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for the
CONSERVATION of ATLANTIC TUNAS

R E P O R T
for biennial period, 1998-99
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INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS

28 CONTRACTING PARTIES (as of December 31, 1999)

Angola, Brazil, Canada, Cape Verde, China, Côte d'Ivoire, Croatia, Equatorial Guinea, European Community, France (St. Pierre & Miquelon), Gabon, Ghana, Guinea Conakry, 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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ICCAT SECRETARIAT

Executive Secretary: Dr. A. RIBEIRO LIMA
Assistant Executive Secretary: Dr. P. M. MIYAKE
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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, 1998-99, Part II (1999)"***, 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 Sixteenth Regular Meeting of the Commission, held in Rio de Janeiro, Brazil, in November, 1999, 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.

Given that the combined length of these reports, the Report for 1999 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.

R. Conde de Saro
Commission Chairman

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(Madrid, Spain - October 11 to 15, 1999)

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STANDING COMMITTEE ON RESEARCH AND STATISTICS (SCRS)

(Madrid, Spain - October 11 TO 15, 1999)

1. Opening of the meeting

1.1 The 1999 meeting of the Standing Committee on Research and Statistics (SCRS) was opened on Monday, October 11, at the Hotel Reina Victoria, in Madrid, by Dr. Joseph Powers, Chairman of the Committee. In his general welcome, Dr. Powers wished the scientists a successful meeting.

2. Adoption of Agenda and arrangements for the meeting

2.1 The Tentative Agenda was reviewed and adopted by the Committee (attached as **Appendix 1**).

2.2 The following scientists served as rapporteurs for the species sections (Agenda item 12) of the 1999 SCRS Report:

Tropical tunas: general		P. Pallares
YFT:	Yellowfin tuna	C. Brown
BET:	Bigeye tuna	N. Miyabe
SKJ:	Skipjack tuna	A. Delgado
ALB:	Albacore	M. Keatinge
BFT:	Bluefin tuna	B. Liorzou
BIL:	Billfishes	E. Prince
SWO:	Swordfish	J. Porter
SBF:	Southern bluefin tuna	Y. Takeuchi
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

3.1 Delegates from the following 18 Contracting Parties were present at the 1999 SCRS Meeting: Brazil, Canada, Cape Verde, China, Côte d'Ivoire, Croatia, European Community, Gabon, Japan, Korea, Libya, Morocco, Panama, South Africa, Tunisia, United Kingdom (Overseas Territories), United States, and Venezuela. Each delegation introduced its members. The List of Participants is attached as **Appendix 2**.

4. Introduction and admission of observers

4.1 Representatives from Iceland, Malta, Mexico, Turkey, the Food and Agriculture Organization of the United Nations (FAO), the Cooperation in the Mediterranean Program (COPEMED), the General Fisheries Commission of the Mediterranean (GFCM), the Indian Ocean Tuna Commission (IOTC), the Secretariat of the Pacific Community (SPC), and Chinese Taipei attended the meeting in an observer capacity and were admitted (see **Appendix 2**, List of Participants). During the Species Groups Meetings, an observer from the Inter-American Tropical Tuna Commission (IATTC) was also present.

5. Admission of scientific documents

5.1 The Committee noted that 150 papers (at the time of opening) had been submitted to this year's meeting, all of which met the criteria for the admission of documents. The List of Documents is given in **Appendix 3**.

6. Review of national fisheries and research programs

BRAZIL: Catch and effort data from Brazilian tuna fisheries are regularly collected via the use of log sheets which skippers are required to complete after each set. Submission of log sheets is mandatory for any vessel (including national and leased) greater than 20 GRT. In addition to log sheets, supplementary information on landings is provided by fishing companies. Prior to November 1998, IBAMA, the "Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis" (Brazilian Institute for the Environment and Natural Renewable Resources) was in charge of managing Brazilian tuna fisheries. In November 1998, the responsibility for all issues relating to highly migratory species (including data collection and submission to ICCAT) was transferred to the Fisheries and Aquaculture Department of the Ministry of Agriculture.

The Brazilian Government is currently undertaking studies on the reproduction, feeding habits, genetics, age and growth of several tuna species, such as skipjack, yellowfin tuna, albacore, swordfish, billfishes, wahoo, and many shark species. These studies are part of the Brazilian Program for the Assessment of the Living Resources in the Economic Exclusive Zone (EEZ), which is the largest national research program on marine science and fisheries ever initiated in Brazil and encompasses a broad range of surveys in oceanic areas off the south, southeast and northeast coasts. Since 1995, surveys have been conducted by several universities and institutions and involve the collection of oceanographic data, as well as fishery-related information from multifilament and monofilament longlines. A telemetry study of swordfish off northeast Brazil is being scheduled for October 1999, and will represent the first of its kind in Brazil. Substantial work has also been done to adapt monofilament longline technology to artisanal and small-scale vessels, with the aim of mitigating harsh social conditions faced by small coastal fishing villages that currently depend entirely on the exploitation of coastal species (see Doc. SCRS/99/35). Data have also been collected from several recreational fisheries where sport tournaments are conducted by local yacht clubs.

CANADA: In 1998, tuna (bluefin, bigeye and yellowfin) and swordfish regulations, consistent with ICCAT Regulatory Recommendations, were in effect in Canada. The Canadian nominal landings of Atlantic bluefin tuna in 1998 were 596.0 MT, leaving 4.7 MT uncaught which will be carried over to the 1999 quota. The Canadian nominal landings of swordfish in 1998 were 1,115 MT, leaving 25.5 mt uncaught which will be carried over to the 1999 quota. In addition, based on data from at-sea Observers on the swordfish longline fleet, a preliminary estimate of the tonnage of dead discards was 16.3 MT of bluefin tuna and 51.7 MT of swordfish. However there are concerns about the validity of the discard estimate in 1998, due to sampling problems (SCRS/99/77). Canada also landed 57 MT of yellowfin, 120 MT of bigeye and 23 MT of albacore.

Research responsibility for the tunas and for swordfish resides at the Biological Station in St. Andrews, New Brunswick. In 1998, pop-up satellite tagging on bluefin commenced in collaboration with Canadian fishermen, and USA scientists and fishermen. Five giant bluefin were tagged. Further improvements were made to the commercial data collection system, and the CPUE series. In 1998, there was 9.4% Observer coverage (by trip) on the fleet fishing for other tunas, although the coverage was not well stratified by time and area.

CAPE VERDE: The most recent estimate of fishing potential of tunas in the Cape Verde EEZ was 25,000 MT (Hallier 1996), even though Cape Verde catches are far from this potential level (3,000 MT). Up to now, it should be noted that while the semi-industrial fleet increased and availability of credit increased, the catches did not increase as expected, but instead declined proportionately from 1997 to 1998.

At present, Cape Verde fishing is essentially artisanal. Of the 1,400 boats (measuring from 4 to 9 m), only 966 have motors. The industrial and semi-industrial fishing vessels average 53 and the majority of these are polivalent. Foreign vessels with EC and Japanese fishing licenses are fish in Cape Verde waters.

Within the overall Cape Verde research program, size sampling on tunas and tuna-like fishes as well as the entry of the sampling data into the data base has continued. Even though the biological sampling of peto and yellowfin is included in the Cape Verde research program, this has been difficult to carry out. Cape Verde also continues to publish an annual statistical bulletin.

CHINA: Chinese catches of tunas and tuna-like species (including sharks) in the Atlantic Ocean amounted to 2,312.5 MT in 1998, which is 1,695.5 MT more than that of 1997. This increase is due to the addition of 12 Chinese flag longliners. The major target species are bigeye tuna, yellowfin tuna and swordfish. Longline is the only fishing method

and the number of longline vessels reached 16 in 1998. Of these, 14 vessels targeted bigeye tuna. A "Tuna Fishery Scientific Research and Working Group" has been established at the Shanghai Fisheries University, whose main objective is tuna research and tuna fisheries management. In March, the Working Group organized a training session aimed at improving the accuracy of statistics and data collection. Participants included managers of all the fishing companies involved in oceanic tuna fishing.

COTE D'IVOIRE: The "Centre de Recherches Oceanologiques (CRO)" is an Ivorian organization under the auspices of the Ministry of Advanced Education and Research. This center is in charge of marine fisheries research in Cote d'Ivoire and is therefore responsible for the research on Atlantic tunas in Cote d'Ivoire, which is a Contracting Party to ICCAT. This summary reports on the activities of this Center as concerns fishery statistics on tunas and other large pelagics in 1998. These activities are broken down into two components: the industrial fishery that the CRO monitors with the IRD (ex-ORSTOM), and the maritime artisanal fishery on large pelagics which is now starting.

The collection of raw data relative to the surveys on the French and Pontesa tuna vessels since 1998 has shown that the total landings were 78,929 MT in 1996, from 50,334 MT in 1997 and from 46,122 MT in 1998. In addition, there were also reported catches of 10,899 MT, 9,221 MT and 9,168 MT of "false fish", which are those fish that were rejected by the factories because they were too small, too salty or too damaged for canning purposes. A comparison of the monthly catches of these landings has shown that, contrary to other years represented by 1996, there has been a decline in the catches landed at the end of 1997 and 1998 in which two moratoria were imposed. This measure has been well followed and the reduction in fishing effort on juveniles that was recommended has also been effective.

The artisanal fishery that catches tunas and other large pelagics on the Ivorian continental shelf was comprised of 100 vessels equipped with driftnets in 1997, and 90 vessels in 1998. These caught a total of 533.3 MT of large pelagic species in 1997 (44.2% marlins, 20.4% sharks, 21.7% tunas, 10.6% sailfish and 3% swordfish) and 331.7 MT in 1998 (33.7% marlins, 11.3% sharks, 32.6% tunas, 16.5% sailfish and 3.9% swordfish).

CROATIA: Over the last two years (1998-1999), the Croatian bluefin tuna fishery has significantly decreased. The reduction is mainly caused by the imposed closed season. As is know, the bluefin tuna fishing season in the Adriatic Sea is only for four months (May to August). Since the closed season has been imposed for purse seiners (the main fishing gear which accounts for more than 95% of all catches) for one of the four fishing months, catches have also declined by more than one quarter. However, all fishing vessels did not respect the closed season throughout the entire period. According to information from fishery inspections, some of those vessels will be penalized since judicial procedures are in process.

The reduction of catches has also been due to the quota system imposed for this type of fishery. Thus, due to such movements in the bluefin tuna fishery, the annual catches are at a level of approximately 900 MT.

The biggest component of the bluefin catches is predicted to come from tuna farms and ranching. Ranching of bluefin tuna has become an important type of marine aquaculture and the farmers are preparing for a fattening period of over one year. If this technological level of bluefin tuna ranching is achieved, the differences among quantities caught (reported catches) and those farmed will be quote significant. For these reasons, it is necessary to stress the need to investigate the bluefin tuna increase in captivity, which should be part of the BYP. It is urgent that the daily increase in weight of bluefin tuna in captivity be determined by scientific methods since the Bluefin Tuna Statistical Documents usually contain information on total weights on harvest. The ICCAT Secretariat as well as government administrators will be unable to control and manage the bluefin tuna fishery and bluefin tuna farming without some knowledge on the daily increases in bluefin tuna weight.

It is also important to point out that the sport and small-scale fishing boats are playing a more important role in this type of fishery, from year to year. The real problem for this type of fishery is how to manage a control system as well as how to obtain data from this fishery.

EUROPEAN COMMUNITY (EC)

EC-IRELAND: During 1998 Irish tuna fishing was exclusively directed at albacore, with some minor by-catches of bluefin tuna and swordfish. A total of nine vessels participated in exploratory fishing trials for tuna: four pairs employed pelagic trawls, three vessels trolling gear, and a single longline vessel. These were in addition to the 18 vessels

participating in the driftnet fishery. The total catch in 1998 amounted to 3,744 MT of albacore. In addition, these vessels caught, as by-catch, 20 MT of bluefin and 26 MT of swordfish. A scientific monitoring program was conducted during the 1998 fishery. This included on-board 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. Results from the sampling program indicate that typical landings from both the driftnet and paired pelagic trawl fisheries are in the size range of 50 – 90 cm, with a median size of 64 cm. These results indicate that both fisheries predominantly target juvenile albacore in the age range of 1 to 3 years old. While the percentage of one-year old fish appears to be greater in the catch of the paired pelagic trawl fleet, the total catch from the driftnet fishery was substantially higher and consequently the majority of albacore taken by Irish fishing vessels in 1998 were 2 years old.

EC-PORTUGAL: The Portuguese catches of tuna and tuna-like-species amounted to 13,979 MT in 1998 which represents a decrease of 21.5% over the catch of 1996 and 41.5% over the catch of 1995. 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 1998, these baitboat fleets caught 8,299 MT in Azores and 3,102 MT in Madeira, which included 6,091 MT of bigeye tuna, 4,594 MT of skipjack, 265 MT of bluefin tuna and 84 MT of albacore.

A longline fleet based at Continental Portugal targets mainly on swordfish and operates in the North and South Atlantic. This catch amounted to 925 MT of swordfish, being 539 MT caught in the NE Atlantic and 386 MT in the South Atlantic.

Since 1990, a fleet of three longliners based in Madeira has been operating in the Eastern Atlantic and in the Mediterranean, catching an average of 300 MT of bluefin tuna per year. A total of 72 MT of bluefin was caught during 1998, which represents a decline of 74.6% over the catch of 1997 and 80.6% over the catch of 1996. These low catches are mainly related to a reduced fishing effort applied in those areas during the past two years by this fleet. One trap has been operating in the South of Portugal since 1995, targeting on bluefin tuna. In 1998, the bluefin catch taken by this trap was 47 MT.

Research programs on tuna are mainly 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. Under the ICCAT Bigeye Year Program (BETYP), attempts to carry out some opportunistic tagging have been made in the Azores and in the Madeira area.

EC-SPAIN: Spanish catches of tunas and tuna-life species in 1998 amount to 106,813 MT, broken down as follows: 31,756 MT yellowfin, 7,231 bigeye, 35,174 MT skipjack, 13,604 MT albacore, 11,353 MT swordfish, 5,800 MT bluefin, and 1,895 MT of other tuna and tuna-like species). As in previous years, considerable effort was made in the collection of the scientific information for ICCAT data requirements. For the species en general, sampling was conducted on more than 310,000 fish (47,916 yellowfin, 50,742 skipjack, 8,825 bigeye, 38,501 albacore, 17,620 bluefin, 136,770 swordfish, and 8,600 various species).

The Spanish fisheries for tropical tunas and Canaries Islands tunas: The Spanish tropical purse seine fishery is directed at yellowfin and skipjack, with by-catches of bigeye and small tunas. The number of vessels has declined by one, as compared to 1997, and is now comprised of 19 vessels. Vessel carrying capacity has also declined to 9,563 MT. Catches increased to 60,549 MT (comprised of: 27,682 MT yellowfin, 27,577 MT skipjack, 4,475 MT bigeye, and 815 MT of other species). A decrease of 34% is noted in the catches by objects, probably due to the time/area closure in effect, mainly due to the decrease in bigeye and skipjack catches. The live bait fishery was comprised of seven baitboats that generally operate on objects ("manchas") and are based at the port of Dakar (Republic of Senegal). The target species are yellowfin, bigeye and skipjack, with total catches of 4,224 MT for all three species combined (251 MT of yellowfin, 3,084 MT of skipjack and 890 MT of bigeye). Effort, in days fishing, was 907 days. In addition, a fishery developed in waters off the Canary Islands and the African coast close to the Islands, by vessels that fish using the live bait fishing method. The number of vessels that operated in 1998 was 381, and these vessels made 3,601 trips, for a duration of 6,745 days at sea. Catches by this fishery amounted to 10,141 MT (comprised of 39 MT of bluefin, 3,259 MT of yellowfin, 313 MT of albacore, 1,034 MT of bigeye, 5,441 MT of skipjack and 55 MT of other species).

The Spanish fisheries for temperate tunas: Catches of bluefin tuna in the Bay of Biscay fishery in 1998 were 2,149 MT. In the Fall, part of this baitboat fleet of northern Spain shifted to the Gulf of Cadiz area (ICCAT Area 58) and caught 55 MT. In the South Atlantic area of Spain and Gibraltar bluefin tuna is caught by trap (1,525 MT), by hand line (26 MT), and by baitboat (54 MT). The Spanish bluefin fishery in the Mediterranean caught 2,000 MT in 1998 (1,573 MT by purse seine, 76 MT by hand line, 253 MT by surface longline, and 4.5 MT by trap.

The total catch of albacore taken by the Spanish surface fleets in the Cantabrian Sea and adjacent waters in the eastern Atlantic to the North of 35°N amounted to 13,404 MT in 1998 (7,346 MT baitboat and 5,834 MT troll). Part of this fleet fished in the western Mediterranean (78 MT).

In 1998, swordfish were caught by the Spanish fleet using surface longline and in the North Atlantic, South Atlantic and the Mediterranean Sea. Total catches were 11,353 MT (9,910 MT in the Atlantic and 1,442 MT in the Mediterranean). Although the number of vessels authorized to fish has remained almost constant as compared to 1997, these vessels have, however, been affected by drastic domestic management measures limiting their fishing activity throughout the year.

As regards the catches of small tunas, there were 300 MT of Atlantic bonito *(Sarda sarda)* and 487 MT of frigate tunas *(Auxis spp.)* were caught in the Mediterranean by traps and surface gears.

With regard to Spanish research and statistics on tropical tunas and Canaries Islands tunas, there were a total of 15 documents were presented to the 1999 SCRS concerning the various tropical tuna fisheries and the Canary Islands fisheries. In the tropical purse seine fisheries, there was a coverage rate of 94% of the catches. There were 106,206 tunas measured. In 1997, a French-Spanish joint project was initiated, whose objective is to analyze the causes for the increase in the catches of bigeye tuna by this fleet, 62 observers were placed on board the tuna purse seiners for a total of 2,706 days at sea with 1,884 sets. In 1999, two new projects ("Esther" and "Tess") have started between the IRD and the IEO to study the development of the fishing power of the Spanish-French tropical purse seine fleet, as well as to review the current data bases on tropical tuna and incorporate these into future European laboratory on tunas (ORDET). The coverage of the baitboat fleet is estimated to be close to 100%. In the Canary Islands area, 11,396 fish were sampled. In 1999, three bigeye tagging cruises were carried out in Canary Islands-African waters, within the framework of the BETYP, and 1,139 bigeye, 55 yellowfin, 4 skipjack and 1 bluefin tuna were tagged, of which 96 have been recovered .

Research and statistics on temperate tunas in the Cantabrian Sea included stratified biological sampling carried out on 3,908 fish ages 1 to 5 (3% coverage rate), and the collection of 407 fin ray spines to determine age (SCRS/99/114). In the Spanish South Atlantic region and the Mediterranean, ICCAT data were obtained from the surface longline fisheries, traps, purse seine, Japanese type longline, hand line, baitboat, troll and other surface gears, by time/area strata. Size samples were taken from 9,263 fish (of which 3,697 fish were sexed) in the Atlantic area of the Strait of Gibraltar and 4,440 fish (1,251 sexed) in the Mediterranean. The observer program on board longliners continued. The DG-XIV-97/29 Projects on the sexual maturity of bluefin tuna also continued, as did the FAIR Project-97/3975 on bluefin tuna tagging using pop-up satellite type tags (32 adult bluefin tagged) in the Barbate (Spain) trap. The DG-XIV-95/10 Project on the distribution of juvenile bluefin tuna has terminated. The IEO (Spain) and INRH (Morocco) Project (SCRS/99/93), financed by the FAO-COPEMED, in the Strait of Gibraltar and Alboran Sea area has carried out a joint study on the overall trap fisheries of these two countries.

Research and statistics conducted by Spain on albacore included surveys and sampling carried out at the major landing ports (8,134 fish sampled from baitboats and 30,501 fish from trollers). Standardized CPUE indices were obtained for ages 1-4 (SCRS/99/115) and research continued on the effect of environmental factors and the catches of the surface fisheries.

As concerns research and statistics on swordfish, a total of 10 papers on swordfish and by-catch species in the Atlantic and Mediterranean were presented to the Swordfish Stock Assessment Session and the Species Groups Sessions held in 1999. These documents dealt with a description of the fisheries (SCRS/99/75), indices of standardized CPUE in biomass, by age and by sex in the North and South Atlantic (SCRS/99/32 and 56), methodology for the calculation of catch by size and sex (SCRS/99/94), the possible relationship of recruitment levels with environmental factors (SCRS/99/57), tag-recapture (SCRS/99/113), and the swordfish feeding (SCRS/99/128). In addition, Spanish scientists participated in the preparation of papers with scientists of other countries (SCRS/99/88 and 129). Documents were presented on preliminary scientific estimates of the levels of landings of species considered as by-catches, associated with the fishing activities of surface longliners during the 1988-1998 period, on tunas (SCRS/99/110), on billfishes (SCRS/99/112), and on preliminary scientific estimates of by-catch species other than tunas and tuna-like species caught in 1997 and 1998 (SCRS/99/82). There were 126,427 swordfish sampled (34% of the fish caught). There were 7,000 swordfish sexed and the tagging of

swordfish and associated species has continued. As regards swordfish in the Mediterranean, ICCAT task data were prepared for the surface longline fishery and observer activities continued on board longliners in the Mediterranean (DG-XIV-97/74 Project).

Spanish research and statistics on small tunas were carried out within the DG-XIV-96/93 Research Project, which continued to study the biological parameters (spawning, growth and stock structure) of these species and to evaluate the impact of the purse seine gears directed at clupeidae on the small tuna species.

Other activities in research and statistics on tropical tunas included the monitoring of the purse seine fleet that operates in the Atlantic Ocean was carried by monitoring the eight of these vessels and by periodic size sampling. The data were collected and presented to ICCAT under NEI.

JAPAN: At present, longline is the only tuna fishing method used by Japan in the Atlantic. The Japanese longline fishery operates covering a vast area between 60°N to 50°S. However, the areas fished in the recent years are mostly in the eastern side of the Atlantic, reflecting target species. Bigeye has been a primary target species which accounts for a major part of the total catches (about 70%), followed by yellowfin tuna, swordfish, bluefin tuna and southern bluefin tuna in order of importance of the catch. The Japanese longline catches in 1998 and 1997 were similar, except for a decline in bigeye catches by about 5,000 MT in 1998. The provisional total Japanese catch (excluding sharks) in 1998 in the Atlantic and Mediterranean Sea is 38,300 MT, a slight decline (1,700MT,) from 1997. There was noticeable change in major fishing ground, and a shift of fishing effort to the tropical area North of 5°N from 1997 to 1998 which resulted in an increase in swordfish catches from the area North of 5°N.

As for Japanese research activities in the Atlantic, Japan participates in the ICCAT Bigeye Year Program, which the Government of Japan is partly financing. It is planned to send a Japanese research boat in 2000 to the tropical Atlantic in support of this Program. General biological sampling for bigeye by observers on-board Japanese longline boats was started also in support of this Program. Regarding the Bluefin Year Program, archival tagging is scheduled to take place in Croatia in October, 1999, for farm cultured fish ranging from 15 to 20 Kg.

KOREA: In 1998, five Korean tuna longliners were engaged in fishing activities in the Atlantic Ocean and the total catch from these vessels amounted to 290 MT, which represents a decrease of 85% as compared to the previous year. The decrease in catch was due to the decreased number of fishing vessels that operated in this ocean. Bigeye and yellowfin tunas made up the major component of the total catch, accounting for 56% and 22%, respectively.

The catch of bigeye tuna decreased from 796 MT in 1997 to 163 MT in 1998 and yellowfin tuna catches amounted to 65 MT, a decline of 75% from the previous year's catch. A minor quantity of other tunas and billfishes were also caught by longliners.

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

MOROCCO: Tuna catches by Morocco in 1998 amounted to 13,440 MT, of which about 65% were caught in the Moroccan Atlantic. In terms of weight, small tunas comprised 65% of the total catches, followed by swordfish (25%) and bluefin tuna (12%). Research by Morocco, which was carried out by the INRH with the support of the FAO-COPEMED project, centered on studies on the biology and the major tuna species.

SOUTH AFRICA: South Africa's tuna fishery remains largely a bait boat fishery targeting for albacore. During 1998, South Africa issued permits to longline vessels from Japan (86) and Chinese-Taipei (24) to fish for tunas (and associated species) within the South African EEZ, in terms of bi-lateral fisheries agreements. Further details of the South African tuna fishery can be found in documents SCRS/99/038 and SCRS/99/120.

Annual albacore catches have varied between 3 and 8 thousand MT since 1985. The magnitude of the annual catch depends largely on the availability of albacore in the near shore waters fished by the South African fleet. This variability is thought to be driven more by environmental factors than by biomass levels. A logbook reporting system has been in

place since 1985, but there is substantial under-reporting in some years. Export records are regarded as the most accurate record of the annual albacore catch, because the majority of the catch is exported. Export data were used to revise the reported catches from 1993-1996, and will be used to estimate annual catches reported to ICCAT in the future. Length frequency sampling of the catches is undertaken.

Until recently, access to swordfish stocks was reserved for recreational fishermen by national legislation. There was an insignificant incidental by-catch in the shark longline and demersal trawl fisheries. Local demand for commercial access to the swordfish resource has increased since 1990, prompted by the catches taken in the South African EEZ by foreign fleets, and a pelagic longline fishery was started in November 1997. Some of the vesels in this fishery are equipped with vessel monitoring system (VMS). Although primarily intended as a tuna directed fishery, about 70% of the catch is swordfish. The total swordfish catch by South African vessels in 1998 was 468 MT, some taken in the ICCAT convention area, but most taken in the IOTC area. Length frequency sampling of the catches is undertaken, and tissue samples have been collected for genetic analysis. South Africa initiated an observer scheme in 1998, and it will be expanded in 1999. The scheme will target both local and foreign vessels fishing within the South African EEZ.

At the 1998 ICCAT commissioners meeting, the four parties participating in the fishery for southern albacore (Brazil, Chinese-Taipei, Namibia and South Africa), were requested to submit bimonthly summaries of catches to South Africa in order to monitor progress toward filling the ICCAT recommended TAC for southern albacore. Some of the participating parties have not submitted albacore catch data to South Africa. Catch information submitted to date is summarized in Table 2 of document SCRS/99/120.

UNITED KINGDOM (OVERSEAS TERRITORIES): The Bermuda commercial fishing fleet continues to direct most of its fishing effort towards pelagic species. In addition to the artisanal fleet which fishes primarily around the Bermuda seamount and off-shore banks, there are a small number of purpose-built local longliners which fish throughout Bermuda's 200 mile EEZ and in international waters. All Bermuda-based longliners are equipped with an Andronics satellite-based vessel monitoring system (VMS). The longliners target swordfish, bluefin tuna and yellowfin tuna although catches of other tuna species such as albacore and bigeye are observed. Landings of these longliners are regularly sampled for biological data and tissue samples for genetics research as well as for compliance with ICCAT recommendations. The total catch of tunas and tuna-like species in 1998 was 184 MT. The dominant species in the local catch is wahoo with landings of 108 MT followed by yellowfin tuna with 53 MT. An age and growth study of wahoo is ongoing as are tagging studies of wahoo, yellowfin and blackfin. In addition, Bermuda is involved in several cooperative regional genetics studies.

Bermuda continues to be actively involved in the ICCAT Enhanced Research Program for Billfish and this past summer co-sponsored a pilot study involving the use of pop-up satellite tags to evaluate post-release mortality of blue marlin working with Bermuda charter fishing vessels. The results of this study are reported in SCRS/99/97.

UNITED STATES: Total (preliminary) reported U.S. catch of tuna and tuna-like fishes (including swordfish, but excluding other billfishes) in 1998 was 26,631 MT. This represents a decrease of 2,883 MT (10% decrease) from 1997. Estimated swordfish catch (including estimated dead discards) decreased 185 MT to 3,655 MT, and provisional landings from the U.S. fishery for yellowfin in the Gulf of Mexico decreased in 1998 to 2,006 from 2,634 in 1997. The estimated 1998 Gulf of Mexico landings of yellowfin accounted for 36% of the estimated total U.S. yellowfin landings in 1998. U.S. vessels fishing in the northwest Atlantic landed an estimated 1,234MT of bluefin, a decrease of 99 MT compared to 1997. Provisional skipjack landings increased by 21 MT to 105 MT from 1997 to 1998, estimated bigeye landings decreased by 208 MT compared to 1997 to an estimated 928 MT in 1998, and estimated albacore landings increased from 1997 to 1998 by 249 MT to 830 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 1997 and 1998 focused on several items. Research on development of methodologies to determine the genetic discreetness of large pelagic fishes in the Atlantic was continued. Larval surveys for bluefin tuna and other large pelagics in the Gulf of Mexico was continued. Research continued on development of robust estimation techniques for population analyses. Research was also continued on approaches for characterization of uncertainty in assessments and methods for translating that uncertainty into risk levels associated with alternative management approaches. U.S. scientists also continued to coordinate efforts for the ICCAT Enhanced Research Program for Billfish and for the Bluefin Year Program. Cooperators in the Southeast Fisheries Center's Cooperative Tagging Program tagged and released 2,499 billfishes (swordfish, marlins and sailfish) and 2,383 tunas in 1998. This represents

a decrease of 23% from 1997 levels for billfish, and a increase of 21% for tunas. Cooperative research was conducted with scientists from other nations on both spawning and indices of abundance for yellowfin tuna.

VENEZUELA: In Venezuela, the industrial tuna fishery is carried out by three gear types: purse seine, baitboat and longline. In addition, there are artisanal fisheries that target tunas and tuna-like species using driftnets and surface longline as the fishing gear.

In 1998, catches by the industrial fleet were 19,847 MT, of which 71% was taken by the purse seine fleet, 18% by baitboats, and 11% by the longline fleet. The most important species in the catches is yellowfin, comprising 65% of the purse seine catches and more than 80% of the baitboat and longline catches. The second most important species is skipjack tuna, comprising more than 20% of the purse seine and baitboat catches.

Research continued at the institutes that collaborate in the ICCAT Enhanced Research Program for Billfish, including studies on yellowfin spawning, and the seasonality of the different billfish species caught by the Venezuelan fleet. Biological sampling continued on gonads and hard parts of swordfish, billfishes and dolphin fish.

OBSERVERS

ICELAND: One Icelandic longline vessel started operating in bluefin tuna fisheries late in the year 1998 and the total catch taken by Icelandic boats was seven fishes weighing less than 2 MT in that year. Since the year 1996, however, Japanese longline vessels have been given permission to catch part of their ICCAT quota within the Icelandic EEZ. Icelandic authorities have used this opportunity to achieve information on the bluefin migrating into Icelandic waters and research program has been conducted under supervision of The Marine Research Institute of Iceland.

Observers were stationed on board all the Japanese vessels while fishing in Icelandic waters. They collected data on catch statistics in all years (fish lengths and weights, sex, location and date) and biological samples were collected in the year 1998 (stomach contents, vertebrae for age reading, gill tissue for genetic research).

Results from these investigations were presented at SCRS bluefin tuna species group meeting (SCRS/99/74). Total number of fish in the years 1996, 1997 and 1998 was 89, 1610 and 2282 weighing 12.0, 185.6 and 246.8 MT (gilled and gutted weight), respectively. The number of fish caught per fishing day in each year was 2.6, 9.5 and 5.8 respectively. Fork lengths ranged from 80 to 299 cm but mean length from all years was 121cm. Age was estimated for 116 fish and ranged from 4 to 17 years. Preliminary results of diet analyses from 147 fish show frequency of occurrence for fish, squid and crustacea of 62%, 69% and 53% respectively and numerical frequencies for the same prey groups were 13%, 9% and 78%.

MALTA: Fishing for bluefin tuna has been undertaken by Maltese fishermen for a very long time. The bluefin tuna fishing season in Malta starts in the month of May and extends until July.

In 1998, tuna were targeted by 52 multi-purpose vessels (less than 20 m in length) and by 150 full time and part time fishermen. The total landings for 1998 amounted to 245 MT, of which 45% was exported to Japan.

The fishing gear used originally included the "Tonnara", while now the only fishing gear is the drifting surface longline. Bait includes Atlantic mackerel and Japanese squid. At the beginning of the season, i.e May, effort is exerted mainly in the southwestern area of the region, and later further to the East, following the normal movement of bluefin tuna. The potential sampling size per boat per season for Maltese fishermen is approximately 80 bluefin tuna and ranges between 50 and 100 bluefin, depending on the year.

MEXICO: The Mexican longline tuna fishery in the Gulf of Mexico is a developing fishery. The target species is yellowfin tuna and there are annual catches close to 1,000 MT.

National regulations on this fishery establish mandatory coverage of 100% of the fishing trips with scientific observers on board the fleet. The information collected includes catch data on all the species (retained on board, discarded alive and dead discards), fishing effort exerted, biological sampling, environmental parameters, technological aspects, as well as observations of marine mammals and marine turtles.

As regards collaboration in scientific research, Mexico provides statistical data on the fishery to ICCAT. In addition, Mexico collaborates with the National Marine Fisheries Service/NOAA of the United States in the "Cooperative Research Plan on Pelagic Fishery Issues in the Gulf of Mexico", within the framework of the MexUS-Gulf Scientific and Technological Cooperation Agreement.

At the national level, research is being carried out on the time-area distribution and abundance of bluefin tunas, in relation to environmental parameters such as seas surface temperature.

TURKEY: The University of Istanbul, Faculty of Aquatic Products, has been carrying out intensive research on tunas in Turkish waters since 1993. Doctoral theses on bluefin tuna, swordfish, Atlantic black skipjack (little tuna) and bullet tuna in Turkish waters have been completed.

Two larval surveys covering the Sea of Marmara and the Aegean Sea were carried out in 1998 on board the Faculty research vessel, with financial support provided by the Turkish Scientific Research Fund and the Istanbul University Research Fund. Collaboration on genetics research was carried out between the University of Istanbul and the Universities of South and North Carolina. A tagging program on Atlantic bonito covering the Black Sea, the Sea of Marmara and the eastern Mediterranean Sea will begin in due course.

As the eastern Mediterranean Sea is not yet included in the COPEMED Program, it is strongly recommend that Turkey be included in this research Program.

CHINESE TAIPEI: Chinese Taipei currently only operates a longline fishery in the Atlantic Ocean and the Mediterranean Sea. There were 195 longliners in operation in 1998, slightly less than the 1997 level. The total 1998 catch taken by the fleets was estimated at 45,000 MT (preliminary), a continuous decrease of about 7,000 MT from 1996 and 1997 levels. An overall decrease was observed in the catches of the main species.

Albacore was caught all year round in the entire Atlantic Ocean. The preliminary total catch in 1998 was estimated as 19,204 MT. Of this amount, 3,098 MT were caught in the north Atlantic, and 16,106 MT in the south Atlantic, which represents a decrease of about 2,000 MT from the 1997 level.

Bluefin tuna were caught mainly in the Mediterranean and the adjacent eastern Atlantic. Total bluefin tuna catches made in 1998 were 456 MT, a decrease of 50 MT from the 1997 catch. The amount was less than 75% of the 1994 catch.

Bigeye tuna catches were estimated as 16,314 MT, a decrease of about 3,000 MT from the 1997 level. Yellowfin tuna catches amounted to 5,328 MT in 1998, an increase of 1,000 MT as compared to 1997. Swordfish catches in the entire Atlantic were 1,433 MT in 1998. Of this amount, 286 MT were caught in the North Atlantic and 1,147 MT in the South Atlantic.

To increase the accuracy of the catch statistic and for a better understanding of the fishery, a pilot observer program to survey by-catch species was carried out. This survey was conducted from mid-November, 1997, to early March, 1998, on a longline vessel operating in the Atlantic. Shark statistic reported by fishermen in the logbook system were aggregated for all species. To improve this, a sampling program was adopted in 1998. The program focused mainly focus on the catch observations on by-catch species. There were eight sampling trips conducted, of which two were carried out in the Atlantic.

Chinese Taipei has participated in ICCAT activities since 1970, and has continuously provided catch statistics since 1973. Chinese has in the past and will continue to cooperate and endeavor to implement the resolutions and recommendations adopted by ICCAT. Details are documented in SCRS/99/131.

7. Review of the ICCAT Bluefin Year Program (BYP) - activities, progress and future plans

7.1 The Bluefin Year Program (BYP) East Atlantic Coordinator, Dr. B. Liourzou, and the West Atlantic Coordinator, Dr. G. Scott, reported to the Committee on the research activities carried out in 1998 and 1999, under the auspices of the Program. The 1999 Report of the BYP is attached as **Appendix 4**.

7.2 The Committee noted that good progress had been made in the field of electronic tagging, but that there was still a need to reinforce the tagging network, in order to avoid the loss of valuable tags and information, particularly in Italy. These electronic tags provided useful information on the level of mixing rates between the two sides of the Atlantic, and the Committee agreed that further coordination between the east and west Atlantic was needed.

7.3 Samples were being collected and exchanged within and between the east and west Atlantic for genetic and other analyses. As agreed in 1998, the University of Gerona (Spain) had become the storage center for biological samples for the east Atlantic. It was noted that the cold storage freezer at this center had still not been purchased and it was recommended that this be done within the current budget as planned.

7.4 It was agreed that the priority areas for research in 2000 should be stock structure and electronic tagging.

7.5 The Committee recognized that substantial savings had been made by operating the BYP in conjunction with several EC and COPEMED projects. However, it was stressed that such savings should not be taken for granted in the future, and therefore the same level of funding was requested for 2000 as had been approved for 1999.

7.6 At a later session, the Executive Summary of the BYP and the Plan for 2000, which had been discussed among the pertinent scientists, was presented to the Committee, and accepted after discussion. The Executive Summary is included in **Appendix 4.**

7.7 The Committee draws the attention of the Commission to Tables 1 and 2 of the Executive Summary of the BYP, which shows the 1999 budget balance sheet and the proposed budget for 2000. The major part of the 2000 budget can be covered by the unused balance from 1999, which will be short by US$12,481. The Committee recommends that this amount (about the same level as the 1999 Commission funding) be funded by the regular Commission budget in 2000. Since the BYP is providing very important biological information, and since considerable savings have been made in past research from outside funding, the minor contribution at such a level would produce a good return from the Program.

8. Review of the ICCAT Bigeye Year Program (BETYP), activities, progress and future plans

8.1 The Bigeye Year Program Coordinator, Mr. G. Fisch, reported to the Committee on the activities started to date under the BETYP. A meeting of the BETYP coordinating group was held in Madrid in January 1999 to draw up a tentative plan for 1999, and to decide on the responsibilities of the BETYP Coordinator (SCRS/99/22).

8.2 Since Mr. Fisch assumed his position in June, 1999, he has initiated the necessary contacts for contracting fishing vessels for tagging cruises in Azores, Madeira, Canary Islands, Senegal and Ghana. Tags had already been ordered by the Secretariat for the BETYP, and tagging started in several areas, under the agreements outlined in document COM-SCRS/99/18.

8.3 The Committee noted that the funding by EC, Japan, Chinese Taipei, the Canary Islands, Madeira and Azores had only been formally committed in early 1999, and that this commitment had only been made for one year. The amount received in 1999 was less than originally proposed, and for this reason the Program Plan had been modified in accordance with this reduced funding.

8.4 The Committee expressed their thanks to Dr. J. Hampton, from SPC who, at the request of the BETYP Working Group, provided valuable advice on tagging. Dr. Hampton's contribution is submitted as document SCRS/99/149.

8.5 Mr. Fisch also presented the BETYP plan for 2000, which mainly consisted in more concentrated tagging cruises. The Committee agreed that this level of tagging was necessary in these areas, but care should be taken to monitor tagging cruises in Ghana, in order to ensure that the program is effective. It was also planned to expand activities to the use of pop up tags in 2000, and to collect samples for genetic sampling and hard parts analysis. The research vessel, provided by Japan, is scheduled to undertake activities on bigeye tuna during 2000-2001.

8.6 The BETYP plan for 2000 also allowed for the possibility of tagging skipjack during the campaign, as it was hoped that this would not imply any additional costs other than the tagging materials, which could be assumed within the ICCAT regular budget. The Committee, however, stressed that efforts should first be concentrated on bigeye tuna, in accordance with the aims of the Program.

8.7 It was noted that the Program Plan proposed by the BETYP for 2000 was dependent on the confirmation of the tentative commitment of funds from Japan and the EC, to a level similar to 1999 funding. Further funding sources would be explored by the BETYP coordinator and the ICCAT Executive Secretary during the year. The BETYP progress report and Program Plan for 2000 are attached as **Appendix 5**.

9. Review of the ICCAT Program of Enhanced Research for Billfish

9.1 Dr. E. Prince, West Atlantic Coordinator, presented a progress report on the Enhanced Billfish Research Program which summarized the results of activities in both the east and west Atlantic in 1999. Dr. Prince regretted the delays that staff shortages had caused in entering Venezuelan observer data in the base, but added that the data up to 1997 had now been provided to the Secretariat. Dr Prince also reported on the financial aspects of the Billfish Research Program in 1999.

9.2 Dr. Prince later introduced the Billfish Program Plan for 2000, and the necessary budget. It was noted that the authorizing of certain expenditures, such as the on site training of samplers and the collection of statistical and biological samples, depended on additional funds being available.

9.3 The Progress Report for 1999 and the Plan for 2000 was accepted by the Committee and is attached as **Appendix 6**. The Committee wished to draw the Commission's attention that the major part of the Billfish Program Plan for 2000 will be covered by external, voluntary funding (including from the private sector). The Committee recommended Commission's funding at the same level as in 1999. In order to obtain outside funding, the Committee would like to point out that the Commission's funding is essential as "seed money".

10. Reports of scientific meetings in which ICCAT was involved

10.1 **General Fisheries Commission for the Mediterranean (GFCM)**. The Assistant Executive Secretary, Dr. P. M. Miyake, who represented ICCAT at the 1999 GFCM meetings (FAO Headquarters in February and June, and in Alicante, Spain, in July) informed on the recent reorganization of the GFCM as an autonomous fisheries management body (see COM-SCRS/99/14). Dr. Miyake indicated that the newly formed Scientific Advisory Committee (SAC) was closely structured to ICCAT's SCRS. In response to the GFCM's request that a joint GFCM-ICCAT stock assessment on Mediterranean swordfish be carried out in 2000, Dr. Miyake reiterated the need that substantial new data be available to warrant an assessment, and such data are currently not available. It was noted that Malta has offered to host this meeting in March, 2000. Another issue at the 1999 GFCM meetings which has significant relevance to ICCAT was that the lack of a quorum at the meeting prevented GFCM's adoption of the 1998 ICCAT management measures.

10.2 **18th Session of the Coordinating Working Party on Fisheries Statistics (CWP)** - (Luxembourg - July 5 to 9, 1999). The ICCAT Executive Secretary, who chaired the CWP meeting and also represented ICCAT, presented an overview of some of the issues discussed, such as the harmonization of the data base between regional agencies, plans for an internet interactive link among the agencies' data bases, discussions on the definition of the nationality of catches, and the developments in the collection of shark statistics. Details can be found in document COM-SCRS/99/15.

10.3 **First Inter-Tuna Agency Meeting** (Luxembourg - July 10, 1999). Dr. P. M. Miyake summarized the results of this half day meeting in which representatives from IATTC, CCSBT, SPC, IOTC and ICCAT participated. Items discussed included the monitoring of flag of convenience fleets among oceans, posting of interactively linked information on the tuna agencies web pages (i.e. catch data including geographical and temporal information, meeting schedules, management regulations and meeting reports).

10.4 **7th Expert Consultation on Indian Ocean Tunas** (Mahe, Seychelles - November 9 to 14, 1998). Dr. P. Pallarés (EC-Spain) represented ICCAT at this meeting. She summarized the main points of her report (see Document SCRS/99/25), relative to the objectives of the Consultation, where were to review the current status of the Indo-Pacific Tuna Development and Management Program (IPTP) and develop proposals on the structure and functioning of the Scientific Committee of the Indian Ocean Tuna Commission (IOTC).

10.5 **11th ICES Dialogue Meeting** (Nantes, France - January 26 & 27, 1999). Dr. J. Powers, the SCRS Chairman, represented ICCAT at this meeting. This informal meeting dealt primarily with the relationship between scientific advice and fisheries management and reiterated the importance of communication between administrators and scientists and

fisheries constituencies. Discussions centered on the precautionary approach, the form and nature of scientific advice, and confidence building. Dr. Powers' report is presented as SCRS/99/26.

10.6 **IATTC Working Group on Fish Aggregating Devices (FADs)** - (Guayaquil, Equador - June 7, 1999). ICCAT was represented by Mr. J. Ariz (EC-Spain). His report (see SCRS/99/27) summarizes the discussions of the Working Group, how the massive deployment of FADs has affected catches, particularly bigeye catches, in both the Pacific and the Atlantic. The Group stressed the need and importance of such programs as ICCAT's BETYP and within that framework, the tagging activities are of particular relevance.

11. Reports of the Ad Hoc Working Group on the Precautionary Approach

11.1 The Convener of the Working Group on the Precautionary Approach, Dr. V. Restrepo, briefly summarized the findings of this Working Group which met in Dublin, Ireland, in May 1999. The objectives of this meeting was to develop a discussion document on what "precautionary approaches" means in the context of the assessment and management of the stocks under ICCAT mandate. The report of the Working Group was presented to the Committee as COM-SCRS/99/11.

11.2 Dr. Restrepo thanked the species rapporteurs for their help in filling out the questionnaires which had served as a basis for the discussions of the Group. He highlighted two of the recommendations from the Report which related directly to the work of the SCRS, that "the SCRS should develop clear guidance for reporting stock status, particularly in reference to (long term) sustainable levels and to MSY-related benchmarks" and that "simulation studies...should be undertaken in order to facilitate the definition of limit reference points by ICCAT, by stock, in accordance with the precautionary approach".

11.3 Dr. L. Kell introduced document SCRS/99/91 which described a preliminary simulation model based on east Atlantic bluefin tuna developed using flexible software that allows the implications for management of a variety of plausible hypotheses about stock and fishery dynamics to be explored. In response to doubts expressed as to the model's ability to take into account all the factors relevant to highly migratory and viscous stocks, Dr. Restrepo stressed that this model was only one example using one species, but that such models could be adapted and modified according to the characteristics of the various stocks, and invited interested scientists to attend a demonstration of the running of the simulation model.

11.4 The Committee noted that the FAO Consultation on Tuna Precautionary Approaches is scheduled for early 2000 in Thailand. Four working groups are currently working and drafting reports to present to the final Consultation, and many ICCAT scientists are participating in these working groups and Steering Committees.

11.5 At a later session, the Executive Summary Report of the Working Group was presented to the Committee. The Committee reviewed it and adopted the Summary, which is attached as **Appendix 10.**

12. EXECUTIVE SUMMARIES ON SPECIES:

YFT - YELLOWFIN TUNA

No new assessment was conducted for yellowfin as the Tropical Tuna Species Group centered its effort on bigeye this year. The conclusions reported here generally reflect the results of the last assessment. However, there have been substantial revisions to historical catches since that assessment, largely due to new catch information which has become available, which the Committee has accepted provisionally. The text of this report has been updated as necessary, primarily to address these catch changes.

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 eastern Atlantic where several recaptures are recorded each year. Taking into account this east-west transatlantic migration, 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 (Atlantic Yellowfin Working Group; Tenerife, 1993). The main spawning ground is the equatorial zone of the Gulf of Guinea, with spawning occurring from January to April. In addition, preliminary information on yellowfin tuna spawning in the western central Atlantic indicated a protracted spawning season from May to November in the Gulf of Mexico and southeastern Caribbean Sea. 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, to return to the east Atlantic fishing grounds for spawning when they reach about 110 cm. A 40-year time series of longline catch data shows 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 0.8 for ages 0 and 1, and 0.6 for age 2 and older.

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 45°N and 40°S 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. 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, Mauritania and the Canary Islands developed a new fishing method in which the baitboat acts as a floating object to attract bigeye, but also yellowfin and skipjack. 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). 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 young yellowfin and by-catch, extending the fishing grounds westward to 30°W and south of the equator.

Large yellowfin are caught by purse seiners and longliners. However, deep longlines, which began being used in the early 1980's, mainly target other species (bigeye, swordfish, and bluefin) and therefore the proportion of yellowfin caught by longliners in the Atlantic is becoming less important (in 1998, it amounted to 12% of the total). Amounts caught by this gear are similar between the east and west Atlantic.

Yellowfin catches in the Atlantic as a whole reached an historical high in 1990 (191,800 MT), but have since declined by 23% to 147,400 MT in 1998 (**YFT-Table 1**). However, the relative contributions of the various gear types have remained similar (**YFT-Figure 2**). In the east Atlantic, landings reached a high of 138,000 MT in 1981 and 1982, then declined to a low of 77,000 MT in 1984, gradually increasing to a new record of 157,000 MT in 1990, and subsequently fluctuating between 104,000 MT and 126,000 MT. During the past 5 years, the distribution of catches among gears has remained fairly stable in the eastern Atlantic, with an average of 78% of the catches being taken by purse seiners, 13% by baitboats, and 7% by longliners. In the west Atlantic, total catches fluctuated between 25,000 and 39,000 beginning in 1982, reached a high of 46,000 MT in 1994, and then declined to 25,300 in 1998. During the past 5 years, the distribution of catches among gears has fluctuated widely in the western Atlantic, with an average of 34% of the catches being taken by purse seiners (ranging between 19% and 43%), 17% by baitboats (15%-24%), and 26% by longliners(19%-32%).

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 3-5% 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 has declined from a high of 45,500 standard fishing days in 1983 to an average of 35,200 standard fishing days for the period 1991-97.

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 (but note that the catch of age 0 in 1997 is an over-estimate due to substitution problems). Catches of ages 2-5 have been relatively stable over time. Catches have been similar in magnitude for ages 2-4, but there is a substantial reduction in catch from age 4 to age 5+.

A potentially important change in the fishery has been a voluntary moratorium, by Spanish and French tuna boat owner's associations, on fishing on floating objects during November 1997-January 1998 and again from November 1998-January 1999 in the region between 5° N and 4° S and east of 20° W. Preliminary examination of the effects of the moratorium suggests a redistribution of effort outside of this area or toward free-swimming schools, increasing catches of larger yellowfin. There was an overall reduction by 40% of floating object sets compared to the period before the moratorium. The catch of small yellowfin was reduced during the moratorium; however, an increase of small yellowfin catches in the rest of the year resulted in annual small yellowfin catches which were similar to years prior to the moratorium. The effect of the moratorium on the estimated fishing mortality levels will be more fully evaluated during the next assessment.

YFT-3. State of the stock

A full assessment was last conducted for yellowfin tuna in 1998, using various production models and several types of VPAs.

The MSY estimated from equilibrium production model analyses based on the assumption of a 3% annual increase in purse seine fishing efficiency (which translates into an overall increase of 66% since 1981) was 155,800 MT, and the corresponding effort was 61,300 standard days (**YFT-Figure 4**). The MSY obtained using a 5% increase in efficiency (an overall increase of 134% since 1981) was 147,500 MT, and the corresponding effort was 56,600 standard days. The most important difference between the two scenarios is the relationship of catch and effort in recent years to the equilibrium MSY and effort levels. Both estimates of MSY are higher than the preliminary 1997 landings of 130,800 MT. However, for the 3% scenario, current effort is somewhat below the MSY level, whereas for the 5% scenario, it is somewhat above the MSY level. A non-equilibrium production model using the same CPUE index with a 3% annual increase in efficiency resulted in an estimate of MSY of 151,700 MT (a level between the two estimates of MSY from the equilibrium production model) and a 1997 biomass of 117% (range 92% to 135%) of B_{MSY}. The corresponding fishing mortality rate was 73% of F_{MSY}. The effects of higher rates of increase in efficiency were not tested; however, in general, higher assumed annual rates of increase in efficiency will result in higher fishing mortality ratios and lower biomass ratios. Thus, if an annual

rate of increase in efficiency of 5% were to have been assumed, both the fishing mortality ratio and the biomass ratio are likely to have been closer to, or beyond, equilibrium MSY levels.

VPA analyses were also based on the purse seine index assuming a 3% annual increase in efficiency, although sensitivity analyses using indices from other fisheries were also considered. Results are compared in **YFT-Figure 6** for four alternative scenarios, based on three models which differed in terms of methods of tuning and treatment of the plus group. Although absolute numbers vary, the four scenarios show very consistent relative trends. These analyses indicated that recruitment has fluctuated without trend, while spawning biomass decreased in the early to mid 1980's due to increasing fishing mortality rates, had recovered by 1990 due to reduced fishing mortality rates and somewhat higher recruitment., but has subsequently declined back to levels similar to those of the mid-1980s. Fishing mortalities estimated by the alternative VPA models appear to have been high in the early to mid 1980's. Trends in fishing mortalities in recent years are less reliable due to estimation problems common to all of the methods used (and are therefore not shown in the figures). In particular, the ratio of fishing mortality of the oldest age compared to that of a younger reference age and had a large influence on the VPA results.

In summary, the production model analyses imply that although catches are slightly lower than equilibrium MSY levels, effort may be either above or below the MSY level, depending on the assumption made about the rate of increase in the efficiency of purse seiners. VPA analyses indicate that fishing mortalities on juvenile yellowfin tuna exhibited a pronounced increasing trend in the late 1980s and early 1990's, but estimates for recent years are uncertain. Preliminary deterministic projections from two of the VPA runs indicated that current catches are sustainable if recruitment continues at or above the average magnitude observed over the last decade. Yield-per-recruit analyses indicate that current (1997) fishing mortality may be close to the level of F_{max} (above or below depending on the model used), and than 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 7**).

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 total carrying capacity were to remain constant, is also cause for concern.

YFT-5. Effects of current regulations

In 1973, the Commission recommended a minimum size of 3.2 kg for yellowfin tuna, with a tolerance level of 15% in number of fish. 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 by purse seiners averaged 41.8% undersized yellowfin tuna over the period 1991-96. In the same period, baitboat fisheries landed 79.6% undersized fish. In 1997, the calculated proportions of undersized yellowfin were 66.1% for the purse seine fleet and 76.1% for the baitboat fleets. Overall percentages of undersized yellowfin considering all gears were estimated to be 60.8% in 1996 and 65.7% in 1997. However, the Tropical Tuna Species Group identified substitution problems in constructing the catch at size in 1997 that could result in overestimates of undersized catches for that year. Even so, 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 intermediate sizes dominate in the western Atlantic. Unfortunately, it may be difficult to realize substantial reductions in catches of undersized fish in the eastern 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 recommends that further analysis of the advantages and disadvantages of the 3.2 kg minimum size be conducted.

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 carrying capacity has declined somewhat in recent years, at least for the eastern Atlantic surface fleets (from 51,500 MT in 1992 to 43,900 MT in 1997), 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.

YFT-6. Management recommendations

Estimated catches of yellowfin tuna have averaged 148,000 MT over the past three years, according to the updated catch data. This estimate falls within the range of estimates of MSY from production model analyses. However, the current catch trend varies substantially from that used to calculate the MSY estimates (**YFT-Figure 5**), and the potential result of this change is unclear. Because of this uncertainty and differences due to the assumptions 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. Therefore the Committee reaffirms its previous recommendation that measures to reduce overall effort, or at least to freeze it at current levels, should be initiated immediately. Due to the difficulties of defining and estimating "effective effort", the Committee recognizes the difficulty of implementing the 1993 recommendation , and therefore recommends setting a limit on total catch instead. Catches of the order of 148,000 MT (the average for the three-year period 1996-98) to 156,000 MT (the highest estimate of MSY) may be sustainable. However, if the Commission wishes to avoid further increases in fishing mortality, catches of less than 148,000 MT will more likely achieve this objective. Considering the uncertainty in the stock status in light of the revisions to the catch trend, the Committee recommends a cautious approach until a full assessment can be accomplished. When making decisions based on the results of the last assessment, the Commission should be aware that there are many other sources of uncertainty (which are discussed fully in the 1998 SCRS Yellowfin Tuna Detailed Report).

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 voluntary moratorium on fishing on floating objects (and other measures to reduce catches of small fish) begun in late 1997, in general the approach shows promise as a means of reducing fishing mortality on juvenile yellowfin tuna. The Committee recommends continuation of this program at least until such time that its effectiveness can be measured. The Committee stresses that unless all fleets fishing on floating objects participate in the program, its effectiveness will be diminished.

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

Maximum Sustainable Yield (MSY)[1,3]	147.5 - 155.8
Current (1998) Yield	147.4
Current (1999) Replacement Yield	Unknown
Relative Biomass B_{1997}/B_{MSY}[2,3]	92-135%
Relative Fishing Mortality: F_{1997}/F_{MSY}[3]	variable between models; probably exceeds 1
Management Measures in Effect	– 3.2 kg minimum size – Effective fishing effort not to exceed 1992 level

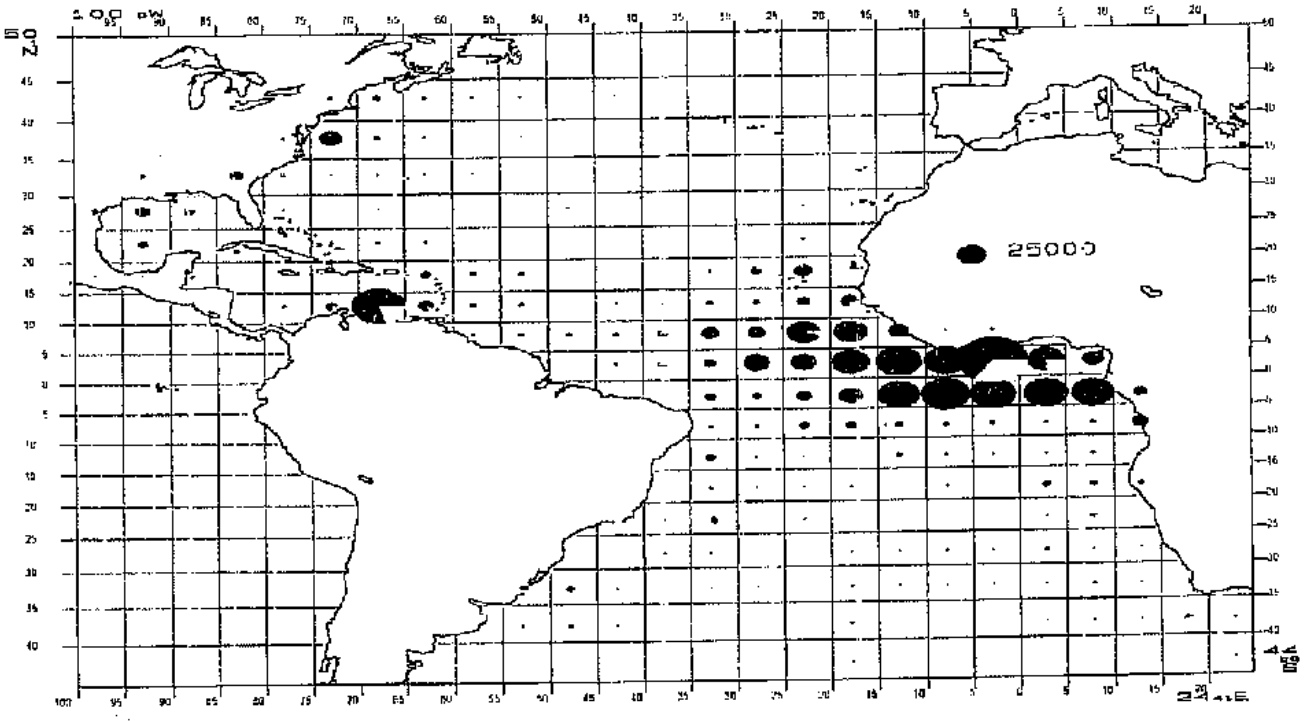
1 147.5-155.8 for the equilibrium production model and 151.7 for the non-equilibrium production model.
2 Result from non-equilibrium production model.
3 Result from 1998 SCRS.

YFT- TABLE 1. Reported landing of yellowfin tuna (MT).

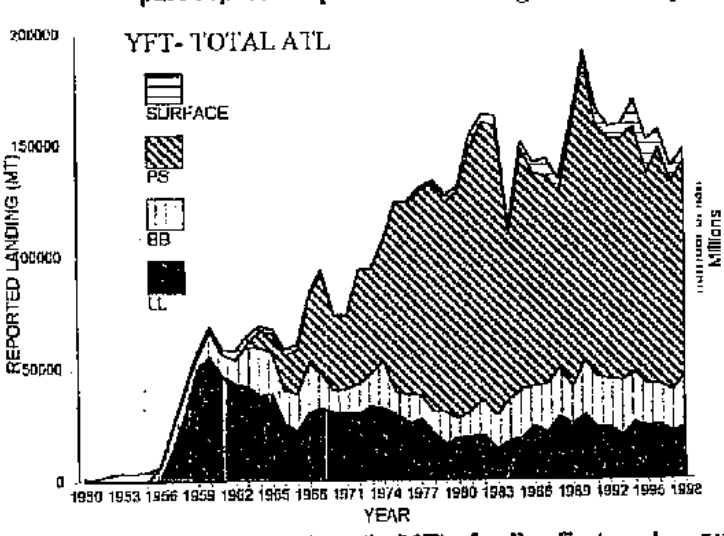
yft	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
TOTAL	**124960**	**131013**	**134044**	**127517**	**130912**	**154524**	**163653**	**163130**	**113597**	**151064**	**142160**	**143568**	**134209**	**161321**	**191798**	**165911**	**157922**	**159163**	**170054**	**152150**	**156009**	**139801**	**147434**
EAST ATL	**111020**	**117541**	**119246**	**114158**	**117798**	**138114**	**138214**	**125067**	**76639**	**111829**	**106606**	**110304**	**99173**	**123240**	**157114**	**125684**	**117579**	**117210**	**116436**	**111851**	**118530**	**103738**	**115414**
SURFACE	98183	101879	107956	107381	105290	130126	128255	116913	67961	104212	102922	105823	91669	116853	149470	118661	112963	112423	107576	103257	109473	97101	106977
Baitboat	*12794*	*10943*	*8980*	*13715*	*7690*	*9788*	*13211*	*11507*	*14694*	*16120*	*15301*	*16750*	*16020*	*12168*	*19560*	*17772*	*15095*	*18461*	*15735*	*13604*	*13872*	*14042*	*17551*
Purse Seine	*85260*	*90552*	*98098*	*92291*	*97026*	*114993*	*111820*	*103502*	*50860*	*86576*	*85325*	*86141*	*73117*	*102200*	*127673*	*98626*	*96103*	*92448*	*90176*	*88284*	*94063*	*81738*	*88168*
Other Surface	*129*	*384*	*878*	*1375*	*574*	*5347*	*3224*	*3904*	*2407*	*1516*	*2296*	*2932*	*2532*	*2485*	*2237*	*2263*	*1765*	*1514*	*1665*	*1369*	*1538*	*1321*	*1258*
LONGLINE	*12837*	*15662*	*11290*	*6777*	*12508*	*7986*	*9959*	*6154*	*8678*	*7617*	*3684*	*4481*	*7504*	*6387*	*7642*	*5503*	*3872*	*4220*	*8620*	*8109*	*8649*	*5932*	*8133*
UNCL.GEAR	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*2*	*1520*	*744*	*567*	*240*	*485*	*408*	*705*	*304*
ANGOLA	1005	2085	2296	904	558	959	1467	788	237	350	59	51	246	67	292	510	441	211	137	216	78	70	115
BELIZE.SH.OB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3	0
BENIN	0	0	0	48	95	100	113	49	65	60	19	3	2	7	1	1	1	1	1	1	1	0	0
CANADA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAP-VERT	115	104	470	581	864	5281	3500	4341	2820	1901	3326	2675	2468	2870	2136	1932	1426	1536	1727	1781	1448	1721	1417
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
CHINA.PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	123	138	177	110	74	63
CHINESE TAIPE	678	208	203	190	71	432	203	452	87	146	254	193	207	96	2244	2163	1554	1301	3851	2681	3985	2993	3570
CONGO	0	0	0	0	140	50	0	0	0	11	20	15	15	21	22	17	18	17	14	13	12	0	0
CUBA	2400	3000	2339	3168	5128	2945	2251	1916	1467	1585	1332	1295	1694	703	798	658	653	541	238	212	257	269	0
EC-ESPAÑA	33423	35525	33636	40083	38759	51428	54164	51946	40049	66874	61878	66093	50160	61651	68605	53465	49871	40393	40591	38249	34848	24513	31716
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
EC-PORTUGAL	3	0	125	185	77	208	981	1333	1527	36	295	278	188	181	179	328	195	128	126	231	288	176	266
ESTONIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	234	0	0	0	0	0	0	0
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
GABON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	88	218	225	225	295
GAMBIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	16	15	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
GHANA	945	621	546	1426	1974	5510	9797	7689	9039	12550	11821	10630	8555	7035	11988	9254	9331	13283	9984	9268	12160	16504	17807
HOND-SH-OB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	3	4	3
JAPAN	5238	2647	1722	1241	2217	2863	4815	3062	4344	5765	3634	4521	5808	5882	5867	4467	2961	2627	4194	4770	4246	2741	4351
KOREA	7636	11060	8625	6449	5349	4288	4010	1629	1917	1668	965	1221	1248	1480	324	259	174	169	436	453	297	101	65
LATVIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	255	54	16	0	55	151	223	97
LITUANIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	332	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
NAMIBIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	14	72	69	3
NEI-1	0	0	0	0	0	0	3121	5388	1104	0	0	2077	3140	5436	12513	6382	10478	9878	8282	8698	11938	11088	11836
PANAMA	2892	1736	1477	739	1661	341	1436	1682	2239	1273	0	0	0	0	0	6703	4055	8157	8937	11633	11519	8425	7646
NORWAY	0	0	0	0	0	0	0	0	0	0	813	418	493	1787	1790	0	0	0	0	0	0	0	0
POLAND	0	0	0	0	0	0	20	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
SAO TOME & PF	15	45	39	28	31	97	193	194	177	180	180	178	184	198	228	223	229	140	0	0	1	4	0
SENEGAL	0	0	0	0	0	0	0	0	0	0	0	0	0	2	90	53	40	6	83	108	68	68	68
SOUTH AFRICA	6	167	281	4595	540	178	49	456	759	382	55	68	137	671	624	52	69	266	486	183	157	116	243
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
U.S.S.R	1652	1794	667	806	448	541	1004	1282	2168	3768	1851	1275	3207	4246	3615	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

YFT- TABLE 1. Reported landing of yellowfin tuna (MT).

