November 2004

Indian Ocean Tuna Commission
Commission des Thons de l'Océan Indien

Report of the Seventh Session of the Scientific Committee

Victoria, Seychelles, 8-12 November 2004

IOTC-2004-SC-R[EN]

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BIBLIOGRAPHIC ENTRY

IOTC. Report of the Seventh Session of the Scientific Committee. Victoria, Seychelles, 8-12 November 2004. *IOTC-2004-SC-R[EN]. 91 pp*

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1. OPENING OF THE SESSION

1. The Seventh Meeting of the Scientific Committee (SC) was opened on 8 November 2004 in Victoria, Seychelles, by the Chairperson, Dr. Geoffrey Kirkwood (United Kingdom), who welcomed the participants (Appendix I). The Meeting was attended by 26 participants from ten Members, one observer from FAO[1] and two invited experts.

2. While fully understanding the advantages in separating in time the meetings of the SC and the Commission, the SC noted with concern that there was a reduced participation of member countries to this meeting, in particular from Indian Ocean coastal states.

2. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION

3. The Scientific Committee adopted the Agenda as presented in Appendix II. The list of documents presented to the meeting is given in Appendix III.

3. ADMISSION OF OBSERVERS

4. Pursuant to Rule XIII.9 of the Rules of Procedure, the Scientific Committee acknowledged the presence of two invited experts from Taiwan,China.

4. PROGRESS REPORT OF THE SECRETARIAT

5. The IOTC Executive Secretary provided a brief verbal summary of Secretariat activities in 2004, and the SC noted the following matters:

- After a prolonged period of recruitment, the Secretariat is now approaching a full complement of staff. The Executive Secretary (Alejandro Anganuzzi) was appointed in April 2004; Deputy Secretary (Chris O'Brien) commenced work in October 2004; Julien Million is the full-time tagging assistant to Indian Ocean Tuna Tagging Programme (IOTTP); and Lucia Lepere who started in August is maintaining databases and processing data requests.
- The acquisition of information and updating of databases continued to be a major focus of the Secretariat's activities throughout the year.
- The IOTTP was also a major work activity for the Secretariat in 2004, especially the Executive Secretary. It is also expected to be major activity for the Secretariat in 2005.
- The following four Working Party meetings were held in 2004: Tropical Tunas in July, Tagging in July; Temperate Tunas in August, and Billfish in September/October.
- The development of the IOTC statistical software, FINSS (Fisheries INtegrated Statistical System — formerly known as WinTuna), continued during 2004. The FINSS User's Manual was completed in September.

6. The SC congratulated the Secretariat on the amount and quality of the work performed under difficult circumstances during the last year.

5. DATA COLLECTION AND STATISTICS

7. Prior to 2004, the permanent Working Party on Data Collection and Statistics (WPDCS) met before the Scientific Committee meeting then reported their deliberations to the SC. In 2004, the SC Chair conducted the Data Collection and Statistics item as a plenary session of the Scientific Committee.

[1] Food and Agricultural Organisation of the United Nations

8. **At the conclusion of agenda item 5, the SC recommended that at future SC meetings, Data Collection and Statistics should be a permanent agenda item to be addressed by the SC in plenary. However, a special Data Collection and Statistics group may be formed if required.**

5.1 Status of the IOTC Databases

9. Document IOTC-2004-SC-INF01 described the main activities carried out in relation to data acquisition and data processing since the last WPDCS meeting, and the status of the databases at the IOTC Secretariat.

10. The SC noted the following problems:

- *Late reporting:* Timeliness of reporting deteriorated during 2004; almost no 2003 catch statistics were available before the deadline of 30 June 2004. Late reporting of data greatly reduces the ability of working parties to provide up-to-date advice on stock status to the Commission. A summary of the state of data submissions for 2003 is provided in Appendix IV.
- *Catches series not available*: The catches of some fleets known to operate in the Indian Ocean have never been reported to the Secretariat: these include the catches of large longliners (NEI-DFRZ[2]) operating under several flags mainly Belize, Equatorial Guinea and Panama in recent years. Although the Secretariat has been estimating their catches, the estimates are highly uncertain.
- *Underreporting of catches*: The catches reported for several fleets are apparently incomplete; these include the large longliners from Seychelles and the EC, fresh tuna longline vessels from Indonesia, industrial purse seiners from Iran and several artisanal fisheries, mainly a gillnet fishery operating off Yemen.
- *Catches not reported by species and/or gear*: These include the catches of 7 to 11 industrial purse seiners (NEI-PS) operating under the flags of Belize and Panama in recent years and several artisanal fisheries, mainly in Indonesia and India.
- *Lack of catch and effort information* for non-reporting longline fleets (fresh tuna longliners from Taiwan,China and NEI-DFRZ), the purse seine fishery of Iran, the longline fisheries of Indonesia and Seychelles and many artisanal fisheries, mainly Indonesia, India and the baitboat fishery of Maldives (since 1994).
- *Poor quality catch and effort data* for longliners of the Republic of Korea, Philippines and Taiwan,China (some years) and NEI-purse seiners.
- *Lack of size frequency data* for NEI-PS, most industrial longline fleets, namely Taiwan,China (since 1989), Philippines, Seychelles, and NEI-DFRZ, and important artisanal fisheries (Maldivian baitboats since 1998, gillnets of Yemen and Indonesian artisanal fisheries).
- *Low sample sizes of size frequency data* for Japanese (recent years) and Korean longline fisheries and many artisanal fisheries.

11. While SC members congratulated the IOTC Secretariat on the excellent access to data from the IOTC databases, they were highly concerned about the negative impacts that the above matters have on the stock assessments which use the data.

12. **The SC strongly recommended that the Commission take steps to address the above issues as a first step to reducing the uncertainty in current stock assessments.**

[2] NEI (Not Elsewhere Included – pertains to non-reporting fleets,) - DFRZ (deep freezing longliners) and PS purse seiners

5.2 Review of data on species

13. Data problems were further elucidated by discussions on the species specific data related problems identified by the Working Parties for Tropical Tunas (IOTC-2004-WPTT-R[EN+FR]), Billfish (IOTC-2004-WPB-R[EN+FR]) and Temperate tunas (IOTC-2004-WPTMT-R[EN+FR]).

14. For tropical tunas, the SC acknowledged the current data issues. In particular, the SC expressed the need to review the Republic of Korea's data as this has the potential to be a valuable input into stock assessments. The IOTC Secretariat was tasked with working with the Korean Scientists over the next year and reporting back to the SC in 2005.

15. For billfish the SC acknowledged the current data problems, including the problem of declaration of catches aggregated by groups of species, and the lack of size frequency data from most fisheries, in particular gillnet fisheries.

16. For temperate tunas, the SC identified the lack of size frequency data as the main problem, in addition to the general uncertainties related to data from longline fleets.

17. The SC also expressed its concern about the timeliness of data delivery to the Secretariat as the current delays in reporting data adversely affect the currency and therefore the usefulness of stock assessments. Currently, the 2004 assessments use data up to the end of 2002. The SC agreed that it was highly desirable that stock assessments include data from the previous year.

18. **The SC recommended that particular attention be given to submission of data on species for which the Working Parties will be conducting an assessment.**

19. **The SC strongly recommended that countries should make every effort to improve the timeliness of data transfer to the Secretariat. This includes data from both the artisanal and industrial sectors.**

20. The SC was highly appreciative of the efforts of Taiwanese scientists in 2004; in particular for their participation in all working parties, providing access to the valuable Taiwanese fisheries datasets and contributing to analyses.

5.3 Progress Report of the IOTC-OFCF Project

21. The activities of the IOTC-OFCF[3] Project during 2004 (its third year of operation) were described in IOTC-2004-SC-03[EN+FR]. Highlights included:

- A Regional Workshop on Data Collection and Statistical Systems to provide a forum for sharing experiences and ideas about fisheries statistical systems. The report on this workshop and a summary of country reports was published in September and will be distributed to institutions and libraries in the region.
- The appointment of Mr. Shunji Fujiwara as a Fishery Technical Expert to the Project.
- Advances in the Indonesian sampling programmes leading to an improved capability to estimate catches of the large fleet of fresh-tuna longliners.
- Continued funding and technical assistance for the sampling programme in Phuket, Thailand.
- An agreement with the Marine Research Centre of Maldives (MRC) to provide support for extending the coverage of their size-frequency sampling of tuna. The MRC has committed to carry on the sampling, independently of the IOTC-OFCF Programme from 2005.

[3] Indian Ocean Tuna Commission - Overseas Fishery Cooperation Foundation of Japan

- A Memorandum Of Understanding (between the National Aquatic Resources Research and Development Agency (NARA), IOTC and OFCF) to support the existing (size frequency) sampling programme conducted by NARA, and improve catch estimates of tunas and swordfish.

- Conducting a training programme on the collection of fisheries data, collection of data for the estimation of catches on tuna and tuna like fisheries, FINSS (formerly known as 'WINTUNA'), data transfer and validation tools and extracting data from FINSS in Jakarta in December 2004.
- Production of the FINSS User's Manual.
- In February 2005, a training course on data processing and database management will be held in Seychelles.

22. The document also provided a preliminary work plan for 2005/2006. Proposed activities included:

- Given the importance of the catches from Indonesia, it is expected that the Indonesian project will still receive significant support in 2005-06. However, special emphasis will be placed in the gradual transfer of the activities to Indonesian authorities.
- Support to the (Phuket) Thai and Sri Lankan sampling programmes.
- Possible missions to Thailand to provide assistance in reviewing and improving the current system for collecting data from its artisanal fisheries.

23. The SC endorsed the proposed IOTC-OFCF work plan for April 2005 – March 2006 in principle, noting that the final plan will be determined by IOTC and OFCF in the Joint Committee Meeting to be held in April 2005. Furthermore, the SC encouraged members to begin thinking about the future of the project beyond March 2007.

5.4 Guidelines for observer programmes

24. In response to the recommendation of the Working Party on Data Collection and Statistics in 2003, a review of observer programmes from the EU, USA, Canada and Japan was presented to the SC (IOTC-2004-SC-INF09). The SC commended the author for the work that has gone into the review.

25. Noting that the nature and extent of observer programmes vary widely, the SC noted that the Commission would have to clearly specify its requirements for any future observer programme, but that the above report was a useful starting point should the SC be requested to provide input to the design of such a programme in the future.

26. A small group of SC members, coordinated by Dr T. Nishida (Japan), agreed to correspond intersessionally with a view to proposing standards required for observer programmes in anticipation of any requirements from the Commission.

5.5 Progress on a survey of predation of longline-caught fish

27. The SC noted that Japan is currently conducting a five year survey to examine predation of longline caught tuna and tuna related species (IOTC-2004-SC-INF07). This survey is due to end in August 2005. The SC noted the timetable of work and analyses outlined in the above paper and agreed that the planned workshop on this topic should be held after the analyses have been completed. This is likely to be in late 2006 or 2007.

5.6 Preparation of a Field Manual

28. In 2003, the Working Party on Data Collection and Statistics recommended that the IOTC Secretariat develop a proposal for an IOTC Field Manual. Such a proposal was presented in IOTC-2004-SC-INF08.

29. The SC noted that the preparation of an IOTC Field Manual was well advanced as the major parts of such a document were required for a training workshop to be held in Indonesia in December as part of the IOTC-OFCF project. The SC noted that some information is being developed or is already available in manuals developed by other tuna commissions, and every effort should be made not to duplicate work.

30. **The SC noted that a Glossary of Fisheries terms is to be included in the manual, and recommended building upon existing glossaries such as those from ICCAT[4] and FAO.**

31. **The SC recommended that the work on the manual be continued**, and looked forward to reviewing the manual at its next meeting. The SC also briefly discussed the costs of production and distribution of the manual, noting that IOTC does not have funds budgeted to cover these aspects. Noting the important contribution such a manual will have in improving fisheries data and statistics, the SC urged IOTC to hold discussions with OFCF to explore the possibility of OFCF contributing to the costs of production and distribution.

6. PRESENTATION OF NATIONAL REPORTS

32. National Reports were presented by EU-France (IOTC-2004-SC-INF02), EU-Spain ((IOTC-2004-SC-INF03), UK (IOTC-2004-SC-INF04), South Africa (IOTC-2004-SC-INF06), Japan (IOTC-2004-SC-INF07), China (IOTC-2004-SC-INF14), Australia (IOTC-2004-SC-INF15), Republic of Korea (IOTC-2004-SC-INF16), Seychelles (IOTC-2004-SC-INF17), and France, Mayotte (IOTC-2004-SC-INF18). Abstracts of these reports are located in Appendix V.

33. In addition, Thailand and Sri Lanka provided the Scientific Committee with verbal updates of their National Reports.

34. SC noted the following update on the Taiwanese fisheries provided by the invited experts. In 2003, 373 large tuna longliners (>24 m) and some small longline vessels fished in the Indian Ocean. Of the large vessels, there were 341 frozen tuna longliners and 32 fresh tuna longliners. The number of frozen tuna longliners increased by 29 since 2002 (9 from other oceans and 20 being ex-FOC deep longliners that re-registered as Taiwanese). The total catch of frozen tuna and tuna-like species was 116,500 t in 2003. Fresh bigeye and yellowfin tunas catch was 17,000 t in 2003 (compared with 23,000 t in 2002). The fresh tuna catch is typically made up of 40% bigeye tuna. Frozen bigeye catch in 2003 was about 57,000 t, an increase of 13,000 t from 2002. This increase was due to an increase in the number of deep longliners, significant target-shifting from albacore to bigeye by some vessels due to a substantial decline of albacore price, and good fishing conditions in waters off Tanzania and Seychelles. The latter resulted in the increase of fishing vessels applying for fishing license by 144% (72) for Tanzania and by 75% (60) for Seychelles in 2003, respectively. Frozen yellowfin catch was 23,000 t in 2003, a similar high level comparing to the previous years. Most of the catch was taken in the waters off Oman and India. The albacore catch in 2003 was 11,000 t, down by 15,000 t from 2001 due to a major drop in the market price for albacore and a consequent shift to targeting bigeye. The swordfish catch was 13,000 t, well below the high catches (17,000-18,000 t) of the mid-1990′s. The SC was encouraged by plans by Taiwan,China to improve data quality (focusing on the data processing systems, increasing data sources for cross-checking and data verification). The experimental observer programme launched in 2001 was expanded in 2004. Two observing trips were made in 2003. The programme has been expanded in 2004 and three observers are observing six trips in the Indian Ocean (collecting information on target and bycatch species, and biological data/samples for various research studies).

35. The SC agreed that the GAO database (used to facilitate access by fisheries scientists to environmental data) noted in the EU-France report should be made available on the IOTC website.

36. The SC welcomed the National Report from South Africa, noting that there is a paucity of tuna fisheries information available from South African waters (and that the South African fisheries operate across an area of particular scientific interest i.e. the waters of the Atlantic and Indian Oceans continuum). The SC also noted South Africa’s intention to seek IOTC Cooperating Non-contracting Party status as a first step to becoming a Cooperating Contracting Party.

37. The SC noted that many EU fishing vessels partially shifted their landing operations from Seychelles to Mombassa (Kenya) in 2003 where catch sampling was not undertaken. If this situation arose again in the future, the EU scientists plan to send a sampling team to Mombassa to collect the data.

38. The SC noted a presentation on seabird tropical ecology by scientists from La Réunion (France) investigating seabirds as indicators of the state of the environment in the western Indian Ocean.

[4] International Commission for the Conservation of Atlantic Tunas

39. The SC also noted a presentation on the activities of the Food and Agriculture Organisation of the United Nations (FAO), Marine Resource Service. This included a summary of the objectives, activities and results of FAO's Project on the Management of Tuna Fishing Capacity: Conservation and Socio-Economics. An update of FAO's Fisheries Global Information System (FIGIS) was also provided and the SC noted the catch data and other information on tuna and tuna-like species that are available from that System. The SC received an overview of the 2003 meeting of FAO's Committee of Fisheries, together with FAO's activities resulting from that meeting (including a range of expert and technical consultations).

40. The SC expressed their appreciation for the important work FAO does on tuna fisheries matters at the global level.

41. The SC noted the proposed experimental fishing research programme, document IOTC-2004-SC-INF05, to examine the feasibility of developing a new longline fishery for tropical tuna in the south-western Indian Ocean, bearing in mind the environmental impact of this type of fishing. The suitability of using new hooks and different kinds of bait will be studied in an attempt to be more selective in the catches, maintaining target species catch rates but reducing the catch of bycatch species considered to be "sensitive" (the case of marine turtles) and of no commercial value. Biological information will be collected and opportunist tagging will be carried out. The cruise will be carried out by two Spanish longliners with the permanent presence of scientific observers from IEO. The work will start in December 2004 and continue for a period of 12 months.

7. STATUS OF TUNA AND TUNA-LIKE RESOURCES IN THE INDIAN OCEAN

7.1 Report of the Working Party on Tropical Tunas (WPTT) and presentation of the Executive Summaries

42. The Sixth Meeting of the Working Party on Tropical Tunas (WPTT) took place in Victoria, Seychelles, 13-20 July 2004. The WPTT Chair introduced the 2004 WPTT report (IOTC-2004-WPTT-R[EN+FR]) and executive summaries covering the status of bigeye, yellowfin and skipjack tunas. The stock assessment for bigeye was revised in 2004.

43. The SC praised the valuable collaborative effort of the Japanese and Taiwanese scientists working on the bigeye CPUE data in 2004, supported by the Secretariat, and strongly encouraged this to continue into the future.

44. The SC noted with concern the apparent diverging trends in the percentages of bigeye tuna in the catches taken by Taiwanese and Japanese longline fleets operating in the main equatorial bigeye fishing grounds of the Atlantic and Indian Oceans. In the Atlantic, percentages of bigeye tuna in the catches have been consistently high, and very similar for the two fleets up to 2002. By contrast, in the Indian Ocean, the percentages of bigeye tuna in the catches of the two fleets (which were almost identical up to until the early 1990's) have, since 1995, diverged. For the Japanese fleet there has been a constant decline in the percentages of bigeye in the catches (with a concomitant decline in the bigeye catch rates), while for Taiwanese fleet, the percentages have remained stable (and catch rates have increased).

45. The Scientific Committee endorsed the research recommendations of the WPTT and commended it for its work in 2004.

46. **In addition, the SC recommended that national scientists and the WPTT address the following matters in 2005:**

- *The marked difference in the trends of the Japanese and Taiwanese bigeye CPUEs over the last 10 years*. Progress could be achieved on this issue if (i) further analysis of the catch and effort data from these fleets is undertaken using the two approaches determined by a small working party of the WPTT and outlined in Appendix V of IOTC-2004-WPTT-R[EN+FR] and (ii) extra information on targeting and fishing practices is obtained. The SC believed that the best opportunities to collect this information (e.g. depth reached by the various segments of the lines, targeting and species composition) would be through observers.

- *Verification of the quantities and species composition of tunas reported in longline log books*. This will be achieved by increasing the extent of port sampling of landings by longliners, especially for those fishing bigeye and yellowfin in the equatorial areas.

47. The Executive Summaries for yellowfin, bigeye and skipjack tunas, as adopted by the Scientific Committee, are provided in Appendix VI.

48. The SC was briefed on the 2nd World Bigeye Tuna Meeting held in Spain (ICCAT) in March 2004. The SC noted that the report and documents from this meeting are now available on the ICCAT website.

7.2 Report of the Working Party on Billfish (WPB) and presentation of the Executive Summary

49. The Fourth Meeting of the Working Party on Billfish (WPB) took place in Mauritius, 27 September to 1 October 2004. In the absence of the WPB chair, the Secretariat introduced the 2004 WPB report (IOTC-2004-WPB-R[EN+FR]) and Executive Summary for swordfish. The stock assessment for swordfish was updated in 2004.

50. The Scientific Committee endorsed the research recommendations of the WPB and commended it for its work in 2004.

51. The SC noted that there is a Fourth International Billfish Symposium will take place in Coronado, California (USA), in November 2005, and proposed that the next meeting of the WPB be timed to take place after this meeting in 2006.

52. The Executive Summary for swordfish, as adopted by the Scientific Committee, is provided in Appendix VI.

7.3 Report of the Working Party on Temperate Tunas (WPTMT) and presentation of the Executive Summary for albacore

53. The First Meeting of the Working Party on Temperate Tunas (WPTMT) took place in Shimizu, 2-5 August 2004. In the absence of the WPTMT chair, the Secretariat introduced the 2004 WPTMT report (IOTC-2004-WPTMT-R[EN+FR]) and the Executive Summary for albacore. A stock assessment for albacore was attempted for the first time in 2004.

54. The Scientific Committee endorsed the research recommendations of the WPTMT and commended it for its work in 2004.

55. The Executive Summary for albacore, as adopted by the Scientific Committee, is provided in Appendix VI.

56. The SC noted the contents of a report on the biology, stock status and management of southern bluefin tuna (attached as Appendix VII) and thanked CCSBT for providing it.

Management Advice

Yellowfin tuna (*Thunnus albacares*)

Considering all the stock indicators and assessments, as well as the recent trends in effort and total catches of yellowfin, the Scientific Committee considered that:

1) Total catches under current (2002) fishing patterns were close to, or possibly above MSY[5]. In these circumstances, any further increase in both effective fishing effort and catch above levels in 2000 should be avoided.
2) The current trend for increasing fishing pressure on juvenile yellowfin by purse seiners fishing on floating objects is likely to be detrimental to the stock if it continues, as fish of these sizes are well below the optimum size for maximum yield per recruit.
3) The Scientific Committee also noted that juvenile yellowfin tuna are caught in the purse-seine

[5] Maximum Sustainable yield

fishery that targets primarily skipjack tuna. Some measures to reduce the catches of juvenile yellowfin tuna in the FAD[6] fishery will be accompanied by a decrease in the catches of skipjack tuna.

In interpreting the high catches of 2003 and 2004, the SC noted that if the hypothesis of an increase in biomass is correct, such increase is most likely the result of just two exceptional recruitments and not necessarily a long-term increase in productivity of the stock. Under these circumstances, increased catches from these year classes are unlikely to be detrimental to the stock.

On the other hand, there could be serious consequences if the hypothesis that there was only an increased catchability during 2003 and 2004 is correct. In this case, the very large catches would represent a much higher fishing mortality and, certainly, would not be sustainable. Furthermore, they would lead to a rapid decline of the existing adult biomass of yellowfin tuna and a serious over-exploitation of the stock, according to the status of yellowfin tuna as assessed in 2002. If such is the case, urgent management actions might be needed to reduce fishing mortality, from the 2000 level.

Skipjack tuna (*Katsuwonus pelamis*)

The Working Party on Tropical Tunas has not made any specific management recommendations for the skipjack stock. However, the life history characteristics of skipjack tuna, the information presented in the documents reviewed, and the information in the stock status indicators prepared during the meeting suggests that there is no need for immediate concern about the status of skipjack tuna.

Bigeye tuna (*Thunnus obesus*)

The results of further assessments of the bigeye tuna stock using age-structured production models presented in 2004 to the WPTT are more pessimistic than previous assessments.

The Scientific Committee had already noted with concern the rapid increase of catches of bigeye tuna at its meeting in 1999. Since then, catches have decreased for two of the past three years. Nevertheless, taking into account the results of the current assessment, which represents the best effort to date to analyze the available data in a formal context, it is likely that current catches are still above MSY and it is possible that fishing effort has exceeded the effort that would produce MSY.

The current level in catch in numbers of juvenile bigeye tuna by purse seiners fishing on floating objects is likely to be detrimental to the stock if it continues, as fish of these sizes are well below the optimum size for maximum yield per recruit.

The Scientific Committee also noted that juvenile bigeye tuna are caught in the FAD purse-seine fishery that targets primarily skipjack tuna. Some measures to reduce the catches of bigeye tuna in this fishery could be expected to result in a decrease in the catches of skipjack tuna.

The Committee recommends that a reduction in catches of bigeye tuna from all gears, eventually to the level of MSY, be started as soon as possible and that fishing effort should be reduced or, at least, it should not increase further.

Albacore (*Thunnus alalunga*)

A stock assessment for Indian Ocean albacore (*Thunnus alalunga*) was attempted in 2004 by the Working Party on Temperate Tunas. Results of the analyses conducted were considered unreliable, although one of the results suggested that current catch levels might not be sustainable. Other

[6] Fish aggregating device

indicators, such as the average size in the catch and catch rates, have not shown declines in recent years.

Taking into account the absence of a reliable assessment of the status of albacore tuna and the need for a precautionary approach, the SC recommended that the Commission be very cautious in allowing increases in catch or fishing effort until the problems with the assessments have been resolved.

Swordfish (*Xiphias gladius*)

On the basis of the stock indicators the SC concluded that the current level of catch (about 30,000 t) is unlikely to be sustainable. Of particular concern are the trends in abundance of swordfish in the western Indian Ocean, where the highest catches are currently taken. The spatial structure of the CPUE suggests that there may already be overfishing of swordfish in the southwest Indian Ocean. However, these reductions in catch rates have not been accompanied by reductions in average size of the fish in the catch, as has been the case in other oceans. The SC expressed concern regarding the very rapid increase in effort targeting swordfish in other areas of the Indian Ocean and the relatively large incidental catch of swordfish in fisheries targeting bigeye. These increases in effort exploiting swordfish have continued since 2000.

The fact that large, rapid increases in fishing effort followed by a reduction in catch rates have been seen in the southwest Indian Ocean indicates that this might also occur in other areas where fishing effort directed to swordfish is increasing rapidly.

The SC recommends that management measures focussed on controlling and/or reducing effort in the fishery targeting swordfish in the southwest Indian Ocean be implemented. Similar measures may be needed in the future if reductions in catch rates are detected in other areas of the Indian Ocean.

8. ACTIVITIES IN RELATION WITH THE INDIAN OCEAN TUNA TAGGING PROGRAMME (IOTTP)

8.1 Report of the Working Party on Tagging (WPT)

57. The report of the Sixth Session of WPT (IOTC–2004-SC-WPT-R[EN]) was presented by the WPT Chair. Significant progress has been achieved on a number of elements of the programme and a number of problem areas were also identified.

58. It was noted with satisfaction that Japan has increased the amount of funding available to the programme to US$250,000 (maximum) per year for three years.

59. It was also acknowledged that Thailand, as it imports large quantities of tuna for its local canneries, was an important participant of the IOTTP. However, currently there has been little dissemination of information about the programme in this country. It was noted that Thailand is appointing a National Tagging correspondent to provide liaison with the IOTTP.

60. The issue of securing live bait for the IOTTP project is still a major problem. The Scientific Committee indicated that this being a critical issue, it should be given high priority. The SC endorsed the various initiatives in this area and pledged its support for any bait expert consultation that would examine the potential of different bait species in the region, should it be organised by the projects Chief Coordinator.

61. **The SC recommended that IOTC should secure access to EEZs and coastal areas for the purpose of obtaining bait for the programme as soon as the tagging vessels have been selected. Additionally, it recommended that the possibility of using artificial bait be studied in more detail and encourages Japanese**

Scientists and industry to provide help in this regard. The SC also recommended that live bait purchased from farms should be seen as an option and quotations for prices should be obtained as soon as possible.

62. The current status of the work on the tagging simulation models was discussed. Two different models are in development, and results are expected to be available next year.

63. **The Scientific Committee recommended that an extra day be allocated in association with the next WPTT meeting, to allow evaluation and discussion of the results from the tagging simulation models, if they are available in time.**

64. A proposal for increasing the use of electronic (archival) tags was discussed (IOTC-2004-SC-INF11). The SC agreed that the information provided by electronic (archival) tags is extremely important and would be impossible to obtain through other means, so it recognised the merits of the proposal. It was noted that current budget already has provisions for 200 of these tags. **The SC supports this project but, acknowledging the budgetary implications, recommended that external sources of funding for the additional archival tags should be sought.**

65. Regarding publication and dissemination of tagging data, the Scientific Committee indicated that this should follow existing Secretariat confidentiality guidelines, when required.

8.2 Current status of the Regional Tuna Tagging Program –Indian Ocean (RTTP-IO) arrangements

66. The SC was briefed about the current status of RTTP-IO arrangements. It was noted that this a IOC project, and the Secretariat was acting in capacity of supervisor of the project. A chief coordinator and project manager have already been selected, and tenders for the provision two pole-and-line vessels are currently been studied. If a tender is approved, the boats should be available early next year.

67. The Scientific Committee commended Seychelles Government and Seychelles Fishing Authority for making available three large offices for the project in Victoria.

68. The Scientific Committee noted with concern that the approved RTTP-IO does not include provisions for funding all the tagging technicians required. On the other hand, it acknowledged that training in tagging techniques, in association with the programme was an integral part of the RTTP-IO. The SC strongly encouraged IOTC countries to take advantage of this excellent opportunity to up-skill their staff by providing trainees for the tagging crews.

69. Furthermore, the SC noted that the administrative rules on the EU funding make it impossible to engage nationals of non-ACP[7] countries (or non-EU) in the RTTP-IO and this results in the exclusion of technicians from Indian Ocean countries (which are not in Africa)..

70. The Scientific Committee indicated its concerns about the constraints described by the Secretariat concerning the funding for the participation of nationals of non-ACP countries in the activities of the RTTP-IO. **The SC recommended that, if the Commission wishes to ensure equal participation of all IOTC Members in the RTTP-IO activities, external sources of funding may need to be identified.**

8.3 Report on recent activities related to the IOTTP

8.4 Small-scale tagging projects

71. **The SC noted with satisfaction the progress achieved in the various small-scale tagging programmes, and recommended that support of these projects be continued**.

[7] African, Caribbean and Pacific

8.6 Progress on a tag seeding experiment

Discussions on the above three agenda items were held in combination and are reported as such below.

72. The IOTC Secretariat reported on a broad range of activities relating to the IOTTP undertaken over the last 12 months. These include the commencement of pilot and small-scale tagging programmes in Mayotte, Maldives, Eastern Indian Ocean (SEAFDEC[8] and NRIFSF[9]), and Seychelles (Document IOTC-2004-SC-INF19), as well the progress of recent tag seeding experiments.

73. The relatively low tag recovery rates from some of the small-scale tagging programmes were discussed. Inadequate publicity and lack of publicity materials might be among the main causes. It was agreed that the current seeding programmes and the continuation of the small-scale and regional tagging programs would increase awareness among participant parties.

74. The SC also recognised that participation in observer programmes, in particular by longline vessels, is important to help estimate tag recovery and reporting rates. **To this end, the Scientific Committee recommended that existing and future observer programmes in the Indian Ocean should brief their observers to assist in this matter.**

75. The SC agreed that seeding experiments are an important part of the project, since they allow estimating rates of reporting from different stages of the fish handling, such and unloading and processing. In this sense, they should continue throughout the IOTTP. **The SC recommended that seeding experiments should be carried out regularly during the IOTTP through existing observer programmes, since this might be the only reliable way to estimate tag reporting rates.**

8.5 Progress Report on FADIO activities

76. The Scientific Committee was updated on recent activities and tagging operations in the Western Indian Ocean that have taken place in the context of the FADIO[10] project. These are small-scale tagging activities taking place in collaboration to the IOTTP. The main objectives are tagging of tunas normally not available to the pole-and-line gear, which is the primary gear that will be used by the IOTTP and tagging of tunas and other pelagic species associated to Fish Aggregating Devices (FAD).

77. In 2004, the operations included the collocation and recovery of several archival tags of on FAD-associated pelagic species and further experiments to test and calibrate their echo sounders and sonars.

78. The Scientific Committee remarked the usefulness of this kind of information in the understanding of the biology of the species and the behaviour of fish associated to FADs. It encouraged the FADIO project to continue its experiments and, if possible, to extend them to bigeye tunas.

