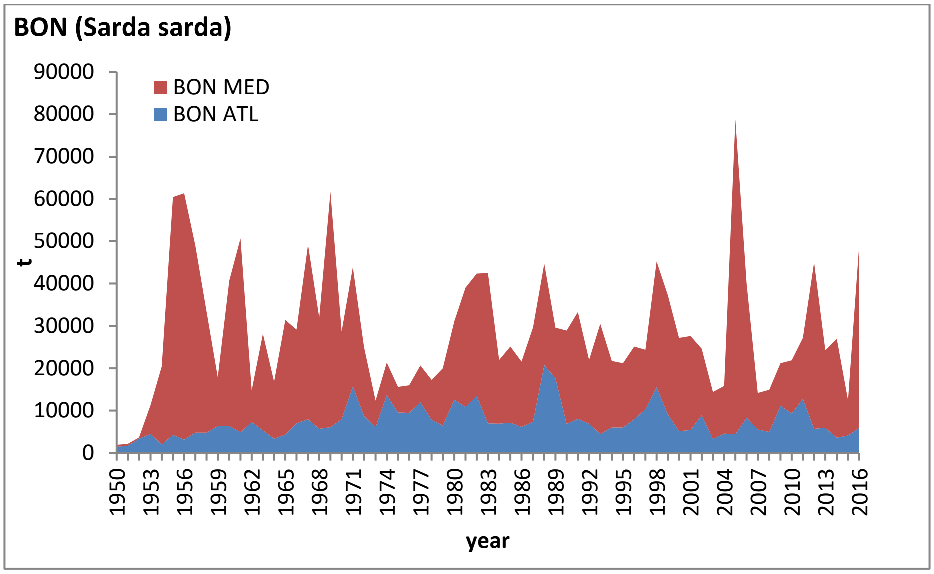
Stock	Rank	Productivity	Susceptibility	Vulnerability
LTA	1	1.35	2.29	2.09
KGM	2	1.35	1.67	1.78
SSM	3	1.60	1.67	1.55
BON	4	2.18	2.29	1.53
BRS	5	1.71	1.67	1.46
WAH	6	1.94	1.60	1.22
FRI	7	2.33	2.00	1.20
BLF	8	2.06	1.40	1.02
CER	9	2.27	1.67	0.99
BLT	10	2.35	1.60	0.88

(b) Long Line Fishery

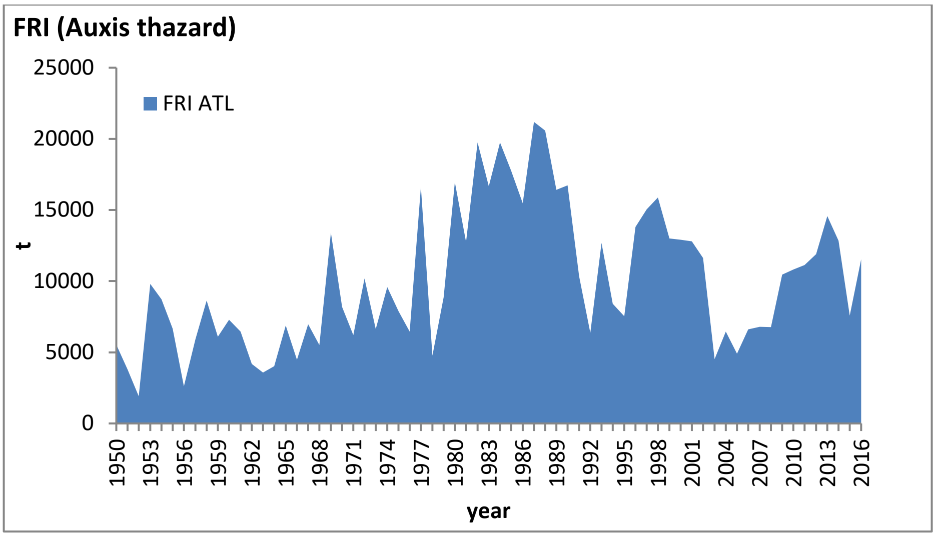
Stock	Rank	Productivity	Susceptibility	Vulnerability
WAH	1	1.94	2.57	1.89
KGM	2	1.35	1.33	1.68
LTA	3	1.35	1.29	1.67
SSM	4	1.60	1.67	1.55
BRS	5	1.71	1.67	1.46
BLF	6	2.06	1.86	1.27
BON	7	2.18	1.86	1.19
BLT	8	2.35	1.80	1.03
CER	9	2.27	1.67	0.99
FRI	10	2.33	1.40	0.78



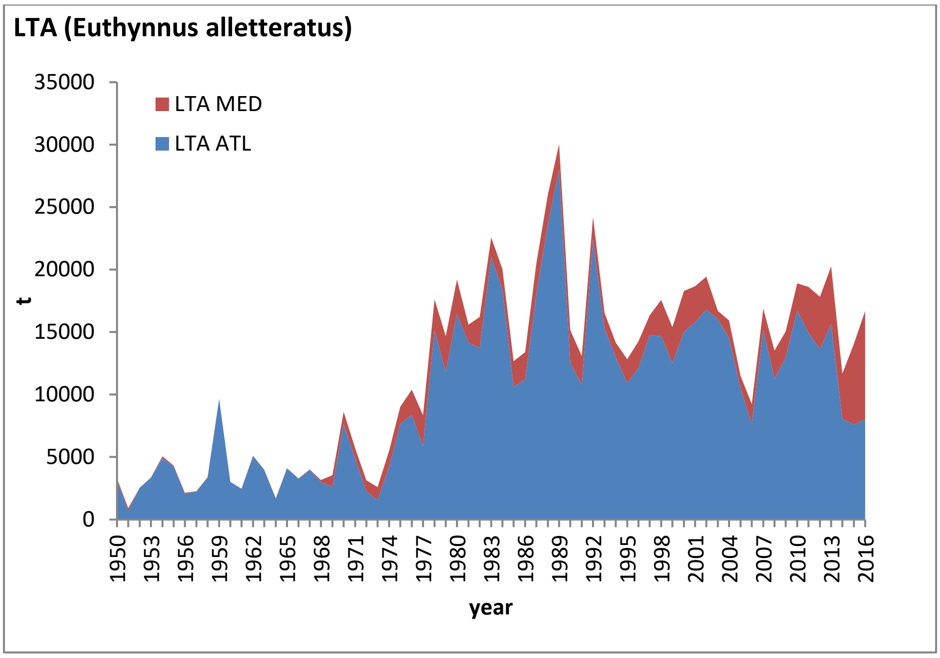
SMT-Figure 1. Estimated landings (t) of small tunas (combined) in the Atlantic and Mediterranean, 1950-2016. The data for the last three years are incomplete.



a)

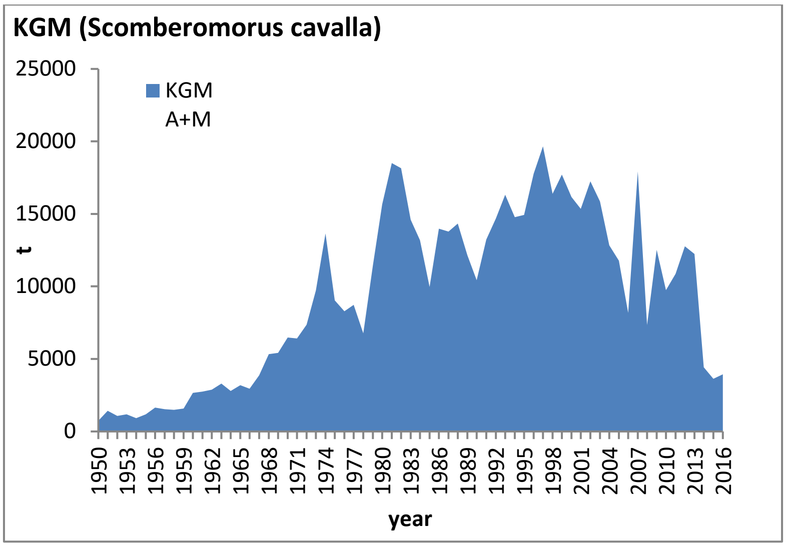


b)

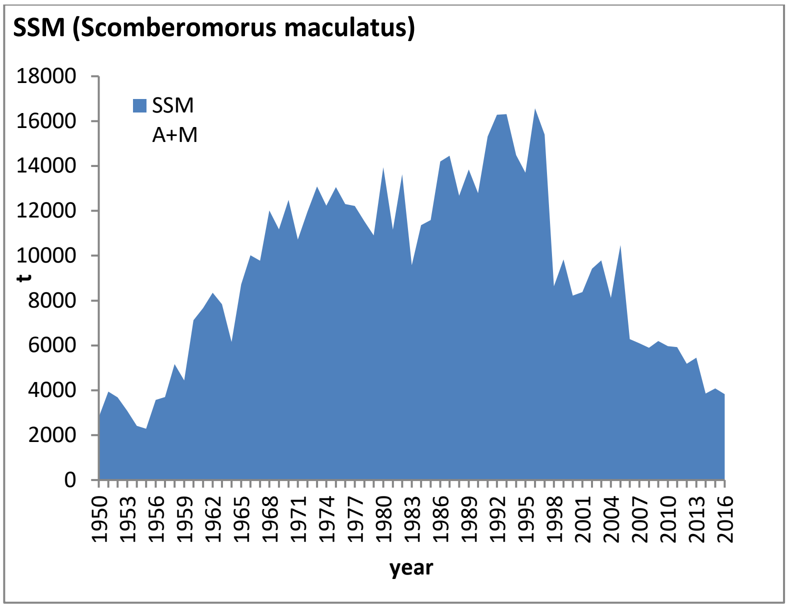


c)

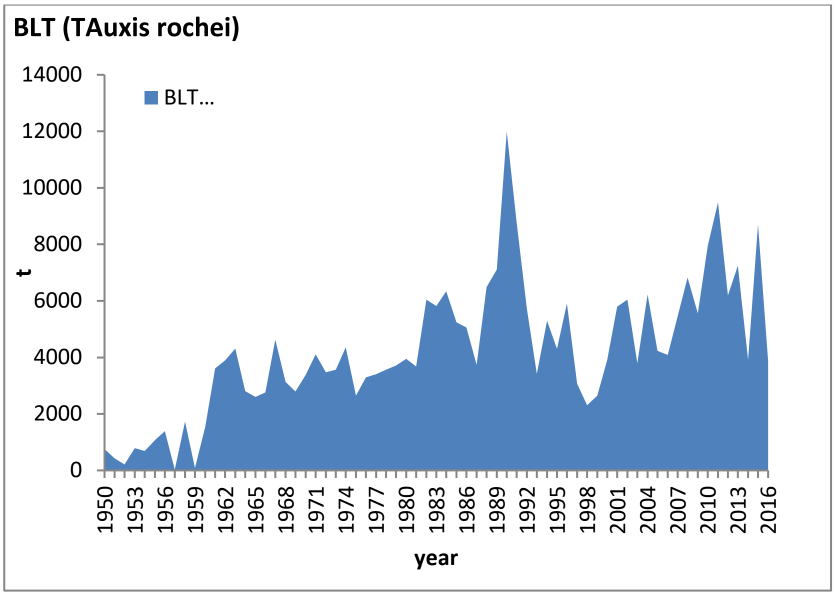
SMT-Figure 2. Estimated landings (t) of the major species of small tunas in the Atlantic and Mediterranean, 1950-2016. The data for the last years are incomplete.



d)

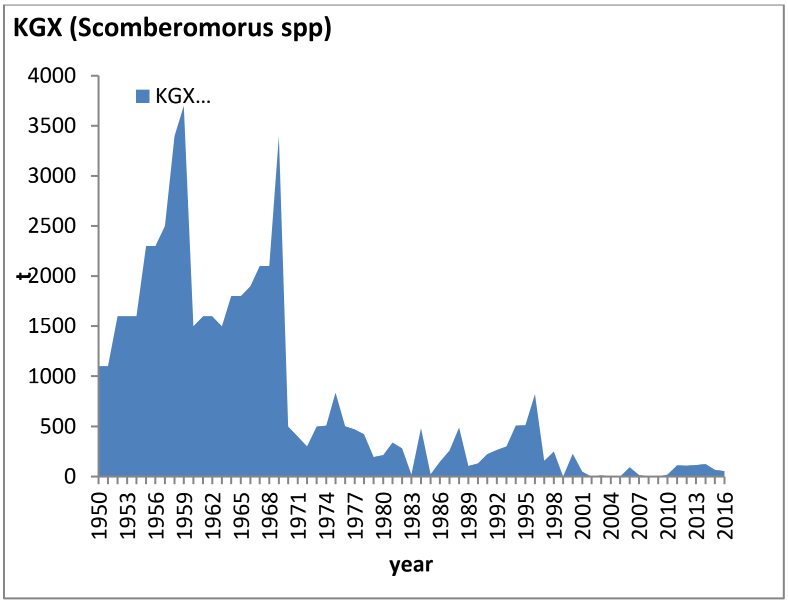


e)

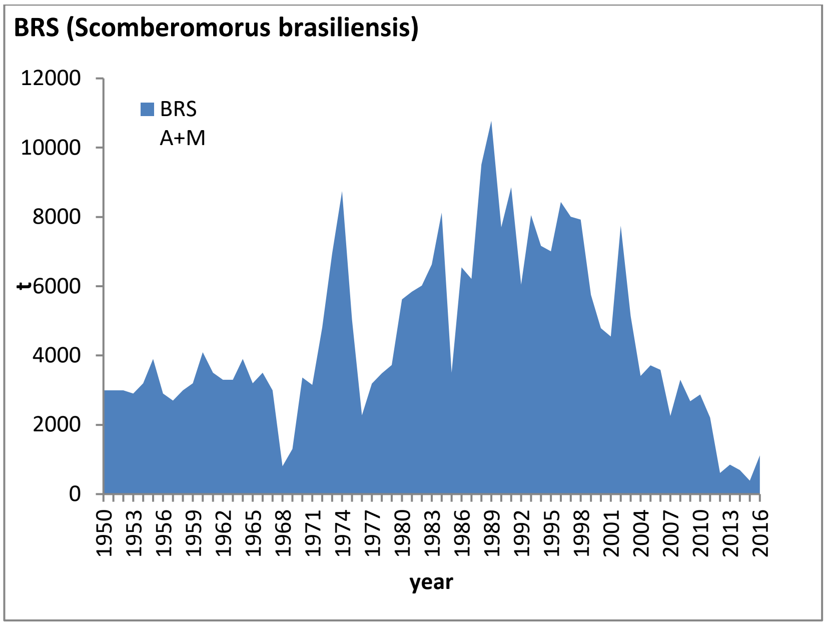


f)

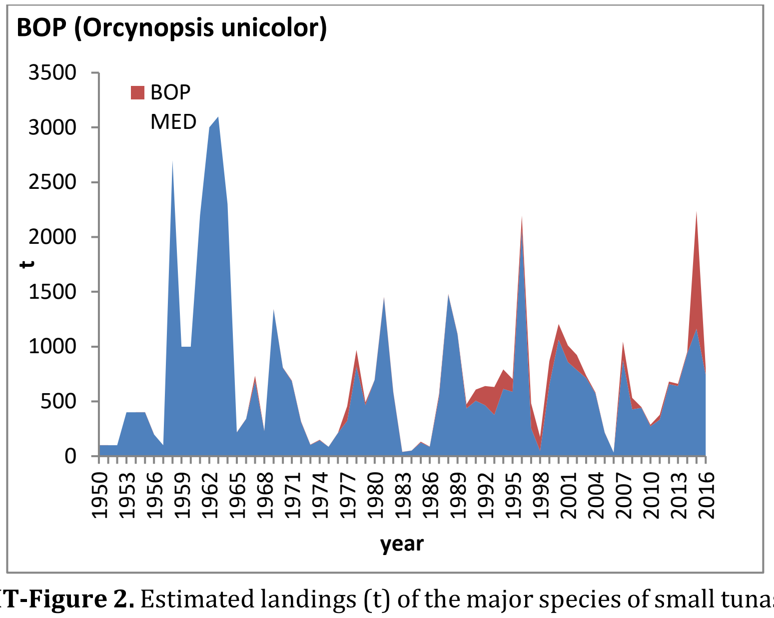
SMT-Figure 2. Estimated landings (t) of the major species of small tunas in the Atlantic and Mediterranean, 1950-2016. The data for the last years are incomplete.



g)

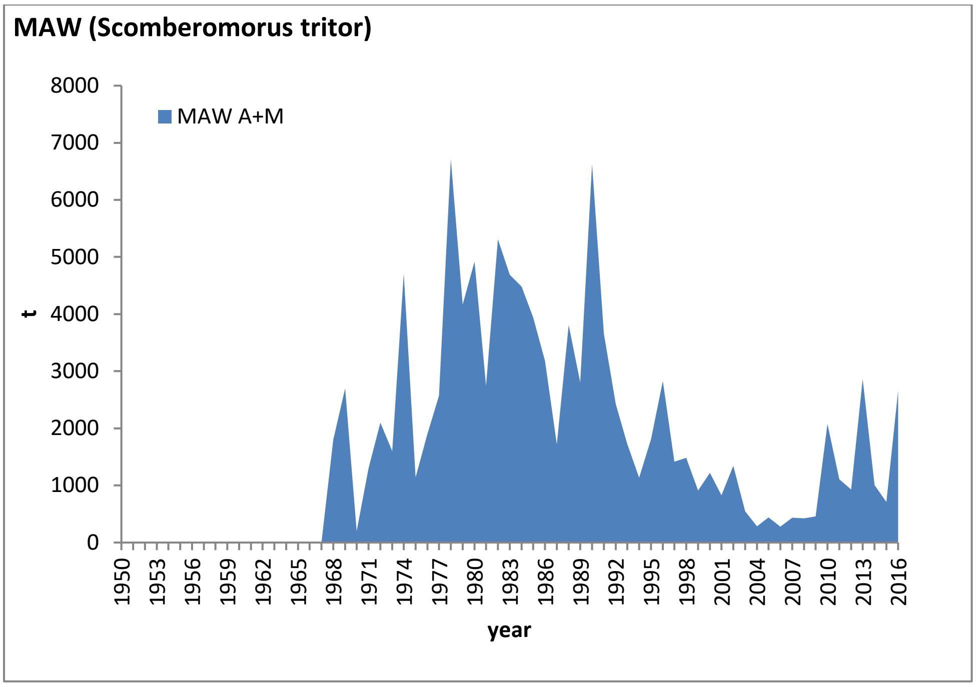


h)

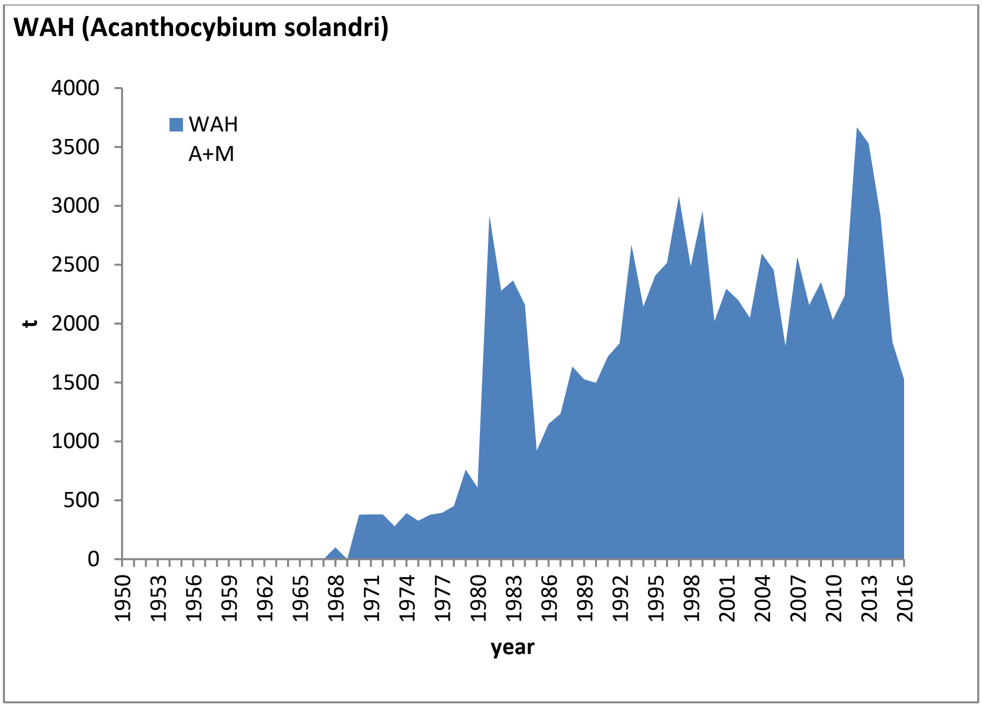


i)

SMT-Figure 2. Estimated landings (t) of the major species of small tunas in the Atlantic and Mediterranean, 1950-2016. The data for the last years are incomplete.

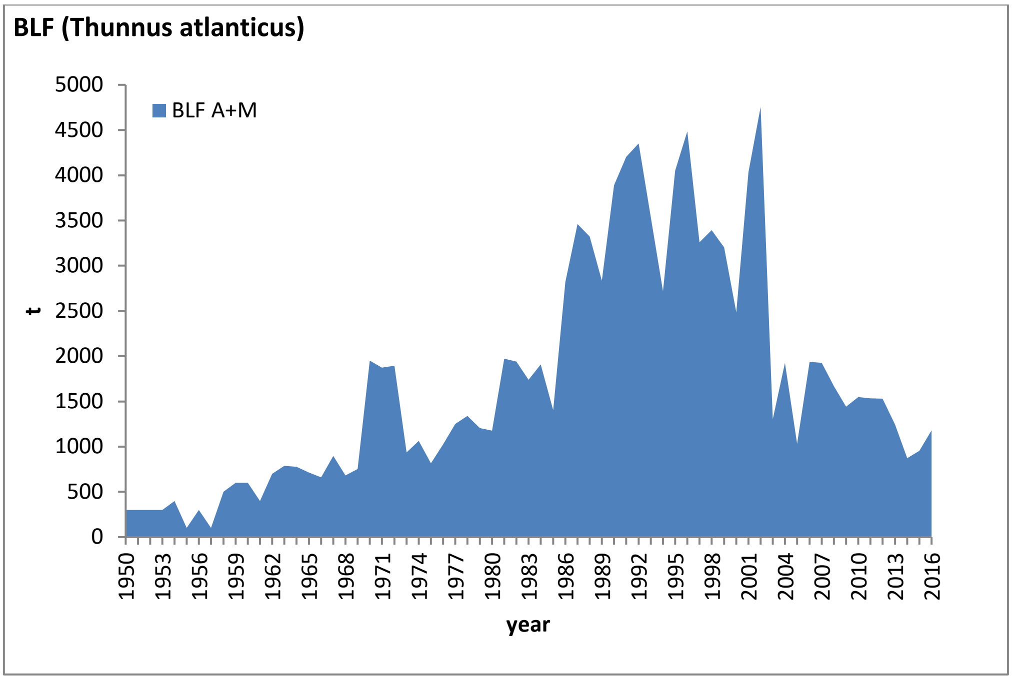


j)

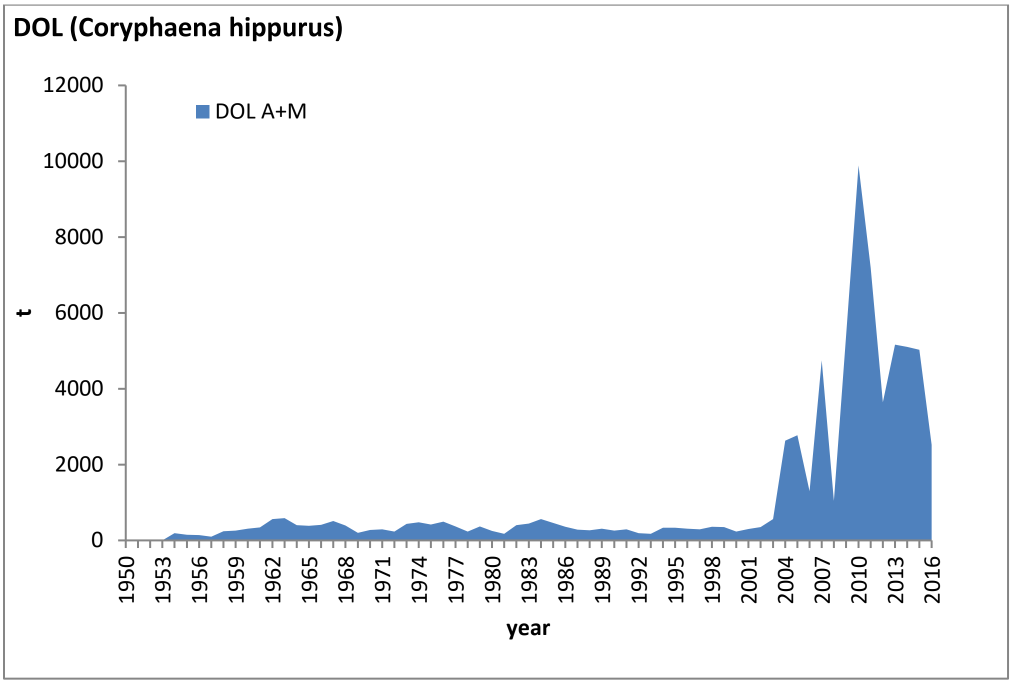


k)

SMT-Figure 2. Estimated landings (t) of the major species of small tunas in the Atlantic and Mediterranean, 1950-2016. The data for the last years are incomplete.

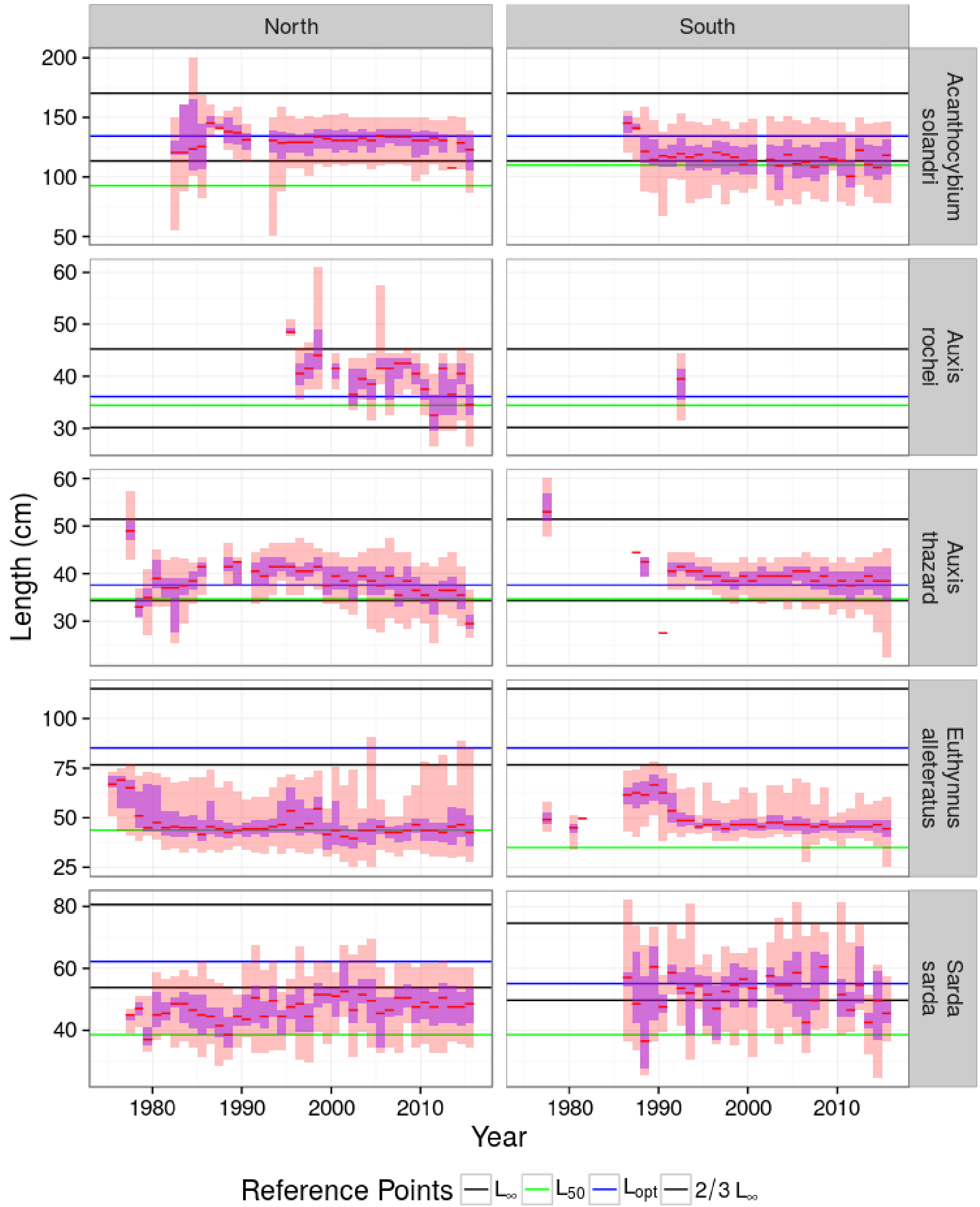


l)

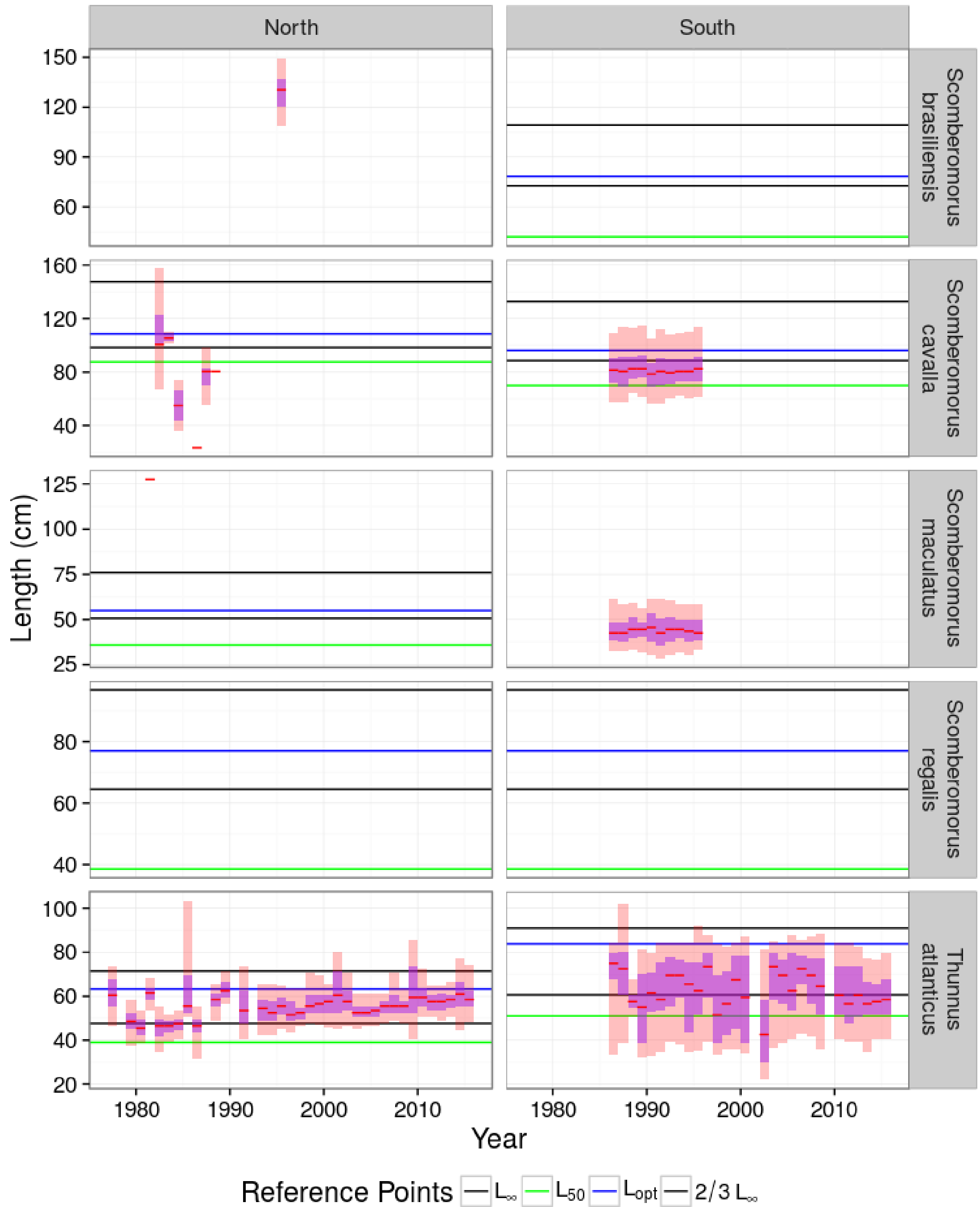


m)

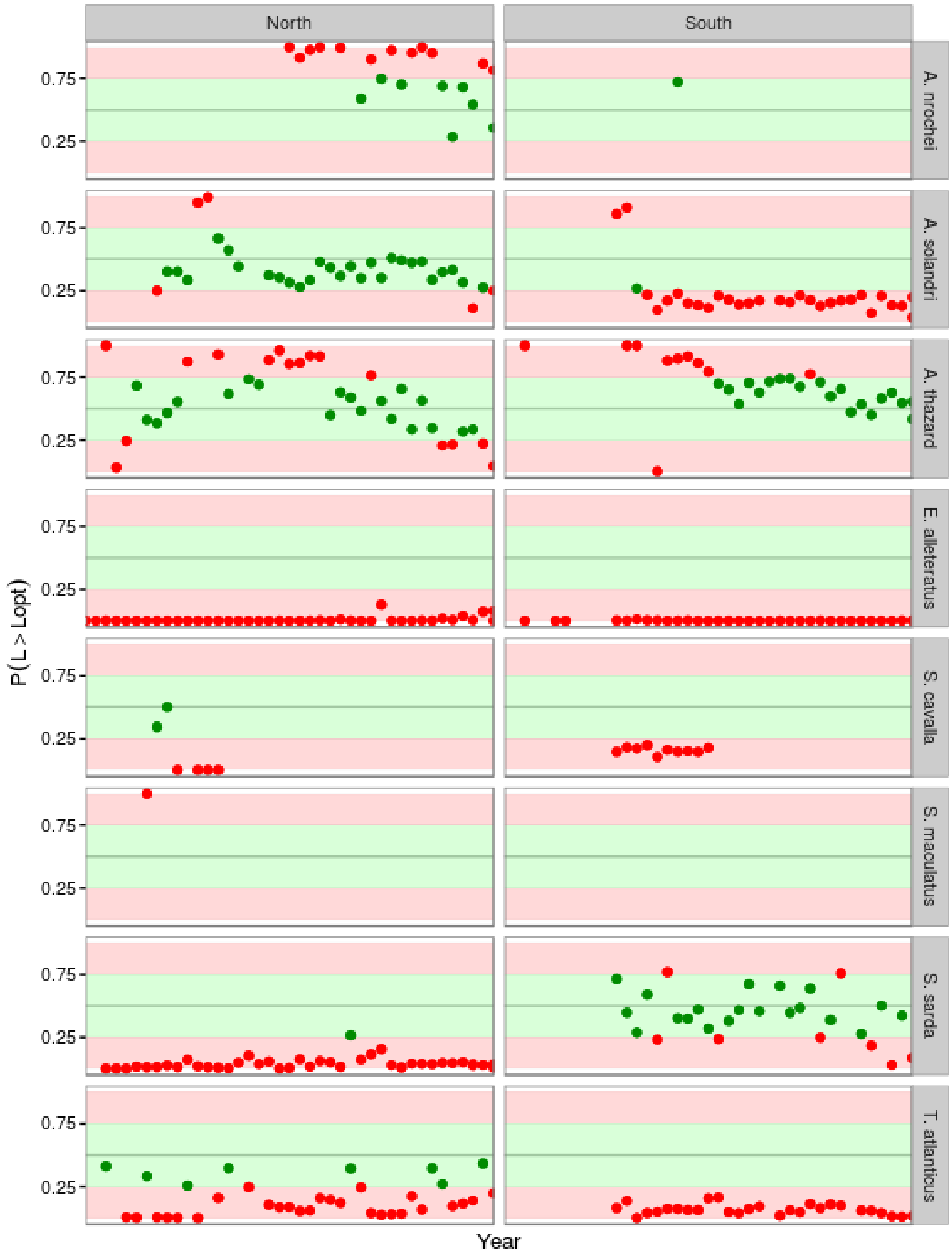
SMT-Figure 2. Estimated landings (t) of the major species of small tunas in the Atlantic and Mediterranean, 1950-2016. The data for the last years are incomplete.



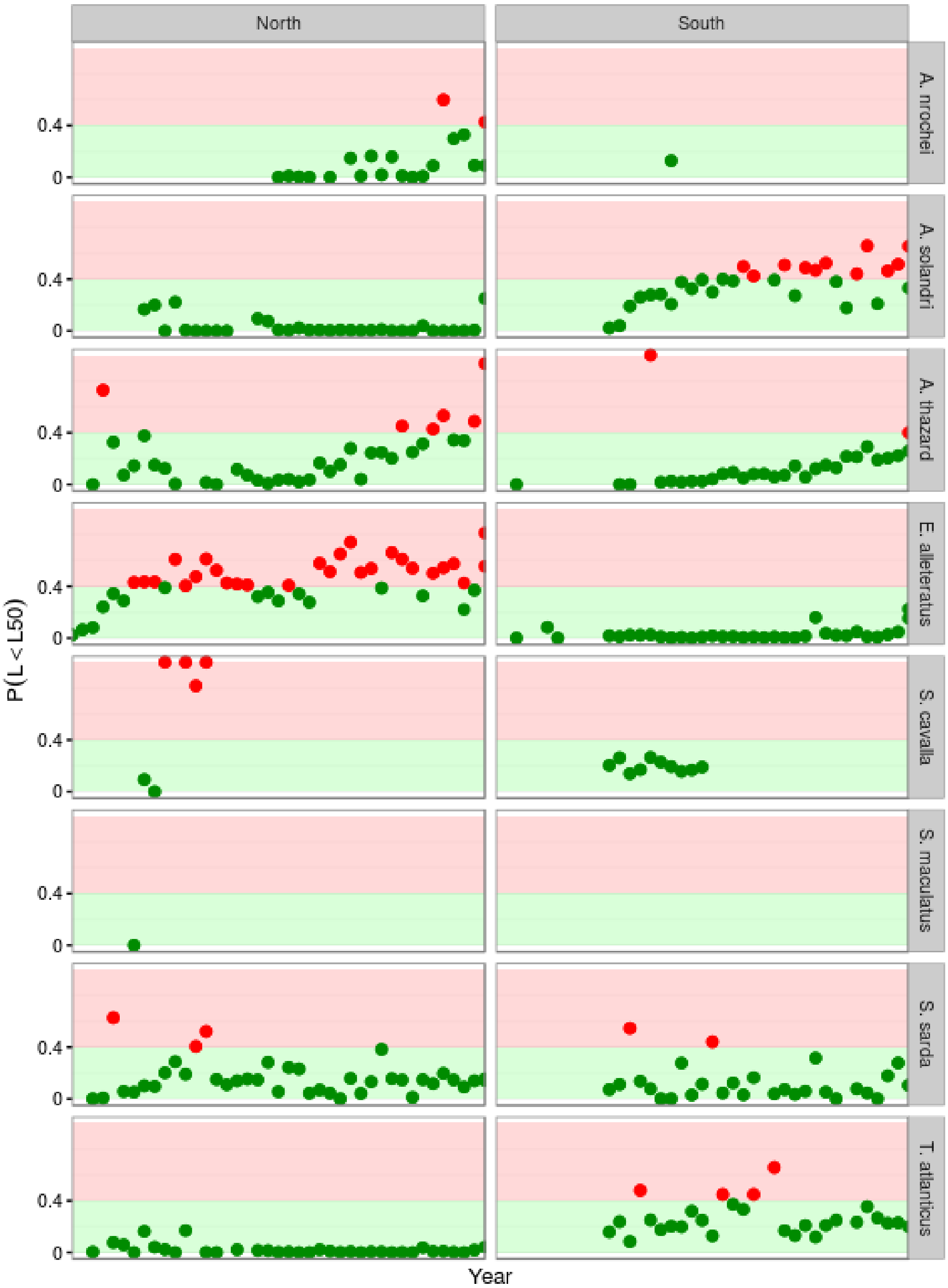
SMT-Figure 3a. Length distributions and reference points by species and Atlantic region for version 4 of Task II size data. The horizontal lines show the reference points i.e. asymptotic length (L_∞), length at 50% mature (L_{50}) and two estimates of the size at which a cohort reaches its maximum biomass (L_{opt}) and its proxy ($2/3{\sim}L_\infty$). The bars show the length distributions, i.e. median, interquartiles (5%, 95%).



SMT-Figure 3b. Length distributions and reference points by species and Atlantic region for version 4 of Task II size data. The horizontal lines show the reference points i.e. asymtopic length (L_∞)), length at 50% mature (L_{50}) and two estimates of the size at which a cohort reaches its maximum biomass (L_{opt}) and its proxy ($2/3 \sim L_\infty$). The bars show the length distributions, i.e. median, interquartiles (5%, 95%).



SMT-Figure 4a. Proportion of length distributions greater than L_{opt} by species and Atlantic region. 50 is used as a target reference point and so catches where the proportions of individuals greater than L_{opt} is >25% and <75% are coloured green.



SMT-Figure 4b. Proportion of length distributions less than L50 by species and Atlantic region; 40% is used as a limit reference point and so when the proportion of individuals less than L50 is >40% is coloured red.

8.13 SHK – SHARKS

Two intersessional meetings (a data preparatory and a stock assessment meeting) were conducted in 2017 for North and South Atlantic shortfin mako (*Isurus oxyrinchus*) stocks. Both meetings were held in Madrid, Spain, 28-31 March and 12-16 June. Information about the status of the blue shark (*Prionace glauca*) is available in the 2015 report of the assessment, while information about the status of the porbeagle (*Lamna nasus*) stock is available in the SCRS 2009 report of the assessment of that species. An Ecological Risk Assessment had also been conducted for 16 shark species (20 stocks), which is detailed in the 2013 report of the Sharks Working Group.

SHK-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.

Blue shark, shortfin mako and porbeagle are large pelagic sharks that show a wide geographic distribution; the first two from tropical to temperate waters worldwide, while the porbeagle has a distribution associated with cold-temperate waters. Shortfin mako and porbeagle have an aplacental viviparity with an oophagy reproductive system, which decreases their fecundity but increases the probability of survival of their young. The blue shark is placental viviparous and has an average litter size of 35 individuals, while the shortfin mako has an average litter size of around 12 and the porbeagle a litter size of usually just four individuals. Although high uncertainty regarding their biology remains, available life history traits (slow growth, late maturity and small litter size) indicate that they are vulnerable to overfishing. A behavioral characteristic of these species is their tendency to segregate temporally and spatially by size-sex, during feeding, mating-reproduction, gestation and birth processes. Tagging studies have suggested that they exhibit 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 pattern by ontogenetic stages and in some cases identifying their pupping/mating grounds. Numerous aspects of the biology of these species are still poorly understood or completely unknown, particularly for some regions, which contributes to increased uncertainty in quantitative and qualitative assessments.

SHK-2. Fishery indicators

Earlier reviews of the shark database resulted in recommendations to improve data reporting on shark catches. Though global statistics on shark catches included in the database have improved, they are still insufficient to permit the Committee to provide quantitative advice on stock status for most stocks with sufficient precision to guide fishery management toward optimal harvest levels. While reported and estimated catches for blue shark, shortfin mako and porbeagle are still generally subject to higher levels of uncertainty than the major tuna stocks, they have been considered sufficiently complete for the purpose of quantitative stock assessment, and are provided in **SHK-Table 1** and **SHK-Figures 1 and 2**.

Multiple standardized CPUE data series for blue shark were used in 2015 for both the North and South Atlantic stocks. For the North Atlantic stock, the eight indices of abundance used were: US longline observer, Japanese longline (early and late), U.S. observer cruise, Portuguese longline, Venezuelan longline, Spanish longline, and Chinese Taipei longline; for the South Atlantic stock, the six indices used were: Brazilian longline, Chinese Taipei longline, EU-Spain longline, Japanese longline (early and late) and Uruguayan longline. For both stocks, the series were generally flat or showed increasing trends, which conflicted with the also increasing catch tendencies, especially for the South Atlantic stock (**SHK-Figure 3**).

The CPUE series available for the 2017 shortfin mako stock assessments showed decreasing trends since approximately 2010 for the North Atlantic stock and generally increasing trends since approximately 2008 for the South Atlantic stock. (**SHK-Figures 4-5**). For each stock, the CPUE series generally showed a trend similar to that of the catches, particularly the South Atlantic stock, which could be problematic for the stock assessments based on production models.

During the porbeagle assessment in 2009, standardized CPUE data were presented for three of the four stocks (NE, NW and SW) (**SHK-Figure 6**). These series when referring to fisheries targeting porbeagle may not reflect the global abundance of the stock and where they refer to sharks caught as by-catch they could be highly variable. In 2010, only new information from the Japanese longline fleet on the CPUE of shortfin mako and porbeagle was presented.

With regard to the 16 species (20 stocks) included in the 2012 ERA, the Committee believes that, in spite of existing uncertainties, results are more robust than those obtained in the 2008 ERA. With this information the Committee considers it easier to identify those species that are most vulnerable to prioritize research and management measures (**SHK-Table 2**). These ERAs are conditional on the biological parameters used to estimate productivity as well as the susceptibility values for the different fleets. The committee highlights the higher participation of scientists from diverse CPCs, who provided valuable data for this ERA.

SHK-3. State of the stocks

Stock assessments and Ecological Risk Assessments carried out for elasmobranchs within the ICCAT Convention area have focused only on Atlantic stocks, and not on shark stocks in the Mediterranean Sea, to date. The 2012 ERA conducted by the Committee was a quantitative assessment consisting of a risk analysis to evaluate the biological productivity of these stocks and a susceptibility analysis to assess their propensity to capture and mortality in pelagic longline fisheries. Three metrics were used to calculate vulnerability (Euclidean distance, a multiplicative index, and the arithmetic mean of the productivity and susceptibility ranks). The five stocks with the lowest productivity were the bigeye thresher (*Alopias superciliosus*), sandbar (*Carcharhinus plumbeus*), longfin mako (*Isurus paucus*), night (*Carcharhinus signatus*), and South Atlantic silky shark (*Carcharhinus falciformis*). The highest susceptibility values corresponded to shortfin mako (*Isurus oxyrinchus*), North and South Atlantic blue sharks (*Prionace glauca*), porbeagle (*Lamna nasus*), and bigeye thresher. Based on the results, the bigeye thresher, longfin and shortfin makos, porbeagle, and night sharks were the most vulnerable stocks. In contrast, North and South Atlantic scalloped hammerheads (*Sphyrna lewini*), smooth hammerhead (*Sphyrna zygaena*), and North and South Atlantic pelagic stingray (*Pteroplatytrygon violacea*) had the lowest vulnerabilities. The Committee observed that the data regarding night shark distribution was considered to be incomplete and therefore the results with regard to this species should be considered preliminary and requiring revision before publication.

SHK-3.1 Blue shark

Considerable progress was made on the integration of new data sources, in particular size data, and modelling approaches, particularly model structure, in the 2015 assessment of the status of the stock of North Atlantic blue shark. For both the North and South Atlantic stocks, uncertainty in data inputs and model configuration was explored through sensitivity analysis. Although sensitivity analyses did not cover the full range of possible uncertainty, they revealed that results were sensitive to structural assumptions of the models. All the production model formulations had difficulty fitting the flat or increasing trends in the CPUE series combined with increasing catch trends. Overall, assessment results were uncertain (e.g. the level of absolute abundance varied by an order of magnitude between models with different structures) and should be interpreted with caution.

For the North Atlantic stock, all scenarios considered with the Bayesian surplus production model and the integrated model (SS3) indicated that the stock was not overfished and that overfishing was not occurring, as was also concluded in the 2008 stock assessment (**SHK Figure 7**). However, the Committee acknowledged that there still remained a high level of uncertainty in data inputs and model structural assumptions, by virtue of which the possibility of the stock being overfished and overfishing occurring could not be ruled out. The Committee identified a better definition of fleets for SS3 and a more in depth historical catch reconstruction, especially discard estimates, as some of the main sources of uncertainty that may help to improve model fit and provide a more certain stock status in the future.

For the South Atlantic stock, all scenarios with the Bayesian surplus production model estimated that the stock was not overfished and that overfishing was not occurring, as concluded in the 2008 stock assessment. Estimates obtained with the Bayesian state-space surplus production model formulation should be considered more reliable than other Bayesian production models. These were less optimistic, predicting that the stock could be overfished and overfishing could be occurring (**SHK Figure 8**). Acknowledging the high uncertainty of the results, the Committee cannot rule out that the stock is overfished and experiencing overfishing.

SHK-3.2 Shortfin mako shark

The 2017 assessment of the status of North and South Atlantic stocks of shortfin mako shark was conducted with updated time series of relative abundance and annual catches (C1), life history, and with the inclusion of length composition data. An alternative series of catch data based on ratios of shark catches to catches of the main target species (C2) was also estimated and used in the assessments. The results obtained in this evaluation are not comparable to those obtained in the last assessment conducted in 2012 because the input data and model structures have changed significantly: the catch time series are different (1950-2015 for the 2017 assessment and 1971-2010 for the 2012 assessment) and were derived using different assumptions; the CPUE series in the North have been decreasing since 2010 (the last year in the 2012 assessment models); some of the biological inputs have changed (growth curve, natural mortality at age) and some are now sex specific for the North; with the new biological inputs the intrinsic rate of population growth (r_{max}) for the North Atlantic used to construct prior distributions is now about half that used in the 2012 assessment; and additional length composition data also became available for the North. Additionally, in 2012 only a Bayesian production model (BSP1) and a catch-free age-structured production (CFASPM) model were used, whereas more modeling platforms that more fully use the data available were explored in the current assessment (BSP2JAGS [Just Another Gibbs Sampler emulating the Bayesian production model], JABBA [Just Another Bayesian Biomass Assessment], CMSY [Catch at MSY], and SS3 [Stock Synthesis 3]). It is the Committee's view that the 2017 stock assessment represents a significant improvement in our understanding of current stock status, for North Atlantic shortfin mako in particular.

For the North Atlantic stock, results of nine stock assessment model runs were selected to provide stock status and management advice. Although all results indicated that stock abundance in 2015 was below B_{MSY}, results of the production models (BSP2JAGS and JABBA) were more pessimistic (B/B_{MSY} deterministic estimates ranged from 0.57 to 0.85) and those of the age-structured model (SS3), which indicated that stock abundance was near MSY (SSF/SSF_{MSY} = 0.95 where SSF is spawning stock fecundity), were less pessimistic. F was overwhelmingly above F_{MSY} (**SHK-Figure 9**), with a combined 90% probability from all the models of being in an overfished state and experiencing overfishing (**SHK-Figure 10**).

For the South Atlantic stock, 4 assessment model runs (2 BSP2JAGS runs and 2 CMSY runs) were considered to provide stock status and management advice. The combined probability of the stock being overfished was 32.5% and that of experiencing overfishing was 41.9% (**SHK-Figure 11**). The combined probabilities from all the models of being in the red, yellow, and green quadrants of the Kobe plot are provided in **SHK-Figure 12**. Based on the diagnostics of model performance, the estimates of unsustainable harvest rates appear to be fairly robust at this stage whereas the biomass depletion and B/B_{MSY} estimates must be treated with extreme caution. The Committee considers results for the South Atlantic to be highly uncertain owing to the conflict between catch and CPUE data.

SHK-3.3 Porbeagle shark

In 2009, the Committee attempted an assessment of the four porbeagle stocks in the Atlantic Ocean: Northwest, Northeast, Southwest and Southeast. In general, data for Southern hemisphere porbeagle are too limited to provide a robust indication on the status of the stocks. For the Southwest, limited data indicate a decline in CPUE in the Uruguayan fleet, with models suggesting a potential decline in porbeagle abundance to levels below MSY and fishing mortality rates above those producing MSY (**SHK-Figure 13**). But catch and other data are generally too limited to allow definition of sustainable harvest levels. Catch reconstruction indicates that reported landings grossly underestimate actual landings. For the Southeast, information and data are too limited to assess their status. Available catch rate patterns suggest stability since the early 1990s, but this trend cannot be viewed in a longer term context and thus are not informative on current levels relative to B_{MSY}.

The Northeast Atlantic stock has the longest history of commercial exploitation. A lack of CPUE data for the peak of the fishery adds considerable uncertainty in identifying the status relative to virgin biomass. Exploratory assessments indicate that biomass is below B_{MSY} and that recent fishing mortality is near or above F_{MSY} (**SHK-Figure 14**). Recovery of this stock to B_{MSY} under no fishing mortality is estimated to take ca. 15-34 years. The 2009 EU TAC of 436 t in effect for the Northeast Atlantic may have allowed the stock to remain stable, at its depleted biomass level, under most credible model scenarios. Since 2010 the EU TAC has been set at zero.

The Canadian assessment of the Northwest Atlantic porbeagle stock indicated that biomass is depleted to well below B_{MSY}, but recent fishing mortality is below F_{MSY} and recent biomass appears to be increasing. Additional modelling using a surplus production approach indicated a similar view of stock status, i.e. depletion to levels below B_{MSY} and fishing mortality rates also below F_{MSY} (**SHK-Figure 15**). The Canadian assessment projected that with no fishing mortality, the stock could rebuild to B_{MSY} level in approximately 20-60 years, whereas surplus-production based projections indicated 20 years would suffice. Under the Canadian strategy of a 4% exploitation rate, the stock was expected to recover in 30 to 100+ years according to the Canadian projections.

During the 2009 porbeagle assessment, both porbeagle stocks in the northwest and northeast Atlantic were estimated to be overfished, with the northeastern stock being more highly depleted. In addition, porbeagle received a high vulnerability ranking in the 2008 and 2012 ERAs. The main source of fishing mortality on these stocks was from directed porbeagle fisheries which are not under the Commission's direct mandate.

SHK-4. Outlook

SHK-4.1 Blue shark

Due to the difficulty of determining current status for both the North and South Atlantic stocks of blue shark, in particular absolute population abundance, the Committee in 2015 considered that it was not appropriate to conduct quantitative projections of future stock condition based on the range of scenarios considered at the stock assessment meeting.

SHK-4.2 Shortfin mako

For shortfin mako, projections could only be carried out with the BSP2JAGS production model for the North Atlantic and no projections could be conducted for the South Atlantic due to the uncertainty in stock status. Projections indicated that current catch levels (3,600 t for the Task I catches [C1] and 4,750 t for the alternative catches estimated based on ratios [C2], mean of 2011-2015) in the North Atlantic will cause continued population decline and that catches would need to be 1,000 t or lower to prevent further population declines (**SHK-Figure 16**). However, the Kobe II strategy matrices showed that for a constant annual catch of 1,000 t, the probability of being in the Kobe plot green zone would only be 25% by 2040 (**SHK-Table 3**). The Committee notes that the Kobe II strategy matrices may not reflect the full range of uncertainty in the outlook because projections were not carried out with SS3 due to technical reasons and because the model is still under development. Although in terms of current stock size the SS3 model is more optimistic than the aggregated biomass dynamic (production) models, the future outlook is probably more pessimistic because the fisheries are removing mostly juveniles and thus it can be anticipated that spawning stock size will keep declining for years after fishing pressure has been reduced until recruits reach maturity. It should be noted that ICCAT fisheries are not removing mature females.

SHK-4.3 Porbeagle

Projections for porbeagle were not conducted in the 2009 assessment because of the great uncertainty in determining stock status for any of the stocks.

SHK-5. Effect of current regulations

The Commission adopted Rec. 16-12, which in paragraph 2 establishes a catch limit for blue sharks in the North Atlantic (39,102 t as the average of two consecutive years). At present, the Committee is not in a position to assess the effect of this measure because the recommendation only came into effect in 2017. However, the Committee noted that the preliminary catch in 2016 was 42,117 t.

In 2013 Uruguay prohibited retention of porbeagle sharks and Canadian directed fisheries for porbeagle have also been closed since 2013. The other main porbeagle directed fishery in the North Atlantic (EU) ceased operations in 2010.

The General Fisheries Commission for the Mediterranean (GFCM) adopted ICCAT's thresher shark Recommendation (banning retention of bigeye threshers *Alopias superciliosus*) in 2010. In 2012, the GFCM adopted Recommendation GFCM/36/2012/3 prohibiting retention, transhipment, landing, display and sale of the 24 elasmobranch species listed under Annex II of the Barcelona Convention *Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean* including shortfin mako, porbeagle, smooth hammerhead (*Sphyrna zygaena*), scalloped hammerhead (*Sphyrna lewini*), and great hammerhead (*Sphyrna mokarran).* The European Union implemented this measure for relevant EU Member States in 2015.

Porbeagle, hammerheads, oceanic whitetip sharks *(Carcharhinus longimanus)*, and manta rays *(Mobula birostris, M. alfredi)* were listed under Appendix II of the Convention on International Trade in Endangered Species (CITES) in 2013. Threshers *(Alopias* spp.), silky sharks *(Carcharhinus falciformis)* and the remaining mobulids were added in 2016 (effective October 2017). CITES Appendix II carries a requirement that Parties issue export permits based on findings that 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 signals a commitment to international cooperation toward conservation, includes makos, porbeagles, hammerheads, threshers, and silky sharks. Mobulid rays are listed on Appendix I, which mandates strict protection. CMS has developed a Memorandum of Understanding specific to sharks as well as a Conservation Action Plan which may aid in implementation of CMS listings for elasmobranchs.

SHK-6. Management recommendations

Precautionary management measures should be considered particularly for stocks where there is the greatest biological vulnerability and conservation concern, and for which there are very few data and/or great uncertainty in assessment results. Management measures should ideally be species-specific whenever possible.

Considering the need to improve stock assessments of pelagic shark species impacted by ICCAT fisheries and bearing in mind Rec. 12-05 adopted in 2012 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.

The Committee reiterates that the CPCs provide estimates of shark catches in both ICCAT and non-ICCAT fisheries for species that are oceanic, pelagic, and highly migratory within the ICCAT Convention area. The magnitude of shark entanglements in FADs should be investigated. Methods for mitigating shark by-catch in fisheries also need to be investigated and applied.

SHK-6.1 Blue shark

Considering the uncertainty in stock status results for the South Atlantic stock of blue sharks, the Committee strongly recommends that the Commission considers a precautionary approach for this stock. If the Commission chose to use the same approach taken for the North Atlantic stock, the average catch of the final five years used in the assessment model (28,923 t for 2009-2013) could be used as a limit. For the North Atlantic stock, while all model formulations explored predicted that the stock was not overfished and that overfishing was not occurring, the level of uncertainty in the data inputs and model structural assumptions was high enough to prevent the Committee from reaching a consensus on a specific management recommendation.

SHK-6.2 Shortfin mako

For the North Atlantic stock of shortfin mako, the probabilities in the Kobe matrices indicate that to stop overfishing and start rebuilding, the constant annual catch should be reduced to 500 t or less. This will achieve the goal of stopping overfishing in 2018 with a 75% probability, but it only has a 35% probability of rebuilding the stock by 2040. Only a 0 t annual catch will rebuild the stock by 2040 with a 54% probability.

The Kobe II strategy matrix (**SHK-Table 3**) shows the range of possible options for the Commission to consider. If the Commission wishes to stop overfishing immediately and achieve rebuilding by 2040 with over a 50% probability, the most effective immediate measure is a complete prohibition of retention. Additional recommended measures that can potentially further reduce incidental mortality include time/area closures, gear restrictions, and safe handling and best practices for the release of live specimens (since post release survival can reach 70%).

The Committee emphasizes that there will be a need for CPCs to strengthen their monitoring and data collection efforts to monitor the future status of this stock, including but not limited to total estimated dead discards and the estimation of CPUE using observer data.

For the South Atlantic stock of shortfin makos, given the uncertainty in stock status, the large fluctuations in catch, the high intrinsic vulnerability of this species, and the depleted status for the North Atlantic stock, the Committee recommends that until this uncertainty is reduced, catch levels should not exceed the minimum catch in the last five years of the assessment (2011-2015; 2,001 t with catch scenario C1).

SHK-6.3 Porbeagle

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) and cooperate with the current Areas Beyond National Jurisdiction (ABNJ) coordinated South Atlantic stock assessment. In particular, porbeagle fishing mortality should be kept to levels in line with scientific advice and with catches 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, ICCAT should facilitate appropriate communication.

NORTH ATLANTIC BLUE SHARK SUMMARY

Provisional Yield (2016)		42,117 t[1]
Yield (2013)		36,748 t[2]
Relative Biomass	B_{2013}/B_{MSY}	1.35-3.45[3]
	B_{2013}/B_0	0.75-0.98[4]
Relative Fishing Mortality	F_{MSY}	0.19-0.20[4]
	F_{2013}/F_{MSY}	0.04-0.75[5]
Stock Status (2013)	Overfished	Not likely [6]
	Overfishing	Not likely [6]
Management Measures in Effect:		[Rec. 16-12]

[1] Task I catch.
[2] Estimated catch used in the 2015 assessments.
[3] Range obtained with the Bayesian Surplus Production (BSP) and SS3 models. Value from SS3 is SSF/SSF_{MSY}.
[4] Range obtained with the BSP model.
[5] Range obtained with the BSP and SS3 models.
[6] Although the models explored indicate the stock is not overfished and overfishing is not occurring, the Committee acknowledges that there still remains a high level of uncertainty.

SOUTH ATLANTIC BLUE SHARK SUMMARY

Provisional Yield (2016)		24,077 t[1]
Yield (2013)		20,799 t[2]
Relative Biomass	B_{2013}/B_{MSY}	0.78-2.03[3]
	B_{2013}/B_0	0.39-1.00[3]
Relative Fishing Mortality	F_{MSY}	0.10-0.20[3]
	F_{2013}/F_{MSY}	0.01-1.19[3]
Stock Status (2013)	Overfished	Undetermined[4]
	Overfishing	Undetermined[4]

[1] Task I catch.
[2] Estimated catch used in the 2015 assessments.
[3] Range obtained with the Bayesian Surplus Production (BSP) and State-Space Bayesian Surplus Production (SS-BSP) models.
[4] Given the uncertainty in stock status, the Committee cannot make a determination but cautions that the stock may have been overfished and overfishing may have occurred in recent years.

NORTH ATLANTIC SHORTFIN MAKO SUMMARY

Provisional Yield (2016)		3,377 t[1]
Yield (2015)		3,227 t[2]
Relative Biomass	B_{2015}/B_{MSY}	0.57-0.95[3]
	B_{2015}/B_0	0.34-0.57[4]
Relative Fishing Mortality	F_{MSY}	0.015-0.056[5]
	F_{2015}/F_{MSY}	1.93-4.38[6]
Stock Status (2015)	Overfished	Yes
	Overfishing	Yes
Management Measures in Effect:		[Rec. 04-10], [Rec. 07-06], [Rec. 10-06][Rec. 14-06]

[1] Task I catch.
[2] Task I catch used in the stock assessment.
[3] Range obtained from 8 Bayesian production and 1 SS3 model runs. Value from SS3 is SSF/SSF_{MSY}. Low value is lowest value from 4 production model (JABBA) runs and high value is from the SS3 base run.
[4] Range obtained from 8 Bayesian production and 1 SS3 model runs. Value from SS3 is SSF/SSF_0. Low value is lowest value from 4 production model (JABBA) runs and high value is highest value from 4 production model (BSP2JAGS) model runs.
[5] Range obtained from 8 Bayesian production and 1 SS3 model runs. Value from SS3 is SSF_{MSY}. Low value is lowest value from 4 production model (JABBA and BSP2JAGS) runs and high value is from the SS3 base run.
[6] Range obtained from 8 Bayesian production and 1 SS3 model runs. Values from the production models are H (harvest rates). Low value is lowest value from 4 production model (BSP2JAGS) runs and high value is from the SS3 base run and highest value from 4 production model (JABBA) runs.

SOUTH ATLANTIC SHORTFIN MAKO SUMMARY

Provisional Yield (2016)		2, 641 t[1]
Yield (2015)		2,686 t[2]
Relative Biomass	B_{2015}/B_{MSY}	0.65-1.75[3]
	B_{2015}/B_0	0.32-1.18[4]
Relative Fishing Mortality:	F_{MSY}	0.030-0.034[5]
	F_{2015}/F_{MSY}	0.86-3.67[6]
Stock status (2015)	Overfished	Possibly[7]
	Overfishing	Possibly[7]
Management Measures in Effect:		[Rec. 04-10], [Rec. 07-06], [Rec. 10-06] [Rec. 14-06]

[1] Task I catch.
[2] Task I catch from the stock assessment.
[3] Range obtained from 2 Bayesian production (BSP2JAGS) and 2 catch-only (CMSY) model runs. Low value is lowest value from the CMSY model runs and high value is highest value from the BSP2JAGS model runs.
[4] Range obtained from 2 Bayesian production (BSP2JAGS) and 2 catch-only (CMSY) model runs. Low value is lowest value from the CMSY model runs and high value is highest value from the BSP2JAGS model runs.
[5] Range obtained from 2 Bayesian production (BSP2JAGS) and 2 catch-only (CMSY) model runs. Low value is from the BSP2JAGS model runs and high value is from the CMSY model runs.
[6] Range obtained from 2 Bayesian production (BSP2JAGS) and 2 catch-only (CMSY) model runs. Low value is lowest value from the BSP2JAGS model runs and high value is highest value from the CMSY model runs.
[7] The Committee considers that results have a high degree of uncertainty.

NORTHWEST ATLANTIC PORBEAGLE SUMMARY

Current Yield (2008)		144.3 t[1]
Relative Biomass	B_{2008}/B_{MSY}	0.43-0.65[2]
Relative Fishing Mortality	F_{MSY}	0.025-0.075[3]
	F_{2008}/F_{MSY}	0.03-0.36[4]
Domestic Management Measures in Effect		TACs of 185 t and 11.3 t[5]
Stock Status (2008)	Overfished	Yes
	Overfishing	No
Management Measures in Effect:		[Rec. 15-06]

[1] Estimated catch allocated to the Northwest stock area. Not updated as area boundaries have not been formally defined.
[2] Range obtained from age-structured model (Canadian assessment; low) and BSP model (high). Value from Canadian assessment is in numbers; value from BSP in biomass. All values in parentheses are CVs.
[3] Range obtained from BSP model (low) and age-structured model (high).
[4] Range obtained from BSP model (low) and age-structured model (high).
[5] The TAC for the Canadian EEZ was 185 t (in 2008) (MSY catch is 250 t); the TAC for the USA is 11.3 t (dressed weight).

SOUTHWEST ATLANTIC PORBEAGLE SUMMARY

Current Yield (2008)		164.6 t[1]
Relative Biomass	B_{2008}/B_{MSY}	0.36-0.78[2]
Relative Fishing Mortality	F_{MSY}	0.025-0.033[3]
	F_{2008}/F_{MSY}	0.31-10.78[4]
Stock Status (2008)	Overfished	Yes
	Overfishing	Undetermined[5]
Management Measures in Effect:		[Rec. 15-06], TAC of 0 t[6]

[1] Estimated catch allocated to the Southwest stock area. Not updated as area boundaries have not been formally defined.
[2] Range obtained from BSP (low and high) and CFASP models. Value from CFASP model (SSB/SSB_{MSY}) was 0.48 (0.20).
[3] Range obtained from BSP (low) and CFASP (high) models.
[4] Range obtained from BSP (low and high) and CFASP models. Value from CFASP model was 1.72 (0.51).
[5] Given the uncertainty in stock status, the Committee cannot make a determination but cautions that overfishing may have occurred in recent years.
[6] Retention of porbeagle sharks has been prohibited in Uruguay since 2013.

NORTHEAST ATLANTIC PORBEAGLE SUMMARY

Current Yield (2008)		287 t[1]
Relative Biomass	B_{2008}/B_{MSY}	0.09-1.93[2]
Relative Fishing Mortality	F_{MSY}	0.02-0.03[3]
	F_{2008}/F_{MSY}	0.04-3.45[4]
Stock Status (2008)	Overfished	Yes
	Overfishing	No
Management Measures in Effect		[Rec. 15-06], TAC of 0 t[5]
		Maximum landing length of 210 cm FL[5]

[1] Estimated catch allocated to the Northeast stock area. Not updated as area boundaries have not been formally defined.
[2] Range obtained from BSP (high) and ASPM (low) models. Value from ASPM model is SSB/SSB_{MSY}. The value of 1.93 from the BSP corresponds to a biologically unrealistic scenario; all results from the other BSP scenarios ranged from 0.29 to 1.05.
[3] Range obtained from the BSP and ASPM models (low and high for both models).
[4] Range obtained from BSP (low) and ASPM (high) models. The value of 0.04 from the BSP corresponds to a biologically unrealistic scenario; all results from the BSP scenarios ranged from 0.70 to 1.26.
[5] In the European Union the TAC has been set at zero t since 2010.

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**
TOTAL				3668	9600	11300	11584	11650	39578	35623	37023	40664	35800	32765	37983	36305	43072	43888	50464	53901	58842	65193	73192	63241	56840	62923	62012	66273
	ATN			3560	9589	8590	8468	7395	29283	26763	26172	28174	21709	20066	23005	21742	22359	23217	26927	30723	35198	37178	38083	36778	37058	36574	39626	42117
	ATS			107	10	2704	3108	4252	10145	8797	10829	12444	14043	12682	14967	14438	20642	20493	23487	23097	23459	27799	35069	26421	19682	26114	22300	24077
	MED			1	0	6	8	2	150	63	22	45	47	17	11	125	72	178	50	81	185	216	40	42	100	235	85	79
Landings	ATN		Longline	2884	7458	7645	7547	6130	28678	26152	25382	27305	20699	19290	22880	21297	22167	23067	26810	30514	35031	36952	37777	36549	36875	36241	38777	41772
			Other surf.	492	994	373	300	559	426	419	681	732	905	708	70	380	126	104	63	80	63	59	100	109	74	205	725	257
	ATS		Longline	107	10	2704	3108	4246	10135	8790	10801	12444	14042	12678	14961	14339	20638	20434	23417	22708	23453	27785	34531	25878	19382	24166	21355	23309
			Other surf.	0	0	0	0	0	6	4	27	0	1	4	6	99	3	59	10	375	6	14	534	411	167	1835	818	629
	MED		Longline	0	0	5	7	1	147	61	20	44	47	17	10	43	71	83	48	81	18	50	40	41	68	190	84	78
			Other surf.	1	0	1	1	1	2	2	2	1	1	1	0	81	0	95	2	1	167	165	0	0	32	45	1	2
Discards	ATN		Longline	184	1136	572	621	602	180	170	104	137	105	68	55	63	66	45	53	129	102	167	205	119	109	128	124	87
			Other surf.	0	0	0	0	103	0	22	4	0	0	0	0	1	0	0	0	1	1	1	2	1	0	0	0	0
	ATS		Longline	0	0	0	0	7	5	4	1	0	0	0	0	0	0	0	60	14	0	0	4	132	132	114	122	139
			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	
	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	
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
			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
			Brazil	0	0	0	0	0	0	0	0	7	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	1162	836	346	965	1134	977	843	0	0	0	0	1	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	
			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
			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	
			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
			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
			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	
			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**
			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
			EU.United Kingdom	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
			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**
			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**
			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	4239
			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
			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	
			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
			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	**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
			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
			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
			U.S.A.	215	680	29	23	283	211	255	217	291	39	0	0	7	2	2	1	8	4	9	65	56	32	39	31	30
			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	
			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
		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	266
			Suriname	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	181	281	0	0	**0**
	ATS	CP	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
			Brazil	0	0	0	0	743	1103	0	179	1683	2173	1971	2166	1667	2523	2591	2258	1986	1274	1500	1980	1607	1024	2551	2263	
			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
			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
			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
			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
			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**
			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
			EU.United Kingdom	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**
			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
			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	**0**
			Japan	0	0	1388	437	425	506	510	536	221	182	343	331	209	236	525	896	1789	981	1161	1483	3060	2255	3199	2236	2135

				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
			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
			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
			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**
			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**
			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
			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
			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
			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
			U.S.A.	0	0	0	0	0	0	0	0	0	3	0	1	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**
		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	1846
		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	
	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**
			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**
			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
			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**
			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
			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
			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**
			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**
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
			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
			U.S.A.	184	1136	572	618	704	180	192	100	137	106	68	55	65	66	45	54	130	103	167	206	106	99	122	82	43
			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	
		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
	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	
			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**
			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
			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	
			U.S.A.	0	0	0	0	7	5	4	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	132	132	112	122	139
	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**

A total of 1623 t BSH (Prionace glauca) Moroccan catches for 2016, reported erroneously as BSK (Cetorhinus maximus), will be added later on to Task I.

SMA-Table 1. Estimated catches (t) of Shortfin mako (Isurus oxyrinchus) by area, gear and flag. (v1, 2017-09-29)

				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
TOTAL				4084	5748	5896	8407	7808	5799	5680	4345	5151	4739	5375	7704	6263	6611	6326	6935	5447	6179	6675	7031	7385	5646	6177	5956	6018
	ATN			3103	4158	3758	5347	5346	3580	3879	2791	2592	2682	3416	3923	3864	3479	3378	4083	3566	4116	4188	3771	4478	3646	2904	3232	3377
	ATS			981	1590	2138	3060	2461	2213	1793	1549	2555	2050	1957	3779	2398	3115	2938	2850	1881	2063	2486	3258	2905	2001	3273	2724	2641
	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	
Landings	ATN		Longline	2806	3464	3401	3868	5092	3397	3703	2695	2272	2452	3145	3906	3439	3172	3105	3901	3387	3919	4007	3549	4191	3362	2628	2879	3146
			Other surf.	258	671	335	1450	253	182	176	94	320	230	270	17	425	307	272	176	169	177	178	213	268	278	265	342	225
	ATS		Longline	966	1579	2117	3044	2445	2189	1781	1539	2532	2033	1942	3748	2323	3101	2895	2809	1799	2057	2485	3196	2842	1953	3240	2706	2624
			Other surf.	15	11	21	15	16	25	12	10	22	18	15	31	76	14	43	30	82	7	1	62	55	47	31	15	13
	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	
			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	
Discards	ATN		Longline	38	24	21	29	1	0	0	0	0	0	0	0	0	0	0	7	9	20	2	9	19	5	12	10	6
			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
	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
			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
	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	
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
			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
			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	
			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
			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
			EU.España	2145	1964	2164	2209	3294	2416	2223	2051	1561	1684	2047	2068	2088	1751	1918	1816	1895	2216	2091	1667	2308	1509	1481	1362	1574
			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
			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
			EU.United Kingdom	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**
			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**
			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	75
			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
			Maroc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	420	406	667	624	947	1050
			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
			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**
			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**
			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
			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	
			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
			U.S.A.	376	948	642	1710	469	407	347	159	454	395	415	142	521	469	386	375	344	365	392	383	412	406	398	524	296
			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	
			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
		NCC	Chinese Taipei	0	0	61	21	16	25	31	48	21	7	0	84	57	19	30	25	23	11	14	13	14	8	4	13	7
		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	
	ATS	CP	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
			Brazil	0	0	0	0	83	190	0	27	219	409	226	283	238	426	210	145	203	99	128	192	196	93	268	124	
			China PR	0	34	45	23	27	19	74	126	305	22	208	260	0	0	0	77	6	24	32	29	8	9	9	5	3
			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
			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
			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
			EU.United Kingdom	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**
			Japan	460	701	1369	1617	514	244	267	151	264	56	133	118	398	0	0	72	115	108	103	132	291	114	181	108	77

				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
			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
			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
			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**
			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**
			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**
			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
			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
			U.S.A.	0	0	0	0	0	2	1	0	2	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
			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**
			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**
		NCC	Chinese Taipei	0	0	116	166	183	163	146	141	127	63	0	626	121	128	138	211	124	117	144	203	150	157	158	152	92
	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**
			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**
			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**
			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**
			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**
			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**
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
			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**
			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
			U.S.A.	38	24	21	28	1	0	0	0	0	0	0	0	0	0	0	7	10	20	2	9	18	5	11	8	4
			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	
		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
	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	
			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
			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
		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
	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**

POR-Table 1. Estimated catches (t) of porbeagle (Lamna nasus) by area, gear and flag. (v1, 2017-09-29)

				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
TOTAL				2603	1910	2729	2140	1560	1859	1469	1403	1469	509	848	648	745	571	507	525	611	484	136	90	149	185	67	60	22
	ATN			2603	1909	2726	2136	1556	1833	1451	1393	1457	507	838	604	725	539	470	512	524	421	119	68	111	156	29	56	20
	ATS			0	1	2	3	3	26	17	10	11	1	11	43	17	31	37	13	85	62	16	21	37	29	38	4	1
	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
Landings	ATN		Longline	1979	1156	1734	1405	1169	1407	1089	975	920	33	297	257	466	234	225	384	355	203	85	38	79	115	8	8	4
			Other surf.	622	753	991	731	386	426	362	418	537	474	541	347	259	305	245	127	169	219	31	29	32	39	13	13	11
	ATS		Longline	0	0	1	3	3	21	15	4	11	1	11	43	17	31	37	13	85	62	16	21	37	29	13	4	1
			Other surf.	0	1	1	0	0	4	1	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	
	MED		Longline	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	1	0	0	1	0	0	0	0
			Other surf.	0	0	0	0	1	0	1	0	1	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	1
Discards	ATN		Longline	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	2	8	34	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
	ATS		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	
Landings	ATN	CP	Canada	813	919	1575	1353	1051	1334	1070	965	902	8	237	142	232	202	192	93	124	62	83	30	33	19	9	4	2
			EU.Denmark	80	91	93	86	72	69	85	107	73	76	42	0	0	0	0	0	0	0	0	0	2	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**
			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	
			EU.Germany	0	0	0	0	0	0	0	0	17	1	3	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	0	4	8	7	3	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	
			EU.Portugal	0	0	0	0	0	0	0	0	7	4	10	101	50	14	6	0	3	17	7	0	0	0	0	0	**0**
			EU.Sweden	4	3	2	2	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			EU.United Kingdom	0	0	0	0	0	0	1	6	8	12	10	0	0	24	11	26	15	11	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**
			Japan	0	0	0	0	5	4	0	0	0	0	0	0	0	0	0	12	10	13	13	14	49	98	0	0	2
			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**
			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
			Norway	41	24	24	26	28	17	27	32	22	11	14	19	0	8	27	10	12	10	12	11	17	9	5	4	6
			U.S.A.	1	50	106	35	78	56	13	3	1	1	1	0	1	0	0	0	1	1	1	11	4	27	7	9	5
		NCO	Faroe Islands	1149	165	48	44	8	9	7	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	ATS	CP	Brazil	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.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	
			EU.España	0	0	0	0	0	2	2	2	7	1	2	9	4	0	3	5	4	13	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	
			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	
			EU.Portugal	0	0	0	0	0	0	0	0	0	0	0	0	4	2	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**
			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**
			Japan	0	1	0	0	3	14	0	1	0	0	0	0	0	0	0	5	41	34	8	7	25	15	13	4	1
			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**
			Uruguay	0	0	0	3	0	5	13	2	4	0	8	34	8	28	34	3	40	14	6	12	12	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	2	0	0	1	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	
			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	
			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	

				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
			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	
	MED	CP	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
			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	
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	1	2	3
			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**
			U.S.A.	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	2	7	34	1
		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**
	ATS	CP	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**
		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**

SHK-Table 2. Vulnerability ranks for 20 stocks of pelagic sharks calculated with three methods: Euclidean distance (v1), multiplicative (v2), and arithmetic mean (v3). A lower rank indicates higher risk. Stocks listed in decreasing risk order according to the sum of the three indices. Red highlight indicates risks scores 1-5; yellow, 6-10; blue, 11-15; and green, 16-20. Productivity values ranked from lowest to highest.

BTH=bigeye thresher; LMA=longfin mako; SMA=shortfin mako; POR=porbeagle; CCS=night shark; FAL SA=silky shark South Atlantic; CCP=sandbar shark; OCS=oceanic whitetip; FAL NA=silky shark North Atlantic; ALV=thresher shark; BSH NA=blue shark North Atlantic; DUS=dusky shark; SPK=great hammerhead; BSH SA=blue shark South Atlantic; TIG=tiger shark; PLS SA=pelagic stingray South Atlantic; SPL NA=scalloped hammerhead North Atlantic; SPZ=smooth hammerhead; SPL SA=scalloped hammerhead South Atlantic; PLS NA=pelagic stingray North Atlantic.

Stock	v_1	v_2	v_3
BTH	3	1	1
LMA	5	3	2
SMA	1	8	2
POR	2	7	4
CCS	11	4	5
FAL SA	12	5	6
CCP	15	2	6
OCS	4	13	8
FAL NA	8	11	8
ALV	9	14	11
BSH NA	6	19	10
DUS	17	6	12
SPK	14	10	13
BSH SA	7	20	14
TIG	10	16	15
PLS SA	18	9	16
SPL NA	16	12	16
SPZ	13	17	18
SPL SA	19	15	19
PLS NA	20	18	20

SHK-Table 3. Kobe II strategy matrix giving the probability that the fishing mortality will be below the fishing mortality rate at MSY (top), the probability that the biomass will exceed the level that will produce MSY (middle), and the two combined (bottom) based on production model (BSP2-JAGS) projection results for North Atlantic shortfin mako.