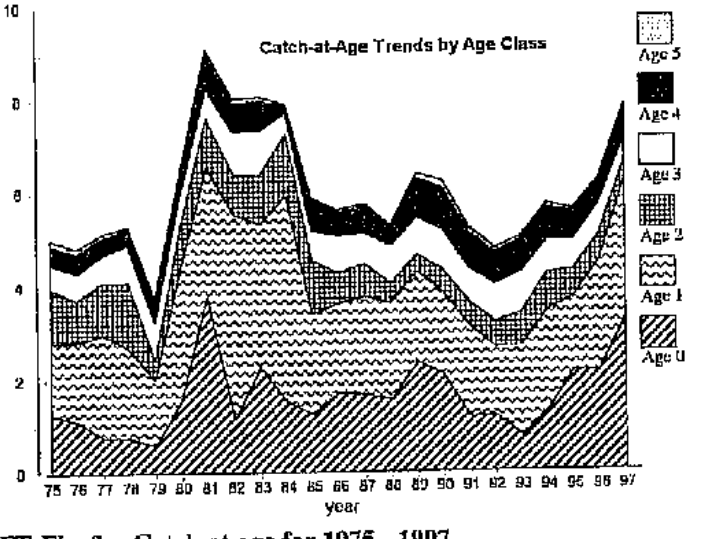
yft	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
UK-S.HELENA	108	34	37	69	55	59	97	59	80	72	82	93	98	100	92	100	166	171	150	181	151	109	181
VENEZUELA	0	0	0	0	0	0	0	0	0	634	0	0	0	0	0	0	0	0	0	0	0	0	0
WEST ATLANTI	**13940**	**13472**	**14798**	**13359**	**13114**	**16410**	**25439**	**37310**	**36552**	**38709**	**27376**	**26820**	**29281**	**32556**	**26596**	**32468**	**32981**	**36166**	**45966**	**33936**	**30240**	**29353**	**25310**
SURFACE	679	1457	4743	3637	5664	4797	15112	29402	27005	26988	13659	16506	13705	18439	12397	21462	19162	24686	32260	16266	19915	20093	16312
Baitboat	*0*	*0*	*1012*	*605*	*392*	*1917*	*2970*	*3603*	*3698*	*5478*	*2421*	*5468*	*5822*	*4834*	*4718*	*5359*	*6276*	*6383*	*7094*	*5297*	*4560*	*4275*	*5982*
Purse Seine	*634*	*1073*	*3662*	*1035*	*5135*	*2822*	*12112*	*25749*	*23203*	*20994*	*9822*	*6665*	*6034*	*11647*	*6800*	*14414*	*11359*	*16081*	*19612*	*6338*	*10784*	*11710*	*7105*
Other Surface	*45*	*384*	*69*	*1997*	*137*	*58*	*30*	*50*	*104*	*516*	*1416*	*4373*	*1849*	*1958*	*879*	*1689*	*1527*	*2222*	*5554*	*4631*	*4571*	*4108*	*3225*
Longline	*12774*	*11374*	*9572*	*9277*	*6707*	*11321*	*9861*	*6880*	*8023*	*10659*	*12216*	*9784*	*14509*	*13201*	*13159*	*9534*	*12014*	*9193*	*8954*	*8727*	*8533*	*8471*	*8150*
Uncl. Gear	*487*	*641*	*483*	*445*	*743*	*292*	*466*	*1028*	*1524*	*1062*	*1501*	*530*	*1067*	*916*	*1040*	*1472*	*1805*	*2287*	*4752*	*8943*	*1792*	*789*	*848*
ARGENTINA	57	43	4	0	0	8	7	0	0	44	23	18	66	33	23	34	1	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	151	0
BRASIL	715	1302	852	1353	1008	2084	1979	2844	2149	2947	1837	2266	2512	2533	1758	1838	4228	5131	4169	4021	2767	2705	2514
CANADA	161	0	318	0	0	0	0	0	0	0	2	40	30	7	7	29	25	71	52	174	155	100	57
CHINA.PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	555
CHINESE TAIPE	1284	164	181	848	616	435	407	87	559	780	1156	709	1641	762	5221	2009	2974	2895	2809	2017	2668	1473	1758
COLOMBIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2404	3418	7172	0	0	0
CUBA	1200	900	661	232	689	1997	1503	793	2538	1906	2081	1062	98	91	53	18	11	1	14	54	40	40	15
DOMINICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	12	23	30	31	9	0	0	0
EC-ESPAÑA	0	266	2029	1052	0	0	0	1957	3976	1000	0	0	0	0	0	1451	1290	810	0	0	0	0	46
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
GHANA	0	0	0	0	265	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
JAMAICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	21	0
JAPAN	3069	1408	1647	1707	1117	2983	3288	1218	1030	2169	2103	1647	2395	3178	1734	1698	1591	469	589	457	1004	814	1001
KOREA	4574	6522	4259	4414	1933	3325	2249	1920	989	1655	853	236	120	1055	484	1	45	11	0	0	84	156	0
MEXICO	0	0	0	0	16	42	126	612	1059	562	658	33	283	345	112	433	742	855	1093	1126	771	826	788
PANAMA	1283	582	1440	102	807	262	675	62	246	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NETH.ANT	151	151	173	173	173	173	173	173	173	150	150	160	170	170	170	150	160	170	155	140	130	130	130
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
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
TRIN & TOBAGC	0	0	0	0	0	0	0	232	31	0	0	0	1	11	304	543	4	219	0	0	27	56	23
U.S.A	546	808	1616	298	504	394	247	226	1252	6259	5774	9059	10268	8350	5406	6853	7158	5199	8093	8131	7745	7674	5621
UK-BERMUDA	11	10	12	26	35	21	22	10	11	42	44	25	23	22	15	17	42	58	44	44	71	51	53
URUGUAY	0	0	0	0	0	67	214	357	368	354	270	109	177	64	18	62	74	20	59	53	171	53	88
VENEZUELA	626	827	1306	2811	5397	4500	14426	26576	21879	20535	11755	11137	10949	15567	10556	16495	13759	16647	24753	9686	13756	14656	12214
UNKOWN AREA	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**753**	**406**	**526**	**8178**	**6444**	**5755**	**5525**	**8088**	**7759**	**7362**	**5787**	**7652**	**6363**	**7239**	**6710**	**6710**
Longline	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*753*	*406*	*526*	*956*	*1297*	*2324*	*2643*	*3939*	*4240*	*3768*	*5787*	*7652*	*6363*	*7239*	*6710*	*6710*
NEI-134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	96	604	862	1315	1399	1399
PANAMA	0	0	0	0	0	0					7222	5147	3431	2882	4149	3519	3594	3134	3422	2588	1954	1156	1156
NEI-71	0	0	0	0	0	0	0	753	406	526	956	1297	2324	2643	3939	4240	3768	2555	3626	2913	3970	4155	4155
CHINESE TAIPE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



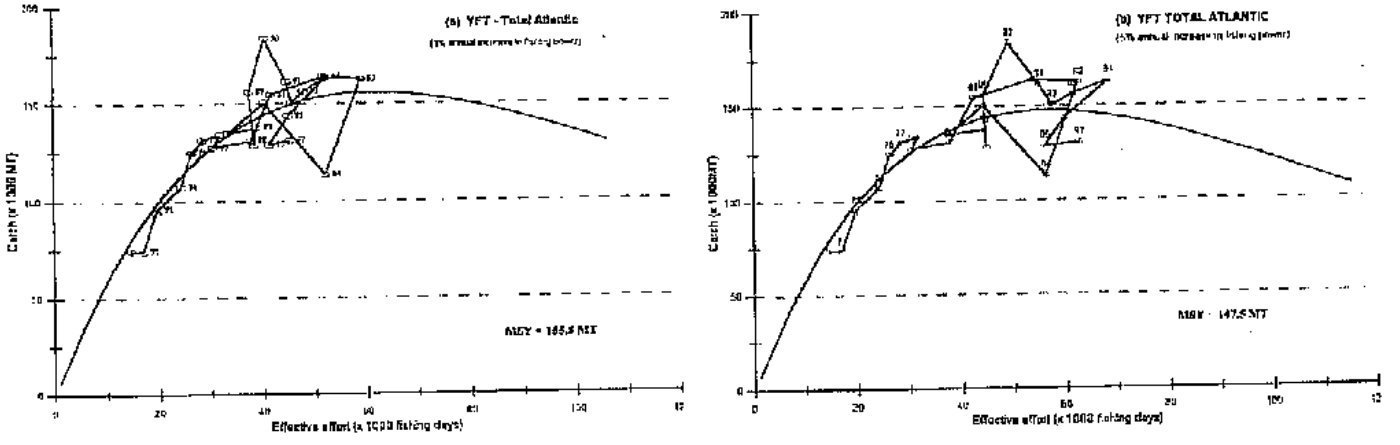
YFT-Fig. 1. Distribution of yellowfin tuna catches by gear and area (darkest section represents longline, medium shaded part represents purse seine and light section represents baitboat catches).



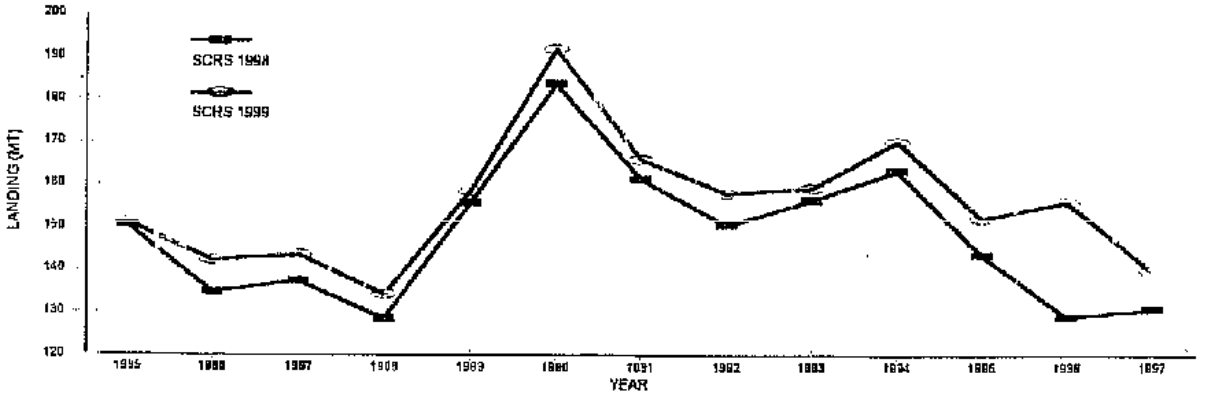
YFT-Fig. 2. Reported landings (in MT) of yellowfin tuna by fishing gears in the Atlantic, 1950-1998.



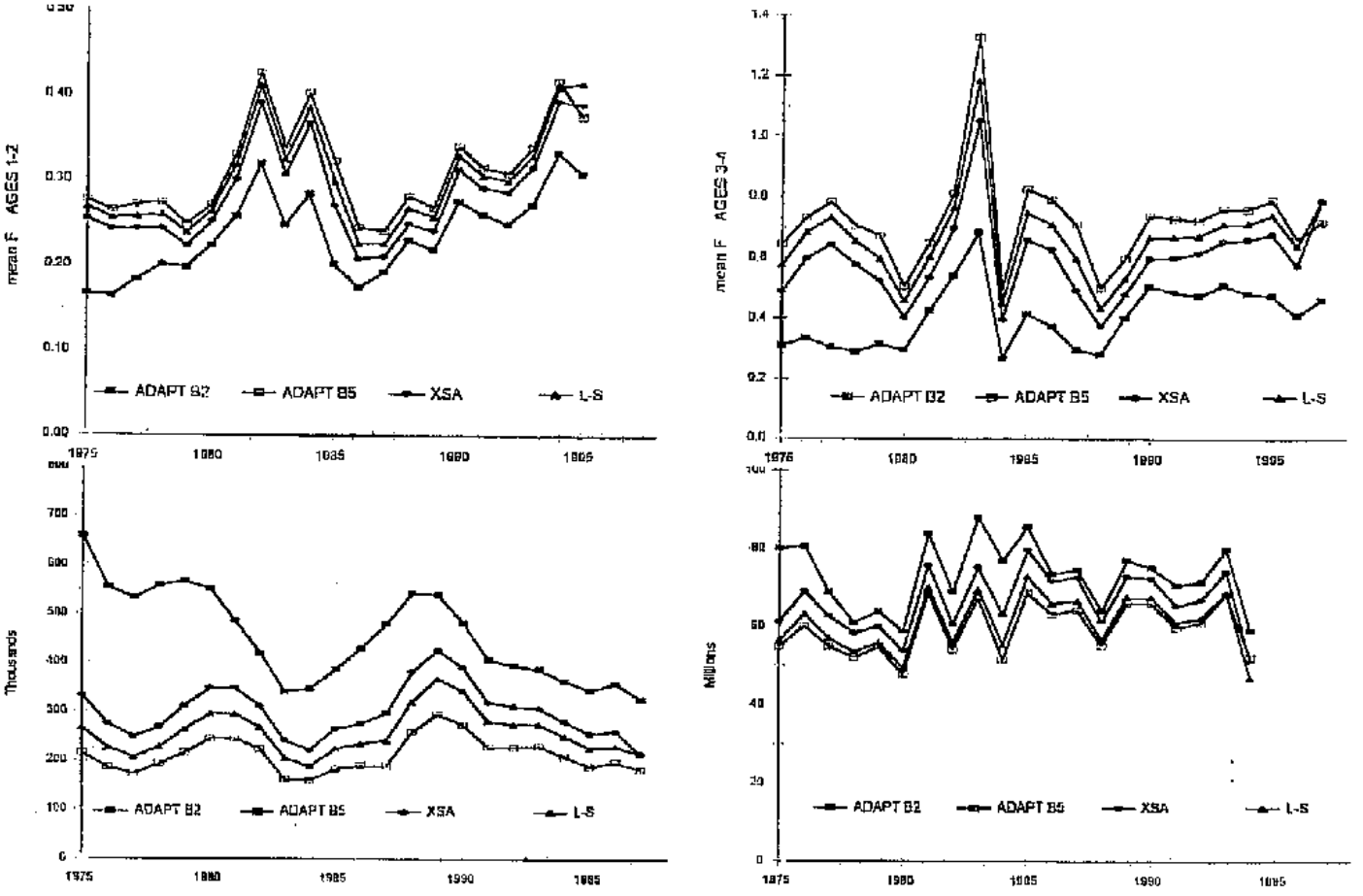
YFT-Fig, 3, Catch at age for 1975 - 1997.



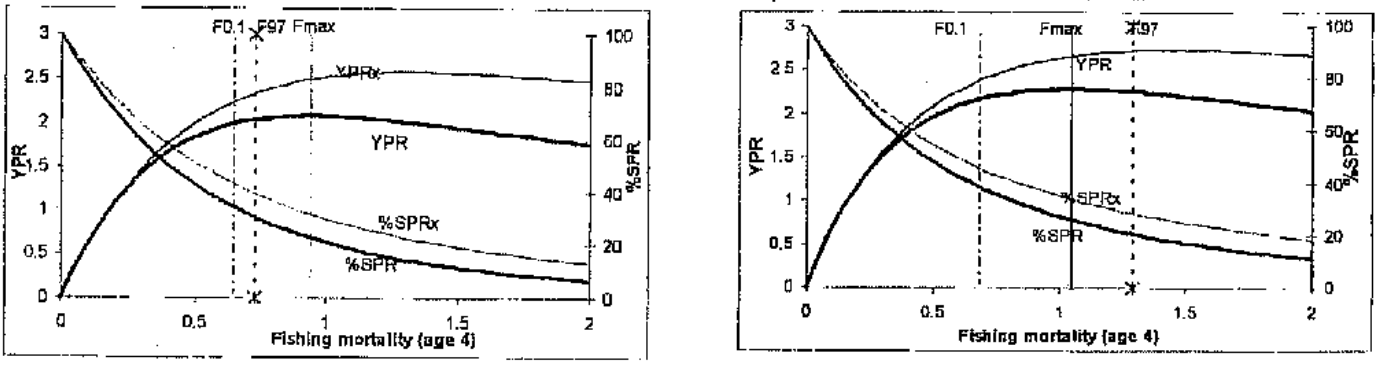
YFT-Fig. 4. Equilibrium production model (M=1, K=4) results assuming an annual increase of (a) 3% and (b) 5% inn purse seine fishing power since 1981.



YFT-Fig. 5. Catch trends available during 1998 SCRS session and that of 1999 for the period 1985-1997.



YFT-Fig. 6. Summary of VPA results for four alternative scenarios, based on three different models.



YFT-Fig. 7. Yield per recruit analyses for ADAPT B2 run (top) and XSA run (bottom). Thick lines assume current selectivities while thin lines assume no fishing mortality on undersized fish. Estimates of $F_{0.1}$, F_{max} and F_{97} correspond to the thick lines only.

BET – BIGEYE TUNA

Compared to other tuna species, bigeye has received less attention 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 in 1996. This program was adopted by the Commission in the same year, and started its operation this year after external funds were made available. 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 50°N and 45°S. This species dwells in deeper water than other tuna species and indicates extensive vertical movements. 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 be 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 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, small to large and small fish for longline, directed baitboat and purse seine fisheries, respectively. Corresponding average weights are 45-50 kg, 20-30 kg and 5 kg for these three types of fisheries. 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 IN other Oceans, baitboats catch significant amounts of medium and large size bigeye tuna except in Ghana. Tropical purse seine fleets operate in the Gulf of Guinea and off Senegal in the eastern Atlantic and off Venezuela in the western Atlantic. French and Spanish fleets are the major components in the east, and the Venezuelan fleet operates in the west. Bigeye catch by the Venezuelan fleet was very minor. Since 1990, changing flags of convenience became common for the French and Spanish purse seiners. The bigeye catch by re-flagged fleets became significant since 1991. Unlike the other re-flagged fleets, however, all data necessary for stock assessment has been collected. While bigeye tuna is a primary target species for most of longline and baitboat fisheries, this species has been of secondary important species for purse seine fisheries.

There are two major longline fisheries, operated by Japan and Chinese Taipei, whose catch accounted for about 40% of total catch in 1998. Korea has reduced its activity in the Atlantic considerably since 1990. The activities of the longliners which fly flag of convenience appeared to be started since the early 1980s, and became significant 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.

This year the catch was revised to include catches made by flag of convenience longline fleets. Those fleets include Belize, Honduras and Panama and the information is based on Japanese import statistics recently made available for 1991 through 1998. The estimates are minimum, as the weight is in product and not converted to round weight, but, on the other hand, the ocean origin is not clear. In particular, the catch estimates for Panama during the early 1990s may) include catches from other oceans. The same data series prior to 1991 as well as catches by other flag of convenience countries after 1981 became available after the assessment was made. Those were relatively minor and will be included in the assessment in the future. Newly added catches for 1991-1998 fluctuated between 14,000 MT and 20,000 MT, without trend (**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 74,000 MT over the next 15 years. In 1991, it passed 95,000 MT and continued to increase, reaching a historic high of nearly 130,000 MT in 1994. The catch has declined since then, and 1998 figure was 95,000MT. The increase in catch during 1990-1994 was attributable to all major fisheries (baitboat, purse seine and longline), whereas the decline in catches after 1995 was mostly due to the decline by purse seine (50%) and longline (25%) fisheries. It was reported that the intense use of drifting natural log and artificial fish aggregating devices (FADs) was a primary cause of increased catch for purse seiners, 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 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 EU-managed purse seine fleet also contributed to the decline of catch in 1997 and 1998. The increase in longline catches is 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 flag of convenience fleet. 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.

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. The first 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 the flag of convenience countries, 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 overexploited. 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. The current catch has declined by almost 35,000 MT from the highest in 1994 partly due to the moratorium on FADs set for the purse seine fishery as well as the catch limit imposed on Chinese Taipei, but it is not well determined whether or not this level of catch will be sustained. The available information, such as the continued decline of CPUE from the longline fishery and biological reference points presented in this assessment, tends to suggest that the stock will continue to go down if the current catch level is maintained.

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 55% for the last three years (1996-1998). According to the yield-per-recruit analysis **(BET-Figure 7)**, 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 the evaluation has not been fully completed, this regulation appears effective in reducing fishing mortality for juvenile bigeye, at least during the closed season (see 1998 SCRS Report).

The last management measure for this species is a catch limit of 16,500 MT for Chinese Taipei. According to its catch report, the bigeye catch implemented in 1998 for Chinese Taipei was below that level (16,314 MT), and thus this measure was strictly abided by Chinese Taipei.

BET-6. Management recommendations

The revision of catch statistics indicates a larger increase of the total bigeye catch since 1993 compared with the previous year estimates, reaching around 130,000 MT in 1994 from less than 100,000 MT of catch in the 1990-1992 period. The total catch declined after 1994 to about 95,000 MT in 1998. However, the estimates from all production models considered 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 100,000 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 97,000 MT in 1999). The 1998 catch is, 95,000 MT, slightly less than 1992 catch, but 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 that which produces MSY, further reduction of fishing mortality, hence catch reduction, from the 1998 level, is required regardless of the MSY estimates for the two periods. Therefore, the Committee recommends a catch reduction towards 80,000 MT which could prevent a further decline of the stock, but a further reduction of catch is required to rebuild the stock at MSY.

A voluntary time/area closure to FAD fishing introduced in the purse seine fishery during November, 1997, to January, 1998, and during November, 1998, to January, 1999, reduced juvenile catch. This measure became an ICCAT regulation in June, 1999. The effect would be higher if all the surface fleets fishing on FADs participated in this closure. As a result, the percentage of fish less than 3.2 kg (minimum size) has stabilized to about 55% since 1996 compared to the increasing trend in previous years. However, the Committee remains concerned that the percentage of undersized fish continued to be high. Despite the fact that it

may be difficult to perfectly implement the minimum size regulation due to the multi-species nature of the surface fisheries, the Committee reiterates the importance of implementation of this regulatory measure since it contributes to the improvement in yield-per-recruit (overall catch) as well as in spawning-per-recruit (higher survival of spawning stock).

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*
Current (1998) Yield	94,800 MT
Current (1998) Replacement Yield**	72,000 - 85,000 MT ***
Relative Biomass (B_{1998}/B_{MSY})**	0.57 - 0.63***
Relative Fishing Mortality (F_{1998}/F_{MSY})**	1.50 – 1.82***
$F_{0.1}$****	0.22
F_{max}****	0.35
Management Measures in Effect	-- 3.2 kg minimum size -- 25% of FADs fishing vessels and 5% of others to be covered with observers. -- Provide a list of vessels (>80 GRT) fishing Atlantic bigeye. -- Limit on number (associated with GRT) of Atlantic BET 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). -- Provide a list of vessels (>24 m LOA) fishing Atlantic BET by August 31. -- Limit number of Chinese Taipei BET fishing vessels to 125. -- Catch limit (16,500 MT) for Chinese Taipei. -- Moratorium on FAD fishing, Nov. 1999 to Jan. 2000, in eastern tropical area.

* This range is representative of MSY ranges predicted by the non-equilibrium production model and the equilibrium production model.
** Non-equilibrium production model estimate.
*** These are ranges of point estimates obtained and no confidence limits are given.
**** Yield-per-recruit estimate based on the 1998 selectivity pattern.

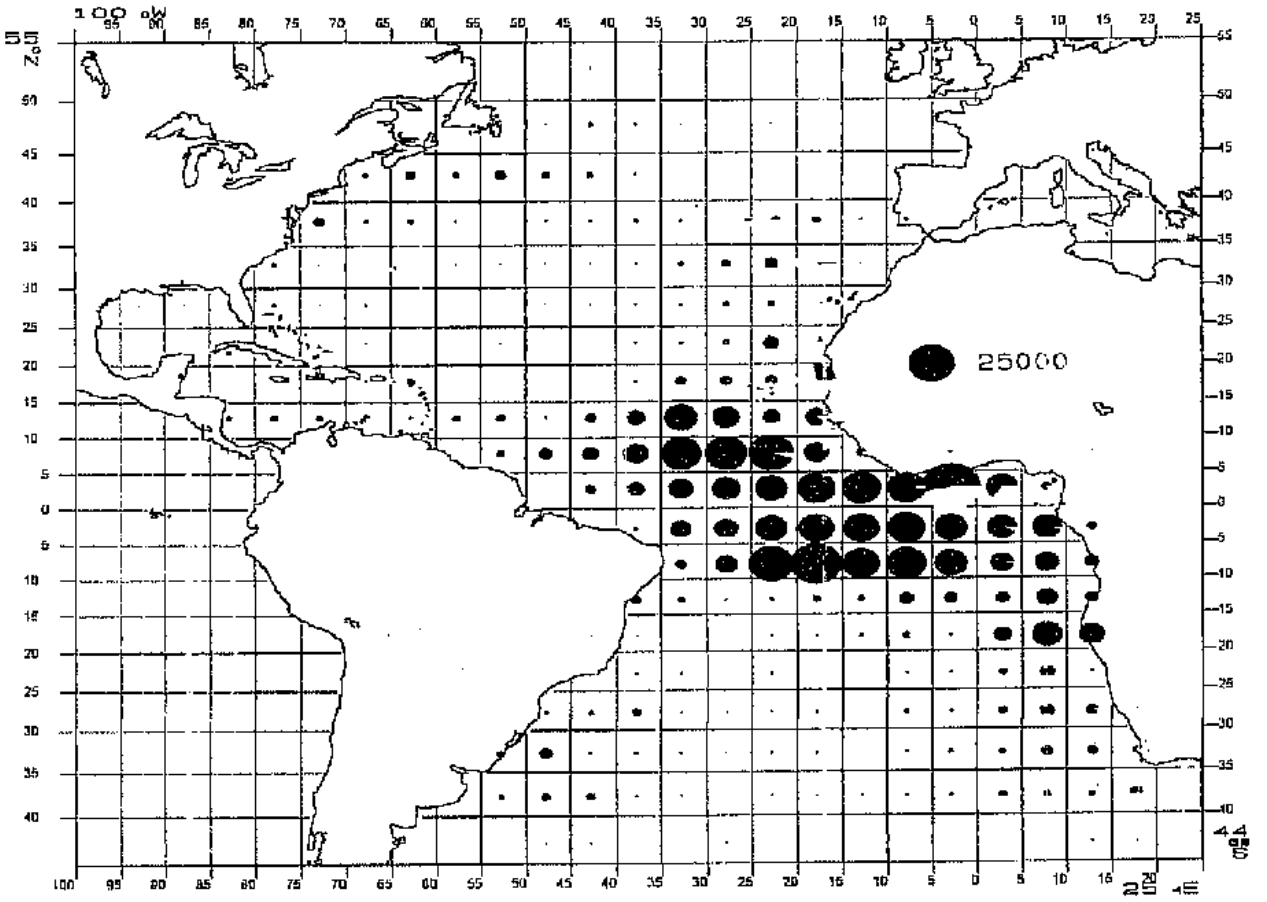
BET-TABLE 1. Reported landings of bigeye tuna in MT by flag and major gear

BET	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
TOTAL	45302	54880	52693	45975	63820	68186	73711	59277	69339	74218	62094	52585	63524	74734	79142	95731	96514	109571	129545	124899	119499	102891	94786
SURFACE	*17455*	*25349*	*23897*	*18415*	*22142*	*26578*	*21653*	*25585*	*27688*	*25290*	*25233*	*20271*	*17926*	*19401*	*27703*	*34196*	*34116*	*46578*	*51450*	*50640*	*45682*	*36111*	*35804*
BAITBOAT	*9939*	*12758*	*14629*	*9591*	*12349*	*10124*	*6922*	*9796*	*11439*	*17651*	*15618*	*12631*	*9710*	*12672*	*18106*	*17750*	*16248*	*16467*	*20296*	*25552*	*19040*	*18721*	*20904*
PURSE SEINE	*7067*	*11875*	*9094*	*8343*	*9204*	*15656*	*14476*	*15654*	*16063*	*7554*	*9286*	*7148*	*7859*	*6371*	*9407*	*16169*	*17467*	*29676*	*30434*	*24786*	*26446*	*17037*	*14657*
OTHER SURF	*449*	*716*	*174*	*481*	*589*	*798*	*255*	*135*	*186*	*85*	*329*	*492*	*357*	*358*	*190*	*277*	*401*	*435*	*720*	*302*	*196*	*353*	*243*
LONGLINE	*27847*	*29531*	*28796*	*27560*	*41678*	*41608*	*52026*	*33648*	*41599*	*48810*	*36796*	*32220*	*45541*	*55098*	*51333*	*61393*	*62271*	*62815*	*77885*	*74000*	*73660*	*66619*	*58835*
UNCL GEARS	*0*	*0*	*0*	*0*	*0*	*0*	*32*	*44*	*52*	*118*	*65*	*94*	*57*	*235*	*106*	*142*	*127*	*178*	*210*	*259*	*157*	*161*	*147*
ARGENTINA	176	84	23	0	0	0	0	0	0	100	41	72	50	17	78	22	0	0	0	0	0	0	0
BELIZE.SH.OI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	6	0
BENIN	0	0	0	0	0	40	45	0	0	0	15	6	7	8	10	10	7	8	9	9	9	9	3
BRASIL	678	1183	812	782	698	505	776	535	656	419	873	756	946	512	591	350	790	1256	596	1935	1707	1237	644
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
CANADA	23	0	0	0	0	0	0	0	0	0	11	144	95	31	10	26	67	124	111	148	144	166	120
CHINA.PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62	379	421	460	378	1330
CHINESE TAI	3701	3364	2970	2486	2561	1887	2147	1623	925	1220	1125	1488	1469	940	5755	13850	11546	13426	19680	18023	21650	19242	16314
CONGO	0	0	0	0	5	0	0	0	0	8	19	10	10	14	15	12	12	14	9	9	8	0	0
CUBA	1300	1800	2300	2300	1385	711	521	421	447	239	171	190	151	87	62	34	56	36	7	7	5	0	0
EC-ESPANA	7436	9736	6849	5419	8430	10010	9332	8794	13617	10340	10884	8875	7984	7660	10355	14735	14790	16632	21943	17673	15160	12245	7240
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
EC-PORTUGA	2929	4522	5350	3483	3930	3525	1861	4075	4354	6457	7428	5036	2818	5295	6233	5718	5796	5616	3099	9662	5610	5437	6219
G.EQUATORI/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	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
GHANA	170	237	124	238	332	780	791	491	2162	1887	1720	1178	1214	2158	5031	4090	2866	3577	4738	5517	5805	7431	13252
GRENADA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65	25	20	10	10	0	1	0
HONDURAS-C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	69	31	66	22
JAPAN	8170	10144	9863	12150	20922	22091	33513	15212	24870	32103	23081	18961	32064	39540	35231	30356	34722	35053	38503	35477	33171	27033	22290
KOREA	6923	8090	9716	8022	10235	12274	10809	9383	8989	10704	6084	4438	4919	7896	2690	802	866	377	386	423	1250	796	163
LIBERIA	0	0	0	0	0	0	0	0	0	0	0	0	0	206	16	13	42	65	53	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
MAROC	170	324	394	414	387	622	625	552	120	30	0	8	0	0	0	0	0	0	0	0	0	0	0
MEXICO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0	6	8
NAMIBIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	29	7	46	16
NEI-1	0	0	0	0	0	0	338	1141	157	0	0	85	20	93	785	1877	1559	2394	2625	4181	5335	3090	2702
NEI-134*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	155	607	1458	3077	4721	4721
NEI-28	2135	1493	2127	513	4518	2500	3107	2732	1952	1104	2967	3698	4430	5162	5893	7445	8819	10438	13423	10374	6785	2837	2328
NEI-71*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8787	5911	4143	8244	8601	7827	9970	9970
NORWAY	0	0	0	0	0	0	0	0	0	0	0	0	60	0	0	0	0	0	0	0	0	0	0
POLAND	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PUERTO RIC	0	0	0	0	0	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
SAO TOME &	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0
SENEGAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	4	126	177	135	135	54
SOUTH AFRIC	0	0	0	19	422	381	137	187	60	102	168	200	553	367	296	72	43	88	76	27	7	10	41

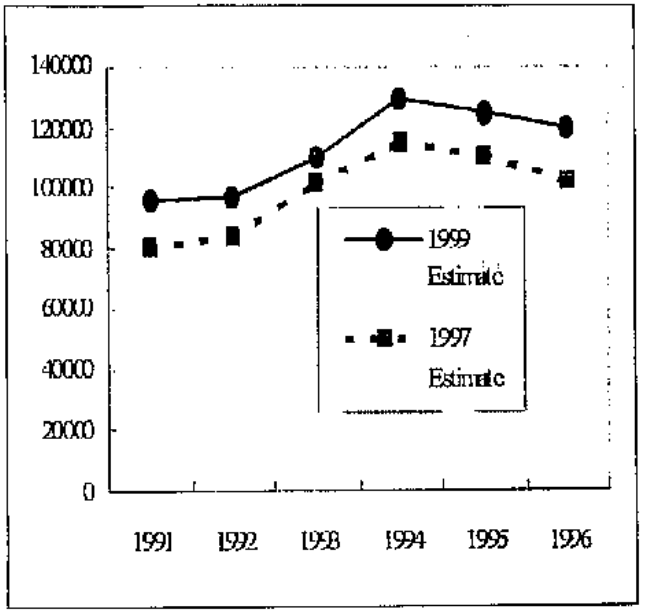
BET-TABLE 1. Reported landings of bigeye tuna in MT by flag and major gear

BET	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
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
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
TOGO	0	0	0	0	0	0	0	14	52	18	24	22	7	12	12	6	2	86	23	6	33	33	33
TRINIDAD & T	0	0	0	0	0	0	0	191	41	22	0	0	1	19	57	263	0	258	0	0	17	8	4
U.S.A	28	331	248	212	202	152	377	254	408	353	747	1008	918	761	650	962	751	982	1328	1209	882	1137	928
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
URUGUAY	0	0	0	0	0	86	397	605	714	597	177	204	120	55	38	20	56	48	37	80	124	69	59
USSR	4907	4086	2202	2229	2813	2832	635	352	1233	870	1071	1887	1077	424	95	0	0	0	0	0	0	0	0
VENEZUELA	21	464	244	347	661	1684	999	4284	4142	2918	1136	349	332	115	161	476	270	809	457	457	189	274	222

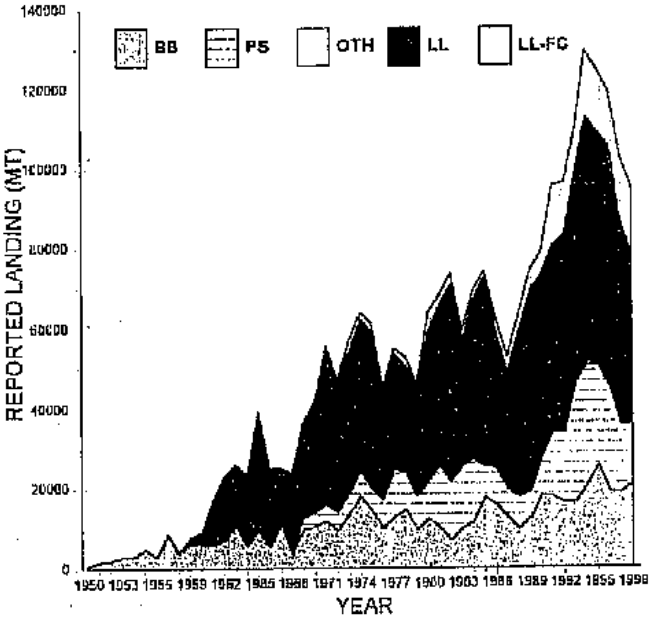
* May include catches from other oceans.



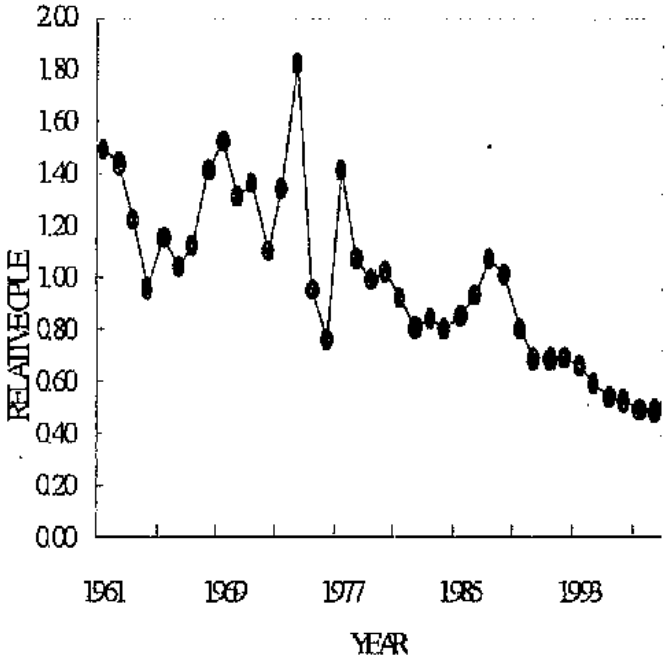
BET-Fig. 1. Geographical distribution of bigeye catch by major tuna fisheries. Dark shaded, light shaded, medium shaded and balck areas in circles corresponds to catches by longline, purse seine, baitboat and other fisheries, respectively.



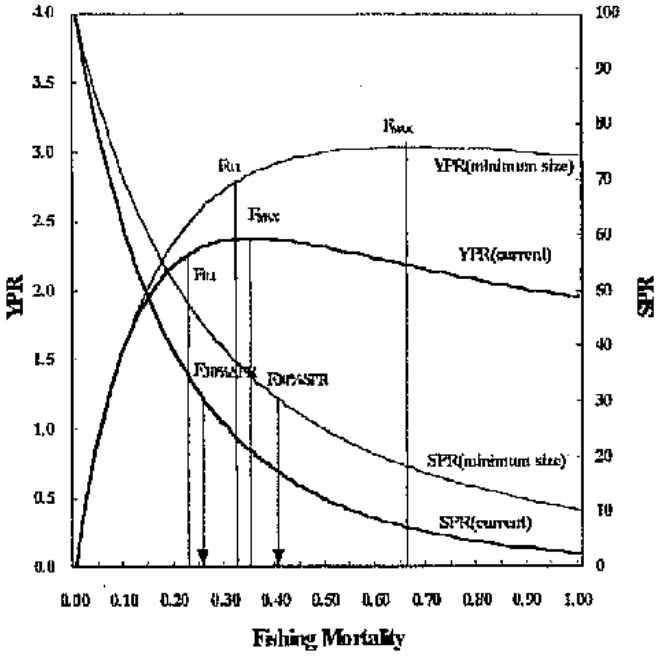
BET-Fig. 2. Comparison of total landing estimates for 1991-1996 made in 1997 and 1999. Most of these differences were addition of longline and to some extent of purse seine landings of countries of flag of convenience.



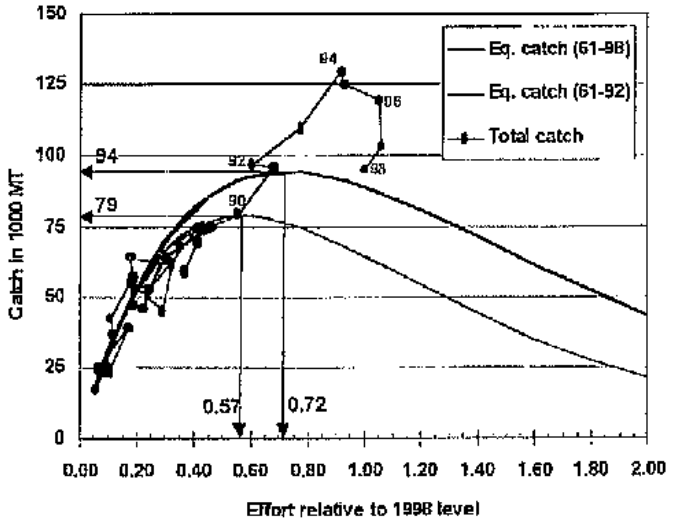
BFT-Fig. 3. Accumulative landings (MT) of bigeye tuna in the entire Atlantic by gear categories., BB, PS, OTB, LL, LL-FC denote baitboat, purse seine, other, longline and flag of convenience longline fisheries, respectively.



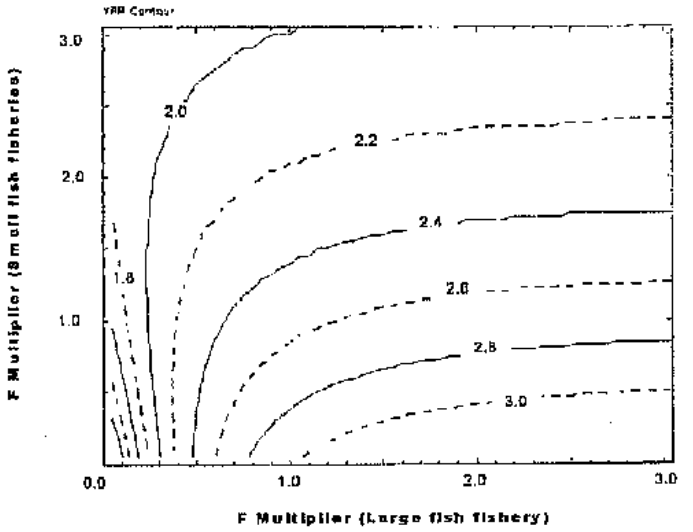
BET-Fig. 4. Abundance indices (in number of fish) from the Japanese longline fishery.



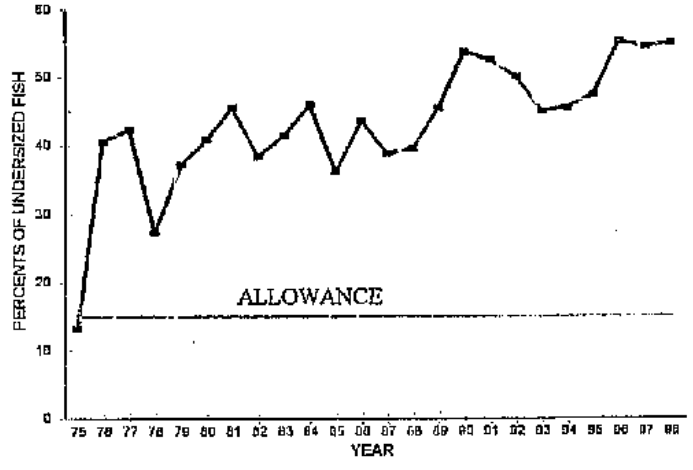
BET-Fig. 6 Yield-per-recruit (YPR) and spawning biomass-per-recruit (SPR) for bigeye tuna assuming current selectivity (heavy line) and selectivity reflective of a 3.2 kg minimum size (fine line). Vertical lines with an arrow indicate $F_{30\%SPR}$



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



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



BET-Fig. 8. Annual change of percentages of undersized fish (< 3.2 kg minimum size) for overall fishery.

SKJ – SKIPJACK TUNA

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 which is associated with floating objects, both natural and diverse FADs which have been used extensively since the early 1990s by purse seiners and baitboats (during the 1991 to 1998 period, about 70% 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 will 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 (22%) and with small bigeye (17%) and also with other tuna species.

A comparison of size distributions of skipjack between periods prior to and after the introduction of FADs show that, in the eastern 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 Group 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 30°W. The boundary of 30°W 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 30°W, 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. 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 eastern Atlantic.

The total catches in the Atlantic Ocean in 1998 amounted to 132,432 MT (SKJ-Table 1). As concerns the eastern 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 (30°W), 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 Spain, France and the NEI fleet (Vanuatu, Malta, Morocco, Belize, Guinea, Dutch Antilles, Panama, and St. Vincent), followed by the baitboat fisheries (Ghana, Portugal, Spain and France). In 1998, catches reached 102,122 MT, which represents a slight decrease as compared to 1997 (109,001 MT) **(SKJ-Figure 2).**

In the west Atlantic, the most important fishery 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 Brazilian fleets. The 1998 catches amounted to 30,016 MT, slightly less than in 1997 (31,619 MT) **(SKJ-Figure 3).**

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 eastern Atlantic Ocean, the total carrying capacity of the baitboat fleets remained stable between 1972 and 1998. 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 slightly **(SKJ-Figure 4).**

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, while an increase in effort was observed between 1997 and 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 1°x1° squares in which the purse seine fishery caught skipjack in the eastern Atlantic shows an increasing trend since the end of the early 1970s **(SKJ-Figure 4).** 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 1°x1° 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 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 eastern 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°x1° exploited **(SKJ-Figure 5)**, 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.

On an overall level, the Grainger & García index (**SKJ-Figure 6**), a gross indicator of stock status for situations such as that of the skipjack fisheries in the eastern 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 were available from the Brazilian baitboat fishery and the Venezuelan purse seine fishery (**SKJ-Figure 7**), and in both cases the indices showed a stable stock status.

SKJ-4 Outlook

Uncertainties in the underlying assumptions for the analyses prevent 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 two years (1997 and 1998) 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 regulation in effect for skipjack. However, the French and Spanish boat owners have voluntarily applied a Protection Plan for Atlantic tunas, for the period of November, 1997, through January, 1998, and November, 1998, through January, 1999. The purse seine skipjack catches on FADs by fleets applying the Protection Plan were reduced by more than 40% in 1998, relative to 1996 levels.

SKJ-6 Management recommendations

No management recommendations were proposed.

ATLANTIC SKIPJACK SUMMARY *

	East	*West*
Maximum Sustainable Yield (MSY)	not estimated	not estimated
Current (1998) Yield	102,871 MT	30,046 MT
Current Replacement Yield (1998)	Not estimated	not estimated
Relative Biomass (B_{1997}/B_{MSY})	Not estimated	not estimated
Relative Fishing Mortality: F_{1997}/F_{MSY}	Not estimated	not estimated
Management Measures in Effect	None	None

SKJ-TABLE 1. Reported landings of skipjack (MT) by flag and major gear

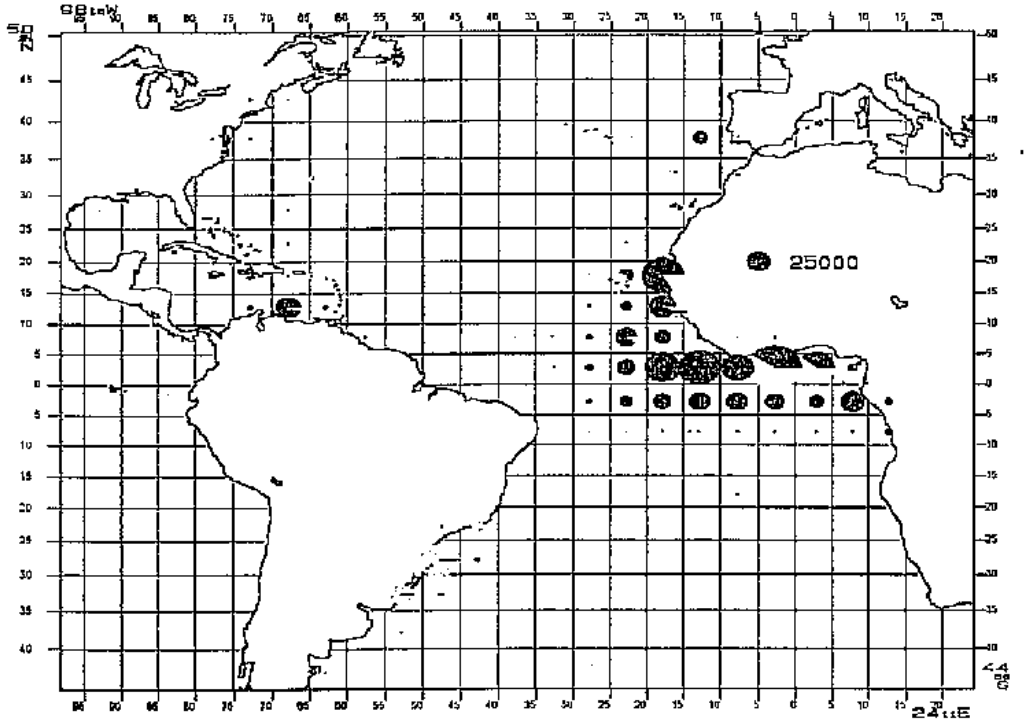
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
WEST ATLANTIC	3661	3229	6970	6187	12483	22904	32209	31433	34871	39964	31836	23917	23559	26106	25776	32886	29823	32931	28902	20033	27357	31619	30046
BAITBOAT	*2800*	*2400*	*2612*	*4365*	*9351*	*17999*	*22402*	*20057*	*16771*	*28490*	*25278*	*18675*	*21057*	*23292*	*22246*	*23972*	*20852*	*19697*	*22645*	*17744*	*23741*	*26797*	*26006*
PURSE SEINE	*700*	*600*	*3461*	*1489*	*3072*	*4654*	*9705*	*11121*	*17958*	*11191*	*5208*	*4964*	*2315*	*2466*	*3241*	*8527*	*8509*	*12794*	*5712*	*2059*	*3349*	*4347*	*3542*
OTHER SURF	*161*	*229*	*697*	*333*	*60*	*251*	*102*	*255*	*142*	*283*	*1350*	*278*	*187*	*348*	*289*	*387*	*462*	*440*	*545*	*230*	*267*	*475*	*498*
ARGENTINA	0	33	4	0	17	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BRASIL	83	168	633	2064	6070	13913	18322	15944	13567	25101	23155	16283	17316	20750	20130	20548	18533	17762	20582	16530	22519	26564	25784
CANADA	181	0	86	0	0	180	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COLOMBIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2074	0	0	0	0	0
CUBA	2600	2400	1800	2000	2255	1086	1134	1700	1248	1632	1277	1101	1631	1449	1443	1596	1638	1017	1268	886	1000	1000	651
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
EC-ESPAÑA	0	266	2031	1052	0	0	0	209	2610	500	0	0	0	0	0	1592	1120	397	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
GHANA	0	0	0	0	185	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GRENADA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0
JAPAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NEI-2a	0	0	720	161	1026	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UK-BERMUDA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
USA	519	301	1032	737	981	2753	28	696	852	1815	1114	721	40	67	302	856	563	366	98	75	120	81	104
VENEZUELA	0	0	0	0	1890	4900	12645	12778	16526	10712	5690	5750	4509	3723	3791	8138	7834	11172	6697	2387	3572	3828	3361
ENTIRE ATLANT	226	220	260	390	109	237	979.6	1004	746	315.18	336.97	241.14	165	344	476	1278	411	293	1058	1932	214	253	264
EL AND TRAB	*48*	*101*	*56*	*13*	*12*	*78*	*46*	*600*	*47*	*30*	*27*	*12*	*13*	*34*	*24*	*38*	*32*	*23*	*26*	*37*	*26*	*61*	*77*
UNCLASSIFIED G	*178*	*119*	*204*	*377*	*97*	*159*	*934*	*404*	*699*	*285*	*310*	*229*	*152*	*310*	*452*	*1240*	*379*	*270*	*1032*	*1895*	*188*	*192*	*187*
ARGENTINA	0	0	0	0	0	0	137	243	505	101	138	90	7	111	106	272	123	50	1	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	0
BRAZIL	0	2	2	1	1	0	0	1	0	0	0	3	0	0	0	0	2	9	6	30	9	0	0
BULGARIA	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CANADA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CHINESE TAIPEI	22	0	12	10	7	9	20	8	13	7	1	2	8	22	0	37	29	11	17	5	15	54	75
COLOMBIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	789	1583	0	0	0
DOMINICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	38	41	24	43	33	0	0	0
EC-ESPAÑA	90	90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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
EC-PORTUGAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
ESTONIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	102	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	51	0	0	0
GRENADA	0	0	1	4	8	1	1	15	12	7	9	5	22	11	23	25	30	25	11	3	11	15	15
JAMAICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62	0	0

SKJ-TABLE 1. Reported landings of skipjack (MT) by flag and major gear

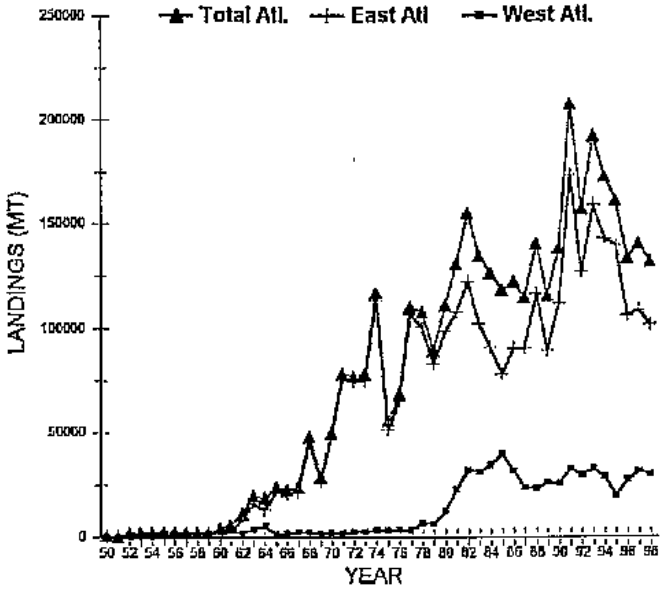
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
TOTAL	69345	110577	108115	89696	111358	131060	155555	135037	126825	118714	122712	115135	140684	116120	138659	208188	157795	193065	173570	161938	134010	141062	133181
BAITBOAT	31510	44786	44177	49010	47485	56917	66890	54930	44856	58358	55287	57478	69072	64292	58815	65588	56539	51414	60768	51733	56107	65623	61482
PURSE SEINE	33761	58283	62141	38455	59806	71127	84529	76613	79753	59539	64101	56098	69928	49726	78043	139809	99007	139890	110888	107786	77102	74587	70820
OTHERS	4074	7508	1797	2231	4067	3016	4136	3494	2216	817	3324	1559	1684	2102	1801	2791	2249	1761	1914	2419	801	852	879
EAST ATLANTIC	65458	107128	100885	83119	98766	107919	122366	102600	91208	78435	90539	90977	116960	89670	112407	174024	127561	159841	143610	139973	106439	109190	102871
BAITBOAT	*28710*	*42356*	*41365*	*44645*	*38134*	*38918*	*44488*	*34873*	*28085*	*29868*	*30009*	*38803*	*48015*	*41000*	*36569*	*41616*	*35687*	*31717*	*38123*	*33989*	*32366*	*38826*	*35476*
PURSE SEINE	*33061*	*57653*	*58680*	*36966*	*56734*	*66473*	*74824*	*65492*	*61795*	*48348*	*58893*	*51134*	*67613*	*47260*	*74802*	*131282*	*90498*	*127096*	*105176*	*105727*	*73753*	*70240*	*67278*
OTHER SURF	*3687*	*7059*	*840*	*1508*	*3898*	*2528*	*3054*	*2235*	*1328*	*219*	*1637*	*1040*	*1332*	*1410*	*1036*	*1126*	*1376*	*1028*	*311*	*257*	*320*	*124*	*117*
ANGOLA	1514	4036	3501	3626	3482	2532	2257	318	46	131	56	80	30	85	69	66	41	13	7	3	15	52	52
BENIN	0	0	0	8	30	60	68	38	10	20	11	5	3	7	2	2	2	2	2	2	2	0	0
CANADA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAP-VERT	825	748	1284	998	2094	1588	1636	1400	1391	2030	877	2076	1456	971	806	1333	864	860	1007	1314	470	591	687
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
CONGO	0	0	0	0	1250	200	0	5	10	8	8	8	8	11	12	9	9	10	7	7	6	0	0
CUBA	200	100	200	100	196	198	189	135	310	246	569	81	206	331	86	0	0	7	0	0	0	0	0
EC-ESPAÑA	16165	22257	25066	18748	26364	35458	38016	28934	46659	35100	41992	33076	47643	35300	47834	79910	53397	63660	50538	51594	38538	38513	29731
EC-FRANCE	17039	31138	25903	18602	25767	26926	31132	29727	12994	13645	13045	17114	16504	15211	17099	33271	21890	33735	32779	25188	23116	17014	18332
EC-PORTUGAL	2068	4386	4584	3074	1954	2825	5530	1113	3974	2409	5446	8420	14257	7725	3987	8059	7477	5651	7528	4996	8295	4399	4505
GABON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	11	0	26	0	0
GHANA	2199	3492	2866	4299	5812	7858	18272	24376	20697	19082	22268	24347	26597	22751	24251	25052	18967	20225	21258	18607	19602	27667	27667
GUANA	15042	16845	14614	14686	12304	12935	9930	6002	1504	2098	2031	1982	3200	2243	2566	4792	2378	0	0	0	0	0	0
KOREA	1948	3600	8132	12017	6718	7538	2827	1553	687	153	0	0	0	0	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	4513
NAMIBIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	15	0	1	0
NEI-1	0	0	0	0	0	0	1560	3383	927	590	540	1372	3732	2263	10516	19695	20559	34598	28371	31361	14952	14729	14729
NEI-2B	2467	3970	2980	1750	1735	144	2541	1611	0	0	0	0	0	0	0	0	0	88	129	0	0	0	0
NORWAY	0	0	0	0	0	0	0	0	0	0	540	581	738	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	1175	1110	540	1471	1450	381	1146	2086
SAO TOME & PRI	35	118	160	34	33	90	78	103	18	20	20	20	21	22	25	24	25	15	0	0	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	265
SOUTH AFRICA	0	40	90	2	48	88	37	44	11	64	87	88	157	96	17	15	7	6	4	4	1	6	6
U S A	1766	5859	6797	2073	2606	2800	79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
USSR	3633	6674	2856	1161	2991	1750	3957	1223	1000	1404	1688	547	1822	1915	3635	0	0	0	0	0	0	0	0
UK-STA HELENA	19	12	21	76	70	112	271	103	85	62	139	139	158	397	171	24	16	65	55	115	86	294	298
VENEZUELA	0	0	0	0	0	0	0	0	0	358	0	0	0	0	0	0	0	0	0	0	0	0	0

SKJ-TABLE 1. Reported landings of skipjack (MT) by flag and major gear

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
JAPAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KOREA	26	9	42	2	4	47	21	530	29	20	11	6	3	6	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
LITUANIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	221	0	0	0	0	0	0	0
MAROC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEXICO	0	0	0	0	1	3	0	25	30	48	11	13	10	14	4	9	8	1	1	0	2	3	1
NEI-2b	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NETH ANT	0	0	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	45	40	35	30	30	30
RUMANIA	0	0	0	0	8	0	0	0	0	0	3	0	0	59	142	349	73	0	0	0	0	0	0
SOUTH AFRICA	0	0	0	0	0	22	0	60	3	2	14	0	0	0	0	0	0	0	0	0	0	0	0
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
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
TRINIDAD & TOB	0	0	0	0	0	0	0	1	2	1	0	0	1	0	0	0	0	2	0	0	0	0	0
U.S.S.R.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UK-BERMUDA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
USA	0	19	63	292	0	0	651	0	0	0	1	1	1	6	2	1	1	1	2	61	0	4	1
VENEZUELA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0	0	0	0	0	0



SKJ-Fig. 1. Distribution of reported surface skipjack catches by 5x5 area and by gear (medium shaded part represents purse seine and light section represents baitboat catches)



SKJ Fig. 2. Total, eastern and western Atlantic skipjack landings (MT), 1950-1998. (Dnta for 1998 are preliminary estimates as of July, 1999).

