INTERNATIONAL COMMISSION
for the
CONSERVATION of ATLANTIC TUNAS

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INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS

CONTRACTING PARTIES

(as of December 31, 2001)

Algeria, Angola, Barbados, Brazil, Canada, Cape Verde, China, Côte d'Ivoire, Croatia, Equatorial Guinea, European Community, France (St. Pierre & Miquelon), Gabon, Ghana, Guinea Conakry, Honduras, Japan, Korea (Rep.), Libya, Morocco, Namibia, Panama, Russia, Sao Tomé & Principe, South Africa, Trinidad & Tobago, Tunisia, United Kingdom (Overseas Territories), United States, Uruguay, Venezuela.

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Panel No.	***PANEL MEMBERSHIP***	***Chair***
-1- Tropical tunas	Angola, Brazil, Canada, Cape Verde, China, Cote d'Ivoire, European Community, Gabon, Ghana, Japan, Korea (Rep.), Libya, Morocco, Namibia, Panama, Russia, Sao Tome & Principe, Trinidad & Tobago, United Kingdom (Overseas Territories), United States, Venezuela	United Kingdom (Overseas Territories)
-2- Temperate tunas, North	Algeria, Canada, China, Croatia, European Community, France (St. Pierre & Miquelon), Japan, Libya, Morocco, Panama, Tunisia, United Kingdom (Overseas Territories), United States	European Community
-3- Temperate tunas, South	European Community, Japan, Korea (Rep.), Namibia, South Africa, United Kingdom (Overseas Territories), United States	Japan
-4- Other species	Algeria, Angola, Brazil, Canada, China, Côte d'Ivoire, European Community, France (St. Pierre & Miquelon), Gabon, Japan, Morocco, Namibia, South Africa, Trinidad & Tobago, United Kingdom (Overseas Territories), United States, Uruguay, Venezuela	United States

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FOREWORD

The Chairman of the International Commission for the Conservation of Atlantic Tunas presents his compliments to the Contracting Parties of the International Convention for the Conservation of Atlantic Tunas (signed in Rio de Janeiro, May 14, 1966), as well as to the Delegates and Advisers that represent said Contracting Parties, and has the honor to transmit to them the ***"Report for the Biennial Period, 2000-2001, Part II (2001)"***, which describes the activities of the Commission during the second half of said biennial period.

This issue of the Biennial Report contains the reports of the 17th Regular Meeting of the Commission, held in Murcia, Spain, in November, 2001, and the reports of all the meetings of the Panels, Standing Committees and Sub-Committees, as well as some of the Working Groups. It also includes a summary of the activities of the Secretariat and a series of National Reports of the Contracting Parties of the Commission, relative to their activities in tuna and tuna-like fisheries in the Convention Area.

The Report for 2001 has been published in two volumes. ***Volume 1*** includes the Reports of the Secretariat on its activities, the Proceedings of the Commission Meetings and the reports of all the associated meetings (with the exception of the Report of the Standing Committee on Research and Statistics -SCRS), as well as the National Reports of the Contracting Parties of the Commission. ***Volume 2*** contains the Report of the Standing Committee on Research and Statistics (SCRS) and its appendices.

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

J. Barañano
Acting Commission Chairman

TABLE OF CONTENTS

REPORT OF THE STANDING COMMITTEE ON RESEARCH & STATISTICS (SCRS)
(Madrid, Spain - October 8 to 12, 2001)

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

(Madrid, Spain -October 8 to 12, 2001)

1. Opening of the meeting

The 2001 meeting of the Standing Committee on Research and Statistics (SCRS) was opened on Monday, 8 October, at the Hotel Reina Victoria, in Madrid, by Dr. Joseph Powers, Chairman of the Committee. Dr. Powers, while welcoming the participants, recalled the tragic death of Mr. Ante Dujmusic, former head SCRS scientist from Croatia, and expressed condolences to his family and colleagues on behalf of the SCRS.

2. Adoption of Agenda and arrangements for the meeting

2.1 The Tentative Agenda was reviewed and modified by separating the responses to the Commission from the recommendations to the Commission. With this modification the agenda was and adopted by the Committee and is attached as **Appendix 1**.

2.2 The following scientists served as rapporteurs for the species sections (Agenda item 7) of the 2001 SCRS Report:

Tropical tunas- general	P. Pallares
YFT - Yellowfin tuna	C. Brown
BET - Bigeye tuna	N. Miyabe
SKJ - Skipjack tuna	J. Ariz
ALB - Albacore	M. Keatinge
BFT - Bluefin tuna	J.M. Fromentin
BIL - Billfishes	E. Prince
SWO - Swordfish	J. Porter
SBF - Southern bluefin tuna	Y. Uozumi
SMT - Small tunas	L. Gouveia

2.3 The ICCAT Secretariat served as rapporteur for all the other SCRS Agenda items.

3. Introduction of Contracting Party delegations

Delegates from the following 18 Contracting Parties were present at the 2001 SCRS Meeting: Angola, Brazil, Canada, China, Cote d'Ivoire, Croatia, European Community, France (St. Pierre & Miquelon), Ghana, Japan, Korea, Libya, Morocco, Namibia, Tunisia, United Kingdom (Overseas Territories), United States of America, and Venezuela. The List of Participants is attached as **Appendix 2**.

4. Introduction and admission of observers

Scientists from Chinese Taipei, Malta, Mexico, FAO, the Indian Ocean Tuna Commission (IOTC), and Birdlife International were admitted to the meeting as observers (see **Appendix 2,** List of Participants).

5. Admission of scientific documents

The Committee noted that, at the time of the opening of the meeting, a total of 154 scientific papers had been submitted to the 2001 SCRS, all of which met the criteria for the admission of documents. Of these, 23 were meeting reports, administrative documents or Secretariat reports. Noting that many documents were brought to the species group meetings without advance notice being given to the Secretariat, the Chairman drew the attention of scientists to the importance of timely submission of titles and abstracts of documents to be discussed. The List of Documents is attached as **Appendix 3**.

6. Review of national fisheries and research programs

Angola

Tuna fishing in Angola, as well as other fishing, is influenced by the presence of the cold Benguela current to the South, and the warm Guinean current to the North. The wide species diversity to the South is associated to a favorable distribution due to the cold current. The most widely caught species are: yellowfin tuna *(Thunnus albacares)*, bigeye tuna *(Thunnus obesus)*, skipjack tuna *(Katsuwonus pelamis)*, Atlantic bonito *(Sarda sarda)*, Spanish mackerel *(Scomber japonicus)*, Atlantic black skipjack *(Euthynnus alletteratus)*, swordfish *(Xiphias gladius)*, and other minor species.

Tuna fishing is carried out by the artisanal fishery as well as the semi-industrial and industrial fishery, and the fishing methods varies according to the target species.

In 2000, there were 8,404 MT of tunas were caught along the Angolan coast, which represents a decease of almost 30% as compared to 1999. Of these catches, 54% (4,534 MT) was from the local semi-industrial and industrial fishery, 27% (2,286 MT) from the industrial fishery fleet of the European Community (12 longliners), and 19% (1,584 MT) from the artisanal fishery. The small tuna catches were all caught by the artisanal fishery, the local semi industrial and industrial fishery, whereas the large tunas were caught by the European Community fleet.

Of the tuna catches in 2000, 54% (4,788 MT) were taken by pelagic trawl, 27% (2,284 MT) by longline, 12% (1,050 MT) by bottom trawl, whereas catches by baitboat, purse seine and trap were very minor. It is important to note that the large tunas have all been caught by longline, while the small tuna were most caught by the other fishing techniques mentioned above.

A on-going national program that started in 2000 is centered on a census of vessels and the collection of biological data aimed at improving the data required by ICCAT.

Brazil

In 2000, the Brazilian tuna longline fleet consisted of 89 vessels, a 27% increase from 1999, when 70 vessels were operating. The number of baitboats operating in 2000 was 39. The Brazilian catch of tunas and tuna-like fishes, including billfishes, sharks, and other species of minor importance, was 44,217 MT (round weight), representing an increase of about 13% from 1999. The majority of the catch again was taken by baitboats (about 60%), with skipjack tuna being the most abundant species. The total catch of the tuna longline fishery, equal to 15.909 MT, was about 10% higher than in 1999. Albacore, accounting for about 23% of the catches, was the most caught species. Swordfish catches in 2000 reached about 3,500 MT, representing 22% of the total catch of longliners and a decrease of 26% from 1999, when 4,720 MT were caught.

Several research activities continued to be conducted on tuna species in Brazil. As a result of these efforts, five papers on swordfish biology were presented to the SCRS Meeting, dealing with reproduction, size distribution and factors that influence catch. Besides, genetic samples were taken from swordfish caught off northeastern Brazil. Data have also been collected from several recreational fisheries based off southeast and northeast Brazil, where sport tournaments are conducted by local yacht clubs. Besides, tagging has also been done and, nowadays, almost all marlins and sailfish caught by the sport fishing tournaments are released.

In order to adequately comply with ICCAT recommendations, the Brazilian government has, in the past, implemented several fishery regulations. A new Rule (I.N. 16/ 2001), regulating the Brazilian tuna fishery, was published on July 30 of the present year, establishing the following:

- A catch limit for swordfish of 4,720 MT. Since the number of boats allowed to catch swordfish in 2001 was the same as in 2000, and the swordfish by-catch allowed for all vessels was reduced from 15 % to 5 %, from September 15 on, the Brazilian swordfish production in 2001 is expected to remain at about 3,000 MT, a reduction of about 15 % from 2000 and about 1,700 MT less than the limit established for the country (4,720 MT);

- A catch limit of 52 MT of white marlin and 253 MT of blue marlin and the mandatory release of all specimens that are still alive by the time of boarding; mandatory monthly submission of information on the catches of swordfish, bigeye tuna, albacore, white marlin and blue marlin; mandatory observer coverage for at least 10 % of the leased vessels; and all leased vessels were obliged to install a satellite Vessel Monitoring System (VMS).

Due to the implementation of management regulations, several national and chartered vessels reduced their swordfish catches, both as target species as well as by-catch. Some vessels changed the target species from swordfish to sharks, albacore and bigeye tuna.

Furthermore, on September 21, 2000, the Brazilian Government established a Permanent Committee for the Management of Brazilian Tuna Fisheries, which includes representatives of several Government bodies, such as, *inter alia*, the Ministry of Agriculture, the Ministry of the Environment and the Brazilian Navy, the private sector and the scientific community. The establishment of this Permanent Committee is expected to enhance the transparency of the management process of Brazilian tuna fisheries and significantly strengthen its institutional aspects.

Canada

In 2000, Canada landed 2077 MT of tuna and tuna-like species, 3% more than in 1999. Swordfish landings decreased by 151 MT, to 968 MT. With the reduction in swordfish quota, much more attention has been given to longline fishing for bigeye, albacore and yellowfin, so that catches of these other tunas by the longline fleet represented almost 40% in the year 2000 (327, 122, 105 MT, respectively), compared to about 20% in 1999. Canadian vessels fishing bluefin tuna landed 549 MT in 2000, 27 MT less than 1999. For the first time since 1988, the southwest Nova Scotia fishery has been surpassed in importance by the Gulf of St. Lawrence fishery.

The Canadian Atlantic statistical system provides real-time monitoring of catch and effort for all fishing trips. This involves industry-funded Dockside Monitoring and Observer programs, and mandatory submission of Log Records. Canada fully supports research that improves the basic inputs and approaches to stock assessments. Cooperative research was conducted with scientists from other countries on biological investigations and development of indices of abundance for species of concern to ICCAT. In particular, Canada (government scientists and managers, and industry) has supported and participated in recent state-of-the-art bluefin tagging studies that have raised the possibility of a previously unknown spawning area in the Central Atlantic. As the management implications of possible spawning of bluefin tuna in the central Atlantic are enormous, Canada has fully supported the 2001 exploratory research cruise to sample spawning size bluefin tuna and larvae in the central north Atlantic through both cash and in-kind contributions (as per the ICCAT Recommendation). Canada has also placed emphasis on understanding and documenting incidental catch on pelagic longline, including hosting the 2000 Conservation of Arctic Flora and Fauna (CAFF) Workshop on Seabird Incidental Catch in the Waters of Arctic Countries.

China

Longlining is the only method for fishing tuna by Chinese tuna fleet. By the end of 2000, sixty (60) Chinese tuna longliners from eight fishing companies had permits for fishing tuna in the Atlantic Ocean from the Chinese fisheries authority. Of these , 57 were actively fishing last year, mainly in tropical waters, between and 10ºN and 10ºS. Most of the new access fishing boats started fishing operations at the end of October or even late November. Bigeye tuna is still the main species targeted by Chinese longliners.

In 2001, the Chinese tuna fleet caught 9,205 MT of tuna and tuna-like species, which was 1,774 MT less than in 1999. Bigeye tuna catches decreased from 7,347 MT in 1999 to 6,563 MT in 2000, and yellowfin tuna catches went from 2,190 MT in 1999 down to 1,674 MT last year. The fishing conditions were the main reason for the lower catchability in 2000.

The catch data statistics submitted to the ICCAT Secretariat cover the entire tuna fleet operating in Atlantic Ocean and contain more species information in 2000 than in the previous year. China has submitted "tuna catch and effort statistics by gear, month and species", "the list of authorized vessels fishing for bigeye tuna in the Atlantic"(including ICCAT form 1-2) and the catch data from Chinese longline fleet in the Atlantic Ocean (Task 1) before the dead line set by ICCAT Secretariat. China has also submitted the estimated historical data of blue shark and short mako, which was based on the data collected between 1994 and 1996 in combination with the weight of dried shark fin collected from sample logbooks by fisheries scientists.

In order to better implement the ICCAT recommended conservation and management measures, an Atlantic Tuna Fishing Industries Coordination Group was established last January. This Coordination Group will assist the China Fisheries Association in dealing with tuna fishing related issues, such as quota allocation among fishing companies, receipt of tuna observers, and submission of catch data statistics required by the China tuna working group.

Under the support of the Ministry of Science and Technology and the Ministry of Agriculture, a comprehensive research project on the tuna and tuna fisheries in the Atlantic was carried out this year. The main components of the project include the collection of environmental information on the fishing ground, biological information on the catch, and setting up a central fisheries database which will be used as one of the important management means for monitoring the activities of the Chinese tuna fleet in the Atlantic. Scientists on board the fishing boats are now also recording details on discards, incidental catches of seabirds, if any, and are looking forward to the chance to conduct some comparative tests for the purpose of reducing by-catch, such as reducing the catch of south Atlantic swordfish.

A tuna observer program in ICCAT waters was carried out in 2001. Two observers are now working on two tuna longliners. They will remain on board the fishing vessel the year around according to the schedule. The results of the data analysis from the observer program will be presented at the next ICCAT meeting.

In order to further strengthen the monitoring and management of activities of the Chinese tuna fishing fleet in the Atlantic Ocean, The China Fisheries Authority plans to establish a VMS system on board the tuna longliners next year. All Chinese tuna longliners in Atlantic Ocean will be equipped with a VMS system in the near future.

Côte d'Ivoire

The CRO, within its research programs, monitors the landings of the four maritime fisheries (tuna, sardine, demersal and artisanal). Only two of these fisheries are of concern to ICCAT, the tuna fishery and the maritime artisanal driftnet fishery. The tuna fishery is carried out almost exclusively by foreign vessels, since Côte d'Ivoire does not have any tuna vessels. These vessels, mainly French and Spanish, operate in the central east Atlantic and land or transship at Abidjan. The artisanal driftnet fishery targets billfishes and sharks in Ivorian waters.

In 2000, the CRO monitored the regular landings of 29 French tuna vessels as well as those of other nationalities, except Spanish vessels, that landed 54,402 MT of tuna. These were comprised of 60.83% yellowfin, 33.90% skipjack, 5.21% bigeye, and 0.06% albacore. In addition, there were 14,000 MT of "false fish" from all the landings and transshipments carried out at Abidjan.

All these total landings or transshipments which represent, each year, a major part of the catches of tropical tunas from the Atlantic, make Abidjan the second tuna port of Africa, behind Victoria (Seychelles).

As concerns the artisanal fishery, the driftnets in 2000 exerted a nominal effort of 5,342 canoe trips, representing an effective effort (corrected) of 12,145 trips, with a total catch of about 319 MT of large fish, comprised of 14.85% sharks, 13.95% sailfish, 64.53% blue marlin, 0.38% white marlin, and 6.29% swordfish.

In addition to these targeted species, important quantities of small tunas (juvenile yellowfin and bigeye, skipjack, black skipjack and frigate tuna) were caught by this fishery.

Croatia

In 2000, the annual catch of tunas and tuna-like fishes by the Croatian fishery in the Adriatic Sea was 930 MT of bluefin tuna. Almost the total amount was caught by purse seine and a small part was caught by the sport fishery. Almost the total catch is transferred to floating cages for growing and fattening. The new National Fisheries Information System for collecting catch data has been introduced in 1999, including: time, date and geographical

position of the catch, name of the vessel and its owner, captains name, type of fishing gear used, quantities of catch in weight and number, as well as the name of the person that submitted these data. There is still some uncertainty in data, since almost the total catch is sued for farming purposes, which results in contradictions between catch and trade data.

Research activities have been carried out to analyze catch-at-size data for 1999 through 2001 (SCRS/01/091), showing an increased proportion in the number of small bluefin tunas in the catches as compared to the data for previous years. As the ICCAT recommendation of closure of purse seine fishing in the Adriatic Sea from 1st to 31st May was introduced in order to protect juveniles, the fact is that in practice it has resulted just in a transfer of fishing effort (from and into the Adriatic Sea). We suggest that the *Recommendation by ICCAT on Changes of Closed Season for the Bluefin Tuna Purse Seine Fishery in the Mediterranean Sea* (Ref: 98-6 BFT) be changed in order to establish the closed season for the bluefin purse seine fishery during the same period over the entire Mediterranean Sea fishing area.

Due to the increased activities on bluefin tuna growing and fattening and uncertainty in catch-trade data, preliminary research has been carried out on the growth rate of bluefin tuna from the Adriatic Sea that are reared in the floating cages (SCRS/01/092), providing some very important indices. Recognizing this as a very important issue, in the future we suggest that more effort within the Bluefin Year Program (BYP) be allocated to studies concerning tuna farming.

Some research has been done in analyzing biometric data of bluefin tuna from the Adriatic Sea, giving results that, if compared to some future equivalent study concerning biometric research on West Atlantic bluefin tuna, could offer additional arguments for or against the current two-stock hypothesis.

European Community (EC)

EC-France

Information on national fisheries

The total French catches of tunas and tuna-like species in the Atlantic Ocean and Mediterranean in 2000 amounted to 67,824 MT, a level slight below that of 1999. This catch shows a decline trend in French catches since the mid-1990s, mainly due to the effect of the moratorium in the Gulf of Guinea, to the decrease in the number of tropical pursers, and to the decline in the catches of temperate species.

- Temperate tunas

Albacore: Albacore fishing in the Atlantic Ocean in 2000 was carried out by the three fleets that normally catch this species: the driftnet, pelagic trawl, and baitboat fisheries. The total catches amounted to 6,019 MT, which represents a decline for the three fleets as compared to 1999 catches.

In the Mediterranean albacore are caught as by-catch by purse seiners and are fished actively by the sport fishery from mid-August to the end of October, and their catches vary between 3 and 5 MT.

Bluefin tuna: Overall catches of bluefin tuna in 2000 amounted to 7,321 MT.

In the Mediterranean, bluefin tuna have been mainly caught by purse seiners since the 1970s; the catch in 2000 (6,780 MT) showing a declining trend since 1994. The majority of the fishing effort is concentrated in the western part of the Mediterranean basis, with however a marked extension towards northern Africa. The majority of the catches consist of fish whose average weight is between 10-30 kg, except during the Balearic season, when the catches are comprised of fish weighing from 140-250 kg.

Catches of bluefin tuna in the East Atlantic were 588 MT in 2000, which is within the average of the last decade. Albacore is the main target species of the French tuna fisheries in the northeastern Atlantic; the other fleets catch bluefin tuna as by-catch using pelagic trawl or driftnet.

Other species: Swordfish are caught occasionally in the northeastern Atlantic, as by-catch of the fleets that target albacore; catches in 2000 were 122 MT.

• Tropical tunas

Given the multi-species character of the tropical tuna fisheries, information by fleet is more appropriate than information by species. The most notable fact concerning this fishery is the important decline in the catches due both to the effect of the moratorium in the Gulf of Guinea and to the decrease in fishing effort. The total catches of tropical tunas was 54,362 MT in 2000.

Purse seine fleet: The total catch of the14 French purse seiners in 2000 was 50,728 MT, as follows: 29,373 MT of yellowfin tuna, 16,686 MT of skipjack tuna, 4,013 MT of bigeye tuna, 23 MT of albacore, and 434 MT of small tunas. In comparing the average catches made during the period prior to the moratorium (1993-96) with catches made during the period of the moratorium (1997-2000), the catches are considerably less (-26%), particularly for skipjack (-40%) and bigeye (-55%); yellowfin catches remained relatively stable (-7%). This is due mainly to the important decline in the sets on floating objects and to some on free schools.

Size sampling and species composition of the landings continued for the overall European fleet (France, Spain and the associated NEI fleet), in collaboration with Côte d'Ivoire and Senegal. There were 340,000 tuna identified to estimate species composition of the catches, and 210,000 fish were measures in 2000. As a result, the catch statistics were transmitted to ICCAT by species and by size category for the 1991-2000 period.

Baitboat fleet: In 2000, the five French-flagged baitboats based at Dakar caught a total of 3,834 MT, comprised as follows: 416 MT of yellowfin, 1,497 MT of skipjack, and 1,921 MT of bigeye. This decrease in catches concerns mainly yellowfin and skipjack; bigeye catches remained stable. Sampling was carried out on more than 13,000 tunas for species composition and on 7,000 fish for size composition.

Research and statistics

French research on tuna and tuna-like species is carried out by the *Institut Français de Recherche pour l'Exploitation de la Mer* (IFREMER) as concerns the species and the fisheries in the Atlantic (North temperate zone) and the Mediterranean; the *Institut de Recherche pour le Développement* (IRD) conducts research as concern the species and the fisheries in the tropical Atlantic Ocean.

• Temperate tunas

Bluefin tuna: Two programs, co-financed by the European Union (EU) to improve knowledge on the French landings in Spain and to monitor –at the level of the coastal Mediterranean member countries -- (Spain, France, Greece and Italy) efforts to collection and improve the Mediterranean statistical data base and to and improve the collection and the improvement of the Mediterranean statistical data base and to study the reproductive biology of this species, were carried out in 2000.

A new program "Stromboli", co-financed by the EU, concerning bluefin tuna and coordinated by France, stated in the Spring of 2000. Its main objectives are as follows: (*i*) collect and analyze the historical catch data of the Atlantic and Mediterranean traps; (*ii*) test, by simulation models, the potential of this species to withstand exploitation based on its biological and ecological characteristics; and (*iii*) study the possibility of developing abundance indices from aerial surveys in the area of the Balearic Islands and Sicily. This program will continue until 2002.

These programs contribute to the objects of the ICCAT Bluefin Year Program (BYP).

Albacore: For the North Atlantic, biological sampling has been carried out on landings of the catches of some fleets to evaluate their size structure. In addition, technological trials have been carried out in view of the reconversion of the fleets involved in the prohibition on driftnets that enters into force on January 1, 2002. The techniques tested up to now include mainly longline, "automatic" troll line and purse seine.

• Tropical tunas

With regard to tropical tunas, fishery statistics, biological sampling and research are carried out in close collaboration with the research institutes of Côte d'Ivoire and Senegal. These statistics cover 100% of the logbooks of this fleet.

The research currently being carried out on tropical tunas is as follows:

- Analysis of the ethology and dynamics of the association between schools and baitboats developed for the Dakar fleet (MAC program); initiated in 1991, this program concluded in 2000 and the analysis of the interesting and original results is expected in 2001-2002.

- Deployment of oceanographic buoys (the French-Brazilian *PIRATA* Program) to monitor, in real time, the environmental conditions of the sub-surface in the Gulf of Guinea.

- Development and implementation of a "GAO" oceanographic data base so that fishers have valid and easily accessible data by various time-area strata.

- Continuation of studies on the efficiency of European purse seiners (the European *ESTHER* Program) to better estimate the impact of the European fleets on the stocks ; the initial results are expected in 2000.

- Implementation of a study on the feeding dynamics the high seas pelagic fishery environment.

- Lastly, the IRD is closely involved in the BETYP Program: development of an "integrated statistical production model" to better integrate available knowledge on the fisheries and the biology of the species, support for the collection of statistics on the baitboat and purse seine fisheries of Ghana in collaboration with the Marine Fisheries Research Department (MFRD) and participation in three of the four oceanographic cruises of the Japanese research vessel *Shoyo-maru*.

EC-Ireland

Irish fishermen have been fishing albacore since 1990 with more than 30 vessels employing drift-nets taking part in the fishery annually at its peak. In 1999 and 2000 participation in the drift-net fishery was restricted to 18 vessels in line with European Union regulations. In addition, domestic legislation was introduced in 2000 restricting all fishing for tuna (including pair-pelagic/mid-water trawling, trolling and long-lining) to vessels specifically licensed to do so. The total Irish catch of Albacore tuna in the 2000 fishery amounted to 3,274 MT, along with a by-catch of Bluefin tuna of 24 MT and a by-catch of swordfish of 36 MT.

In 1998 Ireland initiated, with financial assistance from the European Union, commercial trials on vessels using pair pelagic/mid-water trawls, longlines and mechanized trolls. During 2000, apart from the 18 vessels licensed to use drift-nets, a further 13 vessels participated in diversification trials. Four of these vessels employed trolls, 6 pair pelagic/mid-water trawls, and 3 vessels employed fixed gillnets. The fishery took place between July and October with catches taken mainly in an area bounded by latitudes 46/-50/ North and longitudes 11/-15/ West and in an area bounded by 46/-47/ North and 5/-6/ West.

A scientific monitoring program has been conducted in the fishery each year since 1998. This program includes onboard observers on all vessels taking part in experimental fishing trials and comprehensive sampling of landings from the driftnet fishery. The results of this program have been reported to ICCAT.

Biological information was collected from 313 hauls taken by pair-pelagic vessels. Tows were generally made at night and lasted from 4 to 6 hours. From the total catch of 35,420 albacore taken in the experimental fishery 6,643 were measured, 3,788 from the Bay of Biscay and 2,855 from the South West Coast of Ireland. During August, off the southwest coast of Ireland, the average catch of albacore per haul was 119 fish for a mean tow time of 272 minutes. The CPUE (number of albacore per hour fished) during the 313 hauls ranged from 0 to 356: 18% of tows caught no albacore, 44% of tows caught less than 5 albacore per hour, 35% of tows recorded albacore catches in excess of 100 fish and 4% recorded albacore catches in excess of 500 fish. Fork length ranged from 50 to 127 centimeters with modes centered on 56 cm, 65-67 cm, and 75-78 cm, and other less distinct modes at greater fork lengths. The dominant age group of both pair-pelagic and driftnet caught tuna taken in 2000 was 2-years with smaller numbers of both 1-year and 3-year old fish. Driftnets caught marginally more 2-year old fish than pelagic trawls, whereas pelagic trawls encountered more 4, 5, and 6-year-old fish than driftnets.

EC-Italy

In the year 2000 the level of the Italian catches related to all the tuna and tuna-like species showed some changes compared to the previous year, as reported in detail by the Task 1 form officially provided by the Italian government

to the EC and ICCAT. The reported bluefin tuna catches were quite below the quota, while an increase was reported in swordfish catches and minor changes are shown in the catches of various other tuna-like species.

The most important change reported for the Italian fleet concerns the further reduction of the driftnet vessels, now around 130, in accordance with EC rules, and the national plan to eliminate the driftnet fishery before the year 2002. The socio-economic problem due to the driftnet ban is still partially pending.

The increasing problem is pointed out concerning the difficulty to collect reliable catch data and, particularly, length frequencies from the tuna purse seine activity, due to the transfer of all the fish to floating cages for fattening, without landing these fish in any Italian harbor.

Several Italian scientific institutions have been involved in various research activities, supported by the Direction General for Fishery and Aquaculture and the EC-DG Fishery, providing a series of data collection and specific studies on tuna movements, on longline by-catches, on micro-constituents elements, genetics and swordfish population dynamics. The length frequencies for the various species (based on several thousands samples) have been provided in detail to SCRS, while the results of the studies will be released as soon as the final reports are approved.

A detailed plan to enforce the new data collection system established by the EC has been approved by the Ministry of Agriculture and Forestry Policy, taking into account all the measures requested by the ICCAT. The new data collection system will be effective an enforced as soon as it is approved by the EC.

EC-Portugal

The Portuguese catches of tuna and tuna-like-species amounted to 6,205 MT in 2000 which represents a decrease of 56% over the catch of 1998 (13,979 MT) and of 23% over the catch of 1999, respectively. This decreasing trend is mainly due to the decline in baitboat fisheries in recent years.

The Portuguese tuna fishery takes place mainly in the Azores and Madeira islands, where local baitboat fleets target different species of tuna, depending on the season and local abundance of each species. In 2000, these baitboat fleets caught 2,346 MT in Azores and 691 MT in Madeira, which included 1,351 MT of bigeye tuna, 1,285 MT of skipjack, 277 MT of albacore and 10 MT of bluefin tuna.

A long-line fleet based at Continental Portugal targets mainly on swordfish and operates in the North and South Atlantic. In 2000 the catch amounted to 909 MT of swordfish, being 504 MT caught in the North Atlantic and 392 MT in the South Atlantic. The long-line fleet based in Azores caught 204 MT in the NE Atlantic.

Long-liners based in Madeira has been operating since 1990 in the Eastern Atlantic and in the Mediterranean, catching an average of 300 MT of bluefin tuna per year. A total of 459 MT of bluefin was caught during the year 2000.

One trap has been operating in the South of Portugal since 1995, targeting on bluefin tuna. In 2000, the bluefin catch taken by this trap was 40 MT.

A revision on shark by-catch from the swordfish long-line fishery was carried out for the period 1990-2000. In 2000 the by-catch of the blue shark and short-fin mako were 2,905 and 393 MT, respectively. Among these approximately 80% were caught in the North Atlantic.

Research programs on tuna have been carried out by the Azores University, the Fisheries Research Laboratory of Madeira and the IPIMAR in Portugal mainland. The collection of tuna statistics and sampling size frequencies have been routinely reported to ICCAT Secretariat and the results of the scientific research have also been submitted to the regular meetings and inter-sessional workshops of the SCRS.

An observer program on the Azores bait boat fishery has been carried out since 1998, covering more than 50% of the fleet.

In the year 2001, under the ICCAT Bigeye Year Program (BETYP), 11 bigeye tuna were tagged with pop-up's in the Azores. In July 2001, a Portuguese researcher from Madeira participated on the BETYP tagging cruise off Sao Tomé & Príncipe. A total number of 1767 tunas were tagged, of which 955 skipjack, 603 yellowfin and 209 bigeye.

EC-Spain

The Spanish catches of tunas and tuna-like species in 2000 (Atlantic and Mediterranean) were 110,470 MT, comprised of 24,850 MT yellowfin, 10,688 MT bigeye, 37,227 MT skipjack, 16,398 MT albacore, 12,419 MT swordfish, 6,246 MT bluefin, 2,641 MT other species. Through the Information and Sampling Network size data from 253,227 fish were obtained, as well as species identification on about 100,000 additional fish. A total of 41 scientific documents have been presented (see document NAT/01/13).

Fisheries

• Tropical tunas and Canary Islands tunas

The purse seine fishery targets yellowfin and skipjack, with by-catches of other species, such as bigeye and small tunas. In 2000, the number of vessels remained at 19 units. Carrying capacity increased slightly, from 9,988 MT (in 1999) to 10,517 MT in 2000. Effort declined to 5,880 days (5,943 days in 1999). Catches increased to 64,710 MT, as follows: 24,050 MT yellowfin, 33,445 MT skipjack, 6,427 bigeye, and 789 MT other species. The baitboat fishery is carried out by 7 baitboats. In recent years the major part of their catches are carried out on tuna objects ("manchas"). The total catches amounted to 4,611 MT, as follows: 454 MT yellowfin, 2,660 MT skipjack, 1,497 MT bigeye, with 519 days fishing. In the Canary Islands area, 363 tuna vessels fish using live bait, with an estimated duration of 4,034 days at sea. Their catches were 3,743 MT, which was the lowest catch of the entire series considered, due to the conclusion of the fishing agreement between Morocco and the EU.

• Temperate tunas

Bluefin tuna catches in the East Atlantic and Mediterranean were 6,246 MT(3,474 MT in the East Atlantic and 2,772 MT in the Mediterranean). Albacore catches in the fisheries of the Cantabrian Sea and adjacent waters of the East Atlantic, North of 35ºN, were 15,512 MT (Baitboat: 10,499 MT, Troll: 5,064 MT). In the Mediterranean, 152 MT were caught. Swordfish catches were 12,419 MT, of which 10,983 MT were caught in the Atlantic and 1,436 MT in the Mediterranean. Small tuna catches were as follows: *Auxis spp* 1,040 MT; Atlantic bonito *(Sarda sarda)* 354 MT, and Atlantic black skipjack *(Euthynnus alletteratus)* 10 MT.

Research and statistics

Work continued with the Information and Sampling Network to develop the ICCAT basic scientific statistics.
• Tropical tunas and Canary Islands tunas

Work continued within the framework of the following Projects: *ESTHER* (a study on the development of the fishing power of the Spanish-French tropical purse seine fleet); *TESS* (a review of the current tropical tuna data bases and their integration into the future European laboratory on tunas, ORDET). The *BIOTHON* Project was initiated to reinforce the level of for species and size composition at the major landing ports of the purse seine tuna fleet. Sampling of baitboats in Dakar continued as well as at the 10 major Canary Islands ports. Within the BETYP, a new bigeye tagging cruise was carried out in Canarian-African waters in which 463 bigeye tuna, 1 yellowfin tuna, and 41 skipjack were tagged. Up to now, 298 bigeye, 8 yellowfin, and 8 skipjack tunas have been recovered.

• Temperate tunas

Bluefin tuna: A total of 18,628 fish were sampled. Studies were carried out on statistics, stock structure, biology, abundance indices, environmental effects, electronic tagging using pop-up tags, time-area trends, and fleet characteristics.

Albacore: There were 15,231 fish sampled in the Atlantic from baitboats and 28,237 fish from the troll fishery; 629 fish were sampled in the Mediterranean. Research work included a description of surface fleet activities, updating of the ICCAT tag-recovery data base, a description of migrations, a study of stock structure, and estimates of natural mortality.

Swordfish and associated species: There were 102,082 swordfish sampled in the Atlantic and Mediterranean. Sampling for size and sex continued. Documents were presented on abundance indices by age, size-weight relationship for swordfish and pelagic sharks, and scientific estimates of landing of species considered as by-catches: large pelagic sharks, billfish and tunas. Voluntary tagging of swordfish, pelagic sharks and billfish continued by

observers on the commercial fleet. There were about 300 recoveries of various species. A "Logbook to Determine and Identify Tuna-like Species" was developed to assist the swordfish fleet. The project on the analysis of nuclear DNA also continued and studies were carried out on the availability of juveniles to longline, the minimum size regulation, and the measures recommended to protect juveniles, and studies on sexual maturity through histological analysis of gonads. A Project also continued to assess the state of sexual maturity (and sex identification) by analysis of hormonal levels in plasma and tissue.

Other activities

• Mediterranean tunas

The FAO/COPEMED Project on large pelagics continued, coordinated by the Oceanographic Center of Malaga of the IEO which carries out its activities mainly on the various aspects of the biology of bluefin tuna and swordfish. Scientific documents were presented to the SCRS on biometric relations, sex ration by size class, size-age relationship, sexual maturity and standardized abundance indices. In addition, studies were carried out concerning environmental effects on the state of the bluefin tuna stock.

Ghana

Baitboats and purse seiners exploited tuna resources off the EEZ of Ghana. The total number of vessels currently in operation is 36, comprised of 26 baitboats and 10 purse seiners. Catches for the year 2000 dropped to 53,000 MT from 85,000 MT in 1999. This significant drop was attributed to the low effort exerted in the fishery (days at sea) primarily due to high operational costs rendering most vessels inoperative. Sixty-one percent (61%) of the overall tuna landings were made by the baitboats. Landings of skipjack recorded were 66%, yellowfin 30% and bigeye 4% respectively. Purse seiners continue to work in association with baitboats ,often sharing the catch off FADs. This collaboration has led to a mixture of varying sizes of fish often landed by the baitboats leading to some problems in stratification by gear. Ghanaian scientists participated in a tagging cruise organized by the Bigeye Year Program (BETYP) off Sao Tome during the months of April to August 2001. As of September 2001, over 300 tuna species have been recovered from the two conventional BETYP cruises; the first in November 1999. Beach sampling of billfishes continued off the western coast of Ghana as part of the ICCAT Enhanced Research Program for Billfish.

Japan

Longline is the only gear currently operated by Japan in the Atlantic Ocean. The number of Japanese longline vessels which operated in the Atlantic in 2000 was estimated to be about 220 (a continuous decline over the past 5 years). The provisional 2000 catch of tunas and tuna-like fishes in the Atlantic Ocean and Mediterranean Sea by the Japanese fishery is 35,800 MT (1,200 MT or a 3% decease from 1999). Bigeye is the most important species, accounting for about 65% of the total catch, followed by bluefin tuna, yellowfin and swordfish. In 2000, the catch by species was nearly the same as in 1999, except for southern bluefin tuna, swordfish and albacore. Southern bluefin catches increased by 700 MT while swordfish and albacore catches declined by6 1,100 MT and 150 MT, respectively.

Generally speaking, the geographic distribution of fishing effort was similar to that of recent years. Some shift from the gulf of Guinea to neighboring waters was observed due to poor fishing, especially during the second half of the year.

The monitoring of fishing activities, including data collection, submission of fishing data, and the study on the improvement of stock assessment methodology, are important research items , for which the National Research Institute for Far Seas Fisheries (NRIFRSF) has been responsible. This year, Japan participated in all ICCAT meetings and continued to provide routine fisheries statistics (Task I and Task II). With regard to the ICCAT research programs, Japan presented a brief summary of the cooperative research cruise in the tropical Atlantic, that was conducted in 2000-2001 under the Bigeye Year Program, trying to provide better biological information on this species. Tagging with archival, pop-up and conventional tags, especially for adult bigeye, sonic tracking and a plankton net survey were conducted. With regard to the Bluefin Tuna Year Program, Japan continued archival tagging of bluefin tuna in Croatia but on a much reduced scale. The genetic study on the stock structure of swordfish has continued and information was provided to the SCRS.

Japan carried out six scientific observer trips between June 2000 and July 2001, both in the tropical and temperate waters in the Atlantic. The main objectives of this project are the collection of fishery data, biological information on adult bigeye tuna, including size measurements and the collection of tissue, gonad and hard part

samples, and some oceanographic data. The preliminary results of these observations were presented in the SCRS documents. Additional observer trips are currently on-going to cover bluefin operations in the North Atlantic.

Korea

In 2000, the annual catch of tuna and tuna-like fishes by the Korean fishery in the Atlantic Ocean amounted to 292 MT, representing an increase of 5.4% over the previous year. Yellowfin, bigeye and southern bluefin tuna made up the major component of the total Korean catch, accounting for 49%, 24%, and 21%, respectively, and occasional catches of southern bluefin tuna were reported when the fishery moved further South. Bigeye tuna catches decreased from 124 MT in 1999 to 70 MT in 2000, but yellowfin tuna catches increased to 143 MT. The 2000 catch of southern bluefin tuna was 62 MT, which accounts for about 21% of the total catch, and increased by 121% as compared to 1999. Other tunas and billfish were also caught by longline in small quantity.

Routine scientific monitoring work was carried out by the National Fisheries Research and Development Institute (NFRDI). This monitoring covers the collection of catch and fishing effort statistics from the Korean tuna longliners in the Atlantic to meet data requirements of ICCAT. To implement the recommendations adopted by ICCAT, Korea has taken the necessary measures, including the introduction of new domestic regulations.

Libya

Bluefin tuna continues to be an important component of the Libyan fishery. Fishing activities targeting bluefin tuna were carried out using different fishing methods: trap nets, purse seiners, and longliners. During the year 2000, a total catch of 1,549 MT of bluefin, 4.5 MT of *E. alletteratus*, 8 MT of swordfish and 3 MT of sharks were caught.

A large research program has been carried out by the Marine Biology Research Centre with the framework of the COPEMED Program, including biological parameters such as length frequency distribution, length-weight relationship, reproduction and sex ratio. This program continued through the year 2001.

Morocco

The major tuna species caught are bluefin tuna, bigeye tuna and small tunas (skipjack, Atlantic bonito, frigate tuna, etc.). These species are caught mainly by trap (bluefin tuna), hand line (bluefin tuna), driftnet and longline (swordfish and small tunas) and secondly by purse seine (bluefin tuna and bigeye tuna).

During 2000, catches of tunas and tuna-like species rose to 13,296 MT, an increase of 13% over that of 1999, due to the increase in the catches of small tunas (5,981 MT as compared to 4,246 MT in 1999); catches of these species represent about 45% of the total weight.

Bluefin tuna catches amounted to 2,923 MT in 2000, a decrease of 4% as compared to 1999. Swordfish catches, which also declined, were on the order of 2,822 MT. Ninety-six percent (96%) of the total swordfish catch was taken in the Mediterranean as was 24% of the bluefin tuna catch.

As concerns the conservation and management measures adopted by ICCAT, Morocco has implemented, by ministerial decree, a minimum size limit on species fished in national waters. The monitoring of fishing activities has been further reinforced on land and at sea (a scheme of monitoring and recovery by satellite is in place).

In terms of research, the *Institut National de Recherche Halieutique* is actively involved in the programs, coordinated by COPEMED, to study the biology and fishing of bluefin tuna and swordfish.

Namibia

The tuna fishery in Namibia consists of a surface baitboat fishery and a longline fishery, targeting albacore, bigeye tuna and swordfish, with some minor catches of yellowfin tuna. Namibian companies have their own vessels and through charter arrangements foreign flagged vessels fished on behalf of Namibian right holders.

A total of 59 baitboats were licensed by Namibia during 2000, of which only 24 were actively fishing during the season. Of these vessels, 32 were Namibian registered vessels and 27 were chartered vessels from South Africa. The baitboats landed a total of 2,631 MT of tuna like species, with the majority of the catch being 2,240 MT of albacore.

Namibia also licensed 37 longline vessels during 2000, of which 18 were South African, 16 Japanese and 3 Namibian flagged. Of these longline vessels 24 were actively fishing during the season.

Proper recording of all catches and effort is mandatory under Namibian laws and is applied to all vessels, regardless of flag or charter arrangement. Skippers have to record catch and effort data on logsheeets after each set made. All fish have to be offloaded at the Namibian ports where the Fisheries Inspectors collect the catch/effort data and reconcile them with the skipper's records. Except for small vessels, a very high proportion of vessels registered in Namibia (more than 80%) have observers on board collecting valuable data, including length frequencies.

Tunisia

The fish commonly grouped under the category of large pelagics are among those of major importance off the Tunisian coast, particularly bluefin tuna *(Thunnus thynnus)*, Atlantic black skipjack *(Euthynnus alletteratus)*, Atlantic bonito *(Sarda sarda)*, bullet tuna *(Auxis rochei)*, and swordfish *(Xiphias gladius)*.

The first two species maintain a local industry, since a major part of these fish are canned. Bluefin tuna and swordfish continue being the preferred species for the export market. These products are mainly exported to Japan and some European countries. In 2001, a large part of the purse seine catches of bluefin tuna were exported to Spain for fattening prior to their export to Japan.

Although the number of tuna vessels has declined considerably, from 70 vessels in 1998 to only 49 in 2000, their total catches, particularly bluefin catches, have not declined.

At present, there are about 50 tuna vessels measuring between 15 and 38 m draft that fish tunas along the Tunisian coasts. As concerns swordfish, 40 longline vessels fish this species in Tunisian waters. The major part of the effort is concentrated off the northern coast of the country, although since 1998, this activity takes place all along the Tunisian coast. In 2000, more than 79% (or 362 MT) of the total national catch of this species (483 MT) was taken off the southeastern coast.

In 2000, the catches of tunas and tuna-like species (swordfish) amounted to 6,560 MT. In terms of proportion, small tunas comprise 59.3% of the total catches (3,893 MT), while the estimated catches of bluefin tuna are 2,184 MT (33.3% of the catch) and swordfish the catches (414 MT) represented 7.4%.

The purse seine landings of bluefin tuna currently comprise more than 97% of the national catches.

The two Tunisian traps, located to the North of the country, catch less and less bluefin tuna. In 2000, their total catch of bluefin tuna did not surpass 13MT of bluefin tuna, which represents less than 0.6% of the national catches.

With regard to research activities, Tunisia continues, through the National Research Institute, to participate in the research work of COPEMED, a program dedicated to the study of the fishing, biology and ecology of the large pelagics in the Mediterranean and which is jointly financed by FAO/COPEMED and the INSTM.

United Kingdom (Overseas Territories)

The United Kingdom represents five Overseas Territories at the International Commission for the Conservation of Atlantic Tunas. These are: Anguilla, Bermuda, the Falkland Islands, St. Helena and the Turks and Caicos Islands.

There was no fishing for ICCAT species conducted in the Anguilla zone during the year 2000.

The Bermuda commercial fishing fleet for tuna and tuna-like species consisted of 199 vessels during 2000 with approximately one-third of these vessels actively fishing for tuna and tuna-like species. During 2000, the total catch of tuna and tuna-like species by Bermuda was 109 MT.

At present there is no commercial exploitation of any species under an ICCAT management regime in the Falklands Islands zone. A by-catch of 1 MT of slender tuna *(Allothunnus falli)* was reported during 2000.

During 2000, the total catch of tuna and tuna-like species by St. Helena was just in excess of 266 MT. There were no catches of yellowfin or bigeye tuna less than the minimum weight of 3.2 kg.

Bermuda is actively involved in the ICCAT Enhanced Program for Billfish Research and was involved in the steering committee to organize and investigate the presence of bluefin tuna in the Central North Atlantic area.

In accordance with the ICCAT Recommendation, in 2001 Bermuda introduced new regulations which set minimum sizes of retention for blue marlin and white marlin.

United States

Total (preliminary) reported U.S. catch of tuna and tuna-like fishes (including swordfish, but excluding other billfishes) in 2000 was 24,202 MT, a decrease of about 13% from 27,770 MT in 1999. Estimated swordfish catch (including estimated dead discards) decreased 83 MT to 3,481 MT, and provisional landings from the U.S. fishery for yellowfin in the Gulf of Mexico decreased in 2000 to 2,214 from 2,899 in 1999. The estimated 2000 Gulf of Mexico landings of yellowfin tuna accounted for about 31% of the estimated total U.S. yellowfin landings in 2000. U.S. vessels fishing in the northwest Atlantic landed an estimated 1,212 MT of bluefin, a decrease of 2 MT compared to 1999. Provisional skipjack landings decreased by 108 MT to 44MT from 1999 to 2000, estimated bigeye landings decreased by 688 MT compared to 1999 to an estimated 574 MT in 2000, and estimated albacore landings increased from 1999 to 2000 by 90 MT to 407 MT.

In addition to monitoring landings and size of swordfish, bluefin tuna, yellowfin tuna, billfish, and other large pelagic species through continued port and tournament sampling, logbook and dealer reporting procedures, and scientific observer sampling of the U.S. fleet, major research activities in 2000 and 2001 focused on several items. Research on development of methodologies to determine the genetic discreteness of large pelagic fishes in the Atlantic was continued as were larval surveys for bluefin tuna and other large pelagics in the Gulf of Mexico. Research on development of robust estimation techniques for population analyses and on approaches for characterization of uncertainty in assessments and methods for translating that uncertainty into risk levels associated with alternative management approaches was further conducted.

U.S. scientists also continued to coordinate efforts for the ICCAT Enhanced Research Program for Billfish and for the Bluefin Year Program. Participants in the Southeast Fisheries Science Center's Cooperative Tagging Center (CTC) and the Billfish Foundation tagging program tagged and released 9,149 billfishes (swordfish, marlins, sailfish, and spearfish) and 850 tunas in 2000. This represents an increase of 7% from 1999 levels for billfish, and a 13% decrease for tunas. Electronic tagging studies of bluefin tuna and of marlins were substantially enhanced. Cooperative research was conducted with scientists from other nations on development of assessment methodologies, on biological investigations and on development of indices of abundance for species of concern to ICCAT.

Venezuela

The Venezuelan industrial tuna fishery is carried out using three types of fishing gear: baitboat, purse seine and longline. There are also artisanal fisheries that catch tunas and tuna-like species using driftnets and surface longline.

The 2000 catch of the industrial fleet amounted to 16,379 MT, of which 67% were taken by the purse seine fleet, 28.4% by the purse seine fleet, and 4.6% by the longline fleet. The species with the highest catches were yellowfin tuna (67.5% of the purse seine catches, 61.3% of the baitboat catches, and 55.1% of the longline catches); skipjack, the second most important species in the landings (23.1% of the purse seine catches and 9.9% of the baitboat catches). There were reported albacore catches of 1,376 MT in 2000, which were higher than those reported in previous years, the majority of which were taken by baitboat. Swordfish catches were 40 MT, including those from the artisanal fishery. Shark by-catches amounted to 106 MT whereas billfish catches reached 202 MT.

Venezuela conducts research work aimed at evaluating the tuna resource within the framework of the Program "Assessment of the Large Pelagic Fisheries", which is carried out by the *Instituto Nacional de Investigaciones Agrícolas* (INIA), in cooperation with the *Servicio Autónomo de los Recursos Pesqueros y Acuícolas* (SARPA). This program collects catch and effort statistics from the baitboat, purse seine, industrial longline, artisanal and driftnet fisheries that catch tunas and billfishes. The program also conducts an assessment of the *Scomberomorus cavalla* fisheries in the eastern area of the country and adjacent areas. Port sampling of the landings also continued.

The research carried out within the Enhanced Billfish Research Program, which is financed by ICCAT, continued with the collaboration of the National Institute of Agricultural Research and the Oceanographic Institute of Venezuela of the University of Oriente. From the observer program on board longliners, information has been

collected on size frequency, sex ratios of all the species caught, catch and effort data and fishing area. There were 22 juvenile swordfish tagged and released in 2000 and 11 in 2001.

The overall coverage in the collection of data from the fishing logbooks was 59.8%, and coverage by type of fishery was 75.5% for purse seine, 80.11% for baitboat, and 40.1% for longline.

At the same time, Venezuela has implemented measures aimed at monitoring the size of the catch of swordfish, sailfish, blue marlin and white marlin. Also, the Placer de la Guaira protection area has been extended. limiting the industrial longline fishing operations and reserving this area only for artisanal driftnet vessels.

Observers

Chinese Taipei

The distant water longline (DWLL) fishery is currently the only tuna fishery operated in the Atlantic Ocean and the Mediterranean Sea by Chinese Taipei. The total number of vessels operating in this Ocean was about 188 in 2000, a slight decrease from the previous year. The total catch of tuna and tuna-like species by this fleet was estimated to be about 50,002 MT in 2000, similar to that of 1999. Albacore (22,520 MT) was the most dominant species caught, accounting for 45% of the total, while bigeye (16,795 MT) and yellowfin (5,661 MT) tunas together accounted for another 45%. Collection and compilation of catch statistics for tuna and tuna like species in Chinese Taipei were carried out on a routine basis. The compiled data including Task I and Task II for all tuna and tuna-like species within the competence of ICCAT, as well as the number of vessels have been reported to the ICCAT Secretariat.

Tuna research conducted by scientists in Chinese Taipei was presented at the regular meetings and inter-sessional working group meetings of the SCRS. In addition to the domestic research conducted by scientists in Chinese Taipei, the authorities have also supported various scientific research programs implemented by the ICCAT including bigeye tuna, bluefin tunas and billfish. In 1999 and 2000, a contribution of US$100,000 to the Bigeye Tuna Year Program (BETYP) was made on a voluntary basis.

In terms of implementation of the relevant ICCAT conservation and management measures, the fishery authority in Chinese Taipei has promulgated a number of regulations in compliance with these measures. Currently, catch and/or size limits on bigeye, eastern bluefin, northern and southern swordfish, as well as blue marlin and white marlin have been set for our DWLL fleet operating in the Atlantic Ocean. Catches of these species in 2000 were mostly within catch limits recommended by the ICCAT. In addition, a certificate system including requirements on "ICCAT Bluefin tuna Statistical Document" and "Swordfish Certification of Eligibility (COE)" for export to USA and Japan was established for the sale of bluefin tuna and swordfish caught in the Atlantic Ocean. Further details can be found in document SCRS/01/156.

Malta

Bluefin tuna are targeted by surface longlines. This type of fishing was the only method available to the Maltese fishermen owing to the precautionary approach adopted by the Department of Fisheries in implementing Sections 13 to 17 of the Fishing Regulations (LN205/34) and through which no purse seine licences for large pelagics have ever been issued. The landed tuna are all gilled and gutted and a conversion factor needs to be applied in order to get an estimate of the total round weight. The estimated total bluefin tuna catch for the year 2000 is 376 MT.

During the year 2000, 140 MT of swordfish were caught by longlines. These were either targeted directly or else caught as by-catch with bluefin tuna. 4 MT of albacore were landed locally. These were caught as by-catch.

Malta is still actively taking part in the FAO-COPEMED project on the fisheries biology of bluefin tuna and swordfish. It is also participating in the Bluefin Year Program.

Mexico

The Mexican tuna fishing in the Atlantic is only carried out in the exclusive economic zone, which includes the area south of the Gulf of Mexico. The fleet is comprised of 32 vessels which use longline in their fishing operations. The major species is yellowfin tuna *(Thunnus albacares)*, although other tuna species, large fish and shark species are also taken as by-catch.

In 2000, the estimated catch of yellowfin tuna was 1,390 MT, which represents almost 85% of the total catch. This catch is the highest recorded for the entire history of the fishery, and shows an increase of about 15% as compared to the previous year. Besides, bluefin tuna, bigeye tuna and skipjack, etc. were also taken as by-catches.

Since 1992, Mexico has had an on-board observer program in place that covers 100% of the fishing trips made by the Mexican tuna fleet in the Atlantic. The information collected by the observers has been the basis of the research studies that include the following: (1) analysis of abundance indices; (2) area distribution of yellowfin tuna and associated species; (3) bio-economic modeling; and (4) analysis of by-catches. All these studies, however, are in the initial stages. Work has also been carried out to develop estimates of catch and effort, which will result in obtaining values of these parameters with partial information.

Mexico has implemented measures to regulate tuna fishing activities in the Atlantic. These measures regulate a minimum size of the catch, fishing effort, and the maximum percentage of by-catch allowed. In addition, a regulation has been implemented that protects juvenile yellowfin and bigeye *(T. obesus)*.

SCRS Chairman's Note

The Chairman noted that, in this year characterized by a low assessment workload, scientists were able to concentrate their efforts on other scientific activities. This is reflected in the wide variety of research activities that were mentioned by the participants, which are summarized above.

7. Executive Summaries on species

The Committee stresses that the main purpose of an Executive Summary is to provide a succinct overview to the Commission. These are Summaries of the biology and fisheries affecting stocks of concern, the status and outlooks for these stocks, evaluations of effectiveness of management measures agreed by the Commission, and recommendations for additional management measures that the Committee feels would improve the odds of meeting the Commission's objective of attaining Maximum Sustainable Yield levels from the stocks. In order to avoid misunderstanding the Committee's intent, the SCRS stresses the need to recognize and cite all the conditions and uncertainties identified in the Executive Summary, if figures and tables are used apart from the entire Executive Summary Report.

The Committee also suggests that, in order to obtain a more rigorous scientific understanding of these Executive Summaries, readers consult the corresponding Detailed Reports, which are published in the Collective Volume series.

The Committee also notes that the texts and tables in these summaries generally reflect the information that was available to ICCAT immediately before the plenary meetings of the SCRS, as they were drafted by the Species Group meetings. Therefore, catches reported to ICCAT during or after the SCRS meeting may not be included in the Summaries.

7.1 YFT - YELLOWFIN TUNA

No new assessment was conducted for yellowfin tuna this year. The conclusions reported here generally reflect the results of the last assessment, which was conducted during 2000. However, there have been revisions to historical catches (1991-1999) since that assessment, largely due to improved classification of NEI catches by country. As a result of the removal of duplicate catch reports, the total catch values from 1991-1998 changed to varying degrees from the values used for the last assessment. The text of this report has been updated as necessary to reflect data changes and additions.

YFT-1. Biology

Yellowfin tuna is a cosmopolitan species distributed mainly in the tropical and subtropical oceanic waters of the three oceans, where they form large schools. The sizes exploited range from 30 cm to 170 cm FL. Smaller fish (juveniles) form mixed schools with skipjack and juvenile bigeye and are mainly limited to surface waters, while larger fish are found in surface and sub-surface waters. Since the inception of the yellowfin tagging program which has been carried out in the North American sport fishery since 1985, individuals of this species have often been recovered in the West Atlantic, but the majority of the long-term recoveries are made in the East Atlantic where several recaptures are recorded each year. The main spawning ground is the equatorial zone of the Gulf of Guinea, with spawning occurring from January to April. In addition, spawning occurs during May to August in the Gulf of Mexico and from July to November in the southeastern Caribbean Sea, although the relative importance of these spawning grounds is unknown. Such separate spawning areas might imply separate stocks or substantial heterogeneity in the distribution of yellowfin tuna. Nevertheless, taking into account the transatlantic migration indicated by tagging, as well as other information (e.g. time-area size frequency distributions and locations of fishing grounds), a single stock for the entire Atlantic is assumed as a working hypothesis (Atlantic Yellowfin Working Group; Tenerife, 1993). From the Gulf of Guinea, the juveniles move towards more coastal waters off Africa. When they reach the pre-adult stage (60-80 cm: fish from age 1.5 - 2), it is presumed that the majority migrate west towards the American coasts, with the majority of these in turn returning to the East Atlantic fishing grounds for spawning when they reach about 110 cm. A 40-year time series of longline catch data indicates that yellowfin are distributed continuously throughout the entire tropical Atlantic ocean. Growth patterns are variable with size, being relatively slow initially, and increasing at the time the fish leave the nursery grounds. Males are predominant in the catches of larger sized fish. Natural mortality is assumed to be higher for juveniles than for adults. This assumption is supported by tagging studies for Pacific yellowfin.

YFT-2. Description of the fisheries

The distribution of yellowfin tuna catches in the Atlantic is shown in **YFT-Figure 1**. Yellowfin tuna are caught between 45ºN and 40ºS by surface gears (purse seine, baitboat, troll and handline) and with sub-surface gears (longline). Troll and handline, although used in artisanal fisheries, have never been a large component of the yellowfin fisheries, although these gear types can represent a large proportion of the catch by a nation. The baitboat fisheries in equatorial areas have always targeted juveniles in coastal waters, together with skipjack, young bigeye and other small tunas. Baitboat fisheries are still active in waters of Mauritania and Senegal, Ghana (Tema), the Canary Islands, Cape Verde, Madeira, Venezuela and Brazil. In the 1980's, the fleets which operate in the areas off Senegal developed a new fishing method in which the baitboat acts as a floating object which attract bigeye, and to a lesser extent yellowfin and skipjack; the Canary Islands began to adopt this method in the 1990's. Since the early 1990's, Ghanian baitboats have fished on artificial floating objects.

Purse seine fisheries began operating in the East Atlantic in the 1960's, and developed rapidly in the 1970's. Beginning in 1975, the fishing area was extended from coastal waters to the high seas, especially at the equator, where large sized yellowfin are caught during the spawning season. In coastal areas, purse seiners catch juveniles in mixed schools. This gear is very efficient as it catches a wide range of sizes (40 to 160 cm), although catches in the east include very few intermediate-sized fish (70 to 100 cm) whereas both small and larger fish are caught. Venezuelan purse seiners operating mostly in coastal areas of the West Atlantic mainly catch fish of intermediate sizes.

Particularly since 1991, the purse seine fleets which operate in the East Atlantic have developed a fishery which targets schools associated with artificial floating objects. This translates into an important increase in catches of skipjack, juvenile bigeye and, to a lesser extent, increases in catches of juvenile yellowfin and by-catch, extending the fishing grounds westward to 30ºW and south of the equator.

Longline fisheries principally catch yellowfin larger than 70 cm. However, deep longlines, which began being used in the early 1980's, mainly target bigeye, and therefore the proportion of yellowfin caught by longliners in the Atlantic is becoming less important (in 2000, it amounted to 14% of the total). There are, however, longline fisheries directed at yellowfin tuna, most notably in the Gulf of Mexico and the Caribbean Basin. Coincident to the development of purse seine fisheries during the 1960's and 1970's, longline catches diminished. Amounts caught by longline gear now tend to be somewhat higher in the West Atlantic than in the East Atlantic.

Yellowfin catches in the Atlantic as a whole reached a historical high in 1990 (192,500 MT), but have since declined by 30% to 135,000 MT in 2000 **(YFT-Table 1)**. However, the relative contributions of the various gear types have remained similar **(YFT-Figure 2a)**. In the East Atlantic, landings reached a high of around 138,000 MT in 1981 and 1982, then declined to a low of 76,000 MT in 1984, gradually increasing to a new record of 157,000 MT in 1990, and subsequently fluctuating between 126,000 MT and 100,000 MT, with a generally declining trend. An average of 78% of the total catches in the East Atlantic over the past 15 years have been taken by purse seiners. In the West Atlantic, total catches have exhibited relatively little fluctuation over the past 15 years, averaging about 32,000 MT, of which 32% on average has been taken by purse seiners (although purse seine catches have fluctuated widely, ranging from 6,000 MT to 20,000 MT), 17% was taken by baitboats, 34% by longliners, and the remaining 17% on average by other surface gears. The changes to the historical catch trend which have been implemented since the last assessment are depicted in **YFT-Figure 2b**.

Effective effort for the eastern tropical Atlantic purse seine fishery is estimated by first standardizing to French class 5 purse seiners, and then further adjusting based on the assumption of an estimated annual increase of 3% in fishing power since 1981. The need to adjust for increases in efficiency results from the many improvements in the purse seine fishery, including the use of floating objects, bird radar, sonar, and satellite imagery, and is supported by data analysis (See Yellowfin Tuna Detailed Report). These calculations indicate that effective effort for the purse seine fishery reached a high of 27,600 standard fishing days in 1983, declined to a low of 14,700 in 1986, increased again to a new high of 30,000 in 1992 before declining to the 1999 level of 21,000 standard fishing days.

Trends in catch at age are shown in **YFT-Figure 3**. The variability in overall catch at age is primarily due to variability in catches of ages 0 and 1 (note that the catches of age 1 have increased in 1998 and to a greater extent in 1999).

YFT-3. State of the stock

A full assessment was last conducted for yellowfin tuna in 2000 using various age-structured and production models; emphasis was placed on the development of the production models, thus the results from these forms of analysis were the basis for the Committee's advice.

Both equilibrium and non-equilibrium production models were examined. The data used for the equilibrium models assumed a fixed increase in fishing power of 3% per year. In contrast, the non-equilibrium estimated changes in fishing power trends internally by fleet.

The estimate of MSY based upon the equilibrium models ranged from 144,600 to 147,300 MT; the estimates of F_{MSY} ranged from 70,000 to 52,700 standard fishing days. The total 1999 yellowfin catch was 144,000 (recorded as 140,000 MT at the time of the assessment). The overall effective effort for 1999 was estimated to be 60,100 standard fishing days (in French purse seine units; this effective effort is obtained from the CPUE of the French and Spanish fleets, assuming a 3% annual increase in fishing power beginning in 1981). Therefore, the equilibrium model results estimated that the fishing effort in 1999 was either somewhat above or below F_{MSY}.

The point estimate of MSY based upon the non-equilibrium model was 152,200 MT; the point estimate for F_{1999}/F_{MSY} was 0.88 (**YFT-Figures 4a and 4b**). The Committee was unable to estimate the level of uncertainty associated with these point estimates. Therefore, the non-equilibrium model results estimated that the fishing effort in 1999 was somewhat below F_{MSY}. Estimates of changes in fishing power partially agreed with the 3% assumption used in the equilibrium models for the French purse seine fleet and for the Spanish purse seine fleet until 1990 but differed for the Spanish purse seine fleet after 1990.

In summary, the production model analyses implied that although catches could be slightly lower than MSY levels, effort may be either above or below the MSY level, depending on the assumptions made about changes in fishing power. Consistent with the production model results, yield-per-recruit analyses also indicated that 1999

fishing mortality rates could either be above or about levels which could produce MSY. Yield-per-recruit analyses further indicated that an increase in effort is likely to decrease the yield per recruit, while reductions in fishing mortality on fish less than 3.2 kg could result in substantial gains in yield per recruit and modest gains in spawning biomass per recruit **(YFT-Figure 5)**.

YFT-4. Outlook

Since reported yellowfin landings appear to be close to the MSY level and fishing effort and fishing mortality may be in excess of the levels associated with MSY, it is important to ensure that effective effort does not increase further. Thus the possibility that the fishing power of the purse seiners and other fleets may further increase, even if the total capacity of the fleet were to remain constant, is also cause for concern.

YFT-5. Effects of current regulations

In 1973, the Commission adopted a regulation that imposed a minimum size of 3.2 kg for yellowfin tuna, with a 15% tolerance in the number of fish per landing. This regulation has not been adhered to, as the proportion of landings of yellowfin tuna less than 3.2 kg has been far in excess of 15% per year for the purse seine and baitboat fisheries. Based on the newly-revised catch species composition and catch at size data arising from improved analyses of the European purse seine data and other revisions of the database, it now appears that overall catches in number by purse seiners averaged 53.1% undersized yellowfin tuna over the period 1993-98. In the same period, baitboat fisheries landed 75.2% undersized fish. Landings of undersized fish occur primarily in the equatorial baitboat fisheries. In 1999, the calculated proportions of undersized yellowfin were 70.9% for the purse seine fleet and 80.7% for the baitboat fleets. Overall percentages of undersized yellowfin considering all gears were estimated to be 54.5% in 1998 and 69.9% in 1999. The potential size sampling problems may have influenced these percentages. However, the overall percentages are almost certainly considerably higher than the 15% tolerance level. Almost all undersized yellowfin tuna are caught in eastern Atlantic waters, since larger sizes dominate in the West Atlantic. Unfortunately, it may be difficult to realize substantial reductions in catches of undersized fish in the East Atlantic because small yellowfin are mostly associated with skipjack, especially when fishing occurs on floating objects; thus it is difficult to avoid catching small yellowfin when catching skipjack, the latter being an important component of eastern Atlantic purse seine fleet catches. The Committee suggests that the Commission consider the practicality of maintaining the 3.2 kg minimum size regulation.

In 1993, the Commission recommended "that there be no increase in the level of effective fishing effort exerted on Atlantic yellowfin tuna, over the level observed in 1992". Although it is evident that total fleet capacity has declined somewhat in recent years, at least for the eastern Atlantic surface fleets (from 55,700 MT in 1992 to 42,900 MT in 1999), the direction and amount of change in effective fishing effort depends on changes in gear technology and fishing strategies which are assumed to have increased efficiency. If the assumption of a 3% annual increase in fishing power is considered, total effective effort has remained relatively stable since 1990.

The effects of the moratorium on FAD fishing are detailed in the Report of the Working Group for the Evaluation of a Closed Area-Season for the Use of FADs by Surface Fisheries.

YFT-6. Management recommendations

Estimated catches of yellowfin tuna have averaged 142,000 MT over the past three years. This average falls slightly below the range of MSY from the equilibrium and non-equilibrium production model analyses conducted during the last assessment. It is unclear how the changes to the historical catch trend would affect these results. Nevertheless, the Committee considers that large changes in the estimates of MSY are unlikely, and the conclusion is maintained that the yield in 2000 likely remains close to the replacement yield. However, depending on the assumption about annual rates of increase in efficiency, recent levels of fishing effort and fishing mortality may be somewhat above or below the levels associated with equilibrium MSY catches. There are many other sources of uncertainty which may affect the estimates; these are discussed fully in the 2000 SCRS Yellowfin Tuna Detailed Report. Therefore the Committee reaffirms its support for the Commission's 1993 recommendation "that there be no increase in the level of effective fishing effort exerted on Atlantic yellowfin tuna, over the level observed in 1992". The Committee's most recent point estimates of effective fishing effort fall below the estimate for 1992.

The Committee also continues to recommend that effective measures be found to reduce fishing mortality of small yellowfin, based on results of yield per recruit analysis. Although there are insufficient data to fully evaluate the effects of the moratorium on fishing on floating objects (and other measures to reduce catches of small fish)

begun in late 1997, in general, the approach was intended to benefit bigeye tuna and is not expected to reduce the mortality of juvenile yellowfin tuna. In fact, the fishing mortality on juvenile yellowfin tuna appears to have increased substantially during the moratorium years, although it is unclear that this is related to the moratorium.

ATLANTIC YELLOWFIN TUNA SUMMARY
(yields in 1,000 MT)

Maximum Sustainable Yield (MSY)[1, 3]	144.6 - 152.2
Current (2000) Yield	135
Current (2000) Replacement Yield	May be close to current yield
Relative Biomass B_{1999}/ B_{MSY}[2, 3]	103%
Relative Fishing Mortality: F_{1999}/F_{MSY}[1, 3]	88-116%

Management measures in effect:
- 3.2 kg minimum size [Ref. 74-1]
- Effective fishing effort not to exceed 1992 level [Ref. 93-1]
- Closed area/season for fishing on FADs [Ref. 99-1]

[1] These are ranges of point estimates and no confidence limits are given.
[2] No estimate of uncertainty was calculated around this point estimate during the assessment. Point estimates during the 1998 assessment ranged from 92-135%.
[3] Result from 2000 SCRS.

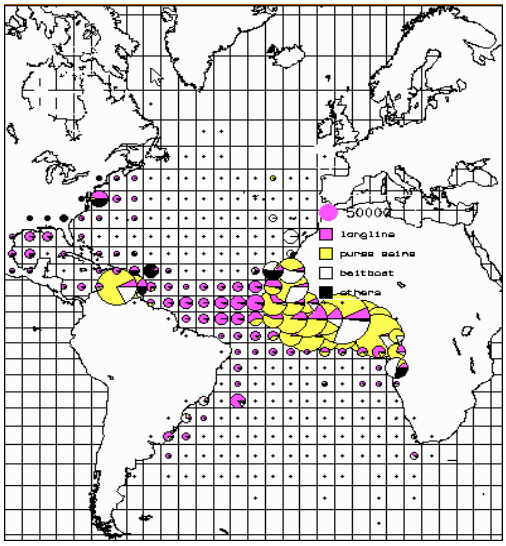
YFT-Table 1. Estimated landings of yellowfin tuna in 1976-2000*, by major area, gear and flag.

		1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	TOTAL	124960	131013	134044	127517	130961	155818	165001	165373	113939	156547	146534	144428	135219	161321	192456	166152	162299	160127	170521	152019	153371	138202	148030	143871	135152
AT. EAST		111020	117541	119246	114158	117798	138114	138711	124953	76053	113656	106606	110304	99180	123238	157112	125675	121975	116953	116294	111010	114756	101435	111819	107099	99685
	SURFACE	98183	101879	107956	107381	105290	130128	128255	118913	67961	104212	102922	105823	91669	116853	149472	120173	118072	112846	107791	103055	106189	95471	103783	99394	90968
	Baitboat	12794	10943	8980	13715	7690	9788	13211	11507	14694	16120	15301	16750	16020	12168	19560	17772	15095	18470	15735	13604	13872	14042	17548	18943	12719
	Purse Seine	85260	90552	98098	92291	97026	114993	111820	103502	50860	86576	85325	86141	73117	102200	127673	98618	100468	92295	90151	87597	89156	78370	83659	77581	75057
	Other surf.	129	384	878	1375	574	5347	3224	3904	2407	1516	2296	2932	2532	2485	2239	3783	2509	2081	1905	1854	3161	3059	2576	2870	3192
	LONGLINE	12837	15662	11290	6777	12508	7986	10456	6040	8092	9444	3684	4481	7511	6385	7640	5502	3903	4107	8503	7955	8567	5964	8036	7705	8717
	ANGOLA	1005	2085	2296	904	558	959	1467	788	237	350	59	51	246	67	292	510	441	211	137	216	78	70	115	170	35
	BELIZE.SH.OB	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
	BENIN	0	0	0	48	95	100	113	49	65	60	19	3	2	7	1	1	1	1	1	1	1	3	1	1	1
	CAMBODIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0
	CAP-VERT	115	104	470	581	864	5281	3500	4341	2820	1901	3326	2675	2468	2870	2136	1932	1426	1536	1727	1781	1448	1721	1418	1663	1851
	CAYMAN ILS	0	0	0	0	602	1460	100	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	0	0	0	0	0	0	0	0	0	0	0	84	71	1535	1652
	CHINESE TAIPEI	678	208	203	190	71	432	203	452	87	146	254	193	207	96	2244	2163	1554	1301	3851	2681	3985	2993	3643	3389	4346
	CONGO	0	0	0	0	140	50	0	0	0	11	20	15	15	21	22	17	18	17	14	13	12	12	12	12	12
	COTE D'IVOIRE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1215	1030	1022	1329	1560
	CUBA	2400	3000	2339	3168	5128	2945	2251	1916	1467	1585	1332	1295	1694	703	798	658	653	541	238	212	257	269	0	0	0
	EC-ESPANA	33423	35525	33636	40083	38759	51428	54164	51946	40049	66874	61878	66093	50167	61649	68603	53464	49902	40403	40612	38278	34879	24550	31337	19977	24651
	EC-FRANCE	51624	49948	55192	47776	54372	55085	45717	40470	7946	12304	17756	17491	21323	30807	45684	34840	33964	36064	35468	29567	33819	29966	30739	31246	29789
	EC-PORTUGAL	3	0	125	185	77	208	981	1333	1527	36	295	278	188	181	179	328	195	128	126	231	288	176	267	34	92
	ESTONIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	234	0	0	0	0	0	0	0	0	0
	FAROE-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	1
	G.EQUATORIAL	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
	GABON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	88	218	225	225	295	225	162
	GAMBIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	16	15	0	0	0	0	0	0	0	0
	GEORGIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	22	10	0	0	0	0	0	0	0
	GHANA	945	621	546	1426	1974	5510	9797	7689	9039	12550	11821	10830	8555	7035	11988	9254	9331	13283	9984	9268	12160	16504	17807	28328	17010
	JAPAN	5238	2647	1722	1241	2217	2863	4815	3062	4344	5765	3634	4521	5808	5882	5887	4467	2961	2627	4194	4770	4246	2733	4092	2281	2242
	KOREA	7636	11060	8625	6449	5349	4288	4010	1629	1917	1668	965	1221	1248	1480	324	259	174	169	436	453	297	101	23	94	142
	LATVIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	255	54	16	0	55	151	223	97	97	36
	LITUANIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	332	0	0	0	0	0	0	0	0	0
	MAROC	1574	2167	3440	2986	3243	4817	4540	2331	614	2270	2266	1529	0	0	0	0	0	0	0	0	0	0	0	0	0
	NAMIBIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	14	72	69	3	147	59
	NEI-1	0	0	0	0	0	0	3121	5388	1104	0	0	2077	3140	5436	12513	6377	11868	10053	8550	8990	12791	12996	13585	10596	6668
	NETHERLAND.ANT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6771
	NORWAY	0	0	0	0	0	0	0	0	0	0	813	418	493	1787	1790	0	0	0	0	0	0	0	0	0	0
	PANAMA	2892	1736	1477	739	1661	341	1933	1568	1653	3100	0	0	0	0	0	6700	7030	7838	8644	10854	5759	3137	1753	930	1209
	PHILIPPINES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	126	173	86
	POLAND	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RUSSIA FED.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3200	1862	2160	1503	2936	2696	4275	4931	4359	737
	SAO TOME & PRINCIPE	15	45	39	28	31	97	193	194	177	180	180	178	184	198	228	223	229	140	0	0	1	4	4	4	4

		1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	SENEGAL	0	0	0	0	0	0	0	0	0	0	0	0	0	2	90	53	40	6	83	108	68	68	68	68	68
	SEYCHELLES.SH.OB	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
	SOUTH AFRICA	6	167	281	4595	540	178	49	456	759	382	55	68	137	671	624	52	69	266	486	183	157	116	229	318	353
	U.S.A	1706	6400	8131	2884	1614	1472	636	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	U.S.S.R	1652	1794	687	806	448	541	1004	1282	2168	3768	1851	1275	3207	4246	3615	0	0	0	0	0	0	0	0	0	0
	UKRAINE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	215	0	0	0	0	0	0	0	0	0
	UK-S.HELENA	108	34	37	69	55	59	97	59	80	72	82	93	98	100	92	100	166	171	150	181	151	109	181	116	136
	VENEZUELA	0	0	0	0	0	0	0	0	0	634	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AT. WEST		13940	13472	14798	13359	13163	17704	26290	39666	37480	42365	31750	27680	30284	32807	27095	32640	32894	37230	46245	34019	30575	29510	27514	28978	28129
	SURFACE	1166	2098	5226	4082	6428	6381	16364	32697	28977	32622	19343	17690	15548	19774	13880	23230	21117	27305	36872	25215	21945	20786	18798	16996	18286
	Baitboat	0	0	1012	605	392	1917	2970	3603	3698	5478	2421	5468	5822	4834	4718	5359	6276	6383	7094	5297	4560	4275	5511	5349	5255
	Purse Seine	634	1073	3662	1035	5135	2822	12112	25749	23203	20994	9822	6665	6034	11647	6800	14414	11359	16081	19612	6338	10784	11710	9157	6523	8035
	Other surf.	532	1025	552	2442	901	1642	1282	3345	2076	6150	7100	5557	3692	3293	2362	3457	3482	4841	10166	13580	6601	4801	4130	5124	4997
	LONGLINE	12774	11374	9572	9277	6735	11323	9926	6969	8503	9743	12407	9990	14736	13033	13215	9410	11777	9925	9374	8804	8631	8724	8716	11981	9842
	ARGENTINA	57	43	4	0	0	8	7	0	0	44	23	18	66	33	23	34	1	0	0	0	0	0	0	0	0
	BARBADOS	94	58	67	81	40	30	36	51	90	57	39	57	236	62	89	108	179	161	156	255	160	149	150	155	155
	BRASIL	715	1302	852	1353	1008	2084	1979	2844	2149	2947	1837	2266	2512	2533	1758	1838	4228	5131	4169	4021	2767	2705	2514	4127	4689
	CANADA	161	0	318	0	0	0	0	0	0	0	0	0	30	7	7	29	25	71	52	174	155	100	57	22	105
	CANADA-JPN	0	0	0	0	0	0	0	0	0	0	2	40	0	0	0	0	0	0	0	0	0	0	0	0	0
	CHINA.PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	628	655	22
	CHINESE TAIPEI	1284	164	181	848	616	435	407	87	559	780	1156	709	1641	762	5221	2009	2974	2895	2809	2017	2668	1473	1685	1022	1315
	COLOMBIA	0	0	0	0	0	0	3	29	0	180	211	258	206	136	237	92	95	2404	3418	7172	238	46	46	46	46
	CUBA	1200	900	661	232	689	1997	1503	793	2538	1906	2081	1062	98	91	53	18	11	1	14	54	40	40	15	15	0
	DOMINICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	12	23	30	31	9	0	0	0	80	80
	EC-ESPANA	0	266	2029	1052	0	0	0	1957	3976	1000	0	0	1	3	2	1462	1314	989	7	4	36	34	46	26	0
	EC-FRANCE	0	0	0	86	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	265	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GRENADA	100	364	166	148	487	64	59	169	146	170	506	186	215	235	530	620	595	858	385	410	523	302	302	430	430
	JAMAICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	21	0	0	0
	JAPAN	3069	1408	1647	1707	1117	2983	3288	1218	1030	2169	2103	1647	2395	3178	1734	1698	1591	469	589	457	1004	806	1081	1513	1206
	KOREA	4574	6522	4259	4414	1933	3325	2249	1920	989	1655	853	236	120	1055	484	1	45	11	0	0	84	156	0	0	0
	MEXICO	0	0	0	0	16	42	128	612	1059	562	658	33	283	345	112	433	742	855	1093	1126	771	826	788	1283	1390
	NETHERLAND.ANT	151	151	173	173	173	173	173	173	173	150	150	160	170	170	170	150	160	170	155	140	130	130	130	130	130
	PANAMA	1283	582	1440	102	807	262	675	62	246	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	535
	PHILIPPINES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	106	78
	ST.LUCIA	69	67	67	28	27	25	26	23	56	79	125	76	97	70	58	49	58	92	130	144	110	110	110	123	123
	ST.VINCENT	0	0	0	0	0	0	0	0	0	0	0	0	0	1	40	48	22	65	16	43	37	35	35	38	38
	TRINIDAD & TOBAGO	0	0	0	0	0	0	0	232	31	0	0	0	1	11	304	543	4	4	32	51	77	124	133	133	112
	U.S.A	546	808	1616	298	553	1688	1095	2553	2180	9735	9937	9661	11064	8462	5666	6914	6938	6283	8298	8131	7745	7674	5621	7734	7051
	UK-BERMUDA	11	10	12	26	35	21	22	10	11	42	44	25	23	22	15	17	42	58	44	44	67	55	53	59	31
	URUGUAY	0	0	0	0	0	67	214	357	368	354	270	109	177	64	18	62	74	20	59	53	171	53	88	88	45
	VENEZUELA	626	827	1306	2811	5397	4500	14426	16750	16427	18100	9554	11137	10756	15567	10556	16503	13773	16663	24789	9714	13772	14671	13995	11187	10549
	VENEZUELA-FOR	0	0	0	0	0	0	0	9826	5452	2435	2201	0	193	0	0	0	0	0	0	0	0	0	0	0	0

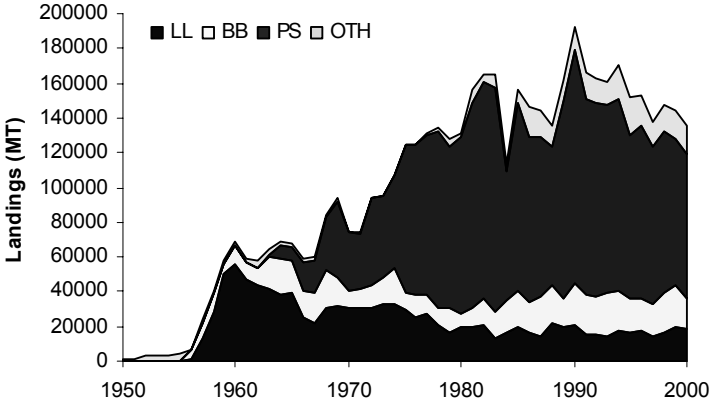
		1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
UNCL.		0	0	0	0	0	0	0	754	406	526	8178	6444	5755	5276	8249	7837	7430	5944	7982	6990	8040	7256	8697	7794	7338
	CHINA.PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	139	156	200	124	0	0	0	0
	EC-ESPANA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	201
	NEI-105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	284	400	59	62	0	0
	NEI-111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	649	0
	NEI-134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	98	604	862	1315	1399	2894	1911	1584
	NEI-40	0	0	0	0	0	0	0	0	0	0	0	0	0	137	162	78	68	18	174	143	223	48	41	0	0
	NEI-71	0	0	0	0	0	0	0	754	406	526	956	1297	2324	2643	3938	4240	3768	2555	3626	2913	3970	4155	4057	3453	2646
	NEI-81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	393	1263	1396	951
	NEI-94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34	46	22	0	0
	PANAMA	0	0	0	0	0	0	0	0	0	0	7222	5147	3431	2496	4149	3519	3594	3134	3422	2588	1954	1156	358	385	0
	ST.VINCENT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1956

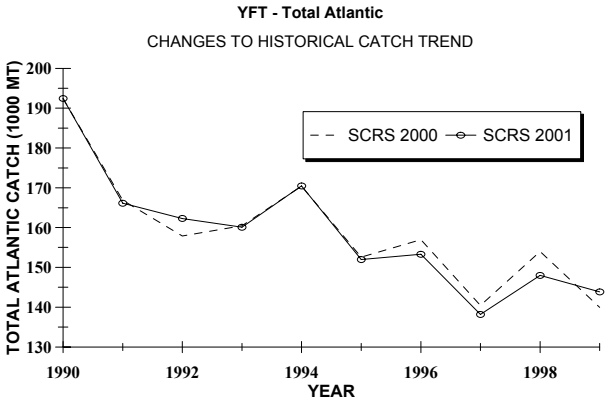
* As of 5 October 2001. Subsequently, catches were reported by EC-Portugal (143 MT for 1999 and 122 MT for 2000, in the eastern Atlantic).



