INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS
COMMISSION INTERNATIONALE POUR LA CONSERVATION DES THONIDES DE L'ATLANTIQUE
COMISIÓN INTERNACIONAL PARA LA CONSERVACIÓN DEL ATÚN ATLÁNTICO

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

(Madrid, Spain, 3 to 7 October 2016)

October 2016

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1. Opening of the meeting

The 2016 Meeting of the Standing Committee on Research and Statistics (SCRS) was opened on Monday, 3 October, at the Hotel Velázquez 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, addressed the meeting and welcomed all the participants to Madrid. He noted that 2016, as with previous years, has been very busy for both the SCRS and the Secretariat, with many ICCAT scientific meetings being held during the year. He then reiterated that the Secretariat is always committed to assisting the SCRS in its work and expressed his certainty that the work during the week would meet the high expectations of the Contracting Parties. He took the opportunity to announce that ICCAT celebrates this year its 50th Anniversary and to state that ICCAT has performed at high level and reached innumerous achievements during the last 50 years. He also congratulated all the scientists and the Secretariat staff who contributed to the success of ICCAT. 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 2016 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 Atlantic albacore (ALB), yellowfin tuna (YFT), sailfish (SAI) and Mediterranean swordfish (SWO-Med). Also a data preparatory meeting was held for bluefin tuna this year, in preparation for a new assessment in 2017.

The following scientists served as rapporteurs of the various species sections (Agenda Item 8) of the 2016 SCRS Report.

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

The Secretariat served as rapporteur for all other Agenda items.

3. Introduction of Contracting Party delegations

The Executive Secretary introduced the 26 Contracting Parties present at the 2016 meeting: Algeria, Angola, Brazil, Cabo Verde, Canada, China (P.R.), Côte d'Ivoire, El Salvador, European Union, Japan, Korea (Rep.), Liberia, Mauritania, Mexico, Morocco, Namibia, Norway, Russian Federation, São Tomé and Príncipe, Senegal, Tunisia, Turkey, United Kingdom (O.T.), United States, Uruguay and Venezuela. 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 (Birdlife International – BI, Federation of Maltese Aquaculture Producers – FMAP, International Seafood Sustainability Foundation – ISSF, Oceana, Pew Charitable Trusts, The Ocean Foundation, and World Wild Fund – WWF) were admitted as observers and welcomed to the 2016 SCRS (see **Appendix 2**).

5. Admission of scientific documents

The Secretariat informed the Committee that 210 scientific papers and 69 scientific presentations had been submitted at the 2016 intersessional meetings. The Secretariat also informed that, last year, 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 12 reports of intersessional and regular Species Groups meetings, 35 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 2016 Secretariat Report on Research and Statistics related to fisheries and biological data submitted for 2015, including revisions to historical data. The activities and information included in this report refer to the period between 1 December 2015 and 16 September 2016 (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 information requested in Task I nominal catch (T1NC) was revised in 2015. The information requested in Task I, has now been separated (in two sub-forms) the positive catches (form ST02A) more detailed, and, the "zero" catch component (sub-form ST02B) more aggregated (only one zero required per major species/stock, year, CPC, and gear). The Secretariat highlighted that for the second year (2014 and 2015) T1FC data was requested on an individual vessel basis. The outcome of this exercise continues to be quite promising. In the near future, the SCRS will count with better information to properly evaluate the effective fishing activity taking place in the ICCAT Convention area. The deficiencies/problems with the Task II Catch and effort data (T2CE) was also noted, which has serious implications for the estimation of related datasets such as CATDIS, EFFDIS, CAS and CAA. The Secretariat also stated historical revisions in the ICCAT Task II database will be included in future EFFDIS estimations and estimates of error and uncertainty around the final EffDis estimates will be calculated (for purse seine and longline).

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 and this may be 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 will provide suggested revisions to this form for potential adoption by the SCRS in 2017. The Secretariat then provided a summary of the use of various data funds. These did not include activities funded by the ICCAT Atlantic-wide Research Programme for Bluefin Tuna (ICCAT GBYP), Enhanced Billfish Research Program (EBRP) or the ICCAT/Japan Capacity-Building Assistance Project (JCAP).

The Committee was presented with an update of the various ICCAT publications. The new 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 2015, more than 50% of the documents have been submitted after the deadlines. The ownCloud web server has now been used for two 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. In several instances, the Secretariat has been requested to provide access details to non-participants. As there is currently no protocol regarding the provision of access details, the Secretariat would like to clarify the procedures with the SCRS.

During 2015, the Secretariat undertook an exhaustive work plan in terms of statistical related tasks, aiming to complete all the major SCRS demands and priorities for 2016. All major tasks were finalised in a timely manner, and the outcome used by the SCRS during 2016. As always, however, in order to complete priority tasks, several ongoing priority projects (the ICCAT-DB documentation framework, full revision of the tagging database and the respective frontend applications, the ICCAT GIS system with the various shape files, deployment of statistical databases on the ICCAT Cloud) have been partially implemented or totally postponed for 2017. It is important to note that, those postponed projects, have no immediate repercussions for the accomplishments of the SCRS in 2016. The JAVA project (after the excellent achievements of 2015) was enlarged by an additional year aiming to incorporate new developments. The Secretariat has also undertaken additional training in JAVA technologies (however, not sufficient) aiming to maintain and continue the development of applications as well as other resources and tools for the maintenance of the ICCAT databases. In addition, in the beginning of 2017 (after preparing the 2017 forms version), the Secretariat will make available to the CPC a tool (using the same code base) that validates the forms ST01 to ST06 before submitting the final forms to ICCAT. It is expected that, this tool will help the ICCAT CPCs to easily pass the SCRS validation criteria.

The Secretariat has continued the series of periodic publications developed throughout the history of ICCAT, which includes: Volume 72 (8 issues) of the *ICCAT Collective Volume of Scientific Papers*; *Part II of the Biennial Period 2014-2015*, corresponding to s Volume I (Commission meeting report), II (SCRS Plenary meeting report) and Volume 3 (Annual Reports); Volume 43 (I) of the Statistical Bulletin; and, Volume IV (Secretariat reports). 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, whom reiterated their willingness to enhance the collaboration with ICCAT and requested a greater involvement of the SCRS in the process of selection, review and publication of the documents, through an Editorial Committee. On the other hand, ALR expressed their willingness to publish a few more ICCAT papers (12-15) on an annual basis.

The Committee acknowledged the extensive workload conducted by the Secretariat and thanked them for their support of the SCRS documentation processes. The Committee noted that although there are still issues with the deadlines for submission of documents, in general the process has facilitated the access to documents prior to the start of intersessional meetings and this should be acknowledged. It was noted that documents that arrived late had not been excluded from the meetings although their submission by the deadlines is encouraged as requested by the SCRS in 2015. It was stressed, however, that the late submission of data was extremely problematic and this should continue to be improved to facilitate the work of the SCRS.

Ms. Mari Mishima who coordinated the ICCAT-Japan Capacity-Building Assistance Project (JCAP) during the past five years terminated her mandate this year. She came back especially to introduce the project that started in December 2014 as a five year-project and presented a progress report of the activities conducted in 2016. 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 Coordinator's 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. The SCRS and the Secretariat expressed their appreciation to Japan. Since Japan decided not to assign a new Coordinator to this programme, the Secretariat will from now on take that responsibility.

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

Les captures algériennes des thonidés et des espèces voisines enregistrées pour l'année 2015 sont de l'ordre de 567,694 tonnes pour l'espadon, de 370 ,258 tonnes pour le thon rouge et de 2905,939 tonnes pour les thonidés mineurs. La campagne de pêche au thon rouge vivant au titre de l'année 2015 a été réalisée par une flottille nationale de 12 navires thoniers senneurs dont les longueurs est comprises entre 22 et 40 m. C'est une campagne réalisée par trois groupe de pêche conjointe, qui a permis la capture 342 tonnes. Cependant, durant la transfert de la cage de transfert vers la cage d'engraissement, l'utilisation du caméras stéréoscopiques a permet de constaté que la quantité contenue dans la cage de transfert est supérieure de 28 t par rapport à ce qu'il a été constaté lors de l'opération de transfert vers la cage de transport. A ce titre et en application de la recommandation de l'ICCAT 14-04 et notamment de l'annexe 9, il a été procédé à la correction du BCD. A cet égard, la quantité totale pêchée au titre de la campagne 2015 est 370 tonnes. Un échantillonnage de 50 individus de thon rouge capturés morts a fait l'objet de mensuration de taille et de sexage à bord du navire de pêche. Pour l'espadon *Xiphias gladius*, des échantillonnages de taille et de poids ont été effectués au niveau des ports de débarquement sur 60 individus. S'agissant de la collecte des données statistiques de l'activité de pêche, le dispositif existant à l'échelle nationale contribue efficacement à l'alimentation et l'actualisation de la base de données sur toute l'activité de pêche. En outre, ce dispositif est renforcé par la réalisation régulière de deux campagnes annuelles d'évaluations des ressources halieutiques des eaux sous juridiction nationale l'une pélagique et l'autre démersale. Le volet recherche est pris en charge par le Centre National de la Recherche et du Développement de la pêche et de l'Aquaculture (CNRDPA) qui fournit l'information scientifique et les orientations pour les prises de décision de gestion des ressources halieutiques et assure le suivi des thonidés et des prises accidentelles, notamment les requins et tortues.

Angola

The scombrid species caught along the Angolan coast are divided in two major groups, of which the big tunas, that includes *Thunnus alalunga* (Albacore), *Thunnus obesus* (Patudo) and *Tunnus albacores* (Yellowfin tuna) and the small tunas, that includes *Euthynnus alletteratus* (Little tunny), *Scomberomorus tritor* (Spanish mackerel), *Sarda sarda* (Atlantic bonito) and *Auxis thazard* (Frigate tuna). As target species, they are caught by the industrial vessels, using as gear longline and purse seiners, operating in joint venture regime with Angolan companies. The artisanal fishery also makes an important contribution at the catches, by using gill-nets, line and hook and traps as fishing gears.

The total catch of the tuna caught by longliners and purse seiners for the year 2015 was 17 630 Tones. Purse seiners represented 95% of the catches, with dominance of Skipjack tuna *Katsuwonus pelamis*, 67.29% and Yellowfin tuna (*Thunnus albacares*) (20,28%). The late species is the main catch of the longlines (57,46%) followed by the Bigeye tuna (*Thunnus obesus*) (34,22%).

In 2015, the tuna fleet has been fishing through the year. Higher catches were recorded from January to April and from October to November, especially due to the contribution of the Skipjack tuna, the Yellowfin tuna and the bigeye tuna respectively.

The registered total catch from the artisanal fishery was 14 847tons, with dominance of *Scomberus Japonicus* (50.8%), *Euthynnus alletteraus* (16.8%), and *Sarda sarda* (8.2%) and *Scomberomorus tritor* (7.86%)

Observer program is being put in place in order to fully monitor the fishing operations and collect the biological information of big tunas. The catch data are processed at the National Directorate of Fisheries and the Institute of the Artisanal Fisheries. The observer program is in due course in order to increase the quality of data collected and the respective stock assessment.

Brazil

In 2015, the Brazilian tuna fleet fishing for tunas and tuna-like fish consisted of 93 fishing boats, registered in 5 different ports. The Brazilian catch of tunas and tuna-like fish, including marlins, sharks and other species of less importance (e.g. wahoo, dolphinfish, etc.) was 32,833.5 t (live weight), representing a decline from 2014, when 39,296.4 were landed. Most of the catches again were done by bait-boat vessels (18,185.5 t; 55.4%), targeting skipjack (SKJ), which accounted for the majority of their catches (17,499.0 t), as well as of the total production of tuna and tuna-like species landed in Brazil. Longline catches reached 8,663.1 t, being made mainly of swordfish (SWO) (2,567.4 t); bigeye tuna (BET) (2,249.5 t); blue shark (BSH) (2,080.2.0 t); and yellowfin (YFT) (1,185.8 t). About 18% of all Brazilian catches of tunas and tuna-like fish (5,984.8 t) came from about 300 artisanal and small-scale boats (10 to 20 m LOA), based predominantly in the southeast and northeast region and targeting a variety of species, with various fishing gears, including mainly handline, trolling and other surface gears. The main species caught by this fleet, as usual, were the yellowfin tuna, bigeye tuna, and dolphin fish. Due to the discontinuity of the financial support provided by the Ministry of Fisheries and Aquaculture to the Scientific Subcommittee of the Standing Committee for the Management of the Tuna Fisheries in Brazil, several scientific activities are yet suspended, such as the collection of biological data, including the size of the fish caught. Nevertheless, some initiatives are in course in 2016 to reverse this regrettable situation, as the creation of the Secretariat of Aquaculture and Fisheries of the Ministry of Agriculture. Research on the bycatch of seabirds and sea turtles in the longline fishery, however, has continued, including the development of measures to avoid their catches.

Cabo Verde

La capture totale préliminaire des thonidés en 2015 a été environ 17.000 tonnes, capturés principalement avec le senneur, dans la pêche industrielle et semi industrielle et avec la ligne à main, dans la pêche artisanale. La flotte semi industrielle, se compose d'un ensemble hétérogène de navires, la majorité d'une longueur comprise entre 6 et 25 mètres, monté par 5-14 pêcheurs. En 2015, le nombre de navires industriels ou semi industriels enregistrés, par l'autorité maritime, était de 60. Jusqu'à présent, nous avons uniquement disponible l'effort total et il est prévu, dès que possible, d'informer leur discrimination. Ils ont été recueillis et envoyés les tailles de fréquence des principales espèces de poissons de thon pêchés au Cabo Verde. La tendance de la capture, en ce qui concerne à l'année précédente, est à la baisse. Il n'y a pas de pêche dirigée directement aux ressources requins, principalement en raison de l'absence d'une flotte spécialisée, des coûts d'exploitation élevés, d'autre part, la population n'a pas l'habitude de leur consommer. Au cours de 2015, il n'y avait pas de demande d'un permis de pêche par la flotte locale. La pêche des requins est pratiquée principalement par la flotte palangrière de l'UE (Espagne et Portugal) dans le cadre des accords de pêche avec le Cabo Verde. Les captures de requins par la flotte de l'UE dans la ZEE du Cabo Verde a augmenté ces dernières années. Les istiophoridés et l'espadon, font toujours partie des captures déclarées de l'UE (2% et 13% respectivement). Dans la pêche sportive, ils ne sont pas encore créés des conditions pour la collecte des données. L'INDP est le responsable pour le suivi régulier des activités de pêche des thoniers et le travail consiste en collecter des statistiques de captures et d'effort de pêche. Ce travail est complété par des informations de diverses sources (usines, Direction des ressources marins, Douane etc.). Des échantillonnages multi spécifiques sont également réalisés en pêche industrielle et pêche artisanale.

Canada

Bluefin tuna are harvested in Canadian waters from July through December. The adjusted Canadian quota for 2015 was 528.88 t which includes a 51.98 t transfer from Mexico. A total of 685 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 458.4 t. An additional 72.2 t was harvested as bycatch in the pelagic longline fleet in the swordfish and other tunas fishery. These figures include 1.654 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 2157.7 t with landings reaching 1579.3 t. The tonnage taken by longline gear was 1481.0 t while 98.2 t were taken by harpoon. Of the 78 licensed swordfish longline fishermen, 64 were active in 2015. Only 53 of 1,157 harpoon licenses reported swordfish landings in 2015.

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 2015, other tunas accounted for approximately 14%, 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; tagging of bluefin tuna that addresses questions related to mixing, migration and the distribution within the Canadian EEZ and 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 estimating discard mortality from a dedicated study using 131 pop-up archival satellite tags (PSATs) to determine post-release mortality of live discards, and incorporating this information into assessments of northwest Atlantic populations of porbeagle, shortfin mako and blue sharks.

China (People's Rep.)

The number of vessels from China operated in the Atlantic Ocean increased from 13 in 2014 to 24 in 2015. Longline was the only fishing gear used to fish tunas, tuna-like species and sharks and the target species were still bigeye tuna and bluefin tuna. The total catch was 5841.5 t (in round weight), 3040.8 t higher than that in 2014 (2800.7 t). The catch of bigeye tuna and bluefin tuna amounted to 4941.8 t and 45.084 t in 2015, respectively. The catch of bigeye tuna accounted for 84.6% of the total in 2015 and it was 2710.0 t higher than that in 2014 (2231.8 t). Yellowfin tuna, swordfish and albacore tuna, etc. were taken as bycatch. The catch of yellowfin tuna increased from 92.4 t in 2014 to 169.6 t in 2015. The catch of swordfish was 468.5 t, with a 76.0% increase compared with the previous year (266.2 t in 2014). The catch of albacore tuna was 141.4 t, which was 72.7 t more than that in 2014 (68.7 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. Two observers in 2015 have been dispatched on board two Chinese Atlantic tuna longliners covering the areas of S5°32′-N9°25′，W18°32′-W32°18′ (targeting bigeye tuna) and N51°35′-N53°42′，W29°57′-W31°39′ (targeting bluefin tuna) since August 2015. Data of target species and non-target species (sharks, sea turtles, especially) were collected during the observation.

Côte d'Ivoire

Les quantités totales de thonidés débarquées aux différents quais s'élèvent à 1274150,9 de kilogramme. Avec respectivement 516845,99 kg de thonidés majeurs, 586756,75 kg de thonidés mineurs, 128266,03 kg de porte-épée et 42282,12 kg de requins. Dans les deux types de pêche, le SKJ et le YFT sont les espèces dominantes. Elles représentent la presque totalité de la production des thonidés majeurs.

La production des thonidés mineurs est supérieure à celle des thonidés majeurs. Le genre Auxis domine avec des pics de production pendant la période froide. Les espèces associées ne sont pas débarquées en grande quantité cependant leur production n'est pas négligeable.

Toutes ces espèces capturées et débarquées dans la zone d'Abidjan constituent une source inestimable en proteine animale pour la population.

En effet, vu l'importance de ces thonidés dans l'économie nationale et dans le souci d'une meilleure gestion du stock existant, une connaissance de la biologie et un renforcement du personnel enquêteur est indispensable.

Aussi, s'avère-t-il urgente de permettre à la Côte d'Ivoire d'être désormais partie prenante dans le programme de suivi des statistiques par la présence d'observateurs à bord des navires.

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, Netherlands, Portugal, Spain, and United Kingdom.

The EU fleet targets most of the species that are regulated by ICCAT i.e. bluefin tuna, skipjack, yellowfin, bigeye, albacore, swordfish, marlins, sailfish 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, longlines, hand-lines, troll, harpoons, mid-water trawls, traps and sport fishing. 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-catch, interactions with associated species, the composition of fleets, etc.

Moreover, the EU pays special attention to ensure a timely and complete submission of information by keeping the EU Member States 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

Longline is the only tuna fishing gear deployed by Japan at present in the Atlantic Ocean. The coverage of the logbook from the Japanese longline fleet in 2015 is estimated to be about 99%. In 2015, the number of fishing days was 13,400, which was 61% of the past ten years' average. The catch of tunas and tuna-like fish (excluding sharks) is estimated to be about 23,000 t, which is about 83% of the past ten years' average. In 2015, the most dominant species was bigeye tuna, representing 54% of the total tuna and tuna-like fish catch in weight. The second dominant species was yellowfin tuna occupying 15% and third one was albacore (9%). A total of 710 fishing days were monitored by observers between August 2015 and April 2016, covering 8.7% of the entire operations in 2015 (calendar year).

Korea (Rep. of)

In 2015, 4 Korean longline vessels engaged in fishing for tuna and tuna-like species in the Atlantic Ocean. The total catch for 2015 was estimated at 824 mt which declined to 56.1% from the previous year. Annual total catches of the three tuna species, bigeye tuna, albacore tuna and yellowfin tuna were 675 mt, 8 mt and 47 mt, respectively. Fishing area in 2015 was almost the same as in the previous years, which had been in the tropical area of the Atlantic Ocean (20°N ~20°S, 20°E~60°W) throughout the year. There was no fishing activity of Korean tuna purse seine vessel in 2015. Data collection and reporting is complying with the Act on Fisheries Information and Data Reporting revised and put into effect from 7 July 2015. Electronic data reporting system was changed from a weekly to a daily basis since the 1st of September 2015. It includes not only catch, effort, discard/release for target and bycatch species but also the method of bycatch mitigation used. The information shall be submitted to the National Institute of Fisheries Science (NIFS), and then, the NIFS undertakes the cross-checking of data among logbook, catch document, observer report and VMS data. The observer coverage was 13.8 % in terms of efforts (number of hooks) in 2015.

Mauritania

En Mauritanie, les espèces de thons hauturiers sont ciblées uniquement par des flottilles étrangères travaillant dans le cadre des accords bilatéraux et opérant sous le régime de licence libre. Les flottilles de ces parties contractantes qui ont atteint en 2016 environ 62 thoniers débarquent leur production dans des ports étrangers.

Les espèces de thons côtiers sont pêchées accessoirement par les unités hauturières de petits pélagiques. Les statistiques montrent que la capture accessoire du thon hauturier réalisée par la pêche hauturière a atteint, en 2015, 4300 tonnes (soit une augmentation de 144% par rapport à 2014) composée essentiellement de *Sarda sarda* avec une contribution de 58% contre 30% pour *Euthynnus* sp. et 12% pour *Auxis thazard*.

Les captures débarquées par la pêche artisanale et la pêche côtière sont subi une légère augmentation en 2015. Après la chute observée en 2014 pour une quantité moins de 500 tonnes composée essentiellement de *Scomberomorus tritor*. Il est à noter que les débarquements des thonidés pêchés par la senne tournante en Mauritanie se font généralement la nuit ce qui n'est pas couvert par le système de suivi actuel. Un programme de suivi axé sur ces pêcheries devrait être envisagé pour renforcer la collecte des données sur les thons mineurs et tropicaux pendant les horaires qui n'ont pas couvert par le Système de Suivi de la Pêche Artisanale et Côtière (SSPAC).

En fin plusieurs programmes de recherches axés sur les thons rouges et les thons mineurs ont été lancés par l'IMROP en 2016 avec l'appui financier de l'ICCAT. Le premier programme vise la collecte des données et les informations disponibles sur la présence des thons rouges dans la zone Mauritanienne et le deuxième la collecte des données biologiques sur les thonidés mineurs en vue d'étudier les structures des tailles et les paramètres de croissance.

Morocco

Au cours de l'année 2015, la pêche des espèces de thonidés et des espèces apparentées au Maroc a atteint une production de 9120.9 TM contre 6792.09 TM au cours de l'année 2014, soit une hausse d'environ 34 % en termes de volume.

Pour le thon rouge, les captures ont atteint 1 498,1 TM, alors que celles de l'espadon se sont élevées à 1 330,4 TM. Par rapport à l'année précédente, les prises de thon obèse sont restées stables autour de 308,5 TM, celles de la palomette ont augmenté de 27 %, avec 1120,7 TM, alors que les prises du listao ont accusé une baisse importante de 46 % et n'ont pas dépassé 575,5 TM.

Les captures des thonidés mineurs ont enregistré 2 221,9 TM, soit une augmentation de 90 % par rapport à 2014. Quant aux requins et squalidés, leurs prises ont connu une forte hausse et ont atteint 2974,6TM ; cette augmentation se justifie par l'amélioration du processus d'identification des différentes espèces de requins (ventilation spécifique).

Le Maroc, à travers l'Institut National de recherche Halieutique (INRH), collecte et soumets régulièrement à l'ICCAT les données Tâche II des thonidés et espèces apparentées. Il a participe également depuis 2011 au projet de recherche ICCAT sur le thon rouge (GBYP) à travers la réalisation de marquage électronique et la collecte des échantillons biologiques et génétiques de thon rouge pour améliorer les connaissances sur les structures des stocks. Aussi, l'INRH contribue activement dans le programme de recherche des thonidés mineurs (SMTYP) en récupérant les séries historiques Tâche I et II relatives aux thonidés mineurs, mais aussi à travers la réalisation d'études biologiques sur ces espèces.

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 RFMO's or International Organisation of which Namibia is a member. 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 2015, 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 July 2016 (Task I and Task II). The landings for some species, namely, albacore (ALB), bigeye tuna (BET) and yellowfin tuna (YFT) have increased in 2015 when compared to 2014, while other species, such as oil fish (OIL) and longfin mako (LMA) were recorded during 2015, but not in 2014 and 2013.

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 RFMO's and International Organisations.

Norway

Norway caught several specimens of Atlantic bluefin tuna (*Thunnus thynnus*) as bycatch in non-ICCAT fisheries in 2015. There have also been observations of Atlantic bonito (*Sarda sarda*) in Norwegian waters in 2015 and a catch of 30 kilo of this specimen was registered. Several observations of Atlantic bluefin tuna were made along the coast of Norway in 2015. Norway continuously works on present and historical data on tuna and tuna like species and aims at incorporating the data on these species into an ecosystem perspective. Norway participated at the SCRS annual science meeting in 2015.

Russia

In 2010-2015, during trawl fishing of the Russian vessels in the ICCAT Convention area tuna occurred in catches. During non-specialized trawl fishing (for small coastal fish species) tuna occurred as a by-catch. A purse-seine specialized fishing for tunas of a tropical group is in progress at the moment. Issues aimed at resuming of this type of fishery are being resolved. A specialized (purse-seine) fleet did not operate in 2010-2015.

In Russia, work related to research of tunas and other species of tuna fishery is carried out by federal state unitary enterprises: the Atlantic Research Institute of Fisheries and Oceanography ("AtlantNIRO"), Kaliningrad, and the Russian Federal Research Institute of Fisheries and Oceanography ("VNIRO"), Moscow. These institutions collect fishery and biological statistics, analyze collected data, carry out operative fishery monitoring, prepare proposals and recommendations required for tuna fishing vessels operation. Within the framework of ICCAT activities Russia participates in the work of Panel 1 on "Tropical Tunas". Research carried out in 2015-2016 comprised collecting and processing current fishery and biological materials.

Senegal

La flottille thonière industrielle sénégalaise en 2015 est composée de six (6) canneurs et trois (3) senneurs qui exploitent essentiellement les thons tropicaux notamment l'albacore (*Thunnus albacares*), le thon obèse (*Thunnus obesus*) et le listao (*Katsuwonus pelamis*) et un (1) palangrier qui cible l'espadon. Toutefois, une partie des pêcheries artisanales (la ligne à la main, la ligne de traîne et la senne tournante et les filets) capturent les poissons porte-épée (marlins et voilier) et les petits thonidés (thonine, maquereau, bonite, auxide etc.) et les requins.

Les prises totales de thons tropicaux des canneurs sénégalais sont estimées à 3139 t dont 584 t d'albacore, 1897 t de listao, 502 t de patudo et 126 t de thonine et 30 t d'auxide. Les Prises de thons tropicaux des senneurs sénégalais sont de 5467t. Les captures sont composés de 1196 t d'albacore, 2775t de listao, 394 t de patudo, 1098 t d'auxide et 4 t de germon.

Pour la pêche palangrière sénégalaise ciblant l'espadon, les prises de 2015 sont estimées à 222 t dont 143 t d'espadon, 56.5 t de requins, 9.8 t de marlin bleu et 12 t de thons albacore. Concernant les pêcheries artisanales de petits thonidés et espèces apparentées, les prises de 2015 ont été estimées à 9677 t.

Le suivi des activités de pêche des thoniers qui s'activent dans l'océan atlantique et qui fréquentent le port de Dakar est toujours assuré par le Centre de Recherches Océanographiques de Dakar-Thiaroye (CRODT). Dans le cadre du programme de recherche intensive sur les Istiophoridés, la collecte des statistiques (captures et effort de pêche en nombre de sortie) et l'échantillonnage sont toujours menés au niveau des principaux ports de la pêche artisanale.

Trinidad and Tobago

The Trinidad and Tobago landings of tuna and tuna-like species from commercial and recreational vessels for the year 2015 were estimated at 3 561 t, this being essentially a 90 t increase in landings of the non-artisanal longline fleet over the 2014 estimate. Yellowfin tuna landings of 1 179 t comprised 78% of the 2015 landings of the fleet. There were 30 operational longliners in 2015. The biological data collection programme for key tuna and tuna-like species landed by the non-artisanal longline fleet remains suspended.

Tunisia

La Tunisie effectue différentes activités de recherche sur le thon rouge Thunnus thynnus, les thons mineurs et l'espadon Xiphias gladius. Ces activités sont réalisées au sein du Laboratoire des Sciences Halieutiques de l'Institut National des Sciences et Technologies de la Mer (INSTM). Elles sont définies tenant compte principalement des recommandations de l'ICCAT et des priorités du SCRS, telles que : le suivi des pêcheries et la préparation des données pour l'évaluation des stocks.

Pour le thon rouge, nous étudions l'indice d'abondance (CPUE), les structures démographiques et les relations biométriques. Ces investigations concernent la campagne de pêche des senneurs et l'activité d'engraissement.

En 2016, nous avons lancé un programme scientifique de suivi de la pêcherie palangrière de l'espadon. Ce programme se base sur le suivi d'un échantillon de bateaux dans les principaux ports. Le suivi concerne les moyens de pêche, la durée des sorties, les lieux et la période de pêche, les débarquements d'espadon et des espèces accessoires, les structures démographiques et les relations biométriques et ensuite l'indice d'abondance (CPUE).

La pêche aux thons mineurs représente une activité socio-économique importante. Le programme scientifique actuel concerne le suivi des structures démographiques des débarquements des espèces (Auxis rochei, Euthynnus alletteratus) dans le port de Teboulba (Est-Tunisien).

Turkey

Total catch amount of marine fishes of Turkey was 397,730.7 t during the year 2015. The portion of the tuna and tuna-like fishes in total catch was 6,553.8 t including Mediterranean swordfish. In 2015, catch amount of the tuna and tuna like species were 1,091.0 t, 4,573.0 t, 34.9 t, 53.4 t, 325.5 t, and 476.0 t for bluefin tuna, Atlantic bonito, swordfish, albacore, little tunny and bullet tuna, respectively. Most of bluefin tunas were caught by purse seiners, which have an overall length 26-62 meters. The fishing operation was conducted intensively off Antalya Bay in the south of Turkey and in the Eastern Mediterranean region. The bluefin tuna catch started at the end of May and finished at the end of June. Conservation and management measures regarding swordfish, bluefin tuna fisheries and farming are regulated by national legislation through notifications, considering ICCAT's related regulations.

United Kingdom - OTs

The level of fishing effort in the United Kingdom Overseas Territories (UK OTs) engaged in ICCAT during 2015 was similar to 2014 in terms of vessels registered, with a slight decrease in the Bermuda fleet. 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 UK OTs continue 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 robust management frameworks 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 2015 was 5,858 t, a decrease of about 14% from 6,779 t in 2014. Swordfish catches (including estimated dead discards) decreased from 1,945 t in 2014 to 1,722 t in 2015, and provisional landings from the U.S. fishery for yellowfin tuna decreased in 2015 to 2,076 t from 2,630 t in 2014. U.S. vessels fishing in the Northwest Atlantic caught in 2014 an estimated 896 t of bluefin tuna, an increase of about 86 t compared to 2014. Provisional skipjack tuna landings increased by about 2 t to 78 t from 2014 to 2015, bigeye tuna landings decreased by 21 t compared to 2014 to an estimated 838 t in 2015, and albacore landings decreased from 2014 to 2015 by 210 t to 248 t.

U.S. government (NOAA) and university scientists, working independently or in collaboration (including collaborations with scientists from other CPCs), conducted research in 2015 involving a variety of ICCAT and bycatch 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, fecundity, and genetics (including direct estimates of stock size). Additional topics included the influence of environmental factors on distribution and catch rates, and factors (e.g. hook type) affecting bycatch rates and survival.

Uruguay

Durante el año 2015, la flota atunera uruguaya no mantuvo actividades. En lo que va del 2016 se presentaron a DINARA varios proyectos para la incorporación de nuevos buques a la pesquería de grandes recursos pelágicos, por lo que se espera una recuperación del sector a partir del 2017.Se continuó con el análisis de estadísticas de captura y esfuerzo de las especies de interés de la Comisión. Se realizó una campaña de investigación, a bordo del B/I de DINARA, dirigida a grandes recursos pelágicos. Durante la misma se registró la captura, se realizaron muestreos de talla y sexo, se tomaron muestras biológicas, y se continuó con el Programa de Marcado convencional y marcado satelital. También se realizaron experimentos para evaluar medidas de mitigación de la captura incidental. Uruguay participó y aportó trabajos en diversas reuniones del SCRS, incluyendo la reunión del grupo de trabajo sobre métodos de evaluación de stock (2 documentos), la reunión de preparación de datos de tintorera (6 documentos), la reunión de evaluación de stock de tintorera, la reunión de evaluación de stock de patudo, la reunión del subcomité de ecosistemas y la reunión del grupo de especies de pequeños túnidos. Se continuó con el trabajo de control en puerto de buques de tercera bandera iniciado durante 2009. Se realizaron inspecciones en puerto para determinar cuáles son las especies desembarcadas, cuál es su origen y controlando aspectos formales de la documentación de los barcos. Todas las Recomendaciones de la CICAA aprobadas durante la Reunión de la Comisión en el año 2015 han sido internalizadas en Uruguay, y actualmente rigen bajo decreto.

Venezuela

La flota industrial venezolana dirige sus capturas a los túnidos tropicales. El año 2015 contó con 77 buques de pesca activos: 70 palangreros, 3 cerqueros y 4 cañeros. Ese año se produjeron capturas de tunidos y especies afines provenientes del Océano Atlántico en el orden de las 6609,22 t, dentro de las cuales 6399,69 t corresponden a desembarques y 209,53 t a descartes. El 89,85% de los desembarques lo representan los atunes, entre los cuales el más importante fue el aleta amarilla (T. albacares) con 47,23 %, mientras que el bonito listado (K. pelamis), el albacora (T. alalunga), el ojo gordo (T. obesus), el aleta negra (T. atlanticus) y la carachana (A. thazard), alcanzaron 29,96 %, 8,47 %, 2,0 %, 1,22 % y 0,97 %, respectivamente. La captura incidental de especies afines estuvo conformada por peces pico, entre los que se destacan el pez vela (Istiophorus albicans) con 2,3 % y la aguja blanca (Tetrapturus albidus) con 1,58 % y tiburones oceánicos cuyos desembarques representan el 2,31 %, siendo el tiburón azul (Prionace glauca) el que presenta la mayor cantidad dentro de este grupo con 1,95%. El 62,37 % de los desembarques provinieron de la pesquería de cerco, 7,12 % de la de caña, 30,51 % la de palangre. Venezuela realizó descartes de las especies de atún albacora y de las especies de tiburones Alopias superciliosus, Carcharhinus falciformis, Carcharhinus longimanus y Sphyrna lewini. También mantuvo el Programa Nacional de Observadores a bordo de Venezuela (PNOB) de embarcaciones industriales de palangre, caña y cerco con una cobertura de 2,24% del total de los viajes de la flota.

- Cooperating Non-Contracting Parties, Entities and Fishing Entities

Chinese Taipei

In 2015, the number of authorized fishing vessels was 117 with 75 targeting bigeye tuna and 42 targeting albacore, and the total catch of tuna and tuna-like species was about 31,400 t. Bigeye tuna was the most dominant species, which accounts for 52% of the total catch in weight, followed by albacore with catch accounting for 32% of the total catch. We have carried out a scientific observer program for the tuna fishery in ICCAT waters since 2002. In 2015, there were 18 observers deployed on fishing vessels operating in the Atlantic Ocean, and the observer coverage on albacore and bigeye vessels was 7.52% and 11.85%, respectively. The research programs conducted by scientists in 2015-2016 included the researches on CPUE standardizations and assessments of yellowfin tuna, albacore, sailfish 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 the 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 2015, 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 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 ICCAT Yellowfin Tuna Stock Assessment Session (SCRS/2016/207). 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 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 have declined by nearly half from the peak in 1990 (193,600 t) to 108,910 t estimated for 2015. 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 47,900 t), but subsequently increased to 82,340 t in 2015 (**YFT-Table 1; YFT-Figure 2**). Baitboat catches have declined by 70% since 1990 (from 19,600 t to 5,910 t). Longline catches, which were 10,300 t in 1990, declined to 4,330 t in 2015. 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 90%, to 1,950 t in 2015. Baitboat catches also declined 90% since a peak in 1994 (7,100 t), and for 2015 were estimated to be below 750 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 65 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.

The average weight trends by fleet (1970-2015) 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 is expected to maintain healthy stock status ($B>B_{MSY}$, $F<F_{MSY}$) through 2024 with at least 68% probability, increasing to 97% by 2024. This result is similar to the previous assessment result (2011) which indicated that catch levels of 110,000 t were expected to lead to, or maintain healthy stock status through 2017 with a at least 64% probability, and with a 77% by 2024.

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. Recommendation 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 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 anticipated effect of the moratorium described in Rec. 15-01 was estimated (see response to the Commission 18.1) and will be reevaluated when data becomes available. Rec. 14-01 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) and 2014 (97,000 t) were lower than this TAC, but the 2015 estimates are near this level (108,910 t).

YFT-6. Management recommendations

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 is expected to maintain healthy stock status through 2024. 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[*]. 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]
2015 Yield	108,910 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	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. 15-01; effective June 2016]
- 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 (10th-90th percentiles) from joint distribution of age-structured and production model bootstrap outcomes considered.

[*] Second Meeting of the Ad Hoc Working Group on FADs (*Bilbao, Spain, 14-16 March 2016*).

YFT-Table 1. Estimated catches (t) of yellowfin (*Thunnus albacares*) by area, gear and flag. (v1, 2016-09-30)

			1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
TOTAL			167523	163770	163451	173744	154588	149152	137375	144496	136325	132154	153455	134427	122448	119445	101745	104659	95963	106716	113438	108781	102640	104513	97269	96994	108910
	ATE		130626	126058	124706	125530	119314	116096	105034	113576	105615	96531	113132	104767	97467	88207	75677	76388	71795	88593	94661	87987	84962	84652	77790	82153	94206
	ATW		36897	37712	38745	48215	35274	33056	32341	30919	30710	35623	40323	29660	24982	31238	26068	28272	24167	18123	18777	20794	17678	19861	19479	14841	14704
Landings	ATE	Bait boat	17693	15095	18471	15652	13496	11365	12695	14265	16729	10022	14034	11145	9967	14639	9725	12490	7044	7253	7424	6879	9118	6297	4731	6176	5913
		Longline	9082	6518	8537	14638	13723	14236	10483	13872	13561	11369	7570	5869	9183	11537	7317	7234	13437	8562	7385	5544	6602	5510	5659	5322	4328
		Other surf.	3748	2450	2122	2030	1989	2065	2136	1674	1580	2424	2074	1747	2432	2833	2152	2988	2534	1693	3012	1690	1254	1949	2941	1450	1485
		Purse seine	97182	99532	92130	90151	87597	87616	78225	82278	71964	70664	89068	85685	74580	57663	55429	52928	47944	70077	75417	72006	64966	69024	63126	67798	82343
	ATW	Bait boat	5359	6276	6383	7094	5297	4560	4275	5511	5364	6753	5315	6009	3764	4868	3867	2695	2304	886	1331	1436	2311	1108	1403	493	743
		Longline	14100	17336	12129	11790	11185	11882	11554	11671	13326	15760	14872	11921	10166	16019	14449	14249	13557	13192	12782	13038	10677	12558	12308	8345	6744
		Other surf.	3024	2741	4152	9719	12454	5830	4801	4581	5330	5241	7027	3763	6445	7134	5118	6880	5959	1973	3285	3590	2425	2885	2130	3418	5263
		Purse seine	14414	11359	16081	19612	6338	10784	11710	9157	6523	7870	13108	7966	4607	3217	2634	4442	2341	2067	1370	2722	2256	3302	3635	2581	1951
Landings(FP)	ATE	Purse seine	2921	2463	3447	3059	2509	813	1495	1488	1781	2051	387	321	1305	1534	1054	747	836	1008	1423	1869	3021	1872	1332	1401	
Discards	ATE	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	6	0
		Purse seine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	137
	ATW	Longline	0	0	0	0	0	0	0	0	167	0	0	0	0	0	0	5	6	5	9	8	9	7	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	Angola	510	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	0	1	0	3	0	0	5	0	0	0	0	0	0	0	0	405	1794	3172	5861	5207	7036	7132
		Benin	1	1	1	1	1	1	3	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Cambodia	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	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	1932	1527	1612	1943	1908	1518	1783	1421	1663	1851	1684	1802	1868	3236	6019	5648	4568	7905	4638	5856	6002	4603	7513	4507	7866
		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	
		China PR	0	0	139	156	200	124	84	71	1535	1652	586	262	1033	1030	1112	1056	1000	365	214	169	220	170	130	20	78
		Chinese Taipei	2163	1554	1301	3851	2681	3985	2993	3643	3389	4014	2787	3363	4946	4145	2327	860	1707	807	1180	537	1463	818	1023	899	926
		Congo	17	18	17	14	13	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Cuba	658	653	541	238	212	257	269	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Curaçao	0	0	0	0	0	3183	6082	6110	4039	5646	4945	4619	6667	4747	24	1939	1368	7351	6293	5302	4413	6792	3727	5152	6267
		Côte d'Ivoire	0	0	0	0	0	0	2	0	0	673	213	99	302	565	175	482	216	626	90	470	385	1471	2077	324	251
		EU.España	53464	49902	40403	40612	38278	34879	24550	31337	19947	24681	31105	31469	24884	21414	11795	11606	13584	24409	32793	25560	21026	18854	11878	14267	21094
		EU.Estonia	234	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	34788	33964	36064	35468	29567	33819	29966	30739	31246	29789	32211	32753	32429	23949	22672	18940	11330	16115	18923	20280	22037	18506	20291	21087	19443
		EU.Ireland	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	
		EU.Latvia	255	54	16	0	55	151	223	97	25	36	72	334	334	334	334	334	0	0	0	0	0	0	0	0	
		EU.Lithuania	332	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	0	1	
		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	328	195	128	126	231	288	176	267	177	194	4	6	4	5	16	274	865	300	990	537	452	355	335	69	76
		EU.United Kingdom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	21	22	1	0	0
		El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2750
		Faroe Islands	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Gabon	0	0	12	88	218	225	225	295	225	162	270	245	44	44	44	44	0	0	0	0	0	0	0	0	**0**
		Gambia	16	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Georgia	25	22	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Ghana	9254	9331	13283	9984	9268	8182	15080	13222	20815	12304	23392	18100	15002	14044	13019	12897	11115	11502	11037	10457	8676	9591	8786	11652	13282
		Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2906	5265	3461	3736	2603	3124	2803	2949	4023	3754	5200
		Guinea Ecuatorial	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	892	892	199	0	2	11	9
		Guinée Rep.	0	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	0	2	0	0	4	3	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Japan	4467	2961	2627	4194	4770	4246	2733	4092	2101	2286	1550	1534	1999	5066	3088	4206	8496	5266	3563	3041	3348	3637	3843	3358	2844
		Korea Rep.	259	174	169	436	453	297	101	23	94	142	3	8	209	984	95	4	303	983	381	324	20	26	97	77	36

		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	Libya	0	0	0	0	0	0	0	0	0	0	208	73	73	0	0	0	0	0	0	0	0	0	0	0	
	Maroc	0	0	0	0	0	0	0	0	0	0	0	79	108	95	183	222	102	110	110	44	272	55	137	107	72
	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)	4856	10820	9800	8327	8844	9485	6514	7193	5086	5117	9942	7436	4857	3708	1757	0	0	0	0	0	0	0	0	0	
	NEI (Flag related)	2310	1315	1157	2524	2975	3588	3368	5464	5679	3072	2090	133	466	0	0	0	0	0	0	0	0	0	0	0	
	Namibia	0	0	0	35	14	72	69	3	147	59	165	89	139	85	135	59	28	11	1	9	90	0	6	15	42
	Nigeria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	3	1	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	7976	8338	10973	12066	13442	7713	4293	2111	1315	1103	574	1022	0	1887	6170	8557	9363	6175	5982	5048	4358	5004	3899	4587	3412
	Philippines	0	0	0	0	0	0	0	126	173	86	0	50	9	68	13	30	88	53	152	89	134	5	56	0	0
	Russian Federation	3200	1862	2160	1503	2936	2696	4275	4931	4359	737	0	0	0	0	4	42	211	42	33	0	0	0	0	0	
	S. Tomé e Príncipe	187	170	181	125	135	120	109	124	114	122	122	122	122	134	145	137	0	160	165	169	173	177	182	186	301
	Senegal	105	40	19	6	20	41	208	251	834	252	295	447	279	681	1301	1262	819	588	1279	1212	1050	1683	1247	612	1883
	Seychelles	0	0	0	0	0	0	0	0	0	6	0	11	0	0	0	0	0	0	0	0	0	0	0	0	
	South Africa	52	69	266	486	183	157	116	240	320	191	342	152	298	402	1156	1187	1063	351	303	235	673	174	440	1512	925
	St. Vincent and Grenadines	0	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	0	1	0	0	
	UK.Sta Helena	100	166	171	150	181	151	109	181	116	136	72	9	0	0	0	344	177	97	104	65	163	149	53	152	178
	Ukraine	215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	145	483	450	331	23	10	124	21	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	
ATW	Argentina	34	1	0	0	0	0	0	0	0	0	0	0	0	327	327	0	0	0	5	0	0	0	0	0	
	Barbados	108	179	161	156	255	160	149	150	155	155	142	115	178	211	292	197	154	156	79	129	131	195	188	218	262
	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	143	1164	1160	940	264	42	41	38	33	
	Brazil	1838	4228	5131	4169	4021	2767	2705	2514	4127	6145	6239	6172	3503	6985	7223	3790	5468	2749	3313	3617	3499	2836	3316	2866	4896
	Canada	29	25	71	52	174	155	100	57	22	105	125	70	73	304	240	293	276	168	53	166	50	93	74	34	59
	China PR	0	0	0	0	0	0	0	628	655	22	470	435	17	275	74	29	124	284	248	258	126	94	81	73	91
	Chinese Taipei	2009	2974	2895	2809	2017	2668	1473	1685	1022	1647	2018	1296	1540	1679	1269	400	240	315	211	287	305	252	236	143	294
	Colombia	92	95	2404	3418	7172	238	46	46	46	46	46	46	46	46	46	46	0	0	0	0	0	0	0	0	
	Cuba	18	11	1	14	54	40	40	15	15	0	0	65	65	65	65	65	0	0	0	0	0	0	0	0	
	Curaçao	150	160	170	155	140	130	130	130	130	130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	
	Dominica	12	23	30	31	9	0	0	0	80	78	120	169	119	81	119	65	103	124	102	110	132	119	120	0	
	Dominican Republic	0	0	0	0	0	0	0	89	220	226	226	226	226	226	226	226	0	0	0	0	0	0	0	0	
	EU.España	1462	1314	989	7	4	36	34	46	30	171	0	0	0	0	0	1	84	81	69	27	33	32	138	113	105
	EU.France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	122	456	712	412	358	647	623
	EU.Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	EU.Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	151	60	88	179	260	115	127	92	4	2	
	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	31
	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	
	Grenada	620	595	858	385	410	523	302	484	430	403	759	593	749	460	492	502	633	756	630	673	0	0	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	14
	Jamaica	0	0	0	0	0	21	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Japan	1698	1591	469	589	457	1004	806	1081	1304	1775	1141	571	755	1194	1159	437	541	986	1431	1539	1106	1024	734	465	627
	Korea Rep.	1	45	11	0	0	84	156	0	0	0	0	0	0	0	580	279	270	10	52	56	470	472	115	39	11
	Mexico	433	742	855	1093	1126	771	826	788	1283	1390	1084	1133	1313	1208	1050	938	890	956	1211	916	1174	1414	1004	1045	968
	NEI (ETRO)	0	0	0	0	0	0	0	0	0	0	36	0	0	0	0	0	0	0	0	0	0	0	0	0	
	NEI (Flag related)	2008	2521	1514	1880	1227	2374	2732	2875	1730	2197	793	42	112	0	0	0	0	0	0	0	0	0	0	0	
	Panama	2249	2297	0	0	0	0	0	0	5	0	0	0	0	0	0	2804	227	153	119	2134	0	0	1995	902	
	Philippines	0	0	0	0	0	0	0	36	106	78	12	79	145	299	230	234	151	167	0	0	0	30	72	76	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
	Seychelles	0	0	0	0	0	0	0	0	0	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	St. Vincent and Grenadines	48	22	65	16	43	37	35	48	38	1989	1365	1160	568	4251	0	2680	2989	2547	2274	854	963	551	352	505	153

			1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
		Sta. Lucia	49	58	92	130	144	110	110	276	123	134	145	94	139	147	172	103	82	106	97	223	114	98	136	93	175
		Suriname	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1943	1829	0	**0**
		Trinidad and Tobago	543	4	4	120	79	183	223	213	163	112	122	125	186	224	295	459	615	520	629	788	799	931	1128	1141	1179
		U.S.A.	6914	6938	6283	8298	8131	7745	7674	5621	7567	7051	6703	5710	7695	6516	5568	7091	5529	2473	2788	2510	3010	4100	2332	2630	2076
		UK.Bermuda	17	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	0	1	0	0	0	0	1	0	3	10	5
		UK.Turks and Caicos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	6	2	**0**
		Uruguay	62	74	20	59	53	171	53	88	45	45	90	91	95	204	644	218	35	66	76	122	24	6	7	0	**0**
		Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	0	681	689	661	555	873	816	720	330	207	124	17	
		Venezuela	16503	13773	16663	24789	9714	13772	14671	13995	11187	11663	18651	11421	7411	5774	5097	6514	3911	3272	3198	4783	4419	4837	5050	3772	3122
Landings(FP)	ATE	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	50	71	27	109	35	
		Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	77	28	39	40	103	152	58	35	82	256	
		Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	25	22	16	176	95	89	114	86	78	
		Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	267	116	24	
		EU.España	940	859	1149	910	559	87	384	494	733	714	0	0	335	368	142	154	67	270	279	352	358	140	146	353	
		EU.France	982	1033	1554	1461	1074	472	658	703	832	914	344	309	672	597	244	128	33	52	203	181	344	347	129	115	
		Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57	35	17	32	9	34	8	12	13	19	
		Guinée Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	72	0	66	20	67	95	389	876	487	461	
		Mixed flags (EU tropical)	998	571	744	688	876	254	452	291	216	423	42	13	298	570	292	251	416	464	467	857	1601	0	0	0	
		Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	155	125	177	114	99	54	101	54	163	59	
		St. Vincent and Grenadines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	
Discards	ATE	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	6	
		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	137
		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	
	ATW	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
		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	
		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	5	6	5	9	8	9	7	3	3	3
		U.S.A.	0	0	0	0	0	0	0	0	167	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	

Ghana 2015 Task I: total (BB + PS) reported catches (86245 t = 5599 [BET] + 18790 [YFT]+ 59483 [SKJ]) corrected by the SCRS for species catch composition (BET: 13.8%; YFT: 15.4%; SKJ: 70.8%).

EU-France 2015 Task I: last revision (arriving after the species groups deadline) not included in the table.

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%

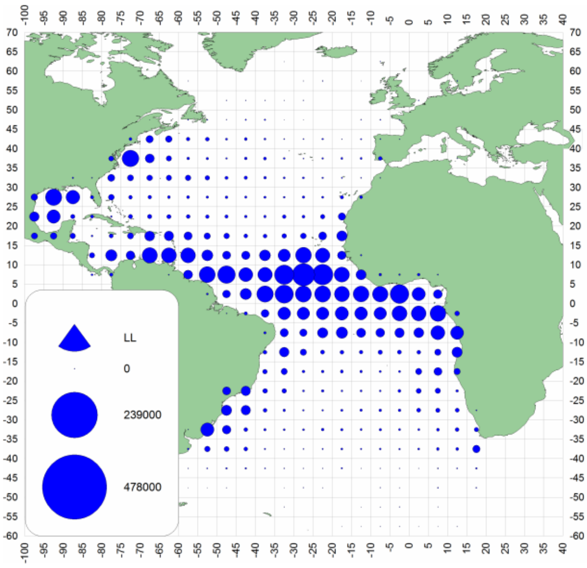
b) Probability that $B>B_{MSY}$

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%

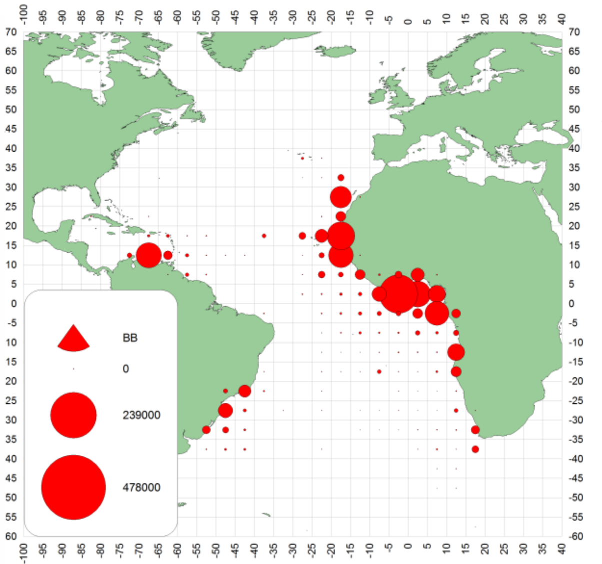
c) Probability that $F<F_{MSY}$ and $B>B_{MSY}$

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%

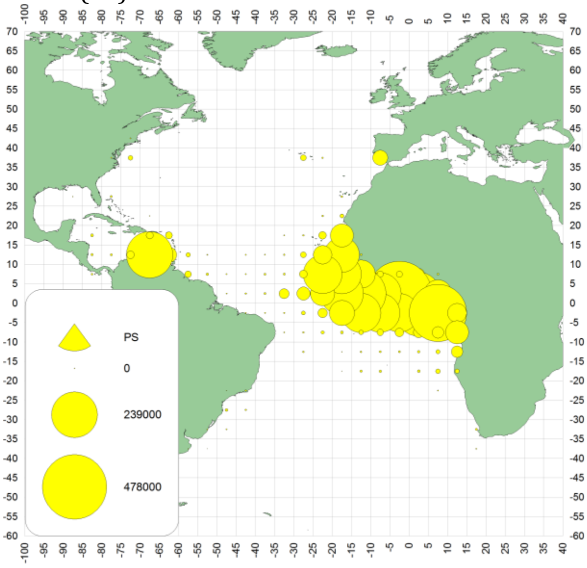
Note: SS, VPA and ASPIC projections applied an assumed catch of 110,337 (2015 estimate with carry-overs) to 2015 and 2016, prior to the application of the constant TACs of 50,000 to 150,000 t in 2017-2024. Due to a software constraint, ASPM projections applied constant TACs beginning in 2015.



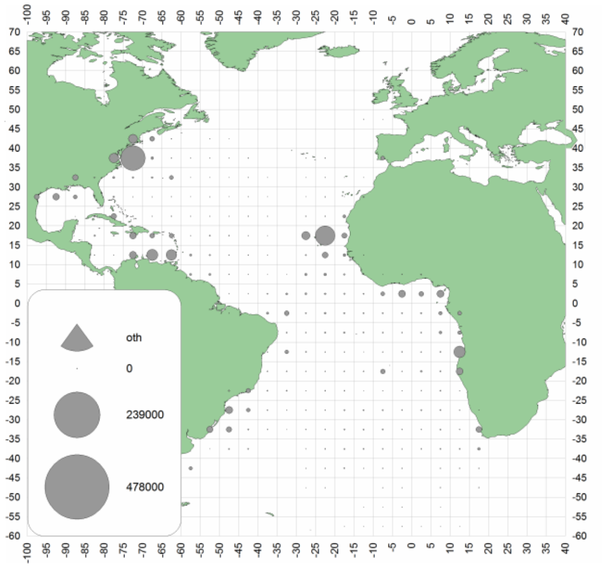
a. YFT (LL)



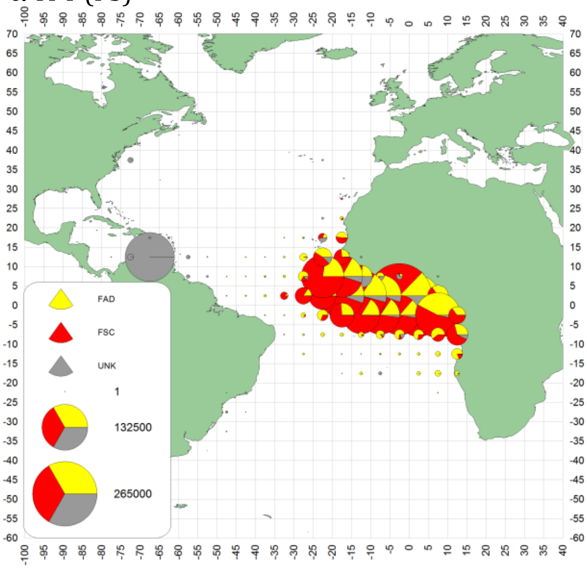
b. YFT (BB)



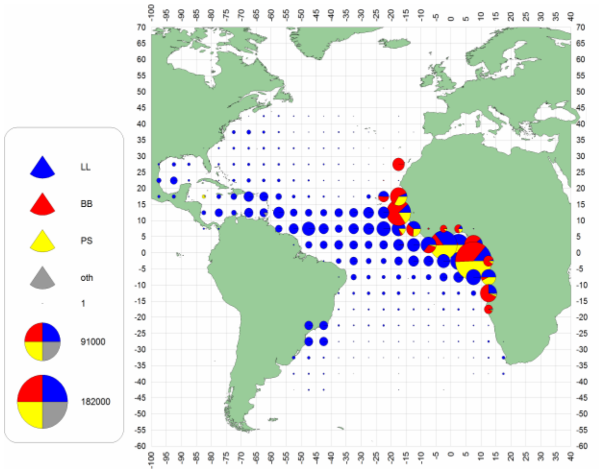
c. YFT (PS)



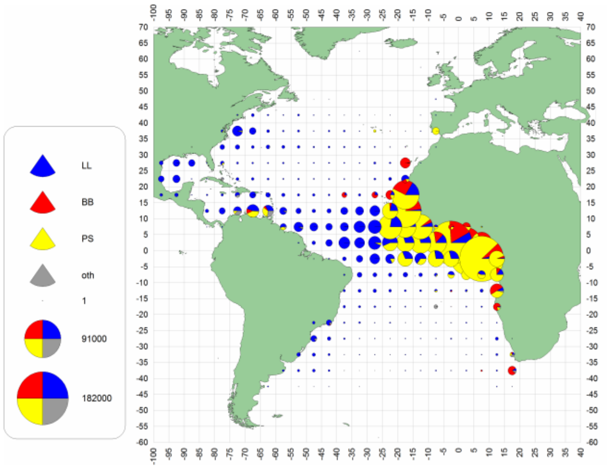
d. YFT (oth)



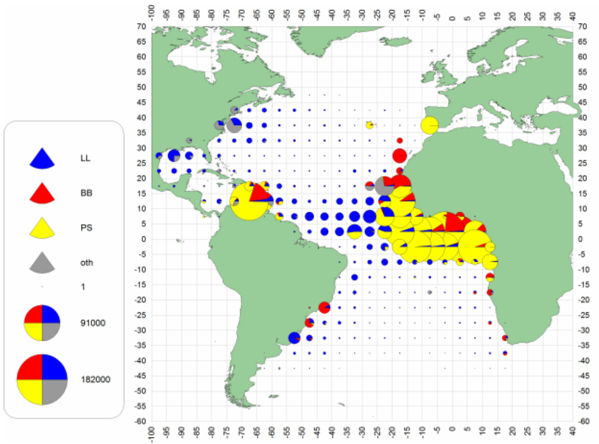
e. YFT (FAD/FREE 1991-2014)



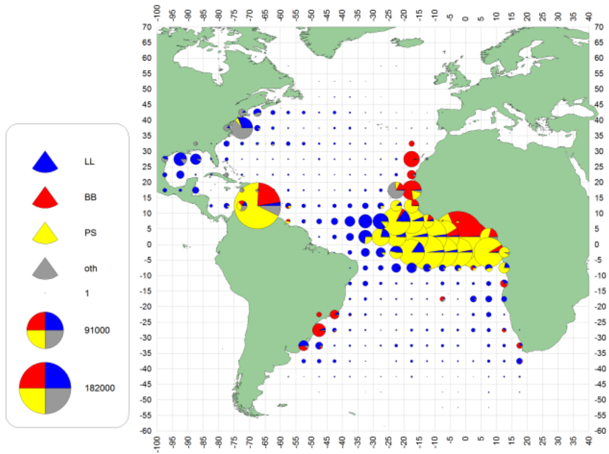
f. YFT(1960-69)



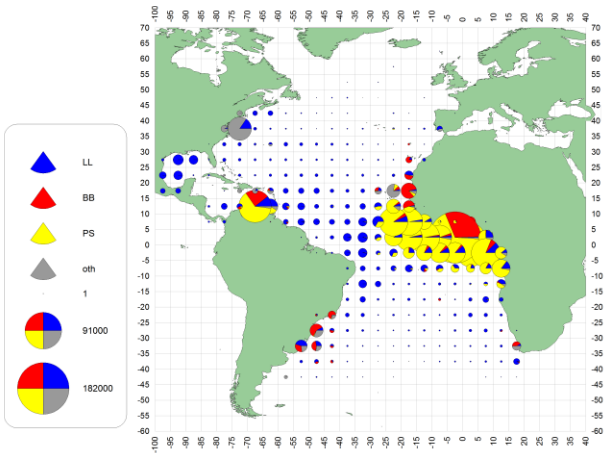
g. YFT(1970-79)



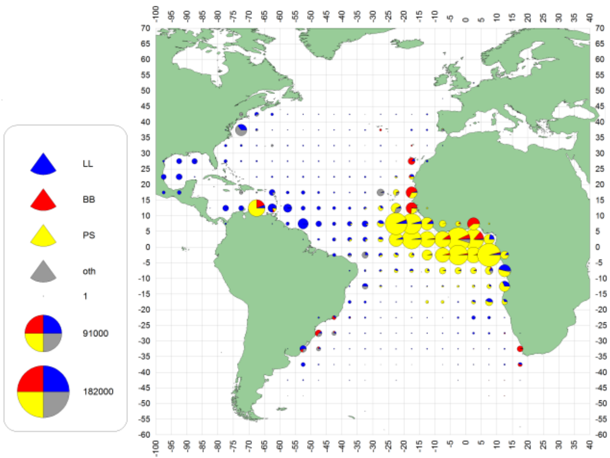
h. YFT(1980-89)



i. YFT(1990-99)

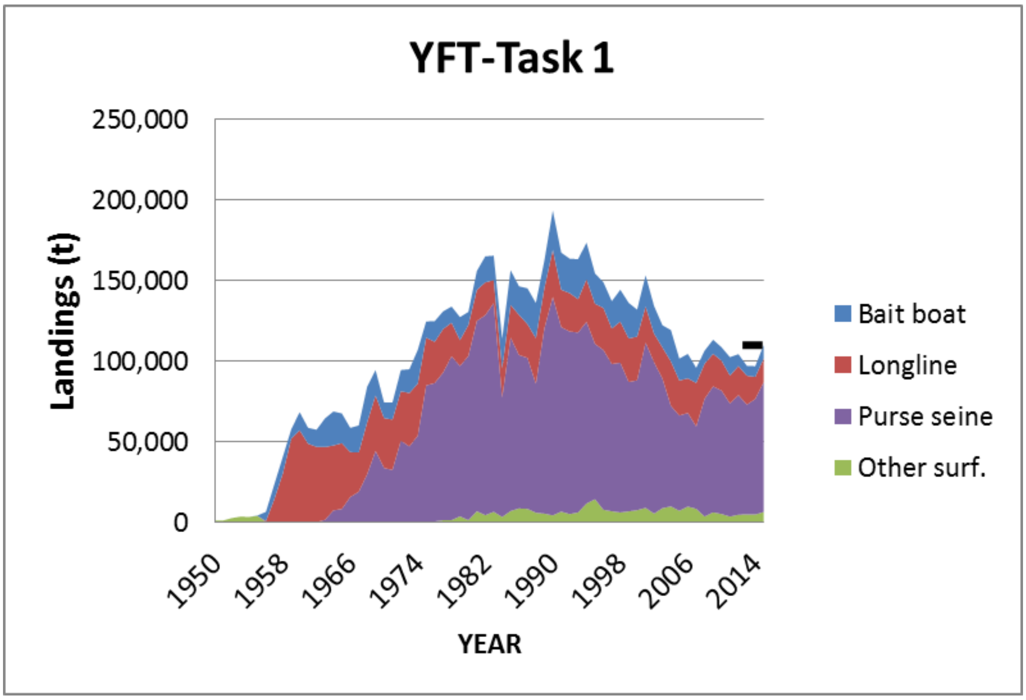


j. YFT (2000-09)

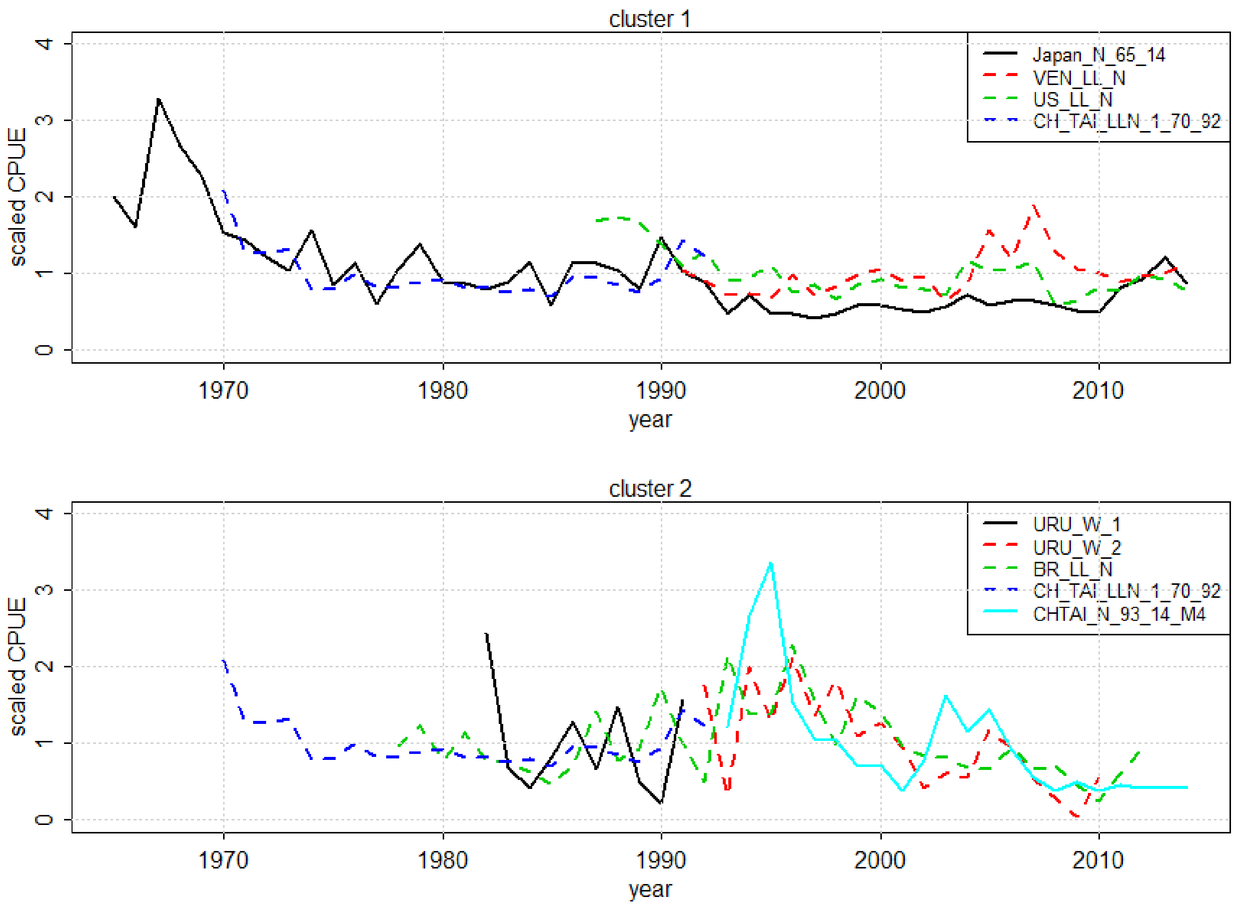


k. YFT(2010-14)

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 1960-2014. Note: the last panel (k) shows only 5 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 2010-2014.

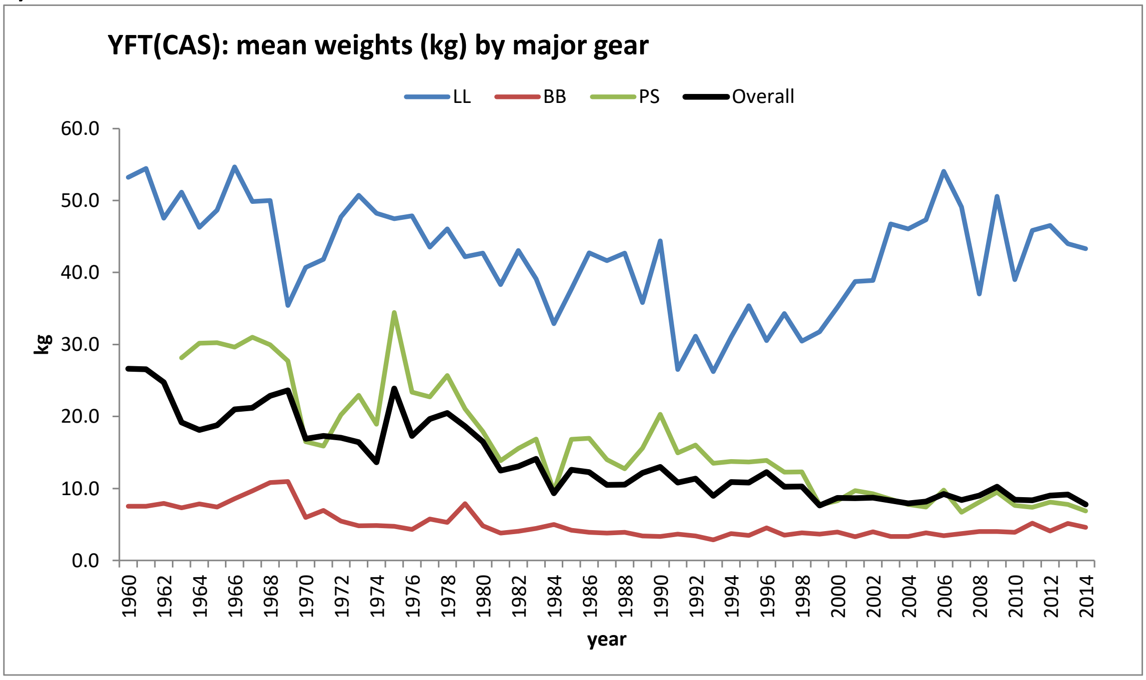


YFT-Figure 2. Estimated annual catch (t) of Atlantic yellowfin tuna by fishing gear, 1950-2015. A TAC of 110,000 t has been in place since 2012 [Rec. 14-01].

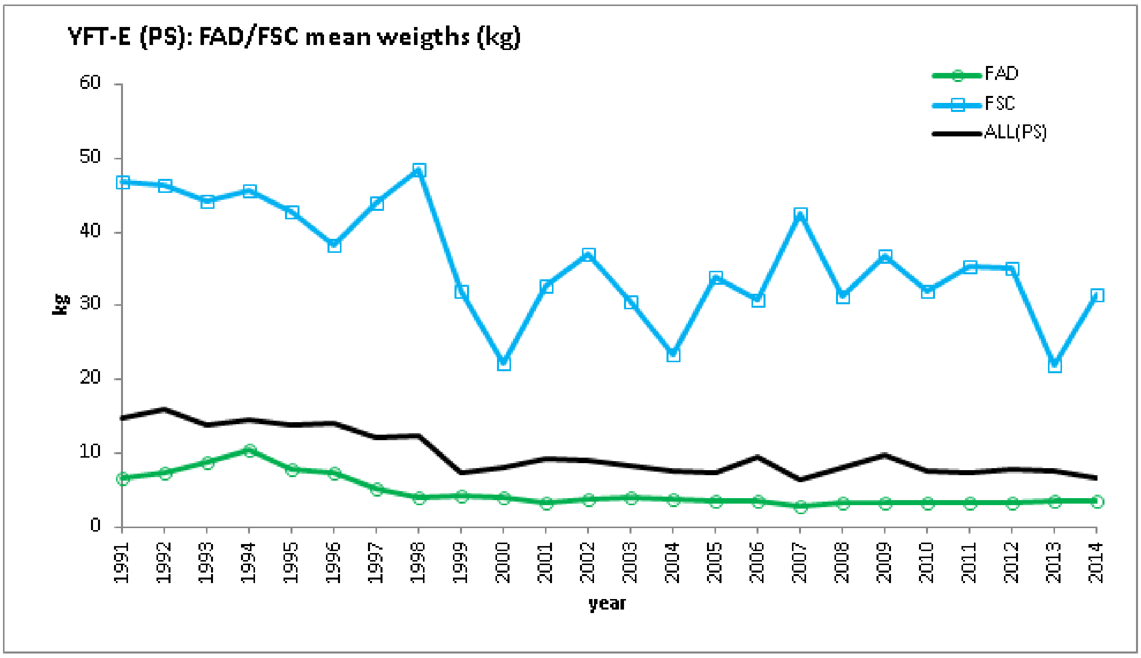


YFT-Figure 3. Yellowfin standardized catch rate trends from cluster 1 (top panel) and cluster 2 (bottom panel) indices of abundance.

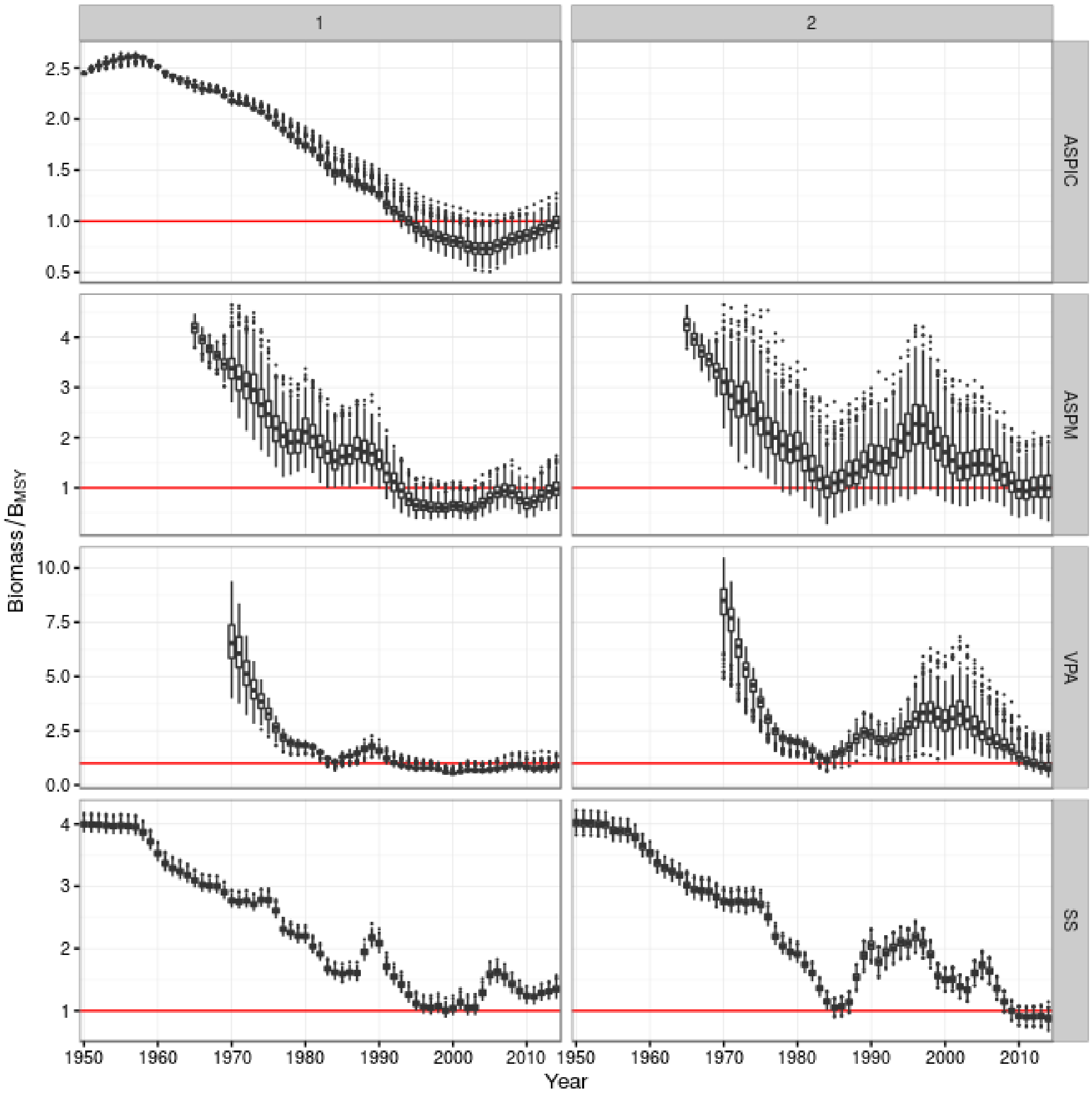
a)



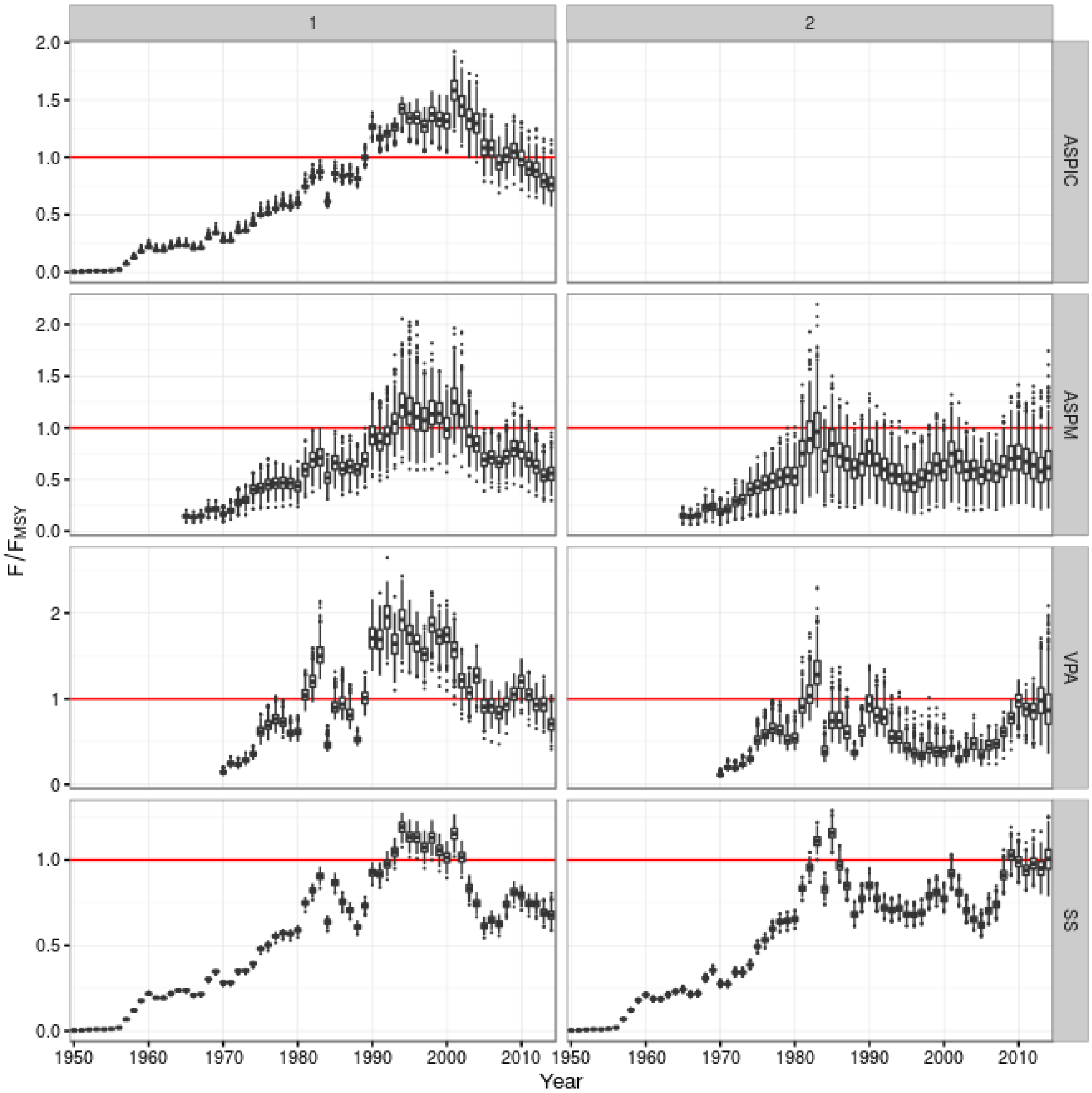
b)



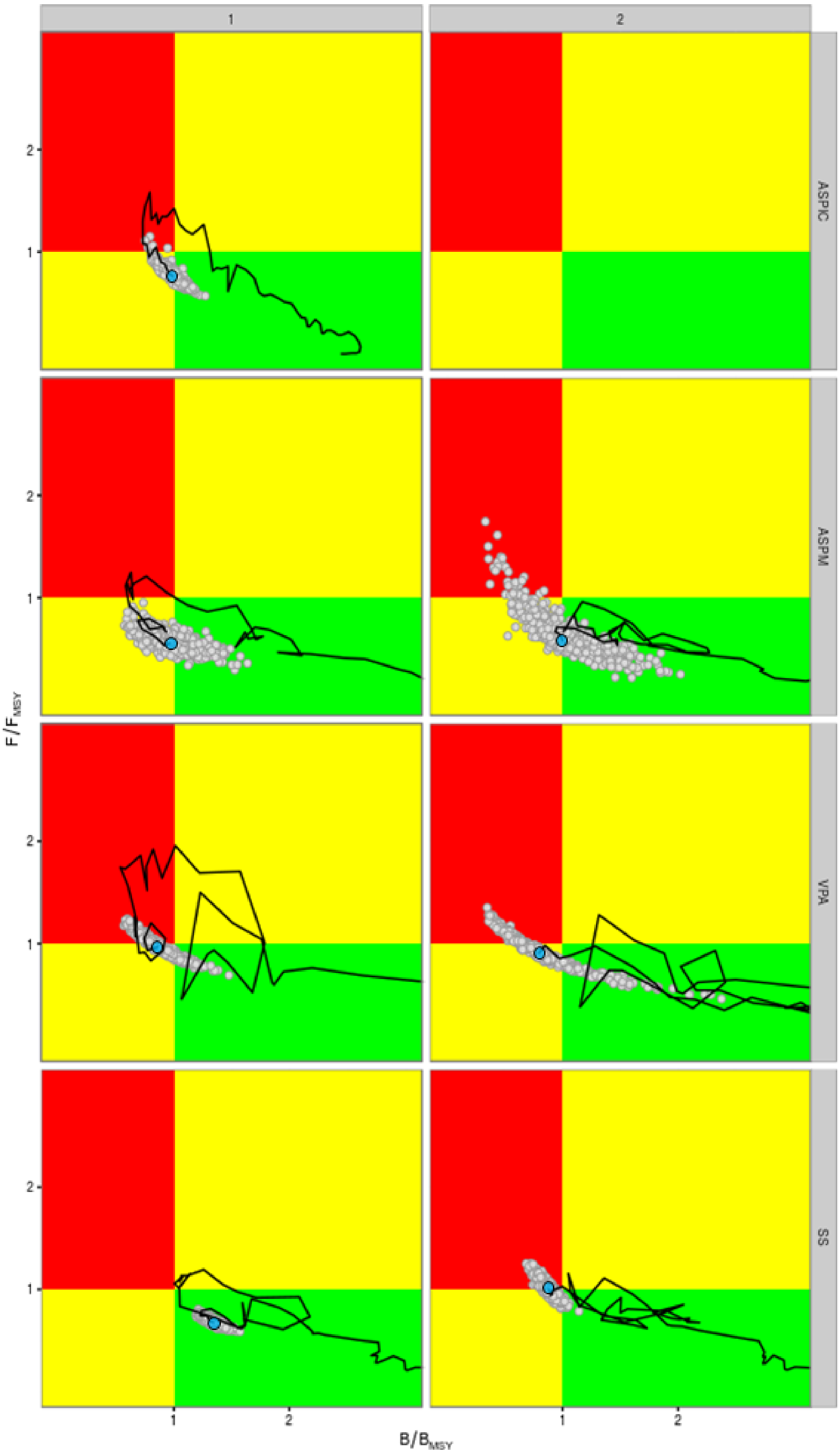
YFT-Figure 4. Trends in estimated mean weight (kg, weighted by respective catches) of yellowfin tuna: a) Overall, by major gear (1960-2014); b) Only eastern purse seine fishery (1991-2014), by operation mode (FSC: free schools; FAD: associated schools). Note: The mean weight of the baitboat fishery (panel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



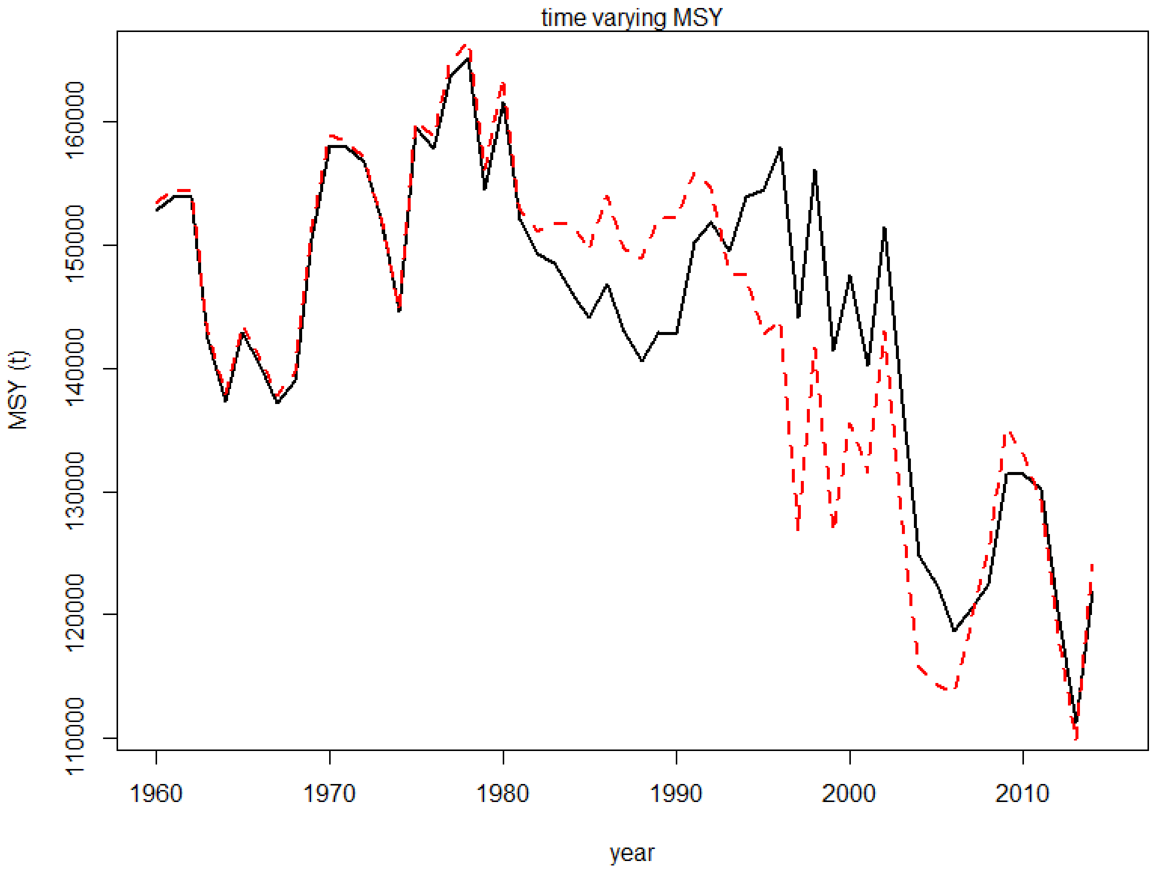
YFT-Figure 5. Trends in biomass relative to the level that produces MSY (red) for the model runs used to develop management advice. Box and whisker plots indicate the uncertainty in bootstrap estimates. (Boxes indicate the annual median estimates, 25th and 75th percentiles; whiskers and points indicate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



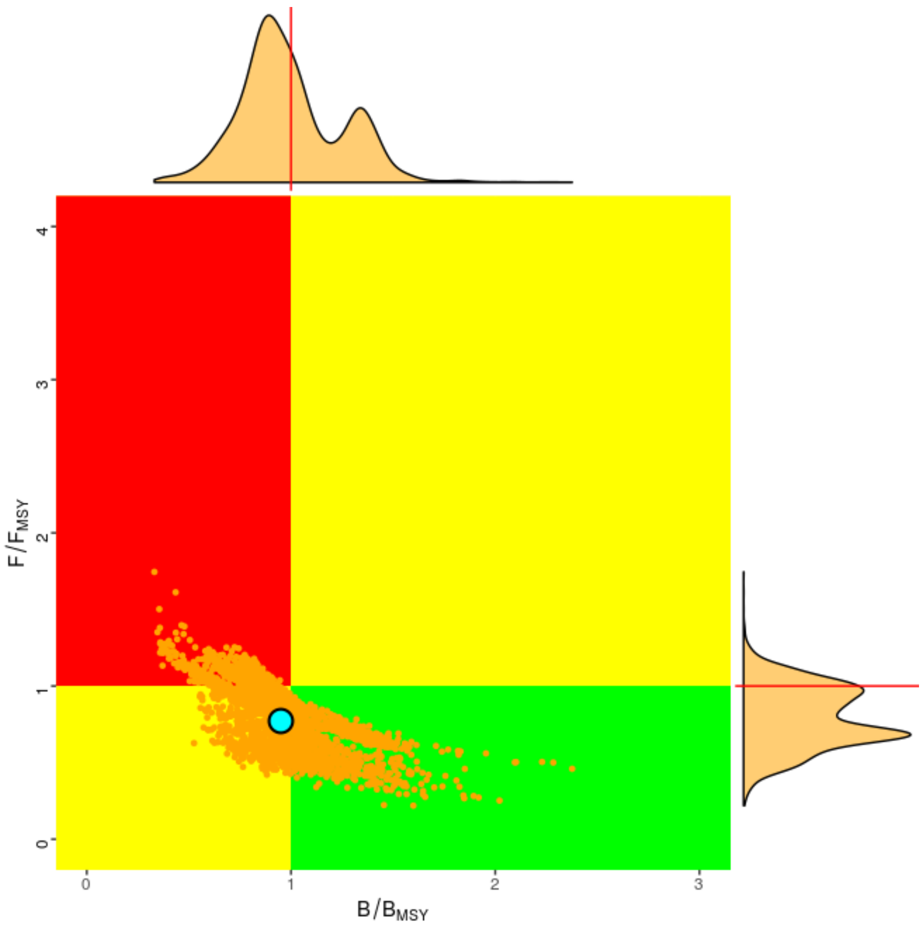
YFT-Figure 6. Trends in fishing mortality relative to the level that produces MSY (red) for the model runs used to develop management advice. Box and whisker plots indicate the uncertainty in bootstrap estimates. (Boxes indicate the annual median estimates, 25th and 75th percentiles; whiskers and points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



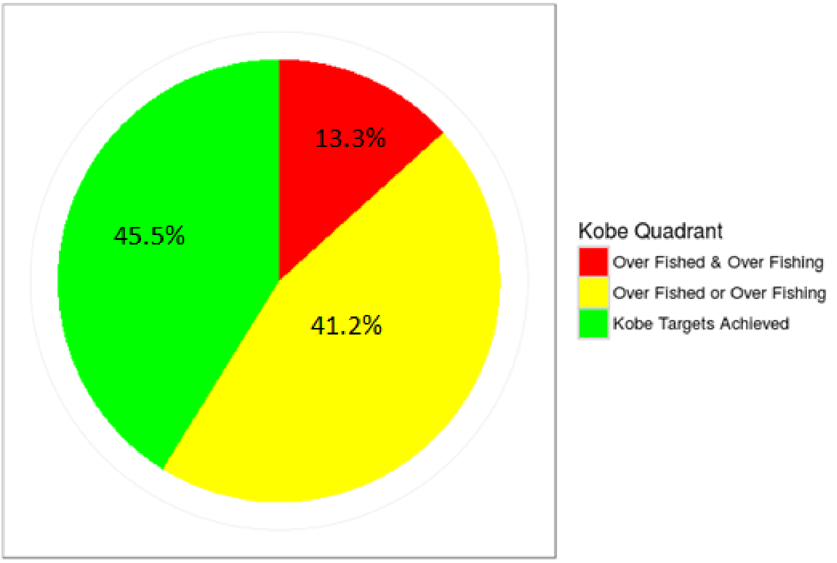
YFT-Figure 7. Kobe Status Plot for each model with 500 bootstrap estimates of the uncertainty in current stock status. The trajectories are intended to demonstrate general trends in stock status, but do not account for known changes in selectivity.



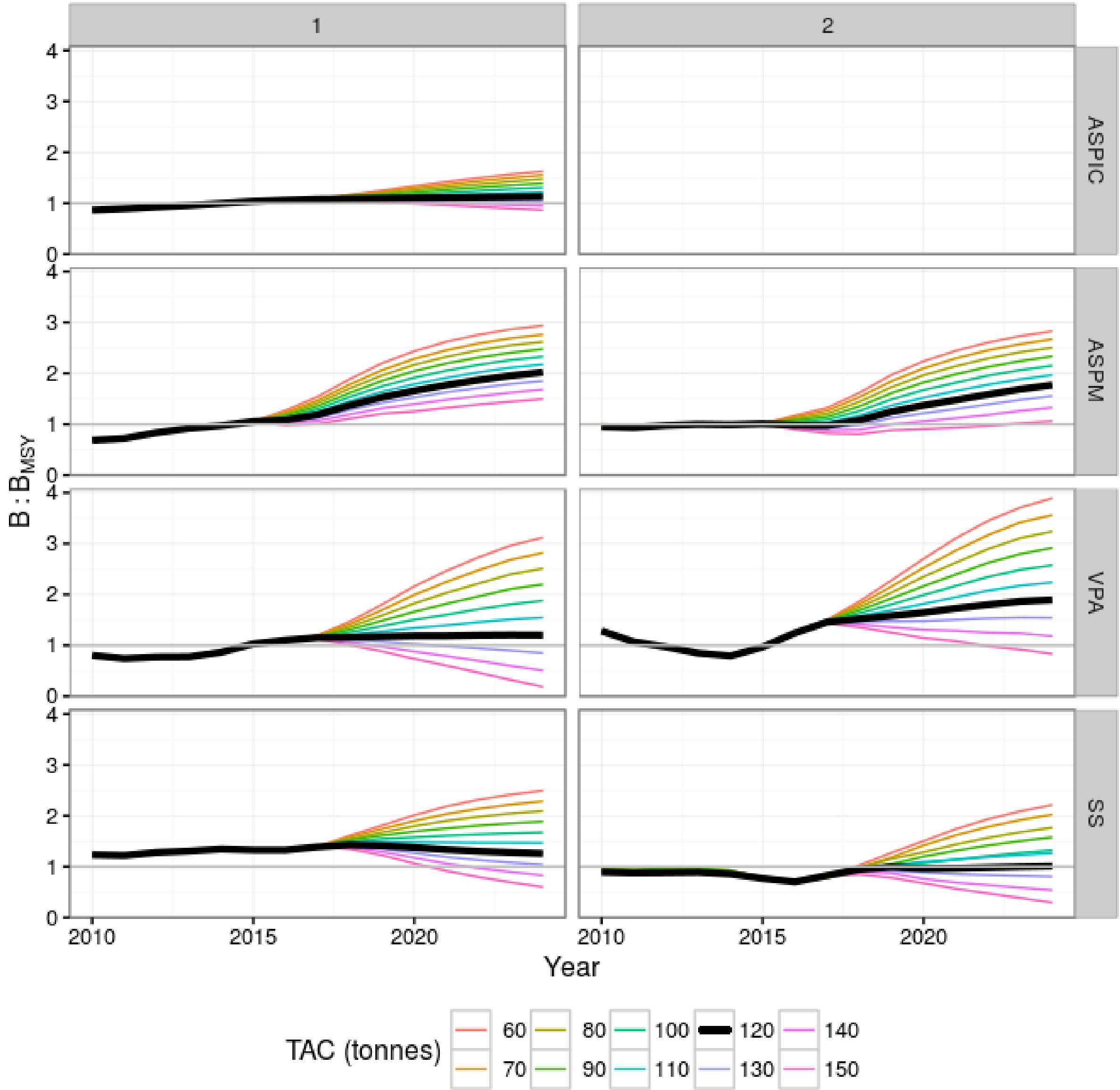
YFT-Figure 8. MSY estimated annually from an age structured stock assessment (SS) using cluster 1 and 2 indices.



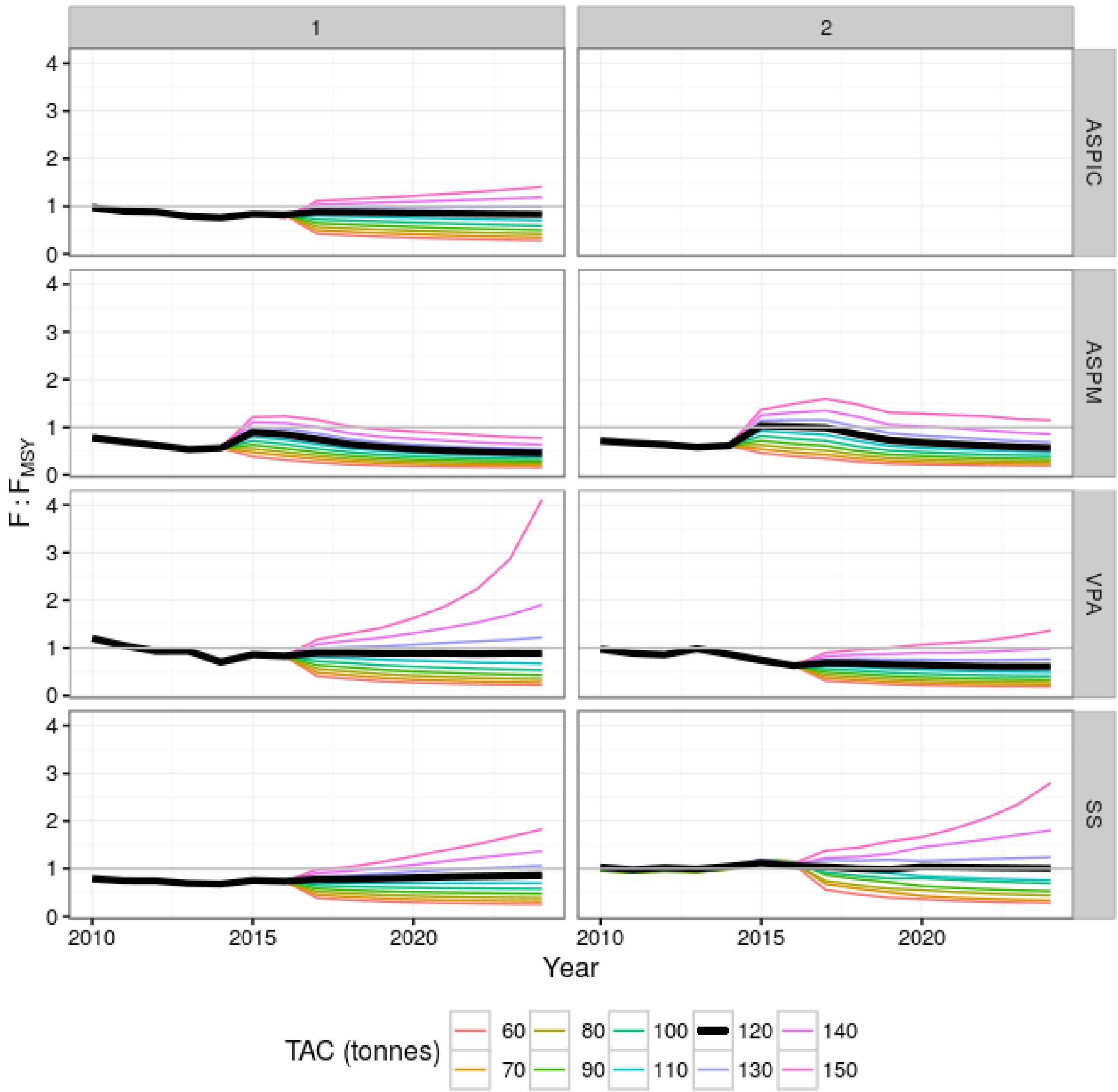
YFT-Figure 9. Kobe Phase Plot and marginal density for all models (used to develop management advice) combined.



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

Last stock assessment for bigeye tuna was conducted in 2015 through a process that included a data preparatory meeting in May (SCRS/2015/011) and an assessment meeting in July (SCRS/2015/015). 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.

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 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.

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 2011-2015, landings of bigeye in weight caught by longline fleets represent 47%, while purse seine fleets represent 37% and baitboat fleets represent 15% of the total (**BET-Table 1**). In 2015, however, landing of bigeye in weight caught by longline represent 50%, while purse seiner and baitboat fleets represent 35% and 12%, 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 an historic high of about 135,000 t in 1994. Reported and estimated catch further declined and fell to 91,000 t in 2001. Since then, catches have fluctuated between around 68,000 t and 90,000 t, with the exception of 2006 (58,900 t). The preliminary catch estimated for 2015 is 79,577 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 2010-2014. In 2015, purse seine catches have slightly decreased. 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 2010, 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. It was also noted that three purse seine moved from the Pacific Ocean to the Atlantic Ocean in 2015.

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.

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.

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 kgs 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.

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.

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 stock assessment was conducted using similar assessment models to those used in 2010 but with updated data and relative abundance indices. 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.

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. 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**). These indices 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 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**) was estimated using 2014 selectivity pattern without accounting for selectivity changes over time. The results based on the twelve cases studied suggest that the stocks 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 90s, 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 is being overfished and overfishing is 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 at the current TAC level of 85,000 t. 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 recent catches from the period 2012 to 2014 has been lower than the adopted TAC the status of the stock has worsened. The proportion of small age 0 and 1 bigeye has shown a continuous increase since the beginning of the time series which may affect the prospect of recovery of the population and worsened the status of the stock as it was forecast in 2010. 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 through Rec. 09-01, Rec. 11-01 and Rec. 14-01. Note that because this TAC does not affect all countries that can land bigeye tuna, in theory the total catch removed from the stock could exceed 85,000 t which will worsen the prospect of rebuilding at current TAC levels. 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. Note, however, that catches for 2013-2015 are still under revision. The TAC was again reduced to 65,000 t. in Recommendation 15-01 which enters 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 maybe improved by the additional measures (*i.e.* FAD moratorium) agreed by the Commission.

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.

BET-6. Management recommendations

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 longterm 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[*]

[*] Second Meeting of the Ad Hoc Working Group on FADs (*Bilbao, Spain, 14-16 March 2016*).

ATLANTIC BIGEYE TUNA SUMMARY

Maximum Sustainable Yield	78,824 t (67,725-85,009 t)[1]
Current (2015) Yield	79,577 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. 15-01] – 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 2014 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. (v1, 2016-09-30)

			1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
TOTAL	A+M		97197	100117	113862	134936	128018	120751	110261	107804	121643	103680	91201	75726	87702	90534	67964	58875	75070	67720	80447	80521	82954	75934	73207	78039	79577
Landings		Bait boat	17740	16248	16467	20361	25576	18300	21276	18999	22301	12365	14540	8523	11450	20812	13058	10636	11833	7761	13476	9506	14267	12648	11403	9959	9904
		Longline	61556	62403	62871	78898	74852	74930	68310	71856	76527	71193	55265	46438	54466	48396	38035	34182	46232	41063	43985	42925	38204	35005	32037	37008	40079
		Other surf.	437	607	652	980	567	357	536	434	1377	1226	1628	1138	1340	1301	717	552	448	220	257	461	977	678	1140	1971	2045
		Purse seine	15524	19223	31582	32665	25355	26624	19147	15525	20254	17533	19511	19414	19578	19005	15128	12962	15865	17904	21648	26636	28229	26766	27996	28492	27512
Landings(FP)		Purse seine	1941	1636	2290	2032	1667	540	993	989	1184	1363	257	214	867	1019	1026	542	692	772	1082	994	1277	823	632	609	
Discards		Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	2
		Purse seine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36
Landings		Angola	0	0	0	0	0	0	0	0	0	0	0	0	0	476	75	0	0	0	452	410	320	394	375	372	**0**
		Argentina	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Barbados	0	0	0	0	0	0	24	17	18	18	6	11	16	19	27	18	14	14	7	12	7	15	11	26	30
		Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	60	70	234	249	1218	1242	1336	1502	1877
		Benin	10	7	8	9	9	9	30	13	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Brazil	350	790	1256	601	1935	1707	1237	644	2024	2768	2659	2582	2455	1496	1081	1479	1593	958	1189	1151	1799	1400	1433	3475	3561
		Cambodia	0	0	0	0	0	0	0	0	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Canada	26	67	124	111	148	144	166	120	263	327	241	279	182	143	187	196	144	130	111	103	137	166	197	218	257
		Cape Verde	151	105	85	209	66	116	10	1	1	2	0	1	1	1	1077	1406	1247	444	545	554	1037	713	1333	2271	2406
		China PR	0	0	70	428	476	520	427	1503	7347	6564	7210	5840	7890	6555	6200	7200	7399	5686	4973	5489	3720	3231	2371	2232	4942
		Chinese Taipei	13850	11546	13426	19680	18023	21850	19242	16314	16837	16795	16429	18483	21563	17717	11984	2965	12116	10418	13252	13189	13732	10805	10316	13272	16453
		Congo	12	12	14	9	9	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Cuba	34	56	36	7	7	5	0	0	0	0	0	16	16	0	0	0	0	0	0	0	0	0	0	0	
		Curaçao	0	0	0	0	0	1893	2890	2919	3428	2359	2803	1879	2758	3343	0	416	252	1721	2348	2688	3441	2890	1964	2315	2573
		Côte d'Ivoire	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	790	576	47	507	635	441	12
		Dominica	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	
		EU.España	14705	14656	16782	22096	17849	15393	12513	7110	13739	11250	10133	10572	11120	8365	7618	7454	6675	7494	11966	11272	13100	10914	10082	10736	10058
		EU.France	5576	6888	12719	12263	8363	9171	5980	5624	5529	5949	4948	4293	3940	2926	2816	2984	1629	1130	2313	3329	3507	3756	3222	3549	2548
		EU.Ireland	0	0	0	0	0	0	0	0	0	0	10	0	0	0	33	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	5718	5796	5616	3099	9662	5810	5437	6334	3314	1498	1605	2590	1655	3204	4146	5071	5505	3422	5605	3682	6920	6128	5345	3869	3135
		EU.United Kingdom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	32	0	0	0	0	0	**0**
		El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	992
		FR.St Pierre et Miquelon	0	0	0	0	0	0	0	0	0	0	0	21	0	28	6	0	2	3	0	2	0	0	0	0	
		Faroe Islands	0	0	0	0	0	0	0	0	11	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Gabon	0	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	4090	2866	3577	4738	5517	4751	10165	10155	10416	5269	9214	5611	8646	17744	8860	2041	8119	7727	8186	10455	9850	9477	10992	9974	11902
		Grenada	65	25	20	10	10	0	1	0	0	0	0	0	0	0	0	0	10	31	0	0	0	0	0	0	
		Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	998	949	836	998	913	1011	282	262	163	993	129
		Guinea Ecuatorial	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	50	0	58	0	3	10	17
		Guinée Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	328	322	1516	1429	902	**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	6
		Honduras	0	44	0	0	61	28	59	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Iceland	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Japan	30356	34722	35053	38503	35477	33171	26490	24330	21833	24605	18087	15306	19572	18509	14026	15735	17993	16684	16395	15205	12306	15390	13397	13464	12449
		Korea Rep.	802	866	377	386	423	1250	796	163	124	43	1	87	143	629	770	2067	2136	2599	2134	2646	2762	1908	1151	1039	675
		Liberia	13	42	65	53	57	57	57	57	57	57	57	57	57	0	0	0	0	0	0	0	0	0	0	0	
		Libya	0	508	1085	500	400	400	400	400	400	400	31	593	593	0	0	4	0	0	0	0	0	0	0	0	
		Maroc	0	0	0	0	0	0	0	0	700	770	857	913	889	929	519	929	700	802	795	276	300	300	308	300	309
		Mexico	0	0	1	4	0	2	6	8	6	2	2	7	4	5	4	3	3	1	1	3	1	1	2	1	2
		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	

		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	NEI (ETRO)	1221	2138	4594	5034	5137	5839	2746	1685	4011	2285	3027	2248	2437	1374	294	0	0	0	0	0	0	0	0	0	
	NEI (Flag related)	8982	6146	4378	8964	10697	11862	16569	24896	24060	15092	8470	531	0	0	0	0	0	0	0	0	0	0	0	0	
	Namibia	0	0	0	715	29	7	46	16	423	589	640	274	215	177	307	283	41	146	108	181	289	376	135	240	465
	Nigeria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	7446	9991	10138	13234	9927	4777	2098	1252	580	952	89	63	0	1521	2310	2415	2922	2263	2405	3047	3462	1694	2774	2315	1289
	Philippines	0	0	0	0	0	0	0	1154	2113	975	377	837	855	1854	1743	1816	2368	1874	1880	1399	1267	532	1323	1964	**0**
	Russian Federation	0	5	0	0	0	13	38	4	8	91	0	0	0	0	1	1	26	73	43	0	0	0	0	0	**0**
	S. Tomé e Príncipe	3	4	4	3	6	4	5	6	5	4	4	4	4	11	6	4	0	92	94	97	100	103	107	110	633
	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
	Senegal	10	5	9	126	237	138	258	730	1473	1131	1308	565	541	574	721	1267	805	926	1042	858	239	230	646	371	1031
	Seychelles	0	0	0	0	0	0	0	0	0	58	0	162	0	0	0	0	0	0	0	0	0	0	0	0	
	Sierra Leone	0	0	0	0	0	0	0	0	0	6	2	0	0	0	0	0	0	0	0	0	0	0	0	0	
	South Africa	72	43	88	79	27	7	10	53	55	249	239	341	113	270	221	84	171	226	159	145	153	47	435	332	193
	St. Vincent and Grenadines	0	1	3	0	0	4	2	2	1	1216	506	15	103	18	0	114	567	171	292	396	38	25	16	30	496
	Sta. Lucia	0	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	6	2	86	23	6	33	33	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Trinidad and Tobago	263	0	3	29	27	37	36	24	19	5	11	30	6	5	9	12	27	69	56	40	33	33	37	59	77
	U.S.A.	975	813	1090	1402	1209	882	1138	929	1263	574	1085	601	482	416	484	991	527	508	515	571	722	867	881	859	838
	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	0	1	1	0	0	0	0	0	0	0	0	0	0
	UK.Sta Helena	3	10	6	6	10	10	12	17	6	8	5	5	0	0	0	25	18	28	17	11	190	51	19	17	44
	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	4	2	**0**
	Uruguay	20	56	48	37	80	124	69	59	28	25	51	67	59	40	62	83	22	27	201	23	15	2	30	0	**0**
	Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	0	104	109	52	132	91	34	42	39	23	9	4	
	Venezuela	476	270	809	457	457	189	274	222	140	221	708	629	516	1060	243	261	318	122	229	85	264	98	94	169	132
Landings(FP)	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	46	42	16	41	23	
	Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75	28	37	38	61	102	40	22	45	97	
	Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	25	20	13	117	59	46	60	34	42	
	Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	95	45	0	
	EU.España	625	571	764	605	371	58	255	328	487	474	0	0	223	244	143	88	49	190	250	211	216	98	80	143	
	EU.France	653	686	1032	970	713	314	437	467	553	607	229	205	446	397	222	79	26	51	150	122	394	192	56	54	
	Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	56	28	15	26	9	18	6	11	5	15	
	Guinée Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	72	0	60	20	22	74	203	288	245	209	
	Mixed flags (EU tropical)	663	379	494	457	582	169	301	193	143	281	28	8	198	378	294	189	348	337	375	324	257	0	0	0	
	Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	151	106	135	97	85	38	70	41	80	27	
	St. Vincent and Grenadines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	
Discards	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
	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	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	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	0	1
	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	

Ghana 2015 Task I: total (BB + PS) reported catches (86245 t = 5599 [BET] + 18790 [YFT]+ 59483 [SKJ]) corrected by the SCRS for species catch composition (BET: 13.8%; YFT: 15.4%; SKJ: 70.8%).

EU-France 2015 Task I: last revision (arriving after the species groups deadline) not included in the table.

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 occurring (F<Fmsy)

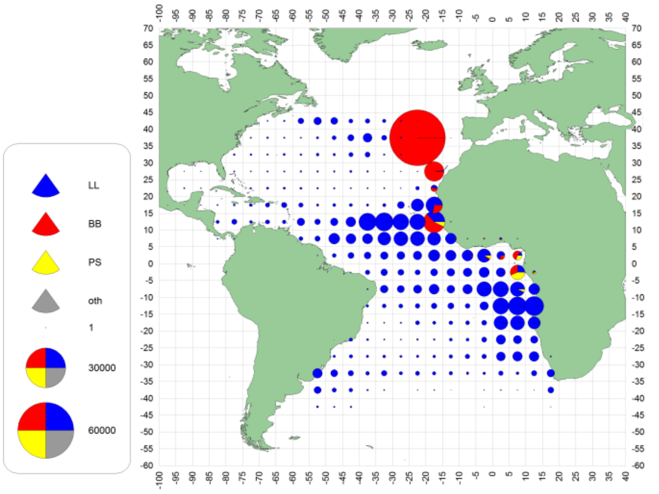
Catch (000 t)	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
0	29	100	100	100	100	100	100	100	100	100	100	100	100	100
40	29	84	89	92	93	94	95	95	96	96	97	97	97	97
45	29	72	80	84	88	89	91	92	93	94	94	94	95	95
50	29	61	70	75	79	83	85	87	89	90	91	92	92	93
55	29	52	59	65	69	73	76	79	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 not being overfished (B>Bmsy)

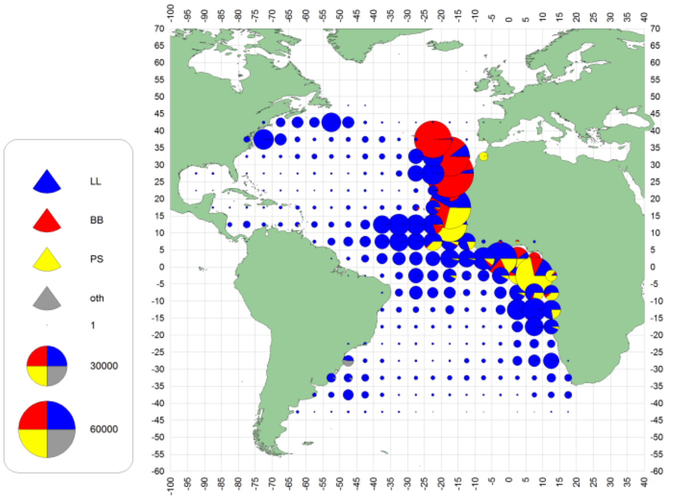
Catch (000 t)	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
0	17	17	21	33	57	74	85	92	95	97	98	98	99	99
40	17	17	18	22	31	40	51	60	67	73	78	81	84	87
45	17	17	18	21	29	37	46	53	60	66	71	76	79	81
50	17	17	18	20	27	34	41	48	53	59	65	69	72	76
55	17	17	18	20	25	31	37	42	47	52	56	61	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	29	31	33	34	36	37
80	17	17	17	17	19	20	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)

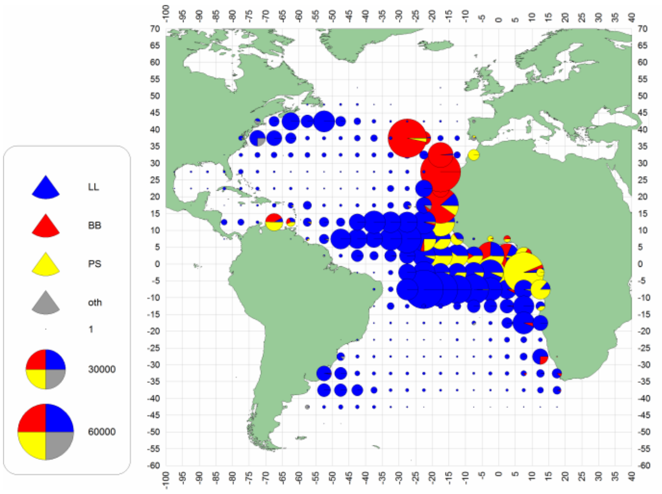
Catch (000 t)	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
0	17	17	21	33	57	74	85	92	95	97	98	98	99	99
40	17	17	18	22	31	40	51	60	67	73	78	81	84	87
45	17	17	18	21	29	37	45	53	60	66	71	76	79	81
50	17	17	18	20	27	34	41	48	53	59	64	69	72	76
55	17	17	18	20	25	31	37	42	47	51	56	60	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



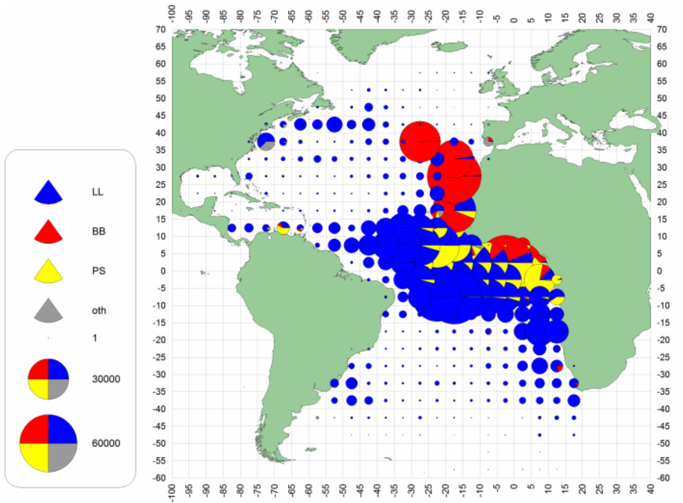
a. BET(1960-69)



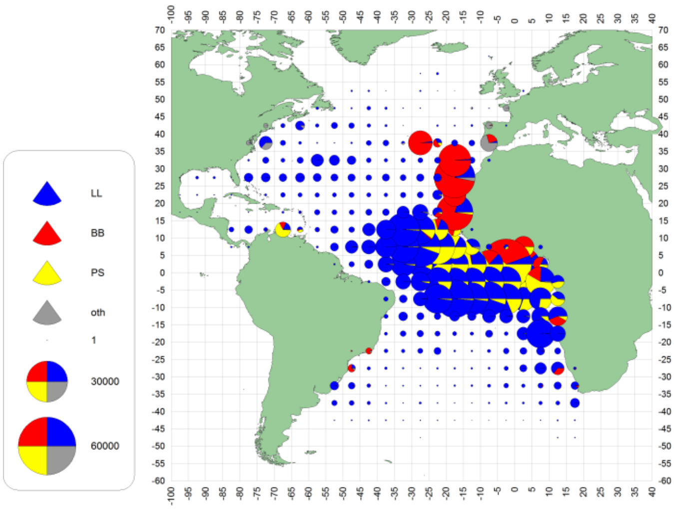
b. BET(1970-79)



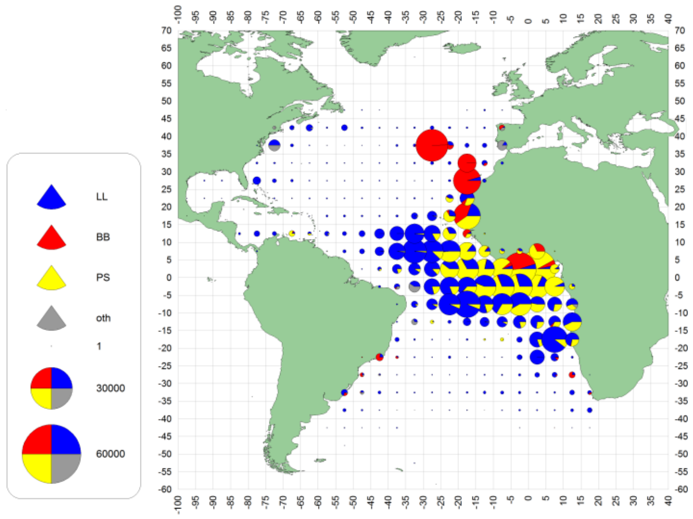
c. BET(1980-89)



d. BET(1990-99)

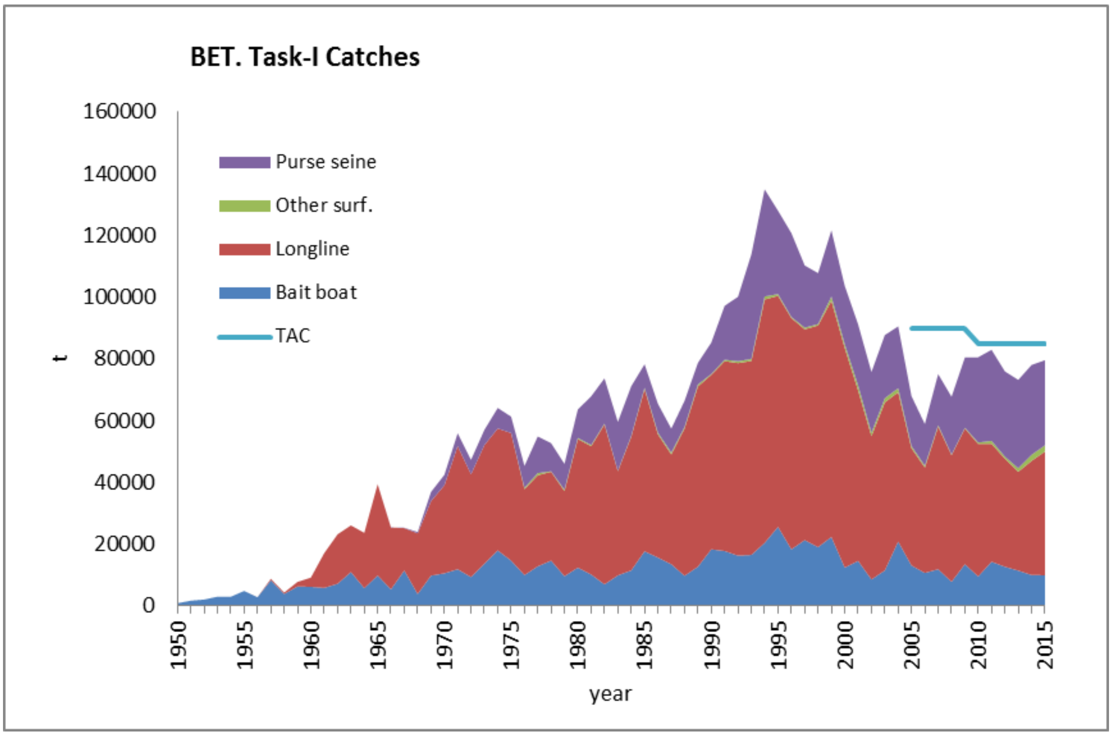


e. BET(2000-09)

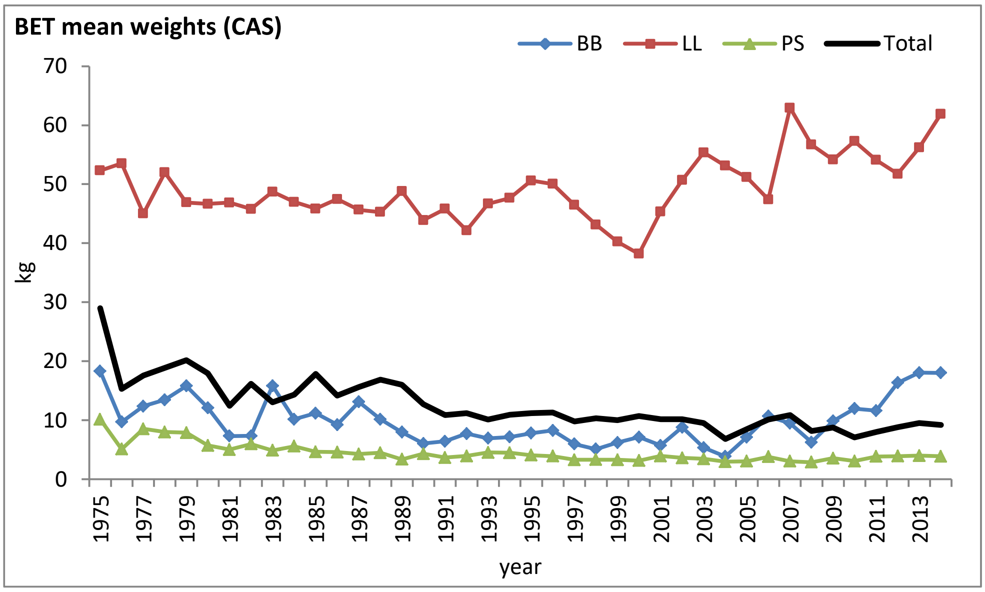


f. BET(2010-14)

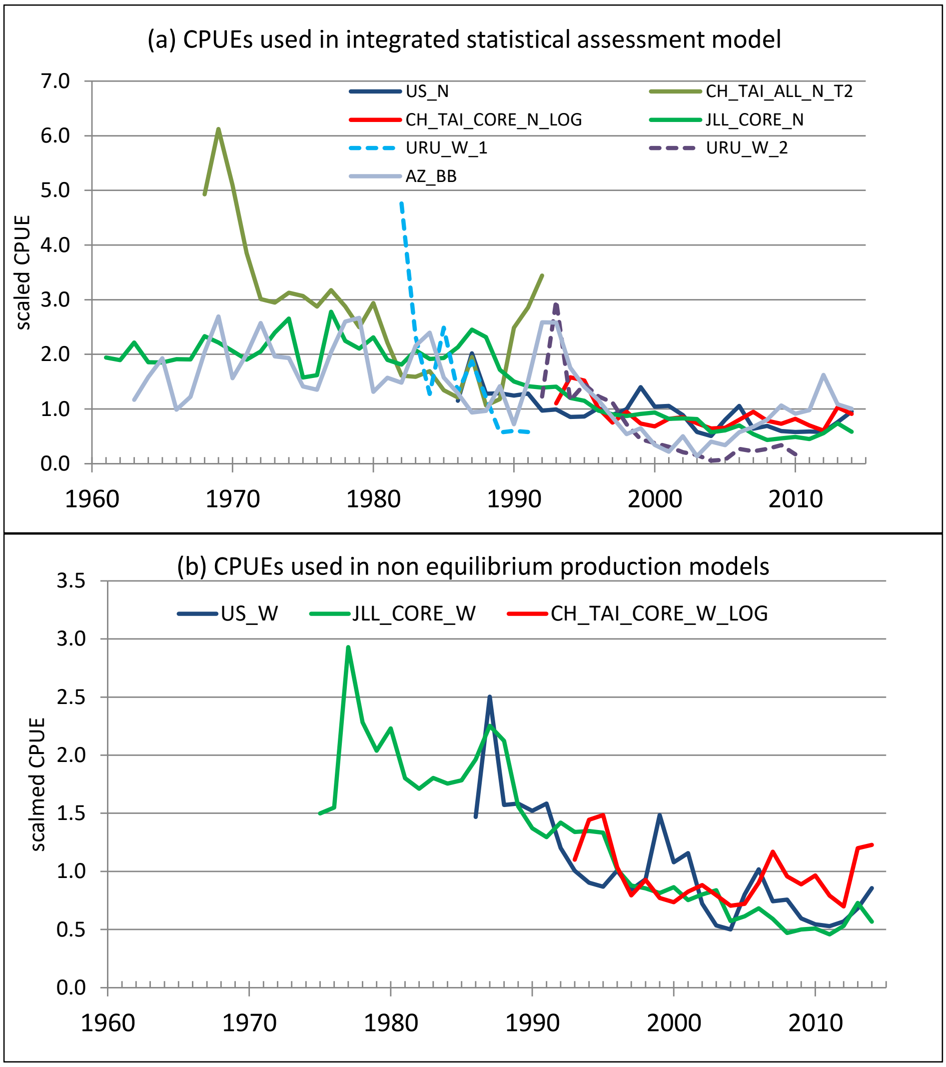
BET-Figure 1 [a-f]. Geographical distribution of the bigeye tuna catch by major gears and decade. The maps are scaled to the maximum catch observed during 1960-2014 (the last decade only covers 5 years).



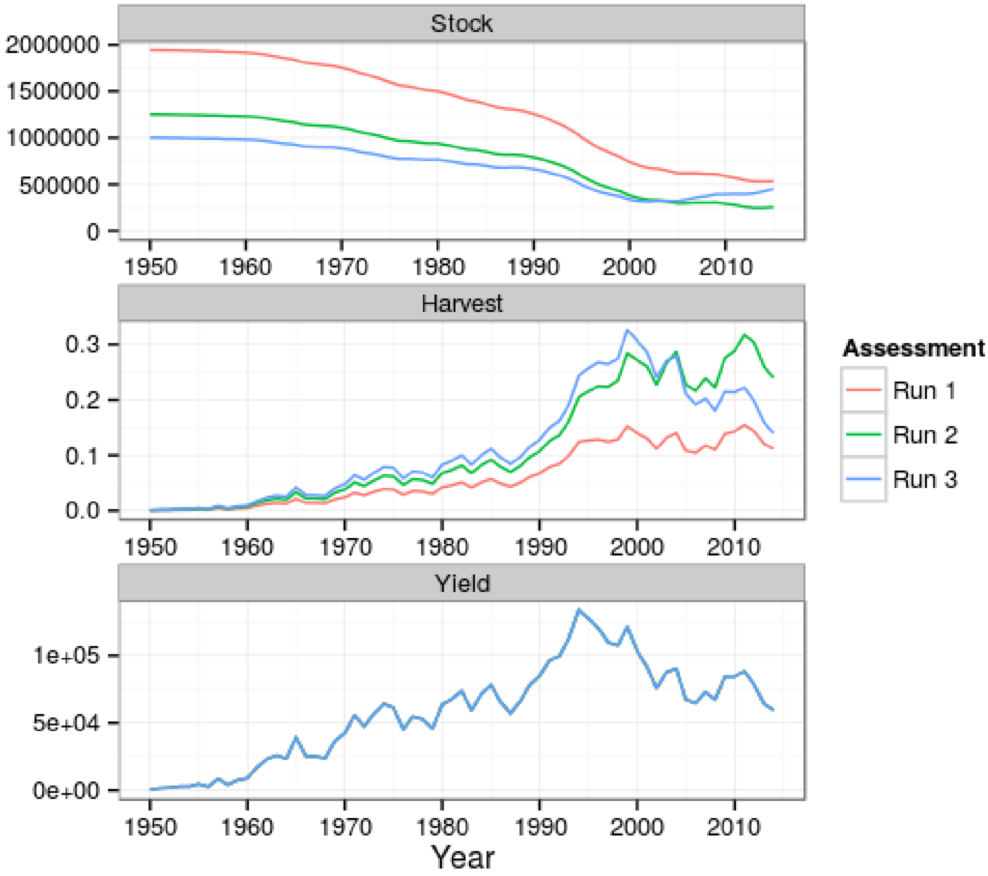
BET-Figure 2. Bigeye estimated and reported catches for all the Atlantic stock (t). The value for 2015 represents preliminary estimates because some countries have yet to provide data for this year or are under revision.



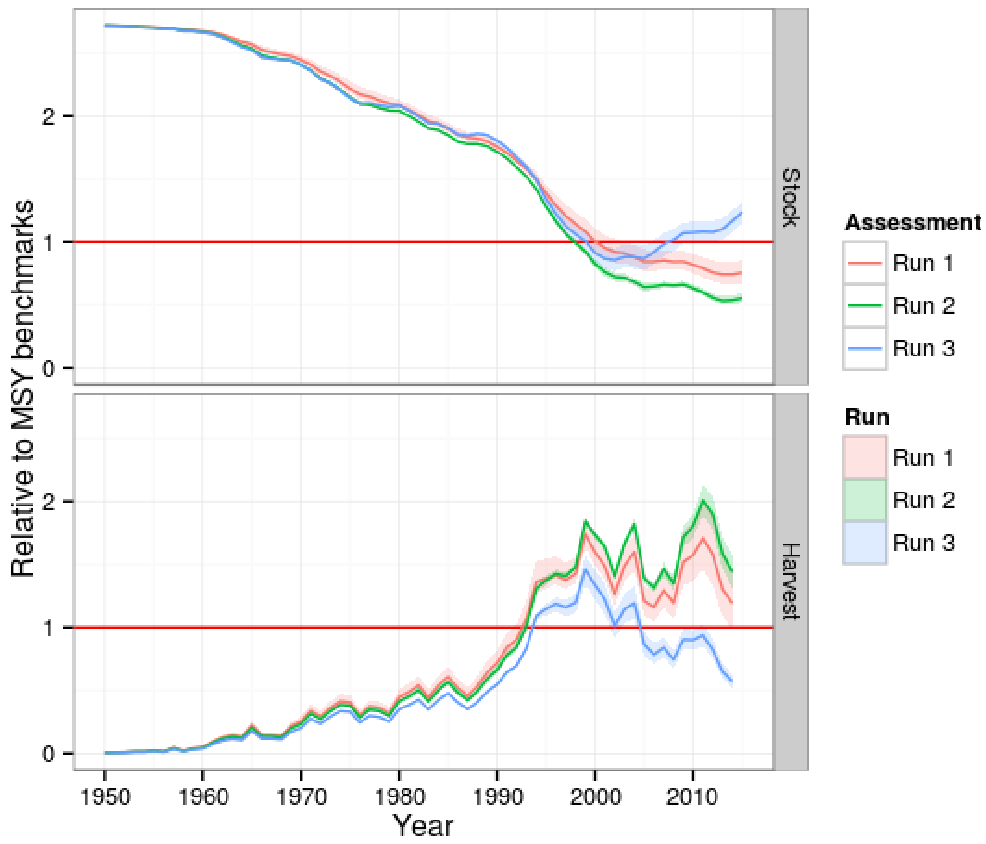
BET-Figure 3. Trend of mean weight for bigeye based on the catch-at-size data for 1975-2014 by major fisheries (BB=Baitboats, LL=Longlines, PS=Purse seine). The mean weight of the baitboat fishery (BB) reflects various baitboat fleets operating in different areas of the Atlantic Ocean.



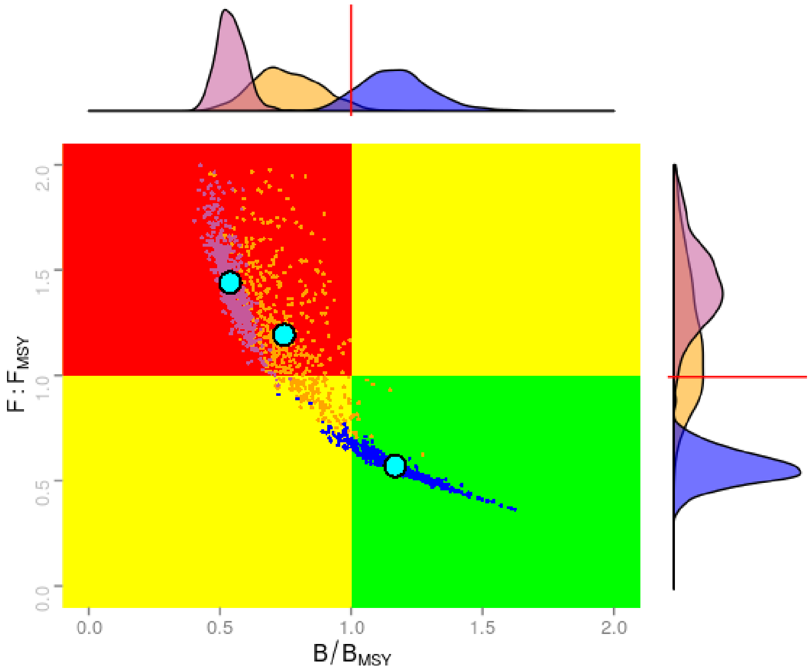
BET-Figure 4. (a) Indices used in the integrated statistical assessment model. Note that these are the annual means but the indices were calculated by area and season for input into the model. (b) Indices used in the non-equilibrium production assessment model.