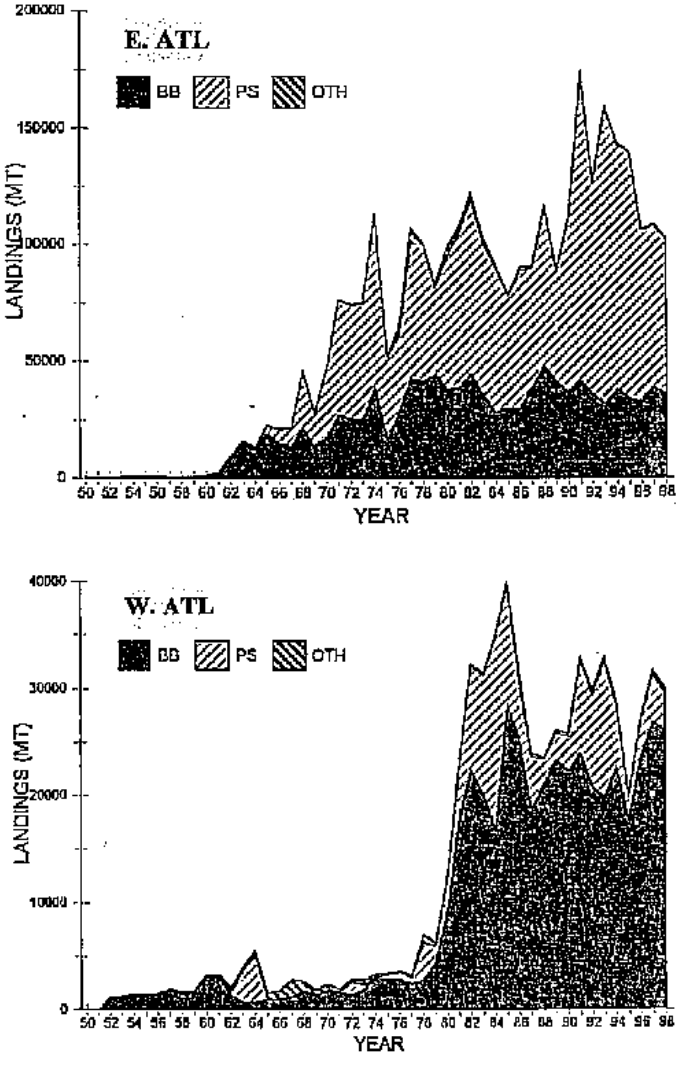
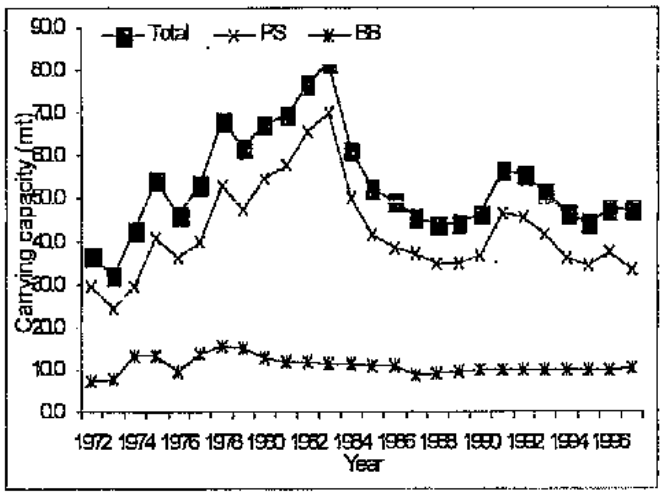
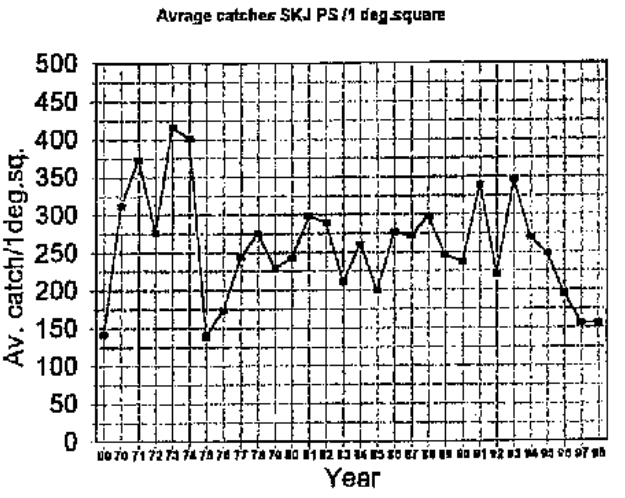
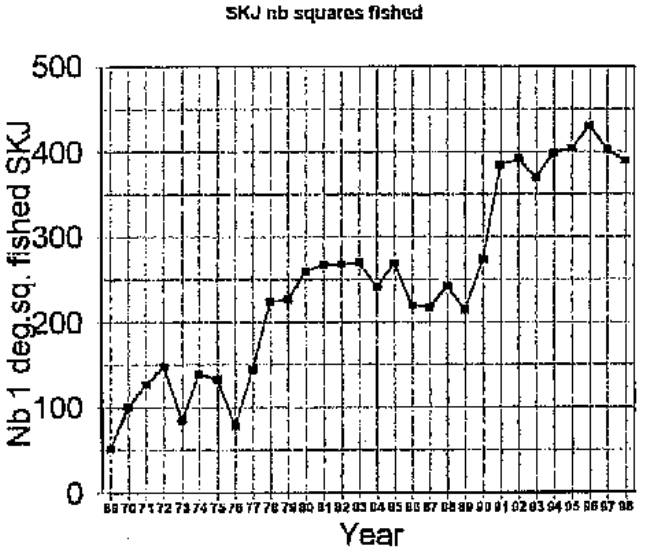


Fig. 3. Accumulated catches of skipjack in the east (upper panel) and west (lower panel) Atlantic by gears.

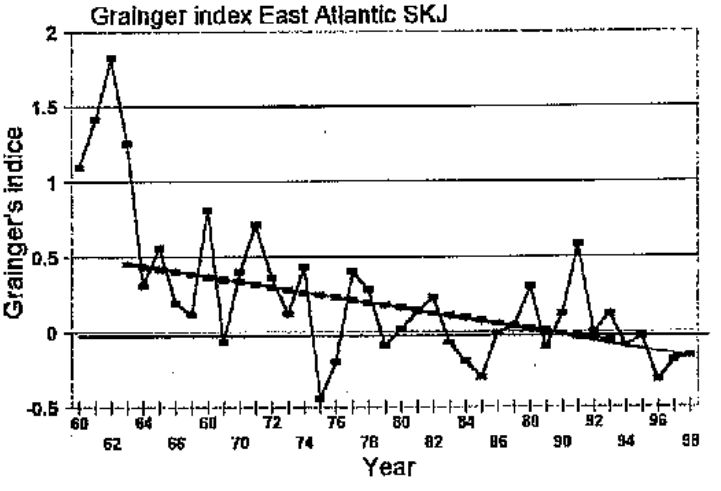




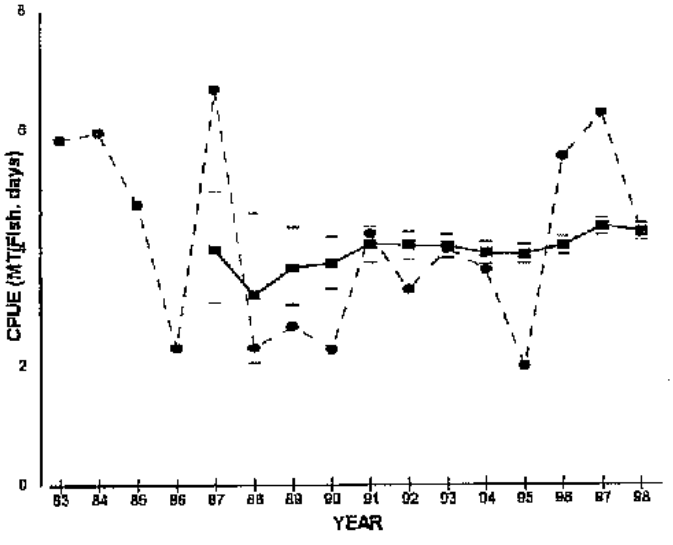
SKJ-Fig. 5. **Skipjack catch per one degree rectangle (where skipjack catches were made) by purse seiners in the east Atlantic, for the period of 1969 - 98, by major region.**

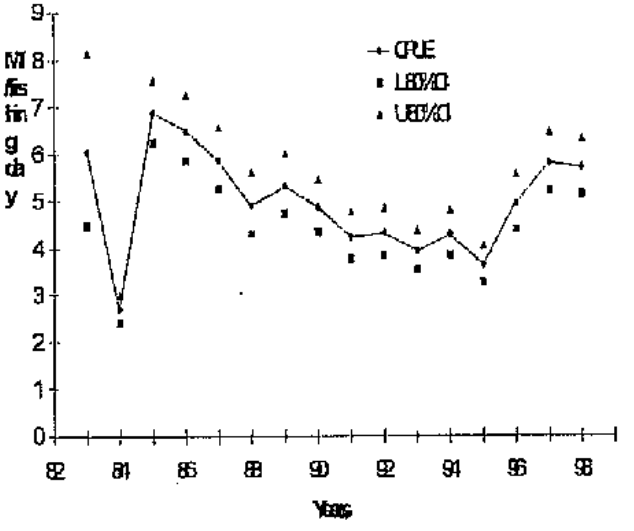


SKJ-Fig. 4. **Carrying capacity (upper panel) and number of 1x1 quadrants with skipjack catches recorded (lower panel) in the east Atlantic purse seine fisheries.**



SKJ-Fig. 6 **Index of Grainger and Garcia (Y-axis) and tendency line calculated for the eastern Atlantic skipjack.**





SKJ-Fig. 7. **Venezuelan purse seiners (left) and Brazilian baitboat (right) CPUE estimated by GLM: delta-log normal model. Dotted line on the left figure shows observed value.**

ALB – ALBACORE

No new stock assessment was conducted in 1999, 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-1. Biology

Albacore is a temperate species 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 5°N) and a Mediterranean stock (**ALB-Figure 1**).

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. 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.

ALB-2. Description of fisheries (ALB-Figure 2)

North Atlantic

The northern albacore stock has traditionally been exploited by surface and longline fisheries. These include Spanish trolling and baitboats, used mainly in the Bay of Biscay and adjacent waters, and some Spanish baitboats and a Portuguese fleet operating in the waters around the Azores Islands. Other surface gears, driftnets and pair-pelagic trawls, were introduced in 1987 in the Bay of Biscay and adjacent waters by France. Ireland and the United Kingdom joined the driftnet fishery at the beginning of the 1990s. In 1998, Ireland initiated experimental fishing trials using trolling and pair-pelagic trawling; these trials continued during 1999. An experimental purse-seine fishery was conducted by EC-France in the Bay of Biscay in 1999, and an experimental longline fishery in 1998.

The surface fisheries mainly target juvenile and sub-adult fish (50 cm to 90 cm FL). A longline fleet from Chinese Taipei targets sub-adult and adult albacore (60-120 cm) in the central and western North Atlantic. Other fleets take minor catches, however in most 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 reduction of fishing effort by the traditional surface and longline fisheries. The total north Atlantic catch in 1998 amounted to 25,697 MT and represents an 11% reduction on the previous year. Much of this reduction stems from a decline in the catches of the baitboat and trolling fleets caused by adverse weather conditions which shortened the fishing season. In contrast, effort and catch in the new surface fisheries has increased markedly since 1987 and in 1998 reached an all time high catch of over 7,000 MT. In 1998, longline catches were similar to those of 1997. It is noted that the autumn baitboat fishery around the Azores Islands has failed since 1996.

South Atlantic

The main surface fleets that target the southern stock correspond to South Africa, Namibia and Portugal. These countries exploit the resource together with Chinese Taipei, Brazilian and Japanese longliners. There are also some minor catches made by the purse seine fleet in the tropical area. The Chinese Taipei longline fleet targets albacore at a fairly high level, but have reduced their effort in 1998. A minor by-catch was reported by the Spanish longline fleet operating in the South Atlantic.

In 1998, albacore catches in the South Atlantic rose by about 9%, reaching 30,046 MT. Reported landings of Brazil, Namibia and South Africa were higher than in the previous year, whereas the catches of Chinese Taipei, Japan and Portugal declined. The increase in South African bait-boat catches was due to a greater availability of albacore in the near-shore waters fished by the South African fleet. South Africa initiated a tuna directed pelagic longline fishery in November 1997. This fleet reported a small albacore by-catch. The growth of Brazilian longline catches, in turn, occurred due to a change in the fishing strategy of some

longline vessels, which changed the target species from bigeye to albacore in response to market forces. The catch of the Brazilian bait-boats also increased substantially, but remain much less than the catches from the longline fishery. The decrease of catches from Chinese Taipei was a result of a lower fishing effort due to self-regulation by the fleet.

Mediterranean

Reported albacore catches in the Mediterranean were minor in 1998. However, the Committee expressed concern that not all countries had submitted catch data.

ALB-3. STATE OF THE STOCKS

In 1999, 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 1998, after a deep review of Task I and Task II data available, still apply. No attempt was made to analyze the status of the Mediterranean stock in 1998.

The 1998 Committee recognized the important improvement of the basic data for both 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 **(ALB-Figure 3 & 4)**

In 1998, the Committee analyzed the state of the northern stock using tuned virtual population analysis (VPA) and a more general age-structured method. The relative abundance indices and other assumptions made for the base case were essentially the same as those used in previous assessments, based on the recommendations made during the Final Meeting of the Albacore Research Program. Only some modifications were made in the model formulation.

The results obtained in 1998 showed consistency with those from previous assessments. Sensitivity analysis were also conducted to explore the influence of several inputs and assumptions. Among various choices, the effect of considering abundance indices derived from non-target fleets was explored; the analysis showed that the inclusion-exclusion of these indices did not influence significantly the results obtained. The Committee noted the remarkable coherence between different methodologies utilized in the assessment of this stock. The Committee further noted that global environmental factors might explain some proportion of the recruitment variability during the last two decades.

Equilibrium yield per recruit analyses made by the Committee indicate that the northern stock is not growth-over fished. Equilibrium yield analyses, made on the basis of an estimated relationship between stock size and recruitment, indicate that current fishing mortality may be about 25% higher than that which would generate MSY (an alternative assessment model indicated that current F may be as high as 140% of F_{MSY}). However, the Committee noted considerable uncertainties in these estimates of current F relative to F_{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 fully-exploited, but neither the possibility that it is over-exploited nor the impact of environment variation should be dismissed.

South Atlantic **(ALB-Figures 5 & 6)**

In 1998 the Committee analyzed the status of the southern stock using both age-structured and age aggregated methods. All these methods obtained variable estimates of stock parameters based on the abundance indices and the catch at age information used. The age-structured model was used to produce base-case assessments of albacore abundance, using CPUE indices for the main fleets exploiting this stock. Sensitivity analyses were conducted to investigate the effect of standardization and choice of abundance indices, growth model and mortality parameters.

The base case results for 1998 were different from those for 1997. The main difference being that the 1998 results indicate a stock at biomass levels above those at MSY, whereas previous results indicated that the stock was below the biomass level at MSY. The Committee estimated that the 1997, F- and B-ratios were 0.75 and 1.28 respectively. However, the variability associated with those estimates and the uncertainties of the assessments was large, and the 1998 Committee could not reach a definite conclusion on the status of the resource.

Mediterranean

The status of the Mediterranean stock has never been quantitatively analyzed, and no stock assessment was conducted in 1999.

ALB-4. Outlook

North Atlantic

The northern albacore stock has mainly been exploited by surface fisheries since the longline fleets shifted their targeting to bigeye tuna. Drift nets and pelagic trawls, which achieve higher catch rates than trolling gear, were introduced ion 1987. The bait-boat fishery targeting adult albacore has been very variable in the last decade depending on environmental conditions that affected the availability of the resources and the ability of the vessels to put to sea. The last analytical assessment, made in 1998, concluded that the stock was at, or above, full exploitation, and drew attention to the need to implement effective controls to limit fishing effort to 1997 levels. Any introduction of new gears into the fishery should be closely monitored in order to avoid further increase in the current level of effort.

South Atlantic

The 1998 Committee could not reach a definite conclusion on the status and outlook of the south albacore stock, due to the uncertainties of the analyses conducted. However, the Committee considered the resource to be close to fully-exploited, but stable under the 1997 level of exploitation.

The total catch in 1998 (30,046 MT) was 9% above the 1997 catch, and 6% above the estimated replacement yield. Catches at this increased level are likely to have a negative impact on the outlook for the resource.

ALB-5. Effects of current regulations

North Atlantic

A European Union regulation restricting the length of driftnets used by EU members to 2.5 km was introduced in 1992. In 1998, an EU regulation was adopted which progressively limits the maximum number of vessels using driftnets pending a total ban from January 1, 2002.

In 1998 ICCAT recommended that Contracting Parties, non-contracting parties, entities or fishing entities, fishing for northern albacore limit the fishing capacity of their vessels, exclusive of recreational vessels, for this stock from 1999 onwards, through a limitation of the number of vessels to the average number in the period 1993-1995. The Committee expressed concern that the current regulation fails to recognize that fishing mortality may increase without any increase in the number of vessels.

Evaluation of fishing capacity

In 1998, the Commission requested the SCRS to carry out an evaluation of the fishing capacity of the different fleets/gears that participate in this fishery with a view to establishing fishing effort correspondences. The Committee was unable to estimate the current level of effective effort in the fishery due to absence of data from some surface fleets. Consequently, the Committee could not track and quantify the changes in effort that are currently taking place in the fishery, nor their consequences. The Committee is concerned with the consequences that any increment in the overall effective effort in the fishery would have given the present status of the stock.

South Atlantic

In 1997, ICCAT adopted a recommendation that countries, entities or fishing entities fishing actively for southern albacore implement suitable measures to limit their catches so as to ensure that the catch limit of 22,000 MT is not exceeded in 1998. The catch in 1998 by countries, entities or fishing entities fishing actively for southern albacore was 29,347 MT, which exceed the recommendation by 33%.

In 1998, ICCAT adopted a recommendation limiting the total catch for southern albacore caught in the Atlantic Ocean south of 5°N to 28,200 MT for 1999. The catch limit for southern albacore caught by countries entities or fishing entities fishing actively for southern albacore, other than the European community, was set at 27,200 MT for 1999.

In addition, it was recommended that all countries, entities and fishing entities actively fishing for southern albacore report total cumulative southern albacore catches to a designated Contacting Party actively fishing for southern albacore within two months of those catches having been made. This recommendation has proved unfeasible, and only Chinese Taipei has reported catches in a timely manner. Brazil report that they are unable to supply bimonthly catch returns due to the long time some of the boats stay at sea (up to 5 months), which delays the catch information for about 6-7 months. South Africa now reports albacore catches based on export data, as these provide the most reliable record of catches. However, there is a three-month time lag on the availability of these data.

Mediterranean

No ICCAT regulations are currently in effect for the Mediterranean stock.

ALB-6. Management recommendations

North Atlantic

The Committee concluded in 1998 that the northern albacore stock appears to be at or above full exploitation. The Committee reiterates the previous recommendation that fishing mortality should not be increased above the 1997 level.

South Atlantic

According to the assessments conducted by the SCRS in 1998, it was concluded that the albacore southern stock is probably being exploited at a high level, close to fully-exploited. This possibility, together with the results of previous assessments, leads the Committee to recommend that fishing mortality should not be increased above its 1997 level until the Committee had greater certainty of a better status of the stock.

Mediterranean

The Committee noted that the status of the Mediterranean stock has never been quantitatively analyzed, and no stock assessment was conducted in 1999. Although reported albacore catches in the Mediterranean were minor in 1998, the Committee further noted that not all countries had submitted catch data. There are currently no ICCAT regulations in effect for the Mediterranean stock.

The Committee suggests that a review of information relating to the status of this stock be conducted.

ATLANTIC AND MEDITERRANEAN SUMMARY (MT)

	North Atlantic	*South Atlantic*	*Mediterranean*
Current (1998) Yield	25,697	30,046	2,520
Maximum Sustainable Yield[1]	32,000 [30,600-33,400]	28,400 [15,800-51,100]	–
Current (1998) Replacement[1]	--	28,200 [17,200-46,300]	Never calculated
Relative Biomass[1]			
B_{1997}/B_{MSY}	0.47 [0.34-0.63]	1.28 [0.37-4.3]	Never calculated
$R_{1990-94}/R_{75-80}$	0.72	0.98	Never calculated
Relative Fishing Mortality[1]			
F_{97}/F_{MSY}	1.39 [uncertain]	0.75 [uncertain]	Never calculated
F_{97}/F_{MAX}	0.91	0.62	Never calculated
$F_{97}/F_{0.1}$	1.60	1.80	Never calculated
Management measures in effect	Limit number of vessels to average number 1993 – 1995	Limit catches to 28,200 MT for 1999.	None

1 Estimated by the Committee in 1998.

ALB-TABLE 1. Reported landings of albacore (in MT) by major gear and area

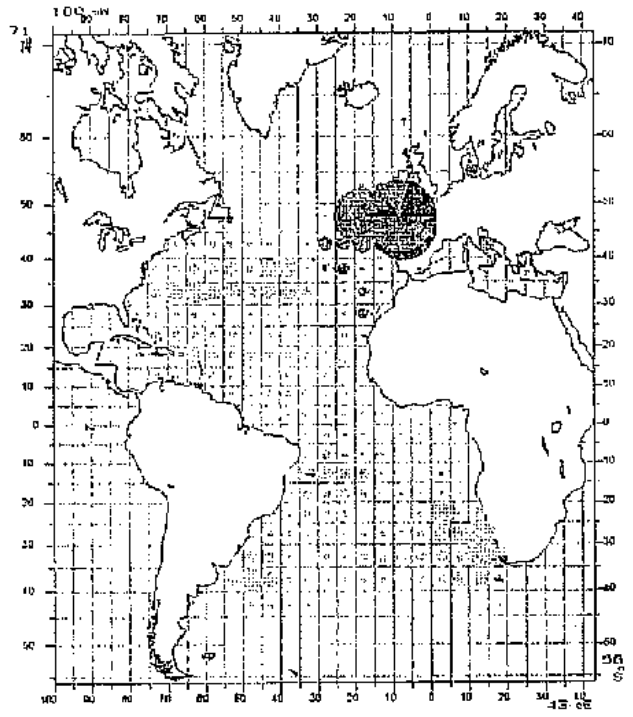
ALBACORE	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
TOTAL	77346	76099	73806	74826	62134	59651	72942	67314	57661	75971	88465	82708	67874	63357	67214	56843	71303	73312	71425	67797	60421	59240	58371
NORTH ATLANTIC	57326	53821	50047	51365	38704	34111	41998	51161	39648	40745	47465	38085	33704	32086	36604	28329	32730	39363	35898	38614	28847	28803	25697
SURFACE	*34320*	*32952*	*35890*	*39158*	*29257*	*24292*	*28808*	*34301*	*19944*	*23334*	*26243*	*30796*	*30701*	*29861*	*33904*	*23000*	*29600*	*31715*	*28729*	*33846*	*24249*	*24700*	*21830*
LONGLINE	*23006*	*20869*	*14157*	*12207*	*9447*	*9819*	*13190*	*16860*	*19704*	*17411*	*21222*	*7289*	*3003*	*2225*	*2700*	*5329*	*3130*	*7639*	*7169*	*4768*	*4598*	*4103*	*3867*
BRASIL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
CANADA	0	0	0	0	0	0	0	0	0	0	1	21	47	22	6	5	1	9	32	12	24	31	23
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
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
CUBA	85	83	89	0	31	48	82	38	69	20	31	15	4	0	2	0	0	0	0	0	0	0	0
EC-ESPANA	26910	25155	25404	29630	25202	20819	25478	29557	15685	20672	24387	28206	27557	25424	25807	17537	19992	19027	17680	20452	16328	17360	13460
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
EC-IRELAND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	60	451	1946	2534	918	874	1913	3743
EC-PORTUGAL	610	62	85	149	79	442	321	1778	775	657	498	433	184	169	3185	709	1638	3385	974	6470	1634	395	99
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	33
GRENADA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	6	6
JAPAN	1345	825	531	1219	1036	1740	781	1156	576	844	470	494	723	764	737	691	466	485	505	386	466	475	442
KOREA	5379	5579	3048	2997	797	938	1326	478	967	390	373	18	16	53	34	1	0	8	0	0	2	1	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
NEI-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	88	71	52	59	40	13	158
NEI-28	1227	557	768	425	193	177	494	357	2551	601	525	44	0	0	0	79	78	0	216	14	45	0	11
NORWAY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SIERRA LEONE	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0
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
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
TRINIDAD & TOE	0	0	0	0	0	0	0	268	194	318	0	0	0	0	4	0	247	639	0	0	0	1	1
U.S.A	0	2	1	0	19	52	24	18	25	17	162	271	114	259	389	484	377	452	671	545	472	577	829
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
UK-BERMUDA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
VENEZUELA	133	102	397	593	300	331	137	823	1076	467	172	26	137	41	95	314	199	246	278	278	312	49	70
SOUTH ATLANTIC	19459	21665	23169	22628	22930	24040	29672	14918	14599	31097	37288	40630	30107	27211	28714	25815	35708	32733	34775	27189	27880	27788	30046
LONGLINE	*19262*	*21194*	*22806*	*21843*	*20671*	*20426*	*25255*	*11941*	*9834*	*22672*	*29815*	*30964*	*21828*	*19407*	*21590*	*21698*	*26519*	*23650*	*24224*	*19718*	*20472*	*19437*	*19640*
SURFACE	*197*	*471*	*363*	*785*	*2259*	*3614*	*4410*	*2922*	*4556*	*8272*	*7117*	*9197*	*7935*	*7450*	*6973*	*4040*	*8878*	*9080*	*10549*	*7471*	*7408*	*8351*	*10406*
UNCL	*0*	*0*	*0*	*0*	*0*	*0*	*7*	*55*	*209*	*153*	*356*	*469*	*344*	*354*	*151*	*77*	*311*	*3*	*2*	*0*	*0*	*0*	*0*
ARGENTINA	48	80	8	0	4	2	7	55	209	153	356	469	344	354	151	60	306	0	2	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
BRASIL	296	688	494	515	476	276	800	731	732	382	520	395	421	435	514	1113	2710	3613	1227	923	819	652	3407
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
CUBA	15	17	11	0	27	53	29	36	67	27	24	10	2	1	2	17	5	3	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	20
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
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

ALB-TABLE 1. Reported landings of albacore (in MT) by major gear and area

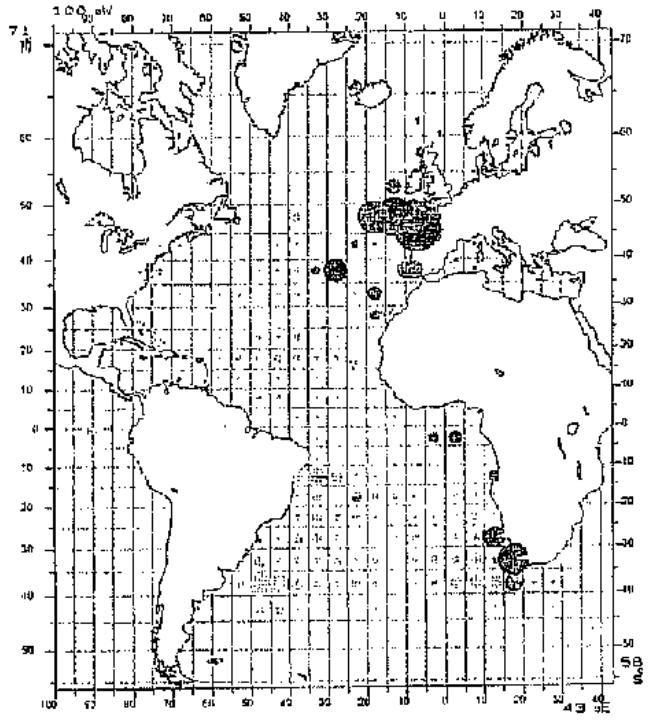
ALBACORE	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
HONDURAS-OB.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	7	1
JAPAN	73	107	135	105	333	558	569	188	224	623	739	357	405	450	587	654	583	467	651	389	435	414	389
KOREA	3376	3829	1413	878	803	682	563	599	348	511	321	383	180	54	19	31	5	20	0	0	18	4	0
MAROC	0	0	2	0	0	0	113	0	0	0	0	41	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	1422
NEI-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	87	166	253	267	71	35	13	13
NEI-28	770	377	354	125	167	129	210	0	0	0	280	924	0	0	0	0	0	0	0	0	0	0	0
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
STA.HELENA	0	1	12	2	4	7	11	7	9	0	0	2	1	1	1	5	28	38	5	82	47	18	1
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
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
URUGUAY	0	0	0	0	0	23	235	373	526	1531	262	178	100	83	55	34	31	26	16	49	75	56	110
MEDITERRANEAN	**561**	**613**	**590**	**833**	**500**	**1500**	**1272**	**1235**	**3414**	**4129**	**3712**	**3993**	**4063**	**4060**	**1896**	**2378**	**2202**	**856**	**242**	**1587**	**3125**	**2541**	**2520**
LONGLINE	*41*	*130*	*150*	*0*	*0*	*0*	*0*	*0*	*226*	*375*	*150*	*161*	*168*	*165*	*624*	*523*	*442*	*0*	*3*	*87*	*366*	*348*	*22*
SURFACE	*0*	*0*	*0*	*0*	*0*	*900*	*572*	*535*	*1663*	*1166*	*120*	*167*	*141*	*141*	*772*	*1355*	*1260*	*855*	*238*	*1499*	*1807*	*1451*	*1346*
UNCL	*520*	*483*	*440*	*833*	*500*	*600*	*700*	*700*	*1525*	*2588*	*3442*	*3665*	*3754*	*3754*	*500*	*500*	*500*	*1*	*1*	*1*	*952*	*742*	*1152*
EC-ESPAÑA	0	0	0	0	0	900	572	535	1331	531	0	0	3	0	84	547	227	290	218	475	404	380	126
EC-FRANCE	0	0	0	0	0	0	0	0	141	250	20	60	31	31	121	140	11	64	23	3	0	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
EC-ITALY	560	613	590	833	500	600	700	700	1942	3348	3208	3433	3529	3529	1191	1191	1464	1	0	1109	1769	1414	1242
JAPAN	1	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	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
YUGOSLAVIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UNKNOWN AREA	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**321**	**663**	**369**	**510**	**407**	**569**	**108**	**108**
CHINA.PR[1]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	8	20	0	0
LONGLINE	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*321*	*663*	*369*	*496*	*399*	*549*	*108*	*0*
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
NEI-28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	161	382	210	363	289	369	58	58
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

1. These catches were later identified as north Atlantic

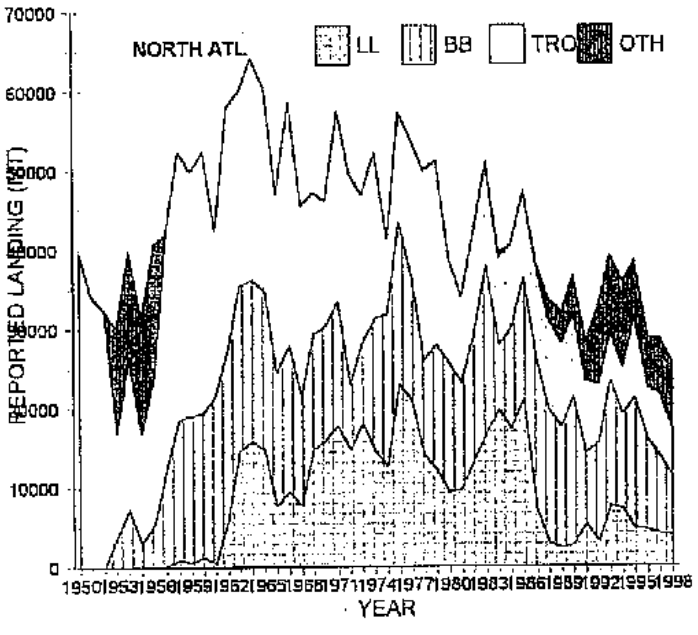
a)

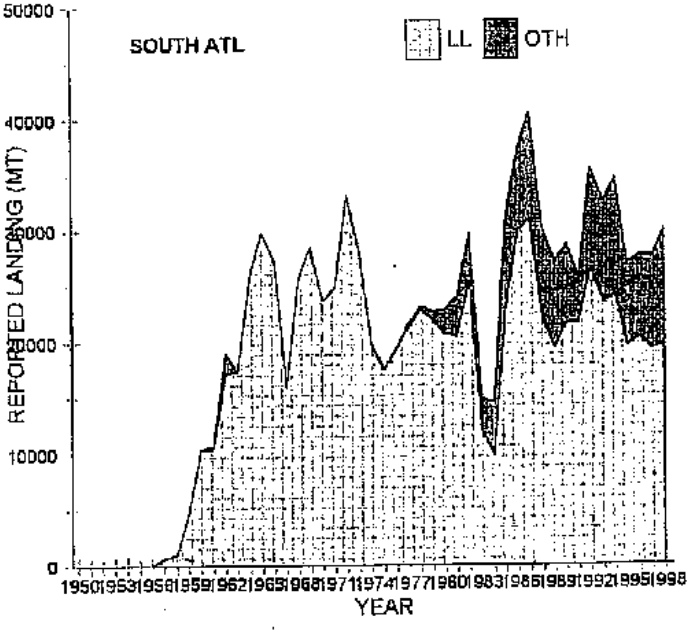


b)

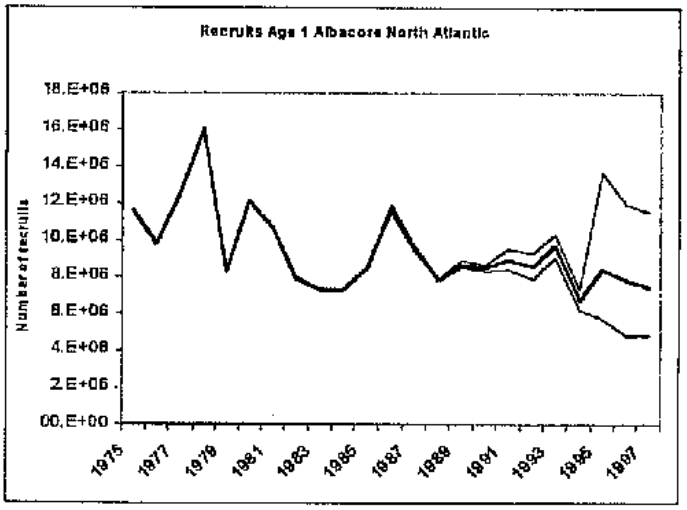


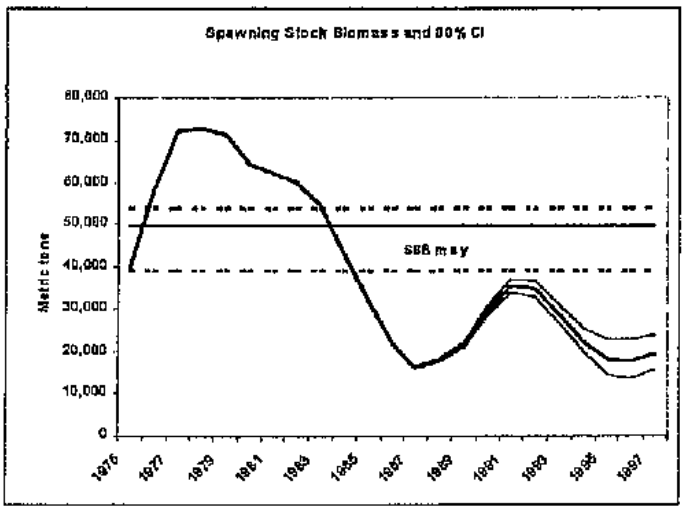
ALB-Fig. 1. **Geographical distribution of annual albacore catches in a)1980-1989 and b) 1990-1996. (Very light portions represent longline and darker portions represent various surface gears).**

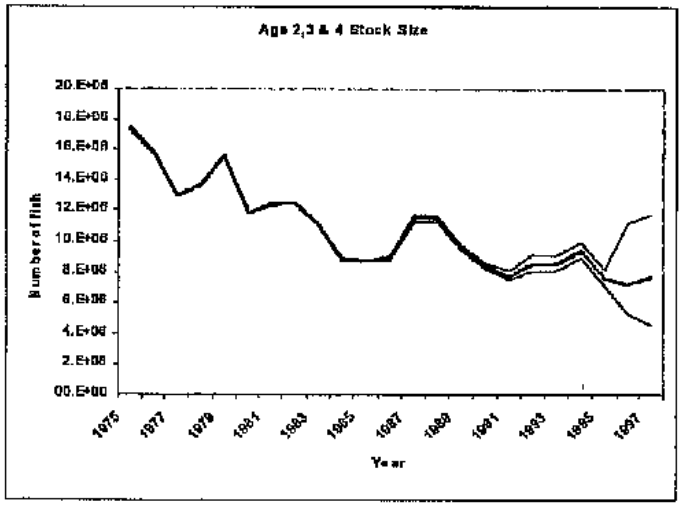


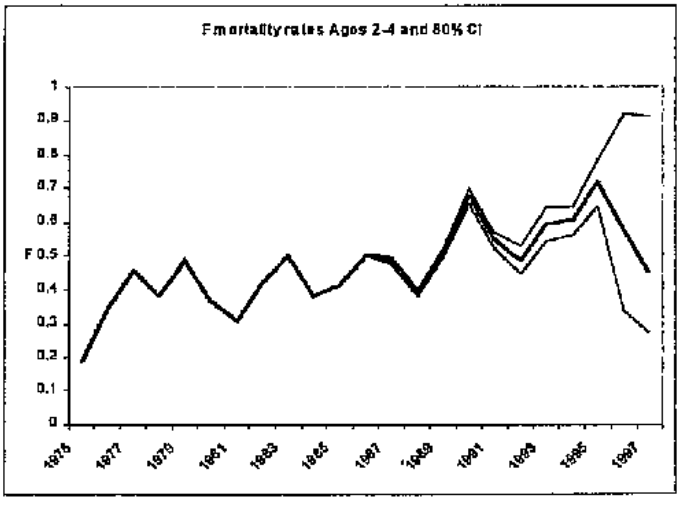


ALB-Fig. 2. **Albacore landing (MT) in north and south Atlantic by major gear types, 1950-1998.**

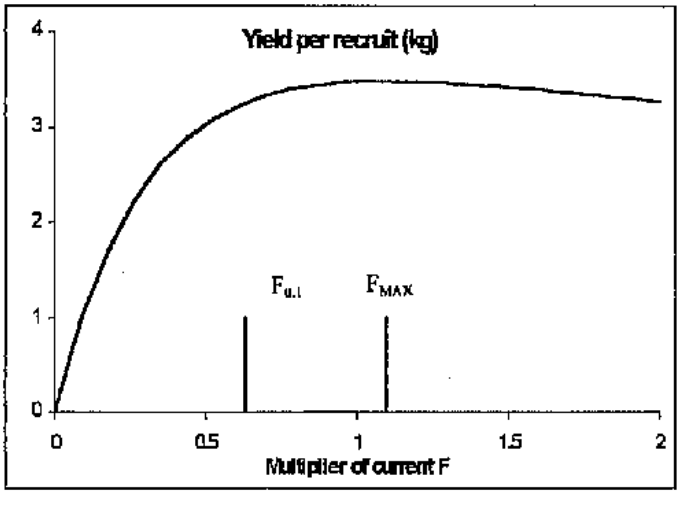


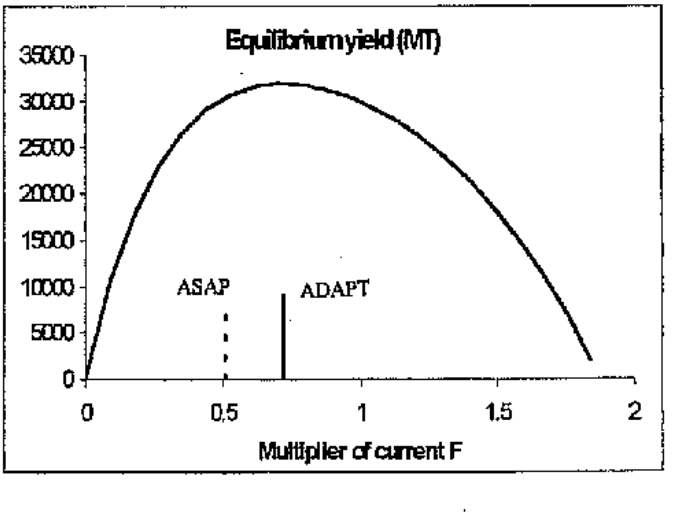




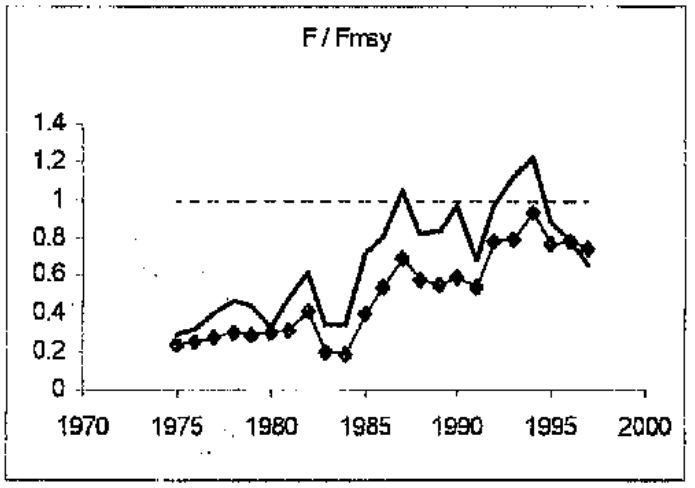


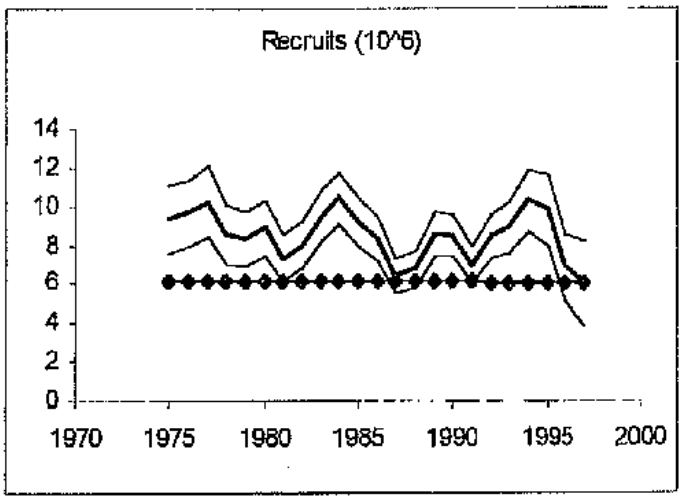
ALB-Fig. 3. **Recruitment, spawning stock biomass (SSB_{MSY} also indicated), fishing mortality and numbers at ages 2 to 4 of North Atlantic albacore, as estimated by ADAPT VPA. (The confidence intervals are underestimated as F-ratio has been assumed constant.)**

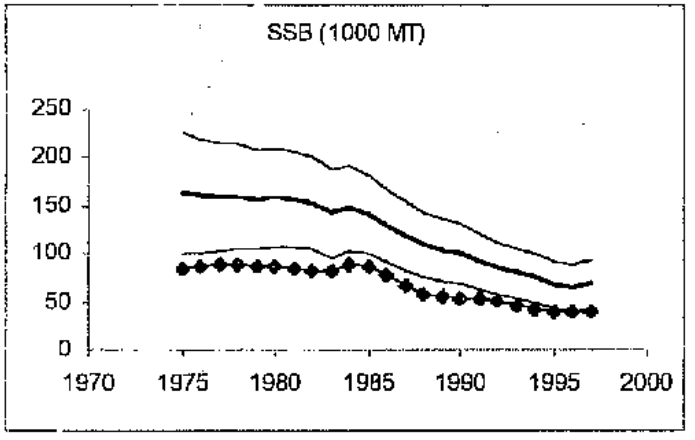




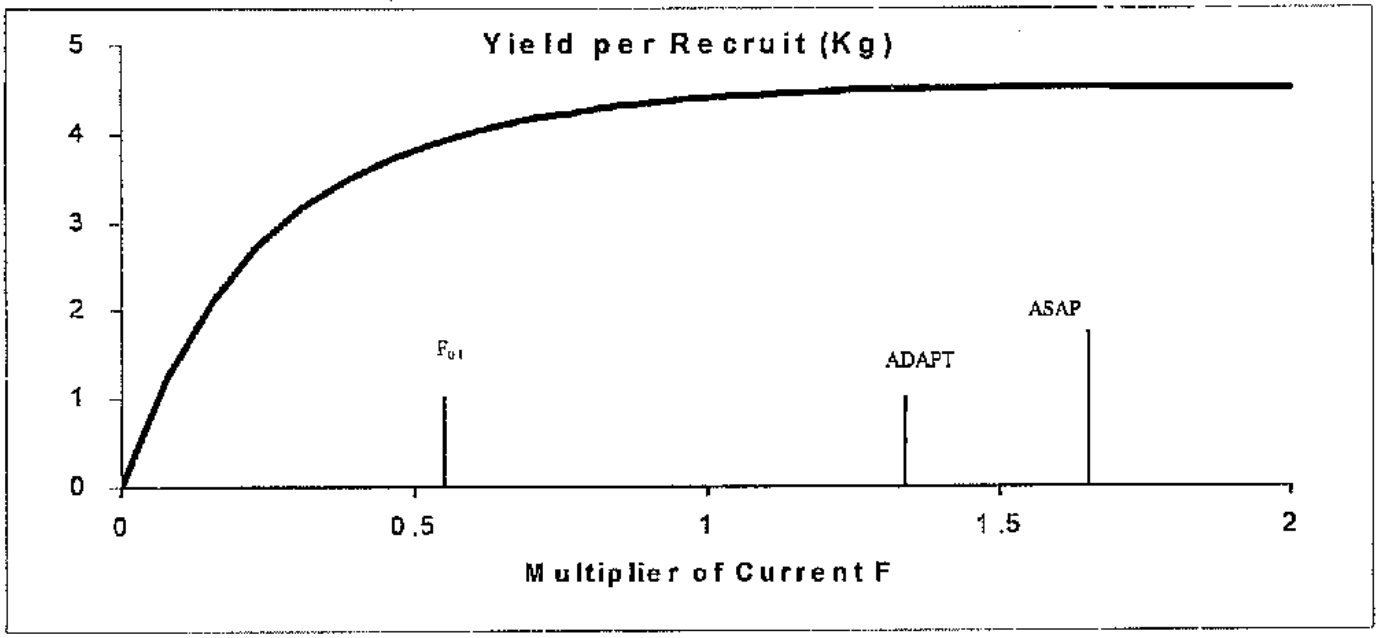
ALB-Fig. 4. **Yield per recruit (a) and equilibrium yield (b) for north Atlantic albacore. $F_{0.1}$ and F_{max} as estimated by ADAPT are indicated. And F_{msy} as estimated by two methodologies (ADAPT and ASAP).**







ALB-Fig. 5 F/F_{MSY}, recruitment and spawning stock biomass as estimated by ASPM (dots) and ASAP (bold line) for albacore southern stock. Confidence intervals (1 SD) re shown as dashed lines.



ALB-Fig. 6. **Yield per recruit analysis for south albacore stock. $F_{0.1}$ and F_{MSY} as estimated by two age-structured methodologies (ASPM and ASAP) are shown.**

BFT - BLUEFIN TUNA

No new stock assessment was conducted in 1999. This report updates only the description of fisheries section (see underlined text). Because of a lack of reports of catch (and catch-at-size) data for several important fisheries, this update is, however, incomplete. The Committee was unable to evaluate the effects of regulations, given the lack of catch and size data from some countries and the difficulty of interpreting the data carried over for these fisheries. Other sections, and the conclusions of the Committee remain unchanged from the 1998 SCRS Report.

The SCRS conducts Atlantic bluefin tuna stock assessments based on the assumption of two distinct stocks, west and east Atlantic (including the Mediterranean Sea), although some mixing occurs between the two stocks (**BFT-Figure 1**). The hypothesis of two separate sub-populations is supported by preliminary findings from recent genetic research. Recent tagging information suggests that migratory behavior may be complex. Even minor mixing could, in principle, have a marked effect on stock assessments based on two distinct stock assumptions, due to the difference in population size between the two stocks. Therefore, the SCRS has investigated mixing assuming a variety of migratory behaviors, using sensitivity analyses. Results of these investigations are either more optimistic and more pessimistic, depending upon the model forms assumed. Additionally, one cannot distinguish on the basis of the existing data which model forms are more likely. Thus, mixing models and the available data are not yet considered sufficient to provide reliable prediction. Nevertheless, the Committee believes that assessments assuming no mixing should be reasonably robust, if adequate management approaches are applied to both the eastern and western Atlantic management units.

The reported total catch of Atlantic bluefin in 1996 reached an historical high (revised to 54,723 MT, from the previously estimated 42,964 MT and 48,514 MT, based on revisions to reported catches and estimates of non-reported catches (**BFT-Table 1, BFT-Figure 2**). The 1997 reported catch (49,196 MT) is slightly lower than the estimated 1996 catch, but is still the second highest on record. The 1998 reported catch is incomplete because of a lack of catch report from one important fishery, EC-Italy, and from other fisheries. The 1998 catch was, thus, estimated at 44,700 MT by carrying-over Italian catches from 1997 reported level. This number would suggest a decrease in comparison to the four previous years, but this needs to be validated by complete reported catches. Note that reported catch has being modified according to a revision of the Turkish statistics. The dramatic increase in total Atlantic bluefin catches from 1994 to 1997 was due to increases in the catch from the East Atlantic and Mediterranean, as the west Atlantic catch has been limited, by quota, to a low level (2,000-2,700 MT) since 1982. The Committee notes that national reviews of catch statistics in the Mediterranean resulted in reported landings that were substantially larger for the period 1991-1995 than were used in the previous assessment.

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 east and west Atlantic management units (**BFT-Figure 1**). A 1994 review of ICCAT tagging data, and more recently the results of satellite tagging studies, have showed that a small number of fished tagged in the east have been recaptured in the west and vice versa.

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 in the western Atlantic generally reach a larger maximum size, and mature at an older age compared to bluefin caught in the eastern Atlantic. Bluefin in the west are assumed to first successfully spawn at age 8 compared to ages 4 to 5 in the east.

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 34°N to 41°W and offshore of that area in the winter. In the East Atlantic, bluefin tuna generally spawn from late May to July according to 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 24°C. Distribution expands with age; large bluefin are adapted for migration to colder waters. Bluefin tuna are opportunistic feeders, with fish and squid common in their diet. First

results of satellite tagging experiments show that bluefin released in southern Spain can migrate to the North of Norway (75.1°N, 1.1°E) and around the Cape Verde Islands (20.3°N, 29.7°W). Although none of the eight successful recoveries demonstrated any transatlantic migrations during a period of time under eight months, much more tagging is needed to reach preliminary conclusions.

BLUEFIN TUNA - WEST

BFTW-2. Description of fisheries

The Japanese longline fishery catches in the west Atlantic more than doubled in 1998 (compared to 1997 catches of 329 MT) to 691 MT. The Canadian reported landings also increased in 1998 to 596 MT (compared to 504 MT in 1997) exclusive of discards. The provisional estimate of Canadian dead discards in 1998 is 16 MT. Reported catches of U.S. fisheries in 1998 decreased slightly to 1,235 MT (compared to 1997 reported catches of 1317 MT) exclusive of discards. The estimate of US dead discards in 1998 is 64 MT. Bermuda reported landings of 2 MT in 1998, the same level reported for 1997. The winter-spring fishery that developed off Cape Hatteras, North Carolina, in 1994 to 1997 failed to develop fully in 1998, and in 1999 most catches occurred further to the South than in 1994-1997, thus limiting access to vessels from some ports. Most fish caught in this fishery were tagged and released and in 1996, 1997, and 1999 some fish were tagged with archival and/or pop-up satellite tags.

The 1998 reported catches (including discards) for the west Atlantic were 2,643 MT. From 1994 through 1998, west Atlantic catches (including reported discards) averaged about 2,400 MT, compared to about 2,500 to 3,000 in the previous five years (1989-1993) **(BFT-Table 1; BFT-Figure 2)**.

BFTW-3. State of stocks (not modified in 1999)

The most recent assessment of western Atlantic bluefin tuna was carried out at the Bluefin Stock Assessment Session, September 13-24 in Genoa, Italy (SCRS/98/22). Several forms of population analysis were used to examine the status of the resource including virtual population analyses (VPA) using a variety of input model forms, and secondarily an age-structured production model (ASPM) with the goal of estimating current stock levels, MSY and spawning stock biomass relative to that which would produce MSY.

Considerable analyses and discussion focused on methods to standardize the basic input abundance indices and to weight these inputs appropriately in the population models. After considerable debate it was felt that given the present level of knowledge, that the best way to characterize the management advice would be to weight all abundance indices equally. By doing this, the Committee is indicating that it cannot say if any one individual index is more likely to measure relative abundance than any other in the analysis. Results of the analyses (VPA's and ASPM's) gave similar relative abundance trends **(see BFT-Figure 3)**.

In terms of the historical perspective, the results of this assessment are similar to previous assessments **(BFT-Figure 4)**. Recruitment was generally higher from 1970 to 1976 than it has been since. A trend in recruitment since 1977 cannot be distinguished. The assessment shows the spawning biomass (age 8+) estimated for 1997 to be 14%-17% relative to 1975 level. The abundance of ages 8+ declined steadily until 1992 with a subsequent slight increase until 1995 and 1996. Correspondingly, the fishing mortality rate on large fish increased steadily in the 1970s until the implementation of regulations in 1982 **(BFT-Figure 5)**, at which time the fishing mortality rate was reduced considerably. However, fishing mortality began increasing again in the 1980s until it again peaked in 1991. Fishing mortality rates for age 1 remained at a low level from the mid-1980s. Note that estimated abundance and fishing mortality rates in recent years (especially of younger ages) should be judged with caution since such VPA estimates are generally imprecise.

As noted above, the relative weights that are given to the individual abundance indices are important. Alternative forms of weighting produced both more pessimistic and more optimistic results than those indicated in **BFT-Figure 3**. Although these produced similar historical abundance patterns, 1998 absolute abundance levels are important in projections.

BFTW-4. Outlook (not modified in 1999)

Projections were developed using VPA outputs and alternative projection methodologies. Necessarily, projections require a stock-recruitment function form from which predictions of recruitment are made based upon the relationship of spawning stock size to recruitment. In the case of west Atlantic bluefin tuna, two stock-recruitment options were tested. One was based on a

Beverton-Holt[1] stock-recruitment function which indicates higher chances of good recruitment as spawning biomass increased (indeed, one of the reasons to rebuild the spawning stock is to increase the likelihood of better recruitment in the future). An alternative 2-line[2] method was tested in which future recruitment was specified to remain near the levels observed since the mid-1970s. The latter method was similar to that used in the 1996 assessment. When that method was used, projections for the west Atlantic indicate that 2,500 MT is sustainable over the next 20 years and that spawning stock will show a net increase (**BFT-Figures 6, 7**).

Alternatively, projections using a Beverton-Holt model for the west Atlantic (**BFT-Figures 6, 7**) indicate that a catch of 2,500 MT cannot be sustained. Projections with that methodology indicate that 2,000 MT is sustainable, with the spawning stock showing a net increase over a period of about 20 years to a level about 20% higher than in 1997. In terms of recovering to MSY level within 20 years (i.e. by 2017), median trajectories indicated a need for a catch reduction to between 2,000 and 2,500 MT for the 2-line stock-recruitment model and to about 0 MT for the Beverton Holt stock-recruitment model.

In both cases transient effects are evident, i.e. biomass increases over the next few years before establishing the more regular long-term trajectory.

When making decisions on these projections, the Commission should note that limited available data make assessments inherently uncertain. The assessment here is no exception. Many additional sources of uncertainty have been considered , including the effect of mixing with the eastern stock of fish (see also the 1998 Detailed Report). Another important uncertainty was the choice of alternative weightings of the input abundance index data. Various weighting criteria were favored for scientific reasons by individual members of the Committee. These weightings produced projections that were both more optimistic and more pessimistic than those in **BFT-Figures 6,7**.

BFTW-5. Effects of current regulations (not modified in 1999)

A regulatory recommendation stating that Contracting parties should limit the fishing mortality to recent levels came into force in 1975. Catch reductions have not been sufficient to reduce fishing mortality rates to comply with this regulation (**BFT-Figure 5**).

A regulatory regime has been adopted for West Atlantic bluefin catches. In general, catch limits have been adhered to. The 1997 overall and country-specific catch levels were well within the quota.

There is a prohibition on taking and landing bluefin less than 30 kg (or 115 cm), with an 8% tolerance by weight on a national basis. Since 1992, the overall percentage of fish less than 115 cm is less than 8%, though the USA exceeded the tolerance in both 1993 and 1997 (10%; 1997 data are provisional). By default, the 1975 minimum size limit of 6.4 kg with a 15% tolerance is adhered to in the West.

BFTW-6. Management recommendations (not modified in 1999)

The most recent assessment of western bluefin showed that the 1997 age 8 and older mid-year biomass was about 14%-17% of the corresponding estimate for 1975. Projections based upon the Beverton-Holt stock recruitment relationship indicate that a catch of 2,000 MT is sustainable; also there is more than a 50% chance than an annual catch of 2,500 MT cannot be sustained, and there is about a 10% probability of a large reduction by the year 2005 (assuming it is possible to exert a high enough fishing mortality rate to maintain a constant catch of 2,500 MT as the stock declines). On the other hand, if a 2-line stock recruitment relationship is assumed, a catch of 2,500 MT is sustainable.

In 1997, the Commission requested development of recovery options aimed at achieving spawning biomass levels which would support MSY within various time periods. For a 20-year period, in terms of Beverton-Holt stock recruitment relationship, this level is likely difficult for the stock to achieve even in the absence of any catches. A 2,000 MT constant catch would allow for 1.5 fold recovery in 20 years to about 10% of the level which could support MSYs of about 7,700 MT/year under this assumption. However, for the 2-line relationship, the spawning biomass would double over the next 20 years, reaching a level of about 93% of the biomass which could support MSYs of about 2,800 MT/year under this assumption.

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1 This model assumes that recruitment will increase with increases in spawning stock biomass.
2 This model assumes that recruitment will not increase with increases in spawning stock biomass.

The Committee draws attention to the fact that if the Commission is satisfied with a chance of about 50% of having a net increase in 20 years of 20% in spawning stock size, then in terms of the projections based upon the Beverton-Holt stock recruitment relationship, the current catch level would need to be reduced to about 2,000 MT. If the Commission wants to be reasonably sure (i.e. have 90% probability) of at least maintaining the status quo, the catch should be reduced to approximately 1,500 MT. But if the goal is to move more rapidly (i.e. within 20 years) to levels that produce MSY, the current catches need to be reduced substantially. In contrast, in terms of the 2-line stock recruitment relationship, if the Commission wants to be reasonably sure (i.e. have 90% probability) of at least maintaining the status quo, the catch should be reduced to approximately 2,000 MT. In terms of a goal to move with about 50% chance of reaching biomass levels supporting MSY within 20 years, current catches need not be reduced under the 2-line stock-recruitment relationship.

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). In particular, (1) the effect of mixing between the stocks cannot be reliably predicted given the available data; (2) assumptions that have to be made about the relationship between stock and recruitment in order to make long-term projections relative to MSY; and (3) the relative weight to be given the input catch rate information are particularly uncertain. Thus, future resource levels could be either higher or lowers than those indicated in the projections. Inherently, the level of constant catch that is sustainable over the long term (more than 20 years) cannot be determined well with the data available to the Committee. Thus the Committee cannot be positive that 1997 catches are or are not sustainable. If existing levels of catch are maintained, it is unlikely that the status of the stock will change measurably in the short term.

It should also be noted that the condition of the east Atlantic stock and fishery could adversely affect recovery in the west Atlantic because of mixing between two stocks.

BFT - 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 30,000 MT in the 1950-65 period. Certain fisheries, such as the traps, go back to ancient times. Other fisheries, such as the Mediterranean purse seine fishery mainly emerged in the 1960s. Based on estimates of 1998 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 80% of the Mediterranean catch.

The total catch taken from the preliminary landings for the east Atlantic and the Mediterranean in 1998 amounted to 42,057 MT, which would be less than 1997 (46,983 MT). However, complete reported catch is needed to confirm this decrease, which should be taken with caution in the meantime. The 1998 catch is nevertheless among the highest catch on record since 1950. (**BFT-Table 1** and **BFT-Figure 1**).

The Mediterranean reported catch has been modified in order to take into account revised Turkish catches. These data were estimated from various sources: reports from fishermen associations, canning factory activities and market declarations and need, therefore, to be validated to check for possible double-counting. After a long discussion, it was decided to include these revised statistics because they appear closer to reality than previous ones. In the Mediterranean, the total estimated catch amounted to 30,203 MT in 1998, as compared to 33,308 MT in 1997, and 39,000 MT in 1996. It should be noted that both nation-specific reviews of historical catches in 1998 and critical reviews of unreported catches have reduced the catches previously attributed to the «nowhere else included» (NEI) category (NEI in **BFT-Table 1**). In recent years, the purse seine catches of EU countries in the Mediterranean increased sharply to a peak of 18,214 MT in 1994. In 1997, among EU Mediterranean purse seine catches (15,973 MT). French catch consisted of 48.1%, followed by Italian catches of 44.3% and Spanish catch of 6.8% (no estimations have been made in 1998 because of the lack of the Italian catch). 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. Longline activity seems to be continuing, in terms of the number of large longliners with or without flags, and even during the Mediterranean closed seasons, as well as in the development of small vessels (see Report of the Joint GFCM/ICCAT Report, 1998). The high demand for the Japanese market is without a doubt the reason for this development.

East Atlantic catches (excluding the Mediterranean) in 1998 (11, 854 MT) decreased in comparison to 1997 (13,675 MT). The 1998 catch is, however, the third highest on record since 1970, but is far below the reported catch of the 1950s. Since 1994,

the Japanese longliners continue to exploit a new fishing zone in the north Atlantic around 60°N and 20°W (including Icelandic waters), in addition to the traditional sectors. The east Atlantic (not including Mediterranean) trap catches more than doubled in 1997 from 1996 and recorded the highest in recent years, since high levels used to be reported in 1950s and 1960s.

BFTE-3 State of the stocks (not modified in 1999)

The Committee notes that national reviews of catch statistics in the Mediterranean resulted in reported landings that were substantially larger for the period 1991-1995 than were used in the previous assessment.

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 8**). 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 8**). 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 8**). 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 (not modified in 1999)

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 9**) 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 (Not modified in 1999. However, some parts are no longer appropriate as the base data have been changed, and the regulations have been revised).

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 8**).

The Commission recommended in 1994 that bluefin tuna catches in the East Atlantic Ocean and Mediterranean Sea should be reduced from the 1993 or 1994 levels (whichever is higher) by 25% starting in 1996 and until 1998. While this regulation can not be evaluated finally until the 1998 catches have been reported, overall, the 1996 and 1997 catches are 8.4% and 2.9% *higher*, respectively, than 1994 levels (which were 27.3% higher than 1993 levels). Further, taking into account the exceptional level of catches taken by French fisheries in 1994 (about 12,000 MT), supplemental quotas were applied to France for 1996-1998. French catches in 1996 and 1997 have been about 50 % higher than these quotas (though the 1997 catch is 30% lower than the 1994 levels). An indirect positive effect of the catch reductions regulation has been to inspire countries to critically review their catch statistics from the early 1990s to the present (SCRS/98/8), and to implement improved statistical reporting systems. In 1997, NEI classified catches were much reduced, due to country-specific reviews of historical catches and statistical systems.

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 has been poorly enforced for the East Atlantic and Mediterranean fisheries (44% and 30% average for 1985 to 1995). In the East Atlantic, even though the percentage is variable (between 16 and 75%), recent percentages in 1995 to 1997 have been 40 to 60%. Overall, in the Mediterranean, the percentage has undergone strong variations (between 13 and 60%), though 1996 and 1997 have been within the tolerance level, indicating a positive effect of recent regulations (area closures), though individual countries are still over the tolerance. In 1997, there was a complete prohibition of retaining bluefin < 1.8 kg. It is known that there are catches of age 0 fish, but they are clearly 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. The SCRS noted that there have been many reported activities by many longliners flying flags of convenience or without any country identification fished in Mediterranean waters in 1995, 1996 and 1997 during the closure period (the number of these boats may have declined in 1997 according to the report of Joint Meeting of GFCM/ICCAT, 1998).

There is a prohibition of purse seine fishing in the Mediterranean in August, and the use of airplanes or helicopters in June (entered into force on 4 August 1997). Most purse-seine fleets have observed this measure in 1997 and 1998. However, if the goal of this regulation is to protect under-sized juveniles, the regulation period may not be appropriate for certain fisheries (e.g., Croatia, EC-France). The dates chosen for this measure adopted in 1996 were not based on solid scientific information, but the SCRS has no scientific basis to propose alternate closure dates. A slight change in the dates would probably not affect the effectiveness of the closure.

BFTE-6. Management recommendations (not modified in 1999)

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 40,000 MT).

The projections indicate that future catch levels of 33,000 MT, or more, are not sustainable (**BFT-Figure 9**). 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 increase in catches since, combined with the results of the present analyses, the Committee considers 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 is concerned about the high catch of small individuals and recommended 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.

It should also be noted that the condition of the east Atlantic stock and fishery could adversely affect recovery in the west Atlantic because of mixing between two stocks.

