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

Report of the Eighth Session of the Scientific Committee

Victoria, Seychelles, 7-11 November 2005

IOTC-2005-SC-R[EN]

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1. OPENING OF THE SESSION

1. The Eighth Meeting of the Scientific Committee (SC) was opened on 7 November 2005 in Victoria, Seychelles, by the Chairperson, Dr. Geoffrey Kirkwood (United Kingdom), who welcomed the participants (Appendix I). The Meeting was attended by 29 participants from nine Members and five observers.

2. While fully understanding the advantages to the Commission in separating in time the meetings of the SC and the Commission, the SC again noted with concern that an unintended consequence was a reduced participation of member countries to this meeting, in particular from Indian Ocean coastal states. Possible remedies are discussed under Agenda Item 12.

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 Observers from the Russian Federation, Birdlife International and SEAFDEC, and 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 2005, and the SC noted the following matters:

- The acquisition of information and updating of databases continued to be a major focus of the Secretariat's activities throughout the year. Some of these activities were carried out with the assistance of the IOTC-OFCF[1] Project.
- The Indian Ocean Tuna Tagging programme also continued to be a major work activity for the Secretariat in 2005, especially for the Executive Secretary. It is also expected to be major activity for the Secretariat in 2006.
- Two Working Party meetings were held in 2005: Tropical Tunas and By-catch in July.
- The development of the IOTC statistical software, FINSS (Fisheries INtegrated Statistical System — formerly known as WinTuna), continued during 2005. The FINSS User’s Manual was also published in 2005.
- The Secretariat has been without a permanent French translator since August and this has affected the production of some reports during the year

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. Following the recommendation from the SC in 2004, data collection and statistics was addressed by the SC in plenary.

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

5.1 Status of the IOTC Databases

8. Document IOTC-2005-SC-INF01 described the main activities carried out in relation to data acquisition and data processing since the last SC meeting, and the status of the databases at the IOTC Secretariat.

9. The SC commended Taiwan,China for the provision of historical size frequency data for its distant water longline fishery (1980-2003). The SC acknowledged the great importance of this dataset for the assessments of major tuna and billfish stocks in the Indian Ocean.

10. The SC noted further progress on the timeliness and quality of data submissions from several fleets and congratulated the IOTC-OFCF Project for its significant contribution to the improvement of the quality of data collected in several countries of the region.

11. The SC noted the following problems:

- Late reporting: Despite some improvement in the timeliness of reporting of the data to the Secretariat, the amount of data available before the deadline for data submission continues to be low. Late reporting of data considerably 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 2004 is provided in Appendix IV.
- Catch 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-DFRZ2) and purse seiners operating under several flags (mainly Belize, Equatorial Guinea and Panama) in recent years and the gillnet fishery operating off Yemen. Although the Secretariat has been estimating the catches by these fleets, these estimates are considered to be highly uncertain.
- Uncertain catch reports: The catches reported for several fleets are considered to be uncertain. These include the large longliners from Seychelles, industrial purse seiners from Iran, and several artisanal fisheries, particularly the fishery operating a combination of gillnets and longlines off Sri Lanka.
- Catches not reported by species and/or gear: These include several artisanal fisheries, mainly in Indonesia and India.
- Lack of catch and effort information for non-reporting longline (fresh tuna longliners from Taiwan,China and NEI-DFRZ) and purse seine fleets, 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 and Philippines and NEI-purse seiners.
- Lack of size frequency data for NEI-PS, 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.

12. The SC noted the current initiatives in Seychelles to address several of these issues, including the ongoing validation of data collected during 2003 and 2004 on its deep-freezing longline fleet. The SC looks forward to the submission of these data to the Secretariat by early 2006.

13. **The SC noted with concern the lack of detailed statistics for the Maldives pole and line fishery in recent years, and recommended that the Secretariat make every possible effort to improve the reporting of data from this country.**

14. The SC noted the marked change in the catch estimates of yellowfin tuna by artisanal boats in Yemen as a result of a recent revision of the available data undertaken by the Secretariat. The SC also acknowledged the desirability of having size frequency data from this important fishery for stock assessments. However, the SC noted

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

that the amount of resources required for the implementation of full-scale sampling on an artisanal fishery like the one in Yemen would be well beyond those currently available in the IOTC-OFCF Project. Notwithstanding this, the Secretariat informed the SC about two programmes in Yemen, envisaged by the World Bank and France, that contemplate the implementation of fisheries data collection in Yemen. The SC requested that the Secretariat arrange for a fact finding mission to Yemen under the auspices of the IOTC-OFCF Project to identify the most effective ways of collecting catch and size frequency data.

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

5.2 Review of data on species

16. Species specific data related problems were reviewed in the Working Parties for Tropical Tunas (IOTC-2005-WPTT-R) and By-catch (IOTC-2005-WPBy-R) reports, and in updates for billfish, temperate tunas and neritic tunas provided by the IOTC Secretariat.

17. For tropical tunas, the SC noted the need to obtain size data from the gillnet fisheries operating off Oman and Yemen, baitboats in Maldives and to increase the amount of size data collected from the main longline fisheries.

18. For billfish, the SC noted several data problems, including the continued practice of declaration of catches aggregated by groups of species, and the lack of size frequency data from most fisheries, particularly gillnet fisheries.

19. For temperate tunas, the SC noted with concern the lack of data from several longline fleets.

20. The SC noted with concern the paucity of data available on by-catch and discards of non-tuna species, especially sharks. The SC emphasised the constraints that this will impose on its ability to provide advice on the stock status of major shark species in 2006, as requested by the Commission during its 9th Session (2005).

21. **The SC noted that the collection of data on shark species for which the Commission was requesting stock assessment should not only concentrate on tuna and tuna-like fisheries, but extend also to other fisheries that target these species. It recommended that the Secretariat attempt to identify major potential sources of such data and report on this to the next meeting of the Working Party on Bycatch.**

22. The SC further noted that as sharks are the main bycatch of tuna fisheries, and given the way in which most sharks are processed (i.e. only the carcasses and/or fins tend to be kept on board), the collection of bycatch data by observers was of utmost importance, and it may be the best way to obtaining reliable detailed statistics.

23. **In this context, the SC noted that existing observer programmes have already collected data on sharks and other bycatch species in the Indian Ocean. . The SC recommended that CPCs holding such observer data make every possible effort to make it available to the Secretariat.**

24. **The SC recommended that particular attention be given by Contracting Parties and Non-contracting Cooperating Parties to submission of data on species for which the Working Parties will be conducting an assessment.**

25. The SC was greatly appreciative of the efforts of scientists from Taiwan,China in 2005; in particular for their participation as invited experts in all working parties, and in providing access to valuable Taiwanese fisheries datasets and contributing to analyses.

5.3 Progress Report of the IOTC-OFCF Project

26. The activities of the IOTC-OFCF[3] Project during 2005 (its fourth year of operation) were described in IOTC-2005-SC-03. Highlights included:

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

- A Regional Workshop on Database Management Systems to provide a forum for sharing experiences and ideas about Database Management Systems. The recommendations in the workshop report provided guidelines on the design and implementation of effective Database Management Systems in terms of Database Design, Data Lineage and Data Safety.
- Advances in the Indonesian sampling programmes leading to an improved capability to estimate catches of the large fleet of fresh-tuna longliners. In July at the WPTT, Indonesian representatives made a presentation of the results from the multilateral catch monitoring programme including the catch and catch-at-size estimates by Indonesian vessels during 2003-04.
- Continued funding and technical assistance for the sampling programme on fresh-tuna longliners in Phuket, Thailand.
- An agreement with the Department of Fisheries of Thailand (DOF) to provide support for extending the coverage of their data collection activities on purse seiners targeting neritic tuna species of Thailand. The information collected through this program will help to assess the reliability of current estimates and modify the current sampling strategy on the basis of the results.
- Continued funding and technical assistance for the sampling programme in Sri Lanka.
- Publication and dissemination of the FINSS User's Manual.
- A training programme on the collection of fisheries data, collection of data for the estimation of catches on the industrial purse seine fishery operating in Iran will take place in Seychelles on next December 2005.
- Fact finding missions to Kenya and Tanzania are planned for compiling country reports with the National counterparts and collecting information on their fisheries for tuna and tuna-like species in February-March 2006.

27. The document also provided a preliminary work plan for 2006/2007. Proposed activities included:

- Given the importance of the catches from Indonesia, it is expected that the Indonesian project will still receive significant support up to December 2006. However, special emphasis will be placed in the gradual transfer of the activities to Indonesian authorities.
- Support to the Thailand and Sri Lankan sampling programmes up to December 2006.

28. The SC endorsed the proposed IOTC-OFCF Project work plan for April 2006 – March 2007 in principle, noting that the final plan will be determined by IOTC and OFCF in the 2006 Joint Committee Meeting.

29. The SC congratulated the IOTC-OFCF for the progress achieved since the Project was implemented, noting the improvements in many areas and especially in the completeness and quality of the statistics submitted to the IOTC Secretariat.

30. The IOTC-OFCF noted that the main objective of the project is to build the required capacity in countries of the region and promote awareness in the fisheries administrations so as the implemented activities are taken over and maintained by the responsible countries in the future. The IOTC-OFCF reported positive responses from countries such as Maldives and Indonesia, where a firm commitment exists from the local governments to maintain the activities in the future.

31. The SC was unanimous in congratulating the IOTC-OFCF Project for its excellent work and most valuable contribution to improving the data available to IOTC and building capacity of its participating countries to implement robust data collection regimes. The SC paid special mention to the dedication and professionalism of the OFCF team and while it acknowledged that the project was scheduled to conclude in 2007, it was unequivocal in its desire for the project to be continued for as long a possible.

32. The SC commended the Government of Japan for this initiative, stressing the great benefit that an extension of this program would have for future stock assessments.

5.4 Guidelines for IOTC Tuna Fisheries Observer Programmes

33. Document IOTC-2005-SC-INF07 provided basic guidelines for a tuna fisheries observer programme, based on information collected on a number of different existing observer programmes operating in the different oceans.

34. The SC thanked Japan for undertaking this work. It noted that the report would be a valuable reference document for countries intending to implement a National observer programme or in the event that the Commission requests further advice a possible IOTC-wide observer programme.

35. The EC informed the SC about the ongoing observer programs on purse seine and longline vessels operating under flags of EC countries. The EC noted that the observer activities on purse seiners concentrated on the collection of data on bycatch and discard species (i.e. species which are very difficult or impossible to monitor at the time of landing). The EC further indicated that the levels of coverage varied among the different fleets, but were (by regulation) set at a level of 10% of the total trips for these fleets.

36. The SC noted that observations that can be made during unloading or onshore may be better done then, rather than at sea when available time is limited.

37. The SC noted from the presentation of the National Report of China that China is currently conducting a tuna scientific observer program in the Indian Ocean, as a part of the national tuna observer program which is supported by the Bureau of fisheries, Ministry of Agriculture. The scientific observer program has been carried out in cooperation with the Branch of Distant Water Fisheries of China Fisheries Association and the Shanghai Fisheries University, and graduate students are chosen to act as tuna scientific observers. In 2002-2003, 127 days fishing were covered by one observer. In 2005, two observers will spend three month at sea.

38. The SC noted from the presentation of the National Report of Australia that Australia has continued its pilot observer programme reported in its 2004 National Report. The level of activity in 2005 was reduced due to the low effort in the fishery.

39. The SC noted from the presentation of the status report on the Taiwanese longline fishery by the Invited Scientists that an observer programme has been implemented in the fishery since 2001. In 2004 there were three observers operating and this was increased to six in 2005, resulting in a coverage of 3%. They collected fishery data and size data on major species and by-catch/incidental catch species, as well as biological samples from some important species for a range of studies.

40. The SC stressed the need for current and future observer programmes to collect catch and effort information in as much detail as possible in order to allow scientists to extrapolate the data collected through observers to the overall fishery and have confidence in the estimates they produce.

6. Presentation of National Reports

41. National Reports were presented by Japan (IOTC-2005-SC-INF04), EU-Spain (IOTC-2005-SC-INF05), Seychelles (IOTC-2005-SC-INF06 and INF06add), EU-France (IOTC-2005-SC-INF08), South Africa (IOTC-2005-SC-INF09), United Kingdom (IOTC-2005-SC-INF11), Republic of Korea (IOTC-2005-SC-INF12), China (IOTC-2005-SC-INF13), Thailand (IOTC-2005-SC-INF14), and Australia (IOTC-2005-SC-INF15). Abstracts of these reports are given in Appendix V.

42. The SC noted the following update on Taiwanese fisheries provided by the invited experts. Four major groups of large-scale Taiwanese longliners have operated in the Indian Ocean recently: the BET-targeting group, the BET/YFT seasonal-targeting group, the BET/ALB seasonal targeting group and the ALB-targeting group. Major fishery changes occurred in 2003 and 2004 including: (1) the BET/ALB group all shifted to catch bigeye due to a low albacore market price in 2003 (46 vessels shifted) and 2004 (20-24 vessels shifted), resulting in a significant continuous decline in albacore catch and an increase in bigeye catch; (2) vessel numbers in the BET/YFT group increased twice in 2004 due to good yellowfin catch conditions; (3) swordfish catch declined due to fewer vessels fishing in the south-western region. Three important plans have been developed in 2005: (1) A large scale fleet reduction program in which 120 LSTLVs worldwide will be scrapped by end of 2006, including the scrapping of 28 vessels from the Indian Ocean by the end of 2005. (2) An enhanced monitoring program in which each participating vessel is allocated individual quota for bigeye, her fishing ground is confined and monitored by VMS (100% installation), a weekly report is required, and statistical documents will be verified using a range of

information. (3) Improved data collection programs, observer coverage will be increased, a port sampling program has been implemented, and international data exchange is to be enhanced.

43. The SC noted the following update on activities from SEAFDEC. SEAFDEC had proposed at the Fifth and Sixth Sessions of the IOTC in 2000 and 2001 to support the IOTC tagging program in the East Indian Ocean using its 1,200 GT research vessel, MV SEAFDEC. To confirm that MV SEAFDEC, a purse seine style research vessel, can undertake a tuna tagging program, tuna tagging was initiated in 2003-04 using the IOTC standard tags. During the trials, SEAFDEC successfully tagged 931 yellowfin and bigeye tunas, and 69 skipjack. The same activity was continued in 2004-05 and 1,073 tunas (841 yellowfin tuna, and 232 bigeye tuna) were tagged. All tagged fishes were observed to be active after released and all tagging data for 2003 and 2004 was provided to the IOTC for inclusion in the tuna tagging database. Since 1995, SEAFDEC has collected by-catch composition from tuna purse seine and longline vessels, and these data have been provided to the IOTC. In the Eastern Indian Ocean this year, SEAFDEC plans to have a three months research survey (using MV SEAFDEC) in cooperation with the Department of Fishery Thailand. The survey will take place from 18 December 05 to 9 February 06. The fishing activities for this cruise will be more focused on by-catch of tuna purse seines and an experiment of tuna longline using circle hook, but further tagging can be done if IOTC requests.

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

44. The Seventh Meeting of the Working Party on Tropical Tunas (WPTT) took place in Phuket, Thailand, 18-22 July, 2005. In the absence of the Chairman of the WPTT, the Chairman of the Scientific Committee introduced the 2005 WPTT report (IOTC-2005-WPTT-R). The key objectives of the meeting were to address the status of yellowfin tuna in the Indian Ocean and to consider possible causes for the exceptional catches of this species in 2003 and 2004.

45. The SC reviewed and accepted the new assessment of yellowfin tuna developed by WPTT and adopted the revised Executive Summary for yellowfin tuna. This is given in Appendix VI. The SC noted that the availability for the first time of size frequency data from 1980 to 2003 for the Taiwanese industrial longline fleet had improved the reliability of the assessment.

46. In relation to the exceptional catches of yellowfin tuna in 2003 and 2004, new information on the catches of yellowfin tuna for the first half of 2005 provided by Seychelles during the meeting indicated that these high catches had continued until the first two months of 2005. Since then, however, catches have returned to more normal or lower than average levels.

47. The Scientific Committee endorsed the WPTT's research recommendations (reproduced as Appendix VII) and commended it for its work in 2005.

48. **In particular, the SC endorsed the pre-meeting timetable recommended by WPTT to facilitate the conduct of future assessments (see IOTC-2005-WPTT-R, paragraph 87) and recommended that similar timelines be used by other working parties undertaking assessments in the future.**

49. The SC placed emphasis on the need to foster the collection of key biological parameters (from a range of fisheries and areas) notably reproductive activity and sex ratio by size which are required in stock assessments.

50. The SC also agreed that, whenever assessments are considered by IOTC Working Parties, the computer programs used and all input and output files must be lodged with the Secretariat at the termination of the meetings.

51. **In addition, the SC recommended that the priority matters for WPTT to address at its 2006 meeting should be:**

- **To undertake a revised stock assessment of bigeye tuna.**
- **To review stock status indicators for yellowfin and skipjack tuna.**

52. **The SC recommended that a set of stock status indicators for all tropical tuna species should be prepared in advance of the 2006 WPTT meeting and subsequent meetings by the Secretariat. The SC also recommended that updates of the Executive Summaries be available at the start of SC meetings.**

53. **Given the issues regarding targeting in longline fisheries raised under section 7.3 below, the SC recommended that WPTT pay particular attention to this issue at its 2006 meeting, both in terms of analysis of historical longline CPUE data and what types of additional information might be required in the future to better identify targeting.**

54. **The SC noted that indices of abundance for the key tuna stocks in the Indian Ocean are still only available from the large-scale industrial longline fleets. It agreed that there remains an urgent need to develop additional indices of abundance based on data from the other major fleets exploiting these stocks, especially for the purse seine fisheries. The SC therefore recommended that development of such indices be further considered by WPTT.**

55. The Executive Summaries for bigeye and skipjack tunas are as adopted at SC7 (Appendix VI), noting they have been amended slightly to reflect the latest available catch data, but the advice and recommendations remain unchanged.

7.2 Executive Summaries of the status of swordfish and albacore tuna.

56. The Executive Summaries for swordfish and albacore tuna, as adopted by the Scientific Committee at SC7, are provided in Appendix VI. Neither of the Working Parties concerned met during the intersessional period, so the advice and recommendations of the last Scientific Committee regarding these species remains unchanged.

7.3 Management advice.

57. The following paragraphs summarise the current management advice on the species that have been reviewed by the Scientific Committee. Note that only the status of yellowfin tuna has been revised since the last session so that the advice for other species has remained unchanged.

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) Fishing mortality rates between 1999 and 2002 were probably slightly below or around Fmsy, and total catches during that period, at an average level of 347,000 t, were probably close to, or possibly above MSY. Total catches in 2003 and 2004 were substantially above MSY; see below for interpretation of the possible reasons for and possible effects of these catches. In these circumstances, any further increase in both effective fishing effort and catch above average levels in 1999 - 2002 should be avoided.
2) The current fishing pressure on juvenile yellowfin by both purse seiners fishing on floating objects and artisanal fisheries 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 estimated in 2002.
3) 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.

While there was greater consistency in the assessment results considered at this meeting than in 2002, the Scientific Committee emphasized that there remain considerable uncertainties in the assessments, as none as yet are able to fully explain the observed trends in standardized longline CPUEs over the duration of the fishery.

In interpreting the high catches of 2003 and 2004, the Scientific Committee noted that if the hypothesis of one or two high recruitments entering the adult stock is correct, the increased catches from these year classes are unlikely to be detrimental to the stock, but these catches would not be sustainable in the longer term unless supported by continued high recruitments.

On the other hand, there could be serious consequences if the hypothesis that there was 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 could lead to a sudden decline of the existing adult biomass of yellowfin tuna, potentially reducing the stock to below MSY levels. If such is the case, management action might be needed to reduce catches and fishing mortality to below the levels prevailing in 1999 – 2002 to allow the stock to recover.

If, as the Scientific Committee believes, the most likely cause of the exceptional catches is a combination of these factors, then some reduction of stock biomass is to be expected in the future. However, the extent of any such reduction will only become apparent in several years following detailed stock assessments.

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 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.

SKIPJACK TUNA (*KATSUWONUS PELMIS*)

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.

ALBACORE TUNA (*THUNNUS ALALUNGA*)

A stock assessment for Indian Ocean albacore 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.

SWORDFISH (*XIPHIAS GLADIUS*)

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.

7.4 Other matters

58. The SC noted the contents of a report on the biology, stock status and management of southern bluefin tuna (IOTC-2005-SC-INF02) and thanked CCSBT for providing it.

59. The Scientific Committee discussed document IOTC-2005-SC-INF16, which reviewed historical shifts in numbers of hooks between floats (HBF) in the Japanese longline fishery in the Western equatorial Indian Ocean. Frequently, HBF has been used as a factor in CPUE standardisation studies to reflect changes in species targeting. The document concluded that until the end of the 1980s, HBF was probably a reasonable indicator of maximum fishing depth, but more recently, with the modernization of the fishing gear, this is probably no longer the case. Consequently, additional information on longline fishing strategies, in particular the way longlines are deployed needs to be collected in order to obtain a standardised CPUE that may be better representative of trends in stock abundance.

60. **The SC agreed that this is an important study that has implications for the assessments of all tuna and tuna-like species taken by longlines. It draws this paper to the attention of each of its working parties, but in particular it recommends that at its 2006 meeting, WPTT should consider both its implications for analysis of historical longline CPUE data and what types of additional information might be required in the future to better identify targeting.**

8. REPORT OF THE WORKING PARTY ON BYCATCH (WPBY)

61. The First Meeting of the Working Party Bycatch (WPBy) took place in Phuket, Thailand, 20 July, 2005. The Chairman of the WPBy, Mr. Kevin Mcloughlin, presented the report, document IOTC-2005-WPBy-R.

62. The Scientific Committee endorsed the recommendations of the WPBy (reproduced in Appendix VII), and commended it for this first meeting. It was noted that next year’s work-plan is ambitious and largely reflects the requirements of Resolution 05/05 of the Commission, which requires the WPBy to provide preliminary advice on the stock status of key shark species and provide a research plan and timeline for a comprehensive assessment of these stocks.

63. The SC noted that the existing bycatch data in the IOTC databases are almost certainly insufficient to achieve even the objective of providing preliminary advice on stock status by 2006. In addition to the fact that existing bycatch data are very seriously underreported, data from other fisheries targeting sharks rather than tunas or billfish, which are likely to represent an important percentage of the total catch of sharks, would need to be obtained. In this context, the SC recalled the experience of ICCAT, which took about 15 years to build a database of shark bycatch data that was capable of producing informative stock assessments or a small number of shark species.

64. The Scientific Committee therefore concluded that it is very unlikely that the WPBy would be able to produce definitive status indicators for shark species at its next meeting. Furthermore, it considered that such an objective would only be achieved in the near future if there is a strong commitment on the part of member countries and national scientists to collect and provide the relevant information.

65. The Scientific Committee agreed that the key first step towards evaluating the status of sharks in the Indian Ocean would be for the WPBy to further develop a research plan with an achievable time-line. This plan should include in particular identification of potentially available sources of data, such as from national research programs, observer programs, etc. and requesting that this information be made available by national scientists and regional bodies.

66. **The SC also recognised that logbooks of longliners often record shark catches, and while species are often combined they may provide some insight into past catches. Japanese training vessels kept accurate logs of all shark catches by species. Therefore it may be possible to estimate shark catches by species using both these records. The SC recommended that Members and Cooperating Non-Contracting Parties submit their historical shark catch records at the next WPBy meeting with a view to these being analysed with the data from the training vessels in the future.**

67. The SC noted that bycatch of seabirds is very low in the tropical areas of the Indian Ocean, but there is the potential of substantial seabird mortalities due to longline fishing in those areas of the Indian Ocean that overlap the distribution of breeding albatrosses (south of 30°S). Given this, Scientific Committee requested that member countries and national scientists make a strong effort to provide any information they have on seabird bycatches so the WPBy can undertake a preliminary assessment of the potential size of the seabird bycatch by longline fisheries.

68. **The Scientific Committee recommended that the Secretariat contact CCSBT and request access to any information on shark, albatross and turtle bycatches by the SBT fishery in the Indian Ocean that might be available.**

69. Additionally, the Scientific Committee strongly encourages members to include bycatch experts as part of their delegations of national scientists to the WPBy in the future.

9. Response to the request from the Commission in relation to Resolution 05/01

70. At its last Session, the Commission agreed in Resolution 05/01 (On Conservation and Management Measures for Bigeye Tuna) that:

"The Scientific Committee be tasked to provide advice, including advice on;

- *the effects of different levels of catch on the SSB (in relation to MSY or other appropriate reference point);*
- *the impact of misreported and illegal catch of bigeye tuna on the stock assessment and required levels of catch reduction; and*
- *evaluation of the impact of different levels of catch reduction by main gear types."*

71. In responding to this request, the Scientific Committee used the results of the best assessment of bigeye tuna available. Given the short amount of time available between the request and the meeting of the WPTT, the working party in charge of conducting assessments for this species, it has not been possible to undertake a full new assessment but only an update of the previous assessment, completed in 2004.

72. This update is based on the most recent catch information, but it does not reflect the most recently available data. Since that last assessment, new size-frequency data for longline fisheries for the period 1980-2003 have become available that could result in important differences in the next assessment to take place at the next meeting of the WPTT in 2006. The advice provided in this section could be affected by those new results.

Updated assessment

73. The updated assessment uses the latest estimates of total catch for the years 1960 to 2003, and a recalculated standardized CPUE index for the Japanese longline fishery. The 2003 total catch used in the assessment excludes 8,000 tons for the year 2003. This amount was agreed by the group undertaking the updated assessment as a plausible estimate of the catch reported as having been caught in the Indian Ocean, but actually caught in the Atlantic Ocean in 2003.