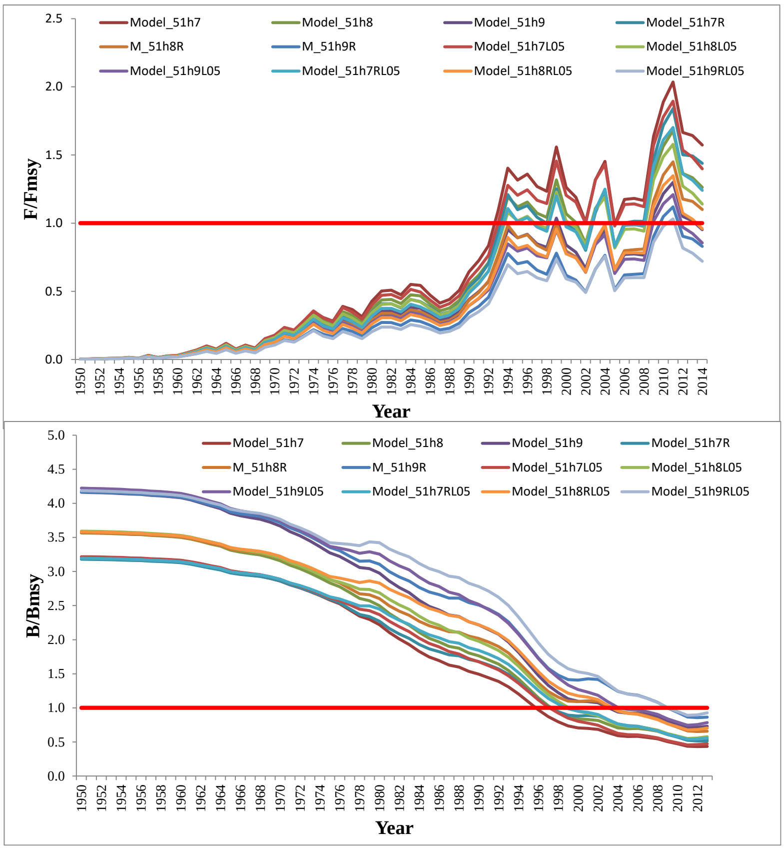
BET-Figure 5. Trajectories of Biomass, fishing mortality and yield from different ASPIC scenarios. Run 1: using USA LL CPUE; Run 2: using Japanese LL CPUE; and Run 3: using Chinese Taipei LL CPUE.



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.



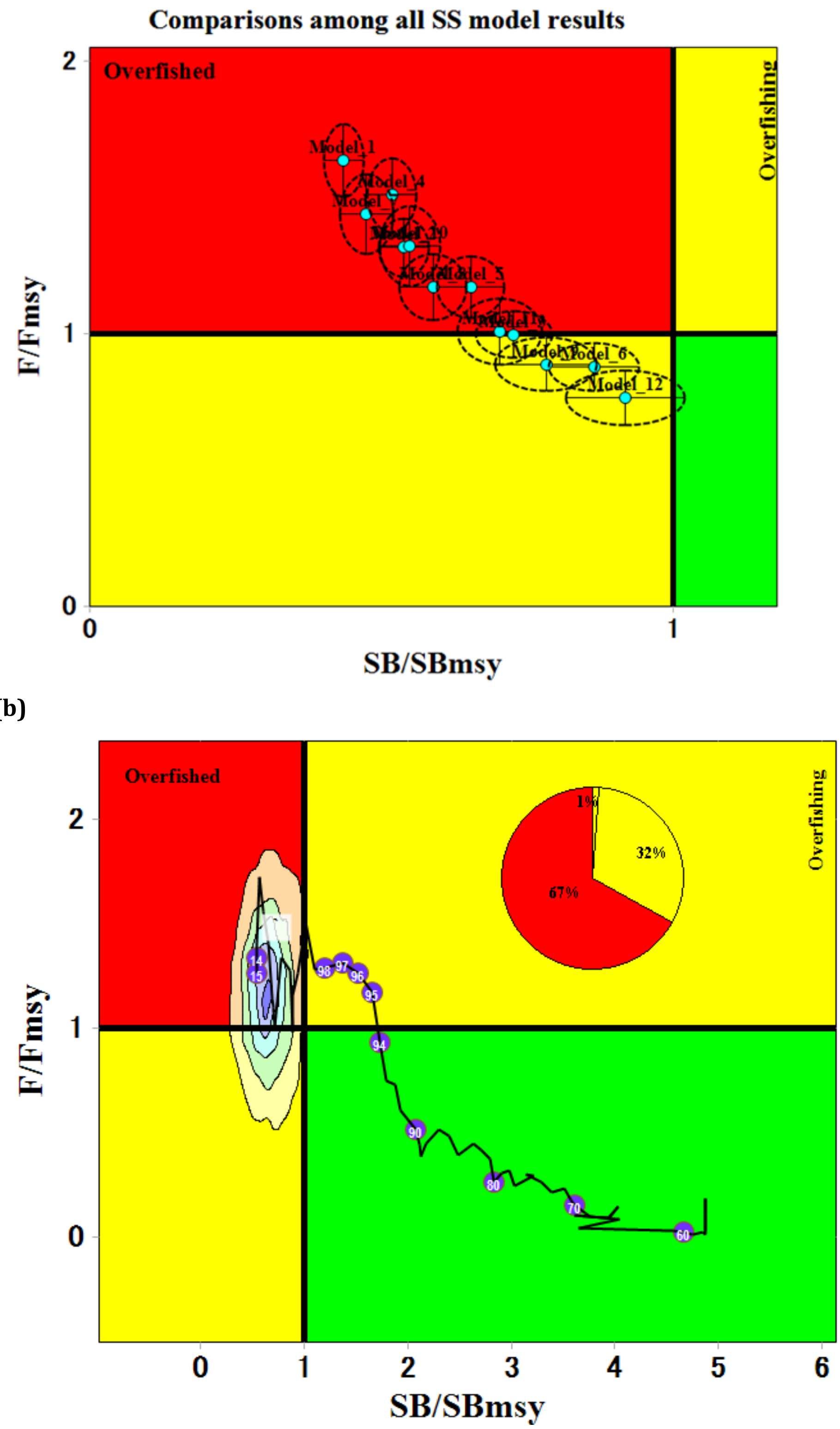
BET-Figure 7. ASPIC: Current status (2014) of bigeye tuna based on ASPIC. Graph combines results for the 3 runs considered. The clouds of points depict the bootstrap estimates of uncertainty for the most recent year (purple = Japan LL run, brown = US LL run, blue= Chinese Taipei LL run). The median point estimate for each models 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).



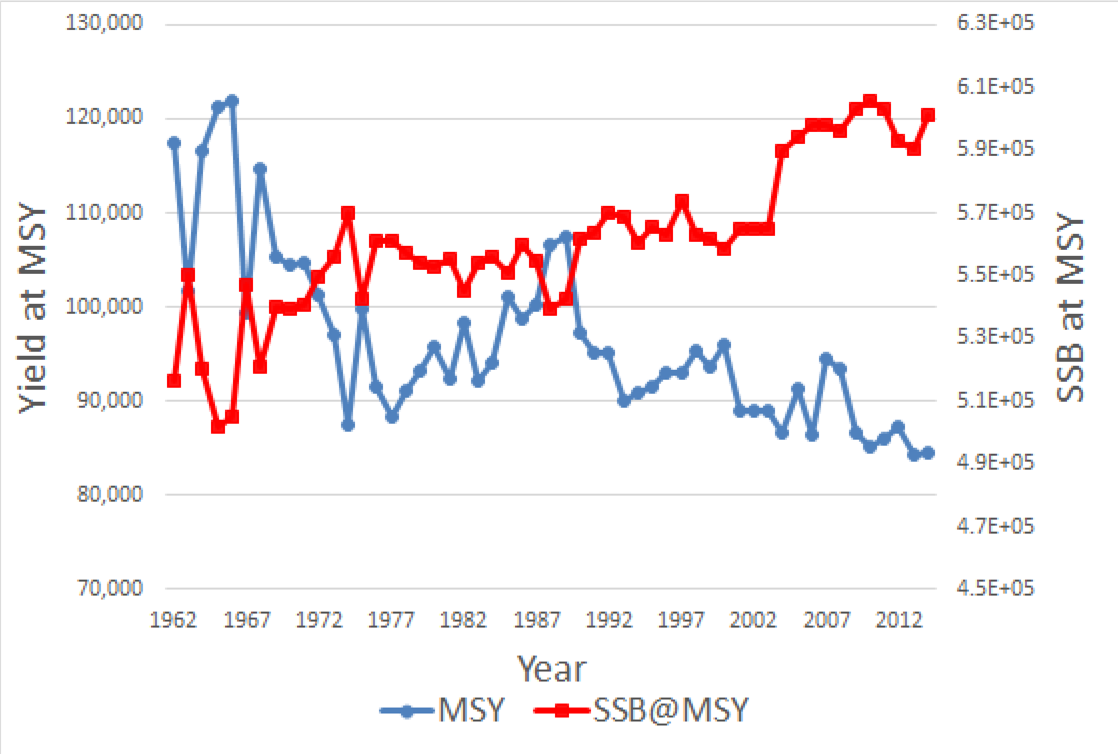
BET-Figure 8. Estimated Spawning Stock Biomass and fishing mortality relative to MSY benchmark (B/B_{MSY} and F/F_{MSY}) both based on 2014 selectivity patterns for the 12 SS3 selected runs.

(a)

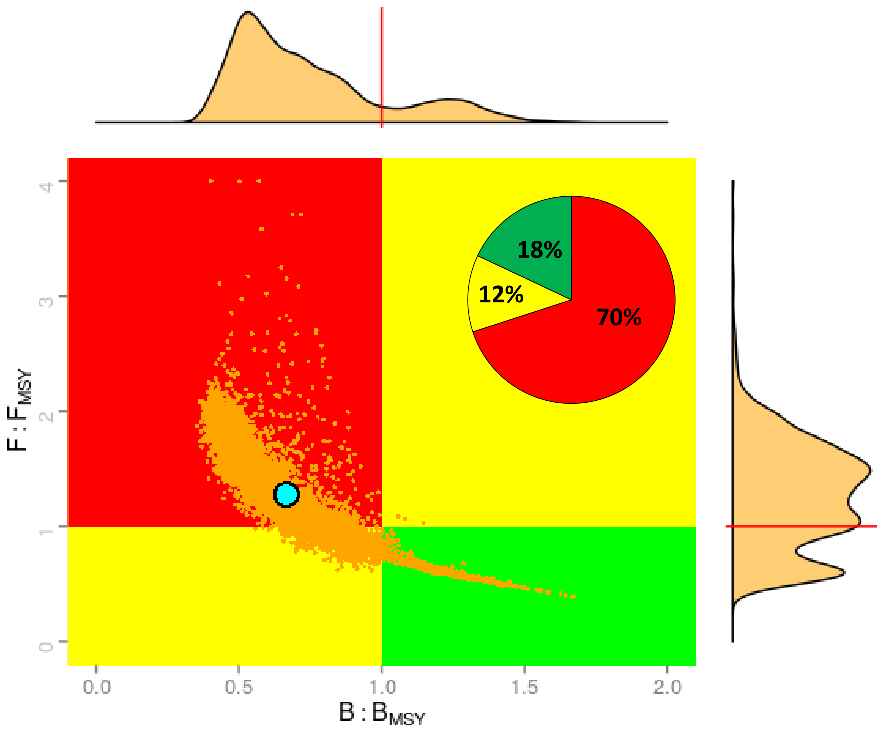
(b)



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. The previous assessment of skipjack stocks was only conducted in 2008. This report is an update of that of 2015 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 229,212 t in 2015 (**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 2015 in the East Atlantic amounted to 209,283 t, which is an increase of about 62% 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 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 2015 made in the West Atlantic amounted to 19,929 t (against the historic record of 40,200 t in 1985). This sharp decrease in 2015 (33% less compared to the average of the 5 previous years), that follows the large catches reported by Brazilian baitboats in 2012, is due to incomplete reporting by Brazil in 2015 (**SKJ-Figure 8**). The fishing effort of this fleet has not increased, but the estimation of catches by Brazilian baitboat fleet for 2015 (17,584 t) is 30% less than 2014 (24,500 t).

It is difficult to discriminate a fishing effort for free schools (composed of large yellowfin tunas) 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] and [Rec. 99-01] or on complete closure to surface fleets [Rec. 15-01] have however been implemented in the East Atlantic but the intended aim was to protect yellowfin and bigeye tuna juveniles.

The new Recommendation [Rec. 15-01] which replaces that concerned with the complete closure of the surface fishery [Rec. 14-01] and establishes a new 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[1]). 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 (2015[1])	209,283 t	19,929 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. 15-01[2]	None

[1] Reports of catches for 2015 should be considered provisional, particularly for the West Atlantic.
[2] This moratorium on FADs entered into force in June 2016 and replaces Rec. 14-01.

[*] Report of the Second Meeting of the Ad Hoc Working Group on FADs (*Bilbao, Spain, 14-16 March 2016*).

SKJ-Table 1. Estimated catches (t) of skipjack tuna (*Katsuwonus pelamis*) by area, gear and flag. (v1, 2016-09-30)

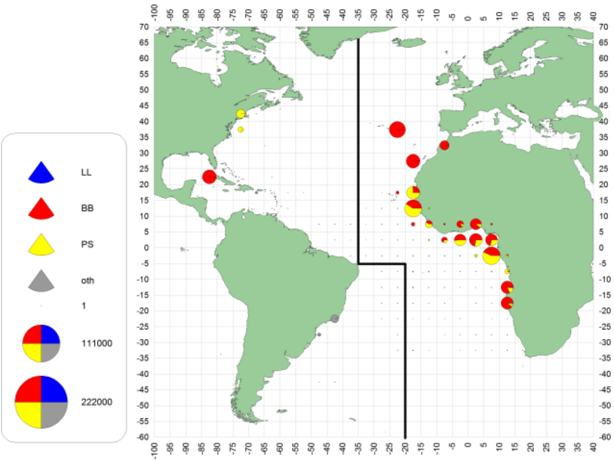
			1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
TOTAL			223469	171204	209807	191381	174529	157116	148955	161452	180687	155671	163620	122524	155483	181705	172082	139731	152580	146633	164760	193125	223500	253191	255730	231174	229212
	ATE		190065	141050	176587	161432	152669	129554	117243	132365	153331	126477	132169	100924	130734	154243	143566	113279	127137	124611	138985	170125	191117	220334	220693	204447	209283
	ATW		33404	30155	33221	29949	21860	27562	31712	29087	27356	29193	31451	21600	24749	27461	28517	26453	25443	22022	25774	23000	32383	32857	35037	26727	19929
Landings	ATE	Bait boat	41302	35660	31656	37817	33691	35872	37314	46784	44762	33909	56689	31076	34445	54602	48185	44711	35418	33019	34549	39175	38566	44893	30294	27152	25042
		Longline	5	3	2	10	3	7	47	85	42	48	53	59	83	67	83	204	428	199	59	46	35	58	79	66	21
		Other surf.	2067	1602	1225	501	488	510	308	1099	470	2513	841	713	563	1125	2351	5270	3432	3794	6361	5098	5822	6708	7126	2109	2423
		Purse seine	131545	91016	125831	107244	105478	88949	71824	76680	98821	79373	72582	67410	88874	90492	87659	59913	82633	81804	89546	117601	137298	161766	176901	168201	181166
	ATW	Bait boat	23972	20852	19697	22645	17744	23741	26797	24724	23881	25641	25142	18737	21990	24082	26028	23749	22865	20617	22770	19923	29468	30693	32397	24814	17538
		Longline	42	37	21	16	34	21	12	21	58	22	60	349	95	206	207	286	52	49	20	30	41	107	1194	462	36
		Other surf.	863	756	709	1577	2023	450	556	516	481	467	951	398	367	404	316	372	1317	455	950	1104	1014	475	538	369	297
		Purse seine	8527	8509	12794	5712	2059	3349	4347	3826	2936	3063	5297	2116	2296	2769	1967	2045	1209	901	2035	1943	1859	1582	908	1081	2059
Landings(FP)	ATE	Purse seine	15145	12769	17873	15860	13010	4217	7749	7716	9237	10634	2004	1666	6769	7956	5288	3181	5226	5796	8471	8205	9395	6909	6293	6918	
Discards	ATE	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Purse seine	0	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	0
Landings	ATE	Algerie	0	0	0	0	0	0	0	171	43	89	77	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Angola	66	41	13	7	3	15	52	2	32	14	14	14	14	10	0	0	0	0	50	636	44	91	514	12	1
		Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1373	2714	7429	15554	6218	10779	12599
		Benin	2	2	2	2	2	2	7	3	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Canada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Cape Verde	1333	864	860	1007	1314	470	591	684	962	789	794	398	343	1097	7157	4754	5453	4682	4909	5155	7883	5535	16016	15254	17600
		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	
		China PR	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Chinese Taipei	5	3	2	10	3	5	47	73	39	41	24	23	26	16	10	9	14	19	6	11	15	2	12	10	4
		Congo	9	9	10	7	7	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Cuba	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Curaçao	0	0	0	0	0	7096	8444	8553	9932	10008	13370	5427	10092	8708	0	3042	1587	6436	9143	9179	11939	12779	17792	18086	19661
		Côte d'Ivoire	0	0	0	0	0	0	0	0	0	1173	259	292	143	559	1259	1565	1817	2328	2840	2840	5968	10923	8063	2365	254
		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	79908	53319	63660	50538	51594	38538	38513	36008	44520	37226	30954	25466	44837	38751	28178	22292	23723	35124	36722	41235	56908	67040	66911	51628	46085
		EU.Estonia	102	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	32928	21890	33735	32779	25188	23107	17023	18382	20344	18183	16593	16637	19899	21879	14850	7034	4168	4439	7789	14749	13067	13139	16242	17406	20564
		EU.Germany	0	0	0	0	0	3	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	0	102	99	99	0	0	0	0	0	0	0	0	0	
		EU.Ireland	0	0	0	0	0	0	0	0	0	0	0	0	0	14	14	14	0	0	8	6	0	0	0	0	
		EU.Italy	0	0	0	0	0	0	0	0	0	0	0	4	29	34	17	0	0	0	0	0	0	0	0	0	
		EU.Latvia	92	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	221	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	95	
		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	8059	7477	5651	7528	4996	8297	4399	4544	1810	1302	2167	2958	4315	8504	4735	11158	8995	6057	1084	12974	4143	2794	4049	1712	1347
		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	6970
		Gabon	0	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	25052	18967	20225	21258	18607	24205	26364	41840	52024	34980	55475	37570	32977	46030	54209	33612	46638	39561	45072	52051	48871	56134	45236	49261	61061
		Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6389	4959	5546	6319	4036	2951	2829	3631	4907	5811	7078
		Guinea Ecuatorial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1224	1224	1010	0	1	1	3
		Guinée Rep.	0	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	4792	2378	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	1	4	5	2	4

			1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
		Korea Rep.	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
		Maroc	254	559	312	248	5024	684	4513	2486	858	1199	268	281	524	809	1894	4032	1592	1309	2580	2343	2151	2267	2045	1068	576
		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)	11335	12409	20291	17418	16235	16211	6161	6748	8893	7127	8122	8544	9688	11075	2873	0	0	0	0	0	0	0	0	0	
		Namibia	0	0	0	2	15	0	1	0	0	0	8	0	0	0	0	0	0	0	71	2	2	15	1	0	
		Nigeria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	12	4	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	8312	8719	13027	12978	14853	5855	1300	572	1308	1559	281	342	0	7126	11490	13468	18821	8253	8518	9590	12509	10927	14558	14165	8532
		Rumania	349	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Russian Federation	1175	1110	540	1471	1450	381	1146	2086	1426	374	0	0	0	0	0	392	1130	313	260	0	20	0	0	2	1
		S. Tomé e Príncipe	201	178	212	190	180	187	178	169	181	179	179	179	179	117	166	143	0	229	235	241	247	254	260	266	360
		Senegal	686	260	95	59	18	163	455	1963	1631	1506	1271	1060	733	1395	4874	3534	2278	3661	4573	2447	4823	4339	4183	4091	5943
		South Africa	15	7	6	4	4	1	6	2	1	7	1	1	2	2	1	0	0	4	4	2	6	8	2	5	2
		St. Vincent and Grenadines	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	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	0	38	36	0	0	0	15	17	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	
		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	24	16	65	55	115	86	294	298	13	64	205	63	63	63	63	88	110	45	15	25	371	29	7	26	6
		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	
	ATW	Argentina	272	123	50	1	0	1	0	2	0	1	0	0	0	30	0	0	0	0	3	12	0	0	0	0	
		Barbados	14	5	6	6	6	5	5	10	3	3	0	0	0	0	0	0	0	0	0	0	1	2	0	1	1
		Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	
		Brazil	20548	18535	17771	20588	16560	22528	26564	23789	23188	25164	24146	18338	20416	23037	26388	23270	24191	20846	23307	20590	30563	30872	32602	24873	17584
		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
		Chinese Taipei	32	26	9	7	2	10	1	2	1	0	1	16	14	27	28	29	2	8	0	2	1	11	1	1	21
		Colombia	0	0	2074	789	1583	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Cuba	1596	1638	1017	1268	886	1000	1000	651	651	651	0	0	624	545	514	536	0	0	0	0	0	0	0	0	
		Curaçao	40	40	45	40	35	30	30	30	30	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Dominica	38	41	24	43	33	33	33	33	85	86	45	55	51	30	20	28	32	45	25	0	13	0	4	0	
		Dominican Republic	156	135	143	257	146	146	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		EU.España	1592	1120	397	0	0	0	0	0	1	1	0	0	0	0	0	0	5	11	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	17	10	0	0	0	0
		EU.Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	9	0	0	23	0	0	0	**0**
		EU.Portugal	0	0	0	0	0	0	0	0	0	4	1	0	3	3	5	21	11	0	6	0	8	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	85
		Grenada	25	30	25	11	12	11	15	23	23	23	15	14	16	21	22	15	26	20	0	0	0	0	0	0	
		Jamaica	0	0	0	0	0	62	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	1	0	0	0	0	0	1	0	1	0
		Korea Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Mexico	9	8	1	1	0	2	3	6	51	13	54	71	75	9	7	10	7	8	9	7	9	8	5	5	7
		Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	543	410	
		St. Vincent and Grenadines	27	20	66	56	53	37	42	57	37	68	97	357	92	251	251	355	90	83	54	46	50	0	36	39	47
		Sta. Lucia	51	39	53	86	72	38	100	263	153	216	151	106	132	137	159	120	89	168	0	153	143	109	171	139	87
		Suriname	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	552	0	**0**
		Trinidad and Tobago	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		U.S.A.	858	560	367	99	82	85	84	106	152	44	70	88	79	103	30	61	66	67	119	54	87	112	117	76	78
		UK.Bermuda	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0
		Venezuela	8146	7834	11172	6697	2387	3574	3834	4114	2981	2890	6870	2554	3247	3270	1093	2008	921	757	2250	2119	1473	1742	1002	1179	2019
Landings(FP)	ATE	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114	395	368	179	636	301	
		Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	419	131	162	276	603	726	411	230	428	1362	
		Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	88	171	116	105	917	415	441	545	520	351	

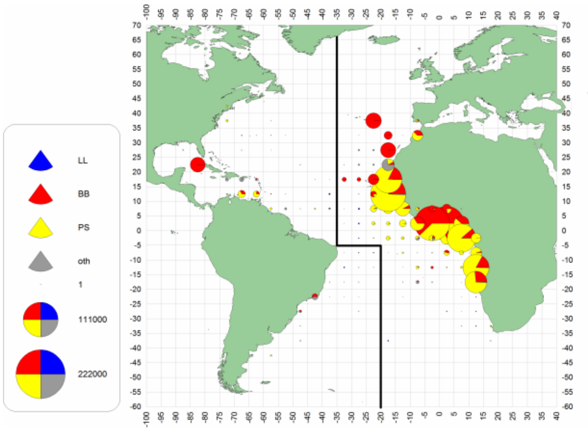
			1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
		Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42	562	544	202	
		EU.España	4876	4455	5959	4719	2899	453	1990	2562	3802	3700	0	0	1738	1907	713	437	366	1158	1994	1394	1842	983	998	1623	
		EU.France	5094	5355	8055	7573	5568	2447	3414	3647	4316	4740	1786	1601	3484	3096	918	346	206	287	1120	743	1480	1646	463	440	
		Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	260	69	66	162	59	136	51	102	72	93	
		Guinée Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	387	0	330	118	359	614	1778	2379	1670	2146	
		Mixed flags (EU tropical)	5176	2959	3858	3568	4543	1316	2345	1508	1119	2194	218	65	1547	2953	1708	1478	3003	2998	2624	3427	2372	0	0	0	
		Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	796	548	977	693	680	354	609	284	962	400	
Discards	ATE	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	
		Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	
		EU.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	631
		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
	ATW	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	
		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

Ghana 2015 Task I: total (BB + PS) reported catches (86245 t = 5599 [BET] + 18790 [YFT]+ 59483 [SKJ]) corrected by the SCRS for species catch composition (BET: 13.8%; YFT: 15.4%; SKJ: 70.8%).

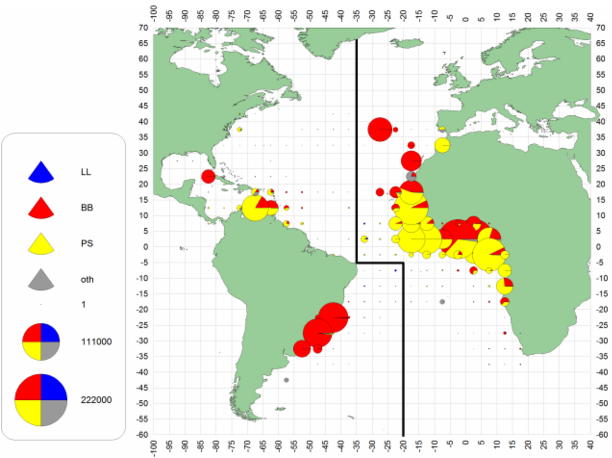
EU-France 2015 Task I: last revision (arriving after the species groups deadline) not included in the table.



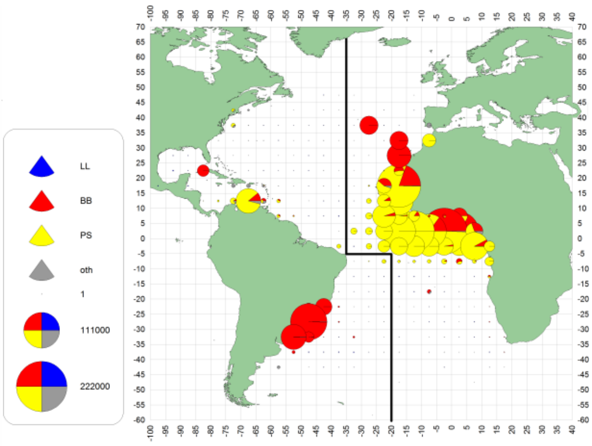
a. SKJ(1960-69)



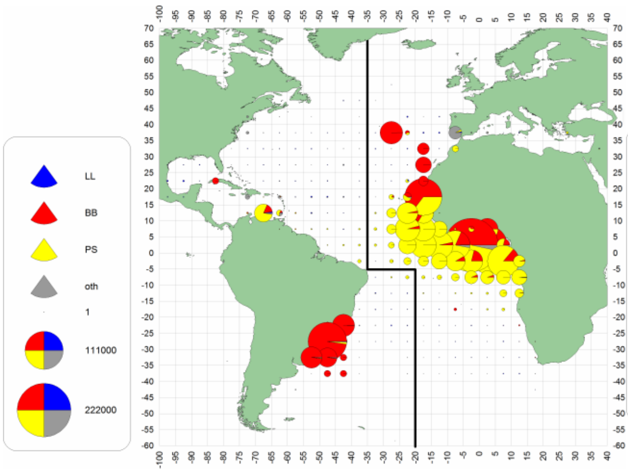
b. SKJ(1970-79)



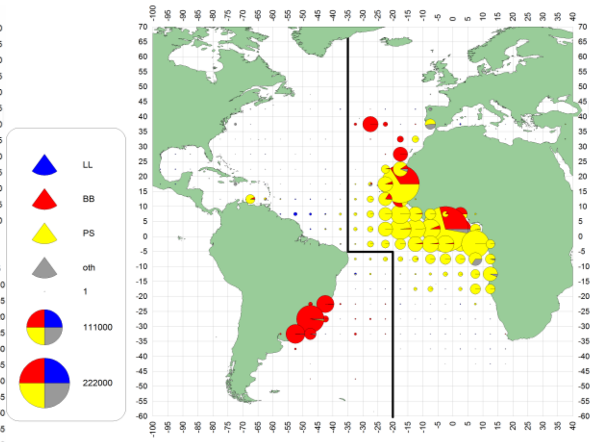
c. SKJ(1980-89)



d. SKJ(1990-99)

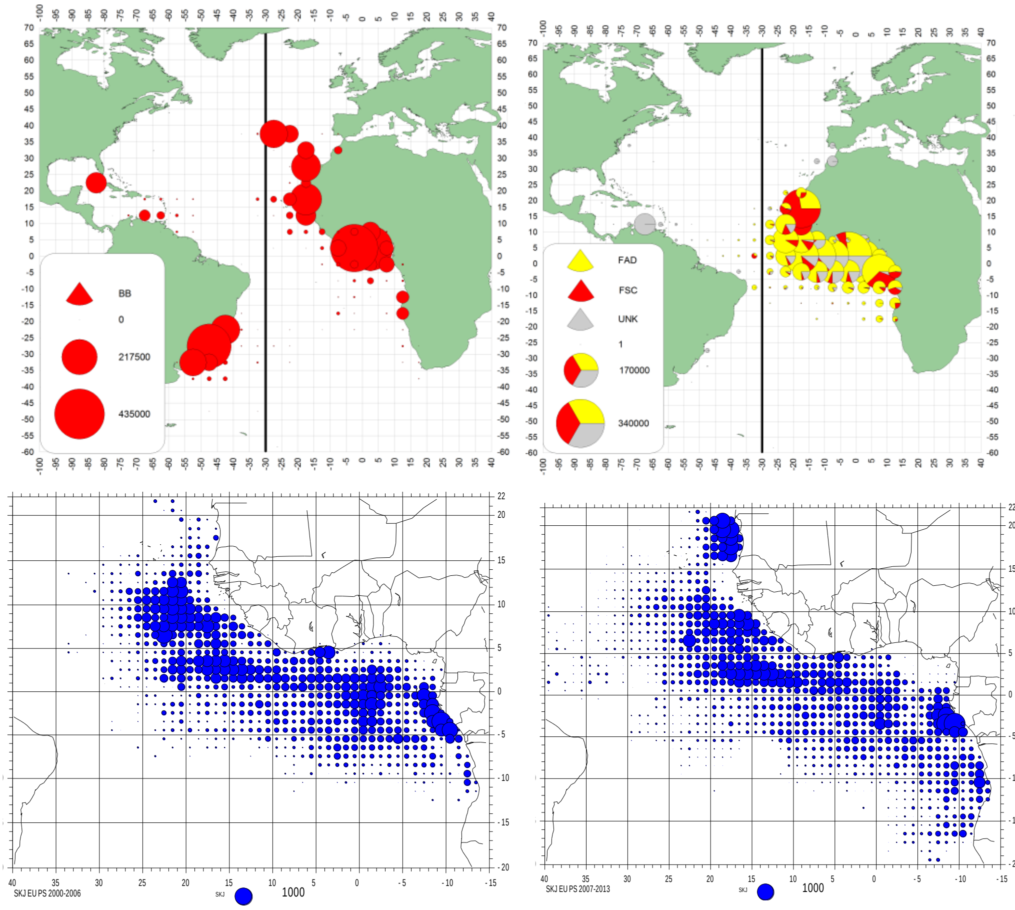


e. SKJ (2000-09)

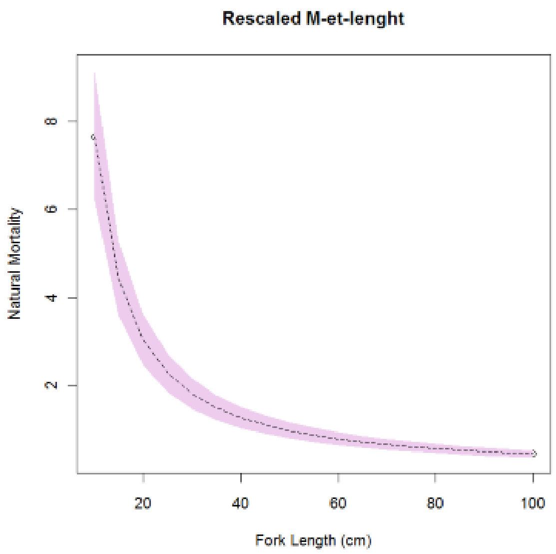


f. SKJ(2010-14)

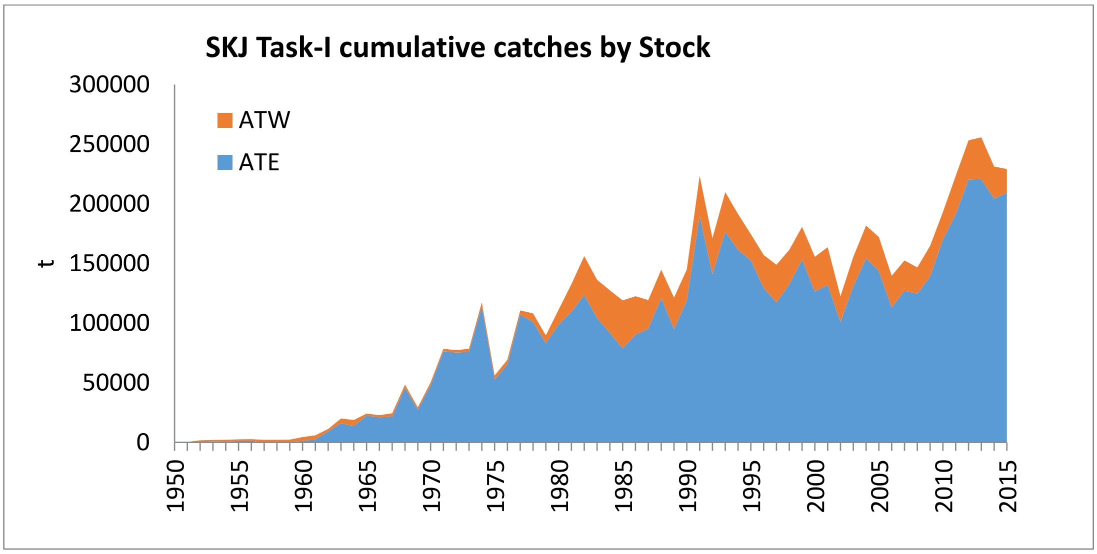
SKJ-Figure 1A [a-f]. Geographical distribution of the skipjack catch by major gears and decade. The maps are scaled to the maximum catch observed during 1960-2014 (last decade only covers 5 years).



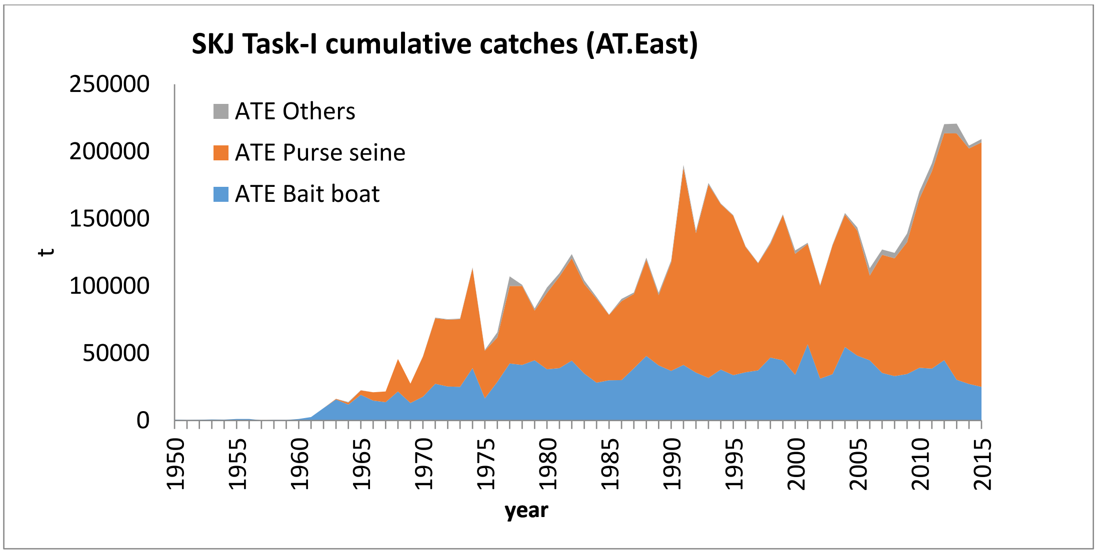
SKJ-Figure 1B. Distribution of skipjack catches in the Atlantic for baitboat (upper left panel) between 1950 and 2014 and for purse seiners (upper right panel) by fishing mode (free schools vs. FADs. UNK is considered to be mainly free schools in the Western and mainly FAD in the Eastern Atlantic) between 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.



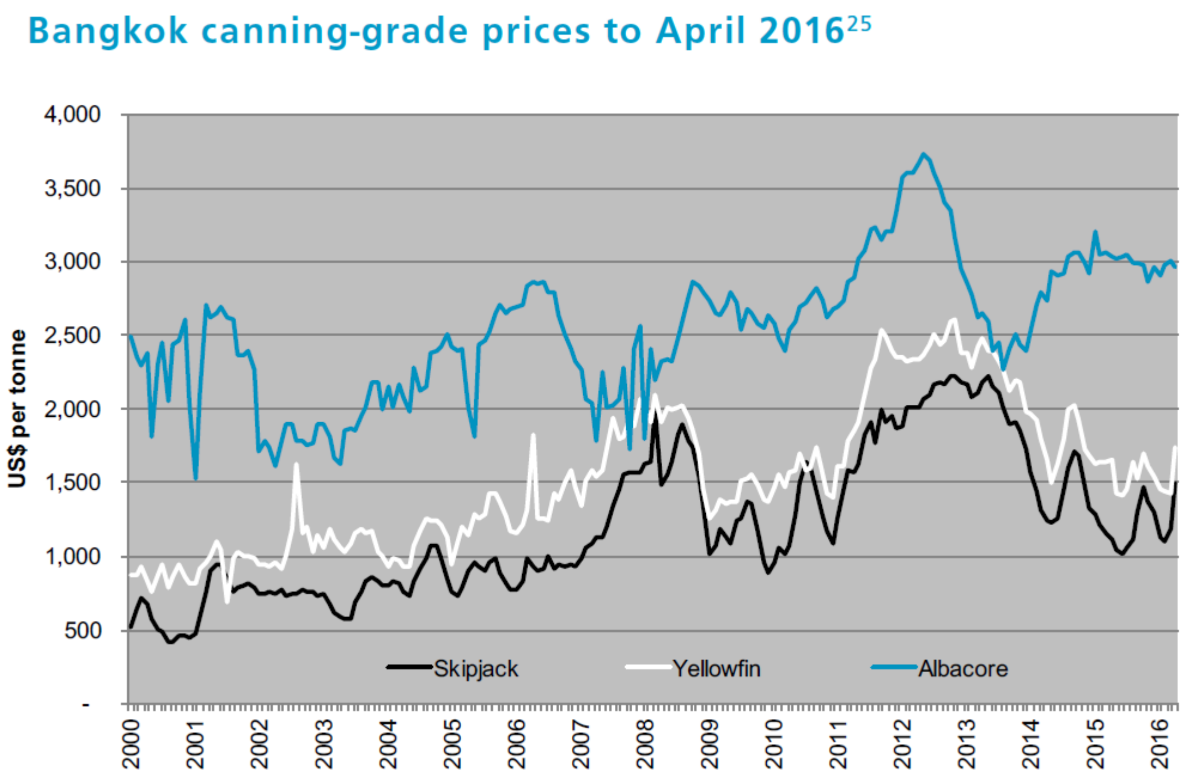
SKJ-Figure 2. Estimates of natural mortality by size of Atlantic skipjack calculated by empirical relationships between mortality and some biological parameters (which show different values from those traditionally used in the East.



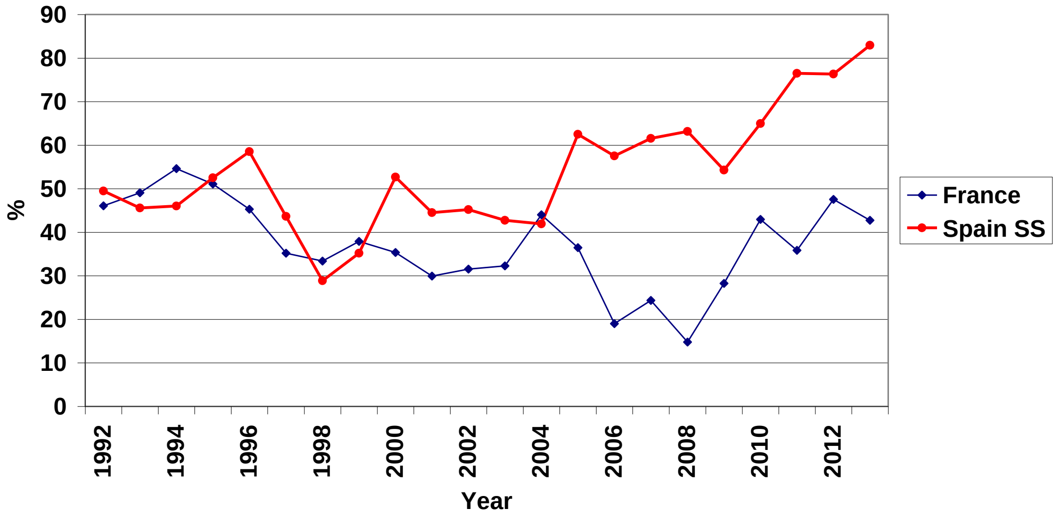
SKJ-Figure 3. Total skipjack catches (t) in the Atlantic and by stock (East and West) between 1950 and 2015. Skipjack estimates in the *faux poissons* landed in Côte d'Ivoire were included in the skipjack trade catches in the eastern Atlantic except for 2015. It is possible that skipjack catches taken 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 2015 figure is still preliminary, in particular for the East Atlantic.



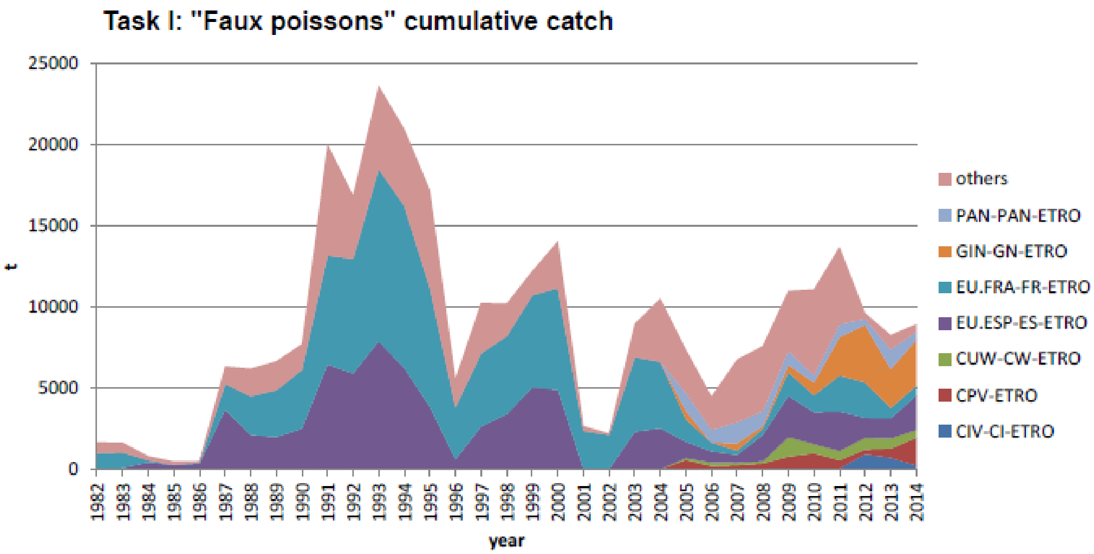
SKJ-Figure 4. Skipjack catches in the eastern Atlantic, by gear (1950-2015), after correction of Ghana's data by species (1996-2014).



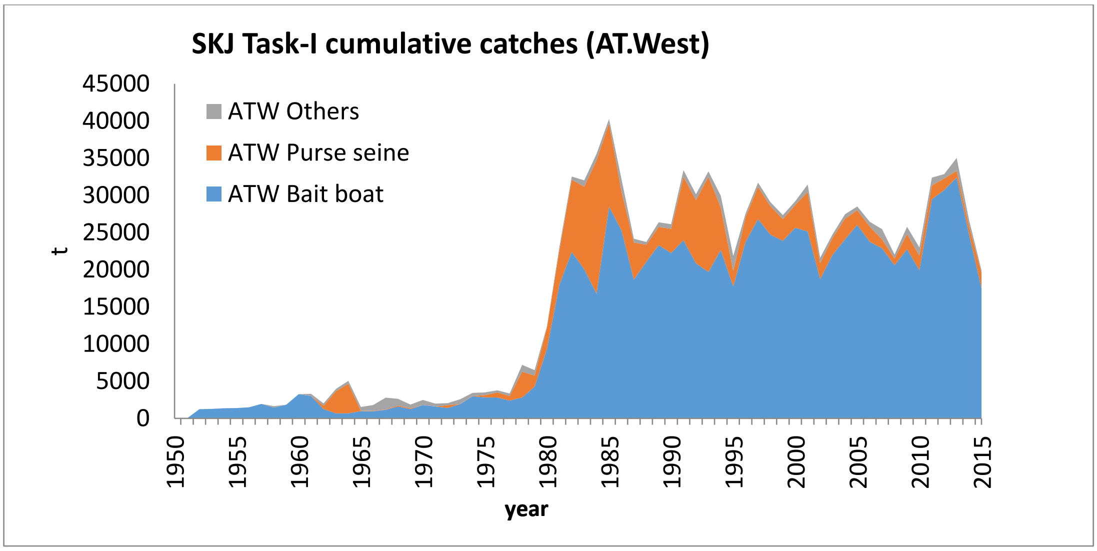
SKJ-Figure 5. Average prices of skipjack and yellowfin in U.S. dollars (adjusted for inflation and converted into the value of the 2015$US) in the Bangkok market.
(Source: http://www.ffa.int/system/files/FFA%20Trade%20and%20Industry%20News_May-June_2016.pdf)



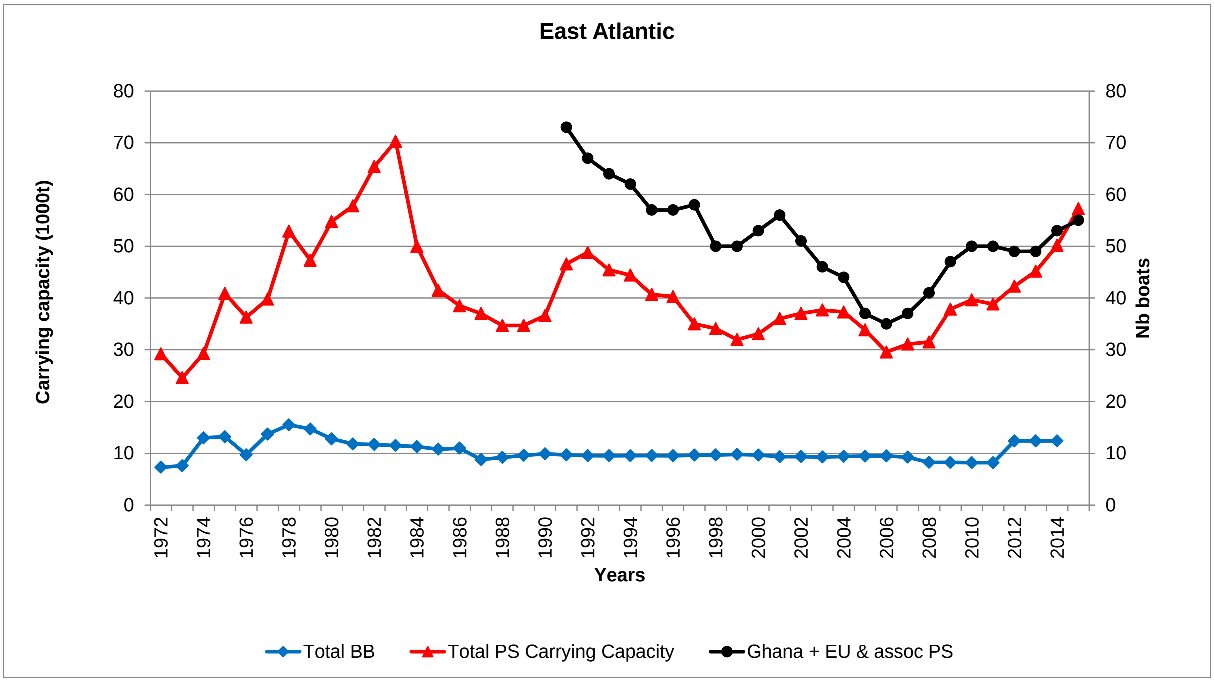
SKJ-Figure 6. Changes in the proportion of skipjack catches made by French and Spanish purse seiners under FADs (1992-2013). The increase in the percentage of catches under FADs coincides with the shift from the Senegal area, known for its seasonal fishing on free schools (see **Figure 1**), and with the increase of skipjack prices.



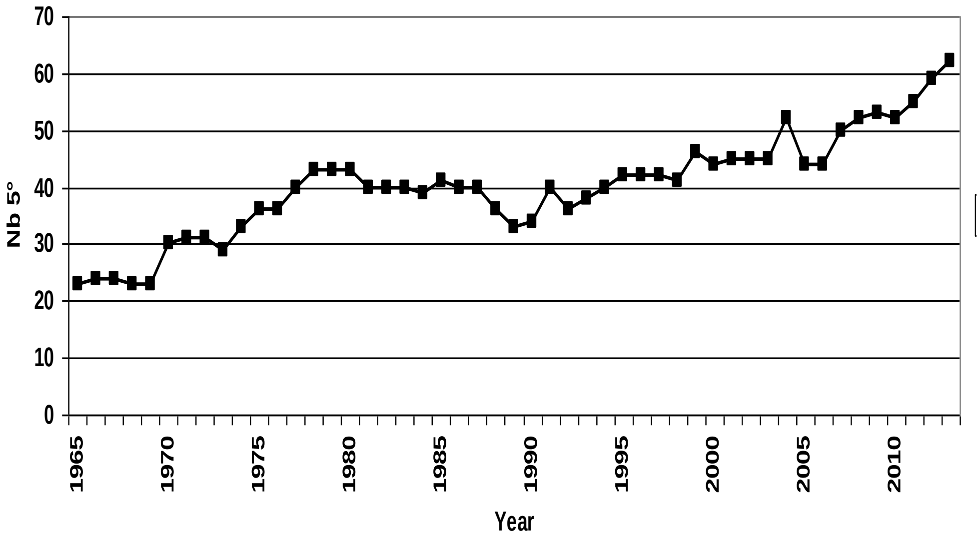
SKJ-Figure 7. Cumulative estimated landings of *faux poissons* (1981-2014) by purse seiners operating in the Eastern Atlantic for the three major species of tropical tunas in the local market of Abidjan (Côte d'Ivoire).



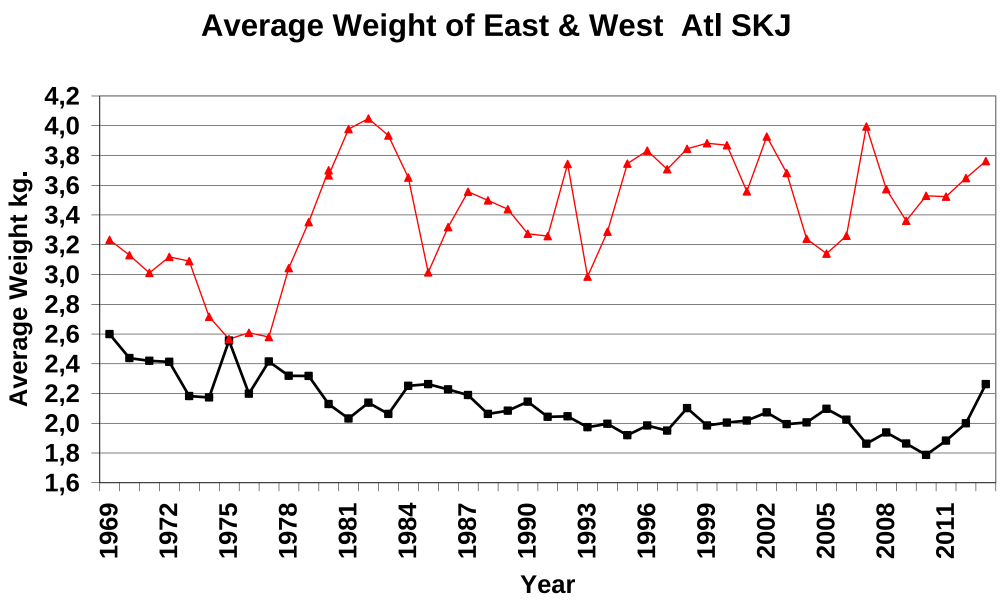
SKJ-Figure 8. Cumulative skipjack catches in the western Atlantic, by gear (1950-2015). The values for 2015 are preliminary.



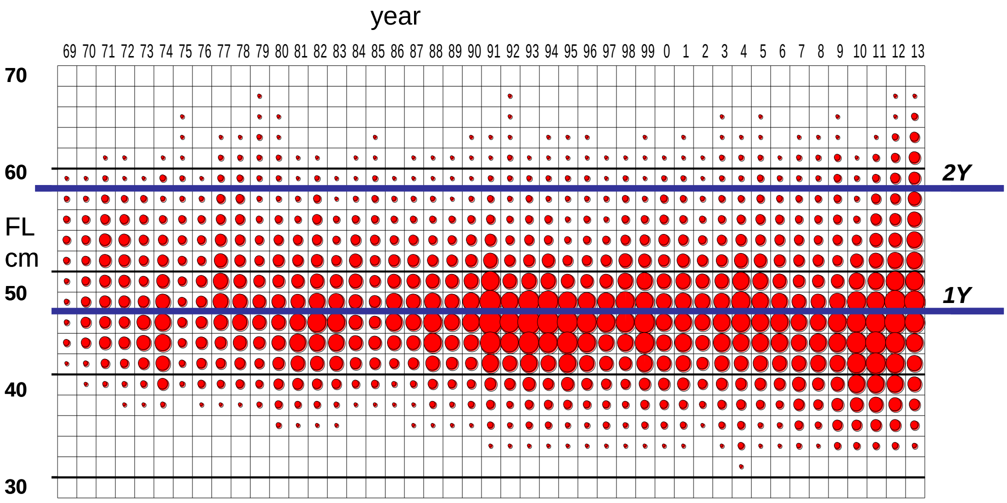
SKJ-Figure 9. Changes over time in the carrying capacity, corrected by the annual percentage of time at sea, (left axis) for the overall purse seiners (1971-2015) and baitboats (1971-2014) operating in the eastern Atlantic and in number of boats for the European purse seiners, associated and Ghanaian fleets (right axis). It is possible that the carrying capacity for some segments of the purse seine fleet was underestimated during recent years.



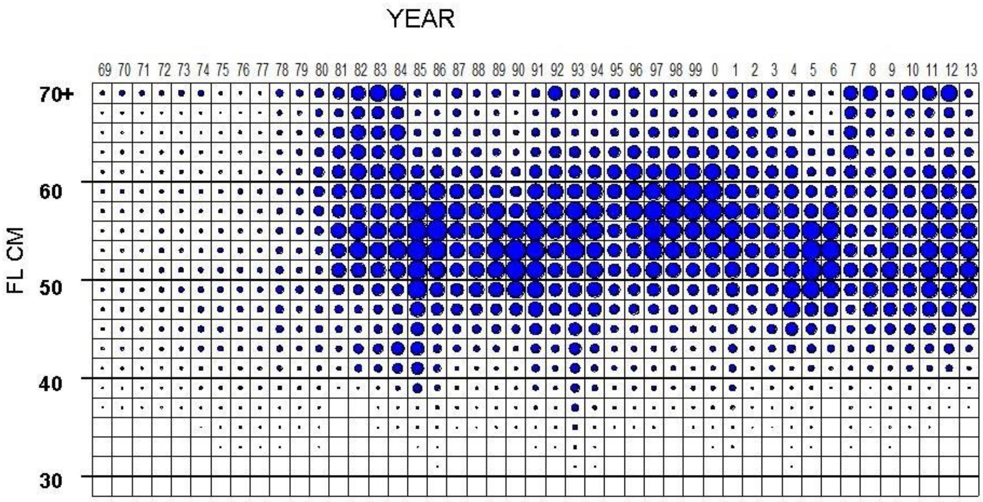
SKJ-Figure 10. Number of 5°x5° squares with annual skipjack catches above 10 t for the European and associated purse seiners operating in the eastern Atlantic (1969-2014). The great increase observed in 1991 could be due to a modification of the species composition correction procedure of the catches implemented at this date (skipjack catches could have been attributed to squares which were not included until then). On the other hand, the recent increase in the area searched successfully corresponds to the extension of the fishery towards the western central Atlantic and off Mauritania and Angola.



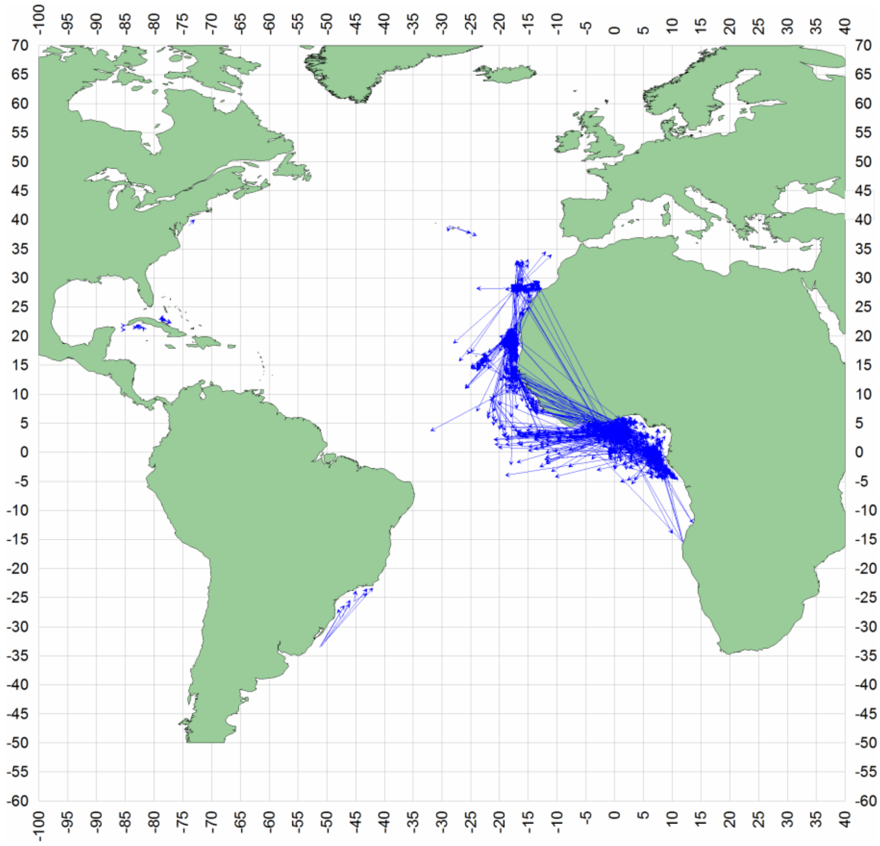
SKJ-Figure 11. Changes in the average weight of skipjack in the eastern (black) and western Atlantic (red).



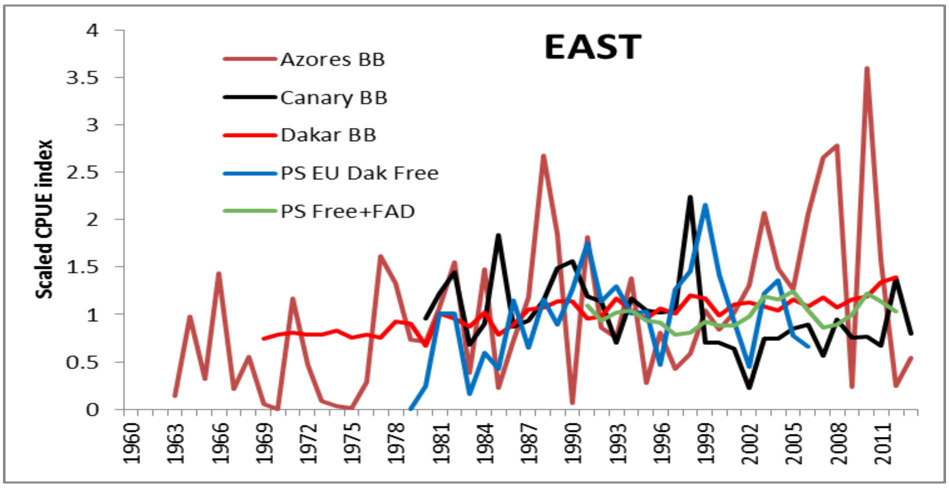
SKJ-Figure 12. Distribution of skipjack catch-at-size by size class (2 cm FL size bin) and year for the eastern Atlantic stock. Each bubble represents the proportion of catch weight stratified by size bin and year. The size limits of ages 1 and 2 are indicated by the horizontal lines (blue).



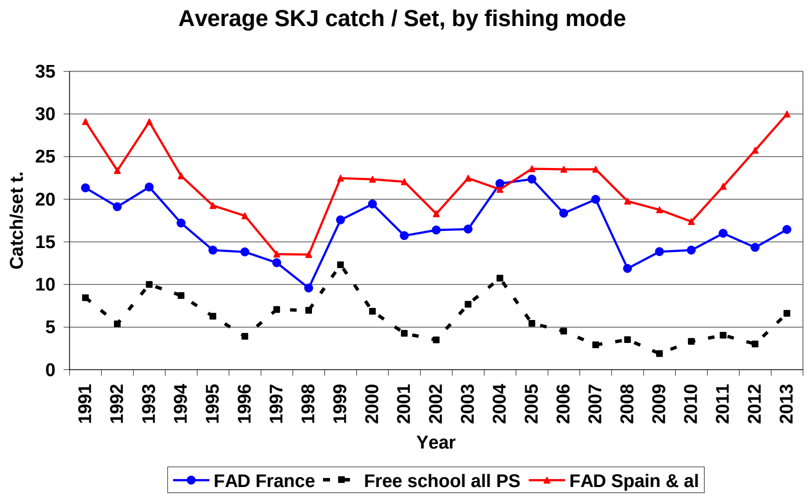
SKJ-Figure 13. Distribution of skipjack catch-at-size by size class (2 cm FL size bin) and year for the western Atlantic stock. Each bubble represents the proportion of catch weight stratified by size bin and year.



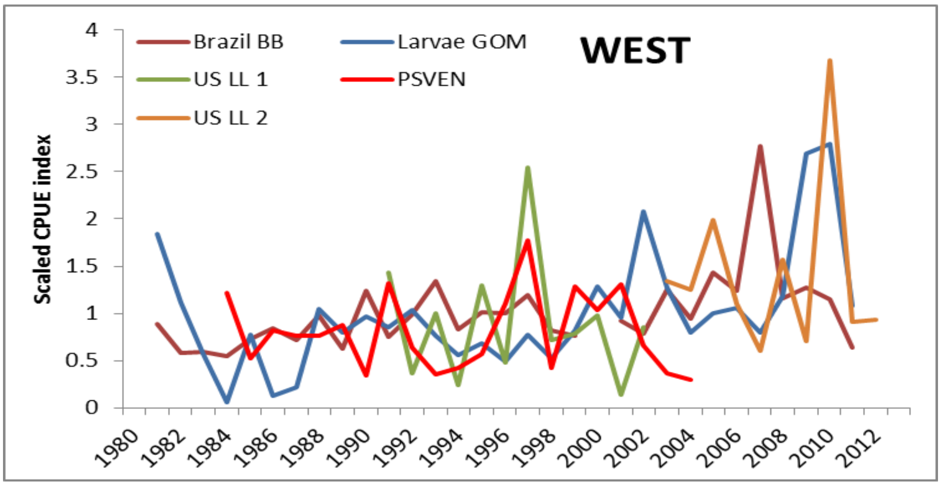
SKJ Figure 14. Apparent movements (straight line distance between the tagging location and that of recovery) calculated from conventional tagging.



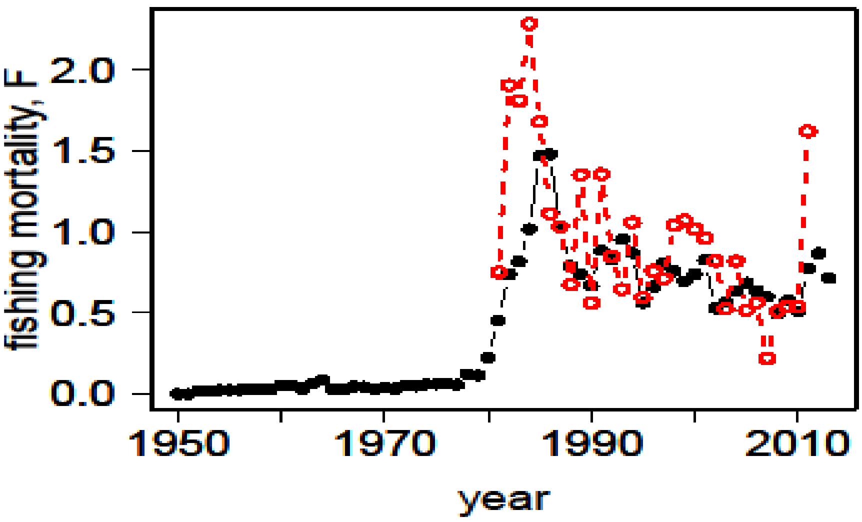
SKJ-Figure 15. Relative abundance indices for the eastern skipjack stock. Each index has been adjusted to its own average level given that to resolve problems regarding scaling, the indices for purse seine have been adjusted to the same level as the Azorean baitboat series.



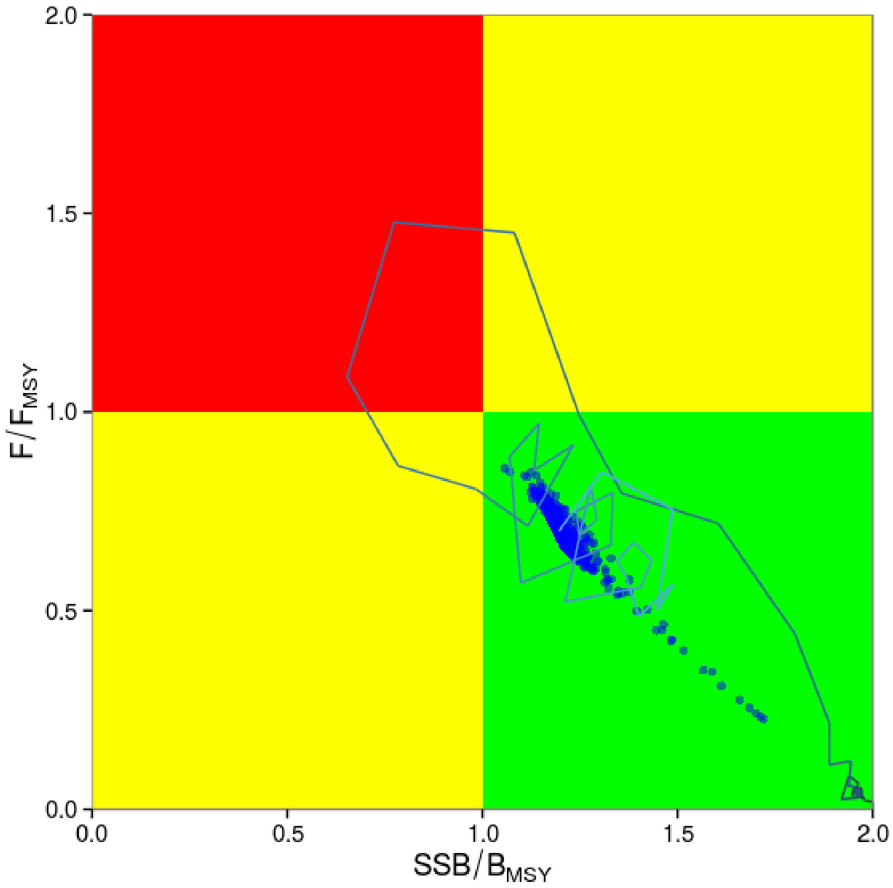
SKJ-Figure 16. Catches by set (t) of eastern Atlantic skipjack and on FADs (France and Spain + associated fleets) and on free schools (all purse seiners).



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 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.

The status of the Mediterranean albacore stock is based on the 2011 assessment using available data up to 2010. Complete information is found in the Report of the 2011 ICCAT South Atlantic and Mediterranean Albacore Stock Assessment Session.

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 2015 was 25,450 t, and the catch in the last five years has remained about 24,000 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 2015, when compared with the average of the last five years, was similar for EU-Ireland, increased (around 20%) for EU-Spain, and decreased (around 10%) for EU-France.

Longline catch contributed to approximately 20% 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 2015 for Japan was below the last 5 year average, while for Chinese Taipei it was 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 mid-1960s and the 1980s, 35,000 t until the last decade were they oscillated around 20,000 t. However, total reported albacore landings for 2015 decreased to 15,144 t, which is among the lowest values in the time series. The Chinese Taipei catch continued to decrease and, in 2015, reached the second lowest value of the last decades. In fact, 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. The 2015 catch for Brazil is lower than catches in the past five years. 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 2015, the estimated South African and Namibian catch (mainly baitboat), was similar to 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 compared to additional sources of information. This allowed identifying some catches that were not included in the ICCAT database, which requires further revisions. In 2015, the reported landings were 2,718 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 62% of the catch during the last 10 years. In 2015 the Italian catch slightly decreased (-15%) when compared with the last five year average.

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 2011, the first stock assessment for Mediterranean albacore was conducted, using data up until 2010. The methods used were adapted to the “data poor” category of this stock. The more data-demanding methods applied, such as a production model, gave unrealistic results.

Some CPUE series for Mediterranean fisheries became available during the last assessment (**ALB-Figure 9**). However, these series were discontinuous and highly variable, with no clear trend over the last couple of decades. Since they are mostly very short, and there is little overlap between time series, they may or may not accurately characterize biomass dynamics in Mediterranean albacore.

The results of the 2011 assessment, based on the limited information available and in simple analyses, point to a relatively stable pattern for albacore biomass in the recent past. Recent fishing mortality levels appear to have been reduced from those of the early 2000s, which were likely in excess of F_{MSY}, and might now be at about or below that level (**ALB-Figure 10**).

ALB-4. Outlook

North Atlantic

Following previous practice during the 2013 assessment and considering Rec. 13-05 and Rec. 15-04 that request to further develop a Limit Reference Point (LRP) and Harvest Control Rules (HCR) for north Atlantic albacore, 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} that should be further tested (**ALB-Figure 11**). The projections assuming catch levels similar to those observed during the last five years (approximately 24,000 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 suggest higher sustainable catch levels compared to most of the previous assessments. However, the Committee has 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.

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 2**). 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 fact that the management advice for the Mediterranean stock was based on catch curve analysis and due to the limited quantitative information available to the SCRS, projections for this stock were not conducted. As a result, future stock status in response to management actions could not be simulated. The outlook for this stock is thus unknown.

ALB-5. Effect of current regulations

North Atlantic

In 2013, the Commission established a TAC for 2014-2016 of 28,000 t [Rec. 13-05], 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 two years (**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 2013 the Commission established a new TAC of 24,000 t for 2014-2016 [Rec. 13-06]. 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

There are no ICCAT regulations directly aimed at managing the Mediterranean albacore stock.

ALB-6. Management recommendations

North Atlantic

Recommendation 15-04 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 by 2020 at the latest, while maximizing average catch and minimizing inter-annual fluctuations in TAC levels. The simulations conducted so far suggest that HCRs with combinations of F targets below F_{MSY} together with $B_{THRESHOLD}$ values below B_{MSY} allow for reasonably good compromises between sustainability targets and fishery profit and stability, and may have the potential to meet the management objectives as outlined in Rec. [15-04]. However, although some of these Harvest Control Rules have been tested in an MSE framework against a broad range of sometimes conflicting objectives, further work is needed to fully test them against a fuller range of uncertainties.

The Committee has noted that the relative abundance of north Atlantic albacore has continued to increase over the last decades and is likely somewhere in the green area of the Kobe plot. However, without additional information, the magnitude of the recovery is not well determined and remains sensitive to many different assumptions. This undermines 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 are 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 (approximately 24,000 t) or the current TAC (28,000 t) suggest that biomass would continue to increase and are likely sustainable. Based on the analyses conducted in 2016 as well as in 2013, the Committee believes that the current TAC would maintain the long-term objectives of the Commission as specified in Rec. 15-04. Given the uncertainty around the current stock status and the projections, the Committee is unable to advice on risks associated with an increase in the TAC. Therefore, the Committee does not recommend an increase of the TAC. Further, the Committee reminds 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.

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 2 and 3**).

Mediterranean

The available information on Mediterranean albacore stock status indicates a relatively stable pattern for albacore biomass over the recent past. Unfortunately, very little quantitative information is available to the SCRS for use in conducting a robust quantitative characterization on biomass status relative to Convention objectives. While additional data to address this issue might exist at CPC levels, our ability to provide quantitative management advice will be seriously impeded until such data become available either through recovery of historical data or institution of adequate fishery monitoring data collection programmes. Recent fishing mortality levels appear to have been reduced from those of the early 2000s, which were likely in excess of F_{MSY}, and might now be at about or lower than that level. However, there is considerable uncertainty about this and for this reason, the Commission should institute management measures designed to limit increases in catch and effort directed at Mediterranean albacore.

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]	Unknown
Current (2016) TAC	28,000 t	24,000 t	Not established
Current (2015) Yield	25,450 t	15,144 t	2,718 t
Yield in last year of assessment (2014)	26,651 t	13,677 t	
Yield in last year of assessment (2010)			2,124 t
B_{MSY}	407,567 t (366,309-463,685) [1]	120,465 t (71,312-208,438) [2]	
F_{MSY}	0.097 (0.079-0.109) [1]	0.202 (0.119-0.373) [2]	
B_{2015}/B_{MSY}	1.36 (1.05-1.78)[1]	1.10 (0.51-1.80) [2]	Not estimated
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_{2011}/F_{MSY}			<=1 [4]
Stock Status	Overfished: NO	Overfished: NO	Not available
	Overfishing: NO	Overfishing: NO	NO
Management measures in effect:	[Rec. 98-08]: Limit number of vessels to 1993-1995 average. [Rec. 13-05]: TAC of 28,000 t for 2014-2016. [Rec. 15-04]: 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. 13-06]: TAC of 24,000 t for 2014-2016	None

[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] Estimated with length converted catch curve analysis, taking M as a proxy for F_{MSY}, in the 2011 assessment.

ALB-Table 1. Estimated catches (t) of albacore (*Thunnus alalunga*) by area, gear and flag. (v1, 2016-09-30)

			1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
TOTAL			56326	69615	73086	71812	67517	60379	59585	59039	67063	70088	69919	60095	61466	53378	57728	67407	48841	42320	41661	40857	48789	52788	45399	42701	43312
	ATN		27931	30851	38135	35163	38377	28803	29023	25746	34551	33124	26253	22741	25567	25960	35318	36989	21991	20483	15375	19509	20039	25680	24633	26651	25450
	ATS		26016	36562	32813	35300	27552	28426	28022	30595	27656	31387	38796	31746	28002	22543	18882	24453	20283	18867	22265	19225	24129	25061	19262	13677	15144
	MED		2379	2202	2138	1349	1587	3150	2541	2698	4856	5577	4870	5608	7897	4874	3529	5965	6567	2970	4021	2124	4621	2047	1503	2373	2718
Landings	ATN	Bait boat	8968	12436	15646	11967	16411	11338	9821	7562	8780	11072	6103	6638	7840	8128	10458	14273	8496	7931	4994	6026	5530	8816	4975	7341	9265
		Longline	5315	3152	7093	7309	4859	4641	4051	4035	6710	7321	7372	6180	7699	6917	6911	5223	3237	2647	2619	3913	3666	3759	6514	3091	4465
		Other surf.	3999	5173	7279	7506	3555	3337	4378	6846	6817	5971	2828	422	551	697	624	625	525	274	427	324	412	352	596	162	28
		Purse seine	222	139	229	292	278	263	26	91	56	191	264	118	211	348	99	188	198	70	84	74	0	167	7	35	115
		Trawl	469	2603	1779	2131	3049	2571	2877	1318	5343	3547	5374	5376	3846	2369	7001	6385	3429	4321	2811	2026	6852	6678	6558	9184	5771
		Troll	8959	7348	6109	5959	10226	6652	7870	5894	6845	5023	4312	4007	5419	7501	10224	10296	6105	5239	4440	7146	3578	5909	5891	6660	5596
	ATS	Bait boat	3454	6490	7379	8947	7091	6960	8110	10353	6709	6873	10355	9712	6973	7475	5084	5876	3375	4350	7926	3748	5938	6710	4411	4741	4965
		Longline	22008	27162	23947	24806	20040	21000	19547	19799	20640	24398	28039	21671	20626	14735	12977	17740	15087	13218	12113	13471	16445	17846	13863	8886	9982
		Other surf.	137	393	39	483	10	209	127	0	73	58	377	323	82	299	288	395	1762	1219	2066	1651	1538	66	897	7	66
		Purse seine	416	2517	1448	1064	412	257	117	434	183	58	25	39	309	16	534	442	58	81	160	355	208	437	91	42	130
		Trawl	0	0	0	0	0	0	120	9	52	0	0	0	12	18	0	0	0	0	0	0	0	0	0	0	
	MED	Bait boat	499	171	231	81	163	205	0	33	96	88	77	29	0	0	0	0	0	0	0	0	0	0	0	0	
		Longline	524	442	410	350	87	391	348	194	416	2796	2597	3704	4248	2335	1997	3026	4119	2694	1582	1719	2317	1959	1392	2317	2429
		Other surf.	1198	1533	879	766	1031	2435	1991	2426	4271	2693	2196	1757	3171	2187	1215	2723	1401	250	2414	404	2245	8	18	31	259
		Purse seine	110	6	559	23	0	0	0	0	0	0	0	1	478	353	317	214	1046	24	26	0	34	68	86	13	13
		Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	7
		Troll	48	50	59	129	306	119	202	45	73	0	0	117	0	0	0	1	0	1	0	1	0	6	0	3	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	0	93	179	209
	ATS	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	
	MED	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	6	7	8	10
Landings	ATN	Barbados	0	0	0	0	0	0	1	1	1	0	2	5	8	10	13	9	7	7	4	6	4	20	22	13	16
		Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	26	39	416	351	155	230	79	1
		Brazil	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Canada	5	1	9	32	12	24	31	23	38	122	51	113	56	27	52	27	25	33	11	14	28	34	32	47	32
		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	5
		China PR	0	0	0	14	8	20	0	0	21	16	57	196	155	32	112	202	59	24	27	142	101	21	81	35	21
		Chinese Taipei	4318	2209	6300	6409	3977	3905	3330	3098	5785	5299	4399	4330	4557	4278	2540	2357	1297	1107	863	1587	1367	1180	2394	947	2857
		Cuba	0	0	0	0	0	0	0	0	0	0	0	1	322	435	424	527	0	0	0	0	0	0	0	0	
		Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	53	39	146	0	0	
		Dominican Republic	0	0	0	0	0	0	323	121	73	95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		EU.España	17233	18175	18380	16998	20197	16324	17295	13285	15363	16000	9177	8952	12530	15379	20447	24538	14582	12725	9617	12961	8357	13719	10502	11607	14126
		EU.France	4123	6924	6293	5934	5304	4694	4618	3711	6888	5718	6006	4345	3456	2448	7266	6585	3179	3009	1122	1298	3348	3361	4592	6716	3441
		EU.Ireland	60	451	1946	2534	918	874	1913	3750	4858	3464	2093	1100	755	175	306	521	596	1517	1997	788	3597	3575	2231	2485	2390
		EU.Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	**0**
		EU.Portugal	709	1638	3385	974	6470	1634	395	91	324	278	1175	1953	553	513	556	119	184	614	108	202	1046	1231	567	2609	929
		EU.United Kingdom	0	59	499	613	196	49	33	117	343	15	0	0	0	0	6	19	30	50	67	118	57	50	133	136	31
		FR.St Pierre et Miquelon	0	0	0	0	0	0	0	0	0	0	0	4	0	7	2	0	3	0	0	0	0	0	0	0	
		Grenada	0	0	0	0	2	1	6	7	6	12	21	23	46	25	29	19	20	15	18	18	18	0	0	0	
		Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	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	691	466	485	505	386	466	414	446	425	688	1126	711	680	893	1336	781	288	402	288	525	336	400	1745	267	283
		Korea Rep.	1	0	8	0	2	2	1	0	0	0	0	0	0	0	59	45	12	59	82	110	60	200	184	64	5
		Maroc	0	0	0	0	0	0	0	0	0	0	0	55	81	120	178	98	96	99	130	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	3	1
		NEI (Flag related)	11	19	13	10	8	11	3	8	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Panama	0	29	60	117	73	11	5	0	0	0	0	0	0	0	0	96	298	113	45	154	103	0	246	126	103
		Philippines	0	0	0	0	0	0	0	151	4	0	0	0	0	0	9	0	8	19	54	0	0	83	0	0	**0**
		Sierra Leone	0	0	0	0	0	0	0	0	0	0	91	0	0	0	0	0	0	0	0	0	0	0	0	0	
		St. Vincent and Grenadines	0	0	2	0	0	0	0	0	1	704	1370	300	1555	89	802	76	263	130	135	177	329	305	286	328	305

		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	Sta. Lucia	0	1	1	0	1	1	0	0	0	1	3	2	10	0	2	2	2	2	0	130	2	3	2	0	0
	Suriname	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	249	216	0	**0**
	Trinidad and Tobago	0	247	0	0	0	0	2	1	1	2	11	9	12	12	9	12	18	32	17	17	23	47	67	71	95
	U.S.A.	479	438	509	741	545	472	577	829	315	406	322	480	444	646	488	400	532	257	189	315	422	418	599	458	248
	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	1	0	2	2	2	0	0	1	1	0	0	0	0	0	1	0	0	1	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	2	**0**
	Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	0	414	507	235	95	20	140	187	196	172	228	195	
	Venezuela	302	193	246	282	279	315	75	107	91	299	348	162	346	457	175	321	375	222	398	288	247	312	181	285	351
ATS	Angola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	168	0	5	**0**
	Argentina	60	306	0	2	0	0	120	9	52	0	0	0	12	18	0	0	0	0	0	130	43	0	0	0	
	Belize	0	0	0	0	2	0	0	0	8	2	0	0	0	0	0	54	32	31	213	303	365	171	87	98	**0**
	Brazil	1113	2710	3613	1227	923	819	652	3418	1872	4411	6862	3228	2647	522	556	361	535	487	202	271	1269	1857	1821	438	425
	Cambodia	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	46	24	0	5	0	5	0	0	0	**0**
	China PR	0	0	0	0	0	0	0	0	39	89	26	30	26	112	95	100	35	25	89	97	80	61	65	34	120
	Chinese Taipei	19883	23063	19400	22573	18351	18956	18165	16106	17377	17221	15833	17321	17351	13288	10730	12293	13146	9966	8678	10975	13032	12812	8519	6675	7157
	Cuba	17	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Curaçao	0	0	0	0	0	0	9	192	0	2	0	0	0	0	0	0	0	0	21	4	4	24	0	0	1
	Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47	43	45	50	0	0	**0**
	EU.España	280	1943	783	831	457	184	256	193	1027	288	573	836	376	81	285	367	758	933	1061	294	314	351	369	259	418
	EU.France	50	449	564	129	82	190	38	40	13	23	11	18	63	16	478	347	12	50	60	109	53	161	73	38	53
	EU.Portugal	81	184	483	1185	655	494	256	124	232	486	41	433	415	9	43	8	13	49	254	84	44	11	1	3	1
	EU.United Kingdom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	
	Ghana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	10	14	25	0	0	0	0	
	Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	0	0	0	56	0	0	15	0	2
	Guinea Ecuatorial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0
	Guinée Rep.	0	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	0	29	0	0	2	0	7	1	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Japan	654	583	467	651	389	435	424	418	601	554	341	231	322	509	312	316	238	1370	921	973	1194	2903	3106	1129	1761
	Korea Rep.	31	5	20	3	3	18	4	7	14	18	1	0	5	37	42	66	56	88	374	130	70	89	33	2	4
	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	
	NEI (ETRO)	8	122	68	55	63	41	5	27	0	0	10	14	53	0	7	0	0	0	0	0	0	0	0	0	
	NEI (Flag related)	149	262	146	123	102	169	47	42	38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Namibia	0	0	0	1111	950	982	1199	1429	1162	2418	3419	2962	3152	3328	2344	5100	1196	1958	4936	1320	3791	2420	848	1057	1062
	Panama	240	482	318	458	228	380	53	60	14	0	0	0	0	0	17	0	87	5	6	1	0	12	3	0	6
	Philippines	0	0	0	0	0	0	0	5	4	0	0	0	0	0	52	0	13	79	45	95	96	203	415	18	**0**
	Senegal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
	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	
	South Africa	3410	6360	6881	6931	5214	5634	6708	8412	5101	3610	7236	6507	3469	4502	3198	3735	3797	3468	5043	4147	3380	3553	3510	3719	4030
	St. Vincent and Grenadines	0	0	0	0	0	0	0	0	0	2116	4292	44	0	0	0	65	160	71	51	31	94	92	97	110	100
	U.S.A.	0	0	0	0	0	1	5	1	1	1	2	8	2	1	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	5	28	38	5	82	47	18	1	1	58	12	2	0	0	0	62	46	94	81	3	120	2	2	0	**0**
	Uruguay	34	31	28	16	49	75	56	110	90	90	135	111	108	120	32	93	34	53	97	24	37	12	209	0	**0**
	Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	684	1400	96	131	64	104	85	35	83	91	
MED	EU.Croatia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	7	12	20	30	11
	EU.Cyprus	0	0	0	0	0	0	0	0	0	6	0	12	30	255	425	507	712	209	223	206	222	315	350	350	495
	EU.España	548	227	298	218	475	429	380	126	284	152	200	209	1	138	189	382	516	238	204	277	343	389	244	283	53
	EU.France	140	11	64	23	3	0	5	5	0	0	0	1	0	0	0	0	2	1	0	1	2	0	0	1	1
	EU.Greece	500	500	1	1	0	952	741	1152	2005	1786	1840	1352	950	773	623	402	448	191	116	125	126	126	165	287	485
	EU.Italy	1191	1464	1275	1107	1109	1769	1414	1414	2561	3630	2826	4032	6912	3671	2248	4584	4017	2104	2724	1109	2494	1117	615	1353	1572
	EU.Malta	0	0	0	0	0	0	1	1	6	4	4	2	5	10	15	18	1	5	1	2	5	19	29	62	37
	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	
	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	0	2	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	120	0	0	0	0	0	

			1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
		NEI (MED)	0	0	500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Syria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	14	0	0	0	1	1	0	
		Turkey	0	0	0	0	0	0	0	0	0	0	0	0	0	27	30	73	852	208	631	402	1396	62	71	0	53
		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	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
		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	
		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
		Venezuela	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	93	179	209
	ATS	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	
		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	
		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	
	MED	EU.Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	6	7	8	10
		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 2015 Task I: last revision (arriving after the species groups deadline) not included in the table.

ALB-Table 2. 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 3. 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<Fmsy

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}

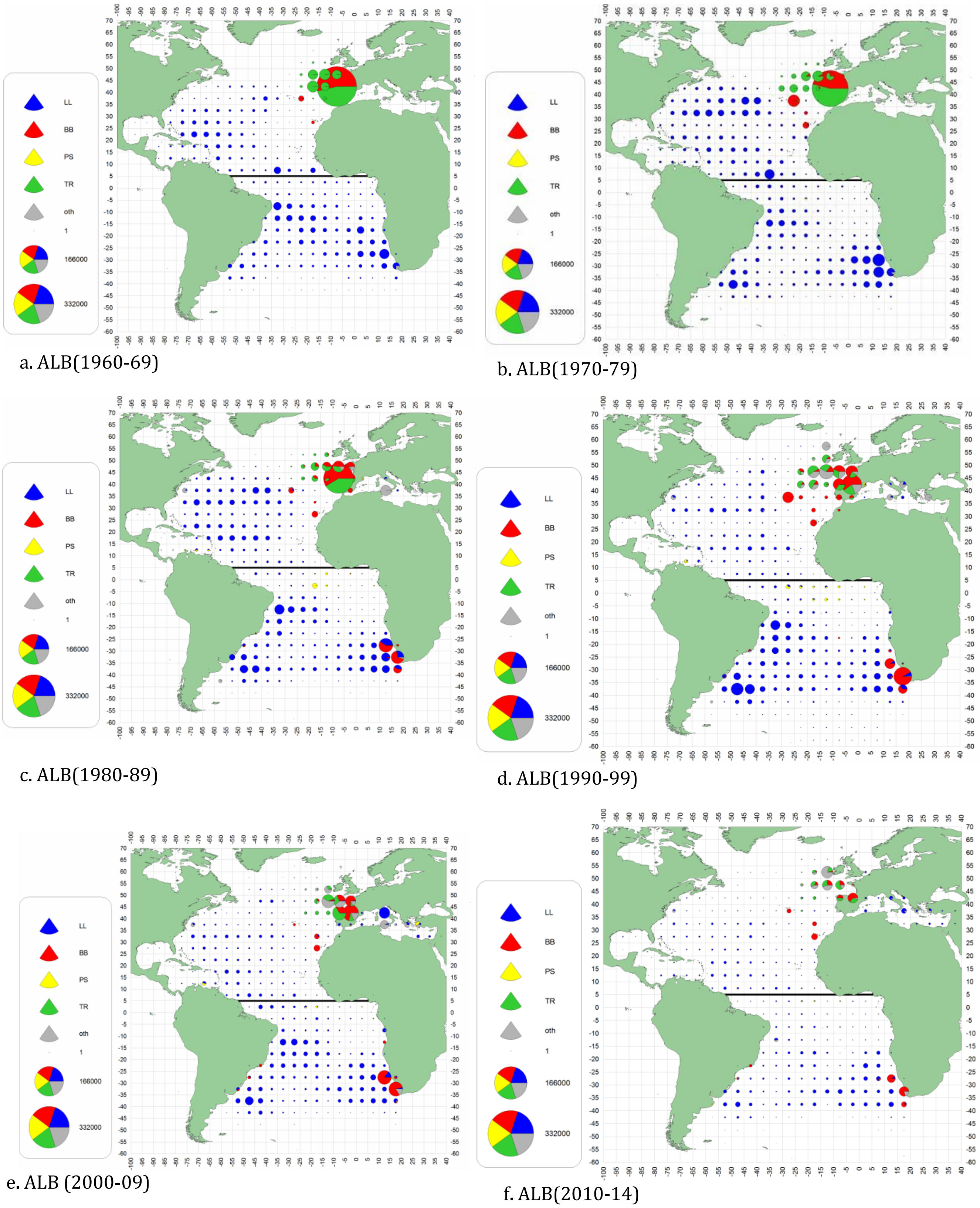
Catch (t)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
12,000	75%	80%	94%	95%	96%	96%	96%	96%	96%	96%	96%	96%	96%	96%
14,000	75%	79%	93%	95%	95%	95%	95%	96%	96%	96%	96%	96%	96%	96%
16,000	75%	78%	91%	94%	94%	95%	95%	95%	95%	95%	95%	95%	95%	95%
18,000	75%	77%	87%	93%	93%	94%	94%	94%	94%	95%	95%	95%	95%	95%
20,000	75%	76%	81%	90%	91%	92%	92%	92%	92%	92%	92%	91%	91%	91%
22,000	75%	75%	76%	84%	87%	86%	85%	84%	84%	83%	83%	83%	82%	82%
24,000	75%	74%	73%	72%	74%	75%	75%	74%	73%	73%	73%	72%	72%	71%
26,000	75%	73%	67%	61%	60%	62%	65%	65%	65%	63%	62%	61%	59%	58%
28,000	75%	71%	61%	55%	53%	51%	49%	48%	47%	46%	45%	43%	42%	41%
30,000	75%	69%	56%	51%	47%	43%	40%	36%	32%	30%	27%	26%	25%	23%
32,000	75%	66%	53%	47%	42%	37%	32%	28%	25%	23%	21%	19%	18%	17%
34,000	75%	62%	50%	43%	37%	31%	26%	23%	20%	18%	16%	14%	13%	11%

F	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
0.75*FMSY	75%	76%	89%	90%	90%	91%	91%	92%	92%	92%	92%	92%	92%	92%
0.80*FMSY	75%	75%	86%	88%	89%	89%	89%	89%	89%	90%	90%	90%	90%	90%
0.85*FMSY	75%	74%	82%	86%	86%	87%	87%	86%	87%	87%	87%	87%	87%	87%
0.90*FMSY	75%	74%	77%	84%	84%	84%	84%	84%	84%	84%	83%	83%	83%	83%
0.95*FMSY	75%	73%	72%	80%	80%	80%	81%	80%	80%	79%	79%	79%	79%	78%
1.00*FMSY	75%	72%	68%	70%	74%	74%	73%	72%	68%	63%	60%	59%	59%	62%

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

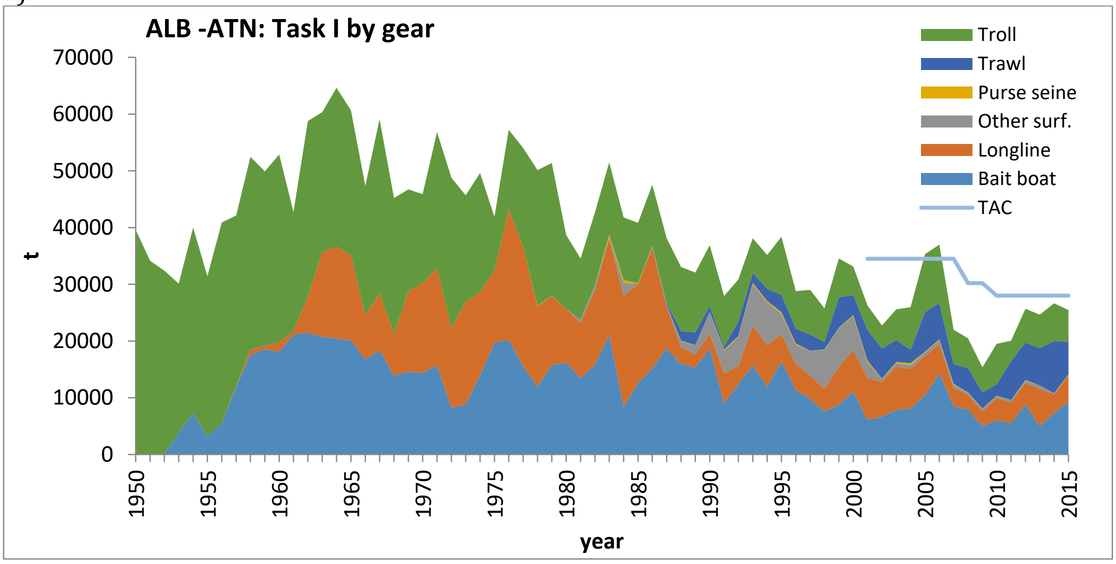
Catch (t)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
12,000	74%	80%	94%	95%	95%	96%	96%	96%	96%	96%	96%	96%	96%
14,000	74%	78%	93%	94%	95%	95%	95%	96%	96%	96%	96%	96%	96%
16,000	73%	77%	90%	93%	94%	94%	95%	95%	95%	95%	95%	95%	95%
18,000	68%	72%	83%	89%	91%	92%	92%	93%	93%	93%	93%	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	Average catch 2017-2019
0.75*FMSY	75%	76%	89%	90%	90%	91%	91%	92%	92%	92%	92%	92%	92%	18,801
0.80*FMSY	74%	75%	86%	88%	89%	89%	89%	89%	89%	89%	90%	90%	90%	19,627
0.85*FMSY	72%	73%	81%	85%	86%	86%	86%	86%	86%	86%	86%	86%	86%	20,445
0.90*FMSY	69%	69%	74%	81%	81%	82%	82%	82%	82%	82%	82%	82%	82%	21,253
0.95*FMSY	64%	64%	65%	73%	75%	75%	77%	77%	77%	77%	77%	77%	77%	22,052
1.00*FMSY	59%	59%	57%	61%	66%	67%	67%	67%	63%	59%	57%	56%	57%	22,842

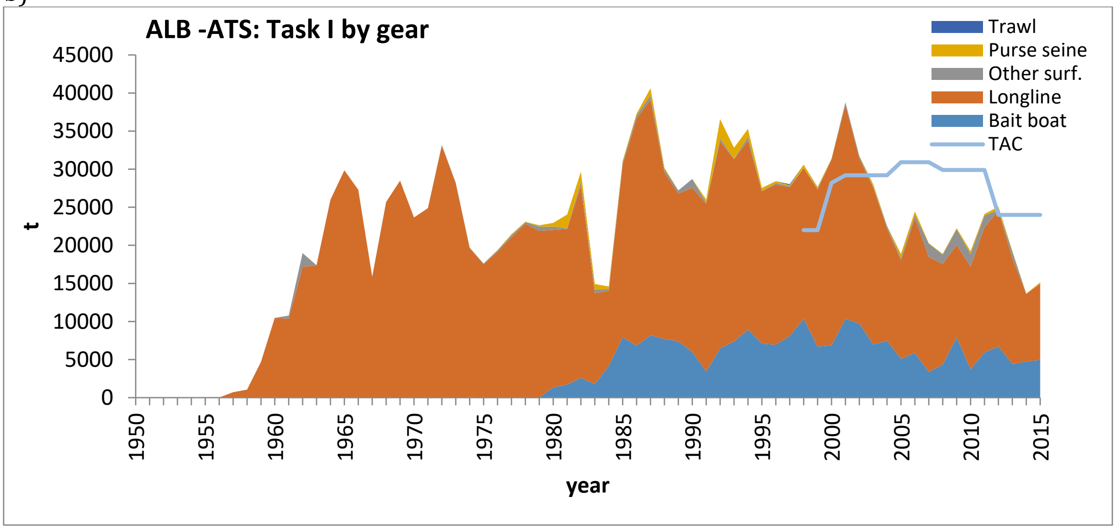


ALB-Figure 1. Geographic distribution of albacore accumulated catch by major gears and decade (1960-2014). Baitboat and troll catches prior to the 1990s, these catches were assigned to only one 5ºx5º stratum in the Bay of Biscay. Plots are scaled to the maximum catch observed from 1960 to 2014 (last decade only covers 5 years).

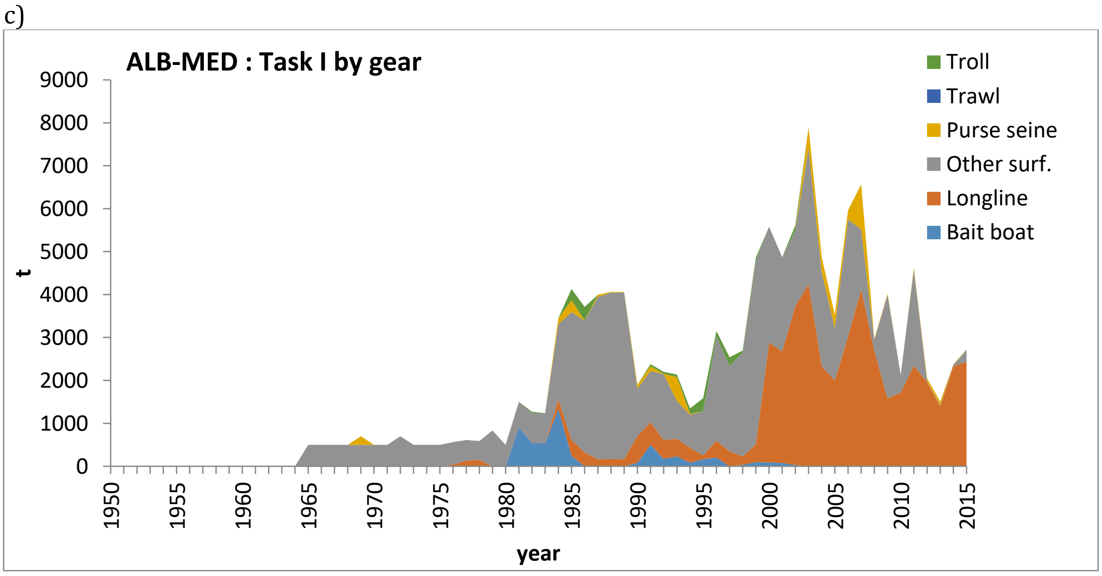
a)



b)

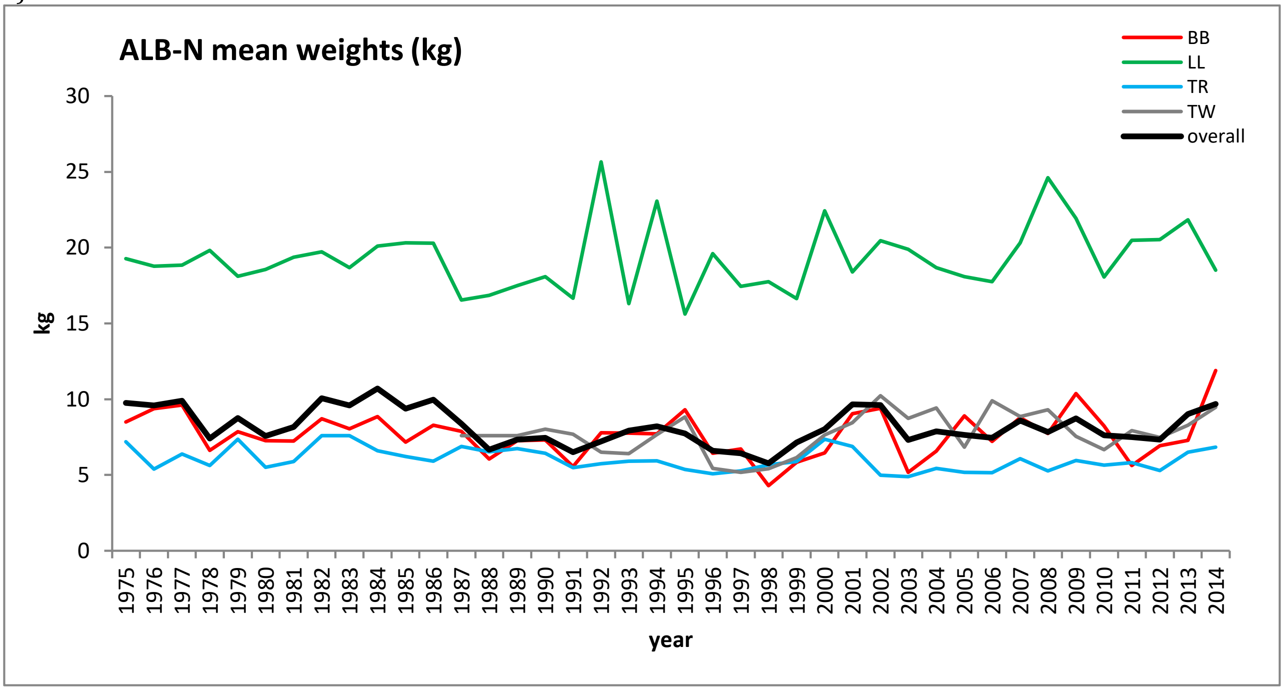


c)

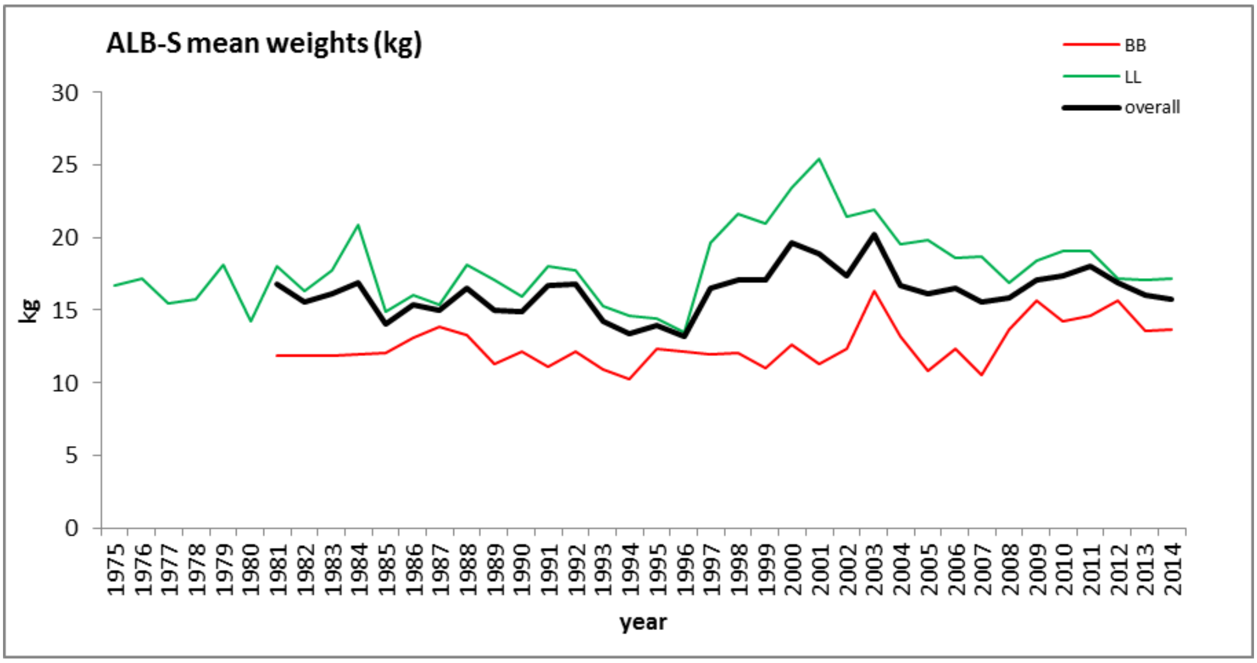


ALB-Figure 2a, b, c. Total albacore catches reported to ICCAT (Task I) by gear for the northern, southern Atlantic stocks including TAC, and the Mediterranean stock.

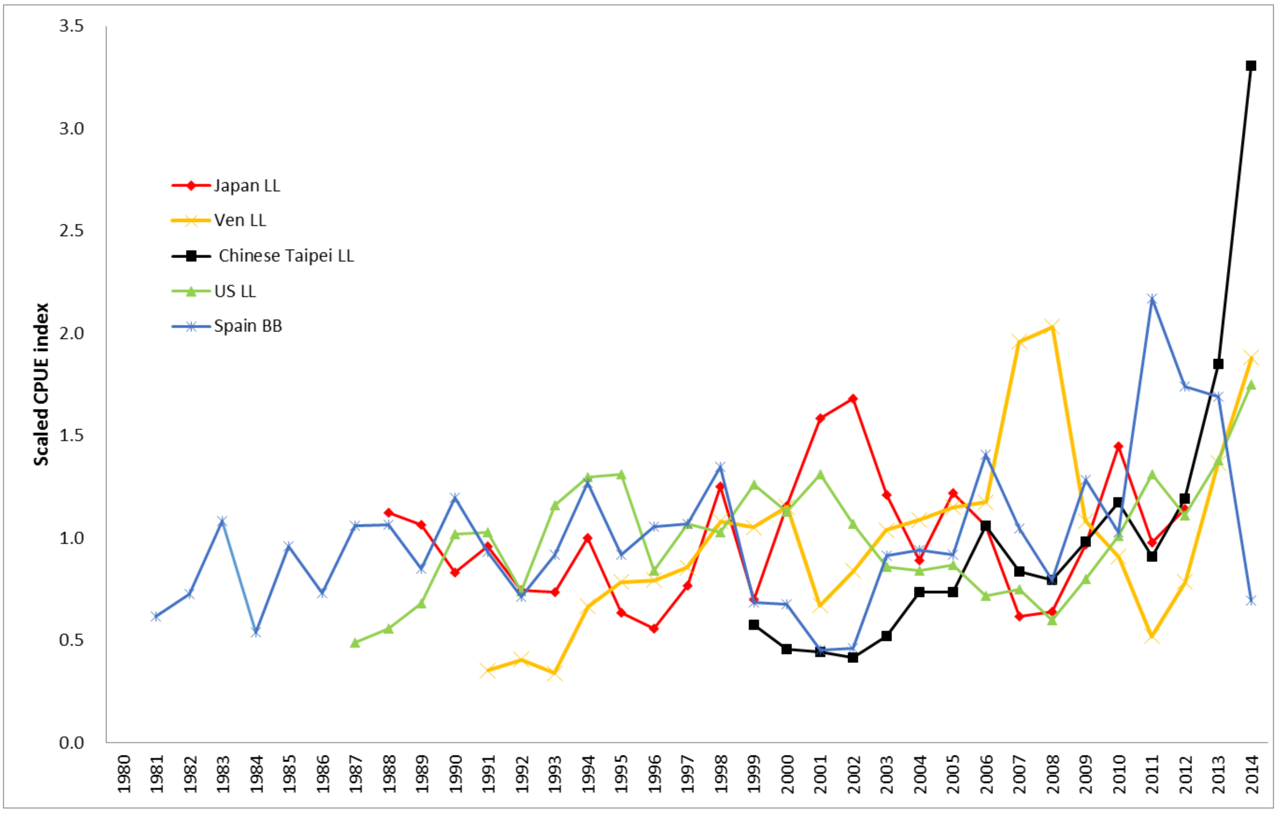
a)



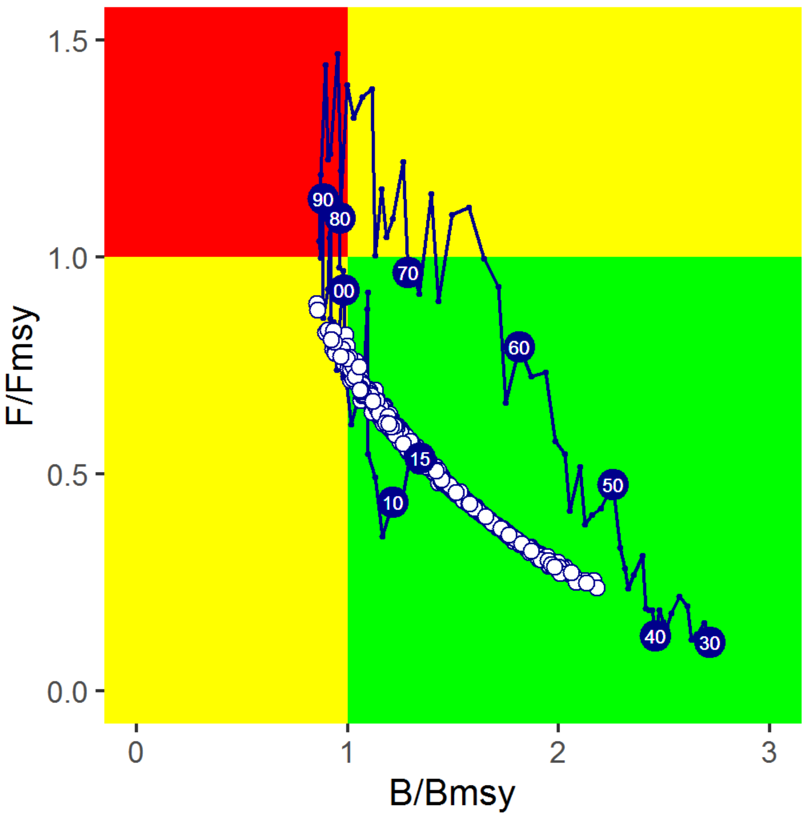
b)



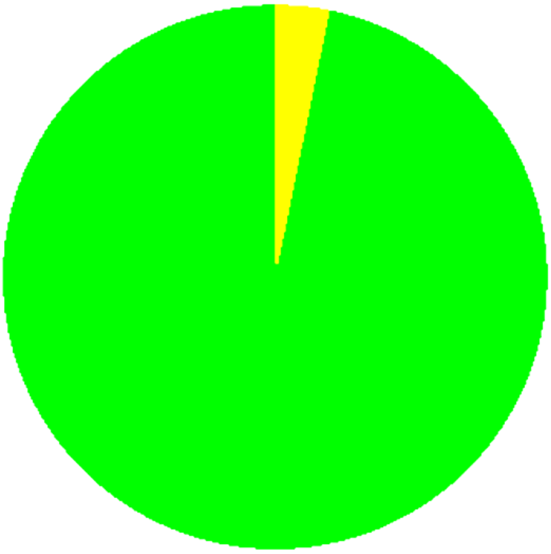
ALB-Figure 3a, b. Mean weight trend by surface and longline fisheries in North Atlantic (a) and South Atlantic (b) stocks. The baitboat fishery in the South Atlantic started in 1979 and mean weights are provided from 1980 onwards.



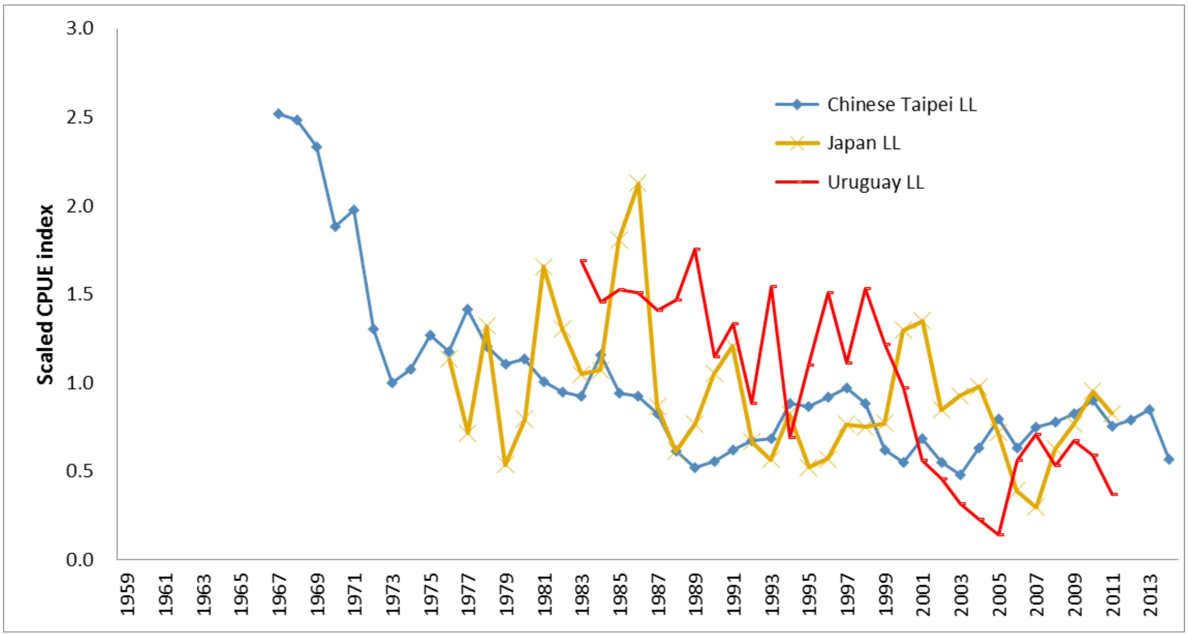
ALB-Figure 4. North Atlantic Albacore. Standardized catch rate indices used in the 2016 stock assessment from the surface fisheries, which take mostly juvenile fish, and from the longline fisheries, which take mostly adult fish.



ALB-Figure 5. North Atlantic Albacore. Joint trajectories of B/B$_{MSY}$ and F/F$_{MSY}$ 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.

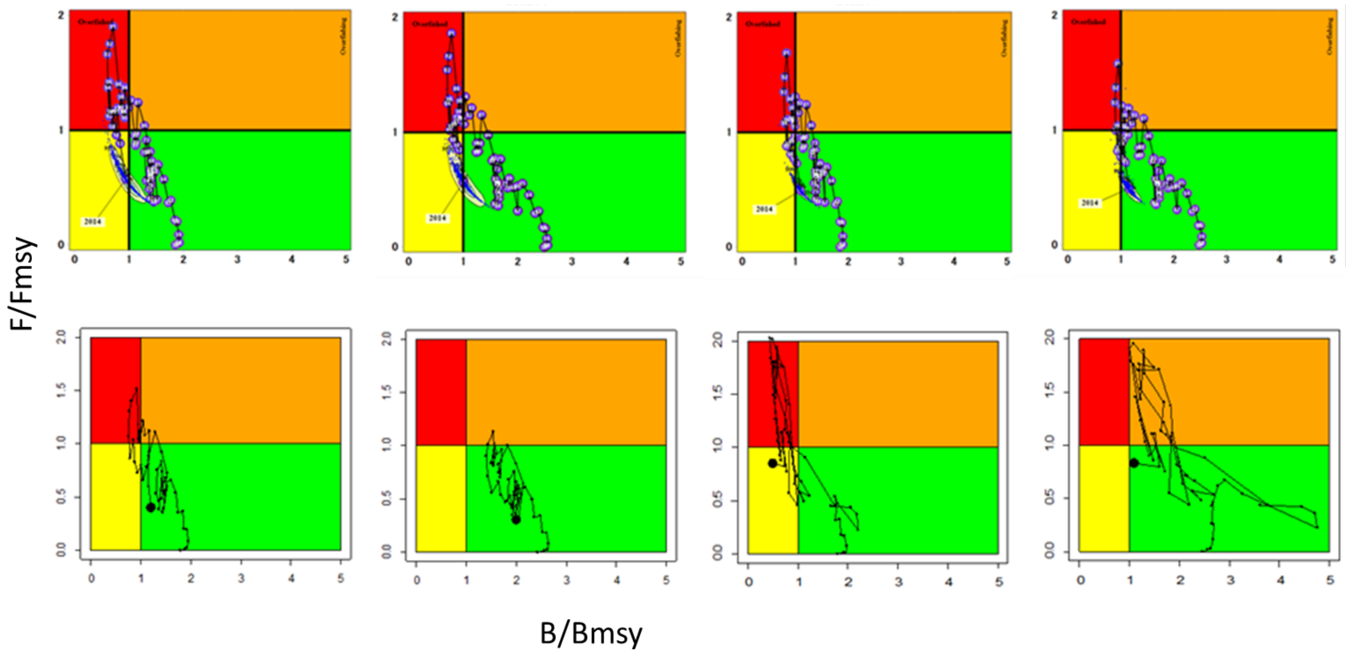


ALB-Figure 6. North Atlantic albacore probability of being overfished and overfishing (red, 0%), of being neither overfished nor overfishing (green, 96.8%), and of being overfished (yellow, 3.2%), according to the Base Case.

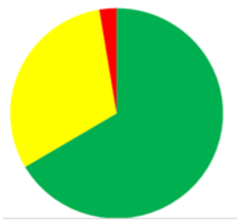


ALB-Figure 7. South Atlantic Albacore. Standardized catch rates used in the 2016 stock assessment.

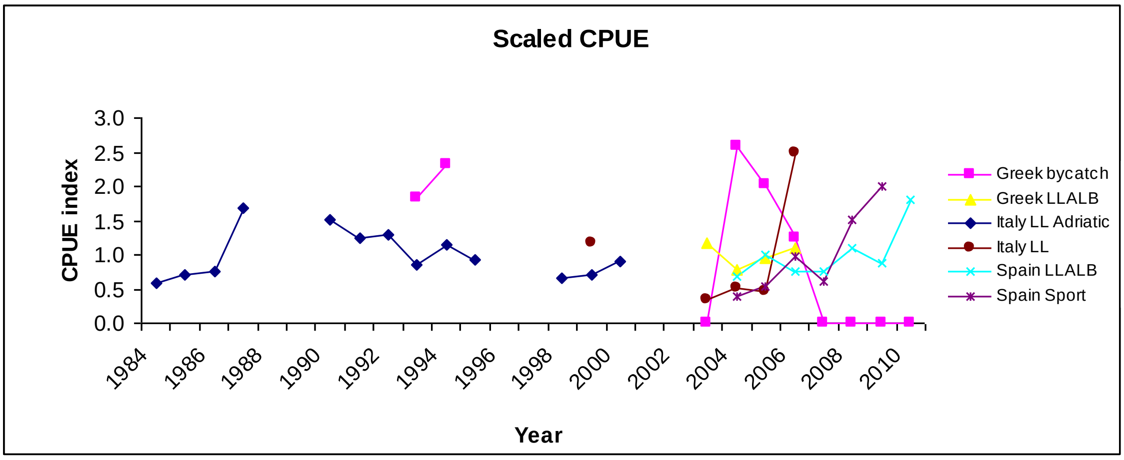
a)



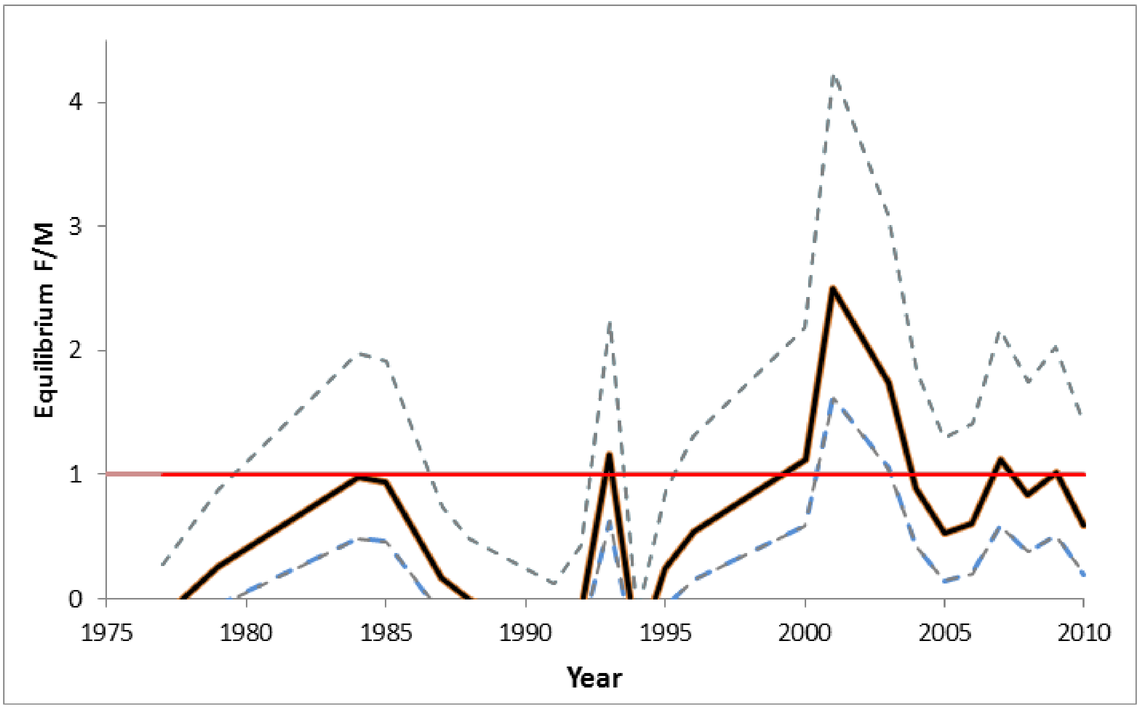
b)



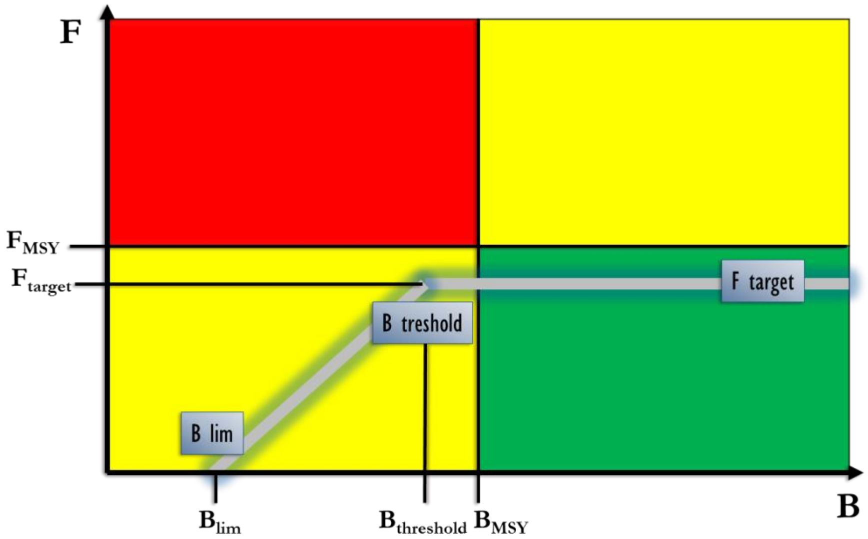
ALB-Figure 8. South Atlantic albacore. a) Stock status trajectories of B/B_{MSY} and F/F_{MSY}, as well as uncertainty around the current estimate (Kobe plots) for the base case ASPIC models (upper row) alongside those from the base case BSP runs (bottom row). From left to right, boxes indicate the following 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 standardized and nominal CPUEs used in the 2011 assessment of the Mediterranean albacore stock. The "Greek by-catch" indicates the probability of albacore by-catch in the swordfish fishery, practically null in some years. This series is the only one that is not included in the base case Bayesian production model.



ALB-Figure 10. Mediterranean albacore. Estimates of equilibrium fishing mortality rate relative to M (as a proxy for $F_{MSY)}$ based on length-converted catch curve analysis produced during the 2011 assessment meeting. The central solid line represents an M assumption of 0.3 with patterns resulting from an assumed M of 0.4 (lower dashed) and 0.2 (upper dashed) also depicted.



ALB-Figure 11. Generic form of the HCR recommended by SCRS (SCRS, 2011). Blim is the limit biomass reference point, BThreshold is the biomass point at which increasingly strict management actions should be taken as biomass decreases and Ftarget, the target fishing mortality rate to be applied to achieve the management objective [Rec. 15-04].

8.5 BFT – ATLANTIC BLUEFIN TUNA

In 2016, the SCRS updated the projections from the 2014 stock assessment using the 2014 and 2015 realized catches. The updated projections for both the east and west bluefin tuna stocks indicated only slight changes in spawning stock biomass and fishing mortality. The 2014 stock assessment used the available data including catch, effort and size statistics through 2013. As previously discussed, there are considerable data limitations for the eastern stock up to 2007. While catch data reporting for the eastern and Mediterranean fisheries has substantially improved since 2008 and some historical statistical data have been recovered, nonetheless, most of the data limitations that have plagued previous assessments remain and will require new approaches in order to improve the scientific advice the Committee can offer. The SCRS strongly recommends the continuation of enhanced data collection program and the replacement of current assessment methods with appropriate approaches that take unquantified uncertainties into account.

During the last decade, there has been an overall shift in targeting towards large bluefin tuna, mostly in the Mediterranean. As the majority of these fish are destined for fattening and/or farming operations, it is crucial to get precise information about the total catch, the size composition, the area and flag of capture. Progress has however been made over the last years and therefore the Committee investigated in 2013-2014 the size data retrieved from the observer on board of cages programmes. There was a considerable quantity of information that were analyzed and compared to current catch at size. These data appeared to be of good quality and this new valuable source of information were integrated into the Task II database. Pilot studies using dual camera system or acoustic coupled with video system have been presented at the SCRS since 2010. The results are encouraging and various studies have shown that this technique provides precise catch composition when it is used with a proper and well defined protocol.

The Atlantic-wide Research Programme for Bluefin Tuna (ICCAT GBYP) research plan outlined the research necessary for improving the scientific advice that the Committee provides to the Commission. This plan was presented to and approved by the Commission and the GBYP was started in 2010. The Committee continues to strongly and unanimously support the GBYP, particularly with respect to obtain fisheries-independent indices of stock size, and welcomes the Commission's continued commitment to the programme. In the absence of such a significant and sustained effort, it remains highly unlikely that the Committee will improve its scientific diagnosis and management advice in the foreseeable future.

Since 2015, the SCRS reviewed new information on the biology, spatial dynamics, catch statistics and fisheries catch rates. The SCRS also discussed progress made by the ICCAT GBYP and other research programs about the aerial survey, tagging, data mining, biological sampling, stock mixing and new modeling approaches. The 2017 assessment will include a large amount of new data and new models. The SCRS is not able to predict the potential impact of these changes but expect changes in absolute stock size or trends.

The Committee reiterates the importance of establishing a scientific research quota to facilitate required research to improve the science, assessments, and management advice and therefore recommends the development of a formal process for implementing such scientific research quotas. Any research quota should be accommodated within the TAC. Research plans/projects funded/facilitated by such quotas should be vetted by the SCRS.

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.

Substantial progress has been made in estimating regional mixing levels for Atlantic bluefin tuna from analyses of otolith stable isotope, genetics, and otolith shapes and the agreement of the predictions of origins by the three approaches has been examined. 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 stock specific age length keys and a new growth model for the western population.

Currently, the SCRS estimate that eastern Atlantic and Mediterranean bluefin tuna are mature by age 4. The western Atlantic stock is estimated to be fully mature at age 9, though recent information received by the SCRS indicates that a few smaller individuals (age 5) of unknown origin caught in the West Atlantic, were mature. 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 weight 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 creation of a biological sample database coordinated with ICCAT GBYP provided the basis for the creation of age length keys and new growth models.

The Committee recognized that there have been important recent contributions to the understanding of bluefin tuna biology and ecology that should have significant impacts on the assessment of the resource, which will be investigated during the next stock assessment.

BLUEFIN TUNA – EAST

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, nearly all of the declared 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 1**). Both the increase and the subsequent decrease in declared production occurred mainly for the Mediterranean (**BFTE-Figure 1**). Since 2008, there was a significant decrease in the reported catch following more restrictive TACs. Declared catch between 2011 and 2015 was 9,774 t, 10,934 t, 13,244 t, 13,250 t, and 16,201 t for the East Atlantic and Mediterranean, of which 5,790 t, 7,100 t, 9,081 t, 9,333 t, and 11,360 t was declared 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 views this lack of compliance with TAC and under-reporting of the catch as a major cause of stock decline over that period. The Committee has estimated that realized catch during this period could have been in 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. Estimates for 2008 and 2009 using updated vessel capacity and performance statistics from the various reports submitted to ICCAT under Rec. 08-05 result in estimates that are significantly lower than the corresponding reported Task I data (see Report of the 2010 ICCAT Bluefin Tuna Data Preparatory Meeting). Although care is needed considering estimates of catch using these capacity measures, the Committee's interpretation is that a substantial decrease in the catch occurred in the eastern Atlantic and Mediterranean Sea in 2008 and 2009.

Recent regulatory measures have affected significantly all the CPUE indices 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. Nonetheless, recent tendencies in the indicators are partly a reflection of positive outcomes from recent management measures. However, the indices for large fish showed very rapid increases in the most recent years and the Committee questioned if these rates of increase were biologically plausible, as indicators of the stock biomass as a whole, and noted that many factors may have contributed to the increase in the index. Fisheries-independent indicators (e.g. aerial, acoustic and larval surveys) and a large-scale tagging programme are nonetheless needed to provide more reliable stock status indicators. It is also noteworthy that no recent abundance indices from the Mediterranean part of the stock were used for the stock assessment.

The only indicator used in the assessment for young fish is from the Bay of Biscay baitboat fisheries. It shows a general increasing trend over the time period, with substantial variability since late 1980s (**BFTE-Figure 2**). This CPUE index covers the longest period of any index (1952-2014), during which several changes in selectivity have taken place, often due to management regulations. From 2012 to 2014, the Spanish baitboat fishery has sold most of its quota so that this index now comes from only four vessels in the French baitboat fishery. This index could not be updated up to 2015 due to data limitations.

Indicators from Moroccan and Spanish traps targeting large fish are standardized catch per unit of effort (CPUE) up to 2012 and include released individuals, which represent more than 10,000 individuals in 2012. The Moroccan trap index was further updated to 2015 and include 25,000 released individuals in 2014 and more than 10,000 in 2015 as estimated by the trap operators. CPUE of Moroccan and Spanish traps showed a substantial increasing trend over the last years and large fluctuations, with periods of high catch rates, as in the early 1980s, late 1990s and late 2000s and periods of lower catch rates, as in the mid-1990s and mid-2000s (**BFTE-Figure 2**). Due to changes in operational practices in the Spanish trap fishery, it has not been possible to maintain the Spanish trap index. In the absence of CPUE data from the Spanish traps, the combined index can be maintained but only includes data from the Moroccan trap fishery since 2013.

Indicators from Japanese longliners targeting large fish in the East Atlantic (South of 40ºN) and the Mediterranean Sea displayed a recent increase after a general decline since the mid-1970s (**BFTE-Figure 2**). However, this index has not been updated since 2009 because this fleet did not operate in the Mediterranean and rarely in the East Atlantic (South of 40ºN) in recent years. Indicators from Japanese longliners targeting medium to large fish in the northeast Atlantic were available since 1990 and have been updated to 2015. This index showed a strong increasing trend since 2010 and has remained at a substantially high level over the last five years (**BFTE-Figure 2**). This index becomes more valuable since the major part of Japanese catch comes from this fishing ground in recent years. The size of bluefin caught in this area showed a large contribution of the 2003 year class. The combined effects of this high proportion of the 2003 year class, the contraction of the spatial coverage of the Japanese longliners in recent years in response to a lower number of boats, and management regulations may affect the ability of this index to track changes in bluefin tuna abundance. However, the method used to standardize confirms consistency of trends among areas which provided some assurance about the continuity of this index.

In addition to the indices used in the 2014 stock assessment, there exist a variety of fishery dependent and independent indicators which may be considered by the Committee for use in future assessments. The Committee acknowledged the importance of the fishery independent indices, particularly in light of the difficulty updating the indices used in the assessment. The Committee encouraged the continuation of these fishery-independent surveys to maintain time series and further method refinement for some of them. The Committee reviewed all available indicators at the data preparatory meeting in July 2016. Three CPUE indices and four fishery-independent indices were presented for eastern bluefin tuna. The Committee did not make any selection of indices for the next stock assessment in 2017. These indices will be reviewed and if appropriate selected for inclusion in the stock assessment during the next data preparation meeting in early 2017.

Updated indices from the Moroccan trap and the Japanese longlines increased over the recent period, however decreased over the last two years for the Moroccan trap index and the last three years for the Japanese longline index. These indices remain consistent with high stock size.

BFTE-3. State of the stock

The quality and the representativeness of catch statistics is one of the most crucial element of the bluefin tuna stock assessment. In spite of recent improvements in the data quantity and quality for the past few years, there remained important data limitations for the 2014 updated stock assessment. These included poor temporal and spatial coverage for detailed size and catch-effort statistics for several fisheries, especially in the Mediterranean. Substantial under-reporting of total catches was also evident between 1998 and 2007. Nevertheless, in 2014, the Committee has updated the 2012 stock assessment as requested by the Commission, applying the same methodologies and hypotheses adopted by the Committee in 2012. The pilot assessment using new historical and recent information about catch was not fully evaluated due to time constraints. Instead, a comparison of the continuity run using these new data was carried out and results were only presented in the detailed reports (section 6.1.1 and Figures 12-14 of Bonhommeau *et al.*, 2015). The Committee believes that while substantial improvements in catch and effort statistics are necessary in the future for more robust stock assessment, it appears unlikely that such substantial improvements can be made regarding historical fishery performance.