ATLANTIC BLUEFIN TUNA SUMMARY

	West Atlantic	*East Atlantic*
Current (1998) Catch	2,643 MT (discards included)	44,700 MT
Current (1997) Sustainable Yield	about 2,000 -2,500 MT[1]	about 25,000 MT
Maximum Sustainable Yield (MSY)	2,800-7,700 MT[1]	not estimated
Relative Spawning Stock Biomass	$(SSB_{1997}/SSB_{1975})^2 = 0.14\text{-}0.17$	$(SSB_{1997}/SSB_{1970}) = 0.19$
Relative Number	$(N_{1998}/N_{1975})^2 = 0.17\text{-}0.20$ (ages 8+)	$N_{1997}/N_{1970} = 0.65$ (ages 8+)
Management Measures in Effect	– No landing of fish <6.4 kg, with a 15% tolerance. – Fishing mortality not to exceed circa 1975 level. – Limit catches <115 cm (30 kg) to no more than 8% by weight. – Total catch limit of 1,995 MT in 1994; 2,200 MT in 1995, 2,202 MT in 1996; and 2,354 in 1997 & 1998. TAC of 2,500 MT from 1999 to 2018 including dead discards.	– No landing of fish <6.4 kg, with a 15% tolerance in # of individuals. – Fishing mortality not to exceed circa 1975 level. – No longlining in Med. in June- July by vessels>24 m. – No purse seining in Adriatic in May. – No purse seining 16 July-15 August, in Med., except in the Adriatic. – No use of spotter helicopter or plane in Med., in June. – A progressive 25% reduction over 3 years starting in 1996 on 1993 or 1994 catches. TAC of 32,000 MT and 29,500 MT in 1999 and 2000, respectively. – No landing, retaining aboard or selling of fish <3.2 kg.

1 For the most recent age-specific selectivity pattern in the fishery, assuming either a 2-line or a Beverton-Holt stock-recruitment relationship.

2 For VPA results fitting a stock-recruitment relationship for the period 1976-1990 and 1970-1994, respectively.

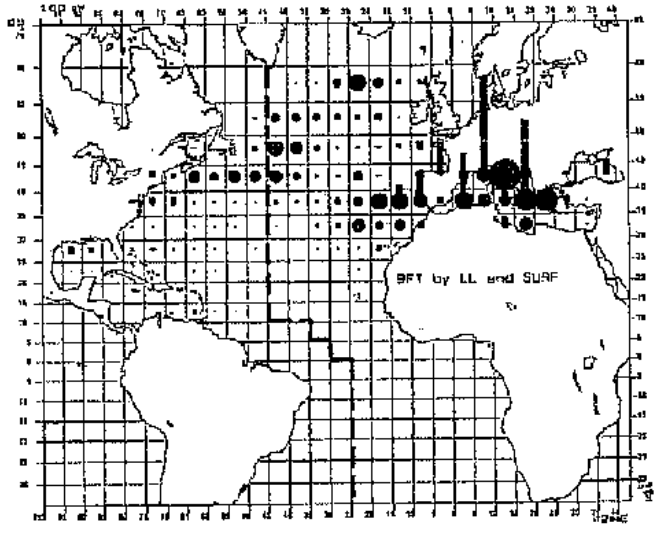
BFT-TABLE 1. Atlantic and Mediterranean bluefin tuna catches (in MT) by region and gears

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
EAST ATL.+ MEDI	**22285**	**18774**	**14645**	**12223**	**14103**	**13845**	**22375**	**21660**	**24425**	**21962**	**19051**	**18196**	**24117**	**20951**	**23144**	**26306**	**31778**	**35703**	**45851**	**46927**	**52242**	**46983**	**42057**
BAITBOAT	*1803*	*2681*	*3904*	*2128*	*1874*	*1553*	*957*	*3032*	*2948*	*2366*	*2253*	*2128*	*2682*	*2683*	*1993*	*1648*	*1466*	*4000*	*2285*	*3093*	*5357*	*3538*	*2789*
PURSE SEINE	*14630*	*10983*	*7556*	*6369*	*6978*	*8795*	*12786*	*10746*	*10302*	*11305*	*9621*	*8857*	*11198*	*9450*	*11284*	*13236*	*18242*	*19299*	*26006*	*24046*	*26344*	*25006*	*24360*
LONGLINE	*3266*	*2396*	*886*	*947*	*1231*	*885*	*4215*	*3575*	*2713*	*1742*	*1407*	*1667*	*2372*	*1945*	*2391*	*5936*	*6276*	*6365*	*8143*	*12203*	*14196*	*9803*	*7795*
OTHER & UNCL GE	*376*	*789*	*841*	*1439*	*769*	*1166*	*744*	*1033*	*3955*	*4159*	*4030*	*3591*	*4207*	*4084*	*3100*	*2493*	*3608*	*4038*	*5672*	*5502*	*3823*	*3788*	*2618*
TRAP	*2006*	*1717*	*1458*	*1350*	*1251*	*1446*	*3673*	*3274*	*4507*	*2390*	*1740*	*1953*	*3658*	*2789*	*4376*	*2993*	*2186*	*2001*	*3745*	*2083*	*2522*	*4848*	*4495*
ALGERIE	49	46	20	150	190	220	250	252	254	260	566	420	677	820	782	800	1104	1097	1560	156	156	157	0
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
CHINA PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42	45
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
CROATIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1418	1076	1058	1410	1220	1360	1105	906
CYPRUS	0	0	0	0	10	10	10	10	10	10	10	10	10	10	10	10	10	14	0	0	0	0	0
DEN-FAROE IS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57
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
EC-ESPANA	2255	3072	4190	3656	2466	2601	3813	5257	7547	5090	3577	3654	5995	5210	5379	3664	4532	7096	5878	8426	8762	8047	5800
EC-FRANCE	4067	3774	2320	1653	1961	2503	5028	4060	4202	5920	3838	4863	6504	4884	5223	5185	6270	8094	12179	10329	9690	8470	7714
EC-GERMANY	0	0	1	1	0	2	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
EC-IRELAND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	20
EC-ITALY	10369	6263	4983	4020	6272	6017	6658	5865	7140	7199	7576	4607	4201	4317	4110	3783	5005	5328	6882	7062	10006	9548	9548
EC-NETHERLAND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EC-PORTUGAL	24	14	56	35	24	17	41	174	34	29	193	163	48	3	27	395	358	208	668	481	473	749	390
EC-SWEDEN	6	2	2	0	0	1	0	1	0	0	0	0	0	0	0	1	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	0
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
ICELAND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
ISRAEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	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
KOREA	5	2	0	1	0	0	0	3	0	77	0	0	0	0	0	0	0	0	688	663	683	613	0
LIBYA	799	336	877	424	398	271	310	270	274	300	300	300	300	84	258	290	650	546	1332	1500	1308	1029	1331
MAROC	332	691	36	208	161	179	993	366	175	98	344	472	577	746	1557	1456	767	494	1812	1713	1621	2603	2430
MALTA	25	47	26	23	24	32	40	31	21	21	41	36	24	29	48	63	48	151	343	353	243	249	53
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
NEI-16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	468
NEI-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	911	159	0	481	522
PANAMA	69	212	156	14	117	46	12	0	17	22	11	76	67	0	74	287	484	467	1450	1517	3400	491	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
NEI-81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	300	71	904	333
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
NEI-105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	240	1990	362	428
NEI-118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	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
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
NORWAY	529	764	221	60	262	161	50	1	243	0	31	0	0	0	0	0	0	0	0	0	0	0	0
POLAND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SOUTH AFRICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
TUNISIE	60	131	141	262	226	218	298	293	307	369	315	456	624	661	406	1366	1195	2132	2503	1897	2393	2200	1745
TURKEY	161	177	127	27	391	565	625	557	869	41	69	972	1343	1707	2059	2459	2817	3084	3466	4220	4616	5093	5899
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
YUGOSLAVIA	562	932	1049	756	573	376	486	1222	755	1084	796	648	1523	560	940	0	0	0	0	0	0	0	0
YUGOS FED REP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	0	0

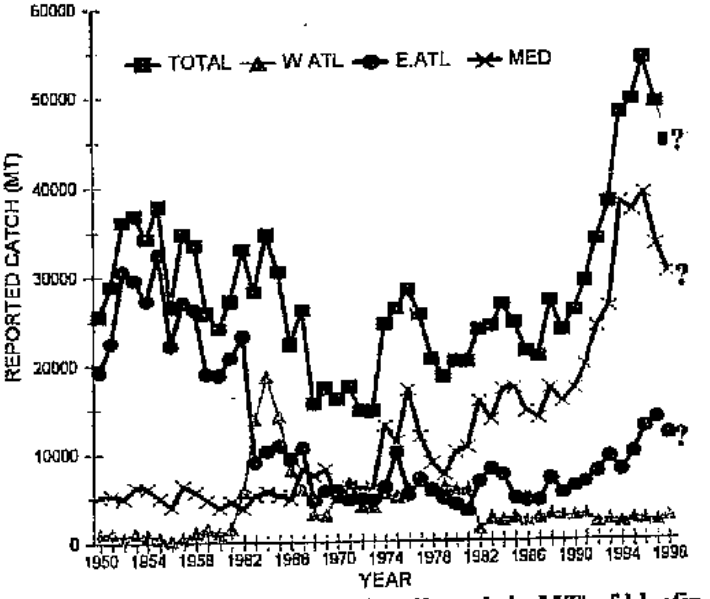
BFT-TABLE 1. Atlantic and Mediterranean bluefin tuna catches (in MT) by region and gears

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
CATCH	**28168**	**25468**	**20408**	**18478**	**19904**	**19616**	**23820**	**24202**	**26717**	**24647**	**21373**	**20788**	**27128**	**23818**	**25942**	**29298**	**33892**	**38014**	**48040**	**49471**	**54723**	**49196**	**44700**
landing	28168	25468	20408	18478	19904	19616	23820	24202	26717	24647	20859	20596	26913	23556	25809	29099	33848	37983	47964	49330	54646	49131	44617
discards	0	0	0	0	0	0	0	0	0	0	514	192	215	262	133	199	44	31	76	141	77	65	83
UNKOWN AREA																							
CHINA.PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	84	118	80	0	0
WEST ATLANTIC	**5883**	**6694**	**5763**	**6255**	**5801**	**5771**	**1445**	**2542**	**2292**	**2685**	**2322**	**2592**	**3011**	**2867**	**2798**	**2992**	**2114**	**2311**	**2105**	**2426**	**2401**	**2213**	**2643**
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*
R&R AND SPOR	*590*	*630*	*475*	*499*	*535*	*523*	*308*	*476*	*401*	*466*	*328*	*539*	*439*	*557*	*780*	*728*	*354*	*628*	*533*	*1039*	*995*	*1145*	*1077*
LONGLINE	*3066*	*3752*	*3217*	*3691*	*3972*	*3879*	*363*	*829*	*835*	*1245*	*764*	*1134*	*1373*	*678*	*739*	*895*	*674*	*696*	*538*	*466*	*528*	*382*	*793*
OTHER & UNCL GE	*645*	*810*	*841*	*684*	*536*	*459*	*542*	*853*	*655*	*597*	*356*	*360*	*601*	*985*	*762*	*933*	*742*	*661*	*657*	*531*	*556*	*371*	*441*
DISCARDS	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*514*	*192*	*215*	*262*	*133*	*199*	*44*	*31*	*76*	*141*	*77*	*65*	*83*
ARGENTINA	0	0	0	0	0	0	0	0	0	6	0	2	0	1	2	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
CANADA	846	972	670	245	324	425	291	433	264	142	73	83	393	619	438	485	443	459	392	576	597	503	595
CHINA.PR[1]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29
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
CUBA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JAPAN	2902	3658	3144	3621	3936	3771	292	711	696	1092	584	960	1109	468	550	688	512	581	427	387	436	322	691
KOREA	7	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEXICO	37	14	28	22	10	20	14	0	0	0	0	0	0	0	0	0	0	0	4	0	0	2	8
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
PANAMA	157	92	58	10	9	14	12	0	0	0	0	0	0	0	0	0	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
NORWAY	0	0	0	0	0	0	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
STA LUCIA	0	0	0	0	0	0	0	0	0	0	0	1	3	2	14	14	14	2	43	9	3	0	0
TRINIDAD & TOBAC	0	0	0	0	0	0	0	0	0	1	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	1317	1235
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
URUGUAY	0	0	0	0	0	1	3	0	9	16	6	0	2	0	0	1	0	1	0	2	0	0	0
DISCARDS	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*514*	*192*	*215*	*262*	*133*	*199*	*44*	*31*	*76*	*141*	*77*	*65*	*83*
CANADA	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	6	16
JAPAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0
USA	0	0	0	0	0	0	0	0	0	0	514	192	215	248	133	199	44	31	76	141	77	51	67

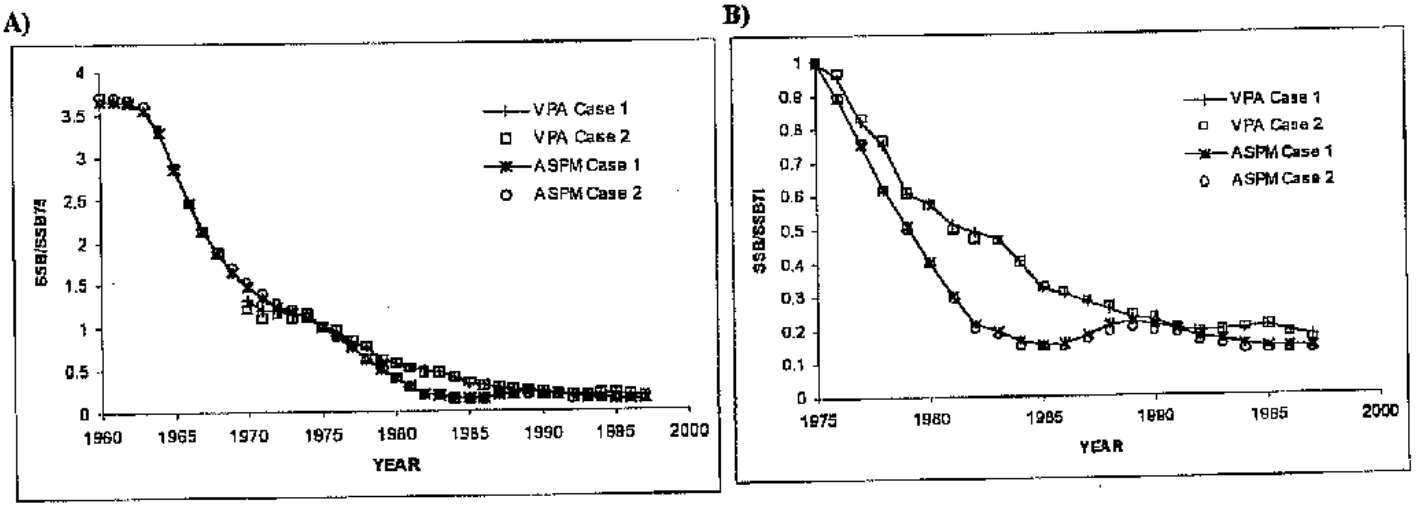
[1] Catches were later identified as west Atlantic



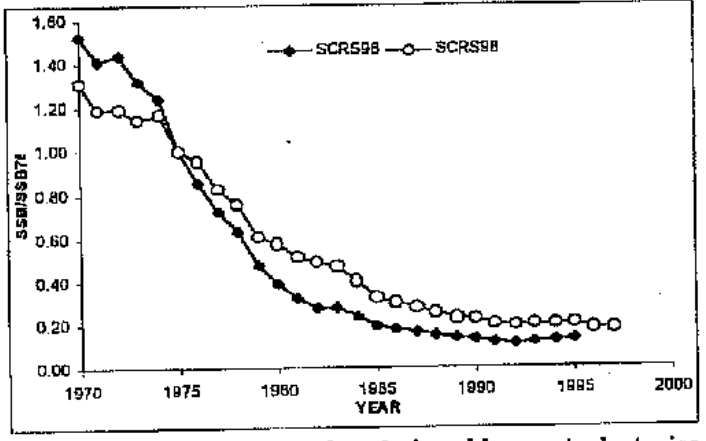
BFT-Fig. 1. Distribution of Atlantic bluefin catches by longline (in circles) and surface gears (histogram), accumulative for the period of 1990-1997. The data for 1998 and revisions made in 1999 session still not incorporated. The division lines for east and west stocks are also shown.



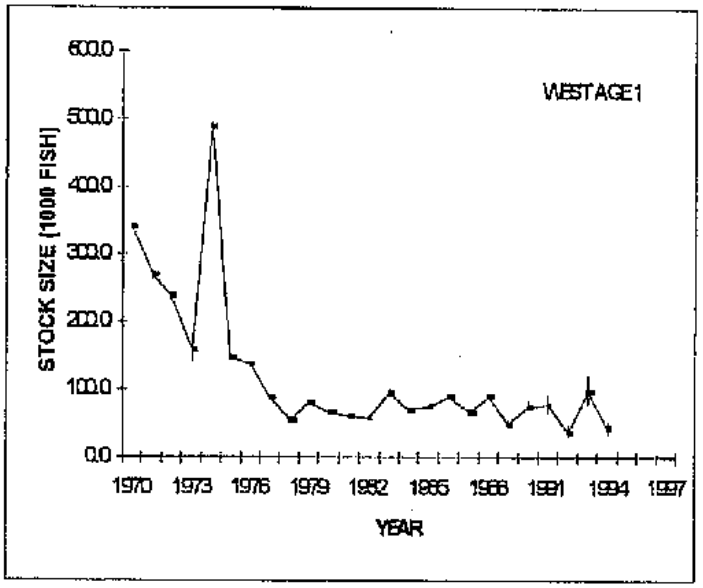
BFT-Fig. 2. Total catch (including discards in MT) of bluefin tuna in east, west Atlantic and the Mediterranean Sea with unreported catches, particularly of Italian data carried over from 1997.

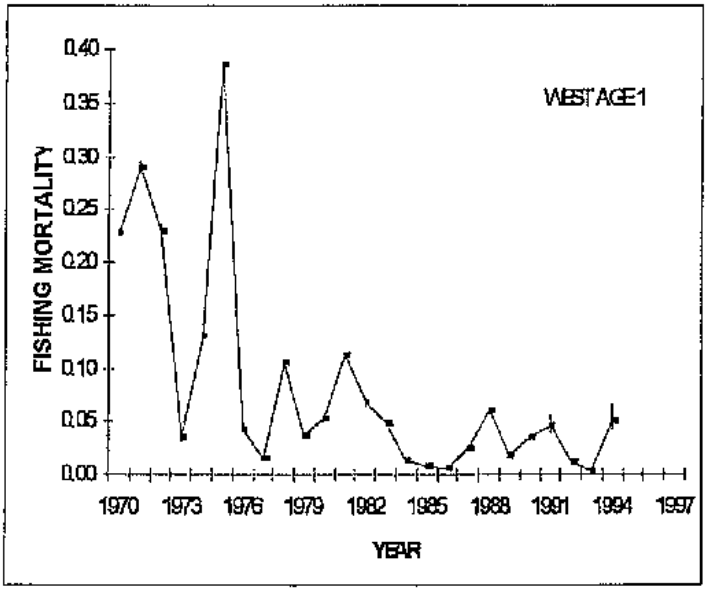


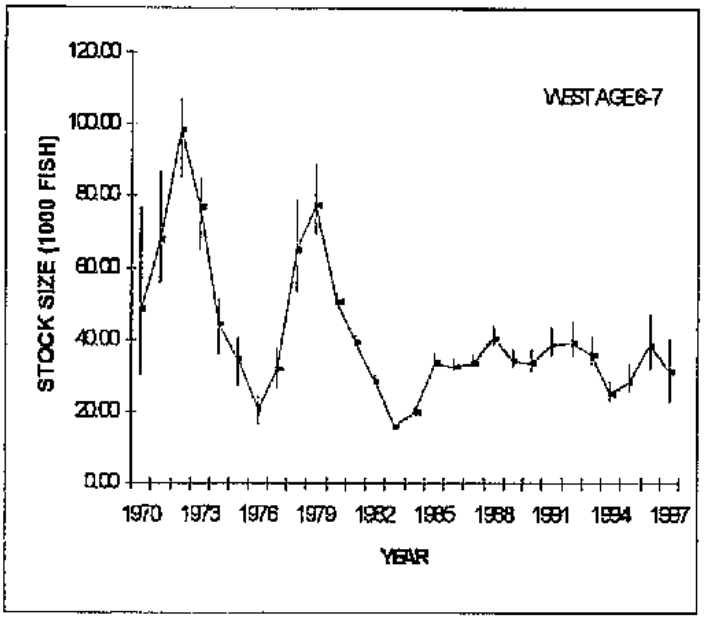
BFT-Fig. 3. Median spawning biomass relative to 1975 for west Atlantic bluefin tuna, estimated using VPA and production models (ASPM) using equal index weights and a constant M=0.14 (case 1) and SBF M vector (case 2). A) represents the trajectories estimated since 1960, B) represents the trajectories since 1975.

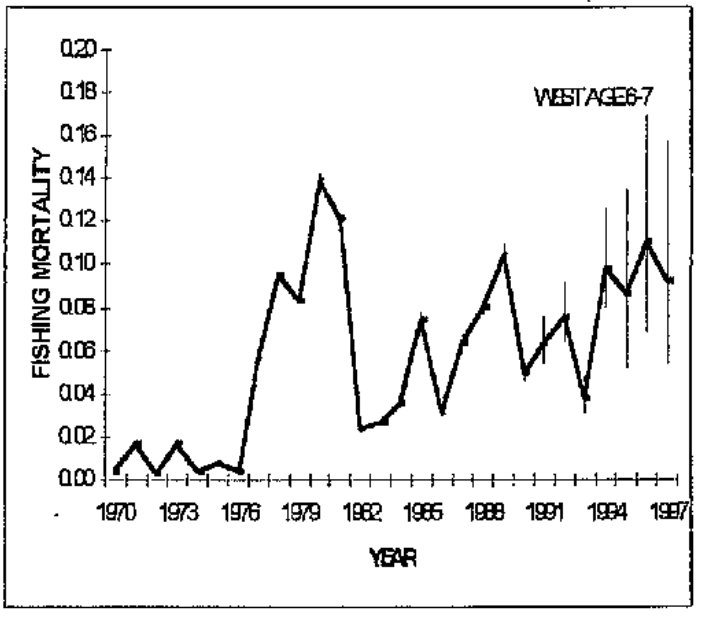


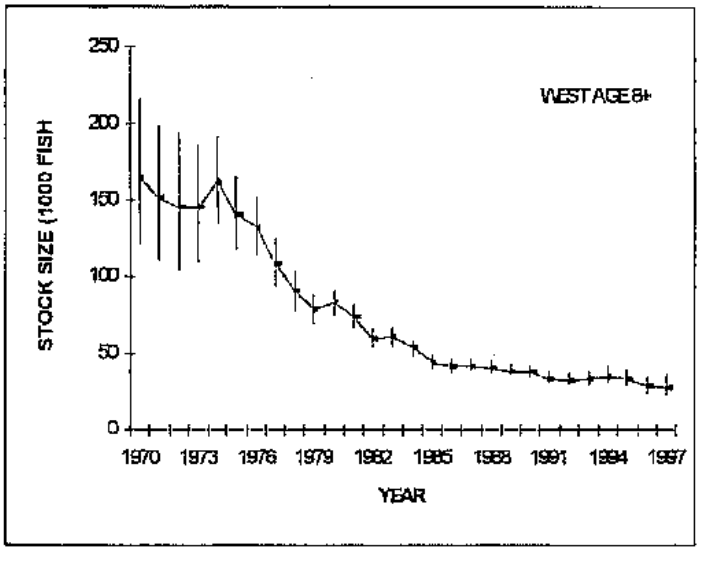
BFT-Fig. 4. Comparison of relative biomass trajectories resulting from the 1996 assessment and the 1998 assessment using updated and new information.

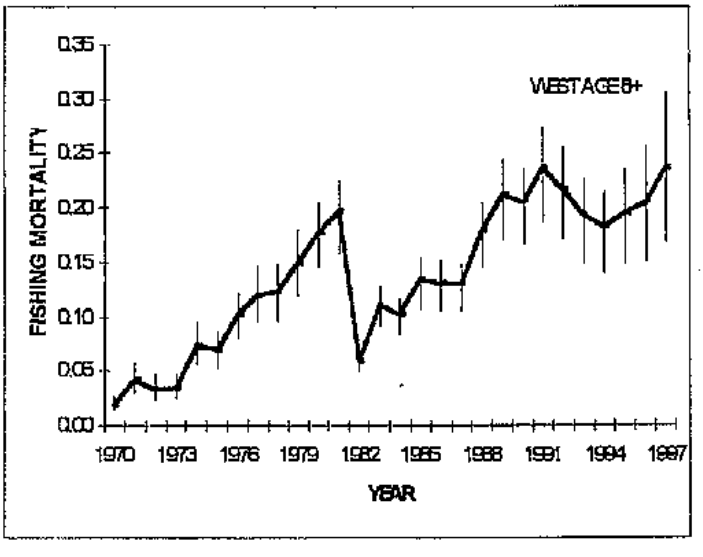




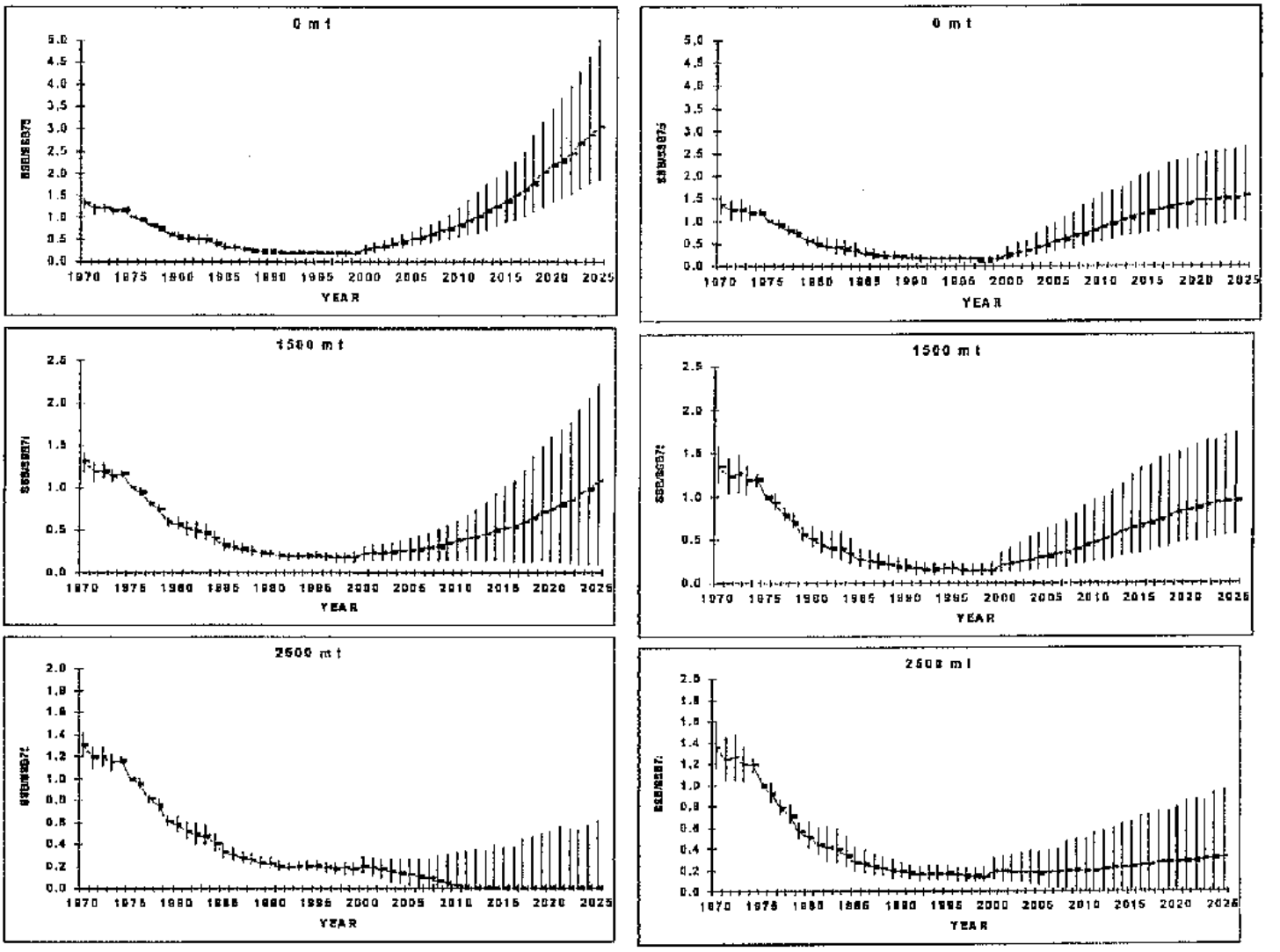




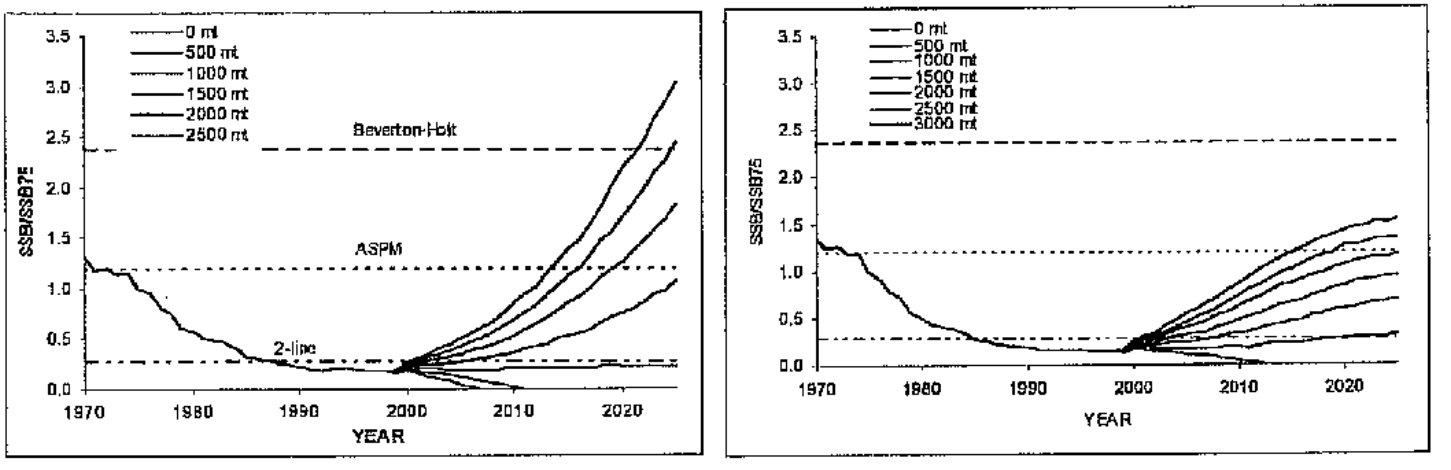




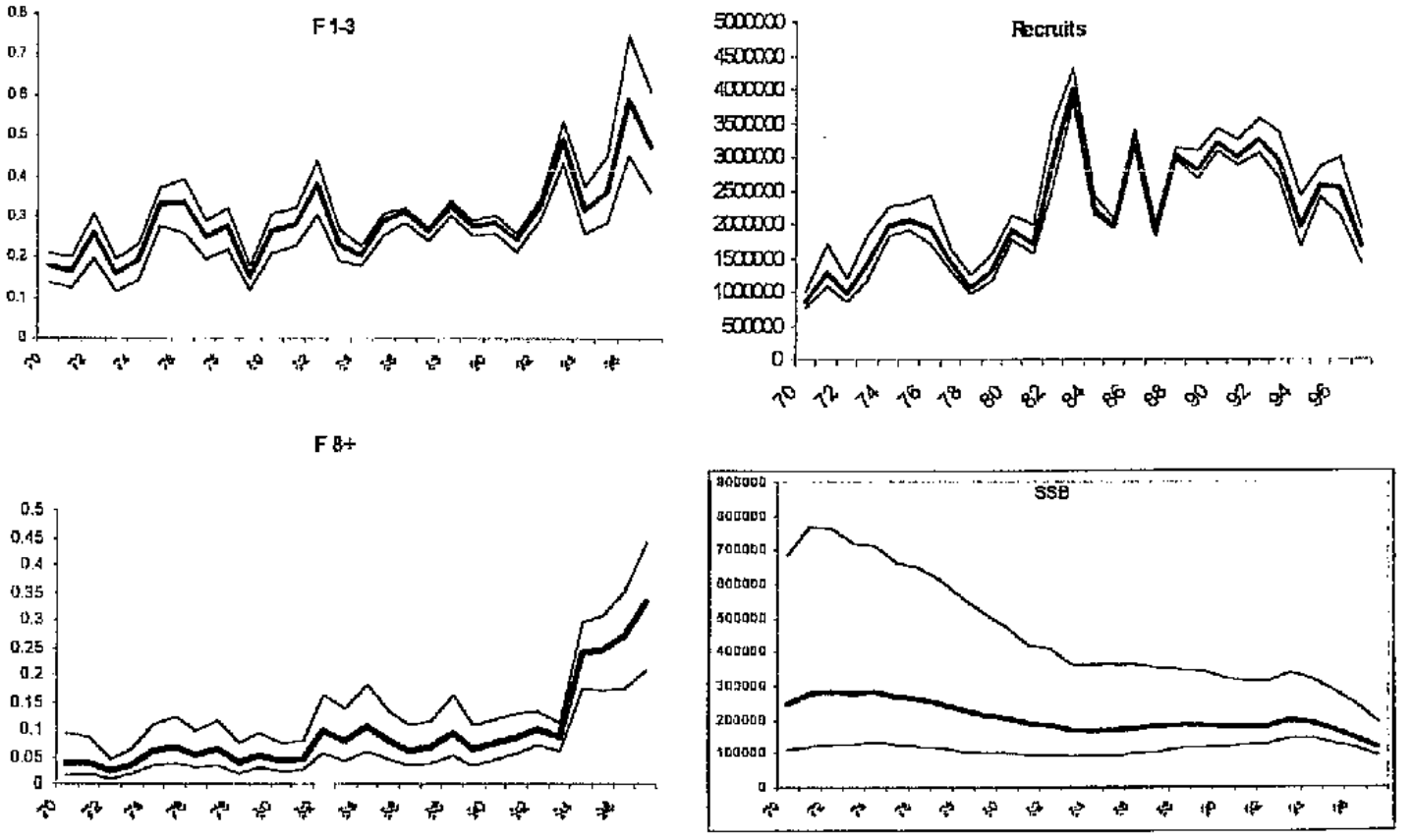
B FT-Fig. 5. Stock size (in number of fish) and fishing mortality rates for west bluefin tuna, estimated by VPA with 80% confidence intervals.



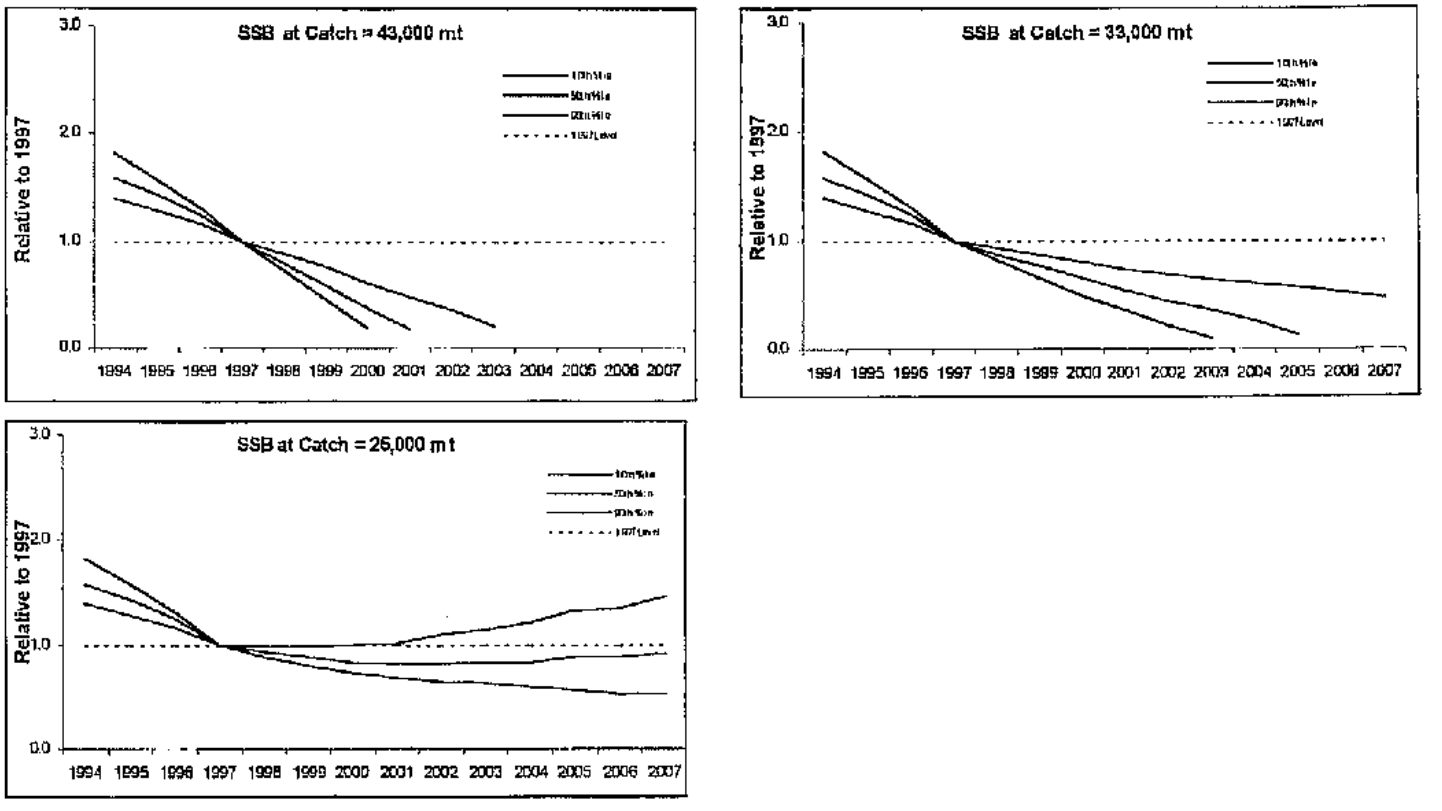
BFT-Fig. 6. **Stochastic projections of the VPA results assuming a Beverton-Holt (left panels) and a 2-line (right panels stock recruitment.**



BFT-Fig. 7. **Median projections made for west bluefin tuna VPA results assuming a Beverton-Holt (left panel) and a 2-line stock recruitment relationship (right panel) for constant catches of 0-3000 MT. Median SSB_{mry} relative to SSB_{75} for the Beverton fit (upper dash) 2-line fit (lower dash, and ASPM model (center dash) are shown as horizontal reference lines.**



BFT-Fig. 8. **Results (fishing mortality of ages 1-3 and 8+ as well as number of recruits and spawning stock biomass) estimated by base case VPA for east bluefin tuna.**



BFT-Fig. 9 **Results of projection of east bluefin spawning biomass assuming constant annual catch of 45, 000, 33,000 and 25,000 MT - east bluefin tuna.**

BUM – BLUE MARLIN

No new assessment was conducted for blue marlin this year. The conclusions reported here generally reflect the results of the last assessment (1996).

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 kgs. 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 shallow deployment of gear. However, significant by-catch landings are also made by offshore longline fisheries that target swordfish, particularly in the West Atlantic Ocean.

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 total 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 total Atlantic hypothesis. Additionally, the Committee concluded that the north/south separation is arbitrary for this tropical species (as with white marlin). Nevertheless, the production model analysis for the North Atlantic hypothesis was conducted in the last assessment. A similar production model analysis of the South Atlantic database would not converge to a solution without fixing several parameters, thus making the assessment results unreliable. Because of the poor model fit, benchmark values for the South Atlantic are not provided in the summary table.

BUM-2. Description of 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 western Atlantic, Caribbean Sea, and east and south Atlantic by various countries have been reported (mainly Spain and the U.S. for eastern and western Atlantic, respectively). Purse seine fisheries also have an incidental catch of blue marlin.

Landings for the total Atlantic first developed in the early 1960's, 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. Unfortunately, landings data are incomplete for 1997 and 1998 because many fisheries-areas that reported landings in 1996 failed to report their 1997/98 landings (**BUM-Table 1** and **BUM-Figure 2**). However, new landings data are becoming available for historically traditional fisheries, as well as some artisanal fisheries. Prior to 1997, landings for the north Atlantic generally show trends similar to those for the total Atlantic. The general trends in catches have followed the intensity of the offshore longline fisheries.

BUM-3. State of stocks

No new stock assessment for Atlantic blue marlin was submitted to the 1999 SCRS. The most recent assessment for blue marlin was conducted during the Third ICCAT Billfish Workshop held in Miami, Florida, during July, 1996. This assessment

included data through 1995. The general results from this analysis using a non-equilibrium production model indicated that biomass had been below B_{MSY} for about three decades for both the total and north Atlantic hypotheses (**BUM-Figures 3 and 4**). The Committee considered these stocks to be over-exploited. The assessment results for the South Atlantic were judged to be unreliable and results are not presented for this hypothesis. Because the South Atlantic information influences the total Atlantic stock analysis, a somewhat different perspective could result if only the North Atlantic catch rate patterns were applied under this hypothesis. However, it should be noted that the Committee indicated that the total Atlantic assessment results were the most appropriate for this species. Bias-corrected point estimates of maximum sustainable yield derived from production model analyses for the 1996 total Atlantic and North Atlantic were about 4,461 and 1,963 MT, respectively. Landings for the total and North Atlantic in 1996, the most recent year landings were fully reported, were estimated at 4,469 and 1,976 MT, respectively. Biomass for the total and North Atlantic in 1996 was estimated to be about 24 and 61%, respectively, of the biomass needed to produce MSY; i.e., B_{1996}/B_{MSY}. Similar statistics for 1997 and 1998 could not be developed because of incomplete reporting. Concerns over the 1996 assessment have been raised by some members of the Committee. Therefore, the Committee recommends that additional detailed analyses of the available data be conducted and that alternative assessment methodologies, which make use of all available information (particularly size frequency, environmental data and review of available CPUE) be explored for application to marlins.

BUM-4. Outlook

Because the landing reports for 1997 and 1998 are incomplete, the data for 1996 represent the most recent estimates of total landings. For the total Atlantic hypothesis, reported landings from 1996 (4,469 MT) were much larger than the estimated equilibrium replacement yield of about 1,920 MT. Landings greater than the replacement yield are expected to result in further decline in stock status. Although the 1995 SCRS previously recognized the increase in stock biomass from North Atlantic production model results (presented at the 1992 SCRS) as a sign of recovery, the slight upturn in the biomass trajectory of the 1996 North Atlantic assessment was not characterized as a recovery by the Committee. It should be reiterated that the Committee recognized that the biology of Atlantic blue marlin was most consistent with the total Atlantic hypothesis. Although the outlook for the North Atlantic hypothesis is more optimistic relative to the total Atlantic assessment results, the Committee has concerns about the status of blue marlin stocks for both stock hypotheses when considered separately. In addition, even though assessment results for the South Atlantic are considered unreliable, similar concerns about the resource status for this hypothesis also exist. Nevertheless, the Committee continues to regard the persistent high level of fishing mortality, which has depressed stock biomass to levels below that which could produce MSY in stock hypotheses examined here, as inconsistent with the management objective of MSY, as well as inconsistent with precautionary approach outlined in the United Nations Agreement on Straddling Stocks and Highly Migratory Fish Stocks.

BUM-5. Effect of current regulations

The only ICCAT regulations in effect for blue marlin are from the 1997 Commission resolution to reduce marlin landings by at least 25% from 1996 levels. This reduction was to be initiated in 1998 and fully implemented by the end of 1999.

Two ICCAT Contracting Parties (the United States and Venezuela) and two non-contracting parties (Mexico and St. Lucia) had previously established domestic regulations for commercial and recreational fisheries involving blue marlin to reduce mortality. The U.S. made changes to its existing regulations for the recreational fishery for billfishes (blue marlin, white marlin, and sailfish) in 1998 by increasing minimum size for each species to conform with the ICCAT resolution to reduce marlin landings by at least 25% from 1996 levels. Mandatory billfish tournament registration was also implemented by the U.S. in 1998 to improve monitoring of this fishery. Also, Venezuela made changes to its existing regulations in 1999 for both the recreational fishery for billfishes, as well as the artisanal fishery for billfishes. In addition, many other countries participating in the recreational fisheries for Atlantic blue marlin have had volunteer release or tag and release policies, which also have the effect of reducing mortality.

BUM-6. Management recommendations

The 1996 stock assessments for Atlantic blue marlin indicate that this species is over-exploited and warrants consideration for development of methods to reduce fishing mortality rates. The Committee believes that one approach to reducing mortality would be to release or tag and release those blue marlin that are caught by longline vessels which appear to be alive when brought alongside the boat. Such an approach would first have to be implemented on an experimental and selective basis while additional research is conducted to determine the rate of survival of billfish caught and released off longline vessels. The projections of

population response to releasing live longline marlin bycatch, submitted to the 1997 SCRS, suggested that this would be an effective approach to reducing mortality to reach the management objective (MSY). This approach could be considered consistent with the precautionary approach outlined in the United Nations Agreement on Straddling Stocks as current best estimates indicate that, if perfectly implemented, this measure would reduce fishing mortality rates below F_{MSY} for this species.

The Committee acknowledges that progress has been made on many aspects of past resolutions on billfish, approved at the 1995 and 1997 Commission meetings, including convening the Third Billfish Workshop, revising the billfish databases, updating billfish assessments, and changing the financial structure of the Billfish Program by providing Commission funding for the first time, starting in 1998. The Committee feels that the earliest updating of marlin assessments that could allow examination of the effects of the 1997 Commission Resolution for reducing blue marlin landings by 25% from 1996 levels (to be fully implemented by the end of 1999), would be when the 1999 data are available in 2000. The Committee is concerned about the incomplete reporting of landings, particularly for the last two years. The Committee recommends that all countries landing blue marlin or having dead discards report these data to the ICCAT Secretariat so assessments planned for 2000 can proceed.

ATLANTIC BLUE MARLIN SUMMARY
(Bias corrected point estimates)

	Total Atlantic	*North Atlantic*	*South Atlantic*
Maximum Sustainable Yield, (MSY):	4,461 MT	1,963 MT	–
Approximate 80% CI	4,096-4,787 MT	1,742-2,133MT	–
Current (1998) Yield (observed)	Incomplete (3198 MT)	Incomplete (1243 MT)	–
1996 Replacement Yield	1,920 MT	1,694 MT	–
Relative Biomass (B_{1996}/B_{MSY})	0.236	0.608	–
Relative Fishing Mortality: F_{1995}/F_{MSY} (approx. 80% CI)	2.87 (1.45-3.41)	1.21 (0.96-1.56)	–
Management Measures in Effect	[1]	[1]	[1]

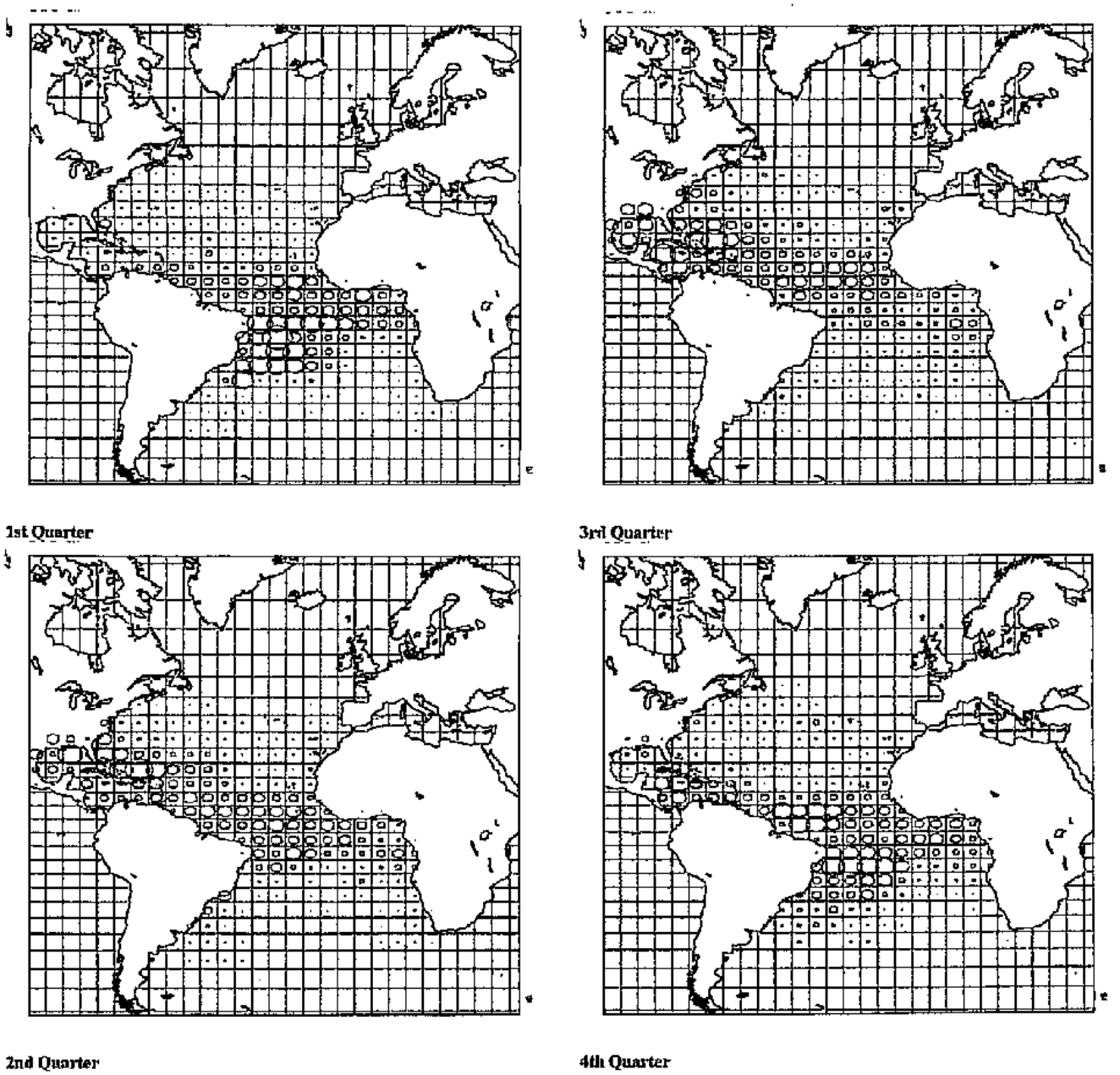
[1] Reduce landings by 25% from 1996 levels.

BUM-TABLE 1. Reported catches of blue marlin (in MT) by flag and major gear

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
TOTAL ATL	**2310**	**2047**	**1506**	**1401**	**1584**	**1947**	**2763**	**1892**	**2663**	**3239**	**2042**	**2115**	**2744**	**4254**	**4504**	**4169**	**2993**	**3216**	**4001**	**3827**	**4469**	**4069**	**3198**
UNKNOWN AREA	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	2	39	21	8	9	8	0	0
U.S.A	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	2	39	21	8	9	8	0	0
NORTH ATL	**1366**	**1255**	**976**	**897**	**1084**	**1509**	**1931**	**1359**	**1577**	**1766**	**1269**	**1034**	**1103**	**1755**	**2141**	**1620**	**1248**	**1444**	**1791**	**1684**	**1976**	**1563**	**1243**
LONGLINE	*978*	*876*	*553*	*480*	*643*	*792*	*1162*	*809*	*920*	*1223*	*695*	*327*	*409*	*1025*	*1597*	*984*	*629*	*808*	*1141*	*1006*	*1328*	*1114*	*896*
SURFACE	*0*	*0*	*0*	*0*	*0*	*213*	*282*	*147*	*201*	*201*	*201*	*201*	*222*	*301*	*215*	*244*	*228*	*229*	*281*	*258*	*261*	*203*	*238*
RR AND SPORT	*268*	*298*	*301*	*299*	*301*	*300*	*299*	*199*	*206*	*168*	*213*	*180*	*186*	*143*	*49*	*58*	*83*	*108*	*113*	*68*	*57*	*52*	*59*
UNCL. GEAR	*120*	*81*	*122*	*118*	*140*	*204*	*188*	*204*	*251*	*174*	*160*	*190*	*162*	*97*	*123*	*196*	*202*	*193*	*153*	*208*	*134*	*97*	*0*
BARBADOS	120	81	72	51	73	117	99	126	126	10	14	13	46	3	18	12	18	21	19	31	25	25	0
BRASIL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
CANADA	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
CHINESE TAIPE	169	64	81	51	160	98	100	125	102	148	117	52	26	11	937	716	336	281	272	187	170	355	139
CUBA	250	220	97	156	162	178	318	273	214	246	103	68	94	74	112	127	135	69	39	85	43	0	12
EC-ESPANA	0	0	0	0	0	63	101	45	103	104	101	100	102	123	102	104	108	100	100	100	102	100	6
EC-FRANCE	0	0	0	0	0	150	180	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	0
EC-PORTUGAL	0	0	0	0	0	0	1	2	1	8	12	8	2	2	2	7	4	15	12	10	4	6	48
GRENADA	0	0	0	0	1	1	12	6	8	11	36	33	34	40	52	64	52	58	52	50	26	47	0
JAMAICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	0
JAPAN	260	118	54	68	193	332	637	192	351	409	174	78	206	593	250	145	193	207	532	496	798	617	667
KOREA	174	307	185	67	48	71	19	43	110	154	36	13	14	252	240	34	11	2	16	16	41	16	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
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
NEI-28	47	87	42	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NETH.ANT	0	0	50	50	50	50	50	50	50	50	50	50	50	50	50	40	40	40	40	40	40	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
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
TRINIDAD & TOI	0	0	0	0	0	0	0	3	7	3	17	1	0	27	3	4	3	226	150	150	150	13	0
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
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
UKRAINE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	5	0	0	0	0	0	0
USA	265	295	295	312	312	342	329	215	280	295	273	291	221	124	29	33	51	80	88	43	35	46	49
VENEZUELA	79	80	94	134	81	106	83	172	117	219	218	60	76	149	70	56	65	66	133	97	113	0	228
DISCARDS																							
USA	0	0	0	0	0	0	0	0	0	0	0	137	124	190	158	140	107	106	103	144	196	97	50

BUM-TABLE 1. Reported catches of blue marlin (in MT) by flag and major gear

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
SOUTH ATL	**944**	**792**	**530**	**504**	**500**	**438**	**832**	**533**	**1086**	**1473**	**773**	**1080**	**1641**	**2498**	**2362**	**2547**	**1706**	**1751**	**2202**	**2134**	**2485**	**2506**	**1955**
LONGLINE	*933*	*739*	*526*	*490*	*498*	*430*	*822*	*533*	*975*	*1362*	*661*	*964*	*1530*	*2002*	*1958*	*2274*	*1450*	*1397*	*1601*	*1502*	*1882*	*2181*	*1342*
SURFACE (INC	*11*	*53*	*4*	*14*	*2*	*8*	*10*	*0*	*111*	*111*	*112*	*116*	*111*	*496*	*404*	*211*	*187*	*354*	*601*	*632*	*602*	*248*	*556*
UNCL. GEAR	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*62*	*69*	*0*	*0*	*0*	*0*	*35*	*55*
BENIN	0	0	0	0	0	6	8	0	9	10	7	4	12	0	6	6	6	6	5	5	5	0	0
BRASIL	41	100	49	34	23	28	30	27	32	33	46	51	74	60	52	61	125	147	81	180	331	193	396
CHINESE TAIPE	240	107	177	139	129	104	150	47	70	165	98	265	266	462	767	956	488	404	391	280	490	1123	439
COTE D'IVOIRE	0	0	0	0	0	0	0	0	100	100	100	100	88	65	72	78	58	110	153	144	144	220	109
CUBA	159	100	113	180	187	108	118	123	159	205	111	137	191	77	90	62	69	0	0	0	0	0	0
EC-ESPAÑA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	82
GABON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	8	0	0
GHANA	0	0	0	0	0	0	0	0	0	0	0	0	0	430	324	126	123	236	441	472	422	0	447
JAPAN	4	17	15	66	115	136	495	248	482	691	335	362	617	962	967	755	824	719	991	913	881	753	457
KOREA	392	356	140	78	46	55	31	88	234	262	60	139	361	437	84	503	13	11	40	40	103	40	0
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
NEI-28	107	103	32	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SAO TOME & PF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	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
URUGUAY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23
DISCARDS																							
U.S.A - LLD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	42	2



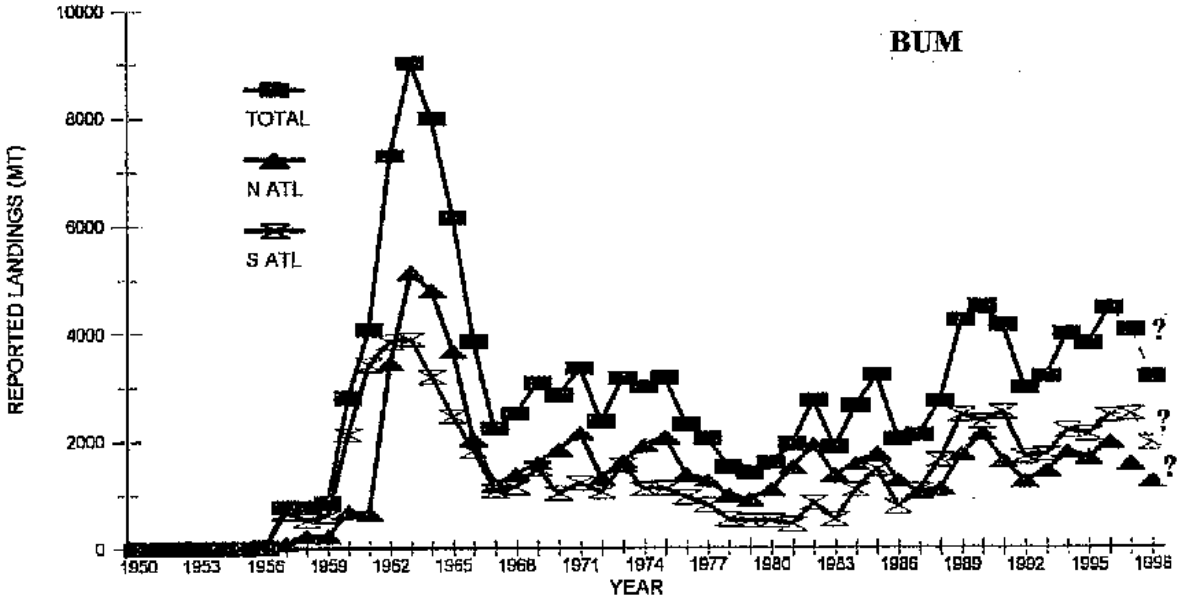
1st Quarter

3rd Quarter

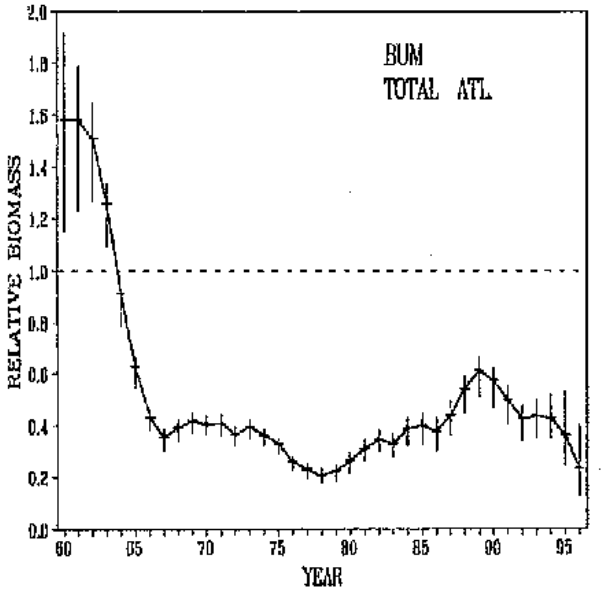
2nd Quarter

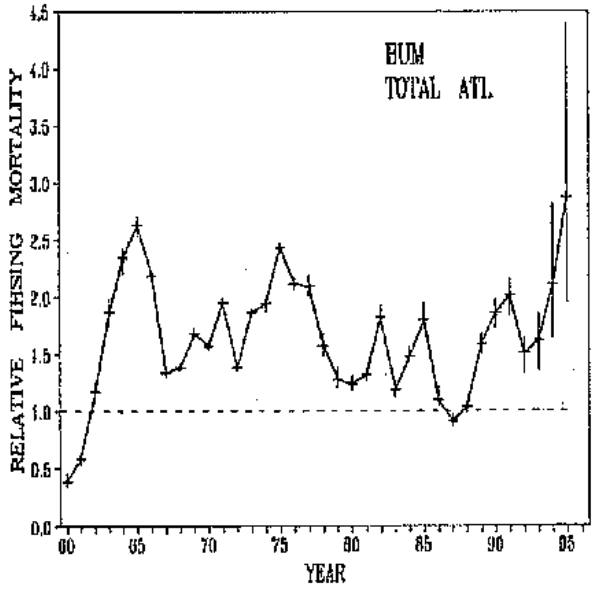
4th Quarter

BUM-Fig. 1. Distribution of blue marlin catches throughout 1950-1994

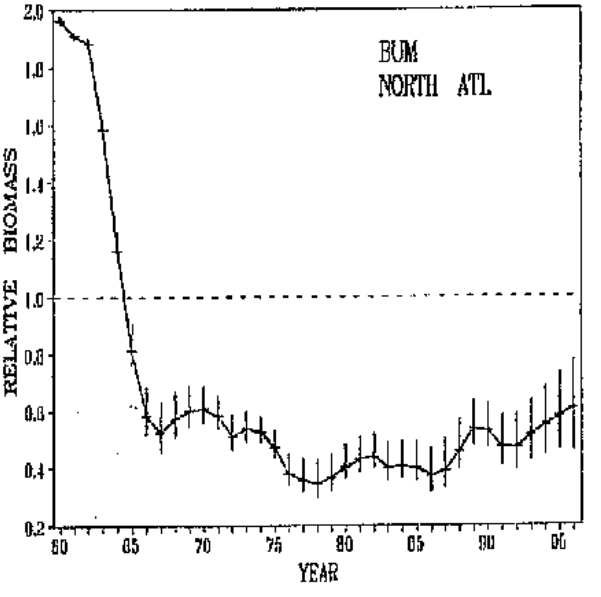


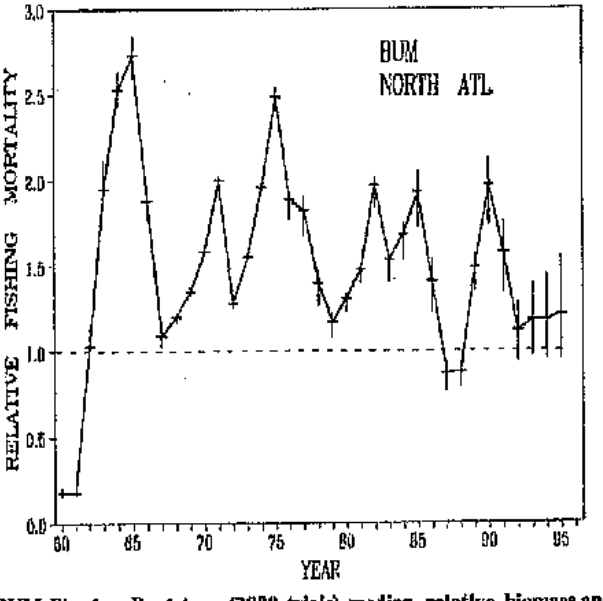
BUM-Fig. 2. Task I catches (MT) of blue marlin by regions, 1950-1998, (1997 and 1998 data were incomplete, therefore 1997/98 points were connected with dashed lines to prior time series and question marks were added).





BUM-Fig. 3. Bootstrap (2000 trials) median relative biomass and relative fishing mortality for blue marlin fisheries from the total Atlantic with approximate nonparametric 80% confidence intervals from the estimation procedures. Other sources of error are not quantified..