Probability that $F<F_{MSY}$

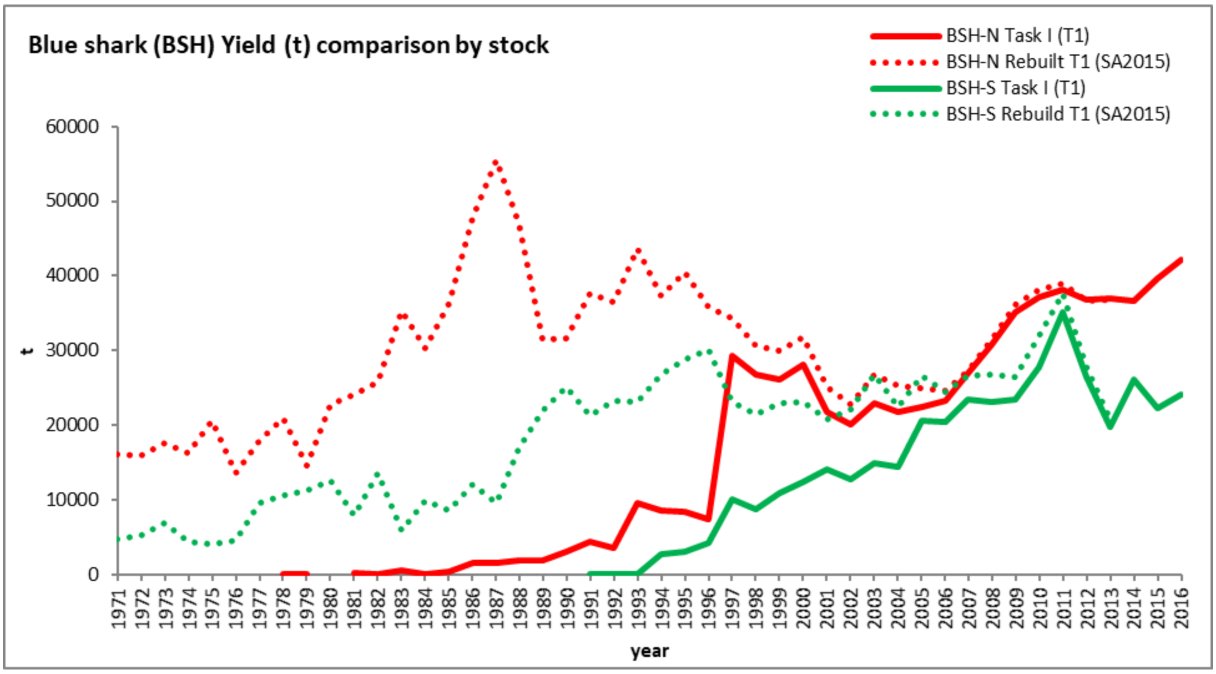
Catch (t)	2018	2020	2022	2024	2026	2028	2030	2032	2034	2036	2038	2040
0	100	100	100	100	100	100	100	100	100	100	100	100
500	75	74	75	75	74	75	75	76	76	75	75	75
1000	30	32	32	32	34	35	36	35	38	38	38	38
1500	11	10	11	13	14	14	14	15	15	16	16	16
2000	2	3	4	4	4	5	4	5	5	5	6	6
2500	1	1	1	1	2	2	2	2	2	2	2	2
3000	0	0	0	0	0	0	0	0	0	0	0	0
3500	0	0	0	0	0	0	0	0	0	0	0	0
4000	0	0	0	0	0	0	0	0	0	0	0	0

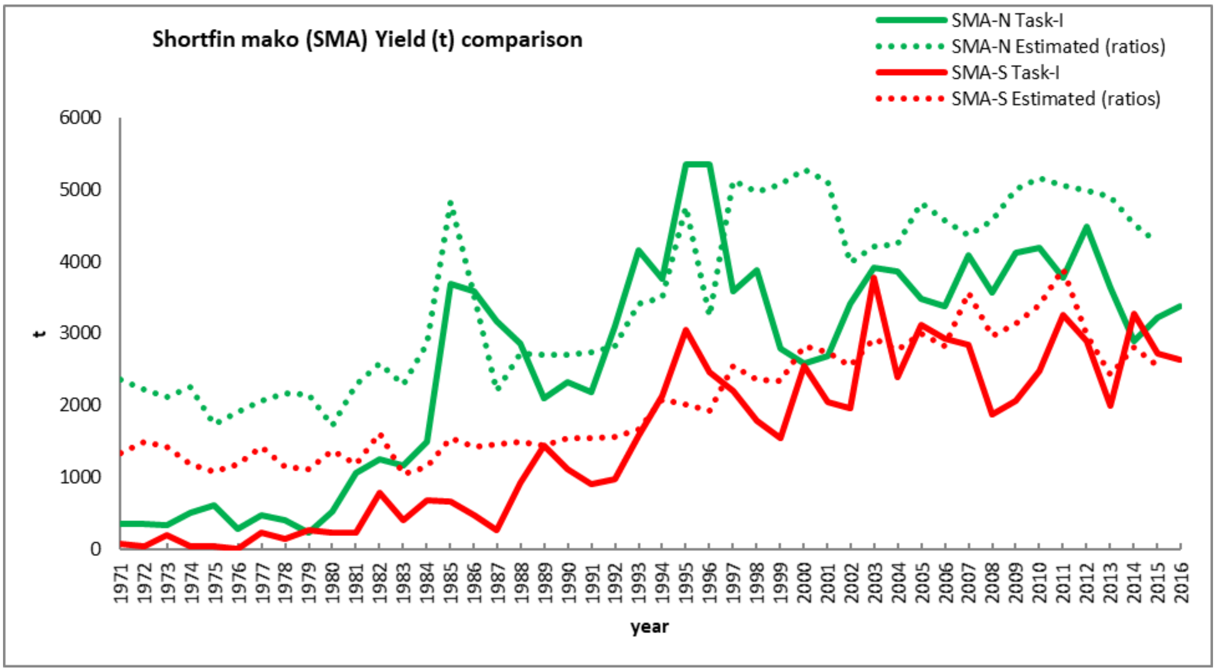
Probability that $B>B_{MSY}$

Catch (t)	2018	2020	2022	2024	2026	2028	2030	2032	2034	2036	2038	2040
0	6	10	16	21	27	31	36	41	43	46	50	54
500	4	9	12	15	19	21	24	27	29	30	33	35
1000	6	9	10	13	16	18	21	22	23	25	25	27
1500	6	8	10	11	12	12	13	15	16	17	16	16
2000	5	7	7	8	9	9	8	9	8	9	9	9
2500	6	7	7	6	7	6	7	7	6	6	6	6
3000	5	6	5	5	5	5	4	4	3	3	3	3
3500	6	6	5	5	5	3	3	2	2	2	2	2
4000	6	4	3	2	2	2	1	1	1	1	0	0

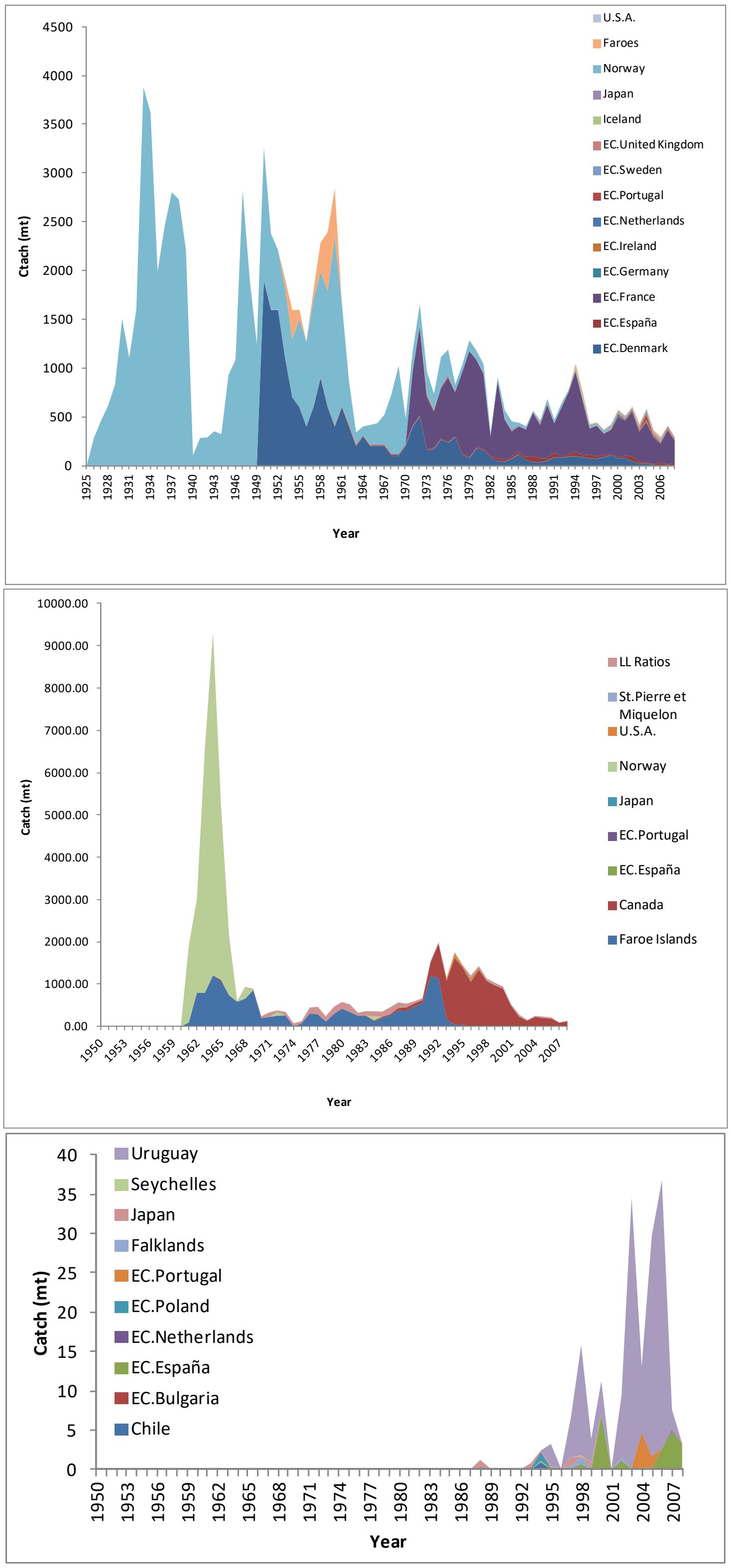
Probability of being in the green zone ($F<F_{MSY}$ and $B>B_{MSY}$)

Catch (t)	2018	2020	2022	2024	2026	2028	2030	2032	2034	2036	2038	2040
0	6	11	16	21	27	31	36	41	43	46	50	54
500	4	9	12	15	19	21	24	27	29	30	33	35
1000	5	8	9	11	15	15	19	20	21	23	23	25
1500	3	4	5	7	7	8	9	10	11	12	12	12
2000	0	2	2	3	3	3	3	4	4	4	5	5
2500	0	1	1	1	1	2	2	2	2	2	2	2
3000	0	0	0	0	0	0	0	0	0	0	0	0
3500	0	0	0	0	0	0	0	0	0	0	0	0
4000	0	0	0	0	0	0	0	0	0	0	0	0

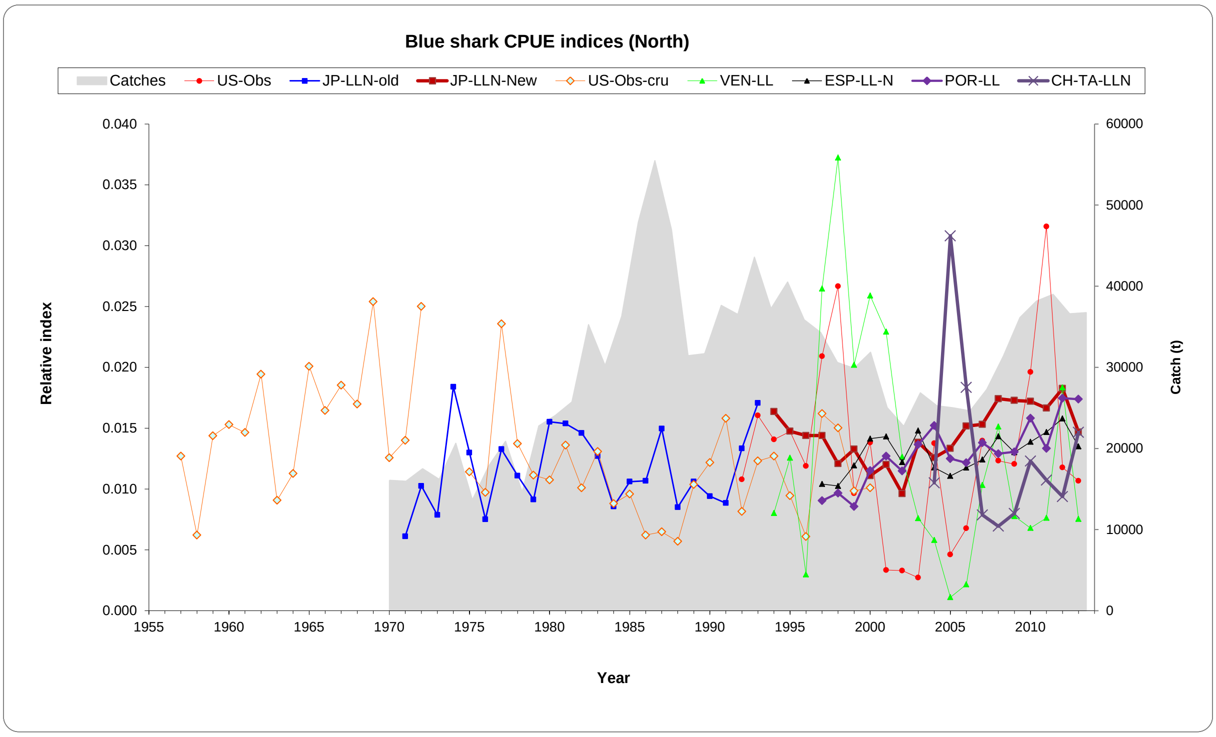


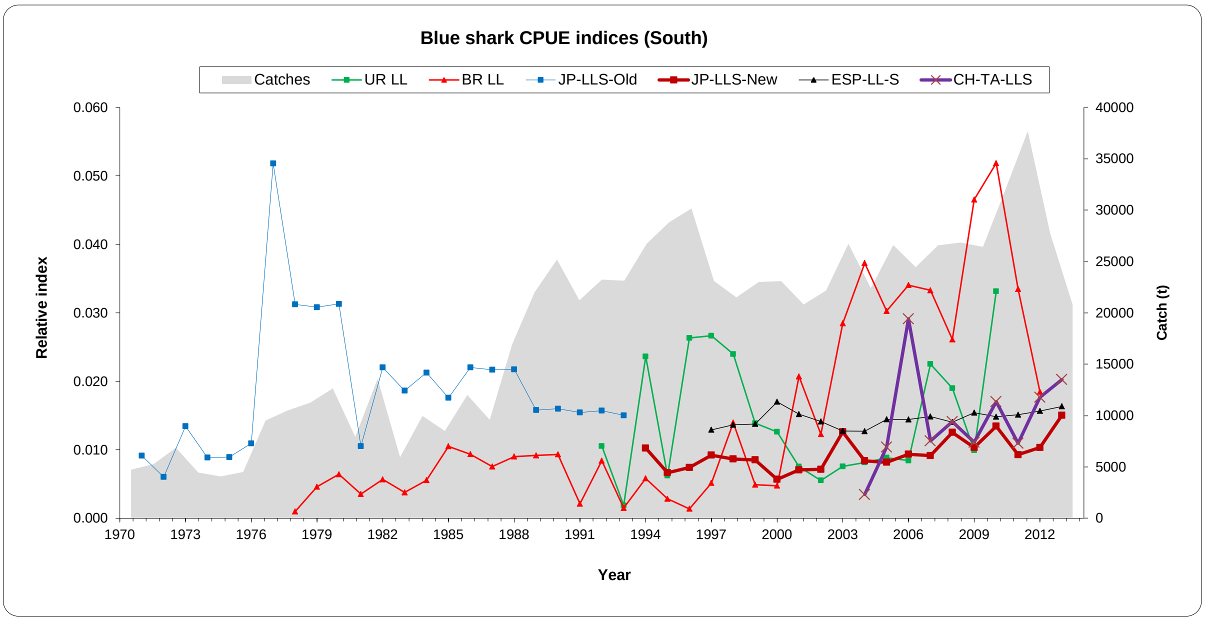


SHK-Figure 1. Blue shark (BSH) and shortfin mako (SMA) catches reported to ICCAT (Task I) and estimated by the Committee (2016 landings are considered provisional).

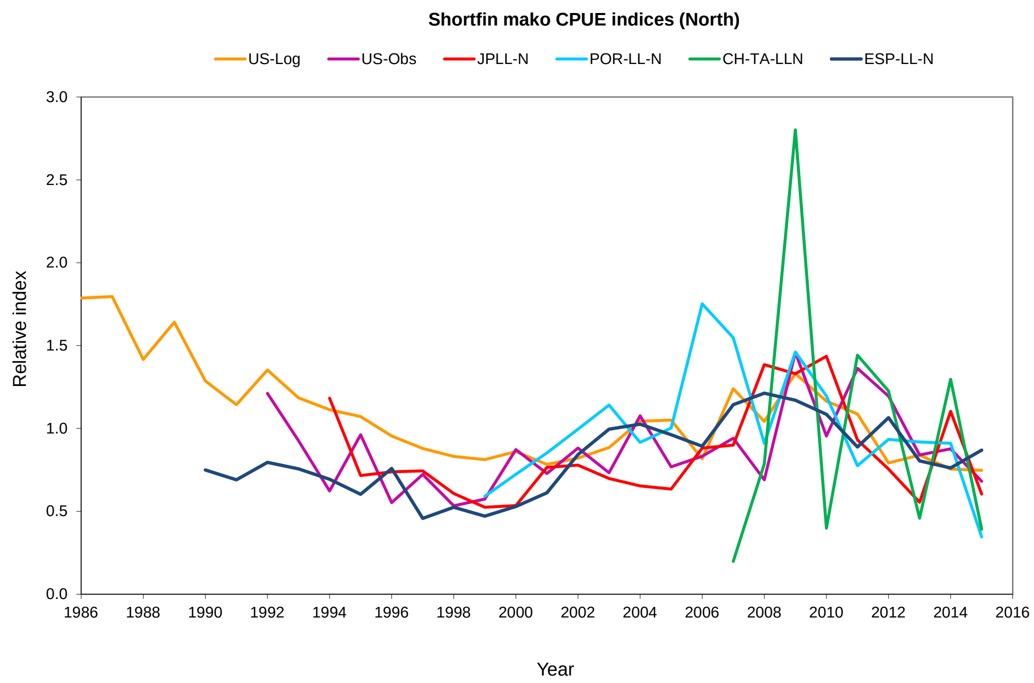


SHK Figure 2. Catch by flag of porbeagle sharks from the northeast Atlantic (top), northwest Atlantic (middle), and southwest Atlantic (bottom) used in the assessment. While these catches are considered the best available, NE catches are believed to underestimate the pelagic longline catches for this species, those from the NW include non-reporting fleets, which in this case represent a small proportion of the total, and those from the SW are Task I data also believed to significantly underestimate actual catches by all fleets.

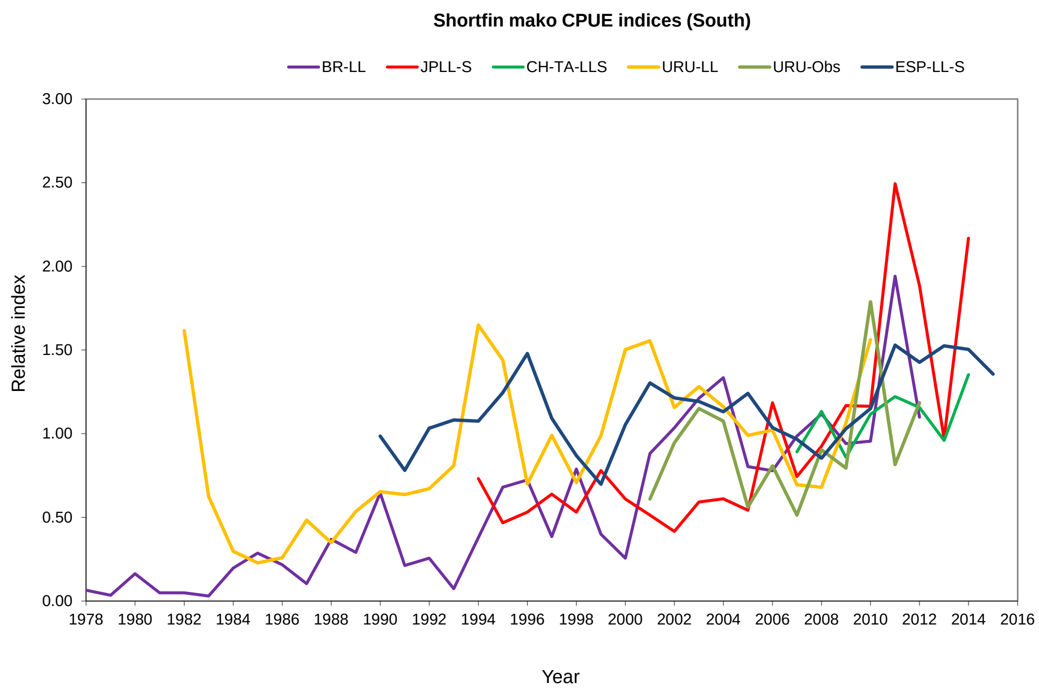




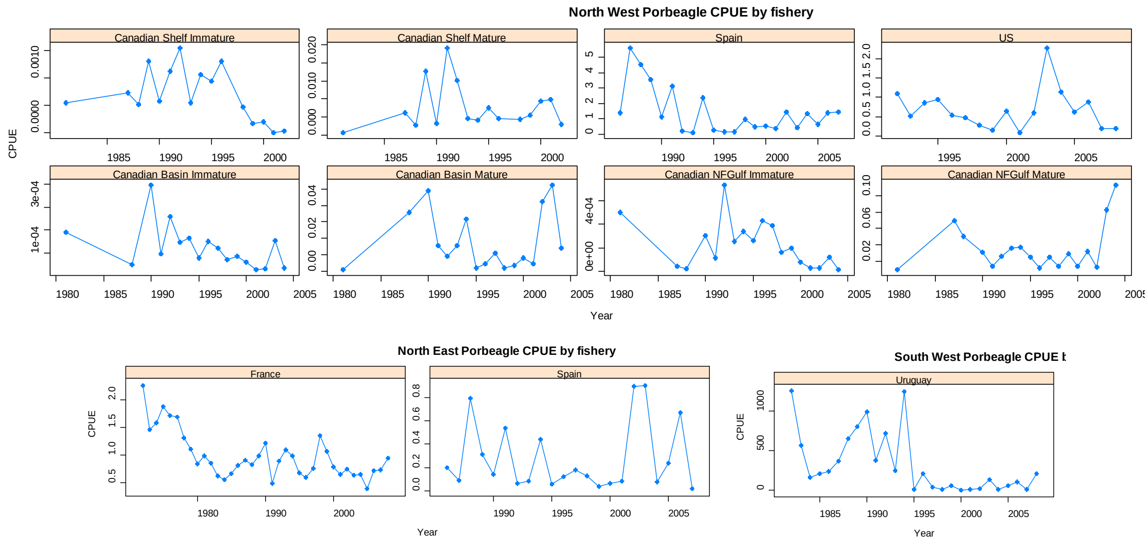
SHK-Figure 3. CPUE series used in the assessments of North and South Atlantic blue shark (BSH) stocks. Total catches (in t) used in the assessments are also shown.



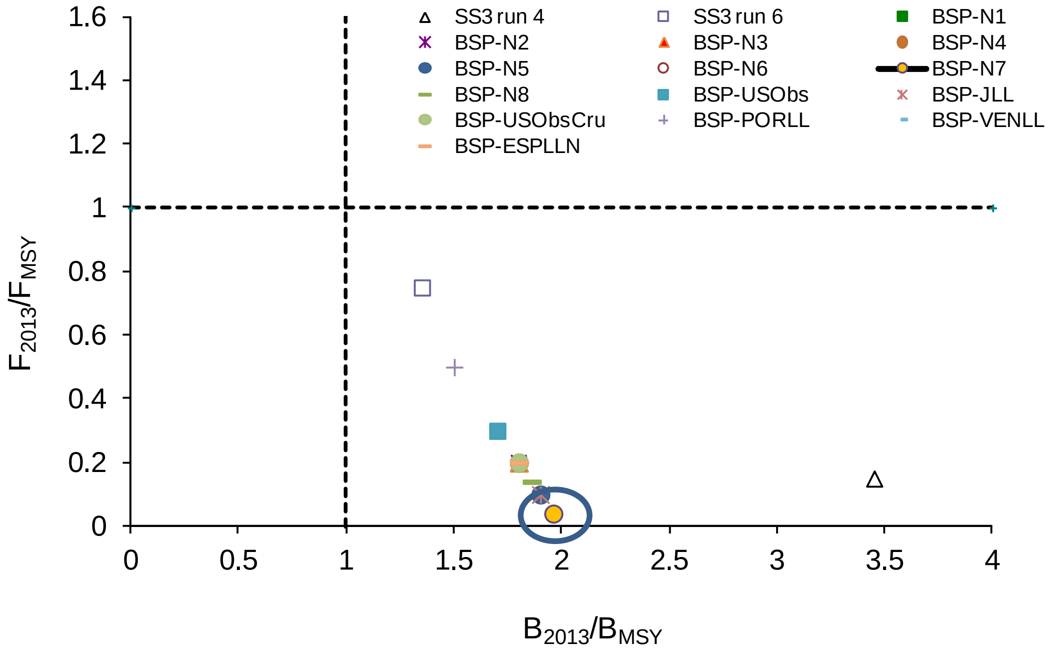
SHK-Figure 4. Indices of abundance for North Atlantic shortfin mako shark.



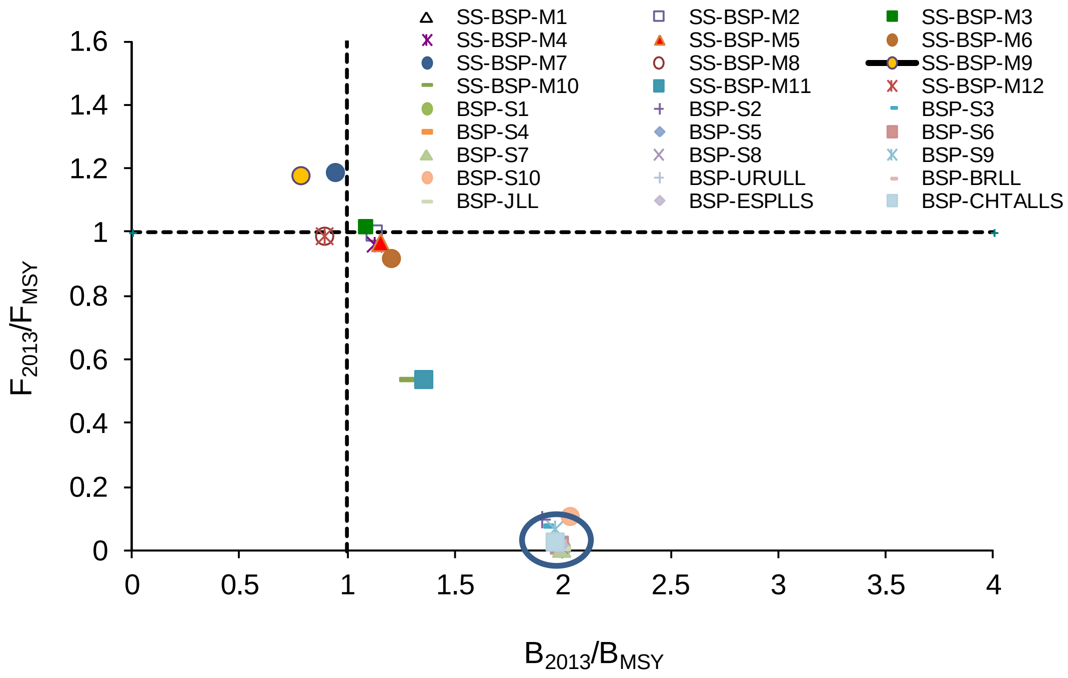
SHK-Figure 5. Indices of abundance for South Atlantic shortfin mako shark.



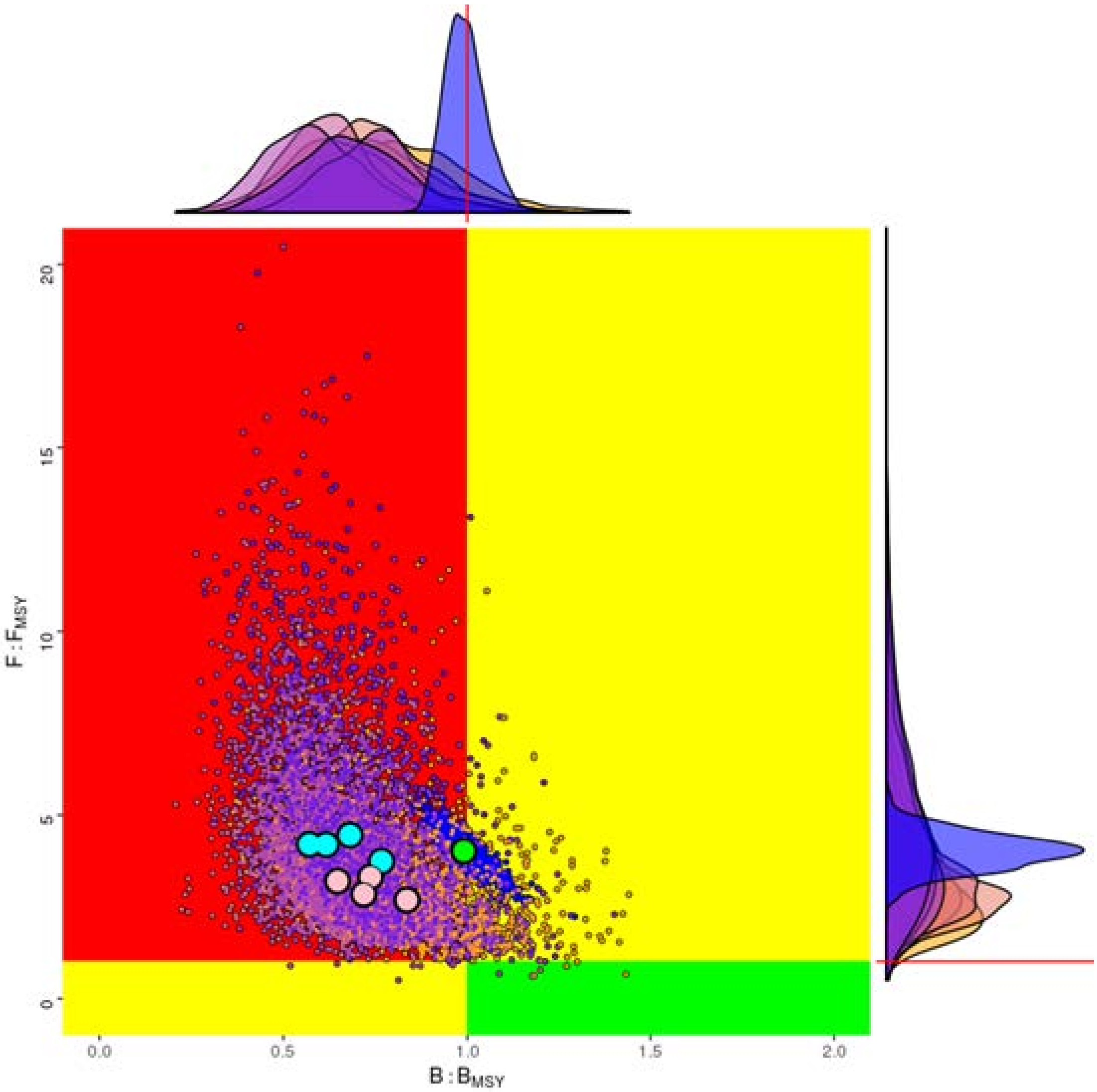
SHK-Figure 6. CPUE series for the porbeagle used in the last assessment NW stock (upper figures), NE stock (lower left figures) and SW stock (lower right figure).



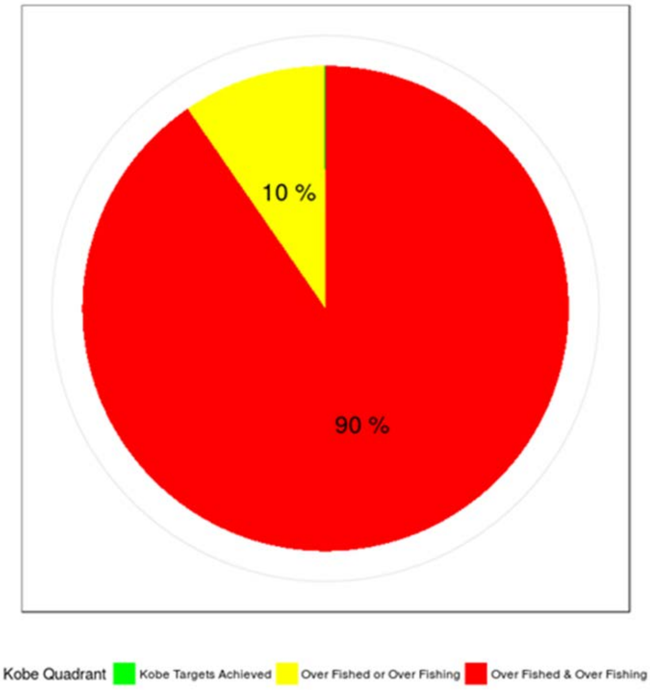
SHK-Figure 7. Phase plots summarizing scenario outputs for the current (for 2013) stock status of North Atlantic blue shark (BSH). BSP=Bayesian surplus production model; SS3=Stock synthesis model. The circle denotes common status for several BSP runs. Note that the x-axis values for SS3 are SSF_{2013}/SSF_{MSY}.



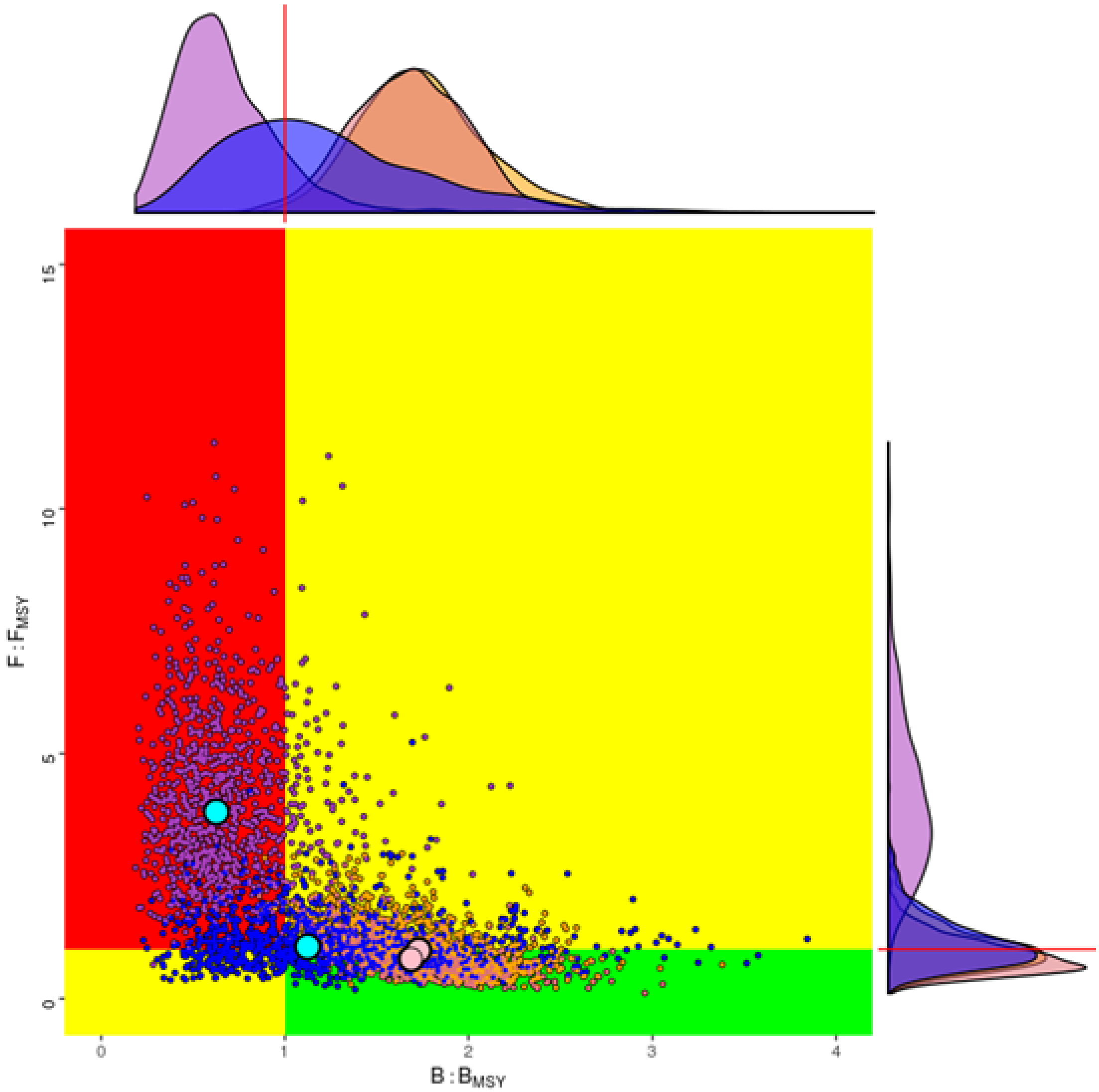
SHK-Figure 8. Phase plots summarizing scenario outputs for the current (for 2013) stock status of South Atlantic blue shark (BSH). BSP=Bayesian surplus production model; SS-BSP=State-space Bayesian surplus production model. The circle denotes common status for several BSP runs.



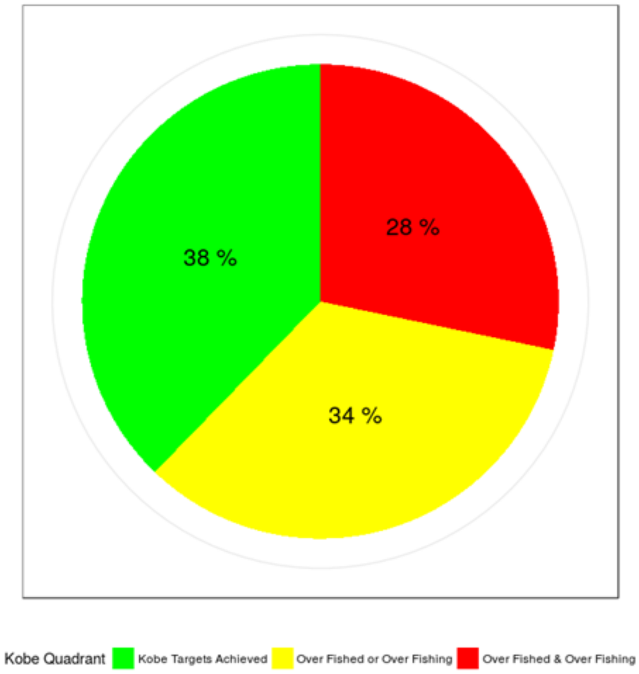
SHK-Figure 9. Stock status (2015) of North Atlantic shortfin makos based on Bayesian production models (4 BSP2JAGS and 4 JABBA runs) and 1 length-based, age-structured model (SS3). The clouds of points are the bootstrap estimates for all model runs showing uncertainty around the median point estimate for each of nine model formulations (BSP2JAGS: solid pink circles; JABBA: solid cyan circles; SS3: solid green circle). The marginal density plots shown are the frequency distributions of the bootstrap estimates for each model with respect to relative biomass (top) and relative fishing mortality (right). The red lines are the benchmark levels (ratios equal to 1).



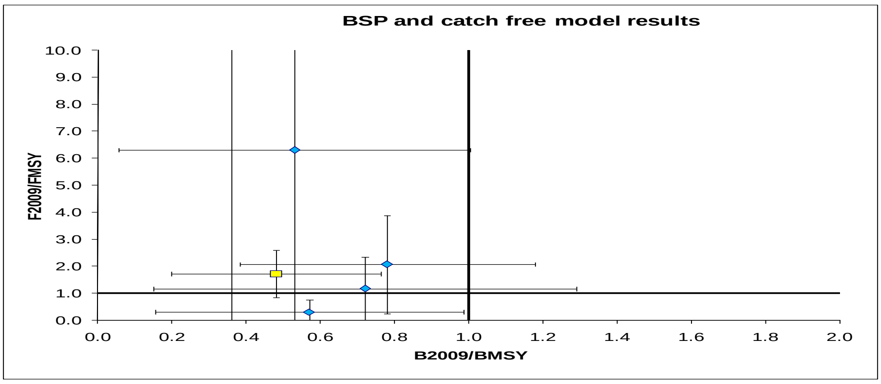
SHK-Figure 10. Kobe pie chart summarizing stock status (for 2015) for North Atlantic shortfin makos based on Bayesian production models (4 BSP2JAGS and 4 JABBA runs) and 1 length-based age-structured model (SS3). Probability of being in the green quadrant is less than 0.5%.



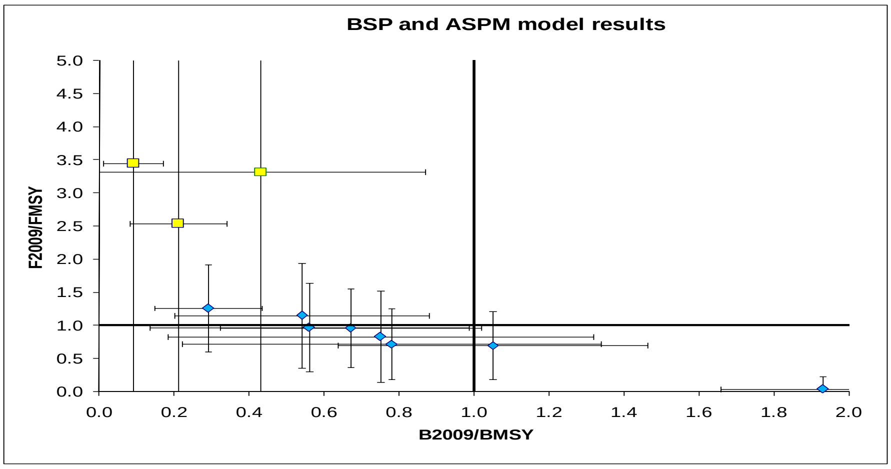
SHK-Figure 11. Stock status (2015) of South Atlantic shortfin makos based on a Bayesian production model (BSP2JAGS) and a catch-only model (CMSY). The clouds of points are the bootstrap estimates for all models combined showing uncertainty around the median point estimate for each of four model formulations (BSP2JAGS: solid pink circles; CMSY: solid cyan circles). The marginal density plots shown are the frequency distributions of the bootstrap estimates for each model with respect to relative biomass (top) and relative fishing mortality (right). The red lines are the benchmark levels (ratios equal to 1).



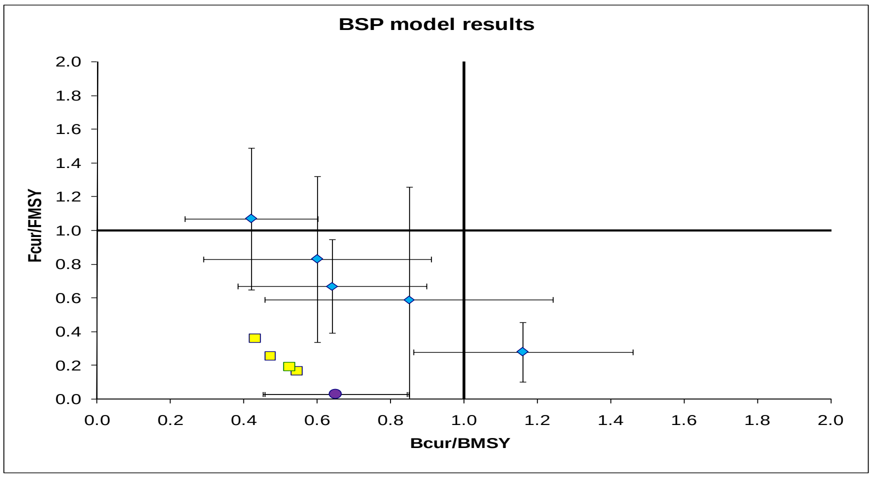
SHK-Figure 12. Kobe pie chart summarizing stock status (for 2015) for South Atlantic shortfin makos based on a Bayesian production model (2 BSP2JAGS runs) and a catch-only model (2 CMSY runs).



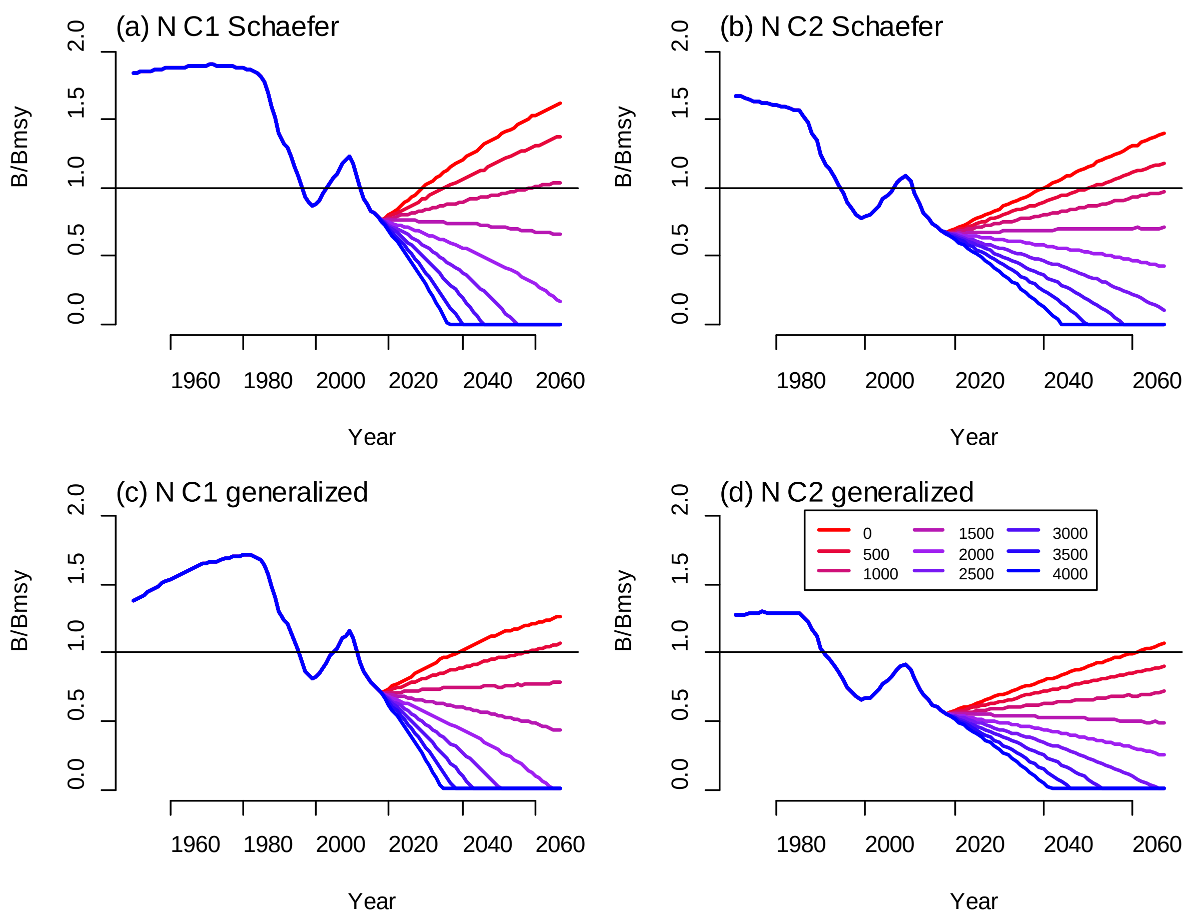
SHK-Figure 13. Phase plot for the southwest Atlantic porbeagle, showing status in 2009 from both the BSP model runs (diamonds) and the catch free age structured production model (square) results. Error bars are plus and minus one standard deviation.



SHK-Figure 14. Phase plot showing current status of northeast Atlantic porbeagle for the BSP model (diamonds) and the ASPM model (squares). Error bars are plus and minus one standard deviation.



SHK-Figure 15. Phase plot showing the northwest Atlantic porbeagle expected value of B/B_{MSY} and F/F_{MSY} in the current year, which is either 2005 (diamonds) or 2009 (circle), as well as approximate values from Campana *et al.* (2010) (squares). B/B_{MSY} was approximated from Campana *et al.* (2010) as N2009/N1961 times 2. Error bars are plus and minus one standard deviation.



SHK-Figure 16. Median constant catch projections (0 – 4000 t) from BSP2-JAGS for the North Atlantic shortfin mako. for 4 model runs: (a) C1 catch with a Schaefer model, (b) C2 catch with a Schaefer model, (c) C1 catch with a generalized production model, and (d) C2 catch with a generalized production model.

9. Report of intersessional SCRS meetings

The reports of the intersessional meetings held in 2017 were presented.

9.1 Meeting of the ICCAT Working Group on Stock Assessment Methods

The WGSAM met in Madrid (8-12 May) and the agenda covered a range of topics including intersessional progress made on CPUE standardization (primarily the inclusion of environmental covariates and the revision of the CPUE Table for Species Groups), Management Strategy Evaluation (MSE), and in implementing the Strategic Plan. Other matters included standardising the format of Executive Summaries, the Peer review of stock assessments and the ICCAT Software Catalogue.

An important development was the formation of Study Groups to promote Intersessional work. Study Groups will be identified by WGSAM members and to help address the objectives of the WGSAM as they pertain to the ICCAT Strategic 5 Year Plan. Two Study Groups were formed namely the Northern Albacore and MSE Study Group and the CPUE Standardization Study Group. Outcomes from this Group were essential if the SRCS is to make progress on the Strategic Plan including streamlining of the current CPUE table in order to reduce unnecessary discussions at future data preparatory meetings and there was agreement that the Northern Albacore and MSE Study Group explore alternative candidate output graphics and summaries based on the Northern Albacore and MSE Study Group results, including those used by other RFMOs.

Anon., 2017k corresponds to the Detailed Report of the meeting.

The Working Group on Stock Assessment methods Work Plan for 2018 is attached as **Appendix 12**.

Discussion

This year WGSAM has established study groups and so far two groups have been established the Northern Albacore MSE and the CPUE Standardization study group. Both these study groups directly address two current objectives of the WGSAM under the ICCAT Strategic 5 Year Plan. The main discussion focused on how these groups will operate, their terms of reference and the potential need for other study groups to be formed (e.g. on communication of uncertainty when providing advice). It was explained that these study groups will mainly work inter-sessionally reporting back to WGSAM and have no formal status under the SCRS. It was suggested that the Northern Albacore MSE study group could be expanded to help progress the MSE work planned for other stocks. There was also discussion about whether Chairs (or a designee) of the SCRS Species Groups should attend WGSAM to help pose problem and facilitate the problem solving process, or alternatively the Species Group Chairs could meet to discuss these recommendations during the Species Group meetings.

9.2 Small tunas Species Group intersessional meeting

The meeting was held at the University of Miami (24-28 April). The issues of substance dealt with were updating the Ecological Risk Assessment (ERA), reviewing of appropriate approaches for future assessment of small tuna stocks, the status of SMTYP programme to improve collaboration among scientists and how the Atlantic Tropical tuna Tagging Program (AOTTP) could improve knowledge on small tuna populations.

The ERA conducted in 2016 was updated to include gear interactions of small tuna caught in the tuna longline and purse seine fisheries of the Atlantic Ocean. Wahoo and little tunny were the most vulnerable species, confirming previous conclusions of the Group about what stocks should be given high priority. The updated analysis using purse seine provides similar results to the longline results.

A variety of data limited approaches are available and it was agreed that best way to do this is to conduct Management Strategy Evaluation (MSE) to determine the best combination of data, assessment and control measures. MSE can also be used to determine the benefits of improving data collection and the value of new information, including that from the AOTTP. To do this the data rich North Atlantic albacore Operating Model (OM) is being used to simulate data poor time series and the results compared with data rich methods.

The Group reiterated that SMTYP should be a collaborative process, increasingly involving more scientists from all nations with major small tuna fisheries.

Anon. 2017l corresponds to the Detailed Report of the meeting.

The Small Tunas Species Group Work Plan for 2018 is attached as **Appendix 12**.

9.3 Tropical Tuna Species Group intersessional meeting

The meeting was held in Madrid, Spain, 4-8 September 2017. In 2017, the Tropical Tuna Species Group identified a number of research lines in order to improve future stock monitoring and management advice. Likewise, substantial progress must be made on the development of the catch statistics and the MSE framework. In 2017, the Tropical Tuna Species Group plans to review all the activities conducted within the Atlantic Ocean Tropical tuna Tagging Programme (AOTTP), the information collected and the plans for future tagging and capacity building initiatives. In addition, in 2017, the Tropical Tuna Species Group discussed and draft a number of responses to the Commission related to Rec. 16-01 and the 2016 FAD Working Group recommendations. Finally the Group developed a work plan and actions in preparation for the MSE of tropical tuna species taking into consideration the assessment schedule of these species in coming years.

Anon., 2017m corresponds to the Detailed Report of the meeting.

The Tropical Tuna Species Group Work Plan for 2018 is attached as **Appendix 12**.

Discussion

During 2016 no assessments of tropical tunas were carried out. The Group noted that they had only one intersessional meeting with a full agenda related mainly to FADs and the Moratorium evaluation. A preliminary work plan for the implementation of the MSE for tropical tuna species was also discussed, taking into account the need for updating all assessments prior to MSE development. It was noted that for 2018 the assessment of bigeye tuna is scheduled, as well as several other tasks, this will require a prioritization of task, increasing the intersessional work and coordination, and possible outsourcing specific analysis. The Committee also noted that some of the Commission requests require several years of data collection before a comprehensive analysis can be presented, for example moratorium effects. Following the presentation of the AOTTP project and the recommendations from the Group, a clarification on how the AOTTP will address these recommendations was requested. Additional information as regards the AOTTP is included in section 10.5 of this report.

The Committee was informed that during 2016 the catches of bigeye and yellowfin tuna had exceeded the corresponding TACs adopted by the Commission. In the case of bigeye catches overpassed about 11% of the TAC, while yellowfin tuna catches exceeded by 16% of the TAC. It was noted by the Committee that compared to the projections done at the latest assessments (in 2015 bigeye and in 2016 yellowfin tuna) these over-catches will change the expected probabilities of recovery of the stocks, likely making the previously estimated probabilities optimistic. However, it was noted that no updated projections were done in 2016. It was informed that new indices of abundance for bigeye and yellowfin tuna were presented from South African fisheries that would be considered in future evaluations. The Committee was informed that in the latest years (2014-2016) catches from a major fishery for tropical tunas (Brazil) in the western Atlantic have not been provided. The latter limits substantially the capacity of the Committee to make proper evaluation of current status, in particular for the western skipjack stock.

9.4 Albacore Species Group intersessional meeting (including stock assessment of Mediterranean albacore)

The Group met in Madrid, 5-12 June, in order to perform an assessment of Mediterranean Albacore and review the work done on the North Atlantic Albacore MSE.

A reliable assessment of Mediterranean albacore stock status is hindered by the inexistence (or low quality) of catch, catch-effort and size statistics over time for some important fleets. Although recent fishing mortality levels appear to be below F_{MSY}, and current biomass is approximately at B_{MSY} level unfortunately, due to the limited quantitative information available to the SCRS, there is considerable uncertainty about these results. Therefore catches should not be increased and possibly reduced until abundance trends are confirmed. The precise level of catch would depend on the level of risk the Commission would like to assume. If the downward abundance trends are confirmed, catch levels would need to be further reduced. As a prerequisite of successful assessments of the stock, a complete revision of Task I (aggregated catch, by gear/fleet) and Task II (catch-effort, size) data is recommended, specifically before the year 2000. The Committee believes that the total amount of removals is probably incomplete. To overcome this, the Group continues to recommend that CPCs make additional efforts to participate and be made aware of capacity building funds available for participation in and contributing to working group meetings.

An update of the MSE work conducted for northern albacore and presented at the 2017 WGSAM inter-sessional meeting was given. The Group agreed to present the MSE results also to the SWGSM whilst acknowledging that diagnostic tests are still being run and that the work will only be considered to have been completely reviewed by the SCRS after the plenary meeting.

Anon., 2017n corresponds to the Detailed Report of the meeting.

The Albacore Tuna Species Group Work Plan for 2018 is attached as **Appendix 12**.

Discussion

Mediterranean

The Mediterranean stock was last assessed in 2011 and was re-assessed 2017 using a Bayesian surplus production model. Stock status is highly uncertain with respect to both fishing mortality and biomass and recent catches are close to the estimate of MSY (3,419 t). In the past, catches have been greater than MSY and the Committee recommended not to increase catches until recent CPUE trends are confirmed and if the downward trend continues, reductions in catches will be required.

North Atlantic

The discussion focused on the evaluation of the Harvest Control Rule, however, as this requires a lot of complex explanations it was agreed to defer the discussion to the section on the response to the Commission (section 20). A main point was that the evaluations were of a HCR and not a management procedure (stock assessment estimator and Harvest Control Rules, HCR). This meant that the results from the simulations differed from the actual assessment. It was explained that the results should be interpreted in a relative rather than absolute manner, i.e. they do not provide advice on what the actual TAC should be but how well candidate HCR meet management objectives.

9.5 Shortfin mako shark data preparatory and assessment meetings

The Shortfin mako shark data preparatory meeting was held in Madrid, Spain, 28-31 March. The major meeting objective was to revise all available data (catch, effort, CPUE, size and tagging) aiming for the Atlantic stock assessment session in June. The results of several updated analyses and cooperative efforts led by national scientists to gather and analyse data were presented, including the analysis of size data by sex and region for the main fleets operating in the Atlantic and a detailed review of all available life history information. The Shark Research and Data Collection Programme (SRDCP) was also reviewed and revised in light of several budgetary changes.

Anon., 2017o corresponds to the Detailed Report of the data preparatory meeting.

The Shortfin mako shark stock assessment meeting was held in Madrid Spain, 12-16 June. The objective of this meeting was to assess the status of the stocks (North and South) of Atlantic shortfin mako shark. The last assessment was conducted in 2012. The populations were assessed using several models, from different types of surplus production models to fully integrated age-structured models. For the first time, projections of stock status were conducted for this species and management advice was provided based on Kobe strategy matrices. The assessment represented a significant step forward in the understanding of shortfin mako populations in the Atlantic Ocean.

Anon., 2017p corresponds to the Detailed Report of the stock assessment meeting.

The Sharks Work Plan for 2018 is attached as **Appendix 12**.

Discussion

Concern was expressed that the results from the eight Biomass dynamic models were generally pessimistic and tended to outweigh the less pessimistic results of the single SS3 model resulting in a highly pessimistic Kobe pie chart. It was explained that the models presented were those selected by the Group as Base cases. In addition, extensive diagnostics were run that showed the relative reliability of the models used for management advice. The SS3 was less pessimistic, however, as the fleets are mainly catching immature individuals, the projections for this SS3 would likely be more pessimistic than those for biomass dynamic models despite the current status being slightly more positive for SS3.

In addition, the possibility of a single stock of shortfin mako across the Atlantic was raised, but it was clarified that the available data from tagging shows no evidence of mixing between the North and South. The contradiction between the catch and CPUE in the South is likely to be due to the quality of the data rather than a result of possible mixing. It was also clarified that despite this being a by-catch species, the CPUEs are standardized and should, as much as possible, reflect trends in abundance. It was noted that CPUEs for some key areas were not available (such as for Morocco), but it was discussed that the Group had to conduct the assessment with the available data.

9.6 Atlantic swordfish data preparatory and stock assessment meetings

The Atlantic Swordfish Data Preparatory meeting was held in Madrid, Spain (3-7 April). One of the major objectives of the meeting was to revise and improve whenever possible, all the existing fisheries and biological information (catches, catch & effort, CPUE, CATDIS, size samples, catch-at-size, and, conventional tagging) aiming to prepare the swordfish Atlantic stock assessment session in June. The work of Group permitted, among other achievements, to improve the overall catch series fisheries (unclassified gear catches are now residual), correct and recover important size samples of various CPCs, and improve the CPUE indices. A detailed work plan was adopted, scheduling the pending tasks and the intermediate work required by both the Secretariat and the national scientists, aiming to have all the conditions (input files, etc.) ready a few weeks prior to the stock assessment session.

Anon., 2017h corresponds to the Detailed Report of the data preparatory meeting.

The Atlantic Swordfish Stock Assessment meeting was held at the ICCAT Secretariat in Madrid (3-7 July) when both the North and South Atlantic stock were assessed. A peer review of the assessment was also undertaken by an external expert.

The South Atlantic stock was assessed using biomass dynamic state space models to allow for process error. The stock was estimated to be below B_{MSY}.

The northern stock was assessed using both biomass dynamic state space models and SS. Both types of models agreed that overfishing is not occurring and biomass is either higher or very close to B_{MSY}. The results, however, are not entirely comparable with those obtained in the last assessment due to the incorporation of more data sources and updated information.

In 2016 the Commission agreed on a roadmap for the completion of MSE in support of the adoption of a harvest control rule for North Atlantic swordfish. This work started in 2017 and shall be completed by 2019 for a possible adoption of an HCR by the Commission.

Anon. 2017i corresponds to the Detailed Report of the stock assessment meeting.

The Swordfish Species Group Work Plan for 2018 is attached as **Appendix 12.**

Discussion

The assessment and results of the evaluation for North and South Atlantic swordfish were presented highlighting the use of several models including stock synthesis and Bayesian productions models that allowed using more detailed and fisheries specific data. Questions were raised in the priors used for the South Atlantic stock, it was noted that most of the priors were non-informative and diagnostics and posterior plots indicated no major problems. The Committee indicated that for the South Atlantic, the assessment is the first evaluation providing stock status and biomass and fishing mortality trends, indicating the overfished status. For the North Atlantic stocks, stock status and projections were estimated as the combination of two models (Stock Synthesis and the Bayesian Production model BSP2).

The Committee noted that recent trends of spatial-temporal catch rates in the North Atlantic are likely associated with oceanographic and climatic changes, suggesting further analysis and evaluations on how these changes can affect stock status and management recommendations in the near future.

9.7 Bluefin data preparatory meeting and stock assessment meetings

The Bluefin Data Preparatory meeting was held in Madrid, Spain, 6-11 March. The major meeting objective was to revise all available data (catch, effort, CPUE, size and tagging) and review of all available life history information, in preparation for the Atlantic stock assessment session in July. The results of several updated analyses and cooperative efforts led by national scientists to gather and analyse data were presented, including the analysis of size data for the main fleets operating in the Atlantic and Mediterranean Sea. A comprehensive work plan on pending task between national scientist and the Secretariat was adopted to be complete prior to the assessment meeting.

Anon., 2017f corresponds to the Detailed Report of the data preparatory meeting.

The Bluefin Stock Assessment meeting was held at the ICCAT Secretariat in Madrid, 20- 28 July. Both the eastern and western stocks were assessed using a variety of models. In addition to substantial revisions to historical fishery data, new fishery-independent series of relative abundance, and new information on life history, a wide range of estimation models were applied to both stocks, including revised configurations of the virtual population analyses (VPAs), statistical catch-at-length, statistical catch-at-age and other integrated assessment models. Of these, the only models deemed to have progressed enough at the conclusion of the meeting to be considered as the basis of management advice were the VPA applications for the eastern stock and the VPA and Stock Synthesis applications for the western stock.

Anon., 2017e corresponds to the Detailed Report of the stock assessment meeting.

The Bluefin Tuna Species Group Work Plan for 2018 is attached as **Appendix 12**.

Discussion

The Committee recognized the great effort from both scientist and the Secretariat during the year to finish the assessment and produce management recommendations. The important inclusion of new revised fisheries data and statistics, biological information (growth, natural mortality), fishery independent indices of abundance was noted, as well as a wide range of assessment models that take full advantage of newer data and better handling of limitations in previous assessments.

The Committee noted that in the current assessment it was not possible to determine biomass reference points for eastern or western bluefin tuna stocks, mainly due to the uncertainty regarding future recruitments. Therefore, stock status and management recommendations were provided on reference to F0.1 exclusively. Projections and TAC recommendations were provided for the upcoming three years with a recommendation for the next assessment in 2020. The Committee noted that overall, the trends of indices, auxiliary data and assessment results indicated a continuation of the recovery of both stocks, in particular the eastern and Mediterranean bluefin tuna. Consequently, the Commission should consider switching from a recovery to a management strategy for bluefin tuna.

The Bluefin Tuna Species Group Work Plan for 2018 is attached as **Appendix 12**.

10. Report of Special Data Collection Research Programmes

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

The activities of the Atlantic-wide Research Programme on Bluefin Tuna (ICCAT GBYP) officially started in March 2010. The sixth phase of ICCAT GBYP activities was completed in February 2017 and most of the activities were reported to the SCRS and the Commission in 2016. The remaining activities in the last part of the sixth phase included (a) the biological studies, (b) the completion of the first part of the feasibility study for the Close kin genetic tagging and, (c) the advances in modelling and MSE efforts. The seventh phase of ICCAT GBYP started on 21 February 2017 and it will be active until 20 February 2018. This phase includes the following activities: (a) coordination, (b) biological studies, (c) data mining and recovery, (d) aerial survey on bluefin tuna spawning aggregations, (e) tagging and (f) modelling approaches. All data recovered in the first phases, covering the period from 1512 to 2009, were made available and presented to the SCRS in 2013, 2015, 2016 and 2017. These data have finally been fully validated and incorporated in the ICCAT bluefin database and used for the bluefin tuna stock assessment. Additional data recovered in phase 6 and in phase 7 were presented to the SCRS in 2017. Most of the electronic tag data from other entities have been recovered in 2016 and in 2017 and made available to the SCRS; the data have been used both for the bluefin tuna stock assessment and for the MSE-OM. ICCAT GBYP in phase 7 also organized additional activities on data recovery, particularly on bluefin tuna longline; the data were presented to the SCRS Sub-committee on Statistics. Tag reporting has further improved, though the recovery rate is still low even if, for the first time, it is over 2.25%. The results of the miniPATs tagging activities conducted since 2011 have further enhanced the knowledge on bluefin tuna behaviour and questioned several previous hypotheses. Technical problems with the last series of electronic tags have been noticed in 2016 and several e-tags were complimentary provided by Wildlife Computer for the activities in phase 7, which were carried out in the EU-Portugal traps and will be carried out in the North Sea (Sweden and Denmark). The large participation of scientific institutions from many countries to the biological studies is further contributing to improve the knowledge on the species biology, but additional effort is needed for having all the analyses pursued. A particular effort for enhancing the ageing of bluefin tuna is devoted in phase 7. The Steering Committee decided to continue the collection of a large amount of samples, both adults and juveniles for the main spawning areas in the Mediterranean, to be used for better assessing both the costs and the difficulties related to a possible CKMR activity that would be potentially useful for providing an estimate of east bluefin tuna SSB. These samples will also improve the number of aging analyses. A contract was issued in 2017 for studying the biological data from the additional spawning area rediscovered in the North West Atlantic (Slope Sea) and the results should be available at the end of phase 7. The fifth aerial survey on bluefin tuna spawning aggregations was successfully carried out in 2017 and the results were made available in real time to the bluefin tuna stock assessment session and were used for the first time in the MSE-OM. The ICCAT GBYP Core Modelling MSE Group held three meetings in 2017. The modelling efforts are continuing in phase 7 and all efforts are directed to further development of a MSE and OM.

The report was adopted and is attached as **Appendix 4**.

Discussion

The Committee thanked the outgoing Coordinator for his dedication to the programme and congratulated him on the exemplary work he has carried out. The Committee further recognized the important information the Programme has provided to the SCRS. It was acknowledged that it was time for the Programme to take stock on what information is currently available and what the priorities are for the future. Many efforts have been made to collect and compile data, but it was recognized that it may be a good time to focus on what information is currently available, and the analysis of the existing data. The Modelling component of the programme was highlighted as an important priority moving forward. It was agreed that the Management Strategy Evaluation Process has been initiated, but it is time to increase the participation in this component and make it more inclusive. The importance of widely disseminating the results of the MSE process was also stressed as well as identifying the appropriate forum to do so as significant time is required to adequately assess this complicated initiative.

It was also noted that the tagging of highly migratory species remains a concern, as does the collection of biological samples from these species. Although several tagging and data collection initiatives exist, there is a need to harmonize efforts in order to ensure the proper stratification and representation of the collected samples. These data are crucial for the success of the complicated models the SCRS is increasingly using for stock assessment. It was also suggested that the Programme should consider the Ecosystem role of bluefin tuna and collect data to facilitate analysis of this role.

10.2 Enhanced Programme for Billfish Research (EPBR)

The ICCAT Enhanced Programme for Billfish Research (EPBR) continued its activities in 2016. The Secretariat coordinates the transfer of funds information, and data. The overall programme Coordinator during 2015 was Dr. John P. Hoolihan (USA), whom also assumed the coordination for the western Atlantic Ocean, and Dr. Fambaye Ngom Sow (Senegal) coordinated activities for the eastern Atlantic Ocean. 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 programme depends on financial contributions, including in-kind support, to reach its objectives. This support is especially critical because the largest portion of billfish catches in recent years comes from countries that depend on the support of the programme to collect fishery data and biological samples. ICCAT has provided financial support in recent years, while annual contributions have been made from Chinese Taipei since 2009. EPBR continued funding support for billfish landing studies carried out by western African CPCs. This resulted in scientists from Côte d'Ivoire, Ghana, São Tomé and Príncipe and Senegal, participating in an ICCAT workshop to develop indices of abundance for sailfish. Subsequently, their data and results were presented and used in the recent sailfish stock assessment session. The billfish age and growth biological sampling programme initiated in 2016 for West African CPCs was hampered by the fact that fishermen did not allow sampling unless fish were purchased. The programme is looking at ways on how to facilitate such purchases with the help of the ICCAT Secretariat. The genetic sampling study to compare mixing and distribution of white marlin and roundscale spearfish is ongoing. No samples have been returned for 2017, as of 15 September.

The report was adopted and is attached as **Appendix 5**.

Discussion

The Committee acknowledged the importance of the work being conducted under the programme due to the lack of information available on billfish species. It was clarified that the programme is reliant on contributions from CPCs to conduct the activities identified as important. Chinese Taipei confirmed their commitment to continue their support for the Programme financially. The Committee also noted that there is a lack of data regarding billfish catches on anchored FADs and a data recovery initiative could be included in future programme activities.

10.3 Small Tunas Research Programme (SMTYP)

In 2017, SMTYP continued the recovery of historical Task I and Task II data series and launched a call for the collection of biological samples for the main small tuna species for the second consecutive year. This will reinforce data mining of Task I and Task II and enhance biological knowledge on those species, aiming at future small tuna stock assessments. In that regards, three contracts were issued by the ICCAT Secretariat during 2017 to conduct data mining and biological studies in the Mediterranean and in the North-eastern Atlantic, whose preliminary results were presented during the annual meeting of the Small Tunas Species Group.

The Group identified the priorities that should be taken into account both in terms of the species to be sampled and the biological data to be collected under the SMTYP in the following biennium. These priorities are presented in the Small Tunas Work Plan for 2018 (**Appendix 12**).

The report was adopted and is attached as **Appendix 6.**

Discussion

The Committee acknowledged the progress being made on small tuna data collection by the Programme.

10.4 Shark Research and Data Collection Programme (SRDCP)

The SRDCP completed the collaborative work related to updating the age and growth dynamics of the shortfin mako in the Atlantic Ocean and the results of the study were used in the 2017 Shortfin Mako stock assessment. The population genetics study to estimate stock structure and phylogeography included additional samples from areas with previously little coverage and confirmed earlier findings. A post-release mortality study of shortfin mako caught on pelagic longline fisheries continued with the deployment of new Survivorship Popup Satellite Archival Transmitting Tags (sPATs). A total of 21 tags have been deployed to date for this project in the northwest, northeast, tropical northeast and equatorial region, and southwest Atlantic. A total of 23 data sets from electronic tagging (14 sPATS and 9 miniPATs) are already available as part of the satellite telemetry study to gather and provide information on stock boundaries, movement patterns and habitat use by the shortfin mako shark and an additional 13 tags are awaiting deployment. Additionally, two projects on porbeagle were started: a life history (reproduction) study aimed at improving the knowledge of its reproductive cycle and a study aimed at better understanding the movement patterns, stock boundary, and habitat use of this species in the Atlantic.

The report was adopted and is attached as **Appendix 7.**

Discussion

The Committee expressed its strong support for this Programme. It was noted that the Commission is increasingly requesting advice on shark species and this Programme has provided crucial data that has been used to assess shark species. The Programme was also acknowledged as initiating beneficial collaborations between a wide variety of CPCs which have facilitated several cooperative studies and facilitated data sharing.

10.5 Atlantic Ocean Tropical Tuna Tagging Programme (AOTTP)

AOTTP has continued to make progress towards its targets since the 2016 SCRS Plenary. More than 500 days at sea have been spent on more than 50 tagging cruises throughout the Atlantic. Nearly 60,000 fish (*ca* 50% of the target) have been tagged with conventional tags in the EEZs of fifteen different countries, for which permission was sought and granted, in addition to the High Seas. More than 8,000 fish have been double-tagged allowing tag-shedding rates to be estimated, while 4,000 have been marked chemically to improve subsequent ageing of recovered fish. More than 300 electronic tags (pop-ups and internals) have been deployed, providing information on tuna migrations and habitat preferences. Scientists and technicians, including 3 women, from developing countries have tagged over half of these fish. Tag-recovery and awareness raising infrastructures have been set up in ten countries, and more than 10,000 tags have been recovered (*ca* 20% recovery rate) for which rewards have been paid. Tag-seeding experiments are under way. A lottery to promote the project among stakeholders was organised in September 2016 by ICCAT, and a large cash prize paid. Posters, t-shirts, and caps have been designed in four languages. An expert group to improve age-determination and build capacity was organised by our partners in Abidjan in March 2017. Relational databases and smartphone applications for populating them have been designed, developed and implemented. More than 60 researchers and technicians from developing countries have been trained in all aspects of tagging at sea, tag-recovery, and data transmission methodologies. AOTTP coordination is continuing to work with the SCRS to build scientific capacity among ICCAT CPCs and make effective use of the tagging data for improving the tropical tuna stock assessments. In spite of the late start the AOTTP is on course to meet its objectives.

The report was adopted and is attached as **Appendix 8**.

Discussion

The Committee noted the extensive work already conducted by the project. There was a strong feeling that the project team should increase collaboration and information sharing with additional experts, particularly those involved in electronic tagging to ensure that the protocols are evaluated and the best possible practice used. This is especially important in light of the disappointing results for electronic tagging thus far. It was noted that several species groups have electronic tagging components to their research programme.

It was also noted that the Tropical Tuna Working Group had expressed the need to increase the number of tag seeding experiments and the number of total tags used in the seeding. The project Coordinator confirmed that this was an important consideration, and plans were already in place to facilitate this request.

The Committee acknowledged that this is an extremely important research project that has a very ambitious scope with the potential to provide a large amount of crucial data to the SCRS. The necessity to maximize the outputs from this project was noted particularly in light of the importance of these tropical tuna species to the Commission. The Secretariat thanked all the contributors to the funding of the project, and in particular the EU. It was also noted that an additional contribution of $US15,000 had recently been received from the USA.

11. Report of the Sub-committee on Statistics

Dr. Guillermo Diaz, Convener of the Sub-committee on Statistics, presented the Sub-committee's report (Madrid, 25 and 26 September 2017) to the SCRS, and acknowledged the enormous work of the Secretariat and all its support to this Sub-committee and the SCRS in general. Dr. Diaz referenced the Secretariat report on Statistics (Anon. in press b) which has detailed explanations of important matters such as, the current CPCs reporting status (using the SCRS filtering criteria to validate 2016 Task I Task II data), the improvements made in statistics (historical revisions and recoveries) and related data handling tools (databases, infrastructure, technologies, etc.), and the progress made in various Secretariat ongoing projects (historical data recoveries, online reporting prototyping, preliminary work on scoring data availability, etc.). The preliminary work of the Secretariat on the ICCAT "scoreboard" on data availability was also welcomed by the Sub-committee which accepted it and supported its future development.

A special emphasis was made regarding the failure of most CPCs to report both dead and alive discards in Task I (mandatory, but highly incomplete in all species), as required by the Commission, and the imperative need to improve this aspect in the short term. The Convener also recalled that, as in last few years, Task I updates which arrive late during the SCRS Species Groups meetings will only be made after the SCRS meeting. In the same subject, but associated with exceptional cases of virtually full Task I corrections made by a CPC to preliminary catches (last four most recent years as defined by the SCRS), the Convener (referring the properly made Japanese Task I corrections to 2014 and 2015 catches of the majority of the species) recommended that the related Species Groups be properly informed (by the CPCs and the Secretariat) of those corrections, in particular when the changes are substantial.

The Convener also summarised the accomplishment status of the 2016 Sub-committee recommendations, reiterating the need to continue advancing on the ones that have not been completed, as is the case of the need of an active participation of the Species Group rapporteurs and CPC statistical correspondents. It was recalled that many decisions made by this Sub-committee usually affect the entire ICCAT community, such as, the set of proposals aiming to improve and normalise the ICCAT coding system, as well as important changes made to Task I and Task II forms (currently all Task II must be reported by month, and allow submissions with multiple years).

The progress made on the ICCAT online reporting system (three complementary developments in place, described in Anon. in press b) deserved also a special mention. The Convener informed that, they share common goals and should converge in the future, if possible under the guidance of the Commission Working Group for the online reporting system implementation. It was also agreed that the SCRS statistical online validation system made by the Secretariat is now sufficiently advanced to start a testing phase during 2018 (details in the report). The Sub-committee considers that the Commission should continue to support this work on online reporting.

The Convener also presented the revised (and adopted) data dissemination rules, which also take into account particular data sharing situations which can be evaluated case by case, and the access to historical meetings data.

Finally, the Sub-committee presented to the SCRS its 2017/2018 work plan **(Appendix 12)**.

The Report was adopted and is attached as **Appendix 9.**

Discussion

The SCRS Chair started by appreciating the increasing level of participation to the Sub-committee in the recent years, and also reiterated the invitation of this Sub-committee for an active participation of the Species Groups Chairs and CPC scientists. The Committee concurred with the appreciation and recommendation of both the SCRS Chair and the Sub-committee on Statistics Chairs, noting that, decisions made during Sub-committee meetings could affect the entire ICCAT community.

Japan informed the SCRS that the Task I corrections for 2014 and 2015 catches (except bluefin tuna) was caused by a software error. These corrections were however, duly informed (reflecting the catches presented in the Annual Report) and did not affect any of the scientific work of made during 2017. The Committee, thanked the Sub-committee Convener for handling a great amount of complex matters in such an effective way, asked if this error only affects Task I or both Task I and Task II datasets. Japan informed that it only affects Task I.

12. Report of the Sub-committee on Ecosystems and By-catch

An Intersessional Meeting of the Sub-committee on Ecosystems and By-catch was held in Madrid, Spain 10-14 July 2017. The progress made towards implementing ecosystems based fisheries management (EBFM) jointly among the five t-RFMOs was presented. The Sub-committee furthered its progress on an EBFM plan by developing the framework for an ecosystem report card that is to be populated intersessionally and presented at the 2018 Sub-committee on Ecosystems meeting and to the Commission. Lastly, the Sub-committee reviewed the available information on the trophic ecology of unique pelagic ecosystems that are important for ICCAT species in the Convention area. During the by-catch section, a proposed revision to the observer data collection forms was discussed. As well, the assessment of the impact of ICCAT fisheries on sea turtles was updated and advances on collaborative work amongst CPC scientists to assess seabird by-catch in the pelagic longline fleets was reviewed. The Sub-committee also noted that several teleost fish species with large landings, which are not by-catch and are not considered by other species groups, require further attention.

Information on the Detailed Report of the meeting of the Sub-committee on Ecosystems and By-catch is available in **Appendix 10**.

Discussion

The Committee supported the proposed intersessional work of the Sub-Committee to develop a draft ecosystem report card to inform the Commission of the current status of components of the ecosystem affected by its management.

A clarification on the recommendation by the Sub-committee on sea turtle mitigation was requested. It was queried as to whether this recommendation should be formulated into a response to the Commission, or whether it would be retained as a recommendation in the text of the SCRS Report. It was clarified that significant progress had been made and consensus text had been drafted on a recommendation. It was the feeling of both the co-convener of the Sub-committee and the Chair of the SCRS that at this stage the recommendation be retained in the SCRS Report. The Committee supported the collaborations being conducted between CPC scientists to evaluate the impact of fishing on seabirds.

13. Considerations of implications of the Meeting of the Joint t-RFMO FAD Working Group

As part of the Kobe process, ICCAT hosted the first meeting of the Joint t-RFMO FAD Working Group in Madrid in April 2017. The meeting allowed scientists, managers and other stakeholders from ICCAT, IATTC and IOTC to discuss issues related to FAD management and research and enhance cooperation between the three t-RFMOs. The meeting identified a list of priority future actions to be taken by the join t-RFMO FAD Working Group and recommended the creation of a technical working group to advance some of these actions. Details of meeting outcomes can be found in the report of the meeting.

The ICCAT Working Group reviewed these conclusions, and results of their discussions are referenced in section 14.

Discussion

ICCAT's leading role in the organization of the meeting, which had a high level of participation, was highlighted. Additionally, the importance of the cooperative work developed prior to the meeting was mentioned. The joint t-RFMO FAD Working Group is the proper forum to share experiences between all those involved in FAD fisheries in different Oceans, as demonstrated by achieving results of the meeting, regardless of WPCFC's decision not to participate. The Committee reiterated the importance of keeping the Working Group active in the future and urged the technical Working Group to start working as soon as possible.

14. Report of the Third meeting of the Ad hoc Working Group on FADs

Rec. [16-02] of the Commission revised the terms of reference of the FAD Working Group and requested a meeting of the Working Group in 2017. The Working Group met in Madrid, 11-12 September 2017, and 8 CPCs and 3 NGOs were in attendance. The Working Group addressed the following points:

- Review of the information on FADs provided by CPCs;
- Evaluate progress made based on the recommendations issued by the Working Group in 2016;
- Considerations from the First Joint t-RFMO FAD Working Group meeting;
- Assessment of developments in FAD-related technology;
- Describe the effects of FAD use on the fishing mortality of stocks of tropical tuna;
- Consideration of recommendations to the Commission for possible additional actions on management of FADs.

Details of the discussions and documents of this meeting are contained in the report of the meeting, which as per the time of the SCRS 2017 Plenary, the meeting report was not yet available. Therefore the SCRS Species Groups have not had a chance to review the outcomes of this meeting. However, the Sub- Committee of Statistics did consider a few of the recommendations made by the ICCAT FAD Working Group during its September meeting and details of these considerations are included in the report of the Sub-Committee (item 11 of this report).

In 2016 the Commission requested the SCRS to provide feedback on the recommendations made by the FAD working group in 2016, such response is contained in section 20.4 of this report.

Anon. 2017q corresponds to the Detailed Report of the Ad Hoc Working Group meeting which is also attached as ANNEX 4.5 to the *Report for Biennial Period 2016-2017, Part II (2017), Vol. 1* (Anon. in press a).

Discussion

The SCRS Chair reported on the topics discussed, mainly following the recommendations and task highlighted from the First joint t-RFMOs FAD Working Group meeting identified for ICCAT (see Section 13 and the Report of the Chair of the First Joint Tuna RFMO FAD Working Group meeting (here)). Within these tasks are the development of a work plan to address research, data collection and analysis of FAD fisheries information, review and adoption of FAD related technical and legal definitions. To facilitate and accelerate the progress toward meeting SCRS and Commission objectives concerning the recommendations of the joint t-RFMO FAD meeting and the ICCAT FAD Working Group, the Coordinator of the Tropical Species suggested forming a "study group" to review and prioritize the recommendations, and prepare a work plan which would be presented to the Tropical Tuna Species Group and the SCRS in 2018. The study group would be open to interested stakeholders. It was also noted the importance of integrating not only the Tropical Tunas Species Group, but also the rapporteur of the Sharks Species Group, and the Conveners of the Sub-Committee on Ecosystems as important research and a new information have been presented from non-target species that interact with FAD fisheries. The study group would meet intersessionally via remote communications (e.g. webinars, video conferencing).