YFT-Fig. 1. Geographical distribution of annual yellowfin catches in 1950-1997, by gear.

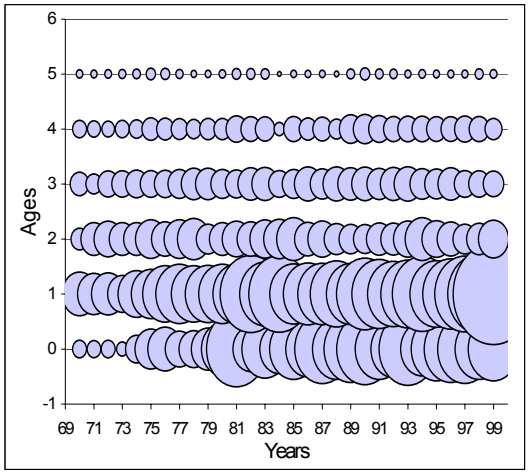
YFT-Fig. 2a. Estimated landings (in MT) of yellowfin tuna by fishing gear in the Atlantic, 1950-2000.

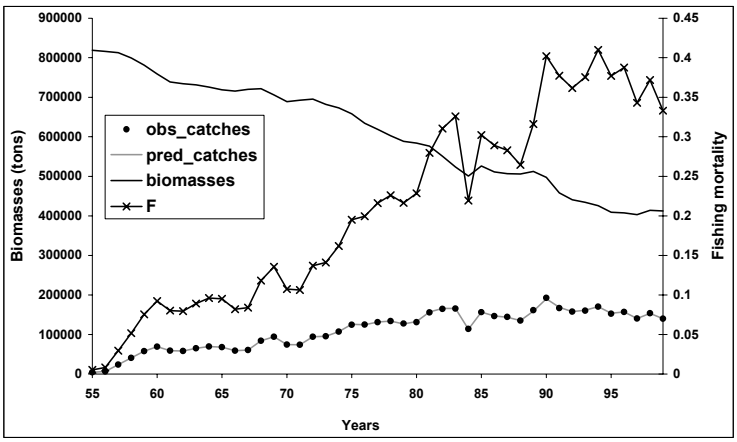




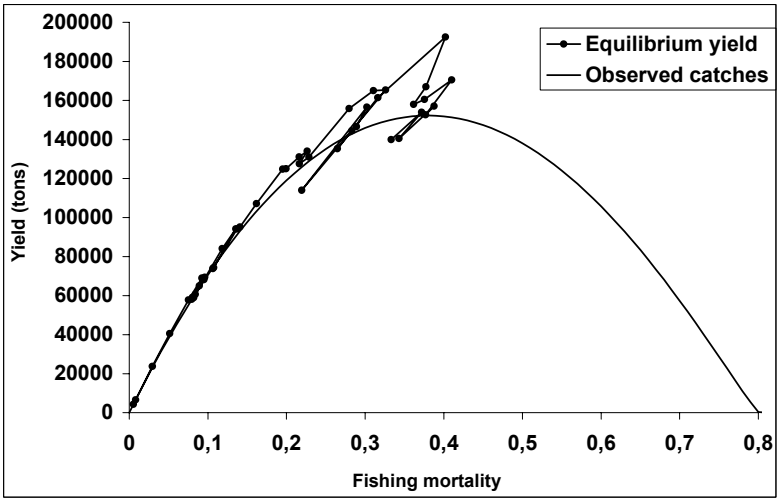
YFT-Fig. 2b. Changes to the available historical catch trend between the last assessment (SCRS 2000) and the current report (SCRS 2001).

YFT-Fig. 3. Relative distribution of Atlantic yellowfin catches by age and year (bubble size is proportional to total catches).

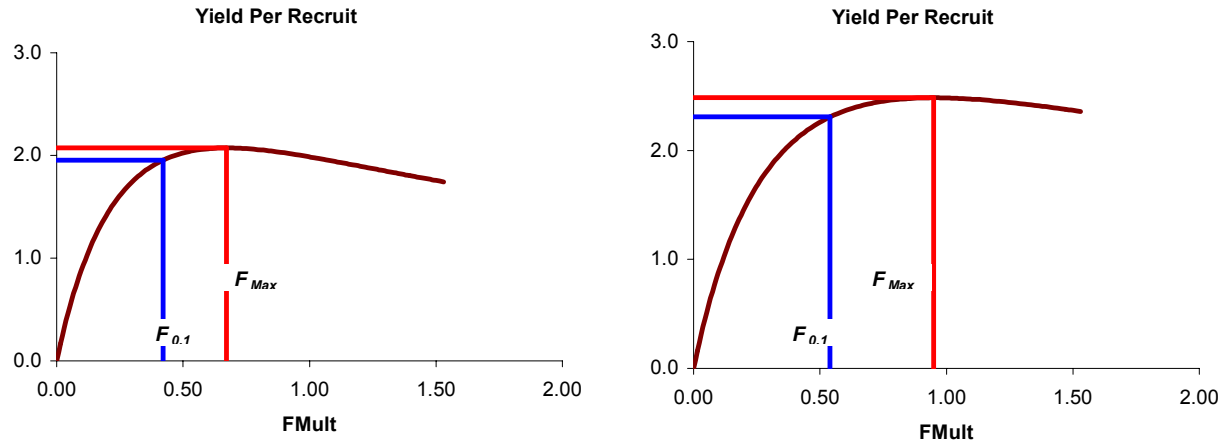




YFT-Fig. 4(a). Nonequilibrium production model results for Atlantic yellowfin: Trajectories of estimated biomass and fishing mortality, and observed catches.



YFT-Fig. 4(b). Nonequilibrium production model results for Atlantic yellowfin: Equilibrium yield curve and observed catch trajectory (line with symbols).



YFT-Fig. 5. Results of equilibrium yield per recruit analyses for yellowfin tuna assuming a current exploitation pattern (left) or assuming zero catch of undersized fish (right). The assumed values of natural mortality (M) are 0.8 for ages 0-1 and 0.6 for ages 2+.

7.2 BET - BIGEYE TUNA

No stock assessment was conducted this year for bigeye tuna, but one is scheduled for next year. Therefore, the major part of the status of the stock and outlook is taken from the last assessment in 1999. This report includes updated fisheries statistics and CPUE from the major fishery.

Compared to other tuna species, bigeye has received less attention in the past with respect to research on basic biological characteristics, in spite of the importance of this species for the Atlantic fisheries that are currently exploiting it. The lack of reasonable estimates of some biological parameters considerably hindered the stock assessment process, and sometimes led to unrealistic results. The ambitious Bigeye Tuna Year Program (BETYP) was proposed and was adopted by the Commission in 1996. The activities were started in 1999 after external funds were made available. The on-going activities are given in the Report of BETYP Activities (COM-SCRS/01/012). The outcome of this program is expected to assist and improve the task of the Committee substantially.

BET-1. Biology

The geographical distribution of bigeye tuna is very wide and covers almost the entire Atlantic Ocean between 50ºN and 45ºS. This species dwells in deeper water than other tuna species and indicates extensive vertical movements. Archival tagging and sonic tracking studies conducted on adult fish in other Oceans revealed that they exhibit clear diurnal patterns being much deeper in the daytime than at night. Spawning takes place in tropical waters when the environment is favorable. From the spawning area fish tend to migrate into temperate waters as they grow larger. Catch information from the surface gears indicates that the Gulf of Guinea is a major nursery ground for this species. Various prey organisms such as fish, mollusks, and crustaceans are found in stomach contents. Bigeye exhibit relatively fast growth; fish about 100 cm in fork length correspond to three years old, and this is when they become mature. Young fish form schools mostly mixed with other tunas such as yellowfin and skipjack tunas. These schools are often associated with drifting objects, whale shark and sea mounts. This association appears to happen less and less as they grow larger.

Circumstantial evidence, such as the time-area distribution of fish and movements of tagged fish, suggests 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. Description of the fisheries

The stock has been exploited by three major gears (longline, baitboat and purse seine fisheries) and by many countries throughout its range of distribution **(BET-Figure 1)**.

The size of fish caught varies among fisheries: medium to large for longline fishery, small to large for the directed baitboat fishery, and small for other baitboat and purse seine fisheries. Corresponding average weights are 45-50 kg, 20-30 kg and 5 kg for these three types of fisheries, respectively. The economic value of fish is also different. Roughly speaking, the price per kg of longline-caught fish at the unloading site is six times higher than those caught by other fisheries such as purse seine.

Longline and baitboat fisheries have a long history that dates back before 1960. Major baitboat fisheries are located in Ghana, Senegal, the Canary Islands, Madeira and Azores. Unlike other Oceans, baitboats catch significant amounts of medium and large size bigeye tuna except in Ghana where mainly small fish are caught. Tropical purse seine fleets operate in the Gulf of Guinea and off Senegal in the East Atlantic and off Venezuela in the West Atlantic. Fleets comprising French, Spanish, Ghanaian and other flag vessels managed by EU countries are the major components in the East, and the Venezuelan fleet operates in the West. Bigeye catch by the Venezuelan fleet was very minor. While bigeye tuna is a primary target species for most of longline and baitboat fisheries, this species has been of secondary importance for purse seine fisheries.

There are two major longline fisheries, operated by Japan (24,000 MT in 2000) and Chinese Taipei (16,800 MT in 2000), whose catch accounted for about 40% of the total catch in 2000. Korea has reduced its activity in the Atlantic considerably since 1990. In more recent years, China and the Philippines started fishing in 1993 and 1998, respectively. The annual catch by PRC was less than 600 MT until 1997 but went up to 1,500 MT in 1998, and passed 6,500 MT thereafter.

Since about 1991, the purse seine and Ghanaian baitboat fisheries introduced a fishing technique that utilizes artificial fish aggregating devices (FADs). Similarly, baitboat fleets in Senegal and the Canary Islands have

developed a method which makes use of baitboats as FADs. These new techniques have apparently improved fishing efficiency and contributed to the increase of bigeye catch.

The activities of the illegal, unreported and unregulated (IUU) longliners which fly flag of convenience appeared to be started since the early 1980s, and became significant thereafter. Two years ago, catches made by the IUU longline fleet was tabled and studied by the Committee for the first time. Those estimates were based on Japanese import statistics and are available since 1983. Honduras, Belize, Equatorial Guinea as well as St. Vincent are the major components. Honduras has a long history of catch but the rest are newly emerged in the statistics. The estimates are considered minimal, as the weight is in product and not converted to round weight, but, on the other hand, the ocean origin is not clear. Similarly, Panamanian catch series during the early 1990s may include catches from other oceans as this catch series was obtained from the same data source. This year, St. Vincent reported its catch to ICCAT for the first time. Because of this and the decreased catch of those IUU countries, the estimated total catches in 2000 for IUU fleets was 15,000 MT, i.e. a 40% decline from the high of 25,000 MT in 1998 **(BET-Figure 2)**.

Total annual catch **(BET-Figure 3)** exhibited an increase up to the mid-1970s reaching 60,000 MT and fluctuating between 45,000 and 84,000 MT over the next 15 years. In 1991, it passed 95,000 MT and continued to increase, reaching a historic high of about 132,000 MT in 1994. The catch had declined since then with some fluctuation. The provisional total catch in 2000 was about 98,600 MT. This trend in catch was similarly observed in all three types of fisheries, although the purse seine catch has reduced most significantly (35%) while the other two fisheries kept their magnitude at about same level since 1994, except for the baitboat fishery in 2000 which resulted in a decline of more than 10,000 MT. It was reported that the intense use of drifting natural log and artificial fish aggregating devices (FADs) was a primary cause of increased purse seine catch during the early 1990s, although other technological advances such as extensive use of sonar, deeper nets, bird radar, etc, may have contributed as well. The reason for the catch decline thereafter was not known but a decline in fleet size, lower abundance of juveniles and/or a reduction of directed effort appeared to be the possible reasons. The moratorium on fishing with FADs by the fleets of France, Spain and other flag vessels managed by the EU countries also contributed to the decline of catch between 1997 and 1999. On the other hand, the Ghanaian fleet increased its catch between 1997 and 1999. The increase in longline catches up to 1994 was primarily due to a rapid shift of target species from albacore to bigeye by the fleet of Chinese Taipei, and increased fishing operations by the Japanese and Chinese Taipei fleets as well as the IUU fleet. While Japan reduced its catch and Chinese Taipei stabilized its catch due to a quota set for its fleet thereafter, IUU fleet as well as People's Republic of China expanded their catch until 1999. The baitboat catch in higher latitude tends to vary year to year suggesting possible influence by local oceanographic conditions. The increased catch after 1993 might have resulted from favorable oceanographic conditions in higher latitude as well as the increase of fishing effort directed to this species. The catch of various baitboat fisheries has maintained at relatively high level until 1999.

BET-3. State of the stocks

Two indices of relative abundance were used to assess the status of the stock: a standardized age-specific index of abundance from the Japanese longline catch and effort data that targets this species and represents roughly 25-40 % of the total catch **(BET-Figure 4)**; and data from the U.S. longline fishery (not age-specific). These indices relate to medium and large sized fish.

Two types of production model analyses were conducted using the Japanese longline index. One model failed to produce parameter estimates within biologically meaningful range, and therefore some parameters were fixed rather than to be searched freely. MSY values were also estimated by the alternative model for two data sets; 1961-1998 and 1961-1992. The estimated range for MSY was considered to be 79,000-94,000 MT. It should be noted that past MSY estimates tend to increase as new data points of high catches are added **(BET-Figures 5)**. The Committee discussed possible reasons, such as an increased productivity, change in availability, geographical and vertical changes in the range of fishing area and change in selectivity pattern, but the Committee could not identify the specific reason for this phenomenon, and thus could not specify the current stock level.

Apparently, the total catch has been larger than the upper boundary of the likely range of MSY since 1991, causing the stock to decline considerably. Results of production model analysis indicate that the estimated current biomass is likely below the corresponding biomass at MSY.

Two types of Virtual Population Analyses (VPA) were conducted using the Japanese and US longline indices. Catch-at-age for 1975-1998 was converted from the catch-at-size. Updated catch-at-age was considerably different from the previous one due to the revisions made in catch, size data and substitution. Unlike the previous assessment, the results were considerably different between the VPA models and depended strongly on the assumptions made regarding the selectivity of the oldest age group, especially in the trends in recruitment and spawning stock biomass except for the recent years. The Committee attempted to investigate the possible reason for this, such as the addition of longline catch by IUU fleets, changes in size selectivity at age (especially for older ages), but it was unable to do so due to time constraints. Despite their differences, however, the various VPAs all indicate that the spawning stock biomass has rapidly and substantially declined over the past 5 years and fishing mortality rates have increased quickly since the early 1990s.

Yield-per-recruit analyses **(BET-Figure 6)** provided the estimates of $F_{0.1}$ and F_{max}, which often used as benchmarks in the stock assessment. While current F is not well determined, it probably exceeds $F_{0.1}$ and is also likely to be higher than F_{max}, indicating that the bigeye stock is over-exploited. Current spawning stock biomass-per-recruit **(BET-Figure 6)** is less than 30% and probably around or lower than 20% of its maximum, which corresponds to a threshold at which recruitment over-fishing may occur for other fish species. Yield-per-recruit analysis suggests that there is no substantial increase in yield by intensifying fishing effort of any sector; however, yield-per-recruit can be increased by a reduction of fishing effort in the small-fish fisheries **(BET-Figure 7)**.

In VPA and yield-per-recruit analyses, the role of natural mortality (M), particularly for small fish, is very important; i.e., the impact of the small-fish catch on the large-fish fishery is large if M is relatively low, but it will be smaller if M is high. Without precise estimates of M, results could be misleading. Therefore, research designed to estimate M, such as tagging programs, should receive high priority.

BET-4. Outlook

Although stock projections were conducted, the results were not considered to be reasonable due to the problems encountered in VPA. Therefore, the outlook of this stock remains highly uncertain. While the Japanese longline index indicated some recovery beginning in 1999 **(BET-Figure 4)**, the annual catches for 1998-2000 were still larger than the upper range of the MSY estimate. However, it is encouraging that the 2000 catch was the lowest since 1993 and the new quota is being applied for the major fishing countries this year.

BET-5. Effects of current regulations

The bigeye minimum size regulation of 3.2 kg was adopted in 1980 to reinforce the same regulation for yellowfin. It is clear that a large quantity of juvenile bigeye tuna smaller than 3.2 kg continue to be captured mostly from the equatorial surface fleets (baitboat and purse seine). The percentage of fish smaller than the minimum size **(BET-Figure 8)** has been generally increasing since 1991 and was at 53-55% for the last four years (1996-1999). According to the yield-per-recruit analysis **(BET-Figure 6)**, full implementation of this regulation could result in an increase in yield-per-recruit of almost 35% at F_{max}.

At the 1997 Commission Meeting, the Commissioners requested that the SCRS examine the results of observer programs adopted in 1996 for all tropical tuna fleets, including the results of a voluntary regulation which establishes a closed area and season of fishing on FADs for the purse seine fleet, in order to determine the areas and seasons of concentrations of juveniles and spawners. Although a full evaluation was not possible due to the multi-species nature of surface fisheries and existence of other types of fishery, this regulation appears effective in reducing fishing mortality for juvenile bigeye, at least for purse seine fishery which complied with this regulation (see Report of the evaluation of a closed area/season for the use of FADs by surface fisheries).

For Chinese Taipei there has been a specific quota of 16,500 MT. According to its catch report, the bigeye catch for Chinese Taipei in 1998 was below this limit (16,314 MT), but slightly higher in 1999 and 2000 (16,837 MT and 16,795 MT).

The last management measure in effect for this species is a catch limit (the average of 1991 and 1992) for 2001 for the major fishing countries whose 1999 catch reported at the 2000 SCRS was larger than 2,100 MT. This cannot

be evaluated at this time, as year 2001 has not yet ended.

BET-6. Management recommendations

The most recent catch statistics indicates a large increase of the total bigeye catch had occurred since around 1990, reaching a record high at around 132,000 MT in 1994 from less than 100,000 MT of catch in the 1990-1992 period. The total catch declined after 1994 to some extent and fluctuated between about 98,600 MT in 2000 and 126,000 MT in 1995. In general, the longline catch indicated a stable trend but the baitboat and purse seine fisheries exhibited larger fluctuations in catch since 1994. The results of all production model analyses indicated the stock is over-exploited in recent years, although MSY levels are not well determined. A declining trend in adult biomass, especially after about 1993, was also shown by various VPA runs. It is likely that catch level above or around 99,000 MT cannot be sustained in the long term and may result in further substantial declines in stock size.

In 1997, the Committee recommended a reduction of overall catch to at least the 1992 level (which was approximately 85,000 MT in the 1997 estimate but revised to 99,000 MT since then). The 2000 catch of about 98,600 MT is still higher than the sustainable catch level. The result of production model suggested range of possible MSY somewhere between 94,000 MT (estimated for period 1961-1998, including the recent increase in catches) and 79,000 MT (estimated for period 1961-1992, before the recent increase of catches). As the present fishing mortality is larger than F_{MSY}, a significant reduction of fishing mortality for all fisheries, hence catch reduction, is required to reach a catch level which produces either of the MSY estimates for the two periods. Last year, the Commission adopted individual quotas for the major fishing parties and entities to limit their catch to the average of 1991 and 1992. If this new measure were complied with, the annual catch would be 90,000 to 100,000 MT. According to our assessment, this level of catch would not be sufficient to rebuild the stock to MSY level.

A voluntary time/area closure of FAD fishing was introduced in 1997 in the purse seine fishery from November to January in order to protect juvenile tunas. This measure became an ICCAT regulation in June 1999, and was further expanded to cover all surface fleet since June 2000. The analysis of available data indicated that while the catch of juvenile tunas by the purse seine fleets which participated this measure have declined, this decline was compensated by the catch by the fleets who did not participated. Therefore, the effect would be higher if this closure was perfectly implemented by all the surface fleets fishing on FADs. The percentage of fish less than 3.2 kg (minimum size) has been the highest at 53-55% since 1996, and the Committee remains concerned that the percentage of undersized fish continued to be very high. The Committee, therefore, recommends that effective measures be found to reduce fishing mortality of small bigeye, taking into account multi-species nature of the surface fisheries. The benefit of reduction in small bigeye catch is supported by results of yield-per-recruit (leading to higher overall catch) as well as spawning biomass-per-recruit (leading to higher survival of spawning stock) analyses.

The Committee anticipates that the on-going BETYP will enhance the assessment in the near future to a great extent so that the Committee can provide the Commission with much more accurate advice.

ATLANTIC BIGEYE TUNA SUMMARY

Maximum Sustainable Yield (likely range)	79,000 - 94,000 MT[1]
Current (2000) Yield	98,608 MT
Current (1998) Replacement Yield[2]	72,000 - 85,000 MT[3]
Relative Biomass (B_{1998}/B_{MSY})[2]	0.57 - 0.63[3]
Relative Fishing Mortality	
(F_{1998}/F_{MSY})[2]	1.50-1.82[3]
$F_{0.1}$[4]	0.22
F_{max}[4]	0.35

Management measures in effect

- 3.2kg minimum size [Ref. 79-1]
- 25% of FADs fishing vessels and 5% of others to be covered with observers [Ref. 96-1]
- Provide a list of vessels (>80 GRT) fishing Atlantic bigeye [Ref. 97-13]
- Limit on number (associated with GRT) of Atlantic bigeye tuna fishing vessels (>24 m LOA) to average number of 1991-1992 (not applicable to countries catching less than 2000 MT average over recent five years) [Ref. 98-3].
- Provide a list of vessels (>24 m LOA) fishing Atlantic bigeye tuna by August 31 [Ref. 98-2]
- Limit number of Chinese Taipei bigeye tuna fishing vessels to 125 [Refs. 98-3, 00-1]
- Catch limit (16,500 MT) for Chinese Taipei [Refs. 98-3, 00-1
- Moratorium on FAD fishing for all surface fleets, Nov. 1 to Jan 31, in eastern tropical area [Ref. 99-1]
- Limit catch to the average of the catch of 1991 and 1992 for those whose reported 1999 catch was larger than 2,100 MT [Ref. 00-1]
- Limit number of fishing vessels for Philippines to five [Ref. 00-1]

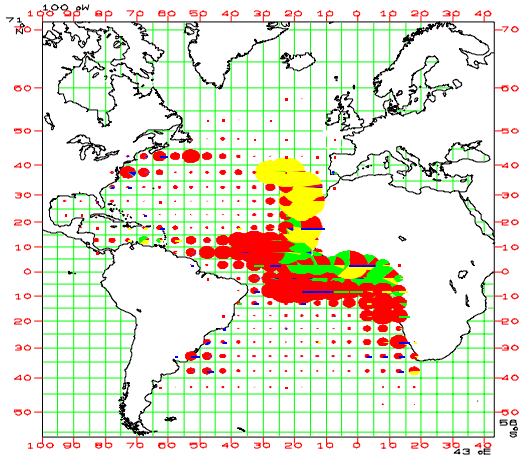
[1] This range is representative of MSY ranges predicted by the non-equilibrium production model and the equilibrium production model.
[2] Non-equilibrium production model estimate.
[3] These are ranges of point estimates obtained and no confidence limits are given.
[4] Yield-per-recruit estimate based on the 1998 selectivity pattern.
[ ] These indicate the reference numbers given in SCRS/01/010.

BET-Table 1. Estimated catches (MT) of Atlantic bigeye tuna in 1976-2000*, by major gear and flag.

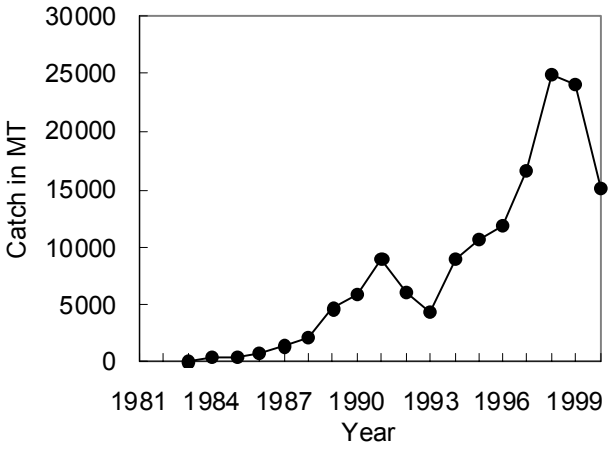
		1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
TOTAL		45302	54880	52693	45975	63596	67753	73493	59384	71051	78215	65395	55975	65796	78067	84336	95929	99011	112188	132195	126272	121184	106541	109519	123235	98608
Landings	Bait boat	9939	12758	14629	9591	12349	10124	6922	9796	11439	17651	15618	12631	9710	12672	18106	17750	16248	16467	20287	25552	19036	18721	21025	21579	9874
	Longline	27847	29531	28796	27560	41677	41608	51805	33757	43303	52595	39942	35570	47758	58389	56537	61556	62359	62871	78270	74804	74876	68227	71811	78886	70049
	Other Surf.	449	716	174	481	366	365	290	177	246	415	549	626	469	635	286	433	603	647	973	561	353	535	314	1333	307
	Purse seine	7067	11875	9094	8343	9204	15656	14476	15654	16063	7554	9286	7148	7859	6371	9407	16190	19801	32203	32665	25355	26919	19057	16370	21437	18378
Landings	ARGENTINA	176	84	23	0	0	0	0	0	0	100	41	72	50	17	78	22	0	0	0	0	0	0	0	0	0
	BARBADOS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	17	18	18
	BELIZE.SH.OB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47
	BENIN	0	0	0	0	0	40	45	0	0	0	15	6	7	8	10	10	7	8	9	9	9	30	13	11	0
	BRASIL	678	1183	812	782	698	505	776	535	656	419	873	756	946	512	591	350	790	1256	596	1935	1707	1237	644	2024	2372
	CAMBODIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	0
	CANADA	23	0	0	0	0	0	0	0	0	0	0	0	95	31	10	26	67	124	111	148	144	166	120	263	327
	CANADA-JPN	0	0	0	0	0	0	0	0	0	0	11	144	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAP-VERT	50	47	464	45	27	72	200	293	167	112	86	60	117	100	52	151	105	85	209	66	16	10	1	1	2
	CHINA.PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	70	428	476	520	427	1503	7347	6564
	CHINESE TAIPEI	3701	3364	2970	2486	2561	1887	2147	1623	925	1220	1125	1488	1469	940	5755	13850	11546	13426	19680	18023	21850	19242	16314	16837	16795
	CONGO	0	0	0	0	5	0	0	0	0	8	19	10	10	14	15	12	12	14	9	9	8	8	8	8	8
	CUBA	1300	1800	2300	2300	1385	711	521	421	447	239	171	190	151	87	62	34	56	36	7	7	5	0	0	0	0
	EC-ESPANA	7436	9736	6849	5419	8430	10010	9332	8794	13617	10340	10884	8875	8475	8263	10355	14705	14656	16782	22096	17849	15393	12513	6854	13379	10688
	EC-FRANCE	6485	8970	8985	7308	6283	8020	7074	8124	4254	4615	4266	3905	4161	3261	5023	5581	6888	12719	12263	8363	9171	5980	5624	5529	5949
	EC-PORTUGAL	2929	4522	5350	3483	3706	3086	1861	4075	4354	6457	7428	5036	2818	5295	6233	5718	5796	5616	3099	9662	5810	5437	6334	3152	1352
	FAROE-ISLANDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	8
	G.EQUATORIAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
	GABON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	87	10	0	0	0	184	150
	GHANA	170	237	124	238	332	780	791	491	2162	1887	1720	1178	1214	2158	5031	4090	2866	3577	4738	5517	5805	7431	13252	11460	5586
	GRENADA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65	25	20	10	10	0	1	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	1	0
	JAPAN	8170	10144	9863	12150	20922	22091	33513	15212	24870	32103	23081	18961	32064	39540	35231	30356	34722	35053	38503	35477	33171	26490	24330	24184	23885
	KOREA	6923	8090	9716	8022	10235	12274	10809	9383	8989	10704	6084	4438	4919	7896	2690	802	866	377	386	423	1250	796	163	124	43
	LIBERIA	0	0	0	0	0	0	0	0	0	0	0	0	0	206	16	13	42	65	53	57	57	57	57	57	57
	LIBYA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	508	1085	500	400	400	400	400	400	400
	MAROC	170	324	394	414	387	622	625	552	120	30	0	8	0	0	0	0	0	0	0	0	0	0	0	700	0
	MEXICO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0	6	8	6	2
	NAMIBIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	29	7	46	16	423	589
	NEI-1	0	0	0	0	0	0	338	1141	157	0	0	85	20	93	785	1896	2705	4921	5036	5197	7812	5841	5278	9068	1696
	NEI-104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0
	NEI-105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	403	468	42	196	194	27
	NEI-111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1412	1870	0
	NEI-112	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	38	13	6	1	2	0	0	0
	NEI-134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	155	607	1458	3077	4721	7322	7964	4450
	NEI-40	0	0	0	0	0	0	0	0	0	0	0	0	0	319	182	194	234	42	100	222	210	97	44	0	0

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
NEI-66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
NEI-71	0	0	0	0	0	0	0	46	369	354	757	1406	2155	4331	5674	8787	5911	4143	8244	8601	7827	9970	11474	9471	6134
NEI-81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	210	1690	4412	4561	4481
NEI-94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	43	36	0	0
NEI-BELARUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	48	0	0	0	0
NEI-UK-OT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	0	0	0	0	0	0
NETHERLAND.ANT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2627
NORWAY	0	0	0	0	0	0	0	0	0	0	0	0	60	0	0	0	0	0	0	0	0	0	0	0	0
PANAMA	2135	1493	2127	513	4518	2500	2844	2732	3165	4461	5173	5616	3847	3157	5258	7447	10002	10438	13234	9927	4777	2098	1252	318	995
PHILIPPINES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1154	2113	975
POLAND	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RUSSIA FED.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	38	4	8	91
SAO TOME & PRINCIPE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
SENEGAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	4	126	177	135	135	0	0	0
SEYCHELLES.SH.OB	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
SIERRA LEONE	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
SOUTH AFRICA	0	0	0	19	422	381	137	187	60	102	168	200	553	367	296	72	43	88	76	27	7	10	41	41	225
ST.LUCIA	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
ST. VINCENT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	4	2	0	1	1215
TOGO	0	0	0	0	0	0	0	14	52	18	24	22	7	12	12	6	2	86	23	6	33	33	0	0	0
TRINIDAD & TOBAGO	0	0	0	0	0	0	0	191	41	22	0	0	1	19	57	263	0	3	3	15	13	12	11	8	5
U.S.A	28	331	248	212	202	158	422	315	538	639	1084	1074	1127	846	623	974	813	1089	1402	1209	882	1137	928	1262	574
U.S.S.R	4907	4086	2202	2229	2813	2832	635	352	1233	870	1071	1887	1077	424	95	0	0	0	0	0	0	0	0	0	0
UK-S. HELENA	0	5	22	8	9	14	23	14	19	0	0	5	1	1	3	3	10	6	6	10	10	12	17	6	8
URUGUAY	0	0	0	0	0	86	397	605	714	597	177	204	120	55	38	20	56	48	37	80	124	69	59	59	25
VENEZUELA	21	464	244	347	661	1684	999	4284	3315	2861	1122	349	226	115	161	476	270	809	457	457	189	274	222	140	226
VENEZUELA-FOR	0	0	0	0	0	0	0	0	827	57	14	0	106	0	0	0	0	0	0	0	0	0	0	0	0

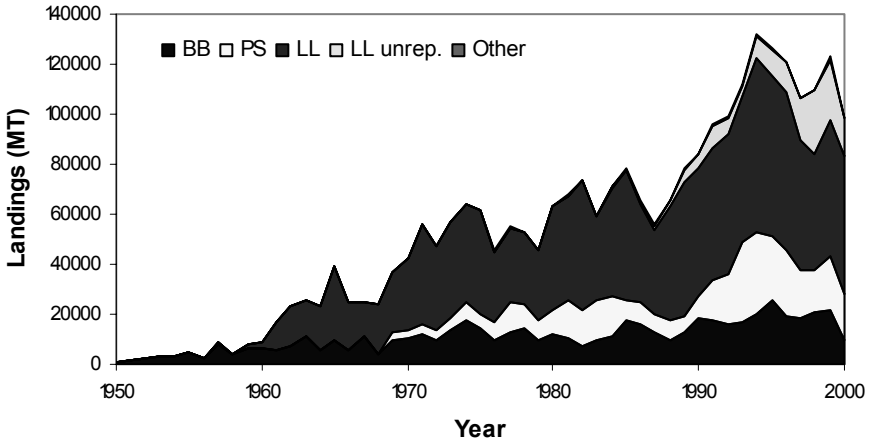
* As of 5 October 2001. Subsequently, catches were reported by EC-Portugal (161 MT for 1999 and 146 MT for 2000) and by Morocco (770 Mt for 2000).



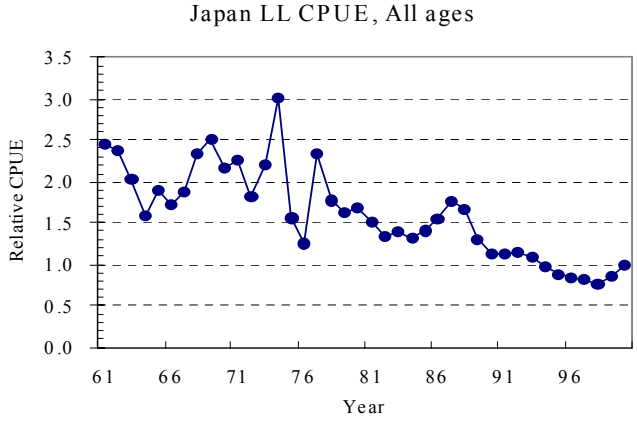
BET-Fig. 1. Geographical distribution of bigeye catch by major tuna fishery. Dark shaded, light shaded, medium shaded and black areas in circles corresponds to catches by longline, purse seine, baitboat and other fisheries, respectively.



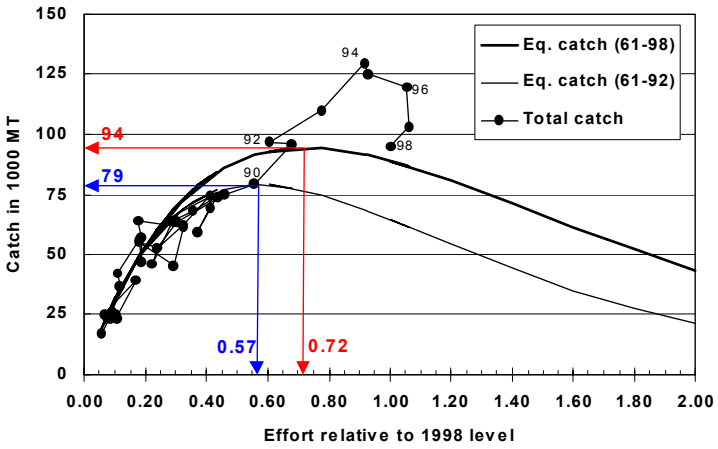
BET-Fig. 2. Estimates of non-reported catch of bigeye by longliners, based on the Japanese import statistics.



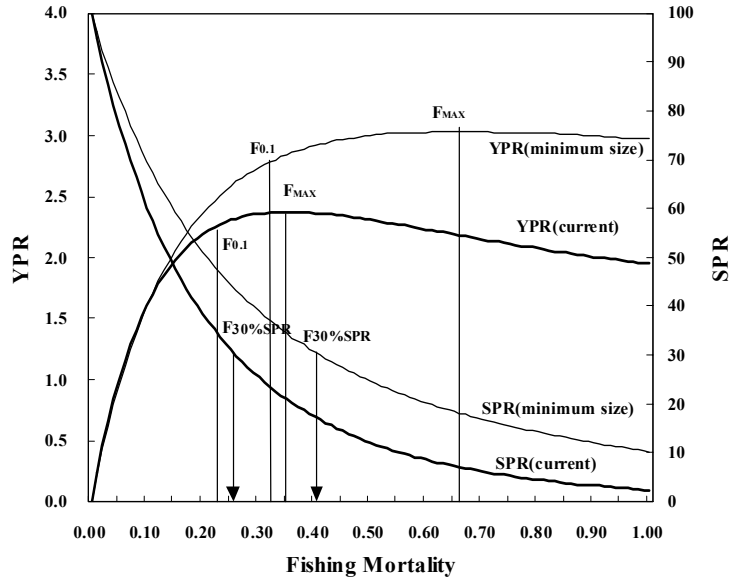
BET-Fig. 3. Cumulative 1950-2000 landings (MT) of bigeye tuna in the Atlantic by gear categories; baitboat (BB), purse seine (PS), other (OTH), longline (LL), and LL-unreported.



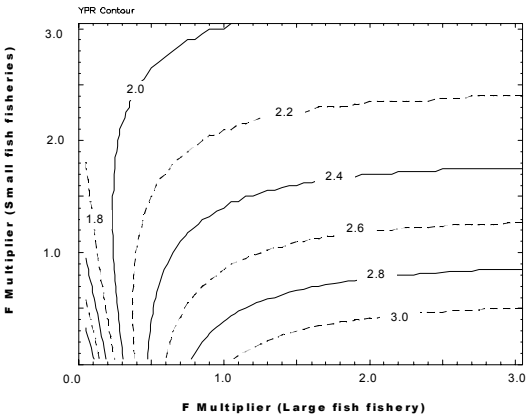
BET-Fig. 4. Abundance index (in relative number of fish) from the Japanese longline fishery.



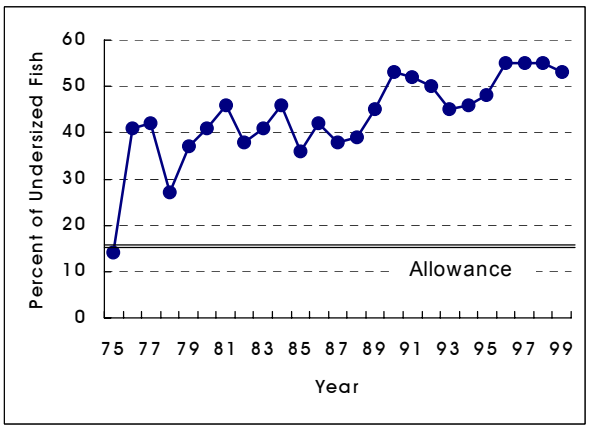
BET-Fig. 5. Production curve (shape parameter=1.01) estimated by PRODFIT plotted with observed catch-effort trajectory. Heavy (upper) line indicates curve estimated with all data points and fine line indicates one applied to data for 1961-1992.



BET-Fig. 6. Yield-per-recruit (YPR) and spawning biomass-per-recruit (SPR) for bigeye assuming current selectivity (heavy lower curves) and selectivity of a full compliance of a 3.2 kg minimum size (fine upper curves). Vertical lines with an arrow indicate $F_{30\%SPR}$.



BET-Fig. 7. Results of multi-gear yield-per-recruit analysis reflecting the 1998 situation. Large fish fishery (X-axis) and small fish fishery (Y-axis) correspond to longline fishery and all other fisheries, respectively



BET-Fig. 8. Annual trend in percentages of undersized bigeye (below the 3.2 kg minimum size) for the overall fishery.

7.3 SKJ - SKIPJACK TUNA

No stock assessment was carried out it 2001. However, this report includes the latest data available on the catches and the fisheries.

SKJ-1 Biology

Skipjack tuna is a cosmopolitan species forming schools in the tropical and subtropical waters of the three oceans. Skipjack spawn opportunistically throughout the year in vast areas of the Atlantic Ocean. The size at first maturity is about 45 cm for males and about 42 cm for females in the East Atlantic, while in the West sexual maturity is reached at 51 cm for females and at 52 cm for males. Skipjack growth is variable and seasonal, and substantial differences in growth rates have been reported between areas. There remain considerable uncertainties about these growth rates and the variability in growth between areas. It is therefore a priority to gain more knowledge on the growth schemes of this species.

Skipjack is a species that is often associated with floating objects, both natural objects or diverse FADs that have been used extensively since the early 1990s by purse seiners and baitboats (during the 1991 to 2000 period, about 40% of skipjack were caught with FADs. The concept of viscosity (low interchange between areas) could be appropriate for the skipjack stocks. A viscose stock can have the following characteristics:

- a local decline of a segment of the stock;
- over-fishing of that component may have little, if any, repercussion on the abundance of the stock in other areas;
- there is a minor proportion of fish that make large-scale migrations.

The introduction of fish aggregating devices could have changed the behavior of the schools and the migrations of this species. Prior to the use of those devices, the free schools of mixed species were much more common than now. Due to the large number of FADs, and the tendency of skipjack to associate with floating objects, substantial behavioral changes, including movements patterns, may occur. These behavioral changes may imply changes in the biological parameters of this species as a result of the changes in the availability of food, predation and fishing mortality. Skipjack caught with FADs are usually associated with small yellowfin (20%) and with small bigeye (17%) and also with other small tuna species.

A comparison of size distributions of skipjack between periods prior to and after the introduction of FADs show that, in the East Atlantic, there has been an increase in the proportion of small fish in the catches, as well as a decline in the total catch in recent years in some areas.

The Committee reviewed the current stock structure hypothesis which consists of two separate management units, one in the East Atlantic and another in the West Atlantic, separated at 30ºW. The boundary of 30ºW was established when the fisheries were coastal, whereas in recent years the East Atlantic fisheries have extended towards the West, surpassing this longitude, and showing the presence of juvenile skipjack tuna along the Equator, to the West of 30ºW, following the drift of the FADs. This would imply the possibility of a certain degree of mixing **(SKJ-Figure 1).**

Taking into account the large distances, various environmental restrictions, the existence of a spawning area in the East Atlantic as well as in the northern zone of the Brazilian fishery, and the lack of additional evidence (e.g. transatlantic migrations in the tagging data), the hypothesis of separate East and West Atlantic stock has been maintained as the more plausible alternative.

In addition, taking into account the biological characteristics of this species and the different areas where fishing takes place, smaller management units could be considered.

SKJ-2. Description of the fisheries

Skipjack are caught almost exclusively by surface gears in the entire Atlantic Ocean, although minor amounts of skipjack are taken by longline as by-catch (see **Figure 1** for catch distribution). Reported catches are considered to be somewhat under-estimated, due to the discards of small-sized tunas, which include skipjack, by the purse seine fleets fishing under objects and by some baitboat fleets in the equatorial area of the East Atlantic.

Total Atlantic catches in 2000 amounted to 137,690 MT (**SKJ-Table 1, SKJ-Figure 2**).

As concerns the East Atlantic, the skipjack fishery underwent important changes in 1991, with the introduction of artificial floating objects (FADs), with the subsequent expansion of the purse seine fishery towards the West (30ºW), in latitudes close to the Equator, following the drift of the objects, the introduction of FADs in the Ghanian purse seine and baitboats(1992), and the development of a fishing technique (whose main target species is bigeye) in which the baitboat is used as the aggregating device, fixing the school (comprised of bigeye, yellowfin and skipjack) during the entire fishing season in waters off Senegal, Mauritania and the Canary Islands (1992). These changes have resulted in an increase in the exploitable biomass of the skipjack stock (due to the expansion of the fishing area) and in its catchability. At present, the most important fisheries are the purse seine fisheries, mainly those of EC-Spain, EC-France, the NEI fleet (Vanuatu, Malta, Morocco, Belize, Guinea, and St. Vincent), Ghana and Netherlands Antilles, followed by the baitboat fisheries (Ghana, EC-Spain and EC-France). In 2000, catches in the eastern Atlantic reached 111,283 MT, which represents a decrease of 20% as compared to 1999 (138,985 MT) **(SKJ-Figure 2).**

The most important fishery in the West Atlantic is the Brazilian baitboat fishery. As concerns the purse seine fisheries, whose catches are considerably less than those taken by baitboat, catches were only made by the Venezuelan and Panamanian fleets. Western Atlantic catches in 200unted to 26,406 MT, 4%less than in 1999 (27,450 MT) **(SKJ-Figure 4).**

There is no information available on the effective fishing effort exerted on skipjack in the East, particularly after the introduction of fishing with artificial floating objects. Considering the carrying capacity of the vessels as a measure of nominal effort, in the East Atlantic Ocean, the total carrying capacity of the baitboat fleets remained relatively stable between 1972 and 2000. On the other hand, purse seine carrying capacity showed an increasing trend until 1983, and a spectacular decline in 1984, due to the shift of a part of the fleet to the Indian Ocean. Since 1991, this carrying capacity of the purse seine fleet has declined gradually until 1997, and since then it has stabilized at about 32,000 MT of transport **(SKJ-Figure 5).**

The increase in the efficiency of the fleet due to technological improvements, the development of fishing with floating objects, etc., as described by the Working Group on Abundance Indices in the Tropical Tuna Surface Fisheries (Miami, 1998), have resulted in an increase (not well quantified) in the effective effort of the different fleets. Preliminary analyses estimated an average annual increase of 5% in efficiency of all the fleets for the period considered (1969-1998). Therefore, fishing effort expressed in number of fishing days is not a precise measure of effective fishing effort on skipjack, even though this type of information should be taken into account.

Fishing effort of Brazilian baitboats decreased by half between 1985 and 1996, whereas an increase in effort was observed between 1997 and 1998. In 1999 and 2000, it remained at the level of 1998.

The fluctuation in the overall size of the area exploited by a fishery is an important component in the assessment of the eastern stock. The number of 1ºx1º squares in which the purse seine fishery caught skipjack in the East Atlantic shows an increasing trend since the end of the early 1970s **(SKJ-Figure 6)**. However, the expansion of the fishing grounds was not continuous throughout the years. It seems skipjack catches are very much related to the number of 1ºx1º squares exploited. In the absence of other measures of fishing effort, the number of squares exploited could be considered as an alternative measure.

SKJ-3. State of the stocks

The last assessment on Atlantic skipjack was carried out in 1999.

The state of the Atlantic skipjack stocks, as well as the rest of the stocks of this species, show a series of characteristics that make it extremely difficult to conduct an assessment using current models. Of these

characteristics, the most noteworthy are:

- Continuous recruitment throughout the year, but heterogeneous in time and area, making it impossible to identify and monitor the individual cohorts;

- Apparent variable growth between areas, which makes it difficult to interpret the size distributions and their conversion to ages;

- The exploitation by many and diverse fishing fleets (baitboat, purse seine), having distinct and changing catchabilities, which makes it difficult to estimate the effective effort exerted on the stock in the East Atlantic.

For these reasons, no standardized assessments were carried out on the Atlantic skipjack stocks. Notwithstanding, some estimates were made, by means of different indices of the fishery and some exploratory runs were conducted using a new development of the generalized production model.

Eastern stock

Standardized catch rates are not available. However, an analysis was made of the different indices of the purse seine fishery which could provide valuable information on the state of the stock. The indices analyzed were: catches, catch per day fishing, number of sets per fishing day, positive sets, catch by 1^{o}x1^{o} exploited **(SKJ-Figure 7)**, average weight, Grainger and Garcia index (annual growth rate of catches with respect to the average catch of the previous three years). For the majority of the indices, the trends were divergent, depending on the area, which may indicate the viscosity of the skipjack stock with limited mixing rates between areas. In general, the development of the catches (with stable nominal effort), the average weights, and the catch per positive set show a possible scenario of local over-fishing in the Equatorial area of maximum fishing concentration on FADs, even though the last index could be biased by increases in the catchability of the purse seiners. Other indices, such as the number of sets per fishing day or the catch by area fished could also show similar biases. In other areas, particularly in the Senegalese area where there is a predominance of fishing on free schools, the trends of the indices showed a completely distinct stock situation (they remain stable).

On an overall level, the Grainger & García index **(SKJ-Figure 8)**, a gross indicator of stock status for situations such as that of the skipjack fisheries in the East Atlantic with increasing effort, showed negative values since the early 1990s. This could be interpreted as a warning sign that catches are too high. However, the Group expressed doubts about the validity of this conclusion to the entire eastern stock.

A new, non-equilibrium production model was presented based on a generalized model. A run of the fit of this model showed a possible decline in the yield of the stock following the introduction of FADs, however the MSY estimates are considered too preliminary to be utilized as a measure of the state of the stock. In the same way, the model estimated a possible generalized increase in the efficiency of the fishing gears of about 5% annually.

Because of the difficulties to assign ages to the skipjack catches, the estimates of the values of natural mortality by age and obtaining indices of abundance (especially for the eastern stock), no catch-by-age matrices were developed and, consequently, no analytical assessment methods (VPA type) were applied.

Western stock

Standardized abundance indices up to 1998 were available from the Brazilian baitboat fishery and the Venezuelan purse seine fishery **(SKJ-Figure 9)**, and in both cases the indices showed a stable stock status.

SKJ-4. Outlook

Uncertainties in the underlying assumptions for the analyses prevent the extracting of definitive conclusions regarding the state of the stock. However, the results suggest that there may be over-exploitation within the FAD fishery, although it was not clear to what extent this applies to the entire stock.

The Committee could not determine if the effect of the FADs on the resource were only at the local level or if it had a broader impact, affecting the biology and behavior of the species. Under this supposition, maintaining high concentrations of FADs would reduce the productivity of the overall stock. however, in the last three years (1997,

1998 and 1999) due to the implementation of a voluntary Protection Plan for Atlantic tunas, agreed upon by the Spanish and French boat owners in the usual areas of fishing with objects, has resulted in a reduction in the skipjack catches associated with FADs. Maintaining this closure could have a positive effect on the resource.

SKJ-5. Effects of current regulations

There is currently no specific regulation in effect for skipjack. However, the French and Spanish boat owners have voluntarily applied a moratorium for the period of November 1997 through January 1998, and November, 1998 through January, 1999. the moratorium was implemented in order to protect bigeye tuna. A similar moratorium was recommended by the Commission and applied during the months of November-December and January of 1999 and 2000. The average purse seine skipjack catches during November-January by fleets that applied the moratoria were reduced by 68% compared to the average catches for the 1993-1996 period (before the moratoria), and those corresponding to the 1998-2000 period. For the entire period, the average skipjack catches made by the purse seine fleets that applied the moratoria decreased by 36%, which is equivalent to 37,000 MT per year.

SKJ-6. Management recommendations

No management recommendations were proposed.

ATLANTIC SKIPJACK TUNA SUMMARY

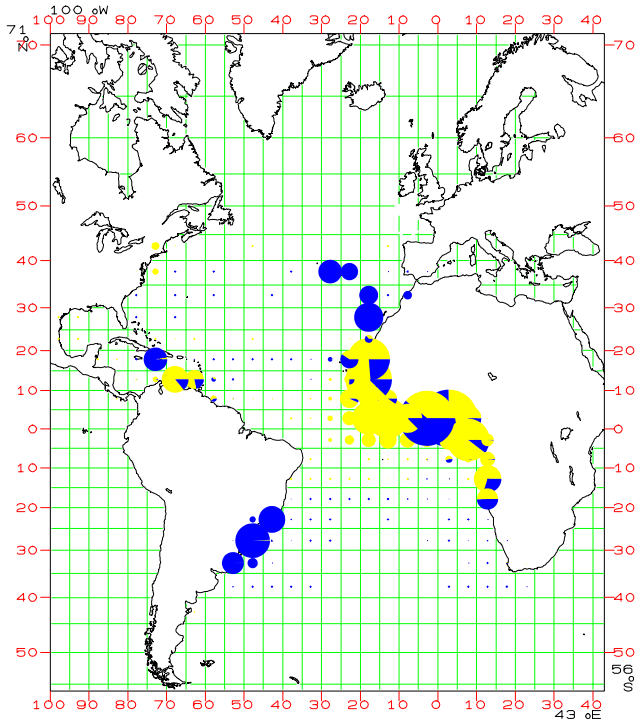
	East Atlantic	**West Atlantic**
Maximum Sustainable Yield	Not estimated	Not estimated
Current (2000) Yield	111,283 MT	26,406 MT
Current Replacement Yield	Not estimated	Not estimated
Relative Biomass (B_{2000}/B_{MSY})	Not estimated	Not estimated
Relative Fishing Mortality: F_{2000}/F_{MSY}	Not estimated	Not estimated
Management measures in effect	None	None

SKJ-Table 1. Estimated landings (reported and carried over, MT) of skipjack tuna in 1976-2000*, by gear, region and flag.

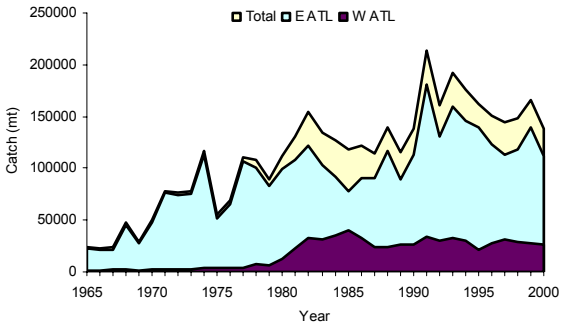
			1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	TOTAL		*69345*	*110577*	*108115*	*89696*	*111358*	*131060*	*154909*	*135038*	*126826*	*118713*	*122172*	*114565*	*139962*	*116119*	*138658*	*213800*	*161420*	*192355*	*175523*	*161631*	*150285*	*144428*	*147738*	*166435*	*137690*
		AT.E	65548	107218	100885	83119	98774	107941	122368	102669	91230	78441	90021	90402	116226	89738	112549	180398	131267	159136	145575	139772	122725	112565	118701	138985	111283
		AT.W	3749	3350	7176	6565	12573	23072	32520	31839	35596	40272	32151	24163	23736	26381	26109	33402	30153	33219	29948	21859	27560	31863	29038	27450	26406
		UNCL	48	9	54	12	11	47	21	530	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Landings	AT.E	Bait boat	28710	42386	41365	44645	38134	38918	44488	34873	28085	29868	30009	38803	48015	41000	36569	41612	35660	31657	38010	33984	32253	38888	42260	41640	29236
		Longline	0	90	0	0	0	22	2	62	22	6	19	6	4	9	0	5	3	2	10	3	7	47	85	42	17
		Other Surf.	3777	7059	840	1508	3906	2528	3054	2242	1328	219	1640	1040	1332	1469	1178	1890	1449	1028	311	308	2294	1806	2588	2445	2675
		Purse seine	33061	57683	58680	36966	56734	66473	74824	65492	61795	48348	58353	50553	66875	47260	74802	136891	94155	126449	107244	105477	88171	71824	73768	94858	79355
		AT.W	Bait boat	2800	2400	2812	4365	9351	17999	22402	20057	16771	28490	25278	18675	21057	23292	22246	23972	20852	19697	22645	17744	23741	26797	24724	23881	22454
		Longline	0	2	2	1	1	9	23	8	25	24	8	6	9	24	23	33	29	19	15	33	19	18	14	7	11
		Other Surf.	249	348	901	710	149	410	390	653	842	567	1657	518	355	599	599	870	763	709	1576	2023	451	702	473	625	516
		Purse seine	700	600	3461	1489	3072	4654	9705	11121	17958	11191	5208	4964	2315	2466	3241	8527	8509	12794	5712	2059	3349	4347	3826	2936	3424
		Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	UNCL	Longline	48	9	54	12	11	47	21	530	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Landings	AT.E	ALGERIE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	171	43	89
		ANGOLA	1514	4036	3501	3628	3482	2532	2257	318	46	131	56	80	30	85	69	66	41	13	7	3	15	52	2	32	14
		BENIN	0	0	0	8	30	60	68	38	10	20	11	5	3	7	2	2	2	2	2	2	2	7	3	2	2
		BULGARIA	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		CAP-VERT	825	748	1284	998	2094	1588	1636	1400	1391	2030	877	2076	1456	971	806	1333	864	860	1007	1314	470	591	684	962	789
		CAYMAN ILS	0	0	0	0	289	1800	30	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	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
		CHINESE TAIPEI	0	0	0	0	0	0	2	2	7	4	0	0	1	3	0	5	3	2	10	3	5	47	73	39	10
		CONGO	0	0	0	0	1250	200	0	5	10	8	8	8	8	11	12	9	9	10	7	7	6	6	6	6	6
		COTE D'IVOIRE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1971	1668	1658	2157	2532
		CUBA	200	100	200	100	196	198	189	135	310	246	569	81	206	331	86	0	0	7	0	0	0	0	0	0	0
		EC-ESPANA	16255	22347	25066	18748	26384	35458	38016	28934	46659	35100	41992	33076	47643	35300	47834	79908	53319	63660	50538	51594	38538	38513	36008	44520	37225
		EC-FRANCE	17039	31138	25903	18602	25767	26926	31132	29727	12994	13645	13045	17114	16504	15211	17099	33271	21890	33735	32779	25188	23107	17023	18382	20344	18183
		EC-GERMANY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0
		EC-PORTUGAL	2068	4388	4584	3074	1954	2825	5530	1113	3974	2409	5446	8420	14257	7725	3987	8059	7477	5651	7528	4996	8297	4399	4544	1810	1302
		ESTONIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	102	0	0	0	0	0	0	0	0	0
		GABON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	11	51	26	0	59	76	21
		GHANA	2199	3492	2866	4299	5812	7858	18272	24376	20697	19082	22268	24347	26597	22751	24251	25052	18967	20225	21258	18607	19602	27667	34150	43460	29950
		JAPAN	15042	16845	14614	14686	12304	12935	9930	6002	1504	2098	2031	1982	3200	2243	2566	4792	2378	0	0	0	0	0	0	0	0
		KOREA	1948	3600	8132	12017	6718	7538	2827	1553	699	153	5	6	3	6	0	0	0	0	0	0	0	0	0	0	0
		LATVIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	92	0	0	0	0	0	0	0	0	0
		LITUANIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	221	0	0	0	0	0	0	0	0	0
		MAROC	538	3851	1891	1863	5001	3017	3956	2532	885	1015	1222	1041	428	295	1197	254	559	312	248	5024	684	4513	2486	858	0
		NAMIBIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	15	0	1	0	0	0
		NEI-1	0	0	0	0	0	0	1560	3383	927	590	540	791	2994	2263	10516	16985	15548	20952	17477	16253	23411	15060	16964	21518	8699
		NETHERLAND.ANT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9409
		NORWAY	0	0	0	0	0	0	0	0	0	0	0	581	738	0	0	0	0	0	0	0	0	0	0	0	0
		PANAMA	2467	3970	2980	1750	1735	144	2541	1611	0	0	0	0	0	0	0	8317	8719	13027	12978	14853	5855	1300	572	1301	2348
		RUMANIA	0	0	0	0	8	0	0	0	0	0	3	0	0	59	142	349	73	0	0	0	0	0	0	0	0

		1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	RUSSIA FED.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1175	1110	540	1471	1450	381	1146	2086	1426	374
	SAO TOME & PRINCIPE	35	118	100	34	33	90	78	103	18	20	20	20	21	22	25	24	25	15	0	0	0	7	0	0	0
	SENEGAL	0	0	0	0	0	0	0	0	0	0	0	0	0	47	134	343	260	53	193	293	265	265	549	417	265
	SOUTH AFRICA	0	40	90	2	48	110	37	104	14	66	101	88	157	96	17	15	7	6	4	4	1	6	2	1	0
	U.S.A	1766	5859	6797	2073	2608	2800	79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	U.S.S.R	3633	6674	2856	1161	2991	1750	3957	1223	1000	1404	1688	547	1822	1915	3635	0	0	0	0	0	0	0	0	0	0
	UK-S.HELENA	19	12	21	76	70	112	271	103	85	62	139	139	158	397	171	24	16	65	55	115	86	294	298	13	64
	VENEZUELA	0	0	0	0	0	0	0	0	0	358	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Landings AT.W	ARGENTINA	0	33	4	0	17	1	137	243	505	101	138	90	7	111	106	272	123	50	1	0	0	0	0	0	0
	BARBADOS	0	0	0	0	0	78	72	39	48	36	33	21	3	9	11	14	5	6	6	6	5	5	10	3	3
	BRASIL	83	190	635	2065	6071	13913	18322	15945	13567	25101	23155	16286	17316	20750	20130	20548	18535	17771	20588	16560	22528	26564	23789	23188	21256
	CANADA	181	0	86	0	0	180	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	9	18	6	6	3	1	2	7	19	0	32	26	9	7	2	10	7	2	1	0
	COLOMBIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2074	789	1583	0	0	0	0	0
	CUBA	2800	2400	1800	2000	2255	1086	1134	1700	1248	1632	1277	1101	1631	1449	1443	1596	1638	1017	1268	886	1000	1000	651	651	651
	DOMINICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	38	41	24	43	33	33	33	33	85	85
	DOMINICAN REP.	78	41	64	87	59	71	80	106	68	204	600	62	63	117	110	156	135	143	257	146	146	146	146	146	146
	EC-ESPANA	0	266	2031	1052	0	0	0	209	2610	500	0	0	0	0	0	1592	1120	397	0	0	0	0	0	0	0
	EC-FRANCE	0	0	0	86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	EC-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	4
	GHANA	0	0	0	0	185	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GRENADA	0	0	1	4	8	1	1	15	12	7	9	5	22	11	23	25	30	25	11	12	11	15	15	23	23
	JAMAICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62	0	0	0	0
	KOREA	0	0	0	0	0	0	0	0	17	20	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	MEXICO	0	0	0	0	1	3	0	25	30	48	11	13	10	14	4	9	8	1	1	0	2	3	0	2	3
	NETHERLAND.ANT	0	0	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	45	40	35	30	30	30	30	30
	PANAMA	0	0	720	161	1026	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	968
	ST.LUCIA	88	100	100	41	40	37	38	35	64	53	76	60	53	38	37	51	39	53	86	72	38	100	100	153	153
	ST.VINCENT	0	0	0	0	0	0	0	0	0	0	0	0	17	28	29	27	20	66	56	53	37	42	42	37	37
	TRINIDAD & TOBAGO	0	0	0	0	0	0	0	1	2	1	0	0	1	0	0	0	0	0	0	3	0	0	0	0	0
	U.S.A	519	320	1695	1029	981	2753	33	697	853	1814	1115	733	57	72	303	856	559	366	98	81	84	84	105	150	44
	VENEZUELA	0	0	0	0	1890	4900	12645	11711	11807	9082	4969	5750	4509	3723	3813	8146	7834	11172	6697	2387	3574	3834	4114	2981	3003
	VENEZUELA-FOR	0	0	0	0	0	0	0	1067	4719	1630	721	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UNCL	CHINESE TAIPEI	22	0	12	10	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	EC-ESPANA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	KOREA	26	9	42	2	4	47	21	530	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

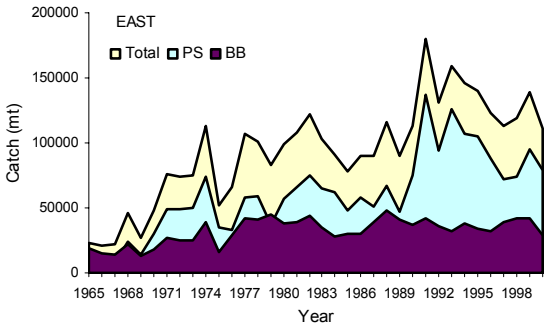
* As of 5 October 2001. Subsequently, catches were reported by Morocco (1199 MT for 2000 in the East).



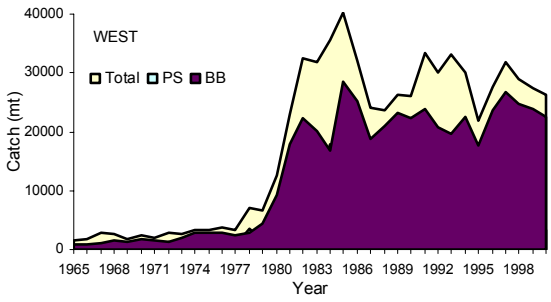
SKJ-Fig. 1 Distribution of reported surface skipjack catches by 5x5 area and by gear (dark=baitboat; light=purse seine).



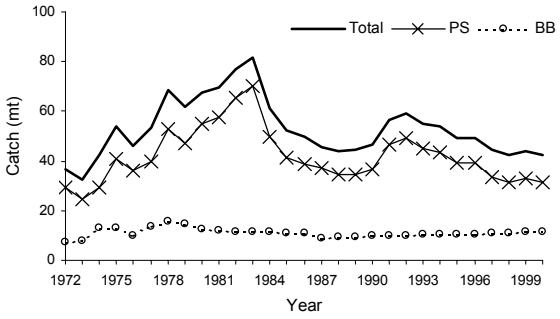
SKJ-Fig. 2 Total, Eastern and Western Atlantic skipjack landings (1950-2000).



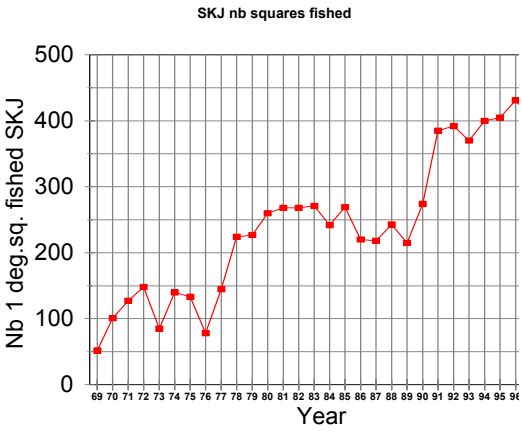
SKJ-Fig. 3 Reported landings of skipjack in the east Atlantic, by major gear.



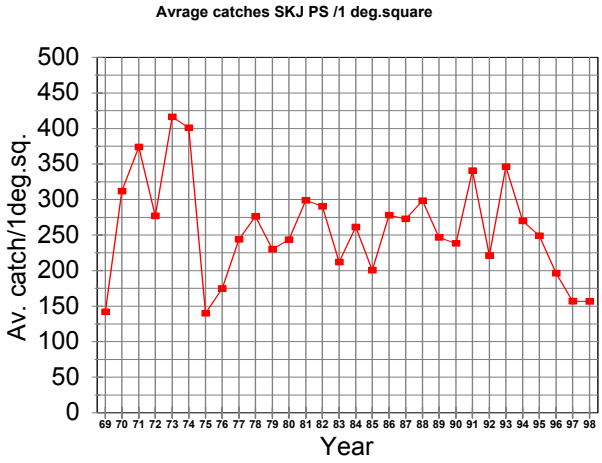
SKJ-Fig. 4 Reported landing of skipjack in the west Atlantic Ocean by major gear.



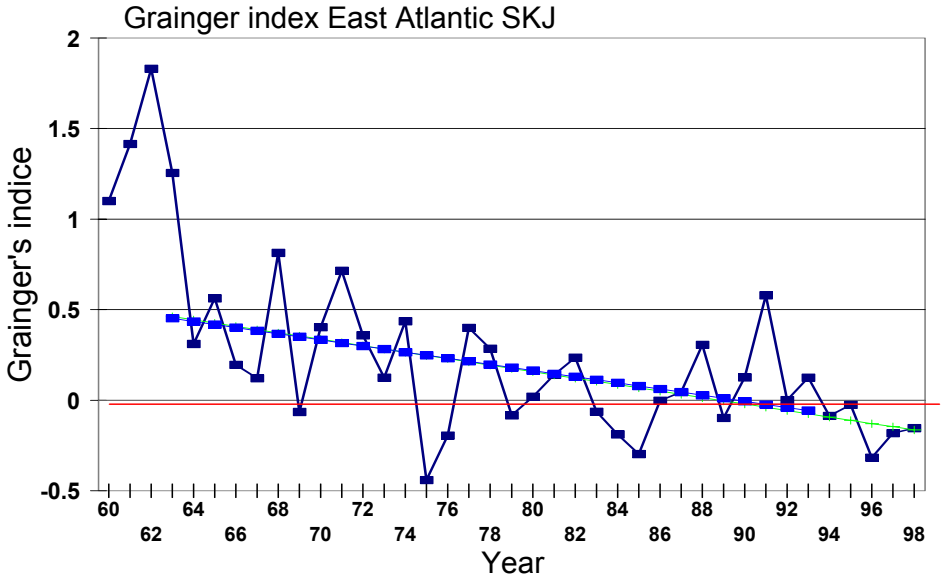
SKJ-Fig. 5 Carrying capacity (in MT) of purse seiners and baitboats in the east Atlantic.



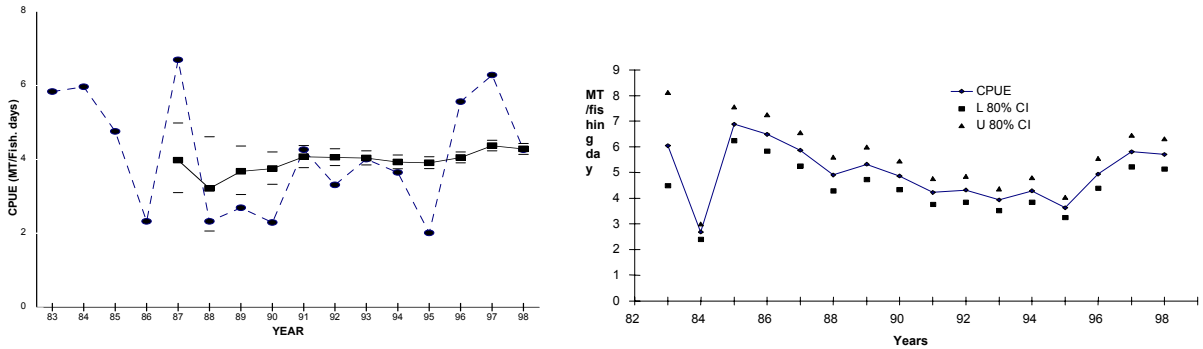
SKJ-Fig. 6 Number of 1x1 degree areas where skipjack catches were reported in the east Atlantic purse seine fisheries.



SKJ-Fig. 7 Skipjack catch per 1x1 degree square (where catches were reported) by the east Atlantic purse seine fishery during the period 1969-1998.



SKJ-Fig. 8 Grainger-and-Garcia index and trend line calculated for Atlantic skipjack.



SKJ-Fig. 9 Venezuelan purse seine (left) and Brazilian baitboat (right) CPUE estimated by GLM delta-lognormal standardization. The dotted line on the left figure denotes observed values.

7.4 ALB - ALBACORE

No new stock assessment was conducted in 2001, however, this report updates relevant catch and fishery information where available. Because of a lack of catch and catch-at-size data for several fisheries this update is incomplete (**ALB-Table 1**).

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)**.

Several documents were presented concerning the stock structure of albacore in the Atlantic and Mediterranean. These were based on tagging and genetic studies, along the lines of the last recommendations of SCRS. The tag release recapture database was updated for the period (1968-1999), including Mediterranean information. An analysis of that database shows no evidence to reject the stock structure assumed in the SCRS at present, although it is shown that albacore is able to cross the north Atlantic-Mediterranean boundary. New genetic tools have been applied in order to clarify albacore worldwide stock structure. The results are once again consistent with the stock structure assumed by ICCAT, with the exception of the Gulf of Guinea region (1ºN), which is at present included in the southern stock, and yet appears genetically closer to the north Atlantic population.

Albacore spawning areas in the Atlantic are found in subtropical western areas of both hemispheres and throughout the Mediterranean Sea. Spawning takes places during austral and boreal spring-summer. A tuna larval survey was carried out during the summer of 2001 in the Mediterranean, showing the distribution of the larvae around the Balearic Islands. Maturity is considered to occur at about 90cm FL (age 5) in the Atlantic, and somewhat smaller in the Mediterranean. Until this age they are mainly found in surface waters, where they are targeted by surface gears. Some adult albacore are also caught using surface gears but, as a result of their deeper distribution, they are mainly caught using longlines. Young albacore are also caught by longline in temperate waters.

An attempt was also made to estimate mortality rates from tagging data. However, as the study area was limited to the surface fishery and no tag recoveries were reported from the longline fleets in more oceanic waters, it was not possible to separate the natural mortality component from the overall attrition rate (natural mortality and immigration) estimated by the model. In conclusion the Committee noted that the value for natural mortality indicated by this approach is not inconsistent with the value currently used in the assessment of the northern Albacore.

ALB-2. Description of fisheries **(ALB-Table 1** and **ALB-Figure 2)**

North Atlantic

The Northern stock is exploited by surface and longline fisheries. Traditional surface fisheries include Spanish trolling and baitboats, used mainly in the Bay of Biscay and adjacent waters, and some Spanish and Portuguese baitboats around the Azorian Islands. New surface fishing gears, driftnets and pair pelagic/mid-water trawling, were introduced in 1987 in the Bay of Biscay and adjacent waters by France. Ireland and United Kingdom joined the driftnet fishery at the beginning of the 1990's. In 1998 Ireland initiated experimental fishing trials using trolling and pelagic trawling. These surface fisheries mainly target juveniles and sub-adults (50cm to 90cm FL). A longline fleet from Chinese Taipei targets sub-adult and adult albacore (60-120cm) in the central and western North Atlantic. Other fleets make minor catches and in most of the cases albacore constitute a component of the by-catch.

The total catch in the north Atlantic has shown a downward trend since mid 1960's, largely due to a reduction of fishing effort by the traditional surface and longline fisheries. In contrast, effort and catch in the new surface fisheries increased between 1987 and 1999. In 2000 the reported catch (33,119MT) was lower than in 1999 but still showed an increase on the average catch in recent years (1996-1999). The Committee noted the significant increase in the reported catch of Venezuelan baitboats. The landings reported in 2000 amount to 1374 compared with an average catch in recent years (1996-1999) of 141 MT.

South Atlantic

The main surface fleets that currently target the southern stock correspond to South Africa and Namibia. These

countries exploit the resource together with Brazil and Chinese Taipei longliners. There are also some minor catches made by the purse seine fleet in the tropical area. The Chinese Taipei fleet target albacore at a fairly high level of effort. There has been an increase in the occurrence of the number of young albacore in the catches reported by Chinese Taipei and Namibia in 1994-1996. South Africa initiated a tuna-directed, pelagic longline fishery in 1997 that takes a small by-catch of albacore.

The reported catch in the south Atlantic (26,310 MT) was 3.5% lower than in 1999. Surface and longline catches have remained relatively constant at around 7,500MT and 20,000MT respectively during the period 1995 - 1999. However, in 2000 albacore catches by baitboats dropped by 33,6% due to a decrease in catches of South Africa. This relatively constant catch is due in part to the implementation of management regulations by some countries in response to the 1994 ICCAT resolution.

Mediterranean

In 2000, the main fishing countries catching albacore in the Mediterranean sea (EC-Italy and EC-Greece) did not report any catches as of 5 October 2001 (**ALB-Table 1** and **ALB-Figure 2**). Subsequently, catches were reported by EC-Italy in the Mediterranean for 2000. The Fifth Meeting of the GFCM/ICCAT Ad Hoc Working Group on Stocks of Large Pelagic Fishes in the Mediterranean recommended that in order to better identify which countries are catching albacore and what fishing methods are being used, a questionnaire should be devised and completed by nations operating in the Mediterranean.

ALB-3. State of the stocks

In 2001, the Committee did not perform an assessment of the status of the albacore stocks in the ICCAT convention area. Therefore the assessment of the northern and southern stocks completed in 2000 still apply. No attempt was made to analyze the status of the Mediterranean stock in 2000.

The 2000 Committee recognized the important improvement in the basic data for both north and south Atlantic stocks although some uncertainties remain, especially in relation to some elemental biological parameters. In this respect, the Committee notes that the quality of any future assessment is potentially jeopardized by the absence of data from some of the participating fleets. These include effort data and structure of the catches (length frequencies in the catches).

North Atlantic

In 2000, the Committee analyzed the state of the northern stock using a model (VPA) and data that were essentially the same as those used in previous assessments.

The results obtained in 2000 (**ALB-Figure 3**) showed consistency with those from previous assessments. The abundance and biomass of adult fish (ages 5+) appear to have declined from the mid-1970s to the late 1980s, followed by an slight increase 1988-1990. The abundance and biomass of ages 5+ do not show any clear trend since 1990. Abundance of recruits (age 1) and juveniles (ages 2-4) varied from year to year with, perhaps, a similar declining trend from 1975-1985. The levels since then have been variable. The Committee noted that global environmental factors might explain some proportion of the recruitment variability during the last two decades. Moreover, previous studies based on historic data, indicate that it is possible that a higher level of recruitment occurred during the 1960's and 1970's associated with a different environmental regime.

The fishing mortality rate of juveniles (ages 2-4) shows a slight increasing trend during the period analyzed. Fishing mortality rates on adults (ages 5+) increased to a peak in 1986, then declined. Recent rates appear to be relatively high, but not as high as the peak year. The fishing mortality rate on ages 8+ also appears to be increasing, however, the estimation of this is quite variable.

With reference to the results shown in **ALB-Figure 4**, equilibrium yield analyses, made on the basis of an estimated relationship between stock size and recruitment, indicate that current spawning stock biomass is about 30% below that associated with MSY. However, the Committee noted considerable uncertainties in these estimates of current biomass relative to the biomass associated with MSY (B_{MSY}), owing to the difficulty of estimating how recruitment might decline below historical levels of stock biomass. Thus, the Committee concluded that the northern

stock is probably below B_{MSY}, but the possibility that it is above it should not be dismissed. However, equilibrium yield per recruit analyses made by the Committee indicate that the northern stock is not being growth-over fished ($F < F_{max}$).

Sensitivity analyses were also conducted to explore the influence of several inputs and assumptions. Results of most sensitivity runs examined were very similar to the base case. However, these analyses suggest a possible conflict between two of the CPUE indices used in the model that needs to be addressed through further research. One of the sensitivity runs examined gave results that were considerably more optimistic than the base case.

South Atlantic

In 2000, the age structured production model and VPA specifications for the south Atlantic albacore assessment were the same as used in 1998. The estimates of MSY from the production model (30,274 MT) and VPA (35,400 MT) models were comparable and both models estimate that current fishing mortality is about 50% below F_{MSY} (**ALB-Figure 5**). Spawning stock biomass appears to have declined substantially relative to the late 1980's, but the decline may have levelled off in recent years (**ALB-Figure 6**) and the estimates remain above the spawning stock biomass at MSY. Thus, the current assessment (based largely on the age structured production model) indicates that the stock is not being over fished and that the recent (1997-2000) level of landings for the southern albacore stock can probably be maintained into the near future without causing a substantial decline in spawning stock biomass. However, the models do not fit the data well (**ALB-Figure 6**) and the parameters are very poorly estimated (as indicated by the very wide confidence intervals), as was true for the previous assessments. Therefore, the Committee cannot rule out the possibility that current fishing mortality is being underestimated until the Committee achieves greater certainty that relative abundance and catch are being measured appropriately.

ALB-4. Outlook

Since the Committee did not perform an assessment of the status of the albacore stocks in 2001 the assessments of the northern and southern stocks completed in 2000 remain the most recent available. No attempt was made to analyze the status of the Mediterranean stock in 2000.

North Atlantic

In 2000, the Committee noted that in terms of yield per recruit, the fishing intensity is at, or below, the fully exploited level. Concerning MSY-related quantities, in 2000 the Committee recalled that these are highly dependent on the specific choice of stock-recruitment relationship. The 2000 Committee believed that using a particular form of stock-recruitment relationship that allows recruitment to increase with spawning stock size provided a reasonable view of reality. This hypothesis together with the results of the VPA assessment indicate that the spawning stock biomass (B_{99}) for the northern stock (29,000MT) is about 30% below the biomass associated with MSY (42,300MT) and that current F is about 10% above F_{MSY}. However, an alternative model allowing for more stable recruitment values in the range of observed SSB values would provide a lower estimate of SSB at MSY, below the current value.

South Atlantic

In 2000 the assessment indicated that the current level of exploitation may be maintained. The more optimistic perspective seen in 1998 was again evident in 2000, without the negative aspects shown in the 1996 and 1997 assessments. This change in perception in 1998 can be partially explained by revision of some of the abundance indices adopted at that time.

ALB-5. Effects of current regulations

North Atlantic

In 2000, the Commission recommended a total allowable catch (TAC) of 34,500 MT be established for 2001. In addition the 1998 recommendation concerning the limitation of fishing capacity on northern Albacore remains in force. The Committee is unable to assess whether or not these recommendations have had an effect on the stock. However, the Committee noted that reported catches for 2000 are below the total allowable catch (TAC) established for 2001.

South Atlantic

In 2000, the Commission recommended the total catch limit for albacore caught in the Atlantic Ocean South of 5º N be set at 29,200 MT for 2001. In addition, the Commission requested that the four active participants in the fishery report their catches to South Africa (a designated Contracting Party actively fishing for southern albacore) on a bi-monthly basis and that South Africa inform the Secretariat when predetermined threshold limits are reached. Although the 2000 catch limit of 29,200 MT was not reached, the fishing fleets in the South Atlantic have a capacity to exceed the recommended catch limit. Therefore the Committee recommends that the Commission take steps to ensure that the monitoring systems mentioned in its 2000recommendation be adhered to.

Mediterranean

There are no recommendations for the Mediterranean.

ALB-6. Management recommendations

North stock

In 2000 the Committee recommended that in order to maintain a stable Spawning Stock Biomass in the near future the catch should not exceed 34,500 MT (the 1999 catch level) in the period 2001-2002.The 2000 Committee further noted that should the Commission wish the Spawning Stock Biomass to begin increasing towards the level estimated to support the MSY, then catches in 2001 and 2002 should not exceed 31,000 MT. The 2001 Committee reiterates its previous advice.

South stock

If the Commission wishes to maintain a stable Spawning Stock Biomass in the near future, then the Committee recommends that catch should not exceed the estimated replacement yield (29,200 MT) in 2002.

Mediterranean

There were no management recommendations for the Mediterranean stock. However the Committee recommends to the Commission that reliable data be provided on catch, effort and size for the Mediterranean albacore. Improvements to these basic inputs are essential before a stock assessment of Mediterranean albacore can be attempted.

ATLANTIC AND MEDITERRANEAN ALBACORE SUMMARY
(MT)

	North Atlantic[1]	**South Atlantic**[2]	**Mediterranean**
Current (2000) Yield	33,134	26,310	Uncertain
Maximum Sustainable Yield	32,600 (32,400-33,100)	30,200 (50 -31,400)	Unknown
Replacement Yield (2000)	Not estimated	29,200 (12,100–31,400)	Not estimated
Relative Biomass			
B_{1999}/B_{MSY}	0.68 (0.52-0.86)	1.60 (0.01-1.98)	Not estimated
Relative Fishing Mortality[3]			
F_{99}/F_{MSY}	1.10 (0.99 - 1.30)	0.57 (0.34-556)	Not estimated
F_{99}/F_{MAX}	0.71 (0.66 - 0.78)	0.31 (0.28 – 0.33) [1]	Not Estimated
$F_{99}/F_{0.1}$	1.25 (1.14 - 1.39)	0.84 (0.74 – 0.89) [1]	Not Estimated
Management measures in effect	[Ref. 98-8][4]: Limit number of vessels to 1993-1995 average. [Ref. 00-06][5]: TAC.	[Ref. 98-9][4]:Limit catches to 29,200 MT. [Ref. 00-07][5].	None

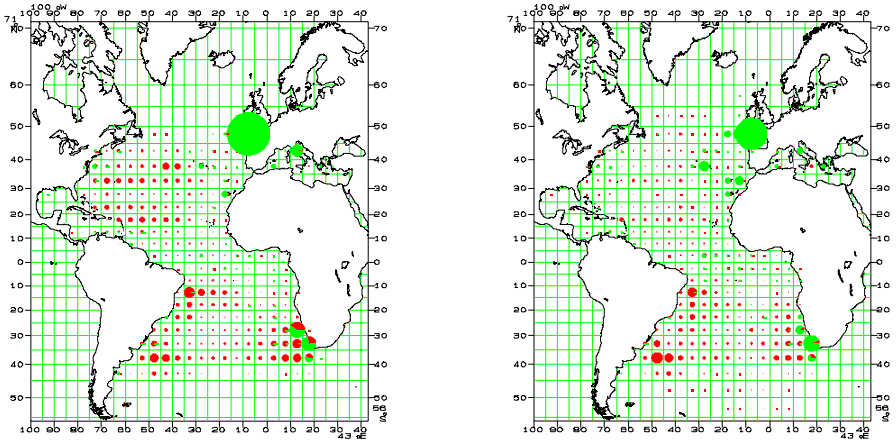
[1] VPA results based on catch data (1975 - 1999). 80% confidence intervals from bootstrap.
[2] ASPM results based on catch data (1956 - 1999). 80% confidence intervals from bootstrap.
[3] F_{99} = North Atlantic, Geometric Mean 1996-1998. South Atlantic, Geometric Mean 1994-1996.
[4] SCRS/00/10bis.
[5] SCRS/01/010.