74. The updated assessment has not changed the basic conclusions of the 2004 assessment. The recent catches have been higher than the maximum sustainable yield (MSY = 99,000 t) and are not sustainable if continued. The current spawning stock biomass (SSB = 21,000 t) is above that corresponding to the maximum sustainable yield level (SSB_{MSY} = 15,000 t), and the current fishing mortality (F_{2003} = 0.56) is below that which would yield the maximum sustainable yield (F_{MSY} = 0.63).

75. This is illustrated by the results of standard projections shown in Figure A.1, which shows that maintaining current catches for 10 years will reduce the SSB to well below the MSY level in 2014 (see left panel), but maintaining the current fishing mortality (F) results in the SSB stabilising at a level of about 20% above the MSY level (right panel).

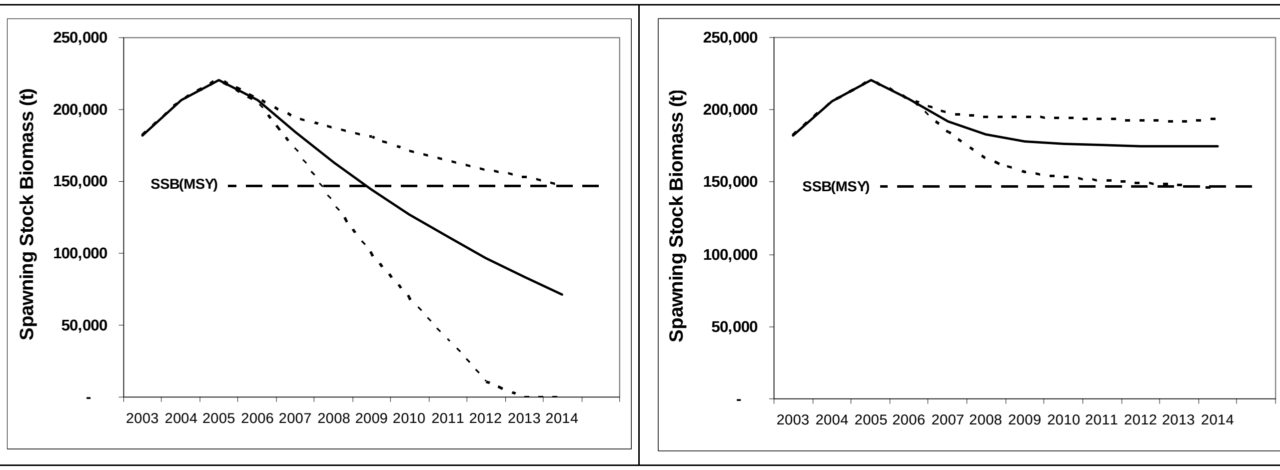

Figure A.1. *Projected Spawning Stock Biomass (SSB) of bigeye tuna for the period 2003-2014 under the assumption of constant catches (left panel) and under the assumption of fishing mortality remaining at the level of 2004 (right panel). 90% confidence intervals are dotted, spawning stock biomass corresponding to the maximum sustainable yield level (SSB(MSY)) is dashed. .*

76. It should be noted that in the first scenario, the constant catch projection, while a reduction in SSB to below MSY level is to be expected (48%), the extent of the reduction by the end of the projection is unlikely, as it would become increasingly difficult for the fishery to maintain that high level of catches as the population decreases in size.

Effects of catch reductions

77. In order to answer the questions posed by the Commission, projections were conducted following the same procedure applied in the 2004 assessment. These projections cover the following scenarios:

Projected scenarios		**SSB in 2014 relative to the MSY level**
Maintain current catch	PS: No reduction LL : No reduction	**48%**
Reduce purse-seine catch	PS: 10% reduction in 2004 LL: No reduction	**69%**
Reduce longline catch	PS: No reduction LL: 10 % reduction in 2004	**86%**
Reduce catches from both gears	PS and LL: 10% reduction in 2004	**106%**

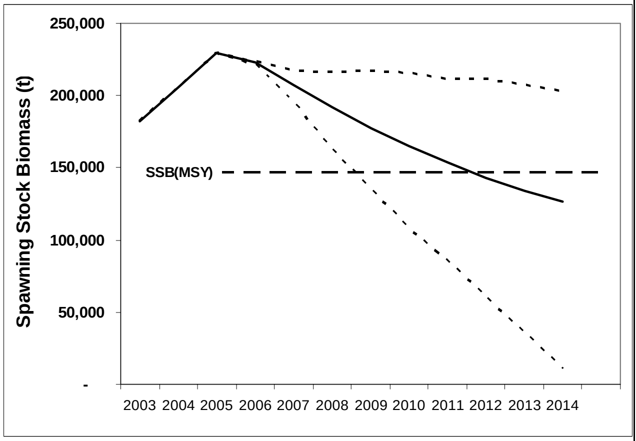

Figure A.2. *Projected Spawning Stock Biomass (SSB) of bigeye tuna for the period 2003-2014 under the assumption of a 10% reduction in longline catches. 90% confidence intervals are dotted, spawning stock biomass corresponding to the maximum sustainable yield level (SSB(MSY)) is dashed. .*

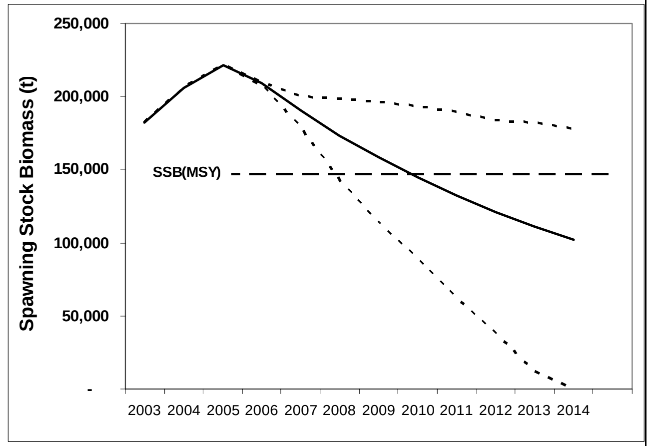

Figure A.3. *Projected Spawning Stock Biomass (SSB) of bigeye tuna for the period 2003-2014 under the assumption of a 10% reduction in purse-seine catches. 90% confidence intervals are dotted, spawning stock biomass corresponding to the maximum sustainable yield level (SSB(MSY)) is dashed*

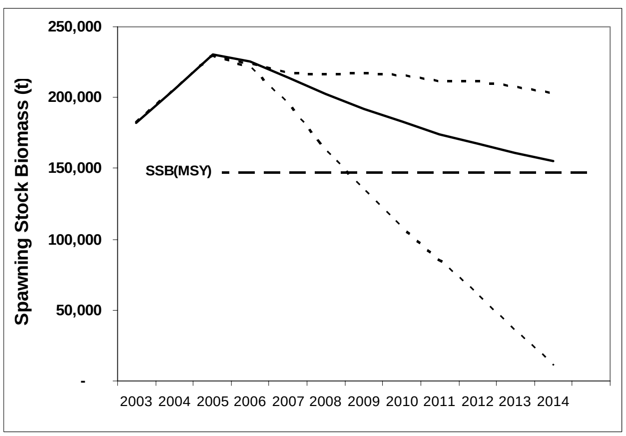

Figure A.4. *Projected Spawning Stock Biomass (SSB) of bigeye tuna for the period 2003-2014 under the assumption of a 10% reduction of both purse-seine and longline catches. 90% confidence intervals are dotted, spawning stock biomass corresponding to the maximum sustainable yield level (SSB(MSY)) is dashed*

78. 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.

79. Of the scenarios that include catch reductions, those that affect only one gear, either the longline or the purse-seine fishery, fail to maintain the SSB above the MSY level (86% and 69% respectively), although a 10% reduction in the catches of longline seems to have more effect than a similar percentage cut in purse-seine catches.

Table A.1. *Catch levels used in the analysis of the effects of illegal catch (in thousands of tons).*

	Total catch in 2004	Unreported catch	Catch after removing unreported catches
Longline	92.5	10.1	82.4
Purse seine	22.8	4.8	18.0

80. Only the scenario with a 10% reduction in both the purse-seine and the longline catches maintain the SSB above the MSY level at the end of the ten-year period (106%).

Effect of unreported catches

81. In this analysis of the effect of illegal catches, the Scientific Committee interpreted the term ‘illegal catches’ as including catches from non-reporting fleets, in addition to the catch by vessels identified as IUU by the Commission. The term ‘unreported catches’ refers to catches that have been estimated by the IOTC Secretariat and includes catches from purse-seiners and longliners (both deep freezing and fresh-tuna). The effect of these catches has been investigated by conducting a ten-year projection that assumes that catches will be constant, after removing the unreported catches for each gear (see Table A.1). The results, shown in Figure A.4, indicate that the stock would be maintained above the MSY level throughout the ten years, even when there is no reduction in catches by purse seiners and longliners flagged by Contracting Parties and Co-operating non-Contracting Parties (CPCs). It has to be noted, however, that it is unlikely that such a catch reduction could actually be achieved, since there is already a trend for vessels that previously did not report catches to take up flags of CPCs. In that case, the catches by these vessels would then be counted as CPC catches.

Effect of misreported catch

82. The Scientific Committee also investigated the effect of inclusion of a misreported catch in 2003 of 8,000 tons on the assessment of bigeye tuna. This was done by comparing the results of analyses that exclude and include such a catch.

83. Results indicate that the effect of the misreported catch is very small, with the assessments of the status of the resource being slightly more conservative (see Table A.2). This is entirely to be expected, since the misreporting only changes the catch in 2003 by around 10%, while the assessment is based on catch data from more than 40 years.

Table A.2. *Results of the analysis of the effects of misreported catches.*

	Excluding misreported catch	*Including misreported catch*	*Difference*
SSB(2004) million t	0.21	0.20	-5%
SSB(MSY) million t	0.15	0.15	0
SSB(2004)/SSB(MSY)	1.40	1.33	-5%
F(2003)	0.56	0.61	8%
F(MSY)	0.63	0.65	3%
F(2003)/F(MSY)	0.89	0.94	5%
MSY (thousand t)	99	102	3%

10. ACTIVITIES IN RELATION TO THE INDIAN OCEAN TUNA TAGGING PROGRAMME (IOTTP)

Regional Tuna Tagging Project – Indian Ocean (RTTP-IO)

84. The Chief coordinator of the RTTP-IO provided the SC with an update on the main activities carried out since the implementation of the IOTTP (IOTC-2005-SC-INF19).

85. The SC noted with concern the administrative problems that had occurred during the first year of the project. The SC expressed concern that these administrative difficulties have had a negative effect on the effective early implementation of the RTTP-IO and noted that if these continued, it could compromise achievement of the project goals. It therefore requested that the maximum possible flexibility be used in applying administrative rules to ensure that the project meets its scientific objectives.

86. As of 11 November 2005, 15001 tunas had been tagged comprising 4952 yellowfin, 1345 bigeye and 8708 skipjack with 116 returns. The SC noted the progress of the RTTP-IO since its implementation and congratulated all parties involved on their work to-date.

87. The SC noted that bait availability is and will remain a major prerequisite and constraint for tuna tagging. The SC encouraged the RTTP-IO to persevere in its quest for securing bait supplies, and it also requested that all IOTC members facilitate, to the extent possible, access to their bait fishing grounds for the RTTP-IO vessels.

88. The SC noted that two institutions had requested that additional biological data be collected on the two pole and line vessels operating under the RTTP-IO. The SC agreed that having two pole and line vessels operating in the Indian Ocean during more than two years represented a unique opportunity to collect additional biological and environmental information of relevance to the IOTC. However, it was vital that the collection of any such additional data should not compromise the ability of tagging project staff to fulfil their primary duties.

89. **Consequently, the SC recommended that all bodies interested in the collection of additional information on the tagging vessels should carefully review in their proposals the data collection requirements and consider assigning one of their staff to the collection of the required information on board.**

90. Japan informed the SC about its plans to donate artificial bait to the RTTP-IO to be tried on board the tagging vessels. The SC commended Japan for this initiative and looked forward to seeing the results of this activity next year.

91. The SC expressed concern about the number of tags recovered so far was considerably lower than had been expected. The SC noted that for the RTTP-IO to be successful there is a need to maximise the proportion of recaptured tags that are reported and to obtain as much information as possible on each individual fish recovered. The SC noted that in order to boost the number of recoveries, the publicity campaign must cover all countries where Indian Ocean tropical tunas are fished or processed.

92. **The SC expressed deep concerns regarding the delayed start of the publicity and Tag Recovery Scheme due to administrative constraints attached to the funds available to the RTTP-IO. The SC recommended that every possible effort be taken to allow a prompt start of these activities in all countries, noting that the success of the RTTP-IO will be at risk if they are not implemented as soon as possible.**

93. The IOTC Secretariat presented document IOTC-2005-SC-INF03b describing the results of tag seeding experiments. By far the highest reporting rate (52%) was in the Seychelles, with reporting rates elsewhere being very low. However, even the reporting rate for the Seychelles was considerably lower than expected or desirable.

94. The SC noted that the reporting rates for seeded tagged fish in the different areas were probably commensurate with the effort put into publicity in those regions. The SC stressed once again the need to extend the publicity campaign and tag recovery scheme to all relevant countries in order to maximise the reporting rates and improve the chances of obtaining high quality information on recovered fish.

95. The SC expressed its great appreciation to the skippers of the EC purse seine vessels that participated in the tag seeding experiments.

96. The SC stressed the need to maintain this activity throughout the duration of the RTTP-IO project.

Activities related to the Indian Ocean Tuna Tagging Programme (small-scale programmes)

97. The IOTC Secretariat presented document IOTC-2005-SC-INF03 that described several small-scale tagging activities implemented through the IOTTP.

98. The SC noted that the small-scale tagging activities carried out so far had been cost-effective and produced valuable information, and stressed the need to initiate the new activities in this area. The SC requested that the Secretariat continue with its efforts to secure funding for these activities throughout the duration of the IOTTP.

99. SEAFDEC informed the SC that the tagging in the east Indian Ocean continued during 2003-04 and that the data collected through this activity will be made available soon. The SC requested that further tagging be delayed until a publicity and tag recovery scheme is in place.

FADIO activities

100. The SC was briefed about the progress of the EC-funded program, FADIO, during the last year.

101. The SC noted the high quality of work carried out since the projects implementation and congratulated the scientists involved. The SC looks forward to review the results of these activities in future SC meetings.

102. The EC informed the SC about the early termination of the program TAGFAD due to the problems encountered with finding a suitable tagging platform. The EC advised that the tags will be placed by the boats on big tuna caught in association with floating objects.

11. SCHEDULE OF WORKING PARTY MEETINGS IN 2006-2007

103. The SC agreed to the following schedule of working party meetings for 2006 and 2007.

Working Party	**2006**
Tropical Tunas	5 days in late July in Seychelles
Temperate Tunas	-
Neritic tunas	By email
Billfish	March in Sri Lanka
Methods	-
Bycatch	2 days in conjunction with the WPTT

104. The SC noted that the current Chairperson of the WPTT, Dr. Pilar Pallares is no longer able to continue in this role. Dr. Iago Mosqueira (EU) agreed to act as a convenor leading up to the next WPTT meeting.

12. ANY OTHER BUSINESS

Tuna atlas

105. The SC noted that full funding for the development of a Tuna Atlas had not yet been secured. The EC informed the SC that IRD gave its agreement to fund about 50% the estimated costs; however, IRD is waiting for a co-partner to co finance this project but they need an answer before June 2006.

106. The SC again expressed its support for this project. However, it noted that due to the un-anticipated budget constraints, it might not be possible for the Secretariat to assign funds for this project at this time.

107. **The Scientific Committee recommends that the Commission urgently seeks ways to find matching funds for the production of the Atlas, noting the June deadline required by IRD.**

IOTC Field manual and glossary

108. The Secretariat informed the Scientific Committee about progress related to the production of the IOTC field manual. The SC noted that work is still underway and that parts of the manual would be provided to attendees at next years working party meetings in order to obtain feedback before a draft document is tabled at SC 9.

ASFA

109. The Secretariat informed the SC that all documents produced by the IOTC for the past seven years have been provided to Aquatic Science and Fisheries Abstracts (ASFA) and entered on their computer system.

110. IOTC produces about 80 documents per year and indexing these documents for ASFA is expected to take between one and five working days. The SC noted that in the future, the Secretariat would either have to undertake the indexing of documents itself or outsource the work.

111. **The Scientific Committee recommended that the Secretariat make the necessary arrangements to ensure that IOTC documents continue to be available on ASFA.**

Studies on the genetics of swordfish

112. The SC was briefed on the preliminary results of a study on the genetics of swordfish being undertaken in the waters of Reunion, the Mozambique Channel, Seychelles and Madagascar. The Scientific Committee acknowledged the importance of this kind of work given, the findings of the WPB that local depletions of swordfish may be occurring in some areas of the Indian Ocean. The Scientific Committee strongly encouraged IOTC member countries to collaborate with this project.

Improving the efficiency and effectiveness of IOTC's working parties and the Scientific Committee

113. The Scientific Committee noted with concern the reduced attendance of scientists from developing countries at all IOTC Working Parties in recent years. The Secretariat advised the SC that in the past, funds from the Secretariat's travel budget have been used to assist scientists from developing countries to attend working parties, but the current travel budget does not allow for such expenses. The SC also noted that the reduced attendance at Scientific Committee meetings was a major concern. The SC seeks advice from the Commission on how to address this issue.

114. The Scientific Committee noted that for various reasons, the amount of time between SC and Commission meetings has increased from the original 2 - 3 months when the meetings were first separated. This year, there is scheduled to be seven months (until May 2006) before the Commission receives advice from the present SC meeting. The SC noted with concern that a seven month separation would mean that the Commission would not be receiving the most up-to-date advice. The SC also reiterated that November remained the most suitable time for it to meet and that this timing was now well consolidated in the international calendar of annual scientific meetings (i.e. alongside those of ICCAT, IATTC, CCSBT, WCPFC etc). It recommends that any future consideration of the timings and separation of the SC and Commission meetings should take this into account

115. **The SC noted that the IOTC Secretariat has far fewer staff than other Tuna RFMOs, and this was limiting the quantity and in some instance the quality of services the Secretariat currently provides to the working parties and the Scientific Committee. The SC agreed that if the size of the Secretariat was able to be increased then the technical outputs of SC would be enhanced, and the Commission would greatly benefit from an improved quality of advice. Therefore the SC recommended that the Secretariat organise a task force to, intersessionally, examine the technical requirements and capabilities of the Secretariat and report to the next meeting of the SC.**

13. ADOPTION OF THE REPORT

116. The Report of the Eighth Session of the Scientific Committee was adopted on 11 November 2005.

117. The SC noted with concern the unavailability of a French translation of the SC report at the time the English version was being adopted. This had occurred because of the recent departure from the Secretariat of the French translator. The SC urged that for all future SC meetings, the Secretariat ensure that it has appropriate translation resources to produce a timely French translation of the draft SC report for adoption during the meeting

118. On behalf of the SC, the Chair thanked the Secretariat for their hard work and perseverance in organising, providing information and supporting the meeting.

APPENDIX I

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APPENDIX II
SC8 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
   - 5.2 Review of data on species
   - 5.3 Progress Report of the IOTC-OFCF project
   - 5.4 Guideline of the IOTC Tuna fisheries Observer Programme

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) and presentation of the Executive Summaries
   - 7.2 Other Executive Summaries
   - 7.3 Other matters
   - 7.3.1 Report on biology, stock status and management of southern bluefin tuna.

8. **RESPONSE TO THE REQUEST FROM THE COMMISSION IN RELATION TO RESOLUTION 05/01**

9. **STATUS OF SPECIES TAKEN AS BYCATCH IN INDIAN OCEAN TUNA FISHERIES**
   - 9.1 Report of the Working Party on Bycatch

10. **ACTIVITIES IN RELATION WITH THE INDIAN OCEAN TUNA TAGGING PROGRAMME (IOTTP)**
    - 10.1 Regional Tuna Tagging Project-Indian Ocean
    - 10.2 Report on recent activities related to the IOTTP
    - 10.3 Progress Report on FADIO activities

11. **SCHEDULE OF WORKING PARTY MEETINGS IN 2006-2007**

12. **ANY OTHER BUSINESS**

13. **ADOPTION OF THE REPORT**

APPENDIX III
LIST OF DOCUMENTS

DOCUMENT	TITLE and SOURCE
IOTC-2005-SC-01 [EN]	Provisional Agenda. *Secretariat*
IOTC-2005-SC-01 [FR]	Ordre du jour prévisionnel de la huitième session du Comité scientifique. *Secrétariat*
IOTC-2005-SC-02 [EN+FR]	List of documents / Liste des documents. *Secretariat*
IOTC-2005-SC-03 [EN]	Progress Report on the IOTC-OFCF Project to improve statistical systems in Indian Ocean coastal countries. *OFCF*
IOTC-2005-SC-03 [FR]	État d'avancement du projet CTOI-OFCF. *OFCF/ Secrétariat*
IOTC-2005-SC-04	*No document*
IOTC-2005-SC-05 [EN]	Executive summary on the status of the yellowfin tuna resource (*from IOTC-2005-WPTT-R [EN]*)
IOTC-2005-SC-05 [FR]	Executive summary on the status of the yellowfin tuna resource (*from IOTC-2005-WPTT-R [FR]*)
IOTC-2005-SC-06 [EN]	Executive summary on the status of the bigeye tuna resource (*from IOTC-2004-SC-R [EN]*)
IOTC-2005-SC-06 [FR]	Résumé sur l'état de la ressource de patudo (*tiré de IOTC-2004-SC-R [FR]*)
IOTC-2005-SC-07 [EN]	Executive summary on the status of the albacore tuna resource (*from IOTC-2004-SC-R [EN]*)
IOTC-2005-SC-07 [FR]	Résumé sur l'état de la ressource de germon (*tiré de IOTC-2004-SC-R [FR]*)
IOTC-2005-SC-08 [EN]	Executive summary on the status of the skipjack tuna resource (*from IOTC-2004-SC-R [EN]*)
IOTC-2005-SC-08 [FR]	Résumé sur l'état de la ressource de listao (*tiré de IOTC-2004-SC-R[FR]*)
IOTC-2005-SC-09 [EN]	Executive summary on the status of the swordfish resource (*from IOTC-2004-SC-R [EN]*)
IOTC-2005-SC-09 [FR]	Résumé sur l'état de la ressource d'espadon (*tiré de IOTC-2004-SC-R[FR]*)
IOTC-2005-SC-INF01	Progress report on IOTC data collection and statistics. *Secretariat*
IOTC-2005-SC-INF02	Report on biology, stock status and management of southern bluefin tuna. *CCSBT*
IOTC-2005-SC-INF03	Summary of tagging operations in the Indian Ocean - pilot and small-scale tuna tagging programmes. *Secretariat / RTTP-IO*
IOTC-2005-SC-INF03b	Progress on the Tag Seeding experiment - *Julien Million & Juan Jose Areso*
IOTC-2005-SC-INF04	National report of Japan
IOTC-2005-SC-INF05	National Report of EU-Spain
IOTC-2005-SC-INF06 + Add	National Report of Seychelles
IOTC-2005-SC-INF07	Guideline of the IOTC Tuna fisheries Observer Program (IOTC-TOP). Prepared by IOTC TOP guideline working group.
IOTC-2005-SC-INF08	National Report of EU-France
IOTC-2005-SC-INF09	National Report of Republic of South Africa
IOTC-2005-SC-INF10	Report on the requests to the Scientific Committee raised by the 9th Commissioner meeting (2005) regarding Resolution 05/01 (Conservation and management measure for (Bigeye tuna) – Final draft (October 31, 2005).
IOTC-2005-SC-INF11	National Report of United Kingdom
IOTC-2005-SC-INF12	National Report of Republic of Korea
IOTC-2005-SC-INF13	National Report of China
IOTC-2005-SC-INF14	National Report of Thailand
IOTC-2005-SC-INF15	National Report of Australia
IOTC-2005-SC-INF16[EN]	Historical shifts in hooks between floats and potential target species of the Japanese longline fishery in the equatorial Western Indian Ocean *By Pascal BACH and Alain FONTENEAU - IRD UR THETIS scientists*
IOTC-2005-SC-INF16[FR]	Evolution historique du nombre d'hameçons entre flotteurs et des espèces cibles de la pêcherie palangrière japonaise dans la zone équatoriale de l'ouest de l'océan Indien. *Par Pascal BACH et Alain FONTENEAU - IRD UR THETIS scientists*
IOTC-2005-SC-INF16b	FigDocHBFIOTC2005. *By Pascal BACH and Alain FONTENEAU - IRD UR THETIS scientists*
IOTC-2005-SC-INF17	Summary of Fisheries Status and Management Improvement on Taiwanese Longline Fleet. *Invited Experts*
IOTC-2005-SC-INF18	Report from SEAFDEC
IOTC-2005-SC-INF19	A general presentation on the Regional Tuna Tagging Project –Indian Ocean. *Jean-Pierre Hallier*
IOTC-2005-WPTT-R[EN]	Report of the Seventh Session of the IOTC Working Party on Tropical Tunas. *Secretariat*
IOTC-2005-WPTT-R[FR]	Rapport de la septième session du Groupe de travail de la CTOI sur les thons tropicaux. *Secrétariat*
IOTC-2005-WPBy-R[EN]	Report of the First Session of the IOTC Working Party on Bycatch. *Secretariat*
IOTC-2005-WPBy-R[FR]	Rapport de la première session du groupe de travail de la CTOI Sur les prises accessoires. *Secrétariat*

APPENDIX IV
AVAILABILITY OF IOTC STATISTICS FOR THE YEAR 2004
Excerpt from IOTC-2005-SC-INF01

Proportion of the NC, CE and SF statistics available at the IOTC Secretariat compared to the total catches estimated for 2004 (20th October 2005) and proportion of catches reported by official sources (SO) *versus* total catches so far available.