15. Considerations of implications of the Meeting of the Standing Working Group on Dialogue between Fisheries Scientists and Managers (SWGSM)

The meeting was held in Madrid Spain, 29-30 June. The objectives of this meeting were to analyse of how management objectives have been established for priority stocks (tropical tunas, N-ALB, N-SWO and BFT); to inform on which performance indicators have been identified; and to report on the progress toward MSE/HCR development to date. The Secretariat provided an overview of the outcomes of the 2016 Joint Tuna RFMOs Working Group on Management Strategy Evaluation (MSE). Additionally, the Secretariat provided a summary of the work developed during the Joint Meeting of tuna RFMOs on the Implementation of the Ecosystem Approach to Fisheries Management, initiated by ICCAT and supported by the Common Oceans/ABNJ Tuna Project, which brought together scientists from the five t-RFMOs and national experts. The goals of the latter meeting were to (1) establish a sustained dialogue across t-RFMOs on the issues of EAF and its implementation, (2) understand common challenges in its implementation and (3) identify case specific solutions. A number of recommendations to the Commission were made as regards different issues covered during the meeting.

The Report of the Third meeting of the Standing Working Group to Enhance Dialogue Between Fisheries Scientists and Managers (SWGSM) is attached as ANNEX 4.4 to the *Report for Biennial Period 2016-2017, Part II (2017), Vol. 1*. (Anon. in press a).

16. Progress related to work developed on MSE

16.1 Work developed by the t-RFMO MSE Working Group

The Joint Management Strategy Evaluation (MSE) Technical Working Group (TWG) was created during the Third Joint Meeting of Tuna RFMOs (the "Kobe process") in 2011 to support the implementation of the Precautionary Approach for tuna fisheries management. The TWG has previously reviewed the Kobe Advice Framework and how the adoption of MSE would change the way that risk and uncertainty is communicated. The Working Group had its first official meeting in Madrid from 1-3 November 2016. The objectives of the meeting were to: i) review current MSE practice, successes, failures and potential areas for collaboration; ii) discuss progress on MSE; and iii) identify future actions focusing on areas for collaboration.

The workshop was organised around five themes, namely:

1. The MSE process and stakeholder dialogue;
2. Conditioning operating models;
3. Albacore case study currently underway across t-RFMOs;
4. Computational aspects;
5. Dissemination of results.

The TWG has not conducted a comprehensive review of the approaches and processes used when developing MPs across but agreed these should be developed. However, an initiative is needed to identify additional key issues required to further facilitate adoption of Management Procedures in the t-RFMOs. The Group reviewed the operating models (OMs) currently being developed across the t-RFMOs and found that the range of OMs examined were primarily based on assessment models. In some cases these OMs were developed to contain peculiarities of the stock/species not considered in the current assessment models runs, e.g. including spatial structure, as in the case of Indian Ocean skipjack and Atlantic Ocean bluefin tuna. The current approach using an assessment model as the basis for OM design is a good starting point, though further processes (observation error and ecological processes with time dependence) should be accounted for in OM designs to ensure robustness.

The albacore case study takes advantage of the relative advancement of MSE for several of the albacore stocks across t-RFMOs, and of the relative simplicity of the operating models required. The case study will provide an opportunity to collaborate across RFMOs by conducting comparative studies on worldwide albacore stocks. The study will allow experiences to be shared, and provide a test bed for method development allowing rigorous, transparent, and replicable testing of methods and software. Expected outcomes are improved collaboration on developing a common dialogue, new models and software, and promoting interdisciplinary work.

The TWG has agreed that software validation is important, and should include tests across platforms, open code, and complete traceability. The user interface http://www.stockassessment.org and the use of "Makefiles" was highlighted as an example of such an open and transparent framework, which could be used for both stock assessments and development of MSE. The need for communication and visualisation tools, such as standardised "shiny apps", was highlighted. Support for the development of those tools may be available from partner institutions and/or other organizations. The TWG agreed to continue to work intersessionally on methods development and on case studies; in addition the TWG will investigate holding an MSE/CAPAM workshop followed by a special issue in Fisheries Research in 2019.

16.2 Work conducted under ICCAT GBYP

The bluefin MSE specifications is being developed by the bluefin tuna Core Modelling Group and is funded by the ICCAT GBYP. Four meetings of the ICCAT GBYP Core Modelling MSE Group were held since the 2016 SCRS plenary meeting. The reports of these meetings are available at:
http://www.iccat.int/GBYP/en/modelling.htm

An operating model (OM) framework allowing mixing between the two stocks has been developed and conditioned to data on relative abundance, tagging and stock of origin. A core set of operating models has been agreed to span the major uncertainties identified in bluefin stock assessments.

The Group decided to initially explore management procedures that are based on empirical indicators of stock abundance rather than on model-based indicators of stock abundance as was the case for the northern albacore MSE. The reason for this choice is that experience suggests that such simple formulae are more readily understood and accepted by stakeholders. An initial set of relative abundance indices (three for the west and four for the east) have been selected as possible candidates to be examined as part of the management procedures to be tested for the setting of future TACs. A computer package which will allow the SCRS to easily test management procedures is virtually completed.

The next steps in the bluefin tuna MSE are:

- to encourage different SCRS scientists and managers to suggest management procedures based on the proposed set of relative abundance indices. These interactions could happen through:
    - a special joint meeting of the swordfish working group and bluefin tuna working group which focused exclusively on MSE;
    - a special meeting of panel two which had a strong focus on MSE;

- to evaluate such management procedures over the course of 2018;

- to request the SCRS to select a small set of management procedures and their evaluations to be reported to the 2018 Commission meeting;

- to request the Commission to provide feedback on the tested management procedures and agree on a final set of management procedures to be evaluated for final presentation at the 2019 Commission meeting.

Discussions

An important point of discussion was how to ensure wide collaboration when conducting work on MSE. It was explained that it had been difficult to involve wider participation in the work in 2017 as it was only in this year that the Operating Model (OM) and code were ready and the BFT species group was fully occupied in conducting a full assessment.

It was agreed that in 2018 an intersessional meeting of the BFT species group should be held where teams developing candidate Management Plans (MPs) could work with the Core Modelling Group and members of the bluefin working group. It was pointed out such a meeting was already in the bluefin work plan and the work on developing MPs would be presented in September. It was also agreed that this requires CPCs to commit to developing candidate MPs.

A concern was expressed that the work required to conduct the MSE could create problems when conducting MSEs for other stocks. Hope was expressed that the work being done for bluefin and albacore (supported by the GBYP and the EU) will actually help with other planned MSEs. For example a suggestion was made that scheduling MSE meetings so that overlap may help in allowing different groups to collaborate. It was also agreed that there was a problem with resourcing, both with respect to people and finance.

The need for oversight and to ensure more involvement in the MSE processes was stressed. Although the MSE work for respective species was proceeding independently the WGSAM has a standing term of reference on MSE and the work has been reported to the Meeting of the Standing Working Group on Dialogue between Fisheries Scientists and Managers.

16.3 Work conducted for other species

A comprehensive "full MSE" includes a structured consultation process with managers about objectives; the selection of performance indicators and candidate harvest control rules; the development of a broad set of operating model hypotheses on plausible states of the system; an agreed way to reject and weight Operating Model hypotheses; an observation error model which can mimic the data types, and their error structure, to be included in the management procedure; identification of candidate management procedures, and testing of management procedures with the full feedback loop, including implementation uncertainty. The full MSE also requires extensive consultation between scientists, managers and other stakeholders.

North Atlantic albacore

Rec. 16-06 states that "in 2017, the SCRS shall refine the testing of candidate reference points and associated harvest control rules (HCRs) that would support the management objective", which is "(a) to maintain the stock in the green quadrant of the Kobe plot with at least a 60% of probability, while maximizing long-term yield from the fishery, and (b) where $SSB<SSB_{MSY}$, to rebuild SSB to or above SSB_{MSY}, with at least a 60% probability, and within as short time as possible, while maximizing average catch and minimizing inter-annual fluctuations in TAC levels".

The SCRS continued to work on MSE of albacore and provided reports of its progress to the December 2016 meeting of the tRFMO technical MSE group, the May 2017 meeting of the SCRS WGSAM and the June 2017 meetings of the albacore species group and Standing Working Group to Enhance Dialogue between Fisheries Scientists and Managers (SWGSM). All these groups provided input to the MSE simulations that helped improve the evaluations of management procedures conducted through the Albacore MSE. Details of the results of these evaluations are presented in the above mentioned meeting reports, in the albacore executive summary and in sections 20.16 and 20.17 of this report. The last two sections also contain the possible short term TACs resulting from implementing the harvest control rules tested with the MSE.

Swordfish

In 2016 the Commission agreed on a roadmap for the completion of MSE in support of the adoption of a harvest control rule for North Atlantic swordfish. During the current meeting, the SCRS Chair summarized the implications of the calendar described in the roadmap. This roadmap calls for the process of development of MSE to start in earnest in 2017 and be completed by 2019 for a possible adoption of an HCR by the Commission.

It was pointed out that work on MSE for swordfish is less advanced than for albacore or bluefin tuna and therefore that it will be challenging to abide by the schedule adopted by the Commission. The Swordfish Species Group recognized that delivering MSE results for North Atlantic swordfish according to the schedule agreed upon by the Commission will be very challenging and require time and resources that are not presently available to the SCRS. It was also agreed that a detailed proposal for the research plan to support the North Atlantic swordfish MSE timetable, including costs, should be developed by the SCRS and presented to the Commission.

Any work on MSE for North Atlantic swordfish will be useful for future MSEs for other Atlantic swordfish stocks.

Tropical tunas

The Commission requests related to MSE are contained in [Rec. 16-01]. This includes the review of performance indicators to be used on MSE. The tropical tuna species group discussed how the schedule for the development of MSE, which calls for the MSE results to be first available in 2020, relates to the current schedule of assessments for tropical tunas (2018 for bigeye, 2019 for skipjack and 2021 for yellowfin). The Committee noted that given the multi-species nature of the tropical tuna fishery, the MSE should take this into account. The Committee developed an initial schedule of activities to progress the MSE and the species rapporteurs agreed to develop a budget to be considered by the SCRS and incorporated into a comprehensive MSE budget for the SCRS.

Small tunas

A variety of data limited approaches are available and it was agreed that the best way to do this is to conduct Management Strategy Evaluation (MSE) to determine the best combination of data, assessment and control measures. MSE can also be used to determine the benefits of improving data collection and the value of new information, including that from the AOTTP. To do this the data rich North Atlantic albacore Operating Model (OM) is being used to simulate data poor time series and the results compared with data rich methods.

Resourcing MSE process

The SCRS agreed to provide the Commission a comprehensive proposal that would integrate the needs to conduct MSE for all tuna stocks given that the capacity and resources needed to implement such processes would be more efficiently used if such proposal existed. **Appendix 13** provides a draft of such comprehensive proposal so that the Commission can get an idea of the resources required to implement the MSE process.

The SCRS notes that the FAO ABNJ tuna project is a possible source for supporting parts of the process, particularly those related to capacity building and dialog between stakeholders and that some ICCAT CPCs have already funded components of the process related to the technical aspects of the simulations. It is also worth noting that the resourcing of this process goes beyond the resources currently available to the SCRS.

17. Report of the implementation of the Science Strategic Plan for 2015-2020 in 2017 and work plan for 2018, which includes the update of the stock assessment software catalogue

The report summarizes the progress in the implementation of the plan at the midpoint of the five year period, in the middle of 2017.

The Chair of the SCRS requested guidance to the SCRS and the Commission on the format of this review in 2016. The proposal of the SCRS Chair was to summarize progress by providing a simple table which:

1. identify the main body of the SCRS responsible for implementing the strategies proposed associated with each of the major objectives contained in the plan;
2. provide information on which of the measurable targets included in the plan had been reached;
3. categorize progress toward reaching each of the objectives in simple categories.

Progress is reasonable for most of the objectives, and a few have already been met, and some examples are provided below. For instance there has been an increase in the dialogue between scientists and managers, and broadening technical consultations with other RFMOs. During 2016 and 2017 SCRS scientists, commissioners and other stakeholders met, during meetings of the FAD Working Group, the SWGSM and Panel 2, to help advance the work of the SCRS. Those same years SCRS scientists have participated in tRFMO meetings focusing on FADs, MSE and Ecosystems Based Fishery Management. Another objective been met is the increase in the participation of G77 scientists in SCRS meetings facilitated by the funds made available by ICCAT and by the incorporation of more G77 scientists as SCRS officers. Targets for development of a schedule of MSE work and the planning for the implementation of Ecosystem Based Fishery Management have been already met.

There are some objectives, however, for which progress has been slow and a few examples are provided herein. There is an MOU with Aquatic Living Resources to publish selected peer review papers related to ICCAT work, however, few SCRS scientists are taking advantage of this publishing mechanism. Neither the SCRS nor the Secretariat has developed a specific strategy to better disseminate the results of their work to the general public. There are still some SCRS meetings where there are no scientists in attendance from some of the CPCs which catch a very large part of catch of the stock being assessed.

Table 1 provides detailed information on each of the objectives and identifies progress in meeting the measurable targets.

During 2018, the SCRS Working Groups and Sub-committees will review this progress table and evaluate whether to add or modify the strategies proposed in the plan to ensure full implementation of the plan's objectives.

Table 1. Summary of progress in the implementation of the ICCAT Science Strategic Plan.

Targets already reached/exceeded or will be reached soon	(green)
Good progress with some targets reached but not all	(yellow)
Small progress or no progress with no targets reached	(orange)

DATA COLLECTION				
Goal	***Objective***	***Measureable targets***	***Reporting responsibility for targets***	***Notes on measurable targets***
1.1	*Strengthen the collection of High Quality Task I and II data and to address data gaps that are identified*	*A 20% reduction in missing or lacking data items in the Secretariat's annual report on statistics.*	Secretariat	Improvements in data continue. See Sec. Report on Stats. and Coord. of Research.
1.2	*Improve resolution and precision of total catch composition and distribution and fishing effort data across CPCs*	*Fishery catch/effort maps at 1x1o resolution, by month by major gear type by 2020, in support of fine scale (time and space) fishery management advice.*	Secretariat	Available for some species and fleets
1.3	*Improve the fulfilment of the CPC´s data reporting obligations*	*20% reduction in of non-compliance with CPC reporting obligations according to Secretariat's compilation report within 5 years.*	Secretariat	Significant progress in some data sets but not others, especially those related to by-catch, and discards
2.1	*Identify the types of biological data that is needed (stock structure, growth, maturity, fecundity, etc.)*	*Application of MSE to the main ICCAT stocks to evaluate biological data needs by 2018 & Conduct Ecological Risk Assessment (ERAs) for those species for which lack of information prevents quantitative assessments of stock status, by 2020.*	Sp WG	MSE schedule developed with Commission. ERAs for small tunas initiated

2.2	*Elaborate sampling designs and evaluate the representativeness of samples of length (age) needed for each stock*	*Sampling designs for all the main stocks under Commission responsibility elaborated by SCRS by 2020.*	Sp WG	Little progress
2.3	*Develop coordinated biological sampling programmes for ICCAT stocks*	*Increase of 50% in biological sampling programmes within a 5-year time frame.*	Sp WG	Significant progress for BFT, SMA, BSH and some SMT. Slow progress on billfish in recent years.
3.1	*Develop a comprehensive by-catch & observer data set*	*Representative observer and by-catch data set from 80% of the ICCAT fleets by 2020 and evidence of increase in analyses of CPC observer data through the number of papers submitted to SCRS annually.*	Sub-Com Stat	Large improvement of data provided by some of the major PS fleets. Limited progress for other gears.
3.2	*Elucidate data needs for Provision of Ecosystem Based Fishery Management Advice*	*Developing protocols for the collection of socio-economic data. Application of Integrated ecosystem models*	Sub-Com Stat	Socio-economic data provision no progress because of low priority given by Commission. Sub-com. Ecosystem developing Ecosystem report cards.

DIALOGUE AND COMMUNICATION				
Goal	***Objective***	***Measureable targets***	***Reporting responsibility for targets***	***Notes on measurable targets***
1.1	*Elevate science-management dialogue in support of defining critical elements of the decision framework policies of Rec. [11-13]: "high probability" and "as short a period as possible"*	*To provide mechanisms to the Commission so as to be able to adopt probabilities and deadlines for stocks before 2020 (50% percent of cost to be covered by GEF/ABNJ project).*	SCRS Chair	MSE work schedule adopted by Commission, Panel 2 meeting in 2016. Resourcing needs Commission commitment. Challenging to increase capacity.
2.1	*Institute periodic meetings with decision makers, SCRS scientists, and stakeholder with more opportunity for free interchange (i.e., not in the usual Commission format)*	*An SCRS-COM stakeholders meeting in the format of the SCRS Working Groups (50% percent of cost to be covered by GEF/ABNJ project).*	SCRS Chair	WG Dialogue meeting in 2016, 2017. Panel 2 meeting in 2016. FAD meetings in 2016 and 2017.
3.1	*Increase interaction between SCRS officers*	*100% SCRS officers participate in the SCSTAT meetings. 100% of SCRS officers participate in the annual coordination meeting*	SCRS Chair	In 2016, 15 of 18 attended and in 2017, 14 of 18. Proposal to switch timing of Sub-com Stat. Possibly require only at least one rapporteur from each WG.
3.2	*Develop better dialog between the working group chair and potential participants*	*Broader participation in the working group reports. Develop a protocol for the submission of documents prior to meetings. 100% of the work plans established (containing deadlines, allocated responsibilities, framed within the strategic plan, subject to financial and technical conditions).*	Secretariat	Occurring in some groups not in all. Requires improvement

4.1	*Strengthen linkages and collaboration with other Tuna Regional Fishery Management Organizations (tRFMOs)*	*Broader participation in the Working Group reports. External experts or scientists from other tRFMOs will participate in five SCRS meetings up to 2020. An inter t-RFMOs meeting on an area of common interest before 2020.*	SCRS Chair	TRFMO MSE meeting (Nov 2016) FAD tRFMO meeting May 2017 ICCAT represented in CITES tRFMO meeting on sharks, several tRFMO experts worked as independent reviewers or experts in SCRS meetings.
4.2	*Strengthen linkages and collaboration with ICES*	*Number of meetings with joint participation of ICES-ICCAT*	Secretariat	Secretariat staff collaborated with ICES, MOU signed.
4.3	*Collaborate with a peer-reviewed journal to enhance communication of SCRS science products to the scientific community*	*Partner with at least one peer-reviewed annual publication*	Secretariat	Memorandum with ALR active, but contributions from SCRS very limited.
4.4	*Promoting the dialogue and communication between CPCs in order to carry out scientific research on ICCAT fishery resources in a coordinate and efficient way*	*Full utilisation of the Scientific Capacity Building Fund (SCBF) throughout the period of the plan. 10 collaborative papers on a regional scale to be submitted to the SCRS groups.*	Secretariat	
5.1	*Broad dissemination of the results of the SCRS work to the society as a whole*	*A mechanism in place by 2020*	SCRS Chair	Competitive Research Programme includes proposal for Communication specialist

6.1	*Work on the Ontology of the durability of tuna fisheries in the epipelagic ecosystem*	*No measurable target has been identified*	Unknown	No progress
PARTICIPATION AND CAPACITY BUILDING				
Goal	***Objective***	***Measureable targets***	***Reporting responsibility for targets***	***Notes on measurable targets***
1.1	*Avoid conflict of interests and ensure the independence of the scientific process*	*Code of conduct of the SCRS by 2016*	SCRS Chair	Not started

2.1	*Increase the capacity of the CPCs in meeting data-related obligations*	*20% reduction in Secretariat's annual report on statistics list of specific data elements that are lacking for each stock over a 5-year span.*	Secretariat	Improvements in data continues. See Sec. Report on Stats. and Coord. of Research.
2.2	*Increase the ability of the SCRS in the application of methods used in providing management advice on tuna stock management*	*5 courses are conducted and the training materials are openly available on the website.*	Secretariat	VPA course 2017. Training material not available in the Web.
3.1	*Ensure the participation of scientists from those CPCs that harvest significant portions of the stock*	*100% participation of the CPCs that harvest significant portions of the stock.*	Sp WG	Some progress but remains an issue in some groups. Often driven by political situation in individual countries. Travel fund from ICCAT always available.
3.2	*Increase scientific leadership for SCRS by scientists from G77 economies*	*At least 30% of the SCRS officers belong to G77 countries.*	Secretariat	Currently 6 out of 17, Côte d'Ivoire (1), Morocco (1), Brazil (2), Senegal (1), Uruguay (1).
3.3	*Increase scientific participation in SCRS by scientists from G77 economies*		Secretariat	Many more than 10 participations per year. Scientists from G77 participating in AOTTP. Long term training for more than 6 G77 scientists.

		33% increase in scientific participation at the SCRS by scientists from G77 economies. Supplementing travel/participation funding: 10 participations funded per year. Long-term training of at least 6 scientists from G77 economies. Initiate 3 collaborative projects with the involvement of scientists from G77 economies.		
RESEARCH PRIORITIES				
Goal	***Objective***	***Measureable targets***	***Reporting responsibility for targets***	***Notes on measurable targets***
1.1	*Identify the major uncertainties affecting management advice and the type of research needed to address them*	*Metadatabase for fishery, biological and mark recapture data. At least one cooperative SCRS or peer reviewed research paper for each main specie identifying the main sources of uncertainty and ranges for different (e.g. biological) parameters.*	WGSAM and Groups	Significant progress will be made for tropical tunas and has been done for bluefin tuna and albacore as a result of development of MSE.
1.2	*Quantification of the relative importance of the different uncertainties and prioritisation of future research*	*Simulation approach developed for each main species. At least one collaborative SCRS or peer reviewed research paper describing the relative merits of different research actions, for each main species.*	WGSAM	Simulation framework developed for MSE can be applied to this.
2.1	*Get accurate biological knowledge on stock structure, migrations and life history (growth, maturity, fecundity, maternal effects, etc.*	*Development of peer reviewed papers describing new biological findings.*	Sp WG	Significant progress made for BFT and BSH and SMA.

3.1	*Develop measures of fishing capacity and standardized fishing effort for different fleets*	*Develop SCRS documents and WGSAM reports on the methodologies to quantify fishing capacity and standardised fishing effort. EFFDIS database expanded to PS, GN and other gears, available at the website.*	Sp WG	EFFDIS completed for longline.
3.2	*Further improve standardization of CPUEs for their use as reliable indices of abundance*	*SCRS or peer reviewed paper on best practices to standardize CPUEs of different nature. Peer reviewed paper on the use of floating objects to monitor relative abundance.*	WGSAM	Work on best practices for CPUE standardization of longline well advanced through WGSAM and by ECOFAD on purse seine.
4.1	*Increase availability of fishery independent information to improve stock assessment and monitor the effect of management regulations*	*Development of report about dedicated workshop with specific recommendations on how to move forward. Increased number of peer reviewed and SCRS papers with the outcomes of fisheries independent research surveys. Develop and document experimental designs for mark-recapture surveys of key ICCAT species.*	SCRS Chair	BFT Larval index used in assessment. Design of AOTP tagging based on simulation work.
5.1	*Develop guidelines and robust methodologies that can cope with a range of different situations, including data poor ones*	*Identification and/or development of SCRS or peer reviewed papers on best practices and robust methodologies.*	SCRS Chair	SCRS papers and peer review papers on data poor methods. BFT framework includes many data poor methods.
6.1	*Quantify the effects of adopted as well as potential alternative management measures*	*Development of SCRS and peer review papers with the effects of existing and alternative management measures/strategies.*	Sp WG	Many SCRS papers on MSE, still to complete peer review papers.

7.1	*Identify and fill knowledge gaps so as to be able to provide scientific advice including ecosystem considerations (e.g. assessment of by-catch species, mitigation strategies, environmental effects on population dynamics, fishing impacts on the ecosystem, socio economic aspects, etc.)*	*Development of WG reports with specific Research Plans. Increasing number of people by research discipline participating in the SCRS.*	Sp WG	Ecosystem Sub-committee starts to integrate indicators of stock status from other groups. WGSAM focuses on integrating environmental indicators in assessment.
STOCK ASSESSMENTS AND ADVICE				
Goal	***Objective***	***Measureable targets***	***Reporting responsibility for targets***	***Notes on measurable targets***
1.1	*Integration of the different forms of uncertainties (e.g. natural variability and or lack of knowledge) in status diagnoses and projections*	*Development of a more standardised Terms of Reference for the Data Prep Meetings (and Assessment meetings?) that include a more complete analysis of the advice and uncertainty from the previous assessment. Further evaluate the quality of the fisheries data and related to the knowledge of the species.*	WGSAM	Not yet started
1.2	*Provide scientific advice using methods of analysis that are appropriate for the amount of information available for a given stock*	*Conduct a meeting between the Commissions and CPC to discuss the future roles of the CPCs and the Secretariat in future assessments.*	SCRS Chair	Not yet started, depends a lot on progress on MSE.

1.3	*Consolidate the stock assessment catalogue to ensure the best use of models that should be fully documented*	*Reactivate the Working Group of the Stock Assessment Catalogue and review the protocols of inclusion and updating the software used for stock assessments while maintain a historic repository of version control.*	Secretariat	Collaborated with ICES in promoting historic repositories of assessment data. Implemented data rapporteur in SCRS assessments.
1.4	*Improve Stock Assessments by incorporating improved information on fishery and life history characteristics*	*A written plan of how the data will be collected, stored, shared, and utilised and for exactly what purposes by 2015. Use an MSE approach to quantity the sample sizes needed to improve the information.*	Sp WG	Collaborating on a Global MSE work to see the value of sharing information across ocean basins.
1.5	*Strengthen peer review process*	*Conduct a peer review of at least one assessment each year.*	Secretariat	No peer review in 2016 but one in 2017.
2.1	*SCRS should continue to evaluate precautionary management reference points and robust harvest control rules through management strategy evaluations*	*Establish a 5 year schedule for the establishment of species specific HCRs which will include a default HCR in the absence of species specific information. Produce a review of MSE efforts so far in light of successes, lack of successes and the resources limiting future MSE progress and to collate feedback from managers and stakeholders on the process thus far.*	SCRS Chair	See Matsumoto and Satoh, 2017.
2.2	*Provide advice on the setting of precautionary approach and harvest control rules to avoid overfishing and decline of stocks as well as rebuild overfished and depleted stocks.*	*Establish a 5 year schedule for the establishment of species specific HCRs which will include a default HCR in the absence of species specific information. Advocate the establishment of a standardised precautionary approach limit to be used as a default in the absence of more specific limits. Conduct at least one workshop on the use of MSE to evaluate harvest control rules to be held jointly with other RFMOs.*	SCRS Chair	See Matsumoto and Satoh, 2017.

3.1	*Focus on the fishery and its role in the ecosystem, including the commercial and non-commercial species as well as the habitat.*	*Create a proposal of possible EBFM goals and objectives to the Commission referring to those currently used by other RFMOs that are further along in this process. Support a post-doc or similar position to establish as ecosystem (multi-species, multi-functional group) operating model that can be used to test the aforementioned hypotheses.*	Sub-Com Eco	Collaborated with ABNJ and other RFMOs to review EBFM implementation. Proposal provided to SCRS and Commission during Dialogue meetings. Post-doc supported by EU project.
3.2	*Support a post-doc or similar position to establish as ecosystem (multi-species, multi-functional group) operating model that can be used to test the aforementioned hypotheses.*	*Host a workshop and invite outside expertise to collaborate with the Sub-Committee of Ecosystems to determine an effective approach to the creation of an ESR. In line with other RMFO, compilation of an Ecosystem Status Report that describes the current state and trends in selected ecosystem indicators for communicating this information to participating scientists and managers.*	Sub-Com Eco	Meeting of tRFMO held in Dec 2016 Ecosystem Report Card under development.
3.3	*Develop short term, medium and long-term objective to enhance ecosystem based approaches*	*Conduct a meta-analysis of year/area effects on ICCAT species abundance with the goal of determining historic and recent changes in the spatial distribution of these species, possible regime shifts in productivity, and other relevant characterisations.*	Sub-Com Eco	Slow progress
4.1	*Development and testing of bio-economic modelling approaches and Identification of data needs*	*Protocol to collect bio-socio-economic information.*	Sub-Com Stat	Dialogue meeting failed to advance the question of whether the Commission is interested in the SCRS/Secretariat being involved in the collection and analysis of Socio-economic information.
4.2	*Development and test bio-economic modelling approaches*	*Creation of a plan to apply bio-socio-economic modelling approaches.*	Sub-Com Stat	Dialogue meeting failed to advance the question of whether the Commission is interested in the SCRS/Secretariat being involved in the collection and analysis of Socio-economic information.

Discussion

The Committee thanked the SCRS Chair for reviewing the status of the plan and suggested that in 2018 particular attention should be given to prioritisation of the work to be carried out between 2018 and 2020. It was also suggested that the Science Strategic Plan be further developed to the 2020 and 2025 period.

18. Consideration of plans for future activities

18.1 Annual Work Plans

The Rapporteurs summarized the Work Plans for 2018 for the various Species Groups, the Working Group on Stock Assessment Methods, the Sub-Committee on Statistics and the Sub-committee on Ecosystems and By-catch. These Plans were adopted and are attached as **Appendix 12**.

18.2 Inter-sessional meetings proposed for 2018

Taking into account the assessments mandated by the Commission and the Committee's recommendations for research coordination, the proposed intersessional meetings for 2018 are shown in **Table 18.2**. The Committee noted that the schedule needs to maintain some flexibility in order to account for any changes that may result from the deliberations held by the Commission in November 2017 and the meetings scheduled by other RFMOs.

The European Union put forward an invitation to host the bigeye tuna stock assessment.

18.3 Date and place of the next meeting of the SCRS

The next meeting of the Standing Committee on Research and Statistics (SCRS) will be held in Madrid, Spain, from 1 to 5 October 2018; the Species Groups will meet from 24-28 September 2018 at the ICCAT Secretariat (Madrid, Spain).

Table 18.2. Proposed calendar of ICCAT scientific meetings in 2018.

	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	WED	THU	FRI	SAT	SUN
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				
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				
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	
																	BUM data prep																				
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						
			Small Tunas														MSE: BFT & N Atl-SWO							BET Data prep													
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			
										WGSAM																											
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	
										Ecosystems														BUM 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					
			Sharks														BET 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
																															SPECIES GROUPS						
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				
			SCRS Plenary																																		
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		
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						

The MSE (BFT & N-SWO) meeting schedule is tentative, pending on the agreement among the ICCAT GBYP Core Modelling Group members.

19. General Recommendations to the Commission

19.1 General recommendations to the Commission that have financial implications

Eastern and western Atlantic bluefin tuna

- The collection of hard parts and other tissue samples needs to be improved considerably. The Committee recommends that all CPCs institute biological sampling programmes designed to collect an adequate number of tissue samples in a representative fashion from all fishing fleets, and that the Commission establish an ad hoc working group to help coordinate those programmes. Consideration should be given to conducting an ageing workshop.

Albacore

- The Committee recommended that an independent peer-review of the MSE process and code used in setting the MP would be useful to get external approval on what has been done with the current (North Atlantic albacore and Atlantic bluefin tuna) and future MSEs being proposed (e.g. swordfish and tropical tunas). Possible candidate approaches would be the model used for CCSBT/IOTC with external reviewers from the field evaluating the procedure and technical modules used to design and evaluate the process. This would be of high priority for the albacore MSE and should be undertaken within the next few years. The Committee recommends that the Secretariat approaches the ABNJ project to inquire about the possibility of financial assistance.

- The Committee continues to recommend initiating an albacore research programme for North Atlantic albacore. Over a four year period, the research will be focused on three main research areas: biology and ecology, monitoring of stock status, and management strategy evaluation. The requested funds to develop this research plan have been estimated at a cost of 1.2 million Euros for a four year work plan. More details of the proposed research and economic plan are provided in the 2018 albacore work plan (**Appendix 12**).

- During the most recent series of scientific meetings of the Albacore Species Group, several countries with important albacore fisheries have not been represented at the meeting. This limited the ability of the Group to properly revise the basic fishery data and some standardized CPUEs that were submitted electronically. This continues to result in unquantified uncertainties, which affected negatively achieving the objectives of the meetings. To overcome this, the Committee continues to recommend that CPCs make additional efforts to participate and be made aware of capacity building funds available for participation in and contributing to Working Group meetings.

Tropicals

- The Committee recommends that, the combined historical "FIS" fishery (FRA+CIV+SEN, before 1991) be split in Task II (T2CE and T2SZ/CAS) and allocated to the respective CPC in the line of what was made in Task I catches in the past. The same break down is required (T2CE and CAS) for the combined tropical ETRO fisheries (NEI-ETRO combined fleet) affecting mainly purse seine before 2006. This task should be achieved before the next tropical tuna assessment.

- Bearing in mind that there is funding available to improve the Ghanaian statistics, the Committee reiterates the need for scientists from EU and Ghana to collaborate to adapt the T3 software, and encourages capacity building activities in African countries, particularly for Ghanaian scientists.

Billfishes

- In the recent marlin and sailfish stock assessments, it was indicated that one of the major uncertainties was in the catch estimates reported to ICCAT. It is suspected that small scale fisheries across the region are responsible for a portion of the unreported catches (Arocha *et al.*, 2015). Noting that in 2014, the Commission funded a strategic investment inventory for artisanal fisheries in West Africa contributing to reduce these uncertainties. The endeavor needs completion. Thus, it is a very high priority to conduct a comprehensive analyses of species-specific billfish catch and effort statistics from small scale (or artisanal) fisheries for both CPCs and non-CPCs operating in the western Atlantic, specifically in the Caribbean region where important artisanal fisheries target billfish species. The terms of reference for this endeavor are detailed in the 2018 billfish work plan.

- Noting the success of the recent sailfish CPUE standardization workshop, the Committee recommends that a similar workshop should be held for the proposed 2018 blue marlin stock assessment.

- During the 2011 blue marlin stock assessment an alternative model approach provided added confidence to the Committee determination of stock status. Consequently, the Committee expressed continued interest in exploring multiple model approaches, that fully exploit the currently collected data, and recommends that the Secretariat continue to support external expertise to assist the Committee with its modelling work using other modelling platforms, in preparation for the 2018 stock assessment.

Sharks

- *Porbeagle:* to be assessed in 2019; has large data gaps; important to start projects immediately so that results can be used in 2019 stock assessments (€30,000 for reproductive biology studies; €60,000 for movement, stock boundaries, and habitat characterization studies).

- *Shortfin mako:* first three years of SRDCP devoted to it; however, there will still remain uncertainties on some important biological parameters; genetics study to be completed with additional samples from the Mediterranean (€10,000).

Small tunas

- Continue with the ICCAT SMTYP Research Programme activities in 2018-2019 to further improve the biological information (growth and maturity) for the priority species (the details of this programme are given in the small tunas work pan for 2018-2019 (**Appendix 12**).

- The CPCs should make the necessary arrangements to ensure a large participation of their National scientists in the small tunas species group meetings (both intersessional and species group meetings).

- Extend the species description chapter (*ICCAT Manual*) for other small tuna species such as wahoo (*Acanthocybium solandri*), serra Spanish mackerel (*Scomberomorus brasiliensis*), West African Spanish mackerel (*Scomberomorus tritor*) and dolphinfish (*Coryphaena hippurus*), and if possible update of all other species chapters which were last updated in 2006, except for *Thunnus atlanticus*, which was updated in 2013.

North and South Atlantic swordfish

- *To SCRS plenary on research funding for a stock structure study*. Given new information on genetics, satellite archival tagging and early life history studies that has become available, and the uncertainties in the swordfish stock boundaries (N vs South, N vs Mediterranean, Atlantic vs Indian Oceans), the Committee recommends synthesizing existing information, and collecting additional critical new data (including tissue samples, size, sex and maturity information), in order to properly identify stock composition within the areas identified as mixing zones. The costs for the initial part of the study would be €180,000, specifically €80,000 for a population genetics study and €100,000 for the deployment of approximately 20 popup satellite archival tags. Such costs could be spread over a two year period as follows: €100,000 in 2018/2019 and €80,000 in 2019/2020. This recommendation applies to both the North and South Atlantic and Mediterranean stocks.

- *To SCRS plenary on the MSE timetable and funding*: Delivering MSE results for northern swordfish according to the schedule agreed upon by the Commission will be very challenging and require time and resources that are not presently available to the Group. The Committee recommended that the funding for the MSE for swordfish should be in addition to a proposed strategic research fund for the SCRS and that a detailed proposal to support the agreed North Atlantic swordfish MSE timetable, including costs, should be developed by the SCRS and presented to the Commission. The Committee expressed concern over the existing timeline for provision of the MSE to the Commission. This concern should be addressed in the proposal. Ideally such proposal would integrate the needs to conduct an MSE for tropical tunas, because it is likely that many CPC scientists would have to be involved in both, and draw on the experience of the albacore MSE.

Mediterranean swordfish

- Stock mixing and management boundaries: The Committee noted the need to further improve the current knowledge about stock boundaries between the Mediterranean and North Atlantic swordfish stocks. For this purpose, it was recommended to conduct collaborative and multidisciplinary research, including population genetics, electronic tagging, life history, and to use fine-scale (e.g. 1º squares) and quarterly sampling strata.

- Data recovery plan: The Group noted that the catch and CPUEs time series currently in use in the stock assessment models start in 1985. Therefore the early period of the fisheries, which accounted to increasing catches is not being accounted in the model. As such, the Committee recommended conducting a recovery of historical data, so that the entire history of the fishery is taken into account in the stock assessment models. Particular effort should be dedicated to collecting available information from the major fisheries of the early years, especially EU-Italy fisheries.

- Size and age at maturity: As there are ecological differences between the East and West Mediterranean, the Committee recommended that future work is conducted to explore possible differences in swordfish life-history at the spatial scale.

- Habitat use and availability to the different gears: The Group recommended the use of satellite tagging to provide information on habitat use for comparison of the availability of swordfish to the various fisheries, including comparisons between traditional and meso-pelagic longlines.

Sub-committee on Statistics

- The Committee recommends that the Commission provides the Secretariat with all the support needed to complete the online reporting system. In addition, the Committee recommends that the Commission 'Online reporting Working Group' be expanded to include members of the SCRS and statistical correspondents.

Sub-committee on Ecosystems and By-catch

With regard to Ecosystems:

- Given the large amount of work involved in implementing ecosystem based fisheries management in ICCAT and implementing related products such as Ecosystem Overviews, Ecosystem Assessment Reports and Ecosystem Report Cards, the Committee recommends that €20,000 of financial support be provided to support an external contractor to expedite this process.

With regard to by-catch:

- The Committee requests financial assistance to support the attendance of three to five CPC scientists during the seabird assessment process of ICCAT.

19.2 Other recommendations

Eastern and western Atlantic bluefin tuna

- Noting the divergent trends in the handline indices from the western Atlantic Ocean and the potential role of environmental factors, the Committee recommends that effort be directed towards both identifying environmental factors that affect catchability at basin and local scales and incorporating these factors in the index standardization. The potential for combining the data and creating a joint handline index should also be explored.

- The Committee recommended that paired hard parts be collected in both the East and West to help estimate the bias across all ages. Furthermore that production aging of the backlog of eastern and Mediterranean otoliths focus primarily on the gaps in size and spatio-temporal fishery(ies) representativeness. The effect of bin-size on age-length keys construction should be investigated.

Albacore

- The Committee recognized the lack of standardized CPUE data from the eastern Mediterranean as a potential source of uncertainty when assessing Mediterranean albacore. The Committee recommended the CPCs predominantly fishing in this area (EU-Cyprus, EU-Greece and Turkey) make a concerted effort to generate, and submit, standardized CPUE data. Likewise, the Committee supports the continuation of larval index data collection in the Balearic Sea and other spawning areas, and recommends further research into the use of larval indices to supplement fisheries dependent data in stock assessments. As for Atlantic albacore, the Committee recommended that the feasibility of joint South Atlantic albacore CPUE analyses for longline fleets (Brazil, Chinese Taipei, Japan and Uruguay) using fine scale, operational level data be explored, and to continue efforts to produce new standardized CPUE series from swordfish directed pelagic longline fisheries throughout the Atlantic.

- The Committee recommends to conduct a review and collation of all the available data on age-length from the various studies that have estimated age from spines with the view to update the estimate of the growth curve for Mediterranean albacore. It is also recommended that methods of accounting for selectivity in the year 1 cohort in von Bertalanffy growth function (VBGF) be explored to ensure accurate parameter estimation.

North and South Atlantic swordfish

- *To the WGSAM on CPUE standardisation methods.* For the WGSAM to provide guidelines on how and when to include interactions between years and other factors in the CPUE standardization. Also how to account for targeting effects (e.g. catch ratios, clustering of catch composition and other alternatives). To ask for guidance on how to interpret measures of variance associated with the index in the presence of different model structures, especially in the context of the use of these measures of variances in the process of population modelling (e.g. in the weighting of different CPUEs).

- *To CPCs on submission of data for use in the stock assessments.* All data to be used in the assessment, including Task I and II data, including discards and, when possible live releases, standardized CPUE series, new biological information, etc., should be available at least one week in advance of the data preparatory meetings.

- *To CPCs on target species.* All fleets should record detailed information on log records to quantify which species or species-group is being targeted. Compilation of detailed gear characteristics and fishing strategy information (including time of set) are very strongly recommended in order to improve CPUE standardization.

Mediterranean swordfish

- *Discards.* Recently adopted management measures may have increased discard levels, therefore the Committee noted that participating countries should improve their estimates of discards of juvenile swordfish, not only from the swordfish targeting fisheries but also from the albacore ones, and submit such information to the ICCAT Secretariat.

Tropicals

- *Regarding the AOTTP:*

  - The Committee recommends increasing the tag-seeding efforts, and noted that 4,500 tags were recommended by the AOTTP feasibility study for tag-seeding activities (e.g. 5-15 fish per trip). The Committee recognized that it is desirable to determine the tag reporting rates for all major gear types, and by main fishing area and/or landing port. The Committee also noted that tags should have metallic barbs since plastic dart tags often fall out when applied to dead fish.

  - The Committee strongly recommends additional efforts to improve recovery rates of tagged fish in the longline fleets, in particular Brazil, Canada, Chinese-Taipei, Japan, Mexico and the United States and EU. The Committee recommends that AOTTP personnel contact national observer programme coordinators to make them aware of the programme.

- *Observer coverage:* The Committee recommends increasing the minimum level of observer coverage to 20%. Noting that EMS can complement physical observer programmes and also collect other data that would be useful to the SCRS, the Committee considers that it would be useful to ensure that the different systems available conform to harmonized installation, data collection and reporting protocols, so as to ensure compatibility.

Billfishes

- Noting the severe challenges in interpreting and fitting indices within stock assessment models, it is recommended that National scientists of all CPCs coordinate their work to consider how to reconcile divergent CPUE patterns that may be a function of changes in fleet spatial distribution, oceanography, and/or targeting. Therefore, it is recommended that future assessments of billfish stock status include combined indices of fleets with similar operational characteristics, or that estimated indices be area specific indices of abundance.

- There is a need for research for determining levels of billfish post release mortality, so that the full effects of discards can be included in future stock assessments.

Sharks

- The WGSAM should develop guidelines and criteria for evaluating the plausibility of model scenarios, including model diagnostics that could lead to accepting or rejecting model results.

- Ask CPCs to provide catch statistics (including Task I, Task II, CPUE, and dead and alive discards) of all ICCAT fisheries, including recreational and artisanal fisheries, and to the extent possible non-ICCAT fisheries, capturing pelagic species. Renewed call for electronic and conventional tagging data to all CPCs conducting such research in the Atlantic.

Small tunas

- 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, the replacement of the carry overs, the split of "unclassified" gears by specific gear codes, and the completeness of Task I gaps identified.

- The Committee requests the help of the WGSAM in order to implement simulations to evaluate the robustness of candidate data-poor methods being proposed for providing management advice for small tunas. The Committee is also interested in using simulations to evaluate how to reduce uncertainty by improving specific fishery and biological data on small tunas. The WGSAM should also investigate the benefits and constraints of an approach based on multiple data poor methods, including providing guidance on how to provide statistical weights to the results of different methods for the purposes of combining all results into one. Furthermore, the Committee seeks the help of the WGSAM and the Secretariat in providing guidance about the reliability of the algorithms used in the R-framework used for data poor methods. Specifically, the Committee wants to know whether the WGSAM thinks that these algorithms have been sufficiently tested and reviewed, in spite of the fact they are not currently part of the ICCAT software catalogue.

Working Group on Stock Assessment Methods (WGSAM)

- *Albacore* - The Committee recognizes the need to incorporate environmental studies in albacore and other species assessments. The Committee was exposed to new information suggesting that the mixed layer depth might impact catchability of surface fisheries. The Committee recommends further research to confirm this, as well as to inspect sources of historical environmental information that might help integrate this information in CPUE standardizations of surface fisheries.

- *Sailfish* - Noting the severe difficulties in interpreting and fitting indices within stock assessment model, the Committee recommends work to consider how to reconcile divergent CPUE patterns that may be a function of changes in fleet spatial distribution, oceanography or targeting.

Sub-committee on Ecosystems and By-catch

With regard to Ecosystems:

- It is recommended that in future Species Working Group meetings there be a meeting between the Working Group Chairs and the Ecosystem Sub-Committee Conveners in order to discuss ecosystem related issues.

- Given the need to communicate the status of the unassessed and non-retained species caught by ICCAT fisheries as well as other components of the ecosystem that play a role in supporting the fisheries, the Committee recommends that the SCRS include an Executive Summary of the outcomes of the ecosystem assessments in the annual report of the SCRS.

- It is recommended that the next meeting of the Dialogue between Scientists and Managers Working Group (SWGSM) include an agenda item on the development of Ecosystem Report Cards to support the implementation of an EBFM framework for ICCAT.

With regard to by-catch:

- The Committee acknowledges that large circle hooks are proven to be effective in reducing sea turtle by-catch and might also increase post-release survival. The Committee also acknowledges that circle hooks have different impacts on both target and by-catch species. While they decrease marlin by-catch and swordfish catch rates, they increase tropical tuna and sharks catch rates. Taking into consideration the above scientific information, and that most sea turtle by-catch occurs on shallow longline sets, the Committee recommends the Commission to consider adopting for longline fisheries targeting swordfish and sharks at least one of the following mitigation measures:

  - the use of large circle hooks;
  - the use of finfish bait;
  - other measures considered effective by the SCRS.

- The Committee encourages National scientists to evaluate the overall impact of adopting mitigations measures on the management of the large pelagic fish community.

Sub-committee on Statistics

- The Committee reminds CPCs of their obligation to report total discards and live releases. The Committee also recommends that the SCRS explores ways to provide capacity building to those CPCs that need it to comply with the discard reporting requirements.

- The Committee recommends that the Commission provides the Secretariat with all the support needed to complete the online reporting system. In addition, the Committee recommends that the Commission 'Online reporting Working Group' be expanded to include members of the SCRS and Statistical correspondents.

20. Responses to Commission's requests

The Committee noted that some of the 2017 Responses to the Commission's Request have been carried over for several years running without a response from the Commission. The Committee recommends that a check list of Annual Responses to the Commission be prepared and submitted to the Commission. The Commission is requested to define which requests remain active for the next year (along with any further elaborations on the request) and which requests no longer require a response.

20.1 Ghana's comprehensive and detailed capacity management plan on the level of catches. Rec. 16-01, paragraph 12c

***Background**: [Rec. 16-01], paragraph 12c. Ghana shall be allowed to change the number of its vessels by gear type within its capacity limits communicated to ICCAT in 2005, on the basis of two baitboats for one purse seine vessel. Such change must be approved by the Commission. To that end, Ghana shall notify a comprehensive and detailed capacity management plan to the Commission at least 90 days before the Annual Meeting. The approval is notably subject to the assessment by the SCRS of the potential impact of such a plan on the level of catches.*

According to Rec. 16-01, Ghana is permitted to change the number of its vessels by gear type within its capacity limits communicated to ICCAT in 2005, on the basis of two baitboats for one purse seine vessel subject to the assessment by the SCRS of the potential impact of that plan on the level of catches. According to the ICCAT List of vessels over 20m, 17 purse seiners, 20 baitboats and 2 carriers were operated by Ghana in 2016.

The Group considered whether it was possible to determine if the fishing capacity by vessel gear type (i.e. purse seine, baitboat) remains consistent with the intent of Rec. 16-01, paragraph 12. The Secretariat confirmed that the data sets required to conduct that analysis have been submitted by Ghana, but noted that additional work is required to combine the datasets into a single format that can be used to support the necessary analyses. This work could not be conducted in time to respond to the Commission in 2017. The Group recommended that the Secretariat compile the data needed to support the analysis of Ghanaian fishing capacity in time to conduct these analyses in 2018.

20.2 Evaluate the efficacy of the area/time closure referred to in paragraph 13 in relation with the protection of juveniles of tropical tunas. Rec. 16-01, paragraph 15

***Background**: [Rec. 16-01] paragraph 15. As soon as possible and at the latest by 2018, the SCRS shall evaluate the efficacy of the area/time closure referred to in paragraph 13 for the reduction of catches of juvenile bigeye and yellowfin tunas. In addition the SCRS shall advise the Commission on a possible alternative area/time-closure of fishing activities on FADs to reduce the catch of small bigeye and yellowfin tuna at various levels.*

The current area/time closure was implemented for the first time in 2017. Although an analysis of preliminary 2017-Quarter 1 Task II data for the EU and associated fleets was presented to the Group, the Group noted that the official 2017 fisheries data are not required from CPCs until 31 July 2018. Therefore, the Group was not able to conduct analyses using the full dataset. Furthermore, additional years of data (beyond 2017) would be required to adequately assess the result of the closure, and those data will not be available until after the deadline provided by the Commission.

However, this year the SCRS reviewed historical data (2000-2012) to compare the catch from the area covered by the 2013 closure and the catch from the area covered by the current closure. The difference in FAD-associated bigeye catch between the two areas was minimal. In the SCRS response to the Commission in 2015 that addressed the efficacy of the 2013 closure, the Committee concluded it had not been effective in reducing the catch of juvenile bigeye and yellowfin to a measurable degree. As a result of the similarity in historical catch levels in the two areas, the analyses suggested that the 2017 closure would not be more effective than the 2013 closure.

Committee plans to conduct an evaluation of the effect of the moratorium on the mortality of juvenile tropical tunas in 2018. The work plan will include the elements listed below.

1. For addressing the request of the Commission on "alternative area/time closure of fishing activities on FADs to reduce the catch of small bigeye and yellowfin tuna on various levels" (Rec. 16-01 and 16-15), the Secretariat in collaboration with EU and Ghana scientists, coordinates the assembly of data required at the highest resolution possible, with information of catches, catch composition, size distribution, geographic (1x1) and monthly distributions of catch of tropical tunas from the main purse seine fleets. Additional data can be gather from the current AOTTP programme. The AOTTP Coordinator will collaborate with the SCRS Chair, and tropical species group leads to facilitate the inclusion of AOTTP data in the stock assessment of bigeye and the moratorium analyses to the extent possible.

2. Using data through 2016:

   a) Examine the catch, effort and size frequency (Task II) of yellowfin and bigeye tuna landed by surface fleets in the tropical Atlantic by 1x1 grid and month.

   b) Analysis of the historic surface fleet using purse seine fishery data in relation to the environmental parameters.

   c) Evaluate time/area closures that could achieve certain percentage reductions (10% to 50%) in the annual catches of juvenile yellowfin and bigeye tuna.

   d) Provide information on how these reductions will affect the projected stock status (i.e. SSB/SSB_{MSY} and F/F_{MSY}) and recovery schedule, and other measures as possible (e.g. YPR, SPR).

20.3 Review its 2016 recommendations on observer coverage and advise the Commission on appropriate coverage levels. Rec. 16-01, paragraph 42

Background: *[Rec. 16-01] paragraph 42. In 2017 the SCRS shall review its 2016 recommendations on observer coverage and advise the Commission on appropriate coverage levels for each tropical tuna fishery, taking in consideration the full suite of monitoring tools in the fishery.*

In the SCRS response to the Commission in 2016 on observer coverage it was noted that several studies (Lennert-Cody, 2001; Babcock *et al*., 2003; Sánchez *et al*., 2007; Amandè *et al*., 2012) suggest that sampling coverages of, at least, 20% would be necessary to provide reasonable estimates of total by-catch and the by-catch of common species. In the case of rare species, this percentage would need to be much higher at least 50% (Babcock *et al*., 2003). Thus, the SCRS continues to conclude that current required level of scientific observers (5%) seems to be inappropriate to provide reasonable estimates of total by-catch and recommends increasing the minimum level to 20%. Ideally analysis of by-catch rates should be fisheries specific and done by CPC scientists responsible for the observer programmes as recommended by the Sub-Committee on Ecosystems. However the Committee noted that the catch of common by-catch species that needs to be reported is already required under Rec. [03-13].

The SCRS reiterates also its recommendation from 2016 on Electronic Monitoring Systems (EMS) which are already being used by some tropical tuna purse seine vessels. Noting that EMS can complement physical observer programmes and also collect other data that would be useful to the SCRS, the Committee considers that it would be useful to ensure that the different systems available conform to harmonized installation, data collection and reporting protocols, so as to ensure compatibility. The Committee recommends that tropical tuna purse seine fleets or CPCs wishing to voluntarily implement EMS follow the guidelines described in Ruiz *et al.* 2017. This source of information would help improve current coverage of observer data in tropical tuna fisheries.

Information relevant for the preparation of this response was only made available for the tropical tuna purse seine fishery which currently has the highest observer coverage amongst ICCAT fleets. As a result, this response is limited to this fishery. It is noted, however, that longline fisheries also target tropical tunas and may have high by-catch rates but this information was not made available to the Working Group. Baitboat fisheries also target tropical tunas, although by-catch is generally thought to be small, but this information comes from landings, not observers. Artisanal fisheries including gillnets/troll and handline also catch tropical tunas while fishing for other species, but by-catch information for these fisheries are extremely limited and come only from landings. Some of the more general points in this response, such as on reducing tuna discards, can also be applicable to these fisheries.

20.4 Recommendations made by the FAD Working Group (Annex 8) and develop a work plan. Rec. 16-01, paragraph 49 (a)

Background: *[Rec. 16-01] paragraph 49(a). At its 2017 meeting the SCRS shall address to the extent possible the Recommendations made by the FAD Working Group in 2016 (Annex 8) and for the remaining ones develop a work plan to be presented to the Commission at its 2017 Annual meeting.*

During the 2017 meeting of the tropical tuna Species Group recommendations made by the FAD working group in 2016 were considered, but not those developed by the FAD working group in 2017.

Some actions recommended by the FAD working group in 2016 have already been incorporated into the work plans of the SCRS Tropical Tuna Species Group and Sub-Committee of Statistics. The SCRS, however, has not yet developed a work plan to comprehensively address all the recommendations of the Ad hoc Working Group on FADs. Although many of these actions are relevant to the Tropical Tuna Species Group, others are relevant to the Billfish and Sharks Species Groups and the Sub-Committees on Ecosystems and Statistics. The SCRS Chair, with the help of the rapporteurs of tropical tunas, billfish, sharks, Sub-Committees on Statistics and Ecosystems will prepare, before the end of 2017, a FAD research work plan to coordinate the SCRS response to the recommendations made by the ICCAT FAD working group. This work plan will be reviewed by the appropriate working groups and subcommittees during the intersessional meetings in 2018 and reviewed by the SCRS in plenary in 2018.

20.5 Provide performance indicators for skipjack, bigeye and yellowfin tuna, with the perspective to develop management strategy evaluations for tropical tunas. Rec. 16-01, paragraph 49 (b)

Background: *[Rec. 16-01] paragraph 49(b). At its 2017 meeting the SCRS shall provide performance indicators for skipjack, bigeye and yellowfin tuna as specified in Annex 9, with the perspective to develop management strategy evaluations for tropical tunas.*

After reviewing the indicators developed by ICCAT and those developed by other tRFMOs, the Group agreed that performance indicators developed for North albacore (see *Report of the Second Intersessional meeting of Panel 2*, Anon. 2017b) can be used as an initial list for tropical tunas and that the future of MSE simulation framework should be able to calculate all of them.

The Group noted that the summary advice to the Commission should use only one indicator for each of the main categories, as was the case for northern albacore. These four specific indicators selected for tropical tunas are likely to be different than those used for albacore because there is at least one stock (bigeye) that needs rebuilding. It is therefore important to select one indicator that helps evaluate the success of rebuilding. These summary indicators can be different for different stocks.

The Group agreed that it would be better if indicators that reflect recruitment overfishing and growth overfishing were also incorporated to the list as has been proposed by the SCRS for swordfish. This relates to the fact that, in the past, the Commission has expressed that they are concerned about the sizes of fish that are caught and how these sizes affect maximum sustainable yield.

Although the Group agreed that it would be ideal to have some performance indicators relating to multispecies considerations it would need guidance from the Commission on what multispecies objective(s) the Commission has, if any. These indicators would need to be derived in a way that takes care of fishery, interactions between stocks and possibly biological interactions. Alternatively, the Commission will have to consider tradeoffs by examining species specific objectives for all stocks at the same time, for example if a single species control rule triggers an action, the action will affect all stocks. In their reports to the Commission the SCRS will provide summaries for each stock and all four indicators, and for each indicator for all stocks.

20.6 Develop a table that quantifies the expected impact on MSY, B_{MSY}, and relative stock status for both bigeye and yellowfin resulting from reductions of the individual proportional contributions of major fisheries to the total catch. Rec. 16-01, paragraph 49 (c)

Background: *[Rec. 16-01] paragraph 49(c). At its 2017 meeting the SCRS shall develop a table for consideration by the Commission that quantifies the expected impact on MSY, B_{MSY}, and relative stock status for both bigeye and yellowfin resulting from reductions of the individual proportional contributions of longline, FAD purse seine, free school purse seine, and baitboat fisheries to the total catch.*

The Group plans to conduct an analysis that will directly respond to this request in 2018 (see the work plan).

The Group also noted that the most recent stock assessments of bigeye and yellowfin tunas demonstrate that current MSY may be below what was achieved in past decades because overall selectivity has shifted to smaller fish (**Figure 1 and 2**). In addition, the assessment of bigeye also indicated that as the potential MSY has decreased over time the spawning stock biomass required to produce this MSY has increased (**Figure 1**). Similar results were reported for analyses conducted on bigeye in the Pacific Ocean (WCPFC-2013–WGTT/10).

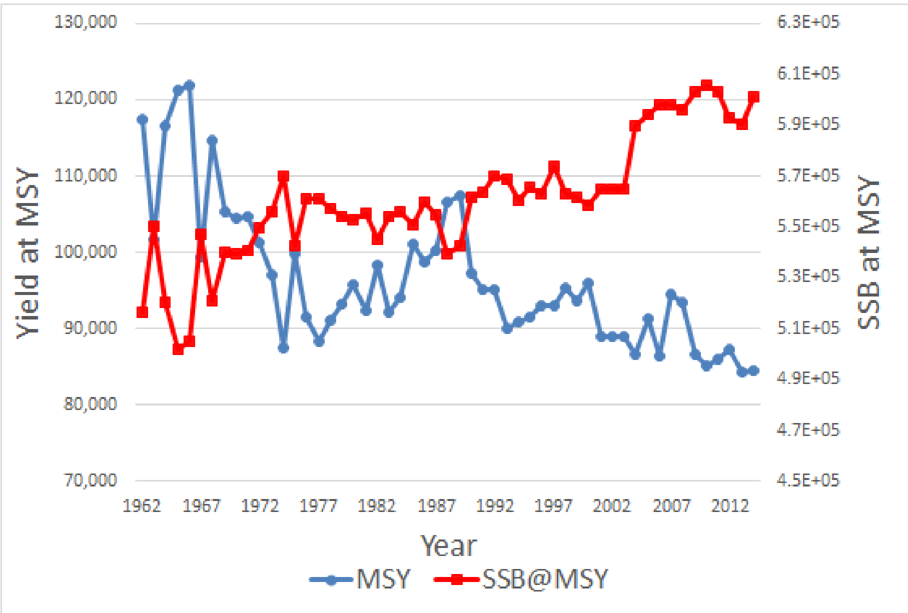


Figure 1. Year/selectivity specific maximum sustainable yield (MSY) and spawning stock biomass (SSB) required to produce that maximum sustainable yield for bigeye tuna.

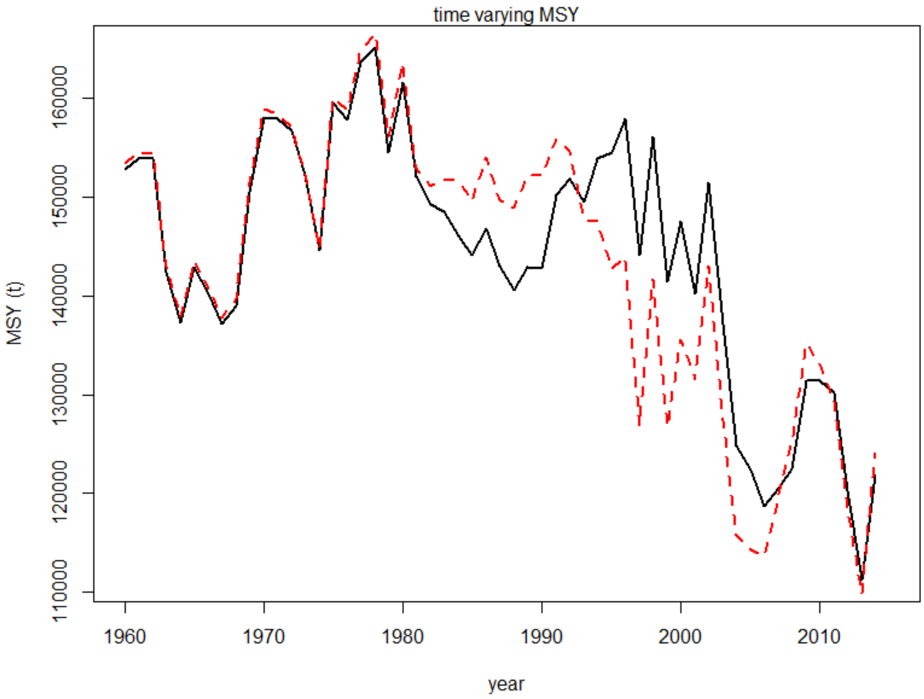


Figure 2. MSY for yellowfin tuna estimated annually from an age structured stock assessment (SS) using cluster 1 and 2 indices.

20.7 Evaluate the contribution of by-catches and discards to the overall catches in ICCAT tropical tuna fisheries, on a fishery by fishery basis. Rec. 16-01, paragraph 53

Background: *[Rec. 16-01] paragraph 53. The SCRS shall evaluate the contribution of by-catches and discards to the overall catches in ICCAT tropical tuna fisheries, on a fishery by fishery basis and advise the Commission on possible measures allowing to reduce discards and to mitigate onboard post-harvest losses and by-catch in ICCAT tropical tuna fisheries.*

Following the ICCAT Glossary the Group consider by-catch to imply species that are not targeted, and discards as all species/sizes that are not retained. In this report, it is assumed that the target of the purse seine fishery are skipjack, yellowfin and bigeye that are landed. For the purpose of this response we are considering this to be the catch of BET+YFT+SKJ that are discarded at sea, plus the catch of all other species (by-catch), whether discarded or not.

According to one recent study on EU purse seine by-catch and discards for 2010-2016, in average, overall by-catch in the purse seine fishery is 113.8 tons and 26.3 tons per every 1,000t of bigeye, yellowfin and skipjack landed in FOB and FSC sets, respectively. An average, 13% of the by-catch results from FSC sets and 87% from FOB sets. The majority of the by-catch consists of tunas: BET+YFT+SKJ that are discarded at sea (21% and 22% in FOB and FSC sets, respectively), and other tuna species[1] that are either retained or discarded (56% and 40% in FOB and FSC sets, respectively) (**Table 1**). While overall by-catch is higher in floating object sets than it is in free school sets, this is not always the case for different species groups. For instance, by-catches of billfishes, sharks and rays are of similar magnitude in FOB and FSC sets (**Table 2**).

[1] “The group “Other tunas” consider all tuna species other than SKJ, YFT and BET.”

Table 1. By-catch tones per 1000 t of production (BET + YFT + SKJ landed) by species group and fishing mode for the period 2010-2016. Convert to average over period 2010 – 2016.

	2010	2011	2012	2013	2014	2015	2016	Average
FOB								
Billfishes	2.82	1.93	2.53	1.62	1.89	1.95	2.03	2.11
Other bony fishes	13.26	15.08	27.06	18.55	16.85	26.08	29.77	20.95
Rays	0.12	0.15	0.94	0.85	0.28	0.16	0.47	0.42
Sharks	1.97	2.78	1.18	4.48	5.14	5.09	5.69	3.76
Target tunas	13.78	22.08	57.17	25.55	32.93	18.65	12.61	26.11
Other tunas	92.89	30.95	71.15	47.26	51.29	57.19	70.93	60.24
Turtles	0.46	0.10	0.42	0.23	0.25	0.14	0.37	0.28
FSC								
Billfishes	2.03	1.56	2.23	1.23	0.82	0.83	0.78	1.35
Other bony fishes	1.79	0.52	2.96	0.30	0.16	0.33	0.37	0.92
Rays	0.58	0.22	0.27	0.56	0.14	0.26	0.56	0.37
Sharks	2.81	1.06	0.07	5.55	3.28	10.73	11.43	4.99
Target tunas	1.12	33.58	1.64	1.23	1.62	9.49	4.00	7.53
Other tunas	26.36	0.54	14.27	2.63	4.68	20.99	7.30	10.97
Turtles	0.27	0.18	0.37	0.14	0.15	0.11	0.14	0.19

Table 2. Estimated contribution of each taxonomic group to the total by-catch (percentage) by fishing mode for the period 2010-2016 The contribution of each fishing mode to the total bycatch is also presented in the column headers.

	2010	2011	2012	2013	2014	2015	2016	Average
FOB	83%	80%	92%	94%	95%	81%	86%	87%
Billfishes	2%	2%	2%	2%	2%	2%	2%	2%
Other bony fishes	8%	18%	16%	15%	15%	24%	26%	17%
Rays	0%	0%	0%	1%	0%	0%	0%	0%
Sharks	1%	4%	1%	4%	4%	5%	5%	3%
Target Tunas	9%	23%	27%	27%	34%	16%	11%	21%
Other Tunas	80%	54%	54%	51%	45%	54%	56%	56%
Turtles	0%	0%	0%	0%	0%	0%	0%	0%
FSC	17%	20%	8%	6%	5%	19%	14%	13%
Billfishes	6%	6%	8%	12%	7%	2%	3%	6%
Other bony fishes	5%	2%	29%	2%	2%	1%	1%	6%
Rays	2%	1%	1%	5%	1%	1%	2%	2%
Sharks	8%	3%	0%	43%	33%	26%	47%	23%
Target Tunas	3%	86%	5%	9%	13%	21%	16%	22%
Other Tunas	76%	2%	53%	27%	42%	50%	29%	40%
Turtles	1%	1%	3%	1%	1%	0%	1%	1%

In total 10,184 number of sets were observed during the time period. There were 163 whale shark interactions that were released alive, almost always before the retrieval of the net. 202 cetacean interactions (13 dolphins, 189 whales) were reported by observers during the whole studied period the majority (177) of which were in Free School Sets. All of them were released alive, almost always before the retrieval of the net. There were 1,228 sea turtle interactions with 11 being discarded dead and 1,217 discarded alive, with more of these encounters occurring in FOB sets.

The SCRS has used the species composition for target species from the EU purse seine as a proxy for other purse seine fleets. This has not been done for by-catch previously but it seems reasonable to assume that the by-catch species composition may also be very similar between purse seine fleets. Discarding practices and handling practices may, however, differ significantly and so cannot be extrapolated from EU purse seine information.

20.8 Advise the Commission on possible measures allowing to reduce discards and to mitigate onboard post-harvest losses and by-catch in ICCAT tropical tuna fisheries. Rec. 16-01, paragraph 53

Background: *[Rec. 16-01] paragraph 53. The SCRS shall evaluate the contribution of by-catches and discards to the overall catches in ICCAT tropical tuna fisheries, on a fishery by fishery basis and advise the Commission on possible measures allowing to reduce discards and to mitigate onboard post-harvest losses and by-catch in ICCAT tropical tuna fisheries.*

One way to reduce discards is to prohibit them. IATTC, IOTC and WCPFC have adopted management measures that prohibit the discarding of bigeye, yellowfin and skipjack in the purse seine fishery, except if the fish are unfit for human consumption or in case of insufficient well space during the last set in a trip. The Commission could consider adopting a similar measure for ICCAT PS fisheries which could improve catch statistics and may also have socio-economic benefits (e.g., for food security). It has been shown that there are local markets with high demand for these discards from tuna purse seiners in the main landing ports in West Africa i.e. Abidjan, Tema and Dakar (Amandè *et al*., 2016a, Amandè *et al*., 2016b). Therefore, retaining these discards probably offers more shared benefits from a social and economic point of view than the reverse. Prohibiting discards of other species is also an option, although its implementation may be more difficult due to considerations of well space and species sorting onboard For other fisheries, information such as estimates of total dead and live discards by fleet and gear type, is required to quantify the levels and nature of discarding before clear advice can be provided on discard reduction.

CPCs could also consider other measures, e.g. market incentives, to increase utilization and reduce discards for all tropical tuna fisheries. Utilization already takes place in West Africa. Socio-economic studies of these markets could lead to the identification of mechanisms to enhance them or to implement them in other ports where purse seiners land their catches. Workshops that involve PS skippers have proven to be useful in providing direct feedback on possible discard reductions and incentives for retaining all catches.

Since discards and the catch of certain by-catch species is generally higher in FOB sets, the limitation of FADs fishing effort such as the measures defined in Rec. [16-01] is an indirect way to reduce discards and mitigate by-catch. Studies of the volume of non-tuna species aggregated under FADs suggest that it largely independent of the amount of tuna species present (Dagorn *et al.*, 2012). Thus, avoiding sets with low aggregated biomass will result in relatively higher tuna catches and lower bycatches. However, this may be difficult to regulate in practice. Finally, research is underway to develop acoustic means to discriminate species and sizes of fish aggregated under FADs. Once developed, this technology could be used in echosounder buoys to help fishing masters decide on fishing strategies that reduce unwanted catch.

Various measures to mitigate by-catch of vulnerable species (e.g. elasmobranchs, marine turtles) have been effectively tested and implemented at-sea. These include, the use of non-entangling FADs, release of sharks and turtles from deck, release of sharks from the net before hauling, use of acoustic technology information to help skippers identify the proportion of bigeye and yellowfin tunas compared to skipjack tuna at FADs (Restrepo *et al.,* 2016). The aforementioned methods have proven to be successful in reducing by-catch and/or associated mortality. The Commission should consider some combination of these measures in order to mitigate by-catch. In some cases it is noted that recommendations already exist that include a variety of these measures.

For longline fisheries, the SCRS notes the 2017 recommendation from the Sub-committee on Ecosystems which states that large circle hooks are proven to be effective in reducing sea turtles bycatch and might also increase post-release survival. It is also acknowledged that circle hooks have different impacts on both target and by-catch species. While they decrease marlin by-catch and swordfish catch rates, they increase tropical tuna and sharks catch rates.

Taking into consideration the above scientific information, and that most sea turtle by-catch occurs on shallow longline sets, the Sub-committee recommended the Commission to consider adopting for longline fisheries targeting swordfish and sharks at least one of the following mitigation measures:

1. Use of large circle hooks
2. Use of finfish bait
3. Other measures considered effective by the SCRS

The use of circle hooks have also been advocated and adopted for some billfish species (e.g. Rec. 16-11 for sailfish).

Safe handling of sea turtles on longliners is already advocated in Rec. [13-11]. Recs [11-08], [10-08] and [09-07] for silky, hammerhead and thresher sharks respectively require CPC vessels flying their flag to promptly release these sharks unharmed, either when they come alongside the vessel, or in some cases at the latest before putting the catch into the fish holds, giving due consideration to the safety of crew members. The use of monofilament instead of steel traces or leaders are also known to be effective to reduce shark by-catch in longliner fisheries.

For other fisheries, information such as by-catch rates by species and mitigation studies by fleet and gear type, is required to quantify the levels and nature of by-catch before clear advice can be provided on by-catch mitigation.

20.9 Provide information and guidance on enhancing efforts to address any deficiencies identified regarding fisheries for which biological sampling rates that should be increased and fisheries for which improvements in the collection and/or provision of statistical data are necessary to support the stock assessment. SCRS to report efforts made to enhance biological sampling activities. Rec. 16-08, paragraph 20

Background: *Rec. [16-08] paragraph 20 states that CPCs that harvest Atlantic bluefin tuna should contribute to the research being undertaken through ICCAT's GBYP. Based on analysis at the 2017 Bluefin Tuna Data Preparatory meeting, the SCRS will (a) identify existing Atlantic bluefin tuna fisheries for which biological sampling rates should be increased, (b) identify any such fisheries for which improvements in the collection and/or provision of catch, effort, and/or size data are necessary to support the stock assessment, and (c) provide information and guidance to CPCs and the Commission in 2017 on enhancing efforts to address any deficiencies identified in (a) and (b) above. CPCs should make or continue special efforts to enhance biological sampling activities in Atlantic bluefin tuna fisheries, and SCRS will report to the Commission in 2017 on these efforts. In addition, it is important to continue to explore sampling and/or other approaches for enhancing, and where needed developing, accurate abundance indices for juvenile bluefin tuna. CPCs should also make special efforts to ensure complete and timely submission of any collected data to the SCRS.*

The Committee evaluated the available biological samples from the point of view of developing age-length keys and identifying stock of origin. Although a number of tissue samples (muscle, fin spines or otoliths) have been collected in recent years through the GBYP and various other efforts, most of these appear to have been collected opportunistically or according to sampling plans that are not designed to represent all of the major fishing areas over the entire fishing season. There seems to be little coordination among programs and few, if any CPC's have regulations in place that require the fishing industry to make their catch available to samplers. The Committee recommends a sampling plan be developed that includes minimum of 200 bluefin tuna tissue samples per year from each major fleet, to be collected in a representative fashion with respect to season and area fished. The Committee also recommends the formation of an oversight body (perhaps an ad hoc working group) that will coordinate the sampling and processing to ensure that targets are being met and that the resulting data is maintained.

20.10 The SCRS shall review new available information related to the identification of specific spawning times and areas of bluefin tuna within the western Atlantic Ocean, and advise the Commission on the results for its consideration. Rec. 16-08, paragraph 23

Background: *Rec. [16-08] paragraph 23 requests that as part of the 2017 stock assessment, the SCRS shall review new available information related to the identification of specific spawning times and areas of bluefin tuna within the western Atlantic Ocean, including from those CPCs that harvest western Atlantic bluefin tuna, and advise the Commission on the results of this review for its consideration.*

The SCRS reviewed the information available for additional spawning areas in the western Atlantic. Data are already available in the literature (Mather *et al*., 1995), reporting the presence of larvae outside the main spawning area of the Gulf of Mexico between 1959 and 1970, specifically off Carolinas, Maryland and New Jersey (Watson and Matter, 1961), and these findings were linked to the possible presence of a spawning area along the eastern US coast.

During the last 15 years, several electronic tags showed the presence of adult spawners along the western Atlantic coast (in a large area between the northern Florida and Massachusetts, USA) during the spawning seasons but there was no evidence of spawning. More recent evidence was provided by Richardson *et al*. (2016), reporting again several bluefin tuna larvae found along the western Atlantic, in the Slope Sea area (East US coast). According to the authors, these larvae were surely born outside the Gulf of Mexico, possibly in the Slope Sea or in the nearest southern part of the area. For better understanding the possible spawning in this area, the ICCAT GBYP released a contract in 2017 for studying the sexual maturity of the bluefin tuna in this area and the results will be available on February 2018.

According to both Mather *et al.* (1995) and Richardson *et al.* (2016), the bluefin tuna spawning along the eastern US coast are mostly medium-size fish, smaller than those spawning in the Gulf of Mexico. Richardson *et al.* (2016) reported a size range for the spawners in the Slope Sea between 133 and 212 cm FL. Even the spawning season in this area is different, from early June to early August, but the oceanographic conditions are suitable for spawning. The paper by Druon *et al*. (2016) does not include the eastern US coast within the potential spawning areas for bluefin tuna identified by the habitat model; on the opposite, the model identified the Azorean areas as a potential spawning area.

Both the genetic and micro-chemical analyses carried out by the ICCAT GBYP in the last years also revealed that a non-negligible percentage of bluefin tunas in the western area has characteristics different from the WBFT and the EBFT and this might be possibly correlated also to additional spawning areas in the Atlantic Ocean.

20.11 Provide guidance on a range of fish size management measures for western Atlantic bluefin tuna and their impact on yield per recruit and spawner per recruit considerations. To comment on the effect of fish size management measures on their ability to monitor stock status. Rec. 16-08, paragraph 27

Background: *Rec. [16-08] paragraph 27 requests the SCRS to provide guidance on a range of fish size management measures for western Atlantic bluefin tuna and their impact on yield per recruit and spawner per recruit considerations; and also to comment on the effect of fish size management measures on their ability to monitor stock status.*

The Committee reviewed yield-per-recruit calculations in 2012 using various selectivity patterns by gear based on the 2010 assessment results, and for decreased selectivity pattern by up to 40% for ages 1 to 6 for the whole fishery based on the 2012 assessment results. The Committee recognized that Y/R and SSB/R could be improved by changing the selectivity pattern (decreasing the selectivity of ages 1-6 by 40% resulted in only modest improvements), but this would imply allocation changes with implications beyond strict Y/R and SSB/R considerations. In addition, the Committee was concerned that such changes in selectivity would affect the availability and utility of indices of stock sizes currently used in the assessment. Furthermore, regulations to decrease the catches of ages 1 to 6 bluefin tuna may have unintended negative consequences such as increased discard mortality, which may be difficult to monitor, and changes due to reallocation of effort which may be difficult to predict.

The Committee reiterates last year's request for the Commission to clarify whether it requires further analyses.

20.12 Mauritania will conduct research activities in cooperation with an ICCAT CPC of its choice, and will be subject to the presentation of a specific programme to the SCRS. The result will be made available to the Commission. Rec. 14-04, paragraph 5

Background: *Rec. [14-04] paragraph 5 states in its footnotes that under this quota Mauritania will conduct research activities that will be reviewed by SCRS by the end of 2017. Such activities will be conducted in cooperation with an ICCAT CPC of its choice and will be subject to the presentation of a specific programme to the SCRS. The result will be made available to the Commission.*

The Committee did not receive any report related to research activities conducted by Mauritania, either alone or in collaborations with an ICCAT CPC of its choice, related to bluefin tuna caught under this quota.

20.13 Provide the Commission with the confirmed average round weight and gilled and gutted weight, corresponding to the LJFL of 100 cm. Rec. 16-05, paragraph 16

Background: *Rec. [16-05] paragraph 16. Request prior to the 2017 Annual meeting, SCRS shall provide the Commission with the confirmed average round weight and gilled and gutted weight, corresponding to the LJFL of 100cm.*

The Table below indicates mean weight estimates corresponding to 100cm LJFL, based on large integrated data sets from various Mediterranean areas. Estimates are based on Tserpes *et al.,* 2017 and the relevant equations provided below. As there are important spatial and temporal variations, the 95% confidence intervals of the corresponding estimates are also included (in parenthesis).

Weight type	Estimate (kg)
Gilled-Gutted (GG)	11.06 (9.86-12.37)
Gutted (GW)	11.68 (10.44-13.03)
Round (RW)	12.61 (11.24-14.10)

Length-weight relationships:

$$GG = 0.00000843 \times LJFL^{3.059}$$

$$GW = 0.00000645 \times LJFL^{3.129}$$

$$RW = 1.14 \times GG$$

Where, LJFL is the Lower-jaw fork length (cm); GG is the gilled and gutted weight; GW is the gutted weight; and RW is the round weight.

20.14 Continue to monitor and analyze the effects of the minimum size measure on the mortality of immature swordfish. Recs. 16-03, paragraph 10 and 16-04, paragraph 7

Background: *Rec. [16-03] paragraph 10 and Rec. [16-04] paragraph 7. The SCRS should continue to monitor and analyze the effects of this measure on the mortality of immature swordfish.*

There are two minimum size options that are applied to the entire Atlantic: 125 cm LJFL with a 15% tolerance, or 119 cm LJFL with zero tolerance and evaluation of the discards.

Since the implementation of the minimum landing sizes in 2000, the estimate of percentage of swordfish less than 125 cm LJFL reported landed (in number) 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 and decreased to 13% in 2015 (**Figure 1**). Starting in 1990, the cumulative percentage of the size classes has shown a shift to larger size classes in the North Atlantic, but to slightly smaller sizes in the South (**Figure 2**). The Committee notes that these estimations are highly unreliable and will be biased unless CPCs fully report size samples from the entire catch.

The Committee recently reviewed several studies on swordfish hooking mortality that have showed that the values are very high, in particular for small swordfish. Specifically, for some surface longline gears, the estimates of hooking mortality for specimens <125 cm LJFL ranged between 78-88%, with the post-release mortality of specimens discarded alive unknown. The low survival of discarded swordfish opens the question as to whether the minimum retention sizes currently in place are effective in protecting juvenile swordfish. However, the Committee also noted that minimum size regulations imposed by some CPCs has led to avoidance of areas of high concentration of small swordfish. Implementing other strategies to protect juvenile swordfish such as time/area closures of juvenile hotspots or gear modifications will need completeness of datasets on fishing effort and size data over the entire Atlantic, and should take into account the effects on other species. In view of the Commission objective to protect small swordfish, the Committee therefore recommended that future work should be carried out to determine more precisely the effort, size and sex distribution of undersized swordfish in the Atlantic, using high resolution observer data.

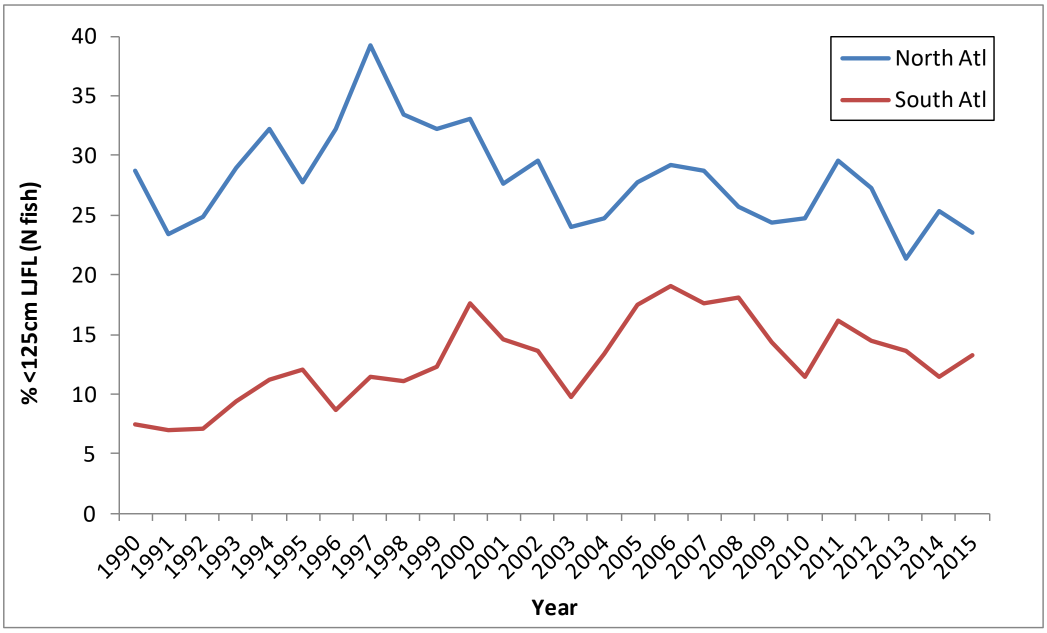


Figure 1. Trends of the % of the swordfish catch (in number of fish) estimated to be smaller than 125 cm LJFL, between 1990 and 2015 for the North and South Atlantic swordfish stocks. Data from the swordfish catch-at-size estimations.