The 2014 assessment results indicated that the spawning stock biomass (SSB) peaked over 300,000 t in the late 1950s and early 1970s and then declined to about 150,000 t until the mid-2000s. In the most recent period, the SSB showed clear signs of sharp increase in all the runs that have been investigated by the Committee, up to almost 585,000 t in 2013 for the update of the 2012 Base Case which corresponds to the maximum estimated SSB over the period (see Report of the 2014 Bluefin stock assessment, **BFTE-Figure 3**). However, the magnitude and the speed of the SSB increase vary substantially among the runs (an SSB between 439,000 t and 647,000 t in 2013) and are, therefore, still rather uncertain (Report of the 2014 bluefin stock assessment, section 6). This increase corresponds to a 4-fold increase in SSB over the past decade and ranges from 3 to 4.5-fold across the sensitivities examined. Trends in fishing mortality (F) for the younger ages (ages 2-5) displayed a continuous increase until recent years. Since 2008, F at ages 2-5 decreased sharply to reach the lowest historical values. For oldest fish (ages 10+), F had been decreasing during the first 2 decades and then rapidly increased since the 1980s and finally declined since the late 2000s (**BFTE-Figure 3**). These recent trends in F were consistent with those obtained during the 2012 stock assessment. For the 1995-2007 years, Fs for older fish were also consistent with a shift in targeting towards larger individuals destined for fattening and/or farming. Recent recruitment levels remain uncertain due to limited information about incoming year class strength and uncertainties in the indicators used to track recruitment. While the reduction in catch less than the minimum size improves the yield per recruit, it makes recent recruitments more difficult to estimate, especially without a recruitment index. The Committee noted that this is the first assessment to estimate extraordinarily large year classes in 2004-2007 (over 40% higher than the highest observed recruitments in the rest of the 64 year time series), and that these high estimates were driven entirely by the recent trends in the two fishery dependent indices for older fish. Other assessment models and some sensitivity analyses on the last stock assessment model did not estimate these recruitments to be nearly as high. Therefore, caution in interpreting the last stock assessment results and current projections is warranted until the very high estimates of recruitment for these year classes can be evaluated.

Since only the projections have been updated and no new stock assessment had been conducted, the estimates of stock status in 2013 remain unchanged. Estimates of stock status relative to MSY benchmarks are highly sensitive to the selectivity pattern (and thus to some technical assumptions in the VPA) and, for the biomass reference point, to the hypotheses about the recruitment levels. 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, the perception of the stock status derived from the 2014 updated assessment has improved in comparison to previous assessments, as F for both younger and older fish have declined during the recent years. All the runs investigated by the Committee also showed a clear increase of the SSB. F_{2013} appears to clearly be below the reference target $F_{0.1}$ (a reference point used as a proxy for F_{MSY} that is more robust to uncertainties than F_{MAX}) in both catch scenarios: $F_{2013}/F_{0.1}$= 0.4 and 0.36 for the reported and inflated catch scenarios, respectively. If F_{2013} is found to be consistent with the Convention objectives, current SSB is most likely to be above the level expected at $F_{0.1}$: $SSB_{2013}/SSB_{0.1}$= 1.10 and 1.11 for reported and inflated catch scenario when considering medium recruitment. In the reported catch scenario, the median of the SSB is about 67% (high recruitment scenario) to 160% (low recruitment scenario) of the biomass that is expected under a $F_{0.1}$ strategy. In the inflated catch scenario, the median SSB ranges from 55% (high recruitment) to 174% (low recruitment, **BFTE-Figures 4 and 5**).

BFTE- 4. Outlook

In 2016, the Committee updated the projections with the realized catch in 2014 and 2015, using similar technical specifications as in 2014, i.e. using three mean recruitment levels and two catch scenarios (reported and inflated) and the same periods to calculate the selectivity patterns as in 2014 (computed as the geometric means over the 2007-2009 and 2009-2011 partial Fs, (see Kell *et al*., 2013 for more details). According to the 2014 VPA results and above specifications, F would remain below $F_{0.1}$ in the 10 coming years with at least 60% of probabilities for all catch levels investigated, and the probability to achieve $SSB_{F0.1}$ (i.e. the equilibrium SSB resulting in fishing at $F_{0.1}$) by the end of 2022, with at least 60% of probabilities, is also reached (**BFTE-Tables 2 and 3**).

Projections are known to be impaired by various sources of uncertainties that have not yet been fully quantified. One of these is that the Kobe matrix was only calculated for the continuity run in the time available. Although the situation has improved regarding recent catch accounting, there are still uncertainties about the speed and magnitude of the SSB increase (see the slope of **BFTE-Figure 3**), key modeling parameters for bluefin tuna productivity, the current and future recruitment levels, the stock structure within the Mediterranean and eastern Atlantic stock and the level of IUU catch (although it is clear to the Committee that the level of IUU has strongly decreased since 2008). Some of these uncertainties, as those reflected above, have not been taken into account in the Kobe matrices. Acknowledging these limitations, the 2015 updated stock projections supported that the rebuilding of eastern bluefin tuna at $SSB_{F0.1}$ level with a probability of at least 60% could be achieved before 2022 with the different TACs examined (up to 30,000 t, **BFTE-Table 4**).

There still remain key uncertainties regarding current and future recruitment levels and the speed and magnitude of the rebuilding of the SSB (**BFTE-Figure 7**). In particular, Kobe matrices are affected by uncertainties in the recruitment estimates, especially those in 2004-2007. While the projections indicate an increase in SSB for most of scenarios, interpretation of these results should be moderated by the fact that a decrease is observed for the last two years for the Moroccan trap index and the last three years for the Japanese longline index. The recent values of these indicators however still reflect high stock abundance.

The stock status for 2015 based on the updated projections indicated little change in the current levels of fishing mortality and spawning stock biomass compared to 2013(**BFTE-Table 1**).

BFTE-5. Effect of current regulations

Catch limits have been in place for the eastern Atlantic and Mediterranean management unit since 1998. In 2002, the Commission fixed the Total Allowable Catch (TAC) for the eastern Atlantic and Mediterranean bluefin tuna at 32,000 t for the years 2003 to 2006 (Rec. 02-08) and at 29,500 t and 28,500 t for 2007 and 2008, respectively (Rec. 06-05). Subsequently, Rec. 08-05 established TACs for 2009, 2010, and 2011 at 22,000 t, 19,950 t, and 18,500 t, respectively. However, the 2010 TAC was revised to 13,500 t by Rec. 09-06, which also established a framework to set future (2011 and beyond) TACs at levels sufficient to rebuild the stock to B_{MSY} by 2022 with at least 60% probability. The 2011, 2012, and 2013 TACs were set at 12,900 t, 12,900 t, and 13,500 t respectively by Rec. 10-04 and Rec. 12-03, at 13,500 t in 2014 (Rec. 13-07), 16,142 t in 2015 (Rec. 14-04), and 19,292 t in 2016 (Rec. 14-04).

The reported catches for 2003, 2004 and 2006 were about TAC levels, but those for 2005 (35,845 t) and 2007 (34,516 t) were notably higher than TAC. However, the Committee strongly believes, based on the knowledge of the fishing capacity, that substantial under-reporting was occurring and that actual catches up to 2007 were well above TAC. The SCRS estimates since the late 1990s, catches were close to the levels reported in the mid-1990s, but for 2007, the estimates were higher i.e. about 61,000 t in 2007 for both the East Atlantic and Mediterranean Sea. As noted, reported catch levels for 2008 (23,862 t), 2009 (19,765 t), 2010 (11,155 t), 2011 (9,774 t), 2012 (10,934 t), 2013 (13,244 t), 2014 (13,250 t), and 2015 (16,201 t) appear to largely reflect the removals from the stock when comparing estimates of catch using vessel capacity measures, although the utility of this method has diminished for estimating catch (**BFT-Table 1, BFTE-Figure 1**). Although care is needed when considering estimates of catch using capacity measures, the

Group's interpretation is 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. While current controls appear sufficient to constrain the fleet to harvests at or below TAC, the Committee has not assessed the current fishing capacity and remains concerned about current capacity which could easily harvest catch volumes well in excess of the rebuilding strategy adopted by the Commission.

2014 analyses from the reported catch-at-size and catch-at-age displayed important changes in selectivity patterns over the last years for several fleets operating in the Mediterranean Sea or the East Atlantic. This partly results from the enforcement of minimum size regulations under Rec. 06-05, which led to much lower reported catch of younger fish and subsequently a significant increase in the annual mean-weight in the catch-at-size since 2007 (**BFTE-Figure 6**). Additionally, higher abundance or higher concentration of small bluefin tuna in the north western Mediterranean detected from aerial surveys could also reflect positive outcomes from increase minimum size regulation. Rec. 06-05 also resulted in improved yield-per-recruit levels in comparison to the early 2000s as well as to a greater recruitment to the spawning stock biomass due to higher survival of juvenile fish.

An important source of uncertainty originated from the reduction in TAC and the unexpected high level of strong year class, which has strongly affected all the index calculations for different reasons (see Report of the 2014 Bluefin Stock Assessment). The difficulties to update the Spanish baitboat, Spanish trap and Japanese indices since 2013 could be highly problematic for the coming years, as those indices are crucial for stock assessment. It 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 programs 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 behavior and fisheries selection pattern.

BFTE-6. Management recommendations

In Recs. 09-06, 10-04, 12-03, and 13-07 the Commission established a total allowable catch for eastern Atlantic and Mediterranean bluefin tuna between 12,900 t and 13,400 t since 2010. This TAC has increased by 20.5 % in 2015 (16,142 t) (Rec. 14-04), and 19.5% in 2016 (Rec. 14-04). Additionally, in Rec. 09-06 the Commission required that the SCRS provide the scientific basis for the Commission to establish a recovery plan with the goal of achieving B_{MSY} through 2022 with at least 60% of probability.

In 2016, the Kobe matrices were presented indicating the probabilities of *i*) $F<F_{MSY}$ (**BFTE-Table 2**) *ii*) $SSB>SSB_{MSY}$ (**BFTE-Table 3**) and *iii*) ($F<F_{MSY}$ and $SSB>SSB_{MSY}$) (**BFTE-Table 4**) for quotas from 0 to 30,000 t for 2016 through 2022. Shading in **BFTE-Table 4** corresponds to the probabilities of being in the ranges of 50-59%, 60-69%, 70-79%, 80-89% and greater or equal to 90%. It should be kept in mind, however, that the Kobe matrices cannot integrate some important sources of uncertainties that currently remain unquantified as mentioned in section BFTE-4 and the Report of the 2014 bluefin stock assessment.

The implementation of previous regulations through Recs. 13-07, 12-03, 10-04, 09-06 clearly resulted in reductions in catch and fishing mortality rates, and in a substantial increase in the spawning stock biomass as estimated in the 2014 stock assessment.

The updated projections in 2016 are consistent with previous projections in that they indicate the goal of achieving B_{MSY} (through 2022) with at least 60% probability might already have been reached or will soon be reached. Therefore, the Commission should consider adding a new phase to the current recovery plan.

Rec. 14-04 defined three yearly steps to reach a final TAC of 23,155 t in 2017. Such stepped increases were to be reviewed annually by the Commission on the advice of the SCRS.

Having considered the stock indicators, the Committee advises that catches not exceeding TACs in Rec. 14-04 are not expected to undermine the success of the rebuilding plan and are consistent with the goal of achieving F_{MSY} and B_{MSY} through 2022 with at least 60% of probability.

EAST ATLANTIC AND MEDITERRANEAN BLUEFIN TUNA SUMMARY		
Current reported yield (2015)		16,201 t*
	Reported catch	Inflated catch
Maximum Sustainable Yield[1]		
Low recruitment scenario (1970s)	23,256 t	23,473 t
Medium recruitment scenario (1950-2006)	33,662 t	36,835 t
High recruitment scenario (1990s)	55,860 t	74,248 t
$F_{0.1}$ [2,3]	0.07yr^{-1}	0.07 yr^{-1}
$F_{2013}/F_{0.1}$	0.40	0.36
$SSB_{F0.1}$		
Low recruitment scenario (1970s)	351,500 t	354,600 t
Medium recruitment scenario (1950-2006)	508,700 t	556,600 t
High recruitment scenario (1990s)	843,800 t	1,121,000 t
$SSB_{2013}/SSB_{F0.1}$		
Low recruitment scenario (1970s)	1.60	1.74
Medium recruitment scenario (1950-2006)	1.10	1.11
High recruitment scenario (1990s)	0.67	0.55
Stock Status:		
Overfished		
Low recruitment scenario	No	
Medium recruitment scenario	No	
High recruitment scenario	Yes	
Overfishing	No	
TAC (2013-2015)	13,400 t – 13,400 t – 16,142 t	
TAC (2016-2017)	19,296 t – 23,155 t	

1 Approximated as the average of the potential long-term yield that is expected at a $F_{0.1}$ strategy. The levels of these yields have been computed using the selectivity pattern over 2009-2011 and can substantially change according to different selectivity patterns.

2 The Committee decided, on the basis of current published literature, to adopt $F_{0.1}$ as the proxy for F_{MSY}. $F_{0.1}$ has been indeed shown to be more robust to uncertainty about the true dynamics of the stock and observation errors than F_{MAX}. Values are given for both reported and inflated catch scenarios, respectively. $F_{0.1}$ have been also computed using the selectivity pattern over 2009-2011 and can thus substantially change according to different selectivity patterns.

3 The recruitment levels do not impact $F_{0.1}$.

* As of 30 September 2016.

BFT-Table 1. Estimated catches (t) of Northern bluefin tuna (*Thunnus thynnus*) by area, gear and flag (v1, 2016-09-30)

			1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
TOTAL			29360	34132	36528	48861	49713	53335	52810	43121	35201	36564	37400	37093	33480	33517	37618	32520	36170	25861	21744	13012	11781	12688	14726	14877	18040
			26440	31851	34161	46748	47288	50821	50476	40464	32430	33789	34616	33775	31175	31392	35862	30708	34533	23862	19765	11155	9774	10934	13244	13250	16201
	ATE		6556	7619	9251	6931	9646	12674	16856	11739	9596	10547	10086	10347	7362	7410	9036	7535	8037	7645	6684	4313	3984	3834	4163	3918	4841
	MED		19884	24232	24910	39818	37642	38147	33619	28725	22834	23242	24530	23428	23813	23983	26826	23173	26495	16217	13080	6842	5790	7100	9081	9333	11360
	ATW		2920	2282	2367	2113	2425	2514	2334	2657	2772	2775	2784	3319	2305	2125	1756	1811	1638	2000	1980	1857	2007	1754	1482	1626	1839
1-Landings	ATE	Bait boat	1648	1418	3884	2284	3093	5369	7215	3139	1554	2032	2275	2567	1371	1790	2018	1116	2032	1794	1260	646	636	283	243	95	172
		Longline	3197	3817	2717	2176	4388	4788	4534	4300	4020	3736	3303	2896	2750	2074	2713	2448	1706	2491	1960	1194	1157	1166	1193	1220	1510
		Other surf.	143	557	995	627	555	273	135	395	404	510	712	701	560	402	1014	1047	502	187	298	143	36	49	141	210	193
		Purse seine	46	462	24	213	458	323	828	692	726	1147	150	884	490	1078	871	332	0	0	0	1	0	0	2	0	
		Sport (HL+RR)	0	0	0	0	0	0	162	28	33	126	61	63	109	87	11	4	10	6	2	23	19	25	21	16	60
		Traps	1522	1365	1631	1630	1152	1921	3982	3185	2859	2996	3585	3235	2082	1978	2408	2588	3788	3166	3164	2307	2137	2311	2564	2376	2905
	MED	Bait boat	148	158	48	0	206	5	4	11	4	0	0	1	9	17	5	0	0	0	38	0	0	2	11	0	25
		Longline	2869	2599	2342	7048	8475	8171	5672	3131	2463	3317	3750	2614	2476	2564	3101	2202	2656	2254	1344	875	869	587	605	586	775
		Other surf.	1409	1894	1615	3226	1044	1200	1040	1882	2978	1069	1101	994	2539	1107	484	307	699	1022	0	275	223	26	72	81	83
		Purse seine	13245	17807	19297	26083	23588	26021	24178	21291	14910	16195	17174	17656	17167	18785	22475	20020	22952	12641	11395	5057	4293	6172	7974	8184	9993
		Sport (HL+RR)	742	952	1238	2257	3556	2149	2340	1336	1627	1922	1327	1647	1401	1351	646	515	95	149	160	353	226	177	189	239	281
		Traps	1471	821	370	1204	772	601	385	1074	852	739	1177	515	221	159	115	129	95	152	144	281	165	125	222	232	192
	ATW	Longline	894	674	695	539	468	547	382	764	914	858	610	729	186	644	425	565	420	606	366	529	743	478	470	497	553
		Other surf.	578	509	406	307	384	432	293	342	281	284	202	108	140	97	89	85	63	82	121	107	148	117	121	119	138
		Purse seine	237	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)	1083	586	854	804	1114	1029	1181	1108	1124	1120	1649	2035	1398	1139	924	1005	1023	1130	1251	1009	887	917	692	810	1085
		Traps	0	1	29	79	72	90	59	68	44	16	16	28	84	32	8	3	4	23	23	39	26	17	11	20	6
3-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	0	9
		Purse seine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	12	9	11	2
	ATW	Longline	128	211	88	83	138	167	155	123	160	222	105	211	232	181	131	149	100	159	207	174	202	224	145	139	17
		Other surf.	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
		Purse seine	0	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	0	14	3	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	
1-Landings	ATE	Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		China PR	0	0	0	0	0	0	0	85	103	80	68	39	19	41	24	42	72	119	42	38	36	36	38	37	45
		Chinese Taipei	0	0	6	20	4	61	226	350	222	144	304	158	0	0	10	4	0	0	0	0	0	0	0	0	**0**
		EU.Denmark	0	0	37	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		EU.España	2272	2319	4962	3137	3819	6186	9519	4163	3328	3493	3633	4089	2138	2801	3102	2033	3276	2938	2409	1483	1483	1329	1553	1282	1655
		EU.France	565	894	1099	336	725	563	269	613	588	542	629	755	648	561	818	1218	629	253	366	228	135	148	223	212	254
		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.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	14	21	52	22	8	15	3	1	1	2	1	1	1	2	4	10	13	19	14
		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	117	38	25	240	35	199	712	323	411	441	404	186	61	27	79	97	29	36	53	58	180	223	235	243	263
		EU.Sweden	1	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	1	0	1	1	12	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**0**
		Faroe Islands	0	0	0	0	0	0	0	67	104	118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Guinea Ecuatorial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
		Guinée Rep.	0	0	0	330	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	1	1	0	0
		Iceland	0	0	0	0	0	0	0	2	27	0	0	1	0	0	0	0	0	0	0	0	2	5	4	30	37
		Japan	2981	3350	2484	2075	3971	3341	2905	3195	2690	2895	2425	2536	2695	2015	2598	1896	1612	2351	1904	1155	1089	1093	1129	1134	1386
		Korea Rep.	0	0	0	4	205	92	203	0	0	6	1	0	0	3	0	1	0	0	0	0	0	0	0	0	**0**
		Libya	0	312	0	0	0	576	477	511	450	487	0	0	0	0	0	47	0	0	0	0	0	0	0	0	
		Maroc	531	562	415	720	678	1035	2068	2341	1591	2228	2497	2565	1797	1961	2405	2196	2418	1947	1909	1348	1055	990	960	959	1176
		NEI (ETRO)	4	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)	85	144	223	68	189	71	208	66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Norway	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
		Panama	0	0	0	1	19	550	255	0	13	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	0	6	0	**0**
		Seychelles	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	
		Sierra Leone	0	0	0	0	0	0	0	0	0	93	118	0	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**
	MED	Albania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	0	0	0	9	34	40
		Algerie	800	1104	1097	1560	156	156	157	1947	2142	2330	2012	1710	1586	1208	1530	1038	1511	1311	0	0	0	69	244	244	370
		China PR	0	0	0	97	137	93	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

			1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
		Chinese Taipei	0	0	328	709	494	411	278	106	27	169	329	508	445	51	267	5	0	0	0	0	0	0	0	0	**0**
		EU.Croatia	1418	1076	1058	1410	1220	1360	1105	906	970	930	903	977	1139	828	1017	1022	825	834	619	389	371	369	384	385	456
		EU.Cyprus	10	10	14	10	10	10	10	21	31	61	85	91	79	105	149	110	1	132	2	3	10	18	17	17	22
		EU.España	1392	2165	2018	2741	4607	2588	2209	2000	2003	2772	2234	2215	2512	2353	2758	2689	2414	2465	1769	942	942	1064	948	1164	1238
		EU.France	4620	7376	6995	11843	9604	9171	8235	7122	6156	6794	6167	5832	5859	6471	8638	7663	10157	2670	3087	1754	805	791	2191	2207	2565
		EU.Greece	175	447	439	886	1004	874	1217	286	248	622	361	438	422	389	318	255	285	350	373	224	172	176	178	161	195
		EU.Italy	3787	5006	5329	6882	7062	10006	9548	4441	3283	3847	4383	4628	4981	4697	4853	4708	4638	2247	2749	1060	1783	1788	1938	1946	2273
		EU.Malta	113	81	259	580	590	402	396	409	449	378	224	244	258	264	350	270	334	296	263	136	142	137	155	160	182
		EU.Portugal	278	320	183	428	446	274	37	54	76	61	64	0	2	0	0	11	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	64	77	77	155
		ICCAT (RMA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	1	0
		Iceland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	0	0	0	0	0	0	**0**
		Israel	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Japan	85	123	793	536	813	765	185	361	381	136	152	390	316	638	378	556	466	80	18	0	0	0	0	0	**0**
		Korea Rep.	0	0	0	684	458	591	410	66	0	0	0	0	0	700	1145	26	276	335	102	0	0	77	80	81	**0**
		Libya	370	425	635	1422	1540	812	552	820	745	1063	1941	638	752	1300	1091	1280	1358	1318	1082	645	0	756	929	933	1153
		Maroc	925	205	79	1092	1035	586	535	687	636	695	511	421	760	819	92	190	641	531	369	205	182	223	309	310	322
		NEI (Flag related)	0	0	0	427	639	171	1066	825	140	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		NEI (MED)	1799	1398	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		NEI (combined)	0	0	0	773	211	0	101	1030	1995	109	571	508	610	709	0	0	0	0	0	0	0	0	0	0	
		Panama	287	484	467	1499	1498	2850	236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Serbia & Montenegro	0	0	0	0	2	4	0	0	0	4	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	0	50	41	0	34	0	0	0	0	40
		Tunisie	1366	1195	2132	2773	1897	2393	2200	1745	2352	2184	2493	2528	791	2376	3249	2545	2622	2679	1932	1042	852	1017	1057	1047	1248
		Turkey	2459	2817	3084	3466	4219	4616	5093	5899	1200	1070	2100	2300	3300	1075	990	806	918	879	665	409	519	536	551	555	1091
		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	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	
		Brazil	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	
		Canada	485	443	459	392	576	597	503	595	576	549	524	604	557	537	600	733	491	575	530	505	474	477	480	463	531
		Chinese Taipei	0	0	0	0	4	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Cuba	0	0	0	0	0	0	0	0	0	0	0	74	11	19	27	19	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	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	0	0	0	0	0	0	0	
		FR.St Pierre et Miquelon	0	0	0	0	0	0	0	0	1	0	0	3	1	10	5	0	4	3	2	8	0	0	0	0	9
		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	
		Japan	688	512	581	427	387	436	322	691	365	492	506	575	57	470	265	376	277	492	162	353	578	289	317	302	347
		Korea Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	52	0	0	0	0	0	0	0	0	**0**
		Mexico	0	0	0	4	0	19	2	8	14	29	10	12	22	9	10	14	7	7	10	14	14	51	23	51	53
		NEI (ETRO)	23	17	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	2	0	0	429	270	49	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Norway	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		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	
		Sta. Lucia	14	14	2	43	9	3	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.	1582	1085	1237	1163	1311	1285	1334	1235	1213	1212	1583	1840	1426	899	717	468	758	764	1068	803	738	713	502	667	877
		UK.Bermuda	0	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**
3-Discards	MED	Albania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		EU.Croatia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	5	5	2	2
		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	9
		Libya	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	4	0	
		Tunisie	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	
		Turkey	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	
	ATW	Canada	0	0	0	0	0	0	6	16	11	46	13	37	14	15	0	2	0	1	3	25	36	17	0	0	3
		Japan	0	0	0	0	0	0	8	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	1	0	0	0
		U.S.A.	128	211	88	83	138	171	155	110	149	176	98	174	218	167	131	147	100	158	204	150	166	206	159	143	20

EU-France 2015 Task I: last revision (arriving after the species groups deadline) not included in the table.

BFTE-Table 1. Estimates of the fishing mortality and the spawning stock biomass relative to the reference point using the updated projections (not from an updated stock assessment that uses updated CPUE, age composition, and other information).

	Reported catch	Inflated catch
$F/F_{0.1}$ estimated for 2015	0.37	0.33
$SSB/SSB_{F0.1}$ estimated for 2015		
Low recruitment scenario (1970s)	1.83	1.98
Medium recruitment (1950-2006)	1.29	1.30
High recruitment (1990s)	0.82	0.7

BFTE-Table 2. The probabilities of $F<F_{MSY}$ for quotas from 0 to 30,000 t for 2017 through 2022 (based on 2016 updated projections). 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%. The highlighted value corresponds to the 2016 TAC. Catch for 2016 is assumed to be equal to the 2016 TAC in all scenarios.

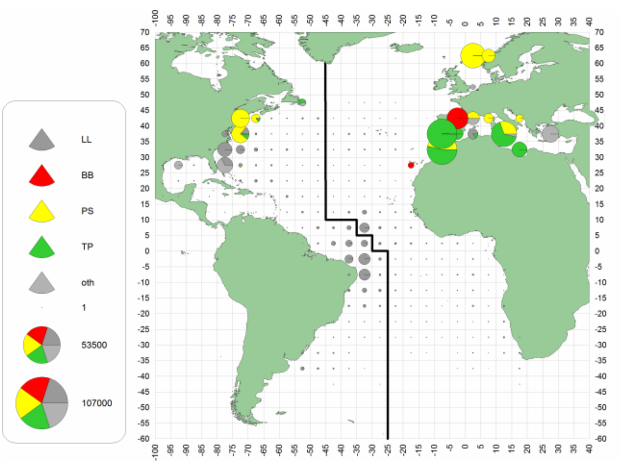
TAC	2017	2018	2019	2020	2021	2022
0 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2000 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
4000 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
6000 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
8000 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
10000 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
12000 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
14000 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
16000 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
18000 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
19296 mt	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
20000 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
22000 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
24000 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
26000 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
28000 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
30000 mt	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

BFTE-Table 3. The probabilities of SSB >SSB_{MSY} for quotas from 0 to 30000 t for 2017 through 2022 (based on 2016 updated projections).. 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%. The highlighted value corresponds to the 2016 TAC. Catch for 2016 is assumed to be equal to the 2016 TAC in all scenarios.

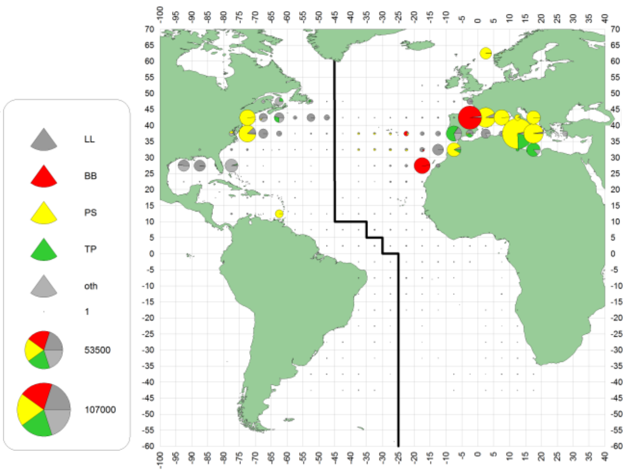
TAC	2017	2018	2019	2020	2021	2022
0 mt	77.0%	84.0%	91.0%	96.0%	98.0%	100.0%
2000 mt	76.0%	84.0%	91.0%	96.0%	98.0%	99.0%
4000 mt	76.0%	84.0%	91.0%	95.0%	98.0%	99.0%
6000 mt	76.0%	83.0%	90.0%	95.0%	98.0%	99.0%
8000 mt	76.0%	83.0%	90.0%	94.0%	98.0%	99.0%
10000 mt	76.0%	83.0%	90.0%	94.0%	97.0%	99.0%
12000 mt	76.0%	83.0%	89.0%	94.0%	97.0%	99.0%
14000 mt	76.0%	82.0%	89.0%	93.0%	97.0%	98.0%
16000 mt	76.0%	82.0%	89.0%	93.0%	96.0%	98.0%
18000 mt	76.0%	82.0%	88.0%	93.0%	96.0%	98.0%
19296 mt	**76.0%**	**82.0%**	**88.0%**	**93.0%**	**96.0%**	**98.0%**
20000 mt	76.0%	82.0%	88.0%	92.0%	95.0%	98.0%
22000 mt	76.0%	81.0%	87.0%	92.0%	95.0%	97.0%
24000 mt	76.0%	81.0%	87.0%	92.0%	95.0%	97.0%
26000 mt	75.0%	81.0%	87.0%	91.0%	94.0%	97.0%
28000 mt	75.0%	81.0%	86.0%	90.0%	94.0%	96.0%
30000 mt	75.0%	80.0%	86.0%	90.0%	93.0%	96.0%

BFTE-Table 4. The probabilities of $F<F_{MSY}$ and SSB $>SSB_{MSY}$ for quotas from 0 to 30000 t for 2017 through 2022 (based on 2016 updated projections). 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%. The highlighted value corresponds to the 2016 TAC. Catch for 2016 is assumed to be equal to the 2016 TAC in all scenarios.

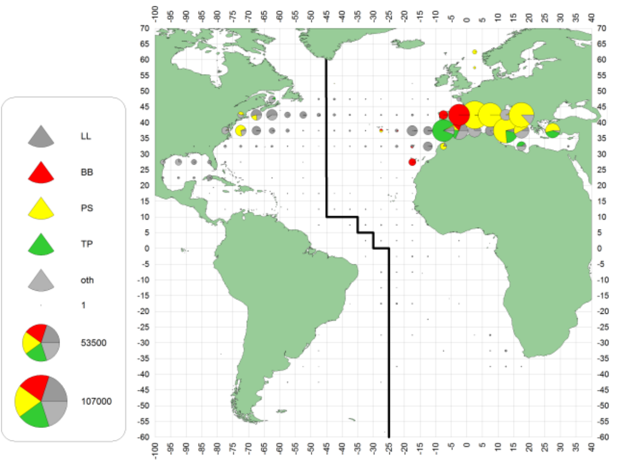
TAC	2017	2018	2019	2020	2021	2022
0 mt	77.0%	84.0%	91.0%	96.0%	98.0%	100.0%
2000 mt	76.0%	84.0%	91.0%	96.0%	98.0%	99.0%
4000 mt	76.0%	84.0%	91.0%	95.0%	98.0%	99.0%
6000 mt	76.0%	83.0%	90.0%	95.0%	98.0%	99.0%
8000 mt	76.0%	83.0%	90.0%	94.0%	98.0%	99.0%
10000 mt	76.0%	83.0%	90.0%	94.0%	97.0%	99.0%
12000 mt	76.0%	83.0%	89.0%	94.0%	97.0%	99.0%
14000 mt	76.0%	82.0%	89.0%	93.0%	97.0%	98.0%
16000 mt	76.0%	82.0%	89.0%	93.0%	96.0%	98.0%
18000 mt	76.0%	82.0%	88.0%	93.0%	96.0%	98.0%
19296 mt	**76.0%**	**82.0%**	**88.0%**	**93.0%**	**96.0%**	**98.0%**
20000 mt	76.0%	82.0%	88.0%	92.0%	95.0%	98.0%
22000 mt	76.0%	81.0%	87.0%	92.0%	95.0%	97.0%
24000 mt	76.0%	81.0%	87.0%	92.0%	95.0%	97.0%
26000 mt	75.0%	81.0%	87.0%	91.0%	94.0%	97.0%
28000 mt	75.0%	81.0%	86.0%	90.0%	94.0%	96.0%
30000 mt	75.0%	80.0%	86.0%	90.0%	93.0%	96.0%



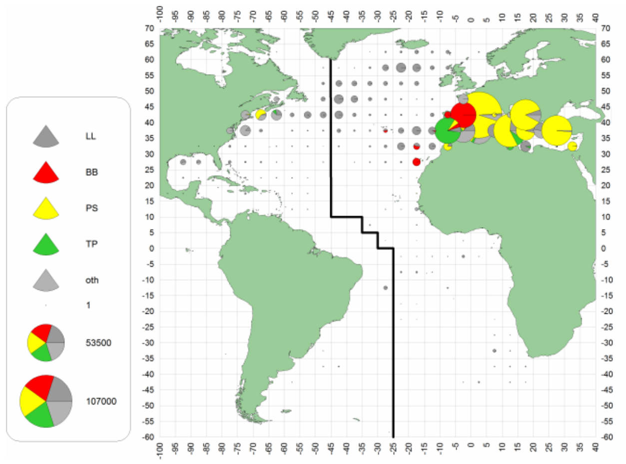
a. BFT (1960-69)



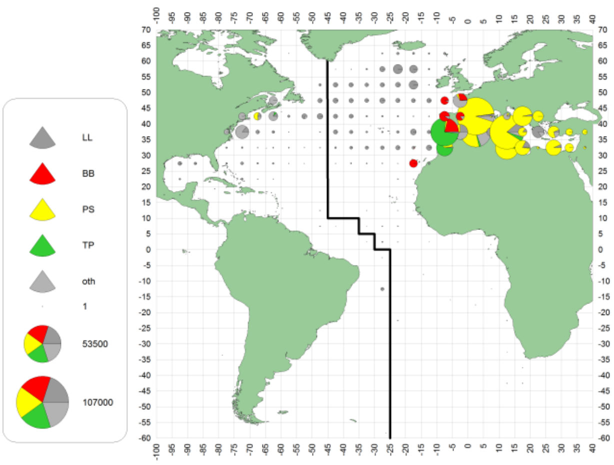
b. BFT (1970-79)



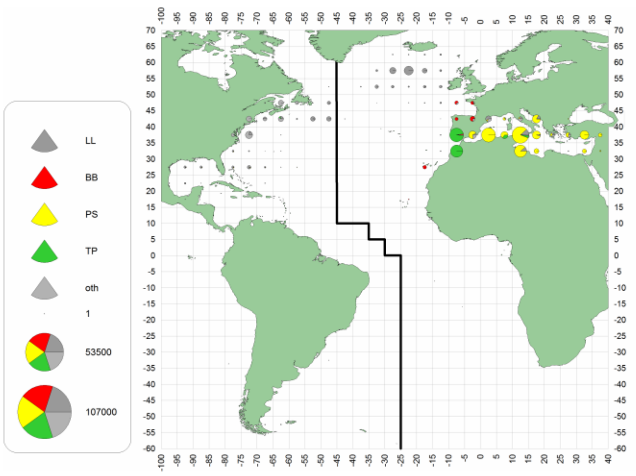
c. BFT (1980-89)



d. BFT (1990-99)

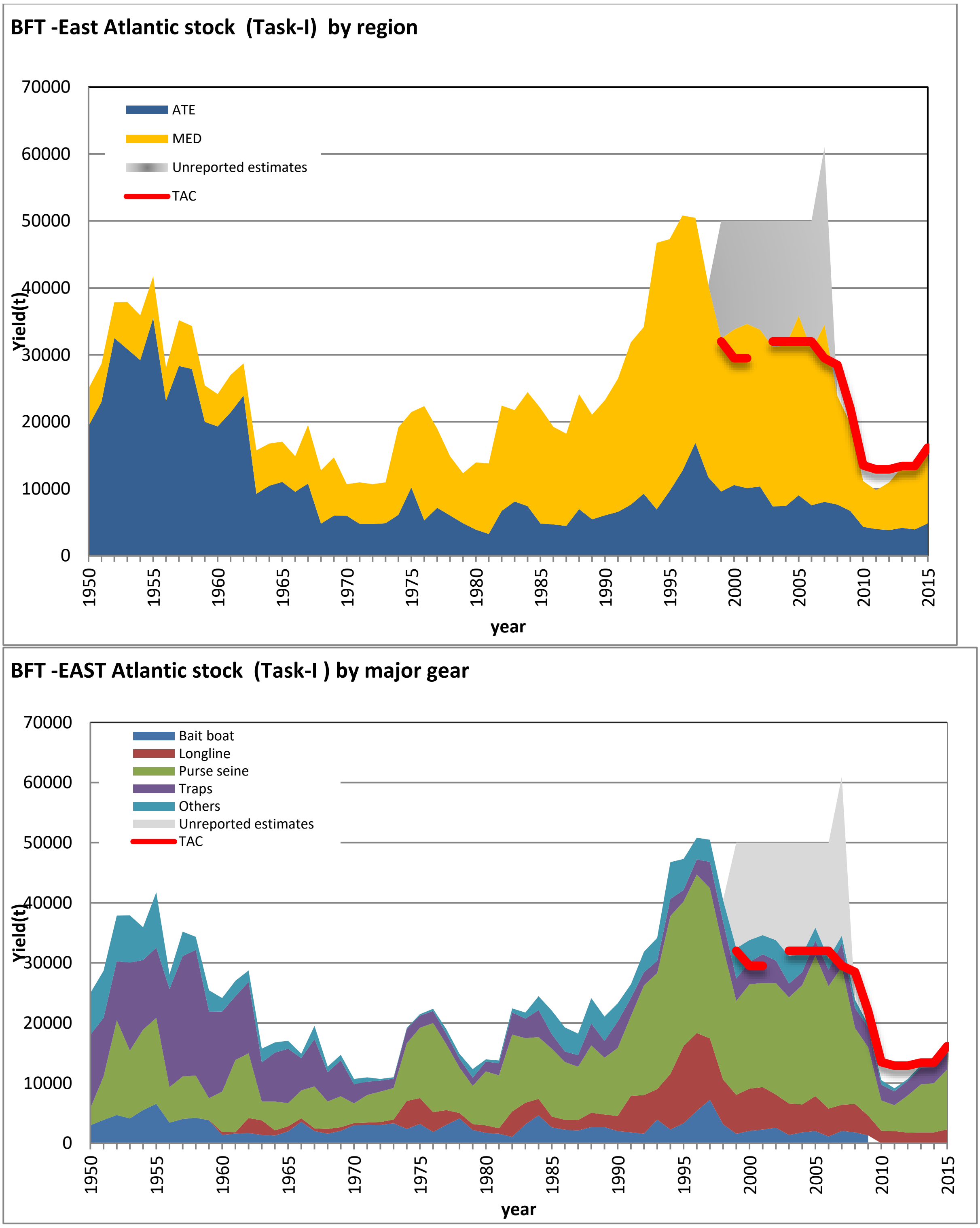


e. BFT (2000-09)

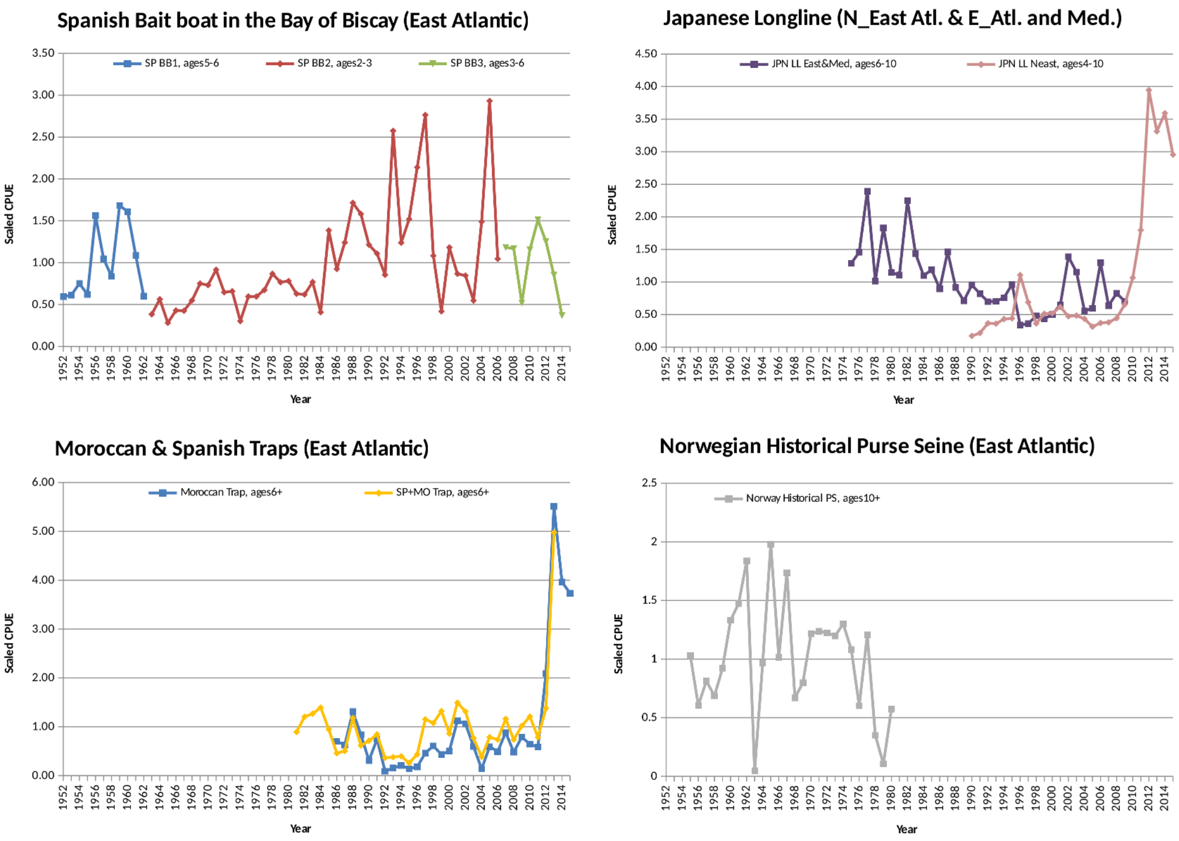


f. BFT (2010-14)

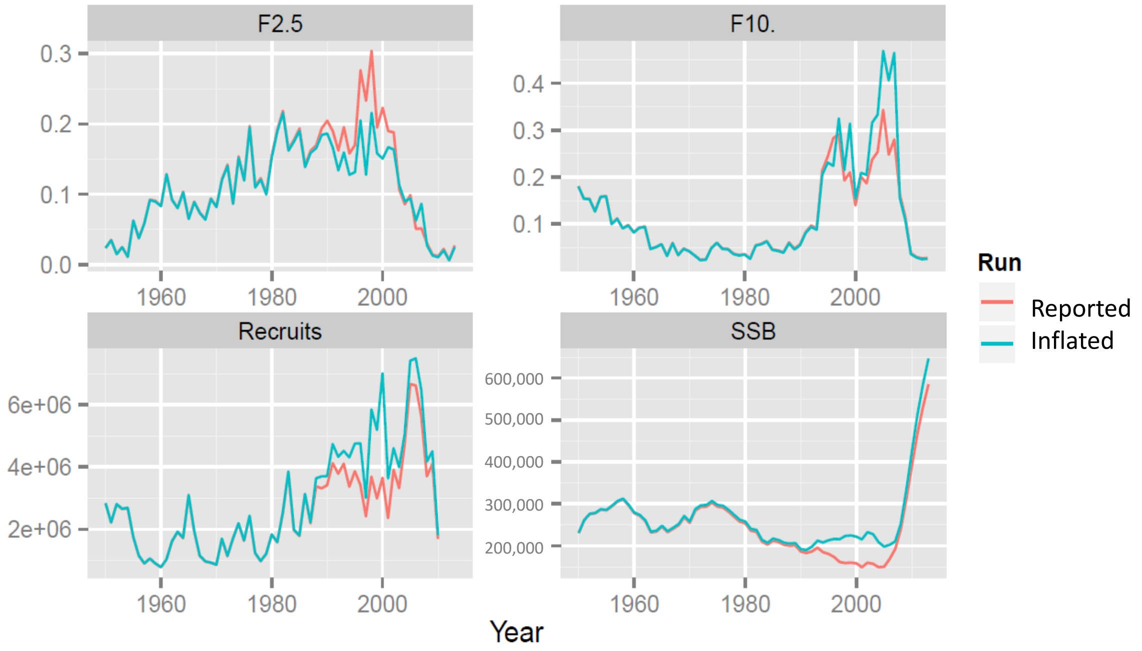
BFT-Figure 1. Geographic distribution of bluefin tuna catches per 5x5 degrees and per main gears from 1960 to 2014 (last decade only covers 5 years).



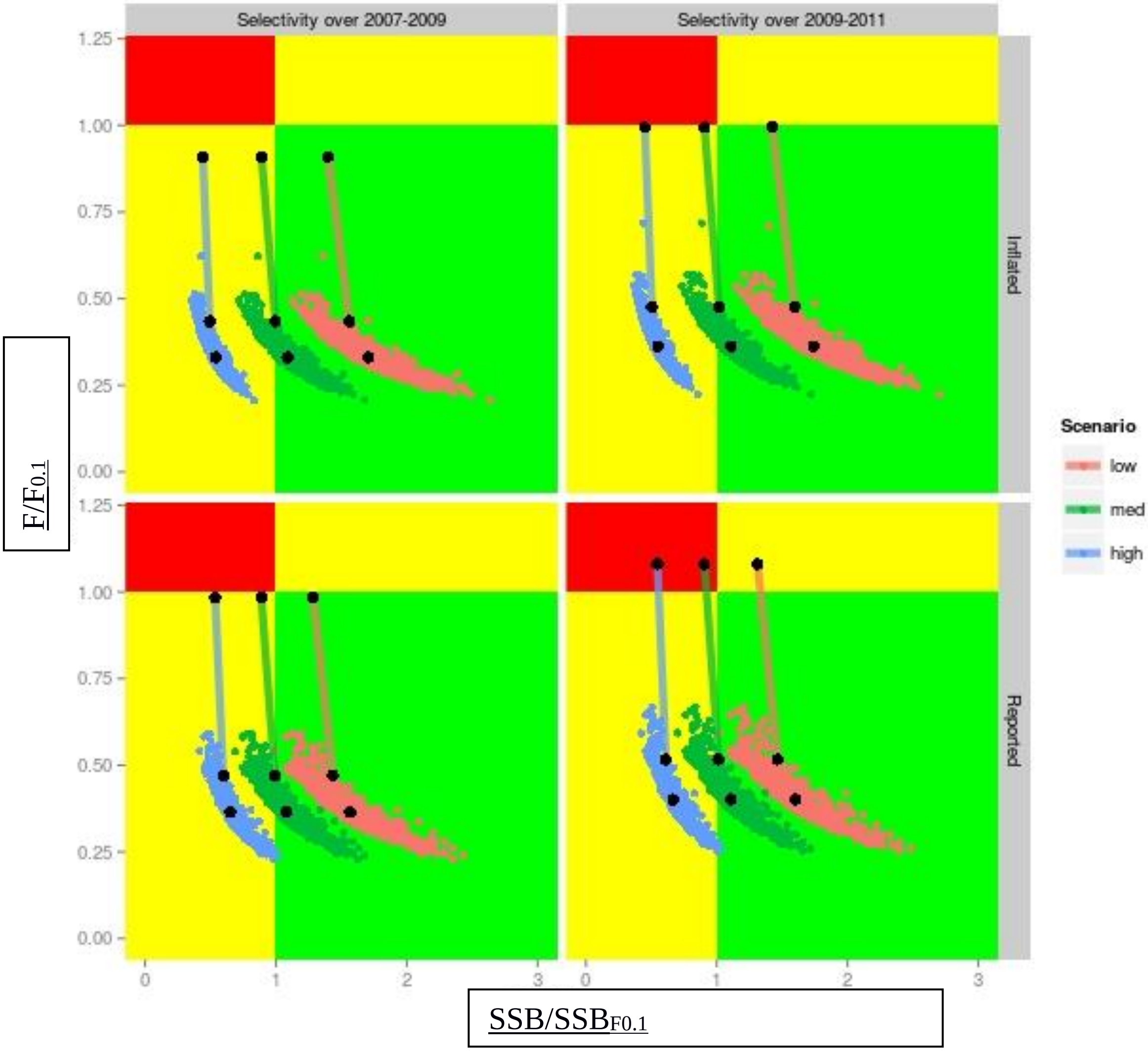
BFTE-Figure 1. Reported catch for the East Atlantic and Mediterranean from Task I data from 1950 to 2015 split by main geographic areas (top panel) and by gears (bottom panel) together with unreported catch estimated by the SCRS (grey shading, using fishing capacity information and mean catch rates over 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.



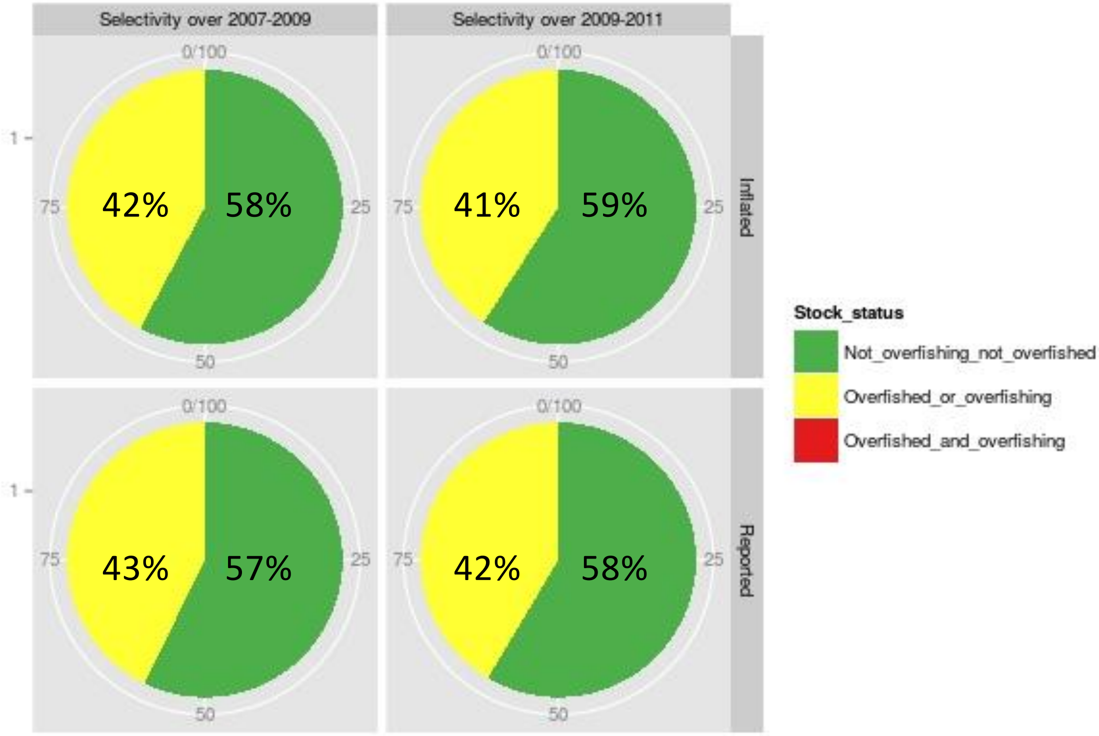
BFTE-Figure 2. Plots of the updated CPUE time series fishery indicators for the East Atlantic and Mediterranean bluefin tuna stock. All CPUE series are standardized series except the nominal Norway PS index. The Spanish BB series (top left panel) was split in three series to account for changes in selectivity patterns, and the latest series in 2014 was updated 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 2015. The Moroccan-Spanish traps CPUE was not updated. The Moroccan CPUE up to 2013 was used only for the sensitivity analysis in 2014 stock assessment, and has been updated up to 2015.



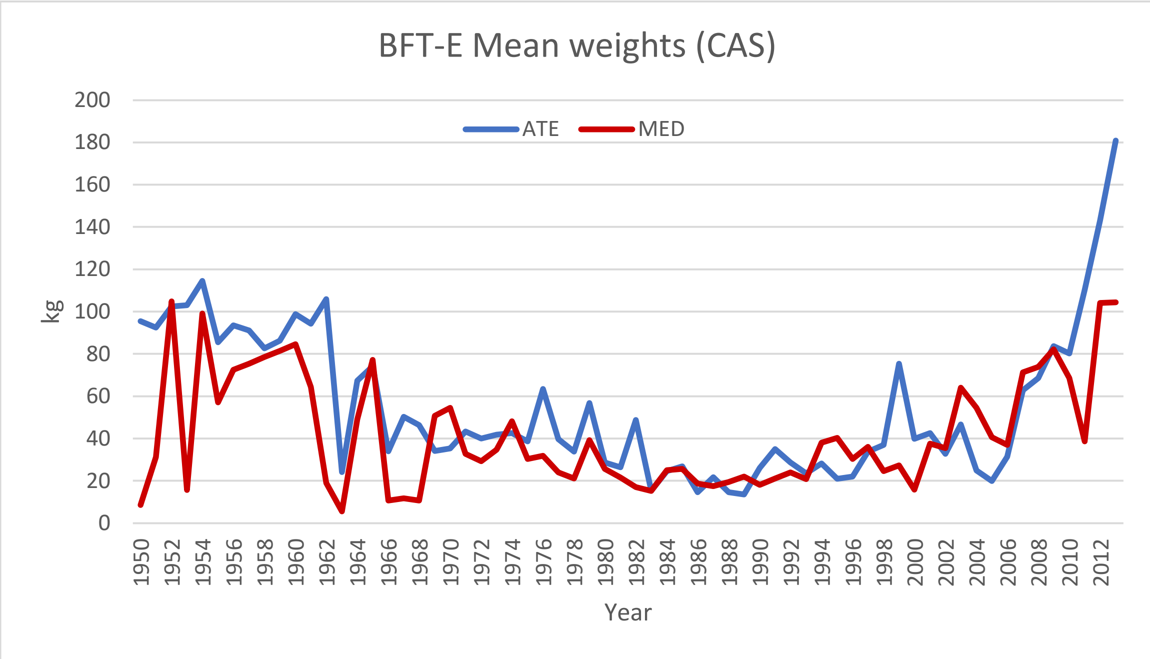
BFTE-Figure 3. Fishing mortality (for ages 2 to 5 and 10+), spawning stock biomass (in metric ton) and recruitment (in number of fish) estimates from VPA continuity run from the 2014 stock assessment (considered as the base case). Red line: reported catch; blue line: inflated (from 1998 to 2007) catch.



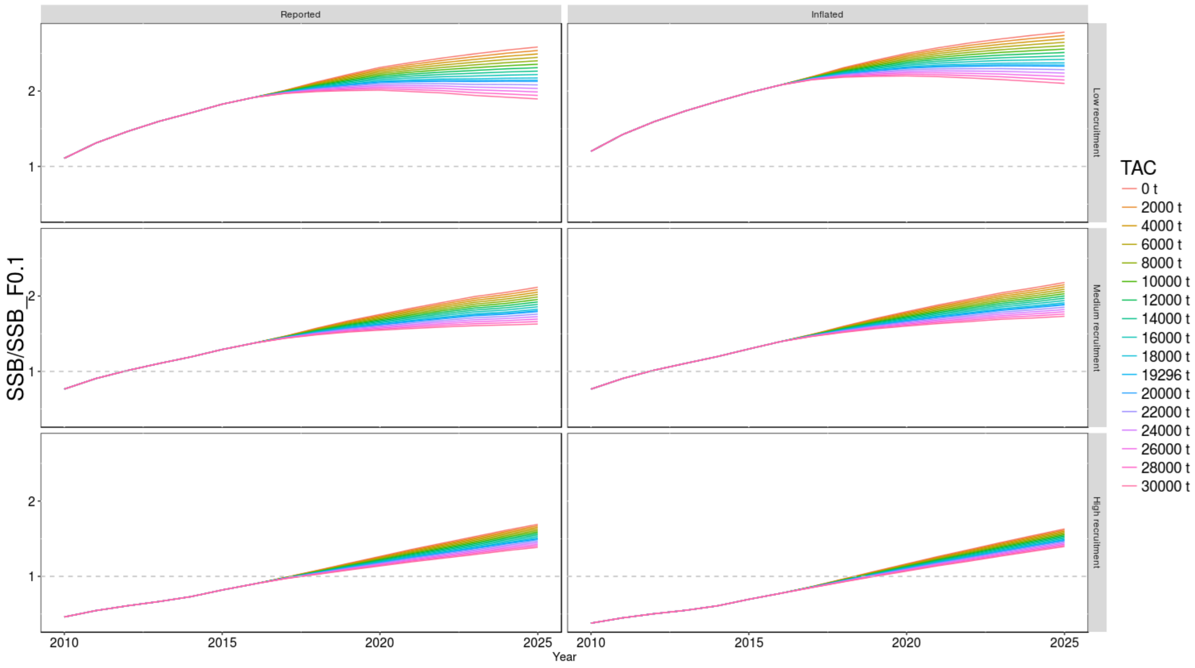
BFTE-Figure 4. Stock status from 2011 to the terminal year (2013) (black dots) estimated from VPA continuity run VPA from the 2014 stock assessment with reported and inflated catch (upper and lower panels) and considering low, medium and high recruitment levels (blue, green and red lines). Blue, green and red dots represent the distribution of the terminal year obtained through bootstrapping for the corresponding three recruitment levels. Left Panel (selectivity over 2007-2009): 2013 SSB and F relative to reference points calculated with the selectivity pattern over 2007-2009 which was same period as the 2010 stock assessment. Right Panel (selectivity over 2009-2011): 2013 SSB and F relative to the reference points with the selectivity pattern over 2009-2011 which was same period as the 2012 stock assessment.



BFTE-Figure 5. Pie chart from the 2014 stock assessment showing the proportion of the VPA continuity run results for the terminal year (2013) that are within the green quadrant of the Kobe plot chart (not overfished, no overfishing), the yellow quadrant (overfished or overfishing), and the red quadrant (overfished and overfishing). Split by catch scenario (reported and inflated) and benchmark (selectivity patterns were estimated over 2007-2009 or over 2009-2011). Here the yellow shading indicates the stock is overfished, but not undergoing overfishing. Results are for all recruitment scenarios combined.



BFTE-Figure 6. Plots of the annual mean weight from the catch-at-size data per main area (ATE: East Atlantic and MED: Mediterranean) from 1950 to 2013 used in the 2014 stock assessment.



BFTE-Figure 7. The 2016 updated projections of spawning stock biomass (SSB) under low (top panels), medium (middle panels), and high (bottom panels) recruitment scenarios under reported (left panels) and inflated (right panels) catch scenarios, with an assumed catch of 19,296 t in 2016 and various levels of constant catch starting in 2017. The dashed horizontal line shows $SSB_{F0.1}$.

BLUEFIN TUNA - WEST

BFTW-2. Fishery indicators

The total catch for the West Atlantic peaked at 18,671 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 with the collapse of the bluefin tuna by-catch longline fishery off Brazil in 1967 and decline in purse seine catches, but 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. The total catch for the West Atlantic including discards has been relatively stable since 1982 due to the imposition of quotas. However, since a total catch level of 3,319 t in 2002 (the highest since 1981, with all three major fishing nations indicating higher catches), total catch in the West Atlantic declined steadily to 1,638 t in 2007 and then increased in 2008 and 2009 to 2,000 t and 1,980 t, respectively. The catch in 2014 was 1,626 t and 1,839 in 2015 (**BFTW-Figure 1**). The decline through 2007 was primarily due to considerable reductions in catch levels for U.S. fisheries. Since 2002, the Canadian annual catches have been relatively stable at about 500-600 t (735 t in 2006); the 2006 catch was the highest recorded since 1977 (972 t). The 2015 Canadian catch was 533 t. Japanese catches have generally fluctuated between 300-500 t, with the exception of 2003 (57 t), which was low for regulatory reasons, and 2009 (162 t). Japanese landings for 2011 were considerably higher than previous at 578 t, while catches in 2014 and 2015 were 302 t and 347 t, respectively.

The average weight of bluefin tuna taken by the combined fisheries in the West Atlantic were historically low during the 1960s and 1970s (**BFTW-Figure 2**), for instance showing an average weight of only 33 kg during the 1965-1975 period. However, since 1980 they have been showing a quite stable trend and at a quite high average weight of 207 kg.

The overall number of Japanese vessels engaged in bluefin fishing has declined from more than 100 vessels to currently less than 10 vessels in the West Atlantic. After reaching a catch level of 2,014 t in 2002 (the highest level since 1979), the catches (landings and discards) of U.S. vessels fishing in the northwest Atlantic (including the Gulf of Mexico) declined precipitously during 2003-2007. The United States did not catch its quota in 2004-2008 with catches of 1,066, 848, 615, 858 and 922 t, respectively. However, in 2009 the United States fully realized its base quota with total catches (landings including dead discards) of 1,273 t and since that time catches have remained around 900 t with a catch in 2015 of 896 t.

The indices of abundance used in the 2014 stock assessment were updated through 2015 (**BFTW-Figure 3**). Updated abundance indices (Japanese longline, U.S. rod and reel, and U.S. longline in the Gulf of Mexico, **BFTW-Figure 3**) showed declines from recent higher levels, including the U.S. rod and reel index for medium fish (ages 4 to 5) which declined to near a historical low in recent years. The catch rates of juvenile bluefin tuna (ages 2 to 3) in the U.S. rod and reel fishery fluctuate with little apparent long term trend, but exhibit a pattern that is consistent with the strong year-classes estimated for 2002 and 2003, yet showed no signal of strong recruitment since then. The catch rates of adults in the U.S. rod and reel fishery showed decreases between 2011 and 2013, and increases in the recent two years. Catch rates of the Japanese longline fishery north of 30ºN has fluctuated substantially over time with peak in the 2012; the highest value of the time series. The Japanese longline CPUE indices declined in 2013, 2014, and 2015 but remain higher than the average in the 1990s and early 2000s, as well as in the 1970s when estimated stock size was substantially higher than in 2013. The catch rate series from the U.S. Gulf of Mexico longline fishery was split after 1991 due to management related impacts upon the indices and was also adjusted for the effects of 'weak' hook regulations implemented in 2011. The early time period (1987-1991) shows no clear trend while the later time period shows a generally increasing trend since the early 1990s. The U.S. Gulf of Mexico longline index showed a similar trend to the Japanese longline, with decline since the peak in 2012 but remained higher than the period of 1990 to 2000. Index values for 2015 were calculated however the index was split in that year due to the possibility that recent (2015) management regulations may have altered fishing practices and may not be comparable to values in prior years.

Indices for the Gulf of St. Lawrence increased rapidly since 2004 and the catch rates in 2011-2013 were the highest among the data points used in the 2014 assessment. The Committee questioned if the rate of increase was biologically plausible for the stock as a whole, and noted that many factors may have contributed to the increase in the index, including changes in stock distribution, management regulations, fishing behaviour and the environment, and may not have been fully accounted for in the standardization. Catch rates in southwest Nova Scotia have shown a recent decrease since 2008. The Gulf of Mexico larval survey (the only fishery independent indicator) continues to fluctuate around the low levels observed since the 1980s but 2011 and 2013 were relatively high.

The Committee reviewed a new fishery independent acoustic survey index developed by Canadian scientists. The index time series extends from 1994 to 2015 and covers a portion of the Gulf of St. Lawrence sampled from herring surveys. The acoustic survey showed similar trends to the Canadian Gulf of St. Lawrence commercial CPUE index, but with less annual variation and smaller recent increases in relative abundance.

BFTW-3. State of the stock

The SCRS continues to caution that the conclusions of the last assessment (2014) and this update of the projections (2016) 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 potential, ageing, age at maturity, and interpretation of CPUE indices of abundance.

The key features of past assessments have been that spawning stock biomass (SSB) decreased steadily from 1970 to 1992 followed by a decade of stability across the turn of the century, and then by a gradual increase over recent years (in the case of the 2014 assessment to 55% of the 1970 SSB). In contrast, recruitment was high in the early 1970s, but subsequently fluctuated without trend, except for two strong year-classes in 2002 and 2003.

The 2013 stock status estimated under the low recruitment scenario recent F(2010-2012) is 36% of F_{MSY} and SSB_{2013} is about 225% of SSB_{MSY} (**BFTW-Executive summary table**) while under high recruitment $F_{(2010-2012)}$ = 88% of F_{MSY} and SSB_{2013} = 48% of SSB_{MSY}.

The Committee recognizes that the large uncertainty in stock status is exacerbated by the lack of appropriate information/data and scientific surveys, and suggests using a scientific research quota (as recommended previously by the SCRS) to help support the improvement of stock abundance indices for western Atlantic bluefin tuna and overcome this standstill situation. However, the Committee also points out that the collection of the information mentioned above is a long term endeavour.

BFTW-4. Outlook

In 2016 the SCRS updated the 2014 projections for the western stock by replacing the catches that had been assumed for 2014 and 2015 with the actual reported catches for those years. In essence, these analyses resulted in very little change in the projections with only slight changes in the Kobe matrices for the various catch levels. Future recruitment was assumed to fluctuate under two scenarios: (i) average levels observed for 1976-2010 (96,500 fish, the low recruitment potential scenario) and (ii) levels that increase as the stock rebuilds (MSY level of 212,000 fish, the high recruitment potential scenario). The Committee has insufficient evidence to favour either scenario over the other and notes that both are plausible (but not extreme) lower and upper bounds on rebuilding potential. As it is unlikely that the conflicting scenarios will be resolved, the Committee considers that a more fruitful course may be to move away from the current high/low recruitment dichotomy and focus instead on adopting certain biological reference points and developing management procedures that are robust to these recruitment and other sources of uncertainty.

The projected stock status for 2015 was similar to the previous (2014) projections **(BFTW-Table 1)**. The updated outlook for bluefin tuna in the West Atlantic is summarized in **BFTW-Figure 8 and BFTW-Tables 2-4**. The low recruitment potential scenario suggests the stock is above the MSY level with greater than 60% probability and catches of 2,500 t or lower will maintain it above the MSY level. Constant catches of 2,250 t would result in a short-term minor decrease but with 2019 SSB approximately equal to that in 2014. If the high recruitment potential scenario is correct, then the western stock will not rebuild by 2019 even with no catch, although catches less than 2,500 t are predicted to prevent overfishing.

The Committee notes that while the projections indicate an increase in SSB from 2013 to 2015 most of the indicators for large fish decrease during the same period. (**BFTW-Figure 3**).

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 previously noted that Recommendations 08-04, 10-03 and 12-02 were expected to result in a rebuilding of the stock towards the Convention objective. The 2014 assessment estimated that the spawning biomass has increased substantially in recent years, which is consistent with these expectations. The Committee also noted that Recommendation 14-05, which was implemented in 2015, is expected to result in a rebuilding of the stock towards the Convention objective, but that there has not yet been enough time to detect the population response to the measure.

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) and 1,750 t in 2011, 2012, 2013 and 2014 (Rec. 10-03, Rec. 12-02, Rec. 13-09) and 2,000 t in 2015 and 2016 (Rec. 14-05).

The 2014 assessment indicates similar historical trends in abundance as in previous assessments, but a more rapid increase in recent years. The strong 2002/2003 year classes and recent reduction in fishing mortality have contributed to this in recent years.

Future stock productivity, as with prior assessments, is based upon two hypotheses about future recruitment: a "high recruitment potential scenario" in which future recruitment has the potential to achieve levels that occurred in the early 1970s and a "low recruitment potential scenario" in which future recruitment is expected to remain near present levels (even if stock size increases). The results of 2014 assessment have shown that long term implications of future biomass are different between the two hypotheses and the issue of identifying one of these two hypotheses, or an alternative one, as being the more realistic remains unresolved.

Updated projections for the west bluefin tuna stock indicated only slight changes in SSB and F from the 2014 projections (**BFTW-Table 1**). The Committee considered that the new information received this year did not warrant any change to the advice given in 2014 regarding the implications of various catch levels.

Probabilities of achieving SSB_{MSY} within the Commission rebuilding period based on the updated projections for alternative catch levels are provided (**BFTW-Table 2-4**). The "low recruitment potential scenario" suggests that spawning biomass is currently above SSB_{MSY}, whereas the "high recruitment potential scenario" suggests that SSB_{MSY} has a very low probability of being achieved within the rebuilding period. Despite this large uncertainty about the long term future productivity of the stock, under either recruitment scenario catches of less than 2,250 t are estimated to allow the spawning biomass to be at or above 2013 levels by 2019 (with 50% probability) and this level of catch should not be exceeded. While the Committee prefer to move away from current recruitment dichotomy, continued stock growth may allow to determine if the average recruitment will increase.

As noted previously by the Committee, both the productivity of western Atlantic bluefin tuna and western Atlantic bluefin tuna fisheries are linked to the eastern Atlantic and Mediterranean stock. Therefore, management actions taken in the eastern Atlantic and Mediterranean are likely to influence the recovery in the western Atlantic, because even small rates of mixing from East to West can have considerable effects on the West due to the fact that eastern plus Mediterranean resource is much larger than that of the West.

WEST ATLANTIC BLUEFIN TUNA SUMMARY
(Catches and Biomass in t)

Current (2015) Catch (including discards)		1,839 t
Assumed recruitment	Low potential	High potential
Maximum Sustainable Yield (MSY)	3,050 (2807-3307)[1]	5,316 (4,442-5,863)[1]
SSB_{MSY}	13,226 (12,969-13,645)[1]	63,102 (50,096-72,921)[1]
SSB_{2013}/SSB_{MSY}	2.25 (1.92-2.68)[1]	0.48 (0.35-0.72)[1]
F_{MSY}	0.20 (0.17-0.24)[1]	0.08 (0.07-0.10)[1]
$F_{0.1}$	0.12 (0.11-0.13)[1]	0.12 (0.11-0.13)[1]
$F_{2010-2012}/F_{MSY}$[2]	0.36 (0.28-0.43)[1]	0.88 (0.64-1.08)[1]
$F_{2010-2012}/F_{0.1}$[2]	0.60 (0.50-0.72)[1]	0.60 (0.50-0.72)[1]
Stock status	Overfished: No	Overfished: Yes
	Overfishing: No	Overfishing: No
Management Measures:	[Rec. 08-04] TAC of 1,900 t in 2009 and 1,800 t in 2010, including dead discards.	
	[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.	

[1] Median and approximate 80% confidence interval from bootstrapping from the assessment.
[2] $F_{2010-2012}$ refers to the geometric mean of the estimates for 2010-2012 (a proxy for recent F levels).

BFTW-Table 1. Estimates of the fishing mortality and the spawning stock biomass relative to the reference point and 80% confidence interval using the updated projections (not from an updated stock assessment that uses updated CPUE, age composition, and other information).

	Low Potential	High Potential
SSB_{2015}/SSB_{MSY}	2.41 (2.05-2.96)	0.51 (0.37-0.78)
$F_{2013\text{-}2015}/F_{MSY}$[1]	0.28 (0.22-0.36)	0.68 (0.51-0.89)
$F_{2013\text{-}2015}/F_{0.1}$[1]	0.48 (0.40-0.58)	0.48 (0.40-0.58)

[1] $F_{2013\text{-}2015}$ refers to the geometric mean of the estimates for 2013-2015 (a proxy for recent F levels).

BFTW-Table 2. Kobe II matrices (based on 2016 updated projections) giving the probability that the fishing mortality rate (F) will be less than the level that will produce MSY ($F<F_{MSY}$, no overfishing) in any given year for various constant catch levels under the low recruitment and high recruitment scenarios. The current TAC of 2,000 t (Rec. 14-05) is indicated in bold. Catch for 2016 is assumed to be 2000t in all scenarios.

Low Recruitment

TAC	2017	2018	2019
0 mt	100.0%	100.0%	100.0%
1500 mt	100.0%	100.0%	100.0%
1700 mt	100.0%	100.0%	100.0%
1750 mt	100.0%	100.0%	100.0%
1800 mt	100.0%	100.0%	100.0%
2000 mt	**100.0%**	**100.0%**	**100.0%**
2250 mt	100.0%	100.0%	100.0%
2500 mt	100.0%	100.0%	100.0%
2750 mt	100.0%	100.0%	100.0%
3000 mt	100.0%	100.0%	100.0%
3250 mt	100.0%	99.8%	99.6%
3500 mt	99.8%	99.4%	98.6%

High Recruitment

TAC	2017	2018	2019
0 mt	100.0%	100.0%	100.0%
1500 mt	99.8%	100.0%	100.0%
1700 mt	98.2%	98.8%	99.0%
1750 mt	98.2%	98.8%	99.0%
1800 mt	97.8%	98.0%	98.4%
2000 mt	**93.4%**	**95.6%**	**96.4%**
2250 mt	84.8%	87.6%	89.0%
2500 mt	71.0%	73.0%	77.0%
2750 mt	53.0%	57.0%	58.4%
3000 mt	37.4%	38.8%	41.4%
3250 mt	23.4%	25.2%	26.2%
3500 mt	14.6%	15.6%	15.6%

BFTW-Table 3. Kobe II matrices (based on 2016 updated projections) giving the probability that the spawning stock biomass will exceed the level that will produce MSY ($SSB>SSB_{MSY}$, not overfished) in any given year for various constant catch levels under the low recruitment and high recruitment scenarios. The current TAC of 2,000 t (Rec. 14-05) is indicated in bold. Catch for 2016 is assumed to be 2000t in all scenarios.

Low Recruitment

TAC	2017	2018	2019
0 mt	100.0%	100.0%	100.0%
1500 mt	100.0%	100.0%	100.0%
1700 mt	100.0%	100.0%	100.0%
1750 mt	100.0%	100.0%	100.0%
1800 mt	100.0%	100.0%	100.0%
2000 mt	**100.0%**	**100.0%**	**100.0%**
2250 mt	100.0%	100.0%	100.0%
2500 mt	100.0%	100.0%	100.0%
2750 mt	100.0%	100.0%	100.0%
3000 mt	100.0%	100.0%	100.0%
3250 mt	100.0%	100.0%	100.0%
3500 mt	100.0%	100.0%	100.0%

High Recruitment

TAC	2017	2018	2019
0 mt	1.2%	1.2%	2.4%
1500 mt	1.0%	1.2%	1.6%
1700 mt	1.0%	1.2%	1.6%
1750 mt	1.0%	1.2%	1.6%
1800 mt	1.0%	1.2%	1.6%
2000 mt	**1.0%**	**1.2%**	**1.4%**
2250 mt	1.0%	1.0%	1.4%
2500 mt	1.0%	1.0%	1.2%
2750 mt	1.0%	0.4%	1.2%
3000 mt	1.0%	0.4%	1.2%
3250 mt	1.0%	0.4%	1.2%
3500 mt	0.8%	0.4%	1.2%

BFTW-Table 4. Kobe II matrices (based on 2016 updated projections) giving the joint probability that the fishing mortality rate will be less than the level that will produce MSY ($F<F_{MSY}$) and the spawning stock biomass (SSB) will exceed the level that will produce MSY ($B>B_{MSY}$) in any given year for various constant catch levels under the low recruitment and high recruitment scenarios. The current TAC of 2,000 t (Rec. 14-05) is indicated in bold. Catch for 2016 is assumed to be 2000t in all scenarios.

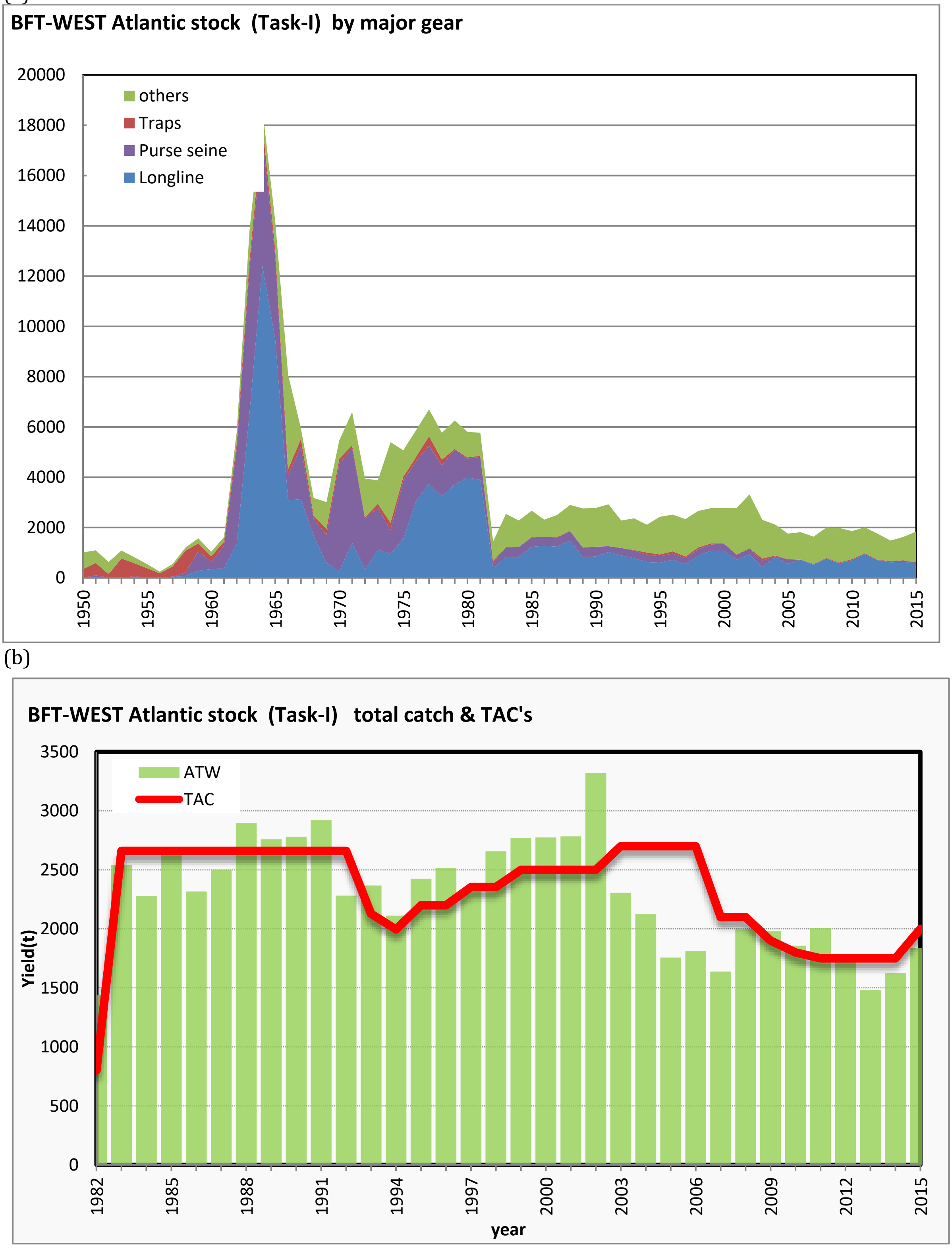
Low Recruitment

TAC	2017	2018	2019
0 mt	100.0%	100.0%	100.0%
1500 mt	100.0%	100.0%	100.0%
1700 mt	100.0%	100.0%	100.0%
1750 mt	100.0%	100.0%	100.0%
1800 mt	100.0%	100.0%	100.0%
2000 mt	**100.0%**	**100.0%**	**100.0%**
2250 mt	100.0%	100.0%	100.0%
2500 mt	100.0%	100.0%	100.0%
2750 mt	100.0%	100.0%	100.0%
3000 mt	100.0%	100.0%	100.0%
3250 mt	100.0%	99.8%	99.6%
3500 mt	99.8%	99.4%	98.6%

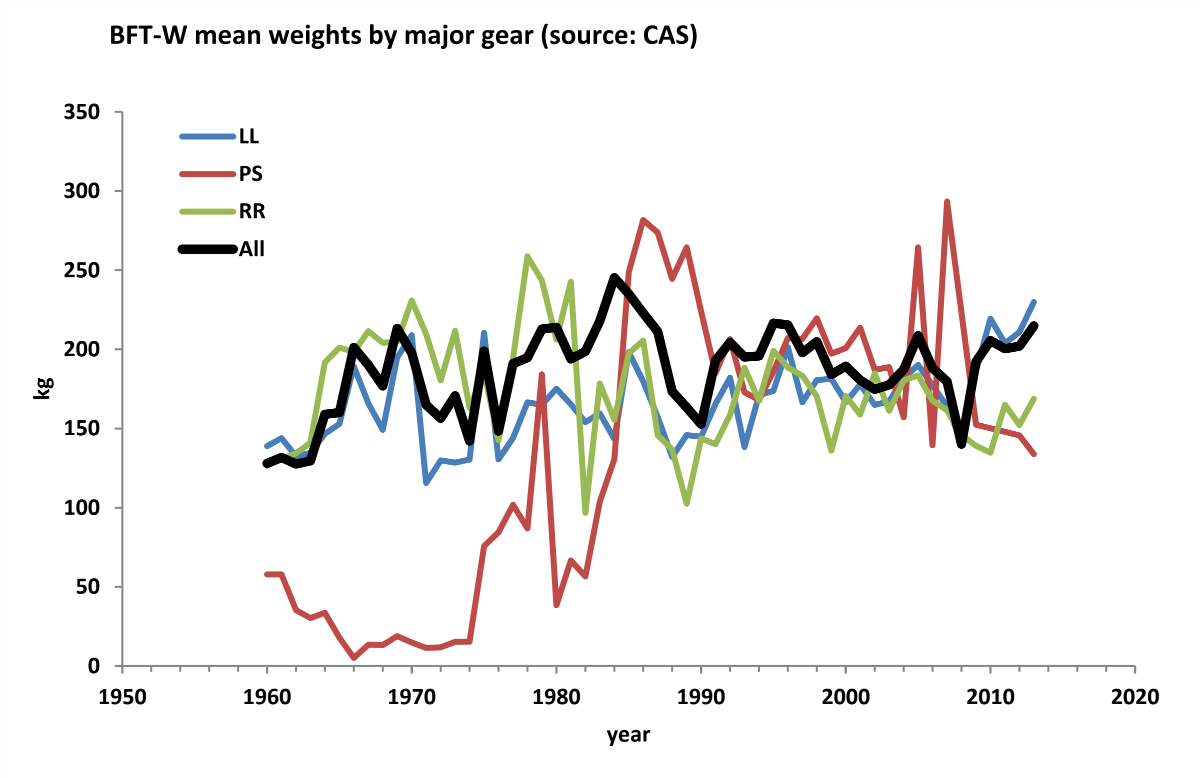
High Recruitment

TAC	2017	2018	2019
0 mt	1.2%	1.2%	2.4%
1500 mt	1.0%	1.2%	1.6%
1700 mt	1.0%	1.2%	1.6%
1750 mt	1.0%	1.2%	1.6%
1800 mt	1.0%	1.2%	1.6%
2000 mt	**1.0%**	**1.2%**	**1.4%**
2250 mt	1.0%	1.0%	1.4%
2500 mt	1.0%	1.0%	1.2%
2750 mt	1.0%	0.4%	1.2%
3000 mt	1.0%	0.4%	1.2%
3250 mt	1.0%	0.4%	1.2%
3500 mt	0.8%	0.4%	1.2%

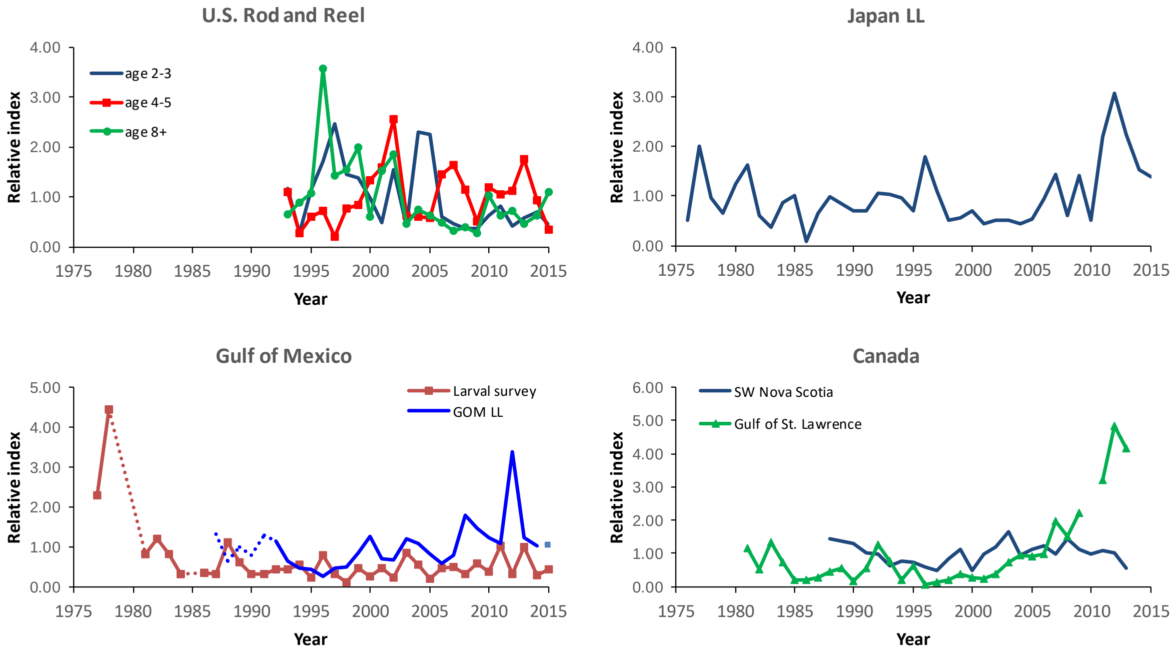
(a)



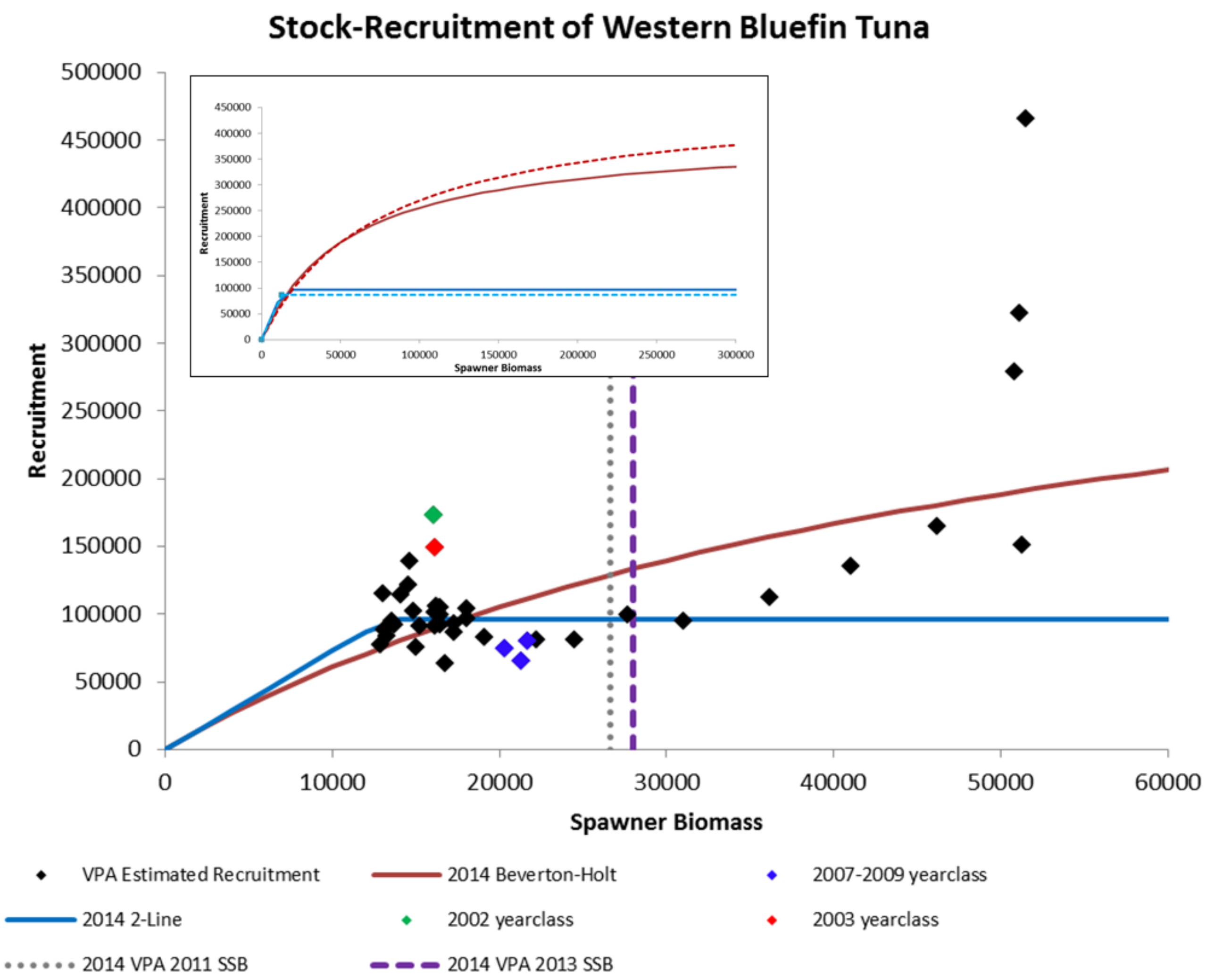
BFTW-Figure 1. Historical catches of western bluefin tuna: (a) by gear type and (b) in comparison to TAC levels agreed by the Commission.



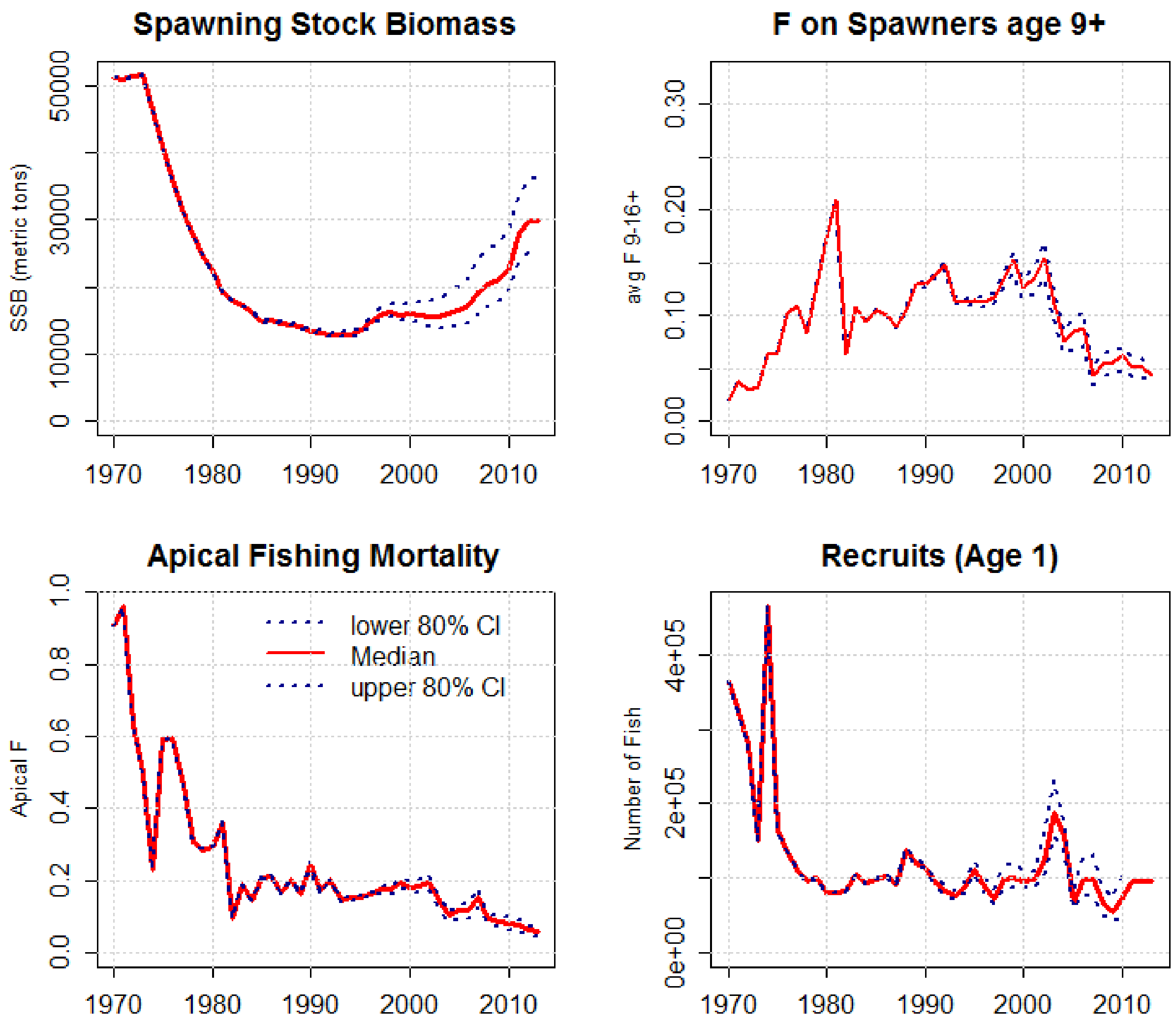
BFTW-Figure 2. Mean weight of western bluefin tuna catches by purse seine, longline, rod and reel, and all gears combined (including other gear types)estimated from the catch-at-size compiled information.



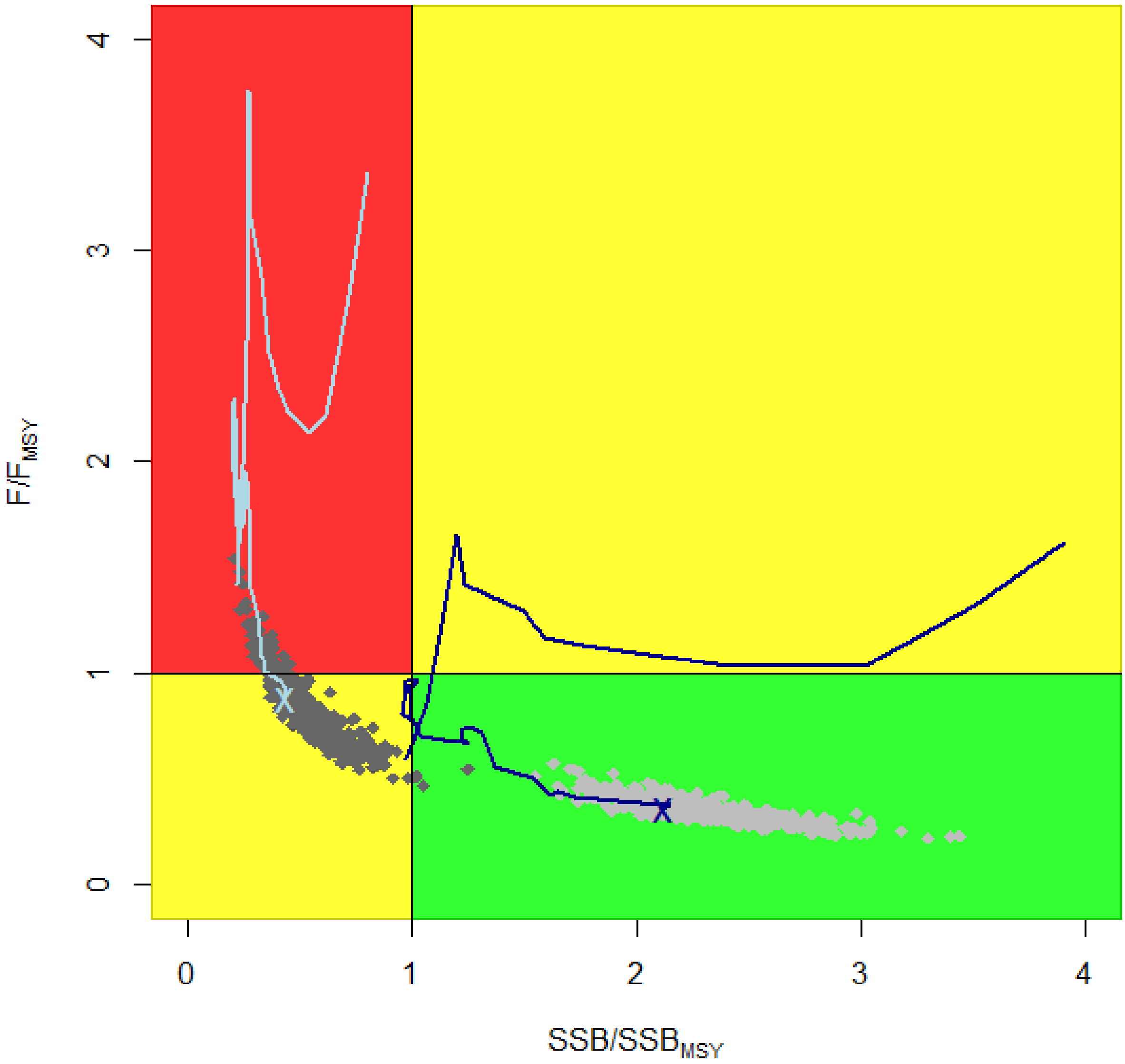
BFTW-Figure 3. Updated indices of abundance for western bluefin tuna. The dashed portions of the larval survey, U.S. Gulf of Mexico, and Canada Gulf of St. Lawrence indices bridge the gaps between years where data were missing or otherwise considered unreliable by the SCRS. The two Canadian indices were not updated since 2014.



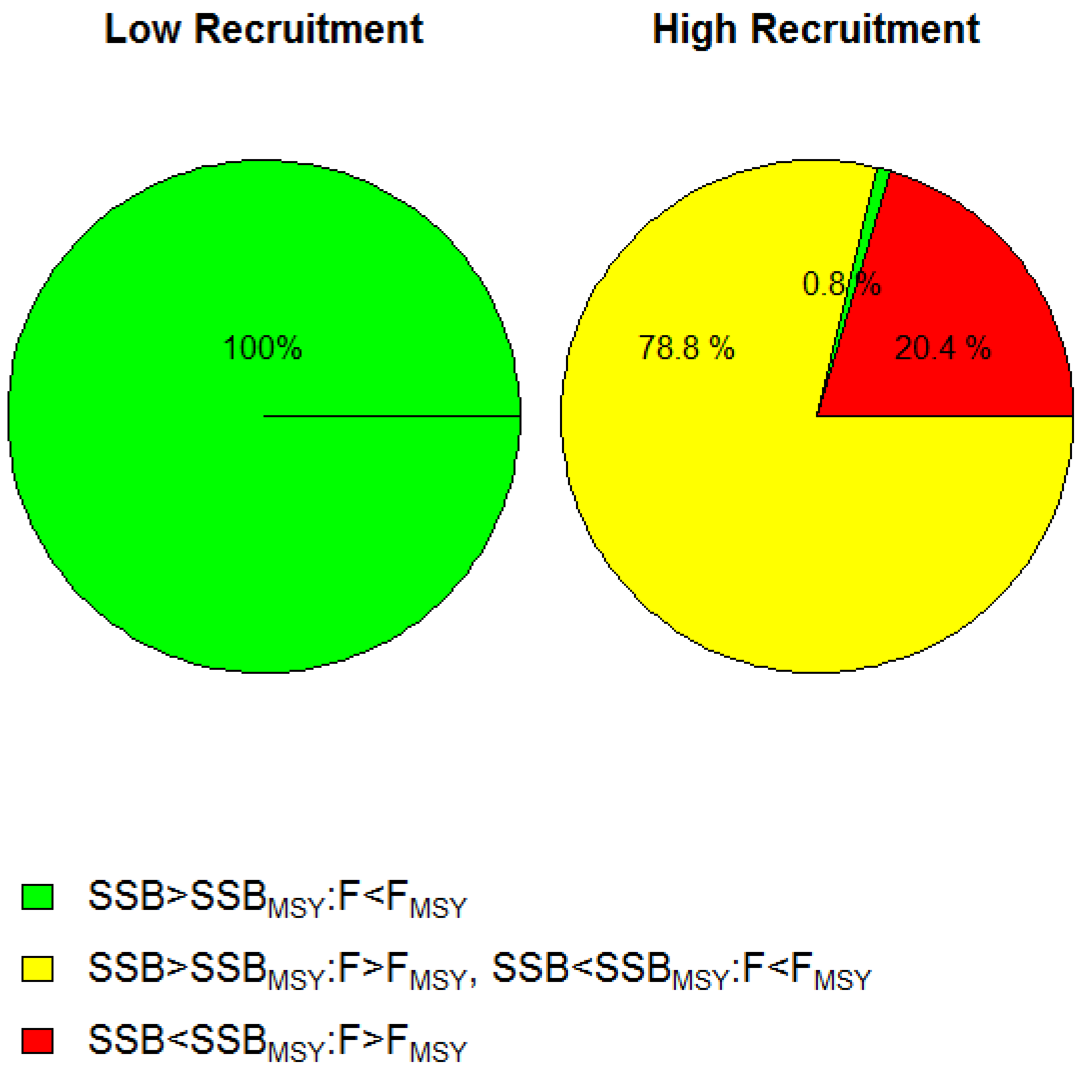
BFTW-Figure 4. Recruitment scenario derived from the 2014 stock assessment. The low recruitment potential scenario (2-line) implies future recruitment will remain near present levels even if stock size increases. The "high recruitment potential scenario" (Beverton-Holt) implies future recruitment increases with stock size and has the potential to achieve levels that occurred in the early 1970s. Points represent the estimates from the 2014 base assessment, with the 2002, 2003, and recent year class estimates (2008-2010) highlighted. The two vertical lines represent SSB estimates from the 2014 assessment for 2011 (leftmost) and 2013 (rightmost). The inset graph shows the corresponding relationships estimated for the 2012 (dashed lines) and 2014 (solid lines) assessments illustrating the difference in the estimated stock recruitment relationship between 2012 and 2014.



BFTW-Figure 5. Median estimates of spawning biomass (age 9+), fishing mortality on spawners, apical fishing mortality (F on the most vulnerable age class) and recruitment for the base VPA model from the 2014 stock assessment. The 80% confidence intervals are indicated with dotted lines. The recruitment estimates for the last three years of the VPA are considered unreliable and have been replaced by the median levels corresponding to the low recruitment scenario.

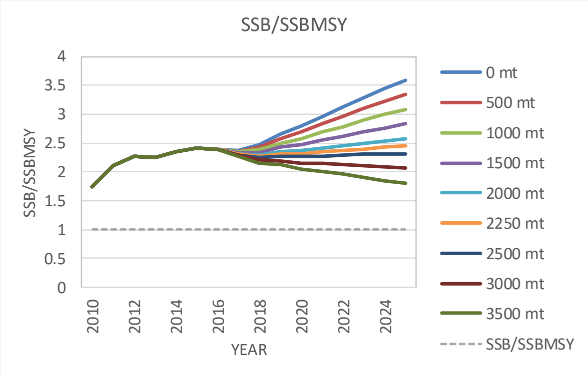


BFTW-Figure 6. Estimated status of stock relative to the Convention objectives (MSY) by year (1973 to 2013) and recruitment scenario based on the 2014 stock assessment (light blue=high recruitment potential, dark blue=low recruitment potential). The light gray dots represent the status estimated for 2013 under the low recruitment scenario, corresponding to bootstrap estimates of uncertainty. The dark blue lines give the historical point estimates for the low recruitment, and the light blue gives the historic trend for the high recruitment.

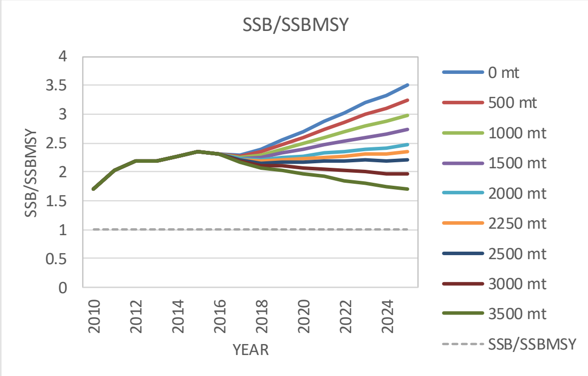


BFTW-Figure 7. Pie chart summarizing stock status from the 2014 stock assessment, showing the proportion of model outputs that are not overfished and not undergoing overfishing (green), either overfished or undergoing overfishing (yellow) and both overfished and undergoing overfishing (red).

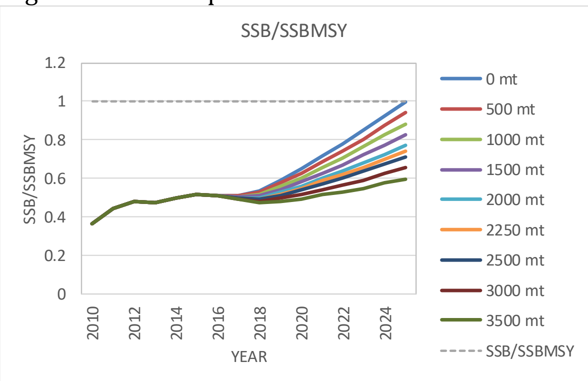
A) 50% probability
Low recruitment potential



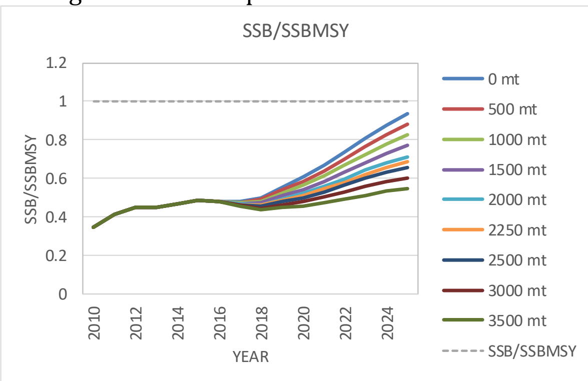
B) 60% probability
Low recruitment potential



C) 50% probability
High Recruitment potential



D) 60% probability
High recruitment potential



BFTW-Figure 8. The 2016 updated projections of spawning stock biomass (SSB) under low recruitment potential (top panels) and high recruitment potential (bottom panels) with an assumed catch of 2,000 t in 2016 and various levels of constant catch starting in 2017. The labels "50%" and "60%" refer to the probability that the SSB will be greater than or equal to the values indicated by each curve. The curves corresponding to each catch level are arranged sequentially in the same order as the legends. A given catch level is projected to have a 50% or 60% probability of meeting the Convention objective (SSB greater than or equal to the level that will produce the MSY) in the year that the corresponding curve meets the dashed horizontal line.

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 and an assessment meeting in April 2011 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. Task I catches of blue marlin (**BUM-Table 1**) in 2015 were 1,864 t, compared to 2,086 t reported for 2014. Task I catches of blue marlin for 2015 are preliminary. 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 (2015) Yield	1,864 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] 2015 yield should be considered provisional.

BUM-Table 1. Estimated catches (t) of Atlantic blue marlin (*Makaira nigricans*) by area, gear and flag. (v1, 2016-09-30)

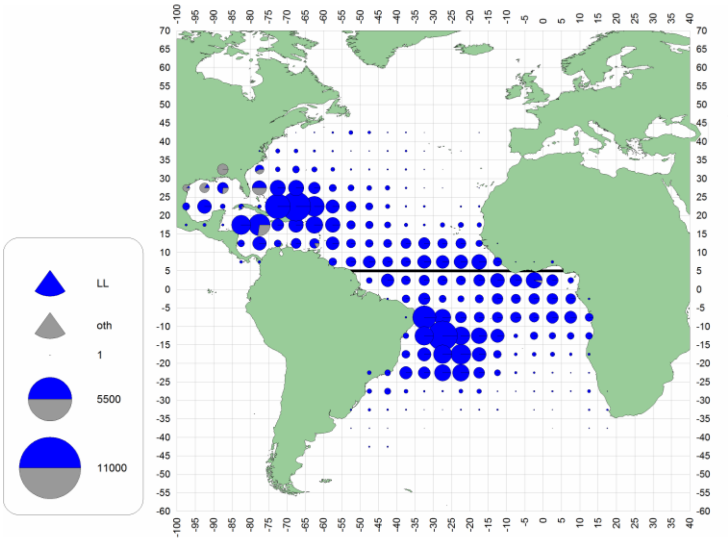
			1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
TOTAL	A+M		4277	3144	3235	4319	4270	5462	5800	5812	5476	5395	4458	3745	4356	2872	3319	2989	3994	4508	3510	3223	2324	2190	1325	2086	1864
Landings		Longline	3374	2232	2223	3047	2877	3796	4269	3723	3445	3161	2398	1832	2245	1894	2063	1829	2477	2557	2309	2050	1579	1466	879	1474	1583
		Other surf.	698	675	770	1041	1165	1403	1303	1981	1910	2138	1939	1774	2069	912	1212	1057	1346	1712	1063	1038	554	465	350	491	187
		Sport (HL+RR)	63	90	114	120	75	66	88	56	38	36	97	90	22	31	20	63	129	200	95	116	135	187	41	67	13
Discards		Longline	142	146	127	111	153	197	139	51	83	60	22	37	19	34	24	38	42	37	40	19	56	70	55	54	81
		Other surf.	0	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		Angola	0	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	12	18	21	19	31	25	30	25	19	19	18	11	11	0	0	25	0	0	0	9	13	14	11	12	34
		Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	3	6	47	19	8	5
		Benin	6	6	6	5	5	5	5	5	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Brazil	61	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	0	62	73	62	78	120	201	23	92	88	89	58	96	0	65	13	77	100	99	61	45	40	44
		Chinese Taipei	1672	824	685	663	467	660	1478	578	486	485	240	294	319	315	151	99	233	148	195	153	199	133	78	62	61
		Cuba	189	204	69	39	85	43	53	12	38	55	56	34	3	4	7	7	0	0	0	0	0	0	0	0	
		Curaçao	40	40	40	40	40	40	40	40	40	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Côte d'Ivoire	105	79	139	212	177	157	222	182	275	206	196	78	109	115	107	178	150	991	463	450	42	23	26	44	30
		Dominica	0	0	0	0	0	0	0	0	0	0	64	69	75	36	44	55	58	106	76	76	60	0	0	0	
		Dominican Republic	0	0	0	0	0	0	41	71	29	19	23	0	207	0	0	0	0	0	0	0	0	0	0	0	
		EU.España	14	47	44	55	40	158	122	195	125	140	94	28	12	51	24	91	38	55	60	165	16	34	44	137	212
		EU.France	98	115	179	191	197	252	299	333	370	397	428	443	443	450	470	470	461	585	498	344	461	395	212	393	400
		EU.Portugal	4	2	15	11	10	7	3	47	8	22	18	8	32	27	48	105	135	158	106	140	54	53	25	23	46
		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	
		Gabon	0	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	126	123	236	441	471	422	491	447	624	639	795	999	415	470	759	405	683	191	140	116	332	234	163	236	88
		Grenada	64	52	58	52	50	26	47	60	100	87	104	69	72	45	42	33	49	54	45	45	45	0	0	0	
		Jamaica	0	0	0	0	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Japan	900	1017	926	1523	1409	1679	1349	1185	790	883	335	267	442	540	442	490	920	1028	822	731	402	430	189	558	589
		Korea Rep.	537	24	13	56	56	144	56	2	3	1	1	0	0	1	6	33	64	91	36	85	57	34	24	10	3
		Liberia	0	0	0	0	87	148	148	701	420	712	235	158	115	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	12	0	0	0	0	0	0	0	0	0	4
		Mexico	0	0	3	13	13	13	13	27	35	68	37	50	70	90	86	64	91	81	93	89	68	106	86	67	72
		Mixed flags (FR+ES)	137	116	146	133	126	96	82	80	83	147	151	131	148	171	150	136	135	139	164	178	49	0	0	0	
		NEI (BIL)	20	38	0	0	0	0	0	0	0	53	184	258	167	89	7	160	209	205	177	0	0	0	0	0	
		NEI (ETRO)	0	0	174	326	362	435	548	803	761	492	274	17	14	0	0	0	0	0	0	0	0	0	0	0	
		Namibia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	10	0	8	36	8
		Panama	0	0	0	0	0	0	0	0	0	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Philippines	0	0	0	0	0	0	0	7	71	38	0	0	0	0	0	0	0	8	0	3	4	0	0	0	**0**
		Russian Federation	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**
		S. Tomé e Príncipe	18	21	25	28	33	36	35	33	30	32	32	32	32	9	21	26	0	68	70	72	0	0	0	0	11
		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	2
		Senegal	4	8	0	9	0	2	5	0	0	0	11	24	32	11	1	5	91	114	61	41	64	164	45	72	10
		South Africa	0	0	0	0	0	0	0	0	0	0	1	4	0	0	0	0	2	0	0	1	0	0	0	1	1
		St. Vincent and Grenadines	0	1	2	2	2	0	1	0	0	0	0	20	0	0	0	0	1	3	2	1	0	0	2	0	**0**
		Sta. Lucia	0	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	0	23	0	73	53	141	103	775	0	0	0	0	0	0	0	0	0	0	0	
		Trinidad and Tobago	6	1	2	16	28	14	49	15	20	51	17	16	9	11	7	14	16	34	26	22	25	46	48	48	35
		U.S.A.	33	51	80	88	43	43	46	50	37	24	16	17	19	26	16	17	9	13	6	4	6	14	9	1	9
		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	18	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	0	1	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	2	2	2	12	2	1	1
		UK.Turks and Caicos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	**0**
		Ukraine	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	Uruguay	1	0	0	3	1	1	26	23	0	0	0	1	5	3	2	8	5	0	6	1	0	0	0	0	**0**
	Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	7	8	6	3	2	
	Venezuela	56	67	86	122	117	148	142	226	240	125	84	88	120	101	160	172	222	130	120	151	116	143	111	139	60
Discards	Brazil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	
	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	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	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.	142	146	127	111	153	197	139	52	83	60	25	49	19	35	25	36	42	38	42	19	50	39	55	53	80

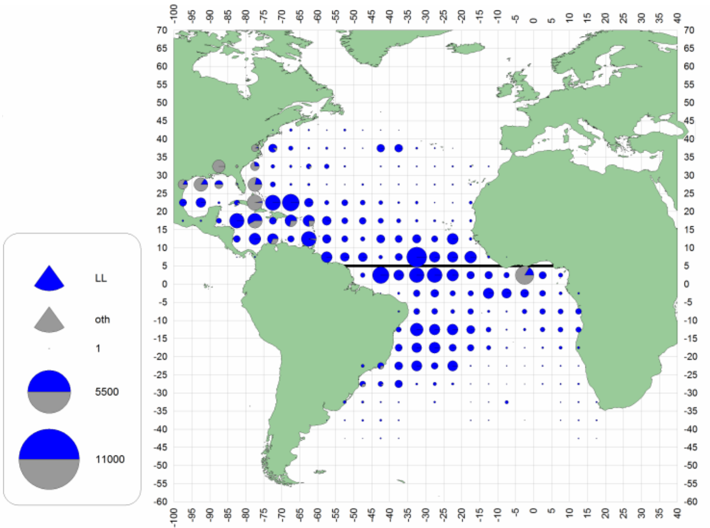
EU-France 2015 Task I: last revision (arriving after the species groups deadline) not included in the table.

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).

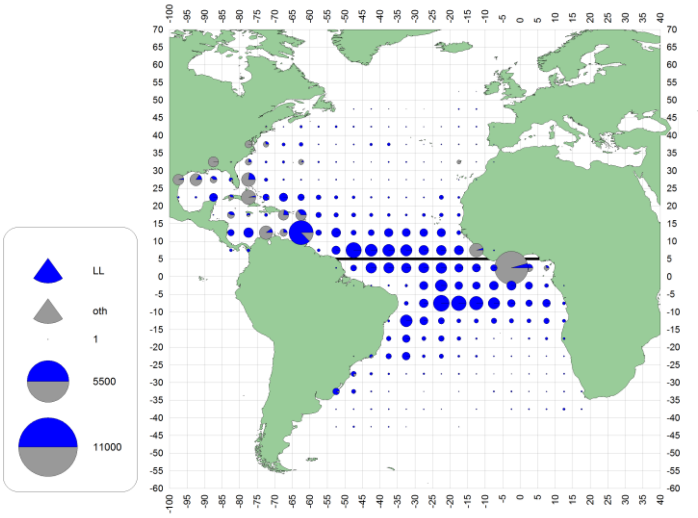
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
0	0	2	9	19	33	49	63	74	81	87	92	94	96	97	98
500	0	2	6	13	23	35	47	58	67	74	80	84	88	91	93
1000	0	1	4	9	15	22	31	40	49	56	63	68	73	77	81
1500	0	1	3	6	9	13	18	24	30	36	41	46	57	55	59
2000	0	1	2	3	5	7	10	12	16	18	21	24	20	29	32
2500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



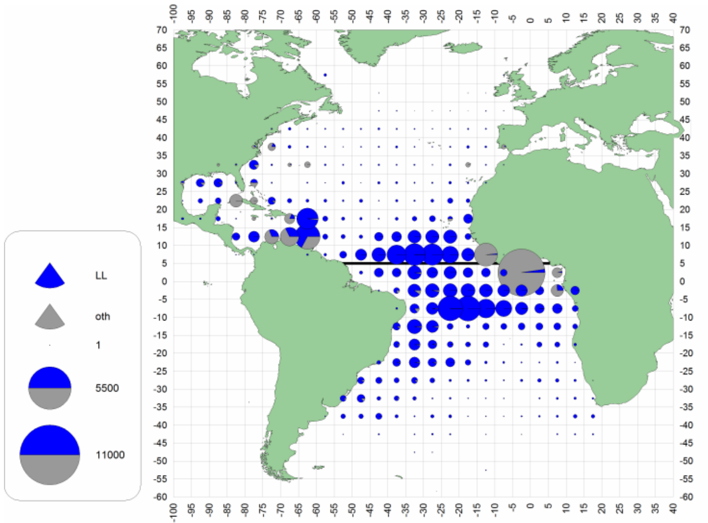
a. BUM (1960-69)



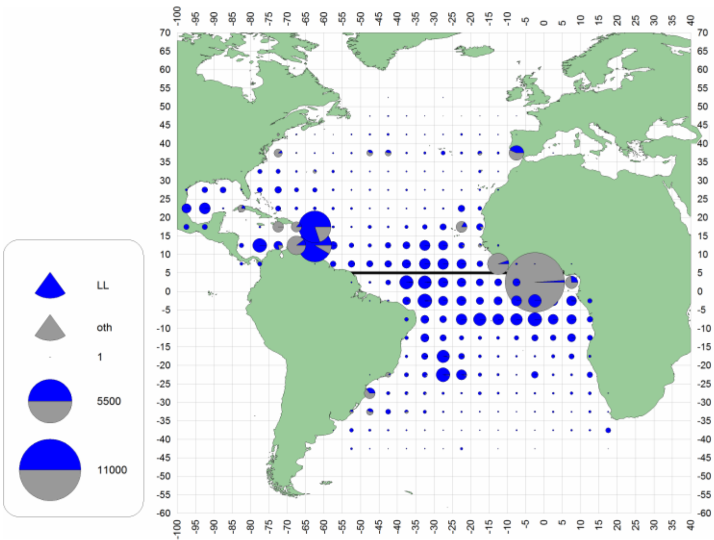
b. BUM (1970-79)



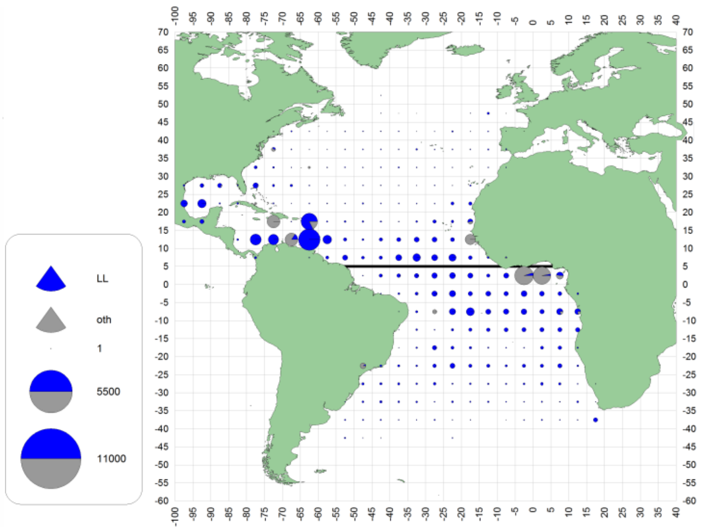
c. BUM (1980-89)



d. BUM (1990-99)

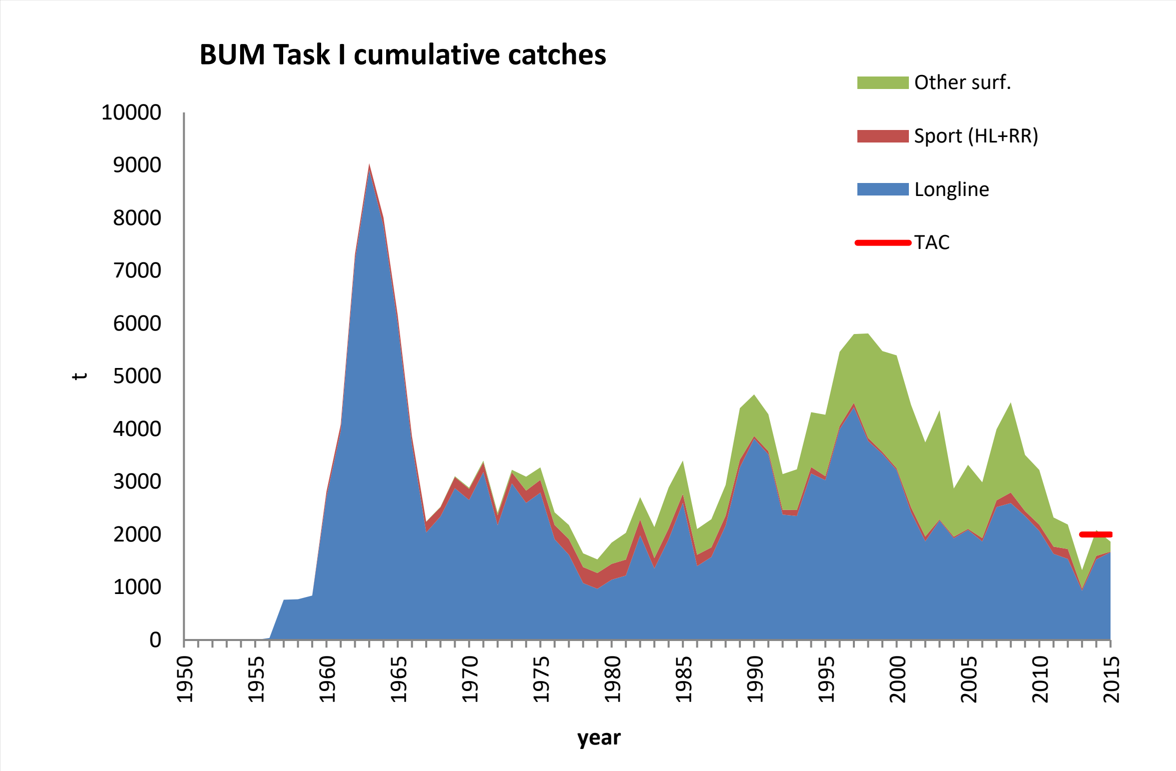


e. BUM (2000-09)

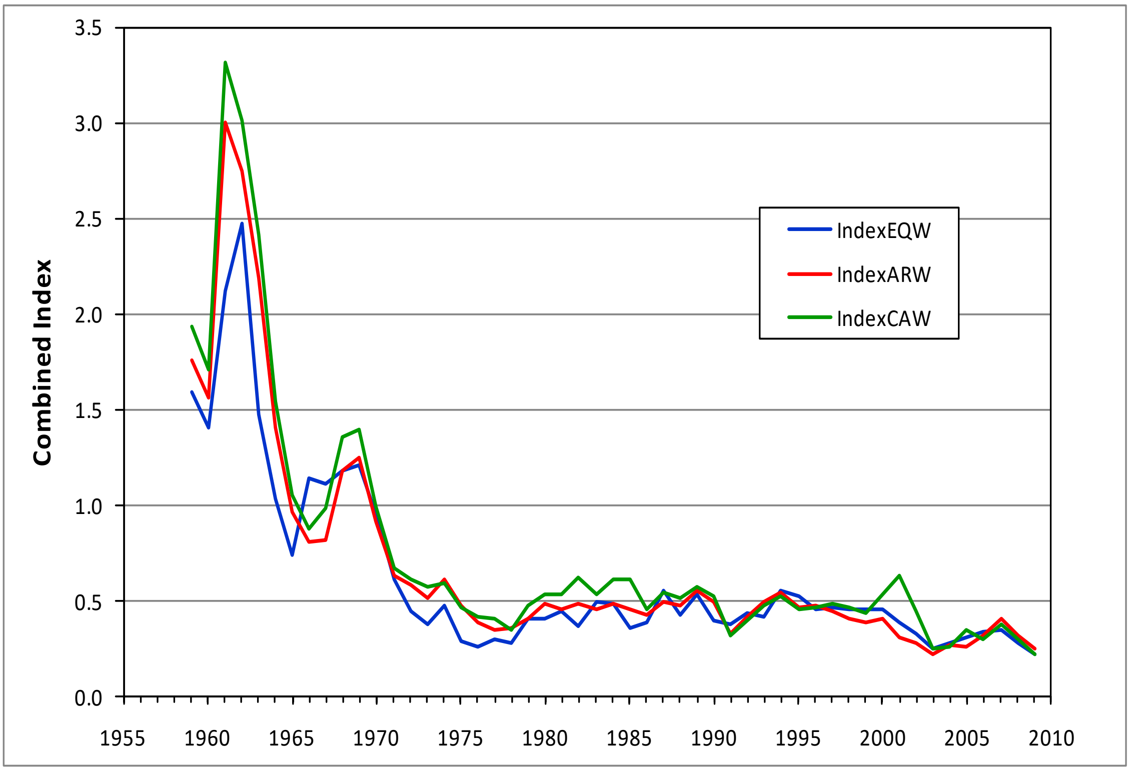


f. BUM(2010-14)

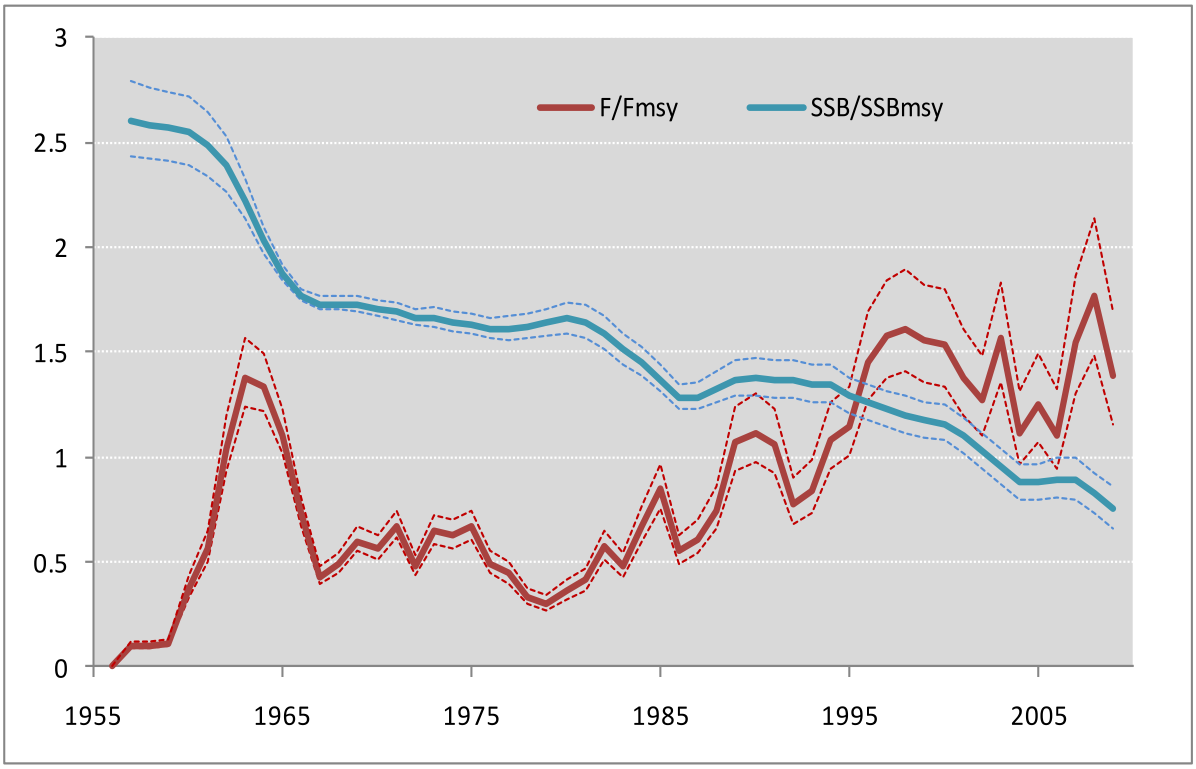
BUM-Figure 1. Geographic distribution of blue marlin total catches by decade (last decade only covers 5 years).



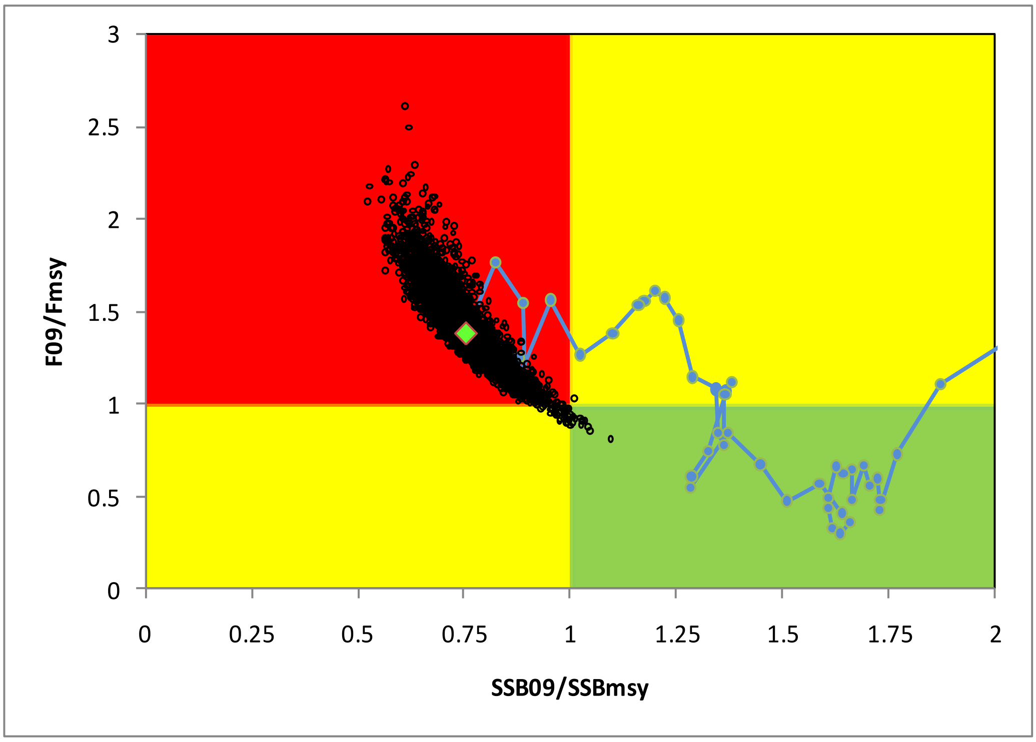
BUM-Figure 2. Total catch of blue marlin reported in Task I for the period 1956-2015.



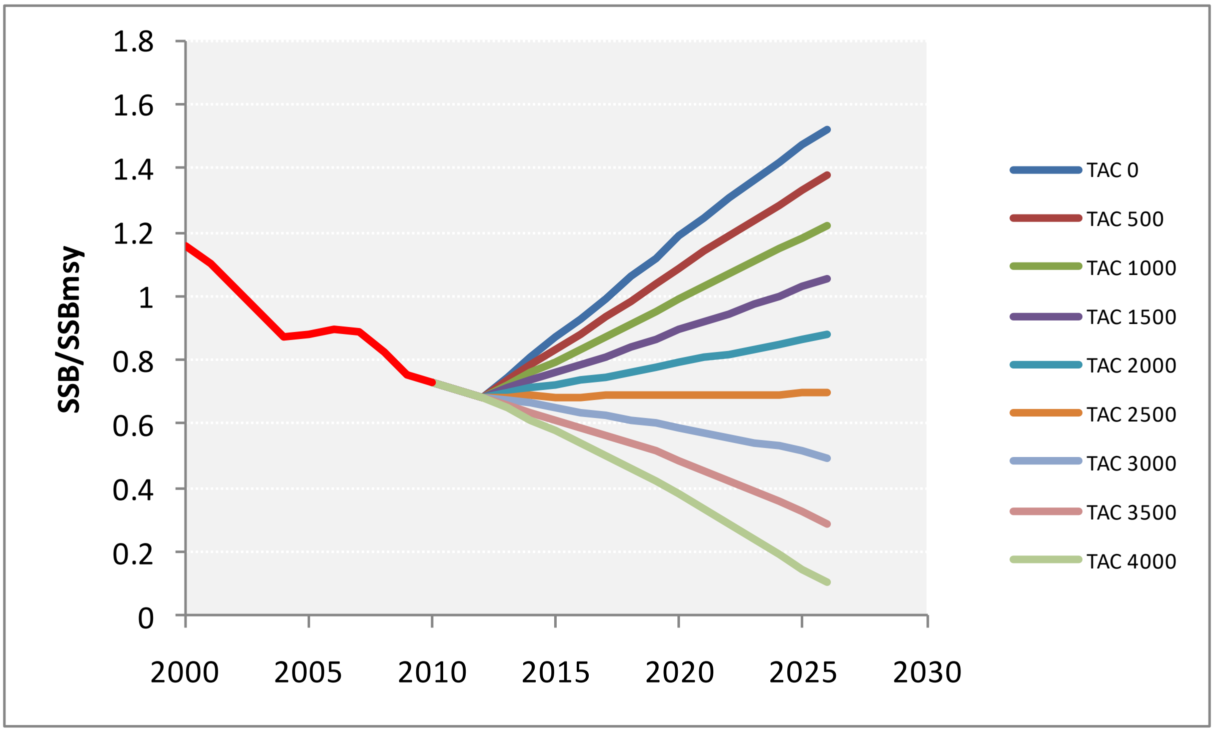
BUM-Figure 3. Blue marlin standardized combined CPUE indices estimated using equal weighting for all CPUE series (EQW), weighting the CPUE series by area (ARW) and by catch (CAW).



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 and an assessment meeting held in May 2012. 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.

Task I catches of white marlin in 2014 and 2015 were 387 t and 465 t, respectively (**WHM-Table 2**). Task I catches of white marlin for 2014 are to be considered preliminary. 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 lead 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, the rebuilding of the stock will proceed more slowly.