2005	NC	CE	SF	SO
Total Catch Estimated	1,525	1,525	1,525	1,243
Available 30/06/2005	934	676	846	
%Available 30/6/2005	61	44	55	
Available 20/10/2005	961	703	855	1,115
% Available 20/10/2005	63	46	56	90
% Available 11/2004	66	41	12	100

FLEET	Catch	NC	CE	SF	DI	FC	FT	VR	TI	SO
EUROPEAN COMMUNITY	280.7									F
INDONESIA	221.7									F
IRAN, ISLAMIC REPUBLIC	178.4									F
MALDIVES	138.2									nsa
CHINA	9.1						NA			F
TAIWAN,CHINA	121.7						NA			OS
SRI LANKA	121.2									F
SEYCHELLES	89.5									F
INDIA	86.0									F
YEMEN	42.2									nsa
JAPAN	40.1						NA			F
PAKISTAN	24.7									F
OMAN	23.0									nsa
THAILAND	17.8									F
MALAYSIA	16.2									F
MADAGASCAR	12.1									nsa
COMOROS	10.2									nsa
UNITED ARAB EMIRATES	8.5									F
KOREA, REPUBLIC OF	7.7						NA			F
AUSTRALIA	6.9									F
SAUDI ARABIA	6.5									nsa
NETHERLANDS ANTILLES	3.7						NA			OS
PHILIPPINES	3.2						NA			F
TANZANIA	2.0									nsa
BELIZE	1.9						NA			F+
MAURITIUS	1.8									F
KENYA	1.7									nsa
SOUTH AFRICA	1.4									nsa
ST. VINCENT AND THE GRENADINES	1.3						NA			nsa
EQUATORIAL GUINEA	1.3						NA			nsa
TOGO	1.3						NA			nsa
GEORGIA	1.0						NA			nsa
EGYPT	1.0									nsa
QATAR	1.0									F
PANAMA	0.9						NA			OS
FRANCE OT	0.8									nsa
CAMBODIA	0.7						NA			nsa
GUINEA	0.6						NA			nsa
NAMIBIA	0.3						NA			nsa
ICELAND	0.3						NA			nsa
BOLIVIA	0.3						NA			nsa
UKRAINE	0.3						NA			nsa
URUGUAY	0.3						NA			nsa
ERITREA	0.2									nsa
KUWAIT	0.2									nsa
SENEGAL	0.1						NA			F
JORDAN	0.1									F
BAHRAIN	0.1									F
DJIBOUTI	0.1									nsa
BANGLADESH	0.1									nsa
PAPUA NEW GUINEA	0.0						NA			nsa
SUDAN	0.0									nsa
UNITED KINGDOM (BIOT)	0.0									F
EAST TIMOR	0.0									nsa
SINGAPORE	nil									F
NEI (PS)	34.7									nsa
NEI (LL)	0.1									nsa

Key

Catch	Recent catches amounting to (thousands of tonnes) (accounting only for IOTC species)	
NC	Nominal Catch	Fully available
CE	Catch and Effort	Partially available
SF	Size Frequency	Not available
DI	Discards	NA Not Applicable (Foreign ships putting in to ports in the country are not (likely) to come from the Indian Ocean)
FC	Fishing Craft	
FT	Foreign Tuna Vessels Activity	
VR	List of Active Vessels	
TI (refers to first dataset available)	Timeliness	Good (before 1st July); Fair (whithin July); Poor (after 1st August)
SO (refers to nominal catch data)	Data Source	F: Statistics available from flag country; F+: Statistics from both flag and country/ies other than flag country; OS: All statistics from countries other than flag country; nsa: No statistics available at all

The table on the left (above) shows the catches for 2004 available in the IOTC Nominal Catches database by the deadline for data submission (30 June 2005) and by 20 October 2005. The 40% of the catch was still not available by the deadline, with only the 63% of the catches available before 20 October, 2005.

The table on the right lists the fleets of countries to which the Secretariat sent data requests during the year 2005. The countries are sorted by their most recent catches and the status regarding the availability of catches, effort, size frequency and craft statistics indicated through different colours. Timeliness of reporting and data source are also shown in each case.

APPENDIX V
NATIONAL REPORT ABSTRACTS

AUSTRALIA

Document IOTC-2005-SC-INF15. This National Report summarises recent catch and effort by Australian domestic fisheries in the Eastern Indian Ocean. The Southern and Western Tuna and Billfish Fishery is predominantly a longline fishery that mainly targets broadbill swordfish, but also takes significant catches of bigeye tuna and yellowfin tuna. Poor market prices and increased operating costs have led to a marked reduction in catch and effort in the last two years following a period of rapid expansion. A total of 13 Australian longliners fished in the region in 2004, 27 vessels fished in 2003 and 40 in 2002. Longline fishing effort declined over this period, from approximately 6 million hooks in 2002 to 4 million hooks in 2003 and 1.5 million hooks in 2004. There was a corresponding decline in catches of swordfish (370 t in 2004 compared to 1184 t in 2003), bigeye (91 t in 2004 cf. 205 t in 2003) and yellowfin tuna (151 t in 2004 cf. 191 t in 2003). Australia's 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. In 2002, 1144 t of skipjack tuna was caught by purse seine. No skipjack tuna were reported in 2003 and only 30 t were reported in 2004. In our last national report we reported on the activities of a pilot observer program monitoring the longline fishery. This program is continuing but activity has been low due to the low level of effort in the fishery. The 2003-04 data is provided again for information. A formal management plan for the fishery has been finalised and is likely to come into force by mid-2006. This will see the catches of the major target species being managed via quotas.

CHINA

Document IOTC-2004-SC-INF13. This report summarises fishery statistics relating to the tuna fisheries in the Indian Ocean during the 2004 fishing season and provides a comparison with previous years. Longlining is the only fishing method used by Mainland China vessels to catch tuna and tuna-like species in the IOTC waters. There were 63 Chinese longliners fishing the area in 2004, including 32 deep frozen longliners over 30m LOA. Longliners mainly target bigeye tuna, but also take significant catches of yellowfin tuna as bycatch. There was a corresponding increase in catches of bigeye (8321 t in 2004 cf. 4569 t in 2003) and yellowfin tuna (3781.2 t in 2004 cf. 2279 t in 2003). The data collection and logbook submission system, scientific observer program and training programs have been established and operating under strong support by Fisheries Bureau of Ministry of Agriculture and Branch of Distant Water Fisheries of China Fisheries Association. Two observers were despatched to conduct their missions on board the tuna longliners in 2005.

EC-SPAIN

Document IOTC-2005-SC-INF05. 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 2004 a total of 20 purse seiners and 24 longliners operated in the area. Purse seiners' carrying capacity for most of the boats falls between 800 and 2,000 t. Longline vessels range from 27 to 42 meters in length. Spanish total catches in 2004 were as follows: 80,810 t of yellowfin (YFT), 64,393 t of skipjack (SKJ), 8,634 t of bigeye (BET), 76 t of albacore (ALB), 4,713 t of swordfish (SWO), and 193 t of other species, resulting in a grand total of 158,819 t , the third highest catch since the beginning of the fishery. Purse seine catch in 2004 decreased by 13% as a consequence of the important decrease (by 27%) of the catch of skipjack. Tropical tuna sampling in 2004 has been carried out to a good level of coverage: 1220 samples and 201,546 fish were measured. In 2003 a biological sampling program (including sex ratio and maturity) in the Seychelles cannery was started. For the longline fleet, 31,756 swordfish have been measured (37% of the total landings) and sex at age for most spatio-temporal strata has been obtained through biological sampling.

Regarding research, two Spanish research Institutes (IEO and AZTI) are involved in the tropical tuna scientific groups, while IEO is also involved in swordfish research. Since the beginning of the 90's a Spanish expert on fisheries has been permanently based in Mahé. Scientists involved in these fisheries have actively participated in the meetings and activities of the WPTT, WPBy and the SC. This year 13 documents have been presented. Research programs are or will be conducted in order to implement the scientific recommendations, in particular: for collecting information on supply vessels and fishing on FADs. For this purpose a joint IEO-AZTI working plan has been established. To estimate the by-catch associated with the purse seine fishery, a total of 9 trips have been covered by observers in the Indian Ocean in 2004 and 10 trips in first ten months of 2005. Opportunistic tagging of swordfish and by-catch of longline catch have continued in 2004 with a total of 38 swordfish, 64 sharks and individuals from other by-catch species. So far 3 blue shark recaptures have been recorded. A experimental cruise by two Spanish longliners, with the permanent presence of scientific observers from IEO started in December 2004. Until now, 67 tunas (64 BET, 1 ALB, 1 YFT and 1 SKJ) have been tagged and two tagged BET have been recovered. Another research project is currently being carried out in the Indian Ocean, with the participation of four Spanish fishing boats (two purse seiners and two supply vessels). This pilot action mainly aims to understand and decrease the impact of FAD fishing on the juveniles of non-target tuna species (YFT and BET). To this end, acoustic data will be collected using sonar and echosounders, and subsequently analysed to establish criteria that will enable a reduction in catches of juveniles of tropical tuna based on acoustic selectivity. At the same time, experiments will be undertaken with several prototypes of artificial floating objects and the behaviour of fish around them will be studied, with the objective of finding a typology that will result in fewer entanglements of turtles without reducing the catch of the target species. Data will be collected for six months, from May to November 2005.

EC-FRANCE

Document IOTC-2005-SC-INF08.

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 109 113 t — similar to that of the the 2003 level (109,835 t).

Purse seiners. Nominal fishing effort increased slightly in 2004 with the total number of sets up by 11% (due to a weak reduction (-4%) in sets on floating objects and a one strong increase (+22%) in sets on free schools. After a decrease in catches from 1994 to 1998 (mainly due to a reduction in the number of purse seiners), there has been a steady increase in total catches. Catches were up by 10% in 2003 and 2004 despite the reduction in nominal effort and the number of positive sets. 2004 was an atypical year, similar to 2003 in terms of the high yellowfin tuna catches on free schools and low catches of other species. Total CPUE in 2004 was slightly lower than the high levels reported, again the catch rates were due to continued good catches of yellowfin on free-swimming schools. In both 2004 and 2003 there was a strong spatial concentration of the fishery in a relatively small area. In general, average weights in 2004 for all the species were high and similar to those in 2003, but 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 (30), 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. Catches of the main species (swordfish and yellowfin, bigeye and albacore tunas) decreased for all the species in 2000-2002, but stabilised in 2003 and 2004. Between 1994 and 2000, swordfish was the only species for which size frequency data were collected. Since 2002, data on large pelagics has been collected by the the longliners operating from Réunion

Artisinal fisheries. The artisinal fishery included 80% of the fishing vessels operatin from rom Réunion. The fleets consts mainly of 5-7 m motorised boats and 7-12 m more powerfilly motorised boats both using mainly line fishing techniques. The fleets captures mainly large pelagics with 653 t being taken in 2004 (about 60% of the total)

Response to the recommendations of the IOTC Scientific Committee. The majority of recommendations (relevant to France) made by the various working groups have been implemented or are about to be.

Research. 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. In IRD. Since January 2005, the old research unit THETIS was restructured to form two new units: OSIRIS (Observatoires et systèmes d'information des pêches tropicales) continues to carry out the main activities: scientific observers on tuna boats, and the collection, management, analysis of fisheries data; and THETIS undertakes a research relating to dynamics of the tropical ecosystem and the tuna fisheries of the Indian Ocean. The two units participated in various IOTC working parties and other related research areas. In IFREMER. a new system to improve the quality of fisheries data was implemented in 2004. A study on genetic structure of stocks of swordfish in the west of the Indian Ocean was initiated in December 2004. Given the encouraging results, Ifremer proposes to develop a three year program, in collaboration with several regional countries. An examination of swordfish otolith microchemistry is expected to be included.

JAPAN

Document IOTC-2005-SC-INF04. 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-2005-SC-INF12. 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 2004, total catch amounted to 7,735 mt by 36 longliners, which is the record high in Korean longline fishery in this area as compared to 2003. This was mainly due to a shift of longliners from the Pacific to the Indian Ocean since 2003. Catch consists of 114 mt of southern bluefin tuna, 4,068 mt of yellowfin tuna, 2,466 mt of bigeye tuna, 757 mt of other tunas and 330 mt of billfishes. The National Fisheries Research and Development Institute (NFRDI) began to operate fisheries observer program in 2004 to monitor Korean distant-water fisheries 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 longliner fisheries to be urgently implemented but will be gradually developed to cover all required areas of the fisheries.

SEYCHELLES

Document IOTC-2005-SC-INF06 and INF06 add. The Seychelles National Report summarizes activities of the industrial purse seine fleet licensed to operate inside the Seychelles EEZ for the period 2000 to 2004, and the activities of the local “semi industrial’’ longline fishery. The report also highlights the activities carried out to improve the processing and management of industrial longline data and it reports on ongoing research activities. No significant changes have been recorded in the purse seine fleet over the past 4 years. However the number of vessels and total carrying capacity of the Seychelles’ fleet has increased slightly over the past 2 years. Correspondingly the total catch reported by this fleet increased by 13%. Overall the fishing effort has remained stable over the past 4 years. However an increase in the number of sets on free-swimming schools was recorded during the last two years. A significant increase in yellowfin tuna catches on free-swimming schools was also recorded. The activities of the local semi-industrial were greatly reduced between 2002 and 2004 due to an exportation ban of swordfish to the European Market. However the resumption of swordfish export in early 2005 resulted in an increase in fishing activities. The number of longline sets reported in 2005 increased by 84 % and the total reported catch was more than doubled what was recorded during the previous 2 years.

During 2005 important effort was made to improve the processing and management of industrial longline fishery data. FINSS (developed by the IOTC) has now been implemented as the software to manage these data. The clearing of logbooks backlogs is nearly complete. Preliminary validation of 2003 and 2004 data have revealed various problems with some of the data. Steps are on the way to make the necessary corrections and subsequently submit revised data to the IOTC secretariat. Ongoing research work to improve the knowledge of the habitat of longline targeted species (swordfish, bigeye tuna and yellowfin tuna) in the Seychelles Economic Zone continued during 2005. The result of the project should allow fishermen to target different species depending on the market, the fishing seasons and fishing grounds. The project will continue during 2006. Results will be presented at the next WPTT.

SOUTH AFRICA

Document IOTC-2005-SC-INF09. The tuna longline, pole and line/ rod and reel, and shark longline fisheries either target or catch tuna and tuna-like species as by-catch in the Indian Ocean. In addition, there is a boat-based sport fishery.

An allocation process for the issuing of long-term longline fishing rights was held at the end of 2004. The policy for allocation of rights made provision for foreign flagged vessels to operate in the fishery. Consequently, many permit holders transferred their permits to foreign flagged vessels of Japan and Republic of Korea in an attempt to benchmark performance. The foreign flagged vessels mainly targeted bigeye and yellowfin and most fishing effort was concentrated in the Indian Ocean. In 2004, 23 vessels reported catches. Swordfish catch declined from 611 t (dressed weight) in 2003 to 213 t in 2004, and was no longer the dominant species caught. By contrast, yellowfin catches continued to increase to 655 t (dressed weight) in 2004 and became the most important species, contributing to 37% of the catch by weight. Southern bluefin and bigeye tuna catches increased to 9 t (dressed weight) and 292 t in 2004 respectively. These changes in catches were largely due to an increase in the number of Asian flagged vessels fishing under South African permit. The number of active swordfish-directed vessels, which are mainly South African flagged vessels, decreased due to unfavourable economic conditions. It was also noted that yellowfin was still abundant in South African waters as was the case in 2003.

Total reported catch of species relevant to IOTC increased from 139 t in 2003 to 209 t in 2004. This was largely due to an increase in reported shark catch from 116 t in 2003 to 189 t in 2004. Reported catches of yellowfin and king mackeral in 2004 declined to 2 t for both species. Improved market prices for pelagic shark since 2003 and good catch rates provided fishers incentives to fish for mako sharks. Fishing grounds expanded into the Indian Ocean in 2003, with over 140 t (dressed weight) of shortfin mako landed. The number of active vessels increased in 2004 from 5 to 8 and resulted in a fourfold increase in mako landings, reported at 535 t. Shark CPUE remained high at approximately 1 kg.hook-1. Although catch and effort are unknown in the sport fishery it is estimated that over 100 t of yellowfin and 100 t of king mackerel are landed annually.

In 2004, the tuna longline fleet reported 81.9 t of bycatch, of which sharks comprised 50.2 t, billfish (excluding swordfish) 10.4 t and other 21.3 t. Of the shark bycatch reported, blue sharks accounted for approximately 60% and shortfin mako 25% of sharks caught by weight. Blue and black marlins accounted for more than 80% of the marlin bycatch. Oilfish and escolar probably constituted over 70% of the “other” by-catch, with dorado accounting for 10%. There are a large number of ray and shark species (including crocodile sharks) that are also caught but not reported as they are discarded at sea. Also reported catches seldom include incidental catches of seabirds and turtles. The magnitude of these catches can only be obtained from observer data reports, which were unavailable for analysis at the time of this report.

South Africa is a long standing Member of ICCAT. Consequently, South Africa has already implemented ICCAT management and control measures for her fleets, including measures to combat IUU fishing, mandatory VMS, onboard scientific observer coverage for longline vessels, full port inspection scheme, minimum size limits and a daily logbook system for commercial fisheries. South Africa also provides fishery statistics according to IOTC specifications on an annual basis.

Large pelagic research in South Africa has largely been focussed on swordfish and thousands of biological samples have been collected. An on board observer programme is also used to collect length frequencies of billfish, tuna and sharks caught by the longline fleet. This year bigeye tissue samples have also been collected for genetic analysis in collaboration with IRD. MCM together with WWF and Birdlife SA are currently conducting a study to quantify the levels of shark, turtle and seabird by-catch on longline vessels and to investigate various mitigation measures. South Africa initiated a pilot tagging project in the Indian Ocean in 2004, using one commercial longliner as a platform to primarily tag small tuna and billfish during commercial operations. Thus far over 250 fish have been tagged with one swordfish recaptured. Thus proving that it is feasible to conduct tagging from commercial longliners. South Africa once again urges IOTC to financially support this tagging programme so that more vessels can be included in the tagging operation.

THAILAND

Document IOTC-2005-SC-INF14. Nertic tuna and king mackerel species in the Andaman Sea Coast, Thailand comprise six species (*Thunnus tonggol*, *Euthynnus affinis*, *Auxis thazard*, *Katsuwonus pelamis* and *Sarda orientalis*, *Scomberomorus* spp.). The fishing gears used to catch neritic tuna or tuna-like species include purse seine (mainly), king mackerel gill net and trawl. Neritic tuna catches decreased from 45,083 t in 1997 to around 15,000 in 1999. Further the production was quite stable from 1999 to 2004. Since 2000, Thailand has had two long distance tuna longliners, namely Mook Andaman number 018 and 028. Catches and catch rates of these longliners have varied from 94-387 t and 1.1-1.7 per 100 hooks, respectively. The main fishing grounds for these longliners are in the Western Indian Ocean. Yellowfin tuna is the largest component of the catches, followed by bigeye tuna, albacore, swordfish, marlins and sharks. In 2005, six tuna purse seiners began to operate in the Western Indian Ocean. These purse seiners have registered under Thai flag and the owners are Thais. The fishing obligations of these purse seiners are under Thailand, Department of Fisheries and of course under the IOTC umbrella. A research program for data collection and analysis has been set for these six purse seiners.

There are two research programs under the DOF entitled “The Fisheries Information and Statistics (for purse seiners)” and “Data collection on oceanic tuna for longliners and purse seiners at Phuket, Thailand”. Another cooperative projects under DOF/IOTC-OFCF entitled “Enhancement of the data collection and processing system for tuna fisheries in Thailand” and “Enhancement of the data collection and processing system for neritic tuna fisheries in Thailand”. These two projects under DOF/IOTC-OFCF are planned to operate from 1st April 2005 to 31st March 2006 and 1st October 2005 to 31st March 2006, respectively. The results of cooperative project “Enhancement of the data collection and processing system for tuna fisheries in Thailand” were reported to the meeting.

UK

Document IOTC-2005-SC-INF11. No UK-flagged vessels fished for tuna or tuna-like species in the Indian Ocean in 2004/2005 or 2005/2006. This report summarises catches and catch rates of vessels licensed to fish in the British Indian Ocean Territory (Chagos Archipelago) Fishery Conservation Management Zone (FCMZ). The 2004 / 2005 longline season ended with a total estimated catch of 730 t. To date, the total catches recorded from the 2005 / 2006 season are 793 mt. A total of 33 longline vessels fished in the BIOT FCMZ during the 2004 / 2005 fishing season for a total of 656 days, with a total reported catch of 725t, giving a catch rate of 1.10 t/day. In the 2005 / 2006 season to date a total of 24 longline vessels have fished in the BIOT FCMZ for a total of 1034 days with a catch of 793t, giving an overall longline catch rate of 0.767 t/day. This is lower than in previous years as a number of the longliners fishing are of a substantially smaller size class and have substantially lower catch rates. If these smaller longliners are excluded, the catch rate is a more typical 0.923t/day or 0.341 t/1000 hooks. The total catch for the 2004 / 2005 season by purse seiners was 23535 tonnes. This was taken from a total of 991 days fishing, at an overall catch rate of 23.74 t/day. The species composition during the 2004 / 2005 season was once again dominated by yellowfin tuna, which made up 83.79% of the total catch (17163t), skipjack tuna 14.50% (2971t), bigeye tuna 1.70% (348t), based on catch reports and logbooks where catch composition available.

APPENDIX VI

EXECUTIVE SUMMARIES ON THE STATUS OF TUNA RESOURCES

Executive Summary Of The Status Of The Bigeye Tuna Resource

(11 November 2005)

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 100 cm.

FISHERY

Bigeye tuna is predominantly caught by industrial fisheries and appears only occasionally in the catches of artisanal fisheries. Total annual catches have increased steadily since the start of the fishery, reaching the 100,000 t level in 1993 and peaking at 150,000 t in 1999. Total annual catches averaged 119,000 t over the period 2000 to 2004. 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 reaching around 100,000 t over the period 1996-2000 (Figure 1). The recent drop in total catches directly reflects lower catches in the longline fishery. In 2003 and 2004, the longline catches were 87,500 t and 82,300 t, respectively. 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 reached 40,700 t in 1999, but have averaged 25,600 t in recent years (2000-2005) (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

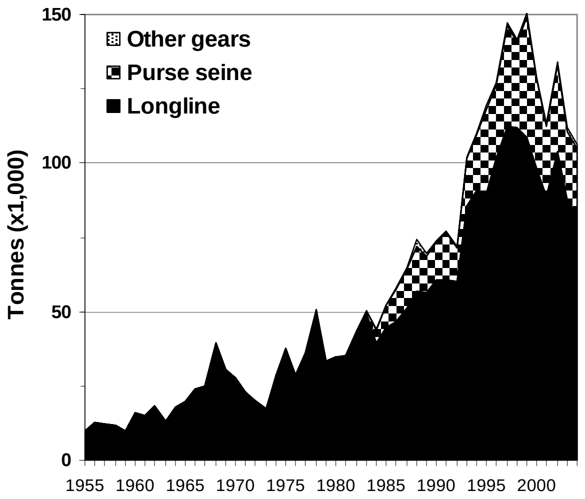
Maximum Sustainable Yield :	96,000 t
Current (2004) Catch:	106,000 t
Mean catch over the last 5 years (2000-2004)	118,800 t
Current Replacement Yield	-
Relative Biomass (B2000/BMSY)	1.31
Relative Fishing Mortality (F2000/FMSY)	1.00
Management Measures in Effect	none

Note: This Executive Summary has been updated to take account of recent catch data. The management advice, and stock assessment results are based on data up to 2003.