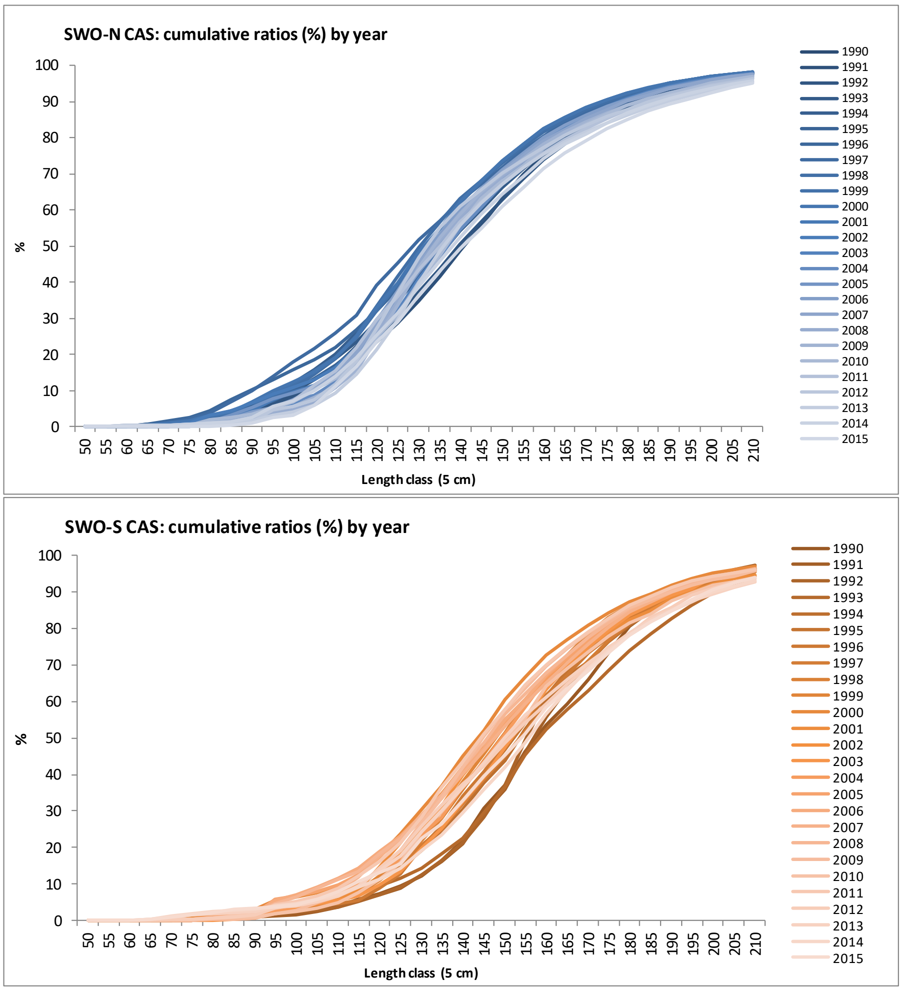


Figure 2. Cumulative % of fish (in number) per size class (5 cm LJFL) estimated for the North and South Atlantic swordfish, between 2000 and 2015. Data from the swordfish catch-at-size estimations.

20.15 Develop a new data collection initiative as part of the ICCAT Enhanced Program for Billfish Research to overcome the data gap issues. Rec. 15-05, paragraph 10 and Rec. 16-11, paragraph 3

Background: *Rec. [15-05] paragraph 10. Request the SRCS to review the data on dead and live discards submitted by CPCs to determine the feasibility of estimating fishing mortality by commercial fisheries, recreational, and artisanal fisheries.*

A preliminary revision of Task I Discards (DD:dead; DL:alive) of the major billfish species provided by the Secretariat showed that since 2006, only two CPCs (Mexico and U.S.A.) have consistently reported dead and live discards for all major billfish species throughout the time period revised (2006-2015). The rest of the seven CPCs that report DD and DL, do not have discard information for the complete time period reviewed. The review conducted does not allow the Committee to determine the feasibility of estimating fishing mortality by commercial, recreational, and artisanal fisheries. If more complete data on discards is provided before the 2018 Data preparatory meeting, the upcoming 2018 blue marlin assessment may provide a better insight in the estimation of fishing mortality by gear from discards.

***Background:** Rec. [15-05] end of paragraph 10, and Rec. [16-11] paragraph 3. Request the SCRS to develop a new data collection initiative as part of the ICCAT Enhanced Program for Billfish Research to overcome gaps in fisheries catching billfish, particularly in artisanal fisheries.*

In order to devise a new data collection initiative as part of the ICCAT Enhanced Program for Billfish Research to overcome data gaps in fisheries catching billfish (directed or as by-catch), particularly in artisanal fisheries, a comprehensive study of strategic investments related to artisanal fisheries data collection in ICCAT Fisheries is required. The requirement was partially fulfilled with an inventory of artisanal fisheries in the West Africa Region, but is not complete due to the absence of a similar study for the Latin America/Caribbean Region, despite the reiterative requests made by the Committee to commit funds to complete such study in the Latin America/Caribbean Region.

As it was stated recently by the Committee, in its response to the Commission on the evaluation of data deficiencies, the Committee noted the potential existence of non-reported billfish catches from the Latin America/Caribbean Region, likely due to the development of moored FAD fisheries in some Caribbean countries over the past decades, and the non-reported catches in recent years from countries that previously reported billfish catch data to ICCAT. This situation puts the Committee in a position in which it cannot determine if these data deficiencies are related to declines in effort or to lack of reporting. In order to overcome this uncertainty, a comprehensive study of strategic investments related to artisanal fisheries data collection in the Latin America/Caribbean Region is warranted urgently. The terms of reference are detailed in the 2018 Billfish Work Plan.

A comprehensive study of strategic investments related to artisanal fisheries data collection in ICCAT Fisheries in the Caribbean Region is a necessary next step to respond to the Commission's desire to overcome data gaps in fisheries catching billfish, particularly those from artisanal fisheries, and improve future stock assessments and the quality of management advice to be provided. The proposed study is also consistent with the SCRS Strategic plan for 2015-2020.

20.16 Refine the testing of candidate reference points (e.g. $SSB_{THRESHOLD}$, SSB_{LIM} and F_{TARGET}) and associated harvest control rules (HCRs) that would support the management objective expressed in paragraph 2 of Rec. 16-06. The SCRS shall also provide statistics to support decision-making in accordance with the performance indicators in Annex 2. Rec. 16-06, paragraph 11

***Background:** Recommendation [16-06] paragraph 12 requires the SCRS in 2017 to refine the testing of candidate reference points (e.g., $SSB_{THRESHOLD}$, SSB_{LIM} and F_{TARGET}) and associated harvest control rules (HCRs) that would support the management objective expressed in paragraph 2 above. The SCRS shall also provide statistics to support decision-making in accordance with the performance indicators in Annex 2.*

The results of the HCRs evaluated under the MSE framework are included in the albacore Executive Summary. Additional information about the MSE can be found in the detailed report of the 2017 albacore species group intersessional meeting. All eight HCRs meet the objective to be in the green quadrant of the Kobe Plot with > 60% probability, and the results are presented in a simple manner to allow the Commission to consider the main tradeoffs between HCRs.

In the Executive Summary, a single performance statistic is chosen for each of the main objectives (namely stock status, safety, stability and catch). Additional performance statistics (as in Annex 2 of Rec. [16-06]) are shown in the **Table 20.16**. For instance, the probability to be between SSB_{lim} and SSB_{thr} has been selected for the plots in the Executive Summary since this indicator showed more contrast between HCRs than e.g. the probability to be below SSB_{lim}, which is very low in all cases. Likewise, some performance statistics related to safety (namely the probability to shut down or the maximum % change in TAC) showed clear contrast between HCRs with and without bounds in the 20% δTAC.

The Committee noted that the performance statistics reflected in **Table 20.16** are medians of the performance statistics across all the 132 OMs. As such, they allow to compare the relative performance of such HCRs under the OMs considered. However, it should be clarified that they do not necessarily reflect the conditions that will prevail if any of the HCRs is adopted. In the future, the Committee could produce additional performance statistics upon request by the Commission (e.g. the percent of OMs that meet the objective under each HCR).

Table 20.16. Performance of eight HCRs, according to the performance statistics defined by Rec. 16-06 Annex 2. The combination of the target fishing mortality (F_{TAR}), Biomass threshold (B_{THRESH}) and the type of stability clause defines the HCR. Two stability clauses were considered: (SC1) maximum change in TAC of 20% always applied from one 3-year management period to the next while also always imposing a 15,000-50,000 t min-max TAC; and, (SC2) same as SC1 but not restricting TAC reductions and not imposing a minimum TAC when $B<B_{THR.}$. Each HCR has a unique identification number in this table and in Figure 12 of the Atlantic Albacore Executive Summary.

HCR				Stock Status	Safety	Catch	Stability
Number	Ftar	Bthresh	Stability clause	pGr%	pBint%	LongY (kt)	MAP (%)
1	0,80	0,80	SC2	85,5	9,0	26,5	8,3
2	1,00	0,80	SC2	78,9	13,0	29,0	8,8
3	0,80	1,00	SC2	88,6	8,3	26,9	8,3
4	1,00	1,00	SC2	84,5	9,2	26,9	8,9
1	0,80	0,80	SC1	85,8	9,3	32,1	5,6
2	1,00	0,80	SC1	74,7	15,8	34,1	6,2
3	0,80	1,00	SC1	86,0	10,4	32,2	6,0
4	1,00	1,00	SC1	77,9	14,3	35,0	6,3

Finally, the SWGSM acknowledged that "ICCAT would need to define what it considers "exceptional circumstances" that would result in suspending the application of the HCR, and also establish guidance on the alternative management response in those circumstances." Moreover, it was suggested that SCRS could provide some advice on the technical aspects of this issue for the Commission's consideration. In other t-RFMOs, exceptional circumstances refer to a wide range of situations, including stock trajectories out of the ranges tested within the MSE framework, extreme environmental regimes, inability to update the stock status and thus to apply the HCR to determine a new TAC, or a biomass estimate below a predefined SSB_{lim}. In the case of North Atlantic albacore, these cases could be considered exceptional circumstances and the Commission would need to decide what to do if such situations are faced. The SCRS could try to incorporate these circumstances in future developments of the MSE framework in order to provide further advice to the Commission.

20.17 The HCRs referred to in paragraph 15 of Rec. 16-06 should be evaluated by the SCRS through the management strategy evaluation process, including in light of new assessments of the stock. Rec. 16-06, paragraph 14

Background: *Recommendation [16-06] paragraph 15 states that the HCRs referred to in paragraph 14 should be evaluated by SCRS through the management strategy evaluation process, including in light of new assessments of the stock.*

The results of the HCRs evaluated under the MSE framework are included in the Albacore Executive Summary (see also response to Commission 20.16 above). The MSE used is specifically tailored to evaluate a series of model-based HCRs as a component of a Management Procedure that mimics the 2016 stock assessment of North Atlantic albacore. Thus, should the Commission select a specific HCR, this would be applied to the results of the last assessment to set a constant annual TAC from 2018 to 2020. In future, stock status could be assessed using alternative methods, but in order to use these alternative methods as components of MPs to manage the stocks, the new MPs would need to be tested within the MSE framework.

20.18 Provide with a summary of the scientific data and information collected and reported pursuant to Rec. 16-14 and any relevant associated findings. Recommend on how to improve the effectiveness of scientific observer programs, including possible revisions to Rec. 16-14 and/or with respect to implementation of these minimum standards and protocols by CPCs. Rec. 16-14, paragraph 12 c and d

Background: *Recommendation requires the SCRS to:*

(a) develop, as needed and appropriate, an observer working manual for voluntary use by CPCs in their domestic observer programmes, that includes model data collection forms and standardized data collection procedures, taking into account observer manuals and related materials that may already exist through other sources, including CPCs, regional and sub-regional bodies, and other organizations;
(b) develop fisheries specific guidelines for electronic monitoring systems;
(c) provide the Commission with a summary of the scientific data and information collected and reported pursuant to this recommendation and any relevant associated findings.

The Sub-committee discussed that some of the information required by Rec. 16-14, paragraph 12, already exists and needs to be compiled. There was a general agreement that a complete response to this recommendation will require coordination among several SCRS Working Groups. It was also agreed that the SCRS Chair, the Chair of the Sub-committee on Ecosystems, and other SCRS Chairs will draft a response to the Commission to be reviewed during the 2018 SCRS Plenary meeting.

20.19 Review Rec. 14-09 and consider revisions to improve its effectiveness. To inform this review, the SCRS is requested to provide advice on the VMS data that would most assist the SCRS in carrying out its work, including frequency of transmission for the different ICCAT fisheries. Rec. 14-09, paragraph 7

Background: *Recommendation [14-09] paragraph 7 requires that to review the use of Vessel Monitoring System (VMS), the SCRS is requested to provide advice on the VMS data that would most assist the SCRS in carrying out is work, including frequency of transmission for the different ICCAT fisheries.*

The Committee reiterated the utility of VMS data for assessing fishing activity in the Atlantic Ocean. It was noted that the ICCAT FAD Working Group had also stressed the need to access VMS data in order to better characterize fishing effort of purse seiners and therefore improve the corresponding CPUE indices. The Sub-committee noted that scientists should have access to this data to improve their analyses. While acknowledging that the higher the frequency of reporting the more useful the VMS data is, the Committee still has to complete a full analysis of the optimum frequency of VMS transmission for different ICCAT fisheries. Nevertheless, the 4-hour frequency of transmission in Rec. [14-09] is insufficient to detect fishing activity for many gear types.

20.20 Confirmation by the Shark Species Group regarding exemption of the necessity for data submission by CPCs. Rec. 16-13, paragraph 2

Background: *In [Rec. 16-13] paragraph 2, regarding submission of data by CPCs on the implementation of shark conservation measures, the Commission requests that: "CPCs may be exempt from the submission of the check sheet when vessels flying their flag are not likely to catch any sharks species covered by the abovementioned Recommendations in paragraph 1, on the condition that the concerned CPCs obtained a confirmation by the Shark Species Group through necessary data submitted by CPCs for this purpose.*

The Sharks Working Group noted that two CPCs had submitted requests for exemption of the requirement to submit information to the Commission regarding the implementation of shark conservation measures (pursuing to Rec. [16-13]). These were provided to the Group for comments. At the Data Preparatory meeting held in March 2017, the Group discussed a list of criteria to review these exemption requests. These criteria are provided below but have not yet been adopted by either the SCRS or the Commission. The Group did not feel they had a clear method to review the exemptions requests received. As such, the Group recommends that no exemptions be granted prior to the adoption of the evaluation criteria recommended by the Group.

The Group recommends that CPCs requesting an exemption of the requirement to submit information to the Commission regarding the implementation of shark conservation measures (pursuing Rec. [16-13]), should submit the following information to the Group so that it can make a determination that the exemption is justified:

- List of species of sharks recorded to be present in the area of tuna fishing activities of the CPC
- Evidence (e.g. scientific surveys, scientific observer data, landing surveys) that clearly indicate the lack of interactions between CPCs tuna fleets and shark species considered by ICCAT conservation measures
- Information on the spatial extent of fishing effort by CPC tuna fleets
- A plan for periodic review of the scientific information that justifies the exemption request

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

20.21 Develop rules of procedure, including a code of conduct for scientists and observers. Rec. 13-12, paragraph 1

Background: *Recommendation [13-12] paragraph 1 states that pursuant to paragraph 2(ii) of Resolution 11-17, SCRS shall develop rules of procedure, including a code of conduct for scientist and observers, in the framework of its Strategic Plan, and submit this to the 2015 Commission Annual meeting for endorsement.*

This recommendation requested the SCRS to develop rules of procedure, including a code of conduct for scientist and observers, in the framework of its Strategic Plan.

The Strategic Plan established the values that should be guiding the conduct for scientists and observers that participate in the work of the SCRS:

"*INTEGRITY: The SCRS applies the highest ethical standards to all its scientific work.*

INDEPENDENCE: The SCRS provides advice that is objective and based on the best scientific information available and not unduly influenced by stakeholders, ideological or political pressure groups or by economic or financial interests.

COOPERATION: The SCRS values and encourages the participation of scientists from all CPCs, acting through scientific collaboration and cooperation to cultivate a diverse set of expertise and to promote best available scientific practices.

COMMITMENT: We are totally committed to provide the best scientific advice in support of the Commission's objective of implementing science-based fishery management.

ABILITY: The SCRS strives to ensure the work of the Committee conforms to the highest scientific standards and state of the art methodologies, constantly improving the foundation of knowledge to support the mandate.

TRANSPARENCY: The SCRS conducts its work in open sessions and encourages the participation of National scientists and external experts; the information, analyses and decision-making process are well documented and easily accessible to all interested Parties."

Every scientist should make sure these values are always reflected in the work they conduct as part of the SCRS.

The SCRS also has some practices that define the rules and procedures that facilitate the participation at SCRS meetings. These include:

- the guidelines for observer status [Rec 05-12], which establish how scientists that are not associated with a CPC delegation can attend and participate in the SCRS meetings;

- the *Protocols to Follow for the Use of Data Funds & Other ICCAT Funds*[1], which contain the procedures to help developing ICCAT Contracting Parties to obtain assistance to attend SCRS meetings.

There are also procedures on how data managed by the ICCAT Secretariat can be accessed by scientists: *Rules and procedures for the protection, access to, and dissemination of data compiled by ICCAT*[2], which include general principles, specific definitions of confidentiality provisions and non-public domain data and corresponding templates for data requests and confidentiality agreements.

Whilst having to ensure transparency the SCRS needs to make sure of the integrity of the information that it provides. Therefore, all intersessional meeting reports will contain the following text:

"The results, conclusions and recommendations contained in this Report only reflect the view of the Species/Working Group/Sub-Committee. Therefore, these should be considered preliminary until the SCRS adopts them at its annual Plenary meeting and the Commission revise them at its Annual meeting.

Accordingly, ICCAT reserves the right to comment, object and endorse this Report, until it is finally adopted by the Commission."

20.22 Conversion algorithm for the caging operations. Rec. [14-04] Annex 9, item iii

Background: *In 2016 the SCRS provided to the Commission a response to their request regarding algorithms for the purposes of bluefin tuna caging operations (Response to the Commission 18.13 of the SCRS 2016 Report). During the discussions of this response that took place during the 2016 Commission meeting, it was noted that the algorithm proposed by the SCRS,*

$$RWT = 2.8684\ E\text{-}5 * SFL \wedge 2.9076 \qquad (1)$$

may not be appropriate for caging operations in the Adriatic. The Commission agreed to use the alternative algorithm for the Adriatic until additional guidance on a more appropriate algorithm was provided by the SCRS,

$$RWT = 3.508\ E\text{-}5 * SFL \wedge 2.883091788 \qquad (2)$$ [3]

where, RWT is the specimen round weight (in kg) and SFL is the specimen straight fork length (in cm).

During 2017 Croatian scientists collected additional information on lengths and weights of fish caged in the Adriatic Sea and presented to the SCRS a document (Kataviç *et al.*, 2017) confirming that equation (2) is more appropriate for the Adriatic than equation (1). Therefore, the Committee recommends equation (2) to be used to convert SFL in to RWT during caging operations in the Adriatic Sea.

[1] https://www.iccat.int/Documents/MeetingsFunds/ENG/Protocol_Fund_SCRS_ENG.pdf
[2] http://www.iccat.int/Data/REP_EN_10-11_I_1_Annex_6_Confidentiality.pdf
[3] Rodriguez-Marin *et al.* 2015.

21. Other matters

21.1 Collaboration with other International Organizations (ICES, CITES, GEF, etc.)

Collaboration with ISSF

The International Seafood Sustainability Foundation (ISSF) continues providing the Secretariat with detail catch (by vessel trip, species and commercial size category) for all purchases made ISSF-participating companies. These correspond to unloading of Atlantic catches from tropical tunas (bigeye, yellowfin, and skipjack) and albacore to canning plants around the world. This information has previously been used by the SCRS scientists to complement and improve the Ghanaian Task II statistics. It has been noted that the submissions have been made in a diverse range of formats. As such, ISSF agreed in 2015, to look into standardising the data submissions. As such, the data received are still being stored by ICCAT, but have not been made available for use to the SCRS at this stage.

TES

In 2017 ICCAT representatives from ICCAT (SCRS Chair and Sharks Species Group Chair) attended a meeting entitled "The Cooperation on implementing CITES for marine species: achievements, lessons learned and future opportunities" that was held in Geneva, Switzerland from the 13-15 March 2017. This continued the beneficial cooperation established between ICCAT and CITES in recent years.

The Secretariat also acknowledged that a recommendation had been made by the Sharks Working Group for the ICCAT Secretariat to make an official request to CITES to facilitate the sampling of CITES listed species for the purposes of scientific research conducted under the auspices of ICCAT research programmes. The Secretariat agreed that it would establish contact with the CITES secretariat to seek a solution to this concern and report back to the sharks working group in 2018.

ICES

Considering the fruitful experience ICCAT and ICES have had in recent years with regard to scientific collaboration, there is the willingness of both organisations to strengthen this cooperation and explore new initiatives and discussions have commenced between the Secretariats. In 2017 was agreed that it is appropriate and desirable to improve collaboration between ICCAT SCRS-ICES, particularly in the areas of by-catch and sharks issues, through our Sub-committee on Ecosystems and by-catch and the Shark species group. Specifically, it would be convenient to keep the participation of ICES scientific experts in ICCAT shark stock assessments and vice versa. It is envisioned that following the joint ICCAT/ICES training courses that have been held in the past, ICCAT could continue to work with ICES on areas of capacity building.

GEF- Common Oceans/ABNJ Tuna Project

At the 2015 ICCAT Commission meeting, it was decided to continue to cooperate with this programme provided that there are benefits to ICCAT. To this end, since the previous SCRS plenary, the ICCAT Secretariat has participated in several ABNJ Common Oceans initiatives. These include participation in the following meetings that were funded or partially funded by the project:

1. Joint tuna RFMO MSE meeting held at the Secretariat office, Madrid (1-3 November 2016);
2. Joint Meeting of tuna RFMOs on the Implementation of the Ecosystem Approach to Fisheries Management, which took place in FAO HQ in Rome, Italy (12-14 December 2016);
3. 1st Regional Seabird By-catch Pre-assessment Workshop held at the Kruger Park, South Africa (23 February – 1 March 2017);
4. Tuna compliance network meeting held in Vigo, Spain (27-31 March 2017);
5. 1st Joint T-RFMO FAD Working Group Meeting, held in Madrid Spain (19-21 April 2017).

In addition, ICCAT has been coordinating a feasibility study on the development of an online reporting system. This includes both a feasibility study to determine the resources, costs, technologies required to implement an online reporting system, as well as the production of a demo online reporting tool. Due to the requirements of the ABNJ project, this study and demo are generic and could potentially be applied across the tuna RFMOS.

ICCAT also made several proposals to the FAO Common Ocean/ABNJ Tuna Project steering committee for future collaborations. So far, ICCATs attempts to increase collaboration with the project have not been completely successful. Final decisions on funding the proposals made (listed below) are still pending:

1. Proposal for a 2nd Joint t-RFMO FAD Working Group Meeting;
2. Proposed meeting of the t-RFMO MSE Working Group (and associated activities);
3. Lead and coordinate an Ecosystem Component: Common oceans ABNJ tuna project, including a follow up meeting to that held in December 2016;
4. Support for ICCAT Port Inspection Expert Group for Capacity Building and Assistance.

Further information regarding ICCATs involvement in the FAO Common Oceans/ABNJ Tuna Project are provided in **Appendix 14.**

The Committee noted the concerns the Secretariat had expressed regarding their involvement in the GEF-Common Oceans ABNJ Tuna Project but expressed a desire that involvement in the project should be continued where possible. It was noted that particularly with regards to advancing the MSE and EBFM processes, productive collaboration and cooperation in these areas could be used to maintain ICCAT involvement in the project.

Clarification was requested on how the issues with the GEF- Common Oceans ABNJ Tuna Project arose and why ICCAT has been struggling to be involved in the project when other RFMOs seem to be benefiting from their funding. It was clarified that when the original project activities were finalized, ICCAT had been largely excluded despite being part of the planning process. These issues have been clearly documented in past SCRS and Commission meeting reports.

21.2 Consideration of implications of the Fifth Meeting of the Working Group on Convention Amendment and of the Meeting of the Ad Hoc Working Group to Follow up on the Second Performance Review

Convention Amendment

The Working Group on Convention Amendment held its fourth meeting in June 2017. Most of the pending issues have been discussed and proposals have been put forward. The issue of changing the Depositary from FAO to EU did not received the agreement of all CPC's. However, discussions between CPCs are occurring and a Chair's text proposal for amendment of the International Convention for the Conservation of Atlantic Tunas will be presented at the Commission meeting in November 2017.

Performance review

The Ad Hoc Working Group to Follow-up on the Second Performance Review was held in June 2017. A number of tasks were agreed to be carried out by the various subsidiary bodies of the Commission based on the issues identified in the Second independent ICCAT Performance Review.

21.3 Update of the ICCAT glossary

The Chair informed the Committee that the Ad hoc Working Group on FADs is working on several definitions related to FAD fishing. Additionally, t-RFMO technical Working Group on MSE is also working on definitions related to the MSE process.

21.4 Consideration of new publication guidelines: Executive summaries, Detailed reports and SCRS Report

Due to the lack of time during the Plenary session it was decided to postpone the discussions on this item to 2018.

***21.5 Peer* review publication (SCRS documents): agreement with Aquatic Living Resources journal**

Due to the lack of time during the Plenary session it was decided to postpone the discussions on this item to 2018.

22. Adoption of report and closure

The Chair thanked the SCRS for its hard work this year.

Dr. Die thanked the Secretariat staff for their excellent work, as well as appreciating their professional attitude. Dr. Die then expressed his appreciation towards the interpreters.

On behalf of the Executive Secretary, the Assistant Executive Secretary showed his appreciation towards Dr. Die for the work carried out during his third Plenary meeting as SCRS Chair. Dr. Neves dos Santos also thanked Dr. Die for the trust he placed in the Secretariat and expressed his appreciation towards the Secretariat staff for their efforts in supporting the SCRS work throughout the year and during the meeting. Finally, Dr. Neves dos Santos thanked the interpreters for their hard work during the week and wished everyone a safe journey home.

The Report of the 2017 SCRS meeting was adopted and the 2017 Meeting of the SCRS was adjourned.

Appendix 1

Agenda

1. Opening of the meeting
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
6. Report of Secretariat activities in research and statistics
7. Review of national fisheries and research programs
8. Executive Summaries on species:

   YFT-Yellowfin, BET-Bigeye, SKJ-Skipjack, ALB-Albacore, BFT-Bluefin, BUM-Blue marlin, WHM-White marlin, SAI-Sailfish, SWO-Atl. Swordfish, SWO-Med. Swordfish, SMT-Small tunas, SHK-Sharks
9. Report of inter-sessional SCRS meetings
   - 9.1 Meeting of the ICCAT Working Group on Stock Assessment Methods
   - 9.2 Small tuna Species Group intersessional meeting
   - 9.3 Tropical Tuna Species Group intersessional meeting
   - 9.4 Albacore Species Group intersessional meeting (including stock assessment of Mediterranean albacore)
   - 9.5 Shortfin mako shark data preparatory and assessment meetings
   - 9.6 Atlantic swordfish data preparatory and assessment meetings
   - 9.7 Bluefin data preparatory and stock assessment meetings
10. Report of Special Data Collection and Research Programs
    - 10.1 Atlantic-Wide Research Programme for Bluefin Tuna (ICCAT GBYP)
    - 10.2 Enhanced Billfish Research Programme (EBRP)
    - 10.3 Small Tunas Year Programme (SMTYP)
    - 10.4 Shark Research and Data Collection Programme (SRDCP)
    - 10.5 Atlantic Ocean Tropical tuna Tagging Programme (AOTTP)
11. Report of the Sub-committee on Statistics
12. Report of the Sub-committee on Ecosystems and By-catch
13. Considerations of implications of the Meeting of the Joint t-RFMO FAD Working Group
14. Report of the Ad Hoc Working Group on FADs
15. Considerations of implications of the Meeting of the Standing Working Group on Dialogue between Fisheries Scientists and Managers
16. Progress related to work developed on MSE
    - 16.1 t-RFMO MSE Working Group
    - 16.2. Work conducted under ICCAT GBYP
    - 16.3. Work conducted for other species
17. Report on the implementation of the Science Strategic Plan for 2015-2020 in 2017 and work plan for 2018, which includes the update of the stock assessment software catalogue

18. Consideration of plans for future activities
    - 18.1 Annual Work Plans
    - 18.2 Inter-sessional meetings proposed for 2018
    - 18.3 Date and place of the next meeting of the SCRS
19. General recommendations to the Commission
    - 19.1 General recommendations to the Commission that have financial implications
    - 19.2 Other recommendations
20. Responses to Commission's requests
    - 20.1 Ghana's comprehensive and detailed capacity management plan on the level of catches. Rec. 16-01, paragraph 12 (c)
    - 20.2 Evaluate the efficacy of the area/time closure referred to in paragraph 13 in relation with the protection of juveniles of tropical tunas. Rec. 16-01, paragraph 15
    - 20.3 Review its 2016 recommendations on observer coverage and advise the Commission on appropriate coverage levels. Rec. 16-01, paragraph 42
    - 20.4 Recommendations made by the FAD Working Group (Annex 8) and develop a work plan. Rec. 16-01, paragraph 49 (a)
    - 20.5 Provide performance indicators for skipjack, bigeye and yellowfin tuna, with the perspective to develop management strategy evaluations for tropical tunas. Rec. 16-01, paragraph 49 (b)
    - 20.6 Develop a table that quantifies the expected impact on MSY, B_{MSY}, and relative stock status for both bigeye and yellowfin resulting from reductions of the individual proportional contributions of major fisheries to the total catch. Rec. 16-01, paragraph 49 (c)
    - 20.7 Evaluate the contribution of by-catches and discards to the overall catches in ICCAT tropical tuna fisheries, on a fishery by fishery basis. Rec. 16-01, paragraph 53
    - 20.8 Advise the Commission on possible measures allowing to reduce discards and to mitigate onboard post-harvest losses and by-catch in ICCAT tropical tuna fisheries. Rec. 16-01, paragraph 53
    - 20.9 Provide information and guidance on enhancing efforts to address any deficiencies identified regarding fisheries for which biological sampling rates that should be increased and fisheries for which improvements in the collection and/or provision of statistical data are necessary to support the stock assessment. SCRS to report efforts made to enhance biological sampling activities. Rec. 16-08, paragraph 20
    - 20.10 The SCRS shall review new available information related to the identification of specific spawning times and areas of bluefin tuna within the western Atlantic Ocean, and advise the Commission on the results for its consideration. Rec. 16-08, paragraph 23
    - 20.11 Provide guidance on a range of fish size management measures for western Atlantic bluefin tuna and their impact on yield per recruit and spawner per recruit considerations. To comment on the effect of fish size management measures on their ability to monitor stock status. Rec. 16-08, paragraph 27
    - 20.12 Mauritania will conduct research activities in cooperation with an ICCAT CPC of its choice, and will be subject to the presentation of a specific programme to the SCRS. The result will be made available to the Commission. Rec. 14-04, paragraph 5
    - 20.13 Provide the Commission with the confirmed average round weight and gilled and gutted weight, corresponding to the LJFL of 100 cm. Rec. 16-05, paragraph 16
    - 20.14 Continue to monitor and analyze the effects of the minimum size measure on the mortality of immature swordfish. Recs. 16-03, paragraph 10 and 16-04, paragraph 7
    - 20.15 Develop a new data collection initiative as part of the ICCAT Enhanced Program for Billfish Research to overcome the data gap issues. Rec. 15-05, paragraph 10 and Rec. 16-11, paragraph 3

20.16 Refine the testing of candidate reference points (e.g. $SSB_{THRESHOLD}$, SSB_{LIM} and F_{TARGET}) and associated harvest control rules (HCRs) that would support the management objective expressed in paragraph 2 of Rec. 16-06. The SCRS shall also provide statistics to support decision-making in accordance with the performance indicators in Annex 2. Rec. 16-06, paragraph 11

20.17 The HCRs referred to in paragraph 13 of Rec. 16-06 should be evaluated by the SCRS through the management strategy evaluation process, including in light of new assessments of the stock. Rec. 16-06, paragraph 14

20.18 Provide with a summary of the scientific data and information collected and reported pursuant to Rec. 16-14 and any relevant associated findings. Recommend on how to improve the effectiveness of scientific observer programs, including possible revisions to Rec. 16-14 and/or with respect to implementation of these minimum standards and protocols by CPCs. Rec. 16-14, paragraph 12 c and d

20.19 Review Rec. 14-09 and consider revisions to improve its effectiveness. To inform this review, the SCRS is requested to provide advice on the VMS data that would most assist the SCRS in carrying out its work, including frequency of transmission for the different ICCAT fisheries. Rec. 14-09, paragraph 7

20.20 Confirmation by the Shark Species Group regarding exemption of the necessity for data submission by CPCs. Rec. 16-13, paragraph 2

20.21 Develop rules of procedure, including a code of conduct for scientists and observers. Rec. 13-12, paragraph 1

20.22 Conversion algorithm for the caging operations. Rec. [14-04] Annex 9, item iii

21. Other matters

21.1 Collaboration with other International Organizations (ICES, CITES, GEF, etc.)

21.2 Consideration of implications of the Fifth Meeting of the Working Group on Convention Amendment and of the Meeting of the Ad Hoc Working Group to Follow up on the Second Performance Review

21.3 Update of the ICCAT glossary

21.4 Consideration of new publication guidelines: executive summaries, detailed reports and SCRS report

21.5 Peer review publication (SCRS documents): agreement with Aquatic Living Resources journal

22. Adoption of report and closure

Appendix 2

List of Participants

CONTRACTING PARTIES

ALGERIA

Kouadri-Krim, Assia
Chef de Bureau, Ministre de l'Agriculture du Developpement rural et de la Pêche, Rue des Quatre Canons, 16000
Tel: +213 21 43 31 97, Fax: +213 21 43 31 97, E-Mail: dpmo@mpeche.gov.dz; assiakrim63@gmail.com

ANGOLA

Chilamba, Victor
Avenida 4 de Fevereiro Nº 30, Edificio Atlántico Marginal, C.P. 83 Luanda
Tel: +244 222 310 759, Fax: +244 222 310 199, E-Mail: victorpescas15@gmail.com

Jonico, Vanaquissa Chingolo
Tel: +244 923 543 257, E-Mail: vanajonico@yahoo.com.br

Mandinga Barreto, Tânia
Chefe de Departamento de Pesca, DNPPRP- Direcçao Nacional de Pescas e Protecçao de Recursos Pesqueiros, Av 4 de Fevereiro, Nº 84
Tel: +244 912 20 21 00, E-Mail: tania.mandinga@gmail.com

Miguel, Jose Manuel*
Direcçao Nacional das Pescas e Protecçao das Recursos Pesqueiros
Tel: +244 927 879 348, E-Mail: jmperegrina5@gmail.com

Nsaku, Domingas *
Instituto Nacional de Investigaçao, Rua Mortala Mohamed, Ilha do Cabo
Tel: +244 923 503 734, E-Mail: dnsaku41@hotmail.com

Simba, Daniel *
Senior of National Fishery Directoriate, Ministério das Pescas, Direcçao Nacional das Pescas, Avenida 4 de Fevereiro Nº 30, Edificio Atlântico, Caixa Postal 83, Luanda
Tel: +244 949 703 640, Fax: +244 222 310 1999, E-Mail: simbaleitao1@gmail.com

Virgilio Narciso Avelino, Estevao
Técnico del Departamento de Biología y Conservación de Recursos Marinos, Instituto de Investigación Pesquera, Av. 4 de fevereiro, 26 - Edificio Atlântico, C.P. 2601, Luanda
Tel: +244 91 222 6041, E-Mail: viestevao@hotmail.com

CANADA

Bowlby, Heather *
Bedford Institute of Oceanography, 1 Challenger Drive, Dartmouth, Nova Scotia, B2Y 4A2
Tel: +1 902 426 5836, Fax: +1 902 426 1506, E-Mail: heather.bowlby@dfo-mpo.gc.ca

Duprey, Nicholas
Science Advisor, Fisheries and Oceans Canada - Fish Population Science, Government of Canada, 200-401 Burrard Street, Vancouver, BC
Tel: + 604 499 0469, E-Mail: nicholas.duprey@dfo-mpo.gc.ca

Hanke, Alexander
Scientific, St. Andrews Biological Station/ Biological Station, Fisheries and Oceans Canada, 531 Brandy Cove Road, St. Andrews New Brunswick E5B 2L9
Tel: +1 506 529 5912, Fax: +1 506 529 5862, E-Mail: alex.hanke@dfo-mpo.gc.ca

Maguire, Jean-Jacques *
1450 Godefroy, Québec G1T 2E4
Tel: +1 418 688 3027, E-Mail: jeanjacquesmaguire@gmail.com

* Delegates who only participated in the Species Groups.

Melvin, Gary
Biological Station - Fisheries and Oceans Canada, Department of Fisheries and Oceans, 531 Brandy Cove Road, St. Andrews, New Brunswick E5B 2L9
Tel: +1 506 529 5874, Fax: +1 506 529 5862, E-Mail: gary.melvin@dfo-mpo.gc.ca

CHINA, (P. R.)

Guan, Wenjiang
Associate Professor, College of Marine Sciences, Shanghai Ocean University, 999 Huchenghuan RD, Linguang New City, Pudong, 201306 Shanghai
Tel: +86 21 6190 0167, Fax: +86 21 6190 0301, E-Mail: sqtian@shou.edu.cn; wjguan@shou.edu.cn

Yang, Xiaoming
Associate Professor, Shangai Ocean University, College of Marine Sciences, 999 Huchenghuan Rd., Pudong Area, 201306 Shangai
Tel: +86 21 61900167, Fax: +86 21 61900304, E-Mail: xmyang@shou.edu.cn

Zhu, Jiangfeng
Associate Professor, Shangai Ocean University, College of Marine Sciences, 999 Hucheng Huan Rd., 201306 Shangai
Tel: +86 21 61900167, Fax: +86 21 61900304, E-Mail: jfzhu@shou.edu.cn

CÔTE D'IVOIRE

Amandè, Monin Justin
Chercheur Halieute, Centre de Recherches Océanologiques de Côte d'Ivoire, Département Ressources Aquatiques Vivantes - DRAV29 Rue des Pêcheurs, BP V 18, Abidjan 01
Tel: +225 05 927 927, Fax: +225 21 351 155, E-Mail: monin.amande@yahoo.fr; monin.amande@cro-ci.org

EUROPEAN UNION

Arrizabalaga, Haritz
AZTI - Tecnalia /Itsas Ikerketa Saila, Herrera Kaia Portualde z/g, 20110 Pasaia Gipuzkoa, Spain
Tel: +34 94 657 40 00, Fax: +34 94 300 48 01, E-Mail: harri@azti.es

Bal, Guillaume
Marine Institute, Rinville, Oranmore, Co Galway, Ireland
Tel: +353 858 351 670, Fax: +353 9 138 7201, E-Mail: guillaume.bal@marine.ie

Biagi, Franco
Directorate General for Maritime Affairs and Fisheries (DG-Mare) - European Commission, Rue Joseph II, 99, Bruxelles, Belgium
Tel: +322 299 4104, E-Mail: franco.biagi@ec.europa.eu

Briand, Karine *
Orthongel / Institut de Recherche pour le Dévelppement IRD, Avenue Jean Monnet CS30171, 34203 Sète, Cedex, France
Tel: +33 04 99 57 3248, E-Mail: karine.briand@ird.fr

Carnevali, Oliana
Universita Politecnica Delle Marche - Ancona, Department of Environment and Life Science, Italy
Tel: +39 338 264 2235, Fax: +39 071 220 46 50, E-Mail: o.carnevali@univpm.it

Centenera Ulecia, Rafael
Subdirector General de Acuerdos y Organizaciones Regionales de Pesca, Dirección General de Recursos Pesqueros y Acuicultura, Ministerio de Agricultura, Alimentación y Medio Ambiente, C/ Velázquez, 144 2ª Planta, 28006 Madrid, Spain
Tel: +34 91 347 6048/679434613, Fax: +34 91 347 6049, E-Mail: rcentene@magrama.es; orgmulpm@magrama.es

Coelho, Rui
Portuguese Institute for the Ocean and Atmosphere, I.P. (IPMA), Avenida 5 de Outubro, s/n, 8700-305 Olhão, Portugal
Tel: +351 289 700 504, E-Mail: rpcoelho@ipma.pt

De Oliveira, José *
CEFAS, Pakefield Road, Lowestoft - Suffolk, NR330HT, United Kingdom
Tel: +44 073 937 63048, E-Mail: jose.deoliveira@cefas.co.uk

Farrugia Drakard, Veronica
MESDC - DFA, Aquaculture Directorate, Fort San Lucjan, Triq il-Qajjenza, Marsaxlokk, Malta
Tel: +356 229 26918, E-Mail: veronica-heather.farrugia-drakard@gov.mt

Fernández Costa, Jose Ramón
Ministerio de Economía y Competitividad, Instituto Español de Oceanografía - C. Costero de A Coruña, Paseo Marítimo Alcalde Francisco Vázquez, 10 - P.O. Box 130, 15001 A Coruña, Spain
Tel: +34 981 205 362, Fax: +34 981 229 077, E-Mail: jose.costa@ieo.es

Ferreira de Gouveia, Lidia
Técnica Superior, Direcçao Regional das Pescas, Direçao Serviços de Investigaçao - DSIEstrada da Pontinha, 9000 Funchal Madeira, Portugal
Tel: +351 291 203200, Fax: +351 291 229691, E-Mail: lidia.gouveia@madeira.gov.pt

Gaertner, Daniel
IRD-UMR MARBEC, CRH, CS 30171, Av. Jean Monnet, 34203 Sète Cedex, France
Tel: +33 4 99 57 32 31, Fax: +33 4 99 57 32 95, E-Mail: daniel.gaertner@ird.fr

Garibaldi, Fulvio *
Laboratorio di Biologia Marina e Ecologia Animale Univ. Degli Studi di Genova, Dipartimento si Scienze della Terra, dell'Ambiente e della Vita (DISTAV), Corso Europa, 26, 16132 Genova, Italy
Tel: +39 010 353 8576, Fax: +39 010 357 888, E-Mail: largepel@unige.it; garibaldi.f@libero.it

Gordoa, Ana
Centro de Estudios Avanzados (CEAB - CSIC), Acc. Cala St. Francesc, 14, 17300 Blanes Girona, Spain
Tel: +34 972 336101, E-Mail: gordoa@ceab.csic.es

Goujon, Michel
ORTHONGEL, 5 Rue des Sardiniers, 29900 Concarneau, France
Tel: +33 2 9897 1957, Fax: +33 2 9850 8032, E-Mail: mgoujon@orthongel.fr

Grubisic, Leon
Institute of Oceanography and fisheries in Split, S.I. Mestrovica 63 - P.O. Box 500, 21000 Split, Croatia
Tel: +385 91 407 0955, Fax: +385 21 358 650, E-Mail: leon@izor.hr

Herrera Armas, Miguel Angel
OPAGAC, C/ Ayala 54, 2º A, 28001 Madrid, Spain
Tel: 91 431 48 57, Fax: 91 576 12 22, E-Mail: miguel.herrera@opagac.org

Katavic, Ivan *
Institute of Oceanography and Fisheries, Mestrovica 63 - P.O. Box 500, 21000 Split, Croatia
Tel: +385 21 408000, Fax: +385 21 358650, E-Mail: Katavic@izor.hr

Lino, Pedro Gil *
Instituto Português do Mar e da Atmosfera - I.P./IPMA, Avenida 5 Outubro s/n, 8700-305 Olhão, Portugal
Tel: +351 289 700504, E-Mail: plino@ipma.pt

Lizcano Palomares, Antonio
Subdirector Adjunto de la Subdirección General de Acuerdos y Organizaciones Regionales de Pesca, Ministerio de Agricultura, Alimentación y Medio Ambiente, Secretaría General de Pesca, C/ Velázquez, 144 2ª Planta, 28006 Madrid, Spain
Tel: +34 91 347 6047, Fax: 91 347 60 42, E-Mail: alizcano@magrama.es

Lombardo, Francesco *
Università Politecnica delle Marche, Dipartimento Scienze della Vita e dell'Ambiente, Via Brecce Bianche - Ancona, Italy
Tel: +39 333 5914492, E-Mail: francescolombardo80@gmail.com

Macías López, Ángel David
Ministerio de Economía y Competitividad, Instituto Español de Oceanografía, C.O. de Málaga, Puerto pesquero s/n, 29640 Fuengirola Málaga, Spain
Tel: +34 952 197 124, Fax: +34 952 463 808, E-Mail: david.macias@ieo.es

Martínez Cañabate, David Ángel
ANATUN, Urbanización La Fuensanta 2, 30157 Algeciras, Spain
Tel: +34 968 554141, Fax: +34 91 791 2662, E-Mail: es.anatun@gmail.com;david.martinez@ricardofuentes.com

Maufroy, Alexandra
IRD, 5 rue des sardiniers, 29900 Concarneau, France
Tel: +33 2 98 97 19 57, Fax: +33 2 98 50 80 32, E-Mail: amaufroy@orthongel.fr

Merino, Gorka
AZTI - Tecnalia /Itsas Ikerketa Saila, Herrera Kaia Portualde z/g, 20110 Pasaia - Gipuzkoa, Spain
Tel: +34 94 657 4000; +34 664 793 401, Fax: +34 94 300 4801, E-Mail: gmerino@azti.es

Murua, Hilario
AZTI - Tecnalia /Itsas Ikerketa Saila, Herrera Kaia Portualde z/g, 20110 Pasaia Gipuzkoa, Spain
Tel: +34 667 174 433, E-Mail: hmurua@azti.es

Navarro Cid, Juan José
Grupo Balfegó, Polígono Industrial - Edificio Balfegó, 43860 L'Ametlla de Mar Tarragona, Spain
Tel: +34 977 047700, Fax: +34 977 457 812, E-Mail: jnavarro@grupbalfego.com

Ortiz de Urbina, Jose María
Ministerio de Economía y Competitividad, Instituto Español de Oceanografía, C.O de Málaga, Puerto Pesquero s/n, 29640 Fuengirola Málaga, Spain
Tel: +34 952 197 124, Fax: +34 952 463 808, E-Mail: urbina@ieo.es

Ortiz de Zárate Vidal, Victoria
Ministerio de Economía y Competitividad, Instituto Español de Oceanografía, C.O. de Santander, Promontorio de San Martín s/n, 39004 Santander Cantabria, Spain
Tel: +34 942 291 716, Fax: +34 942 27 50 72, E-Mail: victoria.zarate@st.ieo.es

Pascual Alayón, Pedro José
Ministerio de Economía y Competitividad, Instituto Español de Oceanografía, C.O. de Canarias, Vía Espaldón, Dársena Pesquera, Parcela 8, 38180 Santa Cruz de Tenerife Islas Canarias, Spain
Tel: +34 922 549 400, Fax: +34 922 549 554, E-Mail: pedro.pascual@ca.ieo.es

Peristeraki, Panagiota (Nota)
Hellenic Center for Marine Research, Institute of Marine Biological Resources, P.O. Box 2214, 71003 Iraklion, Greece
Tel: +30 2810 337 830, Fax: +30 2810 337 822, E-Mail: notap@hcmr.gr

Petrina Abreu, Ivana
Ministry of Agriculture - Directorate of Fishery, Ulica Grada Vukovara 78, 10000 Zagreb, Croatia
Tel: +385 164 43171, Fax: +385 164 43200, E-Mail: ipetrina@mps.hr

Peyronnet, Arnaud
Directorate-General, European Commission _ DG MARE D2, Conservation and Control in the Mediterranean and the Black Sea, Rue Joseph II - 99 06/56, B-1049 Brussels, Belgium
Tel: +32 2 2991 342, E-Mail: arnaud.peyronnet@ec.europa.eu

Poisson, François *
IFREMER - l'Unité Halieutique Méditerranée (HM) UMR - Ecosystème Marin Exploité (EME), Avenue Jean Monet, B.P. 171, 34203 Sète, France
Tel: +33 499 57 32 45; +33 679 05 73 83, E-Mail: francois.poisson@ifremer.fr; fpoisson@ifremer.fr

Rodríguez-Marín, Enrique
Ministerio de Economía, Industria y Competitividad, Instituto Español de Oceanografía, C.O. de Santander, Promontorio de San Martín s/n, 39004 Santander Cantabria, Spain
Tel: +34 942 291 716, Fax: +34 942 27 50 72, E-Mail: rodriguez.marin@st.ieo.es

Rouyer, Tristan
Ifremer - Dept Recherche Halieutique, B.P. 171 - Bd. Jean Monnet, 34200 Sète, France
Tel: +33 (0)4 42 57 32 37; +33 (0)7 82 99 52 37, E-Mail: tristan.rouyer@ifremer.fr

Ruiz Gondra, Jon *
AZTI-Tecnalia, Txatxarramendi z/g, 48395 Sukarrieta (Bizkaia), Spain
Tel: +34 94 6574000, Fax: +34 94 6572555, E-Mail: jruiz@azti.es

Santiago Burrutxaga, Josu
Head of Tuna Research Area, AZTI-Tecnalia, Txatxarramendi z/g, 48395 Sukarrieta (Bizkaia) País Vasco, Spain
Tel: +34 94 6574000 (Ext. 497); 664303631, Fax: +34 94 6572555, E-Mail: jsantiago@azti.es; flarrauri@azti.es

Sundelöf, Andreas
Swedish University of Agricultural Sciences, Institute of Marine Research Turistgatan, 5, SE-453 30 Lysekil, Sweden
Tel: +46 703 068 775, Fax: +46 5231 3977, E-Mail: andreas.sundelof@slu.se

Tserpes, George
Hellenic Center for Marine Research (HCMR), Institute of Marine Biological Resources, P.O. Box 2214, 71003 Heraklion Crete, Greece
Tel: +30 2810 337851, Fax: +30 2810 337820, E-Mail: gtserpes@hcmr.gr

JAPAN

Butterworth, Douglas S.
Emeritus Professor, Department of Mathematics and Applied Mathematics, University of Cape Town, Rondebosch, 7701 Cape Town, South Africa
Tel: +27 21 650 2343, E-Mail: doug.butterworth@uct.ac.za

Itoh, Tomoyuki *
Chief of Temperate Tuna Group, Bluefin tuna Resources Division, National Research Institute of Far Seas Fisheries, Japan Fisheries Research and Education Agency, 5-7-1 Orido, Shizuoka Shimizu 424-8633
Tel: +81 54 336 6000, Fax: +81 54 335 9642, E-Mail: itou@fra.affrc.go.jp

Kimoto, Ai
Researcher, Bluefin Tuna Resources Division, National Research Institute of Far Seas Fisheries, Japan Fisheries Research and Education Agency, 5-7-1 Orido, Shizuoka Shimizu 424-8633
Tel: +81 54 336 6000, Fax: +81 54 335 9642, E-Mail: aikimoto@affrc.go.jp

Kitakado, Toshihide *
Associate Professor, Faculty of Marine Science, Tokyo University of Marine Science and Technology, Department of Marine Biosciences, 4-5-7 Konan, Minato, Tokyo 108-8477
Tel: +81 3 5463 0568, Fax: +81 3 5463 0568, E-Mail: kitakado@kaiyodai.ac.jp; toshihide.kitakado@gmail.com

Matsumoto, Takayuki
Research Coordinator for Oceanography and Resources, National Research Institute of Far Seas Fisheries, Japan Fisheries Research and Education Agency, 5-7-1 Orido, Shizuoka Shimizu 424-8633
Tel: +81 54 336 6016, Fax: +81 54 335 9642, E-Mail: matumot@affrc.go.jp

Miwa, Takeshi
Associate Director, International Affairs Division, Resources Management Department, Fisheries Agency, Ministry of Agriculture, Forestry and Fisheries, 1-2-1 Kasumigaseki, Chiyoda-ku, Tokyo 100-8907
Tel: +81 3 3502 8460, Fax: +81 3 3504 2649, E-Mail: takeshi_miwa090@maff.go.jp

Nakatsuka, Shuya
Research Coordinator, National Research Institute of Far Seas Fisheries, Japan Fisheries Research and Education Agency, 5-7-1 Orido, Shizuoka Shimizu 424-8633
Tel: +81 54 336 6000, Fax: +81 54 335 9642, E-Mail: snakatsuka@affrc.go.jp

Okamoto, Hiroaki
Director Bluefin tuna Resources Department, National Research Institute of Far Seas Fisheries, Japan Fisheries Research and Education Agency, 5-7-1 Orido, Shizuoka Shimizu 424-8633
Tel: +81 54 336 6000, E-Mail: okamoto@fra.affrc.go.jp

Oshima, Kazuhiro
Chief of Ecologically Related Species Group, National Research Institute of Far Seas Fisheries, Japan Fisheries Research and Education Agency, 5-7-1, Orido, Shizuoka Shimizu-ku 424-8633
Tel: +81 543 36 6047, Fax: +81 543 35 9642, E-Mail: oshimaka@affrc.go.jp

Satoh, Keisuke
Tuna Fisheries Resources Group, Tuna and Skipjack Resources Division, National Research Institute of Far Seas Fisheries, Japan Fisheries Research and Education Agency, 5-7-1, Chome Orido, Shizuoka-Shi Shimizu-Ku 424-8633
Tel: +81 54 336 6044, Fax: +81 54 335 9642, E-Mail: kstu21@fra.affrc.go.jp

Semba-Murakami, Yasuko *
Researcher, Tuna Fisheries Resources Group, Tuna and Skipjack Resources Division, National Research Institute of Far Seas Fisheries, 5-7-1 Orido, Shimizu-ku, Shizuoka-City, Shizuoka 424-8633
Tel: +81 5 4336 6045, Fax: +81 5 4335 9642, E-Mail: senbamak@fra.affrc.gjo.jp

Tsuji, Sachiko
Researcher, National Research Institute of Far Seas Fisheries, Japan Fisheries Research and Education Agency, 2-12-4, Fukuura, Kanazawa, Yokohama, Kanagawa, 236-8648
Tel: +81 45 788 7511, Fax: +81 45 788 5004, E-Mail: sachiko27tsuji@gmail.com

Uozumi, Yuji
Visiting Scientist, National Research Institute of Far Seas Fisheries, Japan Fisheries Research and Education Agency, 5-7-1 Orido, Shizuoka Shimizu 424-8633
Tel: +81 54 336 6000, E-Mail: uozumi@affrc.go.jp

KOREA REP.

Kim, Doo Nam
Distant Water Fisheries Resources Division, National Institute of Fisheries Science, 216 Gijang-Haeanro, Gijang-eup, Gijang-gun, 46083 Busan
Tel: +82 51 720 2330, Fax: +82 51 720 2337, E-Mail: doonam@korea.kr

Lee, Sung Il
Division, National Fisheries Research & Development Institute, 216 Gijang-Haeanro, Gijang-eup, Gijang-gun, 46083 Busan
Tel: +82 51 720 2331, Fax: +81 51 720 2337, E-Mail: k.sungillee@gmail.com; k.sungillee@korea.kr

LIBERIA

Kay, D. Wisseh
Director Research & Statistics, Bureau of National Fisheries, Monrovia
Tel: +231 776 066 416, E-Mail: d.wissehkay@yahoo.com

MAURITANIA

Habibe, Beyahe Meissa
Institut Mauritanien de Recherches Océanographiques et des Pêches - IMROP, B.P. 22, Cite IMROP Villa Nº 8, Nouadhibou
Tel: +222 2242 1047, Fax: +222 574 5081, E-Mail: beyahem@yahoo.fr; bmouldhabib@gmail.com

MEXICO

Ramírez López, Karina
Instituto Nacional de Pesca y Acuacultura - Veracruz, Av. Ejército Mexicano No. 106 - Colonia Exhacienda, Ylang Ylang, C.P. 94298 Boca de Río Veracruz
Tel: +52 22 9130 4520, E-Mail: kramirez_inp@yahoo.com; kramirez.inp@gmail.com

MOROCCO

Abid, Noureddine
Responsable du programme de suivi et d'étude des ressources des grands pélagiques, Center Régional de L'INRH á Tanger/M'dig, B.P. 5268, 90000 Drabed Tanger
Tel: +212 53932 5134, Fax: +212 53932 5139, E-Mail: noureddine.abid65@gmail.com

Baibbat, Sidi Ahmed *
Biologiste Charge de suivi des thonidés, centre régional de DAKHLA, Institut national de recherches halieutiques, 2, BD Sidi Abderrahmane, ain diab., 20100 Dakhla
Tel: +212 66 129 8983, E-Mail: baibat@hotmail.com

Faraj, Abdelmalek
Directeur Général d l'Institut National de Recherche Halieutique, Institut National de Recherche Halieutique, Département des Ressources Halieutiques, Centre de Sidi Abderrahmane, 20000 Casablanca
Tel: +212 6 61649185, Fax: +212 6 61649185, E-Mail: faraj@inrh.ma;abdelmalekfaraj@yahoo.fr

Grichat, Hicham
Chef du Service des Espèces Migratices et Aires Protegeés, Ministère de l'Agriculture et de la Pêche Maritime, Département de la Pêche Maritime, Direction des Pêches Maritimes, B.P 476 Nouveau Quartier Administratif, Haut Agdal Rabat
Tel: +212 537 68 81 15, Fax: +212 537 68 8089, E-Mail: grichat@mpm.gov.ma

Hassouni, Fatima Zohra
Chef de la Division de la Protection des Ressources Halieutiques, Division de la Protection des Ressources Halieutiques, Direction des Pêches maritimes et de l'aquaculture, Département de la Pêche maritime, Nouveau Quartier Administratif, Haut Agdal, Rabat
Tel: +212 537 688 122/21;+212 663 35 36 87, Fax: +212 537 688 089, E-Mail: hassouni@mpm.gov.ma

Malouli Idrissi, Mohammed
Chef du Département des Ressources Halieutiques a l'institut national INRH, Institut National de Recherche Halieutique (INRH) à Casablanca, Bd Sidi Abderahmane, 2, Ain Diab, Casablanca
Tel: +212 52 239 7388, E-Mail: malouliinrh@yahoo.fr; malouli@inrh.ma

Rouchdi, Mohammed
Secrétaire Général de l'Association Marocaine des Madragues, Association Marocaine des Madragues (AMM), Nouvelle Zone Portuaire Larache BP 138, Larache
Tel: +212 537 754 927, Fax: +212 537 754 927, E-Mail: rouchdi@ylaraholding.com; madrague.tr@gmail.com

NAMIBIA

Tjizoo, Beau Mbeurora
Ministry of Fisheries and Marine resources, Strand Str. - Box 912, Swaropmund
Tel: +264 4101159, Fax: +264 404 385, E-Mail: beau.tjizoo@mfmr.gov.na

Uahengo, Toivo Pendapala
Chief Statistician, Namibian Ministry of Fisheries and Marine Resources, Private Bag 13355, Windhoek
Tel: +264 8114 95525, Fax: +264 8552 5532, E-Mail: toivo.uahengo@mfmr.gov.na

NIGERIA

Okpe, Hyacinth Anebi
Chief Fisheries Officer, Fisheries Resources Monitoring, Control & Surveillance (MCS) Division, Federal Ministry of Agriculture and Rural Development, Department of Fisheries Lagos Victoria Island
Tel: +234 70 6623 2156, Fax: +234 09 314 4665, E-Mail: hokpe@yahoo.com; Hyacinthokpe80@gmail.com

NORWAY

Nottestad, Leif
Principal Scientist, Institute of Marine Research, P.O. Box 1870 Nordnesgaten, 33, 5005 Bergen
Tel: +47 99 22 70 25, Fax: +47 55 23 86 87, E-Mail: leif.nottestad@imr.no

RUSSIAN FEDERATION

Leontev, Sergey
Expert, Head of the Laboratory, FSUE - VNIRO, Russian Federal Research Institute of Fisheries & Oceanography, 17, V. Krasnoselskaya, 107140 Moscow
Tel: +7 499 264 94 65, Fax: +7 499 264 94 65, E-Mail: leon@vniro.ru; ums@fishcom.ru

Nesterov, Alexander
Head Scientist, Atlantic Research Institute of Marine, Fisheries and Oceanography (AtlantNIRO) 5, Dmitry Donskoy Str., 236022 Kaliningrad
Tel: +7 (4012) 215645, Fax: + 7 (4012) 219997, E-Mail: nesterov@atlantniro.ru; oms@atlantniro.ru

S. TOMÉ E PRÍNCIPE

Da Conceiçao, Ilair
Chef du Département de Recherche, Statistiques et de l'aquaculture, Direcçao das Pescas, Responsavel pelo serviço de Estatística Pesqueira, Bairro 3 de Fevereiro - PB 59
Tel: +239 990 9315, Fax: +239 12 22 414, E-Mail: ilair1984@gmail.com

SENEGAL

Ndaw, Sidi
Chef du Bureau des Statistiques à la Direction des Pêches, Ministère de la Pêche et de l'Economie Maritime, Direction des Pêches Maritimes, 1, rue Joris, Place du Tirailleur, B.P. 289, Dakar
Tel: +221 33 823 0137; +221775594914, Fax: +221 33 821 4758, E-Mail: sidindaw@hotmail.com; dopm@orange.sn; dpm@mpem.gouv.sn

Sèye, Mamadou
Ingénieur des Pêches, Chef de la Division Gestion et Aménagement des Pêcheries de la Direction des Pêches maritimes, 1, Rue Joris, Place du Tirailleur, Dakar
Tel: +221 33 823 01 37, Fax: +221 821 47 58, E-Mail: mamadou.seye@mpem.gouv.sn; mdseye@gmail.com

Sow, Fambaye Ngom
Chercheur Biologiste des Pêches, Centre de Recherches Océanographiques de Dakar Thiaroye, CRODT/ISRALNERV - Route du Front de Terre - BP 2241, Dakar
Tel: +221 3 0108 1104; +221 77 502 67 79, Fax: +221 33 832 8262, E-Mail: famngom@yahoo.com

SOUTH AFRICA

Goosen Meyer, Melissa
Large Pelagic Research Technician, Convenor of the Large Pelagic and Shark Scientific Working Group, Fisheries Research and Development, Inshore Research, Department of Agriculture, Forestry and Fisheries, Foretrust Building, 9 Martin Hammerschlag Way, Foreshore, 8000 Cape Town, Private Bag X2, Vlaeberg 8018
Tel: +27 21 402 3627, E-Mail: melissag@daff.gov.za; mel.goosen@gmail.com

Kerwath, Sven
Chairman of the Large Pelagics and Sharks Scientific Working Group, Fisheries Research and Development, Inshore Research, Department of Agriculture, Forestry and Fisheries, Foretrust Building, 9 Martin Hammerschlag Way, Foreshore, 8000 Cape Town, Private Bag X2, Vlaeberg 8018
Tel: +27 83 991 4641, E-Mail: SvenK@daff.gov.za

Pheeha, Saasa
Director, Marine Resource Management, Department of Agriculture, Forestry and Fisheries, Foretrust Building, 9 Marting Hammerschalg Way, Foreshore 8000, Cape Town, Private Bag X2, Vlaeberg 8018
Tel: +27 21 402 3563, Fax: +27 21 402 3618, E-Mail: saasap@daff.gov.za

TUNISIA

Hajjej, Ghailen
Attaché de recherche, Laboratoire des Sciences Halieutiques, Institut National des Sciences et Technologies de la Mer (INSTM), Port de pêche, 6000 Gabès
Tel: +216 75 220 254, E-Mail: ghailen3@yahoo.fr; ghailen.hajej@instm.rnrt.tn

Missaoui, Hachemi
Directeur Général, Institut National des Sciences et Technologies de la Mer-INSTM, 28 Rue 2 Mars 1934, 2025 Salommbô
Tel: +216 71 730548, Fax: +216 71 732622, E-Mail: hechmi.missaoui@instm.rnrt.tn; dgfa2009@gmail.com

M'Rabet, Ridha
Directeur Général de la Pêche et de l'Aquaculture - DGPA, Ministère de l'Agriculture, des Ressources Hydrauliques et de la Pêche, 30 Rue Alain Savary, 1002
Tel: +216 71 892 253, Fax: +216 71 799 401, E-Mail: bft@iresa.agrinet.tn; ridha.mrabet@iresa.agrinet.tn

Zarrad, Rafik
Institut National des Sciences et Technologies de la Mer (INSTM), BP 138 Mahdia 5199
Tel: +216 73 688 604, Fax: +216 73688602, E-Mail: rafik.zarrad@instm.rnrt.tn; rafik.zarrad@gmail.com

UNITED KINGDOM (OVERSEAS TERRITORIES)

Luckhurst, Brian
2-4 Via della Chiesa, Acqualoreto, 05023 Umbria, Italy
Tel: +39 339 119 1384, E-Mail: brian.luckhurst@gmail.com

UNITED STATES

Brown, Craig A.
Chief, Highly Migratory Species Branch, Sustainable Fisheries Division, NOAA Fisheries Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami Florida 33149
Tel: +1 305 586 6589, Fax: +1 305 361 4562, E-Mail: craig.brown@noaa.gov

Cass-Calay, Shannon
NOAA Fisheries, Southeast Fisheries Center, Sustainable Fisheries Division, 75 Virginia Beach Drive, Miami Florida 33149
Tel: +1 305 361 4231, Fax: +1 305 361 4562, E-Mail: shannon.calay@noaa.gov

Cortés, Enric
Research Fishery Biologist, NOAA-Fisheries, Southeast Fisheries Science Center, Panama City Laboratory, 3500 Delwood Beach Road, Panama City Florida
Tel: +1 850 234 6541, Fax: +1 850 235 3559, E-Mail: enric.cortes@noaa.gov

Díaz, Guillermo
NOAA-Fisheries, Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami Florida 33149
Tel: +1 305 898 4035, E-Mail: guillermo.diaz@noaa.gov

Lauretta, Matthew
NOAA Fisheries Southeast Fisheries Center, 75 Virginia Beach Drive, Miami Florida 33149
Tel: +1 305 361 4481, E-Mail: matthew.lauretta@noaa.gov

Morse, Molly *
University of Massachusetts, School for Marine Science & Technology, 200 Mill Road, Suite 325, Fairhaven, MA 02719
Tel: +1 310 924 5554, E-Mail: mmorse1@umassd.edu

Porch, Clarence E.
Chief, Sustainable Fisheries Division, Southeast Fisheries Science Center, National Marine Fisheries Service, 75 Virginia Beach Drive, Miami Florida 33149
Tel: +1 305 361 4232, Fax: +1 305 361 4219, E-Mail: clay.porch@noaa.gov

Schirripa, Michael *
NOAA Fisheries, Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami Florida 33149
Tel: +1 305 361 4568, Fax: +1 305 361 4562, E-Mail: michael.schirripa@noaa.gov

Walter, John
NOAA Fisheries, Southeast Fisheries Center, Sustainable Fisheries Division, 75 Virginia Beach Drive, Miami Florida 33149
Tel: +305 365 4114, Fax: +1 305 361 4562, E-Mail: john.f.walter@noaa.gov

URUGUAY

Domingo, Andrés
Dirección Nacional de Recursos Acuáticos - DINARA, Laboratorio de Recursos Pelágicos, Constituyente 1497, 11200 Montevideo
Tel: +5982 400 46 89, Fax: +5982 401 32 16, E-Mail: adomingo@dinara.gub.uy;dimanchester@gmail.com

VENEZUELA

Arocha, Freddy *
Instituto Oceanográfico de Venezuela, Universidad de Oriente, A.P. 204, 6101 Cumaná Estado Sucre
Tel: +58-293-400-2111 - móvil: 58 416 693 0389, E-Mail: farocha@udo.edu.ve; farochap@gmail.com

OBSERVERS FROM COOPERATING NON-CONTRACTING PARTIES, ENTITIES, FISHING ENTITIES

CHINESE TAIPEI

Chang, Feng-Chen
Overseas Fisheries Development Council, 3F., No14, Wenzhou St. Da'an Dist. 106
Tel: +886 2 2368 0889 ext. 126, Fax: +886 2 2368 1530, E-Mail: fengchen@ofdc.org.tw; d93241008@ntu.edu.tw

Huang, Julia Hsiang-Wen
Director and Professor, Institute of Marine Affaires and Resource Management, National Taiwan Ocean University, No. 2 Pei-Ning Road, 202 Keelung City
Tel: +886 2 2462 2192 Ext. 5608, Fax: +886 2 2463 3986, E-Mail: julia@ntou.edu.tw

Lu, Ching-Ping
Overseas Fisheries Development Council, 3F., No. 14, Wenzhou St., Da'an Dist., 106
Tel: +886 2 2368 0889 ext. 138, Fax: +886 2 2368 3536, E-Mail: michellecplu@ofdc.org.tw; michelllecplu@gmail.com

Su, Nan-Jay
Assistant Professor, Department of Environmental Biology and Fisheries Science, No. 2 Pei-Ning Rd. Keelung, 202
Tel: +886 2 2462-2192 #5046, E-Mail: nanjay@ntou.edu.tw

OBSERVERS FROM INTERGOVERNMENTAL ORGANIZATIONS

FOOD AND AGRICULTURE ORGANIZATION - FAO

Gutiérrez de los Santos, Nicolás Luis
Fisheries Resources Officer, Fisheries and Aquaculture Resources, Use and Conservation Division. FAO, Viale delle Terme di Caracalla, 00153 Rome, Italy
Tel: +39 06 570 56563, E-Mail: nicolas.gutierrez@fao.org

OBSERVERS FROM NON-GOVERNMENTAL ORGANIZATIONS

BIRDLIFE INTERNATIONAL - BI

Small, Cleo *
Senior Policy Officer, BIRDLIFE International Global Seabird Programme, RSPB, The Lodge, Sandy, Bedfordshire SG19 2DL, United Kingdom
Tel: +44 1767 693 586, Fax: +44 1767 692 365, E-Mail: cleo.small@rspb.org.uk

Winnard, Stephanie *
Birdlife International, The Lodge, Sandy, Bedfordshire, SG19 2DL, United Kingdom
Tel: +44 1767 693 063, E-Mail: stephanie.winnard@rspb.org.uk

FEDERATION OF MALTESE AQUACULTURE PRODUCERS – FMAP

Deguara, Simeon
Research and Development Coordinator, Federation of Maltese Aquaculture Producers - FMAP, 61, St. Paul Street, VLT 1212 Valletta, Malta
Tel: +356 21223515; +356 21226268, Fax: +356 21241170, E-Mail: dsd@aquabt.com

HUMANE SOCIETY INTERNATIONAL - HSI

Abercrombie, Debra
Research Consultant, Humane Society International, 3299 NW 44th Street #6, Fort Lauderdale, FL 33309
Tel: +1 954 253 1265, E-Mail: debra.abercrombie@gmail.com

INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION – ISSF

Justel, Ana
ISSF-Spain, C/ Francisco Giralte, 2, 28002 Madrid, Spain
Tel: +34 91 745 3075, E-Mail: ajustel@iss-foundation.org

Restrepo, Víctor
Chair of the ISSF Scientific Advisory Committee, ISS-Foundation, 1440 G Street NW, Washington DC 20005, United States
Tel: + 1 703 226 8101, Fax: +1 215 220 2698, E-Mail: vrestrepo@iss-foundation.org; vrestrepo@mail.com

PEW CHARITABLE TRUSTS - PEW

Galland, Grantly
Pew Charitable Trusts, 901 E Street, NW, Washington, DC 20004, United States
Tel: +1 202 540 6953, Fax: +1 202 552 2299, E-Mail: ggalland@pewtrusts.org

THE OCEAN FOUNDATION

Boustany, Andre M. *
Duke University, Nicholas School of the Environment Box 90328, Durham NC 27708, United States
Tel: +1 831 402 1364, Fax: +1 919 613 8026, E-Mail: andre.boustany@duke.edu

Miller, Shana
The Ocean Foundation, 1320 19th St., NW, 5th Floor, Washington, DC 20036, United States
Tel: +1 631 671 1530, E-Mail: smiller@oceanfdn.org

THE SHARK TRUST

Fordham, Sonja V
Shark Advocates International, President, c/o The Ocean Foundation, suite 250, 1320 19th Street, NW Fifth Floor, Washington, DC 20036, United States
Tel: +1 202 436 1468, E-Mail: sonja@sharkadvocates.org; sonjaviveka@gmail.com

Hood, Ali
The Shark trust, 4 Creykes Court, The Millfields, Plymouth PL1 3JB, United Kingdom
Tel: +44 7855 386083, Fax: +44 1752 672008, E-Mail: ali@sharktrust.org

UNIVERSITY OF NORTH CAROLINA

Braun, Amy *
University of North Carolina at Chapel Hill, Department of Geography, CB 3220 Chapel Hill, NC, 27599, United States
Tel: +1 919 923 1068, Fax: +1 919 962 1537, E-Mail: ambraun@live.unc.edu

WORLD WILDLIFE FUND – WWF
Buzzi, Alessandro
WWF, Via Po, 25/c, 00184 Roma, Italy
Tel: +3906 84 4971, E-Mail: abuzzi@wwfmedpo.org

García Rodríguez, Raúl
WWF Mediterranean, Gran Vía de San Francisco, 8, 28005 Madrid, Spain
Tel: +34 630 834 267, Fax: +34 913 656 336, E-Mail: pesca@wwf.es

SCRS CHAIRMAN
Die, David
SCRS Chairman, Cooperative Institute of Marine and Atmospheric Studies, University of Miami, 4600 Rickenbacker Causeway, Miami Florida 33149, United States
Tel: +1 673 985 817, Fax: +1 305 421 4221, E-Mail: ddie@rsmas.miami.edu

*****

ICCAT Secretariat
C/ Corazón de María 8 – 6ª planta 28002 Madrid – SPAIN
Tel: +34 91 416 56 00; Fax: +34 91 415 26 12; E-mail: info@iccat.int

ICCAT
Meski, Driss
Neves dos Santos, Miguel
Moreno, Juan Antonio
De Bruyn, Paul
Kell, Laurence
Palma, Carlos
Ortiz, Mauricio
Mayor, Carlos
De Andrés, Marisa
García-Orad, María José
Campoy, Rebecca
Donovan, Karen
Pinet, Dorothée
Navarret, Christel
Fiz, Jesús
Gallego Sanz, Juan Luis
García Piña, Cristóbal
Martínez Guijarro, Ana Isabel
Moreno, Juan Ángel
Muñoz, Juan Carlos
Parrilla, Alberto Thais
Peña, Esther

AOTTP PROGRAMME
Beare, Doug
Güemes, Pedro

ICCAT GBYP PROGRAMME
Di Natale, Antonio
Tensek, Stasa

ICCAT INTERPRETERS
Baena Jiménez, Eva J.
Faillace, Linda
Liberas, Christine
Linaae, Cristina
Meunier, Isabelle
Hof, Michelle R.

Appendix 3

List of 2017 SCRS Documents*

Reference	Title	Authors
SCRS/2017/001	Report of the Bluefin Tuna data preparatory meeting	Anon.
SCRS/2017/002	Report of the Shortfin Mako shark data preparatory meeting	Anon.
SCRS/2017/003	Report of the Atlantic Swordfish data preparatory meeting	Anon.
SCRS/2017/004	Report of the Small Tunas species group intersessional meeting	Anon.
SCRS/2017/005	Report of the Working Group on Stock Assessment Methods meeting	Anon.
SCRS/2017/006	Report of the Albacore species group intersessional meeting	Anon.
SCRS/2017/007	Report of the Shortfin Mako shark stock assessment session	Anon.
SCRS/2017/008	Report of the Atlantic Swordfish stock assessment session	Anon.
SCRS/2017/009	Report of the Sub-Committee on Ecosystems Intersessional meeting	Anon.
SCRS/2017/010	Report of the Bluefin Tuna stock assessment session	Anon.
SCRS/2017/011	Report of the Tropical Tunas species group intersessional meeting	Anon.
SCRS/2017/012	Report of the Sub-Committee on Statistics meeting	Anon.
SCRS/2017/013	Alternative catch estimates from market and third party data	Apostolaki P., Pearce J., Barbari A., and Beddington J.
SCRS/2017/014	First report on cannibalistic feeding behaviour in post-flexion bluefin larvae (*Thunnus thynnus*) of the Balearic Sea (NW Mediterranean)	Uriarte A., Johnstone C., Laiz-Carrión R., García A., Quintanilla J.M., Reglero P., and Alemany F.
SCRS/2017/015	Estimation of conversion factor from curved fork length to straight fork length for farmed eastern bluefin tuna (*Thunnus thynnus*)	Drakard V.F., Gatt M., and Camilleri T.
SCRS/2017/016	Development of a fishery independent index of abundance for Atlantic Bluefin tuna in the Gulf of St Lawrence	Melvin G.D., Munden J., and Finley M.
SCRS/2017/017	Food composition and feeding habits of little tunny (*Euthynnus alletteratus*) from the Tunisian Mediterranean coast	Hajjej G., Hattour A., Missaoui H., and Jarboui O.
SCRS/2017/018	Length-weight relationship for small tunas species caught by purse seine in the gulf of Gabes (Ionian sea-Mediterranean)	Hajjej G., Hattour A., Missaoui H., and Jarboui O.
SCRS/2017/019	Calculating population-wide spatial and seasonal relative abundance indices for Atlantic bluefin tuna for use in operational modelling	Carruthers T.
SCRS/2017/020	Standardized CPUE indices for Canadian bluefin tuna fisheries: 1981-2016	Hanke A.R., and Cheverie A.

* Vol. 74 (1-7) of the *ICCAT Collective Volume of Scientific Papers* includes 2017 SCRS documents (available on the ICCAT web site).

SCRS/2017/021	Stock mixing rates of bluefin tuna from Canadian landings: 1975-2015	Puncher G., and Hanke A.R.
SCRS/2017/022	Validation of the growth equations applicable to the Atlantic bluefin tuna, *Thunnus thynnus* (L.), using Lmax, tag-recapture, length-weight relationships, condition factor and first dorsal spine analysis	Cort J.L., Estruch V.D., and Deguara S.
SCRS/2017/023	Review and update of the Catch at Age (CAA) for the Spain Bay of Biscay Bluefin tuna fisheries for 1950 – 2000	Cort J.L., Santiago J., Arrizabalaga H., Palma C., and Ortiz M.
SCRS/2017/024	Estimation of size at catch and potential growth of farmed Eastern Bluefin tuna (*Thunnus thynnus*) from farm harvest database	Ortiz M.
SCRS/2017/025	The standardized bluefin CPUE of Japanese longline fishery in the Atlantic up to 2017 fishing year	Kimoto A., and Itoh T.
SCRS/2017/026	Estimating the contribution of Atlantic Bluefin tuna sub-populations in the North Atlantic Ocean over the last 6 years	Fraile I., Arrizabalaga H., Kimoto A., Itoh T., Abid N., Rodriguez-Marín E., and Rooker J.
SCRS/2017/027	Genetic assignment of Atlantic bluefin tuna feeding aggregations to spawning grounds	Rodríguez-Ezpeleta N., Díaz-Arce N., Addis P., Abid N., Alemany F., Deguara S., Fraile I., Franks J., Hanke A., Itoh T., Karakulak S., Kimoto A., Lawretta M., Lino P., Lutcavage M., Macías D., Ngom Sow F., Notestad L., Oray I., Pascual P., Quattro J., Richardson D.D., Rooker J.R., Valastro M., Varela J.L., Walter J., Irigoien X., and Arrizabalaga H.
SCRS/2017/028	Integrated analysis for Atlantic bluefin tuna origin assignment	Brophy D., Duncan R., Hickey A., Abid N., Addis P., Allman R., Coelho R., Deguara S., Rodriguez Ezpeleta N., Fraile I., Karakulak S., and Arrizabalaga H.
SCRS/2017/029	Historical Size structure of Bluefin tuna purse seiner's catch: data recovered from Balfegó logbooks data (1985-2000)	Gordoa A., Balfegó M., Balfegó P.V., and Navarro J.
SCRS/2017/030	Update on the bluefin tuna catches from the tuna trap fishery off southern Portugal (NE Atlantic) between 1998 and 2016	Lino P.G., Rosa D., and Coelho R.
SCRS/2017/031	Las almadrabas de la corona de Aragón en los siglos XVI y XVII	Vidal-Bonavila J.
SCRS/2017/032	Annual indices of bluefin tuna (*Thunnus thynnus*) spawning biomass in the Gulf of Mexico (1977-2016)	Ingram G.W.
SCRS/2017/033	Changes of bluefin tuna (*Thunnus thynnus*) larvae fishing methods over time in the western Mediterranean, calibration and larval indices updating	Alvarez-Berastegui D., Ingram Jr G.W., Reglero P., Ferrà C., and Alemany F.