BUM-Fig. 4. Bootstrap (2000 trials) median relative biomass and relative fishing mortality for blue marlin fisheries from the north Atlantic with approximate nonparametric 80% confidence intervals from the estimation procedures. Other sources of error are not quantified.

WHM - WHITE MARLIN

No new assessment was conducted for white marlin this year. The conclusions reported here generally reflect the results of the last assessment (1996).

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**), although they seem to be less abundant in the East Atlantic. 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 know 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 shallow deployment of gear. However, significant by-catch landings are also made by offshore longline fisheries that target swordfish, particularly in the west Atlantic Ocean.

As with blue marlin, the SCRS stock hypotheses for white marlin assessments historically has been a north and south Atlantic stock (divided at 5°N), as well as a 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). Nevertheless, the production model analysis for the North Atlantic hypothesis was conducted in the last assessment. A similar production model analysis of the South Atlantic database would not converge to a solution without fixing several parameters, thus making the assessment results unreliable. Because of the poor model fit, benchmark values for the South Atlantic are not provided in the summary table.

WHM-2. Description of 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 940 and 1,700 MT through 1996 (**WHM-Table 1 and Figure 2**). Unfortunately, landings data are incomplete for 1997 and 1998 because many fisheries-areas that reported landings in 1996 failed to report their 1997-1998 landings. However, new landings data are becoming available for historically traditional fisheries, as well as for some artisanal fisheries. 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 stocks

No new stock assessment was submitted to the 1999 SCRS for Atlantic white marlin. The most current assessment for white marlin was conducted during the Third ICCAT Billfish Workshop held in Miami, Florida, during July, 1996. This assessment included data through 1995, which represented revisions and updating from the previous assessment presented at the 1992 SCRS. The general results from these analyses using a non-equilibrium production model indicated that biomass had been below B_{MSY} for three decades for the total Atlantic hypothesis (**WHM-Figure 3**) and two decades under a North Atlantic hypothesis (**WHM-Figure 4**). The Committee considered these stocks to be severely over-exploited. The assessment results for the South Atlantic were judged to be unreliable and results are not presented for this stock hypothesis. Previous statements in the Blue Marlin Executive Summary Report concerning the influence of the South Atlantic data base on the total Atlantic stock analysis

and recommendations for applying additional analyses involving all available data and using alternative assessment methodologies also apply to white marlin. However, it should be noted that the Committee indicated that the total Atlantic assessment results were the most appropriate for this species. Bias-corrected point estimates of maximum sustainable yield were estimated from production model analyses for the total Atlantic and North Atlantic to be about 2,177 and 536 MT, respectively. Current landings data for 1997 and 1998 are incomplete, however the landings in 1996 for the total and north Atlantic were estimated at 1,520 MT and 481 MT, respectively. Biomass for the total and North Atlantic in 1996 was estimated to be about 23 and 32%, respectively, of the biomass needed to produce MSY; i.e., B_{1996}/B_{MSY}.

WHM-4. Outlook

For the total Atlantic hypothesis, landings for 1996 (1,520 MT), which is the most recent year with full reporting, were much larger than the estimated equilibrium replacement yield of about 921 MT. Landings greater than the replacement yield are expected to result in further decline in stock status. The Committee has concerns about the status of white marlin stocks in both the total Atlantic and North Atlantic, when considered separately. In addition, even though assessments results for the South Atlantic are considered unreliable, similar concerns of the resource status for this hypothesis also exist. Nevertheless, the Committee regards the continuing high level of fishing mortality, which has depressed stock biomass to levels considerably below that which could produce MSY, as **inconsistent** with the management objective of MSY, as well as inconsistent with the precautionary approach outlined in the United Nations Agreement on Straddling Stocks and Highly Migratory Fish Stocks. The improving situation in the total Atlantic over the period 1977-1985 (**WHM-Figure 3**) appears to have reversed itself with a steady decline in biomass indicated over the period 1989-1996. When considering the North Atlantic separately, the relative biomass trajectory has been decreasing steadily over the entire time-series (**WHM-Figure 4**).

WHM-5. Effect of current regulations

The only ICCAT regulations in effect for white marlin are from the 1997 Commission resolution. See Blue Marlin Executive Summary Report.

Two Contracting Parties and two non-contracting parties have existing regulations. The U.S. increased the minium size for white marlin in 1998 for the recreational fishery. Venezuela also changed regulations for the recreational and artisanal fisheries for white marlin in 1999. See Blue Marlin Executive Summary Report.

WHM-6. Management recommendations

The 1996 stock assessments for Atlantic white marlin indicated that this species is severely over-exploited and warrants consideration for development of methods to reduce fishing mortality rates. As with blue marlin, projections of populations response to releasing live longline marlin bycatch, submitted to the 1997 SCRS, suggests that this could be an effective approach to reducing mortality to reach the management objective of MSY. This approach could be viewed as a precautionary measure consistent with the United Nations Straddling Stocks Agreement as current best estimates indicate that, if perfectly implemented, this measure would reduce fishing mortality rates below FMSY for this species. The constraints for examining the effects of the 1997 Commission resolution, which can not be fully evaluated by updating assessments until 2000, referred to previously for blue marlin also holds for white marlin as well. See Blue Marlin Executive Summary Report. The Committee is concerned about the incomplete reporting of landings, particularly for the last two years. The Committee recommends all countries landing white marlin or having dead discards to report these data to the ICCAT Secretariat so assessments planned for 2000 can proceed.

ATLANTIC WHITE MARLIN SUMMARY

	Total Atlantic	*North Atlantic*	*South Atlantic*
Maximum Sustainable Yield(MSY)	2,177 MT	536 MT	–
Approximate 80% Confidence Interval	2,102-2,228 MT	85-771 MT	–
Current (1998) Yield (observed)	Incomplete (1,118 MT)	Incomplete (480 MT)	–
1996 Replacement Yield	921 MT	301 MT	–
Relative Biomass (B_{1996}/B_{MSY})	0.226	0.321	–
Relative Fishing Mortality: F_{1995}/F_{MSY} (approx. 80% CI)	1.96 (1.33-2.91)	2.37 (1.60-8.41)	–
Management Measures in Effect	[1]	[1]	[1]

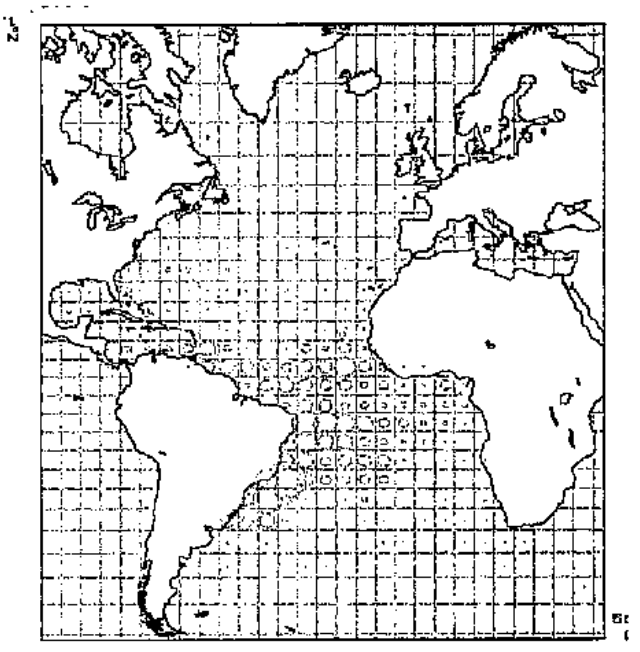
[1] Reduce landings by 25% from 1996 levels.

WHM-TABLE 1. Reported catches of white marlin (in MT) by flag and major gear

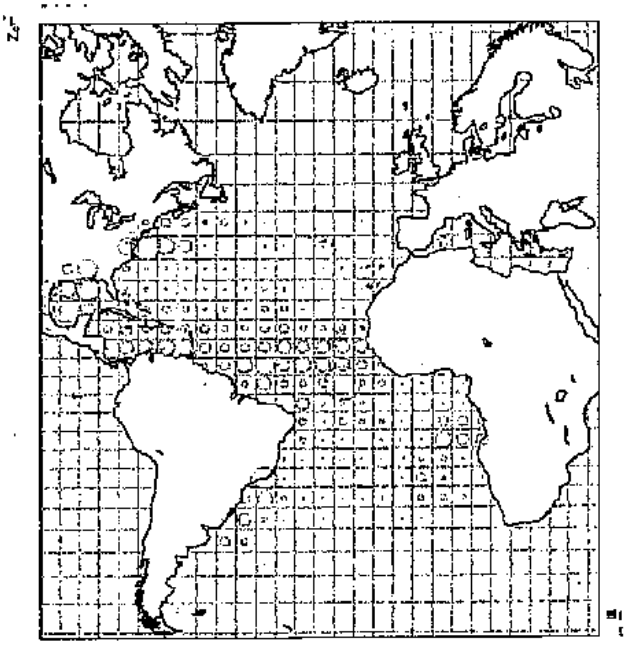
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
TOTAL ATL	**1821**	**1127**	**950**	**1016**	**943**	**1204**	**1112**	**1663**	**1210**	**1795**	**1587**	**1526**	**1336**	**1783**	**1589**	**1547**	**1295**	**1372**	**1900**	**1469**	**1520**	**916**	**1118**
UNKNOWN AREA	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**2**	**0**	**0**	**7**	**4**	**5**	**8**	**3**	**3**	**0**
U.S.A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	3	0	0
KOREA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0
DISCARDS																							
U.S.A -LLD	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	7	4	3	8	0	0	0
NORTH ATL.	**1052**	**501**	**428**	**482**	**521**	**789**	**670**	**1347**	**740**	**966**	**908**	**647**	**416**	**373**	**395**	**217**	**478**	**431**	**602**	**532**	**481**	**233**	**480**
LONGLINE	*938*	*390*	*317*	*370*	*403*	*671*	*548*	*1196*	*570*	*788*	*812*	*433*	*130*	*235*	*251*	*99*	*347*	*315*	*471*	*372*	*377*	*158*	*226*
RR AND SPORT	*114*	*111*	*111*	*111*	*112*	*111*	*110*	*146*	*153*	*149*	*35*	*99*	*76*	*22*	*23*	*11*	*18*	*24*	*30*	*20*	*15*	*3*	*3*
OTHER & UNCL	*0*	*0*	*0*	*1*	*6*	*7*	*12*	*5*	*17*	*29*	*61*	*54*	*150*	*11*	*40*	*17*	*32*	*30*	*62*	*48*	*25*	*39*	*219*
BARBADOS	0	0	0	0	0	0	0	0	0	0	0	0	117	11	39	17	24	29	26	43	15	34	0
BRASIL	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	1	0	0	0	0	0	0	4	4	8	8	0
CHINESE TAIPEI	142	44	79	62	105	174	134	203	96	128	319	153	0	4	85	13	92	123	270	181	146	62	71
CUBA	68	67	43	68	70	189	205	728	241	296	225	30	13	21	14	0	0	0	0	0	0	0	0
EC-ESPAÑA	0	0	0	0	0	0	0	0	9	14	0	0	24	13	4	2	10	0	19	0	10	0	85
JAPAN	540	80	27	42	99	118	84	27	52	45	56	60	68	73	34	45	180	33	41	31	80	31	39
KOREA	64	71	33	16	18	49	12	6	18	147	37	2	2	82	39	1	9	4	23	3	7	2	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
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
NEI-28	17	20	8	1	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	0	0	0	1	0	0	0	0	0
U.S.A	109	109	109	110	116	117	122	148	168	181	119	185	89	16	19	5	8	13	11	9	4	2	2
U.S.S.R	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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
VENEZUELA	112	110	129	183	113	142	113	234	155	155	151	154	42	47	79	43	73	117	110	110	96	5	244
DISCARDS	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*61*	*60*	*105*	*81*	*90*	*81*	*62*	*39*	*92*	*64*	*33*	*32*
USA - LLD	0	0	0	0	0	0	0	0	0	0	0	61	60	105	81	90	81	62	39	92	64	33	32

WHM-TABLE 1. Reported catches of white marlin (in MT) by flag and major gear

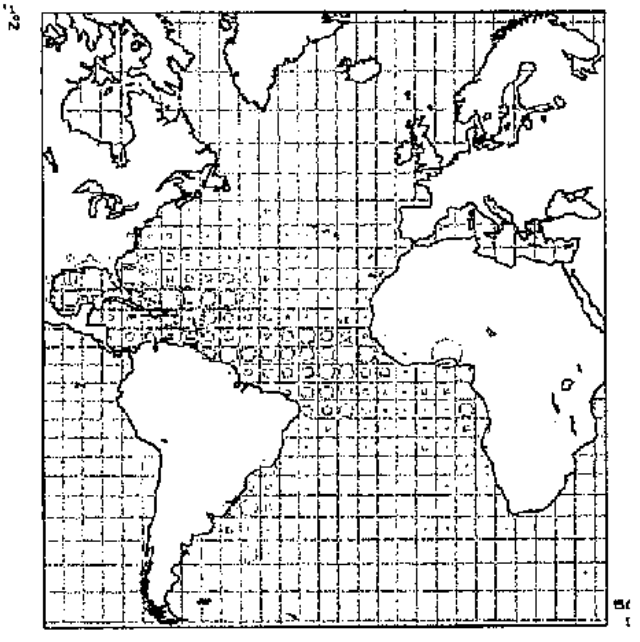
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
SOUTH ATL	**769**	**626**	**522**	**534**	**422**	**415**	**442**	**316**	**470**	**829**	**679**	**878**	**920**	**1408**	**1194**	**1330**	**810**	**937**	**1293**	**929**	**1036**	**680**	**638**
LONGLINE	*742*	*621*	*520*	*530*	*419*	*340*	*442*	*305*	*470*	*825*	*653*	*869*	*831*	*1332*	*1150*	*1307*	*796*	*915*	*1292*	*923*	*624*	*583*	*581*
OTHER GEARS	*25*	*3*	*2*	*4*	*3*	*75*	*0*	*11*	*0*	*4*	*26*	*9*	*89*	*76*	*44*	*23*	*14*	*22*	*1*	*6*	*412*	*61*	*56*
ARGENTINA	2	2	0	0	0	0	0	0	0	4	4	0	0	8	9	6	0	0	0	0	0	0	0
BELIZE.SH.OB	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BRASIL	68	275	175	133	58	100	76	78	60	87	142	92	149	204	203	373	208	301	91	105	75	105	140
CHINA.PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
CHINESE TAIPEI	377	119	198	155	145	136	227	87	124	172	196	613	565	979	810	790	506	493	1080	726	420	379	435
COTE DIVOIRE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	9
CUBA	38	57	127	205	212	116	45	112	153	216	192	62	24	22	6	10	10	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	4
GABON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	406	0	0
GHANA	0	0	0	0	0	0	0	0	0	0	22	6	88	68	31	17	14	22	1	2	1	0	7
JAPAN	3	26	14	15	7	25	27	17	24	81	73	74	76	73	92	77	68	49	51	26	32	30	17
KOREA	220	111	5	24	0	36	57	9	44	225	34	25	17	53	42	56	1	4	20	20	52	18	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
NEI-28	59	31	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SAO TOME & PRI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	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
URUGUAY	0	0	0	0	0	1	10	13	65	44	16	6	1	1	1	1	3	0	0	0	0	0	22
DISCARDS																							
U.S.A - LLD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	1



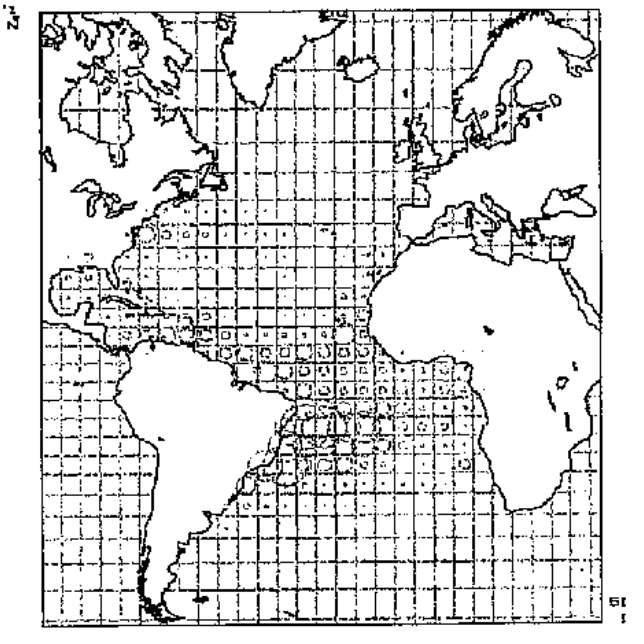
1st Quarter



3rd Quarter

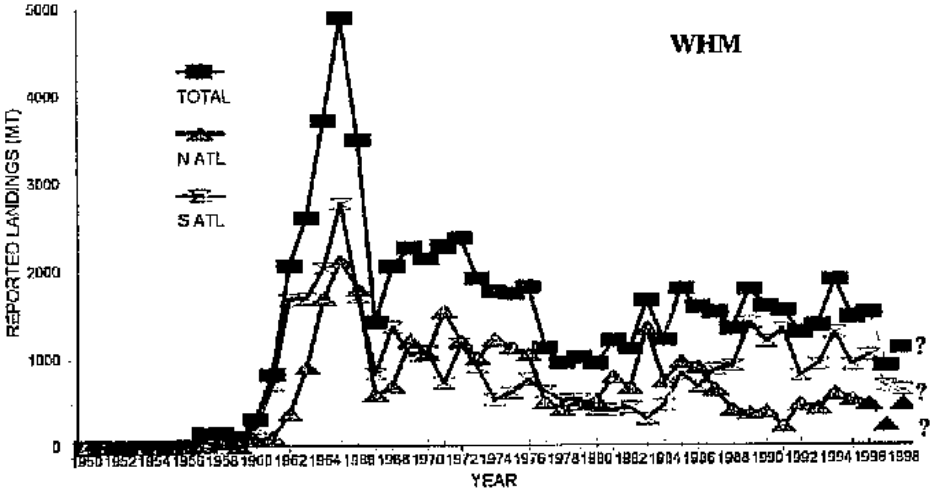


2nd Quarter

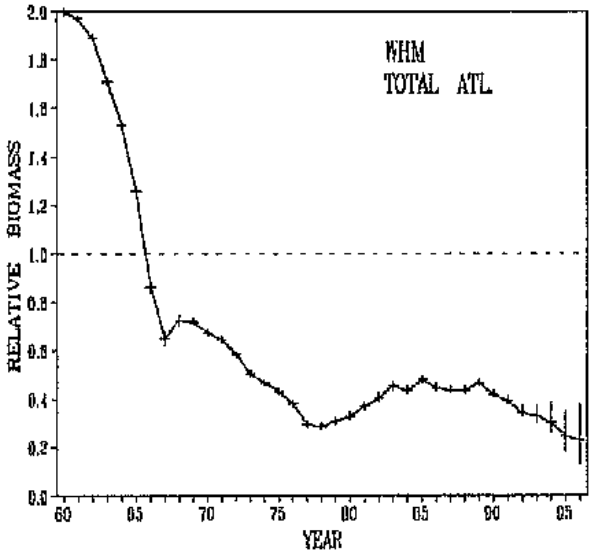


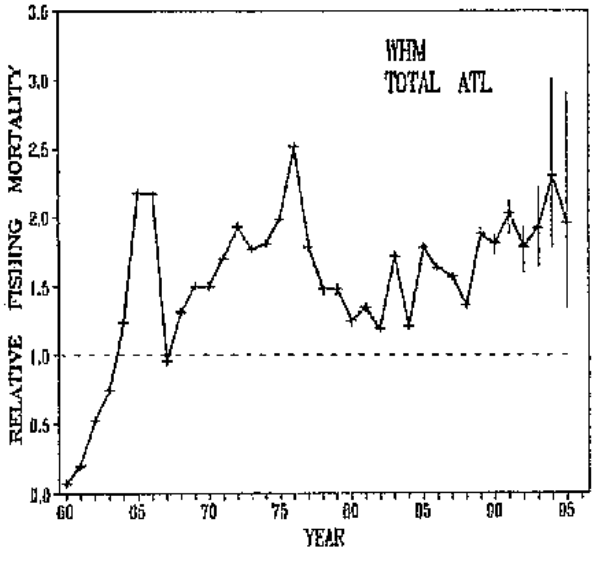
4th Quarter

WHM-Fig. 1. Distribution of white marlin catches throughout 1950-1994

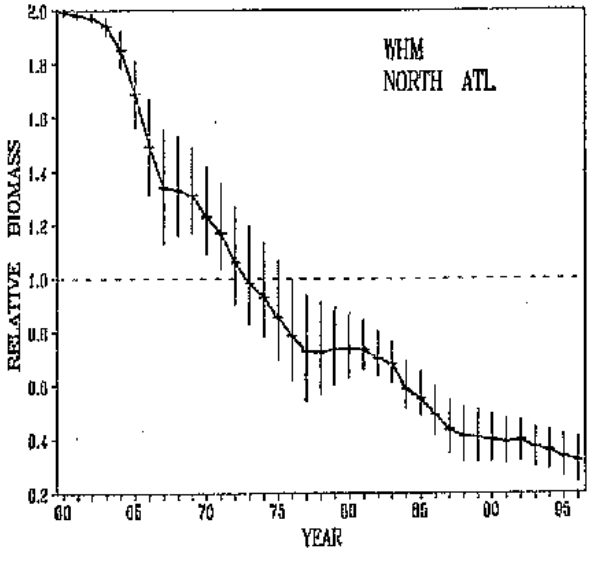


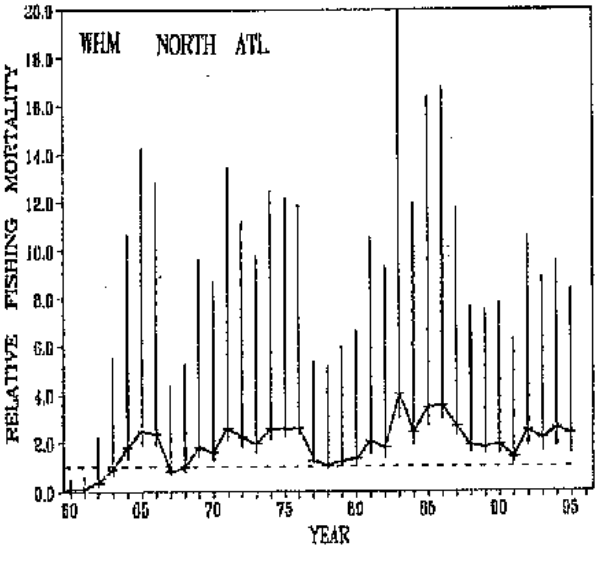
WHM-Fig. 2. Task I catches (MT) of white marlin by regions, 1950-1998, (1997 and 1998 data were incomplete, therefore 1997/98 points were connected with dashed lines to prior time series and question marks were added).





WHM-Fig. 3. Bootstrap (1000 trials) median relative biomass and relative fishing mortality for white marlin fisheries from the north Atlantic with approximate nonparametric 80% confidence intervals from the estimating procedure. Other sources of error are not quantified.





WHM-Fig. 4. Bootstrap (1000 trials) median relative biomass and relative fishing mortality for white marlin fisheries from the north Atlantic with approximate nonparametric 80% confidence intervals from the estimating procedure. Other sources of error are not quantified..

SAI – SAILFISH - SPEARFISH

No new assessment was conducted for sailfish this year. The conclusions reported here generally reflect the results of the last assessments.

SAI-1. Biology

Since longline catches of sailfish and spearfish have been reported together in ICCAT landing statistics (except for Japan since 1994), these species will be summarized together for the purposes of this report. Sailfish and spearfish have a circum-tropical distribution (**SAI-Figure 1**). Although sailfish have high concentrations in coastal waters (more than any other istiophorid), they are still found in oceanic waters. Spearfish are most abundant in offshore waters. Tag returns for sailfish/spearfish have not demonstrated trans-Atlantic or trans-Equatorial movements. 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, even in the offshore catches. The stock hypotheses for sailfish/spearfish assessment purposes are a western Atlantic and eastern Atlantic stock (divided at 30° W).

Sailfish and spearfish are generally considered piscivorous, but also have been known to consume squid. They are found predominately in the upper reaches of the water column and are caught most frequently as a bycatch of the offshore longline fisheries. However, in coastal waters, artisanal fisheries using many types of shallow water gear target sailfish.

Sailfish spawn in tropical and subtropical waters in the spring through summer. Due to their relative rare abundance in offshore waters, virtually nothing is known about spearfish reproduction. Both sailfish and spearfish are considered to be very fast growing, although sailfish and spearfish are probably the slowest growing Atlantic istiophorids. Female sailfish grow faster and reach a larger maximum size than males.

SAI-2. Description of 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 of sailfish in both the western and eastern Atlantic result from the artisanal 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 (primarily Ghana, Senegal, Cote d'Ivoire, and others). Directed recreational fisheries for sailfish occur in the West Atlantic from the United States, Venezuela, Bahamas, Brazil, Dominican Republic, Mexico, and other countries in the Caribbean Sea. Directed recreational fisheries for sailfish in the East Atlantic also exist off West Africa in Senegal. Prior to the 1970's, the major sailfish/spearfish landings were a result of the bycatch from the offshore longline fisheries. The offshore longline fisheries in the West and East Atlantic include those from Brazil, Japan, Korea, Cuba, and Chinese Taipei. Development and geographical expansion of other longline fisheries in the West (by the U.S.) and East (by Spain) also include a bycatch of sailfish/spearfish. Mediterranean spearfish are usually a by-catch from longline and driftnet fisheries from a number of Mediterranean countries. Some occasional catches of spearfish are also made by a direct harpoon fishery.

Landings for the total Atlantic first developed in the early 1960's, reached a peak of almost 3,000 MT in 1965, declined to about 1,600 MT by 1973, reach an historical peak of 6,100 MT in 1976, then fluctuated between 2,000 to 4,000 MT through 1996. Unfortunately, landings data are incomplete for 1997 and 1998 because many fisheries-areas that reported landings in 1996 failed to report their 1997/98 landings (**SAI-Table 1** and **SAI-Figure 2**). Landings for the East Atlantic generally paralleled the total Atlantic increasing trend, whereas the landings in the west were steady over the last decade. It should be noted that a significant segment of the landings between 1965 and 1983 were listed as unclassified regions. During the Third ICCAT Billfish Workshop data preparatory meeting (Miami, FL, July 1996) these data were partitioned into either the West or East Atlantic. However, the Committee continues to recognize that some uncertainties of the landings data, particularly in the East Atlantic, still persist. However, new landings data are becoming available for historically traditional fisheries, as well as some artisanal fisheries. The overall trend in Atlantic landings are very much governed by the large landings from artisanal fisheries off of West Africa.

SAI-3. State of stocks

No new stock assessment was submitted to the 1999 SCRS for Atlantic sailfish/spearfish. The most current assessment for West Atlantic sailfish/spearfish was submitted to the SCRS in 1993 and these analyses included data through 1991. The general results from these exploratory analyses using a non-equilibrium production model indicated that biomass trends had declined to fully exploited or over exploited levels, particularly near the end of the time series **(SAI-Figures 3 and 4)**. Maximum sustainable yield was estimated from production model analyses for the West Atlantic to be about 700 MT, whereas landings for 1996, the most recent year landings were fully reported, were about 905 MT. Biomass in 1992 was estimated to be 62% of the biomass needed to produce MSY. Statements about the current yield are inappropriate due to incomplete landings reported for 1997 and 1998.

The most current assessment for East Atlantic sailfish/spearfish was submitted during the 1997 SCRS and this analysis, using a non-equilibrium production model, included data through 1995. The Working Group decided to exclude the Japanese longline CPUE from the current analysis because of the mixing of spearfish in the sailfish catch for the early part of the time series and changes in gear, deployment locations, target species, and reduced reports of sailfish landings in the most recent part of this time series. The general results from these exploratory analyses, using the artisanal fisheries as the primary index of abundance, indicated that biomass trend had declined to fully exploited levels near the end of the time series **(SAI-Figures 5 and 6)**. Maximum sustainable yield was estimated from the production model analyses for the east Atlantic to be about 1,390 MT, whereas landings for 1996 are about 1,906 MT. Biomass in 1996 was estimated to be 88% of the biomass needed to produce MSY. Similar statistics for 1997 and 1998 cannot be developed because of incomplete landings for these years.

SAI-4. Outlook

The Committee remains concerned about the downward trend in the indices of abundance and the biomass trajectories for western Atlantic sailfish, which indicate the stock has declined to fully exploited or over-exploited levels. The reported landings for West Atlantic sailfish since 1992 were considerably higher than the replacement yield (about 600 MT) and therefore the stock biomass are expected to have continued to decline. However, landings for 1997 and 1998 were incomplete and therefore statements on current stock status are inappropriate, particularly since the most recent western Atlantic assessment was conducted in 1992.

The Committee is encouraged by the increase in information on eastern Atlantic sailfish (particularly standardized artisanal indices of abundance) but also recognizes continued improvement is still necessary. The Committee feels that the most recent assessment results (1995), which indicate the stock is likely fully exploited (more optimistic than for the West Atlantic), reflect the improvements to this data base. The Committee was also unanimous in its conclusion that the West African artisanal indices of abundance best describe populations trends for this stock hypothesis. The reported landings for East Atlantic sailfish in 1996 (1,906 MT) are higher than the replacement yield (about 1,473 MT) and therefore the stock biomass are expected to decline further.

SAI-5. Effect of current regulations

No ICCAT regulations are currently in effect for Atlantic sailfish/spearfish.

See section in the Blue Marlin Executive Summary Report.

SAI-6. Management recommendations

The most recent stock assessments for eastern Atlantic (1995) and particularly western Atlantic sailfish (1992) indicate that this species is at least fully exploited or possibly over-exploited and warrants consideration for development of methods to reduce fishing mortality rates. The need for a stock assessment meeting, previously referenced for blue and white marlin, also applies to sailfish as well. See Blue Marlin Executive Summary Report. The Committee is concerned about the incomplete reporting of landings, particularly for the last two years. The Committee recommends all countries landing sailfish/spearfish or having dead discards, report these data to the ICCAT Secretariat.

ATLANTIC SAILFISH SUMMARY

	West Atlantic[1]	*East Atlantic*
Maximum Sustainable Yield (MSY)	~ 700 MT	1,390 MT
Current (1998) Yield	Incomplete (1,542 MT)	Incomplete (623 MT)
Current (1992/95) Replacement Yield	~ 600 MT	1,473 MT
Relative Biomass ($B_{1992/95}/B_{MSY}$)	~ 0.62	0.87
Relative Fishing Mortality: $F_{1991/95}/F_{MSY}$	~ 1.4	1.3
Management Measures in Effect	None	None

[1] Model D4

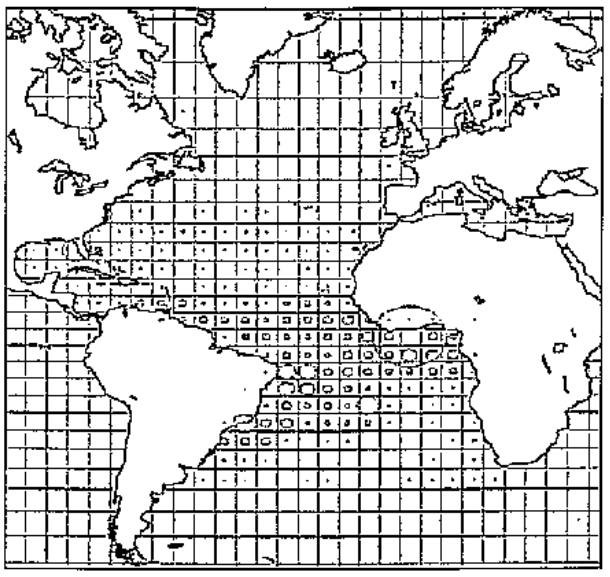
SAI-TABLE 1. Reported catches of sailfish (in MT) by flag and major gear

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
SAI + SPF	**6132**	**2076**	**2937**	**3784**	**2574**	**2458**	**3330**	**3961**	**3175**	**2972**	**2720**	**3089**	**2490**	**2005**	**2710**	**2111**	**2580**	**3431**	**2139**	**2280**	**2741**	**2107**	**1730**
SAILFISH	**6132**	**2076**	**2937**	**3784**	**2574**	**2458**	**3330**	**3961**	**3175**	**2972**	**2720**	**3089**	**2490**	**1972**	**2710**	**2111**	**2580**	**3373**	**2103**	**2243**	**2711**	**2076**	**1713**
UNCL. REGION	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**8**	**2**	**1**	**6**	**2**	**0**	**0**
LL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
CHINESE TAIPEI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JAPAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DISCARDS	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*3*	*8*	*2*	*1*	*6*	*2*	*0*	*0*
U.S.A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	8	2	1	6	2	0	0
EAST ATL	**5319**	**1144**	**2142**	**2881**	**1667**	**1627**	**2355**	**3188**	**2138**	**1964**	**1702**	**2172**	**1629**	**1229**	**1723**	**1299**	**1552**	**2264**	**1041**	**1417**	**1906**	**1530**	**623**
LONGLINE	*599*	*220*	*114*	*83*	*151*	*202*	*309*	*270*	*224*	*148*	*140*	*112*	*98*	*152*	*153*	*46*	*45*	*492*	*167*	*223*	*136*	*182*	*217*
SURFACE	*4720*	*924*	*2028*	*2798*	*1516*	*1425*	*2046*	*2918*	*1914*	*1816*	*1562*	*2060*	*1531*	*1077*	*1570*	*1069*	*1307*	*1695*	*791*	*1122*	*1135*	*1209*	*406*
UNCL	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*184*	*200*	*77*	*83*	*72*	*635*	*139*	*0*
BENIN	0	0	0	0	0	36	48	0	53	50	25	32	40	8	21	20	21	20	20	20	19	0	0
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
CHINESE TAIPEI	217	59	7	19	5	12	67	20	8	9	1	0	0	7	13	0	0	420	101	155	65	150	149
COTE D'IVOIRE	0	0	0	0	0	0	0	0	40	40	40	40	67	55	62	40	71	44	60	71	196	57	55
CUBA	185	65	69	40	79	79	158	200	115	19	55	50	22	53	61	184	200	77	83	72	533	0	0
EC-ESPAÑA	0	0	0	0	0	0	10	0	4	7	9	0	0	14	0	0	0	0	0	0	0	0	18
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
GABON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	109	7	0
GHANA	4517	764	1885	2691	1191	891	1426	2408	1658	1485	925	1392	837	462	395	463	297	693	450	353	303	303	351
HONDURAS-OB.SH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JAPAN	4	24	11	19	33	50	38	47	63	84	71	37	57	57	63	16	42	58	45	52	47	17	50
KOREA	165	46	18	5	34	24	33	3	34	29	2	20	15	17	16	30	3	3	6	6	14	5	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
PANAMA	41	13	4	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
SENEGAL	189	160	143	107	325	498	572	510	163	241	572	596	587	552	1092	546	917	936	260	678	610	842	0
USSR	1	13	5	0	0	37	0	0	0	0	2	5	4	4	0	0	0	0	0	0	0	0	0
WEST ATL.	**813**	**932**	**795**	**903**	**907**	**831**	**975**	**773**	**1037**	**1008**	**1017**	**917**	**861**	**742**	**986**	**809**	**1020**	**1107**	**1061**	**820**	**906**	**407**	**1542**
LONGLINE	*437*	*395*	*279*	*378*	*360*	*408*	*471*	*320*	*512*	*506*	*489*	*451*	*558*	*417*	*382*	*233*	*360*	*568*	*508*	*294*	*269*	*137*	*793*
RR AND SPORT	*266*	*339*	*338*	*350*	*368*	*336*	*331*	*312*	*352*	*228*	*234*	*237*	*38*	*31*	*29*	*32*	*50*	*38*	*73*	*15*	*1*	*1*	*2*
SURFACE	*62*	*119*	*90*	*84*	*97*	*0*	*95*	*50*	*53*	*68*	*43*	*45*	*54*	*44*	*224*	*31*	*131*	*71*	*180*	*225*	*422*	*67*	*370*
UNCL	*48*	*79*	*88*	*91*	*82*	*87*	*78*	*91*	*120*	*206*	*252*	*142*	*154*	*194*	*290*	*449*	*443*	*367*	*272*	*257*	*144*	*145*	*350*
ARUBA	20	20	30	30	30	30	30	30	30	30	30	23	20	16	13	9	5	10	10	10	10	0	0
BARBADOS	0	0	0	0	0	0	0	0	0	0	0	0	0	69	45	29	42	50	46	74	25	59	0
BRASIL	186	287	246	201	231	64	153	60	121	187	292	174	152	147	301	90	351	243	128	245	310	137	456

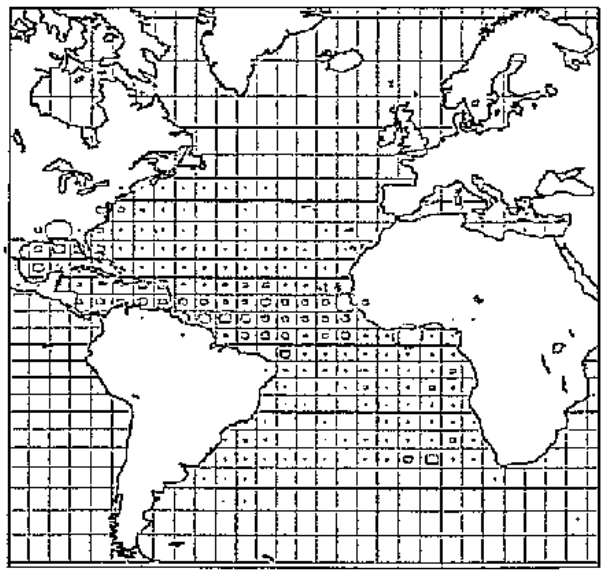
SAI-TABLE 1. Reported catches of sailfish (in MT) by flag and major gear

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
WEST ATLANTIC (Cont'd)																							
CHINESE TAIPEI	126	5	10	18	36	81	22	31	45	39	64	31	300	171	83	73	33	223	233	38	37	4	4
CUBA	0	91	51	151	119	134	181	28	169	130	50	171	78	55	126	83	70	42	46	37	37	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	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	20
GRENADA	0	31	37	40	31	36	27	37	66	164	211	104	114	98	218	316	310	246	151	119	56	83	0
JAPAN	133	23	9	20	22	44	135	22	34	38	28	6	22	22	25	73	1	2	8	2	4	17	2
KOREA	0	65	14	19	51	41	19	0	52	72	14	1	0	17	25	0	3	0	8	8	22	8	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
NETHERLAND ANT	28	28	21	21	21	21	21	21	21	10	10	10	10	10	10	10	10	15	15	15	15	0	0
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
PANAMA	0	18	3	2	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
TRINIDAD & TOBAG	0	0	0	0	0	0	0	64	58	14	24	35	24	10	8	4	4	55	100	100	100	0	0
USA	261	308	308	308	308	308	308	311	311	197	199	200	18	2	4	2	7	7	45	10	1	0	1
VENEZUELA	59	56	66	93	58	72	57	119	81	81	77	80	22	24	24	24	46	64	100	42	148	0	386
DISCARDS	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*42*	*57*	*57*	*62*	*64*	*36*	*63*	*28*	*29*	*69*	*57*	*27*
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*
SPEARFISH	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**33**	**0**	**0**	**0**	**58**	**36**	**37**	**30**	**31**	**17**
UNKNOWN AREA	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**0**	**0**
U.S.A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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
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
EAST ATL	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**33**	**0**	**0**	**0**	**58**	**36**	**26**	**25**	**31**	**17**
JAPAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	58	36	26	25	31	14
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
EC-ESPANA	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	0	0	0	0	0	0	1
WEST ATL.	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**9**	**3**	**0**	**0**
LONGLINE	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*54*	*75*	*10*	*7*	*1*	*0*	*0*	*64*	*2*	*3*	*4*	*1*	*9*
JAPAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	3	4	1	9
TRINIDAD & TOBAG	0	0	0	0	0	0	0	0	0	0	54	75	10	7	1	0	0	62	0	0	0	0	0
U.S.A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DISCARDS	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*4*	*1*	*0*	*0*
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
TRIN& TOB*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

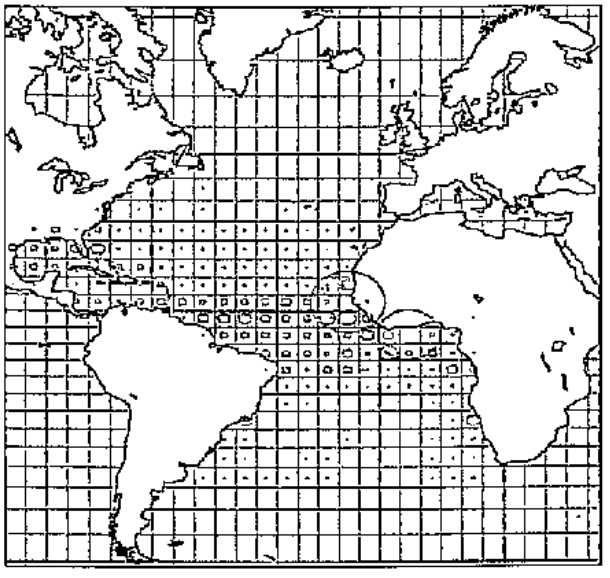
* Less than one ton



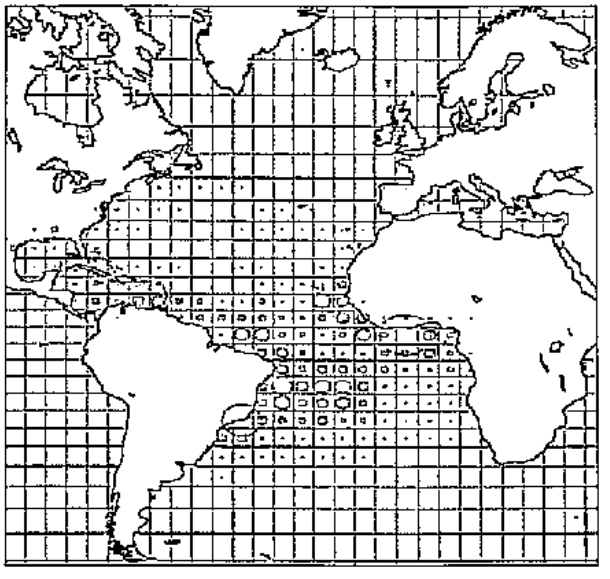
1st Quarter



3rd Quarter

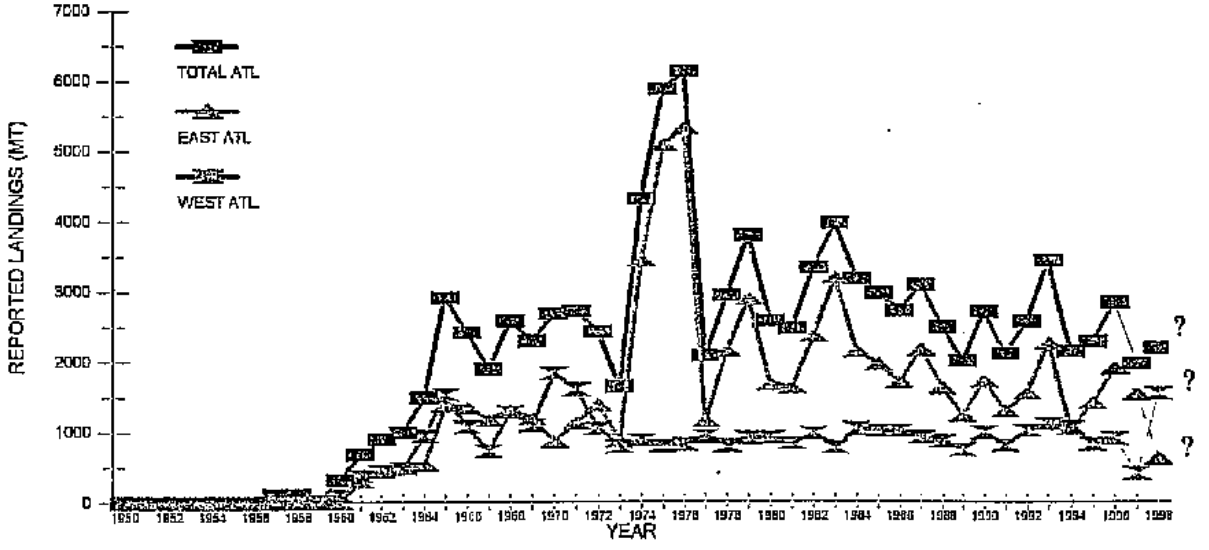


2nd Quarter

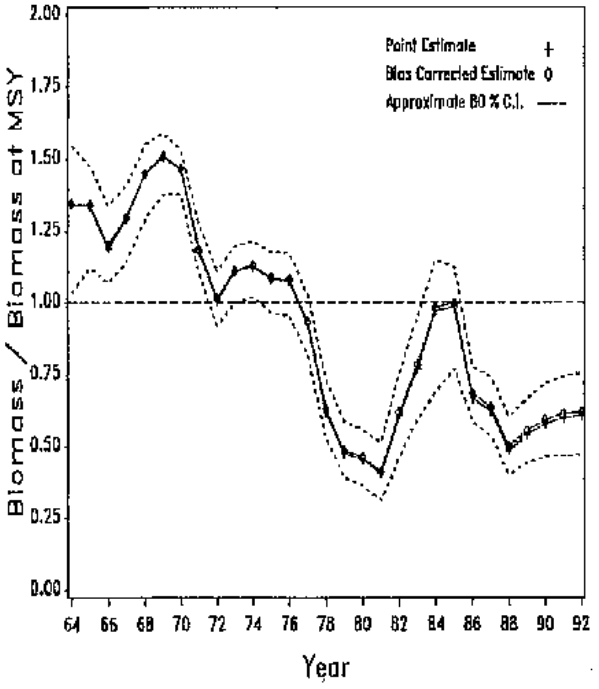


4th Quarter

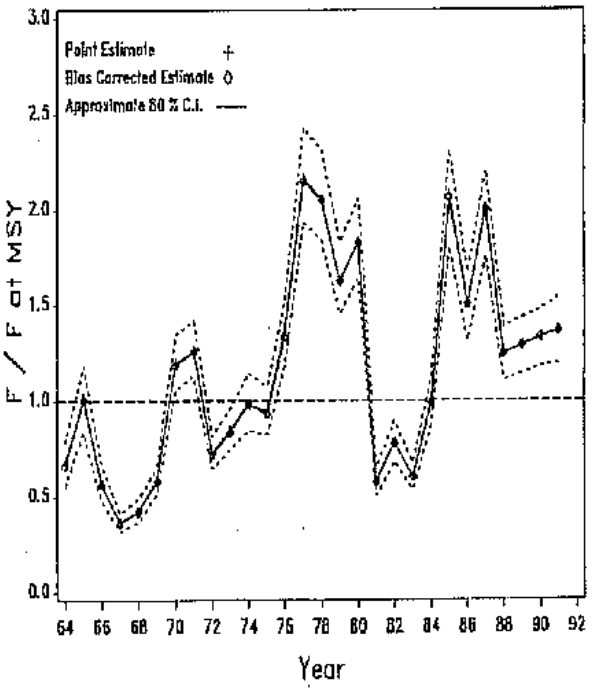
SAI-Fig. 1. Distribution of sailfish catches throughout 1950-1994



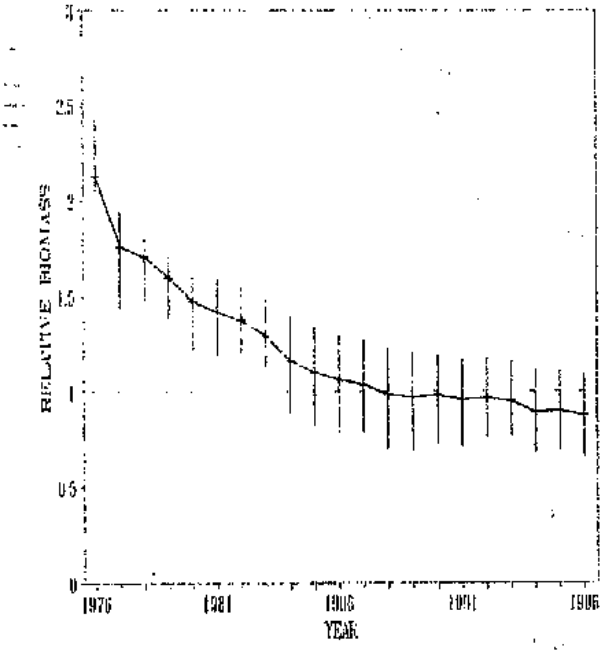
SAI-Fig. 2. Task I catches (MT) of sailfish and by regions, 1950-1998, (1997 and 1998 data were incomplete, therefore 1997/98 points were connected with dashed lines to prior time series and question marks were added).



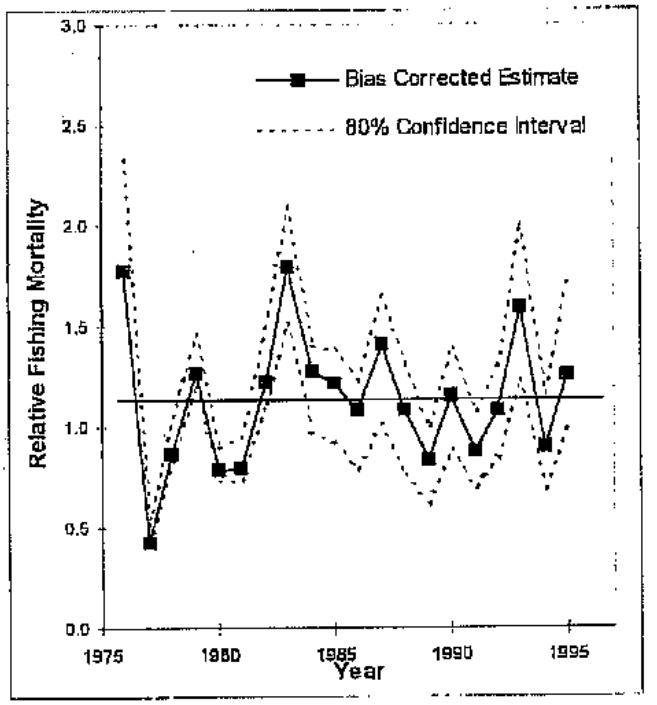
SAI-Fig. 3. Bootstrap annual relative biomass (= B_t / B_{MSY}) from the ASPIC models fitted to west Atlantic sailfish catch and effort information. Confidence intervals are from the estimation procedures and are based on 1000 trials. Other sources of errors are not quantified. Annual values for the first two years are omitted due to extreme imprecision. (1993 SCRS Report).



SAI-Fig. 4. Bootstrap annual relative fishing mortality (= F_t / F_{MSY}) from the ASPIC models fitted to west Atlantic sailfish catch and effort information. Confidence intervals are from the estimation procedures and are based on 1000 trials. Other sources of errors are not quantified. Annual values for the first two years are omitted due to extreme imprecision. (1993 SCRS Report).



SAI-Fig. 5. Bootstrap annual relative biomass trajectory (B_t/B_{msy}) for east Atlantic sailfish from non-equilibrium production method fits. 80 % confidence limits are from the estimation procedures and are based on 1000 trials. Other sources of errors are not quantified.



SAI-Fig. 6. Bootstrap annual relative fishing mortality trajectory (F_t/F_{msy}) for east Atlantic sailfish from non-equilibrium production method fits. 80 % confidence limits are from the estimation procedures and are based on 1000 trials. Other sources of errors are not quantified.

SWO-ATL – ATLANTIC SWORDFISH

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 5°N. This stock separation is supported by recent genetic analyses. However, the precise boundaries between stocks are uncertain, 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 northern 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.

SWO-ATL-2. Description of fisheries

Directed longline fisheries in Spain, the United States and Canada have operated since the late 1950s or early 1960s, and harpoon fisheries have existed since the late 1800s. 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. There are other directed swordfish fisheries (i.e., Brazil, Morocco, Portugal, South Africa, Uruguay, and Venezuela,) and by-catch or opportunistic fisheries which take swordfish (i.e. Chinese Taipei, Korea, France and Brazil). The SCRS scientists believe that ICCAT Task I landings data provide minimum estimates because of unreported landings from vessels flying flags of convenience and from other sources including member and non-member nations.

The total Atlantic reported catch of swordfish (north and south, including discards) reached an historical high of 38,877 MT in 1995, 14% higher than the previous peak catch of 34,177 MT in 1989 (**SWO-Table 1** and **SWO-Figure 2**). The 1998 reported catch was 26,156 MT. As a few countries have not yet reported their catches, this value should be considered provisional and subject to revision.

From 1989 to 1998, the North Atlantic reported catch (landings plus discards) has averaged about 15,200 MT (**SWO-Table 1** and **SWO-Figure 2**), although the 1998 landings plus discards were reduced to 12,175 MT in response to ICCAT regulatory recommendations. In 1998, Spain and the U.S. have decreased their peak north Atlantic landings, by 63% since 1987 and by 52% since 1989, respectively, in response to ICCAT recommendations. If the U.S. discards are counted, the total U.S. landings and discards have declined by 46% from the peak catch level of 1989. Reduced landings have also been attributed to shifts in fleet distributions, including movement of some vessels out of the Atlantic. In addition, some fleets, including the United States, Spain, Portugal and Canada, have changed operating procedures to opportunistically target tuna and/or sharks, taking advantage of market conditions and higher relative catch rates.

The South Atlantic reported catch (landings plus discards) was relatively low (generally less than 5,000 MT) before 1980. Since then, landings have increased continuously through the 1980s and 1990s to a peak of 21,654 MT in 1995 (levels that match peak north Atlantic harvests), followed by a 38% reduction to 13,486 MT in 1998. Since 1988, reported landings have exceeded 12,000 MT. The historic peak in reported landings for 1995 was 26% higher than reported landings in 1990 (17,215 MT). The increase in landings was in part the result of progressive shifts of fishing effort to the south Atlantic, primarily from the north Atlantic, as well as other waters. Reductions in the most recent years are in response to regulations, and are due in part both to a shift to other oceans and to a shift in target species.

Only U.S. (1991-1998) and Canada (1997-1998) report positive estimates of dead discards. Spain reports zero dead discards.

Both the U.S. and Canada used scientific observer data to estimate dead discards. The Canadian estimate sets the proportion of the weight of dead discards to reported landings equal to the proportion of dead discards observed compared to observed landings. However based on the information from national scientists the Committee is concerned about the representativeness of the Canadian sampling. The USA used CPUEs from the observer data and/or from the captain reported logbook data to estimate dead discards. These estimates are included in the stock assessment evaluation and in forward population projections.

SWO-ATL-3. State of stocks

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 and 1998) and the catch at age (1997) used in the north Atlantic assessment show signs of substantially improved recruitment (age 1). This improvement in recruitment 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: 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 current base case assessments indicate 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 CPUE's 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 three years (1984, 1997, and 1998) have north Atlantic swordfish catches been less than 13,400 MT; preliminary estimates of catches in 1998 were about 12,200 MT (**SWO-Figure 5a**).

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. Anticipated catches in 1999 are 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). 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 1998 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 which is commonly considered to result in risks of recruitment over-fishing in other stocks.

South: The Committee noted that catches have been reduced since the last assessment, 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, various evaluations of CPUE patterns were undertaken both during inter-sessional and during the species group meeting yielding consistent interpretations.

A quantitative assessment for the south Atlantic swordfish stock was conducted, 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 is 13,600 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 one year (1998) have reported south Atlantic swordfish catches been less than 13,600 MT (**SWO-Figure 5b**); preliminary estimates of catches in 1998 were about 13,500 MT, a considerable decrease from the average reported level (17,300 MT) for the south Atlantic from 1991 to 1997.

SWO-ATL-4. Outlook

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 (allowing for asymetric production functions) and methods for characterizing uncertainty (Bayesian methods), 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.

The observed high recruitments in recent years (age 1 in 1997 and 1998) should allow for increases in spawning biomass in the future and a more optimistic outlook, if these year classes are not heavily harvested.

For south Atlantic swordfish, the base case model showed that the current biomass has declined to around the MSY level, and that F is around F_{MSY}. If the current catch (~13,500 MT) is continued into the future, the median trajectory increases slightly (**SWO-Figure 6**). However, if total catch in the future is around the current catch limit (14,620 MT), the median trajectory declines below B_{MSY}. Of the various sensitivity analyses, some were more and some were less optimistic. The age structured production model sensitivity analyses were much more pessimistic. The status of south stock is 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. Current regulations

North catch limits. The total allowable catch in the North Atlantic in 1998 was 11,000 MT. Reported landings exceeded this by 6% (11,690 MT) and reported landings plus discards exceeded this by 11% (12,175 MT). Of the six country-specific quotas, Bermuda, Canada, Portugal, Spain and the USA were within their 1998 TAC (or within 1%). These calculations include the carry-over and overage calculations. Japan substantially exceeded its quota in 1997 (by 472 MT) and 1998 (by 838 MT). However, it should be noted that Japan has a five-year (1997-2001) carry-over provision in the ICCAT regulatory recommendation. The Other Category was 73% over the catch limit, due in part to the People's Republic of China reporting 253 MT (360% over their catch limit) and to France reporting 110 MT.

South catch limits. Reported landings in the south Atlantic were 13,476 MT, and reported landings plus discards were 13,486 MT. This is under the 1998 limit of 14,620. Spain and Japan were within their catch limits for the south Atlantic in 1998, while Brazil (67%), Uruguay (14%) and the Other Contracting Parties category (5%) exceeded their 1998 limit.

Minimum size limits. There are two minimum size options that are applied to the entire Atlantic: 125 cm LJFL with a 15% tolerance or 119 cm LJFL with zero tolerance. Only Canada and the USA have adopted the latter. Canada, Chinese-Taipei, Japan, South Africa, Spain, and the United States provide catch-at-size data based on national sampling. Other nations are either partially (Brazil, Portugal) or completely substituted from these data. The evaluation of the level of compliance of these fisheries is affected by the amount and criteria used for these substitution procedures both between and within fisheries. For this reason, caution should be exercised using scientific estimates for compliance purposes. In 1998, the percentage of swordfish reported landed less than 125 cm LJFL was about 19% (by number) overall for all nations fishing in the Atlantic. If this calculation is made using reported landings plus discards then the percentage less than 125 cm LJFL was about 23%. Based on information from nations that supply large amounts of size data to ICCAT (Canada, Spain, USA), there were large numbers of small fish caught in 1998, although the perception of this varies depending if catches (landings plus discards) or only landings are counted. Increases in the 1997 and 1998 Spanish catches of fish less than 125 cm LJFL (37% in 1998) could reflect increases in recruitment, rather than changes in the fishing pattern. Both Canada and the USA reported small fish in 1998 of less then 2% when the 119 cm LJFL criterion

is used, and if only reported landings are considered. However, if catches are considered, then Canada (21%) and the USA (32%) report considerable numbers of small fish less than 125 cm LJFL (and also less than 119cm; 17% and 22%, respectively).

The Committee expressed concern about the uncertainty of the stock structure of Atlantic swordfish and the possibility that the assumed north Atlantic stock does not include the entire catch from the biological stock. When boundaries are uncertain, in this case because of limited or imprecise data, it is important to implement appropriate measures which encompass several possible stock assumptions.

SWO-ATL-6. Management recommendations

North Atlantic

The actions the Commission took to reduce catch in 1997 to 1999 appear to have slowed and/or arrested the decline in the north Atlantic swordfish stock. The Committee recommends 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 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 two years of management action under the strict quota scenario (introduced in 1997), there are positive signs from the fishery in terms of catch rates.

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 observed high recruitment in recent years (age 1 in 1997 and 1998) should allow for increases in spawning biomass in the future and a more optimistic outlook, *if* these year classes are not heavily harvested.

South Atlantic

The Committee noted that catches have been reduced since the last assessment, as was recommended by the SCRS. The SCRS continues to be concerned about the swordfish stock status in the south Atlantic based on the results of preliminary production model analyses, and on the pattern of high catches and declining CPUE trends in some of the by-catch fisheries used as indicators. The result is that the current level of biomass is estimated to be at about at 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 below the level that would support MSY. Catches at the current level (~13,500 MT) would keep the stock at about 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, below current 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 (1998) Yield	12,175 MT	13,486 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[5]
Management Measures in Effect	Country-specific quotas; 125/119 cm LJFL minimum size.	Country-specific quotas; 125/119 cm LJFL minimum size.

