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Seventh Session

Victoria, Seychelles, 2 - 6 December 2002

REPORT OF THE FIFTH SESSION OF THE SCIENTIFIC COMMITTEE

OPENING OF THE SESSION

1. The Fifth Session of the Scientific Committee of the Indian Ocean Tuna Commission (IOTC) was held at the Victoria Conference Centre in Victoria, Seychelles, from the 26th to the 29th of November 2002. It was attended by 30 delegates from 11 IOTC Members, as well as five observers from member countries of FAO or other UN agencies and intergovernmental organizations. Dr Shui-Kai Chang attended as invited expert. The list of participants is reproduced in Appendix I.

2. Mr. Renaud Pianet of France, Chairman of the Scientific Committee, chaired the Session. Mr. Pianet welcomed the delegates and noted the large amount of work to be done in the short time available.

ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION (IOTC-SC-02-01)

3. The Scientific Committee adopted the Agenda as presented in Appendix II of this report. The documents available are listed in Appendix III.

ADMISSION OF OBSERVERS

4. In conformity with the decision of the Third Session of the Commission on the admission of observers, the delegates WWF[1], ICCAT[2] and FFA[3] (international organization) were admitted. The Chairman then invited the delegates to introduce themselves.

PROGRESS REPORT OF THE SECRETARIAT (IOTC-SC-02-02)

5. The Secretariat presented IOTC-SC-02-02, outlining staff changes, the core activities of acquisition, processing and dissemination of information pertinent to the tuna fisheries of the Indian Ocean, as well as a work-plan for the year 2002.

6. The acquisition of information remained the main focus of the Secretariat's activities throughout the year. Requests for submission of the mandatory data were sent to all Member and non-Member countries and new data were entered in the databases. Additional data validation procedures were developed, which allowed the identification of various problems in specific datasets. Some of these problems were resolved after contacting the data correspondent for the party concerned.

[1] World Wildlife Fund
[2] International Commission for the Conservation of Atlantic Tunas
[3] Fisheries Forum Agency

7. The execution of sampling programmes in Thailand and Malaysia continued during 2002. The inception of sampling programmes since March in Sri Lanka and April in Indonesia will help to complete past and current information on non-reporting longliners operating in the Indian Ocean. More details on these programmes are given under point 5.

8. The development of specific procedures for data entry and validation continued during 2002. New procedures were also created for the preparation of reports and datasets for the Working Parties. The preparation and processing of historical information continued, including major reviews concerning the vessel record database and re-estimation of catches of non-reporting fleets. The Secretariat also carried out statistical analyses and data modelling to assist the work of the Working Parties.

9. The development of the IOTC statistical software, WinTuna, continued during 2002 and is now fully operative. Modules were adapted to be used for the IOTC sampling programs. A training session on WinTuna was held in Seychelles in August, under the framework of the IOTC/OFCF project, and follow-up training was provided for data entry operators in Indonesia, Thailand and Mauritius.

10. The Secretariat was involved in a number of activities related with coordination and technical support for the Indian Ocean Tagging Program. IOTC staff were involved in logistic support, hiring consultants, for purchase of equipment and coordination of several pilot tagging experiments and preparation of further proposals of funding of tagging projects. The Secretariat contributed to the preparation of reports on the status of IOTC species and on the survey of predation of longline-caught fish. Support was also given to the Working Parties held in 2002 through the preparation of standard reports and datasets, presentation of documents and editing of the reports of the Working Parties.

11. Activities related to the dissemination of information were carried out as in previous years with the publication and diffusion of data products, proceedings and reports of all the Working Party meetings. The IOTC website was redesigned to expand and improve access to its contents. In addition to all the Working Party and Committee reports, the website now includes electronic versions of virtually all the scientific papers presented to the Working Parties and recent Expert Consultations. These papers have also been published as the Proceedings of the IOTC Working Parties in a CD-ROM format.

12. The Secretariat presented its work plan for 2003, noting that, in addition to the core activities, the start of the Indian Ocean Tagging Program and the likely extension of the IOTC/OFCF project will considerably increase the workload of the Secretariat.

13. The Committee congratulated the Secretariat on the amount and quality of the work performed during the last year, in particular considering the small number of staff working in the Secretariat, and endorsed the plan of work for the year 2003.

14. The Committee noted that several of the IOTC publications are only distributed in electronic format, recognizing that this may affect the dissemination of the information to several developing countries in the region. It was agreed that the distribution of hard copies of the IOTC publications to selected countries would be needed to allow them to access to the new information available.

15. The Committee recommended that the Secretariat assess the number of countries that would be interested in receiving printed versions of the IOTC publications instead of or in addition to the electronic copies available, informing the Commission at its subsequent meeting on the budgetary implications that this would involve.

16. The Committee noted that, as it had anticipated during the meeting last year, the workload on the Secretariat during 2002 has increased due to the planned execution of various field activities. This situation is expected to worsen during 2003 as the field activities will expand even further, more Working Parties meetings are scheduled than in 2002 and additional responsibilities are expected to be added.

17. In this respect, the Committee recognized that monitoring of the Bigeye Tuna Statistical Document programme and the establishment of a Control and Inspection Committee in 2003 will require the development of new databases and reports from the Secretariat. The execution of pilot studies and small-scale tagging projects planned for 2003 will also require direct support from the Secretariat. Furthermore, more preparatory work will be required from the Secretary in support of the species Working Parties in 2003.

18. At the current staffing level, the Scientific Committee believes that the Secretariat will have to reduce its involvement in activities essential to address the mandate of the Commission. Therefore, the Committee strongly recommended that the Secretariat staff be increased by recruiting two additional professional posts in 2003, one at a P-4 and one at a P-3 level. These new posts are considered essential to complete the tasks which have been assigned by the Commission and the Scientific Committee.

19. The Committee further agreed that the involvement of scientists from member countries in the completion of several short-term activities at the Secretariat could be of mutual benefit. In this context the Committee recommended that all Members and Cooperating Parties of the IOTC consider the assignment of scientists to short-term projects to be carried out at the Secretariat. This, it was considered, would have funding implications as, although the salary of the seconded personnel would be paid by the parent institutions, travel and subsistence funds would presumably have to be provided by the Commission.

PROGRESS REPORT OF THE IOTC-OFCF PROJECT (IOTC-SC-02-08)

20. The Secretariat informed the Committee on the activities carried out under the scope of the IOTC-OFCF Project during its first year of operation. The Project funds become available on April 1st and two OFCF[4] Experts arrived to Seychelles on 18th April.

21. The Secretariat informed the Committee that the implementation of a catch monitoring scheme in Indonesia in cooperation with local (DGCF[5], RIMF[6]) and foreign institutions (CSIRO[7]-ACIAR[8]) had taken most of the time and resources of the Project. The activities started with the creation of a Steering Committee in February and continued throughout the year, involving several trips of IOTC and OFCF staff to the country. The main objective of the Project is the collection of information on the activities of fresh-tuna longliners in Indonesia. Sampling is conducted in the ports of Jakarta, Benoa and Cilacap where this fleet lands its catch and lists of licensed vessels and vessel activity records are collected from the DGCF and port authorities.

22. The Secretariat noted that more than 50,000 fish had been monitored in only two months of operation, with valuable biological information collected at the same time. Vessel lists and activity records have also been collected as planned.

23. Other activities during 2002 included a training course on WinTuna for users and administrators held in Seychelles in August, involving twenty participants from ten countries, the extension of the IOTC sampling in Thailand, the provision of computer equipment, implementation and training on WinTuna in Mauritius and preliminary arrangements with the authorities of the Sultanate of Oman to extend the sampling program to include length-frequency measurement of yellowfin tuna caught by its fisheries.

24. The Secretariat proposed that the activities during next year should concentrate on the monitoring of the on-going projects, transfer of the sampling programme in Sri Lanka to the IOTC-OFCF project and start of sampling in Oman. Description of the fisheries and the data collection and processing systems of selected countries in the region will be followed by a Regional Workshop on Statistical Systems, scheduled to be held in Seychelles in the last quarter of 2003.

25. The Committee commended the OFCF for the considerable progress achieved during the first year of operation of the Project. The Committee noted that the amount of data collected in the scope of the Project was of utmost importance and considered that its extension will further improve the cooperation between coastal countries and the IOTC and boost the collection of relevant fisheries data.

26. The Secretariat confirmed that the port sampling included sampling of non-target species, including sharks. The Committee recommended that the sampling of by-catch from fresh-tuna longliners be continued

[4] Overseas Fishery Cooperation Foundation of Japan
[5] Directorate General of Capture Fisheries
[6] Research Institute of Marine Fisheries
[7] Commonwealth Scientific and Industrial Research Organisation
[8] Australian Centre for International Agricultural Research

in order to assess the amounts of NTAD[9] species caught by this fleet. However, the Committee noted that there are difficulties to conduct the sampling of sharks in the context of the IOTC-OFCF project.

PRESENTATION OF NATIONAL REPORTS

27. The following National Reports were presented to the Scientific Committee and discussed : IOTC-SC-02-Inf1 (EC-France), IOTC-SC-02-Inf2 (UK), IOTC-SC-02-Inf3 (Korea), IOTC-SC-02-Inf5 (EC), IOTC-SC-02-Inf7 (EC-Spain), IOTC-SC-02-Inf8, (Japan), IOTC-SC-02-Inf9 (China), IOTC-SC-02-Inf10 (Mauritius) and IOTC-SC-02-Inf11 (Thailand).

28. In addition, India and Seychelles provided the Scientific Committee with verbal updates of their National Reports. The invited expert provided a summary of the current situation of the fishery from Taiwan,China. The abstracts of the documents and verbal updates are included in Appendix IV.

29. The Committee noted that the EC programme to monitor the catches of non-targeted, associated and dependent species on European purse seiners and longliners will be useful to estimate the catches of species that are not usually available from logbooks.

30. To a question on the current sampling of purse seiners under flags other than EC operating in the Indian Ocean the EC delegate indicated that part of this fleet was sampled in the same way as the Spanish fleet.

31. The Committee stressed the importance of the data collected by UK observers on purse seine and longline vessels operating within the BIOT[10](Chagos Archipelago) FCMZ[11] for the estimation of catches of non-target, associated and dependent species and discards. It was noted that the high catch rates of non-targeted species on longliners might have implications for the interpretation of the catch rates of target species due to the decrease of the number of hooks available.

32. The Scientific Committee noted with satisfaction that Korea has taken measures to improve the collection of size frequency data. Questions were raised as to the reasons for the marked reduction of the longline fleet in 1991; however a clear answer does not seem to be available at the time.

33. It was remarked that predation of tunas in the Mauritian longline fleet is mainly the result of pilot whales, however, it was indicated that it is sometimes difficult to distinguish between this species and false killer whales. The Secretariat suggested that cetacean identification sheets designed by the Zoological Society of Paris would help fishermen in the identification of this kind of predator and that it could be produced on waterproof material for distribution.

34. It was noted that, in the past, some catch and effort, as well as size frequency data from the Indian fleets have not been made available to the Secretariat because the data were being used by scientists from a number of institutions. It was indicated that corrective actions have been taken on this issue and that India will submit this information to the Secretariat in the near future.

35. The Scientific Committee remarked that Seychelles, in spite of being a small fishing country, was very important in terms of strategic location and the activity of foreign fleets. The efforts and achievements of this country to improve their data collection systems are commended and appreciated.

Guidelines for the National Reports

36. The Scientific Committee discussed a set of guidelines for the preparation of National Reports, attached as Appendix V. The proposed guidelines include four sections covering (i) general fisheries statistics, (ii) progress on the implementation of recommendations of the Scientific Committee, (iii) progress on national research programs currently in place, and (iv) any other relevant information. The Scientific Committee adopted the guidelines proposed by the Secretariat, indicating that national reports should emphasize sections (ii) and (iii), since the national fisheries statistics are already presented and discussed in detail during the WPDCS. In addition, it was agreed that the section (i) should, as much as possible, be limited to the five

[9] non-target, associated and dependent species
[10] British Indian Ocean Territory
[11] Fishery Conservation and Management Zone

most recent years and that, if necessary, short descriptions of the results of national research programs could be included in section (iii). The guidelines will be posted in the IOTC website.

REPORT OF THE WORKING PARTIES

Report of the Permanent Working Party on Data Collection and Statistics (WPDCS) (IOTC/SC/02/03)

37. The Third Meeting of the Working Party on Data Collection and Statistics took place in Mahé, Seychelles on November 25th 2002 with the participation of 23 scientists from various countries.

38. The WPDCS reviewed the situation of the data holdings at the Secretariat, noting improvement in several areas, including the retrieval of important historical datasets from several countries, better estimation of the catches of fresh-tuna IUU vessels, progress in the sampling programmes in Thailand, Malaysia and Sri Lanka and the implementation of a sampling program in Indonesia under the scope of the IOTC-OFCF Project. At the same time, it was noted that there is still no information reported about the fleet of IUU deep-freezing longliners and the former-Soviet purse-seine vessels that continue to operate in the Indian Ocean. The situation of the data holdings for nominal catches and catch-and-effort data has improved considerably in the past year, although the scarcity of size-frequency data from the longline and artisanal fisheries continues to be a major impediment for the application of rigorous stock assessment.

39. Regarding the situation by groups of species, the WPDCS noted the following:

- Tropical Tunas: Problem areas include the poor knowledge of catches and effort of IUU vessels and the lack of size-frequency information for these IUU vessels and the Taiwan,China, longline fishery, the latter since 1989. The WPDCS noted the improvements in the levels of catch reporting, collection of vessel registry information, estimation of IUU catches, estimation of Indonesian longline catches, recovery of historical data and establishment of new sampling programmes by the Secretariat.
- Billfish: Species aggregation, mislabelling, underreporting and non-reporting are widespread problems, indicating that, although data in the Secretariat's database are considered accurate and reliable for minor fishing entities, they are far from complete. The lack of size frequency statistics from Taiwan,China since 1989 is of concern.
- Neritic Tunas: Reporting of catches of neritic tunas has also been incomplete. In recent years catches have not been reported or were reported aggregated for many Indian Ocean coastal countries. Catch and effort and size frequency statistics for these species are conspicuously absent from the IOTC database because they are rarely included in the data submissions. It is thought, however, that many countries may have collected information for these species.
- Temperate tunas: The quality of the reporting of catches and effort for albacore has been declining since the mid-eighties, in proportion with the increase of IUU longliners operating in the Indian Ocean. Nevertheless, the completeness of the catch and catch-and-effort data is still good. In contrast, the size frequency statistics are poorly represented, because of the lack of reporting by Taiwan,China (since 1989) and IUU fleets.

40. The Committee noted the progress achieved in different areas since its last meeting and commended the Secretariat for its effort to achieve these results. Nevertheless, the Committee stressed that, in spite of the progress, the availability and quality of the statistics gathered at the Secretariat was still very low for several species, periods and fleets, this hampering the work of the Working Parties.

41. The Committee stressed that the timeliness of data submissions must be improved and encouraged countries to provide their data before the stated deadlines. This is important to ensure that the Secretariat can process this information in a timely manner for the activities of the Working Parties.

42. The Committee expressed its satisfaction to learn that the catch-and-effort and size-frequency data from Taiwan,China will be made available for collaborative studies to be presented the nest species Working Parties, and will be submitted to the Secretariat afterwards.

43. The Committee also strongly recommended that Japan and Korea make every possible effort to increase the sampling effort to ensure that the size-frequency samples are representative of the size distribution of the catch.

44. The Committee expressed further concern regarding the extensive lack of catch and effort and size frequency statistics for important artisanal fisheries, especially those operating gillnets.

45. The Committee agreed that the Secretariat should make every possible effort to produce previous year catch estimates for the Working Parties.

46. The Committee noted with satisfaction that, in line with its previous recommendations, several national observer programmes are being planned or already implemented. These programmes will allow the estimation of bycatch and discards in the main industrial fisheries.

FAO Expert Consultation on Harmonization of Catch Certification (IOTC-SC-02-09)

47. The Secretary reported on a meeting held from 9 to 11 January 2002 in La Jolla, California. The meeting recognized that there were currently two forms of catch documentation schemes in use by different regional fishery bodies, categorized respectively as "catch" and "trade" documentation schemes. These two schemes are distinguished by the fact that catch documentation should be delivered immediately following authorized fishing activities and covers fish landed or transhipped and traded within a country, whereas trade documents are delivered when the fish is landed or transhipped and only applies to fish traded internationally.