ALB-Table 1. Estimated landings (MT) of albacore in 1976-2000*, by major area, gear and flag.

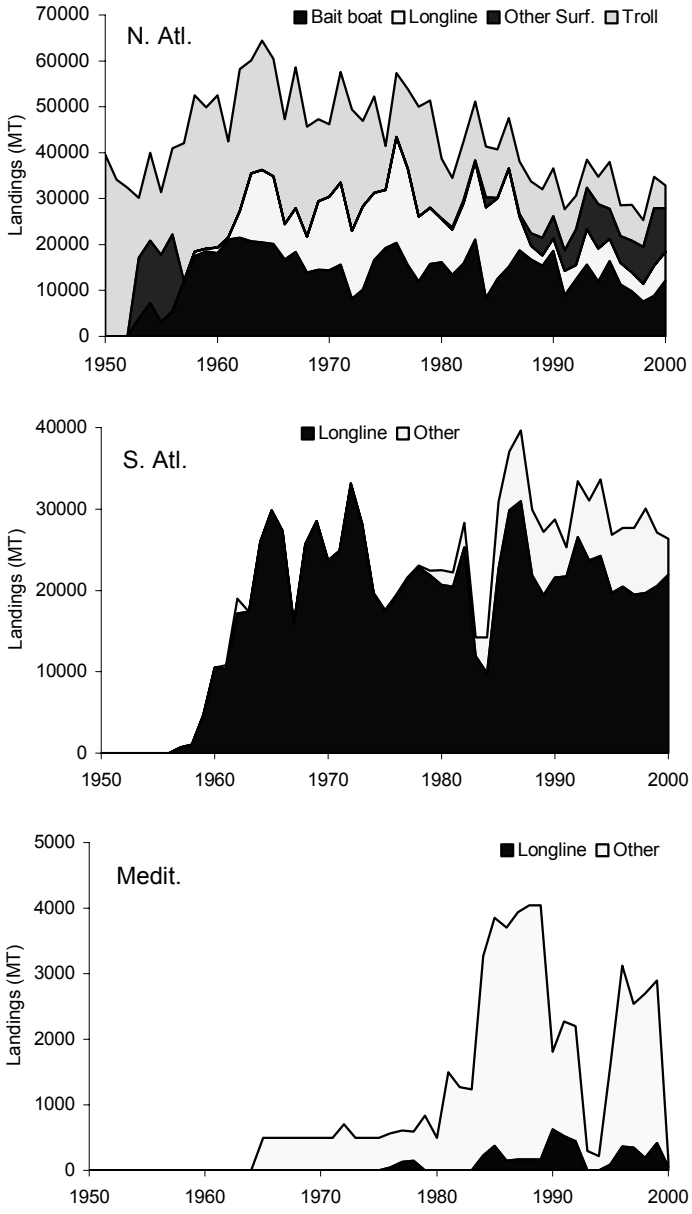
		1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
TOTAL		*77346*	*76099*	*73806*	*74826*	*62136*	*60071*	*73616*	*67643*	*59842*	*76051*	*88553*	*82738*	*68048*	*63340*	*67167*	*56731*	*71289*	*73290*	*71232*	*67729*	*60366*	*59177*	*58756*	*66979*	*63166*
	AT.N	57326	53821	50047	51365	38706	34531	42672	51490	41829	40825	47553	38115	33878	32059	36557	27938	30815	38701	35036	38295	28780	28664	25464	34787	33134
	AT.S	19459	21665	23169	22628	22930	24040	29672	14918	14599	31097	37288	40630	30107	27211	28714	25736	35664	32548	34563	27181	27886	27798	30483	27278	26310
	MEDI	561	613	590	833	500	1500	1272	1235	3414	4129	3712	3993	4063	4060	1896	2378	2202	856	242	1587	3125	2541	2698	4850	157
	UNCL	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	679	2608	1185	1391	666	575	174	111	64	3565
AT.N	Bait boat	20402	15559	11958	15764	16170	13410	15857	21108	8305	12589	15202	18756	16752	15374	18625	8985	12449	15646	11967	16411	11337	9820	7562	8781	12113
	Longline	23006	20869	14157	12207	9451	9819	13206	16863	19709	17413	21231	7296	3013	2228	2683	5304	3103	7659	7195	4776	4620	4043	3874	6644	6272
	Other Surf.	0	0	1	62	10	523	694	367	2231	108	213	343	994	1651	3865	3999	5173	7279	7505	3555	3337	4054	6725	7571	5825
	Purse seine	0	2	0	0	16	0	84	364	555	59	60	1	97	12	1	222	139	229	278	278	263	0	91	55	191
	Trawl	0	0	0	0	0	1	0	0	0	2	0	262	1693	2240	1033	469	2603	1779	2131	3049	2571	2877	1318	4892	3717
	Troll	13918	17391	23931	23332	13059	10778	12831	12788	11029	10654	10847	11457	11329	10554	10350	8959	7348	6109	5959	10226	6652	7870	5894	6845	5016
AT.S	Bait boat	0	66	43	53	1346	1721	2575	1794	4166	7909	6829	8181	7696	7393	5981	3454	6490	7379	8947	7091	6960	8110	10353	6477	4302
	Longline	19262	21194	22806	21843	20671	20426	25255	11941	9834	22672	29815	30964	21828	19407	21590	21698	26519	23650	24224	19718	20472	19447	19699	20559	21949
	Other Surf.	150	293	201	544	449	89	493	484	234	334	400	537	398	411	1139	137	393	39	483	10	209	127	0	73	58
	Purse seine	47	112	119	188	464	1804	1349	699	365	182	244	948	185	0	4	447	2262	1480	909	362	245	114	431	169	
MEDI	Bait boat	0	0	0	0	0	900	539	535	1331	243	0	0	0	0	83	499	171	231	81	163	205	0	33	96	88
	Longline	41	130	150	0	0	0	0	0	226	375	150	161	168	165	624	523	442	0	3	87	366	348	194	416	51
	Other Surf.	520	483	440	833	500	600	700	700	1716	2973	3552	3782	3879	3879	1098	1198	1533	7	6	1031	2435	1991	2426	2315	18
	Purse seine	0	0	0	0	0	0	0	0	141	274	10	50	16	16	91	110	6	559	23	0	0	0	0	1950	
	Troll	0	0	0	0	0	0	33	0	0	264	0	0	0	0	0	48	50	59	129	306	119	202	45	73	
UNCL	Bait boat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	721
	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	321	663	369	496	399	549	108	108	50	2819
	Other Surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	10	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	358	1945	816	895	267	26	66	3	14	25
AT.N	BARBADOS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	
	BRASIL	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
	CANADA	0	0	0	0	0	0	0	0	0	0	0	0	47	22	6	5	1	9	32	12	24	31	23	38	122
	CANADA-JPN	0	0	0	0	0	0	0	0	0	0	1	21	0	0	0	0	0	0	0	0	0	0	0	0	
	CAP-VERT	0	0	0	0	0	0	0	10	10	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	0	0	0	0	0	0	0	0	14	8	20	0	0	21	16
	CHINESE TAIPEI	14837	13723	9324	6973	7090	6584	10500	14254	14923	14899	19646	6636	2117	1294	3005	4318	2209	6300	6409	3977	3905	3330	3098	5785	5299
	CUBA	85	83	89	0	31	48	82	38	69	20	31	15	4	0	2	0	0	0	0	0	0	0	0	0	
	EC-ESPANA	26910	25155	25404	29630	25202	20819	25478	29557	15685	20672	24387	28206	27557	25424	25792	17233	18176	18380	16998	20197	16323	17294	13285	15366	15965
	EC-FRANCE	6800	7733	10400	9320	3955	2929	2855	2391	2797	1860	1200	1921	2805	4050	3300	4123	6924	6293	5934	5304	4694	4618	3711	7189	6019
	EC-IRELAND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	60	451	1946	2534	918	874	1913	3750	4858	3274
	EC-PORTUGAL	610	62	85	149	79	442	321	1778	775	657	498	433	184	169	3185	709	1638	3385	974	6470	1634	395	91	324	278
	EC-U.K	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	59	499	613	196	49	33	117	343	15
	GRENADA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	6	6	6	
	JAPAN	1345	825	531	1219	1036	1740	781	1156	576	844	470	494	723	764	737	691	466	485	505	386	466	414	446	446	358
	KOREA	5379	5579	3048	2997	797	938	1326	478	967	390	373	18	16	53	34	1	0	8	0	0	2	1	0	0	
	MEXICO	0	0	0	0	2	0	0	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	PANAMA	1227	557	768	425	193	177	494	357	2551	601	525	44	0	0	0	0	0	0	0	0	0	0	0	0	
	PHILIPPINES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	
	ST.LUCIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	
	ST.VINCENT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	
	TRINIDAD & TOBAGO	0	0	0	0	0	0	0	268	194	318	0	0	0	0	4	0	247	639	0	0	0	1	1	0	2
	U.S.A	0	2	1	0	21	472	698	347	2206	97	250	301	288	242	357	479	438	508	741	545	472	577	829	314	406

		1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	U.S.S.R	0	0	0	59	0	51	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	1	0	2	2
	VENEZUELA	133	102	397	593	300	331	137	823	580	408	168	26	119	41	95	319	205	246	282	279	315	49	107	91	1374
	VENEZUELA-FOR	0	0	0	0	0	0	0	0	496	59	4	0	18	0	0	0	0	0	0	0	0	0	0	0	
AT.S	ARGENTINA	48	80	8	0	4	2	7	55	209	153	356	469	344	354	151	60	306	0	2	0	0	0	0	0	
	BELIZE.SH.OB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	8	2
	BRASIL	296	688	494	515	476	276	800	731	732	382	520	395	421	435	514	1113	2710	3613	1227	923	819	652	3418	1872	3733
	CAMBODIA	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39	89
	CHINESE TAIPEI	14600	16092	20467	20340	18710	18187	22800	9502	7889	19643	27592	28790	20746	18386	21369	19883	23063	19400	22573	18351	18956	18165	16106	17377	17221
	CUBA	15	17	11	0	27	53	29	36	67	27	24	10	2	1	2	17	5	3	0	0	0	0	0	0	
	EC-ESPANA	0	0	0	0	0	889	106	295	307	155	200	807	185	0	0	390	1818	983	874	419	194	253	193	1027	282
	EC-FRANCE	47	112	40	172	457	912	947	372	7	18	35	100	0	0	0	50	449	564	129	82	190	38	40	13	
	EC-PORTUGAL	0	0	0	0	0	0	0	0	741	1357	1029	899	1153	557	732	81	184	483	1185	655	494	256	124	0	
	HONDURAS-OB.SH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	7	1	6	
	JAPAN	73	107	135	105	333	558	569	188	224	623	739	357	405	450	587	654	583	467	651	389	435	424	418	552	326
	KOREA	3376	3829	1413	878	803	682	563	599	348	511	321	383	180	54	19	31	5	20	0	0	18	4	7	0	18
	MAROC	0	0	2	0	0	0	113	0	0	0	0	41	0	0	0	0	0	0	0	0	0	0	0	0	
	NAMIBIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	915	950	982	1199	1429	1162	2418
	NEI-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	8	122	68	55	63	41	13	218	0	
	PANAMA	770	377	354	125	167	129	210	0	0	0	280	924	0	0	0	0	0	0	0	0	0	0	0	0	
	PHILIPPINES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	4	
	SOUTH AFRICA	150	150	150	480	1850	2320	3180	2760	3540	6697	5930	7275	6570	6890	5280	3410	6360	6881	6931	5214	5634	6708	8412	5101	2072
	U.S.A	0	0	9	11	0	2	102	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	1	1	1
	U.S.S.R	84	212	74	0	99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	UK-S. HELENA	0	1	12	2	4	7	11	7	9	0	0	2	1	1	1	5	28	38	5	82	47	18	1	1	58
	URUGUAY	0	0	0	0	0	23	235	373	526	1531	262	178	100	83	55	34	31	28	16	49	75	56	110	110	90
MEDI	CYPRUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
	EC-ESPANA	0	0	0	0	0	900	572	535	1331	531	0	0	3	0	84	547	227	290	218	475	404	380	126	284	152
	EC-FRANCE	0	0	0	0	0	0	0	0	141	250	20	60	31	31	121	140	11	64	23	3	0	5	5	0	
	EC-GREECE	0	0	0	0	0	0	0	0	0	0	484	500	500	500	500	500	500	1	1	0	952	741	1152	2005	
	EC-ITALY	560	613	590	833	500	600	700	700	1942	3348	3208	3433	3529	3529	1191	1191	1464	1	0	1109	1769	1414	1414	2561	
	JAPAN	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	MALTA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	
	NEI-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500	0	0	0	0	0	0	
UNCL	EC-ESPANA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	279	1816	648	682	255	4	66	0	0	
	EC-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	23
	NEI-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	723
	NEI-134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	3	0	20	7	7	7	
	NEI-71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	160	281	145	130	110	160	43	43	43	
	PANAMA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	240	511	378	576	301	391	58	61	14	
	SIERRA LEONE	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	
	ST. VINCENT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2819

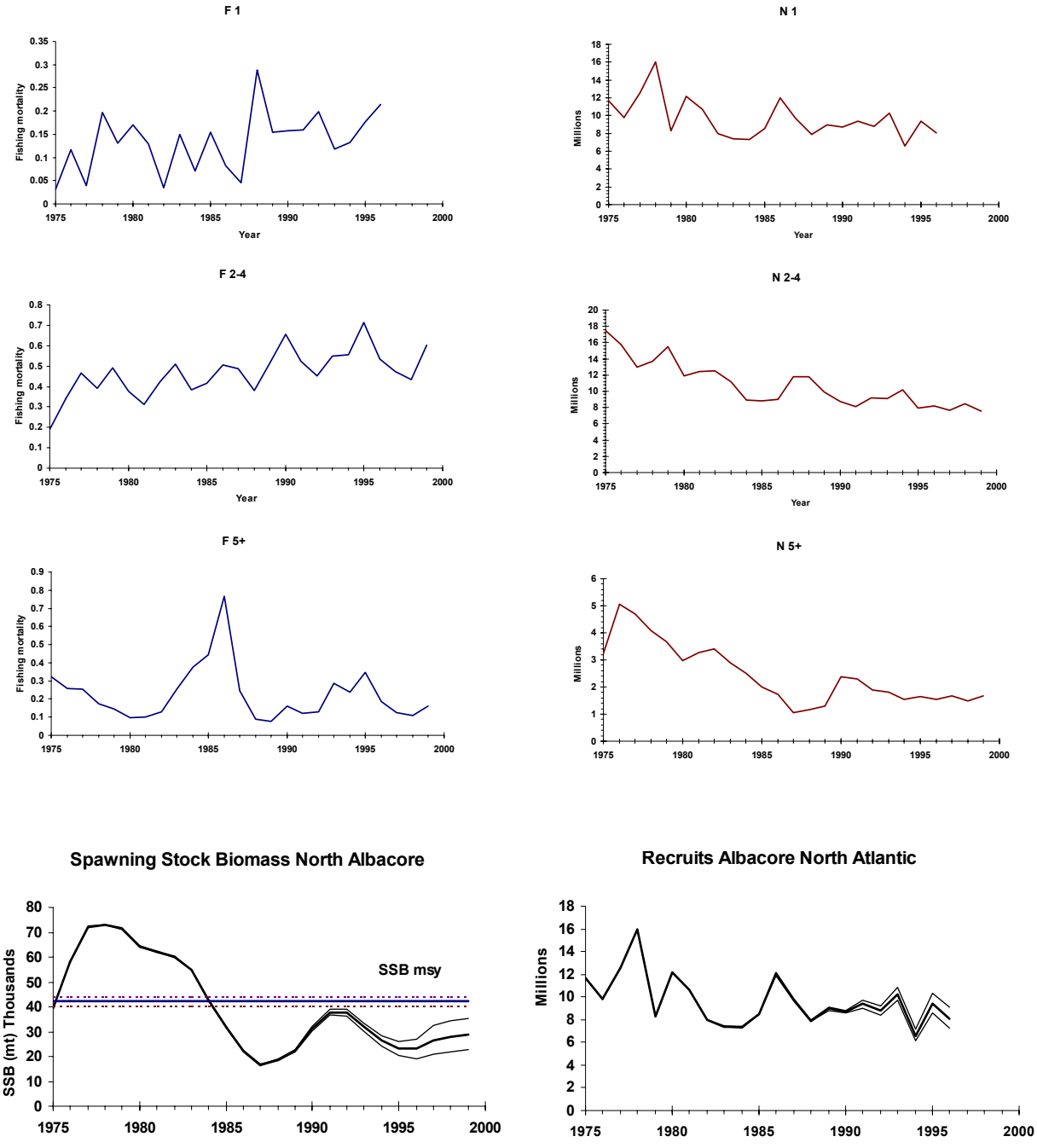
* As of 5 October 2001. Subsequently, catches were reported by EC-Italy in the Mediterranean for 2000 (3630 MT) and by EC-Portugal in the South for 1999 (232 MT) and for 2000 (486 MT)
Empty cells for 2000 indicate that catches were not reported to ICCAT.



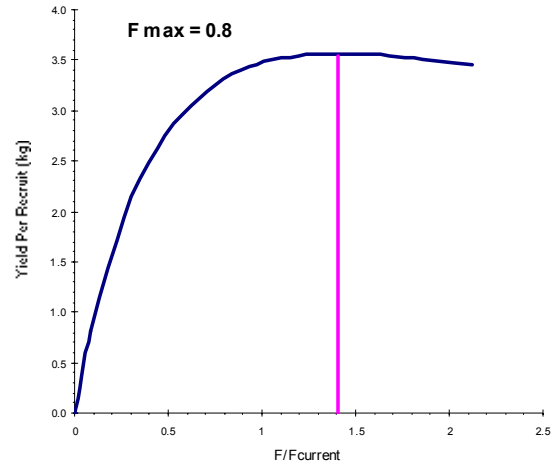
ALB-Fig. 1. Geographical distribution of annual albacore catches in 1980-1989 (left) and 1990-1997 (right). Dark symbols represent longline and lighter symbols represent various surface gears.

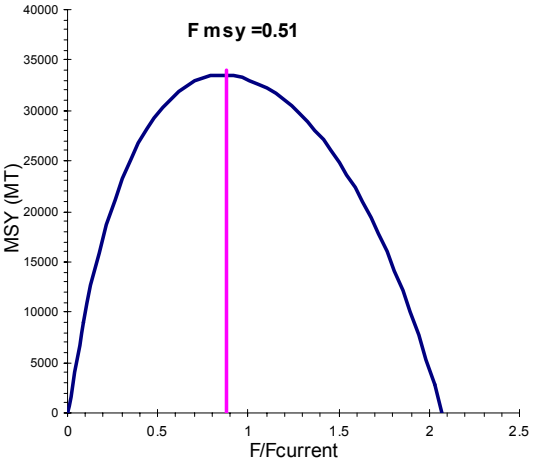


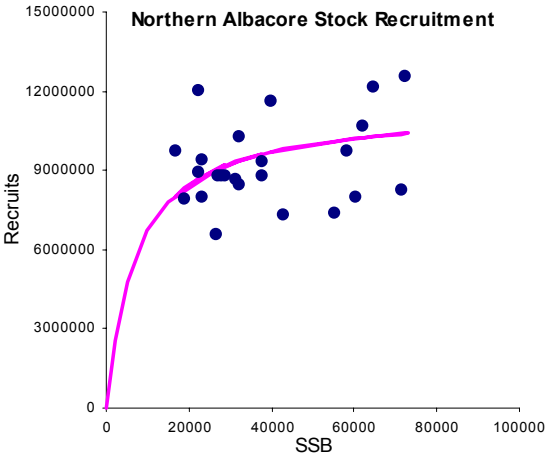
ALB-Fig. 2. Albacore landings (MT) by stock and major gear types for 1950-2000. Data from the Mediterranean Sea are highly uncertain and provisional in recent years.



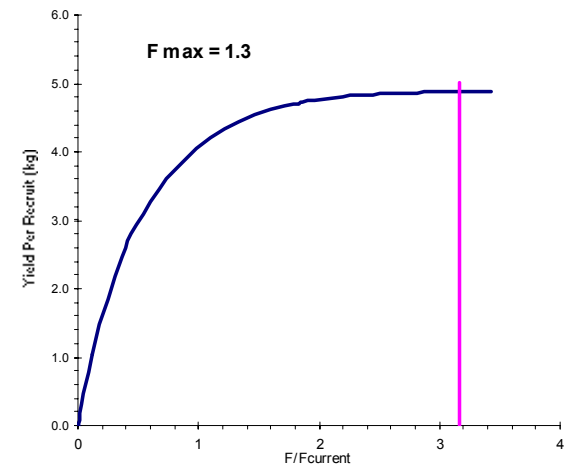
ALB-Fig 3. North albacore base case VPA estimates of fishing mortality (F) and numbers of fish by age-groups (top 6 panels), and Spawning stock biomass and recruits with 80% confidence limits (bottom panels).

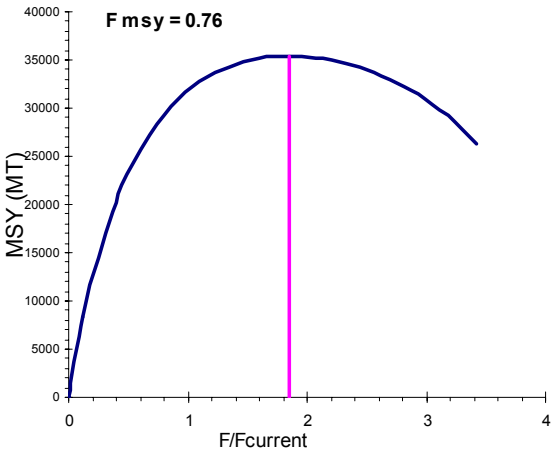


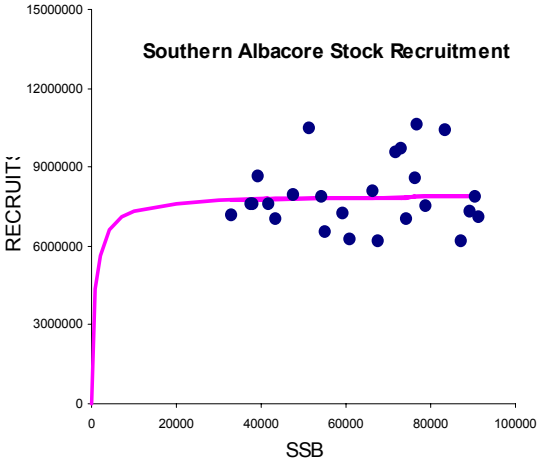




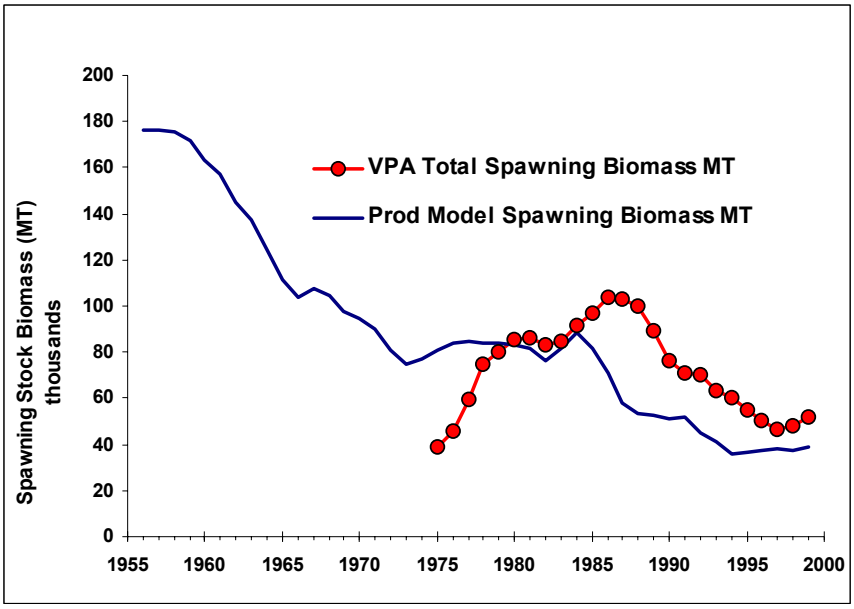
ALB-Fig 4. Yield Per Recruit (top), equilibrium yield (middle), and stock –recruitment relationship (bottom) estimated by VPA for the northern albacore stock. Fishing mortality axis (x-axis) is relative to current fishing mortality ($F_{99} = 0.57$)







ALB-Fig 5. Yield Per Recruit (top), equilibrium yield (middle), and stock –recruitment relationship (bottom) estimated by VPA for the southern albacore stock. Fishing mortality axis (x-axis) is relative to current fishing mortality ($F_{99} = 0.41$)



ALB-Fig. 6. Spawning stock biomass estimates obtained by VPA (ADAPT) and production modeling (ASPM) for the southern Atlantic albacore stock.

7.5 BFT - ATLANTIC BLUEFIN TUNA

In 1998, the Commission adopted a 20 year Rebuilding Program for the western Atlantic bluefin management area [Ref: 98-7] aimed at rebuilding to the stock size that will produce MSY (B_{MSY}) by 2018 with a 50% or greater probability. The Program states that the TAC for the West would only be adjusted from the 2,500 MT level adopted for 1999-2000 if SCRS advises that (a) a catch of 2,700 MT or more has a 50% or greater probability of rebuilding or (b) a catch of 2,300 MT or less is necessary to have a 50% or greater probability of rebuilding. According to the Program, the MSY rebuilding target can be adjusted according to advice from SCRS. In support of the Program, the stock assessment for the western Atlantic bluefin tuna management area was updated in 2000, using data to the end of 1999. As the next stock assessment is not scheduled until 2002, this Executive Summary updates only *the Description of fisheries* and the *Effects of current regulations* sections, and includes information from the recent Workshop on Bluefin Tuna Mixing.

The accumulation of evidence reviewed in 2001 by the Workshop on Bluefin Tuna Mixing indicates that movement of bluefin across the current east/west management boundary in the Atlantic does occur. A plan for modeling taking this mixing into account was developed to integrate the accumulation of knowledge on movement into assessments and to evaluate the effectiveness of alternative spatial boundaries. Completion of this activity may allow the Commission to develop more flexible (and thus complex) management strategies. However, this activity is expected to take several years. Therefore, several short term management options are suggested which the Commission could use as an interim measure and could be integrated into the next assessment. (See Section 15 of the SCRS Report.) Regardless of the management options chosen by the Commission to deal with mixing in the Central North Atlantic, the Commission should also implement rigorous scientific monitoring in that area (see Section 16).

BFT-1. Biology

Present fisheries for Atlantic bluefin tuna are distributed from the Gulf of Mexico to Newfoundland in the West Atlantic, from roughly the Canary Islands to south of Iceland in the East Atlantic, and throughout the Mediterranean Sea **(BFT-Figure 1)**. In 1982, the Commission established a line for separating the eastern and western Atlantic management units based on discontinuities in the distribution of catches at that time in the Atlantic and supported by limited biological knowledge **(BFT-Figure 1)**. However, the overall distribution of the catch in the 1990s is much more continuous across the north Atlantic than was seen in previous decades. Tagging evidence indicates that movement of bluefin across the current east/west management boundary in the Atlantic does occur, that movements can be extensive (including transatlantic) and complex, that there are areas of concentration of electronically tagged fish (released in the west) in the north central Atlantic just east of the management boundary, and that fisheries for bluefin tuna have developed in this area in the last decade. An important proportion of these fish have moved from west of the current boundary. Complementary studies which might show east to west movement are less advanced. The composition, origin and spawning source of these fish in the central north Atlantic area not well known. Nevertheless, it is clear that the current boundary does not depict our present understanding of the biological distribution and biological stock structure of Atlantic bluefin tuna. Note, however, that the current boundary is a *management* boundary and its effectiveness for management is a different issue.

Atlantic bluefin tuna can grow to over 300 cm and reach more than 650 kg. The oldest age considered reliable is 20 years, based on an estimated age at tagging of 2 years and about 18 years at liberty, although it is believed that bluefin tuna may live to older ages. Bluefin tuna are, thus, characterized by a late age at maturity (thus, a large number of juvenile classes) and a long life span, which make it well adapted to variations in recruitment success, but more vulnerable to fishing pressure than rapid growth species such as tropical tuna species. Bluefin tuna in the West Atlantic generally reach a larger maximum size compared to bluefin caught in the East Atlantic. Bluefin in the west are assumed to first successfully spawn at age 8 compared to ages 4 to 5 in the east. Distribution expands with age; large bluefin are adapted for migration to colder waters. Bluefin tuna are opportunistic feeders, with fish, squid, and crustaceans common in their diet.

In the West Atlantic, bluefin tuna are thought to spawn from mid-April into June in the Gulf of Mexico and in the Florida Straits. Results of satellite tagging studies have shown bluefin of spawning size which were tagged in the West were present in the central Atlantic during the presumed spawning period, though this should not be considered as conclusive evidence of spawning. Juveniles are thought to occur in the summer over the continental shelf, primarily from about 35ºN to 41ºN and offshore of that area in the winter. In the East Atlantic, bluefin tuna generally spawn from late May to July depending on the spawning area, primarily in the Mediterranean, with highest concentrations around the Balearic Islands, Tyrrhenian Sea, and central Mediterranean where the sea-surface

temperature of the water is about 24ºC.

BLUEFIN TUNA - WEST

BFTW-2. Description of the fisheries

One of the most noteworthy changes in the fisheries in 1999 and 2000 compared to earlier years was that a substantial amount of additional catch was recorded through the Bluefin Tuna Statistical Document which was not in accordance with Commission's recommended allocation of catch.

The reported total catches (landings and discards) of western Atlantic bluefin tuna in 1999 and 2000 are estimated as 2,774 MT and 2,395 MT, respectively **(BFT-Table 1; BFT-Figure 2)**. The 1999 catches were the highest since 1991. The high level of the 1999 catches were primarily a result of the estimate of unreported catch based on the Bluefin Tuna Statistical Document. Unreported catches were not estimated for 2000.

The Japanese longline fishery catches in the West Atlantic in 1999 decreased almost 50% from the 1998 value (691 MT, which was the highest in the 1990s) to 365 MT, and then increased to 492 MT in 2000. The Canadian reported landings (exclusive of discards) decreased slightly from the 1998 level (595 MT) to 576 and 549 MT in 1999 and 2000, respectively. The provisional estimates of Canadian dead discards in 2000 were higher than in 1998 and 1999. Reported catches of U.S. fisheries in 1999 and 2000 were 1212 MT in both years, having changed only slightly from the 1998 level (1235 MT). The estimates of U.S. dead discards for 1999 were higher than the tabulated dead discards for 2000. Bermuda reported landings of 1 MT in both 1999 and 2000. In addition, there were 13 MT reported by Brazil (Equatorial Guinea flagged vessels chartered by Brazil) for 1999, but no catch has been reported in 2000. Mexico reported 14 MT in 1999 and 29 MT in 2000, both higher than all other reported catches since the early 1980's.

BFTW-3. State of the stock

During the 1998 western Atlantic bluefin assessment (Genoa, Italy, 1998) several forms of population analysis were used to examine the status of the resource. This year, the Committee decided to devote less time exploring alternative forms of population models and to concentrate instead on a deeper examination of the diagnostics of alternative calibrations of a virtual population analysis (VPA).

In response to questions raised during the 1998 assessment, several analyses were conducted inter-sessionally to investigate appropriate ways to weight the basic input abundance indices in the population model. A VPA calibration estimating an equal weight for all indices was used to define the base case assessment. The alternative weighting schemes examined gave similar results to the base case analysis, as did other model runs designed to examine the sensitivity of the results to alternative sets of inputs and assumptions.

Estimated recruitment was generally higher from 1970 to 1976 than it has been since, with the exception of recent (since 1995) values. However, the Committee cautioned that there is high uncertainty associated with these recent estimates. The assessment shows the spawning biomass (age 8+) declined between the early 1970s and 1990, and has since then remained stable **(BFT-Figure 3)**. In terms of the historical perspective, the results of this assessment are similar to previous assessments.

As explained in Section 4- Outlook, the calculation of the stock's long-term potential for productivity was made using two scenarios about the recruitment levels (low or high), to be obtained at high levels of spawning biomass. If the low recruitment scenario is correct, the current spawning biomass is estimated to be about 36 percent of the level expected to produce MSY. If the high recruitment scenario is correct, spawning biomass is expected to be about 10 percent of the biomass at MSY. The Committee's current assessment estimated the 1999 stock size as about 20% of the estimate for 1975. In the past, the Committee used the 1975 stock size as a proxy for B_{MSY}, as indicated by production models. Thus, although the Committee was unable to determine which of the alternative recruitment scenarios is most likely, the assessment indicated that the stock is over fished according to the Convention's objective to maintain ICCAT stocks at the MSY-biomass level. The assessment also indicated that current fishing mortality is greater than that associated with MSY.

BFTW-4. Outlook

Western Atlantic bluefin tuna catches have remained similar since 1983 (the range over this period is 2,114 to 3,114 MT). Since the late 1980s, estimated stock size (measured as the biomass of fish 8 years old and older, which is also assumed to be the spawning biomass) has been relatively stable, as well. Thus, over an extended period of time, catches around recent levels have maintained stock size at about the same level.

In order to provide advice relative to rebuilding the western Atlantic bluefin population, the Committee conducted projections for two scenarios about future recruitment. One scenario assumed that future average recruitment will approximate the average estimated recruitment since 1976, unless spawning stock size declines to low levels (generally lower than those estimated to have occurred in the assessment). The second scenario allowed average recruitment to increase with spawning stock size up to a maximum level no greater than the average estimated recruitment for 1970 to 1974. These scenarios were referred to as the low recruitment and high recruitment scenarios, respectively. The low and high recruitment scenarios implied that the B_{MSY} (expressed in terms of the biomass of fish 8 years and older) is 53% and 215% of the biomass in 1975, respectively. With the current data the Committee could not determine which recruitment scenario is more likely, but both are plausible. Therefore, management strategies should be chosen to be robust to this uncertainty.

The results of projections based on the low recruitment scenario are given in **Figure 4** (for several catch levels) and **Figure 5** (for 2,500 MT only). The projections indicated that a constant catch of 3,000 MT per year has about a 75% probability of allowing rebuilding to the associated B_{MSY} by 2018. Furthermore, a constant catch of 2,500 MT per year has about a 56% probability of allowing rebuilding to the 1975 stock size by 2018.

The results of projections based on the high recruitment scenario are given in **Figure 4** (for several catch levels) and **Figure 6** (for 2,500 MT only). For the high recruitment scenario, a constant catch of about 3000 MT per year has about a 62% probability of allowing rebuilding to the 1975 stock size, and with a constant annual catch of 2,500 MT there is about a 47% chance of rebuilding to the associated B_{MSY}, by 2018.

Probability of achieving target in 2018

Catch (MT)	*Low recruitment scenario*		*High recruitment scenario*	
	B/B_{1975}	B/B_{MSY}	B/B_{1975}	B/B_{MSY}
500	98%	100%	99%	86%
1,000	94%	100%	99%	79%
1,500	87%	100%	97%	71%
2,000	74%	100%	87%	62%
2,300	61%	99%	82%	53%
2,500	56%	94%	74%	47%
2,700	47%	86%	71%	43%
3,000	34%	75%	62%	36%

If the B_{MSY} that corresponds to the low recruitment scenario is adopted as a rebuilding target, then the TAC can be increased to 3,000 MT per year, or more, without violating the Commission's Rebuilding Program. In fact, the projections indicated that it is likely the stock will rebuild to B_{MSY} within a few years with a constant catch of 3,000 MT per year. If the B_{MSY} that corresponds to the high recruitment scenario is adopted as a rebuilding target, then a catch of about the level of the current TAC will satisfy the Rebuilding Program.

The Committee cautioned that these conclusions do not capture the full degree of uncertainty in the assessments and projections. The immediate rapid projected increases in stock size are strongly dependent on estimates of high levels of recent recruitment, which are the most uncertain part of the assessment. Inspection of past assessments indicate that these recent recruitments are less well estimated than indicated by the statistical uncertainty modeled in the assessments. Also, the Committee had some concern that the method used to estimate the probabilities of achieving rebuilding targets may be too optimistic. The implication of mixing between the eastern and the western management areas is not entirely clear, but it adds to the uncertainty. The Committee also noted that while its assessments have been stable over time in terms of the trend in abundance, projections of the future direction of the stock have been much less stable from one assessment to the next (e.g., the projections performed in 1996 were less optimistic than they were in 1994, and in 2000 the projections are more optimistic than they were in 1998).

BFTW-5. Effects of current regulations

The first regulatory measure for a scientific monitoring level was adopted for western Atlantic bluefin catches in 1981. Since then, monitoring levels have been changed in various years. Until 1987, both estimated catches and landings were below or equal to the level of the catch limits. However, from 1988 to 1997, estimated landings were very close to the level of the limits and, for some years, exceeded the limit by a maximum of 100 MT. Estimated catches (including discards) were higher than the limits every year during this period (by about 200 to 300 MT) with the exceptions of 1992 and 1997. The estimated catches exceeded the limits in 1998 and 1999, by approximately 300 MT. It should be pointed out that for compliance purposes, some countries are using fishing years that do not correspond to calendar years, while the catches discussed here are in calendar years. Also, according to the ICCAT regulatory measure, the amount of catch that exceeded quota or was left over from the quota can be carried over to succeeding years. Hence, the catch limit set for each year could have been adjusted accordingly. It should also be pointed out that the excess of the catch limits in most recent years is due to some new fisheries which operated without a quota (see Section BFTW-2).

For the West Atlantic, a size limit of 6.4 kg with 15 percent allowance, in number of fish, has been in effect since 1975. In addition, a prohibition on the taking and landing bluefin tuna less than 30 kg (or 115 cm) with an 8% tolerance, by weight on a national basis, became effective in 1992. It is noted that, since 1992, the proportion of undersized fish for all catches combined has been below the allowance level (e.g., 4.2% and 2.1% in 1998 and 1999, respectively).

BFTW-6. Management recommendations

The Committee's management recommendation is directed at the Rebuilding Program (described in the first paragraph of the BFT section of this report) adopted by the Commission in 1998. In light of the uncertainty in the assessment (particularly with regard to estimates of recent high recruitment), projections, the choice between recruitment scenarios, and assumptions about mixing, the Committee recommended that the TAC should not be changed significantly from the current level of 2,500 MT per year. Projections based on the low recruitment scenario, assuming the estimates of recent high recruitment are accurate, indicate that the TAC could be increased without violating the Rebuilding Program; however high levels of recruitment are inconsistent with the low recruitment scenario. The high levels of recent recruitment estimated in this assessment point to a higher biomass level as a rebuilding target, such as the B_{MSY} associated with the high recruitment scenario, in which case there is almost a 50% probability of rebuilding with the current TAC of 2,500 MT. The Committee noted that B_{MSY} for the high recruitment scenario is not well determined by the spawner-recruit data examined in this assessment. Previous analyses, based on a longer time series of spawner-recruit estimates, indicated that the biomass level in 1975 is a reasonable proxy for B_{MSY}. Maintaining the annual catch at about the current TAC level gives at least a 50% probability of rebuilding to the 1975 biomass by 2018, for both recruitment scenarios.

One implication of mixing of bluefin tuna between the western and eastern management units that is clear from the work of the Committee is that the population of fish and the fisheries in the East and West are related. The condition of the eastern Atlantic stock and fishery could adversely affect recovery in the West Atlantic, which was also noted in the Committee's 1998 and 2000 reports. Therefore, the Committee stressed the importance of continuing efforts to manage the fisheries in both the East and West Atlantic in a sustainable manner. The Commission should also implement rigorous scientific monitoring in the central North Atlantic.

WEST ATLANTIC BLUEFIN TUNA SUMMARY
(Catches and biomass in MT)

Current (2000) Catch* (discards included)	2,395	
Short-term Sustainable Yield	Probably >3,000	
Maximum Sustainable Yield (MSY)	3,500 (3,200-3,800)[1]	7,700 (6,100-9,600)[2]

Relative Spawning Stock Biomass			
B_{1999}/B_{1975}	0.19 (0.12-0.31)[1]		0.21 (0.12-0.33)[2]
B_{1999}/B_{MSY}	0.36 (0.28-0.49)[1]		0.10 (0.06-0.14)[2]
Relative Fishing Mortality			
$F_{current}/F_{MSY}$	1.37 (0.96-1.87)[1]		2.22 (1.51-3.32)[2]
$F_{current}/F_{0.1}$		3.71	
$F_{current}/F_{max}$		2.14	

Management Measures in Effect:

- No landing of fish <6.4 kg, with a 15% tolerance, in number [Refs. 74-1, 98-7]
- Limit catches <115 cm (30 kg) to no more than 8% by weight [Refs. 91-1, 98-7]
- TAC of 2,500 MT from 1999 to 2018 including dead discards subject to revisions consistent with the Rebuilding Program [Ref. 98-7].

* Unreported catches not estimated

[1] Median and approximate 80% confidence interval from bootstrapping; assumes a "low recruitment" scenario at high spawning levels.

[2] Median and approximate 80% confidence interval from bootstrapping; assumes a "high recruitment" scenario at high spawning levels.

BLUEFIN TUNA - EAST

BFTE-2. Description of the fisheries

The East Atlantic bluefin fisheries (including the Mediterranean) are characterized by a variety of vessel types and fishing gears with landing sites located in many countries. Therefore, the landing statistics are difficult to obtain, particularly for the East Atlantic and even more so for the Mediterranean. Historical statistics show there were important catches since more than ten centuries ago, with catches of more than 10,000 MT in the past and an average of about 30,000 MT in the 1950-65 period. (**BFT-Table 1** and **BFT-Figure 2**). Certain fisheries, such as the traps (which in the long-term caught about 15,000 MT on average), go back to ancient times. Other fisheries, such as the Mediterranean purse seine fishery mainly emerged in the 1960s. Based on estimates of 1995-2000 catches, the most important catches, were from: longline, traps and baitboat for the East Atlantic; and from purse seine and longline for the Mediterranean; the purse seine fleet accounts for 60-80% of the Mediterranean catch. Additionally, it is suspected that large quantities of undersized fish are caught but not reported.

At the date of the SCRS BFT-meeting, several important fishing countries had not reported Task I for 2000, so that the total landings reported here are likely to significantly increase in the future. In 2000, the preliminary reported landings for the East Atlantic and the Mediterranean amounted to 27,698 MT, which would be less than 1998 and 1999 (37,714 MT and 33,659 MT, respectively). The reported 2000 catch is about half the peak of 52,737 MT in 1996, but it is probably also under-estimated because of increasing uncertainty about catch statistics. The SCRS already raised this point last year, for which unreported catches have been estimated about 3242 MT. The 1999 and 2000 unreported catches remain uncertain. Unreported catches were not estimated for 2000.

In 1999 the SCRS modified the Mediterranean reported catches to take into account revised Turkish catches. Those revisions were estimated from various sources: reports from fishermen associations, canning factory activities and market declarations; the Committee noted that those changes still need to be validated to check for possible double-counting. In 2001, Algeria became a contracting party and revised their catches. Because of substantial changes in the historical data, the SCRS asked for further justification for the period prior to 1998. In the Mediterranean, the total reported catch amounted to 19,405 MT as compared to 24,036 MT in 1999 and 26,813 MT in 1998. It should be noted that the catches attributed to the «nowhere else included» (NEI) category (NEI in **BFT-Table 1**) declined from 1996 to 1998, but are difficult to evaluate in both 1999 and 2000, because of increasing uncertainty about the (1) information from fish fattening operations (cages) and its relationship to reported national statistics and (2) about bluefin import statistics. Nevertheless, trade data from the Bluefin Statistical Document showed a decline in the catch coming from the IUU vessels in 1999 (so that, the NEI catch attributed to IUU subsequently declined in 1999). IUU longline activity seems, however, to be continuing, even during the Mediterranean closed season. The Committee strongly encourages the collection of information on the number, size and origin of fish entering cages, and the Committee stresses again its need to access to this information and to the basic Bluefin Statistical Document data to build a reliable catch database. Most notable is the decrease in the purse seine catches since 1997 (24,178 MT, 20,391 MT, 14,061 MT and 13,302 MT in 1997-2000, respectively). Most of the Mediterranean purse seine catches came from EC-France, EC-Italy, and Turkey, while smaller contributors included Croatia, Spain and Tunisia. Additionally, most of the purse seine catch of fish is being transferred to cages for growing and fattening and this has changed fishing strategies. Meteorological conditions, changes in fishing power, and in stock abundance may be determining factors in the success or failure of the fishing season conducted around the Balearic Islands on large fish.

East Atlantic catches (excluding the Mediterranean) in 2000 (8,272 MT) decreased in comparison to 1998 and 1999 (10,901 MT and 9,560 MT, respectively). The recent catch magnitude was more or less even among the baitboat, longline and trap fisheries. Spain operates baitboat and trap fisheries that account for nearly one-third of the total catches in this area. A similar catch was made by the longline fishery (mostly Japan). Since 1994, the Japanese longliners continue to exploit a new fishing zone in the North Atlantic around 60ºN and 20ºW (including Icelandic waters), in addition to the traditional sectors. The East Atlantic (not including Mediterranean) trap catches in 2000 (1,416 MT) represented about one third of the recent peak of 4,463 MT in 1997.

BFTE-3. State of the stocks

The Committee notes that basic catch statistics are still undergoing revisions by the reporting agencies and, also, the Committee suspects that there has been increased under reporting in the last few years, especially in 1999. Additionally, the CPUE and size data are not available for important fisheries. Thus, the Committee does not have confidence in updating assessments based upon these data. Therefore, the Committee's best determination of the state of the stock is that which was developed in the 1998 report. That discussion of status is repeated below.

An ADAPT VPA assessment was developed with appropriate specifications (given in the 1998 Detailed Report. Results of this assessment differ somewhat from the previous assessment, due, primarily to an abrupt increase of the catches of the spawning aged fish since 1994 and also to the revision of the catch statistics by various countries mentioned above.

After discussion, it was decided to use the natural mortality estimates made for southern bluefin tuna (a similar species) in which natural mortality is age specific as this is thought to be more biologically correct.

The assessment indicates a strong decline in number and biomass of older fish (spawning stock) since 1993. This corresponds with an the increase in fishing mortality rates **(BFT-Figure 7)**. The decline in spawning stock (biomass and number of fish) beginning in 1993 followed a period of relatively stable abundance in the 1980's. There appears to have been a general trend of increasing recruitment in the early 1980's followed by a period without trend **(BFT-Figure 7)**. Fishing mortality rates for all ages are estimated to have increased during the 1970-1997 period, particularly in the most recent years for the older age groups **(BFT- Figure 7)**. Estimates in recent years should be judged with caution since such VPA estimates are generally imprecise.

The Committee recognizes that many of the inputs to the assessment are uncertain. These include doubts about the historical catches, the absences of size composition for many fisheries, the amount of mixing with the West stock, and the unknown accuracy of abundance indices available for model specifications. These uncertainties make it easier to interpret trends in relative abundance rather than absolute levels of the stock.

BFTE-4 Outlook

For the reasons noted in the status of stock section, the Committee's outlook on future conditions of the stock are best expressed using the 1998 analyses.

In 1998 projections were made assuming that future recruitment would vary around recent levels. Since the Committee was unable to identify adequate assumptions about the relationship between stock size and recruitment, projected recruitments were obtained by sampling from the bootstrap estimates of recruitment from the period 1980 to 1997. It should be noted that incomplete catch data from the period prior to 1950 might indicate that there have been periods in the past with very different levels of recruitment from that at present. Therefore, one should be cautious when making long term projections, especially if spawning stock biomass falls below historically observed levels. For these reasons the Committee focused the projections on the short term trends in abundance and mortality rate in relation to the Commissions recommendation for catch reduction.

Catch projections **(BFT-Figure 8)** were made for the East Atlantic using approximately 43,000 MT (the 1994-1997 average), 33,000 MT (75% of the 1994-1997 average) and 25,000 MT (as recommended in 1996). The projections indicate that the current catch level is not sustainable, and a reduction to 75% of the 1994 level is not sufficient to halt a continuing decline in spawning stock biomass. A catch of 25,000 MT halts the decline in spawning stock biomass in the medium term, but spawning stock biomass is not expected to return to historic levels. If spawning stock biomass falls below the 1997 level, the validity of the projections might be questioned since they used high recent estimates of recruitment which might no longer be appropriate. If future recruitment were to be reduced and fishing mortality were to remain at current levels then declines in spawning stock biomass would be expected.

When making decisions on these projections, the Commission should be aware that assessments (including those reported here) are inherently uncertain. Many sources of uncertainty are considered in the 1998 Detailed Report.

The Committee continues to be concerned about the intensity of fishing pressure on small fish. This contributes substantially to growth over-fishing, and it seriously reduces the long term potential yield from the resource. Additionally, recent abrupt increase of catches of large fish is of grave concern.

BFTE-5. Effect of current regulations

A regulatory recommendation stating that Contracting Parties should limit the fishing mortality to recent levels came into force in 1975 for one year and was extended indefinitely in 1982 for the East Atlantic. Fishing mortality rates have exceeded that of 1974 levels in most years **(BFT-Figure 7)**.

The Commission recommended in 1998 that bluefin tuna catches in the East Atlantic Ocean and Mediterranean Sea should be reduced to 32,000 MT in 1999 and 29,500 MT in the year 2000. This recommendation entered into force in August, 1999 with exceptions noted for Morocco and Libya. Catches in 1999 were 31,487 MT (including SCRS estimates of unreported catches from the Bluefin Statistical Document Program **BFT-Table 1**). Note that there were unprecedented large quantities of these unreported catches (3,387 MT).

In 1975, a minimum size of 6.4 kg with a 15% tolerance, in number of fish, was recommended for the entire Atlantic (including the Mediterranean). The 6.4 kg size regulation had been poorly enforced for the East Atlantic and Mediterranean fisheries. Subsequently the Commission established a minimum size with no tolerance of 1.8 kg (prohibition of retention, landing and sale). This was amended by the Commission to 3.2 kg in 1998 to be implemented in 1999. While it is known that catches of age 0 fish (< 1.8 kg) are still occurring, the Committee does not have sufficient catch at size data to fully evaluate this. Clearly catches of age 0 fish are under-reported.

There is a regulation which entered into force on 1 June 1994 which prohibits large pelagic longliners of more than 24 m in length from fishing in the Mediterranean during the months of June and July. The objective of this regulation is to limit fishing mortality. Various measurements taken by ICCAT to curb IUU fishing activities (such as market-related measures, monitoring transfer of catches of IUU, etc.) appear to be having some positive effects as seen in the decline in bluefin tuna imports to the Japanese market from IUU fishing vessels.

In 1999 the prohibition of purse seine fishing in the Mediterranean (except for the Adriatic) was amended to include the period from 16 July through 15 August. Additionally, purse seining in the Adriatic was prohibited for the month of May. Both prohibitions were designed to protect juveniles. The Committee is not yet able to evaluate the effect of these new measures. However, reservations on the effects of this system were expressed. It seems, however, that the previous closure (for the month of August in the Mediterranean) was being adhered to. In 1997 the Commission prohibited the use of airplanes or helicopters supporting fishing operations in the Mediterranean in the month of June. It is unclear whether this measure is or could be enforced.

BFTE-6. Management recommendations

The Committee strongly notes its concern about the quality of the catch, effort and catch at size data available to conduct quantitative assessments for East Atlantic (and Mediterranean) bluefin tuna now and in the future. Until such time as there is improvement, the Committee's best scientific advice for management is to continue under the recommendations expressed by the Committee in previous reports. That advice is repeated below.

The Committee expressed concern about the status of East Atlantic bluefin tuna resources in the light of assessment results and the historically high catches made in 1996-1997 (in excess of 50,000 MT). Analyses indicate that future catch levels of 33,000 MT, or more, are not sustainable **(BFT-Figure 8)**. Catches of 25,000 MT or less would halt the decline of biomass. It should be noted that even these results may be optimistic since they assume that future recruitment continues at the average level observed since 1981. When making decisions based on these projections, the Commission should be aware that there are many sources of uncertainty (which are discussed in the 1998 Detailed Report). Given the large changes in catches in recent years, combined with the results of the 1998 analyses, the Committee maintains that a 35% reduction in catches from the 1993 to 1994 levels (i.e., to about 25,000 MT) would be necessary to prevent further decline of stock. The Committee remains concerned about the high catch of small individuals and recommends that every effort be made so that the current measures on the size limit of 6.4 kg be adhered to. The Committee reiterated that effective measures be taken to avoid catches of age 0 fish (<1.8 kg) (amended by the Commission in 1998 to "fish less than 3.2 kg"), and not allow any tolerance with respect to the percentage (in number) of age 0 fish in the landings. Because there are big differences between the size of the western and eastern Atlantic bluefin tuna stocks, mixing is likely to influence these two management units differently. Fisheries in the East Atlantic could thus adversely affect the recovery in the West Atlantic if a significant proportion of the western spawners migrate from West to East, and then harvested before returning to the West.

At the year 2000 meeting the Committee noted that a quantitative assessment was not done due to the large uncertainties in the data. This is still a serious concern in 2001 in the absence of Task I data and farming statistics, and due to the possibility of unreported catches. These uncertainties will undoubtedly influence the type of advice

provided to the Commission in the future. Nevertheless, the Commission should consider practical management measures that would be appropriate even when there is a lack of data. The Committee considers that significant enforcement of the controls of catches of undersized fish both at landing the sites and at the market could be such a measure.

EAST ATLANTIC AND MEDITERRANEAN BLUEFIN TUNA SUMMARY

Current (2000) Catch*	27,698 MT
1997 Sustainable Yield	About 25,000 MT
Maximum Sustainable Yield (MSY)	Not estimated
Relative Spawning Stock Biomass	$(SSB_{1997}/SSB_{1970}) = 0.19$
Relative Number	$N_{1997}/N_{1970} = 0.65$ (ages 8+)

Management Measures in Effect

- No landing of fish <6.4 kg, with a 15% tolerance in # of individuals [Ref. 74-1]
- Fishing mortality not to exceed circa 1975 level [Ref. 74-1]
- No longlining in Med. in June- July by vessels>24 m [Ref. 93-7]
- No purse seining in Adriatic in May [Ref. 98-6]
- No purse seining 16 July-15 August, in Med., except in the Adriatic [Ref. 96-2]
- No use of spotter helicopter or plane in Med., in June [Ref. 96-2]
- 32,000 MT quota in 1999, and 29,500 MT quota in 2000 and 2001 (with exceptions for Morocco and Libya) [Refs. 98-5; 00-09]
- No landing, retaining aboard or selling of fish <3.2 kg [Ref. 98-4]

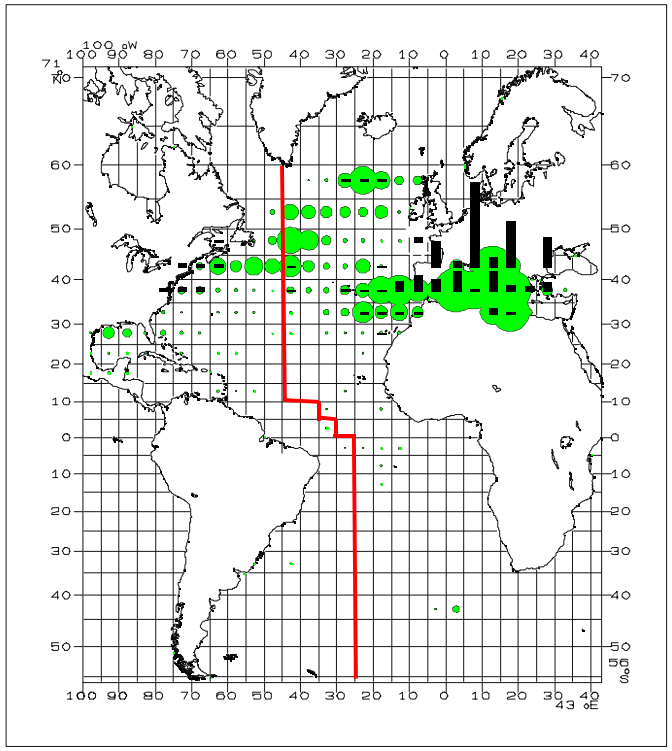
* Unreported catches not estimated for 2000.
Taking into account declarations received after 5 Oct 2001, the current 2000 catch is estimated at 31,935 MT.

BFT-Table 1. Estimated catch and landings (in MT) of northern bluefin tuna in 1976-2000*, by major area, gear and flag.

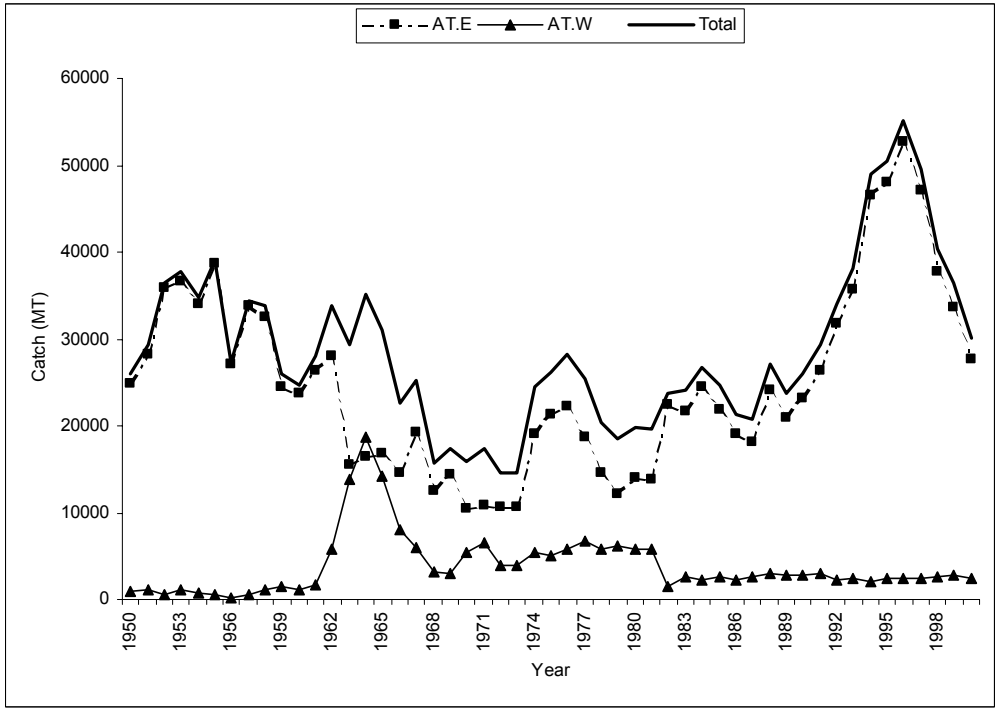
			1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	TOTAL	*(incl. discards)*	*28168*	*25468*	*20408*	*18478*	*19904*	*19616*	*23820*	*24202*	*26717*	*24647*	*21373*	*20757*	*27029*	*23745*	*25949*	*29287*	*34063*	*38082*	*49014*	*50443*	*55232*	*49510*	*40365*	*36433*	*30094*
		AT.E+MED	22285	18774	14645	12223	14103	13845	22375	21660	24425	21962	19051	18196	24117	20951	23144	26306	31778	35703	46570	48003	52737	47170	37714	33659	27698
		AT.W	5883	6694	5763	6255	5801	5771	1445	2542	2292	2685	2322	2561	2912	2794	2805	2981	2285	2379	2114	2440	2495	2340	2651	2774	2395
		UNCL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	330	0	0	0	0	0	
Landings	AT.E+MED	Bait boat	1803	2881	3904	2128	1874	1653	1010	3032	4647	2644	2253	2128	2682	2683	2018	1796	1624	4048	2285	3299	5362	3542	2787	1590	2014
		Longline	3291	2445	912	970	1255	917	4255	3606	2734	1763	1448	1703	2396	1974	2439	5999	6324	6516	9535	13632	14934	10239	6760	9520	6660
		Other Surf.	253	254	205	230	640	941	551	808	1960	3352	3666	3119	3344	3596	1474	1544	2451	2602	2742	1387	1470	1067	1242	1385	1411
		Purse seine	14830	10989	7556	6369	8978	8795	12786	10746	10302	11305	9621	8857	11198	9450	11284	13236	18242	19299	26006	24046	26344	25006	21608	15843	14566
		Sport	100	488	610	1176	105	93	100	194	275	508	323	436	839	459	1553	738	951	1237	2257	3556	2105	2468	1188	1610	822
		Traps	2008	1717	1458	1350	1251	1446	3673	3274	4507	2390	1740	1953	3658	2789	4376	2993	2186	2001	3745	2083	2522	4848	4129	3711	2224
	AT.W	Longline	3066	3752	3217	3691	3972	3879	363	829	835	1245	764	1134	1373	678	739	895	674	696	538	466	528	382	764	914	589
		Other Surf.	311	194	191	196	131	133	323	514	377	293	166	156	425	755	536	578	509	406	307	384	433	295	344	281	283
		Purse seine	1582	1502	1230	1381	758	910	232	384	401	377	360	367	383	385	384	237	300	295	301	249	245	250	249	248	275
		Sport	752	874	904	956	893	808	459	808	676	750	518	726	601	786	1004	1083	586	854	804	1114	1028	1179	1106	1123	1120
		Traps	172	372	221	31	47	41	68	7	3	20	0	17	14	1	2	0	1	29	79	72	90	59	68	44	16
	UNCL	Other Surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	330	0	0	0	0	0	
Discards	AT.W	Longline	0	0	0	0	0	0	0	0	0	0	514	161	116	175	140	188	215	99	85	155	167	161	117	163	113
		Other Surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	4	0	0	0	
		Sport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	3	0	
Landings	AT.E+MED	ALGERIE	49	40	20	150	190	220	250	252	254	260	566	420	677	820	782	800	1104	1097	1560	156	156	157	1947	2142	2330
		CAP-VERT	0	0	0	0	0	0	0	10	1	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	0	0	0	0	0	0	0	0	97	137	93	49	85	103	80
		CHINESE TAIPEI	3	2	0	3	5	6	16	2	0	0	0	0	0	0	0	0	0	334	729	502	472	504	456	249	313
		CROATIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1418	1076	1058	1410	1220	1360	1105	906	970	
		CYPRUS	0	0	0	0	10	10	10	10	10	10	10	10	10	10	10	10	10	14	10	10	10	10	21	31	61
		EC-DENMARK	3	1	2	1	0	3	0	0	1	2	1	0	0	0	0	0	0	37	0	0	0	0	1	0	
		EC-ESPANA	2255	3072	4190	3656	2468	2601	3813	5257	7547	5090	3577	3654	5995	5210	5379	3664	4532	7096	5878	8426	8762	8047	5800	5358	6246
		EC-FRANCE	4067	3774	2320	1853	1961	2503	5028	4060	4202	5920	3838	4863	6504	4894	5223	5185	8270	8094	12179	10329	9690	8470	7713	6741	7321
		EC-GER.F.R.	0	0	1	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		EC-GREECE	0	0	0	0	0	0	5	0	0	11	131	156	159	182	201	175	447	439	886	1004	874	1217	286	248	
		EC-IRELAND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	21	52	
		EC-ITALY	10369	6263	4983	4020	6272	6017	6658	5865	7140	7199	7576	4607	4201	4317	4110	3783	5005	5328	6882	7062	10006	9548	4059	3278	3845
		EC-PORTUGAL	24	14	56	35	24	17	41	174	34	29	193	163	48	3	27	395	358	208	668	481	473	749	377	487	502
		EC-SWEDEN	8	2	2	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
		EC-U.K	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	12	
		FAROE-ISLANDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	67	104	118
		ICELAND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	27	
		ISRAEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	
		JAPAN	2941	2114	638	729	999	615	3534	3286	2550	1426	1080	1180	1427	965	1636	3066	3473	3277	2611	4784	4106	3090	3556	3071	3031
		KOREA	3	2	0	1	0	0	0	3	0	77	0	0	0	0	0	0	0	0	688	663	683	613	66	0	21
		LIBYA	799	336	677	424	398	271	310	270	274	300	300	300	300	84	258	290	650	546	1332	1500	1308	1029	1331	1195	1549
		MALTA	25	47	26	23	24	32	40	31	21	21	41	36	24	29	48	63	48	151	343	353	243	249	244	269	
		MAROC	332	891	36	208	161	179	993	366	175	98	344	472	577	746	1557	1456	767	494	1812	1713	1621	2603	2430	2227	
		NEI-1	0	0	0	0	0	0	1	0	25	3	172	183	638	763	415	1754	1349	1624	0	0	0	0	0	0	
		NEI-105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	240	1990	362	368	0	
		NEI-134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	145	398	0	0	0	0	

			1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
		NEI-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	49	49	0	0	0	0	0	0	0	
		NEI-71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	85	144	223	68	0	0	0	0	0	
		NEI-81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	300	71	904	267	76	
		NEI-94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	66	0	
		NEI-COMB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1803	1088	392	666	0	3242	
		NORWAY	529	764	221	60	282	161	50	1	243	0	31	0	0	0	0	0	0	0	0	0	0	0	0	5	
		PANAMA	69	212	156	14	117	48	12	0	17	22	11	76	67	0	74	287	484	467	1500	1517	3400	491	0	13	
		SIERRA LEONE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	93
		TUNISIE	66	131	141	262	228	218	298	293	307	369	315	456	624	661	406	1366	1195	2132	2503	1897	2393	2200	1745	2352	2184
		TURKEY	181	177	127	27	391	565	825	557	869	41	69	972	1343	1707	2059	2459	2817	3084	3466	4220	4616	5093	5899	1407	
		U.S.A	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		YUGOSLAVIA	562	932	1049	756	573	376	486	1222	755	1084	796	648	1523	560	940	0	0	0	0	0	0	0	0	0	
		YUGOSLAVIA REP. FED.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	0	0	0	4
	AT.W	ARGENTINA	0	0	0	0	0	0	0	0	0	6	0	2	0	1	2	0	0	0	0	0	0	0	0	0	
		BRASIL	0	0	14	10	2	3	1	1	0	1	0	2	0	2	1	0	0	0	0	0	0	0	0	13	0
		CANADA	846	972	670	245	324	425	291	433	264	142	41	50	393	619	438	485	443	459	392	576	597	503	595	576	549
		CANADA-JPN	0	0	0	0	0	0	0	0	0	0	32	33	0	0	0	0	0	0	0	0	0	0	0	0	
		CHINESE TAIPEI	0	1	1	49	15	7	11	2	3	3	3	0	0	0	0	0	0	0	0	0	0	2	0	0	0
		FRANCE. OT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
		JAPAN	2902	3658	3144	3621	3936	3771	292	711	696	1092	584	960	1109	468	550	688	512	581	427	387	436	322	691	365	492
		KOREA	7	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		MÉXICO	37	14	28	22	10	20	14	0	0	0	0	0	0	0	0	0	0	0	4	0	0	2	8	14	29
		NEI-1	0	0	0	0	0	0	14	1	0	0	0	0	0	30	24	23	17	0	0	0	0	0	0	0	
		NEI-31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	
		NEI-81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	429	
		PANAMA	157	92	58	10	9	14	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		POLAND	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		ST.LUCIA	0	0	0	0	0	0	0	0	0	0	0	1	3	2	14	14	14	2	43	9	3	0	0	0	
		TRINIDAD & TOBAGO	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		U.S.A	1931	1956	1848	2297	1505	1530	807	1394	1320	1424	1142	1352	1289	1483	1636	1582	1084	1237	1163	1311	1285	1334	1235	1212	1212
		UK-BERMUDA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	2	1	1
		URUGUAY	0	0	0	0	0	1	3	0	9	16	6	0	2	0	0	1	0	1	0	2	0	0	0	0	
	UNCL	G.CONAKRY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	330	0	0	0	0	0	
Discards	AT.W	CANADA	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	6	16	11	46
		JAPAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	
		U.S.A	0	0	0	0	0	0	0	0	0	0	514	161	116	175	140	188	215	99	85	155	171	161	104	152	67

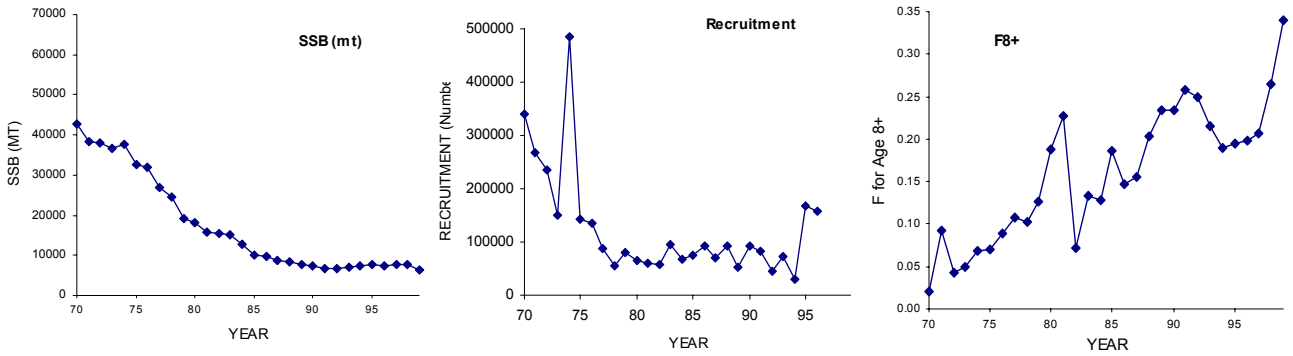
* As of 5 October 2001. Subsequently, catches were reported for 2000 in the Mediterranean by Croatia (930 MT), Malta (376 MT), Morocco (695 MT), and in the eastern Atlantic by EC-Ireland (24 MT), Morocco (2228 MT) and Korea (6 MT). Inclusion of these in the total for the eastern Atlantic-Mediterranean stock would bring the 2000 catch estimate to 31,935 MT.
Empty cells for 2000 indicate that catches were not reported to ICCAT and/or no estimates of unreported catches were made.



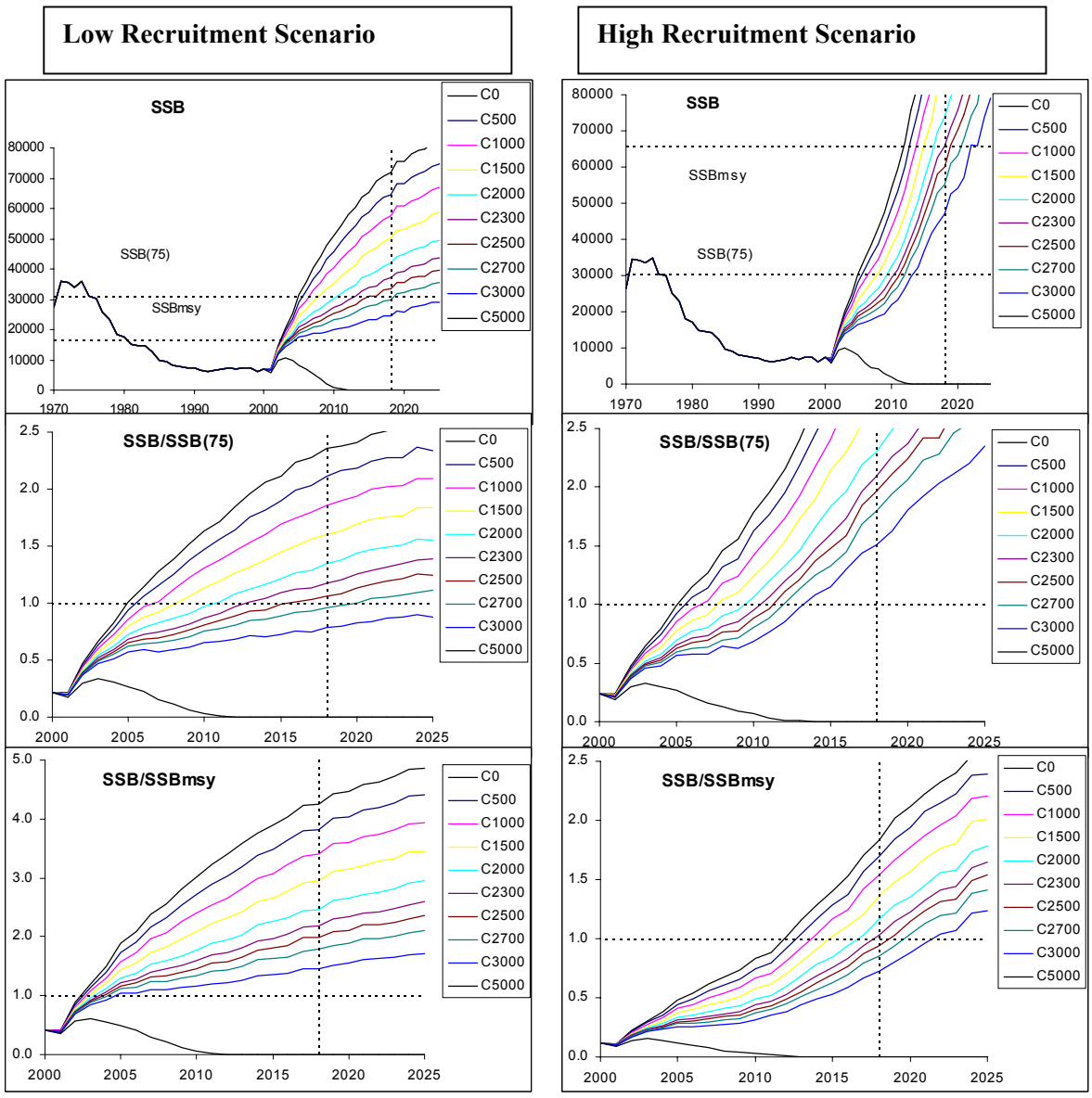
BFT-Fig. 1. Distribution of Atlantic bluefin catches by longline (circles) and surface gears (bars) for the period 1990-1997. The assumed boundary between east and west stocks is also shown.



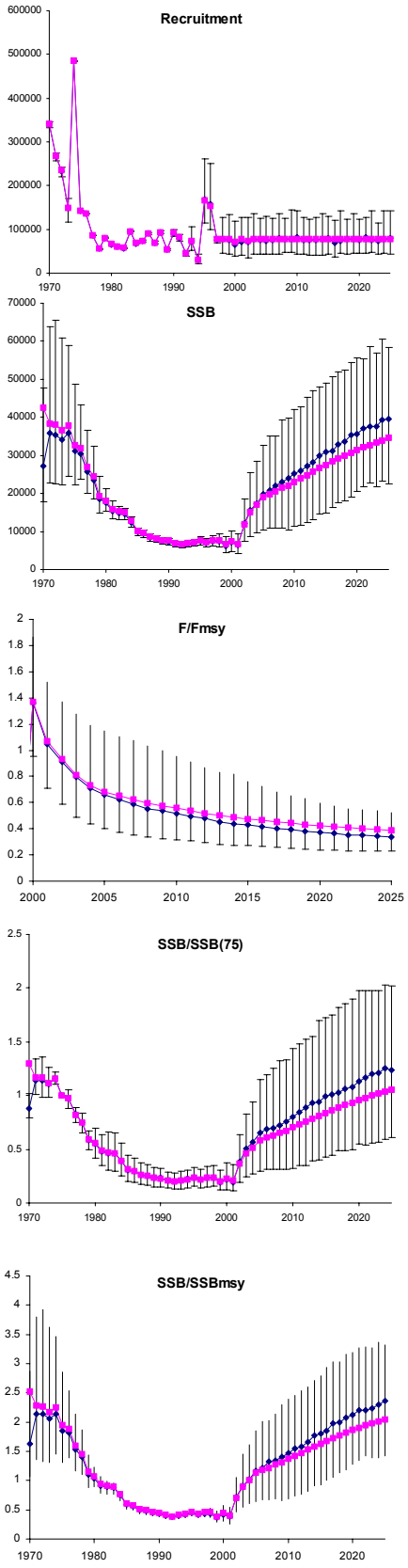
BFT-Fig. 2. Atlantic bluefin catches (including discards) by region. Unreported catches for 2000 were not estimated.



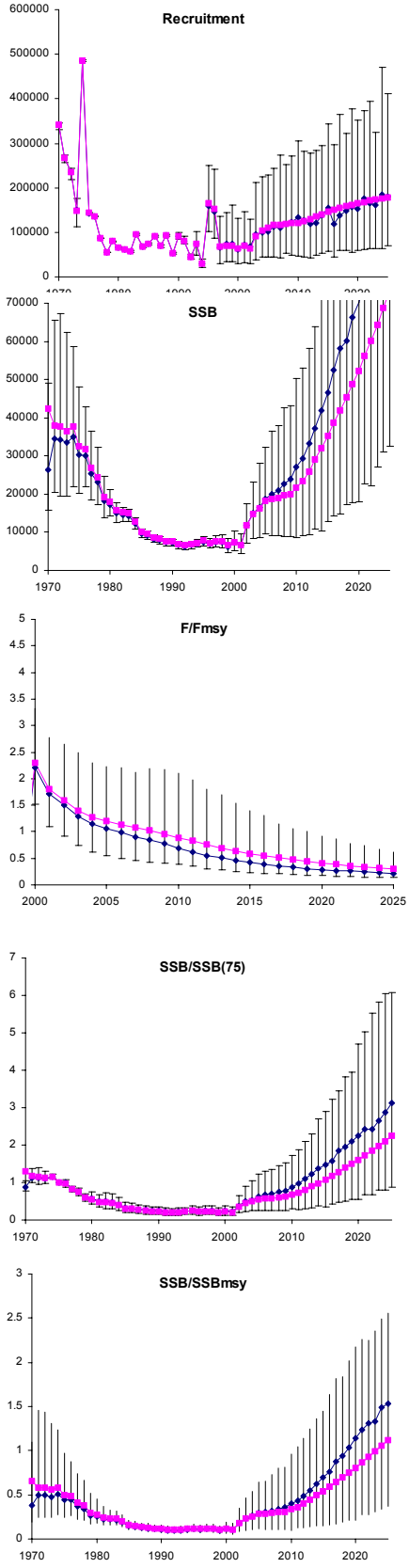
BFT-Fig. 3. West Atlantic bluefin tuna spawning biomass (MT), recruitment (numbers) and fishing mortality rates for fish of age 8+, estimated by the base case VPA run.



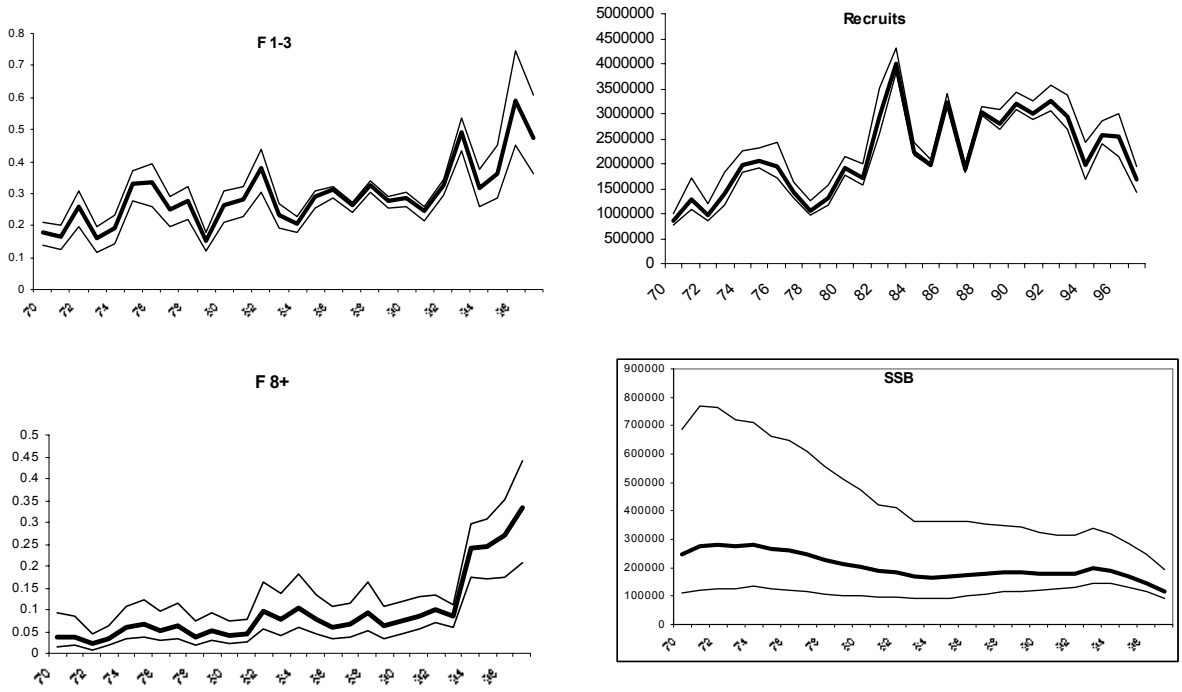
BFT-Fig. 4. Median projections of spawning biomass (SSB) with various levels of constant annual catches for west Atlantic bluefin, expressed in absolute terms, relative to 1975 levels, and relative to estimates of B_{MSY} from the Low (left) and High (right) Recruitment Scenarios.



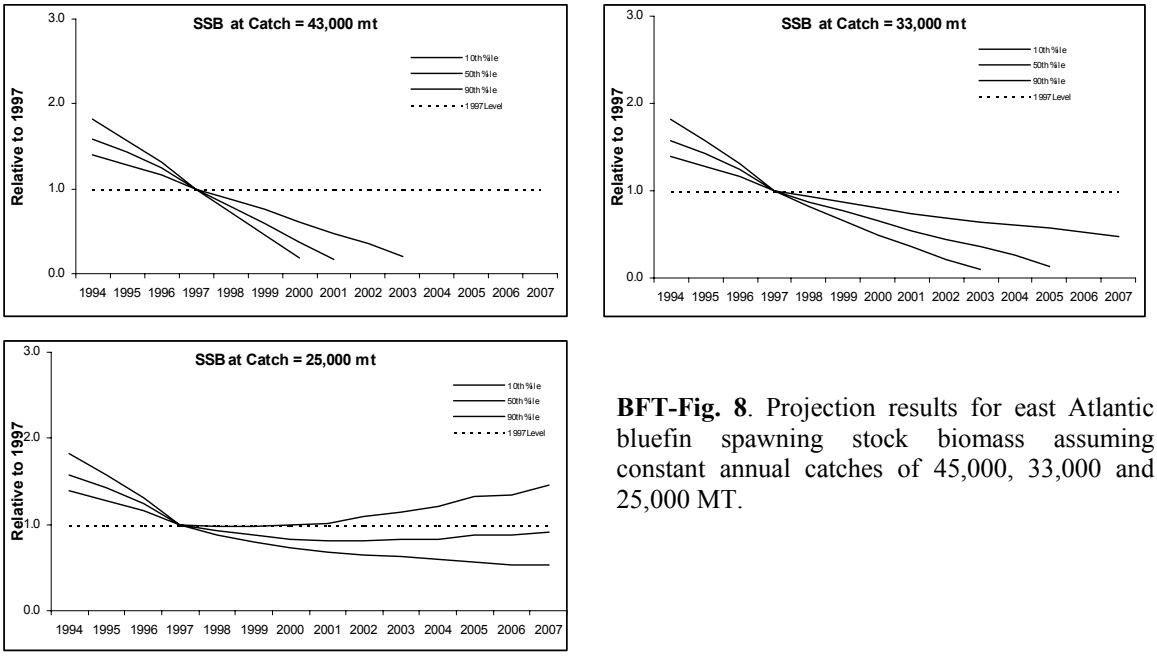
BFT-Fig. 5. Deterministic (squares) and median (diamonds) projection results with 80% confidence intervals for the base case **Low Recruitment** Scenario for west Atlantic bluefin (with 2,500 MT constant annual catches) for recruitment, spawning stock biomass (SSB), F/F_{MSY}, SSB/SSB_{75}, and SSB/SSB_{MSY}.