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

SW0-TABLE 1. Reported cathces (landings and discards) of Atlantic swordfish (MT)

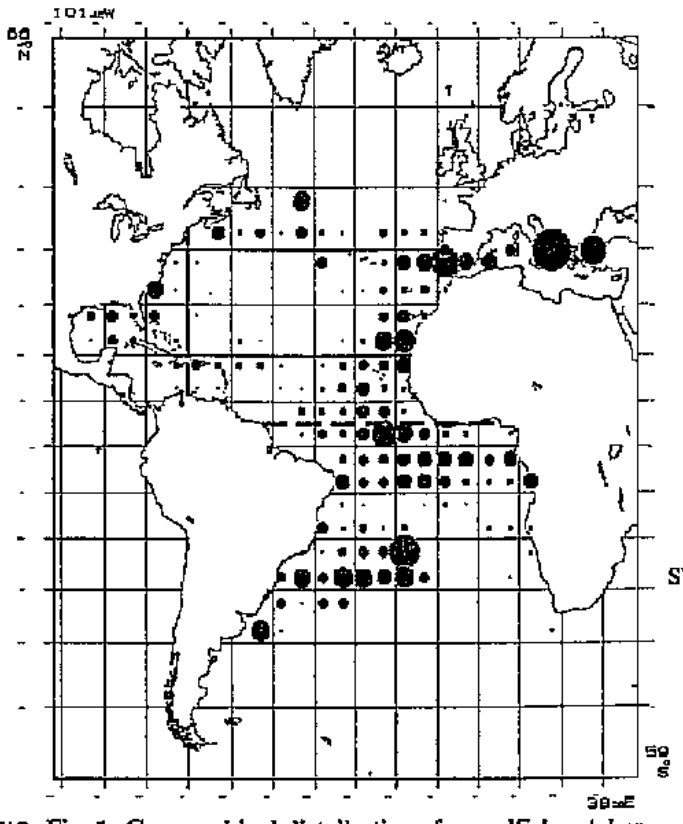
	1976	*1977*	*1978*	*1979*	*1980*	*1981*	*1982*	*1983*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*
TOTAL CATCH (ATL+MEDI)	14145	14544	20559	20778	25460	21968	26005	26825	35596	39197	41098	44554	52808	51938	45315	40802	43907	45892	50933	50798	45193	46094	31119
TOTAL ATL.CATCH	9508	9264	14601	15231	18881	15155	19662	19929	21930	23969	24380	26266	32469	34177	32887	29062	29578	33047	35564	38877	33708	31897	26156
NORTH ATL (Land + Disc)	6696	6409	11835	11937	13558	11180	13215	14527	12791	14383	18486	20236	19513	17250	15672	14937	15394	16827	15300	16697	15021	12931	12175
LANDINGS	*6696*	6409	11835	11937	13558	11180	13215	14527	12791	14383	18486	20236	19513	17250	15672	14690	15011	16419	14592	16171	14433	12480	11690
LONGLINE	*5234*	*5458*	*11123*	*11177*	*12831*	*10549*	*13019*	*14023*	*12664*	*14240*	*18269*	*20022*	*18927*	*15348*	*14026*	*14208*	*14288*	*15737*	*14108*	*15590*	*13607*	*12087*	*11008*
OTHERS	*1462*	*951*	*712*	*760*	*727*	*631*	*196*	*504*	*127*	*143*	*217*	*214*	*586*	*1902*	*1646*	*482*	*723*	*682*	*484*	*581*	*826*	*393*	*682*
DISCARDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	247	383	408	708	526	588	451	485
ANGOLA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BARBADOS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	12
CANADA	15	113	2314	2970	1885	561	554	1088	499	585	1059	954	898	1247	911	1026	1547	2234	1676	1610	739	1089	1115
CAP-VERT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CHINA PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	55	65	79	100	30	253
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
CUBA	283	398	281	128	278	227	254	410	206	162	636	910	832	87	47	23	27	16	50	86	7	7	0
EC-DENMARK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EC-ESPAÑA	2816	3309	3622	2582	3810	4014	4554	7100	6315	7441	9719	11135	9799	6648	6386	6633	6672	6598	6185	6953	5547	5140	4079
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
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
EC-IRELAND	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	15	26
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
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
EC-UK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	1	5	11	11
GRENADA	0	0	0	0	0	0	0	0	0	0	0	0	56	5	1	2	3	13	0	1	4	15	15
JAPAN	1149	793	946	542	1167	1315	1755	537	665	921	807	413	621	1572	1051	992	1064	1126	933	1043	1494	1178	1525
KOREA	335	541	634	303	284	136	198	53	32	160	68	60	30	320	51	3	3	19	16	16	19	15	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
MAROC	12	7	11	208	136	124	91	129	81	137	181	197	196	222	91	110	69	39	36	79	462	267	267
MEXICO	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	14	0	0	14	28
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
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
NEI-28	91	22	76	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NORWAY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
POLAND	0	0	6	0	1	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
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
SENEGAL	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	6	6	0	0	0	0	0	0
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
ST.VINCENT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3	23	0	4	3	1	1
TRINIDAD & TOBAGO	0	0	0	0	0	0	0	21	26	6	45	151	42	79	66	71	562	125	0	0	43	14	15
USSR	19	15	23	10	21	0	69	0	16	13	18	4	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
USA	1429	912	3684	4619	5625	4530	5410	4820	4749	4705	5210	5247	6171	6411	5519	4278	3852	3782	3366	4026	3560	2975	3053
VENEZUELA	43	15	46	182	192	24	25	35	23	51	84	86	2	4	9	78	103	73	69	54	85	74	74
DISCARDS	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*247*	*383*	*408*	*708*	*526*	*588*	*451*	*485*
CANADA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	52
USA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	247	383	408	708	526	588	446	433

SWO-TABLE 1. Reported cathces (landings and discards) of Atlantic swordfish (MT)

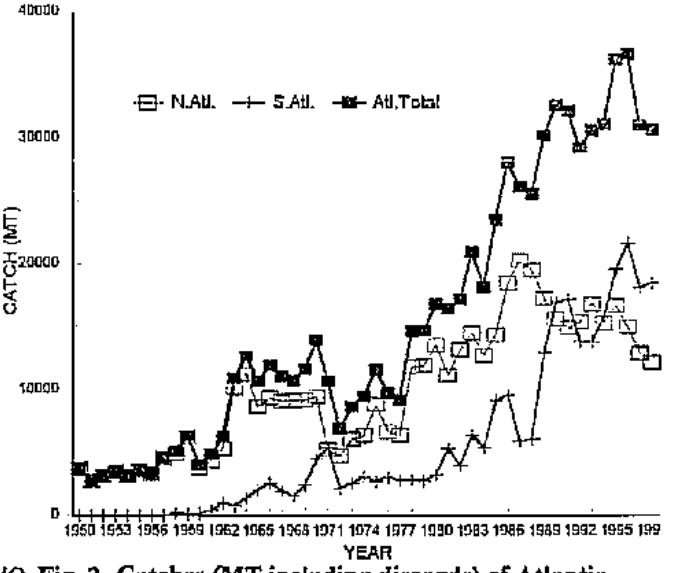
	1976	*1977*	*1978*	*1979*	*1980*	*1981*	*1982*	*1983*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*
SOUTH ATL (Land +Disc)	**2812**	**2855**	**2766**	**3294**	**5323**	**3975**	**6447**	**5402**	**9139**	**9586**	**5894**	**6030**	**12956**	**16927**	**17215**	**13878**	**13801**	**15812**	**19556**	**21654**	**18098**	**18494**	**13486**
LANDINGS	2812	2855	2766	3294	5323	3975	6447	5402	9139	9586	5894	6030	12956	16927	17215	13878	13801	15812	19556	21654	18097	18473	13476
LONGLINE	*2812*	*2840*	*2749*	*3265*	*5179*	*3938*	*6344*	*5307*	*8920*	*8863*	*4951*	*5446*	*12404*	*16398*	*16705*	*13287*	*13173*	*15547*	*17365*	*20806*	*17799*	*18388*	*13370*
OTHERS	*0*	*15*	*17*	*29*	*144*	*37*	*103*	*95*	*219*	*723*	*943*	*584*	*552*	*529*	*510*	*591*	*628*	*265*	*2191*	*848*	*298*	*85*	*106*
DISCARDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	21	10
ANGOLA	0	0	0	0	0	0	0	0	26	228	815	84	84	84	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
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
BENIN	0	0	0	0	0	18	24	0	86	90	39	13	19	26	28	28	26	28	25	24	24	24	0
BRASIL	365	396	372	521	1582	655	1019	781	468	562	753	947	1162	1168	1696	1312	2609	2013	1571	1975	1892	4100	3899
BULGARIA	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CHINA PR.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24
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
COTE D'IVOIRE	0	0	0	0	0	0	0	0	10	10	10	10	12	7	10	21	15	19	24	24	0	0	0
CUBA	317	302	319	272	316	147	432	818	1161	1301	95	173	159	830	448	209	246	192	452	778	60	60	0
EC-ESPAÑA	0	0	0	0	0	0	0	0	0	0	66	0	4393	7725	6166	5760	5651	6974	7937	11290	9622	8461	5831
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
G.EQUATORIAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
GHANA	0	0	0	0	110	5	55	5	15	25	13	123	235	235	235	235	235	0	0	0	140	0	106
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
JAPAN	105	514	503	782	2029	2170	3287	1908	4395	4613	2913	2620	4453	4019	6708	4459	2870	5256	4699	3619	2197	1643	963
KOREA	812	699	699	303	399	311	486	409	625	917	369	666	1012	776	50	147	147	198	164	164	7	18	0
LITUANIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	794	0	0	0	0
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
NEI-28	219	28	83	26	0	0	0	0	0	0	0	0	0	0	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
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
TOGO	0	0	0	0	0	0	0	0	0	6	32	1	0	2	3	5	5	8	14	14	64	0	0
USSR	138	106	161	70	154	40	26	46	158	60	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	791
USA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	171	396	160
DISCARDS	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*21*	*10*
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

SWO-TABLE 1. Reported cathces (landings and discards) of Atlantic swordfish (MT)

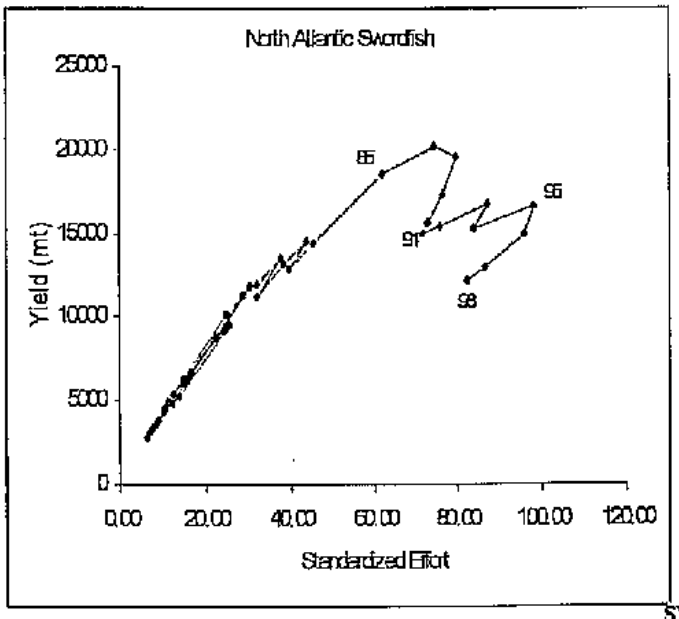
	1976	*1977*	*1978*	*1979*	*1980*	*1981*	*1982*	*1983*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*
MEDITERRANEAN	4637	5280	5958	5547	6579	6813	6343	6896	13666	15228	16718	18288	20339	17761	12428	11987	14712	13253	16077	12447	12074	14669	5458
LONGLINE	*4138*	*4606*	*5046*	*4877*	*5115*	*5411*	*5751*	*6239*	*6640*	*6260*	*7297*	*7781*	*9163*	*6784*	*6873*	*7083*	*7456*	*6932*	*8640*	*5667*	*5495*	*4966*	*3300*
OTHERS	*499*	*674*	*912*	*670*	*1464*	*1402*	*592*	*657*	*7026*	*8968*	*9421*	*10507*	*11176*	*10977*	*5555*	*4904*	*7256*	*6321*	*7437*	*6780*	*6579*	*9703*	*2158*
ALBANIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	13	0
ALGERIA	368	370	320	521	650	760	870	877	884	890	847	1820	2621	590	712	562	395	562	600	807	807	807	0
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
CYPRUS	59	95	82	98	72	78	103	28	63	71	154	84	121	139	173	162	73	116	159	122	75	75	0
EC-ESPAÑA	89	667	720	800	750	1120	900	1322	1245	1227	1337	1134	1762	1337	1523	1171	822	1358	1503	1379	1186	1264	1443
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
EC-ITALY	3747	3747	4506	3930	4143	3823	2939	3026	9360	10863	11413	12325	13010	13009	5524	4789	7595	6330	7765	6725	5286	6104	0
JAPAN	1	0	2	3	1	0	5	6	19	14	7	3	4	1	2	1	2	4	2	4	5	4	5
LIBYA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MALTA	175	223	136	151	222	192	177	59	94	108	97	131	207	121	122	119	71	76	42	58	58	83	0
MAROC	186	144	172	0	0	0	0	43	39	38	92	40	62	97	1249	1706	2692	2589	2654	1696	2734	4900	2360
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
TUNISIE	5	0	0	0	0	7	19	15	15	61	64	63	80	159	176	181	178	357	298	378	352	346	0
TURKEY	7	34	20	44	13	70	40	216	95	190	226	557	589	209	243	100	136	292	533	304	320	320	0



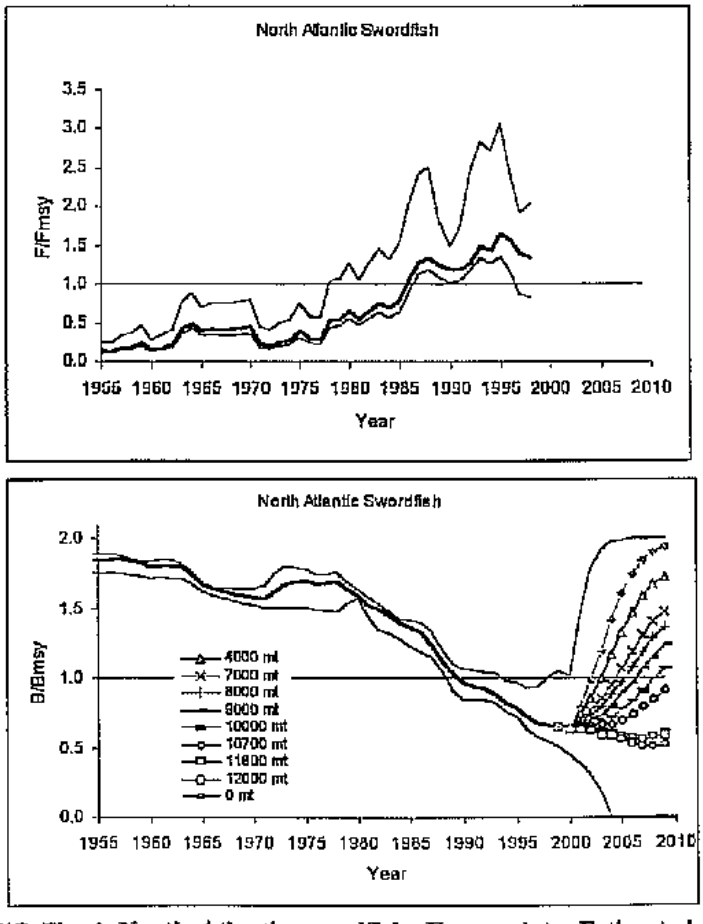
SWO- Fig. 1 Geographical distribution of swordfish catches by longline in 1996. The dashed line at 5° is the assumed boundary between north and south management units.



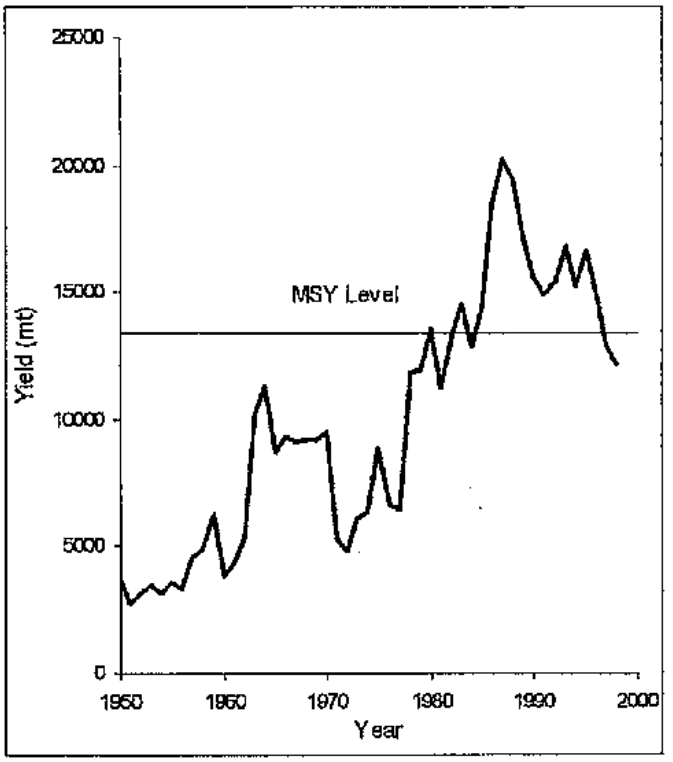
SWO-Fig. 2 Catches (MT including discards) of Atlantic swordfish.

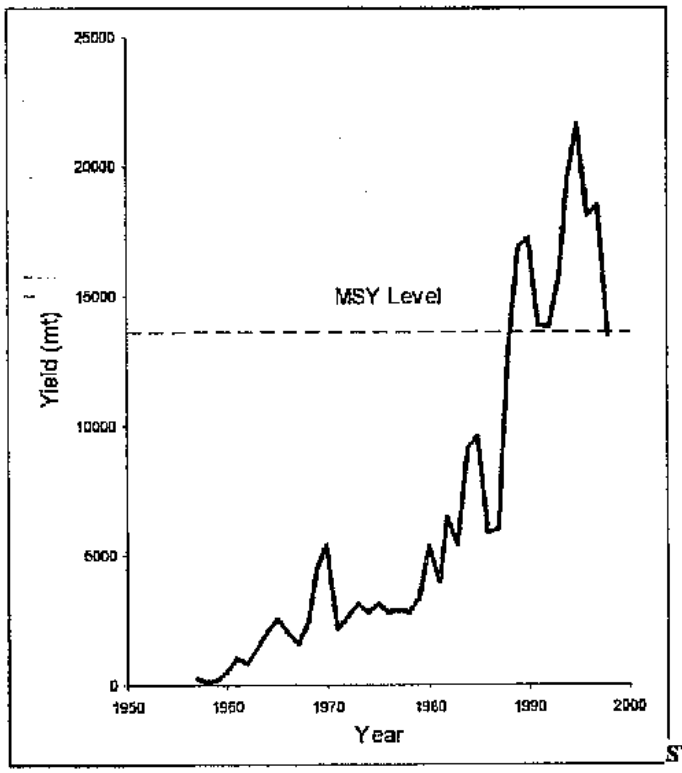


SWO-Fig. 3. Relationship between nominal catch and estimated standardized effort for the north Atlantic swordfish assessment. Selected years are indicated.

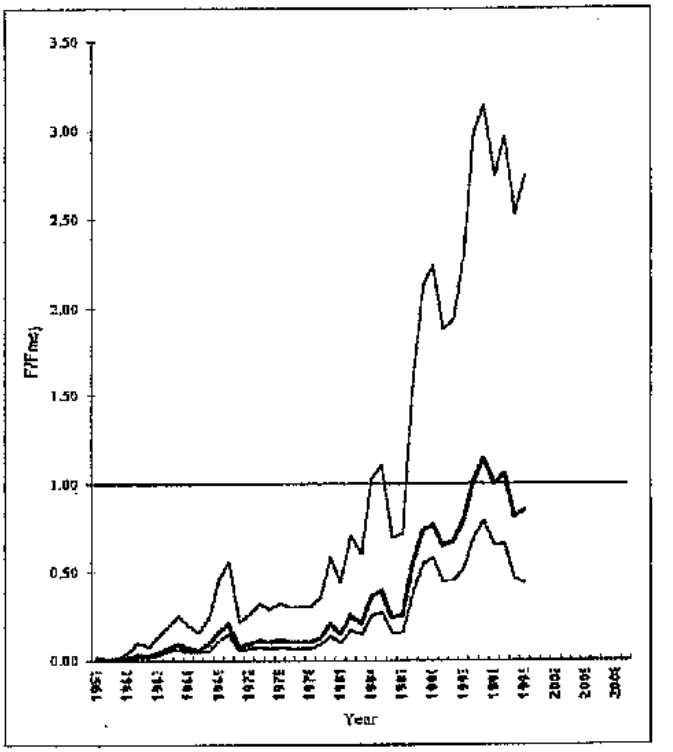


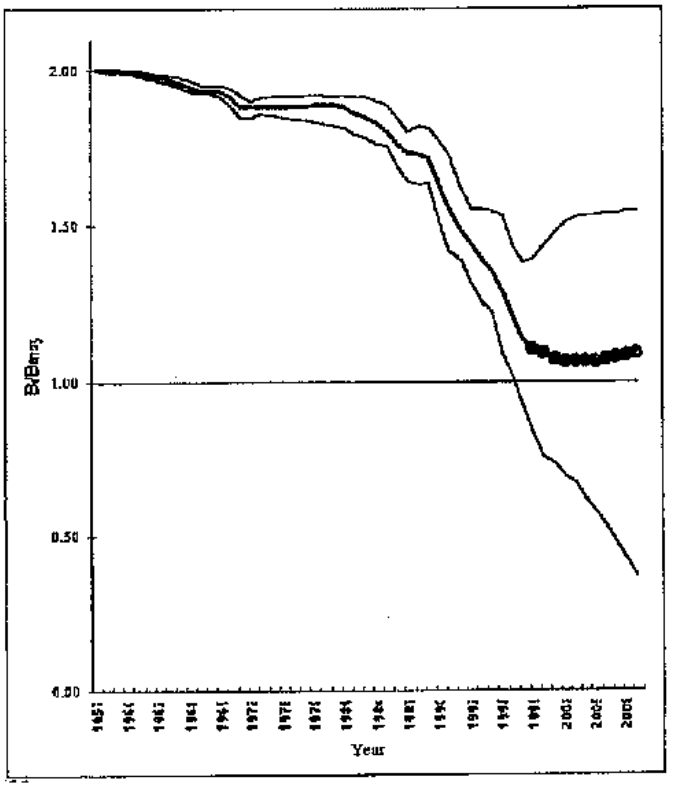
SWO-Fig. 4 North Atlantic swordfish: Upper plate: Estimated fishing mortality rate relative to Fmsy (F/Fmsy) for the period 1955-1998 Upper line is upper 80% confidence bound, lower line is lower 80% confidence bound and center line is median from 700 bootstrap trials. Lower Plate: Estimated biomass relative to biomass at MSY (B/Bmsy) for the period 1955-1999 followed by 10 year projected B/Bmsy 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





SWO-Fig. 5 **Upper plate: Annual yield (mt) trajectory for north Atlantic swordfish relative to estimated MSY level for the north Atlantic.**
Lower plate: Annual yield (mt) trajectory for south Atlantic swordfish relative to estimated MSY level for the south Atlantic.





SWO-Fig. 6 **South Atlantic swordfish: Upper Plate: Estimated fishing mortality rate relative to Fmsy (F/Fmsy) for the period 1957-1998. Upper line represents upper 80% confidence bound, center line the median and lower line the lower 80% confidence bound from 700 bootstrap trials. Lower Plate: Estimated biomass relative to biomass at MSY (B/Bmsy) for the period 1957-1999 and projected with an assumed constant catch of 13,620 MT per year for the period 1999-2009. Upper line represents upper 80% confidence bound, center line the median and lower line the lower 80% confidence bound.**

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 the 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 the catch made by surface fishery peaked around the 1980s at a level close to 50% of the total catch but it declined afterwards to 13% (**SBF-Table 1** and **SBF-Figure 2**). The proportion of the surface catch started increasing again since 1994 and has reached around 30 % in 1997.

The catches of Australia, Japan and New Zealand have been controlled with quota since 1986. 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 at 4,539 MT in 1997, then increased again to 6,318 MT in 1998. Japan caught an additional 1,464 MT in 1998 for the experimental fishing which was conducted to evaluate fish density in an area where no commercial operations have occurred in recent years.

The Atlantic catch has varied widely between 400 and 6,200 MT since 1978 (**SBF-Table 1** and **SBF-Figure 1**), reflecting the shifts of longline effort between the Atlantic and Indian Oceans. The fishing ground in the Atlantic is located off the southern tip of South Africa (**SBF-Figure 5**).

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 stocks

The stock assessment of this species has not been updated under the Conservation of Southern Bluefin Tuna (CCSBT) during 1999. Therefore, the information described below is based on the results of The fourth Scientific Committee of CCSBT held in Shimizu and Tokyo, Japan, from July 23 to August 6, 1998.

The Japanese longline CPUE are standardized based on a range of hypotheses on fish density in cells without fishing effort (**SBF-Figure 3**). 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 one hypothesis. 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.

The Virtual Population Analyses (VPA) were conducted using various model structures, hypotheses on biological parameters, and different interpretations of Japanese CPUE series (**SBF-Figure 4**). All VPAs showed the similar recruitment trend of marked decline from the 1970s to the mid 1990s; the most recent recruitment estimate is about one third of the 1970 level. The tagging data and results of aerial surveys suggested that recruitment of 1993 to 1995 cohorts for which no VPA results were available stayed at low levels.

The parental biomass is notably lower than the 1980 level, the management target level for stock recovery. The recent trend in parental biomass varied from a continuous decline to an upturn since 1994. These trends depend greatly on the way the plus group is treated and the CPUE series used. The overall estimates of current biomass level, after incorporating different beliefs in alternative hypotheses held by different nations, ranged from 25% to 53% of the 1980 level.

Japan conducted an Experimental Fishing Program in July and August, 1998, as well as from June to August of 1999, trying to resolve uncertainties relating to CPUE series. The survey was designed to estimate fish density in areas without commercial operations relative to those in areas freely chosen by fishers. The survey results showed that the fish density in an area outside of commercially selected fishing area was about 30-60% of those in commercially selected area, even when assuming no fish distributing in an area without survey effort, and supported the hypothesis that substantial amount of fish is distributed outside of commercially fishing area.

SBF-4. Outlook

Future projections were performed to examine the medium to long term consequences of current global catch on parental biomass as well as the probability to recover to the 1980 level, based on a set of VPAs incorporating an agreed upon range of uncertainties. The probability of stock recovery to the 1980 parental biomass level before 2020 ranged between 6 to 87% reflecting different interpretations on the plausibility of various hypotheses. As noted above for the parental biomass estimates, the differences in plus group treatments and different interpretations of CPUE indices had major impacts on the assessment of the recovery probability. However, the results of Japanese Experimental Fishing Program suggested that the most pessimistic CPUE interpretations is highly unlikely.

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 the 1989-1990 season.

Management measures of the CCSBT were successful in reducing catches by 1990 but non-member catches, which have shown a marked and continuous increase over the 1990s, have contributed to the erosion of benefits over this period.

The continued low abundance of parental biomass is a cause for serious concern. The increasing pressure on the parental biomass, particularly on the spawning ground, is contributing to the continued low parental biomass. Also, the recent increase in the fishing mortality of juvenile fish is expected to lead to lower recruitment from these cohorts to the parental stock.

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 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)

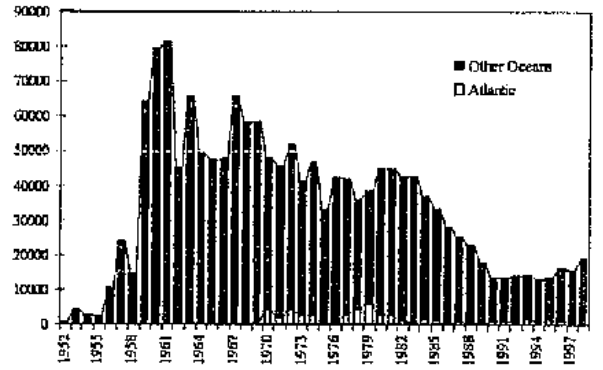
Maximum Sustainable Yield	not estimated
Current (1998) Yield	19,241 MT (preliminary)
Relative Biomass SSB(1998)/SSB (1980)	0.25 - 0.53
Current Management Measures	global quota at 11,750 MT (applicable only to Australia, Japan, and New Zealand)

SBF-TABLE 1. Atlantic and world catches of southern bluefin tuna (in MT) by gear and flag

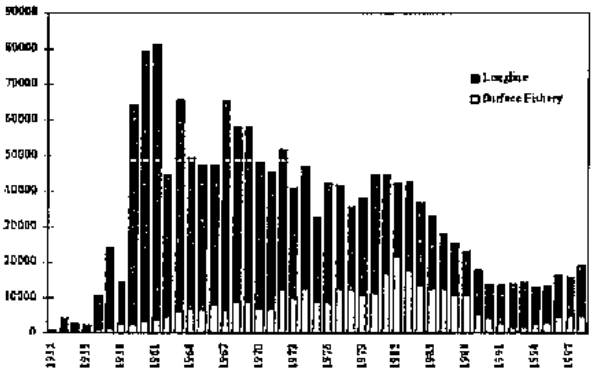
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997*	1998*
ATLANTIC TOTAL	753	3168	4685	6205	2827	2578	1138	525	1636	1497	432	1204	622	711	1266	1346	539	2144	767	1612	1376	365	1228
-CATCH BY GEAR																							
Longline	753	3168	4685	6205	2814	2572	1138	525	1636	1497	432	1200	620	705	1266	1346	539	2144	767	1612	1376	365	1228
Baitboat	0	0	0	0	13	6	0	0	0	0	0	0	0	1	0	0	0	0	0	0	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	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
-CATCH BY FLAGS																							
Chinese-Taipei	61	0	34	13	26	66	3	20	0	29	43	80	72	80	64	15	14	456	172	168	157	47	234
Japan	692	3168	4651	6192	2788	2506	1135	505	1636	1468	389	1120	548	625	1202	1331	525	1688	595	1444	1219	308	984
Korea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	10
Poland	0	0	0	0	0	0	0	0	0	0	0	4	2	5	0	0	0	0	0	0	0	0	0
South Africa	0	0	0	0	13	6	++	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
World Catches (all oce	*42537*	*42185*	*36002*	*38673*	*45054*	*45104*	*42794*	*42881*	*37091*	*33325*	*28319*	*25575*	*23145*	*17842*	*13869*	*13638*	*14076*	*14372.5*	*13280*	*13456*	*16329*	*15777*	*19241*
Longline	*34099*	*29600*	*23658*	*27890*	*33859*	*28348*	*21263*	*25143*	*23678*	*20610*	*15344*	*14212*	*11977*	*12355*	*9500*	*10528*	*12140*	*12149*	*10726*	*10550*	*11552*	*10929*	*14802*
Surface Fishery	*8383*	*12569*	*12190*	*10783*	*11195*	*16843*	*21501*	*17695*	*13411*	*12589*	*12531*	*10821*	*10591*	*5434*	*4319*	*2873*	*1835*	*1899*	*2554*	*2906*	*4777*	*4848*	*4439*

* Preliminary

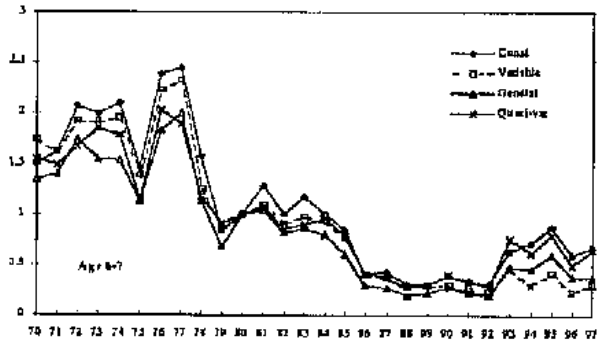
++ Catch < 0.5 MT.

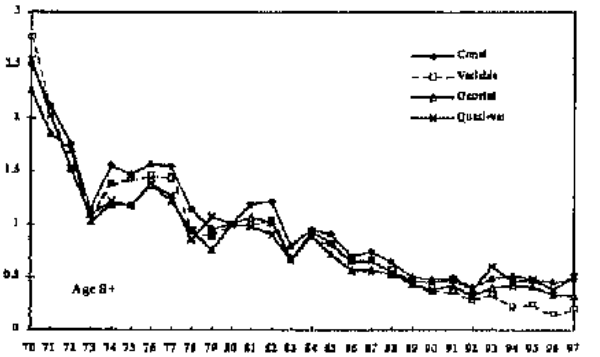


SBF-Fig. 1 World and Atlantic catches of southern bluefin tuna.

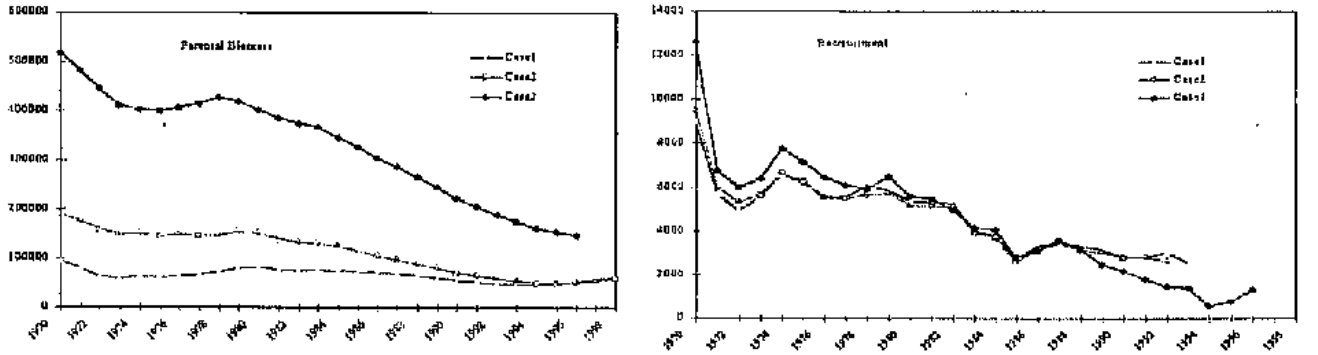


SBF-Fig. 2 Southern bluefin tuna world catch by fishery.

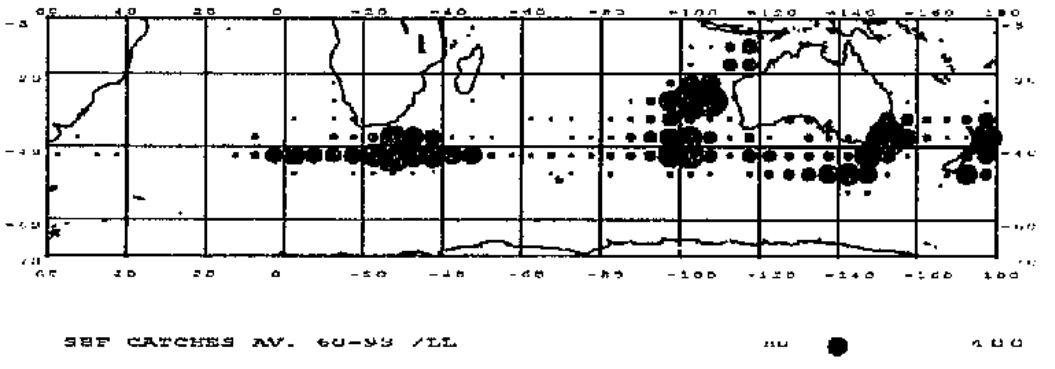




SBF-Fig. 3. Standardized CPUE of Japanese longline relative to 1980 for juvenile (age 6-7) and parental (age 8+) southern bluefin tuna. Different lines correspond to different hypotheses on fish abundance within time-area strata without fishing effort. (Reference: CCSBT/SC/9807/27 and 37)



SBF-Fig. 4 VPA (with marks) and projection (without marks) results. Japanese and Australian reference cases (Case 1 and Case 2) and the result based on different approach (Case 3) were selected for presentation. (Reference : CCSBT/SC/9807/17, 27 and 31 with a modification to make them comparable.)



SBF-Fig. 5 Geographical distribution of SBF catches by longline, 1960-1993.

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 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 (SCRS/99/63, SCRS/99/64), mid-water trawlers (i.e. pelagic fisheries of West Africa-Mauritania), handlines and small scale gillnets (U.S. fisheries, SCRS/99/95). 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 1998 are shown in **SMT-Table 1**. The total reported landings of all species combined generally fluctuated during the period 1976 to 1979, ranging from about 64,000 MT to over 80,000 MT. In 1980, there was a marked increase in reported landings, which continued to increase, reaching a peak at about 144,000 MT in 1988 **(SMT-Figure 1)**. Landings reported for the period 1989-1996 decreased to about 106,000 MT. A preliminary estimate for the total nominal landings of small tunas in 1998 is 82,345 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 1976-1998.

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. Provisional data on by-catch and discards of tropical purse-seine fleet showed that small tuna species comprised 56% of the total discards, which in overall is 1.13% of the total commercial catch (SCRS/99/49). Moreover, the majority of these small tuna discards were taken around floating objects. This source of mortality is not yet fully reflected in the Task I tables.

It was noted that the new statistical data for purse-seiners (Spain, France and NEI) is now reporting the estimated amount of small tunas catches by 1^{o} x 1^{o} square and month **(SMT-Figure 3)**. Document SCRS/99/64 presented a statistical review of

tropical tuna catches including small tuna species, taken by the Spanish purse-seine fleet from 1991 to 1996. The catches were also sorted by type of school association.

In Venezuela, a national sampling program covering the artisanal fisheries has been implemented since 1992, in order to monitor catches of small tunas and other species caught by this fleet. In 1998, Venezuela also provided details of a local artisanal fishery for king mackerel (*Scomberomorus cavalla*) and wahoo (*Acanthocybium solandri*), indicating gears used, seasonality of the catches and CPUE data (SCRS/99/139).

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. Some size data has been reported, by 1°x1° square and by month, under an observer program covering the European purse seine tuna fleets operating in the Atlantic Ocean, during last years.

Status of stock information reported to the Committee is summarized as follows. Annual 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 at that time. 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. Although king mackerel are still considered over-fished, Spanish mackerel in the Gulf of Mexico are no longer considered over-fished by the criteria established by fisheries managers in the United States (SCRS/99/95).

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.

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.

A "U.S. Fishery Management Plan (FMP) for coastal pelagic species in the Gulf of Mexico and Atlantic Ocean Region" has been in effect since 1983. Under the FMP, fisheries management procedures were established to reduce fishing mortality on king and Spanish mackerels. It is believed that vessel landing limits, geographical quotas, and minimum size restrictions have helped to stabilize and improve overall stock conditions.

SMT-6. Management recommendations

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

SMT-TABLE 1. Reported landings of small tunas (in MT) in the Atlantic Ocean and the Mediterranean Sea

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
TOTAL	63594	78950	75631	80697	115299	115795	133654	127109	111485	93300	91960	113745	143845	126345	131976	119231	95101	95402	86733	88145	105986	104272	82345
ATLANTIC	51777	64208	59997	60606	89408	81378	93613	83731	87842	67524	68638	84698	110758	105620	97837	83908	73354	65776	65036	66589	80520	82663	64586
MEDITERRANEAN	11817	14742	15634	20091	25891	34417	40041	43378	23643	25776	23322	29047	33087	20725	34139	35323	21747	29626	21697	21556	25466	21609	17759
BLF - T. atlanticus	1026	1251	1341	1205	1175	1973	1941	1738	1908	1403	2822	3462	3322	2834	3887	4201	4352	3532	2710	4048	4487	3901	3893
Atlantic																							
BRASIL	56	273	195	173	161	85	89	57	203	133	172	254	229	120	335	130	49	22	37	153	649	418	0
CUBA	0	0	0	0	0	721	622	558	487	157	486	634	332	318	487	318	196	54	223	156	287	287	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
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
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
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
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
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
GRENADA	100	71	76	95	68	84	143	102	232	193	256	141	220	134	293	195	146	253	189	123	164	126	126
JAMAICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	148	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
MEXICO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NETHERLAND.AN	0	0	55	55	55	55	55	55	55	55	60	60	70	70	70	60	60	65	60	50	45	45	45
STA LUCIA	0	0	0	0	0	0	0	0	0	0	0	2	1	1	17	14	13	16	82	47	35	40	40
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
USA	0	0	0	0	0	139	41	7	0	11	32	44	154	87	80	111	126	508	492	582	446	547	707
UK-BERMUDA	10	9	7	7	6	4	5	6	4	9	17	11	7	14	13	8	6	5	7	4	5	6	6
VENEZUELA	0	0	0	0	0	0	0	0	0	0	947	1448	1240	652	1150	1598	2148	1222	13	621	758	478	1015
BLT- Auxis rochei	0	0	0	0	0	0	0	0	0	0	2	0	357	723	3634	2171	814	70	100	100	0	464	1700
Atlantic																							
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
RUSSIA FED.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2171	814	70	100	100	0	464	1672
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
USSR	0	0	0	0	0	0	0	0	0	0	0	0	357	723	3634	0	0	0	0	0	0	0	0
BON - Sarda Sarda																							
Atlantic	9490	11977	7854	6485	12568	10760	12169	6840	6849	6946	5892	7395	22353	17766	6843	8301	6902	4587	5807	6228	7862	9102	11010
ANGOLA	831	938	531	251	377	196	253	124	225	120	101	144	180	168	128	102	4	49	20	9	39	32	0
ARGENTINA	283	2026	1746	1288	2600	846	1775	310	2058	1399	699	1607	2794	1327	1207	1794	1559	434	4	138	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
BRASIL	0	0	0	0	0	0	0	0	187	179	523	345	214	273	226	71	86	142	142	137	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
CUBA	0	0	0	0	0	0	0	0	0	0	0	23	173	26	28	0	0	0	0	0	0	0	230
EC-ESPAÑA	4379	1978	1919	717	220	589	434	414	173	398	145	41	91	57	18	8	39	5	3	2	2	1	0
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
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
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
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
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
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
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
ESTONIA	0	0	0	0	0	0	0	0	0	0	0	0	668	859	187	8	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
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
GHANA	0	9	9	0	77	5	71	13	8	10	0	943	0	0	0	0	0	0	0	0	0	0	0

SMT-TABLE 1. Reported landings of small tunas (in MT) in the Atlantic Ocean and the Mediterranean Sea

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
GRENADA	200	136	157	53	52	61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	6	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
LATVIA	0	0	0	0	0	0	0	0	0	0	0	0	1191	1164	221	7	4	0	3	19	301	0	318
LITUANIA	0	0	0	0	0	0	0	0	0	0	0	0	1041	762	162	11	10	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
MEXICO	237	81	59	174	271	408	396	567	744	212	241	391	356	338	215	200	657	779	674	1144	1312	1312	0
POLAND	30	177	44	32	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	225	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
RUSSIA FED	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	948	29	6	0	0	0	0	4960
SENEGAL	164	614	523	159	140	1327	202	497	200	495	510	463	2066	869	558	824	378	227	600	354	570	570	570
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
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
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
TOGO	0	0	0	0	0	0	0	0	0	254	138	245	400	256	177	172	107	311	254	145	197	197	197
TRINIDAD & TOBA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	703	750	750	750	750
USA	23	268	224	502	198	333	209	263	217	110	84	130	89	278	298	468	497	170	127	116	155	182	73
USSR	1281	4164	1602	2125	6433	4559	6329	2375	1290	2073	1085	1083	8882	7363	706	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	0
URUGUAY	3	0	0	16	3	1	0	1	0	0	3	0	0	0	0	26	0	0	0	0	0	0	0
VENEZUELA	756	767	382	443	661	833	864	554	748	774	1401	1020	1153	1783	1514	1514	1443	0	1646	1646	1348	1348	1647
																							** probably includes non-tuna species
Mediterranean	**6499**	**8699**	**9419**	**13486**	**19165**	**29293**	**31518**	**35997**	**15656**	**18487**	**16098**	**22857**	**24548**	**12296**	**22097**	**26088**	**15396**	**26122**	**16111**	**15165**	**17269**	**16778**	**14844**
ALBANIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0
ALGERIE	143	206	196	515	640	740	860	867	874	680	459	203	625	1528	1307	600	600	596	847	351	351	351	0
BULGARIA	40	44	11	1	13	191	4	24	1	1	0	13	0	0	17	17	20	8	0	25	33	0	0
CROATIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	49	128	6	70	0	0	25
CYPRUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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
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
EC-GREECE	511	550	610	712	609	1251	1405	1367	1732	1321	1027	1848	1254	2534	2534	2690	2690	2690	1581	2116	1752	1559	945
EC-ITALY	555	1533	1378	1403	1180	1096	1102	1806	2777	1437	1437	2148	2242	1369	1244	1087	1288	1238	1828	1512	2233	2233	2233
EGYPT	0	1	17	10	3	2	23	14	48	62	68	35	17	358	598	574	518	640	648	828	985	985	985
LIBYA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	71	70	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
MAROC	630	456	128	155	62	309	71	92	75	57	51	127	108	28	69	69	31	25	93	37	67	45	39
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
RUMANIA	2	0	0	0	0	0	0	0	0	0	6	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	0
TURKEY	3178	4503	5536	9082	14910	24300	25978	29485	7618	12809	11426	17333	18133	5008	14737	19645	8863	19548	10093	8944	10284	10284	10284
U S S R	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
YUGOSLAVIA	23	26	39	29	72	39	61	31	37	34	38	62	36	98	79	0	0	0	0	0	0	0	0
YUGOSLAVIA REI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	0	3	2	6	10	0	0
BOP- O. unicolor																							
Atlantic	212	321	817	464	698	1446	584	36	49	124	66	538	1474	1109	420	487	424	349	599	525	2004	246	28
BENIN	0	0	0	1	1	2	2	1	1	1	3	1	2	1	1	1	1	1	1	1	1	0	0
MAURITANIE	80	90	90	90	101	478	99	37	40	40	50	50	50	50	50	0	0	0	0	0	0	0	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
MAROC	132	231	727	373	596	968	483	0	0	83	33	487	1422	1058	369	486	423	348	598	524	2003	246	28
Mediterranean	0	135	153	28	0	0	0	0	0	9	1	26	8	7	37	14	41	54	23	23	13	3	2

SMT-TABLE 1. Reported landings of small tunas (in MT) in the Atlantic Ocean and the Mediterranean Sea

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
LIBYA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	40	0	0	0	0	0
MAROC	0	135	153	26	0	0	0	0	0	9	1	26	8	7	37	14	1	14	23	23	13	3	2
BRS -Sc. brasiliensis	2272	3166	3484	3722	5617	5841	6019	6632	6129	3501	6549	6212	9510	10778	7698	8856	6051	8049	7161	7320	8997	8435	7297
Atlantic																							
BRASIL	283	956	1522	1191	2826	3466	4342	4511	5259	1504	5011	4741	5063	5927	2767	1437	1149	842	1149	1308	3047	2125	1516
GUYANE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	211	571	0
TRINIDAD & TOB/	0	0	0	0	0	0	0	0	0	0	0	0	2704	2864	2471	2749	2130	2130	2130	2130	2130	2130	2130
VENEZUELA	1989	2202	1962	2531	2791	2375	1677	2121	1870	1997	1538	1471	1743	1987	2460	4670	2772	5077	3882	3882	3609	3609	3651
CEH- Sc. regalis	565	629	698	566	604	628	687	677	680	574	500	392	219	234	225	375	390	450	490	429	279	279	279
Atlantic																							
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
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
EC-MARINIQUE	220	510	600	500	500	522	611	567	574	511	448	344	162	175	175	330	310	400	400	400	250	250	250
ST.LUCIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ST.VINCENT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
FRI - Auxis thazard																							
Atlantic	6457	16611	4776	6666	16960	12235	19197	15870	19566	17636	15249	19666	19025	15029	14973	6631	2244	2943	5244	5451	5831	7654	6062
ANGOLA	27	197	357	357	256	351	515	212	256	90	21	115	20	70	28	1	0	4	6	21	29	12	31
ARGENTINA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BARBADOS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BENIN	0	0	0	25	37	64	72	32	49	50	1	3	6	3	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
BULGARIA	0	0	0	0	3	3	0	7	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
EC-ESPANA	418	574	1248	1211	6260	5295	3126	2691	5746	3702	3164	4538	3938	1877	2240	541	228	362	297	386	947	581	569
EC-FRANCE	0	0	0	0	0	0	0	0	640	416	1904	3392	3392	3008	3872	0	119	63	104	126	161	146	0
F I S	0	0	0	0	0	1856	1884	2800	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	14	30	32	1	2	4	26	3	0	0	0	0	0	1	31
ESTONIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	198	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
GHANA	4311	13914	1047	4286	7566	2048	6062	5632	4530	4500	3256	4689	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
JAPAN	14	69	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
LITUANIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	290	0	0	0	0	0	0	0
MAROC	272	668	770	694	968	1267	1126	1271	198	424	302	465	194	599	1045	1131	332	274	122	645	543	2614	2649
NEI-1	0	0	0	0	0	0	0	333	46	0	0	17	381	155	237	244	37	160	412	392	41	523	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
RUSSIA FED	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1078	627	150	405	404	46	36	0
SAO TOME & PRI	0	0	0	0	0	0	0	0	32	0	0	0	0	0	0	0	0	0	0	0	79	323	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
TRINIDAD & TOB/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	0	0	199	367	367
U S A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
USSR	162	242	803	450	664	407	5623	1655	5903	6055	3465	2905	5638	5054	2739	0	0	0	0	0	0	0	0
VENEZUELA	1253	907	550	1645	1176	944	509	1171	1478	1748	2109	2284	2654	2670	3037	1710	327	881	2597	2597	3053	2813	2082
Mediterranean	3290	3408	3587	3707	3952	3678	6043	5820	6337	5240	5057	3740	6126	6387	8360	6397	4631	2679	4817	5016	8619	3826	1888
ALGERIE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	847	847	947	0
CROATIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	21	52	22	28	26	26	0

SMT-TABLE 1. Reported landings of small tunas (in MT) in the Atlantic Ocean and the Mediterranean Sea

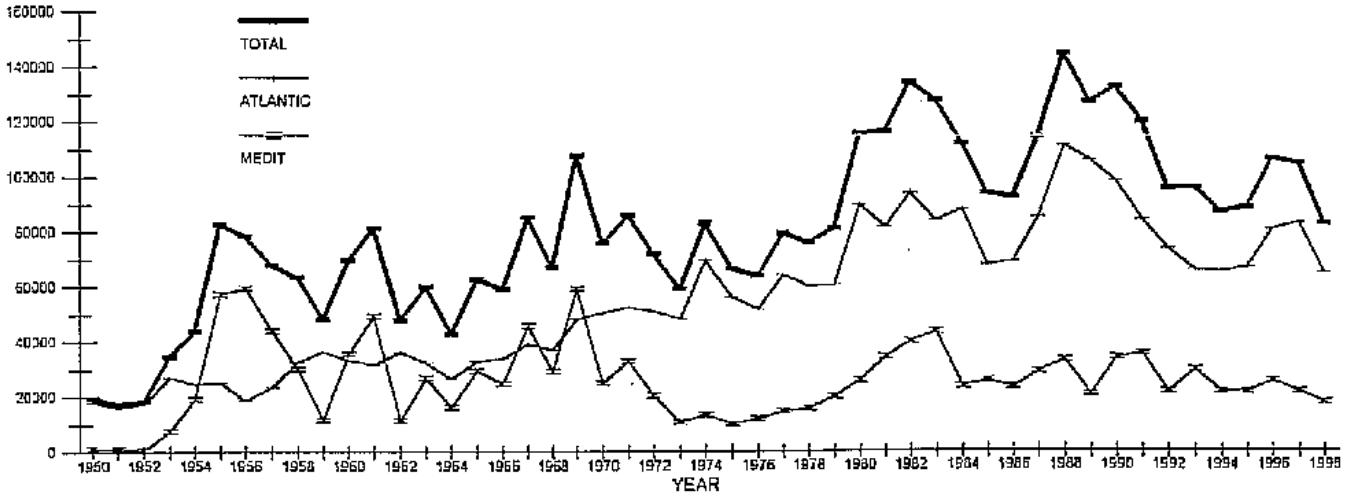
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
GRENADA	200	136	157	53	52	61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	6	0
JAMAICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0
LATVIA	0	0	0	0	0	0	0	0	0	0	0	0	1191	1164	221	7	4	0	3	19	301	0	318
LITUANIA	0	0	0	0	0	0	0	0	0	0	0	0	1041	762	162	11	10	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
MEXICO	237	81	59	174	271	408	396	567	744	212	241	391	356	338	215	200	657	779	674	1144	1312	1312	0
POLAND	30	177	44	32	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	225	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
RUSSIA FED	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	948	29	6	0	0	0	0	4960
SENEGAL	164	614	523	159	140	1327	202	497	200	495	510	463	2056	869	556	824	378	227	600	354	570	570	570
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
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
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
TOGO	0	0	0	0	0	0	0	0	0	254	138	245	400	256	177	172	107	311	254	145	197	197	197
TRINIDAD & TOB/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	703	750	750	750	750
USA	23	268	224	502	198	333	209	253	217	110	64	130	89	278	298	468	497	170	127	116	155	182	73
USSR	1281	4164	1602	2125	6433	4559	6329	2375	1290	2073	1065	1083	8882	7363	706	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	0
URUGUAY	3	0	0	16	3	1	0	1	0	0	3	0	0	0	0	26	0	0	0	0	0	0	0
VENEZUELA	756	767	382	443	861	833	864	554	748	774	1401	1020	1153	1783	1514	1514	1443	0	1646	1646	1348	1348	1647
																							** probably includes non-tuna species
Mediterranean	6499	8699	9419	13486	19165	29293	31518	35997	15656	18487	16098	22857	24548	12296	22097	26088	15396	26122	16111	15165	17269	16778	14844
ALBANIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0
ALGERIE	143	206	196	515	640	740	860	867	874	680	459	203	625	1528	1307	600	600	596	847	351	351	351	0
BULGARIA	40	44	11	1	13	191	4	24	1	1	0	13	0	0	17	17	20	8	0	25	33	0	0
CROATIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	49	128	6	70	0	0	25
CYPRUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EC-ESPANA	397	610	711	713	480	710	990	1225	984	1045	729	51	952	609	712	686	228	200	344	632	690	628	333
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
EC-GREECE	511	550	610	712	809	1251	1405	1367	1732	1321	1027	1848	1254	2534	2534	2690	2690	2680	1581	2116	1752	1559	945
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
EGYPT	0	1	17	10	3	2	23	14	48	62	68	35	17	358	598	574	518	640	648	828	985	985	985
LIBYA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	71	70	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
MAROC	630	456	128	155	62	309	71	92	75	57	51	127	108	28	69	69	31	25	93	37	67	45	39
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
RUMANIA	2	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	0
TURKEY	3178	4503	5536	9082	14910	24300	25978	29485	7818	12809	11426	17333	18133	5008	14737	19645	8863	19548	10093	8944	10284	10284	10284
U.S.S.R.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
YUGOSLAVIA	23	26	39	29	72	39	61	31	37	34	38	62	36	98	79	0	0	0	0	0	0	0	0
YUGOSLAVIA REI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	0	3	2	6	10	0	0
BGP- O. unicolor																							
Atlantic	212	321	817	464	698	1448	584	38	49	124	86	538	1474	1109	420	487	424	349	599	525	2004	246	28
BENIN	0	0	0	1	1	2	2	1	1	1	3	1	2	1	1	1	1	1	1	1	1	0	0
MAURITANIE	80	90	90	90	101	478	99	37	40	40	50	50	50	50	50	0	0	0	0	0	0	0	0
EC-PORTUGAL	0	0	0	0	0	0	0	0	6	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
Mediterranean	0	135	153	28	0	0	0	0	0	9	1	26	8	7	37	14	41	54	23	23	13	3	2

SMT-TABLE 1. Reported landings of small tunas (in MT) in the Atlantic Ocean and the Mediterranean Sea

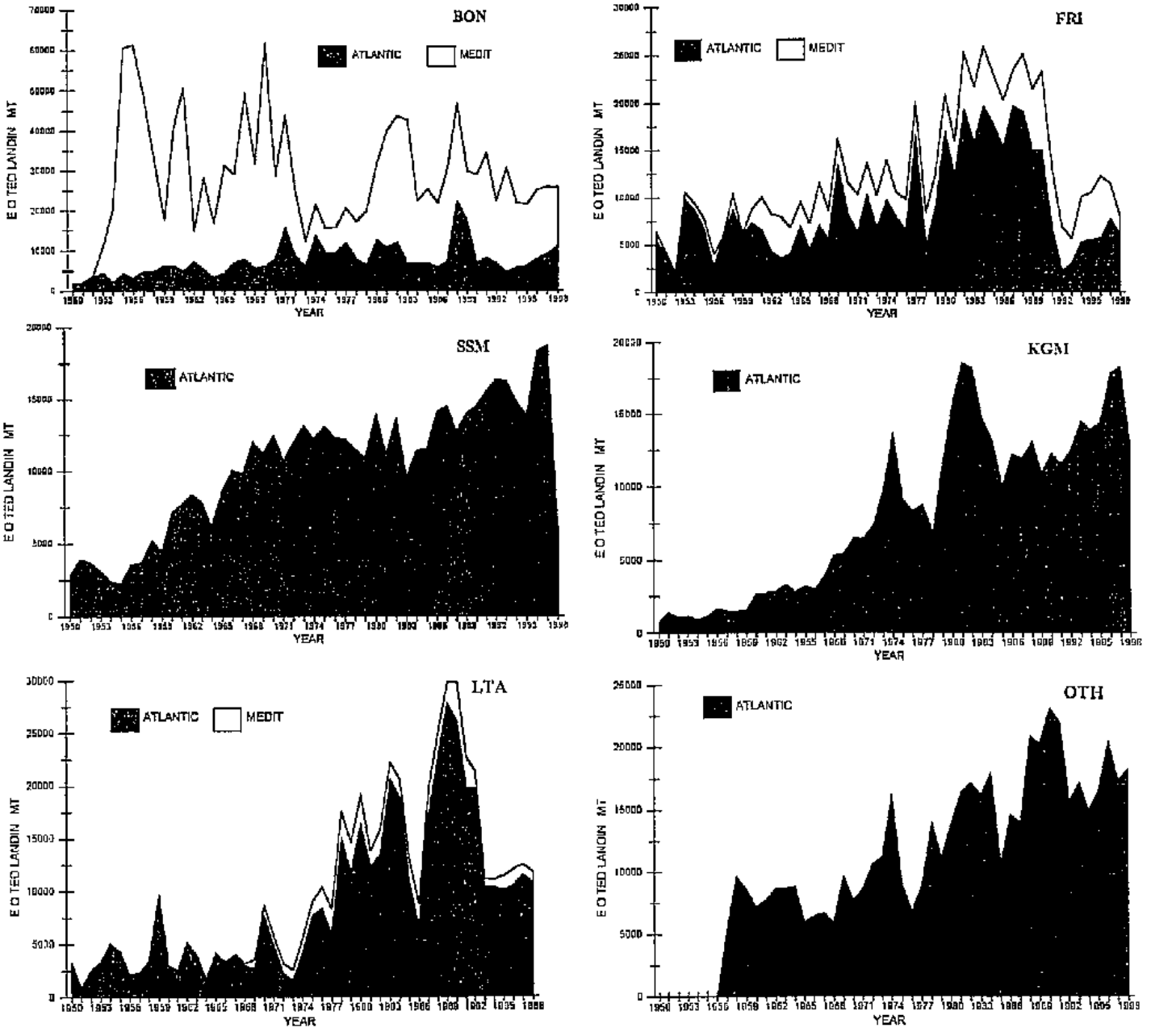
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
CAP-VERT	0	0	0	0	126	236	256	34	16	160	29	14	1	18	65	74	148	17	23	72	63	86	110
COLOMBIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COTE D'IVOIRE	400	431	38	57	177	0	0	0	0	0	20	5300	38	4900	2800	100	142	339	251	253	250	250	250
CUBA	0	0	0	0	131	53	77	6	15	16	24	55	53	113	88	63	33	13	15	27	23	23	0
EC-ESPAÑA	6	33	56	4	485	7	3	2	27	34	12	11	7	11	55	81	1	0	0	10	55	27	110
EC-FRANCE	0	0	0	0	0	1098	1120	0	0	0	0	0	0	195	0	61	11	8	53	59	22	215	21
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
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
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
ESTONIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	66	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
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
GHANA	6044	1165	6049	5547	4134	3287	2141	5008	5966	901	649	5551	11588	12511	14795	11500	11608	359	994	513	113	2025	359
ISRAEL	0	0	0	0	227	203	640	262	271	76	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
LITUANIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0
MAROC	31	15	21	289	16	19	26	19	15	447	47	108	49	14	387	57	370	44	43	230	588	195	189
MAURITANIE	50	50	50	50	31	86	77	54	60	60	50	50	50	50	50	4	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	72	21	53	0	0	0
NEI-28	125	0	3	2	58	36	0	0	0	0	0	0	0	0	0	0	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
RUMANIA	16	86	2	17	9	12	291	216	266	126	81	7	88	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
SAO TOME & PRI	0	0	0	0	0	0	0	0	101	0	0	0	0	0	0	0	0	0	0	0	40	159	0
SENEGAL	705	1540	1446	1697	2444	1586	5017	5623	8408	4566	2392	2985	6343	6512	4775	3767	4088	4883	4072	4072	3773	3773	3773
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
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
U S A	5	53	113	12	88	97	87	107	41	73	104	118	204	129	173	228	597	1286	1142	1312	2183	2014	1546
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
UK-BERMUDA	16	9	7	7	11	11	4	5	5	7	13	13	17	14	8	10	11	5	6	6	7	5	5
VENEZUELA	501	426	390	1270	721	791	311	573	644	1050	1123	1467	1236	1374	1294	1963	1409	1889	2115	2115	1840	1840	2815
Mediterranean	2028	2499	2495	2870	2774	1446	2480	1561	1650	2040	2166	2424	2405	2035	3645	2824	1679	771	746	1350	1565	1002	1025
CROATIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	2	15	15	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
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
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
EC-ITALY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ISRAEL	300	300	200	170	105	35	110	35	60	259	284	273	135	124	129	108	126	119	119	215	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
MALTA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	1	8	8	8	3	3	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
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
OTHERS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	90	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
TUNISIE	479	1009	983	1595	1772	1249	1330	1228	1224	1441	1590	1803	1908	1566	3141	2366	1172	242	204	686	824	336	336
YUGOSLAVIA	2	4	0	0	0	0	0	1	6	1	1	2	5	4	9	0	0	0	0	0	0	0	0
YUGO 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
MAW Sc total	1901	2572	6716	4167	4921	3156	5312	4716	4498	3989	3292	1799	3915	2934	5610	4025	1437	1775	1270	1264	1316	1264	1161
Atlantic																							
ANGOLA	0	20	81	24	70	66	138	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

SMT-TABLE 1. Reported landings of small tunas (in MT) in the Atlantic Ocean and the Mediterranean Sea

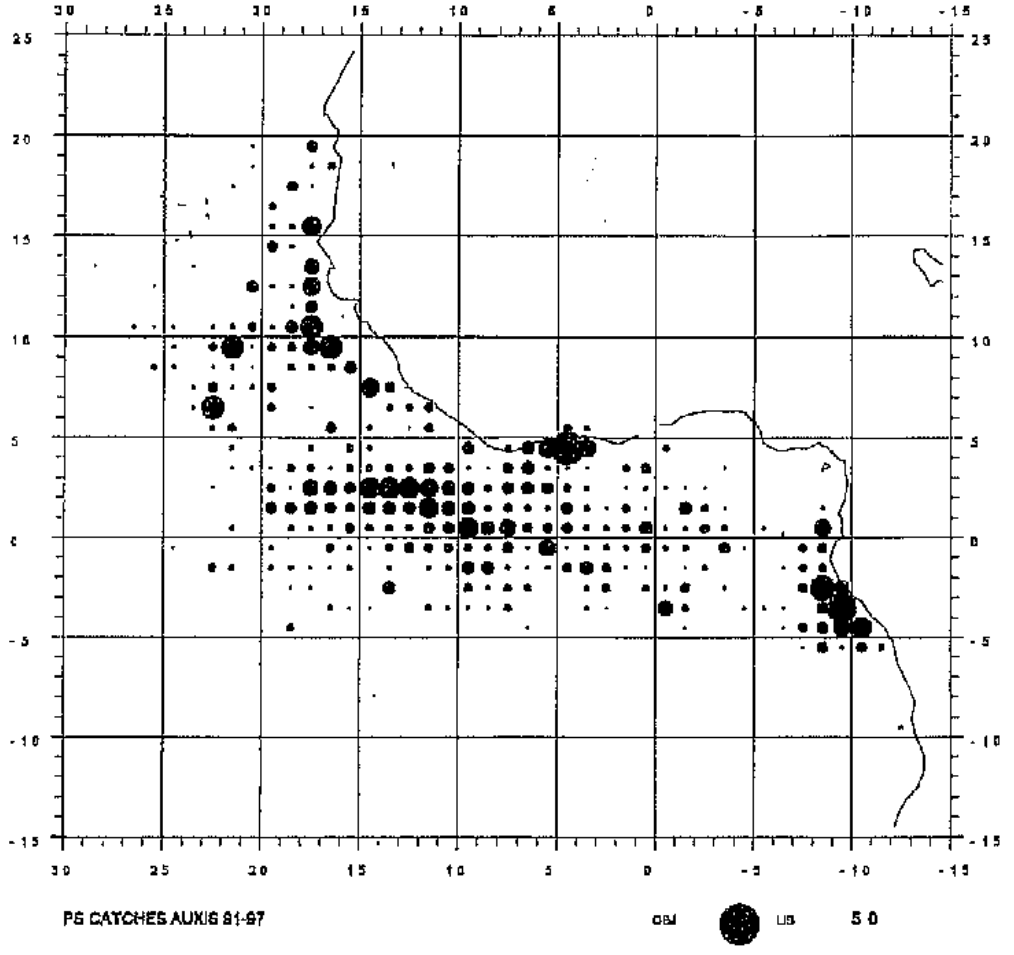
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
BENIN	0	0	0	23	35	60	68	30	46	50	104	17	13	334	211	214	202	214	194	188	188	188	0
ESTONIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	49	0	0	0	0	0	0	0
GABON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	85
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
GHANA	555	720	771	1569	4412	1983	2982	2225	3022	3000	1453	0	1457	1457	1500	2778	899	466	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
LITUANIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	52	4	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
SAO TOME & PRI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0
SENEGAL	1270	1188	1054	1112	404	1045	671	754	1174	732	1516	1754	2159	753	1419	656	332	1076	1076	1076	1076	1076	1076
USSR	76	644	4810	1439	0	0	602	1170	223	206	219	28	143	195	1240	0	0	0	0	0	0	0	0
SSM - Sc. maculatus	12307	12218	11528	10899	13945	11164	13633	9574	11362	11590	14117	14531	12712	13946	14500	15546	16346	16231	14777	13857	18292	18723	5714
Atlantic																							
COLOMBIA	245	283	228	199	213	408	8	10	77	101	81	72	151	112	76	37	95	58	89	69	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
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
GRENADA	0	10	2	0	1	1	1	1	1	4	17	0	0	1	3	0	0	1	2	2	0	0	0
MEXICO	3380	4414	5138	5751	5908	5908	7799	5922	5777	5789	6170	6461	5246	7242	8194	8360	9181	10066	8300	7873	11050	11050	0
ST.LUCIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRINIDAD & TOB/	1544	1484	1933	1208	1337	939	1218	0	0	0	0	0	0	0	0	0	0	0	0	0	1567	1698	1698
USA	6385	5453	3310	2926	5429	2748	3747	2784	3905	3986	5957	5071	5097	4444	4272	5883	5724	5057	4667	3523	3020	3320	1974
WAH - A. Solandri	379	393	452	760	610	2920	2280	2366	2159	920	1150	1235	1612	1507	1470	1687	1805	2570	2100	2359	2522	2744	3641
Atlantic																							
ANTIGUA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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
BARBADOS	0	0	0	189	116	144	219	222	219	120	138	159	332	51	51	60	51	91	82	42	35	47	47
BENIN	0	0	0	1	1	2	2	1	1	1	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	1
CAP-VERT	0	0	0	0	24	2307	1464	1588	1365	142	205	306	340	631	458	351	350	326	361	408	503	605	429
DOMINICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	43	59	59	59	58	58	58	58
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
EC-ESPAÑA	0	0	0	0	0	0	0	0	0	4	9	9	32	18	23	28	32	22	20	15	25	25	517
EC-FRANCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	147
GRENADA	0	0	35	31	25	23	41	94	50	51	82	54	137	57	54	77	104	96	46	49	56	54	54
NETH.ANT	178	178	215	215	215	215	215	215	215	245	250	260	280	280	280	250	260	270	250	230	230	230	230
RUSSIA FED.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	761
SAO TOME & PRI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80	52	52
SENEGAL	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	0	0	0	77	79	150	141	98	80	221	223	223
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
TRINIDAD & TOB/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	118	1	0	0	0	0	0	0
USA	0	0	0	0	0	0	0	0	0	13	12	57	128	110	82	134	203	827	391	764	608	750	614
UK-BERMUDA	20	35	23	33	46	24	40	49	46	46	65	43	61	63	74	67	80	58	50	93	115	103	108
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
VENEZUELA	67	71	54	100	57	77	175	66	125	147	113	106	141	101	159	302	331	513	538	538	479	479	340



SMT-Fig. 1. Reported landings (MT) of small tunas, all species combined, in the Atlantic and Mediterranean, 1950-998 (1997 and 1998 data are very incomplete)



SMT-Fig. 2. Total cumulative landings (MT) of major species of small tunas in the Atlantic Ocean and Mediterranean Sea, 1950-1998. (1997 and 1998 data are very incomlete).