SCRS/2017/034	A potential larval survival index for bluefin tuna (*Thunnus thynnus*) during 1990-2016	Reglero P., Balbín R., Alvarez-Berastegui D., Rasmuson L., Ortega A., Abascal F., Blanco E., Medina A., de la Gándara F., Mourre B., and Alemany F.
SCRS/2017/035	Report of the working group on multi-national pelagic longline index for western Atlantic bluefin tuna	Walter J., Lauretta M., Kimoto A., Hanke A., Ramirez K., and Melvin G.
SCRS/2017/036	Proposals for Atlantic bluefin tuna stock assessment models for 2017	Walter J.
SCRS/2017/037	VPA-2BOX model diagnostics used in the 2014 assessment of eastern Atlantic bluefin tuna	Zarrad R., Walter J., Lauretta M.
SCRS/2017/038	Standardized CPUE of bluefin tuna (*Thunnus thynnus*) caught by Moroccan Atlantic traps for the period 1986- 2016	Abid N., Malouli M., and Mhamed A.B.
SCRS/2017/039	Tentative recovery of historical bluefin tuna catches in the black sea: the Bulgarian catches 1950-1971	Di Natale A.
SCRS/2017/040	A peculiar situation for YOY of bluefin tuna (*Thunnus thynnus*) in the Mediterranean sea in 2015	Di Natale A., Tensek S., Celona A., Garibaldi F., Macias Lopez D.A., Oray I., Ortega García A., Pagá García A., Potoschi A., Tinti F.
SCRS/2017/041	The disappearance of young-of-the year bluefin tuna from the Mediterranean coast in 2016: is it an effect of the climate change?	Di Natale A., Tensek S., Pagá García A.
SCRS/2017/042	ICCAT GBYP tagging activities in phase 6	Tensek S., Pagá García A., Di Natale A.
SCRS/2017/043	Historical and recent data of Sicilian traps: the complexity in data recovery and interpretation	Pagá García A., Di Natale A., Tensek S.
SCRS/2017/044	Update of the abundance index for juvenile fish derived from aerial surveys of bluefin tuna in the western Mediterranean Sea	Rouyer T., Brisset B., Bonhommeau S., and Fromentin J-M.
SCRS/2017/045	Atlantic bluefin tuna area transition matrices estimated from electronic tagging and SATTAGSIM	Galuardi B., Cadrin S.X., Arregi I., Arrizabalaga H., Di Natale A., Brown C., Lauretta M., and Lutcavage M.
SCRS/2017/046	Captures, fréquences de taille et sex-ratio Thon rouge de la côte Algérienne	Krim A.K., Djerbal M., and Daoud N.A.
SCRS/2017/047	Blackfin tuna (*Thunnus atlanticus*) updates on catch, effort and size distribution from Venezuelan fisheries	Narváez M., Ariza L., Evaristo E., Bermudez R., Marcano J.H., Gutierrez X., and Arocha F.
SCRS/2017/048	A revision of the shortfin mako shark size distribution in the Atlantic using observer data from the main pelagic longline fleets	Coelho R., Domingo A., Courtney D., Cortés E., Arocha F., Liu K-M., Yokawa K., Yasuko S., Hazin F., Rosa D., and Lino P.G.
SCRS/2017/049	Standardized CPUE and size distribution of shortfin mako shark in the Portuguese pelagic longline fishery in the Atlantic	Coelho R., Rosa D., and Lino P.G.
SCRS/2017/050	Satellite tagging of shortfin mako for habitat use and post-release survival: progress report for SRDCP	Coelho R., Domingo A., Carlson J., Natanson L., Cortés E., and Miller P.
SCRS/2017/051	Progress on the Atlantic-wide study on the age and growth of shortfin mako shark: progress report for SRDCP	Rosa D., Mas F., Mathers A., Natanson L., Domingo A., Carlson J., and Coelho R.

SCRS/2017/052	Hooking mortality of swordfish in pelagic longlines: comments on the efficiency of the minimum retention size currently in place in ICCAT	Coelho R., and Lechuga R.
SCRS/2017/053	Standardized CPUE of swordfish in the Portuguese pelagic longline fishery in the Atlantic	Coelho R., Rosa D., and Lino P.G.
SCRS/2017/054	Revised standardized CPUE of shortfin mako (*Isurus oxyrinchus*) caught by the Japanese tuna longline fishery in the North Atlantic Ocean between 1994 and 2015	Semba Y., Kai M., and Yokawa K.
SCRS/2017/055	Bayesian surplus production models for shortfin mako sharks: are the results consistent when using different software packages?	Babcock E., and Cortes E.
SCRS/2017/056	Stock status indicators of mako sharks in the western North Atlantic Ocean based on the US pelagic longline logbook and observer programs	Cortes E.
SCRS/2017/057	Evaluation of environmental conditions as predictors for mako shark CPUE using generalized linear mixed modeling and quantile regression	Ofarrell H., and Babcock E.
SCRS/2017/058	CPUE, size and maturity of shortfin mako, *Isurus oxyrinchus*, caught by longliners in the Southwestern Atlantic Ocean	Mas F., Forselledo R., and Domingo A.
SCRS/2017/059	Standardized CPUE of shortfin mako, Isurus oxyrinchus, based on data gathered by the National Observer Program on Board the Uruguayan longline flee (2001-2012)	Mas F., Forselledo R., Pons M., and Domingo A.
SCRS/2017/060	Reproduction of Atlantic bonito (*Sarda sarda*) South of the Moroccan Atlantic waters	Baibbat S.A., Malouli I., Abid N., Kell L., Lucena F., and Benazzouz B.
SCRS/2017/061	Description of a fishing of two Mauritanian longline vessels generating excessive catches of sharks	Braham C.B.
SCRS/2017/062	Updated and retrospective estimates of shortfin mako (*Isurus oxyrinchus*) landings by the Spanish surface longline fishery targeting swordfish in areas of the Atlantic Ocean during the 1950-2015 period	González-González I., Fernández-Costa J., Ramos-Cartelle A., and Mejuto J.
SCRS/2017/063	Updated standardized catch rate of swordfish (*Xiphias gladius*) from the Moroccan longline fishery operating in the north Atlantic	Sid'Ahmed B., Abid N., Malouli M.I., and Benmhamed A.
SCRS/2017/064	A relative index of Atlantic Swordfish abundance based on Canadian pelagic longline data (2002 to 2016)	Hanke A.R.
SCRS/2017/065	Longline data simulation: a paradigm for improving CPUE standardization	Goodyear C.P., Schirripa M., and Forrestal F.
SCRS/2017/066	Testing robustness of CPUE standardization using simulated data: Findings of initial blind trials	Forrestal F.C., Goodyear C.P., Schirripa M., Babcock E., Lauretta M., and Sharma R.
SCRS/2017/067	Estimations of standardized catch rates of swordfish (*Xiphias gladius*) caught by Brazilian fleet as calculated using fixed and random effects	Oliveira E.S.C., Carneiro V.G.O., Rodrigues S.L., and Andrade H.A.
SCRS/2017/068	Update standardized catch rate of swordfish (*Xiphias gladius*) caught in the South Atlantic by the Brazilian fleet	Carneiro V.G.O., Rodrigues S.L., Oliveira E.S.C., and Andrade H.A.
SCRS/2017/069	Observed live releases and dead discards of shortfin mako shark (*Isurus oxyrinchus*) from Canadian fisheries	Bowlby H., Joyce W., and Fowler M.

SCRS/2017/070	Standardized catch indices of Atlantic swordfish, *Xiphias gladius*, from the United States pelagic longline observer program	Lauretta M. and Walter J.
SCRS/2017/071	Standardized catch rates of the shortfin mako (*Isurus oxyrinchus*) caught by the Taiwanese longline fishery in the Atlantic Ocean	Tsai W.-P., and Liu K.-M.
SCRS/2017/072	Length based indicators of Atlantic swordfish and bluefin tuna stock status	Hanke A.
SCRS/2017/073	A first approximation to relative habitat size for swordfish stocks	Arrizabalaga H, Kell L., and Coelho R.
SCRS/2017/074	Annual indices of swordfish (*Xiphius gladius*) spawning biomass in the Gulf of Mexico (1982-2015)	Ingram W.G.
SCRS/2017/075	Update CPUE standardization of the Atlantic swordfish caught by Japanese longliners	Ijima H., and Yokawa K.
SCRS/2017/076	A framework for assessing highly migratory species using Data-Limited Methods	Smith M.W., Isely J.J., Sagarese S.R., Harford W.J., Cass-Calay S.L., and Cummings N.J.
SCRS/2017/077	Preliminary results on the comparison of CPUE and , size of swordfish, *Xiphias gladius*, caught with different longline gears in the Southwestern Atlantic Ocean	Forselledo R., Mas F., and Domingo A.
SCRS/2017/078	Standardized CPUE of swordfish, X*iphias gladius*, based on data gathered by National Observer Program on board the Uruguayan longline fleet (2001-2012)	Forselledo R., Mas F., Pons M., and Domingo A.
SCRS/2017/079	Length-length and length-weight relationships of swordfish, *Xiphias gladius*, caught by longliners in the southwestern Atlantic Ocean	Forselledo R., Mas F., Ortiz M., and Domingo A.
SCRS/2017/080	Production et Effort de pêche sur l'espadon *Xiphias gladius* (Linnaeus, 1758) débarqué par des pêcheurs artisans en Côte d'Ivoire	Bahou L., Konan J.K., and N'Guessan C.D.
SCRS/2017/081	Tools to guide the selection of CPUE series – revisited and revised	Bruyn P.A., and Schirripa M. J.
SCRS/2017/082	Standardized joint CPUE index for bluefin tuna (*Thunnus thynnus*) caught by Moroccan and Portuguese traps for the period 1998-2016	Lino P.G., Abid N., Mohamed M.I., and Coelho R.
SCRS/2017/083	A brief review of Atlantic bluefin natural mortality assumptions	Lauretta M.
SCRS/2017/084	Implications for fisheries management in small tunas. The case study of bullet tuna in the West Mediterranean	Ollé J, Pérez-Bielsa N., Allaya H., Saber S., Macías D., and Viñas J.
SCRS/2017/085	Reproduction du thon à nageoires noires (*Thunnus atlanticus*) autour des DCP ancres de la Martinique	Pau C., Fauvel C., and Reynal L.
SCRS/2017/086	Estimating vulnerability of small tunas captured by longline and purse seine of the Atlantic Ocean	Frédou F.L., Kell L., Frédou T., Beare D., Abid N., and Andrade H.
SCRS/2017/087	Etude préliminaire de quelques paramètres de reproduction de *Auxis rochei* captures dans le golfe de Guinée par les pécheurs artisans	Diaha N.C., Amandé M.J., Konan K.J., Abekan E., and Bahou L.
SCRS/2017/088	Techniques de pêche utilisées en Martinique pour l'exploitation des grands poissons pélagiques du large	Flament M., Monet N., Pau C., and Reynal L.
SCRS/2017/089	Pêche des thonidés mineurs de l'Atlantique Centre Ouest	Reynal L., and Bealey R.

SCRS/2017/090	Annual indices of spawning biomass of little tunny (*Euthynnus alletteratus*) and common dolphin (*Coryphaena hippurus*) based on larval surveys in the Gulf of Mexico (1982-2015)	Ingram G.W.
SCRS/2017/091	Options for an Observation Error Model for North Atlantic albacore MSE	Merino G., Kell L.T., Arrizabalaga H., Santiago J., Sharma R., Ortiz de Zarate V., and De Bruyn P.
SCRS/2017/092	Uncertainty grid for North Atlantic albacore Management Strategy Evaluation: Conditioning Operating Models	Merino G., Kell L.T., Arrizabalaga H., Santiago J., Sharma R., Ortiz de Zarate V., and De Bruyn P.
SCRS/2017/093	Updated Evaluation of Harvest Control Rules for North Atlantic albacore through Management Strategy Evaluation	Merino G., Kell L.T., Arrizabalaga H., Santiago J., Sharma R., Ortiz de Zarate V., and De Bruyn P.
SCRS/2017/094	Spanish mackerel (*Scomberomorus maculatus*) larval indices of relative abundance from seamap fall plankton surveys in the Gulf of Mexico, 1986 to 2014	Hanisko D.S., Pollack A.G., Zapfe G., and Ingram G.W.
SCRS/2017/095	King mackerel (*Scomberomorus cavalla*) larval indices of relative abundance from seamap fall plankton surveys in the Gulf of Mexico, 1986 to 2014	Hanisko D.S., Pollack A.G., Zapfe G., and Ingram G.W.
SCRS/2017/096	Contribution à la biologie et la croissance de la bonite (*Sarda sarda*) des côtes Mauritaniennes	Diagne A., Djimera L., Dia M., and Beyah M.
SCRS/2017/097	Standardized catch rates for simulated longline data	Ortiz M.
SCRS/2017/098	Abundance indices of genus *Auxis* based on larval surveys In the Gulf of Mexico (1982-2015)	Ingram G.W.
SCRS/2017/099	Some methodological approaches to standardizing catch per unit effort in mixed fisheries: application to target species in the longliners of Morocco	Serghini M., Habiba H., and Aziza L.
SCRS/2017/100	A roadmap for CPUE standardization using simulated/observed data: proposed study	Sharma R., Cooper A., Coelho R., and Schirripa M.
SCRS/2017/101	SCRS Annual dashboard: a new tool to complement the management advice to the Commission	Santiago, J., H. Arrizabalaga, G. Merino, and H. Murua
SCRS/2017/102	North Atlantic swordfish biomass dynamic stock assessment revisited	Kell, L.T.
SCRS/2017/103	Des orientations pour la standardisation des captures par unités d'effort selon la stratégie de pèche et les variables environnementales: espadon et thon rouge de la méditerranée	Zarrad R., and Missaoui H.
SCRS/2017/104	An examination of bias in the East Atlantic and Mediterranean Bluefin stock assessment	Kell, L.T.
SCRS/2017/105	Updated standardized catch rates for the North Atlantic stock of swordfish (*Xiphias gladius*) from the Spanish surface longline fleet for the period 1986-2015	García-Cortés B., Ramos-Cartelle A., Fernández-Costa J., and Mejuto J.
SCRS/2017/106	Updated standardized catch rates for South Atlantic stock of swordfish (*Xiphias gladius*) from the Spanish longline fleet for the period 1989-201	Ramos-Cartelle A., García-Cortés B., Fernández-Costa J., and Mejuto J.

SCRS/2017/107	Standardized catch rates in number of fish by age for the North Atlantic swordfish (*Xiphias gladius*) inferred from the Spanish longline fleet for the period 1982-2015	Mejuto J., García-Cortés B., Ramos-Cartelle A., and Fernández-Costa J.
SCRS/2017/108	Updated standardized catch rates of shortfin mako (*Isurus oxyrinchus*) caught by the Spanish surface longline fishery targeting swordfish in the Atlantic ocean during the period 1990-2015	Fernández-Costa J., García-Cortés B., Ramos-Cartelle A., and Mejuto J.
SCRS/2017/109	Standardization of CPUE for south Atlantic albacore by the Japanese longline fishery using revised method	Matsumoto T.
SCRS/2017/110	An alternative hypothesis for the reconstruction of time series of catches for North and South Atlantic stocks of shortfin mako shark	Coelho R., and Rosa D.
SCRS/2017/111	Age and growth of shortfin mako in the North Atlantic, with revised parameters for consideration to use in the stock assessment	Rosa D., Mas F., Mathers A., Natanson L.J., Domingo A., Carlson J., and Coelho R.
SCRS/2017/112	A habitat model for northeast Atlantic Albacore	Goikoetxea, Chust G., Ibaibarriaga L., Sagarminaga Y., and Arrizabalaga H.
SCRS/2017/113	Albacore tuna (*Thunnus alalunga*) catches by the Portuguese pelagic longline fleet targeting swordfish in the North Atlantic (1999-2015)	Coelho R., and Lino P.G.
SCRS/2017/114	Estimation of Mediterranean albacore fisheries' productivity using a Catch Based Method	Merino G., Arrizabalaga H., Restrepo V., Murua H., Santiago J., Ortiz de Urbina J., and Scott G.P.
SCRS/2017/115	Standardized CPUE of albacore (*Thunnus alalunga* Bonnaterre, 1788) caught by the Spanish surface longline fishery in the western Mediterranean, 2004-2015	Saber S., Macías D., Rioja P., and Ortiz de Urbina J.
SCRS/2017/116	Overview of the Italian fleet fishing albacore (*Thunnus alalunga*)	Mariani A., Camolese C., and Dell'Aquila M.
SCRS/2017/117	Standardization of albacore (*Thunnus alalunga*) CPUE rates from the Mediterranean Italian fisheries	Mariani A., Tserpes G., Camolese C., and Dell'Aquila M.
SCRS/2017/118	Spatial distribution of fishing ground of the Spanish albacore (*Thunnus alalunga*) surface fishery in the north eastern Atlantic in 2015 and 2016	Ortiz de Zárate V., Perez B., and Quelle P.
SCRS/2017/119	An updated bibliography on Bluefin tuna trap fishery	Di Natale A.
SCRS/2017/120	CPUE standardization on southern Atlantic albacore, dating from 1967 to 2016, based on catch statistics of Taiwanese longliners	Feng-Chen C., and Shean-Ya Y.
SCRS/2017/121	CPUE standardization on northern Atlantic albacore, dating from 1967 to 2016, based on catch statistics of Taiwanese longliners	Feng-Chen C., and Shean-Ya Y.
SCRS/2017/122	Albacore (*Thunnus alalunga*) larval index in the Western Mediterranean Sea, 2001-2015	Alvarez-Berastegui D., Ingram G.W., Reglero P., Macías D., and Alemany F.
SCRS/2017/123	An exploratory data analysis of the East Atlantic bluefin stock assessment dataset	Kell L.T., Ben Mhamed A., Rouyer T., and Kimoto A.
SCRS/2017/124	An evaluation of bias and prediction skill for the East Atlantic bluefin stock assessment	Kell L.T.,Ben Mhamed A., Rouyer T., and Kimoto A.
SCRS/2017/125	Stock synthesis (SS3) model runs conducted for North Atlantic shortfin mako shark	Courtney D.; Cortés E., and Zhang X.

SCRS/2017/126	Estimates of maximum population growth rate ad steepness for shortfin makos in the North and South Atlantic Ocean	Cortes E.
SCRS/2017/127	Model validation using prediction residuals	Kell L.T.
SCRS/2017/128	Age and growth of Mediterranean Albacore	Garibaldi F., Lanteri L., Valastro M., and Di Natale A.
SCRS/2017/129	Anomalous ratios of blue and shortfin mako shark landings from individual north-Atlantic longline fishing vessels	Queiroz N., Mucientes G., Sousa L.L., Sims D.W.
SCRS/2017/130	Highly spatially resolved catch records of shortfin mako in the Central North Atlantic	Queiroz N., Mucientes G., Sousa L.L., Sims D.W.
SCRS/2017/131	Migratory behaviour of Atlantic bluefin tuna entering the Mediterranean Sea	Carruthers T., Di Natale A., Lauretta M., Pagá-García A., and Tensek S.
SCRS/2017/132	Proposal of implementation of low-fecundity spawner-recruitment relationship for shortfin mako in the North Atlantic	Kai M, and Carvalho F.
SCRS/2017/133	Creating a Species Distribution Model for Swordfish: Evaluations of Initial Habitat Variables	Goodyear C.P., Schirripa M., and Forrestal F.
SCRS/2017/134	Size distributions of Swordfish (*Xiphias gladius*) in the Caribbean Sea and adjacent waters of the Western Central Atlantic, from observer data of the Venezuelan longline fisheries	Arocha F., Marcano J.H., Evaristo E., and Gutierrez X.
SCRS/2017/135	Initial stock assessment results for the North and South Atlantic shortfin mako (*Isurus oxyrinchus*) using a Bayesian Surplus Production Model and the Catch-Resilience method CMSY	Winker H, Carvalho F., Sharma R., Parker D., and Kerwath S.
SCRS/2017/136	Catch-at-size and age analysis for Atlantic swordfish	Hanke A., Kell L.T., and Coelho R.
SCRS/2017/137	Updated combined biomass index of abundance of North Atlantic Swordfish stock 1963-2016	Ortiz M., Mejuto J., Hanke A., Ijima H., Walter J., Coelho R., and Ikkiss A.
SCRS/2017/138	Standardization of the Catch Per Unit of Effort for Swordfish (*Xiphias gladius*) for the South African longline fishery	Parker D., Winker H., West W., and Kerwath S.E.
SCRS/2017/139	ICCAT Atlantic-wide research programme for bluefin tuna (GBYP) activity report for the last part of phase 6 and the first part of phase 7 (2016-2017)	Di Natale A., Tensek S., and Pagá-García A.
SCRS/2017/140	A template for an indicator-based ecosystem report card for ICCAT	Juan-Jordá, M-J. Murua, H., Arrizabalaga, H. and Hanke, A.
SCRS/2017/141	Estimated number of sea turtle interactions with pelagic longline gear in the ICCAT Convention area for the period 2012-2014	Gray C.M., and Diaz G.A.
SCRS/2017/142	Sexual proportion of swordfish (*Xiphias gladius*) caught by Brazilian fleet in Southwest Atlantic	Andrade H.A.
SCRS/2017/143	Resiliency for North Atlantic Swordfish using life history parameters	Sharma R., and Arocha F.
SCRS/2017/144	CPUE standardization of swordfish (*Xiphias gladius*) for the Taiwanese tuna longline fishery in the North Atlantic Ocean for 1968-2015	Su N-J., and Sun C-L.
SCRS/2017/145	Standardizing catch and effort of the Taiwanese distant-water longline fishery in the South Atlantic Ocean swordfish (*Xiphias gladius*), 1968-2015	Su N-J., and Sun C-L.

SCRS/2017/146	Eastern Bluefin Tuna stock assessment using SAM	Ben Mhamed A., Nielsen A., and Kell L.T.
SCRS/2017/147	Update on post-release survival of tagged whale shark encircled by tuna purse-seiner	Escalle L., Amandé J.M., Filmalter J.D., Forget F., Gaertner D., Dagorn L., and Mérigot B.
SCRS/2017/148	A preliminary assessment of the ecological role and importance of squid in the pelagic trophic web of the northwest Atlantic Ocean including the Sargasso Sea	Luckhurst B.E.
SCRS/2017/149	Preliminary report of ICCAT GBYP aerial survey for bluefin tuna spawning aggregations in 2017	Di Natale A., Cañadas A., Vázquez-Bonales J.A., Tensek S., and Pagá-García A.
SCRS/2017/150	North Atlantic oscillation leads to the differential interannual pattern distribution of sea turtles from tropical Atlantic Ocean	Báez J.C., Pascual-Alayón P., Ramos M.L., and Abascal F.J.
SCRS/2017/151	Genetic validation of the use of bill length measurements for identifying species in the wondering albatross species complex: introduction of a new identification method to the Japanese observer program	Inoue Y., Kitamura T., Kanda N., Schofield P., Ryan P.G., Phillips R.A., Burg T.M., and Oshima K.
SCRS/2017/152	New aspects of catch rate: estimating catch and bycatch rate in fish and seabirds at each setting time from sunrise and sunset	Inoue Y., Yokawa K., Ito T. and Oshima K.
SCRS/2017/153	An exploration of Bluefin tuna data in the West Atlantic with ASAP	Maguire J.J., Cadrin S.X., Hanke A., and Melvin G.
SCRS/2017/154	An at-sea trial of seabird mitigation gears including three weighted branch line specifications for tuna longline fisheries	Ochi D., Katsumata N., and Oshima K.
SCRS/2017/155	Review of sea turtle bycatch data in the ICCAT convention area obtained through Japanese scientific observer program	Okamoto, Ochi D., and Oshima K.
SCRS/2017/156	Identifying areas, seasons and fleets of potential highest bycatch risk to South Georgia Albatrosses and Petrels	Clay T.A., Small C., Carneiro A.P.B., Mulligan B., Pardo D., Wood A.G., and Phillips R.A.
SCRS/2017/157	Opportunities in ports to improve data in order to review the effectiveness of seabird measures	Mulligan B., and Small C.
SCRS/2017/158	Update on the seabird component of the common oceans tuna project – seabird bycatch assessment workshops	Maree B.
SCRS/2017/159	Elasmobranches bycatch in the French tropical purse-seine fishery of the eastern Atlantic ocean: spatio-temporal distributions, life stages, sex-ratio and mortality rates	Clavareau L., Sabarros P.S., Escalle L., Bach P., and Mérigot B.
SCRS/2017/160	Skipjack tuna (*Katsuwonus pelamis*) feeding habitat dynamics and accessibility to purse seine fisheries in the Atlantic and Indian Oceans	Druon J-N., Chassot E., Murua H., and Lopez J.
SCRS/2017/161	Main results of the Spanish Good Practices program: evolution of the use of Non-entangling FADs, interaction with entangled animals, and fauna release operations	Lopez *et al.*
SCRS/2017/162	Colonization of drifting fish aggregating devices (DFADs) in the Western Indian Ocean, assessed by fishers' echo sounder buoys	Orúe *et al.*
SCRS/2017/163	Modelling the oceanic habitats of Silky shark (*Carcharhinus falciformis*), implications for conservation and management	Lopez *et al.*

SCRS/2017/164	Estimating the fraction of western Atlantic bluefin tuna that spawn by age from size frequency data collected on the Gulf of Mexico spawning grounds	Porch C., and Hanke A.
SCRS/2017/165	Using FADs to estimate a population trend for the oceanic whitetip shark in the Atlantic Ocean	Tolotti M.T., Capello M., Bach P., Murua H., Pascual-Alayón P., Rojo-Mendez V., and Dagorn L.
SCRS/2017/166	Review and analysis of size frequency samples of Bluefin tuna (*Thunnus thynnus*)	Ortiz M., and Palma C.
SCRS/2017/167	Preliminary Estimation of seabird bycatch numbers by Taiwanese longline vessels in the Southern Atlantic Ocean between 2002 and 2016	Huang H., and Yeh Y.
SCRS/2017/168	Preliminary 2017 stock assessment results for the eastern and Mediterranean Atlantic bluefin tuna stock	Rouyer T., Kimoto A., Kell L., Walter J.F., Lauretta M., Zarrad R., Ortiz M., Palma C., Arrizabalaga H., Sharma R., Kitakado T., and Abid N.
SCRS/2017/169	Revision of Atlantic bluefin tuna Task I nominal catches from Spain	Macias D., Palma C., and Rodriguez-Marin E.
SCRS/2017/170	Direct ageing for constructing age-length keys and re-estimate the growth curve for east Atlantic and Mediterranean bluefin tuna	Rodriguez-Marin E., Quelle P., Ruiz M., Ceballos E., and Ailloud L.E.
SCRS/2017/171	Review and update of the French and Spanish purse seine size at catch for the Mediterranean bluefin tuna fisheries 1970 – 2010	Gordoa A., Rouyer T., and Ortiz M.
SCRS/2017/172	Updated Bluefin CPUE time series from the Balfegó Purse Seine Vessels	Gordoa A.
SCRS/2017/173	Western Atlantic bluefin tuna virtual population analysis (1974-2015)	Lauretta M., Kimoto A., Ortiz M., and Porch C.E.
SCRS/2017/174	Exploratory stock assessment of eastern and western population-of-origin Atlantic bluefin tuna accounting for stock composition	Cadrin S., Morse M., Kerr L., Secor D., and Siskey M.
SCRS/2017/175	Eastern Atlantic Ocean bluefin tuna stock assessment 1950-2015 using stock synthesis	Sharma R., Walter J., Kimoto A., Rouyer T., Lauretta M., Kell L.T., and Porch C.
SCRS/2017/176	Western Atlantic bluefin tuna stock assessment 1950-2015 using stock synthesis	Walter J., Sharma R., and Ortiz M.
SCRS/2017/177	Application of an Atlantic bluefin tuna operating model to generate pseudodata for stock assessment testing	Kerr L.A., Morse M.R., Cadrin S.X., and Galuardi B.
SCRS/2017/178	Simulating virtual population analysis of mixed Atlantic bluefin tuna stocks	Morse M.R, Kerr L.A., and Cadrin S.X.
SCRS/2017/179	Catch-at-age estimates using the combined forward-inverse age-length key	Ailloud L.E., Lauretta M.V., Walter J.F., and Hoenig J.M.
SCRS/2017/180	Update on CPUE bluefin tuna caught by Tunisian purse seines between 2009 and 2016	Zarrad R., and Missaoui H.
SCRS/2017/181	Bluefin tuna catch curve analyses, comparison of alternative ageing protocols	Ortiz M.
SCRS/2017/182	Updated Statistical Catch-at-Length (SCAL) Assessments of North Atlantic Bluefin Tuna	Rademeyer R.A., and Butterworth D.S.
SCRS/2017/183	Datos estadísticos de la pesquería de túnidos de las Islas Canarias durante el periodo 1975 a 2016	Delgado-de-Molina R.
SCRS/2017/184	CPUE des palangriers japonais ayant opères dans les eaux algériennes et des thoniers senneurs nationaux	Kouadri- Krim A., and Ferhani K.

SCRS/2017/185	ISSF bycatch mitigation efforts for tropical tuna purse seine fisheries in the Atlantic Ocean	Restrepo, V., Murua J., Moreno G., and Justel-Rubio A.
SCRS/2017/186	An analysis explaining the reasons for differences in the TAC F0.1 scenario from VPA and SS West BFT	Lauretta M., and Walter J.
SCRS/2017/187	Detailed analysis of the CAL and composition data from the different models to check results for recent year recruitment estimates in models. East BFT	Ailloud L., and Royer T.
SCRS/2017/188	Updates to bluefin tuna stock assessment models 2017 during the Species Group meeting	Anon
SCRS/2017/190	An update on the analysis of bluefin tuna stock mixing	Cadrin S., and Kerr L.
SCRS/2017/191	ICCAT GBYP Bluefin Tuna data recovery in 2017	Pagá-García A., Tensek S., and Di Natale A.
SCRS/2017/192	ICCAT GBYP Electronic tags Data base goes Shiny	Tensek S.
SCRS/2017/193	Summary of activities conducted within AOTTP in 2016 and 2017	Beare D., Guemes P., Garcia J., and Kebe S.
SCRS/2017/194	Tropical tuna growth and migration rates: AOTTP and ICCAT's historical tagging data	Guemes P., Garcia J., and Beare D.
SCRS/2017/195	Standardization of bigeye tuna CPUE in the main fishing ground of Atlantic ocean by the Japanese longline fishery using revised method	Matsumoto T.
SCRS/2017/196	On the Faux Poisson tuna landings in Abidjan: analysis of recent data and proposal to create a task2 file of *faux poissons* tuna catches for major and minor tunas	Fonteneau A, Dewals P., Pascual-Alayón P., Floch L., Amande M.J.
SCRS/2017/197	Bycatch of the European purse-seine tuna fishery in the Atlantic Ocean for the period 2010-2016	Jon Ruiz Gondra, Jon Lopez, Francisco J. Abascal Crespo, Pedro J. Pascual Alayon, Monin J. Amandè, Pascal Bach, Pascal Cauquil, Hilario Murua, Maria L. Ramos Alonzo, Philippe S. Sabarros
SCRS/2017/198	First steps for the conditioning of a multispecies MSE model for tropical tuna fisheries	Agurtzane Urtizberea, Gorka Merino, Hilario Murua
SCRS/2017/199	Estadística de las pesquerías españolas atuneras, en el océano atlántico tropical, período 1990 a 2016	P. Pascual-Alayón, H. Amatcha, F.N'Sow, Mª L Ramos, F. J. Abascal1, V. Rojo
SCRS/2017/200	Modelling the oceanic habitats of Silky shark (Carcharhinus falciformis), implications for conservation and management	Jon Lopez, Diego Alvarez-Berastegui, Maria Soto, Hilario Murua
SCRS/2017/201	Review ICCAT swordfish assessment	Methot R.
SCRS/2017/202	First massive tagging of tropical tunas around the Sierra Leone rise	Nicolas Goñi, Isidor Diatta, Kouadio Justin Konan, Ebenezer Addi, Alexander Salgado, Marina Chifflet, Iñigo Onandia, Igor Arregui
SCRS/2017/203	Statistics of the European and associated purse seine and baitboat fleets, in the Atlantic Ocean (1991-2016)	P. Pascual-Alayón, L. Floch, P Dewals, D Irié, AH Amatcha, M-J Amandè, F.N'Gom
SCRS/2017/204	Standardization of the catch per unit effort for bigeye tuna (*Thunnus obesus*) for the South African longline fishery	Parker D., Winker H., West W., Sven Kerwath S.

SCRS/2017/205	On the dialogue between knowledge backgrounds involved in tagging programs	Iñigo Onandia, Nicolas Goñi, Josu Santiago, Lola Godoy, João Ferreira, Alexander Salgado, Marina Chifflet, Igor Arregui
SCRS/2017/206	Standardization of the catch per unit effort for yellowfin tuna (*Thunnus albacares*) for the South African tuna pole and line (baitboat) fleet for the time series 2003-2016	Parker D., Winker H., West W., Sven Kerwath S.
SCRS/2017/207	Importance des captures accessoires des espèces des divers thons en Mauritanie : quelles hypothèses sur la dynamique de ces ressources	Braham C.B.
SCRS/2017/208	Report on the use of research mortality allowance by ICCAT GBYP in 2012-2016 and the first part of 2017	Di Natale A., Tensek S., and Pagá-García A.
SCRS/2017/209	Length-weight relationships for the Mediterranean swordfish	Tserpes G., Ortiz de Urbina J., Abid N., Ceyhan T., Garibaldi F., Peristeraki P., and Di Natale A.
SCRS/2017/210	Ejecución del programa nacional de observadores a bordo de la flota industrial atunera venezolana del mar caribe y océano atlántico año 2016	Gutiérrez X, Evaristo E., and Marcano J.H.
SCRS/2017/211	Notes about a tagged/recaptured swordfish in the Liguria Sea (western Mediterranean)	Garibaldi F., and Lanteri L.
SCRS/2017/212	Collecting data on board French tropical tuna purse seiners with common observers: results of Orthongel's voluntary observer program OCUP (2013-2017) in the Atlantic Ocean	Maufroy A., Relot-Stirnemann A., Moëc E., Amandè M.J., Bach P., and Goujon M.
SCRS/2017/213	Progress of the ICCAT Enhanced Program for Billfish Research in the Atlantic Ocean during 2017	John Hoolihan
SCRS/2017/214	Progress report of genetic stock structure of shortfin mako (*Isurus oxyrinchus*) in the Atlantic Ocean	Nohara K., Coelho R., Santos MN., Cortés E., Domingo A., Ortiz de Urbina J., Semba Y., and Yokawa K.
SCRS/2017/215	Length-weight relationships, conversion factors and monthly size frequency distribution for swordfish caught by longliners in the Mediterranean Sea	LombardoF., Gioacchini G., Candelma M., Sagrati A., Baiata P., Pignalosa P., and Carnevali O.
SCRS/2017/216	Unusual presence of small bluefin tuna YOY in the Atlantic ocean and in other areas	Di Natale A., Lino P.G., López-González J.A., Pagá-García A., Piccinetti C., Tensek S., and Santos M.N.
SCRS/2017/217	Interpreting ICCAT's data reporting requirements for activities on FADs. An overview from EU-Spain	Báez J.C., Ramos M.L., López J., Santiago J., Grande M., Herrera M.A., Rojo V., Pascual P.J., Murua H., and Abascal F.J.
SCRS/2017/218	Sailfish genetic stocks delimitation and their sympatric distribution in the Atlantic	Ferrette B.L.S., Mourato B.L., Oliveira C., Foresti F., Coelho R., Arocha F., Hoolihan J., Diaha N'G.C., Sow F.N., Santos M.N., Hazin F.H.V., Amorim A.F., Rotundo M.M., Romanov E., Mendonça F.F.
SCRS/2017/219	Swordfish in Algerian waters: size structure and length weight relationship	Ferhani K., Selmani R., Mennad M., Krim A., and Taouchicha L.

SCRS/2017/220	Length-weight relationships applicable to bluefin tuna juveniles (*Thunnus thynnus*) caught for faming purposes during the purse seine fishing season in the Adriatic	Katavic I., Grubisic L., Mihanovic M., Abreu I.P., Talijancic I., and Bubic T.S.
SCRS/2017/221	External review of ICCAT Atlantic swordfish stock assessment	Methot R.
SCRS/2017/223	Summary of a reference set of conditioned operating models for Atlantic bluefin tuna	Carruthers T., and Butterworth D.
SCRS/2017/224	Performance of examples management procedures for Atlantic bluefin tuna	Carruthers T., and Butterworth D.
SCRS/2017/225	ABT-MSE: an R package for Atlantic bluefin tuna Management Strategy Evaluation	Carruthers T., and Butterworth D.
SCRS/2017/226	Catch rate and size frequency of the shortfin mako (*Isurus oxyrinchus*) caught as bycatch by the swordfish longline fishery South of the Moroccan Atlantic coast	Baibbat, S. A., Abid, N. and Idrissi Malouli, M.
SCRS/2017/227	The relationship between F0.1 and FMSY values for the North Atlantic bluefin assessments and its dependence on the Beverton-Holt stock recruitment steepness parameter h	Rademeyer R.A., and Butterworth D.S.
SCRS/2017/228	Comparing electronic monitoring system with observer data for estimating non-target species and discards on French tropical tuna purse seine vessels	Briand K., Bonnieux A., Le Dantec W., Le Couls S., Bach P., Maufroy A., Relot-Stirnemann A., Sabarros P., Vernet A.-L., Jehenne F., and Goujon M.
SCRS/2017/229	Standardized catch rates of bluefin tuna, *Thunnus thynnus*, from the rod and reel/handline fishery off the northeast United States during 1993-2016	Lauretta M.V., and Brown C.A.
SCRS/P/2017/001	First insights into the Atlantic Bluefin tuna stock structure within the Mediterranean Sea	Fraile I., Arrizabalaga H., Macías D., Vallastro M., Addis P., Oray I., and Rooker J.
SCRS/P/2017/002	Automatic detection of Bluefin schools on commercial sonars and its usefulness in monitoring abundance in the Bay of Biscay	Uranga J., Arrizabalaga H., Boyra G., Hernandez M.C., Goñi N., Arregui I., Fernandes J.A., Yurramendi Y., and Santiago J.
SCRS/P/2017/003	Estimating catch-at-age of western Atlantic bluefin tuna: Can we do better than cohort slicing?	Ailloud L., Lauretta M., Walter J., and Hoenig J.
SCRS/P/2017/004	Genetic Identification of Stock Origin and Estimation of Mixing rates of Bluefin tuna from Canadian Landings 2013-2015	Puncher G.N., Hanke A., Hamilton L., and Pavey S.
SCRS/P/2017/005	Resiliency for swordfish north using life history parameters	Sharma R., and Arocha F.
SCRS/P/2017/006	Simulation of Harvest Control Rules for North Atlantic swordfish utilizing a historic perspective	Schirripa M.
SCRS/P/2017/007	North Atlantic Swordfish Stock Synthesis configuration v1.0	Schirripa M.
SCRS/P/2017/008	BSP model runs	Babcock E.A.

SCRS/P/2017/009	Prélèvement des échantillons biologiques aux fins d'études sur la croissance et la maturité	Ngom F., and Diaha C.N'G.
SCRS/P/2017/010	Tuna fisheries in São Tomé e Príncipe	Conceição I., and Costa G.
SCRS/P/2017/011	Studies of the genetic structure of blackfin tuna in the West Atlantic Ocean using microsatellite markers	Saillant E.A., Antoni L., Short E., Luque P., Franks J.S., Reynal L., Pau C., Cummings N., Arocha F., Roque P., Hazin F., Falterman B., Hanke M., Sullivan K., and Duke A.
SCRS/P/2017/012	AOTTP – Preliminary observations on Little Tunny	Secretariat
SCRS/P/2017/013	Integrating uncertainty from data processing into population assessment	Carruthers T., Kell L., and Palma C.
SCRS/P/2017/014	Updated information on the reproductive biology of albacore in the Western Mediterranean Sea	Saber S., Ortiz de Urbina J., Gómez-Vives M.J., and Macías D.
SCRS/P/2017/015	Comparing CMSY and a Bayesian Surplus Production Model (BSM) fitted to average CPUE time series for Mediterranean Albacore	Winker H., and Parker D.
SCRS/P/2017/016	Data-poor assessments for small tunas, mackerels and bonitos in the Atlantic Ocean	Pons M., Kell L.T., Hilborn R., et al.
SCRS/P/2017/017	Fishing the RFMO boundary: South African Shortfin Mako data	Winker H., Kerwath S., and Parker D.
SCRS/P/2017/018	Updating seabirds bycatch estimates in the Spanish Mediterranean drifting longline fishery: years 2000–2016	García-Barcelona S., Pauly Salinas M., and Macías D.
SCRS/P/2017/019	Ringing on board the Spanish Mediterranean longline fleet: first step to know the survival rates of accidentally caught seabirds	García-Barcelona S., Pauly Salinas M., and Macías D.
SCRS/P/2017/020	Linking age-structured (SS3) and surplus production models	Winker H., and Carvalho F.
SCRS/P/2017/021	CMSY and a fitted SPMs: Lessons learned from Mediterranean Albacore with application to South Atlantic shortfin mako	Winker H., and Parker D.
SCRS/P/2017/022	Using Satellite Telemetry to Quantify Fisheries Interaction and Survival of Shortfin Mako Sharks	Byrne M.
SCRS/P/2017/023	A North Atlantic swordfish assessment 2017 using stock synthesis	Schirripa M.
SCRS/P/2017/024	On developing an Ecosystem Report card for ICCAT	Hanke A.
SCRS/P/2017/025	Report of the Joint Meeting of Tuna RFMOs on the Implementation of the Ecosystem Approach to Fisheries Management	Hanke A.

SCRS/P/2017/026	Hooking mortality of swordfish, *Xhipias gladius*, caught by longliners in the southwestern Atlantic Ocean	Forselledo R., Mas F., and Domingo A.
SCRS/P/2017/027	JABBA: Just Another Bayesian Biomass Assessment for South Atlantic swordfish	Winker H., Carvalho F., Parker D., and Kerwath S.
SCRS/P/2017/028	Operational oceanography for assessing tuna environmentally driven ecology traits	Alvarez-Berastegui *et al.*
SCRS/P/2017/029	RFMOs and Sea Turtles	Swimmer Y., and Gutierrez A.
SCRS/P/2017/030	Selecting ecosystem indicators for fisheries targeting highly migratory species	Juan-Jorda *et al.*
SCRS/P/2017/031	Bycatch monitoring in the French Mediterranean longline fisheries – First output of a collaborative research project	Poisson F., Métral L. , Brisset B., Cornella D., Wendling B. , Arnaud-Hond S.
SCRS/P/2017/032	EFFDIS: a modelling approach to estimate overall Atlantic fishing effort by time-area strata (update May 2017)	ICCAT Secretariat
SCRS/P/2017/033	Collaborative work to assess seabird bycatch in pelagic longline fleets (South Atlantic and Indian Oceans)	Inoue Y., and Domingo A.
SCRS/P/2017/034	Rebuilding European Fisheries	Winker H.
SCRS/P/2017/035	Abundance of sea birds in Mauritania	Khallahi B.
SCRS/P/2017/036	The Namibian Large-Pelagic Sampling Programme and possible Seismic impacts	Uanivi U.
SCRS/P/2017/037	An overview of tropical tuna fishery of Angola	Delicado F.
SCRS/P/2017/038	Integrating uncertainty from data processing into population assessment	Carruthers T., Kell L., Palma C.
SCRS/P/2017/039	Fishing on floating objects (FOBs): How tropical tuna purse seiners split fishing effort between GPS-monitored and unmonitored FOBs	Julia Snouck-Hurgronje, Kaplan D., Chassot E., Maufroy A., Gaertner D.
SCRS/P/2017/040	Tentative solutions of problems induced by the gaps between concept and reality	Amandé J., Diaha C., Konan T.
SCRS/P/2017/042	Fisheries and biological data reported during 2017 and recovery plans	Palma C., Mayor C., and de Bruyn P.
SCRS/P/2017/043	Yearly based dataset estimations (CATDIS, EFFDIS, CAS/CAA)	Palma C., Ortiz M. Beare D., and de Bruyn P.
SCRS/P/2017/044	A "Global fisheries Scoreboard on basic data availability" (preliminary)	Palma C., and de Bruyn P.

SCRS/P/2017/045	Review of the ICCAT coding system and ICCAT-DB	Palma C., Mayor C., and de Bruyn P.
SCRS/P/2017/046	Existing practices for SCRS data reporting, foreseeing future "Online Reporting"	Palma C., Mayor C., and Lindstad O.P.
SCRS/P/2017/047	Migratory behaviour of Atlantic Bluefin tuna entering the Mediterranean Sea	Carruthers T., Di Natale A., Lauretta M., Pagá-García A., and Tensek S.

Appendix 4

Report of the ICCAT Atlantic-Wide Research Programme for Bluefin Tuna (ICCAT GBYP)

(Activity report for the last part of Phase 6 and the first part of Phase 7 (2016-2017), including a general overview of the activities up to 2017)

1. Introduction

The ICCAT Atlantic-wide Research Programme for Bluefin Tuna (ICCAT GBYP) was officially adopted by the SCRS and the ICCAT Commission in 2008, and it started officially at the end of 2009, with the objective to:

a) Improve basic data collection, including fishery independent data;
b) Improve understanding of key biological and ecological processes;
c) Improve assessment models and provision of scientific advice on stock status.

The total budget of the programme was estimated at about 19 million Euros for six years, and the European Union and some other Contracting Parties undertook to contribute to this programme in 2009 and in the following years; the budget officially approved by the ICCAT Commission in 2008 was 19,075,000 Euros for six years. The costs of the initial year were 653,864 Euros (against the original approved figure of 890,000 Euros), the costs of the second phase were 2,318,849 Euros (against the original figure of 3,390,000 Euros), while the costs of the third phase were 1,769,363 Euros (against the original approved figure of 5,845,000 Euros). The fourth phase had a total budget of 2,875,000 Euros (against the original approved figure of 5,195,000 Euros) and final costs were 2,819,557 Euros. The fifth phase had a total budget of 2,125,000 Euros (against the original approved figure of 3,345,000 Euros) and final costs were 1,995,787 Euros. The sixth phase had a total budget of 2,125,000 Euros (against the original approved figure of 410,000 Euros) and the final costs were 1,945,137 Euros. The seventh phase has a budget of 1,808,985 Euros. The overall ICCAT GBYP operating budget for the first seven phases, covering eight years (a total of 13,311,541 Euros) is about 69.78% of what it was supposed to be (the 19,075,000 Euros approved by the Commission), and it was used over 8 years instead of 6. Several private or public entities provided some additional funds or in kind support. These budget reductions have had an impact on all activities carried out so far even if the results were always well above the initial objectives.

The ICCAT GBYP funding is provided by voluntary contributions from the ICCAT Contracting Parties. The European Union has funded 80% of the budget for each Phase since the beginning of the programme. The remaining 20% has been provided by most of the CPCs having a bluefin tuna quota for the eastern stock and by other CPCs.

Taking into account that the funding of this programme is a serious constraint on its activities, the Steering Committee submitted a proposal for funding the ICCAT GBYP through an annual scientific quota. This proposal has been rejected by the Commission several times as well as other alternative proposals by some CPCs.

The Steering Committee has repeatedly stated that this programme is of great importance. For this reason, in 2014, the Steering Committee and the SCRS proposed to the Commission to extend the programme up to 2021 and the proposal was endorsed by the Commission along with the SCRS report, however funding is still an issue which needs to be solved. The second external review in 2016 stated that the ICCAT GBYP is a success and should further continue.

The detailed ICCAT GBYP report is presented as document SCRS/2017/139.

2. Coordination activities

2.1 ICCAT GBYP coordination

The sixth phase of the ICCAT GBYP officially began on 20 February 2016, following the signature of the Grant agreement for the co-financing of ICCAT GBYP Phase 5 (SI2.727749) by the European Commission. The partial results were presented to the SCRS and the Commission in 2016 (Di Natale *et al*., 2017) and they have been approved. The final report for Phase 6 has been officially approved by the European Union.

The seventh phase of the ICCAT GBYP officially started on 21 February 2017 following the signature of the Grant agreement for the co-financing of the ICCAT GBYP Phase 7 (SI2.752957) by the European Commission and will end on 20 February 2018.

The staff level (one Assistant and one Data base specialist, in support to the Coordinator) was resumed from May 2015. The ICCAT Secretariat has always provided the support necessary for ICCAT GBYP activities.

The ICCAT GBYP coordination activity has had a total cost so far in the amount of 2,395,429 Euros[1], including many components and also all costs for the Steering Committee and the two external reviews in 2013 and 2016. This cost represents 18% of the total operative budget.

A total of eight calls for tenders and three invitations were issued in Phase 6, awarding a total of 20 contracts to various entities in Phase 6. Nine additional calls for tenders have been announced to date in the first part of Phase 7 and a total of 16 contracts have been awarded to date to various entities in Phase 7.

A total of 132 contracts have been awarded under the ICCAT GBYP up to the first part of Phase 7 to 102 entities, located in 24 different countries; many hundreds of researchers and technicians have been involved to date in the various ICCAT GBYP activities. This extensive and open participation in ICCAT GBYP activities is considered to be one of the best results of this research programme.

A total of 54 reports were produced in the framework of Phase 6 of the ICCAT GBYP. Several additional documents and reports have also been issued by the ICCAT GBYP for the needs of Steering Committee meetings. A total of 50 scientific papers were produced in Phase 6, while others will be published later on. A total of 16 reports have been produced in the first part of Phase 7, along with 17 scientific papers. The total number of reports produced by ICCAT GBYP up to the first part of phase 6 is 263, and 238 scientific papers have been published so far.

3. Steering Committee

The ICCAT GBYP Steering Committee is currently composed of the SCRS Chair, the west bluefin tuna Rapporteur, the east bluefin tuna Rapporteur and the ICCAT Executive Secretary. The external expert was has not been contracted yet.

The activity of the Steering Committee included regular correspondence by e-mail with the ICCAT GBYP coordination, which provided the necessary information, as well as a monthly report. In Phase 6, the Steering Committee held one meeting (30-31 July 2016), discussing various aspects of the programme including the plan for Phase 7, and providing guidance and opinions. In Phase 7 the Steering Committee held one meeting (7-8 March 2017), revisiting entirely the activities for Phase 7. All finalised reports of the Steering Committee are available here.

4. Data mining and data recovery

The total budget for data mining and data recovery activities over three years was 600,000 Euros; so far, the total expenditure for seven years of activities has been 612,801 Euros[2] (102.13% of the original budget), and much more data have been recovered than initially planned. Several SCRS meetings and workshops have been held on buefin tuna data, including the Symposium on Bluefin Tuna Traps. To date, the ICCAT GBYP objectives set for data recovery and data mining in these first Phases have been largely accomplished. The total cost for data mining and data recovery activities represents only 4.6% of the total operative budget over the first ICCAT GBYP phases.

[1] The cost includes 380,950 Euros in the full Phase 6, which might be different at the end of the Phase.
[2] Including the costs planned for Phase 7 (60,000 Euro), an amount which might be different at the end of the Phase.

The specific activity for recovering genetic data from ancient bluefin tuna samples that was carried out in the last part of Phase 4 and in the first part of Phase 5 was duly completed. An initial report (Melvin, 2015) was presented to the SCRS in 2015, while the final comprehensive report (with genetic data from the 2nd century B.C. to the early 1900s) was duly presented at the end of Phase 5. The data demonstrated the lack of any genetic erosion in the bluefin tuna population over these 22 centuries.

The data mining and data recovery activity continued according to the objectives recommended by the Steering Committee, concentrating efforts mostly on trap and LL data. A complete and detailed overview of the data recovered in the last period of Phase 6 and the first period of Phase 7 is available (SCRS/2017/031, SCRS/2017/039, SCRS/2017/40, SCRS/2017/041, SCRS/2017/042, SCRS/2017/043 and SCRS/2017/171, SCRS/2017/191). ICCAT GBYP data were used also in papers SCRS/2017/019, SCRS/2017/027, SCRS/2017/028, SCRS/2017/045, SCRS/2017/166 and SCRS/2017/169. The further analyses of the market and auction data provided to the ICCAT GBYP as a donation in kind (Mielgo, 2015) was presented to the SCRS bluefin tuna data preparatory meeting in March 2017 (SCRS/2017/013). All ICCAT GBYP data have been progressively incorporated in the ICCAT bluefin tuna data base, making them fully available for the SCRS.

The non-GBYP electronic tags data sets recovered in Phase 6, after the necessary checking, were sent (along with the ICCAT GBYP e-tags data) to the two experts defined by the SCRS (Lauretta and Carruthers) and used, together with other biological data, for assessing the mixing in the various areas, both for the bluefin tuna stock assessment and the ICCAT GBYP MSE-OM trials.

Furthermore, an updated bibliography for the bluefin tuna traps, also including video and audio documents, for a total of about 2,200 titles, was made available to the SCRS bluefin tuna species group (SCRS/2017/119).

5. Aerial survey

The ICCAT GBYP aerial survey on bluefin spawning aggregations was initially identified by the Commission as one of the three main research objectives of this programme, in order to provide fishery-independent trends and estimates on the minimum SSB. The original programme included a total of three surveys over a maximum of three areas, but this was later modified by the Steering Committee, and a first power analysis revealed that under the best possible conditions a minimum of six/seven surveys will be necessary for detecting a trend in the four main spawning areas.

The total original budget set for three surveys in three areas was 1,200,000 Euros; the cost of carrying out five surveys in many more areas (four main "internal" areas and seven "external" areas) is approximately 2,024,056[3] Euros (168.67% of the original budget, but with much more than twice the activities). So far, the ICCAT GBYP objectives initially set for the aerial survey on spawning aggregations in these first Phases have been largely accomplished, except for the calibration requested in the past by the Steering Committee, for which a detailed SWOT analysis clearly showed the difficulties for implementing it (see Di Natale, 2016). The costs for the aerial surveys represented so far just 15.21% of the total ICCAT GBYP operative budget and the last external review showed that they have been the lowest when compared to any other aerial survey carried out by other entities.

Two aerial surveys (2013 and 2015), according to the specific request of the Steering Committee, were conducted in a very extended area, including four "internal" areas and seven "external" areas, covering more than 60% of the Mediterranean Sea. The logistic of these extended surveys was extremely heavy and complex.

The Steering Committee, in Phase 5, requested a further complex and comprehensive analysis, including a cost/benefit analysis; the reports are available here. The data collected in Phases 4 and 5 confirmed the validity of the approach adopted in Phases 1 and 2, but at the same time confirmed the need for conducting several surveys before detecting any trend for a minimum SSB, due to the high variability of the oceanography in the Mediterranean Sea and the adaptive behaviour of bluefin tuna. The power analysis recommended to continue the survey in the four main spawning areas only.

[3] Including the costs planned for Phase 7 (388,000 €), an amount which might be different at the end of the Phase.

The ICCAT GBYP reviewers pointed out that the aerial survey is still one of the very few available methodologies for providing fishery independent indices and, if continued, it should be limited to the main spawning areas for the logistic problems linked to the extended survey.

Therefore, the ICCAT GBYP aerial survey was resumed in Phase 7, covering the four main spawning areas (Balearic Sea, southern Tyrrhenian Sea, central-southern Mediterranean Sea and Levantine Sea, for a total effective surface of 265,626 km^2), according to the standardisation adopted in Phase 5. The survey in 2017 has been very successful, also thanks to the extremely supportive cooperation of the EU countries and Turkey. A new strategic approach allowed the ICCAT GBYP to have the reports checked in real time, and the analyses were provided just after one week to the SCRS bluefin tuna species group and then at the SCRS BFT Assessment Session (SCRS/2017/149). These standardised results allowed for the first time to the use of the ICCAT GBYP aerial survey data for the MSE and the OM. The abundance of bluefin tuna schools in 2017 was one of the highest registered so far, confirming the strong presence of the species.

Furthermore, the last survey was able to detect, in real time, a shifting in the abundance of bluefin tuna (less presence in the central-southern Mediterranean, with increased presence in all other areas), which was mirrored by the different strategy of the main purse-seine fleets, confirming the importance of this tool and the need to continue the survey over the four main areas in the next Phases.

6. Tagging

The initial, short-term ICCAT GBYP objective approved by the Commission in 2008 was to implant 30,000 conventional tags and 300 electronic tags in three years in the eastern Atlantic and Mediterranean, with a total budget of 9,765,000 Euros; the mandatory tag awareness and reward campaigns, as well as the tagging design study and protocol, were not included in the original budget. So far, with only 50.95% of the funding (a total of 4,975,482 Euros[4]), the ICCAT GBYP has deployed 85.96% of the conventional tags (25,587) and 128% of the electronic tags (384 in total; 326 mini PATs[5], 50 internal archival tags and 8 acoustic tags). Furthermore, the tagging design and protocols, the awareness and reward campaigns have been included in the activity carried out to date. The costs for tagging in the first seven Phases represented 37.38% of the total ICCAT GBYP budget, and it is certainly the most important cost component of the programme. It is very clear that the general objectives set for the tagging activities in these first Phases have been largely accomplished and even exceeded so far in terms of the total number of tags to be deployed, taking into account the proportion of the available budget.

6.1 Conventional and electronic tagging activity

The tagging activities carried out up to the first part of Phase 6 were reported to the SCRS (SCRS/P/2016/039, Tensek *et al.* 2017 and Pagá *et al.* 2017). The final results of Phase 6 were included in the ICCAT GBYP Report to the EU and then reported to the SCRS at the 2017 bluefin tuna data preparatory meeting (SCRS/2017/042). Furthermore, the data sets obtained from miniPATs implanted in tunas that entered the Mediterranean Sea during the spawning season and coincided with the aerial survey, were used for the first time for a tentative assessment of an additional variance for the ICCAT GBYP aerial survey (Quilez Badía *et al*., 2016).

The strategy adopted by the Steering Committee in Phase 7 was similar to the one enforced in Phase 5 and 6, excluding the conventional tagging (which was limited to the complimentary activities) and focusing the ICCAT GBYP activities only on the electronic tagging with miniPATs.

ICCAT GBYP issued two Calls for Tenders in Phase 6 and six contracts were awarded in 2016. Following the first set of three contracts (for the spring-summer activities), 14 miniPATs were deployed in a Moroccan trap (Larache), 19 (of a total of 20) miniPATs were implanted in tunas caught by a purse seiner in the Turkish area and 20 miniPATs were deployed in a Sardinian trap (Isola Piana). In the second set of contracts, for summer-autumn activities, 24 tags (over a total of 25) were deployed in a Portuguese trap, 15 tags (over a total of 21) were deployed in the Strait of Messina (including 3 complimentary tags provided by WWF) and 15 were planned for the Irish waters, but this contract was cancelled in July 2016 by the Steering

[4] Including the costs planned for Phase 7 (290,000 Euro), which might be different at the end of the Phase.
[5] Additional 40 miniPATs should be deployed in autumn 2017.

Committee. Most of these tags had a premature release, suspected to be mostly due to fishing operations but also due to some manufacturer problems that were noticed for the new type of the miniPATs. However some tags provided important results.

As concerns the tagging activities in Phase 7, two Call for tenders were issued, resulting in two contracts. A total of 40 e-tags were deployed in the Portuguese traps, while other 40 will be deployed in autumn in Danish and Swedish waters (13 tags have already been deployed). 33 tags, among those deployed in Portugal, had already popped off and four of them were moving towards the North Sea. A complimentary activity will be carried out by the *Korean National Institute for Fisheries Science* that will deploy 12 electronic tags in the Atlantic during their bluefin tuna fishing activity, sharing the data with the ICCAT GBYP.

The results of the electronic tagging activities not only provided new and totally unknown insights of several bluefin tuna movements, but finally support the results of the ICCAT GBYP genetic studies, which showed a full mixing in all bluefin tunas sampled in the Mediterranean Sea, without any evident isolation; they also confirmed that several bluefin tunas stay in the Mediterranean over winter.

The results from the tags deployed in Morocco in 2016 show that all tunas entered into the Mediterranean Sea, possibly for spawning. Even here, a re-analysis of the full data sets from the tags deployed in Morocco since the beginning of the ICCAT GBYP, along with the data concerning the fish natal origin obtained by the ICCAT GBYP micro-chemistry analyses, detected a possible solution for explaining why several tunas did not enter in the Mediterranean for spawning in some years. It seems that the highly variable percentage of western Atlantic-origin fish in the Moroccan traps could be a major motivation, although not the only one; this fact revealed another area of mixing that was previously unknown, with a very high interannual variability.

Additional complimentary tagging activities with conventional tags are being or have already been carried out in Phase 5, 6 and 7 in Canada, Ireland, Italy, Morocco, Portugal, Spain, United Kingdom and USA, while others are planned also in other areas. The full data will be available at the end of Phase 7.

In total, up to 20 September 2017, the total number of bluefin tunas tagged in all Phases of ICCAT GBYP is 18,407, and a total of 26,171 tags of various types have been implanted, mostly in juvenile bluefin tunas. Among these, 7,964 bluefin tunas were double tagged, amounting to 43.27% of the total tagged fish, a percentage which is well over the target (set at 40%).

An analysis about the migration into the Mediterranean Sea of bluefin tunas tagged in the Atlantic Ocean (detected with both electronic and conventional tags) was requested by the SCRS bluefin tuna species group during the 2017 bluefin tuna data preparatory meeting and duly provided by the ICCAT GBYP at the SCRS bluefin tuna assessment session (SCRS/2017/131). The ICCAT GBYP tag data have been used also in the paper SCRS/2017/177.

These last activities and results show how important the tagging activity is and how essential it is to continuously refine both the objectives and the comprehensive analyses, taking into account the many ICCAT GBYP (and other) research projects and the extremely complex and adaptive behaviour of bluefin tuna. These results clearly show the great interest of ICCAT GBYP tagging activities, which are able to provide inputs for a more realistic management of the bluefin tuna stocks.

6.2 Tag awareness and tag recovery activities

According to the recommendations provided by the Steering Committee in all meetings, the ICCAT GBYP continued the tag awareness campaign, for the purpose of improving the tag recovery and reporting rates. Further, thousands of awareness material in 12 languages (posters and stickers) were produced and distributed in all Phases. Details are available here. Specific training was provided yearly to ICCAT ROPs (except in Phase 6, when this training was not authorized), requesting that they pay maximum attention to tags (including natural marks) when observing harvesting in cages or any fishing activity at sea. A field tag awareness programme was developed in 2014 in which several countries have been visited, and contact made directly with local authorities, fisher organizations, tuna factories, tuna traps, observers and sport fishers:

The tagging awareness campaign is coupled with a tag reward campaign which includes substantial rewards, special T-shirts and increased annual lottery prizes. The ICCAT GBYP also provides immediate feedback to the tagging teams and the tag recovery persons, informing them about the history of each tag.

To improve information and tagging programme awareness, the ICCAT GBYP is developing contacts with various stakeholder organizations and journalists. Information on the ICCAT GBYP is now present on various websites, while some articles have been published in local newspapers.

A short video on ICCAT GBYP tagging activities, along with a spot, were produced in Phase 6, following a Call for tenders. The videos and spots were translated in 8 languages and were presented at the SCRS meeting in September 2016. While it is now available for free download, it is envisaged to develop the ICCAT GBYP bluefin tuna tagging visibility campaign and use these video materials for this purpose, by distributing them to main TV stations and other media in Mediterranean CPCs. Some CPCs had already used the videos on national television channels. All videos are uploaded on YouTube as a preview and their download in the high quality is easily available on request. For better informing all ICCAT CPCs and scientists about the possibility to freely use these videos and spots, the Secretariat released ICCAT Circular #0361/2017 (on 1 March 2017), with all the details. So far, the ICCAT GBYP videos had 3,127 visualisations in 71 countries.

A total of 648 tags (602 conventional tags, 26 mini-PATs, 13 archival tags, 4 commercial tags and 3 acoustic tags) from bluefin tunas have been reported to ICCAT GBYP up to 19 September 2017, showing a very substantial improvement in the total number of reported tags (see details in SCRS/2017/139). Even if the tag reporting rate is still low (2.48% of the total deployed tags of various types, 2.39% for the conventional tags only), comparing the mean annual bluefin tuna tag reporting rate to the ICCAT one for the eight years (2002-2009) prior to the ICCAT GBYP (0.88 tags/year) and the current reporting rate for the full period of the ICCAT GBYP up to 19 September 2017 (87.37 tags/year), the increase is about 9,928%. As a matter of fact, the tag reporting continuously increased in the years when the conventional tagging activities were carried out and continued even when the conventional tagging was cancelled.

Furthermore, the double tagging activity planned for studying the shedding rate of the different types of spaghetti tags and the specific recoveries reported so far (from 202 fish, with a reporting rate of 2.34%) showed that the results between single-barb spaghetti and double-barb spaghetti are quite comparable, because the single-barb ones were still on the fish in 80.69% of the cases, compared to 79.21% of the double-barb ones. The shedding rate was 40.1%.

6.3 Close-kin genetic tagging

Close-kin genetic tagging (now usually called Close-kin mark recapture, CKMR) is a technique which may provide an estimation of the total abundance and the spawning stock biomass, under the condition to have a very limited number of spawning grounds and a very good and extended sampling, either for spawners and juveniles. It seems to work for southern bluefin tuna and it is now currently used by the CCSBT Commission for assessing this species.

The Steering Committee, in Phase 5, recommended to fund the first part of the feasibility study for Close Kin Genetic Tagging. After a Call for tenders, a contract was awarded and the report was provided in the very last part of Phase 5. The first part of the CKMR feasibility study report provided by the contractor showed some problems in the part of the contents concerning the east bluefin tuna reproductive biology and therefore it was later revised various times. Therefore, the Steering Committee decided to have a refined and revised report in Phase 6, before going on with the dedicated genetic workshop and the second part of the CKMR feasibility study. Both these latter activities were postponed at least to Phase 8.

In Phase 6, the Steering Committee decided to start collecting the necessary samples for practically testing the feasibility and real costs for carrying out a CKMR study for the eastern bluefin tuna; the enhanced sampling was continued in Phase 7; this part is better described under point 7 of this document.

6.4 Other activities related to tagging

In order to better assess the post-release mortality in tag-and-release activities, and following the recommendation of the ICCAT GBYP Steering Committee, the GBYP is supporting a complimentary study which was proposed by the Croatian Institute for Oceanography and Fisheries. This study is using fish caught by a purse-seine and moved into a cage, where the tag and release activity (usually carried out by sport fishers) will be tested. The results of this study will be made available at the end of Phase 7.

A new and useful electronic tag data base with a Shiny application has been developed by ICCAT GBYP in Phase 7 and it is now available for the SCRS scientists (SCRS/2017/192). The application allows for an easy visualisation of the data and particularly the tracks.

7. Biological studies

The initial, short-term ICCAT GBYP objective approved by the Commission in 2008 was to collect samples from 12,000 fish (including western Atlantic and the Japanese catches and markets) and carry out aging, genetic studies, and micro-constituent analyses in three years in the eastern Atlantic and Mediterranean, with a total budget of 4,350,000 Euros. So far, with only 59.75% of funding (a total of 2,598,525 Euros[6]), the ICCAT GBYP collected samples from 12,771 fish (106.4% of the target) up to Phase 6 and carried out ageing, genetic and micro-constituent analyses; furthermore, the sampling design, the sampling protocols and the otolith shape analyses were included in the activity carried out so far. Additional 2,130 fish should be sampled in Phase 7, bringing the total to 14,901 fish, about 124.2% of the objective, but with just about half of the budget. The amount of funds used for biological studies in the first seven Phases represents 19.53% of the total budget available so far for ICCAT GBYP. It is very clear that the general objectives set for the biological studies in these first Phases were largely accomplished so far, even without taking into account the proportion of the available budget.

An SCRS meeting was organized in May 2013 in Tenerife for reviewing the bluefin tuna biological parameters and the report is available here. The latest data were reported to SCRS Plenary in 2016 (Di Natale A., *et al.* 2017). The details of the sampling areas were revised jointly by the ICCAT GBYP coordination and the Steering Committee prior to the field activities in 2016 and 2017 and now there are 12 areas, 38 strata and 79 substrata, allowing for detailed analyses. At the SCRS bluefin tuna data preparatory meeting in 2017, new biological data were presented (see documents SCRS/2017/040, SCRS/2017/041). The last update regarding the situation of the ICCAT GBYP biological studies in Phase 7 was reported to the SCRS in document SCRS/2017/139.

The Steering Committee, in Phase 6, requested ICCAT GBYP to start trying the collection of an additional number of samples from the four main spawning areas in the Mediterranean Sea, to be used for a CSMR trial, also with the purpose to better assess the feasibility and the costs. After several contacts with the industry and the farms, several invitations have been circulated and the first three contracts were released, covering three of the four main spawning areas (with 300 adult fish minimum to be sampled by area).

A Call for tenders was released to cover the usual annual needs in terms of sampling and analyses, but in Phase 6 it also included the additional needs for CKMR samplings, as decided by the Steering Committee. Furthermore, following specific ICCAT GBYP scientific needs, it was also decided to include a comparison of the genetic results obtained using only SNPs, re-analysing the same samples using micro-satellites, in order to have a further confirmation. Another Call was released after the Steering Committee meeting in July, requesting a considerable amount of additional ageing analyses. A contract for biological sampling and analyses was awarded to a large Consortium of 14 entities and 7 sub-contracted entities, belonging to 8 different countries. The Call for tenders for additional aging analyses received no bids.

A ICCAT GBYP workshop for larval studies and surveys was held in Madrid on 12-14 September 2016, with the participation of scientists from EU, Japan and USA, updating knowledge and needs for developing this fishery independent index. The report was presented as Di Natale., 2017.

---

[6] Including the costs planned for Phase 7 (539,000 Euro), an amount which might be different at the end of the Phase.

In Phase 7, the Steering Committee recommended a broader list of biological studies, along with the continuation of the additional sampling activities for CKMR purposes. Four invitations were provided for the additional sampling, resulting in three contracts, while another invitation was issued for an extensive ageing of 2,000 fish, resulting in one contract. A Call for tenders was issued for the other sampling activities and analyses, resulting in three contracts.

In total, 12,771 bluefin tunas have been sampled up to February 2017 and about 40% have already been analysed; additional samples will be analysed in Phase 7, even if most of the genetic and micro-chemical analyses have been postponed to Phase 8. The list of available biological samples by type (muscle/fins, otoliths, spines), already stocked in the ICCAT GBYP tissue bank, currently maintained by AZTI, was circulated during the bluefin tuna intersessional meeting in July 2016 and again at the bluefin tuna data preparatory meeting in March 2017.

The first results, which can still be considered preliminary, are extremely interesting and very promising:

- Genetic analyses show that there is a clear genetic difference between the western Atlantic bluefin tuna and the eastern Atlantic bluefin tuna, and a certain mixing is present in almost all areas, with different proportions and with a high interannual variability. At the same time, for the eastern Atlantic stock, it is evident that there are no subpopulations within the Mediterranean and the intra-Mediterranean mixing is very evident. These results were confirmed with all genetic analytical methods.

- Microchemistry analyses showed that the current main stock components are well identified. Mixing in the Mediterranean Sea is minimal. The presence of important percentages of bluefin tuna from different areas in the central-North Atlantic and the Atlantic Iberian-Moroccan need to be investigated much more and further checked before having more solid results, however, it seems that the two stocks can be present there, with a very high interannual variability. These data were used for the MSE and the OM.

- A variable percentage of bluefin tuna cannot be currently attributed to any of the two stocks. This fact might be related to various factors, including the possible occurrence of additional spawning areas in the Atlantic Ocean, and it shall be further studied in the future. A study for the NW Atlantic area has been committed in Phase 7.

- The otolith shape analyses showed that bluefin tuna population components show some differences in shape. The otolith shape is better for describing the life history of the fish more than clearly detecting the origin in most of the cases.

- A first ageing calibration was carried out in 2014, with broad participation from scientific institutions and scientists belonging to several CPCs. The initial results show good improvements and similar exercises for smoothing the biases, which are essential for more accurate ageing of bluefin tuna, must be continued. The ICCAT GBYP ALK provided additional data in Phase 6, which were passed immediately to the SCRS bluefin tuna species group. A massive ageing of otoliths collected in previous ICCAT GBYP phases and stored in the ICCAT GBYP tissue bank in currently ongoing.

8. Modelling approaches

The initial, short-term ICCAT GBYP objective which was approved by the Commission in 2008 was to carry out operating modelling studies from year 4, with a total budget of €600,000. So far, with 117.5% of the funds (a total of €704,848[7]), the ICCAT GBYP carried out many modelling activities from Phase 2, following the recommendations of the Steering Committee and the SCRS. It is very clear that the general objectives set for the modelling studies in these first Phases have been, to date, largely accomplished taking into account both the needs to develop a MSE and the proportion of the available budget. Furthermore, the modelling plan was fully revised and now it has been extended up to 2021, as it was endorsed by the Commission. The total amount of funds set for the modelling approaches in the first Phases represents only the 5.3% of the total ICCAT GBYP budget available so far.

[7] Including the costs planned for Phase 7 (174,000 Euro), which might be different at the end of the Phase.

Five meetings of the ICCAT GBYP Core Modelling MSE Group have been held so far, setting and updating the Modelling Plan and to revise the actions and their development. The reports are available here. The list of members of the ICCAT GBYP Core Modelling MSE Group was updated in Phase 5 and then again in Phase 6, taking into account the new bluefin tuna rapporteurs and the SCRS Chairman.

A Modelling coordinator and a modeling technical assistant were contracted in Phase 5, according to the decision taken by the Steering Committee. The contract for the modelling assistant was extended also to Phase 6 and 7, while the Steering Committee decided not to extend the contract for the Modelling coordinator, which will possibly be replaced by a Modelling communicator.

An ICCAT GBYP VPA training course was held in Miami on February 2017. 11 scientists attended the course from different ICCAT CPCs. The training was kindly provided by Dr. Laurie Kell, Dr. Ai Kimoto and Dr. Clay Porch. A technical meeting for conducting a SAM assessment was held in Madrid in May 2017. The results are presented in SCRS/2017/146.

The documents concerning the various products developed within the modelling approaches in all Phases are available here. New information was provided to the bluefin tuna intersessional meetings in 2016 (see documents Carruthers and Kell, 2017a, Carruthers and Kell, 2017b and SCRS/P/2016/033) and in 2017 (SCRS/2017/178). All details regarding the ICCAT GBYP activities for the Modelling Approaches are provided in document SCRS/2017/139.

The data obtained from the electronic tagging activities have been included in the trials, including all those recovered in Phase 6 and all the ICCAT GBYP e-data sets. In 2017, for the first time, the ICCAT GBYP aerial survey data were also used for the OM. The work necessary for developing new modelling approaches will take several years, however, according to what was pointed out during the recent ICCAT GBYP review, the results of the modelling efforts will result in a much more focused research activity for the future.

All the ICCAT GBYP data were moved into the ICCAT system almost in real time in each Phase, after being accepted by the ICCAT SCRS Sub-committee on Statistics, while others were provided directly to the specialist identified by the SCRS bluefin tuna species group. In the first part of Phase 7 the great majority of the ICCAT GBYP data was used in the 2017 bluefin tuna stock assessment, in the MSE and in the OM. **Table 1** shows the details.

9. Legal framework

ICCAT adopted Rec. 11-06 in its meeting in Istanbul (November 2011), which allows for a "research mortality allowance" of 20 t of bluefin tuna per year for the ICCAT GBYP and for the use of any fishing gear in any month of the year in the ICCAT Convention area for ICCAT GBYP research purposes. To implement the recommendation, the ICCAT Secretariat issues one or more circulars in each year of the ICCAT GBYP activity.

A total of 245 ICCAT GBYP RMA certificates have been issued up to 1 September 2017, for a total of about 11,519 kg of bluefin tuna in the last 6 years (SCRS/2017/139), but the sampling activity is ongoing.

10. Cooperation with ROP

The ICCAT GBYP coordination, together with the ICCAT Secretariat, is maintaining and improving the contacts with the ROP observers, to strengthen the cooperation and provide opportunities. The ROP observers are engaged in directly checking the bluefin tuna at harvest for improving tag recovery and reporting. The observers are also requested to report any natural mark and a specific form was provided by the ICCAT GBYP to ROPs. The specific training, yearly provided by the ICCAT GBYP Coordinator to the ROP, has been suspended since 2016. Several tags have been reported by ROPs in the last years. The trials for collecting additional biological samples which were agreed with the ROP in Phase 7, will be evaluated at the end of the Phase.

11. ICCAT GBYP Web page

The ICCAT GBYP web page, which was created in the last part of Phase 1, is usually updated regularly with all documents produced by the ICCAT GBYP. In some cases, due to the huge workload, some sets of documents are posted all together. Updates also includes the budget page, where all contributions (monetary or in kind) are regularly listed, to ensure full transparency. The ICCAT GBYP web pages have recently been fully revised and improved.

12. Following activities

The ICCAT GBYP Steering Committee, recommended the following activities for Phase 8:

a) *Data recovery and data mining*: If additional reliable data regarding any bluefin tuna fisheries in the last decades or other additional data sets, not already included in official Task II data, are detected, then these data should be recovered and used for improving our understanding of these fisheries. Efforts will be done for recovering the historical bluefin tuna catches from the ICES area.

b) *Aerial survey*: after the good results of the last survey in 2017, the aerial survey should continue, carrying out the activity only on the four overlapping areas.

c) *Tagging*: Electronic tagging should be partly carried out, focusing the distribution of tags according to the emerging needs set by the SCRS. Tag awareness activity will be continued, possibly improving communications with the media by using the video tools developed in Phase 6. If availability is confirmed by the external specialist, the second part of the CKMR feasibility study will be done, taking into account the preliminary trials for collecting dedicated samples in Phase 6 and 7. Furthermore, the CKMR genetic workshop should be organised.

d) *Biological and genetic sampling and analyses*: Sampling should be continued, covering the less sampled areas or those where mixing problems have recently been detected; the analyses of the available samples should be improved, particularly for microchemistry, genetics and ageing, the latter taking into account the dedicated effort carried out in Phase 7. The trials for obtaining additional samples for CKMR shall be continued.

e) *Modelling*: New additional efforts should be devoted to work on the best approaches to use fishery independent data and innovative approaches to better quantify uncertainties. The dialogue with stakeholders shall be activated and thoroughly improved. The revised plan should be enforced, according to the outputs of the ICCAT GBYP Core Modelling MSE Group. The modelling capacity building shall be further improved.

The total budget necessary for Phase 7 is provisionally set once again at €2,125,000.

The ICCAT GBYP will continue to encourage and support additional research activities carried out by the various CPCs.

Evolution of the Atlantic-Wide Research Programme for Bluefin Tuna: According to the current situation, it has been fully demonstrated that it is impossible to reach the level of funding initially approved by the ICCAT Commission for the first six years of the ICCAT GBYP and, as a consequence, to carry out the various activities as originally planned. The extension of the programme up to 2021 was discussed and endorsed by the Commission in 2014, following the SCRS recommendation. However, the ICCAT GBYP funding system should be revised and better defined, stabilised and improved, in order to ensure the regular development of the activities. Regardless of the type of system envisaged, the budget by Phase or year, subject to the Commission's approval, must be ensured.

The second external review (see Sissenwine M. and Pearce, 2017) provided an independent overview of the work carried out so far and possible proposals for the following extension, underlying that the ICCAT GBYP should become an institutional and continuous stream of scientific data.

Table 1. Details on the use of ICCAT GBYP data up to the first part of Phase 7 in the stock assessment, in the MSE and in the OM.

Activity	***Use in the BFT Stock Assessment***	***Use in the BFT MSE and OM***
Data mining and data recovery	size data, LL CPUE, historical trap data, BB data, non-GBYP electronic tagging data	size data, LL CPUE, historical trap data, BB data, non-GBYP electronic tagging data, historical genetic data
Aerial survey on BFT spawning aggregation	not so far (too short series)	yes
Tagging	conventional tag data, growth data, electronic tag data	conventional tag data, electronic tag data
Biological studies	genetic and microchemical data (mixing), ALK, reproductive characteristics, L/W correlation	genetic and microchemical data (mixing by area), ALK, reproductive characteristics, L/W correlation
Modelling approaches	SAM application, VPA training course	MSE and OM development, Modelling Multi-Year Plan

Appendix 5

Report of the ICCAT Enhanced Programme for Billfish Research (ICCAT/EPBR)

(Expenditures/Contributions 2017 and Programme Plan for 2018)

Summary and Programme objectives

The ICCAT Enhanced Programme for Billfish Research (EPBR) continued its activities in 2017. The Secretariat coordinates the transfer of funds and distribution of tags, information, and data. The overall programme coordinator and western Atlantic coordinator during 2017 was Dr. John P. Hoolihan (USA). Dr. Fambaye Ngom Sow (Senegal) was the 2017 coordinator for the eastern 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 believes that these studies are essential to improve billfish assessments. Efforts to meet these goals during 2016-2017 are highlighted below.

The programme depends on financial contributions, including in-kind support, to reach its objectives. This support is especially critical because the largest portion of billfish catches in recent years comes from countries that depend on the support of the programme to collect fishery data and biological samples. ICCAT has provided financial support in recent years, while annual contributions have been made by Chinese Taipei since 2009.

2017 Activities

Brazil: No allocated funds from EPBR were requested from Brazil in 2016-2017.

Ghana: Billfish catch and effort data derived from artisanal fleets operating along the Ghanaian coast is ongoing.

Côte d'Ivoire: Improved data collection methods and reporting of Task I and II data to ICCAT have been achieved for the artisanal fleets. Rigorous biological sampling on a monthly basis is being carried out. Started in 2015, this project seeks to determine the stages of sexual maturity, the periods of reproduction, the fertility and the dietary habits of sailfish.

São Tomé and Principe: Collection of billfish landing data from artisanal fisheries has continued in São Tomé and Principe, the collection of fishery statistics continued in 2017. A total 562 t catch of billfish was reported for 2016.

Senegal: Field surveys of billfish catches by the artisanal fleet are carried out by the Oceanographic Research Centre of Dakar/Thiaroye. Catch and effort, and size frequency data were collected during 2016-2017. In total 589 t of sailfish and 69 t of blue marlin were reported.

Venezuela: At-sea sampling activities of INIA/IOV-UDO were discontinued in 2015 because of the difficulties of transferring funds to Venezuela in a way that would allow those funds to be used for the project activities. Throughout 2017 contacts have been made between Venezuela and the Secretariat aiming to sign a Memorandum of Understanding that would allow reinstatement of the programme in Venezuela. This important historical data source was based on landings out of the port of Cumaná, where the fleet of industrialized longline vessels target yellowfin tuna and swordfish, but also catch billfish. The reinstatement of this programme is needed to ensure long-term continuity of billfish data collection in the Caribbean.

United States: Dr. Mahmood Shivji, Nova Southeastern University, continued his research collaborations involving genetic analyses of white marlin and spearfishes using samples collected by NOAA Southeast Fisheries Science Center (US), Venezuela, Uruguay, and Brazil.

Genetic sampling kits continued to be distributed to a number of fleets to help identify the percentage of white marlin, longbill spearfish and roundscale spearfish in the mixture of landings that represent these three species.

2018 Plan and activities

The highest priorities for 2018 are to support the objectives established by the billfish work plan and those of the EPBR, with specific emphasis on the collection and preparation of data relevant to the identification of white marlin and spearfishes and the collection of biological data on spearfishes:

- support the collecting and processing of samples of billfish for genetic studies,
- support the monitoring of the Brazilian, Uruguayan and Venezuelan fleets through onboard observers, reporting of conventional tags, and biological sampling,
- support the collection of biological samples in West Africa,
- support the monitoring of billfish catches from West African artisanal fishing fleets,
- investigate possible unreported important billfish catches in the Caribbean, and take steps to develop capacity building where feasible.

All these activities depend on successful coordination, sufficient financial resources and adequate in-kind support. Details of EPBR funded activities for 2018 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 western Atlantic, sampling at landing sites will be conducted for artisanal gillnet landings off central Venezuela, pending available funds. In the eastern Atlantic, monitoring and sample collection will be supported for the artisanal fisheries of Côte d'Ivoire, Ghana, São Tomé and Senegal.

At-sea sampling

In the western Atlantic, continued support will be provided to the sampling made onboard the Venezuelan vessels.

Tagging

The programme will need to continue to support the conventional tagging and recapture reporting conducted by programme partners.

Biological studies

The biological and genetic sampling programmes, particularly for white marlin and spearfish, will continue in 2018.

Results from the Atlantic wide study on genetic differentiation of sailfish led by Brazilian scientist in collaboration with other National scientists was presented to the Group (SCRS/2017/218), preliminary results indicated that sailfish show at least two lineages, but a lack of population structuring between the analysed regions. Thus research is ongoing with the need for a pervasive genetic analysis with a higher resolute molecular marker to investigate the relationship between these lineages and ultimately if there is a need for differential management.

Continued efforts to collect biological samples for reproduction, age and growth studies for all billfish species requires EPBR support to facilitate cooperation from fleets that are monitored with EPBR funds.