48. Trade documentation schemes such as the IOTC Bigeye statistical documentation scheme do not provide an exhaustive enumeration of the bigeye tuna caught by longline fisheries. The main value of such a scheme resides in the possibility of identifying all the vessels catching bigeye tuna. This is of particular importance in the case of longliners that tranship their catch at sea and may never pass through the port of an Indian Ocean coastal country, thus escaping enumeration in the Vessel Record.

49. At a minimum, therefore, the Scientific Committee recommended that the Commission should envisage a requirement for all the information accompanying each shipment of bigeye tuna from Contracting as well as non-Contracting Parties to be transmitted to the Secretariat, notably the elements identifying the vessel. Inclusion of the vessel trip dates (beginning and end of each trip), fishing area, gear used, and landing or transhipment date on each document would provide valuable additional information on the activity level of each vessel concerned. This information will allow identifying whether the catches originate from the Indian Ocean.

Report of the Working Party on Methods (WPM) (IOTC-SC-02-04)

50. For logistic reasons, the meeting of the ad hoc Working Party on Methods (WPM) was held as a sub-group of the Working Party on Tropical Tunas. It was convened on June 3rd 2002 in Shanghai, China. The chairman of the Working Party presented the report (Document IOTC-SC-02-04).

51. The agenda of the WPM concentrated on four main issues, namely (i) review of existing applications of operating models, (ii) review of stock status indicators, (iii) review of procedures for raising size frequency and catch-and-effort data and (iv) methods for standardizing catch-and-effort data.

52. The WPM reviewed a number of previously used status indicators and identified other additional contenders. It was considered that status indicators must be tested for robustness before recommendations can be made. The use of an operating model together with a protocol for testing was suggested as a possible way to achieve this.

53. The WPM identified several important issues encountered when applying GLMs to standardize CPUE data and drew them to the attention of the WPTT.

54. It was agreed that, in the case of IOTC, the main priority for an operating model should be the evaluation of robustness of stock indicators, CPUE standardization procedures and assessment methods. A small group was assigned to work intersessionally on identifying existing operating models, evaluating their suitability for use in IOTC and identifying areas for further (or new) development of models. Due to limitations of staff and time, the Secretariat was able to achieve little development in this area. However, the Scientific

Committee was informed of three new operating model projects being developed by CSIRO, and by CCSBT (used to test the robustness of the stock assessments of SBT), and by the EC (used for management strategy evaluation).

55. The Scientific Committee noted that the IOTTP would require a simulation model to evaluate the most effective number and location of tags. It was suggested that a consultant could be contracted to develop a core set of procedures that could be useful for the tagging program as well as an operating model.

56. The WPM considered that IOTC should be aware of initiatives in other non-tuna commissions regarding the adoption of an ecosystem approach, and recommended that information and developments be brought to the attention of the Committee.

Report of the Working Party on Tropical Tunas (WPTT) (IOTC-SC-02-05)

57. The Fourth Meeting of the Working Party on Tropical Tunas (WPTT) took place in Shanghai, People's Republic of China, on June 3rd-11th 2002. As instructed by the Scientific Committee, the WPTT gave priority to the assessment of yellowfin tuna. The Chairman of the WPTT introduced the report and executive summaries presenting the situation of the three species under its mandate.

58. The Scientific Committee commended the WPTT for the amount of work done, particularly considering the reduced time available for the meeting. It recognized that holding simultaneously three Working Parties meetings (WPM, WPT and WPTT) in the limited time available posed several logistic problems, which affected the ability of the WPTT to produce a final version of the report at the meeting. It was recommended that this be taken into consideration during the planning of the next Working Party meetings.

59. The Committee adopted the executive summaries for yellowfin, bigeye and skipjack tunas, which are listed in Appendices VI to VIII.

60. The Committee also noted the importance of including in the report a sufficient number of figures to illustrate main features of the fisheries and to display information relevant to the conclusions of the Working Party.

61. For reasons of scientific transparency and documentation of its work, the Committee considered important that it be possible to reproduce all the analyses performed during the meeting. To this effect, the addition of an Addendum to the report of the WPTT, containing detailed descriptions of the analyses carried out during the meeting by the participants, was welcomed by the Committee. The Committee also indicated that it was equally important that copies of the software used, together with the input files used and the output files generated be deposited with the Secretariat. This information would be subject to the same rules of confidentiality applying to special datasets made available to the Working Party.

Management recommendations:

Yellowfin tuna:

62. 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:

a. Total catches under current fishing patterns are close to, or possibly above MSY. Furthermore, catches by all main gears have been increasing both consistently and substantially in recent years. In these circumstances, any further increase in both effective fishing effort and catch above levels in 2000 should be avoided.

b. The current trend for increasing fishing pressure on juvenile yellowfin by purse seiners fishing on floating objects is likely to be detrimental to the stock if it continues, as fish of these sizes are well below the optimum size for maximum yield per recruit.

Bigeye tuna:

63. 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 remained high. Taking into account the results of the current assessments, which represent the best effort to date to analyse the available data in a formal context, it is

likely that current catches are well above MSY. Therefore, 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.

Skipjack tuna:

64. At this stage, the Scientific Committee has not made any specific management recommendation concerning skipjack tuna, as it appears that this stock is still in good condition.

65. The Scientific Committee was informed of two meetings to be held by ICCAT in the coming years related to the activities of the WPTT. The first is a worldwide meeting on bigeye tuna to be held in 2004 in Spain, and which is a follow up to the one that took place in 1996 in La Jolla. The second is a Working Group on environmental issues related to tuna, also to take place in 2004. The Scientific Committee agreed that both meetings are relevant to the work of IOTC and that interested scientists should make an effort to participate, particularly in the organization of the meetings.

Report of the Working Party on Tagging (WPT) (IOTC-SC-02-06)

66. A meeting of the WPT was held in connection with the 4th Working Party on Tropical Tunas in Shanghai, China, between June 3 and 11, 2002. The chairman of the Working Party presented the report, which summarizes the current situation of the tagging programmes, as document IOTC-SC-02-06.

67. Initial funding, which will amount to about US$300 000 annually, is available to the Secretariat for tagging, and a number of activities were initiated in 2002 with the involvement of tagging experts. These activities included pilot tagging (Mayotte and Seychelles) and the conduct of technical studies on specific problems, for example in relation to the issue of livebait resources which are essential for the effective conduct of future tagging.

68. Japan confirmed that will provide funding at a level of approximately US$80,000 per year, for a period of five years, subject to annual reviews.

69. The WPT expressed satisfaction on the progress achieved with the large scale tagging project, which will be funded by the EC at a level of €4.5 million, the funding request for which is being prepared by consultants to the *Commission de l'océan Indien*. The WPT noted that this exercise will be finalised towards the end of 2002.

70. The WPT also recommended the conduct, starting in 2003, of various pilot and small-scale tagging activities in countries that have been identified, using funds allocated to IOTC; these operations will have limited scientific objectives but are judged to be of substantial interest. These operations will be conducted in parallel with the large-scale tagging project which will be carried out with the use of a livebait pole-and-line vessel with EC funding. The WP also prepared a list of technical recommendations aimed at the effective conduct of tagging, for example related to livebait, publicity for tagging and tag recovery, tagging in sport fisheries, etc.

71. The WPT, while expressing satisfaction for the progress achieved towards implementing tagging of tunas in the Indian Ocean, was concerned that no tagging project has yet been identified in the eastern Indian Ocean. The WPT reiterated the recommendation made in 2000 and 2001 to the effect that it is essential to tag tunas in a coherent manner over the whole of the Indian Ocean if the objectives of the tagging programme are to be achieved.

72. Some concerns were expressed regarding the way tag recovery rates would be estimated. It was indicated that for purse seiners, EC observers could be used for seeding tags. It was agreed that it is necessary to produce a more specific plan of action on tag seeding when the IOTTP[12] is implemented.

73. Recovery rates for longliners could be estimated by comparing the rates from vessels where an observer is on board with those from vessels without observers. However, for this approach to be successful, the observer coverage rate needs to be sufficiently high.

[12] Indian Ocean Tuna Tagging Programme

74. Several alternatives were discussed for using live and dead bait. It was agreed that a project should be undertaken in Seychelles to study the possibility of locating and capturing live bait. In the eastern Indian Ocean, Indonesia is known to have a well-developed bait fishery which supports a pole-and-line fleet.

75. The EC reported on a new project, TAGFAD, funded by the EC at a level of €800,000 which will place archival tags on tunas associated with FADs. This project has received support from the fishing industry.

76. The Scientific Committee welcomed this initiative as well as the one presented in the report of the FADIO project (IOTC-SC-02-Inf4), indicating that results derived from these projects might be useful for the better understanding of the effects of FADs on Indian Ocean tuna stocks.

77. Preliminary simulation studies concerning tagging have been undertaken. They should be quickly finalized to allow optimizing future tagging operations. It was mentioned that funding from the EC has been requested for a three-month consultancy to develop a simulation model that would allow estimation of the number of fish that would be necessary to tag in order to achieve the goals of the programme. The Committee welcomed these initiatives and encouraged further work in this area.

78. The problem of publicizing the program, in particular at the level of artisanal fisheries, was also discussed. Posters on the objectives and methods of the IOTTP have been printed in English and French and are being translated to Spanish. Posters publicizing the rewards for tag recoveries have been designed and deployed in Mayotte and Seychelles. Scientists from China volunteered to translate these posters to Chinese. India indicated that they have public electronic boards that provide artisanal fishermen with weather and satellite-based fishery forecasts, and volunteered the use of these boards to advertise the tagging program to their fishermen.

79. The Scientific Committee commended the work of the Working Party on Tagging, indicating that a good deal of work has been done this year. It was noted that the situation of funds and resources to implement the project in the western Indian Ocean seems to be on good track. However, operational concerns may limit the possibilities of using these resources in the eastern Indian Ocean. It was agreed that, to ensure the effectiveness of the tagging project, it is necessary that tagging takes place in both areas. It is recommended that every possible effort be made to obtain the necessary resources.

80. The Scientific Committee also considered that it is necessary to create a small advisory committee for allocating priorities and resources for the pilot tagging projects. It was agreed that this steering committee should include the Chairpersons of the Working Parties on Tagging and Tropical Tunas, the Chairperson of the Scientific Committee and the Secretariat.

81. The Scientific Committee encouraged countries to assume responsibility at the national level for the tagging project through the development of their own tagging initiatives, by participating in the small-scale tagging projects and/or by providing funds for the project. In addition, it is important that countries make every possible effort to publicize the project and to ensure reporting of tag recoveries.

82. The Scientific Committee restated its strong support for the IOTTP. The Committee emphasized that no reliable assessment in the Indian Ocean could be achieve without a comprehensive tagging programme. This is a continuous cause for concern considering the continuous increases in tuna catches and the risk of overexploitation to some of the species.

Report of the Working Party on Neritic Tunas (WPNT)

83. The Secretariat informed the Committee that the Working Party on Neritic Tunas, that was expected to meet in Bandar-Abbas (Iran), had to be cancelled two weeks before the scheduled date, as only four scientists from the seventy contacted had confirmed their participation.

Schedule of Working Party meetings in 2003

84. The Committee recommended that the Working Party on Data Collection and Statistics be held in 2003 just before the sixth Session of the Scientific Committee to facilitate participation of scientists also attending that meeting. The Committee noted that the section of National Reports concerning summary fishery statistics was more appropriately discussed in the context of the WPDCS than in the Scientific Committee.

The Committee recommended that the duration of the WPDCS be extended to two days to deal with National Reports and that the SC meet on the four following days.

85. The Committee agreed that the Working Party on Tropical Tunas should meet for six days during the first two weeks of June 2003 in Seychelles, with priority given to skipjack tuna. The Committee agreed that new assessments of bigeye tuna be conducted only if time is sufficient.

86. The Committee agreed that the Working Party on Tagging should meet for two days immediately after the Working Party on Tropical Tunas, also in Seychelles.

87. The Committee agreed that there was no immediate need for the Working Party on Methods to meet in 2003. The Committee further agreed that the current *ad-hoc* work conducted on operating models should continue during 2003 and be revised by the WPM in 2004. The Committee was informed of a tentative meeting to be organized by ICCAT that will be held in 2003 to discuss on the development of integrated models in the context of its BETYP programme.

88. The Secretariat informed the Committee that new data on billfish, especially swordfish, is likely to be available in 2003. The Committee agreed that this justified that the Working Party on Billfish meet in 2003 in Seychelles. The Committee agreed that a five day meeting of the WPB be scheduled for September 2003.

89. The Committee agreed that the Secretariat should continue with the arrangements for the first meeting of Working Party on Neritic Tunas to be held in 2003. The Committee requested the Secretariat to contact the scientists in the region early next year to decide on the date and venue of the meeting.

90. The Committee noted with concern the low participation of scientists from coastal countries to Working Party meetings agreeing that this is in most cases due to lack of funding. The Committee suggested that the Commission should envisage funding the participation of key participants from developing Indian Ocean coastal States that have no alternative financing.

91. The Committee noted the high catches of albacore in recent years. The Committee requested the Secretariat to prepare a document on the status of albacore similar to that of the executive summary on skipjack tuna. The Committee agreed to evaluate the situation of this species at its 2003 meeting and to assess then the need for convening a meeting of the Working Party on Temperate Tunas.

92. The Committee also requested that the Secretariat invite CCSBT[13] to provide a short Executive Summary on the status of the southern bluefin tuna for the next session of the Committee.

93. The Secretariat informed the Committee that the catches of southern bluefin tuna have been updated in 2002 and are now in agreement with those held by CCSBT. The Secretariat informed the Committee on an invitation extended by the CCSBT for the IOTC Secretariat to participate in a meeting that will be held in April 2003. The current methods to estimate the catches of southern bluefin tuna in Indonesia will be reviewed during the meeting.

PROGRESS ON A SURVEY OF PREDATION OF LONGLINE-CAUGHT FISH (IOTC-SC-02-10)

94. The Secretariat presented document IOTC-SC-02-10 summarizing the progress on a survey of predation on longline-caught fish. The collection of information on this subject continued during 2002 and a considerable amount of data has already been gathered by various participants.

95. The Scientific Committee invited the countries involved in the survey of predation of longline-caught fish to report on the progress achieved during 2002.

96. Japan presented document IOTC-SC-02-12, containing a progress report on surveys of predation of Japanese longline-caught fish. In 1998 and 1999, the Scientific Committee recommended that predation of longline catches be further studied. Japan started the predation survey in September 2000, with the participation of about 450 longliners belonging to the Japan Tuna Federation. Since then, a total of 8,810 longline operations reported damage to tuna and tuna-like species from predators in the three oceans. The

[13] Commission for the Conservation of Southern Bluefin Tuna.

figures indicate that damage in the Indian Ocean, and particularly in the equatorial waters and off the south-east coast of Africa, are almost twice that in the Pacific and Atlantic Oceans. The average composition of predators involved is 35% toothed whales, 63% sharks and 5% other predators.

97. India presented document IOTC-SC-02-13 on the results of a study on predation of yellowfin tuna in the longline catches from Indian waters. This study involved two longline survey vessels operated by the Fishery Survey of India (FSI). One of the vessels operates in the Arabian Sea, while the other operates in the Andaman and Nicobar waters. Sharks are identified as the main predator. Observations seem to indicate that certain months (i.e. July in the Arabian Sea and May for the Andaman waters) show higher predation rates. The percentage of annual predation on yellowfin tuna was found to be 10.8% in the Arabian Sea and 5.5% around the Andaman islands.

98. The Seychelles are highly concerned, as predation by marine mammals represents a major economic loss for their semi-industrial longline fishery. Information on predation has been collected since the beginning of the domestic fishery in 1995. Since 1999, foreign longline fleets licensed in Seychelles have been supplied with modified log sheets so as to record the number of fish lost to predation by set. Predation rates reported for 2002 amounted to 12% of the catches, ranging between 10-15% depending on the species.