79. The SC recommended that the close cooperation between FADIO and the IOTTP be continued.

9. SCHEDULE OF WORKING PARTY MEETINGS IN 2005/2006

80. The Scientific Committee agreed to the following schedule of working party meetings for 2005 and 2006.

81. The SC was pleased to note the scheduling of the first meeting of the Neritic Tunas Working party for April 2005 in the Islamic Republic of Iran,

8 Southeast Asian Fisheries Development Center

9 National Research Institute of Far Seas Fisheries (NRIFSF) of Japan

10 Fish Aggregating Devices as Instrumented Observatories of pelagic ecosystems

WORKING PARTY	2005	2006
TROPICAL TUNAS	20-25 JUNE PHUKET	19-23 JUNE SEYCHELLES
TEMPERATE TUNAS	-	TBA
NERITIC TUNAS	4-9 APRIL BANDAR ABBAS (IR IRAN)	
BILLFISH	-	MARCH TBA SRI LANKA
METHODS	-	-
BYCATCH	*OPERATING BY EMAIL*	*OPERATING BY EMAIL*

9.1 Progress on the establishment of a Working Party on Bycatch

82. The Chairman of the Working Party on Bycatch will communicate with members of the SC with a view to identifying those scientists who wish to participate by correspondence in this Working Party.

10. ANY OTHER BUSINESS

10.1 Submission of abstracts to the Aquatic Science and Fisheries Abstracts

83. The Secretariat informed the SC on the progress regarding the submission and publication of abstracts of IOTC documents through the Aquatic Science and Fisheries Abstracts (ASFA). The SC noted that the IOTC had been granted membership of ASFA and that FAO is taking care of the preparation of all documents relating to years prior to 2003 (completion of this work is scheduled for September 2005 or earlier).

84. The Secretariat further informed that the IOTC shall prepare all documents relating to 2003 and following years to be included into the ASFA database with costs estimated at $US1,000.

85. The SC noted that the ASFA database is one of the most complete bibliographic tools available and **recommended that the Secretariat make the necessary budgetary arrangements to assure that all relevant IOTC documents are available through the ASFA database**.

10.2 Glossary of fisheries terms

Covered in agenda item 5.6

10.3 Preparation of a Fishery Atlas

86. Document IOTC-2004-SC-INF10 presented a proposal for the publication of an IOTC Atlas following a recommendation from the SC in 2003. The document contained details on the atlas contents and estimates of the labour and costs that would be needed to complete this task. The budget outline from the proposal is attached as Appendix VIII.

87. The SC noted that this type of publications is useful, and agreed in principle with the proposed contents and acknowledged the scale of the proposed budget (about $US100,000). It was noted, nevertheless, that the

contribution of staff from the Secretariat to such a publication was not possible in the foreseeable future due to the Secretariat's current workload.

88. **The SC noted that the involvement of FAO and/or IRD in the publication of the Atlas could reduce the costs, and recommended that this be examined.**

89. **The SC expressed its support for the production of an IOTC Atlas and recommended that the Commission explore ways to finance its publication.**

10.4 Relationship with other tuna commissions

90. The SC noted that the flow of information about IOTC scientific activities and those of other tuna commissions and regional fishery bodies is poor. The SC stressed that there are considerable advantages to be gained from sharing of information between regional tuna organisations.

91. **To this end, the SC recommended that, when appropriate, members of the SC already attending relevant meetings of regional fisheries bodies be designated to represent the SC, provide a brief update on IOTC scientific activities, and to report back on the activities of those fisheries bodies.** The SC stressed that these activities should not have budgetary implications to the IOTC.

10.5 Election of next Scientific Committee Chair and Vice Chair

92. The SC unanimously re-elected Dr Geoffrey Kirkwood (United Kingdom) and Prof. Xu Liu Xiong (People's Republic of China) as Chair and Vice Chair of the Scientific Committee respectively for next biennium (2005 and 2006). The SC thanked the Chair and Vice Chair for their valuable contributions over the last two years and looked forward to continuing to work under their guidance for the next two years.

11. ADOPTION OF THE REPORT

93. The Report of the Seventh Session of the Scientific Committee was adopted on 12 November 2004.

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APPENDIX II. AGENDA OF THE MEETING

Refer to IOTC-2004-SC-01[EN+FR] for the full, annotated agenda

1. **OPENING OF THE SESSION**
2. **ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION**
3. **ADMISSION OF OBSERVERS**
4. **PROGRESS REPORT OF THE SECRETARIAT**
5. **DATA COLLECTION AND STATISTICS**
   - **5.1 Status of the IOTC Databases (IOTC-2004-SC-INF01)**
   - **5.2 Review of data on species**
     - ***5.2.1 WPTT***
     - ***5.2.2 WPB***
     - ***5.2.3 WPTMT***
   - **5.3 Progress Report of the IOTC-OFCF project (IOTC-2004-SC-03[EN])**
   - **5.4 Guidelines for observer programmes**
   - **5.5 Progress on a survey of predation of longline-caught fish**
   - **5.6 Preparation of a Field Manual (IOTC-2004-SC-INF08).**
6. **PRESENTATION OF NATIONAL REPORTS**
7. **STATUS OF TUNA AND TUNA-LIKE RESOURCES IN THE INDIAN OCEAN**
   - **7.1 Report of the Working Party on Tropical Tunas (WPTT) (IOTC-2004-WPTT-R[EN]) and presentation of the Executive Summaries**
     - ***7.1.1 Executive Summary of the status of the yellowfin tuna* (IOTC-2004-SC-04[EN]).**
     - ***7.1.2 Executive Summary of the status of the skipjack tuna* (IOTC-2004-SC-05[EN]).**
     - ***7.1.3 Executive Summary of the status of the bigeye tuna* (IOTC-2004-SC-06[EN]).**
     - **7.1.4 *Report on the recent World bigeye tuna meeting.***
   - **7.2 Report of the Working Party on Billfish (WPB) (IOTC-2004-WPB-R[EN])**
     - ***7.2.1 Executive Summary on the status of swordfish resource* (IOTC-2004-SC-07[EN]).**
   - **7.3 Report of the Working Party on Temperate Tunas (WPTMT) (IOTC-2004-WPTMT-R[EN])**
     - ***7.3.1 Executive Summary on the status of the albacore tuna* (IOTC-2004-SC-08[EN]).**
     - ***7.3.2 Report on biology, stock status and management of southern bluefin tuna* (IOTC-2004-SC-INF12).**
8. **ACTIVITIES IN RELATION WITH THE INDIAN OCEAN TUNA TAGGING PROGRAMME (IOTTP)**
   - **8.1 Report of the Working Party on Tagging (WPT) (IOTC-2004-WPT-R[EN])**
   - **8.2 Current status of the RTTP-IO arrangements**
   - **8.3 Report on recent activities related to the IOTTP**
   - **8.4 Small-scale tagging projects in the Republic of Maldives and India**
   - **8.5 Progress Report on FADIO activities**
   - **8.6 Progress on a tag seeding experiment**
9. **SCHEDULE OF WORKING PARTY MEETINGS IN 2005-2006 (IOTC-2004-SC-09[EN])**

The Scientific Committee is requested to advise the Commission on a schedule of Working Party meetings for 2005-06. The document describes a tentative schedule for the coming biennium.

   - **9.1 Progress in the establishment of a Working Party on Bycatch**

10. **ANY OTHER BUSINESS**
    - **10.1 Submission of abstracts to the Aquatic Science and Fisheries Abstracts.**
    - **10.2 Preparation of a Fishery Atlas (IOTC-2004-SC-INF10).**
    - **10.3 Glossary of fisheries terms**
    - **10.4 Relationships with other tuna commissions**
    - **10.5 Election of next Scientific Committee Chair and Vice Chair.**
11. **ADOPTION OF THE REPORT**

APPENDIX III. LIST OF DOCUMENTS.

IOTC-2004-SC-01[EN]	Provisionnal Agenda of the Seventh Session of the Scientific Committee	IOTC
IOTC-2004-SC-01[FR]	Ordre du jour prévisionnel de la septième session du Comité scientifique	IOTC
IOTC-2004-SC-03[EN]	Progress Report on the IOTC-OFCF Project to improve statistical systems in Indian Ocean coastal countries	IOTC
IOTC-2004-SC-03[FR]	État d'avancement du projet CTOI-OFCF.	IOTC
IOTC-2004-SC-04[EN]	Executive summary on the status of the yellowfin tuna resource	IOTC
IOTC-2004-SC-04[FR]	Résumé sur l'état de la ressource d'albacore	IOTC
IOTC-2004-SC-05[EN]	Executive summary on the status of the skipjack tuna resource	IOTC
IOTC-2004-SC-05[FR]	Résumé sur l'état de la ressource de listao	IOTC
IOTC-2004-SC-06[EN]	Executive summary on the status of the bigeye tuna resource	IOTC
IOTC-2004-SC-06[FR]	Résumé sur l'état de la ressource de patudo	IOTC
IOTC-2004-SC-07[EN]	Executive summary on the status of the swordfish resource	IOTC
IOTC-2004-SC-07[FR]	Résumé sur l'état de la ressource d'espadon	IOTC
IOTC-2004-SC-08[EN]	Executive summary on the status of the albacore tuna resource	IOTC
IOTC-2004-SC-08[FR]	Résumé sur l'état de la ressource de germon	IOTC
IOTC-2004-SC-09[EN]	Schedule of meetings in 2004 and 2005	IOTC
IOTC-2004-SC-09[FR]	Programme des réunions en 2004 et 2005	IOTC
IOTC-2004-SC-INF01	Sub-Committee on Data Collection and Statistics : Progress Report of the Secretariat	IOTC
IOTC-2004-SC-INF02	Rapport national de la France	France
IOTC-2004-SC-INF03	NATIONAL REPORT. 2004 UE-SPAIN	Instituto Español de Oceanografía – IEO, Instituto Tecnológico, Pesquero y Alimentario - AZTI
IOTC-2004-SC-INF04	UK national report	J. Pearce and G. Kirkwood
IOTC-2004-SC-INF05	Spanish longline experimental fishing cruise in international waters of the Western Indian Ocean in 2004 and 2005	J. Ariz, Delgado de Molina , A. and P. Pallares
IOTC-2004-SC-INF06	NATIONAL REPORT OF SOUTH AFRICA	South Africa
IOTC-2004-SC-INF07	National Report of JAPAN, 2004	Fisheries Agency, Government of Japan and National Research Institute of Far Seas Fisheries
IOTC-2004-SC-INF08	Proposal for an IOTC field manual	IOTC

IOTC-2004-SC-INF09	Recent situation of the regional Tuna Observer Programs (TOP) (Reference paper for the future IOTC TOP)	T. Nishida
IOTC-2004-SC-INF10	Proposal concerning the project of an IOTC Atlas	Fonteneau, Gunn, Nishida, Pallares, Liuxiong and Lucas
IOTC-2004-SC-INF11	Note on the prospects of electronic tagging during the IOTTP - The ELECTAG project	A. Fonteneau, J.P. Hallier et O.Maury
IOTC-2004-SC-INF12	REPORT ON BIOLOGY, STOCK STATUS AND MANAGEMENT OF SOUTHERN BLUEFIN TUNA	CCSBT
IOTC-2004-SC-INF13	Information Paper on Import of Atlantic Bigeye Caught By Large-Scale Tuna Longline Vessels	Japan
IOTC-2004-SC-INF14	National report of China in IOTC waters in 2003	ZHOU Yingqi, DAI Xiajie & XU Liuxiong
IOTC-2004-SC-INF15	National Tuna Fishery Report - Australia - AUSTRALIA'S TUNA AND BILLFISH FISHERIES: CATCH, EFFORT AND FLEET STATISTICS, 2003	Peter Ward, John Kalish and Don Bromhead
IOTC-2004-SC-INF16	National Report of the Republic of Korea	Soon-Song Kim, Dae-Yeon Moon and Jeong-Rack Koh
IOTC-2004-SC-INF17	National Report - Seychelles 2003	V. Lucas, J. Dorizo (SFA) and B. Wendling (SFA)
IOTC-2004-SC-INF18	France, Mayotte et îles éparses - Rapport National 2003	O. Abellard et J. Herfaut
IOTC-2004-SC-INF19	SUMMARY OF TAGGING OPERATIONS IN THE INDIAN OCEAN - PILOT AND SMALL-SCALE TUNA TAGGING PROGRAMMES	IOTC
IOTC-2004-SC-NonDocument-AgendaItem5.2[EN]	Review of data on species - A document to assist 2004 Scientific Committee discussions on Agenda Item 5.2	IOTC
IOTC-2004-SC-NonDocument-AgendaItem5.2[FR]	Examen des données sur les espèces - Support aux discussions du point 5.2 de l'ordre du jour de la session 2004 du Comité scientifique	IOTC
IOTC-2004-WPB-R[EN]	Report of the 4th Session of the IOTC Working Party on Billfish	IOTC
IOTC-2004-WPB-R[EN]	Report of the 4th Session of the IOTC Working Party on Billfish	IOTC
IOTC-2004-WPB-R[FR]	Rapport de la quatrième session du Groupe de travail de la CTOI sur les poissons porte-épée	IOTC
IOTC-2004-WPB-R[FR]	Rapport de la quatrième session du Groupe de travail de la CTOI sur les poissons porte-épée	IOTC
IOTC-2004-WPT-R[EN]	Report of the Sixth Session of the IOTC Working Party on Tagging	IOTC
IOTC-2004-WPT-R[EN]	Report of the Sixth Session of the IOTC Working Party on Tagging	IOTC
IOTC-2004-WPT-R[FR]	Rapport de la sixième session du Groupe de travail de la CTOI sur le marquage	IOTC
IOTC-2004-WPT-R[FR]	Rapport de la sixième session du Groupe de travail de la CTOI sur le marquage	IOTC
IOTC-2004-WPTMT-	Report of the First Session of the IOTC Working Party	IOTC

R[EN]	on Temperate Tunas	
IOTC-2004-WPTMT-R[EN]	Report of the First Session of the IOTC Working Party on Temperate Tunas	IOTC
IOTC-2004-WPTMT-R[FR]	Rapport de la première session du groupe de travail de la CTOI sur les thons tempérés	IOTC
IOTC-2004-WPTMT-R[FR]	Rapport de la première session du groupe de travail de la CTOI sur les thons tempérés	IOTC
IOTC-2004-WPTT-R[EN]	Report of the Sixth Session of the IOTC Working Party on Tropical Tunas	IOTC
IOTC-2004-WPTT-R[EN]	Report of the Sixth Session of the IOTC Working Party on Tropical Tunas	IOTC
IOTC-2004-WPTT-R[FR]	Rapport de la sixième session du Groupe de travail de la CTOI sur les thons tropicaux	IOTC
IOTC-2004-WPTT-R[FR]	Rapport de la sixième session du Groupe de travail de la CTOI sur les thons tropicaux	IOTC

APPENDIX IV. AVAILABILITY OF IOTC STATISTICS FOR THE YEAR 2003

Excerpt from IOTC-2004-SC-INF01

FLEET	Catch	M/C	NC	CE	SF	DI	FC	FT	VR	TI	SO
EUROPEAN COMMUNITY	303	M									
INDONESIA	219	C									
MALDIVES	144										
IRAN	139	M									
CHINA	122	M						NA			
SRI LANKA	121	M									
INDIA	106	M									
SEYCHELLES	82	M									
JAPAN	43	M						NA			
NETHERLAND AMTILLES	40							NA			
PAKISTAN	25	M									
MALAYSIA	17	M									
OMAN	16	M									
THAILAND	15	M									
MADAGASCAR	12	M									
PANAMA	9							NA			
BELIZE	9							NA			
SAUDI ARABIA	8										
YEMEN	8										
COMOROS	8	M									
AUSTRALIA	8	M									
UNITED ARAB EMIRATES	7										
KOREA	4	M						NA			
PHILIPPINES	3	M						NA			
FRANCE OT	3	M									
BOLIVIA	2							NA			
TANZANIA	2										
MAURITIUS	2	M									
SOUTH AFRICA	2	C									
KENYA	2	M									
EQUATORIAL GUINEA	1							NA			
QATAR	1										
EGYPT	1										
HONDURAS	1							NA			
URUGUAY	1							NA			
GUINEA	1							NA			
CAMBODIA	<1							NA			
SAINT VINCENT AND GRENADINES	<1							NA			
KUWAIT	<1										
ERITREA	<1	M									
BAHRAIN	<1										
JORDAN	<1										
BANGLADESH	<1										
DJIBOUTI	<1										
SENEGAL	<1							NA			
SUDAN	<1	M									
UNITED KINGDOM	<1	M									
EAST TIMOR	<1										
SINGAPORE											
VANUATU	Unk	M						NA			
MOZAMBIQUE	Unk										
MYANMAR	Unk										
NAMIBIA	Unk							NA			
PAPUA NEW GUINEA	Unk							NA			
SOMALIA	Unk										

Catch Recent catches amounting to (thousands of tonnes) / Captures recentes (milliers de tonnes)
M/C Is Member (**M**) or Cooperating Non Member Party (**C**) / Membre (**M**) ou Partie Cooperante Non Contractante (**C**)

NC Nominal Catch / Captures Nominales
DI Discards / Rejets
CE Catch and Effort / Capture et Effort
SF Size Frequency / Frequences de Tailles
FC Fishing Craft / Statistiques de Bateaux
FT Foreign Tuna Vessels Activity / Registre d'Activite de Bateaux Thoniers Etrangers
VR Vessel Record / Registre de Bateaux

Fully reported / Soumis
Partially Reported / Partiellement soumis
Not Reported / Non soumis
Zero Report / Soumission nulle
NA Not Applicable / Non applicable

TI Timeliness of Reporting / Fraicheur des Donnees
Good (before deadline) / Bonne (avant dernier delai)
Fair (whithin a month after deadline) / ...ulier (dans le mois suivante au dernier delai)
Poor (more than one month after deadline) / Pauvre (plus d'un mois apres le dernier delai)

SO Data Source / Source des Donnees
All statistics from responsible country / Donnees provenant du pays responsible
Statistics from both responsible and third country / ...ees provenant du pays responsible autant que de pays tiers
All statistics from third countries / Donnees provenant de pays tiers
No statistics reported at all / Aucune donnee soumis

APPENDIX V. NATIONAL REPORT ABSTRACTS

AUSTRALIA

Document IOTC-2004-SC-INF16. Longline and purse seine are the main fishing methods used by Australian vessels to catch tuna and billfish in eastern areas of the IOTC area of competence. Longliners target broadbill swordfish, but also take significant catches of bigeye tuna and yellowfin tuna. There were 40 Australian longliners fishing in the area in 2002, but only 27 in 2003. Longline fishing effort also declined, from more than 6 million hooks in 2001 to 4 million hooks in 2003. There was a corresponding decline in catches of swordfish (1766 t in 2003 compared to 2000 t in 2002), bigeye (319 t cf. 418 t) and yellowfin tuna (232 t in 2003 cf. 354 t in 2002). The reduction in longline activity is attributed to reductions in market prices and increased operating costs. The purse seine fishery mainly targets southern bluefin tuna that are towed to near-shore cages for fattening (over 5000 t of southern bluefin are caught by those vessels each year). Late season catches of skipjack tuna are also taken by the purse seiners in some years. No skipjack tuna were reported in 2003. In 2002, 1144 t of skipjack tuna was caught by purse seine. Australia is engaged in a range of research activities that are of direct relevance to management of the domestic fishery and the broader region.

CHINA

Document IOTC-2004-SC-INF14. Longline is the fishing method used by Chinese vessels only to catch tuna and tuna-like species in the IOTC waters. Longliners target bigeye mainly, but also take significant catches of yellowfin tuna. There was a corresponding increase in catches of bigeye (4568.8 t in 2003 cf. 2792 t in 2002) and yellowfin tuna (2279.1 t in 2003 cf. 1325 t in 2002). There were 33 Chinese longliners fishing the area in 2003 including 16 vessels over 30m LOA. The number of fishing vessels has been sharply reduced since 1998 because of the management and market problems. The data collection and logbook submit system, scientific observer program and training programs have been established and operating under strong support by Fisheries Bureau of MA and Chinese Deep Sea Fisheries Association.

EC-SPAIN

Document IOTC-2004-SC-INF03. Two fleets are operating in the Indian Ocean: the purse seine fleet targeting tropical tuna (yellowfin, skipjack and bigeye) and the longline fleet targeting swordfish. In 2003 a total of 18 purse seiners and 19 longliners operated. Most of the purse seiners are between 800 and 2,000 t of carrying capacity. Longline vessels ranged from 27 to 42 m in length. Spanish catches in 2003 were: 78,968 t (yellowfin), 88,035 t (skipjack), 8,544 t (bigeye), 520 t (albacore) and 4,289 t (swordfish), resulting in a total of 181,356 t, the most important catches since the fishery started. The purse seine catch in 2003 increased 13% as a consequence of the marked increase (48%) of catch of yellowfin. Tropical tuna sampling in 2003 increased considerably (1,909 samples v. 1,028 samples in 2002 representing 196,135 fish measured v. 160,894 fish in 2002) because the full implementation of the new sampling method and the improvement of the sampling structure. In 2003 a biological sampling program (sex ratio, maturity) in the Seychelles cannery was started. In addition, 34,669 swordfish have been measured (46% of the total landings) and sex at age for temporal-spatial strata was obtained.

Two Spanish Research Institutes (IEO and AZTI) are involved in tropical tuna research and the IEO is involved in swordfish research. Since the beginning of the 1990’s a Spanish expert on fisheries has been permanently based in Mahe. And scientists involved in these fisheries have actively participated in the works of the WPTT, WPT and the SC. This year 13 documents have been presented. Research programmes include collecting information on supplies and fishing on FADs. To estimate the by-catch associated with the purse seine fishery, a total of 7 trips were covered by observers in 2003 and 9 trips (to-date) in 2004. Other work includes a joint (IRD-IEO-AZTI) tagging programme on tropical tuna fishing on FADs (2 cruises in 2003), opportunistic tagging of swordfish and by-catch of longline catch.

EC-FRANCE

Document IOTC-2004-SC-INF02.

General Fishery Statistics

Two French (EU) fleets fish for tunas in the Indian Ocean: purse-seiners operate mostly from Seychelles and longliners operate from Réunion. There is also a small-scale fishery operating on anchored FADs at Réunion. Total French catches of tuna and tuna-like species in the Indian Ocean was 109,835 t in 2003, an increase from 2002 (101,153 t) and previous years, despite vessels numbers remaining the same.

Purse seiners

After a decrease in catches from 1994 to 1998, basically due to a reduction in the number of purse seiners, there is a steady increase in total catches, particularly in 2003 (+10%), despite the reduction in nominal effort and the number of positive sets. This increase is essentially on yellowfin tuna (+74%), as the catches of skipack and bigeye tunas declined 28 and 27% respectively. It comes basically from catches on free-swimming schools of yellowfin and bigeye tunas, while the catches of skipjack tuna declined markedly (-30%) for both fishing modes. Since 2001, there have been no catches of in the eastern Indian Ocean (FAO Area 57).

Total CPUE has been exceptionally high in 2003, due to the record catches of large yellowfin tunas on free-swimming schools. Same trends are observed in the catch per positive set, with a very good catch on floating objects (38.5 t) and exceptional on free-swimming schools (51 t), the highest value since the beginning of the fishery. There has been a strong spatial concentration of the fishery in a relatively small area compared to the past.

In general, average weights for all the species and in all fishing modes have increased in 2003, although they are still lower than those observed at the beginning of the fishery.

Longliners

The activity of the Réunion longline fishery has been the subject of a study conducted by the laboratory of Aquatic Resources (IFREMER, Reunion).

The total number of longliners remains stable (33), with a reduction in the number of large vessels (> 16m) balanced by an increase in the number of smaller vessels. Swordfish remains the target species, with a reduction in total catches due to a marked decrease in catch rates. Catches of the main species (swordfish and yellowfin, bigeye and albacore tunas) decreased for all the species in 2002 and were stable in 2003 (1,678 t).

Between 1994 and 2000, swordfish was the only species for which size frequency data were collected. Since the beginning of 2002, a new size-frequency sampling of swordfish has been implemented, and extended to include species under the IOTC mandate as well as dolphinfish.

Research programmes

IRD. Highlights from 2003 included: Continuation of the study of the biotic interactions in the high-seas ecosystems and the trophodynamics of top predators; Continuation of the development of an ecosystem model; Collection and analyses of data on the European tuna fishery data in relation to an important participation in the different IOTC working parties. The IRD has also participated actively in the activities of the Working Party on Tagging.

IFREMER. As knowledge of the stock structure of swordfish is essential to understand the species distribution and its sensitivity to exploitation, the laboratory of Aquatic Resources plans to address this issue through a project based on a combination of genetic analyses and microchemistry of hard parts for this species in the Indian Ocean. Ifremer is also developing a new permanent fisheries monitoring system that should improve the quality of the statistical data from mid-2004. The research programme DORADE, designed to provide a better understanding of the aggregation in epipelagic fish (especially dolphinfish) has been in operation since the beginning of 2001 and is scheduled to be completed by the end of 2004. A summary of the research needs in the subject of FADs, include a bibliographic database (FADBase) was published in 2004. The scientific team of Ifremer Reunion also participates in the activities of the European project FADIO, led by IRD.

JAPAN

Document IOTC-2004-SC-INF07. General fisheries statistics regarding longline and purse seine fisheries in recent 5 years are summarised. In addition, progress on the implementation of recommendations of the past Scientific Committee and also progress on national research programs currently in place are described.

KOREA

Document IOTC-2004-SC-INF16. The Korean tuna longline fishery has shown a decreasing trend from the late 1970s to recent years in both number of fishing vessels and annual catches. In 2003, total catch amounted to 3,840 t by 25 longliners, which is the record high in Korean longline fishery in this area as compared to 2002. The catch consisted of 221 t of southern bluefin tuna, 2,100 t of yellowfin tuna, 1,121 t of bigeye tuna, 194 t of other tunas and 204 t of billfishes. This was mainly due to the shift of longliners from the Pacific to the Indian Ocean 2002. The National Fisheries Research and Development Institute (NFRDI) has maintained a small scale tagging project through which it encourages fishermen to have voluntary tagging practices during their fishing operation. This voluntary tagging program will be continued until a bigger-scale tagging program has been initiated in the future. NFRDI began to operate fisheries observer program in 2004 to monitor Korean distant-water fisheries including those for tunas and to meet the requirements of regional fisheries bodies. At the initiated stage, size of the observer program is fairly small to cover for the longline fisheries to be urgently implemented but will be gradually developed to cover all required areas of the fisheries.

SEYCHELLES

Document IOTC-2004-SC-INF17. The Seychelles National Report summarises statistics of industrial vessels (purse seiners and longliners) licensed to operate inside the Seychelles EEZ and the activities of the local semi-industrial monofilament longline fishery for the period 2003 compared with previous years. No major changes were observed in the fleet composition during 2003. Nearly 70 % of the licenses were issued to purse seiners from the European Union. A record catch of 407,684 t was recorded during 2003. A 10% reduction was recorded in the fishing effort, however the mean annual CPUE of 34.54 t is the highest recorded so far. An increase of 54 % was recorded in the yellowfin catches. The catch by Seychelles registered vessels increase by 46% during 2003. Transhipment and landings in port Victoria increased by 8 % during 2003.

The number of longliners licensed to operate increased from 137 in 2002 to 268 in 2003. A preliminary estimate of the 2003 longline catch is 11,450 t, with a mean catch rate of 0.67 t/hooks. The catch of yellowfin by Japanese longliners increased from 1,158 t in 2002, to 1551 t in 2003. Fishing activities during 2003 were highly concentrated in the area between 0° to 10° S and 40° to 50° W.

The activities of the local semi-industrial longline fishery were greatly reduced during 2003. There was a reduction in the number of fishing trips conducted and the catch dropped from 247 t in 2002 to only 92 t in 2003.

SOUTH AFRICA

Document IOTC-2004-SC-INF06. South Africa has three fishing sectors which either target or catch tuna and tuna-like species as bycatch in the Indian Ocean. These sectors are, in order of importance, tuna longline, pole and line/ rod and reel, and shark longline. In 2003, the longline fishery was still in an experimental phase with 24 vessels actively fishing. Longline catches are dominated by swordfish (> 50% by weight), Catches of bigeye tuna have steadily increased, whereas yellowfin catches fluctuate widely (13-67%) and albacore catches are generally low (< 10%). In 2003, the longliners recorded their highest landings of yellowfin tuna. The high abundance of yellowfin in South African waters was also reflected by unusual catches made by sardine purse seiners and recreational fishers fishing closing to shore. This anomaly was noticed towards the latter half of 2003 and persists today. The average size of yellowfin landed is large, approximately 40 – 60 kg dressed weight. The total landings (dressed weight) in 2003 were: swordfish (556.8 t), bigeye tuna (206.3 t), yellowfin tuna (431.8 t) and albacore (63.9 t).

In 2003 the combined reported catches of the pole and line and rod and reel fleets in the Indian Ocean were yellowfin tuna (139.4 t), albacore (0.2 t), tuna (1.9 t), sharks (120.6 t) and billfishes (0.4 t).

In 2003, the tuna longline fleet reported 104.3 t of bycatch, of which sharks comprised 77.5 t, billfish (excluding swordfish) 10.3 t. Other species landed included oceanic whitetip, silky, thresher and hammerhead. Blue and black marlins accounted for more than 80% of the marlin bycatch. Oilfish and escolar constituted 50% of the "other" by-catch, with dorado accounting for 33%..

Research in South Africa is focussed on swordfish, in particular, elucidating the life history of swordfish occurring in southern African waters. Tissue samples will be collected in 2004 for genetic and heavy metal analysis in order to determine stock delineation of swordfish in this region. This research will be supported by a tagging programme, which was implemented in 2004.

South Africa is in the process of becoming a Cooperating Contracting Party to IOTC. In the interim period South Africa is seeking Cooperating Non-contracting Party status. South Africa will be expanding her tuna/swordfish longline fleet at the end of 2004 when long-term (10 yr) commercial fishing rights are allocated. The targeting of pelagic sharks will be terminated by the end of 2005 due to global concerns of the stock status of oceanic sharks.

UK

Document IOTC-2004-SC-INF04. The UK National Report summarises tuna fishing in the British Indian Ocean Territory (Chagos Archipelago) Fisheries Conservation and Management Zone (FCMZ) during the 2003 / 2004 fishing season (April 2003 to March 2004). A total of 38 longline vessels have fished in the BIOT FCMZ during the 2003 / 2004 fishing season, taking up 54 fishing licences. These longline vessels have fished for a total of 1060 days, with a total estimated catch of 1162 t. In addition a total of 52 vessels were licensed during the 2003 / 2004 fishing season, comprising 46 purse seiners and 6 support vessels Total catches for the season of principal commercial species totalled 1320 t. This catch was taken over a total of 104 days fishing (including both fishing and non-fishing days), at an overall catch rate of 12.69 tonnes day-1.

The BIOT offshore observer programme for 2003 / 3004 ran from 4th December 2003 to the 12th January 2004 with a total of 21 days observation completed onboard longliners. In this programme, biological sampling is carried out and data collected on target tuna, bycatch and discard species. In addition, complete hook-by-hook surveys are carried out of selected longline sets, for which all fish caught were landed. Collection of these observer data fulfils recommendations made by the WPDCS and WPTT.

APPENDIX VI. EXECUTIVE SUMMARIES ON THE STATUS OF SPECIES

Executive Summary Of The Status Of The Yellowfin Tuna Resource

BIOLOGY

Yellowfin tuna is a cosmopolitan species distributed mainly in the tropical and subtropical oceanic waters of the three oceans, where it forms large schools. The sizes exploited in the Indian Ocean range from 30 cm to 170 cm fork length. Smaller fish (juveniles) form mixed schools with skipjack and juvenile bigeye tuna and are mainly limited to surface tropical waters, while larger fish are found in surface and sub-surface waters. Intermediate age yellowfin are seldom taken in the industrial fishery, but are abundant in some artisanal fisheries, mainly in the Arabian sea.

Stock structure is unclear, and a single stock is usually assumed for stock assessment purposes. Longline catch data indicates that yellowfin are distributed continuously throughout the entire tropical Indian Ocean, but some more detailed analysis of fisheries data suggests that stock structure may be more complex. A study of stock structure using DNA was inconclusive.