SMT-Fig. 3 **Frigate tuna (*Auxis thazard*) catches reported in logbooks from purse seiners (Spain, France and NEI) operating in the tropical Atlantic during 1991-1997.**

13. Report of Sub-Committee on Environment

13.1The Report of the Sub-Committee on Environment was presented to the Committee by the Convener, Dr. J. Gil Pereira. The Committee recognized that the Sub-Committee is now stepping into the new phase, proposing the special studies between environment and tuna behavior in various habitat across all the species. It thanked the Sub-Committee's Convener and participants and adopted the report. The Report of the Sub-Committee on Environment is attached as **Appendix 7**. The SCRS also reiterated all the recommendations included in the report.

14. Report of the Sub-Committee on Statistics and review of Atlantic tuna statistics and data management system

14.1The Report of the Sub-Committee on Statistics (attached as **Appendix 8)** was presented by the Convener, Dr. S. Turner. The Committee noted that the Sub-Committee had held a special meeting on October 4-5, to review the current ICCAT data base system and policy and to consider the implementation of a more effective system to meet scientific requirements. The Detailed Report of this inter-sessional meeting was reviewed and accepted, together with all the recommendations included. At the same time, the Committee noted that the Executive Summary of the special meeting, which contains several important recommendations for the Commission concerning the ICCAT data-base system.

14.2 The Committee fully endorsed the recommendation included in the Executive Summary **(Addendum 2 to Appendix 8)** concerning the re-organizing the ICCAT data base on the relational data base system and forwarded it to the Commission. It emphasized that this recommendation can not be achieved without the biostatistician , a position has been requested for many years by the Committee.

14.3 The Report of the regular session of the Sub-Committee was also reviewed and adopted with the recommendations included therein. The Committee thanked the Convener and all the participants at the Inter-sessional and the Regular meeting of the Sub-Committee for their hard work and for formulating these important recommendations. The Report is attached as **Appendix 8.**

15. Report of the Sub-Committee on By-catches. Future plans for the collection of by-catch statistics

15.1The Report of the Sub-Committee on By-catches presented by the Convener, Dr. H. Nakano. The report also referred to the report of the Inter-sessional meeting which this Sub-Committee held in March, 1999, in Messina (see SCRS/99/20). After reviewing the report, the Committee adopted the report and thanked the Convener and all those who participated in both meetings. The report of the Sub-Committee on By-catches is attached as **Appendix 9**.

16. Review of ICCAT scientific publications

16.1The Committee noted that this item was well covered by the Sub-Committee on Statistics. It noted that Sub-Committee is recommending the streamlining of the current publications and a move towards a more electronic publication. The Committee fully endorsed these recommendations made by the Sub-Committee on Statistics concerning the publication policy.

17. Consideration of other SCRS activities

--Organization of the SCRS

17.1The report of the Ad Hoc Working Group on SCRS Organization was presented by the Convener, Dr. G. Scott. Dr. Scott reminded the Committee of the decisions made at the 1998 meeting concerning the establishment of (1) an Advisory Committee, whose function would be to review and filter the Detailed Reports and Executive Summaries that are developed by the Species Groups before they are presented to the SCRS Plenary; (2) an external peer review system for assessments and reporting; and (3) a Working Group on Methodology. He also reported that one of the positions requested by the Committee, the Population Dynamics Expert, approved by the Commission in 1998, had been filled, but the position of biostatistician had not been approved. Dr. Scott reported that this reorganization of the SCRS operating system can be now realized with the new Population Dynamics Expert The report included the proposal to create the new organization and system.

17.2 Discussion ensued on the pros and cons on the proposal. Although there was a general consensus to establish an

Advisory Committee, some reservations were expressed concerning the way in which the members are selected, the timing of the session, the language(s) to be used, and the availability of supplemental funding for the members selected to attend this extra meeting.

17.3 The Committee decided that the Report of the Ad Hoc Working Group should be amended to reflect the opinions expressed and the recommendations made during the discussion in the SCRS Plenary. It was further recommended to the Commission that these revisions on the SCRS organization be put into effect in 2000 on a test basis, to see how it works. At the same time, some details (e.g. selections of members, etc) were left to the SCRS Chairman to finalize from now until the time of the 1999 Commission Meeting in November, in consultation with the Ad Hoc Working Group members and pertinent scientists. The Committee recommended that the Commission approve these revisions of SCRS re-organization, as they are essential to increase the credibility of the SCRS, by adding more accuracy to the advice to the Commission and to increase transparency of the Committee's work. The Report of the Ad Hoc Working Group on SCRS Organization is attached as **Appendix 11**.

-- Inter-sessional scientific meetings proposed for 2000

17.4 The Committee reviewed the request for stock assessments proposed for 2000 by various Species Groups.

17.5 The Billfish Species Group recommended that the Third Workshop on Billfish Assessment be held from July 19 through 28, 2000. This includes a four-day data preparatory meeting and 5 to 6 days for the stock assessment session. The Committee approved this proposal since the last billfish assessments were conducted in 1996 and since the assessment had been postponed from 1999.

17.6 The Committee felt there is no scientific rationale for conducting a bluefin assessment in the year 2000. Even though the TACs and quotas for east bluefin tuna have been established only up to and including the year 2000, the Committee recommended that the next bluefin tuna assessment session should be held in year 2001. In this way, the full evaluation of current (1999-2000) catch limits could be conducted. Since the last bluefin assessment (for both East and West Atlantic) was done in 1998, the Committee believed that there was no reason, scientifically, to conduct another assessment within such a short period as in 2000. In addition, several improvements to the biological knowledge on this species are required before an improved assessment of bluefin tuna can be achieved, such as (1) an increase general in knowledge on bluefin biology; (2) a need to study the best proxy for MSY; and (3) the need to increase the accuracy on estimation of recruitment levels. For the east stock, it was recommended that (1) considerable investigation of basic inputs and (2) critical analyses of methods would be required to improve the assessment. The Committee noted that attending to these issues would lead to an improved scientific basis for conducting future assessments.

17.7 The Committee noted that stock assessments are requested for yellowfin and albacore. In principle, the Committee approved this plan. However, with regard to the dates and venues of these assessments, the Committee decided to keep this flexible for the time being and asked the SCRS Chairman to decide later, in consultation with the Secretariat and with the pertinent scientists. Another reason for not deciding the exact dates and venues at this time is that the schedule for the 2000 Commission meeting is, at present, not known, and the period when the new SCRS organization will take effect, particularly as concern establishing the Advisory Committee, is still uncertain. At any rate, the assessment sessions, except for billfish, cannot be held before the end of August, due to data availability.

17.8 The Committee reiterated the previous discussion regarding the proposed Ad Hoc Joint Working Group of GFCM/ICCAT on Mediterranean Large Pelagic Fishes for the assessment of Mediterranean swordfish in 2000. The response to the questionnaires for data submission, previously made by the Group's Technical Secretary, Dr. Miyake, showed that adequate data are not available to warrant such an assessment in 2000.

18. General recommendations and responses to the Commission

18.1 The Committee discussed whether it should continue to include Item 5. "Effects of current regulations" in the SCRS Report and, if it does, what the contents should contain. It recognized that this problem is brought up every time the group discusses regulatory measures in the context of the SCRS' responsibility to evaluate if the Contracting Parties are following the recommendations. In addition, the feasibility of using the scientists' best estimates (catch or size) for compliance purposes. It was also recalled that the Commission had, at its 1998 meeting, developed a specific form for compliance monitoring purposes, by species. Several opinions were expressed and a general consensus was reached that Item 5 should include information relative to the scientific advice to be used by the Commission for its management decisions, but that the data base containing the scientists best estimates would not necessarily be the best to be used for compliance purposes.

18.2 Recommendations

a) Management recommendations:

Management recommendations are included at the end of the Executive Summaries of each of the species studied. The Committee requested that the Commission give due consideration to these recommendations when considering the management of stocks.

b) General recommendations:

Numerous recommendations, of a general nature, made by the 1999 SCRS to the Commission are noted under various Agenda items and in the reports of the various Sub-Committees and Working Groups. Of these, those requiring special consideration by the Commission and/or financial allocation, are listed below, by species or by item.

TROPICAL TUNA SPECIES:

GENERAL: Development assessment tools for tropical tuna species that take into account the biological characteristics and fishing process by the various fisheries.

Create an error-free and user-friendly data base and data management system for all kinds of data for the stock assessments. This will streamline the stock assessment processes and lead to a comprehensive analysis of data available for the scientists.

In the BETYP tagging program, the tag and release of yellowfin tuna and skipjack tunas are encouraged, when circumstances allow it, since these species are exploited by the same fisheries and the biological characteristics are similar to some extent. The outcome of the tagging programs will benefit not only benefit the improvement of our knowledge on their biology but also will enhance our ability of stock assessment which leads to better management of these two species. The benefit will be much larger for skipjack tuna since no comprehensive assessment was available for this purpose.

YELLOWFIN TUNA: Recognizing that the changing characteristics of the purse seine fishery cause considerable difficulties to the development of abundance indices and the calculation of effective effort levels, both of which are of vital importance to assessments of the stocks, methods to standardize the effective effort over time should be improved. Abundance indices should be developed for all major fisheries exploiting tropical tunas, but the Committee continues to place the highest priority on the development of indices applicable to the youngest age classes, of which a high proportion are caught using purse seine. Useful abundance indices for these youngest age classes have not been available for past assessments.

To facilitate the evaluation of the potential effect of sexually dimorphic growth and differential sex-ratios on the assessment of yellowfin, sex-specific curves should be developed using the most current available data. Additionally, information on sex-ratios by size, gear and area should be collected whenever possible.

Current studies should be continued in order to evaluate the contribution of western Atlantic spawning areas to the total Atlantic yellowfin stock.

ALBACORE: All fisheries included in the analysis of the stock should develop abundance indices. Correspondence among different gears (with respect to effort) should be developed. As regards the Mediterranean, in accordance with current data, the scarcity of information on the catches and the lack of assessments on the Mediterranean stock, no management recommendations could be formulated. Notwithstanding, the Committee recommends that more scientific work be carried out to obtain information relative to the current and past fishing mortality levels in the Mediterranean.

BLUEFIN TUNA: The SCRS has stressed that the priority in the year 2000 is to better understand 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 does not feel that a full stock assessment for bluefin in the year 2000 is warranted. There has been insufficient time since the last assessment to address important issues. Further, the management actions taken, at least in the west, were not sufficiently different to provide a detectable signal in the stock in the short-term. However, in 1998, the Commission recommended that the SCRS conduct a least a west Atlantic assessment in the year 2000.

The Committee felt there is no scientific rationale for conducting a bluefin assessment in the year 2000. Even though the TACs and quotas for east bluefin tuna have been established only up to and including the year 2000, the Committee recommended that the next bluefin tuna assessment session should be held in year 2001. In this way, the full evaluation of

current (1999-2000) catch limits could be conducted. Since the last bluefin assessment (for both East and West Atlantic) was done in 1998, the Committee believed that there was no reason, scientifically, to conduct another assessment within such a short period as in 2000. In addition, several improvements to the biological knowledge on this species are required before an improved assessment of bluefin tuna can be achieved, such as (1) an increase general in knowledge on bluefin biology; (2) a need to study the best proxy for MSY; and (3) the need to increase the accuracy on estimation of recruitment levels. For the east stock, it was recommended that (1) considerable investigation of basic inputs and (2) critical analyses of methods would be required to improve the assessment. The Committee noted that attending to these issues would lead to an improved scientific basis for conducting future assessments.

Issues associated with spawning site fidelity, migration paths, and mixing are amongst the most important of the uncertainties in the assessment and management of Atlantic bluefin tuna. The Committee therefore endorses the research recommendations of the BYP and encourages continued and enhanced co-operation among scientists conducting research on the east and west stocks, particularly in tagging experiments, and to collect and analyze samples for spawning, genetics and microconstituents studies. The Committee suggests that priority be given to the tagging of spawning fish on the Gulf of Mexico and Mediterranean spawning grounds, the collection and exchange of tissue samples for genetics and spawning studies on small juveniles or spawning fish from these spawning grounds, and the collection and exchange of tissue and otolith samples from young-of-the-year (preferably) or one year-old fish for analysis.

BILLFISH: The Committee is concerned about the incomplete reporting of catches and landings, particularly for the last two years. The Committee recommends that all countries landing blue marlin, white marlin and sailfish/spearfish or having dead discards report these data to the ICCAT Secretariat so assessments planned for 2000 can proceed.

The Billfish Species Group recommended that the Fourth Workshop on Billfish Assessment be held from July 19 through 28, 2000. This includes a four-day data preparatory meeting and 5 to 6 days for the stock assessment session. The Committee approved this proposal since the last billfish assessments were conducted in 1996 and since the assessment had been postponed from 1999.

SWORDFISH: It is recommended that the next swordfish stock assessment be conducted in three years time (2002) in order to advance basic research and assessment methods. During the inter-sessional period National Scientists should continue research on stock structure, maturity and fecundity, aging, CPUE, and stock assessment methods as outlined in Section SWO-ATL-5 of the 1999 Swordfish Detailed Report. This type of work is both time-consuming and expensive, but must be made a priority.

The Committee has recommended that stock assessment models used in future sessions should more fully incorporate biological information and the uncertainties associated with biological inputs. To this end it is recommended that an inter-sessional meeting be conducted in spring 2001 in order to focus on improving biological knowledge of swordfish.

SUB-COMMITTEE ON BY-CATCH: Only 24 of the more than 80 countries, entities and fishing entities contacted have reported (and some are very incomplete data sets) Task I shark catch data up to now and only 6 have reported Task II data. The Committee continues to recommend that nations that catch sharks in their Atlantic and Mediterranean tuna fisheries are strongly urged to fulfil the responsibility of reporting Tasks I and II data on sharks.

Noting that many shark and by-catch related scientific meetings are scheduled by various regional agencies, academic institutes and NGO's, it might be beneficial to the Commission and the study of sharks that ICCAT scientists to collaborate and/or participate in such meetings and report back to the Commission. It is recommended that ICCAT scientists continue to report on these activities.

The Sub-Committee considers that it is the responsibility of the nations fishing sharks to collect adequate data and urged these countries to carry out good scientific observer programs, if such have not been already implemented.

SUB-COMMITTEE ON STATISTICS: The Sub-Committee recommends that there be no delay in hiring a biostatistician at the Secretariat, and in developing a relational data base system.

SUB-COMMITTEE ON ENVIRONMENT: It is recommended that a workshop be held in the year 2001. This should address the effects and relationship between environment and recruitment and how these could be reflected in the stock assessments. It is further recommended that an “Executive Summary” be prepared annually to provide Commissioners with an overview of the state of the Ocean, and on environmental influences on the status of tuna stocks.

BIGEYE YEAR PROGRAM (BETYP): The outlook of the bigeye stock remains uncertain. The Committee

anticipates that the on-going four-year 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.

It was noted that the Program Plan proposed by the BETYP for 2000 was dependent on the confirmation of the tentative commitment of funds from Japan and the EC, to a level similar to 1999 funding, which is included in the Program Plan for 2000. Further funding sources would be explored by the BETYP Coordinator and the ICCAT Executive Secretary during the year, and the Committee requested the full support of the Commission for further funding.

BLUEFIN YEAR PROGRAM (BYP): The Committee draws the attention of the Commission to Tables 1 and 2 of the Executive Summary of the BYP, which shows the 1999 budget balance sheet and the proposed budget for 2000. The major part of the 2000 budget can be covered by the unused balance from 1999, which will be short by US$12,481. The Committee recommends that this amount (about the same level as the 1999 Commission funding) be funded by the regular Commission budget in 2000. Since the BYP is providing very important biological information, and since considerable savings have been made in past research from outside funding, the minor contribution at such a level would produce a good return from the Program.

ENHANCED RESEARCH PROGRAM FOR BILLFISH: The Progress Report for 1999 and the Plan for 2000 was accepted by the Committee and are attached as **Appendix 6**. The Committee wished to draw the Commission's attention that the major part of the Billfish Program Plan for 2000 will be covered by external, voluntary funding (including from the private sector). The Committee recommended Commission's funding at the same level as in 1999. In order to obtain outside funding, the Committee would like to point out that the Commission's funding is essential as "seed money".

18.3 Response to the Commission

SWORDFISH: In the 1998 *Resolution for the Development of Recovery Scenarios for North and South Atlantic Swordfish*, in addition to rebuilding plans and the effectiveness of current regulations already presented in the Executive Summary, the Commission requested information on (1) the method by which discards were estimated and included in the SCRS assessment and projections, and (2) the evaluation of alternate methods for reducing small fish mortality.

(1) Discards

Only U.S. (1991-1998: SCRS/99/90) and Canada (1997-1998: SCRS/99/77) report positive estimates of dead discards. Spain reports zero dead discards. Both the U.S. and Canada used scientific observer data to estimate dead discards. The Canadian estimate sets the proportion of the weight of dead discards to reported landings equal to the proportion of dead discards observed compared to observed landings. However based on the information from national scientists the Committee is concerned about the representativeness of the Canadian sampling. The USA used CPUEs from the observer data and/or from the captain reported logbook data to estimate dead discards. These estimates are included in the stock assessment evaluation and in forward population projections.

(2) Alternate methods for reducing small fish mortality

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 fishing mortality on small fish could be further reduced.

The Commission has requested SCRS evaluate alternative methods to reduce small fish mortality. One alternative approach that could be considered is reduction of fishing effort in fishing areas and seasons where there are high proportions of undersized fish in the catch, much like the protection area closure the Commission recommended for reducing catches of small bigeye tuna. Fine scale (5x5) data available to SCRS to accomplish this are limited to only a few fleets and use of these data may not accurately reflect all the fishing grounds and seasons where small fish dominate the total Atlantic catches of swordfish. Data more representative of the total catch are from much larger geographical regions.

Figure 3 and **Figure 41** of the 1999 Swordfish Detailed Report show the distribution of catches of small fish by quarter and fishing area. This information could be used by fishing nations/entities/non-entities to identify areas and times that might be candidates for time-area closures, though a more detailed domestic examination of the data would be required.

19. Collaboration with non-contracting Parties, entities or fishing entities and other fisheries organizations

19.1 The Committee noted that the relation with many non Contracting Parties, Entities and fishing entities is

satisfactory. Chinese Taipei is providing all the data required and has participated in ICCAT's research work, and has made considerable monetary contributions towards the Commission's research. Chinese Taipei has again committee US$15,000 in voluntary contributions (in equal parts) to the ICCAT Billfish Program, to the Bluefin Year Program, and towards Secretariat expenses.

19.2 The Committee also noted, as reported under the Agenda Item 10, the close relationship and excellent collaboration maintained with FAO, FAO-related organizations and Regional Agencies. Particular acknowledgment was made to COPEMED for their assistance on tuna research of the countries in the west Mediterranean Sea. Also closer collaboration with other tuna regional agencies, and NAFO, and ICES, particularly in relation with statistics have been noted. The past policy of nominating national scientists attending many of the meetings of these agencies, representing ICCAT on the observer capacity was reiterated.

20. Date and place of the next meeting of the SCRS

20.1 The Committee decided to hold its next meeting in Madrid, but indicated that the exact dates would be determined by the Commission, and would be dependent on when the 2000 Commission Meeting is held. For planning purposes, it was agreed that the Secretariat inform the scientists of the meeting dates as soon as feasible. It was noted that implementation of the new "SCRS Advisory Committee", as proposed, would likely result in the next SCRS meeting being held in late November, 2000.

21. Other matters

No other matters were discussed.

22. Election of SCRS Chairman

22.1 Dr. Z. Suzuki chaired the Committee for this agenda item. The Committee recognized the excellent leadership of the current SCRS Chairman, Dr. J. Powers, during his two-year term. The delegate of Canada proposed Dr. Powers' re-election by acclamation and the Committee wholeheartedly agreed. Dr. Powers was thus re-elected for a second two-year term as Chairman of the SCRS.

22.2 In accepting re-election, Dr. Powers thanked the Committee for the confidence placed in him and expressed his firm commitment to fulfil his duties to the best of his ability.

23. Adoption of Report

23.1 The 1999 SCRS Report was adopted, including all the modifications introduced by the scientists at the time of adoption. The Committee agreed that other modifications, of an editorial nature, could also be submitted to the Secretariat prior to the end of the meeting, and these would also be incorporated to the Report. The Committee further agreed that the 1999 SCRS Report, including all tables and figures, be posted on the internet for easy access by others.

24. Adjournment

24.1 At the time of adjournment, the SCRS Chairman thanked all the scientists for their collaboration and cooperation during the 1999 sessions. He also expressed his appreciation to the Secretariat staff and the interpreters for their efficiency. The 1999 SCRS Meeting was adjourned on Friday, October 15, 1999.

Appendix 1

1999 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 Review of the ICCAT Bluefin Year Program (BYP) - Activities, progress & future plans
8 Review of the ICCAT Bigeye Year Program (BETYP) - Activities, progress & future plans
9 Review of the ICCAT Program of Enhanced Research for Billfish - Activities, progress & future plans
10 Reports of scientific meetings in which ICCAT was involved
11 Report of the Ad Hoc Working Group on the Precautionary Approach and consideration of precautionary approaches
12 Executive Summaries on species:

YFT-Yellowfin, BET-Bigeye, SKJ-Skipjack, ALB-Albacore, BFT-Bluefin, BIL-Billfishes, SWO-Swordfish, SBF-Southern Bluefin, SMT-Small Tunas

13 Report of Sub-Committee on Environment
14 Report of the Sub-Committee on Statistics and review of Atlantic tuna statistics and data management system
15 Report of the Sub-Committee on By-catches. Future plans for the collection of by-catch statistics
16 Review of ICCAT scientific publications
17 Consideration of other SCRS activities

--Organization of the SCRS
--Inter-sessional scientific meetings proposed for 2000

18 General recommendations and responses to the Commission
19 Collaboration with non-contracting Parties, entities or fishing entities and other fisheries organizations
20 Date and place of the next meeting of the SCRS
21 Other matters
22 Election of SCRS Chairman
23 Adoption of Report
24 Adjournment

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Appendix 3

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SCRS/99/10	(COM/99/10) Compendium of management recommendations and related resolutions adopted by ICCAT for the conservation of Atlantic tunas and tuna-like species - ICCAT Secretariat.
SCRS/99/11	(COM/99/11) Report of the Meeting of the ICCAT *Ad hoc* Working Group on Precautionary Approach (Dublin, Ireland, May 17-21, 1999).
SCRS/99/12	(COM/99/12) Estimated tuna catches which are not reported by national offices - ICCAT Secretariat.
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SCRS/99/15	(COM/99/15) 18th Session of the Coordinating Working Party on Fisheries Statistics (CWP) (Luxembourg, 5-9 July 1999) - P.M. Miyake.
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SCRS/99/18	(COM/99/18) Report on the activities of the Bigeye Year Program (BETYP) up to September 15, 1999 - G. Fisch.
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SCRS/99/20	Report of the Inter-sessional Meeting of the ICCAT Sub-Committee on By-Catch (Messina, Italy, May 11-14, 1999).

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Appendix 4

EXECUTIVE SUMMARY: BLUEFIN YEAR PROGRAM

The Committee reviewed the progress made under the Bluefin Year Program, concluding that most of the research goals outlined for 1999 had been met, though at a lower cost than anticipated and that progress is reported in the Detailed Report.

The current financial status is reviewed below and recommendations for the year 2000 in particular and for the future in general are made. The two primary areas of research considered important by the Committee are stock structure and maturity, and the particular expenditures needed to accomplish the Committee objectives in the year 2000 are outlined.

Financial report

The financial status through 15 October 1999 with anticipated expenditures through December 31, 1999 is in Table 1. At the end of 1999 there should be a balance of $31,319 (4,384,649 pesetas).

General recommendations

The group recommended that an informal committee of scientists from entities involved in Atlantic bluefin research be established to develop procedures for scientists to access samples from the data archives and to review proposals to do so.

The group recommended that each sample archive center (NOS in Charleston, South Carolina, U.S.A. and University of Girona, Spain) submit reports (or updates to reports) on samples available in their archives to the SCRS for each annual meeting and that a second report be submitted to the ICCAT Secretariat by 1 April each year covering at least all samples collected during the previous year. The group requested that laboratories which have independently collected samples and which have not sent duplicate material to one of the sample archive centers, also submit reports to ICCAT and the SCRS. All groups should take care to avoid double counting samples which have been exchanged between groups perhaps by separately tabulating samples received from other laboratories.

Recommended Research Plan for 2000

Stock structure sampling

The participants reviewed the progress to date in 1999 with respect to the proposals related to sampling to determine whether differences existed between eastern and western bluefin. It was noted that expenses to date had been lower than anticipated, though many of the objectives from the research plan for 1999 had been met.

The plan called for establishment of a European center for archiving frozen samples for stock structure studies (genetics and microconstituents) and conducting the associated sampling. The equipment for the center for archiving samples should be purchased before the end of the year; delays were reportedly due to problems in obtaining space at the University of Gerona (Spain).

Much of the planned sampling was conducted at far less expense than originally anticipated, due in large part to the existence of the FAO's COPEMED program and sampling by national scientists. Both the Moroccan and Spanish samples obtained this year were paid for by other programs, but in the year 2000 either those programs will not be in existence (Spain) or they will not be able to pay for the sampling again (Morocco). To the extent possible sampling will be conducted as part of other sampling programs (such as possible sampling under Spanish tag-recapture efforts). Additionally sampling in at least one area, Croatia, is yet to be conducted; it is planned to be carried out in November or December.

The group decided to continue sampling under the sampling design established in 1998, though at a reduced funding level in the anticipation that costs would remain lower than anticipated last year. The target sampling levels in 2000 will be at least 100 samples (of age 0, 50 if age 1 because of much higher costs) from multiple locations (Croatia, Italy, Tunisia, and Spain), 50 age 2 bluefin from Turkey (age 0 and 1 are not available from the fishery), and 125 per age class from a more limited area in the west Atlantic where small bluefin are known to occur. Recommended expenditures in the year 2000 are outlined in **Table 2**.

Maturity sampling

During 1999 two projects (one European Union project and the other a U.S. project) reported successfully developing methods of determining maturity by measuring hormones in muscle tissue. The group noted that these techniques actually attempt to measure possible reproductive participation within a specific year rather than whether a fish is capable of spawning in that or other years. The group noted that it was desirable to accomplish three tasks to complete the research and to begin development of maturity at size relationships. The first is to obtain samples of muscle, gonad and blood at various stages of maturity in different periods and from both sexes, the second is to define the period when the reproductive hormones are present in the tissues, and the third is to obtain samples from a representative sample of the population to characterize the maturity at size.

Obtaining information on maturity can potentially substantially increase our understanding of the stock recruitment relationships for bluefin tuna for use in stock assessments. Additionally it can provide insight into possible stock separation; if maturity analyses support the current assumption of markedly different ages at maturity between eastern and western fish, that would be a strong indication that separate management units exist.

The group decided to attempt to characterize maturity at size in the eastern and western management areas. It is important to obtain samples from throughout as much of the range of the stock as possible. Therefore attempts will be made to obtain samples from the eastern and western Mediterranean (Turkey and Italy plus Spain, respectively), the eastern Atlantic (primarily the Bay of Biscay and off Iceland) and from the western Atlantic. Details of the objectives are given below and details of the sampling design and associated costs are provided in **Table 2**.

The group noted that sampling is requested for some regions in which bluefin catches vary greatly from year to year (such as Canaries and Madeira) or are usually low (Italy in August). If bluefin do not occur in such areas in the year 2000, then expenditures will not be necessary. For areas with generally low catches (Italy, Canary Islands, Madeira) sampling targets may not be met. For the Canary Islands, only limited observations of bluefin are expected so funding is not requested; however if substantial catches of large bluefin occur in that area in the year 2000, financial assistance would be needed. Therefore, the Secretariat should have flexibility in the allocation of funds in consultation with the Bluefin Program Coordinators.

Limited sampling to obtain blood, muscle and gonads

Both the EU and the U.S. programs had difficulty obtaining blood, muscle and gonad samples from the same fish during various periods before, during and after the spawning season to fully demonstrate the validity of their assays. Sampling in Spain in April to June is proposed in **Table 2**. Additionally sampling from member and non-member observer programs (including Canada, Faroe Islands (Denmark), Japan, Iceland and U.S.A.) whenever possible is requested.

Sampling to determine monthly hormone presence

There is uncertainty about the months in which reproductive hormones are present in bluefin muscle. The group developed its sampling design for the year 2000 under the assumption that those hormones would be present at least one month before and one month after the spawning season. However, for possible research after the year 2000, it would be very useful to have such information to optimize sampling efforts.

Muscle samples will be obtained from a relatively small number of fish each month from as many fisheries as possible covering as much of the geographic distribution of Atlantic bluefin as possible.

Sampling to estimate maturity at size

This proposal is to obtain samples which could be used for estimating maturity at size. Analyses of the samples would be conducted subsequently by specialists (as with the genetic and microconstituent tissues). It is anticipated that once these initial samples are processed, additional sampling may be needed.

Numerous muscle samples will be obtained over a broad size range to try to characterize what proportion of fish in various size intervals are mature. Ideally sampling would occur from before and after the spawning period (rather than during the spawning period) when both reproductively active and inactive bluefin might be mixed. However some sampling is planned for the Mediterranean during the spawning season because of limited availability during other periods of the year and to attempt to examine proportions of fish at size in that area which might be participating in reproduction. Sampling is designed to cover the size range from about 70 cm (below the size of first maturity observed in the east) to the largest sizes.

Protocols

Standardized sampling protocols will be distributed before December 1, 1999, to scientists from the entities listed **Table 2** and other potentially interested parties.

Table 1. Financial report of the Bluefin Program for January 1 to October 15, 1999

		Income		*Expense*		*Balance*	
		(In US$)	*(in Pesetas)*	*(in US$)*	*(in Pesetas)*	*(In US$)*	*(In Pesetas)*
Carry-over balance from 1998						25590	3582649
From Commission Budget		14929	2,090,000			40519	5,672,649
From Chinese Taipei		5000	700,000			45519	6,372,649
Anticipated expenses Oct-Dec, 1999:							
European Sample Archive	freezer			12,000	1680000	33519	4,692,649
Morocco *	transport of samples			200	14000	33519	4664649
Croatia	samples			1,000	140000	32319	4524649
Croatia	travel			1,000	140000	31319	4384649

* If importation to Spain can be arranged.

Table 2. Sampling design and associated expenses for the Bluefin Year Program (BYP) in 2000

Project	*Region*	*Nation*	*Sampling activity*	*US $*	*Pesetas*
European Sample Archive Center			Labor	4,000	560,000
Genetics & Microconstituents	East	Croatia	Age 2, 50 fish	1,000	140,000
			Travel	1,000	140,000
		Italy		0	0
		Morocco	Age 0 Mediterranean, 100 fish	400	56,000
			Travel and transport of samples	1,200	168,000
		Spain	Age 0 Mediterranean, 100 fish	300	42,000
			Age 1-3 Bay of Biscay, 50 fish	1,000	140,000
			Labor (paid in maturity project	0	0
		Turkey	Age 2 fish, 50 fish	0	0
			Labor (most cost absorbed maturity project)	200	28,000
	West	U.S.A.	Age 0-3 (ages 0-1 rare), 125 fish per age	0	0
Maturity: hormone presence in tissues	East	Japan	10-15 mature fish/month, 12 months	0	0
		Portugal-Madeira	10-15 mature fish/month, if available, 5 m	600	84,000
			Labor		
		Spain-Canary Is.	10-15 mature fish/month, if available	0	0
		Spain-Med.	30 gonads (with blood), April-June (mat+immat)	2,200	308,000
			Labor	5,000	700,000
		Turkey	10-15 mature fish/month, 11 months	2,200	308,000
			Labor		
	West	Canada	10-15 mature fish/month, Oct-Dec	0	0
		Japan	10-15 fish/month, Oct-May	0	0

		U.S.A.	10-30 fish/month, 8 months	0	0
Maturity at size	East	COPEMED: Libya, Malta, Spain, Tunisia	20 fish/20 cm interval, 3 months	0	0
			Equipment	1,500	210,000
		Japan	20 fish/month, April, May, August, September	0	0
		Italy		4,000	560,000
		Portugal-Madeira	20 fish/20 cm interval, April (March-May), labor	3,600	504,000
			Shipping	700	98,000
		Spain-Med.	20 fish/20 cm interval, smaller fish	700	98,000
		Turkey	20 fish/20 cm interval, April, labor+travel	2,200	308,000
	West	Canada	20 fish/20 cm interval, June-Sept	0	0
		U.S.A.	20 fish/20 cm interval, June-Sept	0	0
			Shipper	2,000	280,000
Transporting samples (unless otherwise covered)				10,000	1,400,000
TOTAL				43,800	6,132,000

1 The SCRS requests that non-Contracting Parties, including the Faroe Islands (Denmark) and Iceland, also participate in the Bluefin Year Program. Iceland's strong commitment to fisheries research (as shown for bluefin in SCRS/99/74) and the presence of Icelandic observers aboard a Japanese vessel fishing in its EEZ provide an excellent opportunity for obtaining valuable information about bluefin reproductive patterns. If possible it would be useful to have muscle samples from 20 fish per 20 cm interval from August and September, and muscle samples from 25 fish per month in October and later. For 15 of the fish sampled per month, it would be useful to have additional samples of blood and gonads.

Appendix 5

2000 PROGRAM PLAN FOR THE ICCAT BIGEYE TUNA YEAR PROGRAM (BETYP)

PROGRAM OBJECTIVES

The aim of the program is to carry out research on bigeye tuna, a species that is widely distributed in the Atlantic Ocean and harvested by the international fishing fleet. The major objective is to clarify the stock structure of bigeye tuna and to study the impact of the fisheries on the stocks. The BETYP is a four year program and the activities carried out in 1999, its first year of operation, are reported in document COM-SCRS/99/18. Reference is made to the Revised ICCAT Bigeye Tuna Year Program, approved in a special meeting in March, 1999. The budget line items have been kept constant with the exception of where new more accurate data is available and the budget for 2000 is the one approved by the Commission during the 1988 annual meeting.

PROGRAM HIGHLIGHTS FOR 2000

SALARIES AND COORDINATION

The Coordinator of the BETYP, Guillermo Fisch, started his activities on June 1, 1999. It was found that the hiring of a full time secretary was not justified and temporary secretarial services have been subcontracted as required. This criterion will be continued in 2000. A part time accounting assistant, translation and auditing services are included in this budget item.

CONVENTIONAL TAGGING

– Azores

Thirty (30) days of tagging are scheduled, starting in April, 2000. The chartering of a baitboat fishing vessel has been secured and the actual tagging operations will be carried out by duly trained personnel of the Department of Oceanography and Fisheries of the University of Azores.

– Madeira

Thirty (30) days of tagging are scheduled, starting in April, 2000. The chartering of a baitboat fishing vessel has been preliminarily secured and the actual tagging operations will be carried out by duly trained personnel of the Regional Directorate of Fisheries.

– Ghana

Forty-five (45) days of tagging are scheduled between January, November and December, 2000. The chartering of a baitboat fishing vessel has been secured and the actual tagging operations will be carried out by duly trained personnel of the Marine Fisheries Research Division based in Tema. The experience gained during the tagging operations scheduled for November and December, 1999, will enable the BETYP Committee and the Coordinator to adjust the extent of the tagging operations during 2000 as the cost of tagging in Ghana have proven to be higher than originally budgeted.

– Canary Islands

Sixty (60) days of tagging are scheduled, starting in March, 2000. The tagging operations will be carried out by experienced personnel of Spanish Institute of Oceanography based in Tenerife from baitboat fishing vessels while conducting commercial fishing activities.

ARCHIVAL AND POP-UP TAGGING

The goal is to tag 50 bigeye tunas starting in April, 2000, using the best electronic tags available. The tags will be released in diverse well selected areas not yet determined.

GENETICS

A preliminary collaboration agreement is being studied with Dr. J. R. Alvarado Bremer from the Department of Marine Biology, Texas A & M University at Galveston. The BETYP will supply the samples according to Dr. Alvarado's research program. The samples will be collected by the National Laboratories in predetermined areas.

GROWTH, HARD PARTS

The collection of hard parts will be done by the National Laboratories according to a common protocol to be designed during 2000. Determination of the laboratories to analyze the hard parts will be also done in the year 2000.

SAMPLING

The National Laboratories will continue to be encouraged to maintain an enhanced level of on board and on shore sampling of bigeye.

CONTRIBUTIONS

The European Commission and the Government of Japan have committed contributions for the year 2000 equal to those of 1999. Other sources of contributions will be explored and pursued by the Executive Secretary of ICCAT and the Coordinator of BETYP.

R/V SHOYO-maru

The provisional plan for the R/V SHOYO-maru, that is scheduled to take place in the Atlantic during 2000-2001 was circulated in July, 1999. Several researchers from the National Laboratories and ICCAT have expressed interest in carrying out research activities during the cruise and the coordination is scheduled to start during the SCRS meetings in October, 1999.

SKIPJACK

During the ICCAT SCRS Skipjack Stock Assessment Session that took place in Funchal, Madeira, between June 28 and July 2, 1999, (See document SCRS/99/21) the Group recommended that skipjack tagging be included within the BETYP tagging program, and that evaluation should be made whether this will involve additional costs, to be assumed within the ICCAT regular budget.

CONCLUSION

Because of the unforeseen changes in the fisheries and opportunities for tagging and sampling, it may be necessary for the ICCAT Secretariat and the Coordinator to make adjustments to the budget program priorities. This changes, if any, will be duly transmitted to the members of the BETYP Coordination Committee. The proposed budget for regular Program activities is attached as **Table 1**.

Table 1. BETYP proposed budget for the year 2000

Budgetary item	*US $*
Salaries	105,000
Coordination	20,000
Travel	20,000
Meetings	30,000
Tagging:	345,000
Azores	20,000
Madeira	20,000
Ghana	250,000
Canary Islands	20,000
Rewards	10,000
Various	15,000
Tag materials	10,000
Archival and pop-up tags pilot study	70,000
Tema statistics improvement	5,000
Hard parts	10,000
Contingencies	10,000
Total	**615,000**

Appendix 6

ICCAT ENHANCED RESEARCH PROGRAM FOR BILLFISH
1999 Expenditures/ Contributions & Program Plan for 2000

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 1999 and are highlighted below.

The ICCAT Enhanced Research Program for Billfish, which began in 1987, continued in 1999. The Secretariat coordinates the transfer of funds and the distribution of tags, information, and data. The General Coordinator of the Program is Dr. J. Powers (USA); the East Atlantic Coordinators are Dr. T. Diouf (Senegal) and Mr. P. Bannerman (Ghana), while the West Atlantic Coordinator is Dr. E. Prince (USA). The billfish data base is maintained at the NMFS Southeast Fisheries Science Center (Miami, Florida) and at the ICCAT Secretariat.

CONTRIBUTIONS AND EXPENDITURES IN 1999

This report presents a summary of the contributions and expenditures for the ICCAT Enhanced Research Program for Billfish during 1999. In 1999, 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 1999 (1997 STACFAD Report, items 9.5 and 9.9). This new development also required that the Program be 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 1999, and the current balance of Billfish Program funds (4,338,416 Pts. or ~US$26,350, as of October, 1999). 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 1999, there was a balance of 1,831,262 Pts (~US$12,800) available for 1999 Program activities, including an allocation of 1,515,000 Pts (~US$10,000) from the regular Commission budget, and voluntary contributions of 795,325 Pts (US$5,000) from Chinese Taipei, and 4,026,550 Pts (US$25,000) from The Billfish Foundation. Thus the total amounts of funds available for the 1999 Billfish Program amounted to 8,168,137 Pts (~US$ 51,350).

Starting in 1996, the FONAIAP (Venezuela) 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. In addition, the "Instituto de Pesca" and IBAMA (Brazil) have provided in-kind contributions by making logistical arrangements for a training course of at-sea observers, which was conducted by the Western Atlantic Coordinator in Santos, Brazil, in 1999. IBAMA had intended to cover half the costs of the first at-sea observer sampling program from Brazil, but unfortunately this could not be accomplished in 1999 due to administrative delays (this activity has been re-scheduled for 2000). 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 1999 (see SCRS/99/96 for details). The Department of Agriculture and Fisheries of Bermuda also contributed in-kind contributions by providing personnel and other resources, as well as substantial financial resources for purchasing pop-up satellite tags used for assessing post release survival of Atlantic blue marlin in the recreational fishery (SCRS/99/97).

Overall, the Program Plan for 1999 was successfully carried out in a timely manner. An SCRS working document or report summarizing the Billfish Program at-sea sampling data base was not done this year. Instead, copies of the data sheets from observer trips for the last nine months were submitted to the ICCAT Secretariat, due to the shortage of U.S.

NMFS staff assigned to carry out quality control and data entry functions. In addition, an electronic copy of the Billfish Program at-sea and shore-based sampling data bases were submitted to the ICCAT Secretariat by the Western Atlantic Coordinator in October, 1999.

Table 2 shows the 1999 Billfish Budget and Expenditures (as of October, 1999). Several additional expenditures are expected to be incurred before the end of 1999 and into the first quarter of 2000, such as payment of observer coverage in Venezuela and Brazil, as well as related insurance in Brazil and Program coordination travel. Therefore, there is a need to carry over the 1999 balance in Billfish Program funds to the 2000 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 1999 budgetary expenditures was dependent on the sufficiency of funds, while in other cases no request for funding was submitted.

Research carried out during 1999 is summarized in the following documents: SCRS/99/90, 96, 97, 98, 99, 100, 101, 102, and 127 for the West Atlantic; and SCRS/99/72, 110, and 127 for the East Atlantic. Additional documents submitted to the 1999 concerning billfish included: SCRS/99/49, 132, 133, 138, and 141.

PROGRAM HIGHLIGHTS

The goals of the Program were at least partially fulfilled with the exploratory stock assessments for blue marlin(SCRS/92/69) accomplished at the Second ICCAT Billfish Workshop in July, 1992, and later with refined blue marlin and white marlin assessments submitted to the 1992 SCRS (SCRS/92/128 and SCRS/92/129). In addition, further progress was made at the 1993 SCRS meeting with the submission of the assessment for west Atlantic sailfish (SCRS/93/99) and improvements in the data base for east Atlantic sailfish reported to the 1994 SCRS (SCRS/94/150, SCRS/94/155, and SCRS/94/156). An exploratory stock assessment for east Atlantic sailfish was submitted to the 1995 SCRS (SCRS/95/105). More recently, updated assessments for blue marlin and white marlin were accomplished at the Third ICCAT Billfish Workshop (COM-SCRS/96/19, SCRS/96/159). Estimated parameters from these recent marlin assessments were used to make future projection of relative biomass and relative fishing mortality and these projections were submitted to the 1997 SCRS (SCRS/97/71). Some progress was also made at the 1997 SCRS concerning standardization for east Atlantic sailfish CPUE (SCRS/97/53, SCRS/97/68, and SCRS/97/52), but problems with this assessment persist.

A study reviewed during the 1998 SCRS demonstrated that spatial and temporal variability in the species composition of U.S. longline catches could be exploited to reduce marlin catches with less than equal effect on the target species (SCRS/98/122). The Committee felt that similar analysis should be performed for the Atlantic basin as a whole. Progress was also made during the 1998 SCRS in evaluating the robustness of the non-equilibrium production model used to assess the stock status of blue marlin populations (SCRS/98/121). The study used an age and length structured blue marlin simulation model to generate time-series of catch and CPUE data similar to that available from the actual fishery. These data were analyzed using ASPIC to estimate the status of the simulated stock, and the results were compared to the known conditions from the simulations. The study concluded that ASPIC estimates of fishing mortality were slightly optimistic and estimates of current stock status were slightly pessimistic, but the error was small for reasonable biological representations of the blue marlin population. Further, the greatest source of potential error in the current assessment is undoubtedly associated with uncertainty in the actual catch and CPUE data used in the assessment, not with the use of the production model itself.

During the 1999 SCRS, preliminary scientific by-catch landing estimates were submitted for the first time for blue marlin, white marlin and sailfish/spearfish, from the Spanish off-shore longline fleet that targeted swordfish for the period 1988-1998 (SCRS/99/110). In addition, two separate documents (SCRS/99/49 and 132) provided information on the by-catch of billfish from tropical purse seine fisheries (Spain and France) and these data may provide a means for estimating the billfish by-catch from these fisheries. A pilot study conducted off Bermuda examined the feasibility of using pop-up satellite tag technology to evaluate the post-release survival of blue marlin caught in the recreational fishery (SCRS/99/97). A second related document evaluated the factors affecting the robustness of estimates of release mortality using pop-up tag technology (SCRS/99/100). Initial results indicate blue marlin survival from recreational catches are quite high and the study recommended its use for commercial longline gear as well. However, pop-up satellite technology is expensive and sample size requirements for precise estimation of post release survival per gear category may be large.

Relative to the new information submitted to the 1999 SCRS, the Committee recommends an evaluation of the species composition of the catch by different fleets and time area strata to see if it is possible to estimate historical catches by the

Spanish longline fleet from Spanish longline effort by year and area prior to 1998. Also, the Committee believes there should be an effort to evaluate the relative catchabilities of marlin and other species by gear and fishing area. The Committee recommends continued examination of the robustness of ASPIC and other alternative assessment schemes that may be applied to blue marlin and other billfishes in the future. The Committee also recommends that the Enhanced Research Program for Billfish be continued and expanded in critical areas, as recommended by the Second and Third ICCAT Billfish Workshops (SCRS/92/16, COM-SCRS/96/19), as many of the data acquisition problems for all billfish species remain, including landings and CPUE data identified above as the greatest sources of potential error in assessments. In addition, maintenance of important elements of the billfish databases, to insure uninterrupted time series, also requires the Enhanced Research Program for Billfish to be continued and expanded.

PROGRAM COORDINATION AND PROTOCOLS

It was confirmed that Drs. J. Powers and E. Prince (U.S.A.) will continue to function as the General Coordinator and West Atlantic Coordinator, respectively. Dr. T. Diouf (Senegal) and Mr. P. Bannerman (Ghana) will act as Co-Coordinators for the East Atlantic Ocean. Research results (SCRS/99/49, SCRS/99/72, SCRS/99/90, SCRS/99/96, SCRS/99/97, SCRS/99/98, SCRS/99/99, SCRS/99/100, SCRS/99/101, SCRS/99/102, SCRS/99/110, SCRS/99/127, SCRS/99/132, SCRS/99/138, and SCRS/99/141), Executive Summaries for each species, as well as a financial summary for 1999, were presented to the 1999 SCRS and Commission meetings.

The summary of the 2000 proposed budget 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 new 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

a) Shore-based sampling

– West Atlantic

Bermuda. Shore-based sampling of the annual billfish tournament will be conducted in Bermuda in 2000. Dr. B. 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 caught in the Bermuda recreational fishery in 2000, provided sufficient funds for this activity can be obtained. This work may also require some travel to Bermuda by the western Atlantic coordinator to facilitate this study.

Brazil. Shore-based sampling of selected billfish tournaments will be continued in Brazil for 2000 in the general vicinity of Santos, as well as other locations. Dr. A. Amorin, *Instituto de Pesca*, will coordinate tournament-sampling activities. It is not anticipated that this activity will require funds in 2000.

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 2000. Funding will be $720 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 2000 is $1,680. Sampling artisanal longline boats and artisanal fisheries in Punto Fijo and Margarita Island will be conducted in 2000 and the requested funding for these segments is as follows: Punto Fijo $360, and Margarita

Island $720. Trips by the West Atlantic Coordinator or his designee may be necessary to organize sampling, collect data, and transport biological samples to Miami in 2000. In addition, the amount of $900 will be required for tag rewards in Venezuela for 2000 that are made by FONAIAP 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 2000. This sampling includes coverage of ten recreational billfish tournaments held in Puerto Cabello, La Guaira, Falcon, and Puerto La Cruz. Requested funding for this activity in 2000 is $1,000 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 2000 is $480. Shore-based sampling in all Venezuelan locations, as well as at-sea sampling (see next section) in Venezuela will be coordinated by Mr. L. Marcano of FONAIAP.

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. C. Isaac and Mr. P. Phillip) in 2000. Shore-based sampling activities will start in early November, 2000, 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 2000 is $1,000.

Jamaica. Shore-based sampling of the size frequency, total landings, and catch and effort statistics from the recreational fishery will continue in 2000. Efforts will also be made to obtain these data from the artisanal canoe fishery as well. Requested funding for 2000 is $1,000.

St. Maarten, Netherlands Antilles. Shore-based sampling of size frequency data for off-loaded billfish carcasses from longline vessels will be continued in 2000 through the Nichirei Carib Corporation. Requested funding for this in 2000 is $1,500. Shore-based sampling of the annual recreational billfish tournament, initiated in 1992, may be continued in 2000 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 will be conducted by Mrs. O. Mora, *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 2000 SCRS concerning this activity but will not require funding in 1999.

U.S. Virgin Islands. Shore-based sampling of recreational billfish tournament in the U.S. Virgin Islands will be continued in 2000 by the Virgin Islands Big Game Fishing Club in St. Thomas. Requested funding for 2000 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 2000. 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 2000 is $1,000.

– East Atlantic

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 2000 by Dr. T. Diouf, the East Atlantic Coordinator. Requested funding for 2000 is $1,500. The East Atlantic Coordinator may travel to Gabon, Ghana, Sao Tome & Principe, and other West African countries in 2000 to verify species identification of recent reported landings.

Côte d'Ivoire. Abidjan shore-based sampling of the artisanal and recreational fisheries for billfish will be continued and directed by Mr. N. Nestor of CRO in 2000. Funding for 2000 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 2000.

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 2000 by Mr. P. Bannerman. Funding for 2000 will be $1,500. Some travel by the East Atlantic Coordinator may be required to accomplish this task in 2000.

Canary Islands. Shore-based sampling of size frequency of off-loaded billfish carcasses from Chinese Taipei longline vessels may be continued in 2000. Requested funding for 2000 is $400.

Morocco. Inquires will be made by Dr. A. 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 2001. Funding for this activity in 2000 is not anticipated.

b) 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 2000. A total of about 15 tuna trips and 15 swordfish trips on mid-sized industrial longline vessels will be made in 2000, and the cost will be $15,000. In addition, two long-range trips on large Korean-type vessels ($2,880), and two trips on smaller longline vessels ($528) will be made in 2000. Therefore, the total west Atlantic at-sea sampling for 2000 will be $18,408. In addition, insurance for at-sea sampling for 2000 will be $1,200.

Brazil. At-sea sampling on Brazilian, Spanish, and U.S. longliners will be initiated in 2000. Dr. F. Hazin from the UFRPE will direct these research activities. Independent funding of this activity from Brazil in the amount of $4,000 is planned to cover at least five trips. Likewise, funding from the ICCAT Billfish Program is intended to match this effort, with a proportionate increase in the total number of trips that can be accomplished in Brazil during 2000. Insurance for Brazilian observers are estimated at $35 per 30 day trip. Total insurance is about $350 if 10 trips are accomplished. Requested funding for 2000 will be $4,000 for sea pay and $350 for insurance.

Bermuda. At-sea sampling of home based longline vessels targeting pelagic species maybe initiated in 2000 by the Department of Agriculture and Fisheries, provided this fishing activity takes place. In addition to implementing ICCAT at-sea sampling activities, possible biological sampling opportunities will also be assessed. ICCAT funding of this research activity is not required in 2000.

Hook damage studies. A proposal was submitted to the western Atlantic Coordinator in November, 1997, by the Virginia Institute of Marine Science to evaluate the hook damage (circle vs. J hooks) on billfish caught off longline vessels. Although several cruises aboard a Venezuelan industrial longline vessel were carried out in 1999, the number of cruises planned for 2000 is unclear. This project is independently funded but will require funding of air faire for a graduate student to travel to Cumaná in late 1999 or early 2000, in the amount of $2,000.

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. Starting in 2000, Ms. O. Mora of INAPE has agreed to initiate detailed data collection for billfish (as required for other at-sampling in the Billfish Program) from the existing observer program on a trail basis. This activity will involve four trips of about 20 days duration each during the 2000 sampling season. A portion of the costs of observers will be covered by the ICCAT billfish program budget ($10 per day) but this expenditure will be limited to a total of $500 for 2000.

TAGGING

The following conventional tagging activities and expenditures are proposed. Tags and tagging equipment for east Atlantic billfish tagging in 2000, distributed to participants by the ICCAT Secretariat, are not anticipated in 2000 because substantial tagging equipment purchases were made in 1998. The total for tag rewards (including the $900 needed in Venezuela) will amount to $1,500 for 2000. A lottery reward of $500 will also be necessary for 2000.

AGE AND GROWTH

Requested funding for biological samples from juvenile and very large billfish, as well as tag-recaptured billfish, is $500 for 2000.

COORDINATION

e-1 Coordination (on-site training of samplers, collection of statistical and biological samples)

Experience in the West Atlantic (SCRS/90/20, SCRS/91/18, SCRS/92/24, SCRS/93/102, SCRS/94/147, SCRS/95/107, SCRS/96/90, SCRS/97/67, SCRS/98/118, SCRS/99/96) 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 2000 will be $14,000. 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

e-2 Miscellaneous/Mailing

The requested funding for 2000 for east Atlantic miscellaneous and mailing is $100. Similar needs for the West Atlantic Coordinator are covered by the U.S. domestic budget.

e-3 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 lagging behind by 2-3 years due to shortage of NMFS staff to accomplish these duties, it is proposed that a work study student from the University of Miami be contracted for these data entry functions. It is the intent that these tasks be accomplished in advance of the billfish assessments scheduled for July, 2000. Costs for quality control and data entry for 2000 are estimated at $4,000.

e-4 Bank charges

Charges by the bank for the transfer of funds and bank checks in 2000 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 2000 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 1999.

Table 1. Funds available in 1999 for the Billfish Program (as of October)

SOURCE	*In US $*	*In Pts.*
Balance at start of Fiscal Year 1999	-12,800	1,831,262
Allocation from ICCAT Regular Budget	-10,000	1,515,000
Voluntary contribution: Chinese Taipei	5,000	795,325
Voluntary contribution: The Billfish Foundation	25,000	4,026,550
TOTAL FUNDS AVAILABLE	-51,350	8,168,137
TOTAL EXPENDITURES (See Table 2)	-25,002	3,829,721
BALANCE IN BILLFISH PROGRAM FUNDS	**-26,348**	**4,338,416**

Table 2. 1999 Budget & Expenditures of the Enhanced Research Program for Billfish (as of October) [1]

	Amount budgeted	*Expenditures*
AGE AND GROWTH: Purchase of hard parts	500.00	0.00
TAGGING:		
Tag rewards	1,000.00	650.00
Lottery rewards	500.00	0.00
Hard part rewards	500.00	0.00
Printing posters and recapture cards in Japanese/Chinese/Portuguese	0.00	0.00
Tags and tagging equipment	2,000.00	0.00
STATISTICS & SAMPLING ENHANCEMENT		
-- *West Atlantic shore-based sampling:*		
Bermuda tournaments	0.00	0.00
Barbados	0.00	0.00
Brazil tournaments	0.00	0.00
Cumaná, Venezuela	300.00	225.00
Puerto La Cruz, Venezuela	240.00	180.00
Juangriego, Venezuela	864.00	648.00
Playa Verde, Venezuela	500.00	375.00
Playa Grande Marina, Venezuela	1,680.00	1,260.00
Venezuela tournaments in Puerto Cabal and Falcon	760.00	570.00
Grenada	1,000.00	0.00
Jamaica 1,000.00	0.00	
Martinique	1,500.00	0.00
Trinidad & Tobago	1,000.00	0.00
St. Maarten Netherlands Antilles	1,500.00	0.00
U.S. Virgin Islands	2,000.00	0.00
– *West Atlantic at-sea sampling:*		
Venezuela	22,300.00	17,565.00
Insurance for Venezuelan Observers	1,250.00	1,250.00
Telemetry/Hook timer studies (travel)	2,000.00	0.00
Brazil	4,000.00	0.00
– *East Atlantic shore-based sampling:*		
Dakar, Senegal	1,500.00	0.00
Côte d'Ivoire	1,500.00	0.00
Ghana	1,500.00	0.00
Canary Islands	400.00	0.00
COORDINATION:		
Travel by Coordinators	14,000.00	2,203.44
Mailing & miscellaneous--East Atlantic	100.00	0.00
Secretariat support	1,000.00	0.00
Bank charges on Billfish account	250.00	76.17
GRAND TOTAL	**66,644.00**	**25,002.61**

1 The Billfish Program Budget for 1999 was prepared in US$ and all the 1999 expenditures were made in that currency.

Table 3. ICCAT Enhanced Research Program for Billfish Budget for 2000 (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, Punto Fijo, Playa Verde, Margarita Island, La Guaira, Playa Grande Marina, Venezuelan tournaments in Puerto Cabello, La Guaira, Puerto La Cruz, and Falcon)	4,960
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)	18,408
Brazil	4,000*
Bermuda	0
Hook damage studies (travel only)	2,000
Uruguay	500
Insurance for Venezuelan Observers	1,200
Insurance for Brazilian Observers	350
— *East Atlantic shore-based sampling:*	
Dakar, Senegal	1,500
Côte d'Ivoire	1,500
Ghana	1,500
Morocco	0
Canary Islands	400*
TAGGING:	
Tag rewards	1,500
Lottery rewards	500
Hard part rewards	500
Printing posters and recapture cards in Japanese, Chinese, and Portuguese	0
Tags and tagging equipment	0
AGE AND GROWTH:	
Purchase of hard parts	500*
COORDINATION:	
Coordination (on site training of samplers, collection of statistical and biological samples)	14,000*
Mailing & miscellaneous-East Atlantic	100
Data base management	4,000
Bank charges	250
GRAND TOTAL:	$ 64,168

* Authorizing these expenditures depends, in part, on additional funds being available.

Appendix 7

REPORT OF THE MEETING OF THE SUB-COMMITTEE ON ENVIRONMENT

1. Opening of the meeting

The meeting of the Sub-Committee on Environment took place on October 13, 1999, in the Hotel Reina Victoria, Madrid. Dr. A. Fonteneau (EC-France), Convener of the Sub-Committee, chaired the session and welcomed all the participants.

2. Adoption of the Agenda and meeting arrangements

The Agenda was adopted with some suggested modifications to include the discussion of the work plan for year 2000 under item 7, and is attached as **Addendum 1 to Appendix 7**. Dr. J. Gil Pereira (EC-Portugal) was nominated rapporteur.

3. Review of contribution papers

Before the presentation of various documents, the Convener referred to the influence of the effects of the environment on tuna biology and their availability to the fisheries, and to the need of integrating this information into the work of SCRS, namely on the stock assessment analysis. He also commented on the small number of documents presented to the SCRS concerning the relationships between the environment and tuna and tuna like species.

From the documents submitted to the 1999 SCRS, five were identified as relating to the work of the Sub-Committee on Environment, documents SCRS/99/54, 57, 66, 74 and 104. Documents SCRS/99/54 and 57 were presented by the authors.

The first document presented (SCRS/99/54) had already been presented in relation to the precautionary approach. This was a preliminary study aimed at describing and understanding the fluctuations in abundance of bluefin tuna in the western Mediterranean and off the Atlantic coasts of Spain and Portugal. It was first shown that the long term fluctuations in trap catches since the XVI century could be considered as representing the natural fluctuations of the stock. These cycles are important as abundance can fluctuate by a factor of 10 between periods of high and low abundance, which occur approximately every century. The origin of these fluctuations are not clear, but French and European programs have been initiated on this subject, from which it is hoped to have results in the next two or three years. At present, the main hypothesis is that of a determinism of environmental origin which could effect the success of bluefin tuna recruitment, which is known to be highly variable. It is possible that there are periods of very high recruitment leading to strong biomass, and *vice versa*. This is an ecological problem which has major implications for the assessment and management of bluefin tuna resources.

Document SCRS/99/57 updates the relationship between the fluctuations in the North Atlantic Oscillation index (winter NAO) and the changes in the standardized index of catch per unit of effort at age 1 in the North Atlantic swordfish stock obtained from the Spanish longline fleet, assumed as a good indicator of the recruitment index for the 1983-1998 period. This document recalls that the production in marine fish stocks is determined by a multifactorial and complex system of interactions among physical, chemical and biological factors with positive and negative correlated effects. The methodology of population dynamics has traditionally endeavored to explain the recruitment (R) as a function of the spawning fraction of the female stock (SSB) as a main factor. However, the inter-annual variability in the atmospheric-oceanographic conditions has generally had an important effect on the survival of the pre-recruits, which contributes to the inter-annual variability of the stock recruitment and biomass. The models which are commonly used do not, however, take into account the ecological or environmental aspects which, in some cases, they could be better able to predict recruitment rates than the biomass of the spawning stock. Moreover, these inter-annual oceanographic changes are normally included within general trends or fluctuations on a mid and long term basis (interdecadal or multidecadal) which do not generally coincide with the short time series available from fisheries.

The paper also indicates that the coincidence of recruitment cycles in north Atlantic swordfish and albacore with NAO values probably is not coincidental. The spawning areas defined for both species in the north Atlantic are geographically

quite close, so both are probably affected by similar oceanographic factors/anomalies in the subtropical northwest Atlantic region.