BFT-Fig. 6. Deterministic (squares) and median (diamonds) projection results with 80% confidence intervals for the base case **High Recruitment** Scenario for west Atlantic bluefin (with 2,500 MT constant annual catches) for recruitment, spawning stock biomass (SSB), F/F_{MSY}, SSB/SSB_{75}, and SSB/SSB_{MSY}.



BFT-Fig. 7. Estimates of fishing mortality rates (ages 1-3 and 8+), recruitment and spawning stock biomass (SSB) obtained by the base case VPA run for east Atlantic bluefin.



BFT-Fig. 8. Projection results for east Atlantic bluefin spawning stock biomass assuming constant annual catches of 45,000, 33,000 and 25,000 MT.

7.6 BUM - BLUE MARLIN

No new blue marlin assessments were conducted in 2001 and for this reason only the biology, description of fisheries and effect of recent regulations sections have been reviewed and updated..

BUM-1. Biology

Blue marlin are found throughout tropical and temperate waters of the Atlantic Ocean and adjacent seas, and range from Canada to Argentina on the western side, and from the Azores to South Africa on the eastern side **(BUM-Figure 1)**. Blue marlin are large apex predators with an average weight of about 100-175 kg. Blue marlin have an extensive geographical range, migratory patterns that include trans-Atlantic as well as trans-Equatorial movements, and are generally considered to be a rare and solitary species relative to the schooling scombrids. Blue marlin are considered sexually mature by ages 2-4, spawn in tropical and subtropical waters in the summer and fall, and are found in the colder temperate waters during the summer. Young blue marlin are one of the fastest, if not the fastest growing of all teleosts, reaching from 30-45 kg by age 1. Females grow faster and reach a much larger maximum size than males.

Blue marlin feed on a wide variety of fish and squid, but show a dietary preference for scombrids. They are found predominately in the open ocean near the upper reaches of the water column and are caught most frequently as a by-catch by the offshore longline fisheries which target tropical or temperate tunas using gears intended to fish shallow. However, significant by-catch landings are also made by offshore longline fisheries that target swordfish and bigeye tuna using gear intended to fish deep.

Prior to 1995, the stock hypotheses for assessment purposes has historically been a North Atlantic and South Atlantic stock (divided at 5°N), and a total Atlantic stock. However, the 1995 SCRS recognized the increased importance of the single Atlantic hypothesis for blue marlin. More recently (1996), the Committee reviewed and discussed new data on genetic mitochondria DNA analysis, as well as tag release-recapture data, and concluded that these data were most consistent with a single (total) Atlantic hypothesis. Additionally, the Committee concluded that the North/South separation is arbitrary for this tropical species (as with white marlin). The Fourth Billfish Workshop reviewed all available data on stock structure and concluded that the single Atlantic hypothesis should be used as the management unit for Atlantic blue marlin.

BUM-2. Description of the fisheries

The fisheries for Atlantic blue marlin are characterized by many different participants. The major landings of blue marlin are incidental to the large offshore longline fisheries that have targeted tuna and swordfish, including Brazil, Cuba, Japan, Korea, Chinese Taipei, and others. Other major fisheries are the directed recreational fisheries of the United States, Venezuela, Bahamas, Brazil, and many other countries and entities in the Caribbean Sea and off the West coast of Africa. Other directed fisheries include artisanal fisheries in the Caribbean Sea and off West Africa. Development and geographical expansion of other longline fisheries that take blue marlin in the West Atlantic, Caribbean Sea, and east and south Atlantic by various countries have been reported (mainly Spain and the U.S. for East and West Atlantic, respectively). Tropical purse seine fisheries also have an incidental catch of blue marlin.

Landings for the total Atlantic first developed in the early 1960s, reached a peak of over 9,000 MT in 1963, declined to the range of about 2,000-3,000 MT during the period 1967-1977, and have fluctuated with an increasing trend over the period 1978-1996, and a decreasing trend thereafter **(BUM-Table 1 and BUM-Figure 2)**. The 2000 reported catches (3,155 MT) are incomplete. The general trends in catches have followed the intensity of the offshore longline fisheries.

BUM-3. State of the stock

The 1996 blue marlin assessment indicated that in the mid-1990s biomass was about 25% of B_{MSY}, that fishing mortality was about 3 times F_{MSY}, and that over-fishing had been occurring for about three decades. MSY was estimated to be near 4,500 MT.

An assessment was carried out in 2000 using similar methods to the previous assessment, but with data sets that had been revised extensively in response to concerns raised since the 1996 assessment. The assessment might reflect a retrospective pattern wherein improvement in estimated biomass ratios result in estimated lower productivity. The new assessment is slightly more optimistic; it suggests that the total Atlantic stock is approximately 40% of B_{MSY}

and that over-fishing has taken place in the last 10-15 years **(BUM-Figures 3, and 4)**. But this assessment also suggests a less productive stock than previously estimated, with an MSY of about 2,000 MT, and a current fishing mortality that is about four times higher than F_{MSY}.

For the assessment, the Committee considered a range of models and data sets, including cases in which much of the historical data were disregarded or downweighted. While the sensitivity analyses were not meant to quantify possible biases, the committee notes that many of the sensitivity runs provided more optimistic results than those reported above, with stock estimates somewhat closer to B_{MSY} levels. However, most of the sensitivity results were within the range of uncertainty reported for the assessment. Thus, there is uncertainty in the assessment related to the historical data that is not well quantified. The Committee notes that the historical catch and effective fishing effort data must be validated and focused research be conducted before such uncertainties can be reduced. To address these uncertainties would require a substantial research investment in historical data validation efforts and in biological investigations of the habitat requirements of blue marlin.

BUM-4. Outlook

Blue marlin landings declined in 1999 by 14% from the 1996 level. As noted, there is uncertainty in the assessment related to the historical data that is not well quantified. However, given that the new assessment estimates that over-fishing is still occurring and that productivity (MSY and stock's capacity to replenish) is lower than previously estimated, it is expected that landings of the magnitude contemplated by the 1996 Commission Recommendation will continue to result in over-fishing of the stock beyond the MSY level. Information is not yet available to evaluate the effects of regulations agreed to in 2000.

BUM-5. Effect of current regulations

ICCAT resolved at its 1997 meeting to reduce marlin landings by at least 25% from 1996 levels and these regulations extended through 2000. The annual amount of blue marlin that can be harvested in years 2001 and 2002 by pelagic longline and purse seine vessels and retained for landing must be no more than 50% of the 1999 landing levels. In 2000, the Commission also recommended that a blue marlin minimum size be established by recreational fisheries, (e.g 251 cm LJFL). Also, all blue marlin brought to pelagic longline and purse seine vessels alive shall be released in a manner that maximizes their survival. Some countries already acted on these recommendations. Information is not yet available to evaluate the effects of regulations agreed to in 2000.

BUM-6. Management recommendations

The current assessment indicates that the stock is unlikely to recover if the landings contemplated by the 1996 Commission Recommendation continue into the future. While there is additional uncertainty in stock status and replacement yield estimates not reflected in bootstrap results, these uncertainties can only be addressed through substantial investment in research into habitat requirements of blue marlin and further verification of historical data. The Committee recommends that the Commission take steps to reduce the catch of blue marlin as much as possible. Steps such as release of live fish from fishing gear, reductions in fleet-wide effort, a better estimation of dead discards, and establishment of time area closures, along with scientific observer sampling for verification could be considered.

ATLANTIC BLUE MARLIN SUMMARY[1]

	Total Atlantic
Maximum Sustainable Yield (MSY)	~ 2,000 MT (~ 2,000 - 3,000 MT)[2]
1999 Yield[3]	3,833 MT
Current (2000) Yield[4]	3,155 MT
1999 Replacement Yield	~ 1,200 MT (~ 840 - 1,600 MT)[2]
Relative Biomass (B_{2000}/B_{MSY})	~ 0.4 (~ 0.25 - 0.6)[2]
Relative Fishing Mortality (F_{1999}/F_{MSY})	4.0 (~ 2.5 - 6.0)[2]

Management Measures in effect

- Reduced pelagic longline and purse seine landings to 50% of 1999 levels [Ref. 00-13][5]

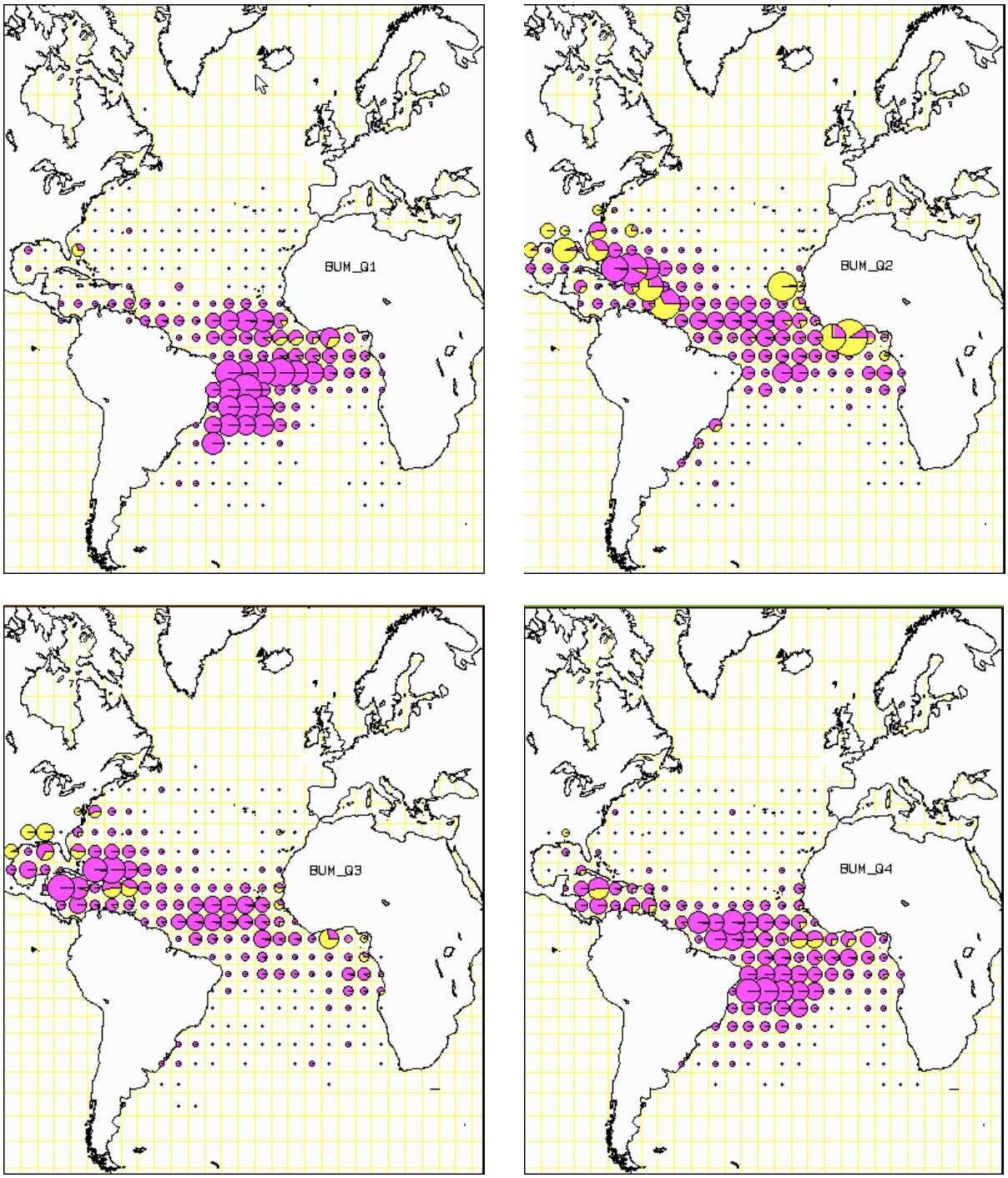
1 Approximately 80% CI from bootstrap for ASPIC model.
2 Uncertainty in these estimates is not fully quantified by bootstrapping.
3 Estimated yield including that carried over from previous years.
4 Current Yield (2000) incomplete.
5 These measures did not take effect until mid-2001.

BUM-Table 1. Estimated catches (landings and discards, MT) of Atlantic blue marlin in 1976-2000*, by major area, gear and flag.

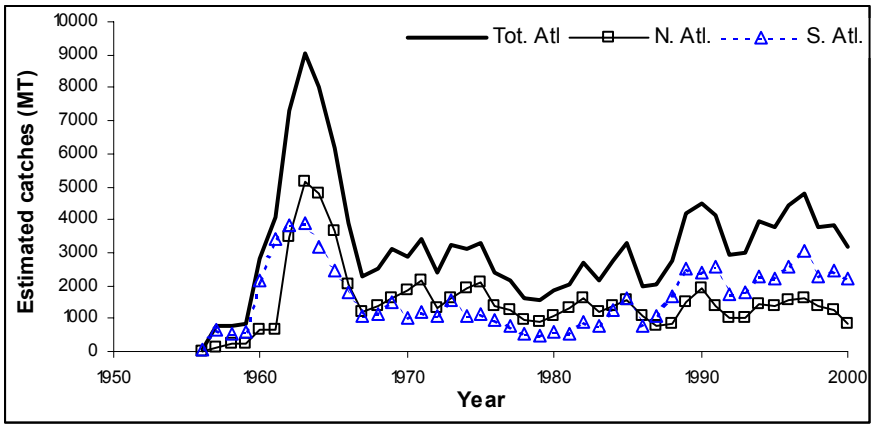
			1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
TOTAL			*2419*	*2181*	*1642*	*1527*	*1847*	*2032*	*2708*	*2130*	*2748*	*3311*	*1993*	*2053*	*2736*	*4214*	*4519*	*4128*	*2952*	*3001*	*3927*	*3800*	*4435*	*4817*	*3783*	*3833*	*3155*
		AT.N	1366	1255	976	890	1075	1288	1644	1209	1374	1561	1063	755	836	1484	1917	1388	1020	995	1448	1391	1584	1628	1354	1254	818
		AT.S	944	792	530	504	619	567	884	749	1252	1623	789	1085	1690	2530	2378	2580	1750	1797	2303	2230	2599	3073	2299	2470	2197
		UNCL	109	134	136	133	153	177	180	172	122	127	141	213	210	200	224	160	182	209	176	179	252	116	130	109	140
Landings	AT.N	Longline	978	876	553	480	643	792	1162	809	920	1223	695	327	413	1009	1596	981	629	600	1046	923	1256	1223	914	795	528
		Other Surf.	0	0	0	0	0	0	1	2	1	0	0	0	22	99	13	28	26	24	58	83	71	148	261	208	13
		Sport	268	298	301	299	301	300	299	199	206	169	214	146	157	125	45	56	73	89	106	67	52	43	44	33	20
		Unclass.	120	81	122	111	131	196	182	199	247	169	154	188	156	94	120	193	200	190	152	208	134	142	87	140	197
	AT.S	Longline	933	739	526	490	498	430	822	533	975	1362	661	964	1530	2017	1958	2280	1473	1415	1643	1565	1991	2250	1517	1564	1347
		Other Surf.	11	52	2	13	119	135	60	216	276	260	127	121	159	512	418	237	208	381	658	663	605	718	634	904	850
		Sport	0	1	2	1	2	2	2	0	1	1	1	0	1	1	2	1	0	1	2	2	2	28	0	0	0
		Unclass.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62	69	0	0	0	0	35	146	0	0
	UNCL	Longline	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	37	19	9
		Other Surf.	109	134	136	126	144	169	174	167	118	122	135	132	137	145	199	138	116	147	134	127	97	82	80	83	125
		Sport	0	0	0	0	0	0	0	0	0	0	0	35	29	18	5	7	10	24	16	10	22	9	11	5	6
		Unclass.	0	0	0	7	9	8	6	5	4	5	6	2	6	3	3	3	2	3	1	0	8	0	0	0	0
Discards	AT.N	Longline	0	0	0	0	0	0	0	0	0	0	0	94	88	157	143	130	92	92	86	111	71	72	47	79	59
		Unclass.	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
	AT.S	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	42	2	2	0
	UNCL	Longline	0	0	0	0	0	0	0	0	0	0	0	44	36	34	16	12	54	35	25	42	125	25	2	2	0
Landings	AT.N	BARBADOS	120	81	72	51	73	117	99	126	126	10	14	13	46	3	18	12	18	21	19	31	25	30	0	0	19
		BRASIL	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
		CANADA-JPN	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
		CHINA.PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41	48	41	51	79	133	9
		CHINESE TAIPEI	169	64	81	51	160	98	100	125	102	148	117	52	26	11	937	716	336	281	272	187	170	355	80	44	43
		CUBA	250	220	97	156	162	178	318	273	214	246	103	68	94	74	112	127	135	69	39	85	43	0	0	0	
		EC-ESPANA	0	0	0	0	0	0	0	0	3	4	1	0	8	7	2	1	7	7	6	0	22	5	6	3	25
		EC-PORTUGAL	0	0	0	0	0	0	1	2	1	8	12	8	2	1	1	4	2	15	11	10	7	3	47	8	15
		GRENADA	0	0	0	0	1	1	12	6	8	11	36	33	34	40	52	64	52	58	52	50	26	47	47	100	100
		JAMAICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	0	0	
		JAPAN	260	118	54	68	193	332	637	192	351	409	174	78	206	593	250	145	193	207	532	496	798	625	656	489	336
		KOREA	174	307	185	67	48	71	19	43	110	154	36	13	14	252	240	34	11	2	16	16	41	16	0	0	0
		MEXICO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	13	13	13	13	27	35	68
		NEI-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57	100	100	100	100	0	0	
		NETHERLAND.ANT	0	0	50	50	50	50	50	50	50	50	50	50	50	50	50	40	40	40	40	40	40	40	40	40	40
		PANAMA	47	87	42	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
		PHILIPPINES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	38	38
		ST.VINCENT	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	2	2	2	0	1	0	0	
		TRINIDAD & TOBAGO	0	0	0	0	0	0	0	3	8	3	17	2	0	28	4	6	4	3	8	45	11	77	70	33	0
		U.S.A	265	295	295	305	303	334	323	210	276	290	267	254	184	103	21	27	39	53	75	37	25	37	39	32	18
		U.S.S.R	0	1	1	0	0	0	0	0	0	0	7	23	0	0	0	0	0	0	0	0	0	0	0	0	0
		UK-BERMUDA	2	2	5	2	4	1	2	7	8	9	11	6	8	15	17	18	19	11	15	15	15	3	5	1	2
		UKRAINE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	5	0	0	0	0	0	0	0	
		VENEZUELA	79	80	94	134	81	106	83	172	117	219	218	60	76	149	70	49	66	74	122	106	137	130	205	220	28

			1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	AT.S	BENIN	0	0	0	0	0	6	8	0	9	10	7	4	12	0	6	6	6	6	5	5	5	5	5	5	5
		BRASIL	41	100	49	34	23	28	30	27	32	33	46	51	74	60	52	61	125	147	81	180	331	193	486	509	297
		CHINA.PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	25	21	27	41	68	15
		CHINESE TAIPEI	240	107	177	139	129	104	150	47	70	165	98	265	266	462	767	956	488	404	391	280	490	1123	498	442	442
		COTE D'IVOIRE	0	0	0	0	0	0	0	0	100	100	100	100	130	82	88	105	79	139	212	177	157	222	182	275	206
		CUBA	159	100	113	180	187	108	118	123	159	205	111	137	191	77	90	62	69	0	0	0	0	0	0	0	
		EC-ESPANA	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	6	23	18	21	38	88	71	82	109	116
		EC-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	2
		GHANA	0	0	0	0	119	129	52	216	166	150	16	5	7	430	324	126	123	236	441	472	422	491	447	624	639
		JAPAN	4	17	15	66	115	136	495	248	482	691	335	362	617	962	967	755	824	719	991	913	881	724	529	403	438
		KOREA	392	356	140	78	46	55	31	88	234	262	60	139	361	437	84	503	13	11	40	40	103	40	2	0	1
		NEI-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	117	100	100	100	100	0	0	
		PANAMA	107	103	32	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38
		PHILIPPINES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	33	0
		SAO TOME & PRINCIPE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	0	0	
		U.S.S.R	1	9	4	0	0	1	0	0	0	7	16	22	32	5	0	0	0	0	0	0	0	0	0	0	0
		URUGUAY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	0	
	UNCL	BARBADOS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	19	0
		CUBA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0
		EC-FRA.ESP	109	134	136	126	144	169	174	167	118	122	135	132	137	144	199	137	116	146	133	126	96	82	80	83	79
		GABON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	8	0	0	0	0
		SENEGAL	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	5	0	0	5	5	5	0	0	0	
		TRINIDAD & 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	55
		U.S.A	0	0	0	7	9	8	6	5	4	5	6	37	37	21	8	6	12	27	13	6	18	9	11	5	6
Discards	AT.N	U.S.A	0	0	0	0	0	0	0	0	0	0	0	94	88	157	143	130	92	92	86	111	71	72	48	79	59
	AT.S	U.S.A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	42	2	2	0
	UNCL	U.S.A	0	0	0	0	0	0	0	0	0	0	0	44	36	34	16	12	54	35	25	42	125	25	2	2	0

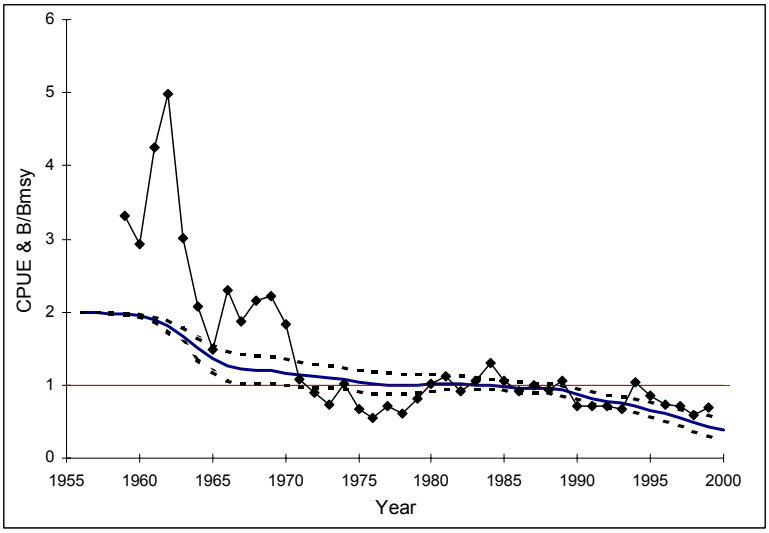
* As of 5 October 2001. Empty cells for 2000 indicate that catches were not reported to ICCAT.



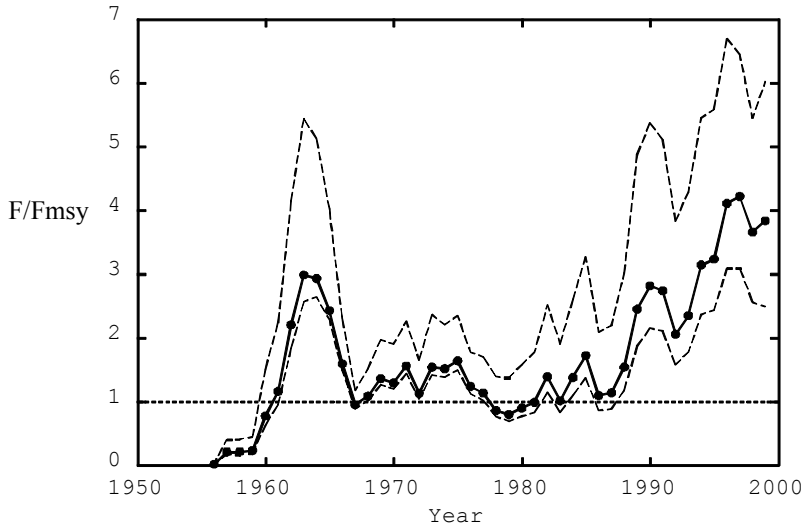
BUM-Fig. 1. Geographical distributions of reported catches (including landings and dead discards) of blue marlin by quarter, combined for all the years from 1950 to 1997. (Heavy-shaded areas represent longline catches and light-shaded areas represent gears other than longline.)



BUM-Fig. 2. Estimated catches (including landings and dead discards in MT) of blue marlin in the Atlantic by region. Catch estimates for 2000 are incomplete.



BUM-Fig. 3. Composite CPUE series (symbols) used in the blue marlin assessment compared to model-estimated median relative biomass (solid lines) from bootstrap results (80% confidence bounds shown by dotted lines).



BUM-Fig. 4. Estimated median relative fishing mortality trajectory for Atlantic blue marlin (center, dark line) with approximate 80% confidence range (light lines) obtained from bootstrapping.

7.7 WHM - WHITE MARLIN

No new white marlin assessments were conducted in 2001 and for this reason only the biology, description of fisheries, and effect of current regulations sections have been reviewed and updated..

WHM-1. Biology

White marlin are found throughout tropical and temperate waters of the Atlantic Ocean and adjacent seas. Their range is almost identical to that of blue marlin **(WHM-Figure 1)**. Their average size is about 20-30 kg. White marlin occur only in the Atlantic Ocean, which is not the case for blue marlin and sailfish. Although white marlin are generally considered to be a rare and solitary species relative to the schooling scombrids, they are known to occur in small groups consisting of several individuals. They spawn in tropical and subtropical waters in mid- to late spring, and are found in the colder temperate waters during the summer. Very little is known about the age and growth of white marlin, although they are considered to be very fast growing, as are all the Istiophoridae. Female white marlin grow faster and reach a larger maximum size than males.

White marlin are generally considered piscivorus, but also have been known to consume squid. They are found predominately in the open ocean near the upper reaches of the water column and are caught most frequently as a by-catch by the offshore longline fisheries which target tropical or temperate tunas using gear intended to fish shallow. However, significant by-catch landings are also made by offshore longline fisheries that target swordfish and big eye tuna using gear intended to fish deep.

As with blue marlin, the SCRS stock hypotheses for white marlin assessments historically has been a North and South Atlantic stock (divided at 5ºN), as well as a single (total) Atlantic stock. However, the 1995 SCRS recognized the increased importance of the total Atlantic hypothesis for white marlin. More recently (1996), the Committee reviewed and discussed new data on genetic mitochondria DNA analysis, as well as tag release-recapture data, and concluded that these data were most consistent with a total Atlantic hypothesis. In addition, the Committee concluded that the North/South separation is arbitrary for this tropical species (as with blue marlin). The Fourth Billfish Workshop reviewed all available data on stock structure and concluded that the single Atlantic hypothesis should be used as the management unit for Atlantic white marlin.

WHM-2. Description of the fisheries

See section on "Description of Fisheries" in Blue Marlin Executive Summary report.

Landings for the total Atlantic first developed in the early 1960's, reached a peak of almost 5,000 MT in 1965, declined to about 1,000 MT per year during the period 1977-1982, and have fluctuated between about 1,000 to 2,000 MT through 2000 **(WHM-Table 1 and Figure 2)**. The 2000 reported catches (839 MT) are incomplete. Landings for the North Atlantic generally show a trend similar to that of the total Atlantic and have followed the intensity of the offshore longline fisheries.

WHM-3. State of the stock

The 1996 white marlin assessments indicated that in the mid-1990s biomass was about 20% of B_{MSY}, that fishing mortality was about 2 times F_{MSY}, and that over fishing had been occurring for about three decades. MSY was estimated to be near 2,200 MT.

An assessment was carried out in 2000 using similar methods to the previous assessment, but with data sets that had been revised extensively in response to concerns raised since the 1996 assessment. The new assessment is more pessimistic; it suggests that the total Atlantic stock less than 15% of B_{MSY}, that over-fishing has taken place for over three decades, and that the stock is less productive stock than previously estimated, with an MSY smaller than 1,300 MT **(WHM-Figures 3,4, and 5).** Current fishing mortality is estimated to be 7 times higher than F_{MSY}, or higher.

For the assessment, the Committee considered a few alternative models and data sets, including cases in which much of the historical data were disregarded or down weighted. While the sensitivity analyses were not meant to quantify possible biases, the committee notes that some of the sensitivity runs provided more optimistic results than those reported above, with stock estimates somewhat closer to B_{MSY} levels. However, most of the sensitivity results were within the range of uncertainty reported for the assessment. Thus, there is uncertainty in the assessment related to the historical data that is not well quantified. In addition, it is expected that the uncertainty in these quantities are

greater than that for blue marlin and would likely result in a wider range than would be estimated through bootstrapping alone. The Committee notes that the historical catch and effective fishing effort data must be validated and focused research be conducted before such uncertainties can be reduced. To address these uncertainties would require a substantial research investment in historical data validation efforts and in biological investigations of the habitat requirements of white marlin.

WHM-4. Outlook

White marlin landings declined in 1999 by 40% from the 1996 level, in conformity with a recommendation made by the Commission (see section 5). As noted, there is uncertainty in the assessment related to the historical data that is not well quantified. However, given that the new assessment estimates that over-fishing is still occurring, that productivity is lower than previously estimated, and that the stock is severely depressed below the B_{MSY} level, it is expected that landings of the magnitude contemplated by the 1996 Commission Recommendation will continue to result in over-fishing of the stock. Information is not yet available to evaluate the effects of regulations agreed to in 2000.

WHM-5. Effect of current regulations

ICCAT resolved at its 1997 meeting to reduce landings by at least 25% from 1996 levels and these regulations extended through 2000. The annual amount of white marlin that can be harvested in years 2001 and 2002 by pelagic longline and purse seine vessels and retained for landing must be no more than 33% of the 1999 landing levels. In 2000, the Commission also recommended that a white marlin minimum size be established for recreational fisheries (e.g. 160 cm LJFL). Also, all white marlin brought to pelagic longline and purse seine vessels alive shall be released in a manner than maximizes their survival. Some countries already acted on these recommendations. Information is not yet available to evaluate the effects of regulations agreed to in 2000.

WHM-6. Management recommendations

The current assessment indicates that the stock is unlikely to recover if the landings contemplated by the 1996 Commission Recommendation continue into the future. While there is additional uncertainty in stock status and replacement yield estimates not quantified in the base case results, these uncertainties can only be addressed through substantial investment in research into habitat requirements of marlins and further verification of historical data. The Committee recommends that the Commission take steps to reduce the catch of white marlin as much as possible. Steps such as release of live fish from fishing gear, reductions in fleet-wide effort, a better estimation of dead discards, and establishment of time-area closures, along with scientific observer programs for verification could be considered.

ATLANTIC WHITE MARLIN SUMMARY[1]

	Total Atlantic
Maximum Sustainable Yield (MSY)	~ 1,300 MT (~ 900 - 2,000 MT)
1999 Yield[2]	1,022 MT
Current Yield (2000)[3]	839 MT
2000 Replacement Yield	<1999 Yield[4]
Relative Biomass (B_{2000}/B_{MSY})	~ 0.15
Relative Fishing Mortality (F_{1999}/F_{MSY})	> 7

Management measures in effect

- Reduce pelagic longline and purse seine landings to 33% of 1999 levels [Ref. 0-0-13][5]

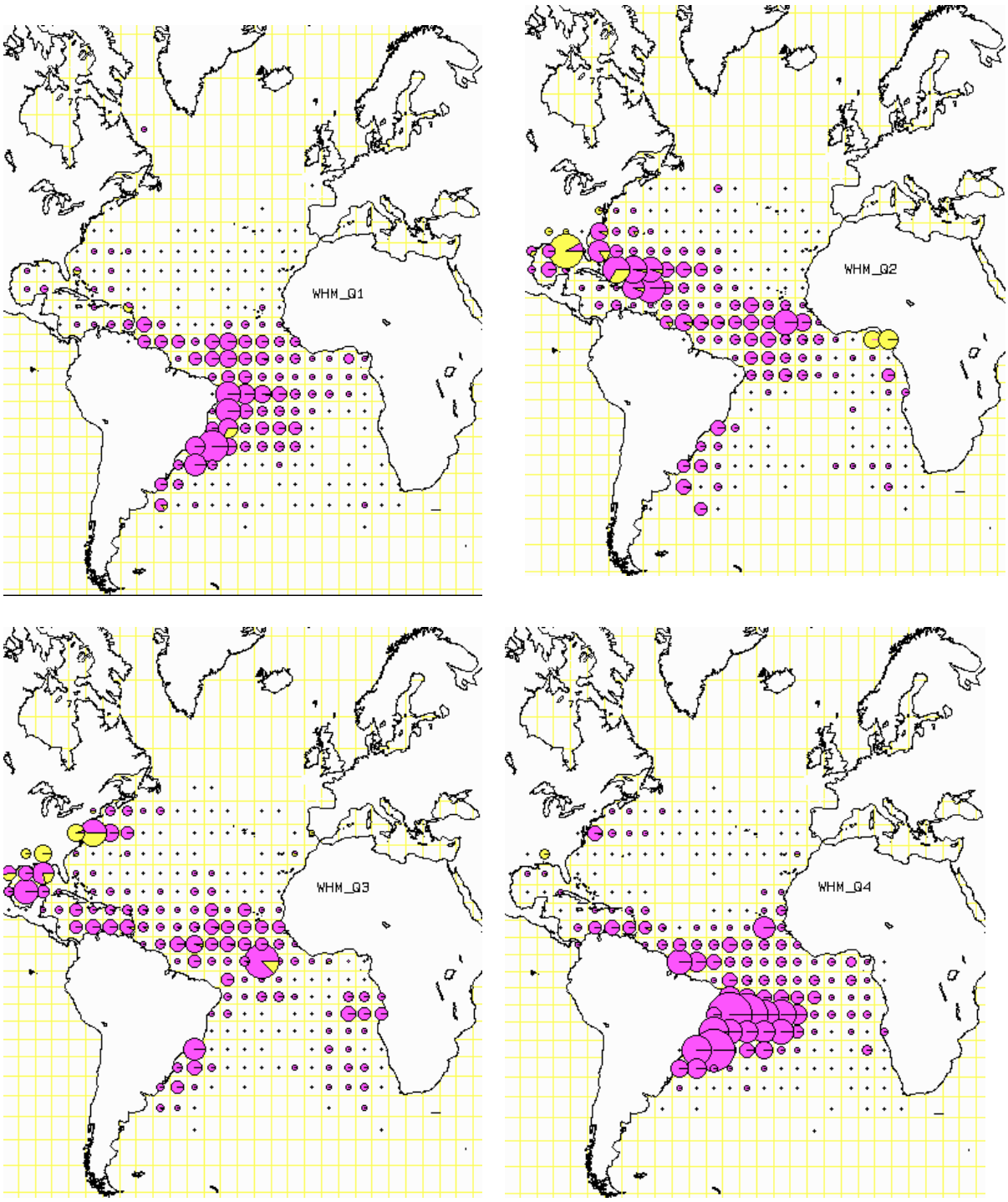
1 These estimates are highly uncertain. Estimates of uncertainty in benchmarks were not available for white marlin, but it is expected that the uncertainty in these quantities is greater than that for blue marlin and would likely result in a wider range than would be estimated through bootstrapping alone.
2 Estimated yield including that carried over from previous years.
3 Year 2000 information is incomplete.
4 Estimates of replacement yield are not well determined.
5 These measures did not take effect until mid-2001.

WHM-Table 1. Estimated catches (landings and discards, MT) of Atlantic white marlin in 1976-2000*, by major area, gear and flag.

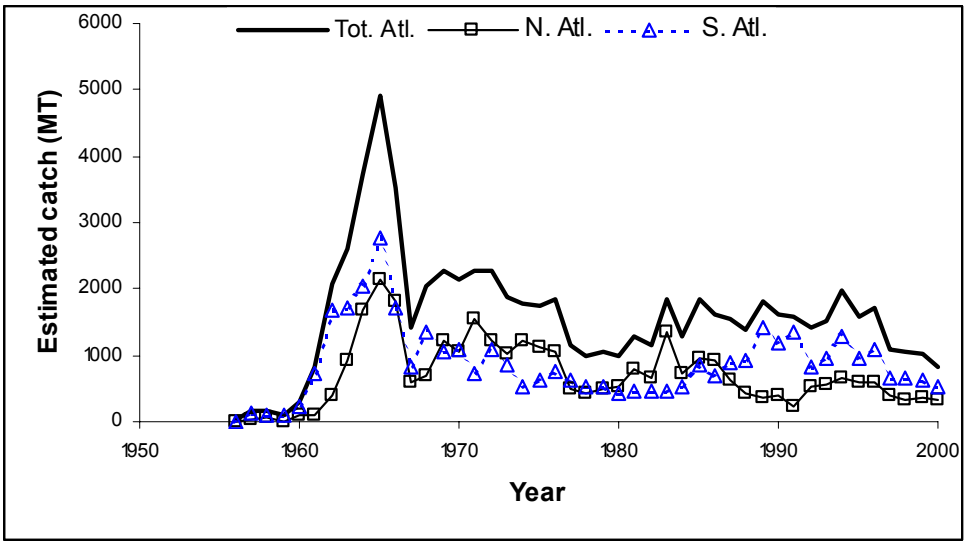
			1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
TOTAL			*1839*	*1150*	*975*	*1039*	*976*	*1280*	*1165*	*1839*	*1287*	*1833*	*1613*	*1552*	*1399*	*1810*	*1628*	*1581*	*1434*	*1516*	*1964*	*1578*	*1702*	*1087*	*1064*	*1022*	*839*
		AT.N	1052	501	428	482	521	789	670	1347	740	966	908	635	445	361	390	221	532	551	648	605	593	394	346	349	317
		AT.S	767	624	522	534	428	460	463	461	525	844	680	879	921	1409	1196	1343	817	945	1296	951	1072	675	675	635	515
		UNCL	20	25	25	23	27	31	32	31	22	23	25	38	33	40	42	17	85	20	20	22	37	18	43	38	8
Landings	AT.N	Longline	938	390	317	370	403	671	548	1196	570	788	812	433	167	234	251	105	404	436	526	450	514	316	300	273	251
		Other Surf.	0	0	0	0	0	0	0	0	0	0	0	0	24	0	0	4	3	4	12	5	2	3	13	23	
		Sport	114	111	111	111	112	111	110	146	153	149	35	96	75	22	23	8	18	24	30	20	15	3	2	1	
		Unclass.	0	0	0	1	6	7	12	5	17	29	61	54	126	11	40	17	32	29	45	43	25	46	0	0	25
	AT.S	Longline	742	621	520	530	419	340	442	308	471	825	654	870	832	1333	1152	1320	803	923	1295	945	659	588	551	624	506
		Other Surf.	25	3	2	4	9	120	21	153	54	15	22	9	89	68	31	17	14	22	1	2	3	5	8	11	9
		Sport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	4	410	0	0	0	
		Unclass.	0	0	0	0	0	0	0	0	0	4	4	0	0	8	9	6	0	0	0	0	0	45	115	0	
	UNCL	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62	0	2	0	0	4	33	25	
		Other Surf.	20	25	25	23	27	31	32	31	22	23	25	25	25	27	37	11	10	12	11	9	7	7	9	8	7
		Sport	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	3	0	0	0	0	0	0	0	0	
		Unclass.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	0	0	0	
Discards	AT.N	Longline	0	0	0	0	0	0	0	0	0	0	0	52	53	94	76	87	75	59	35	87	37	26	30	52	40
		Unclass.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	
	AT.S	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	1	0	
	UNCL	Longline	0	0	0	0	0	0	0	0	0	0	0	10	7	13	5	3	13	7	7	13	27	7	1	5	1
Landings	AT.N	BARBADOS	0	0	0	0	0	0	0	0	0	0	0	0	117	11	39	17	24	29	26	43	15	41	0	0	25
		BRASIL	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
		CANADA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	8	8	8	5	5
		CANADA-JPN	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	
		CHINA.PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	7	6	7	10	20	1
		CHINESE TAIPEI	142	44	79	62	105	174	134	203	96	128	319	153	0	4	85	13	92	123	270	181	146	62	105	80	76
		CUBA	68	67	43	68	70	189	205	728	241	296	225	30	13	21	14	0	0	0	0	0	0	0	0	0	
		EC-ESPANA	0	0	0	0	0	0	0	0	9	14	0	0	61	12	4	8	18	15	25	10	75	71	65	88	118
		JAPAN	540	80	27	42	99	118	84	27	52	45	56	60	68	73	34	45	180	33	41	31	80	29	39	27	18
		KOREA	64	71	33	16	18	49	12	6	18	147	37	2	2	82	39	1	9	4	23	3	7	2	0	0	
		MEXICO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	8	8	0	5	6	11	18
		NEI-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46	50	50	50	50	0	0	
		PANAMA	17	20	8	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		PHILIPPINES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	
		U.S.A	109	109	109	110	116	117	122	148	168	181	119	182	88	16	19	2	8	13	11	9	4	2	2	1	
		UK-BERMUDA	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	
		VENEZUELA	112	110	129	183	113	142	113	234	155	155	151	154	42	47	79	47	125	226	148	171	164	90	80	61	13
	AT.S	ARGENTINA	2	2	0	0	0	0	0	0	0	4	4	0	0	8	9	6	0	0	0	0	0	0	0	0	
		BELIZE.SH.OB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
		BRASIL	68	275	175	133	58	100	76	81	61	87	143	93	149	204	205	377	211	301	91	105	75	105	216	157	60
		CAMBODIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
		CHINA.PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4	3	4	5	10	1
		CHINESE TAIPEI	377	119	198	155	145	136	227	87	124	172	196	613	565	979	810	790	506	493	1080	726	420	379	401	385	361

			1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
		COTE D'IVOIRE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	5	1
		CUBA	38	57	127	205	212	116	45	112	153	216	192	62	24	22	6	10	10	0	0	0	0	0	0	0	
		EC-ESPANA	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	9	4	8	0	18	32	3	4	45	68
		GABON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	406	0	0	0	
		GHANA	0	0	0	0	6	45	21	142	54	15	22	6	88	68	31	17	14	22	1	2	1	3	7	6	8
		JAPAN	3	26	14	15	7	25	27	17	24	81	73	74	76	73	92	77	68	49	51	26	32	29	17	17	15
		KOREA	220	111	5	24	0	36	57	9	44	225	34	25	17	53	42	56	1	4	20	20	52	18	0	0	
		NEI-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	68	50	50	50	50	0	0	
		PANAMA	59	31	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		PHILIPPINES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	8	
		SAO TOME & PRINCIPE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	0	0	
		U.S.S.R	0	3	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		URUGUAY	0	0	0	0	0	1	10	13	65	44	16	6	1	1	1	1	3	0	0	0	0	0	22	0	
	UNCL	BARBADOS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	25	
		BELIZE.SH.OB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	
		EC-FRA.ESP	20	25	25	23	27	31	32	31	22	23	25	25	25	27	37	11	10	12	11	9	7	7	9	8	7
		KOREA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	
		ST.VINCENT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	
		U.S.A	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	3	0	0	2	0	3	0	0	0	
		VENEZUELA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62	0	0	0	0	0	0	0	
Discards	AT.N	U.S.A	0	0	0	0	0	0	0	0	0	0	0	52	53	94	76	87	75	59	35	87	37	26	31	52	40
	AT.S	U.S.A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	1	0	
	UNCL	U.S.A	0	0	0	0	0	0	0	0	0	0	0	10	7	13	5	3	13	7	7	13	27	7	1	5	1

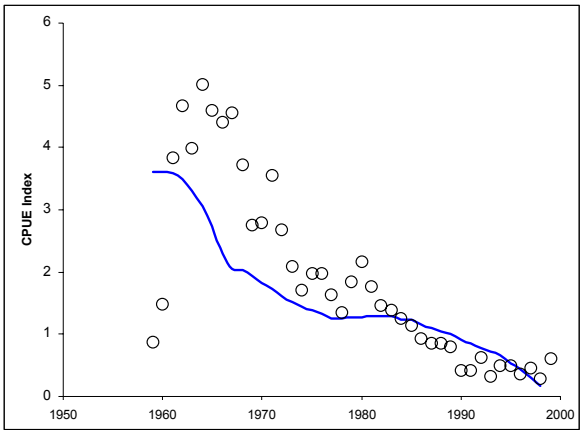
* As of 5 October 2001. Empty cells for 2000 indicate that catches were not reported to ICCAT.



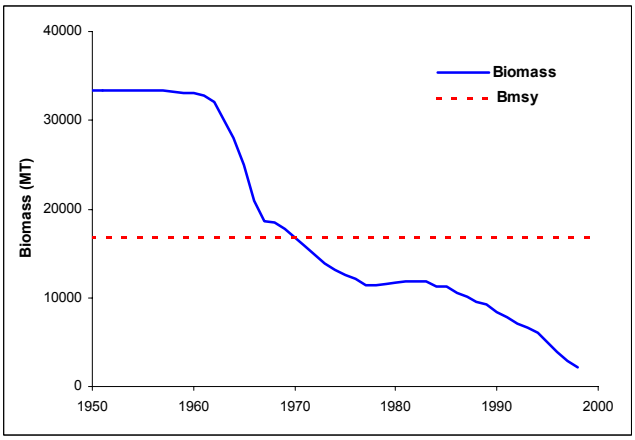
WHM-Fig. 1. Geographical distribution of reported catches (including landings and dead discards) of white marlin by quarter, combined for all the years from 1950 to 1997. (Heavy-shaded areas represent longline catches and light-shaded areas represent other gears.)



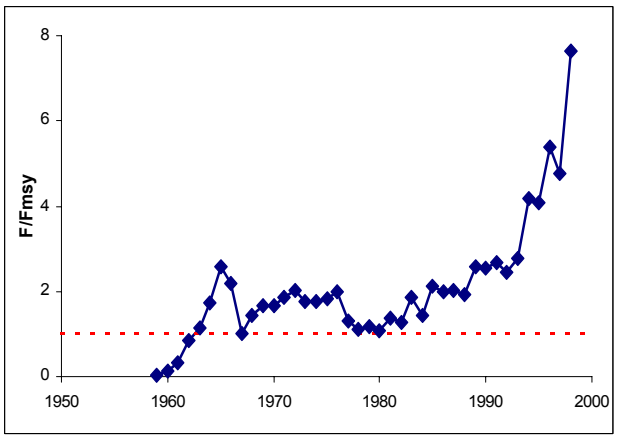
WHM-Fig. 2. Estimated catches (including landings and dead discards) of white marlin in the Atlantic by region. Catch estimates for 2000 are incomplete.



WHM-Fig. 3. Fit of the biomass dynamic model (line) to the combined CPUE index (symbols) for white marlin.



WHM-Fig. 4. Estimated biomass trajectory for white marlin using a single combined index of abundance.



WHM-Fig. 5. Relative fishing mortality trajectory for white marlin estimated with a logistic production model applied to catch and composite CPUE series.

7.8 SAI - SAILFISH/SPEARFISH

SAI-1. Biology

Sailfish *(Istiophorus platypterus)* and spearfish *(Tetrapturus pfluegeri)* have a pan-tropical distribution (**SAI-Figure 1**). Although sailfish have highest concentrations in coastal waters (more than any other istiophorid), they are still found in oceanic waters. Spearfish are most abundant in offshore temperate waters. No trans-Atlantic movements have been recorded, suggesting a lack of mixing between east and west. Although sailfish and spearfish are generally considered to be rare and solitary species relative to the schooling scombrids, sailfish are the most common Atlantic istiophorid and are known to occur along tropical coastal waters in small groups consisting of at least a dozen individuals. Spearfish are generally the rarest Atlantic istiophorid.

Sailfish and spearfish are generally considered piscivorus, but also have been known to consume squid. They are found predominately in the upper reaches of the water column and are caught as a by-catch of the offshore longline fisheries and as a directed catch of coastal fisheries. In coastal waters, artisanal fisheries use many types of shallow water gear to target sailfish.

Sailfish spawn in tropical and subtropical waters in the spring through summer. Due to their relative rare abundance in offshore waters, little is known about spearfish life history. Both sailfish and spearfish are considered to be fast growing species compared to other teleosts. Female sailfish grow faster and reach a larger maximum size than males.

Historically, ICCAT considered Atlantic sailfish/spearfish as separate eastern and western management units (**SAI-Figure 1**). The separation of sailfish into two management units was based on the coastal orientation of the species, tag release/recapture data which suggests a lack of mixing, and morphological data. The Committee re-evaluated the stock structure of Atlantic sailfish based on the results of a genetic investigation submitted to the 2001 SCRS. The study failed to find differences, but this did not necessarily mean a lack of structure, as a very small exchange rate between east and west could produce these results. Therefore, the Committee determined that there was no basis for changing the current stock boundary at this time. However, this issue should be reviewed as more data becomes available.

SAI-2. Description of the fisheries

The fisheries in the West and East Atlantic for sailfish/spearfish are both characterized by participants from many different countries. For example, the recent major catches (landings plus dead discarded catch) of sailfish in both the West and East Atlantic result from the coastal fisheries. In the West Atlantic, the primary artisanal fisheries are from many countries in the Caribbean sea, whereas in the East Atlantic major artisanal fisheries are off West Africa. Directed recreational fisheries for sailfish occur in the West Atlantic and the Caribbean Sea.. Directed recreational fisheries for sailfish in the East Atlantic also exist off West Africa.

Catches of sailfish/spearfish for the total Atlantic which first developed in the early 1960's, are presented in **SAI-Table 1 and SAI-Figure 2,** respectively**.** The Committee continues to recognize that uncertainties in the catch data still persist, particularly in the East Atlantic and Caribbean Sea. However, new catch data are becoming available from some of these fisheries. The Committee decided that when the catch data are missing for a fishery, the figures for the last year for which data were available should be carried over. In some cases, this procedure was maintained for about 10 years. In the Table, catch values that were carried over are identified by shading. The overall trend in Atlantic catches are very much governed by the large catches from coastal fisheries off West Africa.

The 2001 SCRS decided to separate the combined catches of sailfish and spearfish, reported by the pelagic longliners, using the Japanese data (1994-2000), which reported these two species separately. Together with the information of previous studies, the ratio of these two species were calculated by quarter and by 5x5 areas. Using these ratios, pelagic longline combined catch data were separated by two species. The catch of sailfish and spearfish thus estimated are given in **SAI-Table 2, SAI-Figure 3** and **SAI-Table 3, SAI-Figure 4**, respectively.

The Committee felt that significant progress was achieved this year by separating the catches of these two species. The tentative catches of sailfish "only" (**SAI-Tables 2, SAI- Figure 3**) and spearfish "only" (**SAI-Table 3 and SAI- Figure 4**) show different historical trends than the composite catches. However, the work was carried

out during the ICCAT species group session under a time constraint and should be considered preliminary until detailed evaluation of this process can be completed. Thus, the Working Group felt it was premature to adopt these separated catch figures as official ICCAT estimates (i.e. Task I data).

SAI-3. State of the stocks

All previous assessments of Atlantic sailfish were done on aggregate data on sailfish and spearfish obtained from the offshore longline fleets. The previous assessment for western Atlantic sailfish/spearfish (1992 SCRS) concluded that the composite stock was at least fully exploited and that fishing mortality had stabilized since the 1980s at around the level that would produce MSY. The assessment for the Eastern Atlantic sailfish/spearfish stock (1995 SCRS) concluded that there were signs of over-fishing for this composite stock because estimated biomass was below the level that would produce MSY and estimated fishing mortality was greater than the level that would produce MSY. Both of these assessments had considerable uncertainties especially because of the inability of separating spearfish and sailfish catches from the offshore longline fleets and because of the limited number of reliable abundance indices for the early part of the history of the fishery and for the coastal eastern Atlantic fisheries.

Assessments were conducted in 2001 for the eastern and western Atlantic sailfish stocks based on sailfish/spearfish composite catches (**SAI-Table 1**) and sailfish "only" catches (**SAI-Table 2)**. The assessments tried to address the shortcomings of the previous assessments by improving the list of abundance indices and by separating the catch of sailfish from that of spearfish in the offshore longline fleets. Considerable progress was made on obtaining new, or more reliable abundance indices. The new separation of sailfish/spearfish allowed assessments to be attempted on sailfish "only" data. However, considerable uncertainties remain relating to both catches and catch rates that can only be addressed by substantial research investment in historical data validation and in investigations of the habitat requirements of sailfish.

All quantitative assessment models used in 2001 produced unsatisfactory fits. The biomass dynamic models were unable to satisfactorily explain the observed patterns in the abundance indices and catch. It will be necessary to apply population models that can better account for these dynamics in order to provide improved assessment advice.

At present, abundance indices represent the most reliable information and indication of changes in biomass for the stocks of sailfish "only" or sailfish/spearfish. Abundance indices for the eastern stock may be less reliable than those for the western stock. The differences in the indices between the early and later part of the fishery should not be ignored and should be considered to represent an indication of a decrease in the size of these stocks.

For the western Atlantic stock recent catch levels for sailfish/spearfish combined seem sustainable because over the last two decades both CPUE and catch have remained relatively constant (**SAI-Figures 2 and 5**). For the combined sailfish/spearfish western stock, it is not known whether the current catch level is below, or at maximum sustainable yield. For this same stock, tentative catches of sailfish "only" have averaged about 700 MT over the past two decades and the abundance indices have remained relatively stable for the same period (**SAI-Figures 3 and 5**). New analyses do not provide any information on the MSY or other stock benchmarks for the western Atlantic composite or sailfish "only" stock.

In the eastern Atlantic, abundance indices **(SAI-Figure 6)** for sailfish "only" from coastal fisheries have decreased over recent times and so have total estimated tentative catches of sailfish "only" **(SAI-Figure 3)**. In contrast, abundance indices for the Japanese longline fishery **(SAI-Figure 6)** have been rather constant since the mid-1970s but there is concern on the status of this stock, because of the decreases in abundance indices and estimated catches from coastal fisheries.

In summary, although the new attempts at quantitatively assessing the status of these two stocks (eastern and western sailfish) proved to be unsatisfactory, there are early decreases in biomass for these two stocks. These decreases probably lowered the biomass of the stocks to levels that may be producing sustainable catches, but it is unknown whether biomass levels are below those which could produce MSY.

SAI-4. Outlook

The SCRS noted that the methods for splitting sailfish/spearfish in the offshore longline catches are tentative and are subject to other possible methods in future analyses. Therefore, the results could change in the future. Based on the methods applied and considering these limitations, it is unknown if the western or eastern sailfish stocks are

undergoing over-fishing (F>Fmsy) or if the stocks are currently over-fished (B<Bmsy) and for these reasons the outlook for future conditions of the stocks are best interpreted based on the recent trends of CPUE and catch.

For the western sailfish stock, CPUE was highest in the late 1960's and decreased to lower levels by about 1980, after which CPUE remained relatively stable. Over the past two decades, the reported catch of western sailfish has averaged about 700 MT per year. From these observations, the Committee considers that the current catch level is sustainable.

For the eastern Atlantic sailfish, recent reported catches have been in decline, as have the available coastal abundance indices. These patterns could suggest possible further decreases in biomass that, if unchecked, could result in the need for increasingly stringent management actions in the future.

SAI-5. Effect of current regulations

No ICCAT regulations for sailfish or spearfish are in effect.

SAI-6. Management recommendations

The previous management recommendations indicated that the Commission should consider methods for reducing fishing mortality rates. The current western Atlantic assessment leads the Committee to recommend that the west Atlantic sailfish "only" catches should not exceed current levels. For the east Atlantic, sailfish "only" catches should not exceed current levels and the Commission should consider practical and alternative methods to reduce fishing mortality and assure data collection systems.

The Committee is concerned about the incomplete reporting of catches, particularly for the most recent years, the lack of sufficient reports by species, and evaluations of the new methods used to split the sailfish and spearfish catch and to index abundance. The Committee recommends all countries landing sailfish/spearfish or having dead discards, report these data to the ICCAT Secretariat. The Committee should consider the possibility of a spearfish "only" assessment in the future.

ATLANTIC SAILFISH "ONLY" SUMMARY[*]

	West Atlantic	**East Atlantic**
Maximum Sustainable Yield (MSY)	Not estimated	Not estimated
Current Yield (2000)[2]	506 MT[3]	969 MT[3]
Current Replacement Yield	~ 600 MT	Not estimated
Management Measures in Effect	None	None

1 Previous summary table was for sailfish/spearfish composite.
2 Estimated yield includes that carried over from previous years.
3 Current yield (2000) incomplete.

SAI-Table 1. Estimated catches (landings and dead discards, reported and carried over, MT) of Atlantic **sailfish and spearfish** in 1976-2000*, by region, gear and flag.

			1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
TOTAL	*(SAI +SPF)*		*6664*	*2726*	*3596*	*4394*	*3276*	*3278*	*4177*	*4772*	*3751*	*3564*	*3429*	*3805*	*3191*	*2684*	*3675*	*2446*	*2854*	*3913*	*2473*	*2600*	*2953*	*2089*	*2596*	*2359*	*2054*
	SAI sub-total		*6459*	*2476*	*3342*	*4159*	*3006*	*2962*	*3851*	*4460*	*3529*	*3336*	*3123*	*3483*	*2925*	*2407*	*3301*	*2339*	*2762*	*3729*	*2336*	*2483*	*2860*	*1989*	*2476*	*2176*	*1901*
	SPF sub-total		*205*	*250*	*254*	*235*	*270*	*316*	*326*	*312*	*222*	*228*	*306*	*322*	*266*	*277*	*374*	*107*	*92*	*185*	*136*	*117*	*93*	*100*	*120*	*183*	*153*
SAI		AT.E	5646	1544	2547	3256	2099	2131	2876	3687	2492	2328	2105	2566	2064	1664	2314	1482	1706	2473	1206	1559	1927	1292	995	1209	1011
		AT.W	813	932	795	903	907	831	975	773	1037	1008	1018	917	861	743	987	858	1056	1256	1131	924	933	697	1481	967	890
Landings	AT.E	Longline	599	220	114	83	151	202	309	270	224	148	140	112	126	152	153	57	51	523	178	240	164	213	198	265	176
		Other Surf.	4858	1164	2290	3066	1623	1432	1999	2911	2107	1940	1394	1870	1401	1067	1143	734	717	1040	718	657	596	385	535	537	428
		Sport	189	160	143	107	325	497	568	506	161	240	571	584	537	445	1018	507	738	833	227	588	531	555	263	407	407
		Unclass.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	184	200	77	83	75	636	139	0	0	0
	AT.W	Longline	437	395	279	378	360	408	471	320	512	506	489	451	558	417	382	241	371	657	552	386	346	226	1031	453	481
		Other Surf.	62	119	90	84	97	0	95	50	53	68	43	45	54	44	224	72	156	131	196	224	362	221	300	258	178
		Sport	266	339	338	350	368	336	331	312	352	228	234	237	38	31	29	32	50	38	83	25	11	11	11	11	13
		Unclass.	48	79	88	91	82	87	78	91	120	206	252	142	154	194	290	449	443	367	272	260	145	182	112	174	173
Discards	AT.W	Longline	0	0	0	0	0	0	0	0	0	0	0	42	57	57	62	64	36	63	28	29	69	57	27	71	45
Landings	AT.E	BENIN	0	0	0	0	0	36	48	0	53	50	25	32	40	8	21	20	21	20	20	20	19	6	4	5	5
		CAP-VERT	0	0	0	0	0	0	3	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	0	0	0	0	0	0	0	0	3	3	3	3	5	9	4
		CHINESE TAIPEI	217	59	7	19	5	12	67	20	8	9	1	0	0	7	13	0	0	420	101	155	65	150	117	178	120
		COTE D'IVOIRE	0	0	0	0	0	0	0	0	40	40	40	40	66	55	58	38	69	40	54	66	91	65	35	80	45
		CUBA	185	65	69	40	79	79	158	200	115	19	55	50	22	53	61	184	200	77	83	72	533	0	0	0	
		EC-ESPANA	0	0	0	0	0	0	10	0	4	7	9	0	28	14	0	9	2	30	7	13	25	26	18	19	8
		EC-FRA.ESP	327	400	405	375	432	504	521	499	354	364	403	394	408	432	595	174	150	182	160	128	97	110	138	131	98
		EC-PORTUGAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	0	0	0	0	53	6
		GABON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	109	7	0	0	
		GHANA	4517	764	1885	2691	1191	891	1426	2408	1658	1485	925	1392	837	465	395	463	297	693	450	353	303	196	351	305	275
		JAPAN	4	24	11	19	33	50	38	47	63	84	71	37	57	57	63	16	42	58	45	52	47	19	58	17	37
		KOREA	165	46	18	5	34	24	33	3	34	29	2	20	15	17	16	30	3	3	6	6	14	5	0	0	
		NEI-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	15	10	10	10	0	0	
		PANAMA	41	13	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		SAO TOME & PRINC.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	139	0	0	
		SENEGAL	189	160	143	107	325	498	572	510	163	241	572	596	587	552	1092	546	917	936	260	678	610	556	270	412	412
		U.S.A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	1	1	3	1	0	0	0	
		U.S.S.R	1	13	5	0	0	37	0	0	0	0	2	5	4	4	0	0	0	0	0	0	0	0	0	0	
	AT.W	ARUBA	20	20	30	30	30	30	30	30	30	30	30	23	20	16	13	9	5	10	10	10	10	10	10	10	10
		BARBADOS	0	0	0	0	0	0	0	0	0	0	0	0	0	69	45	29	42	50	46	74	25	71	58	44	44
		BRASIL	186	287	246	201	231	64	153	60	121	187	292	174	152	147	301	90	351	243	128	245	310	137	184	356	322
		CHINA.PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	3	9	4
		CHINESE TAIPEI	126	5	10	18	36	81	22	31	45	39	64	31	300	171	83	73	33	223	233	38	37	4	129	33	22
		CUBA	0	91	51	151	119	134	181	28	169	130	50	171	78	55	126	83	70	42	46	37	37	0	0	0	
		DOMINICAN REP.	0	0	0	0	0	0	22	50	49	46	18	40	44	44	40	31	98	50	90	40	40	40	40	40	40
		EC-ESPANA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	7	5	3	36	3	15	20	6	14
		EC-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	7
		GRENADA	0	31	37	40	31	36	27	37	66	164	211	104	114	98	218	316	310	246	151	119	56	83	87	148	148
		JAPAN	133	23	9	20	22	44	135	22	34	38	28	6	22	22	25	73	1	2	8	2	4	17	3	11	3
		KOREA	0	65	14	19	51	41	19	0	52	72	14	1	0	17	25	0	3	0	8	8	22	8	0	0	
		MEXICO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	19	19	0	9	646	40	118

			1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
		NEI-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31	30	30	30	30	0	0	
		NETHERLAND.ANT	28	28	21	21	21	21	21	21	21	10	10	10	10	10	10	10	10	15	15	15	15	15	15	15	15
		PANAMA	0	18	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		ST.VINCENT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	4	4	4	2	1	3	0	1	
		TRINIDAD & TOBAGO	0	0	0	0	0	0	0	64	58	14	25	35	24	11	9	4	4	56	101	101	104	10	0	4	3
		U.S.A	261	308	308	308	308	308	308	311	311	197	199	200	18	2	4	4	11	8	46	13	2	0	1	1	2
		VENEZUELA	59	56	66	93	58	72	57	119	81	81	77	80	22	24	24	65	71	206	162	103	165	185	258	179	93
Discards	AT.W	U.S.A	0	0	0	0	0	0	0	0	0	0	0	42	57	57	62	64	36	63	28	29	69	57	27	71	45
SPF		AT.E	205	250	254	235	270	316	326	312	222	228	252	247	256	270	373	107	92	120	134	107	85	99	111	148	93
		AT.W	0	0	0	0	0	0	0	0	0	0	54	75	10	7	1	0	0	65	2	8	6	1	9	35	60
		UNCL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	
Landings	AT.E	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	36	29	26	31	25	67	33
	AT.E	Other Surf.	205	250	254	235	270	316	326	312	222	228	252	247	256	270	373	107	92	112	98	78	59	68	86	81	60
	AT.W	Longline	0	0	0	0	0	0	0	0	0	0	54	75	10	7	1	0	0	65	2	4	5	1	9	35	60
	UNCL	Unclass.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	
Discards	AT.W	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	0	0	0	
	UNCL	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	
Landings	AT.E	CHINA.PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	
	AT.E	EC-ESPANA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	3	1	1	1	30	14
	AT.E	EC-FRA.ESP	205	250	254	235	270	316	326	312	222	228	252	247	256	270	373	107	92	112	98	78	59	68	86	81	60
	AT.E	JAPAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	26	25	30	22	37	19
	AT.W	EC-ESPANA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	22	50
	AT.W	JAPAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	4	1	8	13	9
	AT.W	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	1
	AT.W	TRINIDAD & TOBAGO	0	0	0	0	0	0	0	0	0	0	54	75	10	7	1	0	0	62	0	0	0	0	0	0	
	AT.W	VENEZUELA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	
	UNCL	U.S.A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	
Discards	AT.W	U.S.A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	0	0	0	0
	UNCL	U.S.A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0

* As of 5 October 2001. Empty cells for 2000 indicate that catches were not reported to ICCAT. Shaded cells indicate carry-overs.
Note: Sums of Table 2 and 3 would not add up to numbers given in Table 1, as Table 2 and 3 report data resulting from preliminary split of sailfish and spearfish, and other preliminary changes, from the combined catch used for assessments only.

SAI-Table 2. Estimated catches (including landings and dead discards, in MT) of sailfish "only" in the Atlantic Ocean, by fisheries and by gears, 1976-2000 (as modified by the Working Group for use in the 2001 assessment).

DataType	SareaName	FleetName	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
TOTAL CATCH			5632	1790	2927	3720	2548	2718	3296	4405	3133	2964	2810	3227	2712	2263	3092	2307	2837	2786	1739	2065	2494	1814	1510	1651	1475
CATCH	AT. E		5225	1371	2463	3189	1974	2008	2692	3504	2352	2240	2028	2478	2008	1568	2214	1445	1678	2043	1097	1404	1874	1152	933	1123	969
	AT.W		407	419	464	531	574	711	604	902	781	724	782	749	705	695	878	862	1159	743	642	662	619	663	576	527	506
LANDING	AT.E	LL	187	47	30	16	26	79	125	87	84	60	63	24	70	56	53	20	23	93	69	84	111	73	136	179	134
		SURF	4961	1231	2354	3096	1886	1841	2498	3368	2227	2155	1920	2381	1892	1475	2110	1194	1410	1813	895	1211	1075	940	798	944	835
		SPORT	76	93	79	77	62	88	69	49	41	25	45	73	46	37	51	47	45	60	50	34	52	0	0	0	
		UNCL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	184	200	77	83	75	636	139	0	0	
	AT.W	LL	88	25	48	99	75	115	158	108	132	212	106	162	124	147	194	83	304	159	171	173	183	131	224	120	174
		SURF	62	119	90	84	97	0	95	50	53	68	23	45	54	44	224	72	156	131	196	224	355	221	300	258	178
		SPORT	266	311	315	321	398	510	327	657	486	256	405	366	326	256	203	291	246	134	115	175	115	171	143	99	47
		UNCL	48	79	88	91	82	87	78	91	120	206	252	142	154	194	290	387	430	332	232	228	119	182	112	174	173
DISCARD	ATW	LL	0	0	0	0	0	0	0	0	0	0	0	42	57	57	62	64	36	63	28	29	69	57	27	71	45
LANDING	AT.E	BENIN	0	0	0	0	0	36	48	0	53	50	25	32	40	8	21	20	21	20	20	20	19	6	4	5	5
		CAP-VERT	0	0	0	0	0	0	3	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	0	0	0	0	0	0	0	0	0	0	1	0	2	5	3
		CHINESE TAIPEI	68	9	2	2	1	2	24	6	2	1	0	0	0	1	3	0	0	31	14	17	28	25	58	97	79
		COTE D'IVOIRE	0	0	0	0	0	0	0	0	40	40	40	40	66	55	58	38	69	40	54	66	91	65	35	80	45
		CUBA	58	10	16	4	8	14	56	55	30	2	2	0	4	8	14	184	200	77	83	72	533	0	0	0	
		EC-ESPANA	0	0	0	0	0	0	10	0	4	7	9	0	28	14	0	9	2	30	7	13	25	26	18	19	8
		EC-FRA.ESP	327	400	405	375	432	504	521	499	354	364	403	394	408	432	595	174	150	182	160	128	97	110	138	131	98
		EC-PORTUGAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	0	0	0	0	53	6
		GABON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	109	7	0	0	
		GHANA	4517	764	1885	2691	1191	891	1426	2408	1658	1485	925	1392	837	465	395	463	297	693	450	353	303	196	351	305	275
		JAPAN	1	5	2	9	14	22	20	25	39	46	49	19	31	27	33	7	16	30	45	52	47	19	58	17	37
		KOREA	52	7	4	1	3	4	12	1	9	3	0	0	3	2	4	3	0	0	1	1	6	1	0	0	
		NEI-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	4	2	0	0	
		PANAMA	13	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		SAO TOME & PRINCIPE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	139	0	0	
		SENEGAL	189	160	143	107	325	498	572	510	163	241	572	596	587	552	1092	546	917	936	260	678	610	556	270	412	412
		U.S.A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	1	1	3	1	0	0	0	
		U.S.S.R	1	13	5	0	0	37	0	0	0	0	2	5	4	4	0	0	0	0	0	0	0	0	0	0	
	AT.W	ARUBA	20	20	30	30	30	30	30	30	30	30	30	23	20	16	13	9	5	10	10	10	10	10	10	10	10
		BARBADOS	0	0	0	0	0	0	0	0	0	0	0	0	0	69	45	29	42	50	46	74	25	71	58	44	44
		BRASIL	28	14	41	53	51	16	43	7	15	73	46	52	27	48	148	23	286	40	17	34	96	66	28	51	81
		CHINA.PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1

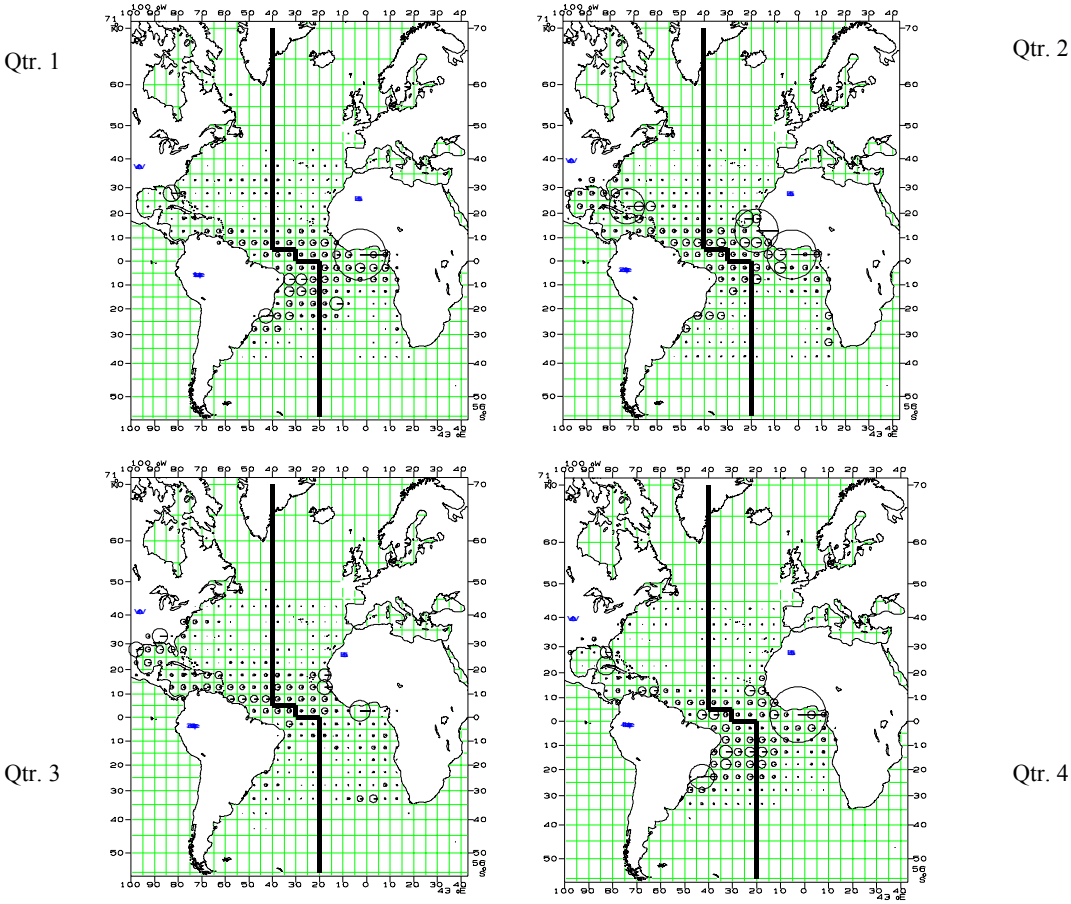
DataType	SareaName	FleetName	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
		CHINESE TAIPEI	19	0	2	5	8	20	6	4	6	15	10	9	54	56	41	18	27	36	31	5	11	2	19	5	6
		CUBA	0	4	9	40	26	33	51	3	22	51	8	52	14	18	62	21	57	7	6	5	11	0	0	0	
		DOMINICAN REP.	0	0	0	0	0	0	22	50	49	46	18	40	44	44	40	31	98	50	90	40	40	40	40	40	40
		EC-ESPANA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	7	5	3	36	3	15	20	6	14
		EC-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	7
		GRENADA	0	31	37	40	31	36	27	37	66	164	211	104	114	98	218	316	310	246	151	119	56	83	87	148	148
		JAPAN	42	8	3	4	1	26	63	16	20	20	11	3	9	13	15	33	0	1	8	2	4	17	3	11	3
		KOREA	0	3	2	5	11	10	5	0	7	28	2	0	0	6	12	0	2	0	1	1	7	4	0	0	
		MEXICO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	4	97	6	29
		NEI-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	4	4	9	14	0	0	
		NETHERLAND.ANT	28	28	21	21	21	21	21	21	21	10	10	10	10	10	10	10	10	15	15	15	15	15	15	15	15
		PANAMA	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		ST.VINCENT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	4	4	4	2	1	3	0	1	
		TRINIDAD & TOBAGO	0	0	0	0	0	0	0	64	58	14	25	35	24	11	9	4	4	56	101	101	104	10	0	4	3
		U.S.A	261	308	308	308	382	502	319	656	478	241	399	354	328	243	188	281	213	122	102	168	106	160	133	89	37
		VENEZUELA	9	3	11	25	13	18	16	14	10	32	12	24	4	8	12	16	58	34	21	14	51	89	39	26	23
DISCARD	AT.W	U.S.A	0	0	0	0	0	0	0	0	0	0	0	42	57	57	62	64	36	63	28	29	69	57	27	71	45

Empty cells for 2000 indicate that catches were not reported to ICCAT.

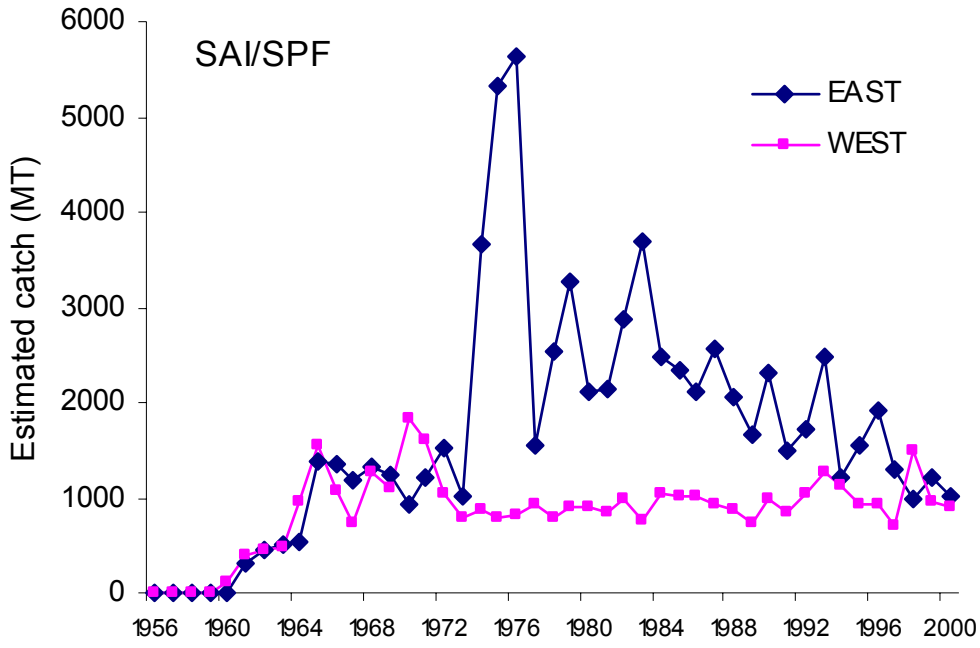
SAI-Table 3. Estimated catches (including landings and dead discards, in MT) of spearfish "only" in the Atlantic Ocean, by fisheries and by gears, 1976-2000 (as modified by the Working Group for use in 2001 assessment).

DataType	SAreaName	FleetName	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
TOTAL CATCH			966	804	573	581	680	763	823	708	742	611	768	704	760	646	662	363	200	1078	634	485	299	314	951	584	502
LANDING	AT. E		617	434	342	302	395	470	510	495	362	316	331	340	316	370	473	144	120	550	242	262	138	239	171	233	135
	AT.W		349	370	231	279	285	293	313	212	380	294	437	364	444	277	189	220	80	528	391	217	160	75	780	351	367
LANDING	AT.E	LL	412	184	88	67	125	154	184	183	140	88	79	93	60	100	100	37	28	438	144	184	79	171	85	152	75
		SURF	205	250	254	235	270	316	326	312	222	228	252	247	256	270	373	107	92	112	98	78	59	68	86	81	60
	AT.W	LL	349	370	231	279	285	293	313	212	380	294	437	364	444	277	189	158	67	493	352	185	135	75	780	351	367
		UNCL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62	13	35	40	32	26	0	0	0	0
DISCARD	ATW	LL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	1	0	0	0	0
	EAST	CHINA.PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	2	3	2	4	1
		CHINESE TAIPEI	149	50	5	17	4	10	43	14	6	8	1	0	0	6	10	0	0	389	87	138	37	125	59	81	41
		CUBA	127	55	53	36	71	65	102	145	85	17	53	50	18	45	47	0	0	0	0	0	0	0	0	0	0
		EC-ESPANA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	3	1	1	1	30	14
		EC-FRA.ESP	205	250	254	235	270	316	326	312	222	228	252	247	256	270	373	107	92	112	98	78	59	68	86	81	60
		JAPAN	3	19	9	10	19	28	18	22	24	38	22	18	26	30	30	9	26	28	36	26	25	30	22	37	19
		KOREA	104	39	14	4	31	20	21	2	25	26	2	20	13	15	12	27	3	3	5	5	8	4	0	0	
		NEI-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	13	9	6	8	0	0	
		PANAMA	28	11	3	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	1	11	4	0	0	31	0	0	0	0	2	5	3	3	0	0	0	0	0	0	0	0	0	0	
	WEST	BRASIL	105	132	107	57	60	29	42	53	70	84	195	93	94	84	50	49	53	168	51	84	53	36	90	238	191
		CHINA.PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	2	2	2	7	3
		CHINESE TAIPEI	107	5	8	13	28	61	16	27	39	24	54	22	246	115	42	55	6	187	202	33	26	2	110	28	17
		CUBA	0	87	42	111	93	101	130	25	147	79	42	119	64	37	64	62	13	35	40	32	26	0	0	0	
		EC-ESPANA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	22	50
		JAPAN	91	15	6	16	21	18	72	6	14	18	17	3	13	9	10	40	1	1	2	3	4	1	8	13	9
		KOREA	0	62	12	14	40	31	14	0	45	44	12	1	0	11	13	0	1	0	7	7	15	4	0	0	
		MEXICO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	16	16	0	5	549	34	89
		NEI-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26	26	26	21	16	0	0	
		PANAMA	0	17	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		TRINIDAD & TOBAGO	0	0	0	0	0	0	0	0	0	0	54	75	10	7	1	0	0	62	0	0	2	0	0	0	
		VENEZUELA	46	51	53	67	43	53	40	101	65	45	62	52	16	13	10	14	7	45	44	13	12	10	21	8	9
DISCARD	AT.W	Sum U.S.A.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	1	0	0	0	0

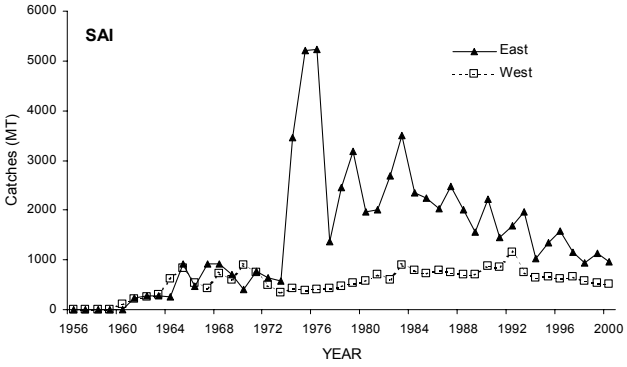
Empty cells for 2000 indicate that catches were not reported to ICCAT.



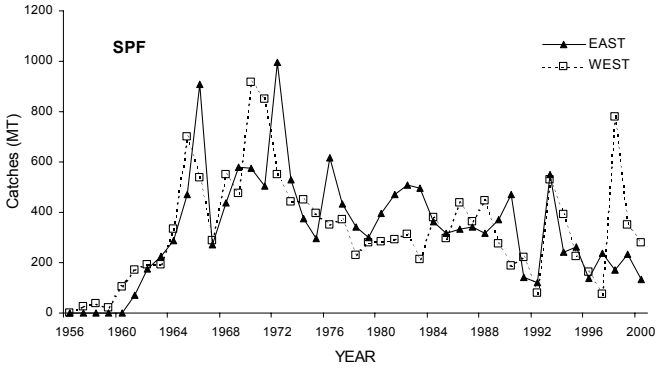
SAI-Fig. 1. Distribution of estimated sailfish/spearfish catches (landings and dead discards, reported and carried over) during 1956-1997. The east/west boundary is indicated by the bold line.



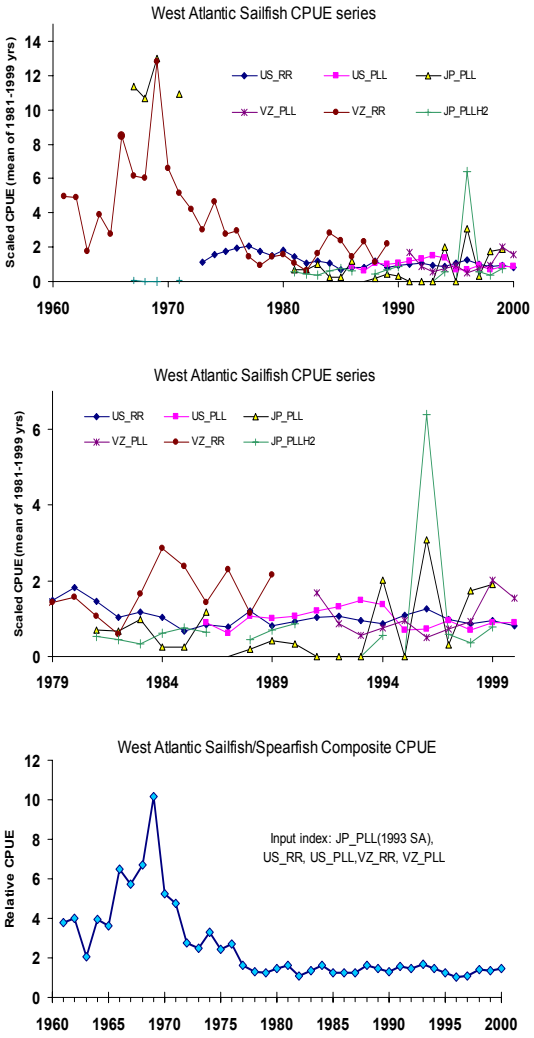
SAI-Fig. 2. Evolution of estimated sailfish/spearfish catches (landings and dead discards, reported and carried over) in the ICCAT Task I database during 1956-2000 for the east and west stocks.