99. The EC informed that predation information has been collected in La Réunion since 1992, noting that pilot whales were the predators most observed. Funds had been allocated to study this subject and a Project will be starting by the first quarter 2003.

100. Mauritius reported surveys that indicate that marine mammal predation rates reach about 20% during the summer months, and is lower during the winter.

101. The Scientific Committee agreed that these studies are of great importance and encouraged participating countries to continue with this work. The Committee agreed that the amount of countries involved and data collected on predation justify the creation of a centralized database. The Committee recommended that all data available on predation be forwarded to the Secretariat and a database created and maintained to gather this information. Japan offered assistance in this task. The Committee noted that very detailed information was collected agreeing that the Secretariat should not disseminate the data without the previous consent of the reporting country.

102. The Committee also requested that countries involved in these studies report their findings to the appropriate Working Party, and in particular to the WPTT and the WPB.

ANY OTHER BUSINESS

Creation of a Working Party on Bycatch

103. The Committee recognized the importance of considering the impact of fishing on the ecosystems associated with the target tuna species and that this issue would be advanced most effectively through the establishment of a Working Party on Bycatch. The Committee identified several potential issues with a range of bycatch species in both artisanal and industrial tuna fisheries and highlighted the issue of shark bycatch due to the level of catch of these species, the high vulnerability of some shark stocks to mortality from fishing and their top position in oceanic ecosystems.

104. The Committee recommends the following:

a. that each Member develops a National Plan of Action on Sharks as identified by the FAO International Plan of Action on Sharks;

b. that the IOTC develops and presents a Regional Plan of Action on Sharks to the FAO;

c. the establishment of a Working Party on Bycatch; and,

d. that Members are reminded that all retained catch and any discards associated to tuna fisheries should be reported to the Secretariat, as practical as possible.

105. The Working Party on Bycatch, in the first instance, should consider the following issues:

a. Identify major bycatch species in Indian Ocean tuna fisheries;

b. Investigate means to monitor and assess bycatch in general with initial emphasis on sharks;

c. Exchange information on bycatch and identify methods to carry out assessments of bycatch;

d. Liaise with groups investigating bycatch issues for other regional bodies (e.g. CCSBT, IATTC[14], ICCAT, CCSBT) involved with the management of tunas; and

e. Propose measures to reduce unsustainable bycatch, as appropriate.

f. Encourage the conduct of research on ecosystems.

106. It was recommended that a small group be created to facilitate communication on bycatch issues among Members and that, in the first instance, the discussions should focus on issues relevant to shark species. A Chairperson should be identified to facilitate exchange of information through the small group, coordination of future activities and reporting to the Scientific Committee. It is recommended that the group meet briefly during the next meeting of the Working Party on Tropical Tunas and plan future activities, as appropriate.

Research on tunas in relation with the environment and ecosystem

107. The Committee was informed that, at the last meeting of the sub-committee on the Environment of the ICCAT SCRS[15], it was recommended that in 2004 a meeting be organized to define and make available data and indices on environmental characteristics which might be relevant for assessment and management of tuna stocks. This meeting will be open to participation by other tuna regional fisheries bodies concerned with similar issues with the goal of holding a meeting in early 2004.

108. The Committee welcomed this initiative and supported the participation in the proposed activities.

109. CLIOTOP, a new IGBP/GLOBEC project was presented in IOTC-SC-02-Inf5. CLIOTOP is a research project devoted to the application of the comparative approach to elucidate the influence of climate on key ecosystem processes involving tuna and other top predators. CLIOTOP will end its implementation meeting late in 2003.

110. The Scientific Committee expressed its appreciation for the information presented and welcomed the CLIOTOP initiative indicating that the issues treated by this project might be of relevance to the work advanced by the Working Parties.

ELECTION OF THE CHAIRPERSON AND VICE-CHAIRPERSON FOR THE PERIOD 2003-2004

111. The Committee unanimously elected Dr Geoffrey Kirkwood from the UK as the Chairman of the Scientific Committee for the period 2003-2004, to replace Mr Renaud Pianet, from France, who completed his mandate. The Committee expressed its deepest appreciation for the contribution of Mr Pianet, who through his dedication and experience, successfully steered the Scientific Committee through its first four years of existence.

112. The Committee also elected unanimously Prof. Xu Liu Xiong, from the People's Republic of China as the vice-Chairman for the biennium. The Committee also expressed its greatest appreciation to the departing vice-Chairman, Dr. V.S.Somvanshi from India, for his contribution during the past four years.

ADOPTION OF THE REPORT

113. The Report of the Fifth Session of the Scientific Committee was adopted on November 29th 2002.

[14] Inter-American Tropical Tuna Commission
[15] Standing Committee on Research and Statistics

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APPENDIX II. AGENDA OF THE MEETING

1. *Opening of the session*
2. *Adoption of the agenda and arrangements for the session (IOTC-SC-02-01)*
3. *Admission of observers*
4. *Progress report of the Secretariat (IOTC-SC-02-02)*
5. *Progress report of the IOTC-OFCF project (IOTC-SC-02-08)*
6. *Presentation of national reports*
7. *Reports of the Working Parties*
   - *7.1. Report of the permanent Working Party on Data Collection and Statistics (WPDCS) (IOTC-SC-02-03)*
     - *7.1.1. Harmonization of catch certification schemes (IOTC-SC-02-09).*
   - *7.2. Report of the ad hoc Working Party on Methods (WPM)(IOTC-SC-02-04)*
     - *7.2.1. Applications of an operating model for testing new assessment methods (IOTC-SC-02-11)*
   - *7.3. Report of the Working Party on Tropical Tunas (WPTT) (IOTC-SC-02-05)*
     - *7.3.1. Presentation of the executive summaries of the status of the yellowfin and bigeye tuna resources*
   - *7.4. Report of the Working Party on Tagging (WPT) (IOTC-SC-02-06)*
     - *7.4.1. Recent activities in relation with the IOTTP*
   - *7.5. Report of the Working Party on Neritic Tunas (WPNT) (IOTC-SC-02-07)*
   - *7.6. Schedule of Working Party meetings in 2003*
8. *Progress on a survey of predation of longline-caught fish (IOTC-SC-02-10)*
9. *Any other business*
10. *Election of the chairperson and vice-chairperson*
11. *Adoption of the report*

APPENDIX III. LIST OF DOCUMENTS

IOTC-SC-02-01	Adoption of the Agenda and arrangements for the Session.
IOTC-SC-02-02	Progress Report of the Secretariat.
IOTC-SC-02-03	Report of the Permanent Working Party on Data Collection and Statistics (WPDCS).
IOTC-SC-02-04	Report of the ad hoc Working Party on Methods (WPM).
IOTC-SC-02-05	Report of the Working Party on Tropical Tunas (WPTT).
IOTC-SC-02-06	Report of the Working Party on Tagging (WPT).
IOTC-SC-02-07	Report of the Working Party on Neritic Tunas (WPNT).
IOTC-SC-02-08	Progress Report of the IOTC-OFCF project.
IOTC-SC-02-09	Harmonization of catch certification schemes.
IOTC-SC-02-10	Progress on a survey of predation of longline-caught fish.
IOTC-SC-02-11	Applications of an operating model for testing new assessment methods.
IOTC-SC-02-12	Progress report on surveys of predation of longline-caught fish (Japan). *National Research Institute of Far Seas Fisheries, Japan*
IOTC-SC-02-13	Observations on predation of Yellowfin tuna in the longline catches from indian waters. *Somvanshi,V.S. and Varghese,S.*
IOTC-SC-02-inf1	EC France - Rapport national 2002.
IOTC-SC-02-inf2	A summary of the 2001 / 2002 Fishing Season in the British Indian Ocean Territory (Chagos Archipelago) Fisheries Conservation and Management Zone. *Pearce,J., Ansell,N., Mynard,N., Kirkwood, G.*
IOTC-SC-02-inf3	Korean Tuna Longline Fishery in the Indian Ocean. *Doo-Hae An, Dae-Yeon Moon and Jeong-Rack Koh*
IOTC-SC-02-inf4	FADIO: a project on the study of tuna behavior around FADs from tagging and acoustics. *Dagorn, L.*
IOTC-SC-02-inf5	Overview of the planned activities on the European purse seine fleets in the Indian Ocean in 2003 in relation with IOTC recommendations: Onboard observer and tagging. *Pianet,R., Pallares,P. , Fonteneau,A., Arrizabalaga,H.*
IOTC-SC-02-inf6	CLIOTOP (CLimate Impacts on Oceanic TOp Predators), a new GLOBEC regional program for open ocean ecosystem processus comparative analysis. *Maury,O.*
IOTC-SC-02-inf7	EC-Spain – National report 2002.
IOTC-SC-02-inf8	Statistics and status of japanese tuna fisheries in the Indian Ocean. *Okamoto,H., Miyabe N.*

IOTC-SC-02-inf9 China national tuna fishery report in IOTC waters (draft). *Xu Liu Xiong & Dai Xiao Jie*

IOTC-SC-02-inf10 Status of Tuna Fisheries in Mauritius. *Norungee, D.*

IOTC-SC-02-inf11 Small tuna fisheries and resources in the Andaman sea. *Pokapunt, W.*

APPENDIX IV. NATIONAL REPORT ABSTRACTS

Abstract of Document IOTC-SC-02-Inf1 (France on behalf of its Overseas Territories)

During the last 5 years, tuna catches have varied between 400 and 600 t a year. This amounts to about 10% of the total catches from the artisanal fishery.

In 2001, total catches of tuna reached 650 t and are 95% due to the artisanal fishery (handline). The emergence of a small-scale longline fishery can be noted, with the arrival of two longline vessels of less than 10 meters overall length. The total catches for those vessels for 2001 were of 45 t, of which tunas and tuna-like species account for 44% (20 t).

A pilot tagging program, aiming at assessing the potentialities for tagging, was implemented in Mayotte. In the light of the successful results, a small-scale tagging program should be implemented during the first half of 2003.

Abstract of Document IOTC-SC-02- Inf1 (EC-France)

Two fleets operate in the Indian Ocean, purse seiners based on Seychelles and Antsiranana (Madagascar) and longliners based on La Réunion. The landings of these fleets are monitored to produce catch-and-effort statistics and length-frequency samples.

Virtually all the 12 recommendations concerning EC-France were acted upon or will be in 2003. Two organizations, IRD and IFREMER are involved in research activities on high seas pelagic resources and their ecosystems. IRD is conducting a programme since 2001 (THETIS) dealing with the biological interactions between the tunas and their prey aimed at evaluating the impact of fisheries on their ecosystems. This programme also studies the tactical and strategic aspects of purse seiner operations in order to better estimate effective fishing effort. Two new Franco-Spanish programmes involving the use of electronic tags (TAGFAD and FADIO) will be initiated in 2003 with European funding and financial support from French and Spanish fishing companies. Finally, growth curves for bigeye and yellowfin tunas are being updated. IFREMER is conducting research activities on data collected in the swordfish programme (growth and reproduction) and started a programme (DORADE) in 2001 on the FAD attraction phenomenon, based on the dolphinfish as a biological model.

Abstract of Document IOTC-SC-02-Inf7 (EC-Spain)

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 2001 a total of 17 purse seiners and 10 longliners (2 during the whole year and 8 partially) were operating. Most of the purse seiners are between 800 and 2,000 t of carrying capacity. Average size of longliners is 30 m. Spanish catches in 2001 were: 47.571 t (yellowfin), 68,346 t (skipjack), 7,930 t (bigeye), 399 t (albacore) and 1,871 t (swordfish), resulting a total of 126,260 t Purse seine catch in 2001 decreased a 12% as a consequence of the important decrease (25%) of catch on FADS. Tropical tuna sampling in 2001 has considerably increased (820 samples against 296 in 2000 and 136,719 against 61,957 in 2000 fish measured) because the full implementation of the new sampling method and the improvement of the sampling structure. Together with that more than 8,000 swordfish have been measured (23% of the total landings) and sex at age for temporal-spatial strata has been obtained by biological sampling.

Regarding research, two Spanish Research Institutes (IEO and AZTI) are involved in the tropical tuna researches and the IEO is also involved in the swordfish research. Since the beginning of the 90's a Spanish expert on fisheries has been permanently based in Mahe. Scientists involved in these fisheries have actively participated in the works of the WPTT, WPB and the SC. This year 10 documents have been presented. Research programs are or will be conducted in order to implement the Scientific Committee recommendations, in particular: plan for collecting information on supplies and fishing on FADs, jointed (IRD-IEO-AZTI) observer program to estimate discards and by catch, jointed (IRD-IEO-AZTI) tagging program on tropical tuna fishing on FADs and opportunistic tagging of swordfish and by catch of longline catch.

Abstract of Document IOTC-SC-02-Inf4 (FADIO)

Document IOTC-SC-02-Inf4, describing FADIO, a project on the study of tuna behavior around FADs from tagging and acoustic, was presented to and discussed by the Scientific Committee. The main objectives of this project are to develop prototypes of autonomous instrumented buoys, and new electronic tags for observing the behavior and abundance of tuna and other pelagic species. In addition the project involves tagging and acoustic surveys of tuna and bycatch species around FADs.

Abstract of Document IOTC-SC-02-Inf5 (EC Observer programmes)

Document IOTC-SC-02-Inf5 presents an overview of the planned activities on the European purse seine fleets in the Indian Ocean in 2003 in relation with IOTC recommendations regarding onboard observers and tagging. European Commission regulations establish the minimum and extended Community programs for the collection of data in the fisheries sector, which include estimations of discards for the main European fisheries. In order to apply this regulation, the European Community has developed a new system of project funding, with the first program started in 2002 and finishing in 2006. These national programs include sampling on biological data, research cruises, tagging projects as well as observer's programs to estimate discards and bycatches. In the case of the tuna fisheries, they are also planned to conform to recommendations and regulations of concerned regional organizations; IOTC, ICCAT and IATTC for the Indian, Atlantic and eastern Pacific Oceans respectively. In this context, France and Spain have developed two national programs; one for the estimation of bycatch and discards (for which funding has already been secured) and another for the archival tagging of FAD-associated tunas in 2003 (funding still pending).

Abstract of Document IOTC-SC-02-Inf2 (United Kingdom)

The UK presented its National Report (IOTC-SC-02-Inf.2) summarizing tuna fishing in the British Indian Ocean Territory (Chagos Archipelago) Fisheries Conservation and Management Zone) in the 2001/2002 fishing season (April 2001 – March 2002). During this season, 36 longline vessels (mainly from Japan and Taiwan, China) caught a total of 1,034 t, primarily of yellowfin and bigeye tuna, and 50 purse seine vessels (Spanish and French) caught nearly 5,800 t of yellowfin, skipjack and bigeye tuna). An observer programme was again conducted during 2001/2002, with observations on one Japanese longliner and 7 Spanish purse seiners. Longline catches have been monitored through a system of complete hook surveys, in which two observers monitored every hook hauled for a chosen set. For the surveyed sets, by arrangement with the skipper all fish were landed. This allows a complete unbiased species composition of the catch to be determined, as well as hook occupancy rates. Species compositions determined in this way for 2000/2001 and 2001/2002 combined were presented in IOTC-SC-02-Inf.2 and found to differ substantially from the corresponding species composition calculated just for retained species.

Abstract of document IOTC-SC-02-Inf3 (Korea)

The commercial Korean tuna longline fishery has operated in the Indian Ocean since the mid 1960s. Korean tuna longline fishery mainly targeted yellowfin, bigeye and albacore tunas. Southern bluefin tuna was listed among the main target species of Korean longliners in recent years. The traditional fishing ground of the Korean tuna longline fishery were mainly found in the central tropical Indian Ocean, but Korean longliners were mainly operated in the western Indian Ocean as from 2000.

The number of Korean tuna longline fishing vessel in the Indian Ocean showed a decreasing trend from a peak of 185 longliners in 1975 but from 1995 onward, about 50 to 60 longliners have operated. The size of Korean tuna longliners ranges from 298 to 525 gross tonnage class. Catches of the Korean tuna longline fishery have shown a decreasing trend from a peak at 71,000 t in 1978 and in 2001, 23 out of 54 registered longliners caught 4,000 t,, showing a decrease by about 42% from the 2000 figure. The CPUE of the Korean longline fishery has also shown a decreasing trend from a peak at 2.48 fish/100 hooks in 1977 and has remained at less than 1.00 fish/100 hooks in recent years.