Spawning occurs from December to March in the equatorial area (0-10°S), but the main spawning grounds seem to be between 50° and 70°E. Yellowfin size at first maturity has been estimated at 110 cm, and recruitment occurs in July. Newly recruited fish are primarily caught by the purse seine fishery on floating objects. Males are predominant in the catches of larger fish, but apparently at a larger size (150 cm) than in other oceans.

Several new growth studies were presented to the WPTT. The Working Party identified two hypotheses regarding growth curves: a “slow-growth” hypothesis, assuming a two-stanza growth curve, and a “fast-growth” hypothesis, assuming a constant growth rate . The two-stanza growth curve is in good agreement with growth curves estimated from size frequencies and tagging studies in the Atlantic and western Pacific Oceans.

There are no direct estimates of natural mortality (M) for yellowfin in the Indian Ocean. In stock assessments, estimates from other oceans have been used, mainly based on results from the western Pacific tagging programme. These indicated a higher M on juvenile fish than for older fish.

There is little information on yellowfin movement patterns in the Indian Ocean, and what information there is comes from analysis of fishery data, which can produce biased results because of their uneven coverage. However, there is good evidence that medium sized yellowfin concentrate for feeding in the Arabian sea. Feeding behaviour is largely opportunistic, generally aimed at large concentrations of crustacea in the tropical areas or small mesopelagic fishes in the Arabian sea.

FISHERY

Catches by area, gear, country and year from 1950 to 2003 are shown in Table 1 and illustrated in Figure 1. Contrary to the situation in other oceans, the artisanal fishery component in the Indian Ocean is substantial, taking approximately 20-25% of the total catch.

The geographical distribution of yellowfin tuna catches in the Indian Ocean in recent years by the main gear types (purse-seine, longline and artisanal) is shown in Figure 2. Most yellowfin tuna are caught in Indian Ocean north of 12°S and in the Mozambique Channel (north of 25°S).

Although some Japanese purse seiners have fished in the Indian Ocean since 1977, the purse seine fishery developed rapidly with the arrival of European vessels between 1982 to 1984. Since then, there has been an increasing number of yellowfin tuna caught (*Figure 3*) although a larger proportion of the catches is made of adult fish, when compared to the case of the bigeye tuna purse-seine catch. Purse seine catches of yellowfin with fork lengths between 30 and 180 cm increased rapidly to some 130,000 t in 1993, after which they have fluctuated around that level.

The purse seine fishery is characterized by the use of two different fishing modes: the fishery on floating objects (FADs), which catches mainly small yellowfin in association with skipjack and juvenile bigeye, and a fishery on free swimming school, which catches larger yellowfin on mixed or pure sets. Between 1995 and 2000, the FAD component of the purse seine fishery represented 50-66% of the sets undertaken (65-80% of the positive sets) and took 46-63% of the yellowfin catch by weight (63-76% of the total catch).

The longline fishery started in the beginning of the 1950's and expanded rapidly over the whole Indian Ocean. It catches mainly large fish, from 80 to 160 cm fork length. The longline fishery targets several tuna species in different parts of the Indian Ocean, with yellowfin and bigeye being the main target species in tropical waters. The longline fishery can be subdivided into an industrial (deep-freezing longliners operating on the high seas from Japan, Korea and Taiwan,China) and an artisanal component (ice longliners operating more in coastal waters). The longline catch of yellowfin reached a maximum in 1993 (195 t), it has since declined, and in 2003 was 87,000 t.

Artisanal catches, taken by baitboat, gillnet, troll, handline and other gears, have increased steadily since the 1980s. In 2003, the total artisanal yellowfin catch was 102,000 t, while the catch by the dominant artisanal gear, gillnets, was 82,000 t.

Yellowfin catches in the Indian Ocean were extraordinarily high during 2003 and 2004, while skipjack and bigeye remained at their average levels. Purse seiners currently take the bulk of the yellowfin catch — mostly from the western Indian Ocean. In 2003, their total catch was over 210,000 t — over 35% more than the previous largest purse seine catch, which was recorded in 1995. Longline and artisanal yellowfin catches were also near their highest levels.

Yellowfin catches in number by gear (purse seine, longline and baitboat) are reported in Figure 3. Annual mean weights of yellowfin caught by different gears and by the whole fishery are shown in Figure 4. After an initial decline, mean weights in the whole fishery remained quite stable from the 1970s to the early 1990s. After 1993, mean weights in the catches in the industrial fisheries have declined. Prior to 2003, although total catch in biomass has been stable for several years, catches in numbers have continued to increase, as there has been more fishing effort directed towards smaller fish, as illustrated in Figure 10. As described above, this situation changed during 2003 and 2004; where most of the very large catches were obtained from fish of larger sizes.

AVAILABILITY OF INFORMATION FOR ASSESSMENT PURPOSES

The reliability of the estimates of the total catch has continued to improve over the past few years, on one hand as a result of the catch sampling program being fully operational now, and on the other hand because several national sets of data have recently become available (Oman, Sri Lanka, Iran).

Two documents dealing with these major and rapid changes observed in the yellowfin surface and longline fisheries in 2003 were presented and discussed by the WPTT. This increase has been observed on large adult yellowfin, with a small catch of juveniles.

A number of papers dealing with fisheries data, biology, CPUE trends and assessments were discussed by the WPTT in 2002, and additional data analyses were performed during that meeting. In particular, estimates of annual catches at size for yellowfin were calculated using the best available information. Estimated catches at age calculated using the catch-at-size data and the two hypotheses regarding growth curves (fast *vs* slow growth) are shown in Figure 6. Two sets of natural mortality at age schedules were agreed, both assuming a higher M on juvenile fish.

Standardized CPUE analysis using both Japanese and Taiwanese data were presented and discussed. New analyses were also carried out on these data sets during the meeting, estimating standardised CPUEs for both the whole Indian Ocean and the tropical area (10N – 15S), where the bulk of the catch is taken. All resulting standardized CPUE series are similar. These showed an initial steep decline, over a period when catches were relatively low and stable, followed by stable standardized CPUEs since the late 1970s, a period during which catches have increased strongly following the development of the purse seine fishery. This is illustrated in Figure 5 for the tropical area. The observed pattern of standardised CPUE does not correspond well with the expected response of CPUE to changes in catch and biomass. There are several possible explanations for this, such as changes in catchability or behaviour, or the population existing in two fractions with differential availability to purse seine and longline gears. However, there is no scientific information to judge which, if any, of these explanations is correct.

STOCK ASSESSMENT

No new assessment of yellowfin was undertaken during 2004 therefore the current stock status is based on the assessment undertaken in 2002.

A full assessment was attempted for yellowfin tuna in 2002. Several papers presenting assessment results were discussed by the WPTT, and additional assessments were carried out during the meeting using agreed data sets.

No new stock assessment methods were presented to the WPTT, and assessments were carried out using methods used at previous meetings, including the modified Grainger and Garcia index, the PROCEAN method, ASPM, a multi fleet statistical catch at age model, sequential population analysis (VPA) and a multigear yield-per-recruit analysis. Many new analyses based on agreed sets of data and hypothesis were performed and discussed during the meeting.

Although there were differences in the details of results from the different assessments, the overall picture is consistent. This can be seen in Figures 7 to 10, which illustrate some of the results from the assessments, expressed in relative units to make them directly comparable. There has been a large and steady increase in fishing mortality since the early 1980s, while there is indication that there has been a substantial decline in biomass since the mid-1980s. Estimates of catchability both for purse-seine and longline fleets show a strong increasing trend since the mid-1980s, especially for the purse-seine fleet, as illustrated in Figures 9 and 10. It should be noted that these figures are intended to illustrate general trends, and should not be viewed as depicting precise estimates of changes in efficiency.

It is not currently possible to obtain a reliable estimate of the fishing mortality at MSY (Fmsy), and some assessment runs were unable to produce plausible estimates of MSY. However, in those cases where plausible estimates or indicators of MSY could be obtained, they consistently indicated that current catches are in the vicinity of, or possibly above, MSY. Even if current catches are below MSY, a continuation of the recent rapid increase in catches and effort would mean that the fishery could very soon reach or exceed MSY.

It is also clear from the basic data that, during the early period of the fishery (from the 1950s to the start of the 1980s), the catches were relatively low and stable around 40,000 t. Since the 1980s there has been a rapid increase in the longline and purse seine effort and the total catch reached over 300,000 t in 1992. Since the mid-1990s there has also been an increase in purse seine fishing on floating objects which has led to a rapid increase in the catch of juvenile yellowfin. The rapid expansion, particularly on juvenile fish, is cause for concern, since it displays all the symptoms of a potentially risky situation. The increases in catches in general has not been as a result of geographic expansion to previously unfished areas, but rather as a result of increased fishing pressure on existing fishing grounds.

Exceptional catches during 2003 and 2004

Yellowfin catches in the Indian Ocean were extraordinarily high during 2003 and 2004. The year 2003 will be a record year once the catches from all fleets are reported to the IOTC Secretariat. These anomalous catches occurred all over western Indian Ocean, in particular on a small area in eastern Africa, although the anomaly extended over a much wider area, from the Arabian Sea to South Africa, in both industrial (purse seine on free-swimming schools and longline) and artisanal fisheries. The fish caught were of large sizes (100-150 cm FL).The SC discussed two possible hypotheses explaining the observed high catches, noting that it is possible that a combination of factors were responsible for this event. There are two main categories of factors:

Increase in the biomass of the population:

According to this hypothesis, large recruitments to the population in recent years could be responsible for the large increase in yellowfin catches. In these years, environmental conditions favourable to good recruitment may have occurred in the Indian Ocean. But recruitment is not the only process by which the biomass could increase. Additional explanations could be reduced natural mortality during some critical life stage and/or increased growth rates related to favourable environmental conditions.

The SC noted there is no evidence from existing data of unusually large numbers of small fish being caught in the surface fisheries prior to 2003. However, the ability to detect this from purse-seine size-frequency sampling during 1998-2000 may have been reduced due to the low level of sampling from areas traditionally associated with small yellowfin tuna.

An increase in catchability due to a concentration of the resource and an increase in the fishing efficiency:

It is possible that due to some unexplained environmental conditions, large yellowfin tuna aggregated over a relatively small area, so that it became easier to catch them in large quantities. In addition, technological improvements in detection equipment on purse-seiners could have the schools more vulnerable to fishing.

While these factors might explain the high catches of industrial fisheries in a small area off eastern Africa, there are also reports of exceptionally high catches by the commercial and artisanal fisheries from Yemen, Oman, Iran, South Africa and Maldives.

The presence of large concentrations of the crustacean *Natosquilla investigatoris*, reported to have occurred in large quantities in various locations of the Indian Ocean was cited as possible reason for the unusual concentrations of yellowfin tuna, as they were observed feeding voraciously on the *Natosquilla* concentrations. On the other hand, it was also noted that these surface concentrations of prey is more likely to reduce than to increase the availability of fish to the longline fishery.

By the end of 2002, most purse seine vessels had new sonar equipment installed. Apparently these devices enable skippers to locate schools at distances up to 5 km, night and day. This means that schools are more vulnerable to fishing, and catches could be expected to increase.

However, there is no indication of similar increases in efficiency in the Atlantic Ocean, where vessels were also fitted with the same equipment. In addition, the high catches also occurred in artisanal and longline fisheries for which there is no indication of recent technological advances.

MANAGEMENT ADVICE

Considering all the stock indicators and assessments, as well as the recent trends in effort and total catches of yellowfin, the Scientific Committee considered that:

4) Total catches under current (2002) fishing patterns were close to, or possibly above MSY. In these circumstances, any further increase in both effective fishing effort and catch above levels in 2000 should be avoided.
5) The current trend for increasing fishing pressure on juvenile yellowfin by purse seiners fishing on floating objects is likely to be detrimental to the stock if it continues, as fish of these sizes are well below the optimum size for maximum yield per recruit.
6) The Scientific Committee also noted that juvenile yellowfin tuna are caught in the purse-seine fishery that targets primarily skipjack tuna. Some measures to reduce the catches of juvenile yellowfin tuna in the FAD fishery will be accompanied by a decrease in the catches of skipjack tuna.

In interpreting the high catches of 2003 and 2004, the SC noted that if the hypothesis of an increase in biomass is correct, such increase is most likely the result of just two exceptional recruitments and not necessarily a long-term increase in productivity of the stock. Under these circumstances, increased catches from these year classes are unlikely to be detrimental to the stock.

On the other hand, there could be serious consequences if the hypothesis that there was only an increased catchability during 2003 and 2004 is correct. In this case, the very large catches would represent a much higher fishing mortality and, certainly, would not be sustainable. Furthermore, they would lead to a rapid decline of the existing adult biomass of yellowfin tuna and a serious over-exploitation of the stock, according to the status of yellowfin tuna as assessed in 2002. If such is the case, urgent management actions might be needed to reduce fishing mortality, from the 2000 level.

YELLOWFIN TUNA SUMMARY

Maximum Sustainable Yield (MSY)	280,000 - 350,000 t
Current (2003) Catch	400,000 - 450,000 t (predicted)
Mean catch over the last 5 years	326,000 t
Current Replacement Yield	
Relative Biomass B_{cur}/ Bmsy	
Relative Fishing Mortality F_{cur}/Fmsy	
Management Measures in Effect	None

Table 1. Catches of yellowfin tuna by gear and main fleets for the period 1950-2003 (in thousands of tonnes). Data as of 20 November 2004.

Gear	Fleet	Av99/03	Av54/03	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78
Purse seine	Total	154.1	47.8										0.0	0.0	0.0									0.1	0.2	0.2	0.3	0.5
Baitboat	Maldives	13.3	5.7	1.5	2.0	2.0	2.0	2.0	2.0	1.0	1.5	1.5	1.5	1.5	1.0	1.5	1.7	1.7	1.8	2.3	1.4	2.5	6.9	5.0	4.6	5.2	4.9	3.8
	Other Fleets	0.6	0.2																	0.0		0.1	0.6	1.2	0.2			
	Total	13.8	5.9	1.5	2.0	2.0	2.0	2.0	2.0	1.0	1.5	1.5	1.5	1.5	1.0	1.5	1.7	1.7	1.8	2.3	1.4	2.6	7.4	6.2	4.8	5.2	4.9	3.8
Longline	Indonesia	29.6	6.8																				0.1	0.3	0.7	1.0	1.3	1.3
	China																											
	Taiwan,China	21.3	14.1	0.2	0.7	1.1	1.3	1.8	2.4	2.2	2.9	3.5	3.4	2.9	2.2	4.4	3.4	22.7	21.1	14.9	11.9	11.8	5.7	4.4	4.6	3.4	8.1	4.2
	Japan	15.4	16.4	21.7	44.2	59.5	31.9	22.6	22.2	36.1	32.7	44.2	22.0	22.2	24.9	40.8	30.2	48.3	23.1	10.3	13.4	7.9	3.9	4.9	6.4	2.8	2.1	4.6
	Republic of Korea	1.4	6.9												0.1	0.1	0.4	5.2	9.1	5.2	7.4	10.3	10.8	13.1	13.3	13.7	33.0	26.5
	Other Fleets	5.2	2.4											0.3	0.5	0.5	0.1	2.3	0.6	1.9	1.6	1.5	1.1	0.7	0.2	1.1	0.9	0.2
	Total	87.3	55.5	21.9	44.9	60.6	33.1	24.5	24.6	38.3	35.6	47.7	25.4	25.3	27.7	45.7	34.0	78.6	53.9	32.3	34.3	31.5	21.7	23.4	25.3	21.9	45.4	37.0
Gillnet	Sri Lanka	32.2	10.1	0.7	0.7	0.8	1.0	1.1	1.2	1.5	1.8	2.7	3.5	3.4	3.2	3.6	4.1	4.5	5.0	3.9	2.8	4.4	5.3	4.7	3.8	6.9	6.3	6.7
	Oman	7.0	5.1	0.7	0.7	0.5	0.5	0.5	0.7	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.8	0.9	2.9	3.4	3.8	4.0	4.4
	Pakistan	5.1	2.8	0.6	0.6	0.5	1.4	0.7	0.7	0.9	0.8	1.2	1.8	2.5	2.7	3.6	3.5	3.5	3.2	2.9	2.4	2.8	2.2	3.0	3.3	3.1	2.8	1.6
	Indonesia	3.1	1.9	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.8	0.6	0.6	1.1	1.1	1.0	1.1	1.6	3.3	4.2
	Other Fleets	2.3	1.7	0.2	0.3	0.4	0.3	0.3	0.3	0.5	0.8	0.2	0.4	0.3	0.3	0.3	0.4	0.4	0.3	0.7	1.4	1.4	5.7	1.8	2.3	4.5	2.7	3.7
	Total	70.5	26.3	2.6	2.7	2.7	3.6	3.1	3.2	3.8	4.4	5.2	6.9	7.4	7.6	8.9	9.4	9.9	10.1	8.8	7.9	10.4	15.2	13.4	13.9	19.9	19.1	20.7
Line	Indonesia	5.7	2.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.5	0.3	0.6
	Comoros	5.5	1.6																	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2
	Other Fleets	5.3	2.3	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.5	0.7	0.9	0.8	0.8	0.9	1.1	1.2	1.3	1.3	1.3	1.6	1.8	1.8	1.5	2.3	4.9	3.3
	Total	16.6	6.1	0.4	0.3	0.4	0.4	0.4	0.5	0.5	0.6	0.8	1.0	1.0	1.0	1.1	1.3	1.5	1.6	1.6	1.6	1.9	2.2	2.2	2.0	3.0	5.4	4.0
All	Total	342.3	141.7	26.4	49.9	65.7	39.2	30.0	30.3	43.6	42.1	55.2	34.9	35.2	37.3	57.2	46.4	91.6	67.4	45.0	45.2	46.4	46.5	45.4	46.1	50.2	75.1	66.0

Gear	Fleet	Av99/03	Av54/03	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03
Purse seine	Spain	56.3	17.7						11.5	18.4	20.0	26.3	44.9	41.1	43.7	44.0	37.8	47.8	43.1	65.1	59.4	61.0	38.6	51.9	49.4	47.7	53.4	79.0
	France	40.5	16.2			0.2	1.0	10.5	36.7	39.1	43.3	46.8	59.9	38.4	45.3	38.1	45.3	39.5	35.8	39.6	35.6	31.2	22.4	30.8	37.7	34.1	36.4	63.3
	NEI-Other	22.0	6.0					0.7	8.4	9.4	6.3	5.2	7.9	4.5	11.9	11.9	8.1	15.5	19.7	19.3	16.7	21.9	20.3	25.8	27.1	19.4	19.1	18.9
	Seychelles	16.8	1.9													0.4	0.2					2.8	7.4	9.8	11.6	12.9	16.6	33.3
	NEI-Ex-Soviet Union	9.2	2.2												0.8		5.2	8.7	5.8	16.3	13.2	10.2	5.3	11.8	10.9	9.8	6.8	6.8
	Iran, Islamic Republic	4.0	0.8														2.1	3.4	2.7	4.3	1.6	1.9	3.3	2.5	2.2	2.2	5.0	8.3
	Other Fleets	5.3	3.1	0.4	0.5	0.4	0.6	2.1	2.3	2.6	4.7	6.4	6.7	6.7	8.0	11.8	15.3	16.1	10.3	9.5	7.8	6.8	6.4	5.6	5.0	6.9	5.0	3.8
	Total	154.1	47.8	0.4	0.5	0.6	1.6	13.2	58.9	69.5	74.3	84.7	119.5	90.7	109.7	106.2	114.0	131.0	117.5	154.3	134.4	135.8	103.6	138.2	143.9	133.0	142.2	213.3
Baitboat	Maldives	13.3	5.7	4.4	4.4	5.6	4.5	7.7	8.2	6.9	6.2	7.4	5.9	5.5	4.9	7.0	8.0	9.3	12.4	11.8	11.5	12.2	13.0	12.6	10.0	11.1	16.3	16.3
	Other Fleets	0.6	0.2			0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.5	0.5	0.4	0.4	0.5	0.5	0.4	0.5	0.6	0.5	0.6	0.6
	Total	13.8	5.9	4.4	4.4	5.9	4.6	7.7	8.2	6.9	6.2	7.4	5.9	5.5	4.9	7.5	8.5	9.8	12.8	12.2	12.0	12.7	13.4	13.1	10.6	11.6	16.9	16.9
Longline	Indonesia	29.6	6.8	1.4	2.1	2.6	2.7	0.8	0.8	0.8	0.7	1.3	2.3	3.8	4.6	5.5	9.3	10.8	14.8	16.7	31.8	38.2	35.7	41.7	29.6	28.4	24.2	24.2
	China																											
	Taiwan,China	21.3	14.1	3.7	3.8	4.1	4.7	5.6	5.8	7.3	16.2	22.3	22.7	22.4	31.6	30.7	56.0	88.2	34.1	23.1	27.9	18.4	23.4	17.7	17.4	18.9	27.7	24.8
	Japan	15.4	16.4	3.3	3.2	4.9	7.3	7.8	7.9	9.5	10.7	8.3	9.3	4.6	6.3	4.4	5.7	5.7	9.7	8.0	12.8	15.6	16.8	14.7	15.5	14.0	14.0	18.8
	NEI-Fresh Tuna	8.9	4.3											11.9	16.6	14.4	16.7	16.5	23.5	16.5	16.7	22.1	15.9	12.8	12.5	6.9	6.6	5.8
	NEI-Deep-freezing	5.4	2.5							0.1	1.1	1.2	3.4	3.2	6.7	5.9	9.2	23.2	9.7	6.7	11.6	5.6	10.9	8.6	7.1	4.4	3.4	3.4
	Republic of Korea	1.4	6.9	18.0	13.2	12.4	19.3	16.2	10.2	12.5	15.4	13.2	14.1	8.7	7.5	3.2	4.4	4.3	4.0	2.7	4.0	4.2	2.6	1.0	2.0	1.5	0.3	2.1
	NEI-Indonesia Fresh Tuna	0.0	2.0								0.1		2.7	10.3	12.6	12.9	15.6	12.6	16.3	8.9	3.7	4.0	0.3	0.0				
	Other Fleets	5.2	2.4	0.4	0.5	0.4	0.4	0.7	0.7	0.3	1.1	0.6	0.5	0.5	0.1	1.9	20.1	33.7	8.2	4.2	3.8	1.9	2.6	4.6	4.6	4.8	4.2	8.0
	Total	87.3	55.5	26.9	22.8	24.4	34.5	31.1	25.5	30.4	45.3	47.0	55.0	65.3	86.1	78.8	137.0	195.1	120.2	86.8	112.2	109.9	108.2	101.1	88.6	78.8	80.6	87.2
Gillnet	Sri Lanka	32.2	10.1	7.4	8.2	9.4	9.2	8.9	6.3	6.8	7.0	7.3	7.6	8.2	9.4	11.5	13.7	16.4	21.3	18.6	23.4	29.2	28.9	36.7	33.3	27.8	29.9	33.5
	Islamic Republic of Iran	20.8	4.9											1.0	2.3	3.2	12.1	13.3	19.5	22.5	28.5	20.0	18.0	24.3	13.5	18.0	19.0	29.5
	Oman	7.0	5.1	4.1	5.0	4.8	3.5	1.6	4.6	2.3	2.5	5.9	15.6	16.3	14.4	9.0	13.5	11.5	19.2	21.4	11.6	9.9	11.3	7.4	7.1	6.3	5.3	8.8
	Pakistan	5.1	2.8	2.8	1.3	2.0	2.5	0.8	0.9	1.5	2.6	2.4	3.9	8.6	3.3	4.9	3.9	2.6	2.4	2.1	3.3	3.9	3.9	9.4	5.3	4.0	3.3	3.5
	Indonesia	3.1	1.9	4.7	4.3	2.5	3.2	3.1	3.3	4.3	6.2	2.7	4.2	3.3	2.2	0.9	0.9	0.8	1.3	1.3	1.1	2.7	1.5	1.8	5.0	3.1	3.1	2.3
	Other Fleets	2.3	1.7	5.1	4.9	0.9	1.6	0.7	1.1	4.3	1.7	2.0	2.4	2.0	2.5	1.7	1.7	1.7	1.7	1.6	1.7	1.9	1.7	1.8	1.8	1.7	1.8	4.4
	Total	70.5	26.3	24.1	23.7	19.5	20.0	15.2	16.2	19.2	19.9	20.3	33.6	39.3	34.1	31.2	45.9	46.5	65.4	67.6	69.6	67.6	65.3	81.3	66.1	60.8	62.3	81.9
Line	Indonesia	5.7	2.3	0.7	0.5	0.1	0.5	0.4	0.3	1.7	1.1	2.3	1.5	0.2	0.9	9.1	6.5	8.3	7.9	11.2	11.9	4.9	8.9	12.3	1.5	2.3	4.3	8.3
	Comoros	5.5	1.6	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	3.7	3.7	3.7	5.0	5.0	5.9	5.9	5.8	5.6	5.6	5.4	5.9	5.4	5.4	5.4
	Other Fleets	5.3	2.3	2.9	3.2	3.8	3.4	2.9	2.3	2.2	2.1	2.2	2.4	2.3	2.5	3.0	3.4	3.3	3.0	3.1	3.0	3.0	2.7	3.0	4.4	5.4	6.9	6.8
	Total	16.6	6.1	3.7	3.8	4.1	4.1	3.5	2.8	4.0	3.4	4.7	4.1	6.2	7.2	15.8	14.8	16.6	16.8	20.2	20.7	13.4	17.2	20.8	11.9	13.1	16.6	20.5
Other	Total	0.0	0.0										0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0
All	Total	342.3	141.7	59.5	55.2	54.6	64.8	70.7	111.5	130.1	149.1	164.1	218.2	207.0	242.0	239.5	320.2	398.9	332.7	341.0	348.7	339.4	307.8	354.5	321.2	297.4	318.6	419.9

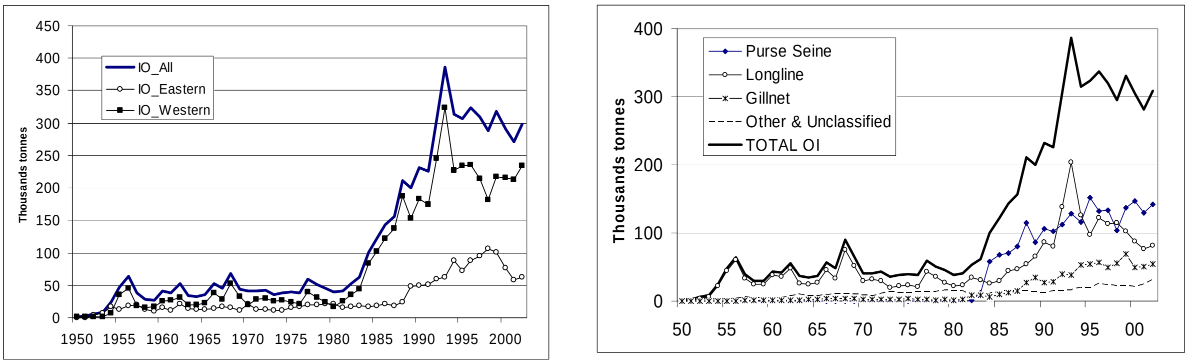


Figure 1. *Yearly catches (thousand of metric tonnes) of yellowfin by area (Eastern and Western Indian Ocean, left) and by gear (longline, purse-seine, artisanal and unclassified, right) from 1950 to 2002.*

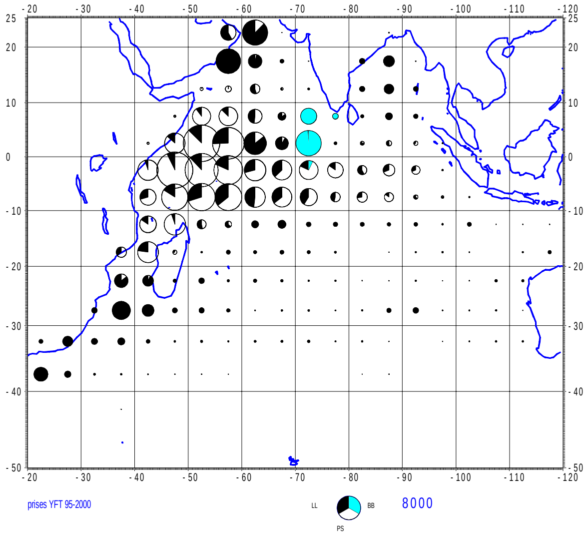


Figure 2. *Average (1995-2000) geographical distribution of yellowfin catches according to the gear (longline, purse-seine and baitboat). The figure is based on available data only, and it does not include catches of important fleets for which spatial distribution is not available.*

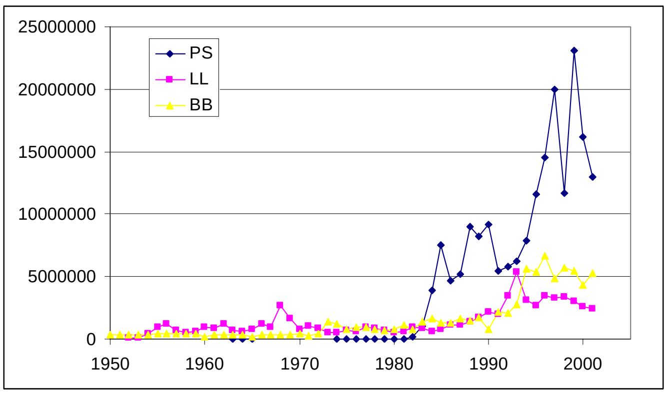


Figure 3. Catch in numbers of yellowfin tuna by gear (PS: purse seine; LL: longline ; BB : baitboat).