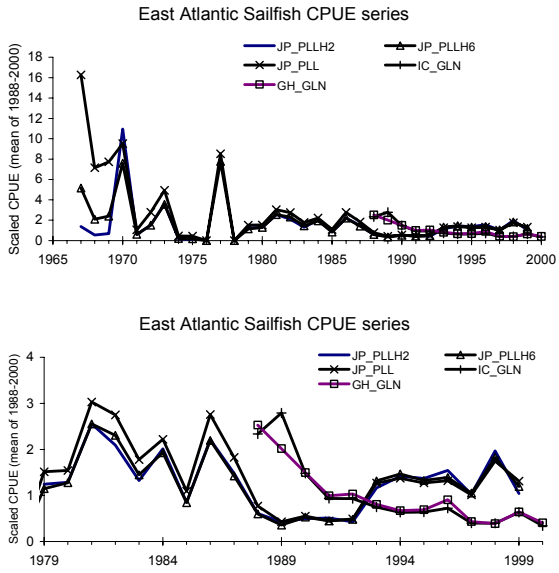
SAI-Fig. 3. Estimated sailfish "only" catches based on the new procedure for splitting combined SAI/SPF catches from 1956-2000.



SAI-Fig. 4. Estimated spearfish "only" catches based on the new procedure for splitting combined SAI/SPF catches from 1956-2000.



SAI Fig 5. Available standardized CPUE for western Atlantic sailfish for the periods 1967-2000 (upper), and for the period 1979-2000 (middle). Time series represented are from two different standardization treatments for the Japanese longline data (JP_PLL and JP_PLLH2), as well from the Venezuela recreational (VZ_RR) and longline fisheries (VZ_PLL), and the United States recreational (US_RR) and longline (US_PLL) fisheries. The bottom plate represents a sailfish/spearfish composite CPUE series that included the Japanese, United States and Venezuela time series.



SAI-Fig 6. Available standardized catch rates for the eastern Atlantic sailfish for the period 1967-2000 (upper) and for the period 1979-2000 (lower). Time series represented are from three different standardized treatments of the Japanese longline data (JP_PLLH2, JP_PLL, and JP_PLLH6), as well from Ghana gillnet (GH_GLN) and Cote D'Ivoire gillnet (IC_GLN)

7.9 SWO-ATL - ATLANTIC SWORDFISH

No new Atlantic stock assessments were conducted in 2000 or 2001. This report updates the Description of Fisheries, Current Regulations, and comments briefly on new information for 2000 and 2001 in the Status of Stocks, Outlook, and Management Recommendations sections. Most of the report and the conclusions of the Committee, remain unchanged from the 1999 Report. For the purposes of this Executive Summary, catches that were not reported were assumed to be equal to the reports for the previous year. In 1999, this was a small amount in the North, but over 6% in the South **(see SWO-ATL-Table 1)**.

SWO-ATL-1. Biology

Swordfish are distributed widely in the Atlantic Ocean and Mediterranean Sea, and range from Canada to Argentina on the western side, and from Norway to South Africa on the eastern side **(SWO-Figure 1)**. The management units for assessment purposes are a separate Mediterranean group, and North and South Atlantic groups separated at 5ºN. This stock separation is supported by recent genetic analyses. However, the precise boundaries between stocks are uncertain, and mixing is expected to be highest at the boundary in the tropical zone. Therefore there is uncertainty as to whether the management units used correspond exactly to the biological stock units. Hence, it is important to have effective management measures throughout the Atlantic and Mediterranean.

Swordfish feed on a wide variety of prey including groundfish, pelagics, deep-water fish and invertebrates. They are believed to feed throughout the water column, following the diel migration of the deep-scattering layer by maintaining their position within a preferred level of illumination (isolume). They are typically caught on pelagic longlines at night when they feed in surface waters.

Swordfish spawn in the warm tropical and subtropical waters throughout the year, although seasonality has been reported. They are found in the colder temperate waters during summer months. Young swordfish grow very rapidly, reaching about 140 cm LJFL (lower jaw-fork length) by age 3, but grow slowly thereafter. Females grow faster than males and reach a larger maximum size. Swordfish are difficult to age, but 53% of females are considered mature by age 5, at a length of about 180 cm.

SWO-ATL-2. Description of the fisheries

Directed longline fisheries from EC-Spain, the United States and Canada have operated since the late 1950s or early 1960s, and harpoon fisheries have existed since the late 1800s. Other directed swordfish fisheries include Brazil, Morocco, Namibia, EC-Portugal, South Africa, Uruguay, and Venezuela. The primary by-catch or opportunistic fisheries that take swordfish are Chinese Taipei, Korea, EC-France, and Brazil. The Japanese 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 in their tuna fisheries. Starting in February of 2000 Japanese vessels fishing in the North Atlantic were required to discard all swordfish as the Japanese block quota had been reached. This regulation has increased the difficulty in estimating the numbers and size frequencies of swordfish in the Japanese catch. The SCRS scientists believe that ICCAT Task I landings data provide minimum estimates because of unreported catch of swordfish made in association with illegal, unreported and unregulated (IUU) fishing activities. However, because trade data are lacking or incomplete for estimating IUU swordfish catch, the amount of NEI swordfish catch by IUU vessels could not be estimated.

Total Atlantic. The total Atlantic estimated catch of swordfish (North and South, including dead discards) reached an historical high of 38,448 MT in 1995, 13% higher than the previous peak catch of 34,097 MT in 1989 **(SWO-Table 1 and SWO-Figure 2)**. The 2000 estimated catch (reported and carried over) was 25,550 MT. As a few countries have not yet reported their 2000 catches and because of unknown IUU catches, this value should be considered provisional and subject to revision.

North Atlantic. From 1989 to 2000, the North Atlantic estimated catch (landings plus discards) has averaged about 15,000 MT **(SWO-Table 1 and SWO-Figure 2)**, although the 2000 estimated landings plus dead discards were reduced to 11,210 MT in response to ICCAT regulatory recommendations. In 2000, EC-Spain and the U.S. have decreased their peak North Atlantic landings, by 59% since 1987 and by 55% since 1989, respectively, in response to ICCAT recommendations. If the U.S. dead discards are counted, the total U.S. landings and discards have declined by 48% from the peak catch level of 1989. Reduced landings have also been attributed to shifts in fleet distributions, including movement of some vessels to the South Atlantic and out of the Atlantic. In addition, some

fleets, including the United States, EC-Spain, EC-Portugal and Canada, have changed operating procedures to opportunistically target tuna and/or sharks, taking advantage of market conditions and higher relative catch rates.

South Atlantic. The South Atlantic estimated catch (landings plus dead discards) was relatively low (generally less than 5,000 MT) before 1980. Since then, landings have increased continuously through the 1980s and the early 1990s to a peak of 21,752 MT in 1995 (levels that match the peak of North Atlantic harvest). The 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. Then the estimated landings decreased to 13,793 MT by 1998 (37% reduction). The reduction in catch following the peak in 1995 was in response to the regulations, and was partly due to a shift to other oceans and to a shift in target species. In 2000, the estimated landings (14,340 MT) were 6% below 1999 levels. This decrease was mainly due to decreased Brazilian (national and chartered) effort, and/or a change in target species by some vessels as a result of the implementation of management measures.

Discards. Only U.S. (1991-2000), Canada (1997-2000), and Japan (2000) report positive estimates of dead discards. Japan (2000) also reported live releases. EC-Spain reports zero dead discards. Both the U.S. and Canada used scientific observer data to estimate dead discards. The Japanese estimates are based on radio reports and are very preliminary.

SWO-ATL-3. State of the stocks

In 2000 and 2001, some of the updated North and South Atlantic CPUE data were available and were examined. The time series show similar trends to those in recent years. The available series for the North stock continue to show signs of optimism as observed in 1999 and 2000. One series for the South (examined in 2000) is stable over the time series.

In 1999, a new assessment of North and South Atlantic swordfish stocks was conducted. In the assessment, updated CPUE and catch data were examined. Sex and age-specific (North Atlantic) and biomass standardized catch rates (North and South Atlantic) from the various fleets were updated. The updated North Atlantic CPUE data show similar trends to previous years, but are also showing signs of stabilization or some improvement in the last few years. In particular, the recruitment index (1997 - 2000) and the catch at age (1997) used in the 1999 North Atlantic assessment show signs of substantially improved recruitment (age 1). The updated recruitment index also showed a high value in 1999 and 2000. These recent improvements in recruitment have already manifested in several age classes and in the biomass index of some fisheries, and should allow for increases in spawning biomass in the future (2001 and thereafter) and a more optimistic outlook, if the recent year-classes are not heavily harvested. The CPUE patterns in the South Atlantic by fleet are assumed to reflect the abundance pattern of different age groups of the population.

North Atlantic

In 1999, the status of the North Atlantic swordfish resource was assessed using both non-equilibrium stock production models and sex-specific sequential population analyses (SPA) based on catch **(SWO-Table 1)** and CPUE data through 1998.The relationship between catches and standardized fishing effort is shown in **SWO-Figure 3**. The base case assessments indicated that the decline in the North Atlantic swordfish biomass appears to have been slowed or arrested due to recent reductions in reported catch, especially compared to the peak catch values of 1987 **(SWO-Figure 4)**. In addition, estimated high recruitment (age1) in 1997 and 1998 could promote improvement in future spawning stock biomass, if these year classes are not heavily harvested. The pattern of decline in stock size followed by recent stabilization is reflected in the CPUEs for several fisheries, although variability in CPUEs leads to uncertainty about the degree of change in recent years. An updated estimate of maximum sustainable yield from production model analyses is 13,400 MT (with estimates ranging from 7,600 to 15,900 MT). Since 1983, only in four years (1984, 1997, 1998 and 1999) have North Atlantic swordfish catches been less than 13,400 MT **(SWO-Figure 5a)**; preliminary estimates of catches in 1999 were about 11,900 MT.

The biomass at the beginning of 1999 was estimated to be 65% (range: 51 to 105%) of the biomass needed to produce MSY. The 1998 fishing mortality rate was estimated to be 1.34 times the fishing mortality rate at MSY (range: 0.84 to 2.05). The replacement yield for the year 2000 was estimated to be about 11,700 MT. At the 1999 assessment meeting, anticipated catches in 1999 were expected to be about this level given the recent fishery performance and current regulations (i.e. about 10% over the ICCAT recommended catch levels for 1997 and 1998).

This prediction has been confirmed in 2000; catches in 1999 were about 11,900 MT **(SWO-Table 1)**. Catches below replacement level are likely to allow the stock to recover.

Overall, the sex-specific sequential population analyses conducted for North Atlantic swordfish in 1999 were consistent with the stock production model results, particularly in terms of the trends in population trajectories. The Base Case sex-specific SPA point estimates for age 1 gradually increased in the early 1980's, shifting to a somewhat higher level from 1985 to 1989. Subsequently, the abundance of age 1 shifted back to a lower level between 1990 and 1996 and then increased to the highest levels of the time series in 1997 and 1998. The trends for ages 2, 3 and 4 are similar with the appropriate time lags, but the pattern is less pronounced. The estimated abundance of older (5+) fish declined to about one third of the numbers in 1978. The estimated fishing mortality rate has generally increased for all ages. The fishing mortality rate during the last three years was about 0.25 /year for males (age 5+) and 0.57 for females (age 9+). Given this fishing mortality pattern, the biomass of adult females would be reduced to a level of about 8 percent of the maximum at equilibrium. This is well below the level that is commonly considered to result in risks of recruitment over-fishing in other stocks.

South Atlantic

The Committee noted that catches have been reduced since 1995, as was recommended by the SCRS. Previous Committees expressed serious concern about the trends in stock biomass of South Atlantic swordfish based on the pattern of rapid increases in catch which could result in rapid stock depletion, and declining CPUE trends of some by-catch fisheries. The Committee has had uncertainties about the CPUE series and their relationship to the abundance of the stock. However, the by-catch index was used in the last assessment as it provided a long enough time series required for fitting a production model; CPUE series from target fisheries are only available for a relatively short time period. Some sources of bias were detected in 2000 in the methodological protocol to obtain catch in weight from a by-catch fleet. Additional methodological analyses presented to the Committee indicated some potential sources of bias which could affect any of the series considered.

A quantitative assessment for the South Atlantic swordfish stock was conducted in 1999 based on the available information at that time, yielding results with greater uncertainty than for the North **(SWO-Figure 6)**. In this non-equilibrium production model evaluation, the estimate of maximum sustainable yield was 13,650 MT (with estimates ranging from 5,000 to 19,600 MT). Biomass at the beginning of 1999 was estimated to be 110% (range: 84 to 140%) of the biomass needed to produce MSY. The 1998 fishing mortality rate was estimated to be 0.84 times the fishing mortality rate at MSY (range: 0.47 to 2.54). The surplus production (estimated replacement yield) for the year 2000 was estimated to be about 14,800 MT. Prior to 1989, South Atlantic catches were below the estimated MSY, but since 1991, only in the year 1998 (13,516 MT) have reported South Atlantic swordfish catches been less than 13,600 MT **(SWO-Figure 5b)**. Estimated catches in 1999 of 15,463 MT were below the average from 1991 to 1997 (17,400 MT).

SWO-ATL-4. Outlook

North Atlantic

For the North Atlantic swordfish stock, the baseline surplus production model showed that, although the decline in swordfish biomass has been slowed or arrested, the population biomass is estimated to be 35% below the level that would produce the maximum sustainable yield. If total catch, including discards and overages, was less than the status quo catch limit of 10,700 MT, there would be a greater than 50% chance that the population would reach B_{MSY} in 15 years, and be approaching B_{MSY} in 10 years. However, 11,800 MT would cause the median population trajectory to continue declining **(SWO-Figure 4)**.

Of the sensitivity analyses performed with other production model formulations and methods for characterizing uncertainty, some were more and some were less optimistic than the baseline model, but all showed that the population was below B_{MSY}. SPA assessments also showed that the female spawning stock biomass was low with respect to common reference points, but the catch levels necessary to rebuild within 5, 10 or 15 years depended on both the management objectives (proxy for B_{MSY}) and the assumptions made, including future recruitment levels, which are influenced by environmental conditions.

The high recruitment observed in recent years (age 1 in 1997 - 2000) should allow for a more optimistic outlook, if the recent year-classes are not heavily harvested. The updated indices examined in 2000 confirmed that a positive

effect of this strong recruitment has already manifested in younger ages and in the biomass indices of several fisheries.

South Atlantic

The updated CPUE data presented in 2000 from a targeting fishery covering a very large geographical area indicates that the standardized CPUE in 1999 was slightly higher than in recent years, with a flat trend over the available time series. CPUE updates from the other fisheries were not available to examine in 2000.

Based on the 1999 Base Case assessment for South Atlantic swordfish, the recent biomass has declined to around 10% above the MSY level, and that F was around F_{MSY}. If the catch of 1998 (~13,500 MT) is continued into the future, the median trajectory was expected to increase slightly **(SWO-Figure 6)**. However, if total catch in the future is around the current catch limit (14,620 MT), the median trajectory was expected to decline slightly below B_{MSY}. Of the various sensitivity analysis done in 1999, some were more and some were less optimistic. The age structured production model sensitivity analyses were much more pessimistic. The status of the South stock was considered more uncertain than the status of the North stock, due to the limitations of the indices of abundance, and the absence of age and growth data.

SWO-ATL-5. Effects of current regulations

This Executive Summary only takes into account catch data transmitted to the SCRS by the different countries and which were available during the meeting. Notwithstanding, according to the information transmitted by the various countries in 1999, the data available for 2000 probably are close to the total catches that would be expected. This year the SCRS has not made any estimate of unreported catches by the carryover of data from previous years.

On the other hand, the assessment of the level of compliance of the minimum size regulation in the fisheries is very much affected by the different methodologies used by each country to obtain this basic information, and the criteria applied in the substitution procedures, both within each fishery as well as between the fisheries and fleets. The lack of catch-at-size data is more marked for the South Atlantic. For these reasons, the SCRS considers that it is not appropriate to apply these scientific estimates for purposes of evaluating compliance, and therefore only summary data are provided.

North Atlantic catch limit. The total allowable catch in the North Atlantic in 2000 was 10,600 MT (10,200 MT retained and 400 MT discarded dead). The reported landings were 10,078 MT and the estimated dead discards were 1,132 MT.

South Atlantic catch limits. The total allowable catch in the South Atlantic in 2000 was 14,620 MT. The reported landings for 2000 were 14,338 MT and the reported dead discards were 1 MT.

Minimum size limits. In 1998, the percentage of swordfish reported landed less than 125 cm LJFL was about 19% (in number) overall for all nations fishing in the Atlantic. If this calculation is made using reported landings plus estimated dead discards, then the percentage less than 125 cm LJFL would be about 23%. These calculations were neither updated nor examined in 2000 and 2001.

Other implications. The Committee expressed concern about the uncertainties of the stock structure of Atlantic swordfish and the possibility that these assumed stocks do not exactly reflect the geographical distribution of the respective stocks. This source of uncertainty should be considered in the assessments, among other possible sources of uncertainty.

In February, 2000, Japan implemented a domestic regulation on its longline vessels that fish North of 5ºN in order to prevent the retention of swordfish caught as by-catch. This measure was implemented to comply with the ICCAT recommendations in effect concerning Japan's catch limit on the North stock. This domestic regulation has resulted in the discard of swordfish caught in the North stock and, to a certain extent, could have influenced similar behavior of the fleet that fishes the South Atlantic swordfish stock. The Committee considers that this regulation, combined with the very limited discard monitoring of the Japanese fishery, has already been considerably detrimental to the availability of scientific data on catches, sizes and CPUE indices of this fleet. The Committee expressed its serious concern over this limitation on data for future assessments.

SWO-ATL-6. Management recommendations

No new assessment was developed in 2000 or 2001, so the recommendations are mainly based on the results obtained in 1999 and updated with some new information provided to the SCRS in 2000 and 2001.

North Atlantic

In the last assessment, the Committee indicated that the actions the Commission had taken to reduce catch in 1997 to 1999 appear to have slowed and/or arrested the decline in the North Atlantic swordfish stock. At that time, the Committee recommended to the Commission, if it desires to rebuild the North Atlantic swordfish stock to biomass levels that would support MSY within 10 years with a probability of greater than 50%, then the catch should be reduced to 10,000 MT. At a constant catch of the 1999 catch limit of 10,700 MT, there is a greater than 50% chance of reaching MSY levels in 15 years. However, this recovery probability is very sensitive to even a 10% overage, and if constant catches of 11,800 MT (1999 catch limit plus 10%) are continued for the next 15 years, the stock will likely not reach biomass levels that will support MSY with a probability of greater than 50%. Therefore if the Commission wishes to rebuild in a 15-year time frame, catch limits (including discards) should not be increased, and should not be exceeded. The Committee noted with concern that the 1999 catches were 11,914 MT, about 11% above the TAC. The management actions taken by the Commission in 1997 to 1999 clearly illustrate the resilience of swordfish, and the responsiveness of the stock to a decrease in fishing mortality. With just three years of management action under the strict quota scenario (introduced in 1997), there are positive signs from the fishery in terms of catch rates. However, the Committee noted that positive signs in recent recruitment may be in part due to environmental influence, and it is unknown if this influence will be positive or negative in the future.

The Committee expressed concern about the high catches (landings plus discards) of small swordfish and the lack of and possible inaccuracies of size data from many fisheries, and emphasized that gains in yield could accrue if the intent of current recommendations on small fish could be more effectively implemented. The high recruitment observed in recent years (age 1 in 1997 - 2000) should allow for a more optimistic outlook if the recent year-classes are not heavily harvested. The updated indices examined in 2000 and 2001 confirmed that a positive effect of this strong recruitment has already manifested in several age classes and in the biomass indices of several fisheries

South Atlantic

The Committee noted that catches have been reduced from the 1991-1997 average, consistent with the recommendations by the SCRS. The estimated catches in 1999 were 15,463 MT. The SCRS continues to be concerned about the swordfish stock status in the South Atlantic based on the results of preliminary production model analysis conducted in 1999 and on the pattern of high catches and declining CPUE trends in some of the by-catch fisheries used in 1999 as indicators of abundance. The result obtained in 1999 was that the recent level of biomass was estimated to be at about 10% above the level that would support MSY. However, if there is a constant catch at the year 2000 catch limit (14,620 MT) for the next 10 years, there is a greater than 50% chance of biomass declining to levels slightly below the level that would support MSY. Catches at the level of 1998 (~13,500 MT) would keep the stock at about (and above) the biomass level that would support MSY. The Commission should be reminded that the production model is affected by high levels of uncertainty in the input data. If the Commission intends to increase the probability of keeping the stock in a healthy condition, it should keep fishing mortality rates, and hence catch, at about MSY levels.

ATLANTIC SWORDFISH SUMMARY

	North Atlantic	South Atlantic
Maximum Sustainable Yield[1]	13,370 MT (7,625 - 15,900)[4]	13,650 MT (5,028 - 19,580)
Current (2000) Yield	11,210 MT	14,340 MT
Current (2000) Replacement Yield[2]	11,720 MT (6,456 - 15,040)	14,800 MT (5,328 - 16,240)
Relative Biomass (B_{1999}/B_{MSY})	0.65 (0.51 - 1.05)	1.10 (0.84 - 1.40)
Relative Fishing Mortality		
F_{1998}/F_{MSY}[1]	1.34 (0.84 - 2.05)	0.81 (0.47 - 2.54)
F_{1998}/F_{max}[3]	1.60 (1.52 - 1.68)	Not estimated[5]
$F_{1998}/F_{0.1}$[3]	3.52 (3.44 - 3.70)	Not estimated
Management measures in effect	Country-specific quotas [Ref. 99-2]; 125/119 cm LJFL minimum size [Ref. 99-2].	Country-specific quotas [Ref. 97-2]; 125/119 cm LJFL minimum size [Refs. 90-2 & 95-10].

1 Base case production model results based on catch data 1950-1998 (SWO-Table 1 1999 SCRS Report).
2 For next fishing year.
3 Base case sex-specific SPA results based on catch data 1978-1998 (SWO-Table 1 1999 SCRS Report); statistics computed based on females only.
4 80% confidence intervals are shown.
5 Production model results do not provide a basis for these estimates.

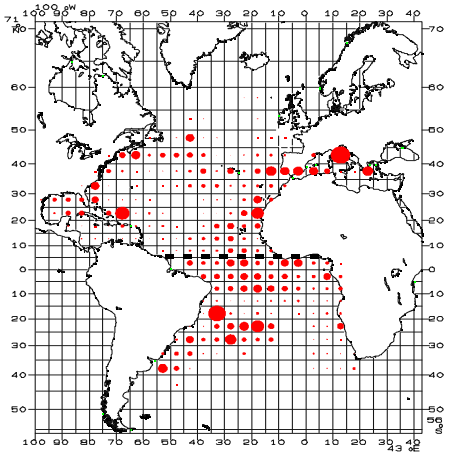
SWO-ATL-Table 1. Estimated catches (landings and discards, MT) of Atlantic swordfish in 1976-2000*, by major area, gear and flag.

			1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	TOTAL		*9508*	*9264*	*14601*	*15231*	*18881*	*15155*	*19662*	*19929*	*21930*	*23969*	*24380*	*26266*	*32469*	*34098*	*32796*	*28647*	*29027*	*32586*	*34895*	*38476*	*33069*	*31324*	*25976*	*27003*	*25550*
AT.N	*TOTAL*		*6696*	*6409*	*11835*	*11937*	*13558*	*11180*	*13215*	*14527*	*12791*	*14383*	*18486*	*20236*	*19513*	*17250*	*15672*	*14934*	*15394*	*16658*	*15292*	*16724*	*14945*	*12917*	*12168*	*11685*	*11210*
	Landings	Longline	5234	5458	11123	11177	12831	10549	13019	14023	12664	14240	18269	20022	18927	15348	14026	14208	14288	15568	14100	15617	13532	12063	10727	10516	9616
		Other Surf.	1462	951	712	760	727	631	196	504	127	143	217	214	586	1902	1646	511	723	682	484	581	825	403	956	640	462
	Discards	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	215	383	408	708	526	562	439	476	525	1131
		Other Surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26	12	9	4	1
	Landings	BARBADOS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	16	12	
		BRASIL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	134
		CANADA	15	113	2314	2970	1885	561	554	1088	499	585	1059	939	898	1247	911	1026	1547	2234	1676	1610	739	1089	1115	1119	968
		CANADA-JPN	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	
		CHINA.PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	337	304	22
		CHINESE TAIPEI	471	246	164	338	134	182	260	272	164	152	157	52	23	17	270	577	441	127	507	489	521	509	286	285	347
		CUBA	283	398	281	128	278	227	254	410	206	162	636	910	832	87	47	23	27	16	50	86	7	7	7	7	
		EC-ESPANA	2816	3309	3622	2582	3810	4014	4554	7100	6315	7441	9719	11135	9799	6648	6386	6633	6672	6598	6185	6953	5547	5140	4079	3993	4595
		EC-FRANCE	0	0	0	0	5	4	0	0	1	4	4	0	0	0	75	75	75	95	46	84	97	164	110	104	122
		EC-IRELAND	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	15	132	81	
		EC-ITALY	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		EC-PORTUGAL	32	38	17	29	15	13	11	9	14	22	468	994	617	300	475	773	542	1961	1599	1617	1703	903	773	777	732
		EC-U.K	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	1	5	11	0	2	
		FAROE-ISLANDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	4
		GRENADA	0	0	0	0	0	0	0	0	0	0	0	0	56	5	1	2	3	13	0	1	4	15	15	42	
		ICELAND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
		JAPAN	1149	793	946	542	1167	1315	1755	537	665	921	807	413	621	1572	1051	992	1064	1126	933	1043	1494	1218	1391	1212	179
		KOREA	335	541	634	303	284	136	198	53	32	160	68	60	30	320	51	3	3	19	16	16	19	15	0	0	
		LIBERIA	0	0	0	0	5	38	34	53	0	24	16	30	19	35	3	0	7	14	26	28	28	28	28	28	0
		MAROC	12	7	11	208	136	124	91	129	81	137	181	197	196	222	91	110	69	39	36	79	462	267	191	119	
		MEXICO	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	14	0	0	14	28	24	37
		NEI-1	0	0	0	0	0	0	0	0	0	0	0	0	76	112	529	0	0	0	0	0	0	0	0	0	
		NEI-2	0	0	0	0	0	12	0	0	0	0	14	3	131	190	185	43	35	111	0	0	0	0	0	0	
		PANAMA	91	22	76	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	
		POLAND	0	0	6	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		RUMANIA	0	0	1	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	1	0	6	6	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	0	0	0	0	2
		ST. LUCIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	
		ST. VINCENT TRINIDAD & TOBAGO	0	0	0	0	0	0	0	21	26	6	45	151	42	79	66	71	562	11	57	106	68	43	75	82	41
		U.S.A	1429	912	3684	4619	5625	4530	5410	4820	4749	4705	5210	5247	6171	6411	5519	4310	3852	3782	3366	4026	3559	2986	3058	2908	2863
		U.S.S.R	19	15	23	10	21	0	69	0	16	13	18	4	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	1	1	5	5	3	3
		VENEZUELA	43	15	46	182	192	24	25	35	23	51	84	86	2	4	9	75	103	73	69	54	85	20	37	30	30
	Dead discards	CANADA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	52	35	50
		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	592
		U.S.A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	215	383	408	708	526	588	446	433	494	490

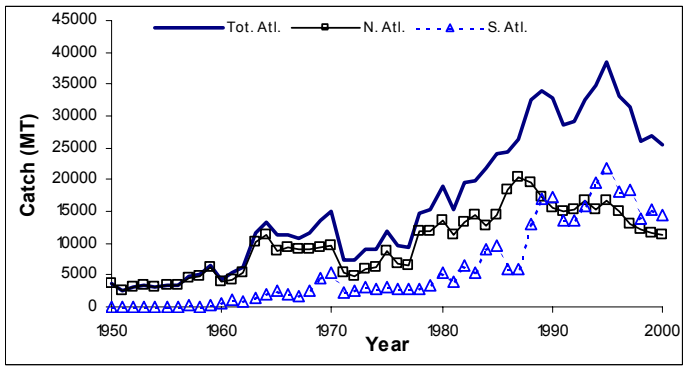
SWO-ATL-Table 1 (cont.). Estimated catches (landings and discards, MT) of Atlantic swordfish in 1976-2000, by major area, gear and flag.

			1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
AT.S	*TOTAL*		*2812*	*2855*	*2766*	*3294*	*5323*	*3975*	*6447*	*5402*	*9139*	*9586*	*5894*	*6030*	*12956*	*16848*	*17124*	*13713*	*13633*	*15928*	*19603*	*21752*	*18124*	*18407*	*13807*	*15318*	*14340*
	Landings	Longline	2812	2840	2749	3265	5179	3938	6344	5307	8920	8863	4951	5446	12404	16398	16705	13287	13173	15547	17365	20806	17799	18239	13649	14792	14180
		Other Surf.	0	15	17	29	144	37	103	95	219	723	943	584	552	450	419	426	460	381	2238	946	324	147	148	520	158
	Discards	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	21	10	6	1
	Landings	ANGOLA	0	0	0	0	0	0	0	0	26	228	815	84	84	84	0	0	0	0	0	0	0	0	0	0	
		ARGENTINA	111	132	4	0	0	0	20	0	0	361	31	351	198	175	230	88	88	14	24	0	0	0	0	0	
		BELIZE.SH.OB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	17	8
		BENIN	0	0	0	0	0	18	24	0	86	90	39	13	19	26	28	28	26	28	25	24	24	10	0	3	
		BRASIL	365	396	372	521	1582	655	1019	781	468	562	753	947	1162	1168	1696	1312	2609	2013	1571	1975	1892	4100	3847	4721	3393
		BULGARIA	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		CAMBODIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	
		CHINA.PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	534	344
		CHINESE TAIPEI	745	675	625	1292	702	528	520	261	199	280	216	338	798	610	900	1453	1686	846	2829	2876	2873	2562	1147	1168	1303
		COTE D'IVOIRE	0	0	0	0	0	0	0	0	10	10	10	10	12	7	8	18	13	14	20	19	26	18	25	26	20
		CUBA	317	302	319	272	316	147	432	818	1161	1301	95	173	159	830	448	209	246	192	452	778	60	60	0	0	
		EC-ESPANA	0	0	0	0	0	0	0	0	0	0	66	0	4393	7725	6166	5760	5651	6974	7937	11290	9622	8461	5832	5758	6388
		EC-FRA.ESP	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
		EC-PORTUGAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	380	389	441	384	381	392
		G.EQUAT.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	
		GHANA	0	0	0	0	110	5	55	5	15	25	13	123	235	156	146	73	69	121	51	103	140	44	106	121	117
		HONDURAS-OB.SH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	4	5	2	8	
		JAPAN	105	514	503	782	2029	2170	3287	1908	4395	4613	2913	2620	4453	4019	6708	4459	2870	5256	4699	3619	2197	1494	1186	815	807
		KOREA	812	699	699	303	399	311	486	409	625	917	369	666	1012	776	50	147	147	198	164	164	7	18	7	0	10
		LITUANIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	794	0	0	0	0	0	
		NAMIBIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	730	469
		NEI-1	0	0	0	0	0	0	0	0	0	0	0	0	0	856	439	0	0	0	0	0	0	0	0	0	
		NIGERIA	0	0	0	0	0	0	0	83	69	0	0	0	0	0	0	0	3	0	857	0	9	0	0	0	
		PANAMA	219	28	83	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	105	
		SAO TOME & PRINCIPE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	14	14	
		SOUTH AFRICA	0	0	0	28	31	9	3	7	0	8	5	5	4	0	0	5	9	4	1	4	1	1	169	76	230
		TOGO	0	0	0	0	0	0	0	0	0	6	32	1	0	2	3	5	5	8	14	14	64	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	171	396	160	179	142
		U.S.S.R	138	106	161	70	154	40	26	46	158	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		URUGUAY	0	0	0	0	0	92	575	1084	1927	1125	537	699	427	414	302	156	210	260	165	499	644	760	889	650	713
	Dead discards	U.S.A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	21	10	6	1

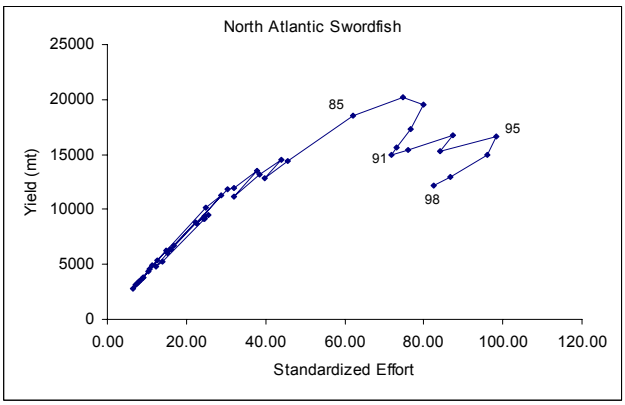
* As of 5 October 2001. Subsequently, catches were reported for the northeastern Atlantic by EC-Ireland (36 MT) and Morocco (114 MT).
Empty cells for 2000 indicate that catches were not reported to ICCAT.



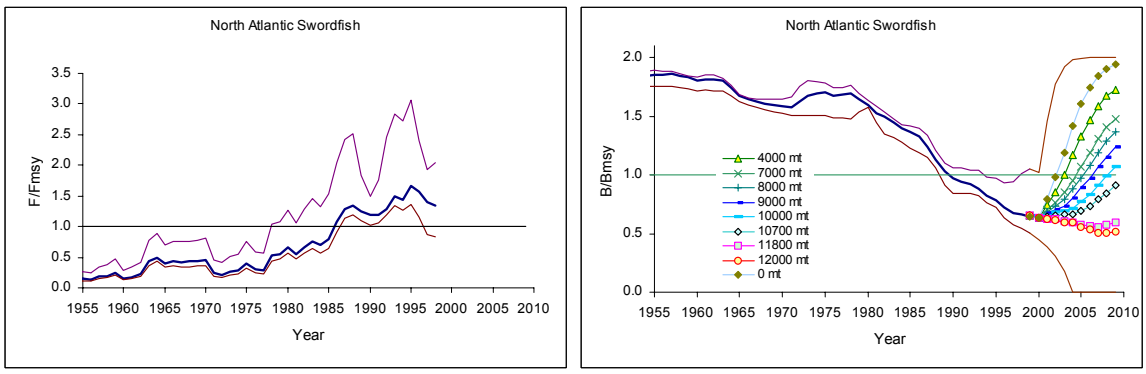
SWO-ATL-Fig. 1. Geographical distribution of swordfish longline catches in 1997. The dashed line at 5° is the assumed boundary between North and South management units.



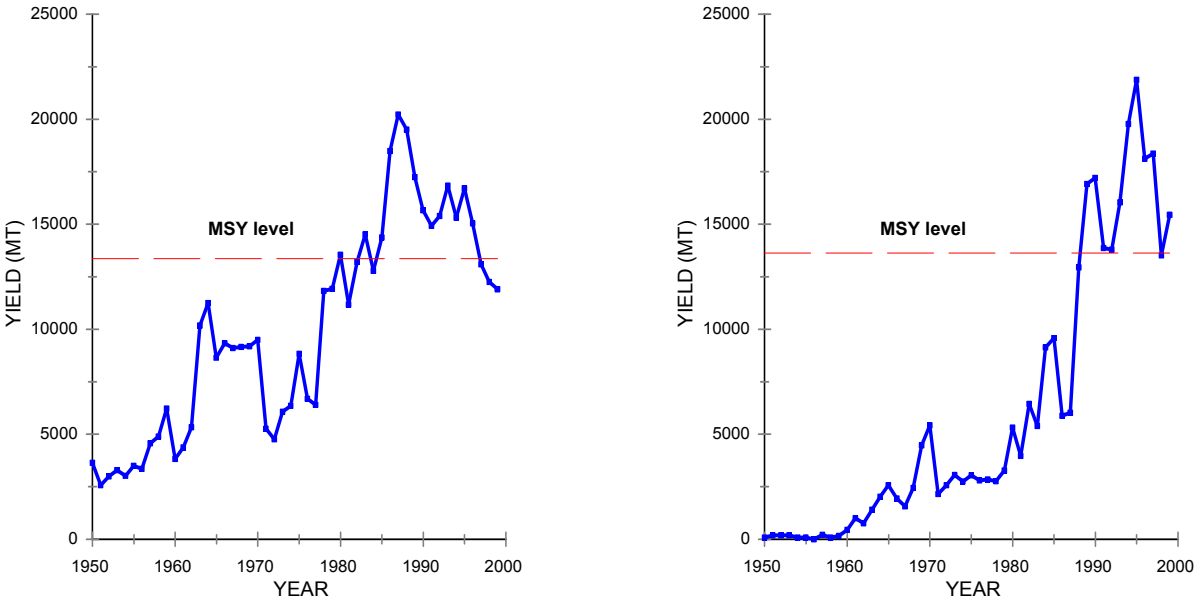
SWO-ATL-Fig. 2. Estimated catches (reported and carried over) of Atlantic swordfish (in MT, including discards) for 1950-2000.



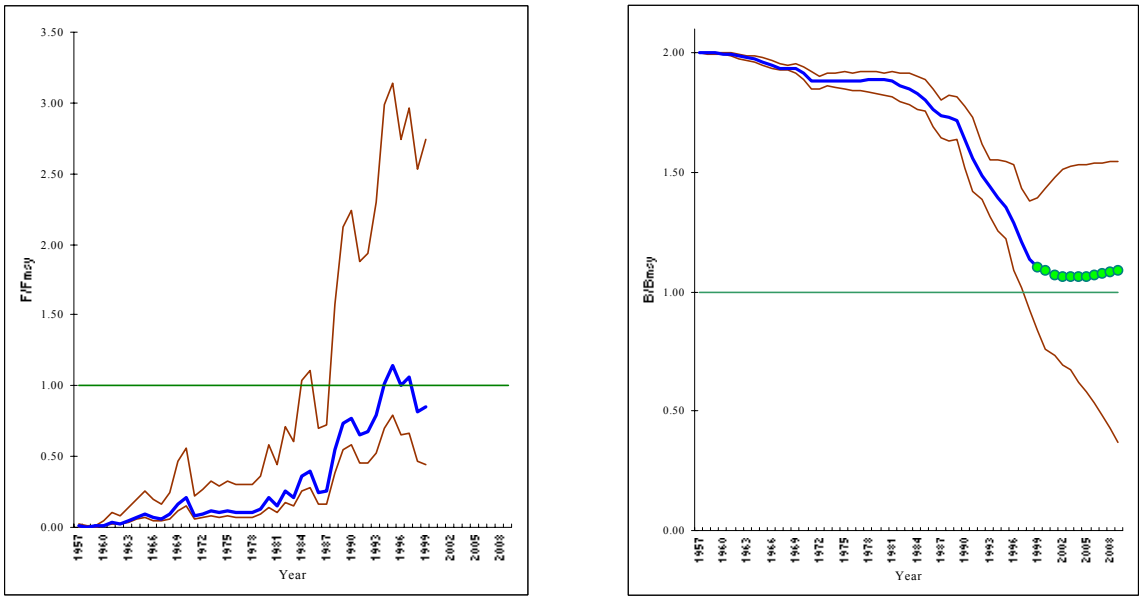
SWO-ATL-Fig. 3. Relationship between nominal catch and estimated standardized effort for North Atlantic swordfish. Selected years are indicated. (Figure from 1999 Report, and not updated in 2001.)



SWO-ATL-Fig. 4. North Atlantic swordfish assessment results. Left panel: Estimated fishing mortality rate relative to F_{msy} (F/F_{msy}) for the period 1955-1998 (median with 80% confidence bounds based on bootstrapping are shown). Right panel: Estimated biomass relative to biomass at MSY (B/Bmsy) for the period 1955-1999, followed by 10-year projected B/B_{msy} under the constant catch scenarios listed. Upper and lower lines represent approximate 80% confidence ranges. For the catch projection period (1999-2009), upper line is the upper 80% confidence bound for the 0 MT projection and lower line is the lower 80% confidence bound for the 12000 mt projection. (Figure from 1999 Report, and not updated in 2001.)



SWO-ATL-Fig. 5. Left panel: Annual yield (MT) for north Atlantic swordfish relative to estimated MSY level. Right panel: Annual yield (MT) for south Atlantic swordfish relative to the estimated MSY level.



SWO-ATL-Fig. 6. South Atlantic swordfish assessment results. Left panel: Estimated fishing mortality rate relative to Fmsy (F/Fmsy) for 1957-1998 (median with 80% confidence bounds based on bootstrapping are shown). Right panel: Estimated biomass relative to biomass at MSY (B/Bmsy) for 1957-1999 and projected biomass ratio under an assumed constant catch of 13,620 MT per year for the period 1999-2009 (median with 80% confidence bounds based on bootstrapping are shown). (Figure from 1999 Report, and not updated in 2001.).

7.10 SWO-MED - MEDITERRANEAN SWORDFISH

In September 2000, the Fifth Meeting of the GFCM/ICCAT Ad Hoc Working Group on Stocks of Large Pelagic Fishes in the Mediterranean Sea attempted to update the Mediterranean swordfish data base. The Committee continues to be concerned about the lack of data on catch, effort and size from some important fisheries in the Mediterranean. The absence of these data make it impossible to conduct reliable stock assessments.

SWO-MED-1. Biology

Swordfish is a cosmopolitan species found in the Atlantic Ocean and the Mediterranean Sea. Several recent genetic studies suggest that Mediterranean swordfish form a unique stock that is reproductively isolated from the Atlantic stocks. Several fisheries and biological studies suggest that there is limited movement from the Mediterranean to areas immediately adjacent in the North Atlantic. Genetic studies have confirmed this pattern.

Swordfish feed mainly in the meso-pelagic zone and its prey is comprised mostly of cephalopods and pelagic fish species. Spawning occurs in the central Mediterranean Sea and around the Balearic Islands and probably in other locations. It has been described that in the Mediterranean, swordfish spawn during the summer months and young swordfish grow very rapidly, reaching more than 80 cm by the end of their first year of life. Females grow faster than males and reach a larger maximum size. Female swordfish reach sexual maturity in their third year of life at a length of about 130 cm, while males mature one year earlier ; this is substantially younger than the age of maturity assumed for the Atlantic stocks (age 5).

SWO-MED-2. Description of the fisheries

Mediterranean swordfish fisheries are characterized by high catch levels. It should be noted that average annual reported catches (about 14,800 MT from 1984 to 1999) are similar to those of the North Atlantic. The Mediterranean is a much smaller body of water compared to the North Atlantic. However, the potential reproductive area in the Mediterranean is probably relatively larger than that in the Atlantic. Further, the productivity of the Mediterranean Sea is thought to be very high.

Swordfish fishing has been carried out in the Mediterranean using harpoons and driftnets at least since Roman times. Mediterranean total swordfish landings showed an upward trend from 1965-72, stabilized between 1973-1977, and then resumed an upward trend reaching a peak in 1988 (20,339 MT) **(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. Since 1988, the reported landings of swordfish in the Mediterranean Sea have declined and since 1990, they have fluctuated from about 12,000 to 16,000 MT. There has been a sharp decline in *reported* swordfish catch in 2000, largely due to the lack of timely reporting by Italy, Greece, and Morocco, so that the actual level of catch in 2000 is highly uncertain.

Swordfish fishing is carried out all over the Mediterranean Sea. The biggest producers of swordfish in the Mediterranean Sea in the recent years (1997-1999) were Italy (44%), Morocco (27%), Greece (9%), and Spain (9%). Also, Algeria, Cyprus, Malta, Tunisia, and Turkey have fisheries targeting swordfish in the Mediterranean. Incidental catches of swordfish have also been reported by Croatia, France, Japan and Libya.

At present, mainly surface longlines and driftnets are used for fishing. Most of the above-mentioned countries operate longline fisheries, and large-scale driftnet fisheries are mostly limited to Italy (3632 MT in 1997) and Morocco (2979 MT in 1999). There are other countries known to be fishing with driftnets that do not report their catches. Swordfish are also caught with harpoons and traps, but traps gears are not used for targeting swordfish.

There is a high demand for swordfish for fresh consumption in most Mediterranean countries.

SWO-MED-3. State of the stocks

The Committee is concerned about the high catches of juvenile swordfish (those which have never spawned) in the Mediterranean, the apparent scarcity of large fish in the catch, and high uncertainty in estimates of high annual recruitments. Even without the aid of a robust analytical assessment, there are obvious warning signs from the Mediterranean fishery that warrant concern. The fact that the fishery is based on 2-3 young year-classes **(SWO-**

MED-Figure 2) makes it vulnerable to recruitment changes. Furthermore, compared to the North Atlantic swordfish stock, the age of maturity is substantially less and fish have a smaller size at age in the Mediterranean, either suggesting possible biological compensation for heavy mortality and/or the influence of different environmental conditions in the Mediterranean. The VPA conducted in 1995 was not updated in 1998 partly because of a lack of sufficient improvements to input data, and partly due to time constraints. The results of the 1995 analysis were highly uncertain owing to uncertainty in the biological parameters, catch (1990-1996 since revised upwards substantially), and standardized CPUE used in tuning the analysis. As such, there was uncertainty about the veracity of the estimated trends in abundance, exacerbated by a lack of knowledge of current stock sizes relative to an unfished condition.

SWO-MED-4. Outlook

Given the absence of a substantial portion of recent data (catch, effort and size), the short time series of reliable data and the long history of exploitation in the Mediterranean, it is uncertain where the Mediterranean stock is in relation to unexploited stock levels. The unknown status of the stock, the very large and uncertain catch of very small fish, and warning signs from the fishery are cause for concern.

SWO-MED-5. Effects of current regulations

Although ICCAT has no specific regulatory measures for Mediterranean swordfish fisheries, several countries do. The EC Mediterranean Member States are enforcing the regulations adopted by the EC to this effect and particularly the minimum size of 120 cm LJFL (with no tolerance). More restrictive measures were adopted by some of these countries at the national level, such as the ban of driftnet use in the Ligurian Sea; the implementation of a closed season (1 October-30 January) by Greece; the setup of a special licensing system for bluefin and swordfish fishing. Spain adopted a limit to the number and size of hooks for longline (2000 hooks). Non-EC Member Countries are enforcing the GFCM regulation of relevance to large pelagic fisheries, particularly the maximum size of driftnets to 2.5 km. Some non-EC Member Countries, such as Croatia and Turkey, apply the minimum size of 120 cm LJFL. Additional national regulations are described in SCRS/98/11-bis.

The Committee reviewed the various measures taken by member countries and noted the difficulties in implementing some of the management measures, particularly that of minimum size. This minimum size regulation may not be practical in all situations given that 64% of the Mediterranean catches of swordfish in 1994 were less than 120 cm. Alternate and complementary measures are suggested in the Report of the Fourth Meeting of the Ad Hoc GFCM/ICCAT Joint Working Group (Genoa 1998).

SWO-MED-6. Management recommendations

Consistent with the Precautionary Approach and if managers want to be assured of maintaining the Mediterranean stock of swordfish, then the Committee strongly recommends reducing the fishing pressure on juvenile swordfish in order to improve yield per recruit and spawning biomass per recruit. In addition, given the uncertainty of the location of the boundary between the Mediterranean and North Atlantic stocks, it is important to identify the biological origin of those catches reported at or near the boundary so that the resulting knowledge can be considered in the management of the North Atlantic and/or Mediterranean stocks.

The Committee continues to recommend that the Commission ensure that reliable data be provided on catch, effort and size for Mediterranean swordfish. Improvements to these basic inputs to the stock assessment are essential before an improved assessment of Mediterranean swordfish can be achieved.

MEDITERRANEAN SWORDFISH SUMMARY

Maximum Sustainable Yield	Not estimated
Current (2000) Yield	Incomplete[1]
Replacement Yield	Not estimated
Relative Biomass (B_{1994}/B_{MSY})	Not estimated
Relative Fishing Mortality	
F_{1994}/F_{MSY}	Not estimated[2]
F_{1994}/F_{max}	~ 1.1 (0.9 - 1.4)[3]
$F_{1994}/F_{0.1}$	~ 1.9 (1.5 - 2.4)[3]
Relative Recruitment	Not estimated[2]
Management measures in effect	
No ICCAT regulations; national and European Union minimum size and effort controls.	

1 For the purposes of this Executive Summary, catches that were not reported were assumed to be equal to the reports for the previous year. In 1999, more than half of the estimated catch was not reported, and even less in 2000 (see SWO-MED-Table 1).

2. Results suggest that it is unlikely that the Mediterranean stock can sustain continued high catches of juveniles without high recruitment. The odds of continued high recruitment diminish as mature fish are removed from the population.

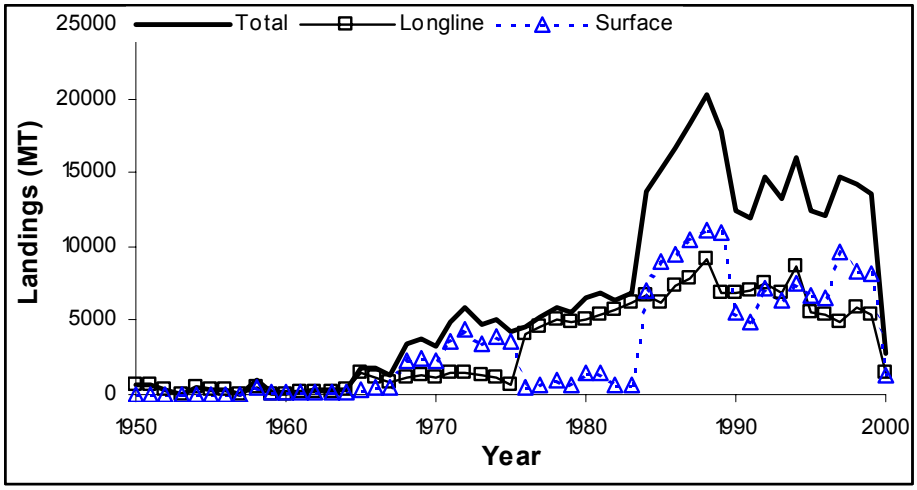
3 Based on stock size weighted average F's for age 2 and 3 fish in 1993 from VPA analysis conducted in 1995. Approximate 80% CI based on estimated CV(F) = 0.2.

~ = approximate value.

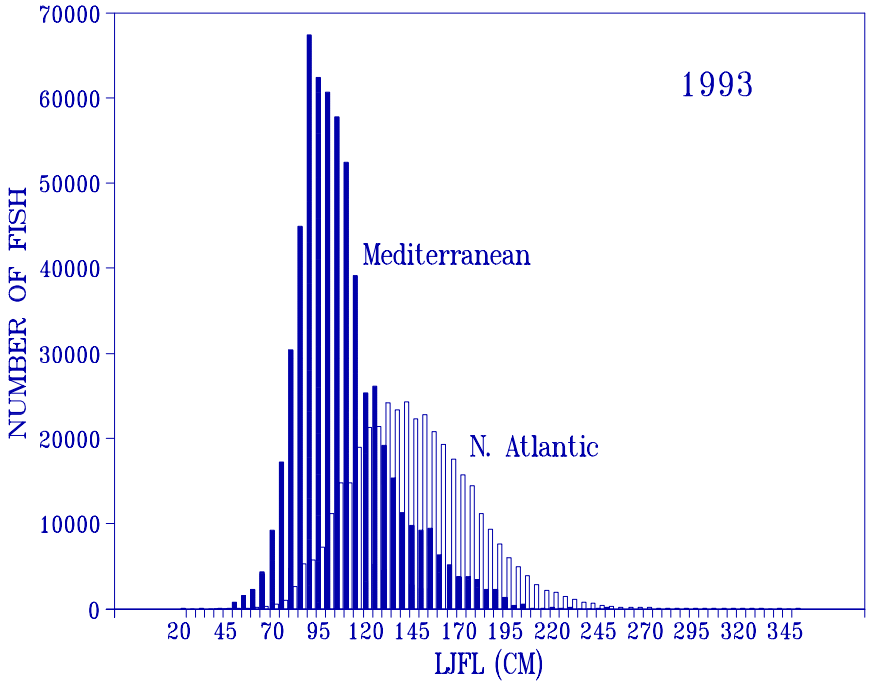
SWO-MED-Table 1. Estimated catches (MT) of Mediterranean swordfish in 1976-2000*, by gear and flag.

		1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
MEDI	*TOTAL*	*4637*	*5280*	*5958*	*5547*	*6579*	*6813*	*6343*	*6896*	*13666*	*15228*	*16718*	*18288*	*20339*	*17761*	*12428*	*11987*	*14712*	*13250*	*16077*	*12414*	*12039*	*14646*	*14202*	*13542*	*2839*
Landings	Longline	4138	4606	5046	4877	5115	5411	5751	6239	6640	6260	7297	7781	9163	6784	6873	7083	7456	6932	8640	5634	5460	4943	5929	5432	1499
	Other Surf.	499	674	912	670	1464	1402	592	657	7026	8968	9421	10507	11176	10977	5555	4904	7256	6318	7437	6780	6579	9703	8273	8110	1340
	ALBANIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	13	13	13	
	ALGERIE	368	370	320	521	650	760	870	877	884	890	847	1820	2621	590	712	562	395	562	600	807	807	807	825	709	816
	CHINESE TAIPEI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	3	0	0	0
	CROATIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	20	
	CYPRUS	59	95	82	98	72	78	103	28	63	71	154	84	121	139	173	162	73	116	159	89	40	51	61	92	82
	EC-ESPANA	89	667	720	800	750	1120	900	1322	1245	1227	1337	1134	1762	1337	1523	1171	822	1358	1503	1379	1186	1264	1443	905	1436
	EC-GREECE	0	0	0	0	0	91	773	772	1081	1036	1714	1303	1008	1120	1344	1904	1456	1568	2520	974	1237	750	1650	1520	
	EC-ITALY	3747	3747	4506	3930	4143	3823	2939	3026	9360	10863	11413	12325	13010	13009	5524	4789	7595	6330	7765	6725	5286	6104	6104	6312	
	EC-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	13
	JAPAN	1	0	2	3	1	0	5	6	19	14	7	3	4	1	2	1	2	4	2	4	5	5	7	5	
	LIBYA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	8
	MALTA	175	223	136	151	222	192	177	59	94	108	97	131	207	121	122	119	71	76	42	58	58	83	116	147	
	MAROC	186	144	172	0	0	0	0	43	39	38	92	40	62	97	1249	1706	2692	2589	2654	1696	2734	4900	3228	3238	
	NEI-2	0	0	0	0	728	672	517	532	771	730	767	828	875	979	1360	1292	1292	0	0	0	0	0	0	0	
	TUNISIE	5	0	0	0	0	7	19	15	15	61	64	63	80	159	176	181	178	354	298	378	352	346	414	468	483
	TURKEY	7	34	20	44	13	70	40	216	95	190	226	557	589	209	243	100	136	292	533	304	320	320	320	113	

*As of 5 October 2001. Subsequently, catches were reported for 2000 by EC-Italy (7515 MT), Malta (140 MT), and Morocco (2708 MT).
Empty cells for 2000 indicate that catches were not reported to ICCAT.



SWO-MED-Fig. 1. Estimated catches (reported and carried over, in MT) of Mediterranean swordfish. Estimates for 2000 are incomplete.



SWO-MED-Fig. 2. Comparison of 1993 size distributions of swordfish catches in the Mediterranean (dark bars) and north Atlantic (lighter bars). It should be noted that the biological parameters (e.g. growth rate, size of maturity, etc.) are different between these areas (see Sections SWO-MED-1 and SWO-ATL-1). (Figure from 1999 Report, and not updated in 2001).

7.11 SBF-SOUTHERN BLUEFIN TUNA

SBF-1. Biology

Southern bluefin tuna are distributed exclusively in the Southern Hemisphere of three oceans. The only known spawning ground is located in an area south of Java, Indonesia and off northwest Australia. Juveniles migrate southwards along the Australian West Coast and stay in the coastal waters of southwest, south, and southeast Australia. As fish grow, they extend their distribution to cover the circumpolar area throughout the Pacific, Indian and Atlantic Oceans.

Southern bluefin tuna are considered to be mature at age 8 at the length of 155 cm. Though the life span of this species was considered to be about age 20 from the tagging results, recent analysis revealed that a significant number of fish bigger than 160 cm were older than age 25. The maximum age obtained from otolith analysis was age 42. Age-specific natural mortality, higher for young fish and lower for old fish, is supported by tagging experiments and applied for stock assessment. Southern Bluefin Tuna is a unique example of an acceleration of growth rate observed through 1960's to 1980's, that was supported by tagging experiments in that periods. This acceleration of growth rate is partially due to the fact that the stock has been faced with high fishing pressure in last fifty years.

Preliminary results from recaptured archival tags suggest that young fish migrate seasonally between the south coast of Australia and middle of the Indian Ocean. Archival tagging is noted as a powerful tool to investigate the biology and movement of fish.

SBF-2. Description of fisheries

Historically, the stock has been exploited by Australian and Japanese fishermen for more than 40 years. During this period, the Japanese longline fishery (taking older aged fish) recorded its peak catch of 77,927 MT in 1961 and the Australian catches of young fish by surface fishery peaked at 21,501 MT in 1982. New Zealand, Chinese-Taipei and Indonesia have also exploited southern bluefin tuna, and Korea started a fishery in 1991.

The proportion of catch made by surface fishery peaked around the 1980s at the level of close to 50% of total catch. but declined afterward to 13%. The proportion of surface catch has dropped to 13-14% in 1992 and 1993 but has increased again and stayed around 30% since1997 (**SBF-Table 1** and **SBF-Figure 1**).

The catches of Australia, Japan and New Zealand have been controlled with quota since 1985. The current catch limits are 5,265 MT for Australia, 6,065 MT for Japan, and 420 MT for New Zealand, which has remained at the same level since 1990. However, the catches by nations other than the aforementioned three have increased steadily and stayed at the level around 2,200 MT during 1991-1994 and then doubled to 4,689 MT in 1996. The catch by these nations stayed high as 4,539 MT in 1997, then increased again to 6,318 MT in 1998. Japan caught an additional 1,464 MT in 1998 and 2,198 MT in 1999 for the Experimental Fishing which was conducted to evaluate fish density in an area where no commercial operations have been occurred in recent years.

The Atlantic catch has varied widely between 400 and 6,200 MT since 1978 (**SBF-Table 1** and **SBF-Figure 2**), reflecting the shifts of longline effort between the Atlantic and Indian Oceans. Fishing ground in the Atlantic is located off the southern tip of South Africa (**SBF-Figure 3**).

Japanese longline vessels changed their catch retention practice to release fish less than 25 kg in 1995 and 1996, and a portion of these releases (considered to be dead discards) were incorporated into total estimate of catch.

SBF-3. State of stock

The Conservation of Southern Bluefin Tuna (CCSBT) established in 1994 has updated the stock assessment of this species. The information described below is based on the results of the sixth Scientific Committee of CCSBT held in Tokyo, Japan, from August 19 to 31, 2001.

Nominal CPUE of Japanese longline CPUE for ages 4-7, and 8-11, CPUE in New Zealand zone, Taiwanese longline CPUE indicated increase since 1988 but Japanese longline CPUE for age 12+ declined in the same period. Trends in CPUE by cohort suggested that the reduced quotas after 1988 had resulted in lower fishing mortality rates, leading better survival to age 8. Tagging estimates of fishing mortality rates showed an increasing trend in mortality at age 3 and 4 for 1993 and 1994 cohorts.

The Japanese longline CPUE are standardized based on interim approaches representing two hypotheses on fish density in cells without fishing effort (**SBF-Figure 4**). The CPUE for parental stock (age 8 and older) continued to decline to the early 1990s and then stayed at about the same level except the last year. The juvenile CPUE declined through the 1970s to the mid 1980s but increased in 1993 to the different levels according to the hypotheses and then stayed about the same level afterward. The sequential increases in the global CPUE by age for fish born in the late 1980s can be followed from 3 year olds in 1990 to 8 year olds in 1995.

Various assessment procedures were utilized in 2001 including the ADAPT-type VPA using various model structures, hypotheses on biological parameters, and different interpretations of Japanese CPUE series, forward VPA incorporating errors in data, forward VPA based on catch at size data, and production models (**SBF-Figure 5**). The results consistently indicated a decline in recruitment with recruitments in the 1990s less than half of those in earlier years.

The estimated parental biomass showed substantial differences in absolute levels as well as relative trends according to assessment procedures and model hypotheses but models were much more consistent regarding trends in abundance during the last decade. The parental biomass is notably lower than the 1980 level, the management target level for stock recovery. Overall, parental biomass has been roughly stable since the mid 1990s or early 1990s depending on the models, then it was considered the recent removals as being close to recent surplus production. The recent trend in parental biomass varied from a continuous gradual decline to a slight upturn.

SBF-4. Outlook

Future projections were performed to examine the medium to long-term consequences of current global catch on parental biomass. In general, assessments that resulted in low historical abundance/high fishing mortality scenarios indicated higher productivity and thus higher probability of stock recovery. The opposite was true for trajectories with high historical abundance and low fishing mortality. Projection under the current global catches resulted in either increasing or decreasing biomass trends depending on model assumptions and input data. The current global catch levels appeared to be roughly close to replacement yield. Consequently, projections showed divergent trends under the current catch level ranging from recovery to continued decline. Overall, few of the scenarios resulted in recovery to the 1980 parental biomass level by 2020 under the current global catches.

SBF-5. Effects of current regulations

Southern bluefin tuna has been managed through quota among Australia, Japan and New Zealand since 1985. The global quota was reduced several times from 38,650 MT in 1984 - 1985 season and current quota has been maintained at 11,750 MT since 1989 -1990 season. These quota reductions and subsequent changes in the selectivity pattern for the surface fishery has resulted in increase in abundance of younger fish. At the current catch level, the probability of the parental biomass being larger in 2020 than it is today is about 50 %, with an equal probability the stock will be smaller in 2020. There is little chance that the stock will be rebuilt to the 1980 levels by 2020, and substantial quota reductions would be required to achieve this goal.

Regarding the choice of quota levels over the next few years, the CCSBT made the following comments: Any growth in non-party catches would be of very serious concern and every effort should be made to decrease total removals or at least keep them at their current level. The low level of parental biomass in relation to historical level is recognized and there is an associated risk of further recruitment declines. This risk is not felt to be particularly high, thus an immediate reduction in total removals is not recommended as a necessary action to prevent stock collapse. It is believed that as the stock has changed relatively slowly under current catches, a policy of maintaining current removals would most likely enable to react in a timely fashion to future stock trends. This ability would be enhanced if more certain monitoring of recruitment and parental biomass could be developed. There is a risk of stock declines if current removals are maintained, and depending upon members aversion to this risk, differing level of catch reductions would be appropriate forms of insurance for the sustainability of the current fishing industries.

SBF-6. Management recommendations

The Committee noted that the ICCAT statistical system will continue to be important for monitoring the fishery for this species in the Atlantic Ocean. While the CCSBT established in May 1994 has competence on the management of this species as a whole in the three oceans, ICCAT is responsible for the management of southern bluefin tuna in the Atlantic Ocean. Therefore, close collaboration should be maintained between the two

organizations as regards of stock assessments and management measures.

No recommendation was made for the management of southern bluefin tuna in the Atlantic.

SOUTHERN BLUEFIN TUNA SUMMARY
(for global stock)

Maximum Sustainable Yield	Not estimated
Current (2000) Yield	15,579 MT (preliminary)
Current Replacement Yield	Around 16,000 MT
Relative Biomass SSB (2000)/SSB (1980)	0.17 - 0.76

Current management measures in effect:
Global quota at 11,750 MT (applicable only to Australia, Japan, and New Zealand)

SBF-Table 1. Atlantic and world southern bluefin catch (MT) by gear, area and country.

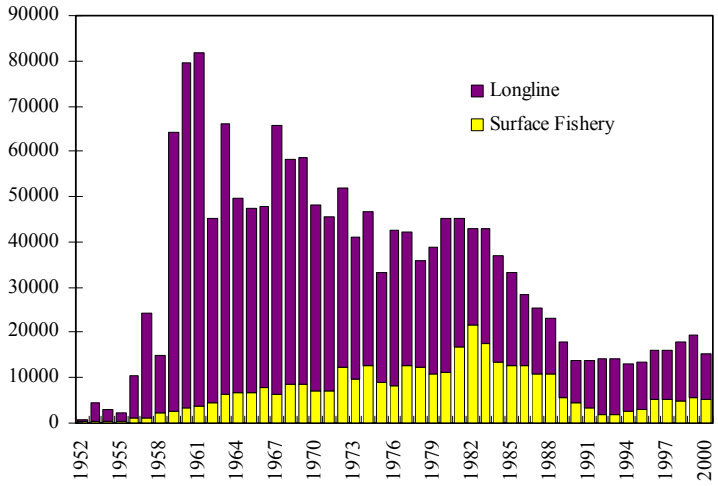
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999*	2000*
ATLANTIC TOTAL	753	3168	4685	6205	2827	2578	1138	525	1636	1497	432	1204	622	711	1266	1346	539	2160	767	1612	1376	358	1020	934	1800
-CATCH BY GEAR																									
Longline	753	3168	4685	6205	2814	2572	1138	525	1636	1497	432	1200	620	705	1266	1346	539	2160	767	1612	1376	358	1020	934	1799
Baitboat	0	0	0	0	13	6	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Sport	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	0	0	0	0	0	0	0	0	0	0	0	4	2	5	0	0	0	0	0	0	0	0	0	0	0
-CATCH BY FLAGS																									
Chinese-Taipei	61	0	34	13	26	66	3	20	0	29	43	80	72	80	64	15	14	472	172	168	157	47	137	71	215
Japan	692	3168	4651	6192	2788	2506	1135	505	1636	1468	389	1120	548	625	1202	1331	525	1688	595	1444	1219	301	882	835	1538
Korea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	28	62
Poland	0	0	0	0	0	0	0	0	0	0	0	4	2	5	0	0	0	0	0	0	0	0	0	0	0
South Africa LL	0	0	0	0	13	6	++	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1
South Africa BB																									1
World Catches (all oceans)	*42509*	*42178*	*35908*	*38673*	*45054*	*45104*	*42788*	*42881*	*37090*	*33325*	*28319*	*25575*	*23145*	*17842*	*13869*	*13638*	*13445*	*13686*	*12962*	*12982*	*16298*	*15915*	*17725*	*19589*	*15579*
Longline	*34099*	*29609*	*23718*	*27890*	*33859*	*28261*	*21287*	*25186*	*23679*	*20736*	*15788*	*14754*	*12554*	*11724*	*9283*	*9149*	*8197*	*8313*	*8262*	*8474*	*11170*	*10599*	*12829*	*14037*	*10448*
Surface Fishery	*8383*	*12569*	*12190*	*10783*	*11195*	*16843*	*21501*	*17695*	*13411*	*12589*	*12531*	*10821*	*10591*	*6118*	*4586*	*4489*	*5248*	*5373*	*4700*	*4508*	*5128*	*5316*	*4896*	*5552*	*5131*

* Preliminary

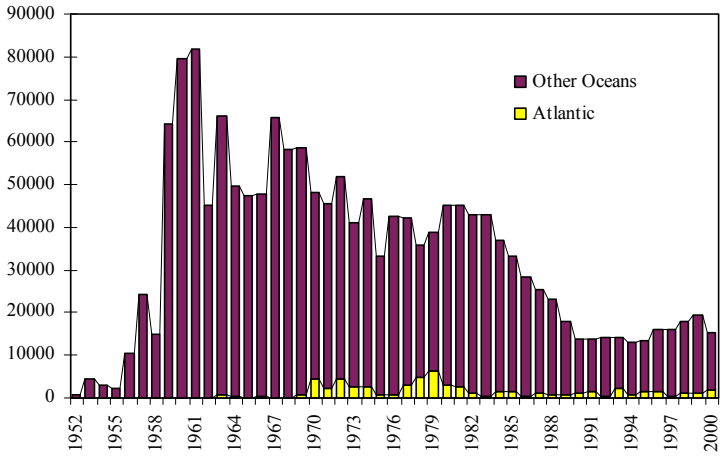
++ Catch < 0.5 MT.

Source : Catch by Japan -- ICCAT Japanese National Report

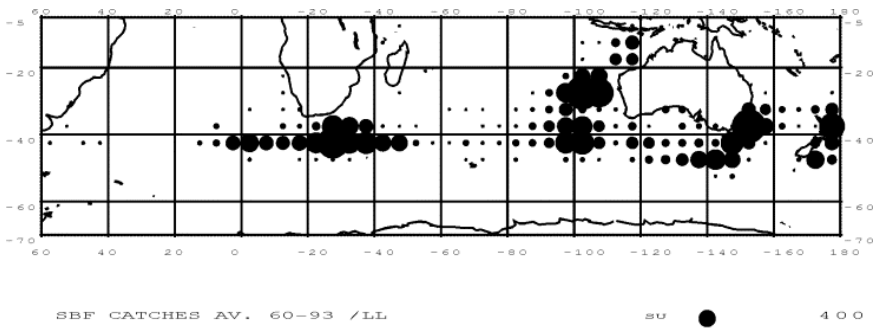
World catches -- Reports of the sixth Meeting of the Scientific Committee of CCSBT held in Tokyo, August 28 to August 31, 2001.
Australian domestic catch was considered to be made by surface fishery, unless the catch estimate by Australian domestic vessels available.
Catches by the other nations except those taken by Taiwanese gillnets were assigned to longline fishery.



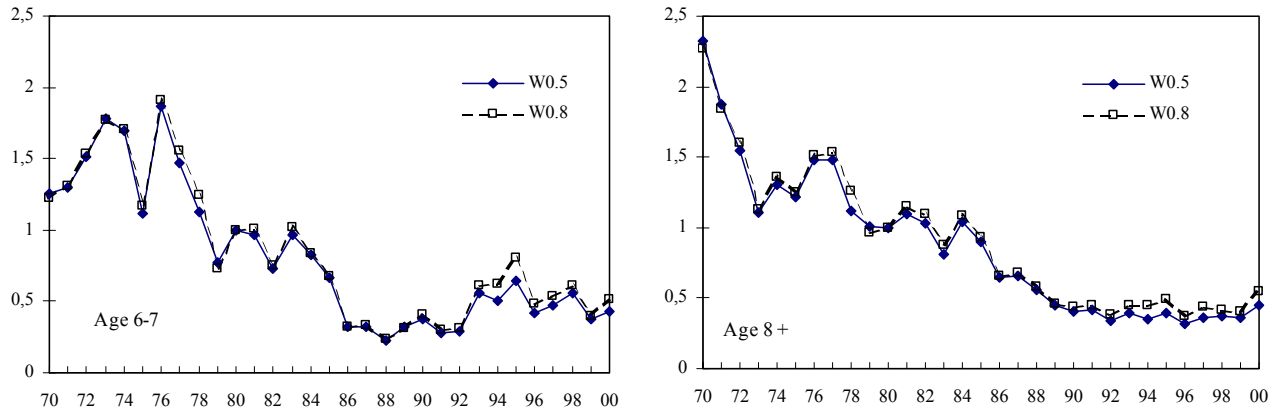
SBF-Fig.1 Southern bluefin tuna global catch by fishery.



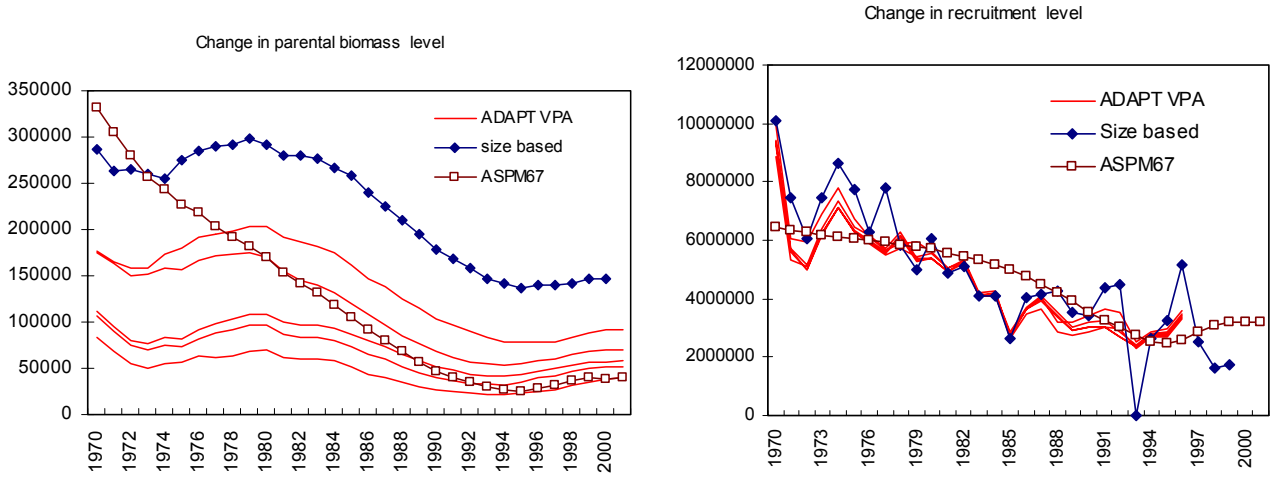
SBF-Fig. 2 Global and Atlantic catch of southern bluefin tuna.



SBF-Fig. 3 Geographical distribution of SBF catch by longline 1960-1993



SBF-Fig. 4 Standardized CPUE of Japanese longline relative to 1980 for juvenile (age 6-7) and parental (age 8+) southern bluefin tuna. Different lines corresponded to different hypotheses on fish abundance within time-area strata without fishing effort.



SBF-Fig. 5 Estimated trends of parental biomass and recruitments by various assessment procedures by Japan. (Reference: Report of the Second Stock Assessment Group Meeting of the CCSBT.)

7.12 SMT - SMALL TUNAS

SMT-1. Biology

Very little is currently known about the biology of small tunas. In fact, scientific studies on these species, are rarely undertaken. This is largely because many of these species are considered to have little economic importance to the Atlantic tuna fleets, and because of difficulties in sampling landings from artisanal fisheries, which constitute a high proportion of the fisheries exploiting small tuna resources. The exceptions are some stocks of Spanish and king mackerel, such as those found in U.S. and Brazilian waters. The large industrial fleets often discard small tuna catches at sea or sell them in local markets, especially in Africa. The amount caught is rarely reported in logbooks.

These species are widely distributed in the tropical and subtropical waters of the Atlantic Ocean, the Mediterranean Sea, and the Black Sea. They are often found in large schools with other small sized tunas or related species in coastal and offshore waters. They have a varied diet with a preference for small pelagics (e.g. clupeids, mullets, carangids and ammodytes), crustaceans, mollusks and cephalopods. The reproduction period varies according to species and spawning generally takes place near the coast, where the waters are warm.

In the eastern tropical Atlantic, the size-at-first-maturity is about 42 cm for Atlantic black skipjack (*Euthynnus alletteratus)*, 30 cm for *Auxis spp.*, 38 cm for Atlantic bonito (*Sarda sarda)*, and 45 cm for mackerel *(Scomberomorus* spp.). The growth rate currently estimated for these species is very rapid for the first two or three years, and then slows as these species reach size at first maturity.

Recent studies indicate that some species of small tunas, ex. *Auxis sp*., could have an important role in large yellowfin diet. This was observed in the Pacific Ocean but also in the Atlantic tropical waters, where large quantities of frigate tuna were found in large yellowfin stomach contents (Menard et al. 1999).

SMT-2. Description of the fisheries

Small tunas are exploited mainly by coastal fisheries and often by artisanal fisheries, although substantial catches are also made, either as target species or as by-catch, by purse seiner, mid-water trawlers (i.e. pelagic fisheries of West Africa-Mauritania), handlines and small scale gillnets (U.S. fisheries, NAT/01/4). Unknown quantities of small tuna also comprise the incidental catches of some longline fisheries. Some U.S. sport fisheries target Spanish and king mackerels on a seasonal basis.

There are over ten species of small tunas, but only five of these account for 85% of the total reported catch by weight each year. These five species are: Atlantic bonito *(Sarda sarda)*, frigate tuna *(Auxis thazard)*, spotted Spanish mackerel *(Scomberomorus maculatus)*, king mackerel *(Scomberomorus cavalla)*, and Atlantic black skipjack *(Euthynnus alletteratus)* **(SMT-Figure 2)**.

Historical landings of small tunas for the period 1976 to 2000 are shown in **SMT-Table 1**. The total reported landings of all species combined during the period 1976 to 1979, reached 80,697 MT. In 1980, there was a marked increase in reported landings, reaching a peak at about 143,845 MT in 1988 **(SMT-Figure 1)**. Landings reported for the period 1989-1994 decreased to about 89,526 MT. The highest amount was observed in 1997 with 153,213 MT and sharp decreases of landings were noticed in the following years to about 88,526 MT in 1999. A preliminary estimate for the total nominal landings of small tunas in 2000 is 81,187 MT. The Committee noted the relative importance of small tuna fisheries in the Mediterranean Sea, which account for 25% of the total reported catch in the period 1976-2000.

Since 1991, tropical purse-seiners operating around artificial flotsam (fish aggregating devices) may have led to an increase in fishing mortality of small tropical tuna species. These species usually comprise part of the by-catch, and are often discarded. This source of mortality is not yet fully reflected in the Task I tables.

Despite recent improvements in statistical reporting by some countries, the Committee also noted that uncertainties remain regarding the accuracy and completeness of reported landings in all areas, including the Mediterranean, and that there is a general lack of information on the mortality of these species as by-catch.

SMT-3. State of the stocks

There is little information available to determine the stock structure of many small tunas species. It was noted

that some size data for small tunas from tropical tuna fleets were available, but these had not been submitted to the Secretariat. The Committee suggests that countries be requested to submit all available data to ICCAT as soon as it is possible, in order to be used in future working group meetings.

Age-structured stock assessments of Spanish mackerel and king mackerel are carried out for the coastal areas of the southeastern United States and the Gulf of Mexico. These assessments indicated that the stocks of Atlantic Spanish mackerel and king mackerel in the Gulf of Mexico were over-exploited. Reductions in fishing mortality were considered necessary, and hence a number of regulations (commercial trip limits, seasonal and area quotas, and recreational bag limits) have been implemented in order to allow the stocks to recover to levels that could provide high average long-term yields and to provide adequate safeguards against recruitment failure. Improvement in stock status has been observed in the Gulf of Mexico Spanish mackerel and king mackerels.

Current information does not generally allow for an evaluation of stock status by the Committee for most of the coastal pelagic species. Most stocks, however, probably do not have an ocean-wide distribution. For this reason, the majority of the stocks can be managed at the regional or sub-regional level.

SMT-4. Outlook

The results of an ICCAT questionnaire circulated in 1996 indicate that small tuna fisheries are very diverse and complex, involving both artisanal and industrial fisheries using a variety of gears, as well as different types and sizes of vessels. The results also indicate that data collection and research including size sampling, age and growth research, maturity studies and tagging, are being conducted by several countries but the results of such studies are not often reported to ICCAT.

Nonetheless, catch and effort statistics for small tunas remain incomplete for many of the coastal and industrial fishing countries. There is also a general lack of available biological information needed to assess the stocks of most of these species. On the other hand, many of these species are of importance to coastal fishermen, especially to some developing countries, both economically and as a source of protein. The Committee therefore reiterates its previous recommendation that studies should be conducted to determine the state of these stocks and the best way to manage them. Such studies are probably best carried out at the local or sub-regional level.

SMT-5. Effects of current regulations

There are no ICCAT regulations in effect for these small tuna species.

SMT-6. Management recommendations

No recommendations were presented due to the lack of data and analyses.

SMT-Table 1. Estimated landings (MT) of small tuna species in 1976-2000*, by region and flag.