***Table 1**. Catches of bigeye tuna by gear and main fleets for the period 1955-2004 (in thousands of tonnes). Data as of 7 November 2005.*

Gear	Fleet	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81
Purse seine	France																											0.0
	Other Fleets																								0.0	0.0	0.0	0.0
	Total																								0.0	0.0	0.0	0.0
Baitboat	Total																0.0		0.0		0.0	0.1	0.1	0.2	0.1			
Longline	Taiwan,China	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	7.4	8.9	6.8
	Indonesia																			0.0	0.2	0.4	0.3	0.3	0.4	0.4	0.5	0.5
	Japan	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	4.2	5.9	7.8
	Korea, Republic of											0.2	0.2	0.5	6.8	7.6	3.5	4.8	4.9	7.3	14.6	26.2	21.8	26.1	34.1	21.5	19.3	19.4
	Other Fleets										0.2	0.4	0.4	0.1	1.9	0.5	1.6	1.3	1.2	0.9	0.5	0.2	0.1	0.2	0.2	0.0	0.2	0.3
	Total	9.7	12.8	12.0	11.7	9.9	16.1	14.9	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	37.7	28.5	35.9	50.5	33.5	34.9	34.8
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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	Total	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	28.5	37.8	28.7	36.1	50.7	33.6	35.0	35.1

Gear	Fleet	Av 00/04	Av 55/04	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04
Purse seine	Spain	9.4	3.2			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	8.6
	France	6.1	2.4	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	5.8
	NEI-Other	3.3	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	2.4	0.9
	Seychelles	3.2	0.4										0.0	0.0					0.9	2.0	3.0	1.8	2.8	3.7	3.4	4.4
	NEI-Ex-Soviet Union	2.5	0.5									0.0		0.4	1.0	0.3	1.3	1.1	1.2	1.9	3.9	2.9	2.9	2.2	2.4	2.2
	Other Fleets	1.1	0.8	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	0.9	0.7
	Total	25.6	8.4	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	24.5	34.0	28.3	40.7	29.9	23.7	29.0	22.9	22.6
Baitboat	Total	1.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0		0.0	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	1.2	1.2
Longline	Taiwan,China	40.9	14.9	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	44.8	41.8
	Indonesia	18.1	5.3	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	11.8	10.4
	Japan	11.7	12.2	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	13.8	9.9	8.1
	NEI-Deep-freezing	7.0	2.8				0.1	1.1	0.9	2.9	2.8	4.4	5.5	3.8	10.7	8.1	9.7	13.0	10.8	16.5	15.5	13.8	6.4	6.3	4.9	3.5
	NEI-Fresh Tuna	4.6	1.3								1.9	2.6	2.3	2.6	2.9	4.6	3.8	4.3	5.3	4.7	4.8	4.6	3.8	5.8	3.6	5.5
	China	3.7	0.5														0.2	0.5	1.7	2.3	2.4	2.8	3.1	2.8	4.6	5.3
	Seychelles	2.0	0.2																		0.1	0.4	0.8	2.1	3.7	2.8
	Korea, Republic of	1.8	8.2	19.5	17.4	11.7	12.8	11.9	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	2.5
	NEI-Indonesia Fresh Tuna		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	2.2	0.7	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	2.0	2.8	2.1
	Total	92.0	47.6	43.4	49.5	39.6	44.8	46.7	51.2	57.0	56.7	60.5	60.8	60.2	85.4	90.6	89.8	101.4	112.4	112.0	108.5	98.3	88.6	103.6	87.2	82.1
Gillnet	Total	0.0	0.1				0.0	0.3	0.1	1.9	0.5	0.2	0.1	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	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.1	0.2
All	Total	119.0	56.4	43.6	50.3	44.1	52.4	57.8	65.1	74.4	69.5	73.7	77.1	71.9	102.0	110.2	119.4	126.9	147.3	141.4	150.5	128.9	113.5	134.2	111.9	106.4



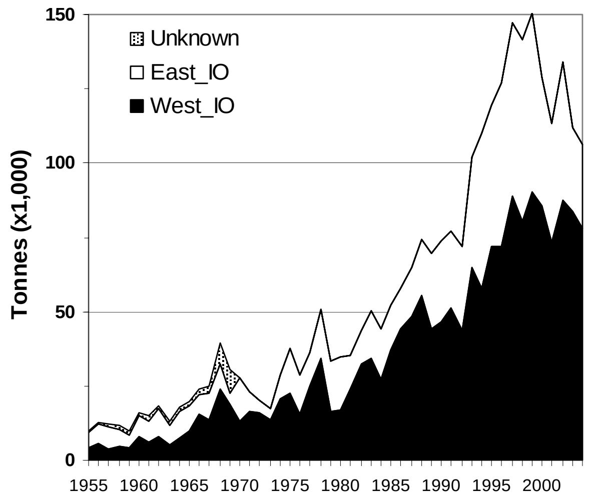


Figure 1. *Yearly catches (thousand of metric tonnes) of bigeye tuna by gear from 1955 to 2004 (left) and by area (Eastern and Western Indian Ocean, right)*

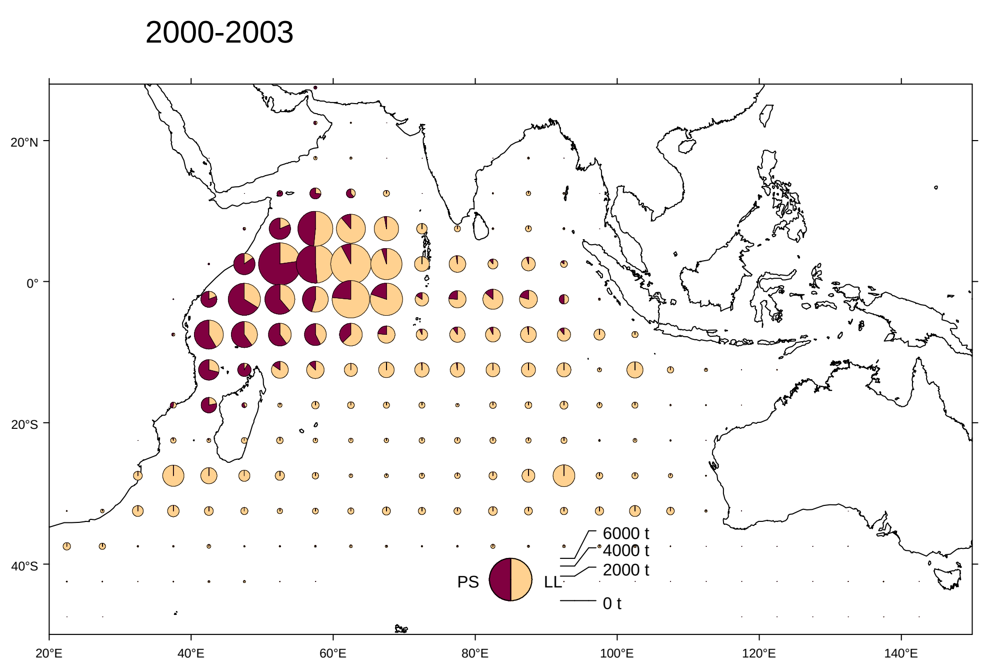


Figure 2. *Mean of annual total catches of bigeye tuna (t) by longline and purse seine vessels operating in the Indian Ocean over the period 2000 to 2003.*

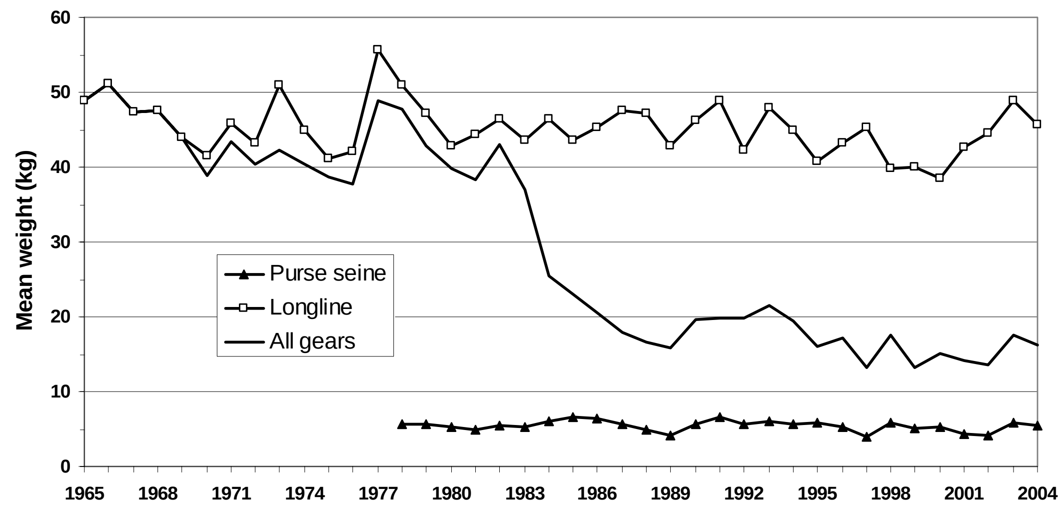


Figure 3. *Mean weight of bigeye measured from purse seine (PS) and longline (LL) catches over time.*

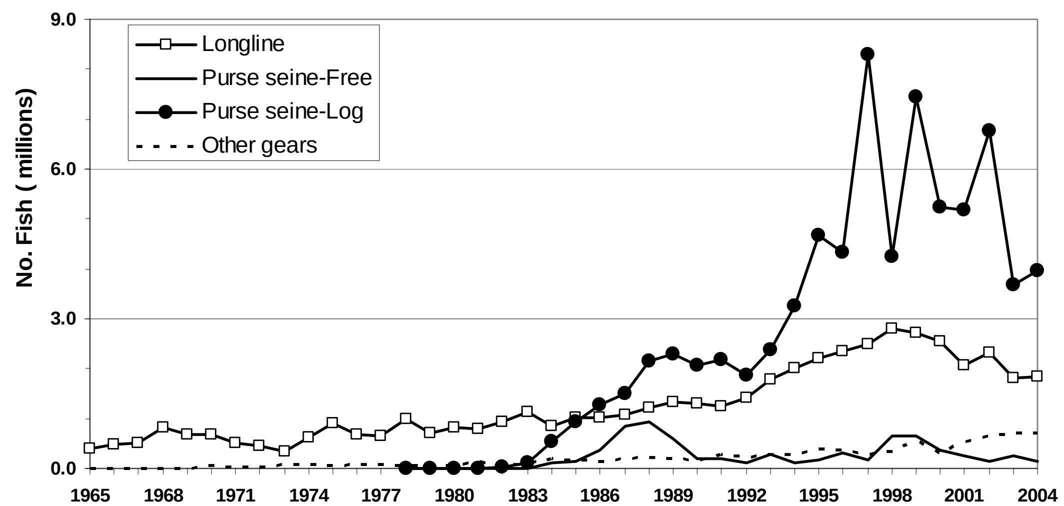


Figure 4. *Catch in numbers of bigeye tuna by gear (PS: purse seine; LL: longline).*

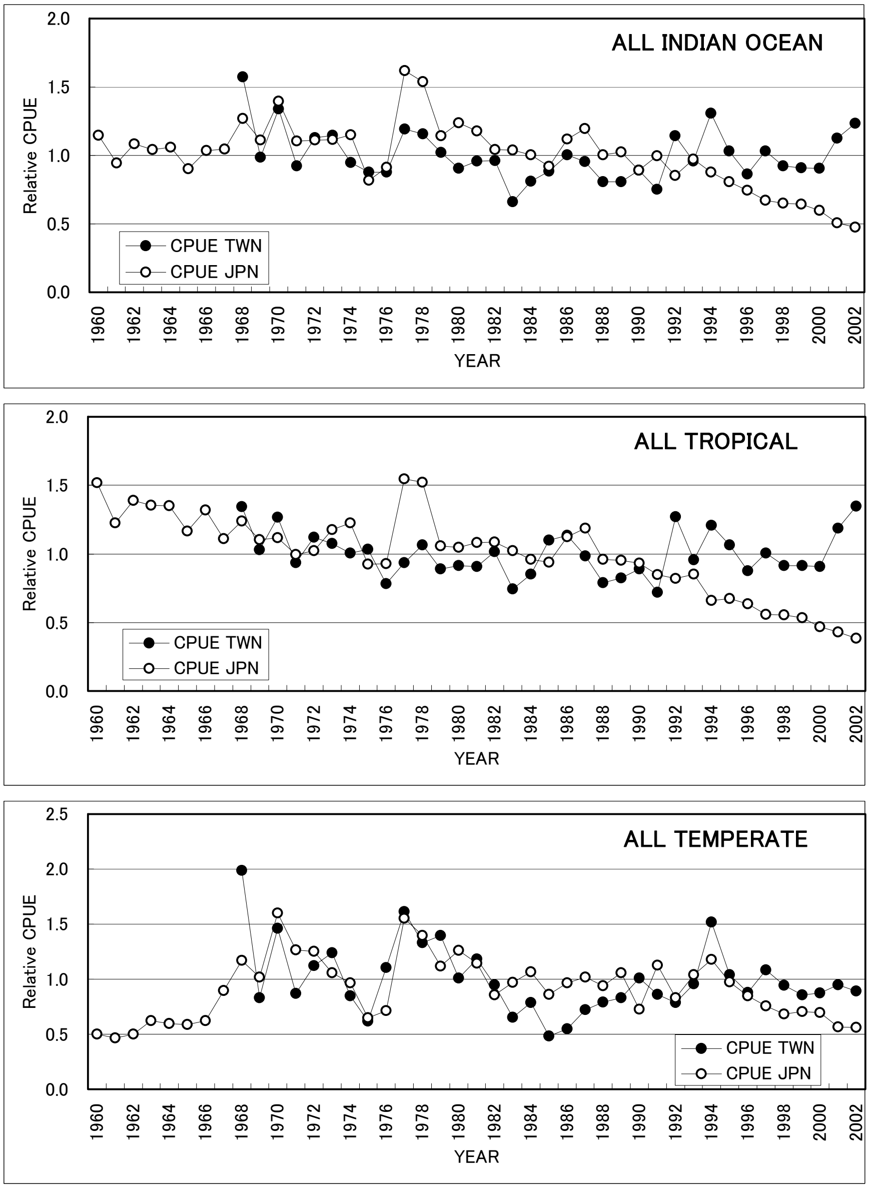


Figure 5. *Standardised bigeye tuna CPUE estimates by area.*

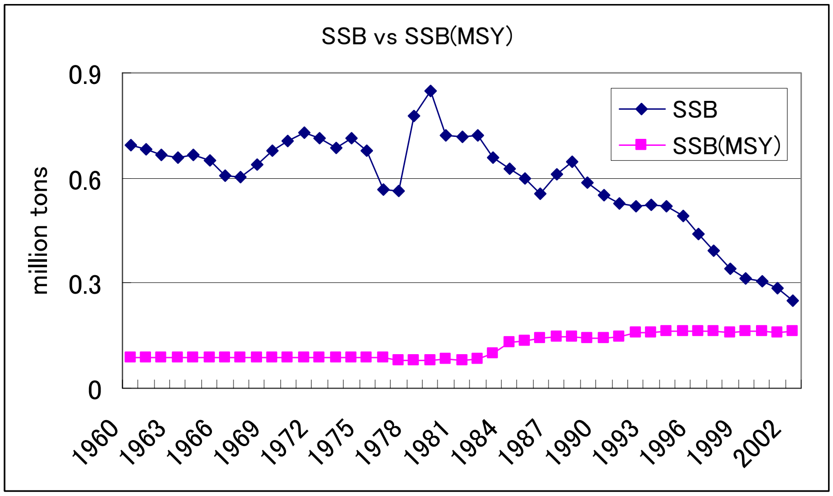


Figure 6. *2004 bigeye stock assessment: spawning biomass trajectories*

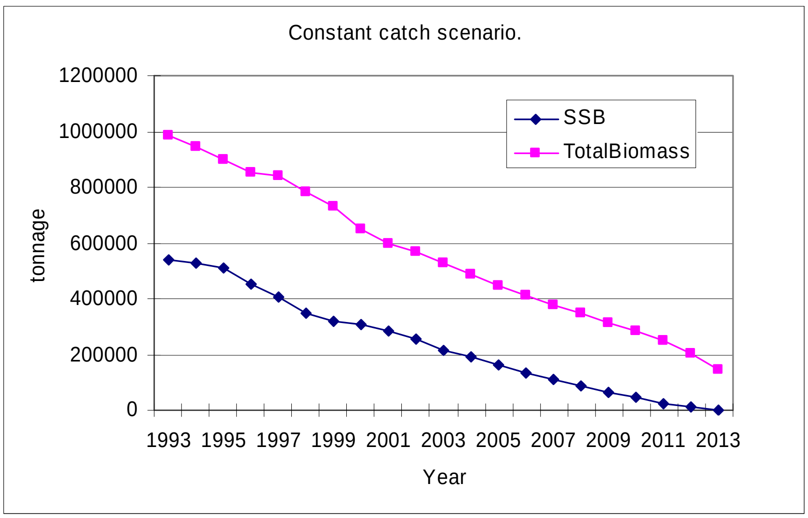


Figure 7. *Forward projections. Trends of SSB and TB in current Catch (2002) level.*

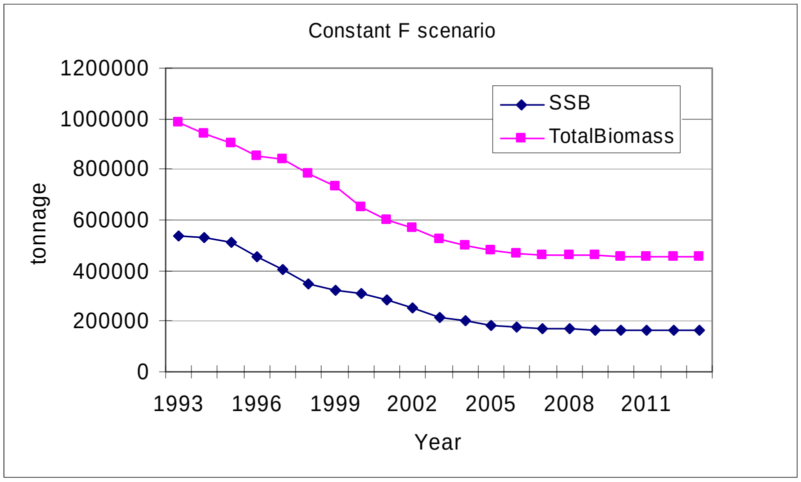


Figure 8. *Forward projections. Trends of SSB and TB in current F (2002) level.*

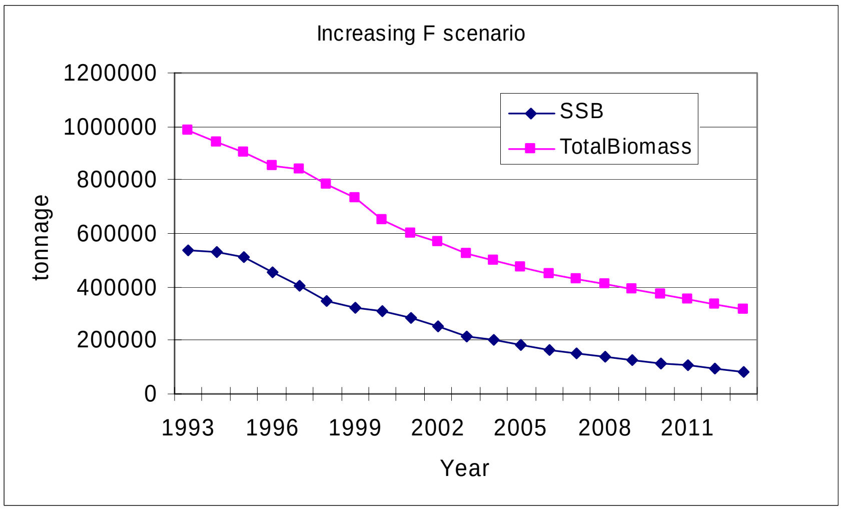


Figure 9. *Forward projections. Trends of SSB and TB in increase F (6% per year).*

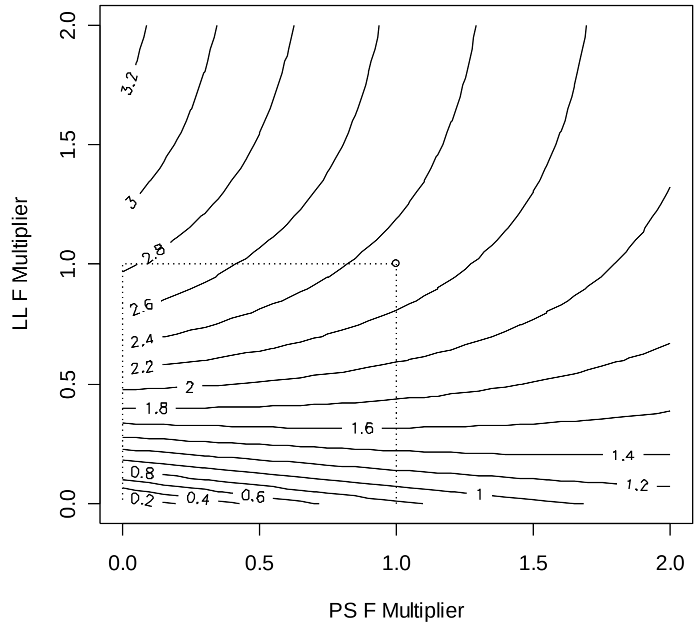


Figure 10. *Multi-gear yield-per-recruit calculations, in kg/recruit, with the growth, natural mortality and fishing mortality assumptions from the base case in the ASPM assessment*

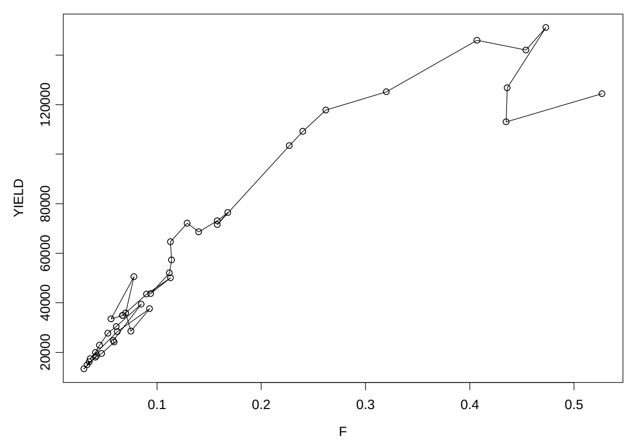


Figure 11. *Annual yield (t) as a function of overall fishing mortality as estimated by the most recent assessment.*

EXECUTIVE SUMMARY OF THE STATUS OF THE YELLOWFIN TUNA RESOURCE

(11 November 2005)

BIOLOGY

Yellowfin tuna is a cosmopolitan species distributed mainly in the tropical and subtropical oceanic waters of the three major oceans, where it forms large schools. The sizes exploited in the Indian Ocean range from 30 cm to 180 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 fisheries, but are abundant in some artisanal fisheries, mainly in the Arabian Sea.

Stock structure is unclear, and a single stock with complete mixing 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 the stock structure may be more complex and that mixing may be incomplete. A study of stock structure using DNA was unable to detect whether there were subpopulations of yellowfin tuna in the Indian Ocean.

Spawning seems to occur mainly from December to March in the equatorial area (0-10°S), with the main spawning grounds between 50° and 70°E. However, secondary spawning grounds are known to exist, for instance off Sri Lanka and the Mozambique Channel and in the eastern Indian Ocean off Australia. Yellowfin size at first maturity has been estimated at around 100 cm, and recruitment occurs predominantly 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 at sizes than 150 cm (this is also the case in other oceans).

A new growth study fitting a two-stanza growth curve to length frequency data was presented to the WPTT. In addition, the Working Party refitted a two-stanza growth curve to the Stequert otolith data. Both growth curves suggested similar growth rates for fish over 70 cm, but growth rates differed substantially for smaller fish. The two growth curves are illustrated in Figure 7.

There are no direct estimates of natural mortality (M) for yellowfin in the Indian Ocean. In stock assessments, new estimates of M at length based on those from other oceans have been used. These were then converted to estimates of M at age using the two growth curves. This 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, with a variety of prey species being consumed, including large concentrations of crustacea that have occurred recently in the tropical areas and small mesopelagic fishes which are abundant in the Arabian Sea.

FISHERY

Catches by area, gear, country and year from 1955 to 2004 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 and 1984. Since then, there has been an increasing number of yellowfin tuna caught 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 around 131,000 t in 1993. Subsequently, they fluctuated around that level, until 2003 and 2004 when they were substantially higher (227,000 t and 233,800 t, respectively).

The purse seine fishery is characterized by the use of two different fishing modes: the fishery on floating objects (FADs), which catches large numbers of small yellowfin in association with skipjack and juvenile bigeye, and a fishery on free swimming schools, which catches larger yellowfin on mixed or pure sets. Between 1995 and 2003, the FAD component of the purse seine fishery represented 48-66% of the sets undertaken (60-80% of the positive sets) and took 36-63% of the yellowfin catch by weight (59-76% of the total catch). Since 1997, the proportion of log sets has steadily decreased from 66% to 48%.

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, although smaller fish in the size range 60 cm – 100 cm have been taken by longliners from Taiwan,China since 1989 in the Arabian Sea. 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 component (deep-freezing longliners operating on the high seas from Japan, Korea and Taiwan,China) and an artisanal component (fresh tuna longliners). The total longline catch of yellowfin reached a maximum in 1993 (196,000 t). Since then, catches have typically fluctuated between 80,000 t and 110,000 t.

Artisanal catches, taken by bait boat, gillnet, troll, hand line and other gears have increased steadily since the 1980s. In recent years the total artisanal yellowfin catch has been around 130,000-140,000 t, with the catch by gillnets (the dominant artisanal gear) at around 80,000 t to 90,000 t.

Yellowfin catches in the Indian Ocean were much higher than previous levels during 2003 and 2004, while skipjack and bigeye catches remained at their average levels. Purse seiners currently take the bulk of the yellowfin catch — mostly from the western Indian Ocean. In 2003 and 2004, purse seine total catches were 227,000 t and 233,800 t, respectively — about 50% more than the previous largest purse seine catch, which was recorded in 1995. Similarly, artisanal yellowfin catches were also near their highest levels in 2003 and 2004. Japanese longliners also recorded higher than normal catches in the tropical western Indian Ocean in 2003 and 2004.

Yellowfin catches in number by gear (purse seine, longline and bait boat) are reported in Figure 3. Current estimates of 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. Since 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 described above, this situation changed during 2003 and 2004; where most of the very large catches were obtained from fish of larger sizes.

AVAILABLE OF INFORMATION FOR ASSESSMENT PURPOSES

The reliability of the estimates of the total catch has continued to improve over the past few years, and the Secretariat conducted several reviews of the nominal catch databases during 2004. This has led to marked increases in estimated catches of yellowfin tuna since the early 1970s. A comparison of time series of estimates of total catches made by the Secretariat in 2004 and in 2005 is given in Figure 5. In particular, the estimated catches for the Yemen artisanal fishery have been revised upwards sharply, based on new information, but they still remain highly uncertain. In 2005, Taiwan,China provided size data for yellowfin tuna by IOTC area for 1980 – 2003, thereby substantially improving the information available to estimate catches by size.

Estimates of annual catches at size for yellowfin were calculated using the best available information prior to the 2005 WPTT meeting. A number of papers dealing with fisheries data, biology, CPUE trends and assessments were discussed by the WPTT in 2005, and additional data analyses were performed during that meeting. Estimated catches at age were calculated (Figure 6) using the catch-at-size data and two alternative growth curves (a refitted Stequert growth curve and a new two-stanza growth model) are shown in Figure 7. The two growth curves were used to develop two sets of natural mortality at age, maturity at age and average weight at age schedules. M was assumed to be higher on juvenile than adult fish.

Standardized CPUE series for both Japanese and Taiwanese longline data were presented and used during the assessments. Standardised purse seine CPUE analyses were also presented and discussed, but these were not used during the assessments because it was believed that they still did not fully account for the increases in purse seine catching efficiency over time.