ATLANTIC WHITE MARLIN SUMMARY

MSY	874 t[1] - 1604 t[2]
Current (2015) Yield	465 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] 2015 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. (v1, 2016-09-30)

			1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
TOTAL	A+M		1743	1552	1679	2202	1876	1679	1517	1912	1736	1521	1088	1010	844	823	751	610	680	670	714	495	537	460	372	387	465
Landings		Longline	1552	1360	1499	2039	1674	1520	1371	1684	1588	1389	966	832	742	739	672	526	606	559	602	414	411	369	252	309	353
		Other surf.	82	83	85	90	79	71	62	189	85	90	101	140	85	55	60	71	46	99	95	65	85	62	103	60	101
		Sport (HL+RR)	19	22	30	30	22	24	14	6	6	2	4	6	1	1	1	2	1	2	2	6	4	6	7	7	3
Discards		Longline	90	88	66	42	100	65	70	32	57	41	17	29	17	27	17	11	26	10	13	10	38	22	10	11	8
		Other surf.	0	0	0	0	0	0	0	1	0	0	1	4	0	0	0	0	0	0	2	0	0	1	0	0	
Landings		Argentina	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Barbados	17	24	29	26	43	15	41	33	25	25	24	15	15	0	0	33	0	0	0	6	3	5	6	6	10
		Belize	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Brazil	377	211	301	91	105	75	105	217	158	106	172	407	266	80	244	90	52	55	53	36	60	71	87	49	115
		Cambodia	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Canada	0	0	0	4	4	8	8	8	5	5	3	2	1	2	5	3	2	2	1	2	1	2	3	5	3
		China PR	0	0	0	9	11	9	11	15	30	2	20	23	8	6	9	6	10	5	9	8	3	4	2	0	0
		Chinese Taipei	803	598	616	1350	907	566	441	506	465	437	152	178	104	172	56	44	54	38	28	20	28	15	7	7	10
		Costa Rica	0	0	0	0	0	0	0	0	3	14	0	0	1	0	0	0	0	0	0	0	0	0	0	0	
		Cuba	10	10	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	
		Côte d'Ivoire	0	0	0	0	0	1	2	1	5	1	2	2	3	1	1	1	1	3	2	0	1	0	1	1	1
		EU.España	26	23	26	26	36	151	93	101	119	186	61	6	22	64	58	51	46	32	16	111	4	34	37	93	113
		EU.France	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	1	5	19	30	22	2	35	40	11	18	25	10	9	7
		Gabon	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Ghana	17	14	22	1	2	1	3	7	6	8	21	2	1	1	1	0	0	4	4	0	1	1	1	0	**0**
		Grenada	0	0	0	0	0	0	0	0	0	1	15	8	14	33	10	12	11	17	14	0	0	0	0	0	
		Honduras	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Japan	122	248	82	92	57	112	58	56	40	83	56	16	33	36	34	39	21	34	43	41	31	42	24	13	15
		Korea Rep.	57	10	8	43	23	59	23	0	0	0	0	0	11	40	7	0	113	96	78	43	43	0	0	0	**0**
		Liberia	0	0	0	0	0	1	1	3	8	4	3	4	3	0	0	0	0	0	0	0	0	0	0	0	
		Mexico	0	0	2	8	8	3	5	6	11	18	44	15	15	28	25	16	13	14	19	20	28	36	30	20	26
		Mixed flags (FR+ES)	11	10	12	11	9	7	7	9	8	12	13	12	13	13	11	10	9	10	12	12	37	0	0	0	
		NEI (BIL)	0	0	0	0	0	0	0	0	0	34	77	4	30	134	42	37	170	204	199	0	0	0	0	0	
		NEI (ETRO)	0	0	114	214	237	285	359	526	498	322	180	11	9	0	0	0	0	0	0	0	0	0	0	0	
		Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Philippines	0	0	0	0	0	0	0	1	12	0	0	0	0	0	0	0	0	1	0	2	2	0	0	0	**0**
		S. Tomé e Príncipe	26	24	17	21	21	30	45	40	36	37	37	37	37	21	33	29	0	36	37	38	39	40	41	42	17
		South Africa	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		St. Vincent and Grenadines	0	0	1	0	0	0	0	0	0	0	0	0	44	0	0	0	0	0	0	0	0	0	0	0	**0**
		Sta. Lucia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	1
		Togo	0	0	0	0	0	0	0	0	1	1	2	0	2	0	0	0	0	0	0	0	0	0	0	0	
		Trinidad and Tobago	3	0	1	11	18	8	32	10	13	4	2	5	12	6	6	5	12	10	11	15	14	39	33	38	32
		U.S.A.	13	11	19	13	7	12	8	5	5	1	3	6	1	1	1	1	0	2	2	2	26	1	4	2	2
		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	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	0	1	0	0	0	0	0	0	0	0	
		Uruguay	1	3	0	3	0	1	24	22	0	0	0	1	9	2	5	9	3	0	5	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	
		Venezuela	163	276	362	236	286	270	177	310	228	178	182	215	168	136	156	190	131	63	128	116	160	121	75	89	104
Discards		Brazil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	19	1	0	0	0	0	0	0	
		Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	
		Korea Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	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.	90	88	66	42	100	65	70	33	58	41	18	33	17	27	17	10	8	10	14	8	36	21	10	11	8
		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	

EU-France 2015 Task I: last revision (arriving after the species groups deadline) not included in the table.

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 SSByr > SSB_{MSY} and Fyr < F_{MSY} for each year (yr) under different constant catch scenarios (TAC tons).

$F<F_{MSY}$

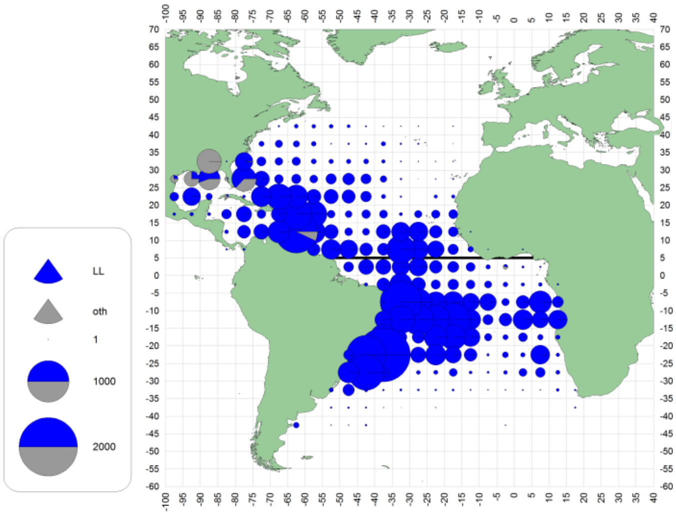
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
0	100	100	100	100	100	100	100	100	100	100
200	100	100	100	100	100	100	100	100	100	100
400	73	74	75	77	79	79	81	82	84	85
600	9	11	12	12	13	14	16	16	17	19
800	0	0	0	0	1	1	1	1	1	1
1000	0	0	0	0	0	0	0	0	0	0
1200	0	0	0	0	0	0	0	0	0	0
1400	0	0	0	0	0	0	0	0	0	0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

$B>B_{MSY}$

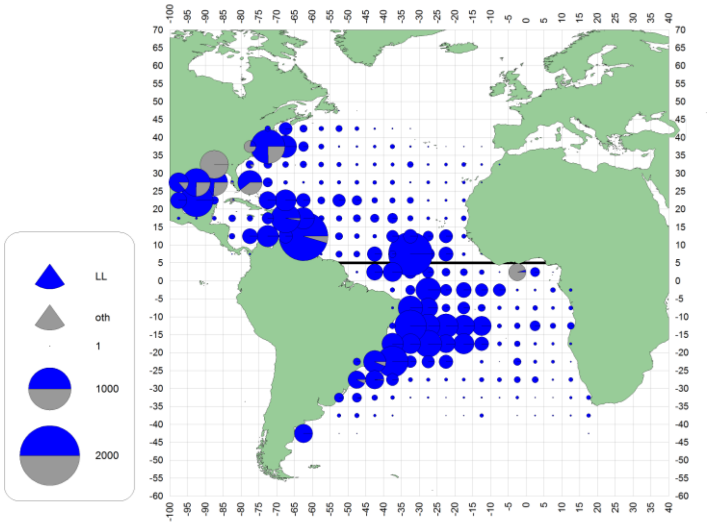
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
0	0	0	0	0	0	0	0	1	1	2
200	0	0	0	0	0	0	0	0	1	1
400	0	0	0	0	0	0	0	0	0	0
600	0	0	0	0	0	0	0	0	0	0
800	0	0	0	0	0	0	0	0	0	0
1000	0	0	0	0	0	0	0	0	0	0
1200	0	0	0	0	0	0	0	0	0	0
1400	0	0	0	0	0	0	0	0	0	0
1600	0	0	0	0	0	0	0	0	0	0

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

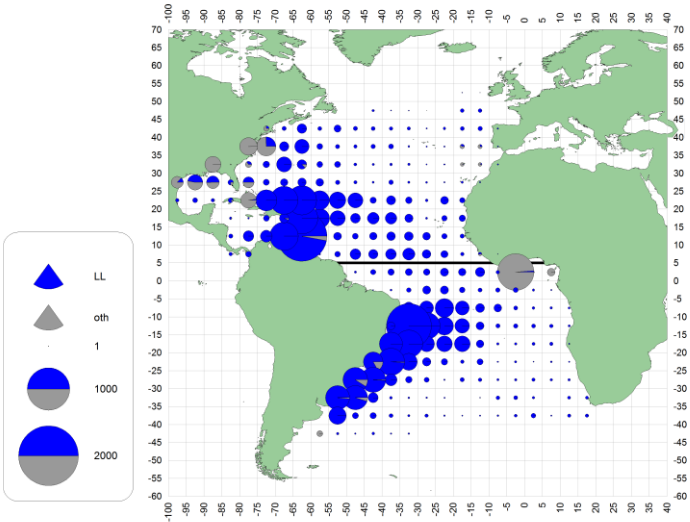
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
0	0	0	0	0	0	0	0	1	1	2
200	0	0	0	0	0	0	0	0	1	1
400	0	0	0	0	0	0	0	0	0	0
600	0	0	0	0	0	0	0	0	0	0
800	0	0	0	0	0	0	0	0	0	0
1000	0	0	0	0	0	0	0	0	0	0
1200	0	0	0	0	0	0	0	0	0	0
1400	0	0	0	0	0	0	0	0	0	0
1600	0	0	0	0	0	0	0	0	0	0



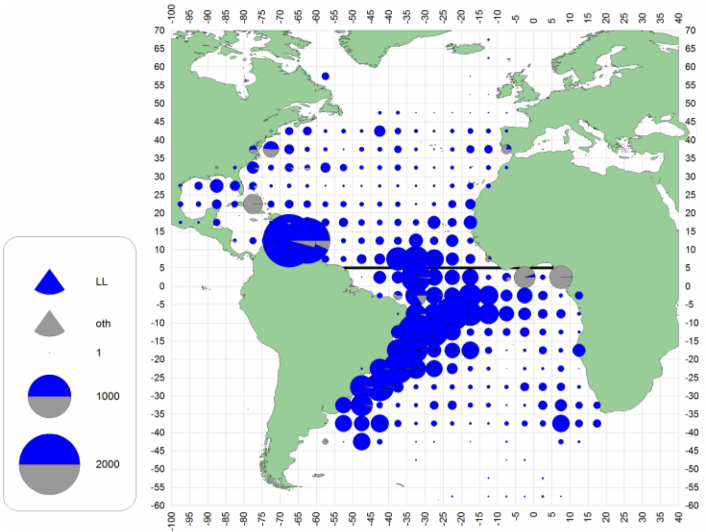
a. WHM (1960-69)



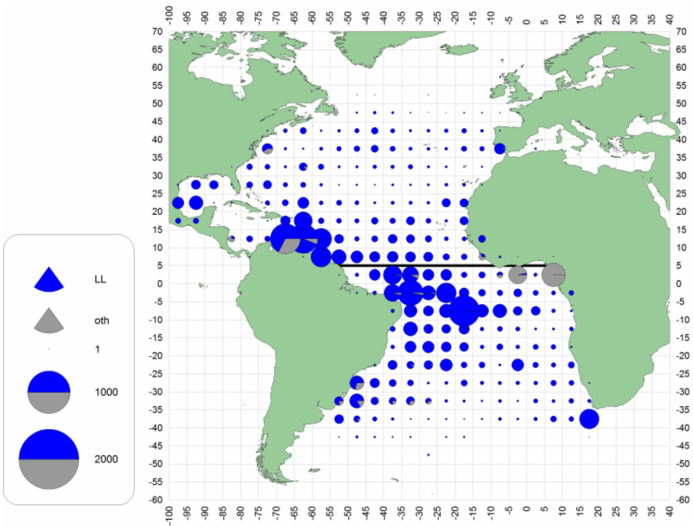
b. WHM (1970-79)



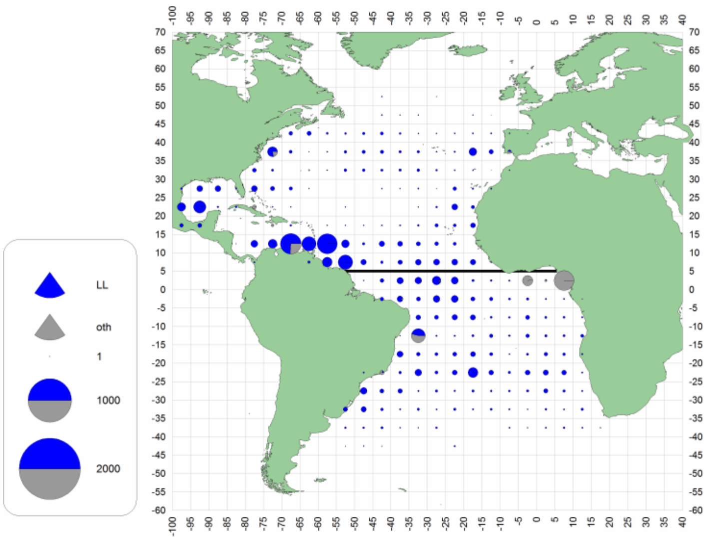
c. WHM (1980-89)



d. WHM (1990-99)

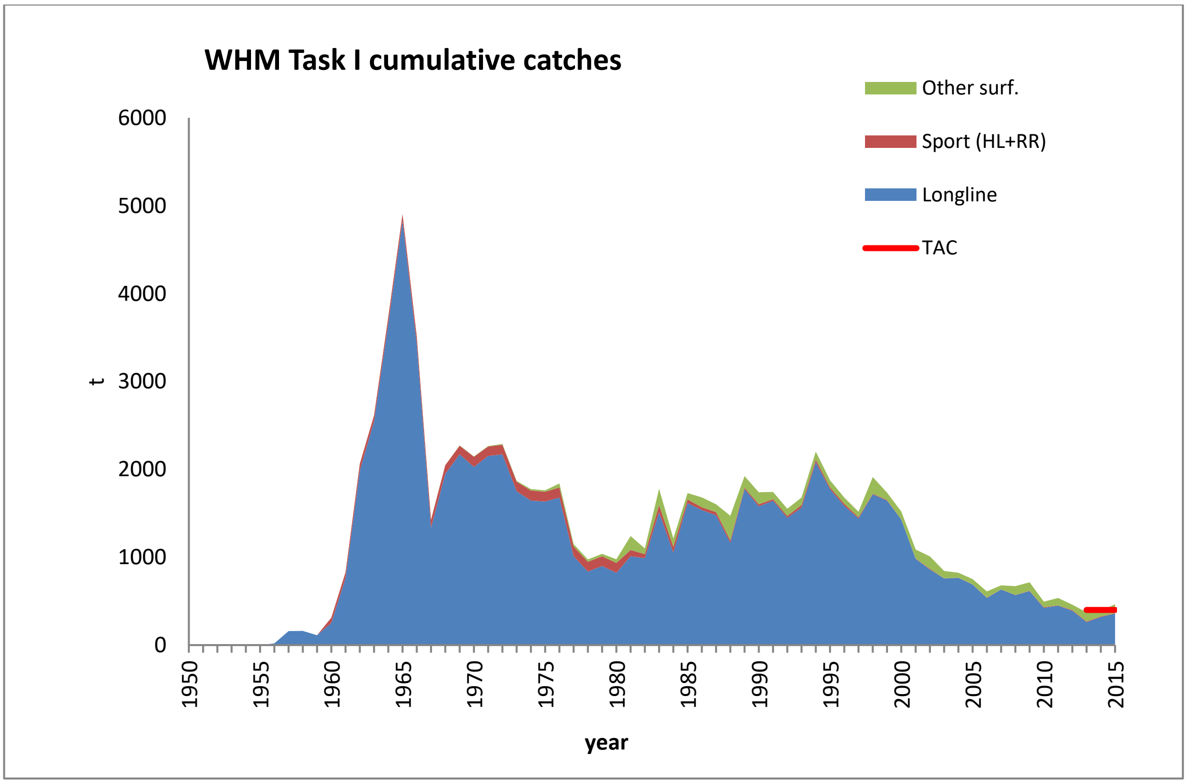


e. WHM (2000-09)

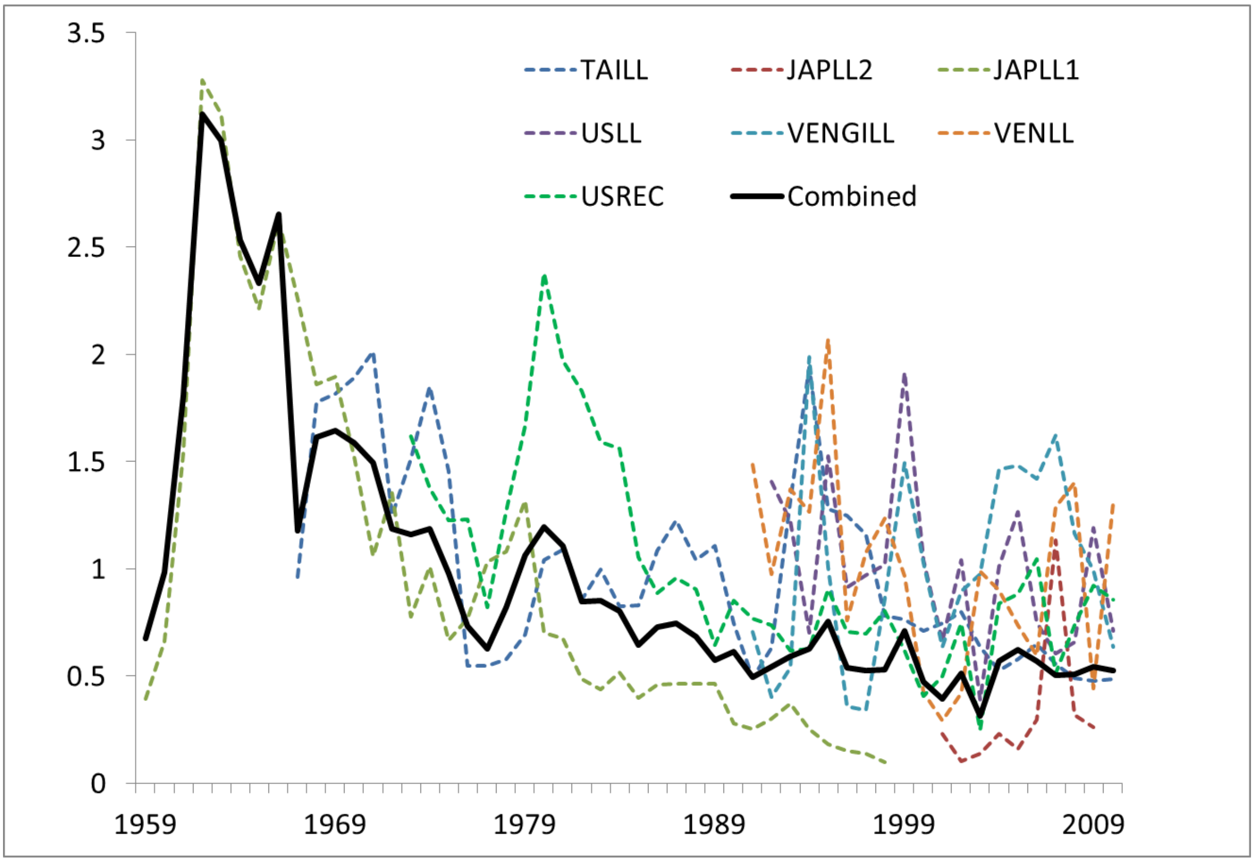


f. WHM (2010-14)

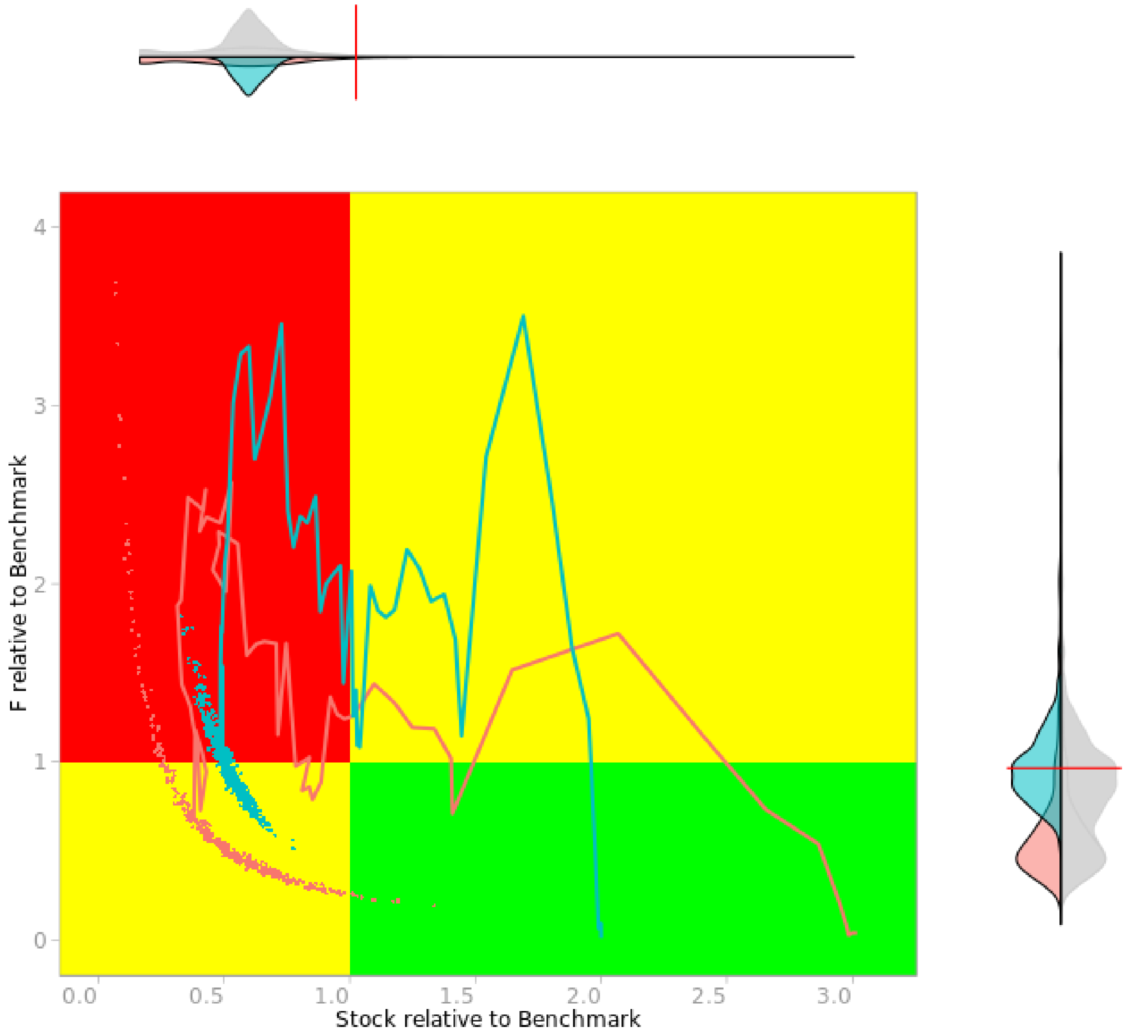
WHM-Figure 1. Geographic distribution of white marlin total catches by decade (last decade only covers 5 years).



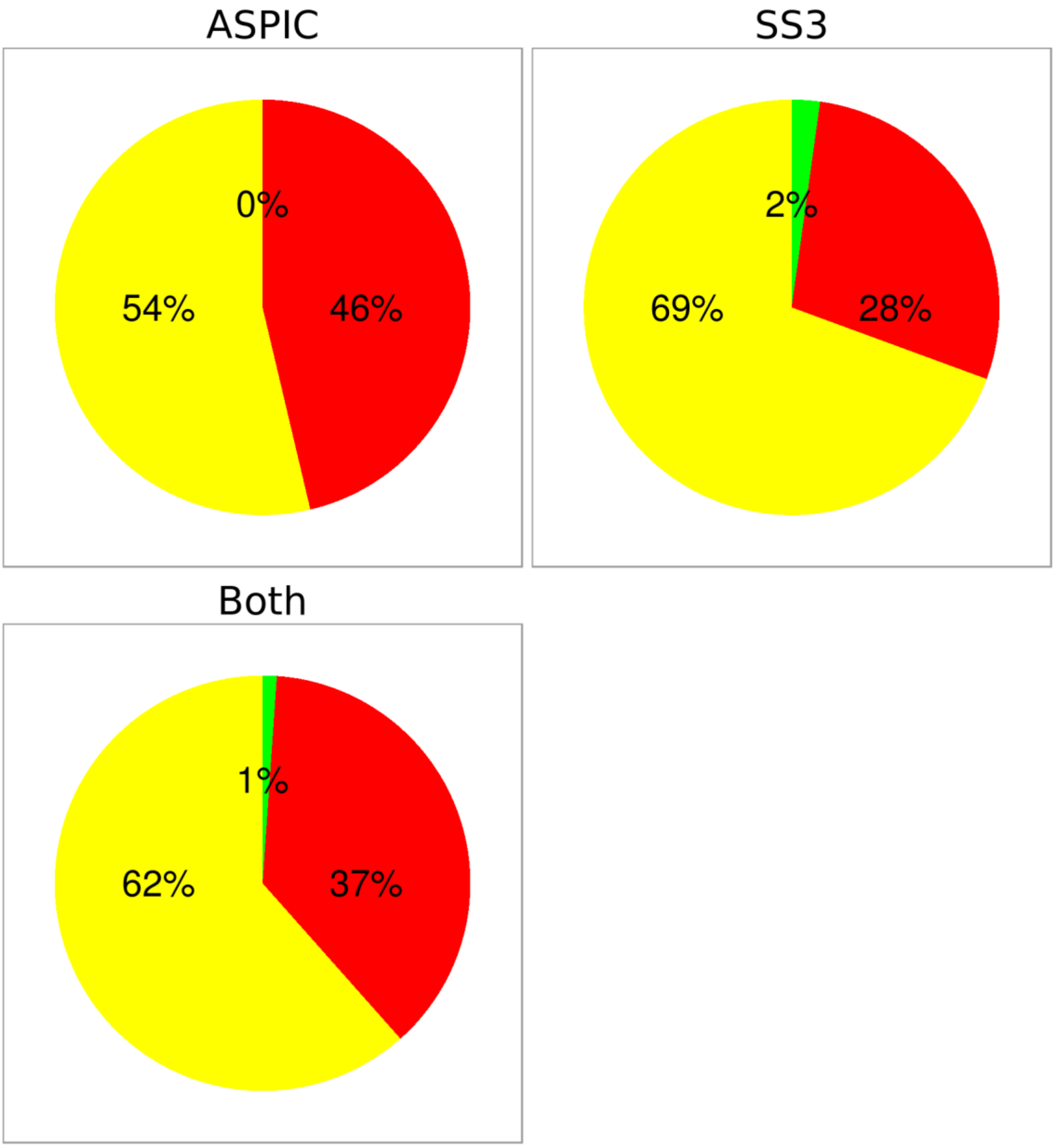
WHM-Figure 2. Total catch of white marlin reported in Task I for the period 1956-2015.



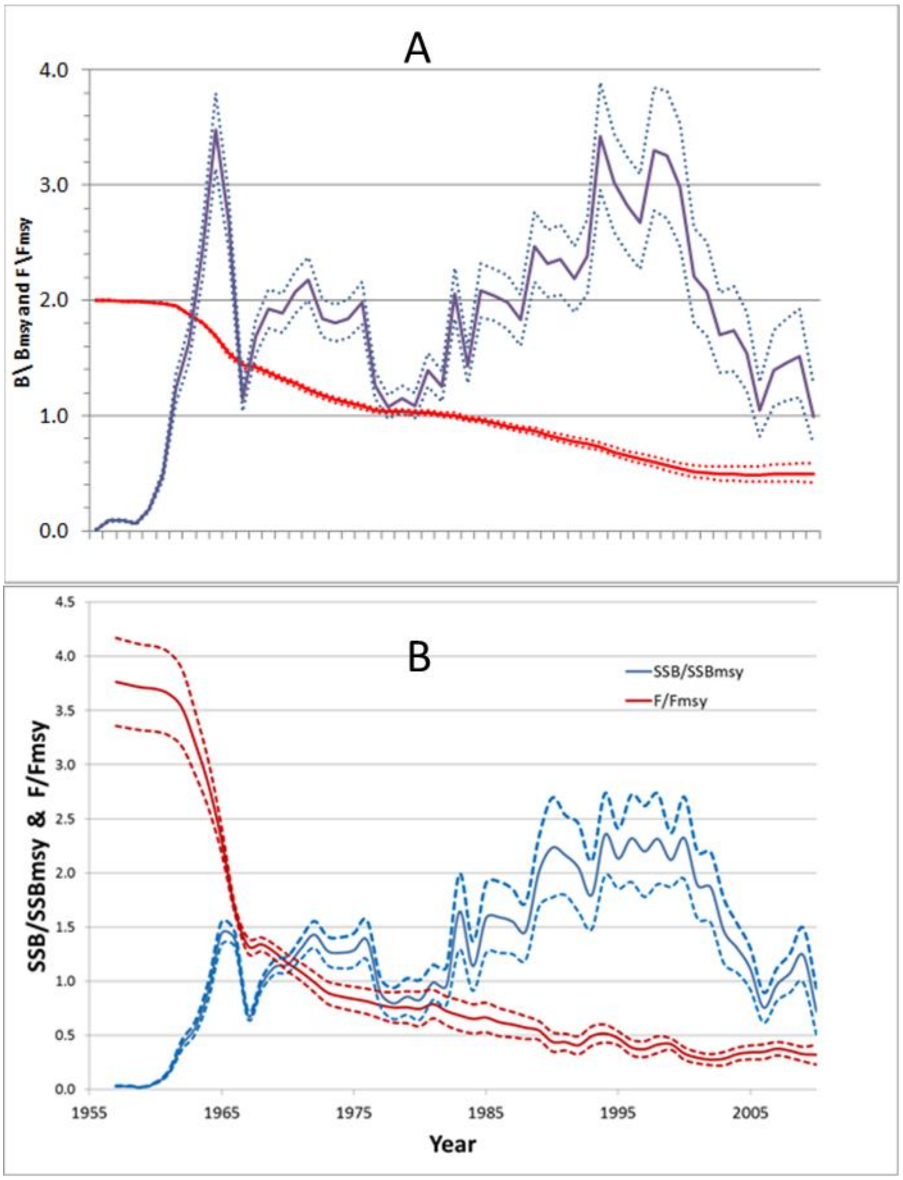
WHM-Figure 3. White marlin indices of abundance presented and selected during the meeting. For graphing purposes the indices were scaled to their respective mean value for the period 1990-2010.



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 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 of catch is apparent since 2008, mainly due to a decreased catch by the surface fisheries (gillnet and purse seine). The total catch in 2015 was 1,271 t, and the average catch in the last five years is about 1,350 t, close to 50% below the historical average of 2,302 t recorded in 1975-2009.

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 2,098 t in 2002 (**SAI-Table 1**; **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. The total catch in 2015 was 892 t, and the average catch in the last five years was about 1,083 t, below the historical average of 1,584 t recorded in 1991-2009, after the inclusion of the artisanal fisheries.

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

No ICCAT regulations for sailfish are in effect, however, some countries have established domestic regulations to limit the catch of sailfish. Among these regulations are: 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, 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 Committee recommends at a minimum that catches should not exceed current levels. Furthermore, taking into account that overfishing may be occurring, the Commission may consider reductions 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 (2015)	892 t	1,271 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]	0.33-2.85 [3]
	0.63 (0.42 – 2.02)[2]	
Overfished	Not likely	YES
Overfishing	Not likely	Possibly
Management Measures in Effect	None	None

[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. (v1, 2016-09-30)

			1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
TOTAL			2701	3239	3228	2292	2445	3023	2604	2975	2922	3976	4603	4411	4137	4335	4058	3854	4137	3962	3753	3088	2821	2859	2285	2081	2163
	ATE		1476	1780	1815	1172	1234	1881	1337	1362	1342	1978	2761	2313	2625	2587	2194	1901	2542	2196	2062	1821	1460	1533	1311	1218	1271
	ATW		1225	1459	1413	1120	1211	1142	1267	1613	1580	1998	1842	2098	1512	1748	1864	1953	1595	1765	1691	1267	1361	1325	974	863	892
Landings	ATE	Longline	47	104	256	151	189	196	206	275	273	195	269	354	322	261	294	566	555	596	555	483	454	485	430	482	466
		Other surf.	1000	983	1111	954	910	1504	644	859	883	1231	1725	1862	2022	2106	1756	1289	1798	1488	927	895	870	985	764	727	749
		Sport (HL+RR)	429	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	268	491	619	407	425	360	427	765	731	1275	1368	1382	1066	1098	1492	1504	1130	1246	1220	1169	1240	1132	856	737	861
		Other surf.	521	599	498	468	410	482	433	553	615	602	402	603	440	642	368	442	452	502	457	92	101	154	86	106	22
		Sport (HL+RR)	371	333	233	217	348	230	350	267	163	76	60	106	0	0	0	2	6	7	4	2	10	19	20	9	3
Discards	ATE	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	
		Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	ATW	Longline	64	36	63	28	29	69	57	27	72	45	11	7	5	7	3	5	8	9	10	4	10	20	12	11	6
		Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	
Landings	ATE	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	0	0	0	0	
		Benin	20	21	20	20	20	19	6	4	5	5	12	2	2	5	3	3	4	0	0	0	0	0	0	0	
		Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		China PR	0	0	0	3	3	3	3	5	9	4	5	11	4	4	8	16	8	1	4	5	2	4	1	1	2
		Chinese Taipei	4	80	157	38	58	24	56	44	66	45	50	62	49	15	25	36	109	121	80	21	51	54	41	17	16
		Cuba	184	200	77	83	72	533	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Côte d'Ivoire	38	69	40	54	66	91	65	35	80	45	47	65	121	73	93	78	52	448	74	24	108	192	80	99	55
		EU.España	13	3	42	8	13	42	38	15	20	8	150	210	183	148	177	200	192	206	280	174	154	201	203	302	333
		EU.Portugal	0	1	2	1	2	1	2	27	53	11	3	8	13	19	31	136	43	49	103	170	121	70	109	33	41
		EU.United Kingdom	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**
		Gabon	0	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	463	297	693	450	353	303	196	351	305	275	568	592	566	521	542	282	420	342	358	417	299	201	220	191	99
		Guinea Ecuatorial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	1	3
		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	6	15	27	45	52	47	19	58	16	26	6	20	22	70	50	62	144	199	94	115	142	157	71	118	72
		Korea Rep.	22	2	2	5	5	11	4	0	0	0	0	0	0	0	0	0	0	0	1	0	5	0	6	10	2
		Liberia	0	0	0	0	33	85	43	136	122	154	56	133	127	106	122	118	115	0	0	0	0	0	0	0	
		Maroc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	
		Mixed flags (FR+ES)	174	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	0	28	269	408	213	55	1	105	43	20	11	0	0	0	0	0	
		NEI (ETRO)	0	0	27	51	57	69	86	127	120	77	43	3	2	16	7	8	10	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	0	1	0	0	0	0	0	0	0	0	0	
		S. Tomé e Príncipe	84	78	81	88	92	96	139	141	141	136	136	136	136	515	346	292	384	114	119	121	124	127	131	134	312
		Senegal	466	860	462	162	167	240	560	260	238	786	953	240	673	567	463	256	737	446	630	484	174	247	165	37	60
		Sierra Leone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	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	4	0	0	0	1	5	0	0	0	0	0	0	0	
		Togo	0	0	0	0	0	0	9	22	36	23	62	55	95	135	47	31	71	0	0	0	0	0	0	0	
		U.S.A.	2	4	1	1	3	1	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	
	ATW	Aruba	9	5	10	10	10	10	10	10	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Barbados	29	42	50	46	74	25	71	58	44	44	42	26	27	26	42	58	42	0	0	18	36	36	39	44	54
		Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	12	0	0	52	8	0	4	0	
		Brazil	90	351	243	129	245	310	137	184	356	598	412	547	585	534	416	139	123	268	433	78	137	108	38	57	51
		China PR	0	0	0	3	3	3	3	3	9	4	3	1	0	1	0	0	0	1	2	1	1	1	0	1	1
		Chinese Taipei	37	17	112	117	19	19	2	65	17	11	33	31	13	8	21	5	14	10	11	6	9	26	7	3	11
		Cuba	83	70	42	46	37	37	40	28	196	208	68	32	18	50	72	47	56	0	0	0	0	0	0	0	
		Curaçao	10	10	15	15	15	15	15	15	15	15	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	5	3	0	1	0	3	3	4	2	0	2	0	0	0	
		Dominican Republic	31	98	50	90	40	40	101	89	27	67	81	260	91	144	165	133	147	0	0	0	0	0	0	0	
		EU.España	8	13	13	19	36	5	30	42	7	14	354	449	196	181	113	148	248	393	451	306	233	239	229	244	311
		EU.Portugal	0	0	0	0	0	0	0	0	0	7	0	2	12	12	110	19	53	101	48	19	9	4	0	0	
		Grenada	316	310	246	151	119	56	83	151	148	164	187	151	171	112	147	159	174	216	183	191	191	191	191	191	191
		Japan	27	0	1	8	2	4	17	3	10	12	3	3	10	5	22	4	1	33	43	36	13	16	7	23	25

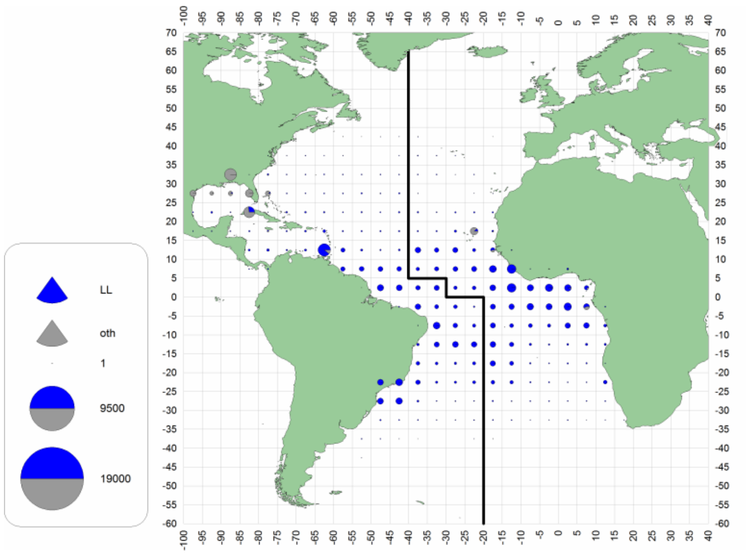
			1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
		Korea Rep.	1	2	3	4	4	12	4	0	0	0	0	0	0	0	0	0	0	0	1	0	45	4	1	1	0
		Mexico	0	0	2	19	19	10	9	65	40	118	36	34	45	51	55	41	46	45	48	34	32	51	63	42	35
		NEI (BIL)	0	0	0	0	0	0	0	0	0	297	268	0	0	0	0	68	81	252	17	0	0	0	0	0	
		NEI (ETRO)	0	0	15	27	30	36	46	67	64	41	23	1	1	9	4	4	6	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
		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	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		St. Vincent and Grenadines	1	4	4	4	2	1	3	0	1	0	2	164	3	86	73	59	18	13	8	7	4	4	3	4	1
		Sta. Lucia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	2	2	3	2	3	1
		Trinidad and Tobago	3	3	1	2	1	4	10	25	37	3	7	6	8	10	9	17	13	32	16	16	38	72	34	29	51
		U.S.A.	343	294	202	179	345	231	349	267	163	76	58	103	0	0	0	0	0	3	3	0	0	7	3	2	2
		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	
		Venezuela	175	205	341	223	180	255	279	515	367	261	249	277	327	509	607	1042	549	382	416	498	590	543	341	210	152
Discards	ATE	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	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	0	0	0	0	0	
	ATW	Brazil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
		Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	
		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	
		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.	64	36	63	28	29	69	57	27	72	45	11	7	5	7	4	5	7	10	10	4	10	19	11	11	6

EU-France 2015 Task I: last revision (arriving after the species groups deadline) not included in the table.

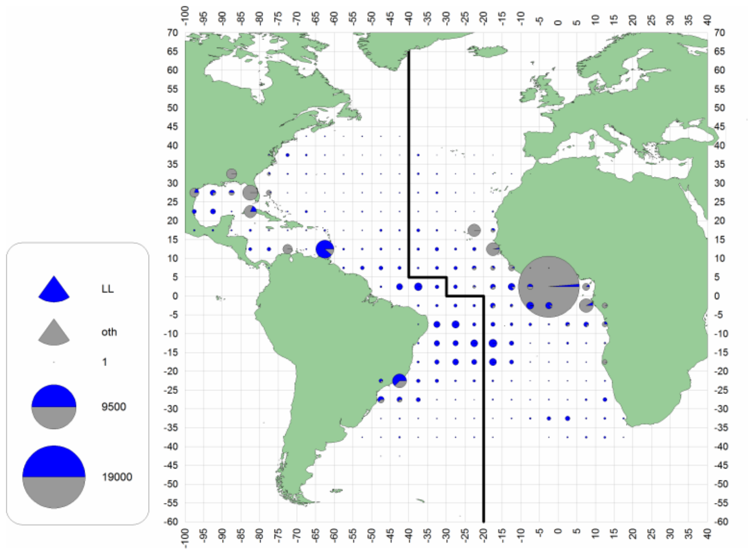
SPF-Table 1. Estimated catches (t) of longbill spearfish (*Tetrapturus pfluegeri*) by area, gear and flag (v1, 2016-09-30)

			1991	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
TOTAL			214	273	540	320	240	165	201	266	306	278	188	179	133	188	169	340	167	166	140	245	147	229	133	76	77
	ATE		131	255	419	198	207	128	194	192	255	178	79	84	50	51	68	75	66	60	78	110	66	169	94	16	17
	ATW		83	19	121	122	33	37	7	74	51	100	110	95	84	137	101	265	102	106	62	135	81	60	39	60	60
Landings	ATE	Longline	24	163	307	100	129	69	126	106	174	118	78	84	50	51	68	75	66	60	78	110	66	169	94	16	16
		Other surf.	107	92	112	98	78	59	68	86	81	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	ATW	Longline	83	19	121	122	26	34	7	74	51	100	110	95	84	137	101	265	102	106	62	135	81	60	39	54	60
		Other surf.	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
		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	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	0
	ATW	Longline	0	0	0	0	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Landings	ATE	China PR	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Chinese Taipei	6	135	263	63	97	41	94	73	112	75	52	62	25	15	25	37	22	2	6	15	7	6	0	0	1
		EU.España	0	0	12	0	5	1	1	9	29	14	7	5	0	0	3	3	0	2	7	29	19	17	8	13	15
		EU.Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	8	2	6	25	9	18	0	0	
		Japan	10	27	31	36	26	25	30	22	33	29	20	16	25	36	40	21	36	53	59	35	31	127	85	3	0
		Korea Rep.	8	1	1	1	1	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Mixed flags (FR+ES)	107	92	112	98	78	59	68	86	81	60	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	6	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	**0**
	ATW	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	3	0	0	0	
		Brazil	0	0	0	0	0	0	0	0	0	27	56	39	3	0	0	5	4	0	0	0	24	4	11	6	5
		Chinese Taipei	36	16	111	116	19	18	2	64	16	11	24	39	12	11	20	17	20	0	0	6	14	3	1	23	1
		EU.España	0	0	5	0	1	0	0	0	24	50	22	5	25	0	5	14	0	2	5	3	4	3	10	11	20
		EU.Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	15	44	10	10	0	3	0	0	
		Japan	46	1	1	2	3	4	1	8	11	11	3	12	40	41	58	54	25	45	26	71	20	19	3	4	0
		Korea Rep.	0	1	2	4	4	10	4	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	1	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	82	0	135	23	13	7	8	5	4	3	3	1
		Trinidad and Tobago	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		U.S.A.	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**
		UK.Bermuda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Venezuela	0	0	1	0	0	1	0	1	0	0	4	0	3	3	17	5	15	3	14	24	12	24	11	13	32
Discards	ATE	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	
		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
	ATW	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	
		U.S.A.	0	0	0	0	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

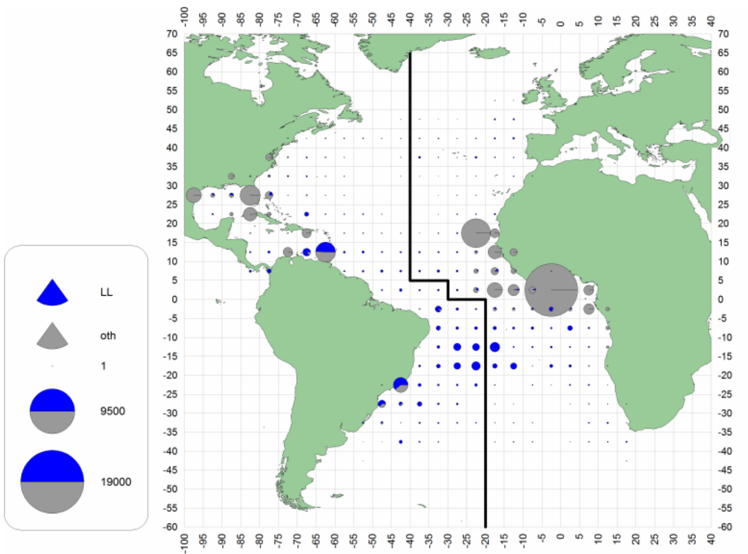
EU-France 2015 Task I: last revision (arriving after the species groups deadline) not included in the table.



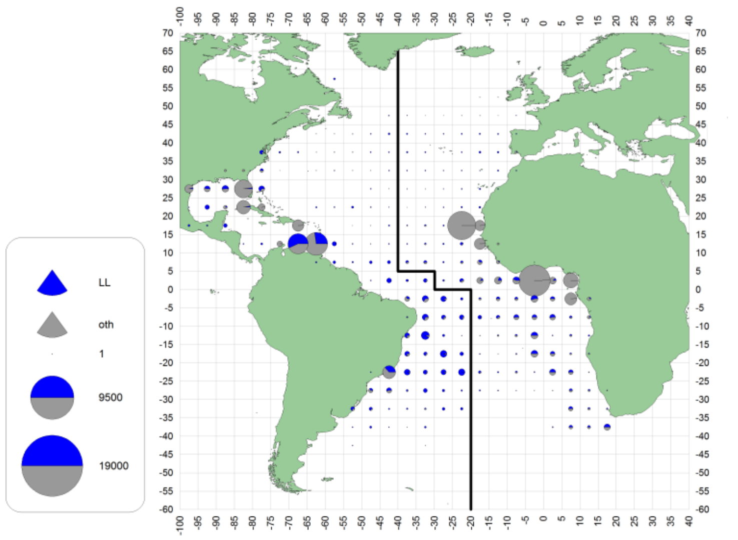
a. SAI(1960-69)



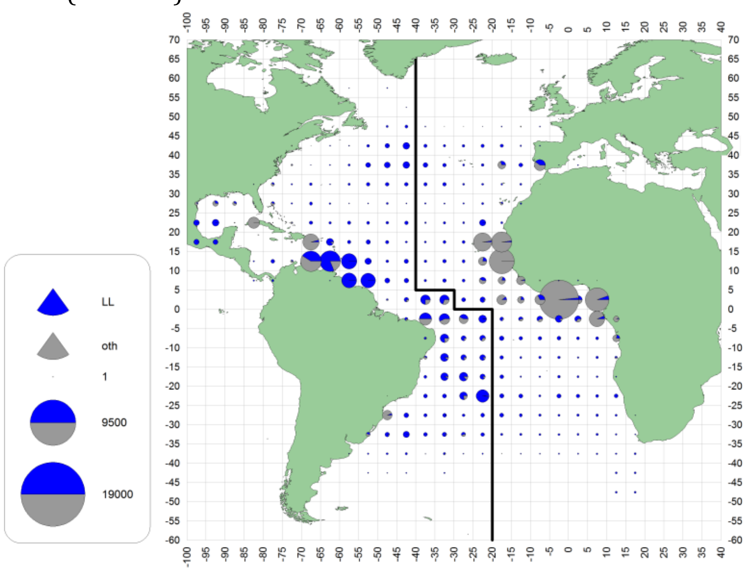
b. SAI(1970-79)



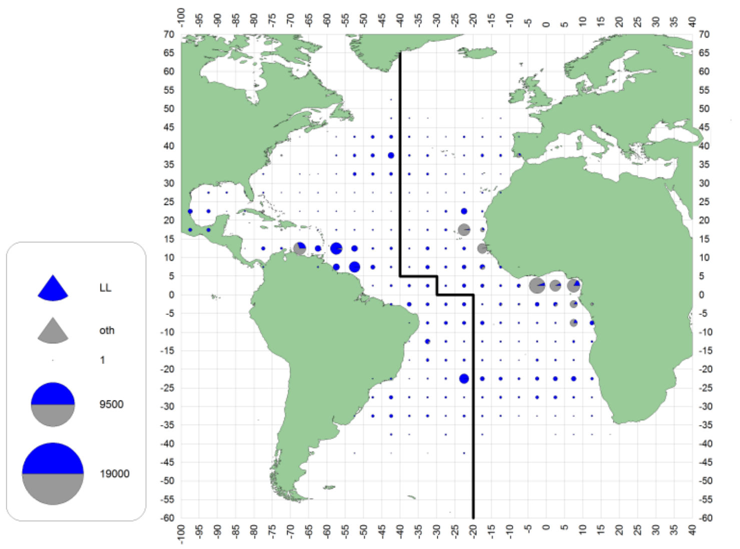
c. SAI(1980-89)



d. SAI(1990-99)

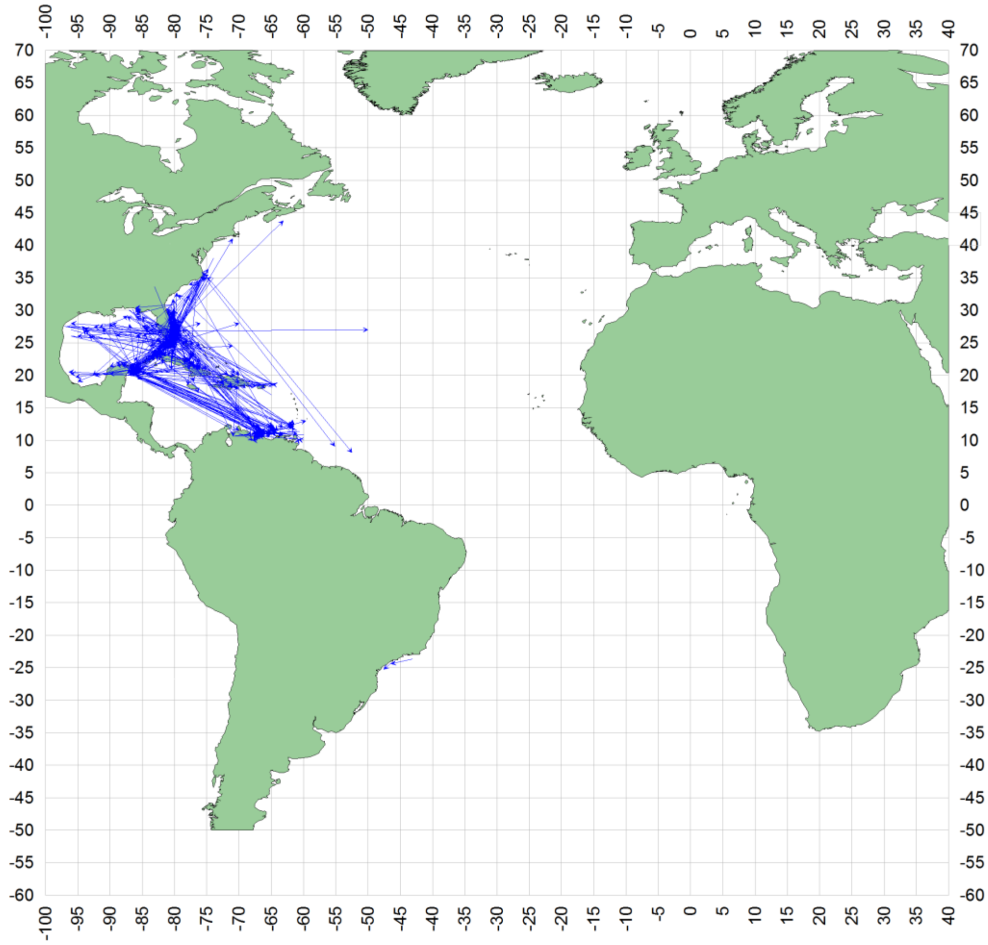


e. SAI (2000-09)

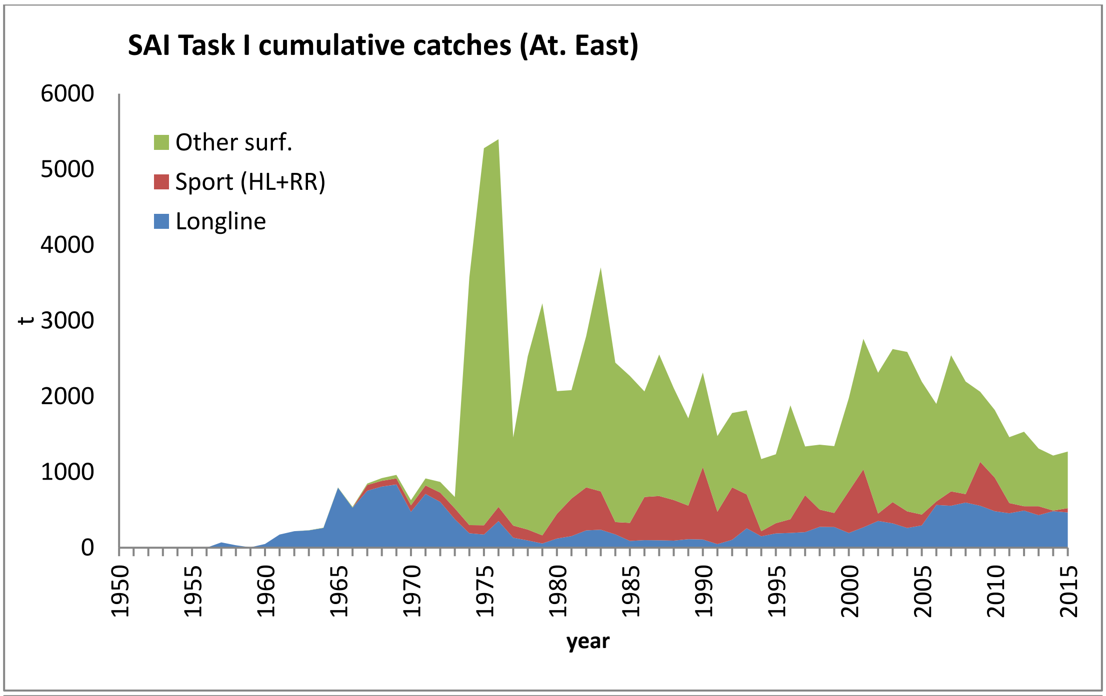


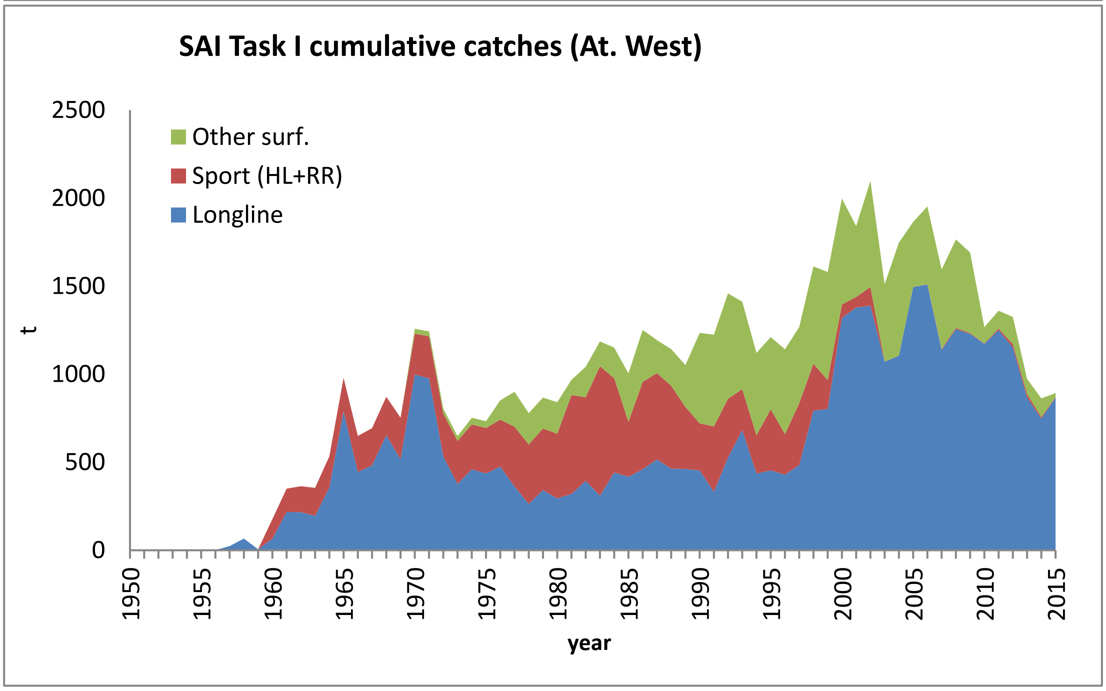
f. SAI(2010-14)

SAI-Figure 1. Geographic distribution of sailfish total catches by decade (last decade only covers 5 years). The dark line denotes the separation between stocks.

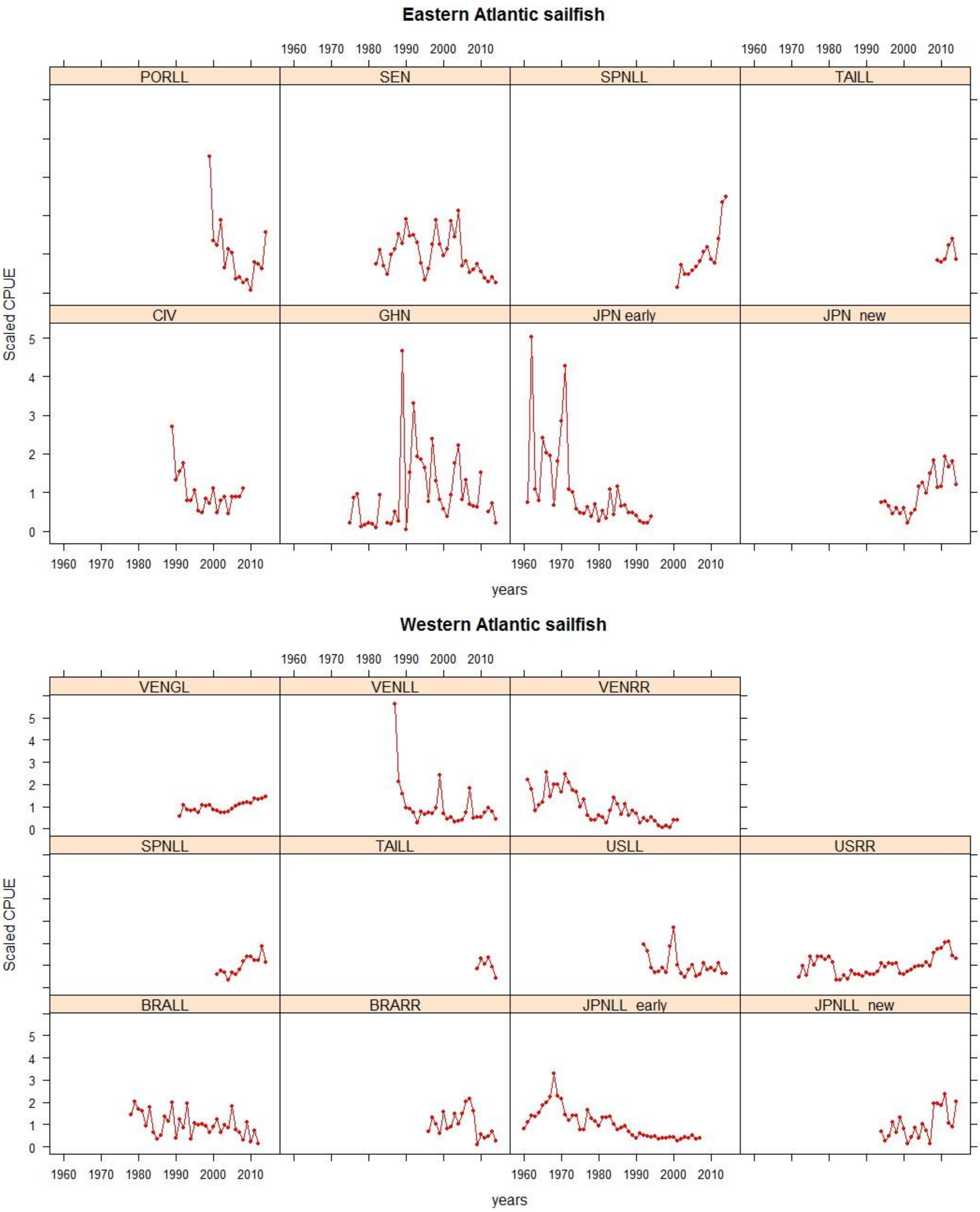


SAI-Figure 2. Conventional tag returns for Atlantic sailfish. Lines join the locations of release and recapture.

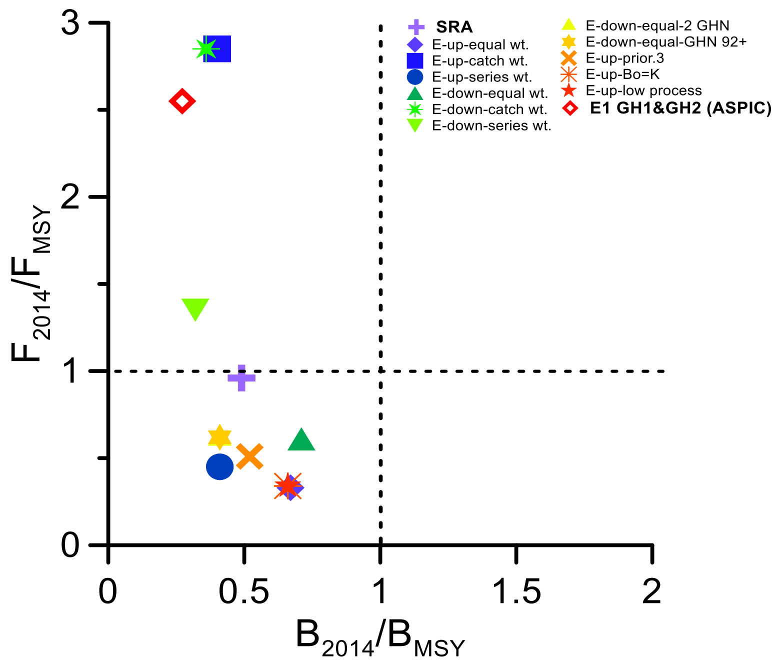




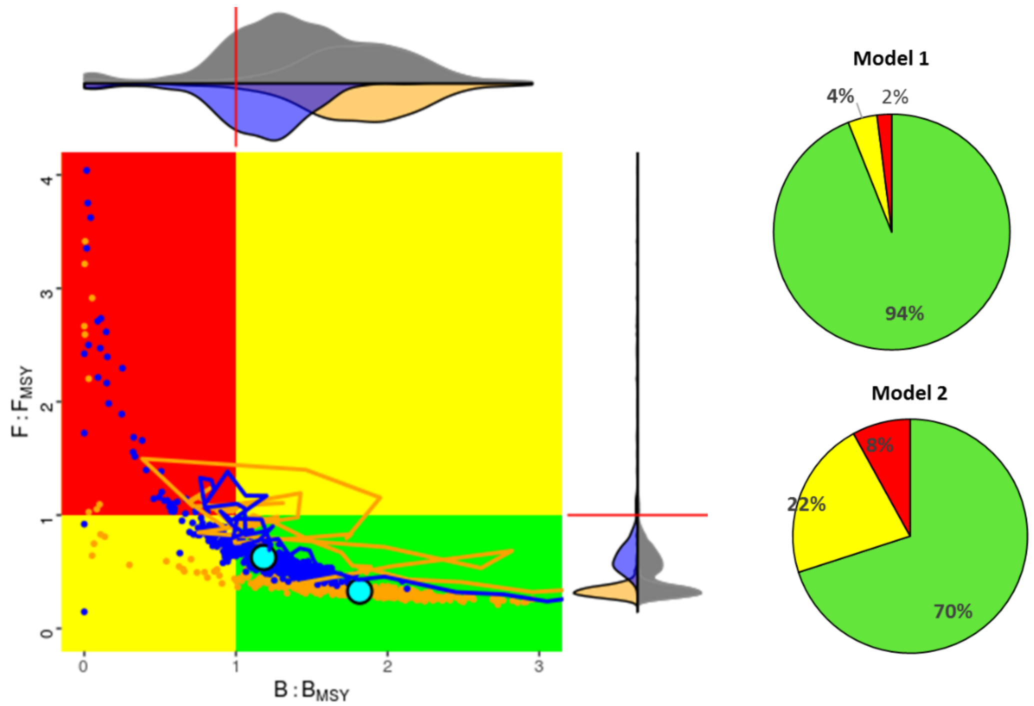
SAI-Figure 3. Task I catches of sailfish for each of the two Atlantic stocks, East and West.



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 September 2013, by means of applying statistical modelling to the available data up to 2011. Complete information on the assessment can be found in the Report of the 2013 ICCAT Swordfish Stock Assessment Meeting. Other information relevant to Atlantic swordfish is presented in the Report of the Sub-Committee on Statistics, included as **Appendix 10** to this SCRS Report, and recommendations pertinent to Atlantic swordfish are presented in Item 17.

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 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 at 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.

The use of area specific CPUE information (rather than flag specific) indicated the possible geographic redistribution of north Atlantic swordfish. Several area specific residual patterns had significant relationships with the Atlantic Multidecadal Oscillation (AMO). These relationships of the eastern Atlantic were opposite to those in the western Atlantic. This pattern mimicked very closely the spatial mapping 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 analysis could be conducted.

For both the North and South Atlantic many 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. Splitting the indices reduces the abundance signal and, to the degree possible, maintaining continuity of the indices will increase the reliability of the assessment results.

Total Atlantic

The total Atlantic estimated catch (landings plus dead discards) of swordfish (North and South, including reported dead discards) in 2015 (22,045 t) is on the levels of (-0.3%) of the reported catch in 2014 (22,101 t). As a small number of countries have not yet reported their 2015 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 2015 (11,108 t) represents a 45% decrease since the 1987 peak in North Atlantic landings (20,236 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, EU-Portugal and Canada, 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 assessment models (Japan, EU-Portugal, Morocco, Canada, EU-Spain and USA). Trends in standardized CPUE series by fleets contributing to the production model are shown in **SWO-ATL-Figure 4**. Most of the series have an increasing trend since the late 1990s, but the U.S. catch rates remained relatively flat. There have been some recent changes in United States regulations that may have impacted catch rates, but these effects remain unknown. The combined index is shown in **SWO-ATL-Figure 4**, rescaled to the final fishery specific indices.

The most frequently occurring ages in the catch include ages 2 and 3.

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 (20,236 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 2015, the 10,937 t reported catches were about 50% lower than the 1995 reported level (**SWO-ATL-Table 1**). The SCRS received reports from Brazil and Uruguay that those CPCs 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.

Six data sets of relative abundance indices (Brazil, Japan, Spain, Uruguay, South Africa and Chinese Taipei) were made available to the Committee. These CPUE indices were standardized using various analytical approaches. The standardized CPUE series presented show different trends and high variability which indicates that at least some are not depicting trends in the abundances of the stock. The available indices are illustrated in Figure **SWO-ATL-Figure 5**. Two combined indices were produced (**SWO-ATL-Figure 6**), one excluding Brazil and the other excluding both Brazil and Chinese Taipei data series.

Discards

Since 1991, several fleets have reported dead discards (see **SWO-ATL-Table 1**). The volume of Atlantic-wide reported discards has ranged from a minimum of 157 t in 2009 to a maximum of 1,139 t in 2000, with 149 t reported for 2015). The Committee expressed concern due to the low percentage of fleets that have reported annual dead discards (in t) in recent years.

SWO-ATL-3. State of the stocks

North Atlantic

Two stock assessment platforms were used to provide estimates of stock status for the North Atlantic swordfish stock, non-equilibrium surplus production model (ASPIC) and Bayesian Surplus Production Model (BSP2).

Results from the North Atlantic base case ASPIC model are shown in **SWO-ATL-Figure 7**. The estimated relative biomass trend shows a consistent increase since 1997. The bias corrected deterministic outcome indicates that the stock is at or above B_{MSY} (**SWO-ATL-Figure 8**). The relative trend in fishing mortality shows that the level of fishing peaks in 1995, followed by a decrease until 2001, followed by small increase in the 2002-2005 period and downward trend since then (**SWO-ATL-Figure 7**). Fishing mortality has been below F_{MSY} since 2000. The estimate of stock status in 2011 is relatively similar to the estimated status in the 2009 assessment, and suggests that there is a greater than 90% probability that the stock is at or above B_{MSY}. However, it is important to note that for the first time since 2002 the reported catches in 2012 (13,875 t) exceeded the TAC of 13,700 t. The most recent estimate of stock productivity is very consistent with previous estimates. The absolute biomass trajectory showed a consistent upturn from the estimated 1997 value, and the biomass values for the most recent years are near the level estimated in the mid 1980s (**SWO-ATL-Figure 9**). The high value in 1963 is not well fit as in prior evaluations. Trends in both fishing mortality and biomass are consistent with those produced by the BSP2 model, with the latter model estimating larger stock biomass and lower fishing mortality across the entire time series (**SWO-ATL-Figure 9**). Estimates of stock status from the BSP2 model are consistent with ASPIC results (**SWO-ATL-Figure 10**).

The stock is considered rebuilt, consistent with the 2009 evaluation. Compared with the 2009 ASPIC base case model, the trajectory of biomass and F ratios are similar until the late 1990s, thereafter the current model predicted slightly lower fishing mortality rates and higher relative biomass, but certainly within the estimated 80% confidence bounds (**SWO-ATL-Figure 11**).

South Atlantic

In 2009, evaluation of the status of the South Atlantic swordfish stock was assessed using a 'Catch only' model. During the 2013 stock assessment two platforms were used to provide stock status advice for the South Atlantic swordfish stock (i.e. ASPIC and BSP2).

The results of both models indicated that there was a conflicting signal for several of the indices used and substantial conflict between the landings history and the indices. Consequently the Committee had low confidence in the estimation of the absolute productivity level of the stock or on MSY-related benchmarks. Both models had similar difficulties estimating these quantities but both offered useful status advice. Consequently each platform provided a reference model on which the stock status was based.

Both models had similar trajectories of fishing mortality and biomass (**SWO-ATL-Figures 12** and **13**) but differed in their absolute levels and their status relative to benchmarks (**SWO-ATL-Figure 14**). Hence the two models differ in their view of current stock status, with ASPIC estimating the stock to be overfished (B_{2011}/B_{MSY} =0.98) but not undergoing overfishing (F_{2011}/F_{MSY} =0.84), and BSP, neither overfished (B_{2011}/B_{MSY} =1.38), nor overfishing (F_{2011}/F_{MSY} =0.47). Though, it should be noted that there is considerable uncertainty around any of these point estimates.

The groups choose to base stock status determination on a combination of model output and ancillary information, of which two pieces of information are informative. First, total removals (1950-2011) for the South Atlantic stock have been only 73% of the total removals for the North Atlantic stock for the same time period. Second the mean weight for the South (**SWO-ATL-Figure 15**) is larger than for the North. Assuming similar production dynamics, both indicators would suggest a lower exploitation rate for the South stock than for the North. Hence, while the Committee does not believe it can estimate the absolute productivity of the stock without improved scientific information, the Committee believes that the stock is not overfished.

SWO-ATL-4. Outlook

North Atlantic

Based on the currently available information to the Committee, the ASPIC base model was projected to the year 2021 under constant TAC scenarios of 8 to 20 thousand tons. Projections used reported catch as of September 5, 2013 for 2012. For those CPCs whose reported catch was not yet available, their catch was assumed to be the average of the last three years (2009-2011), giving a total catch of 14,038 t. Median trajectories for biomass and fishing mortality rate for all of the future TAC scenarios are plotted in **SWO-ATL-Figure 16**. Results from the 2013 assessment indicated that there is a greater than 90% probability that the northern swordfish stock has rebuilt to or above B_{MSY} (**SWO-ATL-Figure 8**), therefore the Commission's rebuilding plan goal has been achieved.

In 2013 it was determined that future TACs above 15,000 t would result in 50% or lower probabilities of the stock biomass remaining above B_{MSY} over the next decade (**SWO-ATL-Table 2**) as the resulting probability of F exceeding F_{MSY} for these scenarios would trend above 50% within four years. A TAC of 13,700 t would have an 83% probability of maintaining the stock and fishing mortality at a level consistent with the Convention objective over the next decade. Projections with BSP2 also used similar specifications for 2012 and 2013 yields and projected over the same time frame. Both models provide very consistent advice that TAC levels of 13,700 t would maintain the stock at a level consistent with the Convention objectives over the next decade.

South Atlantic

The Committee considered that the ASPIC and BSP estimated benchmarks were unreliable due to the conflicting signal between the catch data and the CPUE time series available to the Committee. Hence, it is unknown whether it is possible to obtain substantially higher yields from the stock as BSP suggests or whether the stock is fully exploited as suggested by ASPIC. Until improved scientific information is available in the form of more consistent indices, tagging studies to estimate fishing mortality or abundance or other improved information, this uncertainty may remain.

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. 13-02 and 15-03, which establish a three year management plan for that stocks.

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 12,057 t and exceeded the TAC in one year (2012, 13,875 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 13,618 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 10,804 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.

For the 2006-2008 period, the estimate of the percentage of swordfish reported landed (throughout the Atlantic) less than 125 cm LJFL was about 24% (in number) overall for all nations fishing in the Atlantic (28% in the northern stock and 20% in the southern stock). If this calculation is made using reported landings plus estimated dead discards, then the percentage less than 125 cm LJFL would be of the same order given the relatively small amount of discards reported. These estimates are based on the overall catch at size, which have high levels of substitutions for a significant portion of the total catch.

SWO-ATL-6. Management recommendations

North Atlantic

For continuity of advice relative to previous assessments, ASPIC results are provided in **SWO-ATL-Table 2**, which shows the ranges of total catch limits and associated probabilities associated with stock status by year. The current TAC of 13,700 t has an 83% probability of maintaining the North Atlantic swordfish stock in a rebuilt condition by 2021 almost maintaining the level of biomass. This TAC would be in accordance with Rec. 11-13, adopted by the Commission that indicates that 'For stocks that are not overfished and not subject to overfishing (i.e. stocks in the green quadrant of the Kobe plot), management measures shall be designed to result in a high probability of maintaining the stock within this quadrant'. However, the Committee acknowledges that without better direction from the Commission with regard to what constitutes a 'high probability', it cannot provide more specific advice. TACs up to 14,300 t would still have a higher than 50% probability of maintaining the stock in a rebuilt condition by 2021 but would be expected to lead to greater biomass declines.

South Atlantic

Considering the unquantified uncertainties and the lack of signal in the data for the southern Atlantic swordfish stock, and until sufficiently more research has been conducted to reduce the high uncertainty in stock status, the Committee did not have sufficient confidence in the assessment results to change the previous recommendation to limit catches to no more than 15,000 t.

ATLANTIC SWORDFISH SUMMARY

	North Atlantic	*South Atlantic*
Maximum Sustainable Yield[1]	13,660 t (13,250-14,080)[3]	Unknown
Current (2015) TAC	13,700 t	15,000 t
Current (2015) Yield[2]	11,108 t	10,937 t
Yield in last year used in assessment (2011)	12,834 t[4]	11,055 t[4]
B_{MSY}	65,060 t (54,450-76,700)	Unknown
F_{MSY}	0.21 (0.17-0.26)	Unknown
Relative Biomass (B_{2011}/B_{MSY})	1.14 (1.05-1.24)	Unknown, but likely above 1[5]
Relative Fishing Mortality (F_{2011}/F_{MSY}[1])	0.82 (0.73-0.91)	Unknown, but likely below 1[5]
Stock Status (2011)	Overfished: NO	Overfished: NO[5]
	Overfishing: NO	Overfishing: NO
Management Measures in Effect	Country-specific TACs [Rec. 13-02];	Country-specific TACs [Rec. 13-03];
	125/119 cm LJFL minimum size	125/119 cm LJFL minimum size

[1] Base Case production model (Logistic) results based on catch data 1950-2011.
[2] Provisional and subject to revision.
[3] Point estimate, 80% bias corrected confidence intervals are shown.
[4] Based on catch data available as of 5 September 2013.
[5] This determination is based on the models and the ancillary information (e.g. catch trends, mean weight trends).

SWO-ATL-Table 1. Estimated catches (t) of Atlantic swordfish (*Xiphias gladius*) by gear and flag. (v1, 2016-09-30)

			1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
TOTAL			28826	29207	32868	34459	38803	33511	31567	26251	27123	27180	25139	23758	24075	25252	25643	25718	27932	23596	24761	24209	23978	24554	20281	22101	22045
	ATN		14934	15394	16738	15501	16872	15222	13025	12223	11622	11453	10011	9654	11442	12175	12480	11473	12302	11050	12081	11553	12523	13875	12069	11216	11108
	ATS		13893	13813	16130	18958	21930	18289	18542	14027	15502	15728	15128	14104	12633	13077	13162	14245	15630	12546	12679	12655	11455	10679	8212	10885	10937
Landings	ATN	Longline	14208	14288	15641	14315	15764	13808	12181	10939	10666	9837	8676	8799	10333	11406	11527	10840	11475	10341	11439	10964	11610	12914	11278	10553	10539
		Other surf.	511	723	689	478	582	826	393	800	426	478	433	240	487	449	620	409	546	465	485	437	511	559	593	514	419
	ATS	Longline	13287	13176	15547	17387	20806	17799	18239	13748	14823	15448	14302	13576	11712	12485	12915	13723	14967	11761	12106	11920	10833	10242	7889	10708	10674
		Other surf.	606	637	583	1571	1124	489	282	269	672	278	825	527	920	591	248	522	572	779	574	587	547	298	322	177	263
Discards	ATN	Longline	215	383	408	708	526	562	439	476	525	1137	896	607	618	313	323	215	273	235	151	148	392	391	199	149	149
		Other surf.	0	0	0	0	0	26	12	9	4	1	6	8	5	7	10	8	8	9	7	5	9	10	0	0	
	ATS	Longline	0	0	0	0	0	1	21	10	6	1	0	0	0	1	0	0	91	6	0	147	74	140	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	
Landings	ATN	Barbados	0	0	0	0	0	33	16	16	12	13	19	10	21	25	44	39	27	39	20	13	23	21	16	21	29
		Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	1	112	106	184	141	142	76	8
		Brazil	0	0	0	0	0	0	0	0	0	117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Canada	1026	1547	2234	1676	1610	739	1089	1115	1119	968	1079	959	1285	1203	1558	1404	1348	1334	1300	1346	1551	1489	1505	1604	1579
		China PR	0	0	73	86	104	132	40	337	304	22	102	90	316	56	108	72	85	92	92	73	75	59	96	60	141
		Chinese Taipei	577	441	127	507	489	521	509	286	285	347	299	310	257	30	140	172	103	82	89	88	192	166	115	78	115
		Cuba	23	27	16	50	86	7	7	7	7	0	0	10	3	3	2	2	0	0	0	0	0	0	0	0	
		Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	30	0	7	0	0	
		Dominica	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	
		EU.Denmark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		EU.España	6633	6672	6598	6185	6953	5547	5140	4079	3996	4595	3968	3957	4586	5376	5521	5448	5564	4366	4949	4147	4889	5622	4084	3750	4013
		EU.France	75	75	95	46	84	97	164	110	104	122	0	74	169	102	178	92	46	14	15	35	16	94	44	28	66
		EU.Ireland	0	0	7	0	0	15	15	132	81	35	17	5	12	1	1	3	2	2	1	1	2	5	2	3	15
		EU.Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	**0**
		EU.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	773	542	1961	1599	1617	1703	903	773	777	732	735	766	1032	1320	900	949	778	747	898	1054	1203	882	1438	1241	1420
		EU.United Kingdom	0	0	2	3	1	5	11	0	2	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
		FR.St Pierre et Miquelon	0	0	0	0	0	0	0	0	0	0	0	10	3	36	48	0	82	48	17	90	1	0	18	3	
		Faroe Islands	0	0	0	0	0	0	0	0	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Grenada	2	3	13	0	1	4	15	15	42	84	0	54	88	73	56	30	26	43	0	0	0	0	0	0	
		Guinea Ecuatorial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	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
		Iceland	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Japan	992	1064	1126	933	1043	1494	1218	1391	1089	161	0	0	0	575	705	656	889	935	778	1062	523	639	300	1091	872
		Korea Rep.	3	3	19	16	16	19	15	0	0	0	0	0	0	0	51	65	175	157	3	0	0	0	64	35	
		Liberia	0	7	14	26	28	28	28	28	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Libya	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	
		Maroc	110	69	39	36	79	462	267	191	119	114	523	223	329	335	334	341	237	430	724	963	782	770	1062	1062	850
		Mexico	0	0	6	14	0	22	14	28	24	37	27	34	32	44	41	31	35	34	32	35	38	40	33	32	31
		NEI (ETRO)	43	35	111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Norway	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Panama	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Philippines	0	0	0	0	0	0	0	0	0	0	1	4	44	5	0	8	0	22	28	0	17	36	9	14	**0**
		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	
		Russian Federation	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**
		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
		Senegal	6	6	0	0	0	0	0	0	0	0	0	0	0	108	108	0	38	0	28	11	1	44	43	49	78

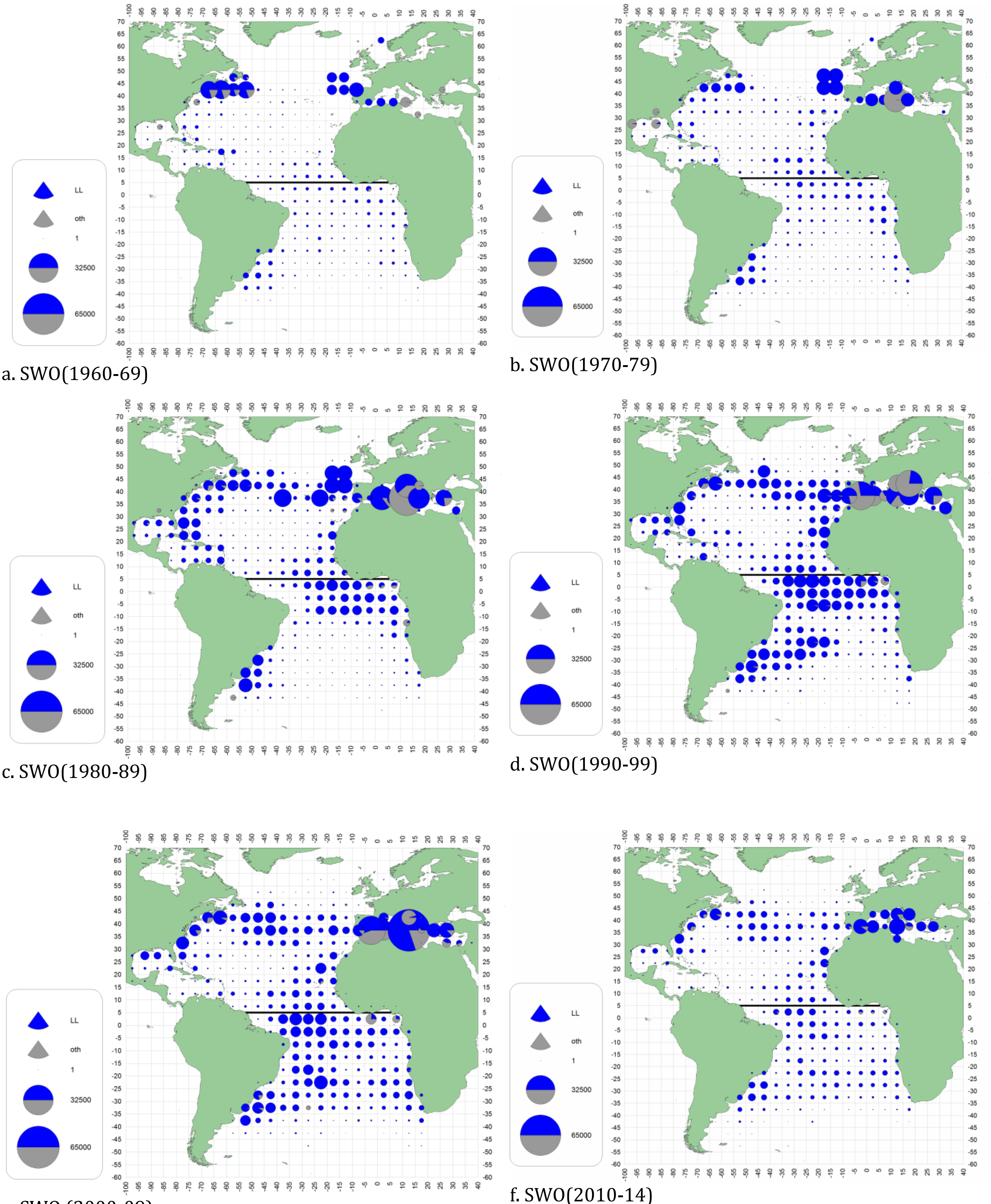
			1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
		Seychelles	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Sierra Leone	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	
		St. Vincent and Grenadines	0	3	23	0	4	3	1	0	1	0	22	22	7	7	7	0	51	7	34	13	11	8	4	40	102
		Sta. Lucia	0	0	0	1	0	0	0	0	0	0	0	0	0	2	3	0	0	2	0	0	0	0	0	0	0
		Trinidad and Tobago	71	562	11	180	150	158	110	130	138	41	75	92	78	83	91	19	29	48	30	21	16	14	16	26	17
		U.S.A.	4310	3852	3783	3366	4026	3559	2987	3058	2908	2863	2217	2384	2513	2380	2160	1873	2463	2387	2730	2274	2551	3393	2824	1809	1583
		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	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	0	4	4	7	0	3	0	0	4	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	13	17	**0**
		Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	0	35	29	14	0	0	0	10	23	15	2	4	7
		Venezuela	75	103	73	69	54	85	20	37	30	44	21	34	45	53	55	22	30	11	13	24	18	25	24	24	29
Landings	ATS	Angola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	18	**0**
		Argentina	88	88	14	24	0	0	0	0	38	0	5	10	8	0	0	0	0	0	0	1	0	0	0	0	
		Belize	0	0	0	0	1	0	0	0	17	8	0	0	0	0	0	0	120	32	111	121	207	197	136	45	104
		Benin	28	26	28	25	24	24	10	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Brazil	1312	2609	2013	1571	1975	1892	4100	3847	4721	4579	4082	2910	2920	2998	3785	4430	4153	3407	3386	2926	3033	2833	1427	2892	2588
		Cambodia	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		China PR	0	0	0	0	0	0	0	29	534	344	200	423	353	278	91	300	473	470	291	296	248	316	196	206	328
		Chinese Taipei	1453	1686	846	2829	2876	2873	2562	1147	1168	1303	1149	1164	1254	745	744	377	671	727	612	410	424	379	582	406	511
		Cuba	209	246	192	452	778	60	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Côte d'Ivoire	18	13	14	20	19	26	18	25	26	20	19	19	43	29	31	39	17	159	100	114	145	82	110	55	42
		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	5760	5651	6974	7937	11290	9622	8461	5832	5758	6388	5789	5741	4527	5483	5402	5300	5283	4073	5183	5801	4700	4852	4184	4113	5059
		EU.Lithuania	0	0	0	794	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		EU.Portugal	0	1	0	0	380	389	441	384	381	392	393	380	354	345	493	440	428	271	367	232	263	184	125	252	236
		EU.United Kingdom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	49	0	0	3	0	0	0	0	0	
		Gabon	0	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	73	69	121	51	103	140	44	106	121	117	531	372	734	343	55	32	65	177	132	116	60	54	37	26	56
		Guinea Ecuatorial	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Honduras	0	3	0	0	6	4	5	2	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Japan	4459	2870	5256	4699	3619	2197	1494	1186	775	790	685	833	924	686	480	1090	2155	1600	1340	1314	1233	1162	684	1949	1321
		Korea Rep.	147	147	198	164	164	7	18	7	5	10	0	2	24	70	36	94	176	223	10	0	0	42	47	53	5
		Mixed flags (FR+ES)	0	0	0	0	0	0	0	0	0	4	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	
		Namibia	0	0	0	22	0	0	0	0	730	469	751	504	191	549	832	1118	1038	518	25	417	414	85	129	395	225
		Nigeria	0	3	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Panama	0	0	0	0	0	0	0	29	105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		Philippines	0	0	0	0	0	0	0	0	0	0	6	1	8	1	1	4	58	41	49	14	35	15	35	58	**0**
		S. Tomé e Príncipe	179	177	202	190	178	166	148	135	129	120	120	120	120	126	147	138	138	183	188	193	60	84	60	94	145
		Senegal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	77	138	195	180	264	162	178	143	97
		Seychelles	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	
		Sierra Leone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	0	0	0	
		South Africa	5	9	4	1	4	1	1	240	143	328	547	649	293	295	199	186	207	142	170	145	97	50	171	152	218
		St. Vincent and Grenadines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	7	16	4	3	2	2	19	0
		Togo	5	5	8	14	14	64	0	0	0	0	0	0	0	9	10	2	0	0	0	0	0	0	0	0	
		U.S.A.	0	0	0	0	0	171	396	160	179	142	43	200	21	15	0	0	0	0	0	0	0	0	0	0	**0**
		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	0	20	4	0	0	0	0	0	0	0	0	0	0	5	6	2
		Uruguay	156	210	260	165	499	644	760	889	650	713	789	768	850	1105	843	620	464	370	501	222	179	40	103	0	**0**
		Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	26	6	3	0	3	1	3	0	1	1
Discards	ATN	Canada	0	0	0	0	0	0	5	52	35	50	26	33	79	45	106	38	61	39	9	15	8	111	59	12	8

		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	0	0	
	Japan	0	0	0	0	0	0	0	0	0	598	567	319	263	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	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	0	1	0	0	0	
	U.S.A.	215	383	408	708	526	588	446	433	494	490	308	263	282	275	227	185	220	205	148	138	223	217	120	137	139
	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	
ATS	Brazil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	91	6	0	0	0	0	0	0	
	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	117	0	0	
	Korea Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	147	70	23	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	0	1	21	10	6	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	

EU-France 2015 Task I: last revision (arriving after the species groups deadline) not included in the table.

SWO-ATL-Table 2. Estimated probabilities (%) that both the fishing mortality is below F_{MSY} and spawning stock biomass is above SSB_{MSY} for North Atlantic swordfish from ASPIC base model.

TAC	2014	2015	2016	2017	2018	2019	2020	2021
13000	88	91	92	92	92	92	93	93
13200	88	91	91	92	92	91	91	91
13400	88	90	90	89	89	89	89	89
13600	88	88	88	88	87	87	86	85
13700	88	88	88	87	85	84	84	83
13800	88	87	86	85	83	82	82	81
13900	88	86	84	83	82	80	79	77
14000	88	84	82	80	79	77	75	74
14100	88	82	80	78	76	74	72	69
14200	88	81	79	76	73	71	67	63
14300	88	80	76	73	70	65	61	56
14400	88	78	74	71	65	60	54	47
14600	88	74	69	63	56	47	40	33
14800	88	70	62	51	43	34	29	22
15000	88	64	55	42	32	25	17	13



a. SWO(1960-69)

b. SWO(1970-79)

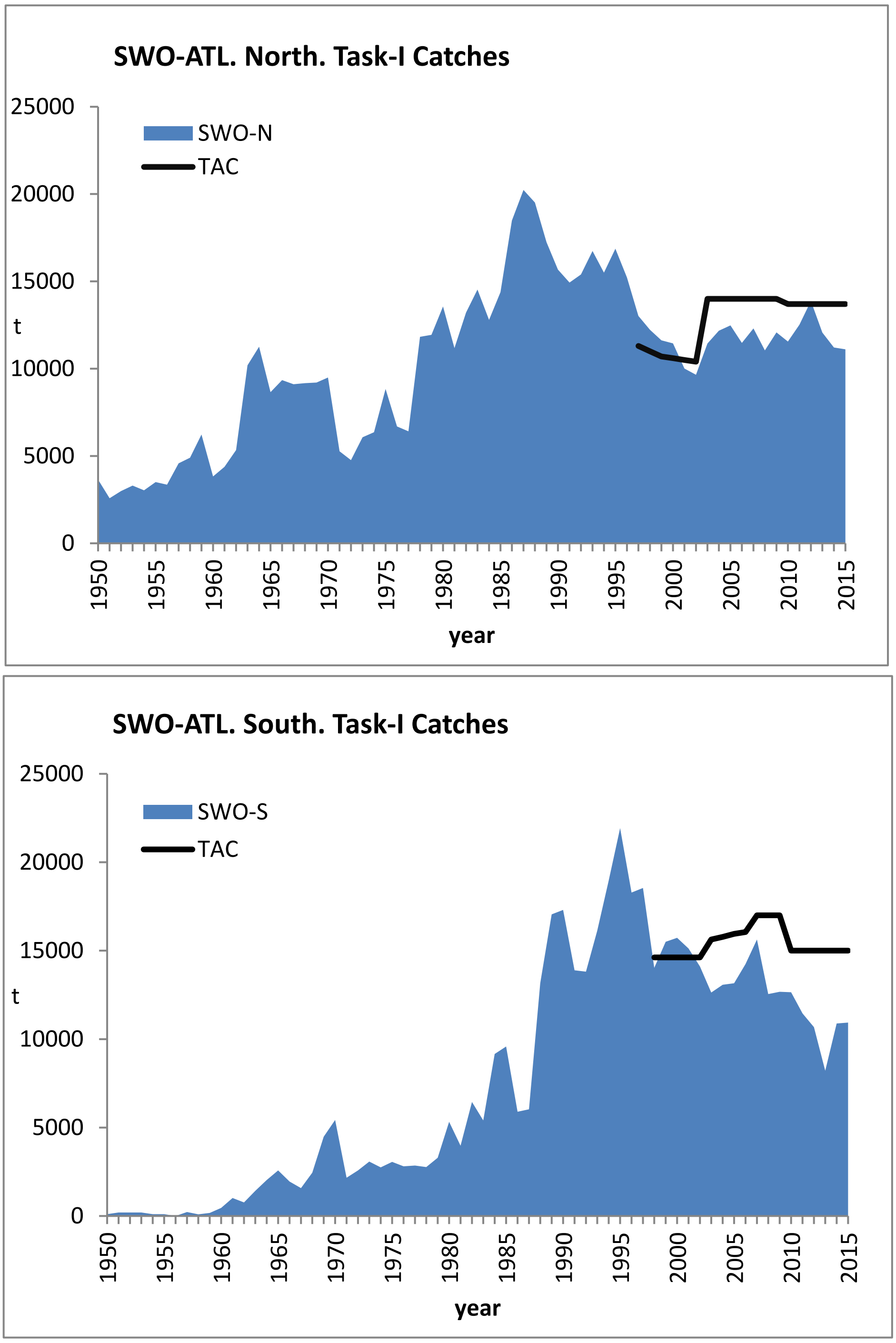
c. SWO(1980-89)

d. SWO(1990-99)

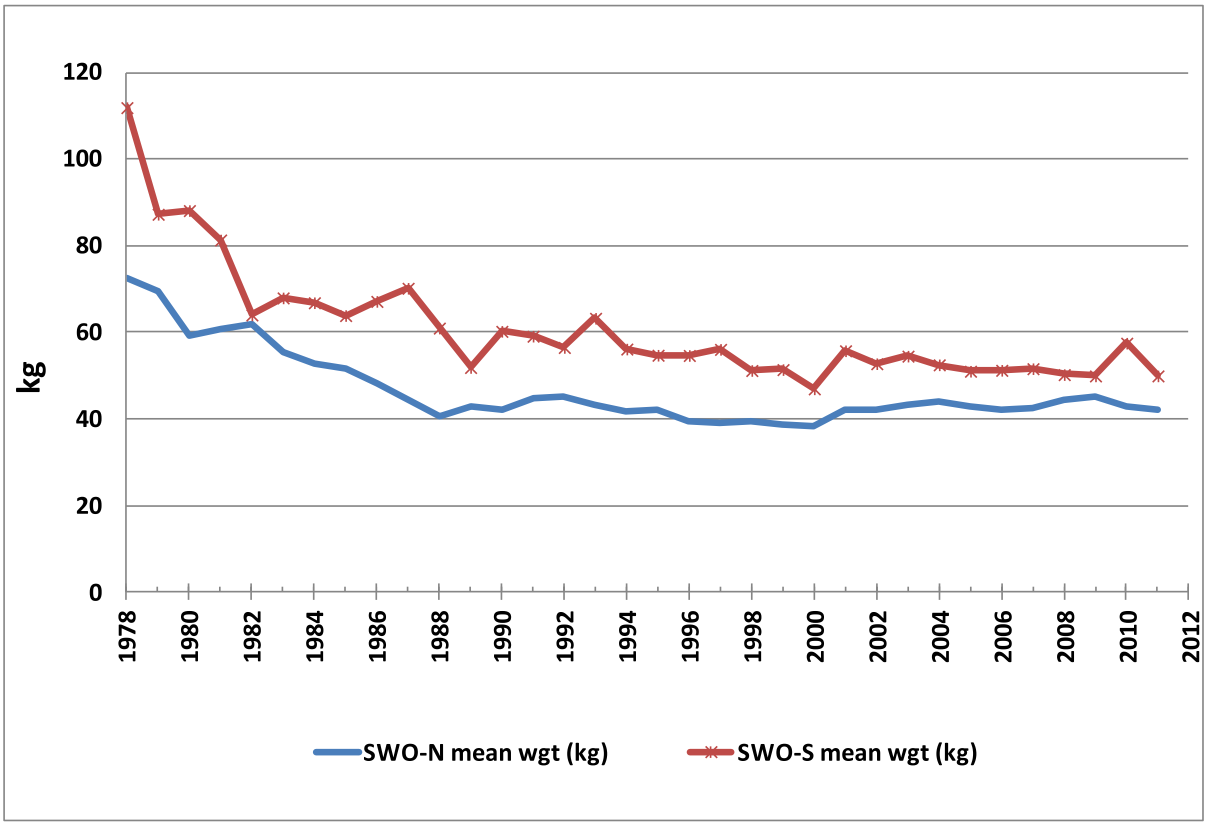
e. SWO (2000-09)

f. SWO(2010-14)

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 1960-2014 (the last decade only covers 5 years).



SWO-ATL-Figure 2. North and South Atlantic swordfish catches and TAC (t), for the period 1950-2015.



SWO-ATL-Figure 3. Trends in mean weight (kg) for the entire North and South Atlantic swordfish stocks. The information for 2010 is being reviewed and should be considered preliminary.

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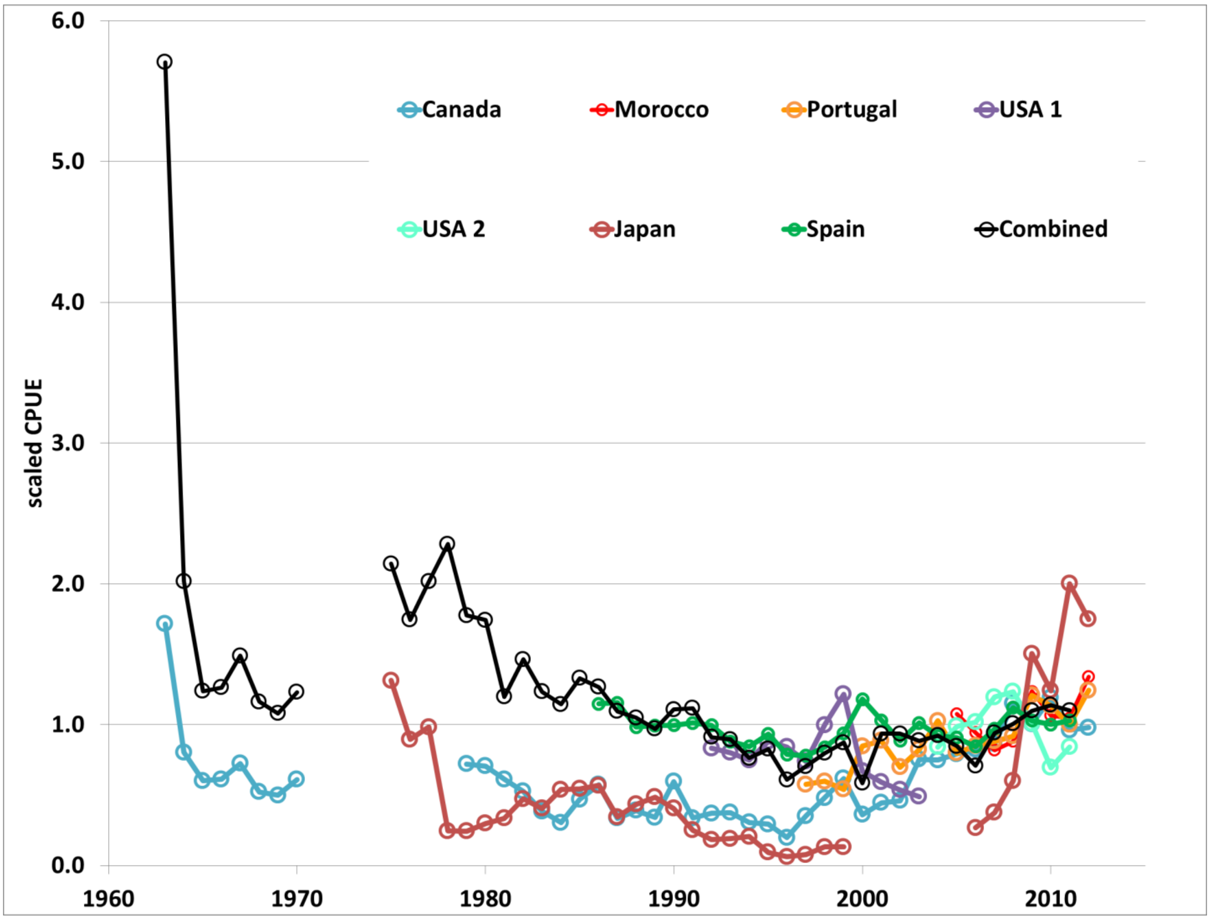
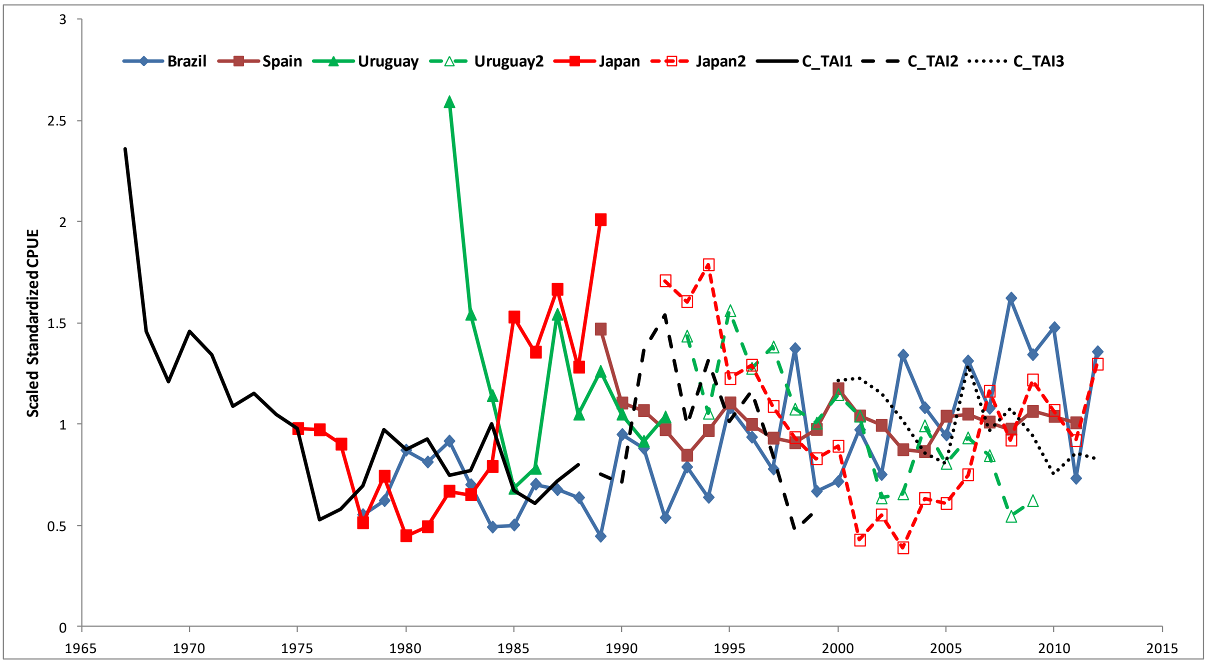
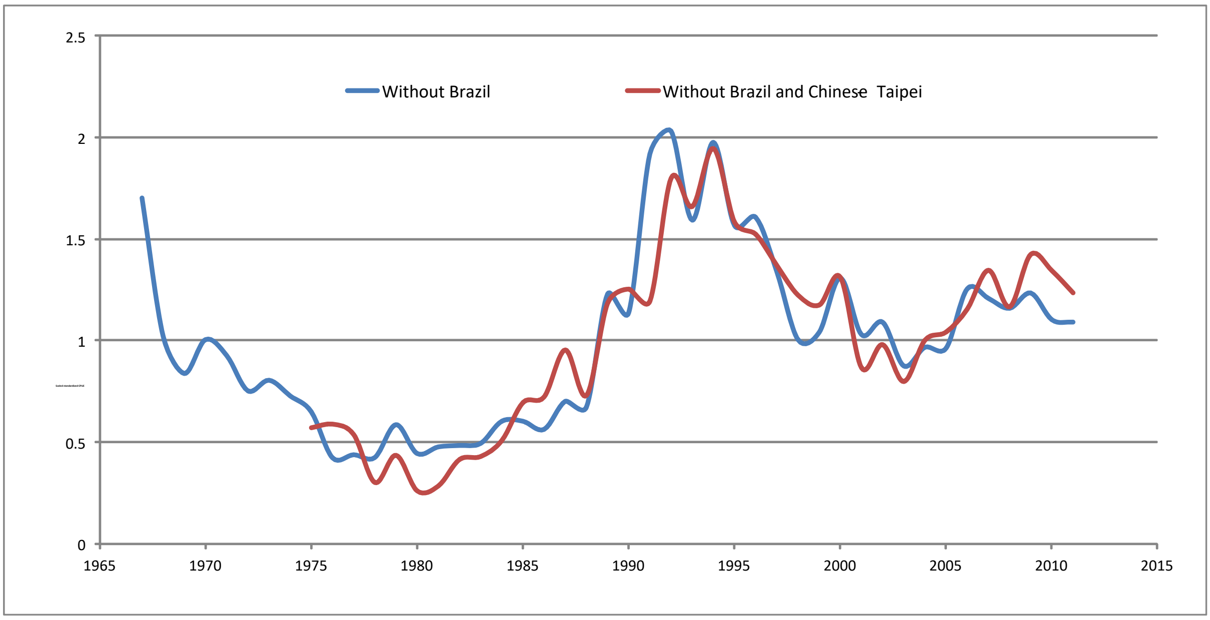


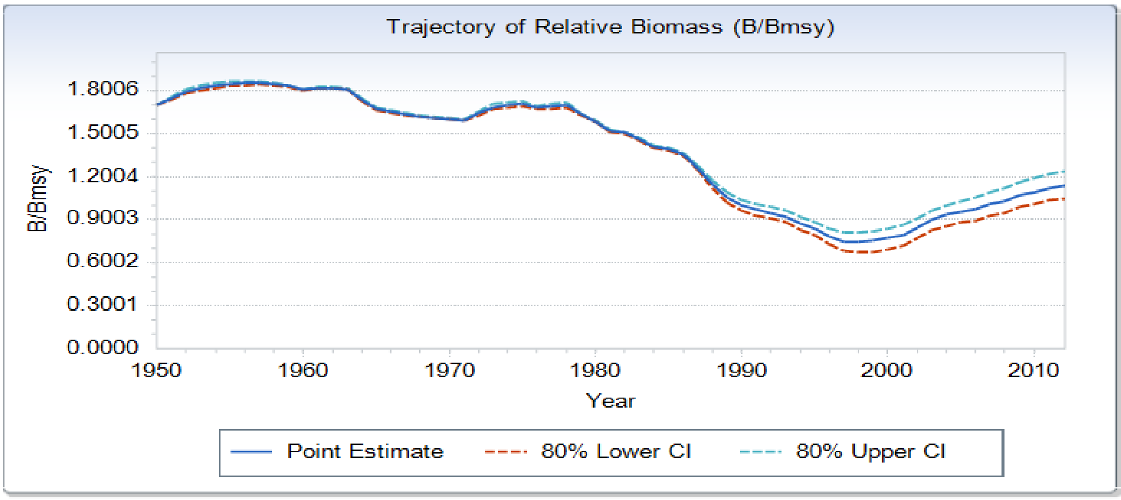
SWO-ATL-Figure 4. Standardized CPUEs series provided by CPCs for the North Atlantic swordfish and the combined index of the base production model. The CPUE series were scaled to their mean for the overlapping years.

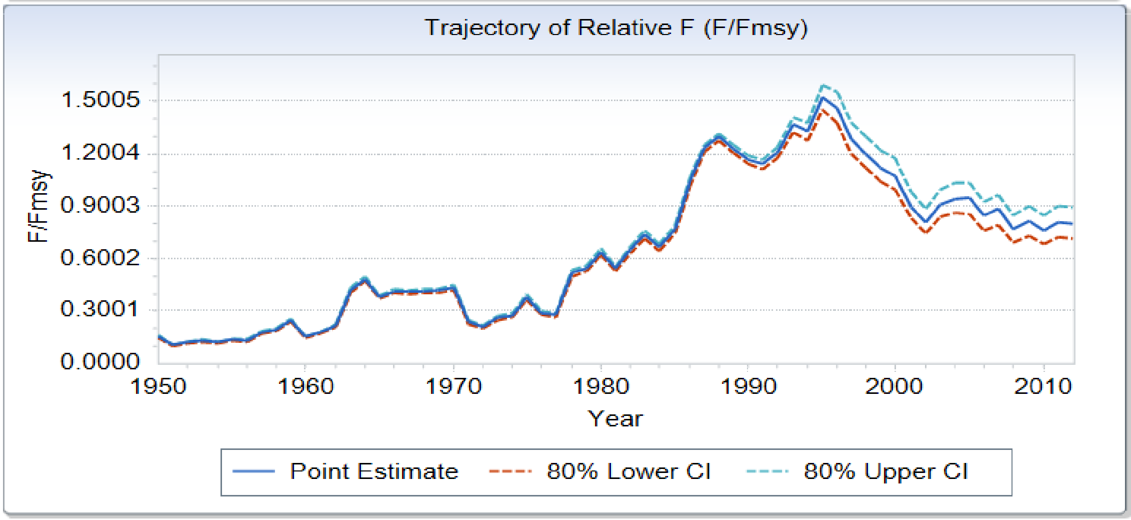


SWO-ATL-Figure 5. Standardized CPUEs series provided by CPCs for South Atlantic swordfish. The CPUE series were scaled to their mean for the overlapping years.

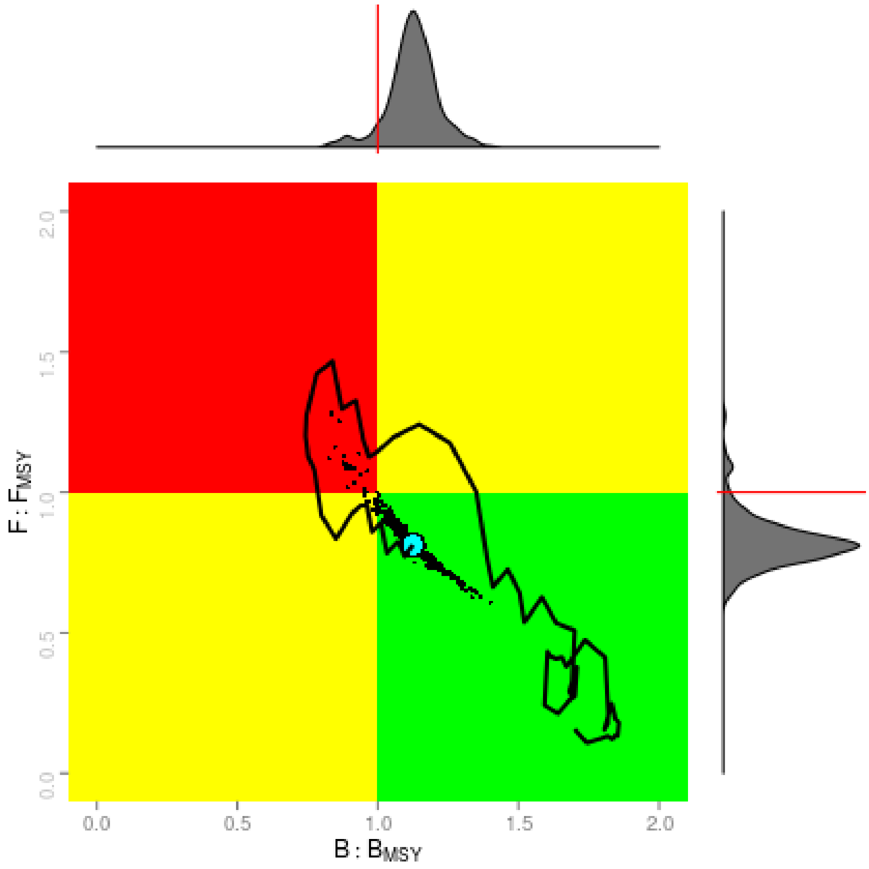


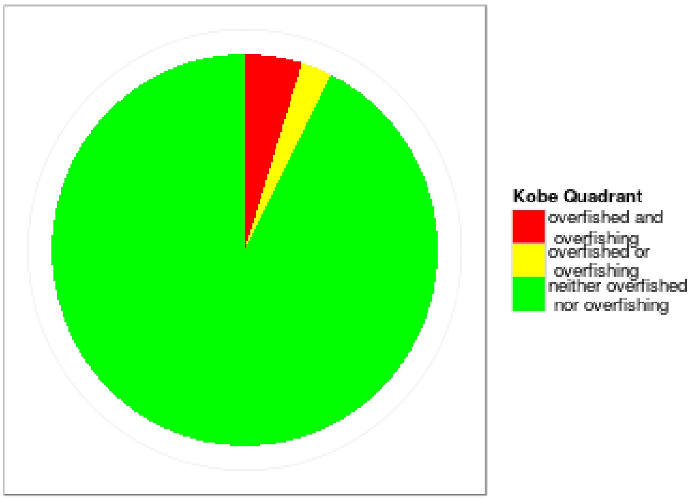
SWO-ATL-Figure 6. South Atlantic swordfish combined standardized CPUE indices.



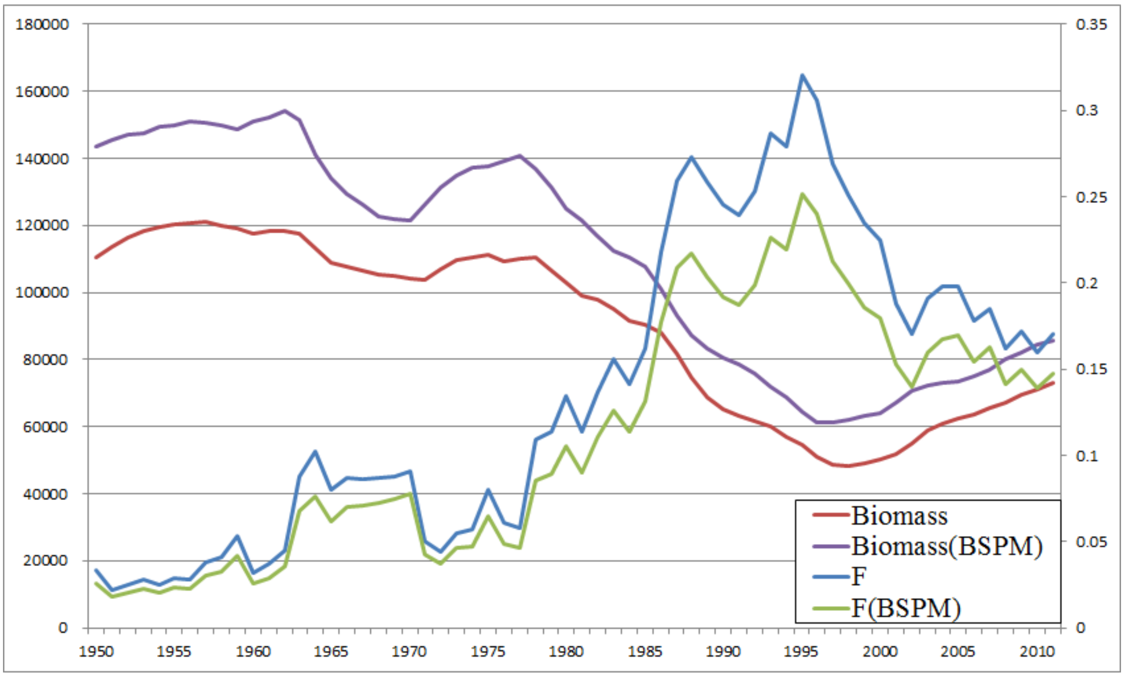


SWO-ATL-Figure 7. Results from the North Atlantic base case ASPIC model: trends in swordfish relative biomass (top) and fishing mortality (bottom).

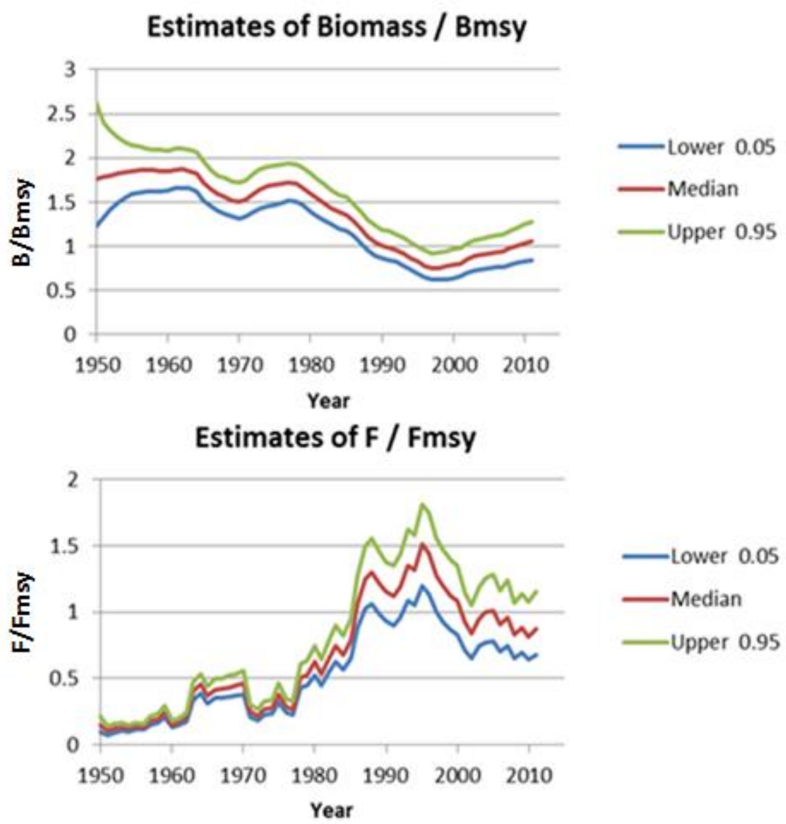




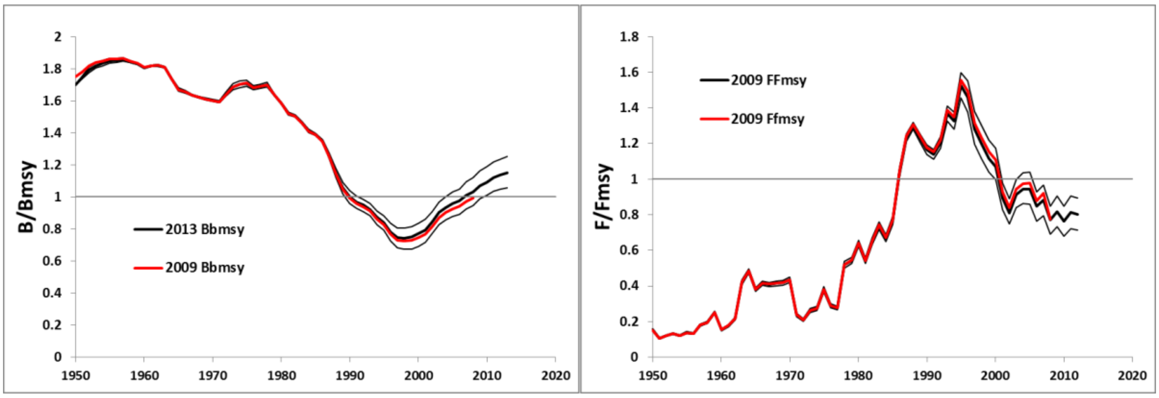
SWO-ATL-Figure 8. North Atlantic swordfish stock status trajectory (solid line) for the period 1950-2011, from the base ASPIC model (solid circle is the estimated median point). The pie chart represents the probabilities of stock being in the different color quadrants (red 3%, yellow 2%, green 95%).



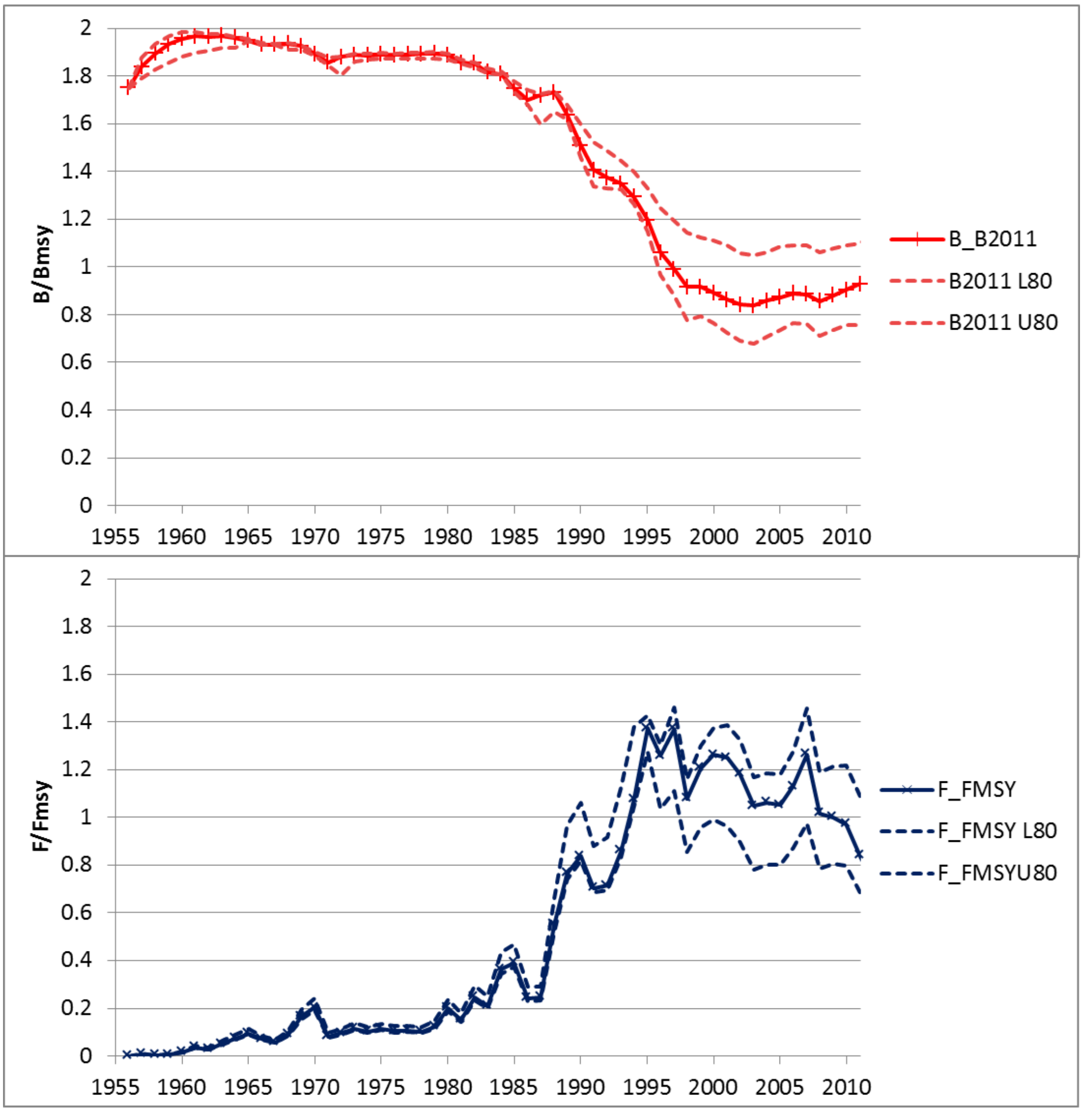
SWO-ATL-Figure 9. Trends in North Atlantic swordfish absolute biomass and fishing mortality estimates from the ASPIC and BSP2 base case models.



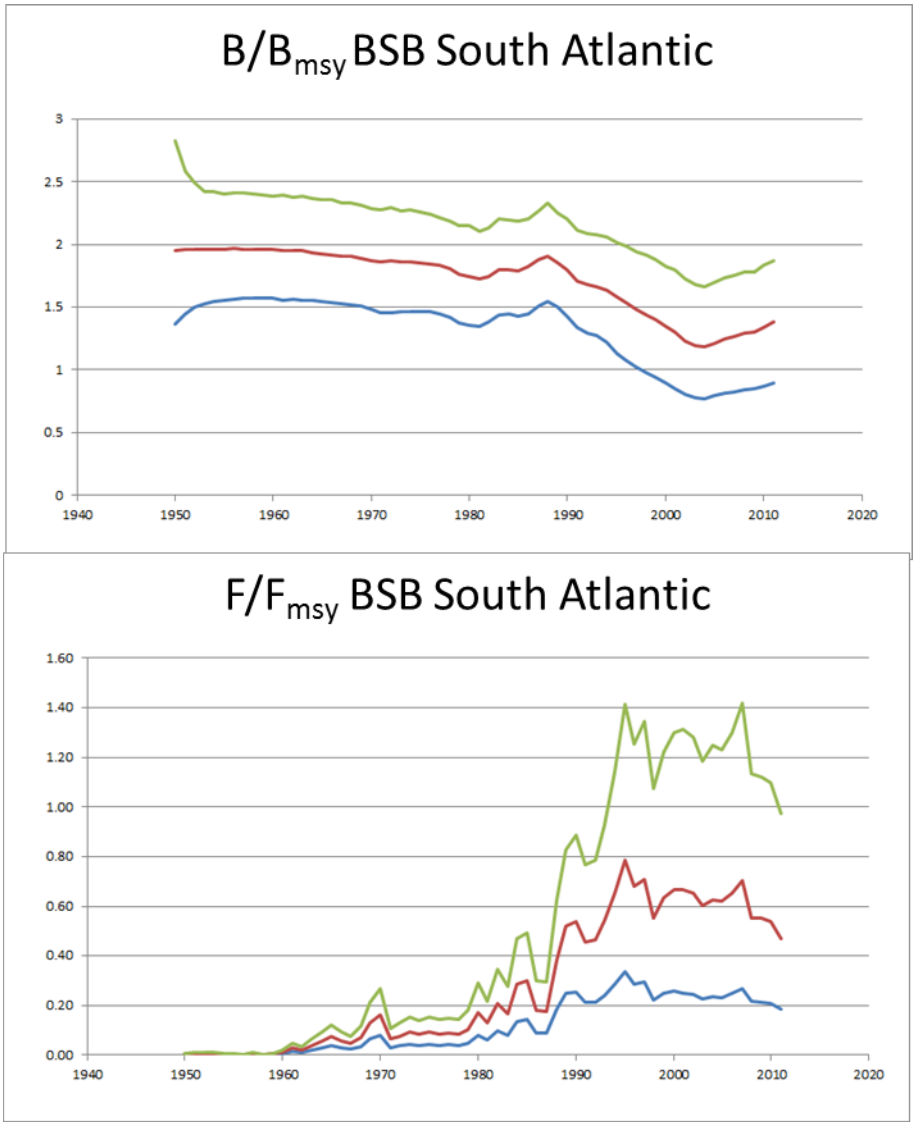
SWO-ATL-Figure 10. Plots of the ratios of i) stock biomass to B_{MSY} and ii) fishing mortality rate to F_{MSY} from the base case BSP2 for North Atlantic swordfish.



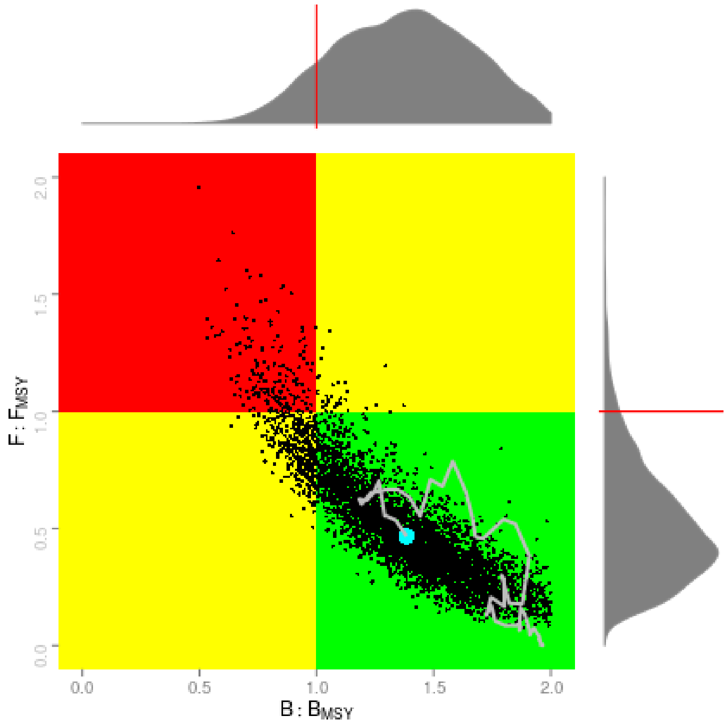
SWO-ATL-Figure 11. Comparison of the relative biomass (left) and fishing mortality (right) estimated by the North Atlantic ASPIC base case models in 2009 and 2013 assessments. Thin lines indicate the 80% confidence bounds for the 2013 estimates.



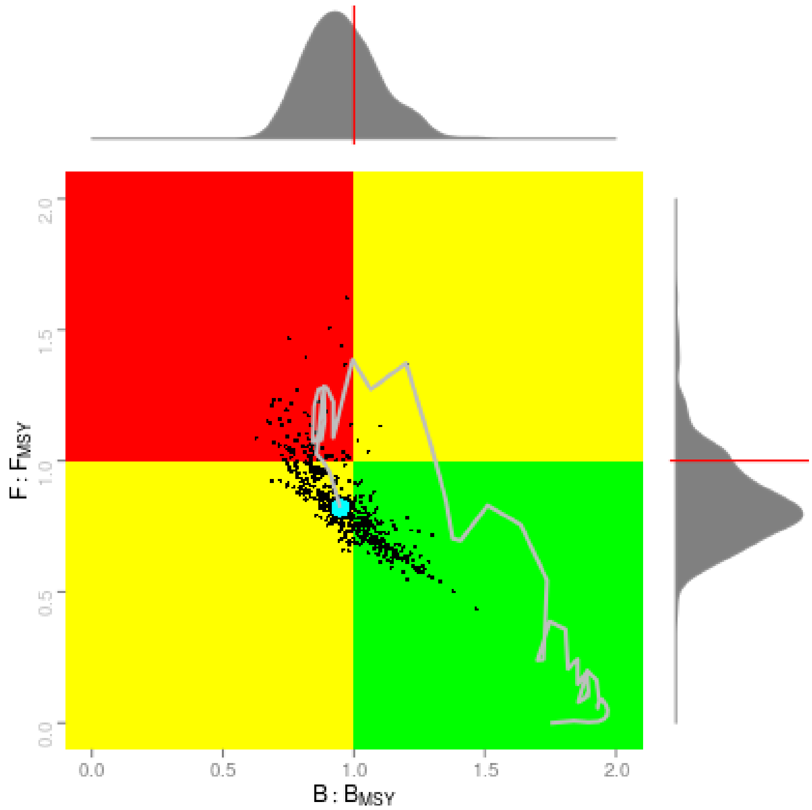
SWO-ATL-Figure 12. South Atlantic swordfish B/B$_{MSY}$ and F/F$_{MSY}$ estimated by ASPIC, dashed lines are the lower and upper 80 percentiles of the bootstrap runs.



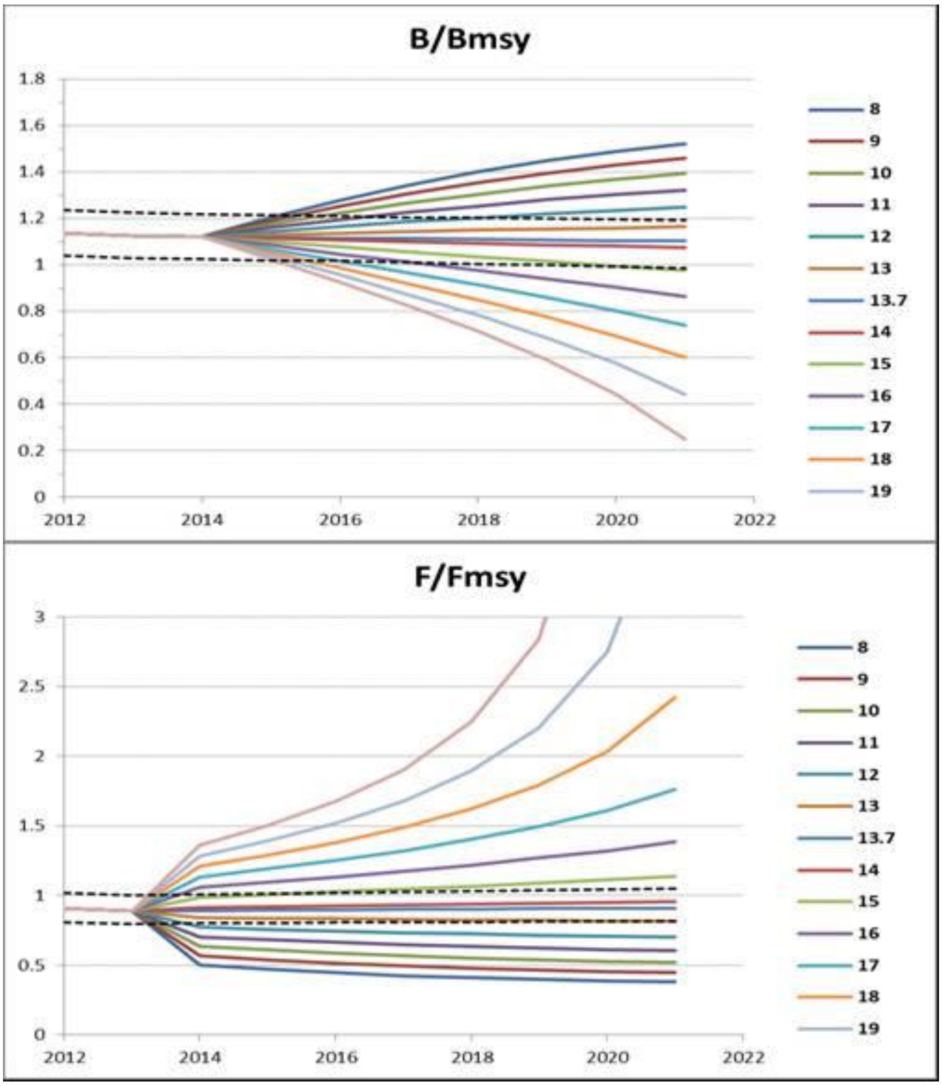
SWO-ATL-Figure 13. South Atlantic swordfish B/B_{MSY} and F/F_{MSY} estimated by BSP2. Posterior median and 90% intervals are plotted.



SWO-ATL-Figure 14. Kobe plots for the BSP2 reference model for southern Atlantic swordfish. The diamonds show the level of uncertainty and the line represents the trajectories of the status of the stocks of B/B_{MSY} and F/F_{MSY}, 1950-2011.



SWO-ATL-Figure 15. Kobe plots for the ASPIC reference model for southern Atlantic swordfish. The diamonds show the level of uncertainty and the line represents the trajectories of the status of the stocks of B/BMSY and F/FMSY, 1950-2011.



SWO-ATL-Figure 16. Median trends of the relative biomass (B/B_{MSY}) and fishing mortality (F/F_{MSY}) for the projected North Atlantic swordfish stock based on the ASPIC SP model base under different constant catch scenarios (thousand tons). The lines show the median value of bootstrap runs and the dashed lines are 80% confidence intervals around projection at 13,700 t in the projection time period and the observed catch in the historical time period. The TAC in 2012 was 13,700 t.