			1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
TOTAL			63594	78950	75631	80697	115299	115795	133654	127109	111485	93300	91960	113745	143845	126345	130948	123069	97884	98705	89460	89756	113460	153213	87351	88576	81237
		ATL	51777	64208	59997	60606	89408	81378	93613	83731	87842	67524	68638	84698	110758	105620	97837	88290	75940	67839	67197	68249	88105	131957	66312	61934	54780
		MEDI	11817	14742	15634	20091	25891	34417	40041	43378	23643	25776	23322	29047	33087	20725	33111	34779	21944	30866	22263	21507	25355	21256	21039	26592	26406
BON	TOTAL		15989	20676	17273	19971	31733	40053	43687	42837	22505	25433	21990	30252	46901	30062	28940	34054	22024	30583	21504	20841	24584	26070	24498	26129	25377
(*Sarda sarda*)		ATL	9490	11977	7854	6485	12568	10760	12169	6840	6849	6946	5892	7395	22353	17766	6843	8305	6913	4586	5822	5652	7389	9546	8549	6080	4949
		MEDI	6499	8699	9419	13486	19165	29293	31518	35997	15656	18487	16098	22857	24548	12296	22097	25749	15111	25997	15682	15189	17195	16524	15949	20049	20429
	ATL	ANGOLA	831	938	531	251	377	196	253	124	225	120	101	144	180	168	128	102	4	49	20	9	39	32	0	2	118
		ARGENTINA	283	2026	1746	1288	2600	846	1775	310	2058	1399	699	1607	2794	1327	1207	1794	1559	434	4	138	0	0	0	0	0
		BENIN	0	0	0	13	19	32	36	16	25	30	6	3	4	7	0	0	0	0	0	0	0	0	0	0	0
		BRASIL	0	0	0	0	0	0	0	0	187	179	523	345	214	273	226	71	86	142	142	137	0	0	0	0	0
		BULGARIA	32	37	22	0	75	8	23	46	0	0	2	0	0	3	0	0	0	0	0	0	0	0	0	0	0
		CUBA	0	0	0	0	0	0	0	0	0	0	0	23	173	26	28	0	0	0	0	0	0	0	230	0	0
		EC-ESPANA	4379	1978	1919	717	220	589	434	414	173	398	145	41	91	57	18	8	39	5	3	2	2	1	0	12	12
		EC-FRANCE	0	0	0	0	8	0	0	2	17	1	0	0	0	0	0	0	0	52	0	0	0	0	0	24	32
		EC-GERMANY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	53	0	0	0	0	0	714	0	0	0	0
		EC-GREECE	0	0	30	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		EC-GUADELOUPE	340	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		EC-MARTINIQUE	549	510	400	500	500	502	587	545	552	491	431	331	395	427	430	820	770	1000	990	990	610	610	610	0	0
		EC-PORTUGAL	0	0	0	6	13	31	55	86	56	50	168	371	377	80	202	315	133	145	56	78	83	49	98	98	162
		EC-U.K	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	287	0	0	0	0
		ESTONIA	0	0	0	0	0	0	0	0	0	0	0	0	668	859	187	8	0	0	0	0	0	0	0	0	0
		GEORGIA	0	0	0	0	0	0	0	0	0	0	0	0	39	54	0	0	0	0	0	0	0	0	0	0	0
		GERMANY D.R	0	0	0	0	288	440	146	274	26	40	23	1	0	0	0	0	0	0	0	0	0	0	0	0	0
		GHANA	0	9	9	0	77	5	71	13	8	10	0	943	0	0	0	0	0	0	0	0	0	0	0	0	0
		GRENADA	200	136	157	53	52	61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	6	0	0	0
		JAMAICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0
		LATVIA	0	0	0	0	0	0	0	0	0	0	0	0	1191	1164	221	7	4	0	3	19	301	0	318	0	416
		LITUANIA	0	0	0	0	0	0	0	0	0	0	0	0	1041	762	162	11	10	0	0	0	0	0	0	0	0
		MAROC	303	131	171	196	312	477	535	561	310	268	251	241	589	566	492	794	1068	1246	584	699	894	1259	1557	1390	1390
		MEXICO	237	81	59	174	271	408	396	567	744	212	241	391	356	338	215	200	657	779	674	1144	1312	1312	0	0	0
		NETHERLAND.ANT	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
		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	2
		POLAND	30	177	44	32	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	225	0	0	0	0
		RUMANIA	79	139	19	0	64	81	249	192	8	32	71	3	255	111	8	212	84	0	0	0	0	0	0	0	0
		RUSSIA FED.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	948	29	0	0	0	0	0	0	0	0
		SENEGAL	164	614	523	159	140	1327	202	497	200	495	510	463	2066	869	558	824	378	227	600	354	570	1513	1857	1441	1441
		SIERRA LEONE	0	0	0	0	57	30	5	5	5	10	10	10	10	10	10	4	6	0	0	0	0	0	0	0	0
		SOUTH AFRICA	0	2	16	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		ST.LUCIA	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3	3	3	4	1	1	1	0	0	0	0
		TOGO	0	0	0	0	0	0	0	0	0	254	138	245	400	256	177	172	107	311	254	145	197	197	197	197	0
		TRINIDAD & TOBAGO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	703	169	266	220	30	117	117
		U.S.A	23	268	224	502	198	333	209	253	217	110	84	130	89	278	298	468	497	170	127	116	155	182	75	83	142
		U.S.S.R	1281	4164	1602	2125	6433	4559	6329	2375	1290	2073	1085	1083	8882	7363	706	0	0	0	0	0	0	0	0	0	0
		UKRAINE	0	0	0	0	0	0	0	0	0	0	0	0	1385	985	0	0	25	0	0	0	342	2786	1918	1114	1114
		URUGUAY	3	0	0	16	3	1	0	1	0	0	3	0	0	0	0	26	0	0	0	0	0	0	0	0	0
		VENEZUELA	756	767	382	443	861	833	864	554	748	774	1401	1020	1153	1783	1514	1518	1454	5	1661	1651	1359	1379	1659	1602	2
	MEDI	ALBANIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0
		ALGERIE	143	206	196	515	640	740	860	867	874	880	459	203	625	1528	1307	261	315	471	418	506	277	357	511	475	405

			1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
		BULGARIA	40	44	11	1	13	191	4	24	1	1	0	13	0	0	17	20	8	0	25	33	0	0	0	0	0
		CROATIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	49	128	6	70	0	0	0	25	120	0
		CYPRUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
		EC-ESPANA	397	610	711	713	480	710	990	1225	984	1045	729	51	962	609	712	686	228	200	344	632	690	628	333	433	342
		EC-FRANCE	0	0	0	0	0	0	0	33	16	0	0	0	10	0	1	10	5	6	0	0	0	0	0	0	0
		EC-GREECE	511	550	610	712	809	1251	1405	1367	1732	1321	1027	1848	1254	2534	2534	2690	2690	2690	1581	2116	1752	1559	945	2135	2135
		EC-ITALY	955	1533	1378	1403	1180	1096	1102	1806	2777	1437	1437	2148	2242	1369	1244	1087	1288	1238	1828	1512	2233	2233	2233	4159	4159
		EGYPT	0	1	17	10	3	2	23	14	48	62	68	35	17	358	598	574	518	640	648	697	985	725	724	1442	1442
		LIBYA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	71	70	0	0	0	0	0	0	0
		MALTA	1	2	2	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	7	0	0	0
		MAROC	630	456	128	155	62	309	71	92	75	57	51	127	108	28	69	69	31	25	93	37	67	45	39	120	120
		NEI-2	0	0	0	0	295	274	276	452	694	359	359	537	561	342	311	311	311	300	300	300	300	75	0	0	0
		RUMANIA	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		TUNISIE	619	768	791	865	700	381	748	600	600	482	504	500	600	422	488	305	643	792	305	413	560	611	855	881	1528
		TURKEY	3178	4503	5536	9082	14910	24300	25978	29485	7818	12809	11426	17333	18133	5008	14737	19645	8863	19548	10093	8944	10284	10284	10284	10284	10284
		YUGOSLAVIA	23	26	39	29	72	39	61	31	37	34	38	62	36	98	79	0	0	0	0	0	0	0	0	0	0
		YUGOSLAVIA REP. FED.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	0	3	2	6	10	0	0	0	0
LTA	TOTAL		10401	8344	17633	14673	19214	13847	15839	22214	20625	12895	8809	19741	25135	29855	28831	23647	22563	12645	12669	12922	15797	14698	15386	14244	13829
(*E. alletteratus*)		ATL	8373	5845	15138	11803	16440	12401	13359	20653	18975	10855	6643	17317	22730	27820	26214	21324	20807	11379	11464	11020	13678	13251	12700	11576	10703
		MEDI	2028	2499	2495	2870	2774	1446	2480	1561	1650	2040	2166	2424	2405	2035	2617	2323	1756	1266	1205	1902	2119	1447	2686	2668	3126
	ATL	ANGOLA	10	1326	826	646	1328	1171	1734	1632	1632	1433	1167	1345	1148	1225	285	306	14	175	121	117	235	75	406	118	132
		ARGENTINA	0	0	0	0	0	0	36	0	0	11	2	2	0	1	1	0	0	0	0	0	0	0	0	0	0
		BENIN	0	0	0	16	24	40	45	20	31	30	90	14	7	43	66	61	49	53	60	58	58	196	83	69	69
		BRASIL	0	0	0	0	0	45	10	0	765	785	479	187	108	74	685	779	935	985	1225	1059	834	507	920	930	930
		BULGARIA	0	1	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		CAP-VERT	0	0	0	0	128	236	258	34	16	160	29	14	1	18	65	74	148	17	23	72	63	86	110	776	491
		COTE D'IVOIRE	400	431	38	57	177	0	0	0	0	0	20	5300	38	4900	2800	100	142	339	251	253	2337	1880	1864	2391	2789
		CUBA	0	0	0	0	131	53	77	6	15	16	24	55	53	113	88	63	33	13	15	27	23	23	0	0	0
		EC-ESPANA	6	33	56	4	485	7	3	2	27	34	12	11	7	11	55	81	1	0	0	10	55	27	110	6	2
		EC-FRANCE	0	0	0	0	0	1098	1120	0	0	0	0	0	0	195	0	1512	1023	948	1116	1008	1034	924	1080	1161	3
		EC-GERMANY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	0	0	0	0	0	0	0	0	0	0
		EC-ITALY	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
		EC-MARTINIQUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	610	610
		EC-PORTUGAL	0	0	0	5	121	8	0	0	0	0	80	21	86	91	2	61	73	45	72	72	218	320	171	14	50
		ESTONIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	66	0	0	0	0	0	0	0	0	0
		GABON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	182	0	18	159	301
		GERMANY D.R	0	0	0	0	0	0	397	543	99	40	10	2	0	2	0	0	0	0	0	0	0	0	0	0	0
		GHANA	6044	1185	6049	5547	4134	3287	2141	5009	5966	901	649	5551	11588	12511	14795	11500	11608	359	994	513	113	2025	359	306	707
		ISRAEL	0	0	0	0	227	203	640	282	271	76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		LATVIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65	0	0	0	0	0	0	0	0	0
		LITUANIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0
		MAROC	31	15	21	289	16	19	26	19	15	447	47	108	49	14	367	57	370	44	43	230	588	195	189	67	67
		MAURITANIE	50	50	50	50	31	86	77	54	60	60	50	50	50	50	50	4	0	0	0	0	0	0	0	0	0
		NEI-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	7	20	0	0	0	3	0	0
		PANAMA	125	0	3	2	58	36	0	0	0	0	0	0	0	0	0	0	0	65	0	0	0	0	0	0	0
		POLAND	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0
		RUMANIA	10	86	2	17	9	12	291	216	266	126	81	7	88	0	0	0	0	0	0	0	0	0	0	0	0
		RUSSIA FED.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	617	306	265	189	96	49	0	88	0	0
		SAO TOME & PRINCIPE	0	0	0	0	0	0	0	0	101	0	0	0	0	0	0	0	0	0	0	0	40	159	0	0	0
		SENEGAL	705	1540	1446	1697	2444	1586	5017	5623	8408	4566	2392	2985	6343	6512	4775	3767	4088	4883	4072	4072	3773	2972	2933	1094	1094
		ST.LUCIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0

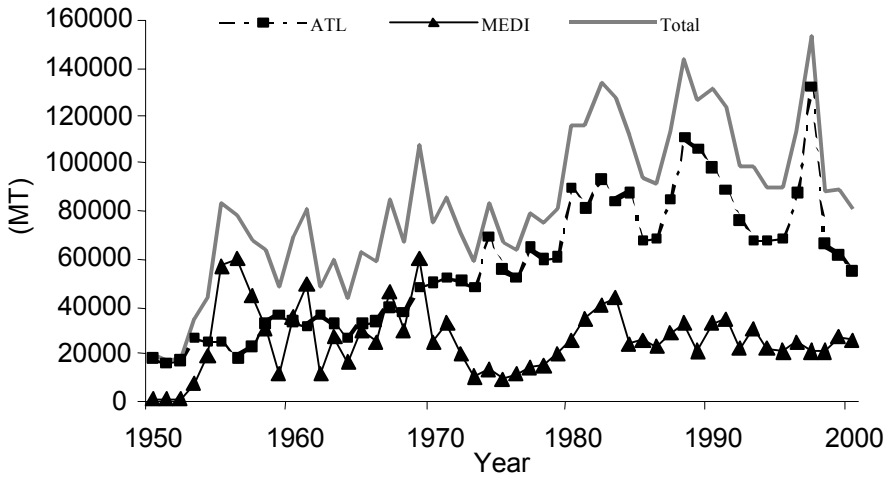
			1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
		ST.VINCENT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
		U.S.A	5	53	113	12	88	97	87	107	41	73	104	118	204	129	173	228	597	1286	1142	1312	2229	2014	1546	1622	1209
		U.S.S.R	470	690	6127	2184	6307	3615	1085	6528	613	1040	271	61	1707	543	667	0	0	0	0	0	0	0	0	0	0
		UK-BERMUDA	16	9	7	7	11	11	4	5	5	7	13	13	17	14	8	10	11	5	6	6	7	6	5	4	2
		VENEZUELA	501	426	390	1270	721	791	311	573	644	1050	1123	1467	1236	1374	1294	1963	1409	1889	2115	2115	1840	1840	2815	2247	2247
	MEDI	ALGERIE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	522	585	495	459	552	554	448	384	562	494
		CROATIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	2	15	15	0	0	0	0	0
		CYPRUS	7	18	11	17	17	22	33	17	31	32	13	25	41	20	23	25	21	11	23	10	19	19	19	19	19
		EC-ESPANA	1134	1059	1192	993	800	6	705	0	32	12	5	0	5	0	0	0	0	0	0	15	18	9	15	0	8
		ISRAEL	300	300	200	170	105	35	110	35	60	259	284	273	135	124	129	108	126	119	119	215	119	119	119	119	119
		LIBYA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	52	0	5
		MALTA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	1	8	8	8	3	3	0	0	0
		MAROC	4	4	0	6	0	61	12	0	1	0	0	0	12	0	16	0	0	0	0	1	0	1	14	8	8
		NEI-2	0	0	0	0	0	0	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	0
		OTHERS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	90	0	0	0	0
		SYRIA	102	105	109	89	80	73	90	80	96	95	73	121	99	121	127	110	156	161	156	155	270	270	270	270	270
		TUNISIE	479	1009	983	1595	1772	1249	1330	1228	1224	1441	1590	1803	1908	1566	2113	1343	664	242	204	696	824	333	1113	740	1453
		TURKEY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500	750	750
		YUGOSLAVIA	2	4	0	0	0	0	0	1	6	1	1	2	5	4	9	0	0	0	0	0	0	0	0	0	0
		YUGOSLAVIA REP. FED.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	28	21	35	22	0	0	0	0
FRI	TOTAL		9747	20020	8343	12575	20912	15913	25240	21690	25903	22876	20306	23406	25151	21416	23333	16128	8704	7106	11435	10600	18337	16542	14285	13859	11108
(A. thazard)		ATL	6457	16611	4776	8868	16960	12235	19197	15870	19566	17636	15249	19666	19025	15029	14973	9557	3803	4079	6312	6299	12428	13484	12011	10517	8709
		MEDI	3290	3409	3567	3707	3952	3678	6043	5820	6337	5240	5057	3740	6126	6387	8360	6571	4901	3027	5123	4301	5909	3058	2274	3342	2400
	ATL	ANGOLA	27	197	357	357	256	351	515	212	256	90	21	115	20	70	28	1	0	4	6	21	29	12	31	2	38
		BENIN	0	0	0	25	37	64	72	32	49	50	1	3	6	3	0	0	0	0	0	0	0	0	0	0	0
		BRASIL	0	0	0	0	0	0	72	11	634	623	941	1260	1904	700	592	746	291	608	906	558	527	215	162	166	166
		BULGARIA	0	0	0	0	3	3	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		CAP-VERT	0	0	0	0	0	0	0	0	0	0	0	2	86	105	75	135	82	115	86	13	6	22	191	154	81
		COTE D'IVOIRE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5269	4458	4432	5764	6768
		EC-ESPANA	418	574	1249	1211	6260	5295	3128	2691	5746	3702	3164	4538	3938	1877	2240	541	228	362	297	386	947	581	570	23	17
		EC-FRANCE	0	0	0	0	0	0	0	0	640	416	1904	3392	3392	3008	3872	703	799	1134	1063	857	800	850	853	920	91
		EC-PORTUGAL	0	0	0	0	0	0	0	0	14	30	32	1	2	4	26	3	0	0	0	0	0	1	31	5	9
		ESTONIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	198	0	0	0	0	0	0	0	0	0
		F.I.S	0	0	0	0	0	1856	1984	2800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		GERMANY D.R	0	0	0	0	0	0	106	55	40	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		GHANA	4311	13914	1047	4286	7566	2048	6062	5632	4530	4500	3256	4689	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	1	0	0	0
		JAPAN	14	89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		LATVIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	243	0	0	0	0	0	0	0	0	0
		LITUANIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	290	0	0	0	0	0	0	0	0	0
		MAROC	272	688	770	694	968	1267	1126	1271	198	424	302	465	194	599	1045	1131	332	274	122	645	543	2614	2137	494	494
		NEI-1	0	0	0	0	0	0	0	333	46	0	0	17	381	155	237	1	4	32	68	70	660	609	553	707	0
		NETHERLAND.ANT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	215
		PANAMA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	243	57	118	341	327	240	91	0	0	0
		RUMANIA	0	0	0	0	0	0	0	0	0	0	51	15	0	0	0	0	0	0	0	0	0	0	0	0	0
		RUSSIA FED.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3249	1441	220	505	456	46	500	761	477	477
		SAO TOME & PRINCIPE	0	0	0	0	0	0	0	0	32	0	0	0	0	0	0	0	0	0	0	0	79	323	0	0	0
		SENEGAL	0	0	0	0	0	0	0	0	0	0	0	0	810	784	1082	311	201	309	309	309	0	0	0	0	0
		TRINIDAD & TOBAGO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	0	56	199	368	127	138	138
		U.S.S.R	162	242	803	450	694	407	5623	1655	5903	6055	3465	2905	5638	5054	2739	0	0	0	0	0	0	0	0	0	0
		UKRAINE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	0

			1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
		VENEZUELA	1253	907	550	1845	1176	944	509	1171	1478	1746	2109	2264	2654	2670	3037	1762	368	886	2609	2601	3083	2839	2164	1631	215
	MEDI	ALGERIE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	174	270	348	306	230	237	179	299	173	225
		CROATIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	21	52	22	28	26	26	26	26	0
		EC-ESPANA	1635	1184	1676	1771	2120	1700	1935	2135	2301	2047	1555	631	2669	2581	2985	2226	1210	648	1124	1472	2296	604	487	669	1024
		EC-FRANCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	4	0	0	1	0	0	0	0	0
		EC-GREECE	0	0	0	0	0	516	2192	1887	2060	1419	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1426	1426	0	0	0
		EC-ITALY	912	1147	1177	1342	1376	1193	1299	1494	1610	1344	1344	906	609	509	494	432	305	379	531	531	229	229	229	462	462
		MALTA	15	9	33	11	18	4	9	11	4	1	13	5	8	18	21	20	11	10	1	2	3	6	6	0	0
		MAROC	357	234	69	73	10	14	77	57	52	48	175	178	811	1177	2452	1289	1644	170	1726	621	1673	562	1140	682	682
		TUNISIE	353	811	589	493	409	237	517	218	294	367	538	606	588	660	985	985	35	20	13	14	13	26	87	1330	7
		YUGOSLAVIA	18	24	23	17	19	14	14	18	16	14	32	14	41	42	23	0	0	0	0	0	0	0	0	0	0
		YUGOSLAVIA REP. FED.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	1	0	0	2	6	0	0	0	0
KGM	TOTAL		8293	8732	6769	11450	15656	18513	18149	14607	13182	9964	12187	11890	13038	10835	12232	11530	12439	14462	13868	14916	17774	19123	12104	14337	10828
(S. cavalla)		ANTIGUA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
		ARGENTINA	466	988	379	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		BRASIL	546	790	845	848	1598	1612	1929	2695	2588	806	2890	2173	2029	2102	2070	962	979	1380	1365	1328	2890	2398	3595	3595	3595
		DOMINICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	0
		DOMINICAN REP.	0	0	0	0	0	0	0	0	0	0	0	0	20	29	33	34	47	52	0	0	0	0	0	0	0
		GRENADA	0	162	175	73	25	30	43	40	19	0	0	0	0	0	0	0	0	0	0	0	2	4	0	14	0
		GUYANE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	270	0	398	0
		MEXICO	1497	1331	1535	2249	1946	2740	4409	2874	2164	2303	2643	3067	3100	2300	2689	2147	3014	3289	3097	3214	4661	4661	0	0	0
		ST.LUCIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0	0
		TRINIDAD & TOBAGO	0	0	0	0	0	0	0	20	43	11	38	82	752	541	432	657	0	1192	0	471	1029	875	746	447	432
		U.S.A	4053	3837	2507	6292	10726	12565	9863	7068	7444	6011	5683	5628	5807	4363	5939	6502	7091	7747	6922	7345	7051	8772	7423	7423	4377
		VENEZUELA	1731	1624	1328	1988	1361	1566	1905	1910	924	833	933	940	1330	1500	1069	1228	1308	801	2484	2558	2140	2139	340	2424	2424
BLF	TOTAL		1026	1251	1341	1205	1175	1973	1941	1738	1908	1403	2822	3462	3322	2834	3887	4201	4352	3534	2718	4051	4487	3919	3967	4076	3181
(*Thunnus atlanticus*)	BLF	BRASIL	56	273	195	173	181	85	89	57	203	133	172	254	229	120	335	130	49	22	37	153	649	418	55	55	55
		CUBA	0	0	0	0	0	721	622	558	487	157	486	634	332	318	487	318	196	54	223	156	287	287	0	0	0
		DOMINICA	0	0	0	0	0	0	0	0	0	0	0	0	1	4	19	10	14	15	19	30	0	0	0	79	79
		DOMINICAN REP.	90	68	78	105	125	124	144	144	106	90	123	199	4	564	520	536	110	133	239	892	892	892	892	892	892
		EC-ESPANA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	307	46	0	0	0	0	0	0	0
		EC-GUADELOUPE	190	530	530	470	440	460	490	482	490	460	470	470	450	460	470	460	470	440	440	480	500	500	500	500	500
		EC-MARTINIQUE	580	300	400	300	300	301	352	327	331	295	259	199	366	395	395	750	700	700	890	890	540	540	540	540	540
		GRENADA	100	71	76	95	68	84	143	102	232	193	256	141	220	134	293	195	146	253	189	123	164	126	126	94	94
		JAMAICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	148	0	0	0	0
		LIBERIA	0	0	0	0	0	0	0	0	0	0	0	0	229	0	0	0	0	0	0	0	0	0	0	0	0
		NETHERLAND.ANT	0	0	55	55	55	55	55	55	55	55	60	60	70	70	70	60	60	65	60	50	45	45	45	45	45
		ST.LUCIA	0	0	0	0	0	0	0	0	0	0	0	2	1	1	17	14	13	16	82	47	35	40	40	41	41
		ST.VINCENT	0	0	0	0	0	0	0	0	0	0	0	0	19	15	38	11	7	53	19	20	18	22	22	15	15
		U.S.A	0	0	0	0	0	139	41	7	0	11	32	44	154	87	80	111	126	508	492	582	446	547	707	617	326
		UK-BERMUDA	10	9	7	7	6	4	5	6	4	9	17	11	7	14	13	8	6	5	7	4	5	4	6	6	5
		VENEZUELA	0	0	0	0	0	0	0	0	0	0	947	1448	1240	652	1150	1598	2148	1224	21	624	758	498	1034	1192	589
BOP	TOTAL		212	456	970	492	698	1448	584	38	49	133	87	564	1482	1116	457	588	600	601	775	640	2136	476	159	844	762
(O. unicolor)		ATL	212	321	817	464	698	1448	584	38	49	124	86	538	1474	1109	420	487	424	349	599	525	2004	249	29	627	626
		MEDI	0	135	153	28	0	0	0	0	0	9	1	26	8	7	37	101	176	252	176	115	132	227	130	217	136
	ATL	BENIN	0	0	0	1	1	2	2	1	1	1	3	1	2	1	1	1	1	1	1	1	1	3	1	1	0
		EC-PORTUGAL	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		MAROC	132	231	727	373	596	968	483	0	0	83	33	487	1422	1058	369	486	423	348	598	524	2003	246	28	626	626
		MAURITANIE	80	90	90	90	101	478	99	37	40	40	50	50	50	50	50	0	0	0	0	0	0	0	0	0	0
	MEDI	ALGERIE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	87	135	198	153	92	119	224	128	216	135

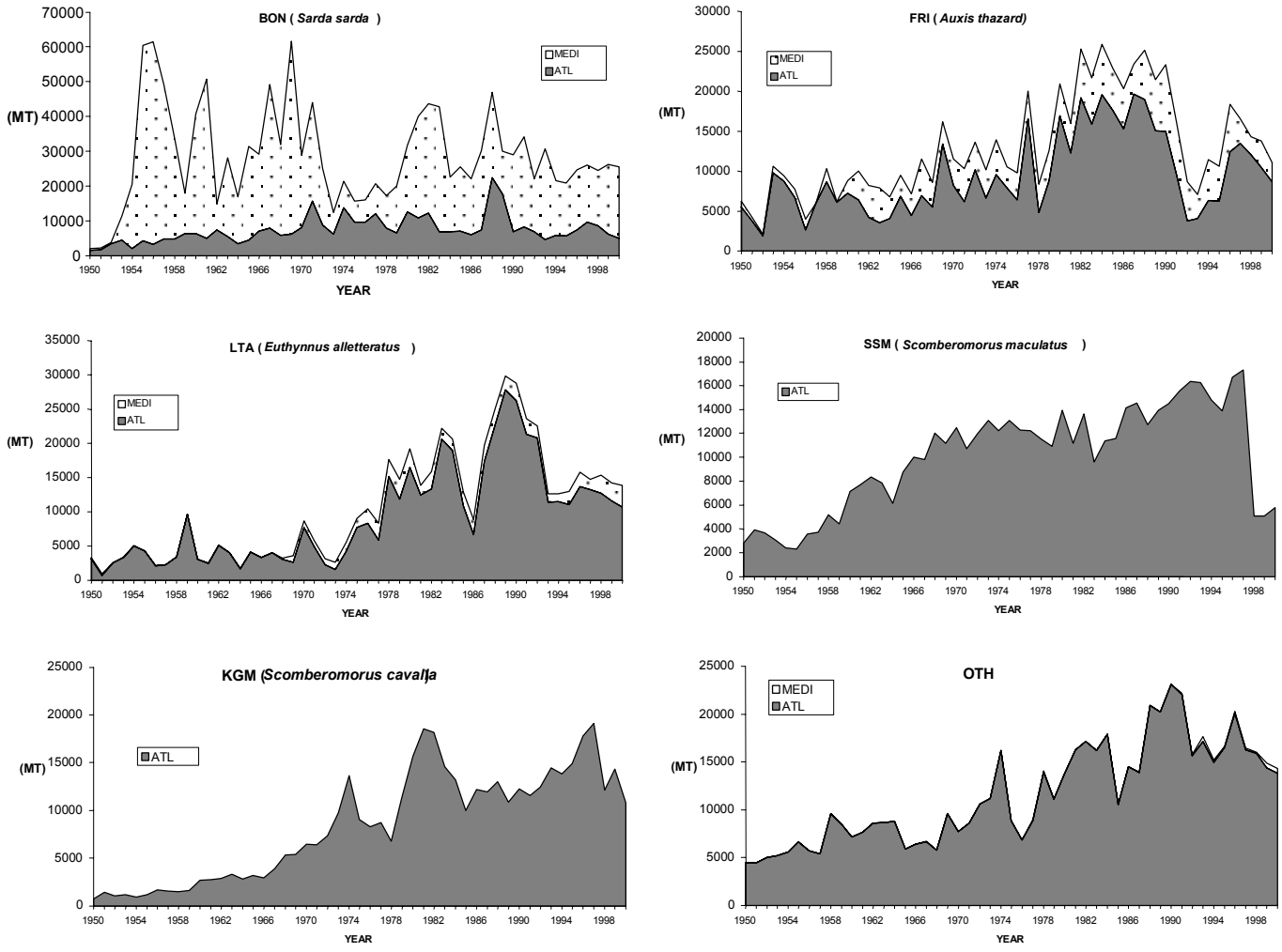
			1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
		LIBYA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	40	0	0	0	0	0	0	0
		MAROC	0	135	153	28	0	0	0	0	0	9	1	26	8	7	37	14	1	14	23	23	13	3	2	1	1
WAH	TOTAL		379	393	452	760	610	2920	2280	2366	2159	920	1150	1235	1612	1507	1470	1687	1807	2571	2104	2361	2514	2758	2310	2911	2093
(A. solandri)		ANTIGUA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
		ARUBA	100	100	115	115	115	115	115	115	115	115	120	90	80	80	70	60	50	50	125	40	50	50	50	50	50
		BARBADOS	0	0	0	189	116	144	219	222	219	120	138	159	332	51	51	60	51	91	82	42	35	52	52	41	41
		BENIN	0	0	0	1	1	2	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		BRASIL	9	3	6	69	1	1	0	0	0	21	141	133	58	92	52	64	71	33	26	1	16	58	40	0	0
		CAP-VERT	0	0	0	0	24	2307	1464	1588	1365	142	205	306	340	631	458	351	350	326	361	408	503	603	429	587	487
		DOMINICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	43	59	59	59	58	58	58	58	50	50
		DOMINICAN REP.	0	0	0	0	0	0	0	0	0	0	0	0	1	3	6	9	13	7	0	0	0	0	0	0	0
		EC-ESPANA	0	0	0	0	0	0	0	0	0	4	9	9	32	18	23	28	32	22	20	15	25	25	29	28	32
		GRENADA	0	0	35	31	25	23	41	94	50	51	82	54	137	57	54	77	104	96	46	49	56	54	54	82	82
		NETHERLAND.ANT	178	178	215	215	215	215	215	215	215	245	250	260	280	280	280	250	260	270	250	230	230	230	230	230	230
		SAO TOME & PRINCIPE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80	52	52	52	52
		ST.LUCIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	77	79	150	141	98	80	221	223	223	310	310
		ST.VINCENT	0	0	0	0	0	0	0	0	0	0	0	0	4	4	28	33	33	41	28	16	23	10	10	52	52
		TRINIDAD & TOBAGO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	118	1	0	0	0	0	1	1	1	2
		U.S.A	0	0	0	0	0	0	0	0	0	13	12	57	128	110	82	134	203	827	391	764	608	750	614	857	640
		UK-BERMUDA	20	35	23	33	46	24	40	49	46	46	65	43	61	63	74	67	80	58	50	93	99	105	108	104	61
		UK-S.HELENA	5	6	4	7	10	12	9	16	23	15	15	18	18	17	18	12	17	35	26	25	23	0	0	0	0
		VENEZUELA	67	71	54	100	57	77	175	66	125	147	113	106	141	101	159	302	333	514	542	540	487	488	360	467	4
SSM	TOTAL		12307	12218	11528	10899	13945	11164	13633	9574	11362	11590	14117	14531	12712	13946	14500	15546	16346	16231	14777	13857	16725	17309	5087	5087	5788
(S. maculatus)		COLOMBIA	245	283	228	199	213	408	8	10	77	101	81	72	151	112	76	37	95	58	69	69	0	0	0	0	0
		CUBA	500	400	600	400	578	657	476	689	544	443	621	1606	803	746	665	538	611	310	409	548	613	613	0	0	0
		DOMINICAN REP.	253	174	317	415	479	503	384	168	1058	1267	1271	1321	1415	1401	1290	728	735	739	1330	2042	2042	2042	2042	2042	2042
		GRENADA	0	10	2	0	1	1	1	1	1	4	17	0	0	1	3	0	0	1	2	2	0	0	0	0	0
		MEXICO	3380	4414	5138	5751	5908	5908	7799	5922	5777	5789	6170	6461	5246	7242	8194	8360	9181	10066	8300	7673	11050	11050	0	0	0
		TRINIDAD & TOBAGO	1544	1484	1933	1208	1337	939	1218	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		U.S.A	6385	5453	3310	2926	5429	2748	3747	2784	3905	3986	5957	5071	5097	4444	4272	5883	5724	5057	4667	3523	3020	3604	3045	3045	3746
KGX *(Scomberomorus spp.)*	TOTAL		502	471	424	197	214	339	283	20	485	22	149	261	491	105	131	225	356	301	508	512	824	0	250	1	137
		BARBADOS	220	135	157	0	0	0	0	0	0	0	138	159	332	68	51	45	51	55	36	42	49	0	0	0	0
		COLOMBIA	133	108	92	54	73	160	80	20	485	22	11	102	159	37	25	7	12	21	148	111	539	0	0	0	0
		CUBA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	236	0	0
		GABON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	140	145	79	0	0	0	0
		PUERTO RICO-TR.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	53	84	86	134	106	0	0	0	0
		RUSSIA FED.	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
		ST.LUCIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	55	79	150	141	98	80	50	0	0	0	0
		ST.VINCENT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	137
		TRINIDAD & TOBAGO	149	228	175	143	141	179	203	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		UKRAINE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	94	90	0	0	0	0	0	0	0	0
CER	TOTAL		565	629	698	586	604	628	687	677	680	574	500	392	219	234	225	375	390	450	490	429	279	279	279	29	29
(S. regalis)		DOMINICAN REP.	105	119	98	86	104	106	76	110	106	63	52	48	57	59	50	45	79	50	90	29	29	29	29	29	29
		EC-GUADELOUPE	240	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		EC-MARTINIQUE	220	510	600	500	500	522	611	567	574	511	448	344	162	175	175	330	310	400	400	400	250	250	250	0	0
		ST.VINCENT	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
BLT	TOTAL		0	0	0	0	0	0	0	0	0	0	2	0	357	723	3634	2206	814	394	177	100	0	0	28	579	1230
(A. rochei)		EC-PORTUGAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	263	494
		RUSSIA FED.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2171	814	70	100	100	0	0	0	0	420
		TURKEY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	0	324	77	0	0	0	0	316	316

			1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
		U.S.A	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		U.S.S.R	0	0	0	0	0	0	0	0	0	0	0	0	357	723	3634	0	0	0	0	0	0	0	0	0	0
BRS	TOTAL		2272	3188	3484	3722	5617	5841	6019	6632	8129	3501	6549	6212	9510	10778	7698	8856	6051	8049	7161	7006	8435	8004	7297	5754	6147
(S. brasiliensis)		BRASIL	283	986	1522	1191	2826	3466	4342	4511	6259	1504	5011	4741	5063	5927	2767	1437	1149	842	1149	1308	3047	2125	1516	1516	1516
		GRENADA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
		GUYANE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	211	571	0	1143	1143
		TRINIDAD & TOBAGO	0	0	0	0	0	0	0	0	0	0	0	0	2704	2864	2471	2749	2130	2130	2130	1816	1568	1699	2130	1328	1722
		VENEZUELA	1989	2202	1962	2531	2791	2375	1677	2121	1870	1997	1538	1471	1743	1987	2460	4670	2772	5077	3882	3882	3609	3609	3651	1766	1766
MAW	TOTAL		1901	2572	6716	4167	4921	3156	5312	4716	4498	3989	3292	1799	3915	2934	5610	4025	1437	1775	1270	1264	1316	871	1108	727	727
(S. tritor)		ANGOLA	0	20	81	24	70	68	138	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		BENIN	0	0	0	23	35	60	68	30	46	50	104	17	13	334	211	214	202	214	194	188	188	362	511	205	205
		ESTONIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	49	0	0	0	0	0	0	0	0	0
		GABON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	85	0	0
		GERMANY D.R	0	0	0	0	0	0	851	537	33	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		GHANA	555	720	771	1569	4412	1983	2982	2225	3022	3000	1453	0	1457	1457	1500	2778	899	466	0	0	0	0	0	0	0
		LATVIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	208	34	0	0	0	0	0	0	0	0	0
		LITUANIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	52	4	0	0	0	0	0	0	0	0
		RUSSIA FED.	0	0	0	0	0	0	0	0	0	0	0	0	143	195	1032	242	0	19	0	0	44	0	0	0	0
		SAO TOME & PRINCIPE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0
		SENEGAL	1270	1188	1054	1112	404	1045	671	754	1174	732	1516	1754	2159	753	1419	656	332	1076	1076	1076	1076	509	512	522	522
		U.S.S.R	76	644	4810	1439	0	0	602	1170	223	206	219	28	143	195	1240	0	0	0	0	0	0	0	0	0	0
MIX	TOTAL		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	4	256	252	164	592	0	0
(Mixed species)		EC-PORTUGAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	256	252	164	289	0	0
		UKRAINE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	4	0	0	0	303	0	0

* As of 5 October 2001. Subsequently, catches were reported by:
Morocco for 2000 in the Mediterranean (115 MT of BON, 763 MT of FRI, and 10 MT of BOP) and in the Atlantic (2163MT of BON, 101 MT of LTA, 582 MT of FRI and 1048 MT of BOP); and
Brazil in the southeastern Atlantic for 2000 (605 MT of LTA, 106 MT of FRI, 2,344 MT of KGM, 38 MT of BLF and 988 MT of BRS).



SMT-Fig. 1. Estimated landings (MT) of small tunas, all species combined, in the Atlantic and Mediterranean, 1950-2000. Data for recent years are incomplete.



SMT-Fig. 2. Estimated landings (MT) of major small tuna species in the Atlantic and Mediterranean, 1950-2000. Data for recent years are very incomplete.

8. *Ad hoc* Working Groups

8.1 Assessment Methods

Dr. Victor Restrepo presented the Report of the ICCAT Working Group on Assessment Methods (SCRS/01/008), which met 11-15 June 2001. The Working Group focused on various issues associated with extending the length of the time series to be used in assessments back in time, a term of reference given by the SCRS in 2000. The report highlights some of the problems that might be encountered in such an exercise, such as accounting for changes in productivity, their likely causes and possible solutions. The report recommends that the SCRS move towards adopting more complex models, such as the "integrated assessment models" that are being adopted elsewhere. However, it also cautioned that adopting such models would have implications for the way in which the SCRS carries out its work, for example by increasing the workload of data-preparatory and other inter-sessional meetings.

The report of the Working Group also encouraged increased interaction on methodological issues with other Regional Fishery Bodies involved in tuna research.

In addition, it recommended that the next meeting be held in 2003 to continue its work on the implementation and use of more complex assessment models. The Committee encouraged species groups to decide on other methodological questions that the Working Group could address at its next meeting.

8.2 Precautionary Approach

Dr. Restrepo explained that one of the main activities on this subject last year had been the participation by several ICCAT scientists in the Expert Consultation on Implications of the Precautionary Approach for Tuna Biological and Technological Research (Phuket, Thailand, 7-15 March 2000). The report of that meeting has now been published as FAO Fisheries Circular No. 963 (2001) and is available from FAO Headquarters.

Another main activity of the Working Group has been to carry out work on the development of simulation tools for evaluating management strategies, including those related to the Precautionary Approach. Dr. Restrepo explained that a group of ICCAT scientists are collaborating to put together a proposal to the EC for funding such applied work. The Committee noted that the Commission could benefit directly from the development of these simulation tools and that, therefore, the Commission should endorse the proposed project.

The Chairman noted that this *ad hoc* Working Group has fulfilled its immediate mandate by participating in the 2000 Expert Consultation and by concentrating the efforts of ICCAT scientists working on evaluating management strategies. The Committee recommended that the Working Group continue to serve as an umbrella for reporting work on management strategy evaluations. In addition, the Working Group could initiate new activities in the future if the Commission makes specific recommendations to that effect.

8.3 SCRS Organization

Dr Gerald Scott, Convener of the *ad hoc* Working Group, presented the report of the meeting that was held during the previous week, and which is attached as **Appendix 4**. That report presents the Working Group's recommendations related to staffing, the timeliness of data and paper submissions, peer review of stock assessments, and the schedule of meetings for the next two years (note that the SCRS has modified these recommendations, below).

The Committee expressed its support to the Secretariat's plans for hiring a scientific editor in the professional staff and an additional staff person in the general services category, in order to cope with the current workload demands.

The Committee also expressed its support for the initiative to begin the process of peer reviews of stock assessments. An annual budget of US$ 10,000 would allow for 2-3 such reviews if used to pay for travel expenses only. The Committee agreed that priority be given to *in situ* reviews, in which reviewers would participate actively

in the assessments and then report back to the SCRS and the species working group providing their opinions about the assessment and suggestions for improvements. The Committee also suggested that each species have a peer review more or less every five years.

There was discussion concerning the process of choosing reviewers. The final recommendation was that a group consisting of the SCRS Chairman, the Species Rapporteur and a scientist from the Secretariat act as coordinators of the selection process and that the selections be made in open consultation (e.g., by electronic mail) with SCRS Head Scientists.

There was also discussion of the future assessment schedule. While noting that the Commission could impose priorities, the following points were suggested for guidance:

- Care should be taken during scheduling in order to minimize conflicts with meetings of other organizations (e.g., GFCM, IOTC, IATTC, SPC)
- Not more than five assessment meetings should take place in any given year.
- No assessment meetings should be scheduled during the Species Group meetings (one week before the SCRS Plenary).
- The SCRS Plenary should be held in late October each year.
- No SCRS meetings should be held in August or November.
- The recommended schedule for 2002 is:

  February: Meeting to review Ghanian statistics and to develop a sampling system.
  March: Billfish planning meeting.
  April: GFCM-ICCAT data preparatory meeting for Mediterranean bluefin and swordfish, and albacore.
  July: Bluefin-East and bluefin-West assessments.
  September: Swordfish-North and Swordfish-South assessments.
  October: Bigeye assessment.
  October: Sub-Committee on Statistics.

- The recommended assessment meetings for 2003 are:

  Blue marlin, white marlin, and sailfish.
  Albacore-North and Albacore-South.
  Swordfish-Mediterranean.
  Yellowfin.
  Skipjack assessment.

- Other meetings that could be held in 2003 or 2004 are:

  Shark (blue and shortfin mako) assessments.
  Workshop on Environment.
  Assessment Methods Working Group.

On a different issue, the Convener of the working group noted that the practice of preparing work plans for the various species groups had been largely abandoned. The Committee agreed that such work plans were very useful to both scientists and the Secretariat. The Committee recommended that the rapporteurs prepare/update work plans early each year.

9. Special research programs

9.1 Bigeye Tuna Year Program (BETYP)

The Report on the BETYP activities from October 2000 to September 2001**(Appendix 5)** was presented by the Program Coordinator, Guillermo Fisch, who described the situation of the program's activities. Seven papers related to this item were presented and discussed during the Tropical Species meetings.

Conventional tagging

It was agreed to continue conventional tagging activities in Azores, Canary Islands and Madeira.

There was consensus on the convenience of carrying out a second dedicated tagging cruise in the Gulf of Guinea. It was recommended that consideration be given to determining the best location or locations for the base of operations in order to maximize the catching possibilities, taking into account the experience gained in 2000. Sao Tome, Gabon and Tema were mentioned as possible locations.

The convenience to intensifying all efforts to increase the recovery of tags was pointed out, even if not all the required data were available in every case.

Archival and pop-up tagging

It was agreed that it would be convenient to continue deployment of pop-up tags and to augment the program with implanted archival tags. Azores and Canary Islands appear to be the best possible locations for deployment. It was suggested that the tags be submitted to immersion tests in order to ascertain that the release mechanism was not malfunctioning. A reward in the order of US$ 500 should be offered for the return of Pop-up tags.

In the case of implantable archival tags, a provision should be made in the budget to hire an expert to train the personnel that will implant the archival tags. A reward commensurate with the US programs should be offered for returned archival tags.

Otoliths and hard parts

It was agreed that the program established with the *Institut pour la Recherche et le Developpement (*IRD) be carried out.

Genetic studies

It was agreed that the program established with the *Museo Nacional de Ciencias Naturales (*MNCN) be carried out.

Tema statistics improvements

It was agreed that a working group be convened to define and implement a reliable sampling scheme for the Gulf of Guinea fisheries. It was proposed that the meeting should be held in Abidjan around February 2002 and under the chairmanship of F. X. Bard. The convenience of visiting the unloading operations in Tema by the members of the working group was mentioned. This could have an effect on the decision of where to hold the meeting, i.e. Abidjan or Tema.

R/V Shoyo-maru

Document SCRS/01/116 summarized research cruise of 2000-2001 by the research vessel *Shoyo-maru* which was conducted as part of BETYP. Longline operation, behavioral study on fish movement around FADs, plankton net sampling and oceanographic observations were conducted. More details are provided in the document. Dr. Miyabe (Japan) informed the Committee that a research cruise with the R/V *Shoyo-maru* is scheduled for 2002 in the Central and North Atlantic and that BETYP could take advantage of this cruise for sampling collection and other research activities.

Endorsement

The Committee expressed strong support for the continuation of the BETYP and the approval of the proposed budget for 2002.

9.2 Bluefin Year Program (BYP)

Progress of the BYP was reviewed by the Committee. The summary report of BYP activities for the preceding year is presented in **Appendix 6**. The Committee noted substantial progress has been made under the BYP. In particular, the research undertaken through the FAO-COPEMED program has resulted in large gains in our understanding of the Mediterranean and eastern Atlantic bluefin fisheries that will substantially improve the Committee's ability to advise the Commission on the status of bluefin in the region. The Committee reviewed and endorsed the 2002 planned research expenditures of the BYP. These recommendations are presented in Section15.

9.3 Enhanced Research Program for Billfish

The Committee reviewed the progress made by the program, the report of which is attached as **Appendix 7**. The Committee also reviewed and endorsed the 2002 planned research expenditures of the program.

10. Sub-Committee on Environment

At the request of the Chairman of the SCRS, the Convener of the Sub-Committee on Environment, Dr. Jean-Marc Fromentin (EC-France) opened the meeting. Dr. Restrepo agreed to serve as Rapporteur. The Convener reminded participants that the Subcommittee was established in 1991 to study the effect of the environment on tunas in general. The Sub-Committee's immediate concern is that of oceanographic forcing on tuna biology and fisheries, rather than on technical or multi-species interactions.

The Convener presented the Report of the May 2001 Workshop on the Environment and Tuna Recruitment (SCRS/01/006) which was held with the main objective of conducting analyses to check and test three environment/tuna recruitment issues that have been put forward recently: (a) the relationship between NAO and tuna recruitment, (b) patterns of recruitment variability among various stocks, and (c) the effects of a variable recruitment on stock size and yields. The Workshop provided several suggestions for integrating environmental factors into the stock assessments conducted by the Committee. A first step might be to identify potential factors for each species and the hypothesized relationships that these factors have with biological characteristics of the species. Then one should note the possible biases that might arise if these factors are not integrated into an assessment and, conversely, what biases might arise if they are included. Simulation tools can be useful to assess such biases.

While the suggestions for scientific investigations made by the 2001 Workshop are useful, the Committee recognizes that it is difficult to integrate the relevant activities into the way assessments are conducted within the SCRS structure. There usually is not enough time to conduct exhaustive exploratory analyses within an assessment working group meeting. Additionally, not all of the expertise needed to fully explore environmental data sets lies within the scientists normally attending SCRS and its working groups. Thus, opportunities to bring in multi-disciplinary expertise and encourage investigation of environmental data sets should be explored. In addition, the following specific actions can aid in achieving a better integration of environmental considerations with assessments:

- Species Working Groups should identify important environmental analyses which can be done prior to the assessment in their Work Plan.
- Establishing space at the Secretariat for visiting scientists to facilitate these analyses.
- Develop biostatistical data bases prior to analyses for use by the informal collaborators.
- Consider periodic intersessional meetings of the Sub-Committee on the Environment with much shorter and focused plenary meetings of the Sub-Committee;
- Encourage communication with other multi-disciplinary scientists/organizations to facilitate implementation of new data sets and new ideas; and

Given these considerations, and the experience from the 2001 Workshop, the Sub-Committee considered that a more efficient use of its resources would be to hold inter-sessional meetings sporadically, which should focus on specific questions. In turn, the meeting of the Sub-Committee during the plenary session of the SCRS should be used to plan and present the results of these inter-sessional meetings.

Following the above consideration, the Sub-Committee recommended that such an inter-sessional workshop in 2003 (or in 2004 at the latest) to examine issues related to the scarcity of temperate and tropical tunas around the Azores, Madeira and the Canary Islands, for the purpose of testing whether this phenomenon is environmentally-driven.

A proposal was also made for the Secretariat to develop and maintain a repository of environmental data that would be made available to ICCAT scientists. There was some discussion about how exactly this should be done and what resources would be required. It was recommended that, in its next meeting, the Sub-Committee develop specific guidance to the Secretariat so that it can develop and maintain such an environmental database.

No other matters were discussed. The Convener noted that the next meeting of the Sub-Committee would be, as usual, at the same time and place as the SCRS next year. The Convener thanked participants and adjourned the meeting.

11. Sub-Committee on By-catches

The Report of the Sub-Committee on By-catches was presented by the Convener, Dr. Hideiki Nakano.

The Sub-Committee discussed the findings of the Data Preparatory Meeting for Atlantic Shark Stock Assessment, which was held in Halifax, September 11 to 14, 2001 (SCRS/01/021). It was recommended that ICCAT and ICES coordinate research activities on sharks. From a scientific point of view, it would be practical for ICCAT to take the responsibility for research on pelagic sharks. Should the Commission require shark assessments, it was recommended that these be scheduled not earlier than 2004, in order to allow time for further data collection.

The Sub-Committee also reviewed new information concerning by-catches, updated the list of by-catch species relevant to ICCAT, and reviewed several national and international activities concerning by-catches.

The Committee endorsed the Sub-Committee's recommendations (**Appendix 8**), some of which appear under Section 16 of this report.

12. Sub-Committee on Statistics

The Report of the Sub-Committee on Statistics **(Appendix 9)** was presented by the Convener, Dr. Steve Turner

Inter-sessional meetings of the Sub-Committee on Statistics were held in May and October 2001 to review progress on the ICCAT Relational Data Bases. The Committee expressed satisfaction with the progress made thus far **(Appendix 10)**.

The report of the Sub-Committee also touched on many issues that affect the operations of the Secretariat and the SCRS, including publications, Internet connectivity and bibliographic references and the increased variety of data to be collected by the Secretariat.

The Report of the Sub-Committee on Statistics was adopted by the Committee. Section 16 of this report contains the relevant recommendations of this Sub-Committee to the Commission.

13. Scientific meetings where ICCAT was represented

Dr. Restrepo introduced a document which listed the meetings at which ICCAT had been represented, either by a member of the Secretariat or by someone else (SCRS/01/014). He explained that the document is an attempt to summarize relevant information about each meeting of relevance to ICCAT in a unified format. In addition to venue information, the summaries present comments written by the person who represented ICCAT, relevant action items for the SCRS or the Commission, and information needed to get the actual meeting report. Dr. Restrepo also explained that the document will be kept up to date each November-October annual cycle.

14. Collaboration with non-contracting Parties, Entities or Fishing Entities and other fisheries organizations

The following activities were noted by Victor Restrepo and Papa Kebe of the Secretariat:

- GFCM: ICCAT was represented at three GFCM meetings in 2001. In addition, there may be a joint ICCAT-GFCM data-preparatory meeting in 2002 for bluefin tuna and swordfish.

- ICES: There continues to be collaboration on assessment methods. In addition, there may be increased collaborations on the collection of shark catch statistics and possibly on shark stock assessments.

- FAO: The FIRMS project, a part of FIGIS (see SCRS report of 2000) will continue as a collaborative project between FAO and several organizations including ICCAT, if adequate funding is found.

- CWP: The ICCAT Secretariat continues to collaborate routinely with CWP on issues dealing with the harmonization and dissemination of fishery statistics.

- Chinese-Taipei, Mexico, and the Philippines: There continues to be excellent collaboration between these Collaborating, Non-contracting Parties, Entities and Fishing Entities and ICCAT, especially in reference to Task I and Task II statistics.

15. Responses to the Commission

15.1 Atlantic bluefin tuna mixing [Ref. 00-11]

At the November 2000 meeting of ICCAT, the Commission resolved that the SCRS examine the effects of bluefin tuna mixing for stock assessments and possible management boundaries through an inter-sessional meeting. The Commission has acknowledged that evaluating management boundaries and management units will necessarily involve a dialogue between scientists and managers. This is an initial step in establishing the management-science dialogue. The goals of this inter-sessional meeting, held in Madrid, 3-7 September, 2001, were as follows:

- To evaluate the information in regards to mixing and movement of Atlantic bluefin tuna,

- To examine alternative assessment models that might be used to characterize the biological hypotheses,

- To suggest alternatives for management structures that might be used given the biological and assessment characteristics, and

- Lastly (and most importantly), to evaluate the information and institutional requirements that will be needed to both assess and manage/allocate the stock(s) under alternative management structures.

The report of the Workshop was presented as SCRS/01/020.

The historical basis of the current 45/W boundary line was primarily related to discontinuities in the distribution of catches at that time in the Atlantic and was supported by limited biological knowledge. Hence the management

approach initiated in 1982 was appropriate at the time. However, the overall distribution of the catch in the 1990s is much more continuous across the north Atlantic than was seen in previous decades. Further, there are new biological data from tagging that describe a greater degree of movement across the east-west boundary line than was indicated from earlier tagging studies. Therefore it is necessary to re-examine this issue based on our current knowledge.

The review of existing information on the kind and extent of mixing, movement and distribution is reported in Section II of the Report of the Workshop on Bluefin Tuna Mixing. While the Commission's mandate for this meeting was an evaluation of the current east/west boundary in the Atlantic, there are many sources of uncertainty and data limitations that restrict the understanding of Atlantic bluefin tuna biology and population dynamics. This includes limitations in basic catch, effort, size samples, studies on growth, maturity, fecundity and other biological information. Nevertheless, in response to the Commission's mandate (and in response to the accumulation of information on movement) the focus of the meeting was on the effectiveness of the current east/west management boundary in the Atlantic.

The accumulation of evidence indicates that movement across the current east/west management boundary in the Atlantic does occur, that movements can be extensive (including trans-Atlantic ones) and complex, that there are areas of concentration of electronically tagged fish (released in the west) in the north central Atlantic just east of the management boundary, and that fisheries for bluefin tuna have developed in this area in the last decade. Clearly, an important proportion of these tagged fish have moved from west of the current boundary. Complementary studies that might show east-to-west movement are less advanced. Thus, conclusions about the composition in this area are premature. Additionally, the spawning source of these fish (east or west) is unknown. Nevertheless, it is clear that the current boundary does not depict our present understanding of the biological distribution and biological stock structure of Atlantic bluefin tuna. Note, however, that the current boundary is a *management* boundary and its effectiveness for management is a different issue.

A plan for modeling and assessment was developed (Section III of the Report) to integrate the accumulation of knowledge on movement into assessments and to evaluate the effectiveness of alternative spatial boundaries. This will provide a basis to advise the Commission on developing alternative management strategies (including more fine-scale spatial management units). Completion of this activity may allow the Commission to develop more flexible (and thus complex) management strategies. However, this activity is expected to take several years. Therefore, several short-term management options were suggested (Section IV of the Report) which the Commission could use as an interim measure and could be integrated into the next assessment. The three Options that are likely to be most useful are:

- Option (1) *status quo*: where the current management boundary, current assessment based on that boundary and current management allocations are continued.

- Option (2) *central-north Atlantic management unit*: where a central-north Atlantic area (including areas east of the current boundary) is defined based on recent fisheries, catch, tagging distributions and biological data; assessments are conducted using the current management boundary; catch limitations and rigorous scientific monitoring requirements are imposed for the central-north Atlantic; and the Commission would develop a sharing arrangement within the central-north Atlantic. Note that there is a precedent for this Option in the 1993 *Recommendation by ICCAT on the Management of Bluefin Tuna Fisheries in the Central North Atlantic Ocean*.

- Option (3) *expanded western Atlantic management unit*: where the western and eastern management units are redefined by expanding the area to include areas of the central-north Atlantic (defined by recent fisheries, catch, tagging distributions and biological data); conduct the assessment based upon this new boundary; and develop a new sharing arrangement.

Note that Options 2 and 3 require redefinition of management boundaries based on recent fisheries, catch, tagging distributions and biological data. However, no management boundary that might be established will exactly describe the biological distributions. A particular boundary is chosen as a proxy for the real overlapping distribution of the fish which balances the need to encompass as many western-spawned fish in the western management unit and as many eastern-spawned fish in the eastern management unit as possible. Obviously, these two interests are

competing. Furthermore, Options 2 and 3 may have a negative impact in other areas, as a geographical redistribution of fishing effort towards either the east or the west may occur.

The choice between the three Options depends primarily on one's views about how effective each option will be relative to the Commission's objectives of rebuilding the bluefin tuna of the western Atlantic management unit and reducing the catch in the eastern Atlantic management unit to a sustainable level. Choosing between the three options is likely to be much more important with respect to the objective for the western Atlantic management unit than for the eastern management unit, because the abundance of fish and the catch in the eastern Atlantic is large relative to the western Atlantic. Thus, the selection of the management boundary is a compromise aimed at including more fish of western Atlantic origin in the western management unit without diluting the western Atlantic assessments and management with too many eastern Atlantic origin fish.

At this stage, the SCRS was unable to prioritize among the three Options. The choice depends on one's judgment about how vulnerable fish of western Atlantic origin are to fishing in the central Atlantic, and to what degree western Atlantic origin fish mix with eastern Atlantic origin fish in the central Atlantic. If the Commission believes that the proportion of western Atlantic origin fish that migrate across the stock boundary and are vulnerable to fishing in the central Atlantic is too small to jeopardize the rebuilding plan for the western Atlantic, then the *status quo* option is appropriate. If the Commission believes that the proportion of western Atlantic origin fish that are vulnerable to fishing in the central Atlantic is large enough to jeopardize the rebuilding plan, then either Option 2 or 3 is appropriate. If the Commission believes the degree of mixing of western and eastern Atlantic origin fish in the central Atlantic management area under consideration is high, Option 2 is appropriate. However, if the Commission believes that there is little mixing and fish are of western origin, then Option 3 (moving the boundary between the western and eastern Atlantic management unit boundary toward the East) is appropriate. Note that all three Options should be considered interim, i.e., they are not expected to be long term solutions to the mixing problem.

It is recommended that the Commission choose one of the three Options until a long-term solution to the mixing problem is developed. It is also recommended that the SCRS conduct assessments based upon all three of these Options in the 2002 assessment session. This implies that several scenarios for management boundaries in Options 2 and 3 will have to be developed and evaluated by the SCRS.

Whichever option may be selected, the Commission should be aware of the need for rigorous scientific monitoring in the central North Atlantic.

15.2 Bluefin tuna conversion factors [Ref. 00-12]

In 2000 the Commission resolved that the SCRS should "report on updating conversion factors for bluefin tuna" used to convert product weight to live weight (round weight).

The SCRS noted that a primary objective to the Bluefin Statistical Document Program has been to facilitate accounting of catches by water body (Mediterranean Sea, east Atlantic and west Atlantic), nation and year for compliance monitoring. Using the Bluefin Statistical Documents, as currently configured, for catch monitoring can result in double counting and not using it can result in under-counting. The Secretariat reported that following conversion factors are currently used by ICCAT.

Gilled and gutted	1.16
Dressed	1.25
Fillet	1.67
Belly meat	10.29
Other	2.00

For Contracting Parties, the SCRS does not report whole weight converted from belly meat, under the assumption that all products would be accurately accounted for, as recommended by the Commission in 1997.

The SCRS noted that the conversions for gilled and gutted, dressed and fillet have been used by the Secretariat for many years. Apparently they were derived in cooperation with the fishing industry, but formal documents about their estimation may not be available.

The SCRS reviewed SCRS/97/80 and SCRS/97/103 which reported on belly-meat to whole weight conversions and noted that they provided very similar estimates. The conversion factor used by the Secretariat for belly meat was taken from SCRS/97/80 because it covered a longer time period and was based on a larger number of fish sampled (72).

New information on 21 different conversion factors was provided in SCRS/01/124. For bluefin loins (dorsal and ventral) the conversion factors were estimated from observations on more than 35 fish, while for other product forms there were insufficient observations (7 or fewer) for the SCRS to have confidence in the estimates. The new factors were not significantly different from those currently used by ICCAT, except that the "Other" category could be separated into "loins" and "other".

The Bluefin Statistical Documents record products in several forms, but primarily as whole, gilled and gutted, fillet and 'other'. For 'other', the individual documents allow for additional description of the product form. Information from the Japanese Fisheries Agency indicated that loins, steaks and belly meat are the primary product forms recorded under Other. From **Table 1** it can be seen that 'Other' accounted for 1% to 6% of the total reported product weight in 1996-2000. The Bluefin Statistical Document data received by the Secretariat is aggregated and so no breakdown of the types of products included in 'other' is currently available. The SCRS reiterates its request that the individual Bluefin Statistical Documents be provided to the Secretariat so that detailed information can be retained (both for questions about such things as product forms as well as for trying to eliminate double counting).

The SCRS concluded that useable estimates of conversion factors are available for the most common product forms (dressed, gilled and gutted, fillet, and belly meat). Fully documented conversion factors, such as those for belly meat and loins noted above, are preferred by the SCRS because estimation methods and uncertainty can be reviewed. The SCRS noted that conversion factors often vary by size of fish, season, region, and/or nation, because of differences in morphology, condition factor and/or ways of preparing products. Evidence of differences are provided in SCRS/97/80 for the belly meat conversion and in SCRS/01/124 for loin conversions. Additional research on condition factors could be useful to adequately document historical conversion factors and estimate additional effects such as those noted above.

The SCRS notes that a larger problem than conversion factors is the possibility that multiple products from the same fish (such as belly meat and loins) may be exported or some products are exported and some are not; these situations can result in counting the same fish multiple times. In the long term, one way to avoid double-counting would be to use a catch certification approach in which individual fish are identified and that identification is retained with each product removed from that fish. A bar-code system is currently being used for such a purpose by at least one large European dealer, and catch certification systems are used in the U.S. and Canada for sold bluefin. There are several catch tracking systems in place globally and the FAO is considering the possibility of harmonizing such systems into catch certification programs. ICCAT and CCSBT use statistical document programs which do not track individual fish.

Table 1. Forms in which bluefin tuna are exported to Japan, shown in MT and percentage of the annual exports as recorded in Bluefin Statistical Documents

				Metric Tons			
	Belly meat	*Dressed*	*Fillet*	*Gilled & gutted*	*Other*	*Round weight*	*Total*
1997	85	2,611	3,927	4,356	540	3,834	15,354
1998	502	3,579	2,453	3,488	148	1,447	11,617
1999	812	4,631	2,642	2,946	363	2,759	14,153
2000	702	4,347	3,406	3,264	906	3,200	15,825
				Percentage			

	Belly meat	*Dressed*	*Fillet*	*Gilled & gutted*	*Other*	*Round weight*
1997	1	17	26	28	4	25
1998	4	31	21	30	1	12
1999	6	33	19	21	3	19
2000	4	27	22	21	6	20

15.3 Effects of tuna farming on bluefin tuna statistics [Ref. 00-10]

In 2000, in view of the rapid development of the practice of bluefin tuna farming and knowing that this practice could be problematic in terms collecting certain types of data, the Commission asked the SCRS to present "*a report on the effects of bluefin tuna farming on the collection of catch statistics, and recommendations on possible solutions, if needed, to improve the Bluefin Tuna Statistical Document (BTSD).*"

From a stock assessment point of view, the Committee's primary interest is in knowing the characteristics of the fish when they are first caught. That is: the number of fish caught, their sizes (weights), the location, the fleet/gear used, and the amount of fishing effort spent in capturing them. Generally, only an estimate of total catch in weight is obtained, but not the details about fish sizes, etc. The practice of tuna farming in itself does not prevent the collection of such information, but it certainly makes it more difficult to obtain reliably because the fish cannot be sampled easily at the time of capture. Indirect sampling methods (e.g., with the aid of cameras) could be used to improve the current catch statistics, but such methods would need to be investigated and validated before being adopted. Any such research would likely need to be conducted in close collaboration with the industry, which would also benefit directly from it.

Improvements on information about fleets and location of the catches would also have an impact on correctly attributing the catches to the fleet that actually makes them. However, this is not directly an effect due to farming, but rather one related to legal matters that are beyond the Committee's mandate and expertise.

A more indirect effect of farming on the catch statistics used by the SCRS has to do with the use of the BTSD summaries to estimate unreported catches. For such estimates to be more accurate, the Committee needs to be able to track individual fish in order to avoid ascribing catches to the wrong flag and to eliminate the possibility of overestimating the live weight of fish that are exported in multiple product types. In addition, it would be necessary to know how much time the fish spent in captivity, and to better understand the growth in weight of bluefin fed different industry diets (e.g., as studied in document SCRS/01/092), in order to estimate the size at capture.

In summary, the Committee recommends the following in relation to this request from the Commission:

- To study the feasibility of using indirect sampling methods to estimate catch in numbers and catch at size of the fish before fattening takes place.
- To study the growth rates of farmed bluefin, primarily in terms of weight.
- To study the feasibility of modifying the Bluefin Tuna Statistical Document so that it can track individual fish (not necessarily one fish per document), and indicate how long individual fish were fattened before being killed.
- To modify the Bluefin Tuna Statistical Document so that it tracks exports of live fish captured by one country and put into cages of another country.

In addition, for the third recommendation to be useful, the reporting of BTSD information to the Secretariat should be done in electronic form for each individual document (Note: the BTSD Recommendations currently in effect only require summaries to be sent to the Secretariat).

15.4 Protection of juvenile swordfish in the Mediterranean [Ref. 00-5]

Background

In 2000, the Commission instructed the SCRS to "*report on possible measures to protect juvenile Mediterranean swordfish, taking into account the biological characteristics and the nature of the Mediterranean swordfish fisheries*." [Ref. 00-5]. This is a brief response to the Commission's request. See also SCRS/01/050.

In preparing this response, the Committee did not address the relative merits of measures aimed at protecting different components of the stock. That is, the response focuses on the protection of juveniles without considering other potentially useful measures such as protecting spawning swordfish.

It should also be noted that, due to the lack of data to support a quantitative assessment for this stock, it is not possible for the Committee to make quantitative estimates of the potential effects of alternative measures to protect juveniles. Thus, the recommendations made are largely qualitative and are based exclusively on available knowledge of swordfish biology and fisheries in the region.

For the purpose of this response, "juveniles" are defined as immature fish.

Relevant biological characteristics

- Spawning occurs in Spring and Summer but usually peaks between June and July.

- The known areas where spawning is concentrated are in the Balearic Islands, and the central Mediterranean Sea (there may be other such areas but more research is needed to locate them).

- Juveniles are found throughout the Mediterranean but often tend to concentrate close to the coast and in areas of favorable trophic and oceanographic conditions.

- 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 142 cm. According to the growth curves used by the SCRS in the past for Mediterranean swordfish, these two sizes correspond to 2 and 3.5 year-old fish, respectively. Males reach sexual maturity at smaller sizes.

- Mediterranean swordfish begin reproducing at considerably smaller sizes than Atlantic swordfish: At a size of 125 cm (the minimum size adopted by ICCAT for Atlantic swordfish with 15% tolerance) no mature females would be expected in the Atlantic, while about 20% of the females in the Mediterranean would be mature.

Relevant fishery characteristics

- Recognizing that there is considerable spatial and temporal heterogeneity in Mediterranean swordfish fisheries, there are two main gear types that target swordfish: driftnet (gillnet) and longline. Very small quantities are caught by targeted harpoon fisheries. Various tuna fisheries also catch swordfish as by-catch.

- Driftnets can be used throughout the region but they must be limited at a local level to times and places where environmental conditions and fish behavior are favorable for catching swordfish. Longlines can be more widely used throughout the region because they can be operated under more adverse conditions and they can be more easily adjusted. In practice, the current usage of these gears in different countries depends on national and international regulations.

- Historically, juveniles have made up a large fraction of Mediterranean swordfish catches. The size frequency distribution landed by each fishery in the region can vary substantially. For example, depending on the fishery, the year, the area and the season, the percentage of landings below 120 cm (the minimum size established by EC for the Mediterranean) can be as low as 15% or as high as 100%.

- The size frequency distribution caught by several fisheries is not well sampled. Another problem is that not many countries report regularly to ICCAT the sizes of fish caught, so that it is not possible to estimate the stock-wide catch of juveniles without making assumptions about similarities between fisheries that may not

hold true.

– Despite the differences in sizes landed by the various fisheries, it is evident that the catch of small swordfish is usually highest during the Fall and Winter months (September to February). However, juveniles can be caught throughout the year.

Comments on possible measures to protect juveniles

– Closed areas. Juvenile concentrations can be found in areas that could be closed, but closed areas may sometimes be difficult to enforce due to the drifting nature of the main fishing gears (for example, if the closed area is small and is located in open waters).

– Closed seasons. Seasonal closures, especially during the Fall-Winter period, would be expected to reduce the catch of juvenile swordfish (and would also reduce the catch of juveniles of other large pelagic species). The degree of reduction in swordfish catch would depend on the timing and length of the closure and the fishery in question. On the other hand, seasonal closures would also reduce the catch of adult swordfish and of other species to varying degrees. The Committee was unable to predict the potential impact of seasonal closures on juvenile swordfish due to the insufficiency of size data reported to ICCAT.

– Minimum size. The amount of juveniles protected by a minimum size regulation would partly depend on the percentage of mature swordfish at that size: the larger the minimum size, the greater the amount of juveniles protected. In practice, the amount of juveniles protected also depends on the actual numbers that are caught and killed by the fishing gear, which is not necessarily the same as the numbers landed. Observer programs may be needed to better quantify catches of undersize fish. It was noted that the EC adopted a 120 cm minimum size for the Mediterranean, but the Committee is not aware of the biological basis for this measure.

Measures intended to protect juveniles will likely have various socioeconomic consequences that the Committee is unable to evaluate. This situation arises due to factors such as a market that is largely directed at small swordfish, and the artisanal nature of many of the fisheries involved, both of which can affect reporting in the presence of restrictive measures. As such, the Committee cannot rule out the possibility that regulatory measures intended to protect juveniles may have the opposite effect.

Proposals for possible measures to protect juvenile Mediterranean swordfish in response to Ref. 00-05

The following proposals address directly the Commission's request. However, these are inter-related with other statistical and research issues which are addressed subsequently. The Commission may wish to consider the following possible measures either separately or jointly, or they may wish to consider other possible measures not addressed here.

Mediterranean-wide

– One or more closed seasons between September and February would reduce the catch of juvenile swordfish and would probably also reduce the overall fishing effort. The effects of a closure of less than 2-months duration would likely be undetectable. However, due to the insufficiency of data, the Committee is unable to recommend the optimum timing and duration of such a seasonal closure.

– Based on known maturity studies, a minimum size should be at least 110 cm LJFL in order to protect only juveniles. Some tolerance (e.g., 15% of fish caught below the minimum size) could be allowed to take into account the behavior of swordfish and the current characteristics of the fisheries: the smaller the minimum size, the smaller the tolerance level should be.

National

– Juveniles can be further protected by additional measures such as closed nursery areas in national jurisdictions.

Other recommendations

- The overall effectiveness of any measures taken to protect juveniles will not be measurable unless more complete catch statistics (especially lengths) are collected and transmitted to ICCAT. In this respect, the Commission should insist that countries fishing for swordfish fulfill their obligation to collect Task I and Task II data and report them to ICCAT and implement observer programs as appropriate.

- More research on swordfish fisheries and biology is needed to provide sufficient information to measure the adequacy of any measures taken to protect juveniles. Collaborative regional research programs could play a useful role in financing relevant research projects. Examples are: (a) studies on gear selectivity and fish availability to avoid small fish; (b) definition of essential nursery habitat for identifying potential closed areas; (c) additional studies on spatial variability in maturity and reproduction to refine decisions on minimum sizes.
- In deciding upon regulations intended to protect juvenile Mediterranean swordfish, the Commission should be aware that the quality of fisheries data used by the SCRS could deteriorate even further.

- A stock assessment for Mediterranean swordfish is necessary to better evaluate any improvements in the data and the merits of alternative management measures. The Committee recommends that the GFCM-ICCAT working group on large pelagic fishes make this a priority.

15.5 Report on Japanese swordfish research plan [Ref. 00-3]

In 2000, the Commission in Recommendation 00-03 requested the following:

"*Japan shall conduct research that significantly improves the understanding of the stock structure and of mixing of Atlantic swordfish, as described in the 1999 SCRS Detailed Report for Swordfish, with emphasis on electronic tagging and genetic studies. A research plan and progress report for this new Japanese research on swordfish should be reviewed by the SCRS in 2001.*"

Background. The management units of the Atlantic swordfish for assessment purposes are separate North and South Atlantic groups separated at 5ºN. This stock separation is supported by recent genetic analyses. However, the precise boundaries between stocks are still uncertain, and mixing is expected to be highest at the boundary in the tropical zone. Therefore there is uncertainty as to whether the management units used correspond exactly to the biological stock units. A significant portion of the Japanese swordfish catch has been obtained from the boundary area (5ºN), which introduces uncertainty in the stock management, because there is high uncertainty in assigning the catch from this border area to either stock.

Japanese Research Objective. The purpose of this Japanese research plan, therefore, is to better characterize the swordfish in the tropical zone where most of the Japanese fishing occurs, using both genetic studies and electronic tagging (SCRS/01/147). It must be understood that this plan only addresses a part of the overall swordfish stock structure research priorities of the SCRS. Further, in order to answer questions about the position of the stock boundary, information from this study must be interpreted in the context of other studies throughout the distribution of Atlantic swordfish. It would be premature to make conclusions about the position of the stock boundary without considering data collected from other areas of the Atlantic as recommended by the SCRS in 1999. This would involve additional new research.

Japanese Progress Report. Japan has collected the genetic samples of swordfish in the Atlantic Ocean since 1990 from research cruises and Observer Programs. More than 400 specimens have been analyzed so far (361 collected by Japan and 57 collected by USA). The results of the genetic analyses using these samples (SCRS/01/146) indicate that there are at least two distinct swordfish stocks in the Atlantic; one in the north higher than 20/N and the other in the south lower than 10/N, and the allele frequencies are stable within each stock through time (1990 to 1998 in the north and 1994 to 1999 in the south). In the tropical area, these recent analyses suggest that a very large fraction of the Japanese catch is composed of fish with a south Atlantic stock-signature.

New Japanese Research. In order to assess the extent and dynamics of these stocks around the 5/N management boundary, Japan intends to conduct intensive Atlantic-wide sampling for further genetic analyses between 10/N and 20/N, through their Observer Program. In 2002, Japan also intends to deploy pop-up archival tags (PSATs) on

swordfish (from their Research Vessel) to clarify the movement patterns of swordfish in this boundary area.

a) Genetics. A total of six observer cruises are expected to be completed in 2001 in the northwest Atlantic. In 2002, more than six observer cruises are planned to collect the genetic samples of swordfish widely in the Atlantic Ocean. The exact number of Observed trips for 2002 and locations to be covered by the Observers have not yet been determined.

b) Tagging. Japan is now planning an approximately 185-day research cruise including about 80 survey days by R/V *Shoyo-maru* in 2002. This research cruise consists of two major parts, to investigate spawning activity of Atlantic bluefin tuna in the Central North Atlantic and to clarify the movement patterns of swordfish and habitat preferences of marlins in the tropical Atlantic. During this cruise, about 30 longline sets will be carried out in the tropical central Atlantic in September and October to deploy five to ten PSATs (number of tags depends on budget). Tissues for the genetic research, hard parts (anal fin and otolith) for ageing and stomach contents also will be sampled.

The Committee strongly recommends the following:

Genetic samples

- Samples from observer coverage. The 10% observer coverage recommended by the Commission should be implemented in 2002 by Japan. Scientists must have input into the deployment strategy to ensure appropriate stratification of samples in space and time. The utility of the results from samples collected by Observers is very much influenced by the experimental design around deployments. Full capture details (e.g., depth, hook position) should be collected for each fish sampled.

- Samples from research vessel samples. Genetics samples should be taken from all swordfish on all legs of the 2002 Japanese research cruise (not just the two dedicated to swordfish and marlin research).

Tagging

- There should be sufficient PSATs to tag the maximum number of swordfish in good condition. Opportunities to tag swordfish are limited, as it requires a research vessel or special charter. Swordfish are fragile and short soak times are essential to increase fish survival on the line and post-release. The PSATs used should have the newest features (e.g., ability to estimate longitude and latitude, pressure sensors, fail safe detachment when the fish goes to a pre-determined depth or remains at a pre-determined constant depth) in order to maximize the information gain of the research.

The Committee reiterated that while the Japanese Research Plan will contribute to the knowledge of swordfish movements, it alone will not result in a redefinition of the north/south Atlantic boundary. Further sampling of other areas is still required before such conclusions can be attempted. Finally, the Committee stressed that the results of these studies must be considered in concert with other studies, throughout the range of swordfish.

15.6 Report of the 2001 Japanese swordfish catch, including discards [Ref. 00-3]

In 2000, the Commission in Recommendation 00-03 requested the following:

"*In 2001 and 2002, the Japanese catch, including discards, will be reviewed by the SCRS and provided to the Commission, based upon the best available scientific information including new observer data for the Japanese fleet as well as from other sources*."

Miyabe and Uozumi (SCRS/00/181) document a revision of the method used to estimate the Japanese swordfish longline catch. Estimates are derived from logbook data. While the SCRS reviewed and endorsed the methodology for these revised estimates, an error in the boundary between north and south swordfish stocks was later found in the calculations. This has been corrected to 5/N (SCRS/01/147) and the recalculations are shown in **Table 1a** by calendar year. Corrections in the estimation of Japanese longline catch by fishing year (1 August to 31 July) have

also been made and are shown in **Table 1b**. Also shown in **Table 1** are the provisional estimates for 2000 of both landings (using logbooks) and discards (using radio reports).

Table 1. Estimated Japanese swordfish landings and dead discards in the Atlantic (MT)

	North Atlantic (>5/N)	*South Atlantic (<5/N)*	*Total*
a) Calendar year (landings, discards)			
1997	1219	1541	2760
1998	1391	987	2370
1999	1212	825	2037
2000[1] landings (Jan)	179592	7070	886592
b) Fishing year (landings)			
1997 (08/97-07/98)	1291	923	2214
1998 (08/98-07/99)	1338	1091	2424
1999[1] (08/99-07/00)	652	8020	1454
2000[1] (08-12/00)	0	188	188

[1] 2000 landing and discard estimates are provisional and subject to change.

On 1 February 2000, the Japanese management authority required all Japanese longliners operating in the Atlantic north of 5/N to discard all swordfish, as their 5-year block quota had been reached (NAT/01/09 and SCRS/01/147). This management action combined with limited monitoring of discards from the Japanese fishery has lead to a serious loss of data.

- Catch estimates are generally calculated using log book data (self-reported by fishermen), however in 2000 and 2001 these logs had no provision for reporting discards.

- A radio-reporting system was implemented: at 10-day intervals, all Japanese longliners fishing in the north Atlantic were required to report the number of swordfish discarded dead and the number discarded alive. The only other information available from these reports was the dates of the 10-day period and vessel identification. Location data were not collected in these reports. There was also some confusion among fishermen on how to report these releases.

- Based on these radio reports the number and tonnage of dead discards were calculated as follows (SCRS/01/147):

  - A preliminary reporting ratio was estimated from the number of vessels reporting discards and the number of vessels thought to be fishing in the North Atlantic: average of 84%.
  - The number of discards reported were then adjusted upwards by this ratio, calculated on a 10-day basis.
  - The total number of swordfish estimated to have been discarded by Japanese longliners between February and December 2000 is 15,668.
  - Of those, 10,225 (65%) were estimated to be dead.
  - Assuming no post-release mortality of live releases, and applying the 1999 quarterly average weight, then it is estimated that 592 MT of swordfish were discarded dead from the Japanese longline fishery north of 5/N between February and December 2000.

- This estimate of dead discards is considered very preliminary. Once log books have been received, then the radio reports will be matched with the log records and the coverage and location of the catch (discards) determined. Currently only about 40% of log books have been received, but it is expected that by June/July 2002 80% will be available. At that time a better estimate of year 2000 discard tonnage by area can be calculated. As no size estimates are available for the discards, a catch-at-size will have to be estimated using 1999 data by area.

- Observer coverage in 2000 was sparse and not in the primary area of swordfish catches (5 trips; <1%) and was insufficient to use to substantially improve the estimates.

- The same problems have occurred in 2001, though there is a new reporting system proposed that includes the landing and discards on one record. Implementation has not yet been scheduled.

The Committee is very concerned that a national implementation of an ICCAT recommendation has lead to this serious loss of data. It is essential that nations ensure that adequate data collection systems are in place prior to implementation of new management measures, in order to measure the benefits/consequences of the actions.

- Recommendations for the improvement of Japanese data collection are as follows and should be implemented as soon as possible:

- The recommended Observer coverage (10% in 2002, see Recommendation 00-03) should be implemented to estimate independently the numbers, tonnage, and size of dead discards and live releases. Deployments of Observers should be made in a scientific manner so as to ensure adequate spatial and temporal coverage of the fishery. Data resulting from this sample should then be used to evaluate the coverage needed to achieve the desired levels of precision.

- Adequate size sampling must be conducted (in 2000 this was 2.3% in the north and 5.0% in the south). These samples should also note the sex of fish. In 1999, the SCRS noted that given the large catches by Japan and the paucity of size samples from this fishery, it was strongly recommended that Japan implement an extensive size-sampling scheme by time and area. This has not been done. Other major fleets in the North Atlantic measure 50% or more of fish landed. Japan should strive to achieve such a level of sampling.

- Log books should be adapted to record information on discards, discard condition, and incidental catch in general. Somehow these data should be made available to scientists in a more timely manner. Real time electronic reporting is encouraged.

15.7 Rebuilding Plan for blue marlin and white marlin populations [Ref. 00-13]

The Commission, at its 2000 meeting, adopted a recommendation relating to the rebuilding plan of blue and white marlins that would take place in two phases. As part of Phase 1, the SCRS was requested to develop, and present to the 2001 Commission meeting, a work plan on how to achieve its mandate under Phase 2.

In Phase 2, the SCRS is required to conduct stock assessments of the blue and white marlins in 2002 and shall, at the 2002 Commission meeting, present its evaluation of specific stock recovery scenarios that take into account the new stock assessments, any new information and any re-evaluation of the historical catch and effort time series.

The SCRS would like to point out that the ICCAT recommendations approved in 2000 only came into effect in July, 2001 and that national regulations will probably be implemented later. Therefore, many of the research activities recommended are currently being developed by the Contracting Parties and non-Contracting Parties, Entities and Fishing Entities but it would still take some time before those are fully implemented. Therefore, the SCRS agreed that it is not yet possible to evaluate the results of these scientific activities, as well as the effect of the recommended regulatory measures.

The SCRS therefore believes that it is premature to move to Phase 2, until we have implemented more thoroughly the research items in Phase 1 and until some evaluations become available on the results of Phase 1. Therefore, the SCRS recommends that an intersessional research planning meeting be held in 2002, as early as possible (March, 2002). This meeting will develop a billfish research plan to: (1) Identify Atlantic marlin habitat, longline gear behavior, and evaluate interaction between marlins and longline gear; and (2) Develop data collection and monitoring systems to address phase 1 recommendations. In addition, the meeting will review and update progress on plans for future assessments. Close collaborations between billfish fishing nations and Entities would be essential for developing such a plan. After Phase 1 is more fully implemented, then the SCRS could more productively proceed to the next step of Phase 2, which could be in 2003 or later. In other words, the stock assessments set by the Commission for 2002 might be more informative if they were conducted after full implementation of Phase 1.

The Committee is very concerned that Contracting Party, Non-Contracting Party, Entity and Fishing Entity

implementation of ICCAT recommendations can lead to a serious loss of data. It is essential that Contracting Parties, Non-Contracting Parties, Entities and Fishing Entities ensure that adequate data collection systems are in place prior to implementation of new management measures, in order to measure the benefits/consequences of the actions.

15.8 Update of the impact of the moratorium on tropical tuna stocks **[Ref. 99-1]**

Background

Following the recommendations of the Committee on the need to reduce fishing mortality of bigeye tuna, especially that of juvenile bigeye, the Community frozen tuna producers' associations, ORTHONGEL, OPAGAC and OPTUC-ANABAC, established an "Agreement of Community Frozen Tuna Producers for the Protection of Atlantic Ocean Tuna" in April 1997. This agreement implied a voluntary auto-regulation of fishing with floating objects through the prohibition of anchoring and fishing with floating objects in a wide area of the Atlantic Ocean, between the African coast and 20º West longitude and between latitudes 5º North and 4º South, during the months of November and December 1997 and January 1998. Later, this agreement was extended to the same months in 1998 and 1999.

In 1998, the Commission adopted a recommendation in the same terms as this agreement, for the same period (1 November through 31 January) beginning in November 1999, binding on all purse seiners flying flags of Contracting Parties and Cooperating Parties, Entities, and Fishing Entities.

In 1999, the Commission extended this recommendation to all surface fleets and requested that the Committee analyze the impact of the moratorium on the stocks and recommend any changes considered necessary to increase its effectiveness, in order to evaluate possible modifications to be applied to the moratorium. The Committee carried out the required analyses in 2000. Following substantial revision of the data after the 2000 SCRS, these analyses were re-conducted and results are presented in SCRS/01/067. During the 2001 SCRS meeting, the analyses were updated to incorporate data through 2000. This Executive Summary outlines the work done by the Committee.

Framework

The effects of the moratorium were estimated by considering the three moratoria affecting purse seine only: November-December 1997-January 1998; November-December 1998-January 1999 and November-December 1999-January 2000 plus the complete surface fleet moratorium November-December 2000.

The analyses were carried out by gear, fleet and species, with more detailed analysis being concentrated on the purse seine fleets. The fleets considered were:

Purse seine. The following three categories were considered:

- European fleet (French and Spanish), from which detailed information is available both from the fishery and from observers. This fleet was taken as a reference as it was considered that it would reflect the maximum effect of the moratorium, as it has complied with three periods and has, furthermore, reduced its effort.

- The NEI fleet associated with Community interests. In most cases information is available at a level similar to that of Community fleets.

- Ghanaian fleet. General information is available from the fishery, but very partial information from observers.

Baitboat. Three categories were considered by area:

- The Ghanaian fleet, which fishes in the equatorial area with floating objects, on the same component of the stocks of yellowfin and bigeye as purse seiners.

– Fleet based in Dakar (French, Spanish and NEI), which fishes in the area near Senegal

– Azores/Madeira/Canary Island fleet, fishing north of 25ºN

Longline. This was analyzed as one fleet as the effects of the moratorium will have the same overall effects on all longliners.

Other fleets. These include other surface gears (hand line...), and fleets of a lesser importance (Venezuelan purse seine and baitboat, South Africa baitboat etc) in terms of catch levels and/or their distance from the moratorium area.

The years 1993 to 2000 were chosen as a reference period, as it was considered that the floating object fishery was fully developed by 1993 and 2000 was the most recent year for which information is available. To evaluate the effects, this was separated into a pre-moratorium (1993-1996) period and the moratorium period (1998-2000). 1997 was excluded from the analyses as it only contained 2/3 of a moratorium period.

For the description of fishery data, all boats associated with Community country interests were considered as NEI. However, the analyses was carried out using the size distribution of the catches which appear in the ICCAT data base as NEI, in which catches of Contracting Party flag vessels are included. For this reason, the totals do not always coincide. These differences should not affect the general results of the analysis as the vessels have similar characteristics and strategies, leading to a similar distribution of size frequencies. Another possible difference between the conclusions of one or other section is the source of the data. In the section on statistics all the data used are from fishing logbooks, while the analyses were carried out using size frequencies based on sampling and, in many cases, substitutions.