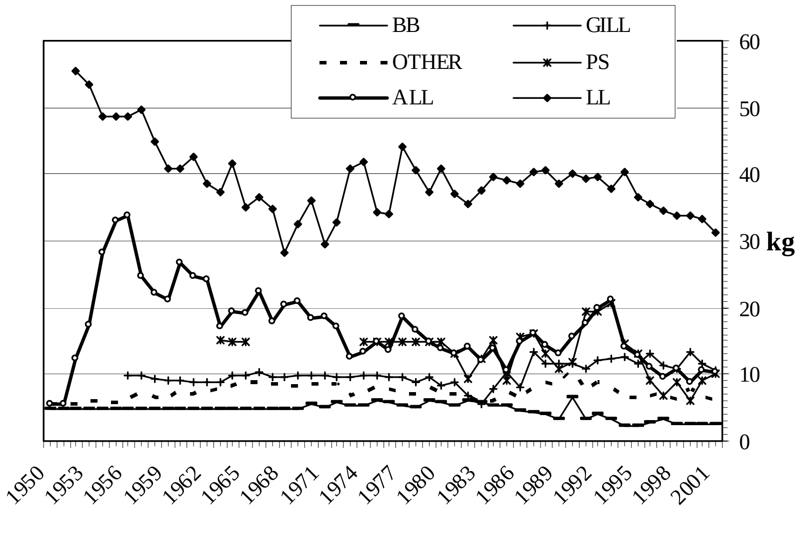


Figure 4. *Yellowfin average weight in the catch by gear (from size-frequency data) and for the whole fishery (estimated from the total catch at size).*

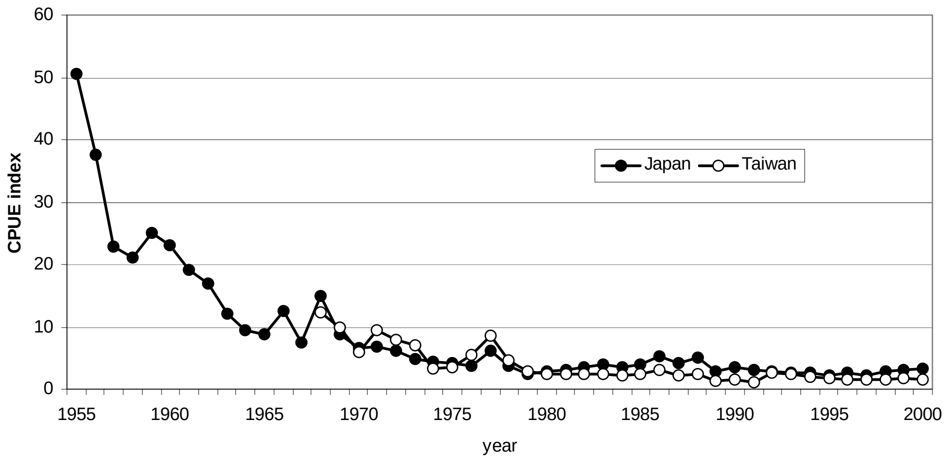


Figure 5. *Yearly standardized CPUE indices based on the Japanese and Taiwan, China longline yellowfin CPUE's in the tropical area (10°N-15°S).*

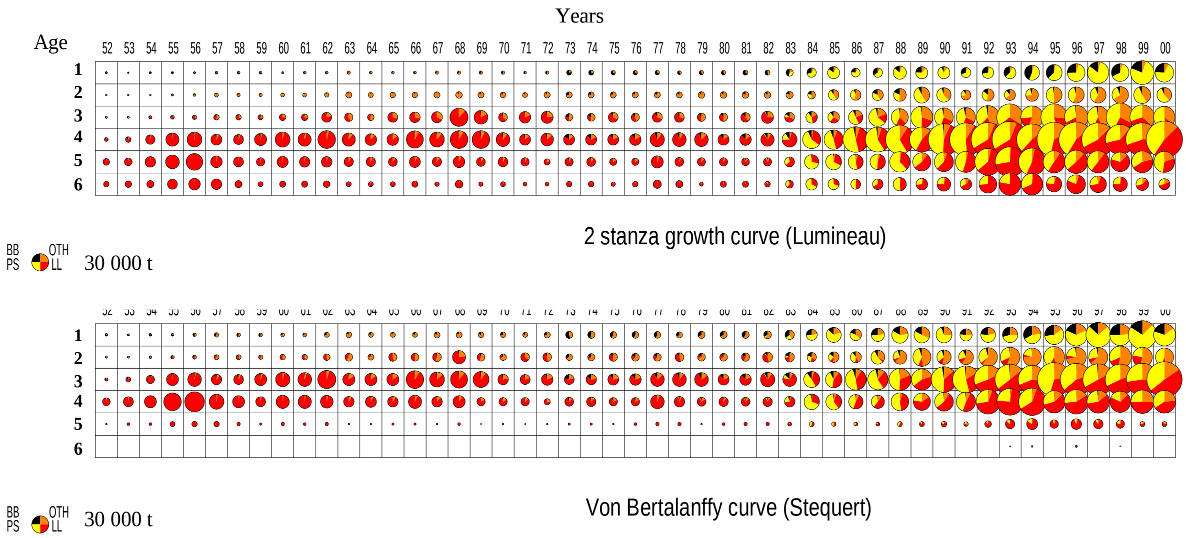


Figure 6. *Catch at age by gear (in weight) according to the two growth hypothesis used by the WPTT: "slow", assuming a two stanzas growth curve (above) and "fast", assuming a constant growth rate (below).*

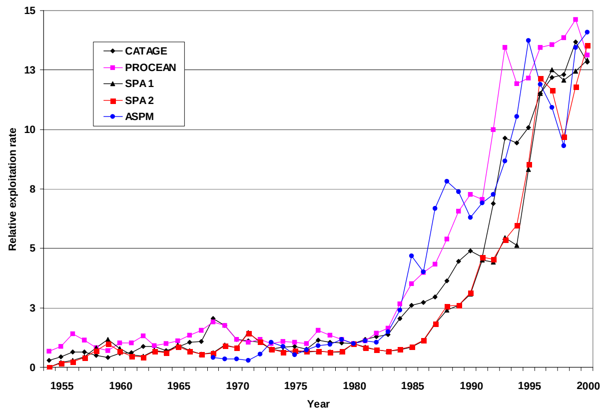


__Figure 7.__ Relative exploitation rates estimated from the five assessments ran by the WPTT (all have been set at 1 in 1980 selected as the reference year).

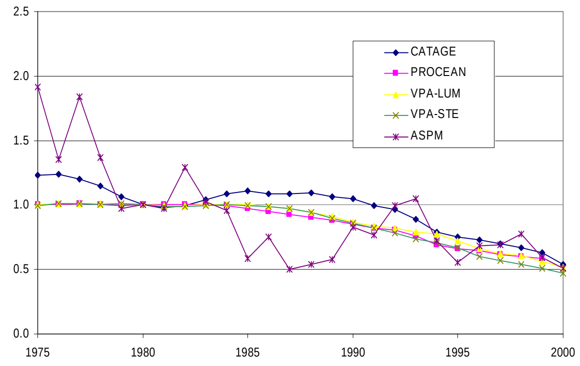


__Figure 8.__ Trend of the relative biomass estimated from the five assessments ran by the WPTT.

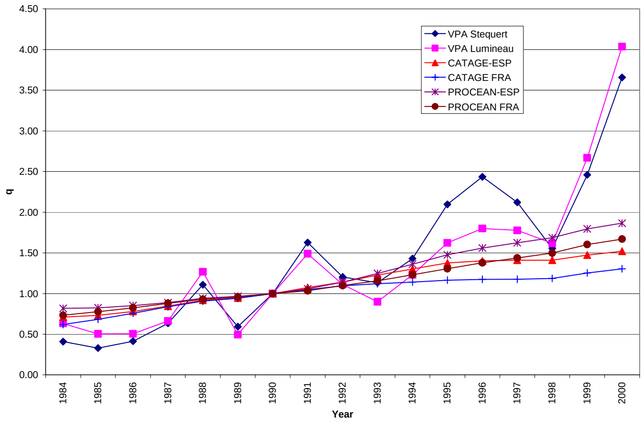


Figure 9. *Average yearly relative catchability coefficients for purse seine fleets estimated from the assessments ran during the meeting; all have been set at one in 1990 selected as the reference year.*

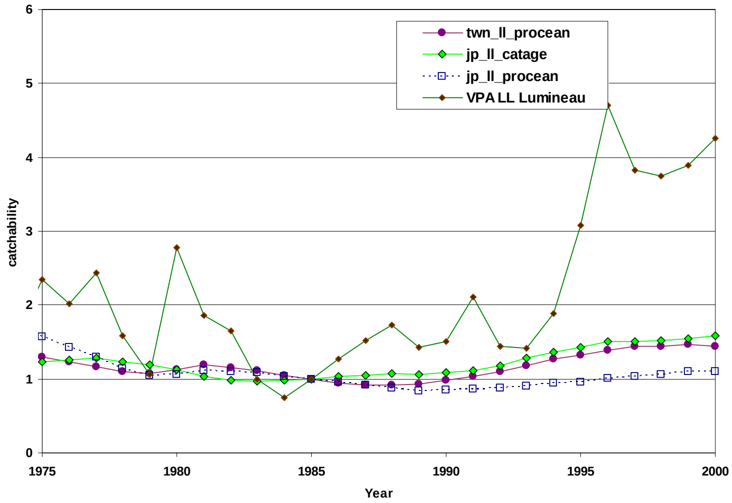


Figure 10. *Average yearly relative catchability coefficients for longline fleets estimated from the assessments ran during the meeting; all have been set at 1 in 1985, selected as the reference year.*

Executive Summary Of The Status Of The Skipjack Tuna Resource

BIOLOGY

Skipjack tuna (*Katsuwonus pelamis*) is a cosmopolitan species forming schools in the tropical and subtropical waters of the three oceans. It generally makes large mixed schools in association with other tunas having a similar size as juveniles of yellowfin and bigeye. This is specially the case with FADs associated schools exploited by the purse seine fishery where skipjack is largely dominant (60-70% of the total catch).

The skipjack tuna resource exhibits characteristics that result in a higher productivity when compared to other tuna species. This species has a short lifespan, and they are exploited during a short period (probably less than 3 years). The species shows high fecundity and spawns opportunistically throughout the year in the whole interequatorial Indian Ocean (north of 20°S, with surface temperature greater than 24°C) when conditions are favorable. As the size at first maturity is about 41-43 cm for both males and females for skipjack, the bulk of their catch is made on fishes that have already spawn.

Although three documents were presented on the skipjack growth, it is still uncertain, mainly because its apparent seasonal and geographical variability . However it seems to be closer to the Atlantic estimates than those from the Pacific Ocean. Consequently, it is still a priority to gain more knowledge on the skipjack time-and-space variability in growth patterns.

In the absence of any stock structure estimate, a single Indian Ocean stock is assumed. However, it appears to be less migratory than the other tunas; taking into account the biological characteristics of this species and the different areas where fishing takes place, smaller management units could be considered.

Because of these characteristics, skipjack tuna resources are considered to be resilient stocks which are not easily over fished.

FISHERIES

Catches increased slowly from the 1950s, reaching some 50,000 t at the end of the 1970s, mainly caught by baitboats and gillnets. The catches increased rapidly with the arrival of the purse seiners in the early 1980s, to become the most important tuna species in the Indian Ocean catches since 1999 with catches exceeding 400,000 t yearly (*Figure 1 and Table 1*).

Skipjack catches peaked in 2002 at 563,000 t: 246,000 t from the main purse-seine fishery, 114,000 t for the Maldivian baitboat fishery and 203,000 t for the other fisheries. The increase in 2002, relative to the previous year, was observed at least for both the purse seine (mainly due to a larger catch on FADs) and the Maldivian baitboat (essentially from an increase in CPUE) fisheries. Catches in 2003 (548,000 t) were similar to those in 2002

In recent years, skipjack catches were shared in similar proportions between the industrial purse seine fishery and the different artisanal ones (baitboat, gillnets and others), the majority of this catch originating in the western Indian Ocean (*Figure 1*). In general, there is low inter-annual variability when compared with similar fisheries in other oceans.

The increase of skipjack catches by purse seine fisheries is related to the development of a fishery in association with Fish Aggregating Devices (FAD); currently, 80% of the skipjack tuna caught by purse-seine is taken under FADs. Catch rates by purse seiners show an increasing trend (*Figure 3 and 5*) possibly due to an increase in fishing power and to an increase in the number of FADs (and the technology associated with them) in the fishery.

The Maldivian fishery has increased regularly its effort with the mechanization of its pole and line since 1974, and then the use of anchored FADs since 1981. Skipjack represents some 75% of its total catch, and catch rates have regularly increased since the beginning of the 80s (*Figure 4*).

Little information is available on the gillnet fisheries (mainly from Sri Lanka, Iran, Pakistan, India and Indonesia) which take around 30 to 40 % of the total catch of skipjack .

The average size of skipjack caught in the Indian Ocean remains relatively large (greater than in the Atlantic, but lower than in the Pacific) with 2.5 kg for purse-seine, 3.0 kg for the Maldivian baitboats and 4-5 kg for the gillnet (Figure 5).

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

No new assessment of skipjack was undertaken during 2004 therefore the current stock status is based on the assessment undertaken in 2003.

The assessment of skipjack tuna was a priority for the WPTT in 2003. The group analyzed the information available for stock assessment and considered that there were large uncertainties in the information needed to conduct a complete assessment of the Indian Ocean skipjack tuna. As an alternative, the group decided to analyze different fishery indicators that provide a general understanding of the estate of the stock.

1. **Trends in catches**: The trend in catches indicate a large and continuous increase in the catches of skipjack tuna since the mid-1980's (*Figure 1*), particularly due to an expansion of the FAD-associated fishery in the western Indian Ocean. There is no sign that the rate of increase is diminishing in recent years.

2. **Nominal CPUE Trends:** *Figure 3* shows the nominal CPUE trends of the purse seine fishery for three major areas: Somalia area, Western Seychelles area and Mozambique Channel. In the Somalia and Western Seychelles area catches have been increasing recently. In each of these areas, with the exception of west Seychelles in 2002 the nominal CPUE has been relatively stable since the late 1980's. Since this is a period during which is believed that effective purse-seine effort has increased substantially it is likely that the true abundance in these areas has decreased. In itself, this is not unexpected given the large increase in catches over that period. However, as these areas may be source of skipjack recruitment to the Maldives artisanal fishery, there is the potential for an interaction to be occurring between these fisheries.

3. **Average weight in the catch by fisheries:** The Working Party noted that the average weights of the skipjack taken from various areas have been more or less the same since 1991 (*Figure 6*). Figure 5 shows catches at size expressed as average weight from three major gears; purse seine, baitboat and gillnet. The purse seine and the baitboat fisheries take the greatest catch around 40-50 cm while catches taken from gillnet fisheries ranges from 70-80 cm.

4. **Number of squares fished:** The trend in the number of one-degree squares visited and with catches of skipjack tuna by the main purse-seine fleets suggests that, after the late 1990's, the spatial distribution of the main purse-seine has remained at the same average level. In 1998, a particularly strong El Niño episode resulted in a much wider spatial distribution of the catches.

Length-based cohort analyses. The WPTT did not develop a formal stock assessment for skipjack tuna. However, a length-based cohort analysis was carried during the meeting to analyze skipjack catches and length frequencies (*Figure 7*). The recent period is characterized by a dramatic increase of catches of smaller size fish due to the development of the purse seine FAD fishery and the largest mode reflects the artisanal (essentially Maldives's pole-and-line) fishery.

The fishing pattern is shown in *Figure 8*. They reflect the evolution of the fishery and in particular the increased mortality on both purse seine and the artisanal components. In particular they represent increase of purse seine fishery in the eighties and of the FAD fishery in the nineties.

Interaction between fisheries and species. A potential problem in the skipjack fisheries is the interaction between industrial and artisanal fisheries, and more particularly between the western Indian Ocean purse-seine fishery and the Maldivian baitboat fishery.

Large numbers of juvenile bigeye and yellowfin tuna are caught in the course of purse-seine sets on FADs that target skipjack tuna.

SKIPJACK TAGGING AND IOTTP

The analysis of skipjack tuna stock status conducted by the WPTT reinforce the previous recommendation that only the results of the large scale tagging programme planned by the IOTC will allow to estimate for skipjack tuna:

- stock structure,
- variability of growth in time and space,

- natural mortality at age,
- stock size,
- as well as the potential interactions between skipjack tuna fisheries.

Subsequently, the Scientific Committee recommended to fully incorporate skipjack tuna in the tagging operations that will be planned for the incoming large scale IOTTP tagging programme

STOCK ASSESSMENT

The Scientific Committee recognized that, in spite of not having a full stock assessment for skipjack, the analysis of the stock status indicators provided by the WPTT does not show reasons for immediate concern.

The SC noted two additional arguments in favour of this conclusion. First, in most fisheries, declining catches combined with increasing effort are usually indicators that a stock is being exploited close or above its MSY. In the case of skipjack tuna, catches have continued to increase as effort increased. Second, the majority of the catch comes from fish that is already sexually mature (greater than 40 cm), as the fishing pattern by size indicates.

The SC noted that, although there might be no reason for immediate concern, it is clear that the catches cannot be increased at the current rate indefinitely. Therefore, it recommends that the situation be monitored closely and be reviewed in the WPTT.

MANAGEMENT ADVICE

The Working Party on Tropical Tunas has not made any specific management recommendations for the skipjack stock. However, the life history characteristics of skipjack tuna, the information presented in the documents reviewed, and the information in the stock status indicators prepared during the meeting suggests that there is no need for immediate concern about the status of skipjack tuna.

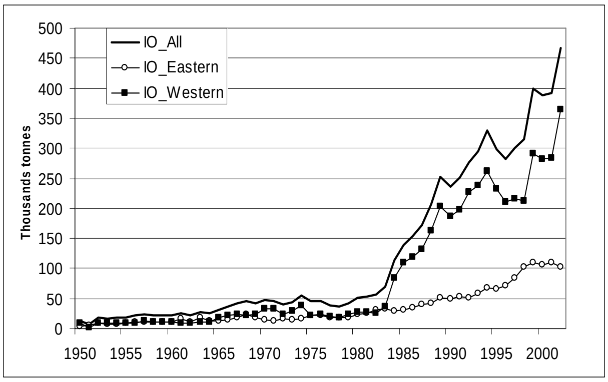
SKIPJACK TUNA SUMMARY

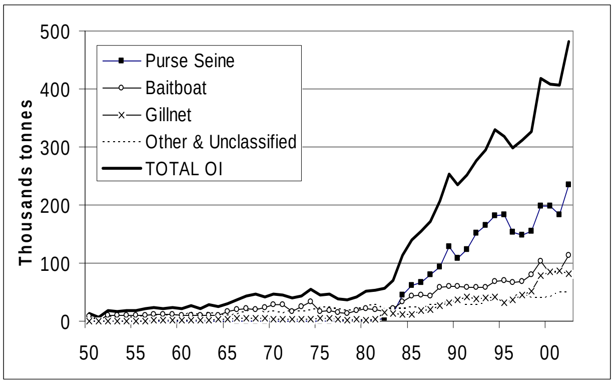
Maximum Sustainable Yield :	unknown
Current (2003) Catch:	548,000 t
Mean catch over the last 5 years	523,000 t
Current Replacement Yield :	-
Relative Biomass (B_{cur}/B_{MSY}) :	unknown
Relative Fishing Mortality (F_{cur}/F_{MSY}):	unknown
Management Measures in Effect :	none

Table 1. Catches of skipjack tuna by gear and main fleets for the period 1954-2003 (in thousands of tonnes). Data as of 20 November 2004.

Gear	Fleet	Av99/03	Av54/03	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78
Purse seine	Indonesia	8.6	2.4																					0.3	0.5	0.7	0.9	0.9
	Japan	2.4	3.4																								0.1	0.9
	Other Fleets	5.1	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	215.0	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.7	1.0	1.8
Baitboat	Maldives	97.1	36.1	9.0	9.0	9.0	10.0	10.0	10.0	9.0	8.0	8.0	8.0	8.0	14.1	16.9	18.9	17.5	19.6	27.6	28.0	17.5	19.5	22.5	14.9	18.6	13.7	13.2
	Other Fleets	4.8	3.1	1.6	1.6	1.7	1.6	1.7	1.6	1.6	2.1	2.1	2.2	2.3	2.6	2.8	2.7	2.9	3.1	0.3	0.0	0.4	5.0	10.9	2.2	0.1	0.6	0.8
	Total	101.9	39.1	10.6	10.6	10.7	11.6	11.7	11.6	10.6	10.1	10.1	10.2	10.3	16.7	19.7	21.6	20.4	22.7	27.9	28.0	17.9	24.6	33.4	17.1	18.7	14.3	14.0
Longline	Total	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Gillnet	Sri Lanka	71.4	20.4	1.1	1.0	1.3	1.6	1.7	1.9	2.4	2.9	4.5	6.0	5.8	5.5	6.3	7.0	7.9	8.8	6.9	5.0	8.8	10.5	9.3	7.2	12.6	12.5	14.7
	Indonesia	67.5	25.5	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.4	1.4	1.5	1.6	1.8	1.9	1.8	1.9	2.1	3.8	4.0	6.3	6.9	8.9	16.4	20.8	28.2	22.0
	Pakistan	3.9	3.6	0.8	0.8	0.7	1.9	0.9	0.9	1.2	1.0	1.6	2.4	3.4	3.6	4.9	4.7	4.7	4.3	3.9	3.2	3.8	3.0	4.1	4.5	4.2	3.8	2.2
	Other Fleets	0.7	1.7	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.4	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.8	0.8	3.2	1.0	1.3	2.5	1.5	2.1
	Total	166.5	54.3	3.0	3.0	3.3	4.7	4.0	4.1	4.9	5.8	7.7	10.1	10.9	11.1	13.2	13.8	14.8	15.3	15.0	12.9	19.6	23.5	23.3	29.4	40.3	46.1	40.9
Line	Indonesia	35.8	12.6	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	1.1	1.2	1.7	1.9	2.6	5.2	6.6	1.1	0.9
	Other Fleets	4.0	3.1	0.3	0.4	0.4	0.4	0.4	0.5	0.6	0.7	1.0	1.3	1.2	1.2	1.4	1.5	1.8	1.9	3.1	2.7	3.0	3.5	3.4	3.4	4.6	4.1	4.1
	Total	39.8	15.7	0.5	0.6	0.6	0.6	0.6	0.7	0.8	0.9	1.2	1.5	1.5	1.5	1.7	1.9	2.1	2.3	4.2	3.9	4.7	5.4	6.0	8.6	11.2	5.3	5.0
All	Total	523.2	169.1	14.1	14.2	14.7	16.9	16.3	16.3	16.3	16.8	19.0	21.9	22.9	29.3	34.6	37.3	37.3	40.4	47.2	45.0	42.5	53.5	63.1	55.6	70.8	66.6	61.8

Gear	Fleet	Av99/03	Av54/03	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03
Purse seine	Spain	80.3	21.7						6.4	18.6	19.1	27.9	39.7	63.9	47.9	41.8	46.7	51.3	61.6	69.6	66.3	62.9	58.6	74.3	79.4	68.5	91.3	88.0
	France	42.4	16.0			0.2	1.0	9.4	27.3	29.8	36.1	35.6	36.1	43.1	29.0	39.4	45.0	48.2	58.4	48.7	40.1	31.3	30.3	42.7	39.9	36.3	54.4	38.9
	NEI-Other	32.0	7.5					0.4	8.2	8.4	6.4	4.8	7.0	7.9	11.0	10.8	10.8	17.4	24.5	22.3	18.4	24.3	31.2	33.4	40.8	26.5	31.9	27.5
	Seychelles	24.1	2.8													1.8	0.6					4.9	10.7	15.8	11.6	26.2	29.9	36.8
	NEI-Ex-Soviet Union	20.1	3.7												0.7		10.1	8.7	8.2	20.6	16.4	11.6	10.2	17.3	19.8	21.1	21.0	21.0
	Indonesia	8.6	2.4	1.0	1.1	1.1	1.4	1.9	1.2	2.5	2.7	2.7	2.9	2.9	3.0	1.5	3.7	6.3	7.3	7.1	8.2	8.8	8.4	8.9	9.2	8.8	7.8	8.1
	Japan	2.4	3.4	0.6	0.4	0.1	0.5	0.6	0.7	0.3	0.6	0.9	2.3	3.4	10.9	15.9	31.7	31.4	20.1	16.1	7.0	6.7	5.7	4.6	2.3	1.8	1.9	1.5
	Other Fleets	5.1	2.5	0.1	1.1	1.8	2.7	1.5	3.1	3.2	4.4	9.9	7.8	8.3	8.8	13.1	6.4	7.1	6.3	3.9	2.7	4.0	3.2	5.1	3.0	9.3	8.1	
	Total	215.0	60.0	1.6	2.5	3.1	5.6	13.7	46.9	62.9	69.3	81.7	95.7	129.6	111.3	124.3	155.1	170.2	186.4	188.2	159.1	154.6	158.4	202.2	206.1	198.4	246.4	221.8
Baitboat	Maldives	97.1	36.1	17.3	22.2	19.6	15.3	19.3	32.3	42.2	45.1	42.6	58.2	57.8	60.7	58.3	57.6	58.0	69.0	69.9	66.2	68.1	77.8	92.3	78.8	86.8	113.9	113.9
	Other Fleets	4.8	3.1	0.4	0.0	0.2	1.3	1.2	1.0	1.0	1.1	1.3	1.8	1.4	1.8	6.9	7.3	14.2	6.8	7.4	7.4	8.7	4.3	7.2	7.5	2.7	3.2	3.2
	Total	101.9	39.1	17.6	22.2	19.9	16.6	20.5	33.3	43.2	46.2	43.9	60.0	59.2	62.5	65.2	64.9	72.2	75.8	77.3	73.6	76.8	82.1	99.5	86.3	89.5	117.0	117.0
Longline	Total	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Gillnet	Sri Lanka	71.4	20.4	12.2	16.2	18.2	17.8	16.2	13.2	14.8	14.5	15.2	15.8	17.3	20.4	23.0	26.9	31.4	38.7	40.3	47.0	55.8	56.7	72.2	73.0	68.1	73.9	69.8
	Indonesia	67.5	25.5	26.7	35.7	40.7	40.9	44.9	49.2	43.9	48.9	27.5	49.1	62.1	44.4	21.1	23.3	25.8	31.5	31.5	37.7	66.6	48.0	51.6	94.5	79.7	60.6	51.1
	Islamic Republic of Iran	22.9	3.0											0.3	0.8	1.1	4.3	4.4	7.4	1.1	2.5	8.3	4.7	13.9	18.5	23.2	23.1	36.0
	Pakistan	3.9	3.6	3.8	1.8	2.7	3.4	1.1	1.2	2.0	1.5	3.7	5.6	7.5	7.6	7.5	6.1	6.9	8.1	7.1	4.4	4.6	4.5	4.9	4.6	3.6	3.3	3.3
	Other Fleets	0.7	1.7	2.8	2.8	2.3	3.3	3.3	4.2	4.4	4.8	6.7	5.6	7.3	6.9	0.6	0.7	1.2	1.2	1.5	1.2	1.6	0.7	0.8	0.9	0.5	0.5	1.0
	Total	166.5	54.3	45.5	56.4	63.9	65.3	65.5	67.8	65.2	69.7	53.2	76.0	94.4	80.1	53.4	61.3	69.6	86.9	81.6	92.8	136.9	114.6	143.3	191.5	175.1	161.4	161.2
Line	Indonesia	35.8	12.6	1.4	1.7	2.5	3.6	3.7	2.8	5.2	1.4	23.6	6.7	4.4	6.2	35.6	26.9	46.4	53.8	49.1	56.6	41.2	50.9	51.6	19.5	30.0	33.8	43.9
	Other Fleets	4.0	3.1	3.8	4.6	5.0	3.3	3.2	3.1	3.2	3.3	3.2	3.4	5.7	6.2	6.3	4.8	4.6	4.5	4.7	4.4	4.8	4.5	3.5	3.9	4.0	4.4	4.2
	Total	39.8	15.7	5.3	6.3	7.5	6.9	6.9	5.9	8.4	4.7	26.8	10.1	10.1	12.4	41.9	31.6	51.0	58.3	53.8	61.0	46.0	55.4	55.1	23.5	34.0	38.1	48.1
Other	Total	0.1	0.0										0.0		0.0	0.0	0.0	0.0	0.0		0.0		0.0		0.0	0.0	0.2	0.2
All	Total	523.2	169.1	70.1	87.5	94.4	94.4	106.7	154.0	179.6	189.9	205.7	241.9	293.4	266.4	284.8	313.0	363.3	407.5	401.0	386.5	414.4	410.6	500.2	507.4	497.0	563.1	548.3





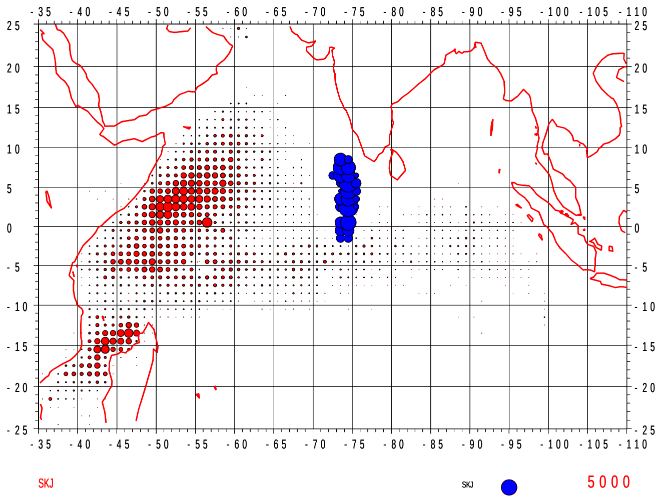


Figure 1*. (a) Yearly catches (thousand of metric tonnes) of skipjack tuna by area (Eastern and Western Indian Ocean, top left) and by gear (top right) from 1950 to 2002 (right). (b) Average spatial distribution of Indian Ocean skipjack catches for 1995—2001 for purse-seine (red/light) and baitboat (blue/dark).*

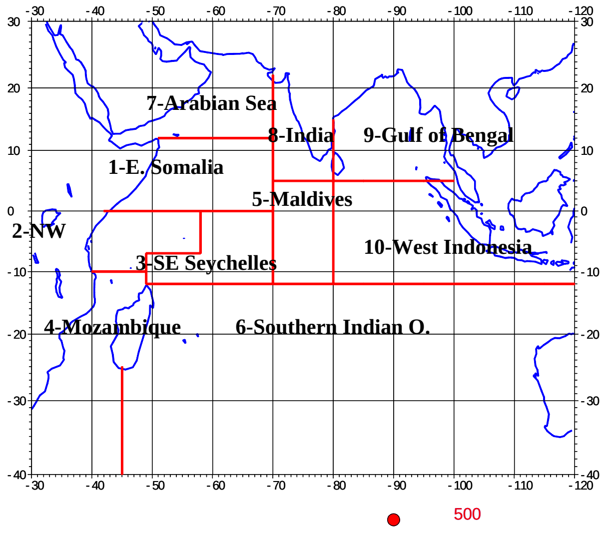


Figure 2. *Areas used for the calculation of the CPUE trends shown in Figure 4*

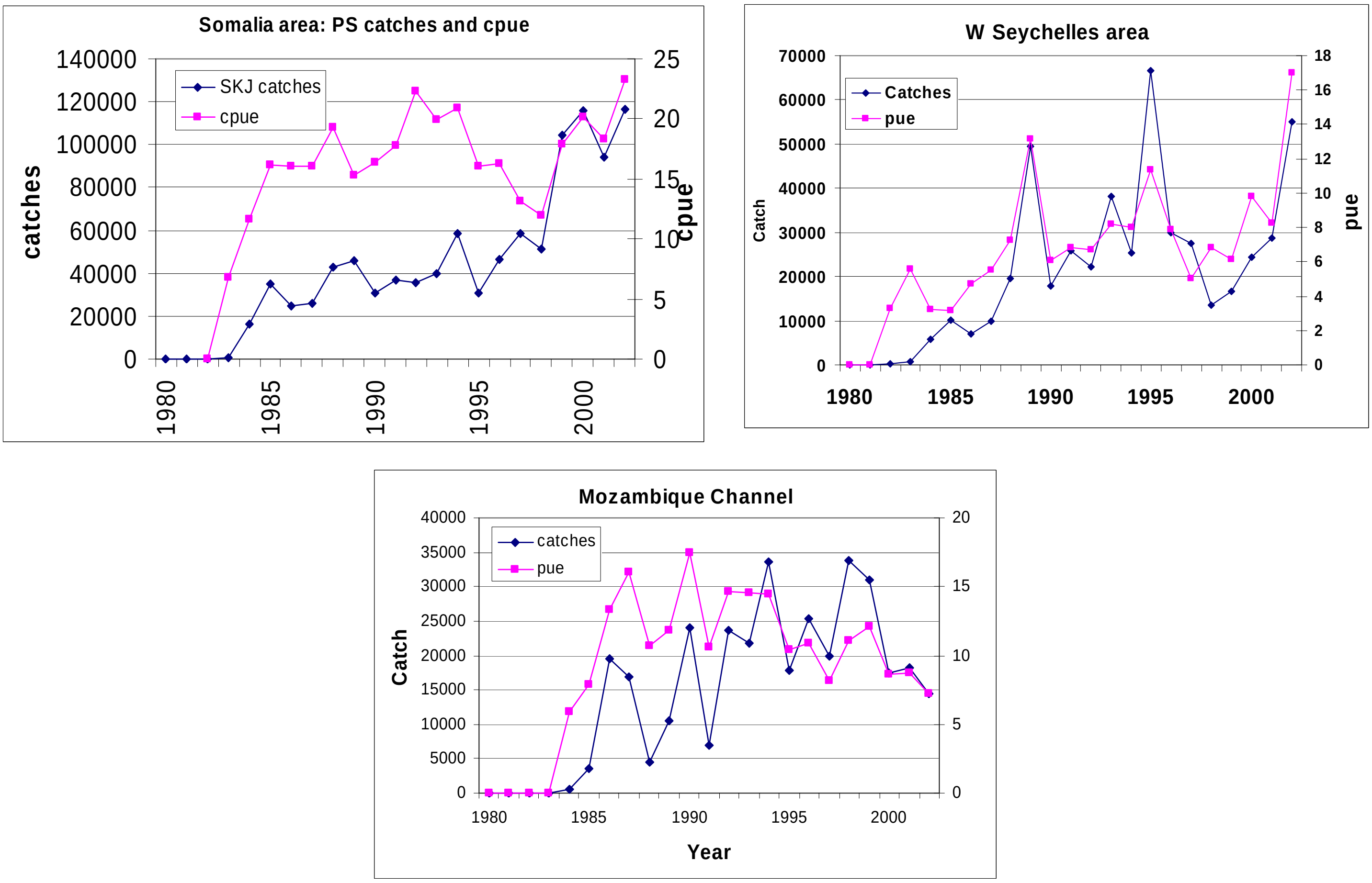


Figure 3. *Nominal CPUEs for three important purse seine fishing ground areas: Somali Basin (top left panel); Mozambique Channel top right panel) and Western Seychelles (bottom panel).*