8.10 SWO-MED – MEDITERRANEAN SWORDFISH

In the last 4 years the Mediterranean swordfish production is stable around to 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.

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.

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.

The Committee is working on updating the existing length-weight relationships and some preliminary analysis that has been done indicates that there are differences among areas; thus Mediterranean-wide equations will be estimated from data sets integrating information from different areas.

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 four years (2012-2015), 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 to 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 Italy (45%), Morocco (14%), Spain (13%), Greece (10%) 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 (2003-2015), the main fishing gears used are longlines (on average, representing 84% of the annual catch) and gillnets. Since 2012, gillnets have been 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 landing size regulations, a list of authorized vessels, and specifications on the technical characteristics of the longline gear. Several countries have also adopted additional fishery restrictions at the national level. The European Union introduced a driftnet ban 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 2012-2015 among the lower of the last three decades. In addition, reported catches of juvenile swordfish of less than 90 cm has also decreased on average 54% in the last two years compared with the levels of the decade of 2000s. However, the regulations foreseen in the above recommendations appear to be insufficient in bringing the stock to levels consistent with the Convention objective.

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 (1980's and 1990's). 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.

Since the establishment of minimum landing sizes, the discard levels of undersized swordfish may have increased. Additionally, it has been shown that high swordfish by-catches composed mostly of undersized individuals exist in albacore fisheries operating in the autumn and winter months coinciding with the swordfish closing season. As the swordfish fishery closure aims to the protection of recruits, the impact of those fisheries needs to be taken into account in future management recommendations.

MEDITERRANEAN SWORDFISH SUMMARY

Maximum Sustainable Yield	19,683 t[1]
Current (2015) Yield	10,068 t (9,966 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), MLS regulations, and a list of authorized vessels [Rec. 13-04]. [3]

[1] Estimates based on the XSA and equilibrium analyses (see text for details).
[2] As of July 2016.
[3] Certain additional fishery restrictions are implemented at the national level.

SWO-MED-Table 1. Estimated catches (t) of swordfish (*Xiphias gladius)* in the Mediterranean by gear and flag. (v1, 2016-09-30)

			1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
TOTAL	MED		15746	14709	13265	16082	13015	12053	14693	14369	13699	15569	15006	12814	15674	14405	14600	14893	14227	12164	11840	13265	11450	9913	9096	9794	10068
Landings		Longline	7393	7631	7377	8985	6319	5884	5389	6496	6097	6963	7180	7767	10415	10667	10848	11228	11028	11465	11020	11918	10288	9131	9047	9711	9950
		Other surf.	8353	7078	5888	7097	6696	6169	9304	7873	7602	8606	7826	5047	5259	3729	3639	3649	3179	672	819	1347	1162	782	49	83	111
Discards		Longline	0	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		Albania	0	0	0	0	0	13	13	13	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Algerie	562	395	562	600	807	807	807	825	709	816	1081	814	665	564	635	702	601	802	468	459	216	387	403	557	568
		Chinese Taipei	0	0	1	1	0	1	3	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	10	20	0	0	0	0	0	0	0	0	4	3	6	6	4	10	16	10
		EU.Cyprus	162	56	116	159	89	40	51	61	92	82	135	104	47	49	53	43	67	67	38	31	35	35	51	51	45
		EU.España	1171	822	1358	1503	1379	1186	1264	1443	906	1436	1484	1498	1226	951	910	1462	1697	2095	2000	1792	1744	1591	1607	2073	2283
		EU.France	0	0	0	0	0	0	0	0	0	0	12	27	0	19	0	0	14	14	16	78	81	12	66	127	153
		EU.Greece	1904	1456	1568	2520	974	1237	750	1650	1520	1960	1730	1680	1230	1120	1311	1358	1887	962	1132	1494	1306	877	1731	1344	691
		EU.Italy	8538	7595	6330	7765	7310	5286	6104	6104	6312	7515	6388	3539	8395	6942	7460	7626	6518	4549	5016	6022	5274	4574	2862	3393	4272
		EU.Malta	129	85	91	47	72	72	100	153	187	175	102	257	163	195	362	239	213	260	266	423	532	503	460	376	489
		EU.Portugal	0	0	0	0	0	0	0	0	0	13	115	8	1	120	14	16	0	0	0	0	0	0	0	0	
		Egypt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	
		Japan	1	2	4	2	4	5	5	7	4	2	1	1	0	2	4	0	3	1	1	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	1	0	0	0	0	0	**0**
		Libya	0	0	0	0	0	0	0	11	0	8	6	0	10	2	0	14	0	0	0	0	0	0	0	0	
		Maroc	1706	2692	2589	2654	1696	2734	4900	3228	3238	2708	3026	3379	3300	3253	2523	2058	1722	1957	1587	1610	1027	802	770	770	480
		NEI (MED)	1292	1292	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Syria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	28	0	0	0	9	4	0	
		Tunisie	181	178	354	298	378	352	346	414	468	483	567	1138	288	791	791	949	1024	1011	1012	1016	1040	1038	1036	1030	1035
		Turkey	100	136	292	533	306	320	350	450	230	370	360	370	350	386	425	410	423	386	301	334	190	80	97	56	35
Discards		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	7
		EU.Greece	0	0	0	0	0	0	0	0	0	0	0	0	0	9	113	16	19	27	0	0	0	0	0	0	

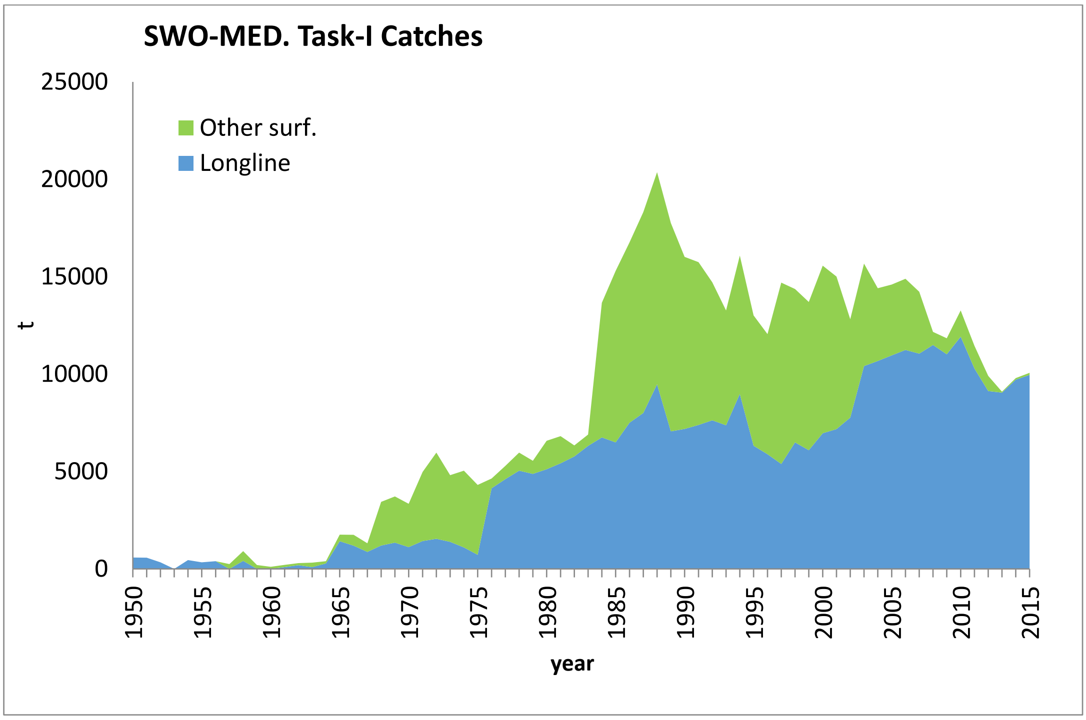
EU-France 2015 Task I: last revision (arriving after the species groups deadline) not included in the table.

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).

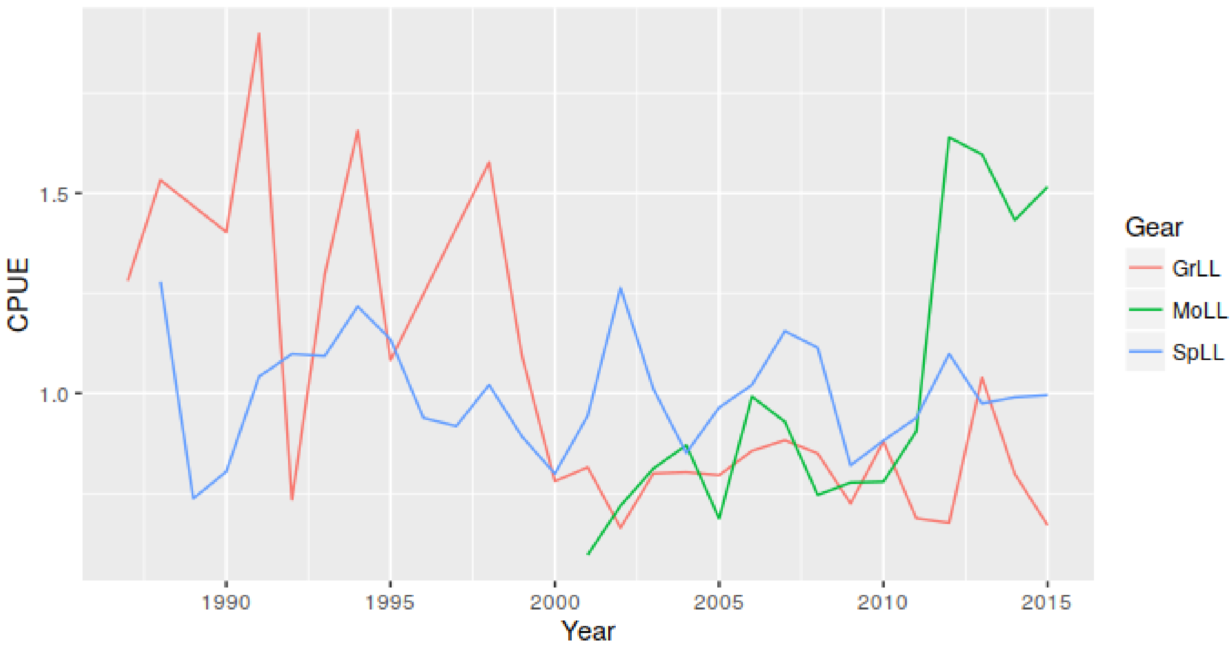
F multiplier		*F/Fsq*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*
0	F_{MSY}	0	0	0	0	0	100	100	100	100	100	100
0.25	F_{MSY}	0.14	0	0	0	0	7	100	100	100	100	100
0.5	F_{MSY}	0.29	0	0	0	0	0	10	69	96	98	100
0.75	F_{MSY}	0.43	0	0	0	0	0	1	3	20	53	72
1	F_{MSY}	0.57	0	0	0	0	0	0	0	2	4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

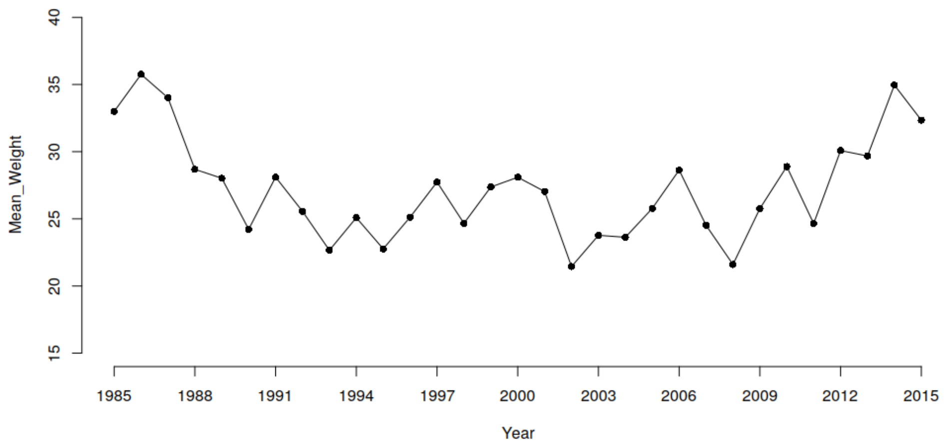
F multiplier		*F/Fsq*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*
0	F_{MSY}	0	0	0	0	0	0	0	0	0	0	0
0.25	F_{MSY}	0.14	1684	2306	3011	3843	4723	5666	6550	7409	8217	8865
0.5	F_{MSY}	0.29	3278	4275	5374	6640	7937	9299	10597	11752	12860	13771
0.75	F_{MSY}	0.43	4786	5949	7203	8639	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



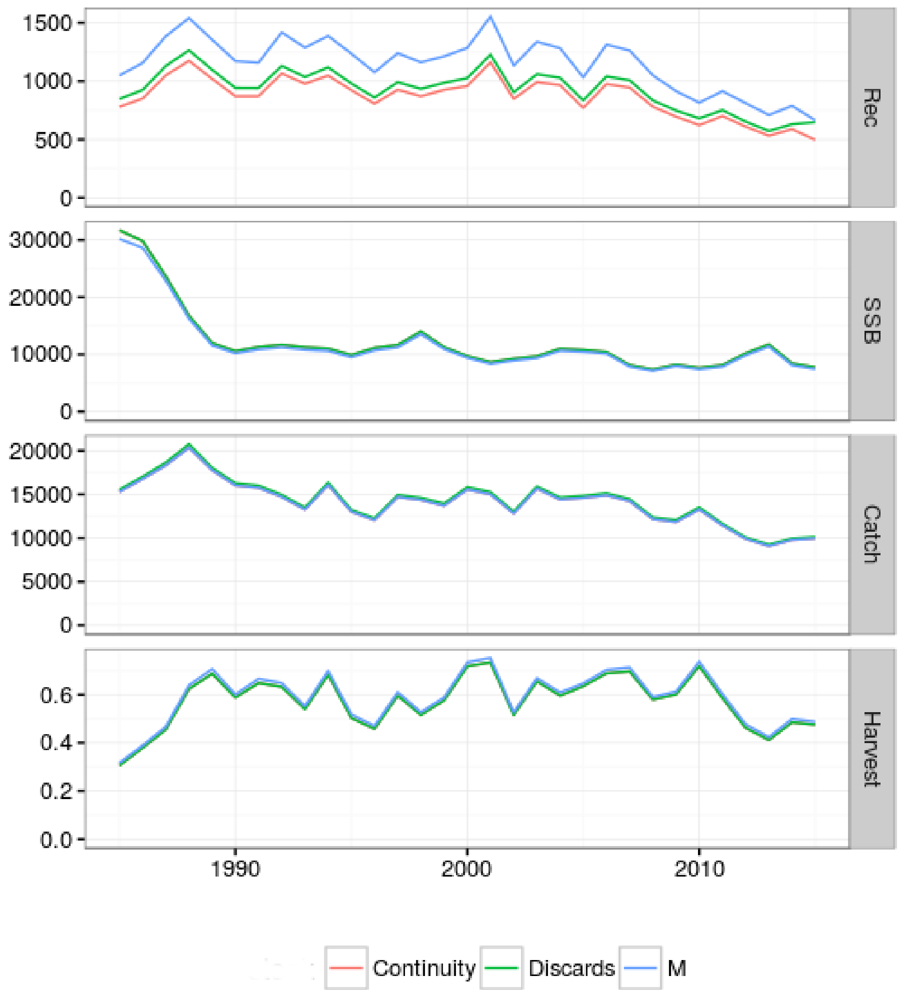
SWO-MED-Figure 1. Cumulative estimates of Task I swordfish catches (t) in the Mediterranean by major gear types, for the period 1950-2015. Misreporting may occur in the earlier period (up to the middle 1980s).



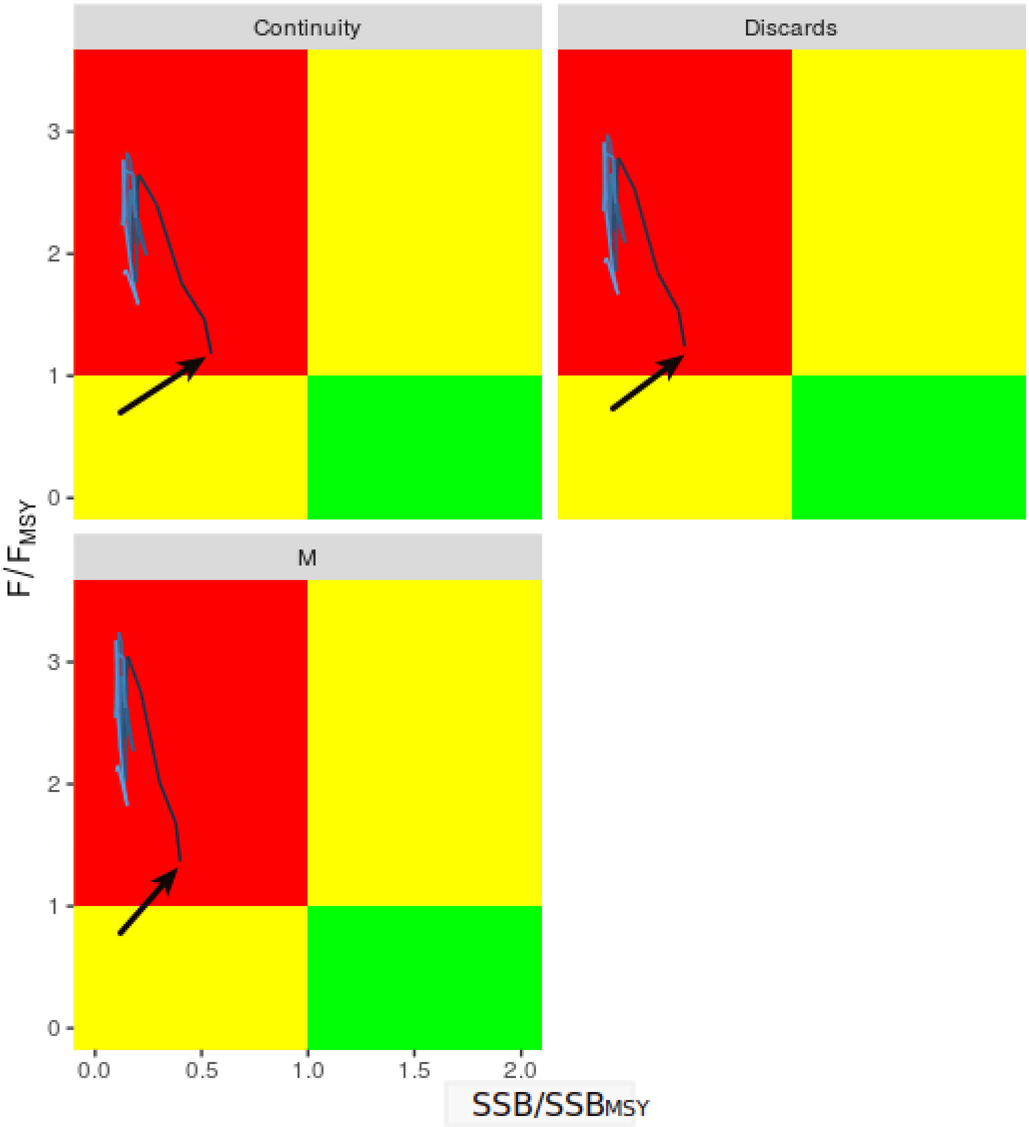
SWO-MED-Figure 2. Relative abundance indices used in the assessment of the Mediterranean swordfish. All indices are scaled to their individual means to facilitate comparison of trends and relative degree of variability. GrLL=Greek longlines, SpLL=Spanish longlines, MoLL=Moroccan longlines.



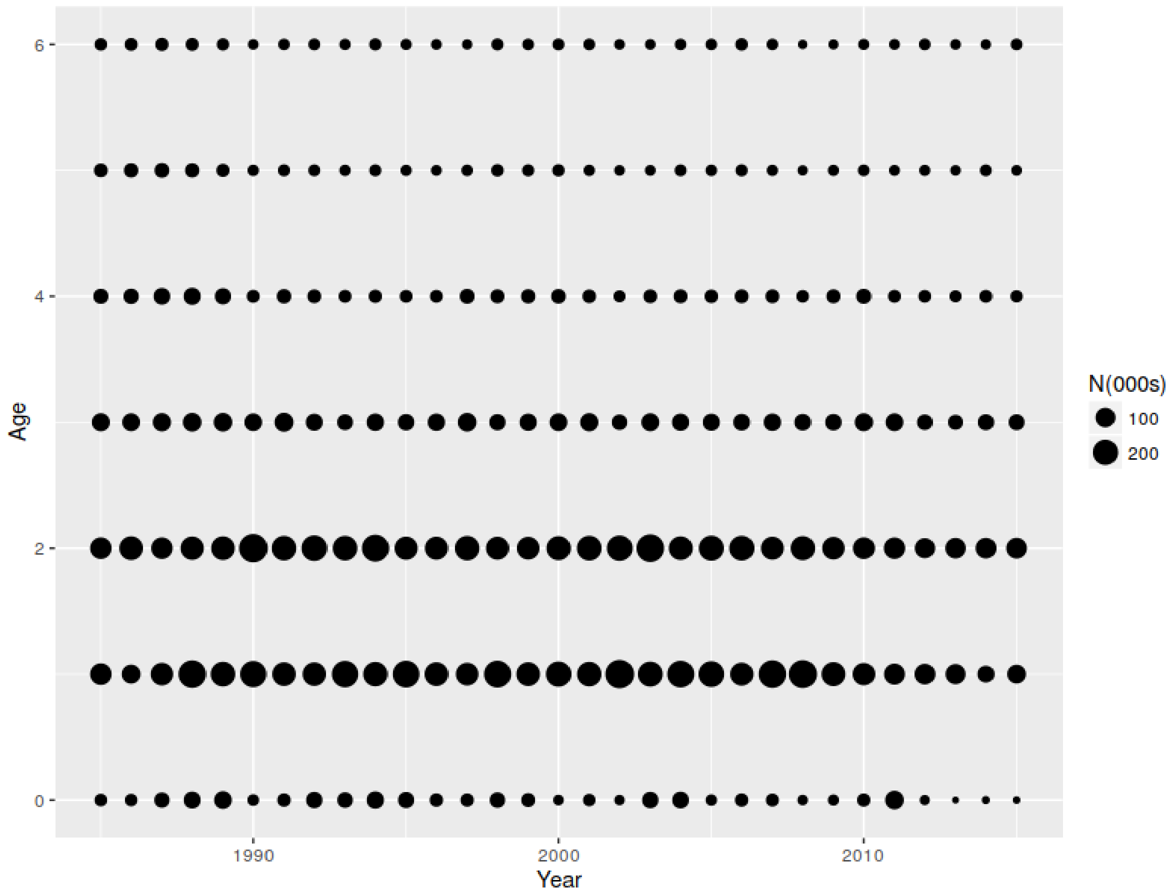
SWO-MED-Figure 3. Time series of mean fish weight (kg) in the catches.



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.

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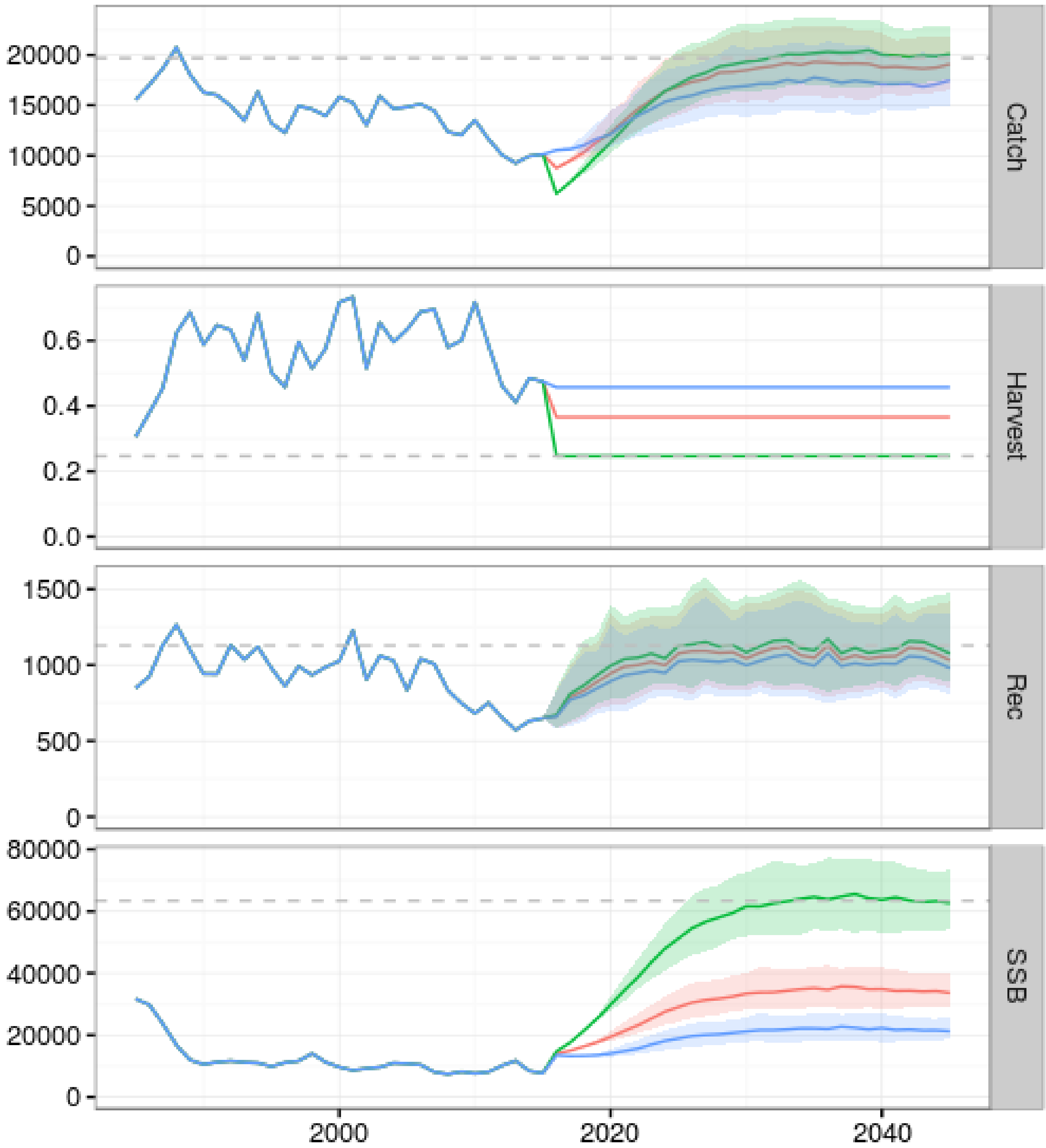


SWO-MED-Figure 7. Projections based on the current selection pattern and three different F (harvest) levels: status quo (blue), 80% of current F (red) and F_{MSY} (green). Estimates are based on the XSA assessment assuming a discard rate of 4 zero-age fish/t. Lines correspond to median estimates and 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 often being 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 recent 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 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 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 preliminary genetic study suggested, for instance, that a clear genetic heterogeneity for the bullet tuna among different geographical locations in the Mediterranean, suggested that the population structure of this species in the Mediterranean is more complex than initially expected.

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.

Recent information on small tuna catches and effort were presented from two observer programs activities in Venezuela: the National Observer Program in 2013 on industrial fleets, and the artisanal off-shore longline fleets that target tuna and tuna-like species. Important small tuna catches consisted of BLF and DOL, and to a lesser degree of WAH.

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 2015 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 2014: 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 2015 is 54,126 t. The Committee pointed out the relative importance of small tuna fisheries in the Mediterranean and the Black Sea, which account for about 28% of the total reported catches 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.

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 3 a, 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 2016, the Ecological Risk Analysis (ERA) was updated for the small tuna caught by longline fishery both in the North and South Atlantic. The study found that six (6) stocks present higher ecological risk; they are: the Southern Atlantic WAH, the North and South Atlantic KGM, the North Atlantic SSM, the South Atlantic LTA and the North Atlantic BLF (**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 BON, BLT, FRI and LTA, the Committee also recommends these 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 has started successfully tagging LTA and WAH.

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.Estimated catches (t) of small tuna species, by area and flag. (v1, 2016-09-30)

				1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
BLF		A+M		4202	4353	3535	2719	4051	4488	3027	3238	3185	2465	4034	4756	1303	1926	1031	1937	1927	1669	1442	1548	1533	1529	1243	874	949
	Landings		All gears	4202	4353	3535	2719	4051	4488	3027	3238	3185	2465	4034	4756	1303	1926	1031	1937	1927	1669	1442	1548	1533	1529	1243	874	949
	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	0
	Landings		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	130	49	22	38	153	649	418	55	55	38	149	1669	1	118	91	242	233	266	10	9	46	124	127	299	131
			Cuba	318	196	54	223	156	287	287	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Curaçao	60	60	65	60	50	45	45	45	45	45	45	45	0	0	0	0	0	0	0	0	0	0	0	0	
			Dominica	10	14	15	19	30	0	0	0	79	83	54	78	42	20	38	47	29	37	45	41	37	39	37	0	
			Dominican Republic	536	110	133	239	892	892	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			EU.España	0	307	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			EU.France	1210	1170	1140	1330	1370	1040	1040	1040	1040	1040	1040	1040	0	0	0	0	0	0	0	32	19	26	0	14	12
			Grenada	195	146	253	189	123	164	126	233	94	164	223	255	335	268	306	371	291	290	291	291	291	291	291	0	
			Jamaica	0	0	0	0	0	148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Liberia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Mexico	0	0	0	0	0	0	0	0	0	0	12	0	10	9	10	10	12	6	7	6	9	5	4	4	4
			NEI (ETRO)	0	0	0	0	0	0	0	0	0	0	0	1	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
			St. Vincent and Grenadines	11	7	53	19	20	18	22	17	15	23	24	24	0	0	0	0	0	0	0	0	0	0	11	0	
			Sta. Lucia	14	13	16	82	47	35	40	100	41	45	108	96	169	96	126	182	151	179	165	203	229	192	147	104	80
			Trinidad and Tobago	0	0	0	0	0	0	0	0	0	0	0	0	5	5	5	5	5	5	5	5	5	5	5	5	0
			U.S.A.	112	127	508	492	582	447	547	707	617	326	474	334	414	675	225	831	422	649	619	622	417	599	418	346	622
			UK.Bermuda	8	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	0	3	0	0	0	0	0	0	1	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	1598	2148	1224	21	624	758	498	1034	1192	696	1902	1210	319	732	225	237	777	231	293	331	473	237	191	88	81
	Discards		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		A+M		8777	5714	3420	5300	4301	5909	3070	2309	2646	3912	5796	6041	3794	6223	4231	4090	5459	6825	5557	7952	9483	6188	7247	3916	8584
	Landings		All gears	8777	5714	3420	5300	4301	5909	3070	2309	2646	3912	5796	6041	3794	6223	4231	4090	5459	6825	5557	7952	9483	6188	7247	3916	8579
	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	5
	Landings		Algerie	174	270	348	306	230	237	179	299	173	225	230	481	0	391	547	586	477	1134	806	970	1119	1236	577	1025	1984
			Brazil	0	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	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	0	222
			EU.Croatia	24	21	52	22	28	26	26	26	26	0	0	0	0	0	0	0	0	0	0	8	13	9	10	12	15
			EU.España	2226	1210	648	1124	1472	2296	604	487	669	1024	861	493	495	1009	845	1101	3083	3389	726	3812	3227	1620	2654	749	1241
			EU.France	8	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
			EU.Greece	1400	1400	1400	1400	1400	1426	1426	0	0	196	125	120	246	226	180	274	157	620	506	169	129	118	155	108	202
			EU.Italy	432	305	379	531	531	229	229	229	462	462	462	2452	1463	1819	866	0	0	342	732	574	653	613	892	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	1	
			EU.Malta	20	10	9	1	2	3	6	1	3	1	1	0	2	8	4	11	14	12	7	11	23	3	85	14	14
			EU.Portugal	0	0	0	0	0	0	0	28	263	494	208	166	231	299	580	867	602	311	436	654	387	55	38	0	
			Maroc	1289	1644	170	1726	621	1673	562	1140	682	763	256	621	246	326	50	199	35	83	336	525	237	194	237	171	811
			Russian Federation	2171	814	70	100	0	0	0	0	0	408	1028	460	122	102	139	22	0	23	48	67	119	366	703	352	345
			Serbia & Montenegro	13	1	0	0	2	6	6	6	7	8	8	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	0	99	75	87	81	84	83	83	0	
			Tunisie	985	35	20	13	14	13	32	93	45	15	2300	932	989	1760	0	0	0	0	0	0	940	935	938	920	
			Turkey	35	0	324	77	0	0	0	0	316	316	316	316	0	284	1020	1031	993	836	1873	1081	2552	907	863	562	476
			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	0	11	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		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	5
BON	TOTAL			33334	21992	30528	21719	21219	25134	24518	45253	37313	27151	27637	24581	14424	15832	78767	40095	14179	14964	21182	20864	24966	45005	24226	26890	11060
		ATL		8079	6881	4531	6037	6030	7939	10441	15523	9143	5179	5400	8864	3307	4584	4391	8345	5542	4922	11162	8281	10524	5684	5861	3538	4170
		MED		25255	15111	25997	15682	15189	17195	14078	29730	28170	21972	22237	15717	11117	11248	74376	31751	8637	10042	10019	12584	14442	39321	18365	23352	6890
	Landings	ATL	All gears	8079	6881	4531	6037	6030	7939	10441	15523	9143	5179	5400	8864	3307	4584	4391	8345	5542	4922	11162	8281	10524	5684	5861	3538	4170
		MED		25255	15111	25997	15682	15189	17195	14078	29730	28170	21972	22237	15717	11117	11248	74376	31751	8637	10042	10019	12584	14442	39321	18365	23352	6890
	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	
	Landings	ATL	Angola	102	4	49	20	9	39	32	0	2	118	118	118	0	0	138	0	931	0	1962	1997	131	267	1134	2	3
			Argentina	1794	1559	434	4	138	108	130	12	68	19	235	1	129	269	110	0	0	0	220	59	6	33	0	0	
			Barbados	0	0	0	0	0	0	0	0	0	0	1	2	2	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	
			Brazil	71	86	142	142	137	0	0	0	0	0	0	0	0	0	90	0	0	0	0	0	171	0	3	0	1
			Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	29	40
			Cuba	0	0	0	0	0	0	0	230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

				1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
			Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	539	539	539	539	0	**0**
			Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3	0	3	13	755	3	0	26	3	16
			Dominica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	16	16	9	4	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.España	8	39	5	3	2	2	1	0	12	12	10	5	23	9	2	15	14	13	36	45	57	7	44	28	10
			EU.Estonia	8	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	820	770	1052	990	990	610	610	610	24	32	0	18	0	0	0	0	122	59	25	208	241	102	245	288	333
			EU.Germany	0	0	0	0	0	714	0	0	0	0	0	38	0	0	0	0	0	0	0	0	0	0	0	6	
			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	0	48	0	0	0	0	56	125	91	108	100	0	
			EU.Latvia	7	4	0	3	19	301	887	318	0	416	396	639	0	0	0	0	0	0	0	0	0	0	0	0	
			EU.Lithuania	11	10	0	0	0	0	0	0	0	0	0	793	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	344	539	539	0	2047	104	1075	54	11
			EU.Poland	0	0	0	0	0	225	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			EU.Portugal	315	133	145	56	78	83	49	98	98	162	47	61	40	50	38	318	439	212	124	476	461	321	184	22	25
			EU.United Kingdom	0	0	0	0	0	287	0	0	0	0	0	0	0	0	0	35	0	0	30	71	113	4	0	0	0
			Gabon	0	0	0	0	0	0	0	0	0	0	0	58	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			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	
			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	
			Grenada	0	0	0	0	0	24	6	14	16	7	10	10	0	0	0	0	0	0	0	0	0	0	0	0	
			Guinea Ecuatorial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	59
			Jamaica	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Maroc	794	1068	1246	584	699	894	1259	1557	1390	2163	1700	2019	928	989	1411	1655	1053	1419	2523	109	145	235	89	90	174
			Mexico	200	657	779	674	1144	1312	1312	1632	1861	1293	1113	1032	1238	1066	654	1303	1188	1113	1063	1046	1080	1447	1534	1115	1110
			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	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Rumania	212	84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Russian Federation	948	29	0	0	0	0	0	4960	0	0	574	1441	461	16	79	316	259	52	368	1042	2293	848	125	416	308
			S. Tomé e Príncipe	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	149	153	158	162	267
			Senegal	597	345	171	814	732	1012	1390	2213	2558	286	545	621	195	183	484	2304	1020	1380	4029	1677	2876	1453	514	1217	1711
			Sierra Leone	4	6	0	0	0	0	0	0	0	11	245	44	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	
			St. Vincent and Grenadines	0	0	0	0	0	0	0	0	0	0	0	0	15	18	0	16	23	27	15	6	20	0	0	0	**0**
			Sta. Lucia	3	3	4	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	
			Togo	172	107	311	254	145	197	197	197	197	0	0	0	0	1583	1215	2298	0	0	0	0	0	0	0	0	
			Trinidad and Tobago	0	0	17	703	169	266	220	30	117	117	56	452	188	280	81	7	16	38	68	68	14	9	16	16	**0**
			U.S.A.	469	498	171	128	116	156	182	76	83	142	120	139	44	70	68	40	97	47	50	46	66	46	50	80	101
			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	0	2	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**
			Ukraine	0	25	0	0	0	342	2786	1918	1114	399	231	1312	30	0	0	0	0	0	0	0	0	0	0	0	
			Uruguay	26	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	1518	1454	5	1661	1651	1359	1379	1659	1602	2	0	61	13	0	16	18	19	12	38	10	21	7	4	9	
		MED	Albania	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Algerie	261	315	471	418	506	277	357	511	475	405	350	597	0	609	575	684	910	1042	976	1009	355	353	614	504	716
			EU.Bulgaria	17	20	8	0	25	33	16	51	20	35	35	35	0	0	0	0	0	0	0	16	8	96	6	5	8
			EU.Croatia	49	128	6	70	0	0	0	25	120	0	0	0	0	0	0	0	0	0	0	59	41	31	56	56	34
			EU.Cyprus	0	0	0	0	0	0	0	0	0	14	0	10	10	6	4	3	0	0	0	0	0	0	0	0	**0**
			EU.España	686	228	200	344	632	690	628	333	433	342	349	461	544	272	215	429	531	458	247	518	574	442	881	585	519
			EU.France	10	5	6	0	0	0	0	0	0	0	0	27	0	0	0	0	15	34	20	23	13	12	30	25	103
			EU.Greece	2690	2690	2690	1581	2116	1752	1559	945	2135	1914	1550	1420	1538	1321	1390	845	1123	587	476	531	798	733	960	678	159
			EU.Italy	1087	1288	1238	1828	1512	2233	2233	2233	4159	4159	4159	4579	2091	2009	1356	0	0	1323	1131	964	1197	472	1245	1053	750
			EU.Malta	0	0	0	0	0	2	7	2	2	1	0	1	0	1	1	11	7	7	3	6	1	3	2	0	2
			Egypt	574	518	640	648	697	985	725	724	1442	1442	1128	1128	0	0	0	0	0	0	0	0	0	0	0	0	
			Libya	0	71	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Maroc	69	31	25	93	37	67	45	39	120	115	5	61	85	78	38	89	87	142	131	57	12	1	0	8	26
			NEI (MED)	311	311	300	300	300	300	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			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	
			Serbia & Montenegro	45	0	3	2	6	10	12	12	14	17	17	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Tunisie	305	643	792	305	413	560	611	855	1350	1528	1183	1112	848	1251	0	0	0	0	0	0	1425	1415	1413	1407	
			Turkey	19151	8863	19548	10093	8944	10284	7810	24000	17900	12000	13460	6286	6000	5701	70797	29690	5965	6448	7036	9401	10019	35764	13158	19032	4573
			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	
			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	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	
BOP	TOTAL			608	641	630	791	703	2196	481	177	868	1207	1012	923	736	581	217	32	1047	533	449	287	377	681	662	952	1171
		ATL		507	465	378	615	588	2064	254	47	651	1062	858	786	713	573	215	32	875	426	442	273	335	657	641	939	1161
		MED		101	176	252	176	115	132	227	130	217	145	154	137	23	8	2	0	172	107	6	14	42	24	21	13	10

				1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	Landings	ATL	All gears	507	465	378	615	588	2064	254	47	651	1062	858	786	713	573	215	32	875	426	442	273	335	657	641	939	1161
		MED		101	176	252	176	115	132	227	130	217	145	154	137	23	8	2	0	172	107	6	14	42	24	21	13	10
		ATL	Benin	1	1	1	1	1	1	3	1	1	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	5	3	1	2	11	21	7	1	2	0	
			Maroc	486	423	348	598	524	2003	246	28	626	1048	830	780	706	503	132	0	634	391	273	199	213	642	555	867	1113
			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	20	41	29	16	63	60	5	18	24	14	28	6	7	70	78	29	240	33	158	53	115	14	84	72	48
		MED	Algerie	87	135	198	153	92	119	224	128	216	135	145	128	0	0	0	0	0	0	0	0	9	7	3	3	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	
			EU.Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	
			Libya	0	40	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Maroc	14	1	14	23	23	13	3	2	1	10	9	9	20	7	1	0	172	107	6	14	30	15	16	8	8
			Tunisie	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0	2	2	2	2	
BRS	Landings	A+M	All gears	8856	6051	8049	7161	7006	8435	8004	7923	5754	4785	4553	7750	5137	3410	3712	3587	2253	3305	2681	2871	2214	613	847	698	389
			Brazil	1437	1149	842	1149	1308	3047	2125	1516	1516	988	251	3071	2881	814	471	1432	563	1521	1042	1281	1162	0	0	2	0
			Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1
			EU.France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Grenada	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Guyana	0	0	0	0	0	211	571	625	1143	308	329	441	389	494	521	377	277	312	141	92	116	124	151	0	387
			Trinidad and Tobago	2749	2130	2130	2130	1816	1568	1699	2130	1328	1722	2207	2472	1867	2103	2720	1778	1414	1472	1498	1498	936	489	695	695	
			Venezuela	4670	2772	5077	3882	3882	3609	3609	3651	1766	1766	1766	1766	0	0	0	0	0	0	0	0	0	0	0	0	
CER	Landings	A+M	All gears	375	390	450	490	429	279	250	250	0	3	5	1	2	1	1	1	0	0	0	0	1	0	0	0	1
			Dominica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
			Dominican Republic	45	79	50	90	29	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			EU.France	330	310	400	400	400	250	250	250	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Sta. Lucia	0	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		10356	6367	12678	8407	7535	13809	14954	15872	13004	12918	12788	11635	4527	6446	4905	6606	6786	6773	10465	10809	11134	11897	14570	12850	7411
	Landings		All gears	10356	6367	12678	8407	7535	13809	14954	15872	13004	12918	12788	11635	4527	6446	2933	5649	5850	4918	7878	7350	8562	9117	11985	10610	7270
	Landings(FP)			0	0	0	0	0	0	0	0	0	0	0	0	0	0	1972	958	936	1855	2587	3459	2571	2780	2585	2240	
	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	141
	Landings		Angola	1	0	4	6	21	29	12	31	2	38	38	38	0	0	0	0	95	0	63	19	59	39	22	47	2
			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	
			Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	266
			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	
			Brazil	746	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	135	82	115	86	13	6	22	191	154	81	171	278	264	344	300	318	378	574	1312	711	853	1811	2461	5418	362
			Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	7	14
			Curaçao	0	0	0	0	0	590	1157	1030	1159	1122	989	710	505	474	0	150	106	485	364	0	235	238	481	1456	1151
			Côte d'Ivoire	0	0	0	0	0	0	0	3	0	1	1	0	0	994	4	354	541	14	813	161	297	38	2837	261	141
			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	541	228	362	297	386	947	581	570	23	17	722	438	635	34	166	73	278	631	1094	950	877	1708	1234	1200	1682
			EU.Estonia	198	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	121	63	105	126	161	147	146	0	91	127	91	0	168	47	6	98	24	24	91	147	246	233	147	258
			EU.Latvia	243	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	290	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	0	9	150	90	0	164	5	85	0	6
			EU.Portugal	3	0	0	0	0	0	1	31	5	9	28	5	4	7	212	3	250	13	0	0	0	0	0	0	1
			EU.United Kingdom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	26	0	0	0	**0**
			El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	435
			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	
			Ghana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2577	2134	1496	2786	3604	2295	2469	2382	0	
			Grenada	0	0	0	0	0	0	1	0	0	0	1	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	98	74	81	78	48	63	0	26	
			Guinea Ecuatorial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	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	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	1131	332	274	122	645	543	2614	2137	494	582	418	441	184	542	61	52	135	179	9	19	862	554	55	21	90
			Mixed flags (FR+ES)	3633	4017	9674	3107	1919	7177	6063	6342	8012	9864	9104	7748	1623	1722	0	0	0	0	0	0	0	0	0	0	
			NEI (ETRO)	1	4	32	68	70	180	120	309	491	291	420	186	71	180	166	0	0	0	0	0	0	0	0	0	
			Panama	243	57	118	341	328	240	91	0	0	0	0	0	0	394	975	970	1349	411	439	425	339	463	504	905	292
			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	
			Russian Federation	1078	627	150	405	456	46	500	2433	477	12	25	308	56	56	63	6	6	12	113	270	912	113	217	139	249
			S. Tomé e Príncipe	41	39	33	37	48	79	223	197	209	200	200	200	200	234	215	290	0	275	282	290	298	307	315	324	636
			Senegal	311	201	342	319	309	0	0	0	7	0	4	0	13	288	151	83	119	383	15	217	201	341	16	22	1407
			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	
			Trinidad and Tobago	0	0	17	0	56	199	368	127	138	245	0	0	0	414	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	

				1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
			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	
			Ukraine	0	0	0	0	0	0	0	0	36	48	0	43	0	0	0	0	0	0	0	0	0	0	0	0	
			Venezuela	1762	368	886	2609	2601	3083	2839	2164	1631	210	444	32	113	182	42	165	52	48	54	215	508	85	150	71	64
	Landings(FP)		Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	154	71	86	78	107	
			Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	144	84	200	189	188	428	130	271	256	268	
			Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	55	29	36	225	233	139	214	149	224	
			Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	177	81	236	
			EU.España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	265	191	108	663	866	889	708	576	555	586	
			EU.France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	444	217	94	151	264	555	500	605	520	221	
			Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	142	75	69	99	53	105	25	150	42	65	
			Guinée Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	168	0	24	37	0	174	518	542	672	441	
			Mixed flags (EU tropical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	507	105	161	383	631	764	247	0	0	0	
			Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	274	230	251	297	261	157	230	158	234	92	
	Discards		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	141
DOL	TOTAL	A+M		291	188	174	334	334	307	295	363	349	234	303	347	564	2632	2772	1295	4753	1042	5381	9889	7187	3647	5162	5103	5289
	Landings		All gears	291	188	174	334	334	307	295	363	349	234	303	347	564	2632	2772	1295	4753	1042	5381	9889	7187	3394	4936	4922	5282
	Discards			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	253	226	181	7
	Landings		Brazil	0	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	0	15
			Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	343	307	245	
			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	199	34
			EU.España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	54	73	73	0	85	166	113	102	161
			EU.France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	372	819	1737	1360	1474	1473	1563
			EU.Italy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	700	525	1133
			EU.Malta	291	188	174	334	334	307	295	363	349	234	303	347	507	473	447	517	274	399	395	530	349	181	385	208	334
			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	
			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	1
			Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42	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	27
			Senegal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	250	
			St. Vincent and Grenadines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	155	56	118	72	96	84	86	48	
			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	407	505
			Suriname	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	515	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	13	1	24
			U.S.A.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	479	503	578	366	668	818
			UK.Bermuda	0	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	0	55	0	14	16	0	0	24	0	38	40	42	29	39
	Discards		Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	253	226	181	
			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	0	7
			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
KGM	TOTAL	A+M	All gears	13241	14691	16331	14777	14930	17782	19660	16394	17717	16161	15360	17258	15863	12830	11766	8185	17936	7344	12533	9742	10868	12762	12248	4432	3642
	Landings		Angola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	139	914	**0**
			Antigua and Barbuda	0	0	1	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	
			Brazil	962	979	1380	1365	1328	2890	2398	3595	3595	2344	1251	2316	3311	247	202	316	33	0	0	1	1	0	115	0	**0**
			Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2
			Dominica	0	0	0	0	0	0	0	0	36	35	2	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Dominican Republic	34	47	52	0	0	0	589	288	230	226	226	226	0	0	0	0	0	0	0	0	0	0	0	0	
			Grenada	0	0	0	0	0	2	4	28	14	9	4	5	0	0	0	0	0	0	0	0	0	0	0	0	
			Guyana	0	0	0	0	0	0	270	440	398	214	239	267	390	312	245	168	326	174	91	59	75	90	99	0	358
			Jamaica	0	0	0	0	0	0	0	0	0	0	0	48	0	0	0	0	0	0	0	0	0	0	0	0	
			Mexico	2147	3014	3289	3097	3214	4661	4661	3583	4121	3688	4200	4453	4369	4564	3447	4201	3526	3113	3186	3040	3130	3090	3335	3019	3281
			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
			St. Vincent and Grenadines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	9	0	0	0	0	**0**
			Sta. Lucia	0	0	0	0	0	1	4	0	0	9	1	1	0	1	1	1	2	0	1	3	4	1	1	0	0
			Trinidad and Tobago	657	0	1192	0	471	1029	875	746	447	432	410	1457	802	578	747	661	567	1043	1001	1001	720	393	495	496	1
			U.S.A.	8213	9344	9616	7831	7360	7058	8720	7373	6453	6780	6603	6061	6991	7129	7123	2837	13482	3013	8247	5630	6939	9187	8062	0	**0**
			UK.Bermuda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			UK.British Virgin Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1
			Venezuela	1228	1308	801	2484	2558	2140	2139	340	2424	2424	2424	2424	0	0	0	0	0	0	0	0	0	0	0	0	
KGX	TOTAL	A+M	All gears	225	266	301	508	512	824	156	251	1	229	48	0	15	0	1	93	16	0	2	20	114	110	117	127	68
	Landings		Barbados	45	51	55	36	42	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Brazil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	
			Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	
			Colombia	7	12	21	148	111	539	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	236	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	5	4	14	19	23

				1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
			EU.Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	26	16	0	2	20	7	2	0	0	
			Gabon	0	0	0	140	145	79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Grenada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Jamaica	0	0	0	0	0	0	155	0	0	44	48	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	
			Puerto Rico	0	53	84	86	134	106	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	14	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	4	
			S. Tomé e Príncipe	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	98	100	102	105	45
			St. Vincent and Grenadines	0	0	0	0	0	1	1	1	1	138	0	0	0	0	0	67	0	0	0	0	1	0	0	0	
			Sta. Lucia	79	150	141	98	80	50	0	0	0	48	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	
			Ukraine	94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
LTA	TOTAL			13086	24202	16554	14175	12829	14254	16348	17583	15391	18298	18668	19453	16713	15939	11503	9247	16878	13514	15060	18898	18613	17836	20251	11676	8897
		ATL	All gears	10771	22447	15296	12978	10934	12138	14746	14668	12515	15003	15804	16810	16029	14500	10461	7642	15191	11256	12961	16728	14945	13650	15619	8071	7730
		MED		2315	1755	1258	1197	1894	2116	1601	2914	2876	3294	2863	2643	684	1439	1042	1605	1687	2259	2100	2170	3668	4186	4633	3605	1167
	Landings	ATL		10771	22447	15296	12978	10934	12138	14746	14668	12515	15003	15804	16810	16029	14500	10172	6747	13539	9194	10911	13232	11286	9880	11990	5930	7526
		MED		2315	1755	1258	1197	1894	2116	1601	2914	2876	3294	2863	2643	684	1439	1042	1605	1687	2259	2100	2170	3668	4186	4633	3605	1167
	Landings(FP)	ATL		0	0	0	0	0	0	0	0	0	0	0	0	0	0	290	894	1652	2062	2050	3496	3660	3770	3629	2141	
	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	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	0
	Landings	ATL	Angola	306	14	175	121	117	235	75	406	118	132	132	132	0	0	2	0	4365	0	128	1759	3455	1905	1085	10	6
			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	61	49	53	60	58	58	196	83	69	69	69	69	0	0	0	0	0	0	0	0	0	0	0	0	
			Brazil	779	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	
			Cape Verde	74	148	17	23	72	63	86	110	776	491	178	262	143	137	81	123	292	250	357	185	102	131	131	131	131
			Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	12	16
			Cuba	63	33	13	15	27	23	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	38	38	76	57	0	**0**
			Côte d'Ivoire	100	142	339	251	253	250	155	136	9	123	1	0	0	153	287	427	2159	1791	1446	1631	50	1062	1433	152	102
			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	
			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	81	1	0	0	10	55	27	110	6	2	22	8	1	489	50	16	0	38	35	136	168	71	52	112	381
			EU.Estonia	66	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	74	13	8	54	59	22	215	21	696	631	610	613	0	10	27	12	0	1	50	35	5	30	27	6	29
			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	65	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	9	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	0	14	69	8	0	18	1	9	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	61	73	45	72	72	218	320	171	14	50	0	2	16	19	21	24	43	10	6	5	14	4	18	0	
			EU.United Kingdom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	15	23	38	0	0	**0**
			Gabon	0	0	0	0	0	182	0	18	159	301	213	57	173	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	
			Ghana	201	11608	359	994	513	113	2025	359	306	707	730	4768	8541	7060	5738	783	1335	745	1692	1465	1001	1274	1138	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	1	1
			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	
			Maroc	57	370	44	43	230	588	195	189	67	101	87	308	76	91	33	0	40	2	63	5	57	10	11	3	0
			Mauritania	4	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)	2422	2678	4975	2071	1279	3359	2836	2936	3846	4745	4238	3334	1082	1148	0	0	0	0	0	0	0	0	0	0	
			NEI (ETRO)	0	0	8	20	0	0	0	0	0	0	0	33	2	0	0	0	0	0	0	0	0	0	0	0	
			Panama	0	0	64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			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	
			Russian Federation	617	306	265	189	96	49	0	88	0	0	0	74	13	0	0	0	0	0	0	268	11	208	399	255	136
			S. Tomé e Príncipe	46	48	41	40	43	40	50	39	37	33	33	33	33	178	182	179	0	183	188	193	198	203	209	214	182
			Senegal	3484	4011	4724	4536	3613	1972	4174	4715	1607	3546	5176	2866	4394	3508	2699	3826	3885	5108	5683	6371	4910	2769	5912	3774	5065
			South Africa	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	
			St. Vincent and Grenadines	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Sta. Lucia	0	0	0	0	0	0	2	2	2	0	1	10	1	0	0	1	0	0	0	0	0	0	1	0	2
			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.	228	597	1286	1142	1312	2230	2015	1546	1623	1209	1451	1366	1492	1382	765	1351	1401	963	1244	1120	1201	1507	1191	1253	1471
			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	10	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	1963	1409	1889	2115	2115	1840	1840	2815	2247	2247	2247	2254	50	0	0	0	0	30	0	2	8	4	1	4	
		MED	Algerie	522	585	495	459	552	554	448	384	562	494	407	148	0	158	116	187	96	142	119	131	98	6	157	341	204
			EU.Croatia	2	3	2	15	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	28	25	44	37	43
			EU.Cyprus	25	21	11	23	10	19	19	19	16	19	19	19	0	0	0	0	6	5	4	0	0	0	0	0	**0**

				1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
			EU.España	0	0	0	0	15	18	9	15	0	8	82	32	0	41	262	116	202	212	86	299	488	441	235	300	456
			EU.France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	42	0	0	0	1
			EU.Greece	0	0	0	0	0	0	0	0	0	0	0	132	0	0	112	69	72	183	148	165	301	276	363	289	131
			EU.Italy	0	0	0	0	0	0	0	0	0	0	0	16	24	38	34	0	0	486	243	365	304	669	557	442	
			EU.Malta	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	3	2	5	3	7	5	21	9	4	7
			Egypt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	849	712	
			Israel	108	126	119	119	215	119	119	119	119	119	119	119	0	0	0	0	0	0	0	0	0	0	0	0	
			Libya	0	0	0	0	0	0	45	52	0	5	4	4	0	0	0	0	0	0	0	0	0	0	0	0	
			Maroc	0	0	0	0	1	0	1	14	8	0	0	3	1	0	9	0	331	19	24	1	0	0	0	0	0
			NEI (MED)	200	200	200	200	200	200	200	200	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Palestine	0	0	0	0	0	90	59	61	60	60	60	129	0	0	0	0	0	0	0	0	0	0	0	0	
			Serbia & Montenegro	5	0	28	21	35	22	18	20	18	16	16	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Syria	110	156	161	156	155	270	350	417	390	370	370	330	0	0	0	0	193	133	163	148	155	304	229	0	
			Tunisie	1343	664	242	204	696	824	333	1113	752	1453	1036	960	657	633	0	0	0	0	0	0	810	800	803	798	
			Turkey	0	0	0	0	0	0	0	500	750	750	750	750	0	568	507	1230	785	1074	1309	1046	1437	1645	1386	682	326
			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	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	223	51	238	144	133	
			Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	76	265	214	189	262	266	179	438	178	
			Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39	42	50	160	185	167	209	284	284	
			Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	162	56	12	
			EU.España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41	126	208	844	970	1030	1096	577	583	873	
			EU.France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	102	145	141	103	207	695	994	1354	720	365	
			Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	178	92	118	17	121	43	126	145	64	
			Guinée Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	21	2	0	358	260	666	1186	202	
			Mixed flags (EU tropical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	139	306	364	262	516	530	0	0	0	
			Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	191	577	368	228	106	250	259	72	30	
	Discards	ATL	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	204
		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
MAW	TOTAL	A+M	All gears	3652	2423	1723	1138	1808	2831	1415	1482	909	1219	828	1345	550	285	443	276	435	422	460	2079	1106	930	2865	1009	712
	Landings		Angola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	86	1650	249	221	1247	0	3
			Benin	214	202	214	194	188	188	362	511	205	205	205	205	0	0	0	0	0	0	0	0	0	0	0	0	
			Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	66	0	0	1	0	0	0	90	35	47
			EU.Estonia	49	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	0	2	0	0	0	0	
			EU.Latvia	34	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	52	4	0	0	0	0	0	0	0	0	0	298	0	0	0	0	0	0	0	0	0	0	0	0	
			EU.Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	10	0	0	0	
			Gabon	0	0	0	0	0	0	0	85	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	
			Ghana	2778	899	466	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	19	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
			S. Tomé e Príncipe	5	3	5	6	6	8	7	8	5	6	6	6	6	21	12	13	0	91	94	96	98	100	102	105	13
			Senegal	520	1225	1019	938	1614	2635	1046	878	700	987	617	794	532	262	431	196	435	329	278	331	749	610	1426	870	649
			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	
			Ukraine	0	90	0	0	0	0	0	0	0	21	0	42	12	0	0	0	0	0	0	0	0	0	0	0	
SSM	TOTAL	A+M	All gears	15318	16285	16317	14490	13697	16571	15403	8641	9837	8220	8383	9414	9793	8119	10470	6282	6102	5900	6197	5974	5931	5185	5459	3857	4078
	Landings		Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
			Colombia	37	95	58	69	69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Cuba	538	611	310	409	548	613	613	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	
			Dominican Republic	728	735	739	1330	2042	2042	231	191	125	158	158	158	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	9	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	
			Gabon	0	0	0	0	0	0	0	0	0	0	0	265	0	0	0	0	0	0	0	0	0	0	0	0	**0**
			Grenada	0	0	1	2	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	
			Mexico	8360	9181	10066	8300	7673	11050	11050	5483	6431	4168	3701	4350	5242	3641	5723	3856	3955	4155	4251	4128	4026	3321	3581	3857	4077
			Sta. Lucia	0	0	0	0	0	0	0	0	0	0	1	27	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	
			U.S.A.	5655	5663	5143	4380	3363	2866	3509	2968	3282	3893	4524	4613	4552	4477	4747	2425	2147	1746	1946	1846	1896	1864	1877	0	**0**
WAH	TOTAL	A+M		1721	1835	2671	2143	2408	2515	3085	2488	2957	2020	2296	2202	2049	2596	2456	1809	2568	2158	2354	2032	2237	3667	3530	2912	1874
	Landings		All gears	1721	1835	2671	2143	2408	2515	3085	2488	2957	2020	2296	2202	2049	2596	2099	1630	2283	1586	1883	1763	1760	3479	3423	2826	1868
	Landings(FP)			0	0	0	0	0	0	0	0	0	0	0	0	0	0	357	179	285	572	471	269	477	85	0	0	
	Discards			0	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		Antigua and Barbuda	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Aruba	60	50	50	125	40	50	50	50	50	50	50	50	0	0	0	0	0	0	0	0	0	0	0	0	
			Barbados	60	51	91	82	42	35	52	52	41	41	0	0	34	45	26	41	36	27	17	30	29	22	21	17	10
			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	
			Brazil	64	71	33	26	1	16	58	41	0	0	0	0	405	519	449	111	75	76	70	19	357	213	202	153	131

		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	Cape Verde	351	350	326	361	408	503	603	429	587	487	578	500	343	458	449	555	524	351	472	470	470	445	445	445	445
	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1132	1012	810	
	Curaçao	250	260	270	250	230	230	230	230	230	230	230	230	0	0	0	0	0	0	0	0	0	0	0	0	
	Côte d'Ivoire	0	1	0	0	0	0	0	0	0	0	0	0	0	16	3	1	11	0	5	5	12	9	95	1	25
	Dominica	43	59	59	59	58	58	58	58	50	46	11	37	10	6	8	15	14	16	10	13	13	0	0	0	
	Dominican Republic	9	13	7	0	0	0	325	112	31	35	35	35	0	0	0	0	0	0	0	0	0	0	0	0	
	EU.España	28	32	22	20	15	25	25	29	28	32	38	46	48	305	237	110	66	38	73	53	87	35	50	41	50
	EU.France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	4	0	0	46	45
	EU.Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3	0	4	3	9	8	10	2	0	0
	Grenada	77	104	96	46	49	56	56	59	82	51	71	59	44	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	1	0	0	0	0	14	21
	Maroc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	76	0	0	0	0	
	Mexico	0	0	0	0	0	0	0	0	0	0	0	0	0	35	0	0	0	0	0	0	0	0	0	16	12
	Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	91	240	120	86	111	99	210	373	228	
	S. Tomé e Príncipe	34	27	36	39	46	80	52	56	62	52	52	52	52	94	88	76	0	131	235	241	247	254	260	266	100
	Saint Kitts and Nevis	0	0	0	0	0	0	0	0	0	0	0	0	7	6	7	0	0	0	0	0	0	0	0	0	6
	Senegal	0	0	64	0	0	1	0	0	5	0	0	0	5	0	1	1	0	0	2	6	0	11	24	0	3
	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	33	41	28	16	23	10	65	52	46	311	17	40	60	0	241	29	24	31	40	31	5	32	24	9
	Sta. Lucia	79	150	141	98	80	221	223	223	310	243	213	217	169	238	169	187	0	171	195	199	0	0	148	155	87
	Suriname	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	588	415	0	**0**
	Trinidad and Tobago	118	1	0	0	0	0	1	1	1	2	1	9	7	6	6	7	6	6	5	5	7	9	9	9	9
	U.S.A.	134	203	827	391	764	608	750	614	858	640	633	846	789	712	558	89	1123	495	522	358	240	399	207	480	787
	UK.Bermuda	67	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	0	3	0	0	0	0	1	0	4	1	1
	UK.Sta Helena	12	17	35	26	25	23	0	0	0	0	0	0	0	0	0	0	0	0	29	19	31	12	16	16	10
	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	302	333	514	542	540	487	488	360	467	4	17	13	9	7	16	13	33	9	25	28	23	38	32	27	30
Landings(FP)	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	40	0	0	0	
	Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	92	9	55	60	22	29	25	4	0	0	
	Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	7	31	57	23	78	9	0	0	
	Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	
	EU.España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	92	63	44	224	262	136	240	56	0	0	
	EU.France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	10	3	16	26	26	17	0	0	0	
	Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	68	11	21	28	7	0	8	0	0	0	
	Guinée Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	8	15	7	0	0	0	0	0	
	Mixed flags (EU tropical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	30	44	97	26	39	0	0	0	0	
	Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39	44	104	102	65	13	66	15	0	0	
Discards	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	104	108	86	
	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	6
	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	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	
	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	
	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	

EU-France 2015 Task I: last revision (arriving after the species groups deadline) not included in the table.

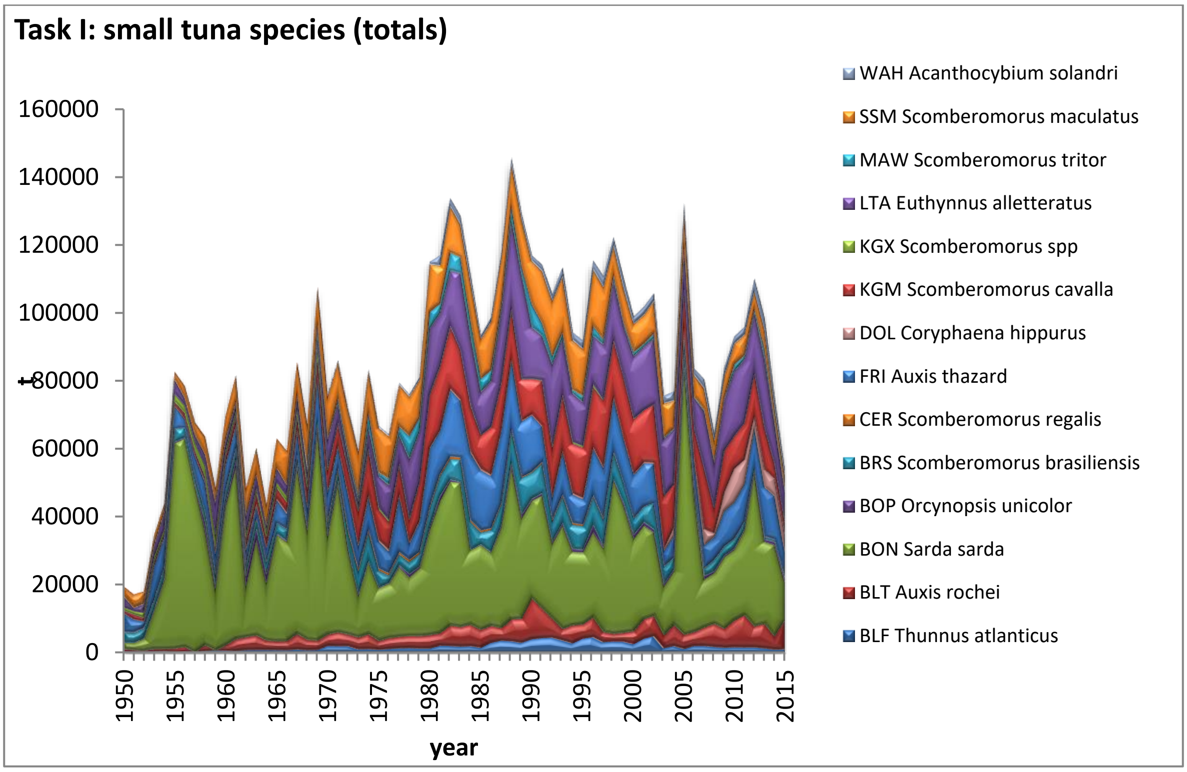
SMT-Table 2. Summary of the life-history parameters currently available for small tunas species in the 5 stock/statistical areas: North and South Atlantic Ocean (both Eastern and Western) and the Mediterranean Sea.

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									

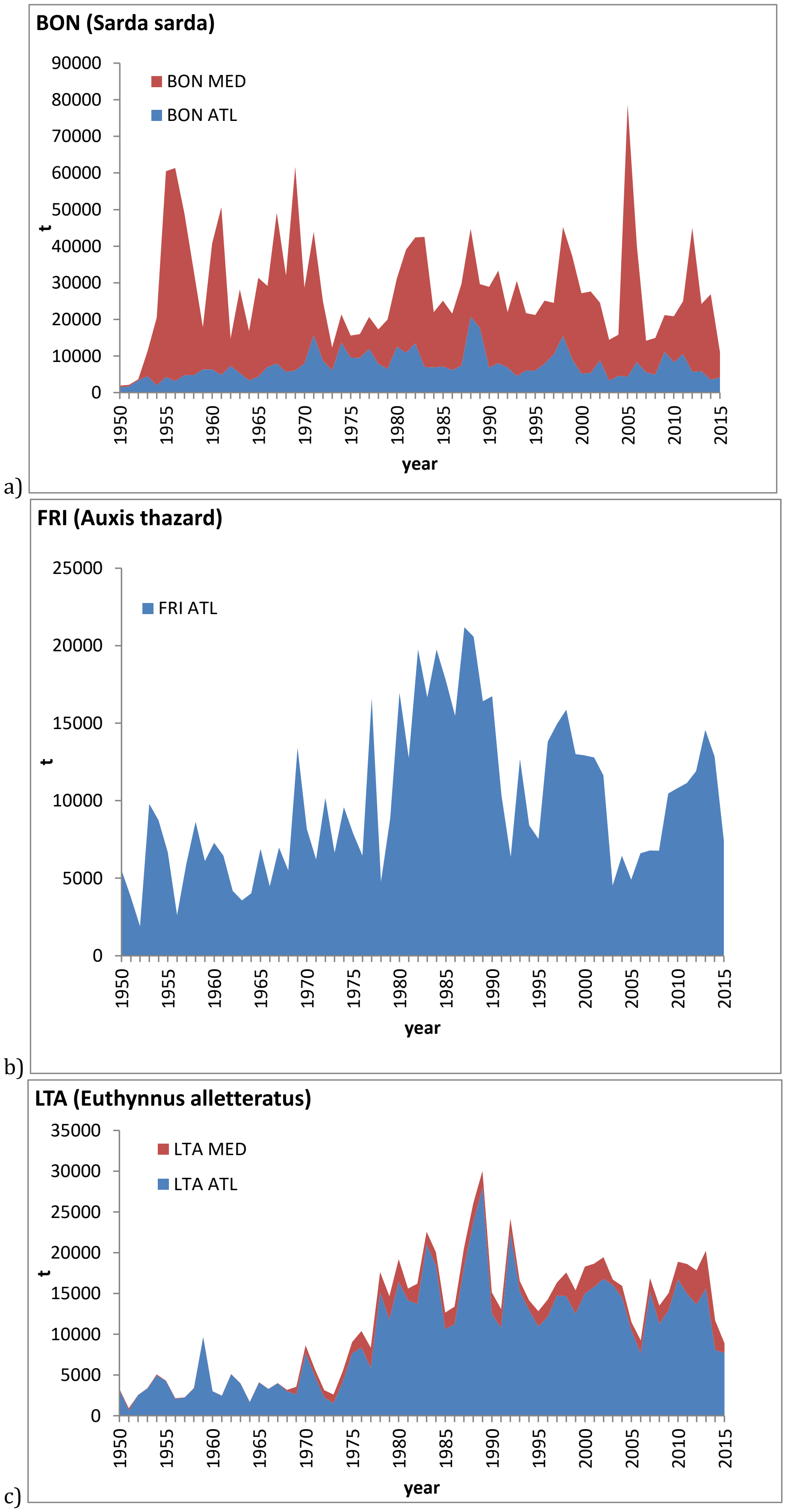
Green: Data available, several studies and at least one of them was published in the last 10 years
Yellow: Data available, single study or several older than 10 years
Red: No existing data

SMT-Table 3. Risk of the small tunas species caught by tuna longline fisheries in the Atlantic Ocean.

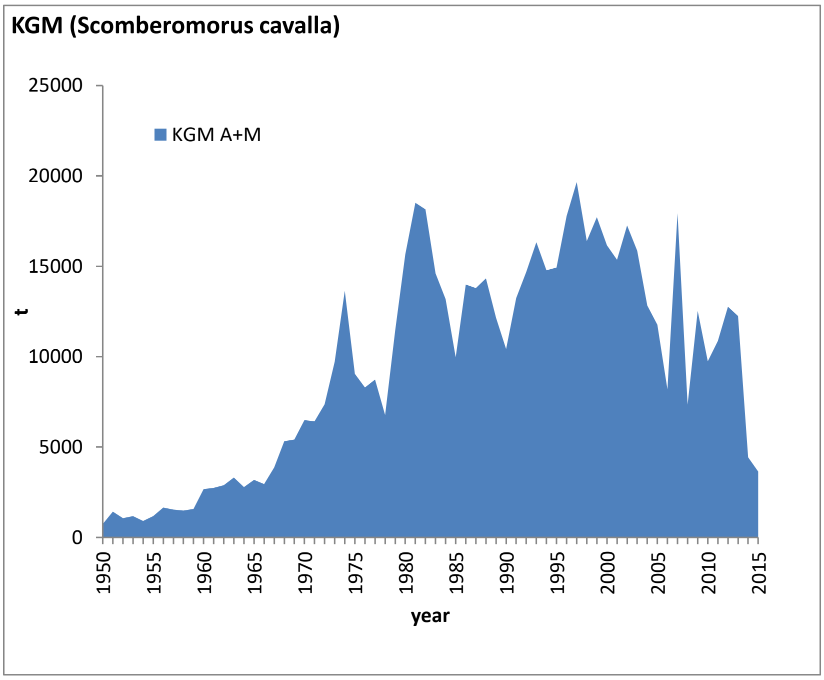
Species	Code	Ocean	Productivity Score	Susceptibility Score	Vulnerability Score	Rank	Risk
Acanthocybium solandri	WAH	S. Atlantic	1.53	2.5	2.10	1	High
Scomberomorus cavalla	KGM	S. Atlantic	1.24	2	2.03	2	High
Scomberomorus cavalla	KGM	N. Atlantic	1.41	2	1.88	3	High
Scomberomorus maculatus	SSM	N. Atlantic	1.60	2	1.72	4	High
Euthynnus alleteratus	LTA	S. Atlantic	2.24	2.5	1.68	5	High
Thunnus atlanticus	BLF	N. Atlantic	2.00	2.3	1.67	6	High
Euthynnus alletteratus	LTA	N. Atlantic	1.47	1.5	1.61	7	Moderate
Thunnus atlanticus	BLF	S. Atlantic	1.82	2	1.54	8	Moderate
Scomberomorus brasiliensis	BRS	S. Atlantic	2.00	2	1.41	9	Moderate
Acanthocybium solandri	WAH	N. Atlantic	1.71	1.5	1.39	10	Moderate
Scomberomorus regalis	CER	S. Atlantic	2.07	2	1.37	11	Moderate
Auxis thazard	FRI	N. Atlantic	2.13	2	1.32	12	Moderate
Scomberomorus regalis	CER	N. Atlantic	2.27	2	1.24	13	Low
Sarda sarda	BON	N. Atlantic	2.29	2	1.22	14	Low
Sarda sarda	BON	S. Atlantic	2.35	2	1.19	15	Low
Auxis rochei	BLT	N. Atlantic	2.53	2	1.11	16	Low
Auxis rochei	BLT	S. Atlantic	2.53	2	1.11	16	Low
Auxis thazard	FRI	S. Atlantic	2.53	2	1.10	18	Low



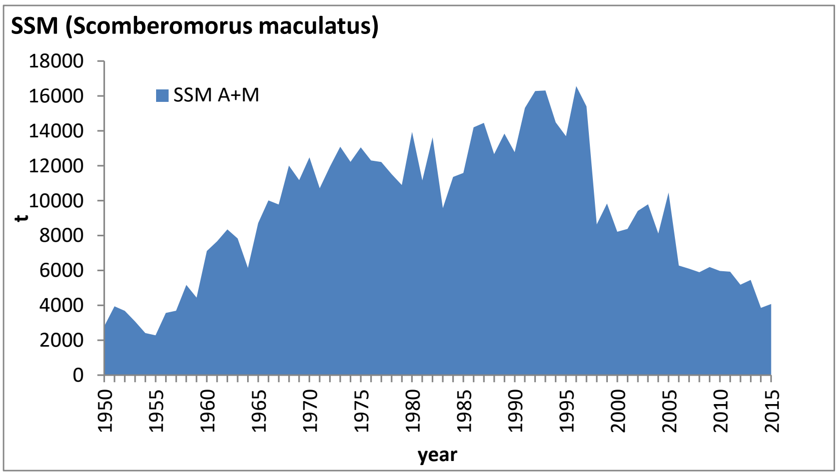
SMT-Figure 1. Estimated landings (t) of small tunas (combined) in the Atlantic and Mediterranean, 1950-2015. The data for the last three years are incomplete.



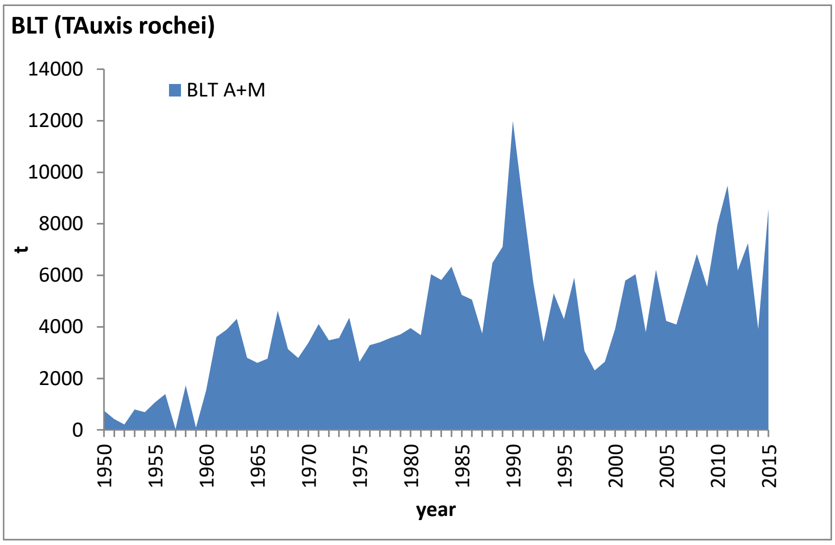
SMT-Figure 2. Estimated landings (t) of the major species of small tunas in the Atlantic and Mediterranean, 1950-2015. The data for the last years are incomplete.



d)

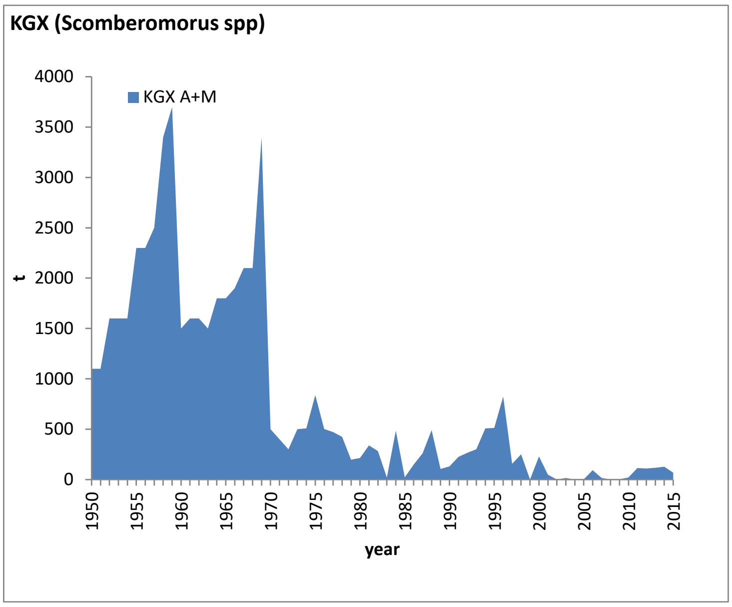


e)

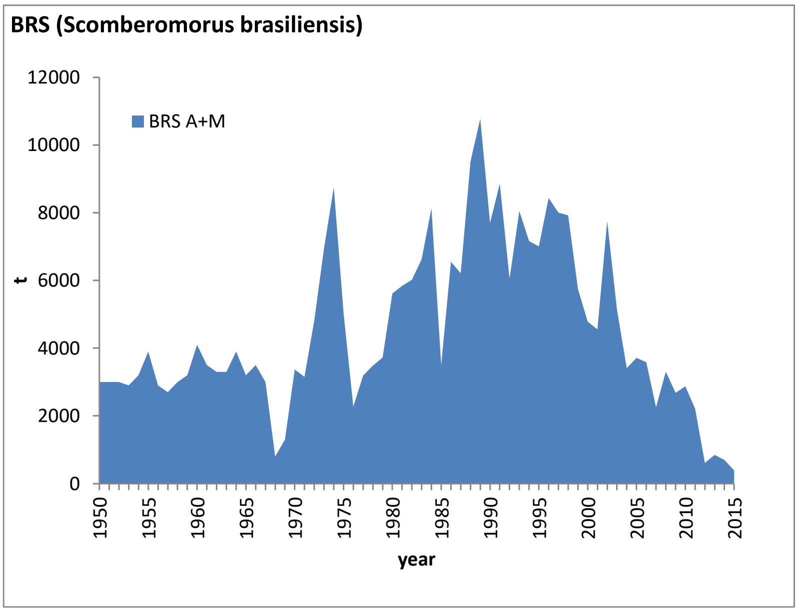


f)

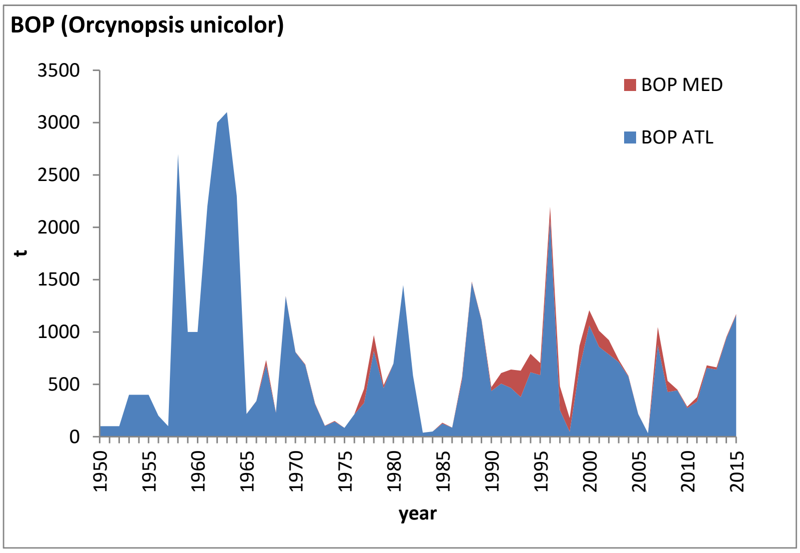
SMT-Figure 2. Estimated landings (t) of the major species of small tunas in the Atlantic and Mediterranean, 1950-2015. The data for the last years are incomplete.



g)

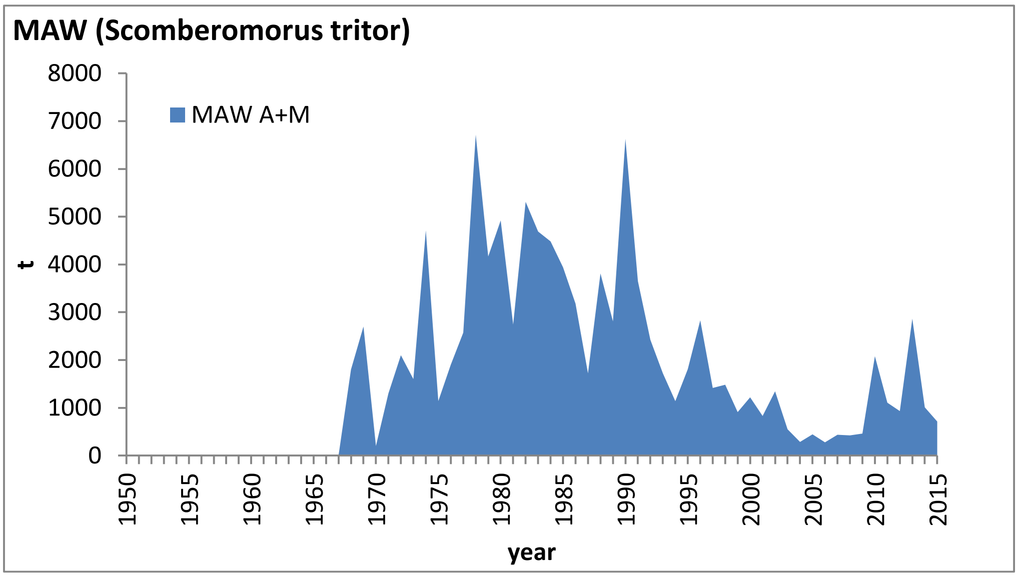


h)

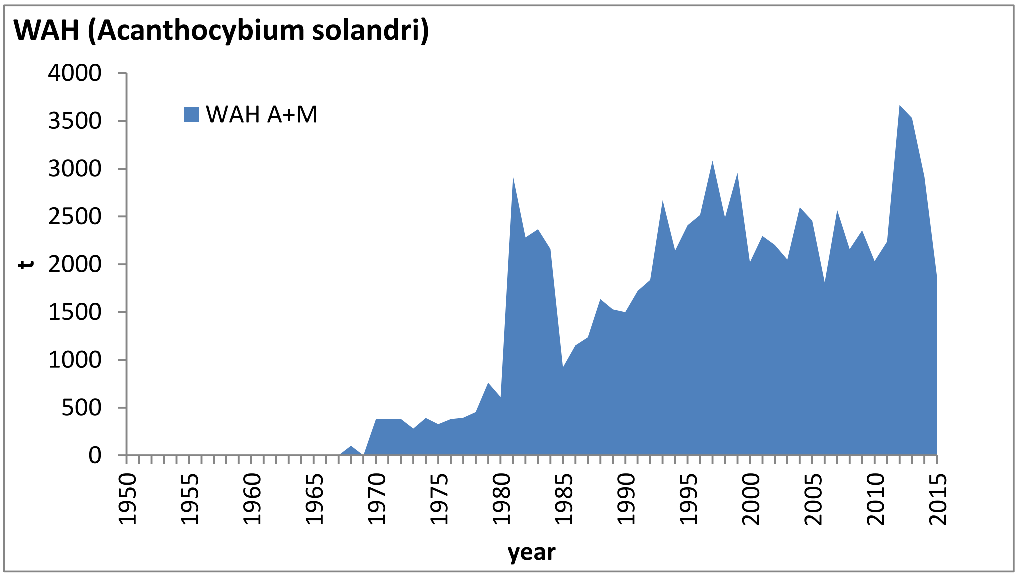


i)

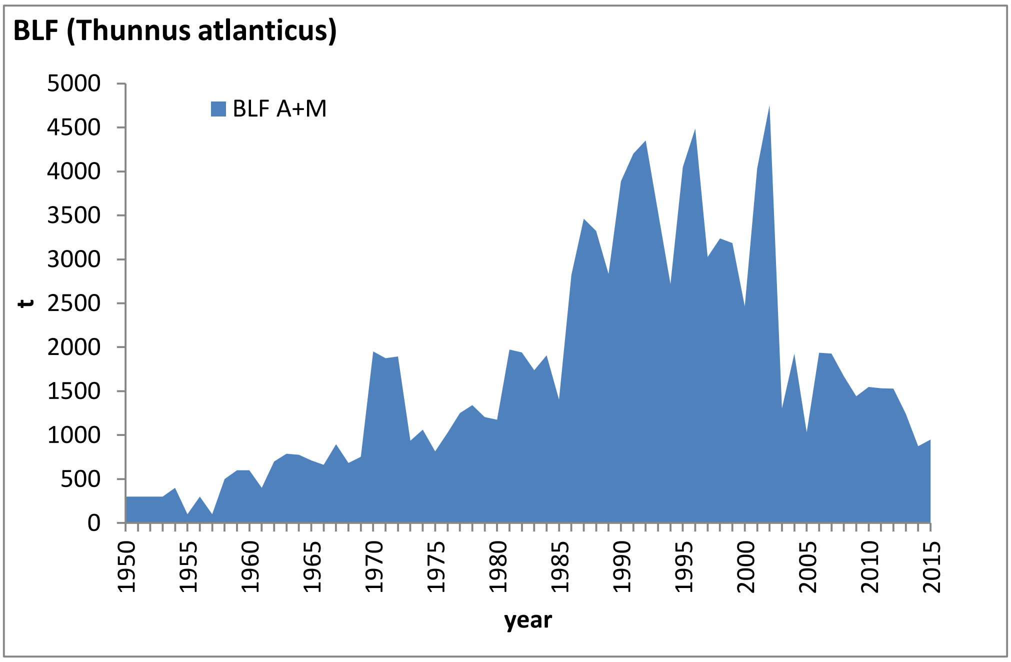
SMT-Figure 2. Estimated landings (t) of the major species of small tunas in the Atlantic and Mediterranean, 1950-2015. The data for the last years are incomplete.


MAW (Scomberomorus tritor)
MAW A+M
t
8000
7000
6000
5000
4000
3000
2000
1000
0
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
year

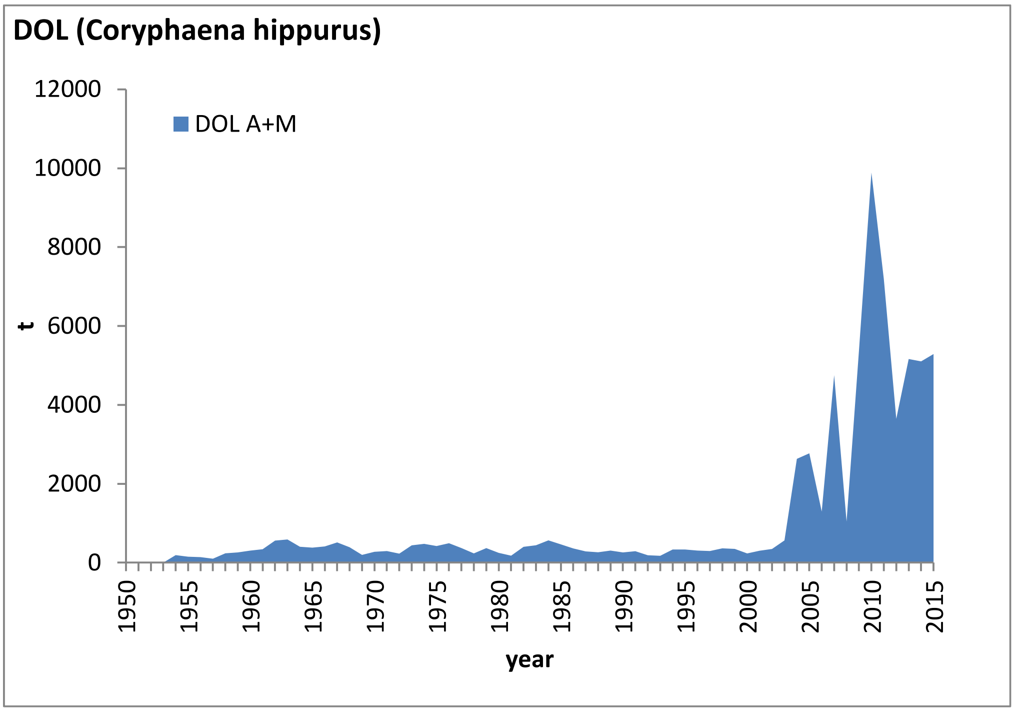
j)


WAH (Acanthocybium solandri)
WAH A+M
t
4000
3500
3000
2500
2000
1500
1000
500
0
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
year

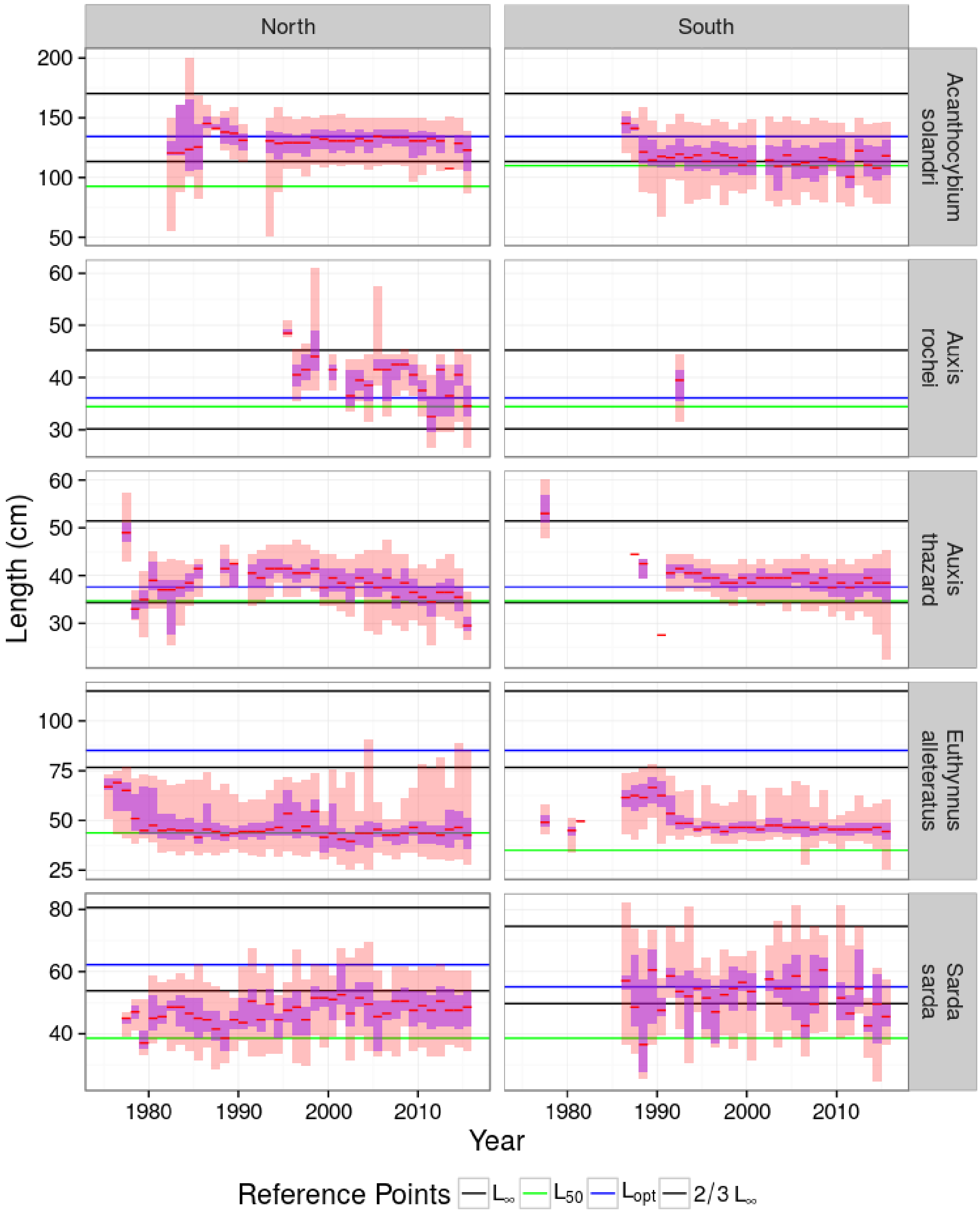
k)


BLF (Thunnus atlanticus)
BLF A+M
t
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
year

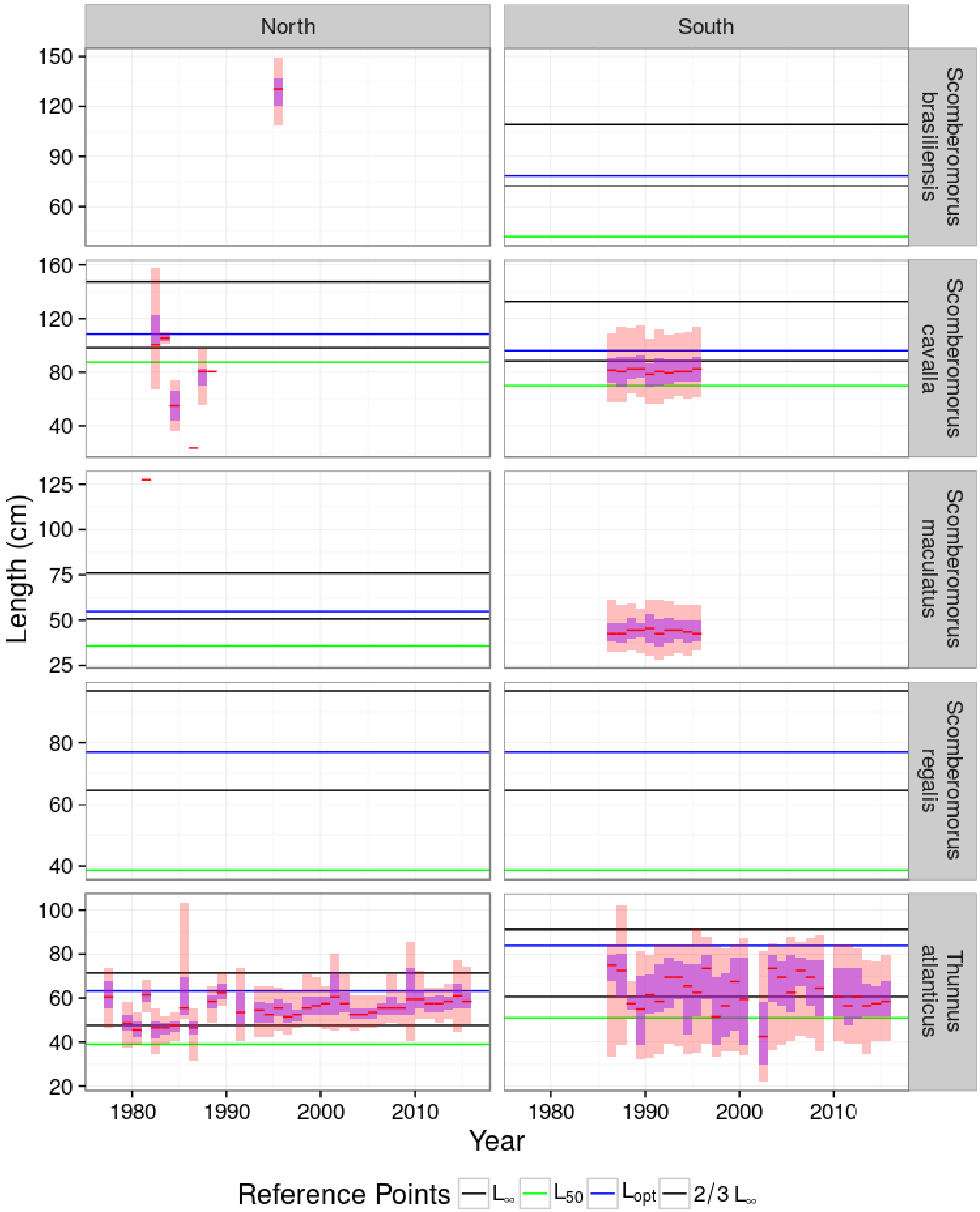
l)

m)


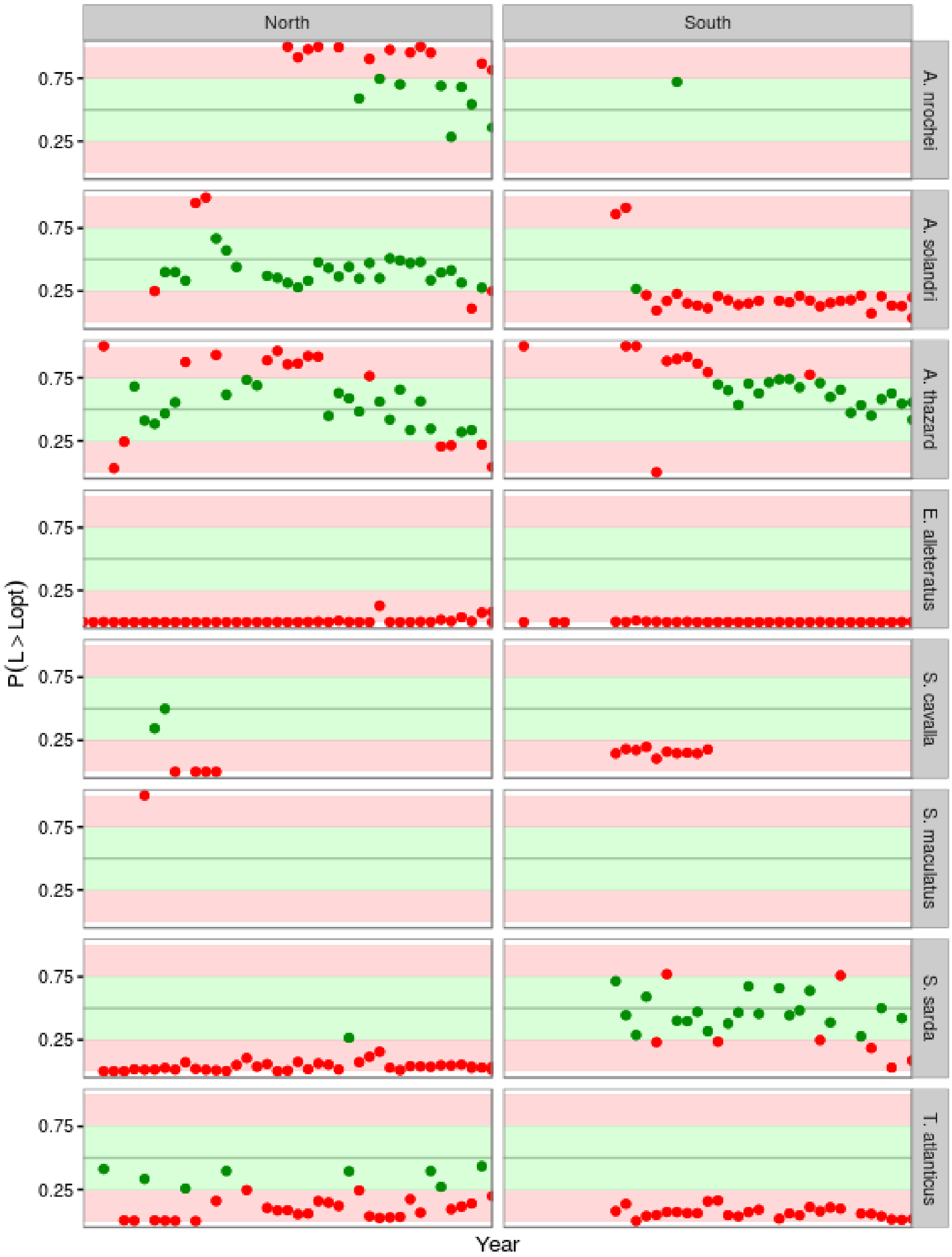
SMT-Figure 2. Estimated landings (t) of the major species of small tunas in the Atlantic and Mediterranean, 1950-2015. The data for the last years are incomplete.



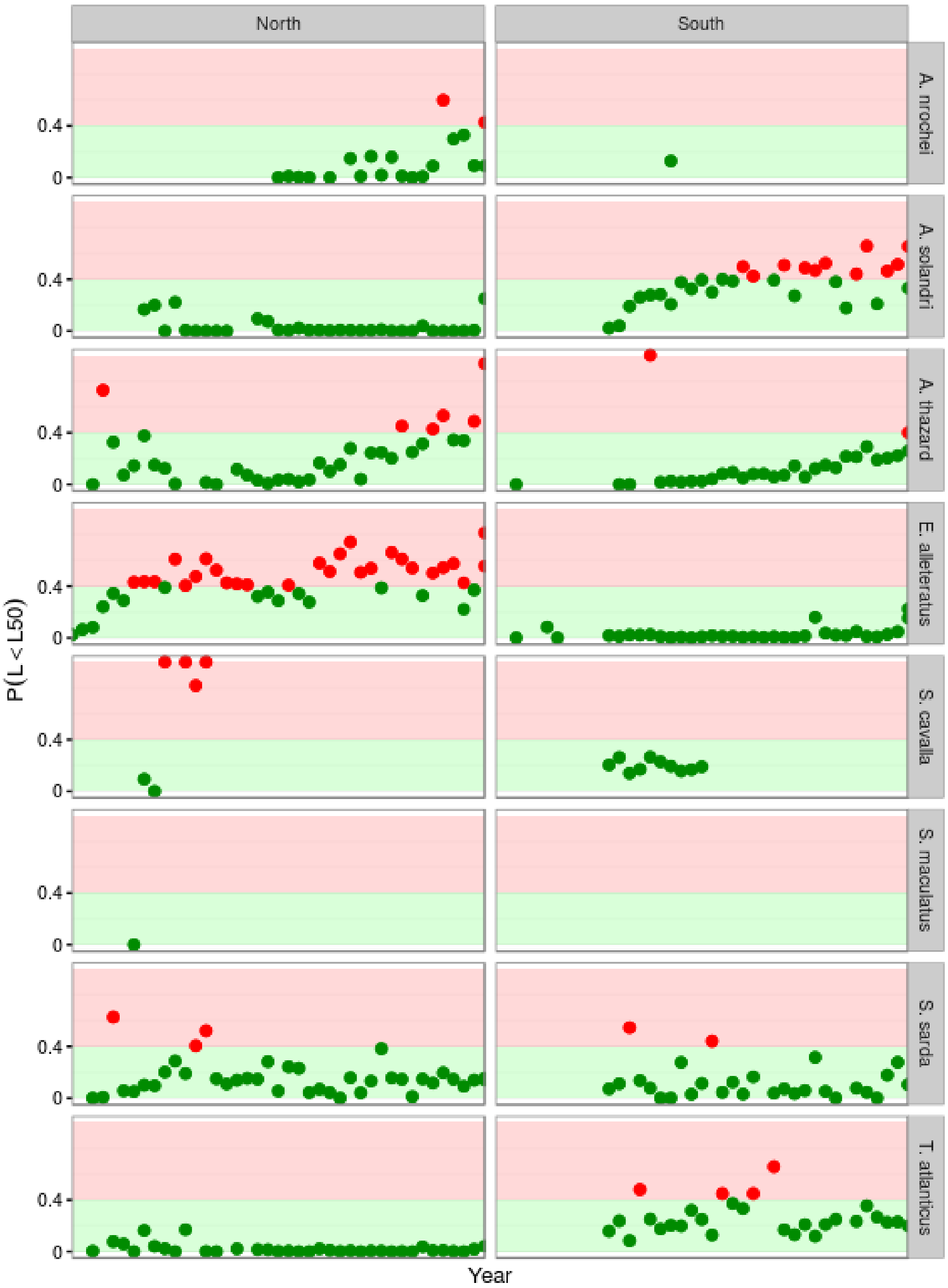
SMT-Figure 3a. Length distributions and reference points by species and Atlantic region for version 4 of task II size data. The horizontal lines show the reference points i.e. asymptotic length (L_∞), length at 50% mature (L_{50}) and two estimates of the size at which a cohort reaches its maximum biomass (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

An intersessional meeting was conducted in 2016 with the main goal of reviewing the data available for the planned 2017 shortfin mako assessment. The meeting was held in Madeira, Portugal, 25-29 April. Information about the status of the blue shark (*Prionace glauca*) is available in the 2015 report of the assessment, for shortfin mako (*Isurus oxyrinchus*) information is available in the 2012 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: Uruguayan longline, Brazilian longline, Japanese longline (early and late), Chinese Taipei longline, and Spanish 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)**.

During the 2012 shortfin mako stock assessment, different standardized CPUE series were presented, both for the South and North stocks. For both stocks, the series were conflicting and did not coincide with the catch tendencies (**SHK-Figures 4-5**). The Committee noted that the increase in the CPUE series could be due to an increase in abundance, an increase in catchability, in the fishing strategy or in data reporting for this species.

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 state-space surplus production model formulation were generally less optimistic, predicting that the stock could be overfished and overfishing could be occurring in some cases (**SHK Figure 8**).

SHK-3.2 Shortfin Mako shark

The 2012 assessment of the status of North and South Atlantic stocks of shortfin mako shark was conducted with updated time series of relative abundance indices and annual catches. Coverage of Task I catch data and number of CPUE series increased since the last stock assessment conducted in 2008, with Task I data now being available for most major longline fleets. The available CPUE series showed increasing or flat trends for the final years of each series (since the 2008 stock assessment) for both North and South stocks, hence the indications of potential overfishing shown in the previous stock assessment have diminished and the level of catches at that time may be considered sustainable.

For the North Atlantic stock, results of the two stock assessment model runs used indicated almost unanimously that stock abundance in 2011 was above B_{MSY} and F was below F_{MSY} (**SHK-Figure 9**). For the South Atlantic stock, all model runs indicated that the stock was not overfished and overfishing was not occurring (**SHK-Figure 10**). Thus, these results indicated that both the North and South Atlantic stocks are healthy and the probability of overfishing is low. However, they also showed inconsistencies between estimated biomass trajectories and input CPUE trends, which resulted in wide confidence intervals in the estimated biomass and fishing mortality trajectories and other parameters. Particularly in the South Atlantic an increasing trend in the abundance indices since the 1970s was not consistent with the increasing catches. The high uncertainty in past catch estimates and deficiency of some important biological parameters, particularly for the Southern stock, are still obstacles for obtaining reliable estimates of current status of the stocks.

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 11**). 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 12**). 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 13**). 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 and Shortfin mako shark

Due to the difficulty of determining current status for both the North and South Atlantic stocks of both species, in particular absolute population abundance, 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.

SHK-5. Effect of current regulations

Two Mediterranean-specific measures relevant to shark species of interest were adopted during 2012. First, 10 elasmobranch species were strictly protected under Annex II of the Barcelona Convention (under the Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean). These species include shortfin mako (*Isurus oxyrinchus*), porbeagle (*Lamna nasus*), smooth hammerhead (*Sphyrna zygaena*), scalloped hammerhead (*Sphyrna lewini*), great hammerhead (*Sphyrna mokarran*), and tope (*Galeorhinus galeus*). Under Annex II protection, these shark species can no longer be captured or sold, and plans for their recovery should be developed. Second, the General Fisheries Commission for the Mediterranean (GFCM) adopted Recommendation GFCM/36/2012/3, under which shark species listed under Annex II of the Barcelona Convention cannot be retained on board, transhipped, landed, transferred, stored, sold, displayed, or offered for sale. Additionally, in 2014, porbeagle was added to Appendix II of CITES, which regulates global trade.

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.

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 or 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 purse seines, gillnets, and artisanal fisheries. Estimates of shark entanglements in FADs are also important. Management measures should be applied to these sectors where catches of shark species are determined to be significant. Methods for mitigating shark by-catch by these fisheries also need to be investigated and applied.

Given the uncertainty in stock status results for the South Atlantic stock of blue sharks, the Committee recommends that recent catch levels (e.g. in the final five years of the assessment model, 2009-2013) not be increased. 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.

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 alive, 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.

Taking into consideration the continued high vulnerability ranking in the ERA, results from the modelling approaches used in the assessment, the associated uncertainty, and the relatively low productivity of shortfin mako sharks, the Committee reiterates, as a precautionary approach, that catches of shortfin mako sharks should not be increased with respect to the 2006-2010 (the last five years of the assessment model) levels until more reliable stock assessment results are available for both the Northern and Southern stocks.

NORTH ATLANTIC BLUE SHARK SUMMARY

Provisional Yield (2015)		43,708 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]

[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 (2015)		24,234 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 (2015)		3,269 t[1]
Relative Biomass	B_{2010}/B_{MSY}	1.15-2.04[2]
	B_{2010}/B_0	0.55-1.63[3]
Relative Fishing Mortality	F_{MSY}	0.029-0.104[4]
	F_{2010}/F_{MSY}	0.16-0.92[5]
Stock Status (2010)	Overfished	No[6]
	Overfishing	No[6]
Management Measures in Effect:		[Rec. 04-10], [Rec. 07-06], [Rec. 10-06][Rec. 14-06]

[1] Task I catch.
[2] Range obtained from BSP and CFASP models. Value from CFASP is SSB/SSB_{MSY}. Low value is lowest value from 16 BSP runs and high value is highest value from 10 CFASP runs.
[3] Range obtained from BSP and CFASP models. Value from CFASP is SSB/SSB_0. Low value is lowest value from 10 CFASP runs and high value is highest value from 16 BSP runs.
[4] Range obtained from BSP and CFASP models. Low value is lowest value from 16 BSP runs and high value is highest value from 10 CFASP runs.
[5] Range obtained from BSP and CFASP models. Low value is lowest value from 10 CFASP runs and high value is highest value from 16 BSP runs, with the exception of a single run where the value was 1.63.
[6] The Committee considers that results have a high degree of uncertainty.

SOUTH ATLANTIC SHORTFIN MAKO SUMMARY

Provisional Yield (2015)		2,585 t[1]
Relative Biomass	B_{2010}/B_{MSY}	1,36-2,16[2]
	B_{2010}/B_0	0.72-3.16[3]
Relative Fishing Mortality:	F_{MSY}	0.029-0.041[4]
	F_{2010}/F_{MSY}	0.07-0.40[5]
Stock status (2010)	Overfished	No[6]
	Overfishing	No[6]
Management Measures in Effect:		[Rec. 04-10], [Rec. 07-06], [Rec. 10-06] [Rec. 14-06]

[1] Task I catch.
[2] Range obtained from BSP and CFASP models. Value from CFASP is SSB/SSB_{MSY}. Low value is lowest value from 13 BSP runs and high value is highest value from 2 CFASP runs.
[3] Range obtained from BSP and CFASP models. Value from CFASP is SSB/SSB_0. Low value is lowest value from 2 CFASP runs and high value is highest value from 13 BSP runs.
[4] Range obtained from BSP and CFASP models. Low value is lowest value from 13 BSP runs and high value is highest value from 2 CFASP runs.
[5] Range obtained from BSP and CFASP models. Low value is lowest value from 13 BSP runs and high value is highest value from 2 CFASP runs.
[6] 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. (v1, 2016-09-30)

			1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
TOTAL			4318	3668	9600	11300	11584	11650	39578	35623	37023	40664	35800	32765	37983	36305	43072	43888	50464	53901	58842	65193	73192	63241	56840	69408	68027
	ATN		4306	3560	9589	8590	8468	7395	29283	26763	26172	28174	21709	20066	23005	21742	22359	23217	26927	30723	35198	37178	38083	36778	37058	39881	43708
	ATS		8	107	10	2704	3108	4252	10145	8797	10829	12444	14043	12682	14967	14438	20642	20493	23487	23097	23459	27799	35069	26421	19682	29292	24234
	MED		3	1	0	6	8	2	150	63	22	45	47	17	11	125	72	178	50	81	185	216	40	42	100	235	85
Landings	ATN	Longline	3037	2884	7458	7645	7547	6130	28678	26152	25382	27305	20699	19290	22880	21297	22167	23067	26810	30514	35031	36952	37777	36549	36875	39549	42859
		Other surf.	497	492	994	373	300	559	426	419	681	732	905	708	70	380	126	104	63	80	63	59	100	109	74	205	723
	ATS	Longline	8	107	10	2704	3108	4246	10135	8790	10801	12444	14042	12678	14961	14339	20638	20434	23417	22708	23453	27785	34531	25878	19382	27343	23288
		Other surf.	0	0	0	0	0	0	6	4	27	0	1	4	6	99	3	59	10	375	6	14	534	411	167	1835	818
	MED	Longline	0	0	0	5	7	1	147	61	20	44	47	17	10	43	71	83	48	81	18	50	40	41	68	190	84
		Other surf.	3	1	0	1	1	1	2	2	2	1	1	1	0	81	0	95	2	1	167	165	0	0	32	45	1
Discards	ATN	Longline	772	184	1136	572	621	602	180	170	104	137	105	68	55	63	66	45	53	129	102	167	205	119	109	128	125
		Other surf.	0	0	0	0	0	103	0	22	4	0	0	0	0	1	0	0	0	1	1	1	2	1	0	0	0
	ATS	Longline	0	0	0	0	0	7	5	4	1	0	0	0	0	0	0	0	60	14	0	0	4	132	132	114	122
		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	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	0
Landings	ATN	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114	461	1039	903	1216	392	4
		Brazil	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Canada	774	1277	1702	1260	1494	528	831	612	547	624	1162	836	346	965	1134	977	843	0	0	0	0	1	0	0	0
		Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		China PR	0	0	0	0	0	0	0	0	0	0	185	104	148	0	0	0	367	109	88	53	109	98	327	0	1
		Chinese Taipei	0	0	0	487	167	132	203	246	384	165	59	0	171	206	240	588	292	110	73	99	148	94	113	99	167
		EU.Denmark	1	1	0	1	2	3	1	1	0	2	1	13	5	1	0	0	0	0	0	0	0	0	0	0	
		EU.España	0	0	0	0	0	0	24497	22504	21811	24112	17362	15666	15975	17314	15006	15464	17038	20788	24465	26094	27988	28666	28562	29041	30078
		EU.France	187	276	322	350	266	278	213	163	399	395	207	221	57	106	120	99	167	119	84	122	115	31	216	132	259
		EU.Ireland	0	0	0	0	0	0	0	0	66	31	66	11	2	0	0	0	0	0	0	0	1	3	2	1	
		EU.Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**0**
		EU.Portugal	2257	1583	5726	4669	4722	4843	2630	2440	2227	2081	2110	2265	5643	2025	4027	4338	5283	6167	6252	8261	6509	3768	3694	3060	3859
		EU.United Kingdom	0	0	0	0	12	0	0	1	0	12	9	6	4	6	5	3	6	6	96	8	10	8	10	10	12
		FR.St Pierre et Miquelon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	0	1203	1145	618	489	340	357	273	350	386	558	1035	1729	1434	1921	2531	2007	1763	1227	2437	1808	6573	8153
		Korea Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	537	299	327	113	
		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	873
		Mexico	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	1	0
		Panama	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	254	892	613	1575	0	0	0	289	153	**0**
		Senegal	0	0	0	0	0	0	0	0	0	0	0	456	0	0	0	0	43	134	255	56	0	5	12	17	13
		Suriname	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	181	281	0	**0**
		Trinidad and Tobago	0	0	0	0	0	0	0	0	0	0	0	6	3	2	1	1	0	2	8	9	11	11	8	10	4
		U.S.A.	308	215	680	29	23	283	211	255	217	291	39	0	0	7	2	2	1	8	4	9	65	56	32	39	31
		UK.Bermuda	0	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	7	24	23	18	16	6	27	7	47	43	47	29	40	10	28	12	19	8	73	75	117	98	52	113	129
	ATS	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	37	259	0	236	109	0	273	243	483	234	171	105
		Benin	0	0	0	0	0	0	6	4	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Brazil	0	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	0	565	316	452	0	0	0	585	40	109	41	131	84	64	48	20
		Chinese Taipei	0	0	0	1232	1767	1952	1737	1559	1496	1353	665	0	521	800	866	1805	2177	1843	1356	1625	2138	1941	2125	2106	1235
		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	92	16
		EU.España	0	0	0	0	0	0	5272	5574	7173	6951	7743	5368	6626	7366	6410	8724	8942	9615	13099	13953	16978	14348	10473	11447	10133
		EU.Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	**0**
		EU.Portugal	0	0	0	0	847	867	1336	876	1110	2134	2562	2324	1841	1863	3184	2751	4493	4866	5358	6338	7642	2424	1646	1622	2420
		EU.United Kingdom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	239	0	0	14	0	0	0	0	0	**0**

			1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
		Ghana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1583	396
		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	16
		Japan	0	0	0	1388	437	425	506	510	536	221	182	343	331	209	236	525	896	1789	981	1161	1483	3060	2255	6397	4580
		Korea Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	222	125	112	61	10	71
		Namibia	0	0	0	0	0	0	0	0	0	0	0	2213	2316	1906	6616	3536	3419	1829	207	2352	2957	1439	1147	2471	2137
		Panama	0	0	0	0	0	0	0	0	168	22	0	0	0	0	0	0	0	521	0	0	0	0	0	0	**0**
		Russian Federation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	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	0	143	147	152	156	206
		Senegal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	203	51	60	0	18
		South Africa	0	0	0	0	0	0	0	23	21	0	83	63	232	128	154	90	82	126	119	125	318	158	179	524	487
		U.S.A.	0	0	0	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	**0**
		Uruguay	8	107	10	84	57	259	180	248	118	81	66	85	480	462	376	232	337	359	942	208	725	433	130	0	**0**
	MED	Algerie	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.Cyprus	0	0	0	0	0	0	0	0	0	9	0	0	3	6	5	0	0	0	0	0	0	0	0	0	**0**
		EU.España	0	0	0	0	0	0	146	59	20	31	6	3	3	4	8	61	3	2	7	48	38	39	37	53	65
		EU.France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	4	5	15
		EU.Italy	0	0	0	0	0	0	0	0	0	0	0	0	0	113	1	95	46	75	175	165	0	0	57	173	
		EU.Malta	3	1	0	1	1	1	2	2	2	1	1	1	0	0	0	0	1	1	2	1	1	2	2	4	5
		EU.Portugal	0	0	0	0	0	0	0	2	0	5	41	14	3	0	56	22	0	0	0	2	0	0	0	0	
		Japan	0	0	0	5	7	1	1	0	0	0	0	0	1	1	2	0	0	2	0	0	0	0	0	0	**0**
Discards	ATN	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	5
		Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	10	6	19
		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	18
		U.S.A.	772	184	1136	572	618	704	180	192	100	137	106	68	55	65	66	45	54	130	103	167	206	106	99	122	83
		UK.Bermuda	0	0	0	0	3	1	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	ATS	Brazil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	14	0	0	0	0	0	0	
		Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	132	132	112	122
		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	6
		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	
		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	1	
		U.S.A.	0	0	0	0	0	7	5	4	1	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

EU-France 2015 Task I: last revision (arriving after the species groups deadline) not included in the table.

SMA-Table 1. Estimated catches (t) of Shortfin mako (*Isurus oxyrinchus*) by area, gear and flag. (v1, 2016-09-30)

			1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
TOTAL			1331	1451	2967	3156	5064	2995	5768	5662	4291	5151	4748	5382	7726	7604	6626	6338	6919	5447	6150	6666	7024	7360	5573	6316	5854
	ATN		803	957	2194	1594	3138	2053	3580	3855	2791	2597	2682	3416	3923	5180	3479	3378	4083	3566	4116	4188	3771	4478	3646	2975	3269
	ATS		529	493	773	1562	1927	942	2182	1798	1495	2549	2059	1964	3801	2423	3130	2951	2834	1880	2034	2477	3251	2880	1928	3341	2585
	MED		0	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	575	661	1499	1238	1658	1798	3397	3679	2695	2277	2452	3145	3906	4755	3172	3105	3901	3387	3919	4007	3549	4191	3362	2699	2917
		Other surf.	217	258	671	335	1450	253	182	176	94	320	230	270	17	425	307	272	176	169	177	178	213	268	278	265	341
	ATS	Longline	519	480	763	1542	1914	927	2160	1788	1485	2540	2041	1949	3770	2347	3116	2907	2792	1798	2027	2476	3189	2817	1880	3308	2567
		Other surf.	9	13	10	20	13	15	23	10	10	9	18	15	31	76	14	43	30	82	7	1	62	55	47	31	15
	MED	Longline	0	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	11	38	24	21	29	1	0	0	0	0	0	0	0	0	0	0	7	9	20	2	9	19	5	12	10
		Other surf.	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	ATS	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	8	0	2	2
		Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	MED	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Landings	ATN	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	28	69	114	99	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	0	111	67	110	69	70	78	69	78	73	80	91	71	72	43	53	41	37	29	35	55	85
		China PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	81	16	19	29	18	24	11	5	2
		Chinese Taipei	0	0	0	61	21	16	25	31	48	21	7	0	84	57	19	30	25	23	11	14	13	14	8	5	10
		EU.España	0	0	0	0	0	0	2416	2199	2051	1566	1684	2047	2068	3404	1751	1918	1816	1895	2216	2091	1667	2308	1509	1481	1362
		EU.France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	2	0	0	0	1	1
		EU.Portugal	314	220	796	649	657	691	354	307	327	318	378	415	1249	473	1109	951	1540	1033	1169	1432	1045	1023	820	219	222
		EU.United Kingdom	0	0	0	0	0	0	0	0	2	3	2	1	1	1	0	0	0	1	15	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	1	2	0	4	0	0	4	0	
		Japan	157	318	425	214	592	790	258	892	120	138	105	438	267	572	0	0	82	131	98	116	53	56	33	138	94
		Korea Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	27	15	8	2
		Maroc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	420	406	667	624	947
		Mexico	0	0	0	0	10	0	0	0	0	10	16	0	10	6	9	5	8	6	7	8	8	8	4	4	4
		Panama	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	49	33	39	0	0	0	19	7	**0**
		Philippines	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	**0**
		Senegal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	17	21	0	0	2	0	2	2
		St. Vincent and Grenadines	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
		Sta. Lucia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	
		Trinidad and Tobago	0	0	0	0	0	0	0	0	1	0	1	2	3	1	2	1	1	1	1	1	0	2	1	1	1
		U.S.A.	315	376	948	642	1710	469	407	347	159	454	395	415	142	521	469	386	375	344	365	392	383	412	406	398	519
		UK.Bermuda	0	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	6	5	1	7	7	17	9	8	6	9	24	21	28	64	27	14	19	8	41	27	20	33	9	13	7
	ATS	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	0	17	2	0	32	59	78	88	1	15
		Brazil	0	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	0	34	45	23	27	19	74	126	305	22	208	260	0	0	0	77	6	24	32	29	8	9	9	5
		Chinese Taipei	0	0	0	116	166	183	163	146	141	127	63	0	626	121	128	138	211	124	117	144	203	150	157	157	112
		Côte d'Ivoire	9	13	10	20	13	15	23	10	10	9	15	15	30	15	14	16	25	0	5	7	0	20	34	19	11
		EU.España	0	0	0	0	0	0	1356	1141	861	1200	1235	811	1158	703	584	664	654	628	939	1192	1535	1197	1083	1077	862
		EU.Portugal	0	0	0	0	92	94	165	116	119	388	140	56	625	13	242	493	375	321	502	336	409	176	132	127	158
		EU.United Kingdom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	11	0	0	0	0	0	**0**
		Japan	506	460	701	1369	1617	514	244	267	151	264	56	133	118	398	0	0	72	115	108	103	132	291	114	362	220
		Korea Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	13	7	7	4	4

			1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
		Namibia	0	0	0	0	0	0	0	0	1	0	0	459	375	509	1415	1243	1002	295	23	307	377	586	9	950	661
		Panama	0	0	0	0	0	0	0	0	24	1	0	0	0	0	0	0	0	10	0	0	0	0	0	0	**0**
		Philippines	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	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	0	13	34	23	0	11
		South Africa	0	0	0	0	0	0	0	19	13	0	79	19	138	126	125	99	208	136	100	144	211	92	177	365	402
		U.S.A.	0	0	0	0	0	0	2	1	0	2	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	13	20	28	12	17	26	20	23	21	35	40	38	188	249	146	68	36	41	106	23	76	36	1	0	**0**
		Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	0	52	12	13	1	0	0	0	0	0	0	0	
	MED	EU.Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	**0**
		EU.España	0	0	0	0	0	0	6	7	5	3	2	2	2	2	2	4	1	0	0	1	2	2	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	
		EU.Portugal	0	0	0	0	0	0	0	1	0	1	5	0	0	0	15	5	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	
		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	
Discards	ATN	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
		Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	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	1
		Mexico	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		U.S.A.	11	38	24	21	28	1	0	0	0	0	0	0	0	0	0	0	7	10	20	2	9	18	5	11	8
		UK.Bermuda	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	ATS	Brazil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	
		Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	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
	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

EU-France 2015 Task I: last revision (arriving after the species groups deadline) not included in the table.

POR-Table 1. Estimated catches (t) of porbeagle (*Lamna nasus*) by area, gear and flag. (v1, 2016-09-30)

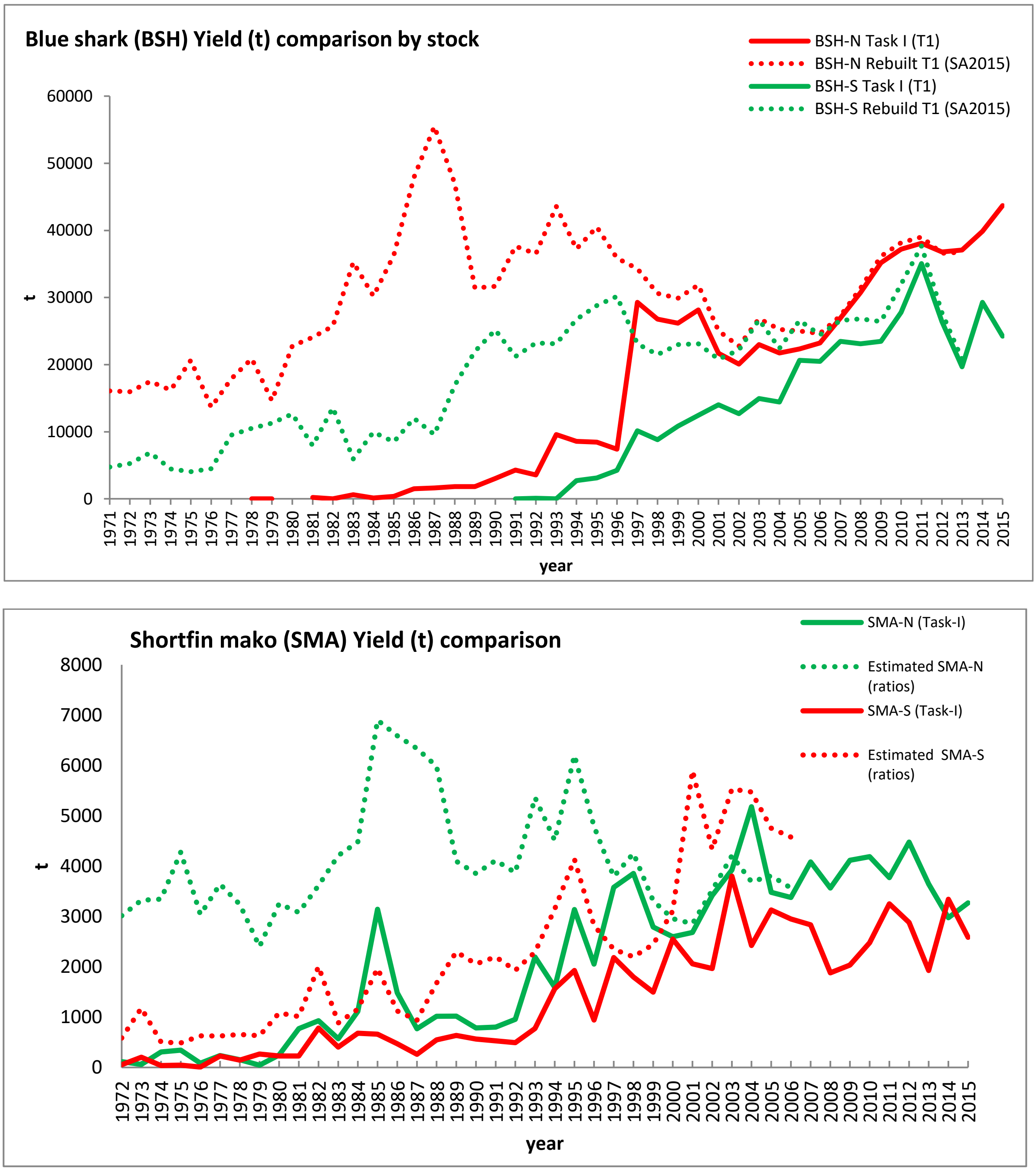
			1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
TOTAL			1991	2603	1910	2729	2140	1560	1859	1469	1403	1469	509	848	648	745	571	507	525	611	484	136	90	149	185	80	65
	ATN		1990	2603	1909	2726	2136	1556	1833	1451	1393	1457	507	838	604	725	539	470	512	524	421	119	68	111	156	29	57
	ATS		0	0	1	2	3	3	26	17	10	11	1	11	43	17	31	37	13	85	62	16	21	37	29	51	7
	MED		1	0	0	0	0	1	0	1	0	1	1	0	0	3	2	1	0	2	1	1	0	1	0	0	
Landings	ATN	All gears	1990	2601	1909	2725	2136	1556	1833	1451	1393	1457	507	838	604	725	539	470	512	524	421	117	67	111	153	22	21
	ATS		0	0	1	2	3	3	26	16	9	11	1	11	43	17	31	37	13	85	62	16	21	37	29	51	7
	MED		1	0	0	0	0	1	0	1	0	1	1	0	0	3	2	1	0	2	1	1	0	1	0	0	
Discards	ATN		0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	2	8	37
	ATS		0	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	Canada	329	813	919	1575	1353	1051	1334	1070	965	902	8	237	142	232	202	192	93	124	62	83	30	33	19	9	4
		EU.Denmark	85	80	91	93	86	72	69	85	107	73	76	42	0	0	0	0	0	0	0	0	0	2	0	0	
		EU.España	47	15	21	52	19	41	25	25	18	13	24	54	27	11	14	34	8	41	77	0	0	0	0	0	**0**
		EU.France	300	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	0	17	1	3	0	0	0	0	0	0	0	0	0	0	0	0	
		EU.Ireland	0	0	0	0	0	0	0	0	8	2	6	3	11	18	0	4	8	7	3	0	0	0	0	0	
		EU.Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		EU.Portugal	1	0	0	0	0	0	0	0	0	7	4	10	101	50	14	6	0	3	17	7	0	0	0	0	**0**
		EU.Sweden	2	4	3	2	2	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
		EU.United Kingdom	0	0	0	0	0	0	0	1	6	8	12	10	0	0	24	11	26	15	11	0	0	0	0	0	**0**
		Faroe Islands	1189	1149	165	48	44	8	9	7	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Iceland	0	1	3	4	6	5	3	4	2	2	3	2	1	1	0	1	0	1	0	1	0	0	0	0	**0**
		Japan	0	0	0	0	0	5	4	0	0	0	0	0	0	0	0	0	12	10	13	13	14	49	98	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**
		Maroc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
		Norway	32	41	24	24	26	28	17	27	32	22	11	14	19	0	8	27	10	12	10	12	11	17	9	5	4
		U.S.A.	5	1	50	106	35	78	56	13	3	1	1	1	0	1	0	0	0	1	1	1	11	4	27	7	9
	ATS	Benin	0	0	0	0	0	0	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Brazil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	**0**
		Chile	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	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	0	2	2	2	7	1	2	9	4	0	3	5	4	13	0	0	0	0	0	**0**
		EU.Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
		EU.Poland	0	0	0	1	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	4	2	0	0	0	0	0	0	0	0	0	
		Falklands	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Ghana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	**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	
		Japan	0	0	1	0	0	3	14	0	1	0	0	0	0	0	0	0	5	41	34	8	7	25	15	26	7
		Korea Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	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	
		Uruguay	0	0	0	0	3	0	5	13	2	4	0	8	34	8	28	34	3	40	14	6	12	12	0	0	**0**
	MED	EU.Italy	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	0	2	0	0	0	0	0	0	
		EU.Malta	1	0	0	0	0	1	0	1	0	1	1	0	0	0	1	0	0	0	1	0	0	1	0	0	
Discards	ATN	Canada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2

		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	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	
	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	
	U.S.A.	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	2	7	35
ATS	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
	Uruguay	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

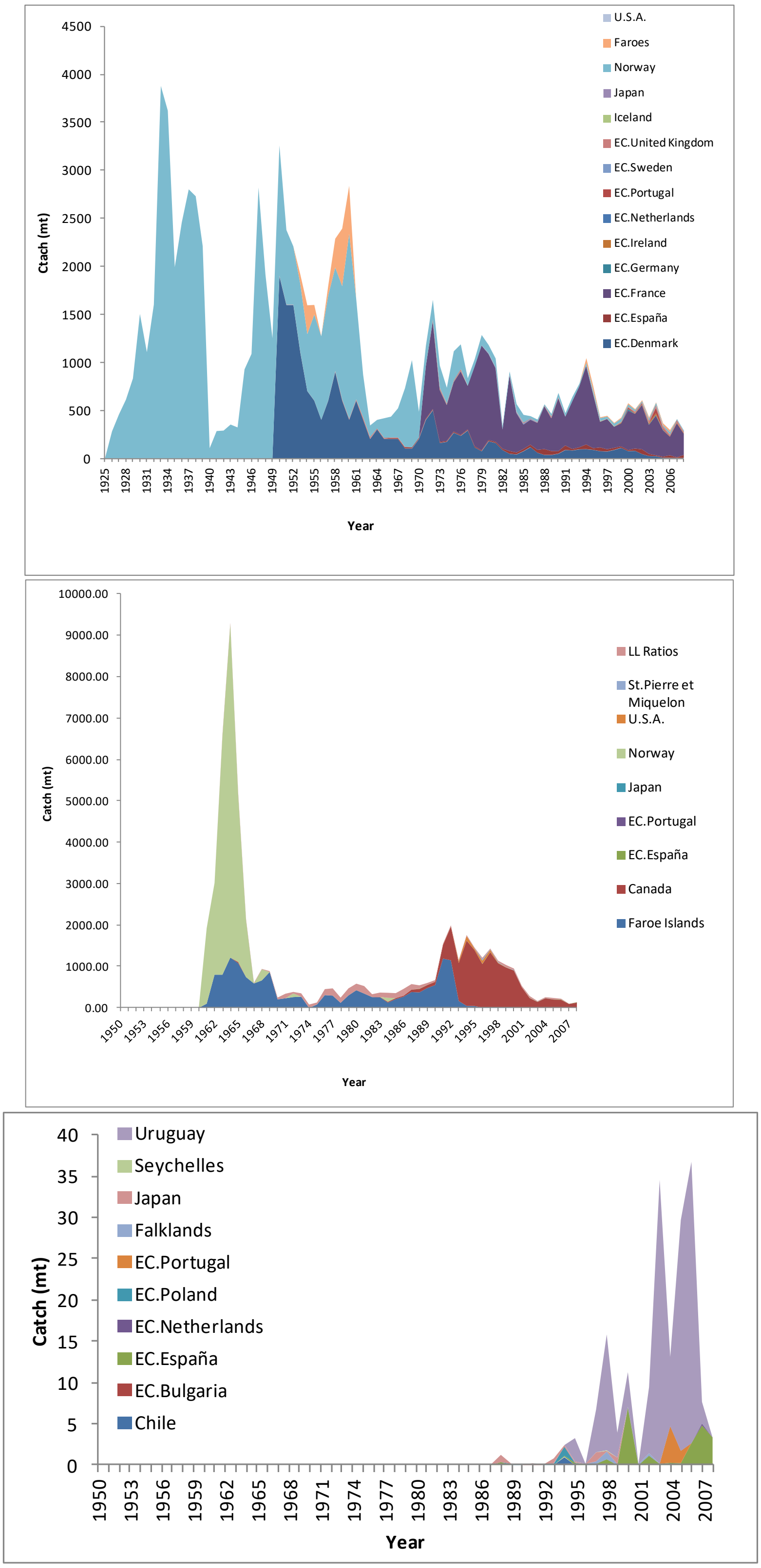
EU-France 2015 Task I: last revision (arriving after the species groups deadline) not included in the table.