Many questions arose during the discussion which followed the presentation of these documents. While it can easily be imagined that the NAO could have an influence on larvae survival in colder waters, it is questionable as to whether this could influence spawning by adults which takes place in the tropical waters on which the NAO has little influence. It is clear that the spawning area of swordfish is mainly in the Caribbean area. It was recalled that hasty conclusions should not been drawn, but that further study was needed on these data to verify constancy over time.

It was noted that in order to try to make any correlation between environmental factors and data from the fisheries, appropriate indicators must be defined for each fishery because the level of correlation is largely affected by the quality (confidence) of the data available from each fishery. The time series available with precise data from tuna fishery data are normally very short in relation to environmental cycles. Given this fact, the possibility of spurious correlations has to be considered.

The benefits of pop-up tags were stressed, especially with regard to the results recently obtained from bluefin tuna, which show movements in areas contrary to the supposed area of distribution of this species (one from the northern coast of Norway and the other off Cape Verde). It was also noted that a new swordfish fishing ground has appeared in the south Atlantic, near the gyre, in a habitat which was supposed to be unsuitable to this species.

This expansion of the fishery should be studied in greater depth, as should its consequences on abundance indices.

4. Anomalies in oceanographic conditions affecting tuna catches

The Chairman drew the attention of the Sub-Committee to the importance which environmental anomalies could have on the catchability of tunas.

New information on anomalies in oceanographic conditions observed off the coasts of Senegal and Mauritania in recent years were presented, in an update of document SCRS/98/146. The shift of the purse seine fishing area to the north was noted, which would be in keeping with the changes in the intensity of the upwelling. These changes in environmental conditions could provoke a geographical movement of resources which is not taken into account by the models in the calculation of abundance indices.

Abrupt changes in local abundance of tunas observed in recent years, in areas such as the Azores and Turkey, could be related with seismic activity. Studies are underway to analyse possible influences which seismic activity could have on the local abundance of tunas.

It was suggested that the strong inter-annual fluctuations in tuna abundance which are regularly seen in the peripheral areas of the distribution of certain species are more likely to be linked to the effects of environmental conditions than to changes in stock abundance. Additional research is required on this subject.

5. Ecology of tunas, with a special focus on the temporal and geographic distribution of spawning and feeding areas of tuna populations

Several subjects were discussed under this Agenda item, notably those concerning life cycles, reproduction, spawning and feeding areas, of species so different as tropical tunas such as skipjack and bigeye and temperate species such as bluefin. In the case of skipjack, spawning takes place in the same areas where the majority of catches are taken. This is also true for bigeye. On the other hand, the spawning areas of bluefin tuna are very far from their feeding grounds.

Reference was also made to the relations between tunas and their environment which could be made through a small scale model. These analytic methods based on individual based models (IBM) using techniques developed in the field of artificial life. The environmental data used are: surface temperature, chlorophyll content, current meter. All these data come from spatial simulation. The aim of these models is to make an entity representing a tuna move about in the environment and analyze its reactions. The final aim is to understand the displacement mechanisms of tunas.

6. Review of studies on the effect of the environment on tuna ecology and the conclusions of international meetings on the environment

The Chairman drew the attention of the Sub-Committee to the works of many international fora on environmental studies and stressed the importance of following this work closely.

Recent studies of demersal fish populations in the North Sea have shown that the exploitation of resources leads to different consequences according to the species, in function of their biological and ecological characteristics. Short-lived species, which mature early and grow quickly are better able to support exploitation than long lived species with slower maturity. Scientists from IFREMER and IRD (France) have initiated studies, based on simulation work, on this subject for the principle species of Atlantic tunas. The preliminary results confirm that tropical and temperate tunas have different capacities to resist exploitation and that it is important to bear these differences in mind when managing the stocks. This study should be completed in a few months and more complete results will be presented at the next meeting of the SCRS.

7. Recommendations and future plans

The Committee noted that it would be desirable to carry out one or more workshops focused on how environmental effects can be incorporated in practical terms into the stock assessment and management advice process of the SCRS.

The Committee considered that the most effective approach would be to select a theme for such a workshop, ensuring that the terms of reference would be of an applied nature (e.g. targeting an improved stock assessment and better management) and would bring together experts, working on different oceans, in both environmental/ecological studies and stock assessment.

The proposed theme is "Recruitment" and would include the following types of questions (all aimed ultimately at improving the assessment and advice products of the SCRS):

- How can environmental effects be used to understand long-term recruitment variation?
- How can environmental effects be used to understand short-term recruitment variation?
- Improvements on short, medium and long-term projections
- Methods for extending historical recruitment estimates

For the workshop to be successful, the Committee recommends that it be held as a real hands-on workshop (as opposed to a symposium). In terms of timing, the Committee suggests the year 2001. It was also recommended that an "Executive Summary" be prepared annually to provide Commissioners with an overview of the state of the Ocean, and on environmental influences on the status of the stocks.

8. Date and place of the next meeting of the Sub-Committee on Environment

The next meeting of the Sub-Committee on Environment will take place at the same time and place as the next SCRS meeting.

9. Other matters

No other matters were discussed.

10. Adoption of the report

The report was adopted.

11. Adjournment

The 1999 meeting of the Sub-Committee on Environment was adjourned.

Addendum 1 to Appendix 7

Agenda of the Sub-Committee on Environment

1 Opening of the meeting

2 Adoption of the Agenda and meeting arrangements

3 Review of contribution papers

4 Anomalies in oceanographic conditions affecting tuna catches

5 Ecology of tunas, with a special focus on the temporal and geographic distribution of spawning and feeding areas of tuna populations

6 Review of studies on the effect of the environment on tuna ecology and the conclusions of international meetings on the environment

7 Recommendations and future plans

8 Date and place of the next meeting of the Sub-Committee on Environment

9 Other matters

10 Adoption of the report

11 Adjournment

Appendix 8

REPORT OF THE MEETING OF THE SUB-COMMITTEE ON STATISTICS

1. Opening of the meeting

1.1 Dr. S. Turner (United States), Convener of the Sub-Committee on Statistics, opened the meeting. The Tentative Agenda was modified in order to discuss the findings of the inter-sessional meeting of the Sub-Committee on Statistics before dealing with the other items on the Agenda. With this modification, the Agenda was adopted, and is attached as **Addendum 1 to Appendix 8**.

2. Report of the Inter-sessional meeting of the Sub-Committee on Statistics

2.1 Dr. Turner presented the Executive Summary of the Inter-sessional Meeting of the Sub-Committee on Statistics, which critically reviewed the current data management policy and system, and recommended a major revision of the ICCAT data base at the Secretariat. It was noted that the SCRS had increasingly been experiencing problems with the data base, and was concerned that these problems would compromise its ability to provide the Commission with the best possible advice, and the Commission's use of the data to monitor compliance with management measures. The Report of the Inter-sessional Meeting of the Sub-Committee on Statistics outlined a plan to resolve these problems, based on the implementation of a relational data base at the Secretariat. The Sub-Committee noted that the overall cost of implementing this would not be very great over the three phases outlined in the report.

2.2 The Committee recognized that the implementation of the new data base requires the hiring of a biostatistician, to assure data quality control essential for the successful operation of a relational data base. The Sub-Committee expressed its grave concern over the failure of the Commission to consider repeated recommendations to hire a biostatistician at the Secretariat, and hoped that this situation would be rectified in 2000. The delays in providing data to the species groups, while in part a result of the current data base system, was also influenced by the shortage of staff at the Secretariat. The need for data to be submitted in consistent and standard formats was also stressed, as failure to provide the data in the required format could cause further delays.

2.3 The Sub-Committee discussed the alternatives available in the event that the Commission did not approve these recommendations, and concluded that the ever increasing demand for data by species groups mandated to monitor stocks would necessitate much longer meetings for all the working groups in order to allow for data preparation. It was recognized that additional costs for scientists participating in lengthy meetings abroad would alone outweigh the one time costs of implementing the relational data base. It was also noted that the quantity of data currently being managed by the Secretariat, and the increased volume of data resulting from ICCAT research programs, would soon render it increasingly difficult for data requests to be processed under the existing system. The more data are accumulated in greater quantities and complexity, the longer the time needed and the greater the costs incurred in upgrading the data base.

2.4 The Executive Summary of the Report, attached as **Addendum 2 to Appendix 8,** is to be forwarded to the Commission for its consideration. The Sub-Committee strongly recommended that the Commission approve this plan, and particularly urged that phase 1 be implemented without delay.

3. Developments in statistics in 1999

a) Timeliness of reporting

3.a.1 The Sub-Committee recognized that the late submission of data by the national offices was an important factor contributing to the delays in the processing and provision of data. However, as many data were not available until late in the year for a variety of reasons, e.g. prolonged fishing trips meant that data were not available until the return of the vessels, often quite late in the year, it was felt that some flexibility should be allowed in relation to the official deadlines, but that all national offices should make every effort to abide by the final deadlines, often set later by the Secretariat, for

data submission before stock assessments. The Sub-Committee agreed that the use of the most current available data was essential to meaningful stock assessments, and that stock assessments should be scheduled for a time when most data could be available.

b) Major revisions in statistics in 1999

3.b.1 The Assistant Executive Secretary, Dr. Peter Miyake, referred to document SCRS/99/9, which reported the major revisions to the historical data base since the 1998 SCRS. Many of these revisions had already been adopted and used by the species groups, pending the formal approval of the Sub-Committee. Stock assessments had also been carried out using the catch at size created on the basis of these revised figures.

3.b.2 Revisions had been made to historical data from Turkey and Panama. Both these series were accepted, but the Sub-Committee reiterated the concerns expressed by the bluefin tuna species group about the uncertainty of Turkish factory and market statistics regarding possible double counting and about the inclusion of imported products in the statistics. The Sub-Committee thanked Dr. Miyake and the scientists from Panama and Turkey for their work in updating historical Panamanian and Turkish catch data, and requested Turkish scientists to further examine their data to ensure they included no double reporting.

3.b.3 Other modifications included revisions to Venezuelan billfish catches, and by-catches of billfishes by the Spanish longline fishery, as well as further revisions to the surface catches of tropical species by EC-Spain, EC-France and NEI-1. Some discussion took place on the non-desirability of continually changing the data base, as it was felt that continuity and repeatability were important elements in ICCAT scientific work. It was concluded, however, that the best scientific data should be used when available, and that the revised data should be incorporated in the base if there were justifiable, well documented, reasons for doing so.

3.b.4 Questions were raised as to the biological justifications for some of the previous revisions to the ICCAT base, particularly some swordfish catches in the Gibraltar area. It was noted that compliance with requirements to submit Task II data (catch and effort and actual size frequency data) would help to verify whether changes were justified in some cases. The Sub-Committee recommended that scientists make every effort to provide detailed catch and effort data, and also recommended that raw size data be submitted together with raised data. Such raw data were essential in the use of certain assessment models, and could also be used to investigate discrepancies between Task I and estimated weight from catch-at-size, of which there had been some cases in the 1999 assessments.

c) Estimation of mis-reporting and non-reporting

3.c.1 Updates to the ICCAT data base also included the addition of estimates of landings by Belize and Honduras, estimated from Japanese import data. The Assistant Executive Secretary informed the Committee that he planned to do further work in this area during the coming year, and that attempts would be made to separate Atlantic Ocean catches from total landings.

3.c.2 Ms. A. Crispoldi, FAO, agreed that trade statistics could be very useful in providing estimates of non reported or under reported catches, and affirmed that FAO also used trade and other fishery independent statistics to verify reported catches.

d) Shark statistics

3.d.1 Ms. Crispoldi (FAO) informed the Sub-Committee that FAO had modified the relevant questionnaires requesting statistics in order to include a more detailed breakdown of shark species. This would show results in the future, but there were no plans to revise historical shark data. There were no plans to effect any special program on sharks statistics, as no special donor funding was currently available.

3.d.2 The Assistant Executive Secretary informed the Sub-Committee that the shark data base was available in ACCESS to those interested in receiving a copy. It was agreed that further discussion on this Item would take place in the meeting of the Sub-Committee on By-Catch.

4. Special actions taken in 1999

a) Secretariat actions in response to SCRS recommendations

4.a.1 The Assistant Executive Secretary informed the Sub-Committee that, in response to earlier recommendations, the Secretariat had made available a preliminary version of the ICCAT bibliography, in ACCESS/EXCEL. The Sub-Committee thanked the FAO for providing the relevant extracts from their ASFA base. While thanking the Secretariat for its work, the Sub-Committee considered that key words for searching references were essential to this type of bibliography, and that many of these were still needed. It was agreed that the Secretariat would work to provide key words for the historical information over time, and in future enter the key words from new documents presented. Scientists were requested to include key words with their documents, and it was agreed that the Secretariat would add this request to the instructions to authors.

b) Improvements of computer facilities and software

4.b.1 The Assistant Executive Secretary referred the Sub-Committee to document SCRS/99/9 for the list of purchases made by the Secretariat during the year. The most important items were the CD Rom recorders, which would allow large data files and bases to be distributed to scientists.

5. Review of ICCAT data base-management and dissemination

a) Review of ICCAT data management policy
b) Review of ICCAT data bases (format, system and quality control)
c) Review of responsibility in data management (national and Secretariat)
d) Policy on data dissemination and publication

5.1 The Sub-Committee noted that many recommendations and discussions on the items a) through d) have been made at the Special Meeting of the Sub-Committee on Statistics and those were reported in the detailed report. The Sub-Committee endorsed all the deliberations and recommendations. It also noted that the issue of the publication policy was substantially discussed but referred to the regular session for further discussion with wider participation.

5.2 The discussions centered on the publication and dissemination of statistics. Publications currently include the "Statical Bulletin", containing Task I data, and the "Data Record" containing the Task II data summary and catalogue, while these data are already available on the ICCAT web-site. It was noted that access to the Internet is still problematic for some countries, but there will be no problem if the data are distributed in CD-ROM or diskette.

5.3 It was proposed and accepted that the "Statistical Bulletin" should contain only total catch by species and by countries and be distributed together with TUNASTAT on diskette or CD-ROM containing the Task I data base. The "Data Record" should contain only data catalogues and be distributed together with the CATDIS data package or PDF files of current "Data Record" pages on CD-ROM or diskette. The possibility of implementing these proposals should be studied by the Secretariat and carried out in 2000 on an experimental basis. It was noted that when Phase II and III of the new relational data base system is achieved, the data base will be accessible through inter-net connection, but in the meantime the distribution of data on CD ROM would at least facilitate scientists and reduce the work of the Secretariat as regards the reproduction and publication of paper copies. In this respect, it was suggested that more detailed explanatory guidelines should be issued with CATDIS, with regard to coding and the nature of data.

5.4 The delay in shipping of the "Collective Volume" series was also discussed. The option of putting all the articles on CD-ROM and sending it by air-mail was examined, together with the further possibility of these being placed on the web-site. These ideas were widely accepted but would require all the papers submitted to be accompanied with computer files, which is not generally the case at present. Furthermore, the space available on the ICCAT home page is very limited and currently only the SCRS Report can be posted on FTP. The Secretariat was requested to investigate the possibility of getting more space available on the web-site. It was acknowledged that PDF files would occupy less space, and it was agreed that the Secretariat would study this possibility.

6. New business

a) Fleet statistics

6.a.1 The Assistant Executive Secretary reported that the request to regional agencies to create vessel registers has been increasing in international fisheries management, particularly in relation to the FAO Compliance agreements. An ICCAT Recommendation is already in force for countries, entities and fishing entities fishing bigeye tuna in the Atlantic Ocean to submit annual lists of the fishing vessels over 24 meters overall length, with specifications. These data are now accumulating and very soon a data base for this type of information will be required.

b) Data reporting for ICCAT special research programs (BYP, BETYP, Billfish)

6.b.1 The data collected through various ICCAT research programs (e.g. Bluefin Year Program, Billfish Program and Bigeye Year Program) have been and/or will be accumulating. The Sub-Committee emphasized the importance of getting all these data centralized at the ICCAT Secretariat. The Sub-Committee was informed that the data from the Billfish Program has been recently transmitted to the Secretariat and that the data from the Bigeye Year Program are also being assembled at the Secretariat.

c) Catch data of unidentified tuna species

6.c.1 The Secretariat circulated the table of reported landings of unidentified tunas and tuna-like species. The total amount reaches a high of over 24,000 MT. These data have never been reviewed by any species group, but may represent some important catches of some species. It was noted that there are many discontinuities in the data series. Such discontinuity might be related to improvements in statistics, in which fishing nations have submitted data by species breakdown for later years. It was suspected some of the landings might include sharks, particularly for longline data.

6.c.2 It was suggested that all the national scientists carefully study the table to see if the reports of unidentified species catches on the table are still valid, and whether there was a way to estimate the species composition of these landings.

7. Recommendations and future plans

7.1 The Sub-Committee recommended that:

- a biostatistician be hired at the Secretariat;
- the Commission approve the plan to establish and implement a relational data base, as outlined in the Executive Summary of the Sub-Committee on Statistics, and particularly urged that phase 1 be implemented without delay;
- the National offices and scientists make every effort to submit Task II data, and that raw size data be submitted together with raised data;
- the "Statistical Bulletin" and the "Data Record" format be changed, reducing the number of pages, while distributing the associated data on CD-ROM or diskette;
- a study be made on the feasibility of distributing the "Collective Volume" on CD-ROM; and
- key words be added to all documents submitted in the future, and that the Secretariat work to add key words to historical entries in the bibliography.

8. Date and place of the next regular meeting of the Sub-Committee on Statistics

8.1 It was agreed that the Sub-Committee on Statistics will meet at the same time and place as the next SCRS meeting.

9. Other matters

9.1 No other matters was discussed.

10. Adoption of Report

10.1 The Report of the Sub-Committee on Statistics was adopted.

11. Adjournment

11.1 The 1999 meeting of the Sub-Committee on Statistics was adjourned.

Addendum 1 to Appendix 8

Agenda of the Sub-Committee on Statistics

1 Opening of the meeting, adoption of Agenda and arrangements for the meeting
2 Report of the Inter-Sessional Meeting of the Sub-Committee on Statistics
3 Developments in statistics in 1999

a) Timeliness of reporting
b) Major revisions of statistics in 1999
c) Estimation of mis-reporting or non-reporting
d) Shark statistics

4 Special actions taken in 1999 (which are not covered under Item 3)

a) Secretariat actions in response to SCRS recommendations
b) Improvement of computer facilities and software
c) Other actions

5 Review of the ICCAT data base-management and distribution

a) Review of ICCAT data management policy
b) Review of ICCAT data bases (format, system and quality control)
c) Review of responsibility in data management (national and Secretariat)
d) Policy on data dissemination and publication

6 New business

a) Fleet statistics
b) Data reporting for ICCAT special research programs (BYP, BETYP, Billfish)

7 Recommendations and future plans
8 Date and place of the next regular meeting of the Sub-Committee on Statistics
9 Other matters
10 Adoption of Report
11 Adjournment

Addendum 2 to Appendix 8

EXECUTIVE SUMMARY – SUB-COMMITTEE ON STATISTICS
RECOMMENDATION FOR MAJOR DATA BASE REVISION

Both the Commission and the SCRS have made much greater use of the ICCAT data base in recent years than in the past. Increasingly the SCRS has experienced problems with the data base and the SCRS has become concerned that these problems will compromise its ability to provide the Commission with the best possible advice and will compromise the Commission's use of the data to monitor compliance with its recommendations. The Ad Hoc Working Group on SCRS Organization "identified a critical need to identify inconsistencies in the currently available data base" and "to increase the Secretariat's efficiency in dealing with an ever increasing flow of information". In 1998 the SCRS instructed the Sub Committee on Statistics to review the Secretariat's data management system and to recommend solutions to these problems. This report summarizes the primary findings and recommendations of a group scientists representing six ICCAT entities, the EC's Eurostat, and the Indian Ocean Tuna Commission (IOTC) which are more fully presented in a detailed report.

The group found the Secretariat's data management policies to be sound, but found that the data management system was obsolete (it has been in place for 30 years). It noted that problems exist in many of the historical data sets and that increased quality control of incoming and historical data was needed. The group noted that the quality control was the primary task for the proposed new biostatistician. The group also reviewed the Secretariat's publication policies and noted that substantial savings could be obtained by simplifying the information in the Statistical Bulletin and the Data Reports and distributing more detailed information electronically.

The group reviewed the Secretariat's work load and its ability to provide data in a timely manner. It noted that the Secretariat often was unable to quickly provide data when multiple groups were meeting. The work load has substantially increased due to the increasing number of management units being assessed, managed and monitored. The size of the data base has doubled in the last 5 year and the complexity has increased with more monitoring of stock status, limits on catch, size and effort, time-area closures, fleet statistics, and import-export statistics. It noted (1) that some of the data management problems were associated with extremely late delivery of data and frequent changes in reporting formats by some reporting entities, but (2) that the archaic nature of the data base system heavily contributed to these delays.

The group recommended that the structure of the Secretariat's data base management system (hardware and software) be substantially revised to increase the efficiency of the Secretariat and to permit scientists and mangers to rapidly and efficiently access the data. Such a system would provide far greater flexibility than the current system. Establishing a high quality relational data base will require extensive quality control of historical data and future data submissions. Hiring the proposed bio-statistician will be essential for the success of this project. Three phases of upgrading the system were outlined with the end product being a highly secure relational data base with access from the World Wide Web for data reporting and retrieval capabilities. During the first phase of development relatively inexpensive hardware and software would be used to establish the relational data base on PCs (servers) and will require a one time investment of about $77,000. The results of the first phase will be transferable to the later phases and will provide a basis for estimating costs of the later phases which are currently projected at $300,000-$500,000, over approximately two years.

Establishing a relational data base is essential to: (1) substantially increase efficiency for Secretariat staff, scientists and managers; (2) strengthen the integrity of historical and future data sets and resulting assessment and monitoring; and (3) greatly increase security.

Nearly all international marine resource commissions are in the process of developing relational data base systems. In recognition of the high quality of the ICCAT data base, many are planning to remove their Atlantic tuna statistics and establish electronic links to the ICCAT to meet requests for such data; a sophisticated data base system will be for necessary to meet those demands.

Proposed budget:

2 servers	$ 8,000
LAN	$17,000
Programming contract	$50,000
Training	$ 2,000
Total	$77,000

Justification for Budget:

Two servers are needed to provide redundancy and security. Were there only one server and were it to fail during a meeting, the SCRS might be unable to provide advice.

A LAN is needed to provide access of multiple users to the relational data base and to increase efficiency of the entire Secretariat staff in their day to day operations.

It will be necessary to contract, on a temporary basis, the services of a programer with data base development skills and preferably some fisheries background. The biostatistician and the systems analyst will have to work closely with the programer to guide him and to be able to take over responsibility for the system after the initial design is completed. The actual value of the contract will depend on whether the system has to be completely designed by the programmer or whether parts of another system (perhaps the system under development by the IOTC) can be used.

-- Phase 1 (years 1-3):

Install local area network (LAN)
Install servers
Development of PC based data base system
Transition of the current ICCAT flat data model to a relational database model.
Train systems programer in Microsoft Access (relational data base management system)
Establishment of data submission protocols
Test and optimize system

-- Phase 2:

Procure and install larger platforms capable of running large scale data base software
Migrate phase 1 relational data base model to the large scale system with sophisticated services
Implement additional backup, archival and safety protocols
Train ICCAT personnel in new computer and data base systems

-- Phase 3:

Continue development and optimization of the system. Establish links via the World Wide Web with appropriate security features so that (1) data reporting and extraction by ICCAT entities can be accomplished remotely and (2) publications and data can be accessible to the public with appropriate limitations.

Appendix 9

REPORT OF THE MEETING OF THE SUB-COMMITTEE ON BY-CATCH

1. Opening of the meeting, adoption of Agenda, and arrangements for the meeting

1.1 At the request of the Chairman of the SCRS, the Convener of the Sub-Committee on By-Catch, Dr. H. 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 9**. Dr. G. Scott agreed to serve as Rapporteur.

2. Review of the Report of Inter-Sessional Meeting of Sub-Committee on By-catch

2.1 The report of the Inter-sessional meeting of the Sub-Committee on By-catch held in Messina, Italy, in May, 1999 (SCRS/99/20) was reviewed. Participants in the meeting included scientists from Brazil; EC-France, EC-Italy, EC-Portugal, EC-Spain, Japan, UK-Bermuda, the United States, and the Secretariat. The Sub-Committee focused its efforts on: (1) updating information on species caught by tuna fisheries, (2) review of additional data submitted to ICCAT on catches of sharks in the Atlantic fisheries for tuna and tuna-like species, (3) review of CPUE data for Atlantic sharks, and (4) review of the activities of other international organizations which have some activity on by-catch of fisheries.

2.2 Recommendations made by the Sub-Committee were accepted as recommendations to the Commission and were included in the recommendations of the SCRS.

3. Review of the revised list of tuna fishery by-catch species, as prepared by the Secretariat

3.1 The revised list of tuna fishery by-catch species made by the group at the Messina meeting, which was included in Document SCRS/99/20, was reviewed. The Sub-Committee reiterated that this list does not provide quantitative information. The list is a simple compilation of all recorded species (including single records) and its aim is only to characterize the species that have been observed in the catch. Since no new information of species observed in the catch by tuna fisheries was provided in documents submitted to the SCRS, no changes were made in the table, which will be kept at the secretariat until there is a need to revise it further.

3.2 A summary table (**Table 1**) of Task I statistics thus far received by the Secretariat was presented. The Sub-Committee requested that the Secretariat continue to provide summaries of the Task I data and to draw comparisons with the FAO data on total shark landings to allow evaluation of the proportion of total recorded shark landings represented by the shark catch coincidental to effort directed at Atlantic tuna and tuna-like species. It was also recommended that the Committee continue to be appraised of the contents of the Task II catch and effort and size frequency data received by the Secretariat in order to provide the Committee a means of evaluating the potential for stock assessment evaluations.

3.3 The issue of data reporting to the Secretariat was discussed. The Sub-Committee recommended that information from both targeted and non-targeted shark effort should be reported. The Committee again reviewed and reaffirmed the mandate of ICCAT relative to this issue. From SCRS/99/20:

" Article IV of the International Convention for the Conservation of Atlantic Tunas states "the Commission shall be responsible for the study of the population of tuna and tuna-like fishes (the Scombriformes with the exception of Trichiuridae and Gempylidae and the genus Scomber) and such other fishes exploited in tuna fishing in the Convention area as are not under investigation by another international fishery organization." The Commission interpreted this language to indicate that ICCAT has responsibility for collecting information on catches of sharks and other fishes which are coincidental to fishing effort directed toward tunas and tuna-like species. Thus, in 1996 after ICCAT nations approved the recommendations for data collection made at the first meeting of the Shark Working Group (Miami, January, 1996) the ICCAT Secretariat instituted a data collection form sent to over 80 Atlantic tuna-fishing nations to report the by-catch of sharks, and requested that this information be reported annually to ICCAT.

At its 1995 meeting and at each subsequent meeting, the SCRS discussed the difficulties of assessing the effect of by-catches of sharks in the Atlantic and Mediterranean tuna fisheries on the status of shark stocks in the Atlantic and Mediterranean. It was noted that without information on fishing mortality levels resulting from effort directed at sharks as well as fishing mortality resulting from by-catch in fisheries directed at other species (including Atlantic tuna fisheries), such assessments could not be completed. The Committee recommended that, should sufficient data become available to support shark stock assessments in the future, ICCAT focus attention on the pelagic shark species (e.g. blue mako, thresher, silky, etc.), since these are likely to be more frequently caught by effort directed at Atlantic tunas. At the 1997 and 1998 SCRS meetings, the SCRS reaffirmed the mandate given to the Commission and the Working Group and reiterated previous recommendations on the working schedule agreed to for collection of statistics and relative abundance patterns for sharks taken in the Atlantic and Mediterranean tuna fisheries, focusing attention on pelagic shark species.[1]

3.4 The Committee acknowledged that it is sometimes difficult to discriminate shark catch that occurs due to targeting effort at sharks compared to coincidental catch of sharks in tuna directed effort, especially when there is mixed targeting during a fishing trip. The Committee recommended that catch from such fisheries be reported to ICCAT, but recommended that targeting information also be provided to permit finer scale comparisons of by-catch and targeted catch, when necessary. In the case of artisanal fisheries, it was pointed out that these are primarily mixed-species fisheries that do not necessarily target sharks or tunas. It was recommended that these catches and landings be reported, as far as possible.

4. Review of any new biological, statistical or fishery information on Atlantic sharks since the Messina meeting.

4.1 Six national reports submitted by Canada, the United States, Japan, Venezuela, Brazil and China (SCRS/99/31, 95, 136, 139, 144 and 148, respectively) provided a variety of information including fishery, catches, research activities and regulations for sharks. The Committee appreciated the submission of this information but it was stressed that catch statistics should be given not only in the national report but also reported on the ICCAT shark data form.

4.2 Document SCRS/99/90 estimated dead discards for swordfish, billfish, large coastal and pelagic sharks caught by the US longline fishery based on the logbook and scientific observer data. Document SCRS/99/138 reviewed the observer program on Japanese longline fishing vessels using data from two observer trips made in the Atlantic. That document also included a list of species caught and percentage of the fish caught alive, by species. A pilot observer program for Chinese Taipei longliners operating in the Atlantic Ocean was described in document SCRS/99/131. Document SCRS/99/150 reported a species list, species composition and catch rates of major species observed in the catch of the Chinese longline fishery using on board observer data.

4.3 Document SCRS/99/63 described the exploitation of schools of tuna associated with the bluefin fisheries in Canary Islands from scientific observer data. This document also provided a description of shark species caught by the fishery.

4.4 Document SCRS/99/82 presented preliminary scientific data about by catch landings (except for tunas and tuna-like species other than billfishes which were presented separately) from the Spanish longline fishery for swordfish during 1997 and 1998. Seventy-eight percent of the by-catch landings described in this document were from the north Atlantic; south Atlantic landings were relatively low by comparison. Qualitatively, sharks landed in 1997 and 1998 represented 99% of the reported landings of by-catch species other than tuna and tuna-like species in this fishery with about 85% of the landed catch represented by blue shark, *Prionace glauca*, and 10% mako shark, *Isurus oxyrinchus*.

4.5 Document SCRS/99/127 provided information on Venezuelan shark by catch from the Venezuelan tuna and swordfish longline fleet. On the basis of logbooks and observer data, estimates of shark by catch for the period 1989-present are being investigated and will be submitted to ICCAT when the research is complete.

4.6 Document SCRS/99/150 provided a summarization of the catch composition and disposition of range of species captured during longline fishing effort made by Chinese vessels operating in the Atlantic. In the document, by-catch was taken to mean species which were not targeted, had relatively low value and for this reason could be discarded. Of the large sharks taken as by catch in this fishery approximately 87% were blue sharks, averaging about 2.7 blue sharks per 1000 hooks. Information on product weights (fin weights) from sharks taken in the fishery was also presented. Estimates of shark discards based on fin weights was proposed.

4.7 Catch information on sharks submitted to ICCAT in response to ICCAT's request for Task I and Task II reports was further reviewed by the Sub-committee on By-catch. The ICCAT Secretariat provided an updated summary of the available Task I reports (**Table 1**). Thus far, only 24 of the more than 80 countries, entities and fishing entities requested to provide information have reported Task I data for some or all years during period 1996-1998. Some countries have reported shark catch in their national reports, but have not yet submitted as Task I data in the ICCAT format, and some countries provided sharks catch statistics with species combined. Response to the ICCAT requests for data on sharks has still been poor. The Committee stressed its previous recommendation that all member nations and Atlantic tuna fishing nations establish adequate data collection systems for collecting Task I and Task II data for sharks and provide the data in annual reports to ICCAT. However, even if these data are included in the national reports, they should also be formally submitted to the Secretariat using the standard data reporting form to avoid confusion. The Committee also acknowledges that using information on total removals will be critical to future evaluations of shark stock status, and hence reporting discards accurately is essential.

4.8 Regarding Task II data, only three nations (Canada, St. Helena reporting on Honduras flag vessels and the United States) have submitted Task II data on sharks to the Secretariat in 1998. So far, five nations have submitted Task II data on sharks, but it is obvious the Task II statistics on sharks is still poor. The Committee continues to encourage member nations to submit Task II data on sharks as well.

4.9 At the ICCAT SCRS in 1997, in order to provide updated information on progress made with respect to the Commission's recommendation on the implementation of national observer programs for longliners, purse seiners, and baitboats, which became binding on ICCAT Contracting Parties in 1997, all those attending the Sub-Committee discussions were asked to provide brief reports on the status of national observer programs. In the SCRS 1999, the information of implementation of national observer activity was reviewed and updated. China, Chinese Taipei and EC-Portugal implemented observer program on their tuna fleets in recent years. Tunisia, Malta and Iceland also described their observer programs. Cape Verde has a port sampling program, but does not yet have an observer program. Panama is planning an observer program in the future. Gabon does not have national observer program. Some nations without industrial fleets are not planning observer programs. Based on the results of the previous reports and updated information, 19 of 30 nations have described national observer programs, 11 nations did not, but some nations did not have industrial fishery; and three nations are planning to implement scientific observer program in the future.

5. Update of activities by other international organizations

5.1 The chairman of the Sub-Committee informed the SCRS of discussions held by the CITES Animals Committee during its meeting in Madagascar in July, 1999. The discussion on the conservation and management of sharks (Resolution conf. 9.17) will be continued at the next CITES Meeting of the Conference of Parties (COP-11) which will be held in Kenya in 2000.

5.2 The activity of the by-catch working group of the Secretariat of the Pacific Community (SPC - formerly South Pacific Commission) was described. By catch is more broadly defined in that organization and includes billfishes and swordfish. The initial work of this group is focusing on swordfish and billfish.

5.3 The framework of IOTC relating to by-catch species was communicated by the representative from the IOTC. Work on by catch for the IOTC has started only recently and is now focused on collection and analysis of observer data from purse-seine vessels.

6. Future Plans & recommendations

6.1 The Committee extracted several recommendations from the report of inter-sessional meeting were as follows:

6.2 Brazilian scientists are recommended to compile and analyze all the existing shark catch data of Brazilian fisheries possibly with the Brazilian Elasmobranch Society and other scientists as appropriate and report the results by the future meeting of the Sub-Committee. These data, together with the other CPUE series (e.g. Japanese, Spanish and Chinese Taipei) should be well reviewed and analyzed.

6.3 A comparative analysis of the U.S. and Canadian observer data from Japanese longline vessels operating in the U.S. and Canadian EEZs and the Japanese logbook data for corresponding times and areas should be counted, for consideration at the future meeting of the Sub-Committee.

6.4 Only 24 of the more than 80 countries, entities and fishing entities contracted have reported (and some are very incomplete data sets) Task I shark catch data up to now and only 6 have reported Task II data. The Committee continues to recommend that nations that catch sharks in their Atlantic and Mediterranean tuna fisheries are strongly urged to fulfil the responsibility of reporting Tasks I and II data on sharks.

6.5 The collection of by-catch data from the Mediterranean is very weak and improvement of the system of collection of such information is essential. An *Ad Hoc* Joint meeting of the GFCM/ICCAT might possible be realized in 2000 to discuss this subject.

6.6 Noting that many shark and by-catch related scientific meetings are scheduled by various regional agencies, academic institutes and NGO's, it might be beneficial to the Commission and the study of sharks that ICCAT scientists to collaborate and/or participate in such meetings and report to the Commission. It is recommended that ICCAT scientists continue to report on these activities.

6.7 The Sub-Committee considers that it is the responsibility of the nations fishing sharks to collect adequate data and urged these countries to carry out good scientific observer programs, if such have not been already implemented.

6.8 The Committee recommended that an Executive Summary reporting format to highlight important items to the Commission.

7. Other matters

7.1 No other matter was discussed.

8. Date and place of the next meeting of the Sub-Committee on By-catch

8.1 It is anticipated that the Sub-Committee on By-catch will reconvene at the 2000 SCRS meeting.

9. Adoption of report

9.1 After review, the Report was adopted.

10. Adjournment

10.1 The 1999 Meeting of the Sub-Committee on By-catch was adjourned.

Addendum 1 to Appendix 9

Agenda of the Sub-Committee on By-catch

1. Opening of the meeting, adoption of Agenda and arrangements for the meeting
2. Review of the report of Inter-Sessional Meeting of Sub-Committee on By-catch (Messina, Italy)
3. Review of the revised list of tuna fishery by-catch species, as prepared by the Secretariat
4. Review of any new biological, statistical or fishery information on Atlantic sharks since the Messina meeting.
5. Update of activities by other international organizations
6. Future plans and recommendations
7. Other matters
8. Date and place of the next meeting of the Sub-Committee on By-catch
9. Adoption of Report
10. Adjournment

Table 1. Summary of shark by-catches (in MT) reported to the Secretariat for 1994 to 1998

1994

	ALV	BTH	BSH	FAL	POR	SMA	OCS	LMA	CCT	CCL	CCS	CCE	DUS	CCP	TIG	SPL	SPK	SPZ	OTH	UNSP	TOTAL
BRAZIL																				2610	2610
CAP VERT			41												284			46	824		1195
CHLTAIP																				851	851
COLOMBIA																				102	102
COTE D'IVOIRE						17												66		13	96
MEXICO		2	2	18		4	2					1			4	3				10	46
USA			8	12	106	310	3	8		119		**	24	135	4					581	1310
US DISC	7	18	572	66	1	18	4	11		1	3	6	246	11		33	4		16	4	1021
TOTAL	0	2	51	30	106	331	5	8	0	119	0	1	24	135	292	3	0	112	824	4167	3600

1995

	ALV	BTH	BSH	FAL	POR	SMA	OCS	LMA	CCT	CCL	CCS	CCE	DUS	CCP	TIG	SPL	SPK	SPZ	OTH	UNSP	TOTAL
BRAZIL																				2289	2289
CANADA			139		1378	111														38	1666
CAP VERT																			909		909
CHLTAIP																				1414	1414
COTE D'IVOIRE						12												69		18	99
GABON																				22	22
BARBADOS																				24	24
GRENADA																				7	7
MEXICO	3		**	25	**	10	4					7			12		10			22	93
STA LUCIA							**		**	**					1		**				1
ST. VINCENT																				9	9
URUGUAY	1		64		3	21													53	349	491
UK			17																	6	23
UK-BERMUDA			3			**									2				10		15
USA			3	23	36	282	4	2		43			51	322	3				99	291	1159
USA DISCARDS	4	40	618	62	0	28	6	14			1		29	3	1	82	1	1		1	891
TOTAL	8	40	844	110	1417	464	14	16	0	43	1	7	80	325	19	82	11	70	1071	4490	9112

** = less than 1 metric tonne

Cote d'Ivoire uncl = mainly FAL

Gabon includes SMA, SPZ, and others

St.Vincent includes Carcharhinus spp

Figures show shark landings except in the following cases:

Bermuda BSH = dead discards

Mexico catches include dead discards 2% of total but does not include live sharks liberated (7 MT). CCL includes FAL and CCB

1996

	ALV	BTH	BSH	FAL	POR	SMA	OCS	LMA	CCT	CCL	CCS	CCE	DUS	CCP	TIG	SPL	SPK	SPZ	OTH	UNSP	TOTAL
BRAZIL																					0
CANADA			12		1015	67														13	1107
CAP VERT																					0
CHI.TAIP																				1473	1473
COTE D'IVOIRE																					0
GABON																				454	454
JAPAN			1044		8	213														99	1364
URUGUAY																				301	301
UK																				18	18
UK-BERMUDA						1	1								1					5	8
USA			7	16		234	55	3		46		1	40	467	3				230		1102
BARBADOS																					0
GRENADA																					0
MEXICO																					0
STA LUCIA																					0
ST. VINCENT																					0
TOTAL	0	0	1063	16	1023	515	56	3		46	0	1	40	467	4	0	0	0	230	2363	5827

** = less than 1 metric tonne

1997

	ALV	BTH	BSH	FAL	POR	SMA	OCS	LMA	CCT	CCL	CCS	CCE	DUS	CCP	TIG	SPL	SPK	SPZ	OTH	UNSP	TOTAL
BARBADOS																				14	14
BRAZIL		30	844	14		159										141				219	1407
CANADA			11		1339	110														42	1502
CAP VERT																					0
CHINA																				2	2
CHI.TAIP																					0
COTE D'IVOIRE																					0
EC-SPAIN	30	147	29915	1	27	3778	4	33						**	3		1	22	1158		35119
EQU. GUINEA*																				**	0
GABON																					0
GRENADA																				9	9
GUYANA																				1893	1893
HONDURAS*																				8	8
JAPAN			996		18	248														78	1340
MEXICO																					0
STA LUCIA																					0
ST. VINCENT																					0
URUGUAY																				260	260
UK																					0
UK-BERMUDA			1			1									1				4		7
USA			1	17	56	244	8	2		36			22	342	1					118	847
USA DISCARDS			185	46								22	25							151	429
TOTAL 97	30	177	31953	78	1440	4540	12	35	0	36	0	22	47	342	5	141	1	22	1162	2794	42837

* = reported by Sta Helena

** = less than 1 metric tonne

1998

	ALV	BTH	BSH	FAL	POR	SMA	OCS	LMA	CCT	CCL	CCS	CCE	DUS	CCP	TIG	SPL	SPK	SPZ	OTH	UNSP	TOTAL
BRAZIL																				367	367
CANADA			21		997	69														44	1131
CHINA																				5	5
COTE D'IVOIRE				**												31		94		24	149
EC-PORTUGAL		**	**			**															0
EC-SPAIN	45	114	28137	11	27	3347	10	23			3		1	**	5	**	2	15	1047		32787
GHANA																				1759	1759
HONDURAS*																				4	4
NAMIBIA																				**	0
SOUTH AFRICA			23			19															42
UK-BERMUDA			**												2				6	**	8
USA			3	10	13	196	5	2		10	**		19	153	1				56	83	551
USA DISCARDS			195	11							20		34						50	1	311
TOTAL 98	45	114	28379	32	1037	3631	15	25	0	10	23	0	54	153	8	31	2	109	1159	2287	37114
JAPAN++			*27368*		*1967*	*5423*														*4832*	*39590* ++

* = reported by Sta Helena

** = less than 1 metric tonne

++ = number of fish, not included in total

Appendix 10

EXECUTIVE SUMMARY
REPORT OF THE WORKING GROUP ON PRECAUTIONARY APPROACH

Background

The *FAO Code of Conduct for Responsible Fisheries* and the *Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and management of Straddling Fish Stocks and Highly Migratory Fish Stocks* developed several concepts relating to precautionary approaches in fisheries, including:

i actions to manage and conserve fisheries resource should be applied using a precautionary approach;
ii absence of adequate scientific information should not be used as a reason for postponing or failing to take measures;
iii specific targets and limit reference points appropriate to precautionary approaches should be determined and established;
iv the level of uncertainty in status and risk associated with actions should be encompassed into strategies;
v enhanced data are required to decrease or lessen restrictive actions.

To address the scientific ramifications of these and other precautionary issues, the Standing Committee on Research ans Statistics (SCRS) created an *ad hoc* Working Group in 1997 to develop a discussion document of what "precautionary approaches" means in the context of ICCAT stocks including: (a) likely criteria (benchmarks); (b) ecological, environmental and distributional aspects; (c) the role of uncertainty; (d) how precautionary information should be communicated to the Commissioners in the future; and (e) other issues as appropriate.

The SCRS working group summarized existing information relevant to Atlantic tunas benchmarks and conducted an inter-sessional meeting for addressing these items. This document reports the progress of the SCRS on these activities and preliminary findings.

The breadth of scientific aspects of the precautional approach

The SCRS notes that precautionary approaches include several scientific aspects as applied to tuna and tuna-like species in the Atlantic including biological, ecological and environmental considerations; technological/fishing issues; data collection mechanisms and the characteristics of stock assessments.

The ecological and biological framework within which tuna exist is spatially broad and heterogeneous. The species are highly migratory, existing under variable environmental conditions. Additionally, environmental conditions affecting tuna productivity and may shift over long time frames. Temperate and tropical tunas can have very different life histories which affect their productivity and resistence to fishing pressure. Precautionary criteria should encompass these characteristics.

The technology of fishing has affected both the rate of exploitation and, perhaps, biological and ecological characteristics. Factors include bycatch of various species and gears designed to reduce that bycatch; possible affects of fish aggregating devices on migratory behavior and resulting biological processes; and the use of multiple gears has important consequences for the estimation of many biological reference points which depend on the overall selectivity (at age or length) of the mix of gears. Also, abundance estimates for tunas are almost entirely based on the catch and effort data. There is difficulty in standardizing these data for technological advances in gear technology and fishing methods; improvements in fishing efficiency due to dramatic improvements in fishing gears are not always well estimated, and may be dangerously interpreted as an increase in stock abundance. Also, Little is known about the influence of tuna fishing gears on the physical habitat, although it is believed that its influence is small.

No ICCAT stock is considered information-rich (8 of 17 are considered informate-moderate and the rest information-poor). Therefore, there is consensus within the SCRS for the need for improved data collection in order to facilitate implementation of precautionary approaches. The terms "information-rich", "moderate" and "poor" relate to both the amount of data available and to the accuracy of recent assessments. Thus, information level is judged both in terms of the amount of available data and our current understanding of the biological dynamics. Specific information needs are for stock identification research to reduce uncertainty. Information-poor stocks need better basic catch, effort and size sampling data. For all stocks there is a lack of fishery-independent measures of abundance, no or poor estimates of natural mortality, and a need to incorporate environmental influences into assessments. Methods for direct aging are also required. Thus, what is needed is to move to higher levels of information-richness, by collecting more of the same types of data that are already being collected. These require additional funding support at all levels of the entire fishery management system from data collection, to research, to assessment, to monitoring of regulations.

The data that the SCRS requires are to be utilized in stock assessments. Stock assessment is the process of integrating the relevant scientific information and providing management advice on the status of the tuna resources relative to management objectives and constraints. Two common measures of stock status (biological reference points) are used; these relate to whether "over-fishing" is occurring and whether a stock is "over-fished". The distinction between the two is important. "Over-fishing" relates to the act of fishing and occurs when fishing mortality is "too high". "Over-fished" refers to the state of the resource stock and occurs when stock biomass is "too low" or depleted. It is possible to be over-fishing without being over-fished and, conversely to be over-fished without over-fishing. The worst situation is that where over-fishing is occurring on an over-fished stock. Both types of reference points should be used. However, although reference points are useful abstractions, care must be taken to incorporate relevant dynamics into their determination. Preliminary categorization of ICCAT stocks indicate that of the 15 stocks categorized, 8 are estimated to be below biomass at MSY (or an appropriate proxy) and 9 are estimated to be above fishing mortality rate at MSY (or an appropriate proxy). The 8 stocks estimated to be below B_{MSY} are also experiencing fishing mortality rates above F_{MSY}. The Committee noted that, in the past, MSY-related reference points have been mis-estimated due primarily to subsequent area and depth expansion of the fisheries. However, the Committee is doubtful that the same magnitude of mis-estimation problems will occur in the future, due to limited scope for future expansion for most ICCAT fisheries. It should be noted that these classifications should not be considered definitive. However, they do provide an indication of exploitation levels as related to the stated objectives of the ICCAT Convention.

SCRS preliminary recommendations and plans

There are several important points arising from this meeting that the SCRS wishes to present. Also, the results of this meeting may imply some alternations in schedules that are given below.

The SCRS notes the distinction between targets (management objectives) and limits (conservation reference points considered to be deleterious and should be avoided). The choice of a particular limit rests with the risks that the managers wish to take and the consequences of the events.

Based on language in the ICCAT Convention, F_{MSY} is probably the most appropriate fishing mortality-based target reference point. However, note that the corresponding B_{MSY} is only appropriate as a target in an average or equilibrium sense; i.e. in natural systems where F_{MSY} is the target, biomass should be expected to fluctuate around B_{MSY}, so there should be no unnecessary cause for alarm when biomass falls somewhat below B_{MSY}. Thus, it may make more sense to consider F-targets in conjunction with biomass limits, rather than biomass targets, *per se*. Other potential candidates for target fishing mortality rates include biological reference points that have frequently been used as proxies for F_{MSY}.

Annex II of the Straddling Stocks Agreement states that F_{MSY} should be a minimum standard for a limit reference point. This is potentially in conflict with the objectives of the ICCAT Convention, which imply that F_{MSY} is the target. In fact, there are very few examples where fishing mortality has been limited to F_{MSY} over a significant period of time, even where MSY has been the stated management objective, and the Committee was not aware of any examples where stocks have collapsed despite fishing mortality being maintained near F_{MSY} over a substantial period.

Generally speaking, a target refers to a management objective (e.g. maximum sustainable catch, as stated in the ICCAT Convention), while a limit refers to conservation and sustainability considerations. From a theoretical viewpoint and with this general distinction in mind, F_{MSY} has been considered so far by fisheries biologists as an optimization reference point. However, depending on the quality and quantity of available information, a situation may exist where a stock managed

at F_{MSY} could encounter sustainability problems: the actual fishing mortality, while maintained around a perceived F_{MSY}, could exceed some sustainable limit due to the level of uncertainty in assessments. For tuna stocks, it is not clear whether the quality and quantity of information allows an F_{MSY} management strategy to avoid sustainability problems with sufficiently high probability. Therefore, the Committee decided to investigate this and related problems using simulation modeling approaches.

There is a need for practical and pragmatic approaches to research and monitoring which will lead to improved assessments and precautionary management within reasonable time frames and within reasonable costs. Priorities for this research need to be based upon the contribution that a proposed research project makes to the assessment and status determination. The simulation framework proposed by the SCRS may be used to address just such issues. The evaluation of management control rules (harvest control rules) in the context of existing and proposed data collection systems can be examined in terms of adaptive experiments, the benefit of additional information and in prioritizing the options for proposed research.

A harvest control rule can be thought of as a pre-agreed course of management actions dependent on the status of the stock. It is a framework for incorporating limits and targets explicitly into the decision-making process. ICCAT's implicit control rule is that once biomass falls below B_{MSY} and/or fishing mortality substantially exceeds F_{MSY}, regulations should be enacted to reduce fishing mortality (by reducing fishing effort or imposing quotas corresponding to reduced levels of fishing mortality and fishing effort).

The performance of a harvest control rule can be evaluated through experimentation in simulation models. That is, scientists can mathematically specify complex ways in which they think the "real tuna world" operates, and then simulate the simpler ways in which we observe that world: the types of statistics collected (catch, effort, sizes, etc.) and methods of analysis used (stock assessments, estimation of reference points). This would allow them to test the reliability of assessment models as well as the effect of natural, long-term fluctuations, considering that reference points assume stationarity. Taking the simulation approach one step further, scientists could also simulate the performance of the management process by including a harvest control rule that links assessment and decision-making explicitly. In the context of the Precautionary Approach, this "experimental" procedure allows scientists and managers to address the costs and benefits associated with alternative degrees or types of conservation measures. The SCRS has chosen this avenue for further evaluation before making recommendations to the Commission on precautionary criteria. A prototype of the simulation model has already been developed.

Like all management decisions requiring scientific input, the process of establishing precautionary criteria requires two-way communication between Commissioners and scientists, since choices of risk and targets lie with the managers, whereas, determining likely consequences, impacts and uncertainties lie with the scientists. This could have implications on the scheduling and timing of the Commission's activities.

In parallel with the ICCAT activities, it should be noted that as a result of a recommendation made during the 1996 ICCAT Tuna Symposium in the Azores, the FAO is organizing an Expert Consultation on Implications of the Precautionary Approach for tuna fisheries, which will meet in Thailand in March, 2000. The FAO consultation will focus on four scientific themes: stock assessment, data collection, biological and environmental research, and fisheries technology. The consultation will draw upon knowledge generated directly by participating experts, as well as from other relevant work, such as ICCAT's. This type of collaboration should be highly beneficial in terms of identifying and confronting problem issues that are common to tuna fisheries in all oceans.

The SCRS requires additional evaluations (as mentioned above) before final determinations of precautionary limits can be made. It is expected that these activities will be sufficiently complete to report to the Commission at its 12th Special Meeting.

Appendix 11

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. 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 Working Group reported its deliberations to SCRS in 1998 and the SCRS recommended the following actions be taken to enhance the credibility of the Commission's scientific work: (1) That a professional fisheries population dynamics expert permanently attached to the Secretariat be hired to chair an Advisory Committee to SCRS, tasked with fostering more consistency in approach and assumptions made for various assessments as well as in the scientific advice provided to the Commission in Executive Summary Reports. (2) That the same individual convene a Working Group on Assessment Methods, with the aim of conducting performance evaluations of the available assessment models used in the various species groups, clarify the implicit assumptions for those methods, establish rules and guidelines on their appropriate use, normalize the methods applied, and maintain at the Secretariat, the software accepted for use by the various species groups. (3) That that individual further investigate and implement methods for broader scientific peer review procedures of the approaches used by the SCRS for assessing stock status and formulating management advice to the Commission.

Additionally, the SCRS recognized that in recent years, there has been a reduced level of staffing for the ICCAT Secretariat, while demands of the Commission and thus the species working groups have been increasing. The SCRS identified a critical need to identify inconsistencies in the currently available data base and to initiate development of a relational data base which would enhance the working of the species groups and to increase the Secretariat's efficiency in dealing with an ever increasing flow of information. Thus, the SCRS also recommended that the Commission fund and the Secretariat hire a biostatistician (in addition to the fisheries population dynamics expert identified above), to increase the efficiency of the Secretariat in meeting the needs of the SCRS species working groups.

The Ad Hoc Working Group on SCRS Organization met during the Species Group Sessions at ICCAT headquarters, October 4-8, 1999, to review progress on the recommendations made in 1998, and to specify in more detail the terms of reference for the Population Dynamics Expert who was hired as a result of the Working Group's recommendations.

Review of progress made on recommendations for enhancing the credibility of the Commission's scientific work

– Population Dynamics Expert

At it's 1998 meeting, the Commission agreed to provide the necessary funds to hire a professional fisheries population dynamics expert permanently attached to the Secretariat as recommended by SCRS in 1998, hence initiating the process recommended by SCRS for enhancing the credibility of the Commission's scientific work. In early 1999, the Secretariat, in consultation with SCRS Chairman and a search committee, broadly distributed a vacancy announcement for a professional fisheries population dynamics expert to be permanently attached to the Secretariat. The search committee reviewed applications of 17 highly-qualified applicants and recommended a selection to the Secretariat in late April, 1999. In early June, the recommended selectee was offered, subsequently accepted a contract for the position, and started employment with the Secretariat in September, 1999.

1 G. Scott (U.S.A.) Convener; J. Mejuto (EC-Spain), A. Fonteneau (EC-France), J. Porter (Canada), P. Miyake (ICCAT), V. Restrepo (ICCAT), J. Powers (SCRS Chair); unable to attend: J. H. Meneses de Lima (Brazil).

-- Advisory Committee

In 1998, the Working Group recommended that an Advisory Committee be established "to review the species group Detailed Reports of the stock assessments and the species group Executive Summary Reports for consistency in approach and assumption and for consistency in formulation of the scientific advice provided to the Commission". The Working Group noted that there were some doubts expressed at the 1998 SCRS Plenary Sessions about how exactly the role of the Advisory Committee would differ from that of the SCRS Plenary itself. The Working Group agreed that it was important to clarify the role intended for the Advisory Committee and to provide more details on the proposed activities to be carried out by the Advisory Committee, which are as follows.

The proposed Advisory Committee would essentially function as a review service for the SCRS, providing screening of the Detailed Reports and Executive Summary Reports of the species groups. Primarily, the Advisory Committee would comment on the appropriateness of the assessment (data and models) and on the adequacy of the draft management advice. If necessary, the Advisory Committee could draft alternative or additional research or management recommendations for consideration by the SCRS. The report generated by the Advisory Committee would be presented to the SCRS but would not be debatable for changes. However, it would be up to the SCRS Plenary to incorporate any recommendations made by the Advisory Committee into its own report.

The benefits to the SCRS would be primarily two: (1) Enhanced review of the assessments (currently, there is very limited time during the SCRS Plenary session to carry out any meaningful review of the scientific basis for the assessments), and (2) greater assurance that the management advice provided to the Commission will be consistent across species (currently there are many inconsistencies, and one of the causes for this is that the species groups function in complete independence of one another).

The benefits that would accrue to SCRS, however, come at some cost. The Committee discussed that by the nature of the proposed Advisory Committee, the discussions would not be conducted in the three official languages and thus some flexibility compared to the current system would be lost. To some extent, transparency would be lessened *if,* for instance members of the proposed Advisory Committee had inadequate national funding to support attendance at its meetings. Some flexibility could also be lost due to the relatively small size (fewer than 10 individuals) of the proposed Advisory Committee. Additionally, as presently proposed, the Advisory Committee would be comprised of same individuals who are in the SCRS.

The Committee agreed that a process to improve the way in which management advice is provided to the Commission is needed. Alternatives to the proposed Advisory Committee were not apparent and the Committee and the potential benefits are believed to outweigh the costs. Thus the Committee recommended that implementation of the Advisory Committee proceed on an experimental basis. However, it was recognized that the process for nominating Advisory Committee membership needs to be clarified by the Chairman of SCRS before proceeding.

In order to adequately serve the SCRS as outlined above, the Advisory Committee would have to meet after the assessments and before the SCRS Plenary. Generally speaking, the Advisory Committee would address only those species/stocks for which there is an analytical assessment made in a given year, and the relevant reports would need to be translated for assimilation by the Advisory Committee. This implies that the assessments would need to take place on or before early October and the Advisory Committee would meet after early to mid-November, followed by the SCRS Plenary. This further implies that the Commission could not meet until sometime in the following calendar year, if the Commission is to consider the most recent scientific advice on stock status from its Standing Committee on Research and Statistics.

As currently envisioned, the Advisory Committee would be formed by fewer than 10 individuals, so as to be effective and efficient. The Working Group proposes that the SCRS Chairman and the Population Dynamics Expert serve as permanent members to the Advisory Committee, and that the other members be nominated by the SCRS Chairman taking into consideration the needs of the SCRS and the objectives of the Advisory Committee. These members would be knowledgeable about the ICCAT scientific and decision-making process. It is also proposed that these members serve on a rotational basis such that individuals will serve more than one but less than four consecutive years.

The function of the Population Dynamics Expert with respect to the Advisory Committee would be to serve as Convener, providing continuity, and facilitating the Advisory Committee's functioning (*e.g.* by highlighting methodological issues that need to be addressed).

-- Peer reviews

In 1998, the Working Group noted that external reviews should be considered in the context of the work of the Advisory Committee. The Working Group reiterates the important role that external peer review has on the provision of scientific advice for management. The Working Group was pleased to note that this year a scientist from SPC is providing advice on the Bigeye Year Program's research plans. Ideally, though, peer review mechanisms should be formalized operationally and should function routinely. The Population Dynamics Expert should take a lead role in organizing peer review efforts made by ICCAT. The Working Group recommended that the Population Dynamics Expert prepare a paper in year 2,000 to propose different types of review activities that could take place in ICCAT, including budgetary implications. This information will be discussed by the Working Group inter-sessionally and reported to the SCRS next year.

-- Methods Working Group

In 1998, the Working Group recommended establishment of a Methods Working Group, to be chaired by the Population Dynamics Expert. Now that the Population Dynamics Expert has been hired, the Methods Working Group could become operational in year 2,000. The Working Group noted that both swordfish and bigeye species groups are making requests for the Methods Working Group to address.

The Working Group proposed that the organization of the Methods Working Group should be left up to its Chairman, the Population Dynamics Expert, who will refine terms of reference depending on the species groups' requests, in consultation with the SCRS Chairman. However, it was noted that data-related requests should be clearly left to the SCRS Sub-Committee on Statistics to consider.

Participation in meetings of the Methods Working Group should be open, but the Chairman will make an effort to "recruit" experts in the topics being addressed, inside and outside the ICCAT milieu. Participation by outside experts would involve an additional cost of about $4,000 per expert per meeting which should be considered in the ICCAT budget.

-- Miscellaneous Population Dynamics Expert activities

The Population Dynamics Expert should participate in stock assessments. At his discretion, in consultation with the Secretariat, if time allows, the Population Dynamics Expert should participate in other activities that support his role in improving the quality of ICCAT's scientific products.

The Working Group noted that the primary functions of the Assistant Executive Secretary and the Population Dynamics Expert are not to be directly involved in the preparation of detailed data inputs (e.g. CAS, CAGE, distribution maps, etc.) for the scientists or species groups, because such tasks, although important, would detract from the mandate to help improve ICCAT's science. The Working Group believes that these functions are mainly that of a Biostatistician, a position which the Commission has thus far not supported. Under the current staffing level of the Secretariat, assuming these functions by the Assistant Executive Secretary and the Population Dynamics Expert would continue to further undermine efforts to improve the quality of ICCAT's science enterprise and would likely reduce the Secretariat's ability to retain a highly qualified Population Dynamics Expert on staff.

-- Biostatistician

The Working Group reiterated that it is essential for ICCAT to hire a permanent biostatistician to help address the demands from the Secretariat which have kept increasing in recent years. The Biostatistician will play a key role in the modernization of the database and in the provision of data-analysis support to the species groups. As well, the Biostatistician ***is an essential position*** to ensure that the Assistant Executive Secretary and the Population Dynamics Expert will effectively perform their duties. The Working Group noted that the proposed work plan for development of a relational database submitted by the SCRS Sub-Committee for Statistics is dependent upon the hiring of a Biostatistician to be successful. In addition, managing the increasing flow of information available in the ICCAT data bases (historical and recent data concerning biology, tagging, fishery data, etc.), cannot be effectively accomplished without this position. This activity of the biostatistician will work in close cooperation with the various species groups and will allow easy and fast access to the highly valuable ICCAT information base, which is presently difficult to access for species group discussions, especially when multiple groups are meeting simultaneously.

-- Other matters

Work Plans. The Working Group noted that many species groups had developed Work Plans for the 1999 Species Group meetings this year, as was the recommendation made in 1998. This practice has helped in identifying the specific requirements for species group meetings in advance of the meetings. The Working Group reiterates its recommendation for outlining a work plan for assessments and species group meetings in advance of the species group meeting, as both the working group participants and the Secretariat would be aware of the specific expectations of the species group meeting.

Improvements to the current reports

-- Detailed Reports

In 1998, the Working Group recommended to improve detailed reports submitted in support of the stock assessment work carried out during the year. The Working Group reiterates its belief that it is important that the work carried out by species groups be replicable by future groups or others interested in SCRS assessments, and these reports are necessary for the Advisory Committee to proceed. In this regard, it is necessary for the working groups to compose sufficiently detailed reports to allow this to occur. For example, the input data used in stock assessment analyses should be clearly identified in the detailed reports prepared by the species groups. This would include the catch rate information and catch at age information used in analyses. Furthermore, although it has been previously recommended that the analytical software (VPA, production models, or other forms of assessment), input streams, and outputs from that software be provided to the Secretariat so that interested scientists not involved in the assessment meeting of the species group can have access to the information and methods used in developing assessment results. Species groups should also continue to strive to improve the graphical presentations of the available information, including observations of catch and effort distributions across the range of fleets harvesting the resource (fishing maps).

-- Effects of regulations report section

The Working Group discussed the report sections relating to effect of regulations. It has been observed that unnecessary time is spent attempting to examine complex compliance issues relating to the management recommendations agreed to by the Commission. It was felt that the scientific issue relating to the effect of regulations that should be addressed is the measurable effect, if any, on the status of the stock, rather than attempting to evaluate fishery-by-fishery compliance with regulation measures. With the advent of compliance table reports agreed to by the Commission at its 1998 meeting, it is recommended that evaluations of the effect of regulations reported upon in the future by the SCRS should be limited to the measurable effect on stock status.

-- Executive Summaries

The SCRS has previously established a policy regarding the form and content of the Executive Summary Reports, the primary vehicle by which scientific advice is provided to the Commission. The Working Group discussed that a number of organizations have provided favorable comments about the concise manner in which scientific advice to fisheries managers are provided through the SCRS Executive Summaries. For reference, the SCRS policy relating to the form and content of Executive Summaries can be found in the 1995 SCRS Report (Annex INF-95/4).