Descriptive statistics

Purse seine

European fleet and NEI associated: The average annual catch (YFT-SKJ-BET and others) of this fleet have been reduced by 34% (74,682 MT) during the years of the moratorium (1998-2000) with respect to the average of the previous period (1993-1996) **(Table MOR-1)** due to a sharp decline (48%) in the catches from floating objects which have decreased from 54% to 42% of the total catch **(Figure MOR-1a)**. By species **(Figures MOR-1b-d)**, the major decreases have been noted in the catches of skipjack and bigeye, species which are mainly caught using floating objects **(Table MOR-2)**.

From a time/area consideration, the decrease in the catches from floating objects occurs entirely during the months of the moratorium, within the area of the moratorium **(Figure MOR-2)**. Comparing the time-area distribution of the catches during the two periods **(Figure MOR-3)**, one can see that the drastic reduction in catches from floating objects in the closed area is not offset by similar increases in catches of free schools and/or floating objects outside the moratorium area. Similarly, no expansion of the fishing grounds as a result of the moratorium has been noted.

The most important changes in regard to the species composition was the increase in the proportion of yellowfin in the catches, which increased from 39% to 44% (from 18% to 17% on log sets and from 63% to 68% on free school sets), while the proportion of bigeye decreased from 13% to 9%.

Figure MOR-4 shows the evolution in the number of vessels and nominal effort in days fishing. A continuous reduction in the fleet is observed during the period. Nevertheless, the evolution of effort in fishing days shows an additional decrease during the moratoria years.

Bearing in mind that the fleet has continued to reduce during the moratoria years, the decreases observed in the catches cannot be exclusively attributed to the effects of the moratoria. Comparing expected catches (based on the monthly catch trend of the previous period), in the event that there were no moratorium, with the catches obtained with the implementation of the moratorium, a decrease of about 12% in the total catch (15-20,000 MT per year), especially in fish less than 10kg, has been estimated as being attributable to the moratoria.

Ghanaian fleet: **Figure MOR-5b** shows cumulative monthly catches of yellowfin, skipjack and bigeye taken

by the Ghanaian purse seine fleet from 1996-2000. During each year, the greater catches are made during the second half of the year. A continuous increase can be observed for the three species during the period, as this fleet began operations in 1996 and has been expanding during the moratoria years, from two boats in 1996 to ten in 2000 **(Figure MOR-4)**, although increased fuel prices led to a substantial decrease in activity of those vessels in 2000.

Baitboat

Ghanaian fleet: **Figure MOR-5a** shows accumulated monthly catches of yellowfin, skipjack and bigeye by the Ghanaian baitboat fleet for 1996-2000. An increase in the catches of the three species is observed during the moratoria years due, in part, to the association of this fleet with the purse seine fleet (the baitboats help in the search and in the transport of the catch) and possibly also due to the effects of the moratoria. The increase in CPUE **(Figure MOR-6)** of this fleet during the moratoria years can be similarly explained. As in the case of purse seine, the major catches are made in the second half of the year.

Taken together, the Ghanaian purse seine and baitboat catches, which are made up of the same range of sizes and taken in the same area as the European and associated fleet, have increased by an average of 22,800 MT during the moratoria years.

Dakar-based fleet: **Figure MOR-6** shows the catch rate for the European and associated NEI fleet based in Dakar. The stable values of these rates indicate that the moratoria do not seem to have an effect on this fleet.

Longline

Fleets of Japan, Chinese Taipei: **Figure MOR-7** shows the evolution of catch rates for the Japanese and Chinese Taipei fleets. The Japanese CPUE trend shows an increase in catch rates for 1999 and 2000, whereas the Taiwanese trend shows a decrease in 2000. It would not be advisable to establish a relationship between longline catch rates and the moratoria until a longer data series is available. **Table MOR-4** shows the evolution of longline catches between 1993 and 2000 in the Atlantic.

Other fleets

There was no information relevant to other gears or fleets.

Analyses

Fishing mortality and selectivities

To estimate selectivities the group decided to use forward cohort analysis because the imprecision in the estimates of fishing mortality in recent years, obtained by tuned VPA, did not allow the detection of changes which may have occurred. This method assumes constant recruitment. The recruitment values used (50 million for BET and 90 million for YFT) were based on the estimates of previous assessments. Forward cohort analyses suggest that there have been substantial changes in the selectivity and fishing mortality trends of each fishery between the pre-moratorium period (1993-1996) and the years in which a full three months of moratorium took place (1998-2000). Fishing mortality estimates from the eight fisheries for the two periods are shown in **Figure MOR-8**.

Fishing mortality levels for small bigeye tuna (ages 0 to 3) **(Figure MOR-8a)** attributable to the European purse seine fleet were lower during the moratorium than during the pre-moratorium period, although this reduction was smaller during 2000, mainly on age 1. For NEI purse seine fleet, the fishing mortality is substantially lower on ages 0 and 1 in 2000 than during both the 1998-99 and pre-moratorium period. Some of this reduction was due to the moratorium and some was due to changes in the fishing effort of these fleets; however the contribution of these two sources to the reductions cannot be quantified. Ghanaian purse-seine and baitboat fisheries, however, showed a different trend, with fishing mortalities of age 0 and 1 generally showing a large increase during the moratoria years. It is unlikely that changes observed in the Dakar and North baitboat fisheries are directly related to the moratoria.

When the fishing mortalities for all fleets are combined, this shows increased fishing mortalities on ages 1 and 4 during the moratoria years, although the fishing mortalities in 2000 generally were lower than those during 1998-1999.

Yellowfin tuna catch at size was not available through 2000 for these analyses: therefore, **Figure MOR-8b** has been reproduced from document SCRS/01/067. Overall fishing mortality of yellowfin tuna increased for small (age one) and decreased for large fish (ages 3 and 4) during the moratorium years (1998-1999). Increased mortality of small yellowfin is largely attributable to increased total landings by the Ghanaian purse seine. Reduction in fishing mortalities for large yellowfin were seen in the European purse seine and other surface fisheries. Fishing mortality on small yellowfin caused by the European purse seine fleet seems to have remained at the pre-moratorium level.

Yield per recruit and spawning biomass per recruit

In order to estimate the effect of the moratorium, the estimated fishing mortality patterns from these cohort analyses were used to calculate yield per recruit and spawning biomass per recruit. It was assumed that the reduction of the European and NEI associated purse-seine average (1998-1999) fishing mortality rates in relation to the average fishing mortality rates during the pre-moratorium period (1993-1996) is fully due to the moratorium. Based on that six scenarios were considered.

Scenario	*European and NEI purse-seine fleet*	*Ghanaian purse-seine fleet*	*Baitboat and longline fleets*
Pre-moratorium	F of 93-96 applied	F of 93-96 applied	F of 93-96 applied
Moratorium	F of 98-99 applied	F of 98-99 applied	F of 98-99 applied
Moratorium compliance	F of 98-99 applied	EU-NEI PS reduction applied	F of 98-99 applied
Full compliance	F of 98-99 applied	EU-NEI PS reduction applied	F of 93-96 applied
No moratorium	F of 93-96 applied	F of 98-99 applied	F of 98-99 applied
2000	F of 2000 applied	F of 2000 applied	F of 2000 applied

For more details see the 2000 Moratorium Detailed Report in *Collective Volume, 52*.

Bigeye

Survival during the first three years would have increased if, during the moratorium years, all purse seine fleets had reduced effort by the same proportional reduction observed in the EU purse seine fleet. The situation in 2000 is probably still unchanged or slightly better as the combined fishing mortality on fishes less than 3 years old has been slightly reduced as compared to 1998-99 period.

Yield per recruit (**Figure MOR-9**) based on the selectivities in 2000 is close to the situation prevailing during the pre-moratorium period. If fishing mortality had decreased for all purse seine fleets rather than just for the European fleet, yield per recruit would have increased by nearly 4%; however the situation would have been worse (-4%) if no moratorium had been implemented.

The estimated equilibrium spawning biomass per recruit decreased during the moratorium years, but would have decreased further if the moratorium had not been implemented. After the 2000 moratorium, the spawning biomass per recruit has increased by 24% compared to a no moratorium situation, but remains 16% lower than if we could have a full management compliance (not considering the minimum size regulation).

Yellowfin

In order to better understand the results obtained for yellowfin, it should be kept in mind that the moratoria were not aimed at reducing fishing mortality of juvenile yellowfin, as recruitment of this species mainly occurs outside the period of the moratoria.

Survival to three years of age decreased during the moratorium years, and there was also a decline in yield and

spawning biomass. These facts do not appear to be directly related to the moratoria.

Summary of the results

The results of the analyses of the statistics show that the behavior of the fleets during the years in which the moratorium was established (1997-2000) has been different. Some fleets have maintained a continual decrease in nominal effort since the beginning of the 1990s, with larger decreases in the years in which the moratorium was implemented, while other fleets have drastically increased effort during the moratorium years. For bigeye tuna, after 4 years of implementation of the moratorium, the overall trend has resulted in fishing mortality by age comparable to the pre-moratorium situation, but higher for ages 1 and 4.

Despite the assumption of constant recruitment which affects the scale of fishing mortality estimates, there remains a strong suggestion from the above analyses and from the most recent assessments that substantial changes in fishing mortality for both yellowfin and bigeye have occurred for some fisheries during the period of the moratorium years. These changes may be the direct or indirect result of the moratoria, but also may be related to other factors (such as decreasing effort for some fleets). The Committee has been unable to identify all the sources of these changes.

Conclusions

For bigeye, the species which the moratorium was intended to benefit most, the effect of the overall increase in effort during 1997 to 1999 was larger than the effect of the moratorium and resulted in an increase in juvenile selectivity and a decrease in yield per recruit, and in spawning biomass per recruit. However the situation in 2000 seems to fall near the pre-moratorium level in terms of yield per recruit and indicates an increase of the spawning biomass per recruit. A consistent conclusion of the analyses is that the situation would have been worse had the moratoria not been implemented.

The moratorium was not designed to affect yellowfin either positively or negatively because yellowfin recruitment mainly occurs outside the period of the moratorium. However, during the moratorium years, fishing mortality on small yellowfin increased beyond what would have been expected by changes in fishing effort. It is possible, however, that this increase in fishing mortality resulting from an increase in catchers of ages 0 and 1, is not real and reflects increases in recruitment of yellowfin. Yield and spawning biomass per recruit indicators are worse during the recent moratorium years.

During the years of the moratoria, catches in weight of skipjack associated with floating objects made by the European fleet and the European components of the NEI fleets decreased by 48%. During those years the skipjack catches made by such fleets were mainly obtained from free schools. Such decrease in the catch of skipjack associated with floating objects may have lessened the possibility of local depletion that had been suggested in the last assessment.

MOR-Table 1.a. Annual catches (in MT) of the European (French and Spanish) and NEI purse seine fleet from 1993 to 2000 and changes in these catches prior to and during the moratorium years (Numbers in parentheses indicate the relative changes in catches compared to the 1993-1996 pre-moratorium situation).

Year*	***Yellowfin***		***Bigeye***		***Skipjack***		***Others***		***Total***	
1993	90356		31175		125404		2516		249451	
1994	88113		32450		105532		3143		229238	
1995	84579		25362		99050		2402		211393	
1996	82342		25207		83862		3255		194666	
1997	68371	*(-21%)*	16350	*(-43%)*	59695	*(-42%)*	2137	*(-24%)*	146553	*(-34%)*
1998	73347	*(-15%)*	12622	*(-56%)*	56438	*(-45%)*	2844	*(+1%)*	145251	*(-34%)*
1999	57657	*(-33%)*	14902	*(-48%)*	78326	*(-24%)*	2255	*(20%)*	153140	*(-31%)*
2000	62200	*(-28%)*	13475	*(-53%)*	63854	*(-38%)*	1596	*(44%)*	141125	*(-36%)*
Average										
1993-1996	86348		28549		103462		2829		221187	
1998-1999	65502	*(-24%)*	13762	*(-52%)*	67382	*(-35%)*	2550	*(-10%)*	149196	*(-33%)*
1998-2000	64401	*(-25%)*	13666	*(-52%)*	66206	*(-36%)*	2232	*(-21%)*	146505	*(-34%)*

MOR-Table 1b. Catches (in MT) made during the months of the moratorium (November, December and January) by the European (French and Spanish) and NEI purse seine fleet from 1993 to 2000 and changes in these catches prior to and during the moratorium years (Numbers in parentheses indicate the relative changes in catches compared to the 1993-1996 pre-moratorium situation).

Year*	***Yellowfin***		***Bigeye***		***Skipjack***		***Others***		***Total***	
1993	14265		9123		31976		357		55721	
1994	18868		9177		28203		1021		57269	
1995	20804		8703		33561		853		63920	
1996	18046		7908		31559		1412		58925	
1997	4440	*(-75%)*	2875	*(-67%)*	8509	*(-73%)*	246	*(-73%)*	16070	*(-72%)*
1998	8720	*(-51%)*	2163	*(-75%)*	9894	*(-68%)*	910	*(-0%)*	21687	*(-63%)*
1999	10378	*(-42%)*	2416	*(-72%)*	6260	*(-80%)*	426	*(-53%)*	19481	*(-67%)*
2000	11356	*(-37%)*	3739	*(-57%)*	13994	*(-55%)*	186	*(-79%)*	29276	*(-50%)*
Average										
1993-1996	17996		8728		31325		911		58959	
1998-1999	9549	*(-47%)*	2290	*(-74%)*	8077	*(-74%)*	668	*(-27%)*	20584	*(-65%)*
1998-2000	10151	*(-44%)*	2773	*(-68%)*	10049	*(-68%)*	507	*(-44%)*	23481	*(-60%)*

* For 1997, the moratorium concerns only November and December.

MOR-Table 2a. Annual catches (in MT) by the Ghanaian purse seine fleet from 1996 to 2000 and changes in these catches prior to and during the moratorium years (Numbers in parentheses indicate the relative changes in catches compared to the 1996 pre-moratorium situation).

*Year**	*Yellowfin*		*Bigeye*		*Skipjack*		*Total*	
1996	3295		135		5147		8577	
1997	7627	*(+131%)*	109	*(-19%)*	6922	*(+34%)*	14658	*(+71%)*
1998	7294	*(+121%)*	2130	*(+1478%)*	12538	*(+143%)*	21962	*(+156%)*
1999	12285	*(+273%)*	2411	*(+1686%)*	21525	*(+318%)*	36221	*(+322%)*
2000	7331	*(+122%)*	1230	*(+811%)*	11878	*(+131%)*	20439	*(+138%)*
Average								
1998-1999	9789	*(+197%)*	2270	*(+1581%)*	17031	*(+231%)*	29091	*(+239%)*
1998-2000	8970	*(+172%)*	1924	*(+1324%)*	15313	*(+197%)*	26207	*(+205%)*

MOR-Table 2b. Catches (in MT) made during the months of the moratorium (November, December and January) by the Ghanaian purse seine fleet from 1996 to 2000 and changes of these catches prior and during the moratorium years (Numbers in parentheses indicate the relative changes in catches compared to the 1996 pre-moratorium situation).

*Year**	*Yellowfin*		*Bigeye*		*Skipjack*		*Total*	
1996	814		60		1264		2138	
1997	2167		41		1141		3349	
1998	2068		538		3320		5926	
1999	4056		623		4915		9594	
2000	994		592		1601		3187	
Average								
1998-1999	3062	*(+276%)*	580	*(+867%)*	4117	*(+225%)*	7760	*(+263%)*
1998-2000	2373	*(+191%)*	584	*(+874%)*	3279	*(+159%)*	6236	*(+192%)*

* The fishery started in 1996.
For 1997, the moratorium concerns only November and December.

MOR-Table 3a. Annual catches by baitboat fleets from 1993 to 2000 and changes in these catches prior to and during the moratorium years (Numbers in parentheses indicate the relative changes in catches compared to the 1993-1996 pre-moratorium situation).

*Year**	*BB Ghana*		*BB Dakar*		*BB Europe*	
1993	38856		8945		19118	
1994	36973		10296		25697	
1995	33905		8937		27551	
1996	33266		8511		25974	
1997	38338	*(+7%)*	10942	*(+19%)*	21600	*(-12%)*
1998	43497	*(+22%)*	14747	*(+61%)*	20115	*(-18%)*
1999	47196	*(+32%)*	17078	*(+86%)*	15608	*(-36%)*
2000	32109	*(-10%)*	16549	*(+80%)*	6489	*(-74%)*
Average						
1993-1996	35750		9172		24585	
1998-1999	45346	*(+27%)*	15912	*(+73%)*	17861	*(-27%)*
1998-2000	40934	*(+11%)*	16124	*(+76%)*	14071	*(-43%)*

MOR-Table 3b. Catches made during the months of the moratorium (November, December and January) by the baitboat fleets from 1993 to 2000 and changes of these catches prior and during the moratorium years (Numbers in parentheses indicate the relative changes in catches compared to the 1993-1996 pre-moratorium situation).

*Year**	*BB Ghana*		*BB Dakar*	*BB Europe*	
1993	5339			6165	
1994	5717			6296	
1995	8251			5538	
1996	11834		data	3333	
1997	9558	*(+23%)*	not available	4068	*(-24%)*
1998	10176	*(+31%)*	by month	3964	*(-26%)*
1999	12917	*(+66%)*		3053	*(-43%)*
2000	4694	*(-40%)*		510	*(-90%)*
Average					
1993-1996	7785			5333	
1998-1999	11546	*(+48%)*		3508	*(-34%)*
1998-2000	9336	*(+20%)*		2509	*(-53%)*

* For 1997, the moratorium concerns only November and December.

MOR-Table 4. Annual Atlantic total catches by the longline fleet from 1993 to 2000 and changes in these catches prior to and during the moratorium years (Numbers in parentheses indicate the relative changes in catches compared to the 1993-1996 pre-moratorium situation).

Year*	***Yellowfin***		***Bigeye***		***Total***	
1993	14032		62871		76903	
1994	17877		78270		96147	
1995	16759		74804		91563	
1996	17198		74876		92074	
1997	14688	*(-11%)*	68227	*(-6%)*	82915	*(-7%)*
1998	16752	*(+2%)*	71811	*(-1%)*	88572	*(-1%)*
1999	18686	*(+20%)*	78886	*(+8%)*	97572	*(+9%)*
2000	18559	*(+13%)*	70049	*(-4%)*	88608	*(-1%)*
Average						
1993-1996	16266		72705		89172	
1998-1999	18219	*(+10%)*	75348	*(+4%)*	93067	*(+4 %)*
1998-2000	18332	*(+11%)*	73582	*(+1%)*	91581	*(+3 %)*

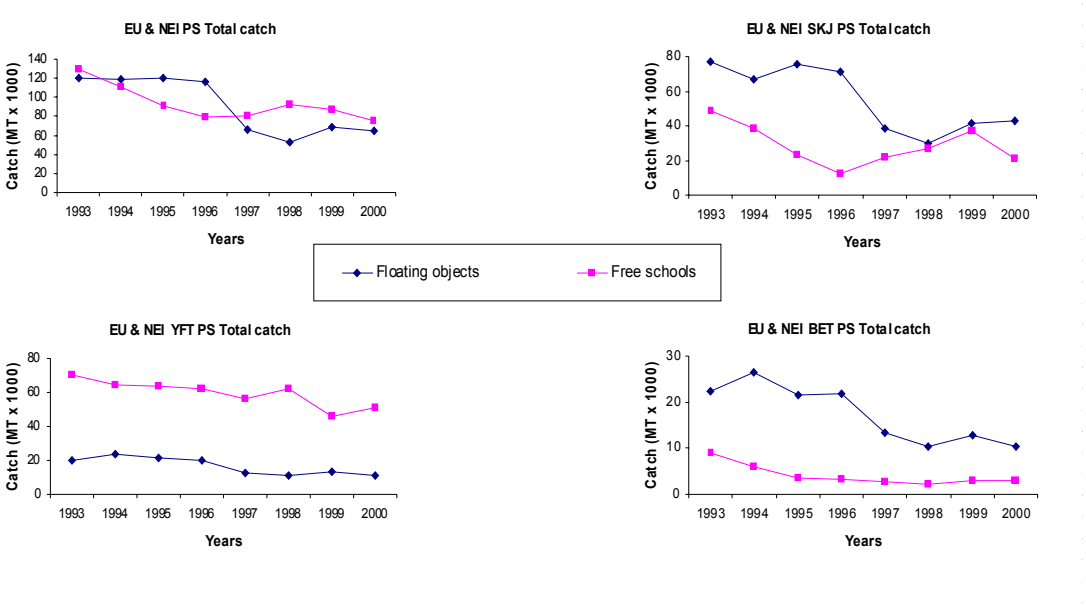


Figure 1.a-d. Evolution of the catch on floating objects and on free schools of the EU and NEI purse-seine fleet from 1993 to 2000.

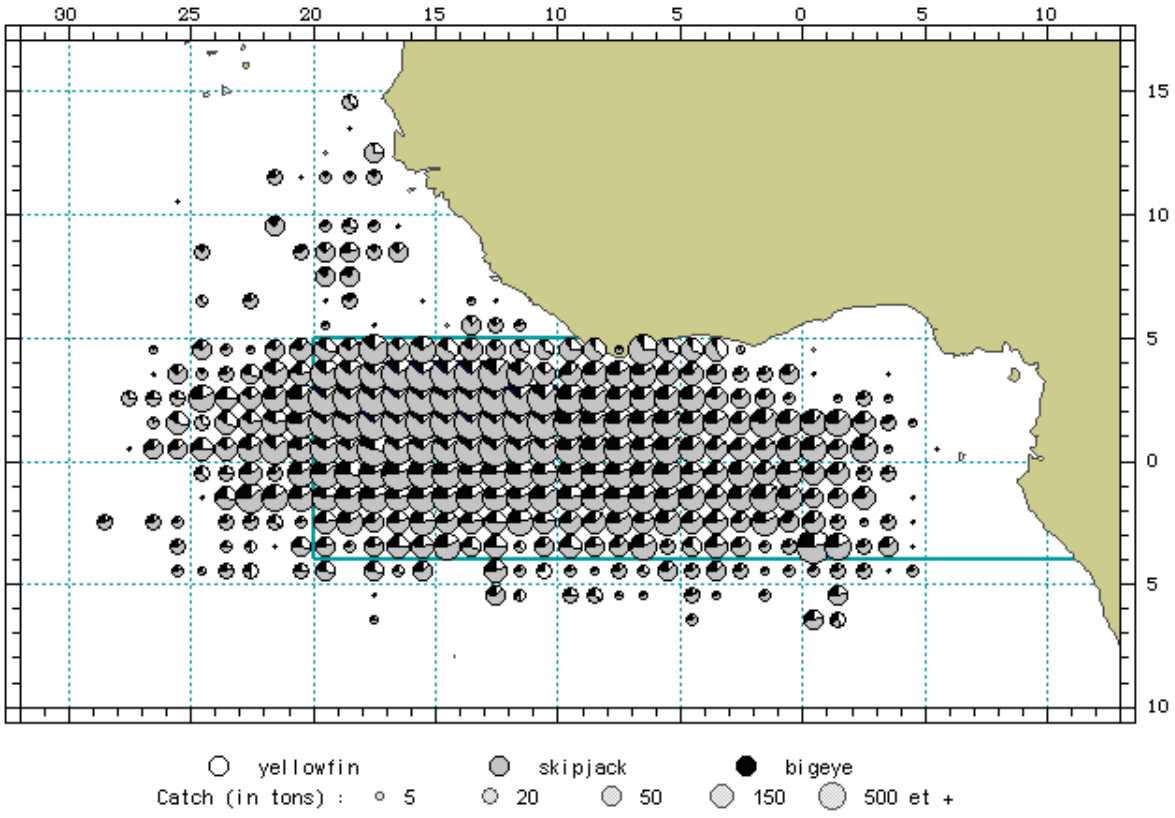


Figure 2.a. Average distribution of tuna catch on floating objects by EU and NEI purse seiners during the moratorium months from 1993 to January 1997.

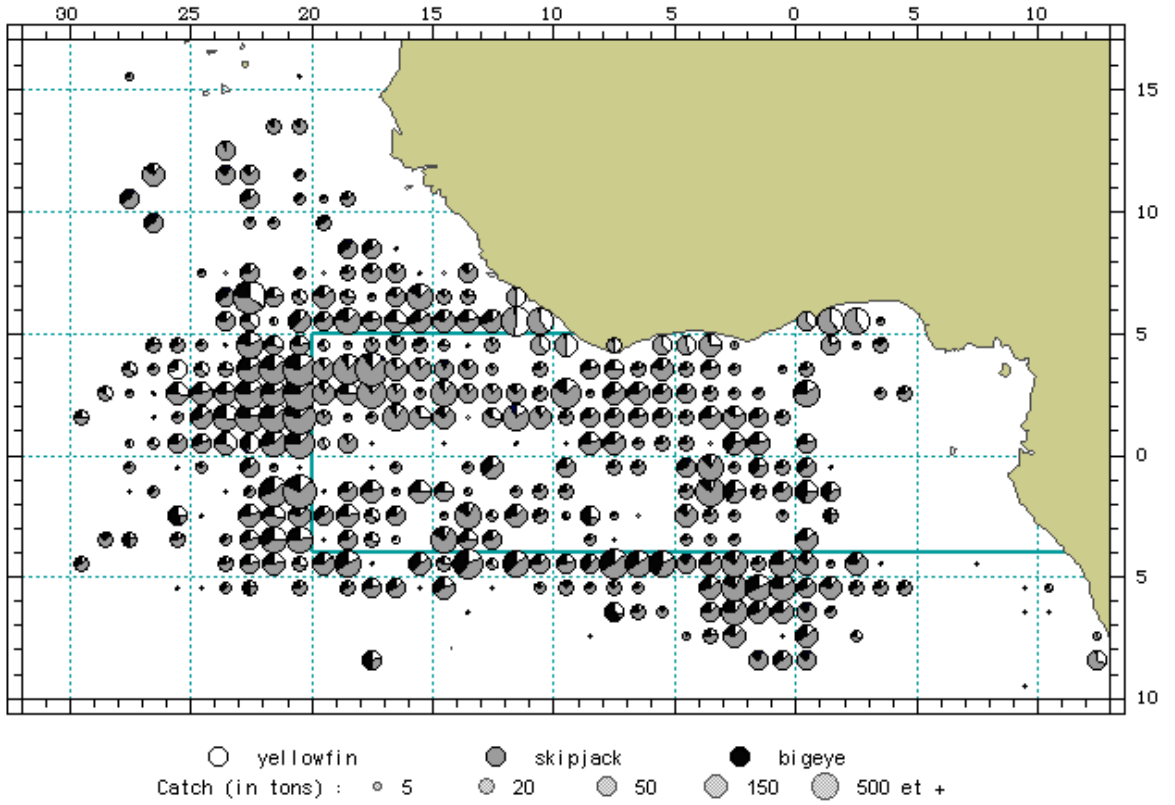


Figure 2.b. Average distribution of tuna catches on floating objects by EU and NEI purse seiners during the moratorium months from February 1997 to 2000.

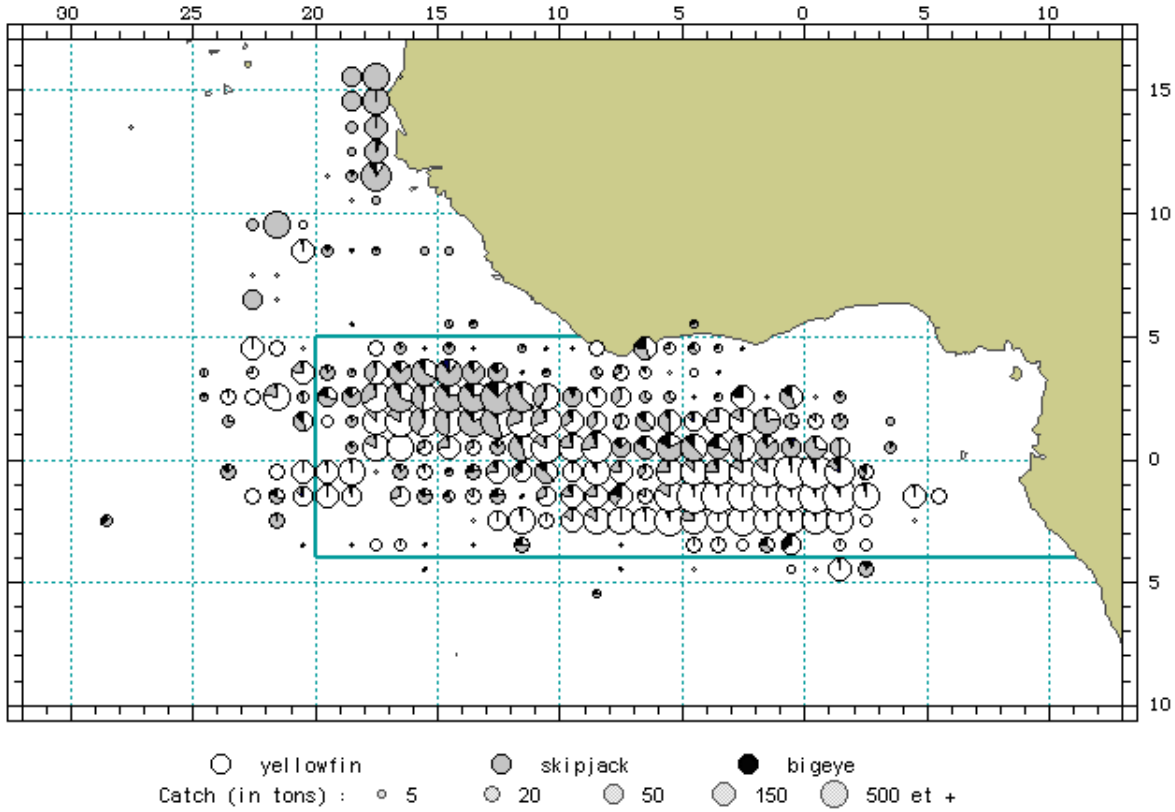


Figure 2.c. Average distribution of tuna catch on free school by EU and NEI purse seiners during the moratorium months from 1993 to January 1997.

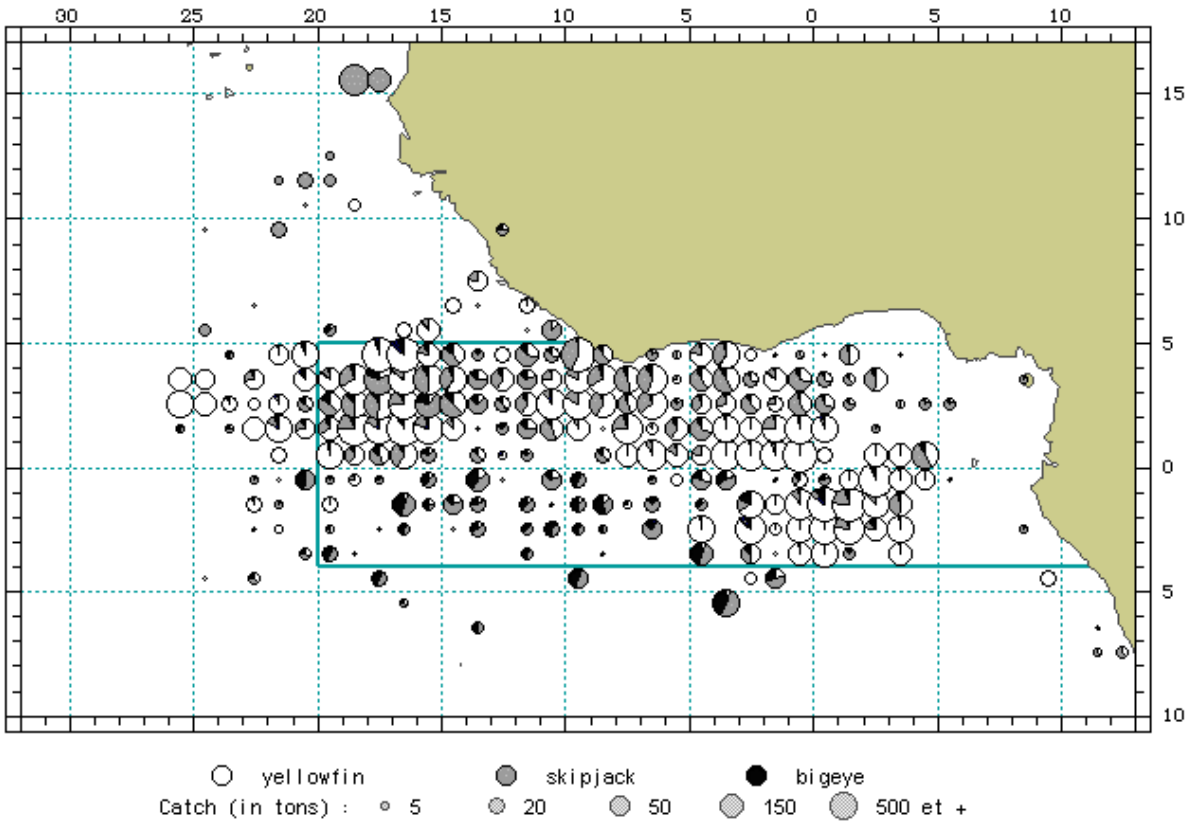


Figure 2.d. Average distribution of tuna catch on free school by EU and NEI purse seiners during the moratorium months from February 1997 to 2000.

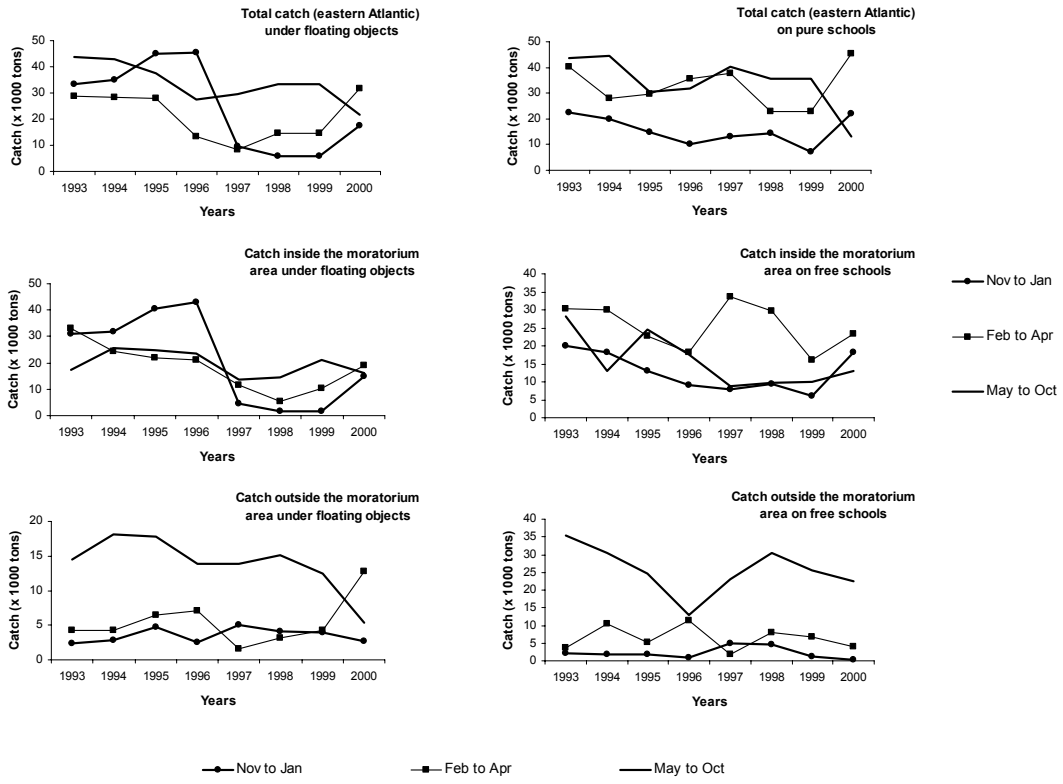


Figure 3.a-f. Monthly evolution of the catch on floating objects and on free schools by the EU and NEI purse-seine fleet from 1993 to 2000.

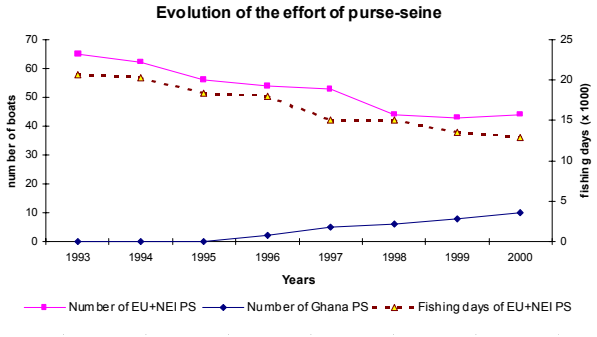


Figure 4. Evolution of the nominal effort of purse-seine fleet of EU (including NEI managed by EU tuna boat owners) and Ghana (for number of boats only) from 1993 to 2000.

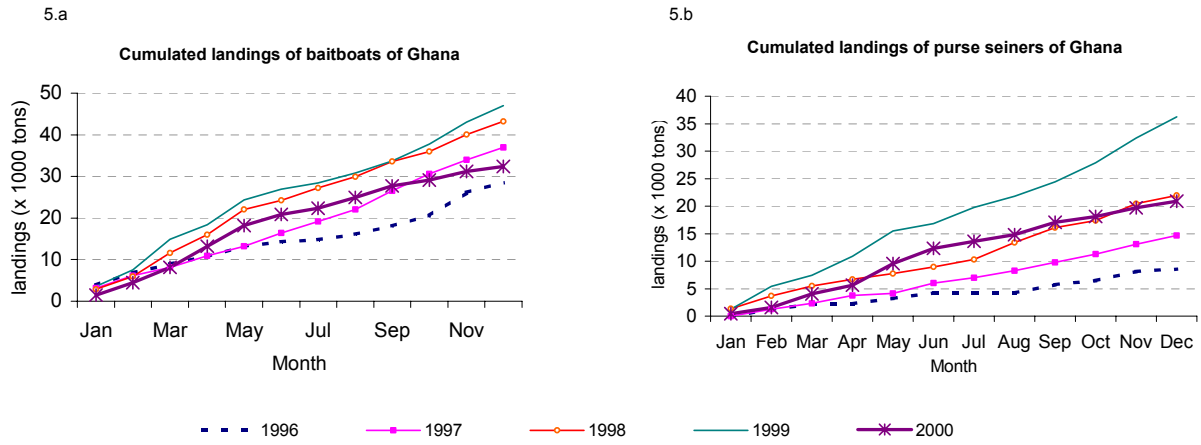
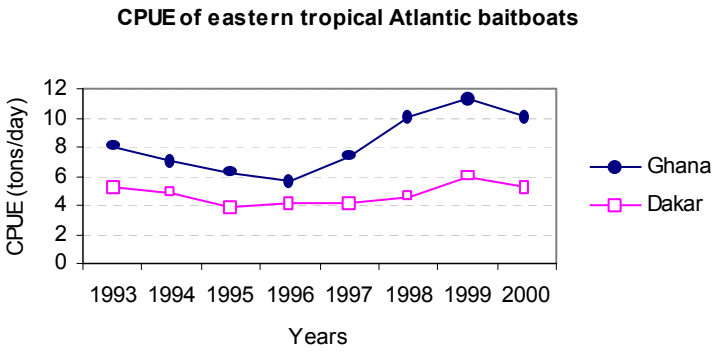


Figure 5a-b. Evolution of the cumulated landings of Ghanaian baitboats and purse seiners from 1996 to 2000.

Figure 6. Evolution of the catch per unit of effort of the eastern tropical Atlantic baitboats from 1993 to 2000.



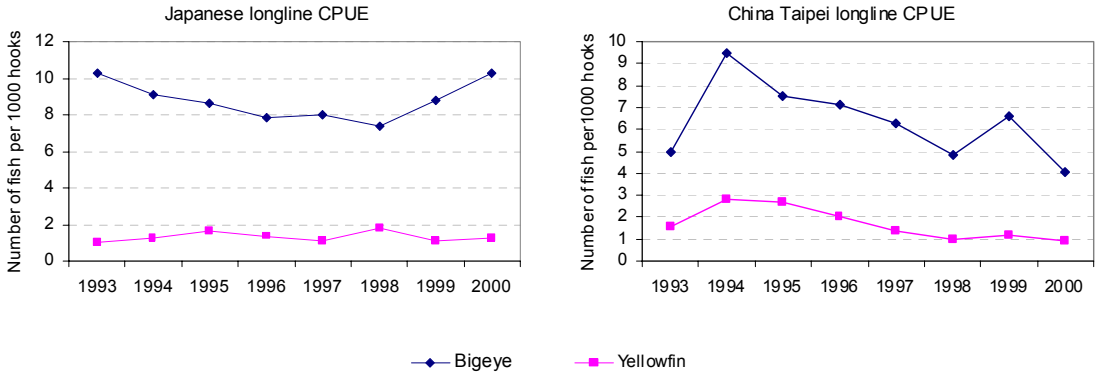


Figure 7. Evolution of the longline catch per unit of effort from 1993 to 2000.

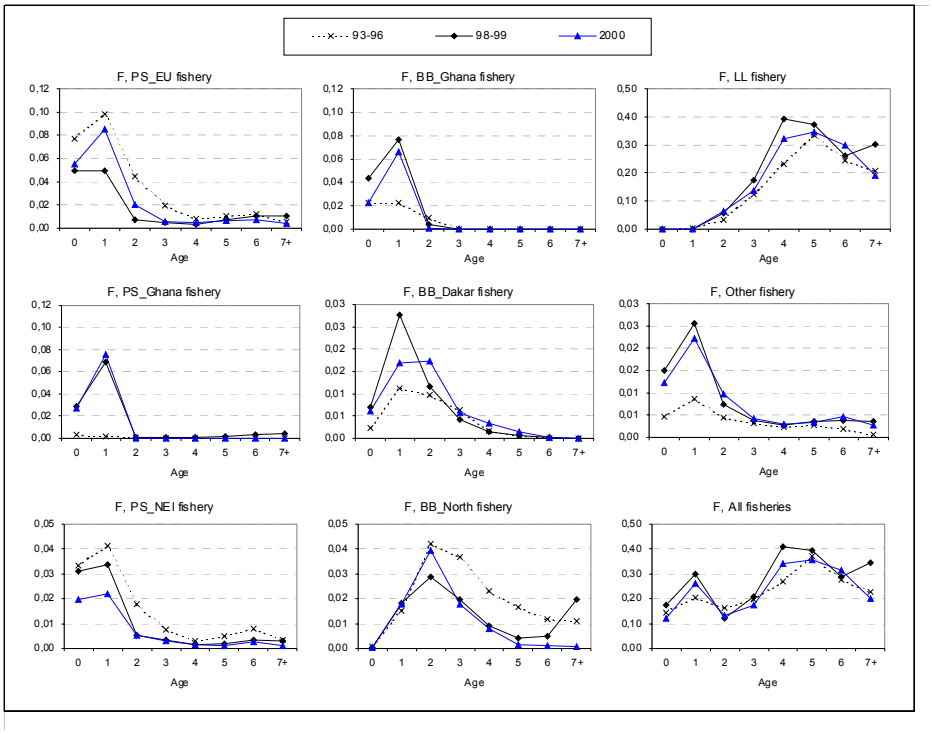


Figure 8.a. Bigeye fishing mortality rates by fleet prior to and during the moratorium years, obtained from forward VPA.

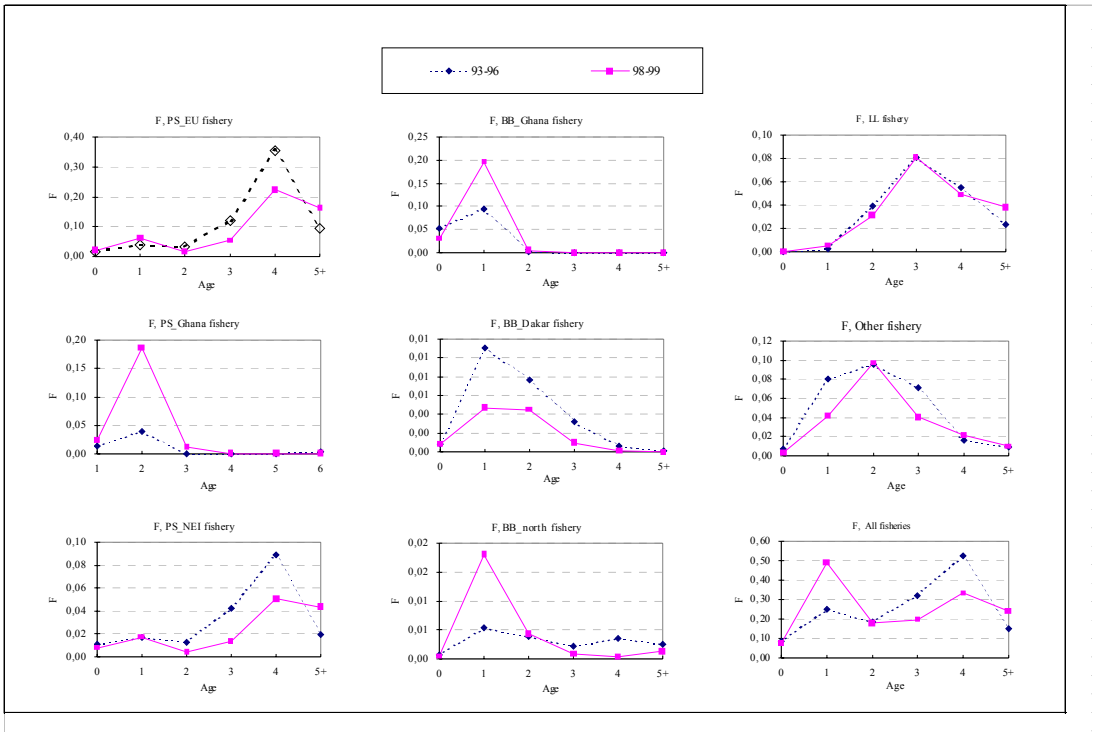
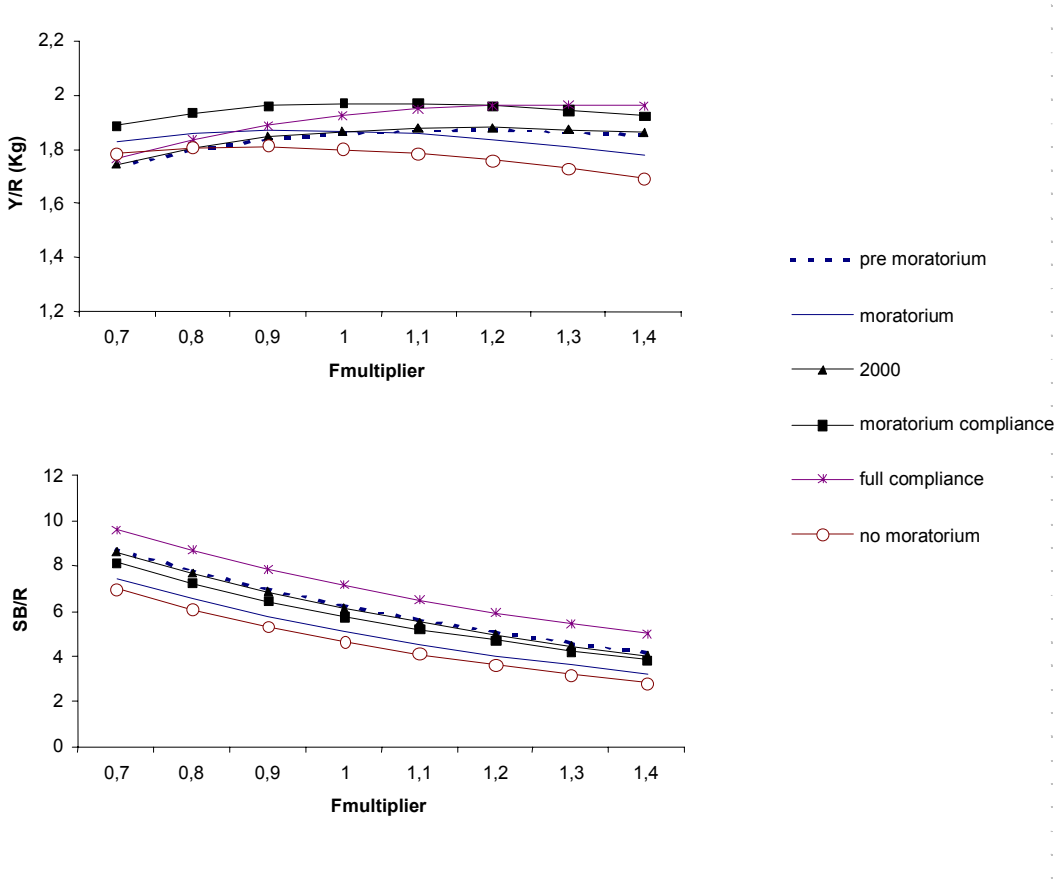


Figure 8.b. Yellowfin fishing mortality rates by fleet prior to and during the moratorium years, obtained from forward VPA (reproduced from SCRS/01/067).



Note: pre moratorium: F for all fleets = average F for 1993-1996
moratorium = F for all fleets = average F 1998-1999
moratorium compliance: assuming a reduction in F for all purse-seine fleets in 1998-1999 equal to that of EU purse seiners
full compliance: moratorium compliance + F for all other fleets maintained at the 1996 level
no moratorium: EU purse-seine F maintained in 1998-1999 at the average F of 1993-1996

Figure 9. Results of the yield per recruit analysis conducted on bigeye tuna

16. General recommendations to the Commission

16.1 Tropical tunas

The Committee recommends that the next assessment of the Tropical Tunas Working group be dedicated to bigeye, as was suggested last year. This assessment should use in parallel traditional – such as production (including ASPM) and VPA analysis – and new models, such as the specific "statistically integrated" model presently developed within the frame of the BETYP programme. Its general frame and components have already been defined, and it is expected that a provisional version will be operational for this assessment.

The Committee considers that the development of an ICCAT Atlas, covering all species and fisheries as well as the main environmental characteristics of the Atlantic Ocean, will be of great interest and utility. A study group should be formed to investigate the format, costs, and data requirements for an atlas of this nature. This study group shall report its findings to the 2002 SCRS.

16.2 Albacore

Given the current status of albacore stocks in the Atlantic, the reported landings for 2000, the results of the assessment carried out in 2000 and reviewed by the species group in 2001, and the already considerable workload for 2002, the Committee recommends that the next assessment stocks take place in 2003.

As there is a general lack of information and data from the Mediterranean albacore fisheries, especially for the recent years, it is recommended that future GFCM-ICCAT joint meetings consider the compilation of albacore fishery statistics in the Mediterranean Sea.

It was noted that some of the main north and south albacore fisheries are still not reporting Task II effort data. Therefore, it is strongly recommended that these data be collected and reported to the ICCAT Secretariat.

16.3 Bluefin tuna

The SCRS again stresses the importance of better understanding of the uncertainties associated with the bluefin tuna stock assessments in order to improve the quality of advice to the Commission in the future. The Committee continues to recommend that the Commission ensure that the ICCAT Secretariat be provided with reliable data on catch, effort, size in the format requested , and on as fine a scale as possible. These obligations are considered a minimum standard as they are clearly stated in the ICCAT Convention, FAO's Code of Conduct for Responsible Fisheries, as well as the UN Implementation Agreement.

In response to similar previous recommendations of the Committee, contracting parties, entities and fishing entities have made progress in initiating improvement. Noteworthy has been the implementation of logbooks by the EC in 2001, reestablishing a limited observer program in 2000 by Japan, new development of standardized trap indices in Spain and Tunisia, standardized baitboat indices in the Bay of Biscay, aerial surveys to use as abundance indices in the Mediterranean, a larval survey in the Mediterranean, a survey in the Central Atlantic and various archival and popup tagging activities to address biological distributions and management boundaries. Additionally, a workshop on Bluefin Mixing developed a plan for long term research and presented several short term management options. Thus, scientific progress is being made.

However, the effects of these clear improvements risk being offset by the considerable uncertainty about the catches. After the last stock assessment of the east Atlantic and Mediterranean stock in 1998, the uncertainty associated with the catches has become greater due to 1) a probable increase in the level of unreported catches following the impostion of quotas, and 2) the development of bluefin tuna farming. The SCRS continues to be especially concerned with the lack of ability to accurately track catches, catch at size, origin of catches and fishing effort expended on fish that are farmed in cages. Several suggestions for improvement were made (see **Section 15** - Responses to Commission). The SCRS is planning to conduct a bluefin tuna assessment (for east and west) in 2002. However, because of the data uncertainties mentioned above, both the detail of analysis that can be conducted for the eastern Atlantic and Mediterranean, and the level of management advice will be limited.

In addition to the need for improvement in basic catch statistics, the SCRS continues to endorse the research directed at spawning site fidelity, migration paths and mixing. There is also a need to study the best proxy for MSY (in the absence of a direct estimate), and to increase the accuracy in the estimation of recruitment levels. Apart from

uncertainties in basic inputs, these issues are among the most important of the uncertainties in the assessment and management of Atlantic bluefin tuna.

The Committee has identified the need for rigorous scientific monitoring in the Central North Atlantic. This monitoring should be in the form of observer coverage (e.g. 10% as recommended by the Commission for 2002 for the Japanese longline fishery; [Rec. 00-3]) and detailed biological sampling for research into topics such as genetics, microconstituents, reproduction and age composition.

16.4 Swordfish – Atlantic

It is recommended that the next Atlantic swordfish stock assessments be conducted in September 2002 (8-day meeting at least 3 weeks prior to the SCRS). All National Scientists are encouraged to provide catch, size and CPUE data up to and including 2001 where available. The Group recognizes that this may not be possible for all fleets. Assessment software should be adapted to accommodate the possibility of incomplete data for 2001.

The priority for the north stock is to monitor the 10-year Rebuilding Program that commenced in 2000. The lumped biomass production model analyses will be updated using data to the end of 2000, or 2001 where available, and include projections to 2009. Age-specific analyses will be conducted, data and schedule permitting.

The priority for the south stock is to update the 1999 lumped biomass production model analyses using data to the end of 2000, or 2001 where available, and include short-term projections.

16.5 Swordfish – Mediterranean

It is recommended that the next Mediterranean stock assessment session be held not before 2003. The Committee recommends that countries that have not yet provided the mandatory data to ICCAT (Task I and II catch, effort and size) or have only provided official data, should try to provide the scientists' best estimates as early as possible, and not later than the 2002 Species Group meetings. The size frequency data should be provided by small strata (gear-time-area) breakdown.

16.6 Billfish

The Committee recommends that an inter-sessional meeting be held in early 2002 to develop a plan for addressing the substantive issues relating to the next stock assessment for blue and white marlin.

The Committee recommends that the next blue and white marlin assessment not be held until 2003 or later, to adequately take into account the substantive issues relating to the assessments.

The Committee recommends that the Commission continue to support substantive research investment into historical data validation efforts and into biological investigation of the habitat requirements of billfish, behaviour of longline gear and interaction of marlin and longline gear, including a better estimation of dead discards, in order to address major sources of uncertainty in stock assessments of these species stocks.

16.7 Sub Committee on Statistics

The Committee recommends that the Local Area Network of the Secretariat be replaced by an independent network.

The Committee recommends that paper copies of the ICCAT Collective Volume of Scientific Papers be made available to libraries who had traditionally kept this series, and to a few key people in each Contracting Party.

The Committee reiterates its recommendation that countries which import bluefin tuna provide the ICCAT Secretariat with copies of the individual statistical documents in a standard electronic format, in order to easily assimilate the data and to help determine the origin of the fish.

The Committee recommends that, given the impact which the various types of data to be collected in accordance with Commission Recommendations - e.g. compliance tables, vessels lists, import/export data- has on the workload of the Secretariat's statistical staff as regards the building and maintenance of databases, the Commission consider increasing the resources of the Secretariat to carry out this work.

16.8 Sub-Committee on By-catches

The Committee recommended that the SCRS schedule a future assessment session for the Atlantic pelagic sharks focusing on blue and shortfin mako sharks, to be held not earlier than 2004.

For assessment purposes, the Committee encourages member nations, entities and fishing entities catching sharks in the Atlantic and Mediterranean, or having caught sharks in the past in these waters, to submit species-specific shark catch statistics including estimation of shark catch, dead discards and size data. Emphasis should be on porbeagle, blue and shortfin mako sharks.

The Committee recommends further collaboration with other international organizations, especially FAO, ICES and GFCM, for the assessment of the Atlantic and Mediterranean stocks of the species mentioned above.

The Committee encourages wider participation in the study of sharks caught in tuna fisheries from member nations, entities and fishery entities and experts in general. For this purpose, financial aid for travel may be required from the Commission or from member nations.

16.9 Sub-Committee on Environment

The Committee recommends that the Sub-Committee on Environment hold an inter-sessional workshop in 2003 (or in 2004 at the latest) to examine issues related to the scarcity of temperate and tropical tunas around the Azores, Madeira and the Canary Islands, for the purpose of testing whether this phenomenon is linked to environmental changes.

The Committee recommended that the ICCAT Secretariat, in the future, be host to (although not develop) an environmental data base which would be available to all ICCAT scientists. If this is accepted, the Sub-Committee on Environment will specify, at the next plenary session, the type of information which it would be desirable to include in such a base, as well the sites on which this data would be made available.

16.10 Ad Hoc Working Group on Assessment Methods

The Committee recommends that the Working Group meet again in 2003 or 2004 to continue the development and implementation of more complex assessment.

The Committee recommends that efforts to catalog the assessment software currently used by ICCAT continue.

16.11 Ad Hoc Working Group on Precautionary Approaches

The Committee recommends that the development of simulation tools for the evaluation of management strategies be pursued.

16.12 Working Group on SCRS Organization

The Committee recommends that an additional professional staff member be hired as scientific editor at the Secretariat, as well as an additional member of the general service staff, to meet the demands of the increased workload of the Secretariat.

The Committee recommends that a peer review program be initiated as an additional quality assurance step for stock assessments.

16.13 Bigeye Year Program (BETYP)

The Committee recommended that the Bigeye Year Program be continued and that the budget proposed for 2002 be approved.

16.14 Bluefin Year Program (BYP)

The Committee endorsed the concept of the proposed exploratory research sampling of larvae and spawning-sized bluefin tuna and the associated oceanographic conditions in the central Atlantic as outlined in SCRS/00/125 and notes the progress reported in SCRS/01/031-Rev. The Committee recognizes that this research is very expensive and is beyond the current capability of the Bluefin Program, but recommends that $10,000 be contributed to support planning, coordination, and implementation. It is recommended that a further $15,000 be allocated for the larval sorting expenses associated with the larval surveys as these are not done in-house by national scientists. These actual costs are expected to be considerably higher.

The Committee endorsed the proposed research sampling of larvae and spawning-sized bluefin tuna and the associated oceanographic conditions in and around the Balearic Islands as outlined in SCRS/01/082 and notes the progress reported in SCRS/01/129. The Committee recognizes that this research is very expensive and is beyond the current capability of the BYP, but recommends that $5,000 be contributed to support planning, coordination, and further implementation of this research.

The Committee endorsed the proposed research activities on tuna farming in the Adriatic Sea submitted by Croatian scientists at the 2001 SCRS meeting (see proposal in 2002 BYP detailed report). The Committee recognizes that full conduct of this research as proposed would require more resources than the current BYP could contribute and that the results will be useful for addressing the growth of fish farmed in the Adriatic, but probably not generalizable to other farming areas. The Committee recommends that $10,000 be contributed in partial support to initiate this research in year 2002 (the research could take two or more years to complete) and that fish purchased for this research also be used to obtain the appropriate biological specimens identified in the BYP research plan for stock structure and maturity sampling.

The Committee endorsed the proposed research for electronic tagging in the eastern Atlantic and Mediterranean submitted by EC scientists at the 2001 SCRS meeting (see 2002 BYP detailed report). The Committee noted that it has previously recommended research into bluefin stock structure making use of high-technology electronic tags. The recent report on bluefin tuna mixing recommended increasing effort on electronic tagging, especially in the Mediterranean, and encouraged cooperation between scientists/organizations of coastal countries through the current organizational structures (*e.g.* COPEMED, EU, or others), with the technical collaboration by scientists from the west involved in these research applications. The Committee recognizes that this research, like other research activities noted above, is very expensive and is beyond the current capability of the BYP, but recommends that $10,000 be contributed to support planning, coordination, and implementation.

The Committee endorsed the proposed research for genetic analysis of available samples proposed by EC scientists at the 2001 SCRS meeting (see 2002 BYP detailed report). The Committee recommends that $10,000 be contributed to accomplish the proposed research.

17. Future SCRS Activities

17.1 Inter-sessional meetings proposed for 2002

The Committee proposed that the following meetings be held in 2002:

Meeting to review Ghanaian statistics and to develop a sampling system: February.
Billfish planning meeting: March (assuming that the Commission can wait to hold the assessment in 2003).
GFCM-ICCAT data-preparatory meeting: April.
Bluefin tuna (east and west) assessments: July.
Swordfish (north and south) assessments: September.
Bigeye tuna assessment: Early October.
Sub-Committee on Statistics: mid-October.

17.2 Date and place of the next meeting of SCRS

The Committee decided that the SCRS would meet again in Madrid in late October (e.g., 21-25 October), 2002.

18. Other matters

18. 1 Document SCRS/01/091 provides analyses of catches in the Adriatic Sea which suggest that the current

closed season for the bluefin tuna purse seine fishery in the area [Rec. 98-6] may be ineffective in its aim to protect juveniles. The Committee was unprepared to fully discuss the document because it had been presented after the end of the Species Group meetings, which is the venue where such detailed discussions should take place. However, the Committee agreed that it was important to conduct an evaluation of the scientific merits of [Rec. 98-6] and suggested that this and other relevant information be presented (and updated if necessary) again at the next meeting of the bluefin tuna species group so that the next SCRS can make specific recommendations to the Commission on this matter.

18.2 No other matters were discussed.

19. Election of SCRS Chairman

19.1 The Chairman asked if there were any nominations for the new SCRS Chairman. The European Community nominated Dr. Joao Gil Pereira (EC-Portugal); the nomination was seconded by Côte d'Ivoire. There were no other nominations.

19.2 Dr. Pereira was selected unanimously as the next SCRS Chairman.

19.3 Dr. Powers congratulated Dr. Pereira on behalf of the Committee and expressed his confidence that Dr. Pereira's deep knowledge of tuna biology and tuna fisheries, as well as his vast experience with the ICCAT process would allow him to excel as Chairman.

19.4 Dr. Pereira, the newly-elected Chairman, thanked the Committee for the confidence placed in him.

20. Adoption of the Report and closure

20.1 The Report was adopted by the Committee.

20.2 The delegate from the European Community expressed his appreciation to Dr. Powers for his very good work and leadership as SCRS Chairman over the past four years. The delegate highlighted Dr. Powers' even-handedness, his ability to seek consensus amongst differing points of view, and his proactive approach to help modernize the scientific process at ICCAT. The Committee joined in thanking Dr. Powers.

20.3 Dr. Powers expressed his deep appreciation to his friends and colleagues in the Committee for the support that they provided him. He noted that the Chairmanship of the SCRS was one of the most rewarding experiences of his professional career.

20.4 Dr. Powers thanked the Secretariat for its work in organizing the meeting.

20.5 The SCRS meeting was adjourned.

Appendix 1

SCRS 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 Review of national fisheries and research programs
7 Executive Summaries on species:
YFT-Yellowfin, BET-Bigeye, SKJ-Skipjack, ALB-Albacore, BFT-Bluefin, BIL-Billfishes, SWO-Swordfish, SBF-Southern Bluefin, SMT-Small Tunas
8 *Ad hoc* Working Groups
- Assessment Methods
- Precautionary Approach
- SCRS Organization

9 Special Research Programs
- Bigeye Tuna Year Program (BETYP)
- Bluefin Year Program (BYP)
- Enhanced Research Program for Billfish

10 Sub-Committee on Environment
11 Sub-Committee on By-catches
12 Sub-Committee on Statistics
13 Scientific meetings where ICCAT was represented
14 Collaboration with non-contracting Parties, entities or fishing entities and other fisheries organizations
15 Responses to the Commission
- Atlantic bluefin tuna mixing
- Bluefin tuna conversion factors
- Effects of tuna farming on bluefin tuna statistics
- Protection of juvenile swordfish in the Mediterranean
- Report on Japanese swordfish research plan
- Report of the 2001 Japanese swordfish catch, including discards
- Rebuilding plan for blue marlin and white marlin populations
- Update of the impact of the moratorium on tropical tuna stocks

16 General recommendations to the Commission
17 Future SCRS activities
Inter-sessional meetings proposed for 2002
Date and place of the next meeting of the SCRS
18 Other matters
19 Election of SCRS Chairman
20 Adoption of report and closure

Appendix 2

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Appendix 3

LIST OF SCRS DOCUMENTS

SCRS/01/006	ICCAT Workshop on Environment and Tuna Recruitment *(Madrid, Spain, May 7-12, 2001)*
SCRS/01/007	Meeting of the *Ad Hoc* Committee for Advice on the Implementation of the ICCAT Relational Database Management System (ICCAT-RDB) *(Madrid, Spain, May 13-14, 2001)*
SCRS/01/008	Report on the ICCAT Working Group on Assessment Methods *(Madrid, Spain, June 11-15, 2001)*
SCRS/01/009	Secretariat's Report on Statistics and Research: 2000-2001
SCRS/01/010	Compendium of Management Recommendations and Related Resolutions Adopted by ICCAT for the Conservation of Atlantic Tunas and Tuna-like Species - ICCAT Secretariat
SCRS/01/010bis	Historical Table - ICCAT Secretariat
SCRS/01/012	Report on the BETYP Activities from October 2000 up to September 2001
SCRS/01/014	Meetings at which ICCAT was represented between November 2000 and October 2001 - ICCAT Secretariat
SCRS/01/016	Progress Report on the Development of the ICCAT Relational Database System (ICCAT-RDB) - C. Palma
SCRS/01/017	Report on visit to Trinidad and Tobago *(April 16-25, 2001)* - P. Kebe.
SCRS/01/020	ICCAT Workshop on Bluefin Mixing *(Madrid, Spain, September 3-7 2001)*
SCRS/01/021	ICCAT Data Preparatory Meeting for Atlantic Shark Stock Assessment *(Halifax, NS, Canada, September 11-14, 2001)*
SCRS/01/022	Report of the BYP Coordination Meeting for Sampling Survey Research in the Central Atlantic and near the Balearic Islands *(Miami, Florida, USA, April 25-26, 2001)*
SCRS/01/023	Results of the ICCAT Survey on Statistic Collection Systems
SCRS/01/026	Compliance with Data Submission Deadlines
SCRS/01/031	Progress Report from the Steering Committee for Central North Atlantic Bluefin Tuna Research (September 2001) - M . Lutcavage, B. Luckhurst, J. Porter, J. Lamkin, Z. Suzuki, B. Richards, S. Heppel, R. Brill
SCRS/01/032	Correlation between the North Atlantic Oscillation Index and stock-recruitment trends of West Atlantic bluefin tuna *(Thunnus thynnus)* - G.P. Scott, C.A. Brown, C.E. Porch, S.C. Turner
SCRS/01/033	Does the North Atlantic Oscillation control some processes influencing recruitment of temperate tunas? - A. Borja, J. Santiago
SCRS/01/034	Can stochastic variations in recruitment induce long-term fluctuations in the carrying capacity? - J.M. Fromentin
SCRS/01/035	Comparison of recruitment variability of Pacific bluefin tuna with global atmospheric-oceanic conditions associated with the El-Niño-Southern Oscillation (ENSO) phenomenon - K. Uehara, H. Yamada, K. Uosaki, D. Inagake
SCRS/01/036	Is the recruitment a key biological process in the Hypothetical NAO-Atlantic tunas relationships? - J.M. Fromentin.
SCRS/01/037	Preliminary results of exploring a relationship between albacore recruitment and atmospheric-oceanographic environment in the North Pacific Ocean - K. Uosaki, K. Uehara
SCRS/01/038	Some remarks on the NAO index related oceanographic factors, and its possible fit to the recruitment index of the North Atlantic swordfish *(Xiphias gladius)* - J. Mejuto.

SCRS/01/039 Time trends in abundance and catchability of yellowfin tuna and their relationship to the North Atlantic Oscillation Index - D. Die, L. Kell, P. Pallares

SCRS/01/040 Current status of ICCAT relational database management system (ICCAT-RDB) - C. Palma.

SCRS/01/041 ICCAT-RDB management system: T1 database (Task 1) status - C. Palma.

SCRS/01/042 Descriptive analysis of the ICCAT bluefin tuna tagging database - J.M. Fromentin.

SCRS/01/043 Bayesian generalized linear models for standardizing catch rate indices of abundance - E.A. Babcock, M. McAllister

SCRS/01/044 The effect of time-correlated uncertainty on the management of yellowfin tuna stocks - D. Die, P. Pallares, L. Kell

SCRS/01/045 An overview of shark data collection by ICCAT - P. Kebe, V. Restrepo, C. Palma

SCRS/01/046 FASST: A fully age-sized and space-time structured statistical model for the assessment of tuna populations - O. Maury, R. Restrepo

SCRS/01/047 Observed shark by-catch from the Venezuelan tuna and swordfish longline fishery from 1994 through 2000 - F. Arocha, O. Arocha, L.A. Marcano

SCRS/01/048 Size-weight relationship of the swordfish *(Xiphias gladius)* and several pelagic shark species caught in the Spanish surface longline fishery in the Atlantic, Indian and Pacific Oceans - B. García-Cortés, J. Mejuto

SCRS/01/049 Preliminary scientific estimations of by-catches landed by the Spanish surface longline fleet in 1999 in the Atlantic Ocean and Mediterranean Sea - J. Mejuto, B. García-Cortés, J.M. de la Serna

SCRS/01/050 On the reduction of juvenile swordfish catches in the Mediterranean / Sur la réduction des prises d'espadon juvénile dans la Méditerranée / Sobre la reducción de capturas de pez espada juvenil en el Mediterráneo - A. di Natale, J.M. de la Serna, G. de Metrio, V. Restrepo, A. Srour, G. Tserpes

SCRS/01/051 ADAPT VPA analysis of Atlantic bluefin tuna assuming a single stock: 1970-1997 - C.E. Porch.

SCRS/01/052 Some suggestions for further analyses of the implications of trans-Atlantic mixing for North Atlantic bluefin tuna assessments - D.S. Butterworth, A.E. Punt

SCRS/01/053 Update on pop-up archival satellite tagging of bluefin tuna in the northwestern Atlantic - M. Lutcavage, R. Brill, J. Porter, P. Howey, E. Murray Jr., A. Mendillo, W. Chaprales, M. Genovese, T. Rollins

SCRS/01/054 Genetic analyses of Atlantic northern bluefin tuna captured in the northwest Atlantic Ocean and the Mediterranean Sea - B. Ely, D.S. Stoner, J.M. Dean, J.R. Alvarado Bremer, S. Chow, S. Tsuji, T. Ito, K. Uosaki, P. Addis, A. Cau, E.J. Thelen, W.J. Jones, D.E. Black, L. Smith, K. Scott, I. Naseri, J.M. Quattro

SCRS/01/055 Stock assessment approaches and their data requirements for dealing with mixing of western and eastern North Atlantic bluefin tuna: a Bayesian perspective - M.K. McAllister, E.A. Babcock

SCRS/01/056 Is Atlantic bluefin tuna a metapopulation? - D.H. Secor.

SCRS/01/057 Migratory movements, depth preferences, and thermal biology of Atlantic bluefin tuna - B.A. Block, H. Dewar, S. Blackwell, T. Williams, E.D. Prince, C.J. Farwell, A. Boustany, S.H.L. Teo, A. Seitz, A. Walli, D. Fudge

SCRS/01/057bis (Supplement to SCRS/01/057) Migratory movements, depth preferences, and thermal biology of Atlantic bluefin tuna - B.A. Block, H. Dewar, S. Blackwell, T. Williams, E.D. Prince, C.J. Farwell, A. Boustany, S.H.L. Teo, A. Seitz, A. Walli, D. Fudge

SCRS/01/058 Whose fish are they anyway? - J.J. Magnuson, C. Safina, M. Sissenwine

SCRS/01/059 Atlantic bluefin tuna: some considerations on mixing on the feeding grounds - F. Hester.

SCRS/01/060 Catches and catch rates of pelagic sharks from the northwestern Atlantic, Gulf of Mexico, and Caribbean - E. Cortés.

SCRS/01/061 Use of a generalized stage-based, age-, and sex-structured model for shark stock assessment - P. Apostolaki, M.K. McAllister, E.A. Babcock, R. Bonfil

SCRS/01/062 Pelagic shark abundance indices based on fishery-dependent and fishery-independent data from the western North Atlantic - J.J. Hoey, E. Pritchard, C. Brown, M. Showell

SCRS/01/063 Age and growth of the blue shark, *Prionace glauca*, in the North Atlantic Ocean - G.B. Skomal, L.J. Natanson

SCRS/01/064 Tag and recapture data for three pelagic shark species, blue shark *(Prionace glauca)*, shortfin mako *(Isurus oxyrinchus)*, and porbeagle *(Lamna nasus)* in the North Atlantic Ocean - N.E. Kohler, P.A. Turner. J.J. Hoey, L.J. Natanson, R. Briggs

SCRS/01/065 Validated age and growth of the porbeagle shark, *Lamna nasus*, in the western North Atlantic Ocean - L.J. Natanson, J.J. Mello, S.E. Campana

SCRS/01/066 Preliminary investigations into the age and growth of the shortfin mako, *Isurus oxyrinchus*, white shark, *Carcharodon carcharias*, and thresher shark, *Alopias vulpinus*, in the western North Atlantic Ocean - L.J. Natanson

SCRS/01/067 Review of the analysis of impact of the Moratorium on the bigeye and yellowfin Atlantic stocks conducted by the SCRS in 2000 - P. Pallarés, P. Kebe

SCRS/01/068 Analysis of tagging data from North Atlantic albacore *(Thunnus alalunga)*: Attrition rate estimates - V. Ortiz de Zarate, M. Bertignac

SCRS/01/069 Update of albacore tag release-recapture information in the North Atlantic and Mediterranean for the period 1968-1999 - A. González-Garcés, H. Arrizabalaga

SCRS/01/070 Study on the migrations and stock structure of albacore *(Thunnus alalunga)* from the Atlantic Ocean and the Mediterranean Sea based on conventional tag release-recapture experiences - H. Arrizabalaga, V. López-Rodas, V. Ortiz de Zárate, E. Costas, A. González-Garcés

SCRS/01/071 Use of lectins to characterize genetic variability and geographic differentiation in natural populations of *Thunnus alalunga* (Bonn. 1788) - V. Lépez-Rodas, H. Arrizabalaga, B. Nieto, A. González-Garcés, E. Costas

SCRS/01/072 Preliminary standardized catch rates for pelagic and large coastal sharks from logbook and observer data from the Northwest Atlantic - J.K. Baum, R.A. Myers, D. Kehler, L. Gerber, W. Blanchard, S.J. Harley, M. Showell

SCRS/01/073 Statistical catch-at-length model for porbeagle shark (*Lamna nasus*) in the Northwest Atlantic - S.J. Harley

SCRS/01/074 Evolución de las capturas de elasmobranquios pelágicos en la pesquería de atunes de Uruguay, con énfasis en los tiburones azul *(Prionace glauca)*, moro *(Isurus oxyrinchus)* y porbeagle *(Lamna nasus)* - A. Domingo, O. Mora, M. Cornes

SCRS/01/075 Porbeagle shark in NAFO subareas 3-6 (2001. Porbeagle shark in NAFO subareas 3-6. DFO Sci. Stock Status Rept. B-3-09 (2001) -

SCRS/01/076 Comparison of sampling efficiencies and quick calculation of bluefin tuna larval abundance of two spawning grounds based on the collaborative larval survey among the EU, US and Japan in 1994 - S. Tsuji

SCRS/01/077 Research activities carried out in the Eastern Atlantic and the Mediterranean applicable to the study of stock structure, migratory patterns and bluefin tuna mixing rate. - J.M. de la Serna

SCRS/01/078 Behaviour of post-spawning Atlantic bluefin tuna tagged with pop-up satellite tags in the Mediterranean and eastern Atlantic - G. de Metrio, G.P. Arnold, B. Block, J.M. de la Serna, N. Deflorio, M. Cataldo, C. Yannopoulos, P. Megalofonou, S. Beemer, C. Farwell, A. Seitz

SCRS/01/079 A historical review of the by-catch from the Portuguese surface long-line swordfish fishery: Observations on blue shark *(Prionace glauca)* and short-fin mako *(Isurus oxyrinchus)* - M. Neves dos Santos, *et al.*

SCRS/01/080 Shark data from Santos longliners fishery off Southern Brazil (1971-2000) - A.F. Amorim, C.A. Arfelli, S.

Bacilieri

SCRS/01/081 Catch rates of sharks in the Brazilian longline fishery operating in the southwestern Equatorial Atlantic Ocean - F.H.V. Hazin, H.G. Hazin, P. Travassos

SCRS/01/082 Bluefin tuna egg and larval survey in the Balearic Sea June 2001 (Tunibal 06/01) - A. García, J.M. de la Serna Ernst, J.L. López Jurado, F. Alemany, E. Rodríguez Marin

SCRS/01/083 Standardized CPUE for blue sharks caught by Japanese longline fishery in the Atlantic Ocean - H. Nakano

SCRS/01/084 Verification of shark CPUE reported by logbook of Japanese longline fishery comparing with the observer data - D. Shiode, H. Nakano

SCRS/01/085 Species composition and CPUE of pelagic sharks observed by Japanese observers for tuna longline fisheries in the Atlantic Ocean - Y. Matsushita, H. Matsunaga

SCRS/01/086 Preliminary results of standardised CPUE for porbeagle caught by Japanese longline fishery in the Atlantic Ocean - H. Matsunaga, H. Nakano

SCRS/01/087 Identification of shark species by SEM observation of denticle of shark fins - S.T. Tanaka, Kitamura, H. Nakano

SCRS/01/088 Preliminary results of standardized CPUE for shortfin mako shark caught by Japanese longline fishery in the Atlantic Ocean - H. Nakano

SCRS/01/089 Observations bio-statistiques sur les requins capturés par la pêcherie de filet maillant dérivant en Côte d'Ivoire - Y.N. N'goran, J.B. Amon Kothias

SCRS/01/090 Evolution de la pêcherie multispécifique de thonidés, espèces voisines et requins par filet maillant dérivant au large de la Côte d'Ivoire - J.B. Amon Kothias, Y.N., N'goran

SCRS/01/091 Croatian Bluefin tuna catches in the Adriatic during 1999 through 2001 by year/month/size structure - V. Ticina, I. Katavic, V. Fanicevic

SCRS/01/092 A preliminary study of the growth rate of bluefin tuna from Adriatic when reared in the floating cages - I. Katavic, V. Ticina, V. Fanicevic

SCRS/01/093 Obtención de estadisticas de captura y esfuerzo de la pesca mexicana del atún en el Golfo de México - R. Solana-Sansores, M. Nava-Abarca, J.O. González

SCRS/01/094 Standardized catch rates for sailfish (*Istiophorus platypterus*) from the Venezuelan pelagic longline fishery off the Caribbean sea and the western central Atlantic - F. Arocha, M. Ortiz

SCRS/01/095 Comparative efficiency between BETYP tags and conventional tags - J.P. Hallier, D. Gaertner

SCRS/01/096 Schools of large yellowfin *(Thunnus albacares)* concentrated by foraging activity on a monospecific layer of *Cubiceps pauciradiatus*, observed in the eastern tropical Atlantic - F.X. Bard, B. Kouamé, A. Hervé

SCRS/01/097 Standardized indices of abundance of sailfish *(Tetrapturus albicans)* off Côte d'Ivoire, 1988-2001 - F.X. Bard, T. Joanny, N. Ngoran Ya

SCRS/01/099 Analysis of early recoveries of BETYP taggings in eastern Tropical Atlantic as compared to ISYP and YYP taggings - F.X. Bard, P. Bannerman

SCRS/01/100 Investigating the effects of recent changes in fishing methods, especially the use of FADs, on species composition and landings of Tema baitboats and purse seiners - F.X. Bard, P. Bannerman

SCRS/01/101 Preliminary scientific estimations of tuna (tribe *Thunnini*) landed by the Spanish surface longline fleet targeting swordfish in the Atlantic Ocean: years 1999-2000 - B. García-Cortés, J. Mejuto

SCRS/01/102 Preliminary scientific estimations of billfish (Family *Istiophoridae*) landed by the Spanish surface longline fleet targeting swordfish in the Atlantic Ocean and Mediterranean Sea: years 1999-2000 - J. Mejuto, B. García-Cortés, J.M. de la Serna

SCRS/01/103 Progress of the ICCAT Enhanced Research Program for Billfish in the western Atlantic Ocean during 2001 - E.D. Prince

SCRS/01/104 Spatio-temporal distribution of longline CPUE and sea surface temperature for Atlantic marlin - C.P. Goodyear

SCRS/01/105 Integration of habitat preference into population abundance indices: Robustness tests using simulated data - C.P. Goodyear

SCRS/01/106 Standardized catch rates for sailfish *(Istiophorus platypterus)* from United States recreational fishery surveys in the northwest Atlantic and Gulf of Mexico - M. Ortiz, C.A. Brown

SCRS/01/107 Standardized catch rates for sailfish *(Istiophorus platypterus)* from the pelagic longline fishery in the northwest Atlantic and the Gulf of Mexico - M. Ortiz, C.A. Brown

SCRS/01/108 Simulated responses of the size distribution of blue marlin to fishing mortality - C.P. Goodyear

SCRS/01/109 Updated standardized catch rates for swordfish ages 3-10+ *(Xiphias gladius)* from the U.S. pelagic longline fleet 1982-2000 - J. Cramer, M. Ortiz

SCRS/01/110 Results of an experiment to evaluate effects of hook type on sea turtle by-catch in the swordfish longline fishery in the Azores - A.B. Bolten, H.R. Martins, E. Isidro, R. Ferreira, M. Santos, A. Giga, B. Riewald, K.A. Bjorndal

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SCRS/01/113 Otolith elemental fingerprints of Atlantic bluefin tuna from eastern and western nurseries - J.R. Rooker, D.H. Secor, V.S. Zdanowicz, G. de Metrio, L. Orsi-Relini, M. Deflorio, N. Santamaria, G. Palandri, M. Relini

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SCRS/01/115 Retrospective analysis of the bluefin tuna Nordic fisheries data - C. Pusineri, C. Ravier, J.M. Fromentin

SCRS/01/116 Report of 2000-2001 research cruise by R/V Shoyo-maru conducted under the ICCAT's BETYP - T. Matsumoto, N. Miyabe, H. Saito, M. Okazaki, S. Chow

SCRS/01/117 Algunas relaciones entre el comportamiento de los cerqueros europeos de túnidos tropicales y las capturas obtenidas - J. Ariz, D. Gaertner, A. Delgado de Molina, P. Pallarés, J.C. Santana

SCRS/01/118 Explotación de los bancos de túnidos tropicales asociados a montes submarinos, en el océano Atlántico, por la flota de cerco española - J. Ariz, P. Pallarés, J.C. Santana, A. Delgado de Molina

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SCRS/01/120 Estadísticas de la flota española de cerco tropical - A. Delgado de Molina, J. Ariz, J.C. Santana, P. Pallarés

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SCRS/01/122 Análisis de la actividad de los buques auxiliares el el océano Atlántico y su efecto sobre el rendimiento de atuneros congeladores - P. Pallarés, X. Mina, A. Delgado de Molina, I. Artetxe, J. Ariz, H., Arrizabalaga

SCRS/01/123 Algunos datos sobre la profundidad que alcanza el arte de cerco en la pesquería atunera tropical - J.C. Santana, A. Delgado de Molina, J. Ariz, P. Pallarés, D. Gaertner

SCRS/01/124 Updated estimates of conversion factors for bluefin tuna from product weight to live weight - E.M. Cunningham, V.R. Restrepo, J.M. de la Serna

SCRS/01/125 Observations on by-catch from a tuna trap fishery off the Algarve (southern Portugal) - M. Neves dos Santos, H.J. Saldanha, A. Garcia

SCRS/01/126 Preliminary standardized catch rates for bluefin tuna *(Thunnus thynnus)* from the trap fishery in Tunisia - A. Hattour, J.M. Ortiz de Urbina

SCRS/01/127 Preliminary study on age at first maturity of bluefin tuna in the Libyan waters - M.Y. Tawil, D. Macias, J.M. de la Serna

SCRS/01/128 Bluefin tuna maturity in Tunisian waters: A preliminary approach - A. Hattour, D. Macias, J.M. de la Serna

SCRS/01/129 Distribution of tuna larvae off the Balearic Sea: Preliminary results of the TUNIBAL 0600 Larval Survey - A. García, F. Alemany, J.M. Rodríguez

SCRS/01/130 Contribución del Proyecto FAO-COPEMED a la investigación biológica del atún rojo en el Mediterráneo - J.M. de la Serna, M.Y. Tawil, A. Farrugia, A. Hattour, A. Srour

SCRS/01/131 Description and evolution of the baitboat fleet targeting bluefin tuna in the Bay of Biscay from 1975 to 2000 - E. Rodríguez-Marín, G. Moreno, C. Rodríguez-Cabello, M. Ortiz, H. Arrizabalaga

SCRS/01/132 Bluefin tuna CPUE standardisation of the baitboat fishery in the Bay of Biscay - M. Ortiz, E. Rodríguez-Marín, H. Arrizabalaga, G. Moreno, C. Rodriguez-Cabello, M. Ruiz, J. Pereira, J.L. Cort

SCRS/01/133 Influence of the improved Spanish baitboat abundance index on the VPA calibration for the East Atlantic and Mediterranean bluefin stock - L.T. Kell, M. Ortiz, H. Arrizabalaga, E. Rodríguez-Marín, G. Moreno

SCRS/01/134 Preliminary study on the environmental effects on bluefin tuna catch rates in the Spanish baitboat fishery of the Bay of Biscay - H. Arrizabalaga, I. Sankristobal, X. Moreno-Ventas, G. Moreno, E. Rodríguez-Marín, L. T. Kell, C. Rodriguez-Cabello, M. Ortiz

SCRS/01/135 Age estimation of bluefin tuna (*Thunnus thynnus*, L.) caught by traps in Libyan waters based on spine reading - N.K. El-Kebir, C. Rodriguez-Cabello, M.Y. Tawil

SCRS/01/136 Note on Spanish albacore *(Thunnus alalunga)* surface fisheries in northeast Atlantic waters in the year 2000 - V. Ortiz de Zárate, C. Rodríguez-Cabello.