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.

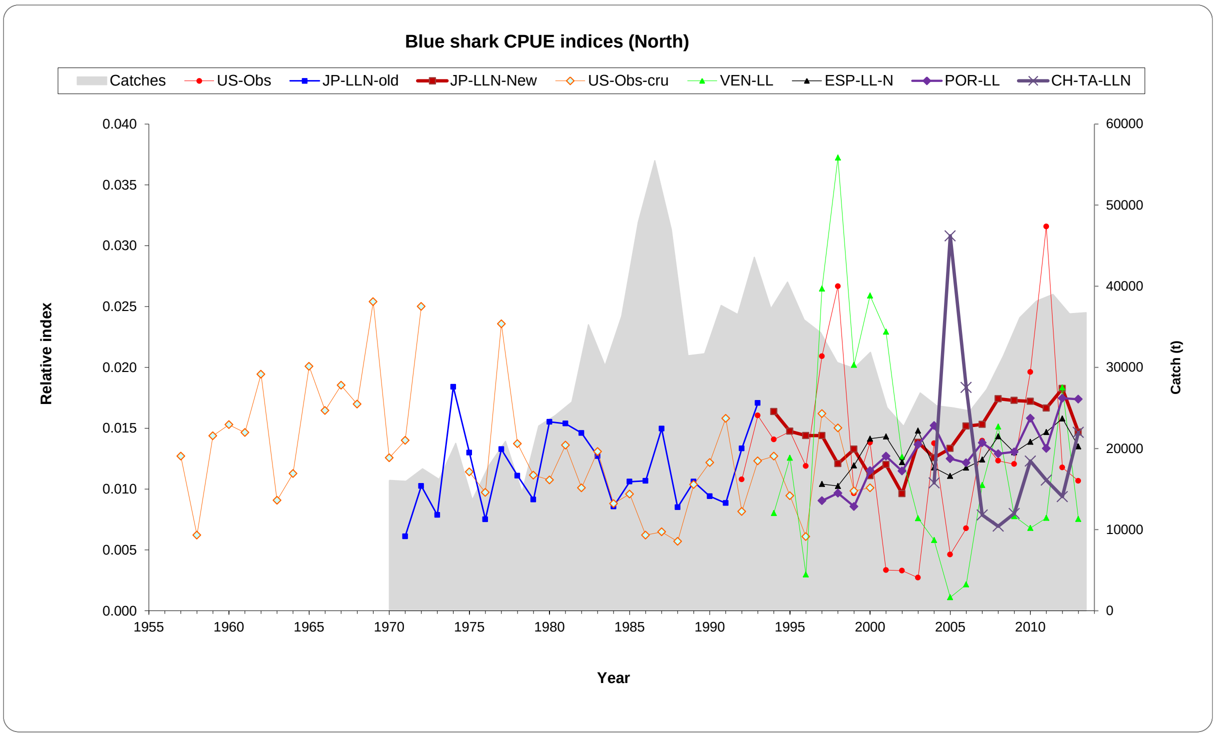
Stock	v_1	v_2	v_3
BTH	3	1	1
LMA	5	3	2
SMA	1	8	2
POR	2	7	4
CCS	11	4	5
FAL SA	12	5	6
CCP	15	2	6
OCS	4	13	8
FAL NA	8	11	8
ALV	9	14	11
BSH NA	6	19	10
DUS	17	6	12
SPK	14	10	13
BSH SA	7	20	14
TIG	10	16	15
PLS SA	18	9	16
SPL NA	16	12	16
SPZ	13	17	18
SPL SA	19	15	19
PLS NA	20	18	20

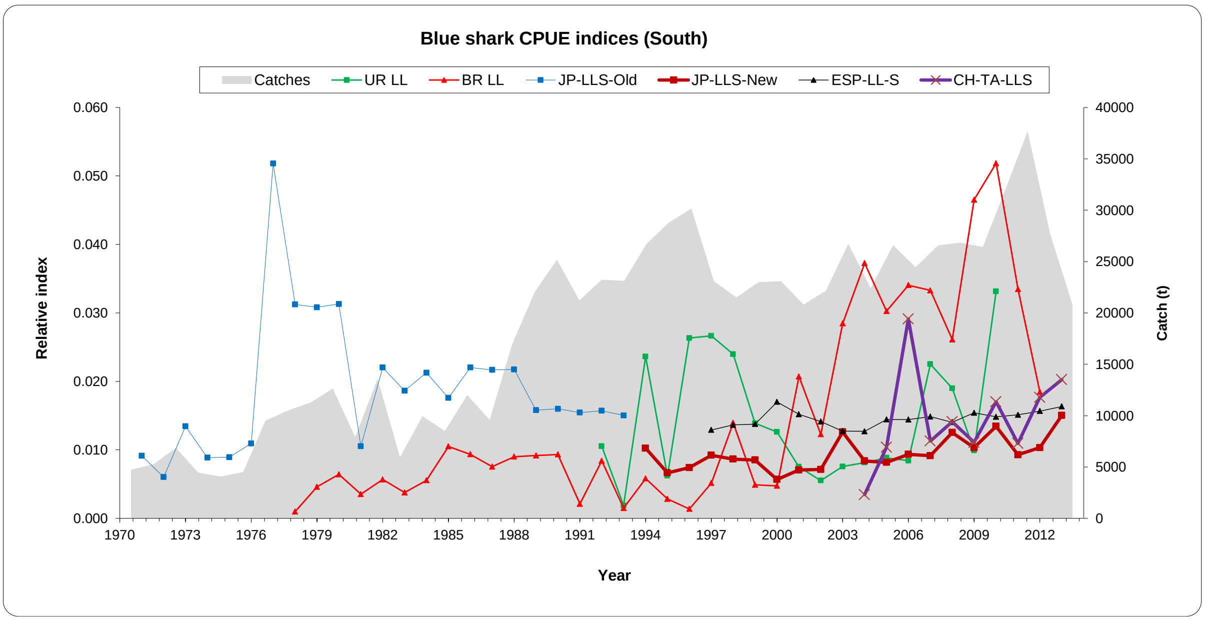


SHK-Figure 1. Blue shark (BSH) and shortfin mako (SMA) catches reported to ICCAT (Task I) and estimated by the Committee (2015 landings are considered provisional).

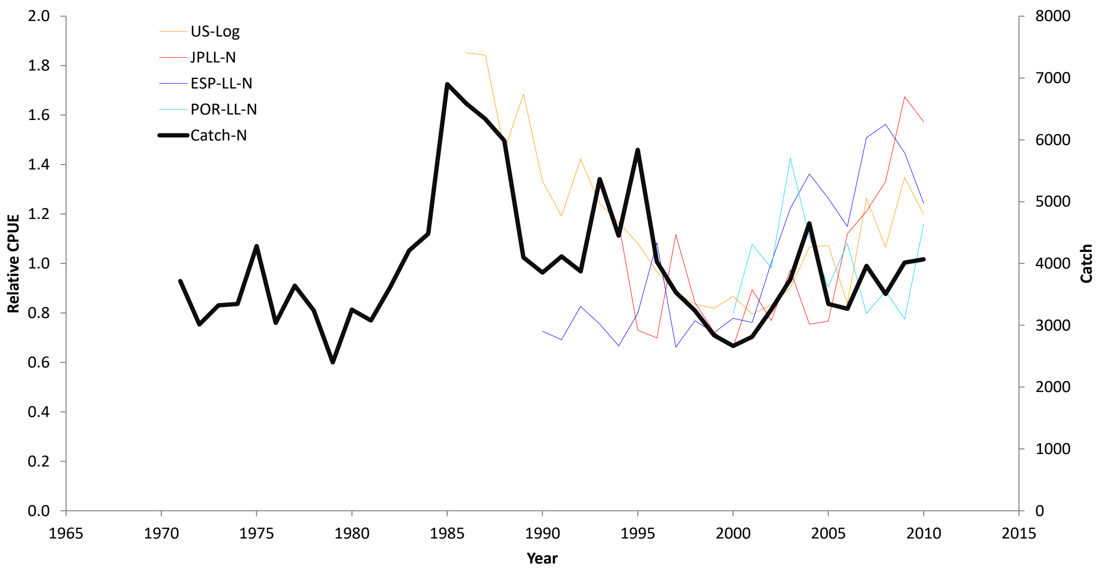


SHK Figure 2. Catch by flag of porbeagle sharks from the northeast Atlantic (top), northwest Atlantic (middle), and southwest Atlantic (bottom) used in the assessment. While these catches are considered the best available, NE catches are believed to underestimate the pelagic longline catches for this 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.

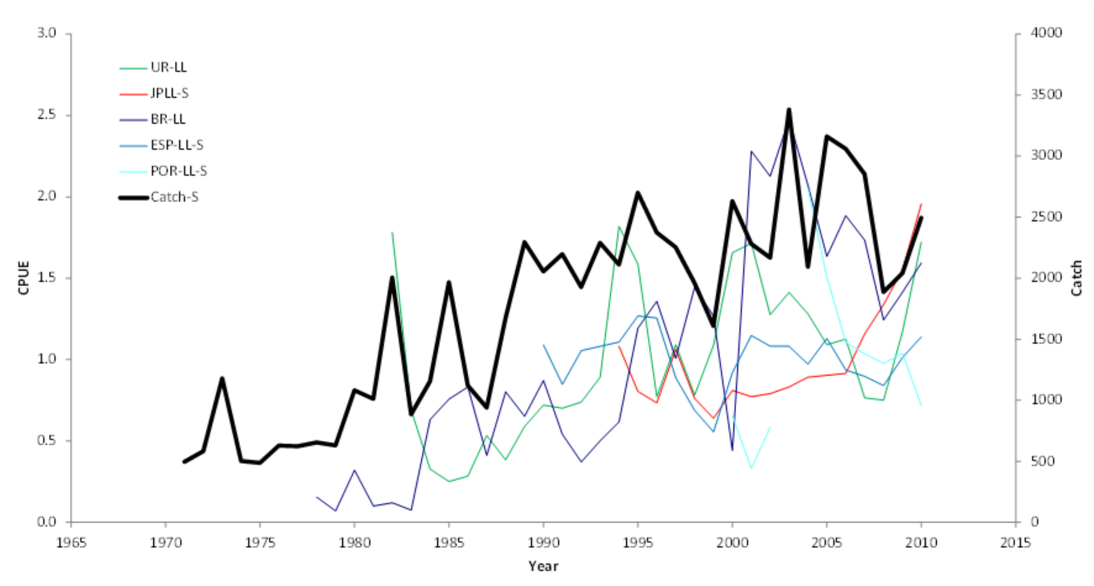




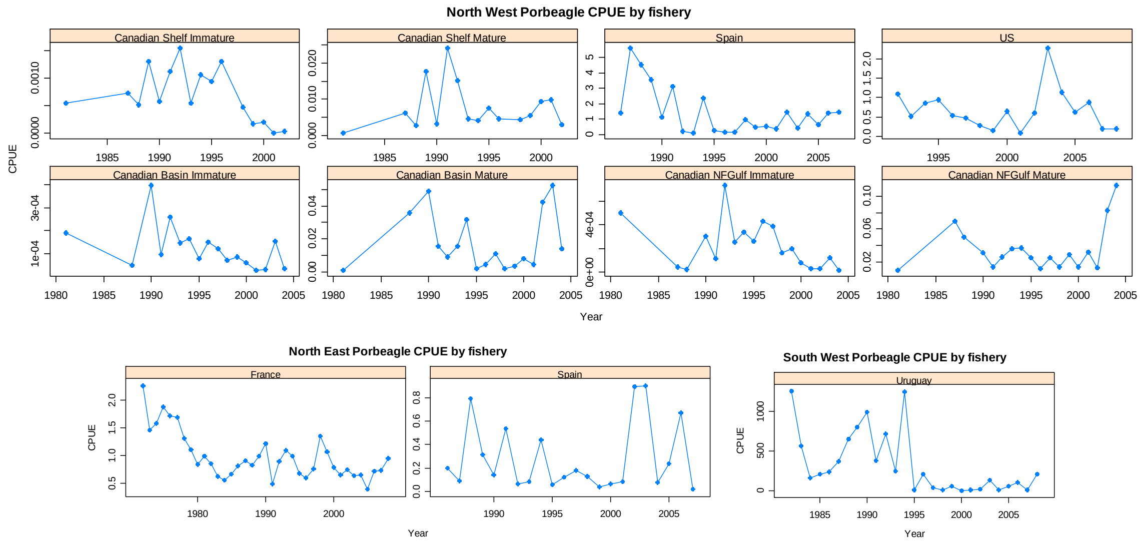
SHK-Figure 3. CPUE series used in the assessments of North and South Atlantic blue shark (BSH) stocks. Total catches (in t) used in the assessments are also shown.



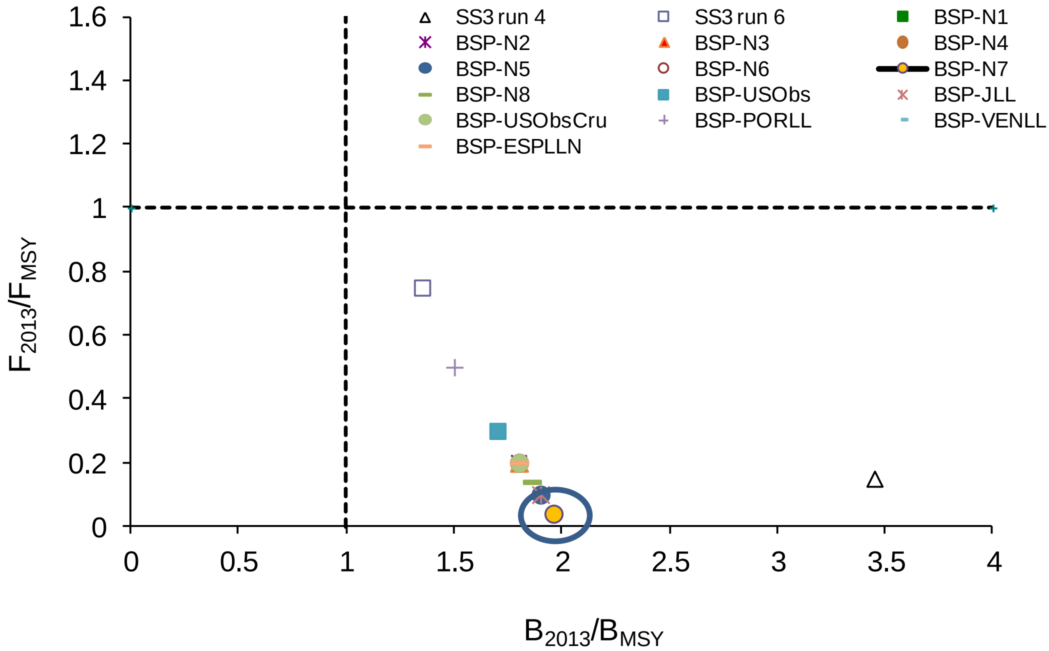
SHK-Figure 4. Indices of abundance for North Atlantic shortfin mako shark, along with total catches (in t) input into the BSP model.



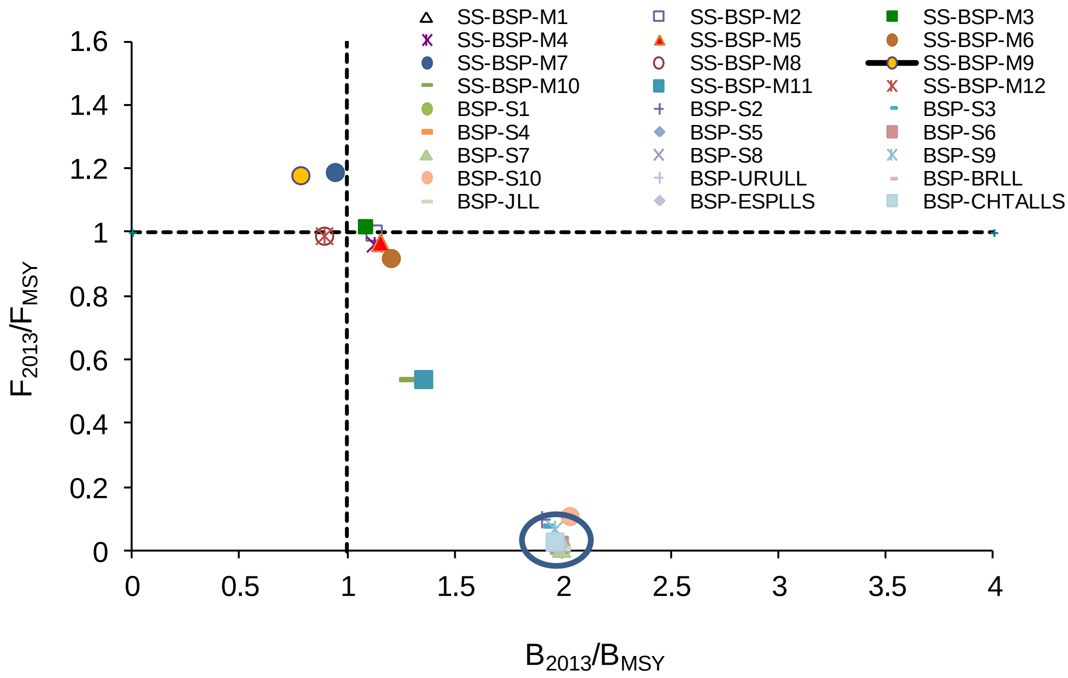
SHK-Figure 5. South Atlantic shortfin mako catches (in t) and indices of abundance input to the BSP model.



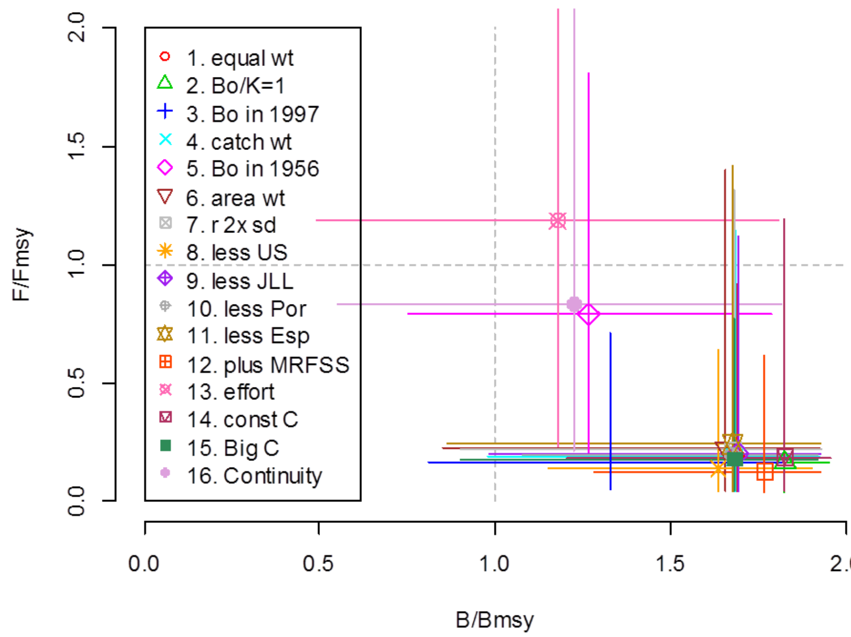
SHK-Figure 6. CPUE series for the porbeagle used in the last assessment NW stock (upper figures), NE stock (lower left figures) and SW stock (lower right figure).



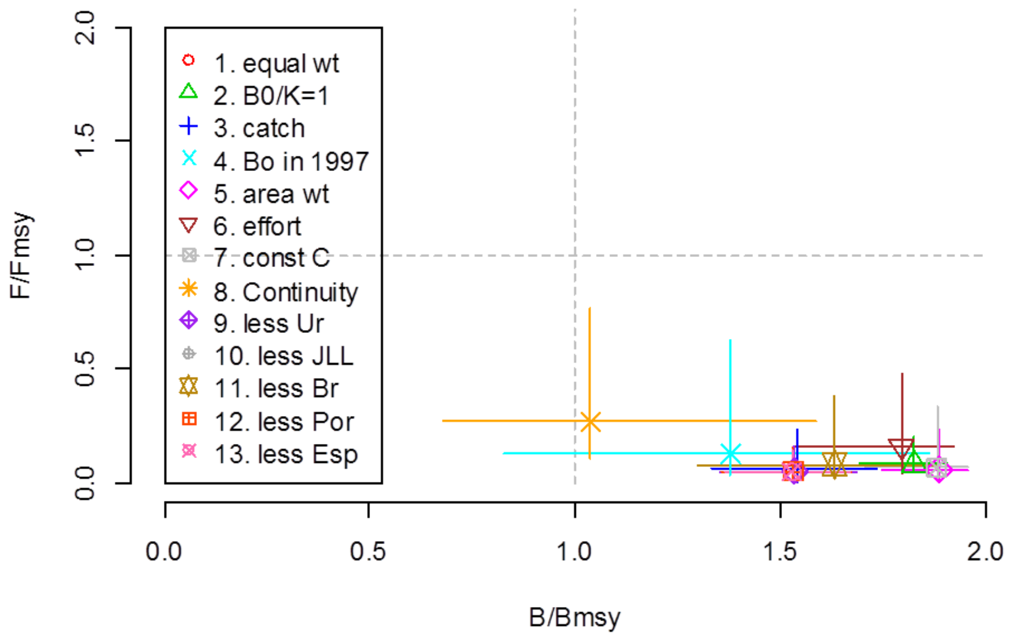
SHK-Figure 7. Phase plots summarizing scenario outputs for the current (for 2013) stock status of North Atlantic blue shark (BSH). BSP=Bayesian surplus production model; SS3=Stock synthesis model. The circle denotes common status for several BSP runs. Note that the x-axis values for SS3 are SSF_{2013}/SSF_{MSY}.



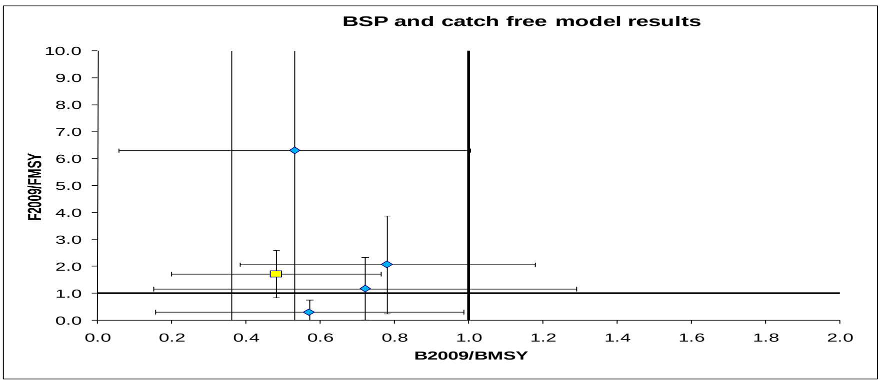
SHK-Figure 8. Phase plots summarizing scenario outputs for the current (for 2013) stock status of South Atlantic blue shark (BSH). BSP=Bayesian surplus production model; SS-BSP=State-space Bayesian surplus production model. The circle denotes common status for several BSP runs.



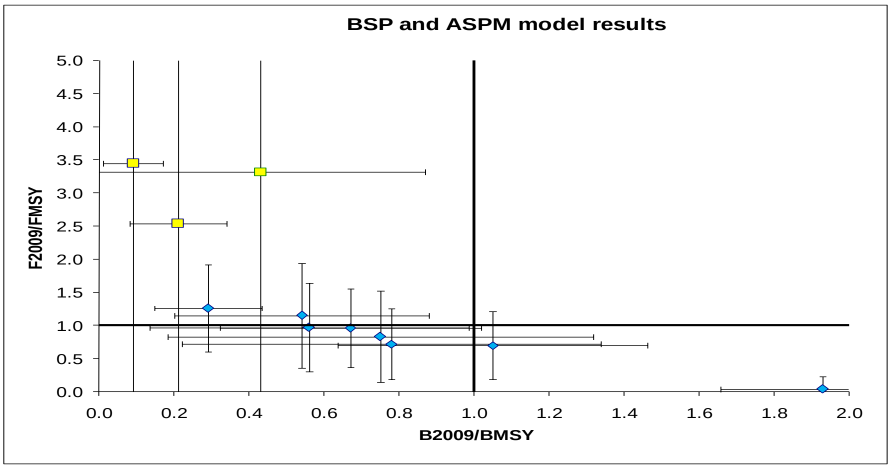
SHK-Figure 9. For North Atlantic shortfin mako sharks, median biomass relative to B_{MSY} and median fishing mortality rate relative to F_{MSY}, with 80% credibility intervals, from BSP model.



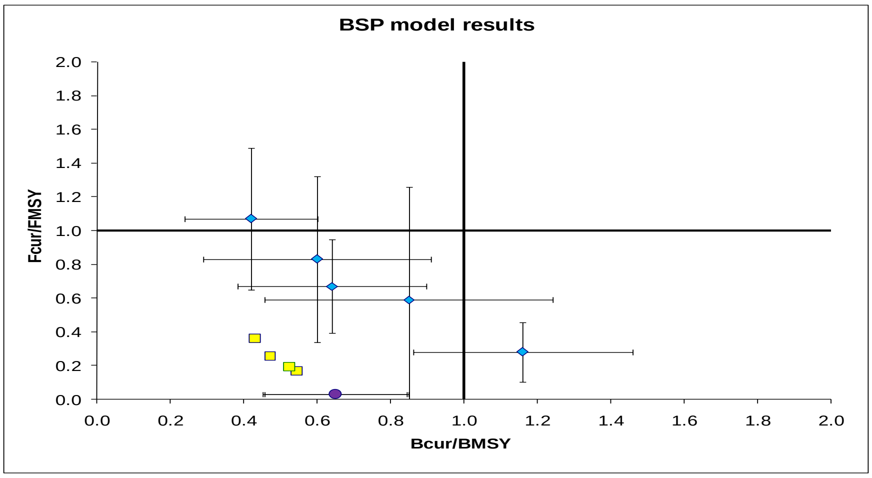
SHK-Figure 10. For South Atlantic shortfin mako sharks, median biomass relative to B_{MSY} and fishing mortality rate relative to F_{MSY}, with 80% credibility intervals.



SHK-Figure 11. 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 12. 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 13. 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.

9. Report of intersessional SCRS meetings

The reports of the intersessional meetings held in 2016 were presented.

9.1 Meeting of the ICCAT Working Group on Stock Assessment Methods

The meeting was held in Madrid, Spain, 15-19 February 2016 with the objective of incorporating oceanographic and environmental factors into stock assessment; identification of data for building a habitat model for North Atlantic swordfish, unifying CPUE datasets; and, how to estimate Maximum Sustainable Yield for fisheries with time varying selectivity. The Working Group also reviewed the work done by the Albacore Species Group on developing a harvest control rule, using Management Strategy Evaluation.

The Detailed Report of the meeting is presented as document SCRS/2016/001.

The Working Group on Stock Assessment methods Work Plan for 2017 is attached as **Appendix 12**.

Discussion

The guidelines for assessing CPUE indices used by the Stock Assessment Working Group were discussed. Several views were expressed, *i.e.* should the CPUE series scores table of the select indices be used in assessments, or just to provide an overview of the quality of these data. It was agreed that the establishment of the guidelines were an important step, and some thought that it was important in the future to find an objective way to select CPUE series for inclusion in stock assessments. It was also pointed out that in some cases major fleets do not submit CPUE and all CPCs should be encouraged to submit CPUE series for stocks that they are fishing.

Several points were raised about the work plan, *i.e.* it needs to be more specific and provide concrete objectives, include interssessional work, and ensure that more people are actively involved. The importance of the Working Group was also discussed, particularly given its importance for developing the work of the SCRS. This is especially true given that assessment Working Groups are going through a period of change, i.e. using increasingly complex models and being asked to conduct MSE to help develop management advice. The need for training was recognized and how to achieve sufficient participation was discussed, e.g. by working with other bodies such as ICES and the tuna RFMOs.

The work on the software catalogue was commended. Additional information is provide in section 15.

9.2 Bluefin data preparatory meeting

The meeting was held in Madrid, Spain, 25-29 July 2016. The Commission approved a delay in the bluefin tuna stock assessment until 2017, on condition that updated stock projections are provided in 2016. During the meeting the Group reviewed: historical and new information on biology and stock structure; Task I and Task II statistics; the indices of abundance available for use in the next stock assessment; age-length keys; and, also discussed and completed the technical specifications for the MSE work.

The Detailed Report of the meeting is presented as document SCRS/2016/011.

The Bluefin Tuna Species Group Work Plan for 2017 is attached as **Appendix 12**.

Discussion

The measures taken under the recovery plan has meant that many of the CPUE series no longer provide good indices of abundance for recent years; for example changes in the operation of the EU-Spain traps. While recent recruitment levels could not be assessed in the update of the assessment conducted this year, as catch data were only available up to 2013. In the assessment planned for 2017 the new catch data will help establish if there has been a recovery. It was stressed therefore that the Species Group should not give the impression to the Commission that recent high recruitment has led to recovery of the stock. Once recovery has been established then the Commission will need to establish a new target.

The importance of the trap indices was noted and that both Morocco and the European Union were working on providing these for the next year assessment.

9.3 ICCAT yellowfin tuna data preparatory and assessment meetings

The data preparatory meeting was held in Pasaia, Spain, 7 to 11 March 2016. The most recent biological and fisheries information were reviewed for this tropical tuna species, whose major fisheries are located in the Gulf of Guinea. Decisions were taken on the main parameters of input for the different evaluation models to be used during the stock assessment session. A work plan was also outlined to submit and compile information not yet available.

The Detailed Report of the data preparatory meeting is presented as document SCRS/2016/002.

The stock assessment meeting was also held in Pasaia, Spain, 27 June to1 July 2016. Two main hypotheses were considered by the Group based on the trends of the indices of abundance, and surplus production model and age structure models were used to assess the status of the stock Production model (ASPIC), Age Structured Production Model (ASPM), Catch Statistical Models - Stock Synthesis (SS3), and Virtual Population Analysis (VPA). The different trends of CPUEs reiterate the importance of obtaining fishery independent indices of abundance. It was also noted, that there was not available an index of abundance for the major fisheries in terms of catches (purse seine fleets). The current status of the stocks was evaluated assuming an equal weighting for each hypotheses and model scenario, indicating that likely it reflects the overall uncertainty in the data.

Detailed Report of the stock assessment is presented as document SCRS/2016/009.

The Tropical Tuna Species Group Work Plan for 2017 is attached as **Appendix 12**.

9.4 ICCAT Albacore tuna stock assessment meeting

The stock assessment meeting was held in Madeira, Portugal, 28 April to 6 May 2016. The meeting aimed at updating the North and South Atlantic albacore stock status and to provide management advice to the Commission. To this purpose the Group also conducted management strategy evaluation for the northern stock and tested harvest control rules and associated reference points. The Group concluded that given the uncertainty in the results it was not in position to provide management advice based on the projections. It was suggested restrict the mean weight plots to periods with sufficient sampling and catches for the major fishing gears. It was requested that the Executive Summary Table for Mediterranean albacore to state that no TAC has been established for this stock.

The Detailed Report is presented as document SCRS/2016/010.

The Albacore Tuna Species Group Work Plan for 2017 is attached as **Appendix 12**.

9.5 ICCAT Sailfish stock assessment meeting

The meeting was held in Miami, United States, 30 May to 3 June 2016. A revision of new information on the species was carried out, leading to important improvements in the biological parameters required for stock assessment modelling. It was noted that the data available for sailfish was somewhat incomplete, which made the assessment process very difficult. A range of different models were applied, but the results from the assessment were inconclusive and thus neither projections, nor Kobe strategy matrices, were developed due to the uncertainty in the stock status results.

The Detailed Report of the meeting is presented as document SCRS/2016/008.

The Billfish Species Group Work Plan for 2017 is attached as **Appendix 12**.

Discussion

The Committee briefly discussed the recommendation for the western stock by the Species Group regarding the hook type that the Group encouraged. It was discussed that a variety of hooks and offset strategies exist, and research is lacking regarding the full implications of these diverse methods on a species by species case. As such it was suggested that a live release with careful handling to decrease post release mortality may be a more appropriate recommendation. It was agreed that the text in the Executive Summary would be further discussed in order to encompass the Committee's advice.

9.6 ICCAT Mediterranean Swordfish stock assessment meeting

The meeting was held in Casablanca, Morocco, 11 to 16 July 2016. A revision of new information on the fisheries was carried out, leading to relevant improvements in the parameters required for stock assessment modelling. A range of different scenarios were applied to the stock. The results showing the stock is currently overfished and suffering overfishing.

The Detailed Report of the meeting is presented as document SCRS/2016/006.

The Swordfish Species Group Work Plan for 2017 is attached as **Appendix 12**.

Discussion

Several questions were asked about the choices made in the assessment, namely the choice of M, the importance of discards, and the steepness of the stock recruitment relationship used in the projections. It was explained that first two were run as robustness tests, but not used to formulate advice as they did not impact on the results.

Problems with the data were noted, particularly the short time series and the lack of signal in the data. However, the conclusions are consistent with the last assessment and it was noted that this is a stock where the situation is serious. Advice needs to focus on monitoring large females and catches of juveniles, e.g. using indicators. Although the stock is still overfished, there have been many management efforts e.g. seasonal closures and minimum size regulations.

For the management only F scenarios were explored, and showed that F needs to be cut substantially to rebuild the stock. However, the high uncertainty was noted, as well as the importance of recovering data from the 1970s and 1980s when the fishery was expanding. Additionally, it was noted that the CPUE indices do not reflect the changes in fishing practices, and difficulties in collecting biological parameters was discussed.

9.7 ICCAT Small tunas Species Group intersessional meeting

The meeting was held in Madrid, Spain, 4 to 8 April 2016. The most recent biological and fisheries information related to small tunas were reviewed, with particular emphasis on bullet tuna, Atlantic bonito and little tunny. Particular attention was given to an update of the Ecological Risk Assessment (ERA) presented in 2015, including species of both the South and North Atlantic. An evaluation of the vulnerability of the species was made, based on their productivity and susceptibility attributes.

The Detailed Report of the meeting is presented as document SCRS/2016/004.

The Small Tunas Species Group Work Plan for 2017 is attached as **Appendix 12**.

Discussion

It was noted many SCRS papers had been submitted this year and that the Group had made a number of important advances. The Rapporteur and the Group were congratulated.

9.8 ICCAT Shark Species Group intersessional meeting

The meeting was held in Madeira, Portugal, 25 to 29 April 2016. The discussion was mainly focused on data preparation for the envisioned 2017 Shortfin mako stock assessment. The ongoing Shark Research and Data Collection Programme (SRDCP) was presented and planning for 2017 and beyond was addressed. A discussion was also held on the revision of the list of sharks species considered of interest to the ICCAT Commission (oceanic, pelagic and highly migratory).

The Detailed Report of the meeting is presented as document SCRS/2016/005.

The Sharks Species Group Work Plan for 2017 is attached as **Appendix 12**.

Discussion

The Chair clarified that this meeting was largely a preparation for the shortfin mako assessment that is scheduled to be held in 2017. Also highlighted, was the collaboration with CITES, and in particular the training course held for participants from the West African region.

10. Report of Special Research Programmes

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

The activities of the Atlantic-wide Research Programme on Bluefin Tuna (GBYP) officially started in March 2010**.** The fifth phase of GBYP activities was completed in February 2016 and most of the activities have been reported to the SCRS and the Commission in 2016. The remaining activities in the last part of the Fifth Phase included (a) the biological studies, (b) the elaboration of the aerial survey data, (c) the costs-benefit analysis for the tagging activities, (d) the power analysis and the cost-benefit analysis of the aerial survey, (e) the first part of the feasibility study for the Close kin genetic tagging and, (f) the meeting of the ICCAT GBYP Core Modelling MSE Group and the advances in modelling efforts; furthermore, the ICCAT GBYP participated at the Bluefin Futures Symposium in Monterey (USA), providing an extensive overview of the data collected so far and the many activities. The Sixth Phase of ICCAT GBYP started on 23 February 2016 and it will be active until 22 February 2017; it included initially the same activities listed in Phase 5, with some different details, but the Steering Committee, after examining the various reports, made some substantial changes, i.e. suspending the aerial survey in 2016. The first activity in Phase 6 was the second external review of the ICCAT GBYP activities and the report was presented to the SCRS at the 2016 meeting. All data recovered in the first phases, covering a period from 1512 to 2009, have been all made available and presented to the SCRS in 2013, 2015 and 2016. The data have been finally fully checked and revised according to the procedure agreed with the SCRS, solving the problems created by the last ancient trap data sets, which implied an important workload; these data have been finally fully validated and incorporated in the ICCAT bluefin data base. Additional data recovered in Phase 6 were presented to the SCRS in 2016. Electronic tag data have been recovered in 2016 and made available to SCRS. ICCAT GBYP in Phase 6 also organized a specific activity in Mauritania and additional activities on data recovery. Tag reporting has improved, though the recovery rate is still low. 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, but electronic tagging activities will be completed in the last part of Phase 6. 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 first preliminary part of a feasibility study for Close-kin Mark Recapture was carried out in 2016. The Steering Committee decided to start 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. An ICCAT GBYP Workshop on Bluefin Tuna Larval Studies and Surveys was held from 12 to 14 September 2016. The modelling efforts are continuing in Phase 6 and all efforts are directed to further development of a MSE.

Discussion

The ICCAT GBYP Coordinator (Dr. Antonio Di Natale) thanked all the Parties who have collaborated and contributed to the work of the project. The Committee acknowledged the wide range of activities and work completed under the programme. It was noted that the importance of the project will likely become apparent during the 2017 bluefin tuna assessment when data from programme is used and integrated into the upcoming assessment. It was stressed that the project has changed substantially during its operation when compared to the original version. The project has achieved several of many significant goals, particularly with regard to biological data collection, an opinion shared with the external review of the project. The Committee acknowledged the important role the project has played in improving the knowledge and information available for bluefin tuna in the Atlantic Ocean.

Despite the success of the Programme, the Committee was made aware of the substantial amount of work required to achieve these aims, the significant shift in the project focus and in particular the burden on the Secretariat. These issues were strongly identified by the Executive Secretary as being problematic for the workload already undertaken by the Secretariat. The complete shift in focus of the project also resulted in several complications that have affected the functioning of the programme

As discussed by the Committee, a major issue remains the prioritization of the fisheries independent indices of abundance. It was noted that this issue should be resolved as a matter of urgency in order to facilitate the future planning and prioritization of activities. Several documents exist, such as the external review as well as the report of the recent larval survey workshop (SCRS/2016/206), that may be used to guide these decisions. MSE techniques could also aid in assessing the relative importance of these indices. With regards to the larval survey workshop, a more general proposal to the Commission, was the possibility of having an “Early life history” Working Group under the SCRS which could address issues of relevance to multiple SCRS Working Groups.

It was acknowledged that the project has suffered from the funding model currently employed, as contracts generally need to be identified, put out for tender, awarded and completed within a very limited time period. A more stable form of funding may help in alleviating this problem. It was also suggested that the ICCAT GBYP Steering Committee could benefit from the input of additional external experts.

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

10.2 Enhanced Research Programme for Billfish (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 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 genetic sampling study to compare mixing and distribution of white marlin and roundscale spearfish is ongoing. Additional sampling kits were ordered and appropriately distributed.

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

10.3 Small Tunas Research Programme (SMTYP)

In 2016, 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 first time. This will reinforce data mining of Task I and Task II and enhance biological knowledge on those species, aiming future small tuna stock assessments. In that regards, four contracts were issued by the ICCAT Secretariat during 2016 to conduct data mining and biological studies in the Mediterranean and in the North-eastern Atlantic, whose 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. These priorities are presented in the Small Tunas Work Plan for 2016 (**Appendix 12**).

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

10.4 Shark Research and Data Collection Programme (SRDCP)

SRDCP held a workshop to conduct collaborative work related to update the age and growth dynamics of the shortfin mako in the Atlantic Ocean. The population genetics study to estimate stock structure and phylogeography is ongoing and new additional samples from areas with little coverage were made available. A post-release mortality study of shortfin mako caught on pelagic longline fisheries continued with the deployment new Survivorship Popup Satellite Archival Transmitting Tags (sPATs) in the temperate Northeast and Western North Atlantic. A total of 12 data sets from electronic tagging 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. A fifth project to characterize the feeding habits and identify potential trophic groups based on stable isotopes and fatty acids has also been initiated.

The report was adopted and is attached as **Appendix 7.**

10.5 Atlantic Ocean Tunas Tagging Programme (AOTTP)

The overall objective of the Atlantic Tuna Tagging Programme (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 the International Commission for the Conservations of Atlantic Tunas (ICCAT). The project officially began on 29 June 2015, being currently in its second year. The total budget for the programme is 15 million Euros, of which the European Union contributes 90% and the rest is made up from voluntary contributions from the ICCAT CPCs and Cooperators. Currently the coordination team is composed of a Coordinator, a Tag Recovery Officer, an Administrative and Financial Officer and an Accountant. After a Call for tenders, a consortium has been selected to implement the tagging in an area involving the territorial waters of up to 19 countries in the eastern Atlantic. Work began around the Azores Islands in late June, with tagging taking place in the Mauritania-Senegal region between early July 2016 and late August 2016. An additional contract has been awarded to tag tropical tunas on the South-western Atlantic (territorial waters of Brazil). Publicity and tag recovery campaigns are under-way with focal points in the Azores, Canary Islands and Ghana, and dedicated tag-recovery offices in Dakar and Abidjan. Publicity materials (posters, t-shirts, etc.) have been designed and reward schemes and payment systems are in place. All data are collected and uploaded using specially developed smartphone applications (Apps). Data collected can be visualised and explored online (using maps and reports) very quickly after they have been collected allowing adaptive management of the tagging design. AOTTP, and its subcontractors has been training scientists from developing countries in all aspects of tagging at sea, data collection and tag-recovery. AOTTP is also working closely with SCRS aiming at the effective use of the tagging data to improve the tropical tuna stock assessments and the provision of scientific advice for management of these fishing resources. As of 15 September 2016, more than 12,000 tunas (bigeye, skipjack, yellowfin, little tunny and a few wahoo) have been tagged, and over 1,500 recoveries recorded representing an overall recovery rate of *ca* 12%. Projections based on past tagging programmes suggest that a recovery rate of *ca* 18% might eventually be achieved. Furthermore the data collection and transmission protocols developed by ICCAT/AOTTP are contributing to achieve high levels of data quality and accuracy. The programme is running as schedule and most of the involved CPCs and stakeholders have showed an exceptional cooperation.

Discussion

The Executive Secretary stated that this project had been in the discussion phase for several years, but has finally been initiated in 2015/2016. This project has progressed significantly and he acknowledged the EU for their financing of 80% of the project and also thanked the United States and Chinese Taipei for their contributions which, in addition to the ICCAT Working Capital Fund, co-finance the project. The Executive Secretary also thanked the governments of coastal countries who have provided access to their waters to this project and encouraged the involvement of additional countries to cover the whole Atlantic region. The Executive Secretary encouraged more CPCs to submit proposals to cover future tenders that will be released under this project. The European Union thanked the Coordinator for his work so far, and expressed its satisfaction with the advancement of the activities, while strongly encouraging more countries to support the project, particularly with regards to co-financing contributions.

The Committee requested clarification regarding the spatial coverage of the tagging to be conducted and it was confirmed that the majority of the tropical Atlantic eastern area will be significantly covered, while tagging is about to initiate in the Atlantic South West. Additional tenders will be re-released in the Atlantic South east and Caribbean with a new tender for the Atlantic North West to be released in the future.

Questions were also raised regarding the high initial recapture rates as well as electronic tag configurations. It was clarified that these high tag recapture rates are in line with other large-scale tuna tagging projects conducted and although the at liberty times are very short, these tags still provide useful information on local fishing mortality and growth.

The report was adopted and is attached as **Appendix 8**.

11. Report of the Sub-committee on Statistics

Dr. Guillermo Diaz, Convener of the Sub-committee on Statistics, presented the Sub-committee's Report, which held its session in Madrid, Spain, 26 and 27 September 2016. After acknowledging the efficient work of the Secretariat, Dr. Diaz presented to the SCRS the current reporting status of the ICCAT CPCs on the basis of applying the SCRS filtering criteria to 2015 Task I and Task II data, the achievements made by various data recovery projects, and finally, the major subjects discussed and recommendations made to improve the quality of fishery statistics and biological data. The Sub-Committee emphasized that some recommendations will require intersessional work (Secretariat, SCRS Chair, Conveners of the two Sub-committees, and Rapporteurs of all Species Groups), noting that a few would require objective responses from specific Species Groups.

The Sub-committee informed how pleased it was to observe a sustained improvement on data reporting obligations (late reporting reduction, less errors in datasets reported), in part due to the application of the filtering criteria (filter 1 only), and recalled that, in 2017 both filter 1 and filter 2 will be used to validate 2016 statistics. On this subject, the Sub-committee recommended that CPCs make their utmost effort to report, whenever possible, their Task I and II data in advance of the 31 July deadline, which will allow an effective and timely response from the Secretariat in cases were corrections are needed.

The Sub-committee also presented to the SCRS a set of proposals aiming to improve and normalise the ICCAT coding system, in particular a solution for handling the recreational/sport fishery, and a proposal to harmonise Task II datasets requiring from now on only monthly based information. The Sub-committee presented to the SCRS the current data dissemination policy of ICCAT together with the guidelines aiming its improvement during 2017. Finally the Sub-committee informed the SCRS about the progress made on ongoing data recovery projects and improvements on data collections systems, in particular the minimum standards for electronic monitoring systems (EMS).

Discussion

The data dissemination policy was one of the important matters discussed at the meeting. The European Union and the United States also acknowledged the need for such an important instrument, noting however that, the data dissemination policy should have as reference the ICCAT overall transparency practices. The doubt posed by Japan requesting clarifications on the data dissemination modes, was responded by the SCRS Chair who informed that dissemination modes are intrinsically part of the future ICCAT data dissemination policy.

It was recalled that the development and adoption of minimum standards for EMS had been recommended by SCRS in 2014 and were also part of the SCRS Strategic Plan, and this was the reason why draft minimum standards had been presented at the meeting of the Sub-Committee. It was noted that data collected by EMS would only be useful if it were actually reported. Several CPCs explained that this is the reason why minimum standards or guidelines for installation, data collection and report generation are required. Otherwise, the EMS offered by different providers will result in data that are inconsistent and incompatible. It was agreed that the proposed minimum standards presented at the meeting of Sub-Committee provided a good start which could be improved in the future if necessary. It was also noted that such improvements should find a balance between potential data utilization and the capacity that CPCs have to provide the data in accordance with the minimum standards.

Finally, the Sub-committee presented to the SCRS its 2016/2017 work plan.

The report was adopted and is attached as **Appendix 10.**

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 5-9 September 2016. The Sub-committee (SC-Eco) discussed the progress made towards the feasibility of and provision of information towards implementing ecosystems based fisheries management (EBFM), as well as the possibility of liaising with other t-RFMOs to discuss issues of mutual relevance and benefit. With regard to the former issue, report cards on the availability of ecosystem based indicators in the different tuna RFMOs were discussed, as well as the necessity to develop these indicators in ICCAT by obtaining the required information in collaboration with the various Species Groups.

As regards the by-catch component, the SC-Eco attempted to examine the trend of annual by-catch in number and rate of seabirds, as a first step in the evaluation of the effect of the new mitigation measures. Additionally, the SC-ECO looked at potential methods to estimate total number of sea turtles accidently caught by longline fisheries to evaluate the impact of ICCAT fisheries on these species. It was noted that the amount of information received was generally low and thus it was very difficult for the Sub-committee to assess the impact of ICCAT fisheries on sea turtles. For the same reason it could not assess the efficacy of the new seabird mitigation measures prescribed in Rec. [11-09], Methods prescribed in Rec. [11-09] highlighted the need for intersessional work between CPCs for which ABNJ meetings can assist. The modification of the ST09 observer data collection forms, and the updating of the EFFDIS dataset were considered important priorities for future by-catch assessments.

The Detailed Report of the meeting of the Sub-committee on Ecosystems and By-catch is presented as document SCRS/2016/012.

The Report of the intersessional meeting is attached as **Appendix 11.**

Discussion

Ecosystems

The Committee commended the Sub-committee on the progress made on Ecosystems Based Fisheries Management (EBFM).

The Committee discussed the recommendation made by the Sub-committee regarding the need for dialogue with the Commission to advance EBFM. It was noted that the Commission has not planned any future meetings of the Standing Working Group on Dialogue between Fisheries Scientists and Managers (SWGSM), the forum recommended by the Sub-committee to hold this dialogue. The Committee therefore discussed the potential for requesting a specific focus group meeting with the Commission to facilitate this dialogue, such as was conducted for FADs in 2016. It was noted, however, that the SWGSM has not be eliminated, and should the need arise, the SCRS can request this Group reconvene should a clear mandate be developed. Other potential options include raising the issue of EBFM at the Panel meetings. It was stressed however that any meeting should be carefully planned and scheduled to maximize participation.

The Committee also noted that ICCAT experts will participate in the ABNJ supported EBFM meeting to be held in December. It was clarified that although ICCAT experts have been invited to this meeting, it is not being organized nor is focused on ICCAT. It was also noted that at this stage the participation in that meeting is expected to be limited, with more open participation envisioned for future phases of this work.

The FAO also provided information regarding a course to be held on the DLM R package software (for data poor stock evaluation), the full details of which are contained in document SCRS/2016/171.

By-catch

The Committee noted that although not covered in the presentation, a methodology was proposed to estimate sea turtle interactions in 2015. This work was further advanced in 2016 and the Sub-committee agreed this methodology should be continued in 2017 to provide updated estimates of interactions. This work does not preclude other methods to be used in the future, but provides an advancement in this important work.

The Committee acknowledged the necessity to simplify the ST09 observer data collection forms. It was noted that these forms were developed based on best practices discussed across tuna RFMOs, however the nature of the observer programmes in ICCAT are very different to those in several other RFMOs (no Secretariat controlled programmes) and thus the forms will be simplified to facilitate data submission.

The Committee noted the difficulty in recovering gillnet fishery data and that it may also be necessary to implement data collection in addition to just historical data recovery. This work may be of importance to several ICCAT Species Groups (e.g. Sharks Species Group).

Lastly, the lack of seabird data for the assessment of the ICCAT seabird mitigation measures was discussed. It was raised by Birdlife International that the updated mitigation measures proposed by ACAP and supported by the Sub-committee should be taken into account when formulating future recommendations on seabird mitigation at ICCAT. The Co-convener of the Sub-committee also requested that all CPCs who have seabird data, contact the co-convener and/or Secretariat to discuss how the data can be submitted and if necessary to seek help to process and analyse the data.

13. Report of the Ad hoc Working Group on FADs

The meeting was held in Bilbao, Spain, 14-16 March 2016. The *ad hoc* Working Group is composed by scientists, fisheries managers, industry representatives and other interested stakeholders and shall report on its work to the Commission, which at its 2016 Annual meeting shall review the progress and outcomes of the *ad hoc* Working Group, identify priority tasks, and assess the need the Working Group to continue its work.

The SCRS Chair informed that during the meeting, the information provided by CPCs, pursuant to the FAD related provisions in the relevant ICCAT conservation and management measures was reviewed and it was noted that this data is incomplete although data provision is improving. An assessment of the use of FADs in tropical tuna fisheries in ICCAT was made, as well as of the relative contribution of FADs to overall fishing mortality in ICCAT tropical tuna fisheries, followed by an assessment of developments in FAD-related technology. Several important recommendations were made that will be passed on to the Commission meeting in November.

The Detailed Report of the meeting is presented as document SCRS/2016/003.

Discussion

The SCRS Chair noted on the successful results of meeting with very active and productive participation of managers, scientist and stake holders. The Working Group made several recommendations that can be very useful for the SCRS Tropical Species Groups, including potential information on fishery independent indices of abundance based on acoustic signals from the buys with echo-sounders, species composition and size distribution of species associated to FADs. It will be also very informative for the analyses of CPUE from FAD fishing operations of historical purse seine catch data. It was also noted that extensive ongoing scientific research on FADs was presented and summarized. These include effects on tuna and other pelagic species, changes in migration pattern, fate and biodegradation of natural and man-made FADs and their potential impacts on tropical ecosystems.

A recommendation from the *Ad hoc* Working Group was made aiming to extend the research and evaluation to all RFMOs where FAD fishing operations are occurring. The European Union and the Secretariat informed the Committee, that there is financial support available, from European Union and if possible ABNJ/FAO, to organize an initial meeting on tropical fisheries on FADs involving the different t-RFMOs (ICCAT, IATTC, WCPFC and IOTC), under the auspices of ICCAT. Overall, the SCRS Committee endorsed and supported the recommendations from the *Ad Hoc* Working Group on FADs stated in their report (SCRS/2016/003). The Committee recognizes that in the future the ICCAT FAD Working Group may still require to continue working towards these objectives.

14. Progress related to MSE

Details of the dialogue on MSE for albacore and bluefin tuna can be found on the 2016 Report of the Panel 2 meeting (Sapporo) and the intersessional meetings of the Albacore and Bluefin tuna Species Groups. Work on MSE on the Northern Stock of Swordfish and tropical tunas is less advanced although there have been a number of papers on the topic presented to the SCRS in the past. The swordfish and tropical tuna Species Groups have started planning for the development of MSE as part of their 2017 work (**Appendix 12**). The description of a possible schedule of MSE implementation for ICCAT stocks is included section 18.2 which includes the response to a commission request.

14.1 T-RFMO MSE Working Group

At the Third Joint Tuna RFMOs meeting it was recognised that Management Strategy Evaluation (MSE) needs to be widely applied in order to implement the Precautionary Approach for tuna fisheries management. Therefore a Joint MSE Technical Working Group was created to work electronically initially. After consultation with the tRFMOs Executive Secretaries/Directors, an initial list of potentially interested experts was provided by each tRFMOs. A first MSE workshop will be held at the ICCAT Secretariat offices from 1 to 3 November 2016 (http://tuna-org.org/mse.htm), and it is open to interested Parties. The agenda of the meeting covers five main themes, *i.e.* development of a dialogue between managers and scientists, conditioning of operating models, computational aspect, the albacore case study and dissemination. At the workshop reviews will be presented covering these themes and will form the basis for agreeing future activities and work plans.

Discussion

The work of the Technical Working Group on Management Strategy Evaluation was discussed. It was explained that the Working Group has done a lot of its work virtually it is now planning to meet in person and is open to all interested persons.

It was noted that while in the t-RFMOs there had been a trend towards the use of MSE there are only a few examples of actual implementation of HCRs. Although Commissions expectations are high, responsibilities are also high, and an important requirement of MSE is an increased dialogue between the SCRS and the Commission. It was noted that while MSE is an important tool it is not essential for the development of HCRs. Although the Commission has not actually committed to implement HCRs, it has asked the SCRS to develop a five year plan.

While the intention had been to implement a HCR for North Atlantic this year it had not been possible due to all the necessary tasks and it was recognised that a multi-year work plan is required. Also until MSE has been used to develop HCRs there is a need to run stock assessments in the traditional way. This will result in an increase of the workload of the SCRS and needs to be communicated to the Commission. Also at some point the Commission has to make the decision about when sufficient work has been done to implement a HCR. Interim HCRs could be adopted which could then be tested further.

Although the philosophy of MSE is very elegant and can potentially provide important benefits the actual details can be difficult to understand for stakeholders. There are also important financial repercussions, since more people need to be involved in the process and Species Groups need to have the required skills.

It was also agreed that the current process of providing scientific advice needs to be reviewed. Such a review has been performed across the t-RFMOs and forms part of the agenda of the Joint t-RFMO MSE Working Group, however, a review needs to be performed of the changes required to the work and structure of ICCAT.

14.2 Considerations from the Intersessional meeting of Panel 2

As required by Rec. [15-04] and Rec. [15-07] the SCRS continued to participate in the ICCAT MSE process by providing input to the Panel 2 meeting of the Commission on the progress on MSE for the northern stock of albacore and for bluefin tuna. At the Panel 2 the SCRS Chair provided a description on how the MSE process may change the way the SCRS conducts assessments, provides advice to the Commission, and management decisions are taken in ICCAT (**Figure 14.2.1**). These changes are consistent with the precautionary principle of management and would provide more predictable management actions in response to changes in the condition of stocks. They would also increase the quality of the advice provided by the SCRS by a more efficient use of the resources required for assessments.

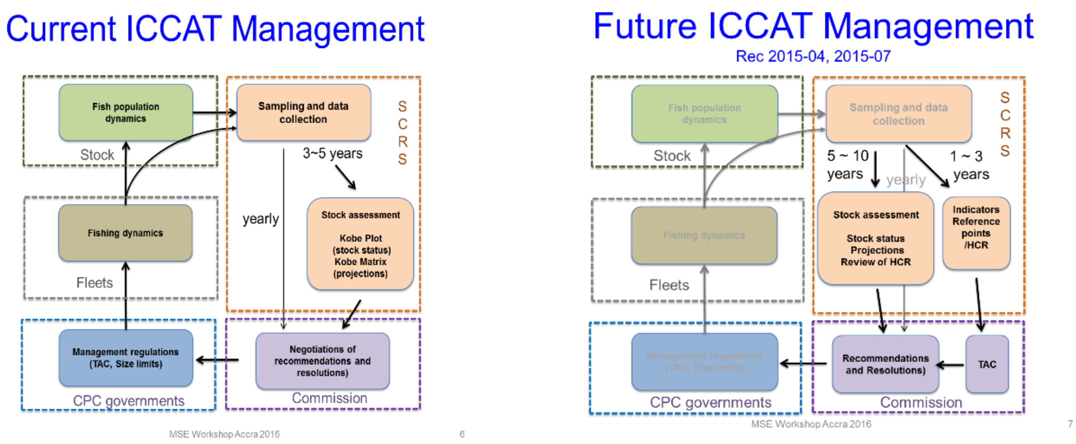


Figure 14.2.1. Changes in assessment frequency and provision of management advice resulting from MSE.

The most important part of the MSE process is the dialogue between managers, scientists and other stakeholders required to implement harvest control rules (HCR). As part of this process SCRS scientists conduct evaluation of alternative management procedures (the combination of a set of data, an assessment method and an HCR) through simulation. The results of these simulations allow the Commission to evaluate the performance of alternative HCRs by examining trade-offs through the examination of performance indicators. These performance indicators allow the Commission to quantitatively examine whether the objectives of management are being met.

The MSE process is one where the SCRS and the Commission share the responsibility of many of its steps (**Figure 14.2.2**). This MSE process of dialogue was initiated through the 2014 and 2015 meetings of the ICCAT Working Group on Dialogue and continued in 2016 at the Panel 2 meeting of the Commission in Sapporo. The Commission has instructed other panels to participate in this dialogue through recommendation Rec. [15-07], however, only Panel 2 has met to date to discuss this topic.

MSE steps:	Commission	SCRS
• Identify **management objectives** and map these to **indicators of performance**;	X	x
• Select hypotheses for **Operating Model** (OM), condition the OM based on data and knowledge,	x	X
• Develop **observation model**	x	X
• Identify candidate MS, limit and target reference points and **harvest control rules** (HCRs)	X	X
• Project the OM forward in time using the Management procedure (MP)		X
• Identify the MP that robustly meet management objectives.	X	

Figure 14.2.2. MSE process and level of responsibilities of the Commission and the SCRS. Larger symbols denote leading role.

At the Panel 2 meeting in July the SCRS provided the participants with a summary of the results of simulations that tested the performance of a large set of management procedures for northern albacore which differed on the values of reference points used to define the HCR and included a set of CPUE and total catch data and a production model as the assessment method. Various performance indicators helped the participants evaluate the performance of the alternative HCRs under a large set of alternative hypotheses about the dynamics of the fishery system. The Panel provided important feedback to the SCRS on performance indicators, the range of HCRs, the type of data to be used in the management procedure and the assumptions made about system functioning. This feedback together with the feedback provided by the albacore Working Group during the 2016 interssessional and species group meetings will shape further MSE work conducted by the SCRS on the northern albacore stock.

14.3 Work conducted under ICCAT GBYP

The SCRS also provided a summary of progress on MSE for bluefin tuna to the Panel 2 interssessional meeting in Sapporo. This work is part of the on-going ICCAT GBYP core modelling group research agenda and was advanced in collaboration with the Bluefin tuna Species Group. The initial aim of the ICCAT GBYP MSE research is to support the bluefin assessment in 2017 by testing alternative stock assessment methods and evaluating the information content of different data streams. The Group has advanced considerably in the conditioning of the operating model and developed a flexible simulation framework for the MSE.

More details on this work is included in **Appendix 4**.

15. Report of the implementation in 2016 of the Science Strategic Plan for 2015-2020 and work plan for 2017, including the definition of an ICCAT training plan, the update of the stock assessment software catalogue, as well as a proposal for a more strategic research plan

The SCRS Chair presented a plan for the implementation of the SCRS Science Strategic Plan 2015-2020. The Plan contains a series of goals for each of five categories:

- data collection
- dialogue and communication
- participation and capacity building
- research priorities
- stock assessments and advice

Each goal has one or more strategies to reach the goals and one or more measurable targets to evaluate whether goals are reached within the timeline of the plan. The SCRS has developed a table (**Table 15.1**) which will report on how much progress there has been towards each target and the party responsible for reporting on the measurable target (Secretariat, Working Groups, Sub-committees or Chair of SCRS). At present **Table 15.1** is only partially completed, however, it is displayed to demonstrate its potential usefulness. The table will be completed to reflect progress by the middle of 2017, the mid-way period of the plan, and reported to the Commission at their 2017 Annual meeting. **Figure 15.1** is an example of a figure that may be used to synthesize graphically the data on progress toward reaching goals of plan.

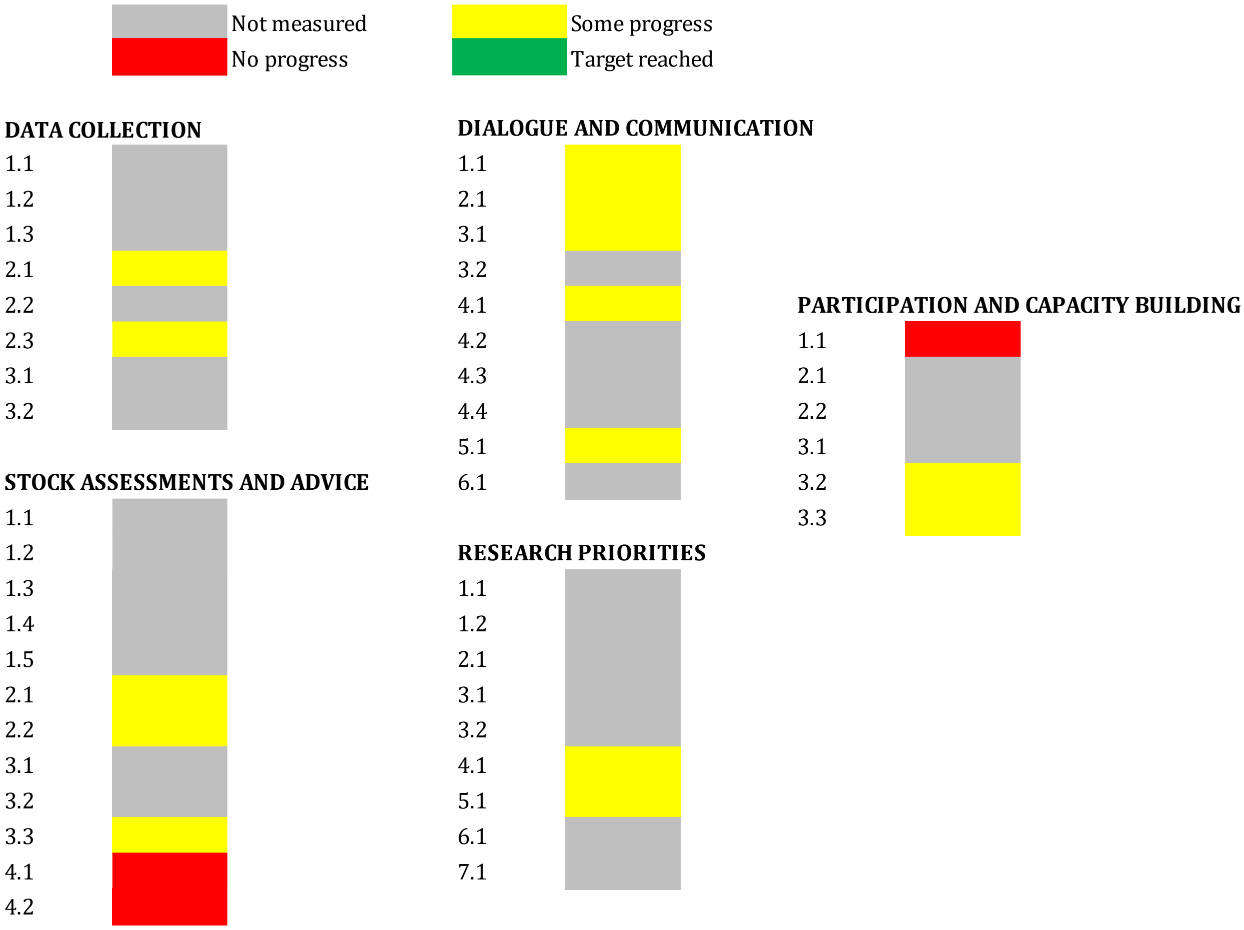


Figure 15.1. Example of report card for progress on the implementation of the Science Strategic Plan.

Table 15.1. Goals, measurable targets, Party responsible for reporting and progress towards goals for selected goals as of September 2016. Objective and Measurable targets are reproduced verbatim from the Science plan.

a) 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	
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	
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	
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	
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	

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	
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.*	SubCom Stat	
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.*	SubCom Stat	
b) 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	[Rec. 15-07] puts the responsibility for dialogue on HCRs and MSE to the panels

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	First FAD Working Group had this format, second not
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
3.2	*Develop better dialogue 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	
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 to be held in Nov 2016
4.2	*Strengthen linkages and collaboration with ICES*	*Number of meetings with joint participation of ICES-ICCAT.*	Secretariat	

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	
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	Strategic 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	

c) 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	
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	
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	

3.2	*Increase scientific leadership for SCRS by scientists from G77 economies*	*At least 30% of the SCRS officers belong to G77 countries.*	Secretariat	
3.3	*Increase scientific participation in SCRS by scientists from G77 economies*	*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.*	Secretariat	
d) 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*	*Meta-database 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.*	Sp WG	

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	
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	
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	
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	
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	SCRS/2016/206 ICCAT GBYP Larval index workshop report. Several SCRS papers on larval indices for WMED and GOM

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 presented
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	
7.1	*Identify and fill knowledge gaps so as to be able to provide scientific advice including ecosystem considerations (e.g. assessment of bycatch 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	
e) 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 Preparatory 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	

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	SCRS redesigning and standardizing format and information content of Executive Summary. SCRS updating glossary
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 maintaining a historic repository of version control.*	Secretariat	
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 quantify the sample sizes needed to improve the information.*	Secretariat	
1.5	*Strengthen peer review process*	*Conduct a peer review of at least one assessment each year.*	Secretariat	
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 SCI_075/2016

2.2	*Establish a five year schedule for the establishment of species specific HCRs which will include a default HCR in the absence of species specific information.*	*Establish a five 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.*	SCRS Chair	See SCI_075/2016
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	
3.2	*Enhance the Ecosystem Approach to Fisheries Management (EAFM)*	*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 to be held in Dec 2016
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	

4.1	*Development and testing of bio-economic modeling 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 be involved in the collection and analysis of socio-economic information
4.2	*Development and test bio-economic modeling 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

ICCAT training plan

The SCRS training plan will be developed in 2017 by the SCRS Chair and presented at each of the Working Groups and Sub-committees for input before it is presented to the SCRS at its 2017 plenary meeting.

Update of the stock assessment Software Catalogue

The original objective of the ICCAT Software Catalogue was not to evaluate the relative merits of a particular stock assessment method, but to provide a check list of whether the software works as intended and is adequately documented. Action 1.3 of the Science Strategic Plan is to review the protocols for including and updating the software used for stock assessments while maintaining a historic repository of version control, a questionnaire was sent to the Rapporteurs of stock assessment Species Groups to canvass their views and to identify the software currently used by the SCRS.

Based on the results of the survey a new protocol for including software in the catalogue was proposed. This has the following objectives:

i) to update the existing catalogue ensuring no outdated software is removed;

ii) use version control to ensure Species Groups use the appropriate versions of the software selected for stock assessment and lastly;

iii) to make sure there is full documentation for the model, e.g. a user manual for the latest version.

To date ASPIC has been added to the new catalogue as an example, for others to evaluate. Currently mpb and Stock Synthesis are being added to the manual. There is also a *github* repository for version control and collaboration, which is being used for VPA2Box and Pro2Box.

ICCAT Strategic Research Programme

The SCRS Chair presented a proposal for the implementation of an ICCAT Strategic Research Programme, as follows:

Rationale

Since its inception ICCAT has invested in scientific research to support its mandate. The ICCAT Secretariat has managed a number of multinational research programmes many which obtained support from individual CPCs others, directly funded by the Commission (**Figure 15.2**). Those programmes funded by the Commission have tended to be smaller than the others, however, they provide a critical source of resources to the SCRS which in some cases, like the Enhanced Programme for Billfish Research (EPBR) has supported data collection and research for long periods. As the demands for funds and the number of SCRS Working Groups requesting resources from the Commission has grown, it has been increasingly challenging for the SCRS and the Secretariat to prioritize requests, manage funds and review the value and quality of the research proposed. Following requests from the SCRS and the Commission made during 2015, this proposal provides an alternative scenario to meet these challenges.

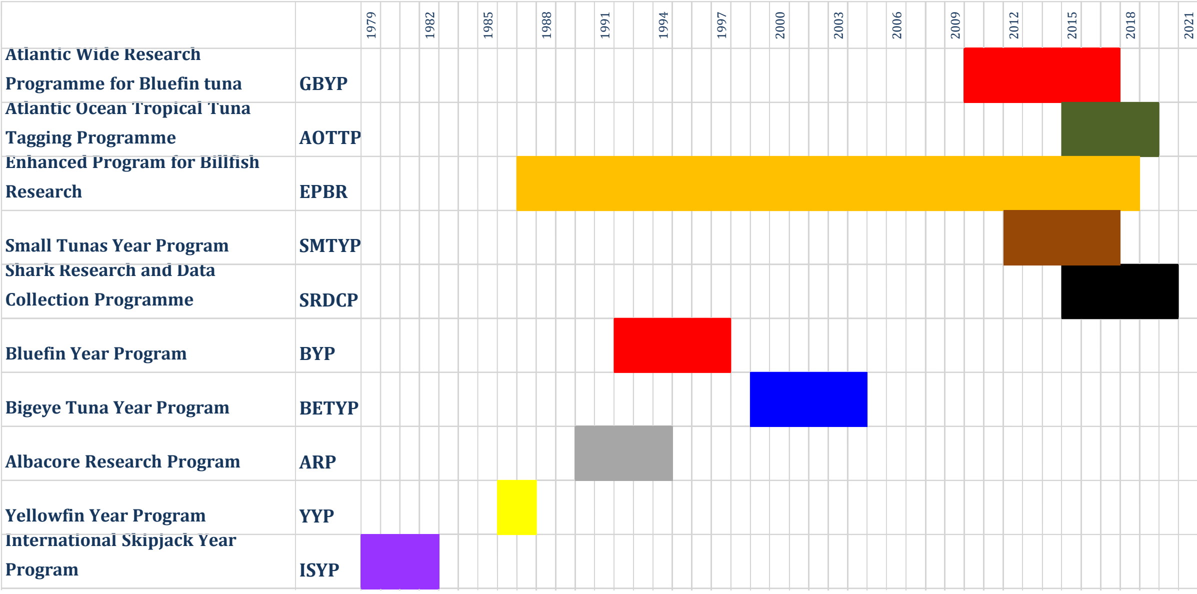


Figure 15.2. Multi-National research programmes conducted by ICCAT.

Goals

The 2015-2020 SCRS Science Strategic Plan lists strengths, weaknesses, opportunities, and threats which the SCRS contends with currently, and lays out specific goals to reach by 2020 in order to improve collection, compilation, analysis, and dissemination of fishery statistics. These goals include various objectives, which then list the strategies to implement in order to obtain each objective. Several of these strategies suggest using or evaluating use of funds for scientific research: For example, 1) evaluating the use of funds currently available and evaluating the efficacy of the training activities conducted by the Secretariat and the SCRS in recent years in order to increase the ability of the SCRS in the application of methods used in providing management advice on tuna stock management[1], or 2) Promoting the dialogue and communication between CPCs in order to carry out scientific research on ICCAT fishery resources in a coordinate and efficient way by using the funding programmes to develop capacity, research, and cooperation between the CPCs, preferably intra-regionally[2], etc. A Strategic Research Programme could help meet these goals.

The Competitive Research Programme will be designed for research that aligns with the Science Strategic Plan, in an effort to secure long-term research for the future. It will not be considered for any other funding recommendations outside of scientific research. The Strategic nature of the Programme would ensure the relevance, quality, and efficient use of research funds to support management of tuna resources. The Programme will also help meet the increasing demands on training and capacity building activities within the SCRS. By developing a focused approach to the funding of research activities, the Commission will ensure that the limited funds available for research are used in the most productive manner.

Schedule

Since ICCAT produces budgets in a two-year cycle, the requests for funding from the Strategic Research programme will have to coincide with this biennial cycle, pending approval of the budget by the Commission[3]. The programme funding will therefore be requested as a new item in the Commission's regular budget for the 2018-2019 cycle.

[1] 2015-2020 Science Strategic Plan, Section 2.2.1 under "Participation and Capacity Building," pp. 332
[2] 2015-2020 Science Strategic Plan, Section 4.4.1 under "Dialogue and Communication," pp. 330
[3] *Report of the Standing Committee on Research and Statistics* (SCRS), October 2015, Section 16, pp. 233

The funding cycle for the programme will therefore be as follows:

- *Early-October*[4]: The SCRS establishes its priorities at its plenary meeting for the next year and research teams should start planning proposals. These priorities should reflect research topics in the strategic research plan that are unlikely to be completed by individual CPC unless they are funded by this program. Funds will be allocated proportionally into specific areas of research based on prioritization of needs (*i.e.* an area given priority status will likely receive more funding).

- *Mid-to late-October*: The Secretariat would release a Request for Proposals (RFP) prior to the Commission meeting. The specific deadline for the RFPs must be determined based on when the SCRS meeting takes place. All submitted RFPs must follow specific guidelines and specifications laid out in the application process in order to be considered.

- A Committee comprised of SCRS officers will review proposals and make recommendations for funding, taking into account the level of funding provided by the Commission for the two-year budget. Funding decisions will be made based on:

    - Relevance of the research to the work of the SCRS
    - Alignment with the Science Strategic Plan
    - Level of Collaboration between CPCs
    - Level of Engagement of G77 economies
    - Contributions of the project to capacity building

- *End of October*: Decisions of funding will be made and research teams will be notified.

- *February*: Release of funding to selected research teams.

Details of the application process will be developed by SCRS in 2017, however, **Appendix 14** contains a draft of such possible template.

In order to enhance the value of the research produced by this programme, increase visibility of research results, and ensure the long-term support by CPCs it is imperative that the programme has a clear communication strategy. This would include providing regular highlights of research results to the SCRS, the Commission and the public. The strategy may be supported by a part time communication specialist that otherwise may prepare products from other teams in the Secretariat such as scientific results from other large research programmes like the ICCAT GBYP and the AOTTP and the regular monitoring and data collection work conducted by ICCAT.

Amount required to support programme

There are several new SCRS requests and on-going SCRS requests from existing research programmes which receive or are proposed to receive funding from the Commission and which would likely fall under the Strategic Research Programme if this were to exist. Such requests include the new demands for funds from the Albacore and Swordfish Species Groups, and the existing programmes for sharks, small tunas and billfish. The Strategic Research Programme may also be used to support the matching contributions of large programmes like the AOTTP and the ICCAT GBYP.

The amount needed for the Strategic Research Programme should be commensurate with the needs for resources required by the SCRS to support the Science Strategic Plan and with the funding capacity of the Commission. Over the last five years the Commission funding for research programmes has grown from €30,600 to €361,897.00 (**Table 15.2**). It is worth noting that the SCRS requests have often largely exceeded the funds committed by the Commission. Of the committed funds only those corresponding to the billfish research programme had been incorporated into the regular budget of the Commission. The other funds have had to be included by the Commission as special budget items at each cycle. Given the level of requests provided by the SCRS for the current and new research programmes, it would be

[4] First cycle would be implemented in 2017.

necessary for the Strategic Research Programme to be supported with an initial annual budget of €600,000. The annual budget will be revised bi-annually by the Commission and will change as a function of the research needs of the SCRS and the capacity of the Commission to fund scientific research.

Table 15.2. Funding provided by the ICCAT Commission to research programmes since 2012.

	2012	*2013*	*2014*	*2015*	*2016*
Billfish	€30,600.00	€31,212.00	€31,212.00	€31,836.24	€20,000.00
Small tunas			€75,000.00	€60,000.00	€82,500.00
Sharks				€135,000.00	€65,000.00
AOTTP					€194,397.00
	€30,600.00	**€31,212.00**	**€106,212.00**	**€226,836.24**	**€361,897.00**

A preliminary application template is provided as **Appendix 14**.

In recent times the SCRS is being asked to produce advice through increasingly complex assessment models and to test harvest control rules through MSE [Rec. 15-04, Rec. 15-07]. In theory CPCs could support these additional demands on the SCRS through increasing the involvement of their scientists in the SCRS process and greater investment on research. Recent experience shows that such increases have not kept pace with the additional demands placed on the SCRS. The Committee stresses that the proposed Strategic Research Plan will be an important element that the Commission can use to provide resources to the SCRS, but not the only element. The resources required to deliver the scientific advice provided by the SCRS far exceed the proposed budget of the Programme. The Programme, however, will be of great value to the Commission, because it will be a secure source of funding for the SCRS to conduct the most critical strategic research to support scientific advice that is not funded directly by CPCs.

16. Consideration of plans for future activities

16.1 Annual Work Plans

The Rapporteurs summarized the Work Plans for 2017 for the various Species Groups, the Working Group on Stock Assessment Methods, the Sub-Committee on Statistics and the Sub-committee on Ecosystems. These Plans were adopted and are attached as **Appendix 12**.

16.2 Inter-sessional meetings proposed for 2017

Taking into account the assessments mandated by the Commission and the Committee's recommendations for research coordination, the proposed intersessional meetings for 2017 are shown in **Table 16.2**. 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 2016 and the meetings scheduled by other RFMOs.

Cabo Verde put forward an invitation to host the Shark and Atlantic Swordfish Data Preparatory meetings (Mindelo, São Vicente). The European Union put forward an invitation to host five meetings: the bluefin tuna Data Preparatory meeting was proposed to be held in the Balearic Island (Spain), the Mediterranean albacore and the shortfin mako shark stock assessment sessions were proposed to be held in the Canary Islands (Spain), the Atlantic swordfish stock assessment session was proposed to be held in Portugal, and the interssessional meeting of the Stock Assessment Methods Working Group in Pasaia (Basque Country, Spain).

16.3 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 2 to 6 October 2017; the Species Groups will meet from 25-29 September 2017 at the ICCAT Secretariat.

Table 16.2. Proposed calendar of ICCAT scientific meetings in 2017.

	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		
										BFT Data Prep (a)																								SMA Data Prep (b)			
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
											SWO Data prep (b)																				SMALL TUNAS (c)						
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 (d)																											
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		
											ALBACORE (e)						SMA Assessment (e)																				
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						
			SWO Assessment (f)							SC-ECOSYSTEMS										BFT Assessment (g)																	
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	
										TROPICALS																					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

Invitations were made by various CPCs to hold meetings in: (a) Mallorca, Spain; (b) Cabo Verde; (c) Miami, USA; (d) Pasaia, Spain; (e) Tenerife, Spain; (f) TBA, Portugal; (g) St. Andrews, Canada

17. General Recommendations to the Commission

17.1 General recommendations to the Commission that have financial implications

Eastern and western Atlantic bluefin tuna

- Next phase of the feasibility of close-kin analysis (including consideration that the estimation of the proportion of each age group which contributes to spawning is one of the highest priorities as a possible objective for a future close-kin analysis).

- Longline cruises to obtain linked samples for reproductive analyses, otolith microchemistry and genetic analyses, with emphasis on obtaining samples of Atlantic bluefin tuna from the South Atlantic for population assignment purposes.

Albacore

- The Committee recommends 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 4 year work plan. More details of the proposed research and economic plan are provided in the 2017 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 and negatively affected successfully achieving the objectives of the meetings. 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 Species Group meetings.

Tropicals

- Task I and Task II data are the basic information necessary to stock assessment. The more these data are accurate the more scientific advice is confident (all things being equal). Due to the heterogeneity of the quality of these basic data, the Species Group recommends that a project is developed as a high priority between Ghanaian and IRD scientists in 2017 in order to complete the development of the T3+ software necessary for the overall treatment of Ghanaian statistics. The Species Group also recommends a transparency around the data treatment using this tool and encourages trainings to capacity building for African countries, particularly for Ghanaian scientists.

- Fund an activity between Côte d'Ivoire, EU-France and Senegal and the ICCAT Secretariat to review an update of Task I and Task II data so that it can be adopted and transmitted to ICCAT by the appropriate CPCs.

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 (SCRS/2014/043). Therefore, it is a very high priority to conduct 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 Caribbean Sea and off the West Africa. Efforts should be made to procure funding for this endeavour.

- 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.

Sharks

- Shark Research and Data Collection Programme (SRDCP): extend to 2017 and beyond. Request €150,000 and change priority from medium to high.

- Historical catch recovery project, observer and dockside training workshops in 2018 (€160,000).

Small Tunas

- Continue with the ICCAT SMTYP research programme activities in 2017 to further improve the biological information (growth and maturity) for the priority species (the details of this programme are given in Table 2 of the summary report of the 2017 Small Tuna Research Programme (SMTYP)).

- Based on the relative importance of the different species to regional fisheries and the existing data gaps on life history parameters, the Group recommends using the AOTTP as an opportunity to study the growth patterns for *Euthynnus alletteratus* (LTA) in the eastern Atlantic Ocean and for *Acanthocybium solandri* (WAH) in the southwestern Atlantic Ocean. Furthermore the Group recommends that in order to increase the probability of collecting information on recaptures of tagged fish, that the AOTTP pays special attention to enhancement of recovery efforts: for LTA, focus should be on artisanal gillnets and purse seine fisheries; for WAH, recovery efforts should focus on longline and handline fisheries.

North and South Atlantic Swordfish

- Model expertise. During the 2013 Atlantic Swordfish Stock Assessment alternatives model approaches provided added confidence to the Group determination of stock status. Consequently, the Group expressed continued interest in exploring multiple models approaches, that fully exploit the currently collected data, and recommends that the Secretariat continue to support external expertise to assist the Group with its modelling work using other modelling platforms, in preparation for the 2017 stock assessment.

- Stock Structure. Given new information on genetics, satellite archival tagging and early life history studies that has become available, the Group recommends synthesizing existing information, and to collect 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 of the work described would be 80,000USD for a population genetics study and 20*5,000USD (=100,000USD) for deployment of 20 popup satellite archival tags. Such costs could be spread over a two year period as follows: 100,000USD in 2016/2017 and 80,000USD in 2017/2018. This recommendation applies to both the North and South Atlantic and Mediterranean Stocks.

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 Committee 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 Group 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 Italian fisheries.

- Size and age at maturity: As there may be spatial differences between the east and west Mediterranean swordfish, the Group recommended that future work is conducted to determine region specific size and age at maturity at a temporal 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 Sub-committee request that CPCs with coastal gillnet fisheries make the effort to participate in the upcoming regional workshops aimed at collecting of gillnet data including historical data.

Sub-committee on Ecosystems

- The Sub-committee recommends that regional workshops should be held with the goal of recovering Task II and other information (e.g sea turtle and seabird by-catch) on gillnet fisheries, from CPCs in which this method of fishing occurs. The Sub-committee recommends searching for sources of funding in order to conduct these workshops and that by-catch related issues be included in the agenda of the gillnet workshops.

- Recommend a peer review expert for one assessment in 2017. To be determined by the SCRS Chair in consultation with the Species Group Rapporteurs.

17.2 Other recommendations

Eastern and western Atlantic bluefin tuna

- Continued sampling and analysis of otoliths and genetic tissues for stock composition analysis, particularly sampling that is representative of principal fishing fleets, size and age classes, and regions. Individual stock assignments should be coupled with age estimates and provided to the ICCAT GBYP database on stock composition.

- Evaluate bias in stock assignment procedures owing to empirical approaches and assignment algorithms. Continue exploration of the influence of incorporating mixing and population structures into assessment and simulation (operating model) frameworks.

- Evaluate potential for spawning in regions outside the Gulf of Mexico and Mediterranean Sea (i.e., the Slope Sea, Azores; Morocco and Canary Islands), including an evaluation of population origin. Use latest models that predict habitat/seasons of spawning bluefin together with observations of co-occurrence of bluefin in those areas/times to define areas of highest priorities for new larval surveys.

Albacore

- The Committee recommends making extra efforts to improve the availability and quality of CPUE series. Efforts should be made to standardize CPUEs of surface (EU-France mid water trawl) and longline fleets (Republic of Korea, EU-Spain and EU-Portugal) even if albacore is a by-catch species. Likewise, existing indices should be improved to the extent possible. In the case of the Japanese longline CPUE, efforts should be made to recover the historical period, by addressing changes in targeting through species composition. Finally, joint analyses of longline CPUEs as well as surface CPUEs are recommended (see **Appendix 12**, Albacore Work Plan).

- The Committee continues to recommend that changes in EU-France historical Task I and Task II be documented, so that the Group can understand the nature of the changes proposed and evaluate the merits of incorporating the new datasets to the ICCAT database as well as the potential implications. It also recommends that Chinese Taipei submits the revised Task II size data to the Secretariat. The Group asked the Secretariat to reach out to these CPCs to facilitate these submissions.

- Reliable evaluation of Mediterranean albacore stock status is hindered by the inexistence (or low quality) of catch, catch-effort and size statistics over time for some of the major fleets. As a prerequisite of a successful assessment of the stock, a complete revision of Task I (aggregated catch, by gear/fleet) and Task II (catch-effort, size) data is required. CPCs with the major fleets (EU-Greece, EU-Italy, EU-Spain and Turkey) should submit all the available historical Task II data to the Secretariat.

North and South Atlantic swordfish

- Model validation. The Committee recommended that methods be developed to evaluate indices of stock abundance based on fisheries dependent data, e.g. by using simulation and cross validation based on detailed data such as logbooks and sales records.

- Impact of management on CPUE series. As fishery-dependent time series of CPUE are absolutely critical to all ICCAT assessments, it is essential to maintain their continuity and ensure they properly capture distribution changes of swordfish stocks. To this end, and to the extent possible, any management action that may affect catchability should either: a) be phased in over a series of years so that there is overlap, allowing the effect of the action to be estimated; or b) have the effect of the action assessed experimentally, e.g. experiments testing the effects of a new hook type. This will achieve two valuable purposes: a) maintaining the integrity of CPUE time series; and b) allow for the direct estimation of the efficacy of the management action.

Mediterranean swordfish

- Length-Weight relationships: Ongoing work and preliminary results shown to the Group indicate that the Length-Weight relationships currently in use in ICCAT for the entire Mediterranean might not be the most appropriate, as there may be spatial differences between the east and west Mediterranean. Therefore the Committee recommended this revision to continue, and an effort to be made to incorporate all available data sets into the analysis, including data from different Mediterranean regions and fisheries.

- Discards. Recently adopted management measures may have increased discard levels, therefore the Group 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

- Electronic Monitoring Systems (EMS) are being used by some tropical tuna purse seine vessels. Noting that EMS can complement physical observer programs 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 document SCRS/2016/180.

- The Tropical Tuna Species Group reinforces the ICCAT *Ad hoc* Working Group on FADs recommendations to develop a set of definitions for floating objects and types of activities developed on them, including "FAD sets" and "FAD fishing". These should be adopted following the guidelines presented in document SCRS/2016/30 (see three tables in Annex of the response 18.2 to the Commission). In addition, definitions and characteristics of non-entangling and bio-degradable FADs should be established by the SCRS.

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

- National Scientists must prepare all information relevant to the assessment of shortfin mako, including catch, CPUE, length composition, and biology, and trade data if available.

- The Working Group on Stock Assessment Methods (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.

Small Tunas

- The Committee recommends that, the Secretariat contact the Statistical Correspondent and/or National Scientists aiming to revise, update, and complete their small tuna T1NC series. 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 recommends that the Secretariat contact the Statistical Correspondent and/or National Scientists of CPCs with inconsistencies identified in T2SZ series. These inconsistencies include, among others, outliers in size measurements, heterogeneity in length types (FL, CFL, WGT, HGTW, etc.) and size class types (1 cm, 2 cm, 5 cm, 1 kg, 2 kg, 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).

- 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.

Working Group on Stock Assessment Methods (WGSAM)

- It was agreed that for stocks with fisheries that are known to have time varying selectivity, or changes in the proportion of catch between gears with different selectivity, the SCRS should provide a time series of year specific MSY estimates and the corresponding B/B_{MSY} and F/F_{MSY} time series based on the year specific B_{MSY} and F_{MSY}. In addition, for reference purposes, a global MSY estimate (based on yield per recruit analysis, spawning potential ratio, Lopt, etc.) should be included.

- The Committee recommended that, to facilitate the adoption of LRP, HCR, and various management strategies by ICCAT, examples of the utility and benefits of these management approaches be presented to the SWGSM. This should facilitate the conversation with managers and help in the discussions on defining management objectives and other necessary elements required to advance this work by the SCRS.

- The Committee again encourages CPCs to provide limited access to CPUE set by set data according to the needs and priorities identified by the different Species Groups and Sub-committees. The method described in SCRS/2015/032 offers one possible approach to accomplish this task.

Sub-committee on Ecosystems

With regard to Ecosystems:

- It is recommended that the next meeting of the Dialogue between Science and Managers Working Group include an agenda item on the implementation of an EBFM framework for ICCAT.

- It is recommended that at the next Species Working Group meeting in 2017 that there be a meeting between the Working Group chairs and the Ecosystem Sub-committee Chairs in order to discuss the contribution of input to ICCAT's EBFM framework.

- The Committee recommends that document SCRS/2016/171 be presented to the WGSAM and the Small Tuna Working Group in order to review the proposal to host a workshop that was described therein.

With regard to by-catch:

- The Committee recommends that the SCRS should request that CPCs provide annual sea turtle and seabird by-catch information including by-catch rates and number for each fleet harvesting ICCAT species.

- Catch rate and number should be broken down to a lower taxonomic level as possible. In addition, mitigation measures adopted by each fleet should also be described.

- The Committee recommends that the Secretariat should continue to revise and update longline and purse seine EFFDIS, though collaboration with CPCs to support the work of the Sub-committee on Ecosystems.

- The Committee recommends that the ST09 observer data submission forms be revised to simplify the reporting requirements in order to facilitate increased submission of observer data. This should be done intersessionally through collaboration between CPC scientists and the Secretariat. This proposal along with suggestions for revising the forms is to be presented to the Sub-committee on Statistics in 2016 after which a preliminary version will be presented to the Sub-committee on Ecosystems in 2017 for potential adoption by the SCRS later that year.

Sub-committee on Statistics

- The 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 Committee recommends that the Secretariat works intersesionally with the SCRS Chair, Convenors of the two Sub-committees, and Rapporteurs 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.

18. Responses to Commission's requests

The Committee noted that some of the 2016 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.

18.1 Evaluate the efficacy of the area/time closure referred to in paragraph 13 in relation with the protection of juvenile tropical tunas, [Rec. 15-01] paragraph 15

Background*: Rec. [15-01] paragraph 15 requests the SCRS to evaluate the efficacy of the area/time closure referred to in paragraph 13 for the reduction of catches of juvenile bigeye and yellowfin tunas.*

The SCRS is requested to evaluate, at the latest by 2018, the efficacy of the area/time closure referred to in paragraph 13 of Rec. 15-01 for the reduction of catches of juvenile bigeye and yellowfin tunas which will be applicable for the first time in 2017. Since this time area closure would not be applicable until January 2017, the anticipated effect was estimated based on examination of 2002-2015 fishery data.

Based on these data, it could be hypothesized, assuming no change on fleet behaviour, that the effects could be the following:

- Major reduction of the Ghanaian catches could be expected, because the closed area will reduce most of the traditional Ghanaian fishing zones (leaving only the productive but small area between the coast and 5°N). The complete closure of the Ghanaian fishery during two months would reduce the catch of small bigeye associated to FAD at an approximate level of 1,700 t from an average reference level of 2006-2012.

- A reduction of 1,300 t. of small bigeye associated to FAD catches from an average reference level of 2006-2012 could be expected from most other purse seiners. However, this figure could be smaller if theses purse seiners redistribute their effort to the areas outside the closure south of 4°S where FAD catches have been quite important in recent years.

The Committee considered this analysis as preliminary and further work is recommended for 2017 and 2018.

The Group reiterates its recommendation to the Commission for establishing the target level of reduction it wishes to reach by such a closure defined in Recommendation 15-01.

18.2 Revise the provisional limits laid down in paragraph 16 in relation with the limitation of FADs, [Rec. 15-01] paragraph 17

Background*: Rec. [15-01] paragraph 17 requests the SCRS to review the provisional limits laid down in paragraph 16 regarding the limitation of FADs while fishing for bigeye, yellowfin and skipjack tunas.*

The SCRS has been asked to revise the conclusions from FAD Working Group in relation with the limitation of FADs. According to the data currently available, the Committee is unable to provide conclusions on any limit of FAD. To progress towards a better assessment framework the Committee recommends adopting a common and harmonized approach to gather information based on minimum data collection requirement and comparable of common terminology describing fishing activities on FADs. With this purpose, the Committee suggests adopting the three tables annexed to the document SCRS/2016/030.

The Committee acknowledges that active buoys and deployed buoys are two different metrics.

Annex

Table 7. Codes, names and examples of different types of floating object that should be collected in the fishing logbook as a minimum data requirement. Table extracted from SCRS/2016/030.

Code	*Name*	*Example*
DFAD	Drifting FAD	Bamboo or metal raft
AFAD	Anchored FAD	Very large buoy
FALOG	Artificial log resulting from human activity (and related to fishing activities)	Nets, wreck, ropes
HALOG	Artificial log resulting from human activity (not related to fishing activities)	Washing machine, oil tank
ANLOG	Natural log of animal origin	Carcasses, whale shark
VNLOG	Natural log of plant origin	Branches, trunk, palm leaf

Table 8. Names and description of the activities related to floating objects and buoys that should be collected in the fishing logbook as a minimum data requirement (codes are not listed here). Table extracted from SCRS/2016/030.

	Name	*Description*
FOB	Encounter	Random encounter (without fishing) of a log or a FAD belonging to another vessel (unknown position)
	Visit	Visit (without fishing) of a FOB (known position)
	Deployment	FAD deployed at sea
	Strengthening	Consolidation of a FOB
	Remove FAD	FAD retrieval
	Fishing	Fishing set on a FOB[5]
BUOY	Tagging	Deployment of a buoy on FOB[6]
	Remove BUOY	Retrieval of the buoy equipping the FOB
	Loss	Loss of the buoy/End of transmission of the buoy

[5] A fishing set on a FOB includes two aspects: fishing after a visit to a vessel's own FOB (targeted) or fishing after a random encounter of a FOB (opportunistic).

[6] Deploying a buoy on a FOB includes three aspects: deploying a buoy on a foreign FOB, transferring a buoy (which changes the FOB owner) and changing the buoy on the same FOB (which does not change the FOB owner).

Table 9. FOB/FAD information added to observer onboard form to comply with RFMOs recommendations. Table extracted from SCRS/2016/030.

Properties	*DFAD*	*AFAD*	*HALOG*	*FALOG*	*ANLOG*	*VNLOG*
FOB built using biodegradable materials (true/false/undefined)	X	X	X	X		
FOB is non-entangling (true/false/undefined)	X	X	X	X		
Meshed material (true/false/undefined) in FOB	X	X		X		
Size of largest mesh (in millimeters)	X	X		X		
Distance between the surface and the deepest part of the FOB (in meters)	X	X	X	X		
Approximate surface area of the FOB	X	X	X	X		
Specifies the FOB's ID whenever present	X	X	X	X		
Fleet owning the tracking device / echo sounder buoy	X	X	X	X	X	X
Vessel owning the tracking device / echo sounder buoy	X	X	X	X	X	X
Anchorage type used for mooring (AFAD registry)		X				
Radar reflectors (presence or not) (AFAD registry)		X				
Lighting (presence or not) (AFAD registry)		X				
Visual range (in nautical miles) (AFAD registry)		X				
Materials used for the floating part of the FOB (list to be defined)	X	X	X	X		
Materials making up the FOB underwater structure (list to be defined)	X	X	X	X		
Tracking device TYPE+ID if possible, otherwise no or undefined.	X	X	X	X	X	X

18.3 Revise the appropriate coverage level of scientific observers in pursuant to Recommendation 10-10. Rec [15-01] paragraph 40

Background: *[Rec. 15-01] paragraph 40, in 2016 the Commission shall revise the appropriate coverage level of scientific observers, in light of the SCRS advice pursuant to Recommendation 10-10.*

The SCRS has been asked to review the appropriate coverage level of scientific observers of fishing vessels targeting tropical tuna. Paragraph 1 of Recommendation 10-10, requires CPCs to have "a minimum of 5% observer coverage of fishing effort in each of the pelagic longline, purse seine, and, as defined in the ICCAT glossary, baitboat fisheries, as measured in number of sets or trips for purse seine fisheries; fishing days, number of sets, or trips for pelagic longline fisheries; or in fishing days in baitboat fisheries".

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 suggests that current 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% and should be studied further to determine the level of coverage appropriate to meet management and scientific objectives.

Moreover, the SCRS noted that the current mandatory level of 5% may not have been implemented by many of the fleets and underlined the need for achieving those minimum coverages so as the SCRS could address the mandate given by the Commission.

The SCRS also noted that some fleets are currently implementing voluntary observer programmes (both human and electronic) that cover 100% of the fishing trips. The SCRS acknowledges the effort conducted by some fleets to increase the observer coverage to 100 % of the trips.

References

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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.

18.4 Continue working on the identification of spawning grounds in the Atlantic and Mediterranean and provide advice to the Commission on the creation of sanctuaries, [Rec. 14-04] paragraph 24

Background: *[Rec. 14-04] paragraph 24 requests SCRS to continue working on the identification, as precisely as possible, of spawning grounds, in the Atlantic and Mediterranean, and provide advice to the Commission on the creation of sanctuaries, [Rec. 14-04] paragraph 24.*

The most important spawning grounds for Atlantic bluefin tuna are the Gulf of Mexico for West bluefin tuna and the Mediterranean Sea for East bluefin tuna. In these two areas, bluefin tuna aggregate to spawn in according to specific oceanographic conditions. In the Mediterranean these areas have been documented by direct observation of spawning, aerial and larval surveys (SCRS/2016/193). For the Gulf of Mexico, spawning zones have been identified through larval surveys and habitat modeling (SCRS/P/2016/054) and, recently, though satellite and archival tagging data. These zones exhibit substantial interannual variability according to changes in oceanographic features.

In addition to the two main spawning grounds, other additional potential spawning areas have been reported in various regions (Caribbean Sea, Bermuda, the eastern US coast, the Ibero-Moroccan area, the Canary Islands, the area North of Madeira, the area around the Azores Islands and even the Gulf of Guinea). In some of these areas, bluefin tuna larval presence has been documented, notably the recent discovery off the continental shelf of US Atlantic Coast (Slope Sea).

Regarding spawning area sanctuaries, such measures have limited effectiveness for highly mobile species and when spawning locations are dynamic in space and time. Moreover, closures could have potential negative consequences due to displacement of fishing effort outside the limits of protected areas or towards Atlantic bluefin tuna juveniles. Closing of the main Mediterranean spawning grounds would have negative consequences for the fishery by reducing the fishing opportunities for a large part of the countries traditionally carrying out the fishery.

The SCRS reiterates its view that spatial spawning closures would provide little population-level benefits while adversely affecting the fishery and that the current suite of season, gear and quota regulations provide sufficient protection of spawning biomass.

18.5 Update the Commission annually and prior to the Commission meeting, on any changes of the estimated bluefin catch rates per vessel and gear, [Rec. 14-04] paragraph 43

Background: *[Rec. 14-04] paragraph 43 requests SCRS to update the Commission annually and prior to the Commission meeting, on any changes of the estimated bluefin catch rates per vessel and gear.*

The Committee did not address this question as there were indications that the impetus behind this request no longer applies and that the request may have been carried over inadvertently from a previous recommendation. Therefore, the Committee reiterates its request to the Commission to confirm that this work is still needed, in which case it could be addressed at the next data preparatory meeting and SCRS species group meeting.

18.6 Continue to explore operationally viable technologies and methodologies for determining the size and biomass at the points of capture and caging and report to the Commission Rec. [14-04] paragraph 82

Background: *Rec. 14-04 paragraph 82 requests CPCs to take the necessary measures and actions to better estimate both the number and weight of bluefin tuna at the point of capture and caging and report the results to the SCRS.*

The Commission requests the SCRS to continue to explore operationally viable technologies and methodologies for determining the size and biomass at the points of capture and caging and report to the Commission at the annual meetings.

Since 2014, CPCs with bluefin tuna farms have been submitting size and weight measures of bluefin tuna at caging operation using stereo camera video systems. In 2015/2016, caging reports were received, from 23 farms and six CPC farm-flags, with over 51,000 thousand size/weight measurements provided. Some of the CPCs involved in the catch operations of fish destined to farming had also submitted stereo camera video reports; although they do not themselves have bluefin tuna farms.

In 2015 three studies related to the use of the stereoscopic camera were presented confirming and demonstrating the reliability and usefulness of video recordings for counting and sizing the bluefin transferred to farms. In 2016 two documents related to stereoscopic camera systems were presented. Document SCRS/2016/201compared age size distribution of the catch of juvenile bluefin in the Adriatic Sea from purse seine operations using age-length keys or the cohort slicing method. The sizing of the catch was obtained with the stereoscopic video cameras. Document SCRS/2016/187 summarizes the size distribution of the caged bluefin for the 2014 and 2015 years submitted by farm-CPCs, overall the size distribution is very similar in the two years, with a tri-modal distribution of small fish (75 SFL cm), medium size fish (120 SFL cm) and large size fish (210 SFL cm). Interestingly, size distributions are very similar for most farms in both years. The analyses indicated also that the average time between catch and caging (two days), when the stereo camera video is recorded is about 13 days ranging from 1 to 31 days in some instances. It was noted that during this time the fish is not feeding, plus the stress of the operation would likely reduce the fish condition, reducing the actual biomass of the caged fish compared to the biomass at catch.

18.7 Evaluate the results of the 100% coverage programme using stereoscopical cameras systems or alternative techniques that provide the equivalent precision to refine the number and weight of the fish during all caging operations Rec. [14-04] paragraph 83

Background: *[Rec. 14-04] paragraph 83 requests all farming CPCs to submit annually to the SCRS, by 15 September, the results of this programme which uses stereoscopical cameras systems or alternative techniques.*

The SCRS should evaluate such procedures and results and report to the Commission by the Annual meeting in accordance with Annex 9 of the Rec. [14-04].

In 2015 documents were presented to the SCRS demonstrating the reliability and accuracy of the stereoscopic camera systems to determine the size (straight fork length SFL) of bluefin tuna at caging and prior to harvest in farms. The results indicated accuracy on size measures close to 99% when compared to actual fish measurements. In 2014 and 2015, over 51,000 stereoscopic camera size (FL) measurements were collected from caging operations providing new size frequency data for use in stock assessments.

In 2015, the number of stereoscopy camera video reports increased substantially as the full compliance of Rec. 14-04 is in place. There are however some potential for duplicate data submissions; for example as CPCs are require to report caging operations within a week of the transfer most farms submitted transfer reports in non-standard formats. Also farm-CPCs submit an Annual Report of all transfer operations following Rec. 14-04 [83]. As complete information [e.g. date of catch, date of actual transfer, e-BCD associated] is not provide in both reports there is difficulty in identify what data is being duplicated in some reports. In other instances, some of the CPCs involved in the catching operation(s) are submitting stereoscopy camera video reports, although the fish is caged in another farm-CPC flag. The SCRS is recommending that the Secretariat in collaboration with the Sub-committee of Statistics review the data reporting requirement and make clear guidelines and forms for streamline the data submission of the stereoscopy camera caging operations reports.

18.8 Evaluate the bluefin tuna national observer programmes conducted by CPCs to report the Commission and to provide advice on future improvements Rec. [14-04] paragraph 88

Background: *[Rec. 14-04] paragraph 88 states each CPC shall ensure coverage by observers, issued with an official identification document, on vessels and traps active in the bluefin tuna fisheries. Data and information collected under each CPCs observer programme shall be provided to the SCRS and the Commission, as appropriate, in accordance with requirements and procedures to be developed by the Commission by 2009 taking into account CPC confidentiality requirements.*

For the scientific aspects of the programme, the SCRS shall report on the coverage level achieved by each CPC and provide a summary of the data collected and any relevant findings associated with that data. The SCRS shall also provide any recommendations to improve the effectiveness of CPC observer programmes.

In accordance with Recs. 12-03, 13-07 and 14-04, data collected under the national bluefin tuna observer programmes has been submitted to the Secretariat. A form presented to the Sub-committee on Ecosystems in 2014 has been adopted for observer data submission. This form could be used for CPCs with observer programmes for bluefin tuna, possibly with modifications to deal with confidentiality issues.

However in 2016 the Secretariat received limited information on bluefin tuna observer programmes, and in a variety of formats. EU-Malta, EU-Portugal and Turkey provided information on bluefin tuna catches in their observer programmes using the requested ST09 forms, while EU-Croatia, Iceland and Norway submitted ST09 forms with trip information, but no observer catch details. EU-Spain and Japan submitted observer reports in non-standard word/pdf format. Due to the disparate reporting formats, and generally poor response to submission of information pursuant to Rec [14-04], the SCRS is not in a position to evaluate these observer programmes as requested by the Commission.

18.9 Review the information from BCDs and other submitted data and further study growth rates so as to provide updated growth tables to the Commission, [Rec. 14-04] paragraph 96

Background: *[Rec. 14-04] paragraph 96 requests the SCRS to review information from BCDs and other submitted data and further study growth rates so as to provide updated growth tables to the Commission.*

Due to time and data limitations it was not possible to revise and update estimates of potential growth rates of bluefin tuna within farms. It is recommended that CPCs continue submitting detailed information of their harvest operations and carry size and weight measure sampling to have appropriated conversion factors for farmed fish and make this available for the SCRS.

18.10 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 comment on the effect of fish size management measures on their ability to monitor stock status, [Rec. 14-05] paragraph 27

Background: *[Rec. 14-05] 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 was unable to conduct any new bluefin tuna yield per recruit analysis to address this particular question during the 2014 stock assessment meeting due to time constraints and, therefore, it reiterates the response provided to the Commission in 2012 (paragraph below). The Committee indicated that, if the Commission still requires these analyses, it will evaluate the impact of adopting alternative larger size limits that take into consideration the age of maturity of western bluefin tuna, on the yield per recruit and spawner per recruit.

The Committee recalls that in 2012 it reviewed yield-per-recruit calculations 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.

18.11 Evaluation of data deficiencies pursuant to [Rec. 05-09]

The Sub-Committee on Statistics will update and submit to the SCRS the evaluation of data elements pursuant to [Rec. 05-09].

Data deficiencies are present for many of the basic information used to support ICCAT assessments, however, there are clear differences between stocks on how these deficiencies affect the ability of the SCRS to conduct assessments of stock status and to provide management advice. In general, data deficiencies are more common for by-catch species than for target stocks. For example, one of the major uncertainties for billfish and shark assessments are related to the incomplete reporting of catch. In the past, many CPCs provided data to ICCAT that did not separate by species the catches of sharks and billfish. Although this practice is now relatively rare, it has undermined the usefulness for stock assessments of historical reported catches of many by-catch species. Data deficiencies are also common for small tunas and species of sharks that are now clearly targeted by some fishing fleets.

More specifically, a recent review of Task I billfish data, suggests the potential existence of catches from Caribbean countries that are not reported. Many of such catches are the result of the development of moored FAD fisheries in several Caribbean countries over the last two decades. In addition, several CPCs that previously reported billfish catches have not reported catches in the last three years and the SCRS does not have information to determine if such lack of reporting is related to declines in effort or to lack of reporting.

For assessments of sea birds and sea turtles, the SCRS relies almost exclusively on data obtained by on-board scientific observers, because few fleets record these species in their logbooks. Unfortunately few CPCs submit such observer data with details regarding the time, area and gear used in the fishing operation in a way that can be used to calculate catch per unit of effort for these species. Given that most fleets of artisanal gillnet and longline fleets do not have on board observers, there are very few reports of sea turtle catches for these fleets. These data deficiencies strongly hamper the work of the Sub-committee on Ecosystems in evaluating the impact of fishing upon sea turtles and sea birds.

The SCRS is now working on evaluating data poor assessment methods using management strategy evaluation (MSE). This will allow the performance of stock assessment models that uses alternative data sources to be evaluated. These tools can be used to answer the question of how much a particular data set contributes to the assessment of stock status and to achieving management objectives, thus providing a quantitative evaluation of the impacts of data deficiencies.

18.12 Provide the Commission with a 5-year schedule for the establishment of species-specific HCRs Rec. [15-07] paragraph 4

Background: *[Res. 15-07] paragraph 4 request the SCRS to start by evaluating candidate HCRs during the assessment process planned for the northern albacore stock and provide the Commission with a 5-year schedule for the establishment of species-specific HCRs.*

Rec. [15-07] request the SCRS to:

"*As the next steps in MSE implementation and taking into account the inputs mentioned above, as soon as feasible for stocks subject to assessment and where possible, the SCRS shall advise the Commission on options for limit, target and threshold reference points and associated HCRs. In 2016, the SCRS will start by evaluating candidate HCRs during the assessment process planned for the northern albacore stock and will provide the Commission with a 5-year schedule for the establishment of species-specific HCRs."*

In this response an extensive evaluation with MSE of trade-offs related to alternative management procedures, including HCRs, will be referred as a "full MSE". A proposed schedule showing when the earliest anticipated time a full MSE can be completed is shown in **Figure 18.12**.

In regards to the stock of northern albacore, the SCRS has completed an initial evaluation of a range of HCR through MSE and presented the results to the albacore Working Group, and Panel 2[7]. The Panel 2 meeting and the SCRS requested further development of the MSE model and a broader set of simulations which will be reviewed in 2017 by the albacore Species Group. The Joint Tuna RFMO Management Strategy Evaluation Working Group will also focus on a global MSE for albacore tuna that will help the SCRS to continue its work on Atlantic albacore MSE. The SCRS intends to review new MSE simulations and provide a new set of results and complete a full MSE for northern albacore in 2017.

The other stocks that Rec. [15-07] mentions in relation to MSE and HCRs are bluefin tuna, northern swordfish and tropical tunas. The SCRS has made advancements in MSE for bluefin tuna because of funding from ICCAT GBYP. The Core modelling group of the ICCAT GBYP has developed an MSE framework to support the 2017 assessment of bluefin tuna. This MSE framework will be used to test Management procedures, including HCRs, after the assessment of 2017. The evaluation of management procedures for stocks with the substantial level of mixing shown by bluefin tuna and the variety of stakeholders to be involved in the consultation process is likely to be a lengthy and complex process. The earliest a full MSE can be completed for bluefin tuna is 2018.

The northern and southern stock of swordfish will be assessed in 2017. The SCRS has done some initial research to define an appropriate MSE model for northern swordfish, however, such research is in its initial stages. This MSE is probably of the same level of complexity than the one for north albacore, so the earliest the SCRS can complete a full MSE for northern swordfish is 2019.

The Tropical Tuna Species Group will start the development of MSEs for tropical tunas in 2017 with an intersessional meeting focused on expanding the initial work done by ICCAT in the early 2000s. The stock of bigeye will be assessed in 2018. Considering the early stage of MSE development in tropical tunas and given that the MSE is likely to need to be approached as a multispecies evaluation, the earliest a full MSE for tropical tunas can be completed is 2020.

[7] See Report of the 2016 Intersessional Meeting of the Panel 2, Sapporo Japan, 20-21 July 2016.

The above mentioned work on MSE will require substantial investment of research resources by CPCs and ICCAT. The proposed schedule assumes these research resources will be available. The work on bluefin tuna can continue and be completed provided the ICCAT GBYP is funded in Phase 7. An initial update of MSE simulations for albacore is likely to be funded from the same source used to the work to date but the more extensive simulations requested by the SCRS and Panel 2 will require more resources. The albacore Species Group has costed such additional resources in their proposal for an albacore research programme.

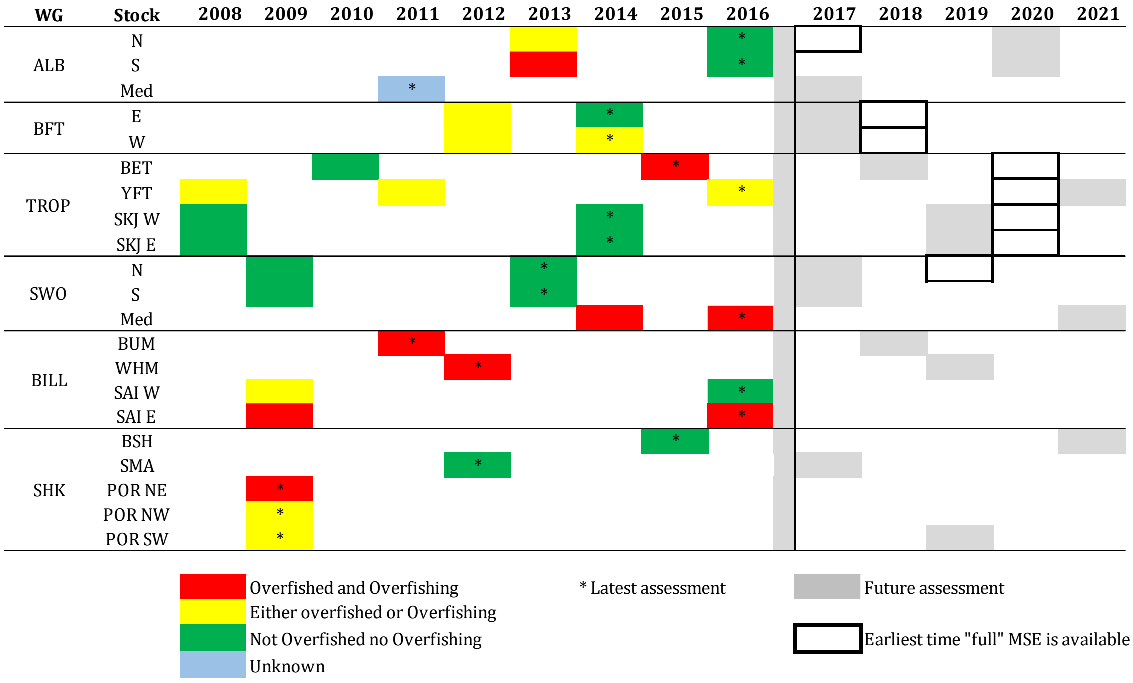

Figure 18.12. Recent history of assessments of ICCAT stocks and preliminary schedule of future stock assessments and earliest anticipated time for completion of “full” MSEs. Future schedule is modified from the one proposed in the ICCAT five-year strategic research plan. Colours represent stock status according to Kobe.

The MSE for tropical tunas will require investment in resources that are currently not available to the Tropical Tuna Species Group. This will include capacity training for scientists, managers and stakeholders to participate in this process. The Tropical Tuna Species Group will develop a plan and a budget required for the tropical tuna MSE during its inter-sessional meeting in early 2017.

The successful completion of full MSEs for the species/stocks mentioned in [Rec. 2015-07] are likely to facilitate future MSE for other stocks. There will always be, however, a considerable cost for each stock-specific MSE because each simulation model needs to, at least partially, be tailored to each stock and fishery complex. This stresses the need for ICCAT to have areliable source of research funds to support MSE development. The Strategic Research Programme proposed in section 15 can be a reliable source of funds to partially support the MSE work.

The SCRS will need guidance from the Commission on the adequacy of the proposed schedule. This schedule is only indicative of the time required to complete a full MSE under the similar level of research investment seen recently within ICCAT. It needs to be remembered that the duration of the MSE process is not only dependent on funding and completion of MSE simulations, but rather on the complexity of the consultation process required to implement management procedures, including HCRs, for the various types of stocks managed by ICCAT.

18.13 Request from the Panel 2 intersessional meeting (Japan): SCRS clarification by the Commission regarding the use of algorithms for the purpose of bluefin tuna caging operations in Mediterranean Sea during May-June period

Background: C*aging operations for bluefin tuna are subject to significant controls, defined under Annex 9 of Recommendation [14-04]. Amongst these provisions, it is compulsory to use the most up-to-date Length/Weight relationships (algorithms) established by SCRS in order to convert lengths into weights. The Panel 2 during its interssessional meeting held in Sapporo (Japan) in June 2016, requested the SCRS for clarification by the Commission regarding the use of algorithms for the purpose of bluefin tuna caging operations.*

After an extensive review of historic and recent weight at size relationships for bluefin tuna in the Mediterranean Sea, the Committee recommended estimating a weight at size relationship with only observations within the Mediterranean Sea collected within May and June, and condition factor between 1.4 and 2.6, from the compiled data of the Rodriguez et al. (2015) paper.

The new relationship:

RWT = 2.8684x10-5* SFL ^ 2.9076

where, RWT corresponds the round weight in kilograms and SFL to the straight fork length in centimetres, likely represents the most appropriate weight at size for fish caught in the Mediterranean Sea during the months of May and June, and the Committee recommended that this relationship be used to estimate the biomass at catch from stereoscopic camera system recordings. It is noted that this weight-size relationship estimate overall lower weights at size compared to the SCRS BFT weight-size relationship adopted for the BFT-E stock population in 2015.

The Committee also recommends to continue size and weight sampling of bluefin tuna to better estimate changes in fish condition associated with regions and months within the Mediterranean Sea, with a special emphasis in the Adriatic where small individuals are captured and caged.

18.14 Request from the Second Meeting of the Working Group of Fisheries Managers and Scientists in support of the WBFT Stock Assessment: SCRS to explore options/proposals for the development of new fishery independent indices of abundance and the improvement of existing bluefin tuna indices

Background: *During the Second Meeting of the Working Group of Fisheries Managers and Scientists in support of the WBFT Stock Assessment, held in Prince Edward Island (Canada) in 2014, it was reiterated the requested to the SCRS to explore options/proposals for the development of new fishery independent indices of abundance and the improvement of existing bluefin tuna indices.*

One of the objectives of the Second Meeting of the Working Group of Fisheries Managers and Scientists in support of the WBFT Stock Assessment, held in Prince Edward Island (Canada) in 2014, was to explore options/proposals for the development of new fishery independent indices of abundance and the improvement of existing bluefin tuna indices. In this regard, a small Working Group met in July 2016 to develop a multi-national pelagic longline index for WBFT. The Committee was successful in combining datasets, assigning relevant environmental and gear variables and produced a dataset of 99,054 individual longline sets over the years 1992-2015 from the Gulf of Mexico and the Atlantic Ocean north of 30^0N latitude and west of 45^0W longitude. This represents the most comprehensive collection of set-by- set longline data for western Atlantic bluefin tuna yet compiled.

The recommended next step is to convene another small Working Group to evaluate statistical modelling approaches and diagnostics for creating one or several combined indices, focusing on whether the statistical models can account for the very different target and non-target fishing strategies of each CPC. The Committee also reviewed a new fishery independent acoustic survey index developed by Canadian scientists. The index time series is from 1994 to 2015 and covers a portion of the Gulf of St. Lawrence sampled from herring surveys. The Committee agreed that this new index may prove useful for 2017 stock assessment.

19. Other matters

19.1 Collaboration with other International Organizations (ICES, CITES, GEF, etc.)

CITES

In 2016 ICCAT and CITES collaborated in order to conduct a training course for field workers, scientists and data managers from the West Africa region (in English, French and Spanish simultaneously). There are several countries in this region that were identified as priority countries for assistance under the EU-CITES project with regard to implementing the new CITES listings for sharks and rays. These workshops were originally planned to be conducted in Côte d'Ivoire in April 2016, however, due to circumstances beyond the control of the Secretariat, the course was moved to Madrid from the 12-15 September 2016. Training covered issues such as species identification, including the provision of ID cards, biological and fisheries sampling techniques, data reporting requirements and implementation of CITES shark listings on Appendix II. Unfortunately due to the change in location, the course become more expensive than was previously budgeted and so additional activities such as the collection of catch and biological data using these funds was no longer possible. The course included 36 participants from 12 countries, all from the West African region. It is hoped that this training will improve the quality of data being collected in the region, leading to significantly increase the member states capacity to make NDFs. This process is not currently possible with the information available. It will also improve the data available to ICCAT for the assessment and management of shark stocks in the region through analysis of the data by the ICCAT shark species group.

The Committee was informed that the CITES CoP17 adopted listing proposals for silky and thresher sharks despite FAO advice that these proposals did not meet CITES listing criteria.

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. It has been agreed therefore 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. The Secretariat attended the 2016 ICES Woking Group on Sharks (WKSHARKS Lisbon, Portugal, 19-21 January 2016) providing a summary of the ICCAT data on elasmobranchs including catches, fishing effort, size and tagging information. The main work, in recent years, of the ICCAT sharks working task was also highlighted, as well as a summary of the management actions undertaken by the Commission for these species. In addition, discussions have taken place with ICES in 2015 regarding the continuation of the development of stock assessment methods, following on from the highly successful Strategic Initiative on Stock Assessment Methods (SISAM), by potentially holding joint intra-regional stock assessment methods Working Groups from 2016 onwards. Lastly, it was proposed 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.

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, 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.

GEF- Common Oceans ABNJ Tuna Project

As the ICCAT request for eBCD financial assistance was rejected by the GEF-Common Oceans ABNJ Tuna Project, the cooperation with the programme was submitted to the 2015 ICCAT Commission meeting. It was decided to continue to cooperate with the programme provided that there are benefits to ICCAT. The ICCAT Secretariat is discussing with the management team of the ABNJ project, the possibility to cooperate in the following areas:

- FADs - A joint tuna RFMO FAD Working Group meeting is under discussion and being planned for the near future.

- Implementation of the Ecosystem Approach to Fisheries. The Secretariat (as well as CPC scientists) will participate in an initial EAF meeting to be held at FAO in Rome in December.

- The organisation of the tRFMO-MSE Working Group and follow up activities. A physical meeting will be held in November 2016 at the ICCAT Secretariat in Madrid, with travel support provided by ABNJ.

The Agreement on the Conservation of Albatrosses and Petrels (ACAP)

In 2016, ICCAT signed guidelines for cooperation with ACAP. This cooperation is a non-binding agreement that covers such issues as participation as observers in each other's meetings, as well as consultation, cooperation and collaboration on issues of common issue.

19.2 Consideration of implications of the Fourth Meeting of the Working Group on Convention Amendment and on the virtual Working Group on ICCAT Performance Review

Convention Amendment

The Working Group on Convention Amendment held its fourth meeting in March 2016. Most of the pending issues have been discussed and proposals have been put forward. However, the issue of changing the Depositary from FAO to EU did not received the agreement of all CPC's. However, it was agreed that some discussions between CPCs would occur before the Commission meeting in November 2016.

Performance review

As decided by the Commission in its 24th Regular Meeting, a Panel of 3 experts has been selected by CPCs to conduct the second ICCAT Performance Review. The Panel has recently provided the report, which will be submitted to the Commission at the forthcoming meeting in November 2016.

19.3 Update of the ICCAT glossary

The update of the ICCAT glossary was discussed in 2015 at the SCRS plenary, especially in relation to MSE related terms. The Commission in [Rec. 15-07] provide definitions for some terms related to MSE. Given that a meeting of the MSE tuna RFMO Working Group will be held in Nov 1-13 2016, and that this Working Group plans to discuss the standardization of such terms for all tuna RFMOs, the Committee recommends that the final proposal for an update of the ICCAT Glossary should be completed after such meeting is held.

19.4 Consideration of new publication guidelines: executive summaries, detailed reports and SCRS report

Publications guidelines for executive summaries, detailed reports and SCRS report were initially established in 1995, and revised in 2003 by the SCRS, aiming to make them consistent, concise and easy to read by end users. However, as in the past, year after year it has been noted that some of the publications are getting larger and not necessarily respecting the size limits adopted by the SCRS. On the other hand, the Commission has adopt a resolution [11-04] on this regards and the Secretariat often receives requests to make these more concise and objective. Accordingly the Secretariat presented new publications guidelines for executive summaries, detailed reports and SCRS report.

However, some flexibility may be accepted as regards those stocks for which it may not be possible to provide some of the information listed below (e.g. stock for which data poor models are used for the provision of advice).

The Committee thanked the Secretariat for the work done to provide these revised guidelines. It was proposed that these guidelines should be brought to the awareness of the Commission in 2016, elaborating the intention of the SCRS to streamline the current Executive Summaries. Thereafter, the guidelines would be discussed by the Working Group on Stock Assessment Methods (WGSAM) in 2017. Using feedback from the WGSAM, the new guidelines would be revised and implemented for a few example species (two of those not scheduled for assessment) for presentation alongside the existing Executive Summaries, at the Species Group meetings in 2017. Based on this comparative work, the SCRS would be in a better position to potentially recommend the adoption of these guidelines in 2017.

In order to reduce the time of dissemination of the SCRS scientific papers, the Committee decided that the Secretariat shall contact the authors soon after the end of the SCRS meetings to inquire on their will to have the papers published on the ICCAT Collective Volume of Scientific Papers and request final versions.

19.5 Proposal for the creation of an ad hoc Working Group on early life history

Participants in the GBYP funded workshop on early life history proposed the SCRS the creation of an *ad hoc* Working Group on early life history (SCRS/2016/206). The Committee supports the creation of such *ad hoc* Working Group.

20. Election of the SCRS Chair

The Executive Secretary opened the proceedings for the election of the new SCRS Chair. He reiterated the responsibility of the position especially with regard to the forthcoming challenges of the SCRS. He noted the SCRS commitment to scientific transparency and dialogue which are among the main values to take into account when considering the position.

One candidate was nominated to fill the position, namely Dr. David Die (USA). Dr. David Die was elected Chair of the SCRS for a second mandate.

The ICCAT Executive Secretary and several CPC's expressed his congratulations to the re-elected Chair of the SCRS for his willingness to stand for this difficult position and ensured their commitment to fully collaborate and support him. The Executive Secretary then thanked Dr. Die for his work, and presented a token of appreciation on behalf of the Secretariat and the SCRS.

21. Adoption of Report and closure

The Chair thanked the SCRS for its hard work this year.

Dr. Die thanked the Secretariat staff for all their excellent work and appreciated its professional attitude and then expressed his appreciation for the interpreters.

The Executive Secretary closed the meeting showing his appreciation to Dr. Die for the work done during his second plenary meeting as SCRS Chair. Mr. Meski also thanked Dr. Die for the trust he placed in the Secretariat and thanked the Secretariat staff for their efforts in supporting the SCRS work before and during the meeting. Mr. Meski thanked the interpreters for their hard work this week and wished everyone a safe journey home.

The Report of the 2016 SCRS meeting was adopted and the 2016 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 programmes
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 Bluefin data preparatory meeting

   9.3 Yellowfin tuna data preparatory and assessment meetings

   9.4 Albacore assessment meeting

   9.5 Sailfish assessment meeting

   9.6 Mediterranean Swordfish assessment meeting

   9.7 Small tuna species group intersessional meeting

   9.8 Shark species group intersessional meeting
10. Report of Special Research Programmes

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

    10.2 Enhanced Billfish Research Program (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
13. Report of the *Ad Hoc* Working Group on FADs
14. Progress related to MSE

    14.1 T-RFMO MSE Working Group

    14.2 Considerations from the Intersessional meeting of Panel 2

    14.3 Work conducted under ICCAT GBYP
15. Report on the implementation of the Science Strategic Plan for 2015-2020 in 2016 and work plan for 2017, which includes the definition of an ICCAT training plan, the update of the stock assessment software catalogue, as well as a proposal for a more strategic research plan.
16. Consideration of plans for future activities

    16.1 Annual Work Plans

    16.2 Inter-sessional meetings proposed for 2017

    16.3 Date and place of the next meeting of the SCRS

17. General recommendations to the Commission

    17.1 General recommendations to the Commission that have financial implications

    17.2 Other recommendations

18. Responses to Commission's requests

    18.1 Evaluate the efficacy of the area/time closure referred to in paragraph 13 in relation with the protection of juvenile tropical tunas, [Rec. 15-01] paragraph 15

    18.2 Revise the provisional limits laid down in paragraph 16 in relation with the limitation of FADs, [Rec. 15-01] paragraph 17

    18.3 Revise the appropriate coverage level of scientific observers pursuant to Recommendation 10-10. Rec [15-01] paragraph 40

    18.4 Continue working on the identification of spawning grounds in the Atlantic and Mediterranean and provide advice to the Commission on the creation of sanctuaries, [Rec. 14-04] paragraph 24

    18.5 Update the Commission annually and prior to the Commission meeting, on any changes of the estimated bluefin catch rates per vessel and gear, [Rec. 14-04] paragraph 43

    18.6 Continue to explore operationally viable technologies and methodologies for determining the size and biomass at the points of capture and caging and report to the Commission, [Rec. 14-04] paragraph 82

    18.7 Evaluate the results of the 100% coverage programme using stereoscopical cameras systems or alternative techniques that provide the equivalent precision to refine the number and weight of the fish during all caging operations. [Rec. 14-04] paragraph 83

    18.8 Evaluate the bluefin tuna national observer programmes conducted by CPCs to report the Commission and to provide advice on future improvements, [Rec. 14-04] paragraph 88

    18.9 Review the information from BCDs and other submitted data and further study growth rates so as to provide updated growth tables to the Commission, [Rec. 14-04] paragraph 96

    18.10 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 comment on the effect of fish size management measures on their ability to monitor stock status, [Rec. 14-05] paragraph 27

    18.11 Evaluation of data deficiencies pursuant to [Rec. 05-09]

    18.12 Provide the Commission with a 5-year schedule for the establishment of species-specific HCRs Rec. [15-07] paragraph 4

    18.13 Request from the Panel 2 intersessional meeting (Japan): SCRS clarification by the Commission regarding the use of algorithms for the purpose of bluefin tuna caging operations in Mediterranean Sea during May-June period

    18.14 Request from the Second Meeting of the Working Group of Fisheries Managers and Scientists in support of the WBFT Stock Assessment: SCRS to explore options/proposals for the development of new fishery independent indices of abundance and the improvement of existing bluefin tuna indices

19. Other matters

    19.1 Collaboration with other International Organizations (ICES, CITES, GEF, etc.)

    19.2 Consideration of implications of the Fourth Meeting of the Working Group on Convention Amendment and the ICCAT Performance Review Virtual Working Group

    19.3 Update of the ICCAT glossary

    19.4 Consideration of new publication guidelines: Executive summaries, detailed reports and SCRS report

    19.5 Proposal for the creation of an ad hoc Working Group on early life history

20. Election of the Chair

21. Adoption of report and closure

Appendix 2

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Appendix 3

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SCRS/2016/001	Report of the Meeting of the ICCAT Working Group on Stock Assessment Methods	Anon.
SCRS/2016/002	Report of the Yellowfin data preparatory meeting	Anon.
SCRS/2016/003	Report of the FADs WG meeting	Anon.
SCRS/2016/004	Report of the Small Tunas species group intersessional meeting	Anon.
SCRS/2016/005	Report of the Sharks species group intersessional meeting	Anon.
SCRS/2016/006	Report of the Atlantic Albacore stock assessment session	Anon.
SCRS/2016/008	Report of the Sailfish stock assessment session	Anon.
SCRS/2016/009	Report of the Yellowfin stock assessment session	Anon.
SCRS/2016/010	Report of the Mediterranean Swordfish stock assessment session	Anon.
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SCRS/2016/012	Report of the Sub-Committee on Ecosystems Intersessional meeting	Anon.
SCRS/2016/013	Report of the Sub-Committee on Statistics meeting	Anon.
SCRS/2016/014	Conditioning operating models on data and knowledge and rejecting and weighting of hypotheses	Kell L.D. and Mosqueira I.
SCRS/2016/015	Evaluation of harvest control rules for North Atlantic albacore through management strategy evaluation	Merino G., Arrizabalaga H., Murua H., Santiago J., Ortiz de Urbina J., Scott G.P. and Kell L.D.
SCRS/2016/016	Preliminary Ecological Risk Assessment of small tunas of the Atlantic Ocean	Lucena-Frédou F., Frédou T.,Ménard F., Beare D., Adib N., and Kell L.T.
SCRS/2016/017	Retaining bycatch to avoid wastage of fishery resources: How important is the bycatch landed by purse-seiners in Abidjan	Amandè M.J., Restrepo V., Scott J.
SCRS/2016/018	FLife: An R Package for modelling life history relationships and dynamic processes	Kell L.T., Mosqueira I. and Fromentin J-M.