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 from the west. Coordinated activities between EPBR, JCAP and ICCAT data funds will continue to be required.

Programme management

Management of the EPBR budget 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 protocol for the use of funds (see Addendum 2 to Appendix 7 of *Report for Biennial Period 2010-2011, Part II (2011), Vol. 2*).

2017 Budget and Expenditures

This section presents a summary of the contributions and expenditures for the ICCAT EPBR during 2016. The Billfish Working Group developed a budget of €69,747.44 for the EPBR. The contributions made to the EPBR for the 2016 programme were €20,000.00 from the regular ICCAT budget and €3,000 from Chinese Taipei. Carryover funds remaining from the previous year were €61,184.16, thus total funds available for 2016 were €84,184.16 (**Table 1**). Expenditures to-date in 2016 have been €3023.00, with an additional €49,777.00 committed to other activities that have either taken place during January-September 2016 or are anticipated during October-December 2016. One of the main reason for the smaller expenditures has been the delay in receiving adequate numbers of genetic samples for processing. The estimated balance of EPBR funds at the end of 2016 is €31,384.16 (**Table 1**).

2018 Budget and requested contributions

The proposed 2018 budget, totalling €49,771.16 is detailed in **Table 2**. The programme is predicted to have a balance of €46,771.16 by the end of 2017 and therefore requests the Commission to provide a contribution of €0.0 for 2018. To achieve all its objectives in 2018 the programme will continue to require contributions of €3,000.00 from other sources, such as those so generously provided lately by Chinese Taipei.

Development of improved age and growth curves and estimates of maximum longevity of billfishes has been recommended by the Group. **Table 2** continues to include research funding allocations to conduct biological sampling for age and growth of sailfish and blue marlin in the eastern Atlantic. Currently, no age and growth information is available for the eastern stock of sailfish, or blue marlin caught in that region.

The consequence of the programme failing to obtain the requested budget will be to stop or reduce programme activities for 2018 including: (1) collection and processing of genetic samples, collection and processing of age and growth samples, (2) at-sea observer trips in Brazil and Venezuela, (3) biological sampling and collection of statistics of catches from fleets in the western and eastern Atlantic, (4) promotion of conventional tagging activities, including distribution of tag recovery incentives. All these activities are critical to continue the improvement of the information available to the SCRS for billfish stock assessments.

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. The EPBR is the only programme that focuses exclusively on billfish. 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.

Table 1. Detailed 2017 expenditures (as by 22/09/2017).

Income			**Euros (€)**
	Balance transferred from 2016		75,671.16
		ICCAT Commission	20,400.00
		Chinese Taipei	3,000.00
	Total income		23,0400.00
Total Budget			**99,071.16**
Expenditures			
	Current expenditures Jan-Sep 2017		**0.00**
Funds obligated until end of the year			
	West Atlantic shore-based sampling:		
		Venezuela	(6,000.00)
	West Atlantic at-sea sampling:		
		Venezuela	(6,000.00)
		Brazil	(5,000.00)
		Other fleets	(2,000.00)
	East Atlantic shore-based sampling:		
		Senegal	(3,000.00)
		Ghana	(3,000.00)
		São Tomé	(2,000.00)
		Côte d'Ivoire	(3,000.00)
	Age & growth biological sampling:		
		Senegal	(3,000.00)
		São Tomé	(3,000.00)
		Côte d'Ivoire	(3,000.00)
	Collection of genetic samples[2]		(2,000.00)
	Mailing genetic samples[2]		(1,000.00)
	Processing genetic samples[2]		(2,000.00)
	Lottery rewards - billfish tagging		(500.00)
	Coordination travel		(6,500.00)
	Bank charges		(300.00)
	Obligated expenditures October-December 2017		**(52,300.00)**
Total Expenditures for full year			**(52,300.00)**
Estimated year-end balance			**46,771.1**

[1] Expenditures contingent on available funds.
[2] Number of samples collected and processed will depend on the final budget of the programme.

Table 2. Detail of proposed expenditures for 2018.

Income			**Euros (€)**
	Balance transferred from 2017 (tentative)		46,771.16
		ICCAT Commission	0.00
		Chinese Taipei	3,000.00
Total income			3,000.00
Total Budget			**49,771.16**
Planned Expenditures			
	West Atlantic shore-based sampling:		
		Venezuela	(6,000.00)
	West Atlantic at-sea sampling:		
		Venezuela	(6,000.00)
		Brazil	(5,000.00)
		Other fleets[1]	(3,000.00)
	East Atlantic shore-based sampling:		
		Senegal	(3,000.00)
		Ghana	(3,000.00)
		São Tomé	(2,000.00)
		Côte d'Ivoire	(3,000.00)
	Age & growth biological sampling:		
		Senegal	(3,000.00)
		São Tomé	(3,000.00)
		Côte d'Ivoire	(3,000.00)
	Collection of genetic samples[2]		(2,000.00)
	Mailing genetic samples[2]		(1,000.00)
	Processing genetic samples[2]		(2,000.00)
	Lottery rewards - billfish tagging		(500.00)
	Coordination travel[1]		(6,500.00)
	Bank charges		(300.00)
Total Expenditures			**(52,300.00)**
Estimated year-end balance			**-2,528.84**

[1] Expenditures contingent on available funds.
[2] Number of samples collected and processed will depend on the final budget of the programme.

Appendix 6

Report of the ICCAT Small Tunas Year Research 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 the recovery of historical series of Task I and Task II data, collecting the available biological data, and conducting biological studies, mainly on growth and maturity for the main species of small tunas.

This programme has a wide geographical sampling coverage:

- Mediterranean and Black Sea: bullet tuna, Atlantic bonito, little tunny and plain bonito;
- West Africa: Atlantic bonito, little tunny, tuna, West African Spanish mackerel, frigate tuna, wahoo;
- Caribbean Sea and south-west Atlantic: blackfin tuna, king mackerel and serra Spanish mackerel and dolphinfish.

2017 Activities

The ICCAT Secretariat launched in February 2017 a Call for tenders with the aim to implement the main activities scheduled within SMTYP in 2017, in particular continuing the recovery of historical Task I and Task II data series and conducting growth and maturity studies for the main species. As a result, the Secretariat selected four scientific institutions and/or individual experts to carry out the tasks aforementioned (**Table 1**). However, the Secretariat only received signed contracts for two of those projects. The biological data collected covered mainly two geographical areas (North-east Atlantic and the Mediterranean Sea) and the following priority species (BON, LTA, FRI, BLT). Given the time constraints raised by many scientists last year, the deadline to submit the final draft report in 2017, was extended to 15 December, allowing scientists to extend longer their biological sampling period.

Activities planned for 2018-2019

During the period 2018-2019, the Group plans to continue collecting biological samples for priority species as the first priority to further improve growth and maturity parameters estimates. The SMTYP programme aims also to launch genetic studies to improve the information on the stocks structure as a second priority.

Nevertheless, these objectives could not be achieved without a financial support from ICCAT. **Tables 2 and 3** give the detailed information on research activities to be conducted by species and research line and the corresponding estimated costs for 2018-2019.

2017 Expenditures

The total expenditures within SMTYP during 2017 amounted to €34,500. The detailed costs for each contracted institution are summarized in the **Table 1.**

Budget for 2018-2019 and expected expenditures

To implement the main activities planned in the framework of SMTYP in 2018-2019, a total budget of €210,000 is needed from ICCAT or other financial resources. The details of costs related to activities to be carried out in 2018-2019 are shown in the **Table 3.**

Table 1. The detailed expenditures within SMTYP during 2017.

Institution	*Amount (€)*
Samar Saber - Spain	12,000.00
IMROP - Mauritania	15,000.00
INDP – Cabo Verde	7,500.00
Total	**34.500.00**

Table 2. The detailed information on the research activities to be carried out by species for 2018-2019 under the ICCAT SMTYP.

Species	*Research line*	*Geographical area*	*CPCs*	*Coordinator*
Little tuna	Aging and growth	North East Atlantic	Senegal, Côte d'Ivoire, EU-Spain, EU-Portugal, Mauritania, São-Tomé, Cabo Verde	To be identified
		South Atlantic	Angola, South Africa	
		Mediterranean Sea	Tunisia, EU-Spain	
	Reproduction	North East Atlantic	Senegal, Côte d'Ivoire, EU-Spain, EU-Portugal, Mauritania, São-Tomé, Cabo Verde	D. Macias
		South Atlantic	Angola, South Africa	
		Mediterranean Sea	Tunisia, EU-Spain	
	Stocks structure/delimitation	North East Atlantic	Senegal, Côte d'Ivoire, EU-Spain, EU-Portugal, Mauritania, São-Tomé, Cabo Verde, Morocco	J. Vinas
		South Atlantic	Angola, South Africa	
		Mediterranean Sea	Tunisia, EU-Spain	
Atlantic Bonito	Aging and growth	North East Atlantic	Senegal, Côte d'Ivoire, EU-Spain, EU-Portugal, Mauritania, São-Tomé, Cabo Verde, Morocco	To be identified
		South Atlantic	Angola, South Africa	
		Mediterranean Sea	Tunisia, EU-Spain	
	Reproduction	North East Atlantic	Senegal, Côte d'Ivoire, EU-Spain, EU-Portugal, Mauritania, São-Tomé, Cabo Verde, Morocco	D. Macias
		South Atlantic	Angola, South Africa	
		Mediterranean Sea	Tunisia, EU-Spain	
	Stocks structure/ delimitation	North East Atlantic	Senegal, Côe d'Ivoire, EU-Spain, EU-Portugal, Mauritania, São-Tomé, Cabo Verde, Morocco	J. Vinas
		South Atlantic	Angola, South Africa	
		Mediterranean Sea	Tunisia, EU-Spain	
Wahoo	Aging and growth	North East Atlantic	São-Tomé, Cabo Verde	To be identified
	Reproduction			D. Macias
	Stocks structure/delimitation			J. Vinas

Table 3. Estimated budget for biological and genetic studies in the frame work of SMTYP for 2018-2019.

Tasks for 2018	*Budget*	*Observations*
Sampling	30,000€	First year focused in the sampling effort and analysis of 1 species (LTA) for the 3 lines of research 3 species, 1 year (total of 30 localities). 60 individuals per locality About 1800 individuals. Possible increase of new location
Growth analysis	15,000€	1 year, 1 species LTA, all locations. About 150 individuals. 2 growth structures to be analyzed
Reproduction analysis	15,000€	1 year, 1 species LTA, all localities, all individuals. 600 individuals
Stock Structure analysis	30,000€	1 year, 1 species LTA, all localities. 50 individuals for locality. About 500 individuals
TOTAL for 2018	**90,000€**	

Tasks for 2019	*Budget*	*Observations*
Sampling	10,000€	Complete Sampling. Analysis of the other species WAH, BON Resampling for further needs
Growth analyses	30,000€	1 year. Finish LTA. All analysis of WAH, BON. 2 structures
Reproduction analyses	30,000€	1 year. Size of first maturity for WAH and BON
Stock Structure analysis	50,000€	1 year, 2 Species WAH and BON, all localities about 750 individuals.
TOTAL for 2019	**120,000€**	
Total budget 2018-2019	**210,000€**	

Appendix 7

Report of the ICCAT Shark Research and Data Collection Programme (ICCAT/SRDCP)

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, the Shark 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. For the first two years the programme focused on biological and other aspects of the shortfin mako and contemplated extensive collaborative work among National scientists with the aim of contributing information to the 2017 Shortfin Mako stock assessment.

2017 Activities

During the 2015 Blue Shark stock assessment meeting and shortly thereafter, four project proposals covering different aspects of the life history, stock structure, and fisheries of the shortfin mako were presented: a pan-Atlantic age and growth study; a population genetics study to estimate the stock structure and phylogeography of Atlantic shortfin mako; a post-release mortality study focusing on pelagic longline fisheries; and a satellite tagging study for determining movements and habitat use. A fifth project, to study the trophic relationships of Atlantic mako sharks through stable isotope analysis and possibly fatty acid analysis, was also presented later. Following are the cumulative SRDCP activities conducted up to 2017.

Age and growth of shortfin mako in the Atlantic Ocean

The project leader for this study is Dr. Rui Coelho, National scientist from EU-Portugal, with participation of scientists from Portugal, Uruguay and United States. There still remain uncertainties about the age and growth parameters of shortfin mako and this project aimed to update the available estimates by ageing specimens from multiple areas 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. The current sample includes a total of 698 vertebrae: 253 from the northwest Atlantic, 103 from the northeast Atlantic, 268 from the southwest Atlantic, and 74 from the southeast Atlantic. All 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, one biologist from each participating institution 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 were analyzed. Growth models were fitted using the von Bertalanffy growth equation re-parameterized to calculate L_0, instead of t_0, and a modification of this equation using the known size at birth. Growth models were compared using information theory criteria and the von Bertalanffy growth equation with fixed L_0 (size at birth = 63 cm FL) adequately described model growth, with resulting growth parameters of Linf = 241.8 cm FL, k = 0.136 $year^{-1}$ for males and Linf = 350.3 cm FL, k = 0.064 $year^{-1}$ for females. The results of this study (SCRS/2017/111) were used in the 2017 Shortfin Mako stock assessment session.

Genetic analysis of shortfin mako in the Atlantic Ocean

Dr. Yasuko Semba, National scientist from Japan took over as project leader for this study from Dr. Kotaro Yokawa. The main goal of this study was to investigate the genetic stock structure of the Atlantic shortfin mako using mitochondrial and microsatellite DNA of specimens collected across the entire Atlantic Ocean. The mitochondrial analyses conducted under this project indicated the differentiation of populations in the northern, southwestern, and southcentral and southeastern areas, which supports current stock structure hypotheses of Atlantic shortfin makos, and also suggested the possibility of multiple stocks within the South Atlantic; however, no significant genetic structuring was found based on the microsatellite analyses. Additional analyses to investigate the fine-scale genetic structure, especially in the North Atlantic, were conducted in 2017 based on tissues collected through collaboration with CPC members of the SSG from the entire Atlantic. Tissues from a total of 54 individuals were collected from the Caribbean Sea, Mediterranean, tropical Atlantic Ocean and Uruguay and were processed. Results of the new analyses confirmed previous findings and were reported more in detail at the SSG's meeting in September 2017 and in document SCRS/2017/214.

Post-release mortality of shortfin mako in the Atlantic Ocean

The project leader for this study is Dr. Andrés Domingo, 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 is currently non-existent, 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), and NOAA (USA) with 13 transmitting tags, and additional information from 8 miniPATs is also available to estimate post-release mortality. Of the 21 specimens with available information, six died (28.6%) whereas the remaining 15 (71.4%) survived, at least the first 30 days after tagging. The updated results from this project were reported and published in document SCRS/2017/050.

Movements, stock boundaries and habitat use of shortfin mako in the Atlantic Ocean

The project leader for this study is Dr. Rui Coelho, National Scientist 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) tags (23 tags: 9 miniPATs and 14 sPATs) have been deployed by scientific observers on Portuguese, Uruguayan, and U.S. vessels in the temperate Northeast, temperate Northwest and Southwest Atlantic. Additionally, in late 2016, 12 additional miniPATs were acquired with the funds from 2016 for deployment in 2017, during the 2nd phase of the project. As one of the original miniPATs (2015) failed due to a depth sensor problem, the tag manufacturer provided one additional replacement tag. As such, for the 2nd phase of the project a total of 13 miniPATs are available for deployment in 2017. Additional tags from other projects (n=15) involving the same partners may also be deployed in these same areas, which cover both hemispheres and both sides of the Atlantic. A total of 747 tracking days have been recorded so far with ICCAT tags. The preliminary movement analysis shows that specimens tagged in the temperate northeast moved to southern areas, while specimens tagged in the tropical northeast region close to the Cabo Verde Archipelago moved easterly to the African continent shelf. One specimen was tagged in equatorial waters and moved south to Namibia. The specimens tagged in the southwest Atlantic off Uruguay stayed in the same general area, and the specimens tagged in the temperate Northwest Atlantic showed some general southward movements. The updated results from this project were reported and published in document SCRS/2017/050.

Trophic relationships of shortfin mako in the Atlantic Ocean

The project leader for this study is Dr. Andrés Domingo, National scientist from Uruguay. The main purpose of this project was to characterize the trophic relationships of Atlantic shortfin makos using stable isotope analysis. Only a few tissue samples were collected to initiate the fatty acid and stable isotope projects in 2016 and 2017 and due to the difficulty in obtaining and shipping samples the project has been temporarily postponed until better logistic arrangements can be established.

Life history (reproduction) of shortfin mako and porbeagle in the Atlantic Ocean

The project leader for this study is Dr. Enric Cortés. 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 on 14-15 July 2017. During this training, scientists from the participating laboratories (SEFSC and NEFSC) worked together to collect reproductive organ samples to aid in determining reproductive habits and maturity for the species. The training was aimed at establishing standardized sampling practices among researchers for more consistent collection of life history data. Sampling took place at the New Bedford North Atlantic Monster Shark Tournament, in New Bedford, Massachusetts, USA. Scientists met each day to gather sampling gear, travel to the tournament for sampling, and return to the laboratory with samples.

2018 Plan and Activities

Age and growth of shortfin mako in the Atlantic Ocean

Most of the work for the North Atlantic shortfin mako has been finished and was used in the 2017 ICCAT Shortfin Mako assessment (presented in paper SCRS/2017/111). For the rest of 2017 and early 2018, the final age estimations for the South Atlantic will be completed. A peer-review paper is then expected to be produced and submitted during 2018 with the final results and conclusions of this project.

Genetic analysis of shortfin mako in the Atlantic Ocean

Although most of the work in the project aimed at investigating the genetic stock structure of the shortfin mako using mitochondrial and microsatellite DNA has been completed (SCRS/2017/214), additional samples of specimens from the Mediterranean Sea are still required and will be obtained and analyzed.

Post-release mortality of shortfin mako in the Atlantic Ocean / Movements, stock boundaries and habitat use of shortfin mako in the Atlantic Ocean

Tag deployment (phase 1) started in late 2015 and all tags were deployed during 2016. Updates of the project were presented at the 2016 ICCAT Shark Species Group intersessional and the 2017 Shortfin Mako data preparatory meetings (Coelho *et al.* 2017, SCRS/2017/050). Phase 2 tags (miniPATS) were acquired in late 2016 and are being deployed in 2017, with the final analysis of this project expected during 2018.

Life history (reproduction) of shortfin mako and porbeagle in the Atlantic Ocean

The next species to be assessed is scheduled to be porbeagle (POR) in 2019. There are currently large data gaps in the biological knowledge of this species, and as such it is important to continue projects on porbeagle so that the results can be available for the 2019 stock assessment. We therefore propose to continue work on the reproductive biology of this species in the western North Atlantic in 2018. Similarly, we also propose to continue work on the reproductive biology of the shortfin mako as this aspect of its life history remains particularly poorly understood. Therefore it is important to continue sampling of reproductive organs from both species. We also envisage conducting a workshop for reviewing and standardizing methods of analysis of reproductive data.

Additionally, even though the main ICCAT shark species are blue shark, shortfin mako and porbeagle, the SSG is also responsible for providing scientific advice on other pelagic, oceanic and highly migratory shark species that are caught in association with ICCAT fisheries. Most of these other species are data-limited, and as such it is a priority to start biological projects and data collection for these species in order to provide better advice in the future.

Movements 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. To that end miniPATs will be acquired and distributed to the participating laboratories for deployment by scientific observers from IPMA (EU-Portugal), DINARA (Uruguay), and NOAA (USA) in three main areas of the Atlantic: the northwest Atlantic, the tropical northeast Atlantic and equatorial region, and the southwest Atlantic.

2017 budget and expenditures

This section presents a summary of the contributions for the SRDCP during 2017. The Shark Species Group developed a budget of €135,000 for Year 3 of the SRDCP that was subsequently reduced to €75,000 (**Table 1**). Of these funds, €17,000 was spent on the shortfin mako genetic analysis, reproductive study, and satellite time; the rest was to be used for purchasing satellite tags to be deployed on porbeagles.

2018 budget and requested contributions

The proposed budget for Year 4 of the SRDCP (2018) totals €100,000 (**Table 2**). Funds are being requested for research on porbeagle and shortfin mako, distributed as follows:

- Reproductive studies of porbeagle and shortfin mako, including sample collection and organizing a workshop to standardize sampling and analytical methodologies: €30,000
- Shortfin mako genetics (complete analysis with additional samples from the Mediterranean): €10,000
- Porbeagle: €60,000 to purchase additional satellite tags for movement and habitat characterization studies

Table 1. 2017 SRDCP budget.

Project	*Participating CPCs*	*Project leader*	*Initial Budget (€) 2017*	*Approved Budget (€) 2017*
SMA				
Stock boundaries (Genetics)	Japan, EU, Uruguay, US, etc.	Yokawa / Semba	15,000	15,000
Movements, habitat use, and post-release mortality (PSATs)	EU, Uruguay, US, etc.	Coelho	40,000	
Life history (Reproduction)	US, Uruguay, Japan, EU, etc.	Cortes	5,000	2,500
PORBEAGLE				
Life history (Reproduction)	US, Uruguay, Japan, EU, etc.	Cortes	15,000	2,500
Movements and habitat use (PSATs)	Uruguay, EU, US, etc.	Domingo	45,000	55,000
Total			**135,000**	**75,000**

Table 2. Proposed budget for 2018 SRDCP.

Project	*Participating CPCs*	*Project leader*	*Budget requested (€) 2018*
SHORTFIN MAKO			
Life history (Reproduction)	US, Uruguay, Japan, EU, Canada	Cortes	
Stock boundaries (Genetics)	Japan, EU, Uruguay, US, etc.	Semba	10,000
PORBEAGLE			
Life history (Reproduction)	US, Uruguay, Japan, EU, Canada	Cortes	30,000
Movements and habitat use (PSATs)	Uruguay, EU, US, Canada	Domingo/Coelho	60,000
Total			**100,000**

Appendix 8

Report of the ICCAT Atlantic Ocean Tropical Tuna Tagging Programme (AOTTP)
(Evidence based approach for sustainable management of tuna resources in the Atlantic)

1. AOTTP Year 1 and 2 Results and Activities

1.1 Background

The overall objective of AOTTP is to contribute to food security and economic growth of the Atlantic developing coastal states by ensuring sustainable management of tropical tuna resources in the Atlantic Ocean. The specific objective of this programme is to provide evidence based scientific advice to developing coastal states, and other Contracting Parties, to support the adoption of effective Conservation and Management Measures (CMMs) in the framework of ICCAT. This will be achieved through improving the estimation, derived from tag-recapture data, of key parameters for stock assessment analyses, i.e. growth, natural mortality, movements and stock structure, etc.

Note that all acronyms are expounded below (**Addendum 1)**.

1.2 Budget

The total budget for the programme is 15 million Euros over five years of which the European Union contributes 90% and the rest is made up from voluntary contributions from the ICCAT CPCs and Cooperators. Since we reported last year 10 contracts have been negotiated and signed (**Table 1**) totaling just over 2 million Euros.

2. Tag-recapture and associated data from the three main tropical tuna and on neritic tuna species in the Atlantic are stored in a database at the ICCAT Secretariat

All the conventional tags needed for the entire AOTTP Programme have now been procured (*ca* 150,000 tags), including those needed for the tag-seeding experiments. Electronic tags for the first phase were procured by International Call for Tender. Desert Star and Wildlife Computers will supply AOTTP with 40 Seatag 3D and 95 Mini PAT-348C pop-up tags, respectively, while Lotek Wireless are providing 400 (LAT 2810) and 40 ARCGEO-9 internal tags. The 95 Wildlife Computers Mini PAT-348Cs, however, were found to have a technical problem in July 2016 and were recalled for repairs which has delayed their deployment. Desert Star tags had then to be deployed in their stead. During October 2016, however, a fault was noted in the Desert Star tags too which caused them to transmit corrupted data to the satellite and the remaining tags were called for replacement. The tags that were successfully deployed, but failed to report adequate data, will be replaced by Desert Star and analyses are ongoing. After a review of the performance of these tags during the first phase a decision will be made on future procurement.

2.1 Tagging of tropical tunas

Tagging activity began at the end of June 2016 in EU (Azores, Portugal), and then continued around the Canary Islands, and off West Africa and South Africa until April 2017. Tagging activities began in April 2017 in the territorial waters of Brazil and in Madeiran waters in July 2017. So far 57,514 tropical tuna across species and size-ranges have been tagged and released (e.g. **Figure 1** and **Table 2**).

Two-hundred and twenty-four have been released for a second time (R-2) and 2 for a third (R-3). The overall distribution between the three main tropical species is well-balanced with: BET at 27%; SKJ at 37%; and YFT at 34%. Two neritic species (LTA and WAH) are also being targeted by AOTTP. So far only 801 LTA and 23 WAH have been tagged against an overall target of 10,000. LTA is of particular interest to West African coastal communities and will be more actively sought for tagging during phase 2.

Twenty percent (24,000) of the 120,000 target are being double-tagged by AOTTP so that 'tag-shedding' rates can be estimated. Up to now 8,710 have been double-tagged, translating to 36% of the overall target, although the percentage varies among the species (**Table 3**) with, for example, 25% BET having been double-tagged, but only 13% SKJ. These imbalances will be redressed during Phase 2.

Size-ranges, or length-frequencies, of individuals tagged and released have been satisfactory overall so far (**Table 4**) although the very large BET and YFT have been difficult to catch, and there is much variability among locations and seasons. The failure to catch very large individuals is probably a function of the baitboat métier that is being used during AOTTP which typically catches smaller or mid-size individuals.

AOTTP is using a range of electronic tags to study the movements, and habitat preferences of tropical tuna: two different brands of pop-up type tag (Desert Star and Wildlife Computers) were bought; and one make of internal (Lotek).

As regards electronic tags, so far a total of 357 have been deployed, including: 24 Desert Star tags, 278 x Lotek internals, and 55 x Wildlife computer tags (**Table 5**). The pop-up tags were programmed (50:50 mix) to release after 90 days and 180 days. Retention times have been disappointing (see **Addendum 3**). For the Wildlife Computer tags mean retention times of 30 days have been recorded with a maximum of 94 days observed so far. Nevertheless useful data are being returned. Retention rates in South Africa, for example, have been relatively high and tracks showing the migrations of large yellowfin tuna between the Atlantic and Indian Ocean are emerging (**see Figure 2**).

Eleven boats have so far been used by AOTTP to tag fish in the eastern Atlantic: the Acoriana (Azores), the Grand Primero (Canary Islands) (**Figure 3**), the Macizo (Canary Islands), the Aita Fraxku (Senegal), the TarrynAmy (South Africa), the Estrela Delva (Brazil), the Katsushio Maru 8 (Brazil), The Thavisson III (Brazil), the Tubarão Tigre (Brazil), the Aldebaran I (Brazil), and the Ponta Calhau (Madeira).

Vessels deployed by AOTTP and partners have done 63 tagging cruises (**Addendum 2**) over the tropical Atlantic spending 609 days at sea, corresponding to 34% of the 1,800 day target (**Table 6**). Trained tagging teams have been deployed on all vessels and all the cruise reports detailing the activities, problems and recommendations are available from ICCAT.

2.2 Awareness Campaigns and Recovery Schemes

AOTTP has developed tag-recovery and awareness activities in all of the most important Atlantic Coastal States based on an initial analysis of tropical tuna landings by port. Awareness and publicity campaigns have now been designed and implemented in the following ten countries: Brazil, Senegal, Cabo Verde, Côte d'Ivoire, Ghana, Mauritania, EU-Portugal (Azores Islands), EU-Spain (Canary Islands), South Africa and Uruguay. Specific officers and staff have been selected in each location to develop and implement the activities (**Figures 4 to 6**). The awareness campaigns focus particularly on fishery stakeholders, but also include the general public. The design and production of the awareness-raising material reflects the specific idiosyncrasies of the fishermen, the crews of the commercial tuna vessels, the stevedores, traders, and fish processors.

2.3 Recovery of tags and transmission of data to ICCAT Secretariat

TROs have been set up in the most important tuna ports of the Atlantic. Contracts have been negotiated and signed with the following: Instituto Português do Mar (IMAR) of Portugal, IEO of Spain, CRODT of Senegal, CRO-CI of Côte d'Ivoire, INDP of Cabo Verde, FSSD in Ghana, Capmarine of South Africa, FADURPE Foundation in Brazil and CICMAR of Uruguay. Data are collected by the TROs, using the smartphone application developed by AOTTP, and quickly transmitted to the ICCAT Secretariat for verification and upload to the database (**Figure 7**).

Up to the end of this reporting period, the number of recoveries is 10,725 (**Figures 8 and 9**) translating to an overall recovery rate of *ca* 19% (**Table 7**).

Recoveries of the electronic, internal/archival tags have been relatively low with a pooled recovery rate of only *ca* 3% observed, although returns from bigeye have been higher (**Table 8**) than for yellowfin. One tag (ATP86659) was recovered in West Africa after being inside a fish for nearly 3 months (a 73cm YFT). After delivery to the ICCAT Secretariat a large data-set was successfully extracted (available at 15 second intervals) from this tag. A single month of data, aggregated by hour, is plotted in **Figure 10** which shows the pronounced diurnal vertical migration behavior of the fish during this period.

Nearly 5,000 fish have so far been tagged chemically by AOTTP (**Table 9**) which is done to help facilitate age-determination if the fish are recovered, and of these 752 have been recovered.

An Android based smartphone application, based on the Memento system, has been developed to collect and submit the data. Specific recovery templates in four languages (English, French, Spanish and Portuguese) facilitate fast and accurate upload of data to ICCAT (**Figure 7**). The system also enables ICCAT to rapidly deal with any issues/mistakes in the data. An important advantage is that it allows immediate feedback between the TRO, AOTTP, and the tag-finder so any questions or problems can be quickly and easily resolved (**Figure 6** – right panel).

Reporting rates are estimated by 'tag-seeding' experiments whereby 'false' tags are surreptitiously inserted into tuna at various points in the tuna value chain. Subsequently everything else remains the same (i.e. fishers, dockers find the tags, rewards are paid, and data sent to ICCAT) but it allows an estimate of the number of tags that might have been 'missed' between capture and market. The TROs are running the tag-seeding experiments in West Africa. Tag seeding experiments to estimate the reporting rates have been implemented in Côte d'Ivoire and Senegal which constitute 85% of the recoveries so far. AOTTP teams have placed 'false' tags in 110 fish. The overall reporting rate is 67% but this varies substantially among the three species and the location at which the tag-seeding experiment was done.

Another important statistic in estimating population size from large-scale fish tagging programmes is the 'tag-shedding rate'. The number of tags shed after tagging can be estimated for all areas and species since *ca* 20% of the tuna released are double-tagged. So far 1972 of the recovered, tagged tuna were double tagged (**Figure 11**). Tag-shedding rates for the four species with recovery data are summarized in **Table 10**. Overall rates are ca 4%.

3. Key parameters supporting stock assessments are estimated on the basis of data collected through the programme and integrated in stock assessments

One key objective of the AOTTP is to help reduce the risk of failing to meet ICCAT management objectives for the main tropical tuna stocks, i.e. that B/B_{MSY} is kept above 1 and F/F_{MSY} below 1. To do this requires robust scientific advice, specifically to reduce the uncertainty in estimates of stock status with respect to reference points and to increase the effectiveness of management measures based on total allowable catches (TACs), harvest control rules (HCRs) and spatial management measures. The AOTTP is, therefore, collaborating with other SCRS and t-RFMO working groups in order to determine the best tagging and data collection protocols to ensure that ICCAT management objectives can be met in a cost effective way.

AOTTP is focusing on only two coastal small tuna species: wahoo and little tunny. As of writing 801 and 23 little tunny and wahoo have been tagged, respectively, with 165 recoveries of little tunny (**Tables 1 and 3**). During the second phase tagging AOTTP will, therefore, target neritic tunas more specifically, building on the numbers tagged during Phase 1.

3.1 Reading of hard parts

During the AOTTP programme 10,000 fish are being targeted for 'chemical tags', i.e. they are injected with a chemical marker that allows their otoliths (or other hard parts) to be 'read', and aged more easily. Chemically tagged fish always carry red spaghetti tags (**Figure 12**), marked with 'KEEP WHOLE FISH'. When a fish with a red tag is reported, TROs arrange to buy the fish, pay any reward etc., take, store and process the biological samples, and ultimately determine the age of the fish from the hard-parts. AOTTP TROs have already purchased and taken biological samples from 387 chemically marked fish (red tags) representing all size classes, the three species, and both genders (**Table 11**). Other biological information like body-weight, state of sexual maturity, and stomach contents complement the analyses. The samples have all been properly processed, stored, and preserved in the laboratory facilities of the project counterparts.

An Otolith Expert Group with specialists from Australia, Cote d'Ivoire, EU-France, EU-Spain, Senegal, South Africa and USA, was set up by AOTTP with the ICCAT SCRS approval. The specific aim was to establish the procedures and protocols for the collection, preservation and reading of otoliths. A formal workshop was then organized at the CRO-CI (Abidjan) on 1-2 March 2017 to initiate the activities, and to facilitate previous exchanges of ideas and discussions (**Figure 13**). The Otolith Expert Group recommended creating a

Reference Collection of Otoliths to orientate and 'calibrate' age-readings. A Call for Tender to create the Reference Collection was thus launched and two contracts will be awarded soon, covering the tropical Atlantic Ocean, and ensuring cooperative and coordinated work.

3.2 Tagging data analyses

As discussed above AOTTP has already generated a large dataset comprising: (i) mark-recapture data from spaghetti tags; (ii) tag seeding data; (iii) data from electronic tags; and, (iv) biological samples such as otoliths. The AOTTP data and publication policy has been discussed and submitted to the SCRS. The data analysis will be mostly developed within the framework of the SCRS. See also Revised Log-frame and Updated Action Plan sections below for more details.

3.3 Information from stakeholders

This activity relates to the organization of the Symposium planned for the final months of the AOTTP project, i.e. between April and June 2020. Plans for this work are outlined, and discussed in the Revised Log-Frame and Updated Action Plan sections.

4. Scientists from developing country Contracting Parties of ICCAT are trained in tagging, data collection, and tagging data/stock assessment analysis

At least 20 scientists/technicians from developing countries have already been trained in tagging techniques at sea, including two from Cabo Verde, seven from Côte d'Ivoire, seven from Ghana, five from Senegal, and eight from Brazil. In addition, all TROs, and their supporting teams, has received training in the AOTTP protocols for collecting tag-recovery information. This includes procedures for introducing data into the recovery template of the AOTTP smartphone application, the subsequent submission of data to AOTTP, and the resolution of any problems via the AOTTP recovery Telegram group (**Figures 14 and 15**). Additional information is provided in section 8.4 and 8.5.

4.1 Training in tagging techniques and data collection

The first tagging phase in the eastern Atlantic (Azores, Canary Islands, and West Africa) was contracted to a Consortium led by AZTI (*http://www.azti.es/*). All the AZTI Consortium partners (CRO-CI, IEO, CRODT, IMAR and FSSD) supplied personnel for the tagging teams on board the chartered vessels. At least 46 individuals (from Senegal, Cabo Verde, Côte d'Ivoire, EU-France, EU-Portugal, EU-Spain, USA (Hawaii), São Tomé and Principe, and Ghana) attended training courses run by AZTI in conventional, chemical and electronic tagging, and associated data collection (**Figure 16**).

The number of scientists from African institutes who were trained and took part in the tagging activities organized by AZTI were as follows:

- Senegal (CRODT – consortium member): 5 persons trained, of which 4 took part in tagging
- Côte d'Ivoire (CRO-CI – consortium member): 7 persons trained, of which 4 took part in tagging
- Ghana (FSSD – consortium member): 2 persons trained directly and 4 indirectly, 3 took part in tagging
- Cabo Verde (INDP – subcontracted by AZTI): 1 person trained who also took part in tagging
- São Tomé and Principe (Fisheries Direction – requested to take part): 1 person trained who also took part in tagging

Numbers of fish tagged during the AOTTP programme by scientists from developing countries is summarized in **Table 12**, showing that over half (56%) have been tagged by latter scientists/technicians.

4.2 Data collection and sampling at recovery

Tag recovery and awareness-raising activities have been set up in the following ten countries: Brazil, EU-Portugal (Azores Islands), EU-Spain (Canary Islands), Cabo Verde, Cote d'Ivoire, Ghana, Mauritania, Senegal, South Africa and Uruguay (**Figure 3**). The AOTTP Publicity and Tag Recovery Officer has visited the Azores twice where training in data collection and sampling at recovery has been provided. Training has also been provided to the TROs in Abidjan, Dakar and Ghana.

4.3 Training in data analysis

As mentioned above this activity will start earlier than was planned in the original AOTTP Grant Contract. After the data have been approved for study AOTTP will organize activities such as study visits and/or working groups. Additional information provided in section 8.5.

5. Beneficiaries

The AOTTP Action Team, together with the ICCAT Secretariat, maintains good relationships with the State Authorities in the target countries. AOTTP is working directly with State Authorities in Brazil, Cabo Verde, Côte d'Ivoire, EU-Spain and Portugal, Ghana, Guinea-Bissau, Mauritania, São Tomé e Príncipe, Senegal, and South Africa, Uruguay, USA. AOTTP contractors are in regular contact with the government departments etc. in order to get the work done. Note also that, during the tagging campaigns in West Africa, permission was granted to AOTTP contractors to catch bait, and tag tuna in the territorial waters of 15 countries (**Table 13**), including one that is not an ICCAT Contracting Party (Benin), demonstrating the interest in, and support for, the project. Having government representatives on board the tagging vessel in West Africa was also often a condition for gaining access to territorial waters for tagging, e.g. Guinea-Bissau, Mauritania, and São Tomé & Príncipe. For these three countries the following individuals came on board the tagging vessel:

- Ahmed DIAGNE (IMROP, Mauritania) in the 2nd trip zone A, as observer;
- Mario Abel NBUNDE (CIPA, Guinea Bissau) in the 3rd trip of zone A, as observer;
- Mirian GOMES CRAVID (Fisheries Department, São Tomé & Príncipe) in the 4th trip of zone B, as tagger.

The relationship between AOTTP and DAFF in South Africa has strengthened due to the tagging programme.

ICCAT CPCs and Cooperators have also contributed funds to the AOTTP programme, including the People's Republic of China, USA, Canada, and Chinese Taipei. The Uruguayan Research Vessel was also made available to AOTTP without charge to tag tuna.

During Year 2 AOTTP worked with the AZTI Consortium for tagging activities in the Azores, the Canary Islands, and West Africa. AZTI subcontracted CRO-CI, CRODT, FSSD, IEO, IMAR, and MFRD/FSSD. In awareness-raising and tag-recovery activities AOTTP is also working directly, and successfully, with many of the same organizations (e.g. CRO-CI, CRODT, MFRD/FSSD, IEO, and IMAR) but also with Capmarine and INDP (Cabo Verde). In other areas of the Atlantic we are working, or have worked, with the FADURPE Consortium (Brazil), LPRC (USA), and Capmarine (South Africa) to tag fish at sea. A contract was also signed in early 2017 with PROBITEC (Spain) to tag fish the EEZ of Venezuela; however due to a number of issues work has not yet started and alternatives in the region are currently being assessed.

Since inception AOTTP has worked with the skippers and crews of eleven commercial fishing vessels and feedback with respect to the relationships between the scientific and technical teams and the fishing crews has been routinely positive, according to the cruise reports where this is often described. The fishers are usually extremely engaged, enthusiastic about the tagging work, and delighted to help in all possible ways.

The otolith workshop in March 2016 was supported by Capmarine (South Africa), CSIRO (Australia), and SPC (New Caledonia) who generously allowed their expert staff (Stewart Norman, Jessica Farley, and Bruno Leroy) to attend the workshop in Abidjan, traveling considerable distances.

AOTTP has an agreement with IATTC to pay rewards on its behalf and collect metadata from tags where possible. The TROs in Abidjan work closely with personnel from IRD and IEO to gain access to log-book data essential for ascertaining where and when a tagged tuna was actually caught.

The SCRS and its scientists, including those from developing states, are enthusiastic about AOTTP and the data being collected. When analyses begin at the end of 2017 SCRS scientists will benefit from training, coaching, and mentoring provided by AOTTP and the ICCAT Secretariat. The fisheries authorities in many ICCAT CPCs are aware of the project and three of their staff (see above) have directly benefited through trips on board the tagging vessels and the training. The ICCAT scientific community will also benefit by having a highly useful dataset for informing policy, the efficacy of management measures (e.g. spatial closures) all resulting in better management of the fisheries in ICCAT's mandate.

6. Visibility

The EU logo and ICCAT logos, with funding statement, are always clearly visible on all communication materials including flyers, pamphlets, posters, reports, newsletters, t-shirts, and caps). The materials can be seen at harbors, at fishing beaches, and on board fishing and recreational vessels throughout AOTTP target countries. AOTTP has been formally presented at many different fora around the Atlantic Coastal States, including:

- Meeting of the ICCAT on stock assessment methods (Doug Beare, Madrid, 19 February 2016)
- ICCAT yellowfin data preparatory meeting (Doug Beare, Pasaia, 11 March 2016)
- ICCAT small tunas species group intersessional meeting (Doug Beare, Madrid, 6 April 2016)
- ICCAT SCRS Plenary (Doug Beare, Madrid, 24 September 2016)
- Fisheries Forum (Pedro Guemes, Azores, 6 July 2016)
- AOTTP summary presentation (Doug Beare, Universidade Veiga de Almeida, Brazil, 3 April 2017)
- AOTTP summary presentation (Doug Beare, Recife, 5 April 2017)
- AOTTP summary presentation (Miguel Neves dos Santos, Doug Beare, Brussels, 19 June 2017, *http://ec.europa.eu/europeaid/news-and-events/atlantic-ocean-tropical-tuna-tagging-programme-aottp_en*)
- AOTTP summary presentation on Small Tunas (Miguel Santos, Miami, 27 April 2017)

AOTTP has already been published widely on the internet, e.g.:

- *http://www.tribunadasilhas.pt/index.php/component/k2/item/11855-6000-atuns-dos-acores-marcados*
- *http://www.laopinion.es/sociedad/2016/08/10/instituto-oceanografia-marcara-6500-atunes/696665.html?utm_source=rss*
- *http://www.dw.com/es/el-at%C3%BAn-tropical-conocerlo-m%C3%A1s-para-pescarlo-mejor/a-39319958*
- *http://ec.europa.eu/europeaid/news-and-events/atlantic-ocean-tropical-tuna-tagging-programme-aottp_en*
- *http://www.africanangler.com/sb_article.asp?id=1063#*
- *http://www.anglerstalk.co.za/Magazine/Mar17/mobile/index.html#p=81*
- *http://fis.com/fis/worldnews/worldnews.asp?l=e&country=0&special*=&monthyear=&day=&id=86263&ndb=1&df=0

The AOTTP Youtube channel with training tutorials etc., can be found here:

- *https://www.youtube.com/channel/UClCXmfvKvmxqeZMU4LFa_hQ*

A video on tagging off Senegal made by our partners, AZTI, can be found here:

- *https://www.youtube.com/watch?v=l9lzrqMI0lo&t=1s*

News and updates have been produced regularly for the AOTTP Steering Groups, and the TROs. Newsletters for DG-DEVCO will also be produced quarterly and the first edition is now available from ICCAT.

7. Revised Logical Framework

Identifying how knowledge gained under AOTTP can reduce uncertainty is one of the key outcomes of the project, and can also be thought of as, 'the Value of Information'. The clarification of 'End Targets', together with a clear work plan, will help ICCAT/AOTTP and DG-DEVCO achieve its objectives. We, therefore, propose to insert the following End Target for all three tropical species (**see Table 14**) in the AOTTP Logical-framework Matrix:

- *Reduce 'cloud' of uncertainty around the Kobe phase plot for a single type of assessment model*.

If the uncertainty can be reduced in a meaningful way it means that the stocks can be managed closer to Commission objectives. Please note, however, that it is difficult to specify the exact amount by which the uncertainty can be reduced as there are 'subjective' factors which cannot be quantified.

8. Updated Action Plan

8.1 Overall

The project started about six months late due to administrative issues but we are catching up. Activities A1.1, A1.2, A1.3, A2.1, A3.1, and A3.2 (**Table 15**) started more or less on schedule and are all now progressing well. The exceptions are A1.1 and A1.3 because tagging activities (and therefore recovery) did not start until Quarter 3, 2016.

8.2 Tagging at sea

For Phase 1 the target was set at 72,500. Tagging began in the Azores at the end of June this year (2,775 tagged, target 4,500) and followed in a clockwise direction around the Atlantic with tagging taking place in the Canary Islands (6,526 tagged, target = 6,500), Mauritania-Guinea Rep. (11,237 tagged, target = 11,000), Gulf of Guinea (26,829 tagged, target = 22,000), and South Africa (218, target = 6,500) until the end of April 2017.

Tagging started in Brazil and Uruguay (*ca* 8,000 tagged, target = 13,000) in April 2017 and is continuing. During 2017, 20 fish will also be fitted with pop-ups in the territorial waters of USA. In February ICCAT signed a contract to tag 9,000 fish in the territorial waters of Venezuela as part of the Phase 1 targets. Unfortunately, however, substantial delays and uncertainty related to this contract raised the need to consider alternatives.

Calls for Tender for Phase 2 tagging in all areas are in preparation, but the final distribution of tags by location and time is being discussed by the AOTTP Steering Committee.

8.3 Tag recovery and awareness raising

AOTTP coordination in Madrid will seek feedback from the TROs and discuss what is working, what is not, and consider strategies for the future. AOTTP will now expand activities into CPCs, areas and fleets which are not yet formally involved in the programme. This work will predominantly target awareness-raising and possibly tagging (by observers) among the longline fleet (mostly Asian, but also North American) which operates in more central areas of the Atlantic Ocean.

8.4. AOTTP research and data analysis

Research will be driven by the priorities of the ICCAT SCRS and Commission. All work will be integrated within ICCAT/SCRS's annual cycle of Working Groups according to ICCAT's Management Framework. Detailed planning will, therefore, have to be adjusted according to the requirements of the SCRS and ICCAT Commission, which can and will eventually change throughout the programme life span. The annual cycle of work can, however, be broadly articulated as follows:

1. AOTTP will keep collecting the tag-recovery data, check and validate them, pay rewards, and store them in a relational database at ICCAT (**Figure 17**).
2. AOTTP will present basic summary statistics (tag release and recovery frequencies, tag-shedding rates, times at liberty and reporting rates) from the tag-recapture database to the relevant SCRS Working Groups each year (in 2017 the Tropical Species Group Intersessional Meeting (4-8 September) and at the SCRS Plenary between (2-6 October)).
3. Based on these statistics, and other information, the SCRS will take decisions on research, management and capacity building priorities within their annual work plans.
4. Once plans are approved by the Commission research activities will be organized by AOTTP (**Table 16**). These may require that Calls for Tender be launched.

8.5 AOTTP capacity building

Scientists and technicians, particularly from ICCAT developing Contracting Parties have already been trained in all aspects of tagging at sea, tag recovery and awareness raising activities. Now that a rich dataset is beginning to accumulate, training and capacity development in all aspects of tagging data analyses, biological parameter calculation, and their eventual incorporation into population assessment models must be planned. This work was not scheduled to start until Quarter 4 2018 in the original AOTTP Grant Contract agreement with DG-DEVCO. However, AOTTP Coordination and the SCRS, believe that by then it will be too late for a successful Final Symposium and proposes instead to arrange four study visits/workshops during the next reporting period (September 2017 to September 2018); two in Q4 2017; one in Q1 2018 and one in Q2 2018 (**Table 16**). These will be based on the 'model' successfully used when the Otolith Expert Working Group was organized in March 2017, or adapted as necessary. This involved inviting recognized global experts to a meeting, organized by colleagues in Abidjan, at which their experience and knowledge was shared with the local scientists. Note that the experts invited gave up their time free of charge to engage with the project.

The priority of AOTTP is to reduce uncertainty in population assessments of tropical tuna by improving understanding of growth, mortality and movements. However, such biological parameter estimations will take time and work to confirm, and capacity building activities will need to start slowly and methodically at the level of understanding the raw data, the database, and how to plot and model them etc. using popular software (e.g. R, Excel, RStudio, QGIS, PostgreSQL).

AOTTP proposes, therefore, to organize a series of workshops - beginning in Madrid during late 2017 - to promote the involvement of ICCAT CPs in the analysis, and scientific interpretation, of AOTTP tagging data. The workshops will be part of a continuous programme of capacity development which will also include funding of MSc and PhD students from developing country CPs for which proposals will be sought. Depending on demand, the workshops will initially be done in both English and French. Participants will be selected according to a minimum level experience and the overall need for developing and improving regional capacity among fisheries managers.

The workshops will be supported by the ICCAT SCRS, and the AOTTP Steering Committee who will help formulate the material to be covered. Representatives of these committees may also be invited to the workshops to guide activities and discussions.

The workshops will be aimed at scientists actively involved in provision of fisheries management advice. The four workshops to be organized within the following reporting period will focus on the themes listed below. Recognized experts in each work/research sub-component will be invited to lead activities and discussions. The following workshops may include fisheries science theory and worked examples:

- AOTTP relational database - improved understanding of relational database and data structures, increasing capacity to work with AOTTP in the development of the mark-recapture databases, increased ability to connect with the remote databases using plotting and statistical software (R, QGIS, Excel);
- Tropical tuna growth (analyses of growth rates, fitting non-linear models);
- Mortality and selectivity (estimating natural mortality and gear selectivity);
- Species movements (quantifying distance traveled, 'stock mixing coefficients' etc.).

Table 1. List of contracts (>60,000 euros) awarded by ICCAT between June 2016 and June 2017.

Date	*Supplier*	*Objective*	*Procedure*	*Total*
8/1/2016	CRO-CI	Recovery activities in the East Atlantic	INTERNATIONAL CALL FOR TENDER	264,628.00 €
8/1/2016	CRODT	Recovery activities in the East Atlantic	INTERNATIONAL CALL FOR TENDER	132,824.00 €
10/5/2016	MRFD	Recovery activities in the East Atlantic	INTERNATIONAL CALL FOR TENDER	60,150.00 €
11/3/2016	HALLPRINT Pty Ltd	Stainless steel head dart tags and applicator tips	3 QUOTES REQUESTED	95,079.32 €
11/14/2016	SERVIGIS	IT consultant for AOTTP database	CALL FOR TENDER	48,370.00 €
1/5/2017	FADURPE	Tagging activities in the West Atlantic	INTERNATIONAL CALL FOR TENDER	665,460.00 €
1/25/2017	CAPRICORN MARINE ENVIRONMENTAL (Pty) Ltd	Tagging activities in South East Atlantic	INTERNATIONAL CALL FOR TENDER	217,684.69 €
2/28/2017	PROBITEC	Tagging activities off North West Atlantic	INTERNATIONAL CALL FOR TENDER	433,400.00 €
4/11/2017	LPRC// TAG A TINY	Tagging activities in North West Atlantic	INTERNATIONAL CALL FOR TENDER	62,688.00 €
5/25/2017	FADURPE	Awareness and tag recovery campaign for the Atlantic in Brazil	3 QUOTES REQUESTED	70,000.00 €

Table 2. Total number of releases by species and release stage code (as of 18/09/2017).

	R-1	*R-2*	*R-3*	*Totals (species)*
BET	15,549	121	1	15,671
BLF	9	0	0	9
BON	12	0	0	12
FRI	1	0	0	1
LTA	800	1	0	801
SKJ	21,227	36	0	21,263
WAH	23	0	0	23
YFT	19,667	66	1	19,734
Total (codes)	**57,288**	**224**	**2**	**57,514**

Table 3. Total number of fish double-tagged and released by species (as of 18/09/2017).

	BET	*BLF*	*BON*	*FRI*	*LTA*	*SKJ*	*WAH*	*YFT*	*Total*
Double Totals	3084	1	0	1	112	2373	2	3137	8710
Single Totals	12587	8	12	0	689	18890	21	16597	48804
Double Tag %	25	12	0	-	16	13	10	19	18

Table 4. Length-frequencies of released tuna (R-1, valid) by species (as of 18/09/2017).

	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	100-110	110-120	120-130	130-140	140-150	150-160	160-170	170-180
BET	12	1428	5150	4331	3512	718	219	207	41	21	6	3	0	2	2	5
FRI	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
LTA	6	81	564	148	1	1	0	0	0	0	0	0	0	0	0	0
SKJ	11	4889	11065	4679	570	25	0	0	0	0	0	0	0	0	0	0
WAH	0	0	0	1	0	0	0	1	1	4	6	4	6	0	0	0
YFT	4	5740	8026	3269	1642	498	231	131	30	10	8	15	31	17	8	5

Table 5. Electronic tag releases by species (as of 18/09/2017).

	DS-SeaTag-3D-PSAT	*Lotek-2810*	*MiniPAT-348C*
BET	19	98	3
SKJ	0	9	0
YFT	5	171	52
Total	21	278	55

Table 6. Tagging campaigns by location (as of 18/09/2017).

Location	*Number*
Azores	12
Brazil (Areia Branca)	4
Brazil (Cabo Frio)	6
Brazil (Fernando de Noronha)	2
Brazil (Itajai)	1
Brazil (SP & SP)	1
Canary Islands	11
Gulf of Guinea	7
Madeira	3
Senegal	4
South Africa	11

Table 7. Total conventional tag-recoveries by species (as of 18/09/2017).

	BET	*BLF*	*BON*	*FRI*	*LTA*	*SKJ*	*WAH*	*YFT*	
Total recovered	3593	0	0	1	169	2278	0	4684	10725
% recovered	23	0	0	100	21	11	0	24	20

Table 8. Internal electronic tag releases, recoveries and percentages by species (as of 18/09/2017).

	Released	*Recovered*	*%*
BET	98	5	3
SKJ	9	0	0
YFT	171	4	2

Table 9. Chemically tagged totals by species (as of 18/09/2017).

	BET	*LTA*	*SKJ*	*YFT*
Releases	1504	6	1375	1880
Recovered	271	0	140	341
%	18	0	10	18

Table 10. Tag-shedding rates (%) by species (as of 18/09/2017).

	BET	*FRI*	*LTA*	*SKJ*	*YFT*
Lost Left	1	0	0	2.6	1.2
Lost Right	3	0	10	5.7	5.2

Table 11. Biological samples collected (as of 18/09/2017).

	Female	*Male*	*Unknown*
BET	73	69	1
SKJ	43	34	0
YFT	89	72	0
Total	205	175	1

Table 12. Numbers of fish tagged by scientists/technicians by nationality (as of 18/09/2017).

Country	*No. of fish tagged and released*
Brazil	7814
Côte d'Ivoire	7154
EU-Spain	19829
EU-France	25
EU-Portugal	3175
Ghana	7775
Senegal	9570
South Africa	215
Unknown	2042
Uruguay	25
Total	**57624**

Table 13. AOTTP permission to work in EEZs.

Country	*Dates*
Morocco	15 June - 20 October 2016
Mauritania	15 June - 20 October 2016
Senegal	15 June - 20 October 2016
Guinea Bissau	15 June - 20 October 2016
Cabo Verde	15 June - 20 October 2016
Guinea (Rep. of)	20 October – 15 June 2016
Sierra Leone	20 October – 15 June 2016
Liberia	20 October – 15 June 2016
Côte d'Ivoire	20 October – 15 June 2016
Ghana	20 October – 15 June 2016
Togo	20 October – 15 June 2016
Benin	20 October – 15 June 2016
São Tomé & Principe and Nigeria - São Tomé & Principe Joint Zone	20 October – 15 June 2016
Gabon	20 October – 15 June 2016
Angola	20 October – 15 June 2016

Table 14. Proposal for revising Indicative List of Indicators.

Indicator	*Unit*		*Baseline*	*Current*	*End target*
Uncertainty around reference points B/B_{MSY} & F/F_{MSY} for YFT	Number	Value	B/B_{MSY}: 0.85 (0.61-1.12) F/F_{MSY}: 0.87 (0.68-1.40) Median (10th-90th percentiles)	B/B_{MSY}: 0.95 (0.71-1.36) F/F_{MSY}: 0.77 (0.53-1.95) Median (10th-90th percentiles)	Reduce 'cloud' of uncertainty around the Kobe phase plot for a given assessment model
		Date	2011	2016	2021 (next assessment)
Uncertainty around reference points B/B_{MSY} & F/F_{MSY} for BET	Number	Value	B/B_{MSY}: 1.01 (0.72-1.34) F/F_{MSY}: 0.95 (0.65-1.55) Median (10th-90th percentiles) Production model (Logistic) results represent median and 80% confidence limits	B/B_{MSY}: 0.67 (0.48-1.2) F/F_{MSY}: 1.28 (0.62-1.85 Median (10th-90th percentiles)	Reduce 'cloud' of uncertainty around the Kobe phase plot for a given assessment model
		Date	2010	2015	2018 (next assessment)
Uncertainty around reference points B/B_{MSY} & F/F_{MSY} for SKJ	Number	Value	B/B_{MSY}: likely > 1 (E stock) / probably close to 1.3 (W stock) F/F_{MSY}: likely < 1 (E stock) / probably close to 0.7 (W stock).	B/B_{MSY}: likely > 1 (E stock) / probably close to 1.3 (W stock) F/F_{MSY}: likely < 1 (E stock) / probably close to 0.7 (W stock).	Reduce 'cloud' of uncertainty around the Kobe phase plot for a given assessment model
		Date	2014	2014	2020

Table 15. AOTTP five-year summary work plan by activity.

Year	*2015*		*2016*				*2017*				*2018*				*2019*				*2020*	
Quarter	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*
A1.1-Tagging of tunas					■	■	■	■	■	■	■	■								
A1.2-Awareness campaigns & recovery schemes				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
A1.3-Tag recovery & transmission to ICCAT					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
A2.1-Reading of hard parts									■	■	■	■	■	■	■	■	■	■	■	■
A2.2-Tagging data analyses													■	■	■	■	■	■	■	
A2.3-Information of stakeholders (AOTTP Symposium)																			■	■
A3.1-Training in tagging techniques and data collection				■	■	■	■	■	■	■	■	■	■	■	■					
A3.2-Data collection and sampling at recovery			■	■	■	■	■	■												
A3.3-Training in data analysis														■	■	■	■	■		

Table 16. AOTTP Year 3 outline.

	2017			*2018*								
Month	*O*	*N*	*D*	*J*	*F*	*M*	*A*	*M*	*J*	*J*	*A*	*S*
A1.1 Phase 1 Tagging (complete Caribbean, USA, and Brazil)	■	■	■									
A1.1-Phase 2 Tagging	■	■	■	■	■	■	■	■	■	■	■	■
A3.1-Training taggers (data collection protocols etc.)	■		■		■		■		■	■	■	■
A1.1-Calls for tender for Phase 2 tagging												
A1.2-Awareness raising in other CPCs and fleets (longliners)	■	■	■	■	■	■	■	■	■	■	■	■
A2.1-Reading of hard parts (otoliths, capacity building, recruiting consultant, reference collection).	■	■	■	■	■	■	■	■	■	■	■	■
A3.3-Tagging Data Analyses capacity building (workshops, support to students, study visits, all to be driven by developing country partners)		■	■	■	■	■	■	■	■	■	■	■
A2.2-Calls for tender for scientists to analyze data, addressing specific SCRS driven research questions.								■	■	■	■	■
A1.3-Tag recovery coordination meeting in West Africa (discuss rewards and visibility protocols)		■										
AOTTP Steering Committee Meeting	■											
EU newsletter			■			■			■			■

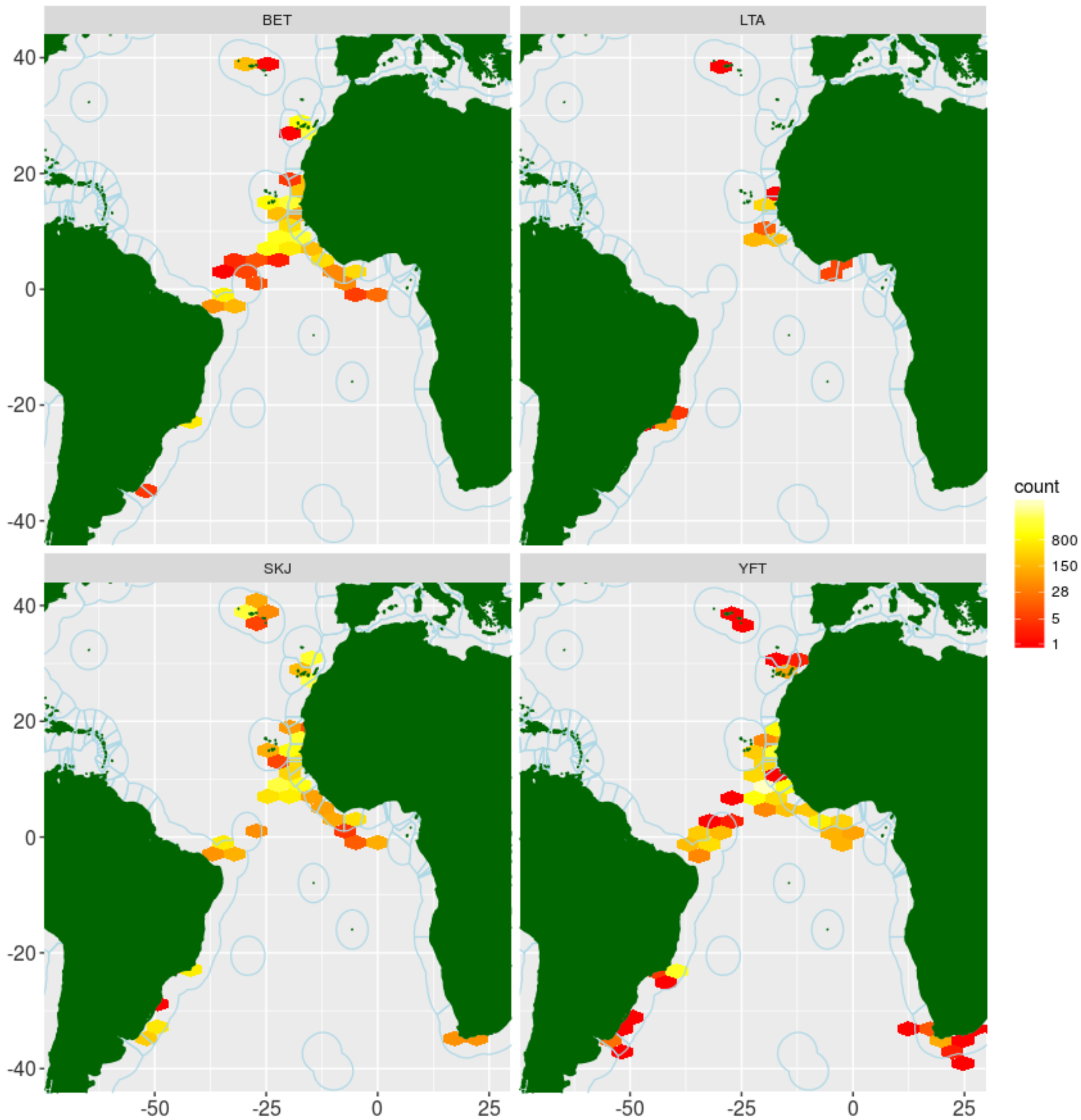


Figure 1. Distribution of tropical tuna (by species) tagged and released by AOTTP between July 2016 and September 2017 (as of 18/09/2017).

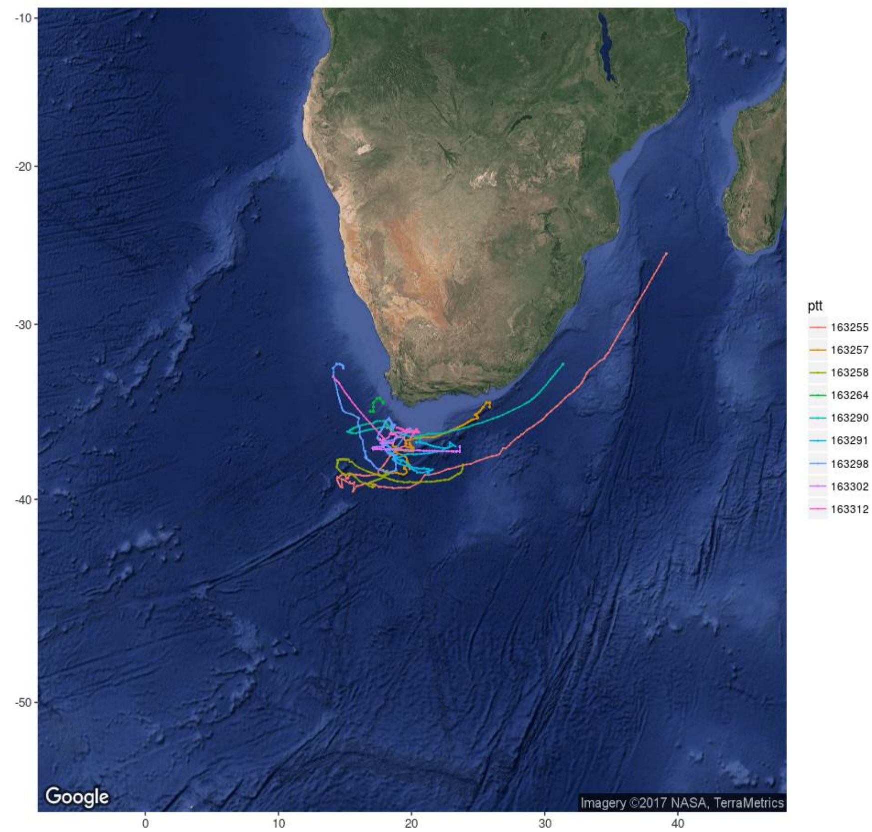
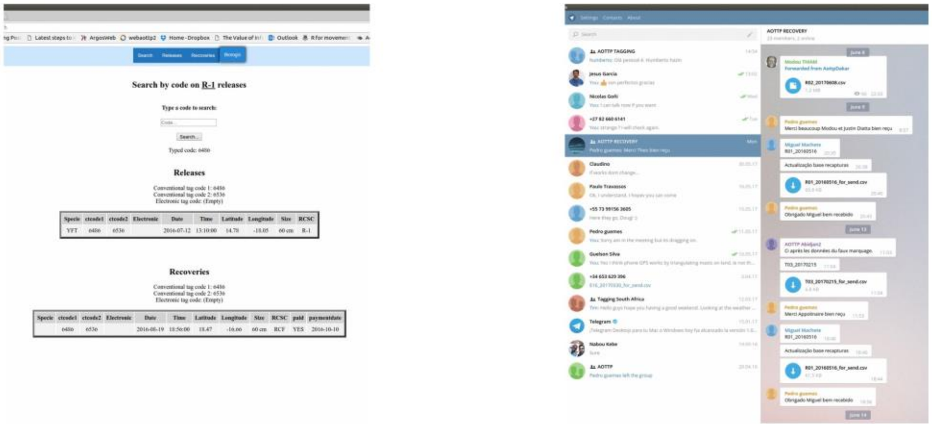


Figure 2. Migrations of yellowfin tuna tagged off South Africa in February 2017.

Figure 3. Grand Primero - baitboat chartered by AOTTP to tag in the territorial waters of the Spanish Canary Islands.

Figure 4. AOTTP Awareness-raising in West Africa.

Figure 5. Rewards and Incentives.



Checking status of recovered tags

AOTTP Telegram Tag Recovery Group

Figure 6. Website for tag-checking (left) and Telegram Recovery Group (right) for data exchange.

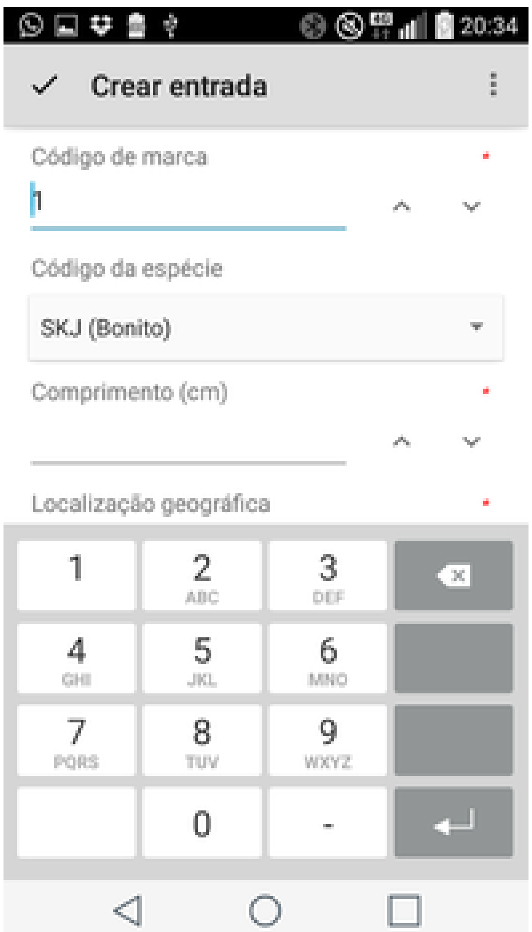


Figure 7. Memento application for data upload to ICCAT.

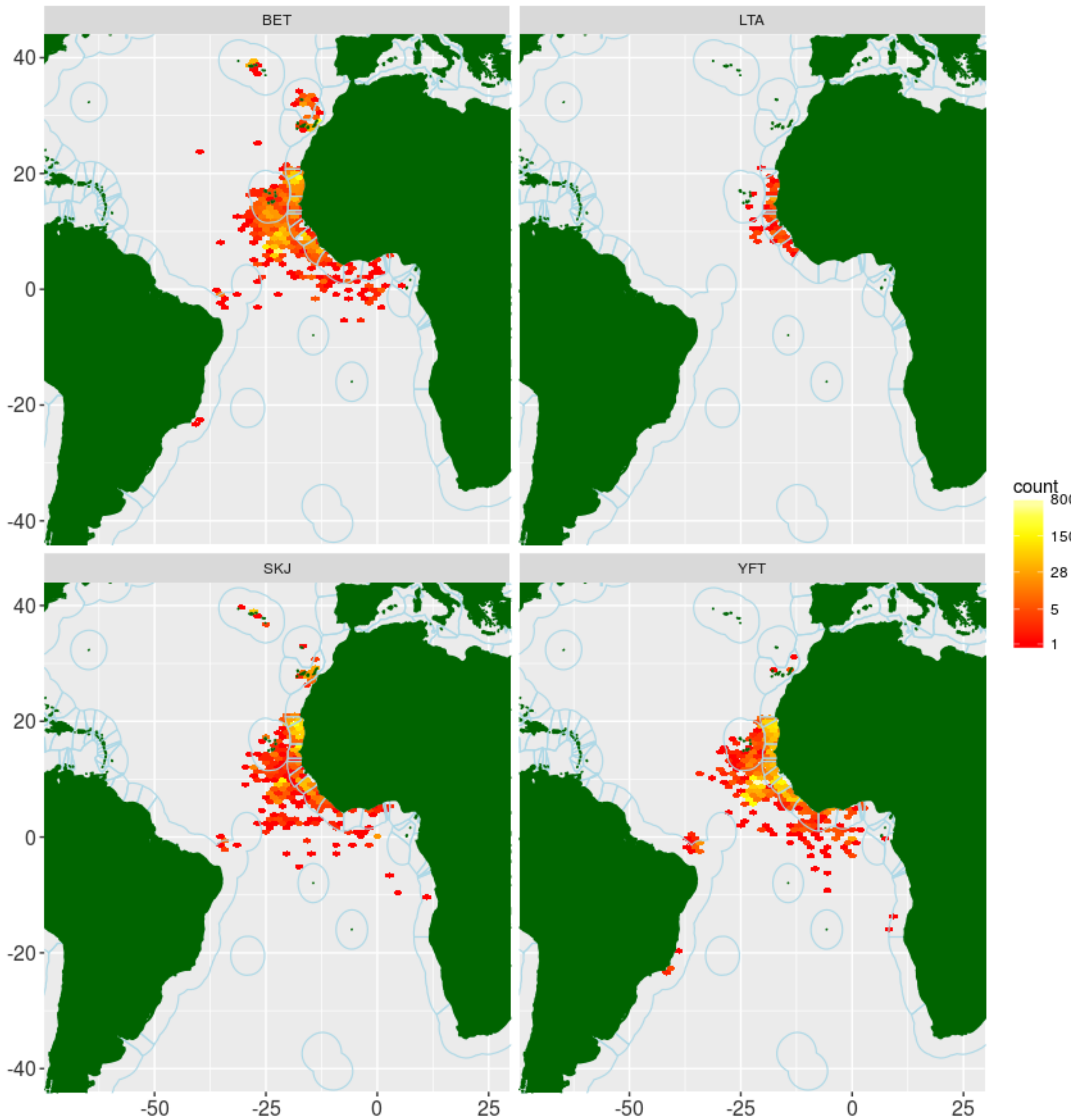


Figure 8. Spatial distribution of tropical tuna recovered by AOTTP between June 2016 and September 2017 (as of 18/09/2017).

Figure 9. Total AOTTP releases (green) and recoveries (red) over time by species (BET=bigeye, LTA=little tunny, SKJ=skipjack, YFT=yellowfin). The numbers have been square-root transformed so they can be seen on the same axes (as of 18/09/2017).

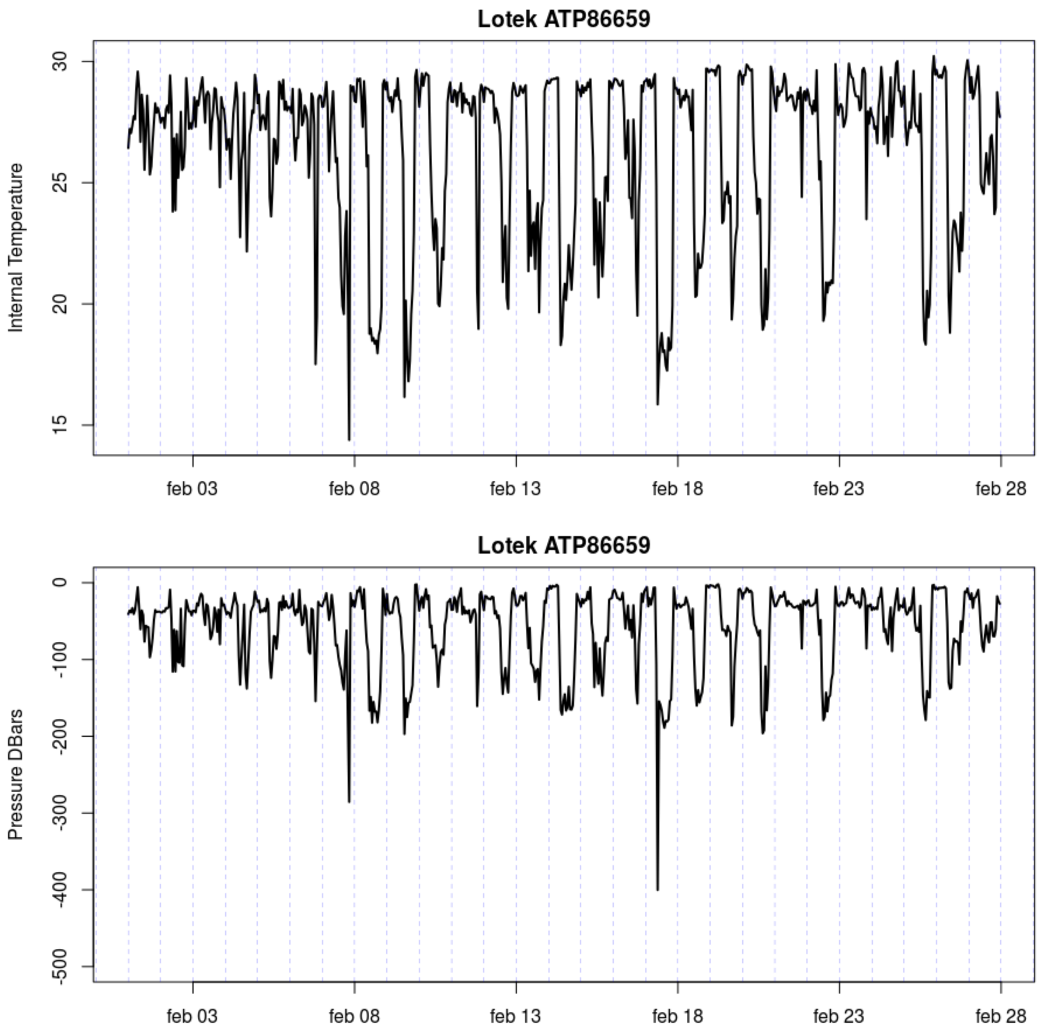


Figure 10. Temperature and depth profiles of YFT tuna tagged off West Africa.

Figure 11. Double-tagged tuna.

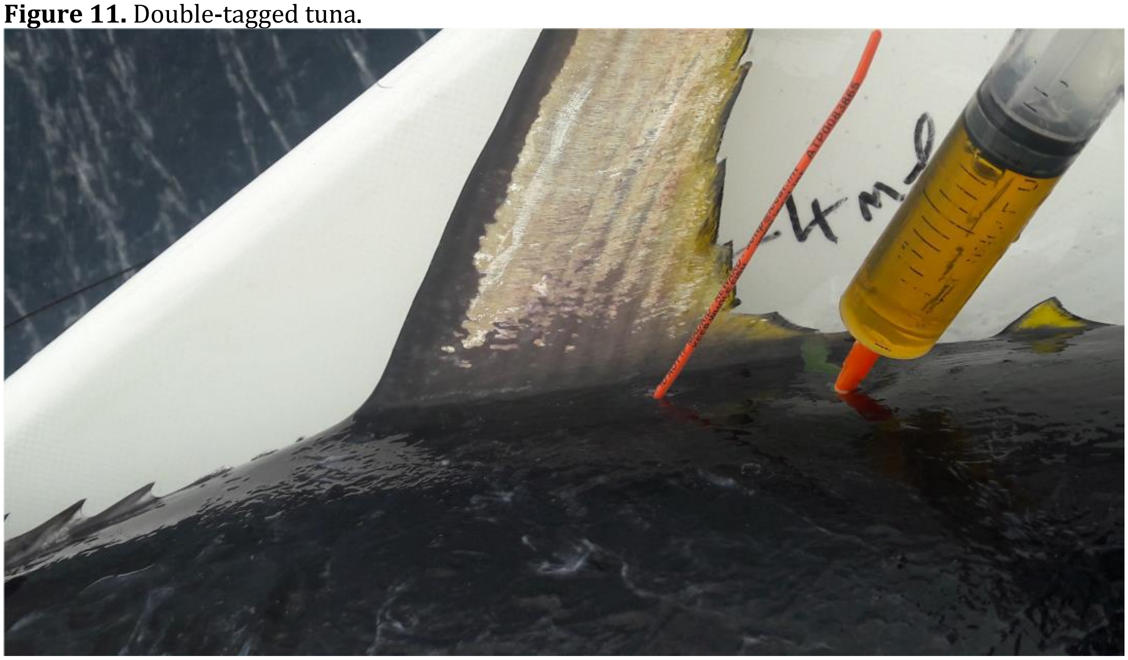


Figure 12. Chemically tagging a tuna.

Figure 13. Otolith expert group meeting March 2017, Abidjan.

Figure 14. Training in smartphone application for data collection and transmission to ICCAT.

Figure 15. Tag recovery training, Azores.

Figure 16. AOTTP tagger training in Cabo Frio, Brazil.

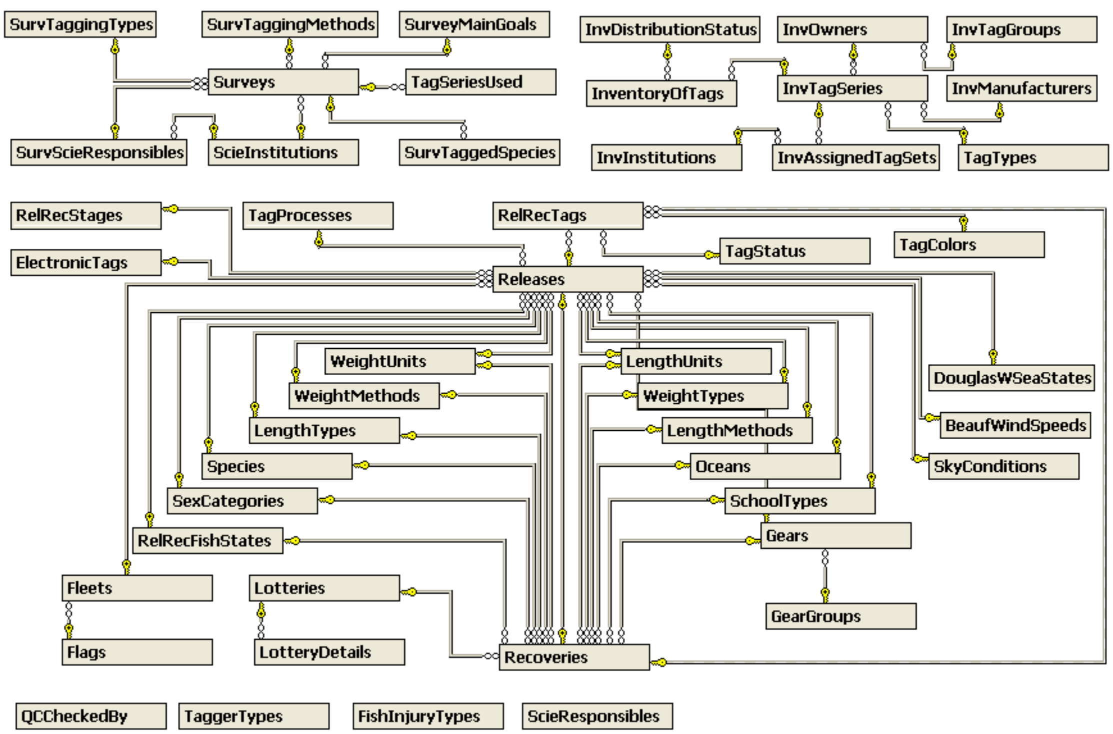


Figure 17. AOTTP tagging database summary.