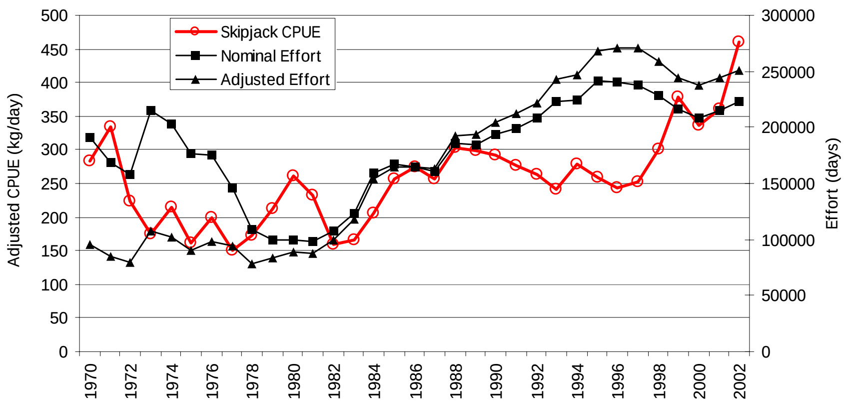


Figure 4. *Time series of Maldives CPUE and the nominal and adjusted effort (WPTT-03-23).*

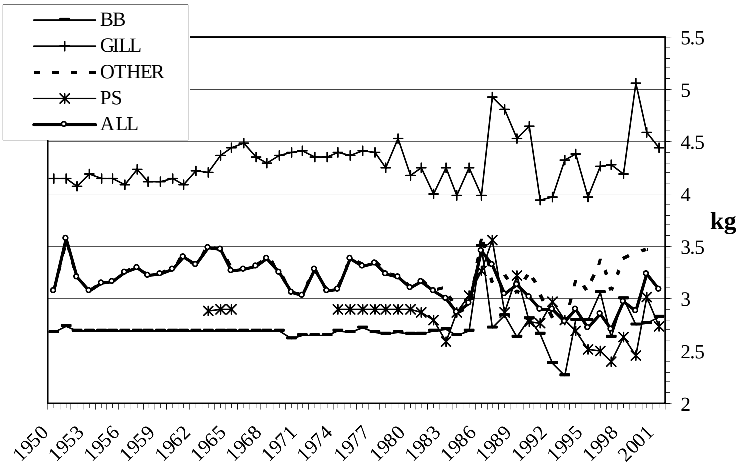


Figure 5. *Skipjack tuna average weight in the catch by gear (from size-frequency data) and for the whole fishery (estimated from the total catch at size).*

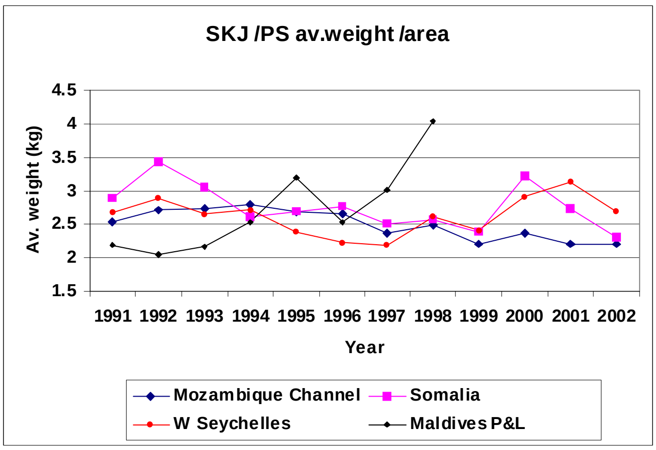


Figure 6. *Time series of average weight of skipjack caught by the purse seine and pole and line by major areas. (1991 - 2002)*

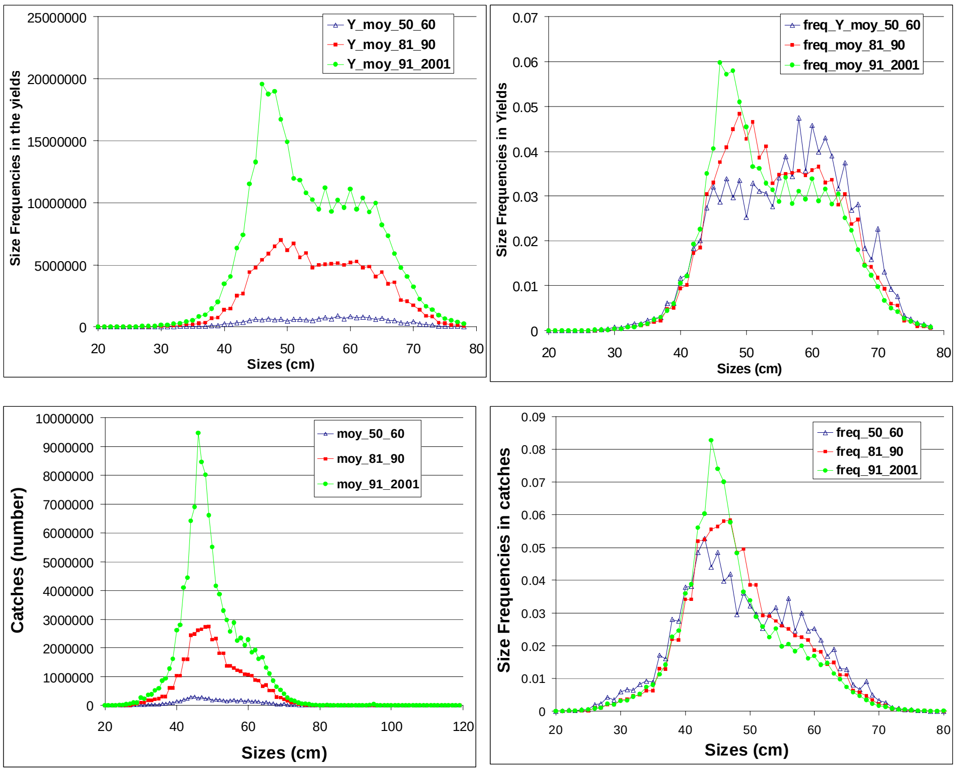


Figure 7. *Size frequencies of the yield (top panels) and catch by numbers (bottom panels) for three time periods: 1950-1960 (green), 1981-1990 (red) and 1991-2001 (blue). Left panels are actual numbers and right panels are in proportions. Note the two modes (40-50 and 55-65 cm) that appear in the yield frequencies but which are less visible in the number frequencies.*

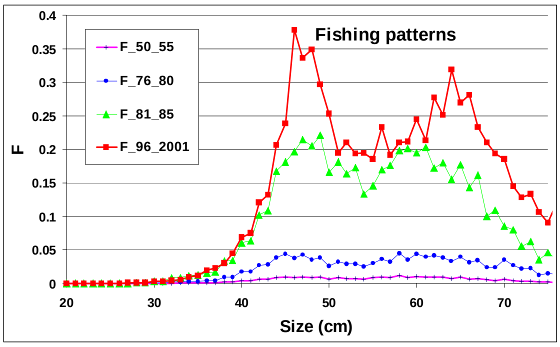


Figure 8*. Estimated fishing mortality by size for four five-year mean periods : (1950-1955, 1976-1980, 1981-1985, and 1996-2001)*

Executive Summary Of The Status Of The Bigeye Tuna Resource

BIOLOGY

Bigeye tuna is a tropical tuna species living in surface waters down to about 300 m depth or more. Juveniles of this species frequently school at the surface underneath floating objects in single-species groups or in aggregations with yellowfin and skipjack tunas. Association with floating objects appears less common as they grow older.

Currently a single stock is assumed for the Indian Ocean, based on circumstantial evidence. The range of the stock (as indicated by the distribution of catches) includes tropical areas, where reproductively active individuals are found, and temperate waters, usually considered to be feeding grounds.

Of the three tropical tuna species, bigeye tuna lives the longest (more than 15 years) and that makes it the species most vulnerable, in relative terms, to over-exploitation. Bigeye tuna start reproducing when they are approximately three years old, at a length of about 100cm.

FISHERY

Bigeye tuna is predominantly caught by industrial fisheries and appears only occasionally in the catches of artisanal fisheries. Bigeye tunas have been caught by industrial longline fleets since the early 1950's, but before 1970 they only represented an incidental catch. After 1970, the introduction of fishing practices that improved the access to the bigeye resource and the emergence of a sashimi market made bigeye tuna a target species for the main industrial longline fleets. Total catch of bigeye by longliners in the Indian Ocean has increased steadily since the 1950's, with catches exceeding 100,000 in the period 1996-2000 (Figure 1). In 2003 the longline catch was 115,000 t. Japan, Indonesia and Taiwan,China are the major longline fleets fishing for bigeye (Table 1). More recently (since the early 1990s) bigeye tunas have been caught by purse seine vessels fishing on tunas aggregated on floating objects. Total catch of bigeye by purse seiners in the Indian Ocean in 2003 was 23,000 t, down from 29,000 t in 2002 (Table 1). Forty to sixty boats have operated in this fishery since 1984. Most of the bigeye catches reported under purse seiners are juveniles (under 10 kg) (Figure 3), and this results in purse seiners taking a larger numbers of individual fish than longliners (Figure 4). Large bigeye tuna (above 30 kg) are primarily caught by longlines, and in particular deep longliners (Figure 3).

In contrast with yellowfin and skipjack tunas, for which the major catches take place in the western Indian Ocean, bigeye tuna is also exploited in the eastern Indian Ocean (Figures 1 and 2). Catches of bigeye decreased in 2000 and 2001 relative to earlier years, in the eastern and western parts of the Indian Ocean, but increased in recent years in the western Indian Ocean. The increase in catches in the eastern Indian Ocean is mostly due to increased activity of small longliners fishing for fresh tuna. This fleet started operating around 1985. In the western Indian Ocean, the catches of bigeye are mostly the result of the activity of large longliners and purse seiners.

An important part of the longline catch is taken by longliners from non-reporting flags (see Table 1). The Commission has initiated sampling programmes in various ports in the Indian Ocean to better estimate catches from this component.

AVAILABILITY OF INFORMATION FOR ASSESSMENT PURPOSES

The reliability of the total catches has continued to improve over the past years, although still up to 25% of the catch has to be estimated. The fact that most of the catch of bigeye tuna comes from industrial fisheries has facilitated the estimation of total catches. Catch and effort data, potentially useful to construct indices of abundance, is also considered to be of good overall quality. Size-frequency information is considered to be relatively good for most of the purse-seine fisheries, but insufficient for the longline fisheries. This is due primarily to a lack of reporting from the Korean fleets in the 1970's, lack of reporting from Taiwanese fleets since 1989 and insufficient sample sizes in recent years in the Japanese fishery.

Information on biological parameters is scarce and improvements are needed in particular concerning natural mortality. The large-scale tagging programme to be initiated soon is oriented towards improving knowledge of this and other biological characteristics. A new growth curve was presented in 2003 which was considered to be an important improvement over previously existing information.

In the case of the purse-seine fishery, it was not possible to derive indices of abundance from catch-and-effort information, because the interpretation of nominal fishing effort was complicated by the use of FADs and increases in fishing efficiency that were difficult to quantify. In the case of the longline fisheries, indices of abundance were derived, although there still remain uncertainties whether they fully take into account targeting practices on different species (Figure 5). One of the major difficulties faced in the bigeye tuna stock assessment was related to the divergent trends observed since the early nineties between Japanese and Taiwanese CPUEs. While the Japanese CPUE has shown a steady decline in the past ten years, the Taiwanese CPUE has been relatively stable but shows a substantial increase in the last two years.

These diverging trends have occurred at the same time as changes in the species composition in the catch of the two fleets. In their main equatorial fishing grounds where bigeye is fished, the two fleets have obtained similar species composition of their catches until the early nineties. However, it can be noted that since 1993, the Japanese longliners have been showing catches dominated by yellowfin (60% during recent years in the area), while catches by Taiwanese longliners in this area are now widely dominated by bigeye (about 70% of their catch in the area). This divergence between CPUEs and species composition of catches taken simultaneously in the same areas by the two fleets could be due, either to statistical problems, or to changes in the targeting by one of the two fleets (or by both fleets) that are currently not accounted for in the CPUE standardization. The trend of the Japanese CPUE was assumed to be a better representation of the true biomass trends, but this assumption remains questionable, as the divergence between the CPUEs of the two fleets is not yet fully understood.

STOCK ASSESSMENT

In 2004, the WPTT conducted a stock assessment on the basis of the best available information using age-structured production models (ASPM). Maximum sustainable yield (MSY) was estimated to be about 96,000 t (95% CI's: 59,000 - 121,000 t), from the results considered to be the most reliable. The assessment suggests that the population is currently above the MSY level but has been declining since the late 1980s (Figure 6). The overall fishing mortality is estimated to be currently that expected at the MSY level, but recent catches, although declining in two of the past three years, have continued to exceed the estimated MSY and therefore they do not appear sustainable. This apparent paradox can be explained by noting that, according to the results of the assessment, the current biomass is above the biomass at MSY. In this case, even a fishing mortality rate less than that at MSY can produce a catch which is greater than MSY, at least temporarily. However, it should also be noted that considerable uncertainty remains around the estimates of current fishing mortality and the estimated fishing mortality at MSY (Figure 11).

The present situation is linked to the rapid increase in both fishing mortality and catches over the last ten years. If current catches are maintained, the population will fall soon to levels below those of MSY.

The recruitment parameters estimated by the model suggest a very weak dependency of the recruitments on the spawning biomass level. However, those parameters are considered to be poorly estimated. In 2004, the WPTT conducted forward projections for the period 2003-2013 on the basis of the results of the

ASPM assessment (using Japanese(1960-2002) CPUE in the whole Indian Ocean), assuming three different scenarios:

- A constant catch scenario, where the catches are maintained at 2002 levels throughout the projected period.
- A constant fishing mortality (F) scenario, in which the fishing mortality is assumed to remain constant at the levels estimated for 1999.
- An increasing fishing mortality scenario, in which fishing mortality is assumed to continue to increase at a rate of 6 % per year during the projected period.

These projections are presented in Figures 7, 8 and 9.

The constant catch scenario predicts the continued steady decline of both the spawning stock and the total biomass, indicating that the current catches are not sustainable (Figure 7).

Projections under the constant F scenario indicate that the spawning stock and the total biomasses would reach an equilibrium at the MSY level by around 2008 (Figure 8). This is a direct consequence of the assumed fishing mortality for the projected period that has been estimated to be exactly the fishing mortality level that would produce MSY.

Projections assuming an increasing F at an annual rate of 6 % are similar to those achieved under the constant catch scenario, i.e., a continued steady decline of both the spawning stock biomass and the total biomass (Figure 9). Of particular concern is the predicted reduction by the year 2013 of the spawning stock biomass to below 20 % of its virgin level, a value that is often considered as a limit reference point.

Given that the current assessment suggests that recruitment is almost independent of spawning stock biomass, the results of the projections reflect mostly yield-per-recruit effects, which could also be evaluated using a multi-gear yield-per-recruit analysis such as the one depicted in Figure 10. This figure illustrates the changes in long-term yield-per-recruit that arise from changes in the fishing mortalities (relative to the current fishing mortality) of the two major fishing gears that exploit bigeye tuna. This calculation was done on the basis of the results and assumptions on input values from the 2003 assessment.

A number of uncertainties in the assessments and the projections conducted have been identified. These uncertainties include:

- Uncertainty about how well the model structure used in the assessment approximates the true dynamics of the population, and about the quality of the estimation of some of the model key parameters.
- Insufficient size information for the catches of longline fisheries, especially in recent years.
- Uncertainty about the procedure utilized in converting the catch-at-size to catch-at-age.
- Uncertainty about the natural mortality at various life stages, including uncertainty about the functional form of its dependency with age
- Uncertainty about the changes in catchability of the different fisheries involved, especially in the purse-seine fishery. Future consideration of an increase in efficiency could result in a more pessimistic appraisal of the stock status. For example, it is possible that the fishing mortality that would result in the MSY has already been exceeded.

- There are uncertainties concerning the available indices of abundance as they provide contradictory information about recent trends in the population.

Although there is scope for improvement in the current assessment, it is unlikely that these uncertainties will be substantially reduced for the next assessment cycle.

MANAGEMENT ADVICE

The results of further assessments of the bigeye tuna stock using age-structured production models presented in 2004 to the WPTT are more pessimistic than previous assessments.

The Scientific Committee had already noted with concern the rapid increase of catches of bigeye tuna at its meeting in 1999. Since then, catches have decreased for two of the past three years. Nevertheless, taking into account the results of the current assessment, which represents the best effort to date to analyse the available data in a formal context, it is likely that current catches are still above MSY and it is possible that fishing effort has exceeded the effort that would produce MSY.

The current level in catch in numbers of juvenile bigeye tuna by purse seiners fishing on floating objects is likely to be detrimental to the stock if it continues, as fish of these sizes are well below the optimum size for maximum yield per recruit.

The Scientific Committee also noted that juvenile bigeye tuna are caught in the FAD purse-seine fishery that targets primarily skipjack tuna. Some measures to reduce the catches of bigeye tuna in this fishery could be expected to result in a decrease in the catches of skipjack tuna.

The Committee recommends that a reduction in catches of bigeye tuna from all gears, eventually to the level of MSY, be started as soon as possible and that fishing effort should be reduced or, at least, it should not increase further.

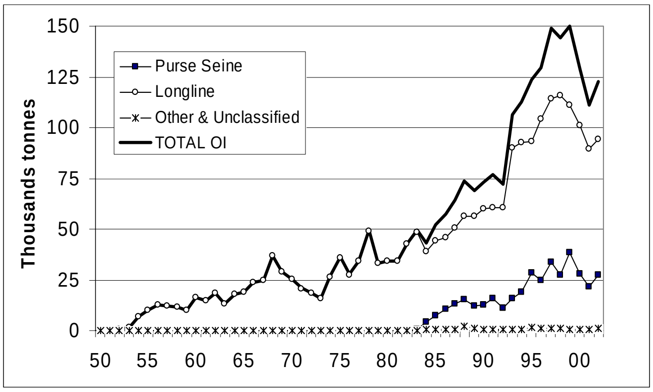
BIGEYE TUNA SUMMARY

Maximum Sustainable Yield :	96,000 t (59,000 - 121,000 t)
Current (2003) Catch:	139,300 t
Mean catch over the last 5 years	133,000 t
Current Replacement Yield	-
Relative Biomass (B_{2000}/B_{msy})	1.31
Relative Fishing Mortality (F_{2000}/F_{MSY})	1.00
Management Measures in Effect	none

Table 1. Catches of bigeye tuna by gear and main fleets for the period 1954-2003 (in thousands of tonnes). Data as of 20 November 2004.

Gear	Fleet	Av99/03	Av54/03	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78
Purse seine	Other Fleets	1.2	0.7																									0.0
	Total	29.3	8.0																									0.0
Baitboat	Total	1.0	0.3																	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1
Longline	China																											
	Taiwan,China	42.3	14.3	0.1	0.2	0.6	0.9	1.5	1.5	1.3	1.9	1.2	1.7	1.8	1.4	2.2	2.3	7.2	8.0	10.0	5.6	5.5	4.0	6.0	5.3	4.2	6.2	4.9
	Indonesia	25.0	5.4																				0.0	0.2	0.4	0.3	0.3	0.4
	Japan	13.0	12.2	6.8	9.5	12.2	11.1	10.2	8.4	14.8	13.0	17.3	11.6	16.0	17.6	21.4	21.8	23.6	14.4	12.7	11.2	8.3	5.2	6.9	5.5	2.1	3.1	10.9
	Republic of Korea,	1.5	8.1												0.2	0.2	0.5	6.8	7.6	3.5	4.8	4.9	7.3	14.6	26.1	21.8	26.1	34.1
	Other Fleets	2.4	0.6											0.2	0.4	0.4	0.1	1.9	0.5	1.5	1.3	1.2	0.9	0.5	0.2	0.1	0.2	0.2
	Total	102.7	46.6	6.9	9.7	12.8	12.0	11.7	9.9	16.1	15.0	18.5	13.3	18.0	19.5	24.1	24.8	39.5	30.4	27.7	22.9	20.0	17.4	28.3	37.6	28.5	35.9	50.5
Gillnet	Total	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Line	Total	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	Total	133.1	54.9	6.9	9.7	12.8	12.0	11.7	9.9	16.1	15.0	18.5	13.3	18.0	19.5	24.1	24.8	39.5	30.4	27.8	23.0	20.0	17.5	28.4	37.7	28.7	36.0	50.6

Gear	Fleet	Av99/03	Av54/03	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03
Purse seine	Spain	10.9	3.1						0.8	1.3	1.8	5.0	6.8	5.9	4.9	6.0	3.6	5.4	5.9	12.2	11.4	15.9	11.2	16.0	11.3	7.8	10.9	8.5
	France	6.7	2.3			0.0	0.0	0.2	2.3	4.3	7.1	7.0	6.2	3.6	4.6	5.4	3.8	5.0	5.4	7.3	6.9	7.8	6.4	8.5	6.7	5.5	7.3	5.3
	NEI-Other	4.8	1.1					0.0	0.5	0.6	1.0	0.8	0.8	0.5	1.0	1.5	0.9	1.9	2.5	3.4	3.4	6.2	5.2	7.5	6.0	3.1	4.1	3.3
	Seychelles	2.9	0.4													0.0	0.0					0.9	2.0	3.0	1.8	2.8	3.7	3.4
	NEI-Ex-Soviet Union	2.8	0.4												0.0		0.4	1.0	0.3	1.4	1.1	1.2	1.9	3.9	2.9	2.9	2.2	2.2
	Other Fleets	1.2	0.7	0.0	0.0	0.0	0.1	0.3	0.5	0.9	0.7	0.7	1.2	2.0	2.2	2.6	2.5	2.6	4.8	4.2	1.7	2.0	1.6	1.7	1.3	1.6	0.9	0.5
	Total	29.3	8.0	0.0	0.0	0.0	0.1	0.6	4.0	7.2	10.6	13.4	15.1	12.0	12.7	15.6	11.3	16.0	18.9	28.4	24.6	33.9	28.3	40.7	29.9	23.7	29.0	23.3
Baitboat	Total	1.0	0.3	0.1	0.1	0.2	0.1	0.2	0.4	0.3	0.2	0.3	0.3	0.3	0.3	0.5	0.4	0.5	0.5	0.5	0.6	0.5	0.6	1.0	0.6	0.9	1.1	1.1
Longline	China	3.1	0.4																	0.2	0.5	1.7	2.3	2.4	2.8	3.1	2.8	4.6
	Taiwan,China	42.3	14.3	7.4	8.9	6.8	11.3	11.3	10.9	12.2	16.8	17.6	19.4	19.9	20.8	29.0	24.0	39.7	27.8	32.7	29.8	34.1	39.7	37.1	36.4	37.0	44.3	56.8
	Indonesia	25.0	5.4	0.4	0.5	0.5	0.8	1.9	2.4	2.4	0.7	2.4	3.2	4.5	4.5	4.5	7.6	7.9	10.8	12.2	23.2	27.9	26.1	30.5	20.9	21.1	26.3	26.3
	Japan	13.0	12.2	4.2	5.9	7.8	11.4	18.3	14.0	17.2	15.8	15.5	12.3	7.7	8.2	7.8	5.6	8.3	17.5	17.2	16.5	18.8	17.1	14.0	13.6	13.0	13.6	11.1
	NEI-Deep-freezing	10.6	2.9							0.1	1.1	0.9	2.9	2.8	4.4	5.5	3.9	10.5	7.9	9.5	12.4	10.2	18.4	18.0	14.8	8.6	5.7	5.7
	NEI-Fresh Tuna	3.2	1.0											1.9	2.6	2.3	2.6	2.9	4.6	3.6	3.9	5.5	4.4	4.2	4.2	2.3	2.6	2.6
	Republic of Korea	1.5	8.1	21.5	19.3	19.4	19.5	17.4	11.7	12.8	11.8	14.4	17.1	12.2	10.7	2.3	4.8	5.3	8.5	6.4	11.3	10.6	3.4	1.4	3.4	1.5	0.2	1.2
	Seychelles	1.5	0.2					0.0	0.1	0.1									0.0	0.0	0.1	0.0	0.1	0.1	0.5	1.0	2.2	3.7
	NEI-Indonesia Fresh Tuna	0.0	1.5								0.1		2.0	7.5	9.2	9.4	11.4	9.2	11.9	6.5	2.7	2.9	0.2	0.0				
	Other Fleets	2.4	0.6	0.0	0.2	0.3	0.3	0.5	0.6	0.0	0.4	0.3	0.3	0.1	0.0	0.1	0.3	1.4	1.4	1.2	0.2	0.2	1.9	2.8	2.3	1.9	2.1	2.8
	Total	102.7	46.6	33.5	34.8	34.8	43.4	49.5	39.7	44.9	46.7	51.2	57.0	56.6	60.5	60.8	60.3	85.2	90.3	89.4	100.6	112.1	113.7	110.5	98.9	89.6	99.7	114.7
Gillnet	Total	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	1.9	0.5	0.2	0.1	0.0	0.0	0.1	0.7	0.2	0.3	0.3	0.1	0.0	0.1	0.1	0.1
Line	Total	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0
All	Total	133.1	54.9	33.6	35.0	35.1	43.6	50.3	44.1	52.4	57.8	65.1	74.3	69.5	73.7	77.1	72.0	101.8	109.9	119.1	126.1	146.9	143.0	152.3	129.4	114.3	130.0	139.3



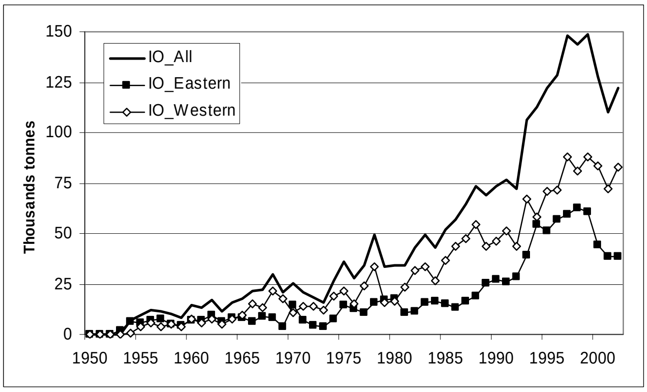


Figure 1. Yearly catches (thousand of metric tonnes) of bigeye tuna by gear from 1950 to 2002 (left) and by area (Eastern and Western Indian Ocean, right)

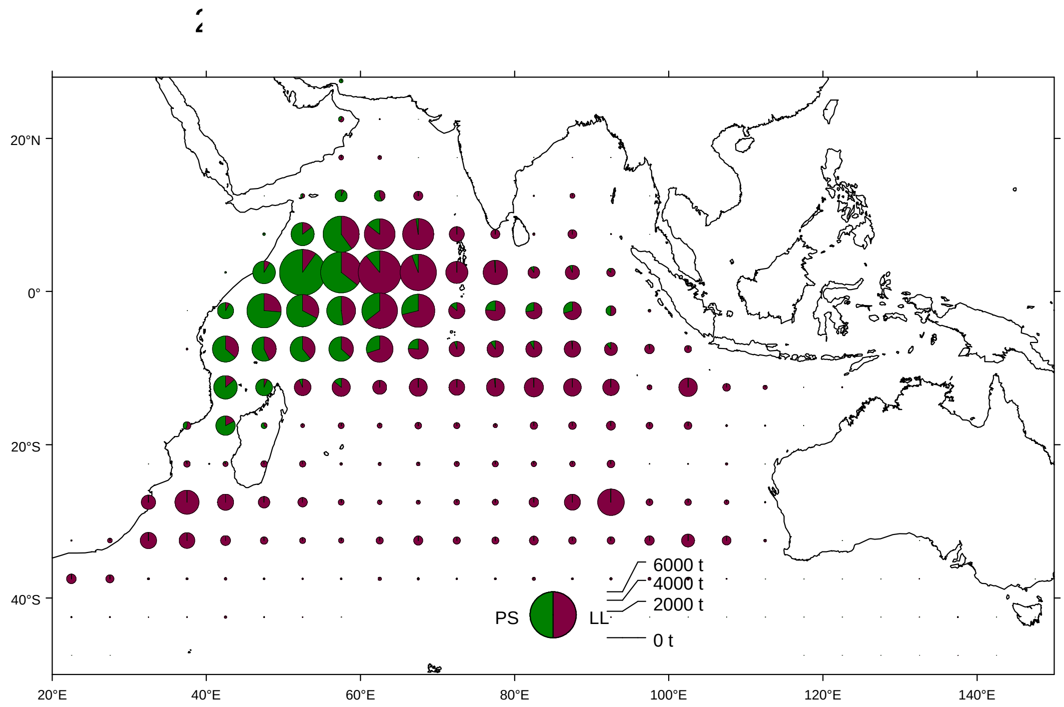


Figure 2. Mean of annual total catches of bigeye tuna (t) by longline (top) and purse seine (bottom) vessels operating in the Indian Ocean over the period 2000 to 2002.

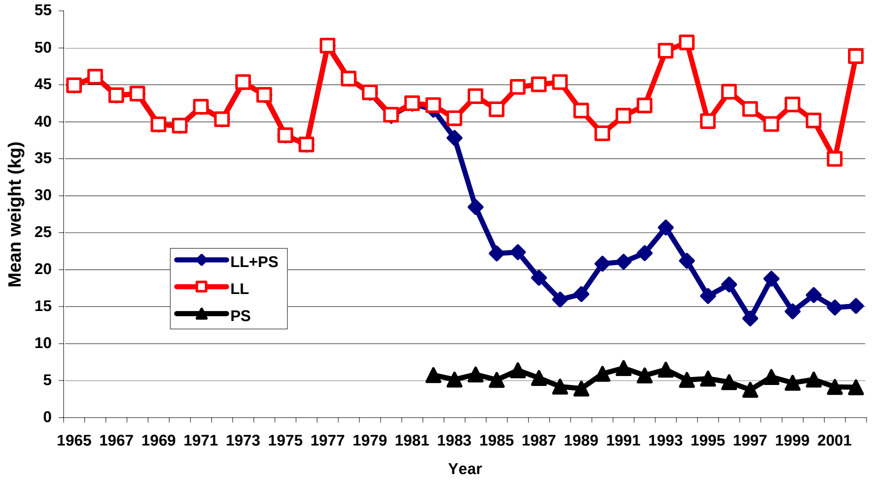


Figure 3. Mean weight of bigeye measured from purse seine (PS) and longline (LL) catches over time.

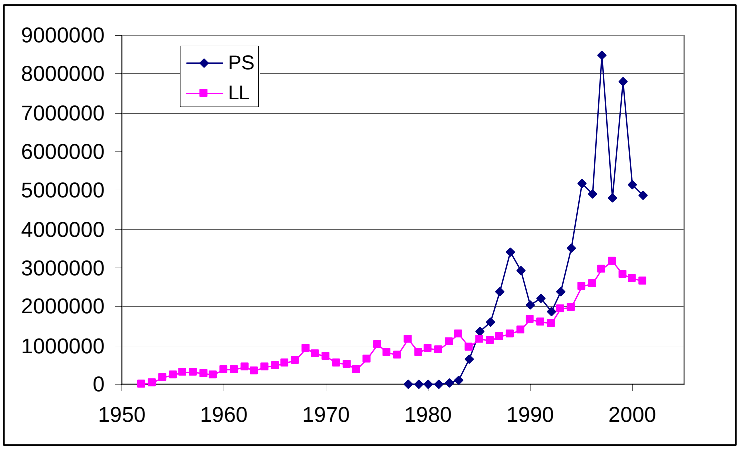


Figure 4. Catch in numbers of bigeye tuna by gear (PS: purse seine; LL: longline).