The Korean government initiated a fisheries observer program in 2002 to monitor its distant water fisheries, including those for tunas, and to meet the requirements of regional fisheries bodies. Two systems have been maintained for the collection of Korean tuna fisheries data. The first system has been operated by the Korean Deep-Sea Fisheries Association to collect total catch by species and the second data collection system which

has been the National Fisheries Research and Development Institute (NFRDI) is to sample catch and effort data based on the logbooks.

Abstract of Document IOTC-SC-02-Inf8 (Japan)

In 1999 Japan achieved a 20% reduction in the number of distant water longline vessels. The total fishing effort by Japanese longliners in the Indian Ocean, which was 135 million hooks in 1997 and 1998, was reduced to 100 and 110 million hooks in 1999 and 2001, following the decrease of vessels, while the percentages of effort in each Ocean to the total has not shown remarkable change. The longline catch for each species in 2001 (2000) was 5,201 t (3,783) for southern bluefin tuna, 3,009 t (2478) for albacore, 12,823 t (12,956) for bigeye and 13,594 t (15,563) for yellowfin. In 2001, the yellowfin catch was a little larger than that of bigeye as was the recent trend. Regarding Japanese purse seine fishery, though more than 10 vessels operated in 1991-1993, this number decreased to only 2 vessels in 2000 and 2001. The total fishing effort (operation days + searching days) of purse seine increased from 349 days in 1989 to 2,393 days in 1992, and decreased drastically to 321 days in 2000 and 262 days in 2001. Nearly 100% of the operations were made on FAD associated schools recently. The total purse seine catch in weight for each species in 2001 (2000) was 1,830 t (2,332), 603 t (952) and 592 t (747) for skipjack, yellowfin and bigeye respectively.

It was indicated that, although Japan has implemented an observer program for longline vessels fishing southern bluefin tuna, the coverage of this program is low but is expected to increase in the future. A similar program covering tropical tunas is still not in place, although there are plans to implement one with similar coverage.

Japan is engaged in a global data revision for the longline fleet to ensure that the information in the Secretariat database was based on the IOTC areas, rather than the FAO statistical areas as in the past.

Most of the Japanese purse-seine vessels which have stopped operating in the Indian Ocean moved to the Pacific Ocean, while some stopped fishing operations completely.

Abstract of Document IOTC-SC-02-Inf9 (People's Republic of China)

A total of 93 Chinese tuna longliners were operating between 45°-95°E and 10°N to 10°S, in the Indian Ocean, 2001, with the total nominal catch of 5,721 t, 786 t or 12% less than the previous year. Bigeye and yellowfin are the two main target species, accounting for 52.3 % and 31% of the total tuna catch respectively. The total fishing effort was 19,994 thousand hooks in 2001, about 7% less than the previous year. The CPUE varied from 248 to 402kg/1,000 hooks, with a mean value 286 kg/1,000 hooks. Catch statistics including FORM 1, FORM 3 and vessel information have been routinely reported to the IOTC Secretariat. WinTuna was made in Chinese version with the help of the IOTC Secretariat. Tuna Statistical Documents have accompanied the bigeye exported since July 2002. New fishing licenses will be issued to fishing vessels after December 1, 2002. A scheme for Vessel Monitoring System (VMS) is being made. A scientific observer program will be carried out, with the first observer dispatching on December 2002.

The lower threshold size for vessels that will be monitored by VMS is 40 meters. The reason for the missing albacore catches before 1999 is that, before that year, owners were not required to report these catch of this species.

Abstract of Document IOTC-SC-02-Inf10 (Mauritius)

The tuna fishery is an important fishery in Mauritius as it forms the basis if a local canning factory. Tuna transshipment has been a valuable tuna fishery related activity for more than three decades. In the year 2001, 16,327 t of tuna and tuna-like species were transshipped. Depuis 1985, an artisanal fishery has also been developed around fish aggregating devices. Catches amount to about 300 t annually and consisting mainly of tuna and dolphin fish. The sport fishery also lands about 400 t of tuna and billfishes. Since recently, a swordfish fishery is being developed. In 2001, six local vessels operated in this fishery and unloaded 88 t of pelagic species. Licenses are issued to European vessels and Asian longliners to operate in the Mauritian EEZ. During 2001, the catch by Asian longliners amounted to 7,523 t, consisting mainly of Albacore tuna. Since recently, the software Wintuna 2000, has been installed at Albion Fisheries Research Centre for data entry and processing. Mauritius has implemented several recommendations of the Scientific Committee.

These include port sampling of longline catch, collection of data on predation by marine mammals, support for tagging program, collection of data on swordfish fishery and submission of statistics to IOTC.

Abstract of Document IOTC-SC-02-Inf11 (Thailand)

The main tuna species caught in the Andaman Sea of Thailand are neritic tunas, including frigate tuna, kawakawa, longtail, bullet and skipjack tuna. The contribution in terms of catch of small tunas has increased from 2,880 t in 1983 to the peak of 42,611 tones in 1995. Most of them are caught with regular purse seine, tuna purse seine and gillnets. In 2001, 300 multipurpose purse seine vessels, including regular and tuna purse seine, and 34 gillnet vessels were reported. All of them operated along the coast within 3-45 km from shore and at the depth of 30-200m. The size of caught fish ranged from 10-60 cm in fork length. The peak of fishing season is during the northeast monsoon. Since April 2000, the IOTC has supported the Department of Fisheries in implementing a sampling program on tuna longline vessels unloading in Phuket. Sampling is conducted monthly by staff of AFDEC at Phuket fishing port. The results in 2001 indicate a total effort of 856 trips, total landing of 4,285 t, with an average catch per trip of 5.01 t. The species composition of the landings consisted of yellowfin tuna 43%, bigeye tuna 32%, billfish 12%, swordfish 11% and others 2%.

Abstract of verbal update from India

India's production of tuna and tuna-like fishes in 2001 was about 135 thousand tonnes mainly neritic tunas caught in small-scale fishery sector. The principal species were kawakawa, skipjack, frigate tuna and yellowfin tuna. The rest of the catches were dominated by the three species of seerfish (*Scomberomorus commerson*, *S. guttatus* and *S. lineolatus*). The main gear used were gillnets, pole and line, hook and lines, and longlines. India is commissioning a census, which will include information and data on fishing craft and gear, besides strengthening data collection and fish catch statistics. Industrial fishing was not significant; only one longliner was operative during the year. The oceanic sector including the catches landed by the two survey and research vessels, landed about 700 t of tuna. The oceanic fishing activity is being revived with 19 longliners permitted on Indian ownership basis. To encourage diversification of existing vessels, two shrimp trawlers are being converted to monofilament longliners. The research findings through exploratory surveys by longlining have shown decreasing trends in abundance indices of YFT and SKJ. The mean size of yellowfin tuna caught in the Arabian Sea sector was observed to be smaller than that caught in the Bay of Bengal and Andaman and Nicobar waters. Conversely, skipjack tuna in the Arabian Sea were observed to have larger mean size than those from the Bay of Bengal and Andaman and Nicobar waters. The survey on predation of YFT caught in longlining has revealed that in the Arabian Sea the predation was 10.8%, whereas in the Bay of Bengal and in Andaman and Nicobar waters 5.5%. India is preparing to participate in the tuna tagging program of IOTC with small scale tagging project. Small boats for pole and line fishing and hand lining and survey vessel for longlining will be used as platforms for the tagging project during 2003-04.

Additionally it was explained that most of India's longline fleet was engaged in shallow longline operations (mainly targeting yellowfin), but that this situation might change in the future.

Abstract of verbal update from invited expert regarding Taiwan province of China

In the Taiwan,China deep sea longline fishery in the Indian Ocean, 335 vessels were operating in 2001, following the slightly decreasing trend in number since 1998. Total catches, except for 1993, average at about 100,000 t/year for the last ten years. Estimated catches of the four major species in 2001 are: albacore 26,000 t (increased from previous year), bigeye 37,000 t (same level of 1999), yellowfin 19,000 t (slight increase) and swordfish 12,000 t (the lowest point since it became a seasonal target in early 1990). Four types of data from this fleet were collected, and emphasis was made on the difference on estimations of nominal catches and catch/effort data.

The bigeye statistical documents program has been implemented since 2002 to secure accurate information on bigeye trading. Experimental VMS and observer programs continued in 2002.

Abstract of verbal update from Seychelles

The Seychelles has a developed tuna fishery in the EEZ practiced by distant water fishing nations. The vessels have been fishing under licence agreement with the Seychelles since early 1980's.

Around 150 longliners from Japan, Taiwan and South Korea are actually active. The number of purse seiners active have slightly decreased since the last two years and actually around 46 vessels are active.

During the WPDCS in 2001, the Seychelles presented a document (WPDCS-01-02) describing the vessels licensed in Seychelles by the flag country and reporting rates of logbooks from industrial vessels.

Reference is also made to a document presented during the WPTT (WPTT-02-08), describing the quality of data reported from the distant water fishing fleets, especially the longliners and purse seiners carrying flags other than the EU.

Since 1995 the Seychelles has developed a semi-industrial longline fishery targeting swordfish, actually 11 vessels are active and around 400 t of fish are landed. The coverage rate of log books for the local fishery is around 90% and 20% of the trip are sampled for the frequency size data. During the working party of billfish in 2001 a document was presented illustrating the trends in abundance indices of swordfish caught in Seychelles compared to the Reunion fishery (catch rates and trends in size frequency).

By catch data from this fishery are collected on log books and submitted to IOTC.

The Seychelles participates in the following on going projects :

- Purse seine fishery sampling activity in collaboration with IRD
- THETIS programme (IRD) on the behaviour of tunas
- The collection of biological and other data from swordfish caught on the longline research vessel
- Tagging pilot project
- Software actually used to compile tuna data : AVDTH from IRD, Wintuna (IPTP version). The development of Wintuna 2000 will permit better processing of the tuna data and reporting obligations to IOTC.
- Publications of SFA : semestrial tuna bulletins.

APPENDIX V. GUIDELINES FOR THE PREPARATION OF NATIONAL REPORTS

At its Fourth Session, the Scientific Committee agreed to request from its Members and Cooperating Non-Member Parties, that National Reports be prepared and presented regularly at its Sessions.

The National Reports will be listed as Information Documents presented to the Scientific Committee and each delegation will be asked to briefly introduce its Report during the Session. The Report should include information for the most recent complete year and the four previous years, if possible. Recent developments in each fishery for tropical tunas (skipjack, yellowfin, bigeye) should be highlighted, and where important, fisheries for small tunas and billfish as well as any available information concerning by-catch from tuna fisheries.

In general, the National Report should include information on:

1. General Fishery Statistics
    a. Catch by species, for each gear type
    b. Fleet structure
    c. Available information on the catches of non-target, associated and dependent (NTAD) species
    d. Description of recent changes in the national data collection and processing systems

This section is intended to provide a summary of the main features of the tuna fisheries for the reporting party. As such, it does not replace the need for submission of data according to the IOTC Mandatory Data Requirements listed in IOTC Resolution 01/05.

2. Report on the implementation of recommendations of the Scientific Committee

The Scientific Committee has produced a number of recommendations concerning collection of information and research on the relevant resources. A summary of the general recommendations will be listed in the IOTC website.

3. National Research Programs currently in place

The reporting party is invited to describe current scientific research taking place in institutions under its responsibility. The emphasis should be placed on describing the activities rather than the results of the scientific research, which would be more appropriately reported in the species Working Parties.

4. Any other relevant information

APPENDIX VI. EXECUTIVE SUMMARY OF THE STATUS OF THE YELLOWFIN TUNA RESOURCE

BIOLOGY

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

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

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

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

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

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

FISHERY

Catches by area, gear, country and year from 1950 to 2000 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 10°S and in the Mozambique Channel (north of 25°S).

Purse seine currently takes the most catch, with a catch of 147,000 t in 2000 coming mostly from the western Indian Ocean. Although some Japanese purse seiners have fished in the Indian Ocean since 1977, the purse seine fishery developed rapidly with the arrival of European vessels between 1982 to 1984. Purse seine catches of yellowfin with fork lengths between 30 and 180 cm increased rapidly to some 130,000 t in 1993, after which they have fluctuated around that level. The purse seine catch in 2000 was 147,000 t. The purse seine fishery is characterized by the use of two different fishing modes: the fishery on floating objects (FADs), which catches mainly small yellowfin in association with skipjack and juvenile bigeye, and a fishery on free swimming school, which catches larger yellowfin on mixed or pure sets. Between 1995 and 2000, the FAD component of the purse seine fishery represented 50-66% of the sets undertaken (65-80% of the positive sets) and took 46-63% of the yellowfin catch by weight (63-76% of the total catch).

The longline fishery started in the beginning of the 1950's and expanded rapidly over the whole Indian Ocean. It catches mainly large fish, from 80 to 160 cm fork length. The longline fishery targets several tuna species in different parts of the Indian Ocean, with yellowfin and bigeye being the main target species in tropical waters. The longline fishery can be subdivided into an industrial (deep-freezing longliners operating on the high seas from Japan, Korea and Taiwan,China) and an artisanal component (ice longliners operating more in coastal waters). The longline catch of yellowfin reached a maximum in 1993, after which it declined to a level of 88,000 t in 2000.

Artisanal catches, taken by baitboat, gillnet, troll, handline and other gears, have increased steadily since the 1980s. In 2000, the total artisanal yellowfin catch was 69,000 t, while the catch by the dominant artisanal gear, gillnets, was 48,000 t.

Annual mean weights of yellowfin caught by different gears and by the whole fishery are shown in Figure 3. After an initial decline, mean weights in the whole fishery remained quite stable from the 1970s to the early 1990s. After 1993, mean weights in the catches in the industrial fisheries have declined. Although total catch in biomass has been stable for several years, catches in numbers have continue to increase, as there has been more fishing effort directed towards smaller fish, as illustrated in Figure 10.

AVAILABILITY OF INFORMATION FOR ASSESSMENT PURPOSES

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

A number of papers dealing with fisheries data, biology, CPUE trends and assessments were discussed by the WPTT, and additional data analyses were performed during the meeting. In particular, estimates of annual catches at size for yellowfin were calculated using the best available information. Estimated catches at age calculated using the catch-at-size data and the two hypotheses regarding growth curves (fast vs slow growth) are shown in Figure 5. Two sets of natural mortality at age schedules were agreed, both assuming a higher M on juvenile fish.

Standardized CPUE analysis using both Japanese and Taiwanese data were presented and discussed. New analyses were also carried out on these data sets during the meeting, estimating standardised CPUEs for both the whole Indian Ocean and the tropical area (10N – 15S), where the bulk of the catch is taken. All resulting standardized CPUE series is similar. These showed an initial steep decline, over a period when catches were relatively low and stable, followed by stable standardized CPUEs since the late 1970s, a period during which catches have increased strongly following the development of the purse seine fishery. This is illustrated in Figure 4 for the tropical area. The observed pattern of standardised CPUE does not correspond well with the expected response of CPUE to changes in catch and biomass. There are several possible explanations for this, such as changes in catchability or behaviour, or the population existing in two fractions with differential availability to purse seine and longline gears. However, there is no scientific information to judge which, if any, of these explanations is correct.

STOCK ASSESSMENT

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

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

Although there were differences in the details of results from the different assessments, the overall picture is consistent. This can be seen in Figures 6 to 9, which illustrate some of the results from the assessments, expressed in relative units to make them directly comparable. There has been a large and steady increase in fishing mortality since the early 1980s, while there is indication that there has been a substantial decline in biomass since the mid-1980s. Estimates of catchability both for purse-seine and longline fleets show a strong

increasing trend since the mid-1980s, especially for the purse-seine fleet, as illustrated in Figures 8 and 9. It should be noted that these figures are intended to illustrate general trends, and should not be viewed as depicting precise estimates of changes in efficiency.

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

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

MANAGEMENT RECOMMENDATIONS

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

1. Total catches under current fishing patterns are close to, or possibly above MSY. Furthermore, catches by all main gears have been increasing both consistently and substantially in recent years. In these circumstances, any further increase in both effective fishing effort and catch above levels in 2000 should be avoided.
2. The current trend for increasing fishing pressure on juvenile yellowfin by purse seiners fishing on floating objects is likely to be detrimental to the stock if it continues, as fish of these sizes are well below the optimum size for maximum yield per recruit.