The two standardized longline CPUE series showed similar trends, with 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 (Figure 8). The observed pattern of standardised longline CPUEs does not correspond well with the expected response of CPUE to changes in catch and biomass, if standardized CPUE is directly proportional to the abundance of the part of the stock exploited by the gear concerned. 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, or a substantial decrease in the accumulated biomass in the oldest age groups in the early years. However, current analyses are unable to distinguish which, if any, of these explanations is correct.

STOCK ASSESSMENT

A full assessment was attempted for yellowfin tuna in 2005 by the WPTT. Two papers presenting assessment results were presented, one using the age structured production model (ASPM) method and one using a new Bayesian two-age-class production model. Additional assessments were carried out during the WPTT meeting using agreed data sets and the following methods: the PROCEAN method, the CATAGE trend (statistical catch at age analysis) method, ASPM, and the Bayesian two-age-class production model.

Although there were differences in the details of results from the different assessments, the overall picture they presented was consistent, particularly in terms of estimated trends in stock biomass and fishing mortality rates. Estimated trends in the fishing mortality rates are shown in Figure 9. Estimates of catchability using the PROCEAN and CATAGE methods show a strong increasing trend since the mid-1980s for both the longline fleets and the purse-seine fleets (Figure 10). The assessment runs considered at this meeting consistently indicated that fishing mortality rates between 1992 and 2002 have been close to or at levels of F corresponding to the Fmsy estimated by the most plausible ASPM assessment. Catches during this period were in the vicinity of, or possibly above, the MSY levels estimated by PROCEAN and the most plausible ASPM assessment. Estimated catches in 2003 and 2004 were well above those MSY levels, and projections carried out indicate that these are not sustainable unless supported by very high recruitments.

The Scientific Committee emphasized, however, that there remain strong uncertainties in each of the assessments conducted. In particular, none are yet able to consistently explain the trends in standardized CPUEs in the early years of the fishery without using trends in catchabilities or recruitment for which there is no evidence. Consequently, the implications drawn from them regarding current stock status are also uncertain.

Since the early-1980s there has also been an increase in both purse seine fishing on floating objects and artisanal fisheries 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 very high during 2003 and 2004. The total catch in 2004 was 495,000 t and 458,000 t in 2003. These catches represented more than a 30% increase above the average annual catch taken in the previous five years (343,400 t), and were substantially greater than the previous high in 1993 (407,000 t). These anomalous catches occurred all over the western Indian Ocean, in particular in a small area off 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 Scientific Committee discussed two possible hypotheses explaining the observed high catches, noting that it is possible that a combination of factors was responsible for this event. There are two main categories of factors:

Increase in the biomass of the population:

According to this hypothesis, there may have been several large recruitments to the population in the late 1990's or early 2000's that could have been 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 Scientific Committee noted there is no evidence from existing data of unusually large numbers of small fish being caught in the surface fisheries in the early 2000's. This could indicate that either the juveniles from these large cohorts were present, but outside the normal purse seine fishing grounds (e.g. in the eastern Indian Ocean), or that the recent cohorts were only at average levels.

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

It is also possible that during 2003 and 2004, the catchability of large yellowfin tuna had increased. Possible factors that could have caused this include aggregation of large yellowfin tuna over a relatively small area and/or depths that made it easier for purse seiners and longliners to catch them in large quantities and technological improvements on purse-seiners that could have the schools more vulnerable to fishing. No technological improvements have been reported for industrial longliners during this period.

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.

Large concentrations of the shallow water crustacean *Natosquilla investigatoris* and swimming crab *Portunus trituberculatus*, were reported to have occurred in 2003 and 2004 in the western Indian Ocean, and yellowfin tuna were observed feeding voraciously on them. New information on anomalies in the thermocline depth and primary productivity in 2003 also supported the hypothesis that there may have been an increased catchability due in some part to environmental factors.

By the end of 2002, most purse seine vessels had new sonar equipment installed. These devices potentially enable skippers to locate schools at distances up to 5 km, both night and day. This could make schools 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, higher catches also occurred in artisanal and longline fisheries for which there is no indication of recent technological advances.

The Scientific Committee agreed that it was most likely that the increased catches were due to a combination of these two sets of factors, increased recruitment in the early 2000s and increased catchability of large yellowfin tuna during 2003 and 2004.

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:

1) Fishing mortality rates between 1999 and 2002 were probably slightly below or around Fmsy, and total catches during that period, at an average level of 347,000 t, were probably close to, or possibly above MSY. Total catches in 2003 and 2004 were substantially above MSY; see below for interpretation of the possible reasons for and possible effects of these catches. In these circumstances, any further increase in both effective fishing effort and catch above average levels in 1999 - 2002 should be avoided.
2) The current fishing pressure on juvenile yellowfin by both purse seiners fishing on floating objects and artisanal fisheries 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 estimated in 2002.
3) 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.

While there was greater consistency in the assessment results considered at this meeting than in 2002, the Scientific Committee emphasized that there remain considerable uncertainties in the assessments, as none as yet are able to fully explain the observed trends in standardized longline CPUEs over the duration of the fishery.

In interpreting the high catches of 2003 and 2004, the Scientific Committee noted that if the hypothesis of one or two high recruitments entering the adult stock is correct, the increased catches from these year classes are unlikely to be detrimental to the stock, but these catches would not be sustainable in the longer term unless supported by continued high recruitments.

On the other hand, there could be serious consequences if the hypothesis that there was 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 could lead to a sudden decline of the existing adult biomass of yellowfin tuna, potentially reducing the stock to below MSY levels. If such is the case, management action might be needed to reduce catches and fishing mortality to below the levels prevailing in 1999 – 2002 to allow the stock to recover.

If, as the Scientific Committee believes, the most likely cause of the exceptional catches is a combination of these factors, then some reduction of stock biomass is to be expected in the future. However, the extent of any such reduction will only become apparent in several years following detailed stock assessments.

YELLOWFIN TUNA SUMMARY

Maximum Sustainable Yield :	Approximately 300,000 - 350,000 t
Current (2004) Catch:	495,000 t
Mean catch over five years before 2003 (1998 – 2002)	343,400 t
Current Replacement Yield	-
Relative Biomass $B_{current}/ B_{MSY}$	
Relative Fishing Mortality $F_{current}/_{FMSY}$	
Management Measures in Effect	none

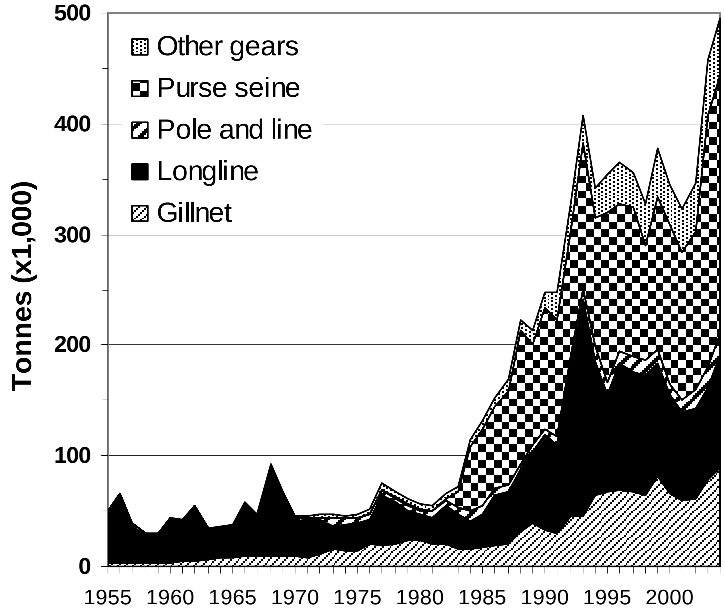
Note: This Executive Summary has been updated to take account of recent catch data. The management advice, and stock assessment results are based on data up to 2003.

Table 1. *Catches of yellowfin tuna by gear and main fleets for the period 1955 to 2004. Data as of 7 November 2005.*

Gear	Fleet	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82
Purse seine	France																											0.2	1.0
	Other Fleets									0.0	0.0	0.0												0.0	0.2	0.1	0.1	0.1	0.1
	Total									0.0	0.0	0.0												0.0	0.2	0.1	0.1	0.3	1.2
Baitboat	Maldives	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						4.6	5.2	4.9	3.8				
	Other Fleets																0.0		0.1	0.6	1.2	0.2						0.4	0.1
	Total	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	0.0		0.1	0.6	1.2	4.8	5.2	4.9	3.8			0.4	0.1
Longline	Taiwan,China	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	3.7	3.8	4.1	4.7
	Indonesia																			0.1	0.3	0.7	1.0	1.3	1.3	1.4	2.1	2.6	2.7
	Japan	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	3.3	3.2	4.9	7.3
	Korea, Republic of											0.1	0.1	0.4	5.3	9.1	5.2	7.4	10.3	10.8	13.2	13.3	13.7	33.1	26.5	18.0	13.2	12.4	19.4
	Other Fleets										0.3	0.5	0.5	0.1	2.3	0.6	1.9	1.6	1.5	1.2	0.7	0.2	1.1	0.9	0.2	0.4	0.5	0.4	0.4
	Total	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	32.4	34.4	31.5	21.7	23.5	25.3	21.9	45.4	37.0	26.9	22.8	24.4	34.5
Gillnet	Sri Lanka	0.7	0.9	1.0	1.1	1.2	1.5	1.8	2.7	3.6	3.4	3.3	3.7	4.1	4.6	5.1	4.0	2.9	3.9	4.9	4.3	3.6	6.8	6.3	6.2	7.1	7.9	9.1	9.2
	Oman	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	4.1	5.0	4.8	3.5
	Pakistan	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	2.8	1.3	2.0	2.5
	Indonesia	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	1.0	1.5	3.2	4.2	4.7	4.2	2.4	3.1
	Other Fleets	0.3	0.4	0.3	0.3	0.3	0.5	0.7	0.2	0.4	0.3	0.3	0.3	0.4	0.4	0.3	0.7	1.3	1.3	5.4	1.8	2.2	4.4	2.7	3.6	4.9	4.7	0.9	1.6
	Total	2.7	2.7	3.7	3.1	3.3	3.8	4.4	5.3	7.0	7.4	7.6	8.9	9.5	10.0	10.2	8.9	7.9	9.9	14.5	12.9	13.6	19.7	19.0	20.0	23.5	23.1	19.2	19.9
Line	Yemen	0.3	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.7	0.8	0.9	1.0	1.0	1.0	1.1	0.8	0.8
	Comoros																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
	Indonesia	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	0.3	0.3	0.3	0.4	0.6	0.3	0.6	0.7	0.5	0.1	0.6
	Other Fleets	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	3.0	3.2	3.9	3.4
	Total	0.6	0.6	0.6	0.7	0.7	0.7	0.8	1.1	1.3	1.2	1.2	1.3	1.5	1.7	1.8	1.8	1.8	2.2	2.5	2.9	2.9	3.9	6.3	5.1	4.7	4.9	5.0	4.9
All	Total	50.1	65.9	39.4	30.2	30.6	43.9	42.3	55.5	35.1	35.5	37.6	57.5	46.8	92.0	67.8	45.3	45.4	46.7	46.6	46.1	47.0	51.0	76.0	67.0	60.4	56.1	55.6	65.8

Gear	Fleet	Av 00/04	Av 55/04	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04
Purse seine	Spain	62.1	19.3		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	80.8
	France	47.0	17.5	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	63.5
	Seychelles	24.6	2.9									0.4	0.2					2.8	7.4	9.8	11.6	12.9	16.6	33.3	48.8
	NEI-Other	20.0	6.3	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	24.5	10.1
	NEI-Ex-Soviet Union	11.3	2.6								0.8		5.2	8.7	5.8	14.6	11.7	9.8	5.3	11.8	10.9	9.8	6.8	15.1	13.8
	Iran, Islamic Republic	6.2	1.1										2.1	3.4	2.7	4.3	1.6	1.9	3.3	2.5	2.2	2.2	5.0	8.3	13.1
	Other Fleets	1.6	2.1	1.5	1.7	1.8	3.8	5.5	5.8	5.7	6.9	11.0	14.1	13.6	7.2	6.5	4.6	3.5	3.2	2.1	1.3	3.9	1.8	0.7	0.3
	Total	172.8	51.7	12.6	58.2	68.8	73.4	83.8	118.6	89.7	108.7	105.4	112.8	128.4	114.4	149.4	129.7	132.2	100.4	134.8	140.3	130.0	139.0	224.1	230.5
Baitboat	Maldives	14.4	4.4								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	17.2	17.2
	Other Fleets	0.6	0.2	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	0.4
	Total	14.9	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	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	17.8	17.7
Longline	Taiwan,China	26.2	14.9	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	42.3
	Indonesia	23.5	7.0	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	20.2	15.0
	Japan	16.4	16.4	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	13.9	14.0	17.3	21.3
	NEI-Fresh Tuna	9.0	4.6							11.9	16.6	14.4	16.7	16.5	23.7	17.1	17.7	21.2	16.6	14.8	13.3	8.0	6.9	8.2	8.5
	NEI-Deep-freezing	3.8	2.5			0.1	1.1	1.2	3.4	3.2	6.7	5.9	8.9	23.8	9.9	6.9	12.1	5.9	9.8	7.4	6.6	3.2	4.0	2.7	2.6
	Korea, Republic of	2.0	7.0	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	4.1
	NEI-Indonesia Fresh Tuna		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	5.4	2.5	0.7	0.6	0.1	1.1	0.7	0.5	0.5	0.1	1.9	20.1	33.7	8.1	4.2	3.7	1.9	2.5	4.4	4.4	4.3	3.6	6.9	7.8
	Total	86.3	57.0	31.1	25.3	30.3	45.3	47.0	55.0	65.3	86.1	78.8	136.7	195.7	120.7	87.6	113.7	109.2	107.7	101.7	88.7	78.3	80.8	82.2	101.5
Gillnet	Iran, Islamic Republic	23.9	5.7							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	39.7
	Sri Lanka	18.3	7.8	8.9	6.2	6.3	6.5	6.8	7.0	7.2	8.3	9.4	10.6	12.1	13.7	14.4	15.1	17.0	16.9	18.6	18.9	18.1	19.0	17.7	17.7
	Oman	7.3	5.2	1.6	4.6	2.3	2.5	5.9	15.6	16.2	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	8.8
	Pakistan	3.8	2.8	0.8	0.9	1.5	2.6	2.4	3.8	8.6	3.3	4.9	3.9	2.6	2.4	2.1	3.2	3.9	3.9	9.4	5.3	4.0	3.3	3.5	3.2
	Indonesia	3.3	1.9	3.0	3.1	4.2	6.1	2.7	4.2	3.1	2.2	0.9	0.9	0.9	1.3	1.3	1.1	2.7	1.5	1.8	4.9	3.0	3.0	2.3	3.2
	Other Fleets	1.0	1.3	0.7	1.0	1.9	0.9	1.5	0.8	1.2	1.7	0.9	1.0	0.9	0.9	0.8	0.9	1.0	0.9	1.0	1.0	1.0	1.0	1.1	0.9
	Total	57.6	24.7	15.0	15.8	16.2	18.6	19.3	31.4	37.3	32.1	28.4	42.0	41.3	56.9	62.6	60.5	54.5	52.6	62.4	50.8	50.3	50.6	62.7	73.5
Line	Yemen	27.2	6.0	1.5	2.3	3.1	3.9	4.6	5.4	6.2	6.9	7.7	8.5	7.6	8.3	13.2	15.0	17.0	19.1	21.1	23.1	25.2	27.2	29.2	31.3
	Comoros	5.9	1.7	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	5.8	6.1	6.1
	Indonesia	5.2	2.6	0.5	0.3	1.8	1.0	2.6	1.5	0.2	0.9	9.9	7.0	9.2	8.8	12.2	13.0	5.5	9.8	13.4	1.8	2.8	4.9	9.1	7.5
	Other Fleets	6.1	2.4	2.9	2.3	2.2	2.1	2.2	2.1	2.1	2.6	3.0	3.4	3.3	3.0	3.1	3.0	3.0	2.7	3.0	4.4	5.4	6.9	7.0	7.0
Line	Total	44.4	12.8	5.1	5.1	7.2	7.2	9.6	9.2	12.2	14.1	24.3	23.8	25.0	26.0	34.4	36.8	31.1	37.2	43.0	35.3	38.7	44.8	51.4	51.8
All	Total	393.4	156.6	72.3	113.7	130.9	152.2	168.6	222.0	212.4	248.2	247.3	328.4	407.2	341.8	353.8	364.4	355.5	326.9	377.1	344.3	322.2	346.8	458.3	495.1

(a)



(b)

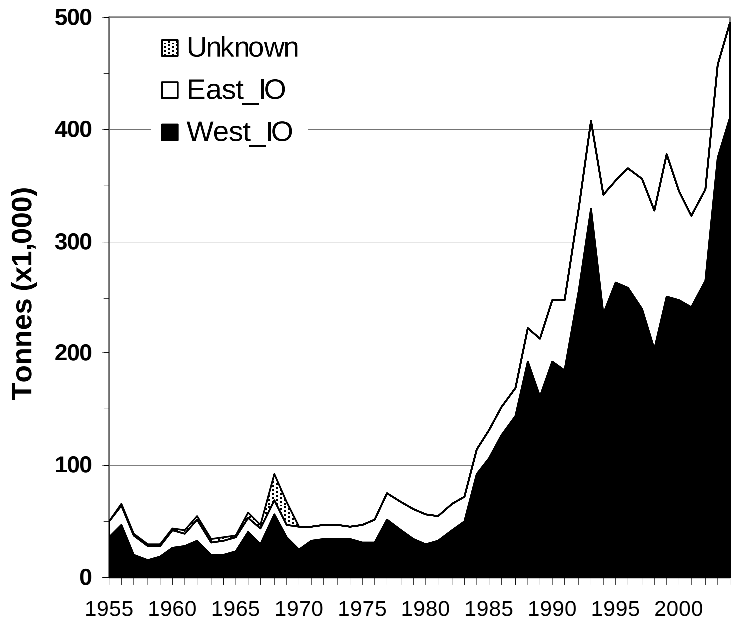


Figure 1. *Yearly catches (tonnes x 1000) of yellowfin by (a) gear and (b) area from 1955 to 2004.*

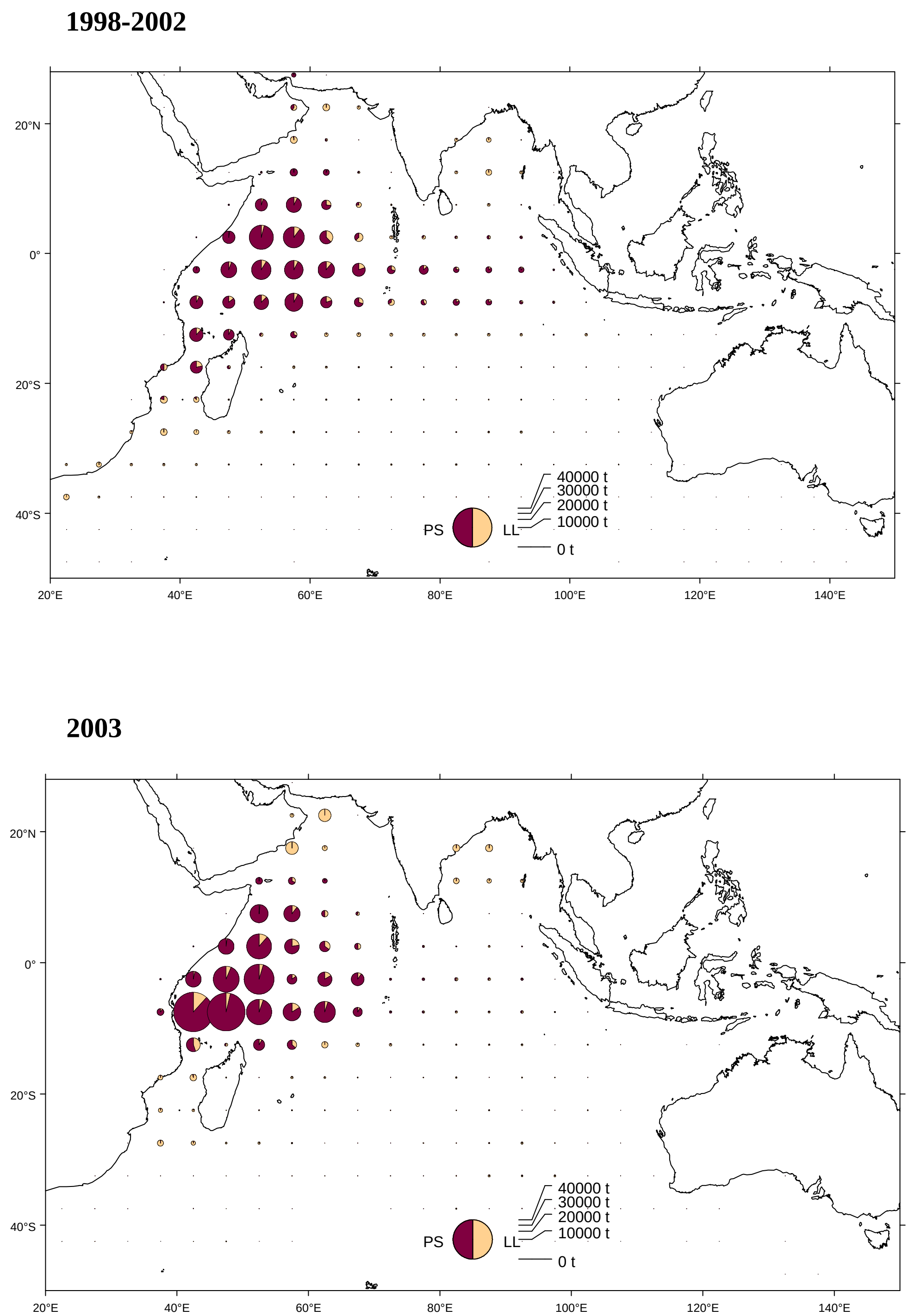


Figure 2. *Location of yellowfin catches taken in the Indian Ocean in 1998-2002 and in 2003 (when catches were exceptionally high).*

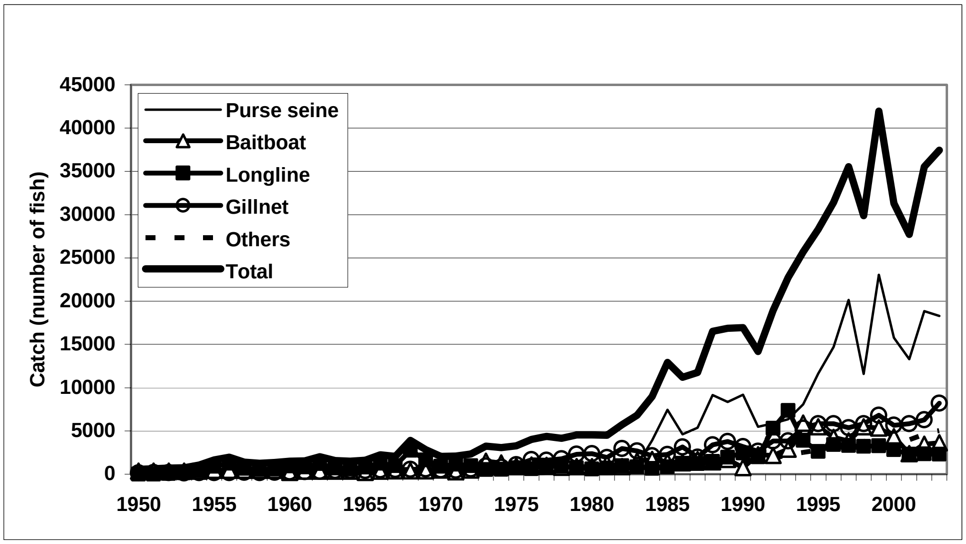


Figure 3. *Numbers of yellowfin caught by gear-type.*

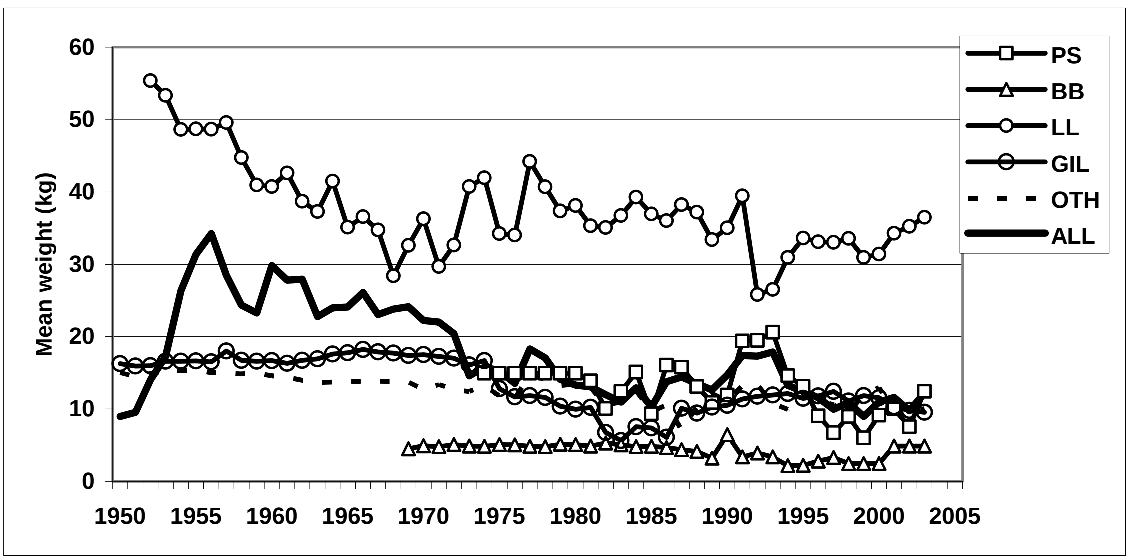


Figure 4. *Mean weight (kg) of yellowfin individuals in the catch by gear and for all gear-types (estimated from the total catch at size). PS: purse seine, BB: bait boat, LL: longline, GIL: gillnet, OTH: other.*