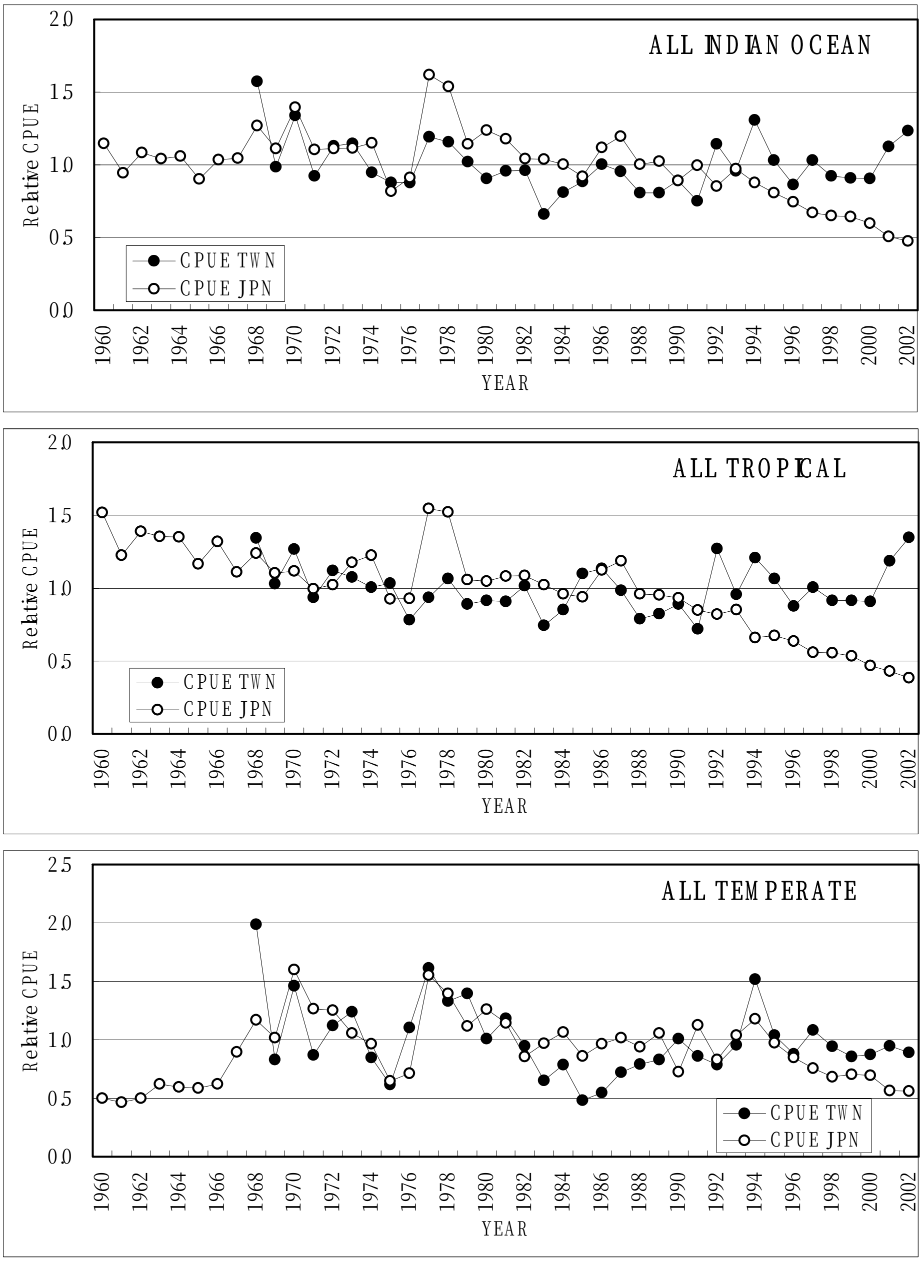


Figure 5. Standardised bigeye tuna CPUE estimates by area.

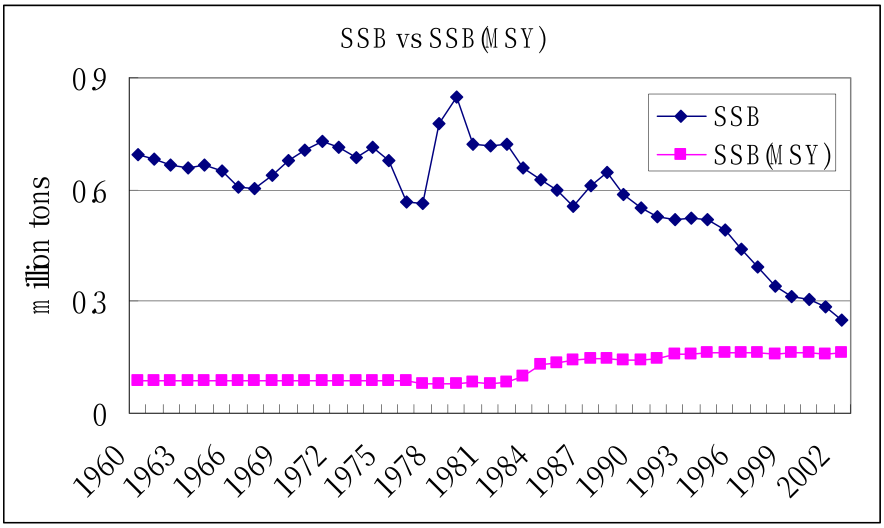


Figure 6. 2004 bigeye stock assessment: spawning biomass trajectories

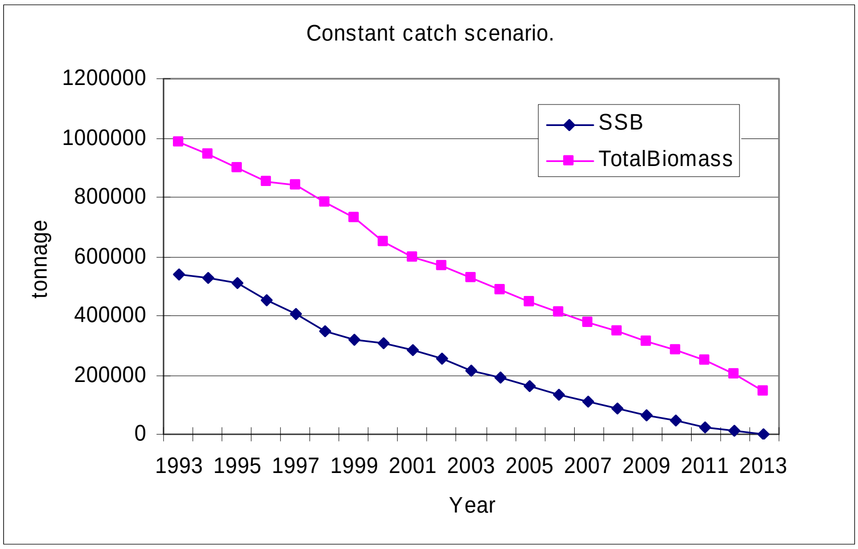


Figure 7. Forward projections. Trends of SSB and TB in current Catch (2002) level.

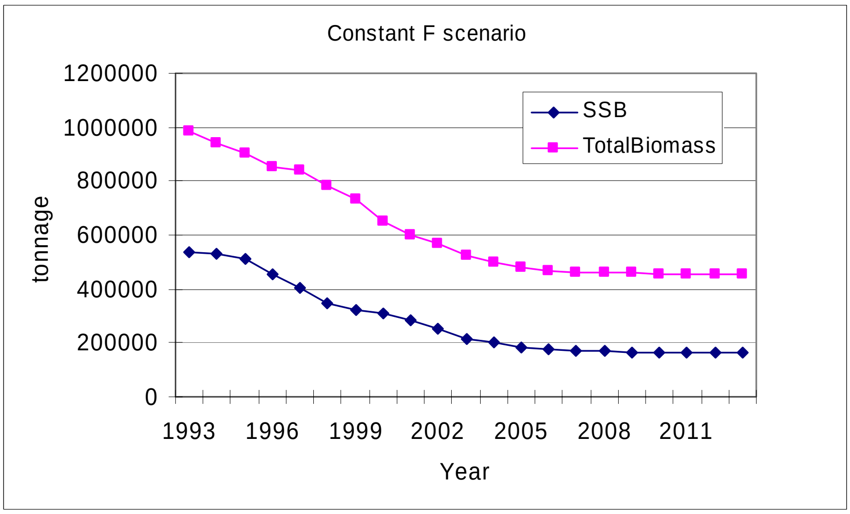


Figure 8. Forward projections. Trends of SSB and TB in current F (2002) level.

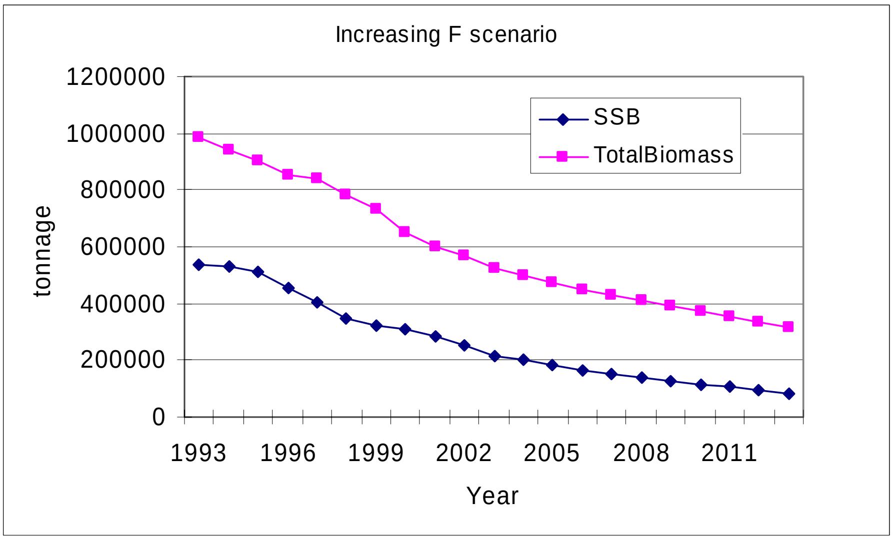


Figure 9. Forward projections. Trends of SSB and TB in increase F (6% per year).

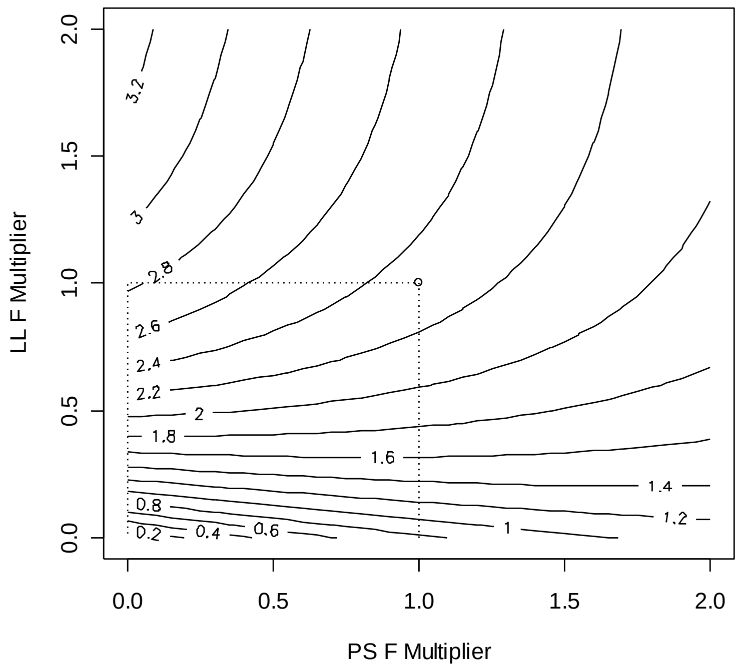


Figure 10. Multi-gear yield-per-recruit calculations, in kg/recruit, with the growth, natural mortality and fishing mortality assumptions from the base case in the ASPM assessment

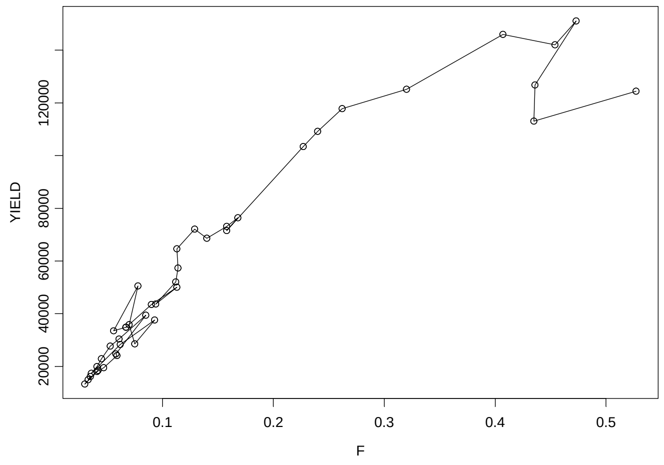


Figure 11. Annual yield (t) as a function of overall fishing mortality as estimated by the most recent assessment.

Executive Summary Of The Status Of The Indian Ocean Swordfish Resource

BIOLOGY

Swordfish (*Xiphius gladius*) is a large oceanic apex predator that inhabits all the world's oceans. They are one of the most widely distributed pelagic fish species and in the Indian Ocean range from the northern coastal state coastal waters to 50°S. The species is known to undertake extensive diel vertical migrations, from surface waters during the night to depths of up to 1000 m during the day, in association with movements of the deep scattering layer and cephalopods, their preferred prey. In contrast to tunas, swordfish is not a gregarious species, although the density of this species increases in areas of oceanic fronts and seamounts.

Genetic studies of the stock structure of swordfish in the Indian Ocean have failed to reveal spatial heterogeneity, and for the purposes of stock assessments one pan-ocean stock has been assumed. However, spatial heterogeneity in stock indicators (CPUE trends), indicate the potential for localized depletion of swordfish in the Indian Ocean, suggesting that mixing across the ocean basin may be limited.

As with many species of billfish, swordfish exhibit sexual dimorphism in maximum size, growth rates and size and age at maturity – females reaching larger sizes, growing faster and maturing later than males. Length and age at 50% maturity in SW Indian Ocean swordfish is 170cm (maxillary-fork length = lmf) for females and 120 cm for males. These sizes correspond to ages of 6-7 years and 1-3 years for females and males, respectively.

Swordfish are highly fecund, batch spawners with large females producing many millions of eggs per spawning event. One estimate for Indian Ocean populations suggests that a female swordfish in equatorial waters may spawn as frequently as once every three days over a period of seven months.

The species is also long lived – reaching maximum ages of more than 30 years. However, the species also exhibits phenomenal growth in the first year of life - by one year of age, a swordfish may reach 90 cm (~15 kg). The average size of swordfish taken in Indian Ocean longline fisheries is between 40kg and 80kg (depending on latitude).

The species life history characteristic of relatively late maturity, long life and sexual dimorphism make it vulnerable to over exploitation.

FISHERIES

Swordfish are taken as a target or by-catch of longline fisheries throughout the Indian Ocean, are rarely caught by purse seines, but are thought to be a component of the "unidentified Billfish" catch by Sri Lankan gill net fisheries in the central northern Indian Ocean.

Exploitation of swordfish in the Indian Ocean was first recorded by the Japanese in the early 1950's as a by-catch in their tuna longline fisheries. Over the next thirty years, catches in the Indian Ocean increased slowly as the level of coastal state and distant water fishing nation longline effort targeted at tunas increased. In the 1990's, exploitation of swordfish, especially in the western Indian Ocean, increased markedly, peaking in 1998 at around 36,000 tonnes (Figures 1 and 2, Table 1). By 2002, twenty countries were reporting catches of swordfish (Figure 3, Table 1). The total catch in 2003 was a little over 32,000 tonnes.

Since the early 1990's China,Taiwan has been the dominant catcher of swordfish in the Indian Ocean (41-60 % of total catch). Taiwanese longliners, particularly in the south western and equatorial western Indian Ocean, target swordfish using shallow longlines at night. The night sets for swordfish contrast with the daytime sets used by the Japanese and Taiwanese longline fleets when targeting tunas.

During the 1990's a number of coastal and island states, notably Australia, La Reunion/France, Seychelles and South Africa have developed longline fisheries targeting swordfish, using monofilament gear and light sticks set at night. This gear achieves significantly higher catch rates than traditional Japanese and Taiwanese longlines. As a result, coastal and island fisheries have rapidly expanded to take over 10,000 tonnes of swordfish per annum in the late 1990's.

STOCK STATUS

Stock assessments of Indian Ocean swordfish stocks are preliminary, and rely heavily on indicators of abundance and stock status such as trends in CPUE and size composition of the catch.

In 2004, the WPB attempted to fit a spatial production model to the available swordfish data. Unfortunately, trial runs did not lead to sensible parameter estimates and there was insufficient time at the meeting to fully explore the model and alternative assumptions, but it was agreed that this approach is worth further consideration.

Consideration of the stock indicators suggest that there has been a marked decline in the stocks of Indian Ocean swordfish since targeting of the species began in the early 1990's. Although there is uncertainty, the indicators and previous assessments suggest that the situation may be more serious in the western Indian Ocean than the eastern Indian Ocean.

The total catches have decreased slightly over the recent five years after reaching a peak of 36,000t in 1998. However, the effective effort (estimated as the catch divided by the standardised Japanese CPUE) has continued to increase over this period. This suggests that the decrease in the catch is not as a result of a reduction in effective effort, but more likely to be as a result of a decrease in the swordfish biomass.

There is a consistent pattern of declines in catch rates in all areas that have been exploited. While the Japanese CPUE indices show more pronounced declines compared to the Taiwanese indices, the severity of the declines appears to be correlated with the magnitude of the catches in the most heavily exploited areas (Figure 5). This pattern is clear when the CPUE's for the eastern Indian Ocean and the western Indian Ocean (which is relatively heavily exploited) are compared (Figure 6)

The standardized CPUE series for the Japanese fleet show relatively large declines since 1990 in several areas: 50% decline in the equatorial western Indian Ocean (Area 3), 90% decline in the south western Indian Ocean (Area 7). There is also evidence of recent declines in Area 4 in the north eastern Indian Ocean (Figure 5). The declines in CPUE in the Japanese series coincide with the timing of large increases in swordfish catches by the Taiwanese and other fleets in the west Indian Ocean areas.

Currently, there is no evidence of any declines in the size-based indices (Figure 7), but the SC recommends that these indices be carefully monitored. Since females mature at a relatively large size, a reduction in the biomass of large animals could potentially have a strong effect on the spawning biomass.

The apparent fidelity of swordfish to particular areas is a matter for concern as this can lead to localised depletion. The spatial structure of the CPUE suggests that there may already be localised depletion of swordfish in the south-west Indian Ocean.

MANAGEMENT ADVICE

On the basis of the stock indicators the SC concluded that the current level of catch (about 32,000 t) is unlikely to be sustainable. Of particular concern are the trends in abundance of swordfish in the western Indian Ocean, where the highest catches are currently taken. The spatial structure of the CPUE suggests that there may already be overfishing of swordfish in the southwest Indian Ocean. However, these reductions in catch rates have not been accompanied by reductions in average size of the fish in the catch, as has been the case in other oceans. The SC expressed concern regarding the very rapid increase in effort targeting swordfish in other areas of the Indian Ocean and the relatively large incidental catch of swordfish in fisheries targeting bigeye. These increases in effort exploiting swordfish have continued since 2000.

The fact that large, rapid increases in fishing effort followed by a reduction in catch rates have been seen in the southwest Indian Ocean indicates that this might also occur in other areas where fishing effort directed to swordfish is increasing rapidly.

The SC recommends that management measures focussed on controlling and/or reducing effort in the fishery targeting swordfish in the southwest Indian Ocean be implemented. Similar measures may be needed in the future if reductions in catch rates are detected in other areas of the Indian Ocean.

SWORDFISH SUMMARY

Maximum Sustainable Yield :	unknown
Current (2003) Catch:	32,000 t
Mean catch over the last 5 years	32,000 t
Current Replacement Yield	-
Relative Biomass (B_{2000}/B_{MSY})	unknown
Relative Fishing Mortality (F_{2000}/F_{MSY})	unknown
Management Measures in Effect	None

Table 1. Catches of swordfish by gear and main fleets for the period 1954-2003 (in thousands of tonnes). Data as of 20 November 2004.

Gear	Fleet	Av99/03	Av54/03	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78
Baitboat	Total	0.0	0.0																	0.0		0.0		0.0	0.0	0.0	0.0	0.0
Longline	China																											
	Taiwan,China	13.7	4.4	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.2	0.2	0.2	0.6	0.8	1.2	0.9	0.9	0.6	1.0	0.9	0.9	0.9	0.6
	Japan	1.4	1.2	0.3	0.5	0.9	0.6	0.7	0.9	1.2	1.3	1.4	1.1	1.3	1.5	1.7	2.2	1.7	1.6	1.2	1.1	0.9	0.8	0.8	0.8	0.4	0.3	0.9
	Indonesia	1.1	0.2																					0.0	0.0	0.0	0.0	0.0
	Republic of Korea	0.0	0.1										0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.1	0.1	0.3	0.5	0.6	0.7	0.8		
	Other Fleets	1.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	29.5	8.7	0.3	0.5	1.0	0.7	0.8	1.0	1.3	1.5	1.6	1.4	1.7	1.9	1.9	2.5	2.6	2.6	2.7	2.1	2.0	1.6	2.0	2.3	1.9	1.9	2.4
Gillnet	Sri Lanka	2.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	2.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Line	Total	0.0	0.0																	0.0		0.0		0.0	0.0	0.0	0.0	0.0
All	Total	31.7	9.1	0.3	0.5	1.0	0.7	0.8	1.1	1.3	1.5	1.6	1.4	1.7	1.9	2.0	2.5	2.6	2.7	2.7	2.2	2.0	1.6	2.0	2.3	1.9	2.0	2.4

Gear	Fleet	Av99/03	Av54/03	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03
Baitboat	Total	0.0	0.0	0.0	0.0																							
Longline	China	0.4	0.1																	0.1	0.2	0.3	0.1	0.4	0.4	0.3	0.4	0.8
	Taiwan,China	13.7	4.4	1.1	1.3	1.1	1.5	1.9	1.7	2.0	3.2	3.8	5.4	4.1	3.8	4.7	9.0	15.3	12.5	18.3	17.6	17.3	16.8	14.7	15.2	12.3	12.9	13.5
	NEI-Deep-freezing	4.0	1.2							0.0	0.2	0.2	0.8	0.6	0.8	0.9	1.5	4.1	3.5	5.3	7.3	5.2	7.8	7.1	6.2	2.9	1.9	1.9
	Spain	2.4	0.3															0.2	0.7	0.0	0.0	0.5	1.4	2.0	1.0	1.9	3.5	3.6
	Australia	1.7	0.2											0.0		0.0	0.0	0.2	0.1	0.1	0.0	0.0	0.3	1.4	1.8	2.9	1.3	1.2
	France-Reunion	1.4	0.3													0.0	0.1	0.3	0.7	0.8	1.3	1.6	2.1	1.9	1.7	1.6	0.8	0.8
	Japan	1.4	1.2	0.6	0.6	0.8	1.0	1.2	1.3	2.2	1.3	1.4	1.5	1.0	1.0	0.9	1.7	1.4	2.6	1.7	2.1	2.8	2.2	1.5	1.6	1.2	1.2	1.2
	Indonesia	1.1	0.2	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.5	0.5	1.0	1.2	1.1	1.3	0.7	0.6	1.3	1.3
	NEI-Fresh Tuna	0.7	0.2											0.5	0.7	0.6	0.7	0.7	1.1	0.8	0.9	1.2	0.9	0.8	0.8	0.4	0.9	0.8
	Seychelles	0.7	0.1																	0.0	0.1	0.2	0.2	0.3	0.5	0.7	0.6	1.4
	Portugal	0.7	0.1																				0.1	0.2	0.2	0.6	0.8	1.6
	Republic of Korea	0.0	0.1	0.6	0.3	0.4	0.3	0.3	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.2	0.1	0.0	0.1	0.0	0.0	0.1
	Other Fleets	1.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.4	0.4	0.5	0.4	0.5	0.3	0.2	0.2	1.2	0.7	0.3	0.6	2.0	2.7
	Total	29.5	8.7	2.3	2.2	2.3	2.8	3.4	3.2	4.2	4.9	5.6	7.9	6.7	7.0	7.8	13.9	23.0	22.2	27.9	30.9	30.7	34.5	32.5	30.3	25.9	27.6	30.9
Gillnet	Sri Lanka	2.3	0.4	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.4	2.0	1.0	1.0	1.1	1.4	1.1	1.2	3.0	2.6	2.9	1.5
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	2.3	0.4	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.4	2.0	1.0	1.0	1.1	1.4	1.1	1.2	3.0	2.6	2.9	1.5
Line	Total	0.0	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0
All	Total	31.7	9.1	2.4	2.3	2.4	2.9	3.5	3.3	4.3	5.0	5.7	8.0	6.8	7.2	8.0	14.2	25.1	23.2	28.9	32.1	32.2	35.6	33.7	33.4	28.6	30.6	32.4

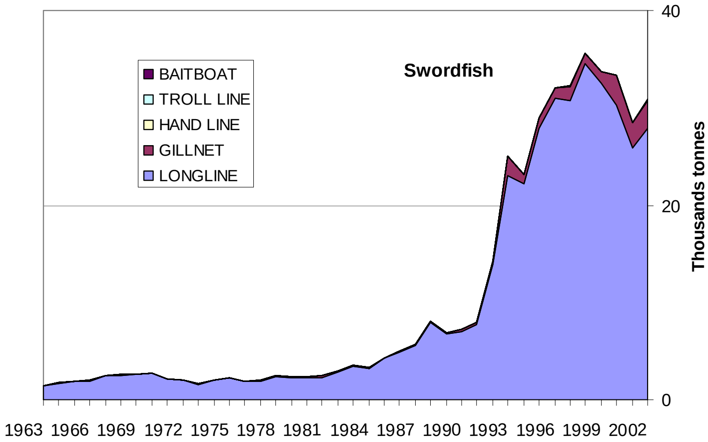


Figure 1: Catches of Swordfish per gear and year recorded in the IOTC Database (1963-2002).

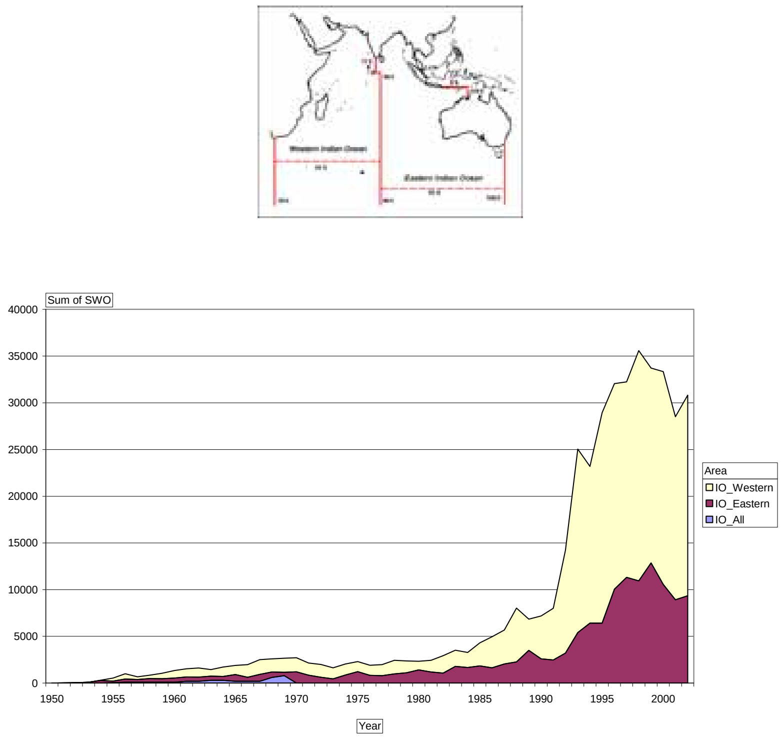


Figure 2: Trends of the swordfish catches in the western and the eastern area of the Indian Ocean between 1970 and 2002.

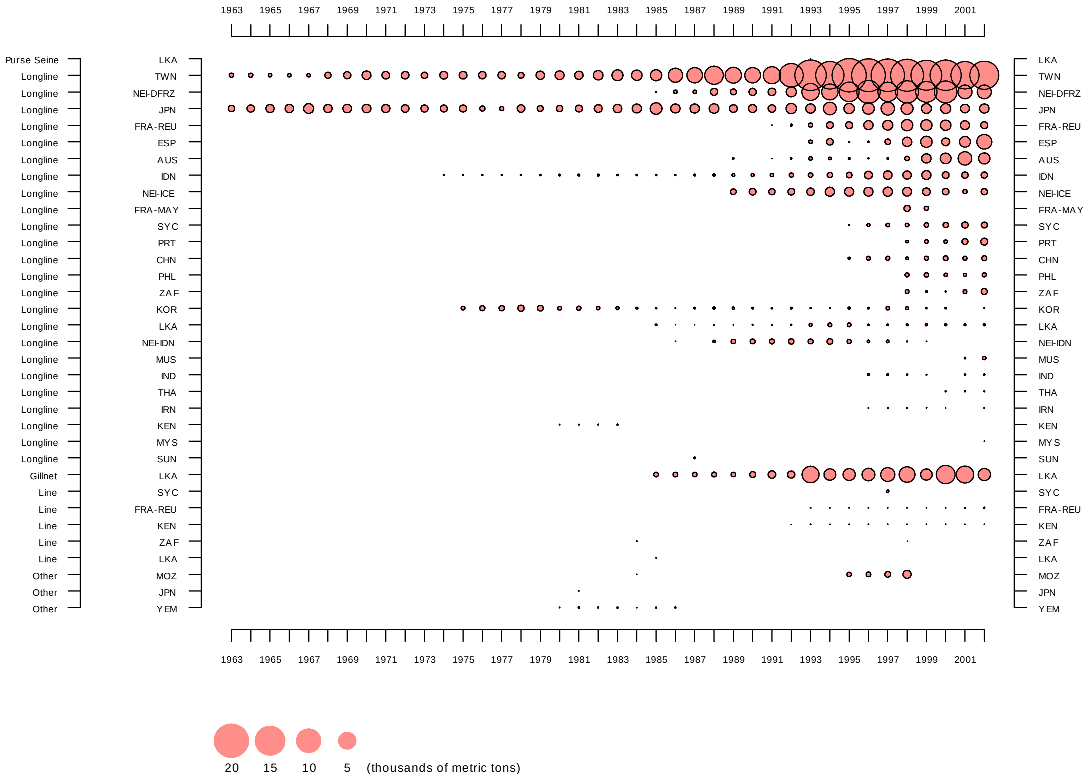


Figure 3: Catches of swordfish in the Indian Ocean for the period 1963-2002, in thousands of metric tons by gear and country/fleet.

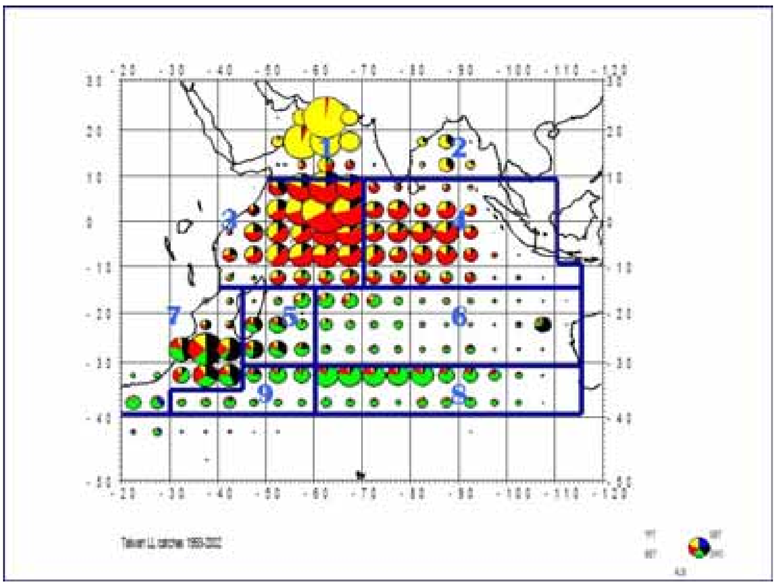


Figure 4: Areas used in the CPUE standardization for the Japanese and Taiwanese fleets.