YELLOWFIN TUNA SUMMARY

Maximum Sustainable Yield (MSY)	280,000 - 350,000 t
Current (2000) Catch	304,000 t
Current (2000) Replacement Yield	
Relative Biomass B_{2000}/ Bmsy	
Relative Fishing Mortality F_{2000}/Fmsy	
Management Measures in Effect	None

Table 1. *Yellowfin catches by area, gear and countries from 1950 to 2000.*

Gear	Fleet	Av96/00	%	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	Fleet
PS	EC	84	26.6																											EC
	NEI-PS	34	10.7																											NEI-PS
	OTHER	12	3.9														0.0	0.0	0.0									0.0	0.0	OTHER
	TOTAL	**130**	**41.2**														*0*	*0*	*0*									*0*	*0*	**TOTAL**
LL	Indonesia	36	11.3																								0.1	0.3	0.7	Indonesia
	Taiwan,China	21	6.6					0.2	0.7	1.1	1.3	1.8	2.4	2.2	2.9	3.5	3.4	2.9	2.2	4.4	3.4	22.6	21.1	14.9	11.8	11.8	5.7	4.4	4.6	Taiwan,China
	NEI-ICE	19	6.0																											NEI-ICE
	Japan	15	4.7			8.9	13.2	24.9	46.5	64.4	36.0	25.7	24.4	40.3	34.6	51.7	25.9	24.8	27.6	44.1	31.6	50.5	25.2	10.3	13.4	7.9	3.9	4.9	6.4	Japan
	NEI-DFRZ	10	3.2																											NEI-DFRZ
	OTHER	8	2.4																	0.1	0.2	4.6	8.0	4.1	6.5	9.6	9.9	11.6	11.7	OTHER
	TOTAL	**108**	**34.1**			*9*	*13*	*25*	*47*	*65*	*37*	*28*	*27*	*43*	*37*	*55*	*29*	*28*	*30*	*49*	*35*	*78*	*54*	*29*	*32*	*29*	*20*	*21*	*23*	**TOTAL**
GILL	Iran	21	6.5																											Iran
	Sri Lanka	19	6.1																											Sri Lanka
	OTHER	15	4.9	0.4	0.4	0.4	0.5	0.6	0.6	0.5	1.4	0.7	0.7	0.8	0.8	1.2	1.8	2.4	2.6	3.5	3.4	3.4	3.1	2.8	2.3	2.8	2.2	3.0	3.3	OTHER
	TOTAL	**55**	**17.5**	*0*	*0*	*0*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*2*	*2*	*3*	*4*	*3*	*3*	*3*	*3*	*2*	*3*	*2*	*3*	*3*	**TOTAL**
BB	Maldives	12	3.8	1.5	1.5	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.0	1.0	1.5	1.5	1.5	1.5	1.0	1.5	1.7	1.7	1.8	2.3	1.4	2.5	6.9	5.0	4.6	Maldives
	OTHER	0	0.1																								0.6	1.2	0.2	OTHER
	TOTAL	**12**	**3.9**	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*1*	*2*	*2*	*2*	*2*	*1*	*2*	*2*	*2*	*2*	*2*	*1*	*3*	*7*	*6*	*5*	**TOTAL**
LINE		7	2.2	0.1	0.1	0.1		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.6	0.6	0.6	0.7	0.6	
UNCL		4	1.2	0.1	0.3	0.4	0.4	0.4	0.4	1.6	3.5	2.4	2.6	3.3	3.7	5.3	8.4	6.0	6.7	6.5	9.2	9.7	7.6	6.6	5.5	7.7	6.3	7.1	7.0	
	TOTAL	**317**		*2*	*2*	*11*	*16*	*28*	*50*	*70*	*44*	*33*	*32*	*48*	*44*	*63*	*41*	*38*	*40*	*60*	*50*	*93*	*67*	*41*	*41*	*43*	*36*	*38*	*39*	**TOTAL**
Gear	Fleet	Av96/00	%	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	Fleet

Gear	Fleet	Av96/00	%	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	Fleet
PS	EU	84	26.6						0.2	1.0	10.5	48.2	57.6	63.3	73.1	104.8	79.4	89.0	82.2	83.1	87.3	78.9	104.8	95.0	92.2	60.9	82.7	89.8	EU
	NEI-PS	34	10.7								0.7	8.4	9.4	6.3	5.2	7.9	4.5	12.7	11.9	13.2	23.6	25.5	36.3	29.4	32.4	28.4	38.2	41.5	NEI-PS
	OTHER NEI	12	3.9	0.1	0.1	0.3	0.2	0.2	0.1	0.3	1.6	1.9	2.0	3.9	5.7	6.0	5.9	7.0	11.7	16.6	17.3	10.4	11.2	6.9	9.0	14.6	15.3	15.7	OTHER
	TOTAL	**130**	**41.2**	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*13*	*58*	*69*	*74*	*84*	*119*	*90*	*109*	*106*	*113*	*128*	*115*	*152*	*131*	*134*	*104*	*136*	*147*	**TOTAL**
LL	Indonesia	36	11.3	1.0	1.3	1.3	1.4	2.1	2.6	2.7	0.8	0.8	0.8	0.7	1.3	2.3	3.8	4.6	5.5	9.3	10.8	14.8	16.7	31.8	38.2	35.7	41.7	31.1	Indonesia
	Taiwan,China	21	6.6	3.4	8.1	4.2	3.7	3.8	4.1	4.7	5.6	5.8	7.3	16.2	22.3	22.7	22.4	31.6	30.7	56.0	88.0	34.0	23.1	27.9	18.4	23.4	17.7	17.4	Taiwan,China
	NEI-ICE	19	6.0														11.9	16.6	14.4	16.7	19.5	27.6	25.7	24.3	24.2	21.6	14.5	10.6	NEI-ICE
	Japan	15	4.7	2.8	2.1	4.6	3.3	3.2	4.9	7.3	7.8	7.9	9.5	10.7	8.3	9.3	4.6	6.3	4.4	5.7	5.7	9.7	8.0	12.8	15.6	16.5	15.1	14.3	Japan
	NEI-DFRZ	10	3.2										0.1	1.1	1.2	4.0	3.6	6.7	7.4	13.4	22.3	9.0	8.0	13.8	6.6	11.5	8.7	9.7	NEI-DFRZ
	OTHER	8	2.4	13.8	32.1	25.2	18.2	13.0	12.0	19.7	16.7	10.7	12.5	16.2	13.2	16.8	19.6	20.4	18.9	40.2	52.0	28.9	16.3	11.1	9.7	5.4	5.5	5.8	OTHER
	TOTAL	**108**	**34.1**	*21*	*44*	*35*	*27*	*22*	*24*	*34*	*31*	*25*	*30*	*45*	*46*	*55*	*66*	*86*	*81*	*141*	*198*	*124*	*98*	*122*	*113*	*114*	*103*	*89*	**TOTAL**
GILL	Iran	21	6.5														1.0	2.3	3.2	12.1	13.3	19.5	22.5	28.5	19.1	18.0	24.3	13.5	Iran
	Sri Lanka	19	6.1							6.7	7.2	5.2	6.1	6.9	6.7	8.1	9.3	7.2	11.0	10.0	10.4	11.1	7.8	12.7	15.5	19.3	27.1	21.7	Sri Lanka
	OTHER	15	4.9	3.1	2.7	1.6	2.8	1.3	2.0	2.5	0.9	1.0	3.8	5.1	8.3	19.3	24.7	17.5	14.1	17.6	14.3	21.7	23.8	14.8	14.0	17.4	17.5	13.2	OTHER
	TOTAL	**55**	**17.5**	*3*	*3*	*2*	*3*	*1*	*2*	*9*	*8*	*6*	*10*	*12*	*15*	*27*	*35*	*27*	*28*	*40*	*38*	*52*	*54*	*56*	*49*	*55*	*69*	*48*	**TOTAL**
BB	Maldives	12	3.8	5.2	4.9	3.8	4.4	4.4	5.6	4.5	7.7	8.2	6.9	6.2	7.4	5.9	5.5	4.9	7.0	8.0	9.3	12.4	11.8	11.5	12.2	13.0	13.0	10.1	Maldives
	OTHER	0	0.1						0.4	0.5	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0						0.0			0.6	0.7	OTHER
	TOTAL	**12**	**3.9**	*5*	*5*	*4*	*4*	*4*	*6*	*5*	*8*	*8*	*7*	*6*	*7*	*6*	*6*	*5*	*7*	*8*	*9*	*12*	*12*	*12*	*12*	*13*	*14*	*11*	**TOTAL**
LINE		7	2.2	0.8	0.7	0.8	1.0	1.0	0.9	0.9	1.0	0.9	0.7	0.4	0.5	0.6	3.9	4.0	4.0	5.5	5.6	6.4	6.4	6.4	6.4	6.8	6.9	8.4	
UNCL		4	1.2	7.4	6.9	7.0	8.6	9.2	8.9	1.7	1.2	1.0	4.3	3.9	2.4	3.2	0.7	0.8	0.9	0.9	1.0	1.0	1.0	8.2	5.0	2.2	1.4	1.7	
	TOTAL	**317**		*37*	*59*	*49*	*44*	*38*	*42*	*53*	*62*	*100*	*121*	*141*	*156*	*211*	*201*	*232*	*227*	*308*	*380*	*311*	*323*	*335*	*318*	*295*	*330*	*305*	**TOTAL**
Gear	Fleet	Av96/00	%	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	Fleet

KEY:

PS	Purse seine	**GILL**	Gill net	**Av96/00**	Average catches for the period 1996-2000
LL	Longline	**LINE**	Hand lines and/or troll lines	**%**	Proportion of the total catch (average 1996-2000) that the average catches (1996-2000) represent
BB	Baitboat	**UNCL**	Other or unknown		

NEI-DFRZ Catches of non-reporting freezing or deep-freezing longline vessels, operating under various flags (Belize, Equatorial Guinea, Honduras, Panama, Vanuatu, etc.) as estimated by the IOTC Secretariat
NEI-ICE Catches of non-reporting fresh-tuna longliners, operating under various flags (Honduras, Taiwan,China, etc.), as estimated by the IOTC Secretariat
NEI-PS Catches of non-reporting purse-seine vessels operating under various flags (Belize, Cayman Islands, Cote d'Ivoire, Liberia, Malta, Netherlands Antilles and Panama)

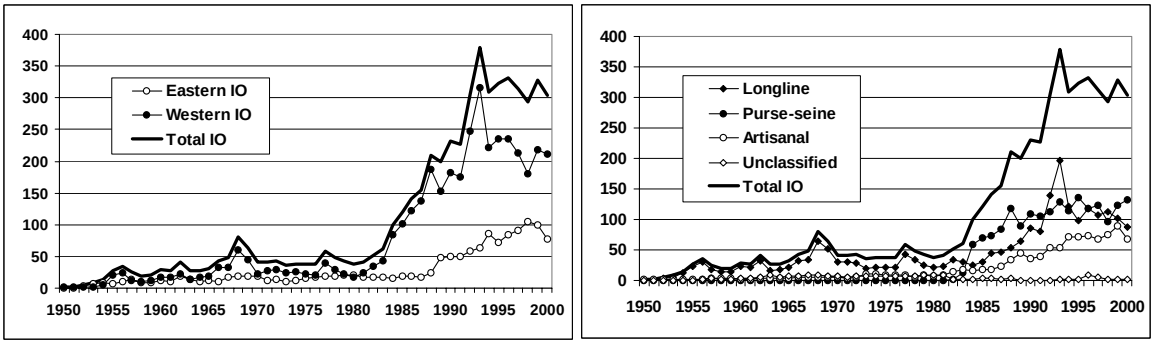


Figure 1. *Yearly catches (thousand of metric tonnes) of yellowfin by area (Eastern and Western Indian Ocean, left) and by gear (longline, purse-seine, artisanal and unclassified, right) from 1950 to 2000.*

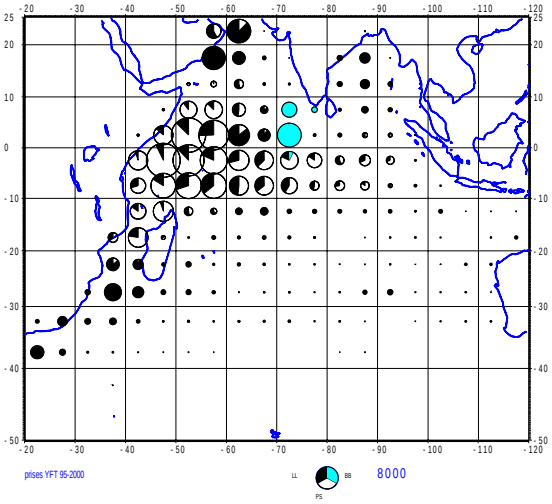


Figure 2. *Average (1995-2000) geographical distribution of yellowfin catches according to the gear (longline, purse-seine and baitboat).*

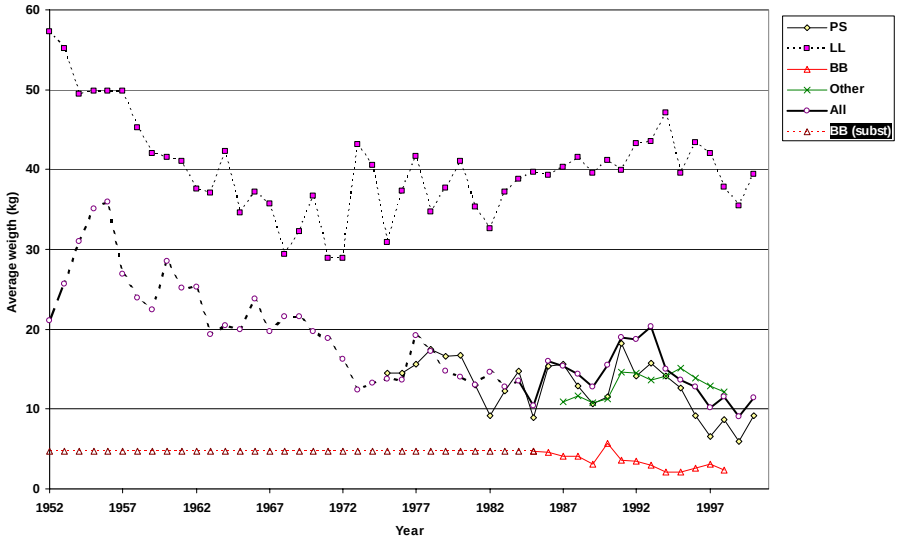


Figure 3. *Yellowfin average weight in the catch by gear (from size-frequency data) and for the whole fishery (estimated from the total catch at size).*

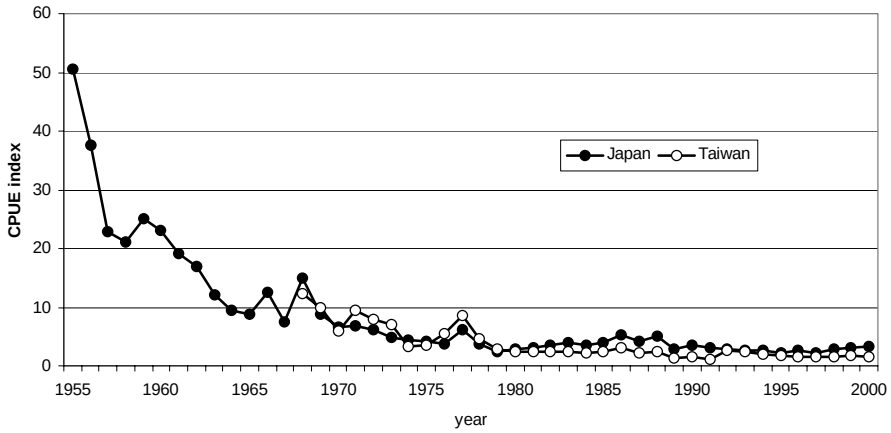


Figure 4. *Yearly abundance indices based on the Japanese and Taiwan, China longline yellowfin CPUE's in the tropical area (10°N-15°S).*