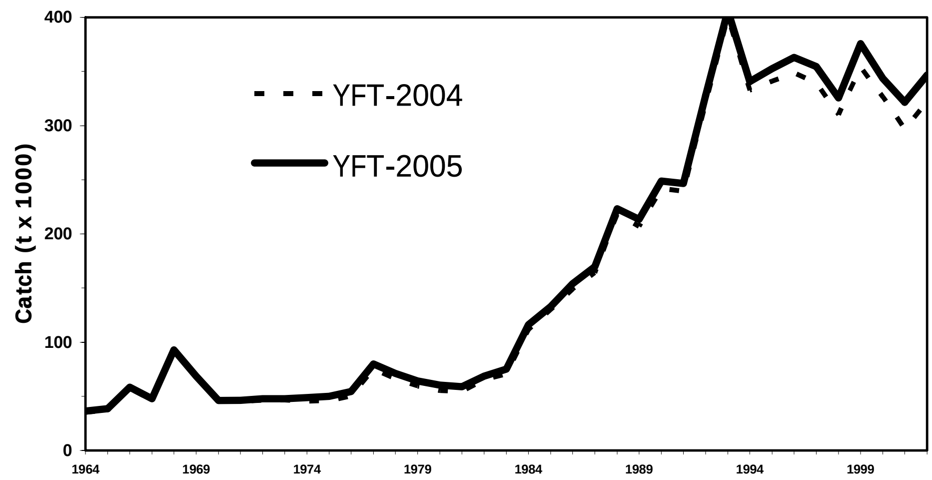


Figure 5: *Yellowfin tuna catch estimates in 2005 following a review of the data by the IOTC Secretariat versus catch estimates in 2004 (1964-2002)*

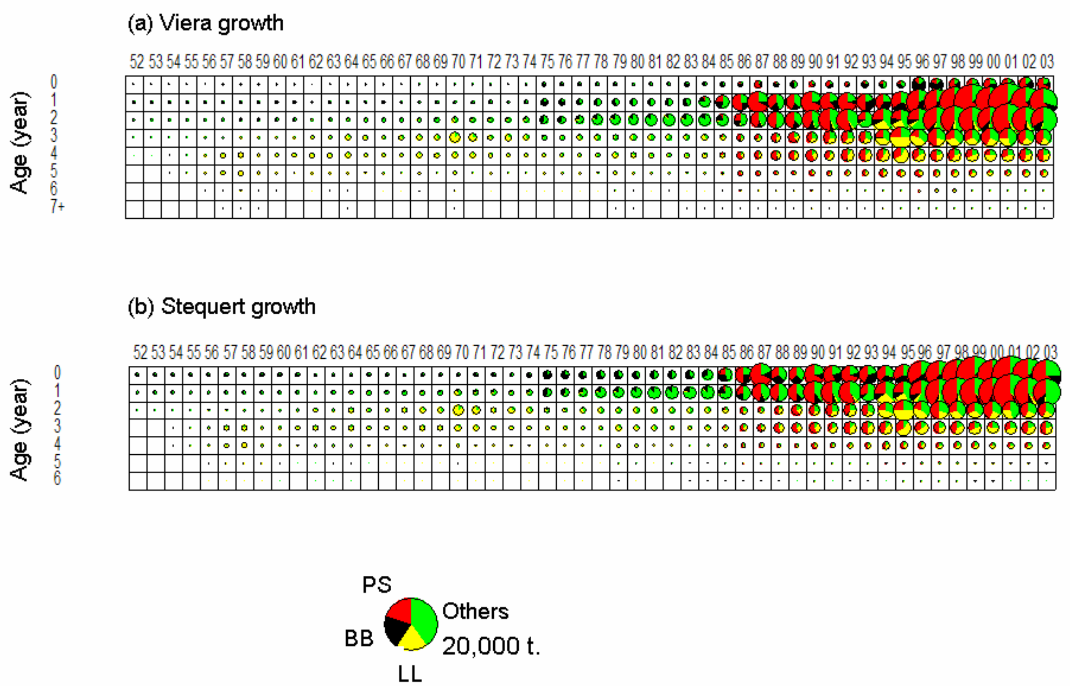


Figure 6. *Catch at age (tonnes) for yellowfin tuna caught in the Indian Ocean (a) estimated using the revised Viera growth curve (b) estimated using the revised Stequert growth curve. PS: purse seine; BB: bait boat; LL: longline fishing.*

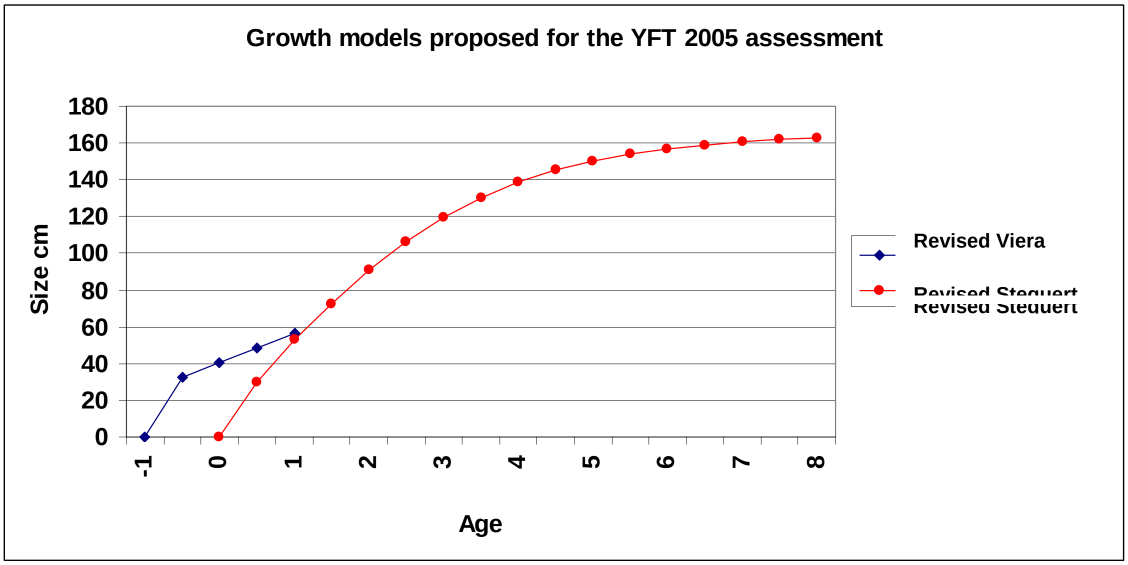


Figure 7. *Yellowfin tuna growth curves used in the 2005 stock assessments.*

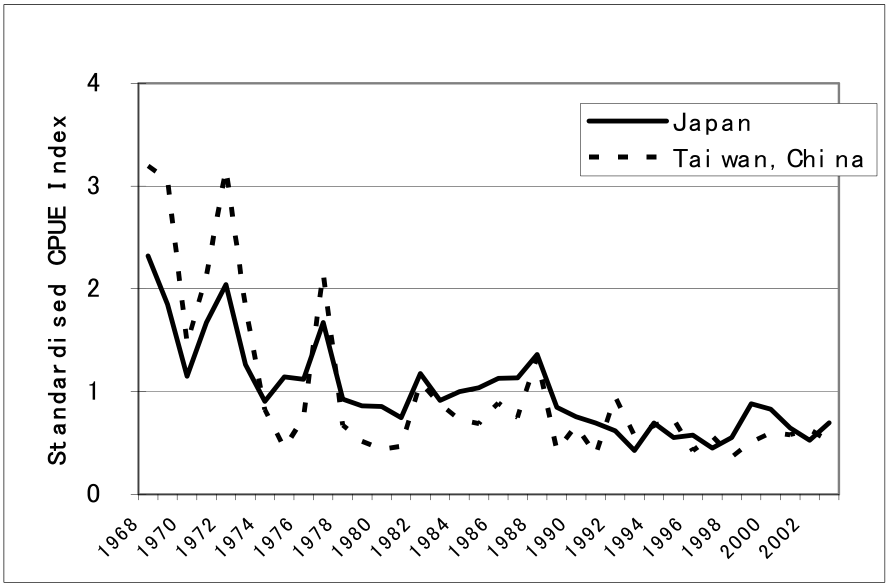


Figure 8. *Yearly standardised CPUE indices for yellowfin tuna based on the Japanese and Taiwan,China longline catch rates in the Indian Ocean*

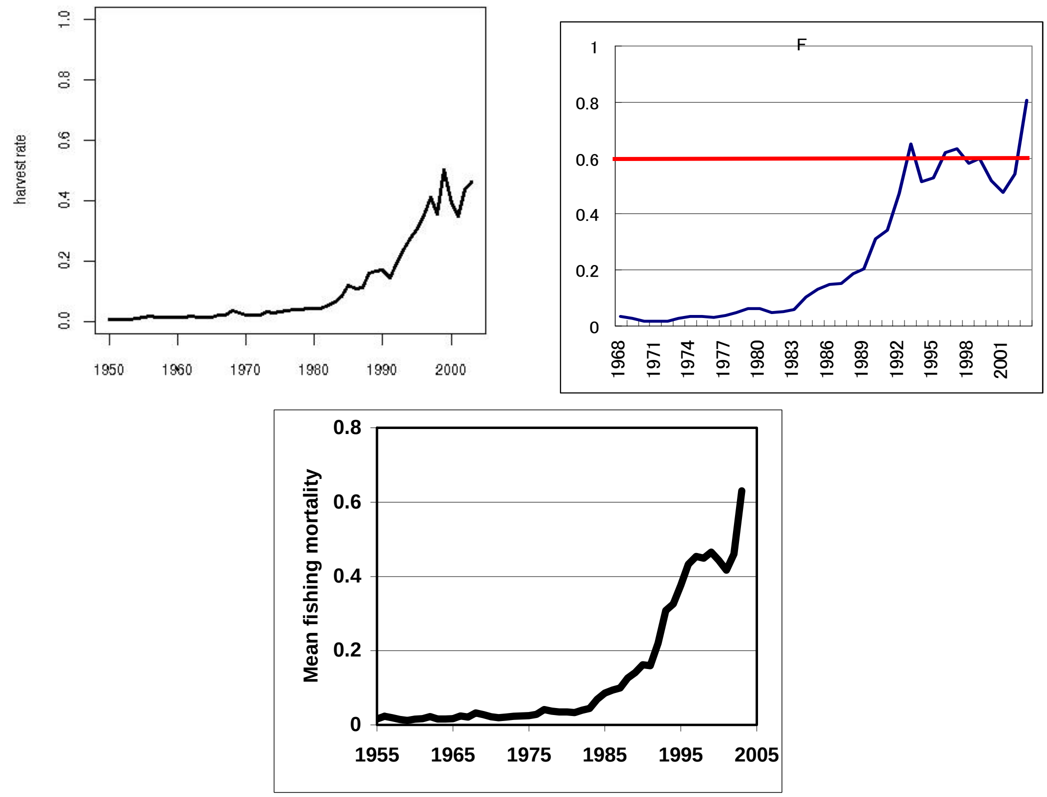


Figure 9. *Yellowfin fishing mortality rate trends from each of the models in 2005. Bayesian (top left), ASPM (top right) and CATAGE (bottom).*

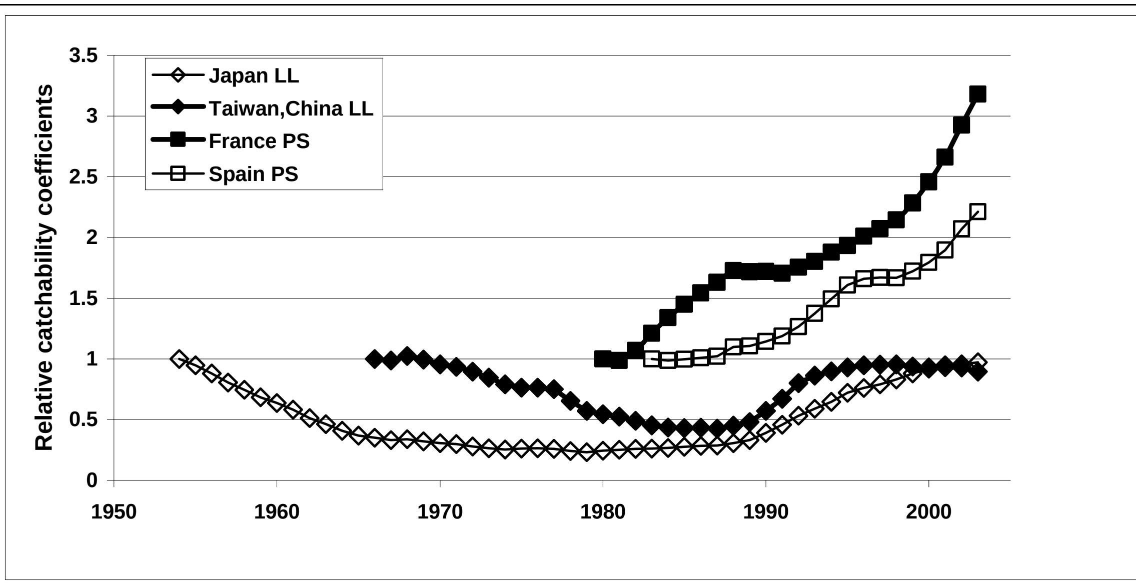


Figure 10. *Mean yearly relative catchability coefficients estimated from CATAGE for Japanese longline (LL), Taiwan,China longline, French purse seine (PS) and Spanish purse seine.*

Executive Summary Of The Status Of The Albacore Tuna Resource

(11 November 2005)

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 1980’s (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 eight 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 4^{th} and 1^{st} 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. Annual catches from 2000 to 2004 averaged 30,600 t. The total catches in 2003 and 2004 have been relatively low at 23,000 t and 20,000 t, respectively.

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 increased steadily from the 1950's, averaging around 10,000 t by the mid-1970s'. Between 1998 and 2002 catches ranged between 20,300 to 26,100 t , equating to just over 60 % of the total Indian Ocean albacore catch. In 2003 and 2004, the catches by Taiwanese longliners were lower at 11,100 t and 9,100 t, respectively.

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 (2004) Catch:	20,000 t
Mean catch over the last 5 years (2000-04)	30,600 t
Current Replacement Yield	-
Relative Biomass ($B_{current}/B_{MSY}$)	unknown
Relative Fishing Mortality ($F_{current}/F_{MSY}$)	unknown
Management Measures in Effect	none

Note: This Executive Summary has been updated to take account of recent catch data. The management advice, and stock assessment results are based on data up to 2002.

Table 1. *Catches of albacore tuna by gear and main fleets for the period 1955-2004 (in thousands of tonnes). Data as of 7 November 2005.*

Gear	Fleet	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81
Purse seine	Other Fleets																										0.0	0.0
	Total																										0.0	0.0
Longline	Taiwan,China	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	15.0	11.0	12.3
	Indonesia																				0.0	0.1	0.1	0.1	0.2	0.3	0.2	0.2
	Japan	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	0.4	0.6	1.2
	Korea, Republic of											0.5	0.6	6.2	0.9	4.4	1.7	2.5	3.9	9.1	9.8	3.9	4.2	2.1	4.6	2.0	1.8	0.9
	Other Fleets										0.1	0.2	0.2	0.0	0.8	0.2	0.7	0.6	0.5	0.4	0.2	0.1	0.0	0.1	0.1	0.0	0.0	0.1
	Total	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	18.1	17.7	13.7	14.7
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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All	Total	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	17.7	13.7	14.8

Gear	Fleet	Av 00/04	Av 55/04	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04
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	0.1
	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	0.1
	Other Fleets	0.3	0.1	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	0.4	0.1
	Total	1.0	0.5	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	1.5	0.2
Baitboat	Total		0.0	0.4	0.0	0.0	0.0		0.0		0.0			0.0	0.0	0.0	0.0									
Longline	Taiwan,China	17.7	9.9	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	9.1
	Indonesia	3.5	0.6	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	4.8	4.6
	NEI-Deep-freezing	3.5	1.4				0.0	0.7	0.7	1.7	1.0	1.2	2.5	1.8	3.2	4.2	4.2	7.3	4.8	9.0	9.4	8.2	4.5	2.9	1.2	0.7
	Japan	2.9	4.6	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	2.2	3.2
	Seychelles	0.9	0.1																		0.0	0.4	0.8	1.1	1.2	0.9
	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	0.4
	Korea, Republic of	0.2	1.3	0.7	0.6	0.4	0.5	0.4	0.4	0.4	0.3	0.2	0.3	0.1	0.1	0.1	0.1	0.2	0.3	0.2	0.1	0.2	0.1	0.0	0.1	0.4
	Other Fleets	0.4	0.3	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	0.3	0.3	0.8	0.7	0.4	0.6	0.5	0.3	0.4
	Total	29.4	18.2	24.2	19.6	16.7	9.3	14.8	17.0	15.0	10.2	9.1	17.8	16.0	17.8	22.2	21.9	28.8	25.7	36.5	37.0	36.6	38.6	31.0	21.2	19.6
Gillnet	Taiwan,China		1.8				0.7	15.2	12.2	14.4	14.4	21.1	9.0	1.3												
	Total		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	0.1	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	0.1
All	Total	30.6	20.5	24.6	19.7	17.3	10.8	30.2	29.4	29.7	24.6	30.6	29.2	20.7	19.2	24.8	23.2	30.4	27.8	38.2	37.7	37.9	40.0	32.0	22.8	20.1

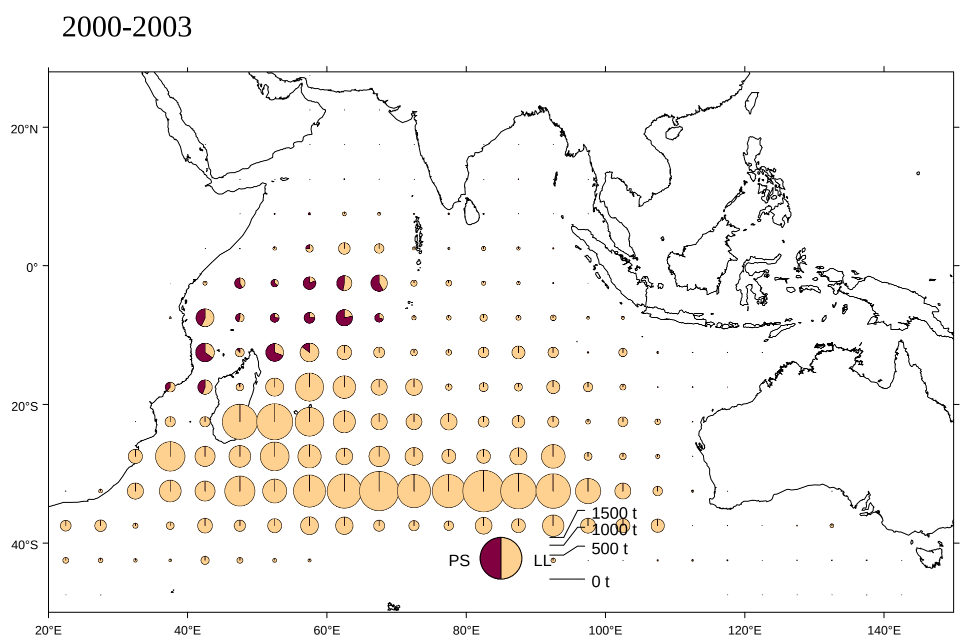


Figure 1. *Average albacore catches by gear during the period 2000-2003. The main spawning grounds appear to be located east of Madagascar between 15° and 25°**S.***

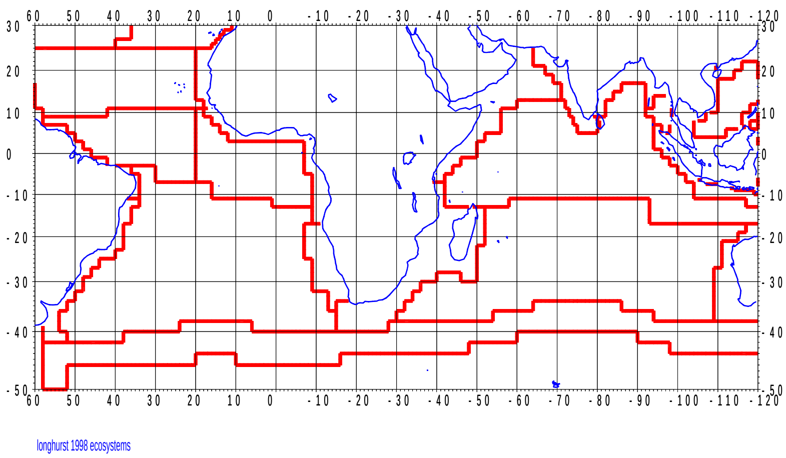
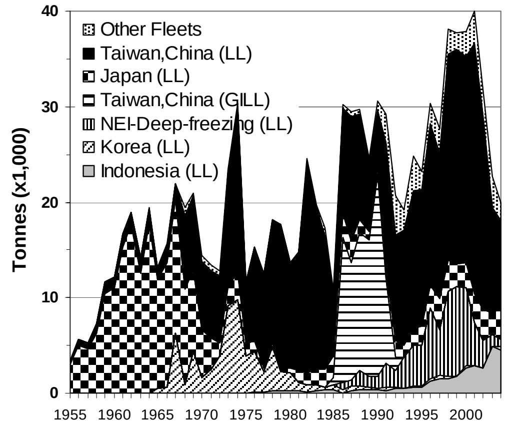
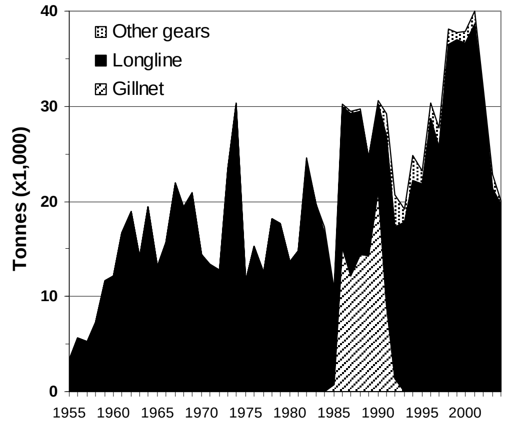


Figure 2. *Ecological areas as proposed by Longhurst (1998)*

Figure 3: *Catches of albacore per fleet and year recorded in the IOTC Database (1955-2004)*	***Figure 4****: Catches of albacore per gear and year recorded in the IOTC Database (1955-2004)*
	

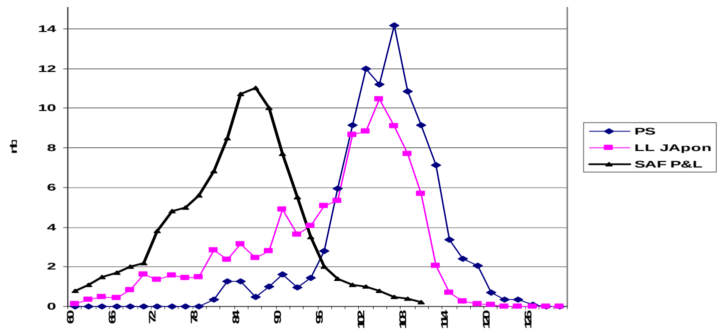


Figure 5*. Average sizes of albacore taken by various fisheries in the Indian Ocean, longliners and purse seiners, and by the pole-and-line fishery in the west coast of South Africa (Atlantic Ocean).*

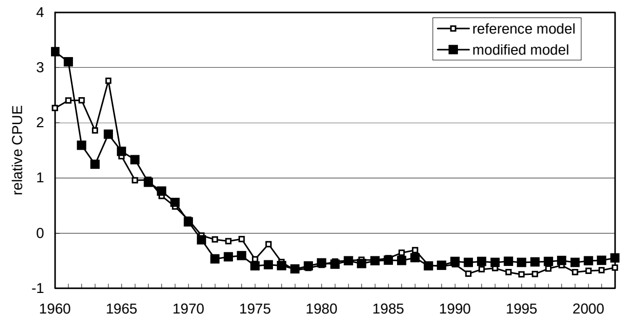


Figure 6. *Standardized CPUEs for the reference and modified models. The CPUE for the modified model were calculated using only from Area 2 and Area 4 where albacore is generally abundant. Both CPUEs were adjusted with taking the difference to mean and dividing it by the standard deviation.*

Executive Summary Of The Status Of The Skipjack Tuna Resource

(11 November 2005)

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 spawned.

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. Annual total catches reached around 400,000 t in the mid-1990's and since 1999 have ranged between 499,000 t and 563,000 t. (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.

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 (2004) Catch:	529,000 t
Mean catch over the last 5 years (2000-04)	528,000 t
Current Replacement Yield :	-
Relative Biomass (B_{cur}/B_{MSY}) :	unknown
Relative Fishing Mortality (F_{cur}/F_{MSY}):	unknown
Management Measures in Effect :	none

Note: This Executive Summary has been updated to take account of recent catch data. The management advice, and stock assessment results are based on data up to 2002.