SCRS/01/137 50 years of Atlantic tuna fisheries: Upon the need to publish an ICCAT Atlas - A. Fonteneau, P. Pallarés

SCRS/01/138 Sailfish catch estimates from U.S. Recreational Fishery Surveys - C.P. Goodyear

SCRS/01/139 Verification of bigeye tuna length and catch data consistency for Taiwanese longline fishery in the Atlantic - C.C. Hsu, H.C. Liu

SCRS/01/140 Statistiques de la pêcherie thonière FIS durant la période 1991-2000 - R. Pianet, V. Nordström

SCRS/01/141 Statistiques de la pêcheries thonière européenne NEI durant la période 1991-2000 - R. Pianet, P. Pallarés, V. Nordström

SCRS/01/142 Nota sobre el marcado de patudo dentro del BETYP - A. Delgado de Molina, R. Delgado de Molina, J.C. Santana, J. Ariz

SCRS/01/143 More allozyme data on bluefin tuna from Balearic Islands - J.M. Pujolar, M.I. Roldan, J.M. de la Serna, C. Pla

SCRS/01/144 Allozyme identification of bluefin tuna from Icelandic waters - J.M. Pujolar, M.I. Roldan, C. Pla

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SCRS/01/146 Boundary between North and South Atlantic stocks of swordfish *(Xiphias gladius)*: an implication from nuclear DNA analysis - S. Chow, K. Nohara, Y. Takeuchi

SCRS/01/147 Recent status of the swordfish catch by the Japanses longlinerrs in the Atlantic Ocean - K. Yokawa, T. Fukuda

SCRS/01/148 Geographical distributions of sailfish and spearfish catches by the Japanese longline fishery data in the Atlantic Ocean - H. Saito, M. Takahashi, K. Yokawa

SCRS/01/149 Standardization of CPUE for sailfish caught by Japanese longline in the Atlantic Ocean - K. Yokawa, Y. Takeuchi

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SCRS/01/151 Report of observer program for Japanese tuna longline fishery in the Atlantic Ocean from August 2000 to July 2001 - T. Matsumoto, N. Miyabe

SCRS/01/152 Comparison between ascending searching minimization algorthm versus knife-edge cutting method from conversion of length distribution to age composition - Y. Chang, S.Y. Yeh

SCRS/01/153 Standardized catch rates of South Atlantic albacore, *Thunnus alalunga*, from the Taiwanese longline fisheries during 1968-1999 - C.L. Wu, S.Y. Yeh

SCRS/01/154 Standardized CPUE trend of Taiwanese longline fishery for norther Atlantic albacore from 1968 to 1999 - S.H. Yang, T.D. Tzeng, S.Y. Yeh

SCRS/01/155 Preliminary report on the maturity and spawning of bigeye tuna *Thunnus obesus* in the central Atlantic Ocean - T. Matsumoto, N. Miyabe

SCRS/01/156 National Report of Chinese Taipei: Update on tuna longline fishery of Taiwan in the Atlantic Ocean - Fisheries Administration

SCRS/01/158 Influence of the type of longline on the catch rate and size composition of swordfish, *Xiphias gladius* (Linnaeus, 1758), in the southwestern Equatorial Atlantic Ocean - H.G. Hazin, F.H.V. Hazin, P. Travassos

SCRS/01/159 Preliminary study on the reproductive biology of swordfish, *Xiphias gladius* (Linnaeus, 1758, in the southwestern Equatorial Atlantic Ocean - F.H.V. Hazin, H.G. Hazin, C.E. Boeckmann, P. Travassos

SCRS/01/160 Distribution et abondance relative de l'espadon (*Xiphias gladius*, Linnaeus 1758) capturé dans l'Atlantique sud-ouest équatorial - P. Travassos, H. Hazin, F. Hazin, S. Mattos

SCRS/01/161 Analyse de la distribution de fréquence de taille des espadons (*Xiphias gladius*, Linnaeus 1758) capturés dans l'Atlantique sud-ouest équatorial - H. Hazin, F. Hazin, P. Travassos

SCRS/01/162 Influencia de las fases lunares en la abundancia relativa del pez espada, *Xiphias gladius* (Linnaeus, 1758), capturado en el océano Atlántico ecuatorial - H.G. Hazin, F.H.V. Hazin, P. Travassos, S. Hamilton, F.P. Ribeiro

SCRS/01/163 La pêche du thon rouge *(Thunnus thynnus)* à la senne tournante dans les eaux tunisiennes (Préliminaire) - A. Hattour

SCRS/01/164 National Report of Malta, 2000 - A. Farrugia

Appendix 4

2001 REPORT OF THE *AD HOC* WORKING GROUP ON SCRS ORGANIZATION

Introduction

At the 1997 meeting of SCRS, discussions were held and recommendations made about the need to review and develop alternative options for organization of the SCRS and annual meetings. In 1998, an *Ad Hoc* Working Group[1] on SCRS Organization was formed "to consider procedures for more effective analysis and reporting, aimed at enhancing the credibility of the Commission's scientific work. The Group should consider an effective system of peer reviewing of reports and develop a plausible format for drafting reports (particularly for the reporting of full assessment results and for updating previous years' work)."

The *Ad Hoc* Working Group on SCRS Organization[2] met during the Species Group Sessions at ICCAT headquarters, October 1-6, 2001, to review progress on recommendations made since its last meeting in 1999, and to further discuss issues related organization of SCRS. Among the issues taken up at the 2001 meeting, were staffing of the Secretariat, further implementation of peer review for quality assurance purposes, the timing of data reporting, late submission of scientific papers, and the assessment schedule for 2002-2003.

Staffing Related to Increasing the Efficiency of Conduct of the Commission's Scientific Enterprise

The Working Group reviewed the proposal outlined in COM/01/008 and recommends hiring two staff members to fill major gaps within the Secretariat. The proposal structures the Secretariat so that different members of the professional staff would coordinate the activities in Statistics, Assessment/Research and Publications.

Therefore, the first position to be filled is that of a professional Scientific Editor for overseeing the preparation and completion of the publications produced by ICCAT. ICCAT reports have generally become larger and more complex. In addition, the advent of electronic publication and wide distribution of the ICCAT reports requires that the reports be of consistent style and of high quality. The WG agreed that there has been a large improvement in the consistency of style and in the quality of the ICCAT reports produced and now distributed electronically and that the effort required to manage these tasks is substantial. As these editorial tasks have been largely undertaken by the senior scientist at the Secretariat, the editorial efforts have taken effort away from his primary scientific tasks. The second position is in the General Services category to assist with translation of reports in the English Department and with general secretarial work.

Peer Review

Peer review is an important component in the recommended overall quality assurance procedures for ICCAT. in order to ensure that management advice derived from assessments is sound. The Working Group discussed the proposed methods of conducting peer review detailed in SCRS/00/040 (Rev.) and recommends that SCRS proceed with the conduct of at least 2 *in situ* reviews per year, starting in year 2002. The purpose of the reviews is to provide additional scientific peer advice to the SCRS and its species groups for improvements in their conduct of stock assessments. Conduct of *in situ* review, wherein the reviewer may provide working papers in advance of the session, actively participates in analysis and in report drafting, permits an immediate feedback to the working group and SCRS and thus, in the short-run, is the method of peer review viewed most practical by the Working Group. It was further suggested that these reviews be conducted for species groups implementing new assessment methods as a first priority. Species group conveners should plan to hold a review of this nature within the next 5 year period and additional reviews at intervals of about every 2-3 assessments, thereafter. With the agreement of the SCRS, reviewers should be selected through consultation between the SCRS chair, the Species Group Convener, and the Secretariat.

Timing of Data Reporting

[1] This report was discussed by the SCRS, who modified some of the recommendations presented here. See Section 8.3.

[2] G. Scott (U.S.A.), Convener; J. Mejuto (EC-Spain), R. Pianet (EC-France), J. Porter (Canada), Y. Uozumi (Japan), J.H. Meneses de Lima (Brazil), V. Restrepo (ICCAT), J. Powers (SCRS Chair).

The new database management system was put in place by the Secretariat as one element of the quality control procedures recommended by SCRS and adopted by the Secretariat. In order to assure quality data for assessments, it is critical that sufficient time (at least one week for Task I data) is available between data submission and the time of a scheduled assessment due to the steps needed in entering and quality assuring data into the database. The Working Group discussed the need to reemphasize that in order to conduct assessments in a timely manner with the most recent data, it is necessary that ICCAT receive Task I and Task II data well in advance of the scheduled assessments. Late submission of data could be a result of a number of factors, among them being insufficient effort by member countries, the time lags in national data reporting and data collection mechanisms, or other causes. Regardless of the cause for late reports, it is a responsibility of member nations to ensure that there is adequate support for data collection and reporting so that the ICCAT reporting time-lines can be adhered to.

Late Scientific Papers

The Working Group discussed the current SCRS policies with respect to submission of scientific papers to the various working groups. It was recommended that these policies be reemphasized to all participating scientists and remain posted on the ICCAT web site. In general, the Secretariat will require titles and abstracts of intended contributions, 25 days in advance of the scheduled meeting during which the contribution will be discussed. In addition, it is the responsibility of the author to deliver the appropriate number of copies of each manuscript at the beginning of each meeting. Typically, 80 copies are required for SCRS Plenary and associated species group meetings, and normally, 30 copies for intersessional meetings.

The Working Group also discussed the current SCRS situation regarding the regularly-late submission of National Reports. The possibility of separating these reports into scientific (for SCRS) and management (for the Commission) parts was discussed as a possible means of reducing the number of late submissions. The Working Group did not reach a consensus on this point.

Assessment Schedule for 2002-2003

The number of assessments anticipated in support of Commission Recommendations within the next 2 years is large. At present, 16 species stocks have been identified as candidates for assessment over the next 2 years (BET, BFTE, BFTW, WHM, BUM, SWON, SWOS, ALBN, ALBS, SWOM, YFT, SKJ, SAIE, SAIW, Blue sharks, Shortfin mako sharks). Of these, the majority (9: BET, BFTE, BFTW, WHM, BUM, SWON, SWOS, ALBN, ALBS) have been identified as candidates for conduct in 2002. In previous years, assessments of up to 6 species stocks have been accomplished, but the SCRS, Secretariat, and National Scientific infrastructures were stretched beyond maximum sustainable levels in these cases. For each assessment, multiple person-months of preparation of data, supporting analysis, and software development and testing are required for the conduct of a successful assessment. With the current infrastructures, an average assessment demand of 4-5 per year is manageable, but even this level leaves little time for conduct, coordination, and analysis of other issues requested of or recommended by SCRS. For this reason, the Working Group recommends that, until the Secretariat, SCRS, and National Scientific infrastructures support greater levels, no more than 5 species stock assessments be scheduled in any year, but that 4 be the norm.

Table 1 lists the anticipated assessments and a tentative schedule for their conduct in 2002-2003. In order to meet the recommended maximum of 5 assessments per year in 2002 and 2003, the Working Group first recommends delay of shark assessments until 2004 or beyond. Further, the Working Group recommends that from the candidate assessments listed for 2002, 4 be moved to 2003. The Working Group discussed the possible need to hold the SCRS Plenary in mid- to late October, 2002, in order to accommodate the heavy workload expected for 2002.

Table 1. Anticipated assessment, data-preparatory, or research-coordination meetings for 2002 and 2003

Year	*Month*	*Assessment/Data Meeting*	*Previous assessment*	*Comments/ Recommendations*	*Other Meetings Potentially Conflicting*
2002	Jan				
2002	Feb				
2002	Mar	BIL Phase I Planning			
2002	Apr	GFCM-ICCAT			IATTC
2002	May				IATTC
2002	Jun				IOTC
2002	Jul	BFTE, BFTW assess	2000, 1998		SCTB/SPC
2002	Aug	BUM, WHM assess	2000, 2000	Possibly move to Sept 2003	SCTB/SPC
2002	Sep	SWON, SWOS assess	1999, 1999		ICES
2002	Oct	ALBN, ALBS, BET assess	2000(ALBN,S), 1999(BET)	Possibly move ALBN+ S to 2003	
2002	Nov				Commission Meeting
2002	Dec				IOTC Comm
2003	Jan				
2003	Feb				
2003	Mar				
2003	Apr	SWOM assess			IATTC
2003	May	Blue shark, Shortfin mako shark		Move to 2004	IATTC
2003	Jun	YFT assess	2000		IOTC
2003	Jul	SAIW, SAIE	1993, 1993		SCTB
2003	Aug				SCTB
2003	Sep				ICES
2003	Oct	SKJ assess	1999		
2003	Nov				Commission meeting
2003	Dec				IOTC Comm

Appendix 5

BIGEYE YEAR PROGRAM (BETYP) - EXECUTIVE SUMMARY[1]

(Report on BETYP activities from October 2000 to September 2001)

During this period, conventional tagging was carried out only in the Gulf of Guinea. Due to several circumstances, no tagging was done in Canary Islands, Madeira and Azores. Two pop-up tags were deployed in December 2000 from the research vessel *Shoyo-maru* and 12 pop-up tags were deployed in Azores in April/May 2001. A contract was signed was signed with IRD from France for the evaluation of hard parts regarding the growth studies component of BETYP, and a contract was signed with the *Museo Nacional de Ciencias Naturales* in Spain to carry out the genetic studies considered within the BETYP Program. Improvement in fisheries statistics in Ghana continued during this period.

The BETYP budget and expenses up to September 2001 are shown on **Table 1**.

Report on BETYP activities by budget line items

Contributions

The contributions received from January to September 2001 are shown on **Table 2**.

Salaries

The salary of the Coordinator and the accounting assistant are included in this line item.

Coordination

This line item includes office supplies, telephone, eventual secretarial and translation services and the external auditing services

Travel

The Coordinator traveled to Azores, Basque Country, Sao Tome, Washington DC, and Ghana to visit the National Laboratories in order to coordinate the BETYP activities, as well as to maintain the necessary contacts for the contracting of fishing vessels to be used in tagging operations.

Meetings

An informal meeting was held in Madrid in February 2001, to establish the Design of an Atlantic Bigeye Tuna Statistical Model. (see document SCRS/01/046). An informal meeting of the BETYP Committee was held in Madrid on October 8, 2001

Conventional tagging operations

Azores. Due to the lack of fish, no conventional tagging activities were held in Azores during 2001.

Madeira. Due to the lack of fish, no conventional tagging activities were held in Madeira during 2001.

Canary Islands. Due to the lack of fish and lack of fisheries agreement with Morocco, no conventional tagging activities were held in the Canary Islands during 2001.

Tema, Ghana. The tagging activities were carried out by personnel of the Marine Fisheries Research Division (MFRD) during the last quarter of 2000. During this period, 1,004 bigeye, 1,405 yellowfin and 2,056 skipjack

[1] Initially presented as document SCRS/01/012 (by G. Fisch) to the 2001 meeting.

were tagged. These activities were carried out during eight opportunistic tagging trips on vessels of TTV, Ltd. from Tema Ghana, according to the terms described in the BETYP SCRS Report of 2000.

Gulf of Guinea, São Tome. A dedicated tagging cruise took place between April 10 and August 10, 2001 on board the Portuguese flagged chartered vessel *Agião*. The tagging team headed by Paul Bannerman included personnel from MFRD, Tema Ghana. Head of cruise during different periods were François Xavier Bard, Renaud Pianet, Jean-Pierre Hallier, Guillermo Fisch and Lidia Gouveia. The chartring cost was € 320,000. During this trip, 332 bigeye, 1,884 yellowfin and 3,652 skipjack were tagged.

The total tuna tagged from October 2000 till September 2001 is shown in **Table 3**.

Due to the experience gained during the last dedicated tagging cruise, it is recommended that a similar cruise be held in 2002 between the months of June and September.

The Summary of BETYP tagging activities since June 1999 up to September 2001is shown in **Table 4**.

Tag Posters

The posters have been translated into English, Spanish, French, Portuguese, Chinese and Japanese and were distributed by the National Laboratories to appropriate institutions.

Pilot study using electronic tags

The BETYP collaborated with two pop-up tags that were deployed in addition to the two already scheduled during the *Shoyo-maru* cruise in December, 2000.

In 2000, the Coordinator was in touch with two manufacturers of electronic tags and with Dr. Molly Lutcavage from the New England Aquarium who has experience in this matter. A project with the collaboration of AZTI, DOP, Dr. Lutcavage and the financial assistance of the Basque Government was established for tagging with electronic tags large bigeye from Azores during the 2001 fishing season. This project was carried out between April 18 and May 24. During the first phase, six pop-up tags were deployed South of São Miguel Island and between May 24 and May 30, five tags were deployed out of Faial Island. One tag was lost due to bad weather.

The tags were scheduled to pop-up in August and November 2001 and May 2002. All tags surfaced and started transmitting data earlier than the scheduled dates. The cause has not been established.

It is recommended that a second experience be scheduled for 2002, with deployments in Azores and the Canary Islands. A continuing funding from the Basque Government and involvement by AZTI and DOP has been preliminarily secured.

Statistics improvement, Tema, Ghana

Extensive work has been carried out at MFRD regarding support to improve the sampling, statistics and tagging operations. This work has been done by Paul Bannerman with the assistance of Xavier Bard who is stationed at IRD Abidjan. Bannerman and Bard are presenting a joint document on their progress to SCRS (SCRS/01/121)

During the opportunistic tagging trips between October 1999 and December 2000, as well as during the five trips with observers in the first half of 2001, 1,353 bigeye, 7,804 yellowfin and 13,490 skipjack tunas were sampled.

Otoliths and hard parts

On July 12, 2001, an agreement was signed between the BETYP and IRD, with the purpose of carrying out a program to study the growth of bigeye (more specifically the potential change in growth rate induced by the massive aggregation at FADs) using the otolith processing technique. BETYP will coordinate the collection of otoliths through the National Laboratories and IRD will carry out the analysis and study of 200 otoliths.

Genetic studies

After contacts with several laboratories, and with the special intervention of Pilar Pallarés from the IEO, an

agreement was signed with the *Museo Nacional de Ciencias Naturales* (MNCN) in order to carry out the genetic studies on the bigeye tunas of the Atlantic Ocean. Samples, to be collected by the National Laboratories under the coordination of the BETYP, from the Gulf of Guinea, Azores, northwest and southwest Atlantic Ocean during two consecutive years, will be analyzed by the MNCN, as well as samples from the Indian and Pacific Oceans. A total of approximately 600 samples will be analyzed.

R/V *Shoyo-maru* research cruise

See Document SCRS/01/116.

Printing and publications

There has been no activity regarding this item.

Proposed BETYP activities for 2002

Conventional tagging

Continue conventional tagging activities as in the three previous years in Azores, Canary Islands and Madeira.

Carry out a second dedicated tagging cruise in the Gulf of Guinea during the months of June, July and August, applying the experience gained during 2001.

Archival and pop-up tagging

Carry out 2 pop-up tagging cruises, in Azores and the Canary Islands, applying the experience gained in 2001.

Otoliths and hard parts

Carry out the program in collaboration with IRD.

Genetic studies

Carry out the program in collaboration with the *Museo Nacional de Ciencias Naturales*.

Tema statistics improvements

Continue assisting the MFRD with the collaboration of Dr. Xavier Bard.

Endorsement

The outlook of the bigeye stock remains uncertain. The Committee anticipates that the on-going BETYP will enhance the assessment in the near future to a great extent, so that the Committee can provide the Commission with more accurate advice. The Committee recommends strong support by the Commission to extend this Program in 2002.

Budget

The proposed budget for 2002, identical to the 2001 budget, is shown in **Table 5**.

Others

An Information Document, Update on BETYP Research, was prepared by the Tropical Tuna Working Group.

Table 1. BETYP Budget 2001 and Situation as of September 15, 2001 (in US$)

Item	*2001 Budget*	*Expenses to 9/15/01**
Salaries	115,000	80,073
Coordination Expenses	15,000	11,425
Travel	15,000	12,786

Meetings	25,000	2,178
Tagging activities, conventional tags		
Azores		0
Madeira	20,000	0
Canary Islands	20,000	0
Tema/ Gulf of Guinea	250,000	320,835
Tagging strategy research		0
Tag materials	5,000	0
Tag rewards	10,000	0
Various	15,000	0
Pilot study, electronic tags	50,000	12,178
Statistic improvements Tema	5,000	3,761
Sampling for growth hard parts	10,000	5,000
Printing and publications	0	0
Contingencies	10,000	0
Total expenses	**585,000**	**448,236**

∗ Some expenses are best estimates

Table 2. Contributions received from January to September 2001 (in US$)

Source	*Amount*
European Commission (20% from 2000)	40,861
European Commission (80% from 2001)	155,470
Japan	230,945
Chinese Taipei	66,560
Peoples Republic of China	24,964
AZTI	46,615
Other Income (bank interest)	238
Total income	**565,653**

Notes:
The exchange rate of the month when the contribution was received was used for the Peseta/Dollar conversion.

Table 3. Total tagged tuna from October 2000 to September 2001

Species	*No. tagged*
Bigeye	1,336
Yellowfin	3,289

Skipjack	5,708
Total	**10,336**

Table 4. Summary of BETYP tagging activities, June 1999-September 2001

Location	*BET*	*SKJ*	*YFT*	*Totals*
Azores	43	217		260
Madeira				
Canarias	1765	45	64	1874
Senegal	946	1403	105	2454
Ghana	1004	2056	1408	4468
São Tomé	332	3652	1884	5868
Total	**4090**	**7373**	**3461**	**14924**

Table 5. Proposed budget for the year 2002 (in US$)

Chapter	*Amount*
Salaries	115,000
Coordination	15,000
Travel	15,000
Meetings	25,000
Tagging	340,000
Azores	20,000
Madeira	20,000
Canary Islands	20,000
Rewards	10,000
Various	15,000
Tag materials	5,000
Archival and pop-up tags continuing study	50,000
Tema statistics improvement	5,000
Hard parts	5,000
Contingency	15,000
Total expenses	**585,000**

Appendix 6

BLUEFIN YEAR PROGRAM (BYP) - EXECUTIVE SUMMARY

The Bluefin Tuna Year Program Working Group (WG) reviewed the progress made under the Bluefin Year Program, concluding that most of the research goals outlined for 2000/2001 had been met.

The current financial status is reviewed below and recommendations for direct BYP-funded research for the year 2002 in particular, and for the future in general, are made. The two primary areas of research considered important by the WG are stock structure and maturity, and the particular expenditures needed to accomplish the WG objectives in the year 2002 are outlined. While sampling for stock structure and maturity remains the highest immediate priority of the BYP, the Committee also recommends support of several additional research activities, which are also itemized below.

Financial report

The financial status through 2 October 2001 with anticipated expenditures through December 31, 2001 is in **Table 1** of the Detailed Report. At the end of 2001 there should be a balance of approximately $54,800 (~9,900,000 pesetas). With the expected 2002 Commission contribution of 2,266,000 pesetas, the 2002 BYP operating budget should be on the order of $66,000 (~12,000,000 pesetas).

Catch uncertainty

As in last year, the BFT WG reiterated its serious concerns about the catch data of the East Atlantic and Mediterranean. These are due to the lack of reported Task I from several fishing countries as well as to suspected non-reported catches. Both the implementation of a TAC and the rapid and strong development of farming, lead to uncertainties regarding the origin (flag and gear), the amount and the composition of the catches. The working group further noted that the SCRS could not confidently recover non-reported catches from the bluefin statistical document, because the complete information about the catches being directly put in cages was not available.

Therefore, in the response to the Commission on the effects of tuna farming on bluefin tuna statistics (Section 15.3), the Committee stressed its concern about the substantial reduction in the information on the size at capture and catch-effort information for bluefin due to the substantial increase in the proportion of the purse seine catches which are transferred to cages for growth and fattening. This reduction in information, unless corrected, will negatively impact the quality of advice that the committee will be able to provide. New research on this topic is also proposed for 2002 and beyond and should be supported.

Progress in 2001

In 1999 and 2000 the SCRS recommended that the next assessment for the east Atlantic and Mediterranean stock be delayed so that research could concentrate on basic biology and statistics. Substantial progress has been made. The Bay of Biscay baitboat index of abundance was extensively examined and revised in four papers. Three of those papers dealt with the development of the baitboat fleet and its fishing power since 1975, the relationships between environmental influences and catch rates, and the estimation of age specific indices. A fourth paper examined the influence of the revised indices on estimates from the VPA conducted in 1998. A new index of abundance was developed from the Tunisian trap fisheries. In addition two reports on the age composition and sexual maturity of fish in Tunisian and Libyan catches based on information collected through the COPEMED program were presented. Information on conversion factors was developed in cooperation with an industry scientist. Furthermore, some provisional information on growth of bluefin held in cages (for farming) in the Adriatic Sea has been collected and presented to the SCRS.

At the 2000 SCRS meeting SCRS/00/125 presented a plan to attempt to catch adult and larval bluefin in an hypothesized spawning area in the central north Atlantic, and Spanish scientists reported that the Spanish government was planning a study of spawners and larvae in the Balearic Islands area. The Bluefin Program endorsed these proposals and recommended that a coordination meeting be held in early 2001. That meeting was held and was reported on in SCRS/01/022. Data collection protocols were standardized for fishing effort and fishing strategies, hydrographic sampling and biological sampling and were developed to the extent possible given that the Spanish

sampling would be conducted aboard both research and commercial vessels while the central Atlantic sampling would be conducted aboard only commercial vessels. The Balearic area research resulted in the capture of 124 bluefin larvae (SCRS/01/129); results from the fishery sampling of spawners and the hydrographic survey were not yet available. The central north Atlantic longline fishing caught no bluefin though other large pelagic species were caught (SCRS/01/31 Rev.); results from the larval sampling were not yet available.

All these new efforts must be emphasized since there has been a paucity of information about catch rates and independent estimates of abundance were scarce for the East Atlantic and Mediterranean bluefin stock. The standardized CPUE time series, together with the information from the Balearic larval survey and the aerial spottings surveys (currently performed within the EU project Stromboli), will provide the BFT working group new valuable information for future assessments. (However, this excellent progress could be overshadowed by uncertainties in the catch data).

In the ICCAT Workshop on Environment and Tuna Recruitment (SCRS/01/006) multiple approaches for developing more powerful analyses of the effects of environment on recruitment were presented. For bluefin tuna in the western Mediterranean a possible influence of sea surface temperature on condition factor of mature bluefin and perhaps reproductive output was reported. Analyses of VPA estimates of recruitment and of the survival ratio of both the west and east Atlantic bluefin, after taking account of trends in the data, indicated no statistically significant influence of the NAO (North Atlantic Oscillation), and similar results were generally found with superposed epoch analysis.

At the ICCAT Workshop on Bluefin Tuna Mixing (SCRS/01/020), numerous documents related to biological information on bluefin tuna stock structure were presented and discussed. These included new information and/or historical reviews of conventional and electronic tagging, genetic research and otolith microconstituent analyses as well as bluefin stock structure in general. Considerable progress has been made.

The Committee reviewed the progress to date in late 2000 and 2001 with respect to the sampling plan detailed in the 2000 BYP report to evaluate progress in accomplishing the plan. It was noted that expenses to date had been lower than anticipated, though a number of the objectives from the research plan described in the 2000 BYP report have yet to be fully met, largely due to the multi-year nature of the sampling plan. Much of the planned sampling in 1999 and 2000 was conducted at lower direct cost to the BYP than originally anticipated, due in large part to the existence of the FAO's COPEMED program and due to national contributions to the BYP. Stock structure sampling targets for 2000 were generally met. Stock structure sampling targets for 2001 were met or partially met in the western Mediterranean and eastern Mediterranean. Sampling targets for the most part in the west Atlantic were not met due to budgetary constraints which impacted sampling of summer fisheries; limited sampling success was achieved from the winter and spring fisheries.

Research Plan for 2002

There has been considerable progress to date on the sampling plan developed by the BYP in 1999 and continued through 2001, but at a lower cost than originally anticipated. While there is a need to maintain sampling to achieve the plan outlined in the BYP sampling plan (see BYP detailed report), the current balance of the BYP enables a broadening of the research plan in 2002 to include additional high priority research.

Taking into consideration ICCAT's recommendations made through the Bluefin Year Program, and with the aim to know and to evaluate the likely impact of tuna farming on statistics, research activities regarding collection of data and biometric sampling, will be carried out in tuna farms settled in Malta and Spain, mainly addressed to improve the ICCAT Statistical Document. This activity will be carried out under the FAO-COPEMED financial support.

As highest priority for the BYP in 2002, the BYP Working Group recommends expenditures of $6,000 to cover expenses associated with stock structure and maturity sampling during the upcoming year.

As next priority for the BYP in 2002, the BYP Working Group recommends expenditures of $60,000 to contribute to the expenses for planning, conduct, and coordination of 5 research activities viewed as important to the future of BYP and in support of providing scientific advice to the Commission on bluefin tuna.

i The Committee endorsed the concept of the proposed exploratory research sampling of larvae and spawning-sized bluefin tuna and the associated oceanographic conditions in the central Atlantic as outlined in SCRS/00/125 and notes the progress reported in SCRS/01/31 rev. The BYP Working Group recognizes

that this research is very expensive and is beyond the current capability of the Bluefin Program, but recommends that $10,000 be contributed to support planning, coordination, and implementation. It is recommended that a further $15,000 be allocated for the larval sorting expenses associated with the larval surveys as these are not done in-house by national scientists. These actual costs are expected to be an order of magnitude higher.

ii The Committee endorsed the proposed research sampling of larvae and spawning-sized bluefin tuna and the associated oceanographic conditions in and around the Balearic Islands as outlined in SCRS/01/82 and notes the progress reported in SCRS/01/129. The BYP Working Group recognizes that this research is very expensive and is beyond the current capability of the BYP, but recommends that $5,000 be contributed to support planning, coordination, and further implementation of this research.

iii The BYP Working Group endorsed the proposed research activities on tuna farming in the Adriatic Sea submitted by Croatian scientists at the 2001 SCRS meeting (see proposal in 2002 BYP detailed report). The Committee recognizes that full conduct of this research as proposed would require more resources than the current BYP could contribute and that the results will be useful for addressing the growth of fish farmed in the Adriatic, but probably not generalizable to other farming areas. The BYP Working Group recommends that $10,000 be contributed in partial support to initiate this research in year 2002 (the research could take two or more years to complete) and that fish purchased for this research also be used to obtain the appropriate biological specimens identified in the BYP research plan for stock structure and maturity sampling.

iv The BYP Working Group endorsed the proposed research for electronic tagging in the eastern Atlantic and Mediterranean submitted by EC scientists at the 2001 SCRS meeting (see 2002 BYP detailed report). The BYP Working Group noted that the Committee has previously recommended research into bluefin stock structure making use of high-technology electronic tags. The recent report on bluefin tuna mixing recommended increasing effort on electronic tagging, especially in the Mediterranean, and encouraged cooperation between scientists/organizations of coastal countries through the current organizational structures (*e.g.* COPEMED, EU, or others), with the technical collaboration by scientists from the west involved in these research applications. The BYP Working Group recognizes that this research, like other research activities noted above, is very expensive and is beyond the current capability of the BYP, but recommends that $10,000 be contributed to support planning, coordination, and implementation.

v The BYP Working Group endorsed the proposed research for genetic analysis of available samples proposed by EC scientists at the 2001 SCRS meeting (see 2002 BYP detailed report). The BYP Working Group recommends that $10,000 be contributed to accomplish the proposed research.

Table 1. Recommended 2002 BYP contributions to bluefin research (US$)

Project description	*2002 Request*	*2002 BYP Balance*
		66,000
Biological sampling	6,000	60,000
Larval and reproduction cruises		
Planning central North Atlantic	10,000	50,000
Larval sorting (central North Atlantic)	15,000	35,000
Coordination for Mediterranean	5,000	30,000
Electronic tagging	10,000	20,000
Farming study	10,000	10,000
Genetics analysis	10,000	0

Appendix 7

ICCAT ENHANCED RESEARCH PROGRAM FOR BILLFISH - EXECUTIVE SUMMARY

(Expenditures/ Contributions 2001 & Program Plan for 2002)

Program objectives

The original plan for the Enhanced Research Program for Billfish (SCRS 1986) included the following specific objectives: (1) to provide more detailed catch and effort statistics, and particularly size frequency data; (2) to initiate the ICCAT tagging program for billfish; and (3) to assist in collecting data for age and growth studies. The plan was initially formulated in 1986 and implemented in 1987 with the intention of developing the data necessary to assess the status of the billfish stocks. Efforts to met this goal have continued through 2000 and are highlighted below.

The ICCAT Enhanced Research Program for Billfish, which began in 1987, continued in 2001. The Secretariat coordinates the transfer of funds and the distribution of tags, information, and data. The General Coordinator of the Program is Dr. Joseph Powers (USA); the East Atlantic Coordinators are Dr. Taib Diouf (Senegal) and Dr. Nestor Ngoran Ya (Côte d'Ivoire), while the West Atlantic Coordinator is Dr. Eric Prince (USA). The billfish data base is maintained at the NMFS Southeast Fisheries Science Center (Miami, Florida) and at the ICCAT Secretariat.

2001: Contributions and Expenditures

This report presents a summary of the contributions and expenditures for the ICCAT Enhanced Research Program for Billfish during 2001. In 2001, funding for the ICCAT Enhanced Research Program for Billfish operated under the new financial arrangement established by the 1997 SCRS (see 1997 STACFAD Report, item 9.3). The STACFAD specified that the Commission should make at least a symbolic contribution (US$ 10,000) to the Enhanced Research Program for Billfish and this was continued in 2001 (1997 STACFAD Report, items 9.5 and 9.9). As a result of this development, the Program in 2001 was fully coordinated by the Secretariat in consultation with area coordinators and member countries.

Table 1 shows the status of funds available towards Billfish Program activities, expenses for 2001, and the current balance of Billfish Program funds (4,466,250 Pesetas or - US $24,835, as of October, 3, 2001). It should be noted that accounting of all income and expenses is carried out in Pesetas, and U.S. Dollar amounts are converted to Pesetas at the official monthly UN exchange rate in effect when the accounting entry is made.

At the start of Fiscal Year 2001 there was a balance of 6,690,695 Pts (- US$36,556) available from the previous year for 2001 Program activities **(Table 1)**. Contributions in 2001 included an allocation of 1,751,000 Pts (- US$10,000) from the regular Commission budget. Thus, the total funds available for the 2001 Billfish Program **(Table 1)** amounted to 8,441,695 Pts (- US$46,556). Other funds that are normally contributed to the Billfish Program were not made available in 2001, therefore it was necessary to reduce major expenditures for 2001 Billfish research activities by about 50%.

Starting in 1996, the FONAIAP (Venezuela) and in 1997, the *Instituto Oceanográfico* (University de Oriente) has provided personnel and other resources as in-kind contributions to the at-sea sampling program, thereby reducing the amount of funds needed for this activity from the ICCAT billfish funds. The U.S. National Marine Fisheries Service assumed some of the costs of coordination travel for the West Atlantic as an in-kind contribution to the Billfish Program for 2001. The Department of Agriculture and Fisheries of Bermuda also contributed in-kind contributions by providing personnel and other resources, used for assessing post release survival of Atlantic blue marlin in the recreational fishery.

Overall, the Program Plan for 2001 was successfully carried out in a timely manner, although reductions in expenditures did affect the amount of research that could be accomplished during 2001. For example, only 22 observer trips on Venezuelan longline vessels were accomplished in 2001, a 40% reduction from the previous year. An SCRS working document or report summarizing the Billfish Program at-sea sampling data base was not presented this year. Instead, electronic copies of the at-sea sampling data base was made available to the Fourth ICCAT Billfish Workshop (SCRS/00/23) held in Miami, Florida, from July 18-28, 2000. The hard-cover publication of the Fourth ICCAT Billfish Workshop was distributed during the 2001 SCRS meeting in October, although the

CD version of the Workshop report was distributed earlier, i.e. during the summer of 2001.

Table 2 shows the 2001 Billfish Budget and Expenditures (as of October 3, 2001). Several additional expenditures are expected to be incurred before the end of 2001 and into the first quarter of 2002, such as payment of observer coverage in Venezuela and Program coordination travel. Therefore, there is a need to carry over the 2001 balance in Billfish Program funds to the 2002 Budget, as has been the practice for this and other special programs in previous years. Several budgetary items show a zero expenditure and this is due to the fact that authorization of some 2001 budgetary expenditures was dependent on the sufficiency of funds, while in other cases no request for funding by Program participants was submitted. The Working Group requests that the Commission again provide the same level of research funding in 2002 as it did in 2001. In addition, voluntary contributions, including those from The Billfish Foundation and Chinese Taipei will also be necessary to carry out the Program Plan in 2002.

Research carried out during 2001 is summarized by area coordinators in SCRS/01/103, SCRS/01/145, SCRS/01/094, and SCRS/01/097.An additional 10 working documents on billfish were submitted to the 2001 SCRS, including: SCRS/01/102, SCRS/01/104, SCRS/01/105, SCRS/01/106, SCRS/01/108, SCRS/01/107, SCRS/01/111, SCRS/01/138, SCRS/01/148, and SCRS/01/149.

2002: Coordination, Protocols, and Program Plan

It was confirmed that Drs. Powers and Prince (U.S.A.) will continue to function as the General Coordinator and West Atlantic Coordinator, respectively. Drs Diouf (Senegal) and Ngoran Ya (Côte d'Ivoire) will act as Co-Coordinators for the East Atlantic Ocean.

The summary of the 2002 proposed budget, totaling US$44,350, is attached as **Table 3**. Highlight reports of research activities will be provided to interested parties annually. In addition, names and addresses of individuals receiving the reports and those involved or interested in the research program will continue to be made available upon request. Projected funds for future research activities will be available in subsequent annual plans.

All agencies and/or personnel receiving funding from the special Billfish Program account are required to summarize annual expenditures of funds to the Commission and research activities, either in the form of a working document to the SCRS or a report to the Program Coordinators. Due to changes in the financial structure of the ICCAT Billfish account, all participating cooperators in this Program are now required to request the release of funds (via fax or email) directly from the ICCAT Secretariat, as well as General Program Coordinator and area Coordinators. In other words, the release of Program funds are not automatic, even if expenditures are described in the Program Plan-- release of funds are contingent upon requests being received by the ICCAT Secretariat and Program Coordinators. In addition, program participants are required to submit data collected in previous years to area Coordinators or directly to the ICCAT Secretariat.

Statistics and sampling

Shore-based sampling

West Atlantic

Bermuda. Shore-based sampling of the annual billfish tournaments will be conducted in Bermuda in 2002. Dr. Brian Luckhurst of the Department of Agriculture and Fisheries of Bermuda will coordinate this activity, and no funds will be required. Bermuda will continue to conduct research involving pop-up satellite tags to evaluate the post-release survival of blue marlin. This work may also require some travel from Bermuda to various locations in thee western Atlantic to facilitate this research. (See post release survival using pop-up satellite tags.)

Brazil. Shore-based sampling of selected billfish tournaments will be continued in Brazil for 2002 in the general vicinity of Santos, as well as other locations off southeastern Brazil. Dr. Alberto Amorin, *Instituto de Pesca*, will coordinate tournament-sampling activities. Shore-based sampling will begin in Fernando de Noronha Island and other locations of northeastern Brazil and this activity will be coordinated by UFRPE. It is not anticipated that this activity will require funds in 2002.

Cumaná, Playa Verde, Punto Fijo, and Margarita Island, Venezuela. Shore-based sampling of size frequency data for billfish carcasses off-loaded from industrialized longline boats at the port of Cumaná will be continued in 2002. Funding will be $300 since some of this activity occurs on weekends and after normal working hours. Likewise, sampling artisanal fisheries in Playa Verde will be accomplished by contracting a technician on a part time basis. Funding for this activity in 2002 is $700. Sampling artisanal longline boats and artisanal fisheries in Punto Fijo and Margarita Island will be conducted in 2002 and the requested funding for these segments is as follows: Punto Fijo $200, and Margarita Island $300. Trips by the West Atlantic Coordinator or his designee may be necessary to organize sampling, collect data, and transport biological samples to Miami in 2002. In addition, the amount of $900 will be required for tag rewards in Venezuela for 2002 that are made by the *Instituto Nacional de Investigaciones Agrícolas* (INIA) staff (this budget item is identified in the Section on Tagging).

La Guaira, Venezuela. Shore-based sampling and detailed analysis of the recreational fishery (centered in La Guaira, Venezuela) will be continued in 2002. This sampling includes coverage of up to ten recreational billfish tournaments held in Puerto Cabello, La Guaira, Falcon, and Puerto La Cruz. Requested funding for this activity in 2002 is $500 since much of this sampling is conducted on weekends and some travel expenses are incurred while attending these events. Also, shore-based sampling, including documentation of the catch and effort statistics for the important recreational fishery at Playa Grande Marina, will be accomplished by contracting a technician on a part-time basis. Funding for this activity in 2002 is $2,000. Shore-based sampling in all Venezuelan locations, as well as at-sea sampling (see next section) in Venezuela will be coordinated by Mr. Luis Marcano of INIA.

Grenada. Shore-based sampling of size frequency and total landings from the artisanal and recreational fishery for billfish will be continued by the Ministry of Agriculture, Lands, Forestry, and Fisheries (coordinated by Mr. Crofton Isaac and Mr. Paul Phillip) in 2002. Shore-based sampling activities will start in early November, 2002, to coincide with the start of the pelagic fishery at this location. This activity will also include sampling of the Spice Island Billfish tournament. Requested funding for 2002 is $1,000.

Jamaica. Shore-based sampling of the size frequency, total landings, and catch and effort statistics from the recreational fishery can not be continued in 2002 until a new contact can be made in this location. Dr. Guy Harvey has since moved to the Cayman Islands and can no longer continue this work. Requested potential funding, should contacts be made, will be $1,000 for 2002.

St. Maarten, Netherlands Antilles. Shore-based sampling of size frequency data for off-loaded billfish carcasses from longline vessels will be continued in 2002 through the Nichirei Carib Corporation. Requested funding for this in 2002 is $1,500. Shore-based sampling of the annual recreational billfish tournament, initiated in 1992, may be continued in 2002 by the West Atlantic Coordinator or his designee (if time permits). Since this tournament normally contributes travel expenses for the week of the tournament, the West Atlantic Coordinator may also assist Nichirei Carib employees in sampling during his stay on the island. Thus, funds for this latter activity will not be required from the Program.

Uruguay. An evaluation of the historical billfish landings and CPUE data base from Uruguay may be conducted by the *Instituto Nacional de Pesca* (INAPE) in order to assess the possibility of recovering historical landing statistics in the necessary formats required for Task I and Task II reporting. A report will be submitted to the 2002 SCRS concerning this activity but will not require funding in 2002.

U.S. Virgin Islands. Shore-based sampling of recreational billfish tournament in the U.S. Virgin Islands maybe continued in 2002 if staff from the Virgin Islands Big Game Fishing Club in St. Thomas is agreeable. Requested funding for 2002 is $2,000.

Trinidad and Tobago. Shore-based sampling of size frequency data for off-loaded billfish carcasses from China-Taiwan and longline vessels from Trinidad may be re-initiated in 2002. This work, if conducted, will be supervised by Ms. C. Chan A Shing of the Ministry of Food Production and Marine Exploitation (Fisheries Division). At least one trip by the West Atlantic Coordinator, or his designee, will be necessary to review the research plan and organize field research activities. Requested funding for 2002 is $1,000.

East Atlantic

The Co-Coordinators for the East Atlantic will need to travel to West African countries to check on data collections. Proposed travel plans for coordination travel should be submitted to the General Program Coordinator/Secretariat prior to the end of 2001.

Dakar, Senegal. Shore-based sampling of the Senegalese artisanal, recreational and industrial fisheries for billfish size frequency, sex determination, and catch and effort data will be continued in 2002 by Dr. Taib Diouf, the East Atlantic Coordinator. Requested funding for 2002 is $1,500.

Côte d'Ivoire. Abidjan shore-based sampling of the artisanal and recreational fisheries for billfish will be continued and directed by Dr N. Ngoran of CRO in 2002. Funding for 2002 will be $1,500.

Gabon. A sampling plan for the artisanal fisheries of Gabon that catch billfish will be developed by Mr. O. Rue Robert, Director of Artisanal Fisheries (Ministry of Fisheries), in consultation with the Eastern Atlantic Coordinator. No program funds will be required for 2002.

Ghana. Shore-based sampling of size frequency and sex determination, and catch and effort of the artisanal gillnet fisheries for billfish will be continued in 2002 by Mr. Paul Bannerman. Funding for 2002 will be $1,500. Some travel by the East Atlantic Coordinator may be required to accomplish this task in 2002.

Canary Islands. Shore-based sampling of size frequency of off-loaded billfish carcasses from Chinese Taipei longline vessels may be continued in 2002. Requested funding for 2002 is $400.

Morocco. Inquires will be made by Dr. Abdallah Srour, of the *Institut National de Recherche Halieutique*, to improve the knowledge of the recreational fishery for billfish in Morocco and for establishing a sampling program in 2002. Funding for this activity in 2002 is not anticipated.

At-sea sampling

West Atlantic

Venezuela. At-sea sampling out of the ports of Cumaná, Puerto La Cruz, and Margarita Island will be continued in 2002. A total of about 10 tuna trips and 7 swordfish trips on mid-sized industrial longline vessels will be made in 2002, and the cost will be $8,000. In addition, two long-range trips on large Korean-type vessels ($1,500), and two trips on smaller longline vessels ($400) will be made in 2002. Therefore, the total West Atlantic at-sea sampling for 2002 will be $9,900. In addition, insurance for at-sea sampling for 2002 will be $1,200.

Brazil. At-sea sampling on Brazilian longliners will be continued in 2002 and Dr. Fabio Hazin from the UFRPE will direct these research activities. However, it is not certain whether this activity will require funding at this time.

Bermuda. At-sea sampling of home based longline vessels targeting pelagic species maybe initiated in 2002 by the Department of Agriculture and Fisheries, provided this fishing activity takes place. Possible biological sampling opportunities on home based longline vessels will also be assessed. ICCAT funding of this research activity is not required in 2002. In addition, the Department of Agriculture and Fisheries will continue to facilitate deployment of pop-up satellite tags on blue marlin from recreational and longline vessels fishing in the west Atlantic. This proposed work represents a continuation of a commitment to study the post release survival of blue marlin. Some travel costs for Dr. Luckhurst may be required for his participation relative to deployment of pop-up satellite tags in various Atlantic locations. Travel costs for this activity in 2002 are shown in the next section.

Post-release survival using pop-up satellite tags

A project to evaluate post release survival of blue and white marlin using pop-up satellite tag technology is planned by scientists from the Virginia Institute of Marine Science (Dr. John Graves), Bermuda Department of Fisheries (Dr. Brian Luckhurst), and the U.S. National Marine Fisheries Service (Dr. Eric Prince). This project is independently funded but will require funding of air fare for research associates to travel to various Atlantic locations for the deployment of tags in 2002 in the amount of $5,000.

Uruguay. At-sea sampling aboard home based longline vessels was initiated in 1998 by the *Instituto Nacional de Pesca* (INAPE) of Uruguay, but no detailed data are collected on billfish, except for measuring length.However, it is uncertain if this activity will take place in 2002 and funding of this project will not be required.

Tagging

The following conventional tagging activities and expenditures are proposed. The purchase of tags and tagging equipment (distributed to participants by the ICCAT Secretariat) for east Atlantic billfish tagging is not anticipated in 2002 as substantial tagging equipment was purchased previously. The total for tag rewards (including the $900 needed in Venezuela) will amount to $1,500 for 2002. A lottery reward of $500 will also be necessary for 2002.

Age and growth

Requested funding for biological samples from juvenile and very large billfish, as well as tag-recaptured billfish, is $500 for 2002.

Coordination

- Training and sample collection

Experience in the West Atlantic continues to indicate that it will be necessary to make a series of trips to specific Caribbean island locations, and occasionally to West Africa, Madeira (Portugal), Bermuda, and Brazil, to maintain quality control of on-going research. The purpose of this travel will be to train samplers in data collection, pick up data, assist in pop-up tagging and data analysis, hand-carry frozen biological samples back to Miami, monitor the rapidly changing pelagic fisheries, and maintain contacts with project cooperatives. The travel to West Africa will be to assist the East Atlantic Coordinators in refining sampling programs, particularly to encourage tag release and recapture activities. Funding for 2002 will be $10,000. Travel may include the following areas:

- West Atlantic

Cumaná, Margarita Island, Caracas, and La Guaira (Venezuela)
Grenada
Santos and Recife (Brazil)
St. Maarten (Netherlands Antilles)
St. Vincent
Trinidad and Tobago
Cancún and Cozumel (Mexico)
Bermuda
Other Caribbean countries

- East Atlantic

Dakar (Senegal)
Abidjan (Côte d'Ivoire)
Ghana
Madeira (Portugal)
Gabon
Other West African countries

- Miscellaneous/Mailing

The requested funding for 2002 for east Atlantic miscellaneous and mailing is $100. Similar needs for the West Atlantic Coordinator are covered by the U.S. domestic budget.

- Data base management

During the 1999 SCRS meeting, a problem surfaced relative to data base quality control and data entry for the at-sea and shore-based sampling components of this program.Given quality control and data entry is still lagging behind due to shortage of NMFS staff to accomplish these duties, it may be necessary to have a work study student from the University of Miami again be contracted for these data entry functions. However, there are no anticipated costs for quality control and data entry for 2002 at this time.

- Bank charges

Charges by the bank for the transfer of funds and bank checks in 2002 are estimated at $250.

Because of unforeseen changes in the fisheries and opportunities for sampling, it may be necessary for the ICCAT Secretariat and the General Coordinator to make adjustments in budgeted program priorities. These changes, if any, will be duly transmitted to the area Coordinators. Also, the proposed budget for regular Program activities in 2002 is attached as **(Table 3)**. The expansion or reduction of expenses will depend, to a large degree, on the available funds. It should be noted that the regular Program activities will be implemented based on receipt of sufficient funds and the carry-over of unused funds from 2001.

Table 1. Funds available for 2002 for the Billfish Program

Source	*In US $*	*In Pts.*
Balance at start of Fiscal Year 2001	36,556	6,690,695
Allocation from ICCAT Regular Budget	+ 10,000	+ 1,751,000
Funds available	46,556	8,441,695
Expenditures (see **Table 2)**	(21,721)	(3,975,445)
BALANCE as of October 3, 2001	**± 24,835**	**4,466,250**

Table 2. 2001 Budget & Expenditures of the Enhanced Research Program for Billfish (as of October 3, 2001) (in US$)

Chapters	*Amount budgeted*	*Expenditures*
STATISTICS & SAMPLING		
West Atlantic shore-based sampling:		
Bermuda tournaments	0	0
Barbados	0	0
Brazil tournaments	0	0
Venezuela:		
Cumaná	720	300
Margarita Island	720	300
Punto Fijo	360	150
Playa Verde	1,680	700
Playa Grande Marina	480	425
Tournaments in Puerto Cabal and Falcon	1,000	443
Grenada	1,000	0
Jamaica	1,000	0
St. Maarten Netherlands Antilles	1,500	0
Uruguay	0	0
U.S. Virgin Islands	2,000	0
Trinidad & Tobago	1,000	0
West Atlantic at-sea sampling:		
Venezuela (Cumaná, Puerta la Cruz, Margarita Island)	18,408	10,215
Insurance for Venezuelan Observers	1,200	1,200
Pop-up satellite study	5,000	0
Brazil	4,000	0
Insurance for Brazilian Observers	350	0
Uruguay	500	0
Bermuda	5,000	0
East Atlantic shore-based sampling:		
Dakar, Senegal	1,500	0
Côte d'Ivoire	1,500	0
Ghana	1,500	0
Morocco	0	0
Canary Islands	400	0
TAGGING		
Tag rewards	1,500	900
Lottery rewards	500	0
Hard part rewards	500	0
Printing posters and recapture cards in Japanese/Chinese/Portuguese	0	0
Tags and tagging equipment	0	0
AGE AND GROWTH: Purchase of hard parts	500	0
COORDINATION		
Travel by Coordinators	14,000	0
Mailing & miscellaneous--East Atlantic	100	0
Data base management	4,000	0
Bank charges on Billfish account	250	33
4th ICCAT BILLFISH WORKSHOP		
Hard cover publication	5,000	6,835
GRAND TOTAL	**77,168**	**21,501**

The Billfish Program Budget for 2001 was prepared in US$ and all the 2001 expenditures were made in that currency.

Table 3. ICCAT Enhanced Research Program for Billfish Budget for 2002 (in US$) (The release of funds is contingent upon conditions described in the text.)

Budget Chapters	*Amount budgeted* (US$)
STATISTICS & SAMPLING	
West Atlantic shore-based sampling:	
Bermuda tournaments	0
Brazil tournaments	0
Venezuela	
Cumaná	300
Punto Fijo	200
Playa Verde	700
Margarita Island	300
Playa Grande Marina	2000
Tournaments in Puerto Cabello, La Guaira, Puerto La Cruz, and Falcon	500
Grenada	1,000*
Jamaica	1,000*
St. Maarten, Netherlands Antilles	1,500
Uruguay	0
U.S. Virgin Islands	2,000*
Trinidad & Tobago	1,000*
West Atlantic at-sea sampling:	
Venezuela (Cumaná, Puerta la Cruz, and Margarita Island)	9,900
Insurance for Venezuelan Observers	1,200
Brazil	0
Insurance for Brazilian Observers	0
Pop-up Satellite Study (Bermuda)	5,000
Uruguay	0
East Atlantic shore-based sampling:	
Dakar, Senegal	1,500
Côte d'Ivoire	1,500
Gabon	0
Ghana	1,500
Canary Islands	400*
Morocco	0
TAGGING	
Tag rewards	1,500
Lottery rewards	500
Tags and tagging equipment	0
AGE AND GROWTH	
Purchase of hard parts	500*
COORDINATION	
Coordination travel (on site training of samplers, collection of statistical and biological samples)	10,000*
Mailing & miscellaneous-East Atlantic	100
Data base management	0
Bank charges	250
GRAND TOTAL:	**44,350**

* Authorizing these expenditures depends, in part, on additional funds being available.

Appendix 8

SUB-COMMITTEE ON BY-CATCHES - EXECUTIVE SUMMARY

1. Opening of the meeting, adoption of Agenda, and arrangements for the meeting

At the request of the Chairman of the SCRS, the Convener of the Sub-Committee on By-Catches, Dr. Hideiki Nakano (Japan) opened the meeting. The Agenda, which was circulated before the meeting, was reviewed and adopted and is attached to this report as **Addendum 1 to Appendix 8**. Dr. Gerald Scott (U.S.) agreed to serve as Rapporteur.

2. Review of new information concerning by-catches

New information concerning by-catch species submitted to the 2001 ICCAT SCRS were reviewed.

Document SCRS/01/074, SCRS/01/089 and SCRS/01/145 provided catch statistics including historical catch, species composition, and size composition by species for longline fishery of Uruguay, the artisanal canoe fishery of Cote D'Ivoire and a longline fishery in Venezuela, respectively.

Document SCRS/01/116, 125 and 151 indicated species lists observed by several fisheries. A summary, including a shark species list, for the research cruise conducted by the Japanese research vessel *Shoyo-maru* under ICCAT's BETYP was documented SCRS/01/116. Document SCRS/01/125 reported on species composition observed tuna trap fishery off Algarve in southern Portugal. Document SCRS/01/151 described Japanese observer activity on their fleet with biological observation in detail. This report also indicated species list encountered by Japanese longline fishery in the Atlantic Ocean.

Document SCRS/01/110 and SCRS/01/158 introduced some experimental results. The result of an experiment for mitigation for sea turtle by-catches in the swordfish longline fishery in the Azores using several hook types was reviewed by the document SCRS/01/110. It was reported that the intent of this research is to develop possible longline gear modifications that could be transferred to other longline fishing nations to reduce possible interaction rates with marine turtles. Document SCRS/01/158 indicated the experimental results comparing multi-filament and monofilament longline gears by species.

3. Update of the list of by-catch species relevant to ICCAT

Document SCRS/01/125 reported on the species composition observed in the tuna trap fishery off Algarve, in southern Portugal. Many coastal teleost species and one shark species were newly reported in this document. These species have been included in the by-catch species list maintained by the Secretariat. The Sub-Committee reiterated that this list does not provide quantitative information. The revised species list will be available through the ICCAT Web site. It was recommended that the Convener of the Sub-Committee update the list, when appropriate, through correspondence with the Secretariat and interested scientists.

4. Review of the conclusions and recommendations from the 2001 shark data-preparatory meeting

The report of the 2001 shark data-preparatory meeting of the Sub-Committee on By-catches held in Halifax, Canada, in September, 2001 (SCRS/01/021) was reviewed. Participants in the meeting included scientists from Brazil, Chinese Taipei, Canada, Japan, Namibia, the United States, and the Secretariat. The Sub-Committee concentrated its efforts on updating fishery statistics and CPUE data for Atlantic sharks focusing on blue, shortfin mako and porbeagle sharks, and developing plans for future assessments. For future assessments, the working group discussed methods for assessments, the timetable for assessments and additional data needs. It was emphasized that although available data basic fishery statistics was yet incomplete for many of the commercially important species, information on life history parameters for shark species was relatively good. Therefore, assessment models emphasizing knowledge about life history parameters will be one option for the assessment. Other methods using long-term tagging data were also suggested. It was also pointed out that estimation of total removals by all fleets, including dead discards, need to be given priority in reporting to permit conducting these assessments.

The Committee was informed that complete shark catch data from the Brazilian fisheries will be made available for the next meeting.

Recommendations made by the Sub-Committee were accepted and some of these were adopted by the Committee as recommendations to the Commission. The Committee noted that a shark assessment could not be conducted before May 2002, but concluded that such assessments may not be practical until 2003 or 2004 given the current assessment demands of the Commission. The Committee recommended seeking guidance from the Commission on the appropriate timing for shark assessments.

5. Review of other national or international activities concerning by-catches

The Secretariat informed the Committee that a scientist from ICES had intended to participate in the meeting but was unable to do so. The Committee considered that it was essential to establish better communications with ICES in terms of shark research and in the planning of future assessments. The group suggested that it would be useful for ICCAT and ICES scientists to meet to formulate a plan for joint activities. The meeting could take place as early as Fall 2001 and should include both the chairmen of ICCAT's Sub-Committee on By-catches and ICES's Study Group on Elasmobranch Fisheries, as well as someone from each Secretariat.

It was also noted that NAFO, GFCM and other international organizations were becoming more active in terms of sharks and that interactions with them in this field would be productive.

The following activities by other international organizations which relate to the business of the Sub-Committee were noted:

1 Pelagic shark book. Proceedings of the pelagic the shark workshop held in 2000, Monterey, California, will be published in 2002.

2 A shark conference entitled "2002 Shark Conference – Sustainable Utilization and Conservation of Sharks" will be held in Taipei at May 13-16, 2002.

3 Australia, Japan and the United States submitted National Plans of Action for Conservation and Management of sharks to FAO COFI which was held in February 2001. Brazil, Namibia and Chinese Taipei are in the process of planning their own Plans of Action.

4 The First Chondrichthyes Workshop of NUPEC (*Nucleo de Pesquisa em Estudo en Chondrichthyes*), will be held in Santos, Brazil, in November 7-16, 2001. The main subjects are taxonomy, fishery, fish in captivity, and fish disease.

5 The Third Brazilian Elasmobranch Society meeting will be held in Paraiba City, Brazil in July 2002.

6 An upcoming CITES meeting to discuss criteria for including species on CITES Appendices. It was noted that a Japanese scientist will attend this meeting. The Committee recommended that Dr. Uozumi represent ICCAT at this meeting.

6. Future plans and recommendations

1 The Committee noted that assessments of blue and shortfin mako sharks could not be conducted before May 2002, but concluded that such assessments may not be practical until 2003 or 2004 given the current assessment demands of the Commission. The Committee recommended seeking guidance from the Commission on the appropriate timing for shark assessments.

2 For assessment purposes, the Committee encourages member nations, entities and fishing entities catching sharks in the Atlantic and Mediterranean, or having caught sharks in the past in these waters, to submit species-specific shark catch statistics including estimation of shark catch, dead discards and size data. Emphasis should be on porbeagle, blue and shortfin mako sharks.

3 It is recommended that member nations, entities and fishing entities develop and conduct observer programs for their own fleets to collect accurate data on shark catches by species (including discards).

4 The Committee recommends further collaboration with other international organizations, especially ICES and GFCM, for the assessment of the Atlantic and Mediterranean stocks of the species mentioned above.

5 The Committee recommends the use of several models such as non-equilibrium production models and statistical age/length-structured models for the assessments.

6 Use of tag-recapture data should be made in the stock assessments.

7 The Committee recommended that scientists undertake to expand and update data in Table 4 of SCRS/01/021 to summarize the available biological and fishery information on porbeagle, blue and shortfin mako sharks in the Atlantic and Mediterranean.

8 Scientists should investigate the use of the ratio of the catch of sharks to the catch of target species as a tool for the estimation of historical shark catches by fleet.

9 The Committee encouraged wider participation from member nations, entities and fishery entities and experts in general. For this purpose, financial aid for travel may be required from the Commission or from member nations.

7. Other matters

No other matter was discussed.

8. Date and place of the next meeting

It is anticipated that the Sub-Committee on By-catches will reconvene at the 2002 SCRS meeting.

9. Adoption of the report and closure

After review, the Report was adopted and the 2001 Meeting of the Sub-Committee on By-catches was closed.

Addendum 1 to Appendix 8

Agenda of the Sub-Committee on By-catches

1 Opening, adoption of agenda and meeting arrangements
2 Review of new information concerning by-catches
3 Update of the list of by-catch species relevant to ICCAT
4 Review of the conclusions and recommendations from the 2001 shark data-preparatory meeting
5 Review of other national or international activities concerning by-catches
6 Future plans and recommendations
7 Other matters
8 Date and place of the next meeting
9 Adoption of the report and closure

Appendix 9

SUB-COMMITTEE ON STATISTICS - EXECUTIVE SUMMARY

1. Opening, adoption of agenda and meeting arrangements

Dr. Steve Turner (United States), Convener of the Sub-Committee on Statistics, opened the meeting. The Agenda, after slight modification, was adopted and is attached as **Addendum 1 to Appendix 9**. The ICCAT Secretariat served as rapporteur.

2. Issues regarding catch data submission

The Sub-Committee reviewed Table 1 of document SCRS/01/09, which records the types of data submitted to the ICCAT Secretariat, and the dates on which the data are received, and document SCRS/01/026, which shows a summary of the data submission dates and a report on general compliance with submission deadlines. This latter was requested by the Sub-Committee on Statistics in 2000 with a view to considering more practical deadlines for data submission. After some discussion, it was agreed that the deadline for Task I data, previously set for the end of April was impractical and should be moved forward to 31 July, but that there would be some flexibility to take account of fisheries for which logbook data was not available until late into the year. Data received during the SCRS Plenary Sessions, however, would not be included in the Species Tables, although data received at any time would be accepted for inclusion in the ICCAT data base.

The Sub-Committee noted that release information for 15,482 tags placed by Japan during the International Skipjack Year Program in the Gulf of Guinea was received by the Secretariat. The United States also submitted a new tagging data base containing 283,850 records, and a new shark tagging data base. EC-Spain also submitted a revised albacore tagging base, and information from the Bigeye Year Program tagging cruises was provided.

It was noted that not all countries responded to the ICCAT request for the completion of the tag inventory, which lists all tags which are used by the various agencies. This information was important as it would allow the Secretariat to return recovered tags received at the Secretariat to the relevant agency as quickly as possible, and to know by whom the reward would be paid. The Sub-Committee recommended that all countries/entities/fishing entities which operated tagging programs submit their lists of tags, both conventional and archival, to the Secretariat for the completion of the tag inventory, and that a simple reporting format for this be developed and circulated.

There was some discussion on the desirability of the information contained in the archival tags being made available to ICCAT, as sometimes the findings of such tagging studies were used by ICCAT Species Groups. It was recognized, however, that there may be problems with the issue of data ownership, as many of these tagging programs were funded by private institutions. It was agreed that partial data could probably be provided, and the Sub-Committee recommended that the type of data needed to document analyses be identified and requested.

Document SCRS/01/017 reported on the ICCAT Systems Analyst's visit to Trinidad and Tobago, and showed the revised data based on his findings. The artisanal and local longline catches had been accepted by the various species groups, but it was agreed that further research was needed to ensure that double reporting of foreign based longliners was avoided, and that these data would not be accepted until after this had been clarified. The Sub-Committee recommended that those countries which had longline vessels based in Trinidad and Tobago cooperate in clarifying whether or not these catches were included in their catch reports.

Table 2 of SCRS/01/009 showed the revised data submitted by Algeria for the period since 1993. Data for the years 1998, 1999 and 2000 had already been accepted by the Secretariat as no data submissions for these years had previously been received. The Sub-Committee agreed that these data (1993-1997) could not be accepted until justification had been received from Algeria, in accordance with the SCRS rules for accepting revisions to historical data.

Other changes to historical data, received during the Species Group meetings which were accepted by the respective Groups, are also reported in COM-SCRS/01/009. [addendum to 009]. Historical revisions had also been received from Malta during the SCRS plenary sessions in document SCRS/01/164, and the Sub-Committee agreed

to defer consideration of these data until their next meeting in 2002.

The Report of the Shark Data Preparatory Meeting (SCRS/01/021) was introduced, and the extensive preparatory work undertaken by the Secretariat was noted.

The Sub-Committee was referred to Table 3 of SCRS/01/009, and document COM-SCRS/01/015. The problems involved in matching trade data with Task I data were noted, particularly with regard to farmed fish and fish products. It was also noted that trade data were submitted in a variety of formats, which hindered the integration of these data into a relational data base. The Sub-Committee recommended that a standard format for the submission of trade data be developed, and that data be cross checked against the individual statistical documents where necessary.

3. Uncertainty in catch data

The Convener drew the attention of the Sub-Committee to document SCRS/01/023, which summarizes the findings of the ICCAT Survey on Statistic Collection systems, created and circulated by the Secretariat in accordance with the recommendation of the Sub-Committee on Statistics in 2000. Copies of the completed questionnaires had been made available to interested scientists. The Sub-Committee noted that few completed questionnaires had been received and that more responses were needed before final conclusions could be reached, although a preliminary overview showed that logbooks and census were the primary sources of landings data. It was agreed that the submissions of completed questionnaires would continue to be collected by the Secretariat.

It was noted that the Brazilian scientists had not responded as they had not received a copy of the questionnaire, but would do so when a copy of the circular was provided.

4. Issues regarding other data requested by the Commission

The Secretariat requested those parties/entities/fishing entities which had stated that data from observer programs could be made available to the Secretariat to submit such data. Only two countries responded to this request, one providing data and one stating that no data was available. Several countries indicated that they had not responded to the request for observer data because no standard format had been set. The Sub-Committee recommended that a small working group be formed to work with scientists who have available observer data, and scientists interested in using that data, in order to identify the type of data available, the level of aggregation required and to develop a format for such data. While several scientists expressed concern over the issue of confidentiality, it was considered that, in general, this could be taken into account in the new data base either by special markers to identify confidential data or through aggregation.

The Sub-Committee noted that Brazilian scientists had not received a copy of the request for observer data.

The additional tasks involving statistical and data compilation e.g. vessel lists, compliance tables and vessel monitoring systems, undertaken by the Secretariat in accordance with Commission recommendations was noted.

The Sub-Committee noted in particular that the compilation of a vessel registry was difficult, as some countries had problems maintaining their own data bases, despite considerable efforts. It was also noted that work on vessel registry was being carried out by the FAO and other regional fisheries bodies, and that it was important to cooperate closely with these organizations to avoid duplication of effort.

5. National and international statistical activities

The ICCAT Systems Analyst attended the 19th Session of the Coordinating Working Party on Statistics in July 2001.Further details can be found in SCRS/01/014.

The ICCAT Secretariat had also collaborated in the joint publication of Atlantic data, undertaken by the FAO, EUROSTAT and other regional fisheries bodies. The Sub-Committee agreed that such cooperation should continue, although priority could not be given to meeting the deadlines for this task, when they conflicted with tasks urgently required by the SCRS.

6. Publications

Two volumes of the ICCAT Collective Volume of Scientific Papers were published in 2001, Volume 52 and 53. The latter contained the proceedings of the Fourth Billfish Workshop and was also published in hard bound volume, with assistance from the Billfish Foundation. Concern was expressed over the lack of paper copies of the Collective Volumes, and it was recommended that these should be made available to libraries which had traditionally kept this series, and to a few key people in each Contracting Party.

For the first time, previously unpublished Task II data was made available in Excel files on CD ROM, which was distributed with Data Record Volume 41, which contained the printed catalogue of all the data available in the ICCAT database. The Sub-Committee considered this format of publishing the Data Record was preferable to the paper version. The Secretariat reported that the possibility of sending out the entire Task 2 dta base in this format, rather than only new data, was being considered; the Sub-Committee supported such an action.

As last year, the data for the Statistical Bulletin were distributed on diskette or made available on the ICCAT Web Page, with only summary tables being published in the hard copy volume. This year, the data set was made available for use with Fishstat Plus, as well as Tunastat.

The Sub-Committee referred to document SCRS/01/009 for more details on the Secretariat's partnership in ASFA. The Sub-Committee hoped by next year that an extract from the ASFA database could be made available to scientists, providing that resources were made available to write the required software.

7. Internet issues

The Sub-Committee congratulated the Secretariat on the improvements made in the Web Page, which provided a considerable amount of information of use to SCRS scientists.

The Sub-Committee noted the problems that the new data base was causing in the Local Area Network both in the Secretariat and within the building in which the Secretariat is located. It was agreed that the installation of a new separate system for the Secretariat was essential to solve these problems.

8. Review of the conclusions and recommendations from the database monitoring meetings

The report of the meeting of the *Ad Hoc* Committee for Advice on the Implementation of the ICCAT Relational Database Management System (ICCAT-RDB), which met in Madrid, 13-14 May 2001 (SCRS/01/007) was reviewed, as was the report of that Committee which met again on 5 October to monitor database progress (SCRS/01/024). These reports will be published in the ICCAT Collective Volume of Scientific Papers, volume 54.

At this latter meeting, the *Ad Hoc* Committee recommended that codes for catch types, i.e. catch, landings, live discards, dead discards and transfers of live fish (farming) be established in 2001/2002, but that the current ICCAT data base codes, including those of geographical strata, not be revised until after the integration of the Task 2 into the relational data base, in order to better identify any additional problems which may arise during this process. It was anticipated that this revision may take place in 2003. The revision of the ICCAT codes would necessitate a simultaneous revision of the ICCAT Field Manual, which the Sub-Committee recommended be made available in electronic format on the Web Page.

The *Ad Hoc* Committee had also discussed the problem with historical data in which codes were used to represent very minor catches (less than one ton) and catches which were known to exist but where the amount was not reported and could not be estimated. It was recommended that historical catches of less than one metric ton be revised in accordance with original data submissions where possible. It was recognized, however, that this would take some time, and was not a priority task. In order to distinguish between zero catch and catch not submitted, the Sub-Committee recommended that future data submissions should include reports of zero catches, by species and strata, where applicable.

In relation to quality control, some checking had already been carried out, but it was noted that further work was

needed on the current size boundaries of many species. It was recommended that the Secretariat provide current parameters for checking boundaries to the Rapporteurs who would then provide finer scale parameters by fishery, if possible.

Future plans for the Relational Data Base included standardized rules for automation of the catch at size. This system needs to be as flexible as possible, and it was recommended that the Secretariat provide information to the rapporteurs of those species for which age-based assessments will be used in the near future.

The Sub-Committee noted that all the catch tables had been produced using the new relational data base, and that this system ensured that the data on the tables reflected the data currently in the ICCAT data base. It was also noted that an increasing amount of data was being submitted electronically as requested, although formats were still variable.

9. Future plans and recommendations

The Sub-Committee on Statistics recommended that:

1 The LAN of the Secretariat be replaced by an independent network.

2 Paper copies of the ICCAT Collective Volume of Scientific Papers be made available to libraries who had traditionally kept this series, and to a few key people in each Contracting Party.

3 The ICCAT Field Manual be revised in conjunction with revision of ICCAT codes after the completion of the next phase of the relational data base development (probably late 2002 or early 2003) and be made available in electronic format on the Web Page.

4 All countries/entities/fishing entities which operated tagging programs submit their lists of tags, both conventional and archival, to the Secretariat for the completion of the tag inventory, and that a simple reporting format for this be developed and circulated.

5 Two small working groups be formed, one to determine the type of information from archival tags needed to document analyses and the associated information be requested, and the other to work with those who have available observer data, in order to identify the type of data available, the level of aggregation required and to develop a format for such data

6 Standard formats be developed for trade data reports based on statistical document programs and that a small working group be formed

7 Codes for catch types, i.e. catch, landings, live discards, dead discards and transfers of live fish (farming) be established in 2001/2002, but current ICCAT data base codes not be revised until after the integration of the Task 2 into the relational data base

8 Historical catches of less than one metric ton be revised in accordance with original data submissions where possible and future data submissions should include reports of zero catches, by species and strata, where applicable.

9 The Secretariat provide Rapporteurs with current boundaries of size limits for individual species in order for them to provide finer scale information by fishery and with standardized rules for the creation of catch at size.

10. Other matters

The timing of the meeting of the Sub-Committee on Statistics was discussed. While there was some concern that holding the meeting the week prior to the plenary may cause problems for some participants, it was recognized that the issues were becoming too complex to be discussed in depth at the plenary. The Sub-Committee therefore recommended that a meeting be held during the week immediately before the plenary, and the findings of the Sub-Committee be presented and reviewed at the SCRS plenary.

The Sub-Committee also discussed document SCRS/01/137, which proposed the creation of an Atlantic Tuna Atlas, using ICCAT data. While it was recognized that the new data bases were not sufficiently advanced to provide the required output at this stage, it was recommended that the data base system, where possible, incorporate the type of displays and diagnostics suggested in document SCRS/01/137, as well as other such treatment for use by scientists and managers as considered appropriate. It was also recommended that a small working group be formed to determine these. The Secretariat noted that the addition of GIS capabilities, which it was planned to add to the relational data base system next year, would allow for the generation of figures such as those proposed in the document.

11. Date and place of the next meeting

It was agreed that the next meeting of the Sub-Committee on Statistics would be held during the week prior to the next SCRS meeting.

12. Adoption of the report and closure

The report was adopted and the meeting was adjourned.

Addendum 1 to Appendix 9

2001 Agenda of the Sub-Committee on Statistics

1 Opening, adoption of agenda and meeting arrangements
2 Issues regarding catch data submission
  – Task I and Task II
  – Tagging data
  – Revisions to historical data
  – Shark statistics
  – Bluefin Tuna Statistical Document and other trade information
3 Uncertainty in catch data
  – Report on survey of fishery reporting systems
  – Future considerations
4 Issues regarding other data requested by the Commission
  – Observer data
  – Vessel registry
  – VMS
  – Compliance tables
  – SCRS requests
  – Others
5 National and international statistical activities
  – International and inter-agency coordination and planning
  – National data collection systems and improvements
6 Publications
  – Collective Volume of Scientific Papers
  – Data Record
  – Statistical Bulletin
  – Biennial Report
  – ASFA and bibliography
7 Internet issues
  – Web page
  – Secretariat connectivity
8 Review of the conclusions and recommendations from the database monitoring meetings
9 Future plans and recommendations
10 Other matters
11 Date and place of the next meeting
12 Adoption of the report and closure.

Appendix 10

ICCAT RELATIONAL DATABASE SYSTEM (ICCAT-RDB) - EXECUTIVE SUMMARY[1]

1. Introduction

This document summarizes the work carried out by the Secretariat during the first year of the development of the ICCAT-RDB. Detailed information is presented in SCRS/01/040 and SCRS/01/041.

The Report of the *ad hoc* Committee for Advice on ICCAT-RDB Implementation that took place in May 2001, in Madrid (SCRS/01/007), outlines the intermediate development stage of the ICCAT-RDB. A prevision of costs for the next year associated with the ICCAT-RDB development is also made.

2. Databases progress outline

For simplicity, each of the two functionally distinct groups of databases contained in the ICCAT-RDB system (Statistical database group for managing statistical data, and, General Purpose database group for supporting and optimizing the Secretariat work load) is described separately, since they have different goals and priorities. Within each group, a brief description of the work performed and current status of each database is made.

2.1 Statistical databases

Overall, the short-term objectives proposed in the work program for the ICCAT-RDB development (SCRS/00/43 adopting the recommendations of DET/00/STAT) for the first year, were totally achieved. Moreover, some particular tasks scheduled for the second year were already started, due to some minor readjustments made in order to optimize development time. The implementation of each database follows a sequential set of tasks: data collection and processing, prototyping of relational structures, development of software for data migration, validation of migration process, transformation of data into the new relational structure, adjustment and optimization of relational structures, and development of client applications (Data-Center with input and output procedures). Additional databases like biological species catalogue, vessels registry catalogue were stored in temporary databases. Respective client/server databases are in the prototyping phase.

"T1": Database to manage Task-I data

At present, this database is fully operational, and the old version of ICCAT was discontinued in June 2001. The client Data-Center of T1 is fully functional. New modules are expected to be included on a demand basis.

"T2a": Database for catch & effort (Task-II)

This database is presently operating at 60% of its potential. The task currently in progress is the development of the client Data-Center. Nevertheless, minor work is needed in the optimization of relational structures and validation of the migration process. Both database versions (old and new) are working in parallel. The discontinuation of the old version is projected for the end of 2001.

"T2b": Database for size samples (Task-II)

The majority of testing procedures (validation of migration and transformation routines, creation of temporary database containers, etc.) applied to subsets of size samples data (in particular, swordfish and bluefin tuna data) have been carried out. A final migration is the next step forward scheduled for December 2001. If we consider only one species, the existing database is operating at 40% of its overall potential. Both database versions (old and new) are working in parallel. The discontinuation of the old version is scheduled exactly as for T2a.

"Tag": Database for tagging

1 Initially presented to the 2001 meeting as document SCRS/01/016 (by C. Palma).

For this particular database a different approach was used. Given the huge data sets associated with each species, and more importantly, the major data revision carried out (e.g., the revised U.S. tagging database will substitute equivalent data already in the ICCAT database) all the migration processes will be carried out on a species basis. At present, bluefin tuna tagging was completely revised and in the Tag database. Future tasks comprehend the use of similar migration processes for the remaining species. Additionally, this database also contains a catalogue of all the tags acquired by ICCAT up to the present. Rebuilding the distribution of tag sets to ICCAT collaborators over time is one additional future task. A simple geographical plot program was developed to validate the position of releases and recoveries.

"Trade": Database for trade (Imports and Exports) data - BSD and other species

The trade data available at ICCAT Secretariat have never been compiled and structured for integration in a database system. The data available (not always in soft copies) comprise several data sets with different structures and also different levels of aggregation. In consequence, a relatively complex job of raw data cataloging (identification of hard copies and/or soft copies) followed by an exhaustive treatment of similar data sets and finally the integration of resultant data sets in relational database containers is under execution. At present, only information for 2000 was treated and integrated in the database.

"Sharks": Temporary Sharks database, catch & effort and size samples

All the catch and effort data relative to sharks were revised, compiled, transformed and integrated in a temporary database. This database (already in MS-SQL Server) has elementary functionality allowing the insertion and extraction of information in a limited manner. It is working at 30% of its overall potential.

2.2. General purpose databases

This database group was planned to be a complementary set of databases developed for the purpose of serving the Secretariat work. Thus, it is not included in the work program for the ICCAT-RDB development (SCRS/00/43). Nevertheless, considering the strategic position of this database group in the overall Secretariat organization, some work was done in this area during the last six months.

"Contacts": Database to manage ICCAT contacts

A list of contacts, collected during the last 15 years by ICCAT Secretariat, was assembled and integrated in a temporary database for future analysis and revision. A prototype of a relational database structure has already been made.

"DocRegsIO": Database for registration of Entry/Exit of Documents

Its main goal is to register the entry and exit of any kind of document (email, faxes, letters, statistical information) coming and going out to/from the ICCAT Secretariat. A temporary version of this database is already implemented and working as a stand-alone database (with data available since the beginning of 2001). The data stored need a specific treatment process, since new attributes were created to classify each document. A client/Server database needs to be drawn.

"Publications": database for ICCAT publications

The main purpose is to manage ICCAT publications (reference lists, attribution of unique numbers to COM and SCRS documents, and management of document versions). Preliminary sketches were drawn. The existent ICCAT bibliographic database will be integrated in this database in the future.

"Meetings": Database for ICCAT meetings

This database is viewed as an important framework. In practical terms only a small implementation study has been made to date. Its main goal is to manage ICCAT meetings (persons involved, organisms represented, publications associated, etc.).

3. Short term plans

3.1 ICCAT-RDB accomplishments

The statistical database group is planned to be at its full working potential for the 2002 SCRS meeting. Since all of the new databases have been designed to be flexible and modular, several modules are going to be included in some of the databases during the next year.

3.2. Budget for the next year

The total budget estimated for the next year will amount to a total of 15600 $US (Table below). It includes the hardware maintenance and the renewal (or upgrade) of software licenses associated with the database development. In addition, the budget proposal also takes into account the development of Geographical Information System (GIS) framework that will be integrated into the ICCAT-RDB, since the first steps of that implementation have been started already.

Product	*Amount (US$)*
Hardware (maintenance and upgrade)	3,000
Software (Database related)	
Microsoft MSDN Universal subscriptions (Upgrade)	2,500
Borland Delphi 6.0 Enterprise (Upgrade)	2,000
Software (GIS related)	
ESRI MapObjects 2.1 developer kit	5,100
Karto Visual Components	1,000
Geo-referenced objects (shape files)	2,000
TOTAL	**15,600**

4. References

SCRS/01/007 Meeting of the Ad hoc Committee for advice on the implementation of the ICCAT relational database system (ICCAT-RDB).

SCRS/01/040 Current status of ICCAT relational database management system (ICCAT-RDB) – C. Palma.

SCRS/01/041 ICCAT-RDB management system: T1 database (Task 1) status – C. Palma.

DET/00/STAT In press. Report of the first meeting of the Ad Hoc Committee on the design and implementation of the Relational Database System. In, Detailed report of the sub committee on Statistics. Col. Vol. Sci. Pap. LII (5).