Addendum 1

List of acronyms

AOTTP	Atlantic Ocean Tropical tuna Tagging Programme
AZTI	Centro Tecnológico experto en innovación marina y alimentaria
BET	Bigeye tuna (*Thunnus obesus*)
CICMAR	Centro de Investigación y Conservación Marina
CIPA	Research Centres. Centro de Investigacao Pesqueira Aplicada (CIPA) de Bisseau
CLPA	Comité Local de la Pêche Artisanale (Sénégal)
CMM	Conservation and Management Measures
CCP	Contracting Parties (ICCAT)
CRO – CI	Centre Recherches Océanologiques (Côte d'Ivoire)
CRODT	Centre Recherches Océanologiques de Dakar (Sénégal)
CSIRO	Commonwealth Scientific and Industrial Research Organization (Australia)
DAFF	Department of Agriculture, Forestry and Fisheries (South Africa)
DEPAq	Departamento de Pesca e Aquicultura (Brazil)
DG-DEVCO	Directorate-General for International Cooperation and Development
DG-MARE	Directorate-General for Maritime Affairs and Fisheries
EEZ	Exclusive Economic Zone
FADURPE	Fundaçao Apolonio Salles de Desenvolvimento Educacional
FSSD	Fisheries Scientific Survey Division (Ghana)
FM	Fausses marques
IATTC	Inter-American Tropical Tuna Commission (USA)
ICCAT	International Commission for the Conservation of Atlantic Tunas
IEO	Instituto Español de Oceanografía
IMAR	Instituto do Mar
IMROP	Institute Mauritanien de Recherches Oceanographiques et des Pêches (Sao Tomé & Príncipe)
INDP	Instituto Nacional para Desenvolvimento das Pescas (Cabo Verde)
IRD	Institute de recherche pour le development
ISRA	Institute Senegalais de Recherches Agricoles
LATEP	Laboratorio de Tecnologia Pesqueira (Brazil)
LPRC	Large Pelagic Research Center (USA)
LTA	Little tunny (*Euthynnus alletteratus*)
MFRD	Marine Fisheries Research Division (Ghana)
MFV	Motor Fishing Vessel
MSE	Management Strategy Evaluation
PAD	Port Autonome de Dakar (Senegal)
PROBITEC	Proyectos Biológicos y Técnicos (Spain)
RV	Research Vessel
SC	Steering Committee
SCRS	Standing Committee on Research and Statistics
SKJ	Skipjack tuna (*Katsuwonus pelamis*)
SPC	Pacific Community (New Caledonia)

tRFMO	Tuna Regional Fisheries Management Organizations
TRO	Tag Recovery Officer
UPV	Universidad Politécnica de Valencia (Spain)
UFERSA	Universidade Federal Rural de Semiarido (Brazil)
UFPRE	Universidade Federal de Pernambuco (Brazil)
UPV	Universidad Politécnica de Valencia (Spain)
YFT	Yellowfin tuna (*Thunnus albacares*)

Addendum 2

AOTTP Tagging Cruises between June 2016 and September 2017

Start	*End*	*Location*	*Vessel*	*Crew*	*Scientists*	*Days_at_sea*
2016-06-25	2016-06-30	Azores	Acoriana	5	3	5
2016-07-03	2016-07-05	Azores	Acoriana	5	3	2
2016-07-09	2016-07-20	Azores	Acoriana	5	3	11
2016-07-23	2016-07-29	Azores	Acoriana	5	3	6
2016-07-31	2016-08-04	Azores	Acoriana	5	3	4
2016-08-11	2016-08-12	Azores	Acoriana	5	3	1
2016-08-16	2016-08-27	Azores	Acoriana	5	3	11
2016-08-29	2016-09-01	Azores	Acoriana	5	3	3
2016-09-07	2016-09-20	Azores	Acoriana	5	3	13
2016-09-27	2016-10-03	Azores	Acoriana	5	3	6
2016-10-06	2016-10-14	Azores	Acoriana	5	3	8
2016-10-12	2016-10-19	Azores	Acoriana	5	3	7
2016-07-09	2016-07-20	Senegal	Aita Fraxku	21	4	11
2016-07-25	2016-08-01	Senegal	Aita Fraxku	21	5	7
2016-08-04	2016-08-13	Senegal	Aita Fraxku	21	5	9
2016-08-18	2016-08-28	Senegal	Aita Fraxku	21	3	10
2016-10-24	2016-11-04	Golfo de Guinea	Aita Fraxku	21	5	11
2016-11-07	2016-11-19	Golfo de Guinea	Aita Fraxku	21	5	12
2017-01-16	2017-01-31	Golfo de Guinea	Aita Fraxku	21	5	15
2017-02-05	2017-02-15	Golfo de Guinea	Aita Fraxku	21	5	10
2017-02-17	2017-02-27	Golfo de Guinea	Aita Fraxku	21	5	10
2017-02-28	2017-03-05	Golfo de Guinea	Aita Fraxku	21	5	5
2017-03-07	2017-03-22	Golfo de Guinea	Aita Fraxku	21	5	15
2016-08-25	2016-09-04	Canarias	El Grand Primero	10	4	10
2016-09-11	2016-09-18	Canarias	El Grand Primero	10	3	7
2016-09-22	2016-10-03	Canarias	El Grand Primero	10	4	11
2016-10-06	2016-10-17	Canarias	El Grand Primero	10	3	11
2016-10-23	2016-10-30	Canarias	El Grand Primero	10	4	7
2016-11-05	2016-11-16	Canarias	El Grand Primero	10	3	11
2016-09-11	2016-09-18	Canarias	El Macizo	10	4	7

2016-09-19	2016-09-27	Canarias	El Macizo	10	3	8
2016-09-29	2016-10-12	Canarias	El Macizo	10	4	13
2016-10-14	2016-10-24	Canarias	El Macizo	10	3	10
2016-10-25	2016-11-02	Canarias	El Macizo	10	4	8
2017-02-02	2017-02-09	South Africa	TarrynAmy	4	4	7
2017-02-15	2017-02-18	South Africa	TarrynAmy	5	3	3
2017-02-22	2017-02-24	South Africa	TarrynAmy	4	3	2
2017-03-01	2017-03-04	South Africa	TarrynAmy	3	3	3
2017-03-14	2017-03-17	South Africa	TarrynAmy	4	3	3
2017-03-21	2017-03-23	South Africa	TarrynAmy	3	3	2
2017-03-26	2017-03-30	South Africa	TarrynAmy	3	3	4
2017-04-02	2017-04-04	South Africa	TarrynAmy	2	3	2
2017-04-10	2017-04-12	South Africa	TarrynAmy	3	3	2
2017-04-26	2017-04-28	South Africa	TarrynAmy	3	3	2
2017-05-04	2017-05-05	South Africa	TarrynAmy	3	3	1
2017-04-05	2017-04-12	Brazil (Cabo Frio)	Estrela Delva	6	2	7
2017-04-25	2017-05-05	Brazil (Cabo Frio)	Estrela Delva	6	2	10
2017-04-07	2017-04-27	Brazil (Areia Branca)	Thavisson III	4	3	20
2017-04-14	2017-05-17	Brazil (Itajai)	Katsushio Maru Eight	24	2	33
2017-07-30	2017-08-15	Brazil (Fernando de Noronha)	Tubarao Tigre	2	3	16
2017-05-23	2017-06-01	Brazil (Cabo Frio)	Estrela Delva	6	2	9
2017-05-11	2017-05-31	Brazil (Areia Branca)	Thavisson III	4	3	20
2017-04-12	2017-06-06	Brazil (SP & SP)	Transmar I	6	4	55
2017-07-12	2017-07-15	Madeira	Ponta Calhau	13	3	3
2017-06-08	2017-06-22	Brazil (Fernando de Noronha)	Tubarao Tigre	2	3	14
2017-07-17	2017-07-20	Madeira	Ponta Calhau	13	2	3
2017-07-21	2017-07-28	Brazil (Cabo Frio)	Estrela Delva	6	2	7
2017-06-20	2017-06-28	Brazil (Cabo Frio)	Estrela Delva	6	2	8
2017-07-21	2017-07-26	Madeira	Ponta Calhau	13	2	5

Addendum 3

Wildlife Computers tag release summary (MiniPAT-348C)

Tag ID	*Deploy Date*	*Data Days*	*Release Type*
163236	16-May-2017	15	Too Deep
163255	03-Apr-2017	63	Floater
163257	03-Apr-2017	42	Floater
163258	03-Apr-2017	43	Floater
163259	03-Apr-2017	94	Interval
163260	17-May-2017	5	Too Deep
163262	25-May-2017	21	Premature
163264	03-Apr-2017	6	Premature
163265	06-Jun-2017	34	Floater
163266	18-Mar-2017	26	Floater
163269	18-Mar-2017	33	Floater
163270	01-Jun-2017	32	Premature
163271	13-May-2017	2	Too Deep
163273	05-Jun-2017	48	Floater
163275	08-Apr-2017	8	Premature
163276	18-Mar-2017	24	Floater
163277	07-Jun-2017	36	Floater
163281	21-Feb-2017	27	Premature
163282	16-May-2017	18	Floater
163283	18-Jan-2017	20	Premature
163284	18-Jan-2017	16	Premature
163285	18-Jan-2017	38	Premature
163287	21-Feb-2017	47	Premature
163289	21-Feb-2017	16	Premature
163290	03-Apr-2017	48	Floater
163291	03-Apr-2017	45	Pin Broke
163293	21-Feb-2017	10	Premature
163294	21-Feb-2017	10	Premature
163295	21-Feb-2017	24	Floater
163296	03-Apr-2017	86	Premature
163298	10-Apr-2017	53	Floater
163299	21-Feb-2017	10	Floater
163300	30-Apr-2017	4	Too Deep
163301	18-Mar-2017	27	Floater
163302	03-Apr-2017	51	Pin Broke
163303	21-Feb-2017	21	Premature
163304	17-May-2017	35	Floater
163306	21-Feb-2017	26	Premature

163307	18-Mar-2017	32	Floater
163308	21-Feb-2017	8	Premature
163309	21-Feb-2017	25	Floater
163310	21-Feb-2017	28	Floater
163311	21-Feb-2017	18	Premature
163314	21-Feb-2017	28	Floater

Appendix 9

2017 Report of the Sub-Committee on Statistics
(ICCAT Secretariat, 25-26 September 2017)

1. Opening, adoption of Agenda and meeting arrangements

The Sub-committee on Statistics met at the ICCAT Secretariat (Madrid, Spain) on 25-26 September 2017. The ICCAT Assistant Executive Secretary, Dr. Miguel Neves dos Santos welcomed the Sub-committee and highlighted the importance of its work and the commitment of the Secretariat to support the work of SCRS and the Commission. The meeting was chaired by Dr. Guillermo Diaz (USA). The Agenda was discussed and adopted without any modifications.

2. Review of fisheries and biological data submitted during 2017

The Secretariat presented information contained in the 2017 Secretariat Report on Statistics and Coordination of Research (Anon. in press b) related to fisheries and biological data submitted for 2016 including revisions to historical data.

The activities and information included in this report refer to the period between 1 December 2016 and 12 September 2017 (the reporting period). All the basic fisheries, and biological statistics have been presented by the Secretariat to the SCRS Working Groups during SCRS inter-sessional meetings. The Secretariat continues to note the improvements in terms of data submission using the ICCAT electronic forms. 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 datasets required by each assessment) a lot of 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 in the last five years, together with some lack of adherence to deadlines established for data submission, continues to constitute an enormous amount of work for the Secretariat, which is not sustainable.

The Secretariat applied, to the 2016 datasets reported, the SCRS filtering criteria to accept/reject statistical forms (2013 Report of the Sub-committee on Statistics, Addendum 2 to Appendix 8, Filters 1 & 2) adopted in 2013. The results are based on a total of 74 flags (from 51 CP's & 5 NCC's: 49 CP's + 16 EU members + 4 UK-OT members + 5 NCCs) with possibly reporting obligations. The forms submitted with errors that the Secretariat was unable to correct were considered unreported data.

2.1 Basic Task I (T1FC and T1NC) and Task II (T2CE and T2SZ) statistics

The Secretariat presented the 2016 data reporting status (Table 1 and 2 of Anon. in press b) of the two datasets of Task I statistics (T1FC: fleet characteristics; T1NC: nominal catches). The Secretariat reminded the Sub-committee of the new structure of the T1FC electronic form (ST01) 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 ST01 increased slightly from 68% in 2016 to 72% in 2017 (53 flags). Six flags reported after the submission deadline. The Secretariat made corrections to the data reported by 2 flags, and 13 invalid forms are waiting a complete revision by CPCs.

The T1NC (nominal catches) dataset was presented for the major ICCAT species (major tunas, major sharks, 13 species of small tunas and dolphin fish). The Secretariat also reminded the Sub-committee that the ST02-T1NC electronic form has 2 subforms: ST02A used to report positive catches (landings, dead discards, and live releases) and ST02B used to report "zero" catches. The T1NC 2016 report card is presented in Table 2 of Anon. in press b. Like the T1FC reporting, 2016 reports showed a slight increase in reporting (63 flags corresponding to 85%) compared to 2015 (80%). Five flags reported late and the Secretariat made corrections to 9 datasets. Eleven CPCs (15%) have yet to report their T1NC data.

As part of the T1NC data review, the Sub-committee also requested information on the reports of dead discards and live releases. Table 1 shows the number of CPCs that have provided this information by year (period 2014-2016) and by main species. The results clearly show that CPCs are not complying with their obligation to report dead discards and live releases. The Sub-committee reiterates that this information is essential for stock assessment purposes and that CPCs that do not provide estimates of discards are in lack of compliance with ICCAT's data submission requirements.

The T2CE (catch and effort) report card is presented in Table 3 of Anon. in press b. A total of 56 flags (76%), including 7 late reporting-flags, reported T2CE. This represents a significant increase in T2CE reporting compared to 2015 (64% reporting). Eighteen flag CPCs have yet to report T2CE data.

The Secretariat presented the Task II size data (combining T2CS and T2SZ) card report in Table 4 of Anon. in press b. The 2016 submission of size also showed a significant increase in reporting. A total of 52 flag CPCs (70%), including 5 late reports, submitted 2016 size data compared to 36 flags (46%) for 2015. Some of the submitted data are pending review and corrections by the Secretariat. A total of 22 CPCs have yet to submit 2016 size data.

2.2 Tagging

The different laboratories and scientific institutions conducting electronic tagging in the ICCAT Convention area reported a total of 153 releases and 85 recoveries made in late 2015 and during 2016. With respect to conventional tagging, a total of 827 were tagged and 339 tags were recovered during the same period. From September 2015 to September 2016, the Secretariat distributed about 3,400 conventional tags. These figures do not include any tags deployed and recovered by the AOTTP.

2.3 Complementary data obtained within ICCAT data collection and research programs (GBYP, AOTTP, EPBR, SMTYP and SRDCP)

The GBYP presented 3 documents SCRS/2017/191, SCRS/2017/192, and SCRS/2017/208. Document SCRS/2017/191 presented the results of data recovery efforts during the first part of Phase 7 of the Atlantic-Wide Bluefin Tuna Research Programme (ICCAT GBYP). The data recovery efforts resulted in incorporating historical data on trap fisheries and recent data from longline fisheries. These data have been reviewed and approved by the bluefin tuna Working Group and have already been included as part of the ICCAT database.

Document SCRS/2017/192 described a newly developed relational database for bluefin tuna electronic tags. It was explained that the system is still on a testing phase. The Sub-committee found the developed application to be a very useful tool. It was also explained that the application can be used in individual computers to use on other tagging datasets.

Document SCRS/2017/208 presented the results of the use of the Research Mortality Allowance (RMA) for the period 2012 to September 2017. The used RMA during that period ranged from 0.3 t to 5 t.

Progress on AOTTP was summarized by the Programme Coordinator. Activities leading to the development of the tag and release database were described, and the contents of that database summarized. Since AOTTP began tagging off the Azores in June 2016 more than 600 days at sea have been spent on more than 60 tagging cruises throughout the Atlantic. Nearly 60,000 fish have been tagged with conventional tags in the EEZs of 15 different countries, in addition to the High Seas. More than 8,000 fish have been double-tagged allowing tag-shedding rates to be estimated, while around 4,500 have been marked chemically to improve subsequent ageing of recovered fish. More than 300 electronic tags (pop-ups and internals) have been deployed. Tag-recovery and awareness raising infrastructures have been set up in ten countries, and more than 10,000 conventional tags have been recovered (ca 20% recovery rate) for which rewards have been paid. Posters, t-shirts, and caps, as rewards to incentivize tag-recovery, have been designed in four languages. More than 200 fish have been purchased and samples taken for determination of age, sex and state of sexual maturity. Relational databases and smartphone applications for populating them have been designed, developed and implemented. More than 60 colleagues from developing countries have been trained in all aspects of tagging at sea, tag-recovery, and data transmission methodologies. AOTTP coordination is working with ICCAT SCRS to build scientific capacity among ICCAT CPCs to make effective use of the tagging data for improving the tropical tuna stock assessments.

2.4 Other relevant statistics (observer data, VMS, BCDs, ISSF, etc.)

The Secretariat indicated that for 2016 only 11 CPCs reported observer data using the ST09 form. The Secretariat also summarized the reported data on seabirds and sea turtles which are extremely limited and sparse. As has already been recognized by the Sub-committee on Ecosystems, this Sub-committee once again reminds CPCs of their obligations to report by-catch data collected by their observer programmes. The limited available data so far has precluded the SCRS to advance the assessment of the efficacy of seabird mitigation measures as required by Rec. 11-09. For the same reason, the assessment of the impact of ICCAT fisheries on sea turtles in the Convention area has also suffered delays and it has been limited to only one gear type.

The Sub-committee reiterated the utility of VMS data for assessing fishing activity in the Atlantic Ocean. It was noted that the ICCAT Ad Hoc Working Group on FADs had also stressed the need to access VMS data in order to better characterize fishing effort of purse seiners and therefore improve the corresponding CPUE indices. The Sub-committee noted that scientists should have access to this data to improve their analyses.

The Secretariat indicated that the data that has been provided by the ISSF are not in a standardized format and, therefore, they can't be easily included into the ICCAT database. The Secretariat and the ISSF will work together to solve this pending issue.

3. Review of Secretariat's standard (yearly based) datasets estimations

3.1 CATDIS and EFFDIS

The Secretariat continued to improve the detailed level of the CATDIS. The last update was presented in June 2017 for the nine major species which included some historical T2CE series. These results were published in the Statistical Bulletin series, Vol. 43(2) of ICCAT.

In early 2017, the Sub-committee on Ecosystems requested that EFFDIS be updated given some general updates in the Task I and II data (particularly from JPN). The revised and updated EFFDIS was presented by the Secretariat in SCRS/P/2017/032. The SCRS reviewed the new EFFDIS and found some problems with the estimation and the nomenclature that were later fixed by the Secretariat. The newly revised EFFDIS was used by the Sub-committee on Ecosystems to estimate the total number of sea turtle interactions with longline gear in the ICCAT convention area. It was discussed that further improvements to the EFFDIS can be obtained by CPCs revising and improving their historical series of T2CE.

3.2 CAS (catch-at-size) and CAA (catch-at-age)

The Secretariat informed the Sub-committee that the CAS database is now complete and functional and it has an active connection between the size data and the substitution tables used for the CAS estimations. As required, the Secretariat also provided updated CAS and CAA matrices for the 2017 swordfish and bluefin tuna stock assessments.

4. Evaluation of data deficiencies pursuant to Rec. 05-09

4.1 2016 Report Cards applying SCRS validation criteria (Filters 1 and 2)

The Secretariat applied, for the fourth consecutive year, the SCRS filtering criteria (Filter 1 and 2, described in Addendum 2 to Appendix 8 of 2013 SCRS report, updated by the SCRS in 2016) to validate and accept Task I (form ST01 and ST02) and Task II (forms ST03, ST04 and ST05) statistics received under those official forms. The filtering criteria are also embedded (most updated SCRS version) in each one of these forms.

For 2016 data, Filter 1 was effectively applied and the results are presented in the SCRS Report Cards (Tables 1, 2, 3, 4, and 5 of Anon. in press b, with a summary in Figure 1). The "orange" cells indicate the datasets that have not passed Filter 1. However, the majority of the Task I forms rejected, were afterwards corrected by the Secretariat and provisionally (marked for revision) integrated into the ICCAT database system (ICCAT-DB). Task II forms not passing Filter 1 were not corrected (left for posterior revisions with the respective CPCs). Filter 2 was used for testing purposes and the results presented to the SCRS. Both filters were used on every Task I and Task II dataset received (scenario 2, methodology described in Palma and Gallego, 2015).

Over these last four years, the Sub-committee have observed continuous improvements in the level of reporting (CPCs reporting ratios), in the reduction of "late-reporting", and also some progress in the level of completeness of the forms (less errors) and level of detail of some information (in particular Task II). This tool has proven, during its short living, 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 Standard catalogues of major ICCAT species (1990-2016)

The Secretariat presented in Appendix 1 of document Anon. in press b, the Task I/Task II data SCRS catalogues for the major ICCAT species (1996 to 2016). These catalogues, also available for small tunas, were published in the 2017 small tuna intersessional meeting scientific report. The Sub-committee acknowledged improvements in data submissions. However, major deficiencies still exist for some ICCAT stocks, particularly for the historical data. Once again, the Sub-committee agreed that this information should be reviewed by the species groups, in particular by those that are scheduled to conduct stock assessments in 2018.

Rec. 05-09 recognized the need to establish a 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. MSE, could be used to conduct cost benefit analyses. Particularly to evaluate how reducing uncertainty can help reduce the risk of failing to meet management objectives.

The Sub-committee continue to express particular concerns regarding the very limited data that so far has been provided from coastal fisheries (*i.e.*, coastal longlines and gillnets) on vulnerable by-catch such as seabirds and sea-turtles. The Sub-committee on Ecosystems, in particular, continues to be concerned that this is limiting its ability to assess the impacts of the ICCAT fisheries on the status of those populations. In addition, the reporting of total dead discards and live releases (see section 2.1) continue to be very poor which impact the estimates of total removal and total mortality needed to conduct stock assessments.

4.3 Report on data recovery activities, new plans, and improvements on national data collections systems

With respect to data recovery and improvements, the Secretariat informed the Sub-committee that some major revisions were completed for bluefin tuna with respect to the UNCL and SURF gears. Two new landing series were included to the ICCAT-DB: a series from EU-Bulgaria (recovered by ICCAT GBYP) and the NEI 'inflated landings' for the eastern stock. Similarly for swordfish, a revision of the UNCL and SURF gears were also conducted. In the case of shortfin mako, EU-Spain conducted a full revision of the longline-surf gear. Work in progress includes a revision of the recreational/sport gears, and, the combined tropical purse seine and baitboat NEI fleets ("NEI(ETRO)") prior to 2006, in the process of being allocated to the respective CPCs (CUW, GTM, PAN, CPV, etc.). Data that have been recovered and required approval by SCRS include EU-France ALB (1980-1998) TW (partial catches only) and USA: bluefin tuna (1975, 1978-1985) gear split and gear reclassification (values exist in Task I). Also a full revision of EU-France TRAW (1991-2015) T2CE series still requires SCRS approval. Other data improvements conducted by the Secretariat include albacore: Chinese Taipei LL albacore (1981-2007), Chinese Taipei LL swordfish (1981-2007) which should be further revised because it doesn't have small fish. SWO: USA swordfish corrections (60's, 70's and 80's) on frequency type and various bluefin tuna series (Algeria, EU-France, EU-Italy, EU-Spain, Japan and Canada).

Document SCRS/2017/228 presented a comparison of data collected by EMS and observers onboard of two EU-France purse seiners. The document indicated that the data collected by the EMS and the observers with regard to fishing operations (e.g., type of set, duration, etc.) were in full agreement. However, for some species differences were found with regard to the total estimated catch and/or discards. The document emphasizes the utility of EMS and also that these systems are to complement scientific observers, but not to fully replace them. During the discussion, EMS was considered to have the potential for monitoring some compliance issues such as the FAD moratorium in the Gulf of Guinea. The Sub-committee was encouraged by the information presented in this document and recommended that more of this type of studies be conducted.

4.4 Potential methods to evaluate and measure (scores) the quality of data

The Sub-committee Chair presented a potential tool to assess the quality of the size data submitted to ICCAT based on a methodology described by Tsagbey *et al.* (2007). The Sub-committee reviewed some examples of the application of the described methodology to ICCAT data and recommended that the Working Group on Stock Assessment Methods reviews the method and provides further advice. The Secretariat also introduced a tool (preliminary study) to score the (Task I and Task II) data completeness of the ICCAT main species/stocks. The approach considers for the fisheries (flag-gear) that land 95% within a given year range (here 1996 to 2016) of the total landings if they have T2CE, T2CS, and/or T2CS data. Details on the calculations to develop these scores are presented in Anon. in press b. **Figure 1** shows the results of the application of this scoring system.

5. Review of existing practices for data submission and validation

5.1 Formats (eFORMS), codes, and deadlines

The Sub-committee indicated that no changes have been made to the deadlines to report Task I and Task II data. However, the Sub-committee continues to recommend that CPCs make their utmost effort to report their data in advance of the 31 July deadline to help the Secretariat with its workload.

The Secretariat also informed the Sub-committee on the advancements made in the improvement of the ICCAT coding system. The details can be found in Anon. in press b.

Form ST07-TropSupVes
The Secretariat informed the Sub-committee that only three CPCs (Belize, EU, and Panama) have provided this information.

Form ST08-FadsDep
The Secretariat indicated that this form has had a poor response due to difficulties to interpret the different fields and definition. Only three CPCs provided information using this form. In 2017 the tRFMO Working Group on FADs made some recommendations to the SCRS regarding data collection and statistics. These recommendations were reviewed by the ICCAT Working Group on FADs in early September, but the meeting report was not available yet to the Sub-committee on Statistics. Document SCRS/2017/217 provided a review of the different issues identified by the EU-Spain purse seine fleet when using this form. The document also provided with potential solutions to be considered by SCRS. The Sub-committee thanked the authors for their work and indicated that the document is a very useful source to fix issues related to the ST08 form. The Sub-committee recommended that this document be presented at the next meeting of the Tropical Tuna Working Group for its consideration and that that Group develop a revised version of ST08 to be presented at the 2018 meeting of this Sub-committee.

Form ST09-ObsProg
The Secretariat introduced the revised ST09 form that was revised and approved by the Sub-committee on Ecosystems during its 2017 meeting. The new form is a simplified version of the original ST09. This revision was done with the expectation that a simpler form will increase the reporting rate of observer data. In addition, the Sub-committee agreed to include the current form CP45 (which collects general information on observer programmes) as a sub-form in the new ST09. This new version of ST09 was approved by the Sub-committee which recommended the SCRS to adopt it and start using it in 2018.

Form ST10-PortSamp
This form was developed in 2015 to report data collected by port sampling programmes covered under Rec. [16-01]. In 2017, submissions were received from six CPCs.

5.2 Procedures to revise/approve statistics

The Secretariat indicated that the procedures to revise and approve statistics haven't changed.

1. A circular is issued (around February each year) requesting "statistics"
   - For [year – 1] or revisions to older years
   - With a deadline (1 day tolerance given)

2. No reminders are sent
3. CPC submit a "ST" form
4. Acknowledged reception
5. Validation is checked (filters, etc.)
   - If valid OK (stored GOTO (6))
   - Otherwise (weather corrections are possible OR not) request a revision (GOTO (3))
6. After storage it passes through deeper validation process
   - (consistency with the past, structural errors, etc.)
7. Wait for possible revisions ((3) on arrival / (8) after deadline)
8. Prepare the data for the SCRS
   - (a period of 4 to 5 weeks is given to accept late reporting: this year 2017-09-12)
9. SCRS deliberation

5.3 Tools supporting data submission (tutorials, instructions, videos, etc.)

The Secretariat did not develop any further tutorials or videos to support data submissions. The Sub-committee, while being mindful of the Secretariat's workload, recommended that this activity be continued when possible.

5.4 Ongoing work on the ICCAT online reporting system (three initiatives)

The Sub-committee acknowledged ICCAT Rec. [16-19] that established the development (and a technical Working Group) of an Online Reporting System: "An online reporting system shall be developed and maintained at the ICCAT Secretariat covering ICCAT reporting requirements, with an initial focus on elements of the required CPC Annual Reports." However, the Sub-committee recognized that the main goal of this recommendation is to work with compliance and Annual Report submissions and not with statistical forms.

The Secretariat has developed a web-based application for the submission and validation of ST forms. A presentation was made that showed how the application works. The Sub-committed was very pleased with the way the application works and encouraged the Secretariat to continued advancing this work. The Secretariat indicated that at this point it needs to move into a testing phase. The Sub-committee recommended that statistical correspondents that are willing to help with the next phase of the project get in touch with the Secretariat.

A second presentation was made that introduced an FAO Common Oceans/ABNJ tuna project feasibility study named "FORS (Fisheries Online Reporting System". This is also a web-based application to report and validate ST forms, but it also includes a 'communication tool' that allows to keep and track email exchanges among the Secretariat and the statistical correspondents. The Sub-committee was also very encouraged by this application and hopes that further development of it continues into the future.

The Sub-committee noted the value of the two applications and agreed that they are not competing efforts, but that they complement each other. The Secretariat indicated that it will need support from the Commission to advance the online reporting system which the Sub-committee agreed with. However, there was a general agreement that the Commission 'online reporting Working Group' should be made aware of this ongoing effort by the Secretariat. The Sub-committee also recommended that if in the future the 'online reporting Working Group' will consider online reporting for ST forms, then the Working Group should be expanded to include members of the SCRS and statistical correspondents.

6. Review of the ICCAT relational database system (ICCAT-DB)

A detailed description of all the work involving the various parts of ICCAT-DB (databases, applications, specific code, documentation, etc.) is presented in the Secretariat report (Anon. in press b). In addition, the Secretariat also did a presentation (SCRS/P/2017/045) summarizing the current status of the ICCAT-DB, the progress made during 2017 (improvements, ongoing projects, documents, etc.), and, the pending work (ongoing and postponed tasks) that should continue in the future. This Sub-committee expressed its satisfaction and congratulated the Secretariat for the effort, dedication and continuous commitment with the improvement of the ICCAT-DB system.

6.1 Improvements, ongoing work, and work plan

The ICCAT-DB system undertook in 2017 a revitalization path foreseeing important future improvement expectations (online reporting systems, improved data dissemination tools, improvements to front-end applications, etc.). Various databases were revised/adapted, to support the changes in the ICCAT regulations. For example, the vessel record database was adapted to support 5 new authorisation lists (ALB-N, ALB-S, ALB-M, SWO-N, and, SWO-M). Various revisions were also made to the statistical set of databases (Task I and II, CATDIS, CAS, etc.) to improve several parts (e.g.: filtering criteria automation) and also to incorporate updates aimed to handle the most up-to-date SCRS requirements. The Secretariat has also started the full redesign of the tagging (conventional and electronic) database module (including applications, forms, special tools, etc.). This ongoing task (recently started) will continue in the future.

The new JAVA "automated data processing framework", used to validate and integrate into ICCAT-DB Task I and Task II forms, in production since 2016, was optimized in various aspects. Most notable is that during 2017, nearly 90% of the ST01 to ST05 forms received during the reporting period were automatically processed (validated and stored) using this framework. The Secretariat is right now extending this framework to process the remainder statistical forms (ST06 under active testing; ST07 through ST10 planned) and also to the conventional tagging forms in the future (as soon as database redesign and electronic forms TG01, TG02 and TG03 are properly adapted). Its JAVA "code base" is also used as the backend data processing engine of the current prototype the Secretariat has also started: the "Online Statistical Data Handling system", a single page web application.

The Secretariat also dedicated a reasonable amount of time validating and improving the ICCAT-DB content, identifying data gaps and problematic datasets for posterior revision by the respective CPCs. This data quality (screening, harmonisation and data completeness processes) improvement work, started three years ago by the Secretariat as a continuous data recovery task. These results have been scrutinised and used entirely by the SCRS and the Commission.

The Secretariat has ongoing the RDMBS migration task (from 2008R2 to version 2016) and expects to finalise it during 2017. There are however, some tasks that were postponed to 2018. The most important ones were, the MS-ACCESS client databases ("t2ce.mdb" and "t2sz.mdb") replacement by SQLITE databases for off-line work, the GIS (shapefiles design, mapping software, etc.) development, and, the vessels record history rebuild (Commission request). The Secretariat had also to delay some work related to the ICCAT cloud infrastructure (various pieces of software for cloud deployment, testing various web solutions, etc.). The Secretariat is committed, depending on the time availability, to start the postponed projects and continue the ones not yet finalised.

6.2 Ongoing documentation work (technical manuals, Javadocs", user guides, etc.)

The ICCAT-DB documentation is made of various types of documents (databases, reference manuals, user guides, "javadocs" from JAVA software, specific articles, etc.). The Secretariat is now (since 2016) treating the documentation process in an integrated way to avoid text redundancy and most importantly, to interconnect the various "pieces" in a single documentation framework, which will strength the "user interaction" potential. This framework is in preparation to be published online (ICCAT cloud infrastructure). The ICCAT-DB documentation process is now continuous (follows its evolution) and the updates will be shown online in real time in the future. Part of the 2017 work was related to improve this integration process, and, very little time (due to the extraordinary workload of the Secretariat) was dedicated to effective "writing". The Secretariat has planned for 2018 to dedicate a larger amount of time to "writing".

6.3 Plans to publish some ICCAT-DB data in the ICCAT cloud infrastructure

The cloud infrastructure (4 cloud servers deployed, including the AOTP dedicated server) has been used as the laboratory (development and testing) of many pieces of software used now by the ICCAT community (Secretariat, scientists, ICCAT programmes, etc.), like the RStudio server, the Shiny solution, and others. Right now, the Secretariat has small projects under development (that will become larger solutions) linked to some ICCAT-DB content (coding system, CATDIS, EFFDIS, etc.) for online publication.

During 2018, the ICCAT "Online Statistical Data Handling system" will be deployed in the ICCAT cloud infrastructure (this Sub-committee decision, after seeing the demonstration, and considering that this product is ready for real world tests) for testing and depuration during one year. It will start (end of 2017) with 10 to 15 users (ICCAT statistical correspondents, scientists, and data experts) and, depending on the problems encountered, more users will be added all over the year. Real fisheries and biological data (covering version "2018" forms ST01, ST02, ST03, ST04, ST05, and possibly ST06) shall be used on this phase. The results shall be presented to this Sub-Committee in September 2018, which will decide if this software is ready for "production".

7. International and inter-agency cooperation on statistical activities (FAO, CWP, FIRMS, CLAV)

Due to scheduling conflicts between SCRS intersessional meetings and the CWP meeting, no Secretariat staff was able to attend (but, it is following its activity) the CWP meeting in 2017. The Secretariat did, however, update the species identification sheets for yellowfin tuna, north and south albacore, east and west sailfish, and Mediterranean swordfish populations which were assessed by the SCRS in 2016 for FIRMS. The Sub-committee was also informed of the FAO/CWP task group work on harmonization of data structure and metadata among tuna RFMOs. Since the last SCRS meeting, the Secretariat has prepared the entries for the Aquatic Sciences and Fisheries Abstracts (ASFA-Proquest) database of the papers published in issues 3, 4 and 5 and issues 1 and 2 of Volumes 68 and 69 of the ICCAT Collective Volume of Scientific Papers, respectively. ICCAT continues to collaborate with the CLAV and has actively shared data and synchronised information with that system.

8. Review of progress on the implementation of the Science Strategic Plan for 2015-2020

The SCRS Chair informed the Sub-committee that a review of the progress on implementing the SCRS Science Strategic Plan would be provided during the 2017 SCRS plenary meeting.

9. Discussion of proposed data dissemination and sharingrules

The Sub-committee recalled that during the 2016 meeting it held some preliminary discussion on a set of new data dissemination and sharing rules for the SCRS. The Chair of the Sub-committee informed that a preliminary draft was shared with the different SCRS group chairs and with the WGSAM during its 2017 meeting with the goal of receiving further input. The Sub-committee adopted the following SCRS data dissemination and sharing rules:

a) Preliminary Task I and Task II and derived estimations (e.g., Catch-at-size, CATDIS) will not be released until they have been reviewed and approved by the Species Groups and the SCRS at its plenary meeting. Preliminary Task I and Task II data will continue to be provided for use in data preparatory and stock assessment meetings and any other SCRS intersessional meetings that require access to these data. The Secretariat will not entertain requests for these data that are not part of the approved work plan of the SCRS Species Groups and Sub-committees.

b) The Secretariat will provide access to the OwnCloud folders one or two weeks prior to the start of the meetings only to those that have registered to attend the meeting.

c) At the start of each meeting, new login information will be provided to those that are present at the meeting. During the meeting and until the report is finalized, sharing the new login information with those that are not attending the meeting is strictly prohibited. Exceptions will be made for those Head of Scientific Delegations that are not attending the meeting and that specifically request access to the OwnCloud. Requests to access the OwnCloud by those that are not attending the meeting (and are not Head of Scientific Delegations) will be considered on a case by case basis by the Species Group and SCRS Chairs.

d) To further increase the transparency of the stock assessment process, the OwnCloud 'Analysis' folder will be made available as an open folder with free access after the meeting report is finalized.

e) Due to limited space in the OwnCloud, all the open folders mentioned in Paragraph 4 will remain available until the end of the calendar year, after which they will be migrated to a protected "Historic" folder. Access to this historic folder will be provided upon request to the Secretariat.

10. Considerations on the Sub-committee on Statistics recommendations (past and 2017)

10.1 Progress with prior year Recommendations of the Sub-Committee

- The Sub-committee recommends that the Species Working Groups assign, along with the "text rapporteurs", a "data rapporteur" during stock assessment and data preparatory meetings who will be responsible for ensuring that all model run inputs and outputs on which management advice is based, are copied to data folders on ownCloud potentially using a standardized format. It is recommended that the Secretariat stores these files in a common assessment output repository which can be easily accessed by the SCRS. This approach would facilitate the request made by the Sub-committee on Ecosystems that stock assessment models made readily available to use as fishery indicators for the EBFM framework.

The Sub-committee recognizes that significant advances have been made in implementing this recommendation by some of the species groups that conducted stock assessments during 2017.

- The Sub-committee recommended that the Secretariat revises the data submission requirements for Task I and II, and compliance, and the electronic forms used for such submissions to identify cases where double reporting (possible redundancy in data requirements) might be occurring. For those cases, the Secretariat will present a proposal to combine electronic forms to the SCRS for those cases where double reporting is occurring.

The Secretariat informed the Sub-committee that an initial revision of the eForms of type "ST" (statistics) showed no redundancy in data reporting. Nevertheless, this redundancy elimination work should continue in the future taking into account all the ICCAT official forms (statistics, tagging, and compliance) and the existing ICCAT data requirements. The Secretariat also indicated that as new data reporting requirements are adopted by the Commission it will continue to perform these revisions on a regular basis.

- The Sub-committee requested that CPCs make their utmost effort to report their Task I and II data in advance of the 31 July deadline. Doing so will allow the Secretariat to process the data faster and contact CPCs when errors/mistakes are found so they can be corrected before the submission deadline.

The Secretariat indicated that no significant improvement on this issue was observed in 2017.

- The Sub-committee recommends that starting in 2017, CPCs report Task II data by month only. Submissions that provide data on quarterly, semiannual, and annual time steps will not be incorporated into the ICCAT-DB and will be considered a wrong submission. The 2017 version of the ICCAT electronic forms for Task II (ST03, ST04 and ST05) should be updated accordingly. In consequence, only 2017 versions of the forms can be used to submit statistics during 2017.

Only a few submissions used other than monthly time steps. The ST03, ST04, and ST05 were modified as requested by the Sub-committee.

- The Sub-committee recommended that the Secretariat delete landings reported for *Scomber scombrus* from the ICCAT-DB as this species is not under the purview of ICCAT and the SCRS.

This task was completed by the Secretariat.

- The Sub-committee recommended that the Secretariat develop a proposal for the Tropical Tunas Working Group to revise the historical series of landings of the three species at once. It is unpractical that the yellowfin, bigeye, and skipjack Working Groups develop their own revisions for a fishery that is multispecies in nature.

The Sub-committee was informed by the Secretariat that this is an ongoing task that is also being coordinated with the Tropical Tunas Working Group.

- The Sub-committee recommends that the Secretariat work intersesionally with the SCRS Chair, Chairs of the two Sub-committees, and Chairs of all Species Groups to develop a proposal with new guidelines for the sharing and dissemination of SCRS data. This proposal will be presented at the next meeting of the Sub-committee on Statistics for its consideration. If possible, the Sub-committee also recommended that a draft of this proposal be presented at the next meeting of the WGSAM for its early consideration and discussion by SCRS.

This task was completed and new data dissemination and sharing rules were adopted by the Sub-committee.

- The Sub-committee reminds all Chairs of the SCRS species groups and Sub-committees that they must attend the meeting of the Sub-committee on Statistics. If for any reason they are unable to attend, they should then appoint a proxy that can represent the Group at the Sub-committee on Statistics meeting.

The Sub-committee informed the SCRS that not all Chairs of SCRS Species Groups attended the meeting of the Sub-committee (as it is required) nor they appointed a proxy to represent them neither.

- The Sub-committee recommends that National scientists review the results of the newly estimated EFFDIS to ensure accuracy.

The Secretariat informed the Sub-committee that comments/suggestions were received from only one CPC.

10.2 Review ofRecommendations from 2017 inter-sessional meetings

The following recommendations for statistics from the 2017 inter-sessional meetings were reviewed and endorsed by the Sub-committee.

Bluefin tuna

- CPC scientists from EU-Germany, EU-Sweden, and EU-Denmark revise their historical Task I catch series (50s and 60s) and, whenever possible, provide the respective Task II (catch and effort, and size samples) information.

- Efforts to recover catch/size/effort data from documents/reports from ICES and other sources be continued. This size information should be reviewed by the Group for its adoption and inclusion into the ICCAT-DB.
- The Group requests that the historical and future time series of Mediterranean purse seine catches between small (<160 SFL) and large (>160 cm SFL) fish be better partitioned.

- The Group reiterates the importance of all CPCs to review and submit their Task II size frequency data by fleet. Furthermore an effort must be made to fill in the gaps in the size composition data (historical and future) to be representative of the temporal and spatial fishing patterns.

Sharks

- The Group recommends that CPCs continue the recovery of Task II CE and SZ data.

- The Group recommends that CPCs continue to revise their historical shark catches with the aim of classifying “unclassified” catch reports into the appropriate species.

- The Group noted the importance of having the sex information on the conventional tagging database. Such data are usually reported for sharks, but currently are not available in the ICCAT database. Therefore, the Group recommends that the Secretariat revises the conventional tagging database to include this field and make it available in the cases where such information was reported.

Swordfish

- To CPCs on discards. Current information on discards of swordfish (both dead and alive) are still very scarce in the ICCAT databases and inconsistently reported by CPCs. The information on the sizes of discards, and the numbers discarded scaled to the total effort (data for both discarded dead and released alive) should be reported in order to quantify discarding in all months and areas. These data must be reported as required by ICCAT Recs. 13-02 and 15-03.

- To CPCs on submission of Task I and II data. All CPCs catching swordfish (directed or by-catch) should report catch, size samples (by sex), catch-at-size (by sex) and effort statistics by as small an area as possible, and by month. Recognizing the differential growth and distribution between sexes, collecting size distribution information by sex is particularly important. The Group strongly reiterates the need for respecting deadlines and providing the data in the ICCAT standard formats, even when no analytical stock assessment is scheduled, as required by ICCAT Recs. 13-02 and 15-03. Missing or incomplete historical data should also be provided.

- Data submission: The Group reiterates that CPCs should comply with all aspects of their data submission obligations which include the reporting of estimates of dead discards and, when possible, live releases.

- Estimation of dead discards: The Group recommended that, until CPCs fully comply with their obligations to report dead discards, the use of observer data as a tool to estimate dead discards as a proportion of the total landed catch be explored.

Small tunas

- 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, the replacement of the carry overs, the split of "unclassified" gears by specific gear codes, and the completeness of Task I gaps identified.

- The Statistical Correspondent and/or National scientists of CPCs should correct inconsistencies identified in T2SZ series. These inconsistencies include, among others, outliers in size measurements, heterogeneity in frequency types (FL, CFL, WGT, HGTW, etc.) and class types (1 cm, 2 cm and 5 cm; 1 kg, 2 kg and 5 kg), and heterogeneity in time (by year, by quarter) and geographical (1x1, 5x5, ICCAT sampling areas, "unknown") strata. For the 13 species of small tuna, the T2SZ revision should have as reference, the stratification of the samples by gear, month, 1°x1°or 5°x5° squares, and, FL size classes of 1 cm (lower limit).

- 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 Secretariat should continue its work on the data recovery and inventory process of tagging data for small tuna. This process will require active participation of the National scientists that hold such data.

Albacore

- For the Mediterranean stock, in principle, changes in mean size of the catch may reflect changes in the age/size distribution of the population and/or changes in the selectivity of the gear(s) or other factors indirectly affecting size selectivity. In order to evaluate annual trends of mean size it is necessary to identify the possible factors) that could explain variability on observed size frequency samples. The Group recommends that methods of standardizing length measurements be implemented. A method for standardizing length data has previously been submitted to the SCRS (Ortiz and Palma, 2012). In addition to length standardization, the Group recommended to conduct a review and collation of all the available data on age-length pairs available from the various studies that have estimated age from spines with the view to update the estimate of the growth curve for the species. It is also recommended that methods of accounting for selectivity in the year 1 cohort in von Bertalanffy growth function (VBGF) be explored to ensure accurate parameter estimation.

Ecosystems

- The Sub-committee requests that CPCs continue or initiate the submission of Task I information for non-target teleost species not categorized under the main/small tuna or shark categories (e.g. oilfish, escolar, Atlantic pomfret, etc.).

FAD Working Group

- SCRS reviews and recommends additional changes, as appropriate, to the minimum standard reporting requirements on data to be collected in FAD fisheries through logbooks.

  (Note: see section 5.1 of this report)

11. Replies to the Commission related to Rec. 16-14, paragraph 12

The Sub-committee discussed that some of the information required by Rec. 16-14, paragraph 12, already exists and needs to be compiled. There was a general agreement that a complete response to this recommendation will require coordination among several SCRS Working Groups. It was also agreed that the SCRS Chair, the Chair of the Sub-committee on Ecosystems, and other SCRS Chairs will draft a response to the Commission to be reviewed during the 2017 SCRS Plenary meeting.

12. Other matters

The co-convenor of the Sub-committee on Ecosystems requested the opportunity to discuss with the Working Group Chairs the proposal to develop the content for both ecosystem report cards and an ecosystem based fisheries management plan for ICCAT. The co-convenor also noted the need to provide for regular opportunities for the Working Group and ecosystem Chairs to meet and exchange information.

The development of the content for the report card was described to occur inter-sessionally in preparation for the 2018 Sub-committee on Ecosystem meeting. It was requested that the Working Group Chairs participate in, and/or lend their expertise to, the development of the components of the report card that relate to their particular species. The co-convenor also indicated that Working Group Chairs will be contacted regarding their participation in the project.

13. Future plans and recommendations

- The Sub-committee reminds CPCs of their obligation to report total discards and live releases. The Sub-committee also recommends that the SCRS explores ways to provide capacity building to those CPCs that need it to comply with the discard reporting requirements.

- The Sub-committee again reiterates that CPCs should report their observer data and any other information needed to advance the assessment of the efficacy of seabird mitigation measures as well as the impact assessment of ICCAT fisheries on sea turtles.

- The Sub-committee recommended that CPCs revise their historical series of Catch-and-Effort and Catch-at-Size.

- The Sub-committee reiterates previous recommendations that submission of T2CE data should be done for all species at once. When CPCs report T2CE data for several species separately, the Secretariat cannot interpret the effort data and, therefore, it is not possible to combine de different data sets.

- The Sub-committee recommended that the Secretariat change the start of the ‘reporting period’ to 1 October from the current date of 1 December.

- The Sub-committee endorsed the ongoing work by the Secretariat to develop an online reporting system for statistical data. The Sub-committee recommends that Statistical Correspondents interested in helping in the testing of this new system to work with the Secretariat.

- The Sub-committee recommends that the Commission provides the Secretariat with all the support needed to complete the online reporting system. In addition, the Sub-committee recommends that the Commission 'Online reporting Working Group' be expanded to include members of the SCRS and statistical correspondents.

- The Sub-committee recommended that the Secretariat modifies the ST04-T2SZ and ST05-T2CS (renamed from ST05-CAS) form to allow the reporting of data only by month and for several years in the same form. Moreover, form ST04-T2SZ should drop geographical grids of type "20x20" and "10x20". These modifications should be made for the 2018 forms version (to report 2017 data). In addition, the Sub-committee also recommended that the Secretariat explores the possibility of further modifying these forms to allow the reporting of data for several species in the same form (study to be presented at the 2018 Annual meeting).

- The Sub-committee recommended that the ST08-FadsDep be revised by the Tropical Tunas Working Group taking into consideration the results presented in document SCRS/2017/217. The revised form should be presented at the next meeting of this Sub-committee.

14. Future Work

Finalize "short term" ongoing projects

Web-form prototyping (for ST forms 1 – 6). 7 – 10 to be started.

JAVA application to validate ST forms (ST01 to ST06) for CPC scientist's use

Replacement of MS-ACCESS (t2ce.mdb & t2sz.mdb) by SQLite 3.8+ databases

Continue "long term" ongoing projects

Continuous update of the ICCAT-DB documentation framework

Maintain the work on the ICCAT cloud infrastructure (deployment/integration of services)

Continue the work on the GIS system (terminate sampling areas geo-referencing :: shapfiles)

Continue the development of an online reporting system as requested by the Commission.

Start projects (short/long term)

"Full" redesign of the "tagging" database (conventional/electronic) system :: (long term)

Migration of MS-SQL server 2008R2 to a new version **- URGENT (outdated now)**

ISSF data unloads project (if no decision is made, these data can never be properly used)

AND SIMULTANEOUSLY: **the ICCAT-DB content/the meetings preparation/the estimations**

Continue data recovery (data gaps, better resolution and normalization of Task II)

Continue improve of Task I (eliminate carry overs, allocate NEI catches to proper flags, reduce UNCL gears, etc.)

Provide the most up-to date INFO to SCRS

15. Adoption of the report and closure

The Chair thanked the participants for their attendance to the meeting and he thanked the Secretariat staff for their continued support of the Sub-committee's work and acknowledged how difficult its work would be without the full assistance of the Secretariat.

Table 1. Number of CPCs that reported dead discards and live releases for years 2014-2016.

		Discarded dead			*Released alive*		
		2014	2015	2016	2014	2015	2016
ALB	ATN	1	3	2			1
	ATS	1					
	MED	1	2	1			1
BET	A+M	1	3	1		1	3
BFT	ATW	1	3	3		1	1
	MED	2	2	1	1		1
	ATE						1
BUM		2	4	2			
SAI	ATE		1			1	
	ATW	3	2	2	1		1
SKJ	ATE		2				
	ATW	1	1				1
SPF	ATE		1				
	ATW					1	1
SWO	ATN	5	4	4	1	2	3
	ATS	3	1	1	1		
	MED		1				1
WHM		2	2	3	3	2	3
YFT	ATE	1	2	0			1
	ATW	1	3	1	1	2	2
BSH	ATN	4	4	4	2	2	3
	ATS	3	2	2	1	1	1
POR	ATN	2	2	2		1	1
	ATS	1	1			1	1
SMA	ATN	2	5	3	1	2	3
	ATS	1	3	3		1	2
	MED		1				

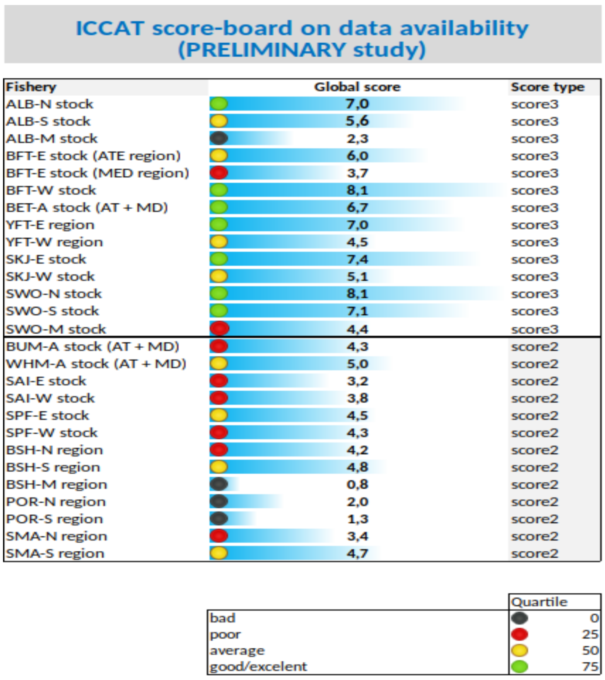


Figure 1. Preliminary results of the scoring of data availability of the major ICCAT species/stocks.

Appendix 10

Report of the 2017 intersessional meeting of the Sub-committee on Ecosystems

(Madrid, Spain, 10-14 July 2017)

The Report of the 2017 intersessional meeting of the Sub-committee on Ecosystems has been published in the Collect. Vol. Sci. Pap. 74(7): 3565-3638.

Appendix 11

LIST OF STATISTICAL CORRESPONDENTS BY COUNTRY

Country	Name	Email
Albania	ALBANIA - Cobani, Mimoza - 5539	mimoza.cobani@bujqesia.gov.al; cobanimimi@yahoo.com
Algerie	ALGERIE - Kouadri-Krim, Assia - 4904	dpmo@mpeche.gov.dz; assiakrim63@gmail.com
Algerie	ALGERIE - Kaddour, Omar - 5158	dpmo@mpeche.gov.dz; kadomar13@gmail.com
Angola	ANGOLA - Kingombo, Pedro Afonço - 1994	Pedroafonco25@yahoo.com.br
Angola	ANGOLA - Airosa Ferreira, Júlia - 2973	fjairosa@gmail.com; julia.ferreira@minpescas.gov.ao
Antigua & Barbuda	ANTIGUA AND BARBUDA - Daven, Joseph - 2063	dcblack11@yahoo.com
Barbados	BARBADOS - Willoughby, Stephen - 50	fishbarbados.dcfo@caribsurf.com;
		fishbarbados@caribsurf.com; bajanwahoo@yahoo.co.uk
Barbados	BARBADOS - Parker, Chris - 2028	fishbarbados.fb@caribsurf.com
Barbados	BARBADOS - Leslie, J. - 2311	fishbarbados@caribsurf.com
Belize	BELIZE - Conorquie, Breanna - 1434	fisheriesofficer@bhsfu.gov.bz
Belize	BELIZE - Lanza, Valarie - 2370	valerie@immarbe.com; director@bhsfu.gov.bz
Belize	BELIZE - Pinkard, Delice - 2716	fishingadmin@immarbe.com; sr.fishofficer@bhsfu.gov.bz
Belize	BELIZE - Neal, Omari - 4601	wilpott@gmail.com;wilfredo@fisheries.gov.bz
Benin	BENIN - , - 1436	sgm@agriculture.gouv.bj
Benin	BENIN - Degbey, Jean Baptiste - 2981	jbdegbey@yahoo.fr
Bolivia	BOLIVIA - , - 2019	despacho@maca.gob.bo
Bolivia	BOLIVIA - Maldonado, Mijaíl Meza - 5399	pescamar@mindef.gob.bo; mijail.meza@mindef.gob.bo;
		mijail.meza@outlook.es
Brazil	BRAZIL - Da Silva Camilo, Camila Helena - 4752	camila.scamilo@agricultura.gov.br; kmimeilyn@gmail.com
Cabo Verde	CABO VERDE - Marques da Silva Monteiro, Vanda - 199	vanda.monteiro@indp.gov.cv
Canada	CANADA - Hanke, Alexander - 4238	alex.hanke@dfo-mpo.gc.ca
Canada	CANADA - Melvin, Gary - 5156	gary.melvin@dfo-mpo.gc.ca
Canada	CANADA - Dalton, Alex - 6008	alexander.dalton@dfo-mpo.gc.ca
CARICOM	CARICOM - Singh-Renton, Susan - 1757	susan.singhrenton@crfm.net
China P.R.	CHINA P.R. - Haiwen, Sun - 216	fishcngov@126.com
China P.R.	CHINA P.R. - Song, Dandan - 4594	inter-coop@agri.gov.cn
Chinese Taipei	CHINESE TAIPEI - Hsu, Chien-Chung - 1459	hsucc@ntu.edu.tw
Chinese Taipei	CHINESE TAIPEI - Huang, Julia Hsiang-Wen - 1460	julia@ntou.edu.tw
Chinese Taipei	CHINESE TAIPEI - Lin, Yen-Ju - 1699	yenju@ms1.fa.gov.tw
Chinese Taipei	CHINESE TAIPEI - Hsia, Tsui-Feng Tracy - 2193	tracy@ofdc.org.tw
Chinese Taipei	CHINESE TAIPEI - Chou, Shih-Chin - 2666	shihcin@ms1.fa.gov.tw
Chinese Taipei	CHINESE TAIPEI - Lin, Ding-Rong - 2791	dingrong@ms1.fa.gov.tw
Chinese Taipei	CHINESE TAIPEI - Lan, Tsung Wen - 4640	tsungwen@ms1.fa.gov.tw
Chinese Taipei	CHINESE TAIPEI - Wei, Dorine Dung Chu - 5396	dungchu@ms1.fa.gov.tw
Côte D'Ivoire	CÔTE D'IVOIRE - Amandè, Monin Justin - 4299	monin.amande@yahoo.fr; monin.amande@cro-ci.org
Cuba	CUBA - Aleaga Aguilera, Liudmila - 2963	aleagaliudmila@yahoo.com
Curaçao	CURAÇAO - Mambi, Stephen A. - 1985	stephenmambi@yahoo.com; stephen.mambi@gobiernu.cw
Ecuador	ECUADOR - Morán Velázquez, Guillermo - 1501	guillermo.moran@pesca.gov.ec;diregpesca@pesca.goav.ec
Egypt	EGYPT - Salem, Ahmed - 3139	ahmedsalem.gafrd@gmail.com; Information@gafrd.org
El Salvador	EL SALVADOR - Portillo, Gustavo Antonio - 5175	gustavo.portillo@mag.gob.sv
European Union	EUROPEAN UNION - Franicevic, Vlasta - 251	vlasta.franicevic@mps.hr
European Union	EUROPEAN UNION - Pascual Alayón, Pedro José - 384	pedro.pascual@ca.ieo.es
European Union	EUROPEAN UNION - Ortiz de Zárate Vidal, Victoria - 466	victoria.zarate@st.ieo.es
European Union	EUROPEAN UNION - Rodríguez-Marín, Enrique - 493	rodriguez.marin@st.ieo.es
European Union	EUROPEAN UNION - Gaertner, Daniel - 579	daniel.gaertner@ird.fr
European Union	EUROPEAN UNION - Turenne, Julien Marc - 620	julien.turenne@agriculture.gouv.fr
European Union	EUROPEAN UNION - Tserpes, George - 649	gtserpes@hcmr.gr
European Union	EUROPEAN UNION - Coughlan, Susan - 658	susan.coughlan@sfpa.ie
European Union	EUROPEAN UNION - Conte, Fabio - 677	f.conte@politicheagricole.it
European Union	EUROPEAN UNION - Piccinetti, Corrado - 689	corrado.piccinetti@unibo.it
European Union	EUROPEAN UNION - Orsi Relini, Lidia - 691	largepel@unige.it
European Union	EUROPEAN UNION - Bertelletti, Mauro - 692	r.rigillo@politicheagricole.it; pesca@rpue.it
European Union	EUROPEAN UNION - Ferreira de Gouveia, Lidia - 718	lidia.gouveia@madeira.gov.pt
European Union	EUROPEAN UNION - Pereira, João Gil - 731	joao.ag.pereira@uac.pt
European Union	EUROPEAN UNION - O'Shea, Conor - 1947	conor.o'shea@sfpa.ie
European Union	EUROPEAN UNION - Afanasjeva, Aina - 2314	fish@latnet.lv

European Union	EUROPEAN UNION - Ribeiro, Cristina Castro - 2315	cribeiro@dgpa.min-agricultura.pt
European Union	EUROPEAN UNION - London, Noel - 2316	noel.london@defra.gsi.gov.uk
European Union	EUROPEAN UNION - Gatt, Mark - 3060	mark.gatt@gov.mt
European Union	EUROPEAN UNION - Bonhommeau, Sylvain - 3977	sylvain.bonhommeau@ifremer.fr
European Union	EUROPEAN UNION - Fernández Costa, Jose Ramón - 3987	jose.costa@ieo.es
European Union	EUROPEAN UNION - Kafouris, Savvas - 4288	skafouris@dfmr.moa.gov.cy
European Union	EUROPEAN UNION - Coelho, Rui - 4298	rpcoelho@ipma.pt
European Union	EUROPEAN UNION - , UE-GENERAL - 4562	MARE-B2@ec.europa.eu
European Union	EUROPEAN UNION - Floch, Laurent - 4693	laurent.floch@ird.fr
European Union	EUROPEAN UNION - Lizcano Palomares, Antonio - 5205	alizcano@magrama.es
European Union	EUROPEAN UNION - Walsh, Jamie - 5401	JamieF.Walsh@agriculture.gov.ie;jamiewalsh_ie@yahoo.com
European Union	EUROPEAN UNION - Ó Suibhealláin, Colm - 5418	colm.Osuilleabhain@agriculture.gov.ie
European Union	EUROPEAN UNION - Lino, Pedro Gil - 5664	plino@ipma.pt
European Union	EUROPEAN UNION - Koleva, Magdalina - 5721	magdalina.koleva@iara.government.bg
European Union	EUROPEAN UNION - Billet, Norbert - 6009	norbert.billet@ird.fr
European Union	EUROPEAN UNION - Sabarros, Philippe - 6010	philippe.sabarros@ird.fr
European Union	EUROPEAN UNION - Bach, Pascal - 6011	pascal.bach@ird.fr
Faroe Islands	FAROE ISLANDS - Kristiansen, Andras - 265	andrask@fisk.fo; fisk@fisk.fo
Faroe Islands	FAROE ISLANDS - Wang, Ulla S. - 1123	ullaw@fisk.fo
France (SPM)	FRANCE (SPM) - Chapalain, Marc - 771	Marc.Chapalain@equipement.gouv.fr;
		sam.dtam-975@equipement-agriculture.gouv.fr
France (SPM)	FRANCE (SPM) - Sinquin, Valérie - 778	valerie.sinquin@outre-mer.gouv.fr;
		sam.dtam-975@equipement-agriculture.gouv.fr
Ghana	GHANA - Bannerman, Paul - 801	paulbann@hotmail.com
Ghana	GHANA - Ayivi, Sylvia Sefakor Awo - 3981	asmasus@yahoo.com
Grenada	GRENADA - Aaron, François - 1517	agriculture@gov.gd; aafrancois2002@yahoo.com
Grenada	GRENADA - Justin, Rennie - 1519	agriculture@gov.gd; justinar7363@hotmail.com
Guatemala	GUATEMALA - Sandoval Reyes, Nancy Yesenia - 2266	yesis81@hotmail.com;dipescaguatemala@gmail.com
Guatemala	GUATEMALA - Marín Arriola, Carlos Francisco - 3494	cfmarin1058@gmail.com;dipescaguatemala@gmail.com;
		visardespacho@gmail.com
Guatemala	GUATEMALA - Góngora Benítez, Freddy Alejandro - 3939	freddy.gongora@gmail.com;dipescaguatemala@gmail.com
Guinea Bissau	GUINEA BISSAU - Pinto, Josepha Gomes - 6201	josephapinto@hotmail.com
Guinea Ecuatorial	GUINEA ECUATORIAL - Asumu Ndong, Lorenzo - 810	lorenzoasumu2013@gmail.com
Guinea Ecuatorial	GUINEA ECUATORIAL - Nzamio Nzene, Pergentino Owono - 81	opergentino@yahoo.com
Guinea Ecuatorial	GUINEA ECUATORIAL - Nguema Asangono, Mariano - 2619	marianonguemaasangono@yahoo.es
Guinea Ecuatorial	GUINEA ECUATORIAL - Ndongo Micha, Andrés - 2971	andresndongmicha@yahoo.es
Guinea Ecuatorial	GUINEA ECUATORIAL - Nso Edo Abegue, Ruben Dario - 3055	granmaestrozaiko@yahoo.es
Guinea Rep.	GUINEA REP. - Kaba, Amara Camara - 6247	amaragbe1@yahoo.fr
Honduras	HONDURAS - Hernández Molina, José Roberto - 818	secretaria@marinamercante.gob.hn; roberto.hernandez48@hotmail.com
Honduras	HONDURAS - Cabrera Quesada, Blas Norberto - 6022	BlasCabreraQ@hotmail.com
Iceland	ICELAND - Gudmundsson, Einar - 2040	eidur.gudnason@utn.stjr.is
Israel	ISRAEL - Sonin, Oren - 1935	orens@moag.gov.il
Japan	JAPAN - Okamoto, Hiroaki - 901	okamoto@fra.affrc.go.jp
Japan	JAPAN - Uosaki, Koji - 923	uosaki@affrc.go.jp
Japan	JAPAN - Nishida, Hiroshi - 1159	hnishi@affrc.go.jp
Korea Rep.	KOREA REP. - Kim, Doo Nam - 1920	doonam@korea.kr
Korea Rep.	KOREA REP. - Kwon, Youjung - 2001	kwonuj@korera.kr
Liberia	LIBERIA - Jueseah, Alvin Slewion - 5718	a.s.jueseah@liberiafisheries.net;alvinjueseah@yahoo.com
Libya	LIBYA - , - 961	secretaria@embajadadelibia.com; embajada@embajadadelibia.com;
		asuntosadministrativos@embajadadelibia.com
Libya	LIBYA - Alghawel, Mussab. F. B. - 5917	ceo@lfa.org.ly; mfl.dir-doic@mofa.gov.ly; cpc.libya.2017@gmail.com
Maroc	MAROC - Abid, Noureddine - 984	noureddine.abid65@gmail.com
Maroc	MAROC - Najem, Khalil - 2593	najem@mpm.gov.ma
Maroc	MAROC - Grichat, Hicham - 3077	grichat@mpm.gov.ma
Maroc	MAROC - Zahraoui, Mohamed - 4662	zahraoui@mpm.gov.ma; zahraouiay@gmail.com
Maroc	MAROC - Hassouni, Fatima Zohra - 5188	hassouni@mpm.gov.ma
Maroc	MAROC - Haoujar, Bouchra - 5467	haoujar@mpm.gov.ma
Maroc	MAROC - Aichane, Bouchta - 5961	aichane@mpm.gov.ma
Mauritania	MAURITANIA - Braham, Cheikh Baye - 5676	baye_braham@yahoo.fr; baye.braham@gmail.com
Mexico	MEXICO - Ramírez López, Karina - 2386	kramirez_inp@yahoo.com; kramirez.inp@gmail.com
Mexico	MEXICO - Estrada Jiménez, Martha Aurea - 3268	mestradaj@conapesca.gob.mx
Mexico	MEXICO - Said Palleiro Nayar, Julio - 6006	julio.palleiro@inapesca.gob.mx
Namibia	NAMIBIA - Iilende, Titus - 1907	titus.iilende@mfmr.gov.na
Namibia	NAMIBIA - Skrypzeck, Heidi - 2045	nskrypzeck@mfmr.gov.na
Nicaragua	NICARAGUA - Marenco Urcuyo, Miguel Angel - 2020	lobodemar59@gmail.com
Nicaragua	NICARAGUA - Jackson, Edward - 5921	ejackson@inpesca.gob.ni; vicepresidencia@inpesca.gob.ni;
Nigeria	NIGERIA - Udeh, B.C. - 3266	avamire@hotmail.com
Norway	NORWAY - Sandberg, Per - 1619	per.sandberg@fiskeridir.no
PAKISTAN	PAKISTAN - Ali Awan, Maratab - 5840	fdcofpakistan@gmail.com
Panama	PANAMA - Delgado Quezada, Raúl Alberto - 1042	rdelgado@arap.gob.pa; ivc@arap.gob.pa
Panama	PANAMA - Quirós, Mario - 1047	mquiros@arap.gob.pa; ordenacion@arap.gob.pa;
		marioquiros52@hotmail.com

Philippines	PHILIPPINES - Tabios, Benjamin F.S. Jr - 2944	tabios.bfar@yahoo.com.ph
Russian Federation	RUSSIAN FEDERATION - , - 1071	oms@atlantniro.ru
S. Tomé e Príncipe	S. TOMÉ E PRÍNCIPE - Do Espirito Costa, Graciano - 1095	costaesprito7@yahoo.com.br;dirpesca1@cstome.net
S. Tomé e Príncipe	S. TOMÉ E PRÍNCIPE - Pessoa Lima, Joao Gomes - 4832	dirpesca1@cstome.net; jpessoa61@hotmail.com
Senegal	SENEGAL - Ndaw, Sidi - 2346	sidindaw@hotmail.com; dopm@orange.sn; dpm@mpem.gouv.sn
Senegal	SENEGAL - Sow, Fambaye Ngom - 3435	famngom@yahoo.com
Senegal	SENEGAL - Sèye, Mamadou - 5953	mamadou.seye@mpem.gouv.sn; mdseye@gmail.com
Seychelles	SEYCHELLES - Clarisse Serge, Roy - 3853	royclarisse@gmail.com; royc@sfa.sc; Sadvisor@gov.sc
Sierra Leone	SIERRA LEONE - Mamie, Josephus C. J. - 3292	josephusmamie2013@gmail.com
South Africa	SOUTH AFRICA - Goosen Meyer, Melissa - 1100	melissag@daff.gov.za; mel.goosen@gmail.com
South Africa	SOUTH AFRICA - Winker, Henning - 6268	henningW@DAFF.gov.za; henning.winker@gmail.com
SRI LANKA	SRI LANKA - Piyasena, G. - 2282	depfish@diamond.landa.net
St. Kitts & Nevis	ST. KITTS & NEVIS - Browne, Nikkita - 5956	nikkita.browne@dmrskn.com
St. Kitts & Nevis	ST. KITTS & NEVIS - Heyliger, Dishon - 5957	dishon.heyliger@dmrskn.com
St. Vincent and Grenadines	ST. VINCENT AND GRENADINES - Ryan, Raymond - 1688	office.agriculture@mail.gov.vc; rayjoel3163@yahoo.com
St. Vincent and Grenadines	ST. VINCENT AND GRENADINES - Williams, Nathaniel - 2054	fishdiv@vincysurf.com; nwilliams@gov.vc;
		office.agriculture@mail.gov.vc
St. Vincent and Grenadines	ST. VINCENT AND GRENADINES - Straker, Leslie - 2326	office.agriculture@mail.gov.vc
Sta. Lucia	STA. LUCIA - Hubert-Medar, Patricia - 2046	deptfish@maff.egov.lc;patricia.medar@maff.egov.lc
Sta. Lucia	STA. LUCIA - Williams-Peter, Sarita - 2991	sarita.peter@maff.egov.lc;deptfish@maff.egov.lc
Syrian Arab Republic	SYRIAN ARAB REPUBLIC - Ali, Abdel Latif - 6209	eng.abdollateef@hotmail.com
Thailand	THAILAND - Karnasuta, Jaranthada - 2962	Jaranthk@fisheries.go.th;dgdof1@dof.thaigov.net
Trinidad & Tobago	TRINIDAD & TOBAGO - Martin, Louanna - 1129	lulumart@hotmail.com; lmartin@fp.gov.tt
Tunisie	TUNISIE - Sohlobji, Donia - 5870	sohlobji_donia@yahoo.fr; doniasohlobji@gmail.com
Turkey	TURKEY - Türkyilmaz, Turgay - 3086	turgay.turkyilmaz@tarim.gov.tr
Turkey	TURKEY - Elekon, Hasan Alper - 3452	hasanalper@gmail.com; hasanalper.elekon@tarim.gov.tr
Turkey	TURKEY - Günes, Erdinç - 4773	erdinc.gunes@tarim.gov.tr; erdincgunes67@gmail.com
Turkey	TURKEY - Erdem, Ercan - 5190	ercan.erdem@tarim.gov.tr
U.K.(O.T.)	U.K.(O.T.) - Benjamin, Gerald - 1993	gerald-benjamin@enrd.gov.sh
U.K.(O.T.)	U.K.(O.T.) - Clerveaux, Luc - 2060	lclerveaux@gmail.com
U.K.(O.T.)	U.K.(O.T.) - Hastings, Mervin - 2308	mhastings@gov.vg
U.K.(O.T.)	U.K.(O.T.) - Trott, Tammy M. - 3024	ttrott@gov.bm
U.K.(O.T.)	U.K.(O.T.) - Hayes, Roisin - 5395	Roisin.Hayes@fco.gov.uk; roisinhayes@rocketmail.com
Ukraine	UKRAINE - Romanov, Evgeny V. - 1744	island@crimea.com
United States	UNITED STATES - Brown, Craig A. - 1209	craig.brown@noaa.gov
United States	UNITED STATES - Díaz, Guillermo - 2080	guillermo.diaz@noaa.gov
Uruguay	URUGUAY - Domingo, Andrés - 1343	adomingo@dinara.gub.uy;dimanchester@gmail.com
Vanuatu	VANUATU - Taleo, Wayne Tony - 2477	ttaleo@gmail.com; ttaleo@vanuatu.gov.vu
Vanuatu	VANUATU - Jimmy, Robert - 2847	robert.jimmy@gmail.com
Venezuela	VENEZUELA - Gutiérrez, Xiomara - 1374	xjgutierrezm@yahoo.es

LIST OF TAGGING CORRESPONDENTS BY COUNTRY

PAIS	Nombre	Email
Albania	ALBANIA - Cobani, Mimoza - 5539	mimoza.cobani@bujqesia.gov.al; cobanimimi@yahoo.com
Barbados	BARBADOS - Willoughby, Stephen - 50	fishbarbados.dcfo@caribsurf.com; fishbarbados@caribsurf.com; bajanwahoo@yahoo.co.uk
Belize	BELIZE - Lanza, Valarie - 2370	valerie@immarbe.com; director@bhsfu.gov.bz
Belize	BELIZE - Pinkard, Delice - 2716	fishingadmin@immarbe.com; sr.fishofficer@bhsfu.gov.bz
Belize	BELIZE - Neal, Omari - 4601	wilpott@gmail.com;wilfredo@fisheries.gov.bz
Bolivia	BOLIVIA - Maldonado, Mijaíl Meza - 5399	pescamar@mindef.gob.bo; mijail.meza@mindef.gob.bo; mijail.meza@outlook.es
Brazil	BRAZIL - Arfelli, Carlos Alberto - 62	arfelli@pesca.sp.gov.br
Brazil	BRAZIL - Ferreira de Amorim, Alberto - 84	prof.albertoamorim@gmail.com
Brazil	BRAZIL - Hazin, Fabio H. V. - 88	fabio.hazin@depaq.ufrpe.br;fhvhazin@terra.com.br
Brazil	BRAZIL - Meneses de Lima, Jose Heriberto - 101	jose-heriberto-lima@ibama.gov.br;jhmeneses@hotmail.com
Brazil	BRAZIL - Travassos, Paulo - 116	p.travassos@depaq.ufrpe.br
Brazil	BRAZIL - Vasconcelos, José Airton - 117	jose.vasconcelos@ibama.gov.br; ja_vasconcelos@ig.com.br
Cabo Verde	CABO VERDE - Marques da Silva Monteiro, Vanda - 199	vanda.monteiro@indp.gov.cv
Canada	CANADA - Lapointe, Sylvie - 161	sylvie.lapointe@dfo-mpo.gc.ca
Canada	CANADA - Hanke, Alexander - 4238	alex.hanke@dfo-mpo.gc.ca
Canada	CANADA - Melvin, Gary - 5156	gary.melvin@dfo-mpo.gc.ca
Canada	CANADA - Dalton, Alex - 6008	alexander.dalton@dfo-mpo.gc.ca
CARICOM	CARICOM - Singh-Renton, Susan - 1757	susan.singhrenton@crfm.net
China P.R.	CHINA P.R. - Haiwen, Sun - 216	fishcngov@126.com
Chinese Taipei	CHINESE TAIPEI - Huang, Julia Hsiang-Wen - 1460	julia@ntou.edu.tw
Chinese Taipei	CHINESE TAIPEI - Lan, Tsung Wen - 4640	tsungwen@ms1.fa.gov.tw
Chinese Taipei	CHINESE TAIPEI - Wei, Dorine Dung Chu - 5396	dungchu@ms1.fa.gov.tw
Côte D'Ivoire	CÔTE D'IVOIRE - Amandè, Monin Justin - 4299	monin.amande@yahoo.fr; monin.amande@cro-ci.org
Curaçao	CURAÇAO - Mambi, Stephen A. - 1985	stephenmambi@yahoo.com; stephen.mambi@gobiernu.cw
Egypt	EGYPT - Abdel Hafiz, Serag Eldien - 2136	gafrd.egypt@gmail.com; Information@gafrd.org
El Salvador	EL SALVADOR - Portillo, Gustavo Antonio - 5175	gustavo.portillo@mag.gob.sv
European Union	EUROPEAN UNION - Francicevic, Vlasta - 251	vlasta.francicevic@mps.hr
European Union	EUROPEAN UNION - Ticina, Vjekoslav - 260	ticina@izor.hr
European Union	EUROPEAN UNION - Arrizabalaga, Haritz - 343	harri@azti.es
European Union	EUROPEAN UNION - De la Serna Ernst, José Miguel - 382	delaserna@ma.ieo.es
European Union	EUROPEAN UNION - Pascual Alayón, Pedro José - 384	pedro.pascual@ca.ieo.es
European Union	EUROPEAN UNION - Mejuto García, Jaime - 449	jaime.mejuto@ieo.es
European Union	EUROPEAN UNION - Ortiz de Zárate Vidal, Victoria - 466	victoria.zarate@st.ieo.es
European Union	EUROPEAN UNION - Rodríguez-Marín, Enrique - 493	rodriguez.marin@st.ieo.es
European Union	EUROPEAN UNION - Gaertner, Daniel - 579	daniel.gaertner@ird.fr
European Union	EUROPEAN UNION - Tserpes, George - 649	gtserpes@hcmr.gr
European Union	EUROPEAN UNION - Piccinetti, Corrado - 689	corrado.piccinetti@unibo.it
European Union	EUROPEAN UNION - Orsi Relini, Lidia - 691	largepel@unige.it
European Union	EUROPEAN UNION - Bertelletti, Mauro - 692	r.rigillo@politicheagricole.it; pesca@rpue.it
European Union	EUROPEAN UNION - Ferreira de Gouveia, Lidia - 718	lidia.gouveia@madeira.gov.pt
European Union	EUROPEAN UNION - Pereira, João Gil - 731	joao.ag.pereira@uac.pt
European Union	EUROPEAN UNION - Cosgrove, Ronan - 2041	cosgrove@bim.ie
European Union	EUROPEAN UNION - Peristeraki, Panagiota (Nota) - 2094	notap@hcmr.gr
European Union	EUROPEAN UNION - Gatt, Mark - 3060	mark.gatt@gov.mt
European Union	EUROPEAN UNION - Papadopoulos, Vassilis - 3101	vpapadopoulos@dfmr.moa.gov.cy
European Union	EUROPEAN UNION - Bonhommeau, Sylvain - 3977	sylvain.bonhommeau@ifremer.fr
European Union	EUROPEAN UNION - , UE-GENERAL - 4562	MARE-B2@ec.europa.eu
European Union	EUROPEAN UNION - Lino, Pedro Gil - 5664	plino@ipma.pt
France (SPM)	FRANCE (SPM) - Chapalain, Marc - 771	Marc.Chapalain@equipement.gouv.fr; sam.dtam-975@equipement-agriculture.gouv.fr
Gabon	GABON - Mbourou, Jeannot Ghislain - 788	mbj200772@caramail.com
Ghana	GHANA - Bannerman, Paul - 801	paulbann@hotmail.com
Ghana	GHANA - Ayivi, Sylvia Sefakor Awo - 3981	asmasus@yahoo.com
Guatemala	GUATEMALA - Sandoval Reyes, Nancy Yesenia - 2266	yesis81@hotmail.com;dipescaguatemala@gmail.com
Guatemala	GUATEMALA - Marín Arriola, Carlos Francisco - 3494	cfmarin1058@gmail.com;dipescaguatemala@gmail.com; visardespacho@gmail.com
Guatemala	GUATEMALA - Góngora Benítez, Freddy Alejandro - 3939	freddy.gongora@gmail.com;dipescaguatemala@gmail.com
Guinea Bissau	GUINEA BISSAU - Nbunde, Mário Abel - 6202	nboma@hotmail.com
Guinea Ecuatorial	GUINEA ECUATORIAL - Asumu Ndong, Lorenzo - 810	lorenzoasumu2013@gmail.com

Guinea Ecuatorial	GUINEA ECUATORIAL - Nzamio Nzene, Pergentino Owono - 8	opergentino@yahoo.com
Guinea Ecuatorial	GUINEA ECUATORIAL - Nguema Asangono, Mariano - 2619	marianonguemaasangono@yahoo.es
Guinea Ecuatorial	GUINEA ECUATORIAL - Ndongo Micha, Andrés - 2971	andresndongmicha@yahoo.es
Guinea Ecuatorial	GUINEA ECUATORIAL - Nso Edo Abegue, Ruben Dario - 3055	granmaestrozaiko@yahoo.es
Guinea Rep.	GUINEA REP. - Camara, Youssouf Hawa - 2291	youssoufh@hotmail.com; youssoufh@yahoo.fr
Honduras	HONDURAS - Hernández Molina, José Roberto - 818	secretaria@marinamercante.gob.hn; roberto.hernandez48@hotmail.com
Honduras	HONDURAS - Cabrera Quesada, Blas Norberto - 6022	BlasCabreraQ@hotmail.com
Iceland	ICELAND - Sigurdsson, Thorsteinn - 833	steini@hafro.is
Iceland	ICELAND - Gudmundsson, Einar - 2040	eidur.gudnason@utn.stjr.is
ISSF	ISSF - Scott, Gerald P. - 1315	gpscott_fish@hotmail.com
Japan	JAPAN - Okamoto, Hiroaki - 901	okamoto@fra.affrc.go.jp
Korea Rep.	KOREA REP. - Kwon, Youjung - 2001	kwonuj@korera.kr
Korea Rep.	KOREA REP. - Lee, Sung Il - 4597	k.sungillee@gmail.com; k.sungillee@korea.kr
Liberia	LIBERIA - Jueseah, Alvin Slewion - 5718	a.s.jueseah@liberiafisheries.net;alvinjueseah@yahoo.com
Libya	LIBYA - , - 961	secretaria@embajadadelibia.com; embajada@embajadadelibia.com; asuntosadministrativos@embajadadelibia.com
Libya	LIBYA - Alghawel, Mussab. F. B. - 5917	ceo@lfa.org.ly; mfl.dir-doic@mofa.gov.ly; cpc.libya.2017@gmail.com
Maroc	MAROC - Abid, Noureddine - 984	noureddine.abid65@gmail.com
Mauritania	MAURITANIA - Bouzouma, Mohamed Elmoustapha - 5938	bouzouma@yahoo.fr
Mexico	MEXICO - Ramírez López, Karina - 2386	kramirez_inp@yahoo.com; kramirez.inp@gmail.com
Mexico	MEXICO - Estrada Jiménez, Martha Aurea - 3268	mestradaj@conapesca.gob.mx
Mexico	MEXICO - Said Palleiro Nayar, Julio - 6006	julio.palleiro@inapesca.gob.mx
Namibia	NAMIBIA - Skrypzeck, Heidi - 2045	nskrypzeck@mfmr.gov.na
Nicaragua	NICARAGUA - Marenco Urcuyo, Miguel Angel - 2020	lobodemar59@gmail.com
Nicaragua	NICARAGUA - Jackson, Edward - 5921	ejackson@inpesca.gob.ni; vicepresidencia@inpesca.gob.ni;
Nigeria	NIGERIA - Oyebanji, M.O. - 3265	samolayeni@yahoo.co.uk
Norway	NORWAY - Nottestad, Leif - 2033	leif.nottestad@imr.no
PAKISTAN	PAKISTAN - Ali Awan, Maratab - 5840	fdcofpakistan@gmail.com
Panama	PANAMA - Delgado Quezada, Raúl Alberto - 1042	rdelgado@arap.gob.pa; ivc@arap.gob.pa
Panama	PANAMA - Quirós, Mario - 1047	mquiros@arap.gob.pa; ordenacion@arap.gob.pa; marioquiros52@hotmail.com
Philippines	PHILIPPINES - Tabios, Benjamin F.S. Jr - 2944	tabios.bfar@yahoo.com.ph
Russian Federatio	RUSSIAN FEDERATION - , - 1071	oms@atlantniro.ru
Russian Federatio	RUSSIAN FEDERATION - Galina, Chernega - 4596	oms@atlantniro.ru
S. Tomé e Príncipe	S. TOMÉ E PRÍNCIPE - Do Espirito Costa, Graciano - 1095	costaesprito7@yahoo.com.br;dirpesca1@cstome.net
S. Tomé e Príncipe	S. TOMÉ E PRÍNCIPE - Pessoa Lima, Joao Gomes - 4832	dirpesca1@cstome.net; jpessoa61@hotmail.com
Senegal	SENEGAL - Sow, Fambaye Ngom - 3435	famngom@yahoo.com
Sierra Leone	SIERRA LEONE - Mamie, Josephus C. J. - 3292	josephusmamie2013@gmail.com
South Africa	SOUTH AFRICA - Da Silva, Charlene - 1101	CharleneD@daff.gov.za
South Africa	SOUTH AFRICA - Kerwath, Sven - 4714	SvenK@daff.gov.za
South Africa	SOUTH AFRICA - Wilke, Christopher - 6491	christopherw@daff.gov.za
Trinidad & Tobago	TRINIDAD & TOBAGO - Martin, Louanna - 1129	lulumart@hotmail.com; lmartin@fp.gov.tt
Tunisie	TUNISIE - Hattour, Abdallalh - 1139	abdallah.hattour@instm.rnrt.tn
Turkey	TURKEY - Günes, Erdinç - 4773	erdinc.gunes@tarim.gov.tr; erdincgunes67@gmail.com
Turkey	TURKEY - Erdem, Ercan - 5190	ercan.erdem@tarim.gov.tr
U.K.(O.T.)	U.K.(O.T.) - Benjamin, Gerald - 1993	gerald-benjamin@enrd.gov.sh
U.K.(O.T.)	U.K.(O.T.) - Trott, Tammy M. - 3024	ttrott@gov.bm
United States	UNITED STATES - Prince, Eric D. - 1303	eric.prince@noaa.gov
Uruguay	URUGUAY - Domingo, Andrés - 1343	adomingo@dinara.gub.uy;dimanchester@gmail.com
Vanuatu	VANUATU - Taleo, Wayne Tony - 2477	ttaleo@gmail.com; ttaleo@vanuatu.gov.vu
Vanuatu	VANUATU - Jimmy, Robert - 2847	robert.jimmy@gmail.com
Venezuela	VENEZUELA - Gutiérrez, Xiomara - 1374	xjgutierrezm@yahoo.es

Appendix 12

Work Plans of the Species Groups for 2018

Tropical Tuna Work Plan

Paragraph 44 of Recommendation [16-01] requested SCRS to conduct a new stock assessment for bigeye tuna in 2018. This is consistent with the strategic research plan of the SCRS and is considered a priority because 1) the last assessment was conducted in 2015, 2) the overexploited status of the stock requires a close monitoring of the population, 3) the TAC agreed for 2016 has been overshot, 4) since the last assessment there have been significant changes to fishery historical data, and 5) new information from the AOTTP Programme would be available to inform the stock assessment. The stock assessment methods used in 2015 for providing the management advice (SS3 and ASPIC) should be used, in addition to other methods available in ICCAT stock assessment software catalogue, in 2018 bigeye stock assessment; which will require substantial data preparatory work by the Secretariat and other members of the Group. Moreover, Recommendation [16-01] and the ICCAT Working Group on FADs also requested the Tropical Working Group to address several questions in 2018, such as the analysis of the current FAD moratoria detailed in Rec. [16-01], standardization of FAD fishery definition and indicators, etc. Thus, due to the large workload foreseen for 2018, the Group considered that a *data preparatory meeting* is necessary during the second quarter of 2018 to prepare the *bigeye assessment Working Group meeting* during the third quarter of 2018.