Table 1. *Catches of skipjack tuna by gear and main fleets for the period 1955-2004 (in thousands of tonnes). Data as of 11 November 2005.*

Gear	Fleet	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81
Purse seine	France																											0.2
	Japan																							0.1	0.9	0.6	0.4	0.1
	Other Fleets									0.0	0.2	0.0														0.0	1.0	1.8
	Total									0.0	0.2	0.0												0.1	0.9	0.6	1.4	2.0
Baitboat	Maldives	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						14.9	18.6	13.7	13.2			
	Other Fleets	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	0.4	0.0	0.2
	Total	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	0.3	0.0	0.4	5.0	10.9	17.1	18.7	14.3	14.0	0.4	0.0	0.2
Longline	Total										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	0.0	0.0	0.0
Gillnet	Indonesia	1.1	1.1	1.1	1.1	1.1	1.1	1.4	1.4	1.5	1.6	1.7	1.9	1.8	1.9	2.1	3.8	4.0	6.3	6.9	9.0	16.5	20.9	28.3	22.0	26.7	35.8	40.8
	Sri Lanka	1.0	1.3	1.6	1.8	1.9	2.4	3.0	4.5	6.0	5.8	5.6	6.3	7.1	8.0	8.8	6.9	5.0	6.8	8.7	7.6	6.5	12.3	12.4	12.5	10.7	14.6	16.6
	Pakistan	0.8	0.7	1.9	0.9	0.9	1.1	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	3.8	1.8	2.7
	Other Fleets	0.2	0.2	0.2	0.2	0.2	0.3	0.4	0.1	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.8	0.8	3.1	1.0	1.3	2.6	1.6	2.1	2.8	2.8	2.4
	Total	3.0	3.4	4.7	4.0	4.1	5.0	5.8	7.7	10.2	10.9	11.2	13.3	13.9	14.8	15.4	15.0	12.9	17.7	21.7	21.7	28.8	40.0	46.0	38.8	44.1	54.9	62.5
Line	Indonesia	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	0.4	1.1	1.2	1.7	1.9	2.6	5.1	6.5	1.1	0.9	1.4	1.7	2.5
	Other Fleets	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	3.8	4.6	5.0
	Total	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	8.5	11.1	5.3	5.0	5.2	6.3	7.5
All	Total	14.2	14.7	16.9	16.3	16.3	16.3	16.8	19.0	22.0	23.0	29.4	34.7	37.3	37.4	40.4	47.3	45.0	42.5	53.5	63.1	55.6	70.9	66.8	62.0	70.2	87.7	94.7

Gear	Fleet	Av 00/04	Av 55/04	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04
Purse seine	Spain	78.3	23.0			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	64.4
	France	41.5	16.8	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	38.0
	Seychelles	26.9	3.4										1.8	0.6					4.9	10.7	15.8	11.6	26.2	29.9	36.8	30.0
	NEI-Other	24.9	7.4		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	20.6	4.7
	NEI-Ex-Soviet Union	20.9	4.1									0.7		10.1	8.7	8.2	18.4	14.7	11.2	10.2	17.3	19.8	21.1	21.0	24.7	17.8
	Iran, Islamic Republic	5.7	0.7															0.8	1.0	2.0	2.7	1.6	2.9	6.7	6.7	10.7
	Japan	2.0	3.4	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	2.4	1.4
	Other Fleets	1.8	2.1	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	1.9	3.0	1.2	2.4	1.4	6.4	1.3		0.0
	Total	202.1	60.9	4.2	11.8	45.7	60.4	66.6	79.0	92.8	126.7	108.2	122.8	151.4	163.9	179.2	178.9	149.2	145.4	150.0	193.2	196.9	189.6	238.6	218.3	167.0
Baitboat	Maldives	98.7	28.1									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	107.0	107.0
	Other Fleets	3.5	2.9	1.3	1.2	1.0	1.0	1.0	1.3	1.7	1.2	1.5	6.7	7.0	13.9	6.8	7.4	7.2	7.8	2.0	2.3	4.6	2.7	3.2	3.1	4.0
	Total	102.2	31.0	1.3	1.2	1.0	1.0	1.0	1.3	1.7	1.2	62.3	65.0	64.6	71.9	75.8	77.3	73.4	75.9	79.8	94.5	83.4	89.5	117.0	110.1	111.0
Longline	Total	0.3	0.1	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	0.7	0.5
Gillnet	Indonesia	72.8	27.3	41.0	45.0	49.3	44.0	49.2	27.8	49.9	62.7	45.9	21.7	24.1	26.7	32.2	31.9	38.2	67.2	48.4	51.6	94.7	79.8	60.7	51.2	77.5
	Sri Lanka	36.7	15.0	17.1	15.8	12.7	13.0	13.3	13.8	14.3	14.4	16.0	17.6	19.1	21.1	23.5	30.2	31.9	33.6	35.0	37.2	38.0	36.3	38.2	35.5	35.5
	Iran, Islamic Republic	30.9	4.1								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	53.6
	Pakistan	3.7	3.7	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	3.5
	Other Fleets	0.6	1.7	3.4	3.2	4.3	4.4	4.8	6.8	5.6	7.3	6.9	0.6	0.7	1.2	1.2	1.5	1.1	1.6	0.6	0.7	0.9	0.4	0.5	0.6	0.7
	Total	144.6	51.7	64.8	65.1	67.4	63.5	68.9	52.0	75.3	92.3	77.2	48.5	54.3	60.3	72.5	71.9	78.1	115.2	93.2	108.3	156.7	143.4	125.8	126.6	170.7
Line	Indonesia	31.2	12.8	3.6	3.6	2.7	5.2	1.3	23.0	6.1	4.0	5.0	34.4	25.8	44.8	52.1	47.7	54.9	40.0	49.6	50.4	19.2	29.4	33.1	42.9	31.1
	Other Fleets	4.5	3.2	3.2	3.2	3.1	3.1	3.3	3.2	3.1	5.4	6.2	6.3	4.8	4.6	4.5	4.7	4.4	4.8	4.5	3.5	3.9	4.0	4.8	4.8	4.9
	Total	35.6	16.0	6.8	6.8	5.9	8.3	4.5	26.2	9.1	9.3	11.2	40.7	30.5	49.4	56.5	52.4	59.3	44.7	54.0	53.9	23.1	33.4	37.9	47.8	36.0
All	Total	528.5	179.2	94.7	106.8	154.2	179.8	190.2	205.4	242.1	293.6	266.5	284.1	312.6	362.5	406.6	398.1	383.7	413.5	409.7	499.3	507.5	496.8	563.2	546.2	529.0

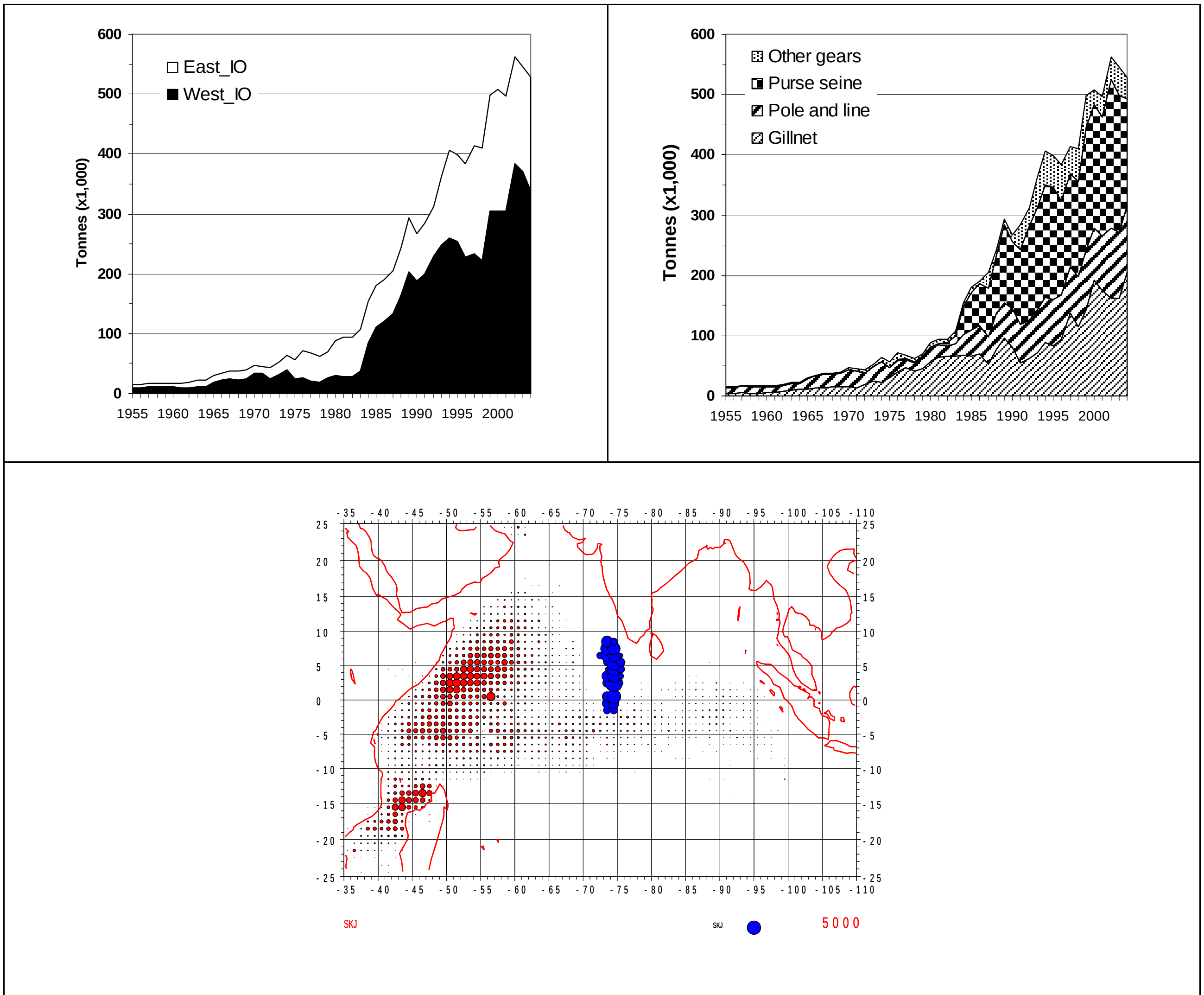


Figure 1*. (a) Yearly catches (thousand of metric tonnes) of skipjack tuna by area (Eastern and Western Indian Ocean, top left) and by gear (top right) from 1955 to 2004 (right). (b) Average spatial distribution of Indian Ocean skipjack catches for 1995—2001 for purse-seine (red/light) and baitboat (blue/dark).*

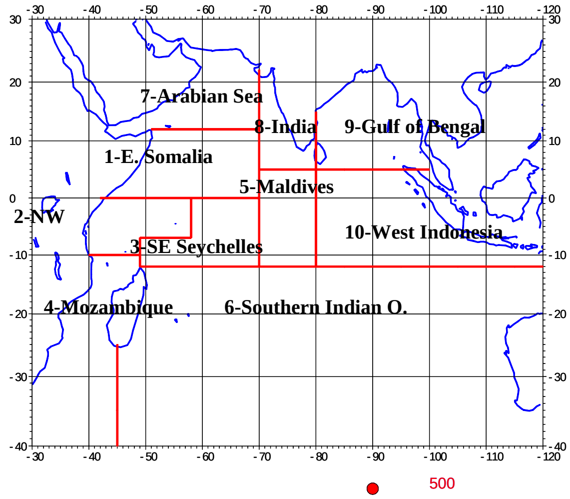


Figure 2. *Areas used for the calculation of the CPUE trends shown in Figure 4*

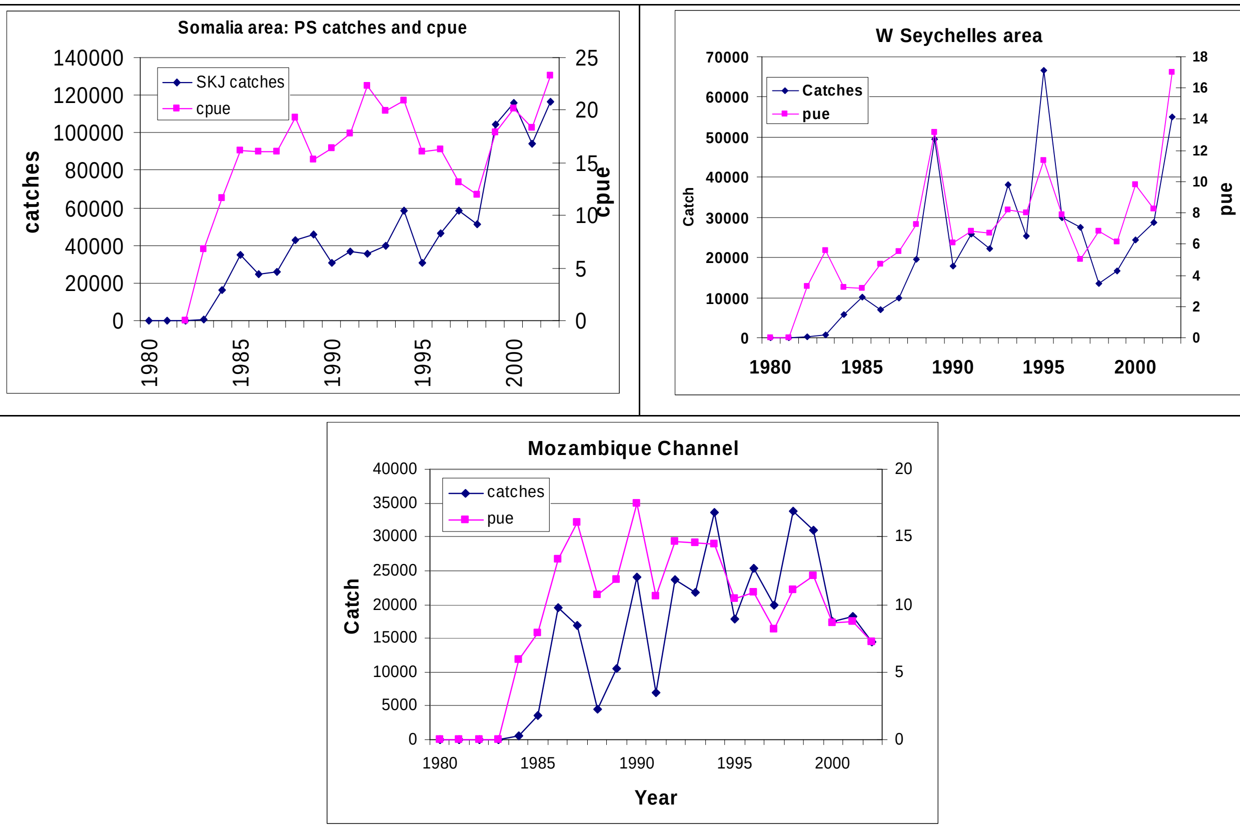


Figure 3. *Nominal CPUEs for three important purse seine fishing ground areas: Somali Basin (top left panel); Mozambique Channel top right panel) and Western Seychelles (bottom panel).*

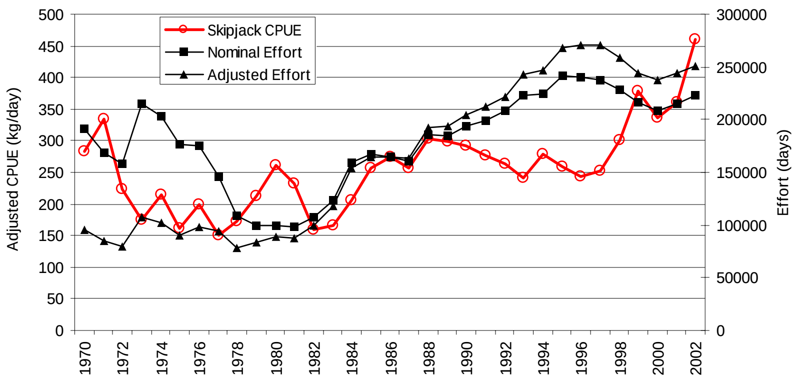


Figure 4. *Time series of Maldives CPUE and the nominal and adjusted effort (WPTT-03-23).*

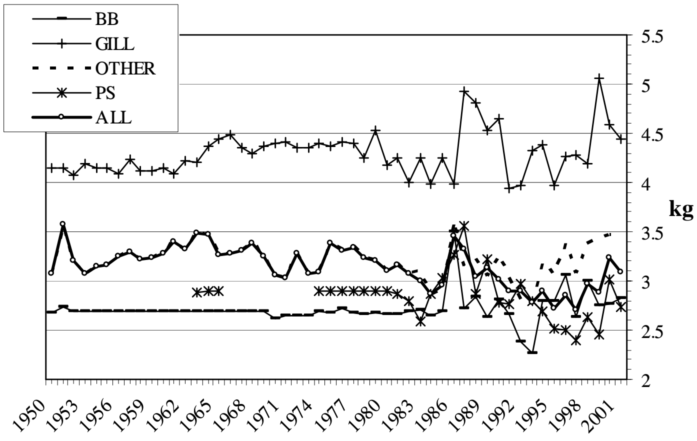


Figure 5. *Skipjack tuna average weight in the catch by gear (from size-frequency data) and for the whole fishery (estimated from the total catch at size).*

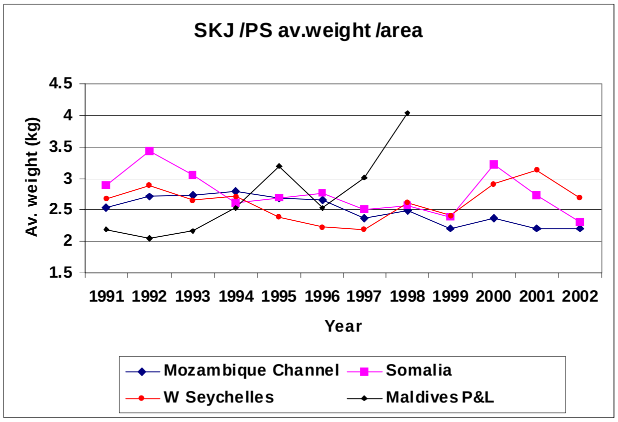


Figure 6. *Time series of average weight of skipjack caught by the purse seine and pole and line by major areas. (1991 - 2002)*

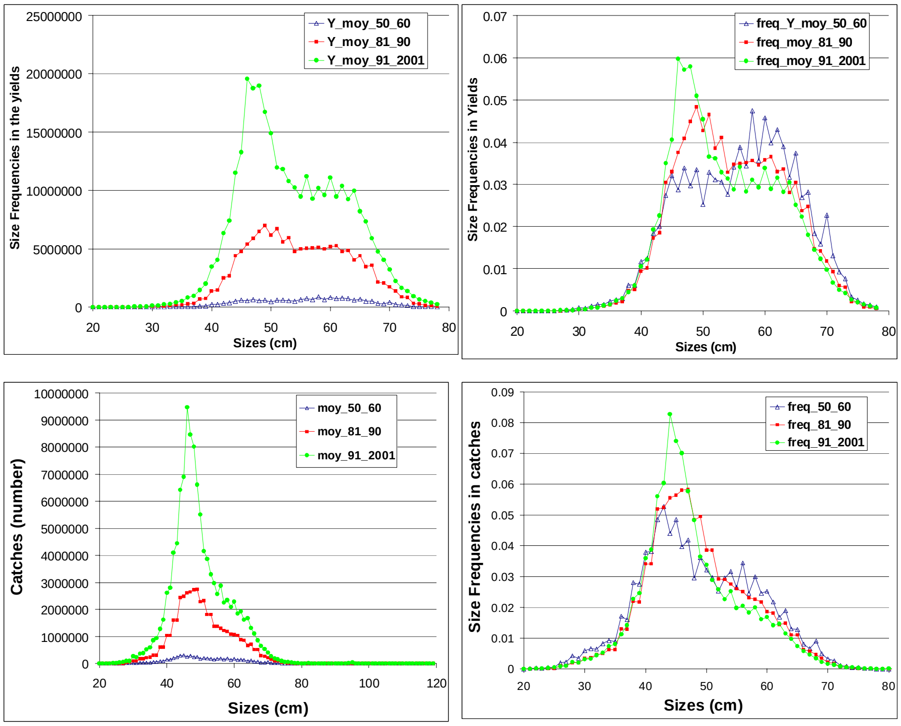


Figure 7. *Size frequencies of the yield (top panels) and catch by numbers (bottom panels) for three time periods: 1950-1960 (green), 1981-1990 (red) and 1991-2001 (blue). Left panels are actual numbers and right panels are in proportions. Note the two modes (40-50 and 55-65 cm) that appear in the yield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

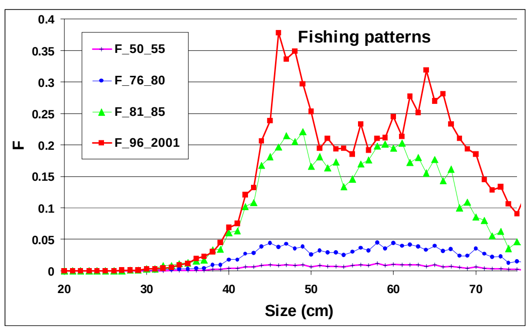


Figure 8*. Estimated fishing mortality by size for four five-year mean periods : (1950-1955, 1976-1980, 1981-1985, and 1996-2001)*

Executive Summary Of The Status Of The Indian Ocean Swordfish Resource

(11 November 2005)

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 35,000 tonnes (Figures 1 and 2, Table 1). By 2002, twenty countries were reporting catches of swordfish (Figure 3, Table 1). The annual total catch has averaged 31,400 t in recent years (2000-2004) and in 2004 was 31,000 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 (2004) Catch:	31,000 t
Mean catch over the last 5 years (2000-04)	31,400 t
Current Replacement Yield	-
Relative Biomass (B_{2000}/B_{MSY})	unknown
Relative Fishing Mortality (F_{2000}/F_{MSY})	unknown
Management Measures in Effect	None

Note: This Executive Summary has been updated to take account of recent catch data. The management advice, and stock assessment results are based on data up to 2002.

***Table 1**. Catches of swordfish by gear and main fleets for the period 1955-2004 (in thousands of tonnes). Data as of 7 November 2005.*

Gear	Fleet	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81
Baitboat	Total																0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Longline	Taiwan,China	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	1.1	1.3	1.1
	Indonesia																				0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
	Japan	0.5	0.9	0.6	0.7	1.0	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	0.6	0.6	0.8
	Korea, Republic of											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	0.6	0.3	0.4
	Other Fleets										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
	Total	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	2.6	2.7	2.1	2.0	1.6	2.0	2.3	1.9	1.9	2.4	2.3	2.3	2.3
Line	Total																0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
All	Total	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	2.6	2.7	2.1	2.0	1.6	2.0	2.3	1.9	1.9	2.4	2.3	2.3	2.3

Gear	Fleet	Av 00/04	Av 55/04	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04
Longline	Taiwan,China	13.0	4.7	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	17.2	16.8	14.7	15.2	12.3	12.9	13.5	11.3
	NEI-Deep-freezing	3.1	1.2				0.0	0.2	0.2	0.8	0.6	0.8	0.9	1.4	4.2	3.6	5.4	7.7	5.5	7.0	6.2	5.8	2.1	1.9	2.4	3.1
	Spain	2.9	0.4												0.2	0.7	0.0	0.0	0.5	1.4	2.0	1.0	1.9	3.5	3.6	4.7
	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	1.8	0.7
	Indonesia	1.6	0.3	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	2.6	2.6
	Japan	1.3	1.3	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	1.3	1.1	1.2
	France-Reunion	1.2	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	0.9
	NEI-Fresh Tuna	0.8	0.3								0.5	0.7	0.6	0.7	0.7	1.1	0.9	0.9	1.1	1.0	0.9	0.9	0.7	1.3	0.6	0.6
	Seychelles	0.7	0.1																		0.0	0.2	0.4	0.4	1.3	1.0
	China	0.5	0.1														0.1	0.2	0.3	0.1	0.4	0.4	0.3	0.4	0.8	0.7
	Portugal	0.5	0.1																	0.1	0.2	0.2	0.6	0.8	0.9	0.0
	Korea, Republic of	0.1	0.2	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	0.3
	Other Fleets	0.9	0.2	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	0.9	0.7	0.3	0.3	1.3	1.6	1.3
	Total	28.3	9.2	2.8	3.4	3.2	4.2	4.9	5.6	7.9	6.7	7.0	7.8	13.8	23.1	22.3	28.0	31.2	30.5	33.3	31.3	29.7	24.9	27.2	31.0	28.5
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	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.1
All	Total	31.5	9.7	2.8	3.4	3.2	4.2	4.9	5.6	8.0	6.8	7.1	7.9	14.1	25.1	23.2	29.0	32.3	32.2	34.8	32.7	32.9	28.1	31.2	33.9	31.6

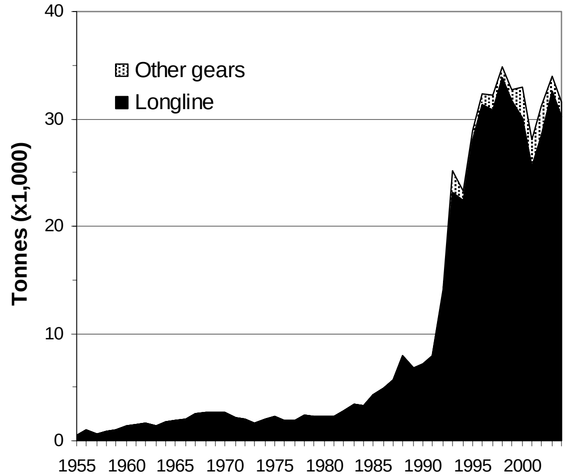


Figure 1: *Catches of Swordfish per gear and year recorded in the IOTC Database (1955-2004).*

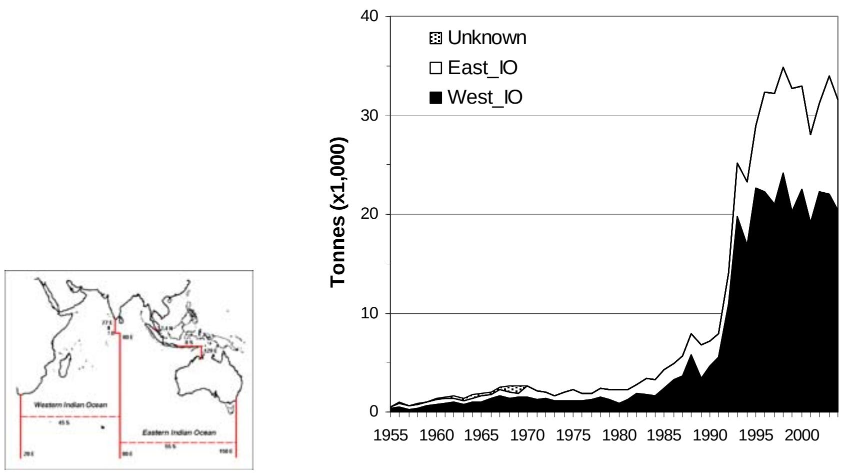


Figure 2: *Trends of the swordfish catches in the western and the eastern area of the Indian Ocean from 1955 to 2004.*