SCRS/2016/019	Proposals for smooth conduction of stock analysis using sophisticated but complicating stock assessment models	Yokawa K.
SCRS/2016/020	Longline data simulation: integrating 3 D species habitat with oceanographic data and depth distributions of pelagic longline hooks	Schirripa M.J., Goodyear C.P. and Foresttal F.
SCRS/2016/021	Preliminary list of updated terms for the Glossary of the International Commission for the Conservation of Atlantic Tuna	Fujimoto R., Die D.J., Restrepo V.R. and Kell L.T.
SCRS/2016/022	An outlook of Tropical Tuna fishing: the case of Liberia	Jueseah A. S.
SCRS/2016/023	Conditioning an operating model for North Atlantic Albacore	Kell L.T., Arrizabalaga H., Merino G., and De Bruyn P.
SCRS/2016/024	An observation error model for North Atlantic Albacore	Kell L.T., Arrizabalaga H., Merino G., and De Bruyn P.
SCRS/2016/025	The implicit North Atlantic Albacore management procedure	Kell L.T., Arrizabalaga H., Merino G., and De Bruyn P.
SCRS/2016/026	Cross testing of biodyn an R package to implement management procedures based on biomass dynamic models	Kell L.T., Arrizabalaga H., Merino G., and De Bruyn P.
SCRS/2016/027	Validation of biodyn an R package to implement management procedures based on biomass dynamic models	Kell L.T., Arrizabalaga H., Merino G., and De Bruyn P.
SCRS/2016/028	A preliminary stock assessment for North Atlantic Albacore using a biomass dynamic model	Kell L.T., Arrizabalaga H., Merino G., and De Bruyn P.
SCRS/2016/029	Review and Analyses of Tag Releases and Recaptures of Yellowfin Tuna ICCAT DB	Ortiz, M.
SCRS/2016/030	Results achieved within the framework of the EU research project: Catch, Effort, and eCOsystem impacts of FAD-fishing (CECOFAD)	Gaertner D., Ariz J., Bez N., Clermidy S., Moreno G., Murua H., and Soto M.
SCRS/2016/031	On the changes of species composition of tuna catches in the Cap Vert area	Fonteneau A., Meisse B., and N'Gom F.
SCRS/2016/032	Standardized catch rates for northern albacore (*Thunnus alalunga*) from the Venezuelan pelagic longline fishery off the Caribbean Sea and adjacent areas of the Western Central Atlantic	Arocha F., Ortiz M., Marcano J. H.
SCRS/2016/033	Spatial and temporal size/age distribution patterns of Northern Albacore (*Thunnus alalunga*) in the Caribbean Sea and adjacent waters of the Western Central Atlantic from observer data of the Venezuelan fisheries	Arocha F., Ortiz M., Evaristo E., Gutierrez X., Marcano J. H.
SCRS/2016/034	Update on the Venezuelan catch and spatial-temporal distribution of shortfin mako shark (*Isurus oxyrhincus*) and other common shark species caught in the Caribbean Sea and adjacent waters of the North Atlantic Ocean	Arocha F., Marcano J.H., Narvaez M., Gutierrez X, Marcano L.
SCRS/2016/035	Japanese longline CPUE for yellowfin tuna (*Thunnus albacares*) in the Atlantic Ocean standardized using GLM up to 2014	Satoh K., and Matsumoto T.
SCRS/2016/036	Exploitation of historical changes of target species for Japanese longline in the Atlantic Ocean and application to standardization of CPUE	Satoh K., and Matsumoto T.

SCRS/2016/037	Preliminarily comparison between Japanese catch, effort and size data of yellowfin tuna stored in the ICCAT and NRIFSF data bases	Satoh K., and Matsumoto T.
SCRS/2016/038	A bayesian space-state Cormack-Jolly-Seber model to estimate age-specific fishing and natural mortalities for Atlantic Yellowfin tuna	Sculley M., and Die D.
SCRS/2016/039	Interaction Between Seabirds and the Spanish Surface Longline Fishery Targeting Swordfish in the South Atlantic Ocean (south of 25ºS) During the Period 2010-2014	Ramos-Cartelle, A., Carroceda, A., Fernández, J., and Mejuto, J.
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SCRS/2016/041	Standardized catch rate in number and weight of Yellowfin Tuna (*Thunnus albacares*) from the United States pelagic longline fishery 1987-2015	Walter J.
SCRS/2016/042	Review of the Spanish Fish Aggregating Device Management Plan: implementation, evolution and recommendations	Soto, M., Justel-Rubio, A. and Lopez, J
SCRS/2016/043	Preliminary estimation of growth parameters for Atlantic Yellowfin tuna from tag-recapture data	Ortiz M.
SCRS/2016/044	An assessment of FAD management options for the ICCAT Convention Area	Galland G.R.
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SCRS/2016/046	Standardized catch rates of Yellowfin tuna (*Thunnus albacares*) caught by the Brazilian fleet (1978-2012) using generalized linear mix models (GLMM) using Delta log approach	Hazin H.G., Sant'Ana R., Hazin Fábio.H.V, Mourato B.; Andrade H.A., and Travassos P.
SCRS/2016/047	Update of standardized CPUE of Yellowfin tuna, *Thunnus albacares*, caught by Uruguayan longliners in the Southwestern Atlantic Ocean (1982-2010)	Forselledo R., Mas F., and Domingo A.
SCRS/2016/048	Standardized catch rate index for Yellowfin tuna (*Thunnus albacares*) from the Taiwanese longline fishery in the Atlantic Ocean, 1970-2014	Huang J.H.W.
SCRS/2016/049	Age and growth of yellowfin tuna (*Thunnus albacares*) in the Northern Gulf of Mexico	Lang E.T., Kitchens L.L., Marshall C.D., and Falterman B.J.
SCRS/2016/050	Statistiques de la flottille de senneurs de la pêche industrielle sénégalaise en 2015	Sow F.N., Diatta I., and Sehghor E.
SCRS/2016/051	Analysis of length data for small tuna	Kell L., Lucena-Frédou F., Abid N., Sid'Ahmed B., and Palma C.
SCRS/2016/052	Preliminary analysis of short-term, high resolution habitat use of a Yellowfin Tuna (*Thunnus albacares*) in the Southwestern Atlantic Ocean, and insights into a predation event	Miller P., and Domingo A.
SCRS/2016/053	Summary of information available on FADs submitted to the ICCAT Secretariat	de Bruyn P.
SCRS/2016/054	Progress on the adoption of non-entangling drifting fish aggregating devices in tuna purse seine fleets	Murua J., Moreno G., and Restrepo V.

SCRS/2016/055	SRDCP - Shark Research and Data Collection Program: Progress report on the age and growth of the shortfin mako in the Atlantic Ocean	Coelho R., Carlson J., Rosa D., Natanson L., and Santos M.N.
SCRS/2016/056	SRDCP - Shark Research and Data Collection Program: Progress report on the satellite tagging of shortfin mako post-release survival and habitat use studies	Coelho R., Miller P., Carlson J., Domingo A., Rosa D., Cortes E., and Santos M.N.
SCRS/2016/057	Update on the small tunas catches from the tuna trap fishery off southern Portugal (NE Atlantic) between 1998 and 2015	Lino P.G., and Coelho R.
SCRS/2016/058	Contribution à l'étude du régime alimentaire de la melva (*Auxis rochei*) de la Cote Algérienne	Ferhani K., Hemida F., and Chakour S.C.
SCRS/2016/059	Preliminary results on fecundity of little tunny (*Euthynnus alletteratus*) in the Tunisian waters	Hajjej G., Hattour A., and Jarboui O.
SCRS/2016/060	Étude de la croissance de la bonite à dos raye (*Sarda sarda*) exploitée au Sud la côte atlantique marocaine	Baibbat S.A., Abid N., and Malouli M.I.
SCRS/2016/061	A length based assessment for Atlantic bonito (*Sarda sarda*) exploited in Moroccan Atlantic coast	Baibbat S.A., Abid N., Malouli M.I., and Kell L.
SCRS/2016/062	Analyse de captures des thonidés mineurs et des Coryphenes débarqués par les pécheurs artisans	Diaha N.C., Amandé M.J., Konan K.J., and Joanny T.T.
SCRS/2016/063	Preliminary Analysis of the Genetic Population Structure of Bullet Tuna in the West Mediterranean	Perez-Bielsa N., Peñarrubia L., Allaya H., Hattour A., and Viñas J.
SCRS/2016/064	Description de la pêcherie des Thons mineurs en Mauritanie	Meissa B.
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SCRS/2016/066	Stock synthesis model sensitivity to data weighting: an example from preliminary model runs previously conducted for north Atlantic blue shark	Courtney D.
SCRS/2016/067	Review of operation and albacore catch by Japanese longline fishery including recent status in the Atlantic	Matsumoto et al.
SCRS/2016/068	Updating of standardized CPUE for north and south Atlantic albacore by the Japanese longline fishery	Matsumoto et al.
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SCRS/2016/071	Standardized catch rates of sailfish (*Istiophorus albicans*) caught as bycatch of the Spanish surface longline fishery targeting swordfish (*Xiphias gladius*) in the Atlantic Ocean	García-Cortés B., Ramos-Cartelle A., Fernández-Costa J., and Mejuto J.
SCRS/2016/072	Fishery indicators for the shortfin mako shark (*Isurus oxyrinchus*) caught by the Portuguese pelagic longline fishery in the Atlantic: nominal CPUEs, catch-at-size and at-haulback mortality	Coelho R., Rosa D., and Lino P.G.
SCRS/2016/073	Standardized North Atlantic albacore (*Thunnus alalunga*) CPUEs from the Spanish baitboat fleet, period: 1981-2014.	Ortiz de Zárate V., Ortiz M., and Pérez B.

SCRS/2016/074	Standardized North Atlantic albacore (*Thunnus alalunga*) CPUEs from the Spanish troll fleet, period: 1981-2014.	Ortiz de Zárate V., Ortiz M., and Pérez B.
SCRS/2016/075	Standardized CPUE from the Rod and Reel and artisanal drift-gillnet fisheries off La Guaira, Venenzuela, updated through 2014.	Babcock E.A., and Arocha F.
SCRS/2016/076	Genetic stock structure of the Atlantic shortfin mako (*Isurus oxyrinchus*)	Taguchi M., Coelho R., Santos M.N., Domingo A., Mendonça F.F., Hazin F., Yasuko S., Sato K., and Yokawa K.
SCRS/2016/077	Standardization Of The Catch Per Unit Effort For Albacore (*Thunnus alalunga*) For The South African Tuna-Pole-Line (Baitboat) Fleet For The Time Series 2003-2015	Winker H., Kerwath S.E., and West W.M.
SCRS/2016/078	CPUE standardization on northern Atlantic albacore caught by Taiwanese longliners, 1967 to 2015	Chang F.-C.
SCRS/2016/079	CPUE standardization on southern Atlantic albacore caught by Taiwanese longliners, 1967 to 2015	Chang F.-C.
SCRS/2016/080	Updated standardized indices of albacore tuna, *Thunnus alalunga*, from the United States pelagic longline fishery	Lauretta M.V.
SCRS/2016/081	Improved data collection and management for Atlantic tuna vessels: a case study of TTV purse seine fleets, Ghana	Iriarte F., Takyi R., and Bannerman P.
SCRS/2016/082	Updated fishery statistics for bigeye, skipjack and albacore tunas from Madeira archipelago	Gouveia L., Amorim A., Alves A.,and Hermida M.
SCRS/2016/083	Update on standardized catch rates for yellowfin tuna (*Thunnus albacares*) from Venezuelan pelagic longline fishery of the Caribbean Sea and Western Central Atlantic	Narváez M., Ortiz M., Arocha F., Medina M., Gutiérrez X., and Marcano J.H.
SCRS/2016/084	Update of standardized CPUE of shortfin mako (*Isurus oxyrinchus*) caught by the Japanese tuna longline fishery in the Atlantic Ocean	Semba Y., and Yokawa K.
SCRS/2016/085	Catch and effort analysis of the Atlantic albacore caught by Japanese longliners in the period between 1960 and 1975	Yokawa K., Shiozaki K., Kanaiwa M., and Matsumoto T.
SCRS/2016/086	Catch and effort analysis of the northern Atlantic albacore caught by Japanese longliners in the period between 1975 and 1993	Yokawa K., Shiozaki K., Kanaiwa M., and Matsumoto T.
SCRS/2016/087	Standardized CPUE of the north Atlantic albacore caught by Japanese longliners in the proposed core area	Kanaiwa M., Yokawa K., Matsumoto T., and Kimoto A.
SCRS/2016/088	Uruguayan research program for pelagic sharks in the Southwest Atlantic Ocean	Domingo, A., Forselledo, R., Mas, F. and Miller, P.
SCRS/2016/089	Standardized catch rates of Albacore (*Thunnus alalunga*) caught by the Brazilian fleet (1978-2012) using Generalized Linear Mixed Models (GLMM) – Delta Log approach	Sant'Ana R., Hazin H.G., Hazin F.H.V, Mourato B., Andrade H.A., and Travassos P.
SCRS/2016/090	Standardized Catch Rates of Shortfin Mako Caught by the Brazilian Fleet (1978-2012) Using a Generalized Linear Mixed Model (GLMM), with a Delta Log Approach	Comassetto, L., Hazin, F. H. V., Hazin, H. G., Sant'Ana, R., Mourato, B. and Carvalho, F.

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SCRS/2016/092	Standardized catch rates of sailfish caught by the Brazilian fleet (1978-2012) using a Generalized Linear Mixed Model (GLMM), with a delta log approach	Mourato B.L., Hazin H., Carvalho F., and Hazin F.
SCRS/2016/093	Estimated sailfish catch-per-unit-effort for the U.S. recreational billfish tournaments and U.S. recreational fishery (1972-2014)	Hoolihan J.P., and Lauretta M.
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SCRS/2016/098	Characterization and standardization of the Atlantic sailfish (*Istiophorus albicans*) catch rates in the East Atlantic from the Portuguese pelagic longline fishery	Coelho R., Lino P.G., and Santos M.N.
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SCRS/2016/119	Updated standardised abundance index for swordfish caught by Moroccan Artisanal fishery in the Strait of Gibraltar, 1999-2015	Abid N., Mhamed A.B., and Idrissi M.M.
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SCRS/2016/141	Studies on eastern bluefin tuna (*Thunnus thynnus*) maturity – Review of old literature	Di Natale A., Tensek S., Pagá García A.
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SCRS/2016/190	An update on the length-weight relationship for bluefin tuna caught by longliners in the Mediterranean Sea	Lombardo F., Baiata P., Pignalosa P., Api M., Maradonna F., and Carnevali O.
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SCRS/2016/202	Global database and common toolbox for tuna fisheries	Taconet P., Chassot E., Guitton J., Vogel N., Williams P., Palma C., Fiorellato F., Anello E., and Barde J.
SCRS/2016/203	Length-weight relationship of swordfish (*Xiphias gladius* L.) caught by longliners in the Mediterranean Sea	Lombardo F., Baiata P., Pignalosa P., Gioacchini G., Candelma M., and Carnevali O.
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SCRS/P/2016/014	Global scombrid life history dataset	Juan-Jordá M. J., Mosqueira I., Freire J., Ferrer-Jordá E., and Dulvy N.K.
SCRS/P/2016/015	Verification of best practices to reduce FAD impacts on bycatch fauna, and of the limitation of the number of FADs	Goñi N. , Santiago J., Murua H., Fraile I., Krug I., Ruiz J., and Pascual P.
SCRS/P/2016/016	Verification of best practices to reduce FAD impacts on bycatch fauna, and of the limitation of the number of FADs	Goñi N. , Santiago J., Murua H., Fraile I., Krug I., Ruiz J., and Pascual P.
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SCRS/P/2016/020	Satellite tagging of blue shark and pelagic stingray for post release survival and habitat use studies in the Mediterranean Sea	Poisson F., Arnaud-Haond S., Demarq H., Cornella D., and Wendling B.
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SCRS/P/2016/022	Stock synthesis model sensitivity to data weighting: an example from preliminary model runs previously conducted for north Atlantic blue shark	Courtney D., Cortés E., Zhang, X., and Carvalho, F.

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SCRS/P/2016/033	Using SatTagSim to provide transition matrices for Movement Inclusive Models	Galuardi B, Cadrin S.X., Arregui I., Arrizabalaga H., Di Natale A., Brown C.,Lam C.H., and Lutcavage M.E.
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SCRS/P/2016/038	Incorporating stock mixing into the assessment and long-term expectations of Atlantic bluefin tuna	Kerr L.A., Cadrin S.X., Secor D.H., and Siskey M.
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SCRS/P/2016/040	Close-Kin Mark-Recapture for Eastern ABFT: Summary of scoping study for ICCAT	Davies C., Bravington M., and Thomson R.
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SCRS/P/2016/042	Genetic close kin pilot project for West Atlantic Bluefin Tuna	Walter J., Lauretta M., Porch C., Grewe P., Bravington M., Davies C., McDowell J., Graves J., and Kaplan D.
SCRS/P/2016/043	A recruitment index for Atlantic Bluefin tuna independent from the fishery	Reglero P., Balbin R., Ortega A., Mourre B., Alvarez-Berastegui D., Abascal F., Blanco E., Medina A., de la Gándara F., Juzá M., Kernec M., Tintoré J., and Alemany F.
SCRS/P/2016/044	Progress of tuna regional fisheries management organizations in applying ecosystem-based fisheries management	Juan-Jordá M.J., Murua H., Arrizabalaga H., Dulvy N.K.,and Restrepo V.
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SCRS/P/2016/049	Improving Age Composition Estimates Using Hybrid Age Length Keys	Ailloud L. E., Hoenig J.E., and Lauretta M. V.
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SCRS/P/2016/052	ABFT larval rearing and juvenile production in captivity; Authors: Aurelio Ortega and Fernando de la Gándara	de la Gándara Garcia; F.
SCRS/P/2016/053	Development of Larval Atlantic Bluefin Tuna Indices	Ingram, W.
SCRS/P/2016/054	Larval Bluefin Tuna Research In The Western Atlantic, Gulf Of Mexico, And Caribbean	Lamkin, J.
SCRS/P/2016/055	Comparative Growth Dynamics Of Bluefin Tuna Larvae From The Gulf Of Mexico And The Mediterranean	Malca, E.
SCRS/P/2016/056	Individual Based Modelling Of Larval Bluefin In The Gulf Of Mexico	Rasmuson, L.
SCRS/P/2016/057	The effect of temperature and dispersal on bluefin tuna larval survival: applications in the Mediterranean Sea	Reglero Baron, P.
SCRS/P/2016/058	Examining The Relationship Between Mesoscale Oceanographic Features And Larval Growth For Atlantic Bluefin Tuna in the Gulf of Mexico and the Mediterranean	Shulzitski, K.
SCRS/P/2016/059	Summary of the symposium/workshop on growth-survival paradigm in early life stages of fish: controversy, synthesis, and multidisciplinary approach	Takasuka, A.
SCRS/P/2016/060	Global database and common toolbox for tuna fisheries	Taconet P., Chassot E., Guitton J., Vogel N., Williams P., Palma C., Fiorellato F., Anello E., and Barde J.
SCRS/P/2016/061	Reporting status of 2015 data for the SCRS	Secretariat

SCRS/P/2016/062	Review of the ICCAT coding system	Secretariat
SCRS/P/2016/063	Review of data reporting/dissemination policy (SCRS data)	Secretariat
SCRS/P/2016/064	Improving the ICCAT-DB system	Secretariat
SCRS/P/2016/065	Biological samples collection for growth and maturity studies /ICCAT-SMTYP	Baibbat S., Malouli I.M., and Abid N.
SCRS/P/2016/066	Biologie et croissance de la bonite (*Sarda sarda*) des côtes mauritaniennes	Beyah M.
SCRS/P/2016/067	Recovering Historical Time Series (1948-2015) of the SMT species from the western Mediterranean Sea (EU-Spain)	Saber S., Ortiz de Urbina J.M., and Macías D.
SCRS/P/2016/068	Biological samples collection of SMT species (2003-2015) for growth and maturity studies (western Mediterranean Sea, EU-Spain)	Saber S., Ortiz de Urbina J.M., and Macías D.
SCRS/P/2016/069	ICCAT GBYP summary data for SCRS SC-STATS	Anon.

Appendix 4

REPORT OS THE ICCAT ATLANTIC-WIDE RESEARCH PROGRAMME FOR BLUEFIN TUNA (ICCAT GBYP)

(Activity report for the last part of Phase 5 and the first part of Phase 6 (2015-2016), including a general overview of the activities up to 2016)

1. Introduction

The Atlantic-wide Research Programme for bluefin tuna 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 1,769,364 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 2,819,425 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 has a total budget of 2,125,000 Euros (against the original approved figure of 410,000 Euros). The overall ICCAT GBYP operating budget for the first six phases, covering seven years (a total of 11,869,782 Euros) is about 62.23% of what it was supposed to be (the 19,075,000 Euros approved by the Commission). 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 sometimes well above the 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 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 detailed ICCAT GBYP report is presented as document SCRS/2016/193.

2. Coordination activities

2.1 ICCAT GBYP coordination

The fifth phase of the ICCAT GBYP officially began on 23 February 2015, following the signature of the Grant agreement for the co-financing of ICCAT GBYP Phase 5 (SI2.702514) by the European Commission. The partial results were presented to the SCRS and the Commission in 2015 (Di Natale and Tensek, 2016c) and they have been approved. The final report for Phase 5 has been officially approved by the European Union.

The sixth phase of the ICCAT GBYP officially started on 21 February 2016 following the signature of the Grant agreement for the co-financing of the ICCAT GBYP Phase 6 (SI2.727749) by the European Commission and will end on 20 February 2017.

The staff level (an assistant and a data base specialist, in addition 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 had a total cost of 2,082,320 Euro[1], including many components and also all costs for the Steering Committee and the two reviews. This cost represents 17.82% of the total operative budget.

A total of fourteen calls for tenders were issued in Phase 5, awarding a total of 20 contracts to various entities in Phase 5. Eleven additional calls for tenders have been announced to date in the first part of Phase 6 and a total of 18 contracts have been awarded to date to various entities in Phase 6.

A total of 110 contracts have been awarded under the ICCAT GBYP up to the first part of Phase 6 to 96 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 43 reports were produced in the framework of Phase 5 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 34 scientific papers were produced in Phase 5, while others will be published later on. A total of 15 reports have been produced in the first part of Phase 6, along with 32scientific papers. The total number of reports produced by ICCAT GBYP up to the first part of phase 6 is 212, and 203 scientific papers have been published so far.

2.2 Second Review

The second review of ICCAT GBYP was carried out in the first part of Phase 6 and the report is presented as document SCRS/2016/192.

The reviewers provided an extensive and detailed analysis of the work carried out from 2010 to 2016 and range of proposals for improving the research in the following years.

The reviewers recognized the important improvements in scientific knowledge obtained by the ICCAT GBYP in the first parts of the programme. Specifically, the reviewers pointed out that "the ICCAT GBYP is a success and should be continued. Advances in biological methods (genetics, otolith microchemistry and shape) to determine spawning ground origin of bluefin tuna are particularly successful." and that "the ICCAT GBYP has successfully advanced methods for determining the stock origin (eastern or western spawning grounds) of bluefin tuna found throughout the Atlantic Ocean. It has retrieved data that give a historical perspective (including ancient history) on fisheries and improved some time series of data that are used in stock assessments. Model development is going well such that it is reasonable to expect mixed spawning stock bluefin tuna fisheries advice in the future (thus addressing need 1 on mixing). Modelling can also be used to guide future research priorities and to quantify data collection priorities. These successes justify the ICCAT GBYP and the potential for transitioning them into operational data streams to support future scientific advice and management is reason enough for continuing the programme".

3. Steering Committee

The ICCAT GBYP Steering Committee is currently composed by the SCRS Chair, the west bluefin tuna Rapporteur, the east bluefin tuna Rapporteur, the ICCAT Executive Secretary and one contracted external expert.

[1] The cost includes 380,950 Euro in the full Phase 6, which might be less at the end of the Phase.

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 5, the Steering Committee held one meeting (26 September 2015), discussing various aspects of the programme including the plan for Phase 6, and providing guidance and opinions. In Phase 6 the Steering Committee held one meeting (30-31 July 2016), revisiting entirely the activities for Phase 6 and providing the plan for Phase 7 to be proposed to the SCRS. All finalised reports of the Steering Committee are available at www.iccat.int/GBYP/en/scommittee.htm

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 538,342 Euros[2] (89.72% of the original budget), and much more data have been recovered than initially planned. Several SCRS meetings and workshops have been held on bluefin 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 4.99% of the total operative budget over the first ICCAT GBYP phases.

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 mining and data recovery activity continued according to the objectives recommended by the Steering Committee, as it was refined several times by e-mail. A complete and detailed overview of the data recovered in this last period is available (see Di Natale *et al.* 2016e, Pagá Garcia *et al*., 2016, SCRS/2016/139, SCRS/2016/142 and SCRS/2016/150). Most of the market and auction data provided to the ICCAT GBYP as a donation in kind were initially validated (Mielgo, 2015) and were finally endorsed by the SCRS, while a selection of data were presented to the SCRS bluefin tuna intersessional meeting; a contract was awarded for a further analyses of the data. Task II data collected by the ICCAT GBYP are currently incorporated in the ICCAT bluefin tuna database. All the historical trap data received as a donation in kind in Phase 4 were checked against the ICCAT GBYP trap database (see Pagá Garcia *et al*., 2016), but a final revision was completed only in 2016 according to the methodology agreed by the SCRS (SCRS/2016/139).

Another activity was conducted for recovering some important sets of electronic tag data to be used for the modelling trials. Three invitations were released. One specialist, Dr. Lutcavage, provided the data to the modelling group in a complimentary way, while another specialist, Prof. Block, was contracted for the delivery of 393 datasets, some of which have already been provided to the Group. These very relevant data sets will seriously improve the model used for identifying the mixing between areas.

Another activity concerned the support to Mauritania for the data mining about the presence of bluefin tuna in their area, as requested by the SCRS. A specific training course on site was organised by ICCAT GBYP in July 2016.

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 main spawning areas.

[2] Including the costs planned for Phase 6 (142,980 Euro), which might be lower at the end of the Phase.

The total original budget set for three surveys in three areas was 1,200,000 Euros; the cost of carrying out four surveys in many more areas (four main "internal" areas and seven "external" areas) is approximately 1,619,624 Euros (134.97% of the original budget, but with 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 by the Steering Committee, for which a detailed SWOT analysis clearly showed the difficulties for implementing it (see Di Natale, 2016a). The costs for the aerial surveys represented so far just a 13.86% of the total ICCAT GBYP operative budget.

The last 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 requested a complex and comprehensive analysis, providing an external contract and an extremely preliminary report (Di Natale *et al.* 2016b). For the first time, it was also possible to use the data obtained from a selection of miniPATs for studying the additional variance associated with the bluefin tuna behaviour during the spawning season in the survey area (Quilez Badía G, 2016). A cost-benefit analysis and a further power analysis was requested in the last part of Phase 5; the reports are available at www.iccat.int/GBYP/en/asurvey.htm. The costs were assessed as the lowest compared with other surveys. 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 adaptive behaviour of bluefin tuna. The power analysis recommended to continue the survey in the four main spawning areas only. The increased CV has also been logically induced by the changes in survey strategies over the years, following the recommendations of the Steering Committee.

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, but that a calibration procedure should be possibly implemented.

In Phase 6 the Steering Committee, which considered that the extended survey was another necessary, taking into account the results of the power analysis and the needs to find the way of having a calibration among all observers, rotating them in the various areas every week, and considering the logistic difficulties for these needs, decided to suspend the survey.

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. So far, with only 50.17% of the funding (a total of 4,899,602 Euros[3]), the ICCAT GBYP has deployed 84.64% of the conventional tags (25,393) and 105.33% of the electronic tags (316; 258 mini PATs, 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 six Phases represented 41.94% of the total ICCAT GBYP budget, 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 5 were reported to the SCRS (see Di Natale A and Tensek S, 2016c, Di Natale *et al.* 2016d, Lauretta *et al*., 2016, Mariani *et al.* 2016 and Addis *et al.* 2016). The final results of Phase 5 were included in the ICCAT GBYP Report to the EU and then reported to the

[3] Including the costs planned for Phase 6 (877,959 Euro), which might be lower at the end of the Phase.

SCRS at the 2016 Bluefin Intersessional Meeting (SCRS/P/2016/139, SCRS/2016/138 and SCRS/2016/143). 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 preliminary 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 6 was similar to the one in Phase 5, excluding the conventional tagging and focusing the activities to the electronic tagging with miniPATs.

ICCAT GBYP issued two Call for Tenders 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). The second set of contracts, for summer-autumn activities, is still going on: 24 tags (over a total of 25) were deployed in a Portuguese trap, 21 tags will be deployed in the Strait of Messina (including 6 complimentary tags provided by WWF) and 15 were planned for the Irish waters, but this contract was cancelled in July 2016 by the Steering 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.

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 full mixing in all bluefin tunas sampled in the Mediterranean Sea, without any evident isolation; they also confirmed that several bluefin tuna 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 showed another area of mixing that was previously unknown.

Additional complimentary tagging activities with conventional tags are being or have already been carried out in Phase 5 and 6 in Italy, Morocco, Spain, Portugal and Canada, while others are planned also in other areas. The full data will be available at the end of Phase 6.

In total, up to 1 September 2016, the total number of bluefin tunas tagged in all Phases of ICCAT GBYP is 17,961, and a total of 25,709 tags of various types have been implanted, mostly in juvenile bluefin tunas. Among these, 7,879 bluefin tunas were double tagged, amounting to 43.87% of the fish, a percentage which is well over the target (set at 40%).

These last activities and results show how important the tagging activity is and how essential it is to continuously refine objectives and 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 in the future Phases of the ICCAT GBYP, providing inputs for more realistic management of the bluefin tuna stocks and populations.

6.2 Tag awareness and tag reporting campaign

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 at: www.iccat.int/GBYP/en/AwCamp.asp. 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:

www.iccat.int/GBYP/Documents/TAGGING/PHASE%204/_Tag_Awareness_Report_2014.pdf. In Phase 6, ICCAT GBYP launched a Call for tender for producing two short videos for improving the tag recovery and reporting and a contract has been awarded; the videos should be available in the second part of Phase 6.

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 total of 447 tags (408 conventional tags, 23 mini-PATs, 11 archival tags, four commercial tags and one acoustic tag) from bluefin tunas have been reported to ICCAT GBYP up to 19 September 2016, showing a very substantial improvement in the total number of reported tags (see details in SCRS/P/2016/139). Even if the tag reporting rate is still very low (1.74% of the deployed tags), comparing the mean annual bluefin tuna tag reporting rate to ICCAT 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 2016 (68.77 tags/year), the increase is about 7715%. As a matter of fact, the tag reporting continuously increased in the years when the conventional tagging activities were carried out and started to slowly decrease again 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 126 fish, with a reporting rate of 1.38%) showed that the results between single-barb spaghetti and double-barb spaghetti are quite comparable, because the double-barb ones were still on the fish in 85.71% of the cases, compared to 84.13% of the single-barb ones. The shedding rate was 30.16%.

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 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.

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 east bluefin tuna; this part is better described under point 7 of this document.

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 49.74% of funding (a total of 2,163,836 Euros[4]), the ICCAT GBYP collected samples from 9,226 fish (76.9% of the target) up to Phase 5 and carried out ageing, genetic and micro-constituent analyses; furthermore, the sampling design and protocols, and the otolith shape analyses were included in the activity carried out so far. Additional 2,575 fish should be sampled in Phase 6, bringing the total to 11,801 fish, about 98.3% of the objective, but with just half of the budget. The

[4] Including the costs planned for Phase 6 (702,853 Euro), which might be lower at the end of the Phase.

amount of funds used for biological studies in the first six Phases represents 18.52% 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 on www.iccat.int/Documents/Meetings/Docs/2013-BFT_BIO_ENG.pdf. The latest data were reported to SCRS Plenary in 2015 in documents Di Natale A and Tensek S. 2016c and Di Natale A., *et al.* 2016e. The details of the areas were revised jointly by the ICCAT GBYP coordination and the Steering Committee prior to the field activities in 2015 and now there are 12 areas, 38 strata and 79 substrata, allowing for detailed analyses. At the SCRS BFT Intersessional Meeting in 2016, new biological data were presented (see documents SCRS/2016/128, SCRS/2016/133, SCRS/2016/134, SCRS/2016/140, SCRS/2016/141, SCRS/2016/154 and SCRS/P/2016/132). The last update about the situation in Phase 6 was reported to SCRS by document SCRS/2016/193.

The Steering Committee, in Phase 6, requested ICCAT GBYP to start trying the collection of a minimum 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 tender was released for covering the usual annual needs in terms of sampling and analyses, but in Phase 6 it included also the additional needs for CKMR, as decided by the Steering Committee. Furthermore, following specific ICCAT GBYP scientific needs, it was decided to include also 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 aging 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.

In total, 9,426 bluefin tunas have been sampled up to September 1, 2016 and about 40% have already been analysed. 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.

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 western Atlantic bluefin tuna and eastern Atlantic bluefin tuna, and a certain mixing is present in almost all areas; at the same time, for the eastern Atlantic stock, it is evident that there are no clear discrimination signs among all Mediterranean areas and the intra-Mediterranean mixing is very evident.
- Microchemistry analyses showed that current stock components are well identified; mixing in the Mediterranean Sea is minimal. The presence of important percentages of bluefin tuna from different areas in central-North Atlantic and in Atlantic Iberian-Moroccan area needs to be much more investigated and checked before having more solid results, but it seems that the two stocks can be present there, with a very high interannual variability; it is possible that intra-Mediterranean components can be further discriminated, but at the moment this is not available.
- Otolith shape has provided the first, very preliminary results and even here it seems that bluefin tuna population components show some differences, but many other analyses are needed to better study the differences. Furthermore, otolith shape seems better 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.

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 91.4% of the funds (a total of €548,247[5]), 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 were largely accomplished so far, 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 4.69% of the total ICCAT GBYP budget available so far.

One meeting of the ICCAT GBYP Core Modelling MSE Group was held in January 2016, in Monterey (USA). The report is available on www.iccat.int/GBYP/Documents/MODELLING/PHASE%205/MODELLING_GROUP_PHASE5_SECOND_MEETING_REPORT.pdf

A modeling coordinator and a modeling technical assistant were contracted in Phase 5, according to the decision taken by the Steering Committee. The contract modelling assistant was extended also to Phase 6, while the Steering Committee decided not to extend the contract for the Modelling coordinator, which will be possibly replaced by a Modelling communicator in the second part of Phase 6. The documents concerning the various products for modelling in Phase 5 are available on www.iccat.int/GBYP/en/modelling.htm , along with all previous documents. New information was provided to the bluefin tuna intersessional meeting in 2016 (see documents SCRS/2016/144, SCRS/2016/145 and SCRS/P/2016/033).

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 BFT rapporteurs and SCRS Chairman. The data obtained from the electronic tagging activities have been included in the trials, including all those recovered in the first part of Phase 6. The work necessary for developing new modeling approaches will take several years but, 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.

9. Legal framework

ICCAT adopted Rec. 11-06 in its meeting in Istanbul in 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 a circular in each year of ICCAT GBYP activity.

A total of 231 ICCAT GBYP RMA certificates have been issued up to 23 September 2016 in respect of a total of about 11,087 kg of bluefin tuna, 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, for strengthening the cooperation and providing opportunities. The ROPs observers are engaged in checking directly 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 ICCAT GBYP to ROPs. The ICCAT GBYP Coordinator provided yearly a specific training to the ROPs. Several tags have been reported by ROPs in the last years.

[5] Including the costs planned for Phase 6 (190,000 Euro), which might be lower 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. The updating 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, in its last meeting on 30-31 July 2016, recommended the following activities for Phase 7:

a) *Data recovery and data mining*: If additional reliable data about any bluefin tuna fisheries in the Mediterranean 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.
b) *Aerial survey*: suspended under the current constraints will be resolved.
c) *Tagging*: Electronic tagging should be partly carried out, focusing the distribution of tags according to the emerging needs set by the SCRS. The re-analysis of electronic tag data for which the old algorithm was used will be necessary for having a common standard among all data sets. Tag awareness activity will be continued, possibly improving the communication to media using the video tools developed in Phase 6. The second part of the CKMR feasibility study will be done, taking into account the preliminary trials for collecting dedicated samples in Phase 6.
d) *Biological and genetic sampling and analyses*: Sampling should be continued, covering the less sampled areas or areas where mixing problems have recently been detected; the analyses of the available samples should be improved, particularly for microchemistry, genetics and aging. The tentative trials for getting and additional number of samples for CKMR shall be continued.
e) *Modelling*: New additional efforts should be devoted for working on the best approaches for using fishery independent data and innovative approaches for better quantifying uncertainties. The dialogue with stakeholders shall be activated and seriously improved. The revised plan should be enforced as soon as possible. The modelling capacity building shall be strongly improved.

The total budget necessary for Phase 6 is provisionally set once again at €2,125,000.

The ICCAT GBYP will continue encouraging and supporting 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 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 SCRS/2016/192) provided an independent overview of the work carried out so far and possible proposals for the following extension.

Appendix 5

REPORT OF THE ICCAT ENHANCED PROGRAMME FOR BILLFISH RESEARCH (ICCAT/ EPBR)

(Expenditures/Contributions 2016 & Programme Plan for 2017)

Summary and Programme objectives

The ICCAT Enhanced Programme for Billfish Research (EPBR) continued its activities in 2016. The Secretariat coordinates the transfer of funds and distribution of tags, information, and data. The overall programme coordinator and western Atlantic coordinator during 2016 was Dr. John P. Hoolihan (USA). Dr. Fambaye Ngom Sow (Senegal) was the 2016 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 2015-2016 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 in recent years, while annual contributions have been made from Chinese Taipei since 2009.

2016 Activities

Brazil: No allocated funds from EPBR were requested from Brazil in 2015-2016.

Ghana: Billfish catch and effort data derived from artisanal fleets operating along the Ghanaian coast is ongoing. Data from 2015 has been submitting to the Secretariat.

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 2016. Efforts were made to improve data collection by purchasing field recording supplies and conducting a two-day training seminar for field assistants. A total 145 t catch of billfish was reported for 2015.

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 2015-2016. In total 53 t of sailfish and 7 t of blue marlin were reported. All data has been updated with the Secretariat.

Venezuela: At-sea sampling activities of INIA/IOV-UDO were discontinued in 2015 because of the inadequacy of the details provided for the transfer of funds. 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 (Dr. Freddy Arocha, *Instituto Oceanográfico*, Universidad de Oriente), Uruguay (Dr. Andrés Domingo, *Recursos Pelágicos, Dirección Nacional de Recursos Acuáticos*, Montevideo); and Brazil (Dr. Fabio Hazan (UFRPE), *Secretaria Especial de Aquicultura e Pesca*, Monteiro Recife, Pernambuco). This work contributed to the publication of Bernard *et al*. (2014).

Genetic sampling kits were 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. Sampling kits have been distributed to fleets in EU-Spain, Ghana, Mexico, Morocco, Portugal, Senegal and Venezuela. Collected samples are transferred to Nova Southeastern University in Florida USA for processing.

2017 Plan and activities

The highest priorities for 2017 are to support the objectives established by the billfish work plan, 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 longline fleets through onboard observers, reporting of conventional tags, and biological sampling,
- support the collection of biological samples in West Africa, and
- 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 2017 are provided below. Some of these will complement general improvements in data collection made with the support of the ICCAT/Japan Data Improvement project (JDMIP) and the new ICCAT/Japan capacity-building assistance improvement project (JCAP) that are especially relevant to the collection of billfish statistics from fleets from West Africa and the Caribbean.

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.

West Atlantic

Sampling at landing sites will be conducted for gillnet landings off central Venezuela, pending available funds.

Eastern Atlantic

Monitoring and sample collection will be supported for the artisanal fisheries of Côte d'Ivoire, Ghana, S*ã*o Tomé and Senegal.

At-sea sampling

West Atlantic

Continued support will be provided to the sampling made onboard the Venezuelan vessels, pending available funds.

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 2016. This programme aims to determine the ocean-wide ratio of white marlin to roundscale spearfish and longbill spearfish, including how this ratio changed over time. The programme was in need of additional sampling supplies. These were ordered in June 2016. There was a market shortages of these items, and the full order has not been received as yet. Thus, no additional sampling kits have been distributed to fishermen yet.

Preliminary results from Brazilian scientists investigating genetic differentiation among groups of Atlantic sailfish is complete (SCRS/2016/025). Mitochondrial DNA was compared using a 645 base pair sequence from the control region. So far, analyses have been undertaken on samples from the western North Atlantic (Florida), Brazil and Senegal. An AMOVA comparison indicated a moderate to strong ($\Phi st = 0.1020$, $P = 0.011$) differentiation between northern and southern hemispheres, and moderate differentiation ($\Phi st = 0.0783$, $P = 0.010$) between eastern and western Atlantic samples. In pairwise comparisons, the largest population differentiation was observed between the western North Atlantic (Florida) and African (Senegal) groups, and the smallest differentiation between the Brazil and African (Senegal) groups. Preliminary results suggest genetic stock structure between both the eastern and western Atlantic, and northern and southern hemispheres. Further work is needed to elucidate and confirm the presence of stock structure. Additional collection and analyses of samples from Côte d'Ivoire, EU-Portugal, EU-Spain, Uruguay and Venezuela are anticipated.

Efforts to collect biological samples for reproduction, age and growth studies requires EPBR support to facilitate cooperation from fleets that are monitored with EPBR funds. In preparation for the next sailfish assessment, emphasis will be placed on biological sampling for age, growth, and reproductive studies of sailfish and spearfishes.

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 fund 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 to the 2011 SCRS Report).

2016 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)**.

Table 1. Detailed 2016 expenditures.

Income			**Euros (€)**
	Balance transferred from 2015		61,184.16
		ICCAT Commission	20,000.00
		Chinese Taipei	3,000.00
	Total income		23,000.00
Total Budget			**84,184.16**
Expenditures			
		Sampling - Senegal	3,000.00
		Bank charges	23.00
	Current expenditures Jan-Sep 2016		**3,023.00**
Funds obligated until end of the year			
		Sampling (port) - Venezuela	(6,000.00)
		Sampling (at sea) - Venezuela	(6,000.00)
		Sampling - Ghana	(3,000.00)
		Sampling - São Tomé	(2,000.00)
		Sampling - Côte d'Ivoire	(3,000.00)
		Tagging rewards	(500.00)
		Collection of genetic samples*	(2000.00)
		Mailing genetic samples*	(1,000.00)
		Processing genetic samples*	(22,000.00)
		Coordination travel	(4,000.00)
		Bank charges	(277.00)
	Obligated expenditures October-December 2016		**(49,777.00)**
Total Expenditures for full year			52,800.00
Estimated year-end balance			31,384.16

* Number of samples collected and processed will depend on the final budget of the programme.

Some of the travel costs and personnel time of the programme coordinators were absorbed by the U.S. National Marine Fisheries Service, University of Miami, Ghana department of fisheries and by the ICCAT Data fund.

2017 Budget and requested contributions

The proposed 2017 budget, totaling €54,784.16 is detailed in **Table 2**. The programme is predicted to have a balance of €31,384.16 by the end of 2016 and therefore requests the Commission to provide a contribution of €20,400.00 for 2017. The requested contribution from ICCAT is necessary to fully implement the EPRB 2016 working plan. To achieve all its objectives in 2017 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** includes new 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 2017 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.

Table 2. Detail of proposed expenditures for 2017.

Income			**Euros (€)**
	Balance transferred from 2016 (tentative)		31,384.16
		ICCAT Comm.	20,400.00
		Chinese Taipei	3,000.00
Total income			23,400.00
Total Budget			54,784.16
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			**2,484.16**

[1] Expenditures contingent on available funds.
[2] Number of samples collected and processed will depend on the final budget of the programme.

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.

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.

2016 Activities

The ICCAT Secretariat launched in March 2016 a Call for tenders with the aim to implement the main activities scheduled within SMTYP in 2016, 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 contracted five scientific institutions and/or individual experts to carry out the tasks aforementioned (**Table 1**). 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).

Activities planned for 2017

It is planned to continue in 2017 the collection of biological samples for priority species to update and further improve growth and maturity parameters estimates for small tunas in other areas. The biological sampling will be extended to cover two new priority species: Serra Spanish mackerel (BRS) and wahoo (WAH) in the South Atlantic and Caribbean Sea. The SMTYP programme aims also to continue recovering historical Task I and Task II data of small tunas.

Nevertheless, these objectives could not be achieved without financial support from ICCAT. **Table 2** gives the detailed estimated costs for 2017.

2016 expenditures

The total expenditures within SMTYP during 2016 amounted to 82 491.04 €. The detailed costs for each contracted institution are summarized in the **Table 1.**

Budget for 2017 and expected expenditures

To implement the main activities planned in the framework of SMTYP in 2017, a total budget of €142,500 is needed from ICCAT or other financial resources. The details of costs related to activities to be carried out in 2017 are shown in the **Table 2.**

Table 1. The detailed expenditures within SMTYP during 2016.

Institution	*Amount (€)*
NECTON - Italy	37,500.00
Samar Saber - Spain	15,000.00
IMROP - Mauritania	6,200.00
CRO - Côte d'Ivoire	8,370.52
CRODT - Senegal	8,370.52
INRH - Morocco	7,050.00
Total	**82,491.04**

Table 2. Estimated costs related to activities planned for 2017 under the ICCAT SMTYP.

Planned activities	*Species*	*Estimated costs (€)*
1. **Recovery of Task I and Task II data:**		
• Eastern Mediterranean: Turkey	Atlantic bonito (BON)	7.500
• North East Atlantic:	Little tunny (LTA)	
– Mauritania	Frigate tuna (FRI)	7.500
– EU. Portugal	Bullet tuna (BLT)	7.500
• South Atlantic & Caribbean Sea:	King mackerel (KGM)	
– Venezuela, Brazil	Serra Spanish mackerel (BRS)	15.000
– Angola	Wahoo (WAH)	7.500
2. **Conducting biological sampling in the major areas**		
• North Est Atlantic		
– Senegal		7,500
– Côte d'Ivoire	Atlantic bonito (BON)	7,500
– Morocco	Little tunny (LTA)	7,500
– Mauritania	Frigate tuna (FRI)	7,500
– Cabo Verde	Bullet tuna (BLT	7,500
– EU (Portugal)		7,500
– São Tomé e Principe		7,500
	Atlantic bonito (BON)	
• Mediterranean Sea	Little tunny (LTA)	
– Tunisia	Frigate tuna (FRI)	
– Algeria	Bullet tuna (BLT)	7,500
		7,500
• South Atlantic and Caribbean Sea		
– Venezuela	King mackerel (KGM)	
– Mexico	Serra Spanish mackerel (BRS),	7,500
– Brazil	Wahoo (WAH)	7,500
– Angola		7,500
		7,500
Total		**€142,500**

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 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 focuses on biological and other aspects of the shortfin mako and contemplates extensive collaborative work among national scientists with the aim of contributing information to the forthcoming 2016 shortfin mako stock assessment. It was noted, however, that it was unlikely that all aspects of the projects would be completed in time for consideration in the stock assessment, due to the fact that the Commission moved up the assessment to an earlier date (2016) than originally anticipated by the Group (2017).

2016 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.

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 aims 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 those samples have been, or are currently being processed and digital images have been uploaded to an ICCAT online repository. In June 2016, a two-day age and growth workshop was organized by NOAA-NEFSC (Narragansett Laboratory) with the participation of the involved scientists, with the objective of establishing the initial reference set for ageing the samples. The sampling processing is expected to be finished in December 2016. One biologist from each participating institution will read and estimate the ages from all the samples, based on the agreed ages from the reference set, and growth models will be developed based on those readings.

Genetic analysis of shortfin mako in the Atlantic Ocean

The project leader for this study is Dr. Kotaro Yokawa, National Scientist from Japan. 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. A total of 392 shortfin makos were collected though collaboration with CPC members of the Group from the entire Atlantic and part of the southwestern Indian Ocean. The observed mitochondrial and microsatellite diversities were comparable among sampling locations. The present mitochondrial analyses indicated that the Atlantic shortfin mako was significantly differentiated at least among the northern, southwestern, and southcentral and southeastern areas, which supports current stock structure hypotheses of Atlantic shortfin makos, and also suggests the possibility of multiple stocks within the South Atlantic. In contrast, the microsatellite analyses did not show any genetic structuring of the Atlantic shortfin mako. Considering the difference of hereditary pattern between these markers, the discrepancy of inference between markers would be caused by sex-biased dispersal, which means that the male-biased gene flow prevents the genetic structuring which is created by the female philopatric behaviour. Given that the stock assessment generally focuses on the dynamics of females rather than males, it would be better to take into account the observed maternal structuring pattern in the stock assessment of the Atlantic shortfin mako. The necessary information could be obtained through electronic tagging studies as well as collaborative analysis of sex-specific size data, which are already ongoing as part of other projects of the SRDCP and the Group's work plan. The Group agreed to continue this study with additional samples, such as from the Caribbean Sea and Mediterranean to explore further detailed genetic flow of this species. The results of this study were reported to the SCRS in document SCRS/2016/076.

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 a total of 14 Survivorship Popup Satellite Archival Transmitting Tags (sPATs) were acquired by ICCAT in late 2015 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 8 sPATs have been deployed thus far by scientific observers from IPMA (EU-Portugal) and NOAA (USA).), Preliminary data are available from five tags, which indicate that three specimens survived and two died as a result of post-release mortality. The remaining tags will be deployed over the next months, and additional tags from other projects involving the same partners may also be deployed in these same areas, which cover both hemispheres and both sides of the Atlantic.

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. To that end, a total of nine mini Pop-up Satellite Archival Transmitting Tags (miniPATs) were acquired by the ICCAT Secretariat in late 2015, for deployment on both adult and juvenile specimens of both sexes in main areas of the Atlantic, including the temperate, tropical Northeast Atlantic and equatorial region, and the Southwest Atlantic. A total of 7 miniPAT tags have been deployed so far by scientific observers from DINARA (Uruguay) and IPMA (EU-Portugal). The data from those 7 tags are already available, and a total of 333 tracking days have been recorded. Of the deployed tags, two released according to the original programming (120 days), two tags had premature releases (66 and 6 days), and three tags were on specimens that suffered post-release mortality (2 to 17 days). The two remaining tags from this project are prepared to be deployed soon. Additional tags from other projects involving the same partners may also be deployed in these same areas, which cover both hemispheres and both sides of the Atlantic.

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 is to characterize the trophic relationships of Atlantic shortfin makos using stable isotope analysis. The first tissue samples to initiate the fatty acid and stable isotope projects were received in mid-September 2016. Samples of shortfin mako and some potential prey are being processed.

CITES-ICCAT Training Course

In 2016 ICCAT and CITES collaborated in order to conduct a training course for field workers, scientists and data managers from the West Africa region (in English, French and Spanish simultaneously). There are several countries in this region that were identified as priority countries for assistance under the EU-CITES project with regard to implementing the new CITES listings for sharks and rays. These workshops were originally planned to be conducted in Côte d'Ivoire in April 2016, however, due to circumstances beyond the control of the Secretariat, the course was moved to Madrid and held from the 12-15 September 2016. Training covered issues such as species identification, including the provision of ID cards, biological and fisheries sampling techniques, data reporting requirements and implementation of CITES shark listings on Appendix II. Unfortunately due to the change in location, the course became more expensive than was previously budgeted and so additional activities such as the collection of catch and biological data using these funds was no longer possible. The course included 36 participants from 12 countries, all from the West African region. It is hoped that this training will improve the quality of data being collected in the region, leading to significantly increase the member states capacity to make NDFs (Non Detrimental Findings). This process is not currently possible with the information available. It will also improve the data available to ICCAT for the assessment and management of shark stocks in the region through analysis of the data by the ICCAT Shark Species Group.

2017 Plan and Activities

Age and growth of shortfin mako in the Atlantic Ocean

A two-day age and growth workshop was organized in June 2016 by NOAA-NEFSC (Narragansett laboratory). It is hoped that age estimation will be completed by the end of 2016. This will entail a vigorous collaboration among National Scientists for cross-reading of vertebral samples. An update of the project was presented to the ICCAT Shark Species Group Intersessional meeting (SCRS/2016/055). A final report is expected to be completed in time for the planned 2017 shortfin mako stock assessment meeting.

Genetic analysis of shortfin mako in the Atlantic Ocean

Although the main aspects of the project and data analyses have been completed and reported (SCRS/2016/076), the Group agreed to continue this study with additional samples, such as from the Caribbean Sea and Mediterranean, to explore further the detailed genetic flow of this species.

Post-release mortality of shortfin mako in the Atlantic Ocean

Tag deployment started in late 2015 and it is expected that all tags will be deployed during 2016. An update of the project was presented to the ICCAT Shark Species Group Intersessional meeting (SCRS/2016/056). All analyses and a final report are also expected to be completed by the planned 2017 shortfin mako stock assessment meeting.

Movements, stock boundaries and habitat use of shortfin mako in the Atlantic Ocean

Tag deployment started in late 2015 and it is expected that all tags will be deployed during 2016. An update of the project was presented to the ICCAT Shark Species Group Intersessional meeting (SCRS/2016/056). All analyses and a final report are also expected to be completed by the 2017 Shortfin mako stock assessment meeting.

Trophic relationships of shortfin mako in the Atlantic Ocean

Tissue samples from the various fleets and areas provided by the National Scientists from Cooperating CPCs will be needed to successfully carry out this project.

2015 and 2016 budget and expenditures

This section presents a summary of the contributions for the SRDCP during 2015 and 2016. The Shark Species Group developed a budget of €135,000 for Year 1 and €65,000 for Year 2 of the SRDCP that was subsequently funded (**Table 1**). In-kind contributions from CPCs to the programme for Years 1 and 2 include €20,000 for the age and growth study, €55,000 for the post-release mortality study, €100,000 for the genetics study, and €20,000 for the isotopes study.

2017 budget and requested contributions

The proposed budget for Year 3 of the SRDCP (2017) totals €150,000 (**Table 2**). Funds are being requested for research on shortfin mako and porbeagle sharks distributed as follows:

- Shortfin mako: €15,000 for genetics studies; €15,000 for trophic relationship studies; €45,000 for movement, habitat characterization, and post-release mortality studies;

- Porbeagle: €15,000 for life history (reproduction) studies; €15,000 for genetics studies; €45,000 for movement and habitat characterization studies.

Table 1. Summary budget of the SRDCP for 2015 and 2016.

Project	*Participating CPCs*	*Project leader*	*Budget (€) 1st year*	*Budget (€) 2nd year*	*In-kind contributions from CPCs (€)**
Life history (Age, growth and reproduction)	Brazil, EU, Japan, Uruguay, US, Venezuela, etc.	Coelho	5,000	15,000	20,000
Post-release mortality (PSATs)	Brazil, EU, Japan, Uruguay, US, Venezuela, etc.	Domingo	40,000	10,000	55,000
Stock boundaries (Genetics; Movements-PSATs)	Brazil, EU, Japan, Uruguay, US, Venezuela, etc.	Yokawa (genetics); Coelho (PSATs)	80,000	20,000	100,000
Isotopes (Trophic relations)	Brazil, EU, Japan, Uruguay, US, Venezuela, etc.	Domingo	10,000	20,000	20,000
Total			**135,000**	**65,000**	**195,000**

* In-kind contribution from CPCs includes portion of investigator salaries, fishery observer time, and research vessel time.

Table 2. Summary budget of the SRDCP for 2017.

Project	*Participating CPCs*	*Project leader*	*Budget (€) 3rd year*	*In-kind contributions from CPCs (€)**
SHORTFIN MAKO				
Stock boundaries (Genetics)	Japan, EU, Uruguay, US, etc.	Yokawa	15,000	15,000
Fatty acids/Isotopes (Trophic relations)	Uruguay, EU, Japan, US, etc.	Domingo	15,000	15,000
Movements, habitat use, and post-release mortallity (PSATs)	EU, Uruguay, US, etc.	Coelho	40,000	40,000
Life history (Reproduction)	US, Uruguay, Japan, EU, etc.	Cortes	5,000	5,000
PORBEAGLE				
Life history (Reproduction)	US, Uruguay, Japan, EU, etc.	Cortes	15,000	15,000
Stock boundaries (Genetics)	Japan, US, Uruguay, EU, etc.	Yokawa	15,000	15,000
Movements and habitat use (PSATs)	Uruguay, EU, US, etc.	Domingo	45,000	45,000
Total			**150,000**	**150,000**

* In-kind contribution from CPCs includes portion of investigator salaries, fishery observer time, and research vessel time.

2017 budget rationale:

1. Shortfin mako: The two first years of the SRDCP were devoted to shortfin mako shark, as the next stock assessment for this species will take place in 2017. However, there are still uncertainties on some important biological parameters, and as such it will be important to continue the work that has been started on this species. Additionally, ICCAT Recommendation [14-06] on shortfin mako caught in association with ICCAT fisheries supports this in saying that: "Paragraph 3: *CPCs are encouraged to undertake research that would provide information on key biological/ecological parameters, life-history and behavioural traits, as well as on the identification of potential mating, pupping and nursery grounds of shortfin mako sharks. Such information shall be made available to the SCRS*". As such, the Group feels that it will be important to continue the shortfin mako shark work, and allocate part of the 2017 funds for this species also with high priority.

2. Porbeagle: after the Shortfin mako assessment in 2017, the next species to be assessed is scheduled to be porbeagle in 2019. There are currently large data gaps in the knowledge of this species, and as such it is important to start projects on this species no later than 2017, so that the results can be used in the stock assessment. ICCAT Recommendation [15-06] on porbeagle caught in association with ICCAT fisheries supports this in saying that: "Paragraph 4: *CPCs are encouraged to implement the research recommendations of the joint 2009 ICCAT-ICES intersessional meeting. In particular, CPCs are encouraged to implement research and monitoring projects at regional (stock) level, in the Convention area, in order to close gaps on key biological data for porbeagle and identify areas of high abundance of important life-history stages (e.g. mating, pupping and nursery grounds). SCRS should continue joint work with ICES Working Group on Elasmobranch Fishes*". The Group therefore agreed that part of the funds for 2017 should be allocated to porbeagle with high priority.

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]

1. AOTTP First Year Results and Activities

1.1 Background

The overall objective of the Atlantic Tuna Tagging Programme (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 the International Commission for the Conservations of Atlantic Tunas (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.

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.

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

2.1 Summary

This work is the foundation on which the AOTTP programme will be built. Tagging activity began at the end of June 2016 in Azores, EU-Portugal waters and is currently ongoing in West African waters. To date more than 12,000 tropical tunas, across species and size-ranges have been tagged and released (see **Figure 1** and **Table 1**) with *ca* 20 released for a second time. The most commonly tagged species so far were skipjack (*ca* 40%), bigeye (*ca* 30%), and yellowfin (*ca* 25%), together with two neritic species (little tunny and wahoo). The balance between species and size-ranges tagged has been good so far (**Table 2**). Skipjack and yellowfin length categories less than 70cm have been well covered, while for bigeye tuna coverage extends to all length categories up to 120 cm. AOTTP teams have already recovered more than 1,500 tags (see **Figures 2, 3 & 4; Tables 3 & 4**) with generally good quality metadata.

2.2 Tagging of Tropical Tunas

Three fishing vessels have been chartered on behalf of ICCAT/AOTTP to tag fish in the eastern Atlantic (see **Figure 1** for progress so far). AOTTP tagging activities began in the Azores in late June 2016 (Cruise reports are available summarising the details) and are continuing currently in the territorial waters of Cabo Verde, Mauritania and Senegal. During September and October tagging will begin in the western part of the Gulf of Guinea. Note that the first tagging phase in the eastern Atlantic is being organized by a Consortium led by AZTI (http://www.azti.es/) who bid successfully for an International Call for Tender launched by ICCAT/AOTTP. All the AZTI Consortium partners (*Centre Recherches Oceanologiques*, Côte d'Ivoire; *Instituto Espanol de Oceanografía*, EU-Spain; *Centre Recherches Oceanologiques* de Dakar, Senegal; *Instituto do Mar*, EU-Portugal; and Marine Fisheries Research Division, Ghana) are supplying personnel for the tagging teams on board the chartered vessels.

[1] This report was prepared prior to the meeting of the AOTTP steering committee on the 28/09/2016.

All the tags (conventional, chemical, and electronic) needed for the first phase tagging work have been procured. Conventional dart or 'spaghetti' tags are the main type of tag being used and the target is 120,000 fish tagged, with 20% of those (24,000) double-tagged so that 'shedding' rates can be estimated. AOTTP bought 86,000 conventional PDAT type plastic tags plus sufficient stainless steel applicators for the first 18 month tagging activities from Hallprint Ltd. Each tag has the unique suffix, ATP, followed by a number, 0 to 1 million, which have all been registered in the official ICCAT system www.iccat.int/en/InvTagging.htm. Note that the red tags will be inserted into fish which are also, either being chemically tagged, and/or electronically tagged, *i.e.* when it is necessary to keep the actual fish in order to make extra determinations or measurements (e.g. sex, reading of hard parts etc.). Electronic tags of various types are also being used during the AOTTP programme since they make regular observations (~every minute) on the actual path taken by a fish between tagging and capture (or pop-up). Electronic tags can be categorized into three main types: satellite pop-up tags; internal archival tags; and sonic/acoustic tags. The electronic tags for AOTTP were procured by International Call for Tender. Desert Star and Wildlife Computers supplied AOTTP with 40 Seatag 3D and 90 Mini PAT-348C pop-up tags, respectively, while Lotek Wireless have provided 400 (LAT 2810) and 40 ARCGEO-9 internal tags. All the tags have now arrived in Madrid. The 90 Mini PAT - 348Cs, however, had a problem and were recalled for repairs which has delayed their deployment.

ICCAT already has a database infrastructure for storing tagging data (*https://www.iccat.org/en/Tag-Desc.htm),* which the AOTTP programme is exploiting and developing. A key element is to transfer the data collected by tagging teams at sea. Three Android Applications for smartphones, in four languages, have been developed using the Memento database infrastructure *(*http://mementodatabase.com/). The first one is specialized for tagging at sea, the second for collecting the recovery data, and the third is used for summarising details of awareness campaigns.

Obviously the data collected by the smartphone Apps are in the correct format for rapid uploading to the main ICCAT database in Madrid. The data are transferred using another smartphone App, Telegram (*https://telegram.org/).* Advantages of the smartphone system, such as accurate determination of location and time-stamp are obvious. Data transferred from the smartphones to the database are displayed and explored using online maps, *e.g.* https://aottp.carto.com/me . The short time between data-submission and upload mean they can be checked quickly for accuracy and that the teams in the field are also in a position to respond quickly to queries.

As part of the data checking and validation process data are placed in the following three categories:

1. Fully documented and validated (both release and recoveries with precise geographic locations, correct species identifications and sensible lengths)
2. Validated movement (both release and recoveries with precise geographic locations and correct species identifications)
3. Validated growth (both release and recoveries with exact dates and reliable lengths)

According to these definitions 57% of AOTTP recovery data are "fully documented and validated", 99% have a "validated movement" (highest reached in any tagging programme to date), and 66% have "validated growth data (see Fonteneau and Hallier, 2015). An example of the movement data is plotted in **Figure 4** which also shows the (more than 1200kms) migration of an individual skipjack tuna between Azores and West Africa during July and August 2016.

2.3 Awareness Campaigns and Recovery Schemes

In past tagging programmes, preparation for tag-recovery on land has been inadequate compared to the time and investment dedicated to tagging activities at sea. AOTTP is attempting to balance these efforts and is developing tag-recovery and awareness activities in the most important Atlantic Coastal States based on an initial analysis of tropical tuna landings by port. This is being done well in advance of the tagging work at sea.

2.4 Recovery of tags and transmission of data to ICCAT Secretariat

AOTTP is using the following two different 'models' to effect tag-recovery across the tropical Atlantic:

1. AOTTP Tag Recovery Officers
2. AOTTP Focal Points

AOTTP Tag Recovery Officers (TROs) are part of dedicated teams, formally contracted by AOTTP, with office space, and transport available. These relatively large (4-8 people), full-time teams are needed in the most important west African ports where landings of tropical tunas can be very high, and where most tags are likely to be found. AOTTP has set up TROs in Côte d'Ivoire and Senegal.

The AOTTP Focal Point 'model' is less formal, less expensive, and exploits existing ICCAT networks. Focal Points are being identified at relevant Fisheries Department and/or Research Institutes/Universities and asked to publicize tag-recovery incentives, recover tags/fish, and transfer the data to ICCAT. AOTTP is using, and will use, Focal Points in all other important locations across the tropical Atlantic such as the Brazil, EU-Portugal (Azores) and EU-Spain (Canary Islands), South Africa and Caribbean, the less important (for landings) West African countries, the U.S.A. and also possibly in Japan (longline caught fish).

Prior to the onset of tagging-at-sea the recovery teams focus on awareness-raising activities. These include organizing informative discussions with fishers, etc. in the main landing areas, processing/storing factories, and among small-scale fishing communities. AOTTP has also designed t-shirts and posters which are distributed by the teams on the ground. FM radio broadcasts and newspaper articles also publicize the AOTTP programme and the rewards available for tag-recovery. SMS messages are also being sent to relevant stakeholders, and a range of informational videos on YouTube are available. Reward schemes are tailored to each geographic location. All the publicity materials have a mobile phone number displayed, which is used by tag-finders to contact the tag-recovery teams who then liaise with tag-finders to ensure rewards are paid/given, and relevant meta-data properly collected. Rewards for the return of a tag and the vitally important metadata (fish length, location of capture) comprise a small cash sum, a mobile phone credit 'top-up', and a t-shirt. The geographic database set up by AOTTP, will also be used for awareness-raising and publicity.

The data collected so far attest to the efficacy of these activities. The AOTTP tag recovery teams have already recovered more than 1,500 tags (**Table 3**) which translates to good recovery rates/percentages (**see Table 4**). Most of the fish recovered have been re-caught fairly soon after being tagged although some individuals have migrated considerable distances in a relatively short period of time (**Figure 4**). Out of *ca* 1,500 recovered tuna *ca* 800 of them were double tagged at the moment of release. In the period between tagging and recovery, 22 tunas shed one of their tags. Shedding rates are low, so far, for bigeye and skipjack at *ca* 0.7% but quite high for yellowfin (*ca* 3%).

3. Estimation of key parameters supporting stock assessments on the basis of data collected through the programme and integrated in stock assessments

The AOTTP project is still in its early stages and too few new tagging data are yet available to reliably calculate any key parameters for stock assessment. The AOTTP project was, however, presented by the Coordinator this year at different SCRS Species Group meetings (small tunas, April 2016; tropical tunas, March and June 2016) and plans are already in place to begin researching and analyzing the data as they start to arrive.

One 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.

At the Small Tunas Species Group Intersessional meeting the issue of indicators for neritic tunas was discussed. There are many potential neritic tuna species that could be studied but the Group thought that it would be better for AOTTP to focus on only two species: wahoo (*Acanthocybium solandri*) and little tunny (*Euthynnus aletteratus*). The tagging teams, therefore, will tag only these species in addition to the three tropical species. In this way AOTTP will (at least) ensure that plausible indicators are developed for two neritic species without effort being spread too thinly. As of writing 355 little tunny have already been tagged with 53 recoveries already recorded (**Table 2**).

3.1 Reading of hard parts

During the AOTTP programme around ten percent (12,000) of the fish tagged with conventional tags will be 'chemically tagged', which means they will be injected with a chemical marker that allows their otoliths (or other hard parts) to be 'read', and the fish thus aged more easily. Chemically tagged fish have two conventional tags; one yellow and one red, marked with 'KEEP WHOLE FISH'. When a fish with a red tag is found and reported, the Tag Recovery Officer or Focal Points will arrange to buy the fish, pay any reward etc. and organise the reading of the hard-parts. Thus far AOTTP has recovered only a few chemically marked fish with red tags. These fish have been purchased by the Tag Recovery Officers, and are currently being analysed.

3.2 Tagging data analyses

There are few AOTTP data yet available and this activity has not formally started. It is important, however, that we now plan properly how the data collected will be researched and integrated into the tropical tuna stock-assessment and management process. This will be coordinated by the Chair of the SCRS (Dr. David Die) and the associated SCRS scientific community. Note that an official ICCAT/AOTTP Data Policy has been drafted and is available on request.

4. Training of scientists from developing ICCAT CPCs in tagging, data collection, and tagging data/stock assessment analysis

Together with its sub-contractors and other partners, the ICCAT/AOTTP programme is providing a wide range of opportunities and training for scientists from developing ICCAT CPCs. Scientists from Côte d'Ivoire, Ghana and Senegal, for example, are subcontracted within the AZTI Consortium and are actively participating in the tagging activities on board the vessels that have been hired. Already forty-six scientists and observers have been trained in tagging techniques at sea, including two from Cabo Verde, seven from CÔte d'Ivoire, seven from Ghana, and five from Senegal.

Training in data collection and sampling at recovery is ongoing. Tag Recovery Officer and Focal Point teams in Côte d'Ivoire (5-6 persons), EU-Portugal (Azores, 1 person) and Senegal (4 persons), have already received training. Training in Ghana was done during the last week of August 2016. Tagging data analysis and interpretation workshops will be organised during the latter stages of the project.

4.1 Training in tagging techniques and data collection

At least forty-six individuals (from Cabo Verde, Côte d'Ivoire, EU-Portugal, EU-Spain, Ghana, US (Hawaii) and Senegal) have already attended training courses run by AZTI in conventional, chemical and electronic tagging, and associated data collection. Note that scientists from other countries will also be invited on board the tagging vessel, receive training and participate in all the tagging activities as a condition of access to their territorial waters, e.g. Dr. Cheik Baye Braham boarded the fishing vessel Aita Fraxku (chartered by AZTI) when she was working in Mauritanian territorial waters during August 2016.

5. Updated Action Plan

An updated overall AOTTP Action plan based on Appendix 2 in the original Grant Contract (Indicative Action Plan for Implementing the Action: 60 months) is provided below (**Table 5**). The project started slightly late due to administrative issues but we are catching up successfully. It was originally planned that activity A1.1 – Tagging of tunas would begin six months after the AOTTP Grant Contract was signed, but we have actually only just begun (June 2016) almost 1 year after the official start of the project. We are confident, however, that all the tagging will be complete by end of June 2018 corresponding to the original Action Plan.

In the immediate future there are a number of priorities for AOTTP Coordination. AOTTP has still not received a proposal for tagging in the Caribbean Sea and is, therefore, considering how to establish additional contacts with relevant stakeholders in the region.

In the western Atlantic (territorial waters of the U.S.A.) tropical tuna will be tagged by recreational/sport fishers. There is no specific budget in AOTTP for chartering vessels for tagging in the territorial waters of the U.S.A., so recreational/sport fishers must be mobilized to do this work, and preparations are under way. At the Steering Committee meeting on 27 June, the AOTTP Coordinator suggested issuing a Call for Tender to build a network (for the remainder of the project) among recreational/sport fishers encompassing the entire tropical Atlantic. Recreational/sport fishing charter skippers would be contacted, and a database built-up. Each skipper would be issued with a 'tagging kit' including, for example, some spaghetti tags, t-shirts, brochures, etc. The recreational/sport fishers would be trained in conventional tagging, and the use of the android data collection smart-phone application. Those charter boat skippers doing well, sending in the data accurately, would then be asked to take out a scientifically trained and experienced technician who would tag fish caught with electronic pop-up tags. Online maps, etc., would also be used to motivate the sport fishers.

AOTTP is also committed to tagging (*ca* 1,000) fish with acoustic or sonic tags. These tags emit sound waves with an individual identification code which can be picked up by stationary buoys or boats equipped with the relevant listening devices/stations (receivers). Triangulation between the listening stations and the fish can allow a researcher to determine the position (latitude, longitude, and depth) of the fish. A good place to do this is around the Azores where large bigeye tuna can be caught and tagged, and where there are arrays of listening buoys maintained by the Portuguese Institute of Marine Research (IMAR, http://www.imar.pt/) and the Ocean Tracking Network (OTN, http://oceantrackingnetwork.org/). The AOTTP has discussed acoustic tagging with representatives from both IMAR and OTN and it would be straightforward to implement. The AOTTP Steering Committee has, however, been sceptical about implementing acoustic tagging work, suggesting that the approach is better for understanding the fine-scale migrations and behavior of tunas rather than the longer distance ones in which AOTTP is more interested. The AOTTP will not, therefore, undertake acoustic tagging in the short-term until a more thorough assessment of the usefulness of such methodology to the AOTTP objectives is made available (including a proper survey design).

6. Visibility

AOTTP has already been presented at a range of fora around the Atlantic Coastal States. ICCAT/AOTTP will direct communication activities/materials/products at the following three main target groups or audiences:

- Direct stakeholders who actually work in the commercial fishing, recreational fishing, and fish-processing industries. This group depends most directly on tuna resources in the Atlantic and is most likely to actually find and report the discovery of a tagged fish

- Marine/fisheries scientists (includes ICCAT CPC representatives at the SCRS, and AOTTP Steering Committee) who will analyze and interpret the AOTTP tagging data, using them to make improved estimates of stock abundance.

- Policy/decision-makers concerned with the actual management (population assessment, quota-setting, etc.) of tropical tuna fisheries.

- NGOs, donors, and the general public primarily concerned with sustainable exploitation, socio-economic issues and conservation.

Each of these three four audiences is clearly very distinct from the other, and each will require different communication and messaging strategies. These are outlined in detail in the Communication Plan available on request. Note that newspaper articles on AOTTP, have already been published in the EU-Portugal and EU-Spain:

- http://www.tribunadasilhas.pt/index.php/component/k2/item/11855-6000-atuns-dos-acores-marcados
- https://www.jornalacores9.net/regional/programa-internacional-quer-marcar-120-mil-atuns-no-atlantico-inclusive-nos-acores/
- http://www.laopinion.es/sociedad/2016/08/10/instituto-oceanografia-marcara-6500-atunes/696665.html?utm_source=rss

The AOTTP youtube channel can be found here:

- https://www.youtube.com/channel/UClCXmfvKvmxqeZMU4LFa_hQ

Table 1. R-1 total releases by species.

Species	*Frequency*
BET	3514
LTA	356
SKJ	5484
WAH	1
YFT	3289

Table 2. Releases (R-1) length-frequencies by species.

	20-30	*30-40*	*40-50*	*50-60*	*60-70*	*70-80*	*80-90*	*90-100*	*100-110*	*110-120*	*120+*
BET	0	440	546	1470	719	121	57	109	47	17	7
LTA	0	3	277	75	0	0	0	0	0	0	0
SKJ	2	1034	2863	1478	93	1	0	0	0	0	0
WAH	0	0	0	1	0	0	0	0	0	0	0
YFT	0	532	783	1084	780	95	9	2	2	0	1

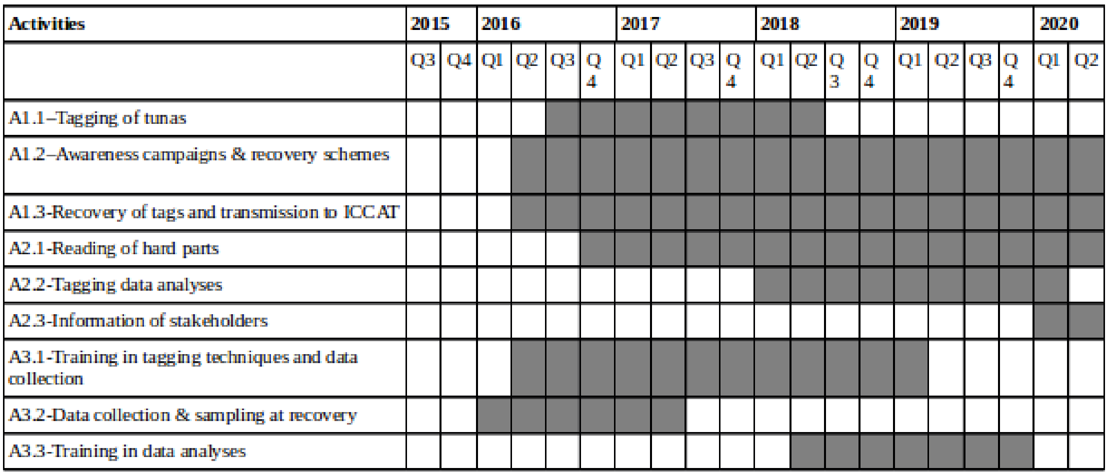
Table 3. R-1 total recoveries by species.

BET	*LTA*	*SKJ*	*WAH*	*YFT*
269	53	806	0	378

Table 4. R-1 recovery percentages by species.

BET	*LTA*	*SKJ*	*YFT*
7.7	14.9	14.7	11.5

Table 5. AOTTP Updated Action Plan.



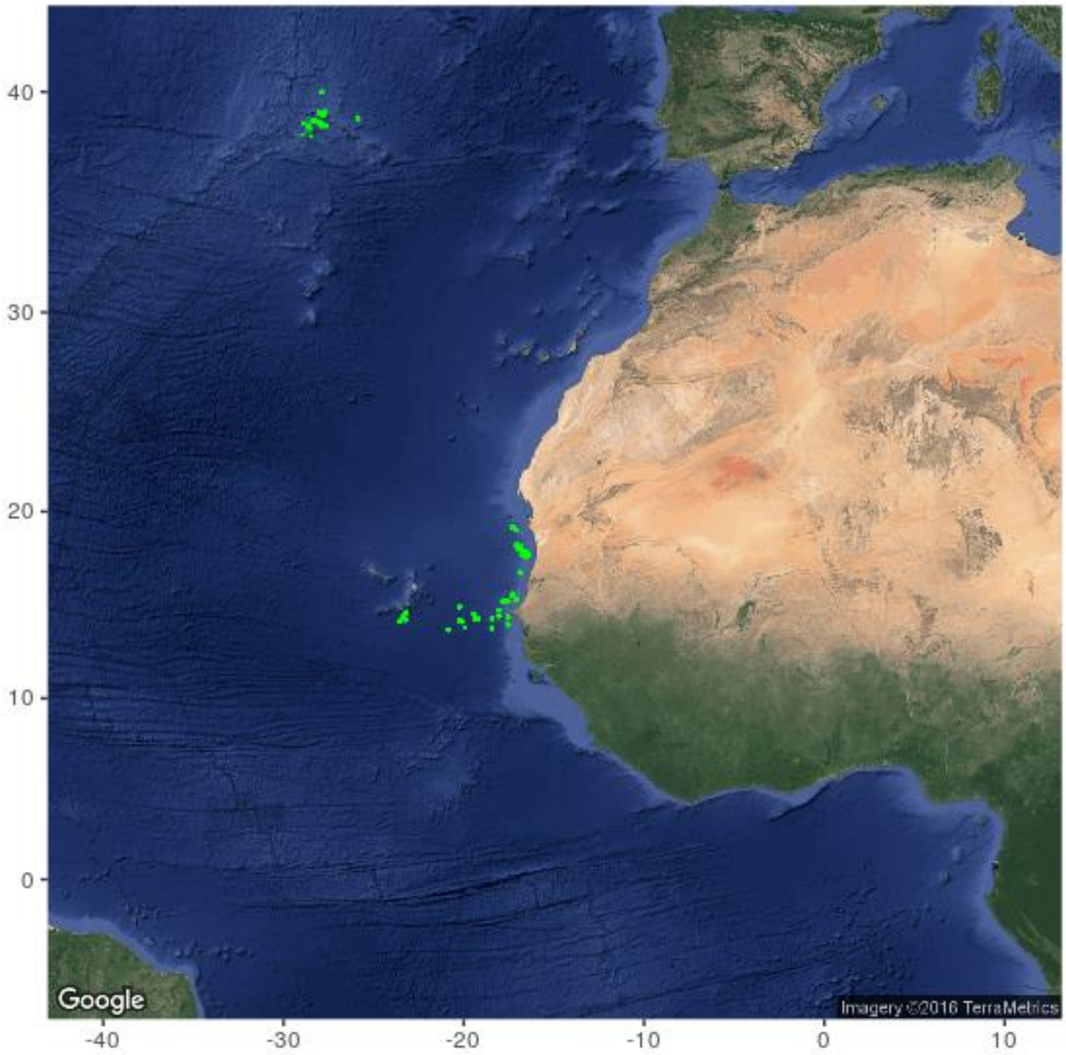


Figure 1. Distribution of tropical tuna tagged and released by AOTTP between July and September 2016.

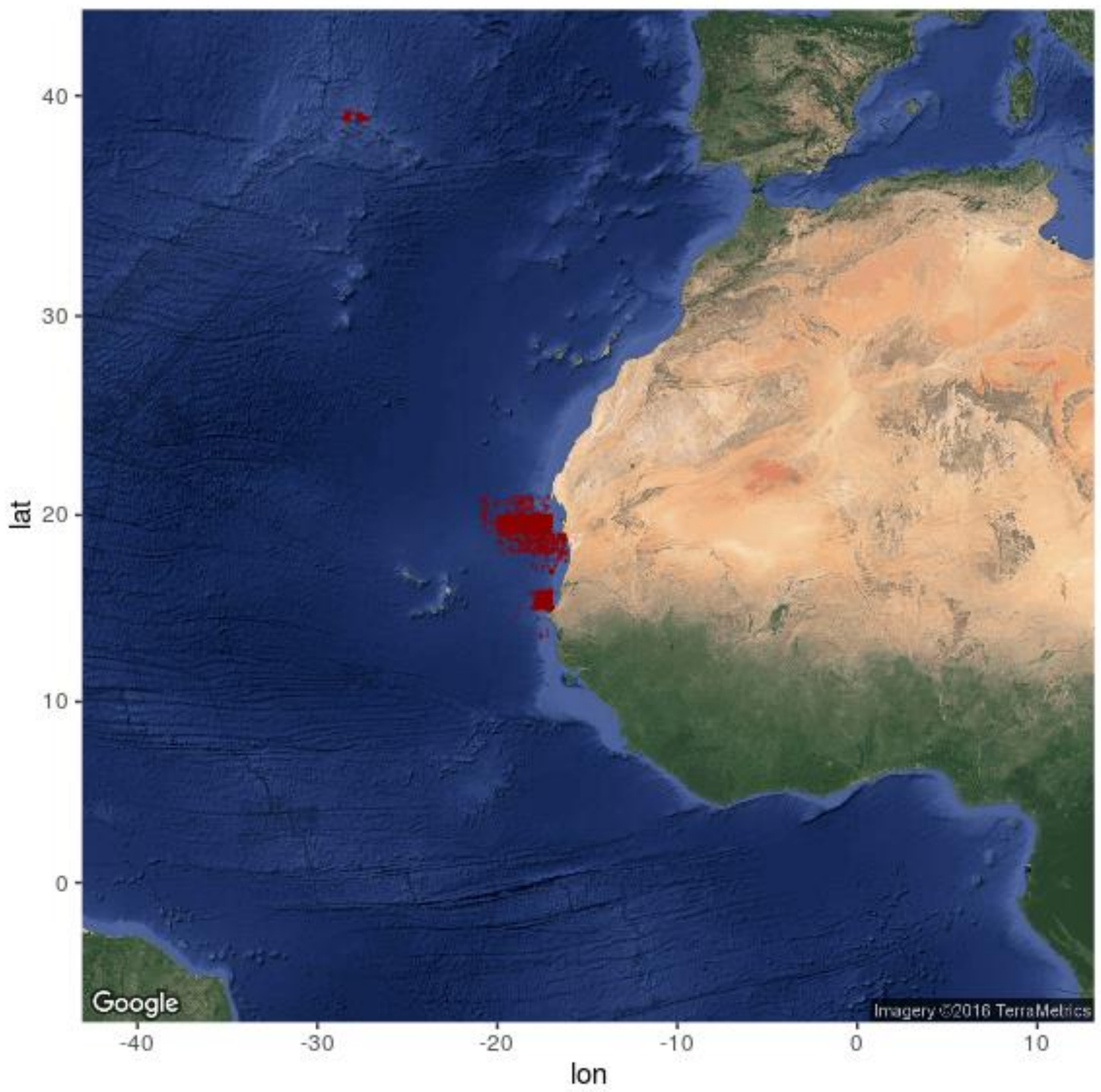


Figure 2. Spatial distribution of tropical tuna recovered by AOTTP between July and September 2016.

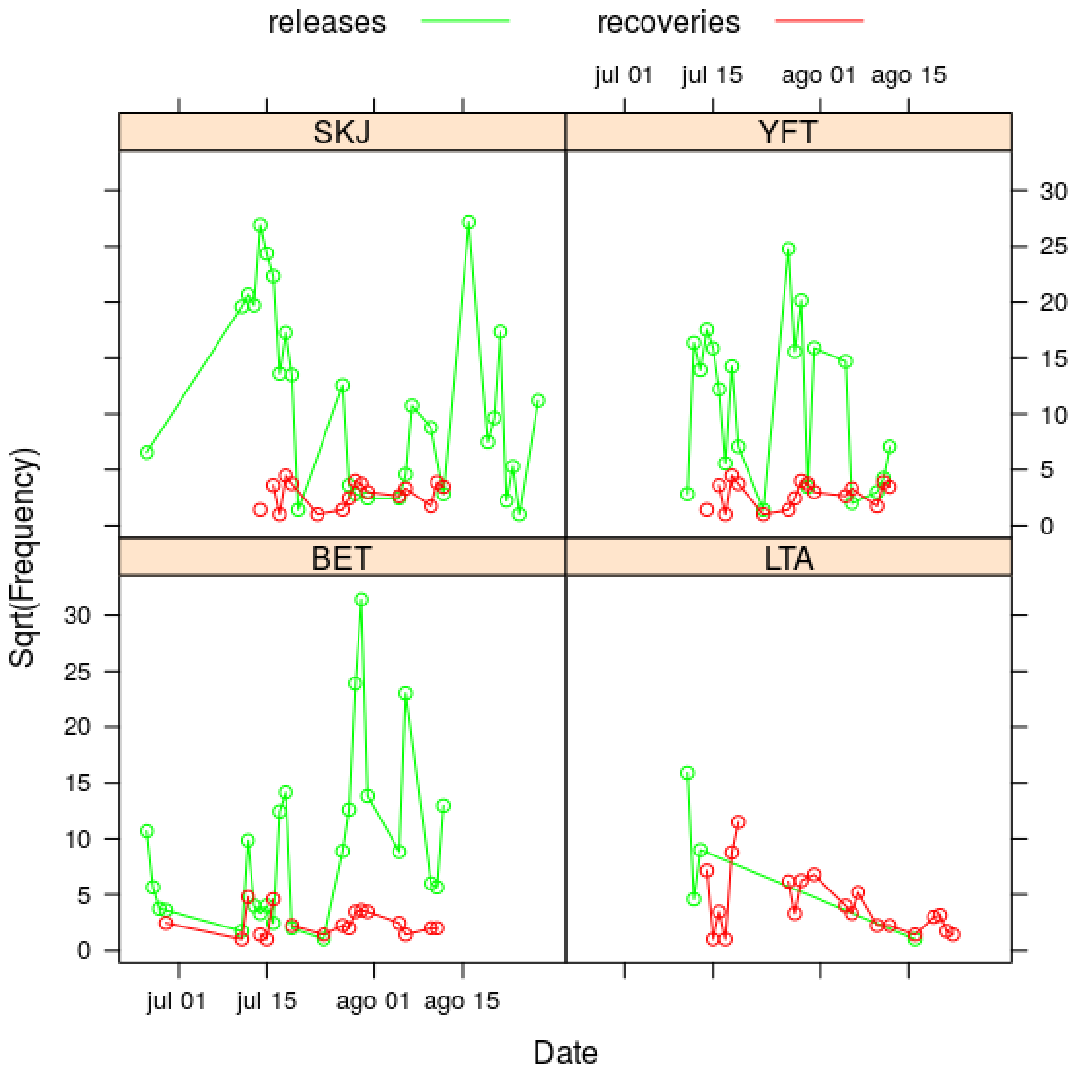


Figure 3. Total AOTTP releases (green) and recoveries (red) over time.

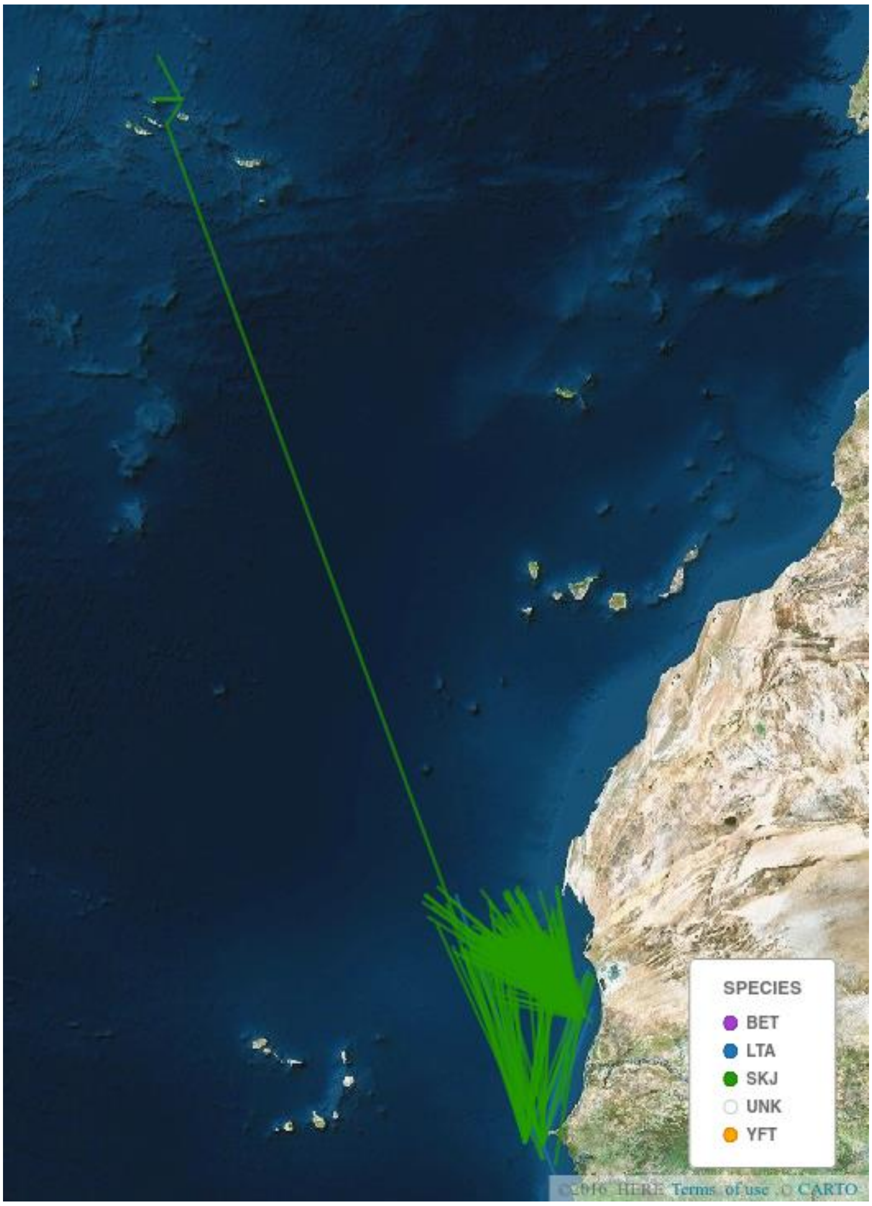


Figure 4. Map summarizing AOTTP skipjack movements.

Appendix 9

LIST OF STATISTICAL CORRESPONDENTS BY COUNTRY

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Canada	Melvin, Gary	gary.melvin@dfo-mpo.gc.ca
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Appendix 10

2016 REPORT OF THE SUB-COMMITTEE ON STATISTICS

(ICCAT Secretariat, 26-27 September 2016)

1. Opening, adoption of Agenda and meeting arrangements

The Sub-Committee on Statistics met at the ICCAT Secretariat (Madrid, Spain) on 26-27 September 2016. The ICCAT Executive Secretary, Mr. Driss Meski, 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. Mr. Meski noted that such assistance is provided following the rules of procedure established by the SCRS and the Commission. The meeting was chaired by Dr. Guillermo Diaz (USA) while Dr. Alex Hanke (CAN) served as rapporteur. The Agenda was discussed, accepted and adopted as modified by the Sub-Committee.

2. Review of fisheries and biological data (new and historical revisions) submitted during 2016

The Secretariat presented information contained in the 2016 Secretariat Report on Statistics and Coordination of Research (SCI_008) related to fisheries and biological data submitted for 2015 including revisions to historical data.

The activities and information included in this report refer to the period between 1 December 2015 and 16 September 2016 (the reporting period). All the basic fisheries, biological statistics and data compliance related information have been presented by the Secretariat to the SCRS Working Groups during SCRS inter-sessional and species 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 2015 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 in a total of 74 flags (from 50 CP's & 4 NCC's: 48 CP's + 18 EU members + 4 UK-OT members + 4 NCCs) with possibly reporting obligations. The forms submitted with errors that the Secretariat was unable to correct were considered unreported data.

2.1 Task I (nominal catches and fleet characteristics)

The Secretariat presented 2015 data reporting status (Table 1 and 2 of SCI_008) of the two datasets of Task I statistics (T1FC: fleet characteristics; T1NC: nominal catches). Overall, the results of applying the filter to accept/reject the data reported in forms ST01-T1FC and ST02-T1NC have improved compared to last year. For T1FC, 50 flags (68% of 74 flags) did report with 37 submissions in time, 7 after the deadline, and 6 flags reporting no fishing activities. Of all the submissions, five of them required some corrections to be made by the Secretariat to pass the filter and be incorporated to the ICCAT-DB. At the end of the reporting period, 24 submissions were still pending (either they were not submitted or did not pass the filter).

The T1NC dataset was presented by major ICCAT species (major tunas, major sharks, and, any of the 13 small tuna species and dolphin fish). The reporting status shows that 59 flags (80% of 74 flags) did report data for some or all the species in good condition (55 timely and 4 after the deadline). The data submitted from 12 flags required corrections the Secretariat at considerable expense of staff time and effort and these submissions were accepted and incorporated into the ICCAT DB. Six CPCs reported no fishing activity during 2015, and at the end of the reporting period there were still 15 pending submissions.

2.2 Task II (catch & effort and size samples)

The 2015 data related report cards of the two datasets of Task II statistics (T2CE: catch & effort; T2SZ: size samples) were also presented (Table 3 and 4 of SCI_008). The reporting status of Task II, after applying the filtering criteria agreed by SCRS in 2013, shows much better results for T2CE than for T2SZ datasets which was a reverse of the trend observed for the 2014 data. In general, those datasets have poor (less information) reporting ratios than for Task I. Both T2CE and T2SZ datasets are analyzed by major ICCAT species (major tunas, major sharks, and, any of the 13 small tuna species and dolphin fish).

The T2CE dataset reporting status shows that 47 flags (64% of the total) reported data (40 timely and 7 after the deadline). The data from five flags required corrections by the Secretariat (that resulted in a significant time and effort by Secretariat's staff) to pass the filter and be incorporated into the ICCAT-DB. Six CPCs reported no fishing activities for 2015 and 27 submissions were still pending at the end of the reporting period.

On the other hand, T2SZ dataset reporting status shows that only 36 flags (49% of 74 flags) reported data for all the species in good conditions (29 on time and 7 after the deadline). Data from 7 flags that did not initially pass the filter required corrections by the Secretariat in order to be included into the ICCAT-DB. Six CPCs reported no fishing activities for 2015 and by the end of the reporting period there were still 38 pending submissions.

The Sub-committee acknowledged the improvements made in the reporting of Task I and II data, in particular with respect to complying with the data submission deadline of 31 July and properly using the eForms which resulted in an increase in the number of submissions passing filter 1. However, the Sub-committee also expressed its concern that the number of CPCs reporting T2SZ 1n 2016 showed a decline with respect to the previous year with only 36 flags (<50%) reporting these data.

2.3 Tagging

Electronic tagging

The laboratories conducting tagging campaigns with electronic tags (pop-up, archival, etc.) in the Convention area have informed the Secretariat of 153 releases 85 recoveries made in late 2015 and during 2016.

Conventional tagging

During 2014-2015, several Contracting Parties have reported tagging 3,827 fish with conventional ICCAT tags, and 339 recoveries (these data do not include deployments and recoveries by the ICCAT GBYP and AOTTP). As in previous years, the Secretariat provided conventional tags for tagging experiments to the ICCAT scientific community (individual scientists or research institutions of the CPCs). From September 2015 to September 2016, the Secretariat distributed 3,400 conventional tags, primarily under the tagging projects of the ICCAT GBYP and to various scientific institutions.

The Secretariat informed the Sub-committee that there is ongoing work to modify forms TG02 and TG03 to facilitate and standardized the reporting of tagging data. The Sub-committee indicated that the capability of downloading individual tag data from the web instead of having to download the entire data set is a desirable feature to develop as well.

2.4 ICCAT GBYP related data

The ICCAT GBYP Coordinator, Dr. Antonio Di Natale, provided the Sub-committee with a brief update on data activities related to the programme (SCRS/P/2016/069). Details on this information can be found in documents SCRS/2016/150 and SCRS/2016/192. In summary, the ICCAT GBYP Coordinator provided some statistics on trap data recovery activities for the period 1512-2009, longline data recovery during the Phase 6 of the programme, and also data recovered from the Canary Island fishery from the early 20th century. Statistics of tags deployed and recovered under the umbrella of the ICCAT GBYP were also provided together with an update of the weight of bluefin tuna reported as part of the Research Mortality Allowance.

2.5 ICCAT biometric relationships and other conversion factors, revision and update work plan

No new biometric relationships were presented to the Sub-committee. However, the Sub-committee was informed of the currently underway efforts to develop biometric relationships for the Mediterranean swordfish stock. In addition, the Sub-committee acknowledged and supported the recommendation by the SHK Working Group for National Scientists to develop biometric relationships for POR, BSH, and SMA caught in their fisheries and report the results to SCRS.

2.6 Other relevant statistics including newly submitted observer data

ST07-TRopSupVes

Form ST07-TropSupVes addressing Rec. 13-01, paragraph 2 was created to obtain information regarding support vessels and in particular for each support vessel, the number of days spent at sea, per 1° grid area, month and flag State and whether it was associated to purse seine/baitboat. In 2016, the Secretariat has received information from three CPCs.

ST08-FadsDep

In 2014, ST08-FadsDep was created and distributed in response to Rec. 13-01 par. 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 to include additional information pursuant to Rec. [15-01] including the number of beacons / buoys and average number of FADs followed and lost. In 2016, the Secretariat has received submissions from six CPCs.

ST09-NatObPrg

For the second year, the majority of by-catch data was requested to be submitted using the recently adopted ST09-NatObPrg forms. As these forms are significantly complex and require substantial work on the part of CPCs to complete, 2016 was considered a continuation of the trial period for the use of these forms which started in 2015. In addition, some modifications were made to the forms to correct any errors and in 2016 several new fields were added based on recommendations made by the ICCAT SCRS working groups. It is acknowledged that these forms will require ongoing revision based on feedback by the Sub-committee and comments provided by the Sub-committee on Ecosystems in 2016. The major revisions include simplifications to this complex form structure in order to facilitate an increased level of data submission. The revision of this form will thus continue in 2017.

For the reporting period, the Secretariat has received submissions using these new forms from 14 CPCs (an increase of 2 from 2015), although several forms were submitted with very little information. Information for 82 ICCAT by-catch and shark species were reported using the new forms. The majority of sea turtle and seabird information was submitted using these ST09-NatObPrg forms, although some countries submitted information separately using non-standard formats. It is recommended that this information is only submitted using the dedicated observer data collection forms as requested by the Secretariat. As it was planned that in 2016 the effect of the new mitigation measures on seabird by-catch (Rec. [11-09]) would be evaluated, additional information regarding seabird interactions was requested. This included historical information for the period 2010-2015 for nations fishing south of 25°S. The Secretariat received information on seabird interaction and release fate in the ST09-NatObPrg forms only, as was requested, although the response was generally poor and no historical data was provided.

The Sub-committee discussed how the very limited information submitted by CPCs with regard to their observer programmes using the form ST09 has significantly hampered the SCRS ability to provide response to the Commission on 3 relevant issues:

[Rec. 10-10] Paragraph 6

Beginning in 2012 and every three years thereafter SCRS shall:

a) report to the Commission on the coverage level achieved by each CPC by fishery;
b) provide the Commission with a summary of the data and information collected and reported pursuant to this Recommendation and any relevant findings associated with that data and information;

c) review the minimum standards established for CPC observer programmes as set out in this recommendation; and
d) make recommendations as necessary and appropriate on how to improve the effectiveness of observer programmes in order to meet the data needs of the Commission, including possible revisions to this Recommendation and/or with respect to implementation of these minimum standards by CPCs.

[Rec. 11-09] Paragraph 8

In 2015, the SCRS shall conduct another fishery impact assessment to evaluate the efficacy of these mitigation measures. Based on this fishery impact assessment, the SCRS shall make appropriate recommendations, if necessary, to the Commission on any modifications.

[Rec. 13-11] Paragraph 2

The SCRS shall continue to improve the ERA initiated for sea turtles in 2013 and shall advise the Commission on its plan for future sea turtle impact analyses at the 2014 meeting. Upon receipt of advice from the SCRS, the Commission shall consider additional measures to mitigate sea turtle by-catch in ICCAT fisheries, if necessary.

The Sub-committee discussed that the goal of the ST09 form is to report data from the National Observer Programmes including catch of target species and bycatch in weight and/or number of individuals; while the goal of ST02-T1NC form is for CPC to report total catches in weight including some bycatch. Therefore, the Sub-committee did not consider that, in general terms, these 2 forms consist in a duplication of reporting. However, the Secretariat indicated that in some cases, like the E-BFT farms observer programme, there might a duplication of data reporting that can confuse the Statistical Correspondents. As such, the Sub-committee recommended that the Secretariat explore cases where data reporting that includes using the ST09 might be duplicated and provide the Sub-committee with a recommendation.

The Sub-committee also endorsed the recommendation from the Sub-committee of Ecosystems to revise the ST09 forms to simplify it with the expectation that a form with less complexity can result in an increase number of submission. For that purpose, the Secretariat will work intersessional with interested National Scientists and SCRS officers to develop a proposal to be presented at the next meeting of the Sub-committee on Ecosystems.

ST10-PortSamp

In 2015, a tenth statistical data submission form (ST10-PortSamp) was created to compiled data and information collected from the sampling programme covered under Rec. [14-01, 15-01]. For the reporting period, submissions were received from four CPCs.

2.7 Development of web based tutorial for ICCAT data submission

The Secretariat presented the educational videos to the Sub-committee developed to help Statistical Correspondents to become more familiar with ICCAT data submission requirements and obligations, and how to fill the ST02-T1NC eForm. The Sub-committee was pleased with the videos and encouraged the Secretariat to continue developing these type of videos for other eForms. The Sub-committee also acknowledged and thanked the JCAP for the support provided in the development of these videos. The available videos can be downloaded following the link http://iccat.int/JCAP_videos/index_en.htm

3. Review of criteria applied to ICCAT statistics

3.1 Application of Filters 1 and 2 on data submission

The Secretariat updated the Sub-committee with the future plans to implement Filter 2 to the data submission. Currently, only Filter 1 is in place and Filter 2 is currently being tested with the expectation that it will start being applied in 2017. The Secretariat indicated that the majority of the problems related with no passing Filter 1 correspond to missing information in the header of the forms. Approximately, 50% of all files that didn't pass the filter were due to this problem which is easily fixed. It was also indicated that the field 'Content' (which indicates if the data submitted is new, or a partial or full revision) is not being consistently filled by CPCs which creates serious difficulties for the Secretariat. Results of applying Filter 1 to the data submitted in 2016 can be found in Sections 2.1 and 2.2

3.2 Changes to ICCAT Coding Systems

The Secretariat presented the Sub-committee with a proposal to update the ICCAT coding system. The proposal can be found in SCRS/P/2016/062. In summary, the Secretariat proposed the following:

i) There will not be any particular gear code assigned to identify a Recreational/Sport fishery. Instead, the field 'PortZone' in the T1NC form will be used to identify if catches from a particular gear correspond to a Commercial or Recreational gear. The Secretariat will take upon the task of updating the historical Task I data (specific proposed changes to be implemented in the short term).

ii) To change the current flag codes from an ISO3166-A3 format to ISO3166-A2 format. Under this change, for example, the current flag code for the United States will change from USA into US. In addition, the Secretariat indicated the need to modify fleet codes to reduce the number currently in use (480) and the length of the codes to be no more than 12 characters. The Secretariat indicated that it needs to contact individual CPCs to obtain their consents to proceed with these changes (specific proposed changes to be presented to SCRS in the near future).

iii) To adopt a standard convention for the naming of sampling areas. For example, for the Gulf of Mexico the name of the sampling area will start with the first two characters of the species code followed by the number '30' (YF30 for YFT, BE30 for BET, etc.). This proposal is to be presented to Species Working Groups for their review and adoption in 2017.

iv) To simplify the frequency type codes by deleting the code 'Age' and use only 'SFL' as the code for Straight Fork Length type. Currently, straight fork length can be reported as SFL or FL (proposal to be implemented in the short term).

v) To simplify the gear type codes by: deleting codes that are not being used such as SURF and FARM, deleting 10 gear codes that identify discards, combining some of the 13 gear codes used for longline and the 8 gear codes for purse seine (specific proposed changes to be presented to SCRS).

The Sub-committee thanked the Secretariat for the proposed changes in the ICCAT coding system and acknowledged that these changes should have been addressed by SCRS much sooner. The Sub-committee agreed with the timeline to implement or develop specific proposals for changing some of these codes.

4. Review of Secretariat yearly based fishery datasets estimations and dissemination

4.1 CATDIS

The CATDIS is yearly updated for the nine major tuna and tuna-like species. The Secretariat has updated these estimations (1950 to 2014) with all the new and revised statistics available until April 2016. This update also includes the full catch-and-effort revision made by Japan for the yellowfin tuna stock assessment. The ICCAT Statistical Bulletin Vol. 43(I)-2016, was based on those estimations.

4.2 CAS (catch-at-size) and CAA (catch-at-age)

Three new CAS estimations were made by the Secretariat during 2016. The yellowfin tuna (East and West regions) was fully updated with all the new information available (including the full revisions of Japan and Chinese Taipei) and enlarged back to the sixties (1960 to 2014). The Mediterranean swordfish stock CAS was also updated (1985 to 2015) to include the most recent years. And finally, the CAS of the two albacore Atlantic (ALB-N and ALB-S) stocks (simple update) where only the four most recent decades were updated (1975-2014). All these estimations were used, one way or another, in the respective stock assessment sessions.

4.3 Others

EFFDIS

Work on a short term EFFDIS contract was conducted in 2015. The objectives of the contract were to develop a robust statistical modelling approach to estimate overall Atlantic fishing effort, update the current EFFDIS estimations for longline gear (1950 to 2014) using the new approach, and develop an estimation procedure for purse seine. The Sub-committee on Ecosystems discussed the updated estimates provided for longline and purse seine fisheries during its 2016 meeting and several new suggestions were made for improvements. Most importantly, historical revisions in the ICCAT Task II database will be included in future EFFDIS estimations and estimates of error and uncertainty around the final EFFDIS estimates will be calculated.

5. Review of existing data submission and dissemination policies

5.1 Statistics reporting formats (e-FORMS) and deadlines

The Secretariat presented SCRS/P/2016/063 on current policies for data submission and data disseminations. The Sub-committee reminded CPCs that the deadline for submission of Task I and II data is 31 July of each year. Species Working Groups and Sub-committees can request CPCs to provide data for intersessional meetings prior to the deadline of 31 July; however these requests are not binding for compliance purposes. In summary, no changes to the data submission policy have been introduced since 2015. However, the Sub-committee encourages CPCs to report their Task I and II data in advance of the 31 July deadline to provide the Secretariat more time to process the data and request potential corrections when needed.

5.2 New eForm to report zero catches

The Secretariat reported on the use of the new sub-form ST02B for the form ST02-T1NC to report zero catches (Table 8c in SCI_008). The Sub-committee was very pleased with the results of using this new form to report zero catches which allow the Commission to better implement Rec. [11-15].

5.3 Other related matters

It was clear to the Sub-committee that there is a need to review and update the data dissemination policy to help the Secretariat to better manage the large number of data requests it receives every year. In addition, the Sub-committee also discussed the current rules for the use of the OwnCloud has now been used for two 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.

However, discussions on these issues during the meeting showed that this is a complex issue that requires careful review and consultations to develop a meaningful and well thought proposal. As such, the Sub-committee agreed to proceed with the following plan:

1. The current policy of not dissemination of newly reported Task I and II data until such data is reviewed and approved by the Species Groups and SCRS will remain in place.

2. The current policy of giving access to the data uploaded into the cloud for the intersessional meetings to only those that have registered for the meeting will also remain in place. The Sub-committee indicated that registered participants will be able to access the data even if for some reason they do not attend the meeting.

3. It was noted that folders in the OwnCloud are protected with read only access after the relevant meeting has finished, and folders remain as such until the end of the calendar year. At the end of the calendar year, all meetings for the past year are stored in a separate 'historic' OwnCloud folder (i.e. still potentially accessible to all). Details to access this historic folder have been provided on a case by case basis upon request. The Sub-committee agree that this practice will also remain in place.

4. The Secretariat will work intersesionally with the SCRS Chair, Chairs of the two sub-committees, and Rapporteurs 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 Working Group on Stock Assessment Methods (WGSAM) for its early consideration and discussion by SCRS.

6. Evaluation of data deficiencies pursuant to [Rec. 05-09]

6.1 Current data catalogues of major species by stock

The Secretariat presented both, the 2015 report cards (SCI_008, Tables 1 to 4) and the data catalogues (1995 to 2015 period) for major ICCAT species (SCI_008, Appendix 1). In both cases, this year those tables also include small tunas (small tuna catalogues published in the report of the 2016 Small tuna intersessional meeting). 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 2017.

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 expressed particular concerns regarding the very limited data that 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.

7. Review of ICCAT-DB (ICCAT relational database system)

The Secretariat described (SCRS/P/2016/064) the current status of the ICCAT-DB, the progress made during the last year in both technical (improvements, finalised and ongoing projects associated, requirements for the future, etc.), and documentation aspects. Overall, this Sub-committee expressed its satisfaction and congratulated the Secretariat for all the achievements and effort dedicated to improve continuously such an important data management system. From the large list presented only the most notable ones are here described.

7.1 Progress made and future plans

The ICCAT "vessels registry" automatic synchronization with the CLAV and eBCD systems was completed (working since February 2016 with updates on a daily basis). The first year of the Java migration project (February 2015 to January 2016) was also completed with all the planned projects (migration to JAVA of 12 VBA front-end applications, 2 new databases managing data arriving in forms ST06 and ST09) finalised. Various improvements were made to various databases (structural changes, optimization, refinements, etc.), like the module that manages the "zero" catch submissions (sub-form ST02B, a Commission request), the module to manage the small scale vessels (sub-form ST01B, a Commission request). Several improvements/redesign to/of some SQL code were carried out to improve various estimations (examples: more flexible SQL scripts for, CATDIS and CAS estimations, species catalogues extractions, year report cards). All the statistical (ST) electronic forms were also updated (version: 2016a) with all the 2015 SCRS requirements.

Under the second year of the "JavaMig" project (started in March 2016), the first version of the "unattended data integration framework" to automatically read/validate/integrate forms of type "ST" (only forms ST01 to ST06, for now) in ICCAT-DB was finalised. Nevertheless, it needs some additional work (tuning and testing). The Secretariat informed that, nearly 30% of "ST" forms received during 2016 were already processed using this new software. The respective documentation (user guides and technical material) is a work in progress.

The Secretariat also made some progress on the ICCAT GIS system, geo-referencing (shapefiles) the recently adopted ICCAT sampling areas. This is an ongoing (not priority) project and still has behind much to evolved over time.

The Secretariat also dedicated a reasonable amount of time improving the ICCAT-DB content, identifying data gaps and problematic datasets for posterior revision by the respective CPCs. This data quality (screening, harmonisation and completeness processes) improvement work, started three years ago (see SCI_008 for details) by the Secretariat as a continuous data recovery and improvement task. All its outcome has been used by the SCRS.

7.2 Status of the code migration (VBA to JAVA) project

All the planned projects were finalised, including the documentation (application user manuals, and JAVA code technical documentation - "javadocs").

7.3 Advances on ICCAT-DB documentation (user guides & reference manuals)

The study aiming to integrate all the ICCAT-DB related documents (databases, reference manuals, user guides, "javadocs", specific articles, etc.) in a web based content framework, was finalised during 2016. In addition, progress was made writing the content (now a continuous & high priority task). An example it is the complete re-writing of the ICCAT sampling areas, published as an article (http://www.iccat.int/Data/ICCAT_maps.pdf).

7.4 Status of the ICCAT cloud infrastructure

The cloud infrastructure (4 cloud servers deployed) has continued to support much of the work of the Secretariat, namely the ICCAT-DB documentation work, the ICCAT cloud computing services (RStudio server, Shiny, statistical data publishing tests, etc.) and recently the development of the web-forms prototype (an important piece of the future ICCAT web-based data reporting dashboard). It is now, a key infrastructure to ICCAT.

8. National and international statistical activities

8.1 International and inter-agency coordination and planning (FAO, CLAV, CWP, FIRMS)

Coordinated Working Group on Fishery Statistics (CWP)

Due to scheduling conflicts between SCRS intersessional meetings and the CWP meeting, no Secretariat staff was able to attend the CWP meeting in 2016.

Monitoring system for fishery resources (FIRMS)

In 2016, the Secretariat updated the species identification sheets for bigeye tuna and north and south blue shark populations which were assessed by the SCRS in 2015.

ASFA

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 tome 1 and 2 of Volume 68 and Volume 67 of the *ICCAT Collective Volume of Scientific Papers*.

iMarine

The iMarine initiative is an open and collaborative initiative aimed at supporting the implementation of the Ecosystem Approach to fisheries management and the conservation of living marine resources. The Secretariat attended an online seminar entitled iMarine Support to Tuna Atlas; From scattered Data to integrated Indicators and SmartForms prototype for Mobile Data Collection of on-Board Scientific Observers Data. The Secretariat remains a member of the iMarine extended board.

CITES

In 2016 ICCAT and CITES collaborated in order to conduct a training course for field workers, scientists and data managers from the West Africa region (in English, French and Spanish simultaneously). Training covered issues such as Species identification, including the provision of ID cards, biological and fisheries sampling techniques, data reporting requirements and implementation of CITES shark listings on Appendix II.

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.

ICES

It has been agreed therefore 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. The Secretariat attended the 2016 ICES Woking group on Sharks (WKSHARKS Lisbon Portugal, Jan 19-21 2016) providing a summary of the ICCAT data on elasmobranchs including catches, fishing effort, size and tagging information.

9. Report on data improvement and data recovery activities

9.1 Data recovery activities

Table 8a of SCI_008 show those historical revisions of T1NC data that were approved by SCRS and were already included in the ICCAT-DB. The recovered data are from six different CPCs. The majority of the data correspond to catches of tropical tunas, but also some information on shark landings and sailfish were part of the revision effort.

Table 8b of SCI_008 show T1NC data that have not yet been integrated into the ICCAT-DB and, still require review and approval by SCRS. These data include catches from 3 CPCs for ALB, YFT, BET, SKJ, and LTA.

Table 9 of SCI_008 show the revision of Task II historical catch and effort data provided by three CPCs. Most noticeable is the revision made by Japan for the period 1968-2011. These historical revisions have been approved by SCRS and incorporated into the ICCAT-DB.

Table 10 of SCI_008 summarized the revisions made to Task II size data that have already been approved by SCRS and incorporated into the ICCAT-DB. These revisions corresponded to a variety of gears, but the majority were for PS and BB and for tropical tunas and small tunas.

9.2 National data collection systems and improvements

Document SCRS/2016/191 provided information about the National Observer Programme of Venezuela for its industrial fleet targeting tunas in the Caribbean Sea and Atlantic Ocean in 2015. The National Observer Programme is directed towards the Venezuelan industrial fishing fleet which operates in the Caribbean and the Atlantic Ocean, aimed at collecting information for control and the establishment of policies and regulations that guarantee the sustainable utilisation of fishery resources. The fishing fleets monitored by this programme target tropical tunas and catch other highly migratory fish such as billfish, sharks, among others; with the use of different fishing gear such as purse seine, baitboat and longline. During 2015, the programme monitored nine fishing trips with a total of 276 days onboard, representing 2.24% coverage of all the fishing trips and a 2.71% of the total number of days at sea. Of these, there were seven longline vessels, of which 99 sets were registered whereby 81,025 hooks were used. A total of 2,342 fish were caught, of which the tuna species were the most representative group amounting to 1,380 fish (58.92%), followed by other fish species accounting for 398 specimens (16.99%), 351 billfish (14.99%), 72 sharks (3.07%), 16 swordfish (0.68%), three turtles (0.13%), 119 stingrays (5.08%), 1 devil ray (0.04%) and 1 manta ray (0.04%). A vessel was monitored in the purse seine fleet, where no sets were registered, therefore there were no catches although an adult mammal was observed. A trip was monitored in the baitboat fleet where 19 sets were observed, including 324 hooks and a total catch of 4,079 fish. In this trip, yellowfin was the most important species observed with 2,782 specimens (66.88%), followed by skipjack, including 1,182 fish (28.98%) and blackfin fish including 169 specimens (4.147%).

The Sub-committee noted that the observer coverage was below the target of 5% and learned that this had occurred because of administrative issues. This caused the coverage to be unrepresentative of the temporal pattern of the fisheries however in general it was felt that 5% coverage would generally return representative spatial and temporal coverage. It was also noted that observers reported on all sets conducted during a trip and not a subset.

9.3 Proposals for data recovery plans and improvements on data collections systems

Document SCRS/2016/181 *e-eye plus: electronic monitoring trial for tropical tuna purse seiners*

Electronic Eye (EE) Plus is an electronic monitoring system based on the automatic photo taking, developed by Marine Instruments S.A. This system is an updated version of the first EE, which has been adapted to the actual monitoring necessities of the tropical tuna purse seine fleet. The overall objective of this study was to test the use of EE Plus on tropical tuna purse seiners, and determine its effectiveness to reliably document fishing effort, set-type, catch by set, and to verify "best practices" implementation, understood as the correct handling of the by-catch and the utilization of non-entangling FADs (Fishing Aggregation Devices). To achieve these objectives, EE Plus and an experienced observer were deployed simultaneously on a complete fishing trip for later comparison of the collected data. Results showed that EE Plus is a valid tool to monitor most of the data needs without significant differences compared to human observers.

Document SCRS/2016/180 presented minimum Standards for the implementation of electronic monitoring systems (EMS) for the tropical tuna purse seine fleet. On the basis of experience gained during many trial studies of EMS on-board purse seine vessels, this document presented a series of proposed standards for the use of EMS to monitor these fisheries. The authors recommended that ICCAT SCRS consider these draft standards in order to facilitate the use of this technology in the Atlantic Ocean. Both human observers and EMSs are complementary each with their own weaknesses and strengths. EMSs are still limited to a purely scientific monitoring program, covering most observers' tasks. However, EMS is valuable for vessels where it is difficult to place an observer onboard or to increase the coverage achieved by human observers.

In 2014, SCRS recommended the adoption of minimum standards for the use of EMS to report and analyze more timely and reliable data from fishing activities onboard tuna surface fleets most especially purse seiners. The Sub-committee also recommended in 2014 that a task group should provide additional advice on this topic. However, such task force was never created. The collaborative work presented in this document offers an appropriate response to this request.

The Sub-committee considered the capabilities provided by electronic monitoring systems, and discussed that it was important to establish the minimum standards that would provide useful scientific information. In particular, given that the system was implemented on purse seine operations, the Sub-committee recommended that the Tropical tuna Working Group review this information. It was noted that a review of the protocols used in the processing of the video streams would assist with this evaluation. Further, it was recognized that it is an important tool for monitoring the fishing operations, type of set, total catch per set, by-catch, discards, FAD deployments and FAD characteristics. EMS could not replace human observers in terms of their ability to identify species that are similar in appearance and in their role as spokes people for science and sample gathering ability. Thus, EMS should be understood as a complement to human observers rather than a substitute. Questions were raised regarding the difference between the observed data and post processing accounting of the catch and whether discrepancies could be attributed to an observer effect. As well, clarification was requested on whether there was a net reduction in effort using the video system. It was noted that in addition to the hardware, as part of the minimum standards described, the EMS should provide a dedicated software to facilitate the review of images in an effective and efficient way. This software should allow the analysis of all the stored data, images and sensor data in a synchronized way, performing all analyses and reporting in an efficient way. Based on the experience from different pilot projects, time for analysing data could be reduced by up to 1/5. The Sub-committee expressed some reservations in regard to the additional data that the system could collect, privacy issues, and the reaction of fishers if the system was used for both compliance and scientific purposes. It was noted that the use of the electronic monitoring systems in purse seine vessels is not mandatory in ICCAT, which raises questions about adopting minimum standards for a system that is only used at this stage on a voluntary basis. It was discussed that the information generated by the tool could be dealt with in the same way as non-video observer data.

In conclusion, the Sub-committee recommends that the minimum standards for purse seine vessels proposed in this document be considered to ensure that EMS data is most useful to the SCRS. However, the Sub-committee reiterates that the Tropical tunas Working Group should also review this information to provide advice to SCRS during plenary meeting. It is important that SCRS during its deliberations on this issue takes into consideration the following aspects of the proposed minimum standards:

i) The use of EMS is not a mandate of ICCAT, but rather are part of industry initiatives to use EMS as a complement for their data and compliance obligations as well as for their own reasons (safety at sea, industry best practices for by-catch). As such, the Sub-committee wondered of the utility of recommending minimum standards for a system that is used only on a voluntary basis in ICCAT purse seine fisheries. Nevertheless, adopting minimum standards would make valuable observer information that is already being generated available to SCRS.

ii) EMS are not meant to substitute scientific observers. Both human observers and EMSs are complementary to each other, with their own weaknesses and strengths. EMS is still limited, especially for the collection of biological samples. However, it could be valuable for vessels where it is difficult to place an observer, or to increase the coverage achieved by human observers.

iii) Because of their potential for collecting data related to compliance, the use of these systems by certain fleets may result in reduced confidence and/or interest in scientific observer programs.

iv) EMS can collect many data elements as well as human observers and in some cases more effectively. These systems can therefore increase the amount of data collected about fishing operations.

v) The Commission has yet to recommend that EMS data be reported to ICCAT. Further, SCRS hasn't discussed or adopted the format and mechanism for the reporting of EMS data, and the Secretariat still has to evaluate the resources needed to maintain and incorporate these data into the ICCAT-DB. These are essential tasks for SCRS and the Secretariat before EMS data can be made available to SCRS.

Document SCRS/2016/202 presented a global database and common tool box for tuna fisheries. Assessing the status of tuna and tuna-like populations for providing management advice requires the analysis of multiple data sets collected by the contracting parties and cooperating non-contracting parties of Tuna Regional Fisheries Management Organizations (tRFMOs) Conventions. Data on the magnitude and composition of landings, discards, and fishing effort are currently managed at basin scale by the Secretariats of the tRFMOs. Consequently, data formats and reference codes have evolved rather independently despite some links with the FAO Coordinating Working Party on Fishery Statistics. A global harmonized database for tuna fisheries data by collating the public domain datasets (total catch, monthly-spatially aggregated catch and effort, and catch at size) from ICCAT, IOTC, IATTC and WCPFC was developed. The database currently covers the period 1919-2014 and is freely accessible online along with a set of open source codes (a "toolbox") to handle the data, i.e. transform the data formats, load the standardized data into the database, and compute a suite of indicators (e.g. global maps of catch). The use of harmonized coding systems and standard nomenclatures is critical to simplify data exchange and dissemination, resulting in benefits for the scientific community and *in fine* for the conservation of healthy stocks. The objective is to propose a core of services to format and exchange tuna fisheries data and indicators, and promote standards for metadata and data formats to facilitate the access to the data through web-based tools. Over the coming years, this toolbox will be enriched with additional contributions by the community of users through a collaborative web site. Among others, the expected benefits of the project are the promotion of communication towards tRFMOs and their member States as well as to the general public.

The Sub-committee was supportive of the initiative to combine the catch and effort data from the five tRFMOs and noted how much more quickly one can produce global scale indicators. It was noted that the toolbox could show important changes in selectivity or global shifts in effort by flag and it was recommended that the database be expanded to include tagging, life history and size data. Continued collaboration was recommended however in reality the Secretariat has very little time to devote to this project. Several concerns were expressed namely a) that the data used in assessments match the data in the global database, b) that guidelines exist limiting the estimations and c) that much of the Task II data is kept secret.

Document SCRS/2016/194 presented a project to improve artisanal and semi-industrial fisheries data through a pilot experiment on the gillnet fishery in Abidjan. A low coast GPS was developed by a student in the framework of his engineer training to solve a common data acquisition problem faced by scientists, fishermen and fishery managers in the majority of African coastal countries. A pilot test was done on a single artisanal pirogue during five consecutive trips. The results obtained were clearly positives and can surely help for improving artisanal and semi-industrial fisheries data. The document pointed out to some technical issues that were not considered during the first step of this work. However, many positive perspectives were unlighted by the authors. Going forward in artisanal and semi-industrial spatial and temporal data improvement is now totally possible. The implication of coastal countries administrations and RFMOs can help for setting a simple geographical information system for the management of artisanal and semi-industrial fisheries.

Recognizing the utility of the GPS systems mounted on pirogues that fish the coast of the Côte d'Ivoire, there was interest in whether it would be possible to monitor fishing activities from all landing points and the extent of the species composition information. It was acknowledged that the catch data was extensive, including total catch as well as species composition and size frequency data by landing area. It was also noted that the utility of the GPS systems extended beyond quantifying effort and location of catches but could also be used to pinpoint the location of AOTTP tag recoveries.

10. Consideration of recommendations from 2016 inter-sessional meetings

The following recommendations for statistics from the 2016 inter-sessional meetings were endorsed by the Sub-committee.

Yellowfin tuna

- After reviewing revisions to the Ghanaian catch statistics, it was noted that assuming homogenous species compositions and size distributions across broad areas and times could have large impacts on the estimated Ghanaian (and other) fisheries catch at size, especially considering that sampling protocols used in Ghana would permit finer scale time and area strata for constructing catch at size estimates. It was further noted that the ongoing pilot study applying Electronic Monitoring Systems on board the Ghanaian purse seine vessels could well provide information for verifying total catches, species composition, and sizes of their purse seine catches. It was recommended that the Ghanaian scientists provide a review of the data available through the EMS project, comparing those data with the data coming from at-sea observers and port samplers for the 2017 SCRS.

- As significant unreported catches of tropical tunas have occurred and may occur off Liberia, the Group recommends an effort to quantify these unreported catches (e.g. with the utilization of the statistical documents of ICCAT of BET) [Recs. 03-13 and 14-01]. The Group also recommends an effort to be made to characterize the by-catch and recreational catches in those waters.

- Noting that the T2SZ LL series of Chinese Taipei for yellowfin between 1980 and 2005 lack a proper time (by trimester) and space (no squares of any type, and, only yellowfin major statistical areas or old sampling areas) and, thus, it also requires a proper revision. In consequence, the Group recommends that the ICCAT Secretariat requests from the Chinese Taipei statistical correspondent a revision of these series with the SCRS recommended format. The Group also requests that the Chinese Taipei statistical correspondent consider the changes in the length and age composition in the fishery that occurred for both bigeye and yellowfin around the years 2003-2005. These changes suggest a substantial change in selectivity of the fishery. However we request confirmation that this was, indeed, due to changes in selectivity and not due to changes in the reporting or data collection.

Small Tunas

- The Group recommends that, the Secretariat contact the Statistical Correspondent and/or national scientists aiming to revise, update, and complete their small tuna T1NC series. 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 Group recommends that the Secretariat contact the Statistical Correspondent and/or national scientists of CPCs with 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, 5 cm, 1 kg, 2 kg, 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 2SZ 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).

- The Group recommends that CPCs report frigate tuna catches (FRI, *Auxis thazard*) in the Mediterranean as bullet tuna (BLT, *Auxis rochei*) because the most recent published genetic studies indicate that FRI do not exist in the Mediterranean.

- 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 tuna

- The Group recommended that the Secretariat contact Chinese Taipei to obtain the revised actual size (T2SZ) by month and 5x5.

Billfish

- The Group continues to express concern regarding the quality and completeness of the Task I and II data. Therefore, the Group recommends that all CPCs report dead discards as well as complete landings, and representative size samples from all their fisheries.

- The Group recommended that sailfish catches reported by Ghana be reviewed due to differences in time periods.

- The Sub-committee supports the determination made by the Sub-committee on Ecosystems that in order to populate an ecosystem based fisheries management framework with indicators representing the status of the assessed species that it would need the species Working Groups to provide the outputs from their base model runs. Preferably there would be a single base model and ideally these outputs would be provided to the Secretariat and kept in an easily accessible repository.

Mediterranean Swordfish

- 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 Group 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 Italian fisheries.

- Recently adopted management measures may have increased discard levels, therefore the Group noted that participating countries should improve their estimates of discards of juvenile swordfish, when applicable, and submit such information to the ICCAT Secretariat.

- The Group requested that Sub-committee on Statistics works in collaboration with the Mediterranean swordfish to evaluate the use of other methodologies in historical reconstructions for future Mediterranean swordfish stock assessments.

- The Group recommended mesopelagic longlines and traditional drifting surface longlines to be considered as different gears by the ICCAT Secretariat, and separate Task I and II series be developed in the future, and that CPCs report data using those different gear codes.

Sub-committee on Ecosystems

- The Sub-committee recommends that the ST09 observer data submission forms be revised to simplify the reporting requirements in order to facilitate increased submission of observer data. This should be done intersessionally through collaboration between CPC scientists and the Secretariat. This proposal along with suggestions for revising the forms is to be presented to the Sub-committee on statistics in 2016 after which a preliminary version will be presented to the Sub-committee on Ecosystems in 2017 for potential adoption by the SCRS later that year.

- The Sub-committee requests the Secretariat to initiate, as a priority, the recovery of Task II data, especially for more recent years in order to improve the information available for estimating the EFFDIS data crucial to ongoing seabird and sea turtle assessments.

- The Sub-committee recommends that the Secretariat should continue to revise and update longline and purse seine EFFDIS, though collaboration with CPCs to support the work of the Sub-committee on Ecosystems.

- The Sub-committee recommends that regional workshops should be held with the goal of recovering Task II and other information (e.g., sea turtle and seabird by-catch) on gillnet fisheries, from CPCs in which this method of fishing occurs. The Sub-committee recommends searching for sources of funding in order to conduct these workshops and that bycatch related issues be included in the agenda of the gillnet workshops.

11. Other matters

11.1 Review progress on prior year recommendations of the Sub-Committee on Statistics

The following recommendations were made by the Sub-committee in 2015:

- The Sub-committee reiterates that the species groups which have not yet done so should review the current values and elaborate a multi-annual work plan to update the biometric relationships and other conversion factors. The work plan should establish priorities by species. The Sub-committee acknowledged that substantial work has been conducted by the different species groups and more work is ongoing or plan for the near future.

- The Sub-committee urged the Tropical tunas species group to review and, if warranted, adopt the Secretariat's proposal to reduce the number of ICCAT Sampling Areas. The Sub-committee acknowledged that the Tropical tunas species group reviewed the Secretariat's proposal which was later adopted and are now in force.

- The Sub-committee reiterates the decision made by the SCRS that the Chairs of all the SCRS species groups and the Sub-committee on Ecosystems must attend the meeting of the Sub-committee on Statistics. The Sub-committee was pleased with the attendance to its meeting by the Chairs of all the SCRS species groups and the Sub-committee on Ecosystems.

- The Sub-committee recommends that the Shark species group develop a plan and a budget for shark Task I and II data recovery activities. This is an ongoing task for the Shark Working Group.

- The Sub-committee recommends that National Scientists review the results of the newly estimated EFFDIS to ensure accuracy. The Sub-committee recognized that more work is needed to fully update the EFFDIS and, therefore, such review has been postponed.

- It was recommended that the Secretariat and USA scientists work together to fully integrate the USA and ICCAT tagging databases. This work is ongoing.

12. Future plans and recommendations

- 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 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 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 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 Sub-committee request that CPCs with coastal gillnet fisheries make the effort to participate in the upcoming regional workshops aimed at collecting of gillnet data including historical data.

- 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 all the forms (which the adopted changes in the codinf system) can be used to submit statistics during 2017. The Sub-committee also reminds CPCs that the eForms with the Task I and II data should be emailed to stats_info@iccat.int (as is it indicated in the ICCAT Circular).

- 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.

- 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 developed their own revisions for a fishery that is multispecies in nature.

- The Sub-committee recommends that the Secretariat works 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.

2016/2017 Work plan

The work plan is included in **Appendix 12** of the 2016 SCRS Report.

13. Adoption of the report and closure

The Chair thanked the participants for their attendance to the meeting. The Chair also thanked Dr. Hanke for acting as rapporteur of the meeting and helping on the writing of the report. In the name of the Sub-committee, the Chair thanked the Secretariat staff for their continue support of the Sub-committee's work and acknowledged how difficult its work would be without the full assistance of the Secretariat.

Appendix 11

REPORT OF THE 2016 INTER-SESSIONAL MEETING OF THE SUB-COMMITTEE ON ECOSYSTEMS
(Madrid, Spain, 5-9 September 2016)

1. Opening, adoption of Agenda and meeting arrangements

The meeting was held at the ICCAT Secretariat, Madrid, from September 5 to 9, 2016. Mr. Driss Meski, ICCAT Executive Secretary, opened the meeting and welcomed participants. The Sub-Committee on Ecosystems Co-conveners, Dr. Kotaro Yokawa (Japan) and Dr. Alex Hanke (Canada) reiterated the ICCAT Executive Secretary's welcome. The Conveners then described the objectives and logistics of the meeting. The Agenda was adopted with several changes (**Appendix 1**).

The List of Participants is included in **Appendix 2**. The List of Documents presented at the meeting is attached as **Appendix 3**. The following participants served as rapporteurs:

Section	*Rapporteurs*
Items 1, 6, 9	P. de Bruyn
Item 2	M-J. Juan Jorda
Item 3, 5.	A. Hanke
Item 4, 7	G. Diaz
Item 8	A. Wolfaardt, B. Mulligan
Item 10	K. Yokawa, A. Hanke

2. Review the progress that has been made in implementing ecosystem based fisheries management and enhanced stock assessments.

Document SCRS/P/2016/046, entitled "Evaluation of Methods of Incorporating Oceanographic Indicators into Indices of Abundance for Stock Assessment: Project Overview and Progress" provided the progress on the building and use of the longline simulator model LLSIM. LLSIM is a computer programme to simulate longline catch data for highly migratory species. The spatial detail of the current version is for the Atlantic Ocean but other spatial features could be accommodated. The data simulations are designed to facilitate the analysis of the precision and accuracy of methods used to estimate population abundance from catch and effort data in fisheries assessments. The basic rationale is to generate controlled random data with sufficient realism so that strengths and weaknesses of alternative methods can be judged using known true values as a standard. The general case is that the number of hooks fished, other gear features, catch and general location of each set are known from real data. Population abundance and its distribution in space are unknown, and an accurate time series of abundance is the objective of the analysis. This model is being used to address the need for testing and validating various methods of including oceanographic data into the standardization of CPUE data as recommended by the Working Group on Stock Assessment Methods. It also addresses the recommendation made by the Sub- Committee on Ecosystems on how best to include environmental indicators into CPUE standardization. Progress was demonstrated on how temperature and dissolved oxygen data from the Community Earth System Model, version 1– Biogeochemistry [CESM1(BGC)] has now been incorporated into the model. This data was able to reproduce often used oceanographic indicators such as the Atlantic Multidecadal Oscillation (AMO), the Tropical North Atlantic Index (TNA) and the Atlantic Warm Pool (AWP). Progress was also demonstrated in building the gear and effort layers of the LLSIM model. A simulated fishery has been developed based loosely on the US longline fleet logbook data 1986-2010. At this stage of development the catchability of each of 131 gear types is being developed. Once this task is completed the Group should be able to distribute a simulated data set to one or more analysis groups for testing of various standardization methods. The results of this exercise will hopefully be ready for presentation at the 2017 Working Group on Stock Assessment Methods (WGSAM) meeting.

The author shared with the Sub-Committee a CPUE standardization exercise planned to be conducted in the 2017 WGSAM meeting. The exercise consists in providing to several groups of people with a set of CPUE time series that need to be standardized using environmental data and other factors, and post evaluating the different group approaches and methods and their effect on the CPUE standardization. During the CPUE standardization exercise, the different groups will not know in advance the time series of true abundance corresponding to the CPUE time series being analyzed. The objective is to evaluate whether current CPUE standardization practices used in ICCAT result in products that are close to the true abundance trends or not. The Sub-Committee raised several questions about the CPUE standardization exercise. The Sub-Committee wondered whether the assessment teams would be given the same starting environmental data sets or if instead they would need to compile them themselves since the different starting points could have an impact on the standardization exercise. The author pointed out that the whole exercise was not totally defined yet, but that the main objective was to provide to a group of people with CPUE time series that needed to be standardized together with environmental data and other common factors to evaluate the impact of the different standardization techniques and methods currently used. For example SST will be provided, which is a common environmental variable used in CPUE standardization exercises, yet the author pointed out that just because it is commonly available does not mean it should be the standard environmental parameter always used. There is a need to evaluate whether the common standard use of SST is good enough. The author highlighted that there is a clear need to evaluate whether the current practices in ICCAT of CPUE standardization without incorporation environmental information are working right or if there is value in adding environmental information to improve the CPUE standardization process. Perhaps the current practices and their outputs are close enough to the true abundance trends of the populations being analyzed and there is no need to complicate and extend the CPUE standardization process. To reiterate, the first thing is to test the performance of current practices and then move on from there.