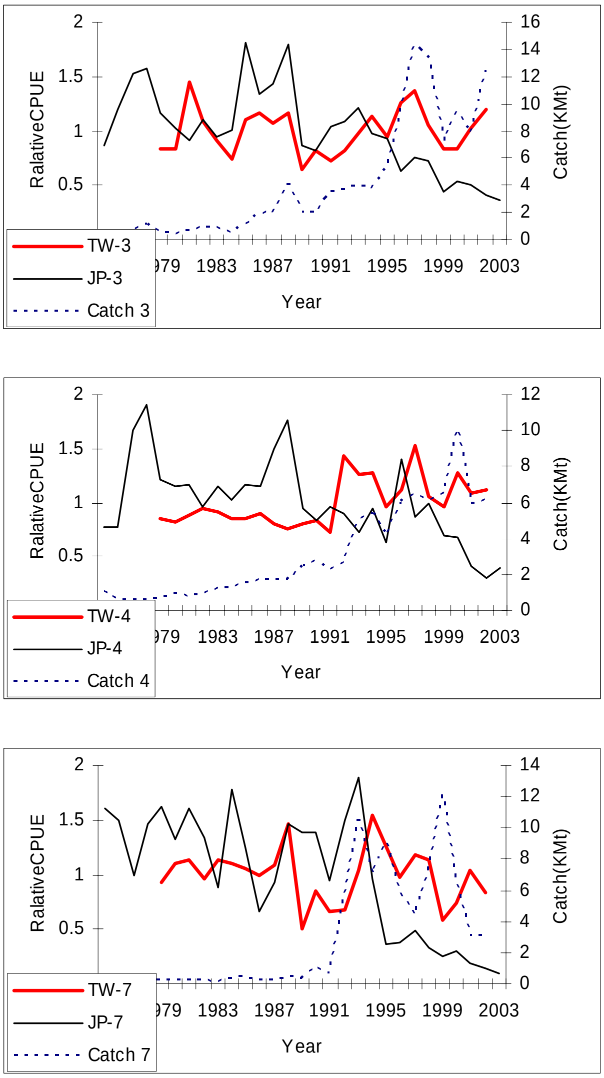


Figure 5: Total catch and standardized CPUE trends (rescaled to their average) for the Japanese and Taiwanese fleets in areas 3 (equatorial western), 7 (south western) and 4 (equatorial eastern). areas are shown in Figure 4.

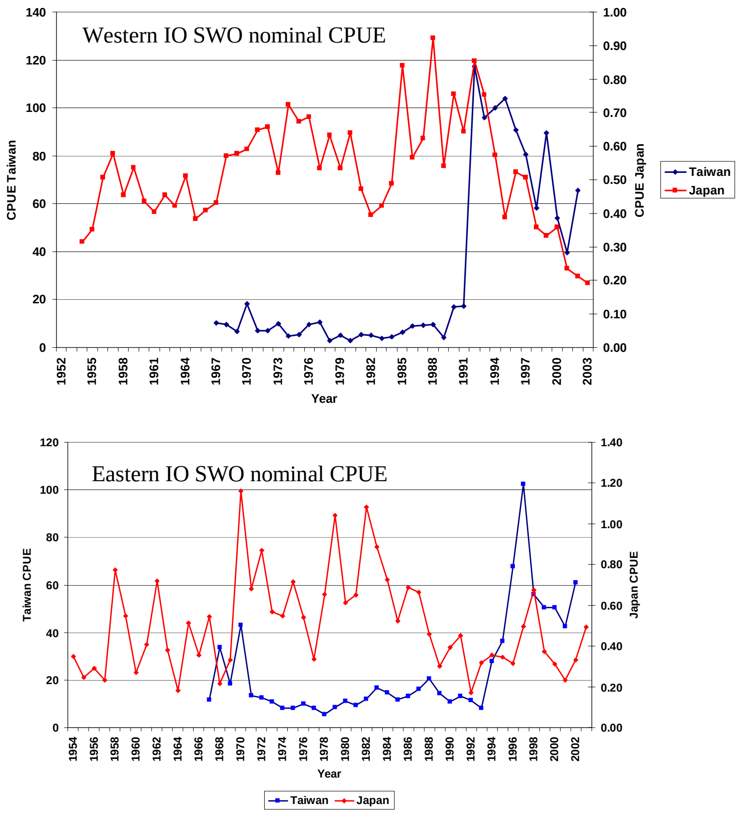


Figure 6: trends of the Taiwanese and Japanese fleets CPUE in the western and eastern areas in Indian Ocean. Areas are shown in Figure 2.

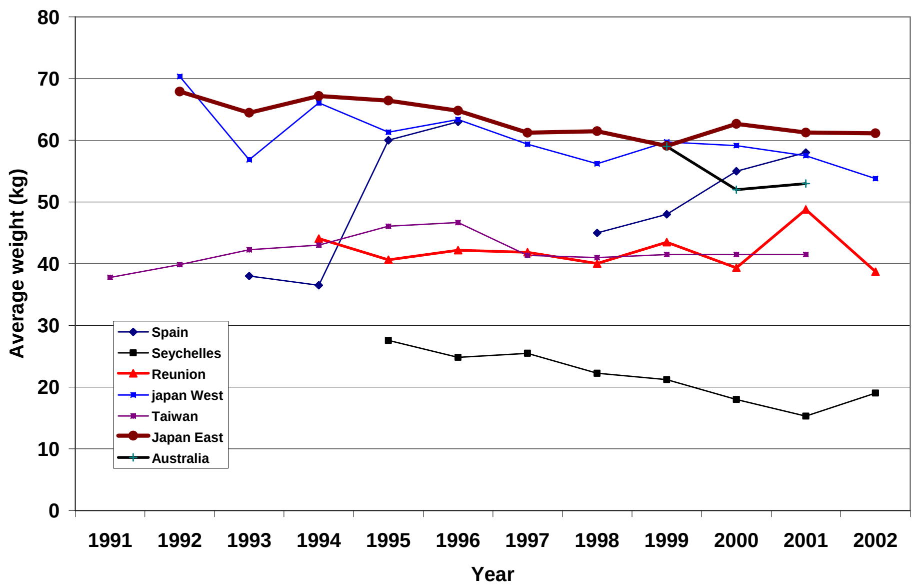


Figure 7: Trends in average size of swordfish in Indian Ocean fisheries.

Executive Summary Of The Status Of The Albacore Tuna Resource

BIOLOGY

Albacore (*Thunnus alalunga*) is a temperate tuna living mainly in the mid oceanic gyres of the Pacific, Indian and Atlantic oceans. Indian Ocean albacore is distributed from 5°N to 40°S. In the Pacific and Atlantic oceans there is a clear separation of southern and northern stocks associated with the oceanic gyres that are typical of these areas. In the Indian Ocean, there is probably only one southern stock because there is no northern gyre.

Albacore is highly migratory species and individuals swim large distances during their lifetime. To do this albacore is capable of thermoregulation, has a high metabolic rate, and advanced cardiovascular and blood/gas exchange systems. Pre-adults (2-5 year old albacore) appear to be more migratory than adults. In the Pacific Ocean, the migration, distribution availability, and vulnerability of albacore are strongly influenced by oceanographic conditions, especially oceanic fronts. It has been observed on all albacore stocks that juvenile are concentrated in cold temperate areas (for instance in a range of sea-surface temperatures between 15 and 18°C), and this has been confirmed in the Indian Ocean where albacore tuna are more abundant north of the subtropical convergence (an area where these juvenile have been heavily fished by driftnet fisheries during the late eighties (Figure 2). It appears that juvenile albacore show a continuous geographical distribution in the Atlantic and Indian oceans in the north edge of the subtropical convergence. Albacore may move across the jurisdictional boundary between ICCAT and IOTC.

The maximum age reported for Indian Ocean albacore is 8 years. However, this may be an underestimate as albacore have been reported live to at least 10 years in the Pacific Ocean.

Little is known about the reproductive biology of albacore in the Indian Ocean but it appears, based on biological studies and on fishery data, that the main spawning grounds are located east of Madagascar between 15° and 25°S during the 4th and 1st quarters of each year (Figure 1). In the Pacific Ocean, albacore grow relatively slowly (compared to skipjack and yellowfin) and become sexually mature at about 5-6 years old. Like other tunas, adult albacore spawn in warm waters (SST>25°C). It is likely that the adult Indian Ocean albacore tunas do yearly circular counter-clockwise migrations following the surface currents of the south Tropical gyre between their tropical spawning and southern feeding zones. In the Atlantic Ocean, large numbers of juvenile albacore are caught by the South African pole-and-line fishery (catching about 10.000 t yearly) and it has been hypothesized that these juveniles may be taken from a mixture of fish born in the Atlantic (north east of Brazil) and from the Indian Ocean.

Overall, the biology of albacore stock in the Indian Ocean is not well known and there is relatively little new information on albacore stocks.

FISHERIES

Albacore are caught almost exclusively under drifting longlines (98%), and between 20° and 40°S (Table 1, Figure 1), with remaining catches recorded under purse seines and other gears (Table 1).

A fleet using drifting gillnets targeting juvenile albacore operated in the southern Indian Ocean (30° to 40° South) between 1985 and 1992 harvesting important amounts of this species. This fleet, from Taiwan,China, had to stop fishing in 1992 due to a worldwide ban on the use of drifting gillnets. Albacore is currently both a target species and a bycatch of industrial longline fisheries and a bycatch of other fisheries.

The catches of albacore increased rapidly during the first years of the fishery, remaining relatively stable until the mid-1980s, except for some very high catches recorded in 1973, 1974 and 1982. The catches increased markedly during the 1990's due to the use of drifting gillnets, with total catches reaching around 30,000 t. Catches have steadily increased since 1993, after the drop recorded in 1992 and 1993 as a consequence of the end of the drifting gillnet fishery. Catches from 1999 to 2003 averaged 35,000 t. The total catch in 2003 was relatively low at 24,000 t.

Longliners from Japan and Taiwan,China have been operating in the Indian Ocean since the early 1950s and they have been the major fishers for albacore since then (Table 1). While the Japanese albacore catch ranged from 8,000 t to 18,000 t in the period 1959 to 1969, in 1972 catches rapidly decreased to around 1,000 t due to changing the target species mainly to southern bluefin and bigeye tuna, then ranged between 200 t to 2,500 t as albacore became a bycatch fishery. In recent years the Japanese albacore catch has been around 2,000 to 3,000 t. By contrast, catches by Taiwanese longliners have increase steadily since the 1950's, averaging around 10,000 t by the mid-1970s'. Since 1998 catches have been around 20,000 t, equating to just over 60 % of the total Indian Ocean albacore catch.

The catches of albacore by longliners from the Republic of Korea, recorded since 1965, have never been above 10,000 t. Other fleets for which important catches of albacore have been recorded in recent years are a fleet of fresh-tuna longliners operating in Indonesia, with catches recorded around 3,000 t, and a fleet of deep-freezing longliners operating under flags of non-reporting countries (NEI-Deep freezing), with current catches of albacore between 5,000 t and 10,000 t (Figure 3).

Large sizes of albacore are also taken seasonally in certain areas (Figure 5), most often in free-swimming schools, by the purse seine fishery, as bycatch of the tropical tunas targeted by this fishery (catching an average 1600 t of albacore yearly during the period 1990-2002).

A unique feature of Indian Ocean albacore fisheries is that this is the only ocean where juvenile fish are infrequently targeted by fisheries (few small albacore being caught by longliners), when in all other oceans (South and North Atlantic, and Pacific) various surface fisheries have been actively targeting these small fish and sometimes producing the majority of albacore catches. This observation would not be valid if in fact, the small fishes taken off the west coast of South Africa are biologically from the Indian Ocean.

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

Nominal Catch (NC) Data

The catches of albacore recorded in the IOTC databases are thought to be complete, at least until the mid-1980s. The fleets for which the majority of the catches of albacore are recorded have always reported good catch statistics to the IOTC. The catches of albacore recorded for Illegal and/or Unregulated and/or Unreported (IUU) fleets (recorded mostly as NEI- in the IOTC Database), which have been operating in the Indian Ocean since the early 1980s, have always been estimated by the Secretariat.

Catch-and-Effort (CE) Data

Catch and effort data are fully or almost fully available up to the early 1990s but only partially available since then, due to the almost complete lack of catch and effort records from IUU and the Indonesian longline fleet.

The effort statistics are thought good quality for most of the fleets for which long catches series are available, with the exception of Taiwan,China (1990-92) and the whole series for the Republic of Korea and Philippines. The use of data for these countries is, therefore, not recommended.

Size Frequency Data

In general, the amount of catch for which size data for the species are available has been very low and the amount of specimens measured per stratum are considered to be insufficient. The quality of this dataset is, therefore, thought poor.

For longline fisheries size frequency data is only available since 1964. Japan is the only country that has been reporting size-frequency data on a regular basis. Nevertheless, in recent years, the number of specimens measured is very low in relation to the total catch and has been decreasing year by year. The size-frequency statistics available from the two other main longline fleets are either very incomplete (Taiwan,China for which only four years are available) or inaccurate (Republic of Korea), which invalidates their use.

The recovery of size data from port sampling regarding fresh tuna longline fleets landing in Phuket, Penang, Sri Lanka and, recently Indonesia, continued in 2002 and 2003, with many specimens of albacore measured. It was also noticed that large amounts of albacore landed in Mauritius by deep-freezing longliners have been also sampled by Mauritian scientists.

Albacore caught in the Indian Ocean are mainly taken at large sizes, in contrast to other oceans, where substantial quantities of juvenile albacore are also taken. Therefore, it could be expected that yield per recruit would be better in the Indian Ocean than in other oceans

Data related issues for albacore

- Lack of size-frequency data from the Republic of Korea and Philippines, Taiwan,China since 1989 and low sample sizes for the Japanese longline fleet.
- Poor knowledge of the catches, effort and size-frequency from fresh tuna longline vessels, especially from Taiwan,China and several non-reporting fleets.
- Poor knowledge of the catches, effort and size-frequency from non-reporting fleets of deep-freezing tuna longliners, especially since the mid-eighties.
- Lack of accurate catch, effort and size-frequency data for the Indonesian longline fishery, except in the most recent years.
- Poor knowledge of the catches, effort and size-frequency data for non-reporting purse seiners.

STOCK ASSESSMENT

The WPTMT conducted a series of analyses based on fitting a production model to various combinations of catch-and-effort data (from Japanese and Taiwanese longline fisheries, and the Taiwanese gillnet fishery). The results of one of the analyses suggested that the stock could be below the level that would produce MSY and that the current fishing mortality is above that required to achieve the MSY, while the remainder failed to produce plausible parameter estimates. In all analyses, there was a discrepancy between the observed and predicted CPUE trends for the most recent years (Figure 5) and the model could not explain appropriately the apparent lack of response in the CPUE to the increase in the catch. Several explanations have been proposed, including a possible increase in productivity of the albacore stock due to a change in environmental conditions, or the inability of the CPUE series to adequately reflect changes in the population abundance. Regarding the first hypothesis, the size frequency data does not offer any evidence supporting the hypothesis of recent increased recruitments.

MANAGEMENT ADVICE

A stock assessment for Indian Ocean albacore (*Thunnus alalunga*) was attempted in 2004 by the Working Party on Temperate Tunas. Results of the analyses conducted were considered unreliable, although one of the results suggested that current catch levels might not be sustainable. Other indicators, such as the average size in the catch and catch rates , have not shown declines in recent years.

Taking into account the absence of a reliable assessment of the status of albacore tuna and the need for a precautionary approach, the SC recommended that the Commission be very cautious in allowing increases in catch or fishing effort until the problems with the assessments have been resolved.

ALBACORE TUNA SUMMARY

Maximum Sustainable Yield :	unknown
Current (2003) Catch:	24,000 t
Mean catch over the last 5 years	35,000 t
Current Replacement Yield	-
Relative Biomass (B_{curr}/B_{MSY})	unknown
Relative Fishing Mortality (F_{curr}/F_{MSY})	unknown
Management Measures in Effect	none

Table 1. Catches of albacore tuna by gear and main fleets for the period 1950-2003 (in thousands of tonnes). Data as of 20 November 2004.

Gear	Fleet	Av99/03	Av54/03	54	55	1956	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78
Longline	China																											
	Taiwan,China	20.3	9.7	0.1	0.3	0.5	0.7	1.0	1.2	1.1	1.4	1.3	1.6	1.5	1.1	1.7	1.6	7.6	7.7	7.2	7.0	7.0	12.0	17.4	6.4	9.7	9.8	12.8
	Japan	2.7	4.6	2.7	3.1	5.1	4.7	6.3	10.4	11.1	15.2	17.6	12.6	17.8	11.4	13.1	14.1	10.1	8.6	4.9	3.3	1.4	2.0	2.8	1.3	1.2	0.4	0.4
	Indonesia	2.5	0.5																					0.0	0.1	0.1	0.1	0.2
	Republic of Korea	0.1	1.3												0.5	0.6	6.2	0.9	4.4	1.7	2.5	3.9	9.1	9.8	3.9	4.2	2.2	4.6
	Other Fleets	0.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.0	0.9	0.2	0.7	0.6	0.5	0.4	0.2	0.1	0.0	0.1	0.1
	Total	34.1	18.0	2.8	3.3	5.6	5.3	7.3	11.6	12.1	16.6	19.0	14.2	19.4	13.2	15.6	22.0	19.4	20.9	14.5	13.4	12.8	23.5	30.3	11.7	15.3	12.5	18.2
Line	Total	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	Total	35.3	20.3	2.8	3.3	5.6	5.3	7.3	11.6	12.1	16.6	19.0	14.2	19.5	13.2	15.6	22.0	19.4	20.9	14.5	13.4	12.8	23.5	30.3	11.7	15.3	12.6	18.2

Gear	Fleet	Av99/03	Av54/03	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03
Purse seine	France	0.4	0.2						0.3	0.5	0.2	0.2	0.2	0.0	0.0	0.9	1.4	0.3	0.3	0.4	0.4	0.5	0.5	0.2	0.4	0.7	0.3	0.6
	Spain	0.3	0.2						0.2	0.1		0.0	0.1		0.1	1.1	1.5	0.9	1.8	0.6	0.8	1.0	0.3	0.2	0.4	0.3	0.2	0.5
	Other Fleets	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.2	0.3	0.4	0.1	0.5	0.4	0.4	0.5	0.8	0.2	0.4	0.3	0.3	0.3
	Total	1.0	0.5		0.0	0.0	0.0	0.0	0.6	0.7	0.2	0.2	0.3	0.0	0.3	2.2	3.3	1.3	2.6	1.3	1.6	2.0	1.6	0.6	1.2	1.3	0.8	1.4
Baitboat	Total	0.0	0.0				0.4	0.0	0.0	0.0		0.0		0.0			0.0	0.0	0.0	0.0	0.0		0.0					
Longline	China																											
	Taiwan,China	20.3	9.7	15.0	11.0	12.3	21.9	17.0	13.9	6.2	11.1	13.1	11.0	7.1	5.8	13.1	11.1	12.0	14.4	14.2	16.9	15.2	21.6	22.5	21.7	26.1	20.3	11.1
	NEI-Deep-freezing	6.7	1.5							0.0	0.7	0.7	1.7	1.0	1.2	2.5	1.8	3.2	4.1	4.1	7.0	4.6	10.0	10.9	8.8	6.1	3.9	3.9
	Japan	2.7	4.6	0.4	0.6	1.2	1.3	1.7	1.8	2.3	2.5	2.3	1.3	0.9	1.0	1.0	1.8	1.3	1.8	2.0	2.4	3.2	3.2	2.3	2.6	3.0	3.2	2.4
	Indonesia	2.5	0.5	0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.1	0.3	0.3	0.4	0.4	0.3	0.5	0.4	0.6	0.7	1.3	1.6	1.5	1.7	2.7	2.9	2.6	2.6
	Seychelles	0.7	0.1																					0.0	0.4	0.8	1.1	1.2
	France-Reunion	0.4	0.1													0.0	0.0	0.1	0.1	0.1	0.3	0.2	0.3	0.3	0.5	0.6	0.3	0.3
	Republic of Korea	0.1	1.3	2.0	1.8	1.0	0.7	0.6	0.4	0.5	0.4	0.5	0.4	0.3	0.2	0.3	0.1	0.1	0.2	0.1	0.2	0.3	0.2	0.1	0.2	0.1	0.0	0.1
	Other Fleets	0.7	0.3	0.0	0.0	0.1	0.1	0.2	0.2	0.0	0.1	0.2	0.2	0.6	0.6	0.6	0.7	0.7	0.8	0.5	0.2	0.3	0.8	0.7	0.4	0.6	0.7	0.8
	Total	34.1	18.0	17.7	13.7	14.8	24.2	19.7	16.7	9.3	14.8	17.0	15.0	10.3	9.1	17.8	16.1	17.7	22.0	21.7	28.5	25.4	37.5	38.5	37.2	40.2	32.3	22.4
Gillnet	China																											
	Taiwan, China	0.0	1.8							0.7	15.2	12.2	14.4	14.4	21.1	9.0	1.3											
	Total	0.0	1.8							0.7	15.2	12.2	14.4	14.4	21.1	9.0	1.3											
Line	Total	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
All	Total	35.3	20.3	17.7	13.7	14.8	24.6	19.7	17.3	10.8	30.2	29.5	29.7	24.6	30.6	29.2	20.7	19.1	24.7	23.1	30.1	27.5	39.2	39.2	38.5	41.6	33.1	23.9

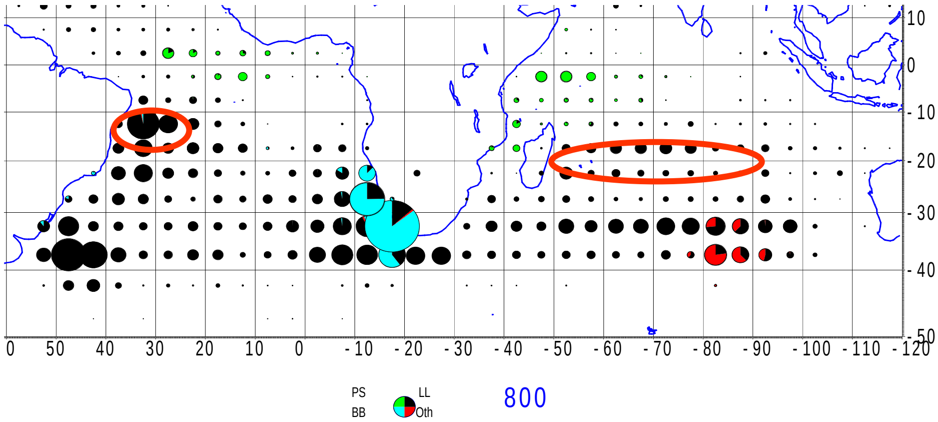


Figure 1. Average albacore catches by gear during the period 1985-2000; the two circles show the spawning zones in the Indian and Atlantic Oceans, this spawning occurring during the last and first quarters

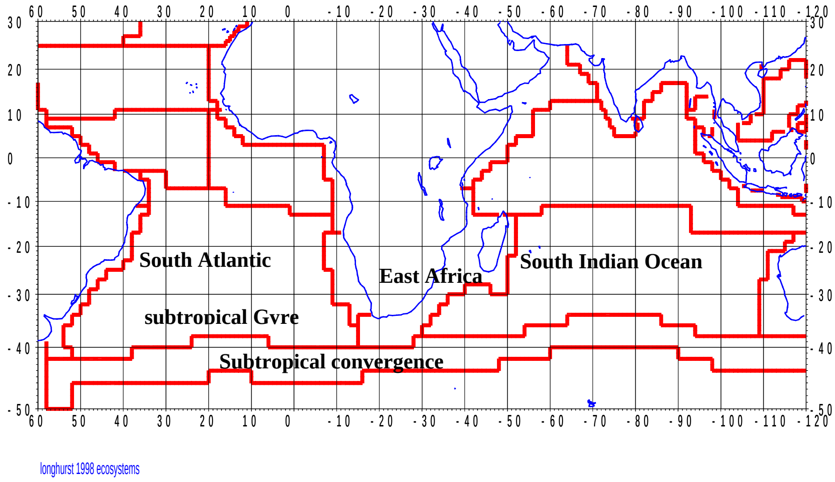


Figure 2. Ecological areas as proposed by Longhurst (1998)

Figure 3: Catches of albacore per fleet and year recorded in the IOTC Database (1963-2002)

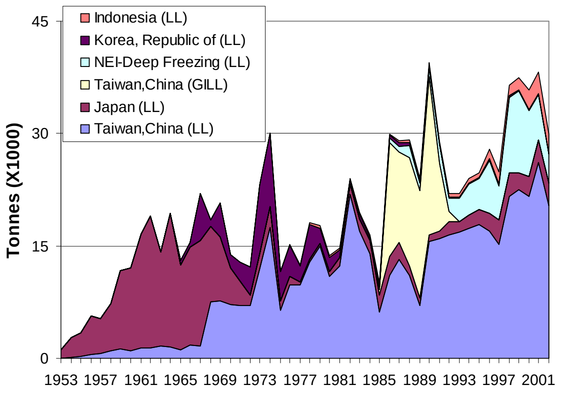
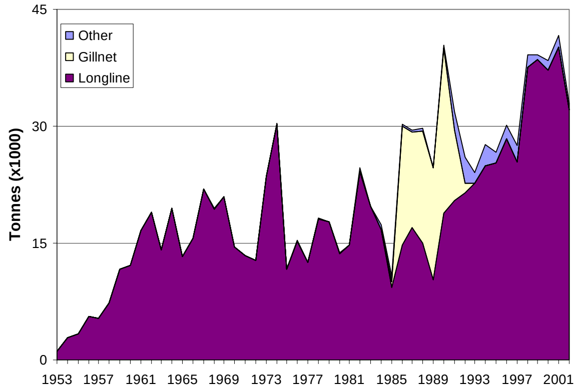


Figure 4: Catches of albacore per gear and year recorded in the IOTC Database (1963-2002)



Note that the catches series estimated during 2003 include catches assigned to each species after allocation of species aggregates to individual species by the Secretariat (2002 catches series only accounted for catches recorded under individual species in the IOTC database).

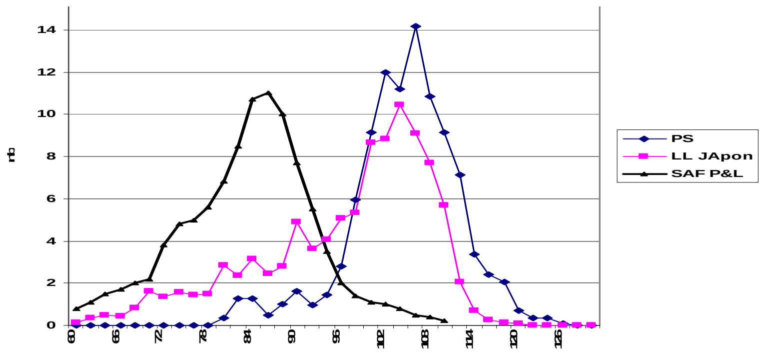


Figure 5. Average sizes of albacore taken by various fisheries in the Indian Ocean, longliners and purse seiners, and by the pole-and-line fishery in the west coast of South Africa (Atlantic Ocean).

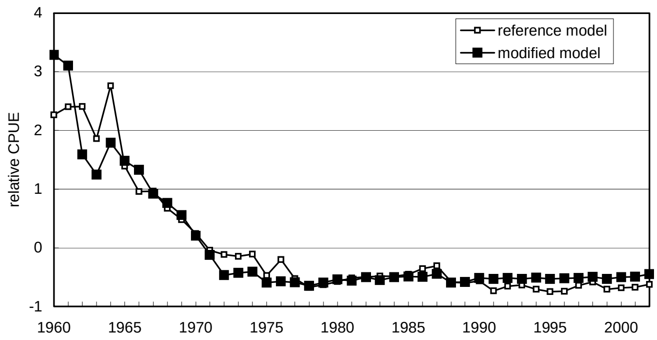


Figure 6. Standardized CPUEs for the reference and modified models. The CPUE for the modified model were calculated using only from Area 2 and Area 4 where albacore is generally abundant. Both CPUEs were adjusted with taking the difference to mean and dividing it by the standard deviation.

APPENDIX VII. REPORT ON THE BIOLOGY, STOCK STATUS AND MANAGEMENT OF SOUTHERN BLUEFIN TUNA

A stock assessment and review of fisheries indicators was conducted by the CCSBT Stock Assessment Group during 2004, results of which are summarized below. This report also updates description of fisheries and state of stock, and provides fishery and catch information

REPORT ON BIOLOGY, STOCK STATUS AND MANAGEMENT OF SOUTHERN BLUEFIN TUNA

1. Biology

Southern bluefin tuna (*Thunnus maccoyii*) are found throughout the southern hemisphere, mainly in waters between 30° and 50° S, but only rarely in the eastern Pacific. The only known breeding area is in the Indian Ocean, south-east of Java, Indonesia. Spawning takes place from September to April in warm waters south of Java and juvenile SBT migrate south down the west coast of Australia. During the summer months (December-April), they tend to congregate near the surface in the coastal waters off the southern coast of Australia and spend their winters in deeper, temperate oceanic waters. Results from recaptured conventional and archival tags show that young SBT migrate seasonally between the south coast of Australia and the central Indian Ocean. After age 5, SBT are seldom found in nearshore surface waters, and extend their distribution over the southern circumpolar area throughout the Pacific, Indian and Atlantic Oceans.

SBT can attain a length of over 2 m and a weight of over 200 kg. Direct ageing using otoliths indicates that a significant number of fish bigger than 160 cm are older than 25 years, and the maximum age obtained from otolith readings has been 42 years. Analysis of tag returns and otoliths indicate that, in comparison with the 1960s, growth rate has increased since about 1980 as the stock has been reduced.. There is some uncertainty about the size and age when SBT mature, but available data indicate that SBT do not mature younger than 8 years (155cm fork length). SBT exhibit age-specific natural mortality, with M being higher for young fish and lower for old fish.

Given that SBT have only one known spawning ground, and that no morphological differences have been found between fish from different areas, SBT are considered to constitute a single stock for management purposes.

2. Description of Fisheries

Historically, the SBT stock has been exploited by Australian and Japanese fisheries for more than 50 years, with total catches peaking at 81,605 t in 1961 (Figure 1). The current (2003) total catch is about 14,024 t (preliminary data), continuing a declining trend in total catches from a recent peak of 19,529 t in 1999, 16,026 t in 2001 and 15,212 t in 2002. Over the period 1952 - 2003, 79% of the catch has been made by longline and 21% using surface gears, primarily purse-seine and pole&line (Figure 1). The proportion of catch made by surface fishery peaked at 50% in 1982, dropped to 11-12 % in 1992 and 1993 and increased again to average 30% since 1996. (Table 1 and Figure 1). The Japanese longline fishery (taking older fish) recorded its peak catch of 77,927 t in 1961 and the Australian surface fishery catches of young fish peaked at 21,501 t in 1982 (Figure 3). New Zealand, Fishing Entity of Taiwan and Indonesia have also exploited southern bluefin tuna since the 1970s - 1980s, and Korea started a fishery in 1991.

73% of the SBT catch has been made in the Indian Ocean, 21% in the Pacific Ocean and 6% in the Atlantic Ocean (Figure 2). The Atlantic Ocean catch has varied widely between 400 and 8,200 t since 1968 (Table 1 and Figure 2), averaging about 1,000 t over the past two decades, and reflecting shifts in longline effort between the Atlantic and Indian Oceans. Fishing in the Atlantic occurs primarily off the southern tip of South Africa (Figure 4).