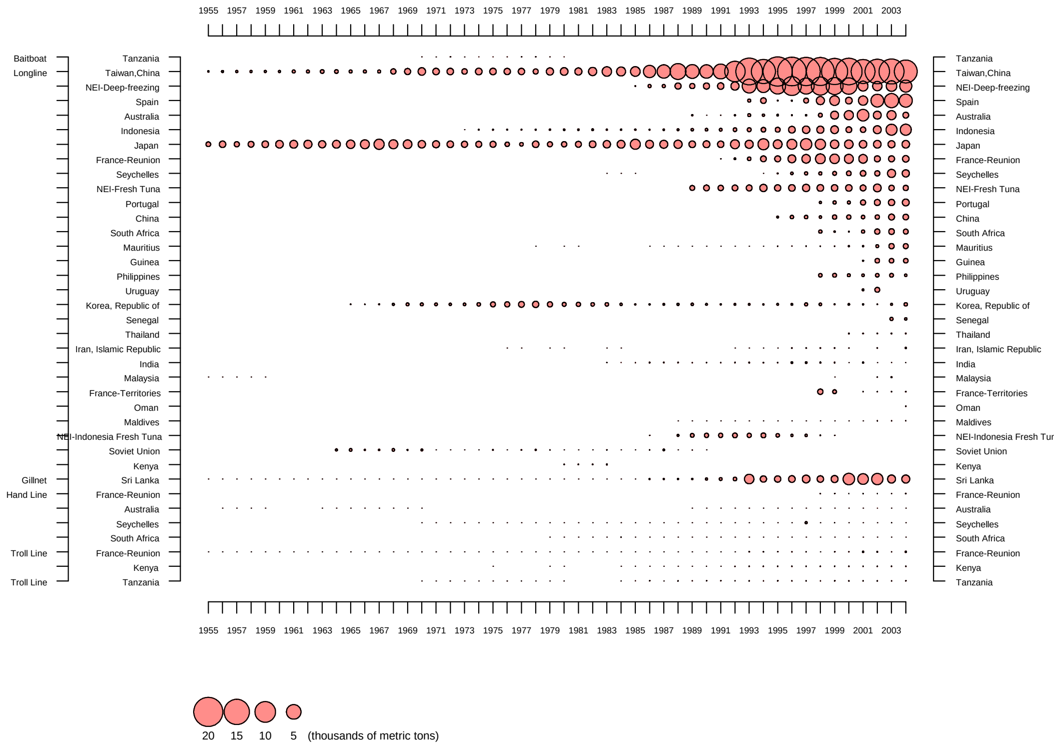


Figure 3: *Catches of swordfish in the Indian Ocean for the period 1955-2004, in thousands of metric tons by gear and country/fleet.*

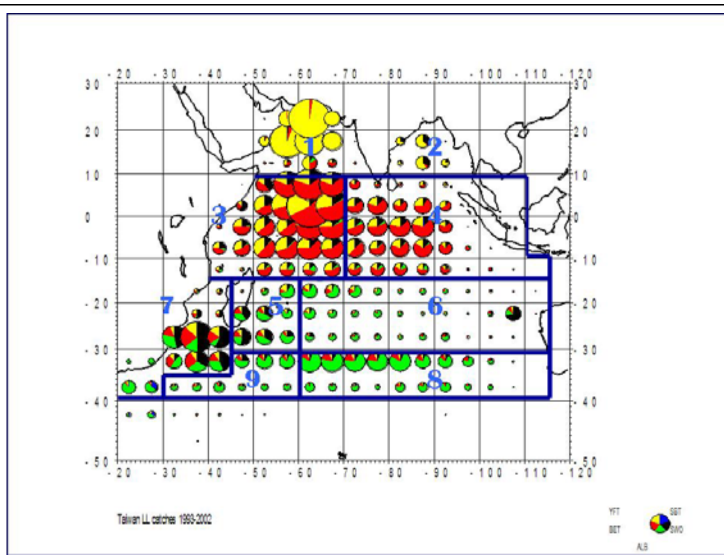
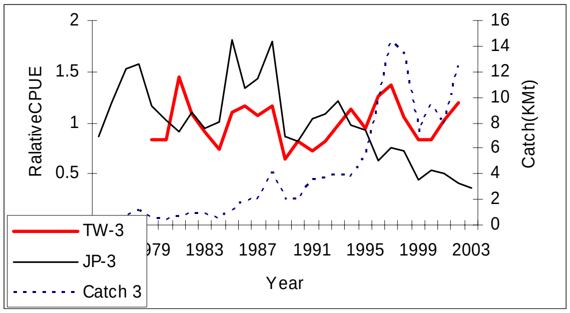
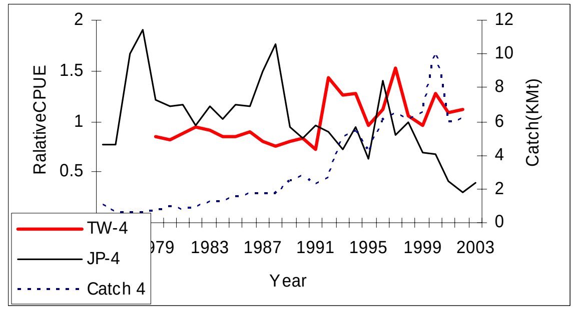


Figure 4: *Areas used in the CPUE standardization for the Japanese and Taiwanese fleets.*





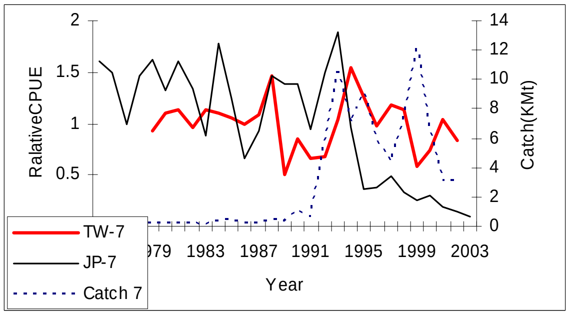


Figure 5: *Total catch and standardized CPUE trends (rescaled to their average) for the Japanese and Taiwanese fleets in areas 3 (equatorial western), 7 (south western) and 4 (equatorial eastern). areas are shown in Figure 4.*

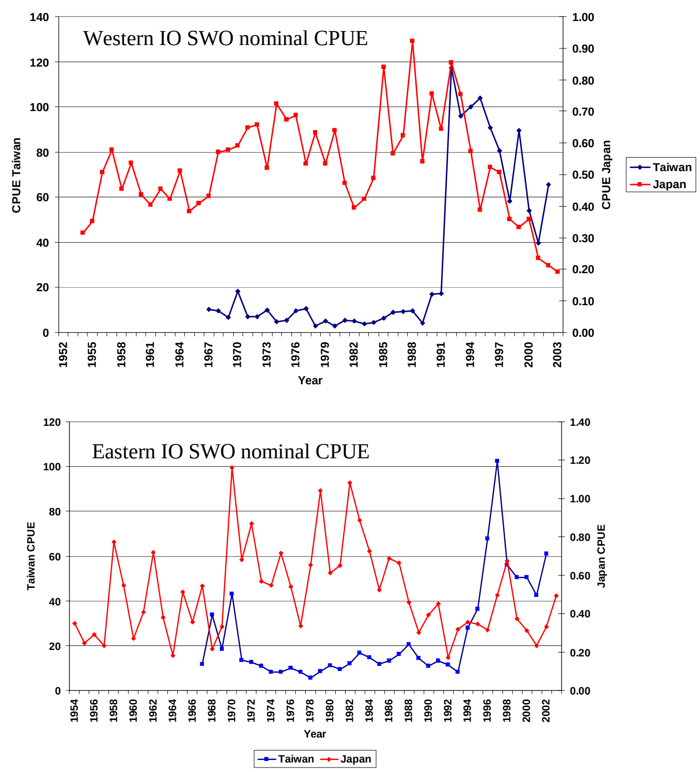


Figure 6: *trends of the Taiwanese and Japanese fleets CPUE in the western and eastern areas in Indian Ocean. Areas are shown in Figure 2.*

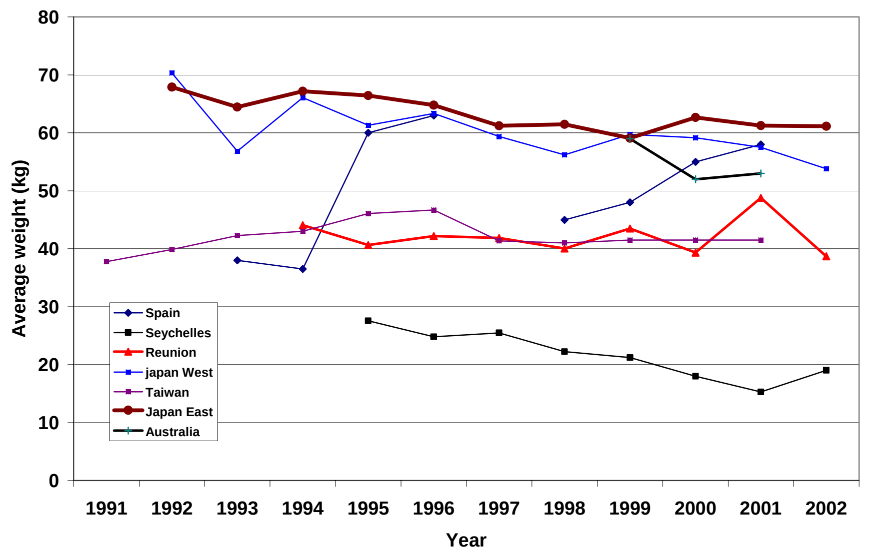


Figure 7: *Trends in average size of swordfish in Indian Ocean fisheries.*

APPENDIX VII
CURRENT RESEARCH RECOMMENDATIONS AND PRIORITIES BY IOTC WORKING PARTIES

Tropical Tunas

(from IOTC-2004-WPTT-R)

Note: no RR&P were given by the WPTT in 2005

General

- The WPTT noted recent work to better interpret longline CPUEs for tunas and tuna-like species, and in particular, better understand the factors that influence them. However, there is still considerable work to be done in this area and scientists are encouraged to continue their work.
- The WPTT also noted the general lack of CPUEs indices for all surface fisheries (e.g. purse seine, baitboat, gillnet), and urges researchers to develop these indices, and thereby improve understanding of the changes that occur in the juvenile components of the stocks.
- To improve understanding of both the impact of tuna fishing on the ecosystem functioning and the consequences that climate changes may have on ecosystem structure and hence on tuna stocks, WPTT recommended that ecosystem modelling including detailed tuna population dynamics be attempted for the Indian Ocean. Research on the influence of top predators on ecosystem functioning including field work, retrospective data analysis and modelling is also encouraged. Researchers interested in this area of work should be aware of (and if possible, collaborate with) the international project GLOBEC-CLIOTOP (refer to Section 7).
- Scientists are encouraged to continue to collect information on predation, to incorporate the effects of the predation into stock assessments, and to develop research on possible mitigation measures.
- Considering the extraordinary large catches of yellowfin in 2003, the WPTT expressed its desire to better understand the situation, and encouraged researchers to enhance the catch, effort and size databases for this species, specially for the major artisanal fisheries e.g. Yemen.
- As many stock assessment new models often take days to be tuned and run, the WPTT stressed the importance of getting all data in advance of the annual WPTT meeting so scientists can prepare their assessments in good time. The WPTT proposed that all the complete set of 2003 data be made available to the Secretariat by the end of February 2005.

Statistics

- All parties with significant gillnet fisheries catching tropical tunas are requested to make every possible effort to collect detailed catch, effort and size frequency statistics on their fisheries and to improve the flow of information to the IOTC Secretariat.
- The WPTT recommended that the IOTC Secretariat continue its efforts to retrieve historical records on logbooks as well as individual weights of tuna and tuna-like species from landings of fresh tuna longliners to Indian Ocean ports.
- All parties with longline vessels fishing for tropical tunas in the Indian Ocean are requested to make every possible effort to improve their logbook and size sampling coverage.
- The WPTT noted that good progress has been made through the IOTC-OFCF Project to describe the data collection and processing systems for tropical tuna species in a range of countries. The WPTT strongly recommended that the IOTC-OFCF Project be continued, given the success of the Project to date.
- The WPTT encourages all countries reporting statistics to the IOTC, to provide summary descriptions of how the catches and/or effort and/or size frequency were generated for each fishery, as well as a description of the data collection and processing systems for tropical tuna species implemented in their country.
- The WPTT noted with satisfaction that some countries have started to collect information on discards, and reiterated their request to other parties having fisheries likely to have tropical tunas discarded, to improve the collection and reporting of discard statistics to the IOTC.
- The WPTT stressed the importance of obtaining statistics from the former Soviet Union purse seiners, and encouraged all parties to contribute in any way to obtain these.
- The WPTT acknowledged the research contribution from Taiwanese scientists and especially welcomed the plan to improve the data quality of their fisheries data, as they are an essential component of the data needed for the assessment of tuna resources in the Indian Ocean.
- The WPTT recommended that a the Secretariat conduct a mission to Yemen, possibly under the auspices of the IOTC-OFCF project, to improve the knowledge on its fisheries.

Stock Assessment

- While some progress has been achieved, all scientists are encouraged to continue research on the standardization of longline CPUE, including studies to differentiate regular and deep longline sets, estimate the changes in fishing efficiency, improve the knowledge on targeting practices by skippers, and examine the effects of environmental factors.

- The WPTT also noted the necessity to get more information on historical and recent changes in fishing practices and gear technology for all fisheries, including the use of FADs and electronic equipment. This will enable researchers to better evaluate the relationship between CPUEs and abundance.
- Scientists are encouraged to continue research to develop reliable indices of abundance for tuna associated with fish aggregating devices.
- The WPTT noted the programmes being set up by EU and Australian scientists to develop operational models and simulation models, and encouraged their application to Indian Ocean tropical tunas.
- The WPTT noted recent and ongoing work to estimate biological parameters such as growth and sex ratio, and encourages researchers to continue work in this area.
- The WPTT encourages researchers to include ecosystem information into stock status evaluations.
- The WPTT encourages researchers to examine the spatial distributions of tropical tunas in the Indian Ocean in order to better define tropical tuna habitats.
- As new stock assessment models (such as MULTIFAN CL) are highly dependant on a large range of input parameters and flags (how the model is structure, which parameters are estimated and how penalties are dealt with). The WPTT recommend that a small group of scientists be convened to assist in the preparation and definition of the inputs and flags to be used in such stock assessments models.

Tagging

- The WPTT noted the good progress of the IOTTP, as well that as of the various pilot and small scale tagging operations promoted and planned by the IOTC in various countries. And encouraged researchers to continue there work on this topic as tagging results will be essential to run an improved and more reliable stock assessment of BET, YFT and SKJ stocks in the Indian Ocean.
- The WPTT recalled its previous recommendation that it will be essential to run the tagging operations in both sides of the Indian Ocean simultaneously and at equivalent levels; and noted the need for a large scale tagging programme in the eastern Indian Ocean.
- The WPTT also supports the various technical recommendations by the WPT that promote the efficient planning and implementation of tagging operations, as well as of recovery of tags and data analysis. The WPTT also reiterated the need to obtain the active cooperation of all the countries involved in the Indian Ocean tuna fisheries.

Bigeye Tuna

- The WPTT recommended that researchers to continue to progress the development of a standardised CPUE for the Taiwanese longliners using the two approaches determined by the small working party and outlined in Appendix V.

Yellowfin Tuna

- Taking note of the problems which arose during the last yellowfin working group regarding the models used/agreed, and in order to improve the efficiency of the next assessment, the WPTT encourages scientists to agree on the methods and inputs to be used and prepare this work before the venue of the working group.
- Taking note of the extraordinary catches of yellowfin observed in 2003, the WPTT expressed its concern on the consequences it may have for the stock and consequently recommends that the following actions be implemented:
- Carefully follow the yellowfin catches by size taken by purse seiners and as far as possible by longliners in 2004.
- Update the biological information on yellowfin growth, spawning and sex ratio at size in the eastern and western Indian Ocean.
- Build a database with environmental information (sea surface temperature, thermocline depth, phytoplankton, Natosquilla, others?) in the western Indian Ocean and analyse this data base (including results from models) in order to understand the origin of the large yellowfin catches in 2003.
- Understand and evaluate the potential effects on the European Union purse seiners efficiency (for FAD and free schools) of the new long range sonar.
- Estimate the potential recent changes in year class strength of yellowfin.
- Evaluate the changes in the 2003/2004 overall geographical distribution (from longline, purse seine and artisanal fleets data) of adult yellowfin stock and identify concentration areas in the western Indian Ocean, as this concentration may tend to increase catchability.
- Analyse and synthesize all the hypothesis that could explain the very high 2003 catches of yellowfin.
- Run a full stock assessment that will evaluate the yellowfin stock status in 2003, including a retrospective analysis.
- Further research on methods leading to the standardization of longline (regular and deep longline differentiation, targeting, changes in fishing efficiency) and purse seine (FAD vs. free schools, changes in fishing efficiency) CPUEs needs also to be done in the case of yellowfin.

Skipjack Tuna

- An important potential problem in the skipjack fisheries is the interaction between industrial and artisanal fisheries, in particular between the western Indian Ocean purse-seine fishery and the Indian and Maldivian baitboat fishery. Countries with artisanal fisheries for skipjack tuna should make a special effort to submit data on these fisheries to the IOTC in order to improve understanding of the interactions. However, the WPTT recognizes that only a tagging programme would provide the necessary data to better estimate the level of the interactions.

Bycatch

(from IOTC-2005-WPBy-R)

Workplan

1. Data
   - Further develop the IOTC catalogue on non-tuna data holdings (including socio-economic data) by members (to be undertaken by the Secretariat). Cooperation is sought from members to provide the required information on data holdings.
   - Comment on the potential of the available bycatch data to develop estimates of bycatch catch rates for the wider Indian Ocean and/or specific regions (to be undertaken by the WPBy for the next meeting)
2. Current state of knowledge
   - Review the current state of knowledge (including biology, catches, stock status) on bycatch species/species groups, particularly sharks, seabirds and sea turtles (to be undertaken by the WPBy for the next meeting)
   - Ongoing work to identify species/species groups of concern by regions and gear-type (to be undertaken by the WPBy for the next meeting)
   - Describe the types of information required to improve knowledge; how such information might be obtained (to be undertaken by the WPBy for the next meeting)
   - Encourage further development of pelagic ecosystem models for the Indian Ocean incorporating tuna and key bycatch species and species groups
3. By the 2006 Scientific Committee meeting (as per the Commission's 2005 resolutions and recommendations)
   - Develop preliminary advice on status of key shark species and propose a research plan and timeline for a comprehensive stock assessment (see above).
   - Review ratios of fin to body weight of sharks

Recommendations

4. Members are encouraged to submit all relevant data on bycatch to IOTC Secretariat
5. Recognising that the best opportunities for obtaining accurate data on bycatch are likely to come from observer programmes, the WPBy strongly encourages further collaboration between observer programmes and expansion and implementation of new observer programmes for the Indian Ocean.
6. Bycatch species specialists should be encouraged to participate in the WPBy.
7. Noting paragraph 1 of IOTC Recommendation 05/09, the WPBy encourages a collaborative and regional approach to dealing with incidental seabird mortality.

Billfish

(from IOTC-2004-WPB-R)

Swordfish stock structure and tagging of swordfish

The WPB considered tagging swordfish as being of key importance to determine realistic hypotheses concerning stock structure. Genetic results are clearly of great interest, but they cannot be used to make realistic hypotheses on movement rates between strata. It was recognized that tagging of swordfish is a difficult and expensive task. However, taking into account the absolute need to validate growth and to determine stock structure, the WPB strongly recommend conducting swordfish tagging in the IOTTP (as was planned in the original IOTTP).

Such tagging could be done in various ways such as: Scientific tagging, primarily with electronic tags, using small rented longliners with short sets of few hooks. Encouraging longline fishermen to tag small swordfish. Such tagging is already conducted in Australia and could be done by observers. .

Swordfish growth

The WPB recommended researchers to try to validate the growth studies already done, and to conduct similar comparative studies in other areas.

Size data analyses

The following additional analyses of Taiwanese size data are recommended:

- Comparison of size frequency distributions for Areas 3 and 7,
- Conversion of lengths to ages using different assumptions on sex ratios at size/age.
- Examination of trends in the 90% quantile for the whole Indian Ocean and specifically for Areas 3 and 7.

Where size data are available for other fisheries the trends in size over time should be similarly examined.

Stock status indicators

Further research is recommended concerning the definition and estimation of stock indicators that reflect the status of stocks of billfish species. Special attention should be given to the choice of indicators which could well measure changes in abundance of older fishes (which are the first to disappear in case of overfishing) and changes in the geographical patterns of the fisheries. The various stock indicators recommended by the WPB in 2001 should be calculated in advance of the WPB meeting in cooperation between scientists from fishing countries and the IOTC Secretariat; and these indicators should be available at the beginning of the WPB meetings.

Analysis of apparent movement of swordfish based on fishery data

The analysis of size specific CPUE by sex and by time and area strata, together with biological data on feeding, sex ratio, reproductive condition etc offer potential to evaluate the apparent movement and stock structure of swordfish. These studies are highly recommended.

Stock assessment – CPUE Standardization:

Following analyses at the 2004 WPB the following further efforts towards standardization of the CPUE series from Taiwanese fleet are recommended, including:

- Improving the definition of variables that could be used as a proxy for targeting.
- Consideration of alternative ways of combining area-specific indices into a global index using different weighting schemes.
- Consideration should be given to defining area strata that take into account environmental factors and fishery distribution and characteristics.

Given the importance of these recommended actions to the swordfish assessment, the WPB encourages a collaborative approach to the work be taken.

- Efforts should be made to provide additional CPUE series from other fisheries (e.g. La Réunion, Seychelles) for the next WPB.
- Stock assessment – Modelling: Ideally, at the next WPB a suite of different types of stock assessment models (including stock production and simple size-based models) should be applied to the available data. The IOTC Secretariat and the WPB Chair should assist in the co-ordination of stock assessment efforts before the next WPB meeting.
- Research on biology of Istiophorids
- The WPB recommended that following research on istiophorids be undertaken.
- Genetic studies of the main istiophorid species, concentrating on obtaining robust sample sizes from widely separated locations in the Indian Ocean. If genetic studies cannot commence in the near future, samples should still be collected and preserved.
- Hard parts from billfish (marlin, sailfish) should be collected and preserved for future age estimation studies. The third (largest) anal spine is probably best for this purpose, but this needs to be verified for each species (with respect to the extent of the matrix in larger fish).
- Popup satellite tagging experiments should be conducted on blue ,black and striped marlins to provide information on many aspects of their biology, including long-term vertical behaviour, movement and mixing rates.
- Increased tagging of billfish in the Indian Ocean should be encouraged on an opportunistic basis. This may be achieved through a coordinated, Indian Ocean wide sport fishery tagging programme, if initiated, as recommended by a recent IOTC consultancy. The forthcoming IOTTP will ensure widespread publicity and offers of rewards for tag returns, enhancing such a sport fishing based tagging programme.
- Improved catch and effort statistics should be collected for artisanal fisheries of coastal countries with the help of IOTC and of the IOTC-OFCF project. This applies to all Istiophorids, but especially sailfish in areas of high recent catches such as Sri Lanka, Iran and Indonesia.
- Selected catch and effort statistics should be collected from key billfish sport fishing areas to provide CPUE indices.
- Selected indicators of stock status should be better identified, selected and prepared before the next WPB meeting and be made available to the WPB allowing to evaluate stocks trends, independently of stock assessments analysis.

Temperate tunas

(from IOTC-2004-WPTMT-R)

Data

The following problem areas were identified in the IOTC database 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.
- Lack of catch and effort data for the Taiwanese fleets for the area between 20-30°E for the whole time series.
- 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 1980s.
- Lack of accurate catch, effort and size-frequency data for the Indonesian longline fishery in recent years.
- Poor knowledge of the catches, effort and size-frequency data for non-reporting purse seiners.

Biology

- The WPTMT recommend that review of existing age and growth information be undertaken with a view to obtaining robust information for input into an albacore stock assessment. If the existing information is uncertain then new work to estimate age and growth should be carried out.
- The stock structure of albacore is uncertain. It is possible that mixing occurs between the Indian Ocean and south Atlantic Ocean populations. The WPTMT noted the need for a large scale tagging program, including archival tags, in the Indian Ocean, and possibly incorporating with other fishery organizations, ICCAT. Tagging program may also provide important information to the knowledge of albacore migration in the Indian Ocean.
- Study related to the maturity of albacore is strongly encouraged by the WPTMT.

Stock assessment

- The WPTMT acknowledged the effort made to collect length information by many fishing entities, and strongly encouraged them to carry on the collection and to improve their data quality. The WPTMT also noted the need for evaluation of these length data before further application.
- The WPTMT acknowledged the importance of age structure information to stock assessment, and strongly encouraged all scientists and fishing entities to carry on constructing the catch at age and age specific abundance indices, based on the evaluated size data and size at age information.
- The WPTMT acknowledged the research contribution from Taiwanese participants, particularly for their effort in the improvement of data collection and analyses, as these are essential components for the assessment of the Indian Ocean albacore tuna resources.