It was also pointed out that the objective of the exercise is to define a standard practice for CPUE standardization, in this case, blue marlin is being used as an example, but any of the species could be used. The author reiterated that the objective of the study is not trying to reproduce the actual CPUEs of any species, that is not needed. The point is to create CPUE time series for which we know the true abundance trend of the studied population, and use it to test the performance of methods. We could also extend this tool to explore the effect of changing catchability over time due to technological improvements and measure the effect on the CPUEs.

The Sub-Committee noted that the study missed salinity as an important environmental variable to determine species distributions, and highlighted it could also be used to determine the habitat suitability index of species. It was raised by the author that an important future step is to validate the habitat suitability model predicted with the real distribution of the species.

The Sub-Committee discussed the overall value of using environmental data to standardize CPUE time series, and how often this type of analyses is used in the Species Working Groups. It was expressed that it is a current practice, perhaps not common enough. However, it was highlighted that it should be considered a priority and worth pursuing further.

Document SCRS/2016/175 entitled "Modelling the oceanic habitats of silky shark (*Carcharhinus falciformis*), implications for conservation and management" aimed to provide the first insights into the environmental preferences of silky sharks by modelling their abundance from observer data with a set of biotic and abiotic oceanographic factors, spatial-temporal terms and fishing operation variables. Investigating the relationship between abundance and environmental conditions is of primary importance for the correct management of marine species, especially highly migratory large pelagic species like silky sharks (*Carcharhinus falciformis*), a species that is currently ranked by the IUCN as near threatened or vulnerable, depending on the region. Tropical tuna purse seine vessels annually deploy thousands of drifting fish aggregating devices (FADs) to facilitate catching tuna. However, using these devices increases the by-catch rate compared with fishing free swimming schools, as well as other potential impacts on the ecosystem. This work considers Spanish observer data (IEO and AZTI database) from 2003 to 2015, and comprising ~7500 fishing sets for the Atlantic Ocean. Oceanographic data (SST, SST gradient, salinity, SSH, CHL, CHL gradient, oxygen, and current information such as speed, direction and kinetic energy) were downloaded and processed for the study period and area from the MyOcean- Copernicus EU consortium. Results provide information on the dynamics and hotspots of silky shark abundances as well as the most significant habitat preferences of the species. Models detected a significant relationship between seasonal upwelling events, mesoscale features and shark abundance and suggested strong interaction between productive systems and the spatial-temporal dynamics of sharks. This information could be used to assist t-RFMOs in the conservation and management of this vulnerable non-target species.

The Sub-Committee questioned how far away we are from using this type modeling approaches, prediction maps of habitat preferences and hotspots for species of by-catch to assist in fisheries management decisions. The Author pointed out that once the validation of the model is complete, it will be possible to provide annual prediction maps of habitat preferences for silky sharks which potentially could be more useful to provide management advice. The Sub-Committee discussed alternative ways of using the current data and suggested to explore the effect of inter-annual variability or other time frames on the habitat preferences of silky shark. Additionally, it was noted that very little is known about this species migrations and their feeding and reproductive areas which should clearly be linked to the distribution maps of the species. The Sub-Committee agreed there should be more work to link environmental data with the behaviour, ecological and habitat preferences of this species. The collection of biological samples and gonad data could complement the habitat preference study to elucidate if species are there for feeding and/or reproduction.

The Sub-Committee also highlighted the fact that the habitat preference maps are based on fishery dependent data which can have an impact on the resulting interpretation of the habitat preference maps. Yet, the author pointed that by collapsing all the fisheries observer data into one time frame and estimating habitat preferences by quarters, the fishing effort was relatively well distributed spatially and by quarter. Additionally, the author is exploring several methods to evaluate if fishing effort distribution is having an effect on the results. The author is also planning to expand these types of analyses to other by-catch species, and focus first on those species that are threatened, as well as including other by-catch and target species, with the objective of identifying habitat overlaps of species spatially and temporally and identify hotspot areas that can be predictable in space and time.

The Sub-Committee also discussed the fact that FADs might be modifying the natural habitat of silky sharks. Additionally, there might be several characteristics about the FAD operations such as their speed and location that might be changing the natural conditions, distribution and behavior of sharks. The study is currently accounting for some of these factors and it is encouraging that it was able to find a link between the spatial presence of sharks and major oceanographic features.

Document SCRS/2016/160 entitled "Aspects of The Migration, Seasonality and Habitat Use of Two Mid-Trophic Level Predators, Dolphinfish (*Coryphaena Hippurus*) and Wahoo (*Acanthocybium Solandri*). In The Pelagic Ecosystem of the Western Atlantic including the Sargasso Sea "provided information on aspects of the ecology of two mid-trophic level predators, dolphinfish *Coryphaena hippurus* and wahoo, *Acanthocybium solandri* in the western Atlantic including the Sargasso Sea. Both species are included in the ICCAT Small Tunas category and are taken principally as by-catch species by longline fisheries. However, they support important commercial and recreational line fisheries in the western Atlantic including the United States and the Caribbean. Both species play an important role in the pelagic ecosystem of the western Atlantic but both have been relatively little studied until recently. Studies show that there is a linkage between oceanography and the seasonality of fisheries landings of these two species and data from Bermuda, in the central Sargasso Sea, are provided as an example. Electronic (PSAT) tagging data has provided evidence of possible migration routes and lengthy residence times of dolphinfish in the Sargasso Sea. These PSAT data also provide important insights into habitat use and diel patterns of feeding in the water column. The evidence presented here shows both the importance of these two species in the overall ecosystem and the need to incorporate these and other species into any ecosystem-based management system for tuna and tuna-like species in the Sargasso Sea.

The Sub-Committee discussed whether there is enough knowledge to affirm that high sea pelagic ecosystems in the Atlantic Ocean are top-down or bottom up driven, and noted how little is known about the trophic ecology of apex predators and how climate and fishing affect the structure and function of the pelagic food web. A preliminary trophic web of the Sargasso Sea was presented to demonstrate the trophic positions in this pelagic ecosystem. It was pointed out that dolphin fish are food competitors with Yellowfin and Albacore tuna in the northern part of their range. The Sub-Committee affirmed that there is relatively little known about the trophic ecology of these species.

The Sub-Committee pointed out a recent paper by Olson *et al.* 2016 (Bioenergetics, trophic ecology and niche separation of tunas, advances in Marine Biology, in press) which discusses how the trophic ecology research of tunas in the Atlantic Ocean is much behind and has yet to provide much of the detail and knowledge that exists in the Pacific and Indian Oceans.

It was also recalled that currently the ICCAT Atlantic Tuna Tropical Tagging Program has a plan to tag wahoo in the Western Atlantic as recommended by the ICCAT Small tuna Working Group.

Additionally, the stock structure of these two species was briefly discussed. The literature suggests that Wahoo appear to comprise a single circumglobal population with little genetic differentiation between oceans and genetic studies of dolphinfish in the North Atlantic Ocean also indicate little population differentiation.

Document SCRS/P/2016/044 evaluates the progress of the five tuna RFMOs (tRFMO) in implementing Ecosystem-Based Fisheries Management (EBFM). Specifically it focuses on reviewing the ecological component, rather than the socio-economic and governance components of an EBFM approach. First it develops a benchmark Conceptual Ecological Model for what could be considered a "role model" of EBFM implementation in a tRFMO. Second, it develops a criteria to evaluate progress in applying EBFM against this benchmark role model. The evaluation assesses the progress of the following four ecological components: targeted species, by-catch species, ecosystem properties and trophic relationships, and habitats, and review 20 elements that ideally would make EBFM more operational. The review finds that many of the elements necessary for an operational EBFM are already present, yet they have been implemented in a patchy way, without a long term vision of what is to be achieved and a formalized plan implementation. In global terms, tuna RFMOs have made considerable progress within the ecological component of target species, moderate progress in the ecological component of by-catch, and little progress in the components of ecosystem properties and trophic relationships and habitats, although their overall performance varies across the ecological components. All the tuna RFMOs share the same challenges of coordinating effectively all ecosystem research activities and developing a formal mechanism to better integrate ecosystem considerations into management decisions and communicating them to the Commission. While tuna RFMOs are at the early stages of implementing EBFM, it is believed implementation should be seen as a step-wise adaptive process which should be supported with the best ecosystem science and an operational plan as a tool to set the path to advance towards its full implementation. With this comparative review of progress it is hoped to create discussion across the tuna RFMOs to inform the much needed development of operational EBFM plans.

The Sub-Committee was supportive of the assessment of the progress of tRFMOs to apply the principles of EBFM. It was emphasized that the intent was not to compare the progress among tRFMOs but to provide the feedback necessary to focus progress within each. Direct comparisons are also difficult because progress will vary due to the specific nature of the problems each tRFMO faces. Some tRFMOs were established before ecosystem principles were addressed in major international treaties and agreements, so more recently establish tRFMOs may have the advantage of having accommodated ecosystem considerations into their basic texts and throughout their administrative structure.

The list of specific actions that a tRFMO must respond to was large and it was recommended that the Sub-Committee prioritize these actions and review them against what has already been included in the SCRS Strategic Science Plan to see if any need to be included in the Groups workplan. It was noted that tRFMOs should collaborate on addressing the prioritized list so that there would be less duplication of effort and to coordinate mechanisms for communication within and between tRFMOs.

Consideration was given to the fact that certain goals of a tRFMO may not be within its capacity to achieve so expecting compliance with some minimum standard might not be possible. Thus mechanisms to increase work capacity within each RFMO are needed. In addition, collaboration with the other tRFMOs and intergovernmental organizations would facilitate progress.

There was some concern expressed over reference points for by-catch species because of their use in an assessment context suggested that many species would be without one. It was however noted that the term reference point has a different meaning and might require different estimation methods for each taxomic groups.

With respect to the reporting of results, there was a request that the success of the measures was represented to show progress relative to some starting point (within the current time period) rather than with an ideal tRFMO. It was noted that this was considered but too difficult to implement. It was noted that the role model RFMO might be difficult to achieve and instead it was highlighted that implementation should be seen as a step-wise adaptive process, evolutionary and not revolutionary, which should be supported with the best ecosystem science

3. Develop proposals for obtaining common Oceans ABNJ tuna project funding to support a joint meeting between tRFMOs on the implementation of the EBFM approach.

The Sub-committee reviewed an invitation sent to the five tRFMOs regarding their interest in participating in a joint meeting on the implementation of the EBFM approach. The invitation included the proposed agenda developed at the 2015 Sub-committee on Ecosystems meeting.

All invitees agreed to participate in a meeting scheduled for 12-14 December 2016 at FAO headquarters in Rome, Italy. A maximum of two attendees were identified by each tRFMO with ICCAT being represented by the SCRS Chair and a representative of the Secretariat.

4. Establish clear EBFM goals and objectives to be discussed and considered by the Commission.

An ecosystem based fisheries management framework was developed for the ICCAT convention area and populated using data sourced from Task II size data, Task II catch effort data, the ICCAT manual, FishBase and peer reviewed literature (SCRS/P/2016/047). The framework included 4 components from the Ecological dimension of the generic EBFM framework defined by Lodge *et al.* 2007. To this was added a monitoring component of the support system. A total of 27 species/stock elements were included in the Target Species component and 13 species plus generic seabird and sea turtle elements were included in the By-catch Species component. Only two habitat elements have been defined for the Habitat Component and one element within the Monitoring and Trophic Relationship components. The framework reveals both the potential to report on the status of the ecosystem within the ICCAT Convention area and problems that must be overcome to make the reporting complete, current, accurate and informative. Ideally, the framework requires a standardized reporting format for all Species Working Groups with database support for biomass and fishing mortality data as well as reference points and life history parameters. Continued efforts to populate the framework will involve work on data inputs, indicators, reference levels and management response for each element of the framework. Lastly, some thought must be given to how the framework's content should be reported and an effort must be initiated to hold workshops, engage experts, start a dialogue with the Species Working Groups, Commission and other tRFMOs with a view to advancing progress on the framework.

The Sub-committee discussed the appropriateness of the data sources proposed to develop the length and weight based indicators, such as the Task II data. Concern was expressed that these might not be the most appropriate data sources in all cases and that other sources of data should be investigated. For example, series of average weights are estimated by the Secretariat for some stocks for which assessments are conducted and those average weights are more representative than those estimated from the Task II Catch-and-Effort data. The Sub-committee recognized the difficulties in obtaining the time series of biomass and fishing mortality estimated in the course of stock assessments used as indicators in the EBFM framework because this information is rarely included in the stock assessment reports. It was pointed out that in the past the WGSAM recommended that time series of estimated B and F be included in the assessment reports. This recommendation from the WGSAM was adopted by the SCRS, but it has been mostly ignored by the Species Working Groups. However, the Sub-committee also recognized the difficulties that might arise providing this information when multiple model runs are performed during the stock assessments and there is no clear favorite. In these cases, the Species Working Groups are expected to select just one series of B and F to use as an ecosystem indicator with the caveat that these indicators were not considered to be optimal representatives of the status of a particular stock. The Sub-committee indicated that the proposed framework in its current format includes extensive fishery information in the Target species component of the framework, but limited elements in the Monitoring and Trophic relationships components. It was discussed that fishery information is already provided in stock assessment reports and Executive Summaries and the Sub-committee wondered if including such information in the framework is a duplication of effort. It was explained that indicators other than B and F could be provided for the target species to reduce the redundancy and that it was necessary to have these elements in place to be able to develop elements in the trophic relationships component. It was also discussed the need to clearly identify the target audience of the ecosystem report cards derived from this framework. The detailed content of the framework was thought to be useful for use by the SCRS to identify data and research needs and to measure progress. It was noted that the framework itself identifies the relationship between conceptual management objectives and the operational objective useful to science and that a more synthesized reporting of the framework would be more accessible to the Commission and other constituents. It was suggested that ecosystem report cards are an excellent tool to provide information and they are already being used by other RFMOs. These report cards can be updated on a regular basis to inform the Commission.

Other available tools are Ecosystem Risk Assessments that help to identify and quantify the importance of the different components of the ecosystem and their interactions where you can estimate the likelihood of an interaction occurring and their potential ecological and economic impact. Ecosystem Risk Assessments can also be used to identify what ecological and socioeconomic components should be tracked and to prioritize work. It was discussed that even though the Commission had embraced EBFM for ICCAT, the Commission still finds that it is challenging to understand the concept and the requirements for its implementation and that the SCRS should continue to work with the Commission to achieve a better understanding of EBFM. Similarly, the concept of EBFM has not been deeply discussed at the Species Working Groups. As such, the Sub-committee agreed that the Sub-committee on Ecosystems should reach out to the Species Working Groups and provide guidance on the best way to collaborate with this effort. The Sub-committee agreed that the framework will be helpful to develop products for the Commission to advance and better understand EBFM. It was discussed the need to develop some of these products in the near future as it is preferable to provide information to the Commission as we advance in our efforts rather than inform the Commission later in the process. The Sub-committee discussed that one approach to move forward is to develop a case study for a particular stock instead of for a particular ecosystem. In other words, it would be easier and perhaps faster to inform the Commission to conduct an assessment of a particular stock incorporating different aspects of the ecosystem (e.g., trophic relationships, environmental data) rather than developing a case study for the Gulf of Mexico or the Sargasso Sea. At the same time, the Sub-committee agreed on the difficulties and limitations associated to advancing this work when the Sub-committee on Ecosystems only meets once a year.

5. Assess research needs and prioritize research activities in order to develop a long term research plan

The Sub-committee reviewed SCRS/2016/170 which provided a long term work plan based on the elements of the SCRS Strategic Science Plan that pertained to Ecosystems. Discussion was then held in regard to the short term and long term objectives and the best way forward.

In a classic EBFM implementation framework, such as that proposed by Levin *et al.* (2009), the first step is to identify the goals and objectives, as these objectives are used to identify data gaps and guide the development of indicators, reference points and management actions. Consideration was given to involving the Commission in the process, however involving management bodies was recommended only once a clear vision of the EBFM framework and reporting format was available. Thus, given that the Sub-committee was also provided with an EBFM framework during the meeting (SCRS/P/2016/047), it was concluded that the most feasible path forward would be to focus on producing an Ecosystem Report Card based on the framework.

The Report Card and framework could be presented at the next Dialogue between Science and Managers Meeting in order to receive feedback on the proposed goals and objectives. The involvement of Species Working Groups in the design and support of the Report Card was also considered an important short term objective. Additional measures for engaging the Commission involved constructing a questionnaire where the responses would be the basis of an ecosystem risk assessment that would identify the Commissions management objectives.

The Sub-Committee determined that the following ecosystem related activities would be important to complete in the coming years with the full awareness of the other SCRS Working Groups:

Short Term

1. To develop an **Ecosystem Report Card** that will be reviewed by the Sub-committee on Ecosystems in 2017

   The purpose is:

   a) Synthesize and summarize multiple and complex information into a smaller number of grades and distinct ecosystem components.

b) Effectively communicate the status and trends of several ecosystem components to the Commission and other stakeholders.

c) Engage the Commission and other stakeholders

2. To request the Commission to include an agenda item in the next Dialogue Meeting between Scientists and Managers, regarding a continued discussion on EBFM.

   The purpose is:

   a) Present the Ecosystem Report Card and Ecosystem framework.

   b) Engage the Commission in the development of Ecosystem Report Card and Ecosystem framework.

   c) Increase awareness of the need to account for ecosystem consideration in fisheries management.

3. To implement new mechanisms or improve current mechanisms to effectively coordinate, integrate and communicate ecosystem-relevant research across the SCRS Working Groups.

   The process might include:

   a) Start discussions with other SCRS Species WG about providing those stock assessment data outputs in a standardized format in order to generate the indicators required for the EBFM framework.

   b) At each intersessional meeting of the Sub-committee on Ecosystems provide a report of the main outcomes from the previous year. For example:

      i. Summary of the main outcomes of the last Commission meeting relevant to the activities of the Sub-committee on Ecosystems. [Secretariat]

      ii. Summary of the main outcomes of the last annual SCRS meeting relevant to the activities of the Sub-committee on Ecosystems. [Chair]

      iii. Summary of relevant activities, outputs, initiatives derived from the other Working Groups relevant to the activities of the Sub-committee on Ecosystems. […]

Medium Term

1. Develop an **Ecosystem Considerations Report** (or Ecosystem Synthesis Report) and include it as part of the ICCAT Manual in a section on Ecosystems Based Fisheries Management.

   The purpose is:

   a) Synthesize and integrate information of the main ecosystem components, processes and interactions in the ICCAT ecosystem using existing analysis and reports to provide an understanding of the ecosystem context in which ICCAT fisheries operate.

   b) Provide a guidance document for the Sub-committee on Ecosystems, and ultimately a guidance document for the Commission to provide an ecosystem context for fisheries management decisions.

   c) Provide a living document where ecosystem research, research priorities (long and short), and data gaps are raised and used to updated the work programme on a year schedule.

2. Conduct an **Ecosystem Risk Assessment (ERA)** with the input and participation from the Commission.

The purpose is:

a) Use the ERA as a tool to (a) define potential relevant ecological, human and institutional interactions and (b) assess their likelihood of occurrence and magnitude of their impact (ecological or economic impact), in order to provide general guidance to the Commission about the interactions on which to focus further research and attention.

b) Provide guidance to the Commission from the ERA results, inform the Commission about what it is already doing to address the impacts and rank the risks identified.

c) Engage the Commission and increase awareness of the need to incorporate ecosystem consideration into decision making process.

6. Total effort estimates by fishery

6.1 Longline

6.1.1 Review Task II longline catch and effort data coverage

The Secretariat provided a brief overview of the availability of Task II data for use in the Effdis data estimations (**Table 1**). It was noted that only data provided in 1x1^{0} resolution and by month are suitable for the Effdis estimation. It was clear that many important/significant fishing fleets have not reported effort information at a sufficient resolution to facilitate Effdis estimation. The Sub-committee therefore recommended as a priority that this Task II data be recovered, especially for more recent years.

The importance of these data was highlighted by the fact that at least 70% of the total effort should be available in order to provide reliable extrapolations for the missing data. The Secretariat clarified that it is likely that less than 70% coverage has been obtained although this would need to be confirmed.

6.1.2 Review the methodology to be used to update the longline EFFDIS data

The contractor who produced the updated EFFDIS estimates in 2015 provided the Sub-committee with a brief summary of the assumptions and data used to conduct the estimation exercise. The full details of this work is provided in document Beare *et al.* 2016. The Sub-committee was then invited to request clarifications on several of the assumptions and issues with the data.

The Sub-committee acknowledged the utility of this information as well as its importance to the continued seabird and sea turtle work. The author noted several caveats with the data used for the estimations. In some cases the summed Task II data is higher than the Task I nominal catches. The Sub-committee clarified that in all cases the Task I data is considered more reliable and so should be the scaling factor. It was noted, however that where these types of conflicts exist, they should be flagged for future clarification with CPCs.

The Secretariat also clarified that there have been substantial revisions by some CPCs to the Task II CE database. These changes may have a significant impact on the Effdis estimations. The revision of the Task II data will be conducted prior to the 2016 SCRS plenary meeting at which stage these data can be provided to the author of the Effdis document in order to revise the estimations. It was also requested that the author provide estimates of error and uncertainty around the final Effdis estimates. In the short term this may be in the form of CVs around the estimates, but more complex solutions will be sought to provide a clearer picture of the uncertainty around these estimates. CPC scientists were encouraged to become involved in this process to ensure the best possible estimates of Effdis are obtained. It was stressed however, that the ongoing work using the Effdis data should not wait for the updated estimates and that the current available information is sufficient to advance the sea turtle and seabird evaluations. Once the new data is available, this can be incorporated in the future.

It was also suggested that there is a need to differentiate between the different types of longline fisheries in order to improve the Effdis estimations, but this will be conducted at a later stage.

6.2 Other gears

The Sub-committee was made aware of an ongoing EU effort to re-estimate and improve their purse seine effort data. This updated information should be used in future PS Effdis estimations. It was also suggested that future efforts should seek to separate free school and FAD fishing effort in order to improve the estimations.

The Sub-committee was reminded of a past recommendation to estimate Effdis for gillnet fisheries. The Secretariat clarified that there is insufficient Task II CE data to conduct this task. As such the Sub-committee recommended that regional workshops be held with the goal of recovering these data from the relevant CPCs directly.

7. Sea Turtles

SCRS/P/2016/045 showed that while ways to reduce sea turtle by-catch have been found, the other effective way of reducing the impact of such by-catch is reducing post-release mortality. This can be achieved by improving on-board handling, hook-removal and release techniques of captured animals. Since 2007 around 1,500 longline fishers, observers and fishery technicians have been trained in these techniques mainly in America and the Mediterranean Sea. Two factors are important when training fishermen: 1) the trainer must have ample experience working on board fishing vessels with turtles – someone who can answer fishermen's doubts and questions, who understands the variety of situations on board a fishing vessel and knows how to adapt to them. Only then will the trainer get the fishermen's attention and respect, and will they feel respected; 2) simply telling fishermen what to do or not to do is not enough; the reasons behind need to be explained – this type of training is about providing fishermen with knowledge to be able to decide what to do in each situation and to gain responsibility over their acts and decisions.

The following link provides a list of available training videos in the different languages:
www.youtube.com/playlist?list=PLvFm4k9xS1jpIpuWI-jltwRDrAC215x6C

In addition, very recently a new syndrome was diagnosed in the Mediterranean Sea in loggerhead and leatherback sea turtles captured by fishing nets (trawling, gill-net, trammel-net), which could greatly alter what we previously knew on post-release mortality of animals released by these fisheries, potentially increasing it by a large %: decompression sickness (DCS).

DCS happens when sea turtles diving at depth get stressed, which changes the normal metabolism of diving and allow nitrogen to be incorporated into the blood supply, and are forced to the surface by the fishing gear. It is still unknown at what minimum depth the animal has to be to suffer DCS, or for how long, but the problem probably arises from a combination of both, plus the degree of stress of the animal. Diagnosis so far has only been done at rescue centres, with a combination of clinical exam (animals arrive very depressed and after some hours become hyperactive, and suddenly die), US scan, radiography, CT scan and response to treatment (decompression chamber), or on freshly dead animals, and it seems that at least 50% of animals brought from trawlers in the Mediterranean during the winter present with this sickness.

The Sub-committee inquired how the effectiveness of training fishers in safe handling techniques can be assessed. There is no direct way to do so, but stranding data could help to make such assessment in some areas. The presenter indicated that attendance to the training sessions was voluntary and the fishers that attended these sessions were very interested in the issue and very willing to learn the safe handling techniques. The Sub-committee discussed the merits of ICCAT developing a poster with 'safe handling' techniques similar to what was produced for sea birds. Although there was discussion that not all techniques work in all fisheries or in all situations, there was a general agreement that there are some minimum standards that can be applied across all ICCAT longline fisheries (e.g., using a net to board sea turtles, cutting the line as close as the hook as possible).

The first of two joint-analysis workshop on the effectiveness of sea turtle mitigation measures in Pacific longline fisheries was held in Honolulu in February 2016 (www.wcpfc.int/node/27494 as WCPFC-2016-SC12/EB-WP-11). This ABNJ (Common Oceans) Tuna project sponsored workshop was attended by 31 participants from 14 countries from all three oceans, as well as invited IGOs and NGOs. The first workshop characterized current sea turtle interaction and mortality rates under existing fishing operations using observer data from a variety of sources representing over 2,300 turtles caught by 31 fleets between 1989-2015. There were three types of analyses undertaken for leatherback, loggerhead, green and olive ridley turtles: 1) estimating the effects of various operational variables on interaction rates at the set level; 2) estimating how turtle interaction rates vary by hook position within baskets; and 3) estimating the effects of various operational variables on turtle at-vessel mortality rates. Post-release mortality rates were not considered due to a lack of available information. In the first analysis, hook category (shape and size), bait species, hooks per basket, and soak time had the largest effect on set level interaction rates, with significant decreases in interaction rates with the use of large circle hooks and/or finfish bait. In the second analysis, interaction rates of olive ridley, loggerhead and green turtles with deep set longlines were highest for those hooks closest to floats. In the third analysis, at-vessel mortality rates were influenced by turtle species, with the lowest mortality rates for leatherback and loggerhead turtles, and increased mortality rates with increased fishing depths. Participants concluded that mitigation measures based on hook shape and size, bait species, and removal of the hooks nearest each float in deep longline sets should be priorities for further analysis. The workshop also generated preliminary species-specific maps of relative abundances. A Delphi technique peer review process is being considered to confirm these maps. A second workshop, to be held in November 2016, will focus on estimating baseline interaction and mortality rates under current fishing operations and testing various mitigation scenarios to determine their effectiveness in reducing impacts.

The Sub-committee inquired whether the ABNJ Tuna Project has plans to conduct similar analysis for other oceans basins. It was indicated that the current project is aiming to estimate interactions and mortalities for the entire Pacific, but might be constrained by the availability of longline effort data for the eastern Pacific. There are no plans under the existing scope of work for the ABNJ Tuna Project to extend the analysis to other Oceans. The Sub-committee was also interested in the source of the SST data used in the analyses. It was pointed out that SST data collected from observers was not fully reliable and, therefore, 1ºx1º monthly Reynolds SST data was used in the workshop.

SCRS/2016/125 stated that in 2010, the International Commission for the Conservation of Atlantic Tunas (ICCAT) requested its Standing Committee on Research and Statistics (SCRS) to conduct an assessment of the impact of ICCAT fisheries on sea turtles (ICCAT 2009). Information on the area of operation and reported fishing effort of 16 longline fleets fishing in the Atlantic in 2014 was obtained from the ICCAT EFFDIS (effort distribution) database. Sea turtle by-catch rates were identified for six fleets operating within the ICCAT Convention area through a comprehensive literature review. For the remaining nine fleets for which data were not available, we assigned by-catch rates based on spatial overlap of fleets with published rates. The total number of sea turtle interactions was estimated using the reported and assigned sea turtle by-catch rates per fleet and multiplied by reported total fishing effort deployed by the fleets. The total number of sea turtle interactions (all species combined) ranged from 18,708 to 25,731 for all ICCAT fleets fishing in 2014. However, this estimate should be considered an underestimation, as not all the pelagic longline effort was taken into consideration in the present study.

The Sub-committee supported the approach used to obtain the preliminary estimates of sea turtle interactions and agreed with the authors with regard to the assumptions, limitations, and future improvements of this work. Most importantly, the Sub-committee agreed that national scientists should review the by-catch rate substitutions used and provide their input (see **Appendix 4**). It was indicated that mortality and number of interactions are not the same. The Sub-committee discussed that there are a number of sources of post-release mortality (SCRS/P/2016/045) that are difficult to quantify, and therefore an estimation of number of interactions is a useful first step. It was also pointed out that sea turtle by-catch rates are dependent on many factors (e.g., hook type and size, bait type) which should be considered when assigning by-catch rates from one fleet to another. But, it was also recognized that such detailed information was not available for most fleets to use in the process of assigning by-catch rates. The Sub-committee agreed in using this work as a platform upon which to improve the estimation of the number of sea turtle interactions. As such, new estimations will be conducted using an updated EFFDIS with the estimated total effort and any new by-catch rate information that might become available. At the same time, the Group agreed to pursue, if possible, other approaches like stochastic modeling to estimate number of sea turtle interactions. The Sub-committee held an extensive discussion with regard to other available sources of sea turtle by-catch data. Most specifically, the Sub-committee discussed the observer data submitted using the ST09 form. The Secretariat informed the Sub-committee that the data submitted was very limited. In view of this, the Sub-committee discussed that one of the reasons for such poor reporting of observer data might be related to the complexity of the ST09 form. The Secretariat agreed to present to the Sub-committee on Statistics a proposal to potentially reduce the complexity of this form with the expectation that this might increase the reporting rates.

The pelagic longline fishery in Brazil started in the mid-fifties according to SCRS/2016/169. This fishery uses different strategies to catch swordfish, tunas and dolphin fish, however those strategies also affect the incidental capture of sea turtles. If the fishing strategies change according to target species and if these strategies affect the sea turtle capture, then classify and group the distinct longline fisheries, based on its characteristic and according to the homogeneity principle becomes necessary to better understand the incidental capture of sea turtles, their causes and consequences. Nevertheless, this approach has not been used and, usually, pelagic longline fisheries have been analyzed as a unique administrative unit, as being homogeneous when affecting the biota. Here we used the information from Projeto Tamar's database (1999-2016) and divided the Brazilian pelagic longline fishery in five distinct fisheries, according to its own characteristics. The results show significant differences for both CPUEs and size classes by turtle specie captured on different longline fisheries. This fact has important implications for the marine turtle conservation as well as for the management of fisheries. When longline fisheries with distinct characteristics are grouped into a single longline fishery, we lose the capacity to understand why some turtle species (or turtle size classes) are more susceptible than others. Thus, the document recommended using "Fishery" as administrative unit in order to understand and reduce marine turtle interactions in fisheries.

The Sub-committee discussed that this document pointed to the fact that caution should be used when assigning by-catch rates to a fleet. It was asked if the 'administrative units' (i.e., fleets with a unique fishing strategy) that operate in large areas might also have different sea turtle by-catch rates in different areas, but no analysis was conducted that could answer that question. The Sub-committee was interested in learning how constant was the gear configuration within each 'unit'. It was pointed out that for some aspects of the gear configuration, the vessels within a unit use a range of values (e.g., number of hooks between floats), but for other variables, such as the use of wire leader, all vessels in the unit use the same. It was also asked how constant through time the components of the 'administrative units' are. The Sub-committee discussed the complexity of the Brazilian fleet, but the vessels of the 'administrative units' described in the document have remained fairly constant for the period of the study.

São Tomé has recorded, as regular species on the high seas and in its coastal waters, five species of marine turtle which come inland to nest (SCRS/2016/172). They also nest in the region of the Atlantic coast of Africa. Despite the importance of the region as a habitat for marine turtles, there is little scientific documentation on the utilisation of the habitat, their abundance and distribution (Thomas *et al*. 2010). The turtles are mainly found in the clear waters of the shallow coastal reefs, bays, estuaries and lagoons. However, the young spend their first few years at sea where they float, which enables them to be carried by the currents before they move towards safer coastal waters. According to the 4th National Report on Biodiversity (2009), *Lepidochelys olivacea* (the olive ridley sea turtle) is the smallest species of turtle and is easily caught by fishers while making its way to the beach to spawn. The study carried out by Carvalho (2008), from MARAPA, an NGO informed that the local population fishes this species of turtle due to the unavailability of other types of food sources such as meat. Moreover, the eggs and nests are taken due to tradition and cultural reasons. For this reason, protection of this species is a priority for the conservation of natural resources in the archipelago. The Gulf of Guinea is also an important food source, migratory route and nesting area for the five marine turtles, where they can be observed. They all appear on the red list and protection lists of international organisations. According to the data from the neighbouring island of Bioko, the olive ridley (*Lepidochelys olivacea*), the hawksbill (*Eretmochelys imbricata*), the loggerhead (*Caretta caretta*) and the leatherback (*Dermochelys coriacea*) regularly nest on the south beach of São Tomé, mostly between October and February.

The Sub-committee inquired if estimates of the number of sea turtle interactions with artisanal fisheries exist and the potential impact of such interactions. It was explained that that information is not yet available, but it is one of the goals of the conservation plan. Population estimates are not available either, at this time only information on the number of nests for those nesting sites that are being monitored is available. The Sub-committee asked is the fishing sector that used to harvest sea turtles and their eggs is now involved in the development of eco-tourism which seems to be the case. There was also interest in finding out if the coastal artisanal gillnet fishery was targeting small tunas. Such fishery exists and there are regulations in place to limit that mesh size that can be used, but enforcement of such regulations has been difficult.

The report outlined in SCRS/P/2016/048 is part of a larger study investigating the efficacy of sea turtle by-catch regulations implemented in U.S. Atlantic and Pacific longline fisheries. Since 2004, longline vessels targeting swordfish (shallow-set) in Hawaii and some regions in the North Atlantic Ocean have had extensive fisheries regulations in place aimed to protect endangered and threatened sea turtles. Specifically, use of maximum 10 degree offset 18/0 circle hooks has replaced traditionally used J or tuna hooks, and fish bait are regulated in many locations where squid baits were once commonly used. In addition, U.S. vessels had mandatory increases in observer coverage (100% in Hawaii shallow-set and 8% for parts of the Atlantic), limits on turtle captures (Hawaii only), as well as additional requirements specific to protected species handling. This report presents longline observer data from the Atlantic Ocean's pelagic observer programme (POP) from the time periods prior to the turtle regulations (~ 1992-2001) and post regulation (~ 2004-2015). Analyses include relationships between the number and species of turtle interactions and operational components such as fishing region, hook type, bait type, SST, use of light sticks, etc. The current analysis includes data from swordfish and mixed sets (swordfish- plus tuna-targeted sets) only, and omits data from fishing experiments. In total, we analyzed statistics from 11,982 unique sets. We analyzed catch probabilities specifically for loggerhead (*Caretta caretta*) and leatherback (*Dermochelys coriacea*) sea turtles. A variety of methods were used, including general linear models (GLMs), general additive models (GAMs), and non-parametric statistics to identify factors related to the fishery dynamics that affect catch risk and magnitude of turtle catch rate (per unit fishing effort). In summary, results of our 20+ year data analyses indicate clear temporal and spatial patterns in sea turtle capture rates by species, and confirm the value of eliminating J hooks and reducing use of squid bait, as well as the value of restrictions on effort and turtle captures.

It was expressed to the Sub-committee that some of the results of the GLM are confound by management regulations. The Sub-committee inquired why the results of the GLM showed that the use of circle hooks had no significant effect on the BPUE when circle hooks is one of the most important mitigation measures to reduce by-catch rates. Such result is due to the fact that the fleet switched from using J-hooks to Circle hooks practically overnight and therefore the model does not have a period where the use of both hook types overlap to assess the effect of hook type on the by-catch rates. The Sub-committee was interested in learning how the 'annual limits' with regard to sea turtle interactions were chosen or determined. It was explained that sea turtle population biologist conduct such determination. As with other cases, the Sub-committee discussed how changes in population size can confound the assessment of the effectiveness of mitigation measures. In the case of sea turtles, it was explained that given their life history, changes in population size happen slowly allowing for a better determination of the effectiveness of mitigation measures. It was also asked if models other than the delta lognormal were used to standardize the BPUE. The authors explained that other models were also tested, but the results are still considered to be preliminary. Finally, the Sub-committee asked why hook size was not considered as a variable in the models as it is well known that small circle hooks are less effective as a mitigation measure than larger hooks. It was explained that the U.S. fleet only uses 16/0 and 18/0 circle hooks which are considered to be 'large' circle hooks and are effective as mitigation measures.

7.1 Work plan for sea turtles

Recognizing that there is a paucity of by-catch data submitted to the ICCAT Secretariat despite repeated requests for this information, the Sub-committee recognized that the method described in SCRS/2016/125 can be used as an alternative method to facilitate the Sub-committees work as this model uses sea turtle CPUE reported in published literature. Thus, the Sub-committee agreed to review and improve the method in 2017, especially with regard to the utilization of observer data collected by CPCs. For this purpose, CPCs are requested to submit sea turtle by-catch information including data not reported using the ST09 data submission form, and also to estimate total removals using their observer data. In 2017, the method and data to be used to estimate the total removal of sea turtles by longline fisheries will be finalized.

8. Seabirds

The agenda for seabirds had been developed to focus largely on a review of Rec. 11-09. However, due to a lack of data, this assessment was not possible. Consequently, the headings in this report have been changed from those listed in the Tentative Agenda to better reflect the presentations and discussions that took place at the meeting.

8.1 Review of seabird conservation measure Rec. 11-09

As context to ICCAT's review of the effectiveness of its seabird conservation measures (Rec. 07-07, Rec. 11-09), a summary was provided on the work of CCSBT's Seabird Mitigation Measure Technical Group (SMMTG) to develop methods for reviewing the effectiveness of tuna RFMO seabird management measures. The CCSBT SMMTG has agreed that the following elements should be included in tuna RFMO seabird assessments:

1. By-catch indicators: monitor seabird BPUE and total birds killed per year.
2. Review degree of implementation: this would involve collaboration of ecosystem and by-catch working groups with relevant compliance Committees.
3. Review and monitor data availability (observer coverage and representativeness, quality of observer data in relation to data fields, quality of fishing effort data), in order to gauge the reliability of the assessment
4. Review content of seabird CMMs (including by-catch mitigation measures, area of application, vessels to which measure applies).

The CCSBT SMMTG also highlighted the importance of tuna RFMOs working collaboratively in their seabird assessments, and the advantages of combining regular monitoring of seabird by-catch by each tuna RFMO with periodic (every 3-5 years) joint tuna RFMO work at a more detailed level. The seabird by-catch component of FAO's GEF-funded Common Oceans Tuna Project is progressing some of the actions identified by CCSBT's SMMTG.

Document SCRS/2016/174 presented an analysis of tracking data for nine species of albatrosses and petrels and the degree of overlap of these species with pelagic longline fishing effort in the Atlantic Ocean. The results of the study are broadly consistent with the previous (2010) overlap analysis, confirming the global importance of the ICCAT area for a suite of albatross species. The Critically Endangered Tristan albatross and Endangered Atlantic yellow-nosed albatross, along with the Vulnerable white-chinned petrel, have the highest exposure to ICCAT longline hooks of the species analyzed. Adjacent to the southern African coast the same two albatross species - plus black-browed albatross migrating from South Georgia – range as far north as 10°S where the *Supplemental Recommendation by ICCAT on Reducing Incidental By-catch of Seabirds in ICCAT Longline Fisheries* [Rec. 11-09] does not currently apply. Estimates of the number of pelagic longline hooks set south of 25°S suggest that pelagic longline effort in areas of high seabird abundance has decreased since between the initial period (2000-2005) and the most recent period (2010-2014).

Considering the result that at least three of the seabird populations for which tracking data are available (Atlantic yellow-nosed, black-browed from South Georgia and Tristan albatross) forage as far north as 10°S in the eastern Atlantic, outside of the area of application of Rec. 11-09, the Sub-Committee highlighted the need to collect by-catch data from these areas. It was noted that BirdLife International's Albatross Task Force are currently working with Namibian fleets, and an observer is being deployed imminently to collect seabird by-catch data on a pelagic longline vessel. The Sub-Committee recognised that although indicative of the possible encounter rate, overlap indices such as those applied in this study do not consider susceptibility to capture, and that the probability of by-catch for a given species depends on their behavioral traits and other factors. As was the case with the first ICCAT seabird assessment (2006-2009), the overlap analysis should be treated as a component of a broader assessment, and provides a coarse map of potential risk. The Sub-Committee agreed that it would be useful to compare the areas of high overlap with by-catch information from observer data, and also to ensure that areas of high overlap were being sufficiently sampled by observer programmes.

SCRS/2016/167 outlined work being progressed by ACAP to develop seabird by-catch indicators and to consider data needs, methodological approaches and reporting requirements. ACAP is currently ratified by 13 countries. In addition, a number of non-Party Range States actively participate in the work of the Agreement. ACAP provides a framework for coordinating and undertaking international activity to mitigate known threats to populations of affected species, including fisheries by-catch. In order to monitor and report on the performance of the ACAP, a Pressure-State-Response framework is being developed and implemented by ACAP. The primary Pressure indicator for by-catch comprises two linked components: i) the seabird by-catch rate across each of the fisheries of member Parties, and ii) the total number of birds killed (by-caught) per year of ACAP species (per species where possible). The Seabird By-catch Working

Group of ACAP is currently undertaking work to develop guidelines on issues that need to be considered in estimating and reporting against these by-catch indicators and, considering the estimation methods currently in use, to propose guidance and recommendations to achieve consistent reporting. This paper provides an outline of the recommendations and guidelines that have been developed to date. It is important to note that this represents work in progress, and is presented to encourage linkages between the ACAP process and similar work being undertaken within ICCAT and other RFMOs.

The Sub-Committee agreed that this work is of relevance to ICCAT's review of the seabird conservation measure, Rec. 11-09. It was noted that the Sub-Committee had previously (in 2015) agreed that the by-catch indicators proposed (by-catch rates, and total number of birds killed) would be useful candidate indicators for the review of Rec. 11-09. It was noted that the ACAP process would focus initially on ACAP countries, and that the reporting framework is being developed to incorporate data rich and data poor scenarios. However, it is intended that the guidelines would be more broadly applicable and hopefully help facilitate a wider-scale assessment of seabird by-catch. The Sub-Committee agreed that it would be useful to maintain linkages between the ACAP process and efforts within ICCAT to estimate and monitor seabird by-catch.

8.2 Review of data received from CPCs on seabird by-catch

The ICCAT Secretariat presented the observer data received from CPCs using the newly adopted ST09 data collection forms (**Table 2 and 3**). The Secretariat highlighted the fact that very few data regarding seabird interactions had been submitted using these forms. The majority of information has been received from a single fleet with little other available information. As such, the Sub-committee questioned whether this data was useful for evaluating the efficacy of Rec. 11-09. It was noted that these forms have recently been adopted, and are quite complex. The Sub-Committee therefore suggested that the these forms be evaluated to simplify the reporting requirements. It was agreed that this would be done intersessionally through collaboration between CPC scientists and the Secretariat.

The problem of data availability to review the efficacy of Rec. 11-09 was further discussed. It was suggested that as the data are not being submitted to the Secretariat at this stage, scientists from the CPCs who are fishing south of 25S should be engaged in a collaborative effort to share operational observer data to evaluate the catch rates of seabirds in this region. This approach was utilized successfully in the sharks species Working Group, and it was recommended that this approach be adopted for this study. As such, a table was created based on the newly developed Effdis dataset, that showed which CPCs have reported fishing south of 25ºS (**Table 4**). It was agreed that these CPCs will be contacted to collaborate and share data to assess the efficacy of Rec. 11-09.

8.3 Seabird papers submitted by CPCs

SCRS/2016/039 reviewed interactions between seabirds and the Spanish surface longline fishery targeting swordfish in the South Atlantic Ocean. A total of 92 sets (132,268 hooks) targeting swordfish between November and March in the years 2010-2014 in the south Atlantic (Lat ≥ 25ºS) were analysed. Various types of bait were used for night setting with monofilament surface longlines. No interaction with seabirds was detected during any of the sets observed and the interaction rate was therefore nil, confirming the low level of interaction with seabirds regularly seen for this type of fishing in large areas of the North and South Atlantic. The use of night setting, low levels of lighting during setting operations and the type of fishing conducted by vessels were identified as the most important factors to explain the lack of interaction with seabirds. Observations of seabirds were also made. Most of the sightings occurred during daytime sailing. During some manoeuvres when vessels were setting or hauling there were sporadic sightings of the spectacled petrel (*Procellaria conspicillata*) and the occasional albatross, although no interaction with fishing operations occurred. The species most often seen was *P. conspicillata*, with groups estimated at over 150 individuals being sighted. Other species observed were *Calonectris diomedea*, various types of storm petrels, and other species such as *Hydrobates leucorhous*, *Thalassarche chlororhynchos, Diomedea exulans* and very rarely *Thalassarche melanophris*.

It was reported to the Sub-Committee that the Spanish fleet is using mitigation requirements in accordance with ICCAT Rec. 11-09. Spanish legislation includes mitigation requirements applicable to the whole Spanish surface longline fishing fleet irrespective of the area and ocean in which they fish. The Sub-committee observed that given the use of the mitigation measures described it would be expected that by-catch rates would be low, particularly in the area observed in the south and central Atlantic where seabird densities are relatively low. The Sub-Committee observed that in the south West Atlantic where effort is high, observer coverage is very low, and that there is a need for more representative observer data. It was noted that it is challenging to cover trips in specific areas in specific time periods and selection depends on a combination of factors such as vessel access, vessel skipper and other logistics and considerations.

A series of papers were presented using Japanese observer programme data. SCRS/2016/162 examined factors affecting seabird by-catch occurrence rate in the southern hemisphere in the Japanese longline fishery using a random forest model. In order to analyse significant factors affecting by-catch occurrence rate the authors constructed four models (albatross mitigation, albatross, petrel mitigation, petrel) examining the effect of species group, season, year, environmental factors, distance from the colonies, a lunar phase, and fish catch. The model was thought likely to be a statistically appropriate because out of bags were in an acceptable range, though a little high. Significant variables in common with the four models analysed were latitude, longitude, elapsed days from the first day of the year, number of observed hooks, species group, sea surface temperature in this study. Also year, cruise ID and lunar phase were significant variables in common with two to three models. Those variables would have the large impact on by-catch occurrence rate. Thus, it was suggested that those variables should be considered in the comparisons between CPCs and in collaboration work.

It was noted that by-catch occurrence rate was higher off southern Africa and in the Tasman Sea than in other areas fished, and that by-catch occurrence rate increased in January-March during the albatross breeding season. The authors clarified that data from 1997 to 2015 were used for the albatross model while data from 2011-2015 was used for the albatross mitigation model. Mitigation measures were not a significant variable in the model. The authors indicated that this may be caused by the timing of the introduction and use of mitigation measures in the Japanese longline fleet, as a portion of the Japanese longliner fleet had already voluntarily introduced mitigation before Rec. 11-09 came into force, which might explain why it is not a significant variable.

The Sub-Committee observed that using random forest models is a useful approach. It was noted that time-series seabird data from breeding colonies could help determine if catch is independent of population trends. The Sub-Committee recommended that it would be useful to develop the model further to better understand factors contributing to seabird by-catch.

Document SCRS/2016/163 modelled by-catch occurrence rates of seabirds for Japanese longliners operating in the southern hemisphere in consideration of factors of year and season, and examined longitudinal changes in the rate across years, using operational data obtained by scientific observers from 1997 through 2015. As a preliminary analysis, differences in species composition of seabirds by-caught between northern and southern regions of waters south of 20°S were examined through hierarchical cluster analysis. By-catch species composition changed at the boundary of 40°S, 35°S and 40°S, off southern Africa, in the Indian Ocean and in the Tasman Sea, respectively. Presence/absence of seabird by-catch data by set was modelled with a generalized additive model (GAM). The data for the GAM analysis were split in two by a boundary dividing the data into northern and southern areas. Estimated by-catch occurrence rate varied at relatively low level in the model of the northern area, while that varied at relatively high level in the model of the southern area. By-catch occurrence rates in an east-west direction differed not only among year periods but also among seasons in both waters north and south of 35°S. The analysis highlighted the importance of consideration of longitudinal variation of by-catch occurrence rate among year and season to estimate total by-catch number.

The authors noted that the results were consistent with those using a random forest model (document SCRS/2016/162), and clarified that clusters used in the analysis were based on the species composition of by-catch. The results showed that grey-headed albatross was the dominant by-catch species in the southern areas, whereas white-chinned petrels were the dominant species bycaught in the northern areas. The authors clarified that the boundaries selected for the study were based on current information regarding species composition and by-catch rates increasing further south. The Sub-Committee noted that the cluster analysis was based on species composition of the BPUE, and demonstrated a notable step-change in species composition of by-catch at 35°S in the Indian Ocean.

Document SCRS/2016/164 provided information of seabirds by-catch south of 25°S latitude between 2010 and 2015, reviewing by-catch data collected by on-board observers on Japanese vessels in the Atlantic and the Indian Ocean. Results revealed that there is a common tendency in between the southern bluefin tuna catch pattern and seabird by-catch pattern. Seabird by-catch pattern is also suggested to be influenced by geographical area as well as environmental conditions. The results of this study also indicate that the recent increasing trend of the nominal CPUE of seabirds is biased by the recent increase of the observer data in the area with higher seabird CPUE. Authors indicated these findings should be considered in future catch and effort data analysis.

The study identified 13 seabird groups. Sub-areas 6 and 7, south west of southern Africa, were found to have high CPUE of birds, with the grey-headed and black-browed albatrosses dominating by-catch. There is a 33°S -45°S band of high capture off South Africa, and highest by-catch rates are in Q2. The authors pointed out that in the south East Indian Ocean, even at higher latitudes, there are notable levels of observed by-catch.

It was explained to the Sub-Committee that CCSBT observers are the main source of Japanese observer data. Coverage of other vessels is therefore relatively low, so values are somewhat biased. The authors expressed concern that nominal CPUE of seabirds show an increasing trend (approximately 0.3 birds/1000 hooks in 2015) off South Africa in the area 20°W-50°E, 25°S-55°S, and suggested that urgent action is required to better understand the reasons for the by-catch and to address them. It was proposed that the previously low estimates of seabird by-catch could be due to low southern bluefin tuna quota allocation and an associated low number of observers. The authors suggested that the trend of increasing by-catch may be because observer coverage has improved, leading to improved estimates of by-catch. The Sub-Committee was informed that Japan is conducting a questionnaire survey and interviews with industry to try to clarify causes for this trend. The Sub-Committee recognised that the document presents useful information, and the authors suggest that it would be possible to extrapolate the data to estimate total mortality and highlighted that it would be beneficial to compare results with those from other CPCs.

Document SCRS/2016/161 describes the operational pattern of Japanese longliners south of 25°S in the Atlantic and the Indian Ocean for the consideration of seabird by-catch. Catch and effort data of Japanese longliners operating south of 25°S in the Atlantic and the Indian Oceans in the period between 2010 and 2015 was analysed to investigate its effect on the seabird by-catch. Waters off South Africa and the southwest Indian Oceans were indicated to be main fishing ground of Japanese longliners, where they caught southern bluefin tuna, albacore, bigeye and yellowfin tunas. Results of the analysis indicate a general increase of the ratio of southern bluefin tuna and a decreased ratio of albacore and bigeye tunas between 2010-2013 and 2014-2015, respectively. This target shift accompanies the southward shift of operational ground. The results of this study also indicated that the main fishing grounds of Japanese longliners off South Africa are located further south by about five degrees compared to the main fishing ground in the south west Indian Ocean due to the effect of warm Agulhas Current. These findings should be considered in the analysis of seabird by-catch data.

The Sub-committee noted that species composition of target catch has changed drastically by area and that environmental conditions complicate catch patterns off South Africa. Eastern Indian Ocean environmental conditions are more consistent and less complex, and fish composition doesn't show the same spatial variability. The authors highlighted that in the eastern Indian Ocean area that they considered Japanese longline vessels target southern bluefin tuna and seabird by-catch species composition is different. The Sub-committee recognised that it is important to consider and account for these factors when assessing seabird by-catch.

8.4 Mitigation trials and advice

SCRS/2016/165 presented results from a study in the Brazilian pelagic longline fleet to compare sliding weights (Lumo Leads) and traditional line weighting in respect of sink rates and catch rates of target and non-target species. Four cruises were conducted in 2015. Three treatments were used to compare catches of target fish species, seabird by-catch and identify sink rates: (1) 60 g Lumo Lead weight at 1.0 m from the hook; (2) 60 g Lumo Lead weight at 3.5 m from the hook, and; (3) 60 g leaded swivel at 3.5 m from the hook. There was no difference in the catch rates of target species among treatments. Eleven seabirds were caught during the experiment (five black browed albatrosses, five white-chinned petrels and one great shearwater). All birds were caught at night and without tori lines. One bird was caught on treatment 1 (0.11 BPUE), three birds in the treatment 2 (0.33 BPUE) and seven birds in treatment 3 (0.85 BPUE). Lumo Leads placed at 1.0 m from the hook sank faster than Lumo Leads and weighted swivel placed at 3.5 m. The high seabird mortality rates on treatments 2 and 3 suggests that the combination of night setting and line weighting placed at 3.5 m is not sufficient to reduce seabird by-catch in the South-west Atlantic to negligible levels.

The Sub-Committee noted that an increasing body of research has shown that reducing the distance between the weight and hook (leader length) improves the sink rate of branch lines, and thus reduces the frequency of seabirds becoming hooked during line setting, with no detectable impact on target fish catch rates. When used in combination with bird scaring lines, line-weighting should ensure that the baited hooks sink fast enough to deter birds from attacking hooks outside the area protected by the bird scaring line. It is also important to reduce the likelihood of albatrosses getting hooked as a result of deep diving species returning baits to the surface. Based on the diving depths of petrels that are commonly caught as by-catch, the baited hooks need to sink below a depth of 10-12 m before the risk to seabirds is significantly reduced. Lumo leads were designed to reduce the incidence of fly-back events following bite-offs, and therefore improve crew safety. The Sub-Committee noted the significant reduction of seabird by-catch using weights at 1 m compared to 3.5 m from the hook reported in the Brazilian study, and that this is consistent with, and provides support for, the ACAP best practice advice presented in SCRS/2016/166.

SCRS/2016/166 presented the current advice provided by the Agreement on the Conservation of Albatrosses and Petrels (ACAP) for reducing the impact of pelagic longline fishing operations on seabirds. The incidental mortality of seabirds, mostly albatrosses and petrels, in longline fisheries continues to be a serious global concern and was the major reason for the establishment of ACAP. ACAP routinely reviews the scientific literature regarding seabird by-catch mitigation in fisheries, and on the basis of these reviews updates its best practice advice. The most recent review was conducted in May 2016, and the document presents a distillation of that review for the consideration of the ICCAT Sub-committee. On the basis of the most recent review, ACAP has confirmed that a combination of weighted branch lines, bird scaring lines and night setting remains the best practice approach to mitigate seabird by-catch in pelagic longline fisheries. Changes to previous advice apply only to the recommended minimum standards for line weighting regimes, now updated to the following configurations: (a) 40 g or greater attached within 0.5 m of the hook; or (b) 60 g or greater attached within 1 m of the hook; or (c) 80 g or greater attached within 2 m of the hook. In addition, ACAP endorsed the inclusion in the list of best practice mitigation measures of two hook-shielding devices. These devices encase the point and barb of baited hooks until a prescribed depth or immersion time has been reached (set to correspond to a depth beyond the diving range of most seabirds) thus preventing seabirds gaining access to the hook and becoming hooked during line setting. ACAP recognizes that factors such as safety, practicality and the characteristics of the fishery should also be taken into account when considering the efficacy of seabird by-catch mitigation measures and consequently in the development of advice and guidelines on best practice.

It was noted that the update to the ACAP advice regarding line-weighting was based on the provision of new results on the sink rates of different line weighting configurations, and studies relating line-weighting configurations to seabird by-catch rates, including the study reported in SCRS/2016/165. The Sub-Committee supported the updated ACAP advice on minimum standards for line-weighting. It was noted that line weighting is one of the three mitigation measures listed in Rec. 11-09. The minimum line-weighting standards included in Rec. 11-09 conform with the previous ACAP advice, and would thus need to be updated to bring them in line with the updated advice from ACAP.

The Sub-committee acknowledged the advice from ACAP regarding the inclusion of two hook-shielding devices as best practice measures. However, given the novel nature of these measures, and that the source papers used by ACAP to conduct their assessment are still in the process of being peer-reviewed for publication, the Sub-committee did not have sufficient information on these two devices and their performance to recommend their inclusion in the list of available seabird mitigation measures for ICCAT fisheries. It was recommended that the scientific papers on the hook-shielding devices be made available to the Sub-committee as soon as they are available.

8.5 Seabird by-catch and mitigation in the Mediterranean

SCRS/2016/173 presented information on seabird by-catch mitigation developments in the Mediterranean, particularly in relation to the General Fisheries Commission for the Mediterranean (GFCM). Recommendation GFCM/35/2011/3 on reducing incidental catches of seabirds in fisheries is now in place. The recommendation does not include requirements for the implementation of mitigation measures by vessels. In order to strengthen the collection and processing of data across the region the GFCM SAC has developed the Data Collection Reference Framework, which establishes a minimum set of parameters against which countries must report. Currently, GFCM Members are discussing the implementation of a mid-term strategy towards the sustainability of Mediterranean and Black Sea fisheries (2017-2020), which is expected to establish a by-catch monitoring programme to obtain representative data on discards and incidental catches, with a view to facilitating the adoption of required management measures towards the reduction of by-catch rates.

The Sub-Committee was reminded that at the time when ICCAT Rec. 11-09 was under discussion, there was insufficient information on by-catch to make a requirement for use of by-catch mitigation measures in Mediterranean waters, and that it would be beneficial to undertake a review of data now available. It was observed that there is in general a limited amount of targeted fisheries data from the Mediterranean that is reported to the Secretariat, but that it would be a useful to query the ICCAT by-catch metadatabase to obtain any relevant data and extract seabird by-catch related documents to determine what information may be available. It was noted that improved data collection, both due to the GFCM DCRF plus the European Commission implementing decision for new programme for data collection for 2017-2019 should ensure improved data on incidental capture of vulnerable species in the Mediterranean.

8.6 Seabird workplan

Recognising that the paucity of seabird by-catch data submitted to the ICCAT Secretariat has prevented an assessment of Rec 11-09, the Sub-committee noted that there are opportunities to progress this work intersessionally through additional mechanisms. The seabird component of the GEF Common Oceans Tuna project will be holding a series of workshops on seabird by-catch assessment in 2017 and 2018, and the Sub-committee agreed that these workshops provide an opportunity to help support an assessment of seabird by-catch within ICCAT, and facilitate a harmonised approach across tuna RFMOs. It was noted that the agenda for these workshops is in the process of being prepared, and the Sub-committee on By-catch Chair and several Sub-committee members offered to help develop the agenda and help progress these initiatives.

The Sub-committee recognised that although the main focus of seabird work would be a review of the effectiveness of Rec. 11-09, there is a need for a separate strategy to investigate seabird by-catch in the Mediterranean area. One of the first steps should be to investigate what fisheries operating in the Mediterranean area are incidentally catching seabirds. The Sub-Committee also recommended that the gillnet workshop planned for 2017 could provide an opportunity to consider seabird issues in the Mediterranean.

9. Other matters

A presentation (SCRS/2016/158) was provided regarding the *Faux Poisson* fishery in Côte d'Ivoire. It was noted however, that this fishery could be better assessed in a stock assessment exercise if the data is available and therefore this presentation is more appropriate for the small tunas or tropical tuna Group. The author thus agreed to present this document in those Working Groups.

Document SCRS/2016/171 described how many of the species managed by tuna RFMOs are data poor and have never undergone a stock assessment. This leaves these stocks vulnerable to over exploitation. Data-limited approaches are available to address the information shortfall. The Data-Limited Methods Toolkit (DLMtool) provides a scientific framework to address these challenges in a transparent and comprehensive manner.

Although the Sub-committee welcomed these new tools to evaluate data poor stocks, it was generally felt that these methods and indeed the proposed course could not be recommended by the Sub-committee at this stage. It was felt that these tools should be evaluated by the Working Group on stock assessment methods who would then be in a more suitable position to evaluate the utility of this proposal to the SCRS.

A research cruise in support of the International Seafood Sustainability Foundation (ISSF) by-catch reduction project was conducted on the tuna purse seine vessel Cap Lopez, 20 July – 5 August 2015 in Ghana waters and described in document SCRS/2016/127. The primary objective was to test the efficacy of a 10m2 net panel to selectively release sharks in good condition from purse seines. Observations of FAD design and by-catch entanglement rates were also conducted with no entanglements observed. However, evaluation of cruise objectives was hindered by a general lack of sharks encountered during the cruise. The release panel was initially trialed in the equatorial western Pacific where a deep, warm mixed layer and a deep net promoted the separation of silky shark (*Carcharhinus falciformis*) and tuna. None of these conditions existed during the Cap Lopez cruise. That and other technical issues suggest that the potential for developing a shark release panel concept is region and vessel specific. The shallow thermocline, shallow net and relatively small size of the vessel created a situation where selective release of sharks would be difficult. Recommendations for further research are provided.

The author noted that even under ideal conditions, the issue still remains to attract sharks out of the net even when the window opens correctly as the presence of fish and/or the FAD in the net encourages the sharks to remain in the net. The author stressed it was difficult to extrapolate data from different oceans and vessels, as the conditions and operations are different. It was also noted that Non-entangling FADs and best release practices are a good solution to reduce shark by-catch.

SCRS/2016/156 outlined a research cruise in support of the International Seafood Sustainability Foundation (ISSF) by-catch reduction project that was conducted on the tuna purse seine vessel MAR DE SERGIO, during March-April 2016 in the eastern tropical Atlantic Ocean. During a 4-week period a group of three scientists joined the fishing trip with the following objectives: (1) Improving pre-set estimation of species composition, sizes, and quantities of tunas associated with FADs using acoustics: Attaching fishers´ echo-sounder buoys from four different brands to the FADs to compare signals; (2) Use of three scientific echo-sounders with frequencies of 38, 120 and 200 kHz and an EK80 wideband echo-sounder for the frequency band from 85 kHz to 170 kHz onboard a work boat, followed by intensive spill sampling to compare acoustic data and species composition; (3) Study of fish behavior inside the net; (4) shark capture and release from the net; (5) Making other observations that could lead to further tests of mitigation techniques. Preliminary results of these studies are presented.

The Sub-committee raised their concern that the type of catch and release described in this study may be too time consuming and complicated for most fishermen to adopt and may be dangerous when handling larger sharks. The author stressed, however, that release from the net is important as mortality is higher when individuals are brought onboard. The author stressed that although one fisher was necessary to conduct this activity, it was performed during the purse seine fishing operation, with no extra time for the purse seine activity, resulting in 20% of sharks released alive from the net. This technique is under development, which means the time needed to perform the operation, safety, and the percentage of released sharks should be improved. It was also suggested that fishermen have a responsibility to mitigate by-catch and therefore need to find solutions in order to avoid sharks by-catch.

SCRS/2016/155 provided information regarding a research cruise in support of the International Seafood Sustainability Foundation (ISSF) by-catch reduction project which was conducted on the sailing/research vessel Sea Dragon, 4-22 October 2015 in the tropical eastern Atlantic. The outcomes from the cruise characterized: (1) the behavior of tunas and other fishes around purse seine drifting FADs; (2) FAD design in relation to entanglements; and (3) horizontal and vertical behavior of oceanic sharks on and off FADs. The vertical behavior and diurnal presence/absence of tropical tunas and non-target FAD associated species were remotely monitored using pressure-sensitive acoustic tags and satellite linked receivers attached to four drifting FADs. Observations of FAD-associated fauna and FAD design were performed by SCUBA and snorkel surveys. Skipjack, bigeye and yellowfin tunas, rainbow runner (*Elegatis bipinnulata*) and oceanic triggerfish (*Canthidermis maculata*) were monitored with acoustic tags. Silky shark (*Carcharhinus falciformis*) and oceanic white tip sharks (*C. longimanus*) were tagged with a mix of acoustic and satellite linked pop-off tags. The fine scale vertical and horizontal behavior of FAD associated tuna, other finfish and sharks is described.

The author clarified that this work is ongoing. The Sub-committee welcomed this news as it was noted that this is an important study on natural behavior although it was acknowledged that more data is needed. It was suggested that this work could benefit from the AOTTP project should spaghetti tags be used in the future as that project is conducting a strong tagging awareness and recovery activity.

10. Recommendations

Recommendations for by-catch:

1. The Sub-committee recommends that the ST09 observer data submission forms be revised to simplify the reporting requirements in order to facilitate increased submission of observer data. This should be done intersessionally through collaboration between CPC scientists and the Secretariat. This proposal along with suggestions for revising the forms is to be presented to the Sub-committee on statistics in 2016 after which a preliminary version will be presented to the Sub-committee on Ecosystems in 2017 for potential adoption by the SCRS later that year.

2. The Sub-committee requests the Secretariat to initiate, as a priority, the recovery of Task II data, especially for more recent years in order to improve the information available for estimating the Effdis data crucial to ongoing seabird and sea turtle assessments.

3. The Sub-committee recommends that the Secretariat should continue to revise and update longline and purse seine Effdis, though collaboration with CPCs to support the work of the Sub-committee on Ecosystems.

4. The Sub-committee recommends that the SCRS should request that CPCs provide annual sea turtle and seabird by-catch information including by-catch rates and number for each fleet harvesting ICCAT species. Catch rate and number should be broken down to a lower taxonomic level as possible. In addition, mitigation measures adopted by each fleet should also be described.

5. In relation to seabird by-catch mitigation, the Sub-Committee recommended that the line-weighting specifications in Rec. 11-09 be updated to conform with the latest ACAP advice: (a) 40 g or greater attached within 0.5 m of the hook; or (b) 60 g or greater attached within 1 m of the hook; or (c) 80 g or greater attached within 2 m of the hook. CPCs are encouraged to test the safety and practicality of the above measure and report the results back to the SCRS.

6. CPCs are encouraged to provide information on best practices for handling and dehooking sea turtles with a goal of preparing and developing a flyer. An identification guide is also required.

7. It is recommended that the ACAP seabird by-catch identification guide be linked to the ICCAT website.

Recommendations for Ecosystem:

8. It is recommended that the next meeting of the Dialogue between Science and Managers Working Group (SWGSM) include an agenda item on the implementation of an EBFM framework for ICCAT.

9. It is recommended that at the next Species Working Group meeting in 2017 that there be a meeting between the Working Group chairs and the Ecosystem Sub-committee Conveners in order to discuss the contribution of input to ICCAT's EBFM framework.

10. The Sub-committee recommends that document SCRS/2016/171 be presented to the Working Group on Stock Assessment Methods (WGSAM) and the Small Tuna Working Group in order to review the proposal to host a workshop that was described therein.

Financial Recommendations:

11. The Sub-committee recommends that regional workshops should be held with the goal of recovering Task II and other information (e.g. sea turtle and seabird by-catch) on gillnet fisheries, from CPCs in which this method of fishing occurs. The Sub-committee recommends searching for sources of funding in order to conduct these workshops and that by-catch related issues be included in the agenda of the gillnet workshops.

11. Adoption of the report and closure

The report was adopted during the meeting. The Conveners thanked all the participants and the Secretariat for their hard work.

The meeting was adjourned.

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Table 1. Summary of information in Task II CE dataset suitable for use to estimate Effdis (for LL).

Sum of recs				YearC																									
StatusTypeID	Flag	TStrata	GeoStrata	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
CP	Angola	mm	1x1																									8	
	Barbados	mm	1x1																					24	12	12	12	12	
			5x5																				23						
	Belize	mm	1x1															4		20									
			5x5																7		29	7	26	50	113	120	145	23	23
	Brazil	mm	5x5	48	35	150	250	159	206	145	508	307	1093	1675	1444	1525	1391	1389	1880	1787	1083	804	654	511	160	896	562	761	
	Canada	mm	5x5			6	12	1	1	110	127	113	120	114	106	103	107	101	106	90	100	85	85	89	73	52	53	64	
	China PR	mm	5x5										66	61	95	131	52	76	120	209	337	285	128	80	167	85	101	57	
	EU.Bulgaria	mm	5x5																					17	24	11	12		
	EU.Cyprus	mm	1x1											33		22	11	10	10	3		5		5					
			5x5																		6				7				
	EU.Denmark	mm	5x5																					1					
	EU.España	mm	5x5			164	206	220	360							22								7		60	33	76	
	EU.France	mm	1x1																									4	
	EU.Greece	mm	5x5															8	8										
	EU.Italy	mm	1x1																						2	3	2	4	
			5x5																					11	13				
	EU.Malta	mm	1x1																		152								
			5x5										16	18					10			165	78	100	92	97	140	271	301
	EU.Portugal	mm	1x1					10		38	2	29		71	127	437	288	247	1000	972	1104	589	688	724	617	14	10	5	
			5x5						34		13	30	115	29	11	35	190	259	46	58	78	301	53	12	43	959	736	763	
	EU.United Kingdom	mm	5x5															4	12				53	34		27	23	25	
	FR.St Pierre et Miquelon	mm	1x1																				2					4	
			5x5																					4	1		2		
	Guinea Ecuatorial	mm	5x5								1												3						
	Iceland	mm	1x1																							2			
	Japan	mm	5x5	288	262	155	267	50	34	41	24	44	39	38	20	38	32	37	41	40	42	42	1101	1018	907	891	620	697	
	Korea Rep.	mm	5x5	37	39	8	12	34			2	11	37	13	1		6	28	33	48			27	26		265	198	97	
	Libya	mm	5x5												1														
	Maroc	mm	5x5																							12	11		11
	Mexico	mm	1x1				10	24			6		10																
			5x5									11		10			28	32	40	37	31	32	34	35	33	35	29	78	
	Namibia	mm	5x5													155		144	196	380	341	211	102	237	171	129	177	196	
	Panama	mm	1x1											121						19	207	368	236				1398	507	
	Philippines	mm	1x1									9	24																
			5x5														2					4		8	8	9	95	43	
	Senegal	mm	1x1																					49	36				
			5x5																			42				157	122	50	
	South Africa	mm	1x1									5	2										266	439	333	253	381	347	
			5x5											110	174	240	107	143	127	93	162	124							
	St. Vincent and Grenadines	mm	5x5													53	111	20		96	124	226	138	207	246	70	200		
	Trinidad and Tobago	mm	1x1																				53	66					
			5x5														91	75	70	52	45				72	77	78	79	
	Turkey	mm	1x1																				1			4	4	2	
	U.S.A.	mm	1x1	83		142	16	24	47		26	22	14	25	19								1125						
			5x5							23														310	420	421	417	327	
	UK.Bermuda	mm	1x1																						17				
			5x5																				13	13		5		5	
			LatLon																								5		
	UK.Sta Helena	mm	5x5												2	7													
	UK.Turks and Caicos	mm	5x5																									5	
	Uruguay	mm	1x1																			189							
			5x5																	37	46				125	69	8		
	Vanuatu	mm	1x1															1328	2664	6164									
			5x5																					187	364	300	328	190	
	Venezuela	mm	1x1			20	33	64	42	45	67	42	307	637			87	701	307	455	1024	568							
			5x5								2												130	191	212	213	387	356	
NCC	Chinese Taipei	mm	5x5	148	157	73	444	942	355	469	304	257	251	117	85	85	1035	866	906	1145	1216	748	724	679	863	850	729	620	661
NCO	Chinese Taipei (foreign obs.)	mm	1x1						5						12														
			5x5											16															
	Cuba	mm	5x5	109												12													
	Dominica	mm	5x5																				2						
	Grenada	mm	1x1																	12	12	12							
	Japan (foreign obs.)	mm	1x1						5						10														
Grand Total				**713**	**493**	**718**	**1250**	**1528**	**1089**	**871**	**1082**	**880**	**2094**	**3088**	**2107**	**2865**	**3538**	**5472**	**7583**	**11717**	**6139**	**4807**	**5745**	**5134**	**5131**	**6098**	**7018**	**5676**	**996**

Table 2. Information regarding sea birds and sea turtles for 2014 submitted using ST09 observer data collection forms.

		Canada			EU.Malta			EU.PRT.Mainlan			Japan			Korea			USA			EU.France		
Common Name	Row Label	CatchWgt	NoDL	NoDD	CatchWgt	NoDL	NoDD	CatchWgt	NoDL	NoDD	CatchWgt	NoDL	NoDD	CatchWgt	NoDL	NoDD	CatchWgt	NoDL	NoDD	CatchWgt	NoDL	NoDD
Albatrosses nei	ALZ										48		53									
Cory's shearwater	CDI																	0	1			
Atlant. yellow-nosed albatross	DCR										4		2									
Grey-headed albatross	DIC										228.1		52									
Black-browed albatross	DIM										21.1		6									
Southern royal albatross	DIP										6	1	1									
Wandering albatross	DIX											1										
Leatherback turtle	DKK	1150	1					22	19	3		25		110	1			49	1		3	
Northern fulmar	FNO											1										
Olive Ridley turtle	LKV							43	35	8	24		2								22	
Great black-backed gull	LVU	2																				
Hall's giant petrel	MAH										28.4		6									
Antarctic giant petrel	MAI										47.5		10									
Grey petrel	PCI										9.3		8									
Light-mantled sooty albatross	PHE										10.2		2									
Sooty albatross	PHU												1									
White-chinned petrel	PRO										1.2		1									
Loggerhead turtle	TTL	440	9			3		6	5	1	28	1						12	0		10	
Marine turtles nei	TTX										83.5	6	4								3	
Green turtle	TUG										45		2								2	

Table 3. Information regarding sea birds and sea turtles for 2015 submitted using ST09 observer data collection forms. (Note: EU. Portugal submitted multiple ST09 forms, which are being verified for possible duplications or redundancies).

		Belize				Canada				EU.Cyprus				EU.France			
Common Name	Code	CatchNo	CatchWgt	NoDL	NoDD	CatchNo	CatchWgt	NoDL	NoDD	CatchNo	CatchWgt	NoDL	NoDD	CatchNo	CatchWgt	NoDL	NoDD
Albatrosses nei	ALZ																
Tristan albatross	DBN																
Grey-headed albatross	DIC																
Black-browed albatross	DIM																
Wandering albatross	DIX																
Leatherback turtle	DKK					9	2254	8								5	
Northern fulmar	FNO																
Olive Ridley turtle	LKV	6		4	2											45	1
Kemp's ridley turtle	LKY															1	
Great black-backed gull	LVU					1	3		1								
Hall's giant petrel	MAH																
Antarctic giant petrel	MAI																
Grey petrel	PCI																
Light-mantled sooty albatross	PHE																
Sooty albatross	PHU																
White-chinned petrel	PRO																
Great shearwater	PUG	8		6	2												
Hawksbill turtle	TTH															1	
Loggerhead turtle	TTL					5	188	5								16	
Marine turtles nei	TTX									0	0	8	2			13	
Green turtle	TUG															3	

		EU.Spain(AZTI_IEO)				Japan				Korea				USA			
Common Name	Code	CatchNo	CatchWgt	NoDL	NoDD	CatchNo	CatchWgt	NoDL	NoDD	CatchNo	CatchWgt	NoDL	NoDD	CatchNo	CatchWgt	NoDL	NoDD
Albatrosses nei	ALZ					43	87.4	1	42								
Tristan albatross	DBN					3	22.5		3								
Grey-headed albatross	DIC					164	118		164								
Black-browed albatross	DIM					16	118.5		16								
Wandering albatross	DIX					10	83	2	8								
Leatherback turtle	DKK	2	543	2		8	16	7	1			2		0		24	0
Northern fulmar	FNO					1	1.1		1								
Olive Ridley turtle	LKV	28	931.2	28		14	221	8	6			2					
Kemp's ridley turtle	LKY																
Great black-backed gull	LVU																
Hall's giant petrel	MAH					5	4	2	3								
Antarctic giant petrel	MAI					3	9.1		3								
Grey petrel	PCI					10	5.2		10								
Light-mantled sooty albatross	PHE					11	5		11								
Sooty albatross	PHU					17	29		17								
White-chinned petrel	PRO					6	8		6								
Great shearwater	PUG					7	8		7								
Hawksbill turtle	TTH																
Loggerhead turtle	TTL					11	217	1	10					1		20	0
Marine turtles nei	TTX					10	3	7	1								
Green turtle	TUG	1	8.48	1													

Table 4. EFFDIS estimates of total hooks for CPCs fishing south of 25ºS and their submission of ST09 forms and/or seabird related information.

CPC	2010	2011	2012	2013	2014	Grand Total	ST09 submission	Seabird information
Belize	2579887.731	3548715.108	4230785.849	4383854.879	1001022.966	15744266.53	Yes	No
Brazil	1477254.734	639209.4918	2308197.463	1907959.74	814554.0707	7147175.499	No	No
China PR		63278.40359		456433.71		519712.1135	Yes	No
Chinese Taipei	24288011.99	29782205.89	25375825.03	25622647.32	20472706.18	125541396.4	Yes	No
EU.España	5027110.471	5128721.199	4212748.549	3123223.261	3895889.948	21387693.43	Partial	No
EU.Portugal	1452475.695	2386276.063	761655.6883	283942.6493	65474.06338	4949824.159	Yes	Blank form
Japan	5948906.791	5767462.238	6548398.871	7632855.344	7113351.098	33010974.34	Yes	Yes
Korea Rep.				268001.065		268001.065	Yes	No
Namibia	312930.6327	164853.7547	122790.952	58238.32028	108750.6983	767564.358	No	No
Other	1581704.399	3085535.113	3047860.458	1858246.94		9573346.91	-	-
South Africa	846159.927	969790.7177	337545.0493	837559.8687	1186153.898	4177209.461	No	No
St. Vincent and Grenadin	653322.0275	1197148.517		354472.365	209867.1865	2414810.096	No	No
Vanuatu	299996.7078	94402.90744	8764.464117		3612.126595	406776.206	No	No

Appendix 1

AGENDA

1. Opening, adoption of Agenda and meeting arrangements

2. Review the progress that has been made in implementing ecosystem based fisheries management and enhanced stock assessments.

3. Develop proposals for obtaining common Oceans ABNJ tuna project funding to support a joint meeting between tRFMOs on the implementation of the EBFM approach.

4. Establish clear EBFM goals and objectives to be discussed and considered by the Commission.

5. Assess research needs and prioritize research activities in order to develop a long term research plan

By-catch

7. Total effort estimates by fishery

7.1. Longline

7.1.1. Review Task II longline catch and effort data coverage.

7.1.2. Review the methodology to be used to update the longline EFFDIS data

6.2 Other gears

8. Sea Turtles

7.1 Work Plan – Sea Turtles

8. Seabirds

8.1 Review of seabird conservation measure Rec. 11-09

8.2 Review of data received from CPCs on seabird by-catch

8.3 Seabird papers submitted by CPCs

8.4 Mitigation trials and advice

8.5 Seabird by-catch and mitigation in the Mediterranean

8.6 Work plan - Seabirds

9. Other matters

10. Recommendations

11. Adoption of the report and closure

Appendix 2

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Appendix 3

LIST OF DOCUMENTS

SCRS/2016/039	Interaction Between Seabirds and the Spanish Surface Longline Fishery Targeting Swordfish in the South Atlantic Ocean (south of 25ºS) During the Period 2010-2014	Ramos-Cartelle, A., Carroceda, A., Fernández, J., and Mejuto, J.
SCRS/2016/125	Preliminary estimates of the number of sea turtle interactions with pelagic longline gear in the ICCAT Convention area	Mckee Gray C.,Diaz G., and Swimmer Y.
SCRS/2016/127	ISSF by-catch reduction research cruise on the F/V Cap Lopez, Gulf of Guinea 2015	Itano D., Filmalter J.D., and Forget F.
SCRS/2016/155	ISSF by-catch reduction research cruise on the Sea Dragon, Eastern Atlantic Ocean 2015	Itano D., Filmalter J.D., and Hutchinson M.
SCRS/2016/156	ISSF by-catch reduction research cruse on the F/V Mar de Sergio in 2016	Sancristobal I., Martinez U., Boyra G., Muir J.A., Moreno G., and Restrepo V.
SCRS/2016/158	Utilization and trade of faux poisson landed in Abidjan	Amandà 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.
SCRS/2016/160	Aspects of The Migration, Seasonality And Habitat Use Of Two Mid-Trophic Level Predators, Dolphinfish (*Coryphaena Hippurus*) And Wahoo (*Acanthocybium Solandri*), in The Pelagic Ecosystem Of The Western Atlantic Including The Sargasso Sea	Luckhurst B.E.
SCRS/2016/161	Operational pattern of Japanese longliners in the south of 25S in the Atlantic and Indian Ocean for the consideration of seabird by-catches	Yokawa K., Oshima K., Inoue Y., and Katsumata N.
SCRS/2016/162	Examination of factors affecting seabird by-catch occurrence rate in southern hemisphere in Japanese longline fishery with using random forest	Inoue Y., Kanaiwa M., Yokawa K., Okamoto K., and Oshima K.
SCRS/2016/163	Modeling of bycatch occurrence rate of seabirds for Japanese longliners operated in southern hemisphere	Inoue Y., Kanaiwa M., Yokawa K., Okamoto K., and Oshima K.
SCRS/2016/164	Information on seabirds bycatch in area south of 25S from 2010 to 2015	Katsumata N., Yokawa K., Okamoto K., and Oshima K.
SCRS/2016/165	Comparative Trails of Lumo Leads And Traditional Line Weighting In The Brazilian Pelagic Longline Fishery	Neves T., Claudino R., Silva-Costa A., Sant'Ana R., Gianuca D., Yates O., and Marques C.

SCRS/2016/166	ACAP Advice For Reducing The Impact Of Pelagic Longline Fishing Operations On Seabirds	Wolfaardt A., Favero M., and Walker N.
SCRS/2016/167	The Development Of ACAP Seabird Bycatch Indicators, Data Needs, Methodological Approaches And Reporting Requirements	Wolfaardt A., Debski I.,Misiak W., Walker N., and Favero M.
SCRS/2016/168	The Conservation Status And Priorities For Albatrosses And Large Petrels	PhillipsR.A., Gales R., Baker G.B., Double M.C., Favero M., Quintana F., Tasker M.L., Weimerskirch H., Uhart M., and Wolfaardt A.
SCRS/2016/169	Fishery As Administrative Unit: Implications For Sea Turtle Conservation	Giffoni, B.B., Olavo G., Leite Jr., Britto. M.K., N.O., and Sales G.
SCRS/2016/170	The Ecosystem Subcommittee's Long Term Research Needs And Priorities As Outlined In The 2015-2020 SCRS Science Strategic Plan	Hanke A.
SCRS/2016/171	Training On Data-Limited Assessments For Tuna And Tuna-Like Species	Gutierrez N.L., Carruthers T., and Newman D.
SCRS/2016/172	Les Tortues Marines de STP	Godinho V.
SCRS/2016/173	Seabird Bycatch Mitigation In The Mediterranean	Tarzia M., Mulligan B., Campos B., and Small C.
SCRS/2016/174	Albatross And Petrel Distribution In The Atlantic Ocean And Overlap With ICCAT Longline Effort	Carneiro A., Mulligan B., Beare D., and Small C.
SCRS/2016/175	Modelling the oceanic habitats of Silky shark (*Carcharhinus falciformis*), implications for conservation and management	Lopez J., Alvarez-Berastegui D., Soto M., and Murua H.

SCRS/P/2016/046	Evaluation of Methods of Incorporating Oceanographic Indicators into Indices of Abundance for Stock Assessment: Project Overview and Progress	Schirripa, M. J., Forrestal, F. Goodyear, C. P.
SCRS/P/2016/047	An Initial EBFM Framework for ICCAT	Hanke, A.
SCRS/P/2016/048	Sea turtle bycatch in U.S. Atlantic & Gulf of Mexico pelagic longlines: Analysis of observer data (POP) 1992-2015	Swimmer, Y. and Guttierrez, A.

Appendix 4

From SCRS/2016/125. By-catch rates (sea turtles /1000 hooks), reported fishing effort (number of hooks) from EFFDIS, estimated total interactions (number of individuals) by species and area and associated quarter (QTR) in the ICCAT Convention Area for different fleets. 'Reference' indicates the study from which the bycatch rates were assigned to the different fleets.

FLEET	SPECIES	AREA	QTR	BYCATCH RATE	EFFORT	NO. INT.	REFERENCE
BELIZE	*C. caretta*	N Atlantic	1	0-0.0128	3,692,311	47	Huang 2015
		Tropics	1	0-0.003	2,403,650	7	Huang 2015
		S Atlantic	1	0-0.0239	210,544	5	Huang 2015
	D. coriacea	N Atlantic	1	0-0.0104	3,692,311	38	Huang 2015
		Tropics	1	0-0.03	2,403,650	72	Huang 2015
		S Atlantic	1	0-0.0038	210,544	1	Huang 2015
	L. olivacea	Tropics	1	0.0024	2,403,650	6	Sales et al., 2008
	C. mydas	Tropics	1	0.0032	2,403,650	8	Sales et al., 2008
BRAZIL	*C. caretta*	SW Atlantic	1	0.39-1.78	1,609,178	627-2864	Pons et al., 2010
		Tropics	1	0.07	2,828,310	198	Sales et al., 2008
	D. coriacea	Tropics	1	0.03	2,828,310	85	Sales et al., 2008
	L. olivacea	Tropics	1	0.01	2,828,310	28	Sales et al., 2008
	C. mydas	Tropics	1	0	2,828,310	0	Sales et al., 2008
CANADA	*C. caretta*	NW Atlantic	2	0.138	134,869	19	Garrison & Stokes, 2014
		NW Atl. coastal	3	0.313	662,795	207	Garrison & Stokes, 2014
		NW Atl. offshore	3	0.119	327,378	39	Garrison & Stokes, 2014
		NW Atl. coastal	4	0.145	156,175	23	Garrison & Stokes, 2014
		NW Atl. offshore	4	0.262	81,614	21	Garrison & Stokes, 2014
	D. coriacea	NW Atlantic	1	0.179	17,779	3	Garrison & Stokes, 2014
		NW Atlantic	3	0.35	327,378	11	Garrison & Stokes, 2014
		NW Atlantic	4	0.295	156,175	46	Garrison & Stokes, 2014
CHINA	*C. caretta*	N Atlantic	1	0-0.0128	60,374	0-1	Huang 2015
		Tropics	1	0-0.003	6,153,398	0-18	Huang 2015
	D. coriacea	N Atlantic	1	0-0.0104	60,374	0-1	Huang 2015
		Tropics	1	0.03	6,153,398	0-184	Huang 2015
	L. olivacea	Tropics	1	0-0.0232	6,153,398	0-143	Huang 2015

FLEET	SPECIES	AREA	QTR	BYCATCH RATE	EFFORT	NUMBER INT.	REFERENCE
CHINA-TAIPEI	*C. caretta*	N Atlantic	1-4	0-0.0128	2,630,935	0-34	Huang 2015
		Tropics	1-4	0-0.003	33,488,024	0-100	Huang 2015
		S Atlantic	1-4	0-0.0239	14,748,208	0-352	Huang 2015
	D. coriacea	N Atlantic	1-4	0-0.0104	2,630,935	0-27	Huang 2015
		Tropics	1-4	0-0.03	33,488,024	0-1005	Huang 2015
		S Atlantic	1-4	0-0.0038	14,748,208	0-56	Huang 2015
	E. imbricata	SE Atlantic	1-4	0.001	8,473,921	8	Petersen et al., 2009
	L. olivacea	N Atlantic	1-4	0	2,630,935	0	Huang 2015
		Tropics	1-4	0-0.0232	33,488,024	0-777	Huang 2015
		S Atlantic	1-4	0-0.0032	14,748,208	0-47	Huang 2015
	C. mydas	SE Atlantic	1-4	0.001	8,473,921	8	Petersen et al., 2009
		Tropics	1-4	0.0032	33,488,024	0-107	Sales et al., 2008
JAPAN	*C. caretta*	N Atlantic	1-4	0-0.0128	6,323,814	0-81	Huang 2015
		Tropics	1-4	0-0.003	30,323,819	0-91	Huang 2015
		S Atlantic	1-4	0-0.0239	9,438,423	0-226	Huang 2015
	D. coriacea	N Atlantic	1-4	0-0.0104	6,323,814	0-66	Huang 2015
		Tropics	1-4	0-0.03	30,323,819	0-910	Huang 2015
		S Atlantic	1-4	0-0.0038	9,438,423	0-36	Huang 2015
	L. olivacea	Tropics	1-4	0-0.0232	30,323,819	0-704	Huang 2015
		S Atlantic	1-4	0-0.0032	9,438,423	0-30	Huang 2015
	C. mydas	SE Atlantic	1-4	0.001	9,433,049	9	Petersen et al., 2009
	E. imbricata	SE Atlantic	1-4	0.001	9,433,049	9	Petersen et al., 2009
KOREA	*C. caretta*	N Atlantic	1-4	0-0.0128	244,852	0-3	Huang 2015
		Tropics	1-4	0-0.003	1,179,180	0-3	Huang 2015
	D. coriacea	N Atlantic	1-4	0-0.0104	244,852	0-3	Huang 2015
		Tropics	1-4	0-0.03	1,179,180	0-35	Huang 2015
	L. olivacea	N Atlantic	1-4	0	244,852	0	Huang 2015
		Tropics	1-4	0-0.0232	1,179,180	0-27	Huang 2015
	C. mydas	Tropics	1-4	0.0038	1,179,180	4	Sales et al., 2008
	C. caretta	N Atlantic	1-4	0-0.0128	244,852	0-3	Huang 2015
NAMIBIA	*C. caretta*	SE Atlantic	1-4	0.02	1,210,015	24	Petersen et al., 2009
	D. coriacea	SE Atlantic	1-4	0.01	1,210,015	12	Petersen et al., 2009
	C. mydas	SE Atlantic	1-4	0.001	1,210,015	1	Petersen et al., 2009
	E. imbricata	SE Atlantic	1-4	0.001	1,210,015	1	Petersen et al., 2009
PORTUGAL	*C. caretta*	NE Atlantic	1-4	0.104	131,870	1	Mejuto et al., 2008
		S Atlantic	1-4	1.505	54,414	82	Santos et al., 2013
	D. coriacea	NE Atlantic	1-4	0.391	131,870	52	Mejuto et al., 2008
		Tropics	1-4	0.45	50,204	23	Santos et al., 2012
		S Atlantic	1-4	0.188	54,414	10	Santos et al., 2013
	L. olivacea	Tropics	1-4	1.2	50,204	60	Santos et al., 2012

FLEET	SPECIES	AREA	QTR	BYCATCH RATE	EFFORT	NUMBER INT.	REFERENCE
SOUTH AFRICA	*C. caretta*	SE Atlantic	1-4	0.02	149,216	3	Petersen et al., 2009
	D. coriacea	SE Atlantic	1-4	0.01	149,216	1	Petersen et al., 2009
	E. imbricata	SE Atlantic	1-4	0.001	149,216	0	Petersen et al., 2009
	C. mydas	SE Atlantic	1-4	0.001	149,216	0	Petersen et al., 2009
SPAIN	*C. caretta*	NW	1-4	1.758	3,860,843	6787	Mejuto et al., 2008
		NE Atlantic	1-4	0.104	3,779,639	393	Mejuto et al., 2008
		Tropics	1-4	0.421	5,081,172	2139	Mejuto et al., 2008
		S Atlantic	1-4	0-0.0239	2,833,280	68	Huang 2015
	D. coriacea	NW	1-4	0.349	3,860,843	1347	Mejuto et al., 2008
		NE Atlantic	1-4	0.391	3,779,639	1478	Mejuto et al., 2008
		Tropics	1-4	0.631	5,081,172	3206	Mejuto et al., 2008
		S Atlantic	1-4	0-0.0038	2,833,280	11	Huang 2015
ST. Vincent and the Grenadines	*C. caretta*	N Atlantic	1-4	0-0.0128	10,647,265	0-136	Huang 2015
		Tropics	1-4	0-0.003	2,127,643	0-6	Huang 2015
		S Atlantic	1-4	0-0.0239	164,344	0-4	Huang 2015
	D. coriacea	N Atlantic	1-4	0-0.0104	10,647,265	0-111	Huang 2015
		Tropics	1-4	0.0.03	2,127,643	0-64	Huang 2015
		S Atlantic	1-4	0-0.0038	164,344	0-1	Huang 2015
	C. mydas	S Atlantic	1-4	0	164,344	0	Sales et al., 2008
	L. olivacea	S Atlantic	1-4	0.01	164,344	2	Sales et al., 2008
VANUATU	*C. caretta*	N Atlantic	1-4	0-0.0128	1,027,757	0-13	Huang 2015
		Tropics	1-4	0.0135	202,295	3	Sales et al., 2008
		S Atlantic	1-4	0-0.0239	36,303	0-1	Huang 2015
	D. coriacea	N Atlantic	1-4	0-0.0104	1,027,757	0-11	Huang 2015
		Tropics	1-4	0.035	202,295	7	Sales et al., 2008
		S Atlantic	1-4	0-0.0038	36,303	0-1	Huang 2015
	L. olivacea	N Atlantic	1-4	0	1,027,757	0	Huang 2015
		Tropics	1-4	0.0024	202,295	1	Sales et al., 2008
		S Atlantic	1-4	0-0.0032	36,303	0-1	Huang 2015
VENEZUELA	*C. caretta*	Tropics	1-4	0-0.003		16	Huang 2015
	D. coriacea	Tropics	1-4	0-0.03		158	Huang 2015

FLEET	SPECIES	AREA	QTR	BYCATCH RATE	EFFORT	NUMBER INT.	REFERENCE
UNITED STATES	*C. caretta*	Florida E Coast	1	0.027	271,589	7	Garrison & Stokes,
		Florida E Coast	3	0.087	180,957	16	Garrison & Stokes,
		Florida E Coast	4	0.054	196,463	11	Garrison & Stokes,
		Gulf of Mexico	1	0.009	441,554	4	Garrison & Stokes,
		Gulf of Mexico	2	0.008	382,056	3	Garrison & Stokes,
		Gulf of Mexico	4	0.021	283,930	6	Garrison & Stokes,
		Mid Atl. Bight	2	0.038	240,897	9	Garrison & Stokes,
		Mid Atl. Bight	4	0.179	186,193	33	Garrison & Stokes,
		NE Coastal	3	0.313	632,043	198	Garrison & Stokes,
		NE Coastal	4	0.145	173,992	25	Garrison & Stokes,
		S Atl. Bight	2	0.02	414,278	8	Garrison & Stokes,
	D. coriacea	Florida E Coast	1	0.027	271,589	7	Garrison & Stokes,
		Florida E Coast	2	0.057	182,088	10	Garrison & Stokes,
		Florida E Coast	4	0.051	196,463	10	Garrison & Stokes,
		Gulf of Mexico	1	0.09	441,554	40	Garrison & Stokes,
		Gulf of Mexico	2	0.0921	382,056	35	Garrison & Stokes,
		Gulf of Mexico	3	0.021	458,515	10	Garrison & Stokes,
		Gulf of Mexico	4	0.047	283,930	13	Garrison & Stokes,
		Mid Atl. Bight	4	0.108	186,193	20	Garrison & Stokes,
		S Atl. Bight	1	0.044	383,385	17	Garrison & Stokes,
		NE Coastal	2	0.065	167,733	11	Garrison & Stokes,
		NE Coastal	3	0.179	632,043	113	Garrison & Stokes,
		NE Coastal	4	0.295	173,992	51	Garrison & Stokes,

Appendix 12

WORK PLANS OF THE SPECIES GROUPS FOR 2017

Tropical Tunas Work Plan

- MSE
  - Review performance indicators for yellowfin and bigeye
  - Provide feedback regarding initial performance metrics for yellowfin and bigeye
  - Initial developments of yellowfin / bigeye MSE
  - Review existing operating models and provide feedback on potential tropical tuna design issues on the Atlantic
  - Develop a programme to implement and fund MSE for tropical tunas for a minimum of three years

- Start the review of the AOTTP data and programme
  - Review data collected and give feedbacks
  - Improve scientific information (growth rate, etc.)
  - Examine the spatial structure for tunas
  - Invite CPCs to participate to the programme (financial)

- Analyze the efficacy of the Moratorium
  - Analyzing the efficacy of the new area/time closure in relation with the protection of juvenile tropical tunas pursuant to Rec. 15-01 by reviewing the data collected through the AOTTP
  - Evaluate how changes to the size structure of the catch affect recovery timelines for bigeye
  - Analyze corrected historical data to advice appropriate time/area moratorium for FAD closure.

- Improving ICCAT Task I and Task II data (including Ghanaian statistics and *faux poisson*)
  - Organizing workshop/training on the T3 treatment's procedure to correct logbook data (hypotheses, tools, etc.)
  - Comparing T3+ process and results to others alternatives
  - Organizing capacity building for coastal and others countries involved in this issue

Albacore Work Plan

During 2016, the north and south albacore stocks were evaluated and several research lines were identified in order to improve future stock monitoring. Likewise, substantial progress was made on the development of the MSE framework, where several HCRs were tested, and many future avenues to improve the framework were identified.

In 2017, the Albacore tuna species group plans to produce a stock assessment of the Mediterranean stock (last assessed in 2011). The assessment update will be based on data poor methods. The Group also plans to further develop and test Limit Reference Points and HCRs for north Atlantic albacore, and improve CPUE series for both northern and southern albacore. Given the large amount of work envisaged for 2017, two successive intersessional meetings are envisaged, one for the Mediterranean assessment and the other one to revise progress on MSE and CPUE work (7-8 days, possibly in May-June).

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 Addendum to this 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 2017 or as soon as possible.

Meanwhile for 2017, 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.

- EU-Portugal, EU-Spain and Korean longline: consider using albacore by-catch information during swordfish oriented operations to produce an abundance index.

Deadline: one week before the intersessional meeting. ***Deliverable:*** SCRS documents, following the standards provided by the Working Group on Stock Assessment Methods (WGSAM). ***Responsibility:*** CPCs.

It is also requested that the recent submissions of Task I and Task II data by EU-France be documented, so that the Working Group can decide to accept the new data, or not. ***Deadline:*** intersessional 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:

- Japanese longline: consider alternative ways to incorporate targeting effects (e.g. based on species composition) to try to recover the early periods.

- Compare and consider feasibility of joint CPUE analyses for longline fleets (Brazil, Chinese Taipei, Japan and Uruguay) using fine scale, operational level data.

- Explore homogeneous approaches to standardize CPUEs of longline and surface fisheries.

Deadline: one week before the intersessional meeting. ***Deliverable:*** SCRS documents, following the standards provided by the WGSAM. ***Responsibility:*** CPCs.

It is also required that the new Task II size data (by month and 5º*5º) by Chinese Taipei is provided to the Secretariat. ***Deadline:*** one week before the intersessional meeting. ***Responsibility:*** Chinese Taipei.

Mediterranean Albacore Stock Proposed Work Plan

The intention is to, at a minimum, update the length-converted catch curve analysis used in the 2011 stock assessment, as well as the catch only method to produce an MSY estimate for this stock (SCRS/2015/159). Following is a list of actions, responsibilities and deadlines:

- Submit all 2015 T2 data: ***Deadline:*** before end of 2016 SCRS. ***Responsibility:*** CPCs.

- Prepare T1, T2CE, T2Sz, CATDIS, and mean weights per fishery and year for Mediterranean albacore. ***Responsibility:*** Secretariat. ***Deadline:*** one month before the intersessional meeting (except CATDIS).

- Update (till 2015, and, if possible, extend back in time) the following yearly standardized CPUEs. ***Deadline:*** one month before the intersessional meeting. ***Deliverable:*** SCRS documents, following the standards provided by the WGSAM. ***Responsibility:*** CPCs.

  - Greek by-catch
  - Greek longline albacore
  - Italy longline Adriatic
  - Italy longline
  - Spanish longline albacore
  - Spanish sport

- Evaluate the indices against the standards provided by the WGSAM. ***Responsibility:*** Albacore Chair and ICCAT Secretariat. ***Deadline:*** Stock assessment meeting.

- Update the length converted catch curve analysis as well as the catch based and other data poor methods until 2015. ***Responsibility:*** EU-Spain and ICCAT Secretariat. ***Deadline:*** Stock assessment meeting. ***Deliverable:*** SCRS documents.

Participation in the Albacore Species Group

Participation in the Albacore species group has been poor in recent years (see the 2011, 2013 and 2016 assessment and data preparatory reports), with CPCs directly involved in the fisheries not participating in the assessment process. Also, delays in the submission of the requested information has hampered the outcome of the Working Group. These issues made it difficult to evaluate the suitability of some data series or to address some uncertainties. The Group recommends that CPCs that can make valuable contributions to the assessments make the necessary arrangements to ensure the presence of their national scientists at those meetings. This is especially important in 2017, when an assessment of the Mediterranean albacore, a data poor stock, is planned (***Responsibility:*** SCRS to identify this requirement to the Commission during the 2016 Annual Meeting).

Addendum

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 SCRS/2010/155, 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 stablish 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, Venezuela and United States. 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-the Canary Islands, 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 interannual 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 ICCAT Panel 2 meeting in Sapporo (July 2016) 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). Following the Panel 2 Meeting in Sapporo, there is also a need to discuss the performance indicators and find better ways to communicate results.

The requested funds to develop this research plan have been estimated in 1,192,000 Euros. 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

The SCRS has now held three data preparatory meetings to incorporate the new information in ICCAT databases from the Atlantic-wide Bluefin Tuna Research Program (ICCAT GBYP) and other programmes. Good progress has been made in a number of areas; however there is still a great deal to accomplish in preparation for the 2017 assessment. In view of this, the SCRS proposes the following work plan for 2017:

1. Preparation for 2017 stock assessment

a) Full revision of the bluefin tuna catch-at-size for the period 1950-2016 following the work plan outline in Table 14 of the 2016 Data Preparatory report. ***Action National Scientists and Secretariat***.

b) Capacity-building workshop (Miami or Sète, January 2017). Course on theory and application of VPA to bluefin tuna, targeting National Scientists and members of Contracting Parties with backgrounds in quantitative fisheries science or ecology. ***Action National Scientists and Secretariat.***

c) CPUE workshop (February 2017): Conduct a small (1-2 representatives from each CPC), 3-4 day intersessional workshop that builds on the previous joint Canada, Japan, Mexico, U.S meeting (Cercedilla, Spain, July 2016) to investigate the feasibility of statistically modeling combined datasets to produce one or several CPUE indices for Western bluefin tuna. This meeting would primarily focus on whether disparities between target and non-target fleets can be reconciled in modeling process. If statistical modeling is feasible for 2 or more fleet/area combinations, then this meeting will produce combined indices in advance of the 2017 Data Preparatory meeting for consideration in the stock assessment. ***Action National Scientists***.

d) Inter-sessional Data Preparatory meeting (March 2017) Conduct a 6-7 day meeting that will focus on the items listed below. ***Action National Scientists and Secretariat***.

- Review and make final revisions to Task I and II data through 2015, including validating and integrating the catch at size statistics with new information from farms, harvesting and stereoscopic cameras, and other sources of information.
- Review and finalize age-length keys.
- Review and finalize stock composition keys (otolith microchemistry, shape, genetics, etc.) and evaluate possible biases in stock assignment procedures.
- Evaluate indices available for use in the next assessment (updating the index criteria table developed during the 2016 data preparatory intersessional workshop).
- Review and finalize the tagging data to be used for the next assessment.
- Review and finalize fecundity schedules, natural mortality and stock structure.
- Review progress on new modelling frameworks.
- Evaluate evidence for the existence of the extraordinary 2004-2007 recruitment years estimated for the eastern Atlantic and Mediterranean population (e.g., produce SCRS paper examining size frequency histograms such as in SCRS/2015/160). ***Action National Scientists***.

2. Intersessional Stock Assessment meeting (June or July 2017) (10 days). ***Action National Scientists and Secretariat***.

a) Assessment will use Task I and II data through 2015.
b) The standardized CPUE series and other data sets prepared by National Scientists for use in the 2017 assessment (east and west) should follow the specifications decided upon during the Data preparatory workshop, but updated to include 2015 if necessary. ***Action National Scientists and Contracting Parties***.
c) Main scientific advice will be based on results from validated and documented software retained in the ICCAT catalogue. These catalogue entries need to be completed by April 2017. ***Action National Scientists***.

3. **Species group meeting.** Update the scientific advice at the species group meeting preceding the 2016 SCRS plenary based on fishery indicators updated through 2016 (as prescribed by Rec. [12-03], paragraph 50). ***Action National Scientists and Secretariat***.

4. **Management Strategy Evaluations** Hold a meeting of the Core Modelling Group at an appropriate venue prior to June 2017, augmented by representatives of groups developing candidate Management Procedures (CMPs). The purpose will be to review and compare results obtained when trialing these CMPs with a view to the developers improving their CMPs and agreeing a priority set of performance statistics and plots for use in subsequent reporting to scientists and later also wider groups of stakeholders. The Committee recommends that the ICCAT GBYP support the continuation of modeling personnel beyond February 2017 to facilitate this MSE evaluation process. A dialogue between scientists, stakeholders and Commissioners should be conducted to develop appropriate management objectives based on results from this process as reported to the September 2017 bluefin session. This dialogue might be facilitated by alternatives such as the creation of a Commission Working Group that focuses on management strategy evaluations or a programme of scientific presentations to stakeholders. ***Action ICCAT GBYP, National Scientists***.

5. **Research**: Continue a series of workshops and related activities (to be sponsored by the ICCAT GBYP and various national programmes) in accordance with recommendations from the 2015 and 2016 data preparatory meetings including:

   a) Evaluate potential for spawning in regions within and outside Gulf of Mexico and Mediterranean Sea (*i.e*., the Azores; Morocco, Canary Islands and Slope Sea) using the available and latest models that predict habitat/seasons of spawning bluefin together with observations of co-occurrence of bluefin in those areas/times to define areas of highest priorities for new larval surveys. Design ichthyoplankton surveys that will allow for rigorous comparisons of the relative magnitude of spawning inside and outside of the putative spawning areas in the Gulf of Mexico and Mediterranean Sea.
   b) Next iteration of the feasibility of close-kin analysis should consider that the estimation of the proportion of each age group which contributes to spawning is one of the highest priorities as a possible objective for a future close-kin analysis.
   c) Continue to deploy archival tags, particularly for juveniles and acquire archival tag tracks in the Mediterranean Sea to support inferences on initial size at spawning and population structure.
   d) Longline cruise to obtain linked samples for reproductive analyses, otolith microchemistry and genetic analyses, with emphasis on the South Atlantic.
   e) Evaluate alternative indicators of stock status based on the available size data (e.g., proportion of catch above the optimal harvest size).
   f) Evaluate relative efficacy (cost/benefit) of aerial surveys, larval surveys and close-kin genetics for independent assessments of the abundance of adult bluefin tuna.

There is a great deal of work to be done in advance of the 2017 assessment, i.e., final validation and incorporation of 10,000s of new files into the current ICCAT databases, calibrating and updating all the size and age conversion methods, evaluating new data and continuing the development of new modeling frameworks. Moreover, new data continues to come in that will improve our understanding of bluefin tuna biology and fisheries. Therefore, the proposed improvements to data and methods will have to be implemented incrementally over the next several assessment cycles. In order to ensure these incremental improvements continue, the assessments should not be more frequent than every three years. The Bluefin species group reiterates that a three to four year period between assessments is also appropriate because bluefin tuna is a long-lived species and it usually takes several years to detect changes in bluefin biomass in response to changes in exploitation or management. More frequent assessments would only be warranted in cases where there is evidence for a rapid change in the available fishery indicators, as per Rec. [12-03], paragraph 50.

Billfish Work Plan

Assessments for the marlins and sailfish stocks were conducted in 2011 (BUM), 2012 (WHM), and 2016 (SAI). The next data preparatory and stock assessment meetings for billfish species are proposed for 2018 (blue marlin) and 2019 (white marlin).

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 marlin and sailfish 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 noticed 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 Caribbean Sea and off West Africa. Efforts should be made to procure funding for this endeavour.

Discards

Information on the number of fish landed, and the numbers discarded (dead and released alive) should be reported in order to fully quantify catches in all months and areas. A need for determining levels of post release mortality warrants additional research, so that the full effects of discards can be included in future stock assessments. Reporting of these data should meet the ICCAT deadlines for submission of Task I and II data. National scientists should investigate whether the available observer data provide insights into the low reporting of dead discards.

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, 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.

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 marlins (BUM, WHM) and to develop a robust estimate of sailfish growth in the Atlantic.

Stock structure

The Group recommended that new information about sailfish stock structure be considered prior to future assessments.

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, it is recommended that the ICCAT data be further evaluated to determine its appropriate value for inclusion in future billfish assessments.

Swordfish Work Plans

Assessments for North and South Atlantic swordfish were conducted in 2013. The next assessment is proposed for 2017.

Proposed work

North and South Atlantic

A list of recommended work was identified as high priority areas where continued efforts are required:

- *CPUE data preparation.* Given evidence that swordfish distribution is influenced by environmental factors that vary spatially and that the indices would need to be spatially explicit to capture the distribution shifts, the group proposes to assess the swordfish stocks using area specific, rather than flag specific, indices of abundance. Consequently, it is recommended that scientists from Brazil, Canada, EU-Portugal, EU-Spain, Japan, Namibia, South Africa, United States, Uruguay, and Chinese-Taipei, as well as any others CPCs, come to the data preparatory meeting with both their updated CPUE time series and the raw data, with the goal of developing alternative and/or combined CPUE indices and resolving the conflicting indices to the extent possible prior to the next assessment. Intersessionally the Swordfish species group rapporteur will facilitate this process. Emphasis should be given to aggregating the CPUE trends by area (rather than the current method of aggregating by nation). For the South Atlantic, some attempt should also be made to use stock assessment methods that can reconcile the contradictory trends in the target and by-catch CPUE series. The advantages of a more spatially explicit approach could be demonstrated in relation to the current methodology and would incorporate effects of oceanographic and climatological processes that can be linked with the raw data prior to aggregation. This item addresses the broader issue affecting all species working groups regarding the need to overcome data confidentiality issues that limit science's ability to accurately estimate stock status but also provides flexibility in the creation of alternative stock delineations.

- *Environmental effects.* 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, EU (Spain and Portugal) and Japan as their indices were the most appropriate for this work. A review of historical size data and fishery data is necessary to decide appropriate modelling structure, which should be conducted by National Scientists and the ICCAT Secretariat. 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.

- *Alternative indicators of stock status.* The Group should engage in collaborative work with the CPC scientists to develop alternative indicators of stock status based on sex and size data from observer programmes and Task II sources.

- *Quantifying lost fish*. The Group will review information on the number of swordfish fish lost before boarding.

- *Weight-length relationships*. The Group recognized 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 2017 the ongoing analysis.

- *Atlantic Swordfish Research Plan.* Given the poor understanding of population dynamics of swordfish, particularly in the South Atlantic, the Group should develop a long term plan for an enhanced programme of research, focussing on independent estimates of fishing mortality, fraction mature by age, growth by sex and stock, movement and migrations, and improving available indices of abundance. This deficiency could be addressed within the context of the SCRS Strategic Plan.

- *Fleet definitions.* The available data (tagging, length compositions, CPUEs, etc.) should be examined spatially and temporally, in an attempt to derive biologically sound spatial and temporal structure, from which to provide appropriate fleet definitions with similar selectivity patterns.

- *Informative priors for carrying capacity.* Given the sensitivity of assessment results in general to prior distributions for carrying capacity in situations where the data are uninformative, the Group recommends that informative priors for K be developed based upon factors such as habitat area, population density and other life history factors.

- *Harvest Control Rules*: Consider potential Harvest Control Rules (HCR) for future stock assessments in the North Atlantic, taking into account the newly developed HCR for albacore which was also applied in the last assessment, in collaboration with the Secretariat.

- *PSAT tag data request:* In order to support the improvement of CPUE standardization through the removal of environmental effects, 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.

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 prepared. 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 continue and update the work on length-weight relationships. National scientists should make available to the Group observed values of length (LJFL) and weight (round and/or gilled and gutted) to allow the ongoing cooperative analysis to be finished by 2017.

– 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.

– 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. A review of the existing relevant information should be presented to the next Working Group meeting to identify current gaps and facilitate the development of future research regarding those issues.

– 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.

– To improve knowledge on the biology of the species including the determination of region and sex specific size and age at maturity and growth parameters, as well as, estimations of spawner and recruit proportions in the catches

– To examine the potential of using alternative indicators and appropriate reference points (Lopt, measures based on reproductive potential, etc.).

Small Tunas Work Plan for 2017

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 2017 Small Tunas Species Group Intersessional Meeting;

- Hold an intersessional meeting in 2017 with the aim to update the ERA using the new Life History parameters dataset developed by the Working Group for each of the 5 major ICCAT areas and extending the analysis to gears other than LL (such as PS). The Small Tunas species group should also focus on applying different data poor stock assessment methods to assess the priority species of SMT (see details below);

- Update the life history parameters dataset including size data for small tunas in order to identify and apply the appropriate stock assessment methods for each species/stock;

- 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.

2017 Small Tuna Species Group Intersessional Meeting

Context

In order to inform the Commission on the stocks status based on the fisheries indicators, the Group suggests organizing a five days' workshop meeting during 2017.

Objectives

The main objectives of this meeting are as follows:

- Update the ERA analysis using the new life history parameters dataset developed by the Small Tunas species group for each of the 5 major ICCAT areas and extending the analysis to other gears such as purse seines;

- Assess the priority species of small tuna species by applying different data poor stock assessment methods;

- Update the metadata base for small tuna species with the new available biological information.

Identified tasks

- The revised Task I and Task II data for small tunas up to 2015 should be submitted to the Secretariat at least two months before the date of the meeting, the data for 2016 should be included if possible (Responsible: National scientists);

- Update the Task I and Task II data (Responsible: ICCAT Secretariat).

Sharks Work Plan

In preparation for the planned stock assessment of shortfin mako in 2017, the Group will conduct the following activities:

- Hold two intersessional meetings to assess the status of the shortfin mako in the Atlantic. The first meeting will be a Data Preparatory (DP) meeting to collate and analyze all existing information required for stock assessment, whereas the second meeting will be the stock assessment session. The following tasks will be required, in some cases prior to the DP meeting, and in others during or immediately after the DP meeting:

  - Estimate catches for time periods where sufficient data were not available, but only for fleets with significant catches
  - National scientists and ICCAT Secretariat to use observer data and other potential techniques to estimate historical catches of fleets with significant catches where that information is missing
  - Gather and analyze available length information for shortfin mako by sex and region
  - Identify fleets based on spatial/selectivity considerations
  - National scientists to update analysis of CPUE indices for shortfin mako up to 2015
  - Identify appropriate CPUE indices for use in shortfin mako stock assessment models
  - Review all life history information for shortfin mako in the Atlantic
  - Present all results available from projects funded by the SRDCP (Shark Research and Data Collection Program) relative to shortfin mako age and growth dynamics, genetics, post-release survival, and stable isotopes and assess their usefulness for this stock assessment
  - Conduct preliminary runs of SS3 with the available inputs based on information presented at the DP meeting

- Continue activities of the SRDCP

Working Group on Stock Assessment Methods Work Plan

The Working Group on Stock Assessment Methods (WGSAM) met in Madrid, Spain in 2016. The next meeting is planned for late April of 2017 in either Portofino, Italy or San Sebastian, Spain.

WGSAM Proposed work in 2017

1. The WGSAM plans to continue its work on the LLSIM simulation study on developing best practices for CPUE standardization. In early 2017 simulated data sets will be developed and distributed to two *ad hoc* study groups, each of which will apply various standardization methods. A comparison of the results will be presented at the 2017 meeting and best practice recommendations developed. The Group notes that participation in the *ad hoc* study groups remain open and encourages participation in these groups.

2. The WGSAM will continue its efforts to develop a template for the task of the unifying CPUE data towards the development of spatially explicit indices of abundance. This template will outline the various fields required and how areas are to be assigned. It will also will take into account all applicable confidentiality requirements inherent in set-by-set data and will have accompanying it a description of how the confidentiality of the participating CPCs will be respected.

3. The WGSAM continues to encourage progress on MSE, Harvest Control Rules, Limit, Threshold and Target Reference points. The WGSAM will continue to discuss and attempt to solidify and formalize a generalized framework from which to conduct future MSEs.

4. The WGSAM continues to encourage work on how best to bring spatially changing oceanographic, environmental conditions and climate change into the assessment process. This could include such things as a set of criteria similar to the CPUE report card for evaluating the suitability of environmental indicators for explicit inclusion in assessment models. This may include consideration such as the mechanistic link between the process and the biology, the model parameters that the covariate may influence and whether appropriate diagnostic and methodological performance of the covariate has been conducted.

5. The WGSAM recognizes the increasing trend in the use of multiple assessment models by the various Species Groups and further recognizes that this practice is often resulting is a wider range of possible management advice and options. This can have the result of making the overall communication of the advice less clear and consequently less effective. The WGSAM further notes that each species group's situation is unique and that general advice on how to approach this concern is difficult. Nonetheless, the WGSAM 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

Work Plan Pertaining to the Ecosystems Component

The Sub-Committee determined that the following ecosystem related activities would be important to complete in 2017:

1. Review the progress that has been made in implementing ecosystem based fisheries management and enhanced stock assessments.

2. Review the progress on developing an Ecosystem Report Card for ICCAT.

3. Review the proceedings of the joint meeting between tRFMOs on the implementation of the EBFM approach.

4. Review updates to the status and pressure indicators, reference levels and management actions for elements of ICCAT's EBFM framework.

5. Review progress on developing indicators for all ecological components of ICCAT's EBFM framework (i.e. target species, by-catch, habitat and trophic relationships).

   a) Review adequacy of existing indicators against proposed new ones.

   b) Review ecosystem drivers of abundance and mode of action.

6. Review mechanisms to effectively coordinate, integrate and communicate ecosystem-relevant research across the ICCAT Species Working Groups and within the SCRS.

Work Plan Pertaining to the By-Catch Component

Seabirds

Recognising that the paucity of seabird by-catch data submitted to the ICCAT Secretariat has prevented an assessment of Rec. 11-09, the Sub-committee noted that there are opportunities to progress this work intersessionally through additional mechanisms. The seabird component of the GEF Common Oceans Tuna project will be holding a series of workshops on seabird by-catch assessment in 2017 and 2018, and the Sub-committee agreed that these workshops provide an opportunity to help support an assessment of seabird by-catch within ICCAT, and facilitate a harmonised approach across tuna RFMOs. It was noted that the agenda for these workshops is in the process of being prepared, and the Sub-committee By-catch Chair and several Sub-committee members offered to help develop the agenda and help progress these initiatives.

The Sub-committee recognised that although the main focus of seabird work would be a review of the effectiveness of Rec. 11-09, there is a need for a separate strategy to investigate seabird by-catch in the Mediterranean area. One of the first steps should be to investigate what fisheries operating in the Mediterranean area are incidentally catching seabirds. The Sub-Committee also recommended that the gillnet workshop planned for 2017 could provide an opportunity to consider seabird issues in the Mediterranean.

Sea turtles

Recognizing that there is a paucity of by-catch data submitted to the ICCAT Secretariat despite repeated requests for this information, the Sub-committee recognized that the method described in SCRS/2016/125 can be used as an alternative method to facilitate the Sub-committees work as this model uses sea turtle CPUE reported in published literature. Thus, the Sub-committee agreed to review and improve the method in 2017, especially with regard to the utilization of observer data collected by CPCs. For this purpose, CPCs are requested to submit sea turtle by-catch information including data not reported using the ST09 data submission form, and also to estimate total removals using their observer data. In 2017, the method and data to be used to estimate the total removal of sea turtles by longline fisheries will be finalised.

Sub-committee on Statistics Work Plan

Finalise ongoing short-term projects

- Web-form (ST03-T2CE) prototyping (Dec/2016)
- JAVA application to validate ST forms (ST01 to ST06) for CPC scientists use (Feb/2017)
- Replacement of MS-ACCESS (t2ce.mdb & t2sz.mdb) by SQLite 3.8+ databases

Continue ongoing long-term 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, create shapefiles)

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 (2016?) - URGENT
- ISSF data unloads project

Continue working on the improvements of the ICCAT-DB content

- Continue supporting SCRS meetings
- Continue data recovery (data gaps, better resolution and normalization of Task II)
- Continue improving Task I data (eliminate carry overs, allocate NEI catches to proper flags, reduce UNCL gears, etc.)

Appendix 13

ADDENDUM TO SAILFISH STOCK ASSESSMENT SESSION REPORT

During the Billfish Species Group meeting at the SCRS 2016, the Group noted that the stock synthesis results had been incorrectly plotted on the Kobe plots showing the Status of the Stock for Sailfish west, and decided to amend them in this addendum. No new analyses were conducted; the results from the stock assessment meeting were not changed.

The resulting Kobe plot from Model_1.1 showed that stock status point estimate was in the green zone (neither overfished or under going over fishing), the MCMC cluster of points were over two thirds in the yellow zone (not overfished but undergoing over fishing) (**Figure 1_Addendum**).

The resulting Kobe plot from Model_2.1 showed that stock status point estimate was in the green zone (neither overfished or under going over fishing), the MCMC cluster of points were about half in the yellow zone (not overfished but undergoing over fishing), but less than a quarter were in the red zone (both overfished and under going over fishing) (**Figure 2_Addendum**).

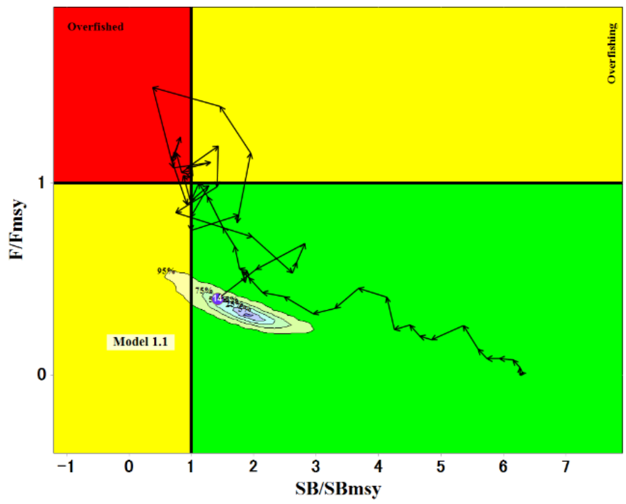

Figure 1_Addendum. Kobe plot for status of stock in sailfish_west based on Model_1.1 (increasing CPUE trends).

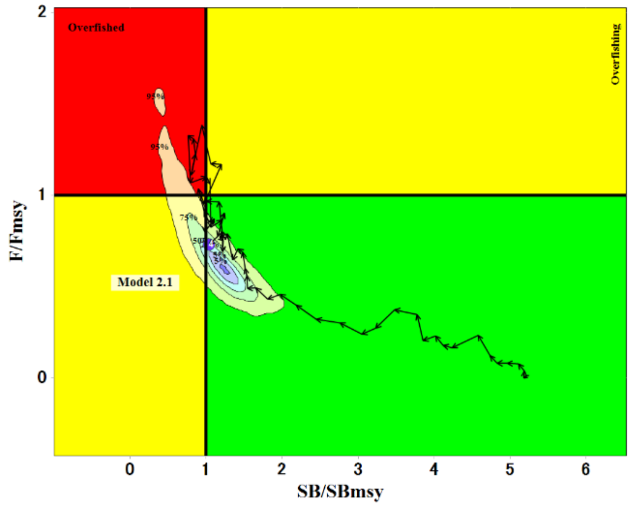

Figure 2_Addendum. Kobe plot for status of stock in sailfish_west based on Model_2.1 (decreasing CPUE trends).

Appendix 14

PRELIMINARY APPLICATION TEMPLATE FOR THE IMPLEMENTATION OF THE STRATEGIC RESEARCH PROGRAMME

I. Request for Proposals (RFP)

a) *Project Objective*

The Strategic Research Programme is designed to streamline funding for essential research which is relevant to the SCRS Science Strategic Plan. The vision is to create a Scientific Committee with broad participation of competent scientists from all the CPCs that fish tuna and tuna-like species in the Atlantic Ocean and adjacent seas, working cooperatively in an effective and transparent way, with solid scientific and technical support of the Secretariat, and to provide objective, reliable, and robust scientific advice to the Commission in support of the Convention objectives.

Once the SCRS has determined their priorities for the two-year funding cycle based on the approved budget from the Commission, the Secretariat will release a Request for Proposals. Lead by a principal investigator (who will have the responsibility of reporting the activities of the project to the SCRS during the plenary meeting), research teams will submit proposals to the SCRS for review.

b) *Programme Priorities*

Proposals must address one of the priority areas listed by the SCRS at their October meeting, as they pertain to ICCAT-managed species. If more than one priority is selected, the priority that most closely reflects the objectives of the proposal should be listed first on the application. Projects should focus on the greatest probability of recovering, maintaining, improving, or developing fisheries as aligned with the 2015-2010 SCRS Science Strategic Plan; collecting data directly applicable for improving stock assessments, collecting and improving data on by-catch estimates and protected species fishery interactions, and/or generating increased social and economic values and opportunities for commercial and recreational fisheries.

II. Award information

a) *Funding availability*

The amount of funding available will vary from one two-year budget cycle to the next, and will depend on the Commission-approved research fund and possible extra budgetary funds which may be provided on a voluntary basis from ICCAT members to support various initiatives.[1] The amount of funding for a proposal will be awarded proportionally on the priority-designation of the research subject, with an annual cap at €100,000 for each project. Applications exceeding this amount will be rejected/returned.

b) *Project/Award period*

The period of award may be for one or two years, depending on the necessity projected in the proposal. Any project requiring more than two years will be required to re-apply at the next RFP.

III. Eligibility Information

a) *Eligible applicants*

Eligible applicants must be researchers conducting research for one of the Working Groups under ICCAT. The Principal investigator must be a scientist working for one of the ICCAT CPCs. Other collaborators may come from non-member countries and NGOs.

b) *Other criteria that affect Eligibility*

TBD

[1] Basic Instrument for the International Commission for the Conservation of Atlantic Tuna (ICCAT), "Budget," pp. 1

IV. Application and Submission information

a) *Address to Submit Application*

TBD

b) *Content and form of application*[2]

All pages should be single-spaced and must be composed in at least a 12-point font with one inch margins on 8 1/2 x 11 paper. The project description may not exceed 25 pages, exclusive of title page, project synopsis, literature cited, budget information, resumes of investigator(s), and letters of support (if any). Applications that do not follow the format requirement will be rejected and returned. Any PDF or other attachments that are included in an electronic application must meet the above format requirements when printed out.

c) *Content Requirements*[6]

1. Signed Title Page: The Application for funding under the Strategic Research Programme must be signed by the authorized representative or principle investigator.
2. Project Synopsis (1-page limit): It is critical that the project synopsis accurately describes the project being proposed and conveys all essential elements of the activities. It is also imperative that potential applicants tie their proposals to one of the programme priorities described above (Section I. Request for Proposals, Part (b). Programme Priorities). The Project Synopsis must identify the principal investigator(s) and include a brief statement of their qualifications.
3. Project Description (10-page limit): The applicant should describe and justify the project being proposed and address each of the evaluation criteria as described below in Section V. Application Review Information. Project descriptions should include clear objectives and specific approaches to achieving those objectives, including methods, timelines, and expected outcomes.
4. Data Sharing Plans
5. Literature Cited
6. Budget and budget Justification: There must be a detailed budget justification accompanying the proposal. Provide justifications for all budget items in sufficient detail to enable the reviewers to evaluate the appropriateness of the funding requested. For multi-year award applications, indicate and describe separate funding amounts for each funding year in the detailed justification.
7. Resumes (2 pages maximum for each major participant).

d) *Submission Dates and Times*

Applications must be received by the date and time indicated by the Secretariat at the time of the release of the RFP.

e) *Funding Restrictions*

TBD

f) *Other Funding Requirements*

TBD

[2] Modified from NOAA MARFIN Federal Funding Opportunity Announcement, pp. 15

Review Process

V. Application Review Information

a) *Evaluation Criteria*

Proposals will be evaluated by three or more SCRS Officers to determine their technical merit. These reviewers will provide individual evaluations of the proposals. No consensus advice will be given. Reviewers provide comments and assign scores to the applications based on the following criteria, with the points shown in parentheses. Applications that best address these criteria will be most Strategic:

1. Importance/relevance of determined SCRS priorities (20 points)
2. Technical/Scientific merit and presentation (20 points)
3. Project costs (5 points)
4. Involvement/participation of scientists from developing countries (20 points)
5. Contribution of the project to capacity building (20 points)
6. Collaboration between ICCAT member countries (10 points)
7. Technical capabilities of the group and overall qualifications of applicants (5 points)

b) *Review and selection process*[3]

Applications must address at least one of the priority areas identified by the SCRS. Once a proposal is received, the Secretariat will start the screening process to ensure that they were received by the deadline date, were submitted by an eligible applicant, and meet the requirements of Section IV. Application and submission information, Part (b). Content and form of application. Proposals do not have to be screened before the submission deadline to identify deficiencies that would cause the proposal to be rejected. However, if it happens that an application is screened early and the applicant is provided information about deficiencies, or should the applicant independently decide it is desirable to do so, the applicant may correct any deficiencies in the proposal before the deadline. After the deadline, the proposal must remain as submitted; no changes can be made to it. If the proposal does not conform to these requirements and the deadline for submission has passed, the application will be returned without further consideration.

Each member of the review panel will independently assign a numerical rating between 1 and 5 for each proposal according to the following scale, and provide comments to support their score (fractions of whole numbers will not be accepted):

1. Not recommended
2. Poor, application was marginally responsive to the evaluation criteria, but does not address programme priorities outlined by SCRS.
3. Fair; application was adequately responsive to the evaluation criteria and marginally addresses programme priorities outlined by the SCRS.
4. Good; application was strongly responsive to the evaluation criteria and partially addresses programme priorities outlined by the SCRS.
5. Excellent; application was highly responsive to the evaluation criteria and exceptionally addresses programme priorities outlined by the SCRS.

The proposals are then ranked in the order of preferred funding based on the overall score generated from rankings provided by review panel members. Given the rankings the panel will make recommendations to the Executive Secretary commensurate with the available funding.

[3] Modified from MARFIN Federal Funding Opportunity Announcement, pp. 25-26

VI. Award Administration Information

a) *Award Notices*

Successful applicants will receive notification that the application has been approved for funding during the month of December be the Secretariat with the issuance of an award signed by the Executive Secretary. This is the authorizing document that allows the project to begin. The award will be issued electronically to the authorizing official of the project.

Unsuccessful applicants will be notified by the Secretariat that their proposals were not selected for recommendation. Panel review comments and individual recommendations will not be provided to unsuccessful applicants, unless requested by the applicant.

b) *Reporting*

Unless otherwise specified by the terms of the award, performance and financial reports are to be submitted semi-annually. All reports, other than a comprehensive final performance report, will be submitted on a semi-annual schedule and must be submitted no later than 30 days following the end of the six-month period from the start date of the award. Comprehensive final reports will be submitted at the SCRS Plenary meeting at SCRS papers.

Synthesis of 2015-2020 SCRS Science Strategic Plan

The Science Strategic Plan identified a number of strengths weaknesses in the current SCRS operation and structure. Applying for scientific research grants competitively would help alleviate some of those weaknesses, especially the financial barriers that often arise in research despite the necessity of that research in making accurate and logical management proposals to the Commission. The Strategic Research Programme would also help the SCRS to create more communication between the scientific community, member countries, and the interested public; understand and remove current deficiencies in stock assessment reporting; and use the best possible science – all in order to reach the specified goals of the Plan. These goals are as follows[4]:

- Improve fishery data collection and reporting from all fisheries that catch tuna, tuna-like species, and other species under purview of the Commission in the area of the Convention. To have a representative view of what is actually happening in the fishery, so that the stocks can be properly evaluated.
- Institute biological sampling programmes commensurate to the needs for the assessment of the different stocks under the Convention.
- Develop programmes for the collection and compilation of additional data necessary to improve the scientific advice to the Commission.
- Improve the dialogue with the Commission
- Promote open dialogue with the Commission and Interested Parties
- Improve the dialogue within the SCRS
- Improve the dialogue with the Scientific Community
- Improve the dialogue with Society
- Improve the mechanisms of communication of the SCRS
- Preserve and promote the independence and excellence of the SCRS and its Working Groups
- Improve science capabilities of the SCRS objectives
- Enhance and improve participation in the SCRS, and in particular enhancing the active involvement of developing economies in the SCRS activities
- Quantify the major uncertainties affecting stock assessment and management advice
- Acquire the necessary biological knowledge in tuna and tuna-like species, as well as in critical by-catch species commensurate to the needs for the assessment of the different stocks under the Convention

[4] 2015-2020 Science Strategic Plan, All Sections, pp. 325-341

- Improve the standardization of the fishery dependent information
- Apply approaches which provide information on population dynamics independent of data from the commercial fishery
- Balance the adequacy between models used and quality of data and knowledge
- Evaluate management measures and strategies in achieving the objectives of the Commission
- Cover research needs so as to be able to include ecosystem consideration in the provision of scientific advice
- Provide objective, reliable, and robust scientific advice to the Commission in support of the Convention objectives (vision)
- Evaluate precautionary management reference points and robust harvest control rules through management strategy evaluations
- Advance ecosystem based fishery management advice
- Broaden the scientific advice to include economic and social aspects of various management measures

Appendix 15

SPEECH BY MR. DRISS MESKI, ICCAT EXECUTIVE SECRETARY

Monsieur le Président,

Mesdames et Messieurs le délégués scientifiques

A l'instar des autres années à cette même période nous nous trouvons à la fin de toute une série de réunions scientifiques tout le long de l'année en cours. Le Secrétariat est toujours fier d'assister les scientifiques dans l'organisation de leurs réunions et leur apporter le soutien dont ils ont besoin. Je voudrais vous exprimer tous mes vifs remerciements pour votre précieuse collaboration et féliciter l'ensemble du personnel du secrétariat pour tout ce qu'il fait pour rendre vos réunions plus efficientes.

Comme vous le savez nous célébrons cette année le 50ème anniversaire de la création de l'ICCAT. Sans vouloir être chauvin, il me semble qu'on peut dire sans aucune réserve que l'institution de l'ICCAT a été une excellente décision. Malgré les difficultés et les contraintes auxquelles elle devait faire face l'ICCAT a été capable de prendre les mesures appropriées à la hauteur de la mission qui lui a été confiée. Malgré les pressions internes et externes qui sont exercées sur notre Commission, elle a pu faire face à tous les défis avec détermination et sans relâche. Je sais que le Comité Scientifique est le premier à subir cette pression. Malgré l'insuffisance de données constatées le plus souvent, le Comité scientifique a pu gérer des situations compliquées et a fourni des conseils ayant permis à la Commission de prendre ses décisions. Ce comité a pu travailler pendant très longtemps avec des moyens modestes mais il était en mesure de sortir des résultats très appréciés pour aider la Commission dans ses prises de décision. Actuellement il y a de nouvelles technologies, beaucoup de progrès ont été faits dans la collecte des données grâce à la mise en place des fonds d'assistance à la science et aux scientifiques pour participer aux différentes réunions. Tout cela contribue de façon significative à l'amélioration de l'approche pour mieux appréhender les problèmes.

Comme je l'ai toujours dit, le Secrétariat est très honoré de soutenir le travail des scientifiques et de leur apporter l'assistance requise. Toute l'équipe est à votre disposition pour vous accompagner durant toute cette semaine. Je souhaite plein succès aux travaux de votre Comité qui seront sans aucun doute d'une grande aide à la Commission dans la prise de ses décisions.

Je vous remercie.