3. Summary of Stock Status

SBT assessments were updated at the 5th meeting of the CCSBT Stock Assessment Group in Korea in 2004. Current assessments suggest the SBT spawning biomass is at a low fraction of its original biomass, and well below the 1980 biomass. The stock is estimated to be well below the level that produces maximum sustainable yield. Rebuilding the spawning stock biomass would almost certainly increase sustainable yield and provide security against unforeseen environmental events.

Recruitments in the last decade are estimated to be well below the levels over the period 1950-1980. Assessments estimate stable recruitment in the 1990's but very low recruitments in 1999 or 2000. Analyses of fishery indicators provide evidence of a markedly lower recruitment from 1999-2001. Indicators also show that the Indonesia LL fishery on spawning fish catches fewer older individuals. One plausible interpretation is that the spawning stock has declined in average age and may have declined significantly in abundance. This is in contrast to assessment model results that the spawning stock has been largely stable over the last decade and increased slightly over the last 4 years.

Projections with 15,000 t annual catch provide highly variable results depending upon assessment assumptions and suggest the stock is more likely to decline with the CCSBT MP Conditioning Model (an integrated statistical assessment model used in testing management procedures), while ADAPT shows roughly equal probability of decline or increase. Given all the evidence, the probability of further stock decline under current catch levels is now judged to be greater than in 2001, when an increase or decline under current catches were considered equally likely.

4. Current Management Measures

SBT have been managed by means of quota limits agreed at tri-partite meetings between Australia, Japan and New Zealand from 1985 through to the establishment of the CCSBT in 1994. The global quota was reduced several times after the initial level of 38,650 t for the 1984 - 1985 season. The combined quota for these three countries was maintained at 11,750t from the 1989 -1990 through to 2002-2003. Following increase in membership of the CCSBT (Korea, and the Fishing Entity of Taiwan joined in 2001 and 2002 respectively), the CCSBT agreed to the following national catch limits for 2003-2004:

Japan	6,065 tons
Australia	5,265 tons
Republic of Korea	1,140 tons
Fishing Entity of Taiwan	1,140 tons
New Zealand	420 tons
Total	14,030 tons

An additional catch limit of 900 tonnes has also been implemented for cooperating non-members, including 50 tons for the Philippines (which was recently admitted as a cooperating non-member) and 800 tonnes for Indonesia.

The CCSBT has also implemented a Trade Information Scheme (TIS) for SBT. This requires all members of the CCSBT to ensure that all imports of SBT are be accompanied by a completed CCSBT

TIS Document, endorsed by an authorised competent authority in the exporting country, and including details of the name of fishing vessel, gear type, area of catch, dates, etc. Shipments not accompanied by this form must be denied entry by the member countries. Completed forms are lodged with the CCSBT Secretariat and are used to maintain a database for monitoring catches and trade. As markets for SBT are now developing outside CCSBT member countries, the TIS scheme was recently amended to require the document to be issued for all exports, and to include the country of destination,

At its annual meeting in October 2003, the CCSBT agreed to establish a list of vessels over 24 metres in length which are approved to fish for SBT, to be completed by 1 July 2004. The list will include vessels from CCSBT members and cooperating non-members. Members and cooperating non-members are required to refuse the import of SBT caught by large scale fishing vessels not on the list.

SOUTHERN BLUEFIN TUNA SUMMARY
(global stock)

Maximum Sustainable Yield	Not estimated	
Current (2002) Yield	14,024 t (preliminary)	
Current Replacement Yield	Less than 16,000 t	
Relative Biomass	SSB_{2004}/SSB_{1980}	0.14 - 0.59
	SSB_{2004} / SSB_K	0.03 - 0.14
Current Management Measures	Global quota of 14,030 t (Australia, Chinese-Taipei, Korea, Japan, and New Zealand) 900 t provision for cooperating non-members	

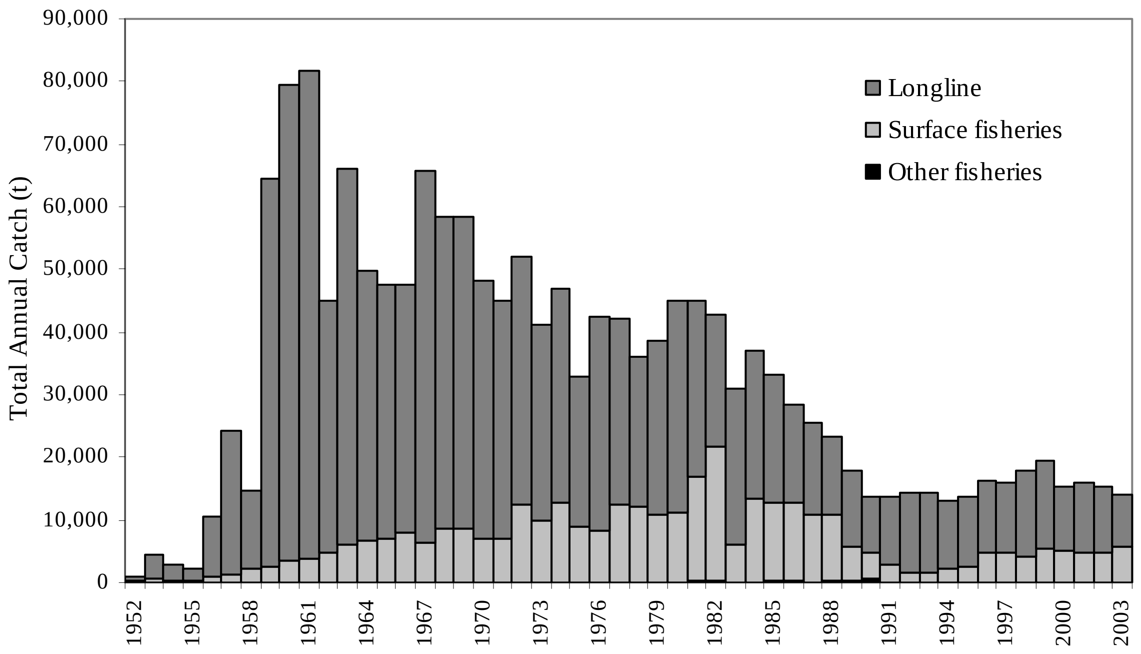


Figure 1. Global southern bluefin tuna catches by fishing gear (t), 1952 to 2003.

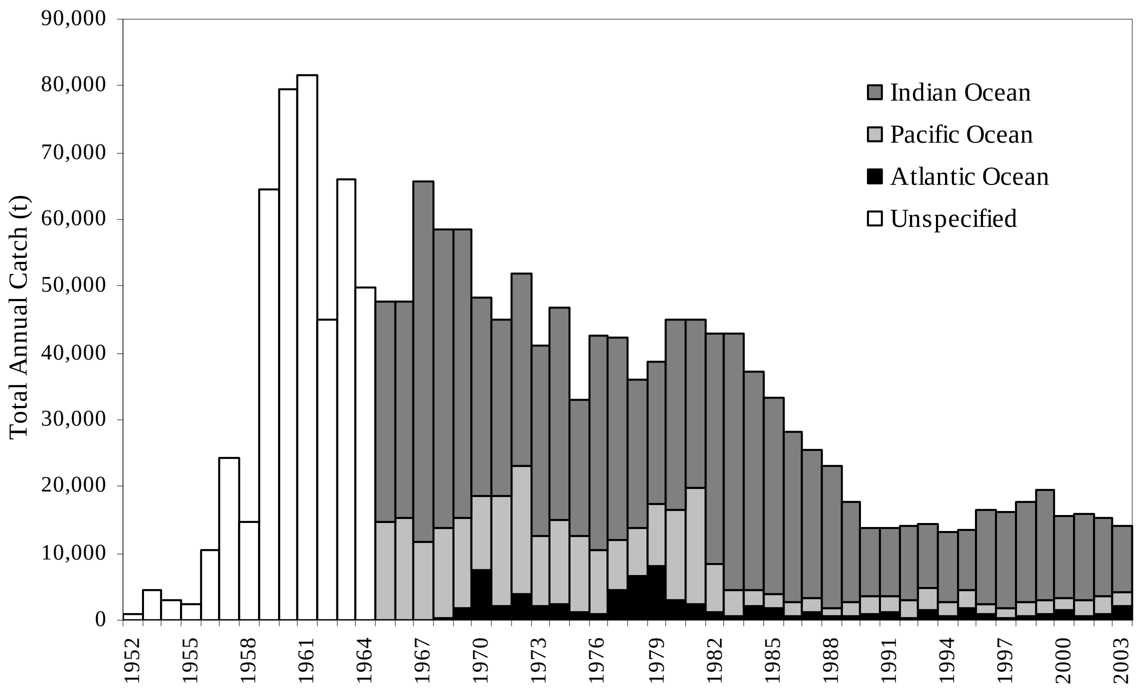


Figure 2. Southern bluefin tuna catches by ocean (t), 1952 to 2003.

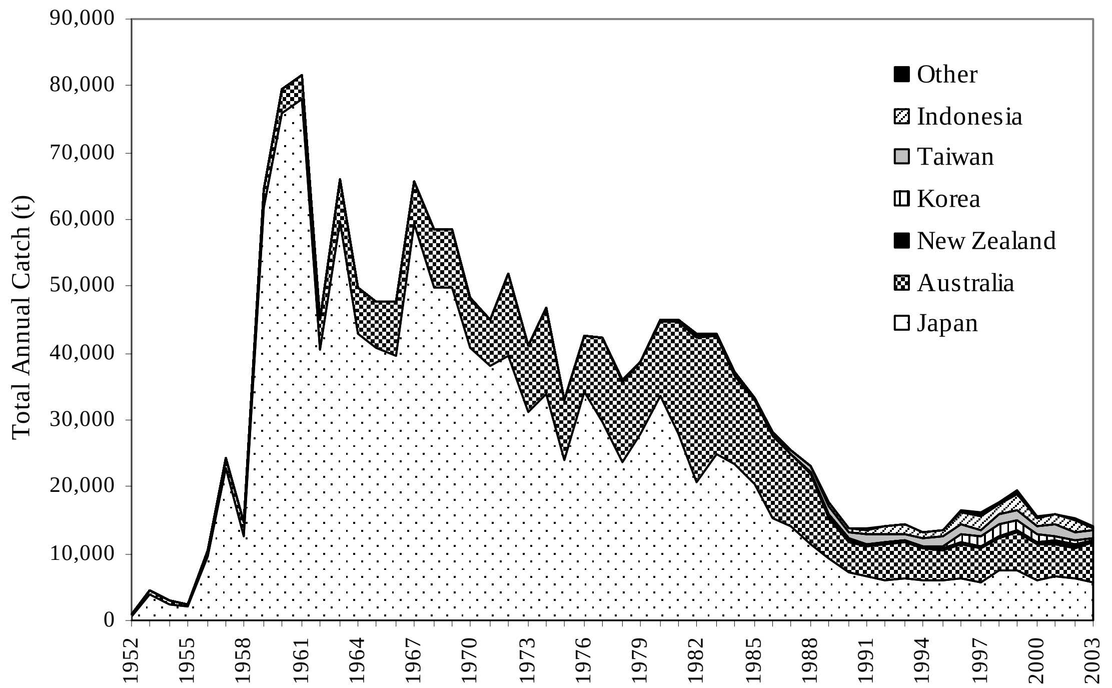


Figure 3. Total annual southern bluefin tuna catch (t) by flag, 1952 - 2003.

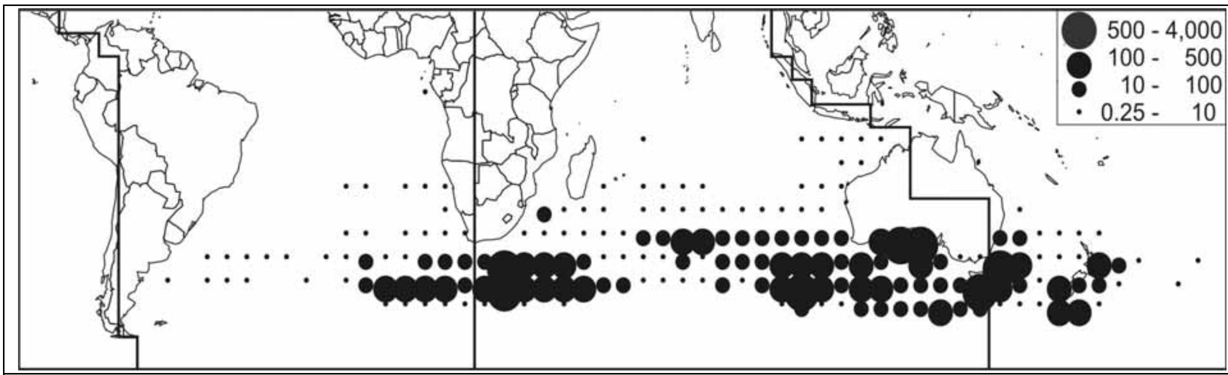
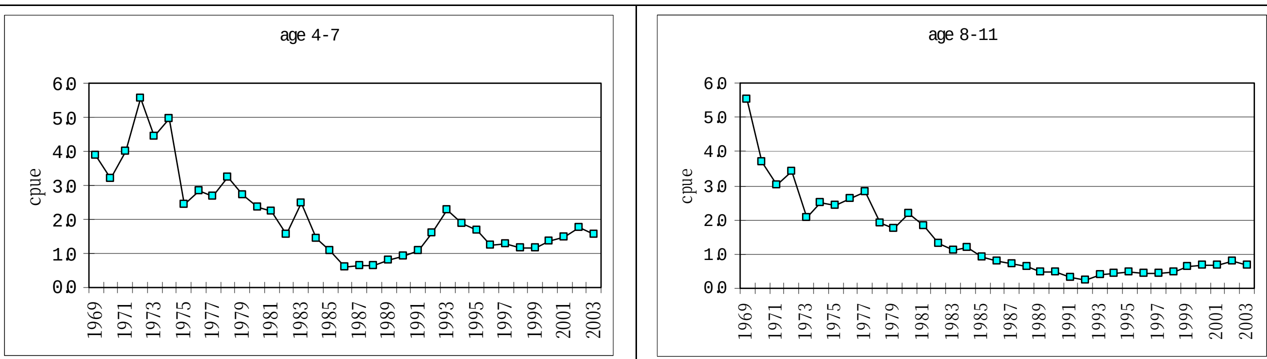


Figure 4. Geographical distribution of average annual southern bluefin tuna catches (t) by CCSBT members from 1983 to 2003 per 5° block by oceanic region. Block catches of less than 0.25 tons are not shown. Oceanic region divisions used in dividing the data for Figure 2 are shown.



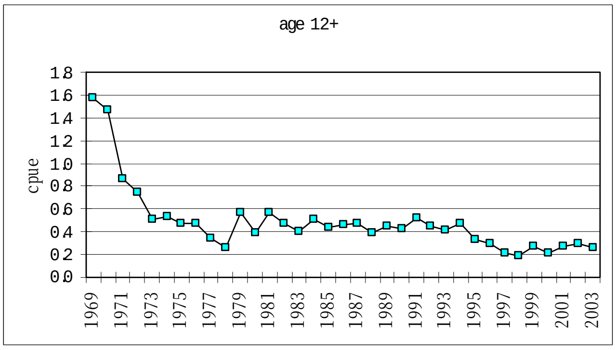


Figure 5. Trends in nominal catch rates of juvenile (age 4-7), maturing (age 8 - 11) and mature (age 12+) SBT (numbers per 1000 hooks) caught by Japanese longliners operating in CCSBT statistical areas 4-9 in months 4-9.

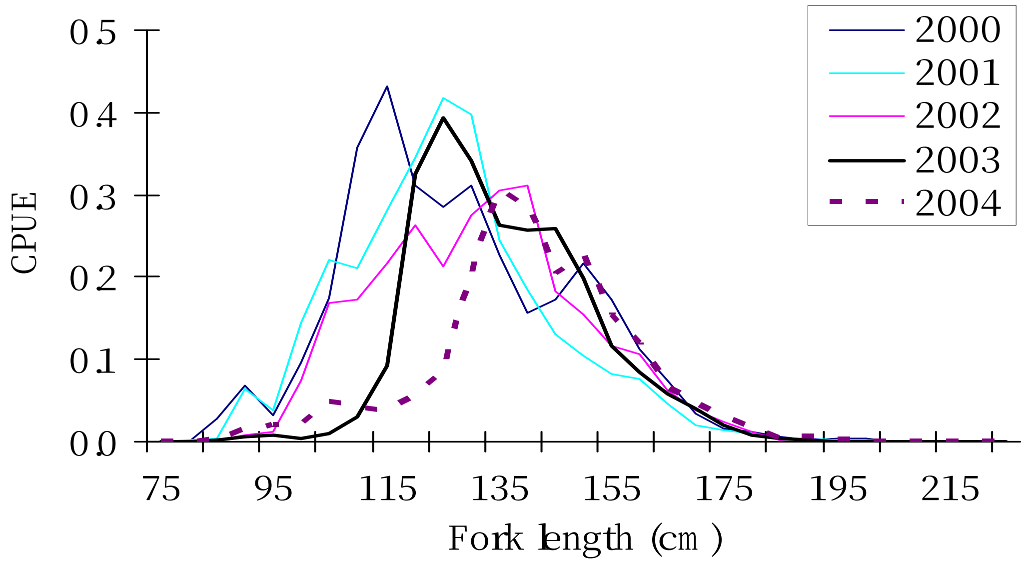


Figure 6. Changes in size composition of nominal CPUE in June in CCSBT Statistical area 4 from Japanese Real Time Monitoring Program data from 2000-2005.

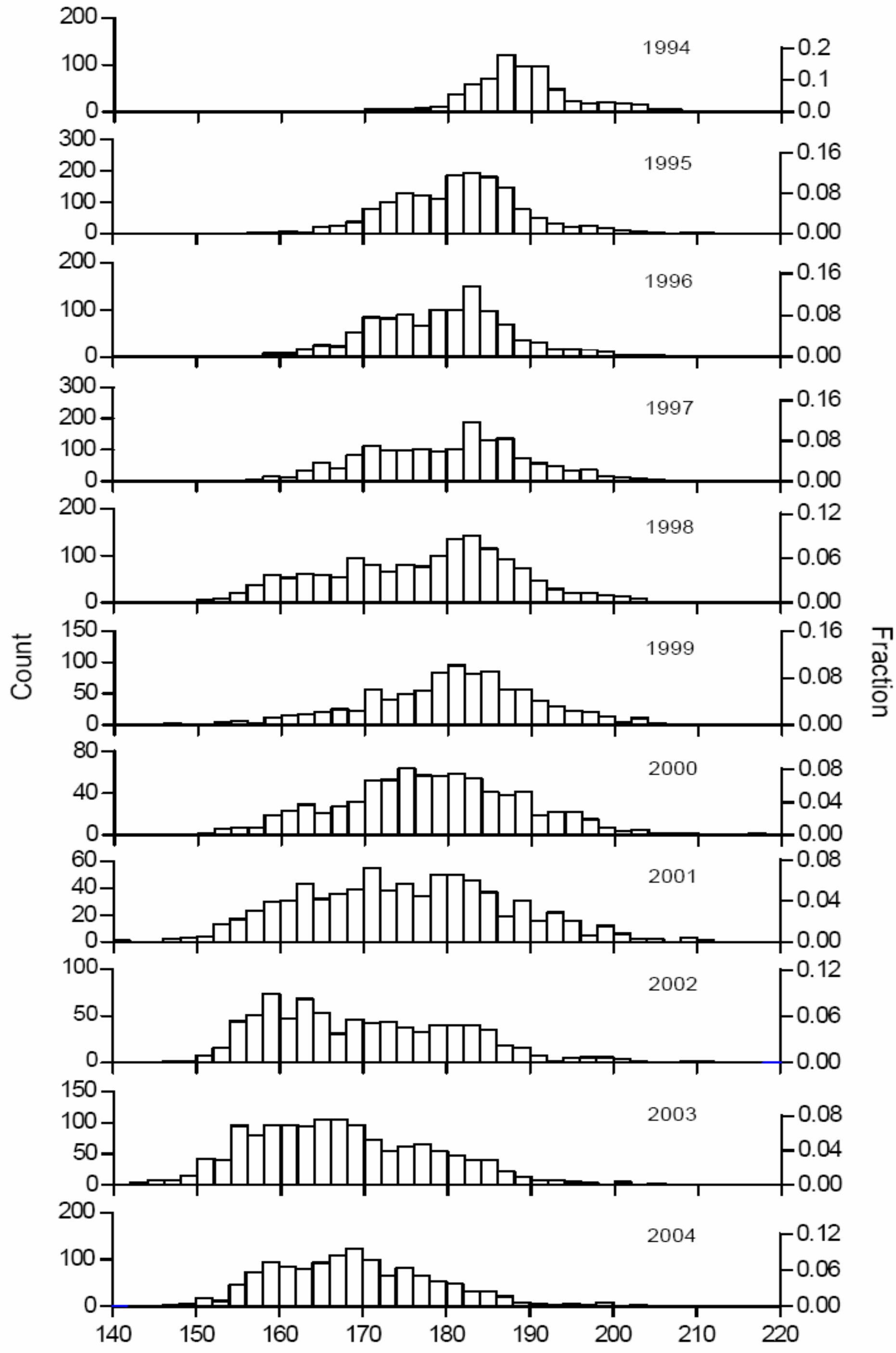


Figure 7. Length frequency (in 2 cm intervals) of Indonesian SBT catches during the spawning season (July 1 of the previous year to June 30 of the given year).

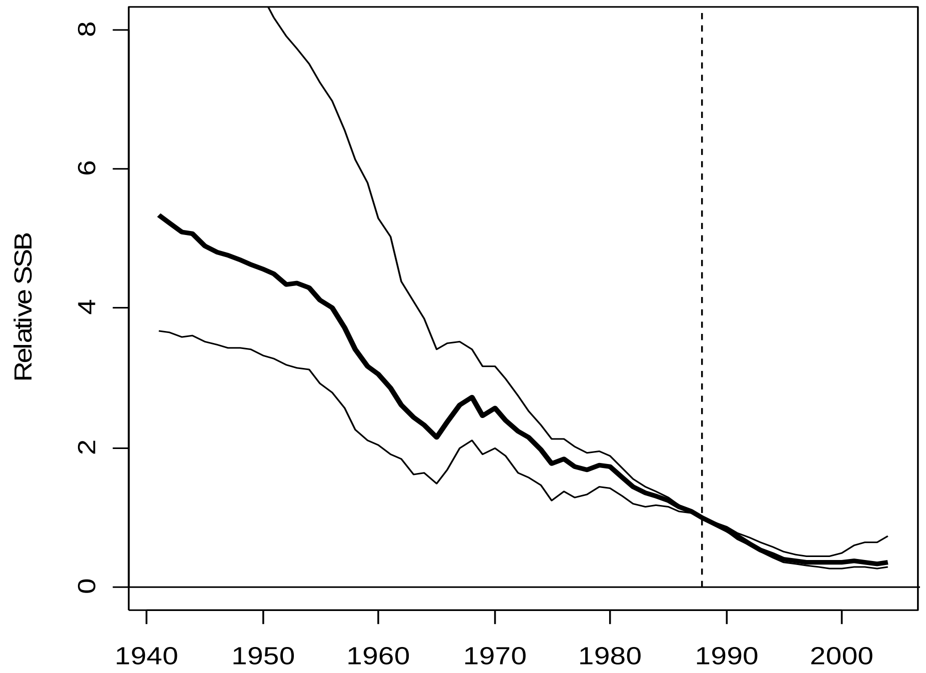


Figure 8. SBT biomass trends (5th, Median and 95th percentiles) from one of the assessments presented at the CCSBT 5th Stock Assessment Group meeting (based on the CCSBT MP Conditioning Model), expressed relative to 1988 (indicated by the dashed line).

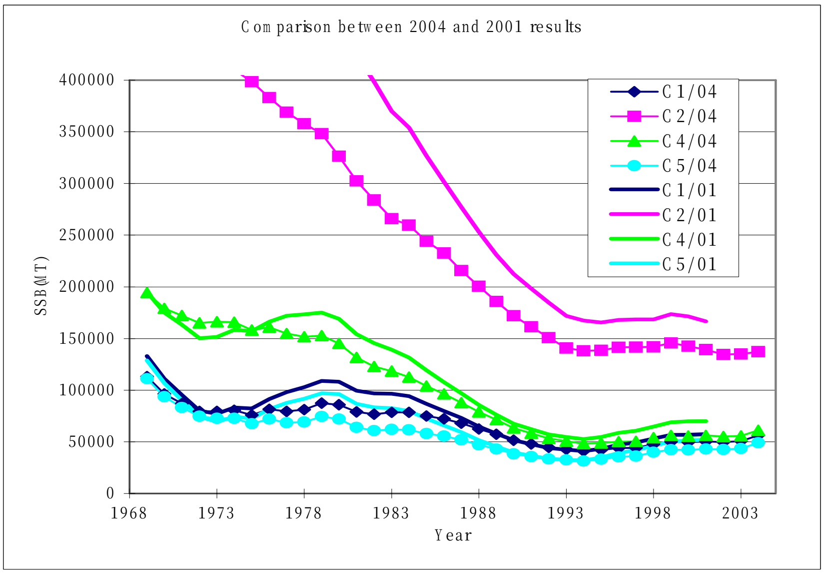


Figure 9: SBT spawner biomass trajectories from another of the assessments presented at the CCSBT 5th Stock Assessment Group meeting (ADAPT VPA) estimates of SSB for different assessment year (2004 and 2001) and plus group options (C1, C2, C4, and C5). (2004 results with markers and 2001 results without markers.)

Table 1. Atlantic Ocean, Indian Ocean, Pacific Ocean and global southern bluefin tuna catch (t) by gear, area and flag.

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
ATLANTIC TOTAL	604	2082	1828	650	1330	602	513	1004	1313	300	1612	483	1845	1040	278	738	819	1470	640	1041	2078
- CATCH BY GEAR																					
Longline	604	2082	1828	650	1330	602	513	1004	1313	300	1612	483	1845	1040	278	738	819	1470	640	1041	2078
- CATCH BY FLAG																					
Japan	573	2082	1733	434	1228	573	493	987	1080	253	1425	420	1237	1015	189	649	689	1203	327	909	1992
Korea	0	0	0	0	0	0	0	0	0	0	80	7	24	0	0	47	100	242	90	116	0
Taiwan	30	1	95	216	102	28	19	17	233	46	108	56	584	24	89	42	30	24	223	16	86
INDIAN TOTAL	38315	32492	29520	25735	22379	21354	15020	10400	10109	11329	9631	10430	9264	13812	14160	15137	16405	12084	13072	11571	9717
- CATCH BY GEAR																					
Longline	21522	19192	16864	13165	11489	10530	9281	5781	7146	9664	8077	8319	6629	9064	9343	10942	11059	6953	8304	6887	3931
Purse Seine	5083	4339	5179	6342	5411	2820	1626	2511	1034	22	536	1269	1840	3099	2991	3555	5325	5132	4767	4683	5787
Pole and Line	11698	8960	7410	6147	5393	7770	3794	1803	1823	1639	1018	841	795	1649	1826	640	22	0	0	0	0
Gill Net	12	0	67	81	87	234	319	305	107	3	0	0	0	0	0	0	0	0	0	0	0
- CATCH BY FLAG																					
Australia	16781	13299	12589	12489	10805	10590	5438	4335	3876	4568	4513	4246	3362	4893	4910	4353	5448	5147	4792	4693	5808
Japan	21391	18935	16780	12938	10946	9754	7536	4383	4137	4238	2869	4132	3684	4248	4500	5838	5126	3370	4453	3153	1949
Korea	0	0	0	0	0	0	0	0	15	41	12	130	341	1320	1424	1749	1361	893	754	630	254
Taiwan	131	243	146	298	608	828	1376	1160	1227	1176	850	963	848	1442	783	1397	1483	1424	1357	1121	1041
Philippines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	80	17	43	79	65
Indonesia	5	11	3	7	14	180	568	517	759	1232	1370	904	829	1614	2210	1324	2504	1203	1632	1691	555
Other	7	3	2	3	7	2	103	4	97	73	17	54	201	295	333	471	403	31	41	203	45
PACIFIC TOTAL	3963	2516	1977	1934	1866	1189	2310	2466	2269	2588	3101	2241	2528	1504	1638	1901	2304	1917	2314	2601	2229
- CATCH BY GEAR																					
Longline	2916	2312	1883	1810	1791	1095	2157	2183	2233	2503	3082	2234	2505	1460	1579	1857	2300	1917	2314	2601	2228
Purse Seine	790	105	0	34	0	0	0	0	0	0	0	0	0	22	7	29	0	0	0	0	0
Pole and Line	125	6	0	8	16	0	13	0	0	33	0	3	0	10	16	0	0	0	0	0	0
Troll	0	0	0	0	0	0	31	21	1	4	0	0	8	3	31	13	3	1	0	1	0
Handline	132	93	94	82	59	94	109	263	35	48	20	4	15	8	5	2	2	0	0	0	0
- CATCH BY FLAG																					
Australia	914	112	0	42	16	1	680	251	613	680	860	454	1145	236	406	543	104	110	61	19	14
Japan	2916	2312	1883	1810	1791	1095	1193	1686	1260	1630	2024	1510	946	1129	898	1013	1740	1427	1894	2130	1821
New Zealand	132	93	94	82	59	94	437	529	164	279	217	277	436	139	334	337	461	380	358	450	389
Korea	0	0	0	0	0	0	0	0	232	0	0	0	0	0	0	0	0	0	1	0	0
Taiwan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	2
Philippines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3
GLOBAL TOTAL	42881	37090	33325	28319	25575	23145	17843	13870	13691	14217	14344	13154	13637	16356	16076	17776	19529	15472	16026	15212	14024

Catches for 2002 and 2003 are preliminary. Catches for Indonesia, the "other" flags, and for gear not listed below (e.g. minor line) have been assigned to the longline category.

Catches have been assigned to the Indian Ocean where location information was not available. This includes catches from Indonesia, Other, Philippines (pre-2000 only), Taiwan (pre-1981 only).

Source: CCSBT Database and Report of the Ninth Meeting of the CCSBT Scientific Committee.

APPENDIX VIII. BUDGET FOR A PROPOSED IOTC ATLAS

Excerpt from IOTC-2004-SC-INF10

Task	Manpower cost	Month manpower	Real cost in US$	IOTC Cost hyp 1: all costs cobvered by the IOTC	IOTC Cost hyp2
Detailed choice of the Atlas content: framework, text and figures and maps	Work to be done by the Atlas task force and the IOTC secretariat; working by E Mail.	1	$5,000	$0	$0
Data preparation allowing to make the figures and maps	Work to be done by the IOTC secretariat, or by an external contract with an expert (assuming no need for new hardware or software)	2	$10,000	$10,000	$0
Technical realization of the figures and maps using the data prepared in 4-2 and ad hoc software.	Work to be done by the IOTC secretariat, or by an external contract with an expert(assuming no need for new hardware or software)	3	$15,000	$15,000	$0
Editing the figures and maps in a nice publishable format and colors	Work to be done by the IOTC secretariat, or by an external contract with an expert	3	$15,000	$15,000	$0
Editing and validating text and figures before their submission to the printer	Work to be done by the IOTC secretariat, or by an external contract with an expert	1	$5,000	$5,000	$5,000
Doing all the tasks leading to the printing of the atlas (provisional working estimate printed in France)			$32,000	$32,000	$32,000
Costs of delivering the IOTC storage facility and later to the final buyer.			$10,000	$10,000	$10,000
Publicity	Work to be done by the IOTC secretariat	0.5	$5,000	$5,000	
Preparation of the CD version of the Atlas		1	$5,000	$5,000	$5,000
1000 copies of the CD			$5,000	$5,000	$5,000
Total budget		**11.5**	**$107,000**	**$102,000**	**$52,000**