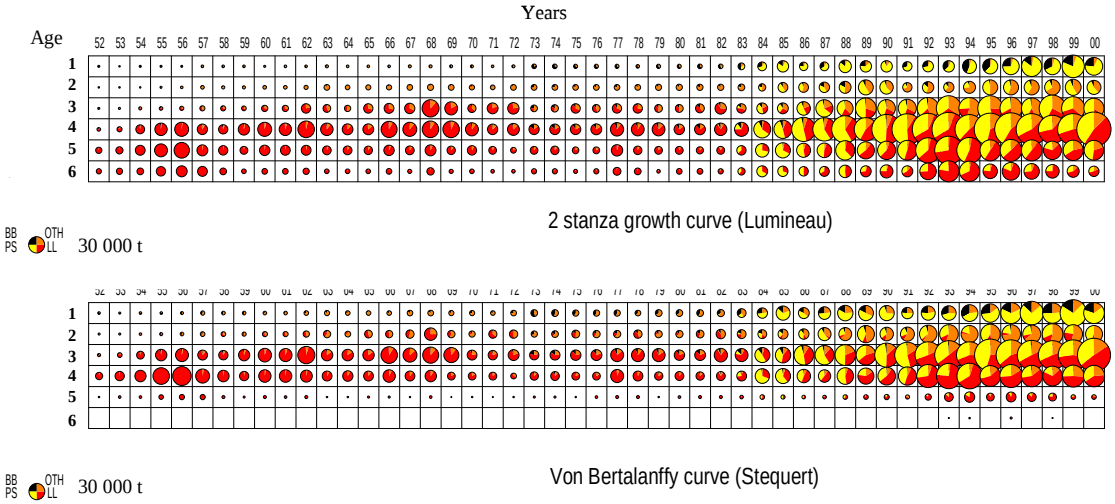


Figure 5. *Catch at age by gear (in weight) according to the two growth hypothesis used by the WPTT: "slow", assuming a two stanzas growth curve (above) and "fast", assuming a constant growth rate (below).*

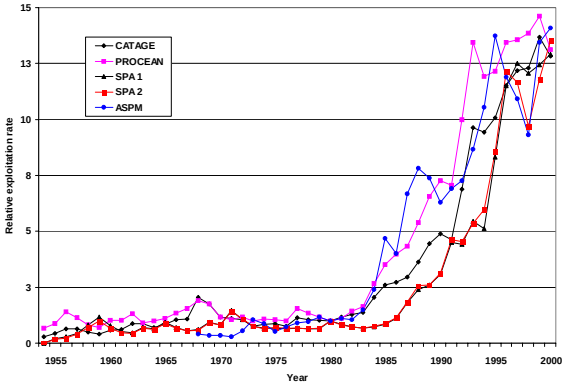


Figure 6. *Relative exploitation rates estimated from the five assessments ran by the WPTT (all have been set at 1 in 1980 selected as the reference year).*

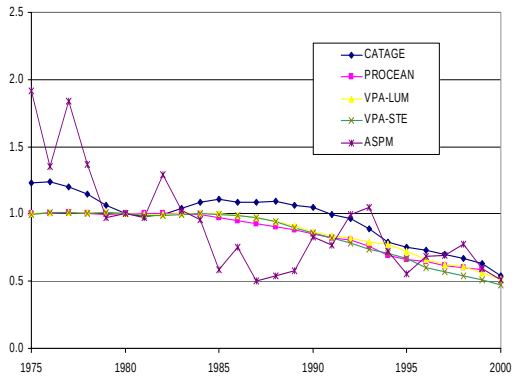


Figure 7. *Trend of the relative biomass estimated from the five assessments ran by the WPTT.*

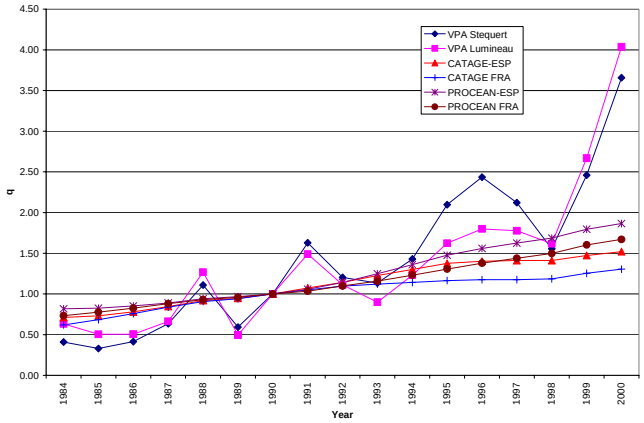


Figure 8. *Average yearly relative catchability coefficients for purse seine fleets estimated from the assessments ran during the meeting; all have been set at one in 1990 selected as the reference year.*

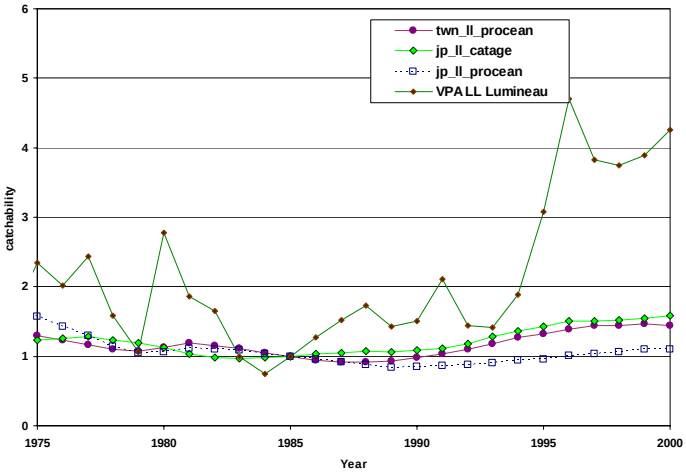


Figure 9. *Average yearly relative catchability coefficients for longline fleets estimated from the assessments ran during the meeting; all have been set at 1 in 1985, selected as the reference year.*

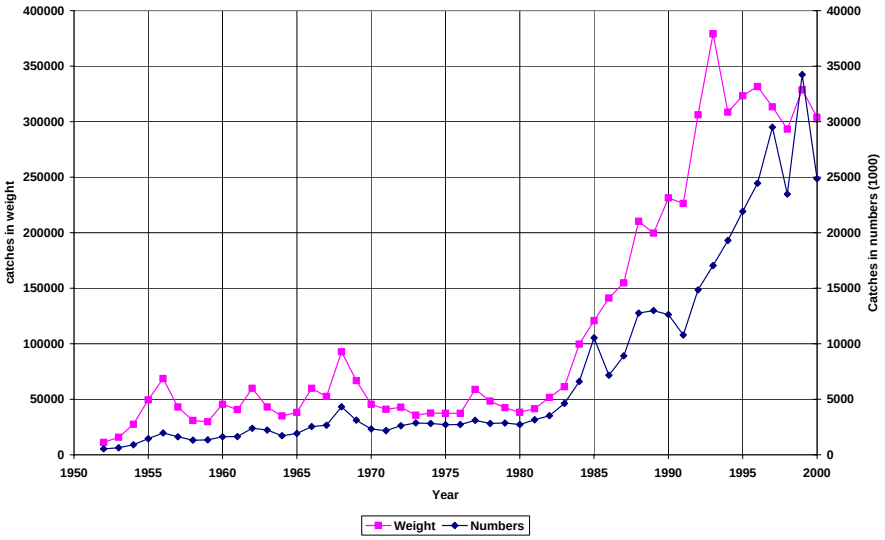


Figure 10. *Total catch of yellowfin tuna in weight and numbers.*

APPENDIX VII. EXECUTIVE SUMMARY OF THE STATUS OF THE BIGEYE TUNA RESOURCE

BIOLOGY

Bigeye tuna is a tropical tuna species occurring 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 ten years) and that makes it the species most vulnerable, in relative terms, to over-exploitation. Bigeye tuna start reproducing when they are approximately three years old, at a length of about 100cm.

FISHERY

Bigeye tuna is predominantly caught by industrial fisheries and appears only occasionally in the catches of artisanal fisheries (*Table 1*). 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. More recently (since the early 1990s) bigeye tunas have been caught by purse seine vessels fishing on tunas aggregated on floating objects. Most of the bigeye catches reported under purse seiners are juveniles. Large bigeye tuna 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 *(Figure 2)*. Catches of bigeye have been consistently increasing over the years in the eastern and western parts of the 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. 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 growth and natural mortality. Current proposals for an Indian Ocean tagging programme are oriented towards improving knowledge of these biological characteristics.

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 4)*.

STOCK ASSESSMENT

In 2001, the WPTT conducted a stock assessment on the basis of the best available information at the time using age-structured production models (ASPM). Maximum sustainable yield (MSY) was estimated to be about 89,000 t, from the results considered to be the most reliable. In 2002, the estimate of MSY was updated to 102,000 t, with a confidence interval of 73,000 – 129,000 t.

The assessments suggest that the population is currently above the MSY level but has been declining since the late 1980s (*Figure 5*). The overall fishing mortality is estimated to be currently below that expected at the MSY level, but recent catches have considerably exceeded 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 more than twice 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.

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. There is an increasing trend in the estimated recruitments in recent years, although it was noted that this might actually be due to a trend in catchability not accounted for in the model formulation.

In 2001, the WPTT conducted forward projections for the period 2000-2010 on the basis of the results of the ASPM assessment conducted at that meeting, assuming two different scenarios:

- 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 Figure 6.

Projections under the constant F scenario indicate that the population would be reduced to a level slightly above MSY, with catches being reduced over time and reaching an equilibrium slightly below the MSY of about 100,000 t. This is a direct consequence of the assumed fishing mortality for the projected period.

Projections assuming an increasing F at an annual rate of 6 % (the average rate of increase in overall fishing mortality in the late 1990s as estimated in the assessment) suggest that a decline in the total catch over the projected period would be slightly less than that under the constant F scenario. However, the decline in longline catches is more pronounced in this scenario, while catches in the purse-seine fishery actually increase during the period. This latter projection depends strongly on the assumption that recruitment is almost independent of spawning stock. Of particular concern is the predicted reduction by the year 2010 of the spawning stock biomass to about 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 7. This calculation was done on the basis of the results and assumptions on input values from the 2001 assessment.

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

- The lack of a growth curve for the Indian Ocean that adequately represents growth for fish of all sizes caught by longline and purse-seine fisheries.
- Insufficient size information for the catches of longline fisheries, especially in recent years.
- Uncertainty about the natural mortality at various life stages.
- Uncertainty about the increase in efficiency 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 still unresolved questions in the current index of abundance.

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 RECOMMENDATIONS

The results of further assessments of the bigeye tuna stock using age-structured production models presented in 2002 to the WPTT confirmed and reinforced the assessment agreed at the 2001 meeting. The WPTT therefore reiterated the technical advice on bigeye tuna given last year.

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 remained high. Taking into account the results of the current assessments, which represent the best effort to date to analyse the available data in a formal context, it is likely that current catches are well above MSY. Therefore, 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.

BIGEYE TUNA SUMMARY

Maximum Sustainable Yield :	102,000 t (73,000 – 129,000 t)
Current (2000) Catch:	131,000 t
Current (2000) Replacement Yield	
Relative Biomass (B_{2000}/B_{msy})	2.15
Relative Fishing Mortality (F_{2000}/F_{MSY})	0.66
Management Measures in Effect	Resolution 98/04: Concerning Registration And Exchange Of Information On Vessels, Including Flag Of Convenience Vessels, Fishing For Tropical Tunas In The IOTC Area Of Competence Resolution 99/01: On the Management of Fishing Capacity and on the Reduction of the Catch of Juvenile Bigeye Tuna by Vessels, Including Flag of Convenience Vessels, Fishing for Tropical Tunas in the IOTC Area of Competence Resolution 99/02: Calling for Actions Against Fishing Activities by Large Scale Flag of Convenience Longline Vessels Resolution No 99/03: on the Elaboration of a Control and Inspection Scheme for IOTC Resolution No 01/06: Recommendation concerning the IOTC bigeye tuna statistical document programme

***Table 1**. Catches of bigeye tuna by gear and main fleets for the period 1950-2000.*

Gear	Fleet	Av96/00	%	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	Fleet
LL	Taiwan,China	35	25.1					0.1	0.2	0.6	0.9	1.5	1.5	1.3	1.9	1.2	1.7	1.8	1.4	2.2	2.3	7.2	8.0	10.0	5.5	5.5	4.0	6.0	5.3	Taiwan,China
	Indonesia	26	18.5																								0.0	0.2	0.4	Indonesia
	NEI-DFRZ	17	12.1																											NEI-DFRZ
	Japan	16	11.2			1.5	3.6	7.9	10.1	13.4	12.4	11.3	8.9	15.6	13.6	18.7	12.4	16.8	18.2	22.6	22.3	24.6	15.0	12.7	11.2	8.3	5.2	6.9	5.5	Japan
	Korea	5	3.9																0.1	0.1	0.4	6.3	6.6	2.6	4.1	4.3	6.6	13.4	24.7	Korea
	NEI-ICE	5	3.7																											NEI-ICE
	OTHER	5	3.5																											OTHER
	TOTAL	**110**	**77.9**			*2*	*4*	*8*	*10*	*14*	*13*	*13*	*10*	*17*	*16*	*20*	*14*	*19*	*20*	*25*	*25*	*38*	*30*	*25*	*21*	*18*	*16*	*27*	*36*	**TOTAL**
PS	EC	20	14.4																											EC
	NEI-PS	6	4.0																											NEI-PS
	OTHER	4	3.1																											OTHER
	TOTAL	**30**	**21.5**																											**TOTAL**
BB		1	0.4																					0.1	0.1	0.1	0.1	0.1	0.1	
GILL		0	0.2																											
LINE		0	0.0																											
UNCL																														
	TOTAL	**141**				*2*	*4*	*8*	*10*	*14*	*13*	*13*	*10*	*17*	*16*	*20*	*14*	*19*	*20*	*25*	*25*	*38*	*30*	*25*	*21*	*18*	*16*	*27*	*36*	**TOTAL**
Gear	Fleet	Av96/00	%	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	Fleet

Gear	Fleet	Av96/00	%	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	Fleet
LL	Taiwan,China	35	25.1	4.2	6.2	4.9	7.4	8.9	6.8	11.3	11.3	10.9	12.2	16.8	17.6	19.4	19.9	20.7	29.0	24.0	39.5	27.7	32.6	29.8	34.1	39.7	37.1	36.4	Taiwan,China
	Indonesia	26	18.5	0.3	0.3	0.4	0.4	0.5	0.5	0.8	1.9	2.4	2.4	0.7	2.4	3.2	4.5	4.5	4.5	7.6	7.9	10.8	12.2	23.2	27.9	26.1	30.5	22.7	Indonesia
	NEI-DFRZ	17	12.1										0.1	1.1	0.9	3.4	3.2	4.4	7.0	5.7	10.0	7.4	11.3	14.9	12.1	19.5	18.2	20.3	NEI-DFRZ
	Japan	16	11.2	2.1	3.1	10.9	4.2	5.9	7.8	11.4	18.3	14.0	17.2	15.8	15.5	12.3	7.7	8.2	7.8	5.6	8.3	17.5	17.2	16.5	18.8	17.1	14.1	12.5	Japan
	Korea	5	3.9	21.0	24.6	32.9	21.2	18.7	18.9	18.9	16.7	11.5	12.4	11.4	13.9	16.5	11.7	10.3	2.1	4.5	7.1	8.2	6.2	10.8	10.2	3.2	1.3	1.8	Korea
	NEI-ICE	5	3.7														1.9	2.6	2.3	2.6	3.4	5.3	5.5	5.7	6.0	6.0	4.8	3.6	NEI-ICE
	OTHER	5	3.5					0.2	0.2	0.2	0.3	0.1	0.1	0.3	0.1	2.0	7.6	9.2	9.5	11.8	11.6	14.1	8.7	3.6	5.0	4.7	5.5	5.7	OTHER
	TOTAL	**110**	**77.9**	*28*	*34*	*49*	*33*	*34*	*34*	*43*	*49*	*39*	*44*	*46*	*50*	*57*	*56*	*60*	*62*	*62*	*88*	*91*	*94*	*104*	*114*	*116*	*111*	*103*	**TOTAL**
PS	EC	20	14.4						0.0	0.0	0.2	3.1	5.7	8.9	11.9	13.0	9.5	9.5	11.4	7.5	10.4	11.3	19.5	18.3	23.7	17.6	24.6	17.4	EC
	NEI-PS	6	4.0								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	NEI-PS
	OTHER	4	3.1			0.0	0.0	0.0	0.0	0.1	0.3	0.5	0.9	0.7	0.7	1.2	2.0	2.2	2.6	2.9	3.5	5.1	5.5	2.8	4.1	4.6	6.3	4.1	OTHER
	TOTAL	**30**	**21.5**			*0*	*0*	*0*	*0*	*0*	*1*	*4*	*7*	*11*	*13*	*15*	*12*	*13*	*16*	*11*	*16*	*19*	*28*	*25*	*34*	*27*	*38*	*27*	**TOTAL**
BB		1	0.4	0.1	0.2	0.1	0.1	0.1	0.2	0.1	0.2	0.4	0.3	0.2	0.3	0.3	0.3	0.3	0.5	0.4	0.5	0.5	0.5	0.6	0.5	0.6	0.6	0.5	
GILL		0	0.2										0.0	0.3	0.1	2.0	0.6	0.3	0.1	0.0	0.0	0.1	1.2	0.3	0.4	0.5	0.1	0.0	
LINE		0	0.0											0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.1	
UNCL											0.0	0.0																	
	TOTAL	**141**		*28*	*34*	*49*	*33*	*34*	*34*	*43*	*49*	*43*	*52*	*57*	*64*	*74*	*69*	*73*	*78*	*74*	*104*	*111*	*124*	*130*	*149*	*145*	*151*	*131*	**TOTAL**
Gear	Fleet	Av96/00	%	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	Fleet