Bigeye Data Preparatory meeting (quarter 2)

The Group requests that all data inputs be prepared through 2017. If the data meeting occurs before July 2018, the Group recognizes that some data inputs may be available only up to 2016 (which should be updated to 2017 before the stock assessment.

The Group considered the following work plan elements for the bigeye data preparatory meeting:

- Update bigeye catches (T1 and T2CE: catch and effort, T2SZ: size frequency) for all CPCs and fleets up until the year 2017. Responsibility: CPCs; deadline: one week before the bigeye data preparatory meeting.

- Improving ICCAT Task I and II data, including complete the re-estimation of the historic Ghanaian statistics for bigeye (yellowfin and skipjack) up to 2017. Bearing in mind that there is funding available to improve the Ghanaian statistics, the Group reiterates the need for scientists from EU and Ghana to collaborate to adapt the T3 software and engage in capacity building to facilitate its use. This exercise will include:

    - A workshop/training on the T3 treatments procedure to correct logbook data (hypotheses, tools, etc.);
    - Comparison of catch estimation by T3+ process and the resulting estimation using alternative methods;
    - Organize capacity building for African nations and others CPCs involved in this issue.

  Responsibility: IRD, MFRD (Ghana) and National scientists in conjunction with the Secretariat; deliverable: SCRS document and estimation of tropical tuna fishery statistics for bigeye, skipjack and yellowfin up to 2017; deadline: one week before the bigeye data preparatory meeting.

- The combined historical "FIS" fishery (FRA+CIV+SEN, before 1991) be split in Task II (T2CE and T2SZ/CAS) and allocated to the respective CPC in the line of what was made in Task I catches in the past. The same break down is required (T2CE and CAS) for the combined tropical ETRO fisheries (NEI-ETRO combined fleet) affecting mainly purse seine before 2006. Responsibility: Secretariat in collaboration with involved CPCs; deadline: one week before the bigeye data preparatory meeting.

- Estimations of *faux poisson* to be provided up to 2017. Responsibility: IRD/CRO; deadline: one week before the bigeye data preparatory meeting; deliverable: SCRS document and estimation of tropical tuna fishery statistics for bigeye, skipjack and yellowfin up to 2017.

- Preparation of a preliminary bigeye CAS/CAA for discussion during the data preparatory meeting. Responsibility: Secretariat; deadline: one week before the bigeye data preparatory meeting; deliverable: SCRS document.

- Update of standardized bigeye CPUE indices until 2017 for the Brazil, Chinese Taipei, Japan, Morocco, United States and Uruguay, and longline fleets. Note that indices for fleets that have wide spatial coverage have to also be provided by area (North, Equatorial and South) as agreed in the last assessment and ideally by year/quarter. Responsibility: CPCs; deadline: one week before the bigeye data preparatory meeting; deliverable: SCRS document and bigeye CPUE indices up to 2017.

- Update of standardized bigeye CPUE indices until 2017 for the European baitboat fishery (Azores and the fleet operating in Dakar) and purse seine fleets separated by fishing mode (FAD and free) by year/quarter. Responsibility: CPCs; deadline: one week before the bigeye data preparatory meeting; deliverable: SCRS document and bigeye CPUE indices up to 2017.

- Update biological information:

    - Indian and Pacific Oceans tagging data showed that bigeye longevity is over 10 years, which may imply lower natural mortality rates than previously being assumed for the Atlantic Ocean. Therefore, last assessment adopted a lower natural mortality vector which is considered to more appropriately reflect the longer longevity. AOTTP data and other sources could be reviewed to infer the most appropriate mortality vector to be used in the assessment. Different mortality vectors should be used as sensitivity cases in the assessment. Responsibility: CPCs; deadline: one week before the bigeye data preparatory meeting; deliverable: SCRS document;

    - Uncertainties in bigeye growth could be also affect the stock assessment. AOTTP data would be very valuable to infer most appropriate growth curve for bigeye for the Atlantic Ocean. Different growth curves should be used as sensitivity cases in the assessment. Responsibility: CPCs; deadline: one week before the bigeye data preparatory meeting; deliverable: SCRS document;

    - A knife-edge maturity was used in 2015 assessment. Recent sampling efforts in the Atlantic has produced a yellowfin maturity ogive based on histological analysis (Diaha *et al.,* 2016) which was used in the most recent yellowfin assessment. Develop a bigeye tuna maturity ogive based on histological analysis to be used in 2018 stock assessment. Responsibility: CPCs; deadline: one week before the bigeye data preparatory meeting; deliverable: SCRS document;

    - Update tagging information about movements using most recent results of the AOTTP. Responsibility: CPCs and Secretariat; deadline: one week before the bigeye data preparatory meeting; deliverable: SCRS document.

Bigeye stock assessment meeting (quarter 3)

- Update T1 and T2 data and produce the final Catch at Size/Age matrix to be used in the stock assessment. Responsibility: Secretariat; deadline: one month before the bigeye stock assessment meeting.

- Review diagnostics of stock assessment models and select final stock assessment models to be used for management advice.

- Review and agree the input parameters for projections of the stock assessment models to provide the management advice.

- Prepare the detailed report of the stock assessment meeting

- Discuss and develop draft executive summary of bigeye

MSE

- Communicate with the Commission to determine appropriate performance metrics for the Tropical Tuna MSE. Discuss performance metrics for single and multiple species models. Responsibility: SCRS Chair; deadline: one month before bigeye assessment meeting.

- Continue to develop and review operating models. Responsibility: National scientists; deliverable: SCRS Document(s); deadline: one month before bigeye assessment meeting.

Start the review of AOTTP data and programme

- Review data collected and give feedback. Responsibility: National scientists; deadline: one month before data preparatory meeting.

- Evaluate new scientific information to be used for estimation mortality, growth rate, spatial structure, movement, etc. Responsibility: National scientists; deliverable: SCRS Document(s); deadline: one month before bigeye data preparatory meeting.

Analyze the efficacy of the new area/time closure in relation to the protection of juvenile tropical tunas pursuant Rec. 16-01 (e.g. by reviewing the data collected through the AOTTP)

Using data through 2016:

- Examine the catch, effort and size frequency (Task II) of yellowfin and bigeye tuna landed by surface fleets in the tropical Atlantic by 1x1 grid and month.

- Evaluate time/area closures that could achieve certain percentage (10% to 50%) reductions in the annual catches juvenile yellowfin and bigeye tuna.

- Provide information on how these reductions will affect the projected stock status (i.e. SSB/SSB_{MSY} and F/F_{MSY}) and recovery schedule, and other measures as possible (e.g. YPR, SPR).

  Responsibility: National scientists; deliverable: SCRS Document(s); deadline: one month before bigeye data preparatory meeting.

Expected impacts on MSY and stock status of different gear catch contribution

- Develop a table for consideration by the Commission that quantifies the expected impact on MSY, B_{MSY}, and relative stock status for both bigeye and yellowfin resulting from reductions of the individual proportional contributions of longline, FAD purse seine, free school purse seine, and baitboat fisheries to the total catch. Rec. [16-01] paragraph 49 (c). *Responsibility:* National Scientists; *deliverable:* text and supporting tables/figures for Commission Response; *deadline:* one week prior to SCRS Species Group meeting.

Review Ghana's comprehensive and detailed capacity management plan (Rec. [16-01] paragraph 12c)

- Combine the datasets into a single format that can be used to support the necessary analyses. Responsibility: Secretariat; deliverable: Dataset; deadline: one month before bigeye data assessment meeting.

Albacore Work Plan

During 2017, the Mediterranean albacore stock was assessed and several research lines were identified in order to improve future stock monitoring. Likewise, substantial progress was made on the development of the North Atlantic albacore MSE framework, which has been specifically tailored to evaluate a series of model-based HCRs within a Management Procedure that mimics the 2016 stock assessment of North Atlantic albacore. As such, the Committee considers that the MSE for North Atlantic albacore should continue its development in the coming years and many future avenues to improve the framework were identified. In 2018, the Albacore Tuna Species Group plans to further develop the MSE framework for North Atlantic albacore, improve biological knowledge for Mediterranean albacore and improve CPUE series for all three stocks. No intersessional meetings are envisaged, but a three day meeting during the Species Groups is suggested.

North Atlantic Stock Proposed Work Plan

Given the uncertainty on the results obtained in the last 2016 assessment, the Group reiterates the need to carry out a comprehensive Research Programme (see **Appendix** to albacore work plan). The main research objectives identified by the Albacore Species Group are:

1. Improved knowledge of the biology and ecology

2. Improved monitoring of stock status

3. Development of Management Strategy Evaluation framework

The Committee endorses the proposed research plan and recommends funding be initiated in 2018 or as soon as possible.

During 2018, a small open group will work electronically to continue the development of the MSE framework, following the advice of the SCRS and the Commission. The work will include conducting additional diagnostic checks (e.g. the characterization of the unrealistic runs and alternatives to decrease their frequency) and exploring additional management procedures (e.g. alternative stock assessment models, model free management procedures). As for the operating models, it is important to characterize those OMs that might not be meeting the objectives under certain HCRs. Additional OMs that consider alternative realities (e.g. regime shifts, autocorrelated recruitment, changes in selectivity) can also be added to the current set of OMs.

Deadline: one week before the Species Group meeting. Deliverable: SCRS documents, following the standards provided by the WGSAM. Responsibility: CPCs.

In addition, it is recommended to produce new, or improve existing CPUE indices, namely:

- French MWT: standardize CPUE and produce new index;
- Japanese longline: consider alternative ways to incorporate targeting effects (e.g. based on species composition) to try to recover the early periods;
- Korean, EU-Portugal and EU-Spain longline: consider using albacore by-catch information during swordfish oriented operations to produce an abundance index.

Deadline: one week before the Species Group meeting. Deliverable: SCRS documents, following the standards provided by the WGSAM. Responsibility: CPCs.

It is also requested that the recent submissions of Task II data by EU-France be documented, so that the Working Group can decide to accept the new data, or not. Deadline: Species Groups meeting. Deliverable: SCRS document. Responsibility: EU-France.

South Atlantic Stock Proposed Work Plan

It is recommended to produce new, or improve existing CPUE indices, namely:

- Compare and consider feasibility of joint CPUE analyses for longline fleets (Brazil, Chinese Taipei, Japan, Uruguay,) using fine scale, operational level data.

Deadline: one week before the interssessional meeting. Deliverable: SCRS documents, following the standards provided by the WGSAM. Responsibility: CPCs.

Mediterranean Albacore Stock Proposed Work Plan

Given the uncertainty on the results obtained in the last 2017 assessment, the main research objectives identified by the Albacore Species Group are:

1. Improved knowledge of the biology (reproduction, growth and age) and ecology;

2. Improved monitoring of stock status, including update of the CPUE series used in the assessment (EU-Spain longline, EU-Italy longline, Balearic larval survey) to confirm recent stock trends;

3. Explore alternative stock assessment methods suitable for data poor stocks.

Deadline: one week before the interssessional meeting. Deliverable: SCRS documents, following the standards provided by the Working Group on Stock Assessment Methods (WGSAM). Responsibility: EU-Spain, EU-Italy.

Appendix to albacore work plan

North Atlantic Albacore tuna Research Programme

The Albacore Species Group proposes to initiate a coordinated, comprehensive four yearlong research programme on North Atlantic albacore to advance knowledge of this stock and be able to provide more accurate scientific advice to the Commission. This plan is based on the plan presented in 2010, which was based on document Ortiz de Zárate, 2011 that has been revised according to new knowledge, reconsidering the new most important priorities and reducing the total cost.

The research plan will be focused on three main research areas: biology and ecology, monitoring stock status and management strategy evaluation, during a four-year period.

Biology and Ecology

The estimation of comprehensive biological parameters is considered a priority as part of the process of evaluating northern albacore stock capacity for rebounding from limit reference points. Additional biological knowledge would help to establish priors for the intrinsic rate of increase of the population as well as the steepness of the stock recruitment relationship, which would facilitate the assessment. Among the key biological parameters are ones related to the reproductive capacity of the northern albacore stock, which include sex-specific maturity schedules (L50) and egg production (size/age related fecundity). In order to estimate comprehensive biological parameters related to the reproductive capacity of the northern albacore stock, an enhanced collection of sex-specific gonad samples need to be implemented throughout the fishing area where known and potential spawning areas have been generally identified. The collection of samples need to be pursued by National scientists from those fleets known to fish in the identified areas and willing to collaborate in the collection of samples for the analysis. Potential CPCs that could collaborate with the sampling programme may include (but not limited to): Chinese-Taipei, Japan, USA and Venezuela. Expected results will include a comprehensive definition of sex-specific maturity development for albacore, spatial and temporal spawning grounds for northern albacore, estimate of L50 and size/age related fecundity.

The albacore Working Group also recommended further studies on the effect of environmental variables on CPUE trends of surface fisheries. The understanding of the relationship between albacore horizontal and vertical distribution with the environment will help disentangle abundance signals from anomalies in the availability of albacore to surface fleets in the North East Atlantic.

It is also proposed to conduct an electronic tagging experiment to know more about the spatial and vertical distribution of albacore throughout the year. Given the typically high cost of this kind of experiment, and the difficulties to tag albacore with electronic tags, it is proposed to deploy 50 small size pop up tags in different parts of the Atlantic where albacore is available to surface fisheries (to guarantee good condition and improve survival), namely the Sargasso sea and off Guyanas, off USA/Canada, Azores-Madeira-Canarias, and the Northeast Atlantic.

Last, the existence of potential subpopulations in the North Atlantic has been largely discussed in the literature. While recent genetic studies suggest genetic homogeneity (Laconcha *et al.* 2015), otolith chemistry analyses (Fraile *et al.* 2016) suggested the potential existence of different contingents, which could also have important management implications. Thus, in order to clarify the existence of potential contingents, we propose to expand the limited study area in Fraile *et al.* (2016) to the entire North Atlantic, as well as to address inter-annual variability through multiyear sampling and analysis of otolith chemistry.

Monitoring of stock status

The Group recommends the joint analysis of operational catch and effort data from multiple fleets be undertaken, following the example of other species working groups. This would provide a more consistent view of population trends, compared to partial views offered by different fleets operating in different areas. The analysis is suggested for both longline fleets operating in the central and western Atlantic, and surface fleets operating in the northeast Atlantic.

Finally, given the limitations of the available fishery dependent indicators, the Group mentioned the need to investigate fishery independent abundance indices. Although the Group is aware that, in the case of albacore, there are not many options to develop such fishery independent indices of abundance, it is proposed to conduct a feasibility test using acoustics during baitboat fishery operations to improve the currently available indices. A fine scale analysis for surface fisheries catch of albacore recruits (Age 1) is suggested to analyse the feasibility of designing some transect based approach for a recruitment index.

Management Strategy Evaluation

The Albacore Species Group recommends that further elaboration of the MSE framework be developed for albacore, considering the recommendations by the Methods and the Albacore tuna Working Groups, as well as the guidance of the Commission and the t-RFMO initiative. Among other things, work should be promoted towards exploring additional operation models (e.g. considering autocorrelated recruitment or regime shifts), improving observation error models (e.g. considering changes in catchability over time), considering alternative management procedures (e.g. harvest control rules that consider bounds to the management action, alternative stock assessment models, and CPUEs with different characteristics, such as very noisy CPUEs or CPUEs that track only some age classes), and considering implementation error (or systematic bias). There is also a need to discuss and propose alternative performance indicators and find better ways to communicate results.

The total requested funds to develop this research plan have been estimated in 1.192.000 Euros, with 542,000 Euros to cover priority 1 tasks. The research programme will be an opportunity to join efforts from an international multidisciplinary group of scientists currently involved in specific topics and fisheries.

Budget

Research aim	*Priority*	Approximate 4 year cost (€)
Biology and Ecology		
Reproductive biology (spawning area, season, maturity, fecundity)	1	200,000
Environmental influence on NE Atlantic surface CPUE	1	50,000
Distribution throughout the Atlantic (e-tags)	2	350,000
Population structure: contingents	3	120,000
Monitoring stock status		
Joint Atlantic longline CPUE	1	30,000
Joint NE Atlantic surface CPUE	1	12,000
Feasibility of fisheries independent survey	3	180,000
Management Strategy Evaluation		
Development of MSE framework	1	250,000
	Total	**1,192,000**

Timeline

Research aim	*Year 1*	*Year 2*	*Year 3*	*Year 4*
Biology and Ecology				
Reproductive biology (spawning area, season, maturity, fecundity)	x	x	x	
Environmental influence on NE Atlantic surface CPUE	x	x		
Distribution throughout the Atlantic (e-tags)	x	x	x	x
Population structure: contingents	x	x	x	x
Monitoring stock status				
Joint Atlantic longline CPUE	x	x		
Joint NE Atlantic surface CPUE	x	x		
Feasibility of fisheries independent survey		x	x	x
Management Strategy Evaluation				
Observation error: CPUE error structures and age classes	x			
Management Procedure: delay difference models	x			
Operating models: regime shifts	x			
Management Procedure: HCRs with bounded TACs	x	x		
Observation error: changes in catchability over time		x	x	
Implementation error		x	x	
Operating models: changes in selectivity		x	x	
Operating models: autocorrelated recruitment		x	x	
Operating models: broader scenarios using MFCL or SS			x	x
Communication: performance indicators and plotting	x	x	x	x

Bluefin Tuna Work Plan

In 2017 the SCRS held two intersessional meetings (data preparatory and stock assessment meeting) to incorporate new information in the ICCAT databases and new modeling frameworks into the assessments of both the eastern and the western bluefin tuna stocks. Given the uncertainties identified in these assessments, the SCRS focused on providing short-term advice through 2020. Accordingly, the SCRS recommends that the next assessment be conducted in 2020.

In the interim, the SCRS proposes to focus its efforts on addressing several areas where the data and assessments might be improved. No intersessional meetings will be scheduled for 2018. The work plan for 2018 is as follows:

1. Update the scientific advice at the species group meeting preceding the 2018 SCRS plenary based on: a) revised forecasts that take into account the actual catches in 2016 and 2017; and, b) updated fishery indicators (as prescribed by Rec. [12-03], paragraph 50). Action National Scientists and Secretariat.

2. Hold a meeting of the Core Modelling Group (TBD in 2018) to specify remaining characteristics of the operating model; define the scope of possible management procedures; and agree on a detailed time schedule for the next few years for use by ICCAT GYBP, the SCRS, and the Commission.

3. Engage in research to address key uncertainties in the assessment, such as:

   (a) Hold a workshop (perhaps sponsored by ICCAT GBYP) to investigate the spawning behaviour of bluefin tuna and in particular at each age class that actively contribute to spawning each year.

   (b) Identify environmental factors that affect catchability at basin and local scales and explore methods for incorporating these factors in the index standardization. The potential for combining the data and creating a joint handline index should also be explored.

   (c) Collect paired hard parts (spines and otoliths) in both the East and West to help estimate the bias across all ages. Complete aging of the backlog of eastern and Mediterranean otoliths, focusing primarily on the gaps in size and spatio-temporal fishery (ies) representativeness. The effect of bin-size on age-length keys construction should be investigated.

   (d) Improve partitioning of the time series of Mediterranean purse seine catches between small (<160 SFL) and large (>160 cm SFL).

   (e) Review and submit Task II size frequency data by fleet. Fill in the gaps in the size composition data (historical and future) to be representative of the temporal and spatial fishing patterns.

   (f) Further investigate comparability over time of the Mediterranean EU-France aerial survey and the larval survey.

   (g) Review protocols and guidance developed by the bluefin tuna working group on model selection and projections (possibly through the SCRS Methods Working Group) with a view towards adopting a standard approach for analysts providing stock assessment models to future SCRS assessments.

4. All members of the Species Group are encouraged to attend the planned meeting in 2018 on the MSE work and the Core Modelling Group. It was noted that those involved in developing candidate MPs do not need to be experts in MSE.

Billfish Work Plan

Assessments for the marlin stocks were conducted in 2011 (blue marlin), and 2012 (white marlin). The next stock assessments for the marlin species are schedule for 2018 (blue marlin) and 2019 (white marlin).

For the upcoming blue marlin stock assessment in 2018 two intersessional meetings will be held, the first meeting will be a Data Preparatory (DP) meeting to compile and analyze all existing information required for the stock assessment, and the second meeting will be the stock assessment (SA) meeting.

Several high priority tasks have been identified that require increased effort, including, but not limited to:

Catch and Effort Data (Task I and II)

Important blue 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. In past assessments, the quality and completeness of Task I and II data has been of great concern. Therefore, all countries catching billfishes (directed or by-catch) should report species-specific catch, catch-at-size, and effort statistics by as small area as possible, and by month. Historical catch data should be revised at the species level and provided to ICCAT within the established deadlines.

It is a very high priority to have comprehensive analyses of species-specific billfish catch and effort statistics from small scale (or artisanal) fisheries of CPCs and non-CPCs operating in the Convention area, specifically from the Caribbean region. Noting that fund allocation is highly likely, the terms of reference for this endeavor are included as an **Appendix** of the present billfish work plan.

Discards

Information on the number of blue marlin landed, and the numbers discarded (dead and released alive) should be reported in order to fully quantify catches in all months and areas. Reporting of these data should meet the ICCAT deadlines for submission of Task I and II data. National scientists and the ICCAT Secretariat can collaborate to investigate whether the available observer data provide insights into the low reporting of dead/live discards. A need for determining levels of post release mortality warrants additional research, so that the full effects of blue marlin discards can be included in the next stock assessment. This research must be presented at the data preparatory meeting.

Standardized CPUE series (Spatially explicit)

Noting the severe difficulties in interpreting and fitting indices within stock assessment models, it is recommended that national scientists of all CPCs coordinate their work to consider how to reconcile divergent CPUE patterns that may be a function of changes in fleet spatial distribution, oceanography, and/or targeting. Therefore, for the next blue marlin assessment efforts should be made to include combined indices of fleets with similar operational characteristics, or that estimated indices be area specific indices of abundance and include additional gear types (not just LL). These standardized CPUE series must be provided at the data preparatory meeting for evaluation.

Life history parameters

Recent marlin and sailfish assessments have relied on growth parameters estimates from other Oceans which may have an unwanted effect on the results of the Atlantic species assessments. Efforts should be made to coordinate interested national scientists in conducting growth and maximum age estimate studies for Atlantic blue marlin. A review of all life history information for Atlantic blue marlin will be compiled prior to the data preparatory meeting.

Tag-recapture information

A comprehensive analysis of the available tagging data for billfish in the ICCAT and other relevant databases are warranted. In recent billfish stock assessment tag-recapture data have been revised, but a comprehensive analysis is missing. Noting the potential use of tagging data applied to Stock Synthesis models, the ICCAT data will be further evaluated to determine its appropriate value for inclusion in the next blue marlin stock assessment. The Secretariat will provide the data and national scientists will conduct the analysis during the data preparatory meeting.

Appendix to the billfish work plan

Terms of Reference

Comprehensive study of strategic investments related to artisanal fisheries data collection in ICCAT fisheries of the Caribbean/Central American region

Proposed Project:

Conduct an inventory of existing data collection programmes in ICCAT fisheries of the Caribbean/Central America States and develop specific recommendations to improve data reporting in artisanal fisheries in the region.

Rationale and Objectives:

ICCAT's Standing Committee on Research and Statistics (SCRS) has identified the need to strengthen data collection and reporting for artisanal fisheries targeting ICCAT species (with particular focus on those targeting billfish and shark species) in the Caribbean and Central American region. Since 2003, ICCAT funds have been invested to help improve the collection of tuna fishery statistics by Parties which do not have sufficient capacity to meet some of their obligations. Success has been seen with projects in Côte d'Ivoire, Morocco, Senegal, and Venezuela. Other Contracting Parties have also benefited from these funds to recover historical data or conduct surveys in the context of artisanal fisheries.

In 2014, ICCAT funded a Strategic Investment Inventory for artisanal fisheries of West Africa. Using that study as a model, this project aims to get a clear understanding of existing data collection programmes and investments related to artisanal fisheries of the Caribbean/Central American region targeting ICCAT species (giving priority to those targeting billfish and shark species), in order to avoid duplication of effort and maximize the effectiveness of ICCAT's capacity building funds. The inventory will be used to support collaboration with relevant programmes in the regions. Ultimately, this study aims to harmonize data collection programmes and increase the level of data reporting to ICCAT.

A contractor with extensive regional experience in artisanal fisheries data collection (on conventional [TUN & SWO] and non-conventional ICCAT species [BIL, SHK, SMT]) and ICCAT data reporting protocols, as well as broad knowledge of government and academic institutions in the region, is essential to the success of this project.

Scope:

The inventory will include Contracting and non-Contracting Parties in the Caribbean/Central America, with a focus on those with substantial catches of ICCAT species in artisanal fisheries (giving priority to those targeting billfish and shark species) and known data deficiencies. The primary countries where a data collecting programme will be explored are Barbados, Curaçao, Guyana, Surinam, Trinidad and Tobago, and Venezuela. Secondary countries may include Central America CPCs, Colombia, Dominican Republic, and Grenada.

Deliverables:

1. Interim report of progress and presentation to the blue marlin data preparatory meeting in 2018.

2. Mid-term report to be submitted by 30 May 2018, including a description of the methodology and work conducted to date.

3. A final report to be submitted to the SCRS for review by 8 September 2018, including: an executive summary, description of the work conducted, detailed inventory of relevant programmes and contacts in the region, description of the fisheries, recommendations for next steps, and references and literature cited.

4. An updated final report based on SCRS input by 1 November 2018.

Budget:

The estimated cost of this study is on the order of US$50,000.

Atlantic and Mediterranean Swordfish Work Plans

North and South Atlantic

Assessments for North and South Atlantic swordfish were conducted in 2017. The next assessment is not yet scheduled. A list of recommended work for the swordfish Working Group was identified as high priority areas where continued efforts are required for North and South Atlantic swordfish:

***Size/Sex distribution study*:**
- *Background/objectives:* The Group recommends that at 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 between 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. Additionally, such study would also provide a contribution for the stock delimitation work.
- *Priority:* High priority
- *Leader/Participation:* EU-Portugal, with collaboration of CPCs willing to participate/share data on size/sex/location from observer programmes.
- *Timeframe:* Start in 2018, to be completed in 2019.

***PSAT tag data request for joint analysis*:**
- *Background/objectives:* The Group encourages all CPCs to provide their swordfish PSAT tag data to an *ad hoc* study Group. At 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 for the better definition of stock boundaries.
- *Priority:* High priority
- *Leader/Participation:* Lead by US, with the participation of CPCs with PSAT tag data
- *Timeframe:* Start in 2018, to be completed in 2019

***Life history*:**
- *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 Group recommends 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:* Medium/High priority

- *Leader/Participation:* To be identified
- *Timeframe:* To be decided

***Weight-length relationships*:**
- *Background/objectives:* The Group recognizes that the adopted length-weight relationships for swordfish require validation with new field information. National scientists are requested to collect and submit observed values of length (LJFL) and round weight data to the Secretariat to facilitate this task, aiming finishing by 2018 the ongoing analysis.
- *Priority:* High priority
- *Leader/Participation:* Canada will lead, with the participation of CPCs willing to submit length/weight observed data.
- *Timeframe:* To be completed in 2018.

***Larval index work*:**
- *Background/objectives:* An initial swordfish larval index was presented in the swordfish data preparatory meeting. The Group recognized the value of adding fishery-independent indexes to the stock assessment, but there were still concerns about the surveyed area. Therefore the Group recommended to include this work into the swordfish work plan to determine if those issues can be solved and this or other fishery independent indexes can be improved and used in the future.
- *Priority:* High priority
- *Leader/Participation:* Lead by US, determine possible participation of Canada.
- *Timeframe:* Should be completed for the next stock assessment.

Continuing work on environmental effects:
- *Background/objectives:* Given the possibility of spatial and environmental effects being partially responsible for the conflicting directions of some of the influential indices of abundance, the Group should further study into this hypothesis during the coming years, use existing PSAT data to compliment this work, and to determine how best to formally include these environmental covariates into the overall assessment process. The U.S. has taken a lead role in this investigation and likely collaborators would include scientist from Canada, Japan, EU (Spain and Portugal) as their indices were 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 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, these works should be done before the next stock assessment.
- *Priority:* High priority
- *Leader/Participation:* Lead by U.S., with participation of other CPCs.
- *Timeframe:* Ongoing, to be considered at the next stock assessment.

***Model predictions cross validation*:**
- *Background/objectives:* Model predictions should be compared to observations (e.g., nominal catch, CPUEs) rather than quantities such as F and SSB that cannot be observed, otherwise there is the risk of subjectively choosing model solutions. It is recommended that the WGSAM uses the North Atlantic swordfish assessment to explore the use of cross-validation of predicted data for model validation. This can also be used for weighting or selecting operating model scenarios in an MSE.
- *Priority:* Medium priority.
- *Leader/Participation:* Stock assessment modellers.
- *Timeframe:* For the next stock assessment.

Activities pertaining from the 2017 External Assessment Reviewer

Future work on stock assessment:
- *Background/objectives:* The 2017 external reviewer supported the Group's conclusions on technical merits regarding which models to use in future. JABBA is good and flexible biomass dynamics formulation and SS provides an age-structured approach that is ready to use size data and oceanographic indicators. It was encouraged full documentation of JABBA and inclusion in the ICCAT catalogue of methods.

- *Priority:* High priority
- *Leader/Participation:* JABBA model developers (South Africa and U.S.), in collaboration with the WGSAM.
- *Timeframe:* JABBA full documentation process is ongoing and expected to be completed in 2018.

Clear presentation on CPUEs

- *Background/objectives:* The reviewer encouraged more explicit, clear presentation and comparison of CPUE trends by fleet and area and season. Outliers need to be identified and potentially down-weighted in combined indices and assessments.
- *Priority:* High priority
- *Leader/Participation:* All CPCs that present CPUE series for the next assessment
- *Timeframe:* Next stock assessment

MSE work

- *Background/objectives:* MSE needs to be able to incorporate AMO effect and spatial distribution and changing catchability in the operating model. From this, it seems feasible to test whether a simple combined CPUE could be an accurate indicator of stock trends. MSE could either take a detailed and technical approach (e.g. spatial and oceanographic effects on the CPUE indices and subsequent effect on the assessment), or it could take a management oriented approach to investigate possible changes in the HCR. While both goals could be done at the same time, it might be better to tackle these as different projects in order to have high client engagement in the HCR project.
- *Priority:* High priority
- *Leader/Participation:* To be decided.
- *Timeframe:* Process to start in 2018, taking into account the ICCAT Commission schedule regarding SWO MSE work.

Sensitivity analysis for catches/discards

- *Background/objectives:* Conduct sensitivity analysis with estimated total catch, including plausible degree of discard/retained catch ratio changing over time.
- *Priority:* High priority
- *Leader/Participation:* Stock assessment modellers and scientists involved in the assessment
- *Timeframe:* Next stock assessment

Mediterranean

For the Mediterranean stock, the last assessment was conducted in 2016. The next assessment should take place not before 2020 in order to give more time for additional data to be collected and see the effects of the recently adopted Rec. 16-05. Additionally, a data preparatory meeting should be conducted the year before, to analyze and prepare data for the stock assessment.

Given the questions raised during the latest assessment the Group should develop a work plan aiming:

- To achieve the collection and recovery of historical data to increase the period covered by time series, the nominal data presented in past studies (e.g. De Metrio *et al*. 1999) should be recovered and evaluated for possible standardization.

    - Time-frame: next assessment
    - Priority: high, depends on funding
    - Participation: mainly EU-Italy in collaboration with other CPs

- To improve stock delimitation and quantify stock mixing between the Mediterranean and North Atlantic swordfish stocks through multi-disciplinary research, including biological, tagging (both electronic and conventional) and genetic investigations. An integrated review of the existing relevant information should be prepared to identify current gaps and facilitate the development of future research regarding those issues.

    - Time-frame: 2018 for the integrated review
    - Priority: high

  - Participation: all CPs

- To better identify the effects of the environment on swordfish biology, ecology and fisheries. Future CPUE analyses should evaluate the benefits of incorporating environmental factors on the distribution of spawners and juveniles.

  - Time-frame: next assessment
  - Priority: medium
  - Participation: all CPs

- To improve knowledge on the biology of the species including the investigation of possible regional differences on size/age at maturity and growth parameters, as well as, estimations of spawner and recruit proportions in the catches.

  - Time-frame: next assessment
  - Priority: medium, depends on funding
  - Participation: all CPs

- To examine the potential of using alternative indicators and reference points (L_{opt}, measures based on reproductive potential, etc.).

  - Time-frame: next assessment
  - Priority: medium
  - Participation: all CPs

Small Tunas Work Plan for 2018-2019

The following actions should be taken into account for improving statistical and biological data as well as the structure of small tuna populations. A substantial improvement in the data within SMTYP would allow conducting assessment in the near future based on the data poor stocks assessment methods in order to provide ICCAT with appropriate management advice for fisheries targeting small tuna:

– National scientists should develop and analyze simple fisheries indicators on small tunas (e.g. CPUE, mean size, proportion of juveniles, estimating fishing mortality, etc.), which should be presented at the 2018 Small Tunas Species Group Intersessional Meeting;

– Select the most appropriate methods and data and knowledge requirements. This work should be electronically by the Group;

– Hold an intersessional meeting in 2018 with the aim to provide management advice for WAH, BON, and LTA, using the data limited assessment methods (for more information please see the 2017 Small Tunas Species Group Intersessional Meeting Report, Anon. 2017l);

– Update the life history metadata base of SMT, with new information collated during the recent years under the SMTYP;

– Collaborate, as much as possible through joint working groups, with other RFMOs to improve and exchange basic fisheries data and data poor stock assessment methods for small tunas.

Sharks Work Plan

Hold an intersessional meeting with the following objectives:

- Review activities and progress of the SRDCP;

- National scientists to identify and start preparing all information relevant to the assessment of porbeagle in 2019, including catch, CPUE, length composition, and biology, and trade data if available;

- Review all porbeagle information available at the Secretariat and results of the ABNJ Southern Hemisphere porbeagle project;

- Review updated ICCAT tagging database incorporating sex-specific information to develop an integrated growth model based on both tag recapture data and growth band counts from vertebrae for shortfin mako;

- Continue update of age and growth and reproductive dynamics of shortfin mako.

Working Group on Stock Assessment Methods Work Plan (WGSAM)

1. Continue its work on the LLSIM simulation study on developing best practices for CPUE standardization.

2. Continues to work on how best to bring spatially changing oceanographic, environmental conditions and climate change into the assessment process.

3. Continues discussion and review of MSE, Harvest Control Rules, Limit, Threshold and Target Reference points.

4. Encourages papers, discussion and debate on how to best maintain the uncertainty captured via the multiple model approach while still making the communication of this practice clear and effective.

Work plan for the Sub-Committee on Ecosystems and By-catch

Pertaining to Ecosystems:

2017 SG meeting

- Present Concept Note to rapporteurs of Species Groups regarding the development of an ecosystem report card, along with the justification and implementation plan. This initiative is to involve the SGs.

2018 Sub-committee on Ecosystems

- Develop a draft Report Card inter sessionally (realistic prototype) in conjunction with SG experts.
- Review Report Card at meeting
- Review/update EBFM implementation plan

2018 Dialogue with Science and Managers and Commission Meetings

- Introduce concept of Report Card and progress on an EBFM plan and involve managers in the development.

Pertaining to by-catch:

- Continue with the collaborative process of assessing the impact of longline fisheries on bycatch of seabirds which has been developed by the Sub-committee in conjunction with CPC scientists, as well as the effectiveness of Rec. 11-09.

- Initiate a process of scientific collaboration among researchers of ICCAT CPCs to elaborate on the results obtained to date regarding knowledge of the impact of the fisheries on sea turtles.

- Advance with the definition and knowledge of fish by-catch species, which are not considered by any ICCAT species group, to understand the effects of their capture on the ecosystem and the set of ICCAT species.

- Strengthen the relationship with the SCRS species groups so as to integrate the analyses of the different groups regarding the by-catch component of the fisheries.

Sub-Committee on Statistics Work Plan

Finalize "short term" ongoing projects

- Web-form prototyping (for ST forms 1 – 6). 7-10 to be started
- JAVA application to validate ST forms (ST01 to ST06) for CPC scientist's use
- Replacement of MS-ACCESS (t2ce.mdb & t2sz.mdb) by SQLite 3.8+ databases

Continue "long term" ongoing projects

- Continuous update of the ICCAT-DB documentation framework
- Maintain the work on the ICCAT cloud infrastructure (deployment/integration of services)
- Continue the work on the GIS system (terminate sampling areas geo-referencing :: shapfiles)
- Continue the development of an online reporting system as requested by the Commission

Start projects (short/long term)

- "Full" redesign of the "tagging" database (conventional/electronic) system :: (long term)
- Migration of MS-SQL server 2008R2 to a new version - *URGENT (outdated now)*
- ISSF data unloads project (if no decision is made, these data can never be properly used)

And simultaneously: **the ICCAT-DB content/the meetings preparation/the estimations**

- Continue data recovery (data gaps, better resolution and normalization of Task II)
- Continue improve of Task I (eliminate carry overs, allocate NEI catches to proper flags, reduce UNCL gears, etc.)
- Provide the most up-to date information to SCRS

Appendix 13

Preliminary Budget for the Implementation of the MSE Work Plan

	2018				***2019***				***2020***				***2021***				***Budget (Thousands of Euros)***				
Species	*ALB-N*	*BFT*	*SWO-N*	*TROP*	*ALB-N*	*BFT*	*SWO-N*	*TROP*	*ALB-N*	*BFT*	*SWO-N*	*TROP*	*ALB-N*	*BFT*	*SWO-N*	*TROP*	*2018*	*2019*	*2020*	*2021*	*Total*
Development of OM framework			X	X													150	0	0	0	**150**
Conditioning of OM				X								X				X	30	0	30	30	**90**
Development of OM alternatives			X					X									70	90	0	0	**160**
Finalization of diagnostics and improvements of MP evaluations	X																20	0	0	0	**20**
Re-evaluation of performance of MPS in light of definition of exceptional circumstances	X																10	0	0	0	**10**
Development of MPs		X			X	X	X	X								X	60	150	0	30	**240**
Evaluation of MPs		X				X	X		X			X				X	60	120	150	60	**390**
Independent review of MSE process	X	X							X		X	X					20	20	20	0	**60**
Production of documentation for stakeholders explaining results of MSE						X			X		X					X	0	20	40	20	**80**
Coordination across species	X	X	X	X	X	X	X	X	X		X	X	X			X	30	30	20	10	**90**
																Total	**450**	**430**	**260**	**150**	**1290**
													Totals by Species				**ALB**	**BFT**	**SWO**	**TRO**	**Coord**
																	200	**250**	**240**	**510**	**90**

Costs do not include capacity building for MSE or meetings for dialogue between scientists and stakeholders/Commission.
ICCAT GBYP is expected to cover the full cost of the BFT MSE.
Note that ALBN and BFT MSE processes have already had significant funding for the last few years.

Appendix 14

Summary Note on the FAO Common Oceans/ABNJ Tuna Project

At its meeting in November 2012 in Agadir, the Commission gave its consent for the Secretariat to take the necessary steps to become a partner of the ABNJ/GEF programme. For this purpose, the Secretariat wrote a letter addressed to the FAO and the GEF to inform that ICCAT would join the programme provided that ICCAT benefited from the activities envisaged.

Since implementation of this programme, the Secretariat has participated actively in various technical and administrative meetings. It has contributed efficiently to the work of the Steering Committee and to the discussion of the different work plans. At the 2015 ICCAT Commission meeting, it was decided to continue to cooperate with this programme provided that there are benefits to ICCAT. To this end, since the previous SCRS Plenary, the ICCAT Secretariat has participated in several ABNJ Common Oceans initiatives. These include participation in the following meetings that were funded or partially funded by the Project:

- Joint tuna RFMO MSE meeting held at the Secretariat office, Madrid (1-3 November 2016);
- Joint Meeting of tuna RFMOs on the Implementation of the Ecosystem Approach to Fisheries Management, which took place in FAO HQ in Rome, Italy (12-14 December 2016);
- 1st Regional Seabird By-catch Pre-assessment Workshop held at the Kruger Park, South Africa (23 February – 1 March 2017);
- Tuna compliance network meeting held in Vigo and Madrid, Spain (27-31 March 2017);
- 1st Joint T-RFMO FAD Working Group Meeting, held in Madrid, Spain (19-21 April 2017).

In addition, ICCAT has been coordinating a feasibility study on the development of an online reporting system. This includes both a feasibility study to determine the resources, costs, technologies required to implement an online reporting system, as well as the production of a demo online reporting tool. Due to the requirements of the ABNJ Project, this study and demo are generic and could potentially be applied across the tuna RFMOS.

The Steering Committee of the FAO Common Oceans/ABNJ tuna Project met at the FAO headquarters in Rome in July 2017 and reviewed the activities undertaken during the last year. Most activities were presented by the Coordinator of the programme, with some additional presentations by those leading individual activities. There was also a presentation on the mid-term evaluation of the project, followed by a brief discussion, and some consideration to a possible second phase of the Project under GEF-7.

The mid-term evaluation highlighted the lack of a role for ICCAT within the Project and recommended greater involvement. The visit to the Secretariat by the ABNJ tuna Project management team, with a similar intent, encouraged the Secretariat to put forward some proposals in areas which had been requested by the Commission members. However, not all the Commission requests were put forward, as some of these did not fall into the categories of activities required, and hence could not meet with approval, most notably possible financing of AOTTP, as the Project design had been developed from the outset and any proposals must fall within the already agreed component areas.

The main proposals put forward are listed below and contained in the **Addendum.** Unfortunately, once again, ICCATs attempts to increase collaboration with the Project were not particularly successful. Although the activities listed below were included in the final budget, the level of funding available is not clear in all cases:

1. Proposal for a 2nd Joint t-RFMO FAD Working Group Meeting;
2. Proposed meeting of the t-RFMO MSE Working Group (and associated activities);
3. To lead and coordinate an Ecosystem Component: Common Oceans ABNJ tuna Project, including a follow-up meeting to that held in December 2016;
4. Support for ICCAT Port Inspection Expert Group for Capacity Building and Assistance.

While some of the proposals put forward by ICCAT were accepted, and others had already been foreseen in the work plan, some of the additional activities were not initially approved, on the basis at the time that they were activities stemming from the Kobe process and required consultation with other tRFMOs to ensure that there was no duplication of effort. The proposals contained in the **Addendum** were circulated to all tuna RFMOs. CCSBT requested some additional information on the ecosystem component, but no objections have been received to date from our sister organisations.

It should be noted that the proposals were not rejected outright and it was indicated that the possibility of funding by the FAO Common Oceans/ABNJ Tuna Project these activities remained. In addition, the Project set aside €300,000 in concept of *Support to replicate Shark By-catch activities area of ICCAT/IOTC.* Further details on this foreseen activity were not available at the time, but it was noted that ICCAT could put forward proposals under this line item for consideration. Such proposals should be developed by the SCRS.

Addendum to Appendix 14

Activities proposed by ICCAT for the work plan and budget for Project year four Common Oceans ABNJ Tuna Project 2017/18

Output 1.1.2

Second Joint T-RFMO FAD Working Group Meeting

The 1st Joint T-RFMO Fad Working Group Meeting took place in Madrid, between19-21 April 2017. In total, 35 Contracting Parties from three t-RFMOs (ICCAT, IOTC and IATTC) attended the meeting, together with eight Non-governmental Organisations and entities, totalling 140 participants. In addition to revising the most up to date knowledge as regards FAD fisheries related issues, a list of key areas for future action for the joint t-RFMO FAD Working Group were discussed by the Group. It was the general opinion that the process conducted during the meeting was extremely productive and it was recommended that a technical working group on FADs should be created under the KOBE process to continue the work initiated during the 1st joint t-RFMO FAD meeting. Moreover, the 2nd Joint t-RFMO FAD Working Group meeting should be held in 2018 under the coordination of ICCAT. The envisioned budget for this task would be on the order of €180,000[1] to organize a 1st meeting of the Technical Working Group on FADs (**€30,000**), and to organize the 2nd joint t-RFMO FAD meeting (**€50,000)** and support the attendance of the selected participants from developing Contracting Parties of the three t-RFMOs (**€100,000).**

Total requested €180,000

[Note: ICCAT understands that €150,000 towards the 2nd joint t-RFMO FAD and the support of the attendance of the selected participants from developing Contracting Parties has been approved, but that the funding for the Technical Working Group is subject to agreement of the other tuna RFMOs]

Output 1.1.4

Proposed meeting of the tRFMO MSE Working Group

A key finding of the Mid-Term Evaluation of the ABNJ Tuna Project was that there is a clear need for follow-up to the regional and global workshops (on both HS/MSE) conducted under the project to strengthen understanding, and to continue to improve the linkage between scientists and managers and decision makers within and between t-RFMOs. The key challenge is how to communicate and promote HS and EAFM/EBFM most effectively with fisheries managers, and the Project needs a more structured, strategic approach towards raising awareness and training on HS and EAFM/EBFM, which will require greater input from communications staff on the Project (see below). However, in addition to building capacity through workshops the Project should help deliver targeted actions that result in a specific deliverable that is working towards a commonly agreed goal, e.g. set of guidelines, or model for testing.

[1] In 2017 ICCAT benefited from €50,000 funding by the EU to organize the meeting, and €100,000 by the ABNJ tuna project which supported the attendance of some of the participants from developing CPs of the three t-RFMOs. The EU funding for the 2nd joint t-RFMO FAD meeting is not guaranteed for 2018.

In addition, a specific recommendation from that report was to identify specific opportunities for project support for follow-up activities for the Joint MSE Technical Working Group being led by ICCAT (this would also allow opportunity for the Project to rebalance activities between the t-RFMO), which could include developing a standard operating model to enhance suitable management plans for tuna stocks as a specific product deliverable.

As such ICCAT would like to propose that several activities be funded by the ABNJ Project in 2017 and 2018 to address some of these issues raised during the mid-term report:

1. Another meeting of the joint t-RFMO MSE Working Group. The aim of this meeting will be to continue the work being conducted by the Joint MSE Technical Working Group. As all t-RFMOs are advancing on their MSE processes, this meeting will be important to continue the momentum being developed. The object is to continue to provide a mechanism for sharing of experiences. To this end it is intended that a meeting be held to evaluate the progress made intersessionally since the previous meeting in 2016. A key outcome of the latter meeting was the development of work plans on key themes. These work plans should be evaluated and updated, while work on software and code should be revised. This meeting will be coordinated by the ICCAT Secretariat in conjunction with the Common Oceans ABNJ Tuna Project. Participation will be similar to the past meeting with participants from each t-RFMO and invited relevant experts. Attendees should again cover a range of stakeholders, i.e. not just modeller but people who have an interest in the results. This list would be drawn up by the t-RFMO-MSE Chair and the Global Coordinator for the ABNJ. The workshop should be scheduled for early 2018. Final dates need to be determined as soon as possible, in order to ensure the availability of participants. Once the date has been set, the venue will be determined. To allow time to achieve the work programme, a full week for workshops and discussions is considered necessary. The deliverable from this meeting should be to elaborate a set of guidelines, or models for testing. Envisioned budget **- €70,000**.

2. Peer/external review of MSE processes in the RFMOs. The success and sustainability of the MSE work within the RFMOs is dependent on the confidence the managers have in the advice being provided. With several of the RFMOs in an advanced state of development of HCRs and the MSE to evaluate them, rigorous review of the code used to conduct the MSEs is necessary. The process has been advanced by several manager-scientist dialogue meeting within the RFMOs, but equally important to the process is the revision of the software and code used to conduct the MSE. ICCAT for example would require a review of the northern albacore MSE code. This could then be published and made available to other RFMOs as a tool to conduct similar exercises. This could contribute to the observation made in the mid-term review regarding developing a standard operating model to develop suitable management plans for tuna stocks. The envisioned budget for this task would be around **€100,000** to contract external experts to review code for several different RFMO MSEs.

3. For consideration – To organize a set of capacity building courses aiming to enhance participation of scientists and managers of developing countries on the MSE processes which are currently being developed in the different t-RFMOs. A group of core scientists, mostly from developing Contracting Parties, will be involved in a course to take place throughout a one year period (e.g. including attending three specific workshops and conducting intersessional work; these workshops will began with the basics of MSE followed by more advanced aspects of the MSE process). As such, scientists would have the chance to develop their expertise between intersessions and enhance their participation on the MSE processes being currently carried out. The second component would be dedicated to managers and would cover two major components: 1. what is expected from managers as regards the MSE process; 2. to present them a shiny app to allow them to play and understand own MSE works. The envisioned budget for this task would be around **€80,000** to organize the workshops/courses, contract the experts/instructors and support the attendance of the selected participants.

Total requested: €250,000

[Note: ICCAT understands that only €50,000 to hold the meeting under (1) above have been approved, but activities under 2 and 3 are subject to agreement by other tRFMOs]

Output: 1.1.5

Ecosystem Component: Common Oceans ABNJ Tuna Project

At the 2016 ICCAT Sub-committee on Ecosystem and By-catch meeting, substantial discussions were held, building on the work initiated in 2013 and continuing through into the work plan for 2017, regarding the implementation of Ecosystem based fisheries management (EBFM). ICCAT is moving along a line to increase the understanding of the concept amongst its members, and how the work being conducted by the various Scientific Committee Species Groups can feed into and compliment the process. Although "ecosystem-based management" can have very different meanings to different people, the Sub-committee is endeavouring to provide operational steps to facilitate a common understanding of the concept. Additionally, the Sub-committee discussed the level of detail that would be necessary for practical implementation of an EBFM. It was acknowledged that ICCAT, and in fact most RFMOs are conducting activities that could be considered part of EBFM. The process has yet to be formalized or clearly defined.

In 2016, noting that the FAO Common Oceans ABNJ Tuna Project, funded by the Global Environmental Facility, was promoting and supporting the preparation of long-term plans for operationalizing the ecosystem approach in fisheries in each of the t-RFMOs, encouraging consideration of the impacts of fishing activities, the Sub-committee agreed to develop an ICCAT led proposal for this component of the Project. It was agreed that the ABNJ Project could provide support for joint meetings of the t-RFMOs led by ICCAT to discuss experiences and proposed approaches to implement the EBFM. The first of these meetings was carried out in December 2016 at the FAO headquarters in Rome, with the financial support of the Common Oceans ABNJ Tuna Project. The objective of the first of these meetings was to establish dialogue between other RFMOs on the issue of EBFM and its implementation, while inviting several external experts on EBFM to provide input and guidance on this process. The meeting was considered a success by the participants and representation was achieved from all the tRFMOs.

It was noted, however, that the process is ongoing and substantial additional work is required. At that stage, The Common Oceans ABNJ Tuna Project pledged its support for an additional meeting, tentatively in mid December 2017 or beginning of 2018. This meeting would need to be different in terms of participants, engaging Commissioners. Participants proposed a three day meeting (including one or two days with Commissioners and one additional day for scientist to process and elaborate. Thus, a mix between scientists and managers is required to continue to advance the process, much like what has been done for Management Strategy Evaluation.

The proposed budget for this second workshop is **US$100,000** in order to cover the travel expenses (including flights and per diem) of 15 individuals (2 from each of CCSBT, IATTC, ICCAT, IOTC and WCPFC Secretariats and 5 external experts), the time and expenses of the workshop coordinator, meeting preparation and hosting costs, as well as associated consumables required during the meeting. Future workshop budgets will be determined based on identified needs and participations.

However, it is also clear that although some progress is being made, the Mid-Term Evaluation of the ABNJ Tuna Project clearly stated that although the Project supported the Joint t-RFMO workshop on the implementation of ecosystem based fisheries management in December 2016 and ICCAT has advanced the considerations of EAF plans by identifying key elements needed to operationalize EAF plans and conducted comparisons with the approaches taken by other RFMOs. However, there has also been limited achievement of Outcome 2 (Roadmaps to operationalise EAFM/EBFM in t-RFMOs developed and submitted for adoption) with no development, to date, of any EAFM/EBFM plans. It goes on to state that the Project is supporting a number of open-ended processes, some of which are being led by partners (i.e. not the Project), such as support to the ICCAT-led workshops on EAFM/EBFM, which will continue after the Project finishes, and, as yet, it is not clear how sustainability of these initiatives will be secured.

Thus it is clear that substantial additional work is required under the ABNJ Project to ensure the EBFM progress is sustainable. The support for an EAFM/EBFM study group, to plan the way forward for this crucial work is also therefore highly desirable. ICCAT would like to open the discussion on the possibility for the Common Oceans ABNJ Tuna Project funding for this group, entailing further virtual and face to face meetings. The former will require funding in terms of cloud sharing tools (for maintaining and sharing the key inputs/documents for this work), as well as additional funding for an expert Technical Working Group to discuss the future of the EBFM work after the Project finishes. This will be conducted after the meeting described above, once input from the managers has been received and synthesized. The budget for this ongoing work will need to be planned in conjunction with the ABNJ staff depending on the envisioned needs of the process.

The estimated costs required to the Common Oceans ABNJ Tuna Project is:

Follow-up meeting in 2017/2018 – **US$100,000**
Cloud computing and sharing tools **– US$5,000**
Expert Technical Working Group to discuss the future of the EBFM – **US$80,000**

Total Requested: €185,000

[Note: ICCAT understands that only €50,000 towards holding the follow-up meeting in 2017/2018 have been approved, but the remaining funds required, as well as funding for cloud computing and sharing tools and the expert Technical Working Group are subject to agreement by other tRFMOs]

Output 2.1.4

Support for ICCAT Port Inspection Expert Group for Capacity Building and Assistance

Given the setbacks in trying to implement the minimum standards for Port Inspection adopted by ICCAT through Recommendation 12-07, ICCAT adopted, in 2016, Recommendation 16-18 which establishes a Working Group to identify the needs of developing States and, *inter alia*, adapt training materials and programmes to reflect specific requirements of the ICCAT port inspection scheme. The first meeting of this Working Group will take place in Madrid in October 2017. Assistance for participants from developing countries is requested, as well as funding for the participation of one expert from IOTC.

The estimated costs are:

DSA in Madrid for up to 20 participants	19,520
Tickets for up to 20 participants	34,000
Bank charges	460
Total	**€53,980**

The above does not include the expert from IOTC, for which a cost of approximately €5,000 is envisaged.

A Letter of Agreement is currently being drawn up between FAO and ICCAT to cover the assistance for participants.

Total requested: €59,000

[Note: This has already been approved and is underway]

Appendix 15

Opening Address by Mr. Driss Meski, ICCAT Executive Secretary

Scientific delegates,
Ladies and gentlemen,

For the 14th consecutive year I am following the work of this Scientific Committee which is of the upmost importance for our Commission. I have therefore had sufficient time to appreciate the serious nature of this Committee, its demands, and to tackle some complications inherent to an operation of this kind.

The likelihood is that this is the last time that I will take part in your meeting and I would like to take this opportunity to make my feelings known at the end of my mandate.

I am very honoured to have performed the functions of ICCAT Executive Secretary over three terms and I am pleased to feel that I have succeeded in performing my duties.

As in all careers, no one is in a position to meet everyone's requirements, otherwise we would be living in a perfect world.

Contrary to what might be believed, I have always appreciated the work of the SCRS, since I have a background in science, and I have always supported the idea of financing its activities through an allocation from the Secretariat's budget.

Since several delegations do not share this point of view, because this would cause contributions to increase, actions by the SCRS have always been dependent on voluntary contributions from CPCs.

I have therefore found myself in a situation where I have to reconcile my position as a manager with the scientific recommendations to which I have always subscribed. In several cases, I have appeared to be against science, as several of my colleagues made me realize.

Personally I believe that I have carried out my work with honesty, clarity and transparency, in accordance with the rules of procedure and have contributed to the smooth running of ICCAT and its committees. I truly hope that my successor outperforms me and gives you greater satisfaction.

During my mandate, it may always have been me who has spoken – I often seem alone at the helm –, I sign all the documents that you receive but you see very little of the teams that are behind all this work. ICCAT is privileged in having a Secretariat that is unique in the world. Highly competent teams, each in their area. Teams that work relentlessly and any time if required. Honest people. I would like to pay tribute to all the Secretariat staff for the work that they have done for me and for ICCAT and I am very grateful for their assistance. All members of the team without exception deserve all my gratitude.

I wish to express particular thanks to Mr. Juan Antonio Moreno, the longest standing member of the team for his unfailing support throughout the 14 years of my mandate.

My thanks to the interpreters who are almost members of the staff.

Finally, as you will certainly know, two prominent professionals have reached retirement age and unfortunately, I am obliged to apply the Secretariat regulations and rules.

These two valuable professionals are our friends Laurence Kell and Antonio di Natale, who you have known for more than 20 years.

Laurie is an excellent professional specialising in stock assessment modeling. He has given great service to ICCAT and we hope to benefit from his services in other forms in the future.

Antonio di Natale is a prominent researcher specialising in bluefin tuna. No one can claim to know bluefin tuna in all such great detail as Antonio. He had led the GBYP with a firm hand for over 7 years. In spite of great difficulties, Antonio has made the most of this programme. Thanks to him, the programme continues to survive. It will be difficult to find a successor for him but we will do what we can, counting on his advice in the future.

I wish them both good luck and I thank them for all that they have done.

Finally, I would like to apologise to anyone who may think that I have been insensitive towards them but I assure you that it was never my intention or will. I would also like to thank Miguel Neves dos Santos for having taken on many activities of late.

Thank you and see you soon.

Appendix 16

References

Amandè, M. J., Chassot, E., Chavance, P., Murua, H., de Molina, A. D., and Bez, N. 2012. Precision in bycatch estimates: the case of tuna purse-seine fisheries in the Indian Ocean. ICES Journal of Marine Science, 69: 1501-1510.

Amandè, M.J., Restrepo, V., Scott, J., Dewals, P., N'Cho Amalatchy, J., Pascual, P., Cauquil, P., Irie Bi Yala, D., Floch, L., and Bach, P. 2017a. Retaining by-catch to avoid wastage of fishery resources: How important is the by-catch landed by purse-seiners in Abidjan? Collect. Vol. Sci. Pap. ICCAT, 73 (3): 947-952.

Amandè, M.J., N'Cho, A.J., Kouakou, N.D., N'Cho, C.M., Koffi, K.F., Kouadio, A.N.C., Dewals, P., and Restrepo, V. 2017b. Utilization and trade of faux poisson landed in Abidjan. Collect. Vol. Sci. Pap. ICCAT, 73 (2): 749-754.

Anonymous. 2010. Report of the 2009 ICCAT sailfish stock assessment session (Recife, Brazil, June 1 to 5, 2009). Collect. Vol. Sci. Pap. ICCAT, 65 (5): 1507-1632.

Anonymous. 2011. Report of the 2010 ICCAT blue marlin data preparatory meeting (Madrid, Spain - May 17 to 21, 2010). Collect. Vol. Sci. Pap. ICCAT, 66 (4): 1554-1660.

Anonymous. 2012. Report of the 2011 blue marlin stock assessment meeting and white marlin data preparatory meeting (Madrid, Spain, April 25 to 29, 2011). Collect. Vol. Sci. Pap. ICCAT, 68 (4): 1273-1386.

Anonymous. 2013. Report of the 2012 white marlin stock assessment session (Madrid, Spain - May 21-25, 2012). Collect. Vol. Sci. Pap. ICCAT, 69 (3): 1085-1183.

Anonymous. 2015. Report of the 2014 ICCAT East and West Atlantic skipjack stock assessment Meeting (Dakar, Senegal -23 June - 1 July 2014). Collect. Vol. Sci. Pap. ICCAT, 71 (1): 1-172.

Anonymous. 2016. Report of the 2015 ICCAT bigeye tuna stock assessment Session (Madrid, Spain – July 13-17, 2015). Collect. Vol. Sci. Pap. ICCAT, 72 (1): 86-183.

Anonymous. 2017a. Report of the 2016 yellowfin stock assessment session (San Sebastian, Spain, 27 June to 1 July 2016). Collect. Vol. Sci. Pap. ICCAT, 73 (1): 76-227.

Anonymous. 2017b. Report of the Second Meeting of the Ad Hoc Working Group on FADs (Bilbao, Spain, 14-16 March 2016). Collect. Vol. Sci. Pap. ICCAT, 73 (3): 883-946.

Anonymous. 2017c. Report of the 2016 ICCAT North and South Atlantic albacore stock assessment meeting (Madeira, Portugal – April 28 to May 6, 2016). Collect. Vol. Sci. Pap. ICCAT, 73 (4): 1147-1295.

Anonymous. 2017d. Report of the 2017 ICCAT albacore species group intersessional meeting (including assessment of Mediterranean albacore) (Madrid, Spain 5-9 June, 2017). Collect. Vol. Sci. Pap. ICCAT, 74 (2): 508-583.

Anonymous. 2017e. Report of the 2017 ICCAT bluefin stock assessment meeting (Madrid, 20-28 July, 2017). Collect. Vol. Sci. Pap. ICCAT, 74 (6): 2372-2535.

Anonymous. 2017f. Report of the 2017 ICCAT bluefin tuna data preparatory meeting (Madrid, 6-11 March 2017). Collect. Vol. Sci. Pap. ICCAT, 74 (6): 2268-2371.

Anonymous. 2017g. Report of the 2016 sailfish stock assessment (Miami, USA – 30 May to 3 June 2016). Collect. Vol. Sci. Pap. ICCAT, 73 (5): 1579-1684.

Anonymous. 2017h. Report of the 2017 ICCAT Atlantic swordfish data preparatory meeting (Madrid, 3-7 April 2017). Collect. Vol. Sci. Pap. ICCAT, 74 (3): 729-840.

Anonymous. 2017i. Report of the 2017 ICCAT Atlantic swordfish stock assessment session (Madrid, 3-7 July, 2017). Collect. Vol. Sci. Pap. ICCAT, 74 (3): 841-967.

Anonymous. 2017j. Report of the Mediterranean swordfish stock assessment session (Casablanca, Morocco, 11-16 July 2016). Collect. Vol. Sci. Pap. ICCAT, 73 (3): 1005-1096.

Anonymous. 2017k. Report of the 2017 meeting of the ICCAT working group on stock assessment methods (WGSAM) (Madrid, Spain, 8-12 May 2017). Collect. Vol. Sci. Pap. ICCAT, 74 (2): 1-75.

Anonymous. 2017l. Report of the 2017 small tunas species group intersessional meeting (Miami, United States, 24-28 April 2017). Collect. Vol. Sci. Pap. ICCAT, 74 (1): 331-378.

Anonymous. 2017m. Report of the 2017 Tropical Tunas Species Group Intersessional Meeting (Madrid, Spain, 4-8 September 2017). Collect. Vol. Sci. Pap. ICCAT, 74 (5): 1873-1954.

Anonymous. 2017n. Report of the 2017 ICCAT albacore species group intersessional meeting (including assessment of Mediterranean albacore) (Madrid, Spain 5-9 June, 2017). Collect. Vol. Sci. Pap. ICCAT, 74 (2): 508-583.

Anonymous. 2017o. Report of the 2017 ICCAT shortfin mako data preparatory meeting (Madrid, Spain 28-31 March 2017). Collect. Vol. Sci. Pap. ICCAT, 74 (4): 1373-1464.

Anonymous. 2017p. Report of the 2017 ICCAT shortfin mako stock assessment meeting (Madrid, Spain 12-16 June, 2017). Collect. Vol. Sci. Pap. ICCAT, 74 (4): 1465-1561.

Anonymous (in press a): Report for biennial period, 2016-17 Part II (2017) - Vol. 1 – Annex 4.4 – Report of the 3rd meeting of the Standing Working Group to Enhance Dialogue Between Fisheries Scientists and Managers (SWGSM).

Anonymous (in press b): Report for biennial period, 2016-17 Part II (2017) - Vol. 4 – Report on Statistics & Coordination of Research in 2017. ICCAT Document SCI-008. 54p.

Anonymous. 2017q. Report of the 3rd meeting of the ad hoc Working Group on FADs (Madrid, Spain, 11-12 September 2017). Collect. Vol. Sci. Pap. ICCAT, 74 (5): 2108-2191.

Arocha, F., Larez, A., Pazos, A., Gutiérrez, X., Marcano, L. and Silva, J. 2015. Billfish catch in the Venezuelan artisanal off-shore pelagic longline fleet: past and present (1986-2013). Collect. Vol. Sci. Pap. ICCAT, 71 (5): 2203-2216.

Babcock, E. A., Pikitch, E. K., and Hudson, C.G. 2003. How much observer coverage is enough to adequately estimate by-catch. Report of the Pew Institute for Ocean Science, Rosentiel School of Marine and Atmospheric Science, University of Miami, Miami, FL.

BFT Species Group. 2017. Updates to bluefin tuna stock assessment models adopted during the 2017 Bluefin Tuna Species Group meeting. Collect. Vol. Sci. Pap. ICCAT, 74 (6): 3483-3485.

Campana, S.E., Gibson, A.J.F., Fowler, M., Dorey, A. and Joyce, W. 2010. Population dynamics of porbeagle in the northwest Atlantic, with an assessment of status to 2009 and projections for recovery. Collect. Vol. Sci. Pap. ICCAT, 65(6): 2109-2182.

Carruthers T. and Kell L. 2017a. Simulation testing a multi-stock model with age-based movement. Collect. Vol. Sci. Pap. ICCAT, 73(6): 2164-2170.

Carruthers T. and Kell L. 2017b. Issues arising from the preliminary conditioning of operating models for Atlantic bluefin tuna. Collect. Vol. Sci. Pap. ICCAT, 73(6): 2171-2182.

Coelho, R., Miller, P., Carlson, J., Domingo, A., Rosa, D., Cortes, E., and Santos, M.N. 2017. Shark Research and Data Collection Program: Progress on the satellite tagging of shortfin mako for post-release survival and habitat use studies. Collect. Vol. Sci. Pap. ICCAT, 73 (8): 2851-2859

Dagorn, L., Filmalter, J.D., Forget, F., Justin Amandè, M., Hall, M.A., Williams, P., Murua, H., Ariz, J., Chavance, P., and Bez, N. 2012. Targeting bigger schools can reduce ecosystem impacts of fisheries. Can. J. Fish. Aquat. Sci. 69: 1463–1467.

De Metrio G., Cacucci M., Megalofonou P., Santamaria N., Sion L. 1999. Trend of swordfish fishery in a northern Ionian port in the years between 1978 and 1997. Collect. Vol. Sci. Pap. ICCAT, 49(1): 94-99.

Di Natale A. 2017. Scientific needs for a better understanding of the Atlantic bluefin tuna (*Thunnus thynnus*) spawning areas using larval surveys. Collect. Vol. Sci. Pap. ICCAT, 73(7): 2255-2279.

Diaha N.C., Zudaire I., Chassot E., Barrigah B.D., Irié Y.D., Gbeazere D.A., Kouadio D., Pecoraro C., Romeo M.U., Murua H., Amandè M.J., Dewals P. and Bodin N. 2016. Annual monitoring of reproductive traits of female yellowfin tuna (*Thunnus albacares*) in the eastern Atlantic Ocean. Collect. Vol. Sci. Pap, 72(2): 534-548.

Druon, J.N., Fromentin, J.M., Hanke, A.R., Arrizabalaga, H., Damalasa, D., Tičina, V., Quílez-Badia, G., Ramirez, K., Arregui, I., Tserpes, G., Reglero, P., Deflorio, M., Oray, I., Karakulak, S., Megalofonou, P., Ceyhan, T., MacKenzie, B.R., Lamkin, J., Afonso, P., Addis, P., 2016. Habitat suitability of the Atlantic bluefin tuna by size class: An ecological niche approach. Progress in Oceanography, 142: 30-46.

Fraile, I., Arrizabalaga, H., Santiago, J., Goñi, N., Arregui, I., Medinabeitia, S., Wells, R. and Rooker, J. 2016. Otolith chemistry as an indicator of movements of albacore (*Thunnus alalunga*) in the North Atlantic Ocean. Marine and Freshwater Research 67: 1002-1013.

Hoolihan, J.P., Luo, J., Goodyear, C.P., Orbesen, E.S. & Prince, E.D. 2011. Vertical habitat use of sailfish (*Istiophorus platypterus*) in the Atlantic and eastern Pacific, derived from pop-up satellite archival tag data. Fisheries Oceanography 20, 192-205.

Katavic, I, Grubisic, L., Mihanovic, M., Petrina, I., Talijancic, I., Bubic, T.S., and Zuzul, I. 2017. Length-weight relationships applicable to bluefin tuna juveniles (*Thunnus thynnus*) caught for farming purposes during the purse seine fishing season in the Adriatic. Collect. Vol. Sci. Pap. ICCAT, 74 (6): 3515-3522.

Laconcha, U., Iriondo, M., Arrizabalaga, H., Manzano, C., Markaide, P., Montes, I., Zarraonaindia, I., Velado, I., Bilbao, E., Goñi, N., Santiago, J., Domingo, A., Karakulak, S., Oray, I.K. and Estonba, A. 2015. New nuclear SNP markers unravel the genetic structure and effective population size of albacore tuna (*Thunnus alalunga*). PLoS ONE 10: e0128247.

Lennert-Cody, C. 2001. Effects of sample size on bycatch estimation using systematic sampling and spatial post-stratification: summary of preliminary results. In IOTC proceedings, pp. 48-53.

Mather, F.J.III, Mason, J.M., Jones, A.C., 1995, Life History and Fisheries of Atlantic Bluefin Tuna. NOAA Technical Memorandum, NMFS-SEFSC, 370: 1-165.

Matsumoto, T. and Satoh, K. 2017. Standardization of bigeye tuna CPUE in the main fishing ground of Atlantic Ocean by the Japanese longline fishery using revised method. Collect. Vol. Sci. Pap. ICCAT, 74 (5): 2013-2021.

Melvin, G.D and Finley, M. 2015. Herring Acoustic Surveys: A new perspective for Atlantic Bluefin tuna in the Gulf of St Lawrence. Document SCRS/2015/203 (withdrawn).

Mielgo, R. 2015. Weight/size structure of Atlantic bluefin tuna fished and/or ranched in the Mediterranean and northeast Atlantic during the period 1995 to 2014 as revealed by trade, market & corporate biometric data. Collect. Vol. Sci. Pap. 71(2).

Ortiz de Zárate, V. ICCAT North Atlantic Albacore Research Program. Collect. Vol. Sci. Pap. ICCAT, 66 (5): 1949-1955.

Ortiz, M and Palma, C. 2012. Standardized southern albacore mean annual size, from fisheries size samples 1956-2010. Collect. Vol. Sci. Pap. ICCAT, 68 (2): 593-603.

Pagá Garcia A., Tensek S., and Di Natale A. 2017. Bluefin tuna (*Thunnus thynnus*) growth and displacements derived from conventional tags data. Collect. Vol. Sci. Pap. ICCAT, 73 (6): 2150-2163.

Palma C. and Gallego J.L. 2015. Results of applying Filters 1 and 2 to the 2013 statistical data reported during 2014. ICCAT Col. Vol. Sci. Pap. 71(6): 3070-3084.

Parker, D., Winker, H., West, W., Sven Kerwath, S. 2017a. Standardization of the catch per unit effort for yellowfin tuna (*Thunnus albacares*) for the South African tuna pole and line (baitboat) fleet for the time series 2003-2016. Document SCRS/2017/206 (withdrawn).

Parker, D., Winker, H., West, W., Sven Kerwath, S. 2017b. Standardization of the catch per unit effort for bigeye tuna (*Thunnus obesus*) for the South African longline fishery. Document SCRS/2017/204 (withdrawn).

Quilez Badía G., Tensek S., Di Natale A., Pagá García A., Cañadas A., Kitakado T. and Kell L.T. 2016. A consideration of additional variance in the Mediterranean aerial survey based on electronic satellite tags. Collect. Vol. Sci. Pap. ICCAT, 72(6): 1544-1552.

Restrepo, V., L. Dagorn, G. Moreno, F. Forget, K. Schaefer, I. Sancristobal, J. Muir and D. Itano. 2016. Compendium of ISSF At-Sea Bycatch Mitigation Research Activities as of 12/2016. ISSF Technical Report 2016-13A. International Seafood Sustainability Foundation, Washington D.C., USA.

Richardson, D.E., Marancik, K.E., Guyon, J.R., Lutcavage, M.E., Benjamin Galuardi, B., Lam, C.H., Walsh, J.H., a, Wildes, S., Yates, D.A., Hare, J.H., 2016. Discovery of a spawning ground reveals diverse migration strategies in Atlantic bluefin tuna (*Thunnus thynnus*) www.pnas.org/cgi/doi/10.1073/pnas.1525636113

Rodriguez-Marin, E., Ortiz, M., Ortiz de Urbina, J.M., Quelle, P., Walter, J., Abid, N., et al. 2015. Atlantic Bluefin Tuna (*Thunnus thynnus*) Biometrics and Condition. PLOS ONE 11(6): e0157291. https://doi.org/10.1371/journal.pone.0157291

Ruiz, J., Krug, I., Justel-Rubio, A., Restrepo, V., Hammann, G., Gonzalez, O., Legorburu, G., Pascual-Alayón, P.J., Bach, P., Bannerman P., and Galán, T. 2017. Minimum standards for the implementation of electronic monitoring systems for the tropical tuna purse seine fleet. Collect. Vol. Sci. Pap. ICCAT, 73 (2): 818-828.

Sánchez, S., Murua, H., González, I., and Ruiz, J. 2007. Optimum sample number for estimating shark by-catch in the Spanish purse seiners in the Western Indian Ocean. IOTC-2007-WPTT-26, 6pp.

Sissenwine, M. and Pearce, J. 2017. Second review of the ICCAT Atlantic-wide Research Programme on Bluefin Tuna (ICCAT GBYP Phase 6). Collect. Vol. Sci. Pap. ICCAT, 73 (7): 2340-2423.

Tensek S., Di Natale A., and Pagá García A. 2017. ICCAT GBYP Psat tagging: the first five years. Collect. Vol. Sci. Pap. ICCAT, 73 (6): 2058-2073.

Tsagbey, S., De Carvalho, M., and Page, G.L. 2007. All Data are Wrong, but Some are Useful? Advocating the Need for Data Auditing. The American Statistician, Volume 71, 2017 - Issue 3.

Tserpes, G., Ortiz de Urbina, J., Abid, N., Ceyhan, T., Garibaldi, F., Peristeraki, P., and Di Natale, A. 2017. Length - weight relationships for the Mediterranean swordfish. Collect. Vol. Sci. Pap. ICCAT, 74 (3): 1346-1353.

Watson, M.E., Mather, F.J.III, 1961, Species identification of juvenile tunas (genus *Thynnus*) from the Straits of Messina, northwestern Atlantic and the Gulf of Mexico. Pacific Bluefin Tuna Biology Conference, Hawaii: 1-4.

Presentations

SCRS/P/2016/039: Di Natale A., Tensek S., and Pagá García A. Review progress made by the GBYP and Phase 6 programme.

SCRS/P/2016/033: Galuardi B, Cadrin S.X., Arregui I., Arrizabalaga H., Di Natale A., Brown C., Lam C.H. and Lutcavage M.E. Using SatTagSim to provide transition matrices for Movement Inclusive Models.

BIENNIAL REPORTS OF THE COMMISSION

Report of the First Meeting of the International Commission for the Conservation of Atlantic Tunas (Rome, December 1-6, 1969). FAO Fisheries Report (84).

Report of the First Special Meeting of the Council (Madrid, April 17-18, 1970). No. 1. – Report for Biennial Period, 1970-71, Part I, 1970.

Report for Biennial Period, 1970-71, Part II,	1971.	
Report for Biennial Period, 1970-71, Part III,	1972.	
Report for Biennial Period, 1972-73, Part I,	1973.	
Report for Biennial Period, 1972-73, Part II,	1974.	
Report for Biennial Period, 1974-75, Part I,	1975.	
Report for Biennial Period, 1974-75, Part II,	1976.	
Report for Biennial Period, 1976-77, Part I,	1977.	
Report for Biennial Period, 1976-77, Part II,	1978.	
Report for Biennial Period, 1978-79, Part I,	1979.	
Report for Biennial Period, 1978-79, Part II,	1980.	
Report for Biennial Period, 1980-81, Part I,	1981.	
Report for Biennial Period, 1980-81, Part II,	1982.	
Report for Biennial Period, 1982-83, Part I,	1983.	
Report for Biennial Period, 1982-83, Part II,	1984.	
Report for Biennial Period, 1984-85, Part I,	1985.	
Report for Biennial Period, 1984-85, Part II,	1986.	
Report for Biennial Period, 1986-87, Part I,	1987.	
Report for Biennial Period, 1986-87, Part II,	1988.	
Report for Biennial Period, 1988-89, Part I,	1989.	
Report for Biennial Period, 1988-89, Part II,	1990.	
Report for Biennial Period, 1990-91, Part I,	1991.	
Report for Biennial Period, 1990-91, Part II,	1992.	
Report for Biennial Period, 1992-93, Part I,	1993.	
Report for Biennial Period, 1992-93, Part II,	1994.	
Report for Biennial Period, 1994-95, Part I,	1995.	(Vols. 1-2).
Report for Biennial Period, 1994-95, Part II,	1996.	(Vols. 1-2).
Report for Biennial Period, 1996-97, Part I,	1997.	(Vols. 1-2).
Report for Biennial Period, 1996-97, Part II,	1998.	(Vols. 1-2).
Report for Biennial Period, 1998-99, Part I,	1999.	(Vols. 1-2).
Report for Biennial Period, 1998-99, Part II,	2000.	(Vols. 1-2).
Report for Biennial Period, 2000-01, Part I,	2001.	(Vols. 1-2).
Report for Biennial Period, 2000-01, Part II,	2002.	(Vols. 1-2).
Report for Biennial Period, 2002-03, Part I,	2003.	(Vols. 1-3).
Report for Biennial Period, 2002-03, Part II,	2004.	(Vols. 1-3).
Report for Biennial Period, 2004-05, Part I,	2005.	(Vols. 1-3).
Report for Biennial Period, 2004-05, Part II,	2006.	(Vols. 1-3).
Report for Biennial Period, 2006-07, Part I,	2007.	(Vols. 1-3).
Report for Biennial Period, 2006-07, Part II,	2008.	(Vols. 1-3).
Report for Biennial Period, 2008-09, Part I,	2009.	(Vols. 1-3).
Report for Biennial Period, 2008-09, Part II,	2010.	(Vols. 1-3).
Report for Biennial Period, 2010-2011, Part I,	2011.	(Vols. 1-4).
Report for Biennial Period, 2010-2011, Part II,	2012.	(Vols. 1-4).
Report for Biennial Period, 2012-2013, Part I,	2013.	(Vols. 1-4).
Report for Biennial Period, 2012-2013, Part II,	2014.	(Vols. 1-4).
Report for Biennial Period, 2014-2015, Part I,	2015.	(Vols. 1-4).
Report for Biennial Period, 2014-2015, Part II	2016.	(Vols. 1-4).
Report for Biennial Period, 2016-2017, Part I	2017.	(Vols. 1-4).
Report for Biennial Period, 2016-2017, Part II	2018.	(Vols. 1-4).

For more information and a complete list of ICCAT publications, please see www.iccat.int

It is suggested that this report be cited in either of the following manners: ICCAT, 2018. Report for Biennial Period, 2016-17, Part II, Vol. 2, ……pp.; or (Author), (Title of paper). In ICCAT, 2018, Report for Biennial Period, 2016-17, Part II, Vol. 2, …… (pages).