KEY:

PS	Purse seine	**GILL**	Gill net	**Av96/00**	Average catches for the period 1996-2000
LL	Longline	**LINE**	Hand lines and/or troll lines	**%**	Proportion of the total catch (average 1996-2000) that the average catches (1996-2000) represent
BB	Baitboat	**UNCL**	Other or unknown		

NEI-DFRZ	Catches of non-reporting freezing or deep-freezing longline vessels, operating under various flags (Belize, Equatorial Guinea, Honduras, Panama, Vanuatu, etc.) as estimated by the IOTC Secretariat
NEI-ICE	Catches of non-reporting fresh-tuna longliners, operating under various flags (Honduras, Taiwan,China, etc.), as estimated by the IOTC Secretariat
NEI-PS	Catches of non-reporting purse-seine vessels operating under various flags (Belize, Cayman Islands, Cote d'Ivoire, Liberia, Malta, Netherlands Antilles and Panama)

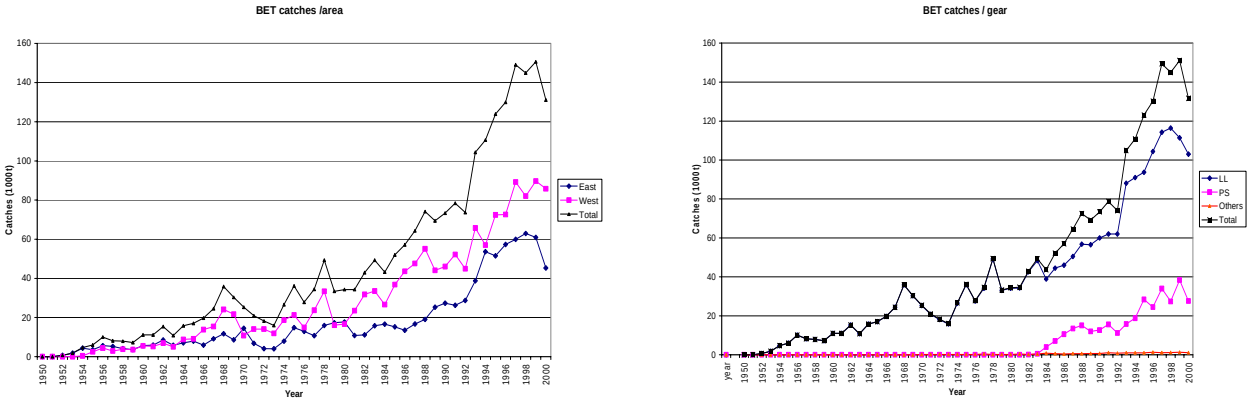


Figure 1 *– Yearly catches (thousand of metric tonnes) of bigeye tuna by area (Eastern and Western Indian Ocean, left) and by gear from 1950 to 2000 (right).*

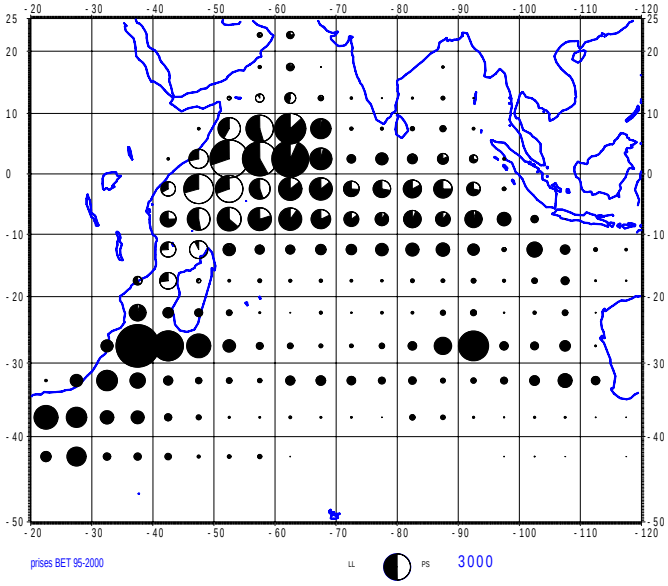


Figure 2 *– Average (1995-2000) geographical distribution of bigeye tuna catches according to gear (longline in black, purse-seine in white).*

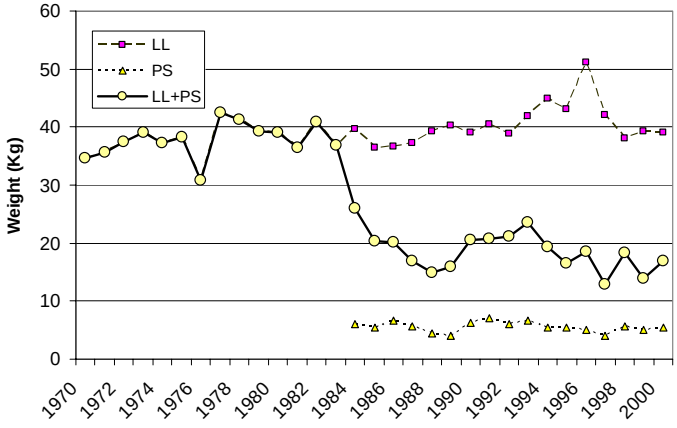


Figure 3*. Average weight in the catch by gear for the period 1970-2000.*

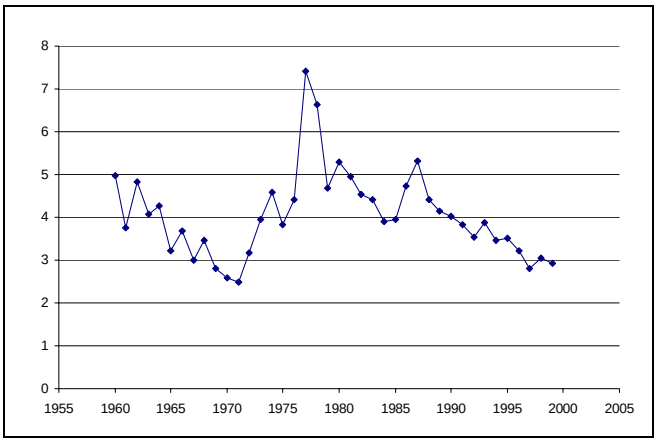


Figure 4. *Yearly abundance index based on Japanese longline bigeye CPUE.*

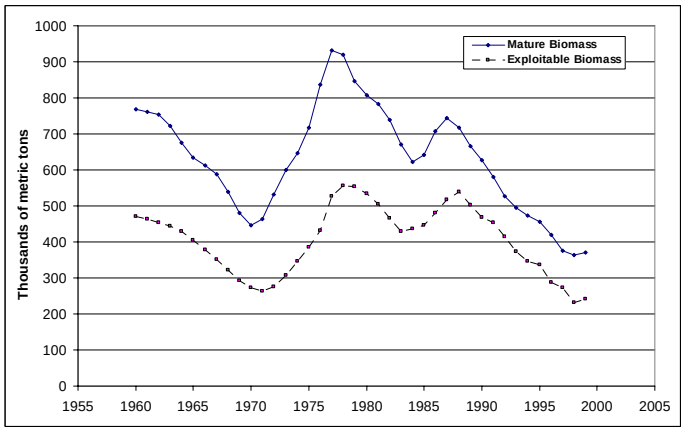
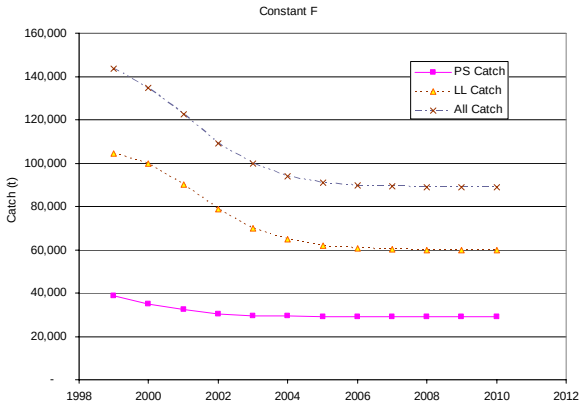
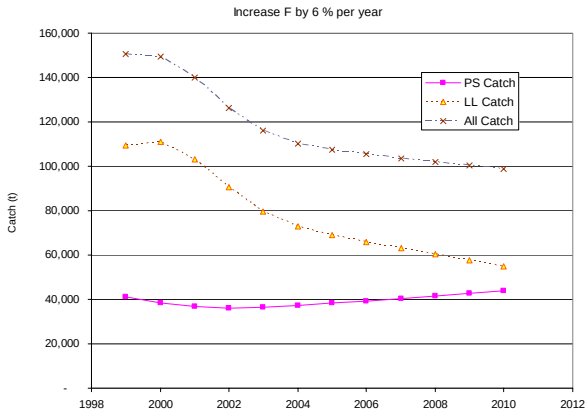


Figure 5*. Trends of the mature and exploitable biomass of bigeye tuna, as estimated by the WPTT in 2001*

Figure 6*. Results of the projections under different scenarios, as calculated by the WPTT in 2001.*





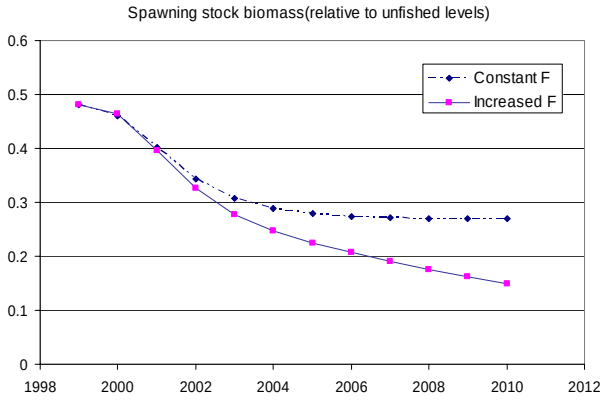
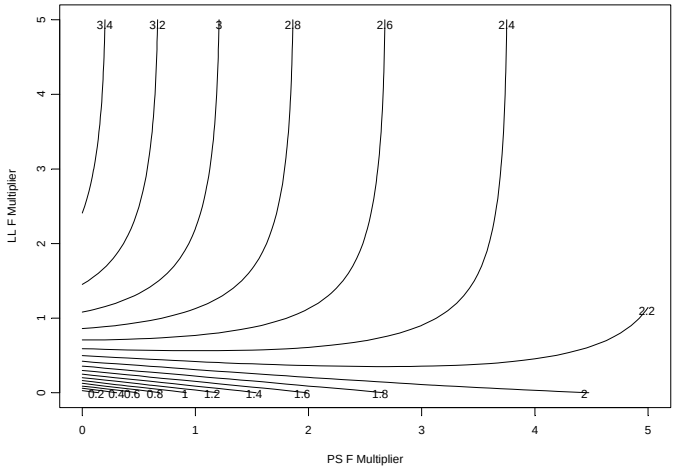


Figure 7. *Multi-gear yield-per-recruit analysis, as estimated by the WPTT in 2001.*



APPENDIX VIII. EXECUTIVE SUMMARY OF THE STATUS OF THE SKIPJACK TUNA RESOURCE

BIOLOGY

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). Furthermore, the species shows high fecundity, spawning at an early age (all skipjack tuna caught are already potential spawners) and a great flexibility in its spawning behaviour by being able to reproduce in all waters with surface temperature greater than 24°C. Because of these characteristics, skipjack tuna resources are considered to be resilient stocks which are not easily overfished.

FISHERIES

Tuna fisheries have been increasingly catching skipjack in the Indian Ocean since the early eighties. Skipjack has been the most important tuna species in the Indian Ocean catches of tunas since 1999 with total catches reaching about 400,000 t yearly (*Figure 1 and Table 1*). These catches have also shown low inter-annual variability as compared with similar fisheries in other oceans. This species is taken in similar proportions not only by industrial purse seiners operating since the early eighties, mainly in the Western Indian Ocean, but also by artisanal pole and line fisheries which are mainly active in Maldives (*Figure 2*) and also in India (not shown on the map). 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 the purse seiners show an increasing trend (*Figure 3*) 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 average size of skipjack caught in the Indian Ocean (2.7 kg in the purse-seine catches and 3.0 kg in the Maldivian baitboat catches) is greater that the average size of skipjack caught in other oceans, such as the Atlantic (*Figure 4*). However, there are indications that there has been a slight decrease in sizes caught in recent years in the purse-seine fisheries.

STOCK STATUS

The stock of skipjack tuna in the Indian Ocean has never been thoroughly studied by scientists despite of its importance for the fisheries in the region. Even if this species has always been considered as being resistant to overfishing, it is evident that the present rate of increase in catches (an average increase of 17,000 t per year since the early eighties) cannot be maintained in the long tem, as all stocks have a limit to their productivity and can suffer, at least locally, from overfishing. For instance, such local overfishing has been observed in the Atlantic where, in recent years, skipjack catches have been decreasing despite of an extensive use of FADs, with a low, and decreasing, average weight (Figure 4). Such trends have not yet been observed in the Indian Ocean but preventive measures should be taken.

Independently of its present level of exploitation, there are two concerns about skipjack fisheries in the Indian Ocean:

- First, the legitimate concern by artisanal fisheries regarding the potential interaction between the industrial and the artisanal fisheries which are fishing in nearby areas (Figure 2). This interaction may, for instance, affect the quantity of the large skipjack tuna taken by Maldivian pole-and-line vessels (*Figure 5*) and it should be further assessed by scientists.
- Second, there has been concern that the current extensive use of FADs by purse-seine may produce a “biological trap” with negative consequences for the biology of the Indian Ocean skipjack stocks (for instance, altering their natural growth, natural movement pattern and natural mortality).

MANAGEMENT RECOMMENDATIONS

At this stage, the Scientific Committee has not made any specific management recommendation concerning this stock, as it appears that this stock is still in good condition.

Despite of its present apparent good health, the Indian Ocean skipjack tuna stock should be carefully analysed by scientists. This analysis should be carried out to: a) better estimate its potential productivity and MSY; b) to estimate the risk of interaction between fisheries, and c) the potential risks introduced by the extensive use of FADs. These analyses would require comprehensive processing of the large data bases collected in Maldives and on purse seiners, for instance, analysing catch and CPUE at size by the two

fisheries (the necessary data are already available in the IOTC). However, the implementation of a specifically designed component of the planned large scale tagging programme will probably remain the only way to comprehensively evaluate the potential risks of interactions between these skipjack fisheries. The development of field research on FAD-associated skipjack would also be necessary to test the FAD-biological trap hypothesis.

SKIPJACK TUNA SUMMARY

Maximum Sustainable Yield :	
Current (2000) Catch:	393,000 t
Current (2000) Replacement Yield	
Relative Biomass (B_{2000}/B_{MSY})	
Relative Fishing Mortality (F_{2000}/F_{MSY})	
Management Measures in Effect	None

***Table 1**. Catches by gear and main fleets for 1950-2000.*

Gear	Fleet	Av96/00	%	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	Fleet
PS	EC	105	30.9																											EC
	NEI-PS	46	13.6																											NEI-PS
	OTHER	20	5.8														0.0	0.2	0.0									0.1	0.2	OTHER
	TOTAL	**170**	**50.3**														*0*	*0*	*0*									*0*	*0*	**TOTAL**
BB	Maldives	77	22.6	8.0	0.8	8.0	9.0	9.0	9.0	9.0	10.0	10.0	10.0	9.0	8.0	8.0	8.0	8.0	14.1	16.9	18.9	17.5	19.6	27.6	28.0	17.5	19.5	22.5	14.9	Maldives
	OTHER	5	1.3	0.2	1.3	1.4	1.5	1.6	1.6	1.7	1.6	1.7	1.6	1.6	2.1	2.1	2.2	2.3	2.6	2.8	2.7	2.9	3.1		0.0	0.0	5.0	10.5	1.8	OTHER
	TOTAL	**81**	**24.0**	*8*	*2*	*9*	*11*	*11*	*11*	*11*	*12*	*12*	*12*	*11*	*10*	*10*	*10*	*10*	*17*	*20*	*22*	*20*	*23*	*28*	*28*	*17*	*25*	*33*	*17*	**TOTAL**
GILL	Sri Lanka	38	11.2																											Sri Lanka
	OTHER	19	5.5	0.5	0.5	0.5	0.7	0.8	0.8	0.7	1.9	0.9	0.9	1.1	1.0	1.6	2.4	3.3	3.6	4.8	4.7	4.7	4.2	3.9	3.1	3.7	2.9	4.0	4.5	OTHER
	TOTAL	**57**	**16.7**	*0*	*0*	*0*	*1*	*1*	*1*	*1*	*2*	*1*	*1*	*1*	*1*	*2*	*2*	*3*	*4*	*5*	*5*	*5*	*4*	*4*	*3*	*4*	*3*	*4*	*4*	**TOTAL**
LINE		3	0.9	0.2	0.2	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.6	0.6	0.4	0.5	0.5	0.3	
LL		0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.2	0.0	0.0	0.0	
UNCL	Indonesia	25	7.3																					2.3	2.4	3.7	4.1	4.4	3.7	Indonesia
	OTHER	3	0.8	4.3	4.1	7.9	5.1	6.6	7.0	10.0	10.0	9.7	10.0	10.0	15.0	9.4	15.5	11.0	10.0	11.6	16.4	20.7	14.6	12.9	10.7	14.5	11.7	13.8	17.1	OTHER
	TOTAL	**27**	**8.1**	*4*	*4*	*8*	*5*	*7*	*7*	*10*	*10*	*10*	*10*	*10*	*15*	*9*	*16*	*11*	*10*	*12*	*16*	*21*	*15*	*15*	*13*	*18*	*16*	*18*	*21*	**TOTAL**
	TOTAL	**338**		*13*	*7*	*18*	*16*	*18*	*19*	*22*	*24*	*22*	*23*	*22*	*26*	*21*	*28*	*25*	*30*	*36*	*43*	*46*	*42*	*47*	*45*	*40*	*44*	*56*	*43*	**TOTAL**
Gear	Fleet	Av96/00	%	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	Fleet

Gear	Fleet	Av96/00	%	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	Fleet
PS	EC	105	30.9						0.2	1.0	9.4	33.7	48.5	55.2	63.5	75.8	107.0	76.9	81.2	91.7	99.5	120.0	118.2	106.3	94.2	89.0	117.0	117.1	EC
	NEI-PS	46	13.6								0.4	8.2	8.4	6.4	4.8	7.0	7.9	11.7	10.8	20.8	25.4	32.7	43.8	34.3	36.3	44.5	52.9	61.9	NEI-PS
	OTHER	20	5.8	0.3	0.5	1.3	1.0	1.8	2.2	3.8	2.8	3.9	4.5	5.9	11.6	11.0	12.7	20.5	31.6	39.9	39.5	27.9	21.3	11.6	18.0	21.8	27.8	18.3	OTHER
	TOTAL	**170**	**50.3**	*0*	*0*	*1*	*1*	*2*	*2*	*5*	*13*	*46*	*61*	*67*	*80*	*94*	*128*	*109*	*124*	*152*	*164*	*181*	*183*	*152*	*148*	*155*	*198*	*197*	**TOTAL**
BB	Maldives	77	22.6	18.6	13.7	13.2	17.3	22.2	19.6	15.3	19.3	32.3	42.2	45.1	42.6	58.2	57.8	60.7	58.3	57.6	58.0	68.7	69.9	66.2	68.1	77.8	92.3	78.8	Maldives
	OTHER	5	1.3	0.1	0.6	0.8	0.4	0.0	0.2	2.1	2.1	1.5	1.8	0.5	0.5	0.5	1.8	0.1	0.2	0.3	0.1	0.1	0.5	0.2	0.9	2.2	10.7	8.7	OTHER
	TOTAL	**81**	**24.0**	*19*	*14*	*14*	*18*	*22*	*20*	*17*	*21*	*34*	*44*	*46*	*43*	*59*	*60*	*61*	*59*	*58*	*58*	*69*	*70*	*66*	*69*	*80*	*103*	*88*	**TOTAL**
GILL	Sri Lanka	38	11.2							10.6	11.2	8.7	10.1	16.7	16.3	19.6	22.6	25.0	27.9	23.8	24.1	21.5	18.2	22.7	27.8	34.6	51.9	51.9	Sri Lanka
	OTHER	19	5.5	4.2	3.7	2.2	3.8	1.7	2.7	3.9	1.9	2.0	2.4	1.8	4.0	6.1	8.6	10.1	11.4	13.2	14.3	19.4	12.1	11.3	15.8	14.8	23.8	28.2	OTHER
	TOTAL	**57**	**16.7**	*4*	*4*	*2*	*4*	*2*	*3*	*14*	*13*	*11*	*12*	*19*	*20*	*26*	*31*	*35*	*39*	*37*	*38*	*41*	*30*	*34*	*44*	*49*	*76*	*80*	**TOTAL**
LINE		3	0.9	0.5	0.4	0.4	0.4	0.5	0.5	0.9	0.9	1.8	0.6	0.6	0.5	0.5	4.3	4.6	5.0	2.9	3.0	2.8	2.8	2.6	3.2	3.3	2.7	3.3	
LL		0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.1	0.1	0.0	0.1	0.6	0.1	0.2	0.1	0.1	0.1	0.1	0.1	
UNCL	Indonesia	25	7.3	5.3	3.7	3.8	8.2	8.6	7.6	12.1	12.0	9.5	10.0	10.1	10.8	12.2	17.4	12.0	11.5	12.8	14.7	17.0	15.2	21.2	27.4	23.9	25.1	25.1	Indonesia
	OTHER	3	0.8	13.9	12.8	12.4	9.7	14.0	17.0	3.9	4.5	5.4	5.1	6.0	7.6	6.9	6.4	5.8	4.7	4.9	5.0	9.5	6.6	6.9	6.2	0.5	0.1	0.1	OTHER
	TOTAL	**27**	**8.1**	*19*	*16*	*16*	*18*	*23*	*25*	*16*	*17*	*15*	*15*	*16*	*18*	*19*	*24*	*18*	*16*	*18*	*20*	*27*	*22*	*28*	*34*	*24*	*25*	*25*	**TOTAL**
	TOTAL	**338**		*43*	*35*	*34*	*41*	*49*	*50*	*54*	*64*	*107*	*133*	*148*	*162*	*198*	*247*	*228*	*243*	*268*	*284*	*320*	*309*	*284*	*298*	*313*	*404*	*393*	**TOTAL**
Gear	Fleet	Av96/00	%	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	Fleet

KEY:

PS	Purse seine	**GILL**	Gill net	**Av96/00**	Average catches for the period 1996-2000
LL	Longline	**LINE**	Hand lines and/or troll lines	**%**	Proportion of the total catch (average 1996-2000) that the average catches (1996-2000) represent
BB	Baitboat	**UNCL**	Other or unknown		

NEI-DFRZ Catches of non-reporting freezing or deep-freezing longline vessels, operating under various flags (Belize, Equatorial Guinea, Honduras, Panama, Vanuatu, etc.) as estimated by the IOTC Secretariat
NEI-ICE Catches of non-reporting fresh-tuna longliners, operating under various flags (Honduras, Taiwan,China, etc.), as estimated by the IOTC Secretariat
NEI-PS Catches of non-reporting purse-seine vessels operating under various flags (Belize, Cayman Islands, Cote d'Ivoire, Liberia, Malta, Netherlands Antilles and Panama)

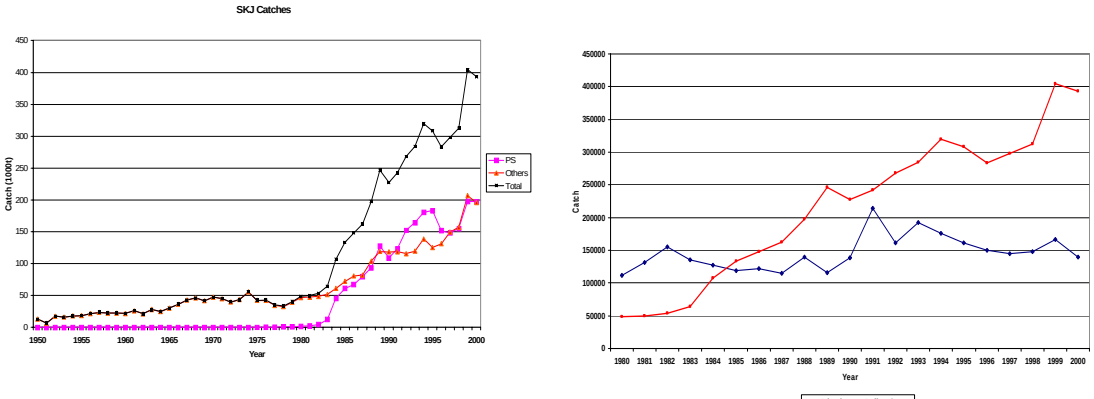


Figure 1. *Yearly catches of Indian Ocean catches by purse seiners (PS) and by artisanal fisheries, and trends of the total catches of skipjack in the Indian and the Atlantic Ocean*

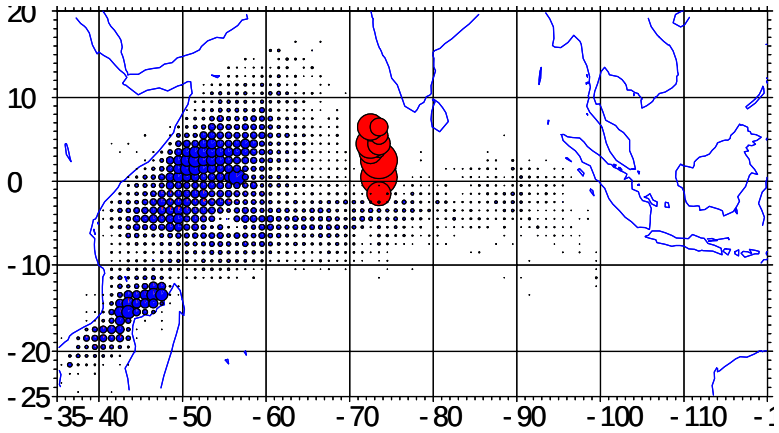


Figure 2. *Average catches of skipjack by the purse seine and Maldivian pole and line fisheries.*

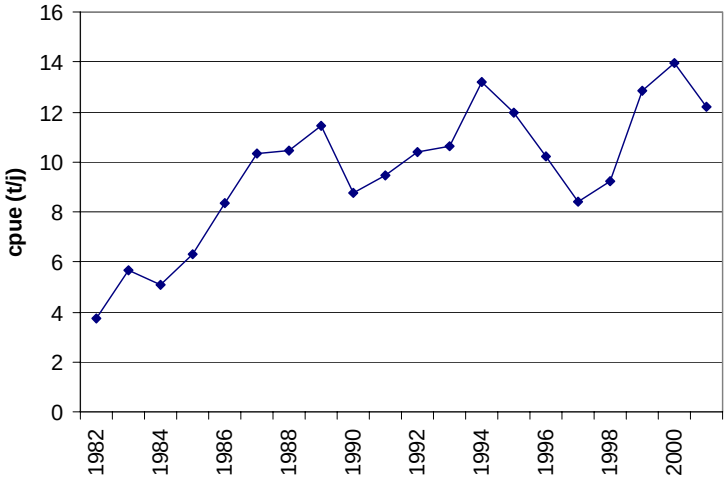


Figure 3. *Nominal catch-per-fishing-day in the purse-seine fishery.*

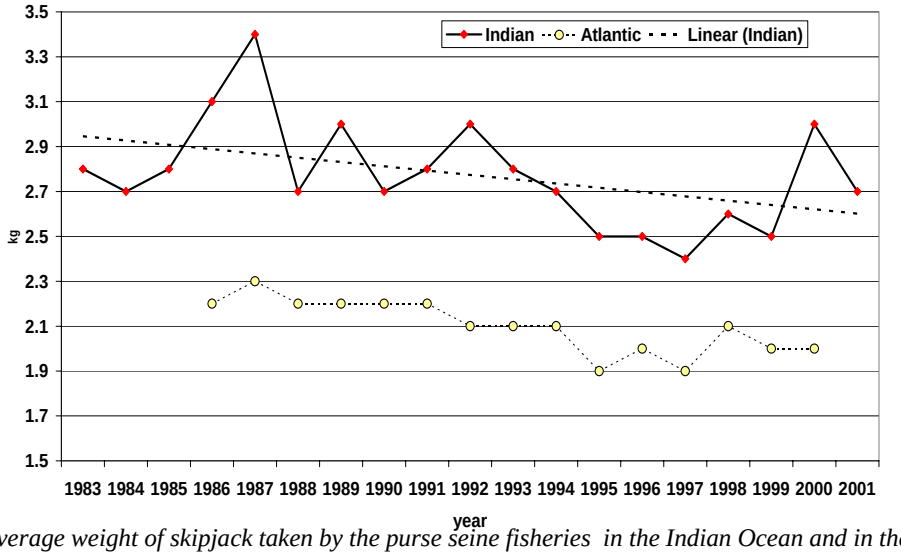


Figure 4. *Average weight of skipjack taken by the purse seine fisheries in the Indian Ocean and in the Atlantic*

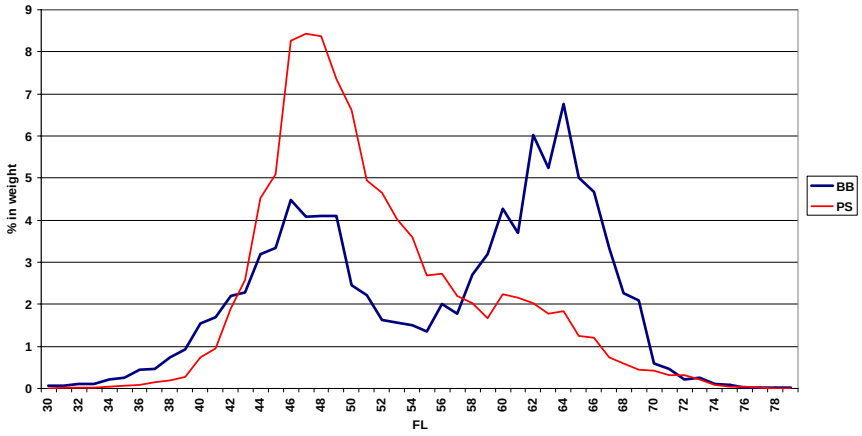


Figure 5. *Typical average size distribution of skipjack taken by purse seine and by Maldivian pole and line vessels (average period 1985-98, in %